CAMERON® LEDEEN
Quarter Turn Actuator

SY Series – IP67 Direct gas

Installation, Operation and Maintenance Manual
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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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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
- To get / request new copies of the manual please contact 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:

\[ \text{CE} \text{ Ex II 2 G c Tx} \]

Where:

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

<table>
<thead>
<tr>
<th>Hazardous area</th>
<th>Installation category according to ATEX Directive No. 2014/34/EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas, fog or vapours</td>
<td>Zone 1</td>
</tr>
<tr>
<td>Gas, fog or vapours</td>
<td>Zone 2</td>
</tr>
</tbody>
</table>

2 G

3 G
M. Actuator Name plate description

The actuator nameplate shows the following data:

2. Order No.
3. Item No.
4. Actuator model
5. Valve size
6. Year of manufacturing
7. Actuator Serial No.
8. Actuator Tag No.
9. Name and complete address of the manufacturer

(*) where applicable

See for reference the nameplate drawing below.
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 gas 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 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°C and up to +70°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.
• 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 kg/m³), 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: 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

![Diagram of chains with angles and working length](image)

<table>
<thead>
<tr>
<th>Chain Diameter (mm)</th>
<th>CMU/Tonn 1 Arm</th>
<th>CMU/Tonn 2 Arms</th>
<th>CMU/Tonn 3 and 4 Arms</th>
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</thead>
<tbody>
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<td>45° &lt; β ≤ 60°</td>
<td>0° &lt; β ≤ 45°</td>
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<tr>
<td></td>
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<td>90° &lt; α ≤ 120°</td>
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<tr>
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<td>Factor 1.0</td>
<td>Factor 2.1</td>
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<td>2.1</td>
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<td>32</td>
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Schlumberger-Private
### LIFTING DEVICES MAXIMUM WORKLOAD

**Slings**

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<tr>
<th>C.M.U.</th>
<th>Width</th>
<th>100%</th>
<th>200%</th>
<th>140% From 7° to 45°</th>
<th>80%</th>
<th>100% From 45° to 60°</th>
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<td>1000</td>
<td>2000</td>
<td>1400</td>
<td>800</td>
<td>1000</td>
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<td>1500</td>
<td>3000</td>
<td>2100</td>
<td>1200</td>
<td>1500</td>
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<td>2 T</td>
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<td>2800</td>
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<td>3000</td>
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<td>8000</td>
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<tr>
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</tr>
<tr>
<td>15 T</td>
<td>240</td>
<td>15,000</td>
<td>30,000</td>
<td>21,000</td>
<td>12,000</td>
<td>15,000</td>
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<td>20,000</td>
<td>40,000</td>
<td>28,000</td>
<td>16,000</td>
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</table>
## NON TEFLOM-COATED TIE-RODS

<table>
<thead>
<tr>
<th>Tie Rod Type</th>
<th>Pitch (mm)</th>
<th>Tightening Torque - Nm (±5%)</th>
<th>Mat. (1)</th>
<th>Mat. (2)</th>
<th>Mat. (3)</th>
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## TEFLOM-COATED TIE-RODS

<table>
<thead>
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<th>Tie Rod Type</th>
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<th>Mat. (3)</th>
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<td>4.00</td>
<td>76</td>
<td>71</td>
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</tbody>
</table>

**Note:**
- Column Mat.(1) applicable to the following materials: A193 B7M, A320 L7M, A453 Gr.660B, B3 4862, 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 Class 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.
III. OPERATION

This series direct gas 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 pneumatic 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.

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)

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)

![](image)

**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 proper 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.

WARNING for GS & SY actuator
Please refer to dwg.STC1234 (for SY actuators) and dwg.STC171 (for GS actuators) to check the available space between valve adapter and position indicator to prevent any interferences.
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.

Gas connections:

a. Before connecting the actuator to the gas supply line, check that pipes and fittings are according to the applicable plant specifications, in order to guarantee the required gas flow for the operation of the actuator and to avoid that the supply pressure drops below the minimum allowable value.

b. 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.

c. 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.

d. After the completion of the gas 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 gas connections.

Electric connections:

a. Introduce connection cables.

b. Make the connections in compliance with applicable wiring diagrams on the documentation supplied.

c. Tighten the cable gland.

d. 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.

a) 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).

b) 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 gas connections. If necessary tighten the fittings.

h) Bleed the air from the hydraulic cylinder, if necessary, by removing the plug mounted on the flange.

i) Check the correct working of the actuator with the gas supply 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 gas 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).

f) Oil tank filling: place the actuator in closed position, unscrew the oil tank cap and fill the tank up to the level corresponding to about 10-15 mm on the dipstick; then screw the oil tank cap.

