REPAIR & TUNE-UP GUIDE

CORVETTE 1963 to 1983

All U.S. and Canadian 305 « 327 • 350 • 396 * 427 • 454 models; including fuel injection

1BOOK
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SAFETY NOTICE

Proper service and repair procedures are vital to the safe, reliable operation of all motor vehicles, as well as the personal safety of those performing repairs. This book outlines procedures for servicing and repairing vehicles using safe, effective methods. The procedures contain many NOTES, CAUTIONS and WARNINGS which should be followed along with standard safety procedures to eliminate the possibility of personal injury or improper service which could damage the vehicle or compromise its safety.

It is important to note that repair procedures and techniques, tools and parts for servicing motor vehicles, as well as the skill and experience of the individual performing the work vary widely. It is not possible to anticipate all of the conceivable ways or conditions under which vehicles may be serviced, or to provide cautions as to all of the possible hazards that may result. Standard and accepted safety precautions and equipment should be used when handling toxic or flammable fluids, and safety goggles or other protection should be used during cutting, grinding, chiseling, prying, or any other process that can cause material removal or projectiles.

Some procedures require the use of tools specially designed for a specific purpose. Before substituting another tool or procedure, you must be completely satisfied that neither your personal safety, nor the performance of the vehicle will be endangered.

Although information in this guide is based on industry sources and is as complete as possible at the time of publication, the possibility exists that the manufacturer made later changes which could not be included here. While striving for total accuracy, Chilton Book Company cannot assume responsibility for any errors, changes, or omissions that may occur in the compilation of this data.

PART NUMBERS

Part numbers listed in this reference are not recommendations by Chilton for any product by brand name. They are references that can be used with interchange manuals and aftermarket supplier catalogs to locate each brand supplier's discrete part number.

SPECIAL TOOLS

Special tools are recommended by the vehicle manufacturer to perform their specific job. Use has been kept to a minimum, but where absolutely necessary they are referred to in the text by the part number of the tool manufacturer. These tools can be purchased, under the appropriate part number, through the Service Tool Division, Kent-Moore Corporation, 29784 Little Mack, Roseville, MI 48066-2298. In Canada, contact Kent-Moore of Canada, Ltd., 2395 Cawthra Mississauga, Ontario, Canada L5A 3P2. Before substituting any tool for the one recommended, read the SAFETY NOTICE at the top of this page.

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Specifications   Vehicle

Fill in this chart with the most commonly used specifications for your vehicle. Specifications can be found in Chapters 1 through 3 or on the tune-up decal under the hood of the vehicle.

Firing Order ________________________ '_________________________________, _______________

Spark Plugs:

Type -- ,-- : --------- '

Gap (in.) ____

Point Gap (in.) ____

Dwell Angle (°) ____

Ignition Timing (°) ____

Vacuum (Connected/Disconnected) _________________________________; __________

Valve Clearance (in.)

Intake ____________________ : ______ Exhaust.

Capacities

Engine Oil (qts)

With Filter Change __________

Without Filter Change _______

Cooling System (qts) ____________

Manual Transmission (pts)_

Type-----------------------_

Automatic Transmission (pts)_

Type----------------------------

Front Differential (pts)_

Type ------------------

Rear Differential (pts)_

Type---------------- _

Transfer Case (pts)_

Type---------------

FREQUENTLY REPLACED PARTS

Use these spaces to record the part numbers of frequently replaced parts.

PCV VALVE	OIL FILTER	AIR FILTER
Manufacturer ___________._	Manufacturer ______________	Manufacturer.
Part No -----------------------------	Part No. _______________________	Part No._____

General Information and Maintenance

HOW TO USE THIS BOOK

Chilton's Repair & Tune-Up Guide for the Corvette is intended to help you learn more about the inner workings of your vehicle and save you money on its upkeep and operation.

The first two chapters will be the most used, since they contain maintenance and tune-up information and procedures. Studies have shown that a properly tuned and maintained car can get at least 10% better gas mileage than an out-of-tune car. The other chapters deal with the more complex systems of your car. Operating systems from engine through brakes are covered to the extent that the average do-it-yourselfer becomes mechanically involved. This book will not explain such things as rebuilding the differential for the simple reason that the expertise required and the investment in special tools make this task uneconomical. It will give you detailed instructions to help you change your own brake pads and shoes, replace points and plugs, and do many more jobs that will save you money, give you personal satisfaction, and help you avoid expensive problems.

A secondary purpose of this book is a reference for owners who want to understand their car and/or their mechanics better. In this case, no tools at all are required.

Before removing any bolts, read through the entire procedure. This will give you the overall view of what tools and supplies will be required. There is nothing more frustrating than having to walk to the bus stop on Monday morning because you were short one bolt on Sunday afternoon. So read ahead and plan ahead. Each operation should be approached logically and all procedures thoroughly understood before attempting any work.

All chapters contain adjustments, maintenance, removal and installation procedures, and repair or overhaul procedures. When repair is not considered practical, we tell you how to remove the part and then how to install the new or rebuilt replacement. In this way, you at least save the labor costs. Backyard repair of such components as the alternator is just not practical.

Two basic mechanic's rules should be mentioned here. One, whenever the left side of the car or engine is referred to, it is meant to specify die driver's side of ihe car. Conversely, the right side of the car means the passenger's side. Secondly, most screws and bolts are removed by turning counterclockwise, and tightened by turning clockwise.

Safety is always the most important rule. Constantly be aware of the dangers involved in working on an automobile and take the proper precautions. (See the section in this chapter "Servicing Your Vehicle Safely" and the SAFETY NOTICE on the acknowledgement page.)

Pay attention to the instructions provided. There are 3 common mistakes in mechanical work:

1. Incorrect order of assembly, disassembly or adjustment. When taking something apart or putting it together, doing things in the wrong order usually just costs you extra time; however, it CAN break something. Read the entire procedure before beginning disassembly. Do everything in the order in which the instructions say you should do it, even if you can't immediately see a reason for it. When you're taking apart something that is very intricate (for example, a carburetor), you might want to draw a picture of how it looks when assembled at one point in order to make sure you get everything back in its

proper position. (We will supply exploded view whenever possible). When making adjustments, especially tune-up adjustments, do them in order; often, one adjustment affects another, and you cannot expect even satisfactory results unless each adjustment is made only when it cannot be changed by any other.

2. Overtorquing (or undertorquing). While it is more common for overtorquing to cause damage, undertorquing can cause a fastener to vibrate loose causing serious damage. Especially when dealing with aluminum parts, pay attention to torque specifications and utilize a torque wrench in assembly. If a torque figure is not available, remember that if you are using the right tool to do the job, you will probably not have to strain yourself to get a fastener tight enough. The pitch of most threads is so slight that the tension you put on the wrench will be multiplied many, many times in actual force on what you are tightening. A good example of how critical torque is can be seen in the case of spark plug installation, especially where you are putting the plug into an aluminum cylinder head. Too little torque can fail to crush the gasket, causing leakage of combustion gases and consequent overheating of the plug and engine parts. Too much torque can damage the threads, or distort the plug, which changes the spark gap.

There are many commercial products available for ensuring that fasteners won't come loose, even if they are not torqued just right (a very common brand is "Loctite®"). If you're worried about getting something together tight enough to hold, but loose enough to avoid mechanical damage during assembly, one of these products might offer substantial insurance. Read the label on the package and make sure the product is compatible with the materials, fluids, etc. involved before choosing one.

3. Crossthreading. This occurs when a part such as a bolt is screwed into a nut or casting at the wrong angle and forced. Cross threading is more likely to occur if access is difficult. It helps to clean and lubricate fasteners, and to start threading with the part to be installed going straight in. Then, start the bolt, spark plug, etc. with your fingers. If you encounter resistance, unscrew the part and start over again at a different angle until it can be inserted and turned several turns without much effort. Keep in mind that many parts, especially spark plugs, use tapered threads so that gentle turning will automatically bring the part you're threading to the proper angle if you don't force it or resist a change in angle. Don't put a wrench on the part until it's been turned a couple of turns by hand. If you suddenly encounter resistance, and the part has not been seated fully, don't force it. Pull it back out and make sure it's clean and threading properly.

Always take your time and be patient; once you have some experience, working on your car will become an enjoyable hobby.

TOOLS AND EQUIPMENT

Naturally, without the proper tools and equipment it is impossible to properly service your vehicle. It would be impossible to catalog each tool that you would need to perform each or any operation in this book. It would also be unwise for the amateur to rush out and buy an expensive set of tools on the theory that he may need one or more of them at sometime.

The best approach is to proceed slowly, gathering together a good quality set of those tools that are used most frequently. Don't be misled by the low cost of bargain tools. It is far better to spend a little more for better quality. Forged wrenches, 10 or 12 point sockets and fine tooth ratchets are by far preferable to their less expensive counterparts. As any good mechanic can tell you, there are few worse experiences than trying to work on a car or truck with bad tools. Your monetary savings will be far outweighed by frustration and mangled knuckles.

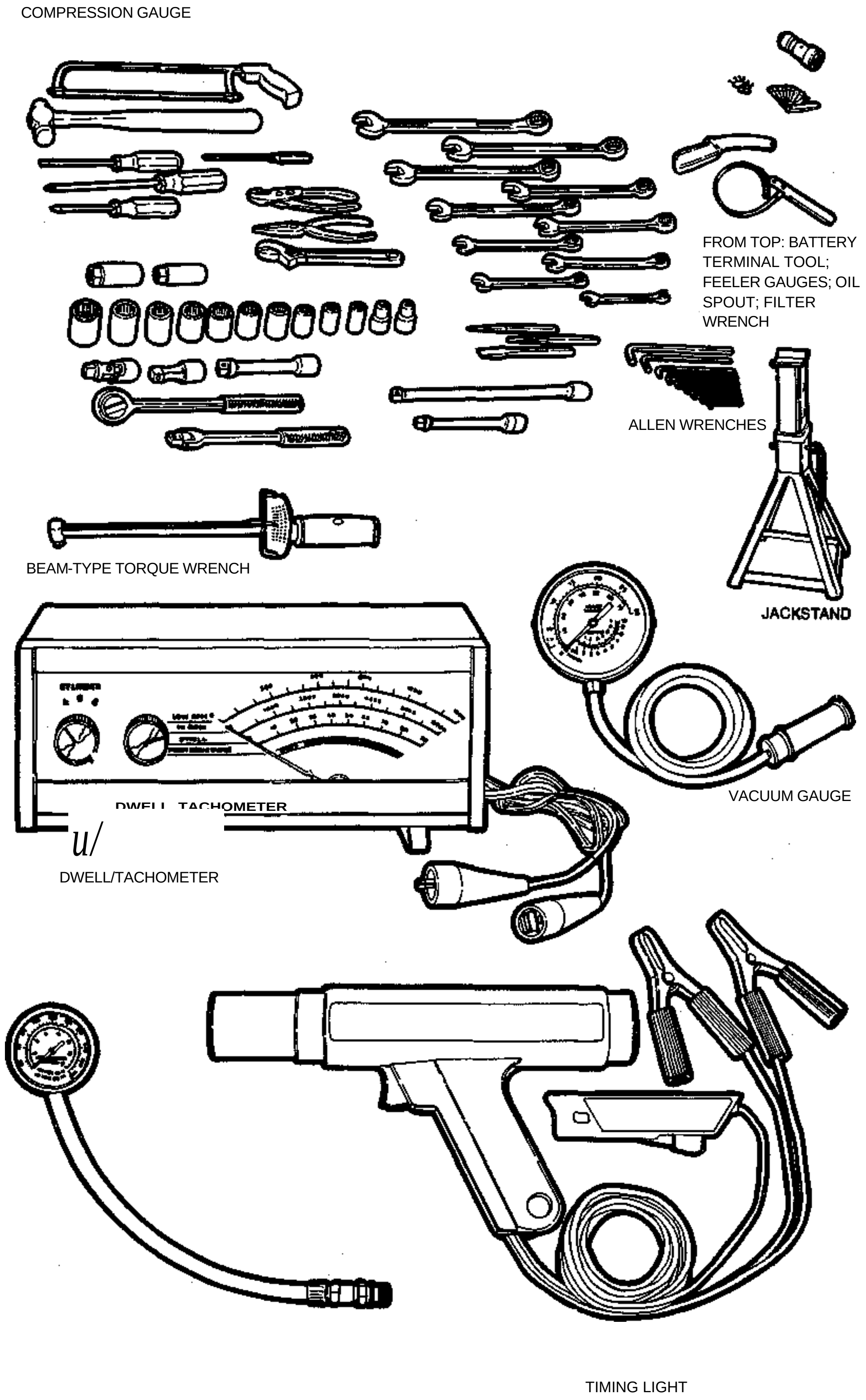
Begin accumulating those tools that are used most frequently; those associated with routine maintenance and tune-up.

In addition to the normal assortment of screwdrivers and pliers you should have the following tools for routine maintenance jobs:

1. SAE (or Metric) or SAE/Metric wrenches—sockets and combination open end/box end wrenches in sizes from % in. (3 mm) to % in. (19 mm) and a spark plug socket (^{13}/ie or % in. depending on plug type).

If possible, buy various length socket drive extensions. One break in this department is that the metric sockets available in the U. S. will all fit the ratchet handles and extensions you may already have *(¥4, %,* and *Yi* in. drive);

2. Jackstands—for support;
3. Oil filter wrench;
4. Oil filler spout—for pouring oil;
5. Grease gun—for chassis lubrication;
6. Hydrometer—for checking the battery;



You need only a basic assortment of hand tools and test instruments for most maintenance and repair Jobs

7. A container for draining oil;
8. Many rags for wiping up the inevitable mess.

In addition to the above items there are several others that are not absolutely necessary, but handy to have around. These include oil dry, a transmission funnel and the usual supply of lubricants, antifreeze and fluids, although these can be purchased as needed. This is a basic list for routine maintenance, but only your personal needs and desire can accurately determine your list of tools. If you are serious about maintaining your own car, then a floor jack is as necessary as a spark plug socket. The greatly increased utility, strength, and safety of a hydraulic floor jack makes it pay for itself many times over through the years.

The second list of tools is for tune-ups. While the tools involved here are slightly more sophisticated, they need not be outrageously expensive. There are several inexpensive tach/dwell meters on the market that are every bit as good for the average mechanic as a $100.00 professional model. Just be sure that it goes to at least 1,200-1,500 rpm on the tach scale and that it works on 4, 6 or 8 cylinder engines. A basic list of tune-up equipment could include:

1. Tach-dwell meter.
2. Spark plug wrench.
3. Timing light (a DC light that works from the car's battery is best, although an AC light that plugs into 110V house current will suffice at some sacrifice in brightness);
4. Wire spark plug gauge/adjusting tools.
5. Set of feeler blades.

Here again, be guided by your own needs. A feeler blade will set the points as easily as a dwell meter will read dwell, but slightly less accurately. And since you will need a tachometer anyway . . . well, make your own decision.

In addition to these basic tools, there are several other tools and gauges you may find useful. These include:

1. A compression gauge. The screw-in type is slower to use, but eliminates the possibility of a faulty reading due to escaping pressure.
2. A manifold vacuum gauge.
3. A test light, volt-ohm meter.
4. An induction meter. This is used for determining whether or not there is current in a wire. These are handy for use if a wire is broken somewhere in a wiring harness.

As a final note, you will probably find a torque wrench necessary for all but the most basic work. The beam type models are perfectly adequate, although the newer click type are more precise.

Special Tools

Normally, the use of special factory tools is avoided for repair procedures, since these are not readily available for the do-it-yourself mechanic. When it is possible to perform the job with more commonly available tools, it will be pointed out, but occasionally, a special tool was designed to perform a specific function and should be used. Before substituting another tool, you should be convinced that neither your safety nor the performance of the vehicle will be compromised.

Some special tools are available commercially from major tool manufacturers. Others can be purchased from your car dealer.

NOTE: *Chevrolet special tools referred to in this guide are available through the Service Tool Division, Kent-Moore Corporation, 29784 Little Mack, Roseville, Ml 48066-2298. In Canada, contact Kent-Moore of Canada, Ltd., 2395 Cawthra Mississauga, Ontario, Canada L5A 3P2.*

SERVICING YOUR VEHICLE SAFELY

It is virtually impossible to anticipate all of the hazards involved with automotive maintenance and service but care and common sense will prevent most accidents.

The rules of safety for mechanics range from "don't smoke around gasoline," to "use the proper tool for the job." The trick to avoiding injuries is to develop safe work habits and take every possible precaution.

Do's

- Do keep a fire extinguisher and first aid kit within easy reach.
- Do wear safety glasses or goggles when cutting, drilling, grinding or prying, even if you have 20-20 vision. If you wear glasses for the sake of vision, then they should be made of hardened glass that can serve also as safety glasses, or wear safety goggles over your regular glasses.
- Do shield your eyes whenever you work around the battery. Batteries contain sulphuric acid; in case of contact with the eyes or skin, flush the area with water or a mixture

of water and baking soda and get medical attention immediately.

• Do use safety stands for any undercar service. Jacks are for raising vehicles; safety stands are for making sure the vehicle stays raised until you want it to come down. Whenever the vehicle is raised, block the wheels remaining on the ground and set the parking brake.

• Do use adequate ventilation when working with any chemicals. Like carbon monoxide, the asbestos dust resulting from brake lining wear can be poisonous in sufficient quantities.

• Do disconnect the negative battery cable when working on the electrical system. The primary ignition system can contain up to 40,000 volts.

• Do follow manufacturer's directions whenever working with potentially hazardous materials. Both brake fluid and antifreeze are poisonous if taken internally.

• Do properly maintain your tools. Loose hammerheads, mushroomed punches and chisels, frayed or poorly grounded electrical cords, excessively worn screwdrivers, spread wrenches (open end), cracked sockets, slipping ratchets, or faulty droplight sockets can cause accidents.

• Do use the proper size and type of tool for the job being done.

• Do when possible, pull on a wrench handle rather than push on it, and adjust your stance to prevent a fall.

• Do be sure that adjustable wrenches are tightly adjusted on the nut or bolt and pulled so that the face is on the side of the fixed jaw.

• Do select a wrench or socket that fits the nut or bolt. The wrench or socket should sit straight, not cocked.

• Do strike squarely with a hammer—avoid glancing blows.

• Do set the parking brake and block the drive wheels if the work requires that the engine be running.

Dont's

• Don't run an engine in a garage or anywhere else without proper ventilation—EVER! Carbon monoxide is poisonous; it takes a long time to leave the human body and you can build up a deadly supply of it in your system by simply breathing in a little every day. You may not realize you are slowly poisoning yourself. Always use power vents, windows, fans or open the garage doors.

• Don't work around moving parts while wearing a necktie or other loose clothing. Short sleeves are much safer than long, loose sleeves and hard-toed shoes with neoprene soles protect your toes and give a better grip on slippery surfaces. Jewelry such as watches, fancy belt buckles, beads or body adornment or any kind is not safe working around a car. Long hair should be hidden under a hat or cap.

• Don't use pockets for toolboxes. A fall or bump can drive a screwdriver deep into your body. Even a wiping cloth hanging from the back pocket can wrap around a spinning shaft or fan.

• Don't smoke when working around gasoline, cleaning solvent or other flammable material.

• Don't smoke when working around the battery. When the battery is being charged, it gives off explosive hydrogen gas.

• Don't use gasoline to wash your hands; there are excellent soaps available. Gasoline may contain lead, and lead can enter the body through a cut, accummulating in the body until you are very ill. Gasoline also removes all the natural oils from the skin so that bone dry hands will suck up oil and grease.

• Don't service the air conditioning system unless you are equipped with the necessary tools and training. The refrigerant, R-12, is extremely cold and when exposed to the air, will instantly freeze any surface it comes in contact with, including your eyes. Although the refrigerant is normally non-toxic, R-12 becomes a deadly poisonous gas in the presence of an open flame. One good whiff of the vapors from burning refrigerant can be fatal.

HISTORY

The 1963 Corvette Stingray is a complete departure from the Corvettes which preceded it. The body, frame, and front and rear suspensions are all of new design. Engines and transmissions are the only components that were shared with the older models. Stingray body styling evolved from the original William Mitchell Stingray sports/racing car which competed in 1959-60. Fiberglass bodywork was retained, but included a steel, reinforcing framework around the passenger compartment. The convertible model, with or without hardtop, was retained and a new body style added, the fastback coupe. Retractable headlights, rotated by two electric motors, were also a new feature for the Corvette.

The frame is a ladder type with five cross-members. The wheelbase has been reduced from the 102 in. of previous models to a more compact 98 in., and the rear track shortened by 2 in. This, coupled with component relocation, resulted in a 48/52 percent front/rear weight distribution; a marked improvement over the 53 percent front weight bias of earlier model Corvettes. Overall body height was reduced by 2 in. Front and rear suspensions are both independent and newly designed for the Stingray. The short/long arm front suspension has the upper arm tilted at an angle of 9° for an anti-dive effect under braking. Steering knuckles pivot in ball joints, instead of the king pins and bushings of the early Corvettes. The fully independent rear suspension is sprung with a nine-leaf transverse spring. Universal-jointed axle driveshafts transmit power to the wheels. Steering gear is recirculating ball type and the linkage includes a hydraulic damper. Power steering and brakes both became optionally available for the first time on a Corvette. Brake drums were enlarged and the brakes were made self-adjusting. Air conditioning became optionally available in kte 1963.

1964 saw detail body changes: functional passenger-compartment exhaust vents and elimination of the split rear window on the coupe, removal of the non-functional vents on the hood, and new wheel covers. The Muncie four-speed transmission, introduced in mid-year 1963 to repkce the Borg-Warner T-10, became the optional four-speed. The solid lifter engines received larger intake and exhaust valves, and horsepower increased from 340 to 365 and from 360 to 375 for the carburetted and fuel-injected engines respectively. Transsistorized, breakerless ignition became optionally available on high performance engines in 1964.

In 1965, the big change was the introduction of four-wheel disc brakes. Braking power and fade resistance were greatly increased over the drum brakes. A flat hood replaced the 1964 hood which had twin indentations and other body changes included restyled wheel covers and functional exhaust vents behind the front wheels. A new version of the 327 cubic inch engine was introduced, the 350 horsepower, hydraulic-cam option. In mid-year, a 396 cubic inch 425 horsepower engine was made available in the Corvette. 396 Corvettes were distinguished by the domed hood required for carburetor clearance. Cars equipped with the 396 received a larger front stabilizer bar and the addition of a rear stabilizer bar. Side-mounted exhausts with chambered mufflers joined the option list in 1965.

The 250, 365, and 375 horsepower engines were dropped in 1966. The 300 horsepower, 327 cubic inch engine became the standard power plant and the standard three-speed transmission was synchronized in all forward gears. The 396 was bored out to 427 cubic inches and offered in two versions, a 425 horsepower and a milder 390 horsepower model. A heavy-duty, four-speed transmission was introduced for use with the high performance 427. Body changes included a new, egg-crate grille, restyled wheel covers, and the addition of backup lights.

1967 body styling changes included a hood scoop on 427 Stingrays, more subdued exhaust vents on the front fenders, and a center back-up light. Wheels were widened % inch to 6 inches and were slotted. The full wheel covers of former models were discarded for trim rings and center caps. The handbrake was changed to the pull-up type, and relocated to the center console. The 300, 350, and 390 horsepower engines remained the same for 1967. A triple-two barrel carburetor set-up was added to the 390 horsepower 427 engine which added an additional 10 horsepower. Also, the same carburetor arrangement was added to the former 425 horsepower engine along with large port aluminum cylinder heads and a matching large port intake manifold. The three-two barrel carburetion also added 10 horsepower to this engine.

For the 1968 Corvette, a completely redesigned body and interior were installed on a basically unchanged chassis. Many of the styling features of the new body had been previewed on the Mako Shark show car. Overall body width and height were reduced, while front and rear tread increased with the use of one inch wider wheels. The convertible model was retained and the fastback coupe was replaced with a hardtop model featuring removable roof panels and rear window. Headlights on 1968 and later cars are raised automatically, with vacuum power when the lights are switched on. Wide oval F70-15 tires repkced the 7.75-15 tires of previous years. The two-speed, Powerglide automatic transmission was superseded by the three-speed Turbo Hydra-Matte, a significant improvement for general driving and performance usage. Engines remained the same, except for the addition of the air-injection reactor pump to control exhaust emissions. Corvettes sold in California have been equipped with the A.I.R. system since 1966.

Body styling remained die same for 1969 except for the addition of a Stingray script above the engine exhaust vent. The doors were slightly reshaped, widening the cockpit by one inch at shoulder height. Wheel width was increased to 8 inches, which also increased front and rear tread. The anti-theft ignition, steering, and transmission lock were introduced in 1969, with the ignition switch mounted on the steering column. Side exhausts were offered for the first time on the new body in 1969. Headlight washers were now included in the standard equipment. The small block stroke was increased to give a displacement of 350 cubic inches; however, horsepower ratings remained the same. 427 engine options remained the same for 1969 with the exception of the redesigned L88 engine. The 2nd design L88 used a large-port aluminum intake manifold with a single 850 cfin Holley carburetor, aluminum large-port open chamber cylinder heads, special camshaft with solid lifters, and redesigned HD connecting rods with ^{7}/ie rod bolts. Also, the rare ZL-1 427 engine was an option on models of this year. The ZL-1 had the same horsepower rating of the L88 (430 hp) and shared many internal components with the L88. The rarity of the ZL-1 engine comes with the fact that it used an aluminum cylinder block with cast iron cylinder liner sleeves.

A new grille, larger parabolic reflector turn signals, and wheel well flares were added to the Stingray body for 1970. Cast metal grilles were added over the engine compartment exhaust vents and the tailpipe exits were made retangular. The seats were redesigned, lowering them one inch for more headroom and making the headrests integral. The 427 stroke was increased for 1970 to give a displacement of 454 cubic inches. Triple, two-barrel carburetion was dropped from the big blocks in 1970. A 370 horsepower 350 cubic inch engine, the LT-1, was introduced to answer the need for a solid lifter, high rpm small block engine. The three-speed, manual transmission was discontinued in 1970, and the four-speed transmission and Positraction rear axle were made standard equipment.

Horsepower was decreased in 1971 through an across-the-board compression reduction. The 350 horsepower, hydraulic-cam version of the small block was deleted from the option list.

1972 saw very few changes made to the Corvette. Rated horsepower was again down, due mostly to a new rating system which utilizes net instead of gross power outputs. The audio alarm antitheft system is not a standard item, and the fiber optic light monitors have been discontinued. Only three engines are offered for 1972, two 350 cubic inch engines and one 454 cubic inch engine. There were no body changes, except for the addition of four new colors.

1973 saw the Corvette receive a new front end with a resilient body color bumper. The cool air induction hood covers the windshield wipers, allowing the wiper door and mechanism to be eliminated. New body mounts and extra soundproofing were also added for 1973. GR70-15 steel-belted radial tires are standard equipment. As far as the small-block engines are concerned, the LT-1 engine was discontinued for this model year. The successor to the LT-1 engine was the L82 high performance engine which used the same short block as the LT-1 but through the use of a hydraulic camshaft and a Quadrajet carburetor, the engine was again down on power. The 454 Turbo-jet was also available with a rating of 275 horsepower.

1974 was a year of very little change for the Corvette. A resilient rear section was added similar to the front system introduced in 1973. Three engines continued to be available, except in California where only the two 350s were available.

Changes to the 1975 Corvette include a catalytic reactor to reduce emissions, a fuel cell-type fuel tank, and the dropping of the 454 engine.

Only one Corvette body style was available for 1976, the convertible was dropped. The Turbo Hydra-Matic 350 replaced the 400 on the base engine. A partial steel underbody replaced the traditional fiberglass, which both improved body strength and heat protection from the exhaust system.

1977 was a year of refinements and a slight appearance change from the 1976 model.

The 1978 Corvette received its most extensive change since its introduction of the current series in 1968 with a new fastback roof line resulting in a new cockpit design and a larger cargo area. A larger 24 gallon fuel cell type fuel tank is used for greater fuel capacity. Increased horsepower and torque ratings are achieved for the special performance engine over the base engine as a result of improvements of the induction and exhaust systems. The base engine uses a Muncie 4-speed manual transmission while the special performance engine uses a Borg-Warner. Both engines use the same Turbo Hydra-Matic transmission.

1979 was a year of very little change with slight refinements of performance and appearance.

In 1980, the Corvette weight reduction plan was initiated. The following components were lightened to reduce the weight of the Corvette: front and rear bumper systems, hood, door panels, windshield and door glass (reduced thickness), selected frame members, and exhaust system. Appearance changes for 1980 include an integral front air dam, deeply recessed front grilles with integral parking lamps, cornering lamps, integral rear spoiler and functional black louvers on the front fenders. Transmission changes include the use of a locking torque convertor with the automatic transmission, and new gear ratios for the 4-speed manual transmission. Engine availability remains unchanged except for California models. California powertrain availability is limited to the new (to the Corvette) 305 engine with an automatic transmission. Miscellaneous components relating to drive train weight loss include the use of an aluminum intake manifold on the L82 engine, stainless steel exhaust manifolds on the 305 California engine, and a new aluminum differential mounting for all models.

The 1981 Corvette has only slight improvements in appearance and convenience items compared to the previous year. Both 350 engines (L48 and L82) and the 305 have been discontinued for 1981. A new L81 350-4 bbl. engine is the only engine available for 1981. The Corvette recorded an industry first this year through the introduction of an FRP (Fiberglass Reinforced Plastic) rear spring which replaces the previous mutli-leaf metal rear spring assembly.

In 1982, appearance and convenience item changes are again minimal. The 350 4-bbl. engine has been discontinued and a 350 engine with twin-throttle body fuel injection (TBI) was introduced. The twin TBI system, referred to as "Cross-fire Injection" by the Chevrolet marketing force, is said to improve both throttle response and fuel economy as compared to the previous 4-bbl. carburetion system. Also, a new 4-speed automatic overdrive transmission with a locking torque convertor is the only transmission available in 1982.

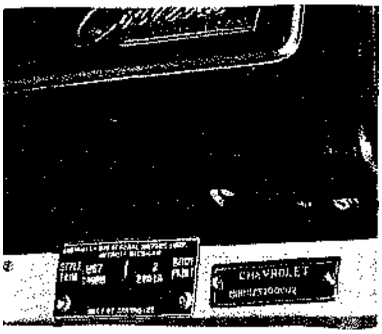
There is no 1983 Corvette model, but the 1984 Corvette is the first completely new design in over fifteen years. A new uniframe design body structure incororates high technology components such as forged aluminum suspension arms and fiberglass transverse leaf springs. The much-improved performance and handling characteristics of the 1984 Corvette continues the tradition of the ultimate American sport car. The L83 350 V8 with Cross Fire Fuel Injection is the only available engine in the 1984 Corvette, but two transmissions are offered. The THM 700 R4 automatic is standard, with an 83 mm 4 speed manual with automatic overdrive optional. The power rack and pinion steering and Z-51 suspension package combine to provide precision and predictability at all speeds, along with the highest lateral acceleration figure (.95G) ever recorded for a production model at the CM Proving Grounds.

Corvettes have proven themselves in all types of automotive competition, and the Stingray has continued to bear the Corvette standard in many forms of racing. A Stingray coupe won the first race entered in October 1962 at Riverside Raceway. Since then, Corvettes have continued their winning ways in road racing in the SCCA A and B-Production classes. Corvettes have also taken numerous trophies in drag racing, in both the stock and modified classes. Sebring, Daytona, and Le Mans have witnessed many Corvette entries; Corvettes have placed well overall and succeeded in winning the GT class several times at these endurance races. The aerodynamic Stingray has also been utilized several times in setting Grand Touring class records during the Bonneville Speed Weeks. Just recently, a stock-bodied 1968 Corvette roadster equipped with a twin-turbocharged 430 cid big-block engine broke the stock-bodied record at Bonneville with two 240+ mph runs. That racing improves the breed has certainly proved to be true in the case of the Corvette, with many race-proven pieces having become standard equipment or options on production Corvettes.

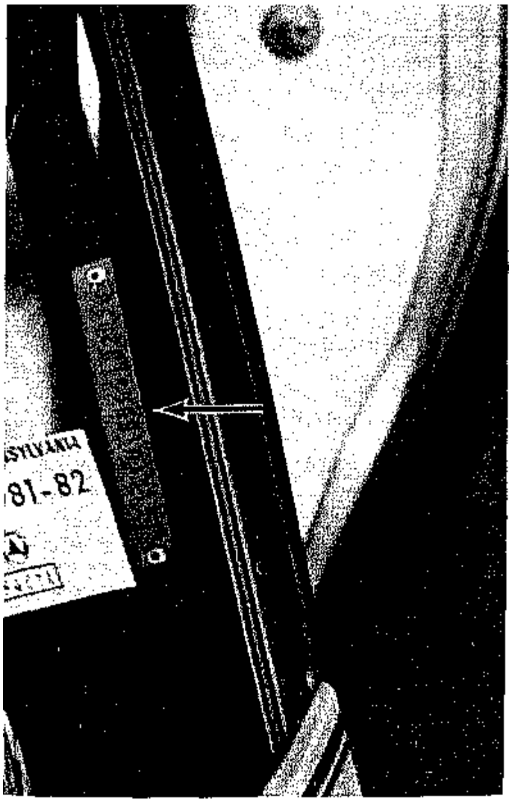
SERIAL NUMBER IDENTIFICATION

Vehicle

The 1963 through 1967 Corvette vehicle serial number, body style, body trim number, and paint combination is located on the instrument panel reinforcing member directly under the glove compartment. The vehicle serial number plate is located on the top left of the instrument panel (1968—76) and on the inside left windshield pillar post (1977-82). The body, trim, and paint number plate is located on the upper left hand door hinge pillar (1968-78) and on the upper horizontal surface of the shroud (1979—84). The vehicle serial number identifies die body style, model year, assembly plant, engine usage (1976-84), and production number.



1963-67 vehicle serial number location



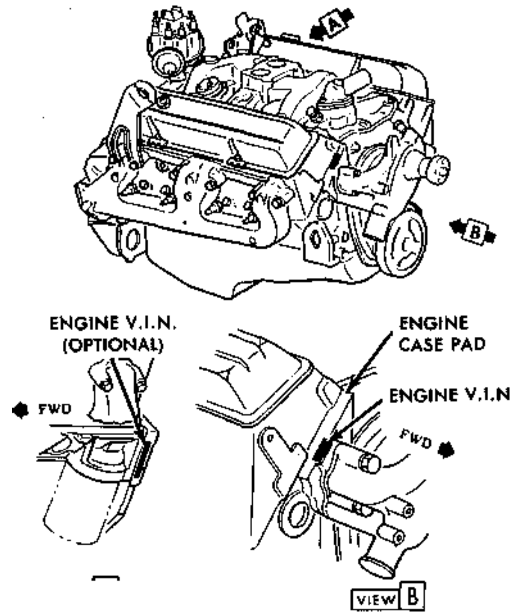
Serial number location on the drivers side windshield pillar—1977-82 models

INTERPRETING THE SERIAL NUMBER

A typical vehicle serial number tag yields manufacturer's identity, vehicle type, model year, engine type, assembly plant and production unit number when broken down as shown in the following charts.

Engine

All Corvette engine identification numbers are stamped on a pad of the engine block which is located at the lower front edge of the right side cylinder head. The first letter designates the plant in which the engine was manufactured and the numbers which follow identify the production date. The two or three letter suffix identifies the engine type and related equipment. On 1972 and later models, if the engine in the vehicle is known to be original, the fifth digit (1972-80) and the eighth digit (1981-84) of the serial number may also identify the engine used in the vehicle.



Typical engine serial number location

V.I.N. Chart 1963-71

1

Mfr Identity[1]	Body Style[2]	Model Year[3]	Assy Plant"	Unit No.[5]
	5645			100025

[1] Manufacturer's identity number assigned to all Chevrolet built vehicles
[2] Model identification
[3] Last number of model year (1968)
[4] F-Flint
[5] Unit numbering will start at 100,001 at all plants

V.I.N. Chart 1981-84

1G1	Restraint	Basic						
Mfr. Identity[1]	System Type[2]	Car Model[3]	Body Type"	Engine Model[5]	Check Digit"	Model Year[7]	Assy. Plant[8]	Unit Number[9]
			400.001 **87**		9			

[1] Manufacturers identity number assigned to all Chevrolet built passenger cars
[2] A—Non-passive restraint with manual seat belts
[3] Y—Corvette
"87—Two door hardtop coupe
[5] Engine code : 6(1981), 8(1982-84)
[6] Manufacturers use only
[7] **B—1981, C—1982, E—1984, etc.**
[8] S—St. Louis, 5—Bowling Green
[9] 9—Unit numbering varies depending upon model

V.I.N. Chart 1972-80

Mfr Iden-flty[1]	Series Code Letter[2]	Body Style[3]	Engine Model[4]	Model Year[5]	Assembly Plant[6]	Unit Number[7]
1	N	47				100025

[1] Manufacturer's identity number assigned to all Chevrolet built vehicles
[2] Model identification
[3] Model identification
"Engine code
[5] Last number of model year (1974) [6] F-Flint
[7] Unit numbering will start at 000001 or 100,001 depending on the model

Engine Identification

1963-64 327 cubic inch engine

Manual transmission	RC
Manual transmission and high performance	RD
Special high performance	RE
Manual transmission and fuel injection	RF
Powerglide	SC
Powerglide and high performance	SD

1964 327 cubic inch engine

Manual transmission and A/C	RP
Manual transmission, high performance, A/C	RQ
Manual transmission, special high performance, A/C	RR
Manual transmission and transistor ignition	RT
Fuel injection and transistor ignition	RX
Manual transmission, transistor ignition, A/C	RU
Powerglide and A/C	SK
Powerglide, high performance, A/C	SL

1965 327 cubic inch engine

Manual transmission	HE
High performance	HF
Fuel injection	HG
Special high performance	HH
A/C	HI
High performance and A/C	HJ

Engine Identification (cont.)

1965 327 cubic inch engine

Special high performance and A/C	HK
Transistor ignition	HL
Transistor ignition and A/C	HM
Fuel injection and transistor ignition	HN
Powerglide	HO
Powerglide and high performance	HP
Powerglide and A/C	HQ
Powerglide, high performance, A/C	HR
Special high performance and hydraulic lifters	HT
Special high performance, hydraulic lifters, A/C	HU
Special high performance, hydraulic lifters, transistor ignition	HV
Special high performance, hydraulic lifters, transistor ignition, A/C	HW

396 cubic inch engine

Special high performance	IF

1966 327 cubic inch engine

Manual transmission	HE
A.I.R.	HH
A.I.R. and Powerglide	HR
Special high performance and A.I.R.	HD
Powerglide	HO
Special high performance	HT
Power steering, special high performance, A.I.R.	HP
Special high performance, A/C, A.I.R.	KH

427 cubic Inch engine

Special high performance and hydraulic lifters	IK
High performance	IL
A.I.R.	IM
Special high performance	IP
Powerglide	IQ
Powerglide and A.I.R.	IR

1967 327 cubic inch engine

Manual transmission	HE
A.I.R.	HH

Engine Identification (cont.)

1967 327 cubic Inch engine

A.I.R. and Powerglide	HR
Special high performance and A.I.R.	HD
Powerglide	HO
Special high performance	HT
Power steering, special high performance, A/C	HP
Special high performance, A/C, A.I.R.	KH

427 cubic Inch engine

4-speed or Powerglide	IL
Triple carburetion	JC
A.I.T., special high performance, triple carburetion	JE
Heavy duty	IT
Aluminum heads	ID
A.I.R.	IM
A.I.R. and triple carburetion	JF
A.I.R. and aluminum heads	JH
Powerglide	IQ
Powerglide and triple carburetion	JD
A.I.R. and Powerglide	IR
A.I.R., triple carburetion, Powerglide	JG
A.I.R., special high performance, triple carburetion	JA

1968 327 cubic inch engine

Manual transmission	HE
Turbo Hydra-Matic	HO
Power steering and A/C	HP
Special high performance	HT

427 cubic inch engine

High performance	IL
High performance and triple carburetion	IM
High performance, triple carburetion, Turbo Hydro-Malic	IO
Turbo Hydra-Matic	IQ
Special high performance and triple carburetion	IR
High performance	IT
Special high performance, triple carburetion, aluminum heads	ID

1969 350 cubic inch engine

High performance	HW
High performance and A/C	HX
Manual transmission	HY
Turbo Hydra-Matic	HZ

427 cubic inch engine

High performance, Turbo Hydra-Matic	LL
High performance	LM
Triple carburetion, high performance, Turbo Hydra-Matic	LN
Heavy duty (L88)	LO
Aluminum heads	LP
Triple carburetion and high performance	LQ
Triple carburetion and special high performance	LR

Engine Identification (cont.)

427 cubic inch engine

Triple carburetion, special high performance, heavy duty clutch Heavy duty and Turbo	LU
Hydra-Matic Triple carburetion, special high	LV
performance, Turbo Hydra-Matic	LX

1970 350 cubic inch engine

Manual transmission	CTL
Turbo Hydra-Matic	CTM
High performance	CTN
High performance and A/C/	CTO
High performance and transistor ignition	CTP
High performance, transistor ignition, A/C	CTQ
Special high performance	CTR
Special high performance and transistor ignition	CTU
Special high performance, transistor ignition, 4-speed	CTV
High performance, 4-bbl carburetor, Turbo Hydra-Matic	CZN
High performance, 4-bbl carburetor, transistor ignition	CRI

454 cubic inch engine

High performance, 4-bbl carburetor, Turbo Hydra-Matic	CGW
High performance and 4-bbl	
Heavy duty with 4-bbl	CZU
Heavy duty with 4-bbl and Turbo Hydra-Matic	CZL
High performance, 4-bbl, transistor ignition	CZN
	CRI

1971 350 cubic inch engine

270 hp, 4-speed 270 hp, THM 330 hp, 4-	CJL
speed 330 hp, THM 330 hp, 4-speed (HD)	CGT
	CGZ
	CJK

454 cubic inch engine

	CGY
365 hp, THM 365 hp, 4-speed 425 hp, 4-	CPJ
speed 425 hp, THM	CPH
	CPW
	CPX

1972 350 cubic inch engine

200 hp with 4-speed	CKW
200 hp with 4-speed and NOX control (Calif.)	CDH
200 hp with Turbo Hydra-Matic 200 hp with	CKX
Turbo Hydra-Matic and NOX control (Calif.) 255 hp with 4-speed 255 hp	CDJ
with Turbo Hydra-Matic 255 hp with 4-speed	CKY
and A.I.R. 255 hp with Turbo Hydra-Matic and	CKZ
A.I.R.	CRT
	CRS

Engine Identification (cont.)

454 cubic Inch engine

270 hp with 4-speed	CPH
270 hp with Turbo Hydra-Matic	CPJ
270 hp	CSR.C

1973 350 cubic inch engine

190 hp with 4-speed	CKZ
190 hp with 4-speed (Calif.)	CLB
190 hp with Turbo Hydra-Malic	CLA
190 hp with Turbo Hydra-Matic (Calif.)	CLC
250 hp with 4-speed	CLR
250 hp with 4-speed (Calif.)	CIS
250 hp with Turbo Hydra-Matic	CLD
250 hp with Turbo Hydra-Malic (Calif.)	CLH

454 cubic inch engine

275 hp with 4-speed	CWM
275 hp with 4-speed (Calif.)	CWT
275 hp with Turbo Hydra-Matic	CWR
275 hp with Turbo Hydra-Matic (Calif.)	CWS

1974 350 cubic inch engine

195 hp with 4-speed	CKZ
195 hp with 4-speed (Calif.)	CLB
195 hp with Turbo Hydra-Matic	CLA
195 hp with Turbo Hydra-Matic (Calif.)	CLC
250 hp with 4-speed	CLR
250 hp with 4-speed (Calif.)	CLS
250 hp with Turbo Hydra-Matic	CLD
250 hp with Turbo Hydra-Matic (Calif.)	CLH

454 cubic inch engine

270 hp with 4-speed	CWM
270 hp with 4-speed (Calif.)	CWT
270 hp with Turbo Hydra-Matic	CWR
270 hp with Turbo Hydra-Matic (Calif.)	CWS

1975 350 cubic inch engine

195 hp with 4-speed	CRJ, CUA, CUB
195 hp with Turbo Hydra-Matic	CRK
250 hp with 4-speed	CRL, CUT, CUD
250 hp with Turbo Hydra-Matic	CRM

1976 350 cubic inch engine

180 hp, 210 hp	CLM, CLR, CLS, CKW, CKX, CLS, CHC, CHR, CKC

1977 350 cubic inch engine

180 hp, 210 hp	CKZ, CLA, CLB, CLC, CHD, CKD, CLD, CLF

1978 350 cubic inch engine

185 hp (Calif.)	CLR
185 hp (high altitude)	CLS

Engine Identification (cont.)

1978 350 cubic inch engine

185 hp AT. (Fed.) 185hpM.T. 225 hp M.T. 225hpA.T.	CUT CLM CMR CMS

1979

195 hp (Calif.)	ZAC
195 hp with 4-speed	ZAA
195 hp with Turbo Hydra-Matic	ZAB
195 hp (High altitude)	ZAD
225 hp with 4-speed	ZBA
225 hp with Turbo Hydra-Matic	ZBB

1980

305 engine Std. 350 eng. (L48) w/M.T. Std. 350 eng. (L48) W/A.T. Hi Pert. 350 eng. (L82) w/M.T. Hi pert. 350 eng. (L82) w/A.T.	ZCA ZAM ZAK ZBD ZBC

1981

Federal models w/M.T. Calif, models w/M.T. Federal models w/AT. Calif, models w/A.T.	ZDA ZDC ZDD ZDB

1982

Federal models Calif, models	ZBA ZBC

1984

350 (L83) 5.7L EFI	ZFC, ZFD, ZFF, ZFN, ZFM

Transmission

THREE-SPEED MANUAL

The Muncie 3-speed serial number is located on a boss above the filler plug. The Borg-Warner T-16, 3-speed serial number is located on a boss at the right rear corner of the transmission extension.

FOUR-SPEED MANUAL

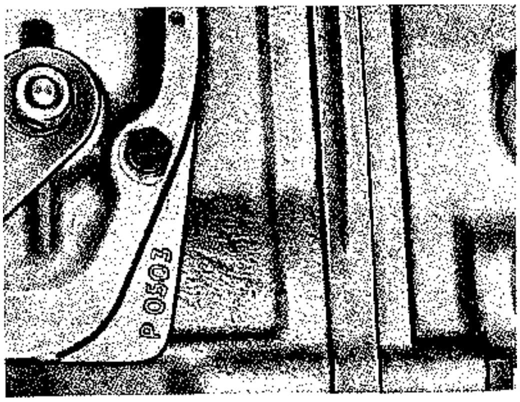
Serial numbers of 4-speed transmissions used in models prior to 1979 are located at one of the three following locations: left side cover flange; left side of the case to the rear of the cover; or the left side of the case below the side cover.

1979 and later transmission I.D. numbers are located on a flange at the right side top of the case.

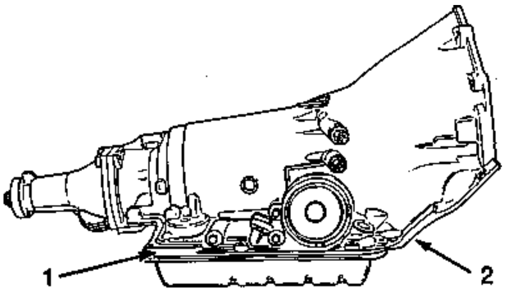
TURBO HYDRA-MATIC

1978 and prior THM 350 serial numbers are located on the right side vertical face of the transmission oil pan.

1979 and later 3-speed automatic transmissions are coded either on the right side of the case above the front of the oil pan or on the case above the left rear of the oil pan. The THM 400 and the THM 700-R4 4-speed automatic transmissions serial number is located on a tag attached to the transmission case above the right rear corner of the oil pan.



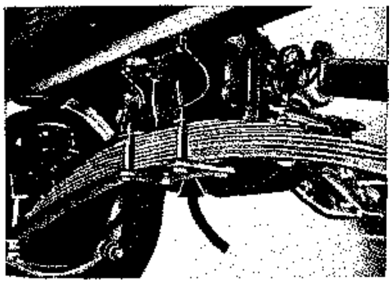
Muncie 4-speed serial number location



Typical automatic transmission stamped serial number location (1) and VIN number location (2)

Rear Axle

All Corvette Stingrays have the rear axle serial number located on the bottom surface of the carrier at the cover mounting flange. The two or three-letter prefix in the serial number identifies the rear-axle gear ratio.



Rear axle serial number

Rear Axle Ratio Identification

Year	Prefix	Axle Ratio and Type
1963-64	CA	3.36 with 3-speed
	CJ	3.08 Positraction
	CB	3.36 Positraction
	CC	3.55 Positraction
	CD	3.70 Positraction
	CE	4.11 Positraction
	CF	4.56 Positraction
	CZ	3.08 with 4-speed
	CX	3.70 with 4-speed
1965	AK	3.36
	AL	3.08 Positraction
	AM	3.36 Positraction
	AN	3.55 Positraction
	AO	3.70 Positraction
	AP	4.11 Positraction
	AQ	4.56 Positraction
	AR	3.08
	AS	3.70 with 4-speed 3.08
	AT	Positraction with 396 engine 3.36
	AU	Positraction with 396 engine 3.55
	AZ	Positraction with 396 engine 3.70
	FA	Positraction with 396 engine 4.11
	FB	Positraction with 396 engine 4.56
	FC	Positraction with 396 engine
1966	AK	3.36
	AL	3.08 Positraction
	AM	3.36 Positraction
	AN	3.55 Positraction
	AO	3.70 Positraction
	AP	4.11 Positraction
	AR	3.08 Positraction
	AS	3.70 with 4-speed 3.08
	AT	Positraction with 427 engine 3.36
	AU	Positraction with 427 engine 3.55
	AZ	Positraction with 427 engine 3.70
	FA	Positraction with 427 engine 4.1 1
	FB	Positraction with 427 engine 4.56
	FC	Positraction with 427 engine
1967	AK	3.36
	AL	3.08 Positraction
	AM	3.36 Positraction
	AN	3.55 Positraction
	AO	3.70 Positraction
	AP	4.11 Positraction
	AS	3.70 with 4-speed 3.08
	AT	Positraction with 427 engine 3.36
	AU	Positraction with 427 engine 3.55
	AZ	Positraction with 427 engine

Rear Axle Ratio Identification (cont.)

Year	Prefix	Axle Ratio and Type
	FA	3.70 Positraction with 427 engine
	FB	4.1 1 Positraction with 427 engine
	FC	4.36 Positraction with 427 engine
1968	AK	3.36"
	AL	3.08 'Positraction
	AM	3.36 Positraction
	AN	3.55 Positraction
	AO	3.70 Positraction
	AP	4.11 Positraction
	AS	3.70
	AT	3.08 Heavy duty Positraction
	AU	3.36 HeaVy dutv Positraction
	AV	3.08 Positraction
	AW	3.08 Heavy duty Positraction
1969	AK	3.36
	AL	3.08 Positraction
	AM	3.36 Positraction
	AN	3.55 Positraction
	AO	3.70 Positraction
	AP	4.11 Positraction
	AS	3.70
	AT	3.08 Heavy duty Positraction
	AU	3.36 Heavy duty Positraction
	AV	3.08
	AW	3.08 Heavy duty Positraction
	AY	2.73 Heavy duty Positraction
	AZ	3.55 Heavy duty Positraction
	FA	3.70 Heavy duty Positraction
	FB	4.11 Heavy duty Positraction
	FC	4.56 Positraction
1970	CAK	3.36
	CAL	3.08 Positraction
	CAM	3.36 Positraction
	CAN,	3.55 Positraction
	CAO, CAS	3.70 Positraction with high performance 350 and close-ratio 4-speed
	CAP	4.11 Positraction
	CAT	3.08 Positraction
	CAU	3.36 Positraction
	CAV	3.08 Positraction
	CAW	3.08 Positraction with Turbo Hydra-Matic
	CAY	2.73 Positraction
	CAX	3.36 Positraction with Turbo Hydra-Matic
	CAZ	3.55 Positraction
	CFA	3.70 Positraction
	CFB	4.11 Positraction
	CFC	4.56 Positraction
	CLR	3.36 Positraction
1971	AA	3.55 Positraction
	AB	3.70 Positraction
	AC	4.11 Positraction
	AD	4.56 Positraction
	AW	3.08 Positraction
	AX.LR	3.36 Positraction

Rear Axle Ratio Identification (cont.)

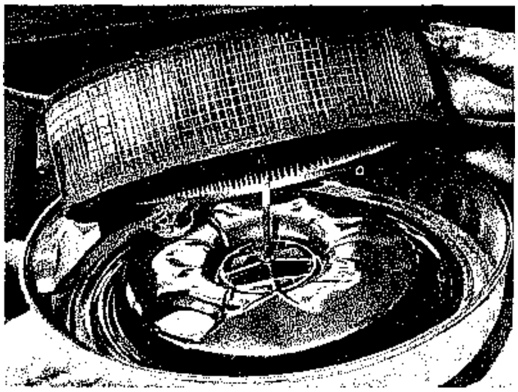
Year	Prefix	Axle Ratio and Type
1972-75	AX, LR	3.36 Positraction
	AC AB	4.11 Positraction
	AA AW	3.70 Positraction
	AV	3.55 Positraction
		3.08 Positraction
		2.73 Positraction
1976-77	OA LR,	3.08 Positraction
	OD OB	3.36 Positraction
	OC	3.55 Positraction
		3.70 Positraction
1978	OK	3.08 Positraction
	OM	3.36 Positraction
	OH	3.55 Positraction
	OJ	3.70 Positraction
1979	OM	3.36 Positraction
	OH	3.55 Positraction
	OJ	3.70 Positraction
1980	DANA	3.07 Positraction
1981	OJ	2.87 Positraction w/A.T.
	OK	2.72 Positraction w/M.T.
1982	DANA	2.87 Positraction
1984	DANA	3.07 Positraction
		3.31 Positraction

ROUTINE MAINTENANCE Air

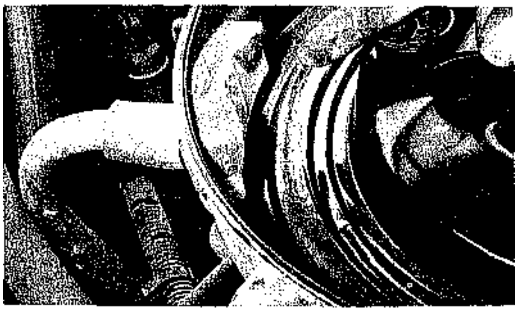
Cleaner

The air cleaner consists of a metal housing for a replaceable paper filter or permanent polyurethane element and the necessary hoses connecting it to the crankcase ventilation system. The air cleaner cover is held by a wing nut on all models. If your Corvette is equipped with a paper element, the factory recommends it should be replaced once every 12,000 miles (1963-72), every 24,000 miles (1973-74), every 30,000 miles (1975-84). Inspection and replacement should come more often when the car is operated under dusty conditions. To check the effectiveness of your paper element, remove the air cleaner assembly and, if the idle speed increases noticeably, the element is restricting airflow and should be replaced. Some high-performance models or cars equipped with optional air cleaners use a polyurethane element that must be removed, cleaned, and reoiled at 12,000 mile or 12 month intervals. Remove the filter and clean it in kerosene. Do not use paint thinner or similar solvent and then squeeze it dry. Allow it to soak in SAE 30 oil

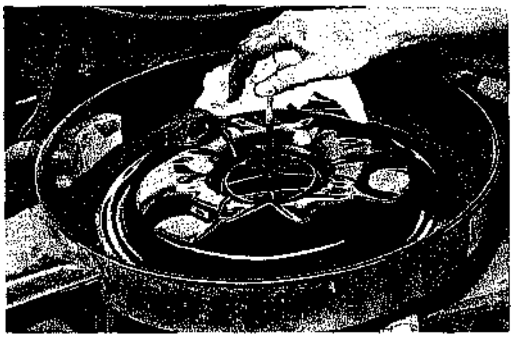
Unscrew the wing nut and remove the cover



Remove and discard the old filter

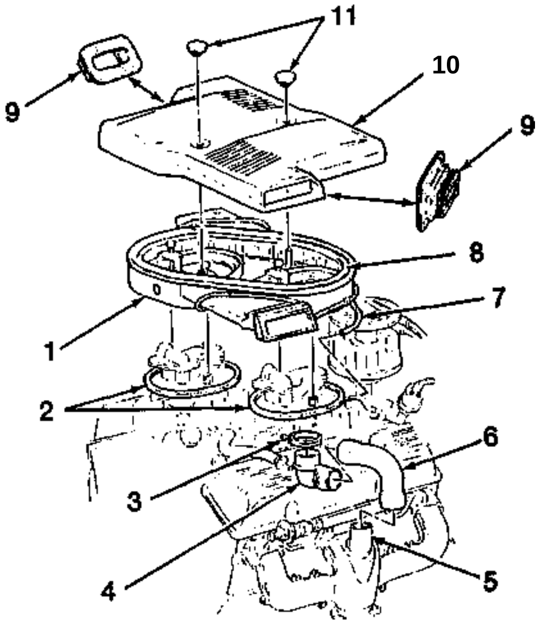


Check the small crankcase breather



Using a clean rag or a paper towel, wipe out the inside of the air cleaner

and again squeeze it dry using a clean cloth to remove excess oil. Clean the inside of the air cleaner housing before reinstalling either type of filter.

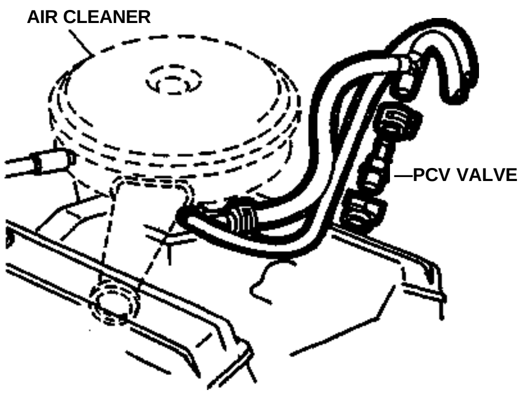


1. Air cleaner assembly
2. Gasket
3. Hose clamp
4. Heat stove adapter
5. Heat stove
6. Heat stove tube
7. Manifold vacuum hose
8. Air filter element
9. Hood seal
10. Air cleaner cover
11. Knurl nuts

Air cleaner assembly—1984 TBI shown

Positive Crankcase Ventilation (PCV)

The PCV valve is screwed into the carburetor or located in the ventilation hose on 1963 models. 1964 and 1965 models are not equipped with a PCV valve, but use a metered orifice fitting instead. This is not replaced, as it is a permanent part of the system, but it should be cleaned with solvent as a part of regular maintenance. The PCV valve



The PCV valve is located in the rocker arm cover on later models

is located in the hose or in the rocker cover on later models. Replace the PCV valve and if so equipped the PCV filter, located in the air cleaner, every 12,000 miles (1963-71), every 24,000 miles (1972-74), every 30,000 miles (1975-84).

Evaporative Emissions Control System

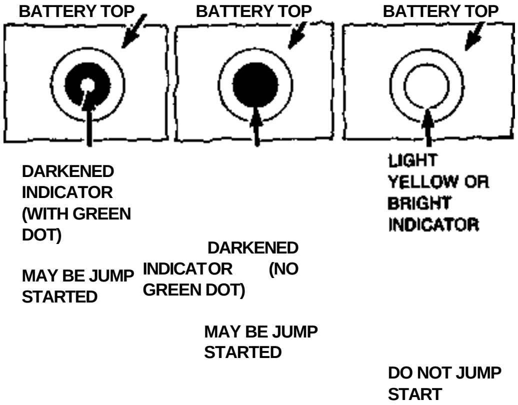
This system, standard since 1970, eliminates the release of unburned fuel vapors into the atmosphere. The only periodic maintenance required is an occasional check of the connecting lines of the system for kinks or other damage and deterioration. Lines should be replaced only with quality fuel line or special hose marked "evap." Every 12,000 miles or 12 months (1970-71), every 24,000 miles or 24 months (1972-74), every 30,000 miles or 24 months (1975-81), the filter in the bottom of the carbon canister which is located in the engine compartment should be removed and replaced. This service is not required on 1982 and later models.

Battery

The major cause of slow engine cranking or a "no-start" condition is battery terminals which are loose, dirty, or corroded. Every 3 months or so, disconnect the battery and clean the terminals of both the battery and the cables. Cleaning tools for this purpose are available at most any auto parts store. When you buy a cleaning tool, be sure to specify whether you have a top terminal or side terminal battery, as the type of tool differs depending upon the style of battery. After you clean the terminals and reconnect the battery, apply a corrosion inhibitor to the terminals. Stay away from using any substance which is not meant specifically for this purpose. Do not apply the corrosion inhibitor to the mating surfaces of the terminals unless specified by the chemical manufacturer.

Batteries themselves can be cleaned using a solution of baking soda and water. Surface coatings on battery cases can actually conduct electricity which will cause a slight voltage drain, so make sure the battery case is clean.

Unless you have a "maintenance-free" battery, check the electrolyte level in the battery (see Battery under Fluid Level Checks in this chapter). Be sure that the vent holes in the caps and the vent tubes are not blocked with grease or dirt. The vent system allows



Maintenance-free batteries contain their own built-in hydrometer

hydrogen gas, formed by the chemical reaction in the battery, to escape freely. If your vehicle is equipped with a Delco Freedom® or Freedom II® battery, check the color of the battery condition indicator (which is actually a built-in hydrometer). If the indicator is green, the battery is sufficiently charged and in good condition. If the indicator is darkened, the battery is discharged. In this case, the reason for die discharge should be determined (e.g.—low alternator output, voltage draw, etc.) then the battery itself should be tested and recharged. If the indicator is light without a green dot visible or if it is yellow in color, the battery must be replaced—DO NOT attempt to test or recharge a battery with this indicator condition. Test the electrical system after the battery has been replaced. CAUTION: *On later models with electronic engine controls, the electrical system and control unit can be quickly damaged by improper connections, high-output battery chargers or incorrect service procedures.*

Check the battery cables for signs of wear or chafing. If corrosion is present on the cable or if the cable is visible through the cable jacket, the cable assembly should be replaced. If cable replacement is necessary, it is best to purchase a high-quality cable that has the cable jacket sealed to tite terminal ends. See "Jump Starting" for more information.

REPLACEMENT BATTERIES

The cold power rating o of a battery measures battery starting performance and provides an approximate relationship between battery size and engine size. The cold power rating of a replacement battery should match or exceed your engine size in cubic inches. Replace the battery tray, if corroded excessively.

Heat Riser

The heat riser is a thermostatically or vacuum operated valve in the exhaust manifold. Not all engines have one. It closes when the engine is warming up, to direct hot exhaust gases to the intake manifold, in order to preheat the incoming fuel/air mixture. If it sticks shut, the result will be frequent stalling during warmup, especially in cold and damp weather. If it sticks open, the result will be a rough idle after the engine is warm. There is only one heat riser on a V8. The heat riser should move freely. If it sticks, apply GM Manifold Heat Control Solvent or something similar (engine cool) to the ends of the shaft. Sometimes rapping the end of the shaft sharply with a hammer (engine hot) will break it loose. If this fails, components must be removed for further repairs. See "Exhaust Manifold" for removal procedures.

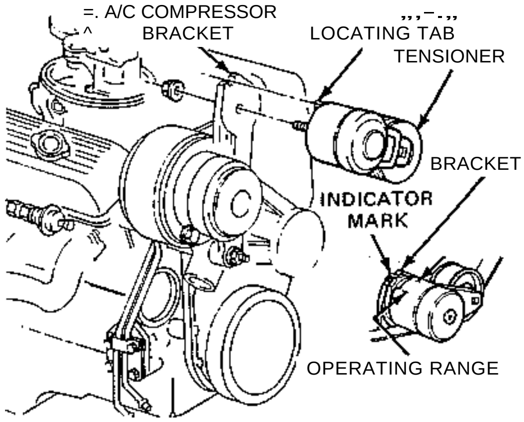
Drive Belts

CHECKING AND ADJUSTING TENSION

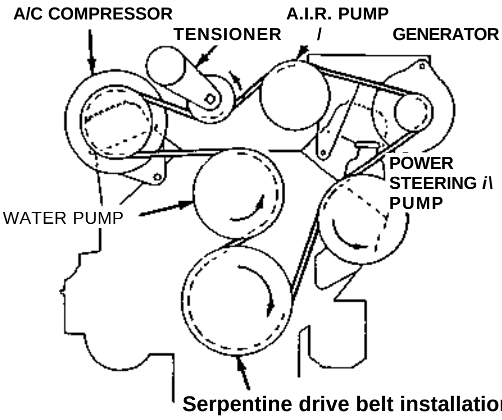
Check the drive belts every 6,000 miles for evidence of wear such as cracking, fraying, and incorrect tension. Determine the belt tension at a point halfway between the pulleys by pressing on the belt with moderate thumb pressure. The belt should deflect about *V** inch at this point. If the deflection is found to be too much or too little, loosen the mounting bolts and make the adjustments.

On all 1984 and later engines, a single serpentine belt is used to drive all accessories formerly driven with V-belts. Belt tension is maintained by a spring loaded tensioner which has the ability to maintain belt tension over a broad range of belt lengths. There is an indicator to make sure the tensioner is adjusted to within its operating range. The belt tension is adjusted with a *Vz* inch breaker bar inserted into the square hole in the tensioner arm and a belt tension gauge (BT 7825 or equivalent) to 120—140 Ibs, as read on the tension gauge installed between the alternator and the A.I.R. pump.

Measuring fan belt tension



Serpentine drive belt tensioner—1984 and later



Serpentine drive belt installation

Cooling System

CAUTION: *Do not perform any coolant system services on a hot engine.*

At least once every 2 years, the engine cooling system should be inspected, flushed, and refilled with fresh coolant. If the coolant is left in the system too long, it loses its ability to prevent rust and corrosion. If the coolant has too much water, it won't protect against freezing.

The pressure cap should be looked at for signs of age or deterioration. Fan belt and other drive belts should be inspected and adjusted to the proper tension. (See checking belt tension).

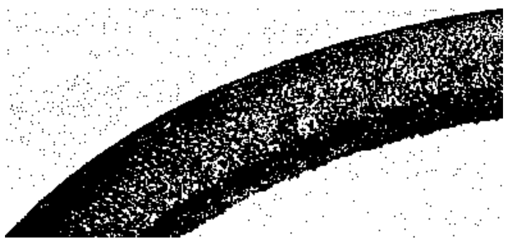
Hose clamps should be tightened, and soft or cracked hoses replaced. Damp spots, or accumulations of rust or dye near hoses, water

HOW TO SPOT WORN V-BELTS

V-Belts are vital to efficient engine operation—they drive the fan, water pump and other accessories. They require little maintenance (occasional tightening) but they will not last forever. Slipping or failure of the V-belt will lead to overheating. If your V-belt looks like any of these, it should be replaced.

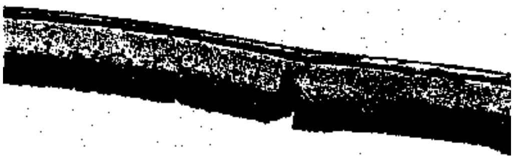
This belt has deep cracks, which cause it to flex. Too much flexing leads to heat build-up and premature failure. These cracks can be caused by using the belt on a pulley that is too small. Notched belts are available for small diameter pulleys.

Cracking or weathering



Oil and grease on a belt can cause the belt's rubber compounds to soften and separate from the reinforcing cords that hold the belt together. The belt will first slip, then finally fail altogether.

Softening (grease and oil)

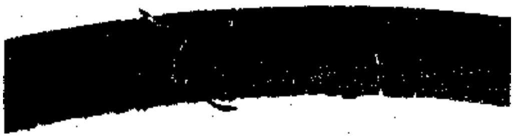


Glazing is caused by a belt that is slipping. A slipping belt can cause a run-down battery, erratic power steering, overheating or poor accessory performance. The more the belt slips, the more glazing will be built up on the surface of the belt. The more the belt is glazed, die more it will slip. If the glazing is light, tighten the belt.

Glazing

The cover of this belt is worn off and is peeling away. The reinforcing cords will begin to wear and the belt will shortly break. When the belt cover wears in spots or has a rough jagged appearance, check the pulley grooves for roughness.

Worn cover

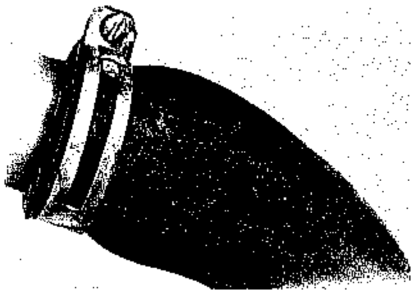


This belt is on the verge of breaking and leaving you stranded. The layers of the belt are separating and the reinforcing cords are exposed. It's just a matter of time before it breaks completely.

Separation

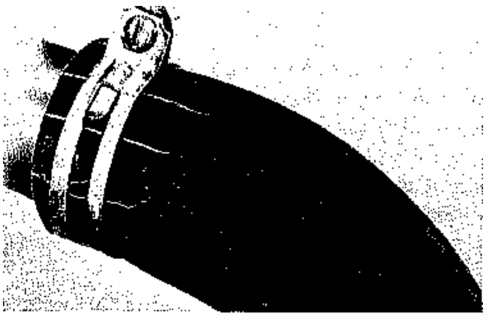
HOW TO SPOT BAD HOSES

Both the upper and lower radiator hoses are called upon to perform difficult jobs in an inhospitable environment. They are subject to nearly 18 psi at under hood temperatures often over 280°F., and must circulate nearly 7500 gallons of coolant an hour—3 good reasons to have good hoses.



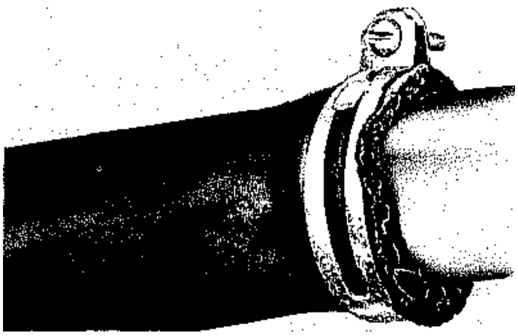
Swollen hose

A good test for any hose is to feel it for soft or spongy spots. Frequently these will appear as swollen areas of the hose. The most likely cause is oil soaking. This hose could burst at any time, when hot or under pressure.



Cracked hose

Cracked hoses can usually be seen but feel the hoses to be sure they have not hardened; a prime cause of cracking. This hose has cracked down to the reinforcing cords and could split at any of the cracks.



Frayed hose end (due to weak clamp)

Weakened clamps frequently are the cause of hose and cooling system failure. The connection between the pipe and hose has deteriorated enough to allow coolant to escape when the engine is hot.

Debris In cooling system

Debris, rust and scale in the cooling system can cause the inside of a hose to weaken. This can usually be felt on the outside of the hose as soft or thinner areas.

pump or other areas, indicate possible leakage, which must be corrected before filling die system with fresh coolant.

CHECK *THE RADIATOR CAP*

While you are checking me coolant level, also check the condition of the radiator cap gasket and the seal inside of the cap (if your vehicle uses a coolant recovery system). The radiator cap is designed to seal the cooling system under normal operating conditions which allows the system to build-up a certain amount of pressure (this pressure rating is stamped or printed on the cap). The pressure in the system raises the boiling point of the coolant to help prevent overheating. If the radiator cap does not seal, the boiling point of the coolant is lowered and overheating will occur. If the cap must be replaced, purchase the new cap according to the type of system you have (with or without a coolant recovery tank) and the pressure rating which is specified for your vehicle.

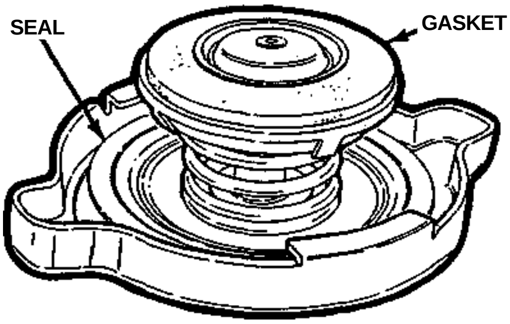
CLEAN RADIATOR OF DEBRIS

Periodically clean any debris—leaves, paper, insects, etc.—from the radiator fins. Pick the large pieces off by hand. The smaller pieces can be washed away with water pressure from a hose.

Carefully straighten any bent radiator fins with a pair of needle nose pliers. Be careful—the fins are very soft. Don't wiggle the fins back and forth too much. Straighten them once and try not to move them again.

DRAIN AND REFILL THE COOLING SYSTEM

Completely draining and refilling the cooling system every two years at least will remove accumulated rust, scale and other deposits. Coolant in late model cars is a 50-50 mixture of ethylene glycol and water for year round use. Use a good quality antifreeze with water pump lubricants, rust inhibitors and other corrosion inhibitors along with acid neutralizers.



Check the radiator cap's rubber gasket and metal seal for deterioration at least once a year

1. Drain the existing antifreeze and cool ant. Open the radiator and engine drain petcocks, or disconnect die bottom radiator hose, at the radiator outlet.

NOTE: *Before opening the radiator petcock, spray it with some penetrating lubricant.*

2. Close the petcock or re-connect the lower hose and fill the system with water.
3. **Add a can of quality radiator flush.**
4. Idle the engine until the upper radia tor hose gets hot.
5. Drain the system again.
6. Repeat this process until the drained water is clear and free of scale.
7. Close all petcocks and connect all the hoses.
8. If equipped widi a coolant recovery system, flush die reservoir witii water and leave empty.
9. Determine die capacity of your cool ing system (see capacities specifications). Add a 50/50 mix of quality antifreeze (ethylene glycol) and water to provide die desired pro tection.
10. Run die engine to operating tempera ture.
11. Stop die engine and check die coolant level.
12. Check die level of protection with an anti-freeze tester, replace die cap and check for leaks.

Air Conditioning

SAFETY PRECAUTIONS

There are two particular hazards associated widi air conditioning systems and diey bodi relate to die refrigerant gas.

First, die refrigerant gas is an extremely cold substance. When exposed to air, it will instantly freeze any surface it comes in contact widi, including your eyes. The odier hazard relates to fire. Ahhough normally nontoxic, refrigerant gas becomes highly poisonous in die presence of an open flame. Inhalation of die vapor formed by burning refrigerant can be fetal. Keep all forms of fire (including cigarettes) well clear of die air-conditioning system.

Any repair work to an air conditioning system should be left to a professional. Do not, under any circumstances, attempt to loosen or tighten any fittings or perform any work other than that outlined here.

CHECKING FOR OIL LEAKS

Refrigerant leaks show up as oily areas on the various components because the compressor oil is transported around the entire system along with the refrigerant. Look for oily spots on all the hoses and lines, and especially on the hose and tubing connections. If there are oily deposits, the system may have a leak, and you should have it checked by a qualified repairman.

NOTE: A *small area of oil on the front of the compressor is normal and no cause for alarm.*

CHECK THE COMPRESSOR BELT

Refer to the section in this chapter on "Drive Belts."

KEEP THE CONDENSER CLEAR

Periodically inspect the front of the condenser for bent fins or foreign material (dirt, buts, leaves, etc.) If any cooling fins are bent, straighten them carefully with needlenosed pliers. You can remove any debris with a stiff bristle brush or hose.

OPERATE THE AIC SYSTEM PERIODICALLY

A lot of A/C problems can be avoided by simply running the air conditioner at least once a week, regardless of the season. Simply let the system run for at least 5 minutes a week (even in the winter), and you'll keep the internal parts lubricated as well as preventing the hoses from hardening.

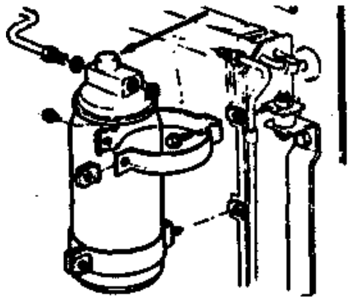
REFRIGERANT LEVEL CHECK

There are two ways to check refrigerant level, depending on how your model is equipped.

With Sight Glass

The first order of business when checking the sight glass is to find the sight glass. It will either be in the head of the receiver/drier, or in one of the metal lines leading from the top of the receiver/drier. Once you've found it, wipe it clean and proceed as follows:

1. With the engine and the air conditioning system running, look for the flow of refrigerant through the sight glass. If the air conditioner is working properly, you'll be able to see a continuous flow of clear refrigerant through the sight glass, with perhaps an occasional bubble at very high temperatures.



Air conditioning sight glass

2. Cycle the air conditioner on and off to make sure what you are seeing is clear refrig erant. Since the refrigerant is clear, it is pos sible to mistake a completely discharged sys tem for one that is fully charged. Turn the system off and watch the sight glass. If there is refrigerant in the system, you'll see bub bles during the off cycle. If you observe no bubbles when the system is running, and the air flow from the unit in the car is delivering cold air, everything is OK.
3. If you observe bubbles in the sight glass while the system is operating, the system is low on refrigerant. Have it checked by a professional.
4. Oil streaks in the sight glass are an in dication of trouble. Most of the time, if you see oil in the sight glass, it will appear as a series of streaks, although occasionally it may be a solid stream of oil. In either case, it means that part of the charge has been lost.

Without Sight Glass

On vehicles that are not equipped with sight glasses, it is necessary to feel the temperature difference in the inlet and outlet lines at the receiver/drier to gauge the refrigerant level. Use the following procedure:

1. Locate the receiver/drier. It will gen erally be up front near the condenser. It is shaped like a small fire extinguisher and will always have two lines connected to it. One line goes to the expansion valve and the other goes to the condenser.
2. With the engine and the air conditioner running, hold a line in each hand and gauge their relative temperatures. If they are both the same approximate temperature, the sys tem is correctly charged.
3. If the line from the expansion valve to the receiver/drier is a lot colder than the line from the receiver/drier to the condenser, then the system is overcharged. It should be noted that this is an extremely rare condition.

4. If the line that leads from the re ceiver/drier to the condenser is a lot colder than the other line, the system is under charged.

5. If the system is undercharged or over charged, have it checked by a professional air conditioning mechanic.

Windshield Wipers

Intense heat from the sun, snow and ice, road oils and the chemicals used in windshield washer solvents combine to deteriorate the rubber wiper refills. The refills should be replaced about twice a year or whenever the blades begin to streak or chatter.

WIPER REFILL REPLACEMENT

Normally, if the wipers are not cleaning the windshield properly, only the refill has to be replaced. The blade and arm usually require replacement only in the event of damage. It is not necessary (except on new Tridon refills) to remove the arm or the blade to replace the refill (rubber part), though you may have to position the arm higher on the glass. You can do this turning the ignition switch on and operating the wipers. When they are positioned where they are accessible, turn the ignition switch off.

There are several types of refills available and your vehicle could have any kind, since aftermarket blades do not necessarily use the same refill as original equipment blades. The two most popular original equipment types are what we refer to .as the first and the third types. The remaining styles are used mainly as aftermarket replacements.

The first type of blade uses a release button that is pushed down to allow the refill to slide out of the yoke jaws. The new refill slides in and locks in place.

The second type of refill is removed by locating where the metal backing strip (or where the refill) is wider and inserting a small screwdriver between the frame and the metal backing strip. Press down to release the refill from the retaining tab.

The third type of refill is replaced by squeezing the two metal tabs located at the end of the refill and sliding the refill out of the frame jaws. When the new refill is installed, the tabs will click into place and lock the refill.

The fourth type of refill is termed the "polycarbonate type." The refill of this type is held into place by a locking lever which is pushed downward out of the groove in the arm to free the refill. The new refill will lock into place automatically as it is installed.

The fifth type of refill is used with the Tridon blade. The Tridon refill has a plastic backing strip with a notch about an inch from the end. Hold the blade (frame) on a hard surface so that it is tightly bowed. Grip the tip of the backing strip and pull upward while twisting counterclockwise. The backing strip will snap out of the retaining tab. Do this for the remaining tabs until the refill is free of the arm. The refills must be replaced with identical new refills.

No matter what type of refill is used, be sure that all of the frame claws engage the refill. Before operating the wipers, be sure that no part of the metal frame contacts the windshield glass.

Fluid Level Checks

ENGINE OIL

The engine oil level is checked with the dipstick, which is located either on the left side of the engine (small-blocks) or the right side of the engine (big-blocks).

NOTE: *The oil should be checked before the engine is started or five minutes after the engine has been shut off. This gives the oil time to drain back to the oil pan and prevents an inaccurate oil level reading.*

Remove the dipstick from its tube, wipe it clean, and insert it back into the tube. Remove it again and observe the oil level. It should be maintained between the "full" and "add" marks without going above "full" or below "add."

CAUTION: *Do not overfiU the crankcase. It may result in oil-fouled spark plugs, oil leaks caused by oil seal failure, or engine damage due to foaming of the oil.*

MANUAL TRANSMISSION FLUID

Remove the filler plug from the side of the transmission (the upper plug if the transmission has two plugs). The oil should be level with the bottom edge of the filler hole. This should be checked at least once every 6,000 miles and more often if any leakage or seepage is observed. Fill with SAE 80 or 90 multipurpose gear lubricant.

NOTE: *The 4 speed overdrive transmission uses two types of fluid. See "Lubrication" for details.*

AUTOMATIC TRANSMISSION FLUID

Run the engine until it reaches normal operating temperature. Park the car on a level surface. With the transmission in Park and the engine idling, the fluid level on the dipstick should be between the "foil" mark and *Vt* inch below "foil" mark. Repkce the dipstick making sure that it is pushed folly into the filler tube.

CAUTION: *Do not overfill the automatic transmission. Use Dexron® or Type A automatic transmission fluid or any other equivalent fluid. One pint raises the level from' 'add'to"full"*

(65 -85'F.) (18 -29 C.)
COOL HOT

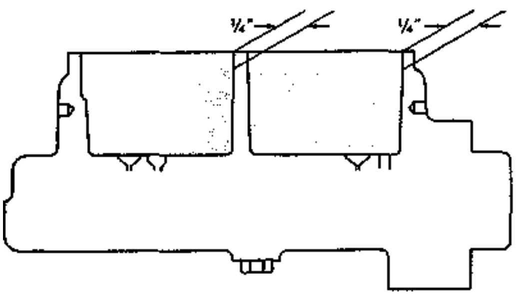
ADD 1 PT.—J ° ≤ i—FULL HOT
!

NOTE: DO NOT OVERf ILL. It takes only one pint to raise level from ADD to FULL with *a* hot transmission.

Automatic transmission dipstick

BRAKE MASTER CYLINDER

Once every 6,000 miles or four months, check the brake fluid level in the master cylinder. The master cylinder is mounted on the firewall and is divided into two reservoirs and the fluid level in each reservoir must be maintained at V4 inch below the top edge. Use only heavy-duty brake fluid (DOT 3 or 4), which is recommended for disc brake applications. See "Brakes" for details.



LEVEL CYLINDER

Checking the master cylinder fluid level

COOLANT

Check the coolant level when the engine is cold. The level of coolant should be maintained 2 in. below the bottom of the filler neck, or the line on expansion tank-equipped models.

CAUTION: *Allow the engine to cool considerably and then add water while the engine is running.*

STANDARD REAR AXLE

The rear axle oil level should be checked when the chassis is lubricated. Remove the plug from the side of the housing. The lubricant level should be maintained at the bottom of the filler plug hole. When repkcing oil, use SAE 80 or 90 multipurpose hypoid gear lubricant.

POSITRACTION REAR AXLE

Lubricant level should be checked at each chassis lubrication and maintained at the bottom of the filler plug hole. Special Positraction oil must be used in this differential.

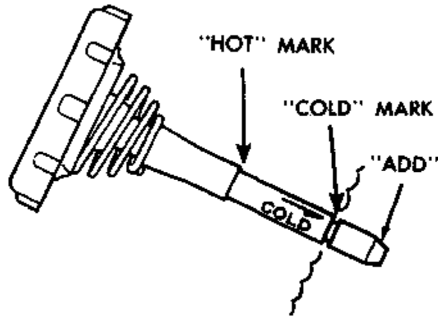
CAUTION: *Never use standard differential lubricant in a Positractton differential.*

MANUAL STEERING GEAR

Check the lubricant by removing the center bolt on the side cover of the steering gear. Grease must be up to the level of this bolt hole.

POWER STEERING RESERVOIR

Maintain the proper fluid level as indicated on the cap of the reservoir. Check this level with the engine off and warm. Use GM power steering fluid or its equivalent. Note: *Avoid using automatic transmission fluid in power steering units except in an emergency.*



Power steering dipstick

Tires

INFLATION PRESSURE

Tire inflation is the most ignored item of auto maintenance. Gasoline mileage can drop as

Capacities & Pressure

Year	Model (cu In.) ©	Engine Crankcase Add 101 for New Filter	Transmission Pts to Refill after Draining: Manual 3-spd	Manual 4-spd	Automatic	fferential (pts)	Fuel Tank (gai)	Cooling System (qts)	Max Coolant Pressure (psi)
1963	327 (hyd. lifters)	4	2	2.5	18	3.7	20	17	13
	327 HP (solid lifters)	5	—	2.5	—	3.7	20	17	13
1964	327 (hyd. lifters)	4	2	2.5	18	3.7	20	17	13
	327 HP (solid lifters)	5	—	2.5	—	3.7	20	17	13
1965	327 (hyd. lifters)	4	2	2.5	18	3.7	20	17	13
	327 (solid lifters)	5	2	2.5	18	3.7	20	17	13
1966	327 (300 hp)	4	3	3.0	18	3.7	20	19	15
	327 HP (350 hp)	5	—	3.0	—	3.7	20	19	15
	427	5	—	3.0	—	3.7	20	22	15
1967	327 (300 hp)	4	3	3.0	19	3.7	20	19	15
	327 HP (350 hp)	5	—	3.0	—	3.7	20	19	15
	427	5	—	3.0	19	3.7	20	22	15
	427 HP	5	—	3.0	—	3.7	20	22	15
1968	327 (300 hp)	4	3	3.0	22	3.7	20	15	15
	327 HP (350 hp)	4	—	3.0	—	3.7	20	15	15
	427	5	—	3.0	22	3.7	20	22	15
	427 HP	5	—	3.0	—	3.7	20	22	15
1969	350 (all)	4	—	3.0	8®	4.0	20	15	15
	427	5	—	3.0	8©	4.0	20	22	15
	427 HP	5	—	3.0	8©	4.0	20	22	15
1970	350 (all)	4	—	3.0	8®	4.0	20	®	15
	454 (all)	5	—	3.0	22	4.0	20	22	15
1971	350 (270 hp)	4	—	3.0	22	4.0	18	15	15
	350 HP (330 hp)	4	—	3.0	—	4.0	18	18	15
	454	5	—	3.0	22	4.0	18	22	15
	454 HP	5	—	3.0	22	4.0	18	20	15
	454					4.0		22	
	350					4.0		IF	
					22				
					8©				
1972	350 (all)	4	—	3.0	22	4.0	18	®	15

	—	3.0			18		15
454	1973 —	3.0	8©	4.0	To" 18	24	15

Capacities & Pressure (cont.)

Year	Model (cuin.)©	Engine Crankcase Add 1 at far New Filler	Transmission Pis to Refill after Draining: Manual 3-spd	Manual 4-spd	Automatic	fferential (pts)	Fuel Tank (gal)	Cooling System (qts)	Max Coolant Pressure (psl)
1974	350	4	—	3.0	8®	4.0	18	17	17
	454	5	—	3.0	8®	4.0	18	22	23
1975-76	350	4	—	3.0	8©	4.0	18	17	17
1977	350	4	—	3.0	8©	3.75	17	21	15
1978	350	4	—	3.0	6©	3.75	24	21.6	15
1979	350.	4	—	3.0®	6©	3.75	24	21.6	15
1980	305, 350	4	—	3.0®	6®	4.0	24	21®	15
1981	350	4	—	3.0®	6®	4.0	24	21®	15
1982	350	4	—	—	10©	4.0	24	21®	15
1984®	350 —		4.0		10®	4.0	20	15	15

® "HP" denotes high performance engine; "hp" denotes horsepower
© For pan removal and filter change only
© 15 qts. for standard engine, 18 qts. with special high performance (L82) engine
® With automatic transmission and air conditioning add 1 qt.
© With optional close-ratio transmission, subtract [1]A qt.
® See "Manual Transmission" for details on 4 speed overdrive

much as .8% for every 1 pound per square inch (psi) of under inflation.

Two items should be a permanent fixture in every glove compartment; a tire pressure gauge and a tread depth gauge. Check the tire air pressure (including the spare) regularly with a pocket type gauge. Kicking the tires won't tell you a thing, and the gauge on the service station air hose is notoriously inaccurate.

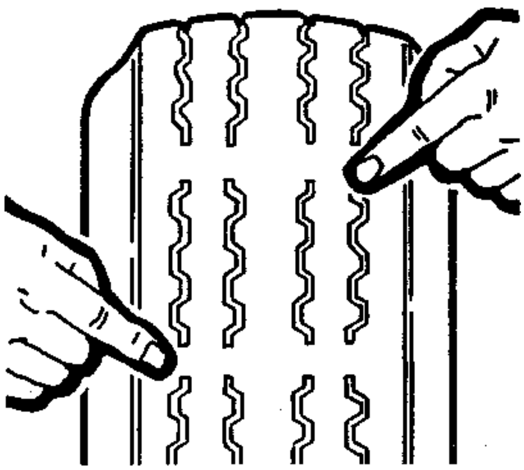
The tire pressures recommended for your car are usually found on the glove-box door or in the owner's manual. Ideally, inflation pressure should be checked when the tires are cool. When the air becomes heated it expands and the pressure increases. Every 10° rise (or drop) in temperature means a difference of 1 psi, which also explains why the tire appears to lose air on a very cold night. When it is impossible to check the tires "cold," allow for pressure build-up due to heat. If the "hot" pressure exceeds the "cold" pressure by more than 15 psi, reduce, your speed, load or both. Otherwise internal heat is created in the tire. When the heat approaches the temperature at which the tire was cured, during manufacture, the tread can separate from the body.

CAUTION: *Never counteract excessive pressure build-up by bleeding affair pressure (letting some air out.) This will only further raise the tire operating temperature.*

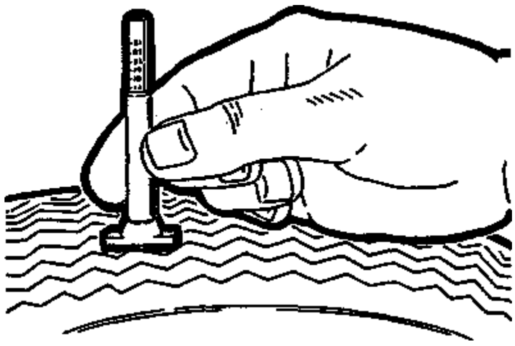
Before starting a long trip with lots of luggage, you can add about 2—4 psi to the tires to make them run cooler, but never exceed the maximum inflation pressure oil the side of the tire.

TREAD DEPTH

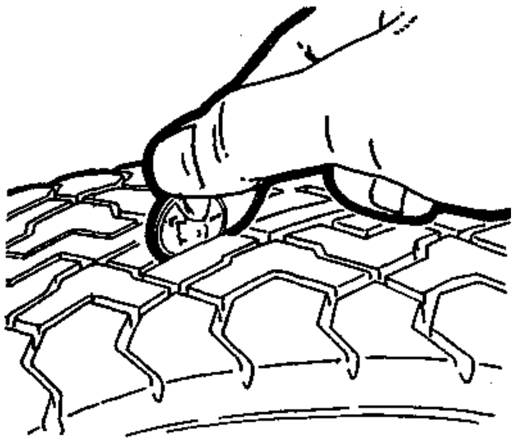
All tires made since 1968, have 8 built-in tread wear indicator bars that show up at *W* wide smooth bands across the tire when Vie" of



Tread wear Indicators will appear when the tire Is worn out



Tread depth can be checked with an Inexpensive gauge



A penny works as weli as anything for checking tread depth; If the top of Lincoln's head Is vlsable In two or more adjacent grooves, the tires should be replaced

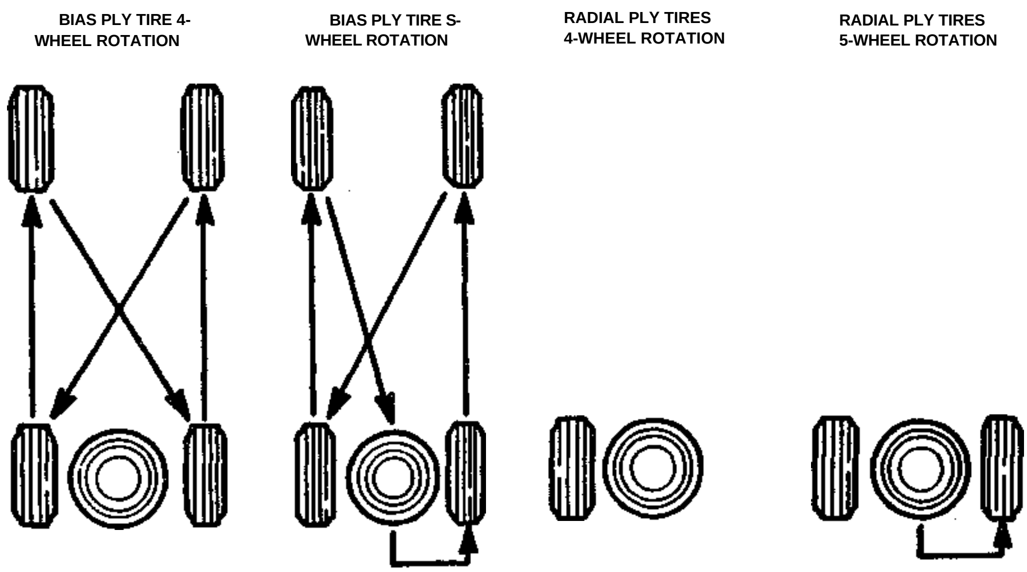
tread remains. The appearance of tread wear indicators means that the tires should be replaced. In feet, many states have laws prohibiting the use of tires with less than Vie" tread. You can check your own tread depth with an inexpensive gauge or by using a Lincoln head penny. Slip the Lincoln penny into several tread grooves. If you can see the top of Lincoln's head in 2 adjacent grooves, the tires have less than Vie" tread left and should be replaced. You can measure snow tires in the same manner by using the "tails" side of the Lincoln penny. If you can see the top of the Lincoln memorial, it's time to replace the snow tires.

TIRE ROTATION

Tire wear can be equalized by switching the position of the tires about every 6000 miles. Including a conventional spare in the rotation pattern can give up to 20% more tire life.
CAUTION: *Do not include the new "Space-Saver®' or temporary spare tires in the rotation pattern.*

There are certain exceptions to tire rotation, however. Studded snow tires should not be rotated, and radials should be kept on the same side of the car (maintain the same direction of rotation). The belts on radial tires get set in a pattern. If the direction of rotation is reversed, it can cause rough ride and vibration.

NOTE: *When radials or studded snows are taken off the car, mark them, so you can maintain the same direction of rotation.*



Tire rotation diagrams; note that radlals should not be cross-switched

TIRE STORAGE

Store the tires at proper inflation pressures if they are mounted on wheels. All tires should be kept in a cool, dry place. If they are stored in the garage or basement, do not let them stand on a concrete floor; set them on strips of wood.

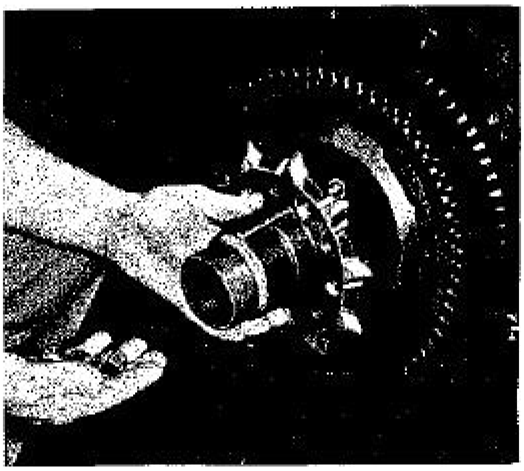
ALUMINUM WHEELS

CAUTION: *If your vehicle has aluminum wheels, whether they are the early "turbine" style or the late (76 and up) slotted style, be VERY careful when using any type of cleaner on either the wheels or the tires. Read the label on the package of the cleaner to make sure that it will not damage aluminum.*

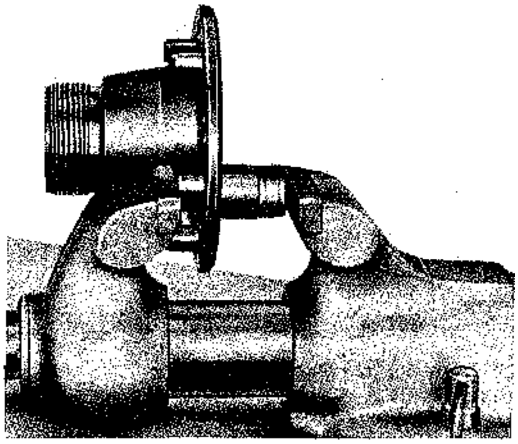
An optional knock-off wheel was introduced with the 1963 Stingray. This wheel option consisted of 15 x 6L cast aluminum wheels, knock-off locking nuts, and wheel adapters. The latter bolt to the hub, using the existing wheel hub bolts. The flange of the adapter had five pins that fitted into corresponding holes in the optional wheels and located the wheel to the hub. The securing device was the single, center, knock-off nut.

Each Corvette delivered with the optional, knock-off aluminum wheels, was equipped with a special knock-off hammer. Owners of these cars were urged to tighten the knock-off nut every 100 miles for the first 500 miles. The suggested method was to strike the ears of the nut eight hard blows.

Should adapter pin replacement become necessary, remove the wheel and tire assembly and remove the adapter from the wheel hub. Select a socket of suitable size that will slip over the adapter pin. Position the socket over the back of the pin and clamp the entire assembly in a vise so that the socket acts as a spacer to receive the damaged pin. Tighten the vise and press the pin from the adapter. Position the replacement pin and start it into the hole by tapping lightly. Position the spacer socket on the opposite side and again clamp the assembly in the vise. Press the replacement pin into the adapter. Check to see that it seats firmly against its bore. Install the adapter and wheel.



Knock-off wheel adapter



Removing adapter pin

NOTE: *The optional 16 in. cast aluminum wheels on 1984 models are designated for right, left, front or rear installation depending on the cooling fins. Rear wheels are one inch wider than the front.*

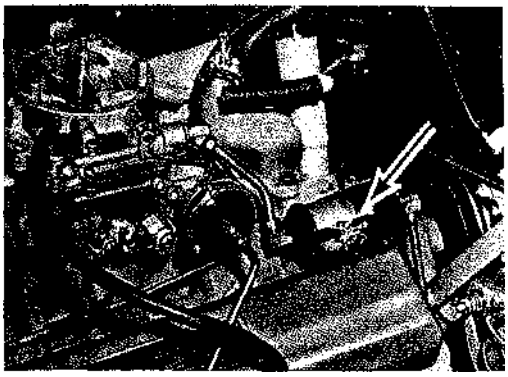
Fuel Filter

The filter in Carter WCFB, Rochester Quadrajet, Holley 2300, and Holley 4150 carburetors is located in the fuel inlet connection and should be replaced at least every 12,000 miles or sooner if engine flooding occurs. The Carter AFB uses an in-line filter, which should be replaced every 24,000 miles. The Rochester and Throttle Body fuel injection uses an in-line filter, which should be replaced every 15,000 miles.

To replace an in-line filter, disconnect the fitting at each end of the filter canister, discard the old filter, and install the replacement in the reverse order of removal.

To replace a fuel inlet filter:

1. Using an open-end wrench (preferably a line wrench), disconnect the fuel line connection from the larger fuel filter nut.
2. Remove the larger nut from the carburetor.



Inline fuel filter

3. Remove the filter element and spring from the carburetor.

4. Check the bronze element for dirt blockage by blowing on the cone end. If the element is good, air should pass through eas-fly.

5. If the car has a paper element instead of a bronze element, check by blowing into the fuel inlet end. If air does not pass through easily replace the element. Do not attempt to clean these elements.

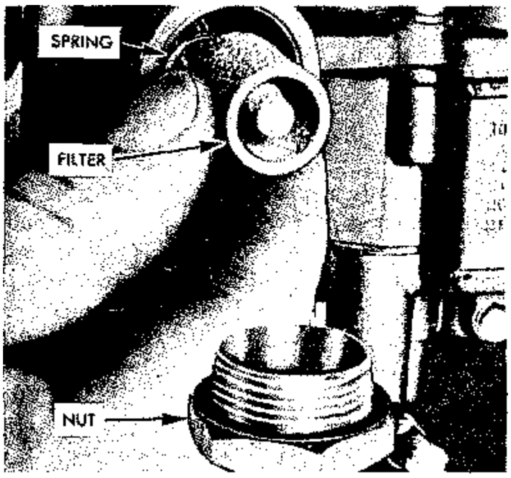
6. Install the spring and then the element into the carburetor, making sure that the small end of the bronze cone is facing out ward.

7. Install a new gasket on the large nut and tighten securely.

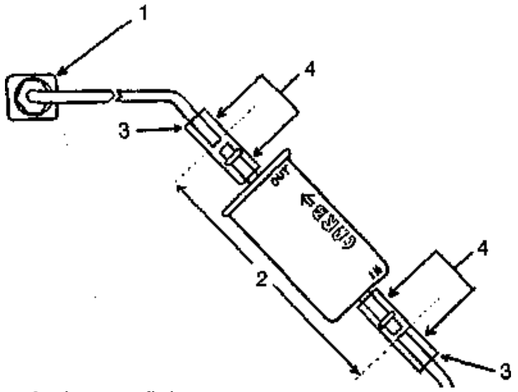
8. Insert the fuel line and tighten the nut with a line wrench.

If your vehicle is equipped with a small filter mounted in die carburetor fuel inlet, it may be wise to consider replacing this filter with a larger "in-line" filter. Although Chevrolet recommends doing this for vehicles which see severe usage (racing, etc.), it is also a wise move for street-driven vehicles. The small, carburetor mounted filter clogs more easily than a large in-line filter. The clogged filter can cause a drastic drop in fuel pressure which will generally cause the engine to run leaner; engine damage can result from an excessively lean fuel mixture. Another negative view of a carburetor mounted filter is that if a fuel pressure problem is encountered, a clogged carburetor mounted filter would not show a pressure loss during a fuel pressure test since the filter is mounted after the fuel pressure test connection. In-line fuel filters are relatively inexpensive and easy to install. The added filtering protection and longer filter life offered by the in-line filter more than make up for its slight additional cost.

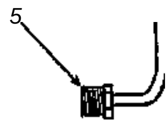
NOTE: *Do not perform this operation on 1976 and later models, as special fuel filters with anti-spillage valves are used.* If you decide to install an in-line fuel filter, first remove and discard the carburetor mounted filter. Position the in-line fuel filter against the fuel line to judge where the fuel line has to be cut. Do not mount the in-line filter straight up as this could allow fuel vapors to block the filter outlet (vapor-lock). Preferably, the filter should be mounted on a 45° angle and be positioned an inch away from surrounding engine components. Mark where the fuel line must be cut, disconnect the line from the fuel pump and remove the fuel line. Using either a "mini" tubing cutter or a hack-



Most late models have this bronze fuel filter located behind the fuel fitting



1. Carburetor fitting
2. Cut fuel line here
3. Fuel-resistant connecting hoses
4. Install clamps here
5. Fuel pump fitting



Typical in-line fuel filter installation

Maintenance Intervals

Maintenance	1963-67	1968-71	1972-74	1975-79	1980-84
Cleaner (Check and Clean) Oil bath Paper element ©	12,000 mi 1 2,000 mi (replace)	12,000 mi (replace)	24,000 mi (replace)	30,000 mi (replace)	30,000 mi (replace)
PCV Valve (Replace)	12 mo/1 2,000 mi	12 mo/1 2,000 mi	12 mo/1 2,000 mi	15,000 mi	30,000 mi.
aporative Canister Replace filter	—	12 mo/1 2,000 mi. (1970-71)	12 mo/1 2,000 mi	24 mo/30,000 mi	24 mo/30,000 mi.
ıgine Oil Check Replace	Each fuel stop 4 mo/6,000 mi	each fuel stop 4 mo/6,000 mi	each fuel stop 4 mo/6,000 mi	each fuel stop 6 mo/7,500 mi	each fuel stop 12 mo/7500 mi.®
Engine Oil Filter (Replace)	every oil change	every oil change	every oil change	every oil change	every oil change
el Filter Replace	12,000 mi	12,000 mi	12,000 mi	15,000 mi	15,000 mi.
owerglide Transmission Fluid Check Replace	6,000 mi 24,000 mi	6,000 mi 24,000 mi	—	—	—
Turbo Hydra-Matic Fluid & Filter Check fluid Change fluid Replace	—	6,000 mi 24,000 mi 24,000 mi	6,000 mi 24,000 mi 24,000 mi	6,000 mi 30,000 mi 30,000 mi	each eng. oil change 100,000 mi.® 100,000 mi.®
anual Transmissions (All) Check lubricant Add lubricant	6,000 mi as necessary	6,000 mi as necessary	6,000 mi as necessary	7,500 mi as necessary	7500 mi. as necessary
Battery Lubricate terminal felt washer Clean terminals Check electrolyte level	6,000© 6,000 mi Twice monthly	6,000© 6,000 mi twice monthly	as necessary twice monthly	as necessary twice monthly ®	as necessary not necessary
Coolant level	Each fuel stop	each fuel stop	each fuel stop	each fuel stop	each fuel stop
ont Wheel Bearings Lubricate	24,000 mi	24,000 mi	24,000 mi	30,000 mi	30,000 mi

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Drive Belts
Check and adjust
(as necessary)

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saw with a fine-toothed blade, cut the fuel line and make sure to clear the line of metal particles left from the cutting. Reinstall the line but do not yet tighten the fittings. Install the in-line filter (if the filter is marked "in" and "out," install the "out" side towards the carburetor), fuel-resistant connecting hoses, and the clamps. Tighten the hose clamps and the fuel line fittings at the fuel pump and carburetor. Start the engine and check for leaks.

LUBRICATION

Oil and Fuel Recommendations

For 1980 and earlier vehicles, oils having one of the following service ratings MUST be used: SE, SE/CC, or SF. For 1981 and later vehicles, use ONLY SF rated oils; it is O.K. to use an SF oil with a combination rating, such as SF/CC. Under the classification system developed by the American Petroleum Institute, the SF rating designates the highest quality oil for use in passenger cars. In view of this, it is recommended that you use an SF rated oil an ANY Corvette. In addition, Chevrolet recommends the use of an SF/Energy Conserving oil. Oils labeled "Energy Conserving (or Saving)," "Fuel (Gas or Gasoline) Saving," etc. are recommended due to their superior lubricating qualities (less friction = easier engine operation) and fuel saving characteristics. Pick your oil viscosity with regard to the anticipated temperatures during the period before your next oil change. Using the accompanying chart, choose the oil viscosity for the lowest expected temperature. You will be assured of easy cold starting and sufficient engine protection.

NOTE: *Some fuel additives contain chemicals that can damage the catalytic converter and/or oxygen sensor on late model engines. Read all labels carefully before using any additive in the engine or fuel system.*

Fuel should be selected for the brand and octane which performs best with your engine. Judge a gasoline by its ability to prevent "pinging," its engine starting capabilities (cold and hot), and general all-weather performance. As far as octane rating is concerned, refer to the "General Engine Specifications" chart in Chapter 3 to find your engine and its compression ratio. If the compression ratio is 9.0:1 or lower, in most cases a regular grade of gasoline can be used.

Oil Viscosity Selection Chart

	Anticipated Temperature Range	SAE Viscosity
Multi-grade	Above 32°F	10W-40 10W-50 20W-40 20W-50 10W-30
	May be used as low as -10°F	10W-30 10W-40
	Consistently below 10°F	5W-20 5W-30
Single-grade	Above 32°F	30
	Temperature between +32°Fand -10°F	10W

If the compression ratio is 9.0:1-10.0:1, use a premium grade of fuel. Vehicles with a compression ratio higher than 10.0:1 (1970 and prior—check the engine chart) should use a premium leaded fuel, if it is available. Most oil companies have discontinued leaded premium gasoline; if you cannot find leaded premium, it has been recommended by several enthusiast publications to mix regular leaded and unleaded premium in a 1:3 proportion (1 part regular leaded to 3 parts unleaded premium). This mixture will give you the lubricating properties of lead and the added performance of a premium gasoline. Also, mixing leaded and unleaded fuels will increase the total octane rating by 1 or more points, depending on the ratings of the gas which is actually used. DO NOT use straight unleaded gas in a vehicle designed to use leaded; excessive valve and valve seat wear will result.

CAUTION: *Unleaded fuel MUST be used in 1975 and later vehicles equipped with catalytic converters. Use of leaded fuel in these vehicles will render the catalytic converter ineffective and damage the oxygen sensor, if equipped.*

Fluid Changes

ENGINE OIL AND FILTER

The mileage figures given in your owner's manual are the Chevrolet recommended intervals for oil and filter changes assuming average driving. If your Corvette is being used under dusty, polluted, or off-road conditions, change the oil and filter sooner than specified. The same thing goes for cars driven in stop-and-go traffic or only for short distances. Always drain the oil after the engine has been running long enough to bring it to operating temperature. Hot oil will flow easier and more contaminants will be removed along with the oil than if it were drained cold. You will need a large capacity drain pan, which you can purchase at any store which sells automotive parts. Another necessity is containers for the used oil. You will find that plastic bottles, such as those used for bleach or fabric softener, make excellent storage jugs. One ecologically desirable solution to the used oil disposal problem is to find a cooperative gas station owner who will allow you to dump your used oil into his tank. Another is to keep the oil for use around the house as a preservative on fences, railroad tie borders, etc.

Chevrolet recommends changing both the oil and filter during the first oil change and the filter every other oil change thereafter. For the small price of an oil filter, it's cheap insurance to replace the filter at every oil change. One of the larger filter manufacturers points out in its advertisements that not changing the filter leaves one quart of dirty oil in the engine. This claim is true and should be kept in mind when changing your oil.

CHANGING YOUR OIL

1. Run the engine until it reaches normal operating temperature.
2. Jack up the front of the car and sup port it on safety stands.
3. Slide a drain pan of at least 6 quarts capacity under the oil pan.
4. Loosen the drain plug. Turn the plug out by hand. By keeping an inward pressure on the plug as you unscrew it, oil won't es cape past the threads and you can remove it without being burned by hot oil.

NOTE: *Dispose of waste oil properly; don't pollute the environment. Avoid prolonged skin contact with used oil either directly or from oil-saturated clothing.*

5. Allow the oil to drain completely and then install the drain plug. Don't overtighten the plug, or you'll be buying a new pan or a trick replacement plug for damaged threads.
6. Using a strap wrench, remove the oil filter. Keep in mind that it's holding about one quart of dirty, hot oil.

1963-67 Corvettes use a cartridge type oil filter. On these models, loosen the center bolt on the filter housing and remove the housing along with the filter. If possible, replace the housing-to-block seal during installation and do not overtighten the housing bolt. Aftermarket adaptors are available to adapt the new style spin-on filters to earlier engines. Some prefer the convenience of a spin-on filter, though the cartridge type filter actually offers a greater filtering area.

7. Empty the old filter into the drain pan and dispose of the filter.
8. Using a clean rag, wipe off the filter adapter on the engine block. Be sure that the rag doesn't leave any lint which could clog an oil passage.
9. Coat the rubber gasket on the filter with fresh oil. Spin it onto the engine *by hand;* when the gasket touches the adapter surface give it another *Vz-%* turn. No more, or you'll squash the gasket and it will leak.
10. Refill the engine with the correct amount of fresh oil. See the "Capacities" chart.
11. Crank the engine over several times and then start it. If the oil pressure gauge shows zero, shut the engine down and find out what's wrong.
12. If the oil pressure is OK and there are no leaks, shut the engine off and lower the car.
13. Wait a few minutes and check the oil level. Add oil, as necessary, to bring the level up to Full.

MANUAL TRANSMISSION

No intervals are specified for changing the transmission lubricant, but after extended heavy duty operation it may be a good idea. The vehicle should be on a level surface and the lubricant should be at operating temperature.

1. Position the vehicle on a level surface.
2. Place a pan of sufficient capacity under the transmission drain plug.
3. Remove the upper (fill) plug to provide a vent opening.
4. Remove the lower (drain) plug and let the lubricant drain out.
5. Replace the drain plug.
6. Add lubricant with a suction gun or squeeze bulb. The correct lubricant is SAE 80W-90 GL-5 Gear Lubricant, or SAE SOW GL-5 for cold climates. Refer to the Capaci ties and Pressures Chart for the correct quan tity.

AUTOMATIC TRANSMISSION

NOTE: *The fluid should be drained while the transmission is warm.*

1. Using a jack, raise the front of the vehicle and support it safely with jackstands. If the transmission pan has no drain plug, visu-

ally check that you can gain access to all of the transmission pan bolts. If you can, proceed to step 8; if not, proceed to step 2.

2. Place a jack under the transmission with a block of wood (a piece of a 2x4 will do) between the jack and the transmission pan.

3. Raise the jack until the wood block contacts the transmission pan.

4. Remove the crossmember-to-transmission mount bolts and the crossmember-to-frame bolts.

5. Raise the transmission SLIGHTLY—just enough to take the weight of the trans mission off of the crossmember.

6. Turn the crossmember sideways and remove it.

7. Place a jackstand close to the transmis sion tailshaft. Lower the jack until the trans mission rests on the stand. Remove the jack and the wood block.

8. Place a drain pan under the transmis sion pan. If the pan has a drain plug, remove it and allow the fluid to drain.

9. If the pan does not have a drain plug, remove the pan bolts from one side of the pan and loosen the rest of the bolts. This will allow the pan to partially drain. Remove the remaining pan bolts and carefully lower the pan away from the transmission.

NOTE: *If the transmission fluid is dark or has a burnt smell, transmission damage is indicated. Have the transmission checked professionally.*

CAUTION: *If the pan sticks, carefully tap sideways on the pan with a rubber mallet or a plastic hammer to break the pan loose. DO NOT dent the pan. Avoid prying the pan off with a screwdriver—this can bend the pan or crack the transmission case.*

10. Empty the pan, remove the gasket material, and clean the pan with solvent (car buretor cleaner works well).

11. Remove any gasket material which may remain on the transmission case.

12. Remove the transmission filter from the valve body. The filter may have either a fi brous or screen filtering element and is re tained by one or two fasteners.

13. Install a new filter using a new gasket or O-ring (TH400's).

NOTE: *If the transmission uses a filter having a fully exposed screen, it may be cleaned and re-used.*

14. Install the pan using a new gasket. Tighten the bolts to 12-14 ft. Ibs. in a criss cross pattern. Recheck the bolt torque after all of the bolts have been tightened once.

15. Add either Dexron or Dexron II trans mission fluid through the filler tube. See the Capacities Chart to determine the proper amount of fluid to be added.

CAUTION: DO NOT *OVERFILL the transmission; foaming of the fluid and subsequent transmission damage due to slippage will result.*

16. With the gearshift lever in PARK, start die engine and let it idle. Do not race the engine.

17. Move the gearshift lever through each position, holding the brakes. Return the le ver to PARK, and check the fluid level with the engine idling. The level should be be tween the two dimples on the dipstick, about *Vs.* in. below the ADD mark. Add fluid, if necessary.

18. Check the fluid level after the vehicle has been driven enough to thoroughly warm up the transmission. Details are given under Fluid Level Checks earlier in the Chapter. If the transmission is overfilled, the excess must be drained off-

REAR ***AXLE***

Refer to the Maintenance Intervals chart for information on when to change the fluid.

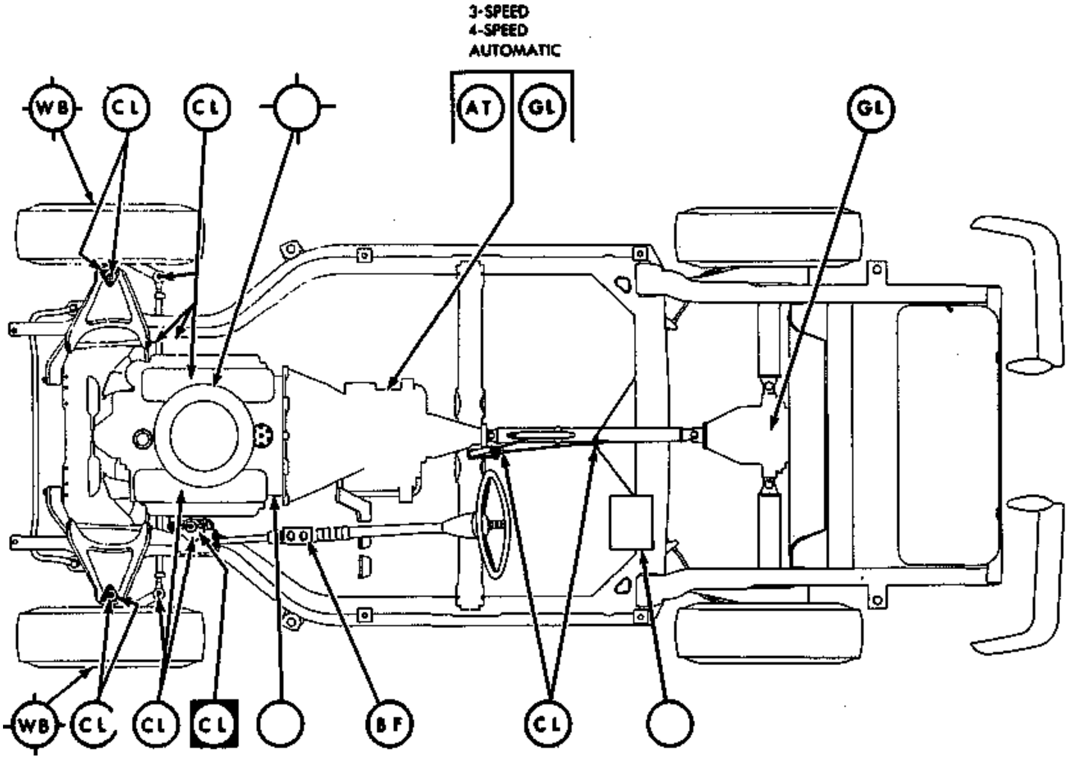
1. Run the vehicle so the lubricant reaches operating temperature.
2. Position a drain pan under the rear axle.
3. Remove the axle housing cover and gas ket and drain the lubricant.
4. Clean the gasket sealing surfaces and install the cover with a new gasket.
5. Torque the cover bolts in a crosswise pattern to 20 ft. Ibs.
6. Add 4 oz. of rear axle lubricant additive (GM 1052358).
7. Use a suction gun or a squeeze bulb and refill the differential housing to a level within %" of the filler plug with rear axle lubricant (GM 1052271) or equivalent. (See the Capac ities Chart),
8. Install the filler plug.

COOLANT

Refer to the Cooling System Section under Routine Maintenance. Observe the recommended specifications for aluminum, if necessary.

Chassis Greasing

Chassis greasing can be performed with a pressurized grease gun or it can be performed at home by using a hand-operated



LUBRICATE EVERY 6,000 MILES

REPLACE EVERY 24,000 MILES

LUBRICATE EVERY 34,000 MILES

* REFILL POSITRACTION REAR AXLE WITH SPECIAL LUBRICANT ONLY

GL-MULTI-PURPOSE OR UNIVERSAL GEAR LUBRICANT*

WB-WHEEL BEARING LUBRICANT

CL-CHASSIS LUBRICANT

S AT-DEXRON AUTOMATIC TRANSMISSION FLUID

BF-BRAKE FLUID

Lubrication points—1963-74

grease gun. Wipe the grease fittings clean before greasing in order to prevent the possibility of forcing any dirt into the component.

Wheel Bearings

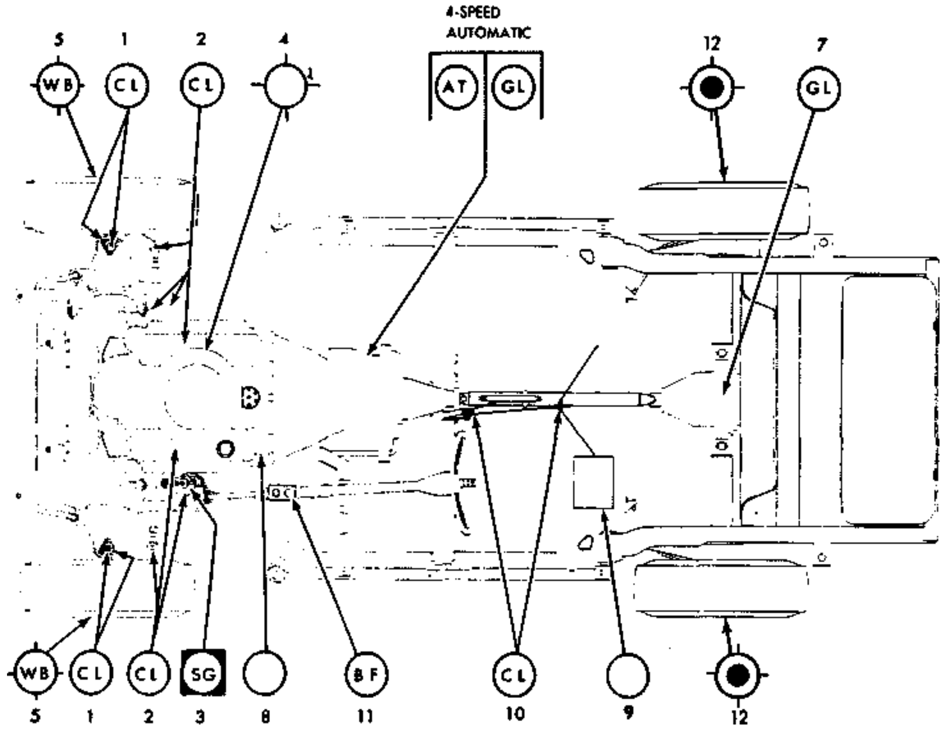
Once every 24,000 miles, clean and repack wheel bearings with a wheel bearing grease. Use only enough grease to completely coat the rollers. Remove any excess grease from the exposed surface of the hub and seal.

It is important that wheel bearings be properly adjusted after installation. Improperly adjusted wheel bearings can cause steering instability, front-end shimmy and wander, and increased tire wear. For complete adjustment procedures, see the "Wheel Bearing" section in Chapter 8.

PUSHING AND TOWING

Corvettes equipped with either the Powerglide or Turbo Hydra-Matic automatic transmissions cannot be push-started. To push-start a Corvette that has either a three-speed or four-speed manual transmission, switch on the ignition, select the highest forward gear and keep the clutch pedal depressed until suitable speed has been provided by the pushing vehicle. When this speed, approximately 15 mph, is reached, slowly release the clutch to start the engine.

Corvettes may be towed at speeds up to 35 mph and distances not over 50 miles with the driveshaft in place, if no engine/drive-line damage is present. If engine/drive-line damage is known or suspected, the driveshaft should be disconnected before towing. Towing connections should not be made on



LUBRICATE EVERY7.500MILES

LUBSICATE FIRST 12,000 MILES

o REPLACE EVERY 30,000«ILtS

CHECK FOR GREASE LEAKAGE
EVERY 30,000 MILES

a REFILL POSITRACTION REAR AXLE
WITH SPECIAL LUBRICANT ONLY

GL-MULTI-PURPOSE OR
UNIVERSAL GEAR
LUBRICANT'

WB-WHEEL BEARING LUBRICANT

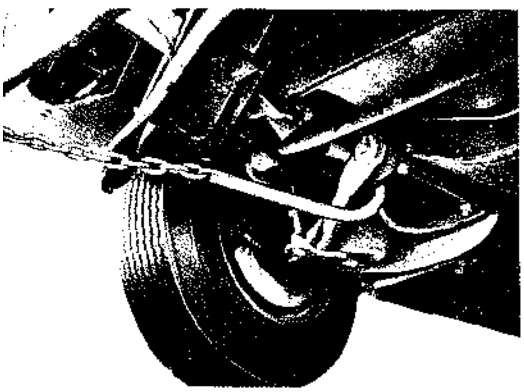
CL-CHASSIS LUBRICANT

AT-DEXRON-H® AUTOMATIC TRANSMISSION FLUID

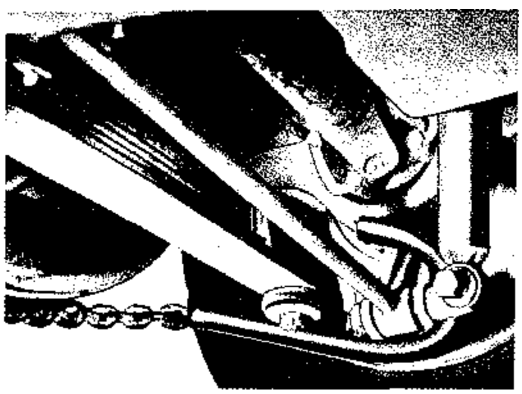
BF-BRAKE FLUID SG-STEERING
GEAR LUBRICANT

1. Front suspension
2. Steering linkage
3. Steering gear
4. Air cleaner
5. Front wheel bearings
6. Transmission
7. Rear axle
8. Oil filter
9. Battery
10. Parking brake
11. Brake master cylinder
12. Rear wheel inner bearing

Lubrication points—1975-82 typical



Front towing point



Rear towing point

bumpers, only on the spindle struts at the rear and the frame crossmember or lower control arm at the front.

JUMP STARTING

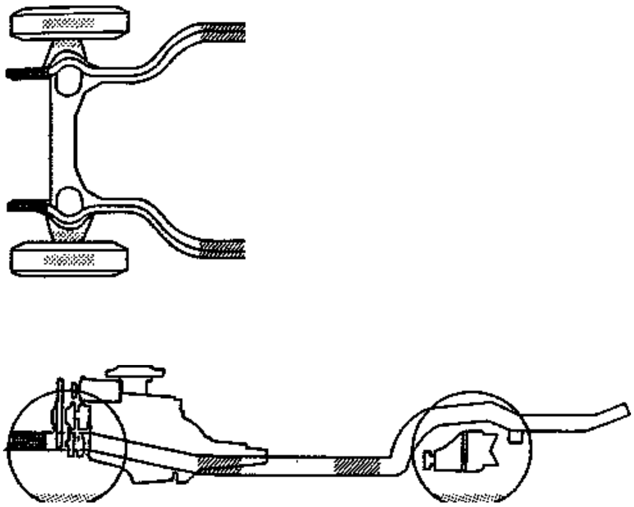
The following procedure is recommended by the manufacturer. Be sure that die booster battery is 12 volt with negative ground. CAUTION: *Do not attempt this procedure on a frozen battery; it will probably explode. Do not attempt it on a sealed Delco Freedom battery showing a light color in the charge indicator. Be certain to observe correct polarity connections. Failure to do so will result in almost immediate alternator and regulator destruction. Never allow the jumper cable ends to touch each other.*

1. Position the 2 vehicles so that they are not touching. Set the parking brake and place automatic transmissions in Park and manual transmissions in Neutral. Turn of the lights, heater and other electrical loads.
2. Remove the vent caps from both the booster and discharged battery. Lay a cloth over the open vent cells of each battery. This isn't necessary on batteries equipped with sponge type flame arrestor caps, and it isn't possible on sealed Freedom batteries.
3. Attach one cable to the positive (+) ter minal of the booster battery and the other end to the positive terminal of the discharged bat tery.
4. Attach one end of the remaining cable to the negative (—) terminal of the booster battery and the other end to the alternator bracket. Do not attach to the negative ter minal of discharged batteries.
5. Start the engine of the vehicle with the booster battery. Start the engine of the vehi cle with the discharged battery. If the engine will not start, disconnect the batteries as soon as possible. If this is not done, the two bat teries will soon reach a state of equilibrium, with both too weak to start an engine. This will not be a problem if the engine of the booster vehicle is kept running fast enough. Lengthy cranking can also overheat and dam age the starter.
6. Reverse the above steps to disconnect the booster and discharged batteries. Be cer tain to remove negative connections first.
7. Reinstall the vent caps. Dispose of the cloths; they may have battery acid on them.

CAUTION: *The use of any "hot shot" type of jumper system in excess of 12 volts can damage the electronic control units on late model engines with computer controls.*

JACKING AND HOISTING

The jack supplied with the Corvette was meant for changing tires. It was not meant to support a vehicle while you crawl under it and work. Whenever it is necessary to get under a vehicle to perform service opera-



DRIVE-ON HOIST, TWO-POST HOIST WITH DRIVE-ON ADAPTORS

JACK STANDS

FLOOR JACK, JACKSTANDS, CENTER POST HOIST

Jacking and hoisting points

tions, always be sure that it is adequately supported, preferably by jackstands at the proper points. Always block the wheels when changing tires.

Since the Corvette is equipped with a Positraction rear axle, do not run the engine for any reason with one rear wheel off the ground. Power will be transmitted through the rear wheel remaining on the ground, possibly causing the vehicle to drive itself off the jack.

Some of the service operations in this book require that one or both ends of the vehicle be raised and supported safely. The best arrangement for this, of course, is a grease pit or a vehicle lift, but these items are seldom found in the home garage. However, small hydraulic, screw, or scissors jacks are satisfactory for raising the vehicle.

Heavy wooden blocks or adjustable jackstands should be used to support the vehicle while it is being worked on. Drive-on trestles, or ramps, are also a handy and a safe way to raise the vehicle, assuming their capacity is adequate. These can be bought or constructed from suitable heavy timbers or steel.

In any case, it is always best to spend a little extra time to make sure that your Corvette is lifted and supported safely.

CAUTION: *Concrete blocks are not recommended. They may crumble if the load is not evenly distributed. Boxes and milk crates of any description must not be used. Shake the vehicle a few times to make sure the jack stands are securely supporting the weight before crawling under.*

Tune-Up and Performance Maintenance

2

TUNE-UP PROCEDURES

This section gives specific procedures on how to tune-up your Corvette. It is intended to be as complete and as basic as possible. Those who are familiar widi die steps involved in a tune-up may wish to slap die following procedures and use die generalized section in chapter 10. However, it is felt that nothing would be lost by first reading over tins section. Perhaps the best procedure to follow would be to read botii sections before starting your tune-up.

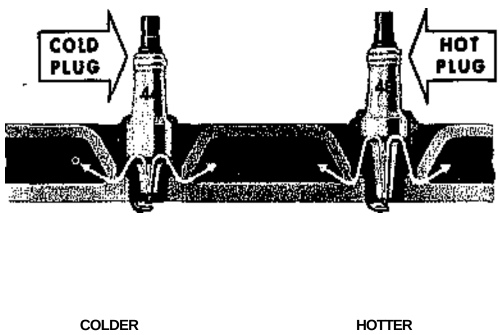
Spark Plugs

A typical spark plug consists of a metal shell surrounding a ceramic insulator. A metal electrode extends downward through the center of die insulator and protrudes a small distance. Located at the end of the plug and attached to die side of die outer metal shell is the side electrode. The side electrode bends in at a 90° angle so diat its tip is even witii, and parallel to, the tip of the center electrode. The distance between diese two electrodes (measured in tiiousandths of an inch) is called the spark plug gap. The spark plug **in** no way produces a spark but merely provides a gap across which the current can arc. The coil produces anywhere from 20,000 to 40,000 volts which travels to die distributor where it is distributed through die spark plug wires to die spark plugs. The current passes along die center electrode and jumps die gap to die side electrode, and, in so doing, ignites die air/fuel mixture in die combustion chamber.

SPARK PLUG HEAT RANGE

Spark plug heat range is the ability of die plug to dissipate heat. The longer die insulator (or die fartiier it extends into die engine), die hotter the plug will operate; the shorter the insulator die cooler it will operate. A plug tiiat absorbs littie heat and remains too cool will quickly accumulate deposits of oil and carbon since it is not hot enough to burn diem off. This leads to plug fouling and consequendy to misfiring. A plug diat absorbs too much heat will have no deposits, but, due to die excessive heat, die electrodes will burn away quickly and in some instances, preignition may result. Preignition takes place when plug tips get so hot diat diey glow sufficiendy to ignite die fuel/air mixture before die actual spark occurs. This early ignition will usually cause a pinging during low speeds and heavy loads.

The general rule of tiiumb for choosing die correct heat range when picking a spark plug is: if most of your driving is long distance, high speed travel, use a colder plug; if most of your driving is stop and go, use a hotter plug. Original equipment plugs are compromise plugs, but most people never have oc-



Spark plug heat range, the higher the number the hotter the plug

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Tune-Up Specifications (cont.)

		Spark Plugs		Distributor			Valves				
							Clearance (In.)		Iirtake		
Year	Model	Type	Gap (In.)	Point Dwell (deg)	Point Gap (In.)	Basic Ignition Timing (deg BTDC)	Intake	Exhaust	(deg BTDC)	Idle Speed (rpm)	Normal Fuel Pressure (psi)
1971	270 hp	R44TS	0.035	28-32	0.019	4®	®	®	26	600®	7V2-9
	330 hp	R43TS	0.035	Transistor Ignition		8©	0.024	0.030	36	700	7'/2-9
	365 hp	R43TS	0.035	28-32	0.019	8	®	®	56	600	7Va-9
	425 hp	R44®	0.035	Transistor Ignition		8	0.024	0.028	44	700	7Va-9
1972	200 hp	R44T	0.035	29-31	0.019	8	©	©	26	800®	7V2-9
	255 hp	R44T	0.035	29-31	0.019	4	0.024	0.030	36	900	7V2-9
	270 hp	R44T	0.035	28-30	0.019	8	®	©	56	750®	7Vz-9
1973	190hp	R44T	0.035	29-31	0.019	12	®	®	26©	900®®	7[1]/2-9
	250 HP	R44T	0.035	29-31	0.019	8	®	®	40	900®®	7V2-9
	270 hp	R44T	0.035	29-31	0.019	10	®	®	56	900®®	7V2-9
1974	195hp	R44T	0.035	29-31	0.019	8®	®	®	26©	900®	7[1]/2-9
	250 hp	R44T	0.035	29-31	0.019	8	©	©	40	900®	7[1]/z-9
	270 hp	R44T	0.035	29-31	0.019	10	©	©	56	800®	7Va-9
1975-76	165 hp	R44TX	0.060	Electronic		6	©	©	26	800®	7[1]/a-9
	205 hp	R44TX	0.060	Electronic		12	©	©	40	900®	7Va-9
1977	180 hp	R45TS	0.045	Electronic		8	®	®	26	800®	7V2-9
	210hp	R45TS	0.045	Electronic		12	®	©	40	900®	7[1]/2-9
1978	185 hp	R45TS	0.045	Electronic		6©	©	®	26	(®	7[1]/a-9
	220 hp	R45TS	0.045	Electronic		12	®	®	40	fiS	7'/2-9
1979	195 hp	R45TS	0.045	Electronic		6©	©	®	26	®	7[1]/2-9
	225 hp	R45TS	0.045	Electronic		12	®	©	40	®	7[1]/2-9

1980	180hp® (305 eng.)	R45TS	0.045	Electronic	4	®	a)	28	®	7¹/a-9
	190 hp (350 eng.)	R45TS	0.045	Electronic	6©	®	a)	26	600®	7¹/z-9
	230 hp (350 eng.)	R45TS	0.045	Electronic	12	®	a)	40	800	7Va-9
1981	190 hp®	R45TS	0.045	Electronic	6	®	a)	38	700®	7¹/2-9
1982	200 hp	R45TS	0.045	Electronic	®	®	a)	NA	®	9-13
1984	205 hp	R45TS	0.045	Electronic	®	®	a)	NA	®	9-13

If the specifications listed on the tune-up sticker under the hood differ from those listed here, the sticker specifications take precedence.
ATDC — After top dead center
BTDC — Before top dead center
TDC — Top dead center
® Hydraulic lifters — one turn down from zero lash
® W/automatic transmission — 450
© W/automatic transmission — 2°ATDC
® W/automatic transmission and A.I.R. — 4°ATDC
©W/automatic transmission and A.I.R. — 700
© W/automatic transmission and A.I.R. — 750
© W/automatic transmission — 600
® W/automatic transmission — 4°BTDC
® W/automatic transmission — 8°BTDC
® W/automatic transmission — 550
© W/automatic transmission — 12°BTDC
©California models— 44°BTDC
©California models— 4°BTDC
O450 rpm w/idle solenoid disconnected
® Models with aluminum cylinder heads use A.C. R43XL
®W/automatJc transmission — 750
©California with automatic transmission — 8°BTDC
® Use the specification listed on the tune-up sticker under the hood
©California only
©Estimated HI
©High altitude models with automatic transmission — 8°BTDC
@ High altitude models with automatic transmission — 650
©W/automatic transmission — 500 ram
Note: Idle speeds of automatic transmission vehicles are checked with the transmission in Drive. 2
Note: Spark plugs listed are original equipment A.C. Delco. These listings are not recommendations by Chilton for any product by name.

casion to change their plugs from the factory-recommended heat range.

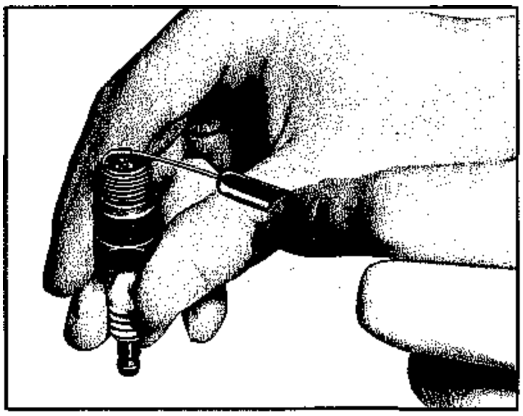
REPLACING SPARK PLUGS

Normally, a set of spark plugs requires replacement about every 10,000 miles on cars with conventional ignition systems (incl. Transistorized) and 20,000-30,000 miles on cars equipped with an H.E.I. (High Energy Ignition) system. Some earlier high performance engines may require more frequent plug changes, especially if idled or operated at low rpm's for extended periods. Any vehicle which is subjected to severe conditions will need more frequent plug replacement.

In normal operation, plug gap increases about 0.001 in. for every 1,000-2,500 miles. As the gap increases, the plug's voltage requirement also increases. It requires a greater voltage to jump the wider gap and about two to three times as much voltage to fire a plug at high speeds than at idle.

When you're removing spark plugs, you should work on one at a time. Don't start by removing the plug wires all at once, because unless you number tiiem, they may become mixed up. Take a minute before you begin and number the wires with tape. The best location for numbering is near where the wires come out of the cap.

1. Remove the radio interference shields which cover the spark plugs and wires (in some models).
2. Twist the spark plug boot and remove the boot and wire from the plug. Do not pull on the wire itself as diis will ruin the wire.
3. If possible, use a brush or rag to clean the area around the spark plug. Make sure that all the dirt is removed so that none will enter the cylinder after the plug is removed.
4. Remove the spark plug using the proper size socket. (^{13}/ie in. through 1971, % in. 1972 and later.) Turn the socket counterclockwise to remove the plug. If the engine has aluminum cylinder heads, be extremely careful when removing the plugs. If any plug turns with difficulty, spray a penetrating lubricant (Liquid Wrench, WD-40, etc.) around the plug threads and turn the plug back in. Wait a couple of minutes for the oil to work its way through the threads and then "nurse" the plug out about *V-t* turn at a time. Be sure to hold the socket straight on the plug to avoid breaking the plug, or rounding off the hex on the plug.



Check the gap with a round wire gauge

5. Once the plug is out, check it against die plugs shown in chapter 11 to determine engine condition. This is crucial since plug readings are vital signs of engine condition.
6. Use a round wire feeler gauge to check die plug gap. The correct size gauge should pass through the electrode gap with a slight drag. If you're in doubt, try one size smaller, and one larger. The smaller gauge should go through easily while the larger one shouldn't go through at all. If the gap is incorrect, use the electrode bending tool on the end of the gauge to adjust the gap. When adjusting the gap, always bend the side electrode. The center electrode is non-adjustable.
7. If die engine has cast-iron heads, squirt a DROP of penetrating oil onto die plug threads and install the plug. If the engine has aluminum heads, apply a small amount of anti-sieze compound to die plug threads and care fully install the plugs. Turn the plugs in by hand until diey are snug.
8. When the plug is finger tight, tighten it with a wrench.
9. Install die plug boot firmly over the plug. Proceed to the next plug.

CHECKING AND REPLACING SPARK PLUG CABLES

Visually inspect the spark plug cables for burns, cuts, or breaks in die insulation. Check die spark plug boots and die nipples on die distributor cap and coil. Replace any damaged wiring. If no physical damage is obvious, the wires can be checked widi an ohmmeter for excessive resistance. (See die tune-up and troubleshooting section.)

When installing a new set of spark plug cables, replace the cables one at a time so there will be no mixup. Start by replacing the longest cable first. Install die boot firmly over die spark plug. Route die wire exacdy die same as the original. Insert the distributor end of the wire firmly into the tower on the distributor cap, then seat the boot over the tower. Repeat the process for each cable.

