

TRW Automotive Commercial Steering Systems

# RCS Rotary Cylinder Service Manual

RCS 40,55,65, AND 85 SERIES



#### **Hazard Warning Definitions**

	A warning describes hazards or unsafe practices which could result in severe personal injury or death.
	A caution describes hazards or unsafe practices which could result in personal injury or product or property damage.
NOTE	A note gives key information to make following a procedure easier or quicker.

#### Disclaimer

This Service Manual has been prepared by TRW Commercial Steering Division for reference and use by mechanics who have been trained to repair and service steering components and systems on heavy commercial vehicles. TRW Commercial Steering Division has exercised reasonable care and diligence to present accurate, clear and complete information and instructions regarding the TRW Commercial Steering RCS Series Rotary Cylinders. Since this is a general Service Manual, the photographs and illustrations may not look exactly like the rotary cylinder being serviced. The procedures, therefore, must be carefully read and understood before servicing.

If inspection or testing reveals evidence of abnormal wear or damage to the RCS rotary cylinder, or if you encounter circumstances not covered in the Manual, **Stop** - **Consult the vehicle manufacturer's Service Manual and warranty**. Do not try to repair or service an RCS rotary cylinder which has been damaged or includes any part that shows excessive wear unless the damaged and worn parts are replaced with original TRW replacement and service parts and the unit is restored to TRW's specifications for the RCS rotary cylinder.

It is the responsibility of the mechanic performing the maintenance, repairs or service on a particular RCS rotary cylinder to (a) inspect the rotary cylinder for abnormal wear and damage, (b) choose a repair procedure which will not endanger his/her safety, the safety of others, the vehicle, or the safe operation of the vehicle, and (c) fully inspect and test the RCS rotary cylinder and the vehicle steering system to ensure that the repair or service of the rotary cylinder has been properly performed and that the rotary cylinder and system will function properly.

#### Patents

TRW Commercial Steering Division RCS rotary cylinders are covered by several United States and foreign patents, either issued or pending.

#### Section 4 Reseal & Repair

Disassembly
Inspection
Assembly
Internal Damage Repair (by reference)
Poppet Component Replacement
Roller Bearing or Retaining Ring Replacement 39
Roller Bearing Replacement - Step Bore Gear 40
Replace Housing Ports, Plugs and Screws
Final Adjustments

#### **Disassembly Preparation**

Stop the vehicle with wheels pointed straight ahead.

Clean off all outside dirt from around fittings and hose connections before you remove the gear.

Remove output shaft connections per vehicle manufacturer's instructions.

WARNING When using a chisel to spread a pinch bolt-type pitman arm boss for assembly or removal from the shaft, maintain a firm grip on the chisel at all times. Failure to do this may result in the chisel flying loose which could cause an injury. Never leave the chisel wedged in the pitman arm boss. If you cannot remove the pitman arm from the shaft with a chisel and your hands, remove the chisel from the arm boss and use a puller only to remove pitman arm.

**CAUTION** Do not use a hammer on the pitman arm to remove it from sector shaft as internal damage to cylinder could result. Be sure there is no spreading wedge left in the pitman arm boss before tightening pitman arm clamp bolt after assembly on sector shaft. Do not pound the universal joint or input shaft coupling on or off the input shaft as internal damage to the steering gear can result.

**CAUTION** Unless the poppet adjuster seat and sleeve assemblies (22) are to be removed and replaced or reset for automatic poppet adjustment, or a manual adjustment with a service poppet adjuster screw (59) and nut (60) is anticipated, do not allow the input shaft on a cylinder with the automatic poppet adjustment feature to rotate more than 20° from "straight ahead position" when the output shaft is disconnected from the vehicle steering linkage; this could disrupt the poppet setting achieved at initial installation. The steering gear is in the "straight ahead position" when the timing marks on the end of the housing trunnion and sector shaft are aligned.

Identify and mark the lines before removing them from the cylinder. Make sure lines are replaced to the same ports from which they are removed. Remove the hydraulic lines from the gear, and immediately plug all port holes and fluid lines.

**A** WARNING RCS auxiliary cylinders can weigh up to 110 pounds (50 kg) dry. Exercise caution when you remove, lift, carry, or fix in a bench vise.

