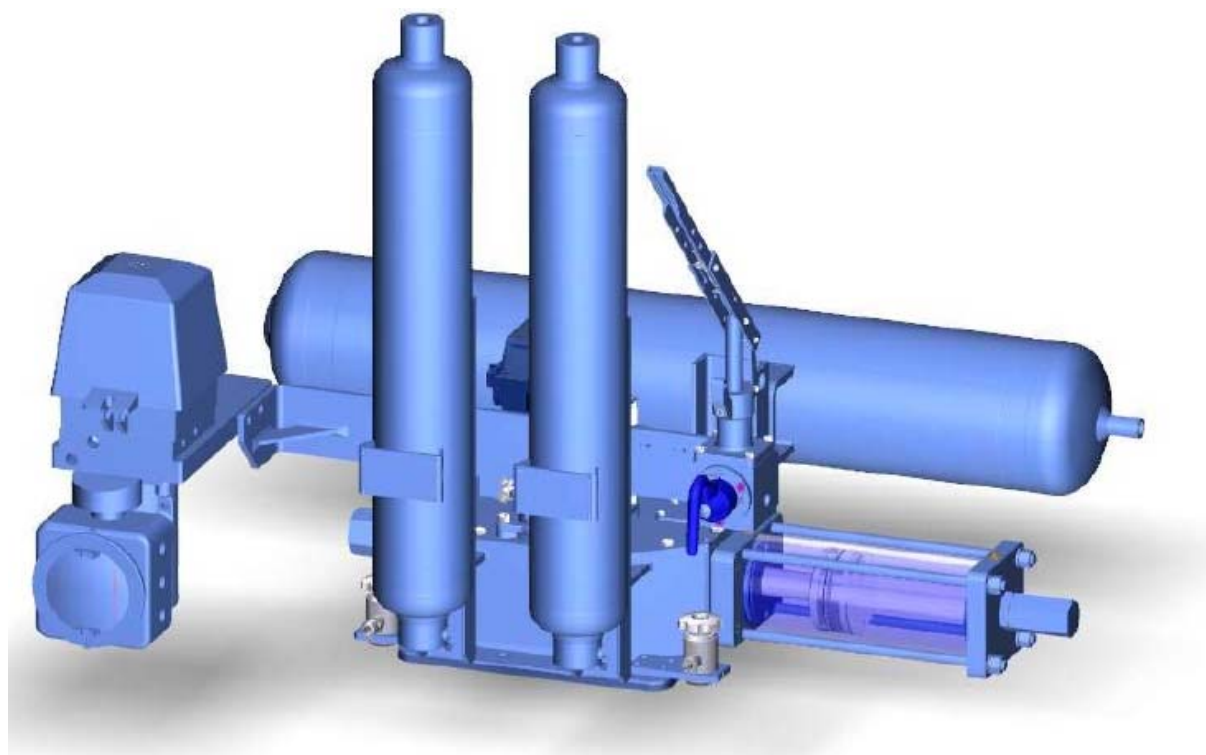


# CAMERON® LEDEEN Quarter Turn Actuator

SY Series – Gas over oil

Installation, Operation and Maintenance Manual



15/9/2018	Initial release	Tartara A.	Cerati S.
DATE	ISSUE	PREPARED BY	APPROVED BY

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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:

# CONTENTS

I.	GENERAL.....	5
A.	Legend for Safety Symbols.....	5
B.	Original Spare Parts.....	6
C.	Operative Staff.....	6
D.	Damages Derived From Use.....	6
E.	Interruptions and suspending.....	6
F.	Modification of The Actuator.....	6
G.	Actuator Disposal.....	6
H.	Safety of the Power Supply Connection (If Applicable).....	7
I.	Safety Recommendations.....	7
J.	Electrostatic Discharges Prevention.....	7
K.	Actuator Marking (According to 2014/34/EU Directive).....	8
L.	Actuator Name plate description.....	9
II.	RECEIVING,STORAGE AND HANDLING.....	10
A.	Preliminary Verification Upon Receipt of Material.....	10
B.	Storage and Preservation.....	10
C.	Handling.....	12
III.	OPERATION.....	17
IV.	COMMISSIONING.....	17
A.	Mounting to Valve (With Adaptor Piece).....	17
B.	Adjustment.....	19
C.	Actuator Start up.....	22
V.	MAINTENANCE.....	31
A.	Routine Maintenance.....	31
B.	Extraordinary Maintenance.....	31
C.	Instruction for replacement of Dynamic seals.....	32
VI.	GREASE AND HYDRAULIC OIL SPECIFICATIONS.....	38
VII.	TROUBLE SHOOTING & REMEDIES.....	39
VIII.	DISASSEMBLY AND REASSEMBLY.....	41
A.	Disassembly:.....	51
B.	Reassembly:.....	56
C.	Adjustment after assembly:.....	59
IX.	SPARE PARTS.....	60

## 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.
- This manual shall be read in conjunction with applicable technical documentation shipped with actuator

### A. Legend for Safety Symbols

Explanation of Warning Symbols (Where Applicable)



In case the actuators are installed in a closed ambient, it shall be required the same to be adequately ventilated, to prevent from high level gas concentration that creates a potentially dangerous atmosphere.



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.

## 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.

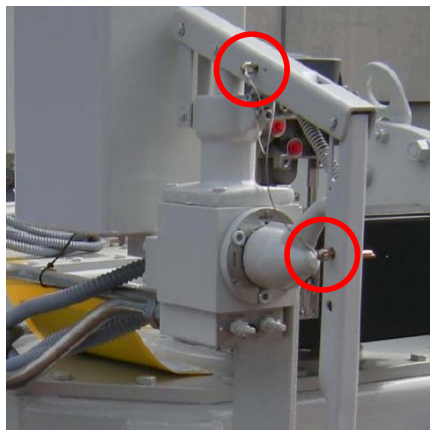
## J. Electrostatic Discharges Prevention

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. Hand Pump Safety (If Applicable)


When the operations on the hand pump are completed, please lock the lever with both security pins or padlocks.






## L. 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


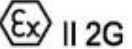

### M. Actuator Name plate description

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 gas/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	CONTROL SIGNAL FAILURE <input type="text"/>
YEAR <input type="text"/>	TCF N. <input type="text"/>
<div style="display: flex; justify-content: space-between; align-items: center;"> <div>           WARNING: ELECTROSTATIC CHARGES            CLEAN WITH DAMP CLOTHS ONLY            OR WITH ANTISTATIC PRODUCTS         </div> <div style="text-align: center;">   </div> <div>  </div> <div> <b>Ledeen</b> Via Gandini 4            27058-Voghera(PV)-Italy         </div> </div>	

## 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 with gas over oil tanks in vertical position and preferably in a warehouse adequately protected against harmful environment.

The recommended ambient temperature is : Minimum - 20°C / Maximum 70°C  
Relative Humidity : Maximum < 75%

#### 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.

- Check that the junction boxes internal parts are perfectly dry and eventually insert a bag with anti-condensation salt, then close accurately.
- Check that the internal electric components (where present) are perfectly dry, when it is not possible to keep the actuator energized, insert a bag with anti-condensation salt, then close accurately.
- 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.

#### Storage recommendations

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

- Restore the paintwork of the components which have been damaged during transport.
- Keep the actuator with gas over oil tanks in vertical position and lift from the ground.
- Check that the internal parts of the junction boxes or of the control cabinets are perfectly dry, insert a bag with anti-condensate salt (Silica Gel indicating type – blue active – for an approximate quantity of  $2\text{ kg/m}^3$ ), then accurately close and seal their enclosures.
- Individual parts, panels, etc. shall be enveloped with polyethylene sheets and sealed or shrink-wrapped. Gauge glasses shall be adequately protected.
- The spare parts, provided that they are maintained in their original packaging, do not require any particular storage recommendation.
- All threaded openings shall be closed with threaded steel plugs, with distinctive colour.
- For electric connections, plastic plugs can be utilized.
- If the actuator is shipped with primer only (i.e. CARBOGUARD 885) the maximum recoating time specified by painting data sheet shall be observed

**Note:** *The hydraulic system of the gas over oil actuators is closed-circuit type and it is filled in with clean oil in the factory. Therefore, if the actuator is kept in its integrity and if all the plugs are not removed, the cleanliness of the oil is maintained without necessity of periodic verifications and/or flushing operations.*

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

### C. Handling

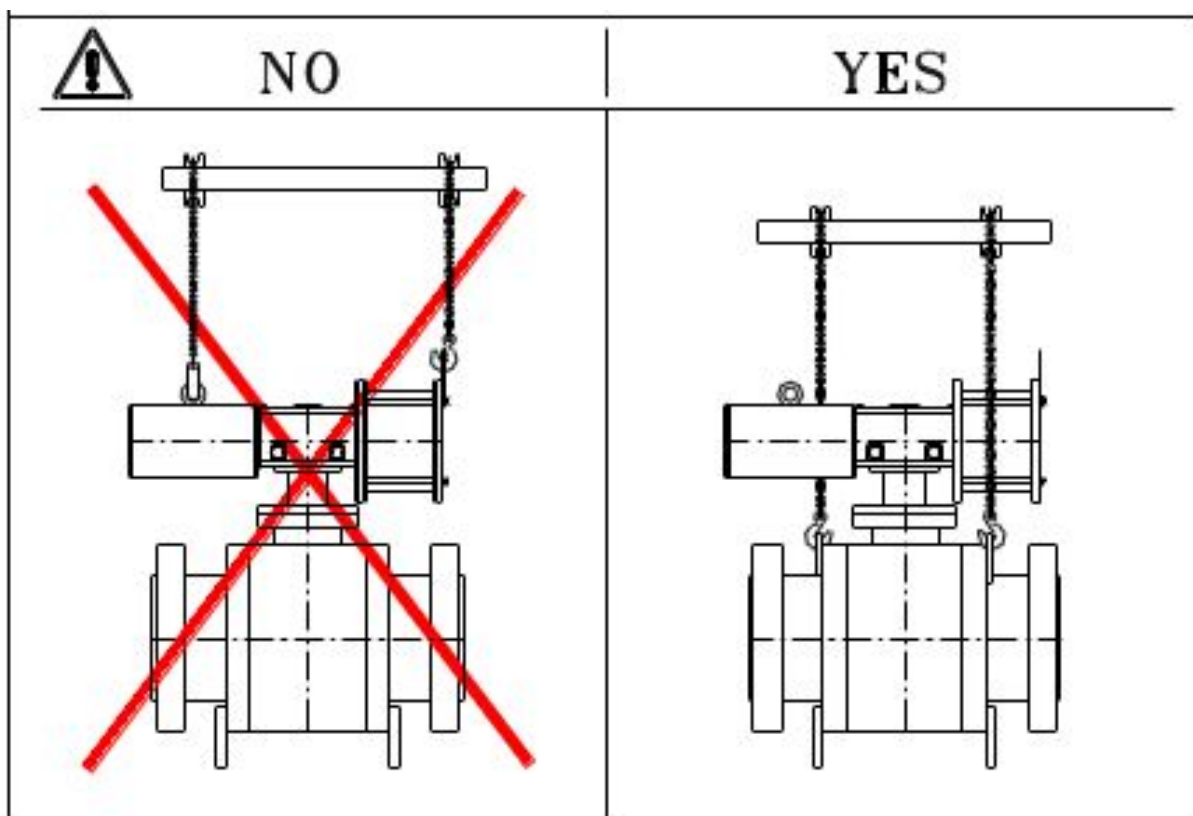
#### Proper Lifting, Weights and Dimensions, Fastener Torque Chart

*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:**

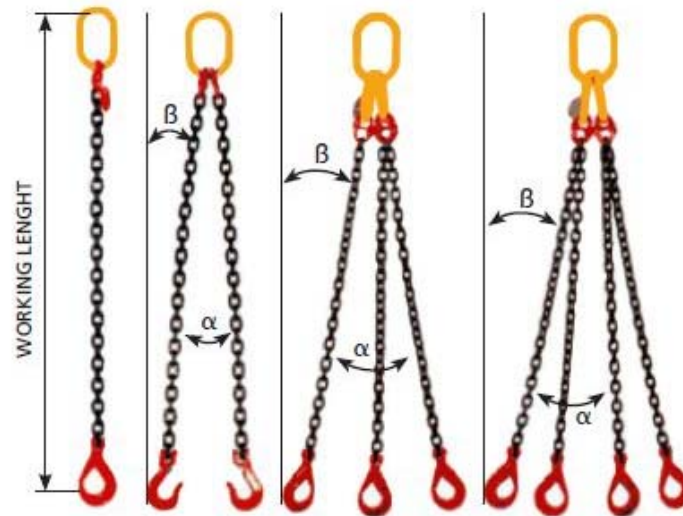


The lifting equipment consists on commercial chains and slings of adequate dimensions, according to the weight of the actuator.

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 52	3,00	5338	6989	
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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>CAMERON</b> 
DATE	17:02:09					
BY	S.C.					
CHK.	F.I.					
APP.	C.L.					
						<b>TIE RODS TIGHTENING TORQUES</b>  <b>STC1325</b>

### III. OPERATION

The gas-over-oil actuator is fed by pressurized gas which, after being filtered, flows through the control valves into the tank relevant to the operation (opening or closing) to be performed. The hydraulic oil contained in the tank is pressurized by the gas and flows into the relevant cylinder chamber, while the oil contained in the other chamber flows into the second tank. The cylinder piston stroke causes the actuator operation.

The oil flow from the cylinder into the tanks is adjusted by means of two flow control valves. In this way it is possible to adjust the stroking time of the actuator. Emergency manual override can be performed by selecting the opening and closing operation by means of the hand actuated directional control valve and then actuating the hand pump.

### IV. COMMISSIONING

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

The actuator can be assembled on top of the valve flange either by using the actuator-housing flange with threaded holes, or by the interposition of a proper mounting hardware.