Stroking time adjustment on emergency hand pump for DIRECT GAS DOUBLE ACTING:

a) Locate the hand pump and his distributor;

b) In the bottom part of the same, locate the screws (480) indicated with the red arrow (item 16 A & B);

c) To increase (slow down the actuator) the stroking time, turn CW the relevant screw;

d) To decrease (speed up the actuator) the stroking time, turn CCW the relevant screw;
e) After EACH adjustment, operate the actuator by means of the pneumatic controls and record the travel time.

**NOTE:**
- There are no2 screws (480), one for open and one for closing stroke.
- The functionality of each screw is indicated in the label (160).
- The screws may totally close the oil flow.
- The screws have a limited stroke (4-5 turns).
- DO NOT apply excessive torque to avoid damages.
- It’s suggested to adjust the screws when the actuator is not moving.
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) Remove the accumulated condensation in the dehydrator filter cartridge through the suitable draining plugs (if applicable).
b) Check the correct valve position signalling on the control panel.
c) 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.
d) Check the correct working of the manual override (handwheel or hand-pump) by operating the actuator for a small percentage not to affect the flow in the main line.
e) The actuator shall be operated back 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) Substitute the dehydrator filter cartridge (if applicable).
c) Check that there is no leakage from the piston rod of the cylinder.
d) 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:**

a) In case of leakage from the gas cylinder, disassemble, clean the seals grooves and substitute the seals if damaged.
b) If there is a leakage from the gas 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. 35). 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 gas 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. 35) 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.
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.

Refer to STC1325 (page 16) for tightening torque.
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 position indicator assembly from the top of the frame by unscrewing the socket head screws.
- Remove the frame cover with gasket by unscrewing the bolts.
- Remove the hex nuts (item 40) and washer (item 41) from the tie rods.
- Remove the end flange (item 32) from liner (item 28) and the tie rods from the head flange.
- Gradually remove the liner from head flange (item 31).
- Remove the piston rod (item 30) from the guide block inside the frame, by unthreading it.
- 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

Warning:

- 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.
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

