

**RIVER CITY PRODUCTS, INC.**



**HOWARD  
PRECISION STEER WHEEL  
CONTROL SYSTEM™**

**Howard**  
***Precision Steer Wheel***  
**Control System™**

**SERVICE MANUAL**

**River City Products, Inc.**

199 W. Rhapsody

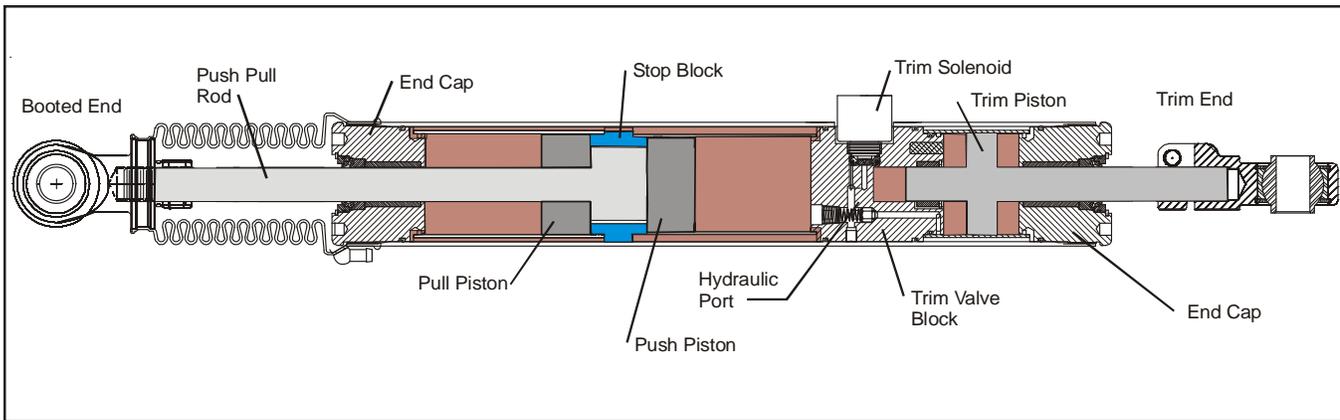
San Antonio, Tx 78216

1-800-879-4277

Web Site

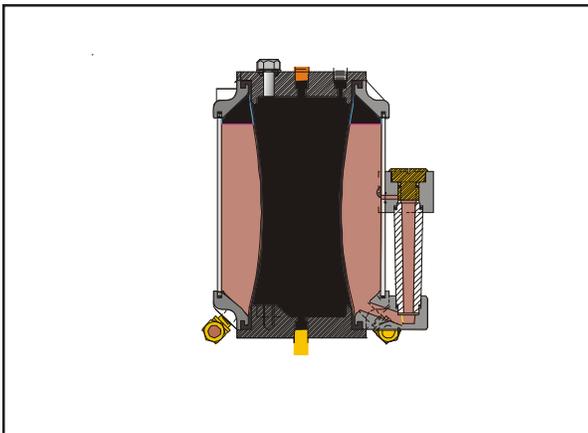
**hpcss.com**

## DESIGN FEATURES



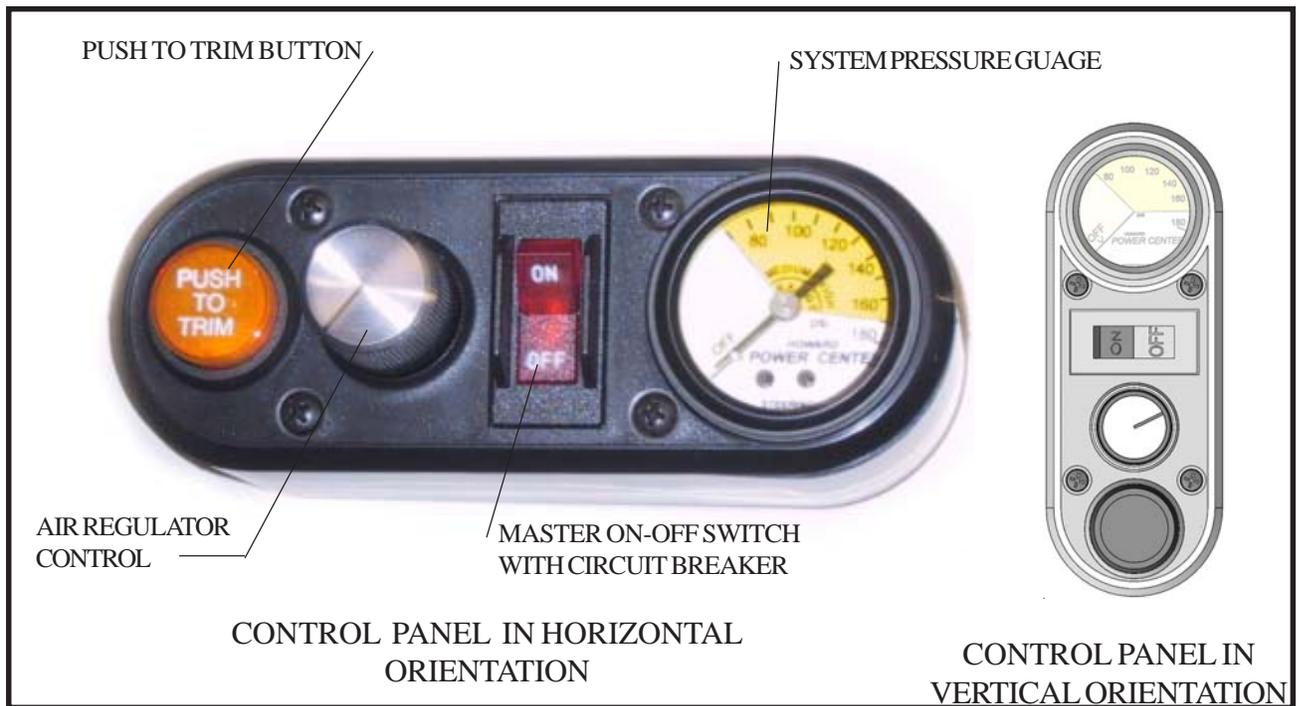
## CYLINDER

1. Zero backlash power centering
2. Infinite trim control
3. High quality Parker seals
4. Shaft protection boot
5. Preloaded rod end bearings for "0" slack
6. Double wall construction
7. High quality finish
8. DOT hydraulic fittings
9. Oil filtration screens
10. Continuous duty trim solenoid



## ACCUMULATOR/COMPRESSOR PANEL

1. Heavy wall aluminum construction
2. Easy to read fluid level sight glass
3. High quality Parker seals
4. Rugged Nitrile bladder
5. Automatically expels moisture
6. Automatically charges & discharges air
7. Multiple mounting brackets
8. Continuous duty solenoids
9. Quality Bosch relays
10. Dependable Thomas Air Compressor
11. Air dryer/filter moisture trap
12. DOT hydraulic fittings
13. Galvanized mounting panel
14. Color coded wiring harnesses



## CONTROL PANEL

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Precision molded ABS housing and face</li> <li>2. Combination master switch/circuit breaker</li> <li>3. Easy to turn air pressure regulator</li> </ol> | <ol style="list-style-type: none"> <li>4. Push button trim control</li> <li>5. Easy to read air pressure gauge</li> <li>6. Multiple mounting position hardware</li> <li>7. Lighted for night operation</li> </ol> |
|--|---|

## SAFETY

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Power Steering Safety Switch automatically cuts the system off in the event power steering fails.</li> <li>2. Master Switch/Circuit Breaker shuts unit down manually or automatically in the event of a short circuit.</li> <li>3. Air Pressure Regulator can be turned down to "0" PSI as an</li> </ol> | <p><u>additional method of turning the system off.</u></p> <ol style="list-style-type: none"> <li>4. When unit is off, there is no effect on the conventional steering system.</li> <li>5. Carefully engineered heavy duty centering cylinder mounting brackets provide maximum <b>"holding strength"</b> during Steer Wheel Blowout.</li> </ol> |
|--|--|

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**NOTICE:** FAILURE TO FOLLOW THE INSTALLATION INSTRUCTIONS IN THIS MANUAL, OR FAILURE TO INSTALL THE COMPLETE KIT FOR SPECIFIC CHASSIS WITH ACCEPTABLE WORKMANSHIP, MAY RESULT IN VOIDING THE WARRANTY.

# DEFINITIONS

**NOTE!:** A “Note” gives key information to make a procedure easier or quicker to follow or understand.

**CAUTION!:** A “Caution” refers to those procedures that must be followed to avoid damage to the vehicle or the steering system.

**WARNING!:** A “Warning” refers to those procedures that must be followed for the safety of the driver and the person installing, inspecting or repairing the vehicle or steering system.

## DISCLAIMER

The information contained in this Installation and Service manual is compiled with due diligence and accuracy. However, nothing contained here-in should take precedence over reasonable judgement pertaining to a proper installation.

The basic components of the **HOWARD PRECISION STEER WHEEL DIRECTIONAL CONTROL SYSTEM** are manufactured to high standards. To achieve the intended benefits of this product, we invite the installing agency to play a major role in providing a professional high quality installation. In the event the Mounting Brackets or any other component supplied with this kit are not applicable to the particular chassis being worked on, please call **CUSTOMER SERVICE** at **1-800-879-4277**. By teamwork between the installation technician and our engineering service department, we will be able to solve installation problems that may happen because of differences in chassis that have not been noted before.