**Warning:**



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

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

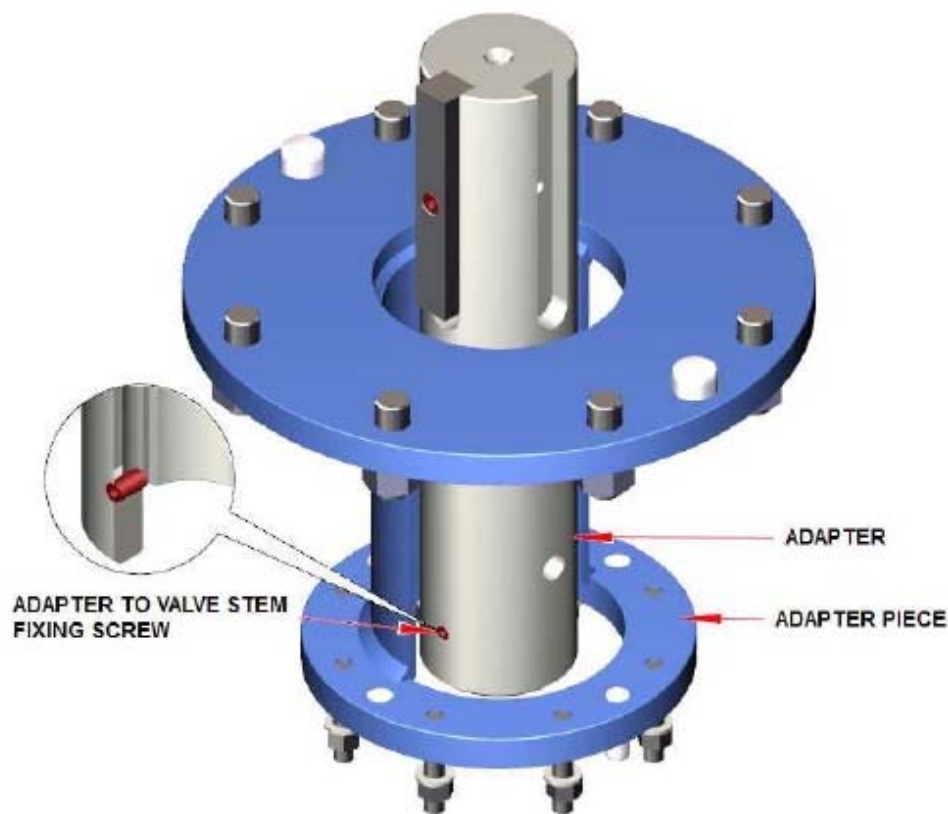
The actuator along with the adapter assembly is shipped to mount on the valve. In case it is necessary to assemble the actuator onto the valve, proceed as follows:

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).

- 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:** Ensure that the adapter is fixed to the valve stem by means of the screw provided along with the adapter.  
(Refer the below picture)



**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:

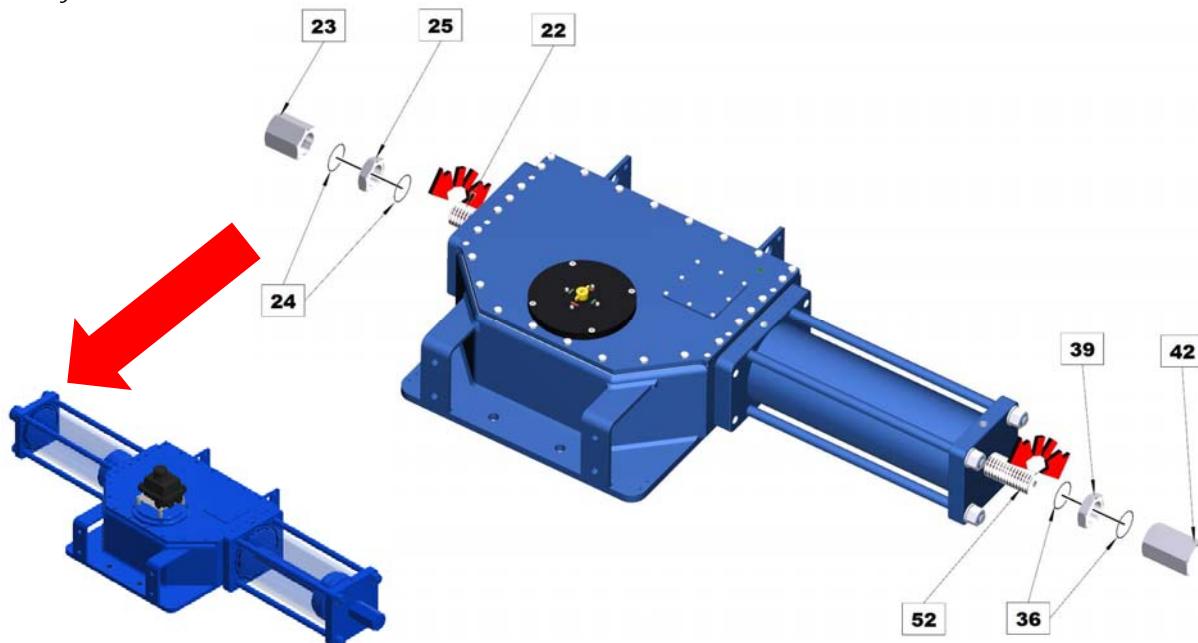
### a) Adjustment of mechanical stops

After having removed relevant cap nut (item 23 & item 42) and loosening locking nut (item 25 & item 39) rotate the mechanical stops (item 22 for opening side & item 52 for closing side) clockwise or counter-clockwise for adjusting the angular stroke.

By rotating the mechanical stops (item 22 for opening side & item 52 for closing side) clockwise, the angular stroke is reduced. Rotating counter-clockwise, the angular stroke is increased.

Check and reassemble seals 24 & 36 before tightening the locking nuts and reinstall the cap nuts; without item 36 the actuator cannot be pressurized.

**Note:** in case of double cylinder actuator, items 22, 23, 24 and 25 will be assembled at the end of hydraulic cylinder.



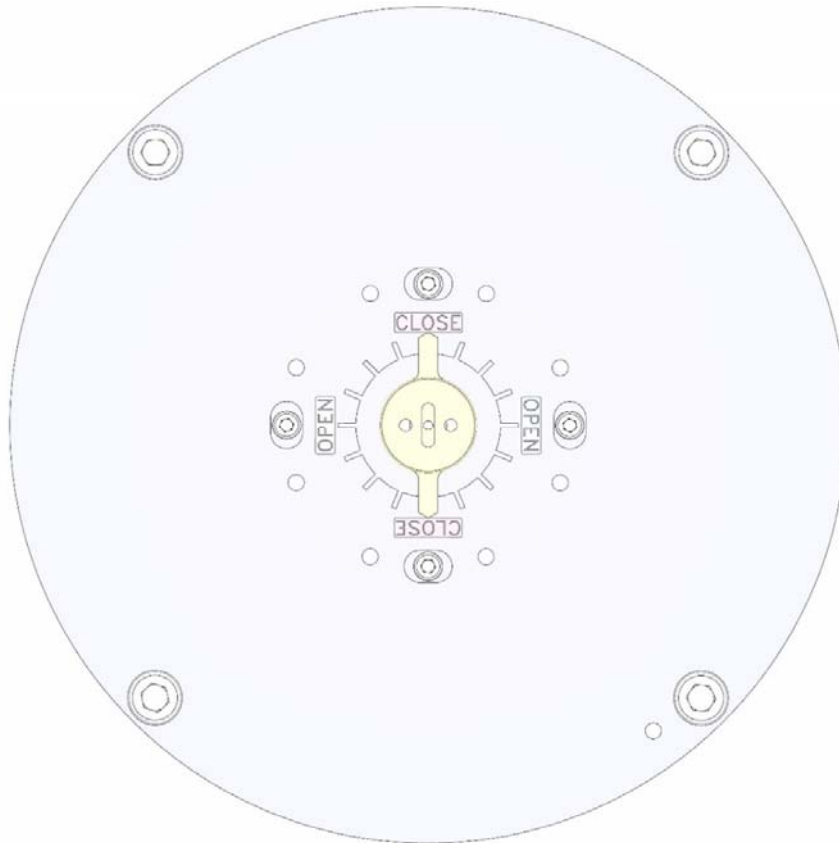
Double acting actuator

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.*

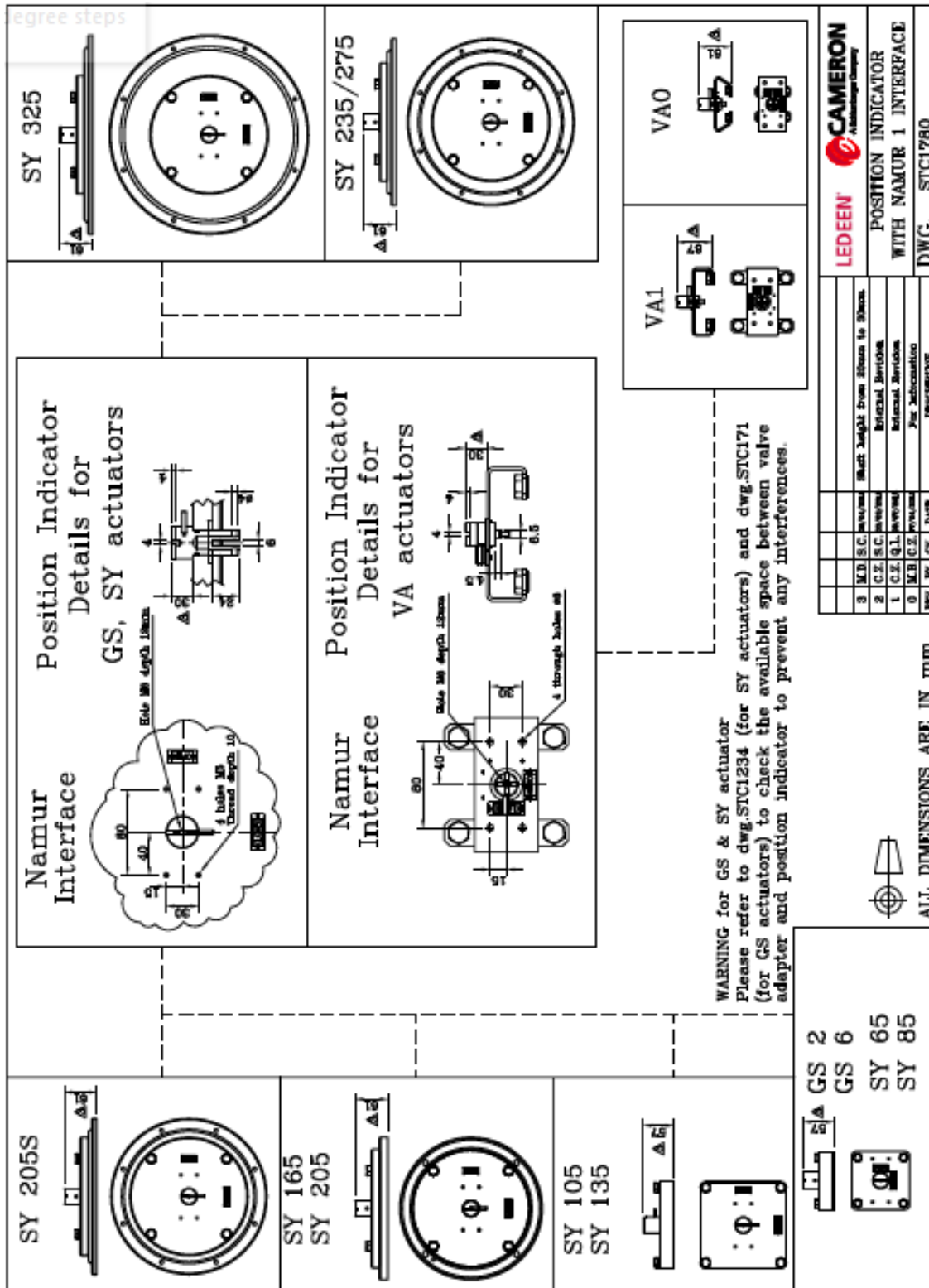


**Position indicator alignment**

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.

For frame equipped with Namur interface, refer to STC1780 for dimensional drawing.





## 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. Protect the cables by means of a flexible tubing, explosion proof type (if applicable).
- Check that the pressure of the process supply, as well as its quality (filtering degree, dehydration) are as prescribed.