NOTE: *Always replace the points and condenser together. Uniset@ points are available which combine the point set and condenser, greatly simplifying installation.*

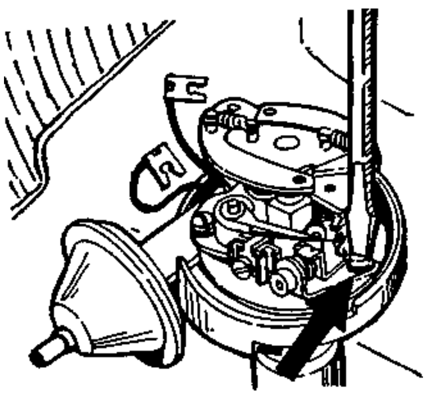
Breaker Points and Condenser

REMOVAL AND REPLACEMENT

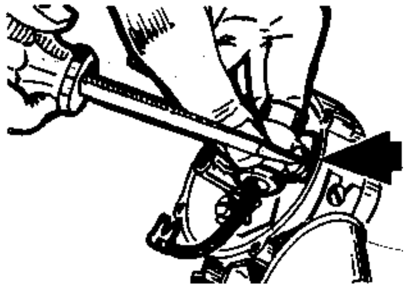
Point alignment is preset at the factory and requires no adjustment. Point sets using the push-in type wiring terminal should be used on those distributors equipped with an R.F.I, (radio frequency interference) shield (1970—74). Points using a lockscrew type terminal may short out due to the shield contacting the screw.

NOTE: *The optional magnetic pulse distributor and the HEI (High Energy Ignition) system used on some 1974 and all 1975—79 models requies no maintenance other than checking the condition of the cap and wires. There are no points to wear out or adjust.*

1. Remove the radio interference shield from around the distributor. Unlatch and remove the distributor cap.
2. Remove the rotor.
3. If so equipped, remove the two-piece R.F.I. shield.
4. Loosen the two mounting screws and slide the contact point set from the breaker plate.
5. Remove the two wires which are connected to the point set.
6. Loosen the condenser bracket screw and slide the condenser from the bracket.
7. Install the new point set and condenser and then tighten the mounting screws.



The points are retained by screws; use a magnetic screwdriver to avoid losing them

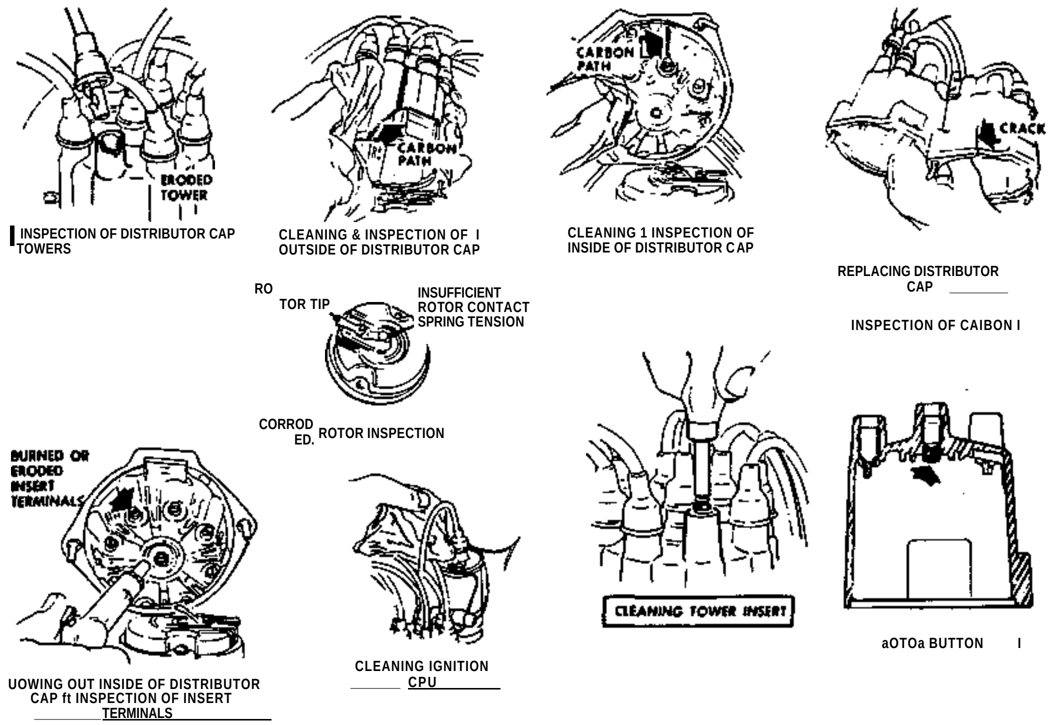


The condenser is held In place by a screw and a damp

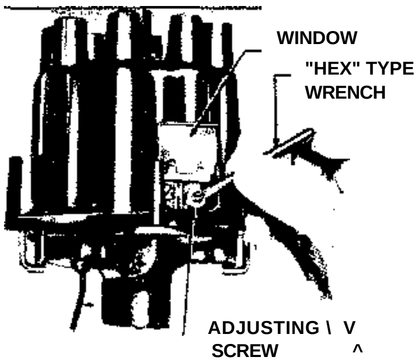
8. Install the wires to the terminal so that they will not interfere with the cap, weight base, or breaker advance plate. Install the half of the R.F.I. shield which covers the points first.
9. Have an assistant "tap" the ignition key to turn the engine until the rubbing block of the point set is centered on one of the distributor cam lobes. Turn the ignition key off.
10. Using a ¥s in. alien wrench, make an initial point setting of 0.019 in.
11. The cam lubricator (if so equipped) must be replaced after 12 months or 12,000 miles. The end of the lubricator should be adjusted to just touch the cam lobes. Additional grease should not be applied to the lubricator.
12. Install the rotor. The two lugs on the bottom of the rotor are shaped differently, so that it can only be installed one way. Tighten the screws. Start the engine and check the point dwell and the ignition timing.

Dwell Angle

Dwell angle is the amount of time (measured in degrees of distributor cam rotation) that the contact points remain closed. Initial point gap (0.019 in.) determines dwell angle. If the points are too wide they open gradually and dwell angle (the time they remain closed) is small. This wide gap causes excessive arcing at the points and, because of this, point burning. This small dwell doesn't give the coil sufficient time to build up maximum energy and so coil output decreases. If the points are set too close, the dwell is increased but the points may bounce at higher speeds and the idle becomes rough and starting is made harder. The wider the point opening, the smaller the dwell and the smaller the gap, the larger the dwell. Adjusting the dwell by making the initial point gap setting with a feeler gauge is sufficient to



Distributor cap and rotor checkpoints



Adjusting point gap (dwell angle) with 1/e in. alien wrench

get the car started but a finer adjustment should be made. A dwell meter is needed to check the adjustment.

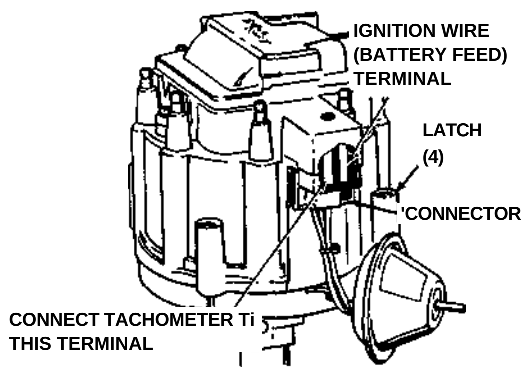
NOTE: *The ignition timing must be checked and adjusted any time the point set is replaced or the dwell is changed. When the dwell is increased, the ignition timing decreases, and vice-versa.*

1. Run the engine to normal operating temperatures and then let it idle.
2. Raise the adjusting window on the distributor cap and insert a *Vs* in. alien wrench into the adjusting screw.
3. Turn the adjusting screw until the specified dwell angle is obtained on the dwell meter.

HEI SYSTEM TACHOMETER HOOKUP

Connect one tach lead to the "TACH" terminal on the side of the distributor and the other to ground. Some tachometers must be connected to the "TACH" terminal and the battery positive terminal. Not all tachometers will operate correctly with the HEI system. Check with the manufacturer if there is any doubt.

CAUTION: *The "TACH" terminal should never be connected to ground.*



Hook up one tach lead to the tachometer terminal on the HEI system

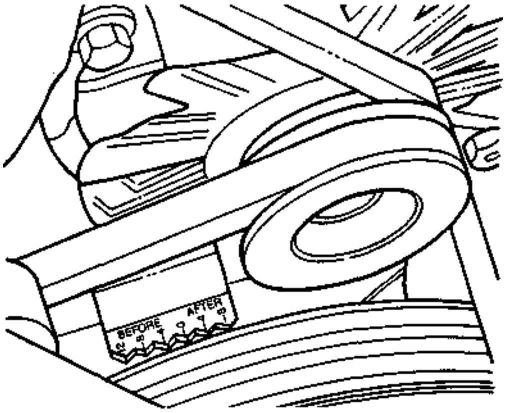
When hooking up a remote starter switch, disconnect the "BAIT" terminal.

Ignition Timing Adjustment

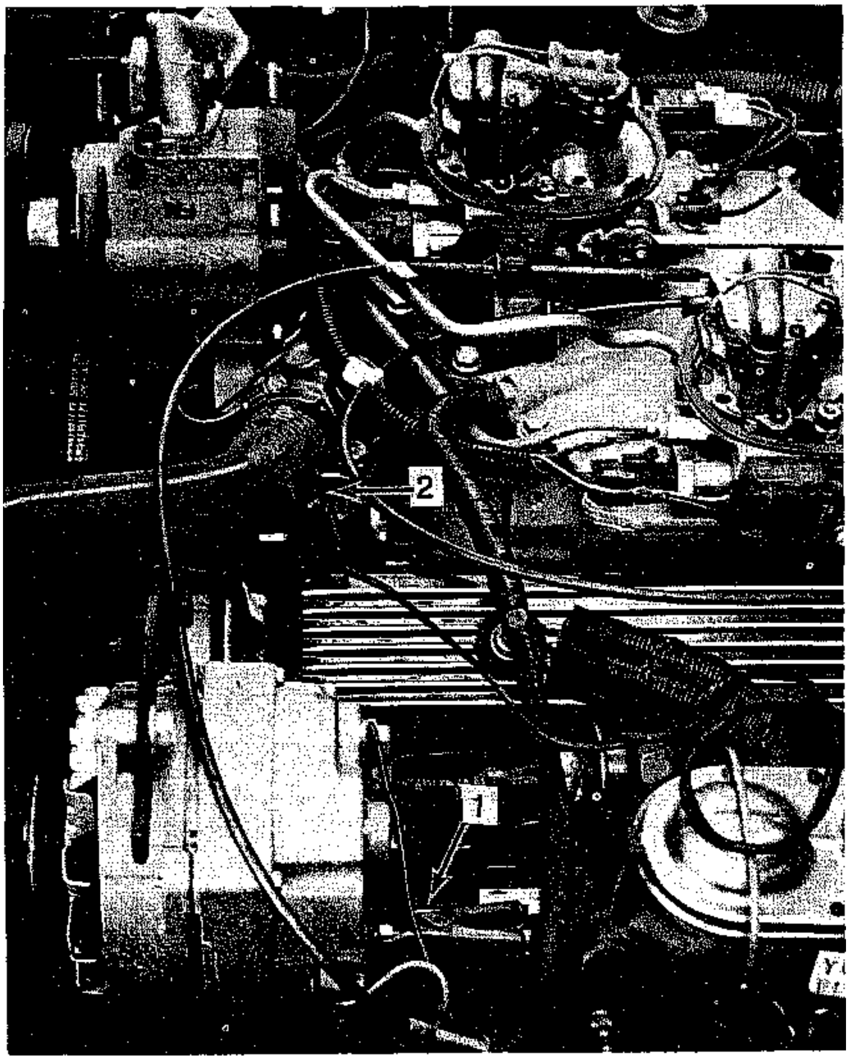
1963-80

Except 1980 California

1. Warm the engine to normal operating temperature and check the idle speed. Adjust the idle speed to specifications, if necessary.
2. If so equipped, disconnect and plug the vacuum advance hose from the distributor.
3. Connect a timing light according to the timing light manufacturers instructions. DO

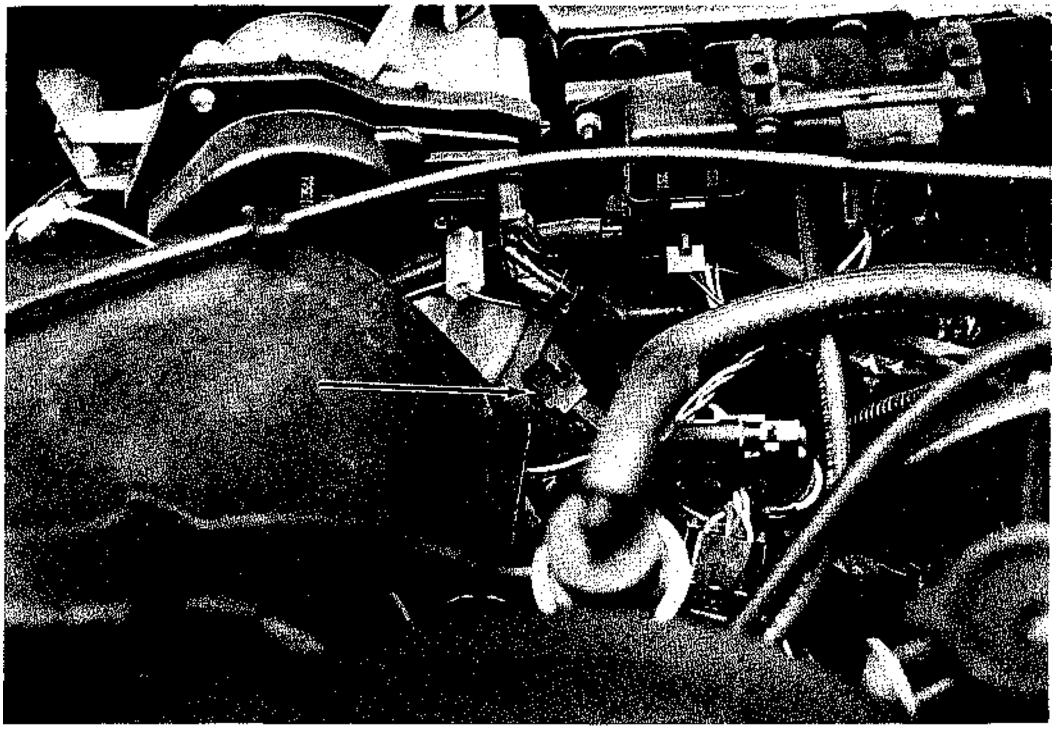


Timing mark location—typical



1. Positive (+) connection at the alternator BAT terminal
2. Negative (-) connection at a good engine ground

12VDC timing light power connections on a typical, externally regulated Delcotron



1982 EST BYPASS wire connector location. On these models, this connector must be separated prior to setting the ignition timing—see text

NOT use a timing light which requires piercing of the spark plug lead. Timing lights which have a lead that must be installed between the plug and the plug wire may be used with conventional ignition systems. On HEI ignition systems, use ONLY an inductive pickup-type timing light.

NOTE: *Timing lights requiring a 12 volt DC power source (battery) may be connected as follows: Connect the positive timing light lead to the BAT terminal of the alternator; the negative timing light lead to a good engine ground.* CAUTION: *Be careful not to ground the positive lead to the alternator case.*

4. Locate the timing tab (metal tab marked in graduations) which is attached to the tim ing cover. Locate the single mark on the vi bration damper (one groove). Clean both the timing tab and the damper marking. Use chalk to accentuate the marks if necessary.

5. Be sure that all wiring and tools are clear of the fan and belts. Start the engine and al low it to idle. Aim die timing light at the marks and note where the vibration damper mark aligns with die timing tab.

NOTE: *The "O" marking on the tab is the top dead center (TDC) mark and all the before top dead center (BTDC) marks are on the "before" (advance] sice of the zero, or the "A" (advance] side of zero. Later models are marked to indicate Before and After.*

6. Loosen the distributor clamp (hold-down) bolt and slowly rotate the distributor as necessary until the damper mark is aligned with the specified mark of the timing tab. Tighten the hold-down bolt and recheck the timing.

7. Turn the engine off and remove the timing light.

8. If so equipped, unplug and reconnect the vacuum advance hose to the distributor.

7980 *CALIFORNIA*

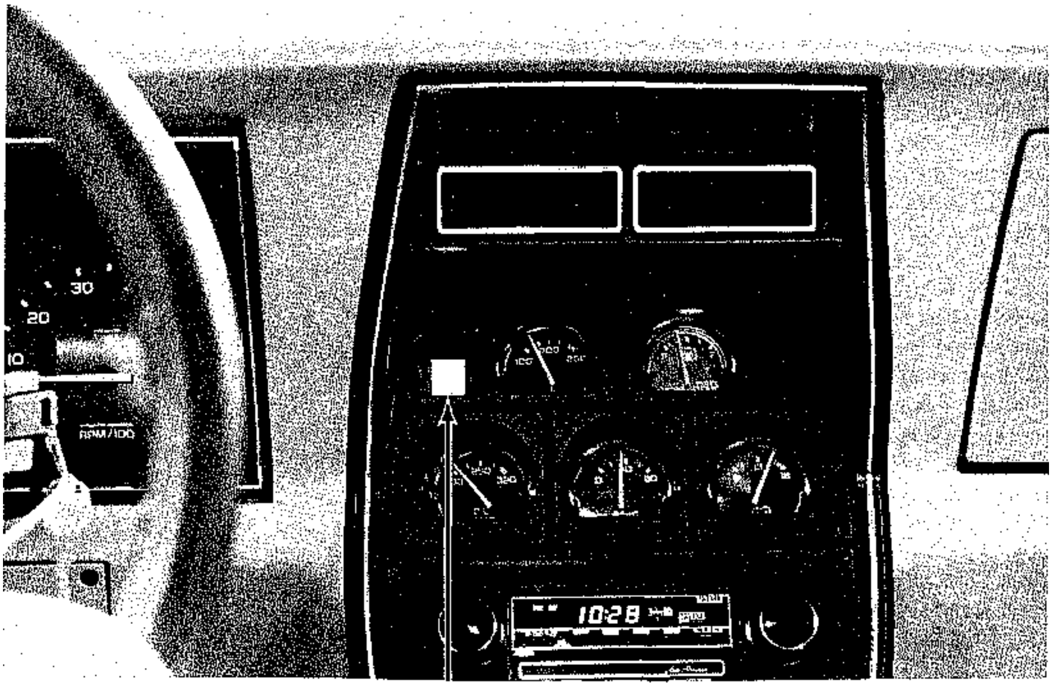
Refer to the underhood emissions label for the proper timing adjustment procedure.

1981

Refer to the underhood emissions label for the proper timing adjustment procedure.

7982-84

The ignition timing of 1982-84 models is adjusted in basically the same manner as previously described (1963-80). The exception to this is that the EST BYPASS wire from the distributor must be disconnected prior to the timing adjustment. Trace the four wires from



CHECK ENGINE lamp location. This lamp will be illuminated while the EST BYPASS wire is disconnected

the distributor housing which join at a common multi-connector, close to the distributor. Follow the tan wire with a black stripe (EST BYPASS wire) from the multi-connector. Past the multiconnector, the EST BYPASS wire has its own, single connector.

NOTE: *On 1984 models, disconnect the 4 terminal EST connector to operate in the bypass timing mode.*

Separate this connector before adjusting the timing. While the EST BYPASS wire is disconnected, the CHECK ENGINE light on the instrument panel will illuminate. After adjusting the timing, reconnect the EST BYPASS connector; the CHECK ENGINE light will go out.

NOTE: *It is not necessary to adjust the idle speed on 1982—84 models prior to the timing adjustment, though the engine must be at normal operating temperature.* 1984 models incorporate an Electronic Spark Control (ESC) into the distributor which retards the spark advance when engine detonation occurs. If the controller fails, the result could be no ignition, no retard or full retard. Some engines will also have a magnetic timing probe hole for use with electronic timing equipment. Consult the manufacturer's instructions for the use of this equipment.

Valve Lash

ADJUSTMENT

Engines equipped with hydraulic lifters VERY rarely need adjustment of the valve lash. If the vehicle runs well and there is no audible "clicking" in the valvetrain, leave it alone. This is because removal of the valve covers on vehicles equipped with air conditioning, various emission controls, cruise control, etc., can be a major project in itself.

On air conditioned models, the A/C compressor must be moved out of the way to gain access to one of the valve covers. Do not disconnect the refrigerant lines to move the compressor. After the cover is removed, either move the compressor to retighten the belt or remove the belt completely so that it will not tangle while the engine is running.

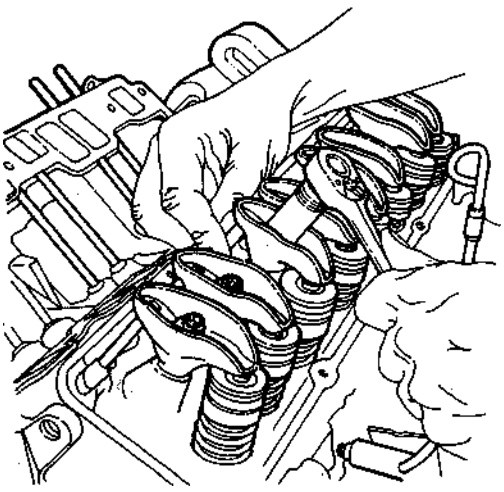
On early models equipped with fuel injection, removal of the left valve cover requires removal of the air cleaner hose, air meter adaptor, and pyrometer housing.

If wiring is attached to metal clips on the valve cover, carefully bend each clip to free the wire from the valve cover. If corrugated plastic tubing containing wiring is attached to the valve cover with plastic clips, the clips can be undone by gently twisting the upper part of the clip *while* holding the lower section. If the clip must be removed, press the lowermost arms of the clips together with needle nose pliers and push upward.

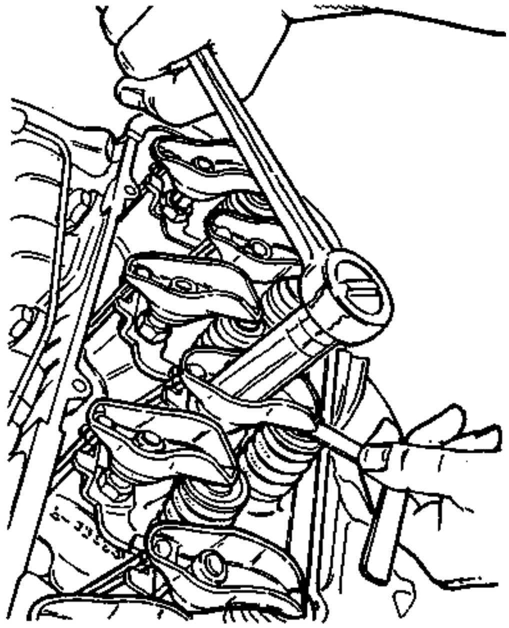
If the vehicle uses a PCV valve pressed into the valve cover grommet, pull the valve from the grommet and remove the valve from the hose. Plug the hose with an old bolt to prevent a vacuum leak. Models having a hose running from the air cleaner to the exhaust manifold require removal of the air cleaner assembly and the hose. Plug any vacuum lines which must be disconnected.

Should it be necessary to remove additional components to gain access to the valve covers, note the wire and/or vacuum hose connection locations and sizes of the bolts which retain the components).

1. Purchase oil stopper clips for the rocker arms. These are available at most auto parts stores. These clips are installed either over (metal style) or in (plastic style) the rocker arm oiling hole located at the pushrod end of the rocker arm. If these clips are not installed, both you and your Corvette will become oil soaked when the engine is started.
2. Start the engine and allow it to reach normal operating temperature.
3. Remove the valve covers. If you have only 8 oil stopper clips, remove only one valve cover and adjust the valves. Then adjust the valves on the other side after the first cover has been reinstalled.
4. Start the engine and allow it to idle.
5. HYDRAULIC LIFTER ENGINES: Slowly loosen the rocker arm nut until the rocker arm starts to clatter. Tighten the nut



Adjusting the valve lash on a hydraulic lifter engine



Adjusting the solid valve lifters

(clockwise) just until the clatter stops. This position is what is termed "zero lash". Slowly tighten the nut *VA* turn then wait about ten seconds for the idle to smooth out. Repeat this until the nut is tightened one full turn past zero lash.

CAUTION: You *must wait until the engine smooths out after each V* turn past zero lash. Impatience in this case can cause engine damage due to valve interference.*

Repeat step *5* for each remaining valve. 5A. MECHANICAL (SOLID) LIFTER ENGINES: Find your intake and exhaust valve adjusting specs in the Tune-Up chart. Use feeler gauges the same thickness as the adjusting specs. Insert the appropriate feeler gauge between the rocker arm and the valve. The feeler gauge should fit with a slight drag. If the gauge does not fit, loosen the rocker adjusting nut until it does. Tighten the adjusting nut until the gauge can be moved with a slight pull. Repeat step 5A for each remaining valve.

6. Remove the oil stopper clips and rein stall the valve covers.
7. Reinstall and/or reconnect and related items.

idle Speed and Mixture Adjustment

Idle mixture and speed adjustments are critical aspects of exhaust emission control. It is important that all tune-up instructions be carefully followed to ensure satisfactory engine performance and minimum exhaust pollution. The different combinations of emission systems application on the different engine models have resulted in a great variety of tune-up specifications. See the "Tune-Up Specifications" chart at the beginning of this chapter. Beginning in 1968, all models have a decal conspicuously placed in the engine compartment giving tune-up specifications.

When adjusting a carburetor with two idle mixture screws, adjust them alternately and evenly, unless otherwise stated.

In the following adjustment procedures the term "lean roll" means turning the mixture adjusting screws in (clockwise) from optimum setting to obtain an obvious drop in engine speed (usually 20 rpm).

NOTE: *Due to the camshaft design of some special high performance engines* (350/LT.I, *427IL88,454/LS6, etc.*) *it is normal for these engines to have a "lopey" idle.*

1963-67 WITHOUT A.I.R.

NOTE: *Adjust with air cleaner removed.* 1. Connect a tachometer and vacuum gauge to the engine, then set the parking brake and shift the manual transmission into Neutral, automatic into Drive.

2. Turn the idle mixture screw(s) in until lightly seated, then back out *IVz* turns.

3. With engine running, adjust the idle speed screw to obtain the specified rpm.

4. Adjust the idle mixture screw(s) to ob tain the highest steady manifold vacuum at the specified speed. If necessary, reset the idle speed screw while adjusting mixture.

NOTE: On *air conditioned models, the air conditioner is turned on and the hot idle compensator valve is held closed while adjusting idle speed and mixture.*

5. Final adjustment should be made with the air cleaner installed.

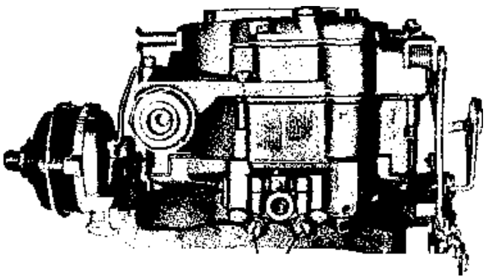
6. Remove tachometer and vacuum gauge.

1966-67 WITH A.I.R.

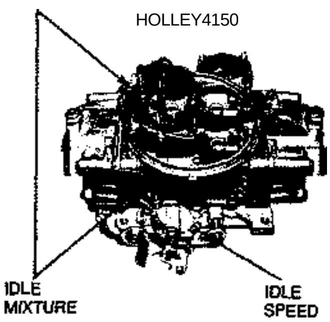
Adjust with air cleaner removed.

1. Connect a tachometer to the engine, place manual transmission in Neutral, auto matic in Drive.

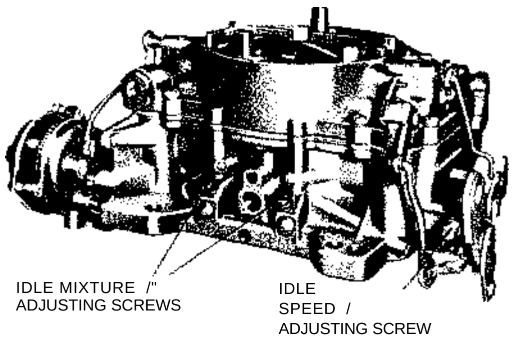
2. Turn idle mixture screw(s) in until lightly seated, then back out 3 turns.



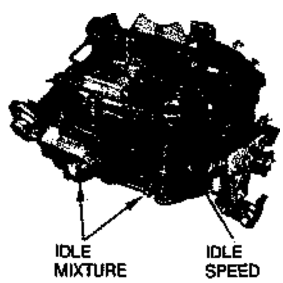
Carter WCFB idle mixture and speed adjustment screws



Holley 4150 idle mixture and speed adjustment screws



Carter AFB idle mixture and speed adjustment screws



Rochester Quadrajet idle mixture and speed adjustment screws

3. With engine running, adjust the idle speed screw to obtain the specified idle speed.

4. Adjust the idle mixture screw(s) in to "lean roll" position, then back them out (rich) *V** turn. Readjust the idle speed screw to keep the engine at the specified idle speed while adjusting the mixture.

NOTE: *On air conditioned cars, turn the air conditioner off with 327 cu in. engines. Air conditioner must be on and hot idle compensator held closed with 427 cu in. engines.*

5. Final adjustment should be made with the air cleaner installed.

6. Remove the tachometer.

1968-69

Adjust with air cleaner installed.

1. Turn the idle mixture screw(s) in until lightly seated, then back out 3 turns.

2. With engine at operating temperature, adjust idle speed screw to obtain specified rpm, manual transmissiopn in Neutral and automatic in Drive.

NOTE: *On all 1968 models except 350 H.P. 327 cu. in. with manual transmission, the air conditioner is turned off. On the above-mentioned vehicles the air conditioner is left on. On 1969 models, turn the air conditioner either on or off according to the instructions on the tune-up decal.*

3. Adjust one idle mixture screw to obtain the highest steady idle speed.

4. Adjust the idle speed screw to the speed specified on the tune-up decal.

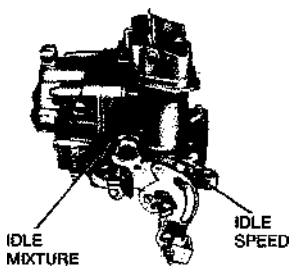
NOTE: *On models equipped with an idle solenoid, adjust the solenoid plunger hex to obtain 600 rpm. Disconnect the wire at the solenoid to deenergize it, allowing the throttle lever to contact the carburetor idle speed screw. Adjust the carburetor idle speed screw. Adjust the carburetor idle screw to obtain 400 rpm.*

5. Adjust the mixture screw in to "lean roll" position, then back out (rich) % turn.

6. Repeat Steps 3, 4, and 5 for the other idle mixture screw.

7. Readjust the idle speed screw to obtain final specified rpm, if necessary.

HOLLEY 2300C (PRIMARY)



Holley 2300 idle mixture and speed adjustment screws

1970

Adjust with air cleaner installed.

If the vehicle is equipped with Evaporative Emission, disconnect the fuel tank line from the vapor canister while making the idle speed and mixture adjustments. Warm up the engine and leave it running while adjusting. The choke valve and, if applicable, air cleaner damper door should remain open. Leave the air conditioning off.

350 (300, 350 and 370 hp) Engines

1. Adjust the idle mixture screws equally to obtain maximum idle speed.

2. On the 300 H.P. engine width manual transmission in Neutral adjust the idle speed screw to obtain 700 rpm. On the 300 H.P. engine with automatic transmission in Drive, adjust the idle speed screw to obtain 600 rpm.

3. On the 350 and 370 H.P. engines, ad just the idle speed screw to obtain 750 rpm with the manual transmission in Neutral.

454 (450 hp) Engine

1. Remove the air cleaner.

2. Disconnect the distributor vacuum hose at the distributor and plug the hose.

3. Adjust the mixture screws for maximum idle speed.

4. With manual transmission in Neutral, adjust the carburetor idle speed screw to ob tain 750 rpm. With automatic transmission in Drive, adjust the carburetor idle speed screw to obtain 700 rpm.

5. Turn one idle mixture screw to obtain a 20 rpm drop in idle speed, then back the screw out % turn. Repeat for the second idle mixture screw.

6. Repeat Step 4 above.

7. Reconnect the distributor vacuum hose and install the air cleaner.

454 (345 hp) and 454 (390 hp) Engines

1. Disconnect the distributor vacuum hose at the distributor and plug the hose.

2. Turn the idle mixture screws in until

they are lightly seated, then back them out 4 turns.

3. With automatic transmission in Drive, adjust the carburetor idle speed screw to ob tain 630 rpm. Adjust the idle mixture screws in equally to obtain 600 rpm.

4. With manual transmission in Neutral, adjust the carburetor idle speed screw to ob tain 700 rpm. Turn one of die mixture screws in until the engine speed drops 40 rpm. Readjust the idle speed screw to obtain 700 rpm. Turn in the other mixture screw until die engine speed drops 40 rpm. Readjust the idle speed screw to obtain 700 rpm.

5. Reconnect the distributor vacuum hose.

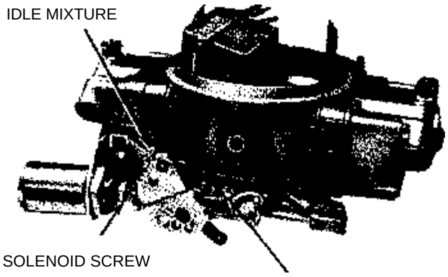
1971

Adjust with air cleaner installed.

The following initial idle adjustments are part of the normal engine tune-up. There is a tune-up decal placed conspicuously in the engine compartment outlining the specific procedure and settings for each engine application. Follow all of the instructions when adjusting the idle. These tuning procedures are necessary to obtain the delicate balance of variables for the maintenance of both reliable engine performance and efficient exhaust emission control.

NOTE: *All engines except the 350 (330 hp) and 454 (425 hp) have limiter caps on the mixture-adjusting screws. The idle mixture is preset and the limiter caps installed at the factory in order to meet emission control standards. Do not remove these limiter caps unless all other possible causes of poor idle condition have been thoroughly checked out.*

The solenoid used on 1971 carburetors is different from the one used on earlier models.



Holley 4150 (with idle solenoid) idle mixture and speed adjustment locations

Combination Emission Control System (C.E.C. solenoid) valve regulates distributor vacuum as a function of transmission gear position.

CAUTION: *The C.E.C. solenoid is adjusted only after: 1) replacement of the solenoid, 2) major carburetor overhaul, or 3) after the throttle body is removed or replaced.*

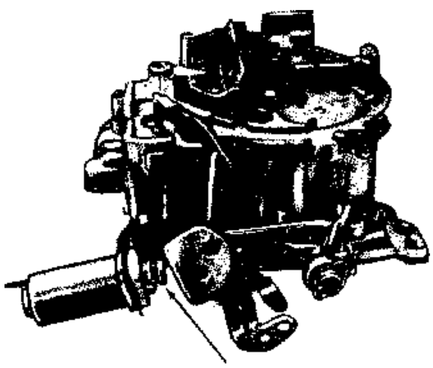
All initial adjustments described below are made:

1. With the engine warmed up and run ning.
2. With the choke fully open.
3. With die fuel tank gas cap removed.
4. With die vacuum hose disconnected at the distributor and plugged.

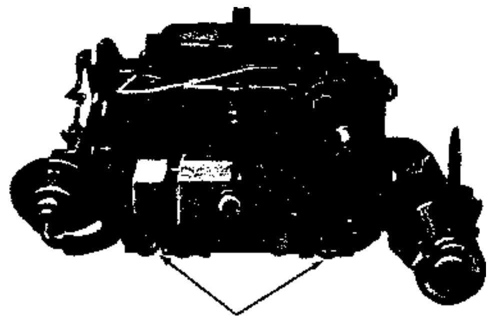
Be sure to reconnect the distributor vacuum hose and to connect the fuel tank to evaporative emission canister line or install die gas cap when idle adjustments are complete.

350 (4-BBL Quadrajet) Engines

Adjust the carburetor idle speed screw (NOT die solenoid plunger) to obtain 600 rpm (manual transmission in Neutral widi the air



Rochester Quadrajet (with idle solenoid) idle speed screw



Rochester Quadrajet (with idle solenoid) idle mixture screws

conditioner off) or 550 rpm (automatic transmission in Drive with the air conditioner on).

350 and 454 (4-BBL Holley) Engines

1. Adjust the carburetor idle speed screw (NOT the solenoid plunger) to obtain 700 rpm (manual transmission in Neutral or automatic transmission in Drive).
2. Adjust the idle mixture screws alternately to obtain the maximum smooth idle speed.
3. Adjust one of the idle mixture screws to obtain a 20 rpm drop ("lean roll"), then back it out %, turn.
4. Repeat Step 4 above for the other idle mixture screw.
5. Readjust the carburetor idle speed screw to obtain 700 rpm if necessary.

454 (4-BBL Quadrajet) Engines

Turn the air conditioner off. Adjust the carburetor idle speed screw (NOT the solenoid plunger) to obtain 600 rpm (manual transmission in Neutral or automatic transmission in Drive).

1972

NOTE: *All carburetors are equipped with idle limiter caps and idle mixture is preset at the factory and should not require adjustment.*

1. Remove the fuel filler cap but do not remove the vapor line.
2. Detach the distributor vacuum hose and plug the hose.
3. Set the parking brake and turn the air conditioner (if so equipped) off. On cars equipped with an automatic transmission, check the wheels.
4. Allow the engine to reach normal operating temperature. Be sure that the choke is open.
5. If the car has an automatic transmission, set the selector in Drive. If the car has a manual transmission keep die transmission in Neutral.
6. Adjust the anti-dieseling solenoid to the *higher* of the two rpm figures given in the specifications.

   CAUTION: *Do not turn the solenoid more than one complete turn unless the electrical lead is disconnected (solenoid deenergized).*

7. Disconnect the solenoid lead and set the idle speed to the *lower* of the two figures given in the specifications. Use the normal idle speed adjusting screw.

   NOTE: *If no lower figure is given, adjust the idle to 450 rpm.*

8. Reconnect all of the wires and hoses which were disconnected in order to perform these adjustments.

1973

Ah[1] models are equipped with idle limiter caps and idle solenoids. Disconnect the fuel tank line from die evaporative canister. The engine must be running at operating temperature, choke off, parking brake on, and rear wheels blocked. Disconnect the distributor vacuum hose and plug it. After adjustment, reconnect the vacuum and evaporative hoses.

Four-barrel 350 and 454 cu in. V8s

1. Adjust the idle stop solenoid screw for 900 rpm on manual, 600 rpm on automatic.
2. Connect the distributor vacuum hose and position the fast idle cam follower on the top step of the fast idle cam (turn air conditioning off) and adjust die fast idle to 1300 rpm on manual transmission 350 engines; 1600 on manual 454 engines and all automatics (in Park).

Optional 350 cu in. (L82) V8

1. Adjust the idle stop solenoid screw (air conditioning off) for a speed of 900 rpm on manual transmission; 700 rpm on automatic (in Drive).
2. Connect the distributor vacuum hose and position the fast idle cam follower on the top step of the cam (turn air conditioning off) and adjust the fast idle to 1300 rpm on manual; 1600 rpm on automatic.

1974

The same preconditions as for 1973 apply.

Four-barrel 350 cu in. V8

1. Turn the air conditioning off. Adjust the idle stop solenoid screw for 900 rpm on manual transmission models; 600 rpm on automatic (in Drive).
2. Connect the distributor vacuum hose. Position the fast idle cam follower on the top step of the fast idle cam and adjust the fast idle speed to 1300 rpm on manual; 1600 on automatic (in Park).

Optional 350 cu in. (L82) V8

1. Turn the air conditioning off. Adjust the idle stop solenoid for 900 rpm on manual; 700 rpm on automatic (in Drive).
2. Connect the distributor vacuum hose.

Position the fast idle cam follower on the top step of the cam and adjust the fast idle to 1300 rpm on manual; 1600 rpm on automatic (in Park).

454 cu in. V8

1. Shut off the air conditioning. Adjust the idle stop solenoid screw for 800 rpm on man ual; 600 rpm on automatic (in Drive).
2. Connect the distributor vaccuum hose and position the fast idle cam follower on the top step of the cam and adjust the fast idle to 1600 rpm on manual; 1500 rpm on automatic (in Park).

1975-76

The same preconditions as for 1973 apply.

1. Turn the air conditioning off.
2. Disconnect the idle speed solenoid. Turn the idle speed screw to adjust for the lower of the two idle speeds specified on the underhood tune-up decal. Adjust automatic transmission cars in Drive with wheels blocked; manual transmission cars in Neu tral.
3. Connect the idle speed solenoid. Open the throttle to extend the solenoid plunger.
4. Use the solenoid plunger to adjust the idle speed to the higher of the two speeds on the underhood tune-up decal.

1977-IDLE SPEED

Run the engine to normal operating temperature, A/C off, vacuum advance line disconnected and plugged, FUEL TANK line at the canister disconnected. Place the manual transmission in neutral; automatic transmission in drive. Connect a tachometer to the engine.

NOTE: *Make sure the parking brake is on and the drive wheels are sufficiently blocked when placing the transmission in drive.*

Without A/C

1. Turn the idle speed screw to achieve the rpm specified on the underhood tune-up decal.

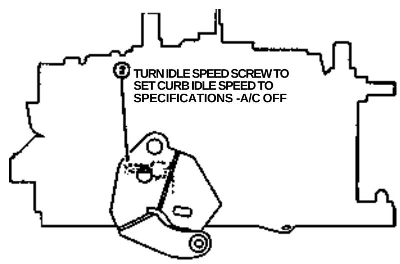
With A/C

1. Turn the idle speed screw to the lower of the two idle speeds specified on the under hood tune-up decal.
2. Turn the A/C system on.
3. Disconnect the A/C compressor lead at the compressor.
4. Open the throttle slightly to allow the solenoid plunger to fully extend.
5. Turn the solenoid screw to higher of the two idle speeds specified on the underhood tune-up decal.
6. Reconnect the A/C compressor lead.

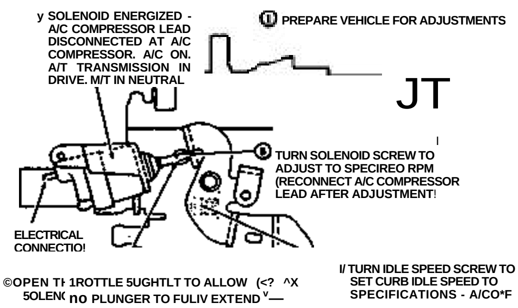
1977-IDLE MIXTURE

NOTE: *Idle mixture screws have been preset at the factory and capped and should not require adjustment, however if the need arises follow the procedure listed below.*

1. Set the parking brake and block the drive wheels.
2. Remove the air cleaner to gain access to the carburetor, but keep the vacuum hoses connected.
3. Run the engine to normal operating temperature with the choke open.
4. Turn the A/C off.
5. Disconnect and plug the vacuum ad vance hose at the distributor.
6. Check the ignition timing and adjust as necessary.
7. Using a sharp knife, carefully remove the plastic caps from the idle mixture screws. Use extreme caution to avoid bending the mixture screws.
8. Lightly seat the screws then back out equally just enough so the engine will run.
9. Place the automatic transmission in drive or the manual transmission in neutral.
10. Back out each screw (richen) % turn at



IDLE SPEED ADJUSTMENT - WITHOUT SOLENOID



A/C IDLE SPEED ADJUSTMENT - WITH SOLENOID

Idle speed adjustment (1977-80 M4MC)

a time until the maximum idle speed is obtained. Then set the idle speed screw to: Standard engine (180 hp) M.T.-800 rpm, A.T.-550 rpm; Optional engine (210 hp) M.T.-900 rpm, A.T. (low altitude) 750 rpm, A.T. (high altitude) 650 rpm.

11. Turn in each screw (lean) *Vs* turn at a time until the idle reaches the following rpm: Standard engine (180 hp)-M.T.-700 rpm, A.T.-500 rpm. Optional engine (210 hp)-800 rpm, A.T. (low altitude), 600 rpm for A.T., high altitude.

12. Reset the idle speed to specification.

13. Reconnect the vacuum hoses and in stall the air cleaner.

1978-80 IDLE SPEED

This procedure applies only to those models which DO NOT have the computer controlled emissions system. Vehicles having the computer system have 13 screws retaining the air horn of the carburetor; vehicles without the computer system have 9 screws retaining the carburetor air horn. Also, computer equipped vehicles do not have the familiar vacuum advance unit installed on the distributor, as the spark advance is controlled by the computer.

CAUTION: // *your vehicle has the computer emissions system, DO NOT attempt to adjust either the idle speed or mixture, as the fuel system calibration could become severely upset.*

Run the engine to normal operating temperature, A/C off, die purge hose at die vapor canister and the vacuum hose at the EGR valve disconnected and plugged. Place the manual transmission is Neutral and the automatic transmission in Drive. NOTE: *Make sure the parking brake is on and the drive wheels are safely blocked before the transmission is placed in Drive.*

Without A/C

1. Turn the idle speed screw to achieve the rpm specified on the underhood specifications decal.

With A/C

1. Turn the idle speed screw to the lower of the two idle speeds listed on the under hood specifications decal.
2. Turn the air conditioning on.
3. Disconnect the A/C compressor lead at the compressor (two-wire connector).
4. Open the throttle slightly to allow the solenoid plunger to extend fully.
5. Turn the solenoid screw to adjust the engine speed to the higher of the two speeds listed on the specifications decal under the hood. Use the higher idle speed, NOT the fast idle speed specification.
6. Reconnect the A/C compressor lead.

1978-80 *IDLE MIXTURE*

Changes in the idle systems of these models make it impossible to properly adjust the mixture without the use of a propane enrichment system, not available to the general public.

In some 1978 and all 1979-80 models, the idle mixture screws are sealed within the dirotde body of the carburetor. Idle mixture adjustments should be left to the professional technician with the proper equipment and experience.

1981-84 IDLE MIXTURE

Idle speed and mixture are controlled strictly by the computer emissions system. Do not attempt to adjust the idle speed or mixture as these functions are controlled by the computer.

NOTE: *For all throttle body injection adjustments, see the Fuel Injection section.*

Engine and Engine Rebuilding

3

UNDERSTANDING THE ENGINE ELECTRICAL SYSTEM

The engine electrical system can be broken down into three separate and distinct systems—(1) the starting system; (2) the charging system; (3) the ignition system.

NOTE: *See "Troubleshooting" for typical diagnosis procedures.*

Battery and Starting System

The battery is the first link in the chain of mechanisms which work together to provide cranking of the automobile engine. In most modern cars, the battery is a lead-acid electrochemical device consisting of six two-volt (2 V) subsections connected in series so the unit is capable of producing approximately 12 V of electrical pressure. Each subsection, or cell, consists of a series of positive and negative plates held a short distance apart in a solution of sulfuric acid and water. The two types of plates are of dissimilar metals. This causes a chemical reaction to be set up, and it is this reaction which produces current flow from the battery when its positive and negative terminals are connected to an electrical appliance such as a lamp or motor. The continued transfer of electrons would eventually convert the sulfuric acid in the electrolyte to water, and make the two plates identical in chemical composition. As electrical energy is removed from the battery, its voltage output tends to drop. Thus, measuring battery voltage and battery electrolyte composition are two ways of checking the ability of the unit to supply power. During the starting of the engine, electrical energy is removed from the battery. However, if the charging circuit is in good condition and the operating conditions are normal, the power removed from the battery will be replaced by the generator (or alternator) which will force electrons back through the battery, reversing the normal flow, and restoring the battery to its original chemical state.

The battery and starting motor are linked by very heavy electrical cables designed to minimize resistance to the flow of current. Generally, the major power supply cable that leaves the battery goes directly to the starter, while other electrical system needs are supplied by a smaller cable. During the starter operation, power flows from the battery to the starter and is grounded through the car's frame and the battery's negative ground strap.

The starting motor is a specially designed, direct current electric motor capable of producing a very great amount of power for its size. One thing that allows the motor to produce a great deal of power is its tremendous rotating speed. It drives the engine through a tiny pinion gear (attached to the starter's armature), which drives the very large flywheel ring gear at a greatly reduced speed. Another factor allowing it to produce so much power is that only intermittent operation is required of it. Thus, little allowance for air circulation is required, and the windings can be built into a very small space.

Hie starter solenoid is a magnetic device which employs the small current supplied by the starting switch circuit of the ignition switch. This magnetic action moves a plunger which mechanically engages the starter and electrically closes the heavy switch which connects it to the battery. The starting switch circuit consists of the starting switch contained within the ignition switch, a transmission neutral safety switch or clutch pedal switch, and the wiring necessary to connect these with the starter solenoid or relay.

A pinion, which is a small gear, is mounted to a one-way drive clutch. This clutch is splined to the starter armature shaft. When the ignition switch is moved to the "start" position, the solenoid plunger slides the pinion toward the flywheel ring gear via a collar and spring. If the teeth on the pinion and flywheel match properly, the pinion will engage the flywheel immediately. If the gear teeth butt one another, the spring will be compressed and will force the gears to mesh as soon as the starter turns far enough to allow them to do so. As the solenoid plunger reaches the end of its travel, it closes the contacts that connect the battery and starter and then the engine is cranked.

As soon as the engine starts, the flywheel ring gear begins turning fast enough to drive the pinion at an extremely high rate of speed. At mis point, the one-way clutch begins allowing the pinion to spin fester than the starter shaft so that the starter will not operate at excessive speed. When the ignition switch is released from the starter position, the solenoid is de-energized, and a spring contained within the solenoid assembly pulls the gear out of mesh and interrupts the current flow to the starter.

The Charging System

The automobile charging system provides electrical power for operation of the vehicle's ignition and starting systems and all the electrical accessories. The battery serves as an electrical surge or storage tank, storing (in chemical form) the energy originally produced by the engine-driven generator. The system also provides a means of regulating generator output to protect the battery from being overcharged and to avoid excessive voltage to the accessories.

The storage battery is a chemical device incorporating parallel lead plates in a tank containing a sulfuric acid-water solution. Adjacent plates are slightly dissimilar, and the chemical reaction of the two dissimilar plates produces electrical energy when the battery is connected to a load such as the starter motor. The chemical reaction is reversible, so that when the generator is producing a voltage (electrical pressure) greater than that produced by the battery, electricity is forced into the battery, and the battery is returned to its fully charged state.

The vehicle's generator is driven mechanically, through V belts, by the engine crankshaft. It consists of two coils of fine wire, one stationary (the "stator"), and one movable (the "rotor"). The rotor may also be known as the "armature," and consists of fine wire wrapped around an iron core which is mounted on a shaft. The electricity which flows through the two coils of wire (provided initially by the battery in some cases) creates an intense magnetic field around both rotor and stator, and the interaction between the two fields creates voltage, allowing the generator to power the accessories and charge the battery.

There are two types of generators; the earlier is the direct current (DC) type. The current produced by the DC generator is generated in the armature and carried off the spinning armature by stationary brushes contacting the commutator. The commutator is a series of smooth metal contact plates on the end of the armature. The commutator plates, which are separated from one another by a very short gap, are connected to die armature circuits so that current will flow in one direction only in the wires carrying the generator output. The generator stator consists of two stationary coils of wire which draw some of the output current of the generator to form a powerful magnetic field and create the interaction of fields which generates the voltage. The generator field is wired in series with the regulator.

Newer automobiles use alternating current generators or "alternators" because they are more efficient, can be rotated at higher speeds, and have fewer brush problems. In an alternator, the field rotates while all the current produced passes only through the stator windings. The brushes bear against continuous slip rings rather than a commutator. This causes the current produced to periodically reverse the direction of its flow. Diodes (electrical one-way switches) block the flow of current from traveling in the wrong direction. A series of diodes is wired together to permit the alternating flow of the stator to be converted to a pulsating, but unidirectional flow at the alternator output. The alternator's field is wired in series with the voltage regulator.

The regulator consists of several circuits. Each circuit has a core, or magnetic coil of wire, which operates a switch. Each switch is connected to ground through one or more resistors. The coil of wire responds directly to system voltage. When the voltage reaches the required level, the magnetic field created by the winding of wire closes the switch and inserts a resistance into the generator field circuit, thus reducing the output. The contacts of the switch cycle open and close many times each second to precisely control voltage.

While alternators are self-limiting as far as maximum current is concerned, DC generators employ a current regulating circuit which responds directly to the total amount of current flowing through the generator circuit rather than to the output voltage. The current regulator is similar to the voltage regulator except that all system current must flow through the energizing coil on its way to the various accessories.

SAFETY *PRECAUTIONS*

Observing these precautions will ensure safe handling of the electrical system components, and will avoid damage to the vehicle's electrical system:

1. Observing these precautions will en sure safe handling of the electrical system components, and will avoid damage to the vehicle's electrical system:
2. Be *absolutely* sure of the polarity of a booster battery before making connections. Connect the cables positive to positive, and negative to negative. Connect positive cables first and then make the last connection to a ground on the body of the booster vehicle so that arcing cannot ignite hydrogen gas that may have accumulated near the battery. Even momentary connection of a booster battery with the polarity reserved will damage alter nator diodes.
3. Disconnect both vehicle battery ca bles before attempting to charge a battery.
4. Never ground the alternator or gener ator output or battery terminal. Be cautious when using metal tools around a battery to avoid creating a short circuit between the terminals.
5. Never ground the field circuit be tween the alternator and regulator.
6. Never run an alternator or generator without load unless the field circuit is discon nected.
7. Never attempt to polarize an alterna tor.
8. Keep the regulator cover in place when taking voltage and current limiter readings.
9. Use insulated tools when adjusting the regulator.
10. Whenever DC generator-to-regulator wires have been disconnected, the generator *must* be repolarized. To do this with an externally grounded, light duty generator, momentarily place a jumper wire between the battery terminal and the generator terminal of the regulator. With an internally grounded heavy duty unit, disconnect the wire to the regulator field terminal and touch the regulator battery terminal with it.
11. Never disconnect components with the ignition ON.

The Conventional Ignition System

MECHANICAL OPERATION

The distributor is geared to the camshaft of the engine, and in the case of a Chevrolet V-8, is also used to drive the engine oil pump in addition to its usual "spark sorting" duties. As the distributor shaft turns, the lobes of the distributor cam actuate the breaker point set, causing the points to open and close. The points are attached to the breaker plate, which on models using a vacuum advance system, is capable of rotating around the distributor shaft a small amount. This rotation of the breaker plate changes the relationship between the distributor shaft and the point set. The change in this relationship alters the time at which the points open, thereby changing the ignition timing. The amount of the ignition timing change, in degrees, is controlled by the vacuum advance diaphragm which senses the engine load through engine vacuum changes. The vacuum advance diaphragm is controlled by either "ported" or "manifold" vacuum. A ported vacuum source is one that is located above the throttle plates of the carburetor, whereas a manifold vacuum source is located below the carburetor throttle pktes (or attached to a fitting directly on the intake manifold). At a given open throttle position, the vacuum signal to the distributor will be basically the same, whether it is from a ported or manifold vacuum source. During idle, however, manifold vacuum is high; ported is low. As vacuum to the advance unit is increased, the amount of degrees which the unit moves (advances) the breaker plate is also increased, and vice-versa (retard). It is because of this that you must disconnect the vacuum advance unit before adjusting the initial timing on engines which have a manifold vacuum source to the distributor. The most important function of the vacuum advance is to advance the ignition timing during cruise conditions for improved fuel economy. As engine load increases, engine vacuum drops, which allows the ignition timing to retard, thereby preventing detonation due to over-advanced timing. Some special high performance models such as the 427/L88 do not have vacuum advance systems. Fuel economy was not designed into such "off-road" engines.

NOTE: *Do not remove the vacuum advance for street usage—fuel economy will suffer, along with engine performance if not set-up properly.*

Another timing feature of the distributor is the centrifugal advance mechanism. This mechanism alters the ignition timing by rotating the distributor cam (a small amount) independent of the distributor shaft. Again, the relationship between the distributor shaft and the point opening is changed due to this rotation. The centrifugal advance mechanism consists basically of two small springs and two specially shaped weights attached to both the distributor cam and the shaft. These components are mounted underneath the ignition rotor. Instead of vacuum, this mechanism uses engine rpm as a guide for advancing the ignition timing. As engine rpm (and distributor shaft rpm) increases, the weights are moved gradually outward (against the spring tension) by centrifugal force. As the weights move outward, the distributor cam is moved to a more advanced timing position. When the engine rpm drops, the springs gradually pull the weights back to their low-speed position, thereby reducing the amount of tuning advance.

ELECTRICAL OPERATION

The point set, or breaker points as they are sometimes called, is the switching device of a conventional ignition system. The "primary" side of the ignition coil is connected to the battery, through the ignition switch, a resistor, and various wiring. When the ignition switch is in the "run" position, voltage from the ignition switch passes through a resistor, which lowers the battery voltage to the coil from 12V down to about 6-8V.

NOTE: *If this resistor is defective, the full 12V from the battery will quickly burn the breaker point contacts and shorten the life of the ignition coil.*

When the ignition switch is in the "start" position, the resistor is bypassed. This provides a full 12V to the ignition system to aid in starting the engine. Voltage flow after the resistor (or bypass wire) is through the primary (low voltage) windings of the coil, to the breaker point set. When the points are closed (grounded), a magnetic field is produced within the primary windings of the ignition coil. When the points open, the coil voltage no longer has an easy path to ground. The magnetic field collapses and transfers the voltage from the primary windings (outer) of the coil to the "secondary" windings (inner) of the coil, through induction. Since the number of secondary windings in the ignition coil is much greater than the primary, the voltage is multiplied to roughly 20-25,000 volts. This high voltage then travels out of the center tower of the ignition coil, through the high tension lead (secondary coil wire) to the center tower of the distributor cap. The voltage is then distributed by the ignition rotor to the outer terminals of the distributor cap (in the "firing order"), through the plug wires and finally, the voltage jumps the gap of the spark plug, causing ignition of the air/fuel mixture in the cylinder.

The condenser, which is also attached to the breaker plate (grounded), acts as a temporary voltage storage unit when the points are closed. This helps to prevent arcing between the point contacts when the points are opened. Rapid metal transfer between the point contacts is indicative of a bad condensor.

The Breakerless Ignition Systems (Including H.E.I.)

Both the transistorized and H.E.I, systems operate in basically the same manner as the conventional ignition system, with the exception of the type of "switching device" used. As stated previously, the switching device of a conventional ignition system is the breaker point set. In the breakerless ignition systems, a toothed iron timer core is mounted on the distributor shaft. The timer core is mounted on the distributor shaft. The timer core rotates inside of an electronic pole piece. The pole piece has internal teeth (corresponding to those on the timer core) and contains a permanent magnet and pick-up coil (not to be confused with the ignition coil). The pole piece senses the magnetic field of the timer core teeth and sends a signal to the ignition module which electronically "calls the shots" concerning control of the primary coil voltage. The ignition coil operates in basically the same manner as a conventional ignition coil (though the ignition coils DO NOT interchange), but is controlled by the timer core, pole piece, and module; instead of the breaker points and condenser.

NOTE: *H.E.I, ignitions use a condensor, but it is primarily used for radio interference purposes.*

As far as the mechanical advance is concerned, the operation is also basically the same as a conventional ignition system, with the exception that the timer core rotates on the distributor shaft instead of the distributor cam used in conventional systems. The vacuum advance unit moves the breaker plate in the same manner as the conventional system, but the timing changes according to the position of the pole piece instead of the breaker points.

Appearance wise, the transistorized ignition distributor looks very much like a conventional distributor, with the exception of a two-wire lead (with a quick-disconnect plug) coming from the dsitributor. Also, the transistorized system uses both an externally mounted ignition coil and an ignition amplifier unit which is finned for heat dissipation.

CAUTION: *Do not use a conventional ignition coil in place of an electronic ignition coil, or vice-versa. Component damage could result.*

The H.E.I, distributor looks nothing like a conventional distributor. The components of an H.E.I, distributor are all contained within the distributor (pole piece, ignition coil, module, etc.).

Refer to Chapter 11 for detailed H.E.I, system troubleshooting. None of the electrical components used in either the transistorized or H.E.I, systems are adjustable. If a component is found to be defective, it must be replaced.

HE/ SYSTEM *PRECAUTIONS*

Before going on to troubleshooting, it might be a good idea to take note of the following precautions:

Timing Light Use

Inductive pick-up timing lights are the best kind to use if your car is equipped with HEI. Timing lights which connect between the spark plug and the spark plug wire occasionally (not always) give false readings.

Spark Plug Wires

The plug wires used with H.E.I, systems are of a different construction than conventional wires. When replacing them, make sure you get the correct wires, since conventional wires won't carry the voltage. Also, handle them carefully to avoid cracking or splitting them and *never* pierce them.

Tachometer Use

Not all tachometers will operate or indicate correctly when used on a H.E.I, system. While some tachometers may give a reading, this does not necessarily mean the reading is correct. In addition, some tachometers hook up differently from others. If you can't figure out whether or not your tachometer will work on your car, check with the tachometer manufacturer. Dwell readings, of course, have no significance at all.

H.E.I. System Testers

Instruments designed specifically for testing H.E.I, systems are available from several tool manufacturers. Some of these will even test the module itself. However, the tests given in the following section will require only an ohmmeter and a voltmeter.

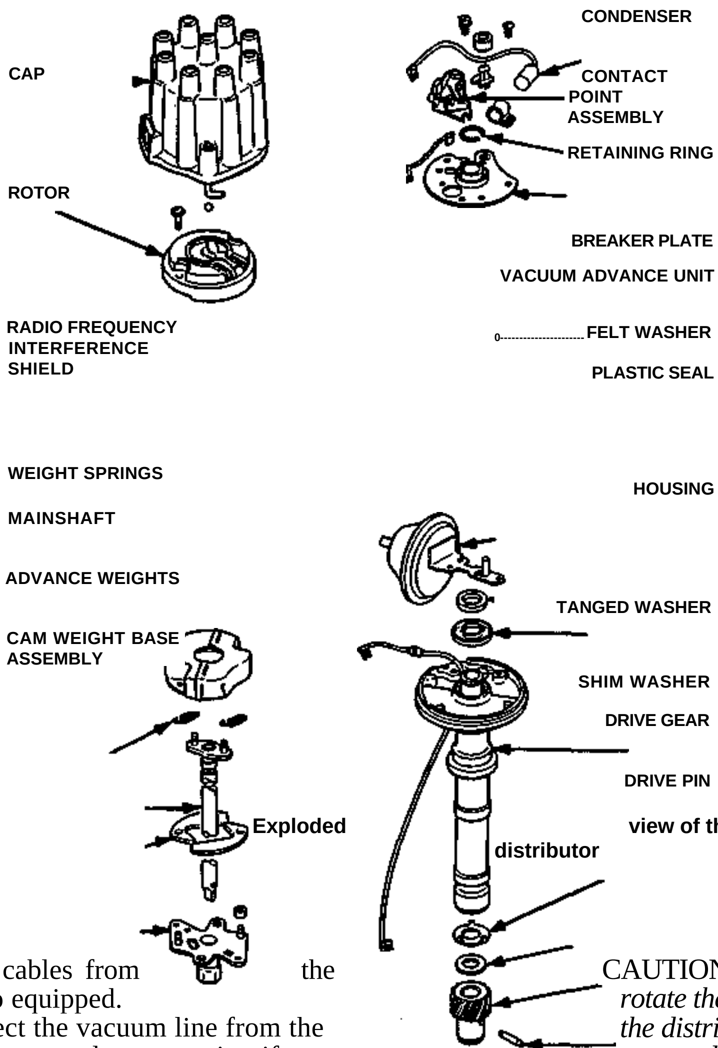
ENGINE ELECTRICAL

Distributor

REMOVAL

Conventional and Transistorized Systems

1. Rotate the engine until the timing mark on the crankshaft balancer is aligned with the top dead center mark (TDC or "0") on the timing tab scale. Remove the air cleaner assembly.
2. Remove the ignition shielding and disconnect the secondary (high tension) coil wire.
3. Release the distributor cap hold-down screws (push down and turn counterclockwise). Raise the distributor cap off of the distributor and check that the firing tip of the rotor is pointed at the #1 terminal of the distributor cap. If it is not; turn the engine one full revolution and again align the timing marks as previously stated. Recheck the rotor position.
4. Pull the plug wires out of the locating looms (if so equipped) and move the cap out of the way. Leave the plug wires attached to the cap.
5. Disconnect the battery cables at the battery.
6. Disconnect the tachometer and fuel



Exploded view of the V8 points-type distributor

injection drive cables from the distributor, if so equipped.

7. Disconnect the vacuum line from the distributor vacuum advance unit, if so equipped.

8. Mark the relationships between the following items:

   a. Rotor firing tip and distributor body
   b. distributor body and either the fire wall or the intake manifold

The combination of these marks will assure that the distributor gear is properly meshed with the camshaft and the ignition timing will be close enough to start the engine after the distributor is reinstalled.

9. On conventional ignitions, disconnect the distributor lead from the negative (—) terminal of the ignition coil. On transistor ized systems, carefully release and pull apart the quick-disconnect of the two-wire distrib utor lead.

10. Remove the distributor hold-down bolt and plate.

11. Carefully pull the distributor from the engine. Note the rotation of the rotor as the distributor is pulled upward, caused by the angled distributor drive teeth.

CAUTION: *Do not rotate the engine while the distributor is removed.*

12. Service the distributor as necessary.

H.E.I. Systems

1. Rotate the engine until the timing mark on the balancer is aligned with the top dead center mark (TDC or "O") on the timing tab scale.

2. Remove the air cleaner assembly and the ignition shielding.

3. With the ignition switch OFF, discon nect the feed, module, and tachometer wir ing from the drivers side of the distributor cap. Do so by releasing the connector retain ing tabs and pulling downward on the con nectors. On 1981—84 models, also disconnect the four-wire connector installed in the wir ing from the opposite side of the distributor.

CAUTION: *Never allow the "Tach" termi-nal to touch ground.*

4. Locate the locking tabs of the spark plug wire retaining ring (on the distributor cap). Move each of the two locking tabs outward to release the retaining ring. With the plug wires still attached to the ring, carefully remove the retaining ring from the distributor cap. Pull

Distributor Specifications

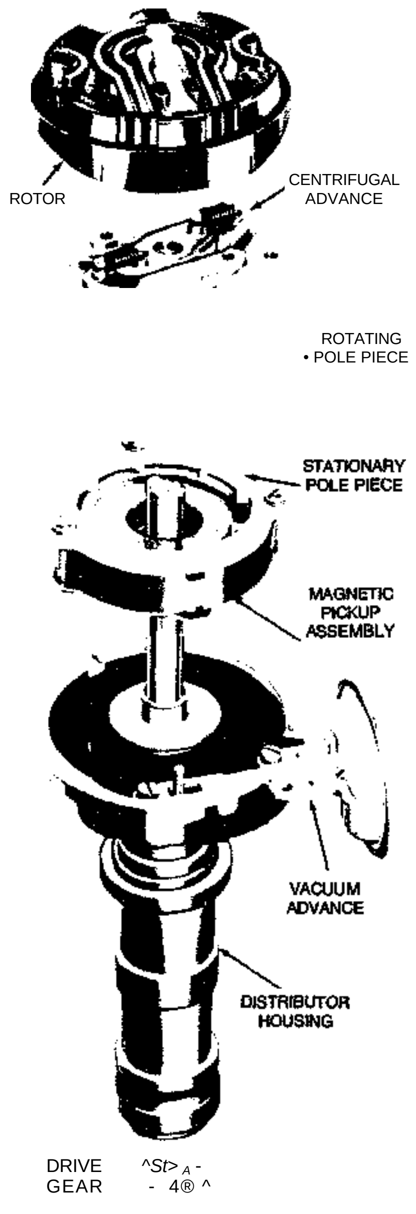
NOTE: *The following specifications are given in degrees advance at crankshaft speed. Half degrees for distributor machine testing.*

			Centrifugal Advance			Vacuum Advance	
Year	Model	Distributor Part Number	Start Degrees @rpm	Intermediate Degrees @rpm	End Degrees @rpm	Start Degrees @ In. Hg	End Degrees @ in. Hg
1963-64	All except fuel injection	1111024	0@700	11 @1600	24 @ 4600	0@8	15 @ 15.5
	Fuel injection	1111022	0@700	11 @700	24 @ 4600	0@8	15 @ 15.5
1965	Base engine	1111076	0@750	15 @ 1500	26 @ 4100	0@4	16.5 @ 8.2
	Special performance	1111069	0@800	NA	24 @ 2350	0@4	16.5 @ 8.2
	Fuel injection	1111070	0@800	NA	24 @ 2350	0@4	16.5 @ 8.2
	Base engine	1111087	0@750	15 @ 1500	30 @ 5100	0@4	16.5 @ 8.2
	Special performance w/transistor ign	1111060	0@800	NA	26 @ 2500	0@4	16.5 @ 8.2
	F.I. w/transistor ign	1111064	0@800	NA	26 @ 2500	0@4	16.5 @ 8.2
1966	300 hp	1111194	0@900	15 @ 1500	30 @ 5100	0@6	15@12
	350 hp	1111438	0@950	20 @ 1800	30 @ 4700	0@8	15 @ 15.5
	390 hp	1111293	0@900	8 @ 1250	32 @ 5000	0@7	12@12
	350 hp w/transistor ign	1111441	0@900	16.5 @ 1400	30 @ 4400	0@8	15 @ 15.5
	390 hp w/transistor ign	1111294	0@900	17 @ 2000	32 @ 5000	0@7	12@12
	425 hp	1111170	0@900	17 @ 2000	32 @ 5000	0@7	12@12
1967-68	300 hp	1111194	0@900	15 @ 1500	30 @ 5100	0@6	15@12
	350 hp	1111438	0@950	20 @ 1800	30 @ 4700	0@8	15 @ 15.5
	390 hp, 400 hp	1111293	0@900	17 @ 2000	32 @ 5000	0@7	12@12
	435 hp	1111296	0@900	NA	30 @ 3800	0@8	15 @ 15.5
	430 hp L88	1111295	0@1200	18 @ 1900	30 @ 5000	—	—
	350 hp w/transistor ign	1111441	0 @ 900	16.5 @ 1400	30 @ 4400	0@8	15 @ 15.5
	390 hp, 400 hp	1111294	0@900	17 @ 2000	32 @ 5000	0@7	12@12

Distributor Specifications (cont.)

NOTE: *The following specifications are given in degrees advance at crankshaft speed. Half degrees for distributor machine testing.*

Year	Model	Distributor Part Number	Centrifugal Advance: Start Degrees @rpm	Centrifugal Advance: Intermediate Degrees @rpm	Centrifugal Advance: End Degrees @rpm	Vacuum Advance: Start Degrees @ in. Hg	Vacuum Advance: End Degrees @ in. Hg
1969	300 hp	1111490	0@900	15 @ 1500	30 @ 51 00	0@8	19@17
	350 hp	1111493	0@1000	10 @ 1700	26 @ 5000	0@7	15@12
	390 hp, 400 hp	1111926	0@900	17 @ 2000	26 @ 3800	0@7	12@12
	435 hp	1111928	0@900	2 @ 1100	30 @ 3800	0@8	15 @ 15.5
	430 hp L88	1111927	0@1200	16 @ 1900	29 @ 5000	—	—
1970	300 hp	1111490	0@900	15 @ 1500	30 @ 5100	0@8	19@17
	350 hp	1111493	0@1150	10 @ 1700	26 @ 5000	0@8	19@17
	370 hp	1111491	0@1000	NA	26 @ 5000	0@8	15 @ 15.5
	390 hp	1111464	0@1085	17 @ 21 00	22 @ 3200	0@7	12@12
	460 hp	1112026	0@1000	NA	21 @ 2300	0@7	12@12
1971	270 hp	1112050	0@1335	11 @2400	18 @ 4200	0@8	15 @ 15.5
	330 hp	1112038	0@1330	16 @ 2250	24 @ 5000	0@8	15 @ 15.5
	365 hp	1112051	0@1145	14 @ 2000	22 @ 3000	0@8	20@17
	425 hp w/manual trans	1112076	0@1300	25 @ 2350	31 @ 6000	0@7	12@12
	425 hp w/auto trans	1112053	0@1310	21 @ 2350	28 @ 5000	0@7	12@12
1972	200 hp	1112050	0@1335	11 @2400	18 @ 4200	0@8	15 @ 15.5
	255 hp	1112101	0@1200	14 @ 2000	28 @ 5000	0@8	15 @ 15.5
	270 hp	1112051	0@1145	14 @ 2000	22 @ 3000	0@8	20@17
1973	190 hp	1112098	0@1100	—	14 @ 4200	0@6	15@14
	250 hp	1112150	0@1200	—	20 @ 5000	0@6	15@12



Exploded view of the transistorized distributor

the plug wires out of the locating looms (if so equipped) and move the ring (with the wires still attached) out of the way.

5. Release the distributor cap hold-down screws (push downward and turn counter-clockwise) and lift the cap assembly off of the distributor. Check that the firing tip of the rotor is pointed at the #1 terminal of the distributor cap; if it is not, rotate the engine one full revolution and again align the timing marks. Recheck the position of the rotor.

6. Disconnect the vacuum line from the distributor vacuum advance unit, if so equipped.

7. Follow steps 5, 7, 8, and 10-12 of the previous procedure, in that order to complete distributor removal.

INSTALLATION—ENGINE NOT DISTURBED

1. Clean the distributor and intake manifold mating surfaces and check the condition of the cork gasket. Replace the gasket if it is damaged.

2. Position the distributor in the engine without yet engaging it. Align the distributor housing-to-engine alignment marks which were made during removal. Position the rotor firing tip slightly counterclockwise of the corresponding distributor housing mark; remember, the rotor will turn slightly during installation.

3. Engage the distributor to the engine by moving it downward. The rotor should turn to its proper alignment position. If it does not, lift the distributor enough to disengage the drive gear, reposition the rotor and lower the distributor.

4. Install the distributor hold-down plate and just snug down the bolt.

5. Make sure that the rotor retaining screws are tight and install the distributor cap.

6. Connect the cables (tach, injection—if so equipped), wires, and vacuum line (if so equipped) to the distributor.

7. On conventional ignitions, reconnect the primary distributor lead to the coil. On models without H.E.I., reconnect the secondary coil wire.

8. On H.E.I, models, install the plug wire retaining ring. Press the ring downward until the two locking tabs engage. Make sure dial the plug wire terminals are firmly seated on the distributor cap terminals.

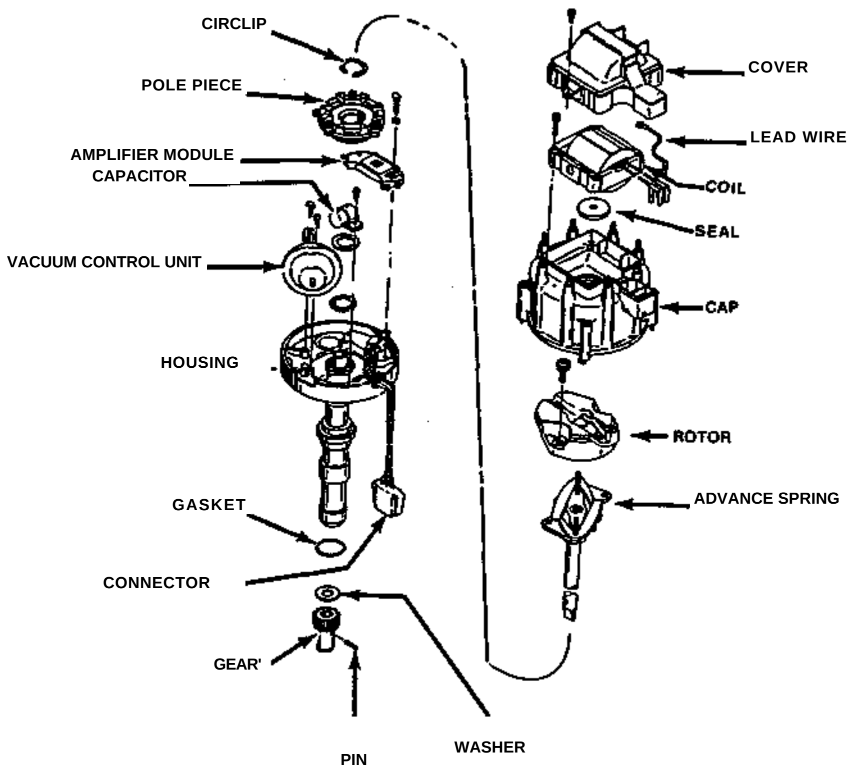
9. Reposition the plug wires into their locating looms, if so equipped.

10. Install the air cleaner and reconnect the battery cables.

11. Adjust the ignition timing as previously outlined and tighten the distributor hold-down bolt. Reinstall the ignition shielding as necessary.

INSTALLATION—ENGINE DISTURBED

1. The piston of the #1 cylinder must be on its compression stroke and at the top of its



Exploded view of the HEI distributor. Engines with the computer emissions system do not have the vacuum advance unit.

travel (top dead center -TDC) in order to time the ignition system to the engine. There are several ways to determine when the piston is on its compression stroke. In any case, the #1 spark plug must be removed. The various methods are as follows:

a. Hold your finger over the spark plug hole and have an assistant turn the engine over slowly. When you feel compression, watch the timing marks. Stop turning the engine over as soon as the timing mark on the crankshaft balancer is aligned with the "0" mark on the timing tab scale.

b. Insert a rag into the spark plug hole (NOT into the cylinder). Turn the engine over slowly until the rag is blown out of the hole. Stop cranking the engine when this happens and check the riming marks. If necessary, "tap" the ignition key until the timing mark on the crankshaft balancer is aligned with the "O" mark on the timing tab scale.

c. Attach a compression gauge to the spark plug hole (preferably the screw-in type; eliminating the need for an assistant). Position the gauge dial so that it may be viewed while cranking the engine. Turn the engine over until the gauge needle reading increases, indicating compression. Stop cranking the engine when this happens and check the timing marks. If necessary, "tap" the ignition key until the timing mark on the crankshaft balancer is aligned with the "O" mark on the timing tab scale. Remove the compression gauge. NOTE: *There are tools available commercially which screw into the #1 spark plug hole and register (more accurately than the above methods) when top dead center is reached. If one of these tools is used, follow the tool manufacturers instructions.*

2. Reinstall the #1 spark plug and connect the plug wire. With the distributor out of the vehicle and the distributor cap installed, lo cate the #1 distributor cap terminal and chalk mark its position on the distributor housing. Remove the distributor cap.

3. Position the distributor into the engine block with the:

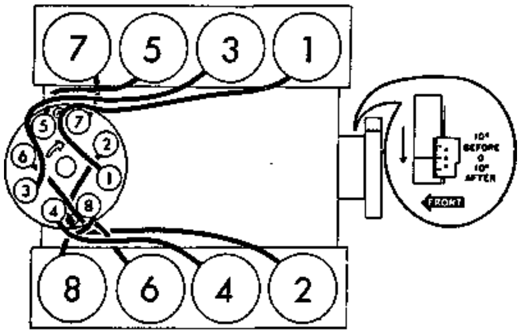
a. vacuum advance unit in its proper position (see the Firing Order illustra tions).

b. firing tip of the rotor pointing to the mark made during step 2.

4. As the distributor drive gear engages, the rotor will turn slightly. If the distributor

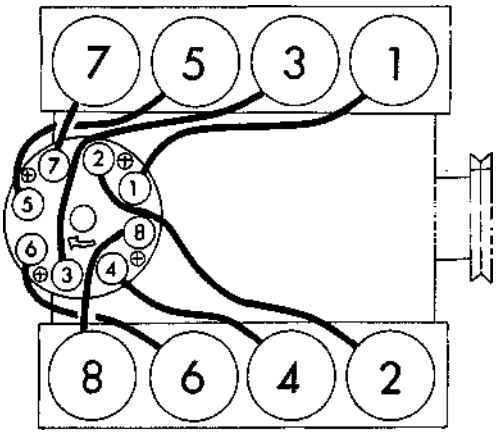
FIRING ORDER

To avoid confusion, replace spark plug wires one at a time.



1963-74 except HEI

ENGINE FIRING ORDER: 1-8-4-3-6-5-7-2
DISTRIBUTOR ROTATION: CLOCKWISE



1974-84 HEI

housing does not sit properly on the block, the oil pump shaft is not engaging with the distributor shaft. In this case, you can do one of two things:

a. Remove the distributor and turn the oil pump driveshaft with a long screw driver to align the pump driveshaft slot with the "blade" of the distributor shaft. This is done strictly by visual approximation.

b. Apply downward pressure on the dis tributor housing (NOT the rotor) and have someone "tap" the ignition key to slowly turn the engine over until the distributor falls into its proper position. After doing this, it is recommended that you recheck the timing by repeating steps 1 and 2.

5. On conventional ignitions, after proper positioning is assured, turn the distributor housing so that the points are just opening.

6. Install the distributor hold-down bolt and plate. Snug down the retaining bolt.

7. Connect the vacuum advance hose, tach drive cable, and injection drive cable, on ve hicles equipped with these items.

8. Connect all wiring and adjust the igni tion timing as previously outlined.

9. Install the ignition shielding.

H.E.S. COMPONENT REPLACEMENT

Distributor Cap

1. Disconnect the feed, module, and ta chometer wiring from the drivers side of the distributor cap. Do so by releasing the wiring connector retaining tabs and carefully pulling downward on the connectors.

2. Locate the locking tabs of the spark plug wire retaining ring (on the distributor cap). Move each of the two locking tabs outward to release the retaining ring. With the plug wires still attached to the ring, pull the ring and wires off of the distributor cap and move the assembly out of the way.

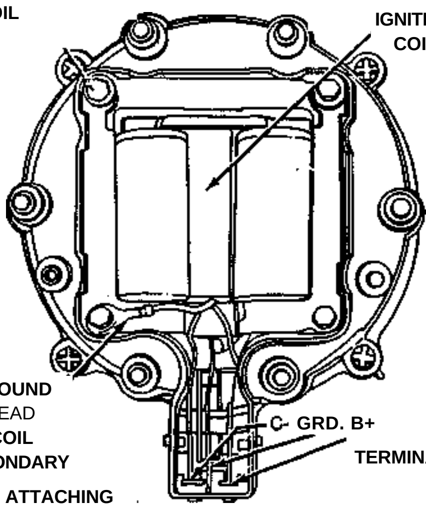
3. Release the distributor cap hold-down screws (push downward and counterclock wise) and lift the cap assembly off of the dis tributor.

4. Remove the coil cover from the distrib utor cap (4 fasteners).

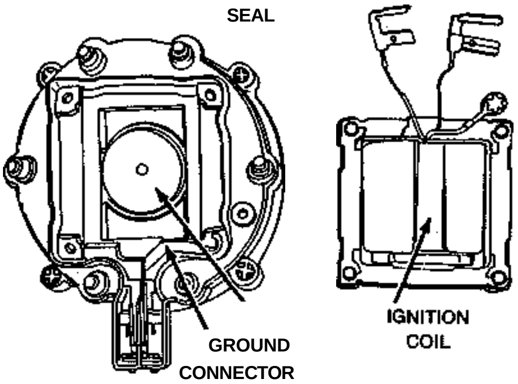
5. Push the spade terminals upward and out of the distributor cap.

6. Remove the four coil screws and lift the coil, spring, carbon contact, and rubber washer out of the distributor cap.

7. Reverse the previous steps to assemble, using a new cap. Lubricate the rubber washer with dielectric lubricant during assembly.



Ignition coil mounted in the HEI distributor cap



After removing the coil, check the condition of the arc seal (1981 shown, other years similar)

Ignition Coil

Perform steps 1, 2, 4, 5, and 6 of the previous distributor cap replacment procedure. Install the new coil, being sure to use the dielectric compound supplied with most coils to lubricate the rubber washer.

Ignition Rotor

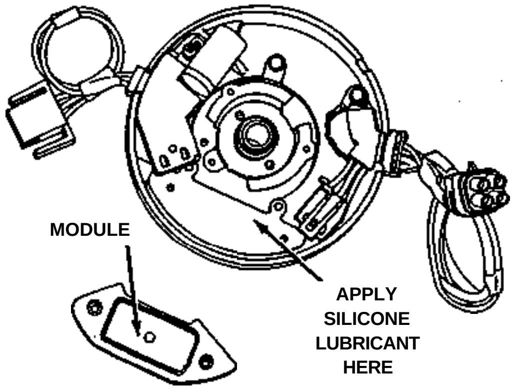
Remove the distributor cap as previously outlined. Loosen the rotor retaining screws (most screws will stay attached to the rotor) and lift the rotor off of the mainshaft assembly. During installation, note the locations of the different locating "dowels" (2) on the underside of the rotor. These dowels help to prevent incorrect rotor installation by allowing the rotor to be installed in only one way.

Vacuum Advance Unit (if so equipped)

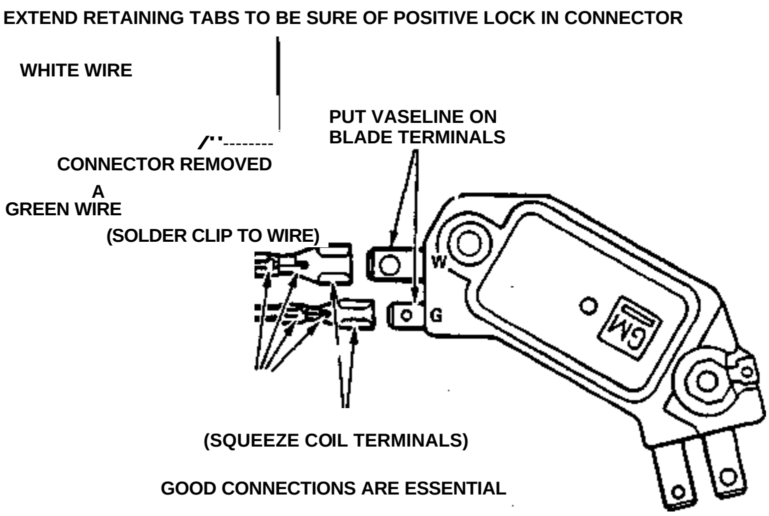
1. Remoy/e the distributor cap and rotor as previously outlined.
2. Disconnect the hose from the vacuum advance unit.
3. Remove the two vacuum advance unit retaining screws and pull the unit outward.
4. Rotate the unit to disengage the operating rod from the distributor.
5. Reverse the previous steps to install.

Module

1. Remove the distributor cap and rotor as previously outlined.
2. Carefully disconnect the wiring from the module.
3. Remove the two module retaining screws and lift the module out of the distributor housing.
4. Apply a light coating of silicone dielectric compound to the distributor housing in the module mounting area before installing the new module. The silicone compound is used to transfer heat from the module to the



Placement of silicone dielectric compound prior to HEI module installation—see text



Proper HEI module electrical connections distributor housing. If the compound is not used, the module will overheat, causing failure of the ignition system.

NOTE: *Silicone compounds are available strictly for this purpose—DO NOT use a regular silicone lubricant or sealer.*

5. Install the new module, using the accompanying illustration as a guide to establish the best possible module connections.

NOTE: *Many H.E.I, failures have been attributed to poor module connections. Inspect the wires, terminals, and connectors for damage and follow tthe accompanying illustration.*

6. Install the rotor and distributor cap as previously outlined.

NOTE: *Items previously listed are the only items of the H.E.I, distributor which are serviceable with the distributor installed. Other services will require distributor removal and disassembly.*

DISASSEMBLY

Conventional Systems

1. Remove the distributor cap and the rotor.
2. Remove the two-piece radio interference shield (2 fasteners), if so equipped.
3. Remove the centrifugal advance springs and weights.
4. Drive the roll pin out of the distributor gear using a drift no larger than die roll pin.
5. Slide the distributor gear off of the shaft and remove the spacers and washers (note their arrangement for reinstaUation).
6. Remove the tachometer drive gear.
7. Inspect the distributor shaft for burrs in the gear mounting area. If there are any burrs or nicks, carefully smooth them with a fine file. This should be done to prevent bushing damage as the distributor shaft is withdrawn from the housing.
8. Slide the distributor shaft assembly out of the housing.
9. Remove the vacuum advance unit (2 screws).
10. Carefully remove the breaker plate retaining ring and lift the breaker plate off of the distributor housing. DO NOT disassemble the breaker plate any further.
11. Remove the point set, condenser, and the condenser mounting bracket from the breaker pkte. Remove the washer and seal from beneath the breaker plate.

Transistorized Systems

1. Remove the distributor cap and the rotor.
2. Remove the centrifugal advance springs and weights.
3. Remove the tachometer drive gear.
4. Support the distributor gear (to prevent damage to the magnetic pickup assembly) and drive the roll pin out of the gear, using a drift no larger than the roll pin.
5. Slide the distributor gear and washer off of the distributor shaft.
6. Inspect the distributor shaft for burrs in the gear mounting area. If there are any burrs or nicks, carefully smooth them with a fine file. This should be done to prevent bushing damage as the distributor shaft is withdrawn from the housing.
7. Remove the centrifugal advance weight support and timer core from the distributor shaft.
8. Disconnect the pickup coil lead connector.
9. Remove the retaining ring which secures the magnetic pickup assembly to the distributor housing.
10. Remove the entire magnetic pickup assembly from the distributor housing. DO NOT remove the three screws which secure the stationary pole piece to the pickup assembly.
11. Remove the washer and felt pad from the pickup mounting.
12. Remove the vacuum advance unit.

H.E.I. Systems

1. Remove the distributor cap assembly and rotor as previously outlined.
2. Remove the centrifugal advance springs and weights from the mainshaft, if so equipped.
3. Drive out the distributor gear roll pin using a drift.
4. Remove the distributor gear and washers. Note the location of the washers so that they may be reinstalled properly.
5. Slide the distributor shaft out of the housing.
6. Disconnect the electrical leads from the module and remove the module. Also remove the capacitor.
7. If the internal teeth of the pickup assembly are fully exposed; remove the pickup retaining ring and remove the pickup assembly from the distributor housing (Do not remove the three screws from the pickup as-

sembly). If the internal teeth of the pickup are not fully exposed; remove the magnetic shield from the pickup assembly (three attaching screws). Remove the pickup assembly retaining ring and remove the pickup components (magnet, pole piece, pickup coil).
8. Remove the vacuum advance unit, if so equipped.

ASSEMBLY

Assembly of the distributor is the reverse of its respective disassembly procedure.

When assembling the distributor, be sure to lubricate the distributor shaft bushings with a few drops of engine oil. Also be sure that the distributor shaft turns freely after it is installed. On conventional, point-type distributors, it is easier to install and gap the points while the distributor is removed.

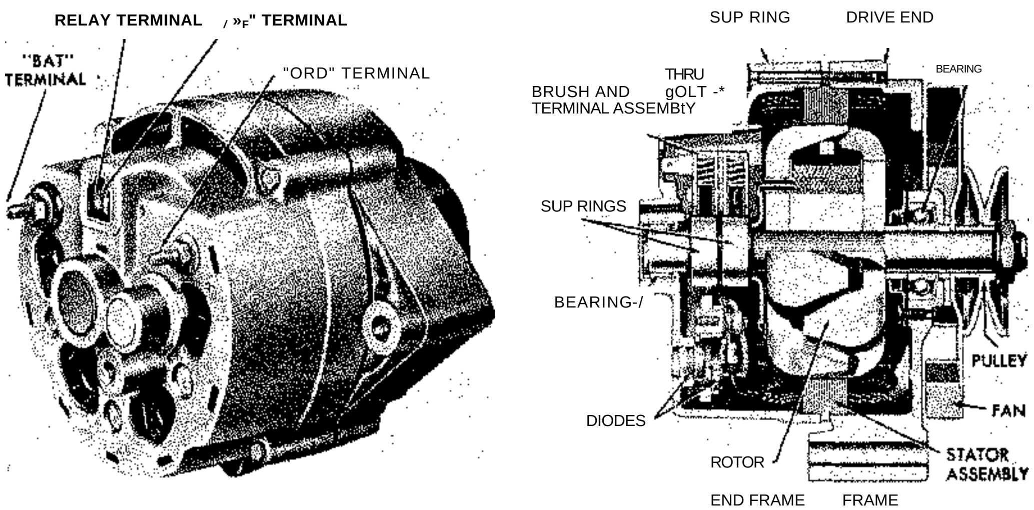
On H.E.I, systems, apply a light coating of silicone dielectric compound to the distributor housing in the module mounting area before installing the module. The silicone compound is used to transfer heat from the module to the distributor housing. If the compound is not used, the module will overheat, causing failure of the ignition system. NOTE: *Silicone compounds are available strictly for this purpose—DO NOT use a regular silicone lubricant or sealer.* Refer to the previous middle replacement procedure for additional module installation information.

Alternator

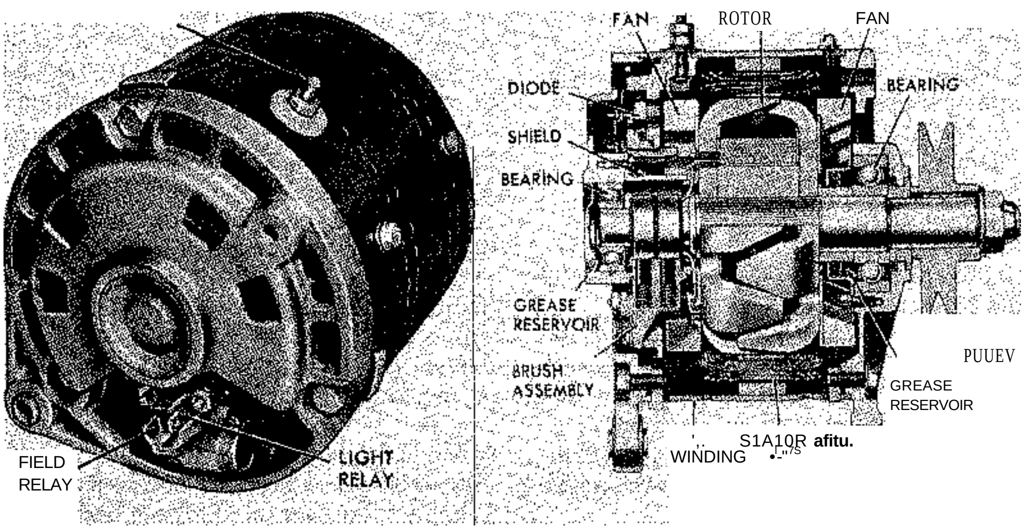
The alternating current generator (alternator) supplies a continuous amount of electrical energy at all engine speeds to keep the battery fully charged. The Corvette, as all other GM vehicles, uses a Delcotron alternator. Delcotron is a trade name of the Delco-designed alternator.

The alternator consists of four main assemblies: drive (pulley) end frame, slip ring (rear) end frame, stator, and rotor. The drive end frame houses a ball bearing which is used to support the front of the rotor and is large enough to withstand the side loads imposed on the rotor by the alternator belt. The slip ring end frame uses a small roller bearing which is used to support the rear of the rotor (The "perforated case" Delcotron uses a ball bearing in the rear, also). These bearings are lubricated during their assembly and need no additional lubrication. If you replace the bearings, try to obtain a fully sealed bearing for the front, to further increase bearing life.

The stator has a laminated core which is attached to the frame of the alternator. On "perforated case" models, the stator is serviced with the main case. A large number of windings cover the inside diameter of the stator, and it is within this circle that the rotor turns. Current passes from two brushes through the slip rings (of the rotor) and finally to the field coils which are wound in a manner concentric to the rotor shaft.

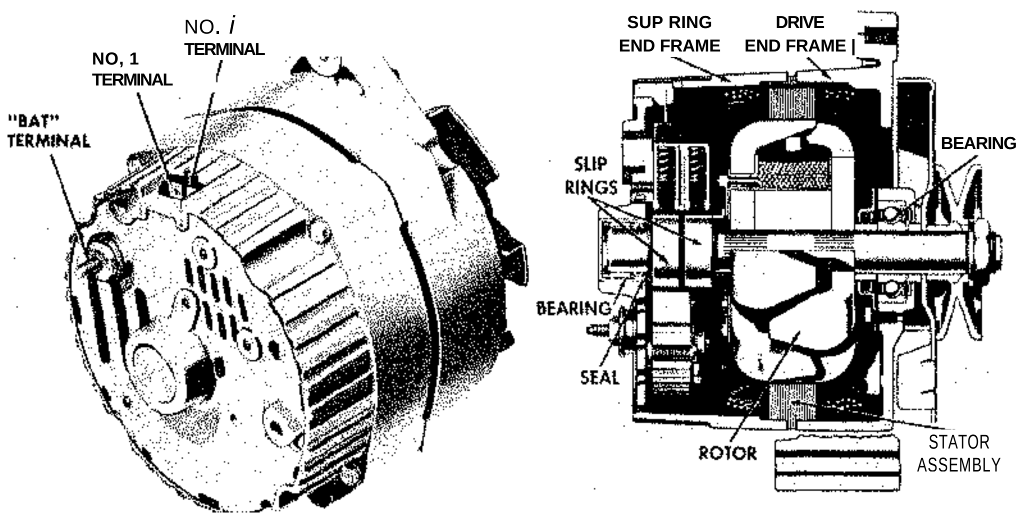


Externally regulated Delcotron—except "perforated case" models



Externally regulated, "perforated case" Delcotron

Both the internally and externally regulated Delcotrons use positive and negative diodes. These diodes are electrical chedk valves, meaning that they will allow current to pass freely in only one direction. The diodes perform the function of changing the alternating current (AC) developed within the stator windings to direct current (DC) which can be used by the 12VDC system. In the externally regulated Delcotron (except the "perforated case" models), the negative diodes (3) are pressed into die slip ring end frame; the positive diodes (3) are pressed into an electrically insulated heat sink attached to the slip ring end frame. The diodes used in the "perforated case" Delcotron are pressed into removable heat sinks. The grounded heat sink contains the negative diodes; the insulated



Internally regulated Delcotron

contains the positive. InternaDy regulated Delcotrons use a different type of diode arrangement. In these models, the negative diodes are permanently mounted in a rectifier bridge assembly. The rectifier bridge utilizes a finned aluminum heat sink for efficient diode cooling, and is mounted inside the slip ring end frame. A positive diode trio is used instead of separately mounted positive diodes. If a negative diode of the rectifier bridge fails, the rectifier bridge assembly must be replaced. Also, the positive diode trio can only be replaced as a unit.

Generally, internally and externally regulated alternators can easily be distinguished by the type of plug-in connector which is used at the alternator. External regulator models use a connector having two side-by-side vertical spade terminals, whereas the internal regulator type uses a connector having two side-by-side horizontal spade terminals. All "perforated case" Delcotrons use external voltage regulators.

Adjustments can be made to the external type of regulator (covered later in this section). The internally mounted voltage regulator is non-adjustable—if it is defective, it must be replaced.

ALTERNATOR PRECAUTIONS

To prevent damage to the alternator and regulator, the following precautions should be taken when working with the electrical system.

1. Never reverse the battery connections.
2. Booster batteries for starting must be connected properly—positive-to-positive and negative-to-negative.
3. Disconnect the battery cables before using a fast charger; the charger has a tendency to force current through the diodes in the opposite direction for which they were designed. This burns out the diodes.
4. Never use a fast charger as a booster for starting the vehicle.
5. Never disconnect the voltage regulator while the engine is running.
6. Avoid long soldering times when replacing diodes or transistors. Prolonged heat is damaging to AC generators.
7. Do not use test lamps of more than 12 volts (V) for checking diode continuity.
8. Do not short across or ground any of the terminals on the AC generator.
9. The polarity of the battery, generator, and regulator must be matched and considered before making any electrical connections within the system.
10. Never operate the alternator on an open circuit. Make sure that all connections within the circuit are clean and tight.
11. Disconnect the battery terminals when performing any service on the electrical system. This will eliminate the possibility of accidental reversal of polarity.
12. Disconnect the battery ground cable if arc welding is to be done on any part of the car.

EXTERNALLY REGULATED ON-CAR CHARGING SYSTEM TESTS

isolation Checks

These are quick checks that will allow the tester to isolate the general source of charging circuit difficulty in either the alternator, regulator, or wiring harness. Once the defective component has been singled out, further checks and repairs may be made using the procedures given in the alternator or regulator sections. Make these checks after looking for obvious problems such as a weak battery or loose fan belt.

Start the engine and bring the idle to between 1500-2000 rpm. Turn off all accessories, lights, radio, etc., and then disconnect the battery ground cable. If the engine stops, it is safe to assume that the alternator is at fault. If, however, the engine continues to operate, the problem lies with either the regulator or wiring harness.

Having eliminated the alternator from suspicion, the next step is to isolate the regulator from the harness and the easiest way is to substitute a known component. Remove the push-on wiring connector from the regulator and insert a regulator that is known to be good into the circuit, remembering to ground the regulator to the car. Idle the engine, remove the battery cable, and check the ammeter. If it indicates a discharge condition, then the possible problem is an open resistor or a shorted, positive diode. If the ammeter continues to indicate a charge, then it is the regulator that is defective.

Alternator Tests

Prepare the alternator for testing by disconnecting the battery ground terminal, the BAT, light relay, field, and GRD leads from the alternator terminals.

Check the positive diodes by connecting an ohmmeter between the R (or light relay) and

BAT terminals, and noting the lowest range on the ohmmeter scale. It should indicate very low resistance. Reversing the connections should result in an infinitely high resistance indication.

If the ohmmeter reads low or high in both directions, the diodes, are defective. A low reading could also indicate a grounded stator.

To test for an open field, connect the ohmmeter between the F (or Field) and GRD terminals and check the low range scale for a reading between 7 and 20 ohms. A zero indication or one of excessively high resistance suggests a faulty alternator.

NOTE: *The 17SI alternator used on the 1984 Corvette uses delta stator windings and cannot be checked for an open circuit.*

Field Relay Tests

Fasten one voltmeter lead to the no. two regulator terminal and ground the other lead to the regulator. Idle the engine between 1500 and 2000 rpm. If the GEN light still burns, and a volt reading of 3.5 to 6.5 is present, then the regulator field relay is faulty.

Accessory Circuit Resistance Tests

A resistor is connected to the ACC terminal ignition switch. To check for an open resistor, connect the voltmeter to the no. 4 connection of the regulator and ground the other voltmeter lead to the regulator. A zero reading, with the ignition switch turned to the ACC notch, indicates an open resistor. The resistance wire is an integral part of the ignition harness and carries a rating minimum of 10 ohms, 6.25 watts. The wire is not solderable and must be crimp-connected.

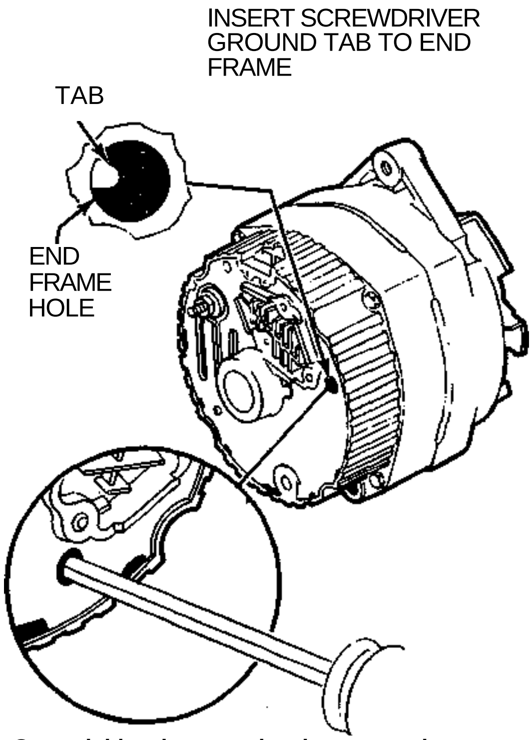
INTERNALLY REGULATED SYSTEM TESTING

Alternator Output Test

1. Connect a test voltmeter, ammeter, and a 10-ohm, 6-watt resistor into the charging circuit. Do not connect the carbon pile to the battery posts at this time.
2. Increase alternator speed and observe the voltmeter—if the voltage is uncontrolled with speed and increases to 16 volts Or more, check for a grounded brush lead clip as previously covered. If a brush lead clip is not grounded, the voltage regulator is faulty and must be replaced.
3. Connect the carbon pile load to the battery terminals.
4. Operate the alternator at moderate speed and adjust the carbon pile to obtain maximum alternator output as indicated on the ammeter. If output is within 10% of rated output as stamped on the alternator frame, alternator is O.K. If output is not within specifications, ground the alternator field by inserting a screwdriver into the test hole in the end frame. If output now is within 10% of rating, replace the voltage regulator; if still not within specifications, check field winding, diode trio, rectifier bridge and stator, as described later.

Low Charging Rate Diagnosis

1. After battery condition, drive belt tension, and wiring terminals and connections have been checked, charge the battery fully and perform the following test:
2. Connect a test voltmeter between the alternator BAT, terminal and ground, ignition switch on. Connect the voltmeter in turn to alternator terminals No. 1 and No. 2, the other voltmeter lead being grounded as before. A zero reading indicates an open circuit between the battery and each connection at the alternator. If this test discloses no faults in the wiring, proceed to Step 3.
3. Connect the test voltmeter to the alternator BAT terminal (the other test lead to



Ground this tab to test the alternator voltage output—Internally regulated Delcotron only

ground), start the engine and run at 1,500-2,000 rpm with all lights and electrical accessories turned on. If the voltmeter reads 12.8 volts or greater, the alternator is good and no further checks need be made. If the voltmeter reads less than 12.8 volts, ground the field winding by inserting a screwdriver into the test hole in the end frame.

CAUTION: *Do not force the tab more than* % in. *into the end frame.*

a. If voltage increases to 13 volts or more, the regulator unit is defective;

b. If voltage does not increase signifi cantly, the generator is defective.

High Charging Rate Diagnosis

1. With the battery fully charged, connect a voltmeter between alternator terminal No. 2 and ground. If the reading is zero, No. 2 circuit from the battery is open.

2. If No. 2 circuit is OK, but an obvious overcharging condition still exists, proceed as follows:

a. Remove the alternator and separate the end frames;

b. Connect a low-range ohmmeter be tween the brush lead clip arid the end frame (Test 1), then reverse the connections. If both readings are zero, either the brush lead clip is grounded or the regulator is de fective. A grounded brush lead clip can be due to damaged insulating sleeve or omis sion of the insulating washer.

REMOVAL AND INSTALLATION

1. Disconnect the negative battery cable at the battery; this will prevent damaging the alternator diodes.

2. Disconnect the wiring from the rear of the alternator (bolt-on and push-in connec tors).

3. Loosen the lower alternator bolt and re move the upper (adjustment) bolt. Slip the drive belt off of the pulley.

4. Remove the pivot bolt and lift the alter nator out of its mounting brackets.

5. Installation of the alternator is the re verse of the previous steps. Adjust the drive belt to the proper tension.

DISASSEMBLY AND ASSEMBLY

Externally Regulated Type—Except "Perforated Case" Models

Remove the pulley by positioning a box-end wrench over the pulley retaining nut and inserting a ^{5}/i6 in. alien wrench in the shaft to prevent it from turning. Unbolt the retaining nut and slide it off the pulley. Disconnect the battery ground strap to prevent diode damage and remove the generator. On the 6.2 in. perforated case generator, remove the blade-connector retaining nuts and remove the connectors. Slip the indicator light relay from the terminal post, then back out die retaining screws, and remove the brush holder. Leave the capacitor attached to the generator. Remove the four, long, case bolts and separate the end frame and rotor assembly from the stator assembly. Cover the slip ring and bearing with tape to prevent contamination.

Remove the rotor from the end frame. Extract the retainer plate screws and remove the retainer plate and the end frame bearing. Remove the three attaching screws and separate the stator from the end frame. Remove the heat sink.

Wash all metal parts with the exception of the stator and rotor assemblies. The rotor slip rings may be cleaned with 400 grain polishing cloth. It is a good idea to rotate the rotor while doing this to guard against rubbing flat spots on the slip rings. Maximum out-of-round tolerance for sh'p rings is 01001 in. Remove as little metal as possible when truing on a lathe. Polish with 400 grain cloth and blow dry. To assemble the alternator: Attach the slip-ring end frame to the stator assembly and position the diode connectors above the diode, relay, and stator leads. Tighten the terminal nuts, then slide the front end frame over the rotor. Slide on the spacer, pulley, washer, and nut, and torque the shaft to 50-60 ft. Ibs. Attach the slip-ring end frame and stator to the rotor and drive end frame assembly and insert and tighten the thru-bolts.

Externally Regulated Type—"Perforated Case" Models

1. Mount the alternator in a vise, clamp ing the drive end mounting flange length wise.

2. Remove the two screws which secure the cover to the brush holder and remove the cover.

3. Remove the nut which retains the in dicator light wire to the bkde connector post. Disconnect the wire from the connector post.

4. Remove the two brush holder assem bly attaching screws and remove the brush holder.

NOTE: *The capacitor lead* is *connected inside the alternator; the capacitor must stay* *with the alternator to avoid overstressing the lead wire.*

5. Scribe alignment marks to indicate the relationships between the end frames and the main base. These components must be prop erly aligned during assembly.

6. Remove the slip ring (rear) end frame attaching bolts (3) and carefully pry the end frame off of the main case assembly. Pry around the circumference of the frame to avoid damaging the frame.

7. Remove the drive end frame attaching bolts (3).

8. Remove the end frame, rotor, and pul ley as an assembly.

9. Remove the shaft nut, washer, pulley, and woodruff key from the rotor shaft and slide the rotor out of the end frame.

10. If you plan to test the diodes and stator, disconnect the stator leads from the diodes using either of the following meth ods.

a. Cut the leads between the stator windings and the diodes

b. Scrape the epoxy coatings from the leads and unsolder die leads from the diodes.

CAUTION: *If you choose method "b", be sure to use a minimum amount of heat to avoid damage to the diodes.*

11. Remove the heat sink retaining screws and remove the heat sinks. Remember that the insulated heat sink contains the positive diodes and that the insulated heat sink is the one with the "batt" terminal.

12. Testing and/or replacement of bear ings or diodes should be performed at this time, if necessary.

Assembly of the alternator is the reverse of the previous steps. Note the following points during assembly:

a. Refer to the illustration which accompanies the "Brush and Holder Replacement" procedure for wiring information.

b. Solder the stator lead-to-diode con nections, if separated during step 10.

c. Align the scribed marks made during disassembly.

d. Lightly clamp the pulley in a soft-jawed vise when installing the pulley nut. Torque the pulley nut to 50-60 ft. Ibs.

e. When installing the brush holder, push each brush into the holder and retain with a straightened paper clip during in stallation. Remove the clip after the holder is installed.

Internally Reglated Type

1. Place alternator in a vise, clamped by the mounting flange only.

2. Remove the four through bolts and separate the slip ring end frame and stator assembly from the drive end and rotor as sembly, using a screwdriver to pry the two sections apart. Use the slots provided for the purpose.

NOTE: *Scribe matchmarks on the parts to aid in assembly.*

3. Place a piece of tape over the slip ring end frame bearing to prevent entry of dirt; also tape shaft at slip ring end to prevent scratches.

4. Clean brushes, if they are to be reused, with trichloroethylene or carbon tetrachloride solvent. Use these solvents only in an adequately ventilated area.

5. Remove the stator lead nuts and sepa rate the stator from the end frame.

6. Remove the screw that secures the diode trio and remove diode trio.

NOTE: *At this point, test the rotor, rectifier bridge, stator and diode trio if these tests are necessary.*

1. Remove the rectifier bridge hold-down screw and the BAT terminal screw, then disconnect condenser lead. Remove rectifier bridge from end frame.

8. Remove the two securing screws and brush holder and regulator assemblies. Note the insulating sleeves over the screws.

9. Remove the retaining screw and con denser from the end frame.

10. Remove the slip ring end frame bear ing, if it is to be replaced, using the proce dure given later in this section.

11. Remove the pulley nut, washer, pul ley, fan and spacer from the rotor shaft, using a ^{5}/ie in. alien key to hold the shaft while loosening the nut.

12. Remove rotor and spacers from drive end frame assembly.

13. Remove drive end frame bearing re tainer plate, screws, plate, bearing, and slinger from end frame, if necessary.

14. To assemble, reverse order of disas sembly. Pulley nut must be tightened to 40-50 ft. Ibs.

CLEANING AND INSPECTION

1. Clean all metal parts, except stator and rotor assemblies, in solvent.

2. Wipe off bearings and inspect them for pitting or roughness.

3. Inspect rotor slip rings for scoring. They may be cleaned with 400 grit sandpaper (not emery), rotating the rotor to make the rings concentric. Maximum out-of-true is 0.001 in. If slip rings are deeply scored, the entire ro tor must be replaced as a unit.

4. Inspect brushes for wear; minimum length is ¥4 in.

ALTERNATOR COMPONENT TESTING

Rotor *

Attach one lead of a 110 volt test lamp or an ohmmeter to either slip ring, and the other lead to the rotor shaft or poles. A lighted test lamp or low ohmmeter reading indicates grounded field windings.

Attach the lamp or ohmmeter connections to each slip ring. The windings are open if the lamp fails to light or the ohmmeter reading is high.

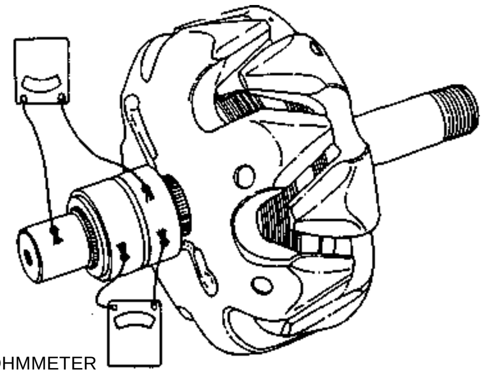
Connect a 12 volt battery and an ammeter in series with the slip rings to check for shorts. The windings are shorted if the reading exceeds 1.5 amps. An ohmmeter may be substituted for the same check and will show a resistance reading of less than 6 ohms if the windings are shorted.

Stator

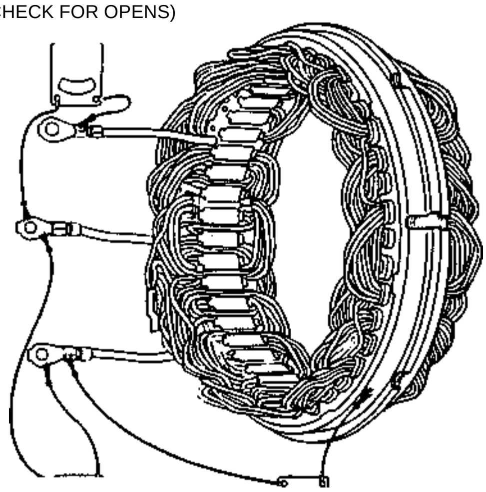
Attach the test lamp or ohmmeter to the stator frame and one of the stator leads. A lighted lamp or low resistance reading indicates grounded windings.

Successively connect the test equipment between each pair of stator leads. Open windings will produce a high resistance and prevent the test lamp from lighting.

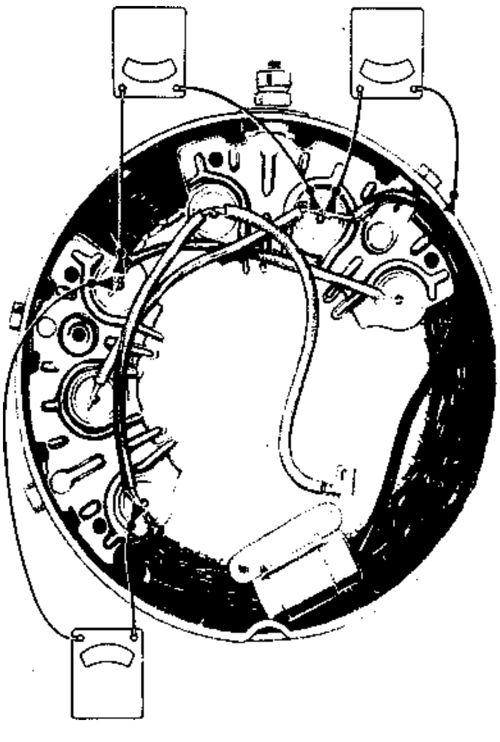
Shorts require special test equipment. If



Rotor testing



Stator testing—except "perforated case" models



OHMMETER

OHMMETER

Stator testing—"perforated case" models

all other tests fail to locate the problem, it is more than likely a short in the stator.

Separately Mounted Diodes (Pressed-in Type)

The diodes may be checked for shorts or opens by using an ohmmeter or a 12 volt test lamp.

CAUTION: *Under no circumstances use a 110 volt test lamp.*

Use a *V/z* volt cell ohmmeter that has been adjusted to the lowest range scale. Attach one lead to me heat sink and the other to the diode lead. A good diode will show a high and a low reading depending on the connection switch. Two low or two high readings signal a faulty diode. Check the other diodes in the same manner. When servicing "perforated case" models, repeat this for the diodes in BOTH heat sinks.

Check the end-frame mounted diodes by connecting one test lead to the frame and the other to the diode lead. Reverse the connection and check the readings. The same diagnosis is true here as for the heat sink diodes.

If an ohmmeter is not available, substitute a 12 volt test lamp. Connect and switch connections in the same fashion as with the ohmmeter. The lamp will light in only one direction. If it lights or fails to light in both directions, the diode is bad.

Diode Rectifier Bridge

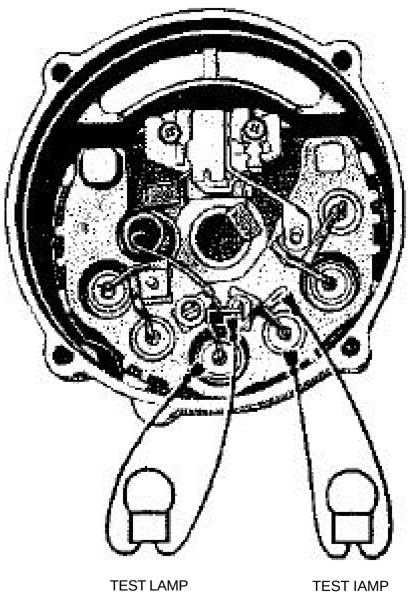
Refer to the accompanying illustration for component identification. Use a self-powered ohmmeter set on its lowest reading scale.

CAUTION: *DO NOT use a 110 volt test lamp to test the rectifier bridge—use only a self-powered ohmmeter.*

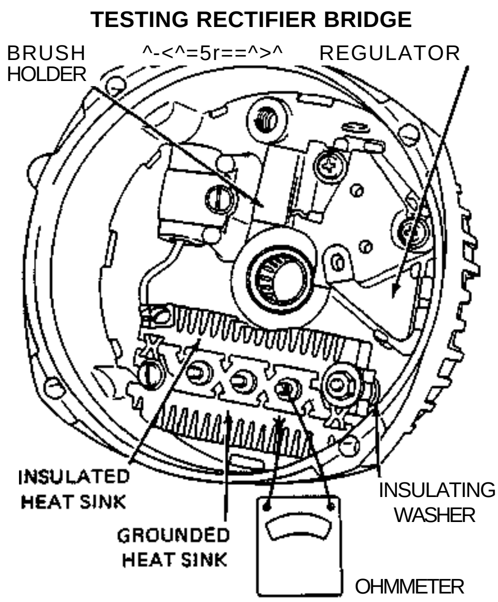
Connect one ohmmeter lead to the grounded heat sink. Connect the other lead to each of the three rectifier bridge terminals (one at a time) and note the ohmmeter readings (1st set). The readings at each of the bridge terminals should be virtually identical. Reverse the ohmmeter leads and repeat the test, again noting the meter readings (2nd set).

Connect one ohmmeter lead to the insulated heat sink. Connect the other lead to each of the three rectifier bridge terminals (one at a time) and note the ohmmeter readings (3rd set). Reverse the ohmmeter leads and repeat the test, again noting the meter readings (4th set).

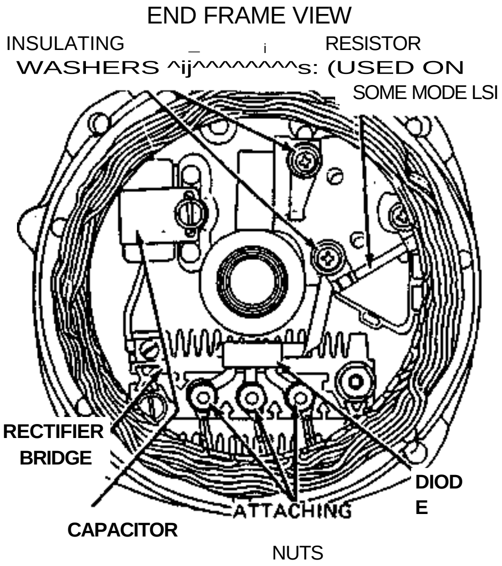
Readings taken for any one full set should be virtually identical, conversely, if you get two different readings WITHIN the same set, replace the rectifier bridge assembly. When comparing readings between sets 1 and 2, one set should read high, the other low. When comparing readings between sets 3 and 4, again, one set should be high, the other low.



Diode check



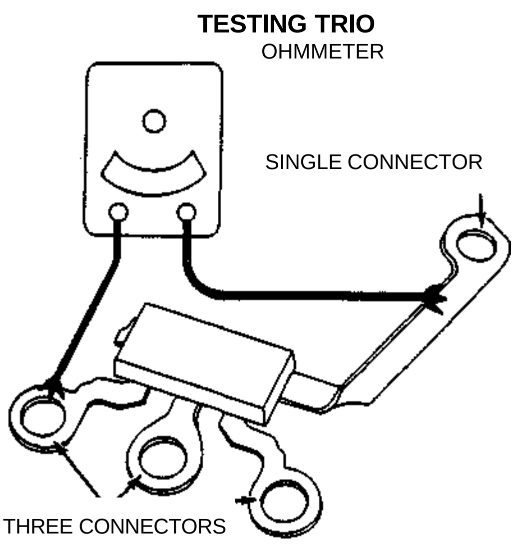
Rectifier bridge check



Location of diode trio

Diode Trio

CAUTION: *DO NOT use a 110 volt test lamp to test the diode trio—use only a self-powered ohmmeter. Set the ohmmeter lead to the single terminal of the diode trio. Connect the other lead to each terminal (one at a time) of the three terminal grouping, and note the ohmmeter reading at each terminal (1st set). Reverse the ohmmeter leads and repeat the same test, again noting the ohmmeter readings (2nd set). Ohmmeter readings WITHIN one set should be virtually identical. When comparing readings BETWEEN each set, one set should be high, the other low.*



Diode trio check

REPAIRS

Pressed-in Diode Replacement

Despite rumors to the contrary, diodes of this type may be replaced. It is not necessary to replace me entire generator assembly as some unscrupulous garage owners convinced their unwary customers in the introductory days of the AC generator.

Two types of diodes, positive and negative, are used in the AC generator. The heat sink contains the positive diodes and these are marked with red. End frame diodes are the negative ones and they have black markings. Do not attempt to drive a diode from its bore or the other diodes may be damaged.

Support the end frame in an arbor press-, select a suitable removal spacer, and press the diode from the frame. Use the same method to install a replacement diode.

To replace heat sink diodes (which includes all of the diodes of "perforated case" models), it is necessary to separate the heat sink from the frame. Observe the stack-up closely to ensure correct reassembly of the BAT and GRD terminal bolts. Replace the diodes as described above, reassemble the bolt stack-ups and attach the heat sink to the end frame.

Bearing Replacement

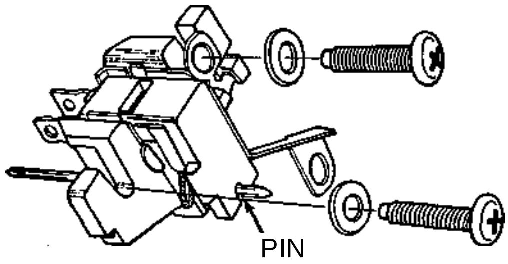
The drive end frame bearing is removed by detaching the retainer frame from the end plate and pressing the bearing out. Fill the bearing *Yi* full with multipurpose grease; do not overfill. Press the bearing into the end frame. Install the retainer pkte.

The slip ring end frame bearing of the 6 in. "perforated-case" generator is pressed off the rotor shaft. The replacement is pressed over the rotor shaft by using an arbor press.

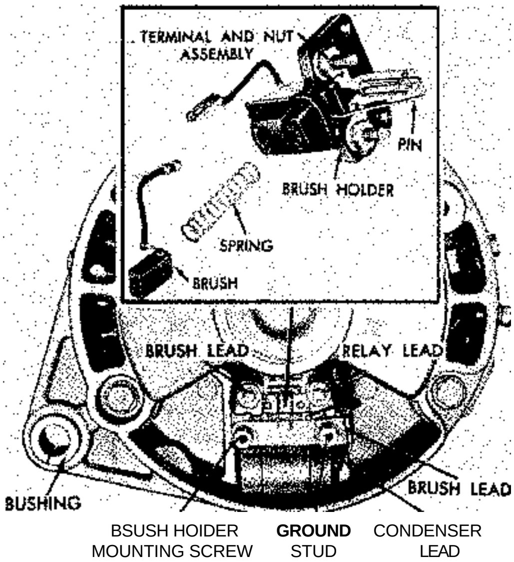
The 5.5 in. aluminum Delcotron slip-ring end bearing is replaced by pressing it out towards the inside of the case. To install the replacement, position a flat plate over the bearing and press it into the outside of the case. Press all bearings and diodes flush with their receptacles.

Brush and Holder Replacement

NOTE: *It is always easier and worth the minimal extra cost to replace the brushes with their holder. For some models, brushes themselves are not serviced separately.* For externally regulated models, except the "perforated case" Delcotron:



Brush holder—Externally regulated Delcotron, except "perforated case" models



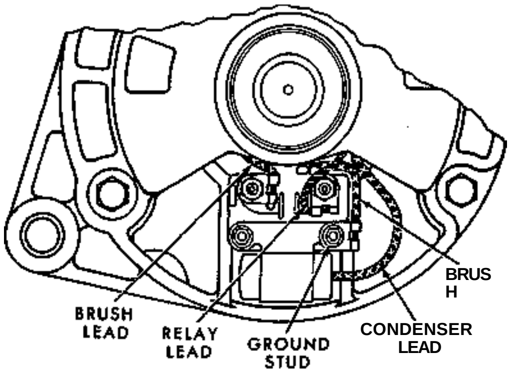
Brush holder—"perforated case" Delcotron

1. Remove the stator lead nut that also holds the relay terminal connector.
2. Remove the two mounting screws and the brush holder assembly.
3. When installing the new brush holder assembly, depress the brushes and insert a straightened paper clip through the holes provided in the holder for brush retention.
4. Install the brush holder assembly.
5. Remove the paper clip after the alter nator is assembled.

For externally regukted models of the "perforated case type:

If the alternator was disassembled according to the previous procedure, just install the new brush holder during assembly. If the alternator has not yet been disassembled, refer to steps 1—4 and 12e of the previous Disassembly and Assembly procedure to replace the brush holder. For internally regulated Delcotrons:

NOTE: *This procedure also includes replacement of the internal voltage regulator.*



Brush holder wiring—"perforated case" Delcotron

1. Remove two brush holder screws and stator lead to strap nut and washer, brush holder screws and one of the diode trio lead strap attaching screws.

NOTE: *The insulating washers must be replaced in the same position on reassembly.*

2. Remove brush holder and brushes. The voltage regulator may also be removed at this time, if desired.
3. Brushes and brush springs must be free of corrosion and must be undamaged and completely free of oil or grease.
4. Insert spring and brushes into holder, noting whether they slide freely without binding. Insert wooden or plastic toothpick into bottom hole in holder to retain brushes.

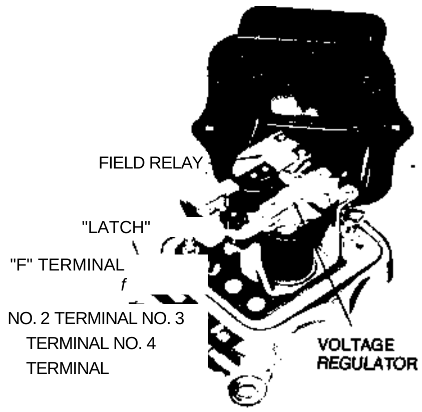
NOTE: *The brush holder is serviced as a unit; individual parts are not available.*

5. Reassemble in reverse order of disas sembly.

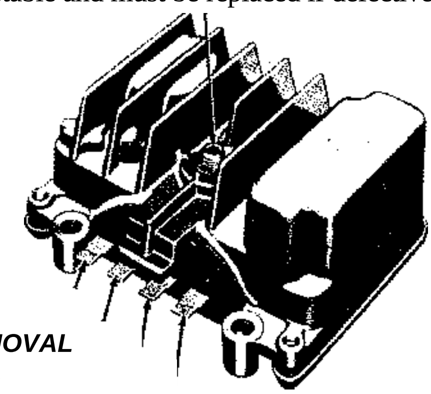
Voltage Regulator

Three types of voltage regulators have been used in the Corvette since 1963. The first type of regulator, hereafter referred to as Type One, is a double-contact model which is mounted externally, separately from the alternator. The Type One regulator was used on most 1963-68 and some 1969 Corvettes. This regulator is housed in a basically square, black metal case and has four electrical terminals.

The second type of regulator, hereafter called Type Two, is a transistorized model which was offered as an option with the transistorized ignition system in 1965. The Type Two regulator is externally mounted and uses: a) one transistor which assists in limiting the voltage to a preset value, and b) two diodes



Type One voltage regulator



Type Two voltage regulator

which protect the system from transient voltage which may occur. The Type Two regulator is easily identified by the finned regulator casing.

The third type of regulator, hereafter called Type Three, is mounted inside of the Delcotron alternator. This electronic regulator, used in some 1969 and all later Corvettes, is non-adjustable and must be replaced if defective.

REMOVAL AND INSTALLATION

Types One and Two

1. Disconnect the negative battery cable at the battery.
2. Disconnect the wiring harness from the regulator.
3. Remove the regulator mounting screws and remove the regulator.
4. Installation is the reverse of the previous steps. Be sure that the regulator base is properly grounded and do not overtighten the mounting screws, as this will cancel the cushioning effect of the rubber grommets.

Type Three

1. Remove the alternator from the vehicle as previously outlined.
2. Scribe a line on the alternator case from front-to-rear which will aid in attaining the proper relationships between components during assembly.
3. Remove the four through-bolts which join the end frame assemblies.
4. Separate the end frames by carefully prying between the drive (front) end frame and the stator. DO NOT pry between the slip ring (rear) end frame and the stator. The stator is wired to the rectifier bridge which is attached within the rear end frame.
5. Disconnect the three stator wire terminals at the rectifier bridge connections.
6. Remove the stator from the slip ring end frame. It may be necessary to carefully pry the stator from the frame.
7. Remove the three screws which retain the brush holder and regulator. Note the positions of the two screws which are equipped with plastic insulating washers—these screws MUST be installed in their original locations.

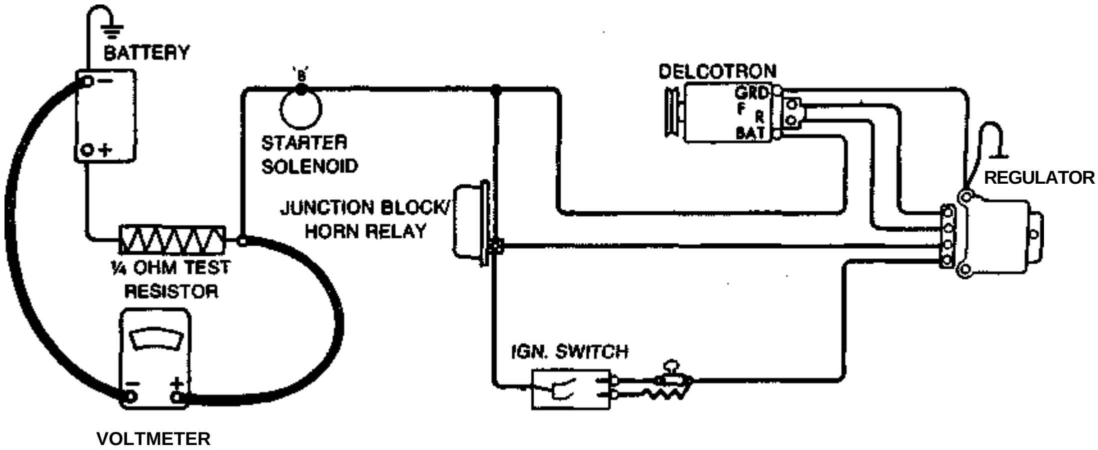
   NOTE: *Some alternators also have a resistor which is installed between the regulator and brush ground terminals. Note its position and reinstall it in the same manner.*
8. Lift the brush holder and regulator out of the alternator frame.
9. The regulator is installed in the reverse of the previous steps. Before installing the brush holder, push the brushes into the holder and insert a straightened paper clip through the holes provided in the holder for brush retention. Remove the paper clip after the alternator is assembled.

VOLTAGE ADJUSTMENT

Types One and Two Only

The adjustment procedure is the same for both types of regulators, except for the locations where the adjustment is made. On the Type One regulator, the adjustment screw is under the regulator cover; the Type Two regulator is adjusted externally after removing the alien screw from the adjustment screw access hole.

1. Insert a % ohm-25 watt fixed resistor into the charging circuit at the horn relay



Schematic for testing the regulator voltage setting

junction block, as shown in the accompanying illustration.

2. Install a voltmeter as shown in the accompanying illustration.

3. Warm the engine by running it for about fifteen minutes at 1500 rpm or more.

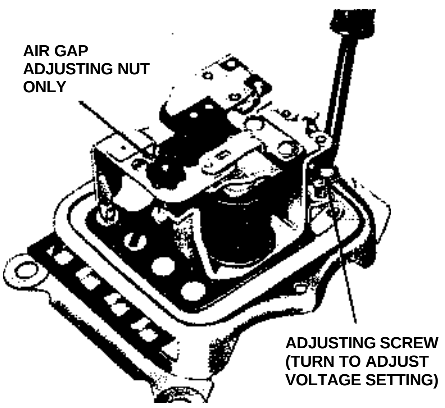
4. Disconnect the regulator connector and reconnect it to cycle the regulator.

5. Read the voltage on the voltmeter. If the voltage reading is 13.5-15.2 volts, the regulator does not need adjustment or replacement. If the voltage is not within these limits, leave the engine running at 1500 rpm and proceed to step 6.

6. On Type One regulators, disconnect the regulator connector and remove the regulator cover. Reconnect the regulator connector. On Type Two regulators, remove the adjustment screw access plug from the regulator case (the plug is actually an alien screw).

7. Observe the voltmeter reading and turn the voltage adjustment screw until the voltmeter reads 14.2-14.6 volts.

8. On Type One regulators, disconnect



Type One voltage regulator—voltage adjustment

the regulator connector, install the cover and reconnect the regulator connector.

9. Continue running the engine at 1500 rpm to re-establish the internal temperature of the regulator (Type One only).

10. Again, cycle the regulator by disconnecting and reconnecting the regulator connector.

11. Recheck the voltmeter reading: If it is between 13.5 and 15.2 volts, the regulator is good; is not, replace the regulator.

CAUTION: *On Type One regulators, always disconnect the regulator connector before removing the regulator cover, to prevent short circuits.*

12. On Type Two regulators, If the voltmeter reading is okay, reinstall the access hole plug.

VOLTAGE TESTING

Type Three Regulator Only

Though other tests of the internal voltage regulator exist, the following test is quite accurate and requires a minimum of tools.

NOTE: *The following test must be performed with the engine at normal operating temperature.*

1. Attach one lead of a voltmeter to the "BAT" terminal of the alternator and the other lead to a good ground.

2. Start the engine and operate at about 1500 rpm.

3. Observe the voltmeter reading: If it is approximately 13.5-15.2 volts, the regulator is properly limiting the voltage to the battery. If the voltage is above about 15.2 volts, replace the voltage regulator as previously described. If the voltage is below 13 volts, locate the test hole in the rear end frame of

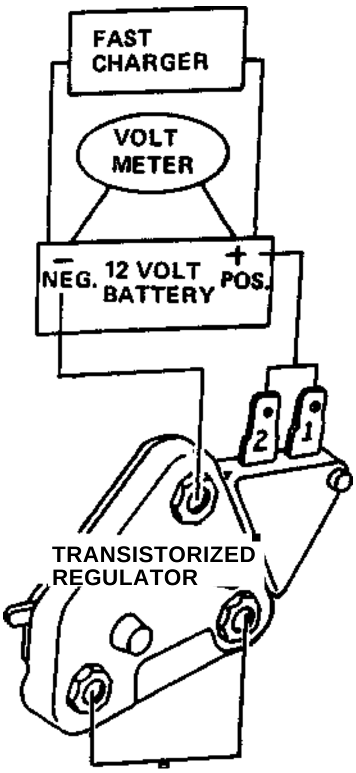
the alternator (refer to the illustration under Alternator Tests.) Insert a screwdriver into the test hole about %" to depress the field grounding tab. Under no circumstances should you push the screwdriver further than 1" into the alternator. If the voltage reading increases as the screwdriver is put into the test hole, the alternator is functioning properly and the regulator must be replaced. If the voltage reading did not increase with the insertion of the screwdriver, the alternator must be disassembled and tested.

NOTE: *If the test hole is not accessible, remove the alternator and test the following components: rotor, stator, rectifier bridge, diode trio, and brushes* (%," *minimum length). Replace any component which may be defective. If these components are okay, replace the voltage regulator.*

TESTING TYPE THREE REGULATOR OFF THE CAR

NOTE: *This test requires the use of a fast charger.*

1. Remove the voltage regulator from the alternator.
2. Connect voltmeter and fast charger to battery as shown.



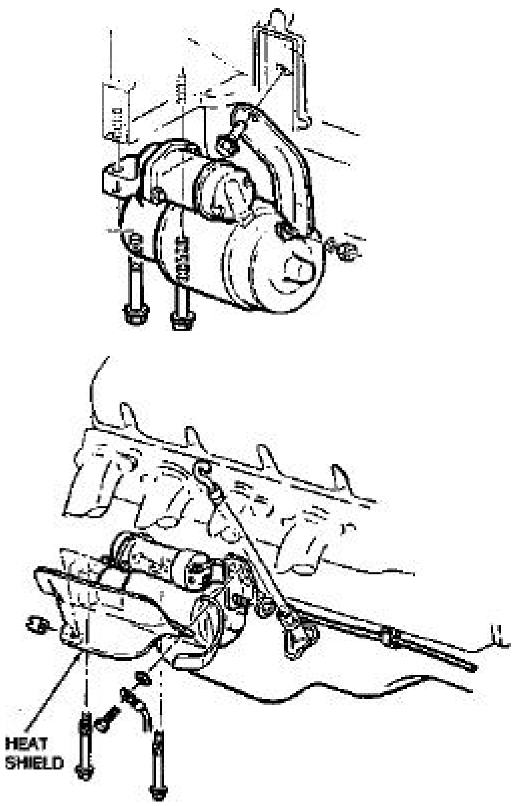
Testing voltage regulator on the bench

3. Connect regulator and test light as shown, observing battery polarity.
4. The test light should be on when connected.
5. Turn on the fast charger and slowly increase the charge rate. Check the voltmeter and make sure that the test light goes out at a minimum of 13.5 volts, and a maximum of 16.0 volts.

Starter

REMOVAL AND INSTALLATION

1. Disconnect the battery cables at the battery.
2. Raise the front of the vehicle to a convenient working height and support with jackstands.
3. Disconnect the wiring from the starter solenoid. Replace each connector nut as the terminals are removed as the thread sizes differ between connectors. Note or tag the wiring positions to avoid improper connections during installation.
4. Remove the front starter support bracket and the heat shield (if so equipped).



Starter mounting—small block (top) and big block (bottom)

Alternator and Regulator Specifications

	Alternator				Regulator						
			Output @ Generator RPM			Field Relay			Regulator		
Year	Model	Field Current Draw @12V	2000	5000	Model	Air Gap (in.)	Point Gap (in.)	Volts to Close	Air Gap (in.)	Point Gap (in.)	Volts at 125°
1963-64	1100628	1 .9-2.3	27A	37A	1119512	0.015	0.030	2.3-3.7	0.067	0.014	13.5-14.4
1965-67	1100693	2.2-2.6	27A	37A	1119515	0.015	0.030	2.3-3.7	0.067	0.014	13.5-14.4
	1100696	2.2-2.6	29A	42A	1119515	0.015	0.030	2.3-3.7	0.067	0.014	13.5-14.4
1968	1100693	2.2-2.6	27A	37A	1119515	0.015	0.030	2.3-3.7	0.067	0.014	13.5-14.4
	1100794	2.2-2.6	27A	37A	1119515	0.015	0.030	2.3-3.7	0.067	0.014	13.5-14.4
	1100696	2.2-2.6	29A	42A	1119515	0.015	0.030	2.3-3.7	0.067	0.014	13.5-14.4
1969	1100696	2.2-2.6	27A	37A	1119515	0.015	0.030	2.3-3.7	0.067	0.014	13.5-14.4
1970	1100900	2.2-2.6	27A	37A	1119515	0.015	0.030	2.3-3.7	0.067	0.014	13.5-14.4
	.1100901	2.2-2.6	27A	37A	1119515	.0.015	0.030	2.3-3.7	0.067	0.014	13.5-14.4
1971-72	1100544	4-4.5	®	®	1119515	0.015	0.030	1.5-3.2	0.067	0.014	13.8-14.8
	1100543,1100950	4-4.5	®	37A	1119515	0.015	0.030	1.5-3.2	0.067	0.014	13.8-14.8
	1100566	2.2-2.6	25A	35A	1119515	0.015	0.030	1.5-3.2	0.067	0.014	13.8-14.8

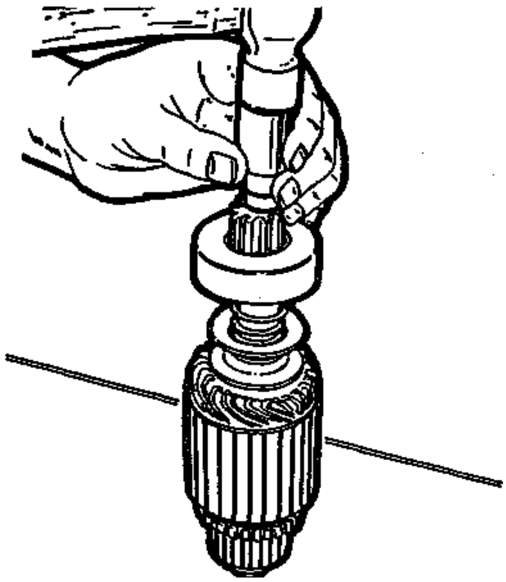
5. Loosen the two main starter mounting bolts, support the starter and remove the bolts. Lower the starter front end first and remove the starter.