At River City Products, Inc. we are dependent on the installer for a quality end product. We appreciate and thank you for helping to make **PRECISION STEER WHEEL DIRECTIONAL CONTROL** work as it should, and to make heavy vehicle driving more enjoyable and safer.

**NOTE!:** Field Modifications to mounting brackets are **NOT** recommended without consulting **River City Products’** Installation Service Engineering.

# INTRODUCTION

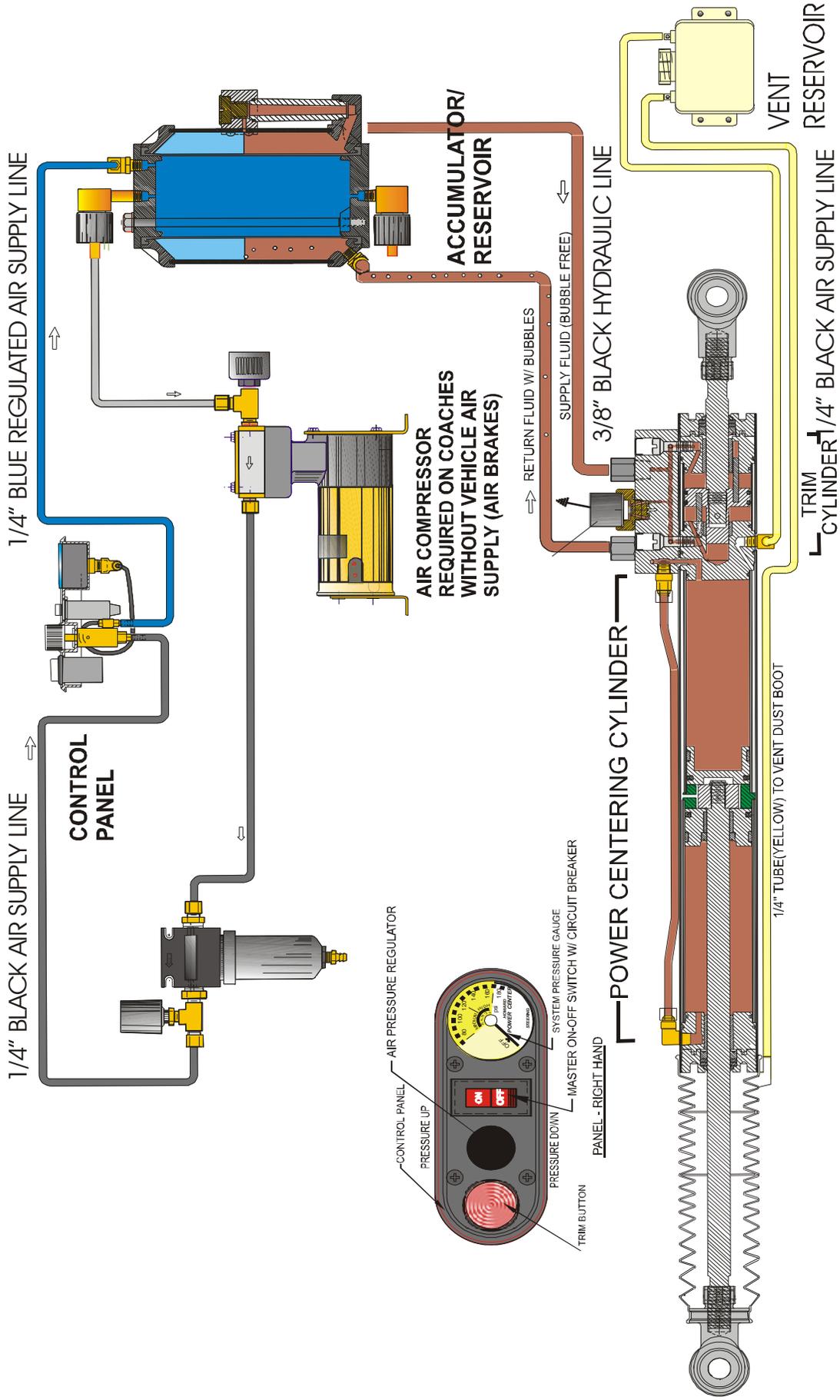
This service manual is an important guide for installing and servicing the *Howard PRECISION STEER WHEEL DIRECTIONAL CONTROL™ System*.

The “General Design and Operation” section addresses the major components of the *PRECISION STEER WHEEL CONTROL System* and explains how they function together. The knowledge you acquire from reviewing this section should assist you in solving any problem you encounter when installing, servicing, or trouble shooting the system.

This manual also contains trouble shooting information and check lists. With these, you can diagnose a problem without having to remove any components from the vehicle. If you must service a system for repair work, the check list will help you determine where the problem may be.

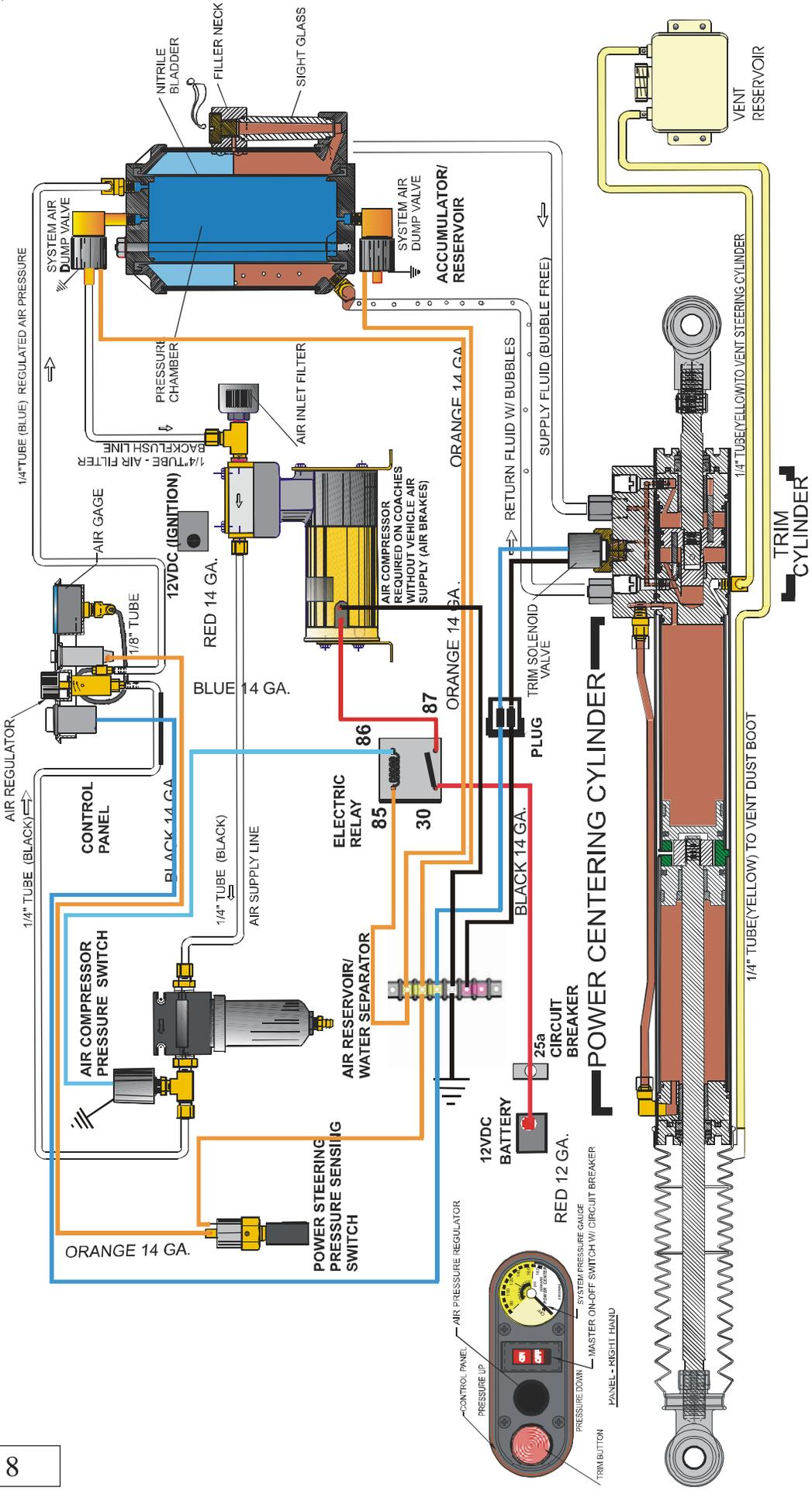
When necessary, reference will be made to the schematic diagrams provided in this manual. As you gain experience in the installation, servicing and trouble shooting of the *Howard PRECISION STEER WHEEL DIRECTIONAL CONTROL™ System*, you may find that some information in this manual could be stated more clearly and more completely. If so, let us know about it. Don't try to second guess the manual. If you have questions about an installation, contact us. Installing and servicing this system should be a safe, straight forward and productive procedure.