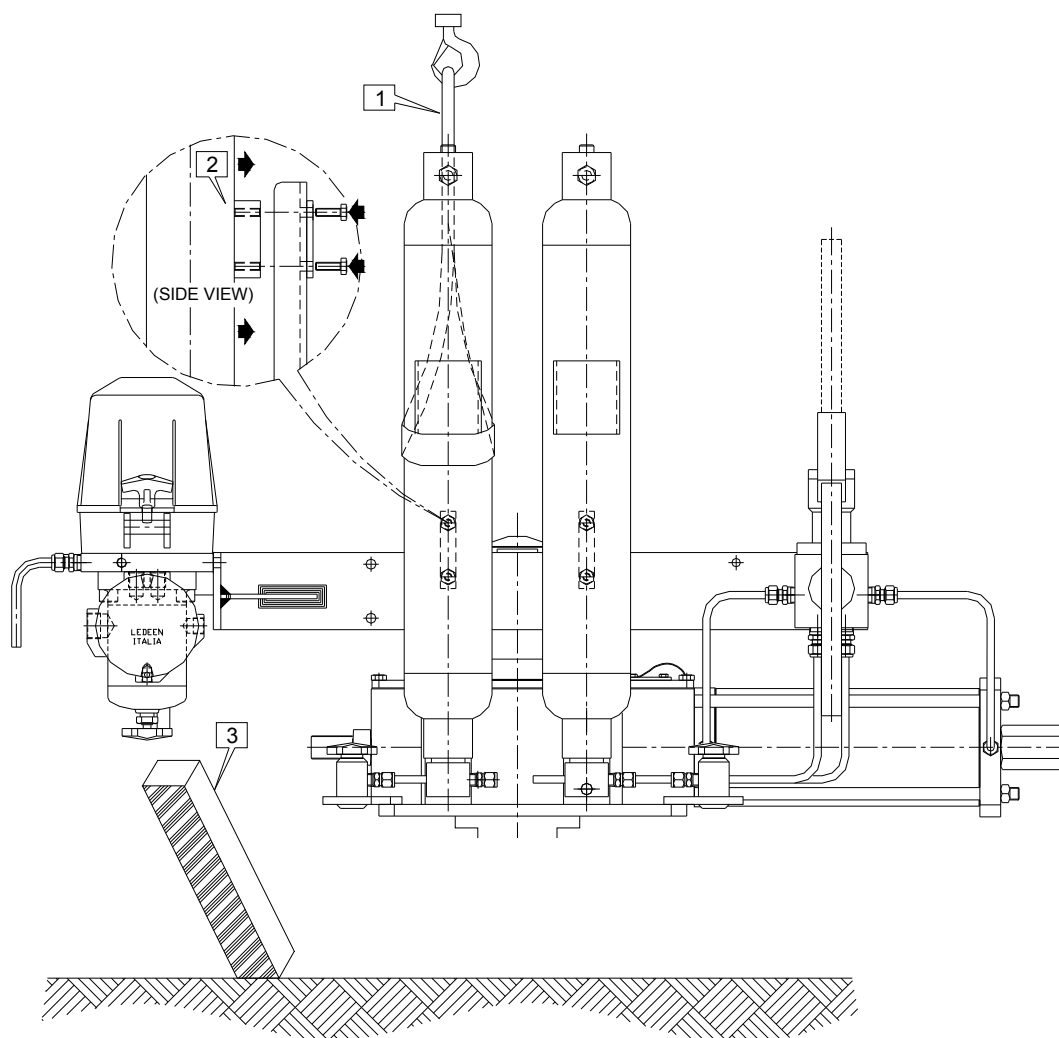
- c) Check that the feed voltage values of the electric components (solenoid valves coils, micro switches, pressure switches etc., if applicable) are as prescribed.
- d) Check that the actuator controls, such as remote control, local control, emergency control etc. (if applicable), are properly working 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) Check the oil level in the tanks by means of the measuring rod and if necessary, add a little oil. (approved for the application) ( see point "c & d " Restoring the Gas-Oil Tank & Flushing procedure ).
- i) Bleed the air from the cylinder, if necessary, by removing the plug mounted on the flange.
- j) Check the correct working of the actuator with the hydraulic supply in open and closed direction.
- k) Check the correct working of the actuator by means of the manual override hand pump (if applicable).
- l) Check the correct hydraulic piping seal.
- m) Restore the paintwork of the components which may have been damaged during transportation or commissioning after having removed the rust.

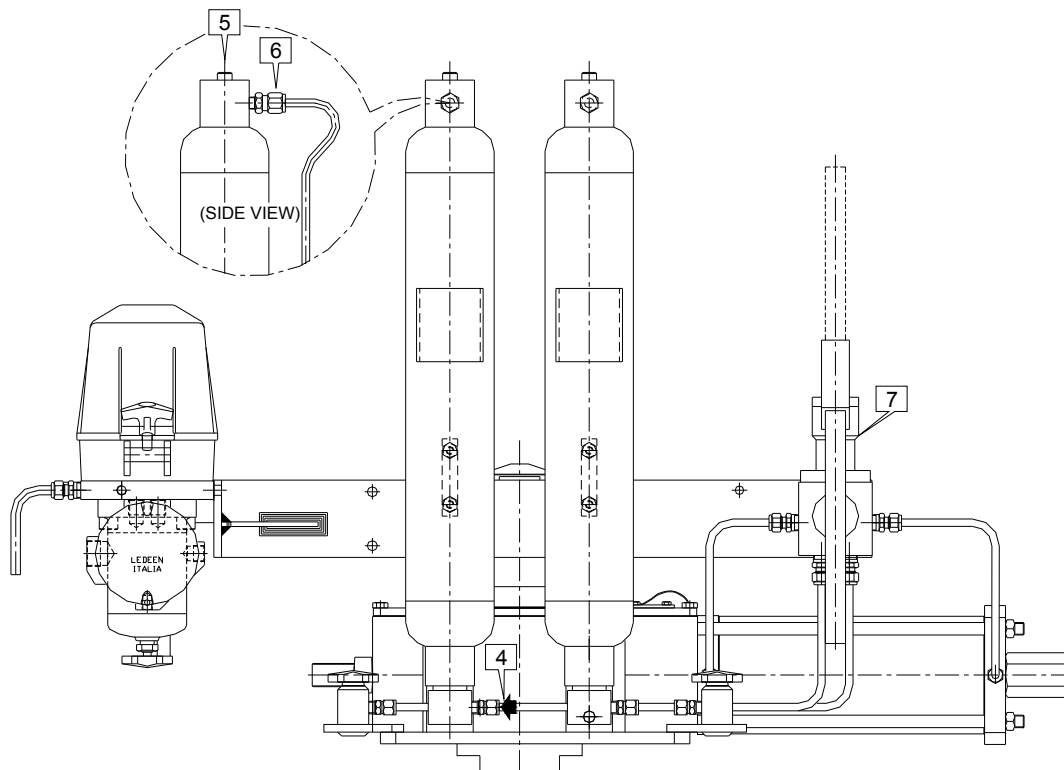
**c. Restoring the Gas-Oil Tank**

- 1. Reposition the repaired gas-oil tank close to the relevant fixing holes on the bracket.
- 2. Insert and tight the two screws to fix again the gas-oil tank to the bracket.
- 3. Remove the support from the bracket/control group.
- 4. Restore the oil tube and lock the relevant fitting on the base of gas-oil tank.
- 5. Remove the cap in the upper of the gas-oil tank and fill the same with the oil (approved for the application) previously removed, then assemble the cap.
- 6. Restore the pneumatic tube on the gas-oil tank and lock it by means of the relevant
- 7. fitting.
- 8. Start the flushing operations following the instructions of the procedure. (Point "d")

Restore the electric and pneumatic supply then verify the correct actuator operation in both opening and closing direction by means of the control group and by means of the hand pump.







#### d. Flushing procedure for Gas Over Oil Actuators

**Important:** Every operation on the actuator must be carried out only after having closed the pressure taps, to prevent undesired operation and enable the operating personnel to work in safe conditions

##### Flushing procedure

With the hand pump manual distributor in "Remote" position, carry out some (3 or 4) complete actuator opening and closing manoeuvres, having care to wait five (5) minutes between each control group air exhausting, to avoid oil/air emulsion in the hydraulic circuit.

##### Oil tanks balancing

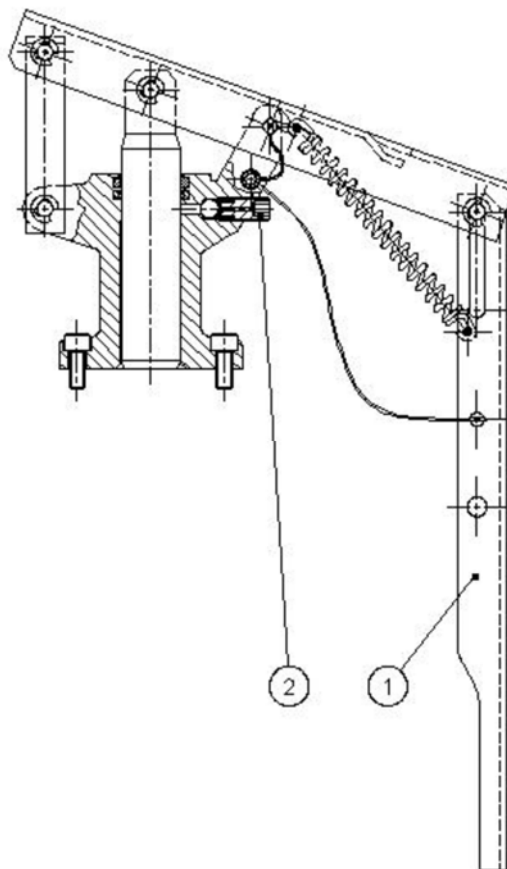
- Check the oil level in the tank by means of the measuring rods. The oil level must correspond to that shown on the plate fixed to the bracket. Excess oil can be drawn off through the drain plugs at the base of the tanks. In case the oil contained in one tank is in excess and the oil in the other one is lower it is possible to reset the right quantity proceeding as follows:
- In order to transfer the oil from a gas-oil tank to the other, keep the actuator in the middle position, then turn the pump distributor valve on the by-pass position so to allow the oil passage from the high

level oil tank to the other. The eventual excess of oil can be removed by unscrewing the plugs at the lower end of the same tank.

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

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

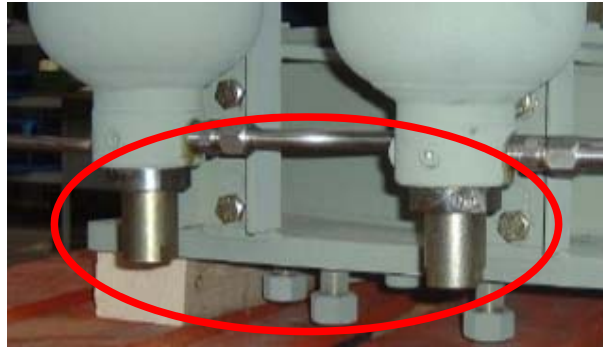
- a) Completely lift the hand pump lever (1);
- b) Loosen the socket head screw (2), in order to exhaust the air from the pump;
- c) Completely lower the hand pump lever (1);
- d) Tighten the socket head screw (2);
- e) Repeat points from a) to d) until the oil drops out from the socket head screw (2).



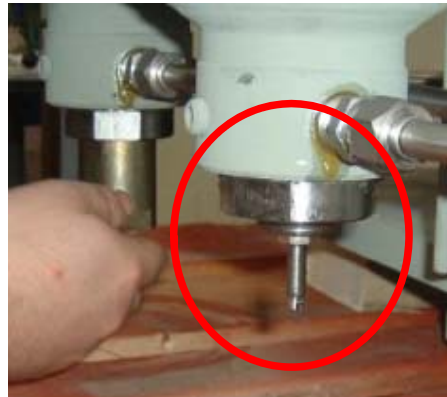
DWG. STC212

### Stroking time adjustment for GAS-OVER-OIL DOUBLE ACTING:

The GAS-OVER-OIL (GOV) actuators are provided with 2 oil reservoirs. At the bottom end there are the two flow regulating valves, used to adjust the stroking time of the actuator.



- To obtain the access to the regulating screw, it is necessary remove the protective caps.
- Loosen the locking nut on the regulating screw



The regulating screws can be adjusted by means of a fixed spanner 5,5mm:

- To increase (slow down the actuator) the stroking time, turn CW the relevant screw
- To decrease (speed up the actuator) the stroking time, turn CCW the relevant screw



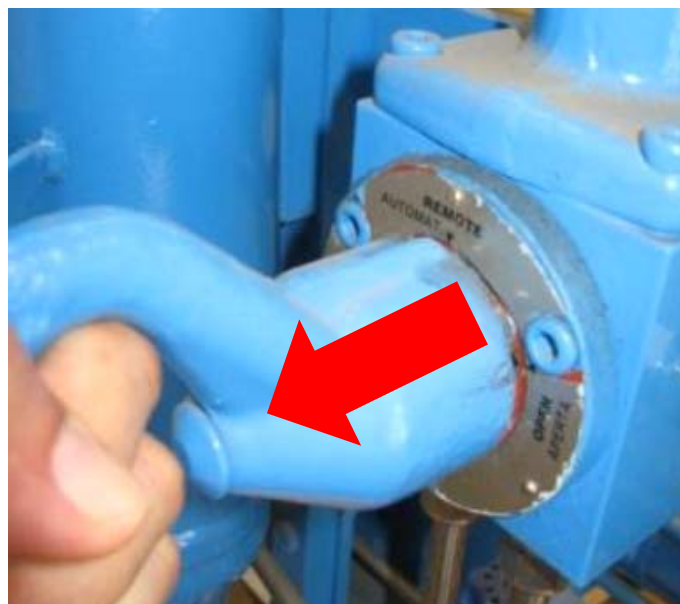
- Once desired stroking time is obtained, tighten locking nut and reinstall protective cap

Use of emergency hand pump for GAS-OVER-OIL DOUBLE ACTING.

1. Unlock the lever by removing the security pins

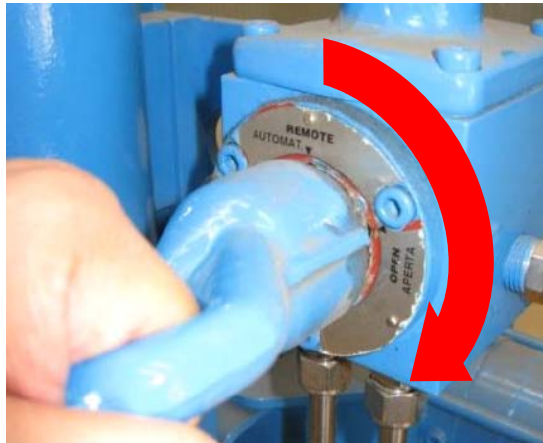


2. Pull out (5-7 mm) the handle to disengage detent



3. To open:

- a. Turn the selector valve handle clockwise in order to align the reference with the indication on the label; detent will engage when "open" position is achieved
- b. Release the handle
- c. Start pumping
- d. Once reached the ending position, secure the lever with one security pin and pull out the handle to release the pressure
- e. Return selector valve handle to the remote position; detent will engage when "remote" position is achieved



4. To close:

- a. Turn the selector valve handle counter clockwise in order to align the reference with the indication on the label; detent will engage when "close" position is achieved
- b. Release the handle
- c. Start pumping
- d. Once reached the ending position, secure the lever with one security pin and pull out the handle to release the pressure
- e. Return selector valve handle to the remote position; detent will engage when "remote" position is achieved



Purge the air any time is necessary (after transportation, commissioning, maintenance, etc.), following the instructions at [page 26](#) of this manual. Lock the plug 2 with max torque of 20 Nm.