<table>
<thead>
<tr>
<th>Problems</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actuator Inoperative</strong></td>
<td>No oil in the system.</td>
<td>Fill to full mark. Check system for leaks</td>
</tr>
<tr>
<td></td>
<td>Oil low in reservoirs.</td>
<td>Check level and fill to marked line. Check system for leaks.</td>
</tr>
<tr>
<td></td>
<td>Oil of wrong viscosity.</td>
<td>Refer to specifications for proper viscosity.</td>
</tr>
<tr>
<td></td>
<td>Filter dirty or plugged.</td>
<td>Drain condensation and replace filter.</td>
</tr>
<tr>
<td></td>
<td>Defective inlet filter cartridge</td>
<td>Clean or replace filter.</td>
</tr>
<tr>
<td></td>
<td>Gas leaks in the pneumatic line</td>
<td>Repair or replace lines.</td>
</tr>
<tr>
<td></td>
<td>Improper low pressure adjustment of pressure controller</td>
<td>Adjust in accordance to the actuator data sheet / certificate value</td>
</tr>
<tr>
<td></td>
<td>Badly operation pump</td>
<td>Bleed air from circuit. Repair or replace pump.</td>
</tr>
<tr>
<td></td>
<td>Badly worn components</td>
<td>Examine and test valves, cylinder, etc. for external and internal leaks. If wear is abnormal, try to locate the cause.</td>
</tr>
<tr>
<td></td>
<td>Oil leak in pressure lines</td>
<td>Tighten fittings or replace defective lines.</td>
</tr>
<tr>
<td></td>
<td>Components not properly adjusted</td>
<td>Refer to Actuator Maintenance Manual for proper adjustment of components</td>
</tr>
<tr>
<td><strong>Actuator Operates Erratically</strong></td>
<td>Air in the hydraulic cylinder</td>
<td>Bleed air from circuit. Examine system for leaks. Make sure oil level is correct.</td>
</tr>
<tr>
<td></td>
<td>Restriction in hydraulic line</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Low oil level</td>
<td>Check level and fill to marked line. Look for leaks.</td>
</tr>
<tr>
<td></td>
<td>Dirty oil</td>
<td>Drain and refill with clean oil. Look for source of contamination and replace oil filters</td>
</tr>
<tr>
<td></td>
<td>Incorrect relief valve pressure</td>
<td>Check pressure and replace relief valves</td>
</tr>
<tr>
<td></td>
<td>Internal component oil leakage</td>
<td>Examine and test the circuit for external and internal leaks. If wear is abnormal, try to locate cause.</td>
</tr>
<tr>
<td></td>
<td>Control valves stuck open</td>
<td>Free all spools so that they return to neutral position.</td>
</tr>
<tr>
<td>Problems</td>
<td>Possible cause</td>
<td>Remedy</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Actuator Operates Slowly</td>
<td>Oil viscosity too heavy</td>
<td>Use oil recommended by the manufacturer</td>
</tr>
<tr>
<td></td>
<td>Control flow valve restriction</td>
<td>Check the flow control valve adjustment</td>
</tr>
<tr>
<td></td>
<td>Badly worn components</td>
<td>Examine and test valves, cylinder, etc. for external and internal leaks. If wear is abnormal, try to locate the cause</td>
</tr>
<tr>
<td></td>
<td>Valves plugged</td>
<td>Clean dirt from components. Clean orifices. Check for source of dirt and correct.</td>
</tr>
<tr>
<td></td>
<td>Oil leak in the lines</td>
<td>Tighten fittings or replace defective lines.</td>
</tr>
<tr>
<td></td>
<td>Components not properly adjusted</td>
<td>Refer to Actuator Instruction Manual for proper adjustment of components.</td>
</tr>
<tr>
<td></td>
<td>Oil leaking past cylinder packings or O-rings</td>
<td>Replace worn parts. If wear is caused by contamination, clean hydraulic system and determine the contamination source.</td>
</tr>
<tr>
<td>Cylinder Leak Oil</td>
<td>Rod seal leaking.</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Loose parts</td>
<td>Tighten parts until leakage has stopped</td>
</tr>
<tr>
<td></td>
<td>Piston rod damaged</td>
<td>Check rod for nicks or scratches that could cause seal damage or allow oil leakage. Replace defective rods.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>FRAME SUB ASSEMBLY</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>DIRECT GAS CYLINDER SUB ASSEMBLY</td>
<td>1</td>
</tr>
<tr>
<td>80</td>
<td>HYDRAULIC CYLINDER SUB ASSEMBLY</td>
<td>1</td>
</tr>
<tr>
<td>100</td>
<td>HAND PUMP</td>
<td>1</td>
</tr>
<tr>
<td>110</td>
<td>MANUAL DISTRIBUTOR</td>
<td>1</td>
</tr>
<tr>
<td>120</td>
<td>OIL TANK</td>
<td>1</td>
</tr>
<tr>
<td>150</td>
<td>CONTROL GROUP</td>
<td>1</td>
</tr>
<tr>
<td>240</td>
<td>POSITION INDICATOR</td>
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Refer to the Double acting actuator sectional assembly drawing below:
<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>ITEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FRAME</td>
<td>19</td>
<td>PLATE FOR END STROKE</td>
<td>37</td>
<td>GUIDE SLIDER</td>
</tr>
<tr>
<td>2</td>
<td>COVER</td>
<td>20</td>
<td>MICRO SWITCH PLATE</td>
<td>38</td>
<td>TIE ROD</td>
</tr>
<tr>
<td>3</td>
<td>SCOTCH YOKE</td>
<td>21</td>
<td>PIN</td>
<td>39</td>
<td>LOCK NUT</td>
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<tr>
<td>4</td>
<td>BUSHING</td>
<td>22</td>
<td>MECHANICAL END STOP</td>
<td>40</td>
<td>HEX.NUT</td>
</tr>
<tr>
<td>5</td>
<td>SLIDING BLOCK</td>
<td>23</td>
<td>CAP NUT</td>
<td>41</td>
<td>WASHER</td>
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<tr>
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<td>O-RING</td>
<td>42</td>
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<tr>
<td>7</td>
<td>GUIDE BLOCK</td>
<td>25</td>
<td>LOCK NUT</td>
<td>43</td>
<td>DU-BEARING</td>
</tr>
<tr>
<td>8</td>
<td>FRAME SEAL</td>
<td>26</td>
<td>BUSHING</td>
<td>44</td>
<td>SOCKET HEAD CAP SCREW</td>
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<tr>
<td>9</td>
<td>GUIDE BAR</td>
<td>27</td>
<td>SOCKET HEAD CAP SCREW</td>
<td>45</td>
<td>PLUG</td>
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<tr>
<td>10</td>
<td>HEX.HEADED BOLT</td>
<td>28</td>
<td>CYLINDER LINER</td>
<td>46</td>
<td>PLUG</td>
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<tr>
<td>11</td>
<td>DOWEL PIN</td>
<td>29</td>
<td>PISTON</td>
<td>47</td>
<td>BACKUP RING</td>
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<tr>
<td>12</td>
<td>CIRCLIP</td>
<td>30</td>
<td>ROD</td>
<td>51</td>
<td>BUSH</td>
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<tr>
<td>13</td>
<td>DU-BEARING</td>
<td>31</td>
<td>HEAD FLANGE</td>
<td>52</td>
<td>MECHANICAL END STOP</td>
</tr>
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<td>14</td>
<td>PLUG</td>
<td>32</td>
<td>END FLANGE</td>
<td>53</td>
<td>POSITION INDICATOR SHAFT</td>
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<td>15</td>
<td>FLANGE</td>
<td>33</td>
<td>O-RING</td>
<td>54</td>
<td>SCREW</td>
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<td>16</td>
<td>GASKET</td>
<td>34</td>
<td>ROAD SEAL</td>
<td>55</td>
<td>POSITION INDICATOR DRIVE BAR</td>
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<tr>
<td>17</td>
<td>SCREW</td>
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<td>PISTON SEAL</td>
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<tr>
<td>18</td>
<td>O-RING</td>
<td>36</td>
<td>O-RING</td>
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Refer to the Manual Distributor sectional assembly drawing below:

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<tr>
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<th>DESCRIPTION</th>
<th>ITEM</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>1</td>
<td>DISTRIBUTOR BODY</td>
<td>13</td>
<td>CYLINDRICAL PIN</td>
</tr>
<tr>
<td>2</td>
<td>DISTRIBUTOR</td>
<td>14</td>
<td>HELICOIDAL PIN</td>
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<td>3</td>
<td>CLOSING FLANGE</td>
<td>15</td>
<td>CIRCLIP</td>
</tr>
<tr>
<td>4</td>
<td>HANDLE</td>
<td>16</td>
<td>CIRCLIP</td>
</tr>
<tr>
<td>5</td>
<td>HANDLE STOPPER</td>
<td>17</td>
<td>BALL</td>
</tr>
<tr>
<td>6</td>
<td>PLUG STOP RING</td>
<td>18</td>
<td>SOCKET HEAD SCREW</td>
</tr>
<tr>
<td>7</td>
<td>DISTRIBUTOR CAP</td>
<td>19</td>
<td>CAP</td>
</tr>
<tr>
<td>8</td>
<td>PLUG</td>
<td>20</td>
<td>O-RING</td>
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<tr>
<td>9</td>
<td>PLUG SPRING</td>
<td>21</td>
<td>O-RING</td>
</tr>
<tr>
<td>10</td>
<td>HANDLE WASHER</td>
<td>22</td>
<td>O-RING</td>
</tr>
<tr>
<td>11</td>
<td>HANDLE CAP</td>
<td>23</td>
<td>O-RING</td>
</tr>
<tr>
<td>12</td>
<td>HEX-NUT</td>
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<td></td>
</tr>
</tbody>
</table>
Refer to the Pump sectional assembly drawing below:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>ITEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>HAND PUMP BODY</td>
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<td>DRAIN SCREW</td>
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Refer to the Solenoid Valve sectional assembly drawing below:

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<td>SOCKET HEAD SCREW</td>
<td>1500</td>
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</table>
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 55.

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:

(Refer to page: 37 for sectional assembly drawing)

- Remove the screw (item 54) placed in the bottom of position indicator shaft (inside the scotch yoke)
- Remove the position indicator shaft on the top of actuator frame
b. Removal of Cylinder sub assembly from Frame & disassembly:
   (Refer to page: 37 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)
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.

