



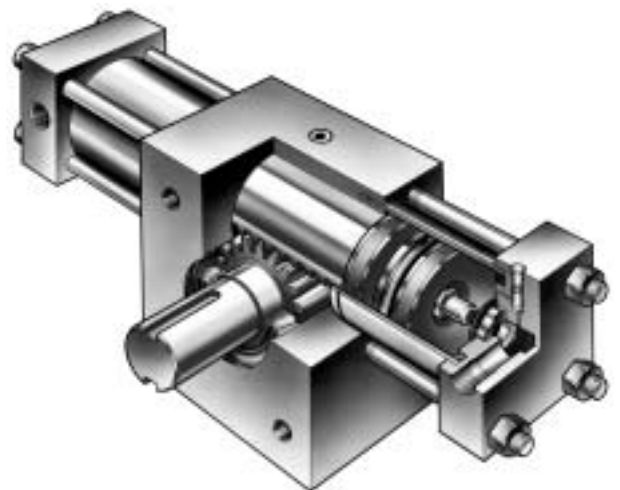
Bulletin HY07-1220-M1/UK

# Maintenance Bulletin HTR Series

Effective : July 2003

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## Hydraulic Rotary Actuators



**Key**

- 1 Shaft seal
- 2 Housing
- 3 Rack bearing (standard on HTR 15 and larger)
- 4 Wear ring
- 5 Piston seal
- 5a Back-up ring (only with seal classes V and W)
- 7 Rack bolt
- 8 O-ring (cylinder tube/housing)
- 9 O-ring (cylinder tube/end cap)