When the operations on the hand pump are completed, please lock the lever with both security pins or padlocks.





## 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:

- Remove the accumulated condensation in the dehydrator filter cartridge through the suitable draining plugs (if applicable).
- Check the correct valve position signalling on the control panel.
- Check the oil level in the tank by means of the measuring rods (see also para. 4-2 "oil tanks balancing"). The oil level must correspond to that shown on the plate fixed to the bracket. Excess oil can be drawn off through the drain plugs at the base of the tanks.
- Check the correct working of the actuator with pneumatic 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 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.
- Check the correct working of the manual override (hand-lever or hand-pump) by operating the actuator for a small percentage not to affect the flow in the main line.
- The actuator shall be operated back just after the partial stroke end line is reached.

Every year:

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

Every 3 year:

- Check that the oil is in good condition and that it is always clear.
- 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.

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

### B. Extraordinary Maintenance



**Warning:**



- a) In case of leakage from the hydraulic cylinder, disassemble, clean the seals grooves and substitute the seals if damaged.
- b) If there is a leakage from the hydraulic piping, tighten the fittings, or if necessary, change them if damaged.
- c) In case of malfunction or leakage from the actuator, disassemble referring to the disassembly section (from page no. [41](#)). 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. [41](#)) 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.

The cylinder may contain dangerous gas and/or liquids.

ENSURE THAT OPERATOR EXPOSURE IS PREVENTED AND THE AMBIENT ADEQUATELY VENTILATED, TO PREVENT FROM HIGH LEVEL GAS CONCENTRATION THAT CREATES A POTENTIALLY DANGEROUS ATMOSPHERE.

- Remove the hex nuts (item 40) and washer (item 41) from the tie rods.
- Remove the end flange (item 32) from liner (item 28).
- Gradually remove the liner from head flange (item 31).
- Remove the piston seal (item 35), and the guide slider (item 37) from piston (item 29). Carefully clean the relative 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 (refer to page [16](#) for tightening torque). 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.

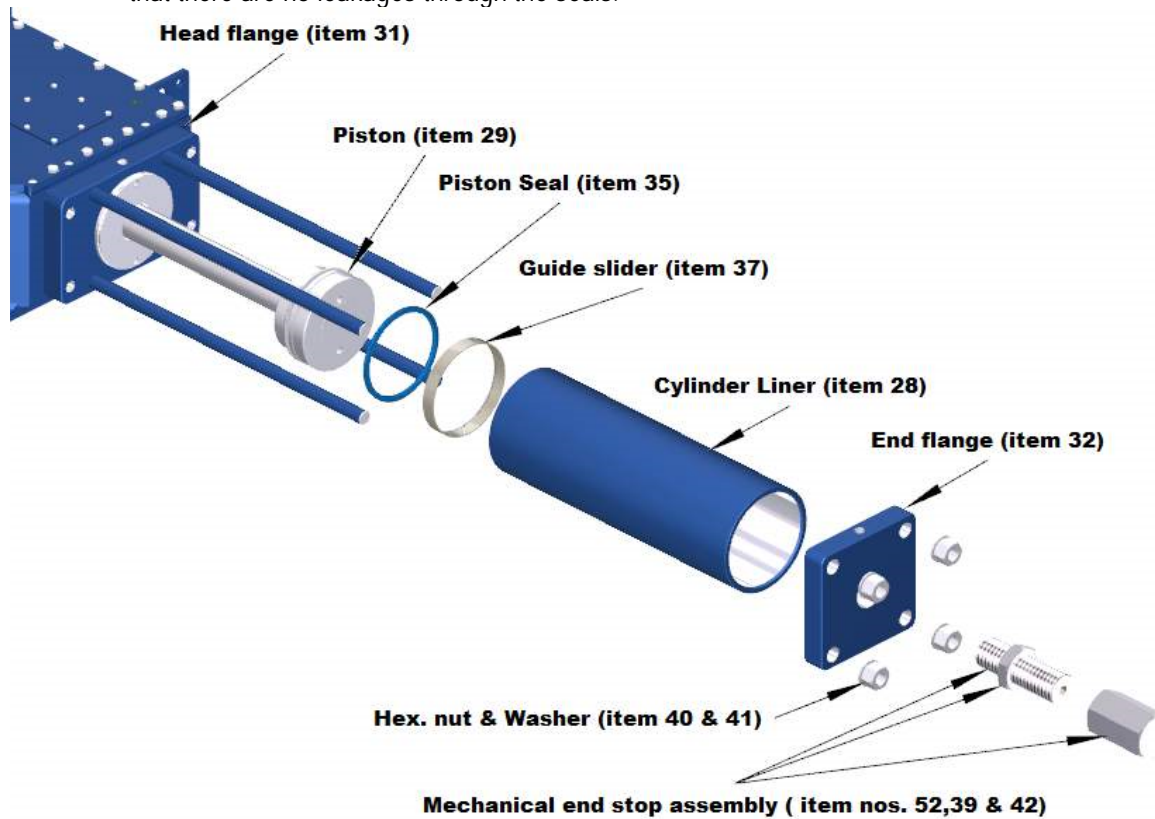


Figure 1

Refer to STC1325 (page [16](#)) for tightening torque

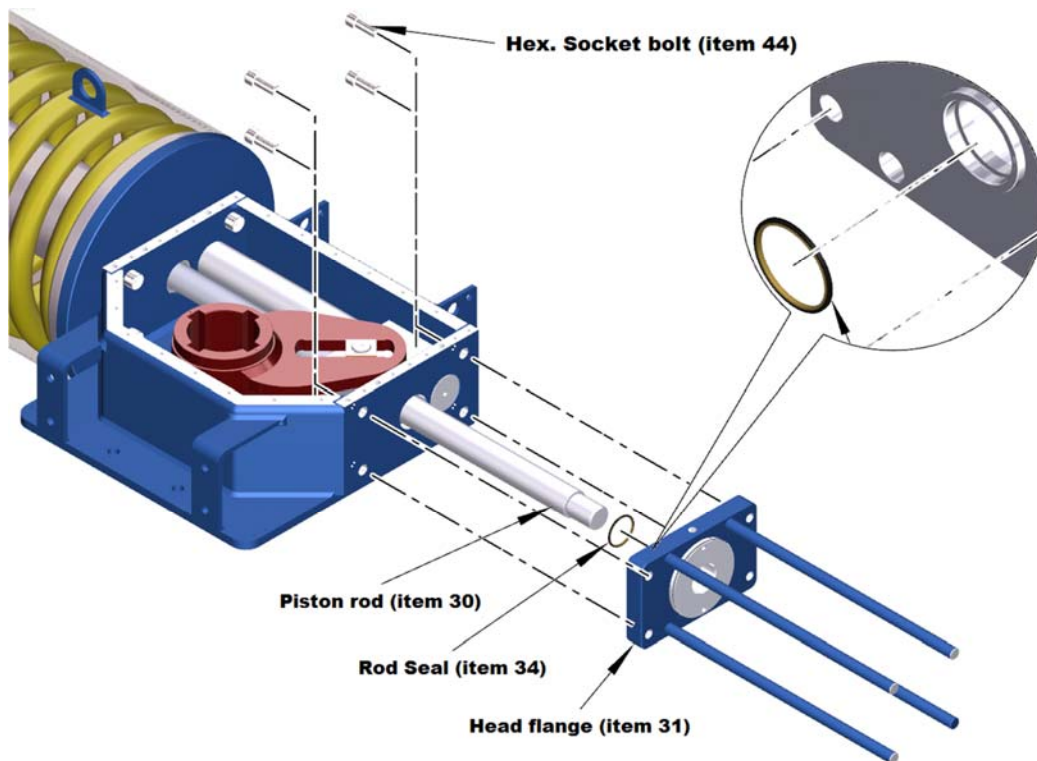


Figure 2

b) Replacement Piston rod seal in head flange: (See Figure 1 & 2)

For replacing piston rod seal in head flange proceed as described below:

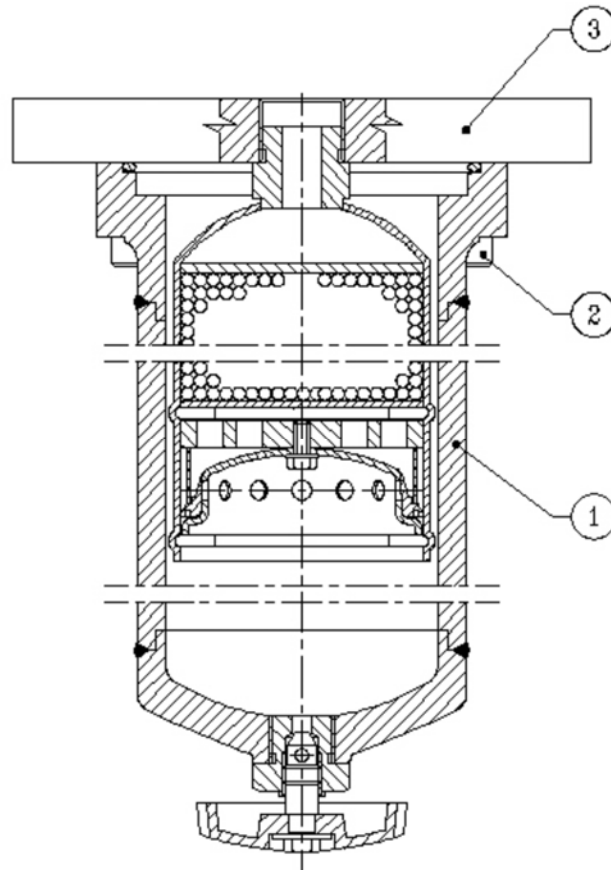
- Remove the hex nuts (item 40) and washer (item 41) from the tie rods.
- Remove the end flange (item 32) from liner (item 28).
- Gradually remove the liner from head flange (item 31).
- Remove the piston (item 29) from piston rod (item 30) by unthreading it.
- Remove the position indicator assembly from the top of the frame by unscrewing the four socket head screws.
- Remove the frame cover with gasket by gasket by unscrewing the bolts.
- Remove the 4 bolts (item 44) which holds the head flange to the frame.
- Pull the head flange (item 31) out of the frame and from the piston rod (item 30).
- Remove the seal (item 34), clean the groove and brush with grease.
- Replace the seal and to reassemble the actuator, follow the procedure in reverse order.

D. How to restore the Dehydrating filter cartridge

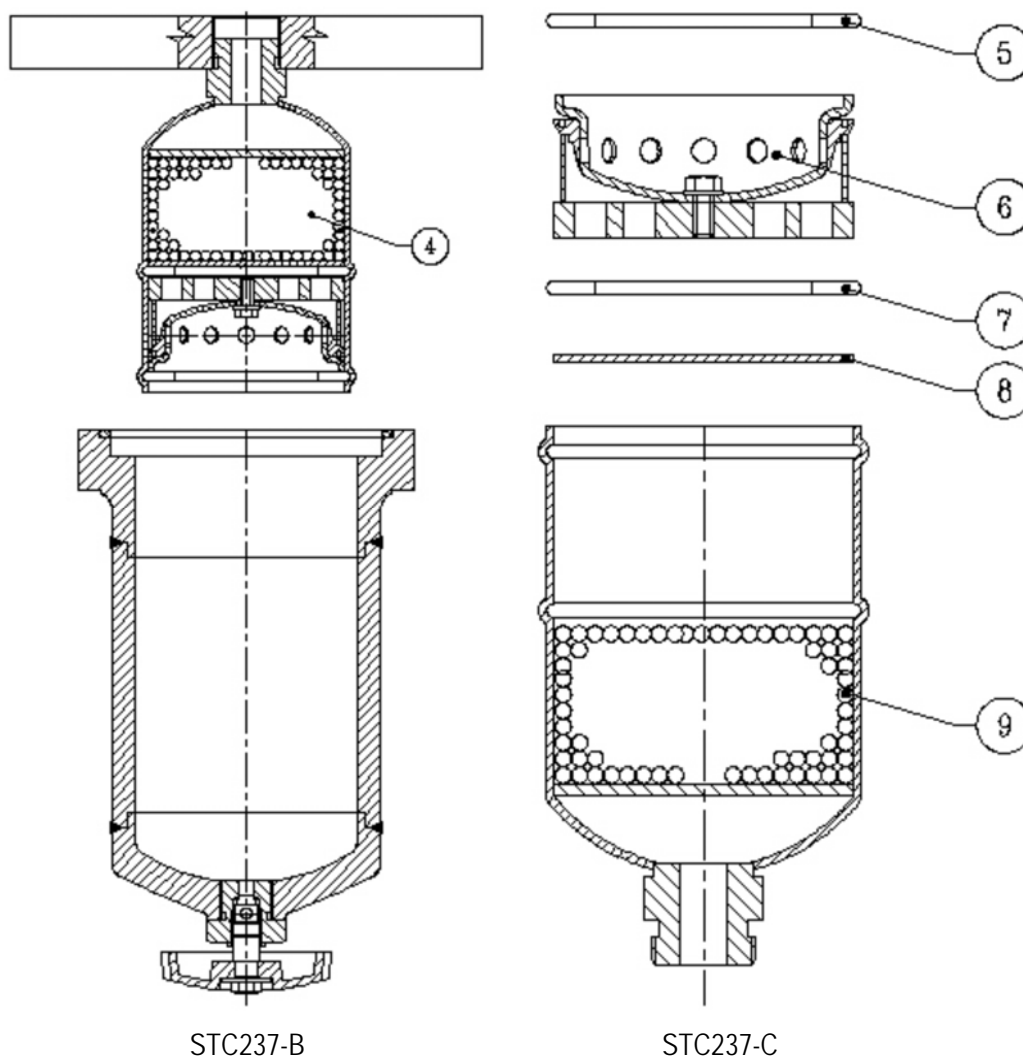


- The utilized molecular sieve has the property to absorb both the hydrogen sulphide and the water.
- When the molecular sieve is saturated, it is necessary to regenerate it.
- For the regeneration proceed as follows (ref. dwg. STC237A/B/C and STC891):
- Close the stop valve related to the involved dehydrating unit.