Remove the cylinder from the vehicle and take it to a clean work surface.

Clean and dry the cylinder before you start to disassemble it.

As you disassemble the cylinder, clean all parts in clean, OSHA approved solvent, and air blow-dry them only.

	Because they are flammable, be extremely careful when using any solvents. Even a small explosion or fire could cause injury or death.			
	Wear eye protection and be sure to comply with OSHA or other maximum air pressure requirements.			
	Never steam clean or high-pressure wash hydraulic steering components. Do not force or			
abuse closely fitted parts. Use care that bearing and sealing surfaces are not damaged by he assembly and disassembly procedures.				

Keep each part separate to avoid nicks and burrs.

Discard all seals, o-rings, and gaskets removed from the cylinder. Replace them with new parts only.

The auxiliary cylinder should be identified to the vehicle from which it was removed. The poppet adjuster seat and sleeve assemblies are set for that particular vehicle only.

### Disassembly

Tools Required		Materials Required		
Allen wrenches Pocket knife RatchetScrewdriver Sockets: •Standard •Torx ViseRolling head pry bar Rubber mallet•Torx Vise			Eme	ery cloth sking tape
	+BTICETE EXCERNENCE O - unit of the second s	Position gear in vise	1.	Put the unit in a vise, clamping firmly against the housing mounting flange or boss. Side cover and end cover should be accessible for disassembly.           CAUTION         Do not clamp against body of housing. If mounting boss or flange is not accessible, fabricate and attach a mounting plate to the housing mounting bosses.
	Testes Libiter Libiter Libiter Libiter Libiter Libiter Libiter Libiter	Unplug ports Appropriate size socket or open- end wrench	2.	Prepare for fluid drainage and unplug hydraulic ports.
TASSESSES UT2CAN	TRAT	Position sector shaft	3.	Rotate the sector shaft until the timing mark on the end of the sector shaft is in line with the timing mark on the end of the housing. This will position the sector shaft for removal.
TASES2266 WF2/-XV		Remove dirt & water seal Small screwdriver	4.	<b>Standard cylinders only</b> - Remove and discard dirt & water seal (39) from the housing trunnion.

	Clean sector shaft Fine grade emery cloth	5.	Remove any paint or corrosion from the exposed area of the sector shaft (42).
WE2 SKILL	Tape sector shaft Masking tape	6.	Tape the serrations and bolt groove of the sector shaft with one layer of masking tape. The tape should not extend onto the sector shaft bearing diameter.
TATI BERE LEVELERE	<b>Remove jam nut</b> 3⁄4" Socket	7.	Remove the sector shaft adjusting screw jam nut (47).
PATE Selector Outrico	Remove side cover bolts	8.	Be prepared for more fluid drainage and remove the six or eight special bolts (48) from the side cover (46).
O 1 GU	Remove side cover	9.	Be prepared for more fluid drainage and remove the side cover and sector shaft assembly from the gear. You may start the shaft and cover assembly removal by tapping the end of the shaft lightly with a soft mallet or wooden hammer handle.



**Discard gasket** 

10. Remove and discard the side cover gasket (45).



Remove vent plug

11. Remove and discard the vent plug (49).



#### Remove sector shaft from cover

12. Turn sector shaft adjusting screw (43) clockwise through the side cover and pull the sector shaft out of the side cover.

Screwdriver



#### Remove side cover seal

13.

¾" Drive socket Rolling head pry bar **CAUTION** Don't damage the bore or DU bushing when removing the seal. RCS85 cylinders are not equipped with the DU bushing.

Clamp the side cover in a vise. Place a standard  $\frac{5}{11}$  or  $\frac{11}{16}$  -  $\frac{3}{8}$  drive socket in the center of the side cover. pry the seal (41) out with a rolling head pry bar, using the socket for support. Discard the seal and remove the socket.



#### Inspect adjusting screw and retainer

14. Inspect the sector shaft assembly for damaged adjusting screw threads. The retainer (44) must be securely staked in place. The adjusting screw must rotate by hand with no perceptible end play (lash).