**Pay special attention to all NOTES!, CAUTIONS!, and WARNINGS!.**



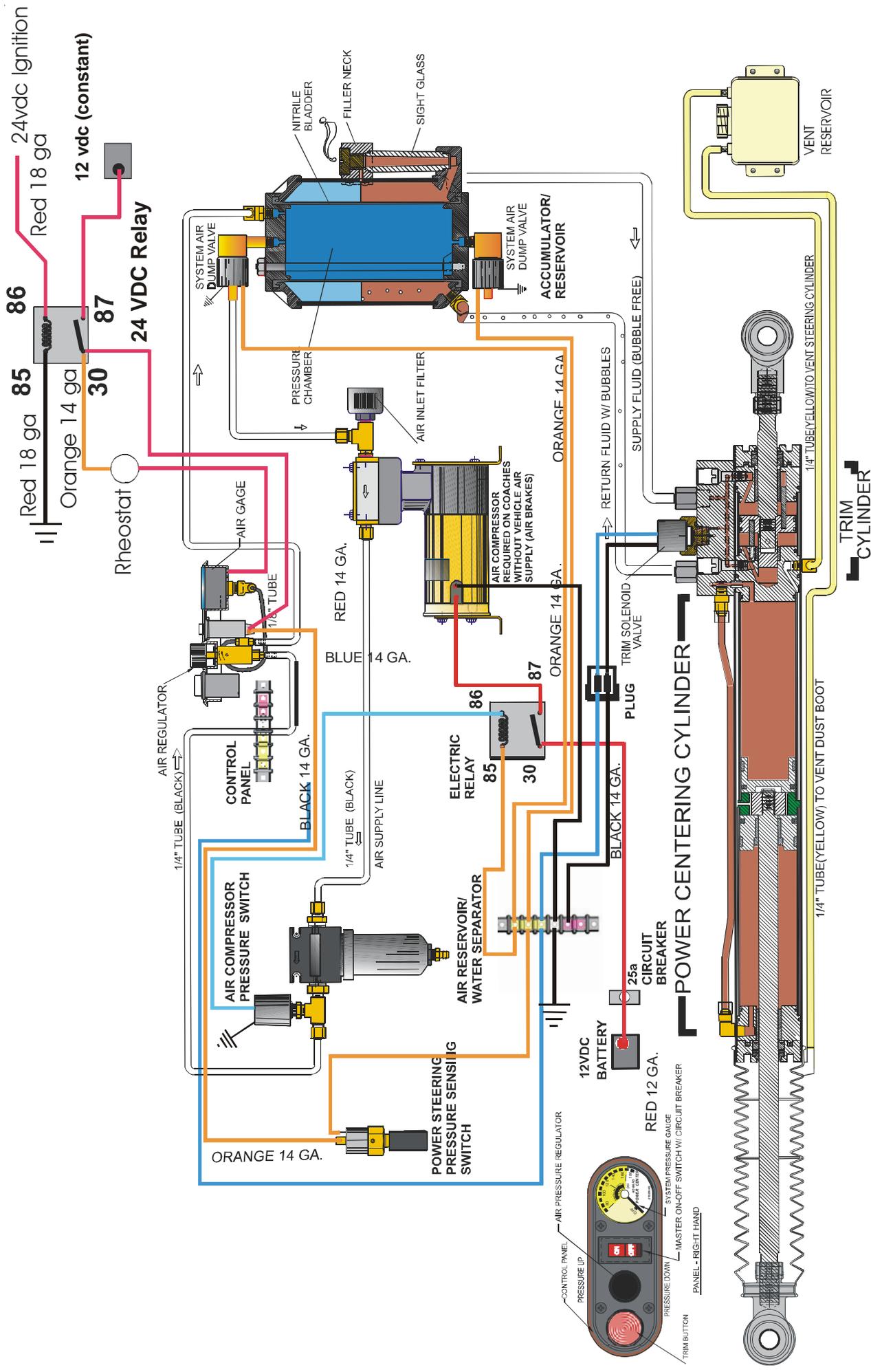
## HOWARD PRECISION STEER WHEEL DIRECTIONAL CONTROL SYSTEM

(TYPICAL HYDRAULIC & AIR LINE LAYOUT)



# HOWARD PRECISION STEER WHEEL DIRECTIONAL CONTROL SYSTEM WITH SEPARATE AIR COMPRESSOR

(TYPICAL ELECTRICAL 12vdc WIRING LAYOUT)

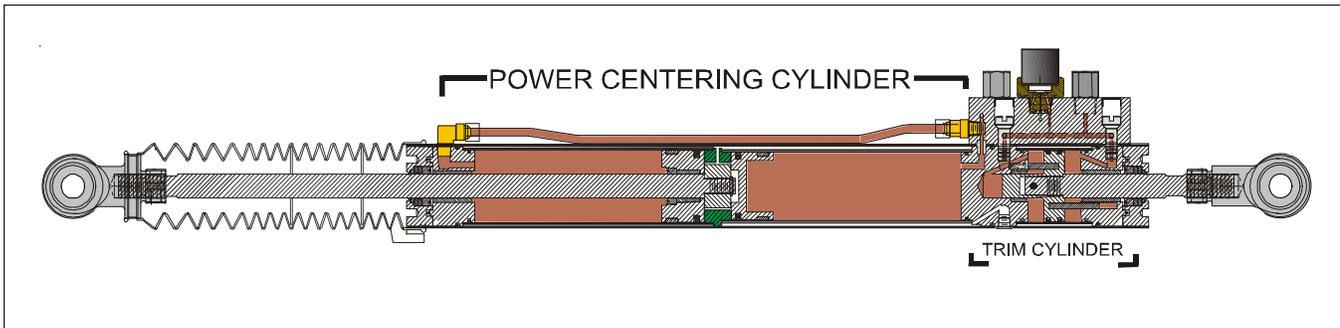


# HOWARD PRECISION STEER WHEEL DIRECTIONAL CONTROL SYSTEM WITH SEPARATE AIR COMPRESSOR (TYPICAL ELECTRICAL 24vdc WIRING LAYOUT)

# GENERAL DESIGN AND OPERATION

## SYSTEM DESIGN

### CYLINDER

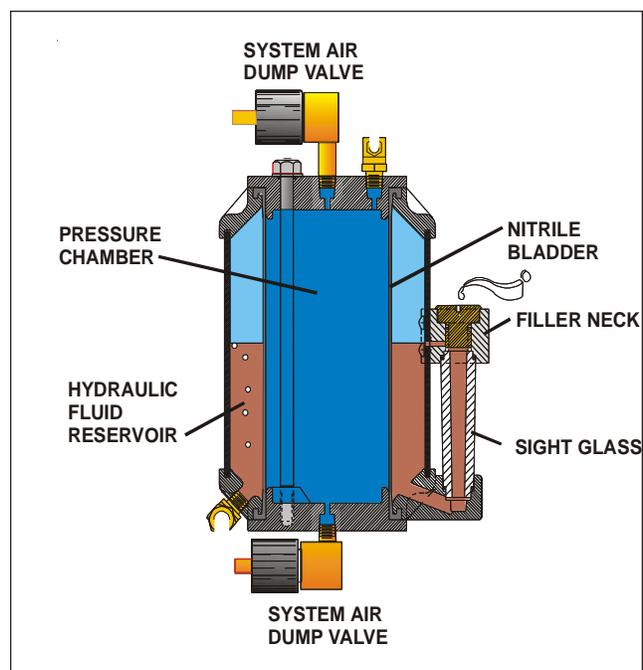


The centering and trim cylinder is comprised of three inner cylinders and one outer cylinder. The inner cylinders house pistons, which allows the cylinder to function in three modes. The trim end of the cylinder is fitted with a trim control box, which is attached to the outer cylinder. A series of check valves and solenoids control fluid flow to and from the cylinder. The design is such that the cylinder is self bleeding. The centering end of the cylinder houses the push-pull rod, which moves the push piston and the pull piston off their shared piston stop block. The trim shaft is connected to

the trim piston which is housed and contained by the trim cylinder. The complete cylinder is mounted to the vehicle with brackets via two heavy duty rod ends. A flexible heavy duty shaft boot protects the push-pull rod from the elements. Nylon stand-off washers inside the boot keep the boot aligned with the rod. The end caps, the outer cylinder, and their corresponding threads have withstood straight pull pressures of 16,000 lbs. without parting. Quality long-lived Parker seals are used throughout the cylinder. The trim shaft rod is protected from the elements by corrosion treatment

