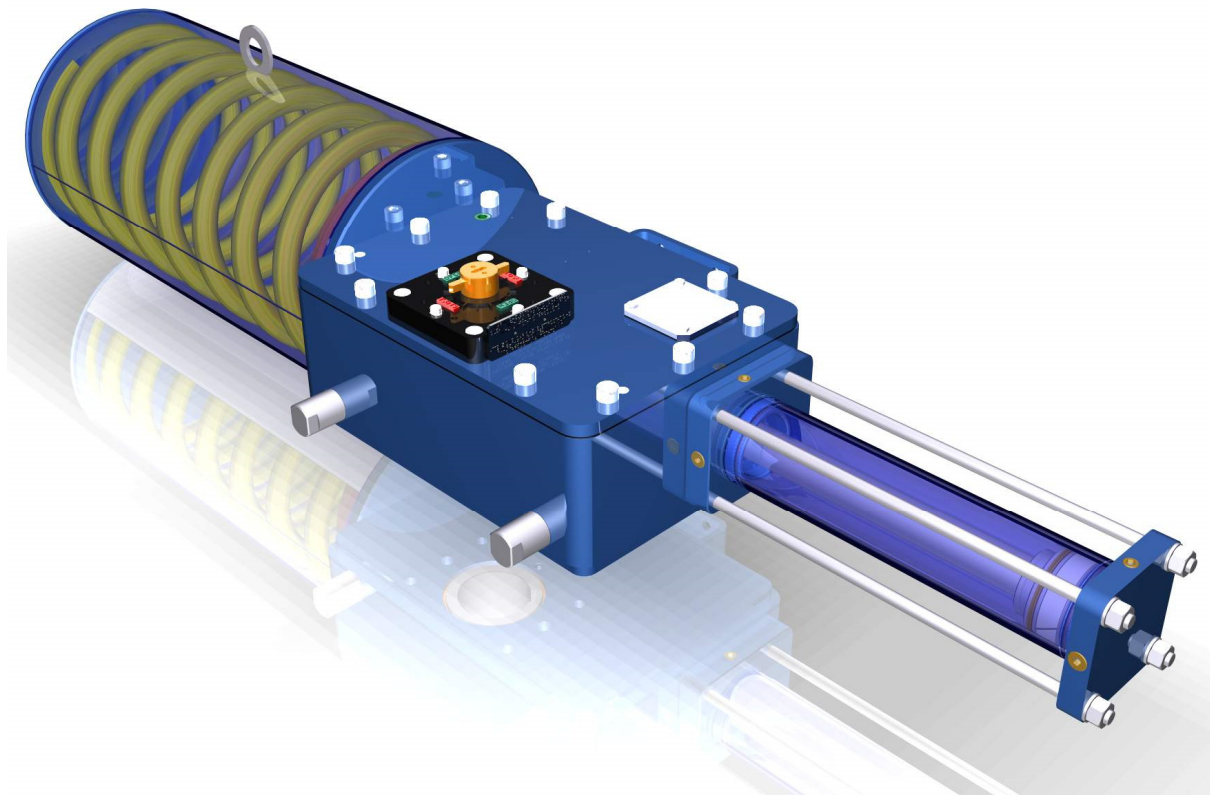


# CAMERON® LEDEEN Quarter Turn Actuator

GS Series – Hydraulic

Installation, Operation and Maintenance Manual



05/02/2018	Initial release	Garberi M.	Cerati S.
<b>DATE</b>	<b>ISSUE</b>	<b>PREPARED BY</b>	<b>APPROVED BY</b>

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## PREFACE

The procedures included in this book are to be performed in conjunction with the requirements and recommendations outlined in API Specifications. Any repairs to the equipment covered by this book should be done by an authorized Cameron service representative. Cameron will not be responsible for loss or expense resulting from any failure of equipment or any damage to any property or death or injury to any person resulting in whole or in part from repairs performed by anyone other than authorized Cameron personnel. Such unauthorized repairs shall also serve to terminate any contractual or other warranty, if any, on the equipment and may also result in equipment no longer meeting applicable requirements.

File copies of this manual are maintained. Revisions and/or additions will be made as deemed necessary by Cameron. The drawings in this book are not drawn to scale, but the dimensions shown are accurate.

This book covers Cameron products.

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**NOTES:**

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## I. GENERAL

- Keep this manual for future reference.
- Please keep this manual near the actuator so that it is available for consultation.
- For questions or clarifications please contact [cameron.slb.com](http://cameron.slb.com)
- To get / request new copies of the manual please contact [cameron.slb.com](http://cameron.slb.com)
- The manufacturer reserves the right to modify , without prior notice, the characteristics of the equipment described in this publication and is not obligated to update any products and manuals previously issued.

### A. Legend for Safety Symbols

Explanation of Warning Symbols (Where Applicable)



Before carrying out any operation on the actuator, the electric power supply (if present) must be shut-off.



Risk of explosion: before carrying out any operation on the actuator, the actuator must be isolated from the hydraulic supply source.



Before carrying out any operation on the actuator, the control group (if present) must be discharged from the pressure therein trapped, particular care shall be taken on storage tanks and pressure filters.



Every operation on the actuator must be performed by qualified personnel, equipped with safety clothes and devices (gloves, helmet, glasses, etc.).



During the operation on the actuator, the operator must pay attention to the presence of liquids potentially noxious for the health and the environment.

## **B. Original Spare Parts**

The use of any non-genuine Cameron spare parts by customer exempts Cameron from any responsibility for indemnity on claims.

## **C. Operative Staff**

The maintenance-staff assigned to Cameron's Ledeen products must have the qualified technical preparation to perform the function. The lack of the above-mentioned preparation, included therein the unavailability to attend adequate training courses by specialized Cameron technicians at its workshop, cannot be charged to the company Cameron, who will be considered exempt from any responsibility on claims. Also the lack of knowledge, by the operative personnel, of the manuals and instruction books supplied by Cameron in the languages indicated in the supply contract, cannot be imputed to Cameron.

## **D. Damages Derived From Use**

Any damage derived from corrosion, fouling, pollution, oxidation, wear, or gradual deterioration of the materials, for which the customer did not specify the adaptability limits, will be at the Customer's own loss.

## **E. Interruptions and suspending**

Damages derived from a period of instrument use failure, during which the instrument wasn't in maintenance condition to assure a perfect preservation, will be at the customer's own loss.

## **F. Modification of The Actuator**

Damages derived from any modification made by the customer without prior authorization from Cameron, especially if not in accordance to the initial conditions established in the buying order, will be at the customer's own loss.

## **G. Actuator Disposal**

To finally dispose the actuator at the end of its operating life, please carry out the following operations:

- Open the frame enclosure.
- Remove the lubricants taking care not to pollute the environment.
- Clean the frame internally using a mixture of water and degreasing soap.
- Dispose of the cleaning fluid and lubricants extracted from the actuator according to the local laws regarding the disposal of waste material.
- After the actuator's disposal, all casings must be sent to the scrapping service.
- In case of replacement of any part, it must be handled and disposed of as listed in the owner's manual.

- If the actuator is provided with spring container:

**Warning:**



**DO NOT OPEN AND/OR FORCE THE SPRING CONTAINER**

The spring container contains one or more compressed springs.

A forced or non-controlled opening of the container can cause the non-controlled and violent ejection of material potentially harmful to people and/or capable of causing damage to property.

The opening and disposal of the spring container must be carried out only by authorized personnel.

Please contact Cameron in case of any doubt or for further information.

#### **H. Safety of the Power Supply Connection (If Applicable)**

Before carrying out any operation on the actuator, check that the power supply is off.

Before connecting the actuator:

- Verify the absence of the power supply and always connect the ground cable to the actuator first.
- Check that the power supply line characteristics are in accordance with the nameplate and installation manual data.

#### **I. Safety Recommendations**

Check that the ground resistance complies with the limits allowed by the National Laws relevant to the country where the actuator is installed.

If the actuator is stored/installed in a hazardous area, do not use open flames and/or devices that could cause sparks.

At the end of any intervention on the actuator please check that all the boxes and covers are properly closed.

The operators assigned to the actuator's maintenance must be authorized personnel or otherwise must have attended a training course dedicated to the use and maintenance of the actuator.

#### **J. Electrostatic Discharges Prevention**


The actuator handling must be carried out using the handling ring supplied with the actuator. In order to prevent the electro-static charges storage, attention must be paid during the cleaning of any external component made from plastic material.

The plastic material must be cleaned only with a damp cloth or with antistatic products.




**K. Actuator Marking (According to 2014/34/EU Directive)**

Please refer to the following example of actuator marking:

CE  II 2 G c Tx

Where:

- CE** = symbol of conformity to the EU applicable directives
-  = ATEX symbol
- II = group II (surface)
- 2 = apparatus of category 2
- G = explosive atmosphere with presence of gas, vapours, fogs
- c = type of protection
- Tx = temperature class

Hazardous area	Installation category according to ATEX Directive No. 2014/34/EU	
Gas, fog or vapours	Zone 1	2 G
Gas, fog or vapours	Zone 2	3 G


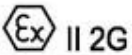

### L. Actuator Name plate description

The actuator nameplate shows the following data:

1. Contract No.
2. Purchase Order No.
3. Customer item
4. Valve and Actuator Tag Number
5. Actuator S/N
6. Actuator model
7. Valve size and rating
8. Actuator supply pressure (\*)
9. Action on oil failure
10. Ambient temperature range
11. Year of manufacturing
12. "CE" mark (\*)
13. Explosion-proof marking, followed by the apparatus group and category
14. ATEX Technical File No. (\*)
15. Name and complete address of the manufacturer

(\*) where applicable

See for reference the nameplate drawing below.

CONTRACT	<input type="text"/>
ORDER N°	<input type="text"/>
ITEM N°	<input type="text"/>
ACTUATOR TAG NUMBER	<input type="text"/>
<input type="radio"/> ACTUATOR SERIAL NUMBER	<input type="text"/>
ACTUATOR MODEL	<input type="text"/>
VALVE SIZE / RATING	<input type="text"/>
ACTUATOR RATED SUPPLY PRESS.	<input type="text"/>
SUPPLY PRESSURE RANGE	<input type="text"/>
<input type="text"/>	
<input type="radio"/> EMERGENCY OPERATION: POWER SUPPLY FAILURE	<input type="text"/>
Tamb: <input type="text"/> <input type="text"/> °C	<input type="text"/>
CONTROL SIGNAL FAILURE	<input type="text"/>
YEAR <input type="text"/>	<input type="text"/>
 	TCF N. <input type="text"/>
WARNING: ELECTROSTATIC CHARGES CLEAN WITH DAMP CLOTHS ONLY OR WITH ANTISTATIC PRODUCTS	
	
<b>Ledeen</b> Via Gandini 4 27058-Voghera(PV)-Italy	

## II. RECEIVING, STORAGE AND HANDLING

### A. Preliminary Verification Upon Receipt of Material

**Warning:**



At receipt of the material:

1. Check the completeness of the supply, by referring to the packing list;
2. Check the tag number, serial number and technical information in the nameplate with reference to the order acknowledgement.
3. The actuators are delivered with plugged connections. Which must remain plugged if not utilized or must be re-plugged with the relevant plug or reconnected after any testing operation.
4. Carry out a preliminary verification in order to ensure:
  - The integrity of the material and the absence of damages;
  - The integrity of the painting. If necessary, carry out the paint touch up, by following the instructions of the painting specification (please refer to the technical documentation);
  - The presence of the plugs on all the hydraulic and (where present) electric connections.

### B. Storage and Preservation

**Warning:**



If the storage of the actuator is necessary, please follow these instructions.

#### Storage conditions

The actuator must be stored in a warehouse adequately protected against harmful environment.

The recommended ambient temperature is : Minimum - 20°C / Maximum 70°C  
Relative Humidity : Maximum + 90%

#### Indoor storage

- Restore the paintwork of the components that have been damaged during transport
- Place the actuators on a wood surface pallet so as to prevent direct contact with the ground.
- Keep the electric components (where present) perfectly dry.