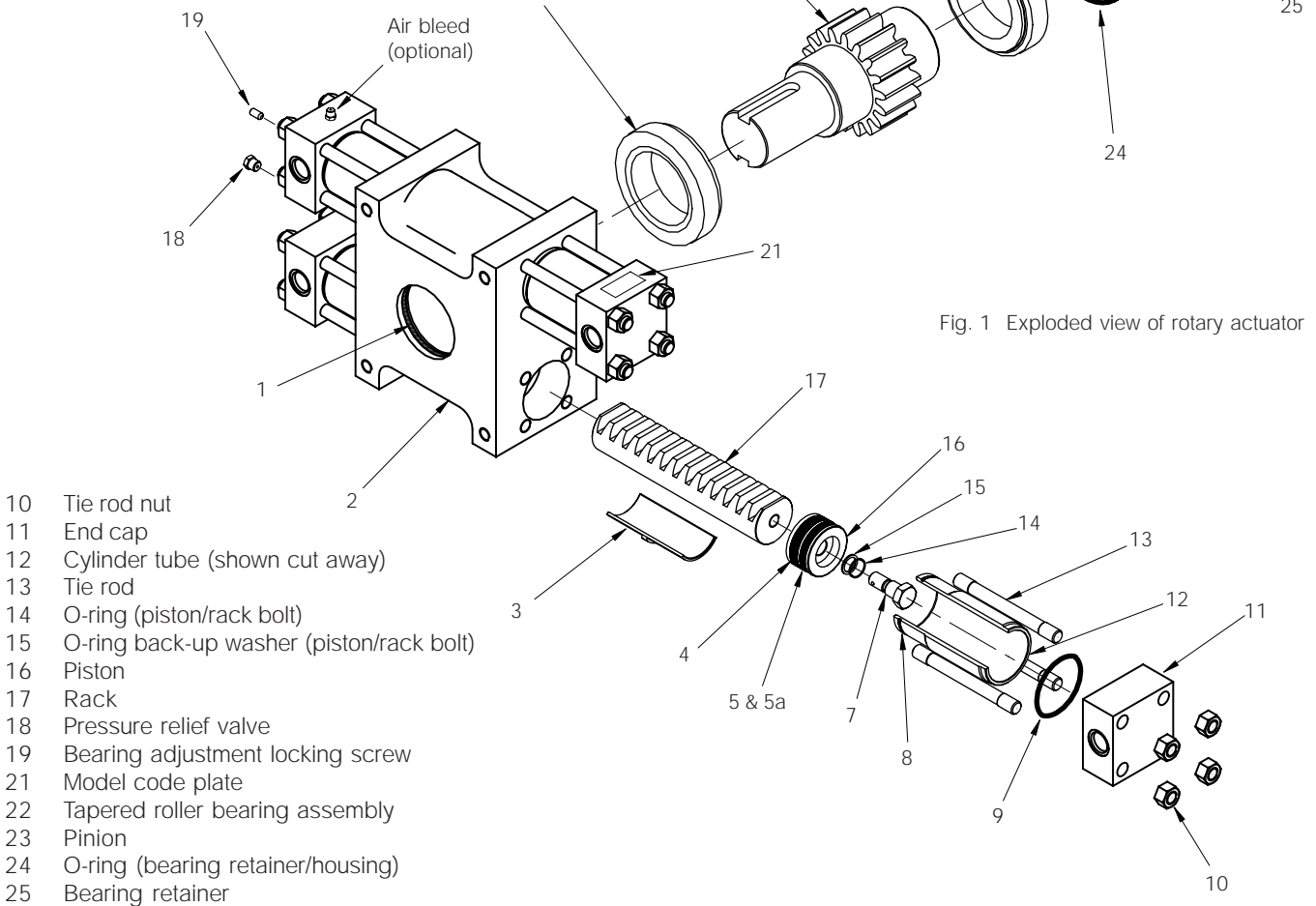


Fig. 1 Exploded view of rotary actuator

- 10 Tie rod nut
- 11 End cap
- 12 Cylinder tube (shown cut away)
- 13 Tie rod
- 14 O-ring (piston/rack bolt)
- 15 O-ring back-up washer (piston/rack bolt)
- 16 Piston
- 17 Rack
- 18 Pressure relief valve
- 19 Bearing adjustment locking screw
- 21 Model code plate
- 22 Tapered roller bearing assembly
- 23 Pinion
- 24 O-ring (bearing retainer/housing)
- 25 Bearing retainer



**WARNING**

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that all aspects of the application are analysed and the information concerning the product or system in the current product catalogue is reviewed. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

**Service Kits Figs. 1 & 2**

Standard units are equipped with polyurethane seals. FPM (code V) and carboxylated nitrile seals (code W) are available as an option. The items contained in service kits are illustrated in figure 2 below.

**Service Kit Numbers**

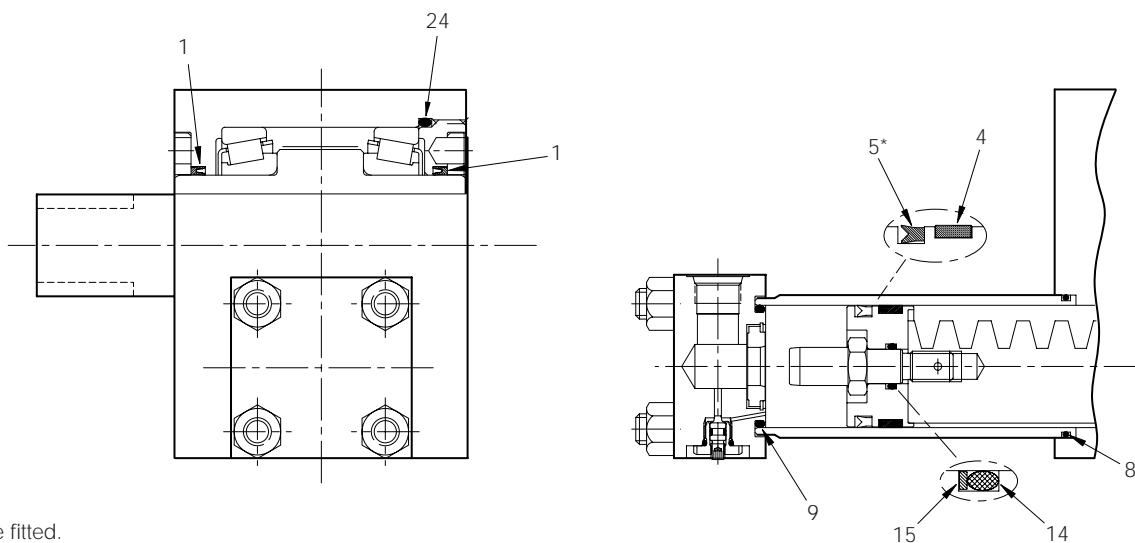
Model	Standard Seals	FPM Seals	Carboxylated Nitrile Seals
HTR.9	PSKHTR.9	PSKHTR.9V	PSKHTR.9W
HTR1.8	PSKHTR1.8	PSKHTR1.8V	PSKHTR1.8W
HTR3.7	PSKHTR3.7	PSKHTR3.7V	PSKHTR3.7W
HTR7.5	PSKHTR7.5	PSKHTR7.5V	PSKHTR7.5W
HTR5	PSKHTR5	PSKHTR5V	PSKHTR5W
HTR10	PSKHTR10	PSKHTR10V	PSKHTR10W
HTR15	PSKHTR15	PSKHTR15V	PSKHTR15W
HTR30	PSKHTR30	PSKHTR30V	PSKHTR30W
HTR22	PSKHTR22	PSKHTR22V	PSKHTR22W
HTR45	PSKHTR45	PSKHTR45V	PSKHTR45W
HTR75	PSKHTR75	PSKHTR75V	PSKHTR75W
HTR150	PSKHTR150	PSKHTR150V	PSKHTR150W
HTR300	PSKHTR300	PSKHTR300V	PSKHTR300W
HTR600	PSKHTR600	PSKHTR600V	PSKHTR600W