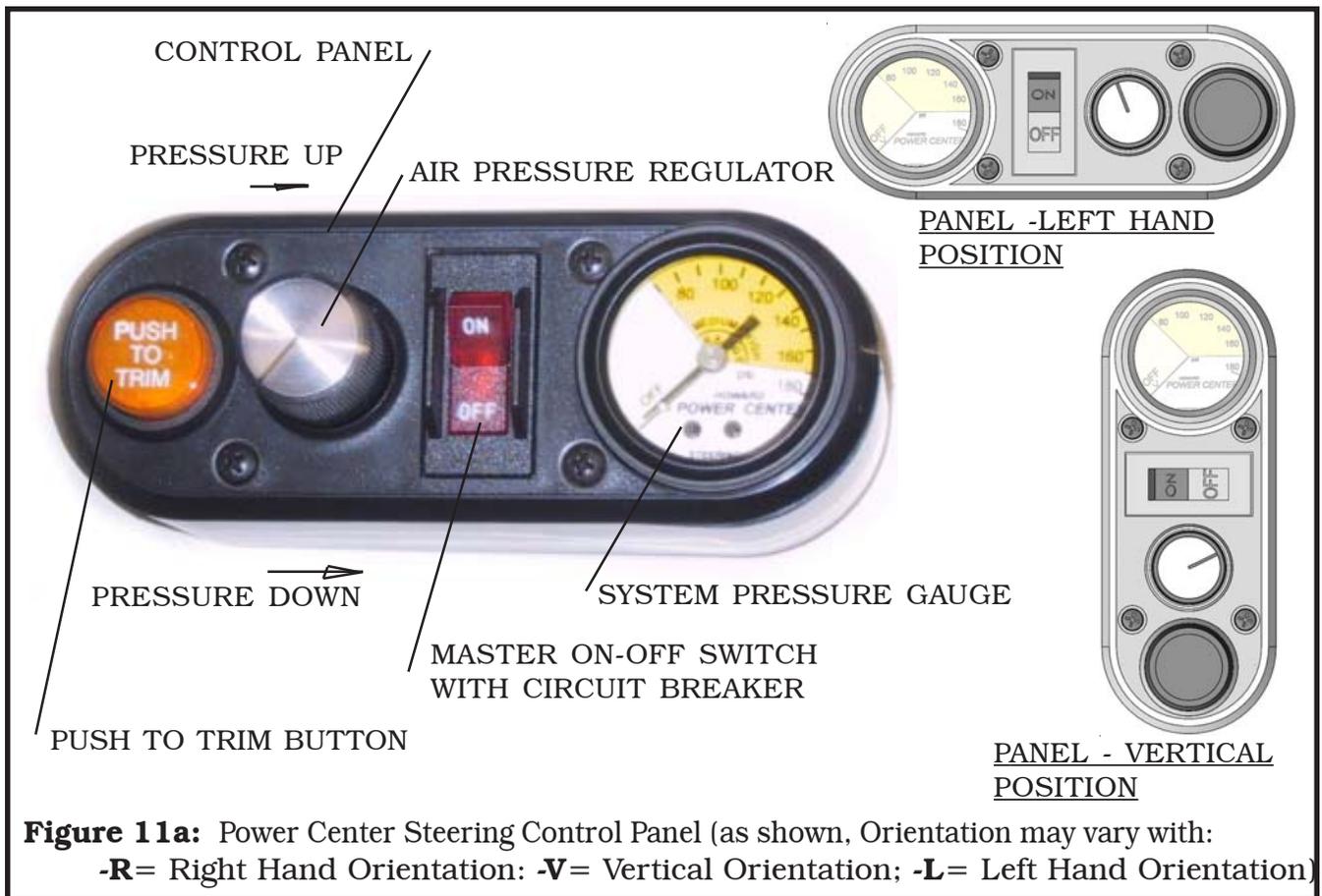
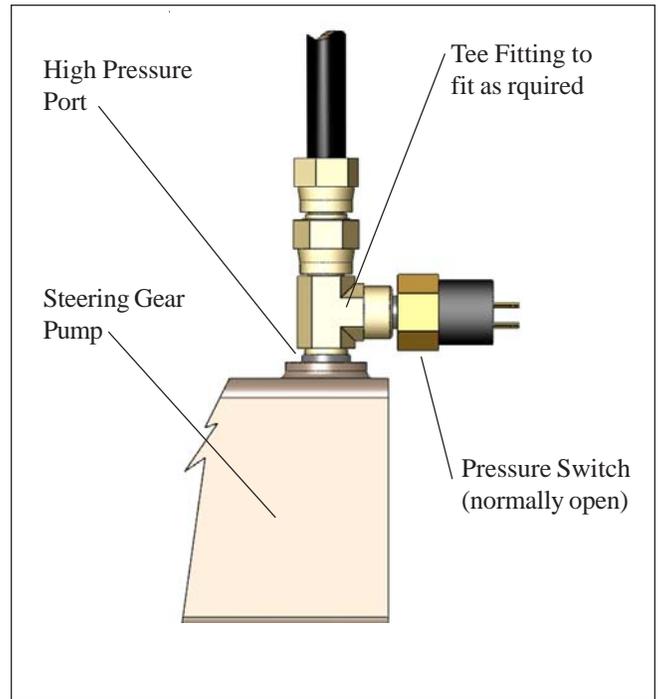
### ACCUMULATOR

This component is comprised of a heavy duty aluminum body, an upper and lower cast aluminum cap, two normally open continuous duty solenoids, a polycarbonate oil level sight glass, a nitrile bladder, and a combination moisture trap filter assembly. D.O.T. fittings are used to attach air and hydraulic lines to the accumulator. Design is such that the charging and discharging of the accumulator is done automatically each time it is turned on and off. Venting design of the accumulator prevents overfilling the oil reservoir.



## POWER STEERING PRESSURE SENSING SAFETY SWITCH

The power steering safety switch is designed to withstand pressures in excess of 3,000 P.S.I.. These switches are provided with multiple mounting fittings for the various chassis'. It is connected in-line with the high side power steering hose. It automatically shuts the Precision Steer Wheel Directional Control System down in the event of power steering failure.



**Figure 11a:** Power Center Steering Control Panel (as shown, Orientation may vary with: -R= Right Hand Orientation; -V= Vertical Orientation; -L= Left Hand Orientation)

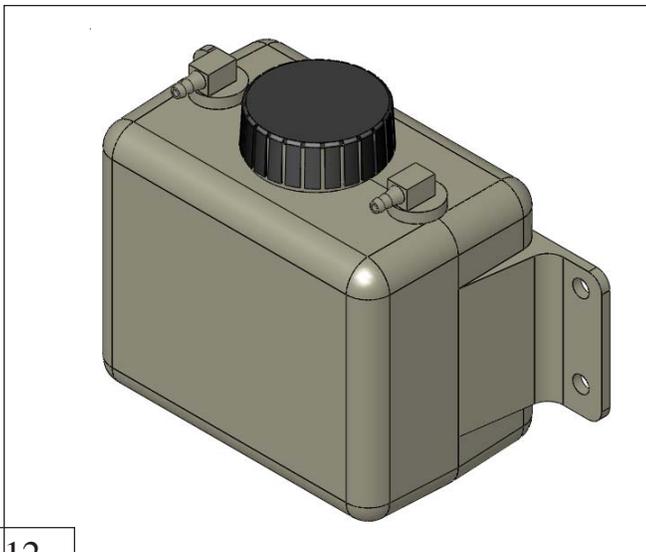
### CONTROL PANEL.

The control panel houses the master/circuit breaker on-off switch, the trim momentary switch, the miniature air regulator, and the air gauge. The control panel is designed for various mounting methods; flush, stand-off, or bracket mounted. Optional is a PVC Side Cover Mount.



## **ACCUMULATOR/COMPRESSOR PANEL**

Designed and offered for those vehicles that require operating pressures above available chassis air pressure. It consists of an accumulator, a compressor, fitted with an intake filter, dryer/filter/moisture trap, Bosch relay, and an air pressure cut-off switch. All components are pre-mounted and assembled on a galvanized panel for ease of installation.



## **VENT BOTTLE**

The vent bottle is designed to allow connection to the cylinder via two 1/4" lines. This reservoir is essential in assuring that only clean air is vented in and out of the cylinder chambers as it operates. It also will capture some fluid in the event of an internal seal failure. The lid is sealed to prevent any fluid being added.

## OPERATION

The Howard POWER CENTER STEERING System does what has never been accomplished before in automotive history. It power centers the steered wheels to a perfect, driver selected position, for straight ahead driving stability, which is not accomplished by any other method.

The power source is air pressure controlled by continuous duty 12 V.D.C. solenoid valves, which charges an air-over hydraulic accumulator. The accumulator transfers the air pressure to hydraulic fluid via a nitril bladder. The pressurized hydraulic fluid provides the force, which holds the steering cylinder and steering tires on a driver selected center. The vehicle's existing power steering system is many times stronger than the power centering system. Therefore, each system does what the other does not do, and a most desirable working relationship is established.

Whenever the vehicle's steered wheels are turned left or right by the power steering, the power centering cylinder's push or pull piston is forced away from its center stop position. When the steering wheel is released, the hydraulic pressure acts as a spring against the cylinder piston, thus pushing the piston back against the center stop block, thus re-centering the steering.

The fixed stop that the push-pull pistons rest against gives the steering wheel an on-center feel, which is also most desirable. This on-center feel helps prevent drivers from oversteering the vehicle, thus reducing unwanted rock and roll or exaggerated tail swing.

As you know, driving down a road does not

always mean that the steering wheel will be centered. Depending on road conditions and wind conditions, holding off-center is sometimes necessary and tiring in order to navigate a straight line. This is where the **trim cylinder**, located oposite the centering cylinder comes into play. The trim piston is held in place by a liquid lock. **When the trim solenoid valve is opened**, the trim piston is free to travel to its driver selected position. **When the trim solenoid is closed**, the piston is again in a liquid lock state and cannot move. This unique liquid lock system gives the trim cylinder infinite adjustment and relieves the driver of the unwanted strain of continually holding against the wind or slanted road condition\*.

The **control panel** gives the driver *manual authority* over use of the system and allows the driver to *adjust the sensitivity of the steering wheel* by regulating the amount of air pressure going to the accumulator. The driver can turn the system "on" or "off" as desired and, with the use of the push button trim control, it is possible to operate the trim cylinder while driving. The "on-off" switch receives 12 V.D.C. power and supplies power to the power steering safety switch and the trim button. The power steering safety switch supplies power to the air supply valves and accumulator dump valves. The two accumulator dump solenoid valves are normally open, which leaves the bladder open to atmosphere. They both close to trap the regulated air pressure when they are energized. The air supply cut-off solenoid is normally closed and opens when energized. The trim solenoid valve is normally closed and only opens when the trim button is pushed.