#### Outdoor storage

- Restore the paintwork of the components that have been damaged during transport
- Place the actuators above the ground level.

- To store the actuator at temperatures below of  $-30^{\circ}\text{C}$  and up to  $+70^{\circ}\text{C}$ , it is necessary to carry out additional checks and tests from time to time, depending on the ambient conditions.

#### Preservation conditions

The procedures that must be performed to the equipment during storage to assure proper operation of the equipment after installation are the following:

- Place the actuators on a wood surface pallet so as to prevent direct contact with the ground.
- Protect all unpainted parts with grease.

**Note :** *Before installing the actuator, perform one complete operation (opening and closing) to verify it strokes properly.*

**C. Handling**

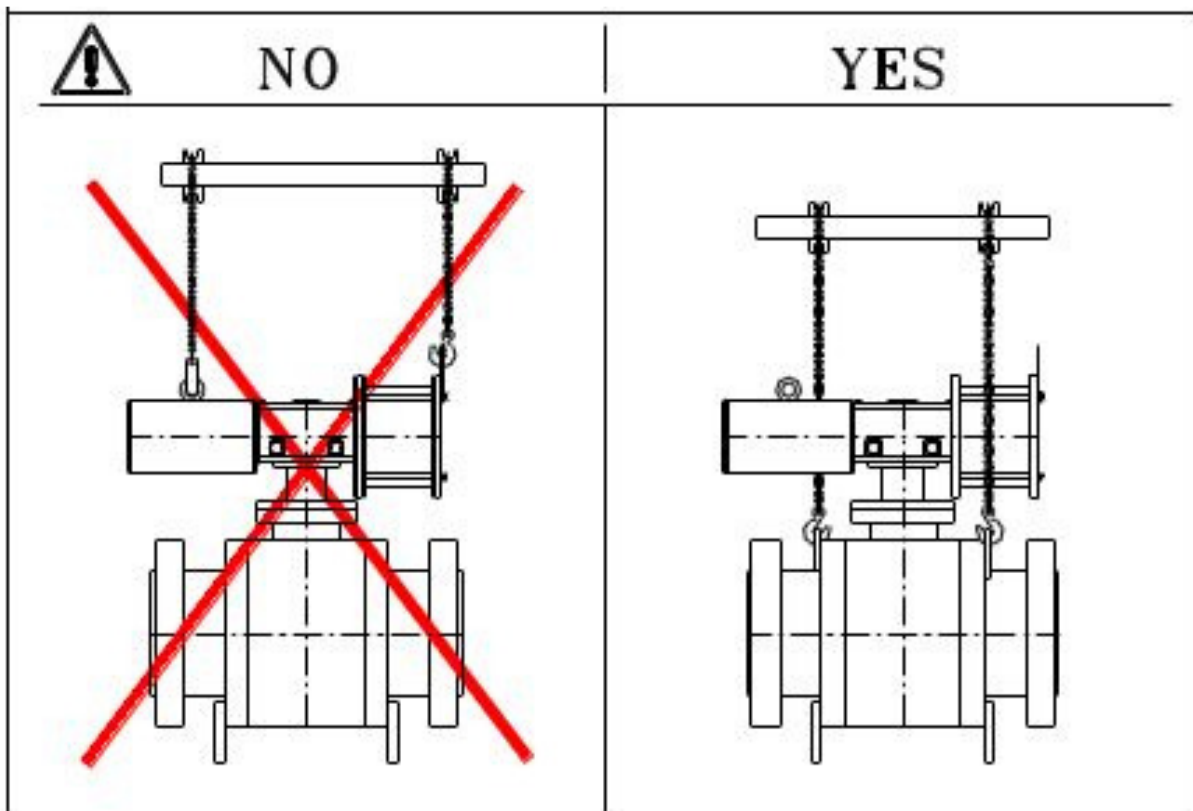
**Proper Lifting, Weights and Dimensions, Fastener Torque Chart**

**Warning:**



**Important:** These instructions refer to the lifting of the actuator only, not assembled on the valve.

**Do not attempt to lift the actuator-valve assembly by using the lifting points of the actuator:**

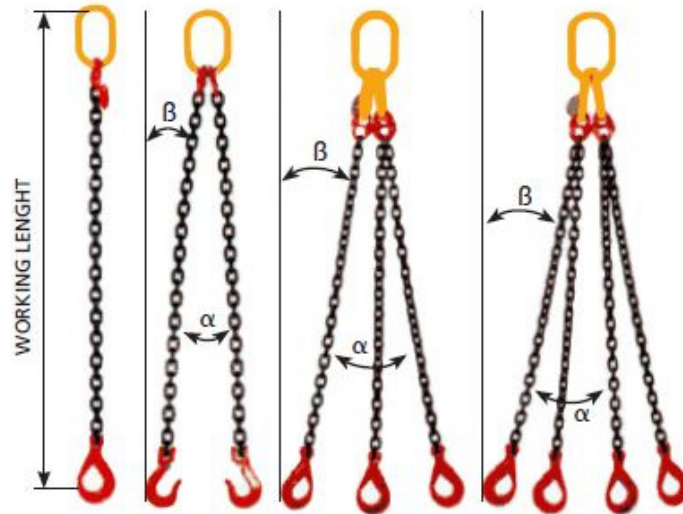


The lifting equipment consists on commercial chains and slings of adequate dimensions, according to the weight of the actuator.

Refer to the following sheets for standard commercial equipment.

**LIFTING DEVICES MAXIMUM WORKLOAD**






**Chains**



Chain Diameter mm	CMU/Tonn 1 Arm	CMU/Tonn 2 Arms		CMU/Tonn 3 and 4 Arms	
		$0^\circ < \beta \leq 45^\circ$ $0^\circ < \alpha \leq 90^\circ$	$45^\circ < \beta \leq 60^\circ$ $90^\circ < \alpha \leq 120^\circ$	$0^\circ < \beta \leq 45^\circ$ $0^\circ < \alpha \leq 90^\circ$	$45^\circ < \beta \leq 60^\circ$ $90^\circ < \alpha \leq 120^\circ$
		Factor 1.4	Factor 1.0	Factor 2.1	Factor 1.5
6	1.12	1.6	1.12	2.36	1.7
7	1.5	2.12	1.5	3.15	2.24
8	2	2.8	2	4.25	3
10	3.15	4.25	3.15	6.7	4.75
13	5.3	7.5	5.3	11.2	8
16	8	11.2	8	17	11.8
19	11.2	16	11.2	23.6	17
20	12.5	17	12.5	26.5	19
22	15	21.2	15	31.5	22.4
26	21.2	30	21.2	45	31.5
32	31.5	45	31.5	67	47.5

**LIFTING DEVICES MAXIMUM WORKLOAD**

**Slings**

Load in %		100%	200%	140% From 7° to 45°	80%	100% From 45° to 60°
C.M.U.	Width					
1 T	30	1000	2000	1400	800	1000
1,5 T	50	1500	3000	2100	1200	1500
2 T	60	2000	4000	2800	1600	2000
2,5 T	75	2500	5000	3500	2000	2500
3 T	90	3000	6000	4200	2400	3000
4 T	120	4000	8000	5600	3200	4000
5 T	150	5000	10,000	7000	4000	5000
6 T	180	6000	12,000	8400	4800	6000
8 T	240	8000	16,000	11,200	6400	8000
10 T	300	10,000	20,000	14,000	8000	10,000
15 T	240	15,000	30,000	21,000	12,000	15,000
20 T	300	20,000	40,000	28,000	16,000	20,000










**NON TEFLON-COATED  
TIE-RODS**

Tie Rod Type	Pitch mm	Tightening Torque - Nm (±5%)		
		Mat. (1)	Mat. (2)	Mat. (3)
M 8	1,25	20	26	25
M 10	1,50	39	51	49
M 12	1,75	68	90	86
M 14	2,00	96	126	121
M 16	2,00	151	197	189
M 18	2,50	206	270	259
M 20	2,50	295	386	295
M 22	2,50	406	532	406
M 24	3,00	509	666	509
M 27	3,00	755	988	617
M 30	3,50	1019	1334	834
M 33	3,50	1198	1568	751
M 36	3,00	1656	2168	1039
M 39	3,00	2144	2807	1345
M 42	3,00	2710	3547	
M 45	3,00	3383	4428	
M 48	3,00	4147	5429	
M 52	3,00	5338	6989	
M 56	4,00	6440	8431	
M 60	4,00	8011	10487	
M 64	4,00	9838	12878	
M 68	4,00	11940	15631	
M 72	4,00	14299	18718	
M 76	4,00	16926	22158	
M 80	4,00	19882	26027	
M 85	4,00	24033	31462	
M 90	4,00	28729	37609	
M 95	4,00	33949	44442	
M 100	4,00	37296	52142	
M 105	6,00	41312	57757	
M 110	4,00	45923	64203	
M 120	4,00	60094	84015	
M 150	6,00	115566	161568	

**TEFLON-COATED  
TIE-RODS**

Tie Rod Type	Pitch mm	Tightening Torque - Nm (±5%)		
		Mat. (1)	Mat. (2)	Mat. (3)
M 8	1,25	15	19	18
M 10	1,50	29	38	37
M 12	1,75	51	67	64
M 14	2,00	82	108	103
M 16	2,00	129	169	162
M 18	2,50	177	231	222
M 20	2,50	252	330	252
M 22	2,50	348	456	348
M 24	3,00	436	571	436
M 27	3,00	647	847	529
M 30	3,50	873	1143	715
M 33	3,50	1198	1568	751
M 36	3,00	1656	2168	1039
M 39	3,00	2144	2807	1345
M 42	3,00	2710	3547	
M 45	3,00	3383	4428	
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M 105	6,00	41312	57757	
M 110	4,00	45923	64203	
M 120	4,00	60094	84015	
M 150	6,00	115566	161568	

Note : - Column Mat.(1) applicable to the following materials : A193 B7M, A320 L7M, A453 Gr.660B, BS 4882, A193 B7 (> M 100)  
 - Column Mat.(2) applicable to the following materials : A320 L7, A320 L43, A193 B7, 39NiCrMo3 (<= M 100)  
 - Column Mat.(3) applicable to the following materials : A193 B8 Classe 2 (<= M 39)  
 - Load required for the hydraulic pre-tightening is calculated based on the stress applied to the tie rod (% Sn), this load shall be increased on the base of the load lost during the pre-tightening (Cp).  
 Cp value reported in the table is for reference only and should be better to calculate it again before every application.

REV	0				 <b>TIE RODS TIGHTENING TORQUES</b> <b>STC1325</b>
DATE	17:02:09				
BY	S.C.				
CHK.	F.I.				
APP.	C.L.				

### III. OPERATION

This series hydraulic actuator is designed for on-off and control service and is applicable over a wide range of pressure, temperature and environments.

The scotch yoke mechanism converts the linear motion of hydraulic piston into valve rotation by the actuator shaft. The symmetric scotch yoke mechanism generates high torque at start (0° degree) and the end (90° degree) of the valve stroke. The canted scotch yoke mechanism generates very high torque when valve is closed.

Hydraulic pressure is applied via supply ports in either end of the cylinder assembly onto pistons running within the cylinder liner. This enables the scotch yoke mechanism of the actuator to drive in both directions.

### IV. COMMISSIONING

#### A. Mounting to Valve (With Adaptor Piece)

**Warning:**



**Note:** No special tools are required for these operations, but only some Allen wrenches and hexagonal wrenches of the required sizes.

The actuator drive sleeve is generally connected to the valve stem by an insert bush or a stem extension. The assembly position of the actuator, with reference to the valve, must comply with the plant requirements (cylinder axis parallel or perpendicular to the pipeline axis).