	Remove end cover bolts Torx socket E-16 or E-18	15.	Mark the orientati prior to removal or torx head end cov	on of the end cover to the housing f the end cover. Remove the four rer bolts (1), and the end cover (5).
	Remove end cover, worm and rack subassembly	16.	Be prepared for m rack piston.	nore fluid drainage and remove the
			<b>A</b> CAUTION disturbed if the pop reset during disass	The set position of poppet seat and sleeve assemblies (22) must not be opets are not going to be replaced or sembly.
0	Pocket knife	16A.	NOTE	If your unit is short "V" construc-
			the end of the rac fixed stop screw. ing the rack pisto piston seal ring (2 the housing. Exp shaft cavity, then from the rack pist	tion, the rack piston seal is on ck piston closest to the poppet Remove the seal before remov- n to prevent the Teflon rack 20) from "hanging up" when it exits bose the seal through the sector cut and remove the seal ring ton.
	Remove seal	17.	Remove and disca	ard the end cover seal ring (6).
	Remove seal ring and o-ring Pocket knife	18.	Cut and remove th (21) from the rack disassembly step	he Teflon seal ring (20) and o-ring piston if not removed during 16A.



housing for brinelling or spalling. Inspect retaining ring for damage. If replacement of either part is required, go to **Roller Bearing or Retaining Ring Replacement** on page 40. If not, proceed to step 24.

**Step Bore cylinders** - Inspect the roller bearing (37) for brinelling or spalling. If replacement is required, go to **Roller Bearing Replacement - Step Bore** on page 40. If not, proceed to step 24.



Inspect housing screws, and plugs

- 24. Inspect the following for damage:
  - •Poppet fixed stop screw (52 or 52A) and washer (53) if equipped.
  - •Poppet adjusting screw (59) and sealing nut (60)
  - •Auto-bleed plug (51)
  - •Manual bleed screw (50)

If any are damaged, go to **Replace Housing Ports**, **Plugs and Screws** on page 41. If not, proceed to the Inspection Section.

### Inspection

Make sure all sealing surfaces and seal cavities are free from nicks and corrosion. Any nicked or corroded surface requires part replacement to ensure proper sealing.

Wash all parts in clean, OSHA approved solvent. Air blow them dry only.

	Because they are flammable, be extremely careful when using any solvents. Even a small explosion or fire could cause injury or death.						
	Wear eye protection and be sure to comply with OSHA or other maximum air pressure requirements.						
	Any of the following conditions present in the steering gear indicates impact damage.						
<u> </u>	Condition Area						
	Cracks or Breaks • Sector shaft teeth • Rack piston teeth • Housing						
	Twisted serrations • Output shaft serrations						
If one of these conditions is found in one component, be sure to inspect all components carefully for signs of impact damage. Replace components noted in individual inspection steps below if you suspect impact damage. Failure to replace all damaged components could result in a serious vehicle accident.							



ALL AND AL	Inspect housing faces	3.	Inspect the housing faces for nicks that would prevent proper sealing. Replace the gear housing if these nicks are present and cannot be easily re- moved with a fine-tooth flat file without changing the dimensional characteristics.
	Inspect side cover bushing/bearing	4.	<ul> <li>RCS40, 55, 65: Inspect side cover (46) DU bushing for damage. Also check side cover bushing to sector shaft clearance. If damage exists, or if clearance exceeds .008" (0.20 mm) replace side cover/bushing assembly.</li> <li>RCS85: Inspect roller bearing in side cover assembly (46) for brinelling or spalling. If either condition exists, replace the side cover and bearing assembly.</li> </ul>
	Inspect sector shaft assembly	5.	Inspect the sector shaft (42) bearing and sealing areas and sector teeth contact surfaces for brinelling, spalling or cracks. Run your fingernail edge across these areas to detect steps. Remove masking tape from the shaft and inspect for twisted or otherwise damaged serrations. If any of these conditions exist, replace the sector shaft. <b>NOTE</b> A service sector shaft will come assembled with the
	Replace ball cap and seal	6.	adjusting screw (43) and retainer (44).         Place a new ball return guide cap seal (29) in the seal groove of the cap (30). Make sure the seal makes full contact with the rack piston surface. Install two new Allen or Torx head screws (31) and torque each screw alternately until a final torque of 18 lbf•ft (24.5 N•m) is achieved.         Image: Caution Ball cap seal is greased to hold seal in groove while assembling. Be sure not to trap the seal outside of the groove during reassembly

#### **Assembly Preparation**

Wash all parts in clean, OSHA approved solvent. Air blow-dry them only.



