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22-1000 applications clunking noise after replacement

Application:

1999-2006 Silverado 1500, 2007 Silverado 1500 Classic
1999-2006 GMC Sierra 1500, 2007 Sierra 1500 Classic

Problem:

After replacing the rack and pinion, some customers may comment on a clunk-type noise coming from under the hood that may also be felt in the steering wheel. These conditions may be more noticeable when turning at low speeds on rough road surfaces.

Cause:

Lower steering column bearing or the intermediate steering shaft may be the source of the noise.

Solution:

GM Technical Service Bulletin No.: 00-02-35-003N, dated: March 26 2008 describes how to inspect and diagnose the lower steering column bearing and intermediate steering shaft as the source of the noise. The bulletin specifies the applications affected and references other vehicles with similar problems.

The lower steering column bearing may create the same noise as a defective intermediate steering shaft. Before replacing the intermediate shaft, check the steering column bearing first for movement by pushing up and down on the intermediate shaft where it attaches to the steering column.

Note:

Please refer to this TSB and your vehicle's service manual for specific diagnostic and detailed instructions. This ProTech bulletin is supplied as technical information only and is not an authorization for repair.

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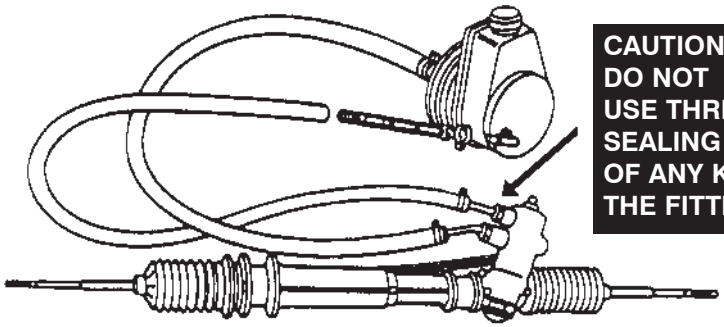
What Causes Binding in the Steering System?

Problem: Binding, poor returnability, noise, no assist to either or both sides, vibration, or leaks.

Cause: Contamination from defective components or hoses is blocking fluid flow, through the spool valve of the steering unit

Solution: When replacing any steering component it is recommended that power steering lines be replaced if more than 4 years old or appear damaged. Also flush the entire system with new fluid to wash away any contaminates. If you do not flush the system and replace lines you could experience a return of the symptoms. Failure to properly service the power steering system will **VOID THE WARRANTY**.



CAUTION: DO NOT USE THREAD SEALING TAPE OF ANY KIND ON THE FITTINGS

Note: Some manufacturers recommend an annual change of the power steering fluid to increase the longevity of the system. Be sure to check any steering or suspension component that may be placing an abnormal load on the system. Check steering input shaft coupler, outer tie-rods, ball joints and upper strut mount bearings (if so equipped).

CARDONE Industries recommends that you use a power steering filter when Power Steering components are replaced.

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Chrysler Town & Country or Dodge Caravan Steering Shudder

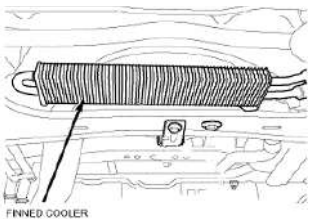
Application: Chrysler Town & Country, Dodge Caravan 2001 – 2005. Part number 22-348.

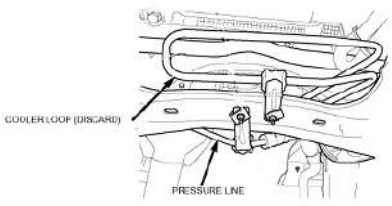
Problem: Steering wheel shudder while parking or at low speeds.

Solution: Chrysler has released several Technical Service Bulletins (TSB) for these applications dealing with noise or vibration during steering maneuvers. Before doing any repairs, perform the diagnostic procedures below to verify the problem, then refer to the TBSs to determine which may apply. Current list of TSBs are: 19-006-05, 19-001-02, 19-005-01, 19-003-03, 02-004-01, 02-003-05, 02-004-05, 19-005-03, and 22-003-01.