\* **NOTE!:** To use the **steering trim system**, *the pressure must be set at 100 lbs. or above*. The system trim works more efficiently at higher pressure settings.

# *Sub Zero Winter Operation*

## NOTICE:

When operating in near or below zero temperatures, *special MIL-H-5606 fluid* must be used. **MIL-H-5606** fluid is available from RCP, PSWC Dealers, Pennzoil, Exxon, Chevron, Mobil, Shell, Texaco, and others.

**NOTE** - in southern states, this low-temp fluid may not be readily available from automobile service stations. It is widely used in aircraft and should be available from those sources.

When using **MIL-H-5606** fluid, the **PSWC** system will operate satisfactorily at temperatures down to **40° below zero**. This compares to a low limit of **10° above zero** for the standard power steering fluid that has been used in all earlier production units. Unless winter operation in near zero temperatures is anticipated, power steering fluid works very well and is more readily available.

Beginning in March 1997, all units produced will have **MIL-H-5606** fluid suitable for **40° below zero** operation. These units will be indentified by a decal on the accumulator reservoir and the centering cylinder will have a “MW” stamp in the end of the trim box.

## **SPECIAL NOTICE:**

When operating in temperatures below **10° above zero**, the fluid must be changed to **MIL-H-5606**. Refer to **Service Bulletin -05** for fluid change procedures.

Should winter operation be necessary with fluid other than **MIL-H-5606** in temperatures lower than **15° above zero**, the system must be turned off well before the **15° above zero** temperature is reached. It *must* be left in the **“off”** position until warmer temperatures prevail.

**NOTE:** Units produced *prior* to March 1997 were serviced with standard power steering fluid. For owners that do not anticipate winter travel in temperatures below 15° above zero, there is **no urgent need** to change to the MIL-H-5606 fluid. These units may continue to be serviced with power steering fluid.

# *5,000 Mile Maintenance Checks*

1. Check the system's *Fluid Level*.

**WARNING!:** Never open fluid portion of the system when **pressurized**

2. Check the *Cylinder Mounting Brackets* for **looseness** and **safety retainer cotter pins**.
3. Check the *Cylinder's Protective Rubber Boot* for **tears** or **loose clamps**.
4. Check the *Hydraulic Lines* and the *Air Lines* for **chafing** or **abrasion**.
5. Check the system's *Wiring* for **chafing** or **abrasion**.
6. Check the *Vent Bottle* for **damage** or **fluid contamination**. The Vent Bottle should be clean and free of any fluids inside.

**NOTE!:** Fluid in Vent Bottle may indicate internal seal leakage.

7. Check the *Power Steering Pressure Sensing Switch*. With the System turned "on" and the Regulator turned up to Maximum, turn the *ignition switch* to the "on" position. **The system's Air Pressure Gauge should not read any pressure at this point.** Then start the vehicle's engine. The Air Pressure Gauge should now show air pressure building up.

**WARNING!:** Should the Air Pressure Gauge indicate Air Pressure when ignition switch is only in the "on" position - without the vehicle's engine running - **TURN THE SYSTEM "OFF"**. **DO NOT** use the system again until the Power Steering Pressure Sensing Switch can be adjusted, repaired, or replaced.

**WARNING!:** When checking Cylinder Functions, keep yourself clear of all Steering System Moving Parts. **DO NOT** put your **HANDS** on the Cylinder when the Steering Wheel is being turned or moved by someone else.

**WARNING!:** **DO NOT** loosen or remove any *HYDRAULIC*, *PNEUMATIC*, or *SOLENOID FITTINGS* when the system is energized. When working on this type of *Pressurized* system. **WEAR SAFETY GLASSES.**

## *Checking the System's Fluid Level*

- The Accumulator/Reservoir is equipped with a **sight glass** which indicates the *system's fluid level*. When the fluid level reaches the **add mark** on the side of the Accumulator, add the specified Hydraulic Fluid to bring the fluid level back up to the top of the Fill Cap.

*Only use* fluid that meets specification **MIL-H-5606** if sub zero winter operation is anticipated or if the accumulator is marked with a decal indicating low temperature fluid. If accumulator is not marked with the low temp fluid decal and no sub zero winter driving is anticipated then standard power steering fluid may be used. Only check fluid level when the cylinder is centered!

**WARNING!:** NEVER OPEN the Fill Cap when the System is Pressurized.

- Care must always be taken to **keep dirt or debris from entering the Accumulator** Before removing the Fill Cap, **clean all dirt, grease, or debris from the Fill Cap area**.
- Due to its design, the Accumulator/Reservoir cannot be overfilled. **However**, the Accumulator/Reservoir can appear to be full of fluid if the steered wheels are not in the **straight ahead** position. Therefore, checking the fluid level should be performed according to the following procedure:
  1. Start the Vehicle's engine.
  2. Turn the *PSWC System* "on" and adjust pressure over 100 P.S.I..
  3. With your hands off the the steering wheel, move the vehicle forward or backward to allow the *PSWC System* to center itself.
  4. Turn both the Engine and the System "off". The correct fluid level will now be indicated in the system's sight glass.
  5. Replenish the system fluid\* to maintain the level at the top of the Fill Cap Threads.

**\* See Note Box above or refer to page 14 of this manual for proper fluid callout.**

**NOTE!:** If the correct sequence for checking oil is not followed, the system can appear to be overfilled. This means that the Centering Cylinder was not centered properly and fluid will escape the Accumulator/Reservoir when the Fill Cap is removed. Should this occur, repeat procedures 1-5 and then re-check fluid level.

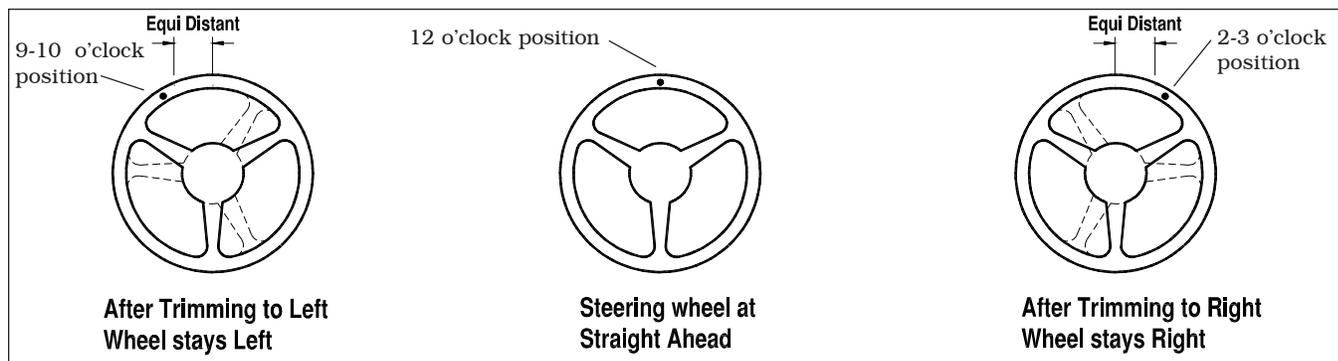
# TROUBLESHOOTING - TECHNICAL

## PRELIMINARY CHECKS

It goes without saying, that the best diagnostic tool you have available to you is the degree of knowledge you acquire about new products as they enter your chosen professional atmosphere. Do not create problems that do not exist - the *PSWC System* is new technology - but is not mysterious - only new. It's design is straight forward - *pneumatics* and *hydraulics* controlled by *12 V.D.C. switches* and *solenoid valves*.

**Preliminary Test:** Set the parking brake on the vehicle. Jack the front axle up, raising the front tires off the ground. Place the appropriate jack stands under the front axle, being sure they will not interfere with any steering components movement. Start the vehicle engine and turn the power system

on. Turn the air regulator knob fully clockwise till it stops. The air pressure gauge should be reading above **100 P.S.I.** The power center system should return and hold the steering wheel and front tires straight ahead. Turn the steering wheel **1/2** turn to the left and release. The wheel should return to center hands off. Repeat **1/2** turn to the right. The wheel should return to center. Test the trim function. Turn the steering wheel **1/2** turn to the left and press the trim button for **15** seconds. Release the trim button and the steering wheel. The steering wheel should be off-center approximately **1/3** turn to the left. Turn the wheel one full turn to the right and hold the trim button down for **15** seconds again. Release the button and the steering wheel. The steering wheel should be off-center approximately **1/3** turn to the right.



If the **PSWC System** functions as described each direction but not equally in each direction or only in one direction, go to “**Setting the Trim (Centering)**”.

If it does not function as described, proceed to the troubleshooting guide and search for the symptom you are experiencing.

The troubleshooting guide that follows is divided into three columns: **Symptoms**, **Causes**, and a **Check List**. The guide will refer you to the appropriate schematic as needed.

**NOTE!:** The internal parts of the cylinder and trim box are not field service items. Do not replace it out of your stock or order a replacement without first contacting our customer service department for approval. This quick phone call can easily prevent anyone from incurring unnecessary expenses.