Replace all seals, seal rings, and gaskets with new ones each time you disassemble the cylinder.

TRW Commercial Steering Division makes complete seal kits available. These parts can be purchased through most OEM parts distributors. Contact your local dealer for availability.

#### Assembly

Tools Required			Ма	terials Req	uired
5/32" Allen wrench Lbf•ft Torque wrench Hammer J37705 (TAS40)	J37071 (TAS55/65) J38779 (TAS85) Press Punch Ratchet Screwdriver	Sockets Torx sockets Vise	ATF oil Grease (Exxon Unirex* RS460 Masking tape 7⁄16"-14 x 71⁄4" All Th		Seal kit: Ross TAS400004 TAS550004 TAS650012 TAS850005 nread
TASSESSI WF2.st		Install dirt seal	1.	Standard cylin trunnion end against the b	nders - Install new dirt seal (38) into the of the housing sector shaft bore and bearing, with the seal lip out.
Install retaining		Install retaining ring	2.	<b>Standard cylir</b> ring (36), sea ring groove.	nders only - Install the outside retaining ating it firmly in the housing retaining

1 A 10 4 51 2 592 4 54 2 503 4 54 2 503 5 55 55 5 5	Install washer	3.	<b>Standard cylinders only</b> - Install washer (40) into the side cover side of the housing seal bore with the small diameter piloted into the retaining ring.
113303 4342303	Press seal into housing J37705 (TAS40) J37071 (TAS55/65) J38779 (TAS85) KM Tools Press	4.	All cylinders - Assemble new seal (41) onto bearing and seal tool so the lip with the garter spring is toward the shoulder of the tool. Working from the side cover side of the housing, pilot the seal tool into the washer and bearing and press with a force of 100-800 lb (445-3,560 N) until the seal is seated firmly. Step Bore cylinders only - Install the inside retaining ring (63) from the side cover opening. Seat the ring firmly in the retaining ring groove.
WF 2 Cakiag	Grease the bearing and seal area Grease	5.	<b>Standard cylinders</b> - Liberally pack the area between dirt seal (38) and pressure seal (41) including roller bearing with clean, high temperature industrial grease, 406038 Exxon Unirex* RS460.
	Install dirt & water seal KM Tool Press	6.	<b>Step Bore cylinders</b> - Install the dirt & water seal (61) with the bearing and seal tool, making sure it is not cocked. Liberally pack the roller bearing and new seals with clean, high temperature industrial grease, Exxon Unirex* RS460.

**Assemble seal ring** 7.



\*Trademark of Exxon Oil Corp.

end cover mounting face groove.

cover pilot groove.

RCS40, 55, 65: Oil new seal ring (6) and assemble in

RCS85: Oil new seal ring (6) and assemble in end



Install rack piston o-ring and seal ring 8.

Install a new backup o-ring (21) and then a new Teflon seal ring (20) on rack piston (19). Do not over-stretch these rings as you install them. Do not allow the Teflon seal ring to be twisted.



#### Position rack piston in housing


9. Apply clean oil to housing cylinder bore and Teflon seal ring. Place the rack piston (19) in the housing piston bore with the rack piston teeth toward the sector shaft opening

**CAUTION** Do not damage the seal ring (19) while installing the rack piston into housing. If the seal ring end of rack piston enters the housing first, the seal ring will be destroyed when the rack is removed.

**CAUTION** The poppet seat and sleeve assemblies (22) must not bottom against the internal poppet stops in the steering gear until the gear is installed on the vehicle and the poppet adjustment procedures are performed.





#### Install end cover bolts

E-16 Torx socket (TAS40, 55, 65) E-18 Torx socket (TAS85 Lbf•ft Torque wrench

Lubricate side cover bushing/ bearing  Lubricate and install the four end cover bolts (1) into the housing. Torque the RCS40, 55 and 65 bolts alternately to 80 lbf•ft (108.5 N•m). Torque RCS85 bolts to 118 lbf•ft (160 N•m).