Perform the following diagnostics to verify the problem:

- Be certain power steering system is bled, fluid level is correct and OE recommended fluid is used.
- Perform stationary turns and low speed turns in "drive" and "reverse". Perform the evaluation with the air-conditioning control set in the "on" and "off" positions.
- If a shudder is observed or felt during the test, determine if the vehicle is equipped with a finned power steering cooler (see picture below).
- If the vehicle is equipped with a finned cooler, Chrysler recommends replacing the power steering pressure hose (see TSBs, contact OE dealer for the appropriate part number).
- If vehicle is not equipped with a finned cooler, Chrysler recommends the installation of a finned cooler (contact OE dealer for the appropriate part number).





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Common Causes of Damaged Rack and Pinion Threads

Application: All vehicles with Power Rack & Pinion Steering Systems.

Problem: Damage to threads/housing during installation of the power steering hoses.

Cause: Cross-threading or over-tightening of the power steering hose fittings.

Solution: Clean and inspect the power steering hose fittings.

- **DO NOT** use power steering hoses that are cracked, chaffed, soft or have damaged fittings.
- Install new "O" rings if applicable. Lubricate with new fluid recommended for your vehicle. **CAUTION: DO NOT USE THREAD SEALING TAPE OF ANY KIND ON THE FITTINGS!**
- Finger-tighten all power steering hose fittings prior to tightening to final torque.
- Torque power steering hose fittings to manufacturer's specifications for your vehicle.
- Flush system using fluid approved for your vehicle according to instructions provided with the replacement rack & pinion and service manual.

Note: Damaged threads/housing due to improper installation will **VOID THE WARRANTY.**

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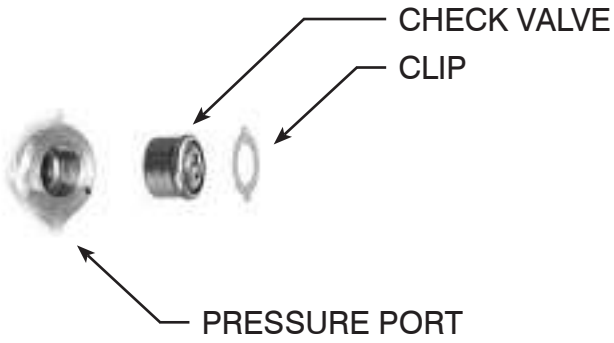
Ford Rack and Pinion Pressure Port Check Valve Installation

Application: Ford Rack and Pinions: 22-214, 217, 218, 219, 220, 224, 225, 228, 230, 231, 232, 234, 235,

Problem: Correctly transferring and installing pressure port check valve.

Solution: The original rack and pinion may have a check valve and retaining clip in the pressure port. See graphic below for a typical installation. The valve prevents fluid from backing up into the pump when the engine is shut off. Not all original units have a check valve, but if one is present, it should be transferred to the replacement rack. Note also that they don't always have a retaining clip. The installation will be successful without the clip; it's there to hold the valve in place during installation and to prevent the valve from falling out if the lines are serviced. If the clip is reused, be very careful not to damage port threads. The most important thing is to install the check valve in the pressure port, being careful to orient the valve as shown. CAUTION: Pressure and Return ports are the same thread size. Please refer to ProTech PT 22-0007 to determine which port is the pressure port.



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Ford Rack & Pinion Pressure-Return Port: Which is Which?

Application: Ford rack & pinion units with same size pressure and return ports.

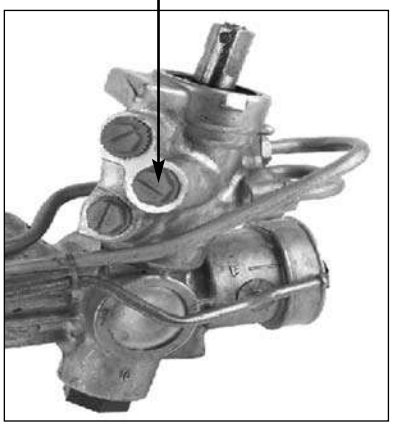
Problem: Because ports are the same thread size, the pressure and return hoses can be reversed, causing violent self-steering and damage to the rack.

Solution: Use figures below to determine the pressure port for your part number.