**How to Order Service Kits**

Service kits for Parker rotary actuators are stocked in all major industrial countries throughout the world. Please contact your nearest Parker office for information and prompt delivery.

**Assembly Torques**

Model	Tie Rod Nuts (10) Nm	Rack Bolt (7 or 31) Nm	Bearing Retainer (25) Nm	Locking Screw (19) Nm
HTR.9 HTR1.8	8	4	20	2.5
HTR3.7 HTR7.5	20	20	41	5.5
HTR5 HTR10	20	20	68	5.5
HTR15 HTR30	41	54	136	5.5
HTR22 HTR45	61	54	136	5.5
HTR75 HTR150	176	217	203	20
HTR300 HTR600	712	570	339	20



\* plus 5a, where fitted.

Fig. 2 Contents of service kit

## Mounting to the Machine

Threaded mounting holes are provided in the face and the base of HTR rotary actuators, for machine mounting. Parker recommends that mounting bolts with a minimum strength of ISO 898/1 grade 10.9 should be used for attaching the rotary actuator to the machine or base. This recommendation is of particular importance where bolts are placed in tension or subjected to shear forces. Mounting bolts should be torque tightened to their manufacturer's recommended figures; if these are not available, the torque figures in the table should be used.

Model	Mounting Bolt	
	Thread x hole depth mm	Torque Nm
HTR.9 HTR1.8	M8 x 1.25 x 13	14
HTR3.7 HTR7.5	M10 x 1.5 x 16	34
HTR5 HTR10	M10 x 1.5 x 16	34
HTR15 HTR30	M12 x 1.75 x 19	81
HTR22 HTR45	M12 x 1.75 x 19	81
HTR75 HTR150	M20 x 2.5 x 30	217
HTR300 HTR600	M30 x 3.5 x 48	976

## Operating Fluids and Temperature Ranges

The table shows the main types of fluid used with hydraulic rotary actuators. If the operating conditions of the particular application cannot be met by the groups described, please consult the factory and supply complete application details.

Seal Class	Materials		Fluid Medium	Temperature Range	Filtration
	Seal	Wear Ring			
Standard	Polyurethane	Filled PTFE	General purpose, petroleum- based fluids	-30°C to +80°C	ISO Class 17/14 Cleanliness Level
V	FPM	Filled PTFE	High Temperature and/or Synthetic Fluids	-20°C to +150°C	
W	Carboxilated Nitrile	Filled PTFE	Water Glycol, High Water Content Fluids	0°C to +80°C	

## Servicing Piston Seals and Tube O-Rings

### Figs. 1 & 2

Fluid leakage from the pressure relief valve (18) normally indicates worn piston seals. While replacement of the seals is necessary to restore the performance of the actuator, close attention should also be paid to the condition of the system fluid and filtration, in order to prevent premature failure of the replacement seals.

Note that, where system fluid has been forced out through the pressure relief valve, the molybdenum grease with which the gear case is packed on assembly will have been washed out. Before the actuator is returned to service, it is essential that the gear case and bearings are thoroughly cleaned and re-packed with molybdenum grease.

Replacement of piston seals can be carried out with the actuator mounted on the machine, subject to access. However, where contamination of the gear case lubricant has occurred, complete removal will be required to permit the gear case and bearings to be cleaned and re-packed with grease.