11. RCS40, 55, 65: Lightly oil DU bushing. Do not grease.

**RCS85 only:** Apply a generous amount of Exxon Unirex\* RS460 (do not substitute another type of grease) to the caged bearing assembly inside the side cover.

**CAUTION** This bearing is sealed and will receive no lubrication from the hydraulic fluid in the gear. Failure to use the proper grease could result in premature bearing wear.

Press seal in side cover J37705 (TAS40) J37071 (TAS55, 65) J38779 (TAS85) Press	12.	Grease and assemble new seal (41) onto installation tool so the side with the garter spring is against the shoulder of the tool. Pilot the tool into the side cover (46) with a force of 100-800 lb (445-3560 N) until it is seated against the bearing or bushing. A CAUTION Make sure the OD of the seal, and the ID of the bore are free from
Lubricate sector	13.	RCS40, 55, 65: Lightly oil short bearing area of sector
shaft		shaft. <b>Do not grease.</b> <b>RCS85 only:</b> Apply a generous amount of Exxon Unirex* RS460 to the short bearing area of the sector shaft.
Install sector shaft into side cover	14.	Insert the sector shaft (42) into the side cover subassembly (46), and screw the sector shaft adjusting screw (43) counterclockwise into the side cover until the screw reaches solid height. Rotate the adjusting screw clockwise one half turn so the side cover will rotate freely on the sector shaft.
Install jam nut	15.	Install the sector shaft adjusting screw jam nut (47) onto the sector shaft adjusting screw (43) a few threads. Final adjustment will be made later.
Assemble vent plug	16.	Press the new vent plug (49) into the hole provided in the side cover until the plug is bottomed. Marning         Do not weld or otherwise plug this hole in any permanent manner.

This is a safety vent which functions only if the side cover seal fails. If the seal fails and the plug cannot vent, the auxiliary cylinder may lock-up or otherwise malfunction.

\*Trademark of Exxon Oil Corp.

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Install side cover gasket  Apply clean grease to the new side cover gasket (45) to hold it in place and assemble it onto the side cover (46).



Center rack piston

18. There are four teeth on the rack piston. Position the rack piston so the space between the second and third tooth is in the center of the sector shaft opening. This will center the rack piston for assembly of sector shaft.

**WARNING** If the rack piston is not centered when sector shaft is installed, gear travel will be severely limited in one direction. This could result in an accident.

#### Install sector shaft and side cover into housing

Masking tape

19. Clean off any old tape on the serrations. Reapply one layer of masking tape. Install the sector shaft assembly into the housing. The center tooth of the sector shaft must engage the center space (between the second and third tooth) of the rack piston, with side cover gasket in place.

**A** CAUTION If the serrations are not properly taped, they will damage the output seal (38) in housing, causing the seal to leak.





#### Install side cover bolts

<sup>13</sup>⁄<sub>16</sub>" Socket (TAS40) <sup>15</sup>∕<sub>16</sub>" Socket (TAS55, 65, 85) Lbf•ft Torque wrench

Remove tape, install dirt & water seal 20. Lubricate and install RCS40, 55 and 65 bolts in positions 3 and 4 first, by hand. For RCS85, Install in positions 3 and 6 first, by hand. Install the remaining special side cover bolts (48) into the side cover and torque them in the sequence shown. If bolts must be replaced, use bolts of the same design, type and length as those you removed. Do not use a substitute.

Torque RCS40 side cover bolts to **118 lbf•ft** (160 N•m), RCS55, 65 and 85 bolts to **170 lbf•ft** (230 N•m).

 Standard cylinders - Remove tape from sector shaft and pack the end of the housing trunnion area at the sector shaft with clean, high temperature industrial grease, Exxon Unirex\* RS460. Apply more of the grease to the inside of the new trunnion dirt seal (39) and assemble it over the sector shaft and into the trunnion bore.