Pressure Line

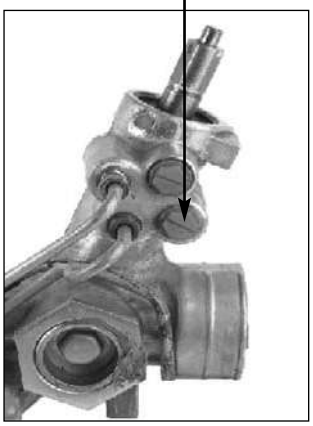
Type 1
For part numbers:
22-214, 22-219, 22-228, 22-230, 22-231, 22-235, 22-239, 22-241, 22-242, 22-243, 22-244, 22-246, 22-250, 22-251, 22-252, 22-253, 22-268, 22-276

Pressure Line



Type 2
For part numbers:
22-218, 22-220, 22-224, 22-225, 22-232

Pressure Line



Type 3
For part numbers:
22-217, 22-234, 22-237, 22-264, 22-271, 22-272, 22-283

Note: The original rack & pinion may have a removable check valve in the pressure port. Transfer the check valve to the replacement unit. Use the figures above to determine the correct port for the check valve. Refer to ProTech 22-0010 for more information.

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GM Rack & Pinion Noise Issue

Application:

2004-2010 Chevrolet Malibu

2005-2010 Pontiac G6

2005-2008 Saturn Aura

Problem:

Complaints related to noise, specifically "clunking" during low speed turns.

Cause:

The manual rack and pinion (23-1810) is part of the Electronic Power Steering System (EPS) for the vehicles listed above. EPS systems provide assist only when needed, so the driver feels when the motor engages/disengages for assist-on/assist-off driving. The different torque characteristic of this system is not typical of a hydraulic system. The noise complaint is most likely due to three possible conditions that are clearly defined in GM TSB 06-02-32-007G, which are:

- Intermediate shaft sticking or slipping
- Interference between the intermediate shaft clamp and steering gear input shaft
- Strut mount or sway bar link condition

Solution:

In addition to the TSB information, there is also a precise mounting bolt torque specification that must be followed to ensure that the rack is properly mounted to the frame. If this specification is not followed, vibration can also lead to misdiagnosed noise.

- Tighten mounting bolts to **52 ft-lbs. (70Nm) plus an additional 90 degrees**.

Note:

In addition to the listed TSB, please refer to your vehicle's service manual for specific diagnostic instructions. This ProTech bulletin is supplied as technical information only and is not an authorization for repair.

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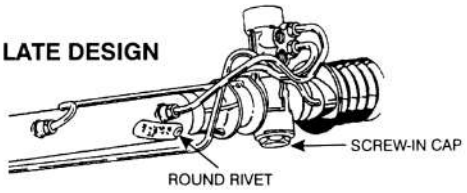
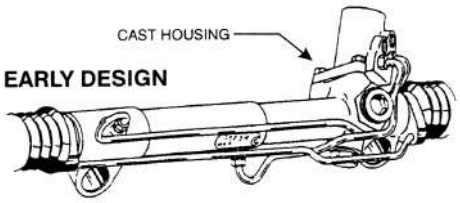
ID Guide for TRW, Saginaw or Ford Design Rack and Pinions

TRW DESIGN

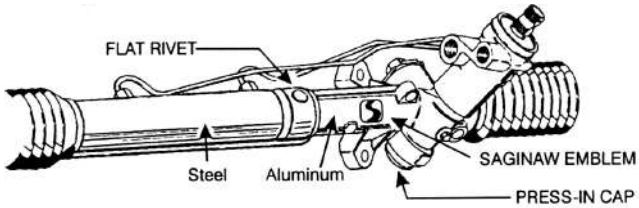




TRW design identified by

- Late design has two-piece housing; Half aluminum spool valve body, Half steel body
- Screw-in dust cap, flat or dome-shaped
- Early design has cast iron spool valve housing bolted to aluminum body
- Roundhead rivet holding metal tag and housings together

SAGINAW DESIGN



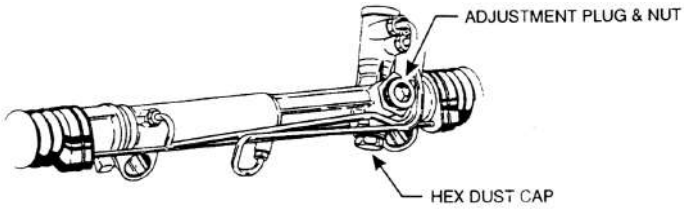
Saginaw design identified by:

- Two-piece aluminum and sheet metal body
- Flathead rivet top and bottom of pressure tube holding body halves together
- Pressed-in dust cap, flat or domed shaped
- One piece stamped adjustment plug and nut
- Saginaw "S" emblem cast on housing

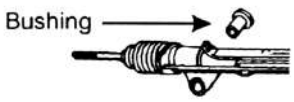
FORD DESIGN

Ford design identified by:

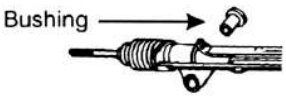
- An all-aluminum one-piece housing
- Hex-shaped screw-in dust cap on bottom of valve housing
- Two piece adjustment plug and flat nut



ONE PIECE MOUNTING BUSHING



ONE PIECE MOUNTING BUSHING



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Don't Let the Power Steering Snake Bite You

Application: All vehicles equipped with power steering.