## TROUBLESHOOTING GUIDE

*(System using Kit Furnished Air Compressor)*

### SYMPTOM

### CAUSE

### CHECKLIST

Air Compressor does not come on / No air pressure registers on gauge

Loss of electrical power. Vehicle engine must be running and power steering pressure must be adequate to trigger the power steering safety switch. This switch provides voltage to all other electrical components.

Start engine. Turn pressure regulator fully clockwise to stop. If air pressure does not come up- then proceed. Follow “*System with kit supplied air compressor Electric schematic*”.

Check voltage at:

- a. 20 amp. circuit breaker constant 12V power supply
- b. bosch relay on compressor panel
  - 1) 12ga. red wire (constant 12V pwr. supply)
  - 2) 14ga. orange wire -( power steering s pressure sensing switch)

Check ground wire from:

- a. compressor switch to panel (chassis ground)
- b. continuity across compressor switch lead wires

Loss of continuity (open circuit) from compressor pressure switch to ground (switch is normally ‘closed’ and “opens” when system reaches cut off pressure)

Faulty compressor switch

Replace compressor pressure switch.

**NOTE!:**The easiest way to check voltage at the solenoids is to disconnect the wires coming off the solenoids that go to chassis ground. Place your test light or test meter between each wire and chassis ground. This procedure will also eliminate the possibility of a corroded or faulty ground connection. Loss of voltage to any of the components (a-e) will disable the system.

**CAUTION!:** Before you unscrew the trim solenoid from the trim box, care must be taken to clean all dirt, grease. or debris from around the base of the valve. Malfunction of the cylinder due to contamination does not constitute a faulty component.

## SYMPTOM

Air compressor “cycles” on or won’t shut off

## CAUSE

Air leak (s) in system

Supply side is 1/4” black & regulated pressure side 1/4” blue line

## CHECKLIST

See system air & hydraulic schematic- perform soapy water test for air bubbles.

- a. After compressor is running- adjust air pressure regulator counter-clockwise to stop (adjust to “zero”psi)
- b. if compressor shuts off check blue line for leak
- c. trace black line if compressor continues to run.

The system returns the wheel from a left and right hand turn, but will not trim right or left.

1. Loss of voltage or chassis ground to the trim solenoid valve.

1. Start engine and turn system on. Follow the System Electrical Schematic.
  - a. Disconnect the ground lead of the trim solenoid. Depress the trim button and test voltage from this wire to ground. You should read approximately **12VDC**. If you do not, check connections to the trim button and the wire leading to the solenoid. If you have voltage to the solenoid, but do not have voltage from the solenoid ground lead to chassis ground, turn the system and engine “off”.

System pulls to the left or right when turned “on” and trim won’t respond

2. System “off-center” or “out of trim range” see- **“Setting the trim-Centering”- page 20-21**

**NOTE!:** Do not use a knife or sharp instrument to slice the tubing over the barbs. Nicking the barbs will result in an air leak when the hose is reattached. Use a small flame or heat gun to soften tubing, then pull it off. Trim damaged tubing and reinstall

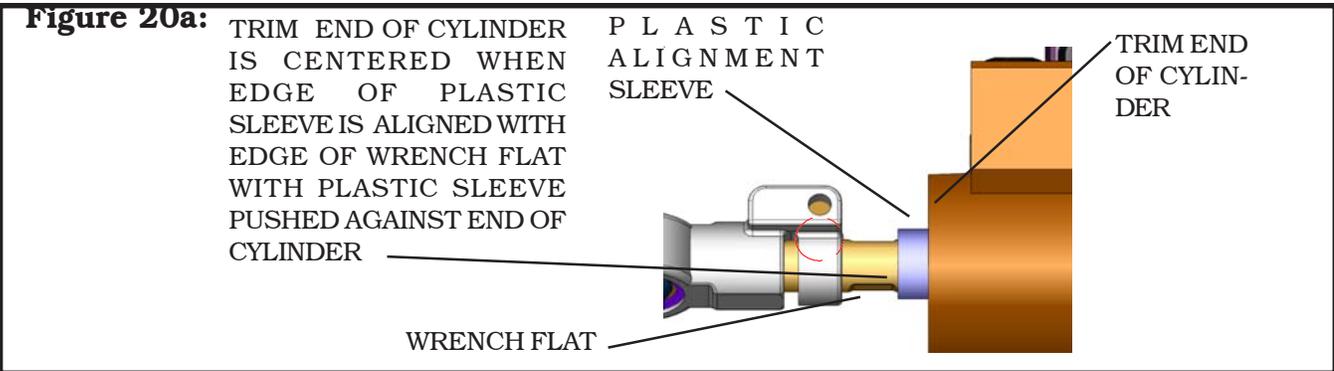
**CAUTION!:** Before you unscrew the trim solenoid from the trim box, care must be taken to clean all dirt, grease, or debris from around the base of the valve. Malfunction of the cylinder due to contamination does not constitute a faulty component.

**See Caution** and proceed. Clip the leads, grabbing the knurled brass base, unscrew it like a light bulb and screw the new valve in firmly by hand. Do not use any tools to tighten the solenoid valve. Reconnect the wires. Repeat Preliminary Test on page 17.

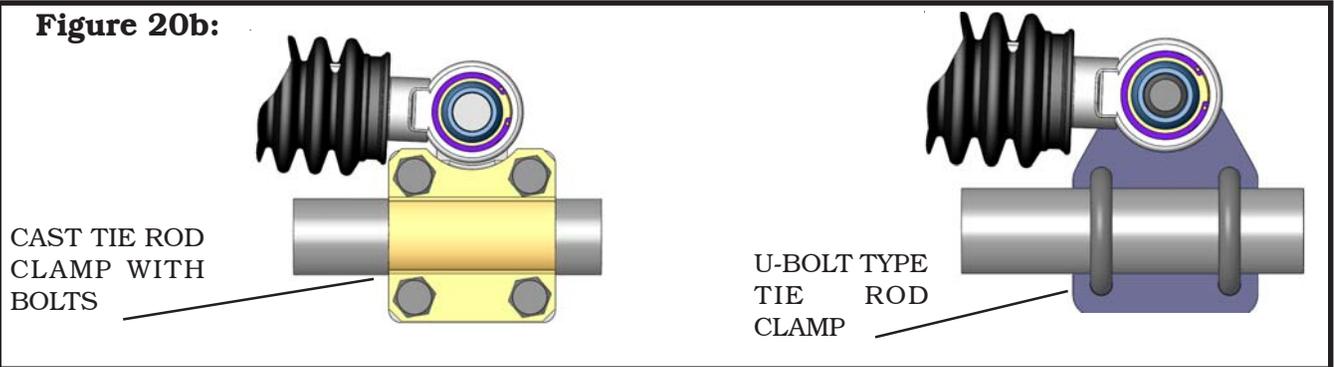
# Setting the Trim (Centering)

**STEP 1:** Start engine, turn Precision Steer Wheel Directional Control System “on” (this centers the steering position).

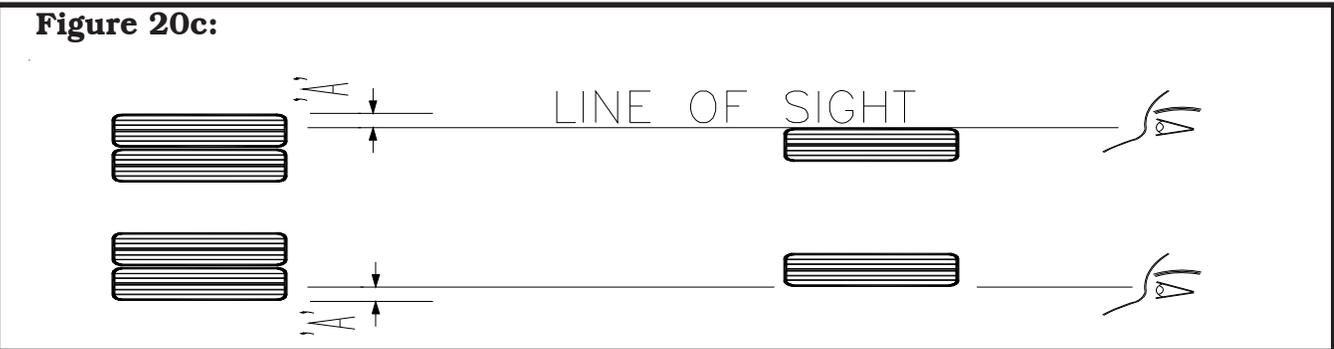
**STEP 2: CENTERING TRIM END:** Turn the steering wheel to the direction that moves the WRENCH FLAT on the TRIM SHAFT out from under the ALIGNMENT MARKER. With the wheels turned, PRESS THE TRIM BUTTON to position the edge of the wrench flat at the edge of the MARKER RING. (Figure 20a)



**STEP 3: CENTERING THE CYLINDER:** Loosen the four (4) CLAMP BOLTS so that TIE ROD BRACKET can slip as the cylinder finds center. Straighten the front wheels as discussed in step 4. When the wheels are centered, securely tighten the four (4) bolts (Torque to 30-35 Ft/Lb). (Figure 20b) **NOTE:** A U-Bolt type Clamp Bracket may be used.



**STEP 4: CENTERING THE WHEELS:** This is done by sighting along the OUTSIDE of the Front Tires looking towards the Rear Tires. (Figure 20c) Turn the steering wheel as required to even the Line-of-Sight Interception at the Rear Tires. A creeper may be useful.