### Disassembly, Inspection and Replacement

**Caution:** always release the hydraulic pressure before beginning service operations.

If dismantling more than one cylinder tube, the parts for each should be kept together and reassembled as a set. Each cylinder tube should be dismantled as follows:

- Place the actuator in its mid-stroke position. Remove the tie-rod nuts (10) and pull the end cap (11) free from the cylinder tube (12).
- Carefully slide the cylinder tube free of the housing (2). Remove the rack bolt/cushion spear (7 or 31) and remove the piston (16) from the rack (17).
 

**Note** On larger models, it may be easier to remove the tube with the piston inside it. In this case, remove the rack bolt (7) first and then pull the tube (12) free of the housing (2). The piston (16) can then be pushed or pulled out of the tube.
- Remove the piston seals (5, and 5a where fitted) and wear rings (4), and the internal O-rings and back-up washers (14 and 15). Inspect for signs of wear.
- Remove and inspect the O-rings (8 and 9) between the housing, cylinder tubes and caps. Replace if there is any sign of damage.

### Total Actuator Disassembly

- Having dismantled each piston/cylinder tube assembly as described above, loosen the lock screw (19) which secures the rear bearing retainer (25).
 

**Caution** Failure to loosen the lock screw will result in damage to the threads of the bearing retainer.
- Using a pin wrench, remove the bearing retainer (25) by turning it anti-clockwise, and remove the O-ring (24).

- 3 Make match marks on the rack(s) (17) and pinion (23) before removal to assist in reassembly, then withdraw the pinion complete with the rear bearing assembly (22). The tapered roller bearing will separate into two pieces, an inner and an outer race, and each bearing must be reassembled as a pair.
- 4 Push the rack(s) (17) from either end to remove from the housing. Take care not to allow the rack bearing (3), if fitted, to drop and damage itself, the housing or the rack.
- 5 Press out the front bearing (22) through the rear of the housing and inspect both bearings for wear or damage. Inspect the shaft seals (1) in the front face of the housing and on the inside diameter of the bearing retainer for signs of wear or damage.
- 6 Unscrew the pressure release valve (18) and ensure that its plunger is free to move against spring pressure.

**Reassembly of the Rotary Actuator**

**Caution** Due to the high pressures which occur between the gear teeth, correct lubrication of the rack and pinion is vital for the long working life of the actuator. A molybdenum grease with a minimum MSO<sub>2</sub> content of 3%, eg: Texaco Molytex EP2 should be used.

- 1 Lubricate and replace the shaft seal (1) in the front of the housing, if removed. Grease and assemble the front tapered roller bearing (22) and insert the bearing, with the roller tapers facing outwards, into the housing as shown in figure 2.
- 2 Lightly grease the rack(s) (17), re-install the rack bearing (3), if fitted, and carefully insert the rack(s).
- 3 Grease the pinion (23) and insert into the housing, ensuring that the match marks on the rack and pinion (see 3, Total Actuator Disassembly, above) are correctly aligned. Fill the gear chamber approximately three-quarters full with molybdenum grease.
- 4 Grease and refit the inner race of the rear bearing (22) to the pinion with the roller tapers facing outwards, as shown in figure 2. Press home the outer race of the rear bearing.
- 5 Lubricate and replace the O-ring (24) in the groove in the housing. Lubricate and replace the shaft seal (1) in the groove in the bearing retainer (25).
- 6 Lightly lubricate the threads of the bearing retainer, refit and torque tighten to the figure shown in the table on page 3. Install the lock screw and torque tighten to the figure shown in the table.
- 7 Refit the pressure release valve (18) and tighten securely.

**For each cylinder tube and piston assembly:**

- 8 Each tube (12) has one grooved end and one reduced end. On assembly, the grooved end engages with the housing, while the reduced end fits into the end cap.
- 9 Lubricate and replace the O-ring (8) in the groove in the tube (12).
- 10 Apply thread sealing compound to the internal thread in the end of the rack, to which the piston attaches.
- 11 Install the O-ring and back-up washer (14 and 15) in the internal groove of the piston (16). Lubricate and fit the wear ring (4) and seal (5, and 5a where fitted) to the piston.
- 12 Insert the bolt (7 or 31) through the piston, then slide the piston into the cylinder tube (12) from the cap end, wear ring side first.
- 13 Slide the end of the cylinder tube over the rack and engage the tube with the bore in the housing, taking care not to damage the O-ring (8). Using a clean, soft-faced mallet, tap the tube into the housing until it is fully pressed home.
- 14 Press the piston into contact with the end of the rack. Torque tighten the rack bolt (7 or 31) to the value shown in the torque table on page 3.
- 15 Lubricate and replace the O-ring (9) in the groove in the end cap (11).
- 16 Place the end cap over the tie-rods and gently 'rock' the end cap until it is in contact with the cylinder tube, ensuring that the O-ring (9) is not trapped.
- 17 Replace the tie-rod nuts (10) and hand tighten them. Ensuring the end-cap is kept square to the housing, progressively tighten the tie-rod nuts using a diagonal sequence, to the value shown in the torque table on page 3.