Problem: Power steering component failure (i.e., Rack & Pinion, Gear Box, Pump, Control Valve or Power Cylinder).

Cause: Contamination in the steering system.

Solution: During installation of the replacement unit carefully inspect the hydraulic hoses. Hoses that appear harmless may have hidden problems. They deteriorate from the inside out, passing contamination throughout the entire system. This results in premature failure of the steering system. ALWAYS FLUSH THE ENTIRE SYSTEM AND REPLACE HOSES TO PREVENT WARRANTY PROBLEMS.

FAILURE TO REPLACE HOSES COULD COME BACK TO BITE YOU!

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Loosening Boot Clamps Before Alignment Prevents Damage

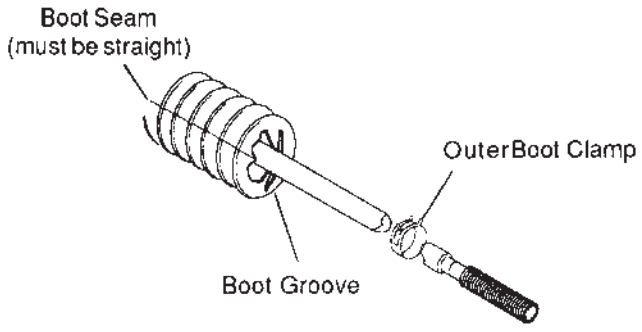
Application: All vehicles with power and manual Rack & Pinion Steering Systems.

Problem: Premature boot (bellows) failure allowing contamination (i.e., water, sand, dirt) to enter the Rack and Pinion, damaging internal components

Cause: Boots twisted during front-end alignment adjustments.

Solution:

1. Remove outer boot clamp.
2. Perform front end alignment
3. Make sure boot seam is straight (not twisted) and boots are in the proper groves—1/8" groove for plastic (hard) boot and 3/4" groove for rubber (soft) boot.
4. Install outer boot clamp.



Note: The boots must be inspected after an alignment performed. Twisted boots will lead to premature failure and **VOID THE WARRANTY.**

ProTech Bulletin Summary: Rack and Pinion, Steering Gear, Control Valve and Power Cylinder

Before replacing any power steering component, the cause of original unit failure must be determined and corrected. Installing a replacement unit without correcting the problem will lead to early failure. Always refer to the vehicle service manual for specific installation procedures and specifications. The ProTech bulletins listed below cover topics that should be done BEFORE, DURING or AFTER installation of the replacement unit. They assist with part selection, describe typical problems and solutions, and provide installation help and service advice.

Before Installation:

20-0016 Consider replacing older hydraulic hoses
22-0005 Ford ID guide
22-0008 1996-1998 GM applications, CARDONE upgrade overcomes bearing problem
27-0002 GM gearbox ID guide
27-0005 27-7565 and 27-7569 difference ID guide

During Installation:

20-0007 O-ring line and fitting seals must be replaced
20-0008 Flushing must be done
20-0010 Relocating hose may eliminate noisy operation
20-0012 Preferred flushing procedure
20-0014 Prevent steering column air bag coil damage
20-0027 Use correct OE approved fluid, do not use "top-off" products
22-0001 No thread sealing tape on fittings, check for damaged hoses, other problems, and flushing tip
22-0003 Loosening boot clamps to prevent boot damage during alignment
22-0004 Common causes of port thread damage
22-0006 Center Take Off (CTO): prevent damage to rack – use only original mounting hardware
22-0007 Ford rack hydraulic ports identical size - which is pressure, which is return ID guide
22-0009 Chrysler van shudder problem
22-0010 Ford rack units may have a pressure port check valve - where does it install
26-0001 Jaguar installation tip for 26-1916
26-0002 Toyota leaking fittings: causes and solutions
27-0001 Chrysler 1962-1972 troubleshooting tips
28-0001 Power cylinder and control valve lines easily crossed