Always double check the vehicle to **MAKE SURE** that the TRIM is **CENTERED PROPERLY.**

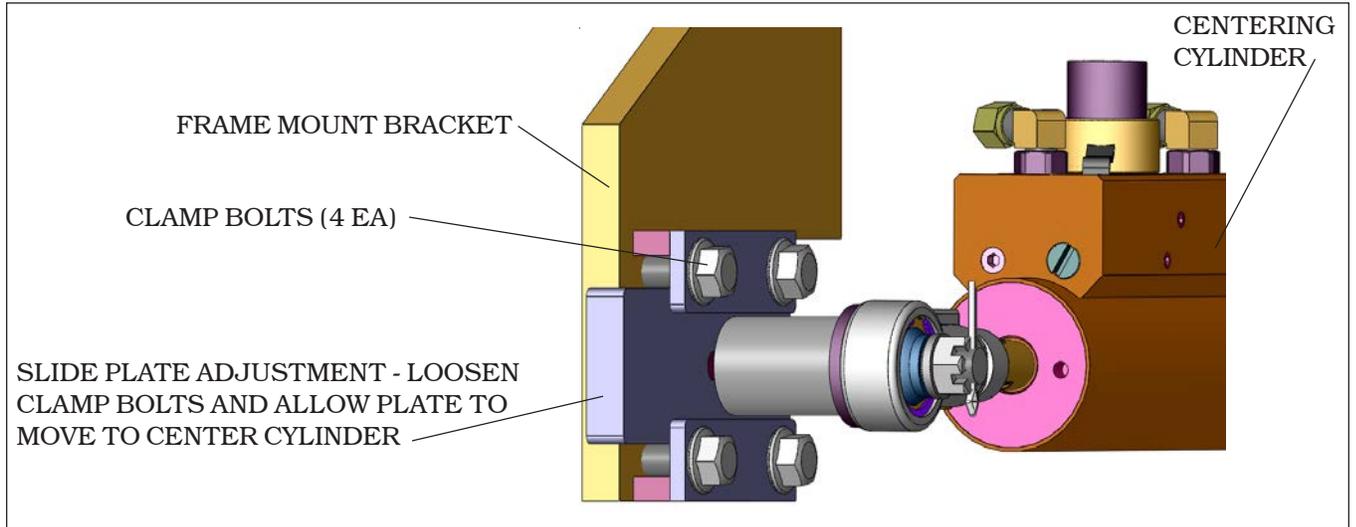
**NEVER ASSUME!!!**

## **Setting the Trim - Adjustable Slider Plate Mount**

### **Centering the Cylinder** (*Adjustable Slide Mount with Clamp Angles*)

(Complete Steps 1,2 and 4 on previous page before proceeding with the following.)

Loosen the four (4) CLAMP BOLTS so that the Adjustable Slider clamp can slip on the base plate as the cylinder is allowed to find center. Straighten the front steer wheels as discussed in (Centering the Wheels) on page 21. When the wheels are straight ahead, securely tighten the four (4) 1/2 flanged clamp bolts. Torque to approximately **85 ft/lb.**



### **Other Driving Situations:**

Symptom: Vehicle wanders and won't track straight (when trimmed for straight) as expected.

Cause: Toe-In not set to specs.

- Check Toe. Total Toe for all chassis needs to be set at 1/8" positive. (Toed in)
- Check to make sure tie rod ends are twisted (see page 23) to take out any rotational slop. This includes tie rods on straight axles and drag links on independent front suspensions.
- Check to make sure joints are well lubricated.
- Check mounting bracket for loose bolts and or clamps.
- Check cylinder rod ends for "looseness".
- Check chassis for worn or loose bushing (i.e. track bars, stabilizer bars..).

Prior to chassis alignment, mark position of system tie rod or drag link clamp bracket for proper trim operation after alignment.

**Call 1-800-879-4277 for additional assistance.**

**e-mail: [customer@hpcss.com](mailto:customer@hpcss.com)**

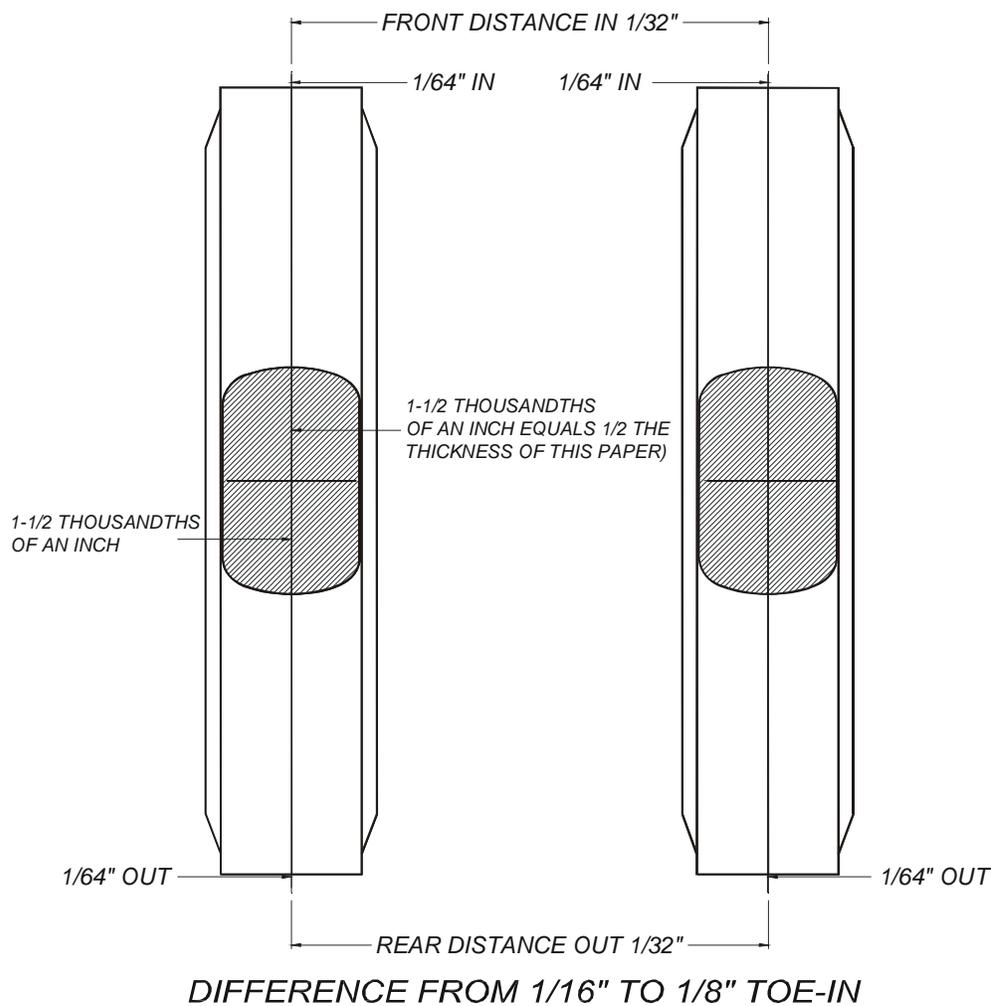
## Drivability Symptoms: Vehicle Excessive Wandering:

### Check Toe In. Toe needs to be set at 1/8" positive.

With Power Center Steering the recommended Toe-In Setting is 1/8". Its been proven with thousands of power centering systems in service for millions of accumulated miles driven with the 1/8" Toe-In setting, tire wear is not affected.

A major tire company conducted a study on trucks and buses with and without Power Center Steering. The tire company reported a 55% improvement in Steer Wheel Tire Life on vehicles with Power Center Steering because of the non-cupping smooth tire wear pattern.

The illustration below shows the almost unmeasurable difference in Tire Foot Print between 1/16" and 1/8" toe settings which explains why no difference in tire wear could be expected because of increased toe.



Trim doesn't seem to hold properly:  
Check for excessive Tie Rod Rotation

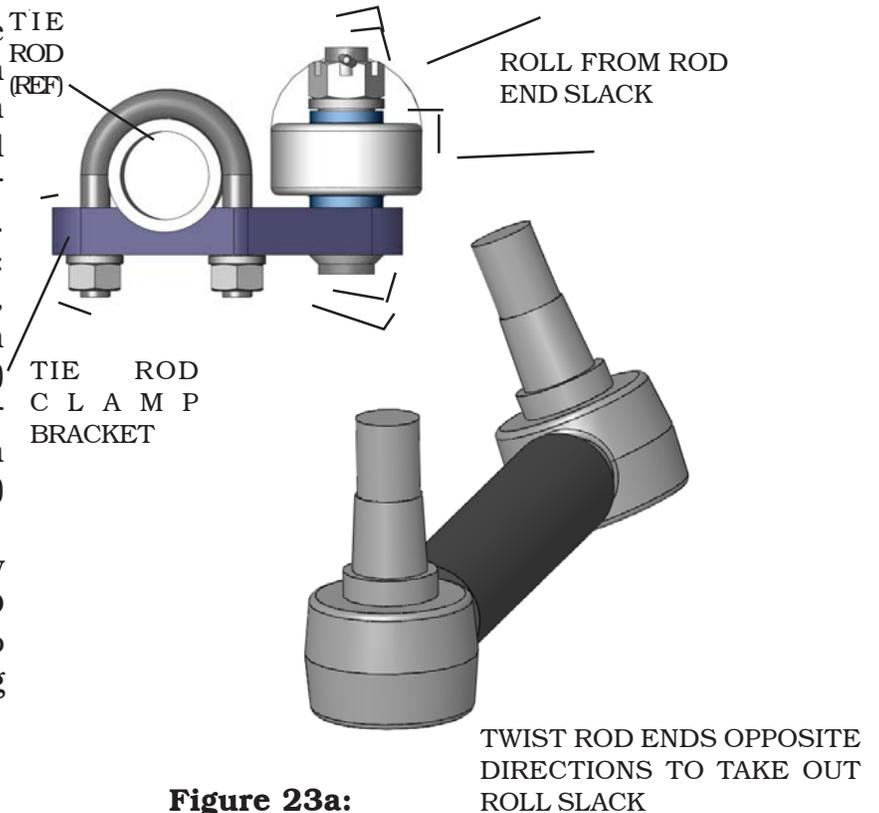
## Minimizing Excess Tie Rod Motion

On SOLID FRONT Axle Vehicles, the Tie Rod System will rock Front-and-Back when the Steered Wheels are turned left and right with the Power Center Steering System engaged.