**Before the installation, please check that the actuator was not damaged during the transportation.**

The actuator along with the adapter assembly is shipped to mount on the valve. In case it is necessary to assemble the actuator onto the valve, proceed as follows:

- a. Check that the coupling dimensions of the valve flange and those of the valve stem meet the coupling dimensions of the actuator.
- b. Clean the flange of the valve and remove anything that may prevent a perfect adherence to the actuator.
- c. Lubricate the shaft of the valve with oil or grease.
- d. Set the actuator position same as that of the valve position, either open or close.

- e. Lift the actuator by means of adequate slings as per the weight of the actuator to render the perfect horizontal (this is very important for easy coupling) utilizing the existing lifting point on the actuator. (refer to page no. [12-15](#))
- f. Clean the adapter piece flange and remove anything that may prevent a perfect adherence to the valve.
- g. Lower the actuator onto the valve in such a way that the adapter, assembled on the valve stem, enters the actuator drive sleeve. This coupling must take place without forcing and only with the weight of the actuator.

**Note:** Caution should be taken while connecting the adapter piece on to the valve stem.

- h. Check if the holes of the valve flange and adapter flange meets as well as any dowel pins (if provided). If yes secure the actuator to the valve using correctly sized fasteners.
- i. Uniformly tighten the fasteners of the adapter flange. (refer to page no. [16](#) for tightening torque of fasteners).

## B. Adjustment

**Warning:**



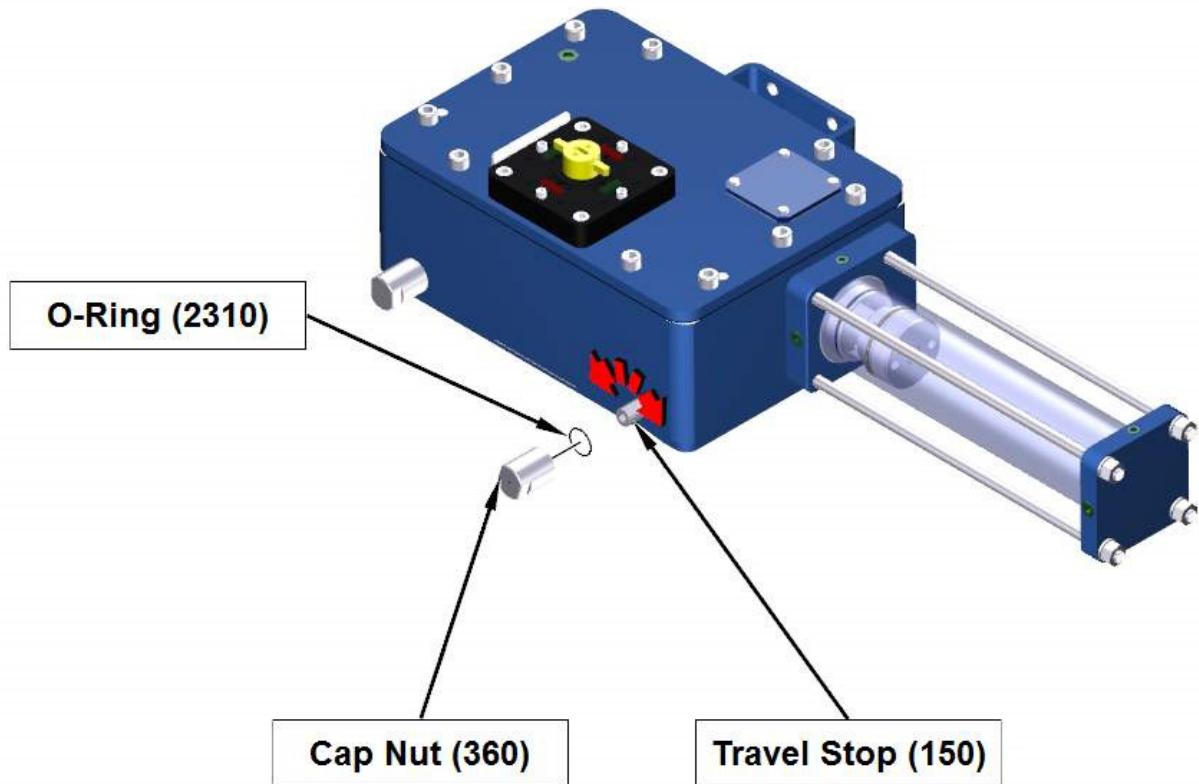
**Note:** No special tools are required for these operations, but only some hexagonal wrenches of the required sizes.

**Important:** The actuator is shipped with a preliminary adjustment and not on the real valve stroke. If it is necessary to change the adjustment, proceed as follows:

### a) Adjustment of mechanical stops

After having loosened the cap nuts (item 360) rotate the travel stops (item 150) clockwise or counter-clockwise for adjusting the angular stroke,

By rotating the travel stops (item 150) clockwise, the angular stroke is reduced. Rotating counter-clockwise, the angular stroke is increased.



**Note:** In case of Spring return actuators, before adjusting the travel stop relevant to the cylinder, it is necessary to pressurize the same with low pressure in order to reduce the pressure provided by the spring thrust against the travel stop to be adjusted.

When the end cap seals need to be replaced (DA & SR) follow the instructions below:

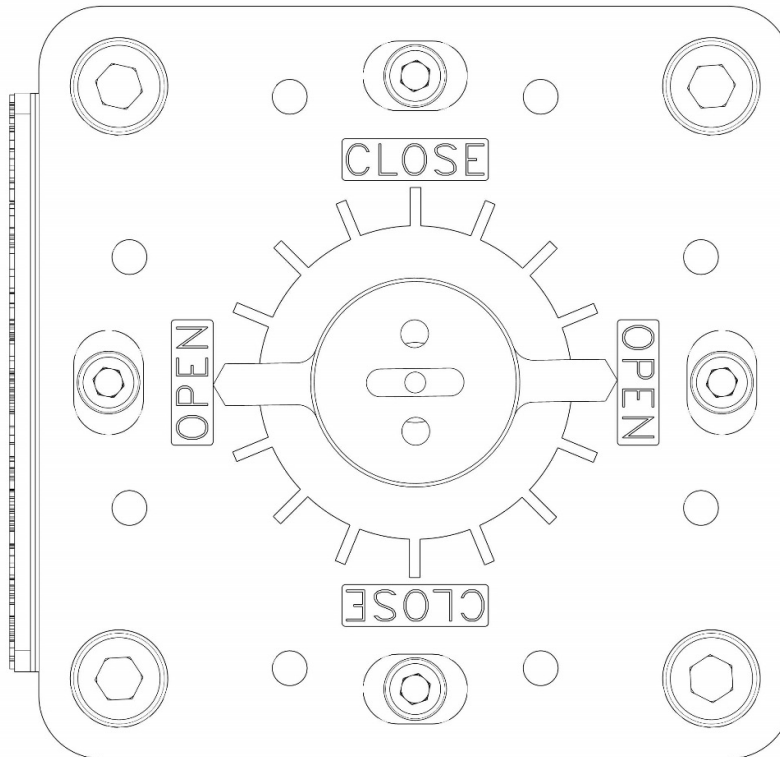
1. Place the actuator in fail safe position.
2. Remove any electric power and pressure supply.
3. Remove the cap nut (item 360) paying attention that the mechanical stop (item 150) does not move from the original position.
4. Remove the existing O-ring (item 2310) from cap nut groove and clean both the groove and the internal thread.
5. Clean the surface of the frame where cap nut is assembling.
6. Install the new O-ring in the groove of cap nut and apply a grease film.  
(suggested grease: Parker super-o-lube or equivalent)
7. Install the cap nut, applying 45-50Nm torque.
8. Restore the normal working condition and pressurize the actuator, checking for leakages through the parts.
9. Restore, if necessary, the paint layer as per the original paint specification.

**b). Verification of Position Indicator**

**Warning:**



**Note:** No special tools are required for these operations, but only some Allen wrenches and hexagonal wrenches of the required sizes.



**Position indicator alignment**

Verify the correct indication of the actuator position by the local position indicator:

- **OPEN** when the actuator is in open position. Pointer will be parallel to the axis of the actuator.
- **CLOSED** when the actuator is in closed position. Pointer will be indicating perpendicular to the axis of the actuator.

## C. Actuator Start up

### a. Arrangement for start-up

**Warning:**



**Note:** No special tools are required for these operations, but only some Allen wrenches and hexagonal wrenches of the required sizes.

#### Hydraulic connections:

- Before connecting the actuator to the hydraulic supply line, check that pipes and fittings are according to the applicable plant specifications, in order to guarantee the required oil flow for the operation of the actuator and to avoid that the supply pressure drops below the minimum allowable value.
- Clean the inside of the pipes used for connection by washing them with suitable detergent and by blowing air into them. Take every precaution to remove any solid or liquid foreign matter from the pipe work to the actuator, so as to avoid possible damages to the actuator itself or loss of performance.
- Fasten the piping in a right way, in order not to cause loosening of threaded connections, in the event that the system may be subject to strong vibrations.
- After the completion of the hydraulic connections, operate the actuator in order to ensure that it works correctly. Also check that its operating times are in accordance with those specified in the test certificate and that there are not leakages in the hydraulic connections.

#### Electric connections:

- Introduce connection cables.
- Make the connections in compliance with applicable wiring diagrams on the documentation supplied.
- Tighten the cable gland.
- Replace the plastic plugs of unused entries with metal plugs.

### b. Start-up

**Warning:**



**Note:** No special tools are required for these operations, but only some Allen wrenches and hexagonal wrenches of the required sizes.

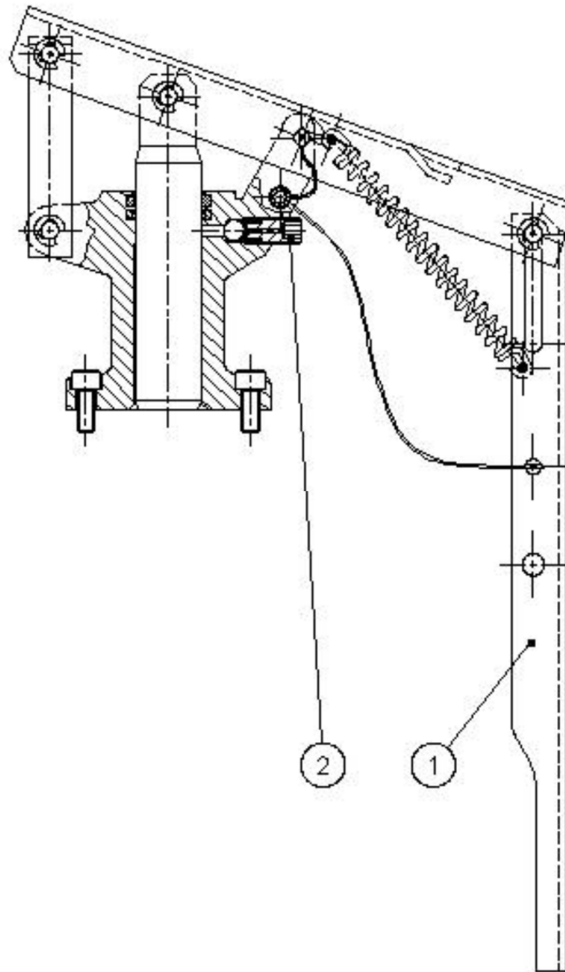
- Carry out the electrical in accordance with the electrical wiring diagram.
- Check that the pressure of the process supply, as well as its quality (filtering degree, dehydration) are as prescribed.

- c) Check that the feed voltage values of the electric components (solenoid valves coils, micro switches, pressure switches etc., if applicable) are as prescribed.
- d) Check that the actuator controls, such as remote control, local control, emergency control etc. (if applicable), are properly working in accordance with the schematic diagram.
- e) Check that the required remote signals (valve position, oil pressure, etc.) are correct.
- f) The setting of the components of the actuator control unit is according to the requirements of the plant.
- g) Check that there are no leaks in the hydraulic connections. If necessary tighten the fittings.
- h) Bleed the air from the cylinder, if necessary, by removing the plug mounted on the flange.
- i) Check the correct working of the actuator with the hydraulic supply and the spring (if applicable) in open and closed direction.
- j) Check the correct working of the actuator by means of the manual override hand pump (if applicable).
- k) Check the correct hydraulic piping seal.
- l) Restore the paintwork of the components which may have been damaged during transportation or commissioning after having removed the rust.