After Installation:

20-0004 Defective old hoses and improper flushing allow contamination to prevent proper operation
20-0005 Prevent problems - replace old hoses
20-0021 Two different in-line filters fight contamination
27-0003 Dodge truck side-to-side movement: TSB alert
27-0006 Popping, crunch noise on certain GM steering gears
27-0007 Binding on turns
27-0008 Test installed unit under pressure to avoid false loose evaluation

CARDONE Technical Service develops ProTech bulletins that are intended to help the installer avoid common installation and service errors. The information presented is derived from our own experience, and product acknowledge gained from component analysis and research. Following these tips will ensure the best possible performance and service life of the replacement unit.

Please note that these bulletins are provided for your technical information only and are not authorization for repair.

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Toyota Rack & Pinion Leaking at Fittings

Application:

Toyota cars and trucks 1988 to 2003, using part numbers 26-1607, 1611, 1615, 1618, 1619, 1664, 1667, 1671, 1676, 1679, 1685, 1690, 1693 and 1695.

Problem:

Replacement rack and pinion leaks from the pressure or return port fittings at the housing (see figure 1).

Cause:

The original fitting O-ring seals were reused or fittings improperly tightened. High heat and pressure make the old seals hard and brittle – this is known as "compression set". Reusing seals causes leaks because they are unable to conform to the sealing surface. To compound the problem, a technician may assume that the leakage can be stopped if more torque is applied to the fittings – this assumption is INCORRECT. The seal on this type of fitting is held in place and activated by the pre-formed flare and grommet in the hydraulic line itself (see figure 2). Over-tightening the fittings can lead to stripped port threads and cracked castings.

Solution:

1. Replace original O-rings with the supplied new O-rings found in the installation kit attached to your rack & pinion.
2. Follow all OE torque and installation specifications and practices (Reference the vehicle's OE Service Manual for installation specifications).
3. Use the correct tools for the installation. For these applications, Toyota suggests certain tools (SST, see figure 3 for typical installation) that will assist and ensure correct installation of this rack & pinion. Refer to the vehicle OE Service Manual for individual installation specifications.

Figure 1

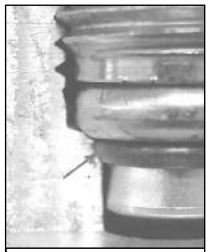

Figure 2

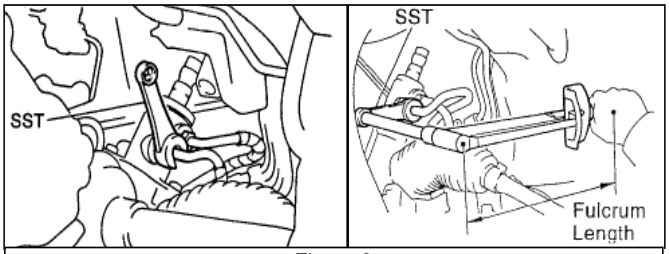

Figure 3

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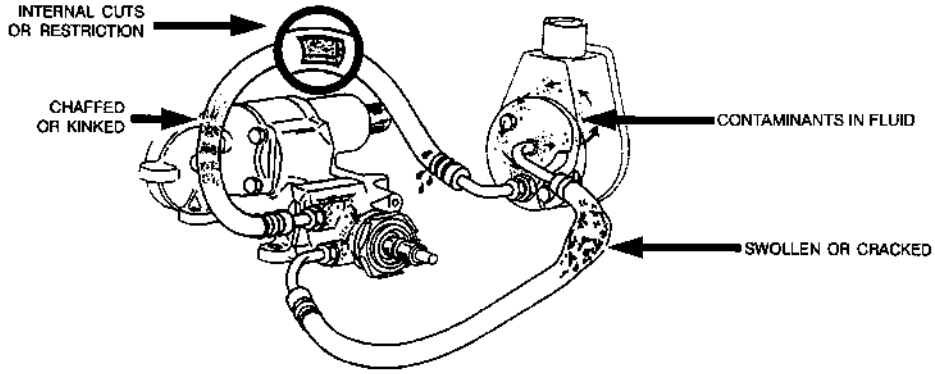
Royal Flush - Simple Power Steering Contamination Test

Prior to replacing any power steering system component, the power steering system must be flushed before operation. Flushing removes old hydraulic fluid and contaminants in the power steering system that will cause accelerated wear or improper operation of the replacement unit. Follow the steps below to properly flush the system.