To Minimize this motion:

- a) Loosen a Tie Rod End Clamp,
- b) Offset the Tie Rod Ends in opposite directions (Figure 23a) - backing off only slightly after rotational movement in each direction stops, and
- c) Retighten the Tie Rod Clamp.

This procedure is highly recommended for all TIE ROD MOUNTED systems also including mounting on the Drag Link.



**Figure 23a:**

# Tools Required for Installing

## Howard Precision SteerWheel Directional control System

The following general list identifies tools commonly used in each PSWDC installation:

- 1/2” Impact Wrench\* (to break nuts loose)
  - 1-1/8” Deep Impact Socket
  - Torque Wrench (if available, this is preferred method to retorque the nuts to factory specs)
  - 3/8” thru 1-1/8” Combination Wrench Set
  - SCREW GUN with *Phillips & Standard Heads*, 1/4” Socket, 5/16” Socket, and 3/8” Socket
  - *Phillips* Screwdriver
  - *Standard* Screwdriver
  - Tape Measure
  - 3/8” Cordless Drill, Electric Drill, or Air Drill
  - Medium *Ball Peen* Hammer
  - *Wire Cutters, Crimpers, & Stripping* Tools
  - 12-volt “hot wire” Test Light
  - Razor Knife or Plastic Tubing Cutter
- 
- **Hydraulic Fluid** that meets the specification **MIL-H-5606** as manufactured by:  
**Pennzoil, Exxon, Chevron, Mobil, Shell, Texaco, etc..**
  - Air Brake **Hose Fittings**, Air Brake **Tubing**, and General Purpose **Electrical Wiring** used for servicing the *PSWDC System* must meet D.O.T. Specifications for the application.

# *SAE Guidelines for Maximum Allowable Torque for Fine Thread Series Bolts*

- When installing Bolts, it is good practice to use *torque wrenches* (when available) to determine when bolts have been adequately tightened.

- **CAUTION!:** Impact wrenches can over or under torque the bolt, thus resulting in a failure to the bolt by over torquing or the slipping or failure of component brackets by undertorquing.

- The Torquing chart in the next column shows the Maximum Allowable Torque on Bolts - Fine Thread Series.

- Consult the original equipment manual on recommended torques.

Maximum Allowable Torque Fine Thread Series		
Dia. Size and Threads/Inch	Grade	Max. Torque Ft.- Lbs.
3/8 - 24 NF	5	35
	8	45
7/16 - 20 NF	5	55
	8	70
1/2 - 20 NF	5	92
	8	129
9/16 - 18 NF	5	131
	8	185
5/8 - 18 NF	5	181
	8	256
3/4 - 16 NF	5	316
	8	446
7/8 - 14 NF	5	502
	8	710
1 - 14 NF	5	748
	8	1,057
1-1/8 - 12 NF	5	949
	8	1,522
1-1/4 - 12 NF	5	1,313
	8	2,107

# *Additional Vehicle Steering System*

## *Maintenance Tips*

- Prevent internal “bottoming” of the steering gear. Carefully check Steering Stops to be sure that they meet the manufacturer’s specifications.
- Regularly check the PSWDC System’s Fluid Level in the accumulator sight glass as well as the Fluid Level in the Power Steering System Reservoir.
- Keep the tires inflated to the correct pressure.
- Investigate and *immediately* correct the cause of **play, rattle, or shimmy** in any part of the steering linkage or steering mechanism.
- Remove the cause of Steering Column Misalignment.
- After any vehicle accident, inspect for any damaged PSWDC System Components or Power Steering Component damage.
- Do not attempt to weld any broken steering component. Replace the component with original Equipment Replacement Parts only.
- Do not straighten any bent steering component - not by cold bending or by heating the component for bending.
- Always clean dirt and debris off of the *PSWDC System* Fill Cap Area before removing the Fill Cap. Prevent dirt or debris contamination of your *PSWDC System*.
- Investigate and correct any found external leaks, no matter how minor.
- Replace filters and pumps in compliance with specifications.
- Have the vehicles’ **alignment** checked **annually**, front and rear, by a qualified shop.
- King Pins/Ball Joint Lubrication should be done with tires off the ground.
- Check the *Cylinder Mounting Brackets* for both looseness and that the **Safety Retainer Cotter Pins** have been installed.

## *Additional Steering Tips*

- Check the Hydraulic Lines and the Air Lines for Chaffing and Abrasions. Also check Line Connections for loosenes.
- Check the *system's Wiring* for Chaffing and Abrasions.
- Check the overall condition of the **Vent Reservoir Bottle**. The bottle should be *clean* and *free of any excessive moisture*.

**NOTE!:** Never Add Fluid to the Vent Reservoir Bottle!

- Check the Power Steering Pressure Sensing Switch. With the System turned “on” and the Regulator set to mid-range, turn the *ignition switch* to the “on” position. Do not start the engine. **The system's Air Pressure Gauge should not read (indicate) any pressure at this point**. Start the vehicle's engine. The PCS System will now turn “on” (activate).

**WARNING!:** Should the **Air Pressure Gauge** indicate *Air Pressure* when the Ignition Switch in the “on” position - *without the vehicle's engine running* - **TURN THE SYSTEM “OFF”**. DO NOT use the system again until the Power Steering Pressure Sensing Switch can be replaced.

**WARNING!:** When checking *Cylinder Functions*, keep hands and arms clear of all Steering Sytem Moving Parts. DO NOT put your HANDS on the Cylinder when the Steering Wheel is being turned or moved by someone else.

**WARNING!:** DO NOT loosen or remove any HYDRAULIC FITTINGS, PNEUMATIC FITTINGS, or SOLENOID FITTINGS when the system is energized. When working on any type of Pressurized System  
- WEAR SAFETY GLASSES!

# *Final Inspection*

- 1. ACCUMULATOR:** Start engine. Turn PCS System “on” and straighten the steered wheels. Turn Engine “off”. Check the Accumulator Sight Glass. *No air Gap should be visible.* Top-Off as required. Check for leaks (**AIR** or **FLUID**). **NOTE:** Check fluid level in Power Steering Reservoir... Replenish if required.
- 2. CYLINDER:** Check mounting bolts and pins for looseness or missing cotter pins. Check routing of harnesses for interference with suspension moving parts. Check for leaks (**FLUID** and **AIR**). Turn wheels left and right, Lock to Lock, to Check Cylinder clearances. Make sure that the steering stops on the spindle are contacting the axle before the cylinder bottoms out internally.

Also double check that the TIE ROD CLAMP does not interfere with the TIE ROD TUBE travel (i.e.: shock mounts, sway bars, etc.).

**NOTE:** If the Tie Rod Tube contacts the centering cylinder in a full left-hand turn or right-hand re-adjust the clamp bracket if possible. RE-CHECK for contact. If there is still interference then call Customer Service.

- 3. CONTROL:** Turn the PCS “off”. -Air Gauge should bleed to 0 P.S.I.. Turn system back “on” - rotate regulator clockwise to stop. Maximum pressure is about 170 P.S.I.. Turn the regulator counterclockwise to stop. System Air Pressure Gauge should bleed to 0 P.S.I.. Reset sytem to 100 P.S.I.
- 4. POWER STEERING PRESSURE SENSING SWITCH:** Check for leaks (**FLUID**). Turn Engine “off”. System Air Pressure should bleed to 0 P.S.I.. Turn ignition to “on” position - System Air Pressure should remain at 0 P.S.I.. Start engine, system Air Pressure should return to previous setting.
- 5. AIR SUPPLY SOLENOID** (Installed in kits without compressors): If Sytem Air Pressure registers when system is turned on - solenoid is OK.
- 6. TRIM BUTTON:** With the wheels straight ahead, turn the steering wheel one (**1**) revolution to the LEFT, push and hold TRIM BUTTON while another person watches the TRIM END of the Cylinder - Cylinder should move toward tie rod end. Turn steering Wheel two (**2**) revolutions to the RIGHT and repeat the TRIM TEST. This time the Cylinder should move away from the tie rod end. Re-center Trim Piston.

**NOTE:** Cylinder movement “toward” and “away from” Tie Rod End might be reversed from above depending upon final installation orientation of the cylinder.

- 7. Lubricate all Front-end** components.