**Step bore cylinders** - remove tape from the sector shaft.

## **Poppet Component Replacement**

Tools Required		Materials Required		
2 lb Sledge Ratchet _bf•ft Torque Soft-jawed vise wrench J36452-A Press ‰r x 6" drill rod		Locquic "T" primer Loctite RC680		
	Place rack piston in vise Soft-jawed vise	1.	If the poppet assemblies are to be removed for replacement, place rack piston in a soft-jawed vise.	
	Loosen poppet adjuster seat J36452-A 2 Lb Sledge	2.	Slide special tool #J36452-A over the seat of poppet adjuster seat and sleeve assembly (22) and engage tool in the slots in the threaded sleeve. Hit the end of the tool firmly four or five times with a 2 lb sledge hammer to loosen Loctite. Poppet adjuster seat and sleeve assemblies (22) are retained by Loctite applied to the threads which makes the assem- blies difficult to remove.	
	Remove poppet adjuster seat	3.	With a ratchet applied to the tool, turn one adjuster seat and sleeve assembly out of the rack piston. If the ratchet does not turn easily, strike the adjuster removal tool again with a hammer. If the engaging tangs won't stay in place while torquing, it might be necessary to hold in place with an arbor press while applying loosening torque. Discard poppet seat and sleeve assembly.	
	Remove poppet components	4.	Remove the two poppets (23 or 23A), spring (24), and push tube (26). Some gears will also have a spacer rod (25) to be removed.	

Remove other seat & sleeve if necessary	5.	Remove and discard remaining poppet seat and sleeve assembly only if required.
		<b>NOTE</b> It is possible to reset one poppet adjuster seat and sleeve assembly for automatic poppet adjustment while it is in the rack piston if one adjuster seat and sleeve assembly and the poppets, spring, spacer rod and push tube are removed.
Reset remaining poppet seat and sleeve assembly Press 3/8" X 6" Drill rod	6.	If one poppet seat and sleeve assy. (22) was left in rack piston, it can be reset for automatic poppet adjustment by inserting a %" (9.52 mm) diameter X 6" (152.4 mm) drill rod down through the poppet seat hole at the opposite end of the rack piston and against the adjuster seat to press the seat in until it bottoms against the adjuster sleeve.
Apply Locquic "T" primer and Loctite RC680 Locquic "T" primer Loctite RC680	7.	Carefully apply Locquic "T" primer to the threads in poppet holes, and threads on the new seat and sleeve assemblies (22). Allow to dry for ten minutes; then carefully apply Loctite RC680 to same threads. <b>M</b> CAUTION             Do not allow Loctite or Locquic to get on the adjuster seat component of the adjuster seat and sleeve assembly. The poppets will not function properly.
Install one poppet seat and sleeve assembly	8.	WARNING Wear eye protection while assembling poppets, as spring loaded poppets could eject and cause eye injury.
Soft-jawed vise		Place rack piston (19) in a soft-jawed vise and turn one new poppet adjuster seat and sleeve assembly (22), (slotted end out) into the poppet hole in one end of rack piston.
Install remaining		<b>A</b> WARNING Do not use the spacer with the new poppet design. You must install the spacer with the old poppet design.
J36452-A Lbf•ft Torque	9.	From the other end of the poppet hole in the rack piston, install: one poppet (23A), poppet spring (24), push tube (26), other poppet (23A), and the other new poppet adjuster seat and sleeve assembly (22). The new components will stack up as shown below.
WIENCH		Torque both poppet seat and sleeve assemblies to <b>18 lbf•ft</b> (25 N•m).

Return to step 20, page 28.

### **Roller Bearing or Ret. Ring Repl. - Standard**

Tools Required		Materials Required	
Press J37071 (TAS55, 65) J37705 (TAS40) J38779 (TAS85) Screwdriver			
Vicessage Wite States	Remove roller bearing if required J37705 (TAS40) J37071 (TAS55/65) J38779 (TAS85) Press	1.	Standard Gears Only: If roller bearing (37) in housing needs to be replaced, place the bearing removal end of the bearing and seal tool against the side cover end of the baering and press it out of trunnion end of the bearing bore. Discard bearing. M CAUTION The bearing must be pressed out from the side cover side to protect the seal counterbore. Be sure to use a bearing removal tool that will clear the retaining ring.
VLS652266 WF2 SKIG	Remove retaining ring Screwdriver	2.	<b>Standard Gears Only:</b> If the retaining ring (36) that is still in the housing bearing bore needs to be replaced, remove it through the trunnion end of the bearing bore to protect the pressure seal bore area from being damaged.
WF2 SKHCO	<b>Install retaining</b> <b>ring</b> Grease	3.	<b>Standard Gears Only:</b> Insert retaining ring (36), if it was removed, into the housing bore from the trunnion end (to protect sealing area). Make sure it is seated in the retaining ring groove closest to side cover end of the bearing bore. Lubricate the bearing bore.
	Press in housing roller bearing	4.	<b>Standard Gears Only:</b> Press the roller bearing (37) into the housing from the trunnion end of bearing bore until it is seated against the retaining ring. Be sure the housing is square with the press base and the bearing is not cocked.