**c. Actuators equipped with Hand-Pump**

If the hand pump working is not effective, carry out the following draining procedure (refer to DWG. STC212):

- a) Completely lift the hand pump lever (1);
- b) Loosen the socket head screw (2), in order to exhaust the air from the pump;
- c) Completely lower the hand pump lever (1);
- d) Tighten the socket head screw (2);
- e) Repeat points from a) to d) until the oil drops out from the socket head screw (2).



DWG. STC212



## V. MAINTENANCE

Every maintenance operation on the actuator must be carried out only after having closed the pressure taps in order to prevent undesired operation and enable the operating personnel to work in safe conditions.

If present, shut-off the electric power supply and check the absence of hazardous atmosphere near the actuator.

### A. Routine Maintenance

**Warning:**



Every 6 months:

- a) Check the correct valve position signalling on the control panel.
- b) Check the correct working of the actuator with hydraulic supply by manually stroking the same for a small percentage not to affect the flow in the main line. The actuator shall be operated back to its initial position just after the partial stroke end line is reached. This operation can be automatically performed by means of the partial stroke test facility, if any.
- c) If provided with a manual override (hand wheel or hand pump) check the correct working by operating the actuator for a small percentage not to affect the flow in the main line. The actuator shall be operated back to its initial position just after the partial stroke end line is reached.

Every year:

- a) Check the lubrication of the scotch yoke and if necessary lubricate with SHELL GADUS S5 or equivalent grease.
- b) Check that there is no leakage from the piston rod of the cylinder.
- c) Remove, if any, the condensation in the housing, by actuating the pressure relief valve placed on the bottom of the housing.

Every 3 year:

- a) If provided with a hand pump override check that the oil is in good condition and that it is always clear.
- b) Ensure the oil is changed as per the oil manufacturer's Material Safety Data Sheet.

**Important:** *In case of oil change, the replaced oil must be disposed of as special waste, in accordance to the laws applicable in the country where the actuator is installed.*

- c) A replacement of all the soft seals in the control panel (where applicable) is suggested.

## B. Extraordinary Maintenance

**Warning:**



- In case of leakage from the hydraulic cylinder, disassemble, clean the O-ring grooves and substitute the O-ring if damaged.
- If there is a leakage from the hydraulic piping, tighten the fittings, or if necessary, change them if damaged.
- In case of malfunction or leakage from the actuator, disassemble referring to the disassembly section (from page no. [31](#)). Clean with care and replace damaged components.

**Important:** *In case that the actuator or any of its part must be replaced, please follow the instructions of the “Actuator Disposal”.*

## C. Instruction for replacement of Dynamic seals

**Warning:**



If there are leaks in the hydraulic cylinder or a malfunction in the mechanical components, or in case of scheduled preventative maintenance, the actuator must be disassembled and seals must be replaced with reference to the disassembly section (from page no. [31](#)) and adopting the following procedure.

**Note:** *When the seals need to be replaced, it is necessary to check before assembly, that their seats are clean and lubricated.*

### a) Replacement of Piston seal: ( See Figure 1 )

For replacing piston seal proceed as described here below:

ENSURE THAT ALL PRESSURE IS RELIEVED FROM THE CYLINDER.

- Remove the hex nuts (item 200) and washer (item 210) from the tie rods.
- Remove the end flange (item 50) from liner (item 10).
- Gradually remove the liner from head flange (item 40).
- Remove the O-ring (item 60), and the guide slider (item 80) from piston (item 20). Carefully clean the relative piston grooves.
- Replace the seals and lubricate them with a grease film.

Taking care not to damage the seals, proceed with the reassembling as follows:

- Reassemble the liner and the end flange.
- Uniformly tighten the hex nuts on the tie rod after installing the washers..  
Carry out a few operations with the actuator, in order to check that the movement is regular and that there are no leakages through the seals.

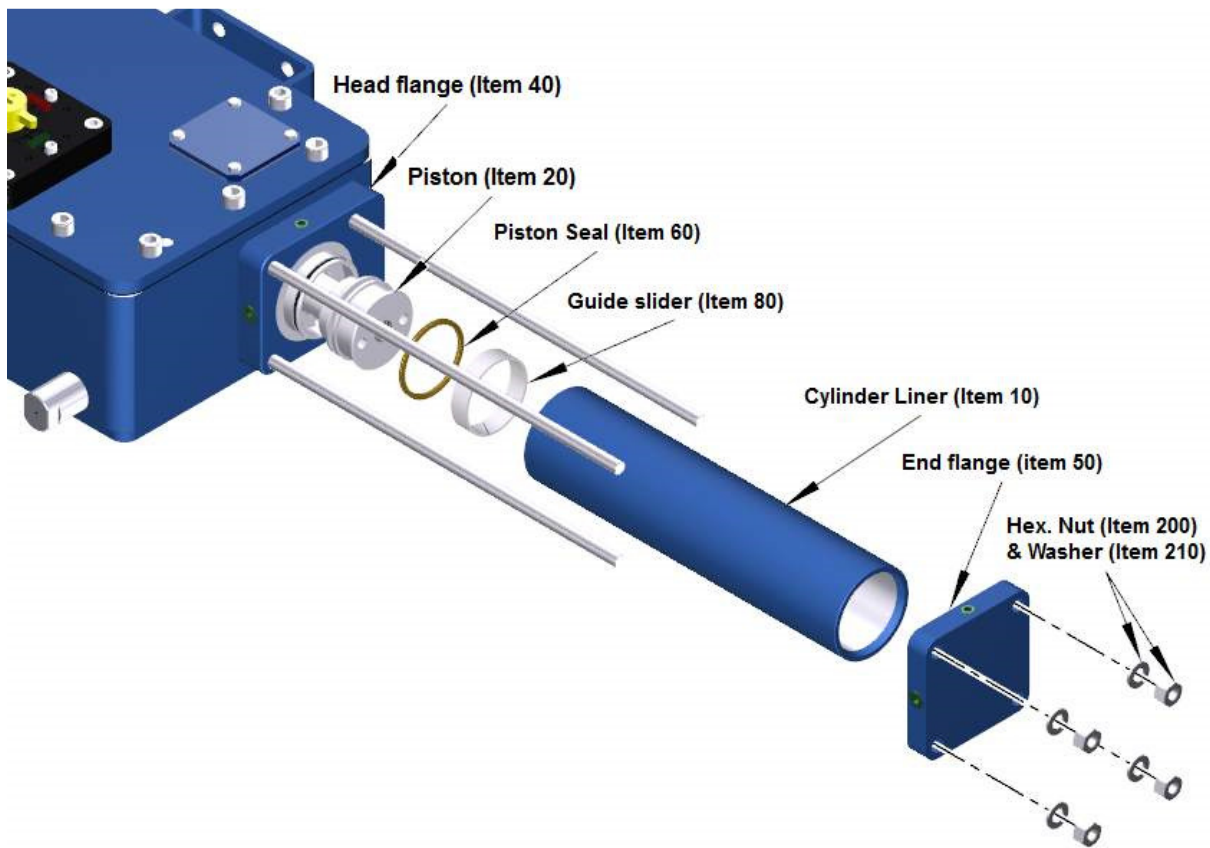


Figure 1

**b) Replacement Piston rod seals : (See Figure 2)**

After removing the liner ( as per the description of point “a” ) for replacing piston rod seal proceed as described here below:

- Unthread the piston (item 20) from the rod and pull the piston out of the rod.
- Remove the O-ring (item 380), Clean the groove and brush with grease.
- Replace the O-ring and to reassemble the actuator follow the disassembly procedure in reverse order to assemble.

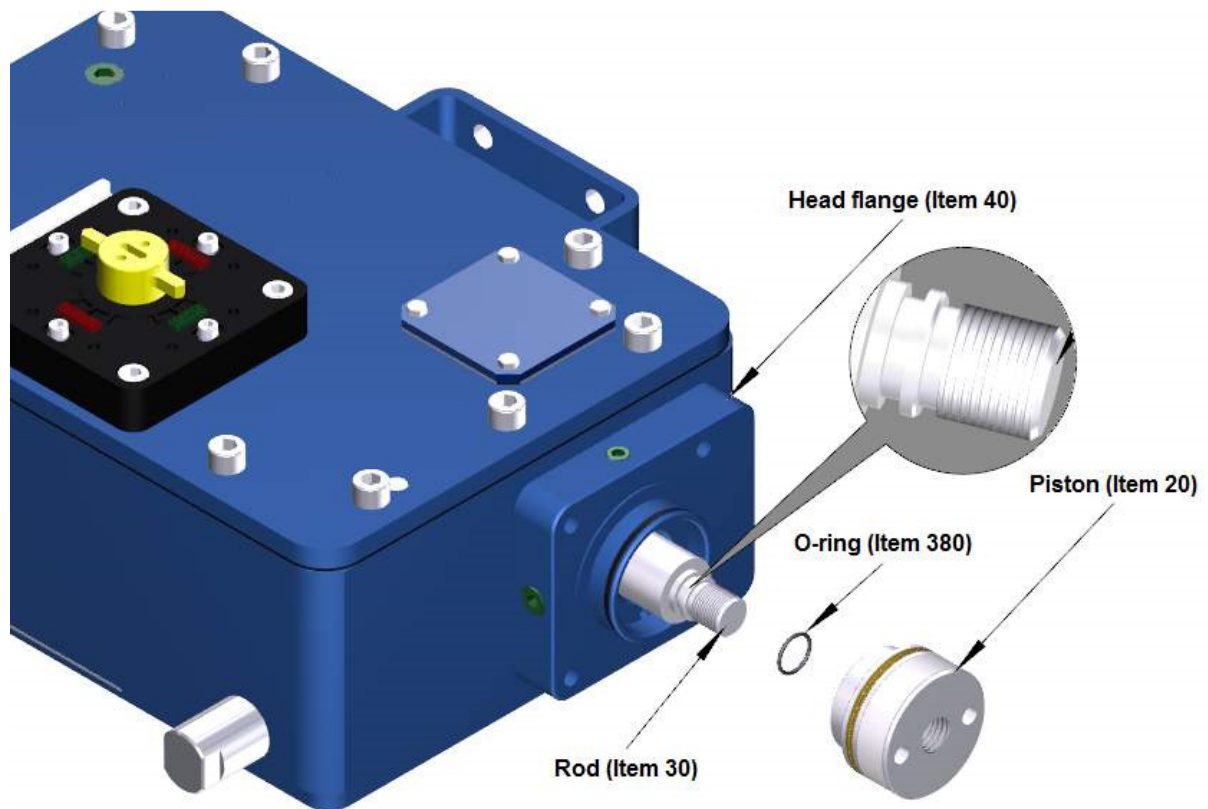


Figure 2

**c) Replacement Piston rod seal in head flange: (See Figure 3)**

After removing the piston ( as per the description of point “b” ) for replacing piston rod seal in head flange proceed as described here below:

- Remove the position indicator from the top of the frame by unthreading the four socket head screws.
- Remove the frame cover (item 2) followed by gasket (item 8) by unthreading the ten number of bolts (item 14).
- Unthread the 4 bolts (item 170) which hold the head flange (item 40) to the frame.
- Pull the head flange out of the frame (item 1) (housing) and from the rod (item 30).
- Remove the seal (item 70), Clean the groove and brush with grease.
- Replace the O-ring and to reassemble the actuator, follow the disassembly procedure in reverse order.