6. Reverse the previous steps to install the starter. Torque the two main starter mount ing bolts to 25-35 ft. Ibs.

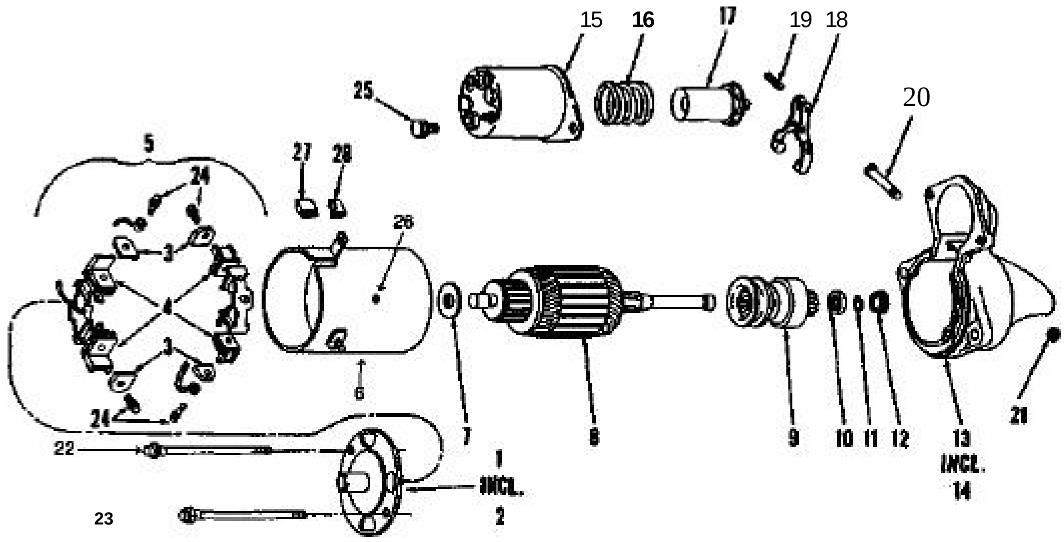
STARTER OVERHAUL

Drive Replacement

1. Disconnect the field coil straps from the solenoid.
2. Remove the two starter through bolts. Separate the commutator end frame, field frame, drive housing, and armature from each other.
3. Slide the two-piece thrust collar off of the end of the armature shaft.
4. Slide a %" deep socket or a piece of pipe of suitable size over the drive end of the armature shaft and against the snap-ring re tainer. Carefully tap the socket or pipe to wards the armature to drive the retainer off of the snap-ring.
5. Remove the snap-ring from the arma ture shaft. Be careful, as the snap ring will distort rather easily. If the snap ring is distorted after removal, it must be replaced.
6. Slide the starter drive and retainer from the armature shaft.



Use a piece of pipe to drive the retainer toward the snap-ring



1. Commutator end frame
2. Bushing (not pictured)
3. Brush
4. Brush holder
5. Brush and holder package
6. Field and frame assembly
7. Washer
8. Armature
9. Drive assembly
10. Retainer
11. Snap-ring
12. Thrust washer
13. Drive end housing
14. Bushing (not pictured)
15. Solenoid assembly
16. Plunger spring
17. Plunger.
18. Lever
19. Roll pin
20. Lever pivot bolt
21. Lever bolt nut
22. Through bolt
23. Through bolt
24. Brush screw
25. Bolt
26. Field retaining screw
27. Plug
28. Grommet

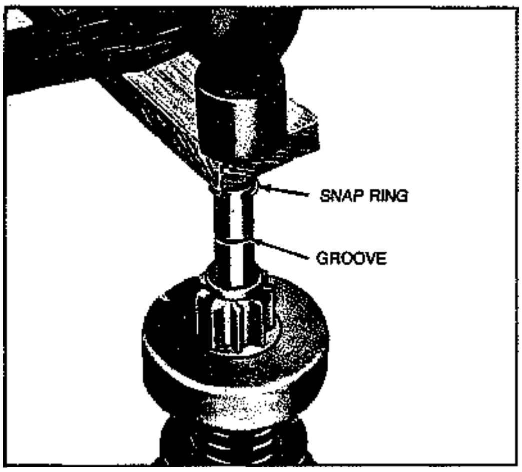
Exploded view of the starter

7. To reassemble, lubricate the drive end of the armature shaft with silicone lubricant and slide the starter drive onto the shaft with the pinion gear facing away from the arma ture. Slide the retainer onto the shaft with the cupped portion facing away from the ar mature.

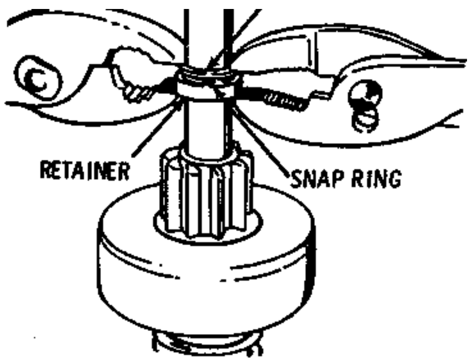
8. Support the armature assembly in a vertical fashion with the drive end pointing upward. Position the snap ring on the top of the shaft, and carefully place a block of wood on the snap ring. Keep the snap ring cen tered. Tap the block of wood to drive the snap *ring* onto the shaft. Using a deep socket that will fit around the shaft without interference and yet contact the snap ring, force the snap ring downward into its groove on the shaft.

9. Place the thrust washer on the shaft. Using two pairs of pliers as shown in the ac companying illustration, force the snap-ring retainer over the snap ring and engage it with the thrust washer.

10. Lubricate the drive housing bushing with silicone lubricant. Install the armature and clutch assembly into the drive housing, engaging the solenoid shift lever with the clutch, and positioning the front end of the armature shaft into the drive housing bushing.



Forcing snap-ring over the armature shaft



Snap-ring installation

(353 THRUST WAS WR

11. Apply a sealing compound (G.M. #1050026 or its equivalent) to the drive housing around the area where the field frame mates with the housing.

12. Slide the field frame assembly over the armature and guide the brushes over the ar mature commutator. Continue to push the field frame until the frame mates to the drive housing. Work slowly and carefully to pre vent brush damage.

13. Lubricate the bushing in the commu tator end frame with silicone lubricant, being careful not to get the lubricant on surround ing components.

14. Place the leather washer onto the ar mature shaft and slide the commutator end frame over the shaft and into position against the field frame. Line up the bolt holes, then install and tighten the two starter through bolts.

NOTE: *If replacement of the starter drive fails to cure improper engagement of the starter pinion to the flywheel, there are probably defective parts in the solenoid and/or shift lever. In this case, it would probably be best to take the starter assembly (incl, solenoid) where a pinion clearance check can be made. If the pinion clearance is incorrect, disassemble the solenoid and shift lever. Inspect these parts and replace as necessary.*

Brush Replacement

1. Disassemble the starter by following Steps 1 and 2 of the previous Drive Replace ment procedure.

2. Replace the brushes one at a time to avoid having to mark the wiring. For each brush: Remove the brush retaining screw and remove the old brush. Install the new brush in the same direction (krge end towards the end of the field frame). Position the wire con nector on the top of the brush, line up the holes and reinstall the screw. Make sure the screw is snug enough to ensure good contact.

3. Reassemble the starter according to Steps 10—14 of the previous procedure.

Solenoid Replacement

1. Remove the screw and washer from the motor connector strap terminal.

General Engine Specifications

Year	Engine Displace-ment (CM in.)	Fuel Delivery System	Horsepower (ffirpmn	Torque @ rpm (ft. lbs.)«	Bore and Stroke (in.)	Compres-sion Ratio	CH Pressure @2000 rpm
1963-64	327	4bbl	250 @ 4400	350 @ 2800	4.00 x 3.25	10.5:1	45
	327	4bbl	300 @ 5000	360 @ 2800	4.00 x 3.25	10.5:1	45
1963	327	4bbl	340 @ 6000	344 @ 4000	4.00 X 3.25	11.25:1	45
	327	Fuel Inj	360 @ 6000	352 @ 5000	4.00 x 3.25	11.0:1	45
1964	327	4bbl	365 @ 6200	360 @ 3600	4.00 x 3.25	11.0:1	45
	327	Fuel Inj	375 @ 6200	350 @ 4000	4.00 x 3.25	11.0:1	45
1965	327	4bbl	250 @ 4400	350 @ 2800	4.00 x 3.25	10.5:1	45
	327	4bbl	300 @ 5000	360 @ 3200	4.00 x 3.25	10.5:1	45
	327	4bbl	350 @ 5800	360 @ 3800	4.00 x 3.25	11.0:1	45
	327	4bbl	375 @ 6200	350 @ 4000	4.00 x 3.25	11.0:1	45
	327	Fuel Inj	365 @ 6200	350 @ 4600	4.00 x 3.25	11.0:1	45
	396	4bbl	425 @ 6400	41 5 @ 4000	4.094 x 3.76	11.0:1	45
1966	327	4bbl	300 @ 5000	360 @ 3200	4.00 x 3.25	10.5:1	45
	327	4bbl	350 @ 5800	360 @ 3600	4.00 x 3.25	11.0:1	45
	427	4bbl	390 @ 5200	460 @ 3600	4.25 x 3.76	10.25:1	60
	427	4bbl	425 @ 5600	460 @ 4000	4.25 x 3.76	11.0:1	60
1967-68	327	4 bbl	300 @ 5000	360 @ 3400	4.00 x 3.25	10.0:1	45
	327	4bbl	350 @ 5800	360 @ 3600	4.00 x 3.25	11.0:1	45
	427	4bbl	390 @ 5400	460 @ 3600	4.25 x 3.76	10.25:1	65
	427	3-2 bbl	400 @ 5400	460 @ 3600	4.25 x 3.76	10.25:1	65
	427	3-2 bbl	435 @ 5800	460 @ 4000	4.25 X 3.76	11.0:1	65
	427®	4 bbl	430 @ 5200	450 @ 4400	4.25 x 3.76	12.0:1	65
1969	350	4 bbl	300 @ 4800	380 @ 3200	4.00 x 3.48	10.25:1	45
	350	4 bbl	350 @ 5600	380 @ 3200	4.00 x 3.48	11.0:1	45

General Engine Specifications (cont.)

Year	Engine Displacement (cu In.)	Fuel Delivery System	Horsepower @rpmB	Torque @ rpm (fl. lbs.)e	Bore and Stroke (in.)	Compression Ratio	Oil Pressure @2000 rpm
1979	350	4bbl	195 @ 4000	285 @ 3200	4.000 x 3.480	8.2:1	45
	350	4bbl	225 @ 5200	270 @ 3600	4.000 x 3.480	8.9:1	45
1980	305	4bbl	180 @ 4200	255 @ 2000	3.736 x 3.480	8.5:1	45
	350	4bbl	190 @ 4400	280 @ 2400	4.000 x 3.480	8.5:1	45
	350	4bbl	230 @ 5200	275 @ 3600	4.000 x 3.480	9.0:1	45
1981	350	4bbl	1 90 @ 4200	280 @ 1600	4.000 x 3.480	8.2:1	45
1982	350	TBI®	200 @ 4200	285 @ 2800	4.000 x 3.480	9.0:1	45
1984	350	TBI®	205 @ 4300	290 @ 2800	4.000 x 3.480	9.0:1	45

•Beginning 1972, horsepower and torque are SAE net figures. They are measured at the rear of the transmission with all accessories installed and operating. Since the figures vary when a given engine is installed in different models, some are representative rather than exact. ® Limited production engine L88, for special purposes © Not available in California <D Throttle body fuel injection

Valve Specifications

Year	Engine Displace-ment (cu In.)	Seal Angle (deg)	Face Angle (deg)	Spring Test Pressure (lbs. @ in.)	Spring Installed Height (in.)	Stem to Guide Clearance (in.)		Stem Diameter (In.)	
						Intake	Exft3EISt	Intake	Exhaust
1963-64	327	46	45	175 @ 1.26	1.66	0.0010-0.0027	0.0016-0.0033	0.3404-0.3417	0.3410-0.3417
	327 (High Pert)	46	45	175 @ 1.26	1.66	0.0010-0.0027	0.0016-0.0033	0.3404-0.3417	0.3410-0.3417
1965-66	327 r	46	45	175 @ 1.26	1.66	0.0010-0.0027	0.0016-0.0033	0.3404-0.3417	0.3410-0.3417
	327 (350 hp)	46	45	175 @ 1.26	1.66	0.0010-0.0027	0.0016-0.0033	0.3410-0.3417	0.3410-0.3417
	327 (fuel inj)	46	45	175 @ 1.26	1.66	0.0010-0.0027	0.0016-0.0033	0.3410-0.3417	0.3410-0.3417
	396	46	45	315 @ 1.38	1%	0.0005-0.0024	0.0012-0.0029	0.3715-0.3722	0.3713-0.3720
	427	46	45	315 @ 1.38	1.88	0.0010-0.0027	0.0015-0.0032	0.3715-0.3722	0.3713-0.3720
	427 (425 hp)	46	45	315 @ 1.38	1.88	0.0010-0.0027	0.0015-0.0032	0.3715-0.3722	0.3713-0.3720
1967	327 (300 hp)	46	45	200 @ 1.25	1%2	0.0010-0.0027	0.0015-0.0032	0.3410-0.3417	0.3410-0.3417
	327 (350 hp)	46	45	200 @ 1.25	1=/32	0.0010-0.0027	0.0015-0.0032	0.3410-0.3417	0.3410-0.3417
	427 (390, 400 hp)	46	45	NA	NA	0.0010-0.0027	0.0015-0.0032	0.3715-0.3722	0.3713-0.3720
	427 (435 hp)	46	45	315 @ 1.38	1⅞	0.0010-0.0027	0.0015-0.0032	0.3715-0.3722	0.3713-0.3720
1968	327 (exc 350 hp)	46	45	198 @ 1.25	1.70	0.0010-0.0027	0.0017-0.0027	0.3410-0.3417	0.3410-0.3417
	327 (350 hp)	46	45	198 @ 1.25	1.70	0.0010-0.0027	0.0017-0.0027	0.3410-0.3417	0.3410-0.3417
	427 (exc 435 hp)	46	45	315 @ 1.38	1.88	0.0010-0.0027	0.0015-0.0032	0.3715-0.3722	0.3713-0.3722
	427 (435 hp)	46	45	315 @ 1.38	1.88	0.0010-0.0027	0.0015-0.0032	0.3715-0.3722	0.3713-0.3722
1969	350	46	45	200 @ 1.25	1.70	0.0010-0.0027	0.0010-0.0027	0.3410-0.3417	0.3410-0.3417
	350 (350 hp)	46	45	200 @ 1.25	1.70	0.0010-0.0027	0.0010-0.0027	0.3410-0.3417	0.3410-0.3417
	427 (390, 400 hp)	46	45	312 @ 1.38	1.88	0.0010-0.0027	0.0010-0.0027	0.3715-0.3722	0.3713-0.3722
	427 (435 hp)	46	45	312 @ 1.38	1.88	0.0010-0.0027	0.0010-0.0027	0.3715-0.3722	0.3713-0.3722
1970	350	46	45	80 @ 1.70	1^32	0.0010-0.0037	0.0010-0.0047	0.3414	0.3414
	454	46	45	75 @ 1.88®	1%	0.0010-0.0037	0.0010-0.0047	0.3718	0.3817
	454®	46	45	75 @ 1.88®	1%	0.0010-0.0037	0.0010-0.0047	0.3718	0.3718

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Crankshaft

Main Brg Journal Dia.	Main Brg Oil Clearance	Shaft End-play	Connecting Rod Journal Diameter
2.2978-2.298	0.0008-0.0034	[illegible]	1.999-2.0
2.2978-2.298	0.0008-0.0034	002-0.	[illegible]
2.7481-2.749	[illegible]	006-0.	2.199-2.2
[illegible]	0.0013-0.0025	[illegible]	[illegible]
[illegible]	0.0008-0.0034	[illegible]	[illegible]
2.4474-2.448	no. 1-2-3-4: 0.0008-0.0020 no. 5: 0.0018-0.0034	[illegible]	[illegible]
no. 1-2-3-4: 2.7481-2.7490 no. 5: 2.7478-2.7488	no. 1-2-3-4: 0.0013-0.0025 no. 5: 0.0015-0.0031	[illegible]	[illegible]
[illegible]	no. 1-2-3-4: 0.0020-0.0032 no. 5: 0.0029-0.0045	[illegible]	[illegible]
2.4484-2.4493	0.0003-0.0015	[illegible]	[illegible]
2.7485-2.7494	0.0013-0.0025	[illegible]	[illegible]
2.7481-2.7490	0.013-0.0025	[illegible]	[illegible]
2.4484-2.4493	[illegible]	[illegible]	[illegible]
[illegible]	0.0013-0.0025	[illegible]	[illegible]
2.7485-2.7494	0.0013-0.0025	[illegible]	[illegible]

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Crankshaft and Connecting Rod Specifications (cont.)

All measurements are given in inches

		Crankshaft				Connecting Rod		
Year	Engine	Main Big Journal Dia	Main Big Oil Clearance	Shaft End-Play	Tlmist on No.	Journal Diameter	Oil Clearance	Side Clearance
	454 (425 hp)	2.7481-2.7490®	0.0013-0.0025®	0.006-0.010	5	2.1985-2.1995	0.0009-0.0025	0.019-0.025
1972	350	2.4484-2.4493®	0.0008-0.0020®	0.002-0.006	5	2.0990-2.1000	0.0013-0.0035	0.008-0.014
	350 (255 hp)	2.4484-2.4493®	0.0013-0.0025®	0.002-0.006	5	2.0990-2.1000	0.0013-0.0035	0.008-0.014
	454 (270 hp)	2.7485-2.7494©	0.0013-0.0025®	0.006-0.010	5	2.1990-2.2000	0.0009-0.0025	0.015-0.021
1973-74	350	2.4502©	0.0013-0.0025®	0.002-0.006	5	2.0990-2.1000	0.0013-0.0035	0.008-0.014
	454	2.7504®	0.0007-0.0019®	0.006-0.010	5	2.1990-2.2000	0.009-0.0025	0.015-0.021
1975-76	350	2.4502®	0.0013-0.0025®	0.002-0.006	5	2.0990-2.1000	0.0013-0.0035	0.008-0.014
1977-84	305, 350	2.4484-2.4493®	0.0008-0.0020®	0.002-0.006	5	2.0988-2.0998	0.0013-0.0035	0.008-0.014

® Nos. 3, 4—2.7481 -2.7490; No. 5—2.7478-2.7488 ® Nos. 2, 3, 4—2.4481 -2.4490; No. 5—2.4479-2.4488 ® No. 5—2.7478-2.7488 ® No. 5 —0.0023-0.0033; with auto, trans. No. 1 —0.001 9-0.0031 ® No. 5—2.4479-2.4488 ® Nos. 2, 3, 4—0.001 3-0.0025; No. 5—0.001 9-0.0035 ® Nos. 2, 3, 4—0.0006-0.001 8; No. 5—0.0008-0.0023 ® Nos. 2, 3, 4—2.7481 -2.7490; No. 5—2.7478-2.7488 ® Nos. 2, 3, 4—0.001 1 -0.0023; No. 5—0.001 7-0.0033 © No. 5—2.4508 ® No. 5—0.0024-0.0040 ® Nos. 1 , 5—2.7499 ©No. 5—0.0029-0.0045

Ring Gap Specifications

All measurements are given in inches

Year	Engine Displacement (cu In.)	Top Compression	Bottom Compression	Oil Control
1963-68	327	0.013-0.023	0.013-0.025	0.015-0.065
1969-71	350	0.010-0.020®	0.013-0.025®	0.015-0.065
1965-74	396, 427, 454	0.010-0.020	0.010-0.020	0.010-0.040
1973-76	350	0.010-0.020	0.013-0.025©	0.015-0.065
1977	350	0.010-0.020	0.010-0.023®	0.015-0.065
1978-84	305, 350	0.010-0.020	0.010-0.023®	0.015-0.065

® 250, 300 hp 350 cu in.
Top—0.013-0.023
2nd—0.013-0.025
® 250, 255 hp 350 cu in.—0.013-0.023 ® 180 hp—0.013-0.025 ® 185,195 hp—0.010-0.025

Ring Side Clearance Specifications

All measurements are given in inches

Year	Engine Displacement (cu. In.)	Top Compression	Bottom Compression	Oil Control
63-68	327	0.0012-0.0032®	0.0012-0.0027®	0.000-0.0050
69-77	305, 350	0.0012-0.0032	0.0012-0.0027	0.000-0.0050®
78-84	305, 350	0.0012-0.0032	0.0012-0.0032	0.002-0.0080
65-74	396, 427, 454	0.0017-0.0032	0.0017-0.0032	0.005-0.0065

©250, 275hp327cu. in.:
Top—0.0012-0.0027
2nd—0.0012-0.0032
© For 1969-73 engines only

Piston Clearance Specifications

Year	Displacement (cu. in)	Advertised Horsepower	pistoiMo-Dore Clearance (In.)®
SMALL-BLOCK ENGINES			
1963-	327	all 80	0.0005-0.0025
	305, 350 (exc. '69 350 hp, LT1 or L82 engs.)	various	0.0007-0.0027
	350 (1969 only)	350	0.0020-0.0036
	350 (LT1 & L82)	various	0.0036-0.0061
1981	350	all	0.0046-0.0061
1982-84	350	all	0.0025-0.0045
	Engine		
BIG-BLOCK ENGINES			
1965-74	396	425	0.0036-0.0065
	427	390, 400	0.0024-0.0045
		430®	0.0058-0.0080
		435	0.0040-0.0065
	454	245, 275	0.0018-0.0035
		345, 360, 390	0.0024-0.0049
		460	0.0040-0.0065

CD Range is from production minimum to service maximum © Limited production L88 engines only

2. Remove the two solenoid retaining screws.
3. Twist the solenoid clockwise to remove the solenoid flange key from the keyway in the housing. Remove the solenoid.
4. To reinstall the unit, pkce the return spring on the plunger and pkce the solenoid body on the drive housing. Push the solenoid inward and turn counterclockwise to engage the flange key. Install and tighten the solenoid retaining screws and the screw and washer which secure the strap terminal.

ENGINE MECHANICAL

Design

The success of the Corvette is largely due to the lengthy option lists that permit an owner to literally tailor his car to a specific type of driving or competition. For this reason, the engines that power the 1963-1984 models

Torque Specifications

All readings are given in ft. Ibs.

Year	Engine Displace-ment (cu in.)	Cylinder Head Bolls	Connecting Rod Cap Bolts	Main Bearing Cap Bolts	Crankshaft Balancer Bolts	Flywtieel-To-Crankshaft Bolts	Manifold Intake	Manifold Exhaust
1963-67	327	60-70	35	80	60®	60	30	18-22
1968-76	327, 350	60-70	45	75®	60®	60	30	18-22
1977-84	305, 350	65	45	80®	60	60	30®	20®
1965	396	80	50	115	85	65	30	20
1966-76	427, 454	80®	50®	100®	85	65	30	20

© Aluminum heads—short bolts 65; long bolts 75
® Engines with 4-bolt mains—outer bolts 65
® Engines with 4-bolt mains—short bolts 95; long bolts 105
®7/16
©Where applicable
©Outer bolts—High Pert.—70ft. Ibs.
® Inboard bolts—30 ft. Ibs.
©Also torque the throttle body plate bolts to 20-34 ft. Ibs. (1982 only)

have been offered in six internal displacements and approximately 14 performance levels.

Induction systems for these engines are varied and range from a single four-barrel configuration to "Tri-Power" (three Holley two-barrels), Rochester fuel injection, and the new "Cross-Fire Injection" which consists of two opposed throttle body fuel injection units.

The 327 cubic inch V8 was offered from 1963 through 1968 and spanned a horsepower range of 250 to 375; the latter figure being obtained with fuel injection. The 327, in addition to fuel injection, has used the Carter WCFB and AFB, Holley, and Rochester Quadrajet carburetors.

The stroke of the 327 was lengthened in 1969 and this brought the displacement to 350 cu in. The 350 as found in the 1969 through 1979 Corvettes has been available in horse power ratings from 165 to 370. It is offered with either a single, four-barrel Rochester or Holley carburetor. The 305 engine used in 1980 California Corvettes only, has the same stroke as a 350 but the cylinder bore is a smaller 3.736". The 305, 327 and 350 engines are collectively referred to as the small block Corvette engines.

The 327 engine was derived from the earlier 265 and 283 Corvette engines, but featured many improvements. The block was a completely new casting and provided stronger main bearing webs. The bottom ends of the cylinders were relieved to clear the longer stroke crankshaft. All 327 and 350 cubic inch engines, except base power plants, are equipped with forged crankshafts. Main bearing diameters were increased from 2.30 to 2.45 inches in 1968.

The large block engines were introduced to provide more torque and more flexible horsepower than the peakier small blocks. The cylinder block is quite conventional, the heads are where the innovation lies. Intake and exhaust valves are canted away from each other for optimum gas flow and port configuration. The seemingly strange angles at which the valves point gave rise to the nickname of "Porcupine" which was applied to these heads when they first appeared on NASCAR racing Chevrolets in 1963.

The large block Corvette engine was introduced in 1965 with an initial offering of 396 cubic inches and 425 hp. The 396 was enlarged to 427 cubic inches with a bore increase in 1966, although the top rated horsepower remained at 425. The 427, optional from 1966 through 1969, was offered in 390, 400, 425, 430, and 435 horsepower versions. Carburetors used on the large blocks included four-barrel Holley and Rochester carburetors and three, two-barrel carburetors. The 427 received a stroke increase in 1970 and became the 454. The "big-block" reached its highest performance rating in 1970 with horsepower output listed at 460 for the rare LS7 engine. Details are scarce as to whether this engine was ever installed in a production vehicle.

Generally speaking, the small and large block Corvette engines are of the same basic design. They feature eight cylinders arranged in a vee configuration. The cylinders are numbered front to rear with cylinders 1, 3, 5, and 7 on the left bank and 2, 4, 6, and 8 on the right, when viewed from the rear. Firing order for both engines is 1-8-4-3-6-5-7-2. Both the crankshaft and camshaft are supported by five bearings. Viewed from the front, crankshaft rotation is clockwise. Lubrication is full pressure, and a gear type oil pump feeds the system through a full flow oil filter. Both the oil pump and the distributor are driven by the camshaft. The main oil gallery pressurizes the bearings via the crankshaft and camshaft. The valve lifter oil gallery provides oil to the lifters which, in turn, feed the rocker arms through the hollow pushrods.

The standard bearer of Corvette high performance models was established, with the 1967 introduction of the 430 horsepower L-88 limited production option engine. This unit was furnished with a Tuft-rided and cross-drilled heavy duty crankshaft, magnafluxed and shotpeened connecting rods with ^{7}/ie inch connecting rod bolts, forged pistons with pop-up domes, and aluminum cylinder heads (open-chambered in 1969).

The peak of large block development was reached in 1969 with the ZL-1 engine. This was the basic L-88 engine but with an aluminum cylinder block.

Engine Removal

This procedure is basically the same for all models regardless of which engine is used. Certain pieces of optional equipment require minor specific changes, but overall, the operation remains the same.

1. Mark the relationship between each hood hinge and the hoodi Remove the hood.
2. Disconnect the battery cables at the battery.
3. Remove the air cleaner assembly and cover the carburetor. Mark any disconnected hoses so that they may be reinstalled prop erly.
4. Raise the front of the vehicle and sup port it with jackstands.
5. Locate and remove the engine coolant drain plugs. There is a drain plug on each side of the engine block, just above the top of the oil pan.
6. Loosen the radiator drain petcock and allow the coolant to drain from the radiator.
7. Remove the radiator hoses and the heater hoses.
8. Remove the radiator fan shroud, radia tor, engine cooling fan(s) and fan clutch (if so equipped).
9. Drain the engine oil.
10. Remove the ignition shielding and re lease the distributor cap hold-down screws. Move the distributor cap (with wires still in tact) out of the way (away from the firewall).
11. During this step, mark the location and/or connection point of each item so that these items may be properly rein stalled/reconnected.
    a. Disconnect the wiring from the starter, ignition coil, and distributor (pri mary wiring).
    b. Disconnect the wiring from the alter nator.
    c. Disconnect the wires from both the water temperature sender and oil pressure sender. If the vehicle has a mechanical oil pressure gauge, disconnect the gauge tube at the engine block.
    d. Disconnect the tachometer drive and fuel injection drive cables at the distribu tor, if so equipped.
    e. Disconnect the engine ground wires.
    f. Disconnect the wiring from the idle solenoid, if so equipped.
    g. Disconnect the wiring from the var ious emission control items, as applicable (e.g.-TCS switch, oxygen sensor, baro metric sensor, air control valve, etc.)
    h. Disconnect the accelerator and transmission linkage (or cables, on late models) at the carburetor, fuel injection unit, or Throttle Body Injection (TBI) unit. If equipped with cables, unbolt the cable brackets from the engine.
    i. Disconnect the fuel supply and evaporative emission lines at the fuel pump. On TBI equipped models, disconnect the flexible hoses which connect die frame-mounted lines to the engine-mounted lines. In either case, plug the fuel supply line to prevent fuel siphoning from -the tank.
    j. Disconnect any vacuum lines which run from a body-mounted item to an engine-mounted item (e.g.-power brake unit, cruise control, etc.)
12. Remove the drive belts from both the power steering pump and die air condition ing compressor, if equipped with these items. Unbolt the pump and compressor from their respective mounting brackets and tie these units out of the way (with lines still at tached—DO NOT disconnect the refrigerant lines from the A/C compressor).

13. Disconnect the cruise control chain or cable from the engine, if so equipped.

14. Disconnect the exhaust pipes from the exhaust manifold flanges. If the vehicle .is equipped with side exhaust, it may be wise to remove the pipe and muffler units com pletely to get them out of the way, thereby protecting them from damage.

15. Remove the starter and solenoid as an assembly.

16. Remove the flywheel splash shield or convertor underpan, as applicable.

17. On automatic transmission equipped vehicles, remove the torque convertor-to-flywheel attaching bolts. Also, on these models, remove the transmission dipstick and tube.

18. On manual transmission equipped models, disconnect the linkage from each of the two levers of the clutch cross shaft. Loosen the outer ball stud nut and slide the stud out of the bracket slot. Move the cross shaft as required to clear the inboard ball stud. Re move the cross shaft from the vehicle.

19. Unless you have a suitable plug to pre vent the transmission from draining after the driveshaft is removed, drain the transmis sion. On automatics without drain plugs it will be necessary to carefully remove the trans mission pan, drain the fluid, and reinstall the pan. Using chain or heavy wire, secure the torque convertor to the transmission so that the convertor will not fall out as the engine is removed (auto, trans, only).

20. Matchmark the driveshaft to the rear axle flange (to prevent a driveshaft imbalance condition if the shaft was installed improp erly), unbolt the universal joint straps from the flange and remove the driveshaft assem bly.

21. Support the transmission using a floor jack and remove the transmission-to-engine mounting bolts (auto, trans.) of the bellhousing-to-engine mounting bolts (man. trans.).

22. 'Remove the engine mount "through" bolts (one per side, positioned front-to-back).

23: Attach the engine lifting devices to the engine lifting brackets. Most engines are equipped with these brackets bolted to the intake manifold. If your engine does not have these brackets, remove the valve covers and the center head bolt from each cylinder head. Attach the lifting apparatus to the cylinder heads and secure with the cylinder head bolts.

CAUTION: Be absolutely sure that the chain which you are using has a weight rating greater than the weight of the engine. If possible, use chain rated at least at 1000 Ibs. Avoid using chains with a lesser rating; serious injury could result if you use an inferior chain.

24. Move the engine forward, enough to disengage the engine from the transmission. Raise the engine enough to clear the front of the car and carefully move the engine over and away from the nose of the vehicle.

25. Service the existing engine as neces sary, or install a replacement.

CAUTION: *Do not allow the engine to hang from the engine hoist for an extended period of time. Never work on the engine when it is attached to the hoist. Support the engine safely on the floor or on an engine stand.*

Engine Installation

Installation of the engine is the reverse of the removal procedure. Make note of the following points before installing the engine:

1. Be sure that all wires, lines, etc., are connected as they originally were.
2. Be absolutely sure that the fuel lines are tightened properly and die throttle re turn springs are installed properly before at tempting to start a new or rebuilt engine.
3. Follow all available bolt torque speci fications.
4. Be sure to fill the engine, transmis sion, and cooling system with the correct quantities and qualities of fluids.
5. If a new camshaft was installed in the engine, the engine should be run for at least one hour after started at a minimum of 1500 rpm to properly "break-in" a new cam. If the cam manufacturers instructions differ, follow their recommendations.
6. Even though most head gasket manu facturers state that their gaskets require no "hot retorque", it is good practice to retorque the head bolts after the engine has been run for a couple of hours.
7. During engine installation, it is wise to replace "disposable" items such as radiator hoses, heater hoses, belts, and flexible fuel lines to prevent annoying (and possibly dan gerous) post-installation problems associated with these items (e.g.-coolant leaks, fuel leaks,, overheating, etc.).
8. Adjust all belts to the proper tension. If the belts are new, recheck their tension after about a *Y2* hour of running time (with a new cam, do this after the cam "break-in" pe riod). Note that a belt is considered "used"

ENGINE OVERHAUL

Most engine overhaul procedures are fairly standard. In addition to specific parts replacement procedures and complete specifications for your individual engine, this chapter also is a guide to accepted rebuilding procedures. Examples of standard rebuilding practice are shown and should be used along with specific details concerning your particular engine.

Competent and accurate machine shop services will ensure maximum performance, reliability and engine life. Procedures marked with the symbol shown above should be performed by a competent machine shop, and are provided so that you will be familiar with the procedures necessary to a successful overhaul.

In most instances it is more profitable for the do-it-yourself mechanic to remove, clean and inspect the component, buy the necessary parts and deliver these to a shop for actual machine work.

On the other hand, much of the rebuilding work (crankshaft, block, bearings, pistons, rods, and other components) is well within the scope of the do-it-yourself mechanic.

Tools

The tools required for an engine overhaul or parts replacement will depend on the depth of your involvement. With a few exceptions, they will be the tools found in a mechanic's tool kit (see Chapter 1). More in-depth work will require any or all of the following:

- a dial indicator (reading in thousandths) mounted on a universal base
- micrometers and telescope gauges
- jaw and screw-type pullers
- scraper
- valve spring compressor
- ring groove cleaner
- piston ring expander and compressor
- ridge reamer
- cylinder hone or glaze breaker
- Plastigage®
- engine stand

Use of most of these tools is illustrated in this chapter. Many can be rented for a one-time use from a local parts jobber or tool supply house specializing in automotive work.

Occasionally, the use of special tools is called for. See the information on Special Tools and the Safety Notice in the front of this book before substituting another tool.

Inspection Techniques

Procedures and specifications are given in this chapter for inspecting, cleaning and assessing the wear limits of most major components. Other procedures such as Magnaflux and Zyglo can be used to locate material flaws and stress cracks. Magnaflux is a magnetic process applicable only to ferrous materials. The Zyglo process coats the material with a flourescent dye penetrant and can be used on any material. Check for suspected surface cracks can be more readily made using spot check dye. The dye is sprayed onto the suspected area, wiped off and the area sprayed with a developer. Cracks will show up brightly.

Overhaul Tips

Aluminum has become extremely popular for use in engines, due to its low weight. Observe the following precautions when handling aluminum parts:

- Never hot tank aluminum parts (the caustic hot-tank solution will eat the aluminum)
- Remove all aluminum parts (identification tag, etc.) from engine parts prior to hot-tanking.
- Always coat threads lightly with engine oil or anti-seize compounds before installation, to prevent seizure.
- Never over-torque bolts or spark plugs, especially in aluminum threads.

Stripped threads in any component can be repaired using any of several commercial repair kits (Heli-Coil, Microdot, Keenserts, etc.)

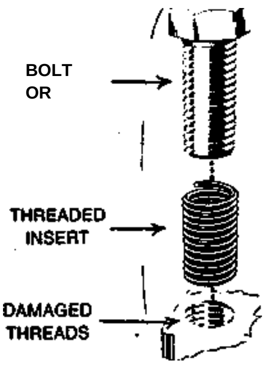
When assembling the engine, any parts that will be in frictional contact must be prelubed to provide lubrication at initial start-up. Any product specifically formulated for this purpose can be used, but engine oil is not recommended as a pre-lube.

When semi-permanent (locked, but removable) installation of bolts or nuts is desired, threads should be cleaned and coated with Loctite® or other similar, commercial non-hardening sealant.

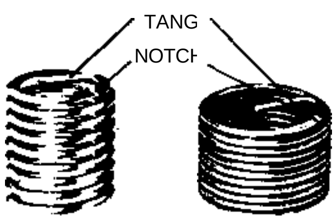
Repairing Damaged Threads

Several methods of repairing damaged threads are available. Heli-Coil® (shown here), Keenserts® and Microdot® are among the most widely used. All involve basically the same principle—drilling out stripped threads, tapping the hole and installing a prewound insert—making welding, plugging and oversize fasteners unnecessary."

Two types of thread repair inserts are usually supplied—a standard type for most Inch Coarse, Inch Fine, Metric Coarse and Metric Fine thread sizes and a spark plug type to fit most spark plug port sizes. Consult the individual manufacturer's catalog to determine exact applications. Typical thread repair kits will contain a selection of prewound threaded inserts, a tap (corresponding to the outside diameter threads of the insert) and an installation tool. Spark plug inserts usually differ because they require a tap equipped with pilot threads and a combined reamer/tap section. Most manufacturers also supply blister-packed thread repair inserts separately in addition to a master kit containing a variety of taps and inserts plus installation tools.

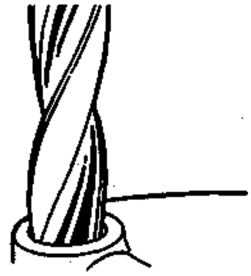


Damaged bolt holes can be repaired with thread repair Inserts

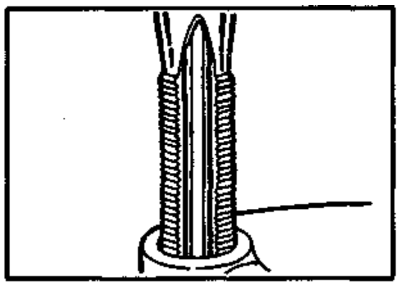


Standard thread repair Insert (left) and spark plug thread Insert (right)

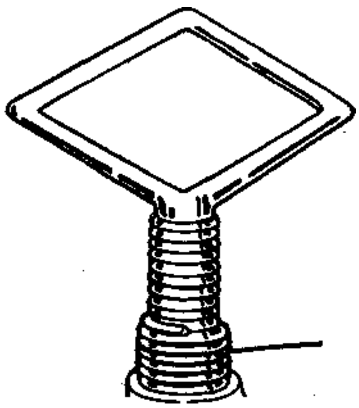
Before effecting a repair to a threaded hole, remove any snapped, broken or damaged bolts or studs. Penetrating oil can be used to free frozen threads; the offending item can be removed with locking pliers or with a screw or stud extractor. After the hole is clear, the thread can be repaired, as follows:



Drill out the damaged threads with specified drill. Drill completely through the hole or to the bottom of a blind hole



With the tap supplied, tap the hole to receive the thread Insert. Keep the tap well oiled and back It out frequently to avoid clogging the threads



Screw the threaded Insert onto the Installation tool until the tang engages the slot. Screw the Insert Into the tapped hole until It Is y«-% turn below the top surface. After Installation break off the tang with a hammer and punch

Standard Torque Specifications and Fastener Markings

In the absence of specific torques, the following chart can be used as a guide to the maximum safe torque of a particular size/grade of fastener. • There is no torque difference for fine or coarse threads. • Torque values are based on clean, dry threads. Reduce the value by 10% if threads are oiled prior to assembly. • The torque required for aluminum components or fasteners is considerably less.

U.S. Bolts

SAE Grade Number	1or2			5			6or7		
Number ol lines always 2 lets than the grade number.	O			©			©		
Boll Size (IncrwsMTriread)	Maximum Torque			Maximum Torque			Maximum Torque		
	R./Lbs.	Kgm	Nm	R./Lbs.	Kgm	.Nm	R./Uis.	Kgm	Nm
%— 20 —28	5 0.8	0.7 6	6.8 8.1	8 1.4	1.1 10	10.8 13.6	10	1.4	13.5
⁵/16— 18 —24	11 13	1.5 1.8	14.9 17.6	17 19	2.3 ^6	23.0 25.7	19	2.6	25.8
%— 16 — 24	18 2.75	2.5 20	24.4 27.1	31 35	4.3 4.8	42.0 47.5	34	4.7	46.0
⁷/16— 14 — 20	28 30	3.8 4.2	37.0 40.7	49 55	6.8 7.6	66.4 74.5	55	7.6	74.5
Vi— 13 —20	39 41	5.4 5.7	52.8 55.6	75 85	10.4 11.7	101.7 115.2	85	11.75	115.2
⁹/16— 12 — 18	51 55	7.0 7.6	69.2 74.5	110 120	15.2 16.6	149.1 162.7	120	16.6	162.7
%— 11 — 18	83 95	11.5 13.1	112.5 128.8	150 170	20.7 23.5	203.3 230.5	167	23.0	226.5
%— 10 — 16	105 115	14.5 15.9	142.3 155.9	270 295	37.3 40.8	366.0 400.0	280	38.7	379.6
%— 9 — 14	160 175	22.1 24.2	216.9 237.2	395 435	54.6 60.1	535.5 589.7	440	60.9	596.5
1— 8 — 14	236 250	32.5 34.6	318.6 338.9	590 660	81.6 91.3	799.9 849.8	660	91.3	894.8

Metric Bolts

Relative Strength Marking	4.6, 4.8			8.8		
Markings	\$%7' \gp			vS2£/		
Bolt Size Thread Size i Fitch (mm)	Maximum Torque			Maximum Torque		
	Ft./Lbs.	Kgm	Nm	a/Lbs.	Kgm	Nm
6x1.0	2-3	.2-.4	3-4	3-6	.4-.8	5-8
8x1.25	6-8	.8-1	8-12	9-14	1.2-1.9	13-19
10 x 1.25	12-17	1.5-2.3	16-23	20-29	2.7-4.0	27-39
12x1.25	21-32	2.9-4.4	29-43	35-53	4.8-7.3	47-72
14 x 1.5	35-52	4.8-7.1	48-70	57-85	7.8-11.7	77-110
16x1.5	51-77	7.0-10.6	67-100	90-120	12.4-16.5	130-160
18x1.5	74-110	10.2-15.1	100-150	130-170	17.9-23.4	180-230
20 x 1.5	110-140	15.1-19.3	150-190	190-240	26.2-46.9	160-320
22x1.5	150-190	22.0-26.2	200-260	250-320	34.5-44.1	340-430
24x1.5	190-240	26.2-46.9	260-320	310-410	42.7-56.5	420-550

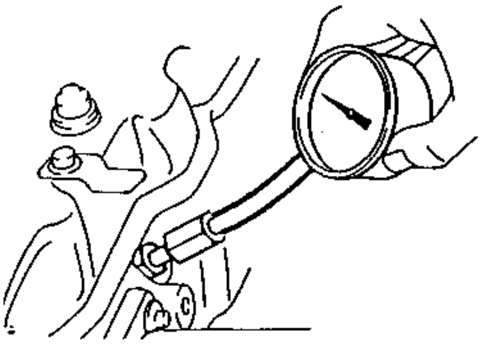
CHECKING ENGINE COMPRESSION

A noticeable lack of engine power, excessive oil consumption and/or poor fuel mileage measured over an extended period are all indicators of internal engine wear. Worn piston rings, scored or worn cylinder bores, blown head gaskets, sticking or burnt valves and worn valve seats are all possible culprits here. A check of each cylinder's compression will help you locate the problems.

As mentioned in the "Tools and Equipment" section of Chapter 1, a screw-in type compression gauge is more accurate than the type you simply hold against the spark plug hole, although it takes slightly longer to use. It's worth it to obtain a more accurate reading. Follow the procedures below for gasoline and diesel-engined cars.

Gasoline Engines

1. Warm up the engine to normal operating temperature.
2. Remove all spark plugs.



The screw-in type compression gauge is more accurate

3. Disconnect the high-tension lead from the ignition coil.
4. On carbureted cars, fully open the throttle either by operating the carburetor throttle linkage by hand or by having an assistant "floor" the accelerator pedal. On fuel-injected cars, disconnect the cold start valve and all injector connections.
5. Screw the compression gauge into the No. 1 spark plug hole until the fitting is snug.

NOTE: *Be careful not to crossthread the plug hole. On aluminum cylinder heads use extra care, as the threads in these heads are easily ruined.*

6. Ask an assistant to depress the accelerator pedal fully on both carbureted and fuel-injected cars. Then, while you read the compression gauge, ask the assistant to crank the engine two or three times in short bursts using the ignition switch.
7. Read the compression gauge at the end of each series of cranks, and record the highest of these readings. Repeat this procedure for each of the engine's cylinders. Compare the highest reading of each cylinder to the compression pressure specifications in the "Tune-Up Specifications" chart in Chapter 2. The specs in this chart are maximum values.

A cylinder's compression pressure is usually acceptable if it is not less than 80% of maximum. The difference between each cylinder should be no more than 12-14 pounds.

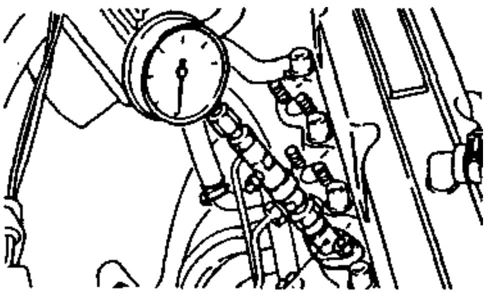
8. If a cylinder is unusually low, pour a tablespoon of clean engine oil into the cylinder through the spark plug hole and repeat the compression test. If the compression comes up after adding the oil, it appears that that cylinder's piston rings or bore are damaged or worn. If the pressure remains low, the valves may not be seating properly (a valve job is needed), or the head gasket may be blown near that cylinder. If compression in any two adjacent cylinders is low, and if the addition of oil doesn't help the compression, there is leakage past the head gasket. Oil and coolant water in the combustion chamber can result from this problem. There may be evidence of water droplets on the engine dipstick when a head gasket has blown.

Diesel Engines

Checking cylinder compression on diesel engines is basically the same procedure as on gasoline engines except for the following:

1. A special compression gauge adaptor suitable for diesel engines (because these engines have much greater compression pressures) must be used.
2. Remove the injector tubes and remove the injectors from each cylinder.

NOTE: *Don't forget to remove the washer underneath each injector; otherwise, it may get lost when the engine is cranked.*



Diesel engines require a special compression gauge adaptor

3. When fitting the compression gauge adaptor to the cylinder head, make sure the bleeder of the gauge (if equipped) is closed.
4. When reinstalling the injector assemblies, install new washers underneath each injector.

after just 5 minutes of running time, and additional belt stretch will usually occur.

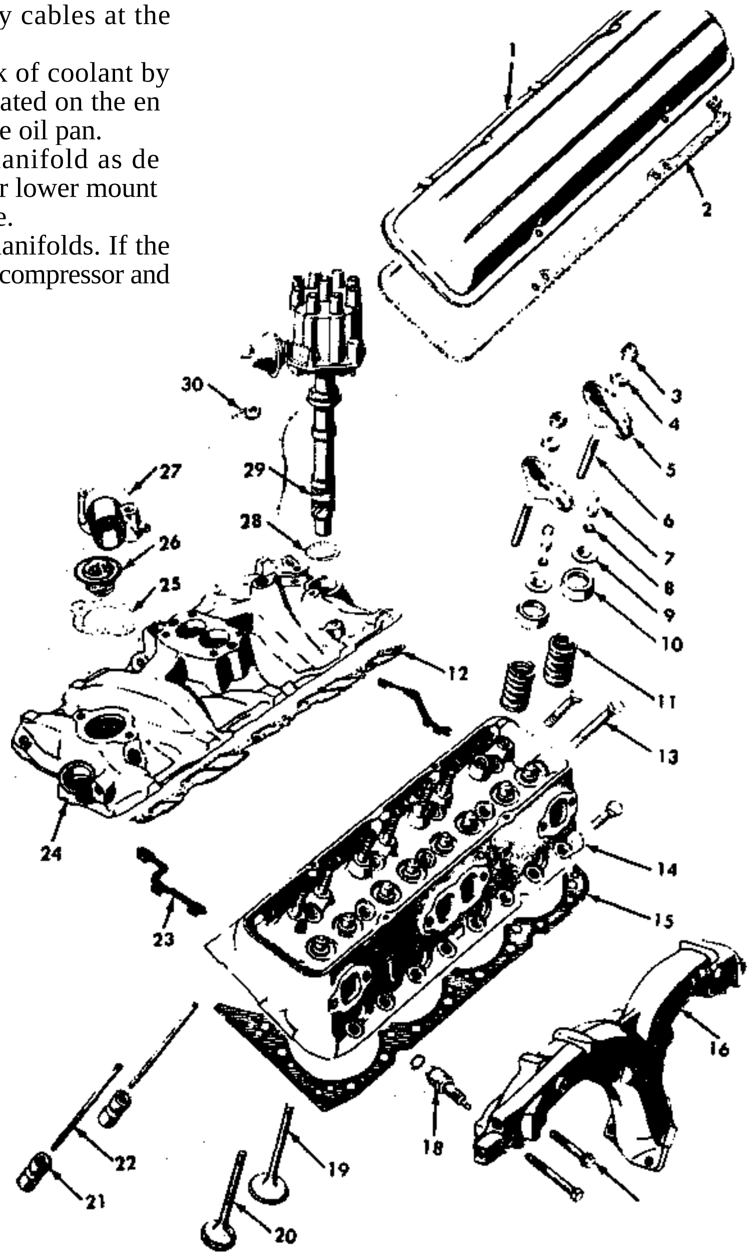
9. ALWAYS check for coolant, fiiel, and oil leaks after the engine is started. If there is leakage, turn off the engine, determine the source of leakage and fix the problem before restarting the engine.

10. Adjust the ignition timing after the engine is started.

Cylinder Heads

REMOVAL AND INSTALLATION

1. Disconnect the battery cables at the battery.
2. Drain the engine block of coolant by removing the drain plugs located on the en gine block above the top of the oil pan.
3. Remove the intake manifold as de scribed. Remove the alternator lower mount ing bolt, and lay the unit aside.
4. Remove the exhaust manifolds. If the vehicle has A/C, dismount the compressor and



1. Rocker arm cover
2. Gasket
3. Nut
4. Ball
5. Rocker arms
6. Rocker arm studs
7. Valve keeper locks
8. O-ring seals
9. Valve spring cap
10. Shield
11. Spring
12. Gasket
13. Bolts
14. Cylinder head
15. Head gasket
16. Exhaust manifold
17. Bc-lts
18. Spark plug and gasket
19. Intake valve
20. Exhaust valve
21. Hydraulic lifters
22. Pu£h rods
23. Intake manifold gaskets
24. Intake manifold
25. Gasket
26. Thermostat
27. Thermostat housing
28. Gasket
29. Distributor
30. Clamp

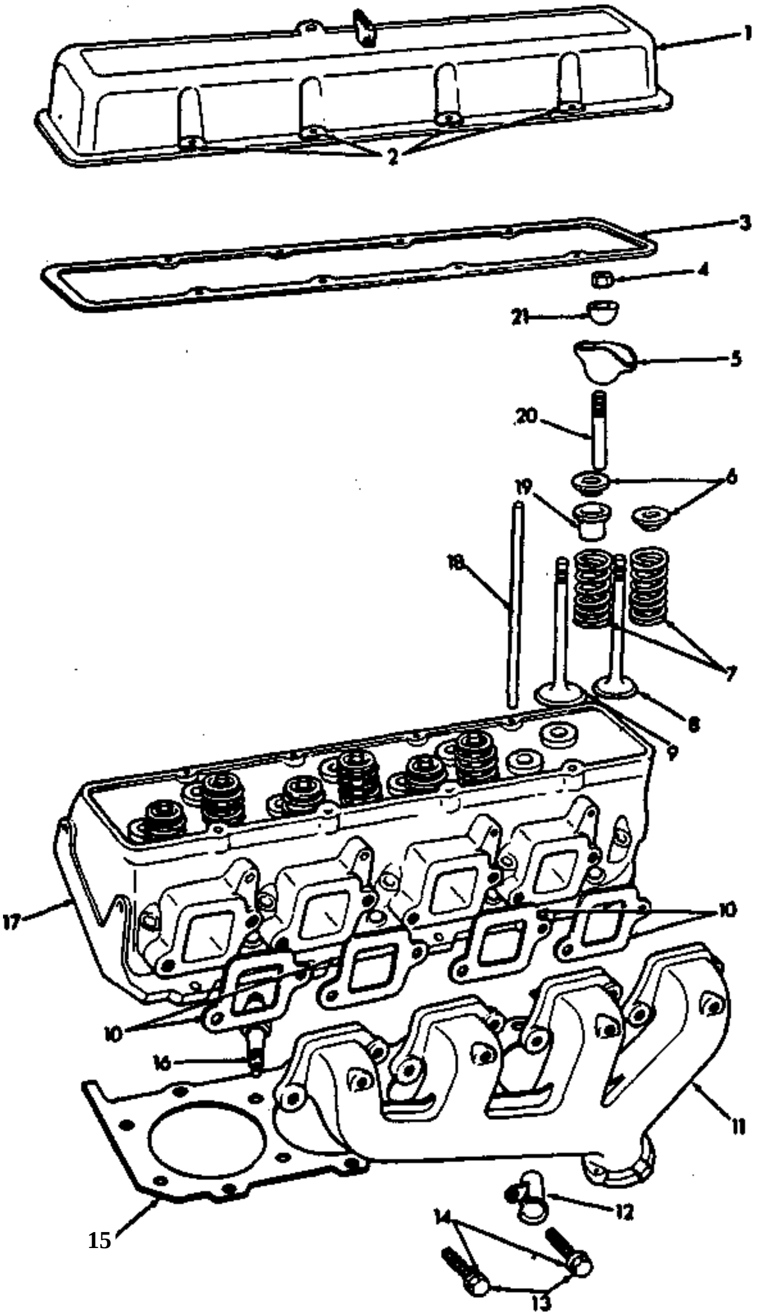
position it out of the way. Do not disconnect the refrigerant lines.

5. Back off the rocker arm nuts and pivot the rocker arms out of the way so that the pushrods can be removed. Identify the pushrods so that they can be reinstalled in then-original locations.

6. Remove the cylinder head bolts and cylinder heads.

7. Install using new gaskets. The head gasket is installed with the bead up.

Exploded view of the small-block cylinder head



1. Valve cover
2. Screw reinforcements
3. Gasket
4. Adjusting nut
5. Rocker arm
6. Valve spring retainer
7. Valve spring
8. Exhaust valve
9. Intake valve
10. Gasket
11. Exhaust manifold
12. Spark plug shield
13. Bolt
14. Washer
15. Head gasket
16. Spark plug
17. Cylinder head
18. Pushrod
19. Spring shield
20. Rocker arm stud
21. Rocker arm ball

Exploded view of the big-block cylinder head

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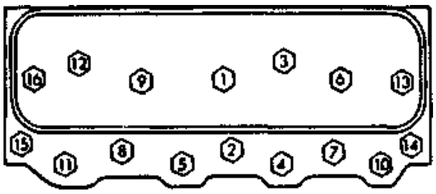
Small block V8 cylinder head bolt tightening sequence



Big block V8 cylinder head bolt tightening sequence

NOTE: *Coat a steel gasket, thinly and evenly, on both sides with sealer. If a steel asbestos gasket is used, do not apply sealer. Clean the bolt threads, apply sealing compound and install the bolts finger tight.*

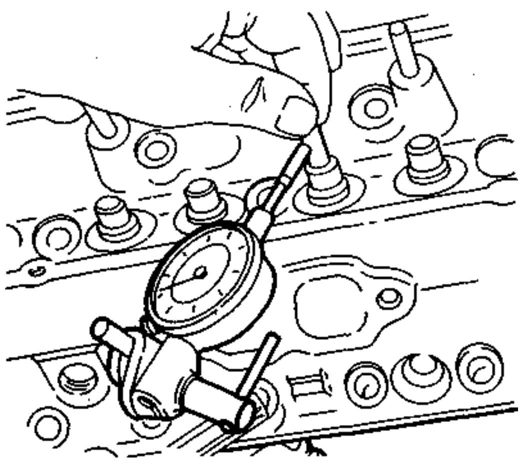
8. Tighten the head bolts a little at a time in the sequence illustrated to the specified torque.
9. Install the exhaust and intake mani folds.
10. Adjust the valves.

OVERHAUL

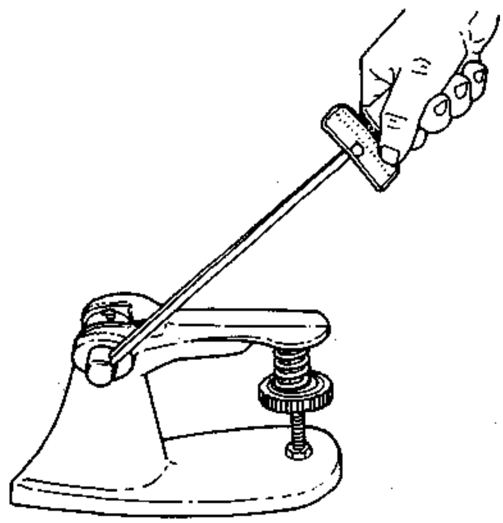
1. With cylinder head removed, remove valve rocker arm nuts, balls and rocker arms (if not previously done).
2. Using Tool J-15062, or equivalent, compress the valve springs and remove stem keys. Release the compressor tool and re move rotators or spring caps, oil shedders, springs and damper assembly, then remove oil seals and valve spring shims.
3. Remove valves from cylinder head and place them in a rack in their proper sequence so that they can be assembled in their origi nal positions. Discard any bent or damaged valves.
4. Clean all carbon from combustion chambers and valve ports using 2 wire brush.
5. Thoroughly clean the valve guides us ing a suitable wire bore brush.
6. Clean all carbon and sludge from push rods, rocker arms and push rod guides. Dis card bent push rods.
7. Clean valve stems and heads on a buff ing wheel.
8. Clean carbon deposits from head gasket mating surface Be careful not to score the machined gasket surface while cleaning.
9. Inspect the cylinder head for cracks in the exhaust ports, combustion chambers, or external cracks to the water chamber.
10. Inspect the valves for burned heads, cracked faces or damaged stems.

NOTE: *Excessive valve stem to bore clearance will cause excessive oil consumption and may cause valve breakage. Insufficient clearance will result in noisy and sticky functioning of the valve and disturb engine smoothness.*

11. Measure valve stem clearance as fol lows:
    a. Clamp a dial indicator on one side of the cylinder head rocker arm cover gasket rail.
    b. Locate the indicator so that move-



Measuring valve stem clearance with dial gauge



Checking valve spring tension—typical

ment of the valve stem from side to side (crosswise to the head) will cause a direct movement of the indicator stem. The indicator stem must contact the side of the valve stem just above the valve guide.

c. Drop the valve head about Vie in. off the valve seat.

d. Move the stem of the valve from side to side using light pressure to obtain a clearance reading. If clearance exceeds specifications, it will be necessary to ream valve guides for oversize valves.

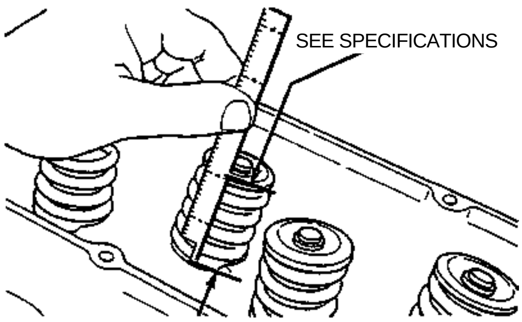
NOTE: *See "Valve Guide and Seat Service" for detailed overhaul procedures.*

12. Check valve spring tension with a suitable spring tester. Springs should be compressed to the specified height and checked against the specifications chart. Springs should be replaced if not within 10 Ibs. (44N) of the specified load (without dampers).

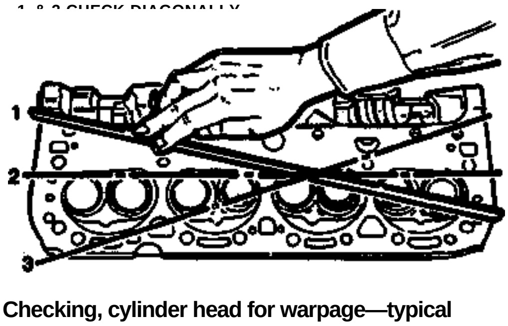
13. Inspect rocker arm studs for wear or damage.

14. Check the cylinder head for warpage with a straightedge. If warpage exceeds .003 in. in a 6 in. span, or .006 in. over the total length, the cylinder head must be resurfaced (which is akin to planing a piece of wood). Resurfacing can be performed at most machine shops.

NOTE: *When resurfacing the cylinder heads(s) ofV8 engines, the intake manifold mounting position is altered, and must be corrected by machining a proportionate amount from the intake manifold flange.*



Measuring valve spring installed height



Checking, cylinder head for warpage—typical

15. Insert a valve in the proper port.

16. Assemble the valve spring and related parts as follows:

a. Set the valve spring shim, valve spring, damper assembly, oil shedder and valve cap or rotator in place.

b. Compress the spring with Tool J-8062, or equivalent.

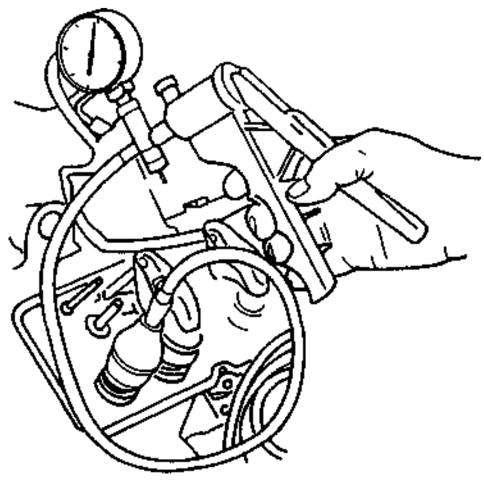
c. Install oil seal in the lower groove of the stem, making sure that the seal is flat and not twisted.

d. Install the valve and release the compressor tool making sure that the valve stems seat properly in the upper groove of the valve stem. Grease may be used to hold the locks in place while releasing the compressor tool.

17. Install the remaining valves, repeating assembly sequence.

18. Check each valve stem oil seal by placing a Leak Detector Tool J-23994, or equivalent, over the end of the valve stem and against the cap (or rotator). Operate the vacuum pump and make sure no air leaks past the seal.

19. Check the installed height of the valve springs, using a narrow thin scale. A cutaway scale will help. Measure from the top of the shim or the spring seat to the top of the oil shedder. If this is found to exceed the specified height, install a valve spring seat shim approximately Vie in. (1.6mm) thick. At no time should the spring be shimmed to give an installed height under the minimum specified.



Checking valve stem oil seals with vacuum tester

Valve Guide and Seat Service

The small-block engines (305,327,350) do not have separate valve guides and seats. The small-block head is basically a one-piece casting; the valves move inside guide bores and seal against seats which are machined into the cylinder head.

All big-block (396,427,454) cylinder heads use separately pressed-in valve guides. Chevrolet does not sell replacement valve guides nor do they publish a factory recommended procedure for replacing the guides. They (the guides) can be replaced, but this can be performed only by a professional automotive machine shop. Valve seats of cast-iron big-block heads are machined into the cylinder head; they cannot be replaced. These seats, as those of the small-block, can be machined during a valve job to provide optimum sealing between the valve and the seat. Aluminum big-block cylinder heads use hardened steel valve seat inserts pressed into the cylinder heads. As in the case with big-block valve guides, Chevrolet does not sell replacement valve seats nor have they published a factory recommended procedure for replacing the seats. Due to the extremely high cost of replacement aluminum heads ($600.00 + each at the time of this printing) be absolutely sure that the machine shop you chose has a noteworthy reputation for precision work.

Whether you have a small or big-block engine, valve guides are most accurately repaired using the bronze-wall rebuilding method. In this operation, "threads" are cut into the bore of the valve guide and bronze wire is turned into the threads. The bronze "wall" is then reamed to the proper diameter. This method is well received for a number of reasons: a) relatively inexpensive b) offers better valve lubrication (the wire retains oil) c) less valve friction (d) preserves the original valve guide-to-seat relationship.

Another method of repairing worn guides is to have the guides "knurled". The knurling process entails cutting into the bore of the valve guide with a special tool. The cutting action "raises" metal off of the guide bore which actually narrows the I.D. of the bore, thereby reducing the clearance between the valve guide bore and the valve stem. This method offers the same advantages as the bronze wall method, but will generally wear faster.

Either of the above services must be performed by a professional machine shop which has the specialized knowledge and tools necessary to perform the service.

FOR DIMENSIONS, REFER TO SPECIFICATIONS

Proper Up Pattern

FirtM Rotation Tip Pattern

toptaCT Rotator and cluck rotation

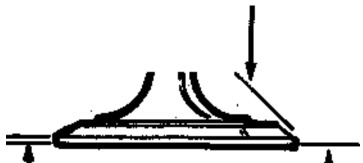
Rotator

topln Rotator andchflcb lotaUon

CHECK FOR, BENT STEM

Typical valve stem wear patterns

DIAMETER.



Critical valve dimensions

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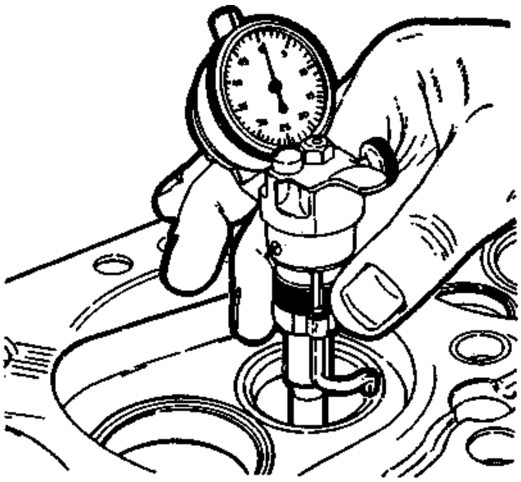
Cutaway view of knurled valve guide

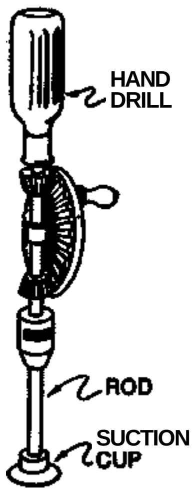


Checking valve seat concentricity with run-out gauge

LAPPING THE VALVES

When valve faces and seats have been re-faced and re-cut, or if they are determined to be in good condition, the valves must be "lapped in" to ensure efficient sealing when the valve closes against the seat.

1. Invert the cylinder head so that the combustion chambers are facing up.
2. Lightly lubricate the valve stems with clean oil, and coat the valve seats with valve grinding compound. Install the valves in the head as numbered.
3. Attach the suction cup of a valve lap ping tool to a valve head. Moisten the suction cup to securely attach the tool to the valve.
4. Rotate the tool between the palms, changing position and lifting the tool often to prevent grooving. Lap the valve until a smooth, polished seat is evident (you may have to add a bit more compound after some lapping is done).
5. Remove the valve and tool, and remove ALL traces of grinding compound with solvent-soaked rag, or rinse the head with solvent.



Fabricated valve lapping tool

Lapping the valve and seat by hand—typical

NOTE: *Valve lapping can also be done by fastening a suction cup to a piece of drill rod in a hand "eggbeater" type drill. Proceed as above, using the drill as a lapping tool. Due to the higher speeds involved when using the hand drill, care must be exercised to avoid grooving the seat. Lift the tool and change direction of rotation often.*

Valve Springs and Seals

Small-block engines use only one type of valve stem oil seal. The small-block seal is simply an O-ring which is installed on the lower groove of the valve stem and seals against the lower inside portion of the valve spring retainer.

Big-block engines have used four types of seals over the years. The first type is a rubber "umbrella" seal which is installed on the valve guide boss of the cylinder head and wipes the valve stem as the valve moves within the seal. The second type of seal is a nylon "umbrella" seal which is integral with the valve spring retainer. The third type is also nylon and is integral with the spring retainer, but,is no longer serviced. If defective, the third type must be replaced with the second type. Both the second and third types seal against the top of the valve stem and divert any oil which may seep through. The fourth type is of the same design and arrangement as the small-block type.

REMOVAL

NOTE: *The following Removal and Installation procedures apply to cylinder heads installed on the vehicle. Access to an air compressor and the purchase of certain special tools is required.*

1. Remove the valve cover (both of the covers if all of the springs and/or seals are to be replaced).

2. Remove the spark plug from the cylin der which is to be serviced.

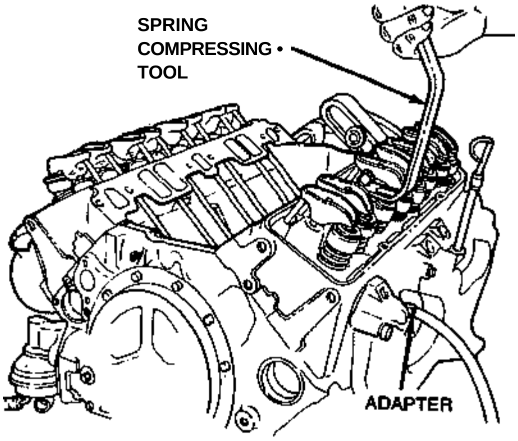
3. Install an air line adaptor in place of the spark plug and attach the air line from the air compressor to die adaptor. The compressed air is used to hold the valves in place when the valve springs are compressed. If either of the valves of the cylinder to be serviced are open, attach the air line after step 4.

4. Remove the rocker arm, ball and push-rod of the valve to be serviced.

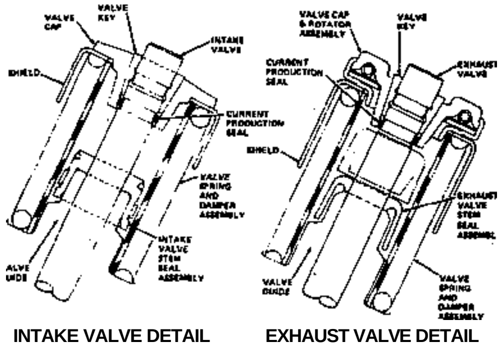
5. Install a special valve spring compress ing tool to the rocker arm stud and retain the tool with the rocker arm nut.

6. Lever the tool handle towards you to compress the spring. Remove the two valve locks (split keys) and release the pressure on the tool handle slowly. Remove the tool, valve spring, and related components.

NOTE: *If the valve does not stay in its uppermost position as the spring is compressed, the valve and/or valve seat are probably burned. A burned valve or seat will allow the compressed air to leak out of the cylinder. Cylinder head should be removed and overhauled.*



Replacing the valve seals using compressed air and a special valve spring compressing tool—small block shown, big block similar



O-ring type valve seal placement. Note the optional seal types are shown as dotted lines.

INSTALLATION

1. If a rubber "umbrella" type seal is used (big-block only), install the seal over the valve stem and seat it onto the valve guide boss.

2. Install the valve spring(s) and retainer over the valve and install the valve compress ing tool. Compress the spring enough to ex pose the grooves of the valve stem.

NOTE: *On big-block models using the nylon seal, the seal must be attached to the retainer prior to installation.*

3. If O-ring type seals are used, position the O-ring into the lower groove of the valve stem, install the locks (retain with grease), and release the spring compressing tool. If the in tegral nylon seals are used, merely install the locks and release the spring compressing tool.

4. Visually check that the locks are posi tioned properly in the retainer.

5. Install the pushrod, rocker arm, and pi vot ball. Tighten the rocker arm nut until it seems to be positioned the same as an undis turbed rocker nut.

6. Disconnect the compressed air line, re move the air line adaptor, and reinstall and connect the spark plug.

7. Adjust the valve as previously outlined and reinstall the valve cover(s).

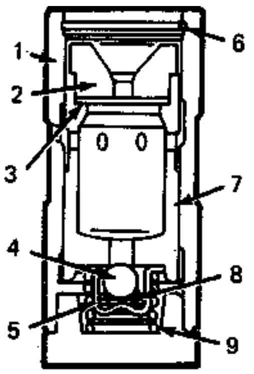
Valve Lifters

NOTE: *Hydraulic valve lifters very seldom require attention. The lifters are extremely simple in design, readjustments are not necessary, and servicing of the lifters requires only that care and cleanliness be exercised in the handling of parts.*

REMOVAL AND INSTALLATION

1. Remove intake manifold as previously outlined.

1. Lifter Body
2. Push Rod Seat
3. Metering Valve
4. Check Ball
5. Check Ball Retainer



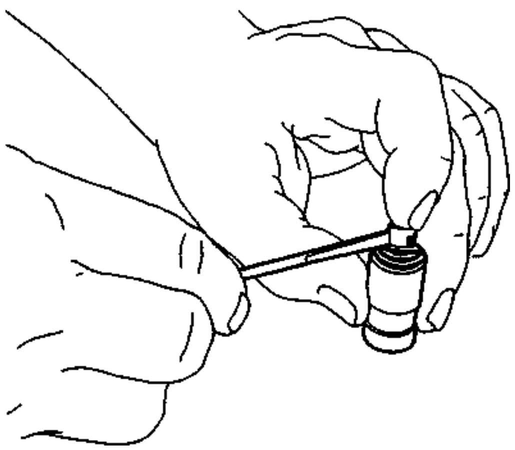
6. Push Rod Seat Retainer
7. Plunger
8. Check Ball Spring
9. Plunger Spring

Typical hydraulic valve lifter showing internal components

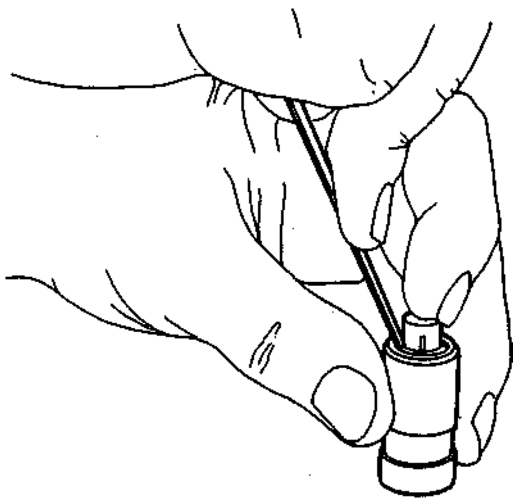
2. Remove valve rocker arms and push-rods.
3. Remove valve lifters. Place valve lift ers, rocker arms and pushrods in order so that they may be installed in original location.
4. Coat foot of valve lifters with Molvr kote® or its equivalent and install valve lift ers. Make sure lifter foot is convex. A suit able hydraulic lifter removal and installation tool makes the job easier.
5. Reassemble in reverse of removal pro cedures. Check valve adjustment.

OVERHAUL

1. Hold the plunger down with a push rod, and using the blade of a small screw driver, remove the push rod seat retainer.



Removing ball check valve from lifter body



Installing ball check valve into lifter body

2. Remove the push rod seat and meter ing valve.
3. Remove the plunger, ball check valve assembly and the plunger spring.
4. Remove the ball check valve and spring by prying the ball retainer loose from the plunger with the blade of a small screw driver.
5. Thoroughly clean all parts in cleaning solvent, and inspect them carefully. If any parts are damaged or worn, the entire lifter assembly should be replaced. If the lifter body wall is scuffed or worn, inspect the cylinder block lifter bore. If the bottom of the lifter is scuffed or worn, inspect the camshaft lobe. If the push rod seat is scuffed or worn, inspect the push rod. An additive containing EP lube, such as EOS, should always be added to crankcase oil for run-in when any new cam shaft or lifters are installed. All damaged or worn lifters should be replaced.

NOTE: *For proper lifter rotation during engine operation, lifter foot must be convex.*

6. Place the check ball on small hole in bottom of the plunger.
7. Insert check ball spring on seat in ball retainer and place retainer over ball so that spring rests on the ball. Carefully press the retainer into position in plunger with the blade of a small screw driver.
8. Place the plunger spring over the ball retainer and slide the lifter body over the spring and plunger, being careful to line up the oil feed holes in the lifter body and plunger.
9. Fill the assembly with SAE 10 oil, then insert the end of a *Vs* in. drift pin into the plunger and press down solid—do not at-

tempt to force or pump the plunger. At this point, oil holes in the lifter body and plunger assembly will be aligned.

10. Insert *a Vie* in. drift pin through both oil holes to hold the plunger down against the lifter spring tension.

11. Remove the *Ya* in. drift pin, refill as sembly with SAE 10 oil.

12. Install the metering valve and push rod seat.

13. Install the push rod seat retainer, press down on the push rod seat and remove the Vie in. drift pin from the oil holes. The lifter is now completely assembled, filled with oil and ready for installation. Before installing lifters, coat the bottom of the lifter with Molykote® or its equivalent.

Rocker Arms and Studs

REMOVAL AND INSTALLATION

NOTE: Some engines are *assembled using RTV silicone sealant in place of rocker arm cover gasket. If the engine was assembled using RTV, never use a gasket when reassembling. Conversely, if the engine was assembled using a rocker arm cover gasket, never replace it with RTV. When using RTV, an Vs inch bead is sufficient. Always run the bead on the inside of the bolt holes.*

Rocker arms are removed by removing the adjusting nut. Be sure to adjust valve lash after replacing rocker arms. *When replacing an exhaust rocker, move an old intake rocker to the exhaust rocker arm stud and install the .new rocker arm on the intake stud.*

Rocker arm studs that have damaged threads or are loose in the cylinder heads may be replaced with new studs available in 0.003 in. and 0.013 in. oversize or the bores may be tapped and screw-in repkcement studs used. Do not attempt to install an oversize stud without reaming the stud bore. Studs are press-fit. Mark IV (big block V8) and kte high performance small-block engines use screw-in studs and pushrod guide plates. NOTE: *If engine is equipped with the A.I.R. exhaust emission control system, the interfering components of the system must be removed. Disconnect the lines at the air injection nozzles in the exhaust manifolds.*

Intake Manifold

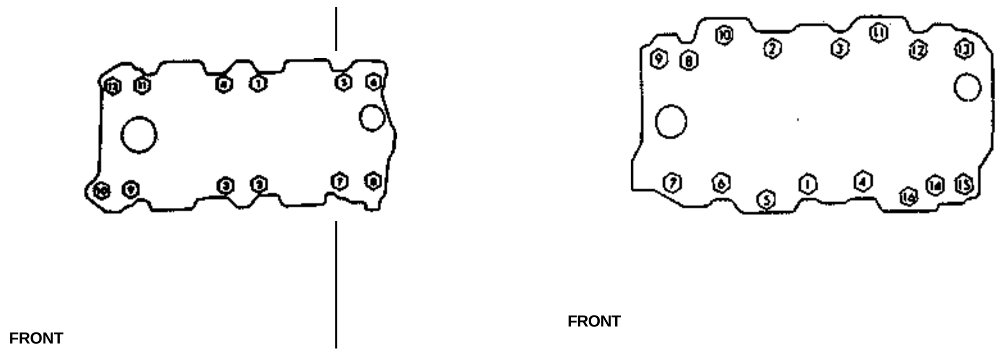
REMOVAL AND INSTALLATION

NOTE: *When servicing late model vehicles, be absolutely sure to mark vacuum hoses and wiring so that these items may be properly reconnected during installation. Also, when disconnecting fittings of metal lines (fuel, power brake vacuum), always use two flare nut (or line) wrenches. Hold the wrench on the large fitting with pressure on the wrench as if you were tightening the fitting (clockwise), THEN loosen and disconnect the smaller fitting from the larger fitting. If this is not done, damage to the line will result.*

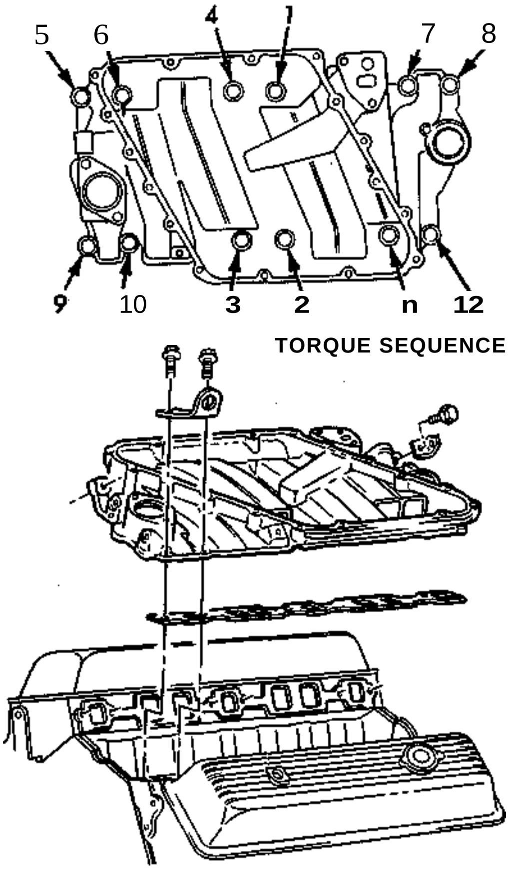
1. Remove the air cleaner assembly.
2. Disconnect the battery cables at the battery.
3. Raise and support the front of tibe ve hicle.
4. Remove the coolant drain plugs from the lower portion of the engine block and al low the coolant to drain.
5. Reinstall and tighten the drain plugs and lower the vehicle.

NOTE: *When servicing 1963-81 models, continue with the following step andfollow through to step 16. When servicing 1982 and later models, skip to step 17 andfollow through to step 32.*

6. On single-carburetor models, discon nect the fuel line at the carburetor. On models equipped with three-two barrel carburetors, disconnect the fuel feed line from the three-way junction block at the front carburetor.
7. On 1963-67 models, remove the ac celerator rod which connects the carburetor linkage to the accelerator linkage at the fire wall. On 1968-81 models, disconnect the ac celerator cable at the carburetor.
8. On 1968-72 models, unbolt the accel-



Intake manifold bolt torque sequence—1963-81 (small block, left side; big block, right side)



1982 and later intake manifold installation and torque specifications

erator cable from the bracket and tie the cable out of the way. On 1973—81 models, unbolt the accelerator cable bracket from the carburetor and tie the cable and bracket assembly out of the way.

9. Disconnect the transmission linkage (or cable) and/or cruise control cable at the carburetor.

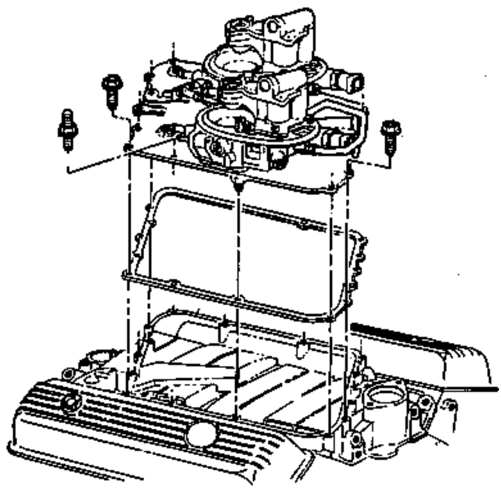
10. Disconnect the vacuum hoses from the distributor and power brake unit, if so equipped. If the power brake line uses a flex hose connected to an engine-mounted metal line, disconnect the flex hose at the metal line.

11. Disconnect the ignition coil and tem perature sending switch wiring (if the switch is mounted on the intake manifold instead of the cylinder head).

12. Mark and disconnect any remaining vacuum lines which will interfere with the removal of the intake manifold and carbu retor assembly.

13. Remove the distributor as previously outlined.

14. If the upper alternator or air condi-



1982 and later TBI plate installation

tioning compressor mounting brackets are mounted to the intake manifold, remove the brackets.

15. Disconnect the heater hose(s) at die manifold and the upper radiator hose at the thermostat housing.

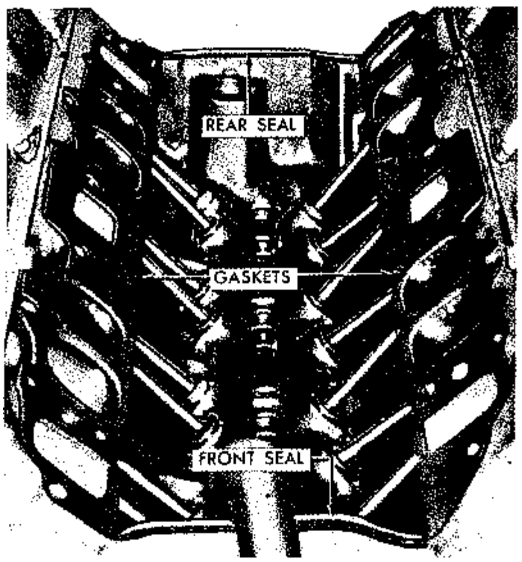
16. Remove the intake manifold and car buretor as an assembly.

NOTE: *The following steps apply only to 1982 and later models.*

17. Disconnect die fuel inlet line at the front Throttle Body Injection (TBI) unit.

18. Remove the exhaust gas recirculation (EGR) solenoid.

19. Disconnect the wiring from die idle air motors, injectors, and the throttle position sensor (TPS).



Intake manifold gasket and seal placement

20. Disconnect the fuel return line at the rear TBI unit.

21. Remove the power brake booster line.

22. Disconnect the accelerator and cruise control cables, unbolt the cable bracket from the manifold and tie the cable and bracket assembly out of the way.

23. Disconnect the air injection hose at the check valve and the air control valve.

24. Unbolt the air injection pump and move it out of the way.

25. Disconnect the positive crankcase ventilation valve hose at the manifold and move the hose aside.

26. Mark and disconnect any vacuum hoses which will interfere with removal of the man ifold.

27. If you plan on removing the TBI units from the upper manifold pkte, remove the fuel balance tube (connecting the units) at this time.

28. Remove the bolts which attach the up per manifold plate (or TBI plate) to the intake manifold. Lift the TBI and plate assembly off of the intake manifold.

29. Remove the distributor as previously outlined.

30. Disconnect the upper radiator hose from the thermostat housing.

31. Disconnect the heater hose from the intake manifold.

32. Remove the intake manifold-to-cylin der head bolts and lift the intake manifold as sembly off of the engine.

33. Installation is the reverse of removal procedures. Note the following points when installing the manifold:

a. Components originally sealed with RTV sealer must be resealed with RTV. Conversely; if no RTV was used originally, it is not necessary to use during assembly.

b. It IS NOT necessary to remove all old RTV before applying the new RTV; just re move the loose pieces and seal over the re maining RTV. If the RTV must be applied around bolt holes, run the bead of RTV on the inside of the holes.

c. If available, use sealing tape on the threads of male fuel line fittings during as sembly.

d. Replenish die cooling system with the proper amount and quality of coolant.

e. Before starting the engine, make sure that the throttle return springs are con nected properly and the linkage does not bind in any way.

f. If disturbed during manifold removal, adjust the drive belt(s) to recommended tension.

g. After the engine is started, check for leaks and readjust the ignition timing, if necessary.

Exhaust Manifold

REMOVAL AND INSTALLATION

1. If equipped with an air injection mani fold attached to the exhaust manifold, re move the air injection manifold according to the procedure outlined in the Emission Con trol section.

2. Raise the front of the vehicle and sup port it safely with jackstands.

3. Soak the exhaust manifold flange studs with penetrating lubricant and remove the flange nuts. Lower the exhaust pipe from the manifold and tie the pipe out of the way.

NOTE: *On later models equipped with a* Y *pipe, it may be necessary to unbolt the pipe from both manifolds. 4t,* Lower the vehicle.

5. Remove the spark plug radio interfer ence shielding, if so equipped. Mark and dis connect the spark plug wires from the plugs and remove the spark plugs and plug heat shields. Disconnect the oxygen sensor, if equipped. Do not allow penetrating oil to contaminate sensor.

6. Unbolt the manifold, working from the outer bolts towards the inner bolts to prevent manifold warpage.

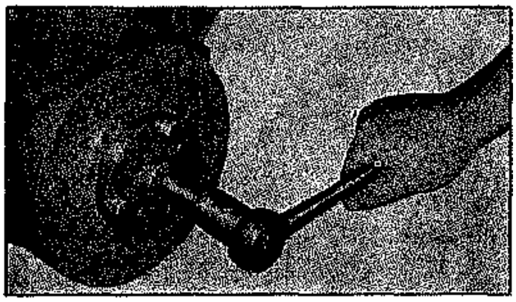
NOTE: *On some 1974-76 models, it may be necessary to raise the right side of the engine to remove the right hand exhaust manifold. To do this, unbolt the fan shroud (but do not remove it), remove the right side engine mount through-bolt, and raise the right side of the engine using a jack with a block of wood between the jack and the oil pan.*

Installation is the reverse of the previous steps. If the engine used gaskets between the exhaust manifold and the cylinder head, replace the gaskets. Repkce the manifold-to-exhaust pipe seal(s). Be sure that all of the mating surfaces are clean. If the threads of the exhaust manifold studs are rusted, use a thread chaser on the studs before installing the manifold.

Timing Chain Cover

REMOVAL

1. Disconnect the battery cables at the battery.



Removing the vibration damper using a puller

2. Remove the radiator and fan shroud as outlined in the Engine Cooling section.
3. Remove the drive belts, cooling fan (en gine-mounted only), and fan pulley.
4. Remove the cooling system drain plugs from the engine block and allow the coolant to drain.
5. Disconnect the brackets and hoses from the water pump and remove the water pump.
6. Remove the pulley, from the crankshaft damper. Also remove the center bolt from the damper, if so equipped.
7. Using a puller, remove the crankshaft damper.

CAUTION: *To prevent damage to the damper, the puller used must attach to the hub of the damper. DO NOT use a jaw-type puller to grasp the outside of the damper.*

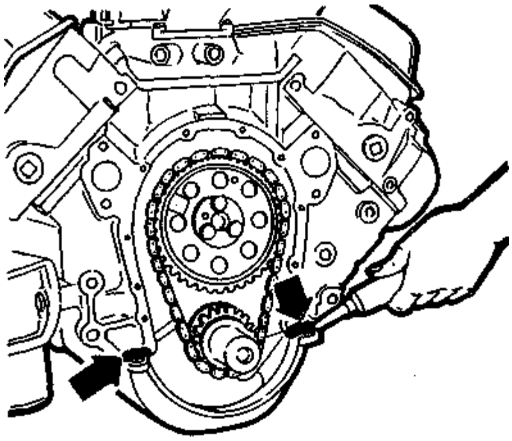
8. On 1974 and earlier small-block models only, remove the oil pan as outlined in the Engine Lubrication section.
9. Remove the timing cover retaining bolts and remove the timing cover.

INSTALLATION

1. Clean the gasket mating surfaces of the water pump, timing cover, engine block, and oil pan.

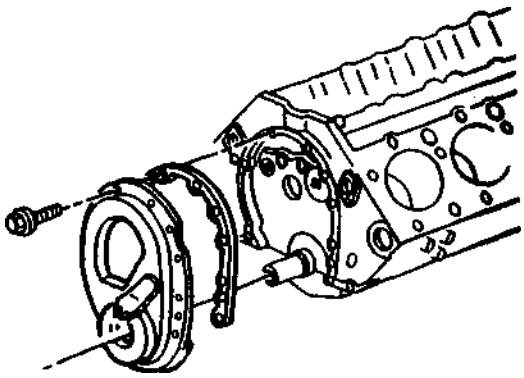
NOTE: *Perform steps 2 and 3 only if the oil pan was not removed.*

2. Using a sharp knife, cut the protrud ing oil pan gasket material flush with the front of the engine block.
3. Apply a *W* bead of RTV sealer to the oil pan-to-engine block front junctions (where the excess gasket was previously removed).
4. Coat the new timing cover-to-oil pan seal and lightly coat the lower portion of the seal with engine oil,
5. Install the timing cover (with gasket and seal). If the oil pan is installed, press downward on the cover to position the cover over the engine block dowel pins. Don't force the cover over the pins.



Apply sealer to the front pads at the area shown (V8)

6. Install and tighten the cover retaining bolts. If the oil pan is installed, visually check that the cover gasket and seal did not distort after the bolts were tightened. Also check that the sealer applied during step 3 compressed, indicating a good seal.
7. Install the oil pan at this point, if it was removed previously. Be sure to apply a small amount of sealer where the oil pan side gas kets meet the front and rear seals.
8. Oil the crankshaft seal and clean both the crankshaft snout and the bore of the damper.
9. Lightly oil the damper bore and the crankshaft snout. Install the damper, using a tool that will pull the damper onto the crank shaft. It is not recommended to hammer the crankshaft into place.
10. The remainder of the assembly is performed in the reverse of steps 1-6 of the Removal procedure. Be sure to fill the cooling



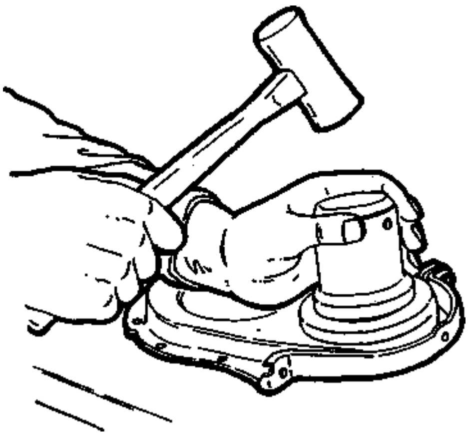
Timing cover and gasket—typical

system, adjust the tension of the drive belts, and check for leaks after the engine is started.

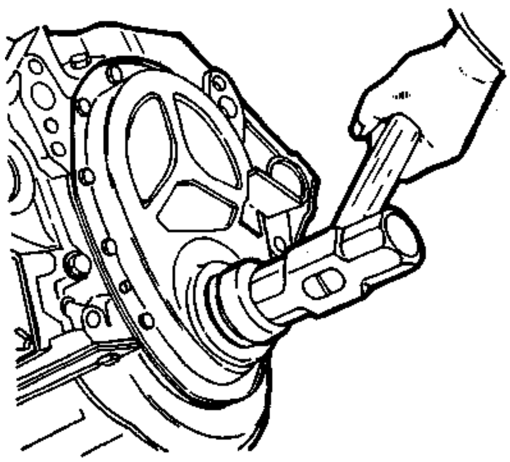
Timing Cover Oil Seal

REPLACEMENT

The timing cover oil seal may be replaced without removing the timing cover. Follow steps 1, 2, 6 and 7 of the Timing Cover Removal procedure to gain access to the cover. Pry the old seal out of the cover, being careful not to damage the cover itseE Install the new seal so that the open end of the seal is toward the inside of the cover. Drive the seal into place using a seal driver. If the seal is to be replaced with the cover removed, support the rear of the cover while driving the seal into place.



Seal installation with the cover removed

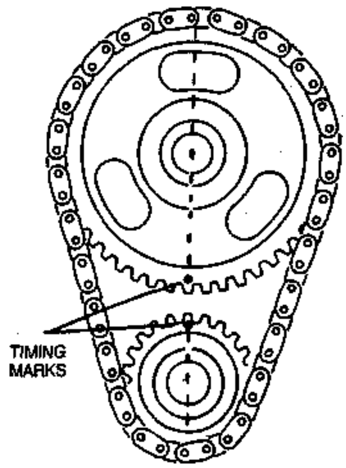


Soal installation with the cover Installed

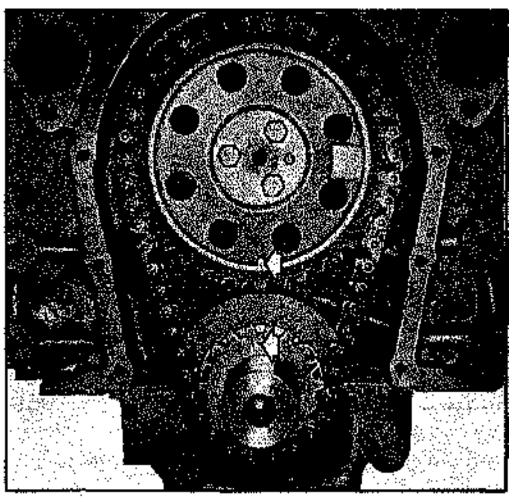
Timing Chain

REMOVAL AND INSTALLATION

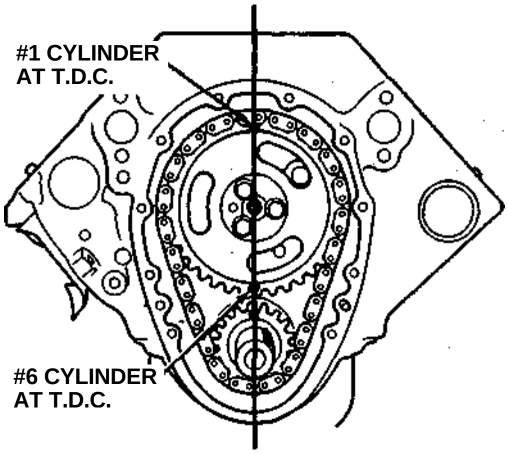
1. Set the engine to top dead center with the number one cylinder on its compression stroke (both valves closed).
2. Remove the timing cover as previously outlined.
3. Remove the three bolts from the camshaft sprocket and pull the sprocket off of the camshaft. Lower the sprocket and remove the camshaft sprocket and chain.
4. Check the camshaft and crankshaft sprockets for wear. It is best to replace the timing set (chain and sprockets) together. If you do not have a puller to remove the crankshaft sprocket, replacement of only the cam sprocket and chain will usually result in a sat-



1963-79 timing mark alignment—with steel camshaft gear



1963-79 timing mark alignment—with nytwHe-camshaft gear



1980 and later timing mark alignment

isfactory repair. Remember that the total deflection of the chain (installed) should not exceed about *Va".*

Most engines are equipped with the nylon-toothed camshaft sprocket. If you drive the car hard, or if the original sprocket failed prematurely, it may be wise to replace the nylon-toothed sprocket with the hardened-iron sprocket available through Chevrolet dealers. Make sure that you explain your intentions when purchasing the timing components, so that the chain and gears are properly matched. An all-metal cam gear produces a little more noise than the nylon-toothed gear, but will last considerably longer.

When installing the new timing components, be sure to align the timing marks of both the cam gear and crank gear. DO NOT rotate the engine while the timing chain is removed. Torque the camshaft sprocket bolts to 20 ft. Ibs. and install the timing cover as previously outlined.

Camshaft

REMOVAL AND INSTALLATION

Remove the radiator and shroud. Remove the fan and fen pulley. Use a gear puller to remove the harmonic balancer. Remove the oil pan, water pump, and the timing chain cover.

On the top of the engine, remove the bat-> tery cables, carburetor(s)/fuel injection unit, (on 1982 and later models, remove the TBI units and the TBI mounting plate as an assembly), distributor shielding, and distributor. Be sure to mark the distributor so that it will not be necessary to retime the engine.

When the intake manifold has been cleared of obstructions, remove it to expose the valve lifters. Cover the open area and remove the fuel pump and push rod.

Remove the rocker arm covers and rocker arms and withdraw the pushrods and lifters. Keep the pushrods and lifters in order so that they can be returned to their original positions. Remove the grille, timing chain, and camshaft sprocket. Loosen the engine side mount through bolts and jack up the front of the engine slightly. This is necessary for the camshaft to clear the radiator brace. Run two ^{5}/ie-18x4 in. bolts into the camshaft from the engine. Do not rotate the crankshaft until the camshaft has been replaced and the sprocket and chain correctly installed and aligned. Alignment procedures are the same as those shown within the previous Timing Chain replacement procedure.

Reverse the operation to complete the replacement. Lubricate the cam and lifters with E.O.S. additive before installation. Make an initial and final valve adjustment as previously described.

INSPECTION

Completely clean the camshaft with solvent, paying special attention to cleaning the oil holes. Visually inspect the cam lobes and bearing journals for excessive wear. If a lobe is questionable, have the cam checked at a reputable machine shop; if a journal or lobe is worn, the camshaft must be reground or replaced. Also have the camshaft checked for straightness on a dial indicator.

NOTE: *If a cam journal is worn, there is a good chance that the bushings are worn.*

Camshaft Bearings

REMOVAL AND INSTALLATION

If excessive camshaft wear is found, or if the engine is being completely rebuilt, the camshaft bearings should be replaced. A special puller tool is necessary.

NOTE: *The front and rear bearings should be removed last, and installed first. Those bearings act as guides for the other bearings and pilot.*

1. Drive the camshaft rear plug from the block.
2. Assemble the removal puller tool with its shoulder on the bearing to be removed. Gradually tighten the puller nut until the bearing is removed.
3. Remove the remaining bearings, leav ing the front and rear for last. To remove these, reverse the position of the puller, so

as to pull the bearings towards the center of the block. Leave the tool in this position, pilot the new front and rear bearings on the installer, and pull them into position.

4. Return the puller to its original position and pull the remaining bearings into posi tion.

NOTE: *Ensure that the oil holes align when installing the bearings. This is very important! You can make a simple tool out of a piece of %2 in. brass rod to check alignment.*

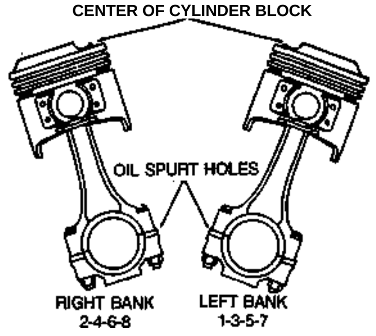
5. Replace the camshaft rear plug, and stake it into position.

Piston and Ring Servicing

Corvette pistons are made of aluminum alloy and should not be exposed to careless treatment. Never use a wire brush to clean these pistons. Use cleaning solvent to remove varnish or carbon. Clean the ring grooves with a groove cleaner tool. Be sure the oil holes in the grooves are clear. Check for cracks, scuff marks, etc., and replace any piston that is suspect. Check the piston skirt measurement with a micrometer and compare to specifications.

Piston pins are matched to an individual piston and should be replaced with the piston as a set, not separately. Clean the pin with solvent and with a micrometer, check the pin external size and the piston pin bore size. Replace both if wear tolerance exceeds the specifications by 0.001 in.

Two compression rings and an oil ring assembly are used on Corvette pistons. The compression rings are marked on their top side and should always be assembled to the piston with this mark upward. Before assembling the rings to the piston, they should be fitted to their individual cylinder bore.



Correct piston/connecting rod positioning for 396, 427, and 454 cu In. engines

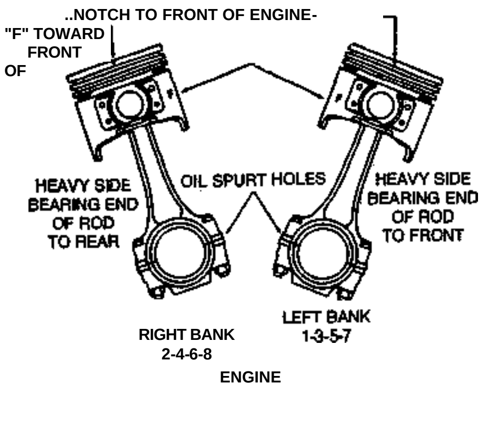
The second ring is identified by a chamfer or step on its lower edge. The top compression ring has a chamfer on its upper edge and is chrome faced. Corvette rings are furnished in oversizes of 0.020 in., 0.030 in., and 0.040 in.

Pistons and Connecting Rods

REMOVAL AND INSTALLATION

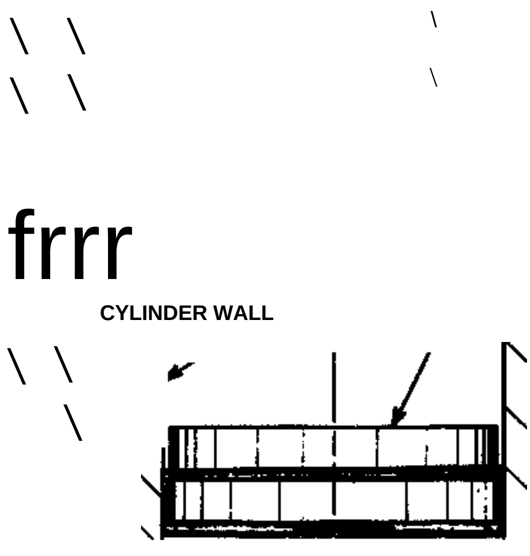
Before removing the pistons, the top of the cylinder bore must be examined for a ridge. A ridge at the top of the bore is the result of normal cylinder wear, caused by the piston rings only travelling so far up the bore in the course of the piston stroke. The ridge can be felt by hand; it must be removed before the pistons are removed.

A ridge reamer is necessary for this operation. Place the piston at the bottom of its stroke, and cover it with a rag. Cut the ridge away with the ridge reamer, using extreme care to avoid cutting too deeply. Remove the



Correct piston/connecting rod positioning for 305, 327, and 350 engines

RIDGE CAUSED BY CYLINDER WEAR



Wear ridge must be removed before piston removal

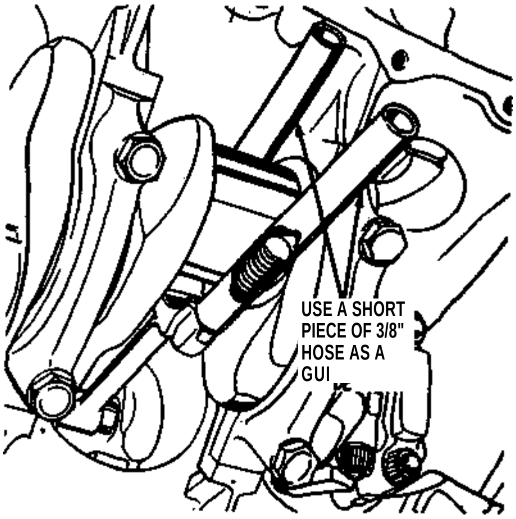
rag, and remove the cuttings that remain on the piston with a magnet and a rag soaked in clean oil.

NOTE: *Make sure the piston top and cylinder bore are absolutely clean before moving the piston.*

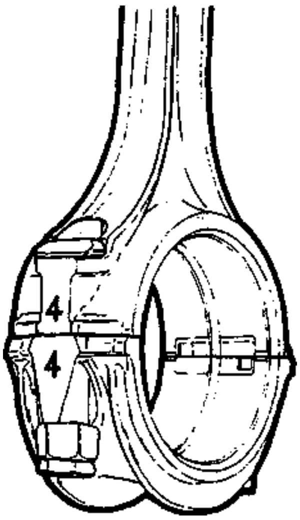
4. Match-mark the connecting rod cap to the connecting rod with a scribe; each cap must be reinstalled on its proper rod in the proper direction. Remove the connecting rod bearing cap and the rod bearing. Number the top of each piston with silver paint or a felt-tip pen for later assembly.

5. Cut lengths of % in. diameter hose to use as rod bolt guides. Install the hose over the threads of the rod bolts, to prevent the bolt threads from damaging the crankshaft journals and cylinder walls when the piston is removed.

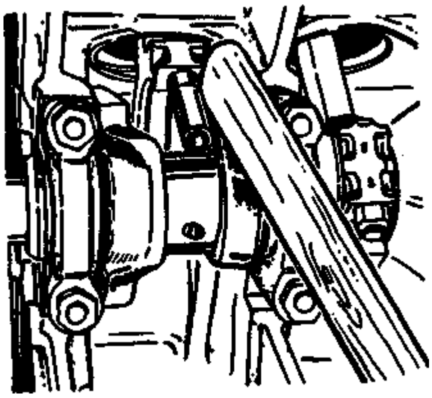
6. Squirt some clean engine oil onto the cylinder wall from above, until the wall is



Fabricate rod bolt guides out of rubber hose to prevent damage to crankshaft journals when removing or Installing pistons



Stamped number matchmarks on connecting rod and cap



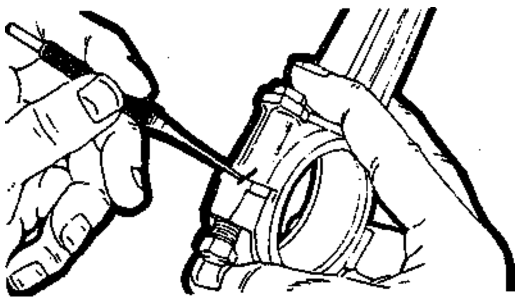
Carefully tap the piston and rod assembly out of the cylinder bore with a wooden hammer handle

coated. Carefully push the piston and rod assembly up and out of the cylinder by tapping on the bottom of the connecting rod with a wooden hammer handle.

7. Place the rod bearing and cap back on the connecting rod, and install the nuts tem porarily. Using a number stamp or punch, stamp the cylinder number on the side of the connecting rod and cap; this will help keep the proper piston and rod assembly on the proper cylinder.

NOTE: On *all V8s, starting at the front the right bank cylinders are 2-4-6-8 and the left bank 1-3-5-7.*

8. Remove remaining pistons in similar manner. On all engines, the notch on the pis ton will face the front of the engine for assem-



Scribe a matchmark on the connecting rod and cap

bly. The chamfered comers of the bearing caps should face toward the front of the left bank and toward the rear of the right bank, and the boss on the connecting rod should face toward the front of the engine for die right bank and to the rear of the engine on the left bank. On various engines, the piston compression rings are marked with a dimple, a letter "T," a letter "O," "GM" or the word "TOP" to identify the side of the ring which must face toward the top of the piston.

Piston Ring and Wrist Pin

REMOVAL AND INSPECTION

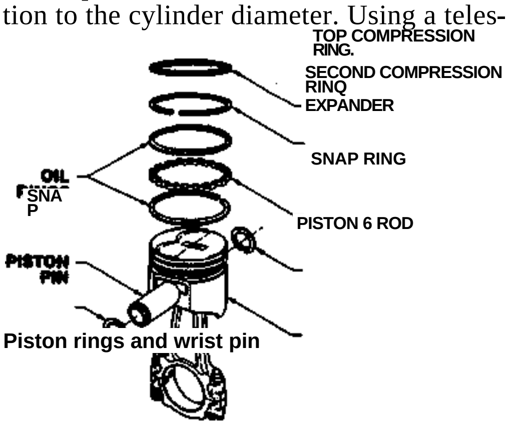
Some of the engines covered in this guide utilize pistons with pressed-in wrist pins; these must be removed by a special press designed for this purpose. Other pistons have dieir wrist pins secured by snap rings, which are easily removed with snap ring pliers. Separate the piston from the connecting rod.

A piston ring expander is necessary for removing piston rings without damaging them; any other method (screwdriver blades, pliers, etc.) usually results in the rings being bent, scratched or distorted, or the piston itself being damaged. When the rings are removed, clean the ring grooves using an appropriate ring groove cleaning tool, using care not to cut too deeply. Thoroughly clean all carbon and varnish from the piston widi solvent.

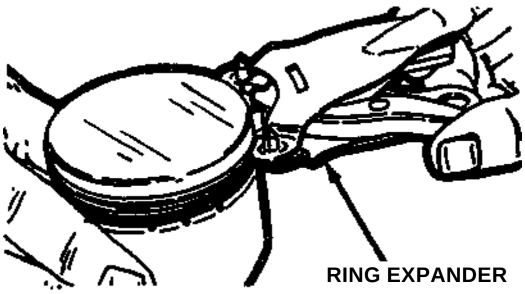
CAUTION: *Do not use a wire brush or caustic solvent (acids, etc.) on pistons.*

Inspect the pistons for scuffing, scoring, cracks, pitting, or excessive ring groove wear. If these are evident, the piston must be replaced.

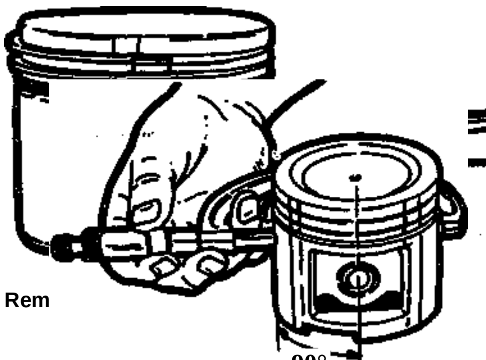
The piston should also be checked in relation to the cylinder diameter. Using a teles-

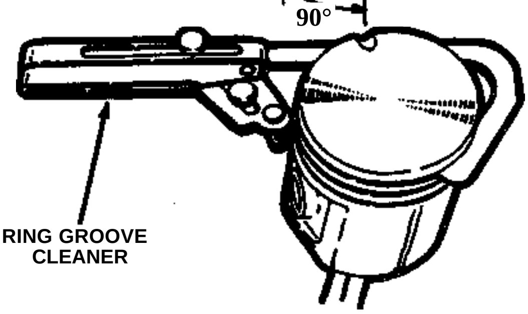


Piston rings and wrist pin



Removing the piston rings with expander tool

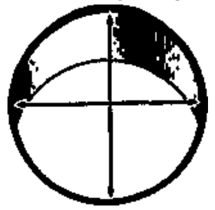




Clean the piston ring grooves with a suitable tool

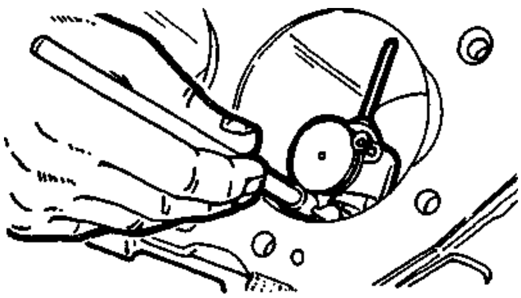
Measure the piston with a micrometer

coping gauge and micrometer, or a dial gauge, measure the cylinder bore diameter perpendicular (90%) to the piston pin, 2Va in. below the cylinder block deck (surface where the block mates with the heads). Then, with the

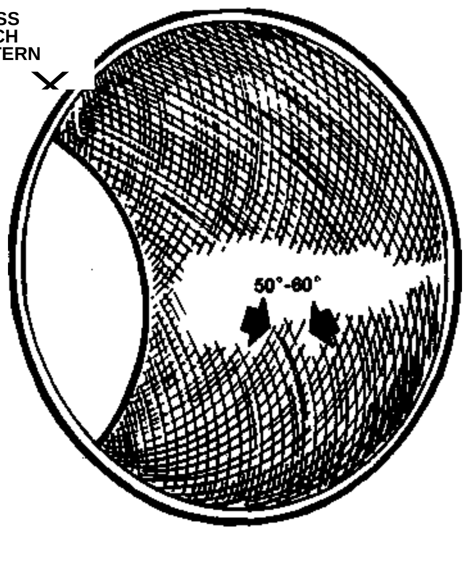


Cylinder bore measuring points

Correct cylinder bore honing pattern



Measure cylinder bore with dial gauge



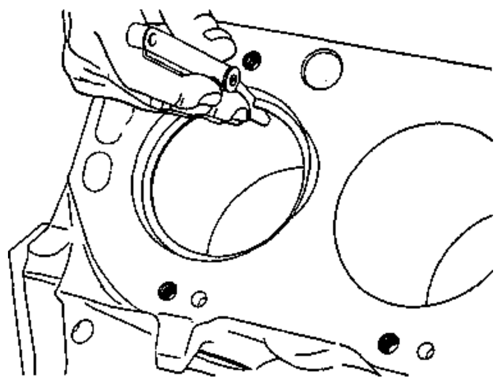
micrometer, measure the piston perpendicular to its wrist pin on the skirt. The difference between the two measurements is the piston clearance. If the clearance is within specifications or slightly below (after the cylinders have been bored or honed), finish honing is all that is necessary. If the clearance is excessive, try to obtain a slightly larger piston to bring clearance to within specifications. If this is not possible obtain the first oversize piston and hone (or if necessary, bore) the cylinder to size. Generally, if the cylinder bore is tapered .005 in. or more or is out-of-round .003 in. or more, it is advisable to rebore for the smallest possible oversize piston and rings. After measuring, mark pistons with a felt-tip pen for reference and for assembly.

NOTE: *Cylinder block boring should be performed by a reputable machine shop with the proper equipment. In some cases, "clean-up" honing can be done with the cylinder block in the car, but most excessive honing and all cylinder boring must be done with the block stripped and removed from the car.*

CHECKING RING END GAP

Piston ring end gap should be checked while the rings are removed from the pistons. Incorrect end gap indicates that the wrong size rings are being used; *ring breakage could occur.*

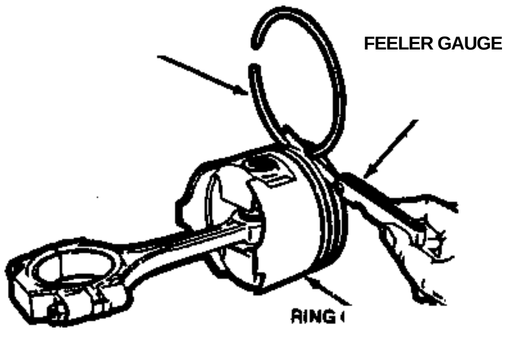
Compress the piston rings to be used in a cylinder, one at a time, into that cylinder. Squirt clean oil into the cylinder, so that the rings and the top 2 inches of cylinder wall are coated. Using an inverted piston, press the rings approximately 1 in. below the deck of the block (on diesels, measure ring gap clearance with the ring positioned at the *bottom* of ring travel in the bore). Measure the ring end gap with a feeler gauge, and compare to the "Ring Gap" chart in this chapter. Carefully pull the ring out of the cylinder and file the ends squarely with a fine file to obtain the proper clearance.



Measure piston ring end gap with feeler gauge

INSTALLATION AND SIDE CLEARANCE MEASUREMENT

Check the pistons to see that the ring grooves and oil return holes have been properly

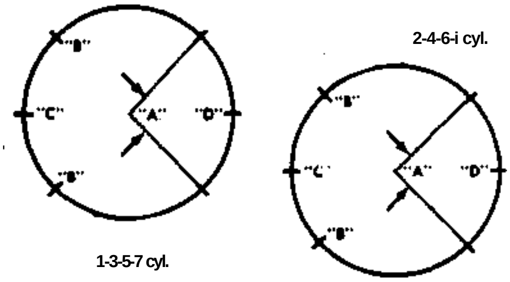


Measure piston ring side clearance with feeler gauge

cleaned. Slide a piston ring into its groove, and check the side clearance with a feeler gauge. Make sure the feeler gauge is inserted between the ring and its lower land (lower edge of the groove), because any wear that occurs forms a step at the inner portion of the lower land. If the piston grooves have worn to the extent that relatively high steps exist on the lower land, the piston should be replaced, because these will interfere with the operation of the new rings and ring clearances will be excessive. Piston rings are not furnished in oversize widths to compensate for ring groove wear.

Install the rings on the piston, *lowest ring first,* using a piston ring expander. There is a high risk of breaking or distorting the rings, or scratching the piston, if the rings are installed by hand or other means.

Position the rings on the piston as illustrated; *spacing of the various piston ring gaps is crucial to proper oil retention and even cylinder wear.* When installing new rings, refer to the installation diagram furnished with the new parts.



"A" OIL RING SPACER SAP (Tang In Hole or Slot within Arc) "B" OIL RING RAIL GAPS "C" 2ND COMPRESSION RING CAP "D" TOP COMPRESSION RING GAP Piston ring gap location—all engines

Connecting Rod Bearings

Conecting rod bearings for the engines covered in this guide consist of two halves or shells which are interchangable in the rod and cap. When the shells are placed in position, the ends extend slightly beyond the rod and cap surfaces so that when the rod bolts are torqued the shells will be clamped tightly in place to insure positive seating and to prevent turning. A tang holds the shells in place.

NOTE: *The ends of the bearing shells must never be filed flush with the mating surface of the rod and cap.*

If a rod bearing becomes noisy or is worn so that its clearance on the crank journal is excessive, a new bearing of the correct undersize must be selected and installed since there is no provision for adjustment.

CAUTION: *Under no circumstances should the rod end or cap be filed to adjust the bearing clearance, nor should shims of any kind be used.*

Inspect the rod bearings while the rod assemblies are out of the engine. If the shells are scored or show flaking, they should be replaced. If they are in good shape check for proper clearance on the crank journal (see below). Any scoring or ridges on the crank journal means the crankshaft must be replaced, or reground and fitted with undersized bearings.

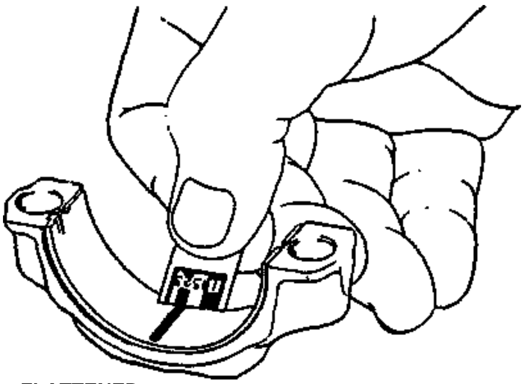
NOTE: *If journals are deeply scored or ridged the crankshaft must be replaced, as regrinding will reduce the durability of the crankshaft.*

ROD BEARING INSPECTION AND REPLACEMENT

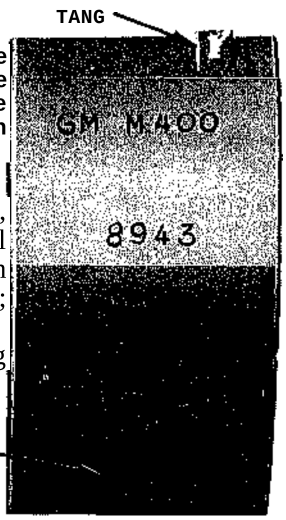
NOTE: *Make sure connecting rods and their caps are kept together, and that the caps are installed in the proper direction.*

Replacement bearings are available in standard size, and in undersizes for reground crankshafts. Connecting rod-to-crankshaft bearing clearance is checked using Plastigage® at either the top or bottom of each crank journal. The Plastigage® has a range of .001 in. to .003.

1. Remove the rod cap with the bearing shell. Completely clean the bearing shell and



Check rod bearing clearance with Plastigage or equivalent



Undersize marks are stamped on the bearing shells. The tang fits in the notch on the rod and cap

the crank journal, and blow any oil from the oil hole in the crankshaft; Plastigage® lengthwise along the bottom center of the lower bearing shell, then install the cap with shell and torque the bolt or nuts to specification. **DO** NOT turn the crankshaft with Plastigage® in the bearing.

3. Remove the bearing cap with the shell. The flattened Plastigage® will be found stick ing to either the bearing shell or crank jour nal. *Do not remove it yet.*

4. Use the scale printed on the Plasti gage® envelope to measure the flattened ma terial at its widest point. The number within the scale which most closely corresponds to the width of the Plastigage® indicates bearing clearance in thousandths of an inch.

5. Check the specifications chart in this chapter for the desired clearance. It is advisable to install a new bearing if clearance exceeds .003 in.; however, if the bearing is in good condition and is not being checked because of bearing noise, bearing replacement is not necessary.

6. If you are installing new bearings, try a standard size, then each undersize in order until one is found that is within the specified limits when checked for clearance with Plas tigage®. Each undersize shell has its size stamped on it.

7. When the proper size shell is found, clean off the Plastigage®, oil the bearing thor oughly, reinstall the cap with its shell and torque the rod bolt nuts to specification.

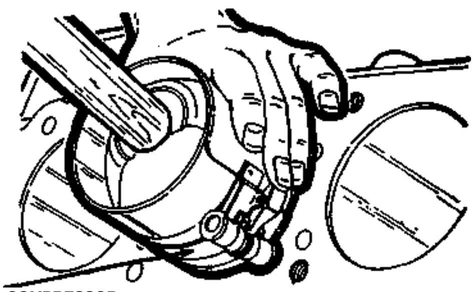
NOTE: *With the proper bearing selected and the nuts torqued, it should be possible to move the connecting rod back and forth freely on the crank jorunal as allowed by the specified connecting rod end clearance. If the rod cannot be moved, either the rod bearing is too far undersize or the rod is misaligned.*

PISTON AND CONNECTING ROD ASSEMBLY AND INSTALLATION

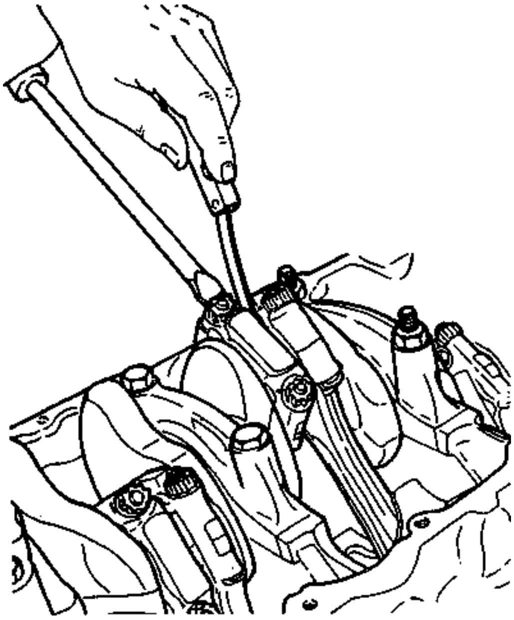
Install the connecting rod to the piston, making sure piston installation notches and any marks on the rod are in proper relation to one another. Lubricate the wrist pin with clean engine oil, and install the pin into the rod and piston assembly, either by hand or by using a wrist pin press as required. Install snap rings if equipped, and rotate them in their grooves to make sure they are seated. To install the piston and connecting rod assembly:

1. Make sure connecting rod big-end bearings (including end cap) are of the cor rect size and properly installed.

2. Fit rubber hoses over the connecting rod bolts to protect the crankshaft journals, as in



Install piston ring compressor, then tap the piston into the cylinder bore carefully. Make sure the piston front marks are correctly positioned when installing



Check the connecting rod side clearance with a feeler gauge. Use a small pry bar to carefully spread the rods to specified clearance

the "Piston Removal" procedure. Coat the rod bearings with clean oil.

3. Using the proper ring compressor, in sert the piston assembly into the cylinder so that the notch in the top of the piston faces the front of the engine (this assumes that the dimple(s) or other markings on the connect ing rods are in correct relation to the piston notch(s).

4. From beneath the engine, coat each crank journal with clean oil. Pull the con necting rod, with the bearing shell in place, into position against the crank journal.

5. Remove the rubber hoses. Install the bearing cap and cap nuts and torque to spec ification.

NOTE: *When more than one rod and piston assembly is being installed, the connecting rod cap attaching nuts should only be tightened enough to keep each rod in position until all have been installed. This will ease the installation of the remaining piston assemblies.*

6. Check the clearance between the sides of the connecting rods and the crankshaft us ing a feeler gauge. Spread the rods slightly with a small prybar to insert the gauge. If clearance is below the minimum tolerance, the rod may be machined to provide ade quate clearance. If clearance is excessive, substitute an unworn rod, and recheck. If clearance is still outside specifications, the crankshaft must be welded and reground, or replaced.

7. Replace the oil pump, if removed, and the oil pan.

8. Install the cylinder head(s) and intake manifold, as previously described.

Crankshaft Servicing

Crankshaft servicing literally makes or breaks any engine; especially a high performance one such as the Corvette.

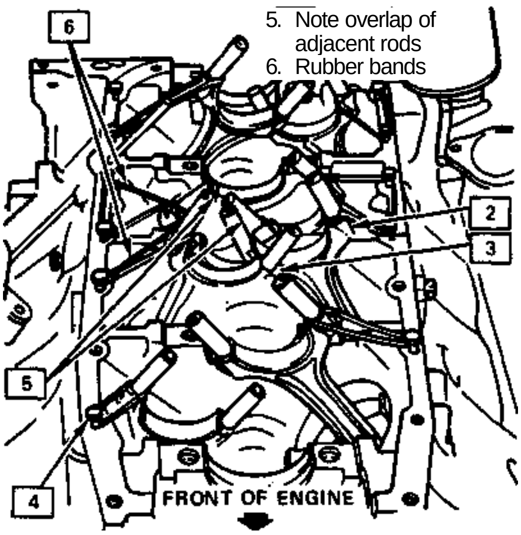
The most critical maintenance operation is the replacement of the crankshaft main bearings. These bearings are of the precision insert design and do not require adjustment through shims. They are offered in undersizes of 0.001 in., 0.002 in., 0.009 in., 0.010 in., 0.020m., and 0.030in.

Despite the advent of these inserts and accompanying precision machine work, it does happen that sizing mistakes are made and no crankshaft should be installed in a block without checking clearances. One of the simplest means of doing so is to use Plastigage®. This is a wax-like plastic material that is formed into precision threads. It will compress evenly between two surfaces, without damage, and when measured, will indicate the actual clearance.

It is easiest to check bearing clearance with the engine removed from the car and the block inverted. This ensures that the crank is resting against the upper bearing shells. If Plastigage is to be used on an engine still in the vehicle, it will be necessary to support the crankshaft at both ends so that clearance between the crankshaft and the upper bearing shells is eliminated.

REMOVAL

1. Drain the engine oil and remove the engine from the car. Mount the engine on a work stand in a suitable working area. Invert the engine, so the oil pan is facing up.
2. Remove the engine front (timing) cover.
3. Remove the timing chain and gears.
4. Remove the oil pan.
5. Remove the oil pump.
6. Stamp the cylinder number on the machined surfaces of the bolt bosses of the connecting rods and caps for identification when reinstalling. If the pistons are to be re moved eventually from the connecting rod, mark the cylinder number on the pistons with silver paint or felt-tip pen for proper cylinder identification and cap-to-rod location.



Support the connecting rods with rubber bands and install rubber rod bolt caps when crankshaft is removed

7. Remove the connecting rod caps. In stall lengths of rubber hose on each of the connecting rod bolts, to protect the crank journals when the crank is removed.

8. Mark the main bearing caps with a number punch or punch so that they can be reinstalled in their original positions.

9. Remove all main bearing caps.

10. Note the position 'of the keyway in the crankshaft so it can be installed in the same position.

11. Install rubber bands between a bolt on each connecting rod and oil pan bolts that have been reinstalled in the block (see illustra tion). This will keep the rods from banging on the block when the crank is removed.

12. Carefully lift the crankshaft out of the block. The rods will pivot to the center of the engine when the crank is removed.

MAIN BEARING INSPECTION

.Like connecting rod big-end bearings, the crankshaft main bearings are shell-type inserts that do not utilize shims and cannot be adjusted. The bearings are available in various standard and undersizes; if main bearing clearance is found to be excessive, a new bearing (both upper and lower halves) is required.

NOTE: *Factory-undersized crankshafts are marked, sometimes with a "9" and/or a large spot of light green paint; the bearing caps also mil have the paint on each side of the undersized journal.*

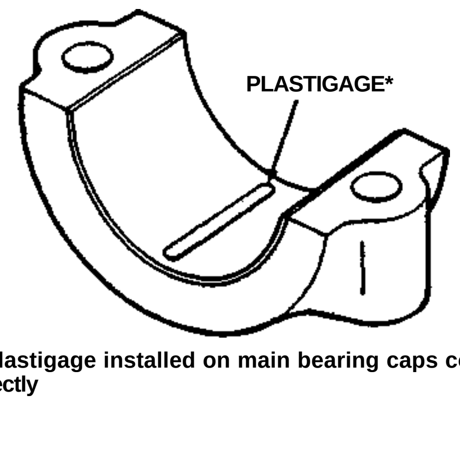
Generally, the lower half of the bearing shell (except No. 1 bearing) shows greater wear and fatigue. If the lower half only shows the effects of normal wear (no heavy scoring or discoloration), it can usually be assumed that the upper half is also in good shape; conversely, if the lower half is heavily worn or damaged, both halves should be replaced. *Never replace one bearing half without replacing the other,*

MEASURING MAIN BEARING CLEARANCE

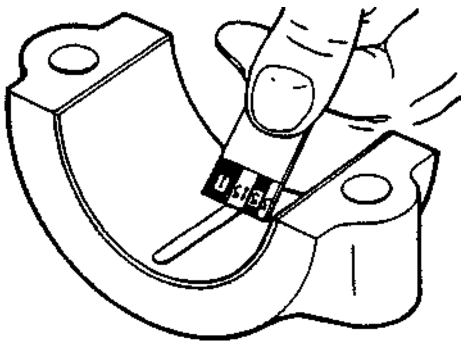
Main bearing clearance can be checked both with the crankshaft in the car and with the engine out of the car. If the engine block is still in the car, the crankshaft should be supported both front and rear (by the damper and to remove clearance from the upper bearing. Total clearance can then be measured between the lower bearing and journal. If the block has been removed from the car, and is inverted, the crank will rest on the upper bearings and the total clearance can be measured between the lower bearing and journal. Clearance is checked in the same manner as the connecting rod bearings, withplastigage®.

NOTE: *Crankshaft bearing caps and bearing shells should NEVER be filed flush with the cap-to-block mating surface to adjust for wear in the old bearings. Always install new bearings.*

1. If the crankshaft has been removed, install it (block removed from car). If the block is still in the car, remove the oil pan and oil pump. Starting with the rear bearing cap, re-



Plastigage installed on main bearing caps correctly



Measure main bearing clearance by comparing flattened strip to Plastigage scale as shown

move the cap and wipe all oil from the crank journal and bearing cap.

2. Place a strip of Plastigage® the full width of the bearing, (parallel to the crankshaft), on the journal.

NOTE: *Plastigage® is soluble in oil; therefore, oil on the journal or bearing could result in erroneous readings.* CAUTION: *Do not rotate the crankshaft while the gaging material is between the bearing and the journal.*

3. Install the bearing cap and evenly torque the cap bolts to specification.

4. Remove the bearing cap. The flattened Plastigage® will be sticking to either the bearing shell or the crank journal.

5. Use the graduated scale on the Plastigage® envelope to measure the material at its widest point. *If the flattened Plastigage® tapers toward the middle or ends, there is a difference in clearance indicating the bearing or journal has a taper, low spot or other irregularity. If this is indicated, measure the crank journal with a micrometer.*

6. If bearing clearance is within specifications, the bearing insert is in good shape. Replace the insert if the clearance is not within specifications. *Always replace both upper and lower inserts as a unit.*

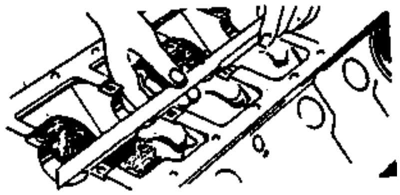
7. Standard, .001 in. or .002 in. undersize bearings should produce the proper clearance. If these sizes still produce too sloppy a fit, the crankshaft must be reground for use with the next undersize bearing. Recheck all clearances after installing new bearings.

8. Replace the rest of the bearings in the same manner. After all bearings have been checked, rotate the crankshaft to make sure there is no excessive drag. When checking the No. 1 main bearing, loosen the accessory drive belts (engine in car) to prevent a tapered reading with the Plastigage.®

MAIN BEARING REPLACEMENT

Engine Out of Car

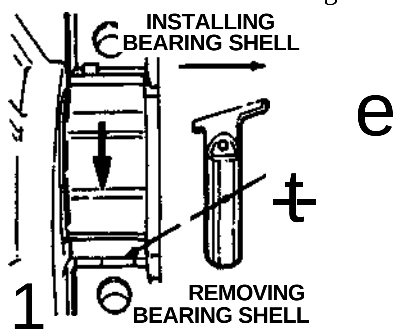
1. Remove and inspect the crankshaft.
2. Remove the main bearings from the bearing saddles in the cylinder block and main bearing caps.
3. Coat the bearing surfaces of the new, correct size main bearings with clean engine oil and install them in the bearing saddles in the block and in the main bearing caps.
4. Install the crankshaft. See "Crankshaft Installation."



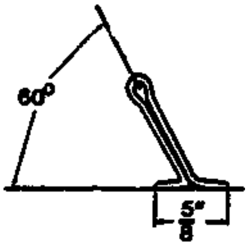
Check main bearing saddle alignment with straightedge

Engine in Car

1. With the oil pan, oil pump and spark plugs removed, remove the cap from the main bearing needing replacement and remove the bearing from the cap.
2. Make a bearing roll-out pin, using a bent cotter pin as shown in the illustration. Install the end of the pin in the oil hole in the crankshaft journal.
3. Rotate the crankshaft clockwise as viewed from the front of the engine. This will roll the upper bearing out of the block.
4. Lube the new upper bearing with clean engine oil and insert the plain (unnotched) end between the crankshaft and the indented or notched side of the block. Roll the bearing into place, making sure that the oil holes are aligned. Remove the roll pin from the oil hole.
5. Lube the new lower bearing and install



Use a roll-out pin as illustrated to remove bearing shells



Fabricate a roll-out pin as illustrated, if necessary

the main bearing cap. Install the main bearing cap, making sure it is positioned in proper direction with the matchmarks in alignment.

6. Torque the main bearing cap bolts to specification.

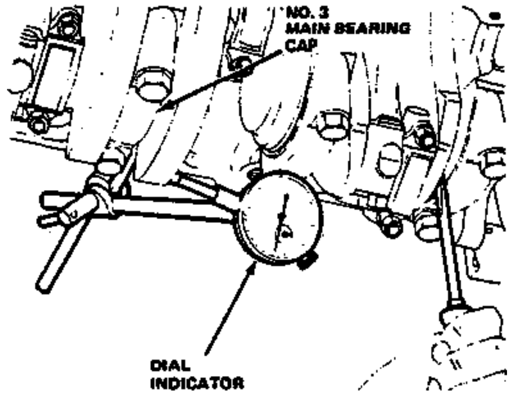
NOTE: *The thrust bearing must be aligned before torquing cap bolts.*

CRANKSHAFT INSTALLATION

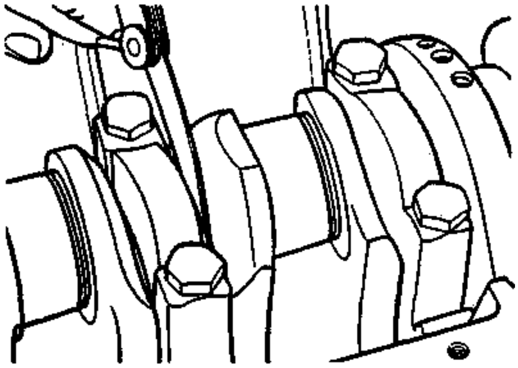
When main bearing clearance has been checked, bearings examined and/or replaced, the crankshaft can be installed. Thoroughly clean the upper and lower bearing surfaces, and lube them with clean engine oil. Install the crankshaft and main bearing caps.

Dip all main bearing cap bolts in clean oil, and torque all main bearing caps, excluding the thrust bearing cap, to specifications (see the "Crankshaft and Connecting Rod" chart in this chapter to determine which bearing is the thrust bearing). Tighten the thrust bearing bolts finger tight. To align the thrust bearing, pry the crankshaft the extent of its axial travel several times, holding the last movement toward the front of the engine. Add thrust washers if required for proper alignment. Torque the thrust bearing cap to specifications.

To check crankshaft end-play, pry the crankshaft to the extreme rear of its axial travel, then to the extreme front of its travel. Using a feeler gauge, measure the end-play at the front of the rear main bearing. End play may also be measured at the thrust bearing.



Measure crankshaft end play with a dial indicator


Use a feeler gauge to check crankshaft end play during assembly

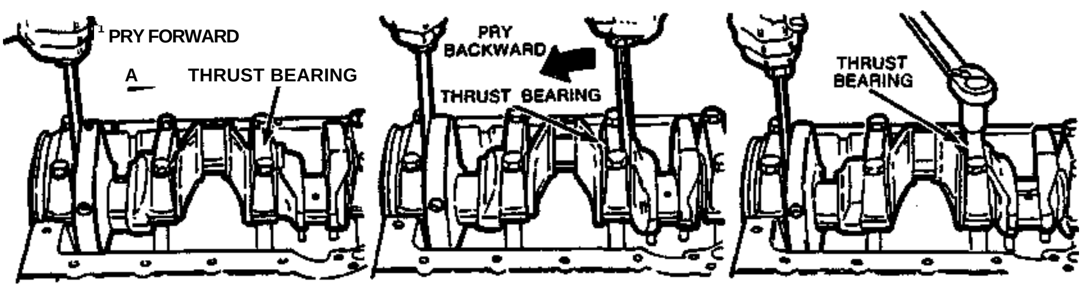
Install a new rear main bearing oil seal in the cylinder block and main bearing cap. Continue to reassemble the engine in reverse of disassembly procedures.