1) Remove pressure and return lines from pump. Flush pump reservoir, return and pressure lines by pouring new fluid through components until fluid runs clear. Be sure to only use fluid recommended for your vehicle.
2) Reconnect pressure line to pump and steering component. Reconnect return line only to steering component.
3) Place return line from power steering unit into a drain pan. Cap return port on reservoir to prevent leakage.
4) Fill power steering pump reservoir with NEW fluid recommended for your vehicle.
5) Disable the engine so it will not start when cranked. Refer to vehicle service manual for correct procedure.
6) Crank engine and continue to replenish fluid until fluid coming from return line has no air bubbles. NEVER LET THE POWER STEERING PUMP RUN DRY! Note: Do not crank engine for more than a few seconds at a time or starter will overheat.
7) Install an in-line power steering filter in return line to increase the life of the power steering components. Connect the return line to the power steering pump, making sure all lines are properly torqued. Overtightening hydraulic lines will strip the threads. Failure to install a filter or properly torque fittings will VOID WARRANTY.
8) Be sure fluid in pump reservoir is at proper operating level.
9) Start the engine and turn the steering wheel from side to side 2 to 4 times to bleed the system.
10) Refill reservoir to proper level if necessary.
11) Check for smooth assist, excessive noise, connections for leakage and system for proper operation.



Note: CARDONE recommends replacing flexible power steering lines that are more than 4 years old.

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Installation Tip for 26-1916 Rack and Pinion

Application: Power Rack & Pinion for Jaguar XJS 1987 to 1991 (CARDONE part number 26-1916).

Problem: Steering wheel not centered after installation of replacement rack.

Cause: Original Equipment manufacturer assembly variations result in different input shaft center positions.

Solution: It may be necessary to remove and center the steering wheel. Installation tips are provided below to assist installation.

Caution - Do not attempt removal of the steering column or steering wheel without first disarming the airbag system (refer to vehicle service manual for specific procedures).

- Disarm airbag system.
- Remove original rack, following service manual procedures.
- Center replacement rack before installation. Input shaft center position can be determined by counting total shaft turns lock-to-lock, dividing the number of turns in half, then positioning the input shaft that number of turns (example: total turns = 3, center position is 1.5 turns from either lock). Jaguar tool JD120 can be used to precisely center rack.
- Check steering wheel position. If off-center, remove and center steering wheel. Adjust tie rods to obtain final center position if necessary.
- Complete installation and arm airbag system as per service manual.

NOTE: PROTECH PT 20-0014 provides an installation tip to protect airbag steering wheel coil during rack installation.

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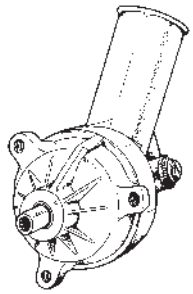
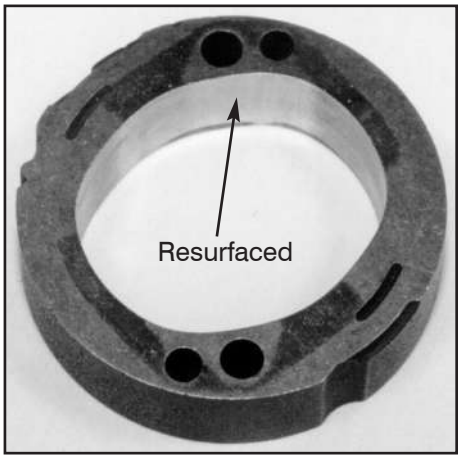
Power Steering Pumps



- Control Valves
- Power Cylinders
- Power Steering Pumps
  - -Filters
- Rack & Pinion Units
- Steering Gears

Cam Rings - In order to prevent low flow, noise, or no pressure, CARDONE resurfaces the cam ring to give it the original, consistent surface. By running your finger around the inside of the cam ring, you will be able to feel the smooth inner surface. Every unit is tested for proper flow and pressure to make sure it meets all OEM specifications. This process ensures a high quality unit that won't come back.



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What is Variable Assisted Power Steering, What is EVO?

What is EVO?