- Open the vent valve assembled at the bottom of the dehydrating filter cartridge container to be substituted in order to exhaust the gas there contained (pay attention not to breathe the gas).
- Disassemble the container (1) after unscrewed the screws (2) which fasten it to the plate (3).
- Unscrew the cartridge (4) from the dehydrating unit support plate and turn it upside-down.
- Remove the ring (5), the body (6), the ring (7) and the filter (8).
- Remove the molecular sieve (9) and put it into a container full of water for 12 hours so that the molecular sieve absorbs the water and releases the hydrogen sulphide there contained.
- Take off the molecular sieve from the water and put it on the drying unit pierced plate.
- Perform the drying cycle: the molecular sieve has to be crossed by a hot air flow at a 300 degrees temperature for 8-12 hours (depending on the quantity of molecular sieve which has to be dried).
- Clean the filter and the interior of the filter cartridge.
- Put the molecular sieve into the filter cartridge; assemble the filter (8), the ring (7), the body (6) and the ring (5).
- Screw the cartridge (4) on the dehydrating unit support plate and mount the container (1) on the plate (3), by screwing the screws (2).
- If the filter cartridge is not immediately utilized, put it in an air tight enclosure, suitable to protect the molecular sieve from ambient humidity.



STC237-A



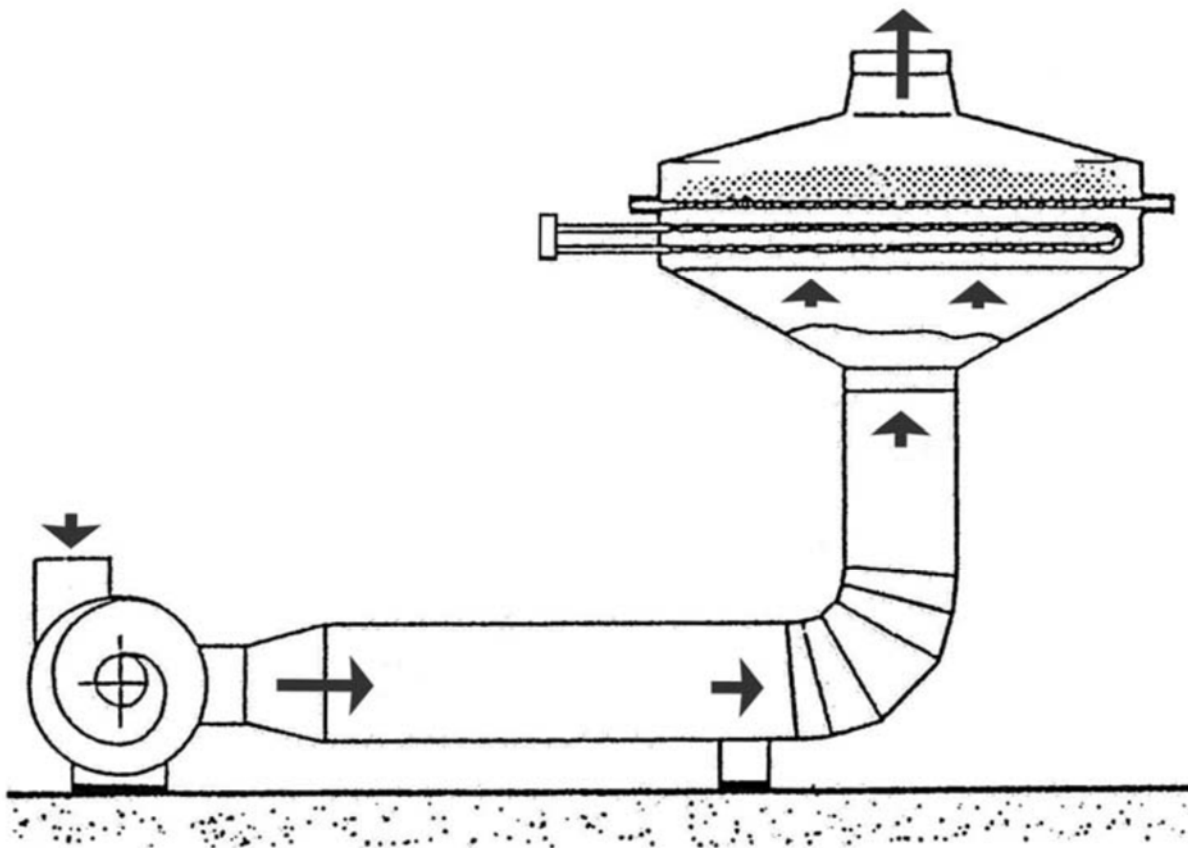
## DESCRIPTION OF DRYING UNIT (STC891)

The drying unit has a pierced plate to support the molecular sieve which has to be dried.

The flow of air is supplied by a ventilator and the air is heated by electric resistances or by a radiator supplied by steam or smoke.

The hot air flows through the holes of the pierced plate through the molecular sieve to be dried.

The air, containing the water vapour and the hydrogen sulphide, is conveyed to the atmosphere by a chimney.



STC891

## 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. Standard 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

May change based on application.



## VII. TROUBLE SHOOTING & REMEDIES

Problems	Possible cause	Remedy
Actuator Inoperative	No oil in the system.	Fill to full mark. Check system for leaks
	Oil low in reservoirs.	Check level and fill to marked line. Check system for leaks.
	Oil of wrong viscosity.	Refer to specifications for proper viscosity.
	Filter dirty or plugged.	Drain condensation and replace filter.
	Defective inlet filter cartridge	Clean or replace filter
	Gas leaks in the pneumatic line	Repair or replace lines.
	Improper low pressure adjustment of pressure controller	Adjust in accordance to the actuator data sheet / certificate value
	Badly operation pump	Bleed air from circuit. Repair or replace pump.
	Badly worn components	Examine and test valves, cylinder, etc. for external and internal leaks. If wear is abnormal, try to locate the cause.
	Oil leak in pressure lines	Tighten fittings or replace defective lines.
	Components not properly adjusted	Refer to Actuator Maintenance Manual for proper adjustment of components
Actuator Operates Erratically	Relief valve defective	Test relief valve to make sure they are opening at their rated pressure. Examine seals for damage that could cause leaks. Clean relief valve and check for broken springs, etc.
	Air in the hydraulic cylinder	Examine system for leaks. Make sure oil level is correct.
	Restriction in hydraulic line	Hydraulic line could be dirty or have inner walls that are collapsing, cutting off oil supply. Clean or replace hydraulic line. Also, check filter line for restrictions.
	Low oil level	Check level and fill to marked line. Look for leaks.
	Dirty oil	Drain and refill with clean oil. Look for source of contamination and replace oil filters
	Incorrect relief valve pressure	Check pressure and clean or replace relief valves
	Internal component oil leakage	Examine and test the circuit for external and internal leaks. If wear is abnormal, try to locate cause.
	Control valves stuck open	Free all spools so that they return to neutral position.



Problems	Possible cause	Remedy
Actuator Operates Slowly	Oil viscosity too heavy	Use oil recommended by the manufacturer
	Control flow valve restriction	Check the flow control valve adjustment
	Badly worn components	Examine and test valves, cylinder, etc. for external and internal leaks. If wear is abnormal, try to locate the cause
	Valves plugged	Clean dirt from components. Clean orifices. Check for source of dirt and correct.
	Oil leak in the lines	Tighten fittings or replace defective lines.
	Components not properly adjusted	Refer to Actuator Instruction Manual for proper adjustment of components.
	Oil leaking past cylinder packings or O-rings	Replace worn parts. If wear is caused by contamination, clean hydraulic system and determine the contamination source.
Cylinder Leak Oil	Rod seal leaking.	Replace seal. If contamination caused seal to wear, look for source. Wear may be caused by external as well as internal contaminants. Check piston rod for scratches or misalignment.
	Loose parts	Tighten parts until leakage has stopped
	Piston rod damaged	Check rod for nicks or scratches that could cause seal damage or allow oil leakage. Replace defective rods.

## VIII. DISASSEMBLY AND REASSEMBLY

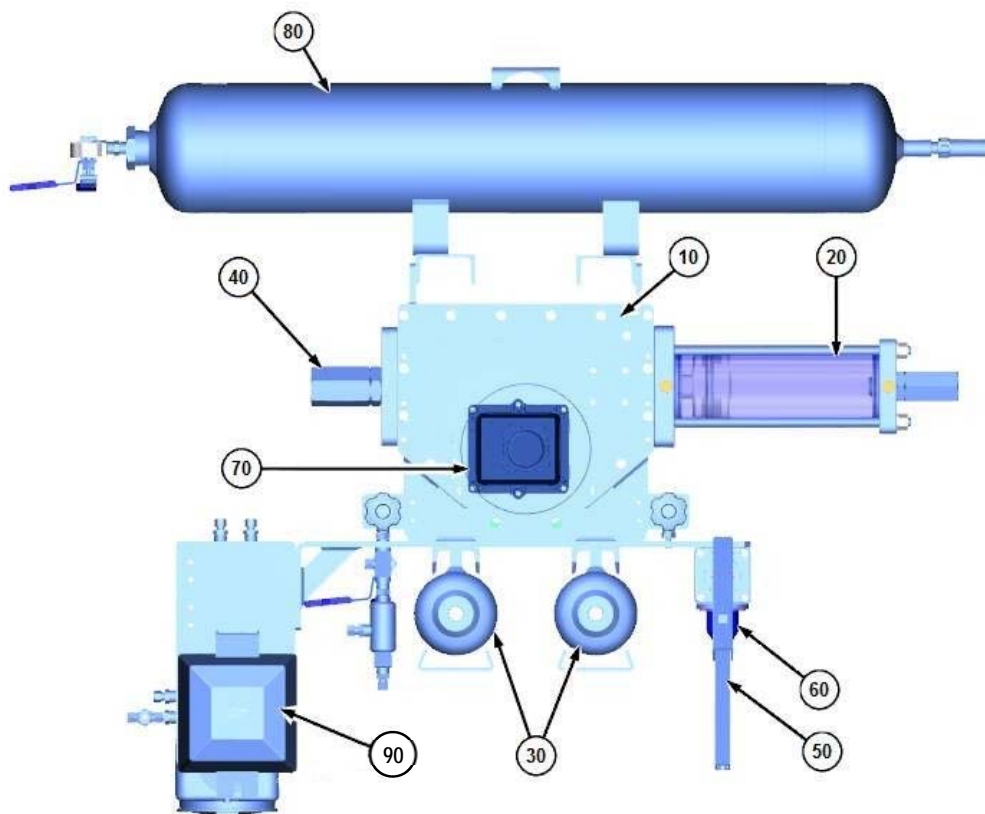
*Warning:*



*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, Torque wrench and Circlip plier.

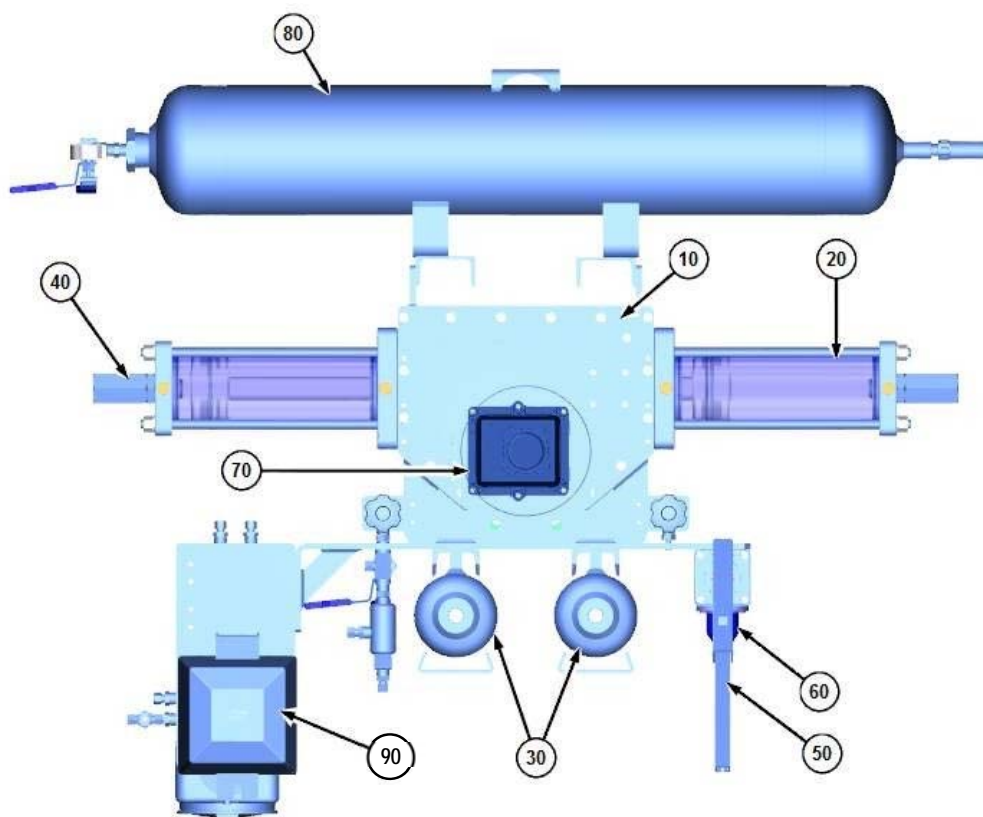
*Note:* If the RFID tag has been provided on the actuator that identifies each actuator with a unique number and when any disassembly process is undertaken, all components removed from within the actuator assembly must be reinstalled within that specific actuator during the reassembly process. DO NOT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

Refer to the Double acting actuator assembly drawing below.