ENGINE LUBRICATION

Oil Pan

REMOVAL AND INSTALLATION All Models

1. Disconnect the battery and remove the dipstick and its tube.



Align thrust bearing as illustrated. Torque caps to specifications

2. Raise the car and support the front on stands. Drain the engine oil.

3. Remove the starter and flywheel shield.

4. Disconnect the steering idler arm and lower it out of the way.

5. Remove the oil pan and discard the side gaskets and end seals.

6. On high performance engines, the oil splash shield must be removed before further operations can be carried out.

7. Glue the side gaskets and end seals to the oil pan.

8. Install the pan on the engine and tighten the bolts in a criss-cross pattern. Do not over-tighten these bolts.

9. Refill the crankcase with the proper en gine oil.

Rear Main Oil Seal

REMOVAL AND INSTALLATION

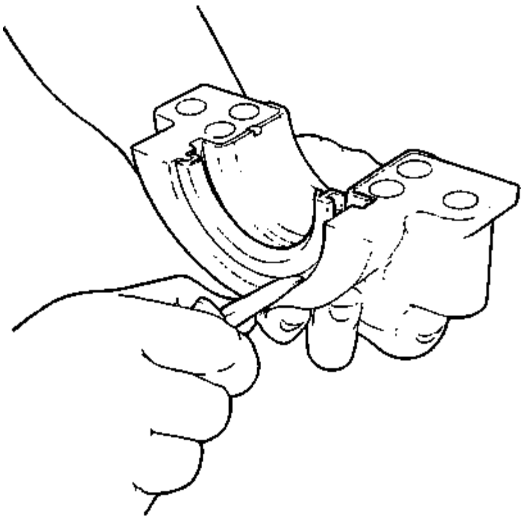
The rear main bearing seal may be replaced without removing the crankshaft. Both upper and lower seals must be replaced at the same time.

NOTE: *Extreme care should be exercised when installing* t/iis *seal to protect the sealing bead located in the channel on the outside diameter of the seal. An installation tool can be used to protect the seal bead when positioning seal.*

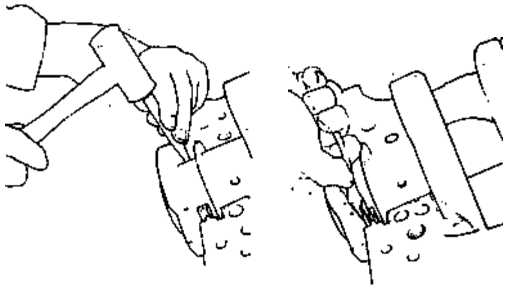
1. Remove the oil pan and oil pump.

2. Remove the rear main bearing cap, and pry the seal out from the bottom with a small screwdriver.

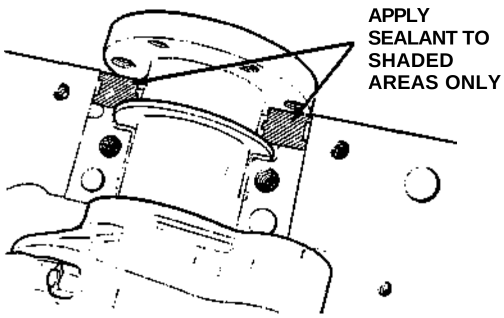
3. Remove the upper seal with a small hammer and a brass pin punch. Tap on one end of the seal until the opposite end can be gripped with pliers.



Removing the lower half of the rear main oil seal



Before installing the rear
bearing cap, apply sealer to the rear main seal as
Removing the upper half of the rear main oil seal
indicated



4. Clean the bearing cap and crankshaft.

5. Coat the lips and bead of the seal with a light engine oil. Do not get oil on the seal ends.

6. Insert the new seal into the bearing cap, rolling it into place with your finger and thumb. Press lightly on the seal, so that the seal tangs on the cap don't cut the bead on the back of the seal.

7. Lubricate the lip of the new oil seal and slowly push it into place while turning the crankshaft. Make sure that the seal tangs don't cut the bead on the back of the seal.

8. Install the main bearing cap and torque to specifications.

Oil Pump

The oil pump is a two-piece housing containing a pressure regulator valve and the two pump gears. It is driven by the distributor shaft, which is in turn driven off the camshaft.

REMOVAL

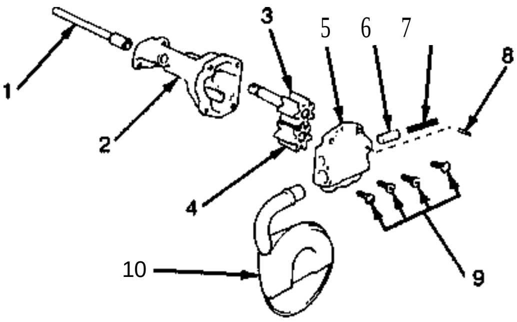
1. Drain and remove the oil pan.

2. Remove the oil pump-to-rear main bearing cap bolt. Remove the pump and the extension shaft.

3. Remove the cotter pin, spring and pres sure regulator valve.

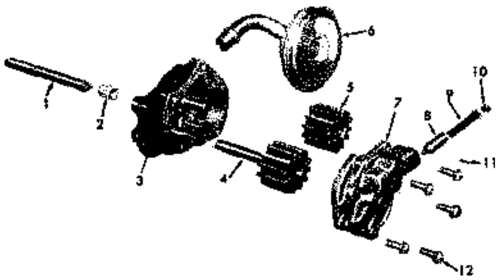
NOTE: *Place your thumb over the pressure regulator bore before removing the cotter pin, as the spring is under pressure.*

1. Shaft extension
2. Pump body



3. Drive gear and shaft
4. Idler gear
5. Pump cover
6. Pressure regulator valve
7. Pressure regulator spring
8. Retaining pin
9. Screws
10. Pickup screen and pipe

Exploded view of small block oil pump



1. Shaft extension
2. Shaft coupling
3. Pump body
4. Drive gear and shaft
5. Idler gear
6. Pickup screen and pipe
7. Pump cover
8. Pressure regulator valve
9. Pressure regulator spring
10. Washer
11. Retaining pin
12. Screws

Exploded view of big block oil pump

OVERHAUL

1. Remove the pump cover attaching screws and the pump cover.

2. Mark gear teeth so they may be reas sembled with the same teeth indexing. Re move the idler gear and the drive gear and shaft from the pump body.

3. Remove the pressure regulator valve retaining pin, pressure regulator valve and related parts, if not done.

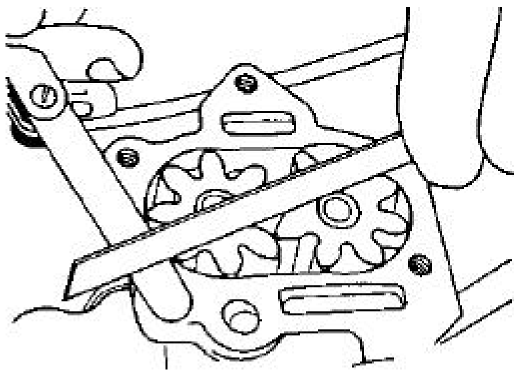
4. If the pickup screen and pipe assem-: bly need replacing, mount the pump in a soft-jawed vise and extract pipe from pump. Do not disturb the pickup screen on the pipe. This is serviced as an assembly.

5. Wash all parts in cleaning solvent and dry with compressed air.

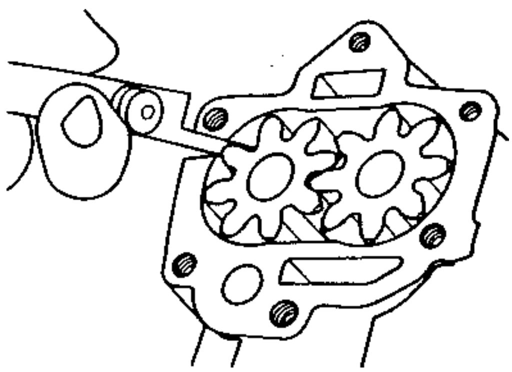
6. Inspect the pump body and cover for cracks or excessive wear. Inspect pump gears for damage or excessive wear.

NOTE: *The pump gears and body are not serviced separately. If the pump gears or body are damaged or worn, replacement of the entire oil pump assembly is necessary.*

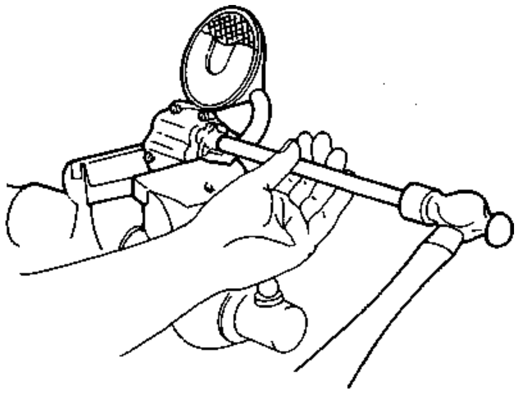
7. Check the drive gear shaft for loose-



Measure oil pump end clearance with feeler gauge and straightedge



Measure oil pump side clearance with a feeler gauge



Install oil pump screen by tapping lightly

ness in the pump body. Inspect inside of pump cover for wear that would permit oil to leak past the ends of the gears.

8. Inspect the pickup screen and pipe as sembly for damage to screen, pipe or relief grommet.

9. Check the pressure regulator valve for fit.

10. If the pickup screen and pipe assem bly was removed, it should be replaced with a new part. Loss of press fit condition could result in an air leak and loss of oil pressure. Mount the pump in a soft-jawed vise, apply sealer to end of pipe, and use a suitable tool to tap the pipe in place.

NOTE: *Be careful of twisting, shearing or collapsing pipe while installing in pump. Do not use excessive force.*

11. Install the pressure regulator valve and related parts.

12. Install the drive gear and shaft in the pump body.

13. Install the idler gear in the pump body with the smooth side of gear towards pump cover opening.

NOTE: *Pack the inside of the pump completely with petroleum jelly. DO NOT use engine oil. The pump MUST be primed this way or it won't produce any oil pressure when the engine is started.*

14. Install the pump cover and torque at taching screws to specifications.

15. Turn drive shaft by hand to check for smooth operation.

INSTALLATION

1. Assemble pump and extension shaft to rear main bearing cap, aligning slot on top end of extension shaft with drive tang on lower end of distributor drive shaft.

NOTE: *When assembling the drive shaft extension to the drive shaft, the end of the extension nearest the washers must be inserted into the drive shaft.*

2. Insert the drive shaft extension through the opening in the main bearing cap and block until the shaft mates into the distributor drive gear.

3. Install the pump onto the rear main bearing cap and install the attaching bolts. Torque the bolts to specifications.

4. Install the oil pan and fill the crankcase with engine oil.

Flywheel and Ring Gear

REMOVAL AND INSTALLATION

The ring gear is an integral part of the flywheel and is not replaceable.

1. Remove the transmission.

2. Remove the six bolts attaching the fly wheel to the crankshaft flange. Remove the flywheel.

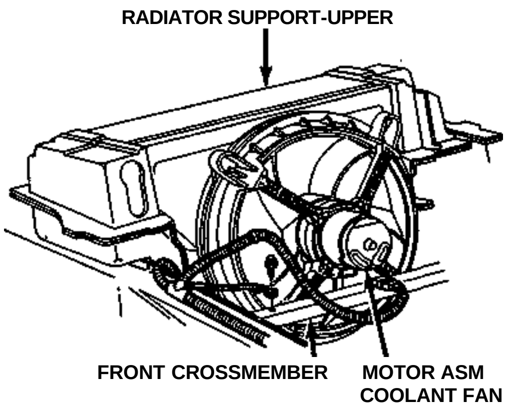
3. Inspect the flywheel for cracks, and in spect the ring gear for burrs or worn teeth. Replace the flywheel if any damage is appar ent. Remove burrs with a mill file.

4. Install the flywheel. The flywheel will only attach to the crankshaft in one position, as the bolt holes are unevenly spaced. Install the bolts and torque to specification. Tighten bolts in criscross pattern.

ENGINE COOLING

The cooling system consists of a radiator, expansion tank, viscous drive fan, thermostat, and mechanical water pump. Small block and certain special-performance large block Corvettes use an aluminum cross-flow radiator. Most large block Corvettes utilize a larger capacity radiator of conventional copper-brass alloy. The viscous drive fan restricts operation at 1500 rpm in cold weather and 3500 rpm during warmer temperatures. This fan requires less horsepower to drive during high rpm operation and reduces under-hood noise. Corvettes equipped with aluminum radiators demand certain precautions during normal operation and maintenance. Caution is advised when removing and replacing the filler cap, to avoid denting or scratching the sealing surfaces of the filler neck. Do not use replacement filler caps that use brass in their construction. Extended use will damage the radiator and necessitate extensive repair or replacement. The same precautionary measure should be taken with replacdment drain cocks. A *Vs* in. cast iron plug may be substituted only for an extremely short period of time. Use only antifreezes and cleaners that are recommended for aluminum cooling systems.

1984 and later models use an electric, single-speed cooling fan mounted directly to the radiator shroud. Fan operation is determined by coolant temperature, operating only enough to maintain engine coolant at or below a preset maximum temperature. The cooling fan is energized through a relay controlled by a sending unit located in the right cylinder bank. The fan only operates when road speed is below 35 mph.



Thermostatically controlled cooling fan—1984 and later

Radiator

REMOVAL AND INSTALLATION

1963-68

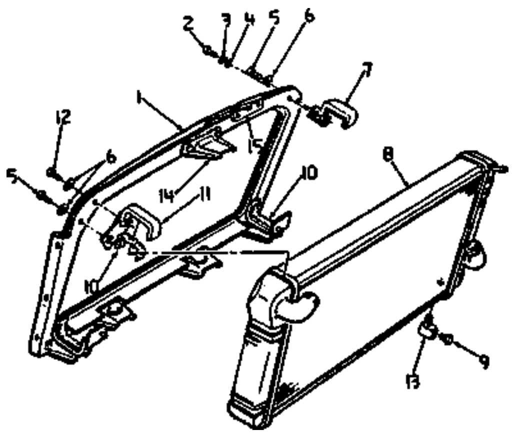
1. Drain the radiator and cylinder block.
2. Remove upper and lower hoses and ex pansion tank hose.
3. Remove radiator shroud(s).
4. Remove retaining clamps and carefully pull radiator up and out of vehicle.
5. Reverse this procedure to install the ra diator. Be sure that the two rubber cushions are correctly seated under the radiator before tightening.
6. Refill the cooling system and check for leaks.

1969-74

1. Drain the radiator.
2. Raise the hood and insert a bolt in the hole of the hood support. Remove the hood.
3. Remove the radiator inlet and outlet hoses and, if applicable, the transmission coolant hoses.
4. If applicable, remove the supply tank hose at the radiator connection.
5. Remove the shroud to radiator support bracket screws (the L88 engine does not have a fan shroud).
6. Remove the shroud to radiator baffle bracket screws and let the shroud rest on the fan.
7. Remove the radiator upper support bracket screws and carefully *lift* the radiator from the car.
8. Install in the reverse order of removal.

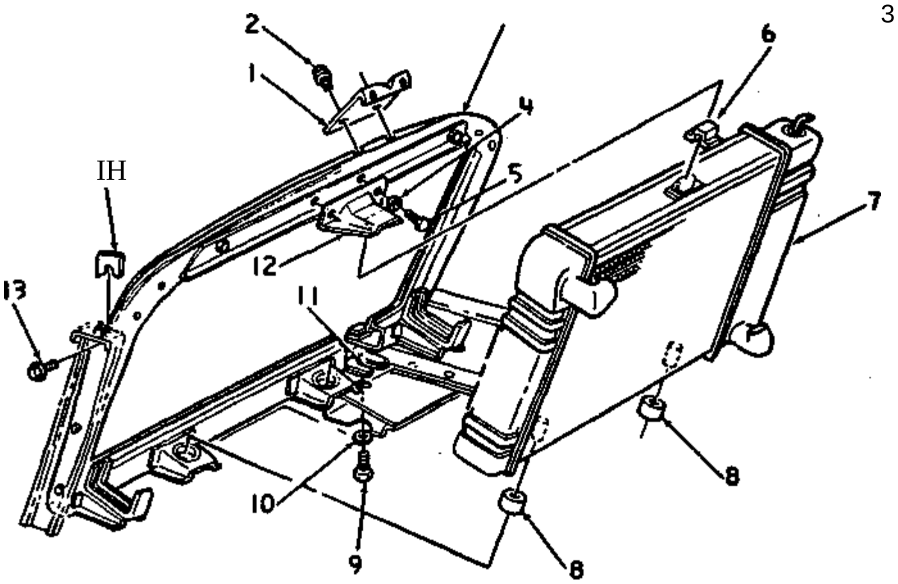
1975-76

1. Drain the radiator and disconnect the battery ground cable. Disconnect cooler lines on automatic transmission models.
2. Remove the hood. This is a two-man job.
3. Remove the radiator support brackets attached to the fan shroud.
4. Remove the two front hood hinge bolts.
5. From inside the wheel well, remove the six radiator side support bolts.
6. Remove the two bottom radiator sup port bolts and the center brace.
7. Pull the radiator support forward and use a clamp to retain it to the right hood hinge.



1. Support
2. Bolt
3. Washer
4. Washer
5. Bolt
6. Washer
7. Plate
8. Radiator
9. Plug
10. Insulator
11. Plate
12. Bolt
13. Elbow
14. Bracket
15. Bracket

Big block and H.O. small block radiator mounting. Most later models use this type of mounting regardless of whether a H.D. radiator Is used



1. Bracket
2. Screw
3. Support
4. Washer
5. Bolt
6. Upper cushion
7. Radiator
8. Cushion
9. Bolt
10. Washer
11. Shim
12. Bracket
13. Screw
14. Shim

Standard duty small block radiator mounting—typical

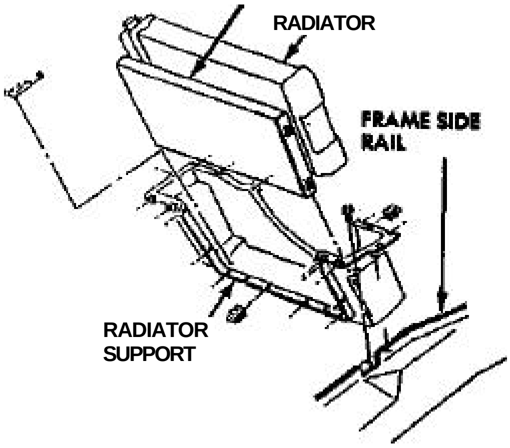
8. Disconnect the two radiator hoses and the overflow hose.
9. Carefully lift the radiator out of the car.
10. If replacing the radiator, remove the shrouds and mount them on the new unit.
11. Installation is the reverse of removal.

1977-82

1. Disconnect the negative battery cable at the battery.
2. Drain the cooling system.
3. If necessary remove the air cleaner snorkel.
4. Raise the front of the vehicle and sup port it with jack stands.
5. Disconnect the fan shroud from the ra diator support bracket.
6. If so equipped disconnect the auto matic transmission cooler lines from the ra diator.
7. Remove the radiator support brackets.
8. Disconnect the radiator upper and lower hoses and the overflow tube from the radiator.
9. Remove the radiator.
10. Installation is the reverse of removal. When installing the radiator make sure it is seated in the mounting pads. When replacing the radiator cap make sure die arrows line up with the overflow tube.

1984 and Later

1. Disconnect negative battery cable.
2. Drain cooling system.
3. Remove upper radiator hose.
4. Remove lower radiator hose.
5. Remove overflow hose at radiator.
6. Remove A/C accumulator and move aside.



Radiator mounting—1984 and later

CONDENSER

7. Remove transmission cooler line.
8. Remove fen wires from fen and shroud.
9. Remove fan to gain access to lower cooler line.
10. Remove transmission cooler line at fit ting.
11. Remove upper shroud bolts.
12. Remove upper shroud.
13. Remove radiator.
14. Installation is the reverse of removal.

Water Pump

REMOVAL AND INSTALLATION

1963-82

1. Drain the radiator.
2. Remove the fan.
3. Loosen the alternator mounting, rotate the alternator, and remove the fan belt. Re move power steering belt, A.I.R. belt, and idler belt, if so equipped.
4. Disconnect radiator and heater hoses.
5. Remove the water pump retaining bolts and remove the pump.
6. Reverse this procedure to install.

1984 and Later

1. Disconnect battery negative cable.
2. Drain cooling system.
3. Remove serpentine drive belt.
4. Remove water pump pulley.
5. Remove AIR pump pulley.
6. Remove air management valve adapter.
7. Remove AIR pump.
8. Disconnect fuel inlet and return lines.
9. Remove rear A/C compressor braces.
10. Remove lower A/C compressor mounting bolt.
11. Remove A/C compressor and idler pulley bracket nuts.
12. Disconnect A/C compressor wires.
13. Slide mounting bracket forward and rear A/C compressor bolt.
14. Remove A/C compressor.
15. Remove right and left AIR hoses at check valve.
16. Remove AIR pipe at intake and power steering reservoir bracket.
17. Remove power steering reservoir bracket including top alternator bolt.
18. Remove lower AIR bracket on water pump.
19. Remove lower radiator and heater hose at water pump.
20. Remove water pump.
21. Installation is the reverse of removal.

NOTE: *If installing new water pump, transfer heater hose fitting from old unit.*

Thermostat

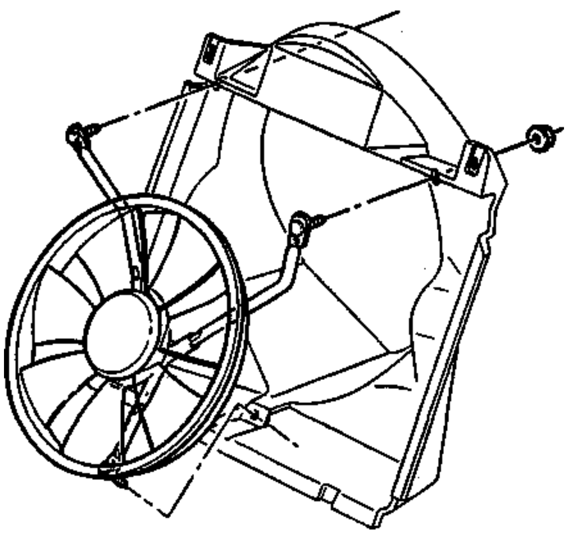
REMOVAL AND INSTALLATION

1. Drain enough coolant from the radiator to bring the level below the thermostat.
2. Remove the two bolts retaining the water neck to the manifold.
3. Lift the water neck (with radiator hose attached) and remove the thermostat.
4. Reverse this procedure to install, using a new gasket.

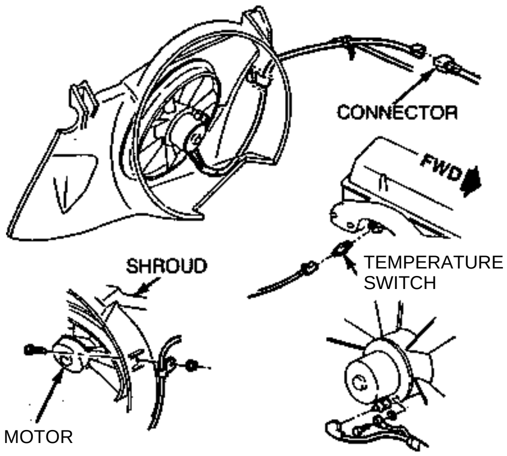
Auxiliary Engine Cooling Fan

Most 1979-82 Corvettes equipped with the heavy duty cooling system option use an auxiliary electric cooling fan. The auxiliary fan is used to supplement the engine-mounted fan during conditions of very high engine temperatures. The auxiliary fan circuit is energized anytime the ignition switch is in the RUN position, though the fan itself will not operate until the engine coolant temperature reaches 238°F., as sensed by the cylinder head-mounted coolant temperature sensor. When the coolant temperature decreases to approximately 201°F., the fan will turn off.

CAUTION: *Keep hands, tools, clothing, etc. clear of the auxiliary fan. The fan can come on automatically even when the engine is not running.*



Auxiliary electric cooling fan used on most 1979-84 models



Electric cooling fan and related wiring

REMOVAL AND INSTALLATION

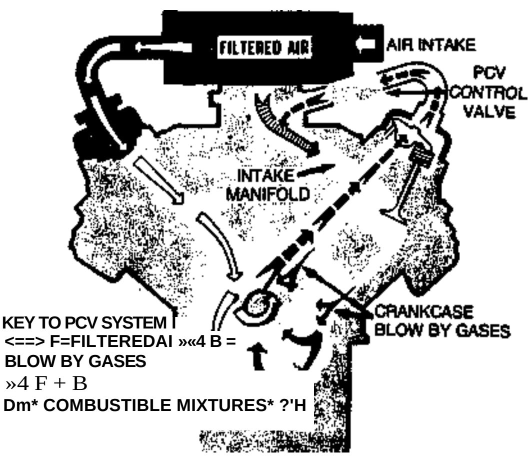
1. Disconnect the battery cables at the battery.
2. Remove the fresh air scoop.
3. Remove the engine-mounted cooling fan.
4. Remove the upper radiator shroud screws.
5. Remove the three fen bracket-to-shroud fasteners, remove the[v] fan and motor assem bly and disconnect the wire from the fan mo tor.
6. Installation is the reverse of the pre vious steps.

Emission Controls and Fuel System

EMISSION CONTROLS

Positive Crankcase Ventilation (PCV)

In this system, crankcase vapors are drawn into the intake manifold to be burned in the combustion chambers; instead of merely venting the crankcase vapors into the atmosphere. An added benefit to engines equipped with this system is that the engine oil will tend to stay cleaner for a longer period of time; therefore, if you notice the oil in your engine becomes dirty very easily, check the functioning of the PCV valve. The valve should rattle when shaken, indicating that sludge has not stopped operation of the valve, and the PCV line to the carburetor or the intake manifold must be clear. Engines which use a PCV system are calibrated to run richer, to compensate for the added air which accompanies the crankcase vapors to the combustion chambers. If the PCV valve or line is clogged, the engine idle will tend to be rough due to the excessively rich mixture. Maintenance is covered in Chapter 1.



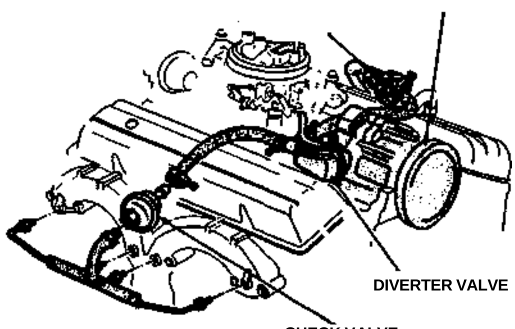
Schematic of the PCV system

Air Injection Reactor (AIR)

Two different systems of air injection have been used on the Corvette. The system used up to and including 1980 (except 1980 Calif.) consists basically of the following components:

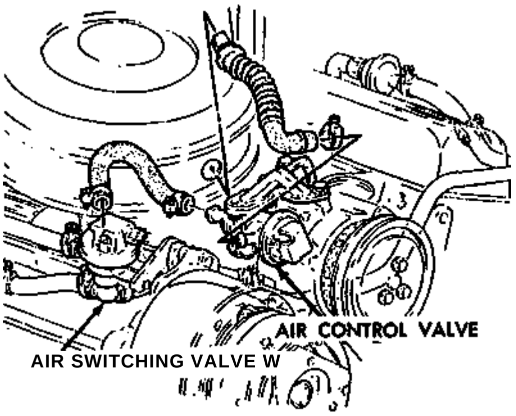
a. Air injection pump—Draws fresh, out side air into the pump, pressurizes the air, then delivers the air to the remaining system components.

b. Diverter valve (sometimes called an anti-backfire valve)—Receives pressurized air from the air injection pump. The diverter valve is controlled by manifold vacuum. During deceleration, manifold vacuum increases sharply. This vacuum increase causes the diverter valve to divert the air from the air injection pump to the atmosphere, thereby preventing backfiring through the exhaust system. If vacuum is evident at the diverter



Typical 350 cu In. engine A.I.R. system components

CHECK VALVE



Typical 1980 and later AIR system control and switching valves

valve vacuum hose at idle yet the engine still backfires only during deceleration, replace the valve. Replacement is a simple matter of disconnecting the vacuum line from the valve and unbolting the valve from the injection pump.

c. Check valves — These valves (one per side of the engine) prevent the entrance of hot exhaust gasses into the AIR system. If AIR pump and hose life is short due to overheat ing, one or both of the check valves is prob ably defective. To check or repkce the valve, disconnect the hose from the valve and un screw the valve from the injection manifold assembly. Blow into each side of the valve: air should pass only in one direction; if air passes through the valve in both directions, repkce the valve. Check each valve in the same manner.

d. Air injection manifold — The manifold directs the injected air to each of the cylin ders. To replace the injection manifold, re move the check valve from the injection manifold and unbolt the injection manifold from the exhaust manifold.

e. Air injection nozzles — The injection nozzles are located behind each tube of the injection manifold. The purpose of -the noz zles is to pinpoint the air injection to the ex haust valves which maximizes the effect of the air injection. The nozzles can be simply with drawn from the exhaust manifold after the in jection manifold has been removed. In addi tion to the affbrementioned items, various hoses, clamps, and tubes are used.

The AIR system used on 1980 California and 1981-84 engines serves the same function as the previous system, but is slightly different in construction and operation. Instead of using a diverter valve, this system uses both an air control valve and an air switching valve. Both the control and switching valves are controlled by the Electronic Control Module (ECM) of the computer controlled emissions system. When the engine is cold, the ECM energizes an air control solenoid, which allows air to flow to the air switching valve. The air switching valve is then energized which directs the air injection to the exhaust manifolds. When the engine warms, the ECM de-energizes the air switching valve, which changes the point of air injection from the exhaust manifolds to the catalytic converter. The extra air at the converter permits the converter to more effectively decrease exhaust emission levels. During deceleration and wide open throttle operation, air is directed to the air cleaner.

Operation of the air pump, check valves, and manifolds remains the same as the 1979 and earlier system.

REMOVAL AND INSTALLATION

Air Pump

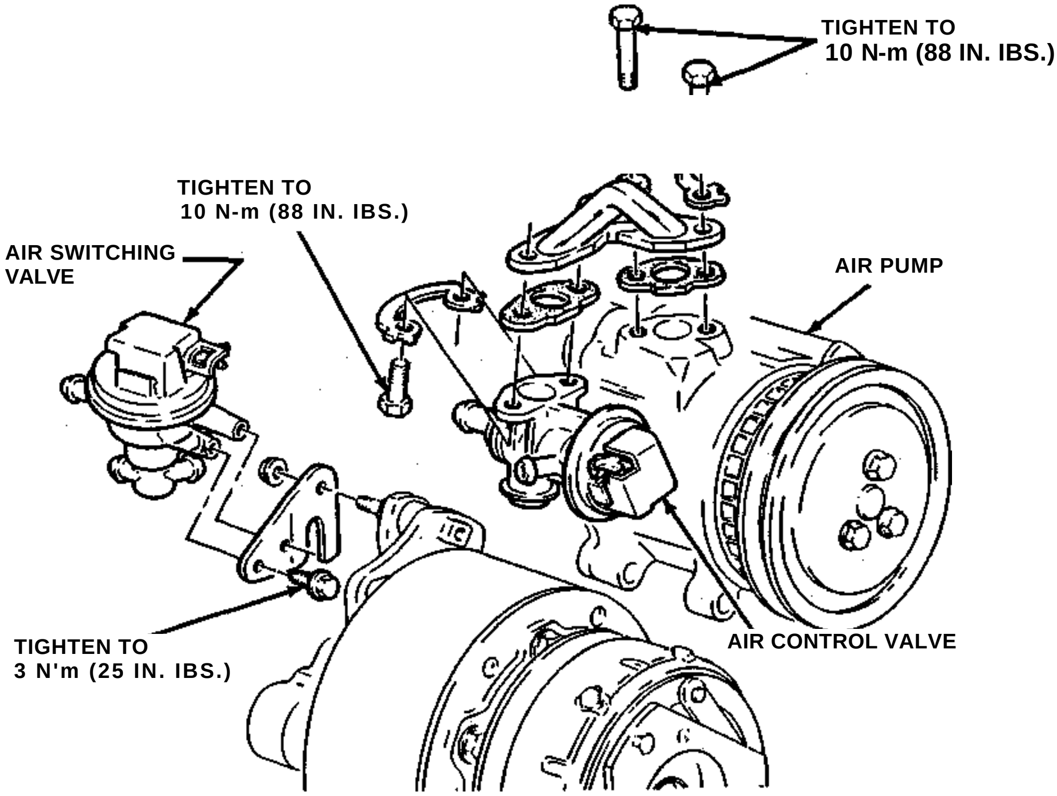
1. Remove the valves and/or adapter at the air pump.
2. Loosen the air pump adjustment bolt and remove the drive belt.
3. Unscrew the three mounting bolts and then remove the pump pulley.
4. Unscrew the pump mounting bolts and then remove the pump.
5. Installation is in the reverse order of re moval. Be sure to adjust the drive belt ten sion after installing it.

Air Control Valve (1980 Calif, and 1981-82) '

1. Disconnect die negative battery cable.
2. Tag and disconnect the vacuum hose(s) from the valve.
3. Tag and disconnect the air outlet hoses from the valve.
4. Bend back the lock tabs and then re move the bolts holding the elbow to the valve.
5. Tag and disconnect any electrical con nections at the valve and then remove the valve from the elbow.
6. Installation is in the reverse order of re moval.

Air Switching Valve (1980 Calif, and 1981-84)

The switching valve is replaced in basically the same manner as the control valve, except



Mounting of the AIR control and switching valves

that it is mounted to a bracket on the A/C compressor.

Thermostatic Air Cleaner (THERMAC or TAC)

NOTE: *High performance engines equipped with open-element air cleaners do not employ this system.*

This system is designed to improve driveability and exhaust emissions when the engine is cold. Components added to the basic air cleaner assembly include a temperature sensor (connected to a manifold vacuum source), vacuum diaphragm motor (connected to the temperature sensor), and an inlet damper door (installed in the air cleaner inlet snorkel). Additional components of the system include an exhaust manifold-mounted heat stove and a hot air duct running from the heat stove to the underside of the air cleaner snorkel.

When the engine is cold, the temperature sensor allows vacuum to pass through to the vacuum diaphragm motor. The vacuum acting on the vacuum motor causes the motor to close the damper door, which prohibits the introduction of cold, outside air to the air cleaner. The intake vacuum then pulls hot air, generated by the exhaust manifold, through the hot air duct and into the air cleaner. This heated air supply helps to more effectively vaporize the fuel mixture entering the engine. As the engine warms, the temperature sensor bleeds off vacuum to the vacuum motor, allowing the damper door to gradually open.

The usual problems with this system are leaking vacuum lines (which prevent proper operation of the sensor and/or motor); torn or rusted-through hot air ducts and/or rusted-through heat stoves (either condition will allow the introduction of too much cold air to the air cleaner). Visually check and replace these items as necessary. Should the system still fail to operate properly, disconnect the vacuum line from the vacuum motor and apply at least 7 in. Hg. of vacuum directly to the motor from an outside vacuum source; the damper door should close. If the door does not close, either the vacuum motor is defective or the damper door and/or linkage is binding. If the door closes, but then gradually opens (with a steady vacuum source), the vacuum motor is defective.

REMOVAL AND INSTALLATION

Vacuum Motor

1. Remove the air cleaner.
2. Disconnect the vacuum hose from the motor.
3. Drill out the spot welds with a Vs" hole, then enlarge as necessary to remove the re taining strap.
4. Remove the retaining strap.
5. Lift up the motor and cock it to one side to unhook the motor linkage at the control damper assembly.

Install the new vacuum motor as follows:

6. Drill a 7/64" hole in the snorkel tube as the center of the vacuum motor retaining strap.
7. Insert the vacuum motor linkage into the control damper assembly.
8. Use the motor retaining strap and a sheet metal screw to secure the retaining strap and motor to the snorkel tube.

NOTE: *Make sure the screw does not interfere with the operation of the damper assembly. Shorten the screw if necessary.*

Temperature Sensor

1. Remove the air cleaner.
2. Disconnect the hoses at the air cleaner.
3. Pry up the tabs on the sensor retaining clip and remove the clip and sensor from the air cleaner.
4. Installation is the reverse of removal.

Evaporative Emission Control (EEC)

1970-1981

Introduced on California cars in 1970, and nationwide in 1971, this system reduces the amount of escaping gasoline vapors. Float bowl emissions are controlled by internal carburetor modifications. Redesigned bowl vents, reduced bowl capacity, heat shields, and improved intake manifold-to-carburetor insulation serve to reduce vapor loss into the atmosphere. The venting of fuel tank vapors into the air has been stopped. Fuel vapors are now directed through fines to a canister containing an activated charcoal filter. Unburned vapors are trapped here until the engine is started. When the engine is running, the canister is purged by air drawn in by manifold vacuum. The air and fuel vapors are then directed into the engine to be burned. This system is designed to reduce fuel vapor emission. The canister filter should be replaced every 12 months or 12,000 miles on Models 1970-74, on Models 1975-81 the interval was extended to 24 months or 30,000 miles. To replace the filter, proceed as follows:

The filter is located in the bottom of the canister. Pull out the old filter and work the new filter into place. It may be necessary to remove the bottom of the canister for access.

1982-84

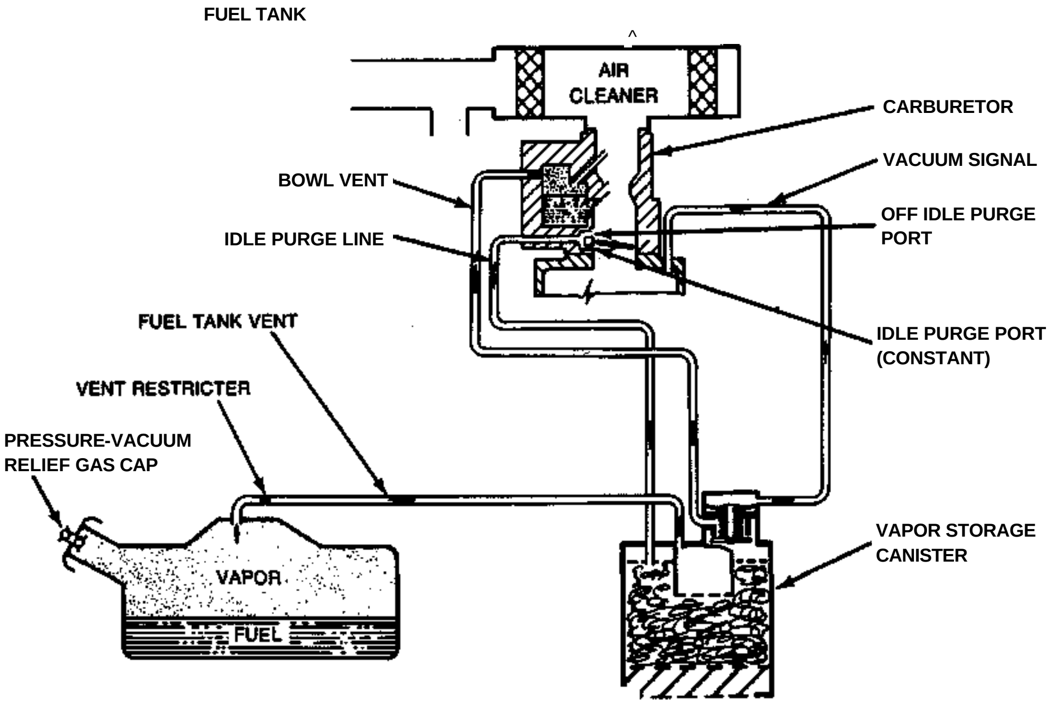
The EEC system for 1982 and later performs the same function as the earlier system, but uses a purge control solenoid which is installed in the vacuum line between the charcoal canister and the PCV valve (mounted on the driver's-side fender, under the hood). The ECM of the computerized emissions system controls the action of the purge control solenoid. Depending upon various conditions of operation, the ECM will either energize or de-energize the solenoid. When the solenoid is energized, vacuum is not available to draw fuel vapors from the canister; when de-energized, vacuum draws the canister vapors into the intake tract of the engine. The solenoid is mounted on the drivers-side fender, inside the engine compartment. Replacement of the solenoid is simply a matter of tagging/ disconnecting the hoses and wiring from the solenoid, and unbolting the solenoid.

Anti-Dieseling Solenoid

Some 1968—76 models may have an idle speed solenoid on the carburetor. All 1972—74 models have idle solenoids. Due to the leaner carburetor settings required for emission control, the engine may have a tendency to "diesel" or "run-on" after the ignition is turned off. The carburetor solenoid, energized when the ignition is on, maintains the normal idle speed. When the ignition is turned off, the solenoid is de-energized and permits the throttle valves to fully close, thus preventing run-on.

The solenoid used on most 1977-81 models is NOT an anti-dieseling solenoid; on these models, the solenoid is used to increase the idle speed when the air conditioning compressor is engaged.

For adjustment of carburetors with idle solenoids see Carburetor Adjustments.



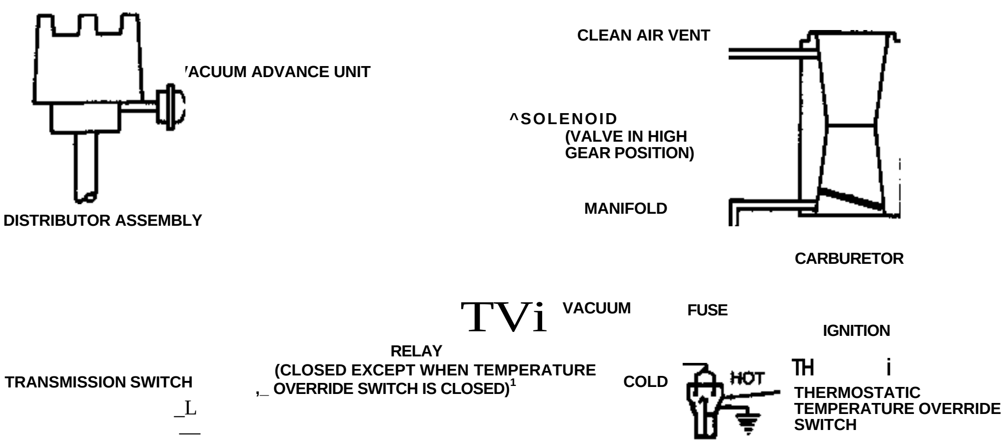
Schematic of the evaporative emissions system (open)—1980; most models similar

Transmission Controlled Spark (TCS)

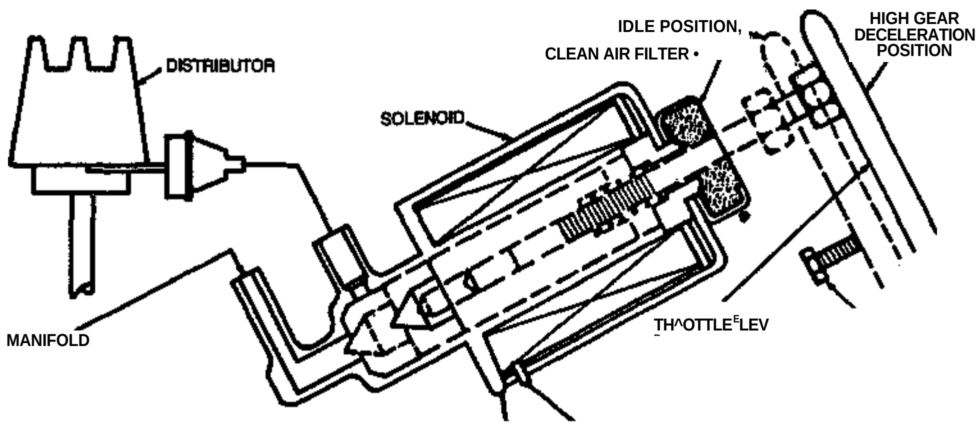
Introduced in 1970, this system controls exhaust emissions by eliminating vacuum advance in the lower forward gears.

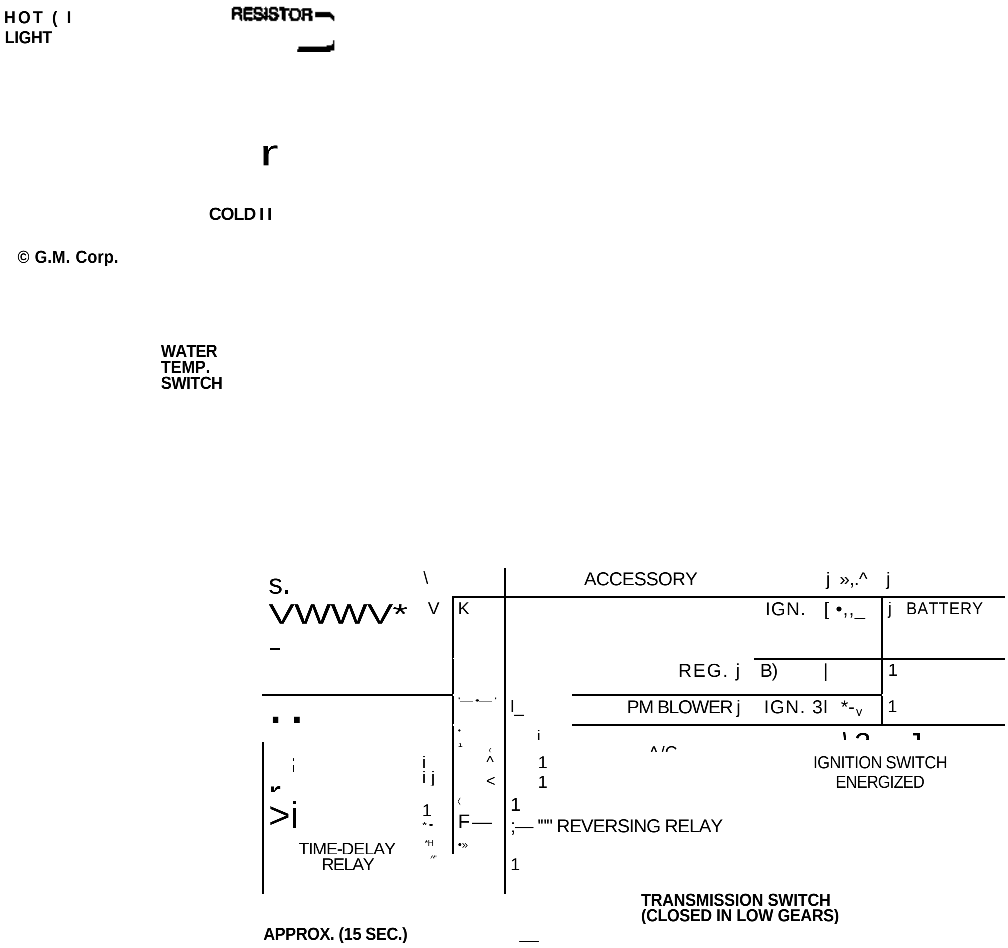
1970

The 1970 system consists of a transmission switch, solenoid vacuum switch, time delay relay, and a thermostatic water temperature switch. The solenoid vacuum switch is energized in the lower gears via the transmission switch and closes off distributor vacuum. The two-way transmission switch is activated by the shifter shaft on manual transmissions, and by oil pressure on automatic transmissions. The switch deenergizes the solenoid in high gear, the plunger extends and uncovers the vacuum port, and the distributor receives full vacuum. The temperature switch overrides the system when engine temperature is below 63° or above 232°. This allows vacuum advance in all gears. A time delay relay opens 15 seconds after the ignition is switched on. Full vacuum advance during this delay eliminates the possibility of stalling.



1970 TCS system schematic





1971 TCS system schematic

1971

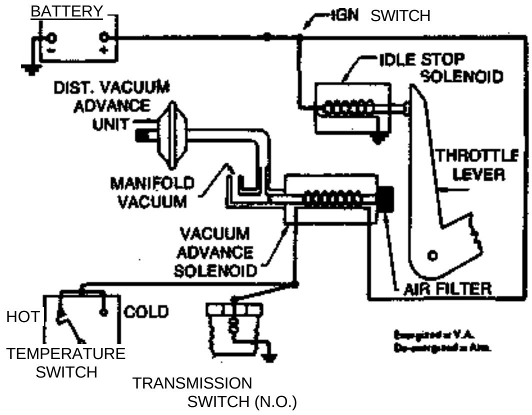
The 1971 system is similar, except that the vacuum solenoid (now called a Combination Emissions Control solenoid) serves two functions. One function is to control distributor vacuum; the added function is to act as a deceleration throttle stop in high gear. This cuts down on emissions when the vehicle is coming to a stop in high gear. The CEC solenoid is controlled by a temperature switch, a transmission switch, and a 20 second time delay relay. This system also contain^ a reversing relay, which energizes the solenoid when the transmission switch, temperature switch or time delay completes the CEC circuit to ground. This system is directly opposite the 1970 system in operation. The 1970 vacuum solenoid was normally open to allow vacuum advance and when energized, closed to block vacuum. The 1971 system is normally closed blocking vacuum advance and when energized, opens to allow vacuum advance. The temperature switch completes the CEC circuit to ground when engine temperature is below 82°. Corvettes also have a high temperature terminal on the switch to complete the CEC circuit when coolant temperature reaches 232°. The time delay relay allows vacuum advance (and raised idle speed) for 20 seconds after the ignition key is turned to the "on" position. Models with an automatic transmission and air conditioning also have a solid state timing device which engages the air conditioning compressor for three seconds after the ignition key is turned to the "off" position to prevent the engine from running-on. Two throttle settings are necessary; one for curb idle and one for emission control on coast. Both settings are described in the Tune-Up chapter.

1972-74

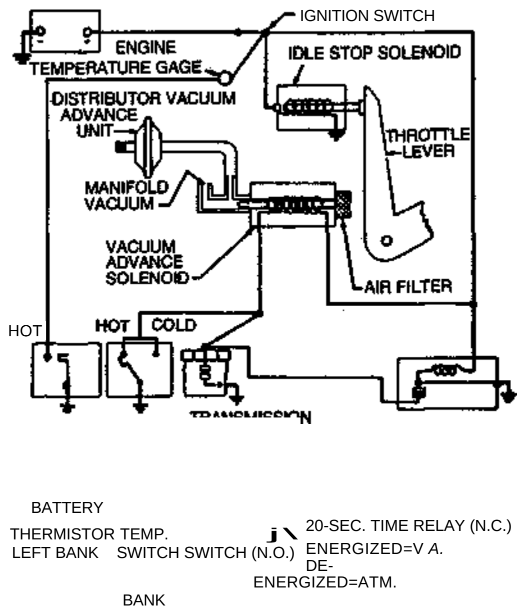
A vacuum advance solenoid similar to that used in 1970 is used. The CEC valve is not used. This relay is normally closed to block vacuum and opens when energized to allow vacuum advance. The solenoid controls distributor vacuum advance and performs no throttle positioning function. The 1973-74 TCS system differs from the 1972 system in three ways. The 23 second uplift delay has been replaced by a 20 second starting relay.

This relay closes to complete the TCS circuit and open the TCS solenoid, allowing vacuum advance, for 20 seconds after the key is turned to the "on" position. The operating temperature of the temperature override switch has been raised to 93°, and the switch that was used to engage the A/C compressor when the key was turned "off' has been eliminated. All models are equipped with an electric throttle control solenoid to prevent run-on. The 1974 TCS system is used only on manual transmission models. System components remain unchanged from 1973. The vacuum advance solenoid is located on the coil bracket.

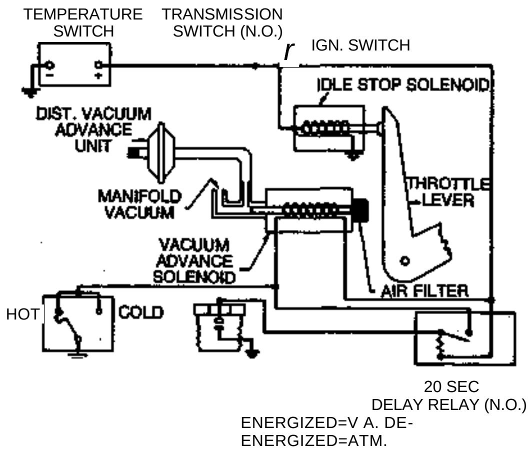
All 1973-74 Corvette models are equipped with a Thermo-Override system instead of the normal TCS system. This system consists of a three-position temperature switch, which is mounted in the right cylinder head and a two-position vacuum advance solenoid. Three vacuum lines are connected to the solenoid, a ported vacuum line from the carburetor, a vacuum line from the intake manifold, and a vacuum line that runs to the distributor vacuum advance unit. When the engine temperature is between 92°F and 232°F, the temperature switch contacts are open and the vacuum solenoid is deenergized. This causes carburetor-ported vacuum to control the operation of the distributor vacuum advance unit. When the engine temperature is below 93°F or above 232°F, the temperature switch contacts are closed and the vacuum solenoid is energized. This moves the plunger in the solenoid to block the ported vacuum opening and connect manifold vacuum to the distributor. When the engine reaches normal temperature, the temperature switch contacts open and ported vacuum is restored to the distributor. TCS is not used on 1975 and later models.



1972 454 TCS system—hot override on



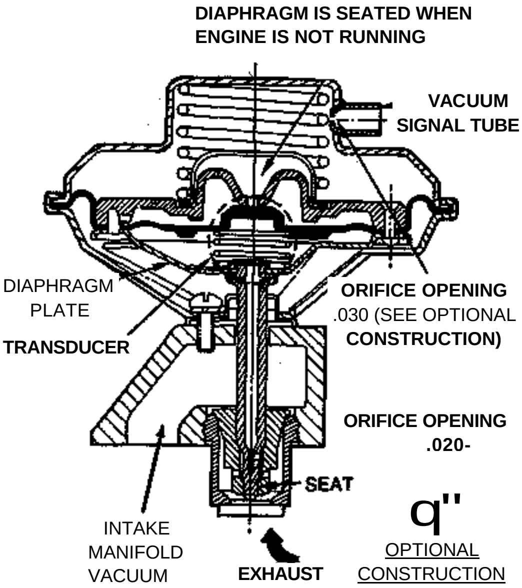
1973 4-speed TCS system



1972 350 TCS system—hot override on

Exhaust Gas Recirculation (EGR)

All 1973-84 engines are equipped with exhaust gas recirculation (EGR). This system consists of a metering valve, a vacuum line to the carburetor, and cast-in exhaust gas passages in the intake manifold. The EGR valve is controlled by carburetor vacuum, and accordingly opens and closes to admit exhaust gases into the fuel/air mixture. The exhaust gases lower the combustion temperature, and reduce the amount of oxides of nitrogen (NOa) produced. The valve is closed at idle between the two extreme throttle positions. In most installations, vacuum to the EGR



Cross section of a negative backpressure EGR valve

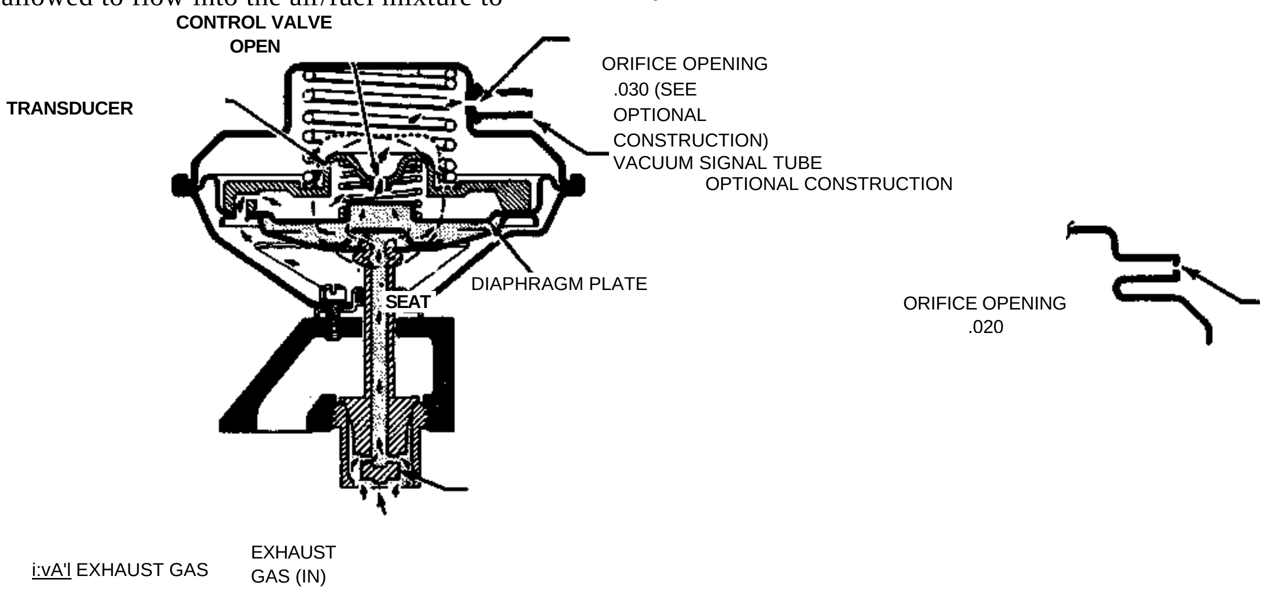
valve is controlled by a thermal vacuum switch (TVS); the switch, which is installed into the engine block, shuts off vacuum to the EGR valve until the engine is hot. This prevents the stalling and lumpy idle which would result if EGR occurred when the engine was cold.

As the car accelerates, the carburetor throttle plate uncovers the vacuum port for the EGR valve. At 3-5 in. Hg, the EGR valve opens and then some of the exhaust gases are allowed to flow into the air/fuel mixture to lower the combustion temperature. At full-throttle the valve closes again.

Some California engines are equipped with a dual diaphragm EGR valve. This valve further limits the exhaust gas opening (compared to the single diaphragm EGR valve) during high intake manifold vacuum periods, such as high-speed cruising, and provides more exhaust gas recirculation during acceleration when manifold vacuum is low. In addition to the hose running to the thermal vacuum switch, a second hose is connected directly to the intake manifold.

For 1977, all California models and cars delivered in areas above 4000 ft are equipped with back pressure EGR valves. This valve is also used on all 1978-81 models. The EGR valve receives exhaust back pressure through its hollow shaft. This exerts a force on the bottom of the control valve diaphragm, opposed by a light spring. Under low exhaust pressure (low engine load and partial throttle), the EGR signal is reduced by an air bleed. Under conditions of high exhaust pressure (high engine load and large throttle opening), the air bleed is closed and the EGR valve responds to an unmodified vacuum signal. At wide open throttle, the EGR flow is reduced in proportion to the amount of vacuum signal available.

1979 and later models have a ported signal vacuum EGR valve. The valve opening is controlled by the amount of vacuum obtained from a ported vacuum source on the carburetor and the amount of backpressure in the exhaust system.

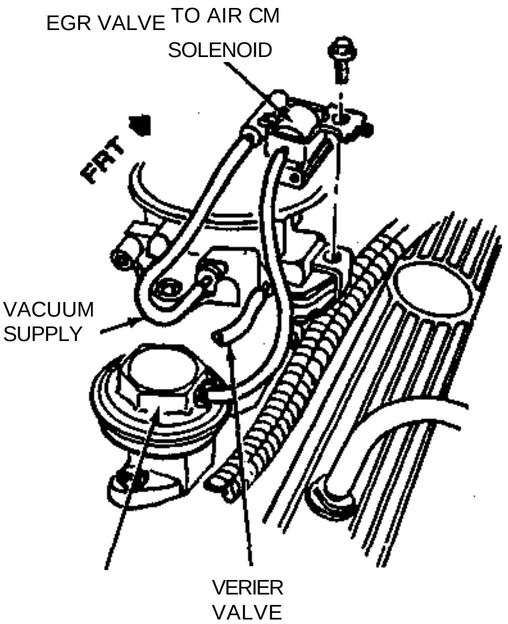


Cross section of a positive backpressure EGR valve

On 1982 and later models, the EGR valve vacuum is controlled by the ECM of the computer emissions system.

EGR *VALVE REMOVAL AND INSTALLATION*

1. Detach the vacuum lines from the EGR valve.
2. Unfasten the two bolts or bolt and clamp which attach the valve to the manifold. With draw the valve.
3. Installation is the reverse of removal. Always use a new gasket between the valve and the manifold. On dual diaphragm valves, attach carburetor vacuum line to tube at top of valve, manifold vacuum line to tube at cen ter of valve.



EGR valve and solenoid used with most computer emissions systems—1982 shown (© Chevrolet Motor Division)

TVS *SWITCH REMOVAL AND INSTALLATION*

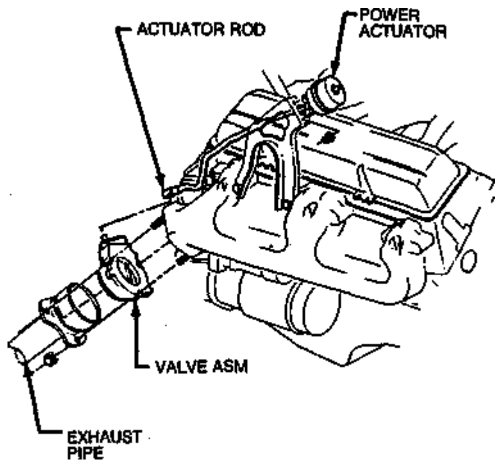
1. Drain the radiator.
1. Disconnect the vacuum lines from the switch, noting their locations. Remove the switch.
1. Apply sealer to the threaded portion of the new switch, and install it, torquine to 15 ft Ibs.
1. Rotate the head of the switch to a posi tion that will permit easy hookup of vacuum hoses. Attach the vacuum hoses to the proper connectors.

Early Fuel Evaporation (EFE)

The 1975-81 EFE system is used to reduce engine warm-up time, improve driveability, and reduce emissions. The system consists of a vacuum controlled heat valve assembly (EFE valve) and a thermostatic vacuum switch (TVS) installed in the coolant thermostat housing of the engine.

The TVS controls the action of the EFE valve. One port of the TVS is connected to a manifold vacuum source; the other port to the EFE valve. When the engine is cold (as sensed by the TVS), the passage within the TVS is open to allow vacuum to act upon the EFE valve. The EFE valve closes, which blocks the exhaust flow from the right side cylinder bank. Because of the blockage, the exhaust gas is forced through passages in the right side cylinder head and the intake manifold. The heat from the exhaust warms the carburetor which improves the vaporization characteristics of the fuel. The exhaust gas exits through the left side exhaust pipe until the EFE valve closes. As the coolant temperature increases, the TVS shuts off the vacuum to the EFE valve. The valve then opens, allowing the exhaust gas to follow its normal route through the right side exhaust pipe.

1982 and later models do not use the EFE system, due to the superior fuel handling capabilities of the Throttle Body (fuel) Injection system.



Typical EFE valve and related components

TESTING THE EFE SYSTEM

After the vehicle has sat overnight, open the hood and note the position of the EFE valve control rod. Start the engine and check that the position of the control rod changes (valve closes). If the valve did not close, disconnect the vacuum line from the EFE valve. If vacuum is felt at this line, either the EFE valve is defective or the linkage is binding. If no vacuum is felt, check the condition of both vacuum lines. If the lines are in good condition, the TVS is defective. If the valve does not open as the engine warms, again check for vacuum at the line attached to the EFE valve. If vacuum is present, the TVS is defective; if no vacuum is present, either the EFE valve is defective or the linkage is binding. NOTE: *// the TVS must be replaced, follow the procedure listed for the TVS used with the EGR system.*

EFE VALVE REMOVAL AND INSTALLATION

NOTE: *Perform this operation only when the engine is cold.*

1. Disconnect the battery cables at the battery.
2. Raise the front of the vehicle and sup port it safely with jackstands.
3. Disconnect the exhaust crossover pipe from the exhaust manifolds and lower the pipe away from the manifolds.

NOTE: *On some models, it may be necessary to completely remove the crossover pipe to allow enough clearance for the EFE valve to slide off the manifold studs.*

4. Disconnect the vacuum line from the EFE valve and remove the valve assembly.
5. Installation is the reverse of the pre vious steps. If gaskets are used at the pipe or valve connections, replace the gaskets.
6. Check for proper operation of the EFE valve.

Catalytic Converter

All 1975 and later models are equipped with a catalytic converter. The converter is located midway in the exhaust system. Stainless steel exhaust pipes are used ahead of the converter. The converter is stainless steel with an aluminized steel cover and a ceramic felt blanket to insulate the converter from the floorpan. The catalyst pellet bed(s) inside the converter consists of noble metals which cause a reaction that converts hydrocarbons and carbon monoxide into water and carbon dioxide.

Computer Emissions Systems

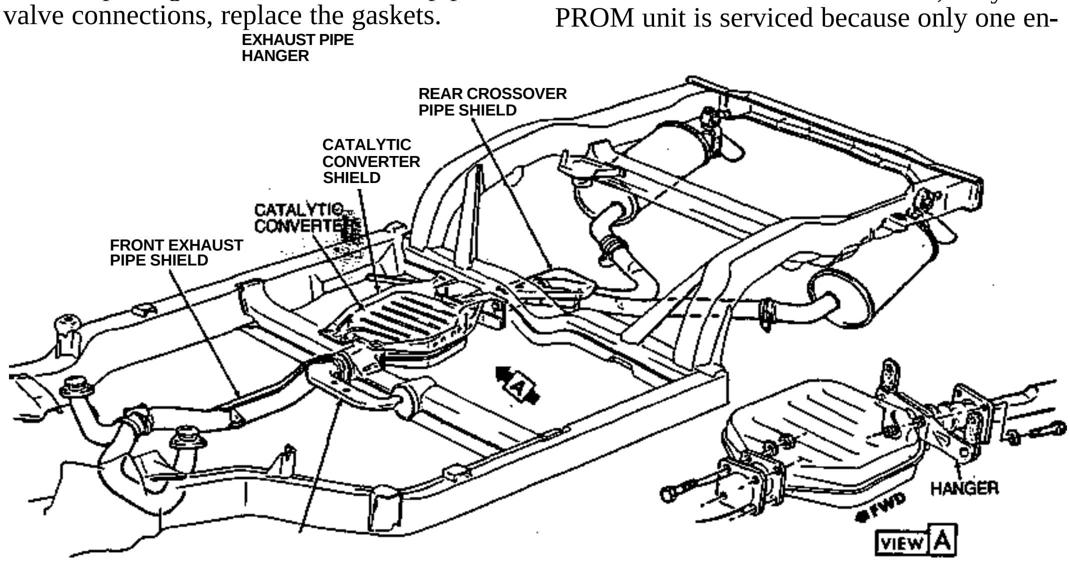
COMPUTER CONTROLLED CATALYTIC CONVERTER (C-4) SYSTEM

The C-4 system is used on 1980 California vehicles having the 305 engine. The "system" was introduced because of increasing governmental pressures to meet more stringent fuel economy and emissions requirements.

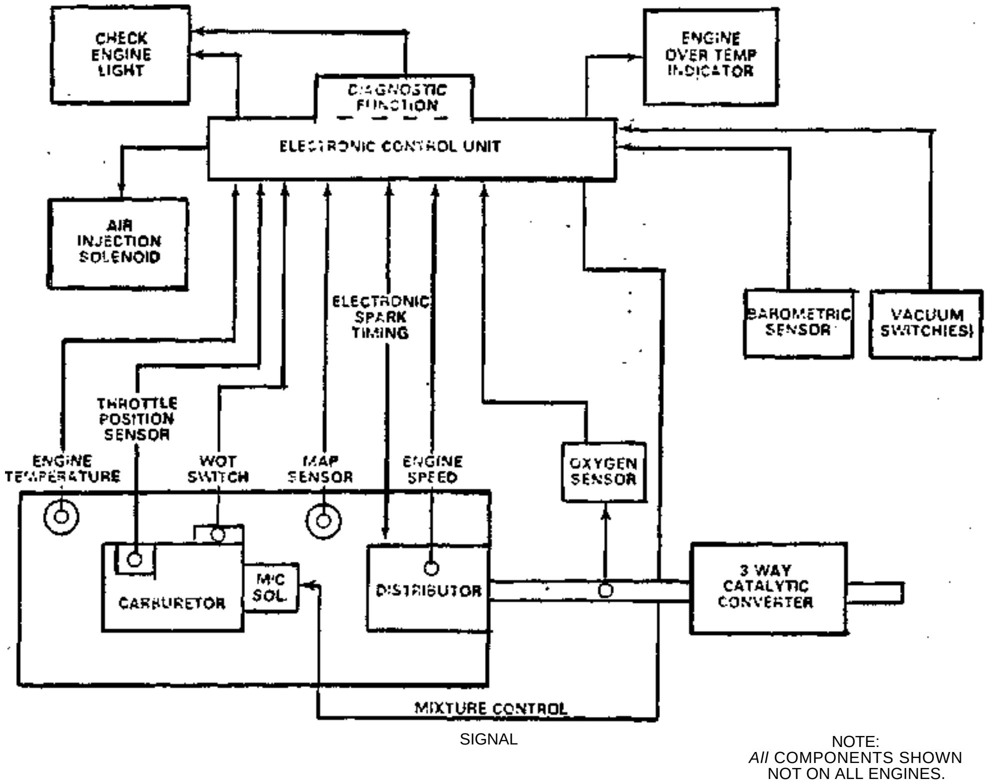
The main components of the C-4 system and brief descriptions of each item follow.

Electronic Control Module (ECM)—The ECM is the actual computer "brain" which monitors and controls the C-4 system.

PROM Calibrator—The PROM (Programmable Read-Only Memory) unit "tailors" the functions of the ECM to a particular vehicle. In the case of the 1980 Corvette, only one PROM unit is serviced because only one en-



1975 Corvette exhaust system showing catalytic converter

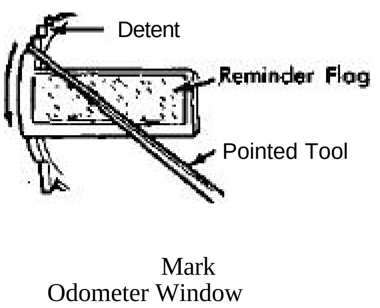


C-4 system schematic

gine/transmission combination was available in Corvettes sold in California. In later years, many different PROM units are used for the same model, according to vehicle weight, drivetrain combinations, and emission requirements of where the vehicle is sold (e.g.—Federal/49 state, California, Canada, etc.).

Oxygen Sensor—The oxygen sensor constantly monitors the amount of oxygen in the engine exhaust. The sensor reads a high oxygen content as a lean mixture; low oxygen content as a rich mixture. The data from the oxygen sensor is processed by the ECM, causing the ECM to vary other system functions accordingly. A "sensor" flag on the instrument panel indicates when the oxygen sensor must be replaced.

NOTE: *To reset the "Emission"flag on the speedometer face, remove the instrument cluster lens. Insert a long, pointed instrument diagonally into the detents on the upper left side of the "Emission" wheel. Rotate the wheel downward until an alignment mark is visible in the left side of the odometer window.*



Resetting emission odometer flag—1980 models only

Engine Coolant Temperature Sensor—This sensor monitors and signals the ECM concerning the engine coolant temperature. The sensor is mounted on the intake manifold and modifies the ECM output signal to compensate for a cold engine condition which improves the cold driveability of the engine.

Vacuum Control Switches—Various vacuum switches are used to monitor engine load, enabling the ECM to adjust the C-4 system accordingly. High vacuum indicates (to the ECM) that the engine is either idling or cruising and low vacuum indicates engine operation at or near wide-open throttle.

Throttle Position Sensor (IPS)—Monitors the degree of throttle opening, allowing the ECM to alter the air/fuel mixture according to engine operating conditions. The TPS is mounted inside the carburetor. Carburetor Model E4ME—This model of carburetor is used only with computer emissions systems. The E4ME plays a key role in the control of exhaust emissions, in that it is a "solenoid controlled" carburetor. The solenoid used in the E4ME is termed a mixture control (MC) solenoid. After the ECM "digests" information from the various monitoring devices, it signals the MC solenoid to alter the air/fuel mixture to compensate for the operating conditions of the engine. The MC solenoid is actually a combination fuel flow valve and air bleed valve, as the metering of fuel or air can be controlled independently. The solenoid acts to supplement the idle and main metering systems of the carburetor.

COMPUTER COMMAND CONTROL (CCC) SYSTEM

The CCC system is used on all 1981-84 models. Basically, the CCC system is an improved version of the C-4 system. The capabilities of the CCC system are greatly extended (compared to the C-4 system) through the use of additional sensors and increased control capacities of the ECM and PROM units.

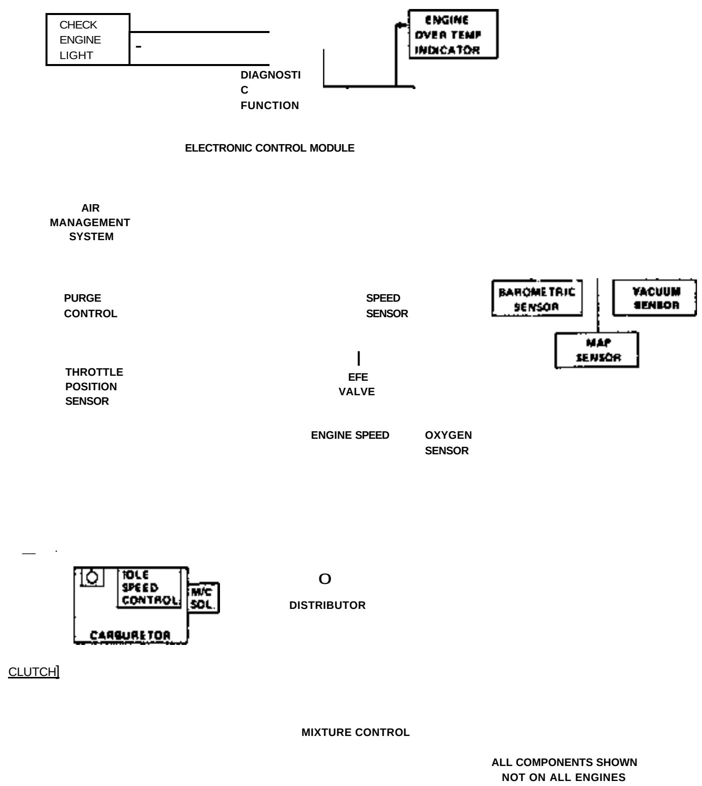
In addition to the functions of the C-4 system, the CCC system also controls the AIR, EGR, Electronic Spark Timing (EST) and Torque Converter Clutch (TCC) systems. On 1982-84 models, the fresh air induction and fuel injection systems are also controlled by the CCC.

Due to the complexity of either computer emission system and increasing federal emission regulations, service, testing, or repair of the system should be performed only by a qualified, professional technician.

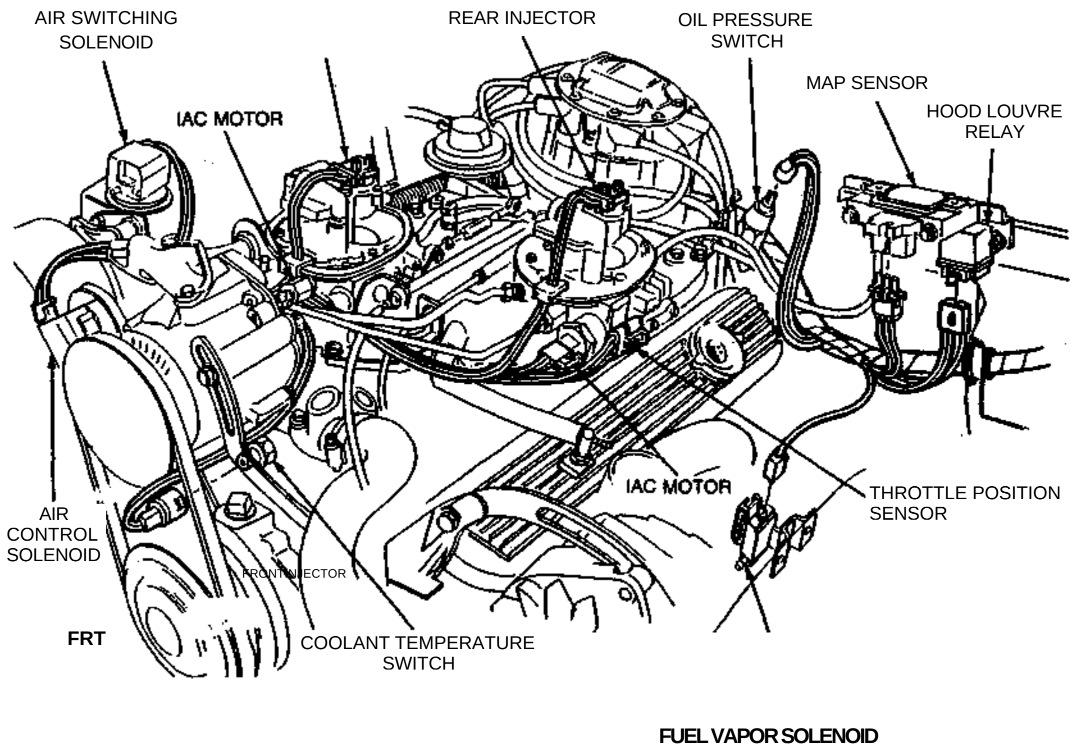
Electronic Spark Timing (EST) System

The EST system is used on 1981-84 Corvettes. The ignition distributor of engines using the EST system does not have vacuum or mechanical spark advance mechanisms, as these functions are controlled electronically by the distributor module assembly and the ECM of the computer emissions system.

The purpose of the EST system is to precisely adjust the spark timing according to



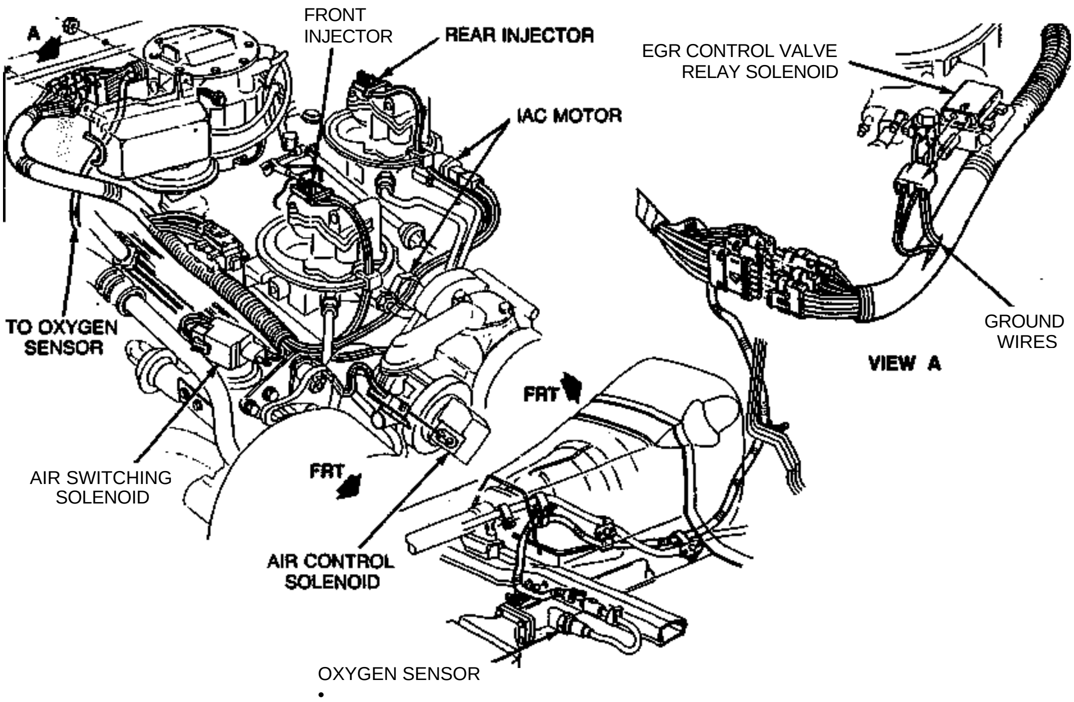
CCC system schematic



Typical CCC system component locations—left side view (1982 shown)

specific engine operating conditions, as sensed by the various monitoring devices of the computer emissions system.

The 1982-84 EST system is slightly different than the 1981 system, in that it uses a detonation sensor, mounted on the right side of the cylinder block in front of the starter. The purpose of the sensor is to "tell" the ECM when the engine begins to "ping," allowing the ECM to signal the distributor module to retard the spark timing just enough to keep the engine on the verge of detonation, without causing engine damage. If severe detonation occurs on engines equipped with the



Typical CCC system component locations—right side view (1982 shown)

detonation sensor, the entire computer emissions system should be professionally tested. Because both types of EST systems are directly tied into the computer emissions system, service, testing, and repair should be performed by a qualified, professional technician.

FUEL SYSTEM

Mechanical Fuel Pump

The 1963-81 Corvette fuel pump is a mechanically operated diaphragm-type pump. The camshaft of the engine has an eccentric (similar to a cam lobe, but more rounded) cast as part of the camshaft. As the camshaft rotates, the eccentric actuates a pushrod which pushes the fuel pump rocker arm to activate the pump.

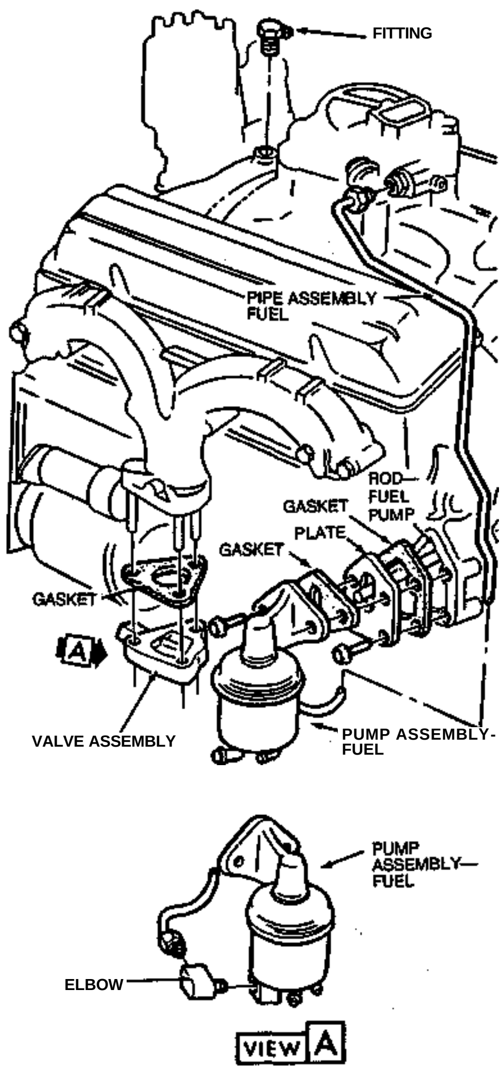
The fuel pump is attached to the right front of the cylinder block. On small-block engines, a fuel pump mounting plate is used, with two gaskets; one between the pump and the plate; the other between the plate and the block. Pumps on big-block engines attach directly to the block and use only one gasket.

The inlet, or suction line of the pump, draws fuel from the tank. The outlet, or pressure line of the pump, supplies pressurized fuel to the carburetor (or fuel injection unit, in early Corvettes). Some models use a third line, which is a vapor return. The purpose of the vapor return is to route the hot fuel and fuel vapor from the pump back to the fuel tank, which considerably reduces the chance of vapor lock.

For all intents and purposes, the fuel pump is not rebuildable. Some '60s Corvettes used a rebuildable pump, though parts for these pumps are no longer available from Chevrolet.

REMOVAL AND INSTALLATION

1. Disconnect the fuel inlet, outlet, and vapor return (if equipped) lines from the pump.
2. On small-block engines, remove the bolt from the front right face of the engine block which is almost opposite the forward pump mounting bolt. Insert a longer bolt (%x!6x2 in.) in this hole and snug down the bolt. This will hold the fuel pump pushrod in place. On big-block engines, the pushrod can be re tained with heavy grease or mechanical fingers during installation.



Typical 1963-81 mechanical fuel pump mounting (1974 350 shown)

3. Remove the fuel pump mounting bolts and remove the fuel pump.
4. Installation of the pump is the reverse of the previous steps. Replace the fuel pump gasket(s) during installation. Start the engine and check the pump for proper operation, and check for leaks.

TESTING

If the engine exhibits a tendency to "starve-out", never assume that the fuel pump is defective until you test the pump. In most cases, a "starve-out" condition is caused by a weak ignition system, plugged fuel filter, or restricted fuel line. 1. Disconnect the fuel line from the carburetor. While this line is disconnected, check the fuel filter.

2. Run a piece of fuel-resistant rubber hose from the line to a graduated container.

3. On engines with standard ignition sys tems, ground the secondary coil wire. On en gines with the HEI distributor, disconnect the BAT connector from the coil terminal.

4. Crank the engine. Fuel should be pumped into the container at a rate of 1 pint in 30 seconds.

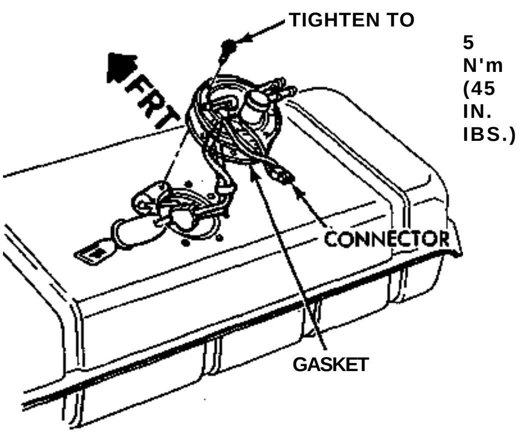
5. Remove the added hose and container and connect a fuel pressure gauge to the fuel line. Crank the engine and read the highest pressure obtained on the gauge. See the Tune-Up Specifications chart in the Tune-Up chapter for the proper fuel pump pressure range.

If the pump failed the tests of either step 4 or 5, replace the pump as previously outlined. If the pump checked okay, remove the pressure gauge and reconnect the fuel line to the carburetor. Reconnect the ignition wiring as originally connected.

Electric Fuel Pump

An electric, impeller-type fuel pump is used on all 1982-84 Corvettes. The pump is designed to deliver a constant flow of fuel to the throttle body fuel injection units. The fuel pressure is regulated at the pressure regulator and compensator units, both of which are integrated with the throttle body injection units.

The pump is mounted inside the fuel tank as part of the fuel gauge sending unit. The pump can be replaced independently of the sending unit.



Electric fuel pump and gauge sender assembly-1982

REMOVAL AND INSTALLATION

1. Disconnect the battery cables at the battery.

2. Remove the fuel filler door and bezel.

3. Remove the fuel filler neck seal and drain hose.

4. Disconnect the lines and electrical con nectors from the sending unit/pump assem bly, and remove the screws which retain the assembly.

5. Remove the sending unit/pump assem bly and the gasket.

6. Separate the pump from the sending unit.

7. Installation is the reverse of the pre vious steps. DO NOT connect the battery until all other steps have been completed.

TESTING

NOTE: A *special fuel pressure gauge (Kent-Moore J-29658) is required to safely perform this test.*

1. Remove the air cleaner assembly and plug the vacuum connection(s) at the TBI unit.

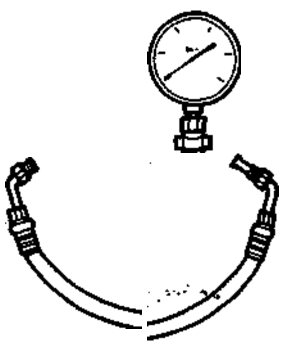
2. Remove the fuel tube which connects between both TBI units.

NOTE: *Use two line wrenches of the appropriate sizes to disconnect each fitting; one wrench to hold the large fitting, the other to loosen the smaller fitting.* CAUTION: A *small amount of fuel will be released from the connections.*

3. Install the fuel pressure gauge between the two TBI units.

4. Turn the ignition switch ON and check for fuel leakage at the gauge arrangement. If leakage is noted, turn the ignition switch OFF and correct the leak.

5. Start the engine and read the fuel pres-



Fuel pressure gauge used to test the fuel pressure on 1982, TBI models

sure on the gauge. Fuel pressure should be 9-13 psi. Turn the engine OFF. Replace the fuel pump if the pressure is not within this range.

6. Remove the fuel pressure gauge, install the fuel tube assembly, and check for leaks.

7. Reinstall the air cleaner and connect the vacuum lines as originally connected.

Carburetor Overhaul and Adjustments—AH Types

Efficient carburetor depends greatly on careful cleaning and inspection during overhaul, since dirt, gum, varnish, water in or on the carburetor parts are mainly responsible for poor performance.

Carburetor overhaul should be performed in a clean, dust-free area. Carefully disassemble the carburetor, keeping look-alike parts segregated. Note all jet sizes.

NOTE: *The carburetor Specifications Chart at the end of the chapter gives the various carburetor applications. Determine which carburetor you are dealing with and refer to the following sections. The sections are divided by carburetor type.* Once the carburetor is disassembled, wash all parts (except diaphragms, electric choke units, pump plunger and any other plastic, leather or fiber parts) in clean carburetor solvent. Do not leave the parts in solvent any longer than necessary to sufficiently loosen the deposits. Excessive cleaning may remove the special finish from the float bowl and choke valve bodies, leaving them unfit for service. Rinse all parts in clean solvent and blow dry with compressed air. Wipe all plastic, leather or fiber parts with a clean, lint-free cloth.

Blow out all passages and jets with compressed air and be sure there are no restrictions or blockages. Never use wire to clean jets, fuel passages or air bleeds.

Check all parts for wear or damage. If wear or damage is found, replace the complete assembly. Especially check the following:

1. Check the float and needle seat for wear. If any is found, replace the assembly.

2. Check the float hinge pin for wear and the floats for distortion or dents. Repkce the float ifjfiikhas leaked into it.

3. (?necK^he throttle and choke shaft bores for out-of-round. Damage or wear to the throttle arm, shaft or shaft bore will often require replacement of the throttle body. These parts require close tolerances and an air leak here can cause poor starting and idling.

4. Inspect the idle mixture adjusting needles for burrs or grooves. Burrs or grooves will usually require replacement of the needles since a satisfactory idle cannot be obtained.

5. Test the accelerator pump check valves. They should pass air one way only. Test for proper seating by blowing and sucking on the valve. If the valve is satisfactory, wash the valve again to remove breath moisture.

6. Check the bowl cover for warping with a straightedge.

7. Closely inspect the valves and seats for wear or damage, replacing as necessary.

8. After the carburetor is assembled, check the choke valve for freedom of operation.

Carburetor overhaul kits are recommended for each overhaul. These kits contain all gaskets and new parts to replace those that deteriorate most rapidly. Failure to replace all parts supplied with the kit (especially gaskets) can result in poor performance later.

Overhaul kits contain specific procedures for the model carburetor the kit applies too. Some carburetor manufacturers supply overhaul kits of three types—minor repair, major repair and gasket kits. They basically consist of Minor Repair Kits:

- All gaskets
- Float needle valve
- Volume control screw
- All diaphragms
- Pump diaphragm spring

Major Repair Kits:

- All jets and gaskets
- All diaphragms
- Float needle valve
- Volume control screw
- Pump ball valve
- Main jet carrier
- Float
- Complete intermediate rod
- Intermediate pump lever
- Complete injector tube
- Assorted screws and washers

Gaskets Kits:

- All gaskets.

After cleaning and checking all components, reassemble the carburetor using new parts, using the exploded views in the car sections, if necessary. Make sure that all screws and jets are tigiit in their seats, but do not overtighten needle valves into their seats or uneven jetting will result. Always use new gaskets and adjust the float.

THROTTLE LINKAGE/CABLE ADJUSTMENT

Four Barrel Carburetors

7963-67

Adjust the length of the throttle linkage to ensure full opening of the throttle plates. Turn the threaded swivel at the throttle so that with the accelerator pedal fully depressed and the carburetor throttle valve fully open, the threaded swivel will freely enter into the throttle lever. The lever should then be turned two full turns to lengdien the control rod.

7968-72

Loosen the accelerator cable clamp bolt at the carburetor bracket. Block the accelerator pedal in the fully depressed position. Open the carburetor throttle fully and tighten the cable clamp bolt to 45 in. ibs.

1973-84 (Including TBI)

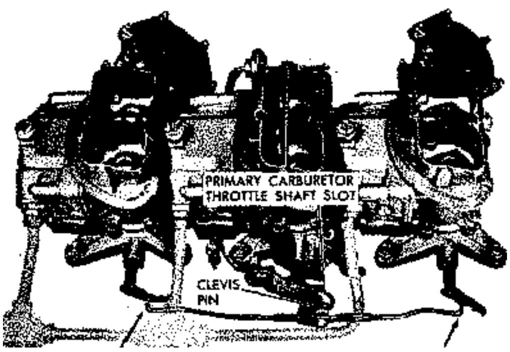
Throttle cable adjustments are not possible on these models.

Three, Two Barrel Carburetors

7967-69

Loosen the cable clamp, then fully depress the accelerator pedal and fully open the throttle plate of the primary carburetor. Torque the cable clamp bolt to 45 in. Ibs.

Bring the engine to operating temperature, set the idle to specifications, and turn it off. Bottom the clevis pin in the throttle slot of the primary carburetor and adjust the secondary closing rod of the rear carburetor so that it lacks *Vz* a rod diameter of being long enough to freely enter the rear secondary throttle hole. Connect the rod. Adjust the forward secondary rod so that it barely enters the throttle lever hole. Connect the rod and check the linkage operation to be sure the plates close completely.



Three, two-barrel carburetor linkage adjustment

Carter WCFB Carburetor

The Carter WCFB is the standard carburetor on 1963-1965 Corvettes.

Functionally, it is two, dual carburetors mounted in a single housing and is comprised of four basic components: choke housing, top cover, main body, and throttle flange. The metering rods, accelerator pump, and choke are located in the primary side of the carburetor body. It has the five conventional systems: float, low speed, high speed, accelerator pump, and choke.

IDLE SPEED AND MIXTURE ADJUSTMENTS

Idle speed and mixture adjustments are best accomplished using a tachometer and vacuum gauge. Make this adjustment with the air cleaner installed.

Bring the engine to operating temperature, check to see that the choke is fully off, and adjust the idle-speed adjustment screw to give 475 rpm (450 on automatic transmissions in Drive range). Adjust the idle-mixture adjustment screws separately until peak vacuum and rpm are indicated on the vacuum gauge and tachometer.

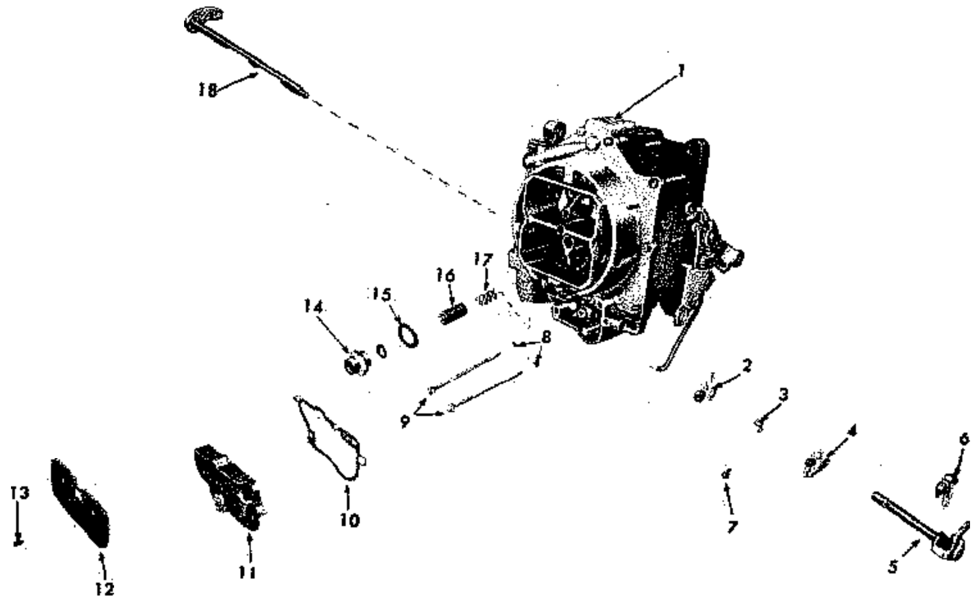
An alternative method is to set the idle-mixture screws lean to a beginning, rough idle, then back screws out (enrichen) % turn. Never bottom the idle-mixture adjustment screws or possible damage to the needle seat may result.

AUTOMATIC CHOKE ADJUSTMENT

The choke is correctly set when the index mark on the plastic cover aligns with the corresponding mark on the choke housing. The introduction of dirt, gum, water or carbon into the choke housing or vacuum passage can detrimentally affect engine performance. Check this system periodically and clean if necessary.

INTERMEDIATE CHOKE ROD ADJUSTMENT

The intermediate choke rod adjustment requires the removal of the choke coil housing assembly, gasket, and baffle plate. Open the



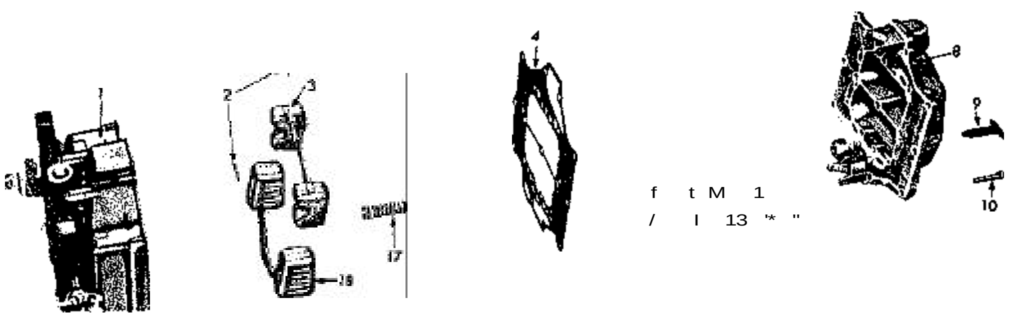
1. Bowl cover
2. Metering rod arm
3. Vent arm
4. Pump operating arm and link
5. Pump countershaft assembly
6. Choke shaft lever
7. Vent arm screw
8. Metering rod discs
9. Metering rods
10. Dust cover gasket
11. Dust cover
12. Choke valve
13. Choke valve screw
14. Inlet fitting nut
15. Filter gaskets
16. Filter
17. Filter spring
18. Choke valve shaft

WCFB bowl cover upper parts

choke valve and position a 0.026 in. wire gauge between the bottom of the slot in the piston and the top of the slot in the choke piston housing. Seat the choke piston on the gauge. The measurement between the top of the choke valve and the air horn divider should be 0.096 in. Adjustment is made by bending the intermediate choke rod.

FLOAT ADJUSTMENT

To make the float adjustment, remove the top cover then disassemble and reassemble the floats without the cover gasket. Make the lateral adjustment by placing the % in. float gauge (supplied in the carburetor overhaul kit) under the center of the secondary float so that



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1. Carburetor body
2. Float hinge pins
3. Secondary float
4. Bowl cover gasket
5. Secondary float needle
6. Secondary float needle seat
7. Needle seat gasket
8. Bowl cover
9. Vacuum piston link
10. Bowl cover attaching screw
11. Needle seat gasket
12. Primary float needle seat
13. Primary float needle

WCFB lower bowl cover parts

14. Vacuum piston
15. Vacuum piston spring
16. Pump plunger assembly
17. Pump plunger return
spring
18. Primary float

the notched portion of the gauge fits over the edge of the casting. Bend the floats until their sides just clear the vertical uprights of the gauge. Repeat the adjustment on the primary float using either the *V&* in. float gauge or a *Vs* in. drill bit.

The vertical adjustment is correct when the floats just clear the horizontal bar of the gauges when the gauges are positioned as described above. The required clearance between the top of the floats and the bowl cover is *Va* in. on the primary floats and *¥4* in. on the secondary floats.

Float drop measurement must be made with the top cover gasket removed. Measure between the lowest point of the floats and the bottom of the top cover. This should be 2 in. for both primary and secondary floats. Adjust the accelerator pump by backing off the idle-speed adjustment screw and positioning the float-drop adjustment gauge (supplied in rebuilding kits) on the dust cover boot. Bend the top flat of the pump arm so that it is parallel to the gauge.

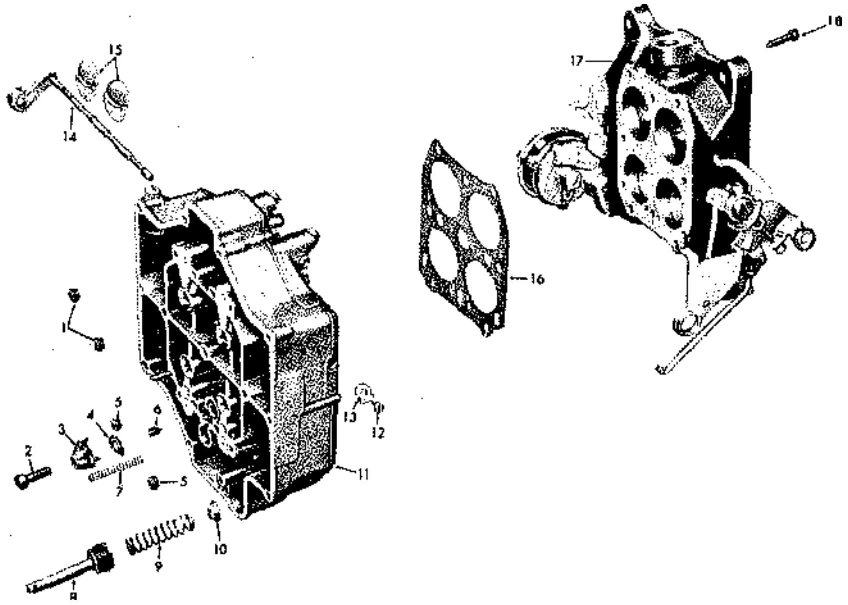
METERING ROD ADJUSTMENT

To adjust the metering rods, back off the idle-speed adjusting screw until the throttle valves are fully seated, then loosen the screw in the metering arm. Depress the metering rod arm upward until it just touches the hanger. Secure the arm with the set screw.

UNLOADER AND SECONDARY THROTTLE LEVER ADJUSTMENT

Make the unloader adjustment with the throttle valves wide open. Measure between the inboard edge of the choke valve and the center wall of the top cover. Bend the unloader tang to obtain a 3/ie in. clearance.

Turn the carburetor upside down to adjust the secondary throttle lever. With the primary valves wide open, the secondary valves should be within 4° to 7° of the wide open position. Bend the connector rod at its upper angle until actuation of the throttle linkage fully opens the primary valves. Bend the tang on the secondary throttle dog so that with the



1. Secondary jets
2. Pump jet cluster attaching screw
3. Pump jet cluster
4. Cluster gasket
5. Metering rod jets
6. Pump discharge needle
7. Vacuum piston spring
8. Pump plunger assembly
9. Pump plunger return spring
10. Pump inlet ball retainer
11. Carburetor body
12. Screw
13. Auxiliary throttle valve cam
14. Auxiliary throttle valve shaft and weight assembly
15. Auxiliary throttle valves
16. Carburetor body basket
17. Throttle flange
18. Throttle flange attaching screw

WCFB throttle body parts

primary throttle valves open, the secondary throttle-to-bore angle will be *SVz*^{0}. There should be 0.017 in.-0.022 in. clearance between the positive closing shoes on the primary and secondary throttle levers with the throttle valves closed.

DISASSEMBLY AND ASSEMBLY

1. Remove the carburetor from the en gine but do not drain the fuel in the bowl. Tap the filter nut lightly with a hammer then remove the inlet nut and gasket and lift out the filter.

2. Disconnect the choke connector rod, intermediate choke rod, and throttle rod. Re move the metering-rod dust cover and vapor vent arm. Loosen the pump operating arm and metering-rod arm securing screws, and withdraw the countershaft.

3. Remove the metering rod arm and link. Turn each metering rod 180° and lift them from the anger. Do not lose the two, meter ing rod discs.

4. Remove the top cover, lifting straight up so as to avoid damaging the floats, vacuum piston, or plunger assembly. Be sure the cover gasket is free of the bowl before lifting the cover. Mark the floats before removing them from the cover, to avoid unnecessary bending during assembly adjustments.

5. Remove the secondary float needle, seat, and gasket, and group together. Re move the pump plunger assembly and spring and soak the leather pump plunger in gaso line or kerosene to prevent it from drying out. Turn the vacuum piston *Vt* turn to disconnect and remove the piston link.

6. At this time, check the fuel in the bowl for contamination. Sweep the bottom of the bowl with a magnet while the fuel is still present. This will pick up iron oxide dust or metallic particles. Water contamination will appear as milky globules at the bottom of the bowl.

7. Invert the carburetor body and re move the pump jet cluster and gasket. Tap out the pump discharge needle. Attach a ^{5}/ie in. six-point socket to a six-inch extension and pry the pump inlet ball retainer and check ball from the bottom of the pump cylinder well.

8. Remove the primary metering rod jets from the pump side of the carburetor. Re move the secondary main jets but do not mix them as their orifices are not the same size. Check the low speed jets to see that they are angled slightly on installation. The antipercolator plugs and bushings and main discharge nozzles are a press fit and should not be removed.

9. Separate the throttle flange and carburetor body. Remove the idle-mixture screws and springs, throttle-lever adjusting screw, washer, and spring. Remove the fast-idle cam assembly and lockout arm. Remove the primary/secondary throttle valve connector rod. Back out the primary throttle shaft screw and washer and remove the throttle levers. Dislodge the secondary throttle return spring. Remove the primary and secondary-throttle valves and shafts. It will be necessary to file the staked ends of the throttle valve securing screws before they can be removed. Remove the choke housing and baffle.

10. Clean and inspect the disassembled components. Use a carburetor cleaning solution to wash everything but the coil housing assembly and pump plunger. Clean the choke housing assembly in gasoline. Reassembly is the reverse of this procedure.

Carter AFB Carburetor

The Carter AFB (aluminum four-barrel) carburetor is a high performance option found on the 327 cubic inch Corvette engine from 1963-1965. It is a four-throat downdraft type and offers improved flow rates over the standard carburetor. A clean air system reduces contamination of the choke vacuum circuit and linkage, and subsequent malfunctioning.

IDLE SPEED AND MIXTURE ADJUSTMENT

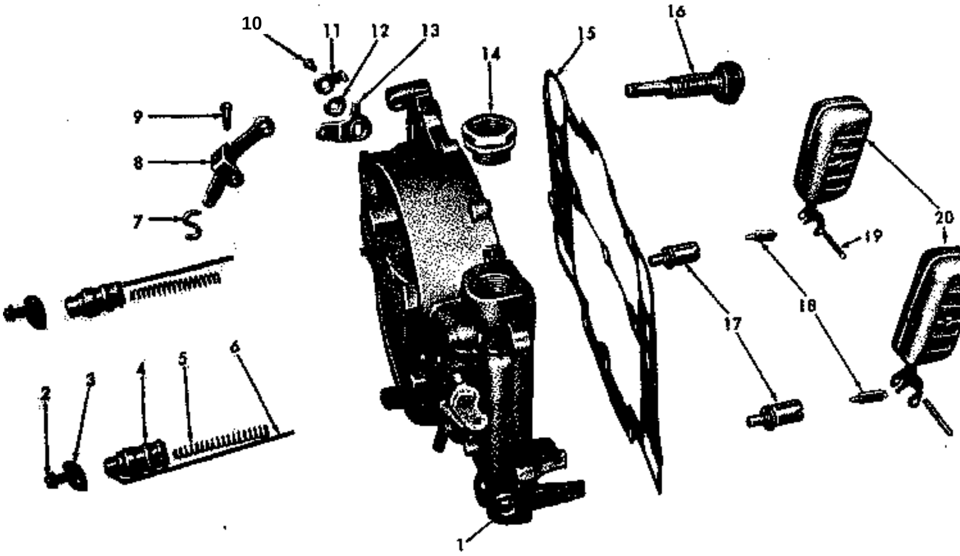
Idle speed and mixture are adjusted with the engine thoroughly warmed and idling and with the aid of a tachometer and vacuum gauge attached to the engine. With the choke fully off, adjust the idle-speed adjustment screw to give 475 rpm (450 for automatic transmission models in Drive). Adjust each idle-mixture screw until peak steady vacuum is achieved at the specified rpm.

AUTOMATIC CHOKE ADJUSTMENT

The automatic choke is correctly adjusted when the scribe mark on the coil housing is aligned with the center notch in the choke housing for Powerglide models and one notch lean with synchromesh.

FLOAT ADJUSTMENTS

Remove the metering rods and the bowl cover. Align the float by sighting down its side

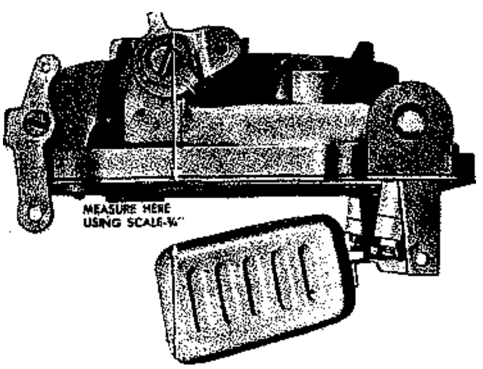


1. Bowl cover assembly
2. Screw
3. Piston cover plate
4. Power piston
5. Spring
6. Metering rod
7. Pump link
8. Pump lever
9. Pump lever pivot screw
10. Screw
11. Choke shaft outer lever
12. Washer (spacer)
13. Choke shaft kick lever
14. Fuel inlet fitting
15. Cover gasket
16. Pump plunger assembly
17. Float needle seat
18. Float needle
19. Float hinge
20. Float

AFB bowl cover parts

to determine if it is parallel with the outer edge of the air horn. Bend to adjust. The float level is adjusted with the air horn inverted and the air horn gasket in place. Clearance between each float (at the outer end) and the air horn gasket should be 5/ie in. Bend to adjust.

The float drop is adjusted by holding the air horn in the upright position and bending the float arm until the vertical distance from the air horn gasket to the outer end of each float measures % in.



AFB float drop adjustment

INTERMEDIATE CHOKE ROD ADJUSTMENT

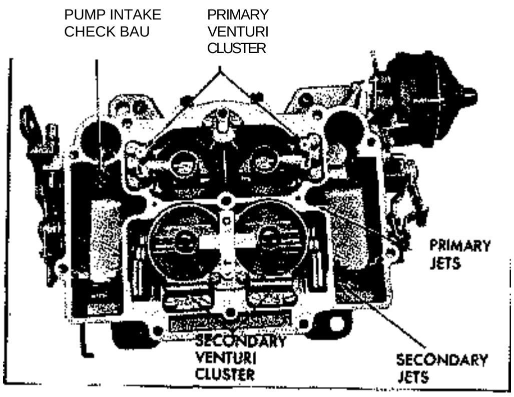
The intermediate choke rod adjustment begins with the removal of the choke coil housing assembly, gasket and baffle plate. Position a 0.026 in. wire gauge between the bottom of the slot in the piston and the top of the slot in the choke piston housing. Close the choke piston against the gauge and secure it with a rubber band. Now bend the intermediate choke rod so that the distance between the top edge of the choke valve and the air horn divider measures 0.070 in.

ACCELERATOR PUMP ADJUSTMENT

The first step in adjusting the accelerator pump is to push aside the fast-idle cam and seat the throttle valves firmly. Bend the pump rod at the lower angle to obtain a Vk in. measurement between the air horn and the top of the plunger shaft.

UNLOADER, CLOSING SHOE, AND SECONDARY THROTTLE ADJUSTMENT

To adjust the unloader, hold the throttle wide open and bend the unloader tang to obtain a 3/ie in. clearance between the upper edge of the choke valve and inner wall of the air horn.



AFB main body components

Clearance between the positive closing shoes on the primary and secondary throttle valves is checked with the valves closed. Bend the secondary closing as required to obtain a clearance of 0.20 in.

The secondary throttle opening is governed by the pick-up lever on the primary throttle shaft. It has two points of contact with the loose lever on the primary shaft. If the contact points do not simultaneously engage, bend the pick-up lever to obtain proper engagement. The primary and secondary throttle valve opening must be synchronized.

DISASSEMBLY AND ASSEMBLY

1. Remove the pump rod and intermedi ate choke rod. Remove the outer lever and washer from the choke staft, then remove the inner lever and fast-idle rod as an assembly. Remove the step-up position cover plates, piston, and step-up rod and spring. Lightly tap the fuel inlet fitting. Before removing it, remove its gasket and strainer then carefully lift the top cover to protect the floats and pump plunger from damage.
2. Remove the float lever pins, floats, float needles, seats, and gaskets. Keep separate to avoid unnecessary adjustment. Remove the pump plunger lever, S link, plunger, and cover gasket.
3. Do not remove the choke valve and shaft(s) unless there is obvious shaft binding or damage to the valve.
4. Remove the accelerator-pump lower spring and, after checking the fuel for con tamination, drain the bowl. Sweep a magnet around the bottom of the bowl while fuel is still present to capture iron oxide dust or metal particles which may damage the needle seats. Water contamination will appear as milky globules at the bottom of the fuel bowl.
5. Remove the choke housing cover, gas ket, and baffle. Remove the O-ring seal from the vacuum opening in the mounting boss. Remove the choke piston, levers, pump clus ter and gasket, and pump discharge needle. Remove the venturi cluster. The venturi as semblies are dissimilar and cannot be assem bled in the wrong location. Primary venturi gaskets differ from secondary.
6. Remove the secondary auxiliary valves, idle-mixture screws and springs, and all four metering jets. Metering rods are used in the primary metering jets and these jets are visi bly larger than their secondary counterparts. Remove the pump intake check valve and seat assembly.
7. Wash all parts except the choke coil housing and the pump plunger in carburetor cleaning solution. Clean the choke housing in gasoline.
8. Reassembly is the reversal of this pro cedure.

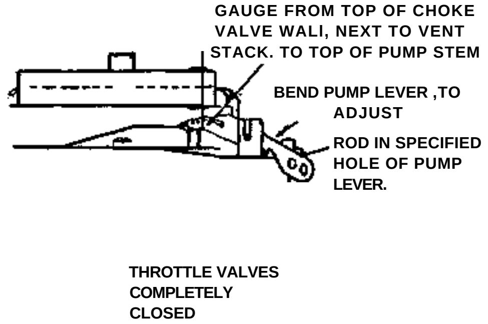
Rochester 4MC, 4MV, M4MC, and E4ME Carburetors

The Rochester Quadrajet® carburetor is a two stage, four-barrel downdraft carburetor. The designation MC or MV refers to the type of choke system the carburetor is designed for. The MV model is equipped with a manifold mounted thermostatic choke coil. The MC model has a choke housing and coil mounted on the side of the float bowl.

The primary side of the carburetor is equipped with 1% in. diameter bores and a triple venturi with plain tube nozzles. During off idle and part throttle operation, the fuel is metered through tapered metering rods operating in specially designed jets positioned by a manifold vacuum responsive piston.

The secondary side of the carburetor contains two 2?4 in. bores. An air valve is used on the secondary side for metering control and supplements the primary bores.

The secondary valve operates tapered metering rods which regulate the fuel in constant proportion to the air being supplied. E4ME carburetors are used only on 1980— 81 engines equipped with computer controlled emissions systems. NOTE: *E4ME carburetors should be serviced only by professional service technicians.*



Quadrajet® accelerator pump adjustment (except E4ME's)

ACCELERATOR PUMP ADJUSTMENT

1. Close the primary throttle valves by backing out the slow idle screw and making sure that the fast idle cam follower is off the steps of the fast idle cam.
2. Bend the secondary throttle closing tang away from the primary throttle lever.
3. With the pump in the appropriate hole in the pump lever, measure from the top of the choke valve wall to the top of the pump stem.
4. To adjust, bend the pump lever while supporting it with a screwdriver.
5. After adjusting, readjust the secondary throttle tang and the slow idle screw.

IDLE VENT ADJUSTMENT

Remove the idle vent valve cover from the air horn, if so equipped. Close the vent valve and open the primary throttle until the vent valve arm touches the bi-metallic strip next to the valve. Measure the distance between the top of the choke valve wall and the top of the pump stem. Bend to adjust.

FLOAT LEVEL ADJUSTMENT

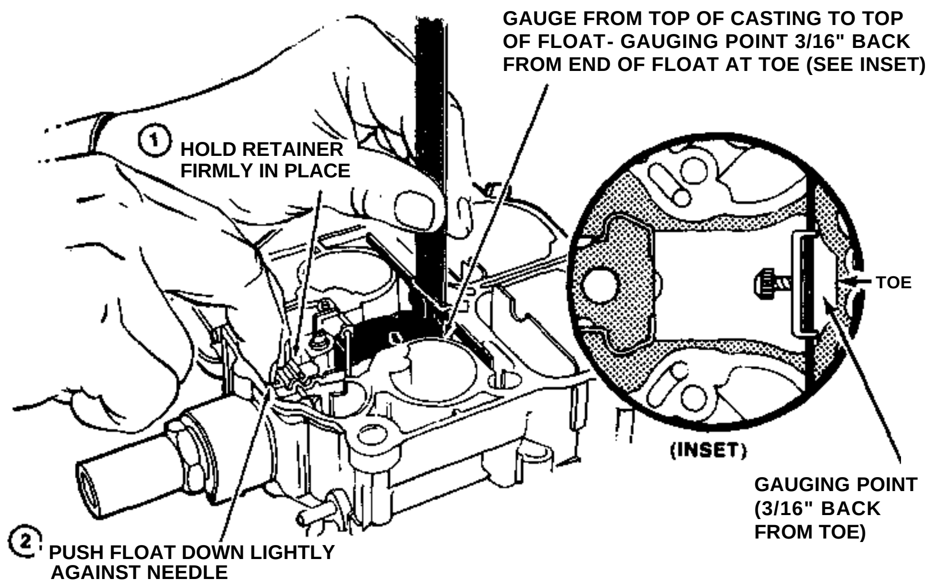
Remove the top cover and gasket, and use an adjustable T-scale to measure the distance from the top of the float bowl gasket surface to the top of the float at a point ^{3}/ie in. back from the toe of the float. While gauging the clearance, push down on the float retainer and press lightly on the float tab to seat the float needle. Bend the float tang to specifications.

FAST IDLE ADJUSTMENT

Close the primary throttles and position the cam follower above the high step of the fast-idle cam. Turn the fast-idle screw clockwise until it touches the lever then turn it down three full turns. Readjust the last idle rpm with the engine cold and running (choke closed).

CHOICE ROD *ADJUSTMENT*

NOTE: *This procedure applies only to models having the choke thermostat mounted on the intake manifold.*



Quadrajet® float level adjustment

5 WAYS TO IMPROVE FUEL ECONOMY

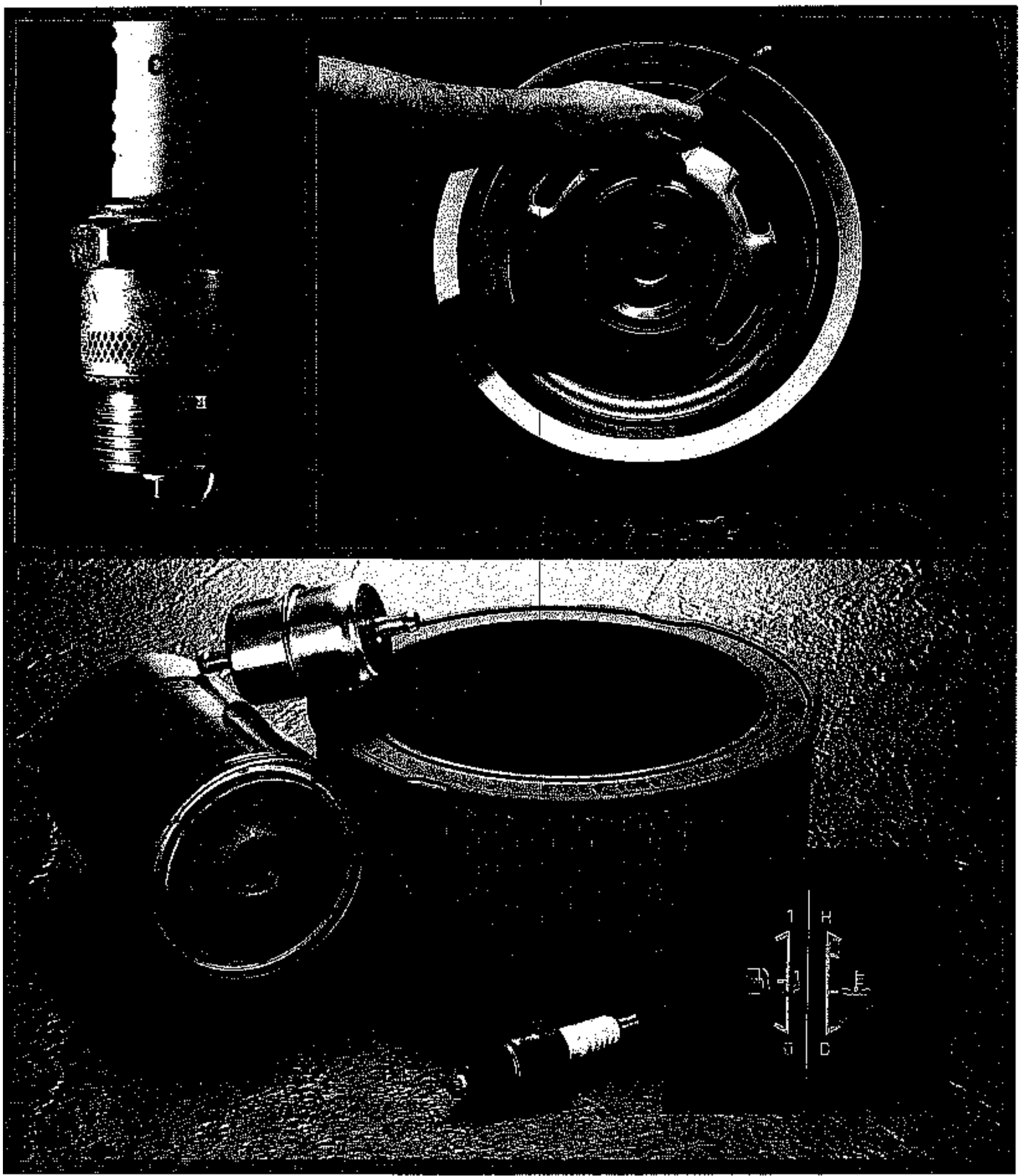
FUEL ECONOMY & TUNE-UP TIPS

CHILTON'S

Tune-up • Spark Plug Diagnosis * Emission Controls

Fuel System « Cooling System * Tires and Wheels

General Maintenance



CHILTON'S FUEL ECONOMY & TUNE-UP TIPS

Fuel economy is important to everyone, no matter what kind of vehicle you drive. The maintenance-minded motorist can save both money and fuel using these tips and the periodic maintenance and tune-up procedures in this Repair and Tune-Up Guide.

There are more than 130,000,000 cars and trucks registered for private use in the United States. Each travels an average of 10-12,000 miles per year, and, and in total they consume close to 70 billion gallons of fuel each year. This represents nearly $^2/3$ of the oil imported by the United States each year. The Federal government's goal is to reduce consumption 10% by 1985. A variety of methods are either already in use or under serious consideration, and they all affect you driving and the cars you will drive. In addition to "down-sizing", the auto industry is using or investigating the use of electronic fuel delivery, electronic engine controls and alternative engines for use in smaller and lighter vehicles, among other alternatives to meet the federally mandated Corporate Average Fuel Economy (CAFE) of 27.5 mpg by 1985. The government, for its part, is considering rationing, mandatory driving curtailments and tax increases on motor vehicle fuel in an effort to reduce consumption. The government's goal of a 10% reduction could be realized — and further government regulation avoided — if every private vehicle could use just 1 less gallon of fuel per week.

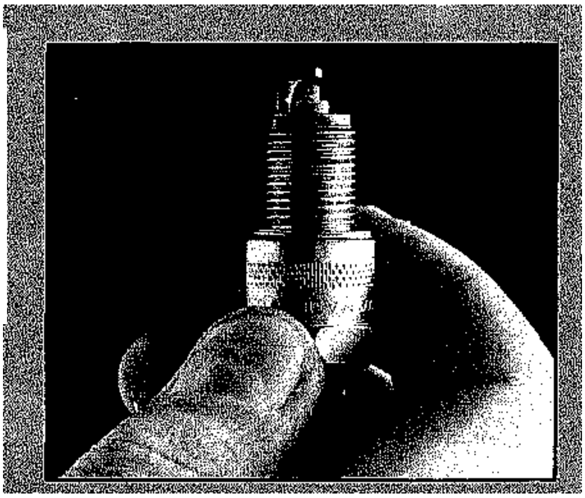
How Much Can You Save?

Tests have proven that almost anyone can make at least a 10% reduction in fuel consumption through regular maintenance and tune-ups. When a major manufacturer of spark plugs sur-

1. Checls--tjief cylinder, compression to; be, sure the'enginewill really benefit;frqrn atune^up; and ;that; it i§'capable; of producing good fuel ecoriornyA,tune-U'p vyill.be wasted on an engine in ROflrmechanical.conclitiqn:, j, , ; , ^ ., 2l 'Replace spark pjugs regularly; New spark plugs;alone'cah increase; fuel; economy 3%.. , 3; Secure the.sparV-pJugs are, the .correct type (heat rajige) ifqr xoiir vehicle. See the Tune-Up Spfecjfications. ,yH , v; , „'',•";•"'< -

conduct heaf away from.the.flring end! It must conduct the" heat away jri an. even pattern to avoid becoming^ spiirce of pre-ignition,yet it must,also operate'hot ejiough to burn off cbn-ductiye,dep'psjtS'that could cause.jriisfiring. ,' Th6 heat range is usually indicated by a nun> ber oh; the, sparlt plug, ipart of the mahufactur: er's designation 'for ;,each individual .spark plug. The'-nuiTibers in (aold-facie indicate the, heat, rahge in each manufacturer's, identif if. cation system., , ; ',;, •'' "-V^;/'-'•••''' ' ' " '

Manufacturer	• Designation
,AG,,'"v, ',- •,;-'•' •,*•' v	,R,,45TS,
\rvK».,io . - • • -	
Bosch (old);; /;<:;;',;,WA	14s;T3d. \ .
Bosch (new);_,";,'-'-'/,;•._-'.	**HR,8^',,'~•',"•" ,"••'**
'CnartipioVV.^c".- - v'.ftBb	15^Y-:;,-;;; '," .;'•
MotprpraftV.t'/,'i>;.-;/;.^BpR42	•';':'- ^
Nipppp,densp :, ^v, . ;W	1.6 EP •, ,, , ,
Prestbjife'uv;'";'-^';	**14GFIS2A/'-;** ;'



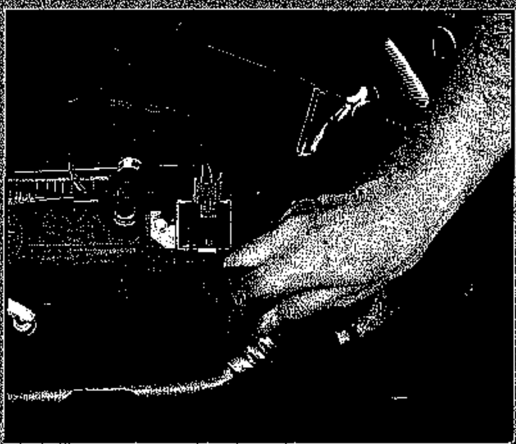
Periodically^ offeck the-spark plugs to be -sure *they <are firing efficiently.'They are excellent indicators of ,-the internal corfdition'of your engine.* , ,;,

, On AC, Bo.sch' (new), Champion, Fram/ Autolite, Mopar, Moto,rcraft: and Prestolite, ,av higher nurpber indicates a hotter plug. On Bosch (old),., NGK arid Nipppndenso, a higher number indicates a colder[1] pl.ugi , 4: Make sure the spark plugs are properly gapped. See,the Tune-Up Specifications ,in this ;'book., •' '.\ , ', '! : :]" ',\ •'-.. '; -'';,'

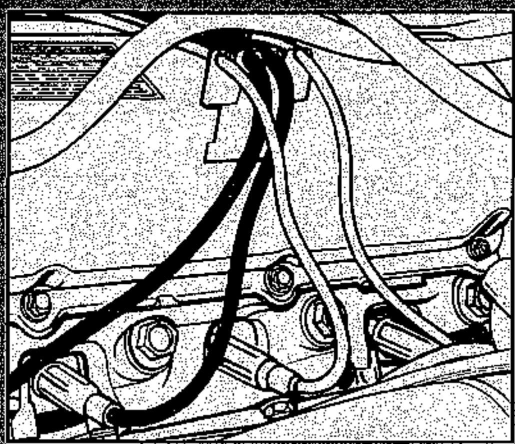
t , 5.;Be sure,the spark"plugs are,firing'efficiently. The Illustrations on.tlie, next 2 pages; - show you ,'h'pw, to, "read", trie firing end of the ••'sparkplugi . " 7', v ..',,": ,'• / •, ; • 6. Check trie ignition timing \and, set it to . specifications. Tests,shpw!fhat;almost all cars have incorrect ignition timing .by more than *2°.,,* veyed over 6,000 cars nationwide, they found that a tune-up, on cars that needed one, increased fuel economy over 11%. Replacing worn plugs alone, accounted for a 3% increase. The same test also revealed that 8 out of every 10 vehicles will have some maintenance deficiency that will directly affect fuel economy, emissions or performance. Most of this mileage-robbing neglect could be 'prevented with regular maintenance.

Modern engines require that all of the functioning systems operate properly for maximum efficiency. A malfunction anywhere wastes fuel. You can keep your vehicle running as efficiently and economically as possible, by being aware of your vehicle's operating and performance characteristics. If your vehicle suddenly develops performance or fuel economy problems it could be due to one or more of the following:

PROBLEM	POSSIBLE CAUSE
Engine Idles Rough	Ignition timing, idle mixture, vacuum leak or something amiss in the emission control system.
Hesitates on Acceleration	Dirty carburetor or fuel filter, improper accelerator pump setting, ignition timing or fouled spark plugs.
Starts Hard or Fails to Start	Worn spark plugs, improperly set automatic choke, ice (or water) in fuel system.
Stalls Frequently	Automatic choke improperly adjusted and possible dirty air filter or fuel filter.
Performs Sluggishly	Worn spark plugs, dirty fuel or air filter, ignition timing or automatic choke out of adjustment.



Check spark plug wires on conventional point-type ignition for cracks by bending them in a loop around your finger.



Be sure that spark plug wires leading to adjacent cylinders do not run too close together. (Photo courtesy Champion Spark Plug Co.)

7. If your vehicle does not have electronic ignition, check the points, rotor and cap as specified.

8. Check >the spark plug wire^>jusedl' wjth^'^ytfpftvplt conventional .point-type ignition.s)«<for cracks v/-lil^1l^iChec»lhq;'di and. burned or broken i insulation,.by faendirig^LVFVac'uumJadvan

wires decrease fuel efficiency by failing to deliver full voltage to the spark plugs. One misfir

9. Check the/outing ofte plug

inn nan he,the rfiRiilt nf snark'.rilKn

adjacent cylinders running parallel to each other and too close together. One wire tends to pick up voltage from the other causing it to fire "out of time".

10. Check all electrical and ignition circuits [illegible] voltage drop and resistance.

[illegible] distributor mechanical and/or [illegible] mechanisms for proper function. [illegible] vacuum advance can be checked by twisting the distributor plate in the opposite direction of rotation. It should spring back when

[illegible] should be slightly loose rather than too tight.

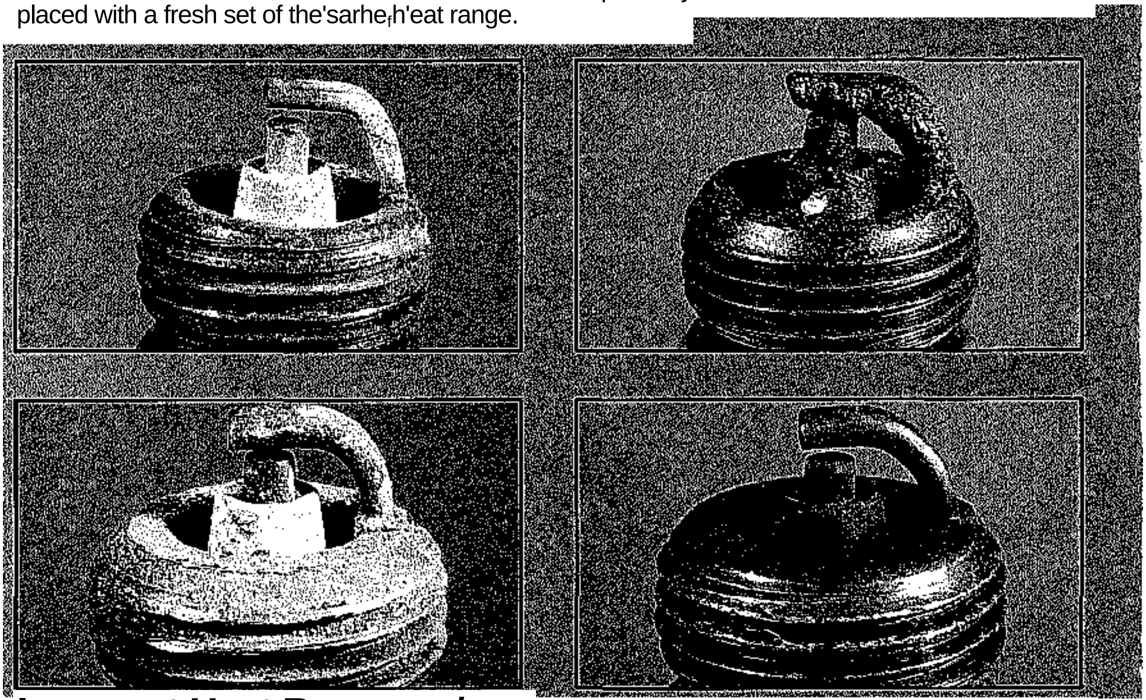
SPARK PLUG DIAGNOSIS

Normal ' - , V '? , , , " -,\ V

APPEARANCE: This plug is typical of one'oper- ,, ating normally.' The insulator nose varies froraa > light tan<to grayish cplor yvitri, slight, electrbde" ? wear. The presence of .slight deposife is normal, on used plugs and will' have" ho, adverse'effect on engine performance.-The spark; pltig^heat range is correct Jorth^engine'and trie ,engine)s , •' running normally., ' ' -< ',,'^'ji,'" >„ ''*" "
CAUSE: Propdrly running engiria'"^" A/', ' - ,,
RECOMMENDATIpN: Before, reinstalling '.this , plug, the electrodes, shpuld;be cleaned and filejd square: Set the gap tp sp'e'cif ications. I;f the plug , has been in service^for,mor'e tharii'10r'i2^000, " miles, trje entire set'should pfoi^ably/be^rje- *_ placed with a fresh set of the'sarhe h'eat range.

Oil Deposits ^ \' ^ ,'v

, APPEARANCE: Trie firing end of;the/plug\is .covered with a-wet,oijy*cbating., ^' '^' j.')"
vcXuSE:T,he,problem is ppo^oii cbntrpl.'On high • mileage enginps, oil is, leaking past'the^ings or valve guides irrto, thejcombustion-'chamber. A , common cause is.also^a plugged PCV'valve,, , .and a ruptured, fuel pump diaphragrri, cap 'also cause this condition. C3il fouled plugsvsuch as •these are,often found,in'new?pr,recent.ly,(over-hauled; engines,, before normal oi| control is (.achieved, and can'be cleaned and reinst^lied.^
,<R*ECqMMeNDATION:'A,hotter spark plug'may temporarily relieve the problem*, but Jhe engine improbably irf need of work.



Incorrect Heat Range :/

APPEARANCE: Thp'effects of h^gfi terhpefature; on a spark.plug are indicated by«,clean white,'- often blistered, tabulator; This pa'n also be accompanied by excessiye wear pf tHe'JBlect^ode, and the absence of deposits. ,' k/\'<"" V1' > j t
CAUSE: Check fof the, correct*'spark''rjjug,heat', range: A plug which is too,hot fpr/fhe,engine. can result in overheating: A car pp'erated'mpstly at high speeds can require a;colde(plug: Arsd^ check ignition timing, coolipg^syslem level, fuel-, mixture and leaking intake manrjplcl.>; > "•' ';;,',
RECOMMENDATIO'Nilf'all jgnitioh ,and engine, adjustments are kriowp'to^e'correct^'arid no ,other; malfunctipp' exists; install ''sparfc plugs one-heat range colder.'" ,••* V t"V->;> • '>'"v

Photos Courtesy'Fram Corporation, ,' >'''• ' (^^,

Carbon Deposits v

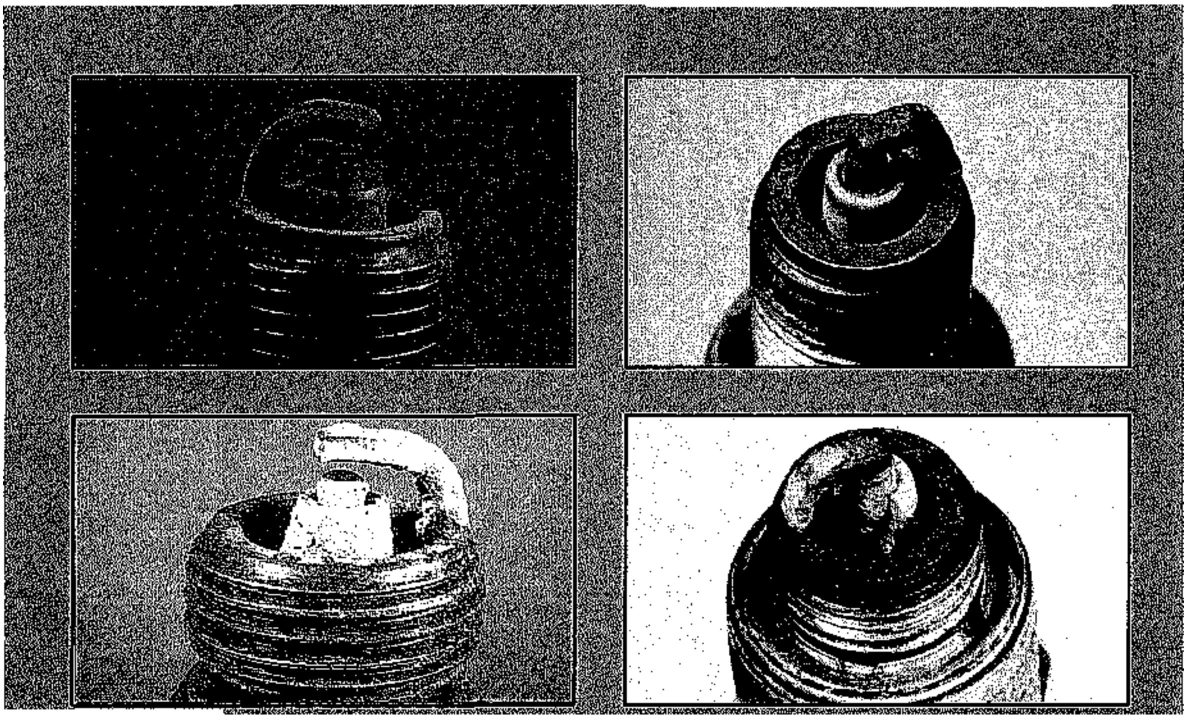
(;'APPEXRANCE: Carboh^oulipg'Is easily.'ideriti-'fied by.trie.prdsence of dryj'soft/black, ^obty •'deposits.. -t , , './sV", i ^'j"1,'
CAUSE:' Changing th<r heat' range'cart'often' •lea'd to carbon fouling, fis-can prolonged,! slow; > 'Stoi3-an'd-start;drivirigi'lri:he heat rangejs/cpr^ ~ rept,'-carbon fciuTirig carijbe"attributed;to a.rich fuel'mixture, sticking^ cKbke, clogged' air. ^blearier, w/qrn" breaker p'omts, ,relarded'!|mihg 'or-, « low,compress)onMf only, on,e dr twd**pluigs 'are , carbon; fouled, check for'corroded Wfc'r^c'ked wiVesdfithe,affected'plugs.,Als6'Iopllfpf',pracks' "m']the distributor cap .between'ihe towers',^of ; affepted cylinders'." '/ -, >i "^5'^'^'
;RECOMMpNiDATldNrAfternhe .prbblerrys por-' rected/tfies&'plugs^can^be

' stalled it not worn severely.

APPEARANCE:; Spark plugs fouled, by <MMT (Methycyclppentadlenyl[1] JMaganeseTrlcarbonyl) ^kve reddish, rusty appearance on the insulator ...and'sidefelectrode, " , CAUSE: MMTjs.an anti-knock additive in gaso-line^ used *ip* replace lead. During the combus-tidn process, the M MT leaves a reddish deposit *,on* the Insulator and side electrode., RECqMMENpAtlQN:«No engine malfunction is Indicated,and the deposits will not,affect plug . performance any, more thanlead, deposits (see /\sn Deposits), MJMj! fouled pl(jgs,can'be .Gleaned^egappedand-reinstalled:','•' ',

High Speed Glazing ;

APPEARANCE: Glazing appears as shiny<coat" ing *on* the plug, either yellow 'or tan In color.";
CAUSE: During hard, fast- acceleration, -plug temperatures rise suddenly. Deposits from nor mal combustion have no ctiance Jo fluff-off; li> i stead, they, melt on the insulator, forming .£(h electrically conductive coating wh,ich ;causes -misfiring. -, , ', * ', ^ "^ '- ' , ,
RECOMMENDATION: Glazed p'l'ugsare nbte^s ily; cleaned, ,-th^y' should b,e .-replaced '-.With'^a fresh"set of plugs of'the correct riealrarigeSlf the co'nciitiqh^recurs, using.'plug's with!a',heat' range one step colder may, bure/the problem:"',



; Ash (Lead) Deposits

. , APPEARANCE: Ash deposits are characterized, '- by,» ifght brown-or.white'colored deposits ,/crusted^qn', the-side "or .center/electrodes.. In some cases it may'giye the pluga rusty appear- ";arj6a" y'' ' ' '" % ' ' • / • ,'
CAUSEfAsh deposits'are normally derived from 'oil, or fuel additives burned during normal com-oustion. Nprmally they are harmless, though ' • .expessive amolints cafi cause misfiring. If de-' posits *arte* pxcesslye in short mileage, the valve 'guides may toe wprhi^'
• REC'olv|MENDAf ION: Ash-fouierfplugs.can be '.clea^^d/pappedand'reinstalled. .;^ "

Photos Courtesy Champion Sp^rk Plug Co.