J37071 (TAS55/65) J38779 (TAS85)

Press

**CAUTION** Use the bearing installation end of the tool. If the bearing removal end of the bearing & seal tool is used to press in bearing, the cage on the new bearing may be damaged.

Return to step 24, page 29.

### **Roller Bearing Replacement - Step Bore**

Tools Required		Ма	terials Required
Press KM Tool J37071-A Screwdriver			
	Remove roller bearing if required J37071-A Press	1.	If roller bearing (37) in housing needs to be replaced, place the bearing removal end of the bearing and seal tool against the trunnion end of the bearing and press it out of the side cover end of the bearing bore. Discard bearing.
	Press in housing roller bearing J37071-A Press	2.	Press the roller bearing (37) into the housing from the side cover end of the bearing bore until it is seated against the step bore. Be sure the housing is square with the press base and the bearing is not cocked.
			<b>CAUTION</b> Use the bearing <u>installation end</u> of the tool. If the bearing <u>removal end</u> of the bearing & seal tool is used to press in bearing, the cage on the new bearing may be damaged.

Return to step 24, page 29.

### **Replace Housing Ports, Plugs, Screws, Fittings**

Tools Required		Materials Required		
Allen wrench Torx sockets Sockets Lbf•in. Torque wrench Lbf•ft Torque wrench				
45728098 3943503	Replace poppet fixed stop screw 5%" Socket or E-14 Torx socket Ibf•ft Torque wrench	1.	If damaged, remove and replace the poppet fixed stop screw (52 or 52A) and washer (53) if equipped. Replace with poppet fixed stop screw (52A), discard the washer. Torque to <b>48 lbf•ft</b> (65 N•m).	
	Replace poppet adjusting screw 7/32" Allen wrench 3/4" or 5/8" closed-end wrench Lbf•ft Torque wrench	2.	If damaged, remove poppet adjusting screw (59) and sealing nut (60) without allowing the nut to change its position on the screw. Assemble the new nut onto the new adjusting screw, matching its position to the nut and screw removed. Torque sealing nut to <b>35 lbf•ft</b> (47 N•m).	
	Replace automatic bleed screw, and aux. port plugs E-14 Torx socket Lbf•ft Torque wrench	3.	If damaged, remove and replace automatic bleed plug (51). Torque to <b>48 lbf•ft</b> (65 N•m).	
3	Replace manual bleed screw 5/16" Hex socket Lbf•in. Torque wrench	4.	If damaged, remove and replace manual bleed screw (50). Torque to <b>30 lbf•in.</b> (3.4 N•m).	

### **Final Adjustments**

Tools Required			Materials Required	
Box-end wrench Lbf•ft Torque wrench Lbf•in. Torque wrench	Screwdriver Sockets			
		Center steering gear	1.	To center the cylinder, rotate sector shaft until the timing mark is in line with the timing mark on the end of housing trunnion.
		Torque adjusting screw	2.	Torque the side cover adjusting screw to 5-10 lbf∙ft, (7-14 N•m) then back out the screw one half turn.
		Check rotational torque	3.	Check the torque to rotate the sector shaft through approximately 20° each side of center.
		Increase rotational torque	4.	Screw in the adjusting screw to provide a torque rise of 40-80 lbf•in (5-9 N•m). over the previously established torque as the sector shaft passes through center.

Torque jam nut5.Torque the jam nut to 40-45 lbf•ft (54-61 N•m).

**NOTE** Torque to rotate the sector shaft must not exceed 380 lbf•in. at any point in travel of the cylinder.

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