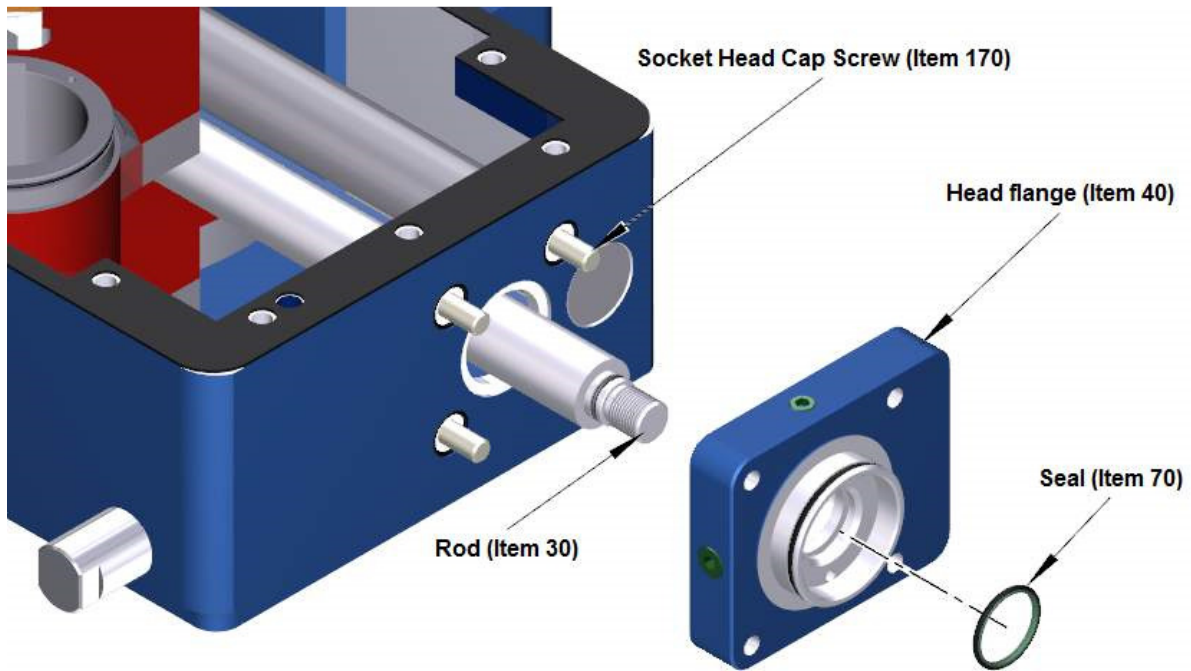


Figure 3

## VI. GREASE AND HYDRAULIC OIL SPECIFICATIONS

### a. Grease specification

Manufacturer:	Shell
Trade name:	Gadus S5 V460 1.5
Colour:	Light Brown
Soap type:	Lithim Complex
Consistency (NLGI GRADE):	1.5
Cone penetration, Worked at 25°C - ASTM D217:	29-320
Dropping point – IP 396	260
Oil type:	Synthetic
Kinematic Viscosity at 40°C	460 cSt
Kinematic Viscosity at 100°C	45 cSt
Equivalent to:	Parker, Super-O-Lube

### b. Hydraulic oil specification

Manufacturer:	Shell
Trade name:	Tellus S2 V
Kinematic Viscosity at 40°C	32 cSt
Kinematic Viscosity at 100°C	6.1 cSt
Viscosity index – ISO2909	143
ISO grade	32
Pour point	-39°C

## VII. TROUBLE SHOOTING & REMEDIES

Problems	Possible cause	Remedy
Actuator doesn't work properly	Lack of hydraulic supply	Check supply line.
	Oil of wrong Viscosity	Refer Page no.29 (or) Consult Cameron Ledeen
	Defective main valve	Consult valve manufacturer documentation.
	Failure of the control group	Consult Cameron Ledeen
	Actuator is incorrectly sized for torque output against the Valve torque.	Check the sizing criteria for both the Actuator and the Valve.
Jerky Movement	1.Low hydraulic supply . 2.Air clog in the cylinder. 3.Valve coupling binding	1.check hydraulic reservoir. 2.Bleed-off the air in oil flow 3.Loosen adapter piece bolts and retry. If OK tighten bolts evenly.
	Undersized tubing or components on hydraulic circuit	Consult Cameron Ledeen
	Piston binding in cylinder	Remove cylinder. Check piston "O"-ring for wear, change if necessary. Grease, Reassembly and test.
	Misplaced or broken spring (s) (only for spring return actuator)	Consult Cameron Ledeen After sales service
	Faulty valve.	Consult valve manufacturer documentation.
Actuator too slow	Low supply pressure	Adjust supply pressure
	Incorrect speed control settings	Adjust speed controls to increase flow
	Exhaust fluid line is blocked	Remove and clean the exhaust port breathers and replace.
	The valve is jammed	Consult valve manufacturer documentation
Actuator too fast	High supply pressure	Reset pressure regulator to suitable pressure
	Incorrect speed control settings	Adjust speed controls to decrease flow
Leakages on hydraulic circuits	Deterioration and/or damage to gaskets and or loosened fittings	Tighten loose fittings Consult Cameron Ledeen
	Damage to fittings	Consult Cameron Ledeen
Leakages on hydraulic cylinder	Damage to seals (Rod / Piston / Gasket)	Replace cylinder seals
Foaming of Oil in System	Water in Oil	Check filter breather on reservoir.
	Wrong kind of oil being used	Use oil recommended by manufacturer
Incorrect position of the valve	Wrong adjustment of mechanical stops	Re-adjust setting
	Wrong electric limit switches indication.	Re-adjust setting



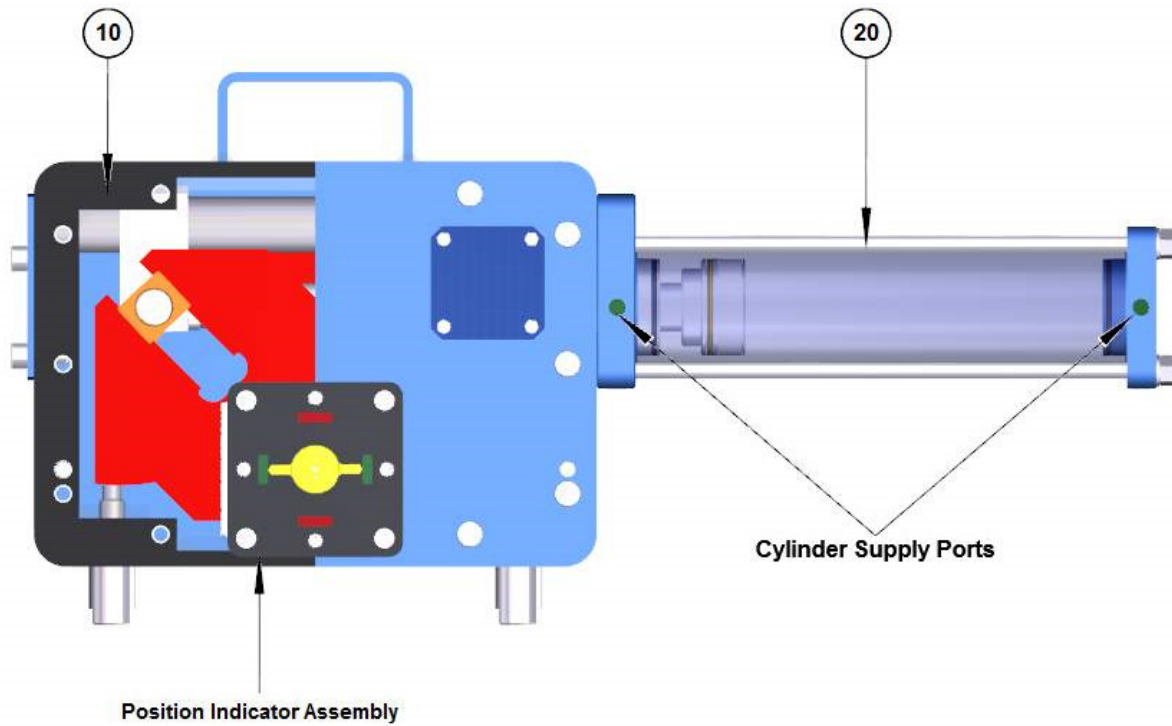
**VIII. DISASSEMBLY AND REASSEMBLY**

**Warning:** 

**Note:** No special tools are required for these operations, but only some Allen wrenches, hexagonal wrenches of the required sizes, Ratchet wrench with extension and Swivel wrench.

**Note:** If the RFID tag has been provided on the actuator that identifies each actuator with a unique number and when any disassembly process is undertaken, all components removed from within the actuator assembly must be reinstalled within that specific actuator during the reassembly process. DO NOT mix components from one actuator assembly with those of a different actuator assembly.

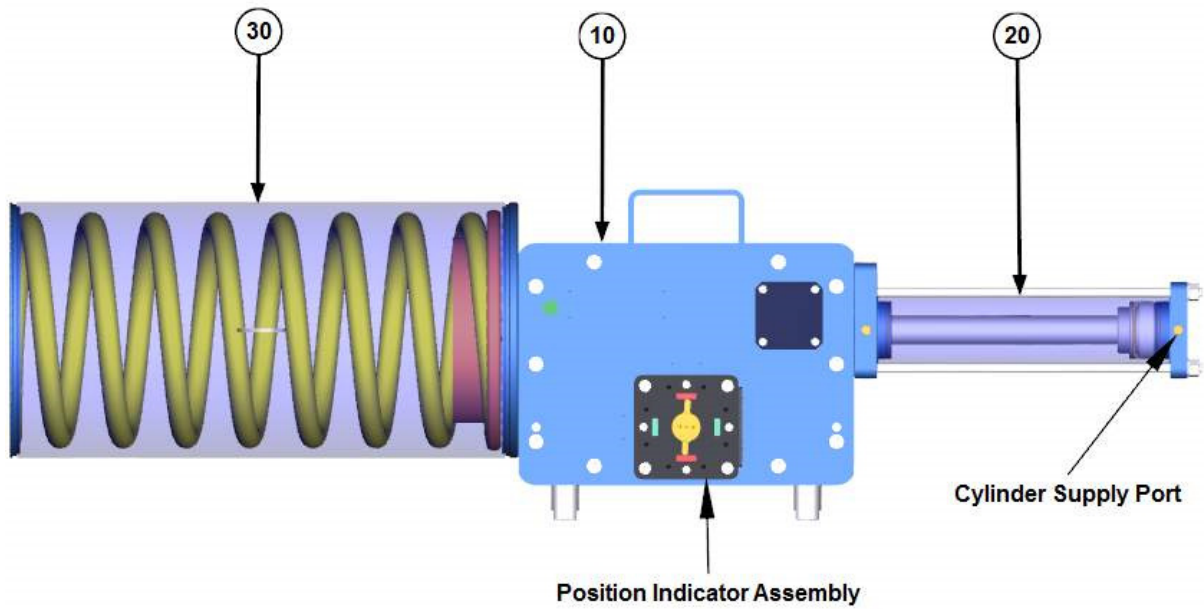
Refer to the Double acting actuator assembly drawing below.