Repeat this procedure for the remaining cylinder tube(s).

**Adjustment of Cushions and Stroke Adjusters (Where Fitted)**

**Part Numbers – Cushions and Stroke Adjusters**

- 26 Cushion adjuster cartridge
- 28 Cushion bush retaining ring
- 29 End cap, cushioned type
- 30 Cushion bush
- 31 Rack bolt/cushion spear
- 32 End cap, stroke adjuster type
- 33 Plain washer
- 34 Threaded adjuster rod
- 35 Thread seal
- 36 Lock nut
- 37 Stroke adjuster retainer
- 38 End cap, cushion and stroke adjuster type
- 39 O-ring (stroke adjuster retainer/end cap)

Model	Cushion Adjuster		Stroke Adjuster	
	Hexagon Wrench - mm	Cartridge Torque - Nm	Adjustment per Full Turn	Hexagon Wrench - in.
HTR.9 HTR1.8	2	9-10	4.0°	5/32
HTR3.7 HTR7.5	2	9-10	3.3°	1/4
HTR5 HTR10	2	9-10	2.5°	1/4
HTR15 HTR30	2.5	25-30	2.0°	3/8
HTR22 HTR45	2.5	25-30	2.0°	3/8
HTR75 HTR150	3	60-65	2.0°	Square Adjuster
HTR300 HTR600	3	60-65	1.2°	

**Cushion Adjustment Fig. 3**

**Caution:** before making adjustment, release hydraulic pressure.

**Do not overtighten the cushion adjuster screw.**

Adjustable cushions operate over the last 20° of the actuator's stroke. To adjust the rate of cushioning, use a hexagon wrench to turn the adjustment screw, clockwise to increase cushioning effect or anti-clockwise to decrease cushioning effect.

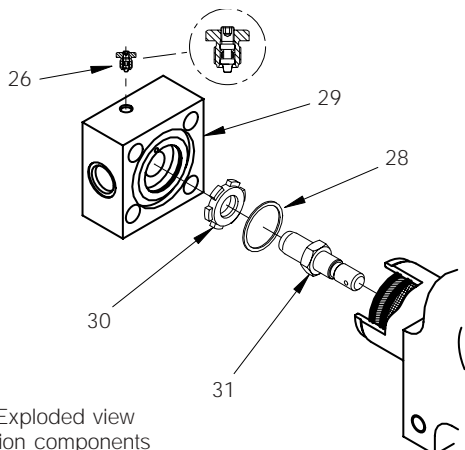


Fig. 3 Exploded view of cushion components

**Adjustment of Stroke Adjuster Fig. 4**

**Caution:** before making adjustment, release hydraulic pressure.

**Do not overtighten the stroke adjuster bolt.**

Adjustment of the stroke adjuster is carried out using the appropriate size of hexagon wrench or spanner, as shown in the table. To limit the full stroke of the rack, and therefore the rotation of the rotary actuator, loosen the lock nut (36) and turn the adjuster rod (34) clockwise to reduce rotation. Tighten the lock nut and restore the system pressure.

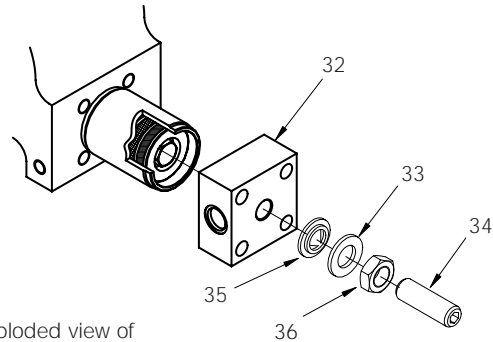


Fig. 4 Exploded view of stroke adjuster components

**Adjustment of Combined Stroke Adjuster and Cushion Fig. 5**

**Caution:** before making adjustment, release hydraulic pressure.

**Do not overtighten the cushion adjuster screw or the stroke adjuster bolt.**

The procedure for adjustment of combined stroke adjusters and cushions is identical to that described earlier for the individual features. Where necessary, the stroke adjuster(s) should be adjusted first, as their positioning will influence the damping action of the cushions.