'*' '• * '' ' ' ^ ''^ '

Detonation

APPEARANCE: Detonation'is usual ly/crjafeqj ' te,rized ,by'a brpken plug insulator.. ,>, ,•• .f-,ff J'
• CAUSE: A portion of the fueLcharge.w'ill, begin> to,burn spontaneously, from the increased jieaf-following, ignition. The explosion that, rpsulis-.applies, extreme pressureio engine/compo nents, frequently -damaging spark plugs/and , pistons.[1] ' , ' - , " ' ', \ >,
- ' Detonation can result by dyer-advan,ced igni-' tiori timing,- inferior gasoline (low octane) lean air/fueL mixture,, poor carburetion, e.hgine, lug ging or an in'crease in compressiiori ratio due^o ' combustion chamber deposits or engine modi- „ fication. - ; .,', , , ' ! - ' '«VJ' ;
, RECOMMENDATION: Replace'[1] the, plugs?after[1]' correcting the problem.- , ' ~ '\ \; ; •

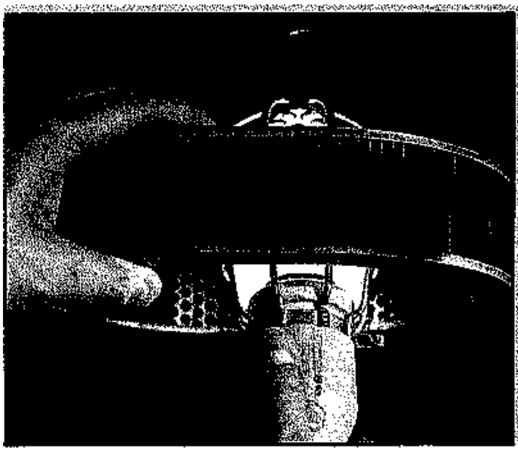
EMISSION CONTROLS

13. Be aware of the general condition of the emission control system: It contributes to reduced pollution and should be serviced regularly to maintain efficient engine operation.

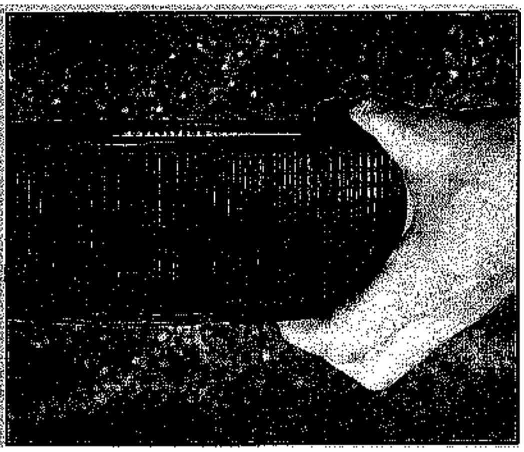
14. Check all vacuum lines for dried, cracked or brittle conditions. Something as simple as a leaking vacuum hose can cause poor performance and loss of economy.

15. Avoid tampering with the emission control system. Attempting to improve fuel econ-

FUEL SYSTEM



Check the air filter with a light behind it. If you can see light through the fitter it can be reused.



Extremely clogged filters should be discarded and replaced with a new one.

18. Replace the air filter regularly. A dirty air filter richens the air/fuel mixture and can increase fuel consumption as much as 10%. Tests show that 14 of all vehicles have air filters in need of replacement.

19. Replace the fuel filter at least as often as recommended.

20. Set the idle speed and carburetor mixture to specifications.

21. Check the automatic choke. A sticking or malfunctioning choke wastes gas.

22. During the summer months, adjust the automatic choke for a leaner mixture which will produce faster engine warm-ups.

COOLING SYSTEM

29. Be sure all accessory drive belts are in good condition. Check for cracks or wear.

30. Adjust all accessory drive belts to proper tension.

31. Check all hoses for swollen areas, worn spots, or loose clamps.

32. Check coolant level in the radiator or expansion tank.

33. Be sure the thermostat is [illegible] erly. A stuck thermostat delays [illegible] and a cold engine uses nearly twice as much fuel as a warm engine.

34. Drain and replace the engine coolant at least as often as recommended. Rust and scale

TIRES & WHEELS

38. Check the tire pressure often with a pencil type gauge. Tests by a major tire manufacturer show that 90% of all vehicles have at least 1 tire improperly inflated. Better mileage can be achieved by over-inflating tires, but never exceed the maximum inflation pressure on the side of the tire.

39. If possible, install radial tires. Radial tires deliver as much as 1/z mpg more than bias belted tires.

40. Avoid installing super-wide tires. They only create extra rolling resistance and decrease fuel mileage. Stick to the manufacturer's recommendations.

41. Have the wheels properly balanced.

omy by tampering with emission controls is more likely to worsen fuel economy than improve it. Emission control-changes oh modern engines are not readily reversible. 16. Clean (or replace) the EGR valve and lines as recommended.

17. Besure that all vacuum lines and hoses are reconnected properly after working under the hood. An unconnected or misrouted vacuum line can .wreak havoc with engine performance.

23. Check for fuel leaks at the carburetor, fuel pump, fuel lines and fuel tank. Be sure all lines and connections are tight.

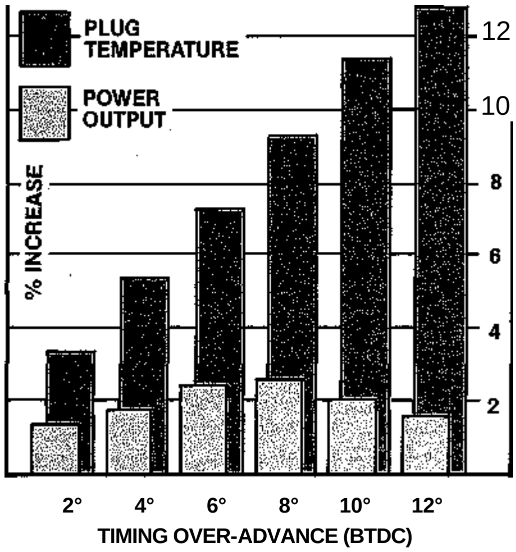
24. Periodically check the tightness ,of the carburetor and intake manifold attaching nuts and bolts. These are a common place for vacuum leaks to occur.

25. Clean the carburetor periodically and lubricate the linkage.

26. The condition of the tailpipe can be an excellent indicator of proper engine combustion. After a long drive at highway speeds, the inside of the tailpipe should be a light grey in color. Black or soot on the insides indicates an overly rich mixture.

27. Check the fuel pump pressure. The fuel pump may be supplying more fuel than the engine needs.

28. Use the proper grade of gasoline for your engine. Don't try to compensate for knocking or "pinging" by advancing the ignition timing. This practice will only increase plug temperature and the chances of detonation or pre-ignition with relatively little performance gain.



Increasing ignition timing past the specified setting results in a drastic increase in spark plug temperature with Increased chance of detonation orpreignition. Performance increase is considerably less. (Photo courtesy Champion Spark Plug Co.)

that form in the engine should be flushed out to allow the engine to operate at peak efficiency.

35. Clean the radiator of debris that can decrease cooling efficiency.

36. Install a flex-type or electric cooling fan if you don't have a clutch type fan. Flex fans use curved plastic blades to push more air at low speeds when more cooling is needed; at high speeds, the blades flatten out for less resistance. Electric fans only run when the engine temperature reaches a pre[illegible]

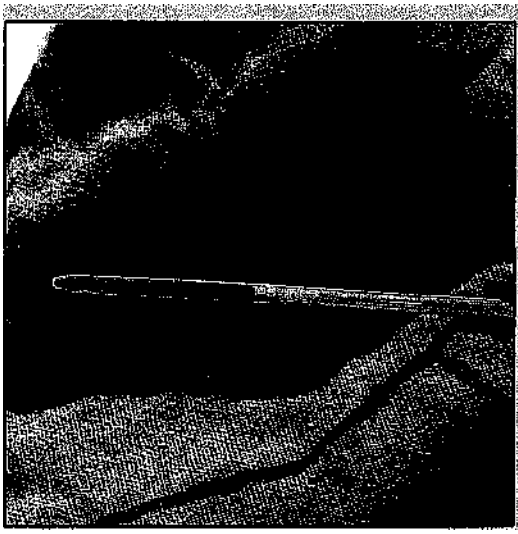
37. Check the radiat[illegible] cracked gasket. If the cap [illegible] the cooling system will not function properly.

42. Be sure the front end is correctly aligned. A misaligned front end actually has wheels going in differed directions. The increased drag can reduce fuel economy by .3 mpg.

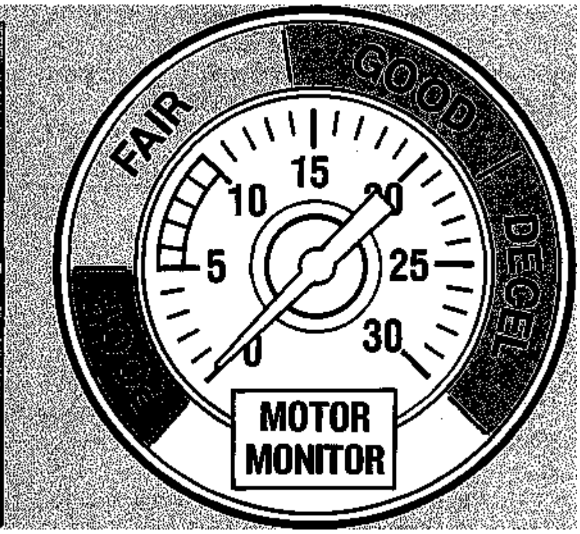
43. Correctly adjust the wheel bearings. Wheel bearings that are adjusted too tight increase rolling resistance.

Check tire pressures regularly with a reliable pocket type gauge. Be sure to check the pressure on a cold tire.

GENERAL MAINTENANCE



Check the fluid levels (particularly engine oil) on a regular basis. Be sure to check the oil for grit, water or other contamination.



A vacuum gauge is another excellent indicator of internal engine condition and can also be Installed in the dash as a mileage indicator.

44. Periodically check the fluid levels in the engine, power steering pump, master cylinder, automatic transmission and drive axle.

45. Change the oil at the recommended interval and change the filter at every oil change. Dirty .oil is thick and causes extra friction between moving parts, cutting efficiency and increasing wear. A worn engine requires more frequent tune-ups arid gets progressively worse fuel economy. In general, use the lightest viscosity oil for the driving conditions you will encounter.

46. Use the recommended viscosity fluids in the transmission and axle.

.47. Be sure the battery is fully charged for fast starts. A slow starting engine wastes fuel.

48. Be sure battery terminals are clean and tight.

49. Check the battery electrolyte level and add distilled water if necessary.

50. Check the exhaust 'system for crushed pipes, blockages and leaks.

51. Adjust the brakes. Dragging brakes or brakes that are not releasing create increased drag on the engine.

52. Install a vacuum gauge or miles-per-gallon gauge. These gauges visually indicate engine vacuum, in the intake manifold. High vacuum = good mileage and low vacuum = poorer mileage. The gauge can also be an excellent indicator of internal engine conditions.

53. Be sure the clutch is properly adjusted. A slipping clutch wastes fuel.

54. Check and periodically lubricate the heat control valve in the exhaust manifold. A sticking or inoperative valve prevents engine warm-up and wastes .gas.

55. Keep accurate records to check fuel economy over a period of time. A sudden drop in fuel economy may signal a need for tune-up or other maintenance.

Position the cam follower on the second step of the fast-idle cam, touching the high step. Close the choke valve and gauge the clearance between the lower edge of the valve and the body. Bend choke rod to obtain the specified clearance.

CHOKE *COIL LEVER ADJUSTMENT*

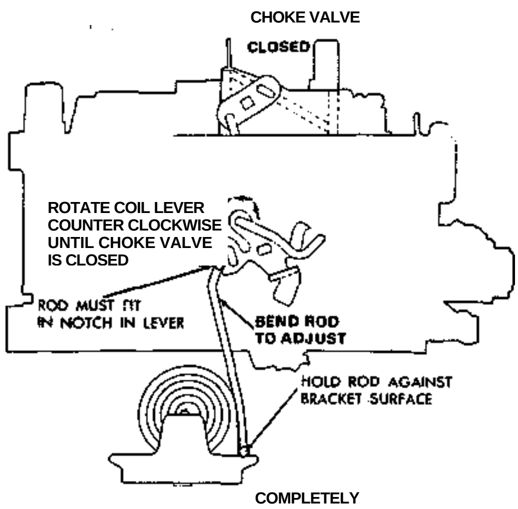
Refer to the accompanying illustration to perform this adjustment.

AIR VALVE ROD ADJUSTMENT

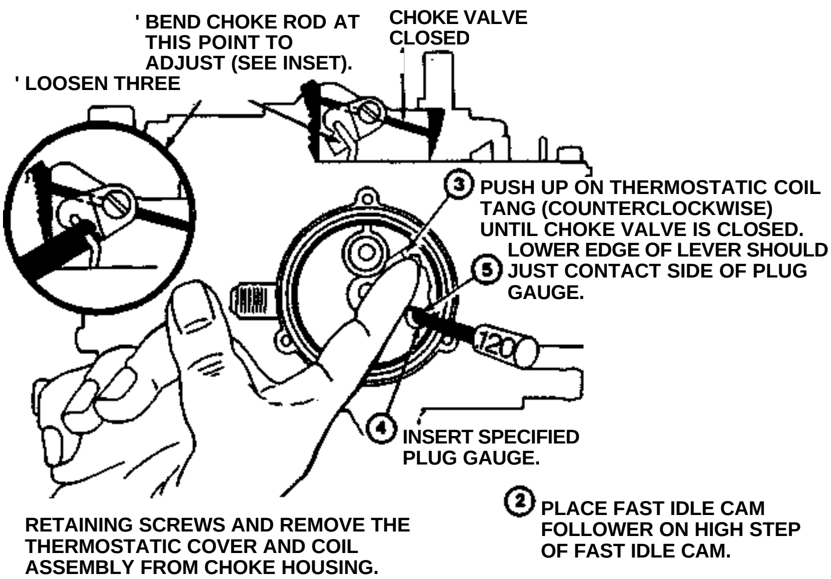
Refer to the accompanying illustration to perform this adjustment.

FRONT VACUUM BREAK ADJUSTMENT

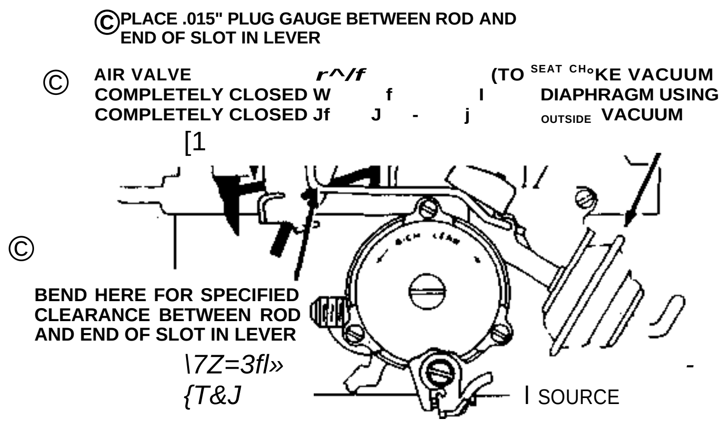
Refer to the accompanying illustrations to perform this adjustment.



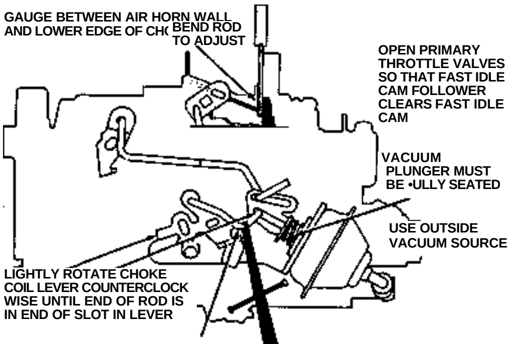
Quadrajet® choke rod adjustment



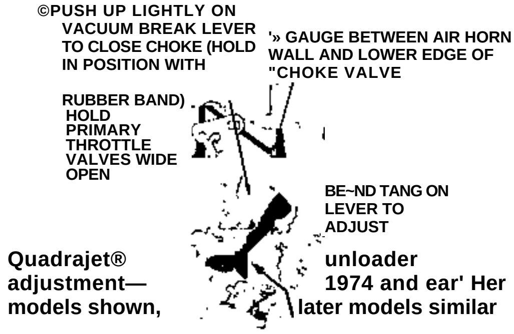
Quadrajet® choke coil lever adjustment



Quadrajet® air valve rod adjustment



Quadrajet[18] front vacuum break adjustment—early models without an adjusting screw



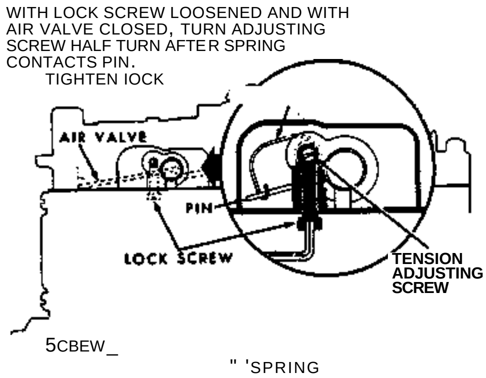
Quadrajet® unloader adjustment—1974 and ear' Her models shown, later models similar

CHOKE UNLOADER ADJUSTMENT

Close the choke valve and secure it with a rubber band hooked to the vacuum break lever. Open the primary throttles all the way. Then measure the distance between the air horn and edge of the choke butterfly. On models up to and including 1976, use the bottom side of the butterfly for this measurement; on 1977 and later models, use the top side. Bend the fast idle lever tang to achieve the proper opening of the choke.

AIR VALVE SPRING ADJUSTMENT

NOTE: *Loosening and tightening the locking screw to adjust the air valve spring re-*



Quadrajet® air valve spring adjustment

FIGURE 1.

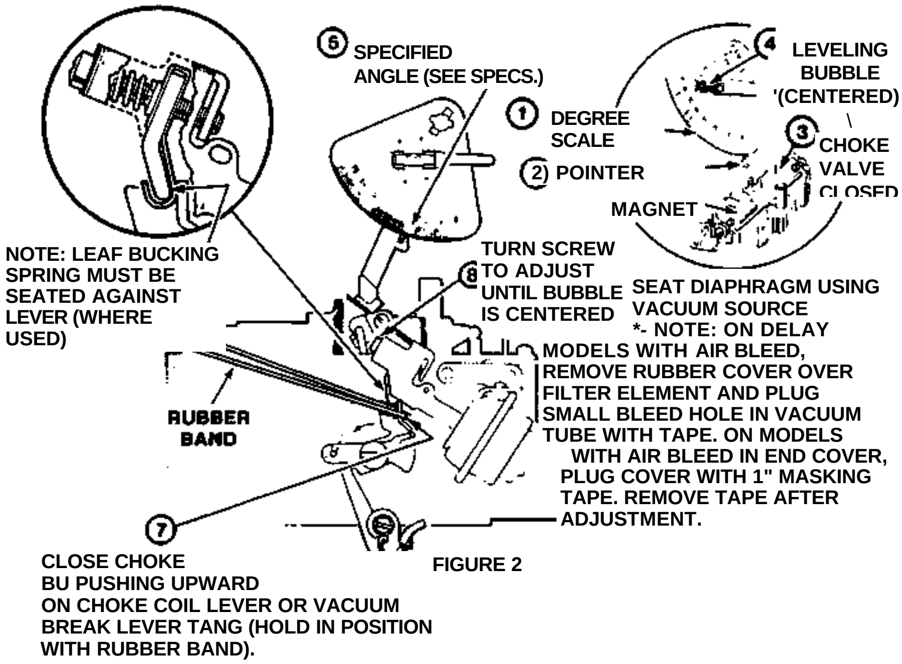


FIGURE 2

Quadrajet[81] front vacuum break adjustment—late models with an adjusting screw *quires a hex wrench on 1977 and later model carburetors.*

Remove all spring tension by loosening the locking screw and backing out the adjusting screw. Close the air valve and turn the adjusting screw in until the torsion spring touches the pin on the shaft, and then turn it the additional number of turns specified. Secure the locking screw.

DISASSEMBLY AND ASSEMBLY

NOTE: *Due to the many minor design changes in the Quadrajet®,* some steps may not apply to your carburetor. E4ME carburetors should be serviced only by qualified, professional technicians.

CAUTION: *NEVER immerse any plastic or rubber carburetor part in carburetor cleaner. Also, use extreme caution when handling the carburetor to prevent damaging the throttle shaft or valves.*

1. Remove the solenoid and bracket from the float bowl, if so equipped. Disconnect the upper choke rod and lever from the choke shaft (one screw). Rotate the lever to remove it from the rod. Remove the choke rod by holding the lower lever outward and twisting the rod counter-clockwise.

2. Remove the secondary metering rods and the hanger by removing the small screw from the hanger. Using a narrow drift punch, tap the accelerator pump lever pivot pin inward, just enough to release the lever. Grasp the lever and pump rod (together) and rotate to remove from the throttle linkage.

3. Remove the air horn-to-float bowl screws (nine).

NOTE: *Be sure to remove the two screws located within the primary venturi area.* You *may not notice these screws at first glance.*

Remove the air horn assembly by lifting it straight up, off of the float bowl.

CAUTION: *Use care to avoid damaging the small brass tubes protruding from the air horn—these tubes are permanently pressed into the air horn.*

4. Remove the vacuum line from the vacuum break unit. Remove the vacuum break assembly and disconnect the rod from the secondary air valve lever.

CAUTION: *Further disassembly of the air horn is not required. DO NOT remove any plugs which are located on the air horn.*

5. Remove the air horn gasket from the float bowl. Use care to withdraw the gasket from beneath the primary metering rod hanger. Remove tie accelerator pump plunger from the pump well.

6. Remove the power piston and metering rods by pushing downward on the piston and allowing the assembly to snap back (upward). This may have to be repeated several times to free the plastic power piston retainer ring.

CAUTION: *Do not pry or pull the power piston from the piston well.* Remove the power piston spring from the well.

7. Remove the plastic filler block from the float bowl. Remove the float, float retainer, and needle from the float bowl. Using a large, flat-bladed screwdriver, remove the needle seat and gasket.

8. Remove the plastic aneroid cavity insert from the float bowl. If desired, unscrew and remove the primary main metering jets from the float bowl.

CAUTION: *DO NOT attempt to remove the secondary main metering jets from the float bowl, as these jets are permanently fixed to the bowl.*

9. Remove the accelerator pump discharge ball and retainer (appears as a screw next to the pump well). Remove the secondary air baffle, if it is to be replaced.

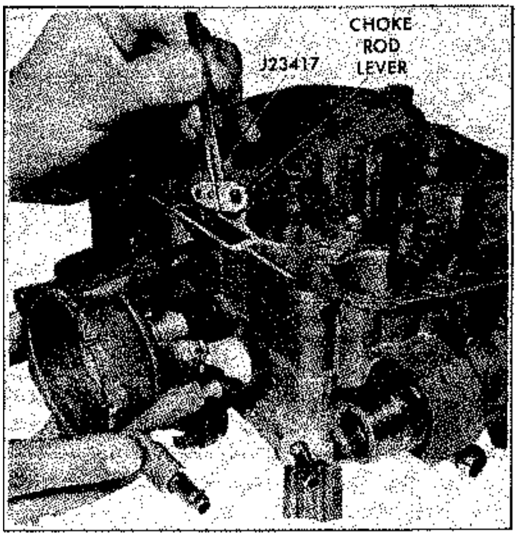
NOTE: *On models using an intake manifold mounted choke thermostat, disassembly of the choke mechanism is not required to clean the carburetor. On models using a hot air, carburetor mounted choke assembly, it is not necessary to disassemble the choke mechanism if you plan to spray carburetor cleaner on the carburetor passages only—if you plan to immerse the carburetor, follow the next two steps to remove the choke assembly from the float bowl.*

10. Remove the choke thermostat cover from the choke housing (three screws). Remove the choke housing retaining screw from inside the choke housing. Remove the complete choke housing assembly from the fuel bowl by sliding it outward.

11. Remove the secondary lock-out lever from the float bowl. Remove the lower choke lever from inside the float bowl by inverting the float bowl.

CAUTION: *Do not immerse the choke housing assembly in carburetor cleaner.*

12. Remove the fuel inlet nut, gasket, and filter. Remove the throttle body-to-fuel bowl screws then remove the throttle body assembly and the gasket.



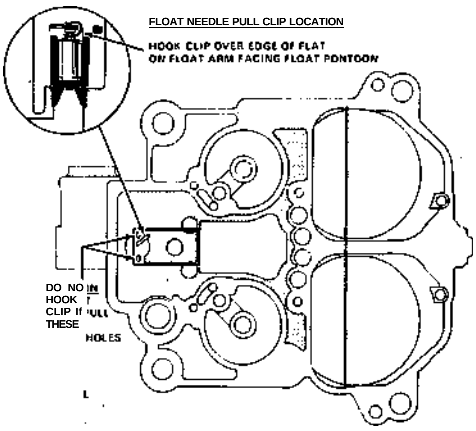
Installing the lower choke rod lever—Quadrajet® typical

Assembly is the reverse of the previous steps. Note the following points during assembly:

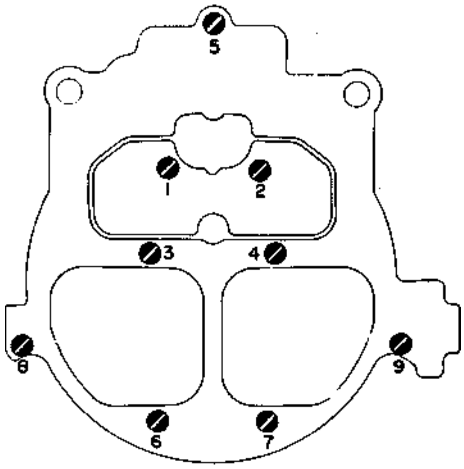
a. Install the lower choke rod lever as shown in the accompanying illustration.

b. When installing the float and needle, DO NOT put die needle clip into either of the float bracket holes. The clip must be installed as shown in the accompanying il lustration.

c. Install the plastic filler block BE FORE the metering rods and hanger. When installing the primary metering rods, make sure the rod tips are positioned in the primary jets, then lower the power pis ton. To seat the plastic power piston re tainer, evenly push it into the top of the piston bore with a small screwdriver.



Correct positioning of the float needle clip—DO NOT put the clip into either of the float bracket holes—Quadrajet®



Quadrajet® air horn screw torque sequence

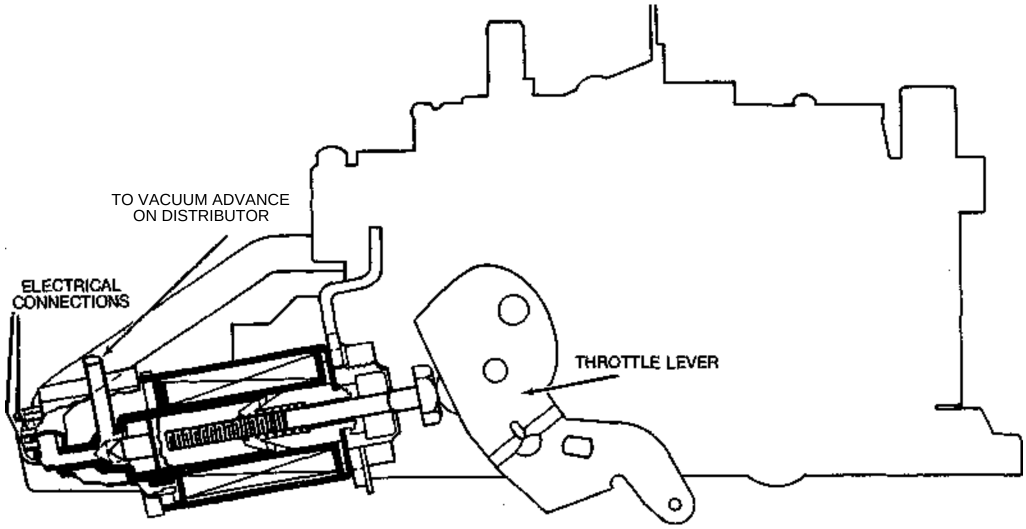
d. When installing the air horn assem bly, be sure to follow the accompanying torque sequence diagram for the air horn screws.

e. When installing die accelerator pump lever and rod, engage die lower end of the rod into the throttle linkage, and align the lever pivot hole with the pivot pin. Push die pin through by carefully prying it widi a screwdriver (between the pin and die choke plate wall).

C.E.C. *VALVE MAINTENANCE—1971 QUADRAJET ONLY*

The Rochester 4MV Quadrajet has a number of revisions for 1971 which include: calibration changes, greater capacity accelerator pump, increase in die size of the vacuum break diaphragm restriction to 0.020 in., a beefed-up, choke-closing assist spring, removal of die wide open kick lever from die choke unloader mechanism and its replacement widi a tang on die fast-idle lever diat contacts the fast-idle cam and forces the choke valve to admit more air under flooded engine conditions, and die adaption of a combination emission control valve (C.E.C. valve). This valve increases the idle speed during high gear overrun and helps to control normally unburned hydrocarbons. The mixture is set at the factory and die idle-mixture screws are capped to prevent adjustment in die field.

When disassembling die carburetor, remove die C.E.C. valve from die carburetor but leave the valve bracket attached to die carburetor. Do not immerse die C.E.C. valve in carburetor cleaner. Disassembly practices differ in die 1971 4MV due to calibration



Quadrajet CEC valve

changes. Of primary importance is the revised procedure for removing the power piston. Do not use pliers but press the piston down and release it. Do not remove the idle mixture screws.

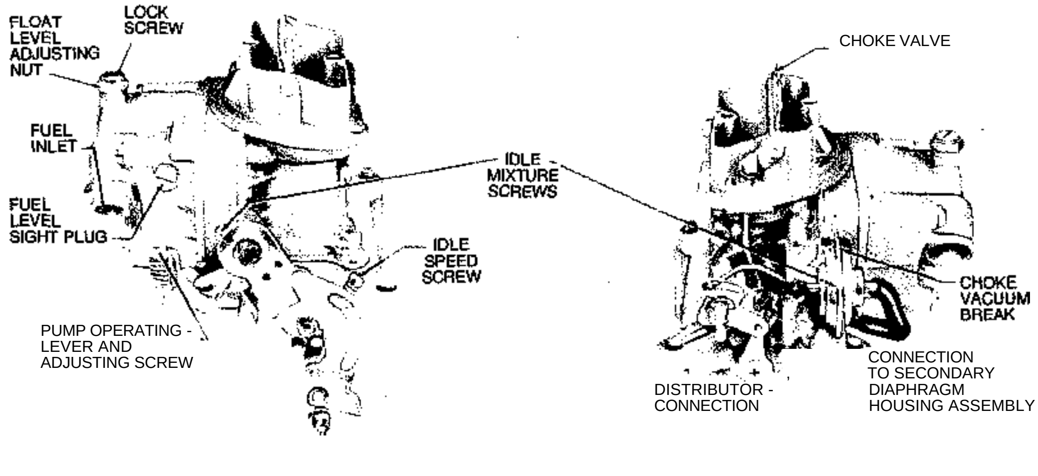
If it should be necessary to replace the idle-mixture adjustment screws, carefully bottom the old screws and count the turns so that the replacement screws will retain the same mixture.

If the throttle body is replaced it will be necessary to adjust the idle-mixture screws. Before making the adjustment, read and follow the instructions on the inner fender tune-up sticker on each 1971 and later Corvette. Lightly bottom the mixture screws and back out four turns. Set the idle-speed adjusting screw to obtain the specified initial idle speed, then make equal adjustments to the mixture screws until the required carbon monoxide level is reached in the exhaust gas. Adjust the idle-speed screw until the final idle setting is achieved. Install the idle-mixture screws' limiter caps and reconnect the distributor vacuum hose and the fuel tank vapor hose.

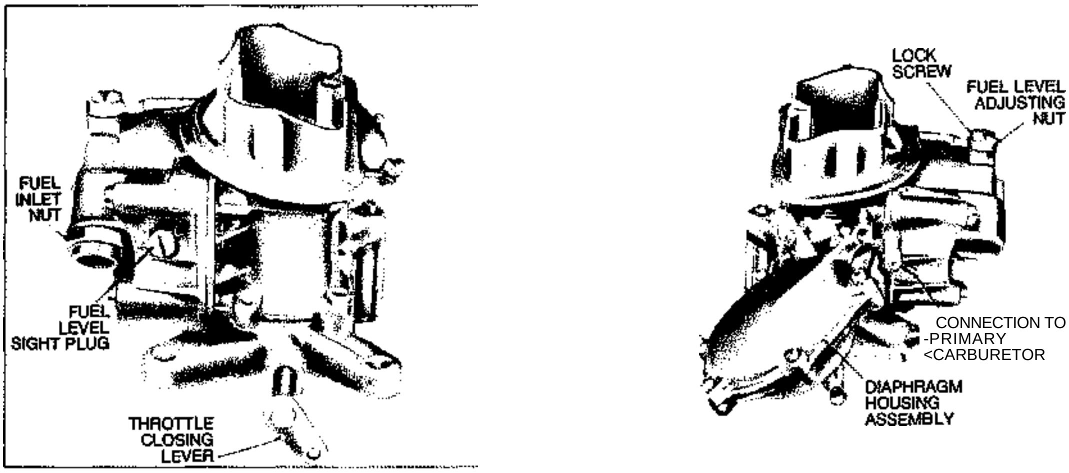
An alternate method is available if access to exhaust gas analyzing equipment is not practical. Follow the same procedure until the mixture adjustment stage. Adjust the mixture screws equally leaner until the final idle speed is achieved. Install the limiter cap, vacuum hose, and tank vapor hose.

Holley 2300 and 2300C Carburetors

The Holley 2300 and 2300C are used as the three, two-barrel high performance option on



Holley 2300C primary carburetor



Holley 2300 secondary carburetor

the 427 engine from 1967 through 1969. This configuration uses one 2300C as the primary carburetor and two 2300 models as the two secondary units. The two models differ in that the C model contains the choke, power, and accelerator pump systems while the straight 2300 does not. The C model is operated through conventional linkage while the two secondaries are vacuum actuated.

IDLE ADJUSTMENT

Adjust the idle-speed screw until it touches the throttle lever. Add one and *Yz* turns to obtain the preliminary adjustment.

Fast-idle adjustment on the primary carburetor is made as follows: crack the throttle, and with the choke closed, place the fast-idle lever against the top step of the fast-idle cam. Bend the fast-idle lever so that the specified opening of the throttle plate on the idle transfer slot of the carburetor is achieved.

FLOAT LEVEL ADJUSTMENT

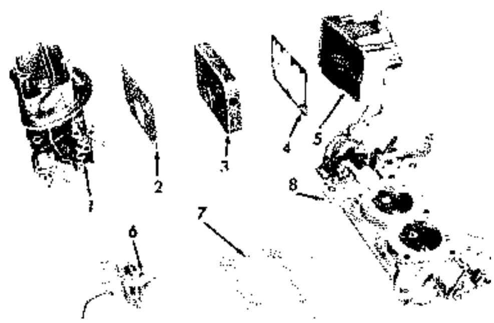
Position the car on a flat, level surface and start the engine. Remove the sight plugs and check to see that the fuel level reaches the bottom threads of the sight plug port. A plus or minus tolerance of Vaz in. is acceptable. To change the level, loosen the fuel inlet-needle locking screw and adjust the nut. Clockwise lowers the fuel level and counterclockwise raises it. Turn the nut Vie of a turn for each Vie in. desired change. Open the primary throttle slightly to assure a stabilized adjusting condition on the secondaries. There is no required float drop adjustment.

ACCELERATOR PUMP ADJUSTMENT-PRIMARY CARB

Secure the throttle plate fully open and depress the pump lever, fully. Gauge the distance between the pump lever arm and the spring adjusting nut. Turn the nut or screw to adjust. The slightest movement of the throttle lever will actuate the correctly adjusted pump lever.

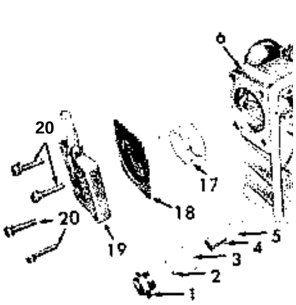
VACUUM BREAK ADJUSTMENT-PRIMARY CARB

Secure the choke valve closed and restrain the vacuum break against its stop. Bend the break rod to achieve the specified measurement between the lower edge of the choke valve and the body.



1. Carburetor body
2. Metering body gasket
3. Metering body
4. Fuel bowl gasket
5. Fuel bowl assembly
6. Vacuum break
7. Throttle body gasket
8. Throttle body

Primary carburetor components



1. Nut—fuel inlet
2. Gasket—fuel filter
3. Gasket—inlet nut
4. Fuel filter
5. Spring fuel filter
6. Fuel bowl
7. Seal—inlet needle and seat assembly
8. Inlet needle and seat assembly
9. Gasket—inlet adjusting nut
10. Nut—inlet adjusting
11. Gasket—inlet lockscrew
12. Screw—inlet lock
13. Float assembly
14. Screw—float hinge
15. Fuel lever sight plug
16. Gasket—sight plug
17. Spring—pump diaphragm
18. Pump diaphragm
19. Cover assembly—pump diaphragm
20. Screw—pump diaphragm cover

Primary carburetor float bowl; secondary has no accelerator pump

CHOKE *UNLOADER ADJUSTMENT-PRIMARY CARB*

Fully open the throttle valve and secure it. Close the choke valve against the throttle shaft unloader tang and bend the choke rod to obtain the specified measurement between the lower edge of the choke valve and the body.

DISASSEMBLY AND ASSEMBLY

Primary Carburetor

1. Remove the fuel bowl, metering body, and splash shield. Disconnect the vacuum break hose, remove the throttle body attachment screws, and separate the throttle body from the primary carburetor body.
2. Remove the fuel inlet baffle, float hinge screws, and the brass float. Remove the needle and seat assembly lock screw, then back out die adjusting nut and remove the seat assembly.
3. Remove the sight plug and gasket, fuel inlet fitting, filter, spring and gasket. Remove the accelerator pump cover, diaphragm, and spring.
4. Check the accelerator pump inlet ball. If damage is evident, replace the bowl assembly.
5. Remove the main metering jets, power valve, vacuum fitting, and the idle-mixture needles and screws.
6. Remove the choke vacuum break, choke lever and fast-idle cam. Remove the accelerator pump discharge nozzle and its check valve.
7. Reverse the above procedure to assemble.

Secondary Carburetors

1. Remove the fuel bowl and metering block. Disconnect the secondary diaphragm housing from die throttle lever and separate the housing from the carburetor body.
2. Remove the throttle body attaching screws and separate the throttle body from the main body. Remove die fuel inlet baffle hinge screws and plastic float.
3. Remove the needle and seat assembly, sight plug, fuel inlet fitting, filter, and spring. Remove the metering body plate and gaskets. Remove the diaphragm cover and diaphragm.
4. Reverse this procedure to reassemble.

Holley 4150, 4160 Series Carburetors

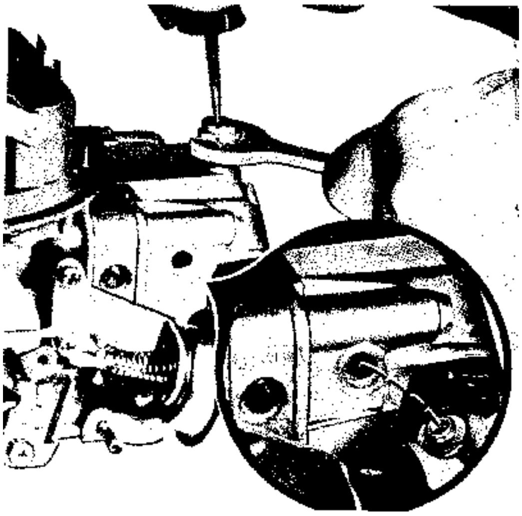
Holley four-barrel carburetors first appeared on the Corvette in 1964. The 4160 used is an end-inlet carburetor, while the 4150 carburetors used have been both end and center-inlet designs. The secondary metering body on the 4150 carburetor is similar to the primary metering body. The 4160 secondary metering body is a cast body and a plate attached to the main body by six screws. The center-inlet 4150 has been utilized on the higher performance versions of the Corvette. In 1971, the Holley carburetor has revised calibration and a C.E.C. valve. Holley part numbers are located on die carburetor air horn.

CHOKE ADJUSTMENT

The early model 4150 uses a bi-metaUic choke mounted on the carburetor. It is correctly set when the cover scribe mark aligns with the specified notch mark. The later model 4150 and 4160 employ a remotely located choke. To adjust, disconnect the choke rod at die choke lever and secure the choke lever closed. Bend the rod so that when the rod is depressed to the contact stop, the top is even with the bottom of die hole in the choke lever.

FLOAT LEVEL ADJUSTMENT

Position the car on a flat, level surface and start the engine. Remove the sight plugs and



Holley float level adjustment

check to see that die fuel level reaches the bottom threads of the sight plug port. A plus or minus tolerance of Vs2 in. is acceptable. To change the level, loosen the fuel-inlet needle locking screw and adjust the nut. Clockwise lowers the fuel level and counter-clockwise raises it. Turn the nut Vie of a turn for each Vie in. desired change. Open the primary throttle slightly to assure a .stabilized adjusting condition on the secondaries. There is no required float drop adjustment.

FAST-IDLE ADJUSTMENT

Early 4150

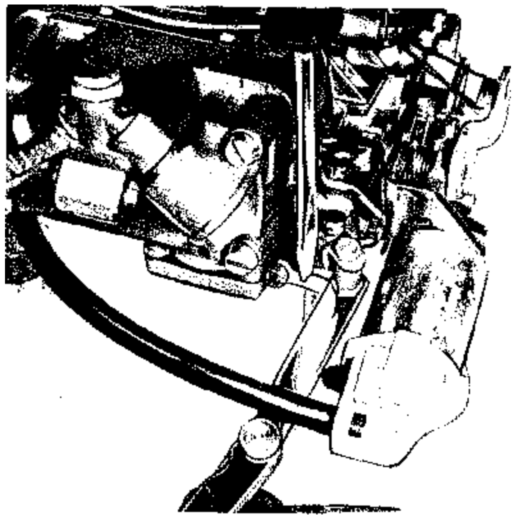
Bring the engine to normal operating temperature with the air cleaner off. Open the throttle. Place the fast-idle cam on its high step and close the throttle. Adjust the fast-idle screw to reach the specified idle speed.

Late Model 4150 and 4160

Open the throttle and place the choke plate fast-idle lever against the top step of the fast-idle cam. Bend the last-idle lever to achieve the specified throttle plate opening.

CHOKE *UNLOADER ADJUSTMENT*

Adjustment should be made with the engine not running. Fully open and secure the throttle plate. Force the choke valve toward a closed position, so that contact is made with the unloader tang. Bend the choke rod to gain the specified clearance between the main body and the lower edge of the choke valve.



Holley accelerator pump adjustment

ACCELERATOR PUMP ADJUSTMENT

Turn off the engine. Block open the throttle and push down the pump lever. Clearance between the pump lever arm and the spring adjusting nut should be 0.015 in. minimum. Turn the screw or nut to adjust this clearance.

SECONDARY THROTTLE VALVE ADJUSTMENT

Late Model 4150 and 4160

Close the throttle plates then turn the adjustment screw until it contacts the throttle lever. Advance the screw % turn more.

AIR VENT VALVE ADJUSTMENT

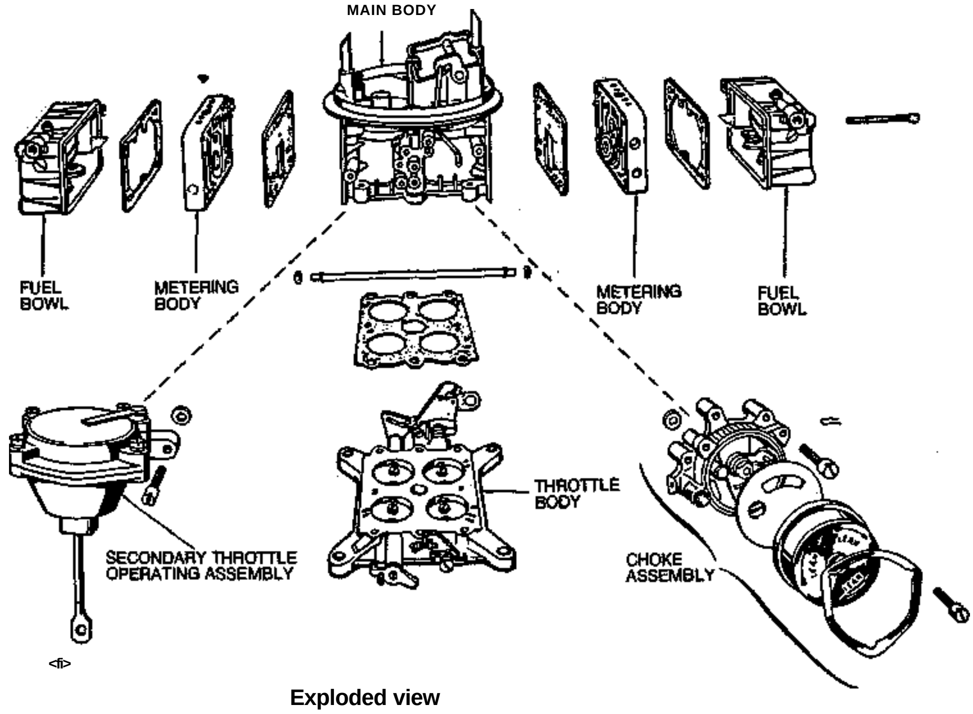
Late Model 4150 and 4160

Close the throttle valve and open the choke valve so that the throttle arm is free of the idle screw. Bend the air vent valve rod to obtain the specified clearance between the choke valve and seat. Advance the idle-speed screw until it touches the throttle lever then advance it *IVz* turns.

VACUUM BREAK ADJUSTMENT

Late Model 4150 and 4160 Holley

Secure the choke valve closed and the vacuum break against the stop. Bend the vacuum break link to gain the specified clearance between the main body and the lower edge of the choke valve.



Exploded view of Holley 4150

C.E.C. VALVE ADJUSTMENT

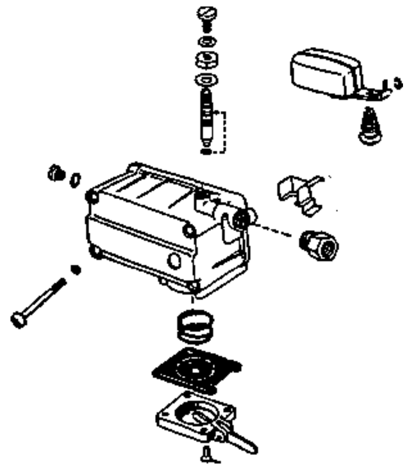
1971 4150 Holley

This adjustment is made only when it has been necessary to remove the throttle plate, overhaul the carburetor, or replace the solenoid. To adjust, warm the engine and place the transmission in Neutral for manual transmissions or Drive for automatic transmissions. If so equipped, turn off the air conditioner. Disconnect the vapor-canister fuel tank hose and remove and plug the distributor vacuum hose. Extend the C.E.C. valve plunger until it touches the throttle lever and then adjust its length until the specified idle speed is reached.

DISASSEMBLY AND ASSEMBLY

Disassembly and assembly are similar for the 4150 and 4160 series carburetors although there are minor differences from model to model. The following is a generalized disassembly and assembly procedure for all Corvette, four-barrel Holley carburetors.

1. Remove the primary and secondary fuel bowls, metering bodies, plates, splash shields, and fuel tubes.
2. Disconnect the secondary throttle-op erating rod from the throttle lever. Remove the secondary throttle-operating assembly and gasket from the main body of the carburetor.
3. Remove the float hinge pin retainer and remove the float and spring from the bowl. If so equipped, remove the inlet baffle.
4. Loosen the inlet needle and seat lock screw and remove the assembly. Remove the sight plug and gasket.
5. Remove the inlet fitting(s), gaskets, fuel filter, and spring.
6. On the primary bowl: remove the air vent assembly (except early 4150); remove the pump diaphragm screws and lift the pump housing, diaphragm, and spring from the fuel bowl; check that the pump inlet ball can move



Exploded view of Holley 4150 bowl

freely. Replace the bowl assembly if ball movement is restricted or if either the ball or passage are damaged.

7. To disassemble the metering body (all except 4160 secondary): remove the main metering jets.

CAUTION: *Use a jet wrench or very wide screwdriver to prevent damaging the jets.*

Use a one-inch, twelve-point socket to remove the power valves. On the primary side, remove the idle mixture screws and seals.

8. On the 4160 secondary: remove the plate and gasket from the metering body dowel pins.

9. On the early model 4150: remove the choke housing, retainer, and gasket. Remove the choke housing shaft, fast-idle cam, and choke piston.

10. On kte model 4150 and 4160 carbu retors: remove the choke vacuum break dis connecting link, fast-idle cam, and choke le ver.

11. Remove the discharge nozzle, invert the carburetor, and shake the discharge needle out.

12. Replace gaskets, seals, and small parts with those provided in the rebuilding kit. Re verse the disassembly procedure to assemble the carburetor.

Fuel Injection—1963-65

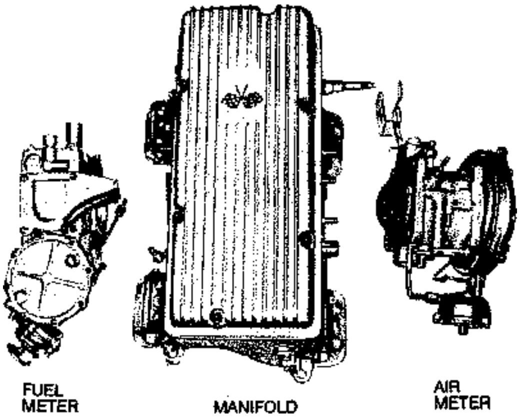
The Rochester fuel injection system was a performance option on 1963 through 1965 327 cubic inch engines. It delivers a constandy regulated air/fuel flow regardless of the engine requirements and eliminates carburetion difliculties caused by cornering or braking. While the fuel injection system is more complex than the ordinary carburetor, it is not beyond the repair capabilities of that average owner/mechanic—provided he adheres to procedure and specification recommendations.

The first hurdle is understanding the design of the fuel injector and this is best done by thinking of the unit as three separate systems, interlocked to accomplish a common function. The first system is die air meter and this simultaneously furnishes the fuel meter with an assessment of die load demands of the engine and feeds air to the intake manifold. The intake manifold is designed to ram charge the air as it distributes it to the cylinders. The fuel meter evaluates the air meter signal and furnishes the correct amount of fuel **to the nozzles where it is injected into the engine.**

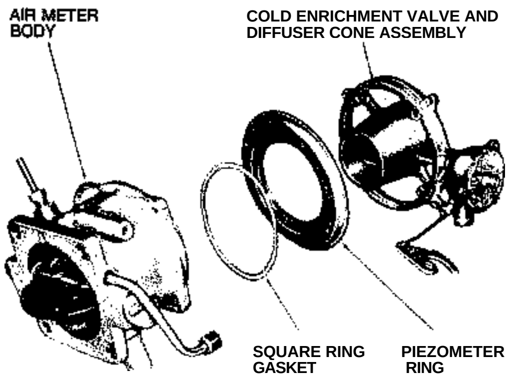
DESCRIPTION AND OPERATION

Air Meter

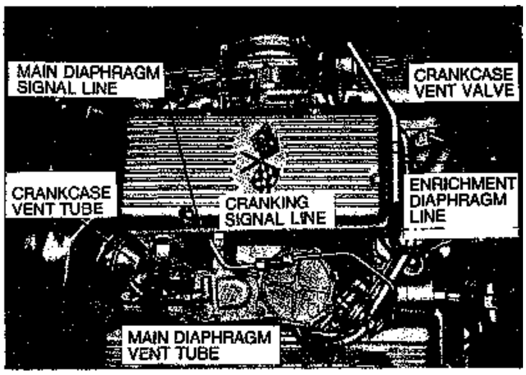
The 1963-1964 air meter consists of three sub-components: the throttle valve, cold enrichment valve and diffuser cone assembly, and die meter housing. The 1965 air meter



Three major components of the fuel injection system



Exploded view of the air meter



Fuel injection lines

was modified to the extent that a choke piston was added and the choke valve stop was relocated in the diiuser cone. This allows an initial choke opening of 10° which increases to 30° after an initial cold start. The throttle valve regulates the flow of air into the manifold and is mechanically actuated by the accelerator pedal. The diffuser cone, suspended in the bore of the air meter inlet, functions as an annular venturi and accelerates the air flow between the cone and the meter housing. The air meter houses the previously mentioned components plus the idle and main venturi signal systems.

The main venturi vacuum signals are generated at the venturi as the incoming air rushes over an annular opening formed between the air meter body and piezometer ring. They are then transmitted through a tube to the main control diaphragm in the fuel meter. The venturi vacuum signal measures the flow of air into the engine and automatically controls the air/fuel ratio. The one exception to this is at idle speeds.

Idle air requirements are handled differently by the fuel injection method. Approximately 40% of the idle-speed air flow enters the engine through the nozzle block air connections tapped into the air meter body. Part of the remaining 60% flows past the throttle valve which is pre-set against a fixed stop. The remainder enters through the idle air, by-pass passage that is controlled by the large, idle-speed adjusting screw. Idle speed is adjusted by turning this screw in or out.

Fuel Meter

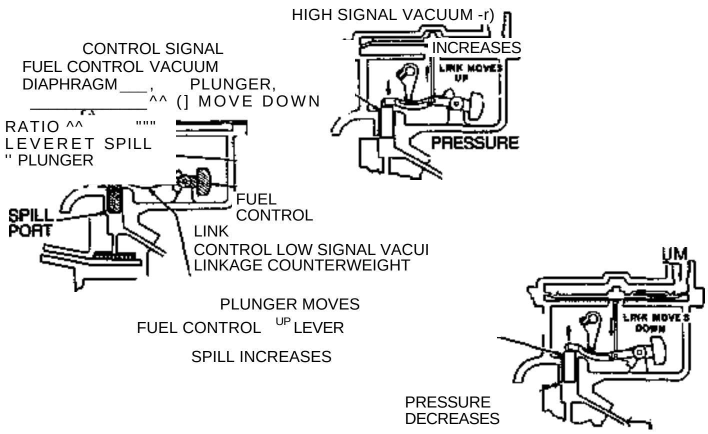
The fuel meter's float-controlled fuel reservoir is basically the same as that found in conventional carburetion. The fuel meter receives fuel from the regular engine fuel pump. The incoming fuel is routed through a 10 micron filter before entering the main reservoir of the fuel meter, where the high pressure gear pump picks it up. This, high pressure, spur-gear type pump is completely submerged in the lower part of the fuel meter main reservoir. A distributor-powered, flexible shaft drives the pump at Yz engine speed. Fuel pressures span a range of near zero to 200 psi, according to engine speed. Fuel not used by the engine reenters the fuel meter through a fuel control system. The 1965 fuel meter contains a vent screen and baffle which helps to stabilize the air/fuel mixture.

Fuel Control System

A fuel control system regulates fuel pressure (flow) from the fuel pump to the nozzles. This flow is controlled by the amount of fuel that is spilled or recirculated from the high pressure pump, through the nozzle block, back to the fuel meter spill ports. This is accomplished by a three-piece spill plunger or disc that is located between the gear pump and the nozzles.

When high fuel flow is required, it moves downward, closing the spill ports to the fuel meter reservoir and concentrating the flow to the nozzle circuits. Correspondingly, the spill plunger or disc must be raised to allow the spill ports to be exposed when a low fuel flow is required. This causes the main output of the gear pump to by-pass the nozzle circuits and reenter the meter reservoir through the now-opened spill ports.

The spill plunger is not mechanically controlled by the accelerator pedal. Fuel control is accomplished by a precisely counterbalanced linkage system sensitive to fuel pressure and diaphragm vacuum. Thus the slightest change in venturi vacuum signal on the main control diaphragm will activate the linkage. One end of the fuel control lever rests against the spill plunger head while the other end connects by a link to the main control diaphragm. The control lever pivots on the roller end of an arm called the ratio lever. When the increased vacuum above the diaphragm forces the control lever upward, the lever pivots on the ratio lever's roller and pushes the spill plunger or disc downward. This closes the spill ports and steps up fuel flow to the nozzles. When decreased vacuum above the diaphragm reverses the pivot action, fuel pressure forces the spill plunger



Fuel control linkage

upward and permits the spill ports to by-pass fuel into the reservoir, thus fuel flow to the nozzles is reduced.

The diaphragm vacuum-to-fuel pressure ratio, and subsequent fuel/air ratio, is regulated by the position of the ratio lever. As the ratio lever changes position, the mechanical advantage of the linkage system also changes, thus providing the correct fuel/air ratio for each driving condition. As long as engine manifold vacuum exceeds 8 in. Hg (mercury), the ratio lever remains at the economy stop and fuel flow follows the dictates of the main control diaphragm vacuum. A sudden decrease in manifold vacuum moves the ratio lever to the power stop. The resulting increase in the mechanical advantage of the linkage system closes the spill ports and increases full flow to the nozzles.

Starting System

Cold engine starting conditions require richer fuel/air mixtures to compensate for poor fuel evaporation. The absence of an accelerator pump prevents the driver from providing extra fuel by pumping the accelerator pedal. The correct method is to depress the pedal once and then release. This pre-sets the throttle for starting by the fast-idle cam. The vacuum signal generated at cranking rpm is very low and must be boosted. This boost is provided by a spring-loaded, open-cranking signal valve located at the enrichment diaphragm housing. This open valve allows the manifold cranking vacuum to react directly on, and lift, the main control diaphragm. This closes the spill valve. In addition, die spring-loaded enrichment diaphragm holds the ratio lever at the rich or power stop, thus providing maximum fuel flow to *the* nozzles. As soon as die engine starts, manifold vacuum overcomes the springs in the cranking signal valve and enrichment diaphragm, and die regular idle system is brought into operation.

The vacuum-controlled, cranking-signal valve circuit was eliminated on 1965 model injectors and replaced by a solenoid-controlled, by-pass fuel circuit. This system delivers the entire output engine fuel pump to the fuel distributor via a by-pass line. The fuel is then routed through a check valve and finally arrives at the individual nozzles. The control solenoid is energized when the ignition switch is held in the start position and the accelerator pedal is depressed less than *Vs* of its travel. Depressing the accelerator pedal further trips a micro-switch on die dirotde linkage and stops fuel delivery to the by-pass circuit.

Idle System

Correct injector operation at idle speed is highly dependent upon the generation of a strong venturi signal and its subsequent transmittal to the control diaphragm. To ensure this signal during cold engine idle, die fast-idle cam holds the throttle valve cracked open. This increases the velocity of air flowing through die venturi which in turn strengdiens the venturi vacuum signal being transported to die main control diaphragm. The electrically heated choke valve remains closed during initial cold engine operation, and diis requires the entire air flow to pass through the venturi. This rerouting of the air flow generates a usable venturi signal even at relatively low engine speeds. Intake manifold vacuum acts direcdy on die enrichment diaphragm. The diaphragm's response movement adjusts die ratio lever to die economy stop as soon as manifold vacuum is sufficient to overcome the diaphragm spring. As die electric heating element senses a rise in engine temperature, it relaxes die diermostat and permits die choke valve to open. Air flow through die venturi decreases and the signal generated here drops. The idle signal system now becomes die more dominant signal.

Fuel control during warm engine idle is a result of main control diaphragm response to die idle circuit signal. With die ratio lever already positioned at the economy stop, air now enters tiirough the idle air circuit and die nozzle blocks.

Acceleration

Acceleration is instantaneous at normal driving speeds. Opening the throttle valve increases bodi air flow and die venturi signal at the main diaphragm. The momentary drop in manifold vacuum causes the ratio lever to move to die power stop position. A calibrated restriction in die main control signal circuit stabilizes the idle signal and adds this to die total signal as long as it is present.

Ratio Lever—Power Stop

The air/fuel ratio requirements for power are basically the same as those necessary for acceleration. The drop in manifold vacuum, caused by a wide-open dirottle condition, moves die ratio lever to the power stop. The open dirotde also provides a stronger venturi signal dirough the increased air flow.

Hot Starting/Unloading

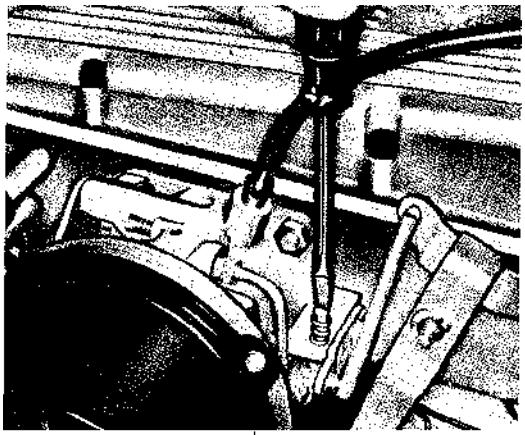
Rich mixtures must be prevented during hot starting/unloading situations. Depressing the accelerator pedal to fully open the throttle valve during starting will prevent high vacuum from reaching die cranking signal valve and will facilitate starting.

Hot Idle Compensator

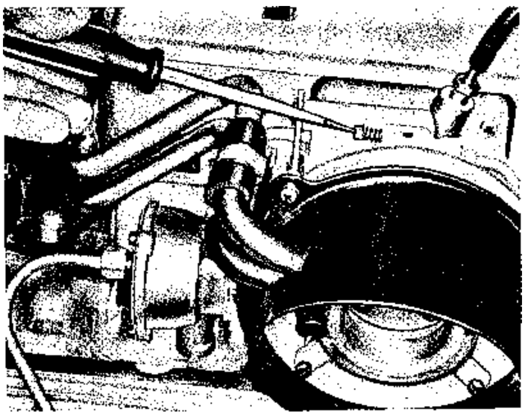
Extremely hot operation conditions can cause rich mixture conditions that detrimentally affect engine smoothness and idling. To remedy this, a thermostatically controlled valve on the top side of the air meter throttle valve allows additional air to bleed into the manifold and restore the idle mixture to a correct ratio.

Idle Speed and Fuel Adjustments

Idle speed and fuel adjustments require presetting of the idle-speed and idle-fuel adjusting screws 1½ turns out from their fully closed position. Start the engine and adjust the idle-speed screw until 800-850 rpm is obtained. Adjust the idle-fuel screw until the smoothest engine idle is attained. Should the two idle-adjusting screws become completely out of phase, purge the system or stop the engine and repeat the entire preceding procedure.



Idle speed adjustment



Idle mixture adjustment

Fast Idle-Speed and Cold Enrichment Adjustments

Adjust the fast idle-speed by bending the enrichment linkage until clearance between the fast-idle cam and the adjusting screw resembles the illustration. With the engine stopped, crack the throttle valve and manually close the cold enrichment valve. Release the throttle linkage and check to see that the fast-idle is now positioned for cold engine operation. Release the cold enrichment valve, warm the engine, and adjust the fast-idle screw to obtain 2200 rpm. Make the cold enrichment adjustment by setting the cold enrichment cover to 3 notches lean. Be sure that the valve linkage operates freely.

Ratio Lever Stop Settings

This series of adjustments requires the use of a manometer. Attach die manometer in a convenient place on the vehicle and use die two-position bracket so that the most vertical position may be obtained. After the unit has been leveled by means of the leveling vial, open both water manometer valves and see if a zero reading exists. If not, adjust the oil leveling screw. If this fails to xero die indicator, add red oil (specific gravity 0.826). Back off the leveling screw for this procedure.

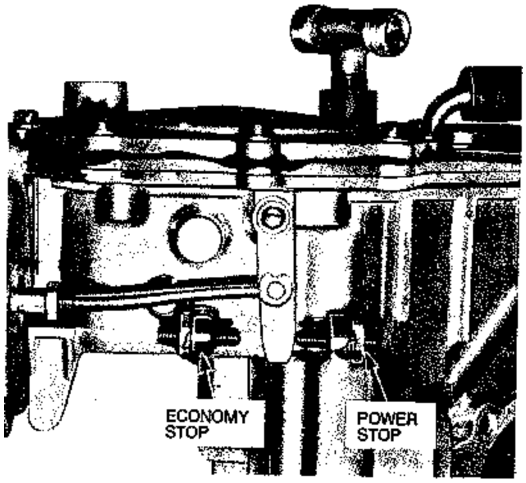
Remove both hose adapters on the mercury (Hg) manometer and plugs located in the adapters. Install the tee fitting in die most easily accessible fuel nozzle circuit. Attach the fuel pressure line to die tee fitting and the mercury manometer. Check die fuel trap inlet to see diat it is properly positioned in die line. Clamp the venturi signal line to die cranking signal valve line and die water manometer. Check the clamp to be sure it is tightiy closed on die line. If it isn't, high vacuum during engine cranking will cause die red oil to be lost. Replace die main diaphragm vent tube widi die large rubber tube. Adjust die scale of die mercury manometer to read zero inches. Recheck die manometer leveling vial and make any necessary adjustments. This completes the installation.

The economy stop adjustment procedure begins widi a visual check of die unit for physical defects. Widi die engine warmed up, check to see that the unit is operating on the economy stop. Some injectors may be difficult to start with the cranking-signal valve line disconnected. The line may be reconnected during die initial starting procedure.

Increase engine rpm until arO.5 in. signal is registered on the water manometer. Check the mercury manometer and record its reading. Decrease the engine rpm and repeat the above procedure. Average three readings for best accuracy. To adjust, loosen the locknut and turn the economy stop screw in or out until the mercury manometer reads 0.8 in. (±0.1 in.) when the water manometer reads 0.5 in.

The power stop readings are obtained with the manometer hooked up as in the previous procedure. Disconnect and plug the vacuum line going to the enrichment diaphragm and the injection unit will operate only on the power stop. Do not prolong this operation or spark plug fouling will result.

Increase the engine rpm until a 0.5 in. signal is reached on die water manometer and check and record die mercury manometer reading. Reduce engine speed and repeat die above operation. Average three readings for die best results. Check die enrichment diaphragm to see that it is not bottoming in die housing. To adjust die power stop, loosen die

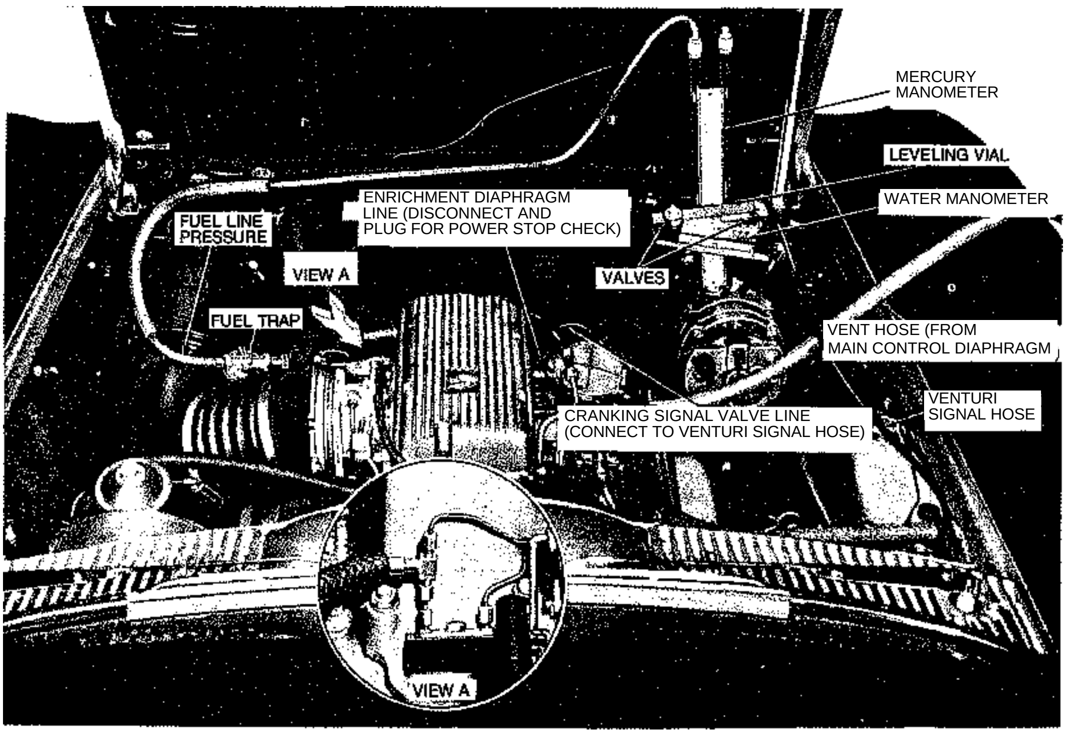


Economy and power stop adjusting screws

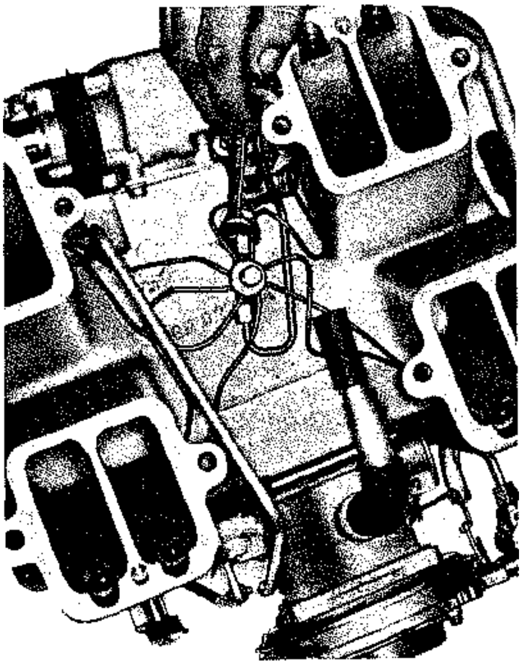
locknut and turn die adjusting screw until a reading of 1.2 in. (±0.1 in.) is reached on die mercury manometer when die water manometer reads 0.5 in.

REMOVAL AND INSTALLATION

1. Disconnect the washer vacuum line, accelerator linkage, electric choke lead wire, and die bellcrank return spring.
2. Loosen die flexible hose clamp and slide die hose from the air meter adapter.



Manometer installation



Removing fuel pressure lines

3. Disconnect the fuel line at the filter and the drive cable coupling at the distributor by sliding the cable into the pump housing to disengage it from the distributor, and then pulling it clear. Don't lose the fiber washer on the end of the cable.

4. Remove the engine/manifold adapter-plate retaining nuts and lift the assembly from the engine.

5. Install a % in. x 2 in. bolt and nut in each manifold outer mounting-hole to allow the unit to be placed upright on a workbench without damaging the nozzles.

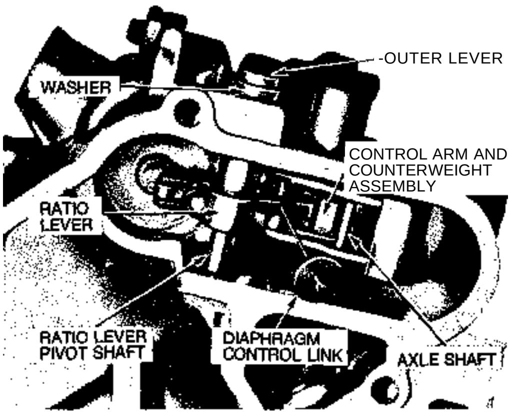
6. Reverse the above procedure to install.

DISASSEMBLY AND ASSEMBLY

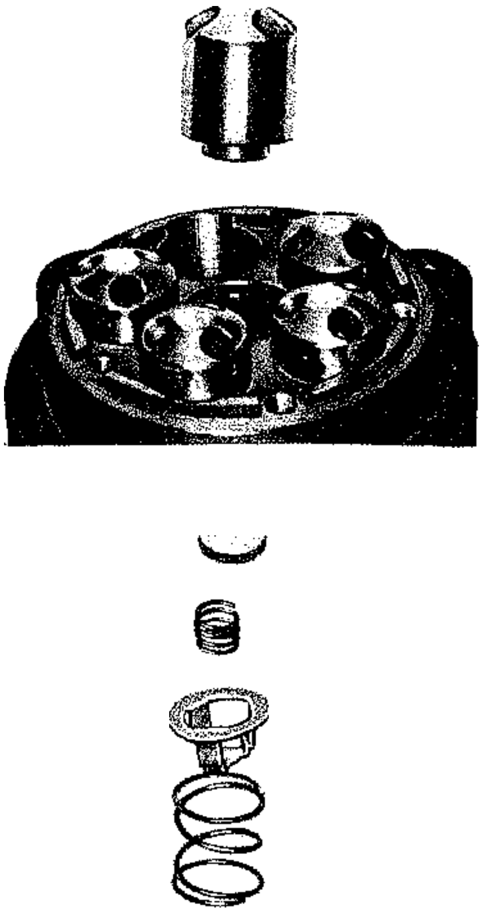
1. The first step in disassembly is to separate the fuel injection unit into its three main components: fuel meter, air meter, and manifold.

2. Separate the air meter from the injector unit by disconnecting the bellcrank from the pivot shaft and leaving it attached to the air meter. Disconnect the main control signal tube at both ends and remove. Remove the retaining nuts and washers and carefully lift the air meter while simultaneously disconnecting the rubber, nozzle balance tube elbow at the air meter.

3. Disconnect the enrichment diaphragm tube at both ends, disengaging the tube at the manifold end first. Disconnect the main control diaphragm vent tube at both ends. Invert the injector and drain the fuel reservoir through the cover vent, then disconnect the fuel pressure lines. Remove the lower retaining screws, the single upper bolt, and the short vent tube. Discard the rubber



Ratio lever control linkage



Fuel pump piston and valve assembly

O-ring at the fuel meter end of the fuel line. Remove the fuel meter from the injector unit.

4. Disassemble the air meter by remov ing the air cleaner adapter, fast-idle cam pi vot screw, difluser cone assembly, and pie zometer ring from the air meter.

5. Remove the idle-speed and idle-fuel adjusting screws. The throttle valve need not be removed unless shaft binding exists.

6. Disassemble the fuel meter by remov ing the diaphragm cover and shield. Care fully remove the diaphragm retaining nut and diaphragm from the control link. The control link must be kept from rotating to prevent damaging the control link.

7. Remove the nylon splash shield, the fuel bowl cover attaching screws and care fully lift the cover, upper support bracket, and gasket from the meter body. Do not bend the control link. Start the link into the slot, then pry the opposite side upward and turn the shield over the link.

8. Remove the fuel pump, enrichment housing, and cranking signal valve. Remove the spill plunger cover and filter, spill plunger and sleeve assembly from the fuel meter bore. If the spill plunger separates from the sleeve, use a hooked wire to pull the sleeve out.

9. Remove the ratio lever and shaft. Ro tate the control arm and counterweights on the axle and remove the axle. Remove the control arm and counterweight assembly from the meter body. This will also remove the lead sealing ball on the outer end of the axle shaft.

10. The fuel pump is secured to the fuel meter by 5 screws. Remove these, noting that the shortest screw is positioned in the 9 o'clock position. With pump separated from the fuel meter, scribe reassembly marks on the pump housing.

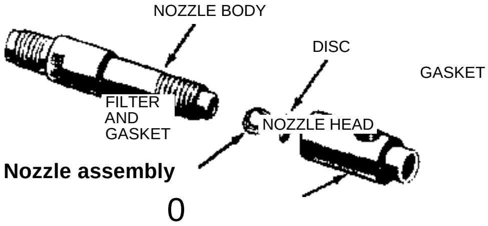
11. Remove the cover attaching screws and the cover. Hand pressure is sufficient to pull the drive shaft from the pump drive gear and housing. Use a suitable driver to remove the drive shaft seal from the pump housing. Bear in mind, the fuel meter contains 48 parts in addition to screws. Be careful. Reassembly is the reverse of this procedure.

12. Nozzles may be disassembled for cleaning but care should be taken to ensure correct reassembly. Never clean nozzle ori fices with wire. If a nozzle is dirty, replace it. Should more than one nozzle be found ex ceptionally dirty, replace the fuel meter fil ter. Replace nozzles only as complete assem blies and according to the following chart:

13.

Nozzle Code	Part Number
W17or18	7017323
X18or19	7017324
Y19or20	7017325

13. Begin disassembly by carefully discon-necting and lifting the fuel lines out of the way. Disconnect either the throttle bell crank or fuel pump drive cable when removing nozzles in their vicinity. Remove the nozzles and nozzle blocks as complete assemblies. Invert the blocks and remove the individual nozzles. Carefully remove the old nozzle gas-kets. Disassemble the unit by securing the nozzle body and inserting a drift punch in the head to turn it. Avoid damaging, losing, or mixing parts. Remember: the nozzle orifice discs are assembled with the bright side to-ward the engine. After cleaning or replacing nozzle assemblies, reinstall them in the noz-zle block, using new gaskets. Check to see that the nozzle gaskets remain in position during reinstallation and that the nozzles are properly placed in the nozzle shields. Reas-sembly is the reversal of this procedure.



Nozzle assembly

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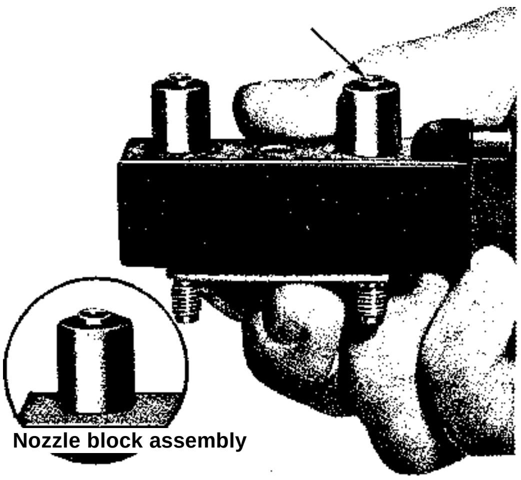
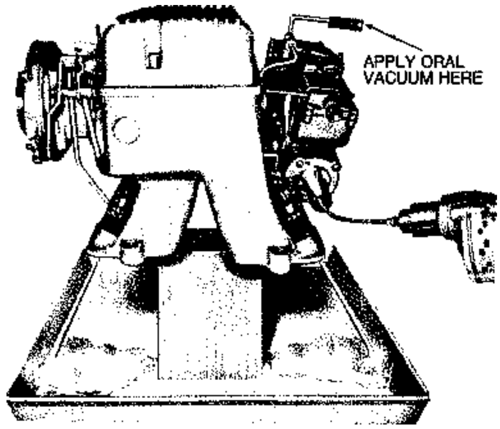


Nozzle block assembly

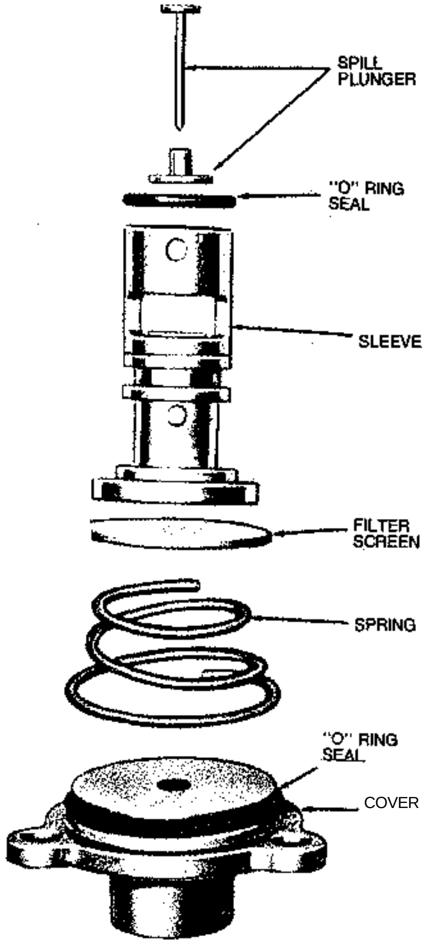


Checking spray pattern

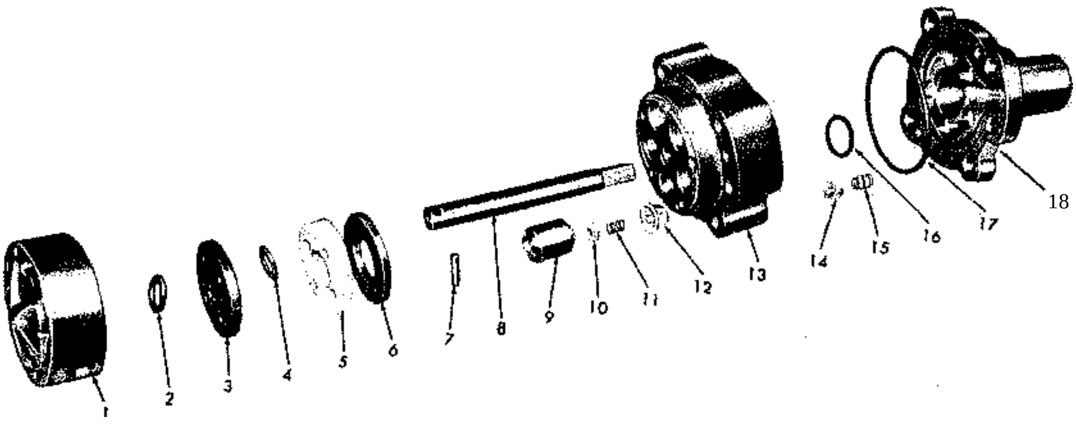
14. A fuel nozzle spray-pattern check should be made whenever a complete nozzle cleaning is made. Drive the gear pump with an electric drill while applying oral vacuum at the main control diaphragm. The latter en sures that all fuel is routed through the noz zle circuit. The spray pattern is correct when each bank of nozzles appears as a single spray when viewed from the end of the assembly.

15. Spill plunger assemblies are basically the same for all fuel injection units. After re moving the assembly from the fuel meter, lu bricate with fuel, and check the valve action. Clean or replace the assembly as required.

16. Reassembly of the air meter is the re versal of the disassembly procedure. At this

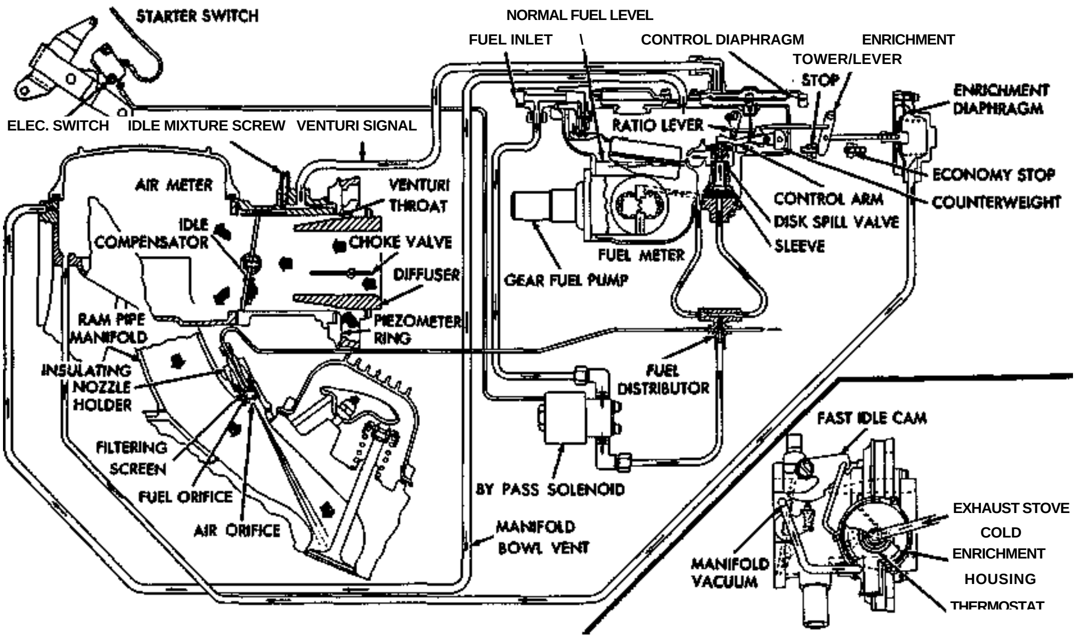


Spill plunger assembly



1. Inlet housing cover
2. Thrust washer
3. Drive plate
4. Thrust washer
5. Wobble plate
6. Bearing plate
7. Drive pin
8. Driveshaft
9. Inlet piston (5)
10. Inlet valve (5)
11. Valve spring (5)
12. Valve retainer (5)
13. Main housing
14. Discharge valve (5)
15. Valve spring (5)
16. O-ring seal
17. O-ring seal
18. Discharge housing

Fuel injection pump



Fuel injection system diagram

time, check for throttle shaft binding. If such a condition exists, attempt to remedy by soaking in solvent. If the throttle shaft still binds, disconnect the throttle shaft from the linkage, remove the throttle plate screws, and file the burrs on the shaft. Remove the shaft, clean, rebush and then reassemble. During reassembly, preset the idle-speed and idle-fuel adjusting screws *IVz* turns out from the bottom.

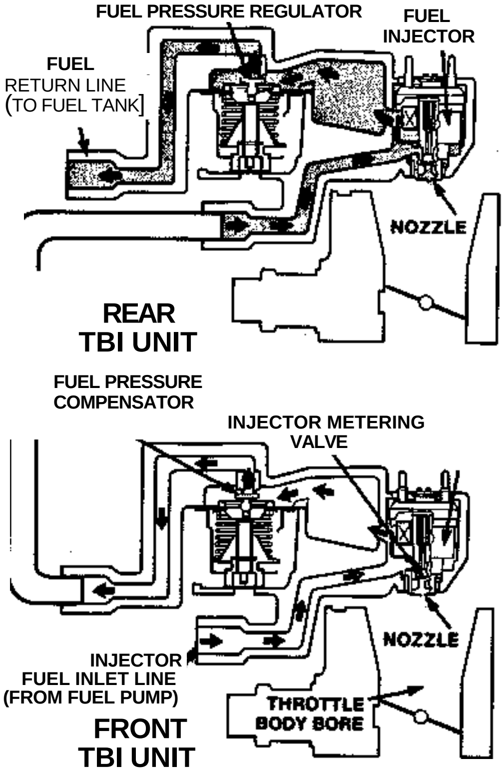
17. Fuel meter reassembly is the reversal of the disassembly procedure. When installing the main control diaphragm, keep in mind that the slots in the diaphragm should readily align with the cover attaching screw holes located in the bowl cover. Repeat the reassembly steps until the diaphragm holes line up naturally. Do not force this alignment. If the diaphragm seemed tight when removed, it is defective. The replacement diaphragm should not be installed in the same condition. At this time check the clearance between the housing and the enrichment diaphragm. A minimum of 0.040 in. is required to prevent interference during power stop operation. Adjust the diaphragm shaft length to gain proper clearance.

Check the fuel reservoir float settings before replacing the top cover. Float level should be $2^{9}/32$ in. while float drop should be $2^{27}/32$ in. Bend to adjust.

Twin Throttle Body Injection (TBI) System (Marketed as Cross-Fire Injection®)

The TBI system, introduced as standard equipment on the 1982 Corvette, is a completely electronic system which meters and delivers precise amounts of fuel and air to the engine, according to the exact engine operating requirements at any given time. The system is controlled by the same on-board computer (ECM) used with the emissions system (CCC). Through the monitoring of various sensors, the ECM determines the optimum air/fuel ratio and signals the TBI units to adjust the ratio accordingly. TBI is designed to offer the owner trouble-free starting, immediate throttle response, and maximum fuel efficiency; regardless of weather conditions, engine rpm, temperature or load.

Trouble diagnosis of the injection system is nearly impossible for the novice mechanic to perform, because of the interaction between the injection, emissions, and ignition systems; all of which are controlled by the ECM. Should you encounter any type of engine performance problem, have a complete CCC system test performed by a qualified, professional technician. If the fault lies in the injection system, you can use the following pro-



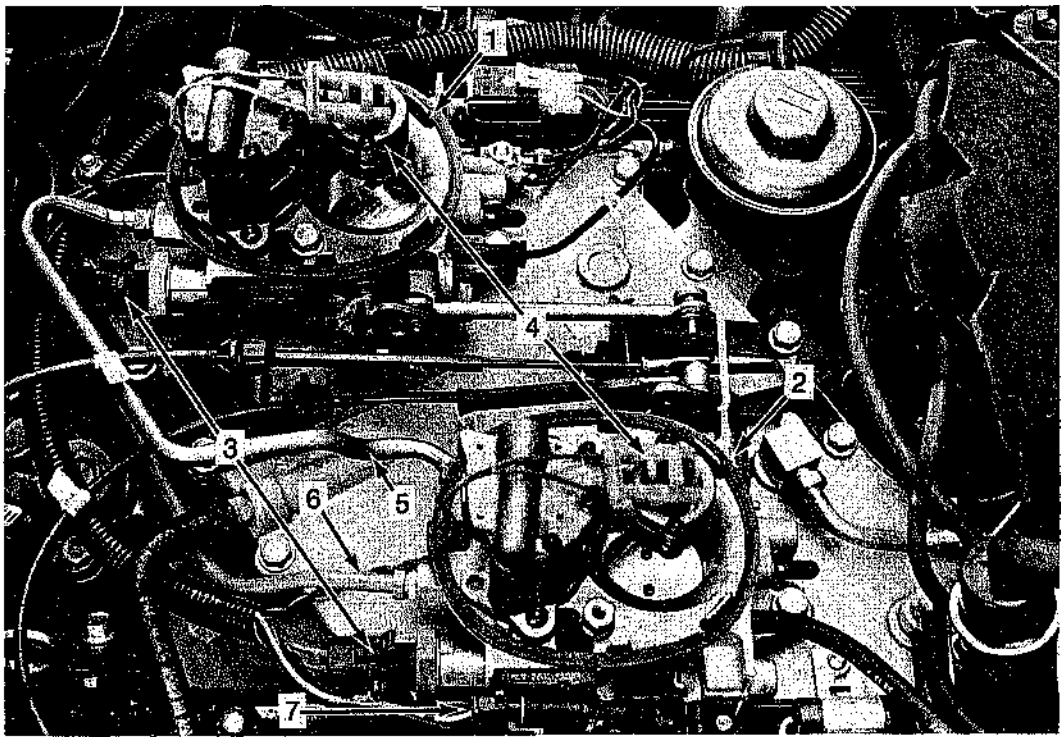
TBI fuel flow schematic

cedures to remove the TBI unites) and replace the defective components).

REMOVAL AND INSTALLATION

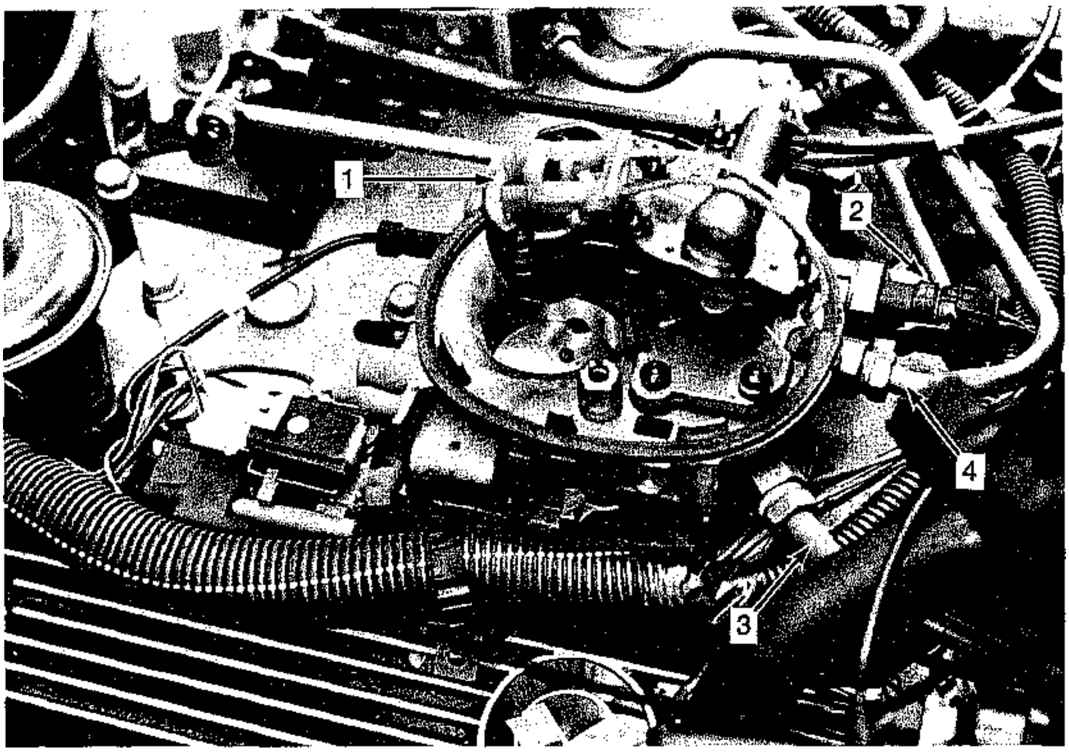
Front TBI Unit

1. Disconnect the battery cables at the battery.
2. Remove the air cleaner assembly, noting the connection points of the vacuum lines.
3. Disconnect the electrical connectors at the injector and the idle air control motor.
4. Disconnect the vacuum lines from the TBI unit, noting the connection points. During installation, refer to the underhood emission control information decal for vacuum line routing information.
5. Disconnect the transmission detent cable from the TBI unit.
6. Disconnect the fuel inlet (feed) and fuel balance line connections at the front TBI unit.
7. Disconnect the throttle control rod between the two TBI units.
8. Unbolt and remove the TBI unit.
9. Installation is the reverse of the previous steps. Torque the TBI bolts to 120-168 inch Ibs. during installation.



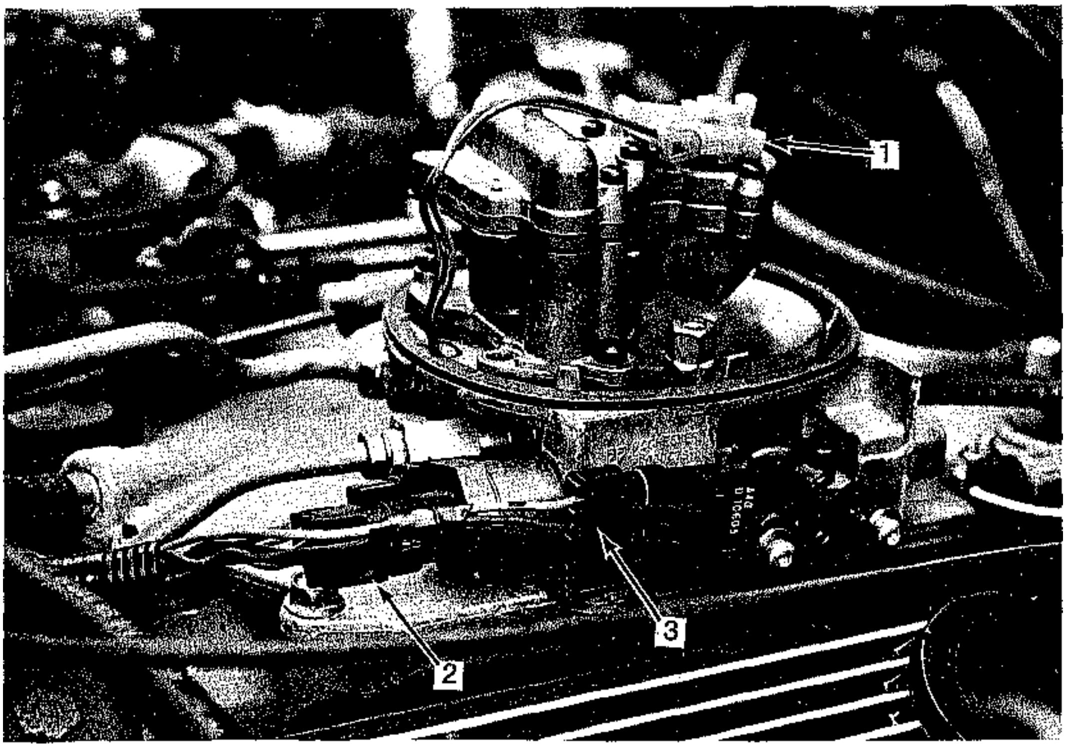
1. Front TBI unit
2. Rear TBI unit
3. Idle air control (IAC) motors
4. Fuel injectors
5. Fuel balance line
6. Fuel return line

Throttle Body Injection (TBI) system nomenclature



1. Fuel injector electrical connection
2. IAC motor electrical connection
3. Fuel inlet line
4. Fuel balance line

Electrical and fuel line connections at the front TBI unit



1. Fuel injector 2. IAC motor 3. Throttle position sensor (IPS)

Electrical connections at the rear TBI unit

Rear TBI Unit

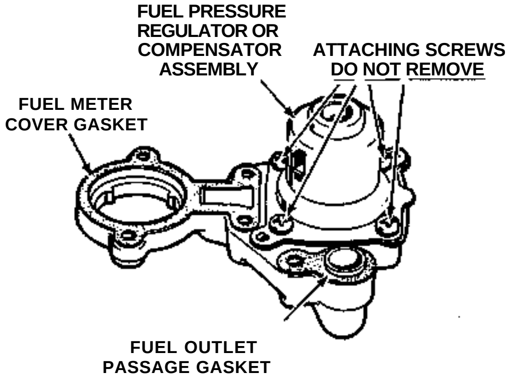
1. Disconnect the battery cables at the battery.
2. Remove the air cleaner assembly, noting the connection points of the vacuum lines.
3. Disconnect the electrical connectors at the injector, idle air control motor, and throttle position sensor.
4. Disconnect the vacuum lines from the TBI unit, noting the connection points. During installation, refer to the underhood emission control information decal for vacuum line routing information.
5. Disconnect the throttle and cruise control (if so equipped) cables at the TBI unit.
6. Disconnect the fuel return and balance line connections from the rear TBI unit.
7. Disconnect the throttle control rod between the two units.
8. Unbolt and remove the TBI unit.
9. Installation is the reverse of the previous steps. Torque the TBI bolts to 120-168 inch Ibs. during installation.

DISASSEMBLY

CAUTION: *Use extreme care when handling the TBI unit to avoid damage to the sivirl plates located beneath the throttle valve.*

NOTE: *If both TBI units are to be disassembled, DO NOT mix parts between either unit.*

1. Remove the fuel meter cover assembly (five screws). Remove the gaskets after the cover has been removed. The fuel meter cover assembly is serviced only as a unit. If necessary, the entire unit must be replaced.

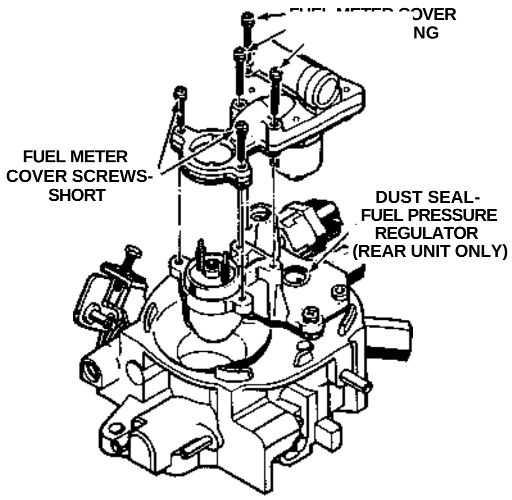


Bottom view of the fuel meter cover assembly—DO NOT remove the four screws indicated

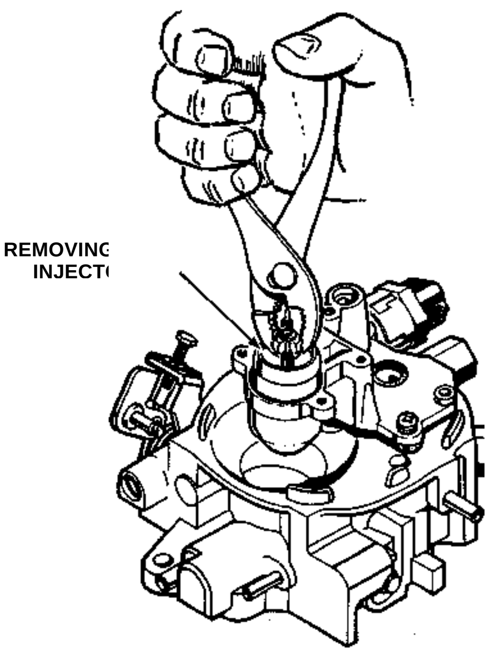
CAUTION: *DO NOT remove the four screws which retain the pressure regulator (rear unit) or pressure compensator (front unit). There is a spring beneath the cover which is under great pressure. If the cover is accidentally released, .personal injury could result.*

Do not immerse the fuel meter cover in any type of cleaning solvent.

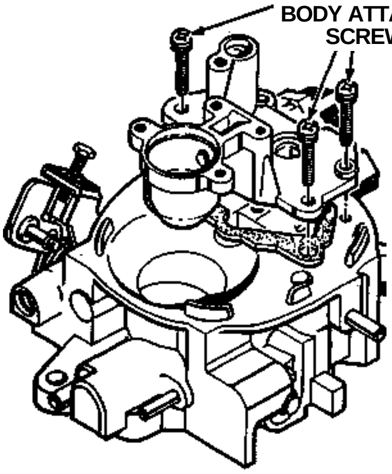
2. Remove the foam dust seal from the meter body of the rear unit.
2. Remove the fuel injector using a pair of small pliers as follows:
   a. Grasp the injector collar, between the electrical terminals.
   b. Carefully pull the injector upward, in a twisting motion.



TBI fuel meter cover screws (five)



Removing the fuel injector



Fuel meter body attachng screws

c. If the injectors are to be removed from both TBI units, mark them so that they may be reinstalled in their original units.

4. Remove the filter from the base of the injector by rotating it back and forth.

5. Remove the O-ring and the steel washer from the top of the fuel meter body, then remove the small O-ring from the bottom of the injector cavity.

6. Remove the fuel inlet and outlet nuts (and gaskets) from the fuel meter body.

7. Remove the fuel meter body assembly and the gasket from the throttle body assembly (three screws).

8. For the rear TBI unit only: Remove the throttle position sensor (TPS) from the throttle body (two screws). If necessary, remove the screw which holds the TPS actuator lever to the end of the throttle shaft.

9. Remove the idle air control motor from the throttle body.

CAUTION: *Because the TPS and idle air control motors are electrical units, they must not be immersed in any type of cleaning solvent.*

ASSEMBLY

NOTE: *During assembly, replace the gaskets, injector washer, O-rings, and pressure regulator dust seal with new equivalents.*

1. Install the idle air control motor in the throttle body, using a new gasket. Torque the retaining screws to 13 ft. Ibs.

NOTE: *DO NOT overtighten the screws.*

2. For the rear TBI unit only: If removed, install the TPS actuator lever by aligning the flats of the lever and the shaft. Install and tighten the retaining screw.

3. Install the fuel meter body on the throttle body, using a new gasket. Also, apply thread locking compound to the three fuel meter body screws according to the chemical manufacturers instructions. Torque the screws to 35 inch Ibs.

4. Install the fuel inlet and outlet nuts, using new gaskets. Torque the nuts to 260 inch Ibs.

5. Carefully twist the fuel filter onto the injector base.

6. Lubricate the new O-rings with lithium grease.

7. Install the small O-ring onto the injector, pressing it up against the fuel filter.

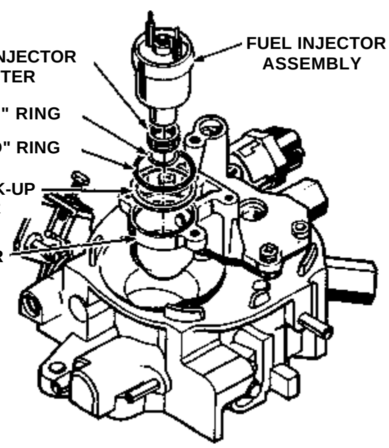
8. Install the steel washer into the injector cavity recess of the fuel meter body. Install the large O-ring above the steel washer, in the cavity recess. The O-ring must be flush with the fuel meter body surface.

9. Using a pushing/twisting motion, carefully install the injector. Center the nozzle O-ring in the bottom of the injector cavity and align the raised lug on the injector base with die notch in the fuel meter body cavity. Make sure the injector is seated fully in the cavity. The electrical connections should be parallel to the throttle shaft of the throttle body.

10. For the rear TBI unit only: Install the new pressure regulator dust seal into the fuel meter body recess.

11. Install the new fuel meter cover and fuel outlet passage gaskets on the fuel meter cover.

12. Install the fuel meter cover assembly, using thread locking compound on the five retaining screws. Torque the screws to 28 inch Ibs. Note that the two short screws must be



Fuel injector installation

installed alongside the fuel injector (one screw each side).

13. For the rear TBI unit only: With the throttle valve in the closed (idle) position, in stall the TPS but do not tighten the attaching screws. The TPS lever must be located ABOVE the tang on the throttle actuator lever.

14. Install the TBI unit(s) as previously outlined and adjust the throttle position sen sor.

ADJUSTMENTS

No internal adjustments of the TBI units are possible. Any time the TPS is removed, it must be readjusted according to the following procedure.

Throttle Position Sensor (TPS) Adjustment

NOTE: *An accurate digital voltmeter is needed to perform this adjustment.*

1. Remove the TPS attaching screws and apply thread locking compound to the screws. Reinstall the screws loosely.
2. Install three jumper wires between the TPS and the TPS wiring terminal connec tions, as shown in the accompanying illustra tion.
3. Turn the ignition ON and measure the voltage between the A and B terminals of the TPS. Rotate the TPS to obtain a voltmeter reading of .525+.075 volts. Tighten the screws.
4. Turn the ignition OFF, remove the jumpers, and connect the TPS wiring to the TPS.

1982-84 THROTTLE BODY INJECTION

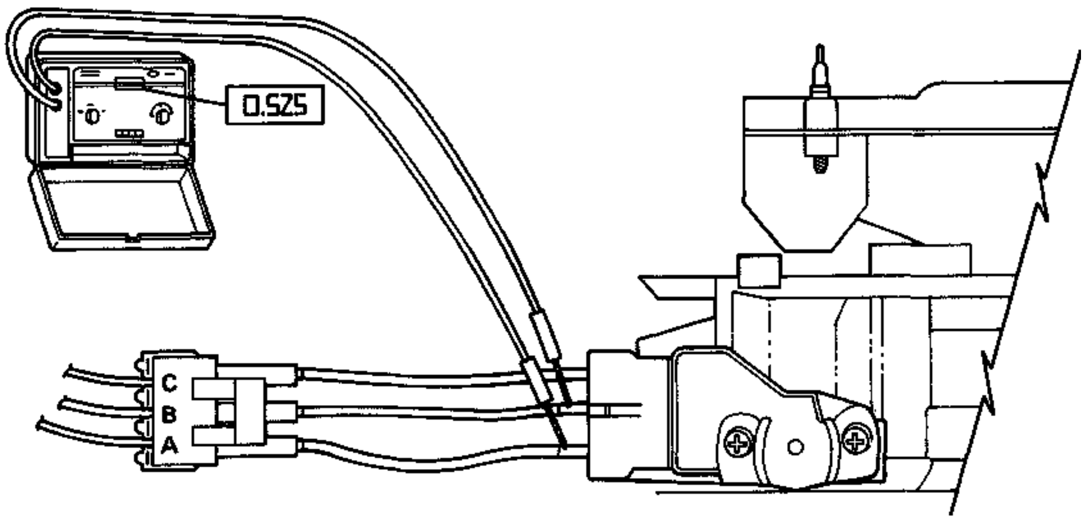
Minimum (die and Throttle Valve Synchronizing

The throttle position of each throttle body must be balanced so that the throttle plates are synchronized and open simultaneously. Adjustment should be performed only when a manifold cover, TBI unit or throttle body has been replaced.

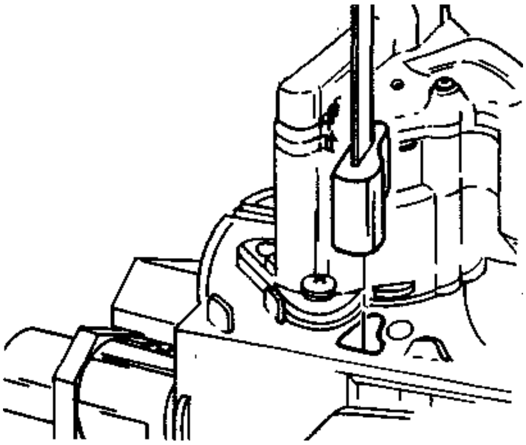
1. Remove the air cleaner and plug the vacuum port on the rear TBI unit for the thermostatic air cleaner.
2. Remove the tamper resistant plugs covering both unit throttle stop screws. Make sure both throttle valves are slightly open to allow fuel to bypass them.
3. Block the drive wheels and apply the parking brake.
4. Connect a tachometer to measure rpm.
5. Disconnect the idle air control (LAG) valve electrical connectors.
6. Plug the idle air passages of each throttle body with plugs (J-33047 or equiva lent). Make sure the plugs are seated fully in the passage so that no air leaks exist.

CAUTION: *To prevent the engine from running at high rpm, be sure the ignition switch is OFF and transmission is in NEUTRAL before connecting IAC valves or removing or installing idle air passage plugs. Failure to do this may result in vehicle movement and possible personal injury.*

7. Start the engine and allow the engine rpm to stabilize at normal operating temper ature.
8. Place the transmission in DRIVE while



Throttle position sensor adjustment—see text



Plug the idle air passages of each throttle *body as* shown

holding the brake pedal to prevent vehicle movement. The engine rpm should decrease below curb idle speed. If the engine rpm does not decrease, check for a vacuum leak.

9. Remove the cap from the ported tube on the rear TBI unit and connect a vacuum gauge or water manometer.

10. Adjust the rear unit throttle stop screw to obtain approximately *Vz* in. of mercury as read on the vacuum gauge, or 6 in. of water as read on the manometer. If not able to adjust to this level, check that the front unit throttle stop is not limiting throttle travel.

11. Remove the vacuum gauge or manometer from the rear unit and install the cap on the ported vacuum tube.

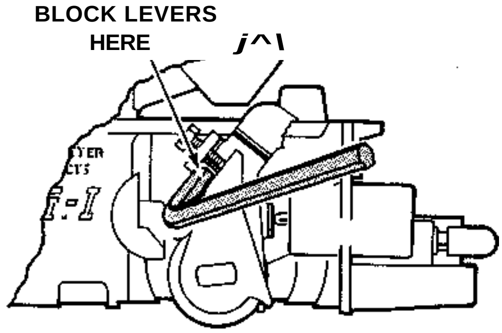
12. Remove the cap from the ported vacuum tube on the front TBI unit and install the gauge or manometer as before. If the reading is not the same as the rear unit, proceed as follows:

a. Locate the throttle synchronizing screw and collar on the front TBI unit. The screw retaining collar is welded to the throttle lever to discourage tampering with this adjustment.

b. If the collar is in place, grind off the weld from the screw collar and throttle lever.

c. Block possible movement of the throttle lever as illustrated, relieving the force of the heavy spring against the throttle synchronizing screw, to prevent the levers from coming into contact.

NOTE: *If the lever* is *not blocked before the throttle synchronizing screw is removed, the screw may be damaged and reinstallation will be done only with great difficulty.*



Block throttle lever movement as shown

d. Remove the screw and collar and discard the collar.

e. Reinstall the throttle synchronizing screw, using thread locking compound.

f. Adjust the screw to obtain *¥2* in. of mercury on the vacuum gauge, or 6 in. of water on the manometer.

13. Remove the gauge or manometer from the ported tube and reinstall the cap.

14. Adjust the rear throttle stop screw to obtain 475 rpm, with the transmission in DRIVE and the parking brake applied. On manual transmission models, leave the gear selector in NEUTRAL.

15. Turn the ignition OFF and place automatic transmission in NEUTRAL.

16. Adjust the front throttle stop screw to obtain .005 in. clearance between the front throttle stop screw and the throttle lever tang.

17. Remove idle air passage plug$ and reconnect LAC valves.

18. Start the engine. It may run at a high rpm but the engine speed should decrease when the idle air control valves close the air passages. Stop the engine when the rpm decreases.

19. The throttle position sensor (TPS) voltage should be checked and adjusted, if necessary. See "TPS Adjustment" for procedures.

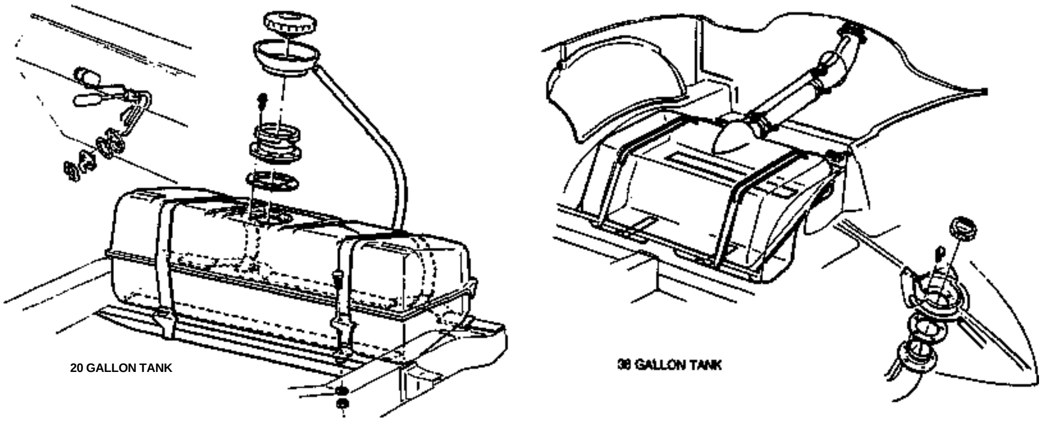
20. Install the air cleaner gasket, connect the vacuum line to the TBI unit and install the air cleaner.

21. Reset the idle speed control motors by driving the vehicle to 30 mph.

Fuel Tank

REMOVAL AND INSTALLATION

CAUTION: *Exercise extreme caution while servicing the fuel tank. Service the tank only in a well ventilated area. DO NOT smoke*



Fuel tank assembly—1963-67 (20 gal.), 1966-67 (optional 36 gal.)

or use any type of drop tight in the service area.

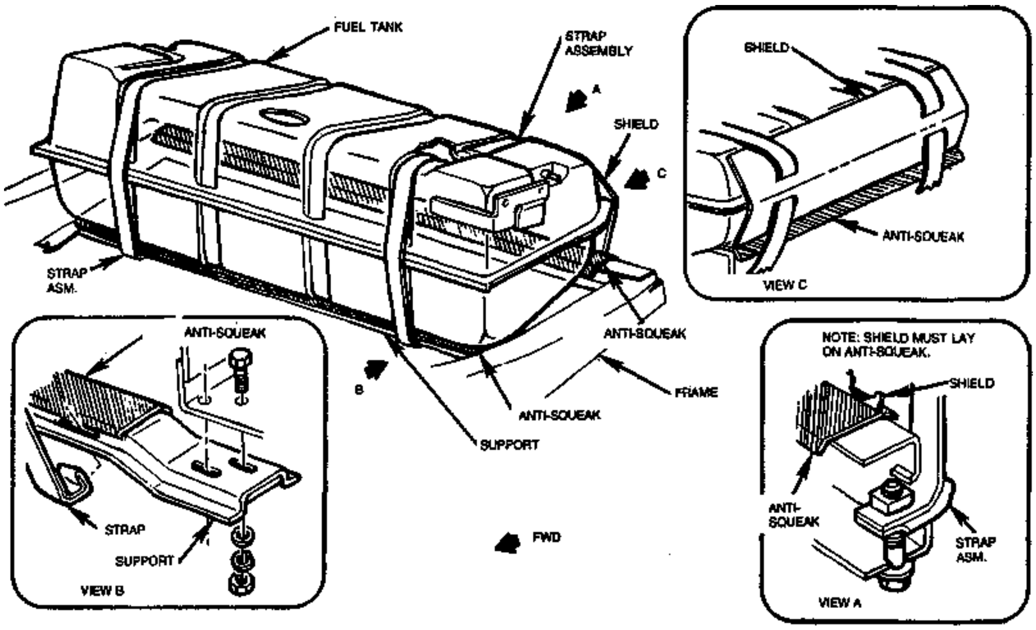
NOTE: *It is best to run the tank as low on fuel as possible prior to removing the tank.*

1974 and Earlier Models

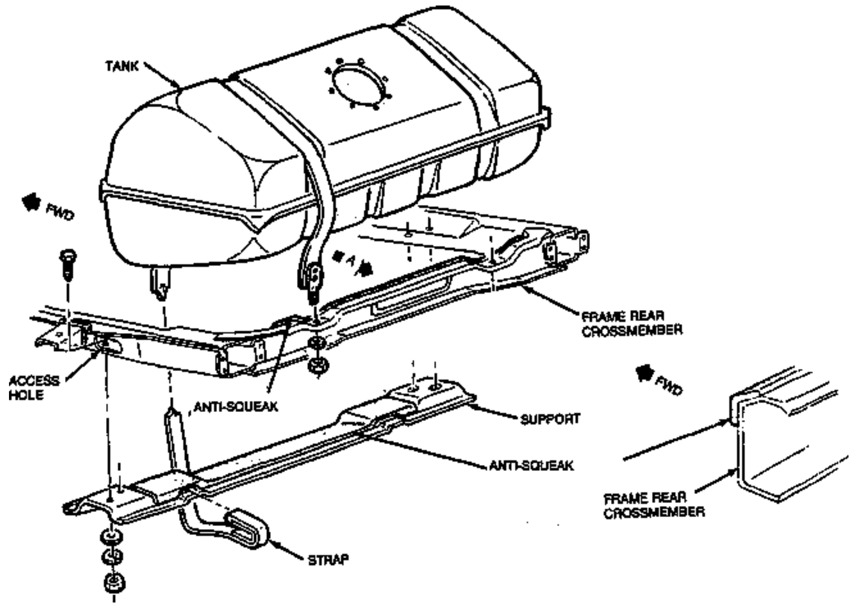
1. Disconnect the battery cables at the battery.
2. Remove the gas cap and the filler neck boot from the top of the tank. Disconnect the drain tube.
3. Raise the vehicle and support it safely with jackstands.
4. Remove the spare tire compartment (if applicable), spare tire, and spare tire carrier.
5. Loosen the U-clamps and separate the exhaust systems at the transmission crossmember. Disconnect the muffler support brackets and slide the exhaust system rearward.
6. Remove the fuel tank strap bolts and disconnect the gauge unit wiring.
7. Disconnect the fuel lines and allow the fuel to drain into a clean container.
8. Unbolt and remove the tank support. Lower the tank, rotating it toward the front of the vehicle to remove it.
9. Installation is the reverse of the pre vious steps.

1975-82 Models

1. Disconnect the battery cables at the battery.



Fuel tank assembly—1968-77



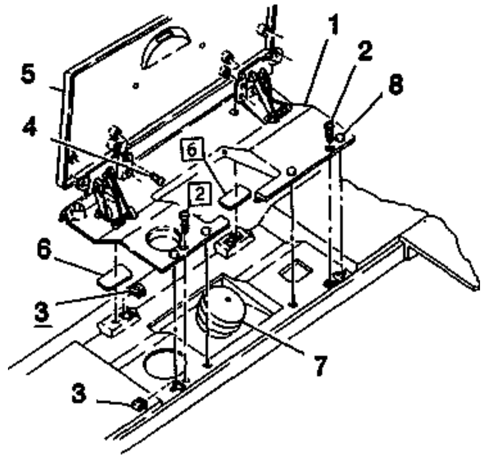
Fuel tank mounting—1978-82

2. Remove the gas cap and siphon the remaining fuel from the tank.
3. Remove the filler neck seal and the drain tube.
4. Disconnect the fuel lines and electrical connectors from the inlet and meter assembly.
5. Raise the vehicle and support it safely with jackstands.
6. Remove the spare tire and carrier.
7. Loosen the U-clamps and separate the exhaust system at the transmission crossmember. Disconnect the muffler support brackets and slide the exhaust system rearward.
8. Remove the fuel tank strap bolts and lower the tank from the vehicle.
9. Installation is the reverse of the previous steps.

1984 and Later Models

NOTE: *If the 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. Allow the fuel level to fall below ¥4 tank for this procedure. The fuel tank consists of a tough, pliable polyethylene liner inside a steel container.*

1. Remove battery ground cable.
2. Drain fuel from the tank into a suitable safety can.
3. Remove fuel tank filler door as an assembly.



1. Filler door bezel
2. Screw
3. U-nut
4. Screw
5. Filler door
6. Sealing strip (2)
7. Fuel tank strap
8. Bumper

Fuel filler door assembly—1984 and later

4. Remove fuel tank filler neck housing and drain hose. Use clean rags to catch any fuel left in the lines.
5. Disconnect fuel feed hose, fuel return hose, vapor hose and electrical connector from fuel meter and pump assembly. The fuel pump may now be removed, if servicing is necessary.
6. Remove license plate to gain access for fascia to impact bar bolts.
7. Remove two carriage bolts securing fascia to impact bar.

8. Raise vehicle and support it safely.
9. Remove spare tire and tire carrier.
10. Disconnect oxygen sensor electrical connector, located in the exhaust manifold.
11. Remove exhaust system as a complete unit by disconnecting from the front cross over pipe at the exhaust manifold.
12. Remove both inner fender braces.
13. Remove both rear inner fender panels.
14. Disconnect antenna ground strap.
15. Remove bolt securing fuel vapor pipe to the left hand fuel tank strap.
16. Disconnect fuel tank cables from rear right and left hand stabilizer shaft brackets.
17. Remove all rear lamps (side marker, tail, backup, license plate and spare tire).
18. Remove screws securing bottom edge of fascia to energy absorber pad.
19. Remove nuts securing each side of fas cia to horizontal body retainer.
20. Remove nuts from right and left verti cal retainers securing fascia to body.
21. Remove frame extension bolts (2 each side).
22. Loosen, but do not remove the re maining frame extension bolts.
23. With the aid of an assistant, remove remaining bolts and pull fuel tank and frame assembly rearward pushing cover outward. Tilt assembly down to remove and clear cover.
24. Remove tank straps and remove tank. If fuel tank is being replaced transfer cables, fuel meter and pump, and fuel vapor connec tor to new tank.
25. Installation is the reverse of removal. Make sure all connections are tight.

NOTE: *A woven plastic filter is located on the lower end of the fuel pickup 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; the tank should therefore be thoroughly cleaned. If trouble is due to contaminated fuel or foreign material that has been put into the tank, it can usually be cleaned.*

CLEANING THE FUEL SYSTEM

CAUTION: *This procedure will not remove fuel vapor. Do not attempt any repair on tank or filler neck where heat or flame is required.*

1. Disconnect the negative battery cable, if not already done.
2. Remove in-line fuel filter and inspect for dirt, rust, or contamination. If filter is plugged, replace but do not install until fuel lines are cleared.
3. Drain the tank into a suitable safety can.
4. Remove fuel meter/fuel pump, located under the filler door.
5. Using a wet sponge, wipe inside liner clean of all foreign material. Rinse out sponge often when wiping liner. Wipe dry. Do not use harsh chemicals when cleaning.
6. Inspect strainer on fuel tank meter/ fuel pump. If dirty or clogged, replace with new strainer.
7. Disconnect inlet fuel line at TBI as sembly and apply air pressure in direction of fuel flow from filter to TBI.
8. Apply air pressure in direction of fuel flow from fuel tank to filter.
9. Disconnect return fuel line at TBI as sembly and apply air pressure from TBI to fuel tank.
10. Connect all fuel lines and install fuel filter. If lines are damaged, see below.
11. Install fuel tank meter/fuel pump with new gasket.
12. Connect fuel lines, fuel vapor pipe and electrical connector. Make sure all connec tions are tight.
13. Connect negative battery cable and add fuel. Do not reuse contaminated fuel.
14. Start engine and check for fuel leaks. Dispose of contaminated fuel properly.

Fuel feed, return and emission pipes or hoses are secured to the underbody with clamp and screw assemblies. Flexible hoses are located at fuel tank, fuel vapor and return lines. The pipes should be inspected occasionally for leaks, kinks or dents. Replace any excessively corroded lines.

NOTE: *Fuel and vapor hoses are specially manufactured. If replacement becomes necessary, it is important to use only replacement hoses meeting manufacturer's specifications. Hoses not meeting minimum specifications could cause early part failure or failure to meet emission standards.* 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 in. of any part of the exhaust system or within 10 in. of the catalytic converter. When making repairs, cut a piece of fuel hose about 4 in. longer than portion of the line removed. If more than a 6 in. length of pipe is removed, use a combination of steel pipe and hose so that hose lengths will not be more than 10 in.

Follow the same routing as the original pipe, and always use screw type hose clamps. Slide hose clamps over replacement part and push the hose an equal amount onto each portion of fuel pipe. Tighten clamps on each side of repair, but do not overtighten. Pipes must be properly secured to the frame to prevent chafing, which could wear a hole in the line.

1963-65 Fuel Injection Specifications

		1963	Early 1964®	Late 1964©	1965
Fuel pressure @ 0.5 H_20(±Hg)	Power Stop	1.2	1.9	1.9	1.9
	Economy Stop	0.8	1.0	1.0	1.0
Fast idle speed (rpm-engine hot)		2000	2200	2200	2600
Float level (in.)		2%2	2%2	2%2	2%2
Float drop (in.)		2^2%2	2^2%2	2^2%2	2^2%2
Vacuum to apply — Enrichment Diaphragm (in. Hg)	Economy Stop	9	6	6	6
	Travel Center	NA	4	4	4
	Power Stop	3	2	2	2
Minimum Enrichment Diaphragm Clearance (in.)		0.040	0.010	0.010	0.010
Cold Enrichment Setting		Index	3 notches lean	3 notches lean	Index
Maximum vacuum to apply — Cranking signal valve (in. Hg)		1	1	—	—
Vacuum to apply — Main signal diaphragm (in. H_2O)		1/2	Va	Vfe	1/2

® Part No. 701 7375-R @ Part No. 701 7380

Holley Model 2100 & 2300

Engine Horse-power		Identification Year No.®	Float Level	Accelerator Pump Lever Adjustment	Choke Unloader Clearance	Vacuum Break (in.)	Fast Idle RPM	Choke Setting
1967	400, 435	R3660A (Prim.)	©	.015	.275	.250	2,200	®
		R3659A (Sec.)	©	.015	__	—	2,200	®
		R3888A (Prim.)	©	.015	.275	.250	2,200	®
1968	400,435	R4055A (Prim.)	.350	.015	.275	.250	2,200	®
		R4056A (Sec.)	.50	.015	—	—	2,200	®
		R3659A (Prim.)	.350	.015	.275	.250	2,200	©
1969	400, 435	R40551A (Prim.)	.350	.015	.250	.275	2,200	®
		R36591A(Sec.)	.50	.015	—	—	2,200	®
		R40561A(Prim.)	.350	.015	.250	.250	2,200	®

® Located on tag attached to carburetor
© Bottom of sight plug port plus or minus *Vsz'*
® Hold the choke valve closed and push downward on the coil rod to the end of travel. The top of the rod should be even with the top of the hole in the choke lever. Bend the rod to adjust. ® Hold the choke valve closed and pull upward on the coil rod to the end of travel. The bottom of the rod end which slides into the hole should be even with the top of the hole. Bend the rod to adjust.

Holley 4150 and 4160 Specifications

Year	Identification No.®	Engine Horsepower	Pump Level Choke (Dry) Setting (in.)	Accelerator Lever Adjustment (In.)	Float (in.)	Choke Unloader Clearance (in.)	Fast Idle On Car (ipm)	Choke Vacuum Break (in.)
1966	R3367A	300, 350	®	.015	®	.260	2,200	.170
	R3416A®	300, 350	®	.015	®	.260	2,200	.170
	R3370A	390	©	.015	©	.260	2,000	.180
	R3433A©	390	®	.015	©	.260	2,000	.180
	R3247A	425	©	.015	©	.350	2,000	.350
1967	R3810A	300, 350	®	.015	©	.265	2,000	.190
	R3814A©	300, 350	©	.015	©	.265	2,000	.175
	R3811A	390	©	.015	©	.265	2,200	.175
	R3815A©	390	©	.015	©	.265	2,200	.175
	R3418A	430	©	.015	©	.350	2,200	.350
1968	R4054A	430	©	.015	®	.350	2,200	.300
1969	R4296A	430	©	.015	®	.350	2,200	.350
1970	R4346	370	©	.015	©	.350	2,200	.300
	R4296A	430	©	.015	®	.350	2,200	.350
1971	R4801A®	330	®	.015	©	.350	2,200	.350
	R4800A®	330	®	.015	©	.350	2,200	.350
	R4803A®	425	®	.015	®	.350	2,200	.350
	R4802A®	425	®	.015	©	.350	2,200	.350
1972	R6239A®	255	®	.015	©	.350	2,350	.350
	R6238A®	255	®	.015	©	.350	2,350	.350

® Located on the tag attached to the carburetor, or on the casting or choke plate
© A.I.R.—Air Injector Reactor System
©Prim.—.170", Sec.—.300"
® Hold the choke valve closed and push downward on the coil rod to the end of travel. The top of the rod should be even with the top of the hole in the choke lever. Bend the rod to adjust. ® Hold the choke valve closed. Pull upward on the coil rod to the end of travel. The bottom of the rod end which slides into the hole in the choke lever should be in line with the notch. Bend the rod to adjust. ® Prim.—.350", Sec.—.450" ©Prim.—.350", Sec.—.500" ® Man. Trans. ® Auto. Trans. ® Float centered in bowl ©Hold the choke valve open. Pull downward on the coil rod to the end of travel. The bottom of the rod end which slides into the hole in the choke lever should be in line with the notch. Bend the rod to adjust.

Carter WCFB & AFB

Year	Application	Identification No.	Float Level (In.)	Float Drop (in.)	Pump Rod (in.)	Choke Setting	Main Metering Jet (In.) Prim	Main Metering Jet (In.) Sec	Metering Rod (in.) Prim	Metering Rod (in.) Sec	Tlirottle Bom (In.) Prim	Tlirottle Bom (In.) Sec	Fast Idle (ipm)
1963-65	250 hp	3501 S (M.T.) 3500S (A.T.)	%2©	3/4	1/2	index	0.086	0.0635	0.042	0.067	1 7/IS	1 7/16	1750
	300,340 hp	3461S(M.T.) 3460S (AT.)	%a	%	1/2	1 lean	0.104	0.0689	0.060	0.069	1 9/ie	1 11/ie	1750

© %" for secondary

evf | CM" | e\T | CM" | CM" | CM" | CM" | CM" | CM" | CM"

S-o-r | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8

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§ 1

Rochester Quadrajet® Carburetor Specifications (cont.)

Year	Engine Horse-power	Carburetor Identification®	Float Level (in.)	Air Valve Spring	Pump Rod (in.)	Idle Vent (in.)	Vacuum Break (in.)	Choke Setting	Choke Rod (in.)	Choke Unloader (in.)	Fast Idle Speed (rpm)
1978	185®	17058202	15/32	%	%a	—	.179	2NL	.314	.277	©
	185@®	17058502	15/32	%	%a	—	.187	2NL	.314	.277	©
	220®	17058211	15/32	®	-%a	—	.203	2NL	.314	.277	©
	220®	17058210	1S/32	®	%a	—	.203	2NL	.314	.277	©
1979	195©	17059203	1%2	%	1/4®	—	.157©	2NL	—	.243©	©
	195®	17059216/17	15/32	7/8	1/4®	—	.157©	1NL	—	.243©	©
	195@®	17059502/04	15/32	7/8	1/4®	—	.164©	2NL	—	.243©	©
	195 @®	17059582/84	15/32	7/8	11/32	—	.203©	1NL	—	.314®	©
	225®	17059211	15/32	1	%2®	—	.157®	2NL	—	.243®	©
	225®	17059210/28	1S/32	1	%2®	—	.157©	1NL	—	.243©	©
1980-81	180	Uses E4ME carburetor-	-computer controlled								©

190®	17080207	7/16	%	y.®	—	.157	—	—	.243®	©
190®	17080204	7/16	%	y«®	—	.157	—	—	.243©	©
230	17080228	7/16	%	%2®	—	.179	—	—	.243©	©

©The carburetor identification number is stamped on the float bowl, near the secondary throttle lever.
® Man. Trans.
® Auto. Trans.
©Inner hole
© Hold the choke valve closed. Pull upward on the coil rod to the end of travel. The bottom of the rod end which slides into the hole in the choke lever should be even with the top of the hole. Bend the coil rod to adjust. ® Hold the choke valve closed and push downward on the coil rod to the end of travel. The top of the rod should be even with the top of the hole in the choke lever. Bend the rod to adjust.
© California
® Hold the choke valve open. Pull downward on the coil rod to the end of travel. The bottom of the rod end which slides into the hole in the choke lever should be in line with the notch. Bend the rod to adjust.
® Hold the choke valve closed. Pull upward on the coil rod to the end of travel. The bottom of the rod end which slides into the hole in the choke lever should be in line with the notch. Bend the rod to adjust.
® Without vacuum advance
©With vacuum advance, without EGR signal
©Front—0.180, rear—0.170
©High altitude
© Not specified by the manufacturer. See the specifications supplied with the carburetor rebuild kit.
© See the underhood specification decal.
© Measured between the top of the choke valve and the choke wall.

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HEATER

Blower Motor

REMOVAL AND INSTALLATION

1963-1967 With or Without A/C

1. It is not necessary to drain the cooling system to remove the heater blower. Remove the radiator expansion-tank retaining straps and move the tank from the work area.
2. Disconnect the ground cable from the battery.
3. Remove the blower motor leads.
4. Mark the blower motor mounting plate and blower motor assembly for correct reassembly.
5. Remove the five retaining screws and remove the blower assembly.
6. Reverse the removal procedure to reinstall, being careful to reposition the blower according to the marks previously made.

1968-1972 Without A/C

1. Disconnect the ground cable from the battery.
2. If so equipped, remove the radiator expansion tank retaining screws and move the tank out of the way.
3. Remove the blower motor leads.
4. Remove the case mounting screws and remove the blower assembly. Gently pry on the flange, should the sealer hold the motor in place.
5. Use the reverse procedure to install the motor.

1968-72 With A/C

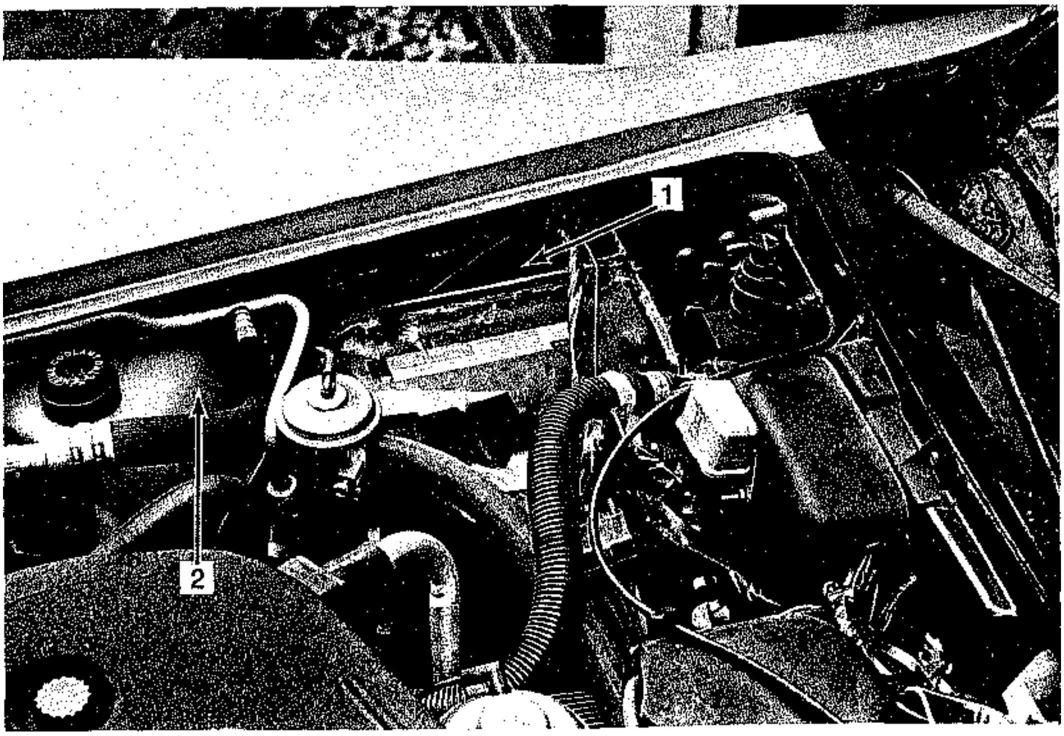
1. Disconnect the battery ground cable.
2. Disconnect the blower motor wire and the rubber air cooling tube.
3. Remove the three sill plate molding screws and pry it out to gain access to the right splash shield retaining bolts.
4. Remove the splash shield retaining bolts and remove the splash shield.
5. Remove the motor to case mounting screws and lower the motor through the splash shield opening.
6. It may be necessary to pry the flange gently if the sealer acts as an adhesive.
7. Reverse the above procedure to install the motor.

1973-82 With or Without A/C

1. Disconnect the negative battery cable at the battery.
2. On 1981-82 models, unbolt the A/C compressor and move the compressor out of the way. DO NOT disconnect die refrigerant lines from the compressor.
3. Remove the coolant recovery jar, if so equipped.
4. Disconnect the wiring from the motor and the cooling tube from the motor case, if so equipped.
5. Remove the mounting screws from the blower motor and remove the motor. If the motor sticks to the case due to the sealer, pry the motor GENTLY away from the case.
6. Installation is the reverse of the previous steps.

1984 and Later

1. Disconnect the negative battery cable.
2. Remove the front wheel house rear panel and move the wheel house seal aside.
3. Remove the motor cooling tube.
4. Remove the relay.
5. Remove the blower motor mounting screws.
6. Remove the blower motor and impeller as an assembly.



1. Blower motor location
2. On air conditioned models, the coolant recovery jar must be removed to gain access to the motor

Typical blower motor location

7. Installation is the reverse of removal. Make sure all electrical connections are clean and tight.

Core

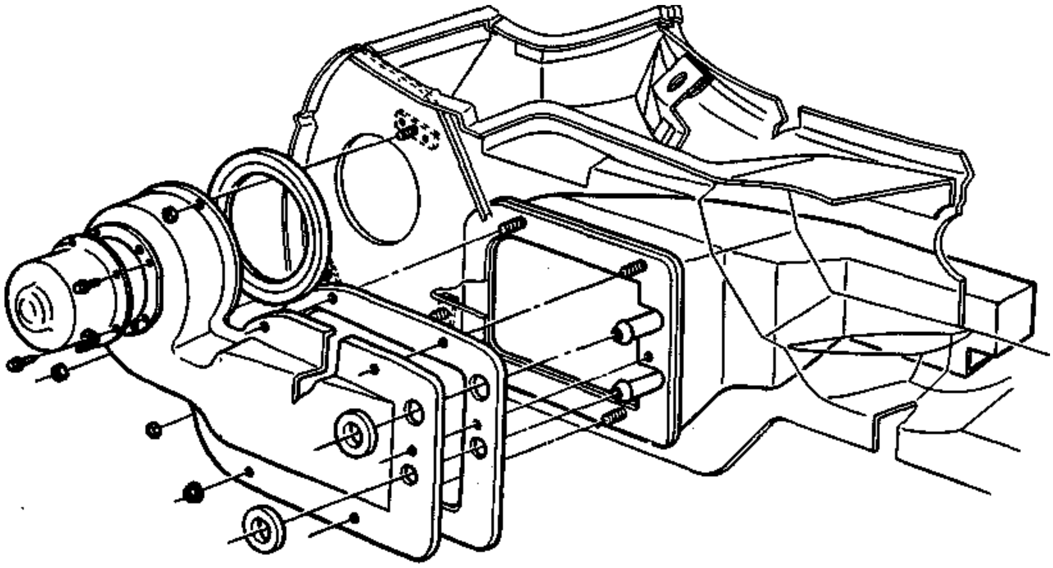
REMOVAL AND INSTALLATION

1963-1967 With or Without A/C

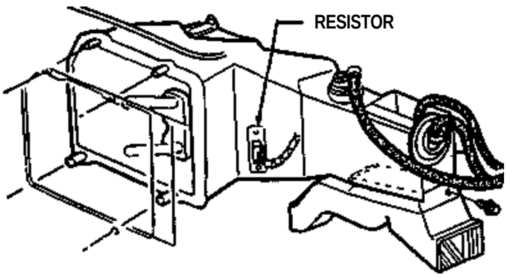
1. Drain the radiator, remove the radiator expansion-tank retaining straps, and move it from the work area.
2. Remove the battery.
3. Remove the water hoses from the heater assembly.
4. Remove the seven stud nuts attaching the blower and an inlet assembly to the firewall. Remove the assembly.
5. Remove the glove compartment and panels on both sides of the console.
6. As a precaution, place a plastic sheet or other waterproof covering over the passenger-side carpet.
7. Remove the two control cables from the instrument panel.
8. Disconnect the wire leads from the lower switch and the resistor.
9. Carefully remove the heater assembly from under the dashboard.
10. Remove the four, core cover retaining screws.
11. Loosen the four screws holding the core retaining yokes and the core to the retainer cover.
12. Remove the rear cover and core.
13. To install, reverse this procedure.