ITEM	DESCRIPTION	QTY
10	FRAME SUB ASSEMBLY	1
20	HYDRAULIC CYLINDER SUB ASSEMBLY	1

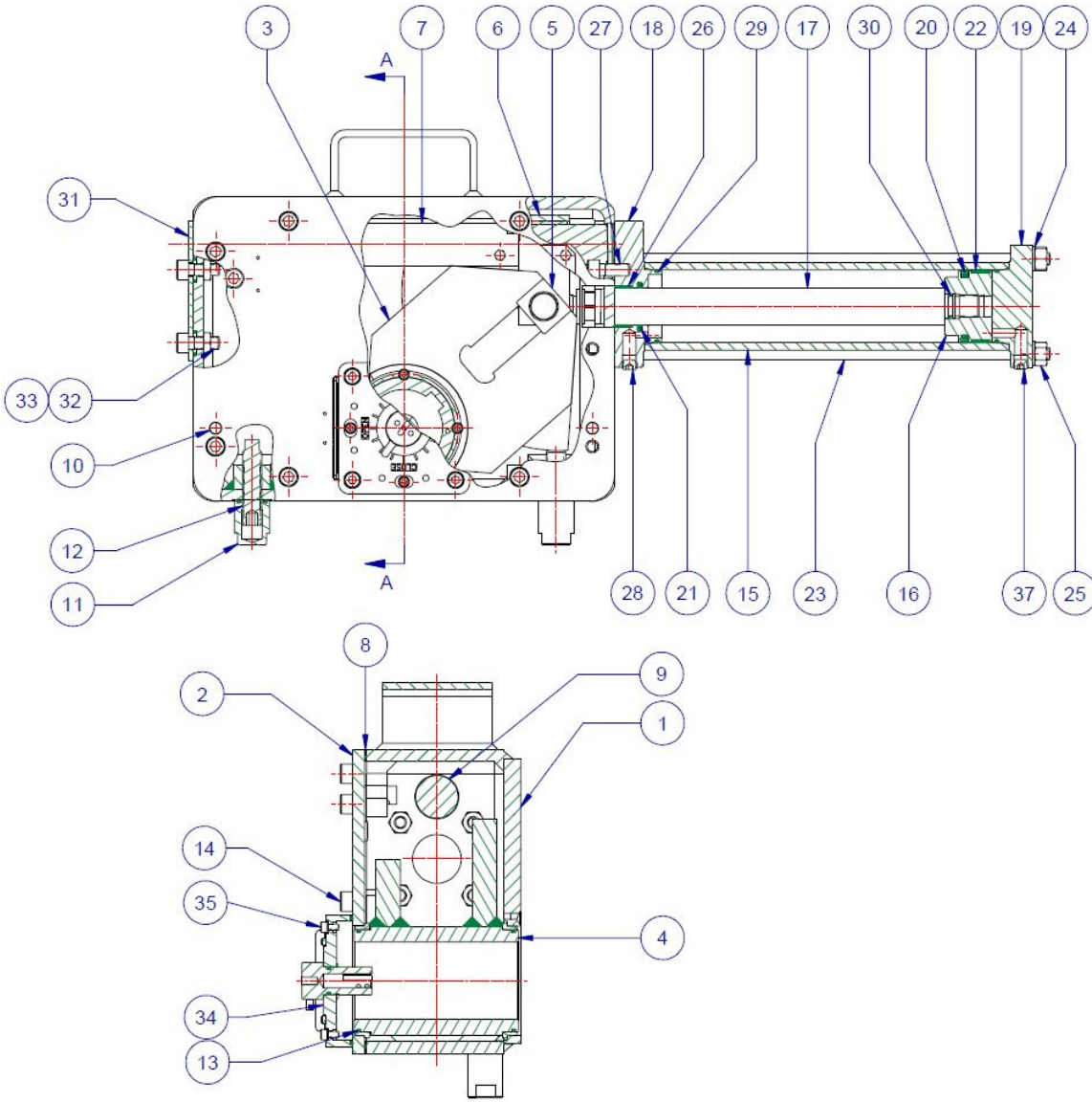


Refer to the Spring return actuator assembly drawing below.



ITEM	DESCRIPTION	QTY
10	FRAME SUB ASSEMBLY	1
20	HYDRAULIC CYLINDER SUB ASSEMBLY	1
60	SPRING CONTAINER	1

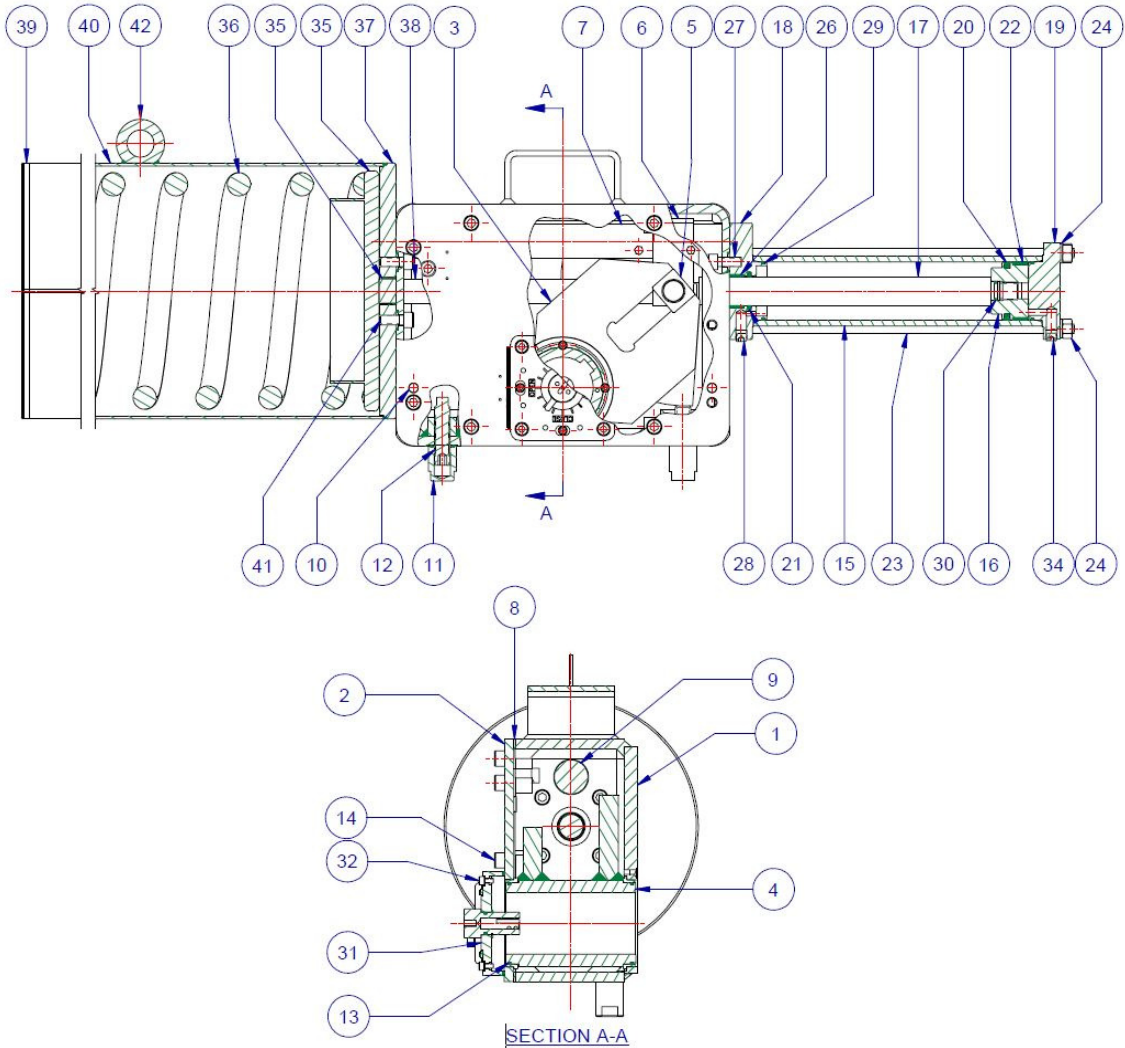
Refer to the Double acting actuator sectional assembly drawing below:



SECTION A-A

ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	FRAME	14	SCOKET HEAD CAP SCREW	26	DU-BEARING
2	COVER	15	LINER	27	SOCKET HEAD CAP SCREW
3	SCOTCH YOKE	16	PISTON	28	PLUG
4	BUSHING	17	PISTON ROD	29	O-RING
5	SLIDING BLOCK	18	HEAD FLANGE	30	O-RING
6	GUIDE BLOCK	19	END FLANGE	31	FLANGE
7	GUIDE BAR	20	O-RING	32	HEX. NUT
9	DU-BEARING	21	O-RING	33	SOCKET HEAD CAP SCREW
10	PIN	22	GUIDE SLIDER	34	POSITION INDICATOR
11	NUT	23	TIE ROD	35	SOCKET HEAD CAP SCREW
12	TRAVEL STOP	24	WASHER	37	PLUG
13	O-RING	25	HEX. NUT		

Refer to the Spring return actuator sectional assembly drawing below:



ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	FRAME	16	PISTON	30	O-RING
2	COVER	17	PISTON ROD	31	POSITION INDICATOR
3	SCOTCH YOKE	18	HEAD FLANGE	32	SOCKET HEAD CAP SCREW
4	BUSHING	19	END FLANGE	34	PLUG
5	SLIDING BLOCK	20	O-RING	35	PUSHING FLANGE
6	GUIDE BLOCK	21	O-RING	36	SPRING
7	GUIDE BAR	22	GUIDE SLIDER	37	HEAD FLANGE
8	GASKET	23	TIE ROD	38	PUSHER
9	DU-BEARING	24	WASHER	39	END FLANGE
10	PIN	25	HEX. NUT	40	LINER
11	NUT	26	DU-BEARING	41	SOCKET HEAD CAP SCREW
12	TRAVEL STOP	27	SOCKET HEAD CAP SCREW	42	LIFTING LUG
13	O-RING	28	PLUG		
14	SOCKET HEAD CAP SCREW	29	O-RING		

**A. Disassembly:**

**Note:** Before removing the actuator from the process piping for inspection by disassembly, check that the operating pressure is at atmospheric pressure. Also check that the pressure within the valve main unit is at atmospheric pressure to assure safety.

**Note:** If the control valve is intended for the control of fluid containing drastic chemicals that are harmful to human body, be sure to check that the inside of the control valve is washed completely before starting the work.

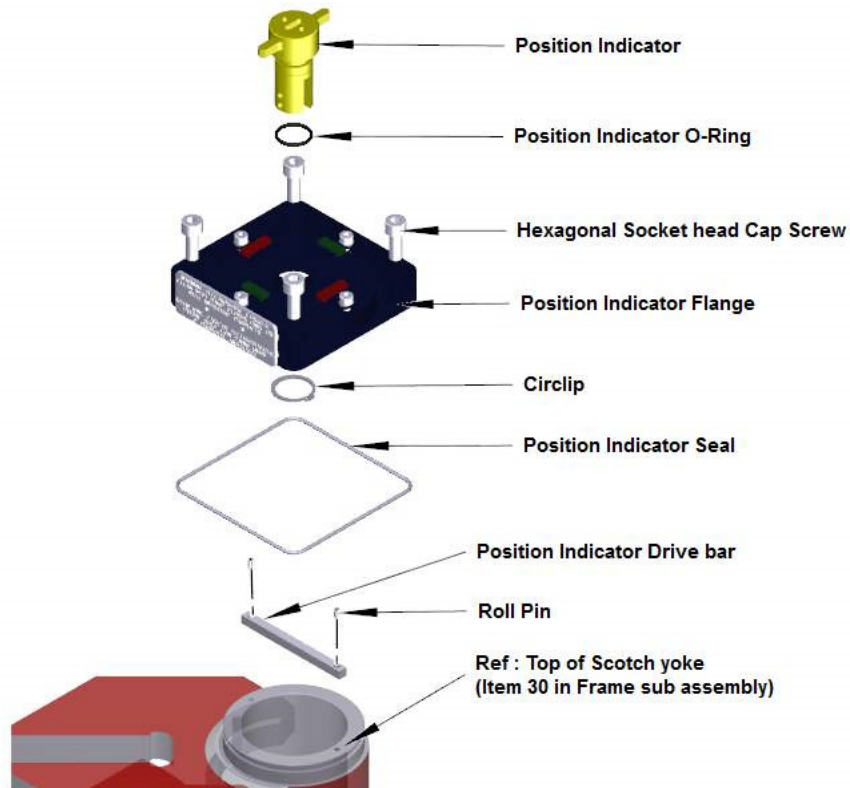
**Note:** Before starting any disassembly of the actuator, ensure that all electrical and supply media connections are off or disconnected. Also that any pressure within the actuator piston has been relieved.