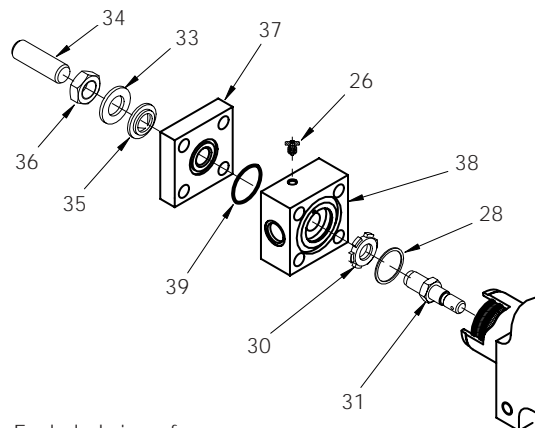


Fig. 5 Exploded view of combined cushion and stroke adjuster

### Servicing Position Switches

The rotary actuator may be fitted with the optional position switches, of either EPS or PS series.

Sensor Type	EPS-6	EPS-7	PS201, 202 and 203
Connector	105000A01F060	103000A01F060	PS 011
Output Function	PNP/NPN, normally open	Normally open	PNP, normally open
Operating Voltage	10 – 30V DC	20 – 250V AC @ 40 – 60 Hz 20 – 300V DC	10 – 30V DC
Operating Current	< 200 mA	< 300 mA	200 mA
Operating Temperature	-25°C to +70°C	-25°C to +70°C	-25°C to +80°C
Protection Class	IP67	IP67	IP67 to IEC60529
Connector Orientation	direct, switching	direct, switching	dependent on switch adjustment
Signal	in sensor	in sensor	in connector

### EPS Series Fig. 6

#### Part Numbers – EPS Position Switch

- 40 EPS position switch
- 40a EPS switch securing screw
- 41 O-ring, distance piece/adaptor plate
- 42 Screw, adapter plate
- 43 Adapter plate
- 44 O-ring, adapter plate/end cap
- 45 End cap, EPS switch type
- 46 Screw, distance piece
- 47 Distance piece

#### Switch Removal

Remove the screws (40a) from the switch (40) and withdraw the switch.

#### Switch Installation

Fit the EPS switch (40) and torque tighten the two screws (40a) to 9Nm.

#### AC/DC 2-wire Sensor (EPS-7)

##### Wiring Diagram

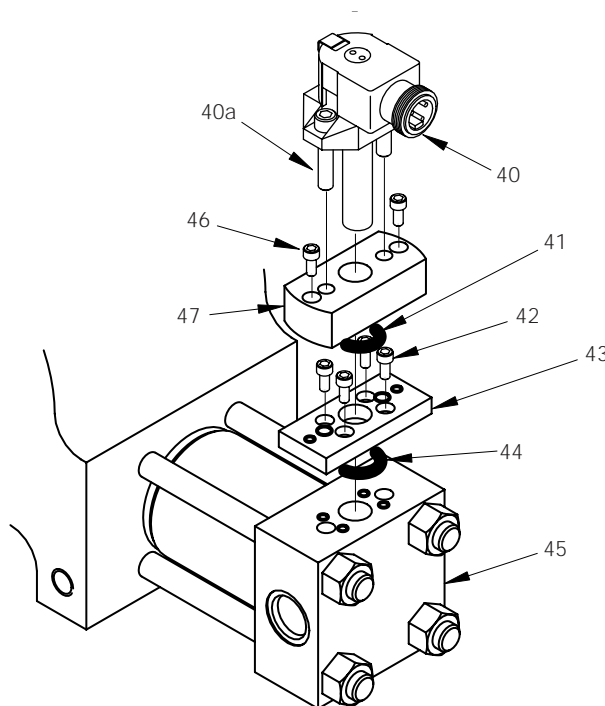
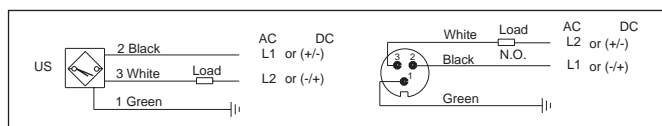
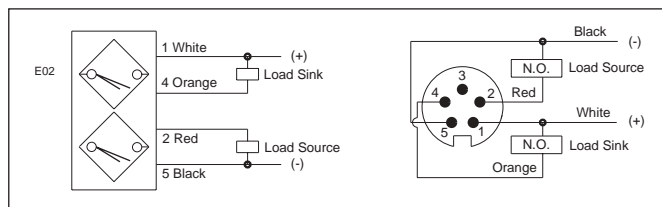