1968-1979 Without A/C

1. Disconnect the battery ground cable.
2. Drain the cooling system and remove and plug the water hoses from the heater connections.
3. Remove the air-distributor duct stud nuts on the firewall.
4. Remove the right instrument panel pad, right-hand dashboard braces, center dash console duct, and the floor outlet duct.
5. Remove the radio and center dashboard console.
6. Pull the distributor duct from the firewall and remove the resistor wires when clearance is sufficient.
7. Remove the heater core retaining springs and remove the core.



Heater and blower assembly-wo/Ac—typical



Heater and distributor assembly—1968-79 wo/AC

8. Installation is the reverse of removal. If core-to-case sealer was damaged during removal, replace with new sealer.

1968-80 With A/C

1. Disconnect the battery ground cable.
2. Drain the cooling system. It is not necessary to evacuate the A. C. refrigerant.
3. Disconnect the heater hoses at the firewall and plug the pipes.
4. Remove the nuts from the distributor studs protruding through the firewall.
5. Remove the right side dash pad and center dash cluster (described under "Instruments").
6. Disconnect the right dash outlet from the center duct.
7. Remove the center duct from the selector duct.
8. Remove the selector duct to the dash panel and pull it to the right and to the rear.
9. Remove the cables and wiring connectors from the selector and remove it from the car.
10. Remove the temperature door cam plate from the selector duct.
11. Remove the heater core and housing from the selector.
12. Reverse the removal procedure to install.

1981-82 All Models

1. Disconnect the negative cable at the battery.
2. Drain the coolant from the radiator.
3. Raise the right front of the vehicle and support it safely.
4. Disconnect the heater hoses at the heater core connections.
5. Remove the heater case retaining nut which is located on the top of the blower case.
6. Remove the glove box.
7. Remove the console side panels.
8. Remove the knobs and nuts from the radio shafts.
9. Remove the two screws which secure the console trim plate to the instrument cluster.
10. Remove the instrument cluster attaching screws.
11. Pull the cluster out slightly and disconnect the electrical connector from the rear of the cluster.
12. Remove the radio as outlined after this procedure.
13. Remove the right side windshield pillar trim panel.
14. Remove the right side dash panel re-

taining screws and pull the panel rearward to release the upper retaining clip.

15. Remove the following ducts:
    a. Right side vent
    b. Main vent distribution
    c. Lower heater deflector
    d. Heater-defroster distribution duct assembly (Disconnect the vacuum line).
16. Disconnect both the temperature cable and the vacuum line at the heater housing.
17. Remove the heater core from the housing.
18. Installation is the reverse of the previous steps.

1984 and Later

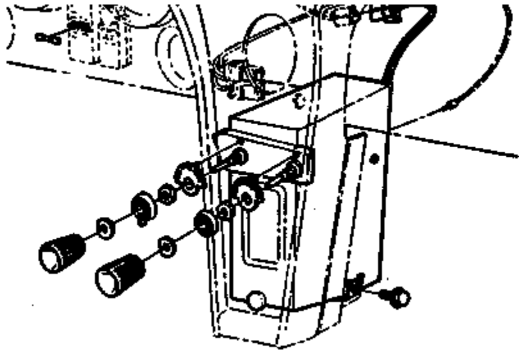
1. Disconnect the negative battery cable.
2. Remove the instrument cluster bezel including the tilt wheel lever and dash pad.
3. Remove the A/C air duct and disconnect the flex hose.
4. Remove the right side acoustic panel.
5. Remove the side window defroster flex hose.
6. Remove the side window defroster duct mounting screws and disconnect the extension.
7. Remove the temperature control cable and bracket assembly at the heater cover. Disconnect the heater door control shaft.
8. Remove the electronic control module (ECM) and disconnect the connectors. Make sure the ignition is switched OFF when removing ECM connectors.
9. Remove the tubular support brace from the door pillar to the instrument panel reinforcement brace.
10. Remove the heater core cover mounting screws.
11. Remove the heater pipe and the heater water control bracket attaching screws.
12. Cut the heater hose at the heater core inlet and outlet connection. The heater hoses should be replaced when installing the core.
13. Remove the heater core. Be careful of any coolant left in the core when handling.
14. Installation is the reverse of removal.

RADIO

REMOVAL AND INSTALLATION

1963-67

1. Remove both console side panels and trim strip(s).



1963-67 radio installation

2. Remove the radio knobs, washers, bezels, and nuts.
3. Disconnect the antenna lead-in, the radio-to-electrical harness, and radio-to-speaker connectors.
4. Remove the one attaching bolt located on the lower, right side of the radio.
5. Turn the radio on its side and remove it from the left side of the console.

1968-71 Coupe

1. Disconnect battery.
2. Remove right and left door sill plates and kick pads.
3. Disconnect right and left side radio-to-speaker connectors.
4. Remove right side dash pad.
5. Remove right and left console forward trim pads.
6. Remove bolt and remove the heater floor outlet duct by pulling it through left hand opening.
7. From front of console, tape radio push buttons in depressed position. From rear of console, disconnect electrical connector, brace and antenna lead-in.
8. Remove radio knobs and bezel retaining nuts. Push radio assembly forward and remove from rear through right side opening.
9. Install by reversing procedure above.

1969-71 Convertible

1. Disconnect battery.
2. Remove right instrument panel pad.
3. Disconnect speaker connectors.
4. Remove wiper switch trim plate screws

to gain access to switch connector and remove connector and trim plate from cluster assembly.

5. Unclip and remove right and left console forward trim pads and remove forwardmost screw on right and left side of console.

6. Inserting a flexible drive socket between, the console and metal horseshoe brace, remove the nuts from the two studs on the lower edge of the console cluster. Remove the remaining screws that retain the cluster assembly to the instrument panel.

7. From rear of console, disconnect electric connector, brace and antenna lead-in.

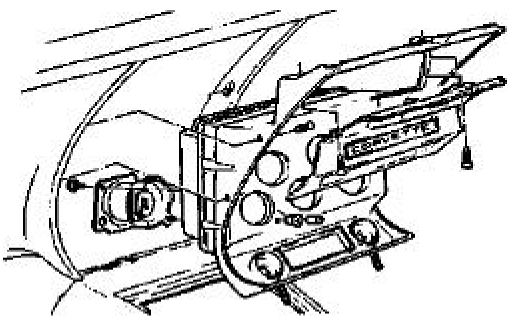
8. Remove radio knobs and bezel retaining nuts.

9. Pull radio assembly forward and remove through right side opening.

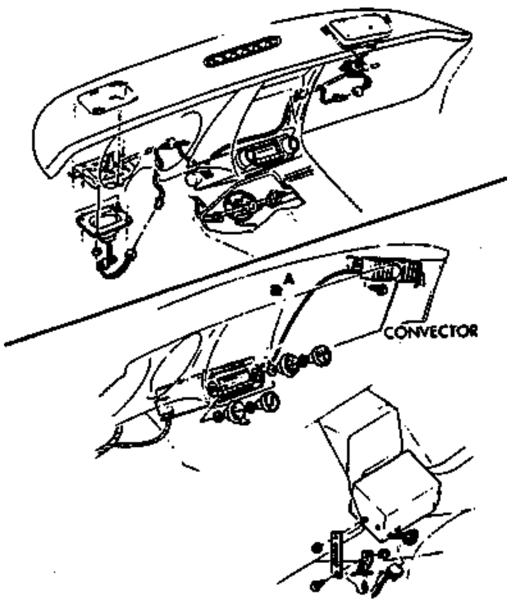
10. Install by reversing procedure above.

1972-76

1. Disconnect the negative battery cable and remove the right instrument panel pad.
2. Disconnect the radio speaker connectors.
3. Remove the wiper switch trim plate screws and tip the plate forward to gain access to the switch connector. Remove the switch connector and trim plate from the dash.
4. Unclip and remove the right and left forward console trim pads. Remove the forwardmost screw on the left and right sides of the console.
5. Working with a flexible drive socket between the console and the metal horseshoe brace, remove the nuts from the studs on the lower edge of the console cluster.
6. Remove the remaining console attaching screws and disconnect the radio electrical connectors, antenna wire and radio brace from the rear of the console. Remove the radio knobs and nuts.



1968-76 center Instrument cluster



Typical 1974-82 radio mounting

7. Pull the top of the console rearward and separate the radio from the console and remove it from the right side opening.

NOTE: *The center instrument cluster trim panel is designed to collapse under impact. Do not deflect the panel to gain access to the radio. Also, the remotely located radio heat sink should be removed with the radio when servicing is required.*

1977-82

1. Disconnect the battery ground cable.
2. Remove the console tunnel side panels.
3. Pull the radio control knobs from the shaft.
4. Remove the two screws that secures the console trim plate to the instrument cluster.
5. Remove the rear defogger switch if so equipped.
6. Remove the five screws from around the upper perimeter of the instrument cluster.
7. Pull the instrument cluster enough to disconnect the electrical connector from the rear of the cluster.
8. Remove the screw holding the radio bracket reinforcement to the floor pan.
9. Pull the radio outward and disconnect the wiring from the back.
10. Installation is the reverse of removal. If a new radio is being installed, save the mounting bracket from the rear of the old one.

1984 and Later

There are several different types of radio and/or cassette sound system available in the 1984 Corvette. By removing the trim plate covering the radio, access can be gained to the mounting screws securing the assembly to the instrument panel. Once the mounting screws are removed, the radio should pull out far enough to disconnect the antenna, power and speaker connectors. One thing all 1984 sound systems have in common is ungrounded speakers. Installing add-on components that utilize the original speakers may cause damage to both the speakers and the added component. If additional access is required to reach a bracket, etc., there are additional trim pads located under the lower right side of the instrument panel, the right front and on the console. The accessory trim plate in the center of the dash, just above the console should provide all the access necessary. Remove the radio carefully and avoid the use of excessive force when pulling the unit forward to get at the connectors.

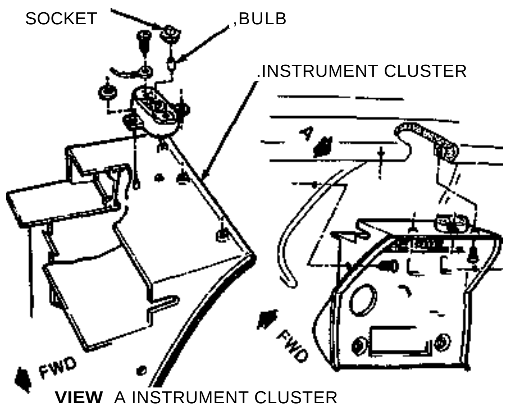
INSTRUMENT CLUSTER

REMOVAL AND INSTALLATION

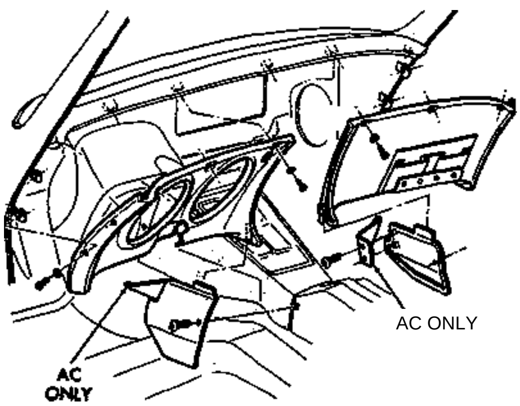
1963-67

AD instruments are contained in one cluster.

1. Disconnect the negative battery cable. Remove the instrument panel harness from the lower steering column switch and disconnect the switch.
2. Remove the steering wheel cap and the center nut and washer.
3. Pull off the steering wheel with a suitable puller.
4. Remove the steering column escutcheon screws and the nuts from the column support U-bolt.
5. Loosen the lower column clamp at the firewall.
6. Loosen the lower, spring stop-clamp and slide the stop and spring down on the shaft.
7. Paint or mark the steering shaft and coupling with chalk. Remove the upper coupling clamp bolt.
8. Pull the jacket and steering shaft assembly from the coupling and very carefully pull it out through the dash, at the same time sliding the lower spring stop, spring, bearing, and seat off the steering shaft.
9. Disconnect the tachometer drive cable, cowl-vent control cable brackets, and headlight motor switch from the instrument cluster.
10. Disconnect the parking brake lever support bracket from the cowl crossmember.
11. Pull the headlight switch on. Reach under the instrument cluster and push in the detent pin on the switch; remove the knob and shaft.
12. Screw out the retaining nut with a wide bladed screwdriver. Remove the bezel and switch assembly from the instrument cluster. Disconnect the wiring connector from the switch.
13. Remove the lock cylinder from the ignition switch by turning it to the "Lock" position and inserting a wire in the small cylinder face hole. Push the wire in while turning the ignition key counterclockwise, until the lock cylinder can be removed.
14. Carefully remove ignition-switch escutcheon nut using a screwdriver held in the escutcheon slot and tapping it with a small hammer.



Typical 1977-82 center instrument cluster



1968-76 Instrument panels and lower trim assembly

15. Remove the ignition switch from the instrument cluster and remove all wiring connectors. Unsnap the two locking tangs with a screwdriver and unplug the ignition connector. Disconnect the ignition switch lamp support.

16. Disconnect the oil pressure line and the instrument and lamp lead wires. Discon nect the trip odometer cable.

17. Remove the cluster retaining screws and pull the cluster slightly forward for ac cess to the speedometer and tachometer ca bles and the remaining wires.

18. Remove cluster. All instruments are now easily accessible for service. Installation uses a reverse of the removal procedure.

1968-77

1. To service instruments other than the speedometer and tachometer, follow radio removal procedures. Small instruments are easily removed, after the center cluster is re moved from the console.
2. To remove the driver's-side instrument cluster, first disconnect the negative battery cable.
3. Lower the steering column.
4. Remove retaining screws and washers at the door opening, dash top, and leftside of the center panel.
5. Unclip and remove the left, front con sole trim-panel.
6. Pull the cluster slightly forward for ac cess to speedometer and tachometer cables, headlight switch connectors, and lamp wires.
7. Remove the cluster. Speedometer and tachometer may now be serviced.
8. Install using a reversal of the removal procedure.

1978-82

NOTE: *This procedure outlines the removal of the speedometer and tachometer cluster. Refer to the previous Radio Removal and Installation procedure to remove the center/console cluster.*

1. Disconnect the negative battery cable.
2. Remove the left air distribution duct.
3. Remove the screws attaching the lens to the bezel and remove the lens.
4. Remove the cluster attaching screws and pull the cluster slightly forward.
5. Disconnect the speedometer cable and lamp connectors as necessary.
6. Installation is the reverse of removal.

1984 and Later

1. Disconnect the negative battery cable.
2. Remove the spring-loaded light switch knob and the light switch nut.
3. Remove the steering column trim cover.
4. Remove the two steering column at taching bolts and lower the steering column to provide access.
5. Remove the cluster bezel front and left side attaching screws.
6. Remove the cluster bezel from the in strument panel.
7. Remove the cluster to instrument panel attaching screws.
8. Pull the cluster carefully rearward to get at the cluster electrical connectors. Metal retaining clips are used at the back of connec tors.
9. Remove the instrument cluster.
10. Installation is the reverse of removal. Make sure all electrical connections are tight and properly plugged together.

SPEEDOMETER CABLE REPLACEMENT

Reach behind the speedometer and depress the retaining clip. Pull the cable from the casing. If the cable is broken, raise the car and disconnect the cable at the transmission. Lubricate only the bottom % of the cable core with speedometer cable lubricant. Reconnect all parts.

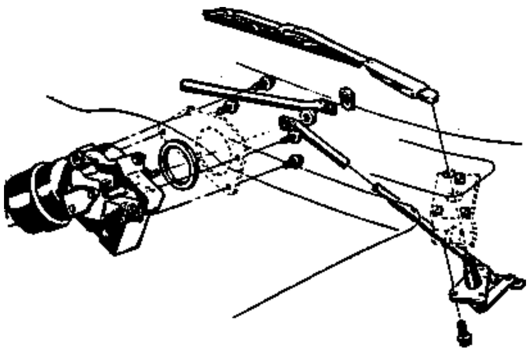
WINDSHIELD WIPERS

Motor

REMOVAL AND INSTALLATION

1963-67

1. Remove the negative cable from the battery.
2. Remove distributor and left-side igni tion shields. Remove the left-side, sparkplug wire bracket and position out of the way.
3. Disconnect the ballast resistor on the firewall, then remove washer inlet and outlet hoses at the pump valve assembly.
4. Remove the distributor cap and posi tion one side.
5. Disconnect washer pump and wiper-motor lead wires.
6. Remove the glove compartment.
7. Ensure that the wipers and motor are parked, then remove the wiper linkage re-



1963-67 windshield wiper motor and linkage

twining clip and disconnect both linkage and spacer from the crank arm.

8. Remove the wiper motor-to-firewall bolts and remove the motor.

9. To install, have an assistant aid in positioning and mount the wiper motor to the firewall. Ensure that the motor is in the parked position.

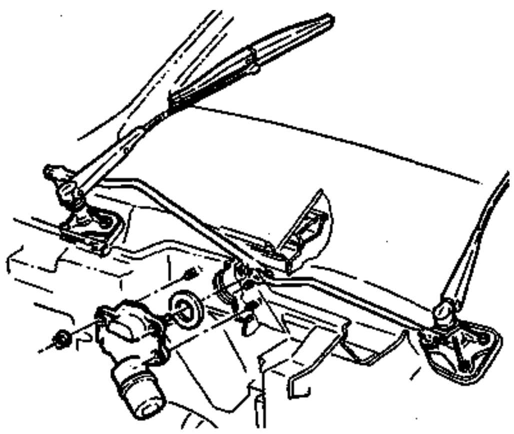
10. Position the left linkage, spacer, and right linkage on the crank arm and install the retaining clip in the groove in the crank arm.

11. Install remaining parts in a reverse order of removal.

12. Connect battery and test wipers and washers.

1968-82

1. Ensure that the wiper motor is in the Park position.
2. Disconnect washer hoses and wire leads from the motor.
3. Remove the plenum chamber grille.
4. Remove the crank arm-to-motor retaining nut.



1968-82 windshield wiper motor and linkage

5. Remove the ignition shielding and distributor cap.
6. Remove the three, motor retaining screws or nuts and remove the motor.
7. Check gaskets and replace if necessary. Ensure that the motor is in Park position.
8. Reverse removal steps to install.

1984 and Later

1. Remove the wiper arms.
2. Remove the air inlet leaf screen.
3. Turn the ignition ON and activate the wiper switch. Allow the motor to rotate the crank arm to a position between 4 and 5 o'clock as viewed from the passenger compartment. Turn off the ignition to stop the crank arm in this position.
4. Disconnect the negative battery cable.
5. Disconnect the upper motor electrical connectors.
6. Remove te wiper motor mounting bolts.
7. With the crank arm in the position described above, the wiper motor may be easily removed from the vehicle. Disconnect the lower electrical connector as the motor is removed.
8. Installation is the reverse of removal.

Wiper Blades and Inserts

REMOVAL AND INSTALLATION

Refer to Chapter One for this information.

Wiper Transmission

REMOVAL AND INSTALLATION

1963-67

1. Remove the wiper block and arm assembly from the transmission.
2. Remove the glove box door and compartment assembly.
3. Remove the three transmission-to-cowl retaining screws.
4. Remove the wiper transmission retaining clip and remove the transmission from the crank arm.
5. Remove the transmission through the glove box opening.
6. To install, reverse the above procedure.

1968-72

1. Make sure the wiper is in the park position.
2. Open the hood and disconnect the battery ground cable.

3. Remove the rubber plug from the front of the wiper door actuator, insert a screw driver and push the internal piston rearward to actuate the wiper door open.
4. Remove the wiper arm and blade as semblies from the transmission.
5. Remove the plenum chamber air intake grille, or screen, if so equipped.
6. Loosen the nuts retaining the drive rod ball stud to the crank arm and detach the drive rod from the crank arm.
7. Remove the transmission retaining screws, or nuts, then lower the drive rod as semblies into the plenum chamber.
8. Remove the transmission and linkage from the plenum chamber through the cowl opening.
9. To install reverse the above procedure. Make sure the wiper assemblies are installed in the park position.

1973-84

1. Make sure the wiper is in the park po sition.
2. Disconnect the battery ground cable.
3. Open the hood and remove the plenum chamber screen.
4. Loosen the nuts retaining the ball sock ets to the crank arm and detach the drive rod from the crank arm.
5. Remove the transmission nuts, then lift the rod assemblies from the plenum cham ber.
6. Remove the transmission linkage from the plenum chamber.
7. To install reverse the removal proce dure. Make sure the wipers are in the park position.

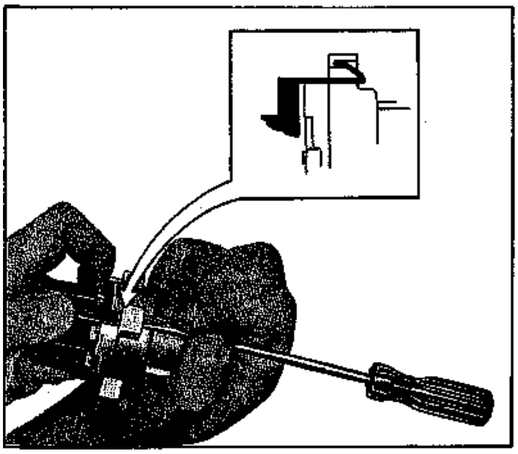
Ignition Switch

REMOVAL AND INSTALLATION

1964-67

NOTE: *See Chapter 8 for steering column switch removal.*

1. Disconnect the ground cable from the battery.
2. Remove the cylinder by placing it in the lock position and inserting a stiff wire in a small hole to depress the plunger. Turn the cylinder counter-clockwise until the cylinder can be removed.
3. Remove the holding nut with Tool J-7607 or its equivalent.
4. Pull the switch from under the dash and remove the connector.



Unlocking the ignition switch connector—1964-68

5. Using a screwdriver, unsnap the lock ing tangs.
6. To install reverse the above procedures

1968

1. Open the battery storage compartment and disconnect the ground cable from the battery.
2. Remove the screws securing the "Cor vette" cover plate in the top center of the cluster assembly.
3. Remove the ash tray and retainer.
4. Remove the radio and bracket.
5. Remove the lock cylinder by position ing the switch in the "ACC" position and in serting a wire in the cylinder face small hole. Push in on the wire to depress the plunger and continue turning the key counterclock wise until the lock cylinder can be removed.
6. Remove the ignition switch bezel nut and pull the ignition switch out from under the dash.
7. Using a screwdriver unsnap the "theft resistant" locking tangs on the connector and unplug the connector.
8. To install reverse the above procedure.

SEAT BELTS

Warning System

1972-73

The seat belt warning system consists of lap belt retractor switches, a pressure-sensitive switch underneath the right-hand front passenger's seat, a warning lamp and a buzzer.

On manual transmission-equipped cars, the circuit is wired through the ignition switch, the parking brake warning light switch, and a relay, which is located between the instrument cluster wiring and the switch on the parking brake. A diode is used to prevent feedback into the parking brake warning circuit.

On cars having automatic transmissions, the seat belt warning circuit is wired through the ignition switch and the combination back-up lamp/neutral safety switch.

With the ignition key in the "RUN" position, a weight of 40-50 Ibs. on the driver's or passenger's seat pressure-sensitive switch) energizes the circuit when the parking brake is released (MAT) or the gear selector placed in a forward drive range (A/I).

A warning light will glow and a buzzer will sound with the circuit energized, unless the seat belts are withdrawn from the retractors and fastened over the kps of the two outboard front seat occupants.

Seat Belts/Starter Interlock System

As required by law, all 1974 and some 1975 Chevrolet passenger cars cannot be started until the front seat occupants are seated and have fastened their seat belts. If the proper sequence is not followed, e.g., the occupants fasten their seat belts and then sit on diem, the engine cannot be started.

If, after the car is started, the seat belts are unfastened, a warning buzzer and light will be activated in a similar manner to that described for 1972-73 models.

The shoulder harness and kp belt are permanently fastened together, so that they both must be worn. The shoulder harness uses an inertia-lock reel to allow freedom of movement under normal driving conditions.

NOTE: *This type of reel locks up when the car decelerates rapidly, as during a crash.*

The lap belts use the same ratchet-type retractors that the 1972-73 models use.

The switches for the interlock system have been removed from die kp belt retractors and placed in the belt buckles. The seat sensors remain the same as those used in 1972-73.

For ease of service, the car may be started from outside, by reaching in and turning the key, but without depressing the seat sensors.

In case of system failure or for service, an override switch is located under the hood. This is a "one start" switch and it must be reset each time it is used.

DISABLING THE INTERLOCK SYSTEM

Since the requirement for the interlock system was dropped during the 1975 model year, these systems may now be legally disabled. The seat warning light is still required.

1. Disconnect the battery ground cable.
2. Locate die interlock harness connector under die left-side of die instrument panel on or near die fuse block. It has orange, yel low, and green leads.
3. Cut and tape die ends of die green wire on die body side of die connector.
4. Remove die buzzer from die fuse block or connector.
5. Reconnect the battery ground cable.

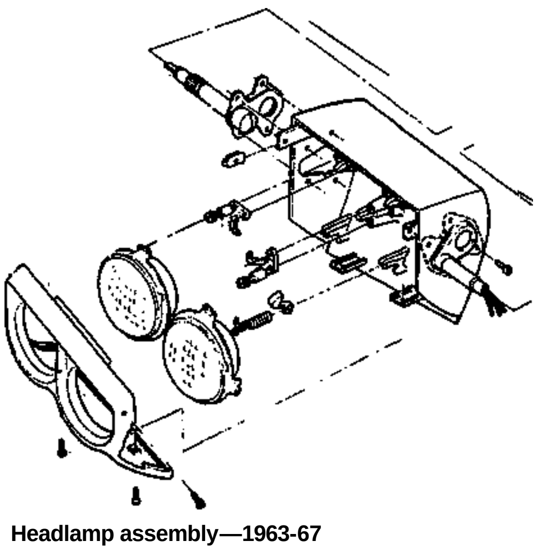
LIGHTING

Headlight Sealed Beams

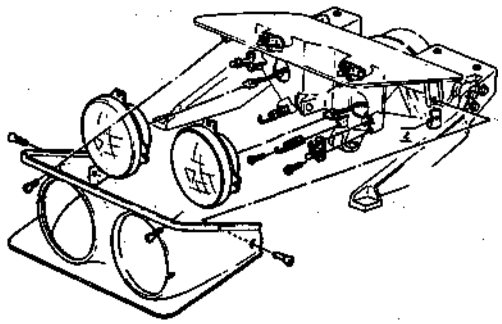
REMOVAL AND INSTALLATION

1. Open die headlight panel to die open position.
2. Remove die headlight bezel retaining screws and remove the bezel.
3. Disengage die spring from die retain ing ring and remove die two attaching screws.

NOTE: *Do not touch the adjusting screws. The retaining ring screws are the screws which go through the closed holes in the retaining ring. The adjusting screws go through the slotted open holes in the retaining ring and adjust the angle of the mounting ring behind the headlight sealed beam.*



Headlamp assembly—1963-67



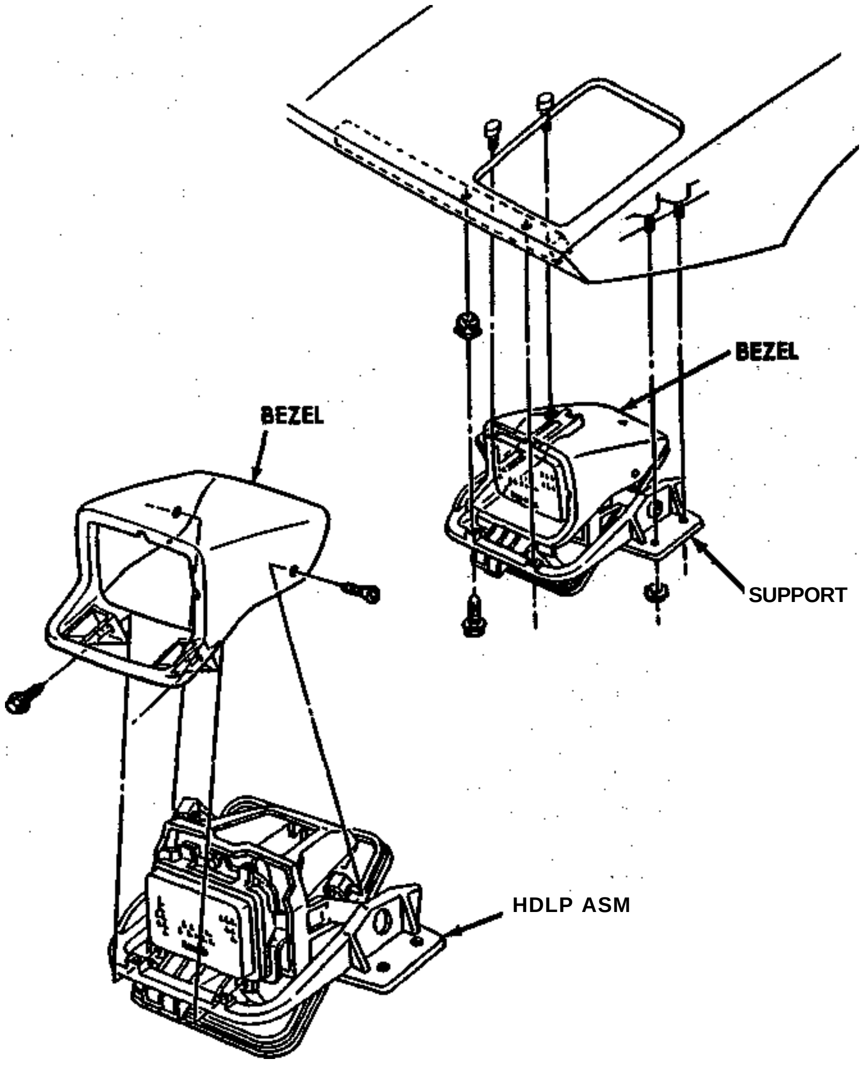
Headlamp assembly—1968-82

Location of horizontal (1) and vertical (2) adjustment screws

4. Remove the retaining ring and disconnect the sealed beam unit at the wiring connector. On 1984 models, rotate the right headlight clockwise and the left headlight counterclockwise to release it from the aiming pins.

5. When installing the sealed beam unit make sure the number which is moulded into the lens is at the top. The number 1 inboard unit takes a double connector plug and the number 2 outboard unit takes a triple connector plug.

NOTE: *Disconnect the headlight motor*



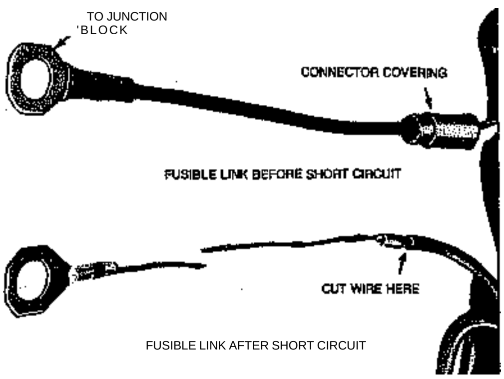
Headlamp assembly—1984 and later models

connector when raising the headlights manually.

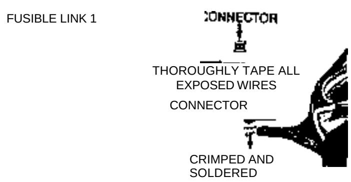
CIRCUIT PROTECTION

Fusible Links

In addition to fuses, the wiring harness incorporates fusible links to protect the wiring. Fusible links are sections of wire, with special insulation, designed to melt under electrical overload. There are four different gauge sizes used. The links are marked on the insulation with the wire gauge size because of the heavy insulation which makes the link appear a heavier, gauge than it actually is. Whenever it is necessary to splice a new wire in always bond the splice with rosin core solder then cover with electrical tape. Using acid core solder may cause corrosion. Tape and seal all splices with silicone to weatherproof repairs.



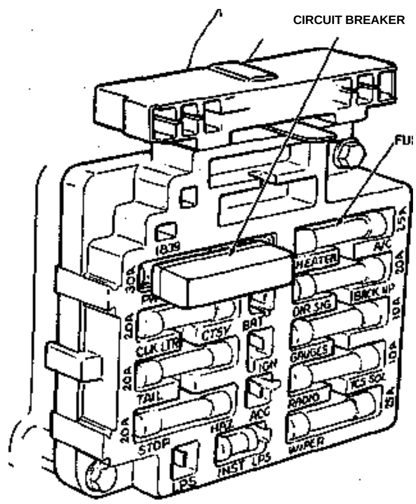
Fusible link (© Chevrolet Motor Division)



Fusible link replacement

Circuit Breakers

A circuit breaker is an electrical switch which breaks the circuit in case of an overload. The circuit breaker is located at the top of the fuse panel. The circuit breaker will remain open until the short or overload condition in the circuit is corrected. Refer to the chart at the end of his chapter to find which circuits are protected and how.

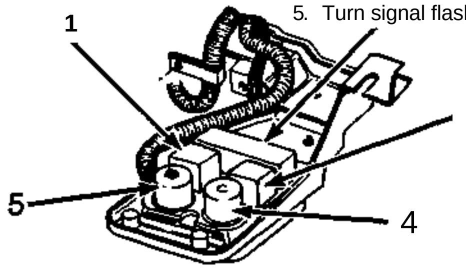


Fuse panel—typical

Fuses and Flashers

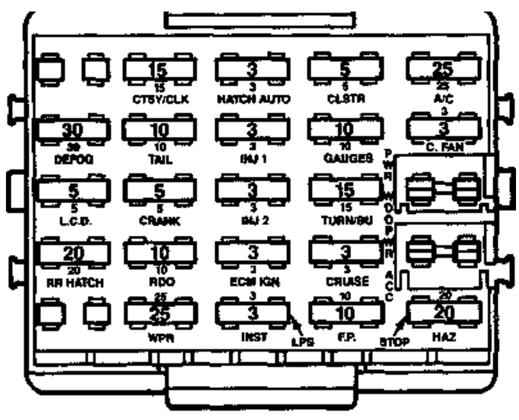
Fuses are located in the junction box below the instrument panel to the left of the steering column. The turn signal flasher and hazard warning flasher also plug into the fuse

4. Hazard flasher
5. Turn signal flasher



1. Horn relay
2. Warning buzzer
3. Electric choke relay

Convenience center and components—typical



Fuse box on late models showing circuit codes and amp ratings on fuses

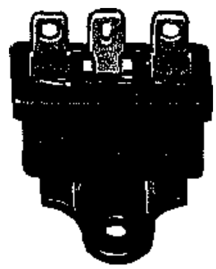
block. Each *fuse* recepticle *is* marked as to the circuit it protects and the correct amperage of the fuse. In line fuses are also used. Refer to the Fuse Chart at the end of the chapter for their location. The fuse block on some models is a swing-down unit located in the underside of the instrument panel adjacent to the steering column. Access to the fuse block on some models is gained through the glove box opening. The Convenience Center on some models is a swing-down unit located on the underside of the instrument panel. The swing-down feature provides central location and easy access to buzzers, relays and flasher units. All units are serviced by plug-in replacement. Location of Convenience Center on specific models may vary.

Thermal Limiter Fuse

1973 and Earlier

The thermal fuse consists of a temperature sensitive fuse link and a wire wound resistor enclosed in a plastic housing. There are three spade-type electrical terminals which plug into an in-line connection at the wiring harness to the air conditioning compressor.

A blown thermal fuse indicates that the air conditioning system is either low or completely out of refrigerant charge, a malfunctioning POA or expansion valve or an improperly located thermal limiter.



Thermal limiter fuse

Circuit Protection Chart

Model Year	Protected Circuit	Type of Protection
1963-66	Headlamp circuit	15 amp circuit breaker
	Headlamp motors and power windows	40 amp circuit breaker
	Instrument, clock, and radio lamps	4 amp fuse
	Taillights	10 amp fuse
	Radio	2 1/2 amp fuse
	Heater	10 amp fuse
	Stop, license, courtesy, and dome lamps	15 amp fuse (1963, 20 amp)
	Parking brake alarm, back-up lamp, and gas gauge	10 amp fuse
	Air conditioning	30 amp fuse
	AC high blower speed	30 amp fuse (in-line)
1967	Back-up lamp and gauges	10 amp fuse
	Heater and air conditioning	25 amp fuse
	Radio and wipers	20 amp fuse
	Instrument lamps	4 amp fuse
	Stop and taillights	20 amp fuse
	Clock, lighter, courtesy lamps, and flasher	20 amp fuse
	AC high blower speed	30 amp fuse
	Solenoid Bat terminal	14 gauge fusible link
	Horn relay	16 gauge fusible link
	Voltage regulator No. 3 terminal	20 gauge fusible link
	Voltage circuit (both sides of meter)	20 gauge fusible link
	Headlamp circuit	15 amp circuit breaker
	Headlamp motors and power windows	40 amp circuit breaker
1968-69	Headlamp circuit breaker	15 amp circuit breaker
	Power window circuit	30 amp circuit breaker
	Wiper/washer	25 amp fuse
	Back-up lights and turn signals	20 amp fuse
	Heater and air conditioning Radio	25 amp fuse
	and power windows Tail and side	10 amp fuse
	marker lamps Instrument lamps	20 amp fuse
	Gauges	5 amp fuse
	Stop light and flasher Clock, lighter,	10 amp fuse
	courtesy and dome lamps AC high	20 amp fuse
	blower speed Solenoid Bat terminal	20 amp fuse
		30 amp fuse (in-line)
		14 gauge fusible link

Circuit Protection Chart (cont.)

Model Year	Protected Circuit	Type ot Protection
1968-69	Horn relay	16 gauge fusible link
	Voltage regulator No. 3 terminal	20 gauge fusible link
	Ammeter circuit (both sides of meter)	20 gauge fusible link
1970	Headlamp circuit	15 amp circuit breaker
	Power window circuit	30 amp circuit breaker
	Wiper/washer	25 amp fuse
	Back-up lights, turn signal, heater	25 amp fuse 25 amp
	Air conditioning and TCS solenoid	fuse 10 amp fuse 20
	Radio and power windows	amp fuse 5 amp fuse
	Taillights and side marker lights	20 amp fuse 20 amp
	Instrument lamps	fuse 30 amp fuse (in-
	Gauges	line) 14 gauge fusible
	Clock, lighter, courtesy and dome lights	link
	AC high blower speed	16 gauge fusible link
	Solenoid Bat Terminal	20 gauge fusible link
	Horn relay	20 gauge fusible link
	Voltage regulator No. 3 terminal	
	Ammeter circuit (Both sides of meter)	
1971 -72	Headlamp circuit	15 amp circuit breaker
	Power window circuit	30 amp circuit breaker
	Radio, TCS system, and power windows	10 amp fuse
	Wiper/washer	25 amp fuse 20 amp
	Stop lights and flasher	fuse 25 amp fuse 20
	Heater and air conditioning	amp fuse 5 amp
	Directional signals, back-up lights, and AC blocking relay	fuse 10 amp fuse 25
	Instrument lamps	amp fuse 25 amp
	Gauges	fuse 20 amp fuse 30
	Clock, lighter, courtesy and dome lights	amp fuse (in-line) 14
	Anti-diesel control and anti-theft alarm	gauge fusible link
	Tail, side marker, and back-up lights	16 gauge fusible link
	AC high blower speed	20 gauge fusible link
	Solenoid Bat terminal	20 gauge fusible link
	Horn relay	
	Voltage regulator No. 3 terminal	
	Ammeter circuit (both sides of meter)	
1973-76	Headlamp circuit	circuit breaker 30 amp
	Power window circuit	circuit breaker 25 amp
	Back-up lamps and turn signals	AGC fuse 25 amp AGC
	Power window relay	fuse 25 amp 3AG fuse 20
	Heater/air conditioning	amp AGC fuse
	Radio, automatic trans, downshift switch, TCS solenoid, rear defogger	3 amp AGC fuse (in-line)
	Rear window defogger (low speed)	5 amp AGC fuse
	Instrument lamps	20 amp SFE fuse
	Taillamps (side marker and parking lamps)	20 amp SFE fuse
	Clock, lighter, courtesy, anti-theft alarm	20 amp SFE fuse
	Stop/hazard warning, key warning buzzer	10 amp AGC fuse
	Gauges/telltale lamps, seat belt buzzer lamp	30 amp AGC fuse (in-line)
	High blower speed (air conditioning)	25 amp AGC fuse
	Wipers/washers	
1977	Headlamp circuit	circuit breaker 30 amp
	Power window circuit	circuit breaker 25 amp
	Back-up lamp and turn signals	AGC fuse 25 amp 3AG
	Heater/air conditioner	fuse 20 amp AGC fuse 5
	Radio, automatic trans., downshift switch, rear defogger	amp AGC fuse 20 amp
	Instrument lamps	SFE fuse 20 amp SFE
	Tail lamps (side marker and parking lamps)	fuse 20 amp SFE fuse 10
	Clock, lighter, courtesy, anti-theft alarm, glove box	amp AGC fuse
	Stop/hazard warning, key warning buzzer	
	Gauges/teletale lamps, seat belt buzzer lamp, and relays (power window relay) High blower	30 amp AGC fuse (in line)
	speed (air conditioning)	25 amp AGC fuse
	Wipers/washers	

Circuit Protection Chart (cont.)

Model Year	Protected Circuit	Type of Protection
1978	Headlamp circuit "Power window circuit Back-up lamp	circuit breaker 30 amp
	and turn signals Heater/air conditioner Radio, rear	circuit breaker 20 amp
	defogger Instrument lamps Tail lamps (side marker and	AGO fuse 25 amp
	parking lamps), underhood	3AG fuse 20 amp
	lamps	AGC fuse 5 amp AGC
	Clock, lighter, courtesy, anti-theft alarm, glove box, dome	fuse 20 amp SFE fuse
	Stop/hazard warning, key warning buzzer	
	Gauges/teletale lamps, seat belt buzzer lamp, and relays	20 amp SFE fuse
	(power window relay), cruise control	20 amp SFE fuse
	Wipers/washers	10 amp AGC fuse
		25 amp AGC fuse
1979	Headlamp circuit	circuit breaker© 30
	Power window circuit	amp circuit breaker 20
	Back-up lamp and turn signals	amp AGC fuse 25
	heater/air conditioning	amp 3AG fuse 20
	Radio	amp AGC fuse 35
	Rear defogger	amp fuse 6 amp AGC
	Instrument lamps	fuse 20 amp SFE fuse
	Tail lamps (side marker and parking lamps), underhood	
	lamp	20 amp SFE fuse
	Clock, lighter, courtesy, anti-theft alarm, glove box, dome	20 amp SFE fuse
	Stop/hazard warning, key warning buzzer	10 amp AGC fuse
	Gauges/teletale lamps, seat belt buzzer lamp and relays	
	(power window relay), cruise control	30 amp fuse
	Auxiliary fan Wipers/washers	25 amp AGC fuse
1980-81	Auxiliary fan	30 amp fuse
	Back-up lamp and turn signals	20 amp fuse
	Clock, lighter, courtesy, anti-theft alarm, glove box, dome, spare tire lamp, horn	20 amp fuse
	Electronic control module, anti theft alarm	10 amp fuse
	Gauges, telltale lamps, seat belt buzzer lamp, power window relay, cruise control	20 amp fuse
	Heater, air conditioning	25 amp fuse
	Instrument lamps	25 amp fuse
	Power window	30 amp circuit breaker
	Radio	10 amp fuse
	Rear defogger	35 amp circuit breaker
	Stop-hazard warning, key warning buzzer	20 amp fuse
	Tail lamps (incl. side marker, parking, and license)	20 amp fuse
	Windshield wipers and washers	25 amp fuse
1982	Anti-theft system (Theft)	10 amp fuse
	Auxiliary fan control (Elec fn)	30 amp fuse
	Back-up lamp and turn signals (Turn B/U)	20 amp fuse
	Clock, lighter, courtesy lamps, anti-theft alarm, glove box, key warning, vanity mirror, power antenna, dome lamp, spare tire lamp (Ctsy Clock)	20 amp fuse
	Electronic control module (ECM)	10 amp fuse
	Heater, air conditioning (A/C)	25 amp fuse
	Dash indicators, except warning lamps (Inst. Lps)	7.5 amp fuse
	Radio, theft horn control, power mirror, cruise control (Radio)	10 amp fuse
	Rear defogger (Defog)	30 amp circuit breaker
	Stop, turn signal, and hazard warning lamps, and horn (Stop haz)	20 amp fuse
	Tail, side marker, and parking lamps (Tail Lp)	20 amp fuse 3
	TBI #1 control circuit (Inj-1)	amp fuse 3 amp
	TBI #2 control circuit (Inj-2)	fuse 5 amp fuse
	TBI cranking circuit (Crank)	20 amp
	Torque convertor clutch disengage circuit, TBI controls, dash warning lamps, courtesy control timer, gauges, seat belt lamp relay, rear window defogger (Gauges)	

Circuit Protection Chart (cont.)

Model Year	Protected Circuit	Type of Protection
1984	Rear window defogger switch (Defog)	30 amp fuse
	L.C.D. speedometer cluster (L.C.D.)	5 amp fuse
	Hatch release relay (Rr Hatch)	20 amp fuse
	Center information cluster, under hood lamps, horn relay, courtesy lamps, map lamps—door, power door lock switches, radio clock, key warning & headlamp on chime, dome lamp timer, spare tire illumination, power antenna relay, cargo lamps, cigar lighter, console storage compartment lamp, vanity mirror lamp (Ctsy/Clk)	15 amp fuse
	Tail lamps (Tail)	10 amp fuse
	Fuel pump, oil pressure sender (Crank)	5 amp fuse
	Radio, theft deterrent module (Rdo)	10 amp fuse
	Wiper switch (Wpr)	25 amp fuse ®
	Hatch release switches—left door, right door, storage compartment (Hatch Auto)	3 amp fuse
	Injector 1 (Inj 1)	3 amp fuse
	Injector 2 (Inj 2)	3 amp fuse
	Electronic spark control module (ESC), electronic control module (ECM) (ECM Ign.)	3 amp fuse
	Instrument panel lamps (Inst/Lps)	3 amp fuse
	L.C.D. speedometer cluster (Clstr)	5 amp fuse
	Rear window defogger switch, center information cluster, canister purge, seat belt chime, auto trans converter clutch brake (TCC), EGR control, air switch, air control, dome lamp timer, "E" cell (Gauges)	10 amp fuse
	Turn signal flasher, fog lamp switch, back-up lamp switch—man trans neutral safety switch—auto trans (Tum/BU)	15 amp fuse
	Cruise engage switch rear view mirror adjuster switch (Cruise)	3 amp fuse
	Oil pressure switch, fuel pump relay, electronic control module (ECM) (P.P.)	10 amp fuse
	A/C control (A/C)	25 amp fuse
	Engine cooling fan relay (C Fan)	3 amp fuse
	Power window switches (Pwr Wdo)	Circuit Breaker©
	Power seat switch, power door lock relay (Pwr Ace.)	Circuit Breaker ®
	Hazard flasher, stop lamp switch (Stop/Haz)	20 amp fuse

© This circuit breaker is built into the main lighting switch and cannot be replaced independently of the switch.
© 30 amp, located in fuse panel
® 35 amp, located in fuse panel
® Wiper motor also has a circuit breaker

WIRING DIAGRAMS

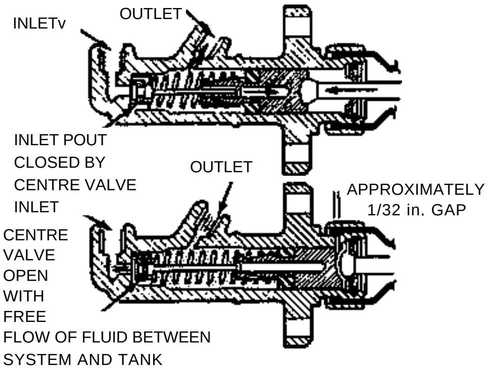
Wiring diagrams have been left out of this book. As cars have become more complex, and available with longer and longer option lists, wiring diagrams have grown in size and complexity also. It has become virtually impossible to provide a readable reproduction in a reasonable number of pages.

Clutch and Transmission

CLUTCH

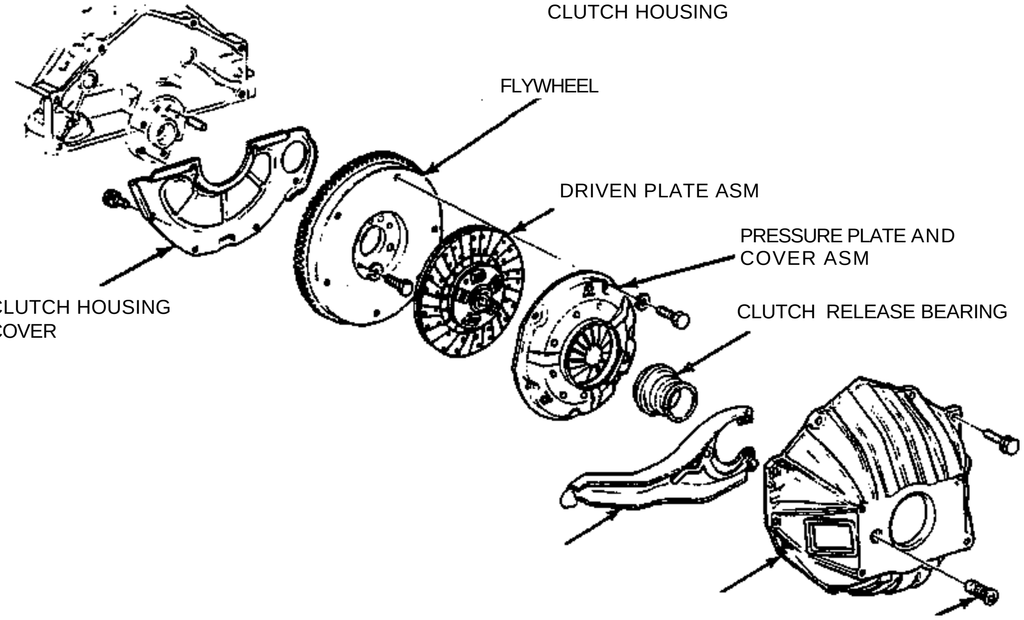
Two types of mechanical clutch assemblies have been available on Stingray. The standard clutch is a bent-finger, centrifugal diaphragm unit first introduced in 1963. This design permits heavy plate loads, yet allows low pedal effort without resorting to center booster springs. The second type of clutch is a dual-plate, bent-finger diaphragm model that was available in 1969 and 1970. It was optional on the 427/454 high performance engines and requires a 14 in. diameter ring gear. The throwout bearing used with 1963 and 1981 models is 1%2" long; the bearing used with 1964-80 models is $1^{1}A$" long. DO NOT replace either of these bearings with the 17s" unit which is popular in other Chevrolet models.

1984 and later models use a hydraulic clutch system. The hydraulic system consists of a master cylinder and a slave cylinder. When pressure is applied to the clutch pedal (pedal depressed), the push rod contacts the plunger and pushes it up the bore of the master cylinder. In the first *Vsz* in. of movement, the center valve seal closes the port to the fluid reservoir tank and as the plunger continues to move up the bore of the cylinder, the fluid is forced through the outlet line to the slave cylinder mounted on the clutch housing. As fluid is pushed down the pipe from the master cylinder, this in turn forces the piston in the slave cylinder outward. A push rod is connected to the slave cylinder and rides in the pocket of the clutch fork. As the slave cylinder piston moves rearward the push rod forces the clutch fork and release bearing to disengage the pressure plate from the clutch disc. On the return stroke (pedal released), the plunger moves back as a result of the return pressure of the clutch. Fluid returns to the master cylinder and the final movement of the plunger lifts the valve seal off the seat, allowing an unrestricted flow of fluid between system and reservoir. A piston return spring in the slave cylinder preloads the clutch linkage and assures contact of the release bearing with the clutch release fingers at all times. As the driven disc wears, the diaphragm spring fingers move rearward forcing the release bearing, fork and push rod to move. This movement forces the slave cylinder piston forward in its bore, displacing hydraulic fluid up into the master cylinder reservoir, thereby providing the "self-adjusting" feature of the hydraulic clutch linkage system.



Cross section of master cylinder on 1984 and later hydraulic clutch system

Before attempting to repair the clutch, transmission, hydraulic system or related linkages for any reason other than an obvious Mure, the problem and probable cause should be identified. A large percentage of clutch and manual transmission problems are manifested by shifting difficulties such as high shift



Typical clutch assembly

effort, gear clash and grinding or transmission blockout. When any of these problems occur, a careful analysis of these difficulties should be accomplished and the basic checks and adjustments performed before removing the clutch or transmission for repairs. Run the engine at a normal idle with transmission in neutral and clutch engaged. Disengage the clutch, wait about 10 seconds and shift the transmission to reverse. No grinding noise should be heard. A grinding noise indicates incorrect clutch travel, lost motion, clutch misalignment, or internal problems such as failed dampers, facings, cushion springs, diaphragm spring fingers, pressure plate drive straps, pivot rings, etc.

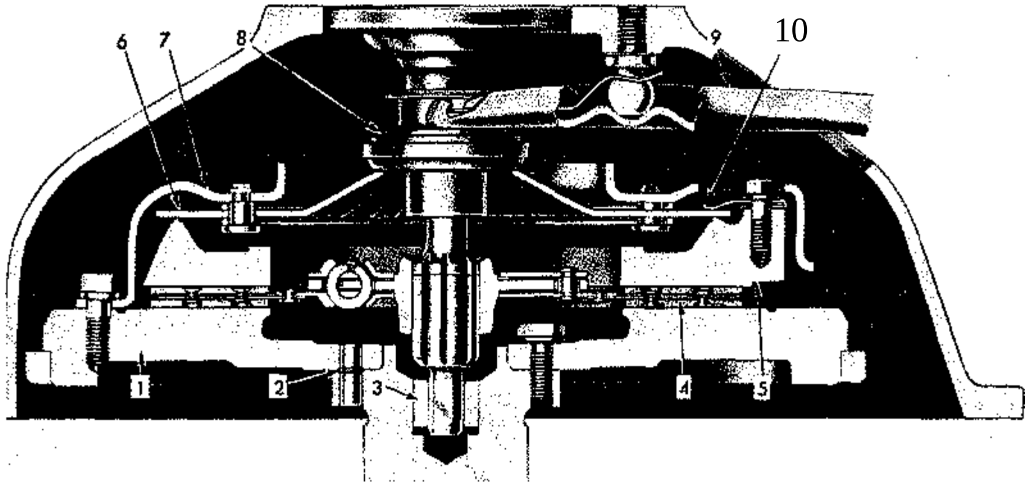
CAUTION: *When servicing clutch parts, do not create dust by grinding or sanding clutch disc or by cleaning parts with a dry brush or with compressed air. (A water dampened cloth—NOT SOAKED—should be used) The clutch disc contains asbestos fibers which can become airborne if dust is created during servicing. Breathing dust containing asbestos fibers may cause serious bodily harm.*

REMOVAL AND INSTALLATION

1. Remove the transmission from the car as outlined in this chapter.
2. Disconnect the clutch-fork push rod and spring. On 1984 models, remove the slave cylinder attaching bolts.
3. Remove the bell housing.
4. Install a clutch pilot tool (wooden versions available at most automotive parts stores) to hold the clutch plate during removal.
5. The flywheel and clutch cover are marked with x's for correct assembly, if these are not visible, scribe new marks.
6. Gradually loosen the clutch-to-flywheel bolts one turn at a time until all spring pressure is released.
7. Remove the bolts and remove the clutch assembly.
8. To install, crank the engine over by hand until the x-mark on the flywheel is on the bottom.
9. Position the clutch disc and pressure plate in the same relative location as removed and support with the clutch pilot tool.

NOTE: *On single-disc models, the clutch disc is installed with the damper springs and slinger toward the transmission. On dual disc models, the discs are installed with the springs away from the flywheel, as shown.*

10. Rotate me clutch assembly until the x-marks on the flywheel and clutch assembly align. Align the cover bolt holes with those in the flywheel.
11. Install bolts in every hole and tighten

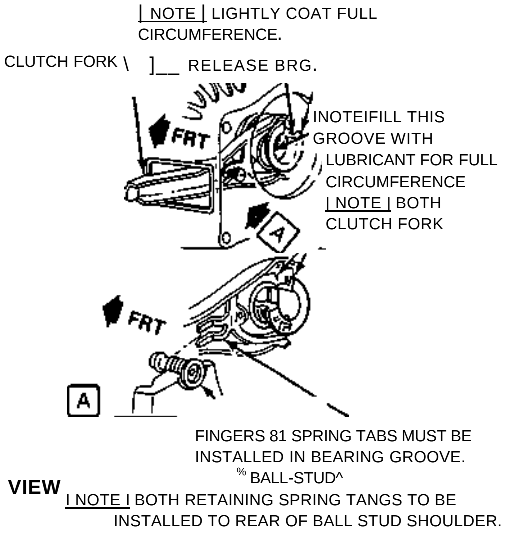


1. Flywheel
2. Dowel hole
3. Pilot bushing
4. Driven disc
5. Pressure plate
6. Diaphragm spring
7. Cover
8. Throwout bearing
9. Fork
10. Retracting spring

Cutaway of single disc clutch

down evenly and gradually. Install the remaining bolts.

12. Remove the clutch pilot tool.
13. Lubricate the ball socket on the clutch fork and reinstall on the ball stud.
14. Pack the recess on the inside of the throwout bearing collar and the throwout groove with graphite grease.
15. Install the bell housing, along with the slave cylinder, if equipped.
16. Install the throwout bearing on the fork. Lubricate the bearing groove.



Clutch release bearing lubrication points—typical

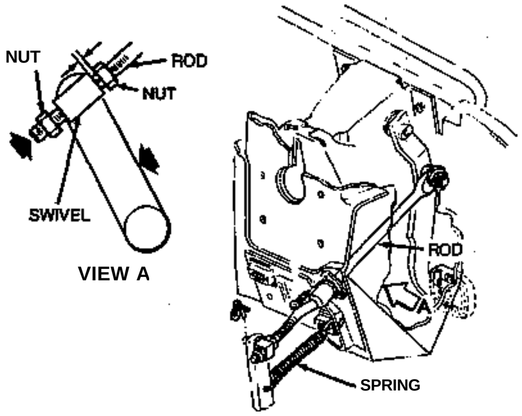
17. Install the transmission as previously outlined.
18. Connect the fork push rod and spring.
19. Adjust the free pedal play and check the clutch release position. Lubricate all link age pivot points.

NOTE: *The clutch pilot bearing is an oil impregnated type bearing pressed into the crankshaft. This bearing requires attention when the clutch is removed from the vehicle, at which time it should be cleaned and inspected for excessive wear or damage and should be replaced if necessary.*

PEDAL REPOSITIONING

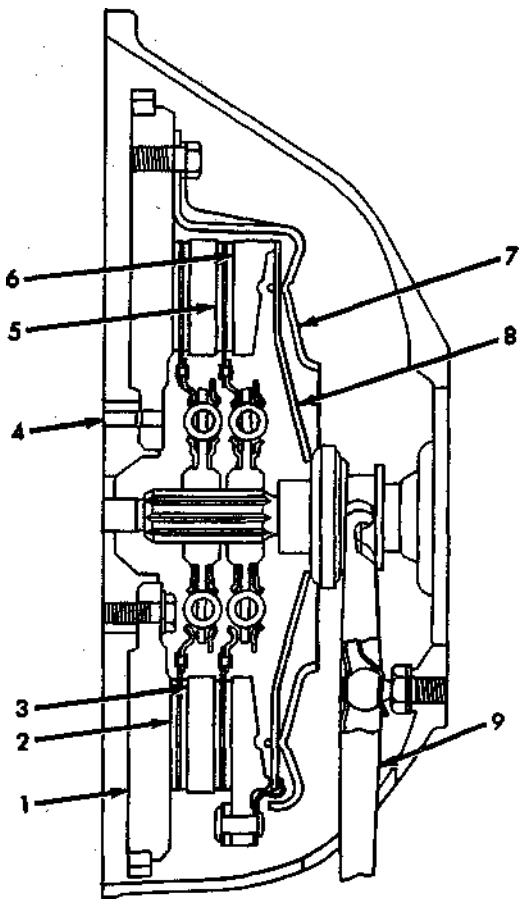
Earlier Corvette clutch linkage includes a provision for a second clutch setting which reduces total pedal travel approximately *1Y2* in. The reduced travel will make the release faster and permit faster gear shifting.

1. Remove the clutch return spring at the cross-shaft and the pedal push rod at the pedal.
2. Loosen the pedal bracket lower bolt, remove the upper bolt, and rotate the bracket so that it will align with the extra upper bolt hole. Install the upper bolt.
3. Disconnect the pedal push rod at the cross-shaft and turn it *Vz* turn. Reconnect the push rod at the cross-shaft.
4. Tighten the bracket bolts and connect the pedal push rod.



Clutch linkage

1. Flywheel
2. Front driven disc
3. Front pressure plate
4. Dowel hole



5. Rear driven disc

Cutaway of dual disc clutch

6. Rear pressure plate
7. Cover
8. Retracting spring
9. Fork

CLUTCH ADJUSTMENT

1963-74

1. Disconnect the spring between the clutch push rod and cross shaft lever.

2. While holding the clutch pedal against the stop, loosen the two locknuts enough to allow the adjusting rod to move against the clutch fork until the throwout bearing lightly touches the pressure plate springs.

3. Turn the upper nut against the swivel and then back it off *4Vz* turns. Tighten the bottom locknut to lock the swivel against the top nut.

4. Reinstall the return spring. Pedal free travel, the distance the pedal can be moved before the throwout bearing contacts the pressure plate spring, should be:

- 1963-64 Corvette—%-l in.
- 1965-71 Corvette—P/4-2 in.
- 1969-70 Corvette with HD clutch—2-*2Vz* in.
- 1972 Corvette—1V4-1% in.
- 1973 Corvette—P/4-iy$_2$ in.
- 1974 Corvette—*1-lVz* in.

1975-81

NOTE: *No manual transmission was available in 1982.*

1. Disconnect the return spring between the floor and the cross shaft.

2. Push the clutch lever and shaft assem bly until the clutch pedal is tightly against the rubber stop under the dash.

3. Loosen the two locknuts on the shaft.

4. Push the shaft until the throwout bear ing just touches the pressure plate spring.

5. Tighten the top locknut toward the swivel until the distance between it and the swivel is 0.4 in.

6. Tighten the bottom locknut against the swivel.

7. Check pedal free travel. It should be 1-*IVz* in.

BLEEDING HYDRAULIC CLUTCH

1984 and Later Models

Bleeding air from the hydraulic clutch system is necessary whenever any part of the system has been disconnected, or level of fluid in the reservoir has been allowed to fall so low that air has been drawn into the master cylinder.

1. Fill master cylinder reservoir with new brake fluid conforming to Dot 3 or Dot 4 specifications.

CAUTION: *Never, under any circum-*

stances, use fluid which has been bled from a system to fill the reservoir as it may be aerated, have too much moisture content and possibly be contaminated.

2. Raise the vehicle and support it safely.
3. Remove the slave cylinder attaching bolts.
4. Hold slave cylinder at approximately 45° with the bleeder at highest point. Fully depress clutch pedal and open bleeder.
5. Close bleeder valve and release clutch pedal.
6. Repeat Steps 4 and 5 until all air is evacuated from the system. Check and refill master cylinder reservoir as required to prevent air from being drawn through the master cylinder.

NOTE: *Never release a depressed clutch pedal with the bleeder screw open, or air will be drawn into the system.*

Clutch Master Cylinder

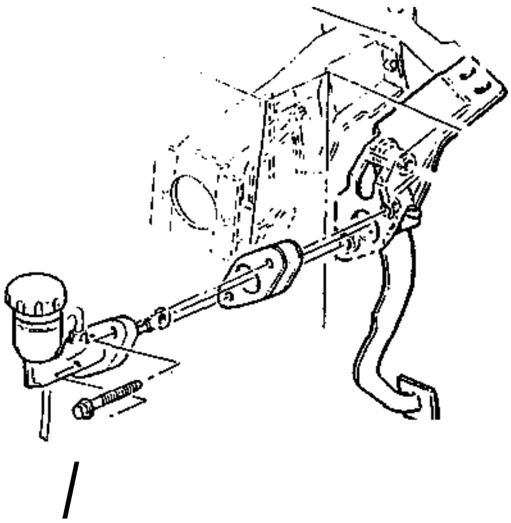
REMOVAL AND INSTALLATION

1984 and Later Models

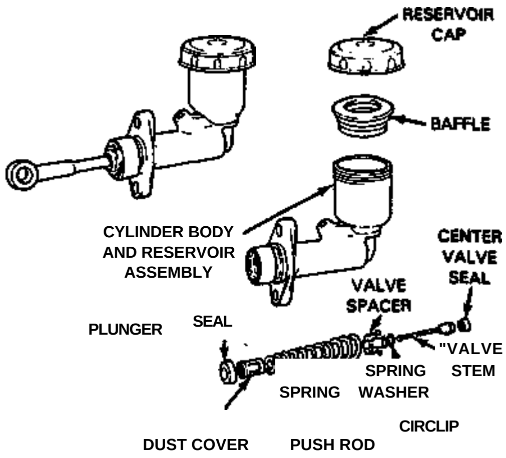
1. Disconnect negative battery cable.
2. Remove hush panel from under dash.
3. Disconnect push rod from clutch pedal.
4. Disconnect hydraulic line at the clutch master cylinder.
5. Remove the mounting bolts for the master cylinder at the front of dash assembly. Remove master cylinder and overhaul, if necessary, as described later.
6. Install mounting bolts for master cylinder at front of dash. Torque bolts to 15—22 ft. lbs. (20-30 N-m).
7. Connect hydraulic line at master cylinder.
8. Connect push rod at clutch pedal. Lubricate pivot point.
9. Install hush panel.
10. Fill master cylinder with new hydraulic fluid conforming to Dot 3 or Dot 4 specifications.
11. Raise vehicle and bleed hydraulic clutch system as previously described. Check all hydraulic lines and fittings for damage or leaks.

OVERHAUL

1. Remove filler cap and drain fluid from master cylinder.
2. Pull back the dust cover and remove the circlip.
3. Remove retaining washer and push rod. Tap the master cylinder on a block of wood to eject the plunger assembly from the cylinder bore.
4. Lift the tab on the spring retainer and remove the spring assembly from the plunger.
5. Compress the spring to free the valve stem from the keyhole of the spring retainer.
6. Remove the spring, valve spacer and spring washer from the valve stem and the valve seal from the valve head.
7. Remove the seal carefully from the plunger, ensuring no damage occurs to the plunger surfaces.
8. Replace all seals and clean the remaining parts in clean brake fluid. Inspect the cylinder bore for visible scores and ridges and check that it's smooth to the touch. Replace the master cylinder if any of the above conditions exist.



Clutch master cylinder mounting—1984 and later



Exploded view of clutch master cylinder

9. Fit the plunger seal to the plunger.

10. Fit the valve seal, smallest diameter leading to the valve head.

11. Position the spring washer on the valve stem so that it flares away from the valve stem shoulder and follow with valve spacer, legs first, and spring.

12. Fit the spring retainer to the spring and compress the spring until the valve stem passes through the key hole slot and engages in the center.

13. Fit the spring to the plunger and press the tab of the spring retainer to secure.

14. Lubricate the seals and the cylinder bore with new hydraulic brake fluid conform ing to Dot 3 or Dot 4 specifications.

15. Insert the plunger assembly, valve end leading into the cylinder bore, easing the en-trace of the plunger seal.

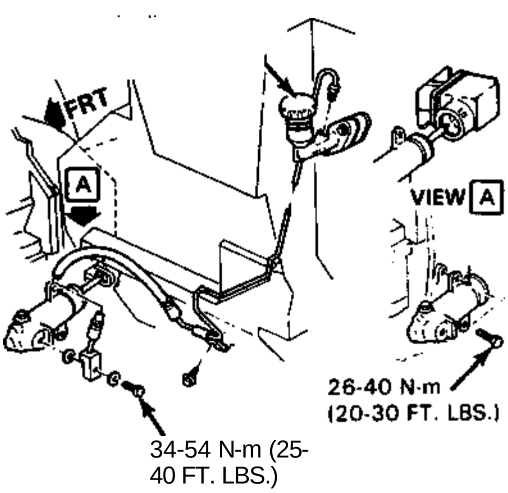
16. Position the push rod and retaining washer into the cylinder bore. Install a new circlip to retain the push rod. Install dust cover onto the master cylinder. Lubricate the in side of the dust cover with Girling Rubber Grease or equivalent.

NOTE: *Be careful not to use any lubricant that will deteriorate rubber dust covers or seals.*

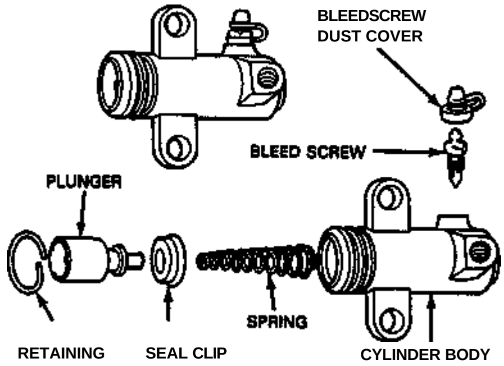
Clutch Slave Cylinder

REMOVAL AND INSTALLATION

1. Disconnect negative battery cable.
2. Raise the vehicle and support it safely.
3. Disconnect hydraulic line at slave cyl inder.
4. Remove mounting bolts for the slave cylinder at clutch housing.



Clutch slave cylinder—1984 and later



Exploded view of slave cylinder

5. Remove the push rod and slave cylin der from the vehicle. Overhaul, if necessary, as described later.

5. Install the hydraulic line to the slave cylinder.

6. Fill master cylinder with new brake fluid conforming to Dot 3 or Dot 4 specifications.

5. Bleed the hydraulic system as previ ously outlined.

5. Install slave cylinder to clutch housing. Lubricate leading end of cylinder with Gir ling Rubber Lube or equivalent. Torque mounting bolts to 20-30 ft. Ibs. (26-40 N-m).

OVERHAUL

1. Remove pushrod and dust cover from the slave cylinder. Inspect the cover for dam age or deterioration.

2. Remove the retaining ring.

1. Tap the slave cylinder on a block of wood to eject the piston and seal.

2. Replace all seals and clean the remain ing parts in clean brake fluid. Inspect the cyl inder bore for visible scores and ridges and check that it's smooth to the touch. Replace the slave cylinder if any of the above condi tions exist.

3. Lubricate the seal and the piston bore with new brake fluid conforming to Dot 3 or Dot 4 specifications.

4. Position spring on piston.

1. Install the piston into the cylinder bore, easing the entrance of the plunger seal.

2. Install the retaining clip.

MANUAL TRANSMISSION

Identification

The manual transmissions used in the 1963-81 Corvettes are the Muncie 3-speed, Saginaw 3-speed, Muncie 4-speed, and the Warner 4-speed. Identification is determined by the side cover design and linkage. The 3-speed Muncie side cover has two bolts on the side cover top edge and the Saginaw 3-speed one. The Muncie and Warner 4-speeds have the reverse fork mounted in the tailshaft. These two may be differentiated by the shape of the side cover; the Warner has a nine bolt curved bottom and the Muncie a seven bolt straight bottom.

1984 models use a new, computer-controlled 4-speed overdrive manual transmission, which is essentially a combination of two separate transmissions. The first is a conventional 4-speed (83MM) manual system with a 1:1 ratio in 4th gear. The second is a two-speed (overdrive) system electronically controlled by the electronic control module (ECM), which operates with a 1:1 or a .68 to one ratio. By combining these two transmissions, the complete unit is actually capable of operating with seven separate gear ratios; one of which is an overdrive. The two-speed, or overdrive unit performs its function using a planetary gear system in combination with two sets of clutch packs.

The operation of these clutch packs is controlled by a hydraulic circuit which causes the movement of the -main finger plate via a piston and accumulator assembly. The accumulator is used to regulate the speed at which the piston moves, and thus, the speed of the complete shift from direct to overdrive or vice versa. This also serves to reduce shock-loading during speed shifting. The ECM is programmed to control the shift solenoid and thus, the entire overdrive unit. It does this by monitoring both vehicle speed and throttle position. The overdrive mode cannot occur when the 4-speed transmission is in first gear. Overdrive is automatically engaged at speeds above 110 mph. The overdrive mode can be forced off by means of a switch on the vehicle console.

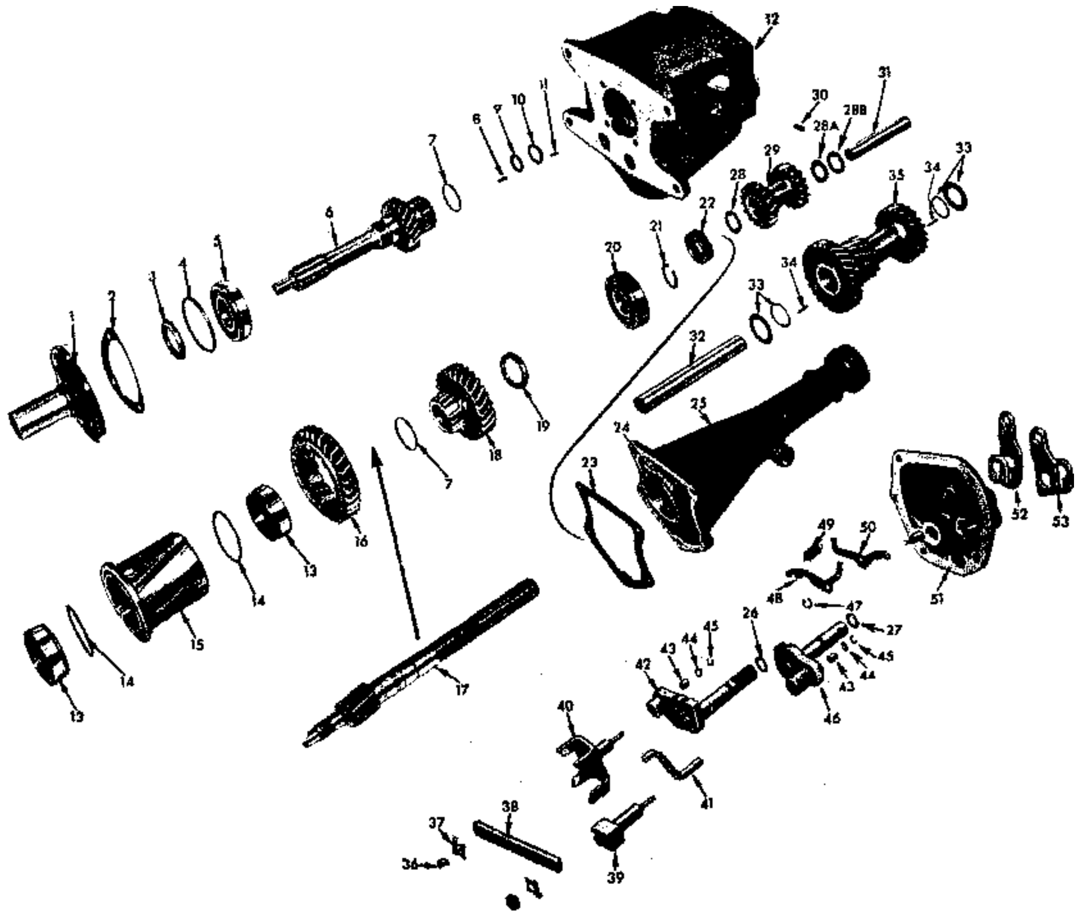
REMOVAL AND INSTALLATION

1963-65 Muncie Three-Speed and 1963 Borg-Warner T-10, Four-Speed

1. Jack the car high enough to provide working clearance.
2. Disconnect the speedometer cable from the transmission. Support with jackstands.
3. Disconnect the shift linkage from the shift rods on the transmission. Remove'the shift lever assembly and linkage.
4. Remove the driveshaft as described in the driveshaft section of Chapter 7.
5. Support the engine at the rear of the oil pan with a jack.
6. Remove the left and right exhaust pipes.
7. Remove the transmission tailshaft-to-crossmember attaching bracket.
8. Remove the two top transmission-to-bell housing bolts and replace them with two guide pins; these may be fabricated from studs. This will prevent damaging the clutch disc.
9. Remove the bottom two bolts and slide the transmission straight back on the guide pin until the input shaft is clear of the clutch splines.
10. Move the transmission back to clear the bell housing; Tilt the forward end of the transmission down and withdraw from the car.
11. To install, insert a guide pin in the up per right bell housing bolt hole.
12. Raise the transmission and support it on the guide pin.
13. Rotate the transmission and engage the input shaft with the clutch disc. Slide the transmission forward until it bottoms against the clutch housing.
14. Install the two, bottom transmission-to-bell housing bolts. Remove the guide pin, and install the top two bolts. Torque all four bolts to 40-50 ft. Ibs.
15. Position the tailshaft mount-to-frame crossmember bracket and install the bolts hand tight. Install the bracket-to-extension mount bolts.
16. Tighten the support bracket-to-frame retaining bolts. Remove the jack from under the oil pan and tighten the bracket-to-exten sion mount bolts.
17. Install the driveshaft.
18. Install the speedometer cable to the transmission.
19. Install the shift lever assembly onto the transmission and connect the shift linkage.
20. Refill the transmission with lubricant. Check and adjust the shift pattern, if neces sary.

1963-81 Four-Speed and 1966-69 Three-Speed

1. Disconnect the negative cable from the battery.
2. Disassemble the shift lever. Unscrew the ball from the lever, lift out the "T" handle



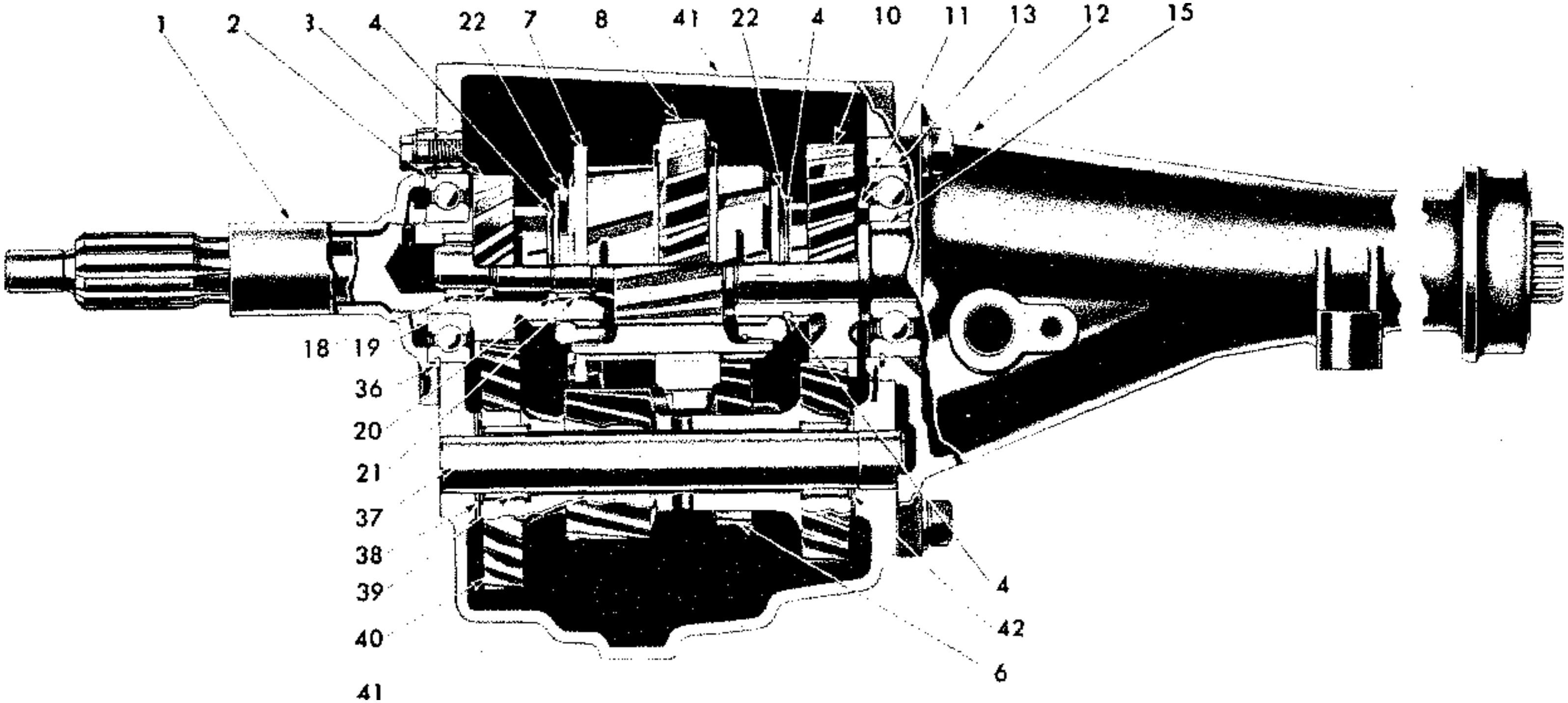
1. Clutch gear bearing retainer
2. Bearing retainer gasket
3. Bearing nut and oil slinger
4. Bearing snap-ring
5. Clutch gear bearing
6. Clutch gear
7. Energizing spring
8. Front pilot bearing roller
9. Thrust washer
10. Thrust washer
11. Rear pilot bearing rollers
12. Transmission case
13. Synchronizer ring
14. Snap-ring
15. Second and third speed clutch
16. First and Reverse sliding gear
17. Mainshaft
18. Second speed gear
19. Thrust washer
20. Mainshaft rear bearing
21. Snap-ring
22. Speedometer drive gear
23. Case extension gasket
24. Rear bearing snap-ring
25. Case extension
26. First and Reverse shifter shaft O-ring
27. Second and Third shifter shaft O-ring
28. Thrust washer

28a. Thrust bearing

28b. Thrust bearing washer

29. Reverse idler gear
30. Reverse idler shaft pin
31. Reverse idler shaft
32. Countershaft
33. Countergear and roller thrust washers
34. Bearing roller
35. Countergear
36. Shifter interlock retainer stud nut
37. Shifter interlock retainer stud nut lock
38. Shifter interlock retainer
39. Second and Third shifter fork
40. First and Reverse shifter fork
41. Shifter interlock shaft
42. First and Reverse shifter shaft and plate assembly
43. Shifter fork spacer
44. Shifter fork washer
45. Shifter fork retainer
46. Second and Third shifter shaft and plate assembly
47. Detent cam retainer
48. First and Reverse detent cam
49. Detent cam spring
50. Second and Third detent cam
51. Side cover
52. First and Reverse shifter lever (outer)
53. Second and Third shifter lever (outer)

Exploded view of Muncie 3-speed



1. Clutch gear bearing retainer
2. Clutch gear bearing
3. Clutch gear
4. Energizing spring
6. Reverse idler gear
7. Second and Third speed clutch
8. First and Reverse sliding gear
10. Second speed gear
11. Thrust washer
12. Case extension
13. Mainshaft rear bearing
15. Mainshaft
18. Front pilot bearing rollers
19. Thrust washer
20. Thrust washer
21. Rear pilot bearing rollers
22. Synchronizer ring
36. Snap-ring
37. Countershaft
38. Thrust washer
39. Roller bearing
40. Countergear
41. Transmission case
42. Roller thrust washer

Cross-section of Munice 3-speed

return spring and "T" handle, and remove the anti-rattle bushings. On 1968 and later cars, remove the console trim plate.

3. Jack the car high enough to provide working clearance. Support with jackstands.

4. Remove the driveshaft as described in the driveshaft section of Chapter 7.

5. Remove the exhaust pipe heat deflec tors and remove the left and right exhaust pipes. On a large block engine it is necessary to remove the forward stud on each manifold.

6. Remove the two rear-mount, cushion-to-bracket attaching bolts. Support the rear of the oil pan with a jack to take off the load from the rear mount cushion.

CAUTION: *Place a board between the oil pan and jack to prevent damage.*

7. Remove the three transmission mount bracket-to-crossmember bolts and remove the bracket.

8. Remove the two mount pad-to-trans mission bolts and remove the rubber mount cushion and the exhaust pipe.

9. Disconnect the shift linkage by remov ing the shift levers at the transmission side cover.

10. Disconnect the speedometer cable at the tailshaft. Disconnect the TCS switch wir ing, on cars so equipped.

11. Remove the two shift lever-and-bracket bolts; lower and remove the assembly.

12. Remove the four transmission-to-ben housing bolts and lower left extension bolt on later models.

13. Pull the transmission rearward until it clears the bell housing. Turn the transmis sion to the left while pulling to the rear.

14. Slowly lower the rear of the engine until the tachometer drive cable on the dis tributor just clears the horizontal ledge across the front of the firewall.

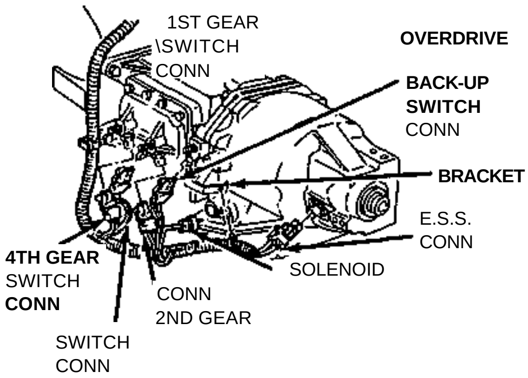
CAUTION: *The tachometer cable can be easily damaged.*

15. Slide the transmission rearward out from the clutch. Lower the front end of the transmission and remove it from the car.

16. Perform the above steps in reverse or der to install the transmission.

1984 4-Speed Overdrive

1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly.
3. Disconnect the throttle valve (T.V.) cable at the left TBI unit.
4. Remove the distributor cap and lay aside.
5. Raise the vehicle and support it safely.



Electrical connectors on 4-speed overdrive transmission

6. Remove the complete exhaust system assembly as follows:

a. Disconnect A.I.R. pipe at the cata lytic converter.

b. Disconnect A.I.R. pipe clamps at ex haust manifold.

c. Disconnect oxygen sensor electrical lead.

d. Remove the bolts attaching the muf flers to the hangers.

e. Remove hanger bracket at the con verter.

f. Disconnect the exhaust pipes from the exhaust manifolds and remove the exhaust system.

7. Remove the exhaust hanger at the transmission.

8. Support the transmission with a jack.

9. Remove the bolts attaching the drive-line beam at the axle and transmission. Re move the driveline beam from the vehicle.

10. Mark the relationship of the propeller shaft to the axle companion flange. Remove the trunnion bearing straps and disengage the rear universal joint from the axle. Slide the propeller shaft slip yoke out from the over drive unit and remove shaft from the vehicle.

11. Disconnect the cooler lines at the overdrive unit.

12. Disconnect the T.V. cable at the over drive unit.

13. Disconnect the shift linkage at the side cover.

14. Disconnect the electrical connectors at the side cover switches, backup light switch, overdrive unit and speedometer sensor.

15. Lower the transmission and support the engine.

16. Remove the bolts attaching the trans mission to the bellhousing. Slide the trans-

mission rearward to disengage the input shaft from the clutch. Remove the transmission from the vehicle.

17. Inspect the clutch components for signs of wear or heat damage. See the Clutch Sec tion, if necessary.

18. Installation is the reverse of removal. Clean and repack the clutch release bearing.

19. Refer to the Rear Suspension Section for installation and specifications for the driveline beam.

20. Torque all fasteners to specifications. Do not overtighten.

21. Adjust the throttle valve (T.V.) cable.

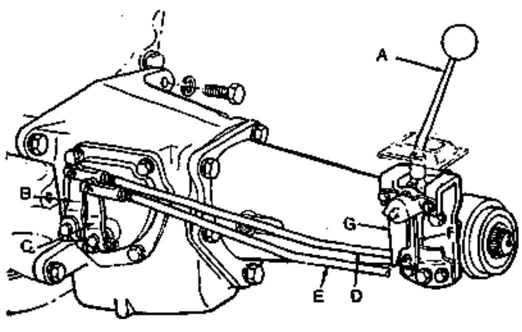
22. Refill the transmission with fluid—(4 Speed) SAE-80W or SAE-80W-90 GL-5 gear lube (Overdrive Unit) Dexron II Automatic Transmission Fluid.

CAUTION: *Do not over-torque the bolts attaching the driveline beam to the transmission. Over-torquing can damage the bushing and seal in the overdrive unit and result in fluid leakage. Inadequate fluid level will damage the transmission.*

LINKAGE ADJUSTMENT

1963 Muncie Three-Speed

1. Position both transmission side-cover selector fork levers and the shift lever in Neutral.
2. Attach rod to lever, then adjust the clevis on its opposite end until the clevis pin will freely enter the side cover lever.
3. Insert the pin and secure it with a cot ter pin.
4. Position the shift lever so that it activates the first and reverse lever, but still remains in Neutral.
5. Attach the first/reverse shift rod to the shift lever, adjust the clevis as done with the other shift rod, and secure it to the selector lever.
6. Tighten the locknuts on both shift rod clevis fittings, and check the shift pattern for correct operation.

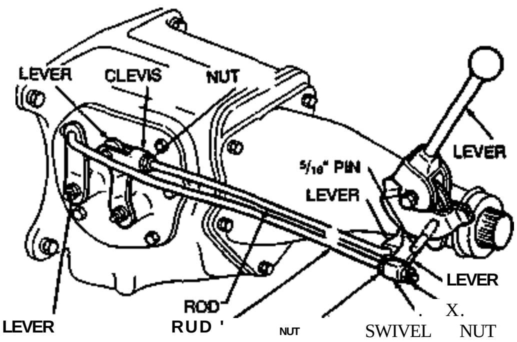


A. Shift lever
B. 2-3 fork lever
C. First/Reverse fork lever
D. 2-3 shift rod
E. First/Reverse shift rod
F. 2-3 shift lever
G. First/Reverse shift lever

1963-64 3-speed linkage

1964-68 Three-Speed

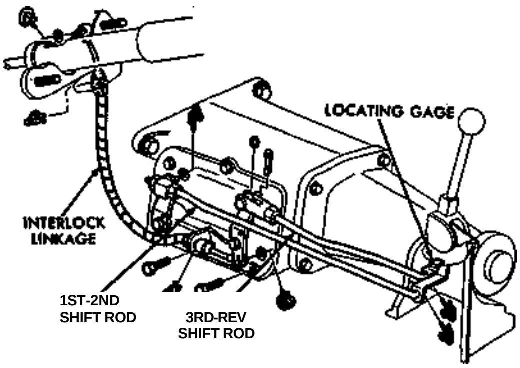
1. Set the side cover selector levers in Neutral and position the shift lever in Neu tral and lock it in pkce with a ^{5}/is in. (early models) or ^{41}/64 in. (late models) locating pin.
2. Attach the first and reverse rod as with earlier transmissions and secure it.
3. Attach the second/third shift rod and at tach it in the same manner.
4. Secure the locknuts on the clevis of each rod, then withdraw the locating pin and check the shift pattern.



1965-68 3-speed linkage

1969 Three-Speed with Backdrive

1. Place the ignition switch in the OFF position and the side cover selector levers in Neutral.
2. Position the shift lever in Neutral and secure it with a ^{41}/64 in. locating gauge, be tween the shift lever notch and the linkage bracket.
3. Adjust the clevis of each rod so that they freely enter the attachment locations on their respective ends. Secure the locknuts, re move the gauge, and shift the transmission into Reverse.
4. Loosen the bracket assembly on the dash and allow any tension in the backdrive cable to position the bracket.
5. Secure the bracket and switch the key from "off" to "lock." Binding of the key will



1969 3-speed linkage

necessitate readjustment of the interlock mechanism.

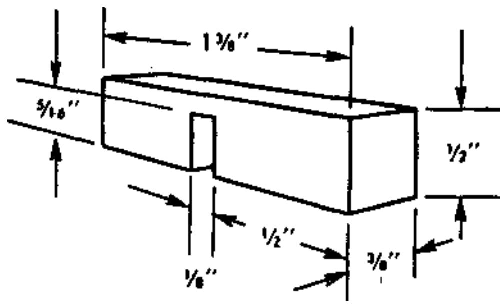
6. Check the shift pattern.

1963 Borg-Warner, T-10 Four-Speed

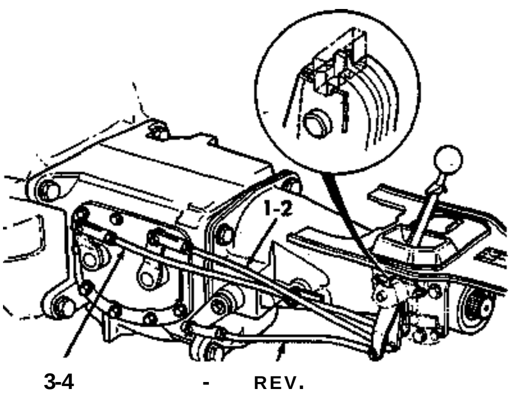
The illustrated wooden gauge, if made, will greatly aid in shift linkage adjustment.

1. Put the shift lever in Neutral, install the block gauge, and remove the clevis pin from the clevis of each shift rod.
2. Adjust the threaded clevis until the clevis pin freely enters the holes in the clevis and the selector levers.
3. Secure the pins and lock the clevis securing nuts.

Remove the gauge block and check the shift pattern. Minor adjustment of the rods may be necessary to remove all traces of shifting roughness.



Borg-Warner T-10 adjustment gauge



1963—Borg Warner T-10 linkage

1963-68 Murrcie Four-Speed

1. Position the individual selector levers and the shift lever in Neutral.
2. Construct a block gauge *Ya* in. thick by ^{41}/64 in. wide and install it in the shift lever bracket assembly.
3. Attach the first/second shift rod to the lever. Hold the lever against the gauge block and adjust the threaded swivel on the shift rod until the clevis pin freely enters the clevis hold and hole in selector lever. Secure the locking nuts.
4. Repeat the procedure and attach the re verse rod to the selector lever, and the bracket lever. Repeat again to adjust the third/fourth rod.
5. Remove the block gauge, check the pat tern for correct shifting, and adjust, if neces sary, to correct minor shifting, and adjust, if necessary, to correct minor shifting difficul ties.
6. An alternate clevis pin hole is placed on each selector lever below the regular pattern hole. This lower placement of the shift rods will tighten the pattern and permit shorter shift lever movement for a faster shift. Bear in mind, however, that this adjustment will increase the shifting effort.

1969-77

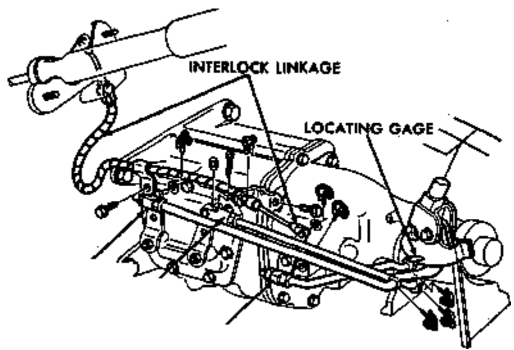
1. Place the ignition switch in "lock."
2. Loosen locknuts at swivels on shift rods and reverse control rod.

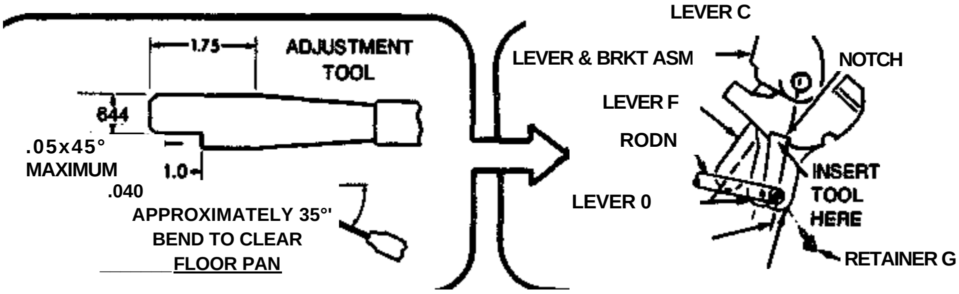
3RD.4TH _

IST-2ND

REVERSE

1964-77 4-speed linkage—typical





Shift linkage adjustment—1978-81. The locating gauge Is shown on the left.

3. Set transmission shift levers in neutral positions.

4. Shift lever into neutral. Insert locating gauge, % thick x 41/64 wide x 3 in. long, into control lever bracket assembly.

5. Hold each lever against the gauge and adjust in turn. Tighten shift rod locknuts and remove gauge.

6. Loosen the interlock bracket assembly bolts at the bottom of the steering column. Make sure that the bracket is not stuck to the dash and then tighten the bracket again.

7. Move the ignition key through "off" and "lock" positions. If there is any binding, readjust the interlock linkage.

1978-81

1. Place the shift lever in the Neutral position.

2. Raise the vehicle and support it safely with jackstands.

3. Disconnect the shift rods from the transmission levers.

4. Preform this step for each of the transmission levers individually: Rotate the transmission lever counterclockwise (forward detent position) then turn it back until the first detent is felt (Neutral position). This is done to verify that each transmission lever is in its Neutral position.

5. Fabricate a locating gauge according to the accompanying illustration. Insert the locating gauge into the notch of the shifter housing and through the shift levers to properly align the levers. It may be necessary to move the shift lever(s) to install the locating gauge completely.

6. Loosen the locknuts of the 3-4 shift rod swivel (front of transmission side cover) and turn the swivel as necessary to allow the swivel to easily enter the hole of the 3—4 transmission lever. Apply a slight rearward pressure to the transmission lever and tighten the swivel locknuts. Attach the shift rod to the transmission lever with the retaining clip (and washer, if used).

7. Repeat step 6 for the 1-2 and reverse shift rods.

8. Remove the locating gauge and lower the vehicle.

NOTE: *After the adjustments have been made, the centerlines of the shifter levers must be aligned to prevent rubbing.*

1984 and Later

1. Disconnect the negative battery cable.

2. Remove the left seat from the vehicle. If equipped with power seats, disconnect the electrical leads.

3. Remove the shift knob.

4. Remove the console cover.

5. Remove the glove box lock.

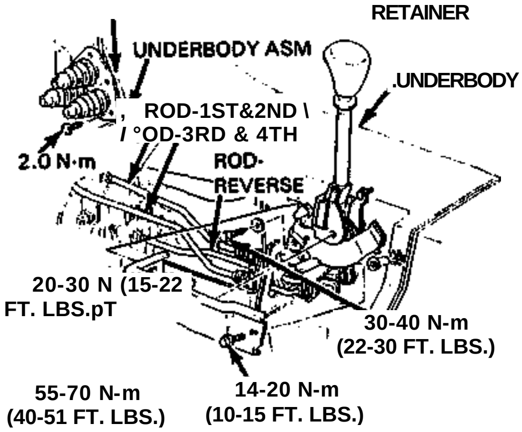
6. Remove the left side panel from the console.

7. Remove the shifter cover.

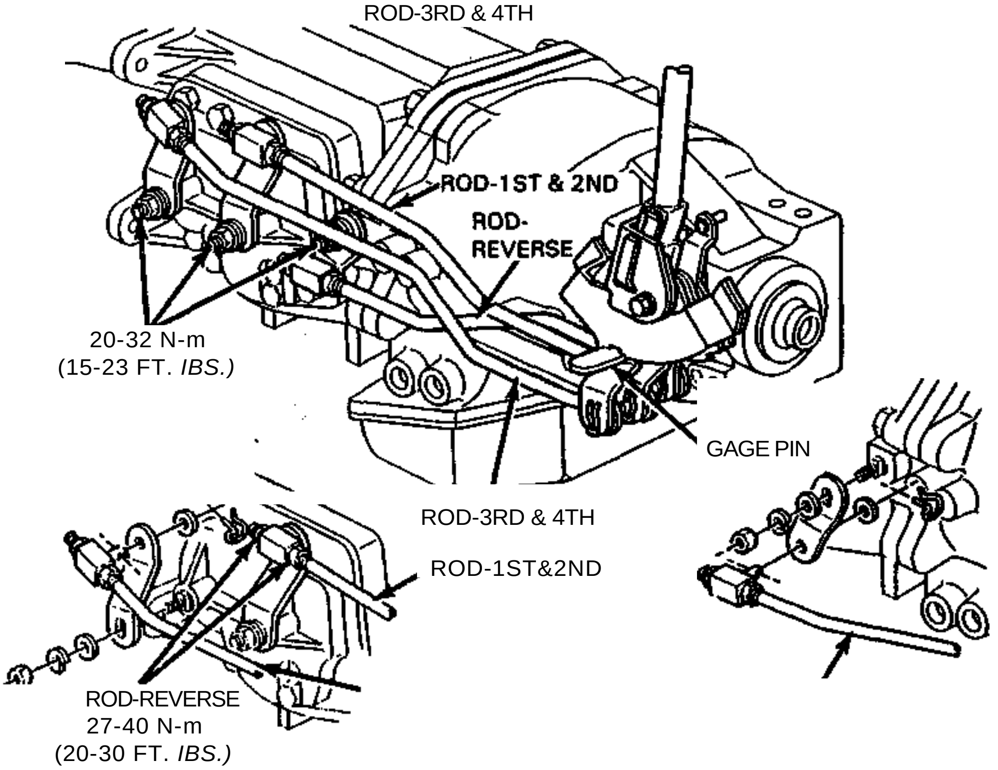
8. Loosen the adjusting nuts on the shifter rods.

9. With the transmission and shifter in neutral, install the alignment pin in shifter as illustrated.

10. Equalize the swivels on all three shift

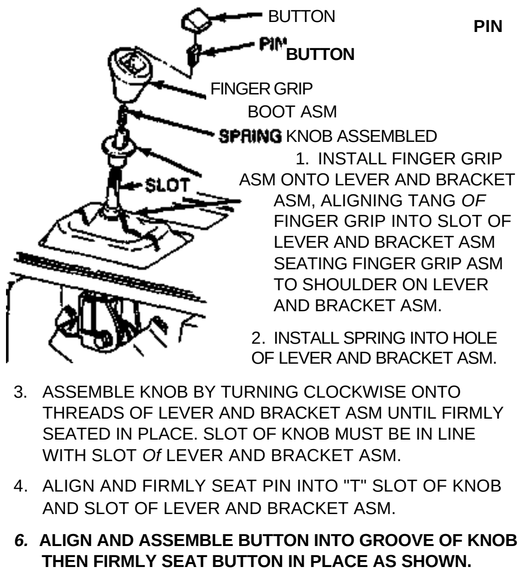


Shifter assembly removal—1984 and later



Linkage adjustments—1984 4-speed overdrive transmission

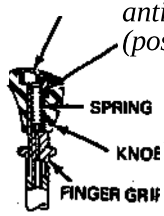
levers. Hand tighten the forward and rear adjusting nuts at the same time with equal force. Do this for all three shifter rods and then torque the forward and rear adjusting nuts at the same time to specifications.



Shifter knob removal—1984 and later

11. Reinstall the components removed by reversing Steps 1 through 7. Lubricate all linkage pivot points.

NOTE: //, *after adjusting the linkage, it is found that high shift effort still exists, an anti-chatter lubricant (positraction additive) may be used. The lubricant is available in a small plastic bottle and can be squirted into the transmission through the filler plug.*

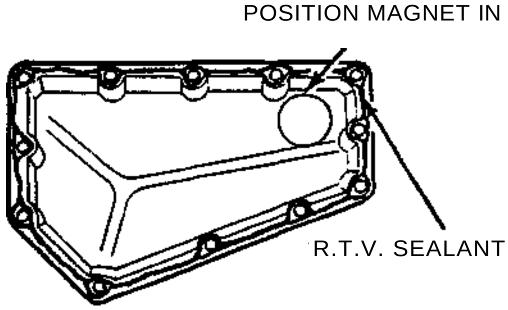


Oil Pan and Filter

REMOVAL AND INSTALLATION

4 Speed Overdrive Only

1. Raise the vehicle and support it safely.
2. With drain pan placed under overdrive



Place magnet as shown when Installing oil pan on overdrive unit—1984 and later

oil pan, remove oil pan attaching bolts from front and side of pan.

3. Loosen rear pan attaching bolts approx imately four turns.

4. Carefully pry oil pan loose, allowing fluid to drain.

5. Remove remaining bolts and remove oil pan.

6. Drain fluid from oil pan. Clean pan with solvent and dry thoroughly with clean com pressed air.

7. Remove filter from the transmission.

8. Install new filter, then install the oil pan using R.T.V. sealer as illustrated.

9. Refill with recommended lubricant. Do not overfill.

AUTOMATIC TRANSMISSION

Identification

The two speed Powerglide transmission was used in the Corvette from 1963-67. From 1967-77, either the Turbo Hydra-Matic 350 (TH350) or the TH400 is used. In the years of 1978-81, the TH350 was the only available automatic transmission. In 1980 (except California models), an electrically controlled locking torque convertor was introduced to improve fuel economy. All 1981-82 models have this feature. In 1982, the TH700R-4, four speed automatic transmission is the only transmission available in the Corvette. The TH700R-4 is an option on the 1984 model. Identification of the 1967-77 transmissions can be made by the shape of the oil pan.

OIL *PAN AND FILTER SERVICE*

NOTE: *The fluid should be drained while the transmission is warm.*

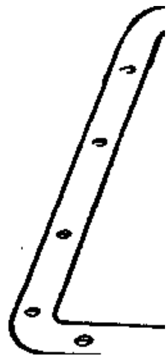
1. Using a jack, raise the front of the ve hicle and support it safely with jackstands. If the transmission pan has no drain plug, visu ally check that you can gain access to all of the transmission pan bolts. If you can, pro ceed to step 8; if not, proceed to step 2.

2. Pkce a jack under the transmission with a block of wood (a piece of a 2 x 4 will do) between the jack and the transmission pan.

3. Raise the jack until the wood block contacts the transmission pan.

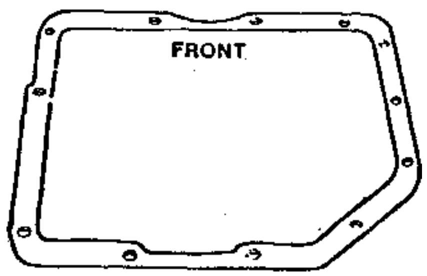
4. Remove the crossmember-to-transmission mount bolts and the crossmember-to-frame bolts.

5. Raise the transmission SLIGHTLY—

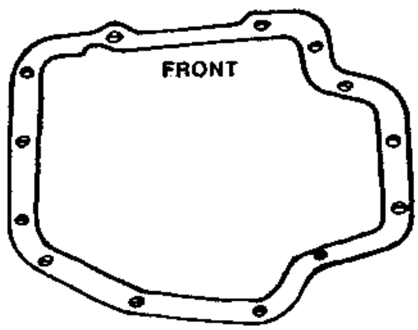


FRONT

Powerglide transmission



Turbo Hydra-Matic 350



Turbo Hydra-Matic 400

700R4

just enough to take the weight of the transmission off of the crossmmember.

6. Turn the crossmember sideways and remove it.

7. Place a jacksiand close to the transmis sion tailshaft. Lower the jack until the trans mission rests on the stand. Remove the jack and the wood block.

8. Place a drain pan under the transmis sion pan. If the pan has a drain plug, remove it and allow the fluid to drain.

9. If the pan does not have a drain plug, remove the pan bolts from one side of the pan and loosen the rest of the bolts. This will allow the pan to partially drain. Remove the remaining pan bolts and carefully lower the pan away from the transmission.

NOTE: *If the transmission fluid is dark or has a burnt smell, transmission damage is indicated. Have the transmission checked professionally.*

CAUTION: *If the pan sticks, carefully tap sideways on the pan with a rubber mallet or a plastic hammer to break the pan loose. DO NOT dent the pan. Avoid prying the pan off with a screwdriver—this can bend the pan or crack the transmission case.*

10. Empty the pan, remove the gasket material, and clean the pan with solvent (car buretor cleaner works well).

11. Remove any gasket material which may remain on the transmission case.

12. Remove the transmission filter from the valve body. The filter may have either a fi brous or screen filtering element and is re tained by one or two fasteners.

13. Install a new filter using a new gasket or O-ring (TH400's).

NOTE: *// the transmission uses a filter having a futty exposed screen, it may be cleaned and re-used.*

14. Install the pan using a new gasket. Tighten the bolts to 12-14 ft. Ibs. in a criss cross pattern. Recheck the bolt torque after all of die bolts have been tightened once.

15. Add either Dexron or Dexron II trans mission Suid through the filler tube. See the Capacities Chart to determine the proper amount of fluid to be added.

CAUTION: *DO NOT OVERFILL the transmission; foaming of the fluid and subsequent transmission damage due to slippage will result.*

16. With the gearshift lever in PARK, start the engine and let it idle. Do not race the engine.

17. Move the gearshift lever through each position, holding the brakes. Return the lever to PARK, and check the fluid level with the engine idling. The level should be between the two dimples on the dipstick, about % in. below the ADD mark. Add fluid, if necessary.

18. Check the fluid level after the vehicle has been driven enough to thoroughly warm up the transmission. Details are given under Fluid Level Checks earlier in Chapter 1. If the transmission is overfilled, the excess must be drained off. Use a suction pump, if necessary.

SHIFT *LINKAGE ADJUSTMENT*

1963-67 Powerglide

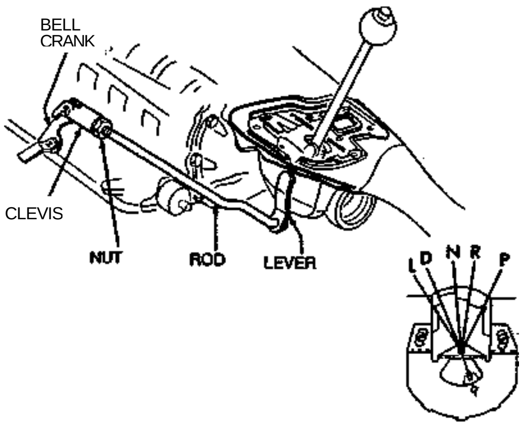
All Powerglides are adjusted in the same manner, although the shift pattern was changed in 1965 from the staggered pattern of 1963-64 to a straight pattern.

1. Disconnect the control rod from the shift lever.

2. Position both the shift lever and the control rod bell crank in Park, then loosen the clevis locknut and rotate the rod until it freely enters the shift lever.

3. Secure the rod to the shift lever and lock the clevis nut.

Powerglide shift linkage

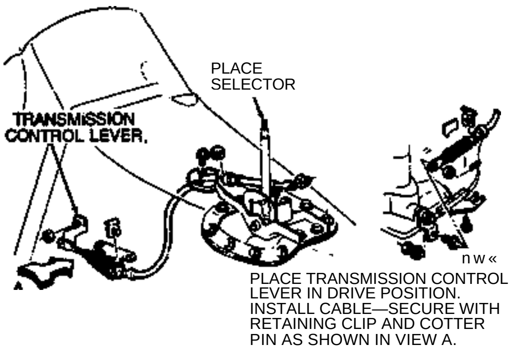


1968-72

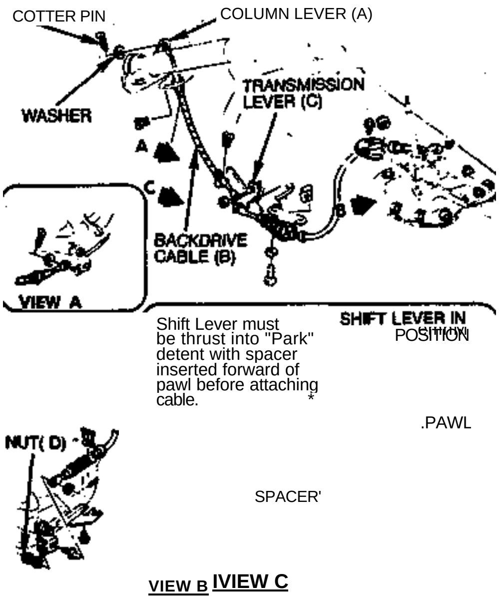
1. Disconnect the pushrod at the trans mission lever.

2. With the transmission lever in Drive detent and the selector lever in Drive, rotate the push-rod until the hole lines up with the lever pin.

3. Install the pushrod on the pin and in stall the retainer clip.

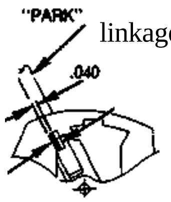


1968-72 Turbo Hydra-Malic shift linkage



1973-77 Turbo Hydra-Malic shift linkage

4. Check operation of the linkage in all positions.

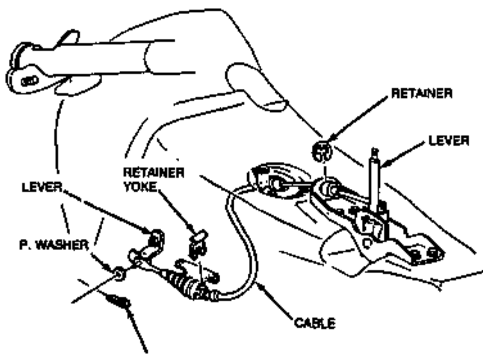


1973-77 Turbo Hydra-Matic 400

1. Loosen the nut on the transmission lever so that the pin can move in the slot. Remove the console cover.
2. Move the transmission lever counterclockwise to the LI position and then clockwise five detents to Park.
3. Place the shift lever in Park and insert a 0.40 in. spacer in front of the pawl.
4. Tighten the nut on the transmission lever to 20 ft. Ibs.
5. Turn the ignition switch to Lock with the shift lever in Park.
6. Remove the cotter pin and washer from the backdrive cable at the column lever. Disconnect the cable.
7. Working under the dash, remove the two nuts at the steering column-to-dash bracket.
8. Turn the lock tube lever counterclockwise (when viewed from the front of the column) to remove any freeplay from the column.
9. Move the bracket until the cable eye passes freely over the retaining pin on the bracket.
10. While holding the bracket in place, have an assistant tighten the bracket retaining nuts.
11. Install the cotter pin and washer to retain the cable to the lever retaining pin.

1978-81 Turbo Hydra-Matic 350

1. Loosen the screw from the swivel so the rod moves within the swivel.
2. Put the transmission control lever in drive (D) and loosen the nubso that the pin moves in the slot of the transmission lever.
3. Position the transmission lever in the "Drive" position by moving the lever counterclockwise to the LI detent and then clockwise three detent positions to "Drive."
4. Tighten the nut to 20 ft. Ibs.
5. Position the transmission control lever in the park (P) position and the ignition switch in the "Lock" position. /
6. Pull down on the rod slightly against the lock stop and tighten the screw to 20 ft. Ibs.



197B-82 Turbo Hydra-Matic shift linkage

1982-84

1. Raise the vehicle and support it safely with jackstands.
2. Disconnect the transmission control cable at the transmission lever. Rotate the transmission lever clockwise to the last detent position.
3. Push the shifter lever as far forward as possible, in the Park position.

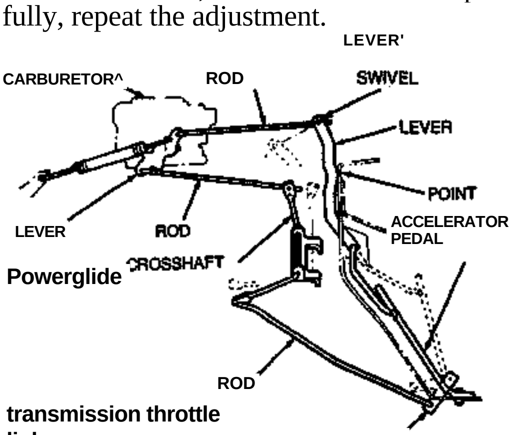
4. Check the alignment of the control ca ble hole against the transmission lever stud. If the cable hole aligns with the stud, attach the cable with the washer and retaining pin; the adjustment is okay. If the stud and hole do not align, loosen the stud mounting nut and slide the stud as necessary to align it with the cable hole. Tighten the stud nut and at tach the cable with the washer and retaining pin.

5. Lower the vehicle.

THROTTLE VALVE LINKAGE ADJUSTMENT

1963-67 Powerglide

1. Fully open the lever and pull the rod forward until it contacts the internal trans mission stop.
2. Adjust the swivel on the rod until the rod freely enters the lever, and then lengthen three full turns.
3. Secure the swivel then remove the toe panel carpeting.
4. Fully depress the accelerator pedal un til the carburetor lever contacts the firewall.
5. Hold in position and adjust the swivel on the rod for freedom of entry into the le ver, then lengthen 2 turns.
6. Check by returning the linkage to idle position and then rotating the lever to fully open.
7. Push the lever down to see if the rod deflects. If it does, or if the lever fails to open fully, repeat the adjustment.

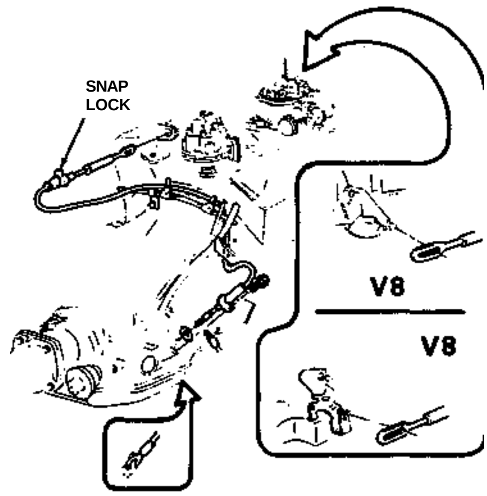


Powerglide transmission throttle linkage

THROTTLE *VALVE (T.V.) CABLE ADJUSTMENT*

1976-80 Turbo Hydra-Malic 350

1. Remove the air cleaner to gain access to the detent cable.



1976-80 Turbo Hydra-Matic 350 detent cable. Note the location of the adjusting snap-lock.

2. Locate the cable adjusting snap-lock which is positioned behind the cable mount ing bracket.
3. Release the snap-lock by pushing it up ward from underneath.
4. Open the carbuetor throttle completely and set the snap-lock by pushing it down ward.
5. Install the air cleaner.

1981-84 Turbo Hydra-Matic 350 and 700R-4

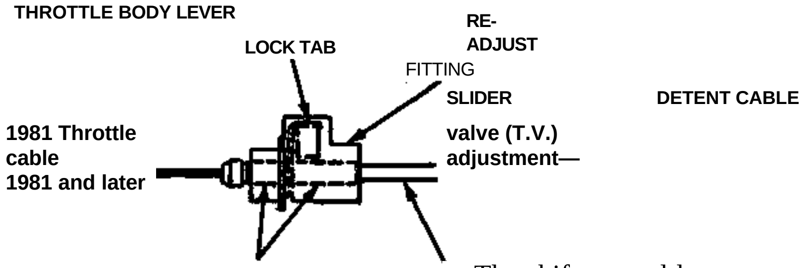
1. Remove the air cleaner to gain access to the detent cable.
2. Depress and hold the metal lock tab.
3. Move the slider back through the cable fitting, away from the throttle body or car buretor lever, until the slider stops against the fitting.
4. Release the metal lock tab.
5. Install the air cleaner.

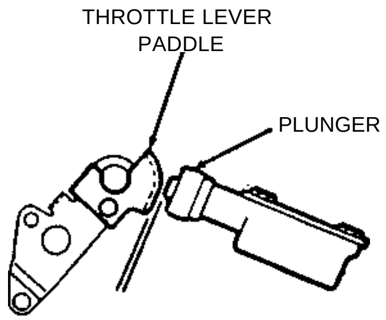
DETENT SWITCH ADJUSTMENT

1968-72 Turbo Hydra-Matic 400

The detent switch is located on flie carbu-retor.

1. Pull the detent switch driver rearward until the hole in the switch body aligns with the hole in the driver.
2. Insert a 0.092 in. pin through the aligned holes to a depth of 0.10 in. to hold the driver in position.
3. Loosen the switch mounting bolt.





1968-72 detent switch adjustment—Turbo Hydra-Matic 400

4. With the throttle held in wide open position, move the switch forward until the driver contacts the accelerator lever.

5. Tighten the mounting bolt and remove the pin.

1973-77 TURBO HYDRA-MATIC 400

The switch is located over the accelerator pedal. After installing a new switch, adjustment is made by pressing the plunger in. This presets the switch and it will self-adjust the first time the pedal is fully depressed.

NEUTRAL SAFETY SWITCH ADJUSTMENT

1963-65 Powerglide

Adjustment is made by varying the length of the bellcrank-to-switch control rod. One end of the rod has a swivel to allow adjustment.

1966-67 Powerglide and 1968-71 Turbo Hydra-Matic 400

In all models the adjustment is made with the shift lever in Drive position. Loosen the switch mounting screws. Align the slot in the contact support with the hole in the switch and insert a ^{3}/az in. pin to hold the support in place.

The shift control lever must be disconnected from the control rod and the shift control knob removed. Then remove the trim plate to get at the switch. Proceed as described in the first paragraph above, then place the contact support drive slot over the drive tang. Tighten the switch mounting screws, then remove the pin. Reinstall the shift control lever and trim plate.

1972 Turbo Hydra-Matic 400

1. Disconnect the shift control lever arm from the control rod.
2. Remove the shift knob.
3. Remove the trim plate.
4. Remove the control assembly retaining screws and lift the assembly away from the seal.
5. Remove the netural switch from the control assembly.

To install:

6. On early 1972 models put the shifter into Drive or Neutral on later models.
7. Align the hole in the contact support with the hole in the switch and insert a ^{3}/32 in. pin to hold the support in place.
8. Place the contact support drive slot over the drive tang and tighten the switch mounting screws. Remove the pin.
9. Install the control assembly mounting screws. Connect the switch wiring and check the switch operation.
10. Install the trim plate and shift knob.
11. Connect the shift lever arm to the transmission control rod.

1973 and Later—All Transmissions

Use the 1972 THM 400 procedure outlined previously except that during installation, the shift lever is positioned in Drive. It is only necessary to use the ^{3}/32 in. pin for alignment when the original switch pin has been sheared off.

LOW BAND ADJUSTMENT

1963-67 Powerglide

Low band adjustment should be performed at 12,000 mile intervals, or if slipping is encountered.

1. Place the selector lever in Neutral.
2. Jack the car up to the required working height and support with jackstands.
3. Remove the cap from the adjusting screw.
4. Lower the left exhaust pipe for clearance.
5. Loosen the adjusting screw *V** turn and hold with a wrench.
6. Using an in. Ibs torque wrench, adjust the band to 70 in. Ib and back-off exactly four turns for a band in use over 6,000 miles and three turns for one in use less than 6,000 miles.

NOTE: *The locknut must be held at exactly V* turn loose during the adjustment. The number of back-off turns must be exactly as stated here.*

Low band adjustment (Powerglide)

7. Tighten the locknut to 15 ft. Ibs.

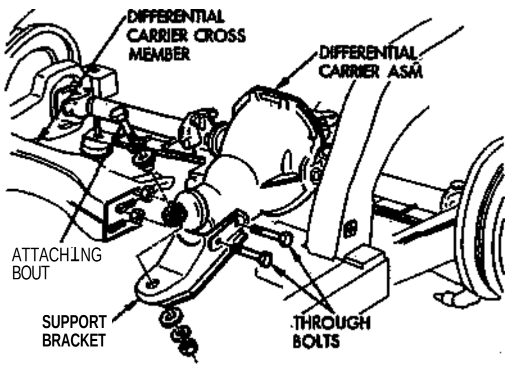
NOTE: *Band and/or clutch adjustments are not required on Turbo Hydra-Matic 350, 400, or 700R-4 transmissions.*

Drive Train

7

DRIVELBNE

The Stingray driveline consists of the driveshaft, differential carrier, and axle driveshafts. The driveshaft is of conventional tubular design with a universal joint at each end. The differential is mounted directly to a suspension crossmember. Power is transmitted to the wheels through universal-joined axle driveshafts. The 1984 Corvette uses two types of drive shafts, one made from aluminum and the other from steel. Each shaft is installed in the conventional manner.



1963-79 differential and axle driveshaft mounting (later models similar)

Driveshaft and Universal Joints

REMOVAL AND INSTALLATION

NOTE: *Follow steps 1, 5, 6, 7, and 8 to remove the driveshaft from 1980 and later Corvettes. During installation, torque the bearing strap fasteners to 15ft. Ibs.*

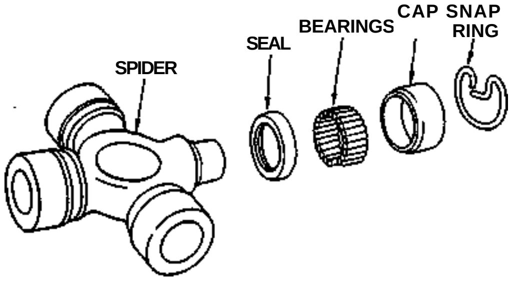
1. Jack the car to a convenient working height and support with jackstands.
2. Wedge a block of wood between the top of the differential carrier and the car floor to keep the carrier from twisting on its rub ber mounts when the front support bracket is disconnected.
3. Loosen and remove the carrier sup port-bracket front bolt. Remove the two rub ber biscuits and large washer. Discard and replace the rubber biscuits if they show any deterioration.
4. Remove the two side bolts or front thru-bolt on later models from the carrier support bracket. Loosen, but do not remove, the rear thru-bolt and swivel the bracket down and away.
5. Mark the driveshaft so that it may be reinstalled in its original position. Remove the U-bolts from both ends of the driveshaft.
6. Push the front yoke into the transmission and remove the driveshaft by pulling it down and to the rear.
7. Check the universal joints and replace damaged or worn units. Grease both univer sal joints before reinstalling them.
8. Install the driveshaft and attach to the transmission yoke and carrier flange.
9. Install the front bolt biscuits and flat washer and raise the bracket to the crossmember.

NOTE: *At this point it may be necessary to install a jack under the carrier. This witt aid in lining up the side-bracket bolt holes and compressing the rubber biscuits.* 10. Install the front crossmember bolt and nut. Install the side bolts. Front bolt torque is 30 ft. Ibs. Torque the two side bolts to 45-55 and the long thru-bolt to 40-60 ft. Ibs.

NOTE: *The carrier support bracket bolts frequently work loose, causing vibration and rear axle hop. Periodic torquing of these four bolts will eliminate this problem.*

UNIVERSAL JOINT OVERHAUL

Except for early Stingrays, Corvettes are equipped with lubed-fbr-Iife universal joints without grease fittings. Whenever universal



Typical universal joint assembly

joints are removed from the car, they should be checked and regreased.

1. Remove the joints from the driveshaft. These can sometimes be tapped out, but stubborn joints must be pressed out.
2. Remove the bearing cups and seals, being careful not to lose any rollers.
3. Inspect the cups and trunnion ends for damage or wear. Ensure that all bearing roll ers are present. Replace the rubber seals.
4. Clean the cups and rollers. Repack the cup with grease and reassemble the joint.

REAR AXLE

Axle Driveshaft

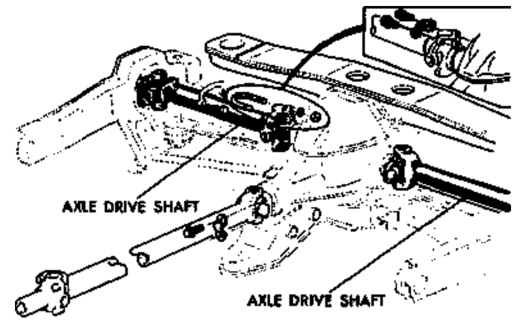
REMOVAL AND INSTALLATION

1979 and Earlier Models

1. Jack the rear of the car up and support with jackstands.
2. Disconnect the inside trunnion from the carrier yoke.
3. On the outer end, bend down the lock-tabs and wire-brush the bolts.
4. Scratch a mark on the camber adjusting cam and the bracket to permit realignment.
5. Loosen the camber adjustment nut and turn the cam so that the eccentric end points inward. Doing this will push the trailing arm out and give more room for driveshaft re moval.
6. Remove the driveshaft, outside end first.
7. To install, position the inside end of the driveshaft in the carrier yoke and asemble U-bolts or clamp and bolts. Torque the bolts to 14-18 ft. Ibs.

NOTE: *When removing and installing both axle driveshafts, be certain to position the carrier side yokes so that the trunnion seats are at 90° angles to each other.*

8. Install the outside end of the driveshaft into the spindle drive flange. Install the locks and bolts. Torque the bolts to 70-90 ft. Ibs. and bend the locktabs up.



1963-79 axle driveshaft installation

9. Realign the camber adjusting cam and bracket. Torque the nut to 15-22 ft. Ibs.

1980-82 Models

1. Raise the rear of the vehicle and sup port it safely with jacks tands.
2. Disconnect the inboard driveshaft trunnion from the side gear yoke. Remove the plastic shield.
3. Disconnect the shaft flange from the spindle drive flange.
4. Mark the camber adjusting cam and the mounting bracket so that their relationship will be properly maintained during assem bly.
5. Loosen the camber adjusting nut. Ro tate the adjusting cam so that the high point of the cam faces inward, which pushes the control arm outward. This will provide addi tional working clearance.
6. Remove the driveshaft, outboard end first. Install the driveshaft in the following manner:
7. Place the inboard driveshaft trunnion into the side gear yokes. For vehicles using U-bolts with 1.06" dia. bearing caps, torque the bolts to 15 ft. Ibs; for U-joints with 1.13" dia. bearing caps, torque the bolts to 25 ft. Ibs.
8. Rotate the yokes so that the trunnion seats are phased 90° apart.
9. Attach the outboard end of the drive-shaft in the same manner as step 7.
10. Install the plastic shield. Align the marks made during step 4 and torque the camber adjusting cam bolt to 130 ft. Ibs.

Drive Shaft Axle

REMOVAL AND INSTALLATION

1. Raise the vehicle and support it safely.
2. Disconnect leaf spring from the knuckle.
3. Disconnect tie rod end from the knuckle.

Rear Axle Identification

NOTE: *Axle identification is stamped on the differential carrier along with the date of manufacture.*

Type	Plant Identification
1963	
3-Speed (3.36 ratio)	CA
Positraction (3.08 ratio)	CJ
Positraction (3.36 ratio)	CB
Positraction (3.55 ratio)	CC
Positraction (3.70 ratio)	CD
Positraction (4.1 1 ratio)	CE
Positraction (4.56 ratio)	CF
4-Speed (3.08 ratio)	CZ
4-Speed (3.70 ratio)	CX
1964	
3-Speed (3.36 ratio)	CA
Positraction (3.08 ratio)	CJ
Positraction (3.36 ratio)	CB
Positraction (3.55 ratio)	CC
Positraction (3.70 ratio)	CD
Positraction (4.1 1 ratio)	CE
Positraction (4.56 ratio)	CF
4-Speed (3.08 ratio)	CZ
4-Speed (3.70 ratio)	CX
1965	
(3.36 ratio)	AK
Positraction (3.08 ratio)	AL
Positraction (3.36 ratio)	AM
Positraction (3.55 ratio)	AN
Positraction (3.70 ratio)	AO
Positraction (4.1 1 ratio)	AP
Positraction (4.56 ratio)	AO
(3.08 ratio)	AR
4-Speed (3.70 ratio)	AS
Positraction (3.08 ratio) "396"	AT
Positraction (3.36 ratio) "396"	AU
Positraction (3.55 ratio) "396"	AZ
Positraction (3.70 ratio)	FA
Positraction (4.1 1 ratio) "396"	FB
Positraction (4.56 ratio) "396"	FC
1966	
(3.36 ratio)	AK
Positraction (3.08 ratio)	AL
Positraction (3.36 ratio)	AM
Positraction (3.55 ratio)	AN
Positractibn (3.70 ratio)	AO
Positraction (4.1 1 ratio)	AP
Positraction (3.08 ratio)	AR
4-Speed (3.70 ratio)	AS
Positraction (3.08 ratio) "396"	AT
Positraction (3.36 ratio) "396"	AU
Positraction (3.55 ratio) "396"	AZ
Positraction (3.70 ratio) "396"	FA
Positraction (4.1 1 ratio) "396"	FB
Positraction (4.56 ratio) "396"	FC
1967	
(3.36 ratio)	AK
Positraction (3.08 ratio)	AL
Positraction (3.36 ratio)	AM

Rear Axle Identification (cont.)

NOTE: *Axle identification is stamped on the differential carrier along urith the date of manufacture.*

Type	Plant Identification
1967	
Positraction (3.55 ratio)	AN
Positraction (3.70 ratio)	AO
Positraction (4.11 ratio)	AP
4-Speed (3.70 ratio)	AS
Positraction (3.08 ratio) "427"	AT
Positraction (3.36 ratio) "427"	AU
Positraction (3.55 ratio) "427"	AZ
Positraction (3.70 ratio) "427"	FA
Positraction (4.11 ratio) "427"	FB
Positraction (4.56 ratio)	FC
1968	
(3.36 ratio)	AK
Positraction (3.08 ratio)	AL
Positraction (3.36 ratio)	AM
Positraction (3.55 ratio)... —	AN
Positraction (3.70 ratio)	AO
Positraction (4.11 ratio)	AP
(3.70 ratio)	AS
Positraction (3.08 ratio) (H.D.) .	AT
Positraction (3.36 ratio) (H.D.) .	AU
Positraction (3.08 ratio)	AV
Positraction (3.08 ratio) (H.D.) .	AW
1969	
(3.36 ratio)	AK
Positraction (3.08 ratio)	AL
Positraction (3.36 ratio)	AM
Positraction (3.55 ratio)	AN
Positraction (3.70 ratio)	AQ
Positraction (4.11 ratio)	AP
(3.70 ratio)	AS
Positraction (3.08 ratio) (H.D.)	AT
Positraction (3.36 ratio) (H.D.)	AU
Positraction (3.08 ratio)	AV
Positraction (3.08 ratio) (H.D.)	AW
Positraction (2.73 ratio) (H.D.)	AY
Positraction (3.55 ratio) (H.D.)	AZ
Positraction (3.70 ratio) (H.D.)	FA
Positraction (4.11 ratio) (H.D.)	FB
Positraction (4.56 ratio)	FC
1970	
(3.36 ratio)	CAK
Positraction (3.08 ratio)	CAL
Positraction (3.36 ratio)	CAM
Positraction (3.55 ratio)	CAN
Positraction (3.70 ratio) 350 H/Per., 4-Speed Closed Ratio	CAO
Positraction (4.11 ratio)	CAP
Positraction (3.70 ratio) 350 H/Per., 4-Speed Closed Ratio	CAS
Positraction (3.08 ratio)	CAT
Positraction (3.36 ratio)	CAU
Positraction (3.08 ratio)	CAV
Positraction (3.08 ratio) 4-speed Automatic	CAW
Positraction (2.73 ratio)	CAY

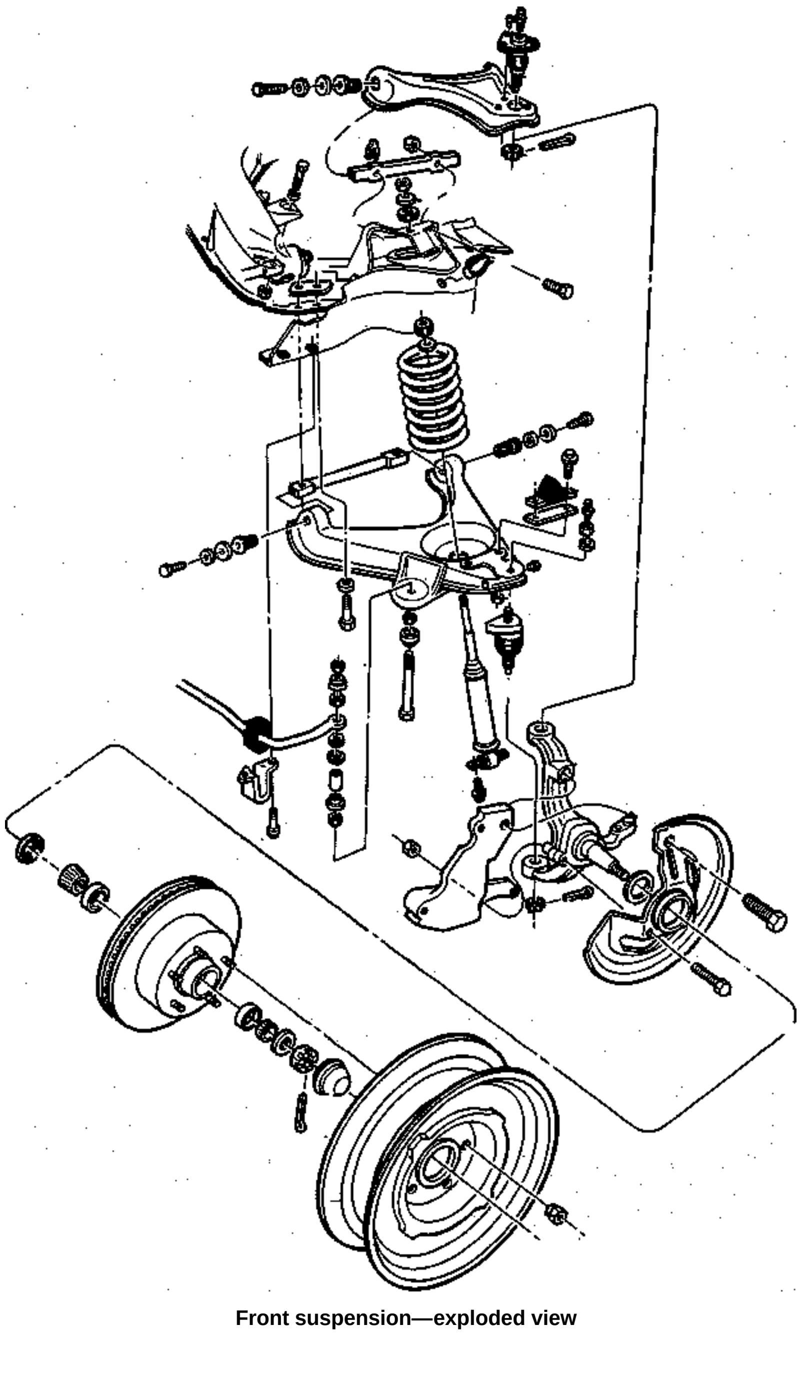
BOUNCE TEST

Each shock absorber can be tested by bouncing the corner of the vehicle until maximum up and down movement is obtained. Release the car. It should stop bouncing in one or two bounces. Compare both front corners or both rear corners but do not compare the front to the rear. If one corner bounces longer than the other it should be inspected for damage and possibly be replaced.

REMOVAL AND INSTALLATION

1. To remove, raise the vehicle and hold the upper stem of the shock absorber with an open-end wrench. This prevents the stem from turning and allows the removal of the retaining nut, washer, and rubber grommet.

2. Remove the two bolts that fasten the lower pivot point of the shock absorber to the lower control arm and slip the shock absorber free.



Front suspension—exploded view

The displacement contributes to the directional sense. Combined with +3° caster, spindle offset gives an effect similar to higher caster without the poor responsiveness.

Coil Springs

REMOVAL AND INSTALLATION

CAUTION: *Great care should be exercised when removing springs, as the compressed force of a coil spring is potentially very dangerous.*

1. Support the car so that the control arms hang loosely.
2. Remove the wheel and tire, stabilizer bar, and shock absorber.
3. Loosen the lower ball joint-to-steering knuckle nut and the two, lower control arms, cross-shaft bushing bolts.
4. Wrap a safety chain around the lower arm and the coil spring.
5. Install a floor jack under the spring and slightly compress the spring.
6. Disconnect the lower ball joint from the steering knuckle.
7. Very slowly and carefully, lower the control arm and release the spring. It may be necessary to pry the spring out of the tower.
8. To install, position the spring on the control arm and jack up the arm.
9. Install the ball joint on the steering knuckle, and remaining components in a re verse order.

Transverse Leaf Spring

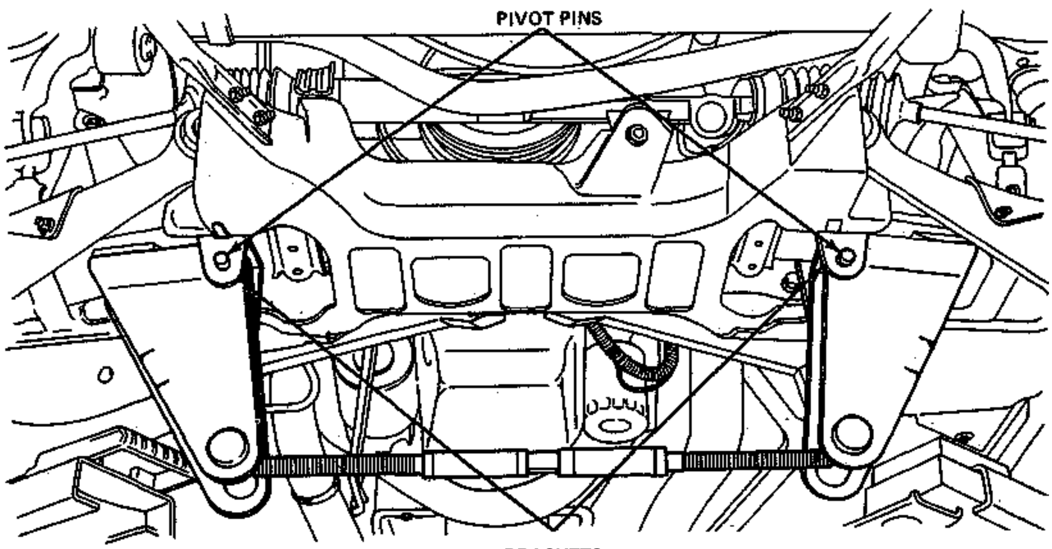
REMOVAL AND INSTALLATION

1. Raise the vehicle and support it safely.
2. Remove the wheel and tire assem blies.
3. Remove both spring protectors.
4. Install spring compressing tool J-33432, or equivalent.
5. Disconnect the lower ball joints with tool J-33436-9, or equivalent.
6. Compress the leaf spring tool.
7. Remove the shock mounting bracket to lower control arm attaching bolts.
8. Remove the spring mounting bolts.
9. Release and remove leaf spring com pressor.
10. Install the spring by reversing the removal procedure. Torque all nuts and bolts to specifications, and check the front end alignment.