EVO means Electronic Variable Orifice. The EVO valve is a key component in variable assist systems. While vehicle manufacturer terminology may differ, a typical system works like this: At speeds below 40 MPH, the Electronic Variable Orifice valve (EVO) is completely open, allowing full hydraulic flow from the power steering pump through the steering unit for maximum power assist. Above that speed, a control module commands the EVO to partially close, restricting hydraulic flow. The reduced assist improves road feel while providing greater directional stability.

Problem:

A properly functioning system requires proper operation of the EVO valve (see below), control module and vehicle speed sensor. A malfunction in the EVO valve can result in loss of regulated assist or even complete loss of power assist. However, this problem often is mistakenly perceived to be a defective power steering pump or steering gear.

Pump-mounted Ford EVO valve

Pump-mounted GM EVO valve and adapter

Diagnostic Tip:

A scan tool should be used to determine if any variable effort system Diagnostic Trouble Codes (DTC) have been set. However, if the EVO has a mechanical or electrical failure or if foreign debris is trapped within the EVO orifices, a DTC may not be produced.

Test Tip:

Many EVO valves fail because the solenoid coil opens or develops an electrical short. This coil can be tested for continuity using a volt/ohm meter. Typical resistance is 10-15 ohms (refer to your vehicle's service manual for specific specs). An open or shorted coil indicates that the EVO is defective. DO NOT attempt to test the operation of the valve by applying direct battery voltage to the solenoid; the coil may draw too much current, causing it to fail. Even if the solenoid coil resistance is within range, the valve itself may malfunction due to debris or contamination. Simply shaking the EVO valve will allow the valve inside to move and rattle. If no rattle is heard, this indicates contamination or debris inside. In most cases, flushing is ineffective. Finally, remember that the ECM directly controls a pulse-width modulated signal to the valve. If the valve tests properly, it is possible that the ECM, vehicle speed sensor or related sensors are not working correctly. Sometimes simply disconnecting the connector from the ECM will restore unregulated assist.

Refer to the vehicle manufacturers' service manual for specific test procedures prior to changing any power system component.

Note:

CARDONE Power Steering Pump numbers ending with "V1" or "V2" (i.e. 20-8747V1) are supplied with the EVO valve. Rack and Pinions ending with "E" are supplied with rack-mounted EVO valve.

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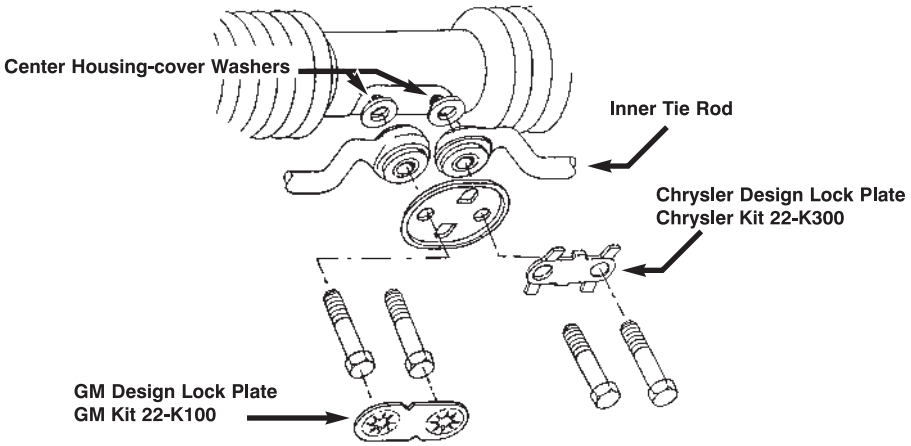
What You Might Be Missing with Your CTO Rack & Pinion Install

Application: All vehicles with center-take-off (CTO) design rack & pinions.

Problem: Noisy operation, stiff or binding steering, or damaged housing.

Cause: After replacing inner tie rods or replacing the rack & pinion the inner tie rod mounting hardware could have been improperly installed or not used.

Solution: Only use original design mounting hardware and fasteners when installing rack & pinions. Never omit mounting components and always install unit exactly to original specifications and procedures. Failure to install both center housing cover washers or to install the wrong locking plate will allow bolts to bottom in housing causing binding and damage to the unit. (Scan code to watch video tip). CARDONE Service Plus Rack & Pinion inner tie rod end repair kits for GM and Chrysler CTO units are now available. Each kit contains all the parts necessary to do the job right the first time (GM Kit 22-K100; Chrysler Kit 22-K300).



LOCKING PLATES DESIGNS ARE NOT INTERCHANGEABLE