Fig. 6 HTR rotary actuator with EPS position switch

#### DC 4-wire Sensor (EPS-6)

##### Wiring Diagram



**PS Series** Fig. 7**Part Numbers – PS Position Switch**

- 50 PS position switch
- 51 Locknut
- 52 Screw, adapter plate
- 53 Adapter plate
- 54 End cap, PS switch type

**Switch Removal**

- 1 Loosen the locknut (51).
- 2 Remove the two screws (52) from the adapter plate (53) and separate the adapter plate from the end cap (54).
- 3 Unscrew the switch (50) from the adapter plate (53).

**Switch Installation**

There are two methods of installation for PS Series position switches. Method 1 aligns the connector lead in a specific direction, while method 2 may be used where connector alignment is not critical.

**Method 1**

- 1 Screw the adapter plate (53) onto the switch (50) and position at the top of the thread.
- 2 Fit the connector to the switch.
- 3 Insert the switch into the cap (54) and hold firmly against its locating shoulder, with the connector's lead in the desired position.
- 4 Screw the adapter plate down until it meets the mounting surface, and then back off until the screw holes align. This will leave a gap of less than 0.5mm under the plate. Fit and torque tighten the two fixing screws (52) evenly to 10Nm.

**Method 2**

- 1 Screw the adapter plate (53) onto the switch (50) and position at the bottom of the thread.
- 2 Insert the switch into the cap (54) and align the screw holes in the adapter plate with the corresponding holes in the mounting surface.
- 3 Fit and torque tighten the two fixing screws (52) evenly to 10Nm.
- 4 Screw the switch down until resistance is felt, and tighten the lock nut (51) to secure in position.

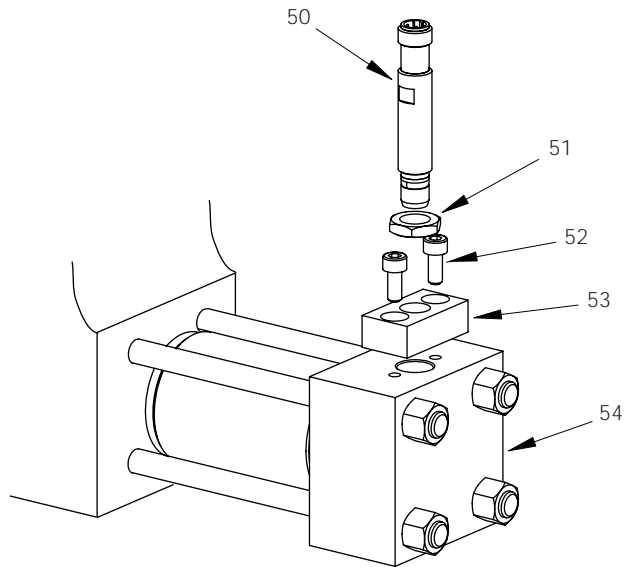
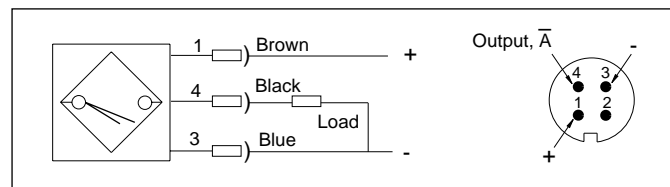


Fig. 7 HTR rotary actuator with PS position switch

**DC 3-wire Sensor (PS Series)  
Wiring Diagram****Repairs**

For further information or repairs, please contact:  
Parker Hannifin plc  
6 Greycaine Road  
Watford  
Herts. WD24 7QA  
Tel: 01923 492000  
Fax: 01923 248557

[www.parker.com](http://www.parker.com)