NOTE: *During removal and installation of transverse spring take care to prevent damage. Handle compressed spring carefully to avoid possible injury.*

Shock Absorbers

Corvette Stingray shock absorbers are the sealed, hydraulic type with no provision for adding fluid or making adjustments. They should be replaced when evidence of faulty operation is discovered. Replace any leaking shock absorber.



Transverse leaf spring removal requires the use of a spring compressor as shown. The pivot pins are removable so that the bracket may be placed over the top of the spring. See text for OEM tool numbers

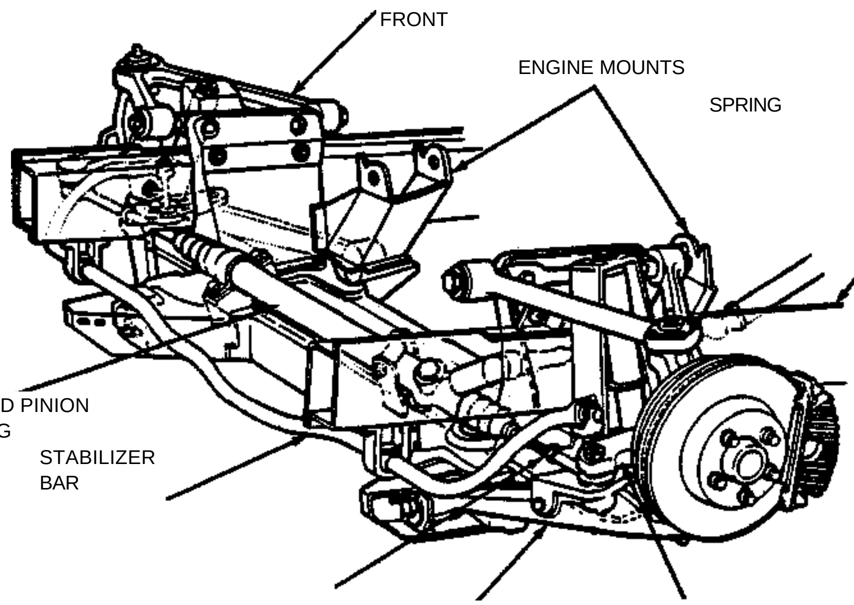
Suspension and Steering

8

FRONT SUSPENSION

The Corvette Stingray front suspension is an unequal length arm, independent design. Springing action is provided by coil springs. Ball joints connect the steering knuckles to the control arms. The upper and lower control arms have their cross-shafts bolted to iked frame members. The upper arm cross-shaft has shims to provide the means for setting caster and camber. The front shock absorbers have their bottom ends attached to the lower control arm while the upper end extends through the frame member. The shock absorbers are double action and fit inside the front coil springs. A stabilizer bar connects the lower control arms to the front frame rails. Tapered roller bearing are used in the front wheels.

On 1984 models, the front suspension uses aluminum for all its major components. These include forged aluminum arms and knuckles and replaces conventional coil springs with a lighter, more durable transverse fiberglass monoleaf spring. Other elements of the front suspension system include long life stabilizer link bushings and the use of spindle offset. Spindle offset is achieved by moving the center of the wheel rearward from the conventional location on line through the ball joints.



Front suspension on 1984 and later models

Rear Axle Identification (cont.)

NOTE: *Axle identification is stamped on the differential carrier along with the date of manufacture.*

Type	Plant Identification
1970	
Positracflon (3.36 ratio) 4-Speed Automatic	CAX
Positraction (3.55 ratio)	CAZ
Positractfon (3.70 ratio)	CFA CFB
Positractfon (4,11 ratio)	CFC
PosRraction (4.5© ratto)..,,, —	CLR
Pbsifractfon (3.36 ratio}	
1971	
Positractfon (3.55 ratio).	AA AB
Positraction (3.70 ratio).	AC AD
Positraction (4.11 ratfo).	AW AX
Positractfon (4.56 ratfo).	LR
Positractfon (3.08 ratfo).	
Positraction (3.36 ratio).	
Positracfton (3.36 ratfo).	
1972-75	
Posifracfion (3.36 ratfo).	AX LR
Positraction (3.36 ratio).	AC AB
Posifraction (4.11 ratio).	AA AW
Posnraetion (3.70 ratio).	AV
Positractfon (3.55 ratio).	
Positraction (3.08 ratio).	
PosBractfon (2.73 ratfo).	OA LR-OD
1976-77	
Positraction (3.08 ratio).	
Posifraction (3.36 ratio).	

Rear Axle Identification (cont)

NOTE: *Axle identification is stamped on the differential carrier along uMh the date of manufacture.*

Type	Identification
1976-77	
Positraction (3.55 ratio).	OB OC
Positraction (3.70 ratio).	
1978	
Positraction (3.08 ratio).	OK OM
Positraction (3.36 ratio).	OH OJ
Positraction (3.55 ratio).	
Positraction (3.70 ratio).	
1979	
Positraction (3.36 ratio).	OM OH
Positraction (3.55 ratio).	OJ
Positraction (3.70 ratio).	
1980	
Positraction (3.07 ratio)	DANA
1981	
Positraction (2.87 ratio) w/A.T.	OJ
Positraction (2.72 ratio) w/M.T	OK
1982	
Positractfon (2.87 ratio)	DANA
1984	
Positraction (3.31 ratio)	DANA

4. Scribe mark on cam bolt and on mounting bracket *so* they can be realigned in the same position.

5. Remove cam bolt and • separate the spindle support rod from the mounting bracket at the carrier.

6. Remove axle shaft trunnion straps at the spindle and at the side gear yoke.

7. Posh out on the wheel and tire assembly and remove the axle shaft.

8. Replace U-Joints as described under "Propeller Shaft." Install by reversing removal.

9. Realign scribe mark on cam bolt with scribe mark on bracket. Torque bolts to specifications.

10. Check and adjust rear suspension alignment as necessary.

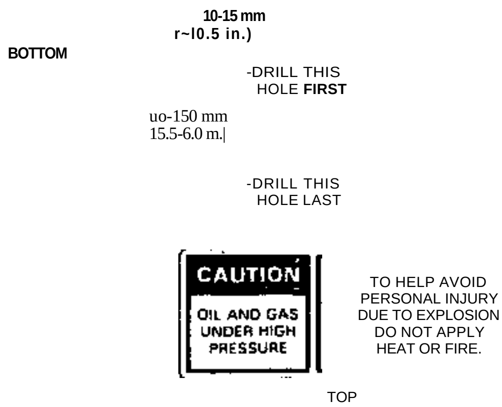
3. Reverse the procedure to install the replacement shock absorbers.

DISPOSAL OF PRESSURIZED SHOCK ABSORBERS

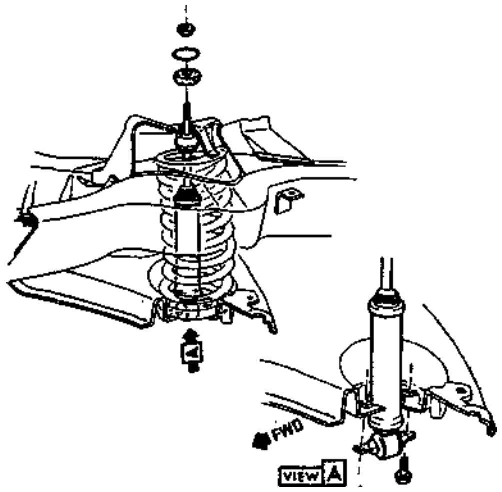
1984 and Later Models

Due to the high pressure of gas it is advised that, upon scrapping or disposal of these shock absorbers, the pressure be released. This is carried out as follows:

1. Clamp shock in vise with piston rod pointing down.
2. Measure approx. 10—15 mm (0.5 in.) from bottom of shock and drill an approx. 5 mm hole so the gas can escape.
3. Measure approx. 140-150 mm (5.5-6.0 in.) from first hole and drill an approx. 5 mm hole to facilitate drainage of oil. Drain all oil from shock absorber.



Gas-filled shock absorbers should be drilled as shown before disposal. Look for the warning label to identify gas shocks on 1984 and later models

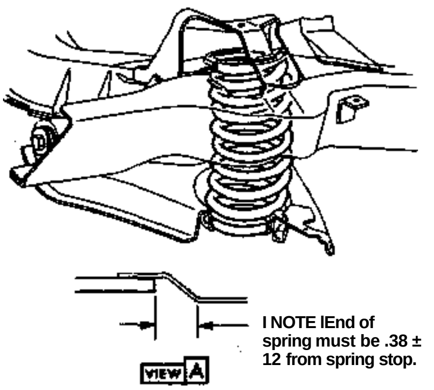


Shock absorber attachments

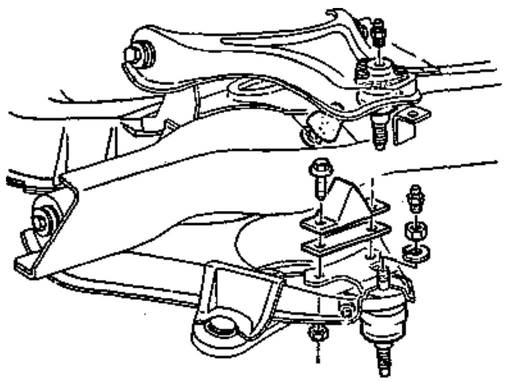
Ball Joints

Erratic front suspension behavior or alignment difficulties suggest possible excessive ball-joint wear. To check, raise the vehicle so that the front suspension hangs freely and remove the wheel and tire assembly. Check the upper ball joint by supporting the lower control arm and by separating the upper ball-joint stud from the steering knuckle. With the steering knuckle and hub hanging freely, install the retaining nut on the ball joint stud and note the torque required to rotate the ball joint with a torque wrench. A ball joint in good condition will require a torque of 2-10 ft. Ibs. Less than 2 ft. Ibs. torque indicates excessive wear and warrants replacement of the ball joint.

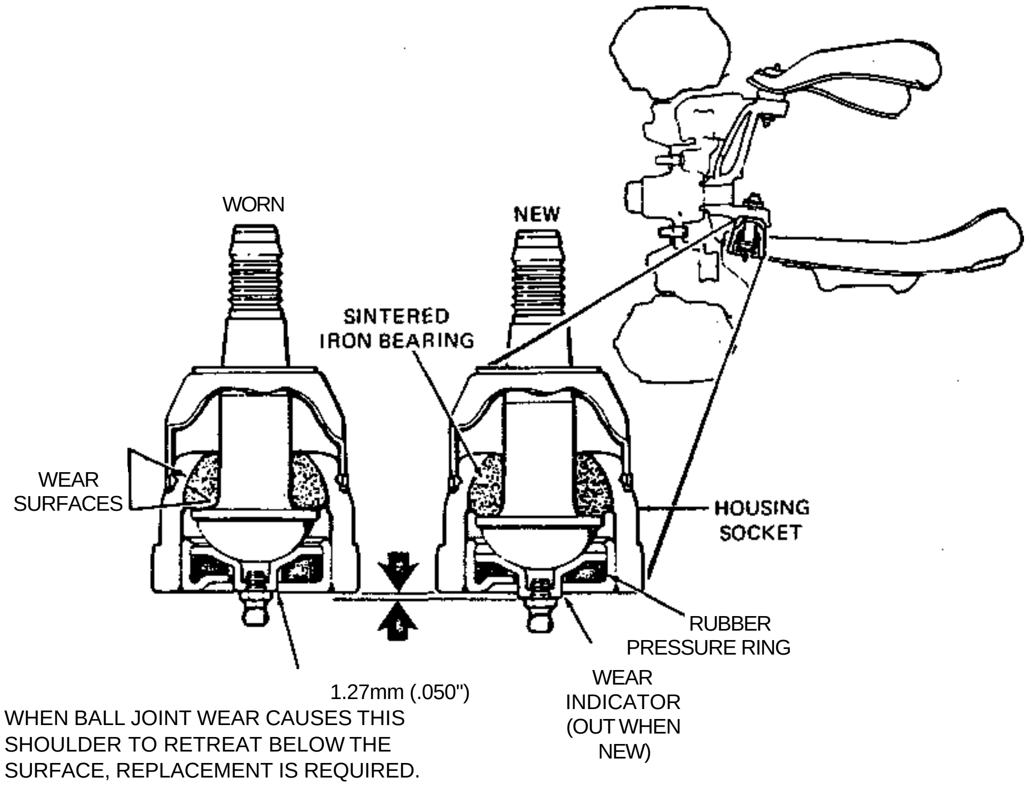
To test the lower control arm ball joint, support the lower control arm so that the wheel hub hangs freely. Measure between the tip of the ball joint stud and the tip of the grease fitting found on the top side of the ball



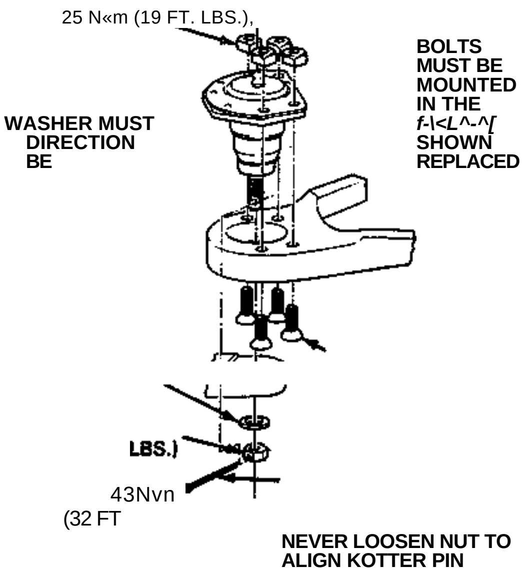
Coil spring positioning



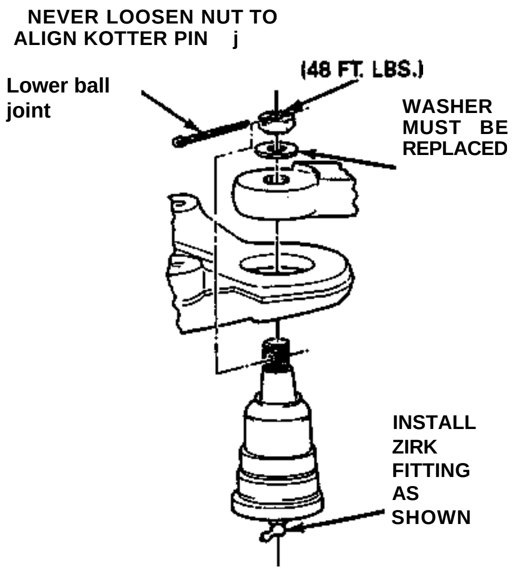
Upper and lower ball joint assemblies



Typical ball joint inspection, showing how to check wear indicator



Upper ball joint installation. OEM rivets must be drilled and replaced with bolts supplied with replacement part (1984 shown)



installation—typical

joint. Now position the support under the wheel hub and repeat the measurement. A difference in measurement of more than Vie in. dictates replacement of the lower ball joint.

REMOVAL AND INSTALLATION

Replacement of the ball joints may be done without removing the control arms from the vehicle.

1. Raise the vehicle and remove the

wheel and tire. Be sure that the lift is positioned so that the front suspension will hang freely.

2. Remove the stabilizer link from the lower control arm, then disconnect the top ball joint from the steering knuckle and let the knuckle and the wheel hub hang unsup ported.

3. The ball joint assembly is riveted to the control arm. Use a suitable cold chisel and knock the heads off the rivets and remove the ball joint.

4. Clean the mounting surface on the control arm and check for signs of cracks or other damage.

5. Measure rne thread diameter of the kit-supplied mounting bolts and drill out the control arm rivet holes to the appropriate size.

6. Install the replacement ball joint as sembly and torque the new securing bolts to 15-25 ft. Ibs. (1963-67), 50 ft. Ibs. (1968-82).

7. Lift the lower control arm so that the upper ball joint stud can be rejoined to the steering knuckle. Torque the retaining nut to 42-47 ft. Ibs. (1963-67); 80ft. Ibs. (1968-82) and install a new cotter pin.

8. To replace the lower ball joint, sup port the lower control arm, disconnect the lower ball joint from the steering knuckle and lift the knuckle and wheel hub out of the way.

NOTE: *Removal of the spring is not necessary so long as the lower control arm is adequately supported.* 9. The lower ball joint assembly is also riveted to the control arm surface. Chisel it free as with the upper ball joint.

10. Replace the joint as previously described, men reconnect the lower ball joint stud to the steering knuckle. NOTE: *It may be necessary to install grease fittings on the replacement ball joints if none are provided.*

Steering Knuckle

REMOVAL AND INSTALLATION

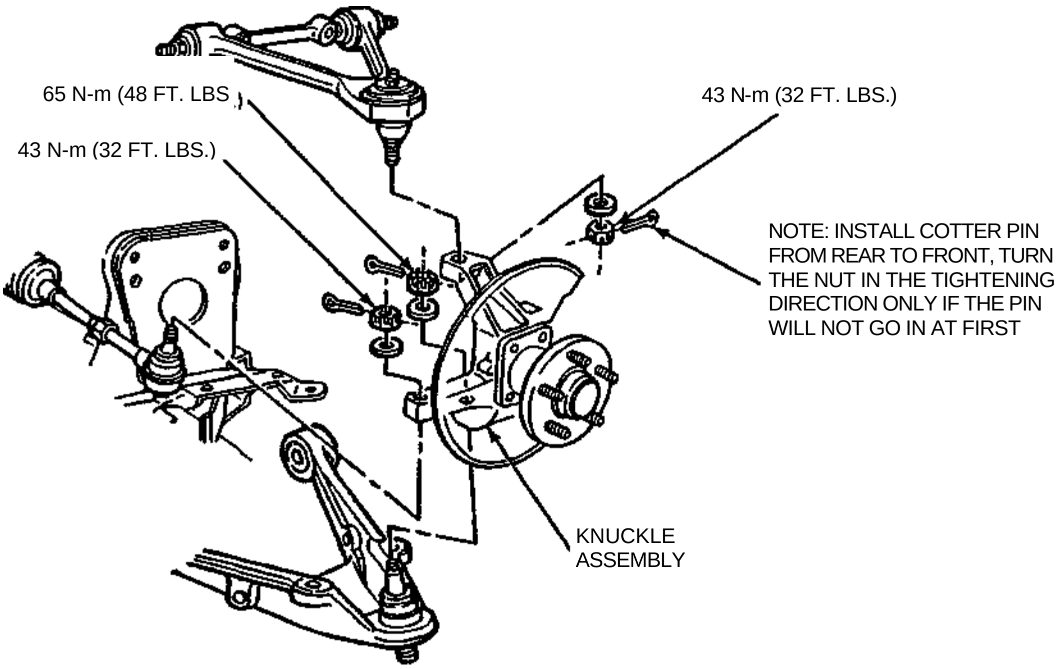
1. Raise the support the vehicle on the lower control arm.

2. Remove the wheel and tire, brake drum or disc caliper, and hub and bearing assem bly.

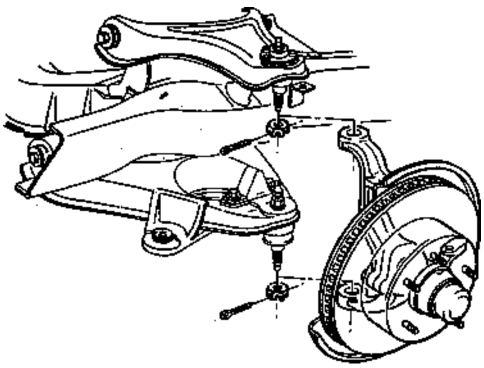
3. On drum brakes, remove the backing plate from the steering knuckle and wire it to the frame. Do not disconnect the brake hose.

4. Remove the upper and lower ball joint stud-retaining nuts and rap the steering knuckle free of the upper and lower control arms.

5. Reverse the procedure to replace the steering knuckle.



Steering knuckle on 1984 and later models



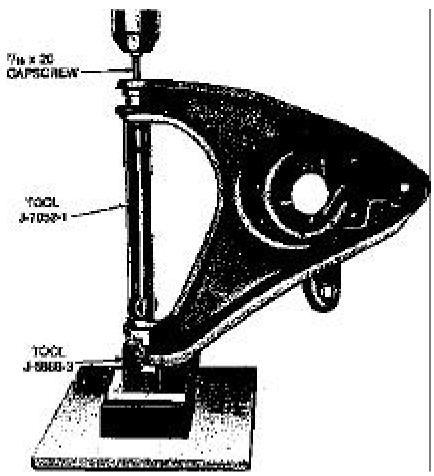
Steering Knuckle

6. Torque the upper stud nut to 50 ft. Ibs., and the lower stud nut to 90 ft. Ibs.

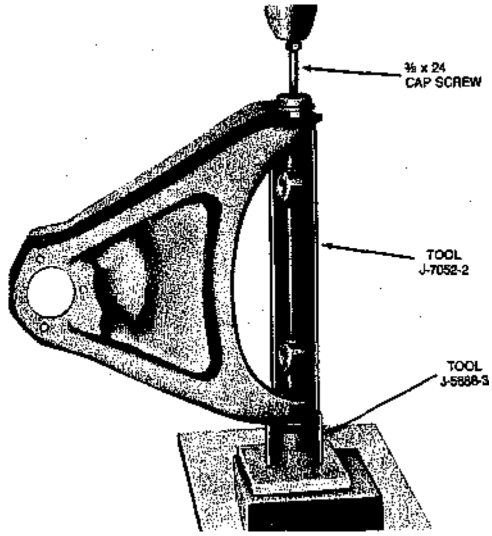
Upper and Lower Control Arms

SHAFT REMOVAL AND INSTALLATION

1. To remove the lower, control arm shaft, remove the front coil or leaf spring as previ ously described.
2. Count the shims at each end of the cross-shaft, then unbolt it from the frame and remove the control arm.
3. Remove the bolts, washers, and col lars from both ends of the shaft, then screw in a 7/ie in. x 20 capscrew into one end of the shaft.
4. Support the control arm in a press and press on the capscrew until the bushing is forced from the arm.
5. Unscrew the capscrew and repeat the procedure on the other end on the cross-shaft.
6. Position the replacement cross-shaft and/or bushings in the control arm and start the bushings into the arm.



Removing the lower control arm shaft



Removing the upper control arm shaft

7. Place the assembly in a press, put a spacer over the bushing, and press into place.
8. Repeat the procedure for the other end, then install the collar and lockwasher but loosely thread in the bolts.
9. Reverse the removal procedure to in stall the spring and lower control arm. After the arm is installed, lower the vehicle to the floor and tighten the cross-shaft bushing bolts to 45-55 ft. Ibs.
10. The procedure for replacing the up- per, control arm shaft is the same as for the lower control arm shaft, except a % in.—24 capscrew is used to remove the bushings. Torque the bushing bolts to 35-40 ft. Ibs.

CONTROL ARM REMOVAL AND INSTALLATION

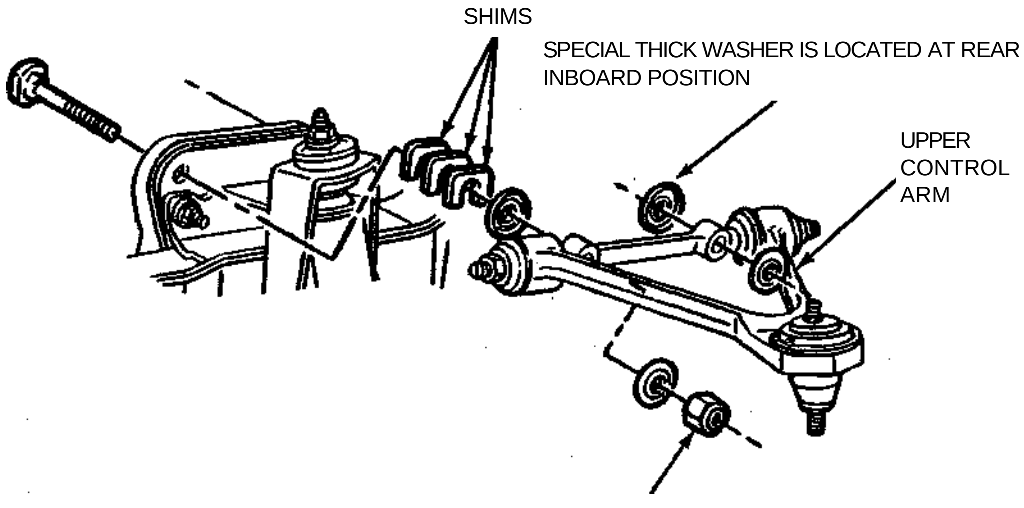
The upper and lower control arms are re- moved by combining the operations for re- placing the upper and lower cross-shafts and the operations for replacing the steering knuckle.

Stabilizer Bar

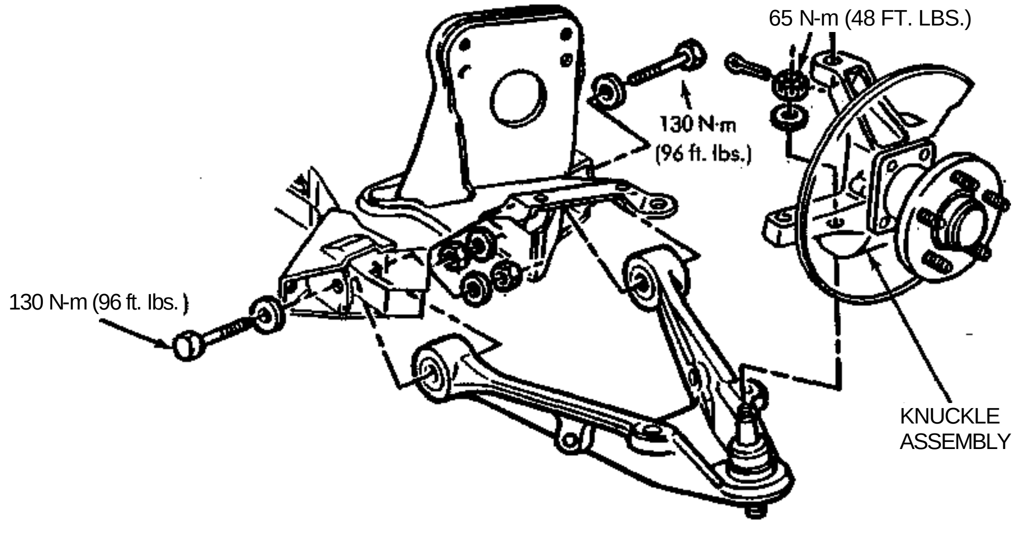
REMOVAL AND INSTALLATION

The stabilizer bar is rubber-mounted to the frame in two locations and attaches to the lower control arms through two links.

1. Raise the vehicle and disconnect the links from the stabilizer bar.
2. Unbolt the rubber frame attachments and remove the bar from the car.
3. Reverse the procedure to install the sta bilizer.



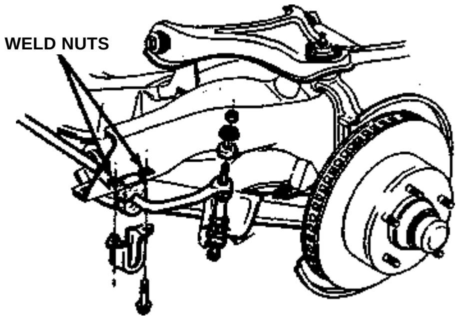
Upper control arm chassis mounting on 1984 and later models



Lower control arm assembly on 1984 and later

4. Hand-tighten all connections until the bar and links are fully assembled.

5. Tighten all connections, lower the ve hicle, and bounce it a few times.



Stabilizer bar mounting

6. Raise the car and tighten all connections with a wrench.

Wheel Hub

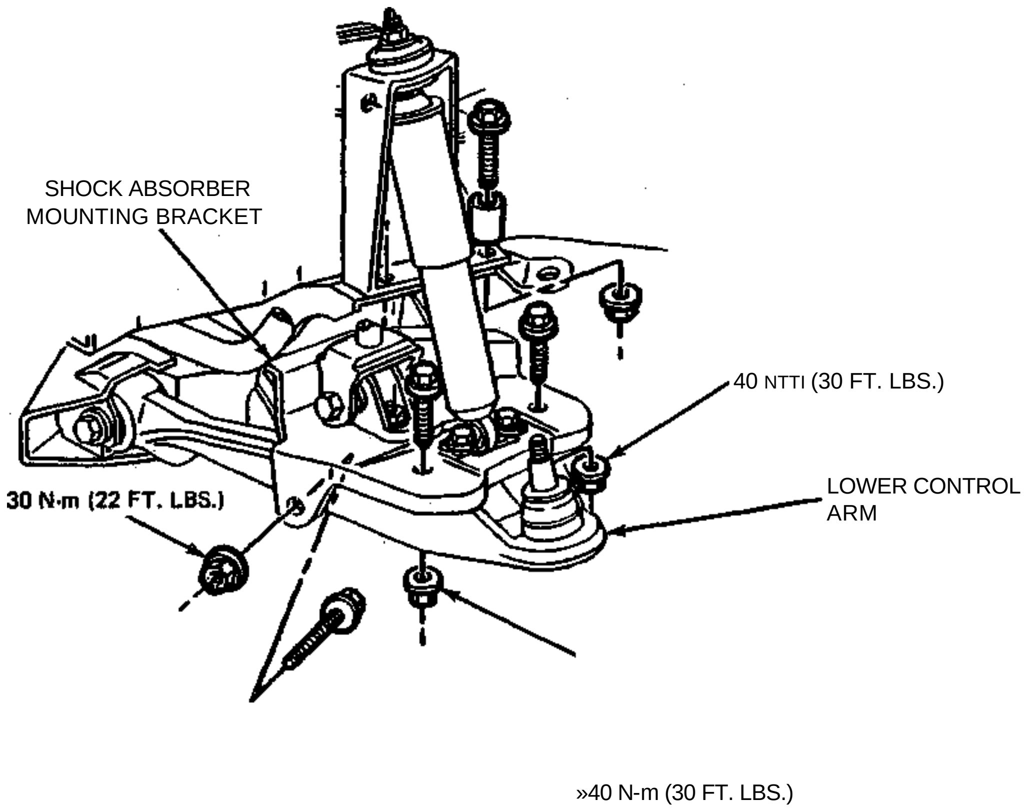
REMOVAL AND INSTALLATION

1. To remove the wheel hub, snap off the wheel covers and loosen the lug nuts, then raise and secure the vehicle.

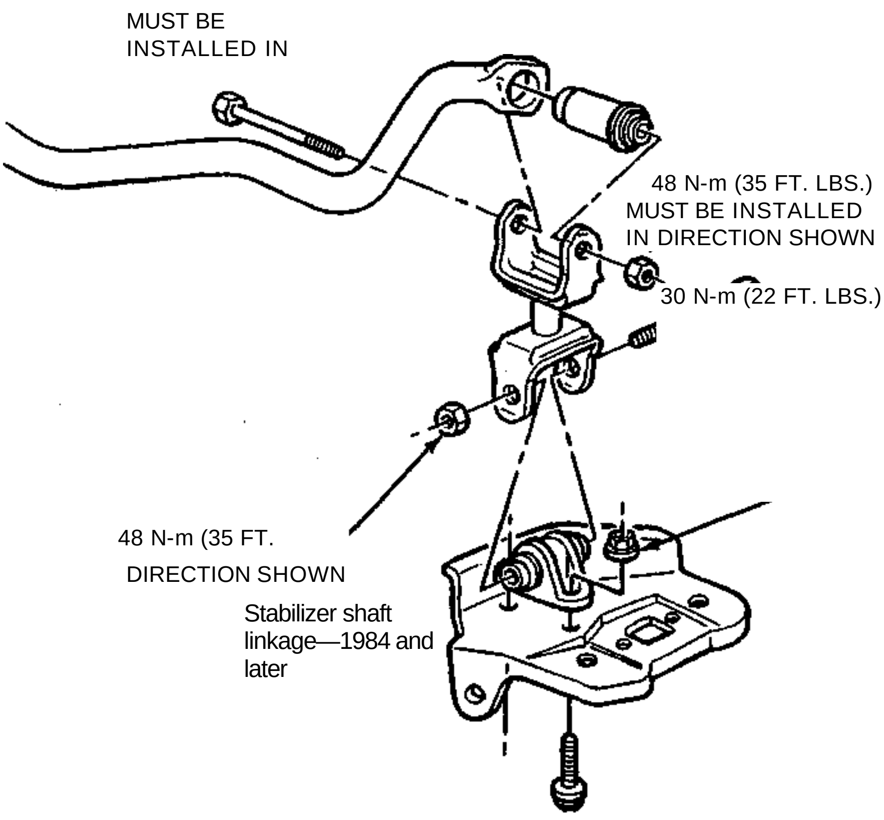
2. Remove the lug nuts, wheel and tire, and brake drum or disc brake caliper.

3. Insert a wood spacer between die brake calipers, on disc brake vehicles, and secure the assembly out of the way.

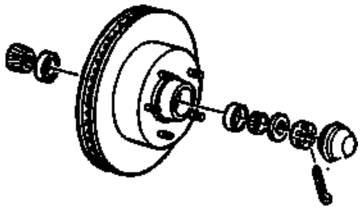
4. Pry off the grease cap and extract the cotter pin from the spindle nut. Back off the spindle nut and washer, and remove the hub



Shock absorber mounting bracket—1984 and later



Stabilizer shaft linkage—1984 and later



Front wheel hub assembly

and disc. Be careful not to drop the outer bearing as the hub comes off.

BEARING REPLACEMENT AND ADJUSTMENT

1. Disassembly of the hub removed the outer roller bearing assembly. The inner roller bearing remains in the hub, held in place by the inner bearing lip seal.

2. Pry out this seal, discard it, and re move the inner roller bearing assembly.

NOTE: *// the bearings are going to be reused, it is not necessary to remove the races. If this is the case, disregard steps 3, 4, 5 and 9.*

3. Select a suitable brass drift punch and insert it through the inner opening of the hub so that it catches the outer bearing race. Notches are provided in the hub for this pur pose.

4. Tap the outer bearing race out. DO NOT attempt to tap the race out from the same spot—move the punch from side-to-side to drive the race out evenly.

5. Repeat steps 3 and 4 for the inner race, but insert the race through the outer opening of the hub to catch the inner race.

NOTE: *Never match a new bearing to an old race (or vice-versa) during assembly—excessive bearing wear will result.*

6. Inspect the races. The bearing sur faces must be perfectly smooth with no signs of discoloration.

7. Thoroughly clean the bearings and the inside of the hub. Blow the bearings dry with compressed air and wipe out the hub.

CAUTION: *DO NOT "spin" the bearings with the compressed air; the bearing rollers could shatter. Be sure that all traces of cleaning solvent are removed after cleaning.*

8. Inspect the bearings. The rollers should be perfectly smooth; the bearing cage should not be deformed. To inspect the inner race of either bearing: Turn the cage and roll ers around the race while holding the rollers inward and the race stationary. If any grinding or chattering is felt while turning, the bearing assembly should be replaced with a new unit.

9. Pack each bearing by pkcing a "ball" of grease on your palm and pushing die larger side of the bearing into the grease with your other hand, forcing the grease into the cage and rollers and out of the narrow side of the bearing. The object of this is to pack the grease between the rollers—smearing grease on the outside of the bearing will do no good whatsoever. Set the packed bearings aside, on a clean surface.

10. If the races were removed, drive the new races evenly and firmly into pkce and lightly coat the races with grease.

11. Install the inner bearing and evenly tap the new inner seal into place. Clean the bear ing and seal areas of die spindle. Lubricate both the spindle and the inner seal lip with a light coat of grease.

12. Carefully install the hub or hub and disc assembly. Install the outer bearing, washer, and spindle nut.

13. On 1963-64 models, assemble the backing plate and drum assembly. On later models, remove the spacer block from the caliper and position the caliper on the caliper bracket, over the disc. Install and torque .the caliper mounting bolts to 70 ft. Ibs.

14. Install me wheel and tire assembly and torque die lug nuts to 75 ft. Ibs.

15. Adjust the bearings and complete die operation as follows:

a. Hand-spin the wheel and tire and torque die spindle nut to 12 ft. Ibs.

b. Loosen die spindle nut then tighten it snug, by hand.

c. Loosen die nut just until die cotter pin holes align.

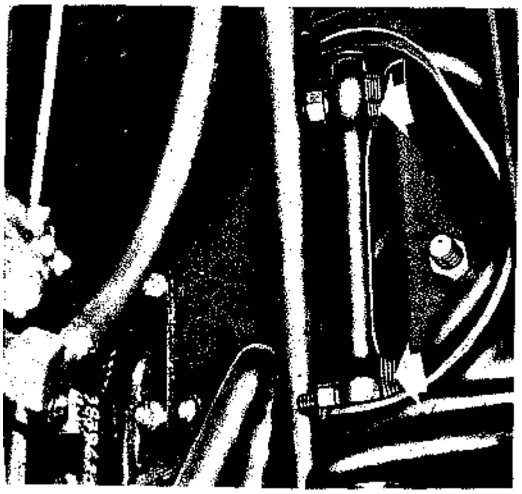
d. Install die cotter pin. Bend die ends of die cotter pin against die nut dien cut off die extra lengdi to prevent interference with die dust cap. Install die dust cap.

e. Spin die wheel—it should rotate smoodily and widiout any signs of grind ing. If a dial indicator is available, set it up against die outer surface of die wheel, par allel to die spindle centerline. Rock die tire in and out; total end play should be 0.001—0.005 in.

Front End Alignment

CASTER ADJUSTMENT

Caster is die measured angle between a true vertical line passing dirough die center of die



Caster and camber shim location

wheel and a line drawn through the center of the upper and lower ball joints. Adjustments to the caster angle are made by the insertion of shims between the upper control arm pivot shaft and the frame bracket. Moving shims front to rear will decrease positive caster. Insertion and removal of a Vs2 in. shim will effect a %° caster change. Adjust caster to specifications.

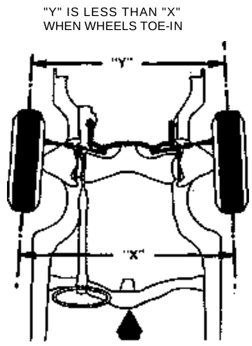
CAMBER ADJUSTMENT

Camber is die measurement in degrees of the outward or inward tilt of the top of the wheel and tire in relation to the true vertical. Tilting of the top of the tire away from the centerline of the vehicle is called positive camber. Tilting toward the vehicle centerline is negative camber. Camber adjustment is made by adding or removing shims equally at both bolts. Camber and caster adjustment may be made at the same time. A Vs2 in. shim will effect a Ve^0 change in camber. Adjust to specifications.

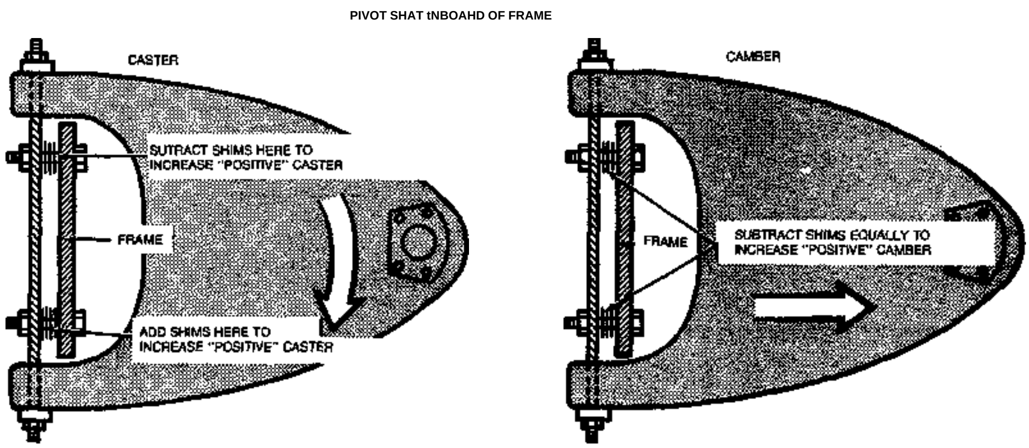
TOE-IN ADJUSTMENT

Toe-in is the measurement in inches of the inward departure of the front of the wheels from a line drawn through the horizontal center of the wheel, parallel to the centerline of the vehicle. Toe-in is expressed as the difference in measurement between the extreme front of the wheel pair and the extreme rear of the wheel pair.

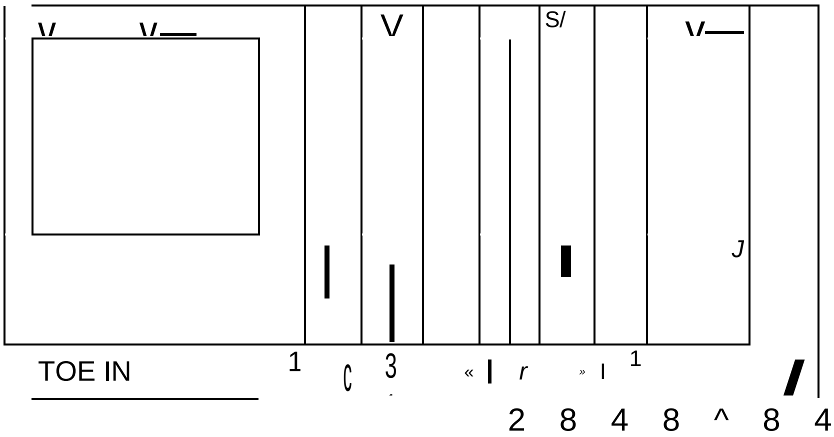
Two methods of setting toe-in may be employed. In the first, position the steering gear on high point and mark the 12 o'clock position on the steering shaft, with the wheel in the straight-ahead position. Loosen both tie rod clamp bolts and adjust each evenly to obtain the total toe-in specified. Secure the inner tie-rod clamp protrusions forward to 90° down to prevent interference with the stabilizer link bolt.



Toe-in adjustment



Caster and camber adjustment



STANDARD SCREEN
INDICATES TOE PER
WHEEL IN INCHES.

.5° 0 .5°

INDICATES TOE PER
WHEEL IN DEGREES
& TENTHS.

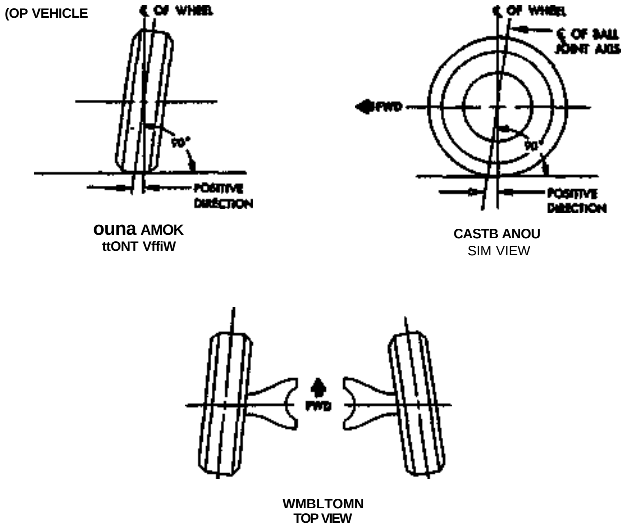
1 o 91 Jf J! n
121212 1212

INDICATES TOE PER
WHEEL IN DEGREES
& TWELFTHS.

1° 45'30'15' 0 15'30'

INDICATES TOE PER
WHEEL IN DEGREES &
MINUTES. (60 MIN. =

Conversion chart for alignment specifications



Caster, camber, toe-In

If a tram gauge is available, position the front wheels straight-ahead. Loosen the tie-rod clamp on one end and adjust the one rod to the total specified toe-in. Loosen the other tie-rod damp and rotate both rods the same amount in the same direction to put the steering gear on high point and the wheel positioned straightahead. Secure die inner tie-rod clamps with the bolts down and horizontal. Secure the outer bolts vertical and to the rear.

REAR SUSPENSION

The Stingray rear suspension is a three-link independent system. Longitudinal location is provided by control arms which pivot at the front on bolts through the frame step-up. The lower link is a strut rod which also serves as a camber rod with adjustment permitted by an eccentric cam on the inner end. The universal-jointed axle driveshafts double as the upper locating links. Shock absorbers attach

Wheel Alignment Specifications

All measurements stated in degrees, unless noted

	Front Wheel Caster		Front Wheel Camber		Rear Whee l Camber		Toe-In (In.)	
Year	Range	Preferred	Range	Preferred	Range	Preferred	Wheel	Wheel
1963-66	1P-2P®	1VaP	1/4P-1'/4P	%P	VaN + Va	VaP	%2-"/3a	Vi8-y,6
1967	y_2P-1V_2P	1P	V4P-1V4P	UP	VaN±1/a	VaP	yi6 -yie	Vinyls
1968-70	1/$_2$P-1VaP®	1P	VZP-VAP	y*p	%N-VaN	—	yi8-5/i8	Vaa-yaa
1971-73	0-2P®	1P	0-1 VaP	3/$_4$p	%N-VaN	—	yi8-yie	Vaa-yaa
1974	VaP-1VaP®	1P	V4P-1V4P	3/4P	%N-VaN	—	%ST-S/32	0±V32
1975-76	VaP-IVaP©	1P	1/4P-11/4P	y_4p	1VI6-V4®	—	Va_2-y_{32}	0±Va_2®
1977-78	2P-2V_2P	2V_4p	V.P-1V4P	y_4p	7/8±1/4	—	yi6 -yie	Vi8 -1/^
1979-80	2P-2V_2P	21/4P	1/4P~1P	%P	VaN±Va	~~~	%2 — %2	^%2 i^/3Z
1981-82	iy$_4$P-2y4P	2V_4P	V4P-1V4P	UP	0±Va	—	V4±1/i6	Vie ± Vie
1984	B/eP-1%P	1VaP	1/aP-s/aP	3/aP	VaP-yaP	3/aP	0-1/4	0-1/4

® 1966 models— VaP-1 VaP ® With power steering— 1 *%P-2%P* ® With power steering— 1 1/4P-3%P ® 1976 models— %N ± V_4

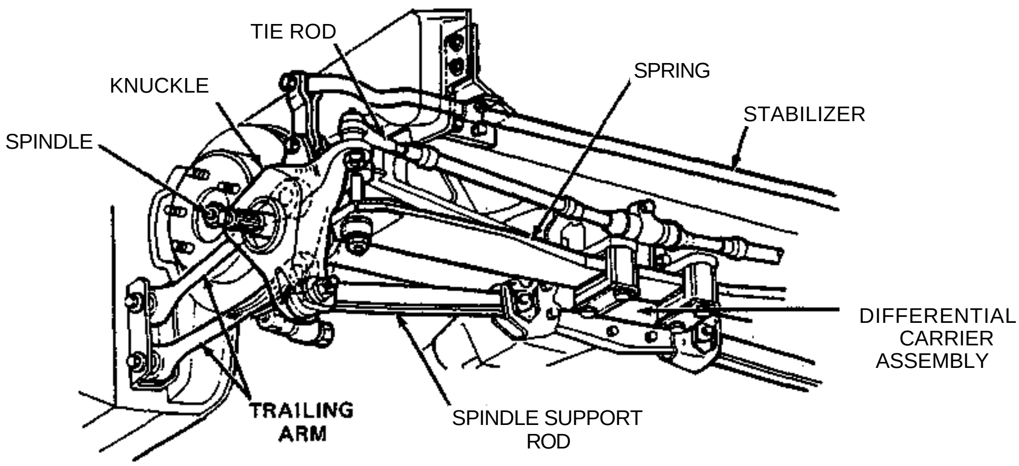
® 1976 models— Vie*1 /aain.
N — Negative P— Positive

to the frame at the top and attach to the spindle/camber rod strut at the bottom. Springing is provided by a multi-leaf transverse spring bolted to the rear cover of the differential carrier. 1980-82 models without the optional, H.D. suspension use a mono-leaf fiberglass reinforced plastic (FRP) spring. 6% in. rubber-cushioned link bolts locate the spring ends to the control arms.

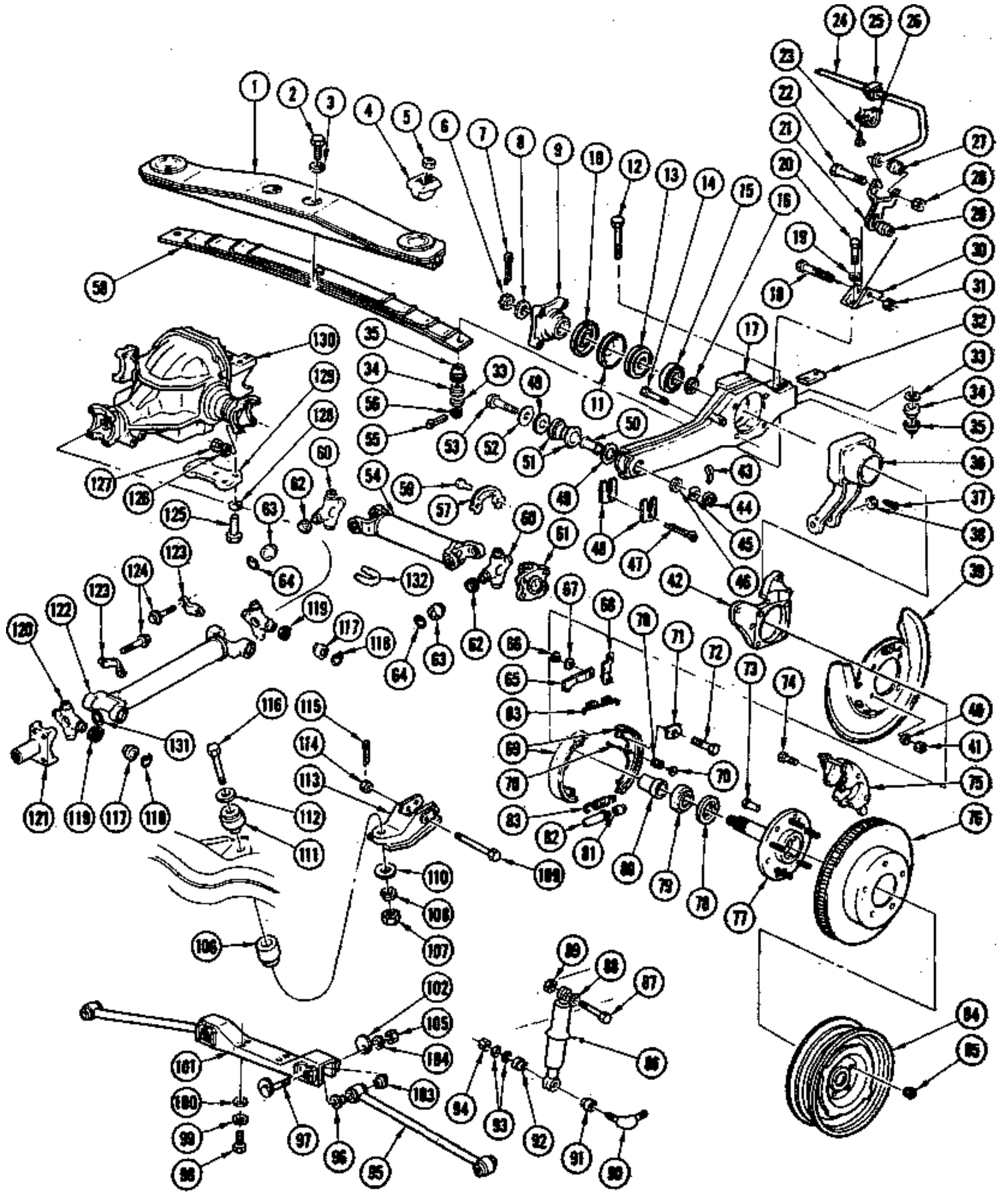
On 1984 models, the rear suspension features a light weight fiberglass transverse spring mounted to the fixed differential carrier cover beam. Light weight aluminum components such as the knuckles, upper and lower control arms, camber control support rods, differential carrier cover beam and the drive line support beam are used throughout the rear suspension. Each wheel is mounted by a five link independent suspension. The five links are identified as the wheel drive shaft, camber control support rod, upper and lower control arms and tie rod. The axle drive shafts and the camber control support rods act together in maintaining an almost constant camber change throughout the entire arc of wheel travel. Fore-aft motion of the wheel is controlled by the upper and lower control arms. Each rear wheel has a short spindle, hub and bearing assembly and knuckle contained at the rear of the upper and lower control arms. The knuckle also acts as a mount for the brake caliper mounting and parking brake backing plate assembly.

Aside from controlling wheel location, each portion of the suspension has additional functions. The control arms and knuckle carries the brake caliper, thus, all brake torque and braking tractive forces are transmitted through the arms. The lateral links transmit side forces to the fixed differential, and through the rubber bushings in the cover beam to the frame. The upper link, or wheel drive shaft, transmits acceleration torque through the differential to the frame. The final duty of the lateral links is to maintain the camber angle of the wheel throughout its travel. Since the camber control support rod and the wheel drive shaft are of different lengths, a certain amount of camber change occurs through jounce and rebound. The overall result of the camber control support rod and wheel drive shaft geometry holds the wheel in a near vertical position at all times.

Direct double-acting shock absorbers are attached at the upper eye to a frame bracket and at the lower eye to the knuckle which has a threaded stud for the shock absorber lower eye. The transversely mounted spring is clamp bolted at the center section to a lower mounting surface on the differential carrier cover beam. The outer ends of the spring are provided with a hole through which the spring is link bolted to the rear of the knuckle. A stabilizer shaft is used which attaches to the section of the knuckle, and extends rearward where it is connected to the frame by two rubber bushings and mounting brackets. A single unit hub and bearing assembly is bolted to each knuckle. The hub and baring assembly supports the drive axle shaft and spindle allowing torque to be transferred from the differential carrier to the wheel and tire. This hub and bearing assembly is a sealed unit and no maintenance is required.



Rear suspension on 1984 and later models



1. MEMBER, Rr. Susp. Mtg. Cross
2. BOLT (7/ie"-14 x 1W)
3. WASHER (7/W)
4. BUMPER, Rr. Spring
5. NUT (%"-16)
6. NUT(%"-20)
7. PIN, Rr. Whi. Spindle
8. WASHER (7/32")
9. FLANGE, Rr. Whi. Spindle
10. DEFLECTOR, Rr. Whi. Spindle
11. SHIELD, Rr. Whi. Inr. Brg
12. BOLT, Rr. Spring
13. SEAL, Rr. Inr. Brg.
14. BOLT(%"-24x2%")
15. BEARING, Rr. WhL Inr
16. SHIM, Rr. Whi
17. ARM, Torque Control
18. BOLT(%"-16x1%")
19. WASHER (5/ie"x19/32")
20. BOLT{5/i6'"-18x%")
21. LINK, Rr. Stab. Shaft
22. BOLT(%"-16x1%")
23. BOLT(S/i6"-18x17/ie")
24. SHAFT, Rr. Stab
25. BUSHING, Rr. Stab. Shaft
26. BRACKET, Stab. Shaft
27. BUSHING, Rr. Stab
28. NUT(%"-16)

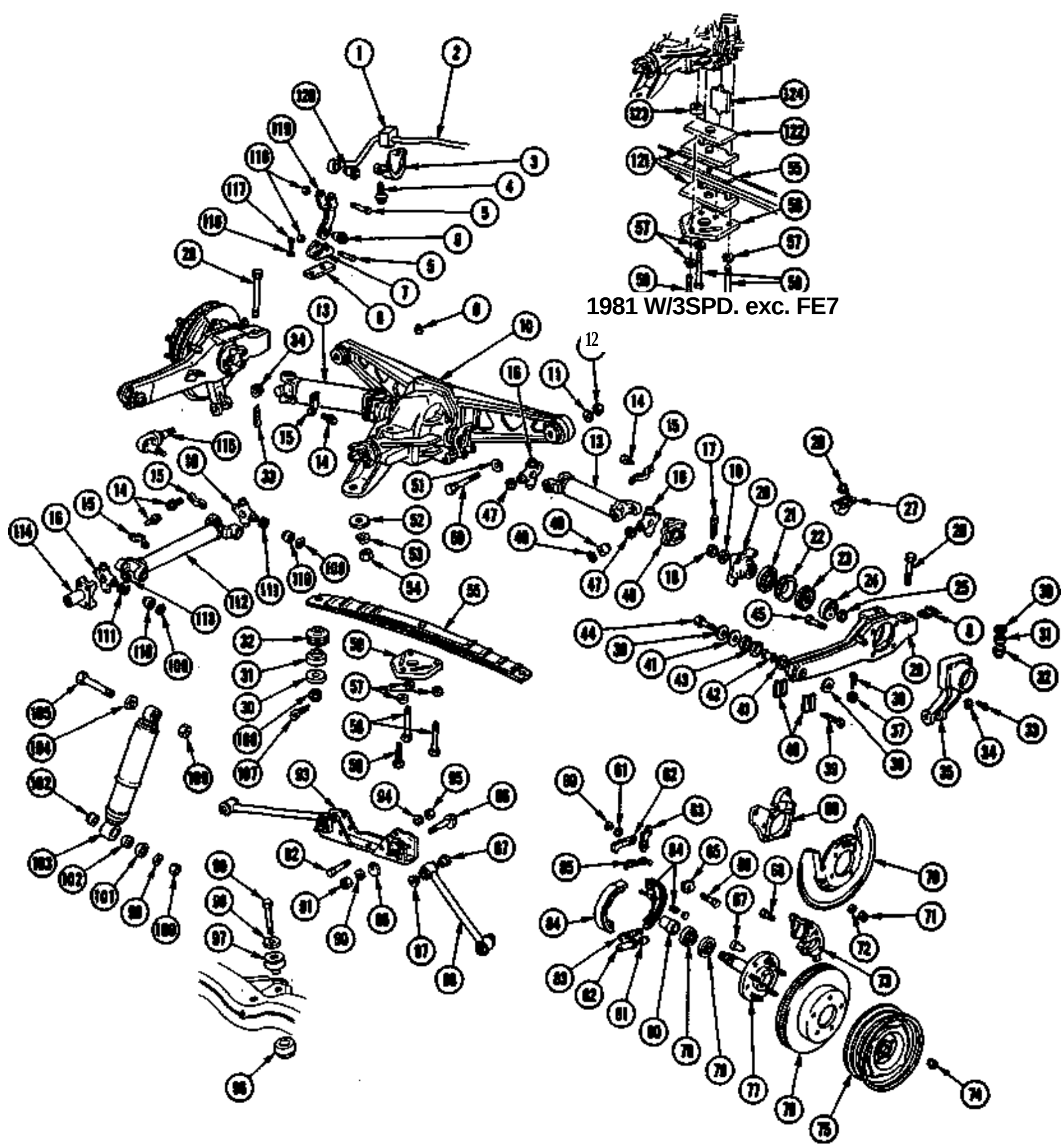
1963-79 rear suspension and related components

Spring

REMOVAL AND INSTALLATION

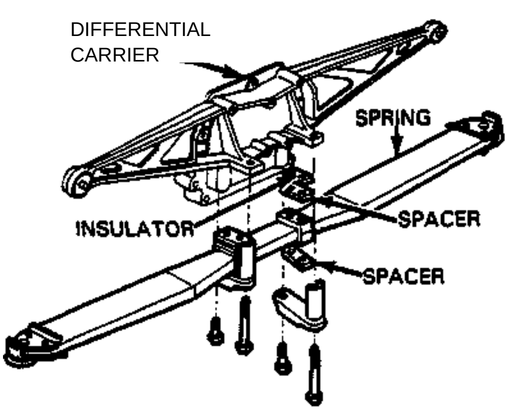
1. Jack the rear of the car up high enough to provide working clearance and support with jacks tands.
2. Position a floor jack under the link bolt on one side. Raise the jack until the spring is compressed tightly, and install a ¥4 in., or larger, chain around the suspension cross-member and the spring. Use a C-clamp to hold the chain to the spring.
3. Lower the jack to permit access to the link bolt, and then remove the link bolt nut, cushions, and retainers.
4. Raise the spring again and remove the chain and C-clamp.
5. Slowly lower the spring until all ten sion is released.
6. Perform the same steps on the other side.
7. Remove the four, spring pad bolts and plate.
8. Withdraw the spring over the exhaust pipes and down from the car.
9. To install, position the spring on the

29. BUSHING, Rr. Stab
30. BRACKET, Rr. Stab. Shaft
31. NUT(%"-16)
32. PLATE (3 xyV'w/2 Holes)
33. RETAINER, Otr. Rr. Spring
34. CUSHION, Rr. Spring
35. RETAINER, Inner
36. SUPPORT, Cont. Arm to Spindle
37. PIN (5/32"-1 1/4")
38. NUT(%"-18)
39. PLATE, Parking Brake
40. WASHER (%")
41. NUT(%"-24)
42. BRACKET, Brake Flange Rr
43. PIN(3/3Z"x1")
44. NUT(7/is")
45. WASHER *CM* x 51/64" x *s/3z")*
46. WASHER (15/3z")
47. PIN (Wx 41/2?)
48. SHIM, Rr. Susp. Torque
49. PLATE, Rr. Susp. Torque
50. RETAINER, Torque Arm Bshg
51. BUSHING, Upr. Rr
52. WASHER (W)
53. BOLT(7/i6"-20x"9/i6")
54. SHAFT, Axle
55. PIN(yfl"x1%")
56. NUT(9/ie"-18)
57. LOCK, Rr. Axle U-Joint
58. SPRING, Leaf Type Rr
59. BOLT *C/16"-20* x 1 1/a")
60. REPAIR KIT, Rr. Whl. Dr. Shaft U-Joint
61. FLANGE, Rr. Whl. U-Joint
62. SEAL, Yoke Brg. (IVsa" x 21/3z") (Also Part of #60)
63. BEARING, U-Joint (Also Part of #60)
64. LOCK RING, U-Joint (Also Part of #60)
65. LEVER ASM., Parking Brake
66. CLIP, Parking Lvr
67. WASHER, Pivot Pin
68. STRUT, Parking Brake
69. SHOE UNIT, Parking Brake
70. PIN, Brake Shoe
71. PLATE, Brake Shoe Guide
72. BOLT(V2"-20x2")
73. RIVET, Spindle
74. BOLT(7/i6"-20x1W)
75. HOUSING ASM., Brake Caliper
76. DISC, Rr. Whl. Brake
77. SPINDLE, Rr. Whl
78. SEAL, Rr. Whl. Otr. Brg
79. BEARING ASM., Rr. Whl. Otr
80. SPACER, Brg
81. SOCKET, Adj. Screw
82. SCREW, W/Nut Parking Brake
83. SPRING, Parking Brake
84. WHEEL ASM., Rr
85. NUT(7/is"-20)
86. ABSORBER UNIT, Rr. Shock
87. BOLT (7/is"-20x 23/16")
88. WASHER (7/ie")
89. NUT (7/is"-20)
90. SHAFT, Rr. Whl. Spindle
91. GROMMET, Shk. Abs. Link Rr. Lwr
92. GROMMET, Shk. Abs. Link Rr.
93. WASHER(y2"x%")
94. NUT(V2"-20)
95. STRUT, Rr. Whl. Spindle Supt
96. CAP, Bushing
97. CAM, Spindle Supt. Strut
98. BOLT(%"-16x%")
99. WASHER (%")
100. WASHER p/32")
101. BRACKET, Rr. Whl. Spindle
102. CAM, Rr. Whl. Spindle
103. CAP, Bushing
104. WASHER C/2'0
105. NUT(Vz"-20)
106. CUSHION, Diff. Carrier Mtg
107. NUT(7/ie")
108. WASHER (7/i6")
109. BOLT(7/i6"-20x4i3/16»)
110. PLATE, Body Mtg. Cushion
111. CUSHION, Diff. Carrier Mtg
112. WASHER *CM1)*
113. BRACKET, Diff. Carrier Mtg
114. NUT (7/ie"-20)
115. PIN (3/32" X1")
116. BOLT *?M'-W* x 2%")
117. BEARING ASM. (Part of #120)
118. RING, U-Joint (Also Part #120)
119. SEAL, U-Joint (Also Part #120)
120. REPAIR KIT, U-Joint
121. YOKE, U-Joint Sleeve Fit
122. SHAFT, Rr. Propeller
123. STRAP, Propeller Shaft
124. BOLT (5/ie"-24 x 1 7/ie")
125. BOLT (9/ie"-12x331/64")
126. WASHER (Wx43^")
127. NUT(%"-24)
128. WASHER (9/ie")
129. PLATE, Rr. Spring Anchor
130. CARRIER ASM., Diff
131. SPACER, Trunnion Brg
132. "U" BOLT (Trunnion Finger Dia. *x/si)*

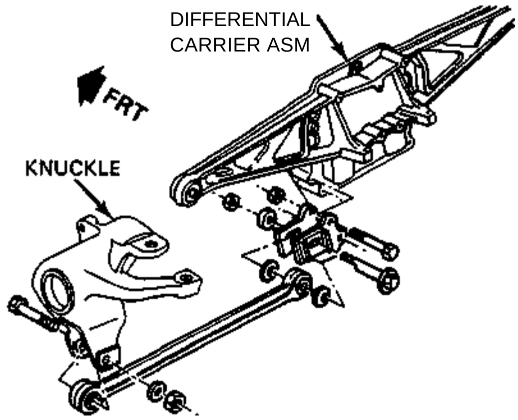


1. BUSHING, Rr Stab Shaft
2. SHAFT, Rr Stab
3. BRACKET, Rr Stab Shaft
4. SCREW, Rr Stab Shaft Brkt
5. BOLT (W-16 x 1%")
6. BUSHING, Rr Stab Shaft Link
7. BRACKET, Rr Stab Shaft Link
8. PLATE, Rr Stab Shaft Link
9. PLUG, W/lnstruction Tag (1^{7}/64"OL)
10. CARRIER, DiffW/Cap
11. WASHER, Lock
12. NUT, Hex
13. SHAFT, Axle
14. BOLT, Hex *?/w»-20* x *V/s")*
15. RETAINER, Prop & Axle Shaft U-JoInt (5.428)
16. REPAIR KIT, U-Joint
17. PIN, RrWhl Spindle
18. NUT, Hex Slot (%"-20)
19. WASHER ($^{7}/_{32}$")
20. FLANGE, Rr Whl Spindle
21. DEFLECTOR, RrWhl Spindle
22. SHIELD, Rr Whl Inr Bearing
23. SEAL, Rr Inr Bearing
24. BEARING, RrWhl Inr
25. SHIM, Rr Wheel
26. NUT, Hex (%"-16)
27. BUMPER, Rr Spring
28. BOLT, Rr Spring
29. ARM, Torque Control
30. RETAINER, Spring Otr
31. CUSHION, Rr Spring
32. RETAINER, Spring Inr
33. PIN, Cotter
34. NUT, Hex Slot (%"-18)
35. SUPPORT, Control Arm to Spindle
36. PIN, Cotter
37. NUT, Diff Carrier Mount (Hex Slot; $^{7}/i_{6}$"-20)
38. WASHER, Torque Control Arm
39. PIN, Cotter
40. SHIM, Rr Axle Torque Arm

1980-82 rear suspension and related components



Rear leaf spring mounting assembly—1984 and later



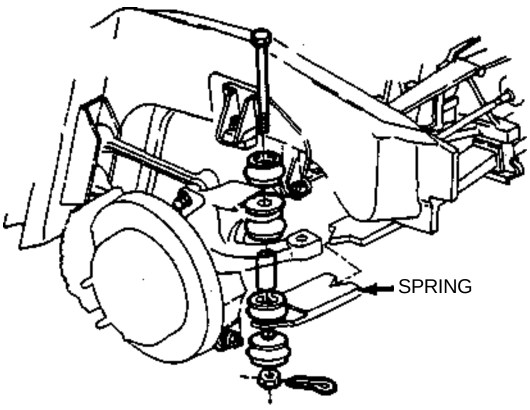
Spindle support rod assembly—1984 and later

bottom carrier mounting pad with the center bolt aligned with the hole in the mounting pad.

10. Install the center clamp and the four mounting bolts. Tighten the bolts to 55-75 ft. Ibs.

11. Jack one end of the spring and secure with chain as in the removal procedure.

41. PLATE, Rr Susp Torque
42. RETAINER, Torque Arm Bushing
43. BUSHING, Upr Rr
44. BOLT, Torque Control Arm
45. BOLT, Hex (%"-24 x 2%")
46. FLANGE, RrWhlU-Joint
47. SEAL, Yoke Bearing (Also Part of #16)
48. LOCK RING, U-Joint (Also Part of #16)
49. BEARING, U-Joint (Alsq Part of #16)
50. BOLT, Hex
51. WASHER
52. PLATE, Body Mtg Cushion
53. WASHER, Lock (^{7}/ie")
54. NUT, Hex (^{7}/ie"-14)
55. SPRING, Rear
56. PLATE, Rr Spring
57. WASHER, Lock (^{7}/ie")
58. BOLT, Hex (M12x1.75x90)(10.9 PC)
59. BOLT, Hex (M12 x 1.75 x 30)
60. CLIP, Parking Lever
61. WASHER, Pivot Pin
62. STRUT, Parking Brake Shoe Lever
63. LEVER, Parking Brake Shoe
64. PIN KIT, Brake Shoe
65. PLATE, Brake Shoe Guide
66. BOLT, Hex (^{7}/i_6"-20x1Vi6")
67. RIVET, Spindle
68. BOLT, Hex (^{7}/is"-20 x *We")*
69. BRACKET, Brake Flange Rr
70. PLATE, Parking Brake
71. NUT, Hex (%"-24)
72. WASHER(%")
73. HOUSING ASM, Brake Caliper
74. NUT, Whl (^{7}/ie"-20)
75. WHEEL ASM
76. DISC, Rr Whl Brake
77. SPINDLE, Rr Whl
78. SEAL, Rr Whl Otr Brg
79. BEARING ASM, Rr Whl Otr
80. SPACER, Bearing
81. SOCKET, Adj Screw
82. SCREW, W/Nut, Parking Brake Adj
83. SPRING, Parking Brake
84. SHOE KIT, Parking Brake
85. SPRING, Parking Brake
86. CAM, Spindle Support Strut
87. BUSHING, Rr Whl Spindle Rod
88. ROD, Rr Whl Spindle
89. CAM, Rr Whl Spindle
90. WASHER, Lock (%")
91. NUT, Hex ('/2"-20)
92. BOLT, Hex (M10 x 1.5 x 70)
93. BRACKET, Rr Whl Spindle
94. WASHER, Lock
95. NUT, Hex (M10x 1.5x70)
96. INSULATOR, Diff Carrier Mt Lwr
97. INSULATOR, Diff Carrier Mt Upr
98. WASHER (W*az* x 1% x *Va)*
99. BOLT, Hex (^{7}/ie"-14 x 3W)
100. NUT, Shock Abs Lwr (V_2"-20)
101. RETAINER, Lwr Grommet Otr
102. GROMMET, Shock Abs Lwr
103. ABSORBER, Rr Shock
104. WASHER, Lock
105. BOLT, Shock Abs Upr
106. NUT(^{7}/is"-20)
107. PIN, Cotter
108. NUT, Hex Slot (^{9}/ie"-18)
109. LOCK RING, U-Joint (Also Part of #16)
110. BEARING, U-Joint (Part of #16)
1-11. SEAL, U-Joint (Also Part of #16)
112. SHAFT, Propeller
113. SPACER, Trunnion Bearing
114. YOKE, U-Joint Sleeve Frt
115. SHAFT, Rr Whl Spindle Rod
116. WASHER, Lock
117. BOLT (5/i_6"-18 x %")
118. NUT, Hex (%"-16)
119. LINK, Rr Stab Shaft
120. BUSHING, Rr Stab Shaft Link
121. SPACER, RrSpr
122. INSULATOR, RrSpr
123. SPACER, Rr Spr *(Vz"* ID ^{11}/ie" OD 3/$_{16}$" Thk)
124. SPACER, Rr Spr, Plate to Diff



Rear leaf spring to knuckle attachment—1984 and later

12. Lower the jack and position the con trol arm for the link bolt installation. Install the link bolt, rubber cushions, and retainers. Install the castellated nut on the link bolt and secure with a cotter pin.

13. Raise the spring and remove the C-clamp and chain.

14. Repeat the above operation on the other side.

15. Lower the car.

Shock Absorbers

BOUNCE TEST

Each shock absorber can be tested by bouncing the corner of the vehicle until maximum up and down movement is obtained. Release the car. It should stop bouncing in one or two bounces. Compare both front corners or both rear corners but do not compare the front to the rear. If one corner bounces longer than the other it should be inspected for damage and possibly be replaced.

REMOVAL AND INSTALLATION

1. Remove the upper shock absorber bolt and nut.

2. Remove the lower mounting nut and lockwasher.

3. Slide the upper eye of the shock ab sorber out of the frame bracket.

4. Pull the lower eye off the strut rod shaft and remove the rubber grommets.

5. To install, position the upper shock ab sorber eye in the frame mounting bracket and install the bolt, lockwasher, and nut.

6. Install the inner rubber grommet and then the shock absorber eye on the strut rod shaft. Install the outer grommet, washer, lockwasher, and nut.

7. Torque the upper nut to 40-60 ft. Ibs. and the lower nut to 50-60 ft. Ibs.

DISPOSAL OF PRESSURIZED SHOCK ABSORBERS

1984 and Later

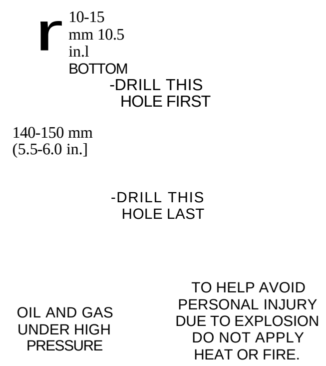
Due to the high pressure of gas it is advised that, upon scrapping or disposal of these shock absorbers, the pressure be released. This is carried out as follows:

1. Clamp shock in vise with piston rod pointing down.

2. Measure approx. 10-15 mm (0.5 in.) from bottom of shock and drill an approx. 5 mm hole so the gas can escape.

3. Measure approx. 140-150 mm (5.5-6.0 in.) from first hole and drill an approx. 5 mm hole to facilitate drainage of oil. Drain shock completely, then dispose of in the normal manner.

NOTE: *All models equipped with the Z-51 suspension use pressurized gas shock absorbers.*



Drill holes as shown to relieve pressure in gas-filled shock absorbers before disposal on 1984 and later models. Gas shocks can be recognized by the warning label attached

Strut Rod and Bracket

REMOVAL AND INSTALLATION

1. Jack the rear of the car high enough to allow working clearance.

2. Disconnect the lower shock absorber eye from the strut rod shaft.

3. Remove the strut rod shaft cotter pin and nut. Drive the shaft out of the spindle support.

CAUTION: *The strut rod shaft is often very hard to remove; take care not to distort either the shaft or the spindle support in the removal process.*

4. Scribe the camber adjusting cam-to-bracket relationship for correct relocation.
5. Loosen the cam adjusting bolt and nut.
6. Remove the four bracket-to-carrier bolts, and lower the bracket.
7. Remove the cam, bolt, and nut. Re move the strut from the bracket and remove the bushing caps.
8. Inspect the strut rod bushings and re place if necessary.
9. Install the inside bushing caps and slip the strut rod into the bracket.
10. Install the cam and bolt assemblies, and align the previously scribed marks. Hand-tighten the adjustment nut.
11. Raise the bracket assembly and install the four bracket-to-carrier bolts. Torque the bolts to 15-22 ft. Ibs.
12. Raise the outer end of the strut rod into the spindle support. Install the strut rod shaft through the spindle support and strut rod.

NOTE: *The strut rod shaft has aflat side which should line up with the matchingflat in the spindle support.*

13. Replace the shock absorber lower eye on the strut rod shaft. Torque the nut to 50-60ft. Ibs.
14. Lower the car and then tighten the camber cam nut to 55-77 ft. Ibs. Tighten the strut rod shaft nut to 80 ft. Ibs. and install a new cotter pin.

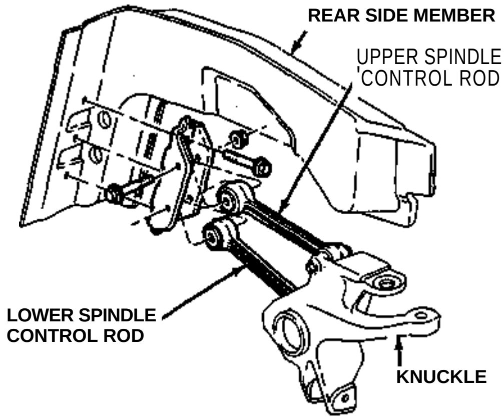
Control Arms, Hub and Knuckle

DISASSEMBLY

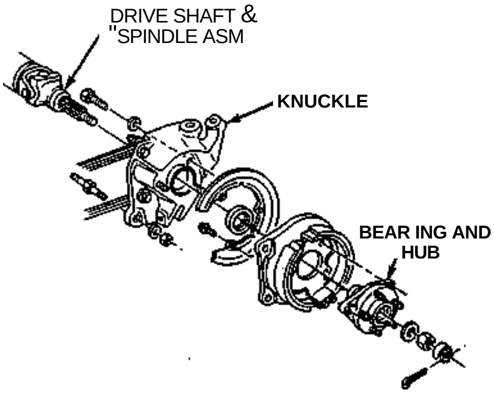
1984 and Later Models

NOTE: *The following procedure outlines the general disassembly of the rear 5-link suspension components.*

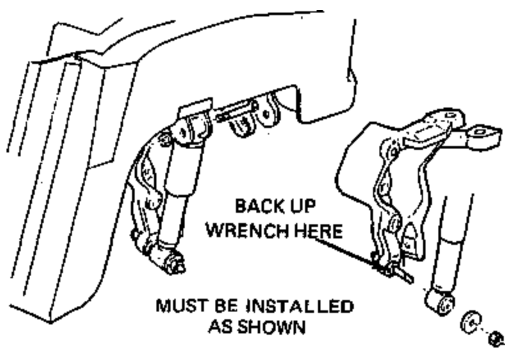
1. Remove center cap from wheel. Break lugnut torque.
2. Remove cotter pin, spindle nut and washer.
3. Raise the vehicle and support it safely.
4. Remove wheel and tire.
5. Remove brake caliper. Do not allow caliper to hang by the brake hose.
6. Remove brake rotor.
7. Disconnect tie rod end from the knuckle.
8. Disconnect transverse spring from the knuckle.



Control arms on 5-link rear suspension—1984 and later



Rear hub and bearing assembly—1984 and later



Rear shock absorber mounting—1984 and later

9. Disconnect parking brake cable from the backing plate.
10. Disconnect shock absorber from the knuckle. Use a backup wrench on the mount ing stud to loosen fasteners.
11. Scribe mark on cam bolt and mounting bracket so they can be realigned in the same position.

12. Remove cam bolt and separate spindle support rod from the mounting bracket,

13. Remove the trunnion straps at the side gear yoke shaft.

14. Push out on the knuckle and separate axle shaft from the side gear yoke shaft. Re move the axle shaft from the vehicle.

15. Lower the knuckle assembly and slide spindle out from the hub and bearing.

16. Using tool J-34161 (Torx® #T55), or equivalent, remove the hub and bearing bolts. Remove hub and bearing with parking brake backing plate from the knuckle.

17. Remove splash shield from the knuck le.

18. Disconnect spindle support rod from the knuckle.

19. Disconnect upper and lower control arms from the knuckle, then remove the knuckle assembly.

20. Remove control arm bolt at the body bracket and remove the arm, if not already done.

21. Installation is the reverse of removal. Inspect the spindle seal and replace if neces sary. Troque all bolts to specification.

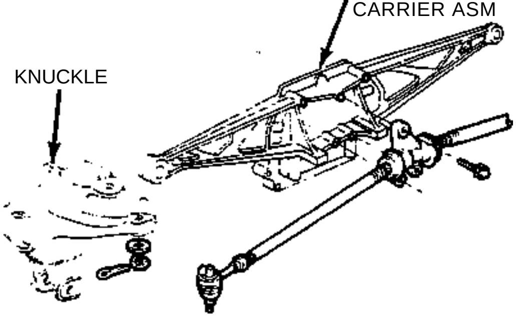
22. Check and adjust rear suspension alignment as necessary.

Rear Axle Tie Rod and/or Adjuster Sleeve

REMOVAL AND INSTALLATION

1984 and Later

1. Raise the vehicle and support it safely.
2. Remove cotter pin and retaining nut from tie rod end at knuckle. Discard the cot ter pin.
3. Loosen jam nut on tie rod end.
4. Using tool J-24319-01, or equivalent, press tie rod end out of the knuckle.
5. Remove tie rod end from the adjusting sleeve. Note the number of turns during re- moval and install the same number during reassembly.
6. To install, reverse the removal proce dures and tighten all bolts to specification.
7. Check and adjust the rear suspension alignment as necessary.

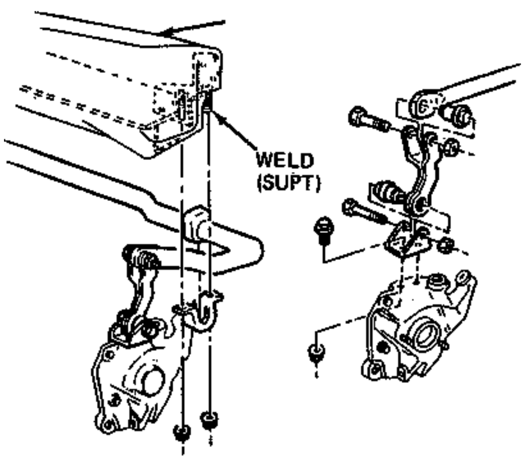


Rear suspension tie rod assembly—1984 and later

Stabilizer Bar

REMOVAL AND INSTALLATION

1. Raise the vehicle and support it safely.
2. Remove spare tire and tire carrier.
3. Disconnect stabilizer bar from knuck les.
4. Remove stabilizer bar bushing retain ers, bushings and bar from the vehicle.
5. To install, reverse the removal proce dures and torque all bolts to specifications.

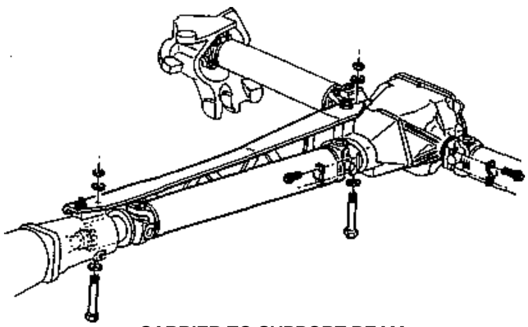


Rear stabilizer bar linkage—1984 and later

Driveline Beam

REMOVAL 1984 and Later

1. Raise the vehicle and support it safely.
2. Remove the complete exhaust system as an assembly as follows:
   a. Disconnect A.I.R. pipe at the con verter.
   b. Disconnect A.I.R. pipe clamps at ex haust pipe.
   c. Disconnect oxygen sensor electrical lead.
   d. Remove the bolts attaching the muf flers to the hangers
   e. Remove hanger bracket at the con verter.



CARRIER TO SUPPORT BEAM

Driveline beam attachments—1984 and later

f. Disconnect the exhaust from the exhaust manifold and remove the exhaust system.

3. Support the transmission with a suitable jack or stand.

4. Remove driveline beam attaching bolts at the differential carrier and transmission extension housing.

5. Remove the propeller shaft.

6. Remove the driveline beam by prying transmission to the driver side of vehicle. Remove support beam from the vehicle.

NOTE: *Do not use excessive force when prying transmission housing.*

Torque Sp

Bolt Location

Cover beam to body Supp
earner Support beam to tr
Truunion straps at side ge
straps at spindle yoke Spi
bearing Hub and bearing
shield to backing plate Sh
to knuckle Shock absorbe
absorber to knuckle Contr
Control arms to knuckle Jo
body Transverse spring to
bolt to support rod

INSTALLATION

Installation is the reverse of removal. Align driveline components. To insure proper alignment of the driveline, a clearance of 45mm±6 (1.77±.250 in.) must be maintained between the top of the beam to the underbody and a clearance of 28mm ±6 (1.1 ± .250 in.) from the right side (passenger side of vehicle) of the beam to the side wall. Take these measurements directly above and to the right of the propeller shaft dampener. Torque all fasteners to specification.

NOTE: *Do not over torque the bolts attaching the driveline beam to the transmission. Over torquing can damage the transmission extension housing, bushing and seal and result in fluid leakage. Inadequate fluid level can damage the transmission. Apply sealant to the mating surfaces of the transmission extension housing, differential carrier and beam.*

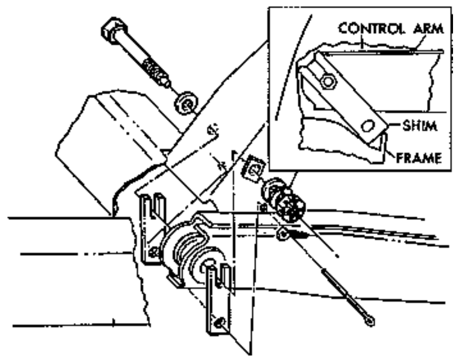
Adjustments

CAMBER

The rear wheel camber adjustment is made by rotating the eccentric cam and bolt assembly that connects the strut rod to the differential carrier bracket, or at the inboard mounting of the support rods on 1984 and later models. Loosen the locknut and turn the eccentric cam bolt until the correct wheel camber angle is obtained. Secure the locknut and toruqe to 55-77 ft. Ibs. (158-213 ft. Ibs. on 1984 and later).

TOE-IN

Rear wheel toe-in is adjusted by the placement of shims of different thickness on both sides of the control arm pivot bushings. These shims are available in Ve4 in., x/32 in., *VB* in.,



Toe-in adjustment shim location

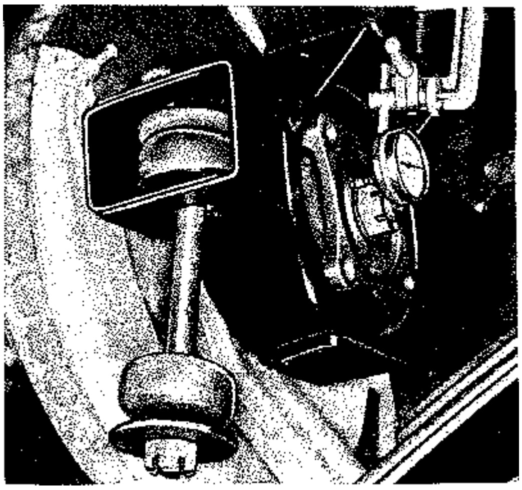
and % in. sizes. To make this adjustment, remove the pivot bolt and position the torque arm so that the correct toe-in specifications are achieved. Insert shims in the gap nearest the car centerline between the bushing and the frame inner wall. Use shims of only the thickness required to bridge the gap. Do not overshim or force the shims during the adjusting. Insert shims in the outside gap until solidarity is reached between the pivot bushing and the frame walls. Insert the bolt, torque the nut to 50 ft. Ibs., and install a cotter pin.

On 1984 and later models, rear toe-in is adjusted by loosening lock nuts on the tie rod ends and turning the adjusting sleeves.

Wheel Bearings

ADJUSTMENT

The spindle bearings ar
design and require an e
to 0.008 in. To measure
wheels clear of the grou
axle driveshaft from the
sufficient clearance to
shaft when the rear sus
adjusted so the strut ro
must be loosened and ro
rod forces the trailing ar
hicle centerline and per
be lowered.



Checking spindle bearing play

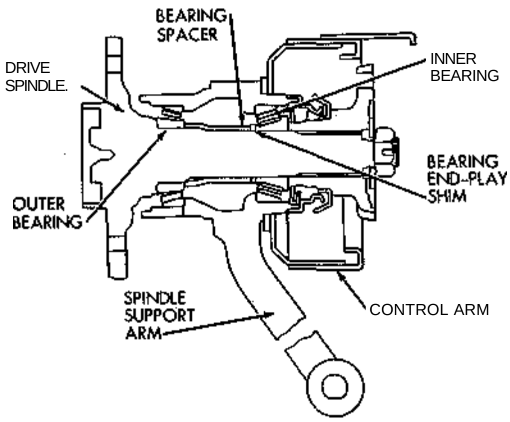
ceeds the 0.001 in. to 0.008 in. tolerances, the bearings must be adjusted.

4. Set the handbrake and remove the drive spindle nut.

5. Release the brake and remove the brake drum or caliper and disc as described in Chapter 9.

6. Remove the spindle flange then rein stall the nut until it is flush with the end of the spindle. Use a puller to withdraw the spindle from its support.

7. Remove the spindle-support dust de flector and pry out the inner seal. Remove



the inner bearing race, roller assembly, shim, and bearing spacer from the spindle support.

8. Check the size of the old shim and, if the dial indicator reading exceeded 0.008 in., replace it with one that is thinner by the re quired amount to bring end-play within al lowable tolerances. A dial indicator reading of less than 0.001 in. requires a shim thick enough to move the end-play beyond the 0.001 in. minimum.

NOTE: *Shims are available in 0.003 in. increments and range in thickness from 0.097 in. to 0.145 in.*

9. Insert the spindle bearing and seal in the spindle support and install the bearing spacer and shim.

10. Place the inner race and roller a sembly on the spindle and a suitable spacer to aid in pressing the bearing into position.

11. Start the nut onto the spindle and against the press spacer. Tighten the nut and press the bearing in a sufficient amount to permit the installation of the spindle drive flange.

12. Remove the spindle nut and washer and discard the nut. Use a new replacement for assembly.

13. Tap the replacement inner seal in place, install the dust deflector, drive flange, spindle washer, and nut. Torque the nut to 100 ft. Ibs. and install a new cotter pin.

REPLACEMENT

Outer Bearing

1. With the wheel spindle removed, at tach a bearing puller around the bearing and secure the tool and spindle in a press, and remove the bearing from the spindle.

2. Remove the outer seal and replace if necessary.

3. Position the replacement seal on the spindle before installing the bearing assem bly.

4. Pack the replacement bearing with a high melting point grease and place it on the spindle, large'end facing the spindle shoul der.

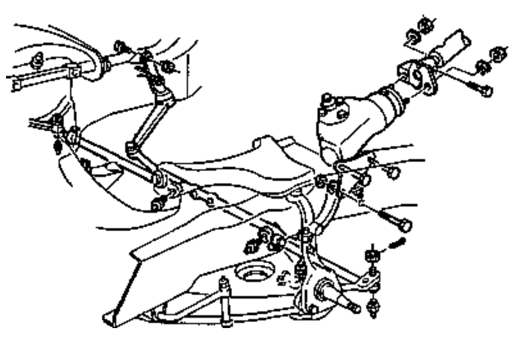
5. Support the spindle and press the bear ing into position. Install the reassembled spindle to the spindle support.

STEERING

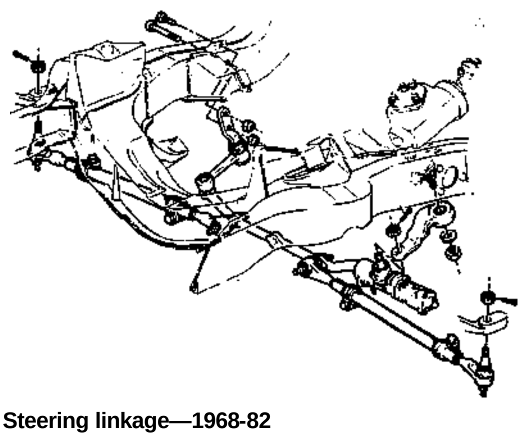
The 1963-82 Corvette steering system is a recirculating ball, relay type. A pitman arm connects the steering gear to the relay rod by way of a pivoted joint. The opposite end of this transverse relay rod attaches to a frame-mounted idler arm by way of another pivoting joint. These joints are the ball and socket type.

Two adjustable tie-rods join each steering arm to the relay rod through self-adjusting ball and socket joints. The steering arms have two tie-rod end holes drilled in them to provide a road steering ratio of: 19.6:1 or 20.2:1 on earlier models; a faster ratio of 17:1 or 17:6.1 on later models. This adjustment is made by disconnecting the tie-rod ends from one steering arm hole and moving to the other. The latest models (1969-1984) have Function Locking Energy Absorbing steering columns. With this design, the mast jacket and steering shaft are designed to collapse during conditions generated by a front end collision.

The collapsible mast jacket has ball bearings embedded in plastic and pressed between the upper and lower jackets. A predetermined load will collapse the assembly. The steering shaft collapses under predetermined loads, shearing the plastic pins. Additionally, these columns contain an anti-theft ignition



Steering linkage—1963-67



Steering linkage—1968-82

switch and ignition lock system. This system prevents the removal of the ignition key unless the automatic transmission is in Park or the manual transmission is in Reverse, and the key is in the "Lock" position. In this position, a rod and lock plate mechanism lock the steering wheel and shift lever.

The power rack and pinion steering system has a rotary control valve which directs hydraulic fluid, coming from the hydraulic pump, to either side of the rack piston. The integral rack piston is attached to the rack and converts hydraulic pressure to a linear force which moves the rack left or right. The .force is then transmitted through the inner and outer tie rods to the steering kunckles which turn the wheels.

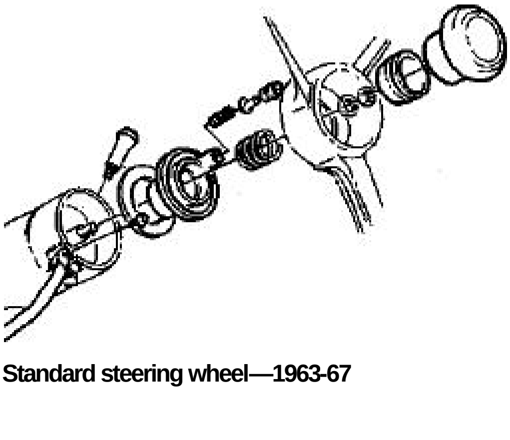
Lip seals, which seal rotating shaft, require special treatment. This type of seal is used on the steering rack and pinion at the rack, at the pinion and valve, and on the drive shaft of the pump. When leakage occurs in one of these areas, always replace the seal(s), after inspecting and thoroughly cleaning the sealing surfaces. Replace the shaft only if very severe pitting is found except for the rack. If the rack shows evidence of corrosion, it should be replaced. If the corrosion in the lip seal contact zone is slight, clean the surface of the shaft with crocus cloth. Replace the shaft only if the leakage cannot be stopped by smoothing with crocus cloth first.

Steering Wheel

REMOVAL AND INSTALLATION

1963-67 Standard Wheel

1. Disconnect the battery ground cable.
2. Pry off the horn cap with a small screw driver.
3. Remove the steering shaft nut and washer.



Standard steering wheel—1963-67

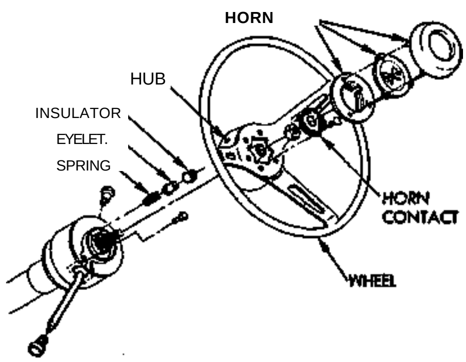
4. Install a wheel puller in the two threaded holes provided. Remove the steer ing wheel.
5. To install, align the wheel in a straight, up-and-down position.
6. Install the washer and nut on the shaft, and while holding the wheel, tighten the nut to 35-40 ft. Ibs.
7. Reinstall the contact assembly and horn cap.

1968-76 Standard Wheel

1. Disconnect the battery ground cable.
2. Pry the horn cap off with a small screw driver and remove the upper horn contact.
3. Remove the six steering wheel retain ing screws and remove the wheel.

NOTE: *To remove the wheel for turn signal switch service, follow Steps 3-6 of the "1963-67 Standard Wheel" procedure. Tighten the nut to 30ft. Ibs. On 1975-76 models, it is necessary to remove the snap-ring from the steering shaft first. Don't forget to install the snap-ring after tightening the nut.*

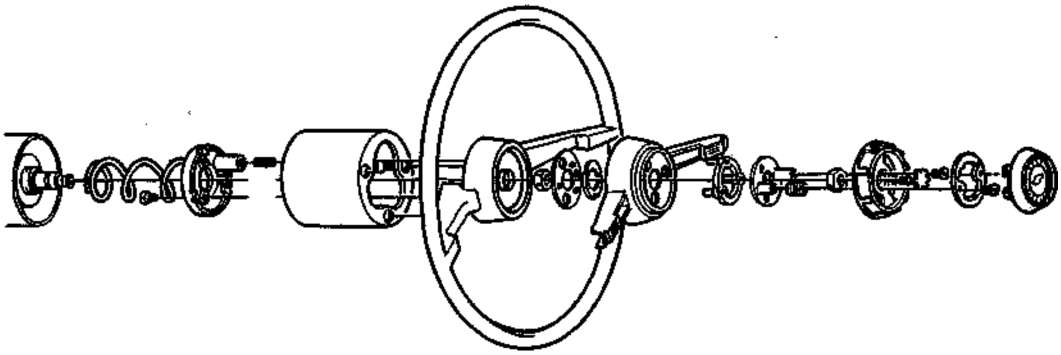
4. To install, attach the wheel to the hub with the six screws.
5. Install the upper horn contact and the horn cap.



Standard steering wheel—1968-76

1965-67 Telescoping Wheel

1. Disconnect the battery ground cable.
2. Pry off the horn cap with a small screwdriver and remove the horn contact as sembly.
3. Remove (he lock screw-to-lock knob retaining screws, and remove the lock screw, lock knob, and the spacer.
4. Remove the six steering wheel-to-hub screws and remove the wheel.
5. Replace the steering wheel on the hub and install the six retaining screws.



Tilt and telescoping wheel—1965-66

6. Install the spacer on the steering wheel and position the lock knob.

7. The lock screw installs through the lock knob, is turned into the shaft, and adjusted to the lock position.

8. Attach the spacer to the steering wheel. Put the lock knob in lock position and attach it to the lock screw with two screws.

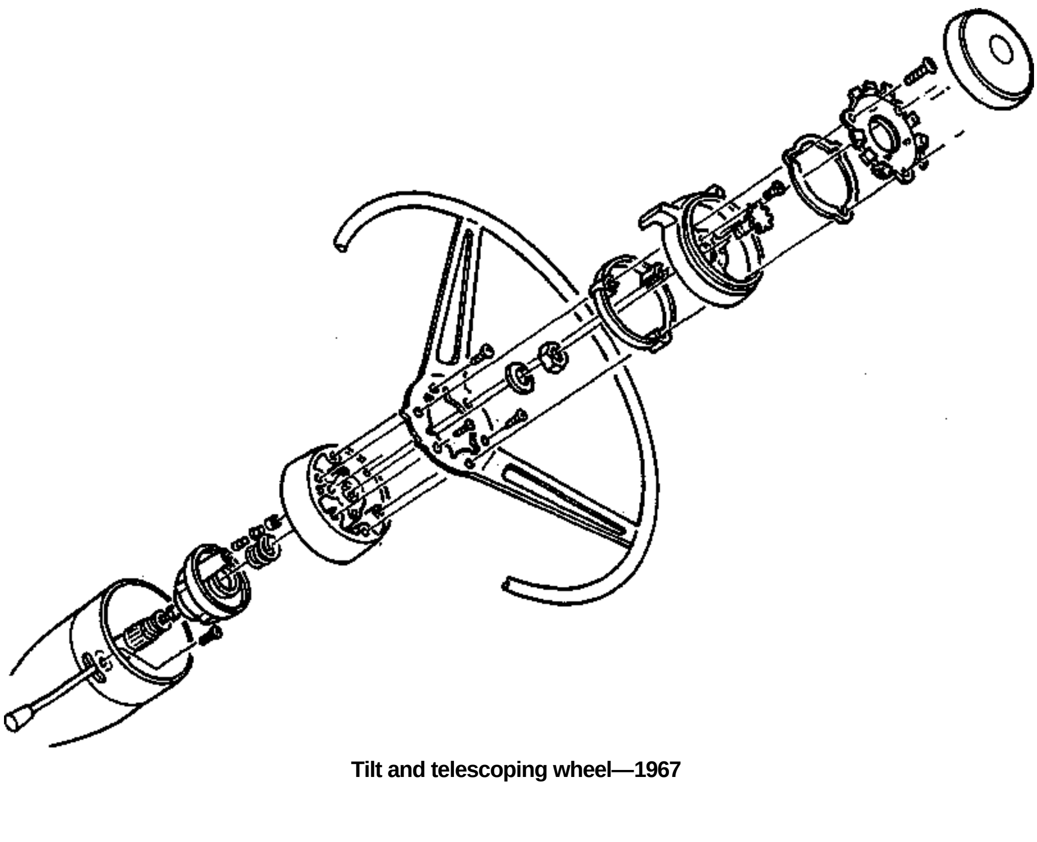
9. Remove the three, spacer retaining screws and install the horn contact to the spacer and the steering wheel with three screws.

10. Install the horn cap.

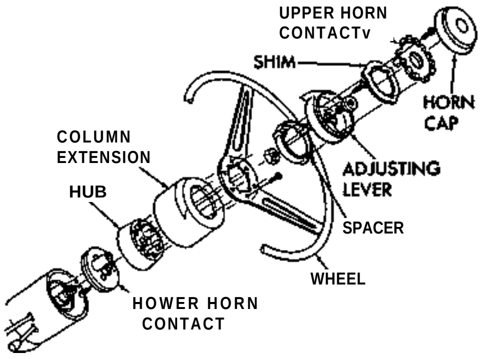
1968-76 Telescoping Wheel

1. Disconnect the battery ground cable.
2. Remove the horn cap and upper horn contact.
3.. Remove the shim, star screw, lock lever, and spacer.

NOTE: *To remove the wheel for turn signal switch service, follow Steps 3-67 Standard WheeF' procedure. Tighten the nut to 30ft. Ibs. On 1975-76 models, it is necessary to remove the snap-ring from the steering shaft first. Don t forget to install the snap-ring after tightening the nut.*



Tilt and telescoping wheel—1967

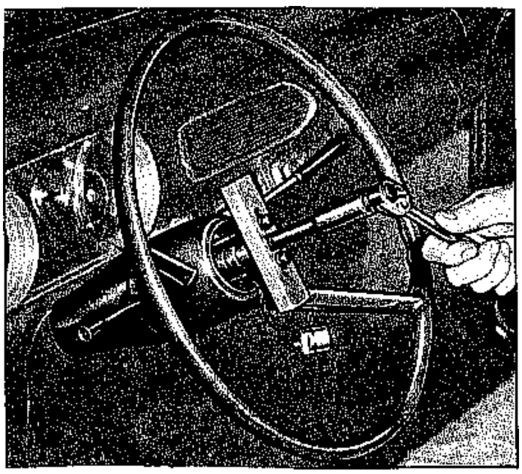


Tilt and telescoping wheel 1968-76

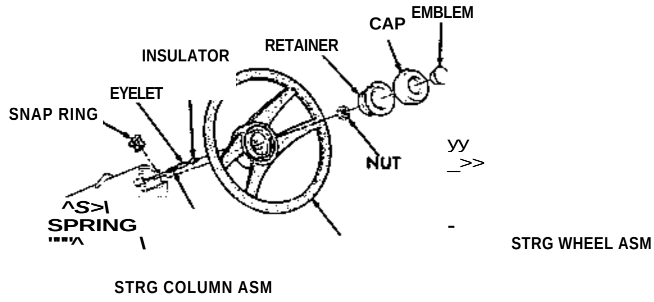
4. Remove the six steering wheel retain ing screws and remove the wheel.
5. Replace the steering wheel on the hub and install the six retaining screws.
6. Position the spacer and lock lever on the steering wheel.
7. Install the star screw through the lock lever, turn it into the shaft, and put it into lock position.
8. Install the spacer to the steering wheel with three screws. Position the lock lever in "Lock."
9. Attach the star screw with two screws and remove the three spacer retaining screws.
10. Install the shims and the upper horn contact.
11. Install the horn cap.

1977-79 Standard Wheel

1. Disconnect the battery ground cable.
2. Pry off the horn button cap.
3. Remove the snap ring then the steer ing wheel nut.



Steering wheel puller—typical

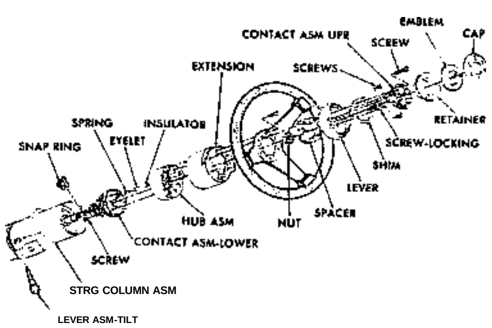


Standard steering wheel—1977-79

4. Install a wheel puller in the threaded holes provided. Butt the center bolt of the tool against the steering shaft and turn clock wise to remove the hub assembly.
5. When installing make sure the turn signal is in the neutral position, then install the hub on the steering shaft and secure it with the nut. Torque the nut to 30 ft. Ibs.
6. Install the snap ring.
4. Attach the steering wheel to the hub assembly with the attaching screws.
5. Install the horn contact and attach with the three screws.
6. Snap the horn button in place.
10. Connect the battery ground cable.

1977-84 Tilt Telescoping Wheel

1. Disconnect the battery ground cable.
2. Pry off the horn button cap.
1. Remove the three screws and remove the upper horn contact assembly.
1. If used, remove the shim then remove the screw securing the center star screw. Re move the star screw and lever.
2. Remove the snap ring and nut from the shaft and remove the steering wheel assem bly with a wheel puller.
1. If it is necessary to disassemble the steering wheel, remove the three screws se curing the steering wheel and separate; then



1977-82 tilt and telescoping steering wheel remove the four screws securing the extension to the steering wheel then separate.

7. To assemble the steering wheel, position the extension to the steering wheel and install the attaching screws. Torque the screws to 20 in. Ibs.

8. Position the spring, eyelet and insulator to the lower contact assembly. Position the assembly to the steering wheel and install the three screws.

9. Position the steering wheel assembly to the steering column and torque the nut to 30ft. Ibs.

10. Install the snap ring.

11. Position the lever to the steering column and install the star screw. Install the screws. Remove the switch by pulling it.

12. Position the upper contact assembly and shim if used and install the three retaining screws.

13. Install the retainer and horn button cap.

14. Connect the battery ground cable.

Turn Signal Switch

REPLACEMENT

1963

The 1963 turn signal switch is mounted on the lower part of the steering column. The switch is operated by a cable from the signal housing located under the steering wheel.

1. Remove the screws holding the switch case to the mast jacket.
2. Remove the control cable from the spring clip at the switch.
3. Loosen the cable-to-switch retaining screw.
4. Disconnect the switch wire.
5. Put the column lever in neutral.
6. Move the switch slide so that it is in the center of the slot on the switch.
7. Install the cable into the spring clip without disturbing the switch slide. Fasten the cable with the screw.
8. Install the switch on the column.

1964-66

1. Remove the steering wheel as previously outlined.
2. Remove the terminal wires from the connector and remove the mast jacket harness cover.
3. Remove the turn signal lever and the three switch retaining screws.
4. Remove the retainer plate, switch housing, and the switch from the mast jacket. Pull each wire separately through the mast jacket slot to prevent damaging the harness.
5. Transfer the wiring harness to the replacement switch and install the components using a reverse of the removal procedure.

1967-68

1. Remove the steering wheel as previously outlined.
2. From under the dash, disconnect the switch harness connector from the chassis harness.
3. Remove the preload spring and the cancelling cam.
4. Remove the turn signal lever. Push the flasher knob in and remove it by unscrewing.
5. Remove the lower trim cover.
6. Remove the retaining ring and the thrust and wave washers from the top of the steering shaft. Cut the wiring above the connector.
7. Unscrew the switch, and slide it, the cover, and the upper bearing housing out of the column. Pull the wire through the column protector and escutcheon.
8. Install the new switch by assembling it and the upper bearing housing into the switch cover, and then working the wire down through the escutcheon and column protector until the switch can be positioned on the mast jacket.
9. Install the switch and remaining components in a reverse order of removal.

Standard Wheel 1969-79

1. Remove the steering wheel as previously outlined.
2. On 1969-75 models loosen the three cover screws and lift the cover off the shaft. On 1976-79 models pry the lock plate cover off with a screwdriver blade.
3. Position the special lockplate compressing tool (J-23131 1969-70 or J-23653 1971-79) on the end of the steering shaft and compress the lockplate by turning the shaft nut clockwise. Pry the wire snap-ring out of the shaft groove.
4. Remove the tool and lift the lockplate off the shaft.
5. Slip the cancelling cam, upper bearing pre-load spring, and thrust washer off the shaft.
6. Remove the turn signal lever. Push the flasher knob in and unscrew it.
7. Pull the switch connector out of the mast jacket and tape the upper part to facilitate switch removal. On tilt wheels, place the

turn signal and shifter housing in Low position and remove the harness cover.

8. Remove the three switch mounting screws. Remove the switch by pulling it straight up while guiding the wiring harness cover through the column.

9. Install the replacement switch by working the connector and cover down through the housing and under the bracket. On tilt models, the connector is worked down through the housing, under the bracket, and then the cover is installed on the harness.

10. Install die switch mounting screws and the connector on the mast jacket bracket. In stall the column-to-dash trim plate.

11. Install the flasher knob and the turn signal lever.

12. With the turn signal lever in neutral and the flasher knob out, slide the thrust washer, upper bearing pre-load spring, and cancelling cam onto the shaft.

13. Position the lockplate on the shaft and press it down until a new snap-ring can be inserted in the shaft groove.

14. Install the cover and the steering wheel.

Tilt-Telescope 1969-84

1. Remove the steering wheel as previ ously outlined and press off the hub with a puller.

2. Remove the steering column/dash trim cover.

3. Remove the C-ring plastic retainer, if so equipped.

4. Install the special lockplate compress ing tool (J23131 1969-70; J23653 1971-81; J23063 1982) over the steering shaft. Position a ^{5}/i6 in. nut under each tool leg and reinstall the star screw to prevent the shaft from mov ing.

5. Compress the lockplate by turning the shaft nut clockwise until the C-ring can be removed.

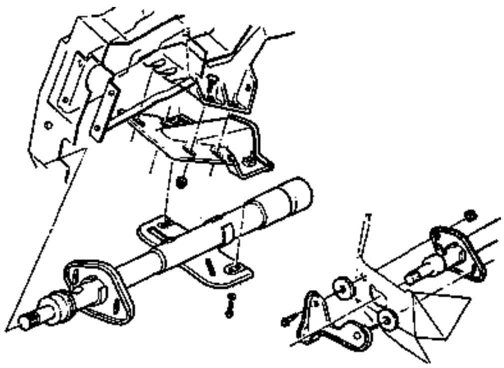
6. Remove the tool and lift out the lock-plate, horn contact carrier, and the upper bearing preload spring.

NOTE: 1969 *Corvette assembly order is: horn control carrier, lockplate, and upper bearing preload spring.*

7. Pull the switch connector out of the mast jacket and tape die upper part to facili tate switch removal.

8. Remove the turn signal lever. Push the flasher in and unscrew it.

9. Position the turn signal and shifter housing in Low position. Remove the switch by pulling it straight up while guiding the wiring harness out of the housing.



Steering column to dash panel

10. Install the replacement switch by working the harness connector down through the housing and under the mounting bracket.

11. Install the harness cover and clip the connector to the mast jacket.

12. Install the switch mounting screws, signal lever, and the flasher knob.

13. With the turn signal lever in neutral and the flasher knob out, install the upper bearing pre-load spring, horn contact carrier, and lockplate onto the shaft. Horn contact carrier is last on 1969 models.

14. Position the tool as in Step 4 and com press the plate far enough to allow the C-ring to be installed.

15. Remove the tool. Install the plastic C-ring retainer.

16. Install die column/dash trim cover. In stall the steering wheel.

Ignition Switch

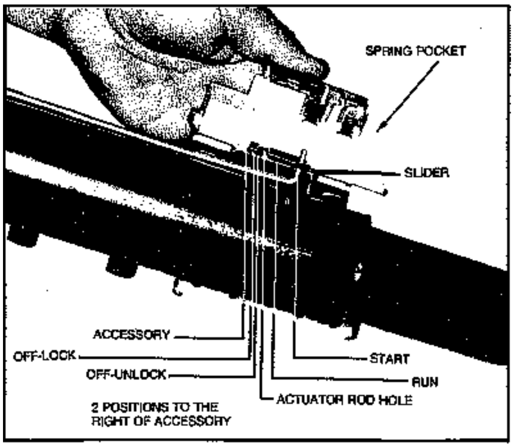
REMOVAL AND INSTALLATION

1969-84

NOTE: *See Chapter 5 for "1964-68 Ignition Switch Removal and Installation* The switch is located inside the channel section of die brake pedal support and is completely inaccessible widiout first lowering die steering column. The switch is actuated by a rod and rack assembly. A gear on die end of die lock cylinder engages die toodied upper end of die rod.

1. Lower die steering column; be sure to properly support it.

2. Put the switch in "Lock" position on models tiirough 1977 and die "Off-Unlocked" position on 1978 and later models. Widi die cylinder removed, die rod is in "Lock" or



Positioning the ignition switch

"Off-Unlocked" position when it is in the next to the uppermost detent.

3. Remove the two switch screws and re move the switch assembly.

4. Before installing, place the new switch in "Lock" or "Off-Unlocked" position and make sure the lock cylinder and actuating rod are in "Lock" or "Off-Unlocked" position (second detent from the top).

5. Install the activating rod into the switch and assemble the switch on the column. Tighten the mounting screws. Use only the specified screws since overlength screws could impair the collapsibility of the column.

6. Reinstall the steering column.

Steering Linkage

The Corvette has two tie-rods. Each rod is a three-piece assembly made up of the rod it-self and two tie-rod ends. The ends screw onto the rod and are clamped in place. Right- and left-hand threads are used to assist toe-in and centering adjustments. The ends are self-adjusting and, with die exception of periodic lubrication, require no servicing.

ADJUSTMENTS—1963-82

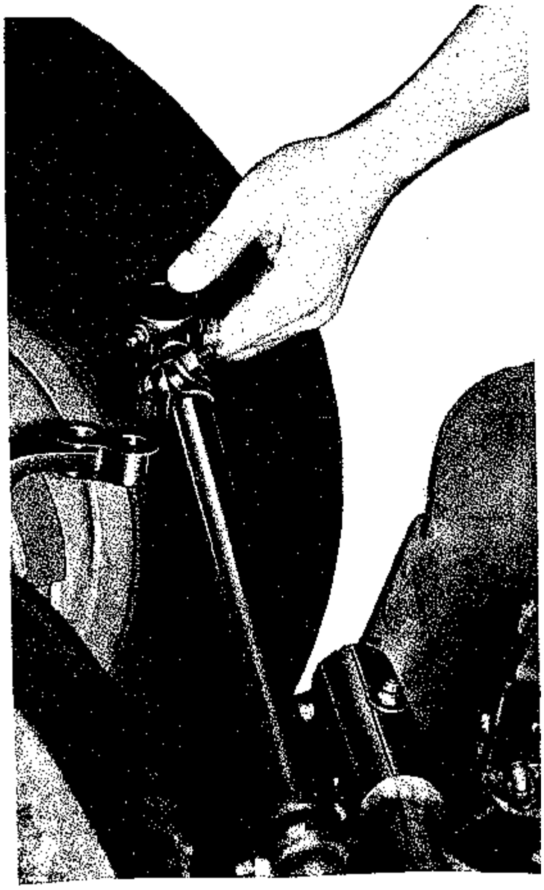
Relay Arm Ball Joint

1. Remove the cotter pin and adjust the end plug slot clockwise until die inside springs are bottomed.

2. Turn the plug % turn counterclockwise and reinsert die cotter pin.

Steering Ratio

1. Two-position steering arms permit an adjustment for quicker steering. Do not make



Steering ratio adjustment

this adjustment on Corvettes equipped witii power steering, as frame interference will re-sult.

2. Disconnect the tie-rod ball joint stud from the steering arm.

3. Insert die stud in die forward hole for a quick steering ratio, or die rear hole for a slower ratio.

4. Install die nut and cotter pin. Repeat this operation on die opposite side.

5. Reset die toe-in after a steering ratio adjustment.

Rack and Pinion Assembly

REMOVAL AND INSTALLATION

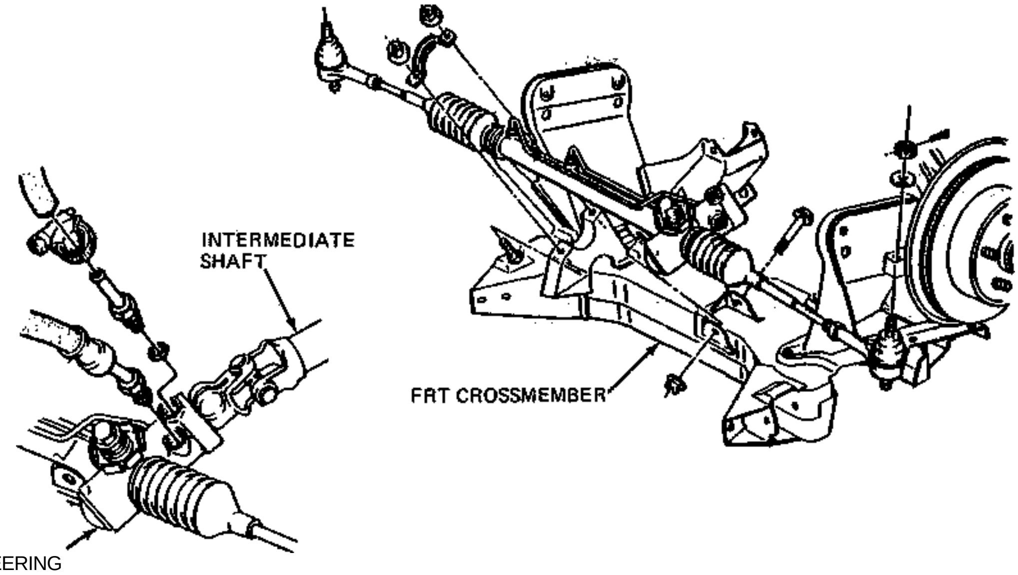
1. Raise the vehicle on a hoist.

2. Remove the drivers side wheel and tire.

3. Disconnect die power steering hoses and cap them off.

4. Disconnect outer tie rod ends both sides.

5. Remove the upper and lower mount ing bolts, passenger side.



Power rack and pinion assembly on 1984 and later models

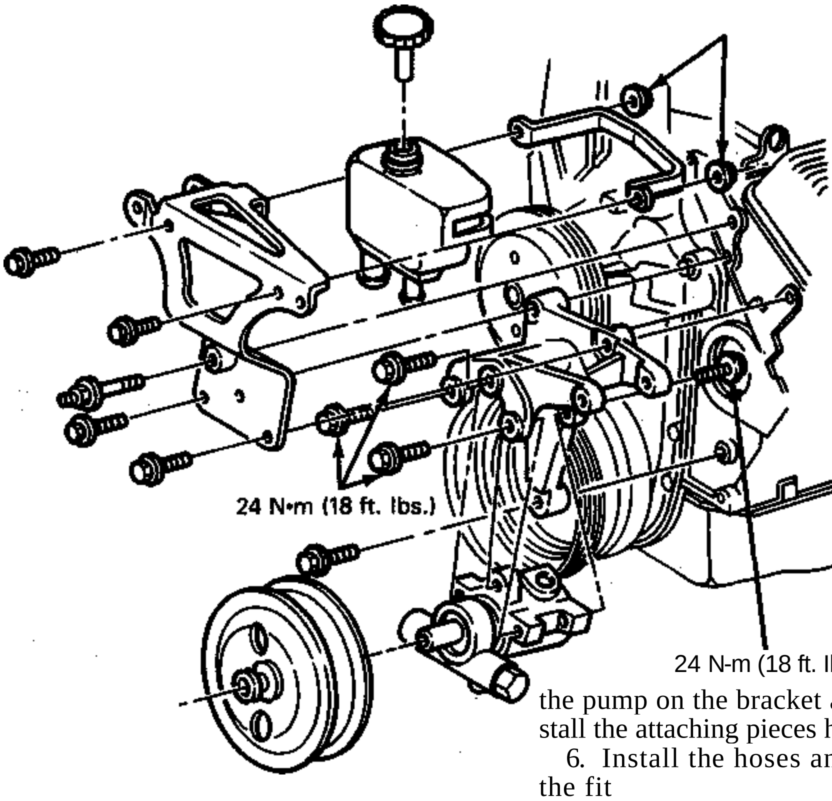
6. Remove the mounting bolt, drivers side.
7. Remove the intermediate shaft lower universal joint at the rack and pinion assem bly.
8. Remove the stabilizer bar.
9. Remove the electric fan.
10. Remove the rack and pinion assembly from the vehicle.
11. Reverse the removal procedure for in stallation.
12. Check and refill the power steering fluid if necessary.
13. Rleed the system.
14. Check and adjust toe in if necessary.

BLEEDING POWER STEERING SYSTEM

1. Run engine until power steering fluid reaches normal operating temperature, ap proximately 170°F (80°C), then shut engine off. Remove reservoir filler cap and check oil level.
2. If oil level is low, add power steering fluid to proper level and replace filler cap. When adding or making a complete fluid change, always use CM #1050017 or equiv alent power steering fluid. Do not use trans mission fluid.
3. When checking fluid level after the steering system has been serviced, air must be bled from the system. With wheels turned all the way to the left, add power steering fluid to level indicated on reservoir.
4. Start engine, and running at fast idle, recheck fluid level. Add fluid if necessary.
5. Bleed system by turning wheels from side to side without hitting stops. Maintain fluid level just above internal pump casting. Fluid with air in it will have a light tan or milky appearance. This air must be elimi nated from fluid before normal steering ac tion can be obtained.
6. Return wheels to center position and continue to run engine for two or three min utes, then shut engine off.
7. Road-test vehicle to make sure steering functions normally and is free from noise.
8. Recheck fluid level as described in steps 1 and 2.

Power Steering Gear

The optional power steering on the Corvette is of the linkage assist type. The steering gear and linkage is identical to that used on manual steering cars. All procedures for the manual gear apply to the power steering gear. A belt-driven pump supplies hydraulic pressure to a sensing valve, and then on demand to a power cylinder on the linkage, which provides the power assist to the linkage. See the "Maintenance" section for adjustment procedure.



Power steering pump, reservoir and mounting brackets on engines with serpentine drive belt

Power Steering Pump

REMOVAL AND INSTALLATION

1. Remove the hoses at the pump, and tape the ends to prevent dirt from entering.
2. Plug the pump fittings to keep the fluid in the pump.
3. Loosen the bracket retaining nuts and remove the drive belt.
4. Withdraw the bracket-to-pump bolts and remove the pump from the car. On large block Corvettes, the alternator drive belt must be removed first.
5. Place the pump on the bracket and install the attaching pieces hand-tight.
6. Install the hoses and tighten the fittings.
7. Refill the pump reservoir. Turn the pulley backward to bleed the pump.
8. Install the belt over die pulley and tighten to the correct tension.
9. Bleed the hydraulic system, as previously described.

Brakes

9

BRAKE SYSTEM

1963-64 Corvettes are equipped with four-wheel drum brakes. These are hydraulically operated, self-adjusting, and feature double-piston wheel cylinders. Three brake options were available with the drum system. Power brakes featured a Moraine vacuum assist master cylinder and were the first power brakes ever offered on the Corvette. The second option was the standard drums (honed to a 20 micro-inch finish and equipped with special heat resistant springs) and metallic linings for more fade resistance. The third option was intended for heavy-duty or competition usage. These cerametallic linings were larger and the drums were finned and scooped.

In 1965, the four-wheel disc brake system was introduced. This system includes a fixed caliper, rotating vented disc, and four-piston pad actuation. A heavy-duty, optional disc brake system is available for special purposes (1965-75). A different front caliper, brake pad, and brake line pressure regulator are used. Heavy-duty brake calipers are easily recognized by the two, pad retaining pins instead of the standard brake's single pin.

1984 models use a Girling brake system with aluminum single-piston calipers.

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.*

Adjustment

DRUM *BRAKES*

Rotate the star wheel adjuster until a slight drag is felt between the shoes and drum, then back off IVi turns on the adjuster. Backing the car and firmly braking will allow the self-adjustment feature to complete the adjustment.

DISC BRAKES

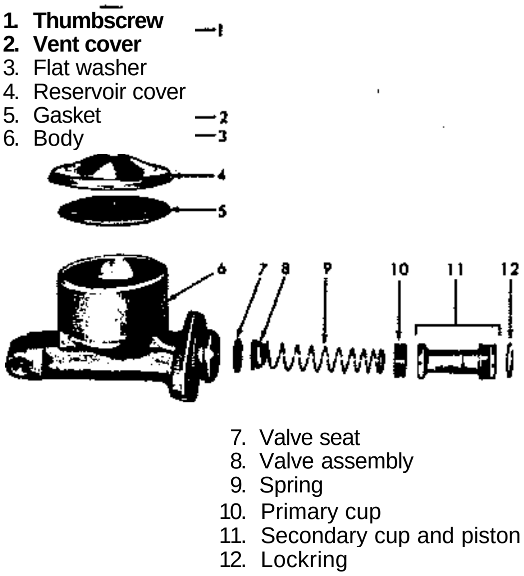
These brakes are inherently self-adjusting and no adjustment is ever necessary or possible.

HYDRAULIC SYSTEM

Master Cylinder—Drum Brakes

REMOVAL AND INSTALLATION

1. Disconnect the hydraulic lines from the cylinder. Plug the lines to keep dirt out of the lines and master cylinder.
2. Remove the clevis pin and clip from the brake pedal arm.
3. Remove the main cylinder-to-firewall nuts and lockwashers, and remove the mas ter cylinder.
4. Install the master cylinder on the fire wall studs. Install the lockwashers, and tighten the nuts.
5. Insert the clevis pin through the clevis and the brake pedal and secure with a cotter pin.
6. Install the hydraulic lines to the master cylinder.
7. Refill the cylinder with brake fluid and bleed the lines.
8. Adjust the brake pedal as necessary.



Exploded view of 1963-64 master cylinder

OVERHAUL

NOTE: *Overhaul of the main cylinder portion of power brake master cylinders is the same as that for manual master cylinders.*

1. Secure the master cylinder in a vise and remove the push rod assembly and the pro tective boot. This exposes the lock ring which, when removed, allows extraction of the pis ton stop, secondary cup, and piston.

2. Remove the cylinder end plug and push out the primary cup, spring, valve as sembly, and seat.

3. Wash the component parts with clean alcohol only, and be sure that all traces of gasoline or kerosene are removed. Gasoline will cause premature deterioration of the cyl inder's rubber parts.

4. Carefully inspect the washed metal parts and the cylinder bore. A corroded cyl inder must be replaced. Discoloration or stains should be removed with crocus cloth. When doing so, wrap the cloth around a fin ger and rotate the cylinder around the sup ported cloth. Do not polish the bore length wise as this can cause a fluid leak.

5. Check the piston-to-cylinder clear ance with a: feeler gauge. Clearance should be between 0.001 in. and 0.005 in.

6. To reassemble, moisten the cylinder bore with clean brake fluid and replace the valve seat, valve assembly, and spring.

NOTE: *Be sure that the valve and seat are properly installed before proceeding. An incorrectly assembled check valve will distort and fail to provide a check valve seal, which will result in a reduction of brake pedal travel and a corresponding loss of actual braking.*

7. Moisten the primary cup with clean brake fluid and install it, flat side out, and seated over the spring. The primary cup is distinguished by a brass support ring at its base.

8. Dip the secondary cup in clean brake fluid and slip it over the end of the piston.

9. Insert the completed assembly, with the bleeder brake end of the piston installed first. Secure the parts with the piston stop and the snap-ring, and install the end plug.

10. Attach the rubber boot and push rod, and replace the cylinder on the firewall.

11. Attach the brake pedal clevis and ad just the push rod-to-piston clearance. Cor rect adjustment calls for a barely perceptible free pedal before piston/push rod contact.

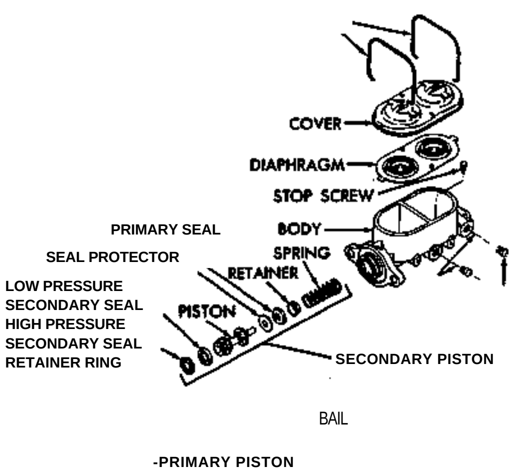
Master Cylinder—Disc Brakes

1967-82

The early disc brake master cylinder is serviced in the same manner as the drum brake master cylinder. The later master cylinder is the dual reservoir type. This offers a separate brake circuit for the front and rear wheel pairs and prevents total loss of braking should one circuit fail.

This master cylinder is actually two complete master cylinders contained in a single housing, with the front reservoir controlling the front brake pairs and the rear reservoir, the rear brake line just below the master cylinder.

Be absolutely certain that replacement parts are identified as identical to those being



Exploded view of 1967-82 master cylinder

replaced when overhauling the dual master cylinder. The displacement capability of the master cylinder is dependent upon the length of the secondary piston.

Overhaul

1. Remove the unit from the vehicle us ing the same general procedure as described for conventional master cylinders.
2. Remove the mounting gasket and boot, and the main cover; purge the unit of its fluid.
3. Secure the cylinder in a vise and re move the push rod retainer and the secon dary piston stop bolt found inside the forward reservoir.
4. Compress the retaining ring and ex tract it along with the primary piston assem bly.
5. Blow compressed air into the piston stop screw hole to force the secondary piston, spring, and its retainer from the bore of the cylinder. An alternate method uses a piece of wire, hooked on one end, to snag and extract the secondary piston.
6. Check die brass tube-fitting inserts and if they are damaged, remove diem. Leave undamaged inserts in place.
7. If replacement is necessary, diread a 6-32 x % in. self-tapping screw into die in sert. Hook die head of die screw widi a claw hammer and pry die insert free.
8. An alternate way to remove die inserts is to first drill die outlet holes to $^{13}/64$ in. and diread diem widi a ^4 in.-20 tap. Position a diick washer over die hole to serve as a spacer dien diread a % in.-20 x % in. hex head bolt into die insert and tighten die bolt until the insert is freed.
9. Use denatured alcohol and com pressed air to clean die component parts. Slight rust may be removed widi fine crocus cloth.
10. Replace die brass tube inserts at this time by positioning diem in dieir holes and direading a brake line tube nut into die out let hole. Turn down die nut until die insert is seated.
11. Check the piston assemblies for cor rect identification and when satisfied, posi tion die replacement secondary seals in die twin grooves of die secondary piston.
12. The outside seal is correcdy placed when its lips face die piston's flat end. The lips of die inner seal face die piston compen sating holes.
13. Slip die primary seal and its protector over die secondary seals. The flat side of diis seal should face die piston's compensating hole flange.
14. Replace die primary piston assembly widi die assembled component found in the overhaul kit.
15. Moisten die cylinder bore and die sec ondary piston's inner and outer seals widi new brake fluid. Assemble die secondary piston spring to its retainer and position them over die end of die piston widi die retainer inside die lips of the primary seal.
16. Insert die combined spring and piston assembly into die cylinder and use a small wooden dowel or pencil to seat die spring against die end of die bore.
17. Moisten die primary piston seals widi new brake fluid and push it, push rod recep tacle end out, into die cylinder.
18. Keep die piston pushed in and snap die retaining ring into place.
19. Relax die pressure on die pistons and allow diem to seek dieir static positions.
20. Replace die secondary piston stop screw and torque it to 25-40 in. Ibs.
21. Replace the reservoir diaphragm and cover.

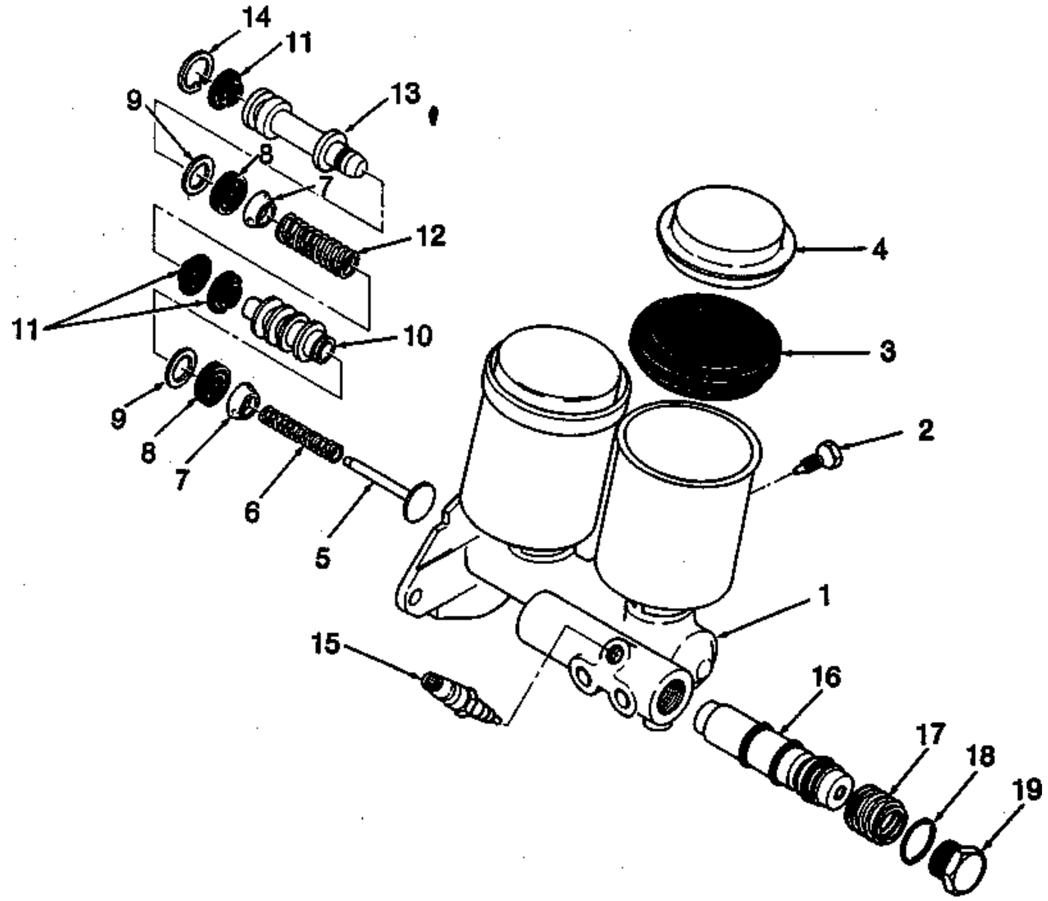
7984 *AND LATER*

This master cylinder assembly is an aluminum and plastic composite with an integral proportioning valve/warning switch, individual reservoirs and a conventional front-to-rear split. Two outlets are provided for the frontal brakes, fed from the front reservoir and secondary piston; with one outlet for the rear brakes, fed by the rear reservoir and primary piston. The master cylinder is removed by disconnecting the brake lines and removing the mounting nuts attaching the assembly to the power booster. Cap all brake lines during service procedures to prevent contamination of the hydraulic system with dirt, grease or water.

NOTE: *Use only D.O.T. 3 or Delco Supreme #11 brake fluid in this brake system. Do not use silicone brake fluid such as Delco Supreme #24, Any type of silicone brake fluid may cause seal damage. Do not use lubricated compressed air to blow off brake parts, as damage to rubber components could occur.*

Overhaul

1. Remove master cylinder reservoir caps, separate the cap and diaphragm, then discard die diaphragms. Inspect the caps for cracks



1. Body and reservoir assemblies
2. Stop bolt
3. Diaphragm
4. Cap
5. Spring locator
6. Secondary spring
7. Seal retainer
8. Primary seal
9. Seal washer
10. Secondary piston
11. Secondary seal
12. Primary spring
13. Primary piston
14. Retaining ring
15. Warning switch
16. Combination piston
17. Spring
18. O-ring
19. Plug

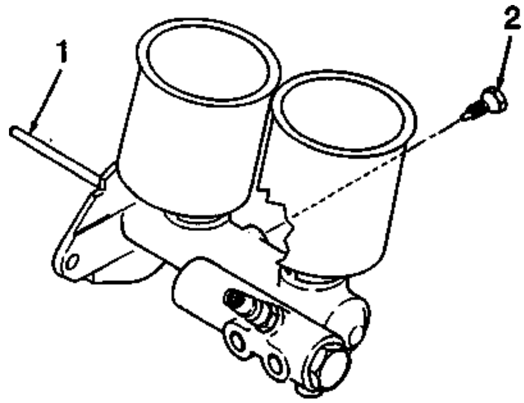
Exploded view of brake master cylinder—1984 and later

or damage and replace, if necessary. Drain and discard any remaining brake fluid.

2. Secure the master cylinder in a suitable holding fixture, like a piece of steel plate with holes drilled to accommodate the mounting bolts and piston bore clamped in a vise. Clamping the aluminum master cylinder in a vise is not recommended and may cause cracks or damage. -

3. Fully depress the master cylinder pistons with a suitable brass rod or wooden dowel and remove the stop bolt. Remove the retaining snap ring with suitable pliers.

NOTE: *Never remove the stop bolt unless both pistons are fully bottomed in the bore.*



Bottom the piston in the bore with a brass or wood rod (1) before removing or Installing stop bolt (2)

4. Remove the brass rod or dowel and primary piston.

5. Lightly tap the open end of the master cylinder body on a block of wood to dislodge the secondary piston.

6. Remove the primary piston spring.

7. Remove the seal retainer with a small screwdriver and discard the retainer.

8. Remove and discard the primary seal and washer. Remove and discard the secon dary seal.

9. Remove the spring locator and spring from the secondary piston.

10. Remove and discard the seal retainer with a small screwdriver.

11. Remove and discard the primary seal, washer and secondary seal.

12. Remove the switch, being careful to retain the plastic body, spring and probe as an assembly.

13. Remove the end plug, then discard the O-ring. O-rings should be replaced when ever the master cylinder is overhauled.

14. Gently tap the master cylinder body on a block of wood to dislodge the combina tion piston with ground spring attached. The combination piston should be discarded and replaced as a complete assembly.

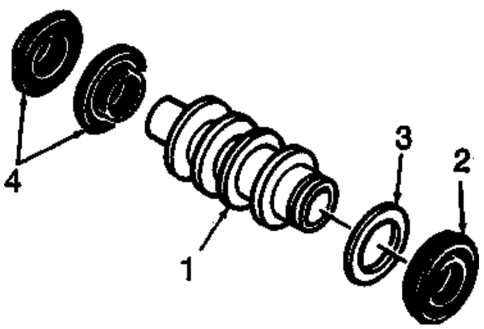
15. Wash all parts to be reused in clean, denatured alcohol. Use only dry, filtered compressed air to blow out passages in the master cylinder body.

NOTE: *Do not wash the replacement com- bination piston in any cleaning solution. New parts are coated with special grease.*

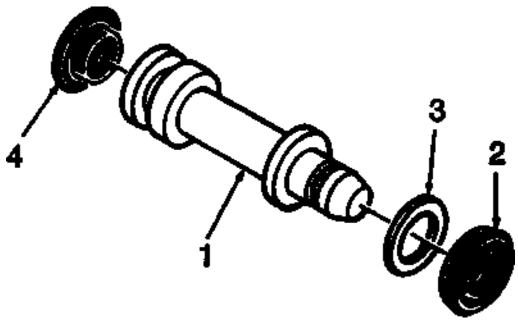
16. Lubricate the secondary piston and seals with clean brake fluid and assemble the seals to the piston.

17. Lubricate and install the primary seal washer and seal.

18. Install the seal retainer while making sure it seats properly in the groove in the sec ondary piston.



Secondary piston (1) showing location of primary seal (2), washer (3) and secondary seal (4)



Primary piston (1) showing location of primary seal (2), washer (3) and secondary seal (4)

19. Install the secondary spring and spring locator in the secondary piston.

20. Lubricate the master cylinder bore with clean brake fluid and install the secondary piston spring assembly.

21. Lubricate the primary piston and pis ton seals with clean brake fluid and install the secondary seals.

22. Install the primary seal washer and seal. Install the seal retainer, making sure it is properly seated in the primary piston groove.

23. Install the primary piston spring, then install the primary piston spring assembly into the master cylinder bore.

24. Using a brass rod or wooden dowel, push on the primary piston until the primary and secondary pistons bottom in the bore. Once the pistons bottom, install the stop bolt and torque to 7-9 ft. Ibs. (9-12 N-m).

CAUTION: *Do not install the stop bolt un- less the pistons are fully bottomed in the master cylinder bore.*

25. Install a new snap ring retainer in the master cylinder bore, making sure it is seated properly into the groove. Remove the brass rod or dowel.

26. Install the fine wire spring over the capped end of the new combination piston.

27. Lubricate both the bore and die com bination piston with clean brake fluid and in sert the piston open end first. Make sure the piston is fully bottomed in the bore.

28. Lubricate a new O-ring with clean brake fluid and install it over the threaded end of the plug. Install the end plug and torque to 75-90 ft. Ibs. (100-120 N-m).