**Note:** Before starting disassembly, ensure spare parts seal kit is available as indicated on page [47](#).

**Note:** If bearing replacement is expected, contact Cameron for additional instructions.

- Detach the actuator from the valve assembly as the first step before starting to disassemble the actuator and the next step is to remove all the accessories.
1. Ensure that the actuator is in the failed position (i.e., at the end of spring stroke) to disassemble the actuator from the valve assembly. Then lift the actuator (Refer to page no. [12-15](#)) in horizontal orientation and place the actuator assembly on a suitable work bench resting on its base.
  2. Remove the hydraulic tubing and electric wiring of the accessories carefully and then remove the accessory devices from the actuator.

**a. Removing Position Indicator assembly from Frame:**



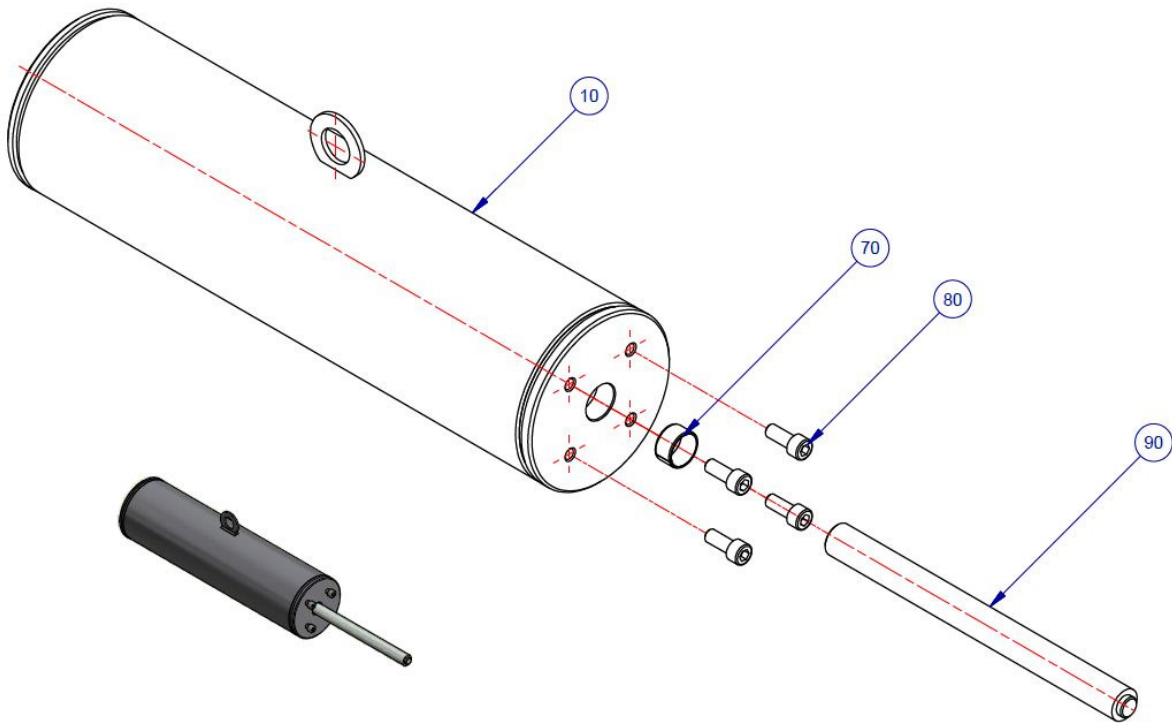
**b. Removal of Spring Container from Frame:** (See the Exploded view below)

(Refer to pages [33 & 34](#) for sectional assembly drawings)

- Remove frame cover fasteners (item 300).
- Remove the frame cover (item 20) with gasket (item 90) and place it on table away from the actuator.
- If desired, remove the inspection hole flange (item 120) with the gasket (item 100) from frame cover by unscrewing the four hexagonal head bolts (item 310) and place the parts on table away from actuator.
- If desired, remove the dowel pin (item 380) from frame.
- Support the spring container with proper lifting devices (Refer to pages [12-15](#)) for removing the spring container assembly from frame. Now, unscrew the four socket head screws (item 80) which holds the spring container to the frame (item 10). Remove the spring container assembly out of the frame with the lifting devices.
- Place the cylinder assembly on table away from the frame.

**Note:** *Pusher rod is neither connected to guide block nor to the spring container. Care should be take while pulling out the spring container.*

- Remove pusher rod from frame and place it away from the actuator.



ITEM	QTY	DESCRIPTION
10	1	SPRING CONTAINER
70	1	DU BEARING
80	4	SOCKET HEAD SCREW
90	1	PUSHER ROD

**c. Removal of Cylinder sub assembly from Frame & disassembly:**

(Refer to Frame Exploded view in Page [41](#))

**Note:** Before commencing any disassembly of the actuator, ensure that the actuator is isolated from the supply pressure and mechanical end stops are released.

- Remove frame cover fasteners (item 300).
- Remove the frame cover (item 20) with gasket (item 90) and place it on table away from the actuator.
- If desired, remove the inspection hole flange (item 120) with the gasket (item 100) from frame cover by unscrewing the four hexagonal head bolts (item 310) and place the parts on table away from actuator.

- If desired, remove the dowel pin (item 380) from frame.
- Rotate the Scotch yoke (item 30) until the hexagonal flats on piston rod besides the guide block (item 80) is accessible.

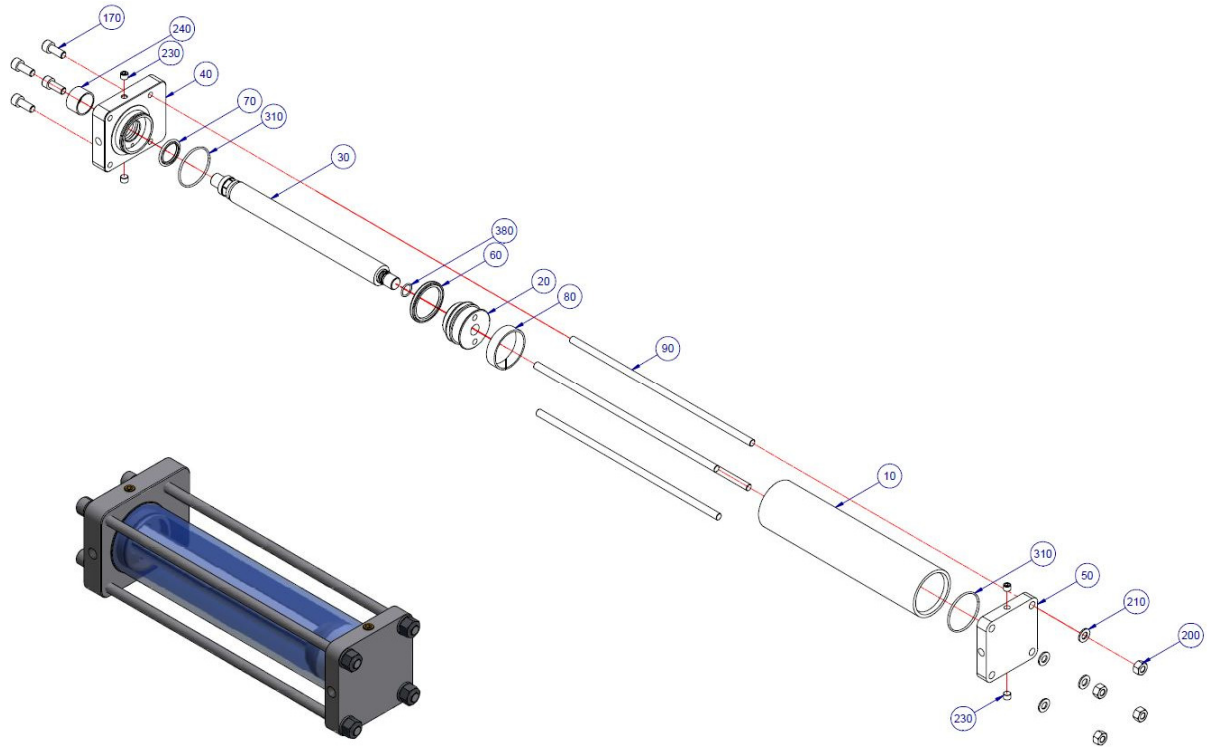
**Note:** *While using the Wrench, care should be taken that the surface of the Piston Rod is not damaged.*

- Unscrew the piston rod (item 30) from the guide block using a wrench. Place the wrench on the tool kit away from actuator.
- Support the cylinder with proper lifting devices (Refer to page [12-15](#)) for removing the cylinder assembly from frame. Now, unscrew the four hexagonal head bolts (item 170) which holds the cylinder to the frame (item 10).
- Remove the cylinder assembly out of the frame with the lifting devices.
- Place the cylinder sub assembly on table away from the frame.



**d. Cylinder sub assembly:**

(See the Exploded view below)



ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
10	CYLINDER LINER	80	GUIDE SLIDER	310	O-RING
20	PISTON	90	TIE ROD	380	O-RING
30	ROD	170	SOCKET HEAD SCREW		
40	HEAD FLANGE	200	HEX NUT		
50	END FLANGE	210	WASHER		
60	SEAL (PISTON)	230	PLUG		
70	SEAL (ROD)	240	DU BEARING		

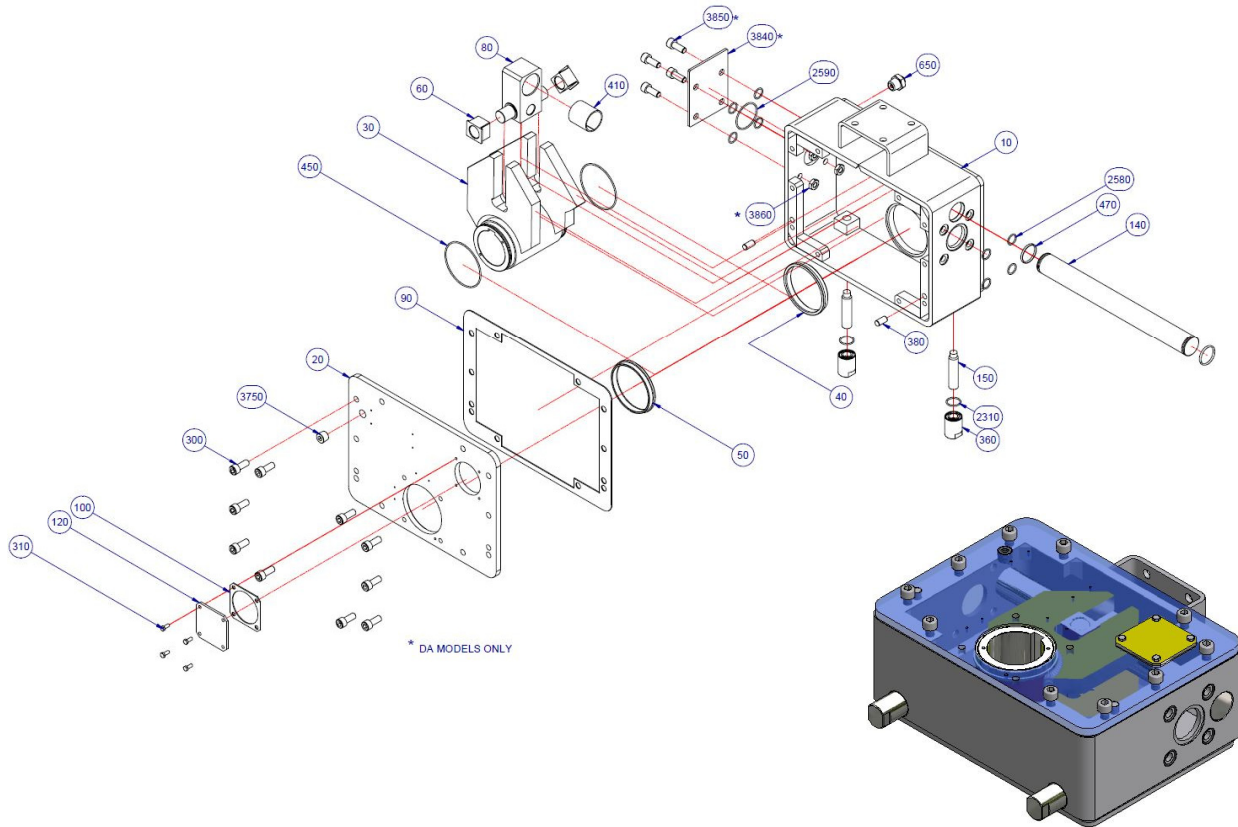
1. Place cylinder on a suitable work bench in a vertical orientation by resting head flange (item 40) at the bottom to disassemble the cylinder assembly,.
2. Remove the end flange fasteners (item 200,210) from the end flange (item 50) and place the parts on table away from cylinder assembly.