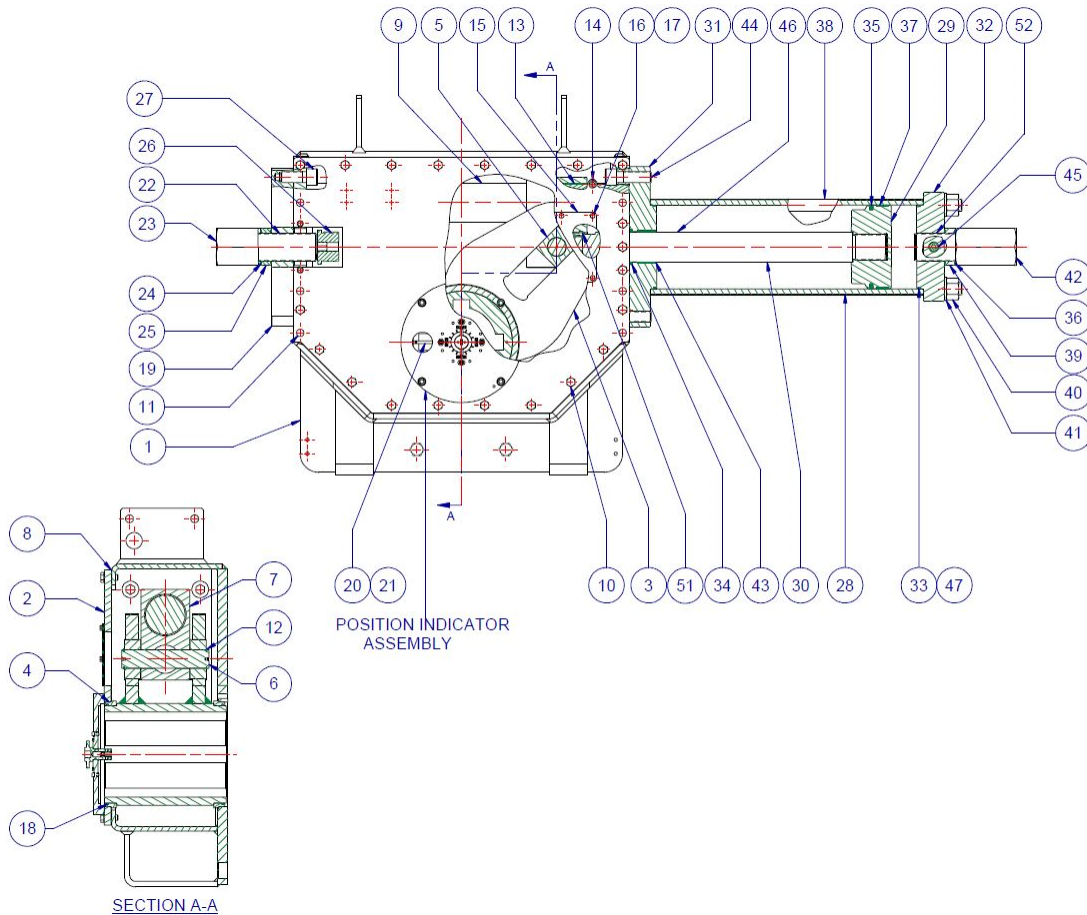
ITEM	DESCRIPTION	QTY
10	FRAME SUB ASSEMBLY	1
20	HYDRAULIC CYLINDER SUB ASSEMBLY	1
30	GAS OIL TANK	2
40	END STROKE	1
50	HAND PUMP	1
60	MANUAL DISTRIBUTOR	1
70	MICROSWITCH HOUSING	1
80	STORAGE TANK	1
90	CONTROL GROUP	1

Refer to the Double cylinder actuator assembly drawing below.



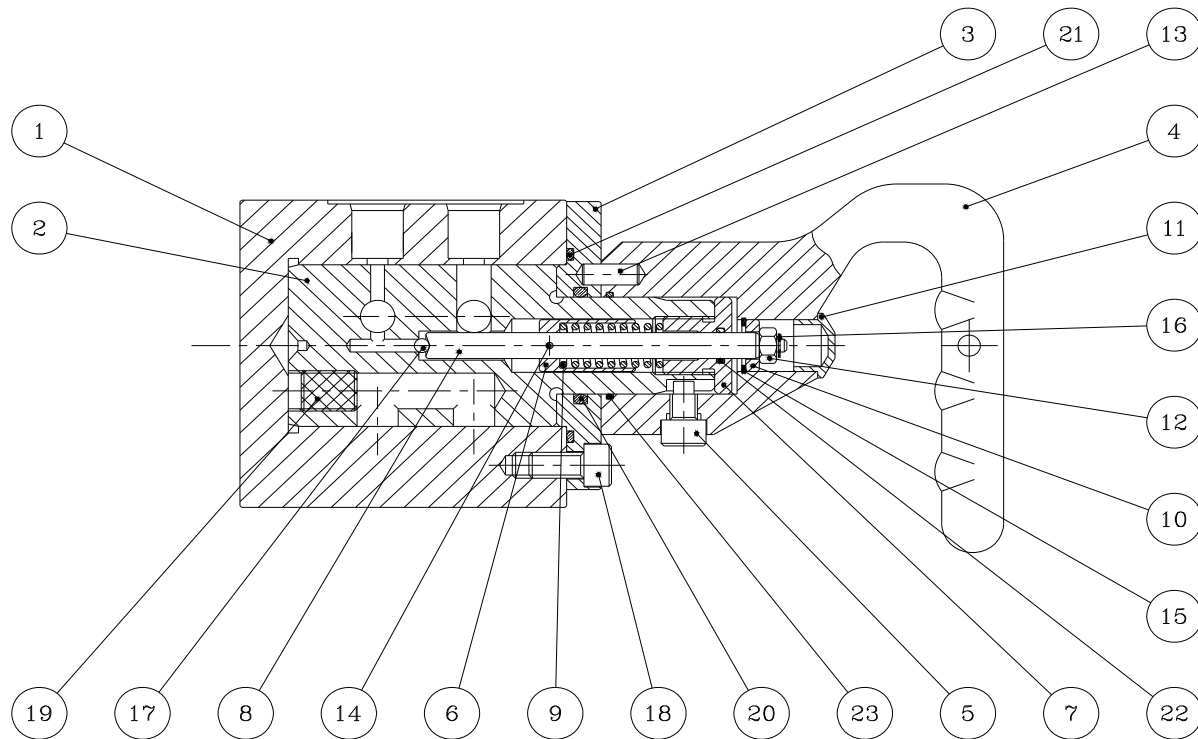
ITEM	DESCRIPTION	QTY
10	FRAME SUB ASSEMBLY	1
20	HYDRAULIC CYLINDER SUB ASSEMBLY	2
30	GAS OIL TANK	2
40	END STROKE	2
50	HAND PUMP	1
60	MANUAL DISTRIBUTOR	1
70	MICROSWITCH HOUSING	1
80	STORAGE TANK	1
90	CONTROL GROUP	1

Refer to the Double acting actuator sectional assembly drawing below:



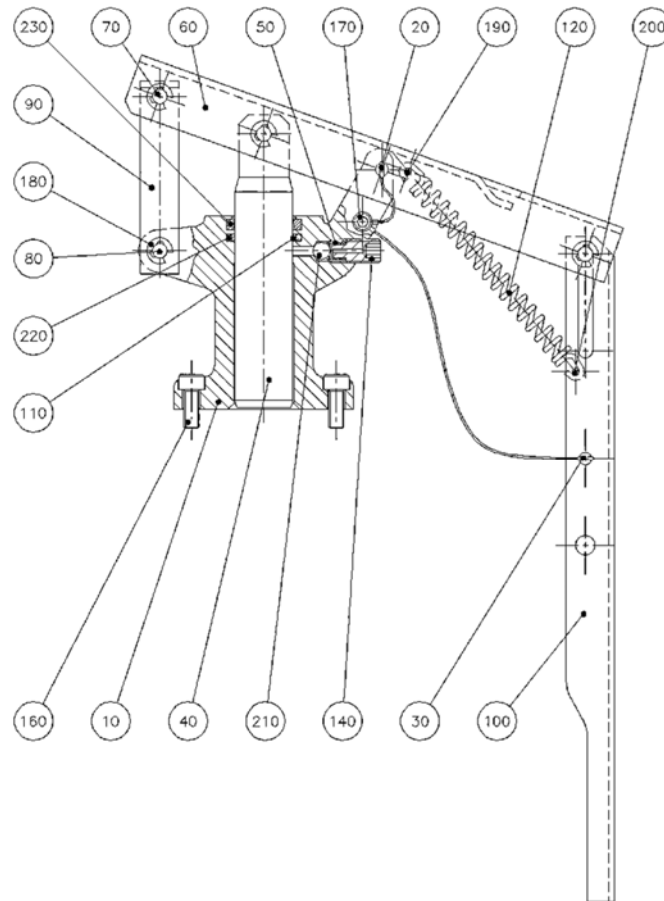
ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	FRAME	19	PLATE FOR END STROKE	37	GUIDE SLIDER
2	COVER	20	MICRO SWITCH PLATE	38	TIE ROD
3	SCOTCH YOKE	21	PIN	39	LOCK NUT
4	BUSHING	22	MECHANICAL END STOP	40	HEX.NUT
5	SLIDING BLOCK	23	CAP NUT	41	WASHER
6	SLIDING PIN	24	O-RING	42	CAP NUT
7	GUIDE BLOCK	25	LOCK NUT	43	DU-BEARING
8	FRAME SEAL	26	BUSHING	44	SOCKET HEAD CAP SCREW
9	GUIDE BAR	27	SOCKET HEAD CAP SCREW	45	PLUG
10	HEX.HEADED BOLT	28	CYLINDER LINER	46	PLUG
11	DOWEL PIN	29	PISTON	47	BACKUP RING
12	CIRCLIP	30	ROD	51	BUSH
13	DU-BEARING	31	HEAD FLANGE	52	MECHANICAL END STOP
14	PLUG	32	END FLANGE		
15	FLANGE	33	O-RING		
16	GASKET	34	ROAD SEAL		
17	SCREW	35	PISTON SEAL		
18	O-RING	36	O-RING		

Refer to the Manual Distributor sectional assembly drawing below:



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	DISTRIBUTOR BODY	13	CYLINDRICAL PIN
2	DISTRIBUTOR	14	HELICOIDAL PIN
3	CLOSING FLANGE	15	CIRCLIP
4	HANDLE	16	CIRCLIP
5	HANDLE STOPPER	17	BALL
6	PLUG STOP RING	18	SOCKET HEAD SCREW
7	DISTRIBUTOR CAP	19	CAP
8	PLUG	20	O-RING
9	PLUG SPRING	21	O-RING
10	HANDLE WASHER	22	O-RING
11	HANDLE CAP	23	O-RING
12	HEX-NUT		

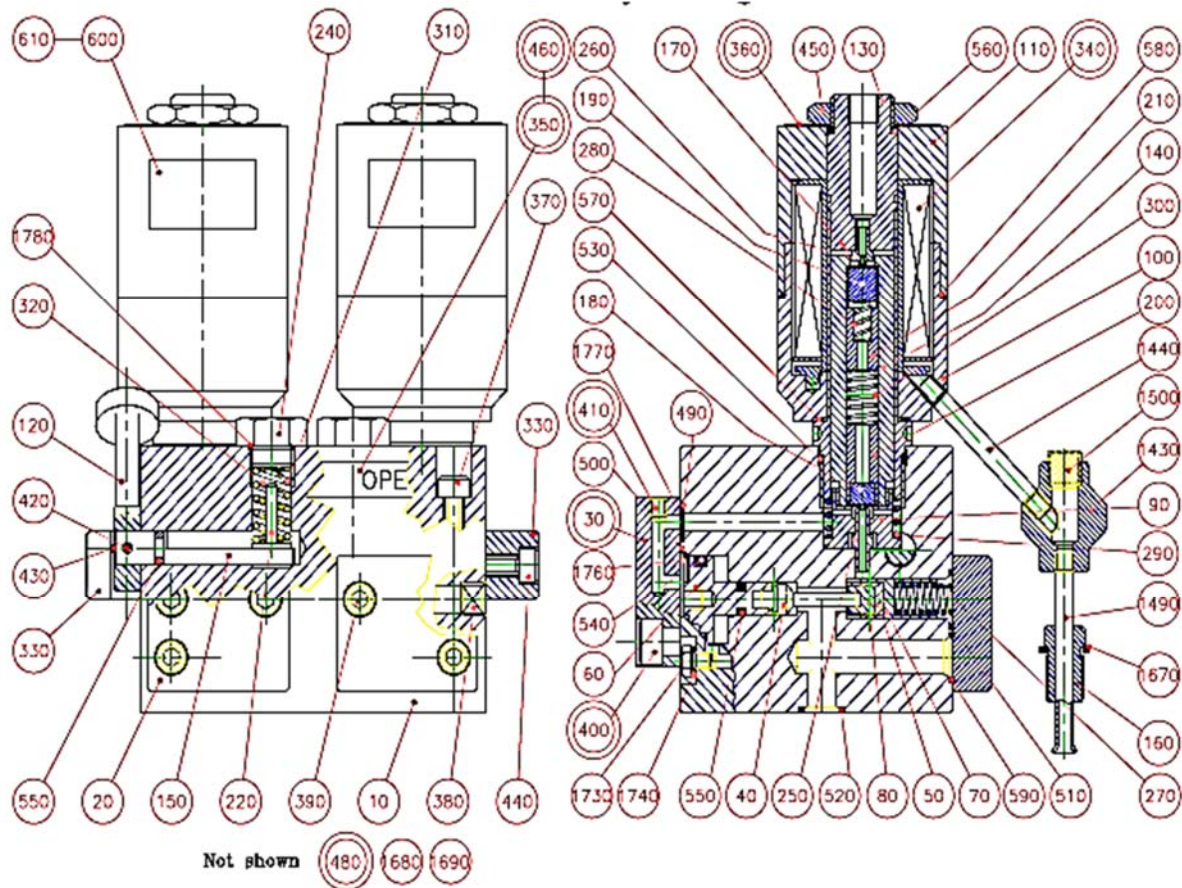
Refer to the Pump sectional assembly drawing below:



ITEM	DESCRIPTION	ITEM	DESCRIPTION
10	HAND PUMP BODY	140	DRAIN SCREW
20	CABLE WITH SPLIT PIN	160	SOCKET HEAD SCREW
30	CABLE WITH SPLIT PIN	170	SOCKET HEAD SCREW
40	PISTON	180	CIRCLIP
50	SPRING DELIVEY	190	HELICOIDAL PIN
60	ARM	200	HELICOIDAL PIN
70	PIN	210	BALL
80	PIN	220	O-RING
90	JOINT	230	SCRAPER RING
100	OPERATION LEVER		
110	SEAL RING		
120	SPRING ARM		



Refer to the Solenoid Valve sectional assembly drawing below:



ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
10	BODY	250	NOZZLE	510	O-RING
20	COVER	260	EXHAUST NOZZLE	520	O-RING
30	COVER	270	PLUG SPRING	530	O-RING
31	SCREW	280	SPRING SHUTTER	540	O-RING
40	SHUTTER	290	CORE SPRING	550	O-RING
50	PLUG	300	SPRING	560	O-RING
60	PISTON	310	SPRING	570	O-RING
70	SPRING GUIDE	320	SPRING	580	O-RING
80	SHUTTER INSERT	330	THRUST BEARING	590	O-RING
90	RING NUT	340	COIL	600	NAMEPLATE
100	HOUSING	350	NAMEPLATE	720	WASHER
110	HOUSING	360	NAMEPLATE	1430	FITTING
120	MANUAL LEVER	370	SOCKET HEAD SCREW	1440	TUBE
130	HOUSING	380	PLUG	1490	PIPE
140	CORE	390	SOCKET HEAD SCREW	1500	PLUG

150	PIN	400	SCREW	1670	WASHER
160	FITTING	410	SCREW	1680	COMPOUND
170	WASHER	420	PIN	1690	COMPOUND
180	PLUG	430	BALL	1730	SCREW
190	PLUG	440	SOCKET HEAD SCREW	1740	SEAL
200	PLUG SEAT	450	NUT	1760	RING
210	PLUG SEAT	460	RIVET	1770	RING
220	PUSHER	490	O-RING	1780	O-RING
240	CAP	500	O-RING		

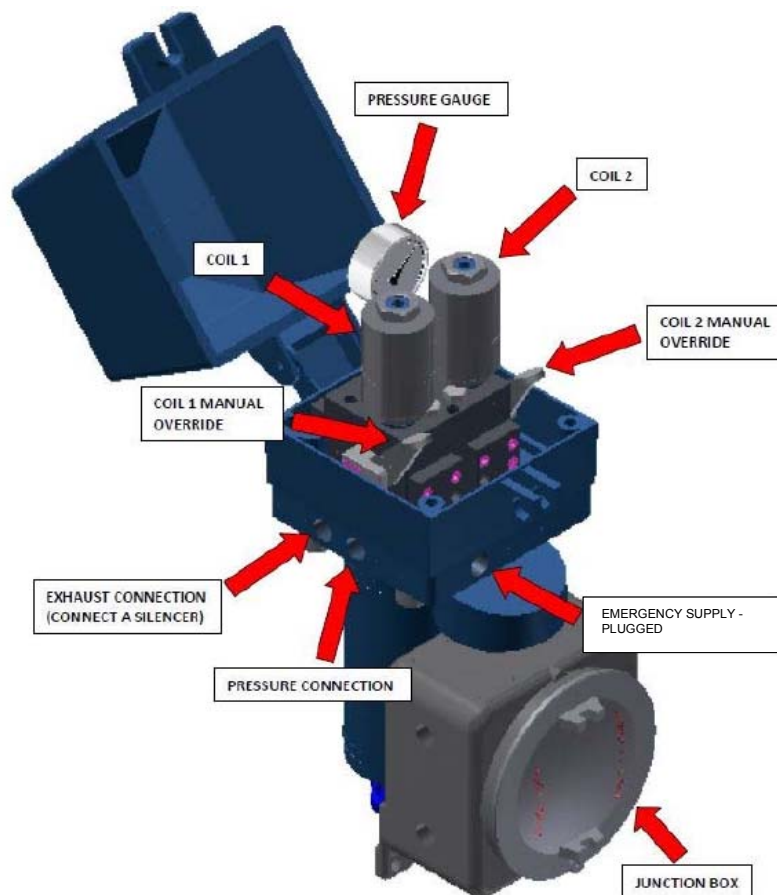
### Instruction to operate the control group

- Place the control group onto an adequate support.

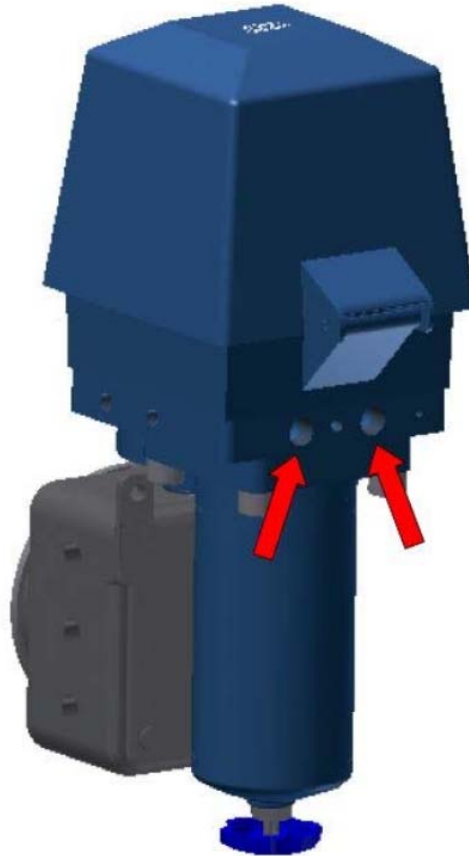
**IMPORTANT:** ensure that the assembly is firmly fixed, as the control group has to be pressurized

- Carry out the pneumatic connection, as per the following picture

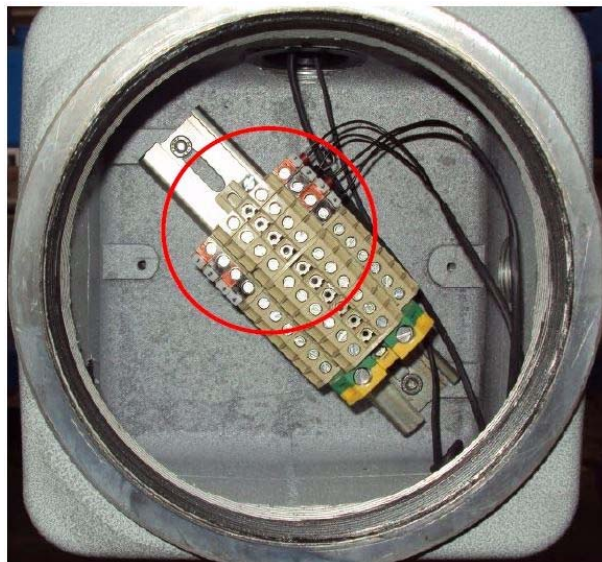
**NOTE:** all the pneumatic connections are 1/2" NPT size



- Connect no.2 pressure gauges (suggested scale: 0-100 bar) to each connection on the rear side of the control group, indicated by the arrows in the following picture.



- Unscrew the cover of the junction box and carry out the electric connections: referring to the following picture, connect the +24 VDC to the no.2 RED terminals and the -24 VDC to the no.2 BLACK terminals.



- Pressurize the control group at a suggested pressure of about 30 bar, verifying on the pressure gauge inside the control group.
- Alternatively energize the coil of each solenoid valve, verifying the pressure in the relevant pressure gauge on the rear side of the control group.
- The same operation can be performed without de-energizing the coils, by operating the levers of the manual override of each solenoid valve.
- Once the above described tests have been completed, de-pressurize the control group, then disconnect the pneumatic and electric connections.

## 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.

The cylinder may contain dangerous gas and/or liquids. Ensure that operator exposure is prevented and the ambient adequately ventilated, to prevent from high level gas concentration that creates a potentially dangerous atmosphere.

If spool piece is present, check that adaptor spool (adaptor) is stuck with valve stem. The same is applicable in case of yoke bushing.

**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.

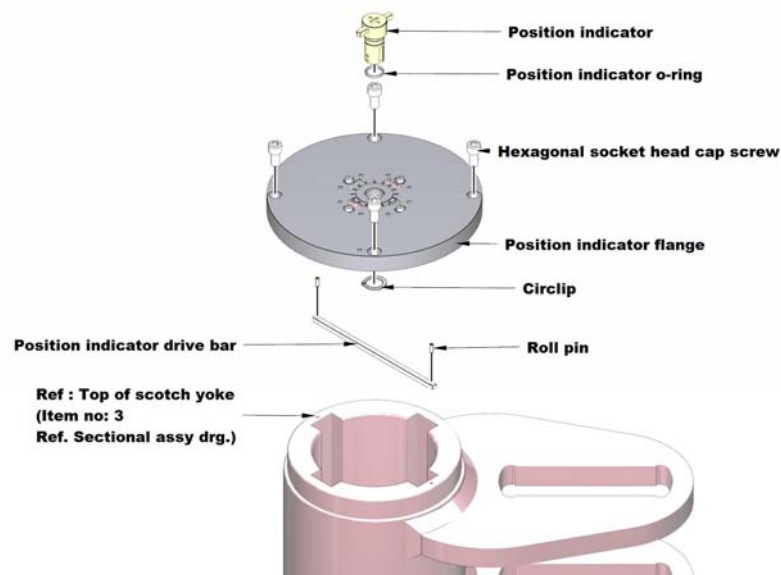
**Note:** Before starting any disassembly of the actuator, ensure that all electrical and supply media connections are off or disconnected. Also that any pressure within the actuator piston has been relieved.

**Note:** Before starting disassembly, ensure spare parts seal kit is available as indicated on page [60](#).

**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 piping 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 Cylinder sub assembly from Frame & disassembly:

(Refer to page: [44](#) for sectional assembly drawing)

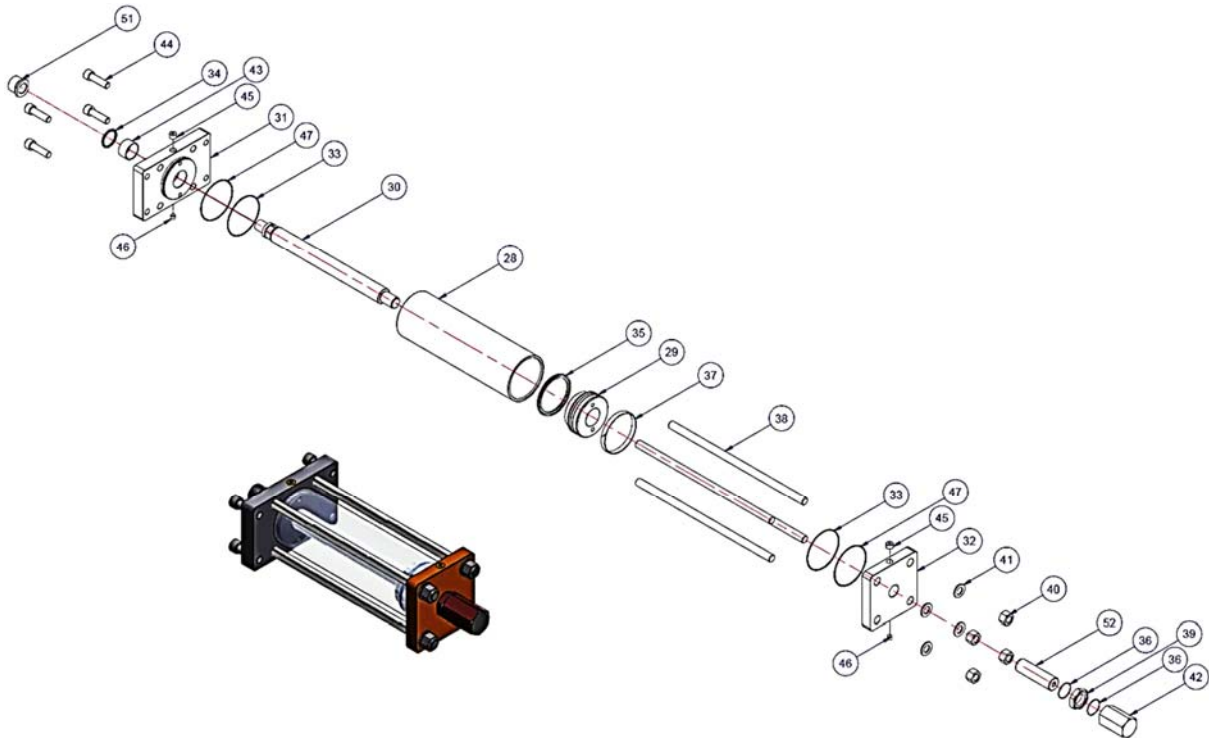
*Note: Before starting any disassembly of the actuator, ensure that the actuator is isolated from the supply pressure, air is exhausted and mechanical end stops are released.*

- Remove frame cover fasteners (item 10).
- Remove the frame cover (item 2) with gasket (item 8) and place it on table away from the actuator.
- If desired, remove the dowel pin (item 11) from frame.
- Rotate the scotch yoke (item 3) until the hexagonal flats on piston rod (Item 30) besides the guide block (item 7) is accessible.