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<table>
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<tr>
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<th>ITEM</th>
<th>DESCRIPTION</th>
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Schlumberger-Private
Frame sub assembly: (See the Exploded view below)
ITEM | DESCRIPTION       | Qty | ITEM | DESCRIPTION                        | Qty  
---|-------------------|-----|------|------------------------------------|------
1  | FRAME             | 1   | 18   | O-RING                             | 4    
2  | COVER             | 1   | 20   | POSITION INDICATOR DRIVE BAR       | 1    
3  | SCOTCH YOKE       | 1   | 21   | ROLL PIN                           | 2    
4  | BUSHING           | 2   | 22   | WASHER FOR INSPECTION FLANGE       | 8    
5  | GUIDE BLOCK       | 1   | 23   | SCREW                              | 8    
6  | SLIDING PIN       | 1   | 24   | O-RING                             | 2    
7  | SLIDING BLOCK     | 2   | 25   | LOCK SCREW                         | 1    
8  | FRAME SEAL        | 1   | 26   | O-RING                             | 1    
9  | GUIDE BAR         | 1   | 27   | SOCKET HEAD CAP SCREW              | 1    
10 | HEX.HEADED BOLT   | 26  | 28   | WASHER FOR FRAME COVER             | 26   
11 | DOWEL PIN         | 6   | 30   | POSITION INDICATOR SHAFT           | 1    
12 | CIRCLIP           | 2   | 31   | POSITION INDICATO ARROW            | 1    
13 | DU-BEARING        | 2   | 32   | CLOSING FLANGE                     | 2    
14 | PLUG              | 1   | 33   | SCREW FOR CLOSING FLANGE           | 8    
15 | FLANGE            | 1   | 34   | BOLT FOR CLOSING FLANGE            | 8    
16 | FLANGE SEAL       | 1   | 63   | O-RING                             | 2    
17 | FLANGE SCREW      | 8   | 64   | SEAL WASHER                        | 16   

Disassembly of Frame sub assembly:

1. Remove the screw (item 27) into the scotch yoke, in order to disassemble the position indicator (item 30).
2. Now loosen and remove the hex headed bolts (item 10) and the cover (item 2).
3. Place the hex bolts (item 10), the frame seal (item 8) and the washers (item 28) on table, away from frame.
4. Loosen and remove bolts (item 33) and nuts (item 34) and remove the closing flange (item 32), if provided.
5. Place the o-rings (item 63) and the seal washers away (item 64).
6. Partially remove the guide bar (item 9), remove the o-rings (item 24) and place them on table, away from frame.
7. Remove the guide bar (item 9).
8. Remove the scotch yoke (item 3) from lower bushing (item 4) and place it on the table, paying attention to the o-ring (item 18).
9. Disassemble the circlip (item 12) and remove the sliding pin (item 6) and the sliding block (item 7), in order to remove the guide block (item 5).
B. Reassembly:

a. Frame sub assembly (Refer the page 50 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.

1. Place the actuator frame (item 1) on a suitable work bench in horizontal orientation resting on its base.
2. Check that the bushing (item 4) and the o-rings (item 18) are properly placed, with a thin film of grease.
3. On a separate work bench, place the scotch yoke (item 3), and put the guide block between the cams.
4. Install the sliding pin (item 6) in the guide block (item 5).
5. Insert the sliding block (item 7) into both ends on sliding pin (item 6) and anchor them using the circlips (item 12).
6. Lift the scotch yoke assembly and insert it into the bushing (item 4), previously positioned into the bottom of the frame.
7. Lubricate the du-bearings (item 13) into the guide block (item 5) and insert the guide bar (item 9).
8. Before completely inserting the guide bar (item 9), install and lubricate the o-rings (item 24) in their grooves.

*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 48 for 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. If required, install also the back-up ring into its groove, in the head flange.

3. Install the piston seal (item 35) onto the piston (item 29) and gradually screw the piston assembly into the piston rod (item 30).

**Note:** While threading the piston rod in the piston apply Loctite 270 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, guide slider (item 37), and the head flange seal without damaging the seals (lubricate the seals with suitable grease).

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. If required, install also the back-up ring into its groove, in the end flange.

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 (lubricate the seals with suitable grease).

9. Install the tie rod washers (item 41) and nuts (item 40), once adjustments have been made to ensure proper alignment of end flange and that the tie-rods are perpendicular (square) to the end flanges, tighten according to the torque table at page 16.

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 37 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. Assemble on the scotch yoke, the position indicator shaft (item 53), threading the screw (item 54) into the drive bar (item 55).
10. Check the bushing in frame cover and apply grease film.
11. Slowly lower the frame cover and place in position by means of locating pins and fasteners.
12. 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 50):
   
   • Item 8, qty. 1
   • Item 16, qty. 1
   • Item 18, qty. 4
   • Item 24, qty. 2
   • Item 26, qty. 1
   • Item 63, qty. 2
   • Item 64, qty. 16

2. End stroke Assembly (For double acting actuator)
   (Refer to frame assembly exploded view on page 50):
   
   • Item 24, qty. 2

3. Cylinder sub Assembly
   (Refer to hydraulic cylinder assembly exploded view on page 48):
   
   • 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 39):
   
   • 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 40):
   
   • Item 220, qty. 1
   • Item 230, qty. 1

6. Solenoid Valve
   (Refer to solenoid valve sectional drawing view on page 41):
   
   • Please contact cameron.slb.com for repair kit