**Note:** *If Hammering is desired on to the machined parts, use nylon hammer.*

3. Remove the end flange (item 50) from liner (item 10) by using the nylon hammer to tap uniformly around the end flange. Place the end flange on table away from cylinder assembly.
4. If desired, remove the O-ring (item 310) from end flange.
5. Gradually remove the cylinder liner (item 10) from head flange (item 40) and place it carefully without damaging the inside surface, away from the work bench.
6. Remove the piston (item 20) and rod ( item 30) subassembly from head flange and place the parts on table away from work bench.
7. Place the piston resting on its bottom on a suitable work bench for removing the piston (item 20) from rod (item 30).
8. Hold the piston for unthreading it from rod. Holds the hexagonal slot end of the rod and unthread it from piston.
9. Remove the piston from rod and carefully place the parts on table away from the work bench without damaging the surfaces of the piston.
10. If desired, remove the seal (item 60) and the guide slider (item 80) from piston.
11. If desired, remove the O-ring (item 380) from rod.
12. Remove the tie-rods (item 90) one by one from the head flange (item 40) by unthreading it.
13. If desired, remove the external O-ring (item 310) and internal seal (item 70) from head flange.

e. Frame sub assembly: (See the Exploded view below)



ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY.
10	FRAME	1	360	NUT	2
20	COVER	1	380	PIN	2
30	SCOTCH YOKE	1	410	DU BEARING	1
40	BUSHING	1	450	O-RING	2
50	BUSHING	1	470	O-RING	2
60	SLIDING BLOCK	2	650	RELIEF VALVE	1
80	GUIDE BLOCK	1	2310	O-RING	2
90	GASKET	1	2580	O-RING	8
100	GASKET	1	2590	O-RING	1
120	FLANGE	1	3750	PLUG	1
140	GUIDE BAR	1	3840	FLANGE	1
150	TRAVEL STOP	2	3850	SOCKET HEAD CAP SCREW	4
300	SOCKET HEAD CAP SCREW	10	3860	HEX NUT	4
310	HEX HEAD CAP SCREW	4			

**Disassembly of Frame:**

1. In order to remove the closing flange (item 3840) from the frame which is at the opposite side of the hydraulic cylinder, unscrew and remove the closing flange fasteners (item 3850 & 3860).

2. Now remove the seals (item 2580 & item 2590) which were present in between the closing flange and the frame.
3. Remove the guide bar (item 140) completely out of the frame by hammering in to the other side (Use Nylon hammer).
4. If desired, remove the seal (item 470) from guide bar.
5. Remove scotch yoke (item 30) from the frame along with the guide block assembly (item 80) and place it on table away from the frame.
6. Remove the guide block assembly from scotch yoke and individually remove the bronze sliding block (item 60) and place on table away from the frame.
7. If desired, remove the position indicator drive bar ( Ref page 41 ) from scotch yoke
8. If desired, remove the seal (item 450) from scotch yoke.
9. Finally remove the travel stops (item 150) after removing the cap nut (item 360) and place on table away from the frame.
10. If desired, remove the seal (item 2310) from cap nut.
11. Disassembly of the actuator is now completed.

## **B. Reassembly:**

- a. **Frame sub assembly** (Refer to page [41](#) for frame exploded view)

**Note :** *With the actuator fully disassembled into its component parts, each part should be thoroughly cleaned and inspected. Any parts damaged or worn out should be replaced. It is recommended as a minimum to replace all sealing components, and to replace the internal components if any damage or erosion is present.*

**Note:** *Ensure that all parts and all necessary tools are available and are clean. Ensure the cleanliness of the work bench.*

**Note:** *During seal assembling, remove dust from the groove and apply grease.*

- Place the actuator frame (item 10) on a suitable work bench in horizontal orientation resting on its base.
- Locate two sliding blocks (item 60) and install it into the guide block (item 80) and mount the guide block assembly into the scotch yoke.
- Locate scotch yoke seals (item 450). Place the seal in its grooves on the outside of scotch yoke (item 30).
- Locate the position indicator drive bar and its roll pins. Install it on to the scotch yoke in appropriate position.
- Lift the scotch yoke assembly and align over the bore of actuator frame.
- Slowly lower scotch yoke assembly into the bore of the actuator frame ensuring that the scotch yoke assembly completely engages within the bushing (item 40) placed in the actuator frame.
- Locate guide bar (item 140).

- Locate two guide bar seals (item 470) and place it in the grooves of guide bar.
- Lightly grease the outside diameter of the guide bar. Install the guide bar into the appropriate opening on the side of the frame where hydraulic cylinder is meant to be assembled.
- Position the guide block assembly bore in a way such that it is aligned with guide bar.
- Use nylon hammer to push the guide bar gradually until it seats on the other side of the frame. Ensure that the guide bar enters through the guide block assembly before reaching the other end of the frame.
- Ensure the smooth rotation of scotch yoke and linear movement of guide block assembly before proceeding to further assembly.
- Locate the travel stops (item 150), cap nuts (item 360) and its seals (item 2310).
- Lightly grease the threads on the frame where travel stop assembly is going to be assembled.
- Install the two travel stops in position of actuator frame and set the stroke required by the actuator. Rotating the dowel pins clockwise reduces the angular stroke and rotating them counter-clockwise increases the angular stroke.
- Install the cap nut seal in its grooves and apply grease film (Suggested grease: Parker super-o-lube or equivalent).
- Clean the surface in contact with the frame and install both the cap nuts into the corresponding dowel pins applying 45-50 Nm torque.

**Note :** *Frame shall not be closed with frame cover at this stage, Once the cylinder sub assembly & spring container (If available) is assembled, the frame shall be closed.*

**b. Cylinder sub assembly into frame** (Refer to pages [33-34](#) for sectional assembly drawings)

**Note:** *Ensure that all parts and all necessary tools are available and are clean. Ensure the cleanliness of the work bench.*

**Note:** *During seal assembling, remove dust from the groove and brush with grease.*

1. Place the cylinder head flange (item 40) on a suitable work bench in horizontal orientation. Make sure that seal groove side face is visible.
2. Locate the head flange external O-ring (item 310) and internal seal (item 70) and carefully place it in its grooves.
3. Locate the piston rod seal (item 380). Install the seal in its grooves.
4. Locate piston (item 20). Install the piston seal (item 60) and guide slider (item 80) to the piston and gradually install the piston assembly into the piston rod (item 30).

**Note:** While threading the rod 0in the piston apply Loctite 243 for thread fixing.

5. Install the piston and rod assembly in a vertical position in such a way that the rod projects out of the head flange. Care should be taken not to damage the cylinder liner (item 10) as well as the piston seals. (If cylinder must be mounted on double acting actuator go to point “4 in c” on page 51 to assemble rod into the guide block of the frame).
6. Locate the liner (item 10). Slide the liner over the piston seal (item 60 & item 80) and the head flange O-ring (item 310) without damaging the seals.
7. Locate the tie rods (item 90) and mount them by threading it into head flange.
8. Locate the end flange O-ring (item 310) and install the O-ring in the end flange groove.
9. Locate the end flange (item 50) and slowly lower it into the cylinder liner and in the tie rods. Ensure the supply ports are properly oriented with the supply ports on the head flange.
10. Locate the tie rod nuts, Install and tighten to secure the end flange.

**c. Assembling Cylinder sub assembly in to the Frame sub assembly:**

(For points 1-5, refer to pages [39](#) & [41](#) for Exploded view)

1. Place the actuator frame assembly in a vertical position to admit the cylinder assembly into the frame bore.
2. Locate the frame side seals (item 2580) and place them into frame grooves.
3. Gradually lower the cylinder assembly into the bushing of the frame bore.
4. Thread the rod into the guide block by using a wrench.

**Note:** While threading the rod into the guide block apply Loctite 243 for thread fixing.

**Note:** While using the wrench, care should be taken that the surface of the Piston Rod is not damaged.

5. Locate the hexagonal socket head screws (item 170).
6. Secure the cylinder assembly in position by means of fasteners (item 170).

**Note:** If it is a Spring return Actuator proceed directly to point d.” Assembling Spring container assembly in to the Frame assembly”.

(For below points, refer to pages [33](#) for Sectional view & [41](#) for frame Exploded view)

7. Place the actuator assembly on a suitable work bench in a horizontal orientation with the actuator frame resting on its base.
8. Locate the closing flange (item 3840), fasteners (item 3850 & 3860) and seals of closing flange.

9. Install seals and then mount the closing flange in the frame in such a way that it serves as a blowout proof for the guide bar (item 140) thereby closing the guide bar slot in the frame.
10. Carefully apply the tightening torque to the closing flange fasteners (item 3850 & 3860) so that the seals are not damaged.
11. Locate the frame gasket (item 90) and frame cover (item 20) assembly and slowly lower and place in position by means of pins (item 380) and fasteners (item 300).
12. Locate the position indicator assembly and install it in position of frame cover in the same axis as that of the scotch yoke.
13. Ensure that the position indicator shaft is correctly located into the position indicator drive bar.
14. Reassembly of the double acting actuator is now complete.

**d. Assembling Spring container assembly in to the Frame assembly:**

(For points 1-5, refer page [36](#) & [41](#) for Exploded view)

1. Lift and turn the actuator in a vertical orientation, Place it on the hydraulic cylinder flange on a wooden or rubber support.
2. Place the pusher rod (item 90) on to guide through frame side bore and assembly into guide block in a vertical position.
3. Locate the frame side seals and place them into frame grooves.
4. Gradually lower the spring container assembly guiding the pusher rod into the bushing of the spring container bore.
5. Locate the hexagonal socket head screws (item 80)
6. Secure the spring container assembly in position by means of fasteners (item 80).

(For below points, refer to pages [33-34](#) for Sectional view & [41](#) for frame Exploded view)

7. Place the actuator assembly on a suitable work bench in a horizontal orientation with the actuator frame resting on its base.
8. Locate the frame gasket (item 90) and frame cover (item 20) assembly and slowly lower and place in position by means of pins (item 380) and fasteners (item 300).
9. Locate the position indicator assembly and install it in position of frame cover in the same axis as that of the scotch yoke.
10. Ensure that the position indicator shaft is correctly located into the position indicator drive bar.
11. Reassembly of the spring return actuator is now complete.

**C. Adjustment after assembly:**

Check the following when assembly is completed. If satisfactory result is not obtained, disassemble the actuator again, find the cause, and assemble it back together.

1. Check valve opening and closing positions

2. Performance Check and Adjustment

- Check that the actuator operates smoothly when specified oil pressure is applied to it.
- Check for leakages through the cylinder and frame seals.

## IX. SPARE PARTS

### 1. Frame sub Assembly

(Refer to frame assembly exploded view on page [41](#)) :

- Item 90, qty. 1
- Item 100, qty. 1
- Item 450, qty. 2
- Item 470, qty. 2
- Item 2310, qty. 2
- Item 2580, qty. 8
- Item 2590, qty. 2

### 2. Cylinder sub Assembly

(Refer to hydraulic cylinder assembly exploded view on page [39](#)) :

- Item 60, qty. 1
- Item 70, qty. 1
- Item 80 , qty. 1
- Item 310, qty. 2
- Item 380, qty. 1

### 3. Spring container Assembly

(Refer to spring container assembly exploded view on page [36-37](#)) :

- No spares required.