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

- Unthread the piston rod from the bush of the guide block using a wrench. Place the wrench on the tool kit away from actuator.
- Unthread the bush from the guide block by using 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 44) which holds the cylinder to the frame (item 1).
- Remove the cylinder assembly out of the frame with the lifting devices.
- Place the cylinder sub assembly on table away from the frame.

c. Cylinder sub assembly:  
(See the Exploded view below)



ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
28	CYLINDER LINER	1	37	GUIDE SLIDER	1	46	PLUG	2
29	PISTON	1	38	TIE ROD	4	47	BACKUP RING	2
30	ROD	1	39	LOCK NUT	1	51	BUSH	1
31	HEAD FLANGE	1	40	HEX.NUT	4	52	MECHANICAL END STOP	1
32	END FLANGE	1	41	WASHER	4			
33	O-RING	2	42	CAP NUT	1			
34	ROD SEAL	1	43	DU-BEARING	1			
35	PISTON SEAL	1	44	SOCKET HEAD CAP SCREW	4			
36	O-RING	2	45	PLUG	2			

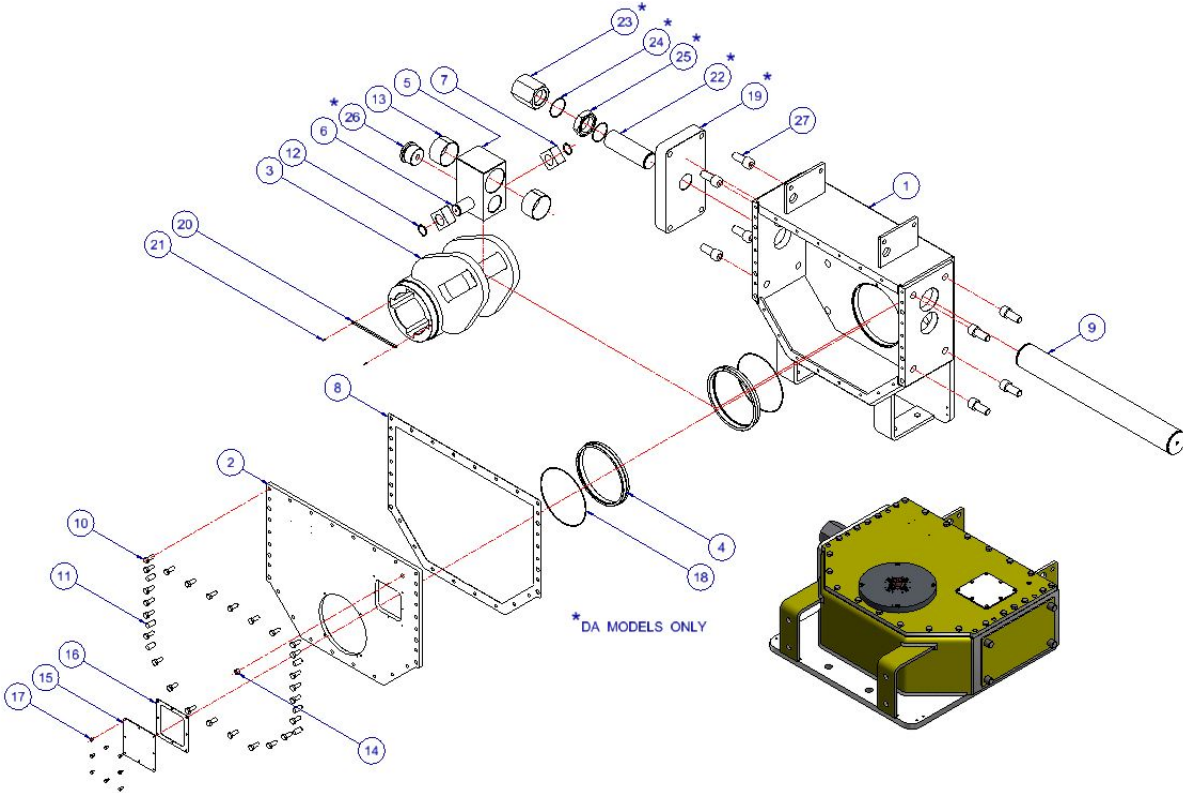


1. Place cylinder on a suitable work bench in a vertical orientation by resting head flange (item 31) at the bottom to disassemble the cylinder assembly.
2. Remove the cap nut (item 42) & locking nut (item 39) from the mechanical end stop (item 52). Then unthread and remove the mechanical stop by using Allen key and place the parts on table away from work bench.

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

3. If desired, remove the seal (item 36) from locking nut.
4. Remove the end flange fasteners (item 40 & 41) from the end flange (item 32) and place the parts on table away from cylinder assembly.
5. Remove the end flange (item 32) from liner (item 28) by using the nylon hammer to tap uniformly around the end flange. Place the end flange on table away from cylinder assembly.
6. If desired, remove the seal (item 33) from end flange.
7. Gradually remove the cylinder liner (item 28) from head flange (item 31) and place it carefully without damaging the inside surface, away from the work bench.
8. Remove bush (item 51) from piston rod (item 30) by unthreading it.
9. Remove the piston and rod subassembly from head flange and place the parts on table away from work bench.
10. Hold the piston (item 29) for unthreading it from piston rod (item 30). Holds the hexagonal slot end of the piston rod and unthread it from piston.
11. Remove the piston from piston rod and carefully place the parts on table away from the work bench without damaging the surfaces of the piston.
12. If desired, remove the seal (item 35) and the guide slider (item 37) from piston.
13. Remove the tie-rods (item 38) one by one from the head flange (item 31) by unthreading it.
14. If desired, remove the external seal (item 33) and internal seal (item 34) from head flange.

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



ITEM	DESCRIPTION	Qty	ITEM	DESCRIPTION	Qty
1	FRAME	1	14	PLUG	1
2	COVER	1	15	FLANGE	1
3	SCOTCH YOKE	1	16	GASKET	1
4	BUSHING	2	17	SCREW	8
5	SLIDING BLOCK	1	18	O-RING	2
6	SLIDING PIN	1	20	POSITION INDICATOR DRIVE BAR	1
7	GUIDE BLOCK	2	21	ROLL PIN	2
8	FRAME SEAL	1	22	END STOP	1
9	GUIDE BAR	1	23	CAP NUT	1
10	HEX. HEADED BOLT	26	24	O-RING	2
11	DOWEL PIN	6	25	LOCK NUT	1
12	CIRCLIP	2	26	BUSHING	1
13	DU-BEARING	2	27	SOCKET HEAD CAP SCREW	4

### Disassembly of Frame sub assembly:

1. In order to remove the end stroke assembly from the frame which is at the opposite side of the hydraulic cylinder, remove the fasteners (item 27) of plate for end stroke (item 19) and remove.
2. Now loosen and remove the cap nut (item 23), locking nut (item 24) and mechanical stop (item 22) from plate. Place the parts on table away from the frame.
3. If desired, remove the seal (item 25) from locking nut.
4. Remove bush (item 26) from guide block (item 7) by unthreading it.
5. Remove the guide bar (item 9) completely out of the frame by hammering in to the other side (Use Nylon hammer).
6. Remove scotch yoke (item 3) from the frame along with the guide block assembly and place it on table away from the frame.
7. Remove the external circlip which hold the guide block assembly to scotch yoke with proper tool. Then remove the sliding block (item 5) and sliding pin (item 6) from guide block (item 7) and place the parts on table away from the frame.
8. If desired, remove the position indicator drive bar (item 20 ref page 54) from scotch yoke.
9. Disassembly of the actuator is now complete.

### B. Reassembly:

- a. **Frame sub assembly** (Refer the page [55](#) 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 1) on a suitable work bench in horizontal orientation resting on its base.
- Locate two sliding blocks (item 5) and circlips (item 12). Install it into the guide block (item 7).
- Check the bearing inside the guide block and apply grease film. Mount the guide block assembly into the scotch yoke (item 3).
- Locate scotch yoke seals (item 18). Place the seals in top and bottom bushings (item 4) assembled on the frame bottom plate & cover.
- Locate the position indicator drive bar (item 20) and its roll pins (item 21) . 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 4) placed in the actuator frame.
- Locate guide bar (item 9).
- 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 mechanical stop (item 22), cap nut (item 23), plate for end stroke (item 19) and lock nut with seals (item 24).
- Lightly grease the threads on the plate where mechanical stop is going to be assembled.
- Install the mechanical stop in position of actuator frame and set the stroke required by the actuator. Rotating the mechanical stop clockwise reduces the angular stroke and rotating it counter-clockwise increases the angular stroke.
- Install the lock nut seal in its grooves and apply grease film. (Suggested grease: Parker super-o-lube or equivalent) Install the lock nut by screwing into the mechanical stops by applying 45-50 Nm torque.
- Finally install the cap nut by screwing in to the mechanical stop.

*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** (Refer page [53](#) for hydraulic cylinder exploded view)

*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 31) on a suitable work bench in horizontal orientation (if cylinder must be mounted on spring return actuator arrange the head flange directly on frame side). Make sure that seal groove side face is visible.
2. Locate the head flange external (item 33) and internal seals (item 34) and carefully place it in its grooves.
3. Locate piston (item 29). Install the piston seal (item 35) and guide slider (item 37) to the piston and gradually screw the piston assembly into the piston rod.

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

4. Install the piston and rod assembly in a vertical position in such a way that the piston rod projects out of the head flange. Care should be taken not to damage the cylinder liner as well as the piston seals. (if cylinder must be mounted on double acting actuator go to point "3 in c" to assemble piston rod into the guide block of the frame)
5. Locate the liner (item 28). Slide the liner over the piston seal and the head flange seal without damaging the seals.
6. Locate the tie rods (item 38) and thread them into head flange.
7. Locate the end flange seal and install the seal in the end flange groove.
8. Locate the end flange (item 32) and slowly lower it into the cylinder liner and in the tie rods. Ensure the oil supply ports are properly oriented with the oil supply ports on the head flange.
9. Locate the tie rod nuts, Install and tighten to secure the end flange, once adjustments have been made to ensure proper alignment of end flanges and that the tie-rods are perpendicular (square) to the end flanges.
10. Locate the mechanical stop (item 52), lock nut (item 39) with seals (item 36)
11. Lightly grease the threads on the end flange where mechanical stop is going to be assembled.
12. Install the mechanical stop in position of end flange and set the stroke required by the actuator. Rotating the mechanical stop clockwise reduces the angular stroke and rotating it counter-clockwise increases the angular stroke.
13. Install the lock nut seal in its grooves and apply grease film. (Suggested grease: Parker super-o-lube or equivalent) Install the lock nut by threading onto the mechanical stops (applying 45-50 Nm torque) followed by cap nut.

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

(Refer page [44](#) for sectional assembly drawing)

1. Place the actuator frame assembly in a vertical position to admit the cylinder assembly into the frame bore.
2. Gradually lower the cylinder assembly into the frame bore.
3. Thread the bush (item 51) into the guide block by using a wrench. Ensure that the bush threaded correctly and does not skip threads.

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

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

4. Thread the piston rod into the bush of the guide block by using a wrench. Ensure that the piston rod threaded correctly and does not skip threads.

5. Locate the hexagonal socket head screws (item 44).
6. Secure the cylinder sub assembly in position by means of fasteners (item 44).
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 8) and frame cover (item 2) assembly
9. Check the bushing in frame cover and apply grease film.
10. Slowly lower the frame cover and place in position by means of locating pins and fasteners.
11. Locate the position indicator assembly and install it in position of frame cover in the same axis as that of the scotch yoke.
12. Ensure that the position indicator shaft is correctly located into the position indicator drive bar.
13. Reassembly of the double acting 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 [55](#)) :

- Item 8, qty. 1
- Item 16, qty. 1
- Item 18, qty. 2

### 2. End stroke Assembly (For double acting actuator)

(Refer to frame assembly exploded view on page [55](#)) :

- Item 24, qty. 2

### 3. Cylinder sub Assembly

(Refer to hydraulic cylinder assembly exploded view on page [53](#)) :

- Item 33, qty. 2
- Item 37, qty. 1
- Item 35, qty. 1
- Item 34, qty. 1
- Item 36, qty. 2
- Item 47, qty. 2

### 4. Manual Distributor Assembly

(Refer to manual distributor sectional drawing view on page [45](#)) :

- Item 20, qty. 1
- Item 21, qty. 1
- Item 22, qty. 1
- Item 23, qty. 1



## 5. Hand Pump

(Refer to hand pump sectional drawing view on page [46](#)) :

- Item 220, qty. 1
- Item 230, qty. 1

## 6. Solenoid Valve

(Refer to solenoid valve sectional drawing view on page [47](#)) :

- Please contact [cameron.slb.com](http://cameron.slb.com) for repair kit