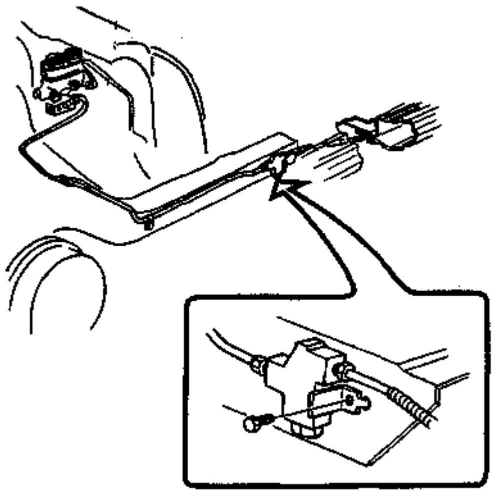
29. Install new diaphragms on the reser voir caps and fill with the recommended brake fluid. Torque mounting bolts to 15 ft. Ibs. (21 N-m). Bleed the brake system and check for leaks after installation.

CAUTION: *The use ofsilicone brake fluid such as Delco Supreme #24 can damage* *the seals and rubber components in the brake system. Use brake fluid that meets or exceeds DOT 3 specifications, such as Delco Supreme #11 or equivalent.*

Pressure Regulating Valve (Rear Metering)

7965-68 *WITH H.D. BRAKES*

The pressure regulating valve is mounted in the rear brake line just below the main cylinder. The valve controls the hydraulic pressure to the front or rear brakes, as applicable, resulting in the correct pressure balance between die front and rear hydraulic systems. The valve guards against premature lock-up of the front or rear wheels when the brakes are applied



Pressure regulating valve—Typical

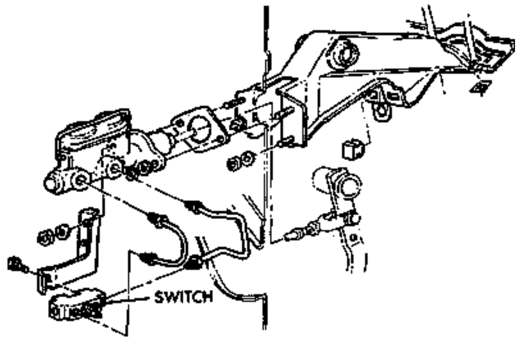
REMOVAL AND INSTALLATION

1. Place some dry rags under the valve to absorb any fluid spilled during removal.
2. Disconnect the hydraulic brake lines and protect the openings from dirt.
I Remove the mounting screw and remove the valve.
4. To install position the valve and install the mounting screw.
5. Connect the hydraulic lines and bleed the brake system.

Brake Pressure Indicator and Distribution Switch

1967-77

This switch is connected to the hydraulic lines from the master cylinder and is a pressure differential type, designed to light the



Brake pressure indicator and distribution switch—typical

brake warning lamp on the instrument panel if either the front or rear hydraulic system fails. The brake warning light will come on only when the brakes are applied. It will not remain on when the brakes are released. This switch is a non-adjustable and non-serviceable component and must be replaced if found defective.

REMOVAL AND INSTALLATION

1. Disconnect the negative battery cable.
2. Disconnect the electrical lead from the switch assembly.
3. Place dry rags below the switch to ab sorb any spilled fluid.
4. Clean any dirt from the switch and hy draulic lines and disconnect the hydraulic lines at the switch. Cover the open line ends to protect the system from dirt.
5. Remove the mounting screw and re move the switch.
6. To install reverse the above and bleed the brake system.

TESTING AND CENTERING THE SWITCH

Whenever work on the brake system is done, it is possible that the brake warning light will come on and refuse to go off when the work is finished. In this event, the switch must be centered.

1. Raise and support the vehicle.
2. Attach a bleeder hose to the rear brake bleed screw and immerse the other end of the hose in a jar of clean brake fluid.
3. Be sure that the master cylinder is full.
4. Turn the ignition key ON. Open the bleed screw while an assistant applies heavy pressure on the brake pedal. The warning lamp should light. Close the bleed screw be fore the helper releases the pedal.

To reset the switch, apply heavy pressure to the pedal. This will apply hydraulic pressure to the switch which will recenter it.

5. Repeat Step 4 for the front bleed screw.

6. Turn the ignition OFF and lower the vehicle.

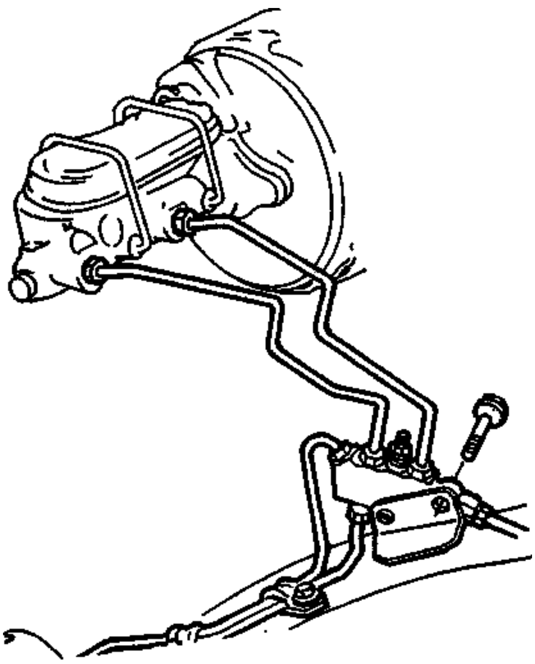
NOTE: *If the warning lamp does not light during Step 4, the switch is defective and must be replaced.*

Combination Valve

1978-82

The combination valve is mounted on the frame and is connected to the hydraulic lines from the master cylinder. The proportioning section of the combination valve proportions outlet pressure to the rear brakes after a predetermined rear input pressure has been reached. This is done to prevent rear wheel lock-up. The valve is designed to have a bypass feature which assures foil system pressure to the rear brakes if the front brake system fails and full system pressure to the front brakes if the rear brake system fails.

The warning switch is designed to constantly compare front and rear brake pressure from the master cylinder and turn on the light on the dash in case of front or rear system failure. The warning light switch portion of the combination valve is not serviceable. If the switch is found defective the combination valve must be replaced.



Combination valve mounted below master cylinder

REMOVAL AND INSTALLATION

1. Disconnect the hydraulic lines at the combination valve. Plug the lines to prevent loss of fluid and to protect the system from dirt.

2. Disconnect the valve switch wire ter minal and remove the combination valve.

3. To install reverse the above and bleed the brake system.

TESTING

1. Raise the vehicle on a hoist.

2. Attach a bleeder hose to a rear brake bleed screw and immerse the other end of the hose in a container partially filled with clean brake fluid. Make sure the master cyl inder reservoirs are filled.

3. Turn the ignition switch to "On" and open the bleeder screw while a helper ap plies moderate pressure to the brake pedal. The warning lamp should light. Before the helper releases the brake pedal close the bleeder screw. Press down on the brake pedal and the light should go out.

4. Attach the bleeder hose to the front brake bleeder and repeat Step 3. Turn the ignition switch off.

5. If the warning lamp does not light dur ing Steps 3 and 4 but does light when a jumper is connected to ground, the warning light switch portion of the combination valve is defective and the combination valve must be replaced.

Brake Bleeding

The hydraulic brake system must be bled any time one of the lines is disconnected or air enters the system. This may be done manually or by the pressure method. Correct bleeding sequence is: left rear wheel cylinder, right rear, right front, left front.

The manufacturer recommends that the entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in the hydraulic system. Flushing is also recommended if there is any doubt as to the grade of fluid in the system. If fluid has been used which contains the slightest trace of mineral oil, all rubber parts that have been subjected to the contaminated fluid should be replaced. When bleeding the rear brake system, the front of the car should be raised higher than the rear. This will position the bleeder valve near the 12 o'clock position and prevent air from being trapped in the caliper.

Pressure Bleeding

1. Clean the top of the master cylinder, remove the cover, and attach the pressure bleeding adapter.
2. Check die pressure bleeder reservoir for correct pressure and fluid level, then open the release valve.
3. Fasten a bleeder hose to the wheel cyl inder bleeder nipple and submerge the free end of the hose in a transparent receptacle. The receptacle should contain enough brake fluid to cover the open end of the hose.
4. Open the wheel cylinder bleeder nip ple and allow the fluid to flow until all bub bles disappear and an uncontaminated flow exists.
5. Close the nipple, remove the bleeder hose and repeat the procedure on the other wheel cylinders according to the bleeding se quence.

Manual Bleeding

An alternative to the pressure method of bleeding requires two people to perform: one to depress the brake pedal and the other to open the bleeder nipples.

1. Observe the cleaning operation of the pressure method, then remove the cover and fill the reservoir.
2. Attach a bleeder hose and clear con tainer as before.
3. Have the assistant depress the brake pedal to the floor, and then pause until fluid flow ceases and the bleeder nipple is closed.
4. Allow the pedal to return and repeat the procedure until a steady, bubble-free flow is seen.
5. Secure the nipple and move to the other wheels in the correct sequence.
6. Periodically check the master cylinder for an adequate supply of fluid. If the reser voir runs dry, air will enter the system and bleeding will have to be done again.

DRUM BRAKES (FRONT OR REAR)

Brake Drums

REMOVAL AND INSTALLATION

1. Jack the car so wheels are off the ground.
2. Remove the wheel or wheels where brake drums are to be removed.
3. Pull the brake drum off—it may be necessary to gently tap the rear edges of the drum to start it off the studs.
4. If extreme resistance to removal is en countered, it will be necessary to retract the adjusting screw. Knock out the access hole in the brake drum and turn the adjuster to re tract the linings.
5. Install brake drums after adjusting the linings.
6. Install the drums in the same position on the hub or axle shaft as removed.

INSPECTION

When a drum is removed, it should be inspected for cracks, scores, or other imperfections. These must be corrected before the drum is replaced.

CAUTION: *If the drum is found to be cracked, replace it. Do not attempt to service a cracked drum.*

Minor drum score marks can be removed with fine emery cloth. Heavy score marks must be removed by "turning the drum." This is removing the metal from the entire inner surface of the drum in order to level the surface. Automotive machine shops and some large parts stores are equipped to perform this operation.

If the drum is not scored, it should be polished with fine emery cloth before replacement. If the drum is resurfaced, it should not be enlarged past 0.060 in. of the original diameter.

It is advisable, while the drums are off, to check them for out-of-round. An inside micrometer is necessary for an exact measurement, therefore unless this tool is available, the drums should be taken to a machine shop to be checked. Any drum which is more than 0.006 in. out-of-round will result in an inaccurate brake adjustment and other problems, and should be refinished or replaced. NOTE: *If the micrometer is available, make all measurements at right angles to each other and at the open and closed edges of the drum machined surface.* Check the drum with a micrometer in the following manner:

1. Position the drum on a level surface.
2. Insert the micrometer with its adapter bars if necessary.
3. Obtain a reading on the micrometer at the point of maximum contact. Record this.
4. Rotate the micrometer 45° and take a similar reading. The two readings must not vary more than 0.006 in.

Brake Shoes

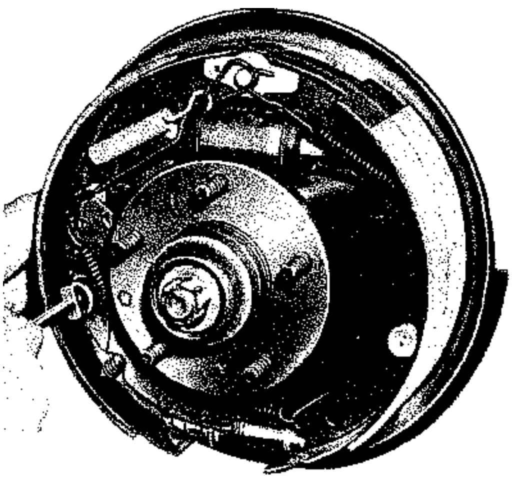
INSPECTION

Remove the drum and inspect the lining thickness on both brake shoes. A front brake lining should be replaced if it is less than *Ys* in. thick at the lowest point on the brake shoe. The limit for rear brake linings is Vis.

NOTE: *Brake shoes should always be replaced in axle sets.*

REMOVAL AND INSTALLATION

1. Support the car on jackstands, slacken the parking brake cable and remove the rear wheels, rear brake drums, and front drums and hub assemblies.
2. Free the brake shoe return springs, ac tuator pull-back spring, hold-down pins and springs, and actuator assembly.
3. On rear wheels, disconnect the adjust ing mechanism and spring, and remove the primary shoe.
4. Disconnect the parking brake lever from the secondary shoe and remove the shoe. Front wheel shoes may be removed simulta neously.
5. Clean and inspect all parts. Scored or out-of-round drums should be reconditioned or replaced.
6. Check wheel bearings, oil seals, wheel cylinders, and rear axle seals; repacking or replacing as needed.
7. Inspect the replacement shoes for nicks or burrs, lubricate the backing plate contact points, brake cable and levers, and adjusting screws, then reassemble.
8. Be sure that the left and right-hand ad justing screws are not mixed. The star wheel should be nearest the secondary shoe when properly installed.
9. Reverse the procedure for reassembly. When completed, make an initial adjustment as described under adjustments.



Freeing hold-down pins and springs

Metallic brakes

Maintenance procedures for the metalic lining-only option are the same as those for standard brakes. Do not substitute these linings in standard drums, unless they have been honed to a 20 micro-inch finish and equipped with the special heat resistant springs.

The oversize metallic lining and finned drum option requires attention to the following maintenance deviations: The adjusting screw uses a solid film lubricant, and should not be cleaned with solvent or lubricated. The final brake adjustment also differs for this option in that the self-adjustment feature actuates when firm pedal application is made when the car is moving forward. Maintenance procedures require these linings to be broken in. Make an initial adjustment then use moderate pedal pressure to make six to eight stops from approximately 30 mph. Follow this with six to eight stops from approximately 60 mph; making each stop at a one-mile interval.

Wheel Cylinder

REMOVAL AND INSTALLATION

1. Jack and support the axle.
2. Remove the wheel and drum.
3. Disconnect the wheel cylinder pipe or hose from the fitting at the flange plate.
4. Disconnect the brake shoe retracting spring from the brake shoes.
5. On rear wheels remove the two cap screws which hold the rear wheel cylinder to the flange plate and remove the wheel cylin der.
6. On front wheels remove the anchor pin which holds the front wheel cylinder to the flange plate and remove the wheel cylinder.

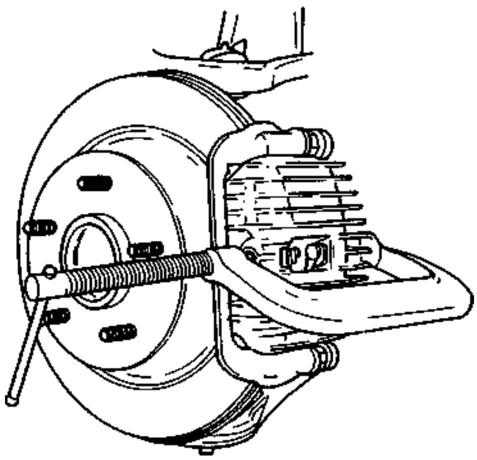
OVERHAUL

Wheel cylinder overhaul procedures are similar to those for the master cylinder. Overhaul kits containing the necessary replacements are readily available. When rebuilding and installing the wheel cylinders, avoid introducing contaminants into the system. Piston- to-cylinder clearance should be 0.003 in. to 0.006 in. and is checked in the same manner as for the master cylinder. Cleaning and honing procedures are the same.

To reassemble, moisten the pistons and cups with clean brake fluid and position the spring in the center of the cylinder. Install the rubber cups—flat side Out—followed by the pistons—flat side in. Complete the assembly with the push rods and protective boots. The front wheel cylinder housings are secured to the backing pkte by a threaded anchor pin. Torque the pin to 65 ft. Ibs.

Wheel Bearings

Wheel bearing removal and installation and adjustment procedures are covered in Chapter 8.



Using C-clamp to retract the caliper piston for pad removal

1. Pushrod boot
2. Piston
3. Piston cup
4. Housing
5. Fluid inlet
6. Spring
7. Piston cup
8. Piston
9. Pushrod boot

Exploded view of wheel cylinder

Parking Brake

ADJUSTMENT

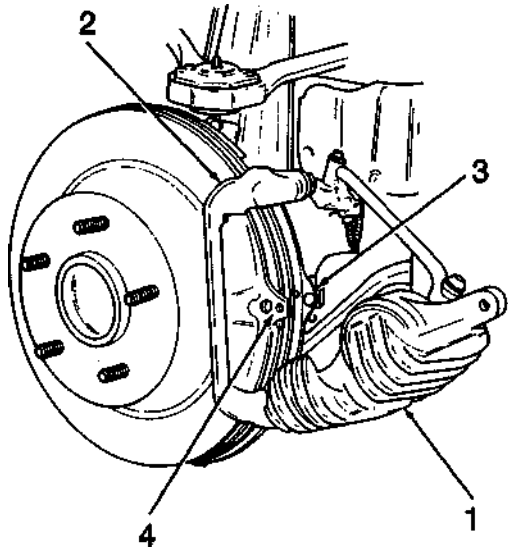
The rear brakes do double duty as both wheel brakes and parking brakes. Such an arrangement makes proper adjustment of the parking brakes dependent upon proper adjustment of the wheel brakes. With the wheel brakes correctly adjusted, remove the idler return spring and loosen the locknut on the convex side of the rear brake cable equalizer. Next, tighten the adjustment nut against the concave side of the equalizer until a 16 Ib strand tension is achieved in the forward brake cable. Tighten the locknut and attach the idler return spring.

DISC BRAKES FRONT OR REAR

Brake Pads

INSPECTION

Brake pads should be replaced when the lining is worn to the approximate thickness of the metal part of the shoe.



Pivot the caliper (1) on the mounting bracket (2) to expose the inboard (3) and outboard (4) brake pads

REPLACEMENT

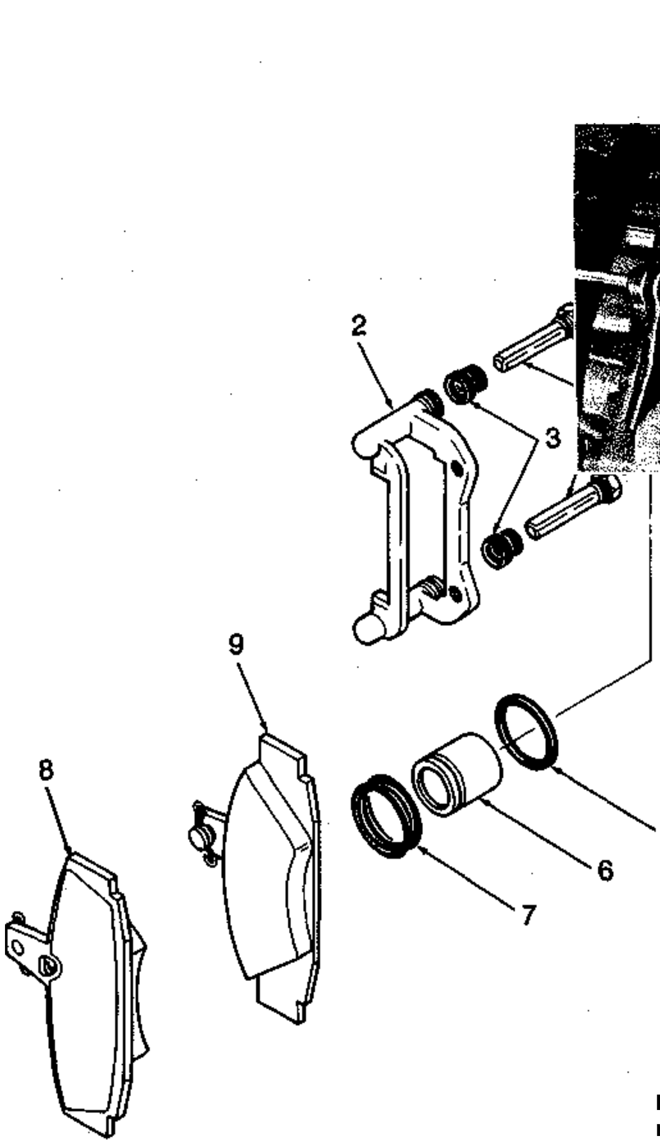
1. Drain % of the brake fluid from the master cylinder.

NOTE: *The insertion of the thicker replacement brakes will push the caliper pistons back into their bores and the resulting hydraulic action mil cause a full master cylinder to overflow.*

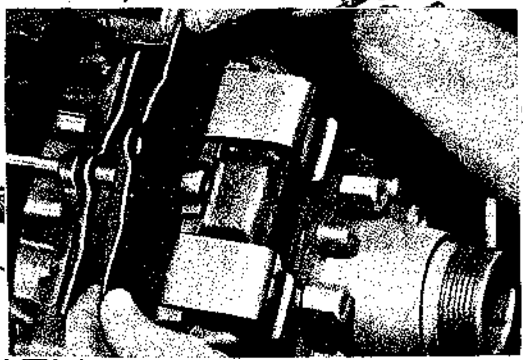
2. Raise and support the car and remove the wheels. On 1984 and later models, use a C-clamp to bottom the caliper piston in its bore.

3. Extract and discard the cotter pin found on the inside end of the brake pad retaining pin(s) (two retaining pins on heavy duty

Exploded view of Girlock caliper assembly on 1984 and later models



10. Guide pin
11. Bleeder screw
12. Cap



Brake pad replacement

brakes). On 1984 and later models, remove and discard the upper self-locking bolt, then rotate the caliper back to expose the pads. The lining wear sensor is on the outboard pad.

4. Withdraw the retaining pin(s) and re move the pads.

5. Force the caliper pistons into their bores and insert the replacement pads.

6. Replace the retaining pins and secure them with new ^{3}/*az* in. x % in. plated cotter pins. On 1984 and later models, install new self-locking bolt and torque to 22-25 ft. Ibs. (30-34 N-m). Bleed the system, if necessary.

Calipers

REMOVAL AND OVERHAUL

1. With the vehicle securely raised and its wheels removed, disconnect the front caliper's brake hose at its support bracket and die rear unit's line from the inside caliper.
2. Tape the open end of each line to pre vent dirt from entering.
3. Pull the cotter pins, retaining pins, and brake pads, and unbolt the caliper from its mounting bracket.
4. Remove the two large bolts and split the caliper case.
5. Remove the fluid transfer hole's O-rings.
6. The pistons are retained by ring-like boots. To remove them, fully depress the pis tons and, with a screwdriver, lever the boots from their seats. Remove the pistons, springs, and seals, using air pressure if necessary.
7. Clean all parts with non-mineral based solvent and compressed air, and replace the rubber parts with those in the brake service kit.
8. Inspect the piston bores for damage or corrosion. Polish corroded bores with crocus cloth and, if this is not enough, replace the caliper. Replace all self-locking bolts.
9. Maintain the proper tolerances by referring to the following chart.

Caliper Piston-to-Bore Clearance

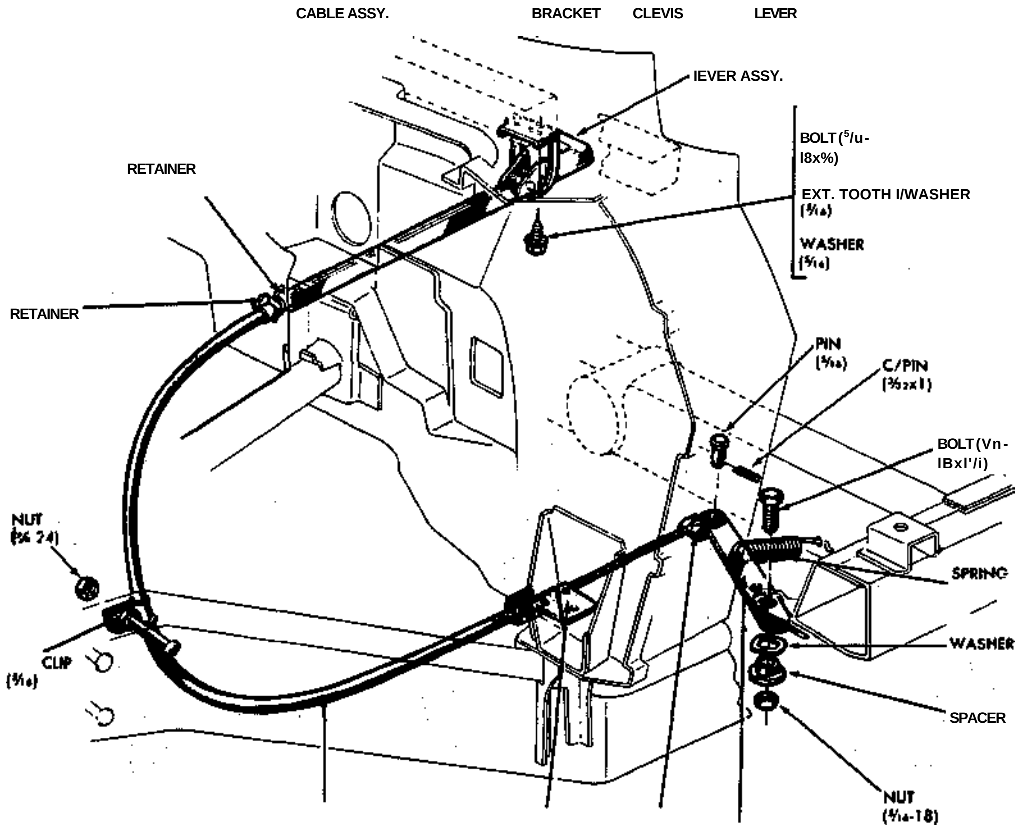
1—3/8in. bore 1 —% in. bore	0.0035-0.009 0.0045-0.010

10. Reverse the disassembly procedure to reassemble. Lubricate parts with brake fluid. NOTE: *Remember, when positioning the piston seal on the piston, that it goes in the groove nearest the pistons flat end with the lap facing the largest end. If placement is correct, the seal lips will be in the groove and not extend over the groove's step. Bleed the brake system after installation.*

Disc

REMOVAL AND MAINTENANCE

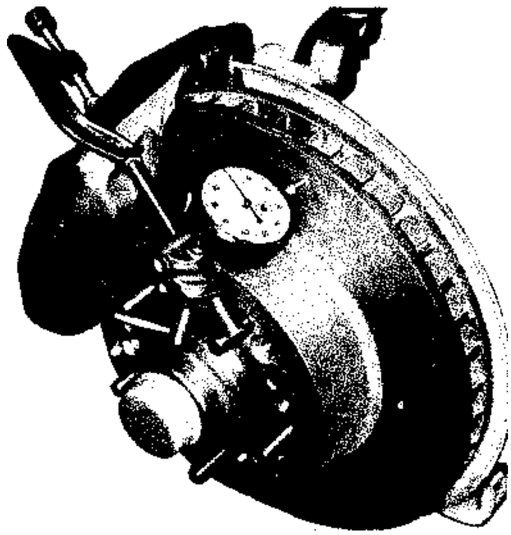
Braking performance is greatly affected by the disc run-out. Lateral run-out must not ex-



1963-64 parking brake assembly

ceed 0.005 in. total. Discs should not be refinished to a thickness of less than 1.215 in. (47/64 in. on 1982 and later)

Should it become necessary to replace the disc, the rivets that attach the disc to its hub must be drilled out. The replacement disc does not have to be riveted to the hub as the lug nuts adequately secure both.



Checking disc run-out

Wheel Bearings

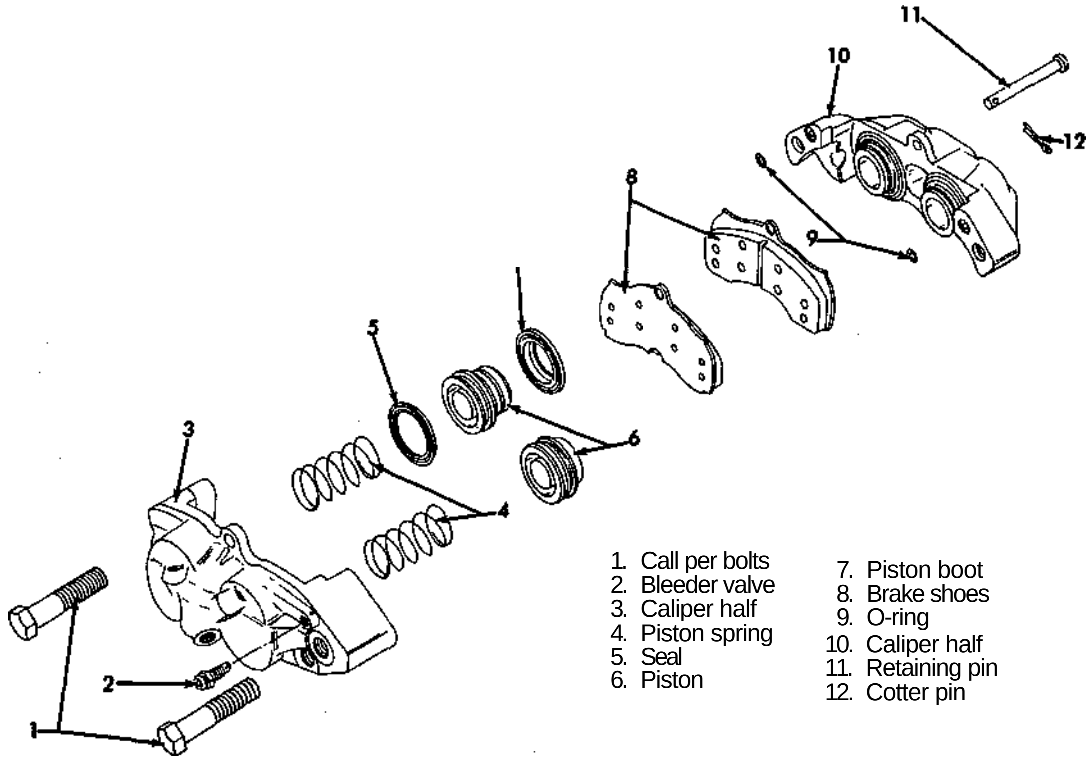
Wheel bearing removal and installation and adjustment procedures are covered in Chapter 8.

PARKING BRAKE

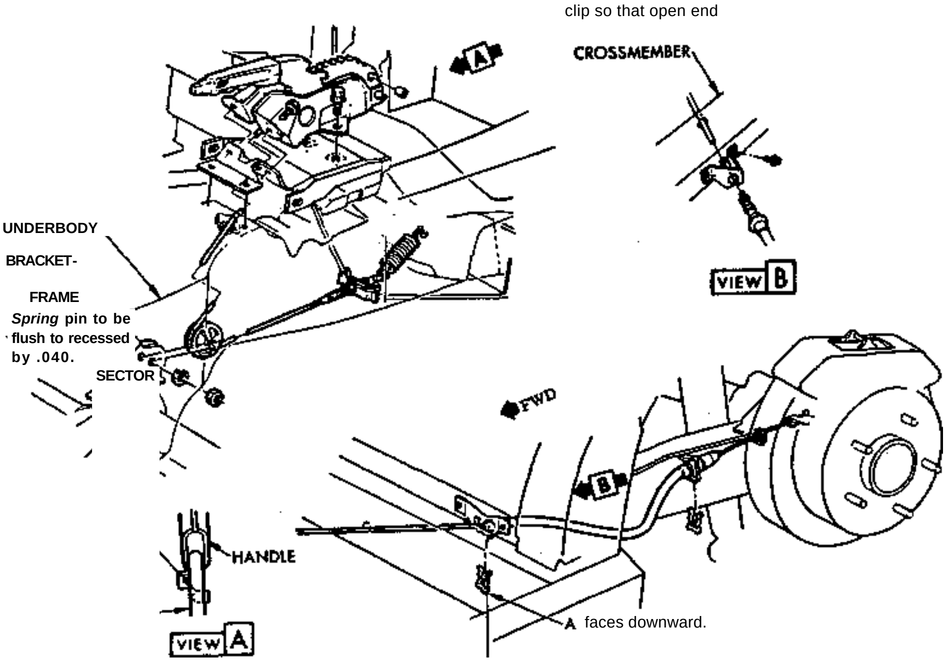
ADJUSTMENT

The parking brake is a conventional drum brake located in the rear wheel disc. Adjustments are similar to those for a regular drum brake.

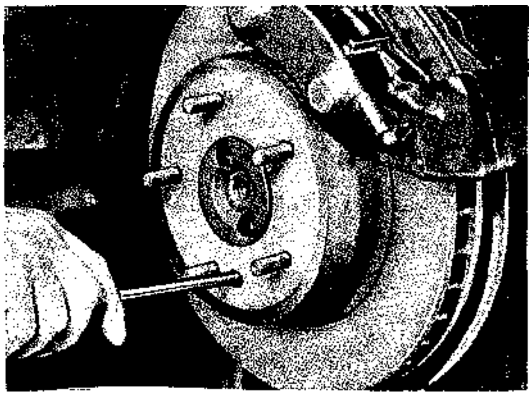
1. Block the front wheels. Jack the rear wheels off the ground and remove the wheels. Release the handbrake.
2. Rotate the disc until the adjusting screw can be seen through the hole in the disc.
3. Loosen the parking brake cables at the equalizer until they go slack. Insert a screw driver and adjust with an up-and-down motion.



Exploded view of callper



Disc brake parking brake cable assembly



Parking brake adjustment on disc brake model

4. Tighten the adjuster until the disc can not move, then back off six to eight notches.

5. Apply the parking brake to the fourth notch. Tighten the cables at the equalizer to -*yve* a light drag with the wheel mounted.

6. Release the parking brake and check for no drag condition.

MAKE SHOE REMOVAL AND REPLACEMENT

1. Jack the car up and remove the wheel and tire.

2. Remove the brake caliper as previously outlined. Do not disconnect the brake line, but remove the line clip from the control arm and hang the caliper above the disc with wire.

3. Drill the disc retaining rivets out and remove the disc from the axle hub.

4. Insert a screwdriver into the adjusting hole and turn the screw several times to ex pand the shoes.

5. Push the brake shoes forward until the front shoe hold-down spring can be seen through the adjusting hole.

6. Insert a pair of needle-nosed pliers through the hole and grasp the hold-down pin. Depress the spring with a screwdriver inserted from the side and turn the pin 90° to free the spring and retainer. Remove the spring and retainer.

7. Repeat this operation on die rear brake shoe.

8. Retract the shoes by turning the ad juster screw. Pull the shoes from the adjuster and remove the adjuster and spring.

9. Separate the shoes at the anchor pin and lift the shoes up and out of the housing, while allowing the straight part of the return spring to go between the outer tip of the an chor pin and the axle flange plate.

10. Lightly lubricate the backing plate shoe

contact surfaces, anchor pin, and adjusting screw threads.

11. Install the return spring on the replacement shoes and position the shoes on the anchor pin.

12. Install the adjuster spring and adjuster. Turn the adjuster screw to expand the shoes.

13. Turn the axle shaft flange so that the adjustment hole aligns with the front hold-down spring pin.

14. Push the shoe forward and over the hold-down pin.

15. Install the spring and retainer over the hold-down pin and using needle-nosed pliers again, and a screwdriver as in Step 6, depress the spring and twist the pin 90°.

16. Repeat the above step on the rear shoe. Another pair of needle-nosed pliers will have to be utilized to hold the pin in position, as head of this pin is not accessible.

17. Turn the adjuster screw to retract the shoes.

18. Install the brake disc onto the studs, making sure that the adjustment holes in the disc and flange align.

19. Install the caliper as previously outlined.

20. Adjust the parking brake as previously described.

21. Install the tire and wheel and lower the car.

22. After installation of new parking brake linings, the shoes should be burnished. At a speed of 50 mph, apply the parking brakes until a slight drag is felt. Keep the brakes on for approximately 50-60 seconds.

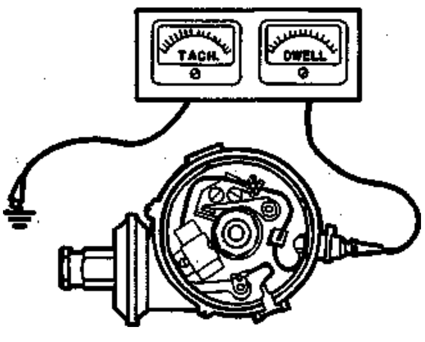
Troubleshooting

10

This section is designed to aid in the quick, accurate diagnosis of automotive problems. While automotive repairs can be made by many people, accurate troubleshooting is a rare skill for the amateur and professional alike.

In its simplest state, troubleshooting is an exercise in logic. It is essential to realize that an automobile is really composed of a series of systems. Some of these systems are interrelated; others are not. Automobiles operate within a framework of logical rules and physical laws, and the key to troubleshooting is a good understanding of all the automotive systems.

This section breaks the car or truck down into its component systems, allowing the problem to be isolated. The charts and diagnostic road maps list the most common problems and the most probable causes of trouble. Obviously it would be impossible to list every possible problem that could happen along with every possible cause, but it will locate MOST problems and eliminate a lot of unnecessary guesswork. The systematic format will locate problems within a given system, but, because many automotive systems are interrelated, the solution to your particular problem may be found in a number of systems on the car or truck.



Tech-dwell hooked-up to distributor

USING THE TROUBLESHOOTING CHARTS

This book contains all of the specific information that the average do-it-yourself mechanic needs to repair and maintain his or her car or truck. The troubleshooting charts are designed to be used in conjunction with the specific procedures and information in the text. For instance, troubleshooting a point-type ignition system is fairly standard for all models, but you may be directed to the text to find procedures for troubleshooting an individual type of electronic ignition. You will also have to refer to the specification charts throughout the book for specifications applicable to your car or truck.

TOOLS AND EQUIPMENT

The tools illustrated in Chapter 1 (plus two more diagnostic pieces) will be adequate to troubleshoot most problems. The two other tools needed are a voltmeter and an ohmmeter. These can be purchased separately or in combination, known as a VOM meter.

In the event that other tools are required, they will be noted in the procedures.

Troubleshooting Engine Problems

See Chapters 2, 3, 4 for more information and service procedures.

Index to Systems

System	.•;• U>iV^V;To>esr ;'.C ;:''•;;' ;;;.-%	Group
Battery	Engine need not be running	1
Starting system	Engine need not be running	2
Primary electrical system	Engine need not be running	3
Secondary electrical system	Engine need not be running	4
Fuel system	Engine need not be running	5
Engine compression	Engine need not be running	6
Engine vacuum	Engine must be running	7
Secondary electrical system	Engine must be running	8
Valve train	Engine must be running	9
Exhaust system	Engine must be running	10
Cooling system	Engine must be running	11
Engine lubrication	Engine must be running	12

Index to Problems

Problem: Symptom	*Begin at Specific Diagnosis,* Number
Engine Won't Start:	
Starter doesn't turn	
Starter turns, engine doesn't	1.1, 2.1
Starter turns engine very slowly	2.1 2.4
Starter turns engine normally	1.1, 4.1
Starter turns engine very quickly	3.1
Engine fires intermittently	,
Engine fires consistently	6.1
Engine Runs Poorly:	5.1 6 1
Hard starting	3.1 4 1 5 . 8.
Rough idle	1 1
Stalling	4.1 5 1 8 .
Engine dies at high speeds	3.1 4 1 5 . 8.
Hesitation (on acceleration from	4.1 5 ,
standing stop)	5.1 8 1
Poor pickup	
Lack of power	4.1 5 1 8 ,
Backfire through the carburetor	1 3.1 4 1 5 . 8.
Backfire through the exhaust	4.1 8 1 9.1
Blue exhaust gases Black	4.1 8 1 9 1
exhaust gases Running on (after	6.1 7 1
the ignition is	5.1
shut off)	3.1 8.1
Susceptible to moisture	
Engine misfires under load	4.1
Engine misfires at speed	4.1, 7.1, 8.4, 9.1
Engine misfires at idle	4.1, 8.4
	3.1,4.1,5.1,7.1,8.4

Sample Section

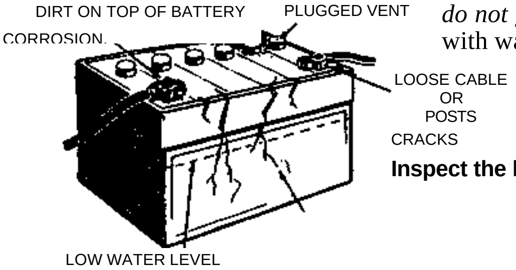
Test and Procedure	*Results and Indications*	*Proceed to*
4.1—Check for spark: Hold, each spark plug wire approximately *W* from ground with gloves or a heavy, dry rag. Crank the engine and observe the spark. ---------------------------------	• If no spark is evident: ----------	-»4.2 -
	—> If spark is good in some cases:	»4.3 -
	—* If spark is good in all cases:—	»4.6

Specific Diagnosis

This section is arranged so that following each test, instructions are given to proceed to another, until a problem is diagnosed.

Section 1—Battery

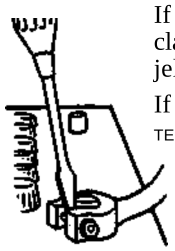
Test and Procedure	*Results and Indications*	*Proceed to*
1.1—Inspect the battery visually for case condition (corrosion, cracks) and water level.	If case is cracked, replace battery:	
	If the case is intact, remove corrosion with a solution of baking soda and water (CAUTION: *do not get the solution into the battery),* and fill with water:	



Inspect the battery case

1.4 1.2

1.2—Check the battery cable connections: Insert a screwdriver between the battery post and the cable clamp. Turn the headlights on high beam, and observe them as the screwdriver is gently twisted to ensure good metal to metal contact.



BATTERY CABLE CONNECTIONS USING A SCREWDRIVER

If the lights brighten, remove and clean the clamp and post; coat the post with petroleum jelly, install and tighten the clamp: 1.4

If no improvement is noted: 1.3

TESTING

1.3—Test the state of charge of the battery using an individual cell tester or hydrometer.

If indicated, charge the battery. **NOTE:** // *no obvious reason exists for the low state of charge (i.e., battery age, prolonged storage), proceed to:* 1.4

Specific Gravity (@ 80° F.)

ADD THIS NUMBER TO THE HYDROMETER - READING TO OBTAIN THE CORRECTED SPECIFIC GRAVITY

SUBTRACT THIS NUMBER FROM THE - HYDROMETER READING TO OBTAIN THE CORRECTED SPECIFIC GRAVITY

Minimum	*Battery Charge*
1.260	100% Charged
1.230	75% Charged
1.200	50% Charged
1.170	25% Charged
1.140	Very Little Power Left
1.110	Completely Discharged

The effects of temperature on battery specific gravity (left) and amount of battery charge in relation to specific gravity (right)

1.4—Visually inspect battery cables for cracking, bad connection to ground, or bad connection to starter.

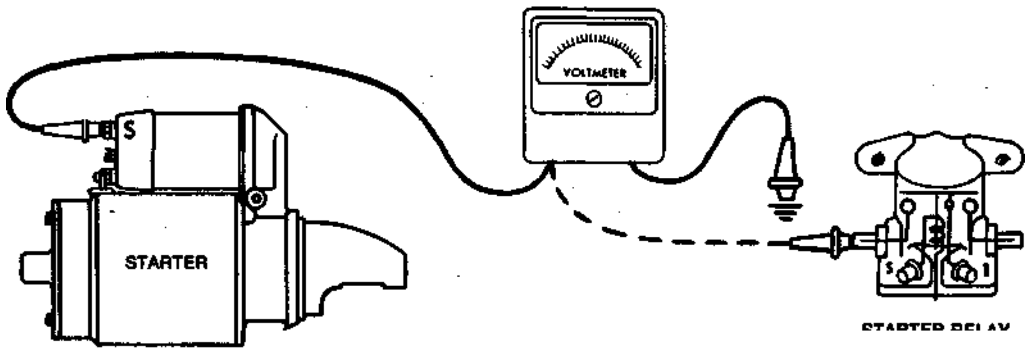
If necessary, tighten connections or replace the cables: 2.1

Section 2—Starting System

See Chapter 3 for service procedures

Note: Tests in Croup 2 are performed with coil high tension lead disconnected to prevent accidental starting.

7esf and Procedure	Results and Indications	Proceed to
2.1—Test the starter motor and solenoid: Connect a juniper from the battery post of the solenoid (or relay) to the starter post of the solenoid (or relay).	If starter turns the engine, normally:	.2.2,
	If the starter buzzes, or turns the engine very slowly:	2.4
	If no response, replace the solenoid (or relay).	**3.1**
	If the starter turns, but the engine doesn't, ensure that the flywheel ring gear is intact. If the gear is undamaged, replace the starter drive.	**3.1**
2.2—Determine whether ignition override switches are functioning properly (clutch start switch, neutral safety switch), by connecting a jumper across the switch(es), and turning the ignition switch to "start".	If starter operates, adjust or replace switch:	**3.1**
	If the starter doesn't operate: '	2.3
2.3—Check the ignition switch "start" position: Connect a 12V test lamp or voltmeter between the starter post of the solenoid (or relay) and ground. Turn the ignition switch to the "start" position, and jiggle the key.	If the lamp doesn't light or the meter needle doesn't move when the switch is turned, check the ignition switch for loose connections, cracked insulation, or broken wires. Repair or replace as necessary:	**3.1 3.3**
	If the lamp flickers or needle moves when the key is jiggled, replace the ignition switch.	

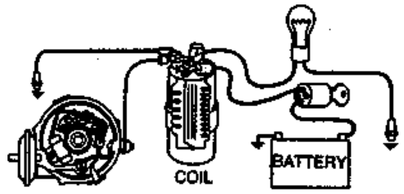


Checking the ignition switch "start" position

2.4—Remove and bench test the starter, according to specifications in the engine electrical section.	If the starter does not meet specifications, repair or replace as needed:	**3.1**
	If the starter is operating properly:	**2.5**
2.5—Determine whether the engine can turn freely: Remove the spark plugs, and check for water in the cylinders. Check for water on the dipstick, or oil in the radiator. Attempt to turn the engine using an 18" flex drive and socket on the crankshaft pulley nut or bolt.	If the engine will turn freely only with the spark plugs out, and hydrostatic lock (water in the cylinders) is ruled out, check valve timing:	**9.2**
	If engine will not turn freely, and it is known that the clutch and transmission are free, the engine must be disassembled for further evaluation:	**Chapter** 3

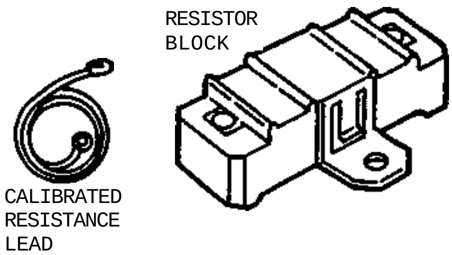
Section 3—Primary Electrical System

Test and Procedure	Results and Indications	Proceed to
3.1 —Check the ignition switch "on" position: Connect a jumper wire between the distributor side of the coil and ground, and a 12V test lamp between the switch side of the coil and ground. Remove the high tension lead from the coil. Turn the ignition switch on and jiggle the key.	If the lamp lights:	3.2
	If the lamp flickers when the key is jiggled, replace the ignition switch:	3.3
	If the lamp doesn't light, check for loose or open connections. If none are found, remove the ignition switch and check for continuity. If the switch is faulty, replace it:	3.3



Checking the ignition switch "on" position

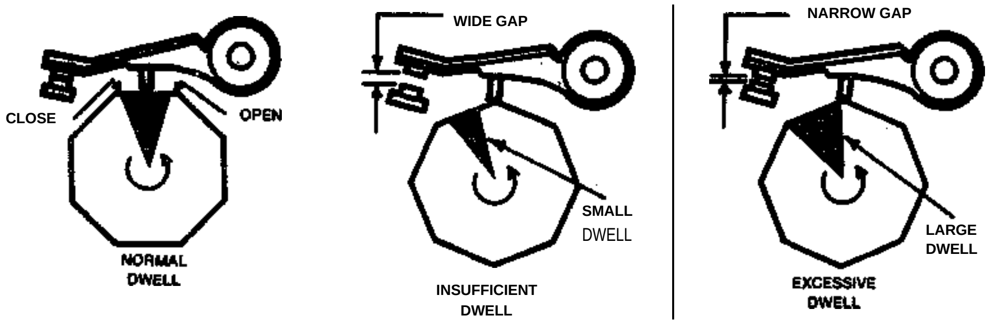
Test and Procedure	Results and Indications	Proceed to
3.2—Check the ballast resistor or resistance wire for an open circuit, using an ohmmeter. See Chapter 3 for specific tests.	Replace the resistor or resistance wire if the resistance is zero. **NOTE:** *Some ignition systems have no ballast resistor.*	3.3



Two types of resistors

Test and Procedure	Results and Indications	Proceed to
3.3—On point-type ignition systems, visually inspect the breaker points for burning, pitting or excessive wear. Gray coloring of the point contact surfaces is normal. Rotate the crankshaft until the contact heel rests on a high point of the distributor cam and adjust the point gap to specifications. On electronic ignition models, remove the distributor cap and visually inspect the armature. Ensure that the armature pin is in place, and that the armature is on tight and rotates when the engine is cranked. Make sure there are no cracks, chips or rounded edges on the armature.	If the breaker points are intact, clean the contact surfaces with fine emery cloth, and adjust the point gap to specifications. If the points are worn, replace them. On electronic systems, replace any parts which appear defective. If condition persists:	3.4

Test and Procedure	Results and Indications	Proceed to "•!
3.4—On point-type ignition systems, connect a dwell-meter between the distributor primary lead and ground. Crank the engine and observe the point dwell angle. On electronic ignition systems, conduct a stator (magnetic pickup assembly) test. See Chapter 3.	On point-type systems, adjust the dwell angle if necessary. **NOTE:** *Increasing the point gap decreases the dwell angle and vice-versa.*	3.6 3.5
	If the dwell meter shows little or no reading;	
	On electronic ignition systems, if the stator is bad, replace the 'stator. If the stator is good, proceed to the other tests in Chapter 3.	

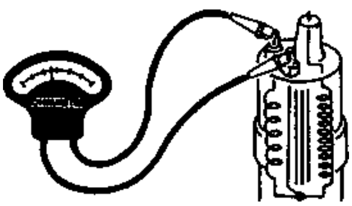


Dwell Is a function of point gap

Test and Procedure	Results and Indications	Proceed to
3.5—On the point-type ignition systems, check the condenser for short: connect an ohmeter across the condenser body and the pigtail lead.	If any reading other than infinite is noted, replace the condenser	3.6

Checking the condenser for short

Test and Procedure	Results and Indications	Proceed to
3.6—Test the coil primary resistance: On point-type ignition systems, connect an ohmmeter across the coil primary terminals, and read the resistance on the low scale. Note whether an external ballast resistor or resistance wire is used. On electronic ignition systems, test the coil primary resistance as in Chapter 3.	Point-type ignition coils utilizing ballast resistors or resistance wires should have approximately 1.0 ohms resistance. Coils with internal resistors should have approximately 4.0 ohms resistance. If values far from the above are noted, replace the coil.	4.1

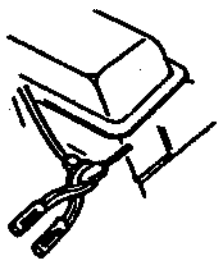


Check the coll primary resistance

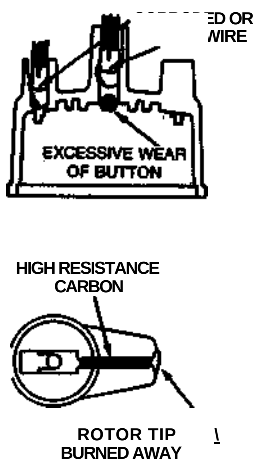
Section 4—Secondary Electrical System

See Chapters 2-3 for service" procedures

Test'and Procedure	Results and Indications	Proceed to
4.1 —Check for spark: Hold each spark plug wire approximately %" from ground with gloves or a heavy, dry rag. Crank the engine, and observe the spark.	If no spark is evident:	**4.2 4.3**
	If spark is good in some cylinders:	**4.6**
	If spark is good in all cylinders:	
4.2—Check for spark at the coil high tension lead: Remove the coil high tension lead from the distributor and position it approximately Vi" from ground. Crank the engine and observe spark. **CAUTION:** ***This test should not be performed on engines equipped with electronic ignition.***	If the spark is good and consistent:	**4.3**
	If the spark is good but intermittent, test the primary electrical system starting at 3.3:	**3.3**
	If the spark is weak or non-existent, replace the coil high tension lead, clean and tighten all connections and retest. If no improvement is noted:	**4.4**
4.3—Visually inspect the distributor cap and rotor for burned or corroded contacts, cracks, carbon tracks, or moisture. Also check the fit of the rotor on the distributor shaft (where applicable).	If moisture is present, dry thoroughly, and retest per 4.1:	**4.1**
	If burned or excessively corroded contacts, cracks, or carbon tracks are noted, replace the defective part(s) and retest per 4.1:	**4.1**
	If the rotor and cap appear intact, or are only slightly corroded, clean the contacts thoroughly (including the cap towers and spark plug wire ends) and retest per 4.1:	
	If the spark is good in all cases:	**4.6**
	If the spark is poor in all cases:	**4.5**

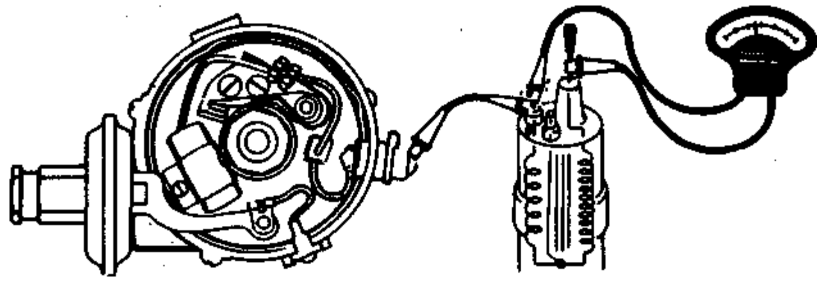


Check for spark at the plugs



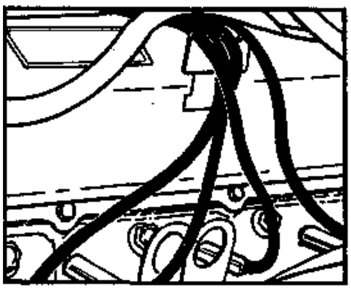
Inspect the distributor cap and rotor

Test and Procedure	*Results and Indications*	Proceed to
4.4—Check the coil secondary resistance: On point-type systems connect an ohmmeter across the distributor side of the coil and the coil tower. Read the resistance on the high scale of -the ohmmeter. On electronic ignition systems, see Chapter 3 for specific tests.	The resistance of a satisfactory coil should be between 4,000 and 10,000 ohms; If resistance is considerably higher (i.e., 40,000 ohms) replace the coil and retest per 4.1. **NOTE:** *This does not apply to high performance coils.*	

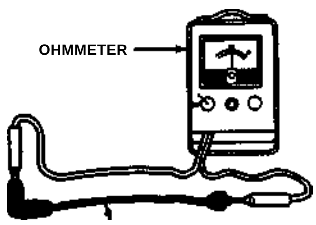


Testing the coll secondary resistance

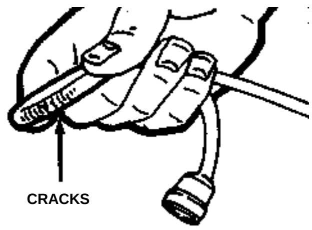
Test and Procedure	*Results and Indications*	Proceed to
4.5—Visually inspect the spark plug wires for cracking or brittleness. Ensure that no two wires are positioned so as to cause induction firing (adjacent and parallel). Remove each wire, one by one, and check resistance with an ohmmeter.	Replace any cracked or brittle wires. If any of the wires are defective, replace the entire set. Replace any wires with excessive resistance (over 8000 fi per foot for suppression wire), and separate any wires that might cause induction firing.	**4.6**



Misfiring can be the result of spark plug leads to adjacent, consecutively firing cylinders running parallel and too close together



On point-type Ignition systems, check the spark plug wires as shown. On electronic Ignitions, do not remove the wire from the distributor cap terminal; Instead, test through the cap



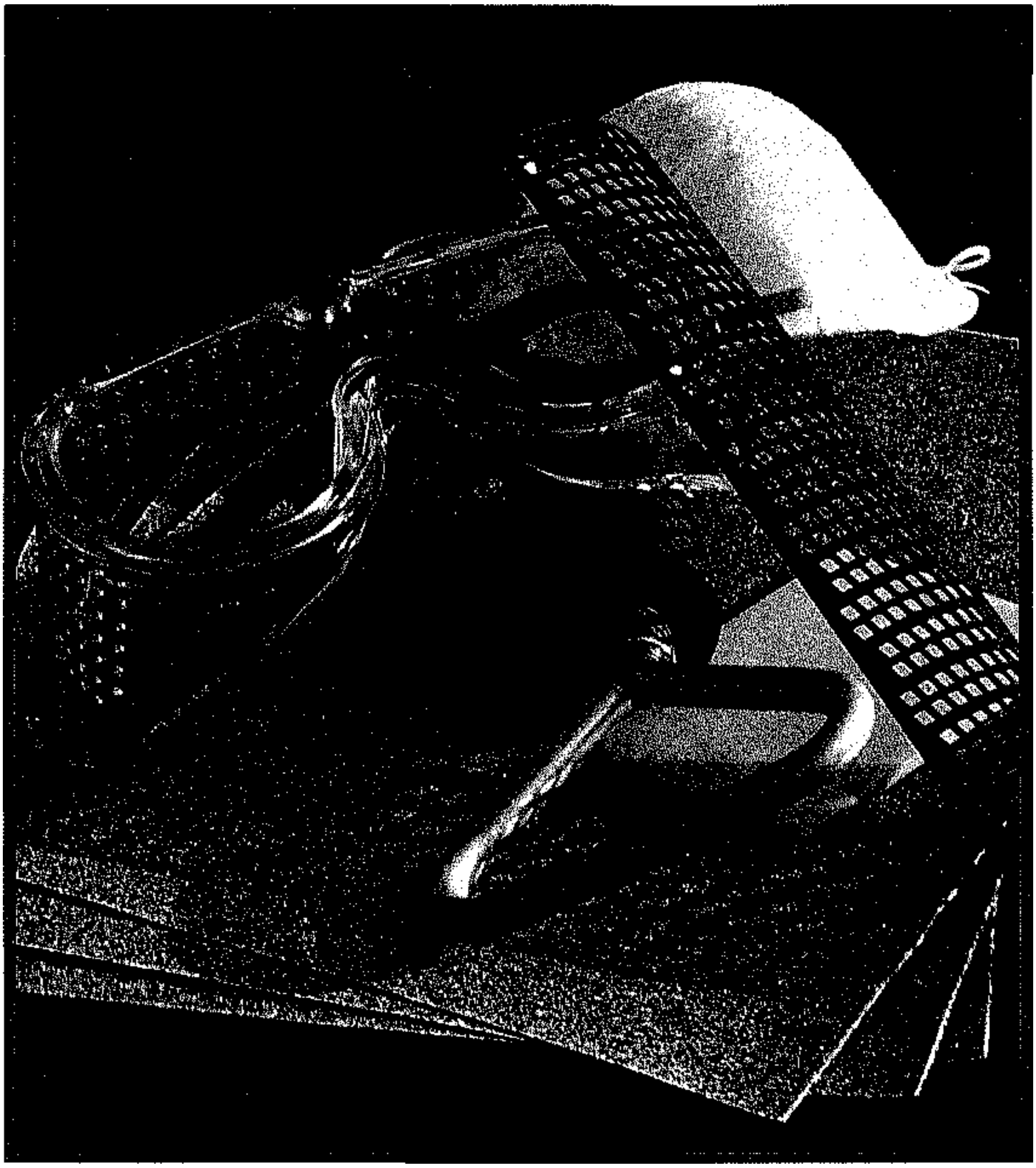
Spark plug wires can be checked visually by bending them In a loop over your finger. This will reveal any cracks, burned or broken Insulation. Any wire with cracked Insulation should be replaced

4.6—Remove the spark plugs, noting the cylinders from which they were removed, and evaluate according to the color photos in the middle of this book.	See following.	**See following.**

CHILTON'S

EASY
STEP-BY-STEP
TIPS FROM PROS

Tools and Materials • Step-by-Step Illustrated Procedures
How To Repair Dents, Scratches and Rust Holes Spray
Painting and Refinishing Tips



With,a little practice, basic body repair procedures can be mastered by any do-it-yourself mechanic. The step-by-step repairs shown here can be applied to almost any type of auto body repair. ,

TOOLS & MATERIALS

You may already have basic tools, such as hammers; and electric drills. Other tools unique to body repair — body hammers, grinding attachments, sanding blocks, dent puller, half-round plastic file and plastic spreaders ,.,-TT are:relatively inexpensive and can be obtained wherever auto parts or auto body repair parts are sold. Portable air compressors arid paint spray guns can be purchased or rented.

Auto Body Repair Kits

The best and most often used products are available to the do-it-yourselfer in .kit form, from major manufacturers of auto body repair products. The same manufacturers also merchandise the individual products for use by pros.

Kits are available to make a wide variety of repairs, including holes, dents and scratches ,and fiberglass, and offer the advantage of buying the materials you'll need; for the job. There is little waste or chance of materials going bad from not being used. Many kits may also .contain basic;body-working tools such as body files, sanding blocks and spreaders. Check the contents of the kit before buying your tools.

: 11 REPAIR TIPS

Safety

Many of the products associated with auto body repair apd refinish-irig cbntain.toxic chemicals. Read all labels before opening containers and store theiti in a safe place and manner.

• Wear eye protection (safety goggles) when using power tools or when performing any operation that involves the removal of any type of material.

• Wear lung protection (disposable mask or respirator) when grinding, sanding or painting.

Sanding

I Sand off paint before using a dent puller. When using a non-adhesive sanding disc, cover the back of the disc with an overlapping layer or two of masking) tape and trim the edges. The disc will last considerably longer.

2 Use the circular motion of the sanding disc to grind *into* the edge of the repair. Grinding or sanding away from the jagged edge will only tear the sandpaper.

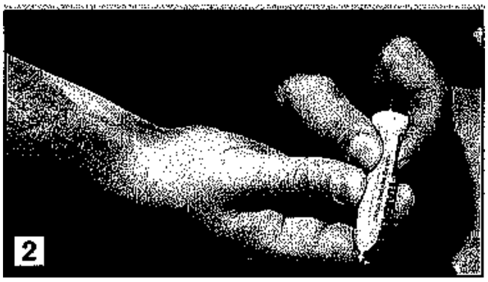
3 Use the palm of your hand flat on the panel to detect high and low spots. Do not use your fingertips. Slide your hand slowly back and forth.

WORKING WITH FILLER

Mixing The Filler

Cleanliness and proper mixing and application are extremely important. Use a clean piece of plastic or glass or a disposable artist's palette to mix body filler.

1 Allow plenty of time and follow directions. No useful purpose will be served by adding more hardener to make it cure (set-up) faster. Less hardener means more curing time, but the mixture dries har,der; more hardener means less curing time but a softer mixture.



2 Both the hardener and the filler should be thoroughly kneaded or stirred before mixing. Hardener should be a solid paste and dispense like thin toothpaste. Body filler should be smooth, and free of lumps or thick spots.

Getting the proper amount of hardener in the filler is the trickiest part of preparing the filler. Use the same amount of hardener in cold or warm weather. For contour filler (thick coats), a bead of hardener twice the diameter of the filler is about right. There's about a 15% margin on either side, but, if in doubt use less hardener.

3 Mix the body filler and hardener by wiping across the mixing surface, picking the mixture up arid wiping it again; Colder weather! requires longer mixing times. Do hot mix in a circular motion; this will trap air bubbles which will become holes in the cured filler.

Applying The Filler

I For best results, filler should not be applied over W thick.

Apply the filler, in several coats. Build it up to above the level of the repair surface so that it can be sanded or grated down.

The first coat of filler must be pressed on with a firm wiping motion.

Apply the filler in one direction only. Working the filler back and forth will either pull it off the metal or trap air bubbles.

REPAIRING DENTS

Before you start, take a few minutes to study the damaged area. Try to visualize the shape of the panel before it was damaged. If the damage is on the left fender, look at the right fender and use it as a guide; If there Is access to the panel from behind, you can reshape it with a body hammer. If not, you'll have to use a dent puller. Go.slovvly and work the metal a little at a time. Get the panel as straight as possible before applying filler.

4 Using an 80-grit grinding disc on an electric drill, grind the paint from the surrounding area down to bare metal. Use a new grinding pad to prevent heat buildup that will warp metal.

I This dent is typical of one that can be pulled out or hammered out from behind. Remove the headlight cover, headlight assembly and turn signal housing.

5 The area should look like this when you're finished grinding. Knock the drill holes in and tape over small openings to keep plastic filler out.

2 Drill a series of holes 1/a the size of the end of the dent puller along the stress line. Make some trial pulls and assess the results. If necessary, drill more holes and try again. Do not hurry.

6 Mix the body filler (see Body Repair Tips). Spread the body filler evenly over the entire area (see Body Repair

3 If possible, use a body hammer and block to shape the metal back to its original contours. Get the metal back as close to its original shape as possible. Don't depend on body filler to fill dents.

Tips). Be sure to cover the area com pletely.

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7 Let the body filler dry until the surface can just be scratched with your fingernail. Knock the high spots from the body filler with a body file ("Cheese-grater"). Check frequently with the palm of your hand for high and low spots.

8 Check to be sure that trim pieces that will be installed later will fit exactly. Sand the area with 40-grit paper.

(If you wind up with low spots, you may have to apply another layer of filler.

,j/% Knock the high spots off with 40-IW grit paper. When you are satisfied with the contours of the repair, apply a thin coat of filler to cover pin holes and scratches.

,4,4 Block sand the area with 40-grit • 1 paper to a smooth finish. Pay particular attention to body lines and ridges that must be well-defined.

4 *f%* Sand the area with 400 paper and • *• then finish with a scuff pad. The finished repair is ready for priming and painting (see Painting Tips).

Materials and photos courtesy of Rltt Jones Auto Body, Prospect Park, PA. ,

REPAIRING RUST HOIK

There are many ways to repair rust holes. The fiberglass cloth kit shown here is one of the most cost efficient for the owner because it provides a strong repair that resists cracking and moisture and is relatively easy to use. It can be used on large and small holes (with or without backing) and can be applied over contoured areas. Remember, however, that short of replacing an entire panel, no repair is a guarantee that the rust will not return.

1 Remove any trim that will be in the way. Clean away all loose debris. Cut away all the rusted metal. But be sure to leave enough metal to retain the contour or body shape.

2 Grind away all traces of rust with a 24-grit grinding disc. Be sure to grind back 3-4 inches from the edge of the hole down to bare metal and be sure all traces of paint, primer and rust are removed.

3 Block sand the area with 80 or 100 grit sandpaper to get a clear, shiny surface and feathered paint edge. Tap the edges of the hole inward with a ball peen hammer.

4 If you are going to use release film, cut a piece about 2-3" larger than the area you have sanded. Place the film over the repair and mark the sanded area on the film. Avoid any unnecessary wrinkling of the film.

5 Cut 2 pieces of fiberglass matte to match the shape of the repair. One piece should be about 1" smaller than the sanded area and the second piece should be 1" smaller than the first. Mix enough filler and hardener to saturate the fiberglass material (see Body Repair Tips),

6 Lay the release sheet on a flat surface and spread an even layer of filler, large enough to cover the repair. Lay the smaller piece of fiberglass cloth in the center of the sheet and spread another layer of filler over the fiberglass cloth. Repeat the operation for the larger piece of cloth.

[redacted]

7 Place the repair material over the repair area, with the release film facing outward. Use a spreader arid work from the center outward to smooth the material, following the body contours. Be sure to remove all air bubbles.

8 Wait until the repair has dried tack-free and peel off the release sheet. The ideal working temperature is 60°-90° F. Cooler or warmer temperatures or high humidity may require additional curing time. Wait longer, if in doubt.

9 Sand and feather-edge the entire area. The initial sanding can be done with a sanding disc on an electric drill if care is used. Finish the sanding with a block sander. Low spots can be filled with body filler; this may require several applications.

4^ When the filler can just be lw scratched with a fingernail, knock the high spots down with a body file and smooth the entire area with 80-grit. Feather the filled areas into the surrounding areas.

^^ When the area is sanded smooth, IB mix some topcoat and hardener and apply it directly with a spreader. This will give a smooth finish and prevent the glass matte from showing through the paint.

4 O Block sand the topcoat smooth • M with finishing sandpaper (200 grit), and 400 grit. The repair is ready for masking, priming and painting (see Painting Tips).

Materials and photos courtesy Marson Corporation, Chelsea, Massachusetts

PAINTING TIPS

Preparation

1 SANDING — Use a 400 or 600 grit wet or dry sandpaper. Wet-sand the area with a 1/4 sheet of sandpaper soaked in clean water. Keep the paper wet while sanding. Sand the area until the repaired area tapers into the original finish.

2 'CLEANING — Wash the area to be painted thoroughly with water and a clean rag. Rinse it thoroughly and wipe the.surface dry until you're sure it's completely free of dirt, dust, fingerprints, wax; detergent or other foreign matter.

3 MASKING — Protect any areas you don't want to overspray by covering them with masking tape and newspaper. Be careful not get fingerprints on the area to be painted,

4 PRIMING — All exposed metal should be primed before painting. Primer protects the metal and provides an excellent surface for paint adhesion. When the primer is dry, wet-sand the area again with 600 grit wet-sandpaper. Clean the area again after sanding.

Painting Techniques

Paint applied from either a spray gun or a spray can (for small areas) will provide good results. Experiment on an old piece of'metal to get the right combl;-nation before you begin painting.

SPRAYING VISCOSITY (SPRAY GUN ONLY) — Paint should be thinned to spraying viscosity according to the di rections oh the can. Use only the recom mended thinner or reducer and the same amount of reduction regardless of temperature.

AIR PRESSURE (SPRAY GUN ONLY) r- This is extremely important. Be sure you are using the proper recommended pressure.

TEMPERATURE — the surface to be painted should be approximately the same temperature as the surrounding air. Applying warm paint, to a cold surface, or vice versa, will completely upset the paint characteristics;

THICKNESS — Spray with smooth strokes. In general, the thicker the coat of paint, the longer the drying time. Apply several thin coats about 30 seconds ,' apart. The paint should remain wet long enough to flow out and no longer; ; heavier coats will only produce sags or wrinkles. Spray a light (fog) coat, followed by heavier color coats.

DISTANCE — The Ideal spraying distance is 8"-12" from the gun or can to the surface. Shorter distances will pro-: duce ripples, while greater distances will result in orange peel, dry film and poor color match and loss of material due to overspray.

OVERLAPPING — the gun or can should be kept at right angles to the surface at all times. Work; to a wet edge at an even .speed, using a 50% overlap and direct the center of the spray at the lower or nearest edges of the previous stroke.

RUBBING OUT (BLENDING) FRESH PAINT — Let the paint dry thoroughly,! Runs or imperfections can be sanded out, primed and repainted.

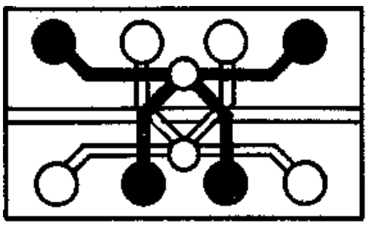
Don't be in too big a hurry to remove the masking. This only produces paint ridges. When the finish has dried for at least a week, apply a small amount of fine grade rubbing compound with a clean, wet cloth. Use lots of water and blend the new paint with the surrounding area.

WRONG	CORRECT	WRONG
Thin coat. Stroke too fast, not enough overlap, gun too far away.	*Medium coat. Proper distance, good stroke, proper overlap.*	*Heavy coat. Stroke too slow, too much overlap, gun too close.*

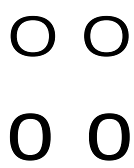
Test and Procedure	Results and Indications	Proceed to
4.7—Examine the location of all the plugs.	The following diagrams illustrate some of the conditions that the location of plugs will reveal.	4.8

Two adjacent plugs are fouled in a 6-cylinder engine, 4-cylinder engine or either bank of a V-8. This is probably due to a blown head gasket between the two cylinders

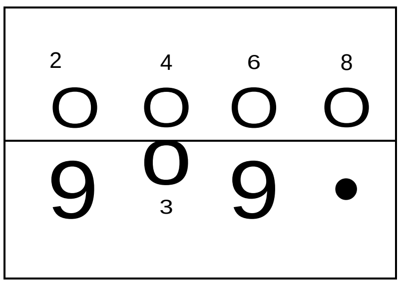
The two center plugs in a 6-cylinder engine are fouled. Raw fuel may be "boiled" out of the carburetor into the intake manifold after the engine is shut-off. Stop-start driving can also foul the center plugs, due to overly rich mixture. Proper float level, a new float needle and seat or use of an insulating spacer may help this problem



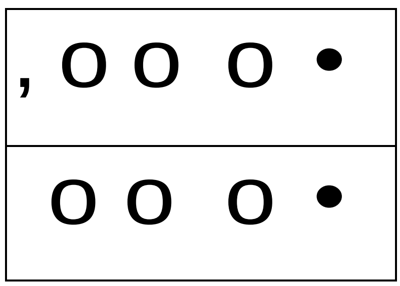
An unbalanced carburetor is indicated. Following the fuel flow on this particular design shows that the cylinders fed by the right-hand barrel are fouled from overly rich mixture, while the cylinders fed by the left-hand barrel are normal



If the four rear plugs are overheated, a cooling system problem is suggested. A thorough cleaning of the cooling system may restore coolant circulation and cure the problem



Finding one plug overheated may indicate an intake manifold leak near the affected cylinder. If the overheated plug is the second of two adjacent, consecutively firing plugs, it could be the result of ignition cross-firing. Separating the leads to these two plugs will eliminate cross-fire



Occasionally, the two rear plugs in large, lightly used V-8's will become oil fouled. High oil consumption and smoky exhaust may also be noticed. It is probably due to plugged oil drain holes in the rear of the cylinder head, causing oil to be sucked in around the valve stems. This usually occurs in the rear cylinders first, because the engine slants that way

Test and Procedure	Results and Indications	Proceed:
4.8—Determine the static ignition timing. Using the crankshaft pulley timing marks as a guide, locate top dead center on the compression stroke of the number one cylinder.	The rotor should be pointing toward the No. 1 tower in the distributor cap, and, on electronic ignitions, the armature spoke for that cylinder should be lined up with the stator.	4.8
4.9—Check coil polarity; Connect a voltmeter negative lead to the coil high tension lead, and the positive lead to ground (NOTE: *Reverse the hook-up for positive ground systems).* Crank the engine momentarily.	If the voltmeter reads up-scale, the polarity is correct:	5.1
	If the voltmeter reads down-scale, reverse the coil polarity (switch the primary leads):	5.1

Checking coll polarity

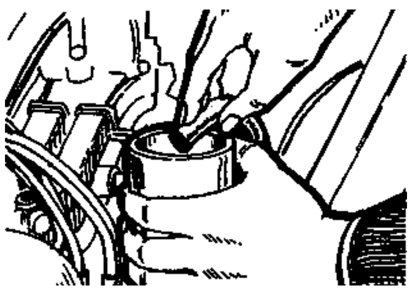
Section 5—Fuel System

See Chapter 4 for service procedures

Test and Procedure	Results and Indications	Proceed to
5.1—Determine that the air filter is functioning efficiently: Hold paper elements up to a strong light, and attempt to see light through the filter.	Clean permanent air filters in solvent (or manufacturer's recommendation), and allow to dry. Replace paper elements through which light cannot be seen:	5.2
5.2—Determine whether a flooding condition exists: Flooding'is identified by a strong gasoline odor, and excessive gasoline present in the throttle bore(s) of the carburetor.	If flooding is not evident:	5.3
	If flooding is evident, permit the gasoline to dry for a few moments and restart. If flooding doesn't recur:	5.7
	If flooding is persistent:	5.5

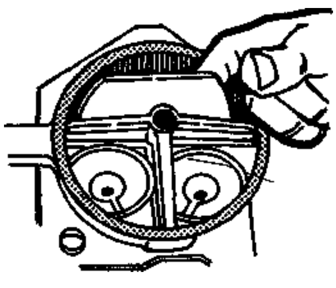
If the engine floods repeatedly, check the choke butterfly flap

Test and Procedure	Results and Indications	Proceed to
5.3—Check that fuel is reaching the carburetor: Detach the fuel line at the carburetor inlet. Hold the end of the line in a cup (not styrofoam), and crank the engine.	If fuel flows smoothly:	5.7
	If fuel doesn't flow (NOTE: *Make sure that there is fuel in the tank),* or flows erratically:	5.4



Check the fuel pump by disconnecting the output line (fuel pump-to-carburetor) at the carburetor and operating the starter briefly

Test and Procedure	Results and Indications	Proceed to
5.4—Test the fuel pump: Disconnect all fuel lines from the fuel pump. Hold a finger over the input fitting, crank the engine (with electric pump, turn the ignition or pump on); and feel for suction.	If suction is evident, blow out the fuel line to the. tank with low pressure compressed air until bubbling is heard from the fuel filler neck. Also blow out the carburetor fuel line (both ends disconnected):	5.7
	If no suction is evident, replace or repair the fuel pump: **NOTE:** ***Repeated oil fouling of the spark plugs, or a no-start condition, could be the result of a ruptured vacuum booster pump diaphragm, through which oil or gasoline is being drawn into the intake manifold*** *(where* ***applicable).***	5.7
5.5—Occasionally, small specks of dirt will clog the small jets and orifices in the carburetor. With the engine cold, hold a flat piece of wood or similar material over the carburetor, where possible, and crank the engine.	If the engine starts, but runs roughly the engine is probably not run enough. If the engine won't start:	5.9
5.6—Check the needle and seat: Tap the carburetor in the area of the needle and seat.	If flooding stops, a gasoline additive (e.g., Gumout) will often cure the problem:	5.7
	If flooding continues, check the fuel pump for excessive pressure at the carburetor (accord ing to specifications). If the pressure is nor mal, the needle and seat must be removed and checked, and/or the float level adjusted:	5.7
5.7—Test the accelerator pump by looking into the throttle bores while operating the throttle.	If the accelerator pump appears to be operat ing normally:	5.8
	If the accelerator pump is not operating, the pump must be reconditioned. Where pos sible, service the pump with the carburetor(s) installed on the engine. If necessary, remove the carburetor. Prior to removal:	5.8



Check for gas at the carburetor by looking down the carburetor throat while someone moves the accelerator

Test and Procedure	Results and Indications	Proceed to
5.8—Determine whether the carburetor main fuel system is functioning: Spray a commercial starting' fluid into the carburetor while attempting to start the engine.	If the engine starts, runs for a few seconds, and dies:	5.9
	If the engine doesn't start:	6.1

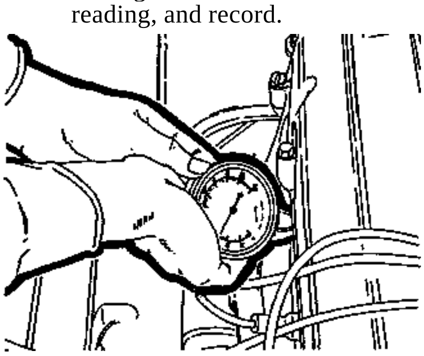
Test and Procedure	Results and Indications	Proceed to
5.9—Uncommon fuel system malfunctions: See below:	If the problem is solved:	6.1
	If the problem remains, remove and recondition the carburetor.	

Condition	Indication	Test	Prevailing Weather Conditions	Remedy
Vapor lock	Engine will not restart shortly after running.	Cool the components of the fuel system until the engine starts. Vapor lock can be cured faster by draping a wet cloth over a mechanical fuel pump.	Hot to very hot	Ensure that the exhaust manifold heat control valve is operating. Check with the vehicle manufacturer for the recommended solution to vapor lock on the model in question.
Carburetor icing	Engine will not idle, stalls at low speeds.	Visually inspect the throttle plate area of the throttle bores for frost.	High humidity, 32-40° F.	Ensure that the exhaust manifold heat control valve is operating, and that the intake manifold heat riser is not blocked.
Water in the fuel	Engine sputters and stalls; may not start.	Pump a small amount of fuel into a glass jar. Allow to stand, and inspect for droplets or a layer of water.	High humidity, extreme temperature changes.	For droplets, use one or two cans of commercial gas line anti-freeze. For a layer of water, the tank must be drained, and the fuel lines blown out with compressed air.

Section 6—Engine Compression

See Chapter 3 for service procedures

Test and Procedure	Results and Indications	Proceed to
6.1 —Test engine compression: Remove all spark plugs. Block the throttle wide open. Insert a compression gauge into a spark plug port, crank the engine to obtain the maximum reading, and record.	If compression is within limits on all cylinders:	7.1
	If gauge reading is extremely low on all cylinders:	6.2 6.2
	If gauge reading is low on one or two cylinders: (If gauge readings are identical and low on two or more adjacent cylinders, the head gasket must be replaced.)	



Checking compression

Test and Procedure	Results and Indications	Proceed to
6.2—Test engine compression (wet): Squirt approximately 30 cc. of engine oil into each cylinder, and retest per 6.1.	If the readings improve, worn or cracked rings or broken pistons are indicated:	See Chapter 3
	If the readings do not improve, burned or excessively carboned valves or a jumped timing chain are indicated: **NOTE:** ***A jumped timing chain is often indicated by difficult cranking.***	7.1

Section 7—Engine Vacuum

See Chapter 3 for service procedures

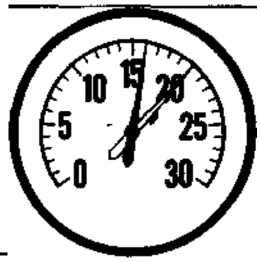
Test and Procedure	*Results and Indications*	Proceed *to*
7.1—Attach a vacuum gauge to the intake manifold beyond the throttle plate. Start the engine, and observe the action of the needle over the range of engine speeds.	See below,	**See below**

INDICATION: normal engine in good condition

Proceed to: 8.1

Normal engine

Gauge reading: steady, from 17-22 in./Hg.



INDICATION: sticking valves or ignition miss

Proceed to: 9.1, 8.3

Sticking valves

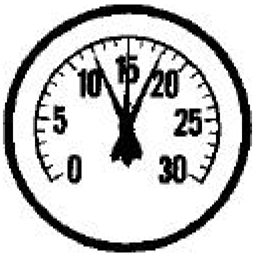
Gauge reading: intermittent fluctuation at idle

INDICATION: late ignition or valve timing, low compression, stuck throttle valve, leaking carburetor or manifold gasket

Proceed to: 6.1

Incorrect valve timing

Gauge reading: low (10-15 in./Hg) but steady



INDICATION: improper carburetor adjustment or minor intake leak.

Proceed to: 7.2

Carburetor requires adjustment

Gauge reading: drifting needle

INDICATION: ignition miss, blown cylinder head gasket, leaking valve or weak valve spring

Proceed to: 8.3, 6.1

Blown head gasket

Gauge reading: needle fluctuates as engine speed increases

INDICATION: burnt valve or faulty valve clearance; Needle will fall when defective valve operates

Proceed to: 9.1

Burnt or leaking valves

Gauge reading: steady needle, but drops regularly

INDICATION: choked muffler, excessive back pressure in system

Proceed to: 10.1

Clogged exhaust system

Gauge reading: gradual drop in reading at idle

INDICATION: worn valve guides

Proceed to: 9.1

Worn valve guides

Gauge reading: needle vibrates excessively at idle, but steadies as engine speed increases

White pointer = steady gauge hand

Black pointer = fluctuating gauge hand

Test and Procedure	Results and Indications	Proceed to
7.2—Attach a vacuum gauge per 7.1, and test for an intake manifold leak. Squirt a small amount of oil around the intake manifold gaskets, carburetor gaskets, plugs and fittings. Observe the action of the vacuum gauge.	If the reading improves, replace the indicated gasket; or seal the indicated fitting or plug: If the reading remains low:	**8.1 7.3**
7.3—Test all vacuum hoses and accessories for leaks as described in 7.2. Also check the carburetor body (dashpots, automatic choke mechanism, throttle shafts) for leaks in the same manner.	If the reading improves, service or replace the offending part(s): If the reading remains low:	**8.1** **6.1**

Section 8—Secondary Electrical System

See Chapter 2 for service procedures

Test and Procedure	Results and Indications	Proceed to
8.1—Remove the distributor cap and check to make sure that the rotor turns when the engine is cranked. Visually inspect the distributor components.	Clean, tighten or replace any components which appear defective.	**8.2**
8.2—Connect a timing light (per manufacturer's recommendation) and check the dynamic ignition timing. Disconnect and plug the vacuum hose(s) to the distributor if specified, start the engine, and observe the timing marks at the specified engine speed.	If the timing is not correct, adjust to specifications by rotating the distributor in the engine: (Advance timing by rotating distributor opposite normal direction of rotor rotation, retard timing by rotating distributor in same direction as rotor rotation.)	**8.3**
8.3—Check the operation of the distributor advance mechanism(s): To test the mechanical advance, disconnect the vacuum lines from the distributor advance unit and observe the timing marks with a timing light as the engine speed is increased from idle. If the mark moves smoothly, without hesitation, it may be assumed that the mechanical advance is functioning properly. To test vacuum advance and/or retard systems, alternately crimp and release the vacuum line, and observe the timing mark for movement. If movement is noted, the system is operating.	If the systems are functioning: If the systems are not functioning, remove the distributor, and test on a distributor tester:	**8.4** **8.4**
8.4—Locate an ignition miss: With the engine running, remove each spark plug wire, one at a time, until one is found that doesn't cause the engine to roughen and slow down.	When the missing cylinder is identified:	**4.1**

Section 9—Valve Train

See Chapter 3 for service procedures

Test and *Procedure*	*Results and Indications*	*Proceed to*
9.1—Evaluate the valve train: Remove the valve cover, and ensure that the valves are adjusted to specifications. A mechanic's stethoscope may be used to aid in the diagnosis of the valve train. By pushing the probe on or near push rods or rockers, valve noise often can be isolated. A timing light also may be used to diagnose valve problems. Connect the light according to manufacturer's recommendations, and start the engine. Vary the firing moment of the light by increasing the engine speed (and therefore the ignition advance), and moving the trigger from cylinder to cylinder. Observe the movement of each valve.	Sticking valves or erratic valve train motion can be observed with the timing light. The cylinder head must be disassembled for repairs.	**See Chapter** 3
9.2—Check the valve timing: Locate top dead center of the No. 1 piston, and install a degree wheel or tape on the crankshaft pulley or damper with zero corresponding to an index mark on the engine. Rotate the crankshaft in its direction of rotation, and observe the opening of the No. 1 cylinder intake valve. The opening should correspond with the correct mark on the degree wheel according to specifications.	If the timing is not correct, the timing cover must be removed for further investigation.	**See Chapter** 3

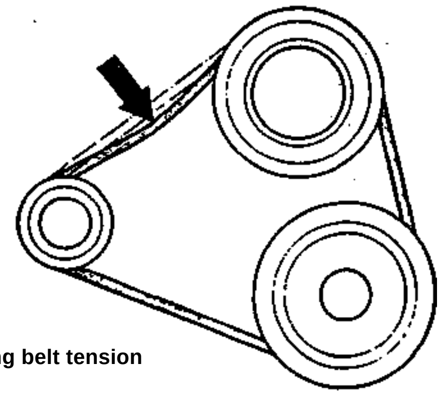
Section 10—Exhaust System

Test arid Procedure	*Results arid Indications*	*Proceed to*
10.1—Determine whether the exhaust manifold heat control valve is operating: Operate the valve by hand to determine whether it is free to move. If the valve is free, run the engine to operating temperature and observe the action of the valve, to ensure that it is opening.	If the valve sticks, spray it with a suitable solvent, open and close the valve to free it, and retest. If the valve functions properly:	**10.2**
	If the valve does not free, or does not operate, replace the valve:	**10.2**
10.2—Ensure that there are no exhaust restrictions: Visually inspect the exhaust system for kinks, dents, or crushing. Also note that gases are flowing freely from the tailpipe at all engine speeds, indicating no restriction in -the muffler or resonator.	Replace any damaged portion of the system:	**11.1**

Section 11—Cooling System

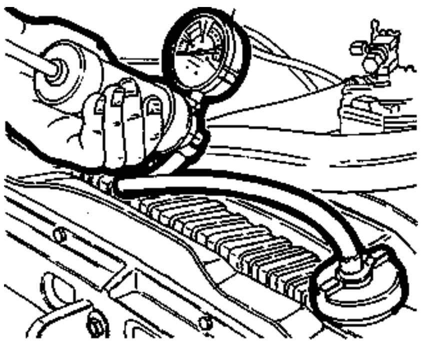
See Chapter 3 for service procedures

Test and Procedure	Results and Indications	Proceed to
11.1—Visually inspect the fan belt for glazing, cracks, and fraying, and replace if necessary. Tighten the belt so that the longest span has approximately *W* play at its mid-point under thumb pressure (see Chapter 1).	Replace or tighten the fen belt as	
11.2—Check the fluid level of the cooling system.		



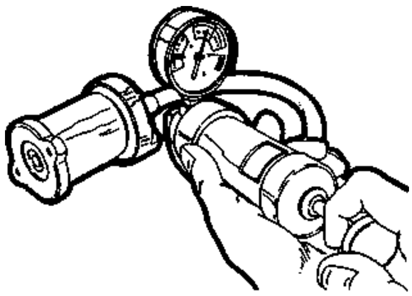
Checking belt tension

Test and Procedure	Results and Indications	Proceed to
	If full or slightly low, fill as necessary:	11.5
	If extremely low:	11.3
11.3—Visually inspect the external portions of the cooling system (radiator, radiator hoses, thermostat elbow, water pump seals, heater hoses, etc.) for leaks. If none are found, pressurize the cooling system to 14-15 psi.	If cooling system holds the pressure:	11.5
	If cooling system loses pressure rapidly, reinspect external parts of the system for leaks under pressure. If none are found, check dip stick for coolant in crankcase. If no coolant is present, but pressure loss continues:	11.4
	If coolant is evident in crankcase, remove cyl inder head(s), and check gasket(s). If gaskets are intact, block and cylinder head(s) should be checked for cracks or holes. If the gasket(s) is blown, replace, and purge the crankcase of coolant:	12.6
	NOTE: *Occasionally, due to atmospheric and driving conditions, condensation of water can occur in the crankcase. This causes the oil to appear milky white. To remedy, run the engine until hot, and change the oil and oil filter.*	
11.4—Check for combustion leaks into the cooling system: Pressurize the cooling system as above. Start the engine, and observe the pressure gauge. If the needle fluctuates, remove each spark plug wire, one at a time, noting which cylinder(s) reduce or eliminate the fluctuation.	Cylinders which reduce or eliminate the fluctuation, when the spark plug wire is removed, are leaking into the cooling system. Replace the head gasket on the affected cylinder bank(s).	



Pressurizing the cooling system

Test and Procedure	Results and Indications	Proceed! to ,
11.5—Check the radiator pressure cap: Attach a radiator pressure tester to the radiator cap (wet the seal prior to installation). Quickly pump up the pressure, noting the point at which the cap releases.	If the cap releases within ± 1 psi of the specified rating, it is operating properly: If the cap releases at more than ± 1 psi of the specified rating, it should be replaced:	11.6 11.6



Checking radiator pressure cap

11.6—Test the thermostat: Start the engine cold, remove the radiator cap, and insert a thermometer into the radiator. Allow the engine to idle. After a short while, there will be a sudden, rapid increase in coolant temperature. The temperature at which this sharp rise stops is the thermostat opening temperature.	If the thermostat opens at or about the specified temperature: If the temperature doesn't increase: (If the temperature increases slowly and gradually, replace the thermostat.)	11.7 11.7
11.7—Check the water pump: Remove the thermostat elbow and the thermostat, disconnect the coil high tension lead (to prevent starting), and crank the engine momentarily.	If coolant flows, replace the thermostat and retest per 11.6: If coolant doesn't flow, reverse flush the cooling system to alleviate any blockage that might exist. If system is not blocked, and coolant will not flow, replace the water pump.	11.6

Section 12—Lubrication

See Chapter 3 for service procedures

\Test and Procedure	Results and Indications	Proceed to
12.1—Check the oil pressure gauge or warning light: If the gauge shows low pressure, or the light is on for no obvious reason, remove the oil pressure sender. Install an accurate oil pressure gauge and run the engine momentarily.	If oil pressure builds normally, run engine for a few moments to determine that it is functioning normally, and replace the sender. If the pressure remains low: If the pressure surges: If the oil pressure is zero:	 12.2 12.3 12.3
12.2—Visually inspect the oil: If the oil is watery or very thin, milky, or foamy, replace the oil and oil filter.	If the oil is normal: If after replacing oil the pressure remains low: If after replacing oil the pressure becomes normal:	12.3 12.3 —

Test and Procedure	Results and Indications	Proceed to
12.3—Inspect the oil pressure relief valve and spring, to ensure that it is not sticking or stuck. Remove and thoroughly clean the valve, spring, and the valve body.	If the oil pressure improves:	
	If no improvement is noted:	**12.4**
12.4—Check to ensure that the oil pump is not cavitating (sucking air instead of oil): See that the crankcase is neither over nor underfull, and that the pickup in the sump is in the proper position and free from sludge.	Fill or drain the crankcase to the proper capacity, and clean the pickup screen in solvent if necessary. If no improvement is noted:	**12.5**
12.5—Inspect the oil pump drive and the oil pump:	If the pump drive or the oil pump appear to be defective, service as necessary and retest per 12.1:	**12.1**
	If the pump drive and pump appear to be operating normally, the engine should be disassembled to determine where blockage exists:	**See Chapter** 3
12.6—Purge the engine of ethylene glycol coolant: Completely drain the crankcase and the oil filter. Obtain a commercial butyl cellosolve base solvent, designated for this purpose, and follow the instructions precisely. Following this, install a new oil filter and refill the crankcase with the proper weight oil. The next oil and filter change should follow shortly thereafter (1000 miles).		

TROUBLESHOOTING EMISSION CONTROL SYSTEMS

See Chapter 4 for procedures applicable to individual emission control systems used on specific combinations of engine/transmission/model.

TROUBLESHOOTING THE CARBURETOR

See Chapter 4 for service procedures

Carburetor problems cannot be effectively isolated unless all other engine systems (particularly ignition and emission) are functioning properly and the engine is properly tuned.

Condition	Possible Cause
Engine cranks, but does not start	1. Improper starting procedure 2. No fuel in tank 3. Clogged fuel line or filter 4. Defective fuel pump 5. Choke valve not closing properly 6. Engine flooded 7. Choke valve not unloading 8. Throttle linkage not making full travel 9. Stuck needle or float 10. Leaking float needle or seat 11. Improper float adjustment
Engine stalls	1. Improperly adjusted idle speed or mixture **Engine hot** 2. Improperly adjusted dashpot 3. Defective or improperly adjusted solenoid 4. Incorrect fuel level in fuel bowl 5. Fuel pump pressure too high 6. Leaking float needle seat 7. Secondary throttle valve stuck open 8. Air or fuel leaks 9. Idle air bleeds plugged or missing 10. Idle passages plugged **Engine Cold** 11. Incorrectly adjusted choke 12. Improperly adjusted fast idle speed 13. Air leaks 14. Plugged idle or idle air passages 15. Stuck choke valve or binding linkage 16. Stuck secondary throttle valves 17. Engine flooding—high fuel level 18. Leaking or misaligned float
Engine hesitates on acceleration	1. Clogged fuel filter 2. Leaking fuel pump diaphragm 3. Low fuel pump pressure 4. Secondary throttle valves stuck, bent or misadjusted 5. Sticking or binding air valve 6. Defective accelerator pump 7. Vacuum leaks 8. Clogged air filter 9. Incorrect choke adjustment (engine cold)
Engine feels sluggish or flat on acceleration	1. Improperly adjusted idle speed or mixture 2. Clogged fuel filter 3. Defective accelerator pump 4. Dirty, plugged or incorrect main metering jets 5. Bent or sticking main metering rods 6. Sticking throttle valves 7. Stuck heat riser 8. Binding or stuck air valve 9. Dirty, plugged or incorrect secondary jets 10. Bent or sticking secondary metering rods. 11. Throttle body or manifold heat passages plugged 12. Improperly adjusted choke or choke vacuum break.
Carburetor floods	1. Defective fuel pump. Pressure too high. 2. Stuck choke valve 3. Dirty, worn or damaged float or needle valve/seat 4. Incorrect float/fuel level 5. Leaking float bowl

Condition	Possible Cause
Engine idles roughly and stalls	1. Incorrect idle speed 2. Clogged fuel filter 3. Dirt in fuel system or carburetor 4. Loose carburetor screws or attaching bolts 5. Broken carburetor gaskets 6. Air leaks 7. Dirty carburetor 8. Worn idle mixture needles 9. Throttle valves stuck open 10. Incorrectly adjusted float or fuel level 11. Clogged air filter
Engine runs unevenly or surges	1. Defective fuel pump 2. Dirty or clogged fuel filter 3. Plugged, loose or incorrect main metering jets or rods 4. Air leaks 5. Bent or sticking main metering rods 6. Stuck power piston 7. Incorrect float adjustment 8. Incorrect idle speed or mixture 9. Dirty or plugged idle system passages 10. Hard, brittle or broken gaskets 11. Loose attaching or mounting screws 12. Stuck or misaligned secondary throttle valves
Poor fuel economy	1. Poor driving habits 2. Stuck choke valve 3. Binding choke linkage 4. Stuck heat riser 5. Incorrect idle mixture 6. Defective accelerator pump 7. Air leaks 8. Plugged, loose or incorrect main metering jets 9. Improperly adjusted float or fuel level 10. Bent, misaligned or fuel-clogged float 11. Leaking float needle seat 12. Fuel leak 13. Accelerator pump discharge ball not seating properly 14. Incorrect main jets
Engine lacks high speed performance or power	1. Incorrect throttle linkage adjustment 2. Stuck or binding power piston 3. Defective accelerator pump 4. Air leaks 5. Incorrect float setting or fuel level 6. Dirty, plugged, worn or incorrect main metering jets or rods 7. Binding or sticking air valve 8. Brittle or cracked gaskets 9. Bent, incorrect or improperly adjusted secondary metering rods 10. Clogged fuel filter 11. Clogged air filter 12. Defective fuel pump

TROUBLESHOOTING FUEL INJECTION PROBLEMS

Each fuel injection system has its own unique 4 of this Repair & Tune-Up Guide for specific components and test procedures, for which it test and repair procedures, if the vehicle is is impossible to generalize. Refer to Chapter equipped with fuel injection.

TROUBLESHOOTING ELECTRICAL PROBLEMS

See Chapter 5 for service procedures

For any electrical system to operate, it must make a complete circuit. This simply means that the power flow from the battery must make a complete circle. When an electrical component is operating, power flows from the battery to the component, passes through the component causing it to perform its function (lighting a light bulb), and then returns to the battery through the ground of the circuit. This ground is usually (but not always) the metal part of the car or truck on which the electrical component is mounted.

Perhaps the easiest way to visualize this is to think of connecting a light bulb with two wires attached to it to the battery. If one of the two wires attached to the light bulb were attached to the negative post of the battery and the other were attached to the positive post of the battery, you would have a complete circuit. Current from the battery would flow to the light bulb, causing it to light, and return to the negative post of the battery.

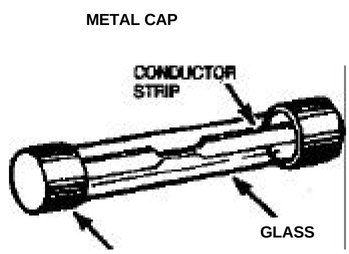
The normal automotive circuit differs from this simple example in two ways. First, instead of having a return wire from the bulb to the battery, the light bulb returns the current to the battery through the chassis of the vehicle. Since the negative battery cable is attached to the chassis and the chassis is made of electrically conductive metal, the chassis of the vehicle can serve as a ground wire to complete the circuit. Secondly, most automotive circuits contain switches to turn components on and off as required.

Every complete circuit from a power source must include a component which is using the power from the power source. If you were to disconnect the light bulb from the wires and touch the two wires together (don't do this) the power supply wire to the component would be grounded before the normal ground connection for the circuit.

Because grounding a wire from a power source makes a complete circuit—less the required component to use the power—this phenomenon is called a short circuit. Common causes are: broken insulation (exposing the metal wire to a metal part of the car or truck), or a shorted switch.

Some electrical components which require a large amount of current to operate also have a relay in their circuit. Since these circuits carry a large amount of current, the thickness of the wire in the circuit (gauge size) is also greater. If this large wire were connected from the component to the control switch on the instrument panel, and then back to the component, a voltage drop would occur in the circuit. To prevent this potential drop in voltage, an electromagnetic switch (relay) is used. The large wires in the circuit are connected from the battery to one side of the relay, and from the opposite side of the relay to the component. The relay is normally open, preventing current from passing through the circuit. An additional, smaller, wire is connected from the relay to the control switch for the circuit. When the control switch is turned on, it grounds the smaller wire from the relay and completes the circuit. This closes the relay and allows current to flow from the battery to the component. The horn, headlight, and starter circuits are three which use relays.

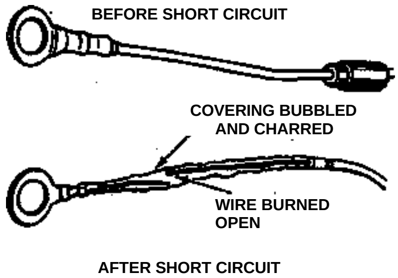
It is possible for larger surges of current to pass through the electrical system of your car or truck. If this surge of current were to reach an electrical component, it could burn it out. To prevent this, fuses, circuit breakers or fusible links are connected into the current supply wires of most of the major electrical systems. When an electrical current of excessive power passes through the component's fuse, the fuse blows out and breaks the circuit, saving the component from destruction.



Typical automotive fuse

A circuit breaker is basically a self-repairing fuse. The circuit breaker opens the circuit the same way a fuse does. However, when either the short is removed from the circuit or the surge subsides, the circuit breaker resets itself and does not have to be replaced as a fuse does.

A fuse link is a wire that acts as a fuse. It is normally connected between the starter relay and the main wiring harness. This connection is usually under the hood. The fuse link (if installed) protects all the



Most fusible .links show a charred, melted Insulation when they burn out

chassis electrical components, and is the probable cause of trouble when none of the electrical components function, unless the battery is disconnected or dead.

Electrical problems generally fall into one of three areas:

1. The component that is not functioning is not receiving current.
2. The component itself is not functioning.
3. The component is not properly ground ed.

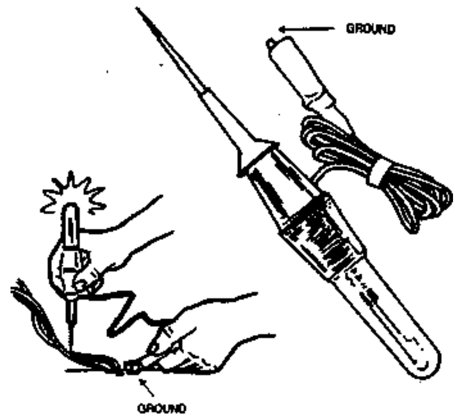
The electrical system can be checked with a test light and a jumper wire. A test light is a device that looks like a pointed screwdriver with a wire attached to it and has a light bulb in its handle. A jumper wire is a piece of insulated wire with an alligator clip attached to each end.

If a component is not working, you must follow a systematic plan to determine which of the three causes is the villain.

1. Turn on the switch that controls the in operable component.
2. Disconnect the power supply wire from the component,
3. Attach the ground wire on the test light to a good metal ground.
4. Touch the probe end of the test light to the end of the power supply wire that was disconnected from the component. If the component is receiving current, the test light will go on.

NOTE: ***Some components work only when the ignition switch is turned on.***

If the test light does not go on, then the problem is in the circuit between the battery and the component. This includes all the switches, fuses, and relays in the system. Follow the wire that runs back to the battery. The problem is an open circuit between the



The test light will show the presence of current when touched to a hot wire and grounded at the other end

battery and the component. If the fuse is blown and, when replaced, immediately blows again, there is a short circuit in the system which must be located and repaired. If there is a switch in the system, bypass it with a jumper wire. This is done by connecting one end of the jumper wire to the power supply wire into the switch and the other end of the jumper wire to the wire coming out'of the switch. If the test light lights with the jumper wire installed, the switch or whatever was bypassed is defective.

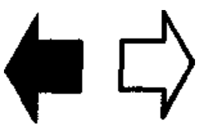
NOTE: ***Never substitute the jumper wire for the component, since it is required to use the power from the power source.***

5. If the bulb in the test light goes on, then the current is getting to the component that is not working. This eliminates the first of the three possible causes. Connect the power supply wire and connect a jumper wire from the component to a good metal ground. Do this with the switch which con trols the component turned on, and also the ignition switch turned on if it is required for the component to work. If the component works with the jumper wire installed, then it has a bad ground. This is usually caused by the metal area on which the component mounts to the chassis being coated with some type of foreign matter.
6. If neither test located the source of the trouble, then the component itself is defec tive. Remember that for any electrical sys tem to work, all connections must be clean and tight.

Troubleshooting Basic Turn Signal and Flasher Problems

See Chapter 5 for service procedures

Most problems in the tum signals or flasher system can be reduced to defective flashers or bulbs, which are easily replaced. Occasionally, the turn signal switch will prove defective. F = Front R=Rear • = Lights off O = Lights on

Condition		Possible Cause
Turn signals light, but do not flash		Defective flasher
No turn signals light on either side		Blown fuse. Replace if defective. Defective flasher. Check by substitution. Open circuit, short circuit or poor ground.
Both turn signals on one side don't work	1 j\/ \j p < 1— 0	Bad bulbs. Bad ground in both (or either) housings.
One turn signal light on one side doesn't work		Defective bulb. Corrosion in socket. Clean contacts. Poor ground at socket.
Turn signal flashes too fast or too slowly		Check any bulb on the side flashing too fast. A heavy-duty bulb is probably installed in place of a regular bulb. Check the bulb flashing too slowly. A standard bulb was probably installed in place of a heavy-duty bulb. Loose connections or corrosion at the bulb socket.
Indicator lights don't work in either direction		Check if the turn signals are working. Check the dash indicator lights. Check the flasher by substitution.
One light indicator light doesn't		On systems with one dash indicator: See if the lights work on the same side. Often the filaments have been reversed in systems combining stoplights with tail-lights and turn signals. Check the flasher by substitution. On systems with two indicators: Check the bulbs on the same side. Check the indicator light bulb. Check the flasher by substitution.

Troubleshooting Lighting Problems

See Chapter 5 for service procedures

Condition	Possible Cause
One or more lights don't work, but others do	1. Defective bulb(s) 2. Blown fuse(s) 3. Dirty fuse clips or light sockets 4. Poor ground circuit
Lights burn out quickly	1. Incorrect voltage regulator setting or de fective regulator 2. Poor battery/alternator connections
Lights go dim	1. Low/discharged battery 2. Alternator not charging 3. Corroded sockets or connections 4. Low voltage output
Lights flicker	1. Loose connection 2. Poor ground. (Run ground wire from light housing to frame) 3. Circuit breaker operating (short circuit)
Lights "flare"—Some flare is normal on acceleration—If excessive, see "Lights Burn Out Quickly"	High voltage setting
Lights glare—approaching drivers are blinded	1. Lights adjusted too high 2. Rear springs or shocks sagging 3. Rear tires soft

Troubleshooting Dash Gauge Problems

Most problems can be traced to a defective sending unit or faulty wiring. Occasionally, the gauge itself is at fault. See Chapter 5 for service procedures.

Condition	Possible Cause
COOLANT TEMPERATURE GAUGE	
Gauge reads erratically or not at all	1. Loose or dirty connections 2. Defective sending unit. 3. Defective gauge. To test a bi-metal gauge, remove the wire from the sending unit. Ground the wire for an instant. If the gauge registers, replace the sending unit. To test a magnetic gauge, disconnect the wire at the sending unit. With ignition ON gauge should register COLD. Ground the wire; gauge should register HOT.
AMMETER GAUGE—TURN HEADLIGHTS ON (DO NOT START ENGINE). NOTE REACTION	
Ammeter shows charge Ammeter shows discharge Ammeter does not move	1. Connections reversed on gauge 2. Ammeter is OK 3. Loose connections or faulty wiring 4. Defective gauge

Condition	Possible Cause
OIL PRESSURE GAUGE	
Gauge does not register or is inaccurate	1. On mechanical gauge, Bourdon tube may be bent or kinked. 2. Low oil pressure. Remove sending unit. Idle the engine briefly. If no oil flows from sending unit hole, problem is in engine. 3. Defective gauge. Remove the wire from the sending unit and ground it for an instant with the ignition ON. A good gauge will go to the top of the scale. 4. Defective wiring. Check the wiring to the gauge. If it's OK and the gauge doesn't register when grounded, replace the gauge. 5. Defective sending unit.
ALL GAUGES	
All gauges do not operate All gauges read low or erratically All gauges pegged	1. Blown fuse 2. Defective instrument regulator 3. Defective or dirty instrument voltage regulator 4. Loss of ground between instrument voltage regulator and frame 5. Defective instrument regulator
WARNING LIGHTS	
Light(s) do not come on when ignition is ON, but engine is not started	1. Defective bulb 2. Defective wire 3. Defective sending unit. Disconnect the wire from the sending unit and ground it. Replace the sending unit if the light comes on with the ignition ON.
Light comes on with engine running	4. Problem in individual system 5. Defective sending unit

Troubleshooting Clutch Problems

It is false economy to replace individual clutch components. The pressure plate, clutch plate and throwout bearing should be replaced as a set, and the flywheel face inspected, whenever the clutch is overhauled. See Chapter 6 for service procedures.

Condition	Possible Cause
Clutch chatter	1. Grease on driven plate (disc) facing 2. Binding clutch linkage or cable 3. Loose, damaged facings on driven plate (disc) 4. Engine mounts loose 5. Incorrect height adjustment of pressure plate release levers 6. Clutch housing or housing to transmission adapter misalign ment 7. Loose driven plate hub
Clutch grabbing	1. Oil, grease on driven plate (disc) facing 2. Broken pressure plate 3. Warped or binding driven plate. Driven plate binding on clutch shaft
Clutch slips	1. Lack of lubrication in clutch linkage or cable (linkage or cable binds, causes incomplete engagement) 2. Incorrect pedal, or linkage adjustment 3. Broken pressure plate springs 4. Weak pressure plate springs 5. Grease on driven plate facings (disc)

Troubleshooting Clutch Problems (cont.)

Condition	Possible Cause
Incomplete clutch release	1. Incorrect pedal or linkage adjustment or linkage or cable bind ing 2. Incorrect height adjustment on pressure plate release levers 3. Loose, broken facings on driven plate (disc) 4. Bent, dished, warped driven plate caused by overheating
Grinding, whirring grating noise when pedal is depressed	1. Worn or defective throwout bearing 2. Starter drive teeth contacting flywheel ring gear teeth. Look for milled or polished teeth on ring gear.
Squeal, howl, trumpeting noise when pedal is being released (occurs during first inch to inch and one-half of pedal travel)	Pilot bushing worn or lack of lubricant. If bushing appears OK, polish bushing with emery cloth, soak lube wick in oil, lube bushing with oil, apply film of chassis grease to clutch shaft pilot hub, reassemble. NOTE: Bushing wear may be due to misalignment of clutch housing or housing to transmission adapter
Vibration or clutch pedal pulsation with clutch disengaged (pedal fully depressed)	1. Worn or defective engine transmission mounts 2. Flywheel run out. (Flywheel run out at face not to exceed 0.005") 3. Damaged or defective clutch components

Troubleshooting Manual Transmission Problems

See Chapter 6 for service procedures

Condition	Possible Cause
Transmission jumps out of gear	1. Misalignment of transmission case or clutch housing. 2. Worn pilot bearing in crankshaft. 3. Bent transmission shaft. 4. Worn high speed sliding gear. 5. Worn teeth or end-play in clutch shaft. 6. Insufficient spring tension on shifter rail plunger. 7. Bent or loose shifter fork. 8. Gears not engaging completely. 9. Loose or worn bearings on clutch shaft or mainshaft. 10. Worn gear teeth. 11. Worn or damaged detent balls.
Transmission sticks in gear	1. Clutch not releasing fully. 2. Burred or battered teeth on clutch shaft, or sliding sleeve. 3. Burred or battered transmission mainshaft. 4. Frozen synchronizing clutch. 5. Stuck shifter rail plunger. 6. Gearshift lever twisting and binding shifter rail. 7. Battered teeth on high speed sliding gear or on sleeve. 8. Improper lubrication, or lack of lubrication. 9. Corroded transmission parts. 10. Defective mainshaft pilot bearing. 11. Locked gear bearings will give same effect as stuck in gear.
Transmission gears will not synchronize	1. Binding pilot bearing on mainshaft, will synchronize in high gear only. 2. Clutch not releasing fully. 3. Detent spring weak or broken. 4. Weak or broken springs under balls in sliding gear sleeve. 5. Binding bearing on clutch shaft, or binding countershaft. 6. Binding pilot bearing in crankshaft. 7. Badly worn gear teeth. 8. Improper lubrication. 9. Constant mesh gear not turning freely on transmission mainshaft. Will synchronize in that gear only.

Condition	*Possible Cause*
Gears spinning when shifting into gear from neutral	1. Clutch not releasing fully. 2. In some cases an extremely light lubricant in transmission will cause gears to continue to spin for a short time after clutch is released. 3. Binding pilot bearing in crankshaft.
Transmission noisy in all gears	1. Insufficient lubricant, or improper lubricant. 2. Worn countergear bearings. 3. Worn or damaged main drive gear or countergear. 4. Damaged main drive gear or mainshaft bearings. 5. Worn or damaged countergear anti-lash plate.
Transmission noisy in neutral only	1. Damaged main drive gear bearing. 2. Damaged or loose mainshaft pilot bearing. 3. Worn or damaged countergear anti-lash plate. 4. Worn countergear bearings.
Transmission noisy in one gear only	1. Damaged or worn constant mesh gears. 2. Worn or damaged countergear bearings. 3. Damaged or worn synchronizer.
Transmission noisy in reverse only	1. Worn or damaged reverse idler gear or idler bushing. 2. Worn or damaged mainshaft reverse gear. 3. Worn or damaged reverse countergear. 4. Damaged shift mechanism.

TROUBLESHOOTING AUTOMATIC TRANSMISSION PROBLEMS

Keeping alert to changes in the operating characteristics of the transmission (changing shift points, noises, etc.) can prevent small problems from becoming large ones. If the problem cannot be traced to loose bolts, fluid level, misadjusted linkage, clogged filters or similar problems, you should probably seek professional service.

Transmission Fluid Indications

The appearance and odor of the transmission fluid can give valuable clues to the overall condition of the transmission. Always note the appearance of the fluid when you check the fluid level or change the fluid. Rub a small amount of fluid between your fingers to feel for grit and smell the fluid on the dipstick.

If the fluid appears:	*It indicates:*
Clear and red colored	Normal operation
Discolored (extremely dark red or brownish) or smells burned	Band or clutch pack failure, usually caused by an overheated transmission. Hauling very heavy loads with insufficient power or failure to change the fluid often result in overheating. Do not confuse this appearance with newer fluids that have a darker red color and a strong odor (though not a burned odor).
Foamy or aerated (light in color and full of bubbles)	1. The level is too high (gear train is churning oil) 2. An internal air leak (air is mixing with the fluid). Have the trans mission checked professionally.
Solid residue in the fluid	Defective bands, clutch pack or bearings. Bits of band material or metal abrasives are ciinging to the dipstick. Have the transmission checked professionally.
Varnish coating on the dipstick	The transmission fluid is overheating

TROUBLESHOOTING DRIVE AXLE PROBLEMS

First, determine when the noise is most noticeable.

Drive Noise: Produced under vehicle acceleration.

Coast Noise: Produced while coasting with a closed throttle.

Float Noise: Occurs while maintaining constant speed (just enough to keep speed constant) on a level road.

External Noise Elimination

It is advisable to make a thorough road test to determine whether the noise originates in the rear axle or whether it originates from the tires, engine, transmission, wheel bearings or road surface. Noise originating from other places cannot be corrected by servicing the rear axle.

ROAD NOISE

Brick or rough surfaced concrete roads produce noises that seem to come from the rear axle. Road noise is usually identical in Drive or Coast and driving on a different type of road will tell whether the road is the problem.

TIRE NOISE

Tire noise can be mistaken as rear axle noise, even though the tires on the front are at fault. Snow tread and mud tread tires or tires worn unevenly will frequently cause vibrations which seem to originate elsewhere; *temporarily, and for test purposes only,* inflate the tires to 40-50 Ibs. This will significantly alter the noise produced by the tires, but will not alter noise from the rear axle. Noises from the rear axle will normally cease at speeds below 30 mph on coast, while tire noise will continue at lower tone as speed is decreased. The rear axle noise will usually change from drive conditions to coast conditions, while tire noise will not. Do not forget to lower the tire pressure to normal after the test is complete.

ENGINE/TRANSMISSION NOISE

Determine at what speed the noise is most pronounced, then stop in a quiet place. With the transmission in Neutral, run the engine through speeds corresponding to road speeds where the noise was noticed. Noises produced with the vehicle standing still are coming from the engine or transmission.

FRONT WHEEL BEARINGS

Front wheel bearing noises, sometimes confused with rear axle noises, will not change when comparing drive and coast conditions. While holding the speed steady, lightly apply the footbrake. This will often cause wheel bearing noise to lessen, as some of the weight is taken off the bearing. Front wheel bearings are easily checked by jacking up the wheels and spinning the wheels. Shaking the wheels will also determine if the wheel bearings are excessively loose.

REAR AXLE NOISES

Eliminating other possible sources can narrow the cause to the rear axle, which normally produces noise from worn gears or bearings. Gear noises tend to peak in a narrow speed range, while bearing noises will usually vary in pitch with engine speeds.

Noise Diagnosis

The Noise Is:	*Most Probably Produced By:*
1. Identical under Drive or Coast	Road surface, tires or front wheel bearings
2. Different depending on road surface	Road surface or tires
3. Lower as speed is lowered	Tires
4. Similar when standing or moving	Engine or transmission
5. A vibration	Unbalanced tires, rear wheel bearing, unbalanced driveshaft or worn U-joint
6. A knock or click about every two tire revolu tions	Rear wheel bearing
7. Most pronounced on turns	Damaged differential gears
8. A steady low-pitched whirring or scraping, starting at low speeds	Damaged or worn pinion bearing
9. A chattering vibration on turns	Wrong differential lubricant or worn clutch plates (limited slip rear axle)
10. Noticed only in Drive, Coast or Float conditions	Worn ring gear and/or pinion gear

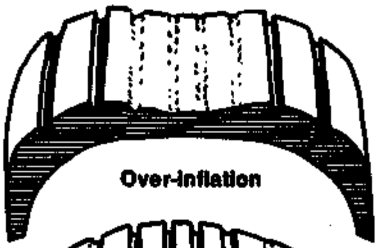
Troubleshooting Steering & Suspension Problems

Condition	Possible Cause
Hard steering (wheel is hard to turn)	**1. Improper tire pressure** 2. Loose or glazed pump drive belt **3. Low or incorrect fluid** 4. Loose, bent or poorly lubricated front end parts 5. Improper front end alignment (excessive caster) **6. Bind in steering column or linkage** 7. Kinked hydraulic hose 8. Air in hydraulic system **9. Low pump output or leaks in system** 10. Obstruction in lines **11. Pump valves sticking or out of adjustment** 12. Incorrect wheel alignment
Loose steering (too much play in steering wheel)	1. Loose wheel bearings 2. Faulty shocks **3.. Worn linkage or suspension components** 4. Loose steering gear mounting or linkage points 5. Steering mechanism worn or improperly adjusted 6. Valve spool improperly adjusted 7. Worn ball joints, tie-rod ends, etc.
Veers or wanders (pulls to one side with hands off steering wheel)	1. Improper tire pressure 2. Improper front end alignment 3. Dragging or improperly adjusted brakes 4. Bent frame 5. Improper rear end alignment **6. Faulty shocks or springs** 7. Loose or bent front end components 8. Play in Pitman arm **9. Steering gear mountings loose** 10. Loose wheel bearings 11. Binding Pitman arm 12. Spool valve sticking or improperly adjusted 13. Worn ball joints
Wheel oscillation or vibration transmitted through steering wheel	1. Low or uneven tire pressure 2. Loose wheel bearings 3. Improper front end alignment 4. Bent spindle 5. Worn, bent or broken front end components 6. Tires out of round or out of balance 7. Excessive lateral runout in disc brake rotor 8. Loose or bent shock absorber or strut
Noises (see also "Troubleshooting Drive Axle Problems")	1. Loose belts 2. Low fluid, air in system 3. Foreign matter in system 4. Improper lubrication 5. Interference or chafing in linkage 6. Steering gear mountings loose 7. Incorrect adjustment or wear in gear box 8. Faulty valves or wear in pump 9. Kinked hydraulic lines 10. Worn wheel bearings
Poor return of steering	1. Over-inflated tires 2. Improperly aligned front end (excessive caster) 3. Binding in steering column 4. No lubrication in front end 5. Steering gear adjusted too tight
Uneven tire wear (see "How To Read Tire Wear")	1. Incorrect tire pressure 2. Improperly aligned front end 3. Tires out-of-balance 4. Bent or worn suspension parts

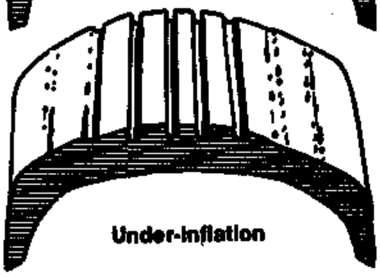
HOW TO READ TIRE WEAR

The way your tires wear is a good indicator of other parts of the suspension. Abnormal wear patterns are often caused by the need for simple tire maintenance, or for front end alignment.

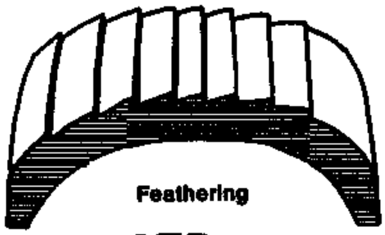
Excessive wear at the center of the tread indicates that the air pressure in the tire is consistently too high. The tire is riding on the center of the tread and wearing it prematurely. Occasionally, this wear pattern can result from outrageously wide tires on narrow rims. The cure for this is to replace either the tires or the wheels.



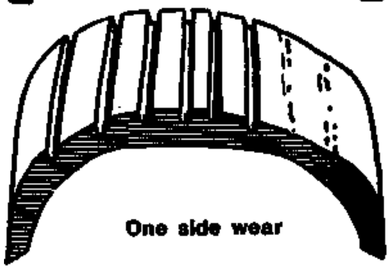
This type of wear usually results from consistent under-inflation. When a tire is under-inflated, there is too much contact with the road by the outer treads, which wear prematurely. When this type of wear occurs, and the tire pressure is known to be consistently correct, a bent or worn steering component or the need for wheel alignment could be indicated.



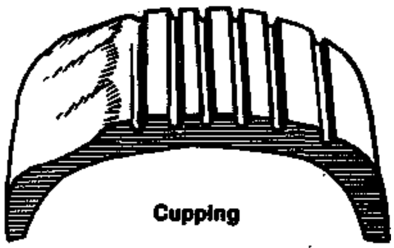
Feathering is a condition when the edge of each tread rib develops a slightly rounded edge on one side and a sharp edge on the other. By running your hand over the tire, you can usually feel the sharper edges before you'll be able to see them. The most common causes of feathering are incorrect toe-in setting or deteriorated bushings in the front suspension.



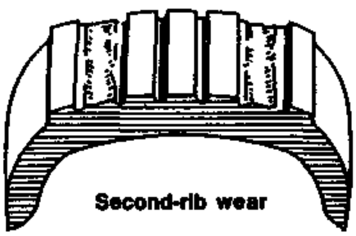
When an inner or outer rib wears faster than the rest of the tire, the need for wheel alignment is indicated. There is excessive camber in the front suspension, causing the wheel to lean too much putting excessive load on one side of the tire. Misalignment could also be due to sagging springs, worn ball joints, or worn control arm bushings. Be sure the vehicle is loaded the way it's normally driven when you have the wheels aligned.



Cups or scalloped dips appearing around the edge of the tread almost always indicate worn (sometimes bent) suspension parts. Adjustment of wheel alignment alone will seldom cure the problem. Any worn component that connects the wheel to the suspension can cause this type of wear. Occasionally, wheels that are out of balance will wear like this, but wheel imbalance usually shows up as bald spots between the outside edges and center of the tread.



Second-rib wear is usually found only in radial tires, and appears where the steel belts end in relation to the tread. It can be kept to a minimum by paying careful attention to tire pressure and frequently rotating the tires. This is often considered normal wear but excessive amounts indicate that the tires are too wide for the wheels.



Troubleshooting Disc Brake Problems

Condition	*Possible* Cause
Noise—groan—brake noise emanating when slowly releasing brakes (creep-groan)	Not detrimental to function of disc brakes—no corrective action required. (This noise may be eliminated by slightly increasing or decreasing brake pedal efforts.)
Rattle—brake noise or rattle emanating at low speeds on rough roads, (front wheels only).	1. Shoe anti-rattle spring missing or not properly positioned. 2. Excessive clearance between shoe and caliper. 3. Soft or broken caliper seals. 4. Deformed or misaligned disc. 5. Loose caliper.
Scraping	1. Mounting bolts too long. 2. Loose wheel bearings. 3. Bent, loose, or misaligned splash shield.
Front brakes heat up during driving and fail to release	1. Operator riding brake pedal. 2. Stop light switch improperly adjusted. 3. Sticking pedal linkage. 4. Frozen or seized piston. 5. Residual pressure valve in master cylinder. 6. Power brake malfunction. 7. Proportioning valve malfunction.
Leaky brake caliper	1. Damaged or worn caliper piston seal. 2. Scores or corrosion on surface of cylinder bore.
Grabbing or uneven brake action-Brakes pull to one side	1. Causes listed under "Brakes Pull". 2. Power brake malfunction. 3. Low fluid level in master cylinder. 4. Air in hydraulic system. 5. Brake fluid, oil or grease on linings. 6. Unmatched linings. 7. Distorted brake pads. 8. Frozen or seized pistons. 9. Incorrect tire pressure. 10. Front end out of alignment. 11. Broken rear spring. 12. Brake caliper pistons sticking. 13. Restricted hose or line. 14. Caliper not in proper alignment to braking disc. 15. Stuck or malfunctioning metering valve. 16. Soft or broken caliper seals. 17. Loose caliper.
Brake pedal can be depressed without braking effect	1. Air in hydraulic system or improper bleeding proeedure. 2. Leak past primary cup in master cylinder. 3. Leak in system. 4. Rear brakes out of adjustment. 5. Bleeder screw open.
Excessive pedal travel	1. Air, leak, or insufficient fluid in system or caliper. 2. Warped or excessively tapered shoe and lining assembly. 3. Excessive disc runout. 4. Rear brake adjustment required. 5. Loose wheel bearing adjustment. 6. Damaged caliper piston seal. 7. Improper brake fluid (boil). 8. Power brake malfunction. 9. Weak or soft hoses.

Troubleshooting Disc Brake Problems (cont.)

Condition	Possible Cause
Brake roughness or chatter (pedal pumping)	1. Excessive thickness variation of braking disc. 2. Excessive lateral runout of braking disc. 3. Rear brake drums out-of-round. 4. Excessive front bearing clearance.
Excessive pedal effort	1. Brake fluid, oil or grease on linings. 2. Incorrect lining. 3. Frozen or seized pistons. 4. Power brake malfunction. 5. Kinked or collapsed hose or line. 6. Stuck metering valve. 7. Scored caliper or master cylinder bore. 8. Seized caliper pistons.
Brake pedal fades (pedal travel increases with foot on brake)	1. Rough master cylinder or caliper bore. 2. Loose or broken hydraulic lines/connections. 3. Air in hydraulic system. 4. Fluid level low. 5. Weak or soft hoses. 6. Inferior quality brake shoes or fluid. 7.. Worn master cylinder piston cups or seals.

Troubleshooting Drum Brakes

Condition	Possible Cause
Pedal goes to floor	1. Fluid low in reservoir. 2. Air in hydraulic system. 3. Improperly adjusted brake. 4. Leaking wheel cylinders. 5. Loose or broken brake lines. 6. Leaking or worn master cylinder. 7. Excessively worn brake lining.
Spongy brake pedal	1. Air in hydraulic system. 2. Improper brake fluid (low boiling point). 3. Excessively worn or cracked brake drums. 4. Broken pedal pivot bushing.
Brakes pulling	1. Contaminated lining. 2- Front end out of alignment. 3. Incorrect brake adjustment. 4. Unmatched brake lining. 5. Brake drums out of round. 6. Brake shoes distorted. 7. Restricted brake hose or line. 8. Broken rear spring. 9. Worn brake linings. 10. Uneven lining wear. 11. Glazed brake lining. 12. Excessive brake lining dust. 13. Heat spotted brake drums. 14. Weak brake return springs. 15. Faulty automatic adjusters. 16. Low or incorrect tire pressure.

Condition	Possible Cause
Squealing brakes	1. Glazed brake lining. 2. Saturated brake lining. 3. Weak or broken brake shoe retaining spring. 4. Broken or weak brake shoe return spring. 5. Incorrect brake lining. 6.- Distorted brake shoes. 7. Bent support plate. 8. Dust in brakes or scored brake drums. 9. Linings worn below limit. 10. Uneven brake lining wear. 11. Heat spotted brake drums.
Chirping brakes	1. Out of round drum or eccentric axle flange pilot.
Dragging brakes	1. Incorrect wheel or parking brake adjustment. 2. Parking brakes engaged or improperly adjusted. 3. Weak or broken brake shoe return spring. 4. Brake pedal binding. 5. Master cylinder cup sticking. 6. Obstructed master cylinder relief port. 7. Saturated brake lining. 8.. Bent or out of round brake drum. 9. Contaminated or improper brake fluid. 10. Sticking wheel cylinder pistons. 11. Driver riding brake pedal. 12. Defective proportioning valve. 13. Insufficient brake shoe lubricant.
Hard pedal	1. Brake booster inoperative. 2. Incorrect brake lining. 3. Restricted brake line or hose. 4. Frozen brake pedal linkage. 5. Stuck wheel cylinder. 6. Binding pedal linkage. 7. Faulty proportioning valve.
Wheel locks	1. Contaminated brake lining. 2. Loose or torn brake lining. 3. Wheel cylinder cups sticking. 4. Incorrect wheel bearing adjustment. 5. Faulty proportioning valve.
Brakes fade (high speed)	1. Incorrect lining. 2. Overheated brake drums. 3. Incorrect brake fluid (low boiling temperature). 4. Saturated brake lining. 5. Leak in hydraulic system. 6. Faulty automatic adjusters.
Pedal pulsates	1. Bent or out of round brake drum.
Brake chatter and shoe knock	1. Out of round brake drum. 2. Loose support plate. 3. Bent support plate. 4. Distorted brake shoes. 5. Machine grooves in contact face of brake drum (Shoe Knock). 6. Contaminated brake lining. 7. Missing or loose components. 8. Incorrect lining material. 9. Out-of-round brake drums. 10. Heat spotted or scored brake drums. 11. Out-of-balance wheels.

Troubleshooting Drum Brakes (cont.)

Condition	*Possible Cause*
Brakes do not self adjust	1. Adjuster screw frozen in thread. 2. Adjuster screw corroded at thrust washer. 3. Adjuster lever does not engage star wheel. 4. Adjuster installed on wrong wheel.
Brake light glows	1. Leak in the hydraulic system. 2. Air in the system. 3. Improperly adjusted master cylinder pushrod. 4. Uneven lining wear. 5. Failure to center combination valve or proportioning valve.

Mechanic's Data

General Conversion Table

Multiply By	To Convert	To	
	LENGTH		
2.54	Inches	Centimeters	.3937
25.4	Inches	Millimeters	.03937
30.48	Feet	Centimeters	.0328
.304	Feet	Meters	3.28
.914	Yards	Meters	1.094
1.609	Miles	Kilometers	.621
	VOLUME		
.473	Pints	Liters	2.11
.946	Quarts	Liters	1.06
3.785	Gallons	Liters	.264
.016	Cubic inches	Liters	61.02
16.39	Cubic inches	Cubic cms.	.061
28.3	Cubic feet	Liters	.0353
	MASS (Weight)		
28.35	Ounces	Grams	.035
.4536	Pounds	Kilograms	2.20
-	To obtain	From	Multiply by

Multiply By	To Convert	To	
	AREA		
.645	Square inches Square	Square cms.	.155
.836	yds.	Square meters	1.196
	FORCE		
4.448	Pounds	Newtons	.225
.138	Ft/lbs.	Kilogram/meters	7.23
1.36	FUlbs.	Newton-meters	.737
.112	InVlbs.	Newton-meters	8.844
	PRESSURE		
.068	Psi	Atmospheres	14.7
6.89	Psi	Kilopascals	.145
	OTHER		
1.104	Horsepower (DIN)	Horsepower (SAE)	.9861
.746	Horsepower (SAE)	Kilowatts (KW)	1.34 .625
1.60	Mph Mpg	Km/h Km/1	2.35
.425			
—	To obtain	From	Multiply by

Tap Drill Sizes

National
(ioarse or U.S.S.

ScrawS TapSfcB	Threads Per Inch	Use Drill Number
No. 5...	...... 40	.39
No. 6...	.... 32	.36
No. 8 ...	.... 32	.29
No. 10 ...	...... 24 ___	.25
No. 12...	.... 24 ___	.17
*/4 . 5/16	.... 20 ___	. 8
	... .18 _____	.F
% .	...... 16	5/16
7/16,	...... 14	.U
%.	.... 13	
9/16.	.... 12	27/64 .
%.,	...... 11	17/32 .
%.,	.... 10	21/32 .
%..	 9	"9/64

National Coarse or
U.S.S.

Screw A TapSIzo	Threads Par Inch	Use Drill Number
1 ..	.... 8	%
1 1/B	7 ..	ra/64
1 1/4	.... 7	1 7/M
V/2	. . 6 .	1"/32

National
FitworSAE.

Screw & Tap Size	Threads Par Inch	Use Drill Number
No. 5....		44...
No. 6....		37
No. 8....		40...
No. 10....		33
		36....

........29
..... 32 21

National
FlneorSAE.

Screw & Tap Size	Threads Par Inch	Use Drill Number
No. 12 . .	...... 28	.15
.	.... 28	. 3
V4. 6/16%	.... 24	. 1
	.... 24	.0
7/16	...... 20	.W
'/2.	.... 20	»/6«
9/16	.... .18	M/64
% .	.... 18	37/64
%.	.... 16	11/16 .
%.	.... 14	13/16 .
1'/8.	.... 12	1 3/64 .
V/4.	.... 12	1 11/64 .
1V2.	.... 12	1 27/64

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Ford/Mercury/Lincoln 1968-85 Covers all U.S. and Canadian models of FORD Country Sedan, Country Squire, Crown Victoria, Custom, Custom 500, Galaxie 500, LTD through 1982, Ranch Wag - on, and XL; MERCURY Colony Park, Com - muter, Marquis through 1982, Gran Mar- quis, Monterey and Park Lane; LINCOLN Continental and Towne Car	6842
Ford/Mercury/Lincoln Mid-Size 1971-85 Covers all U.S. and Canadian models of FORD Elite, 1983-85 LTD, 1977-79 LTD II. Ranchero, Torino, Gran Torino, 1977 -85 Thunderblrd; MERCURY 1972-85 Cougar,	6696

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198345 Marquis. Montego. 198045 XR-7; LINCOLN 198245 Continental. 196445 Mark VII. 197640 VersaMes	
Ford Plck-Ups 196546 Coven al'/,"/, and 1 ton. 2- and 4-wheel drive U.S. and Canadian pick-up, chassis cab and camper models, induing desel en-	(913
Pert **Pick-up* 196542 laaaM**	7469 7338
Fort Ranger 1913-14 Coven al U.S. and Canadan models	6649
Fort Vans 1981-86 Coven all U.S. and Canadan V,. '%and 1 ton van and cutaway chassis morjets, includ-ing desel engines	7309 7587
6M A-Body 191245 **Coven al front wheel drive U.S. and Canadan models of BUICK Century. CHEVROLET Celebrity. OLDSMOBILE Cuflass Cien and PONTIAC 6000 GM C-Bady 1965**	
Coven al front wheel drive U.S. and Canadan models of BUICK Electra Park Avenue and Electra T-Type. CADILLAC Fteetwood and devme. OLDSMOBILE 98 Regency and Re-	7059 7657
J-Car 198245 **Covers al U.S. and Canadian models of BUICK Skyhawk. CHEVROLET Cavalier. CADILLAC Cbnarron. OLDSMOBILE Firena and PONTIAC 2000 and SunbM QM H-Body 191541 Coven al U.S. and Canadian models of front wheel drive BUICK Somerset and Skylark, OLDSMOBILE Calais, and PONTIAC tend Am**	7049 6935
	6937
	6960 5912
DM X-lody 199049 Covers all U.S. and Canadan models of BUICK Skylark. CHEVROLET Citation. OLDS-MOBILE Omega and PONTIAC Phoenix	6817
QM ~~luotompad~~ 197140 **Coven all U.S. and Canadian models of BUICK Skyhawk (197540). CHEVROLET Vega and Monk OLDSMOBILE Statin, and PONTIAC Astre and 197540 Sunbird**	6739
GwMda/Moaarck 197S4Z **Covers al U.S. and Canadan models**	7563 6834
Honda 197344 **Coven aH U.S. and Canadian models**	6981
IfttamattoMl Scout 1997-71 Covers aH U.S. and Canadian models	
Jttp 194547 **Coven all U.S. and Canadian CJ-2A. CJ-3A. CJ-3B. Cj-5. CJ-6. CJ-7, Scrambler and WTuiQter models**	7659 6065
JMB WuoMtf	5907
TiKk 1*J7~46 **Coven al U.S. and Canaolan models of Wagoneer. Cterokee. Grand Wagoner. Jeepster, Jeepster Commando, J-fOO. J-200VJ-300. J-10. J20. FC-150 and FC-170**	
Ustf/DaytoM 190445 **Coven all U.S. and Canadan models**	
Mmrkk/Conwl 1970-n **Covers art U.S. and Canadan models**	
Maata 197144 **Coven all U.S. and Canaolan models of RX-2. RX-3. RX-4. 808. 1300. 1600. Cosmo. 6LCand626**	
Manta Pkk-Uas 197241 **Coven al U.S. and Canadian models**	
Maicaoaa lam 1959-7B **Covers aft U.S. and Canadan models**	
Meraca<s4«a 19U-73 **Coven al U.S. and Canadan models**	

RTUQTWa	Part No.
J197444 Cows al U.S. and Canadan models	6809
Mta*MtM. Cortto. Traoto. Stadia, **6aUrt19M4J** Coven al U.S. and Canadan models	7583 6780
IN 199141 **Coven al U.S. and Canadan models**	6963 6542
Mtsltae/Curt/MMtar 197945 **Coven al uT. and Canadan models**	6812 6845
MMtaMVo»gar 1965-71	
MnsMM R1974-79 **Covers all**	6575 5982
Covers al U.S. and Canadan models	7027 6552
U.S. and ~~Canadan~~ models **117144**	7571 7346
Coven al U.S. and Canadan models of DODGE omni, Miser. 024. Charger 2.2; PLYMOUTH Horizon. Miser. TC3. TC3 Tourismo; Rampage	
Opal 1971-75 **Coven al U.S. and Canaolan models**	7048 7165
Pmoaet 197l-74 Coven al U.S. and Canadan models	5621 7031
PteWBobeal 197140 Coven al U.S. and Canadan models	5988
Ptymoua 1968-71 Coven al U.S. and Canadan models	7572 6978
PoflUac Ftan 199445 Coven all U.S. and Canadan models	6962 5905
PMUac MM-Itu 197441 Coven al U.S. and Canadan models of Ventura. Grand Am. LeMans. Grand LeMans. GTO. Phoenix, and Grand Prix	5795
Poneha 924/921 197941 Coven al U.S. and Canadian models	7467 7043
RtMUtt 197545 Coven all U.S. and Canadan models	7035
1991-73 **Coven al U.S. and Canadan models**	6326 6529
RX-7 197941 **Covers al U.S. and Canadan models**	7040 6962
1MB M 1169-75 Coven all U.S. and Canadan models	5796
MM 900 197945 **Coven al U.S. and Canadan models**	7081 6637
Snowmobiles 197640 **Coven Arctic Cat. John Deere. Kawasaki, Polaris. SW-Doo and Yamaha**	
Subaru 197044 Coven al U.S. and Canadan models	
TampasVGTO/UMaat 1999-71 Coven afl U.S. and Canadan models	
Toyota 1966-71 Coven al U.S. and Canadian models of Corona, Mkll, Corona. Crown. Land Cruiser. Stout and Hi-Lux	
Toyota 1979-79 tlMisll	
TeyoUCtHa/Saan 197145 Coven al U.S. and Canadan models	
Toyota Trucks 197945 Coven a» U.S. and Canadian models ol pick-ups, Land Cruiser and **4Rumer**	
vSuaat/DBStif 1961-75 Coven al U.S. and Canadan models	
Volvo i»M*M **Coven al U.S. and Canadan models**	
Veto 197941 **Coven al U.S. and Canadan models**	
VW FroM MaH MM 197441 Coven al U.S. and Canadan models	
VW 1949-71 Coven al U.S. and Canadan models	
VW 1970-79 Spaatsk	
VW 197*41 **Coven al U.S. and Canadan Beetles.**	

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