INSTALLATION
MAINTENANCE

- General overview
- Tooling
- Installation
- Hydraulic remote control
- Adjustment of opening or closing adjustable end stops
- Actuator disassembly
- Actuator re-assembly
- Trouble-shooting

KSB is ISO 9001 approved
The purpose of this manual is to describe the installation/maintenance procedures and actions to be carried out in case of breakdowns or faulty operation of the ACTO 25 to 200 hydraulic actuators.

**OVERVIEW**

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<td>Circlips</td>
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* 412.4 : for ACTO 50 – 100 and 200
  412.6 and 412.7 : for ACTO 25
* 310.3 : for ACTO 25 – 50 and 100
  310.4 : for ACTO 200
RECOMMENDED TOOLS (not supplied)
- Pneumatic screwing machine
- Mallet
- Open ended spanner 10 and 13
- Allen key 4
- Spur spanner Ø 7
- Clamp spring retaining ring
- Threaded rod M 12 for ACTO 100 et 200

SPECIAL TOOLING (not supplied)
- Definition drawings

TEST EQUIPMENT (not supplied)
- Hydraulic power pack 0–350 bar

CONSUMABLES
- Superflux HV46 oil
- Grease EPEXELF MO2 (Elf) or RETINAX HDM (Shell) or equivalent

INSTALLATION

BEFORE ANY ACTION
- Index the mounting position of the actuator onto the valve (Position N or M)
- Index the mounting position of the position plate 970.2 onto the housing 103
- Index the index position of the pinion 877 in comparison with the indications of the position plate 970.2

ADAPTATION
The adaptation onto the valves is achieved either directly or through adaptor parts:
- interchangeable inserts manufactured to the size and the shape of the different valve shafts
- adaptor flanges for coupling.

ACTUATOR POSITION ONTO THE VALVE
The actuator can be positioned in 4 positions, at 90° intervals.
Standard arrangement is N position 1
When a manual override is fitted on the actuator, the actuator should be mounted in accordance with M position 2.
If the actuator is disconnected, fit it onto the valve following the steps as defined before the uncoupling, then drain the actuator.

The arrangement position can be modified at site. The procedure below should be followed as well as the specific assembly operations as described in the maintenance procedure.

TRANSFORMATION Position N → Position M:
- remove the circlips 932,
- remove the pinion 877 from the rack,
- rotate pinion of 90° and re-insert in the rack,
- put in place the circlips 932,
- remove the 2 screws 901,
- rotate the position plate 970.2 of 90°,
- remove the 2 screws 901.
DRAINING PROCEDURE

PIPING CONNECTION
All components and pipework must remain sealed until connected.
All openings must be fitted with recommended plugs.
Pickling of internal surfaces of pipework is always necessary when pipes and fittings contain scale, corrosive products, magnetic particles or when pipeworks have to be welded or heated.
Pickling must be confined only to the pipework. All sensitive components (actuators, solenoid valves, deck boxes, ...) are to be isolated and bypassed. All traces of pickling, neutralising and cleansing solutions must be removed from the system before connection and oil filling.

DRAINING
All newly installed hydraulic systems require cleaning to remove foreign matters and any contamination.
In order to reduce the circulation time; it is advised to perform a first injection with nitrogen under a 30–40 bar pressure for a 30 second to 1 minute period.
All elements, part of the system (hydraulic power pack, distribution panel or stand, actuators) are delivered perfectly clean, with obturated ends.
Therefore, it is most important to flush all the pipe connections to the various equipment:
- hydraulic power pack towards solenoid valves rack or deck boxes
- solenoid valves rack or deck boxes towards the actuators.
Flushing through KSB AMRI components is not allowed.
All components must be disconnected or by-passed.

It is recommended to use the KSB-AMRI flexible connector R471-10200.
This equipment can be connected to the hydraulic block fitted on the actuator.

All opened lines and parts must be efficiently sealed.

Under no circumstances, process pumps should be used for flushing.
The pump used for flushing must be a dedicated unit and be external to the system. The pump capacity should be such that the flow speed be maintained at a minimum of 5m/s to 8m/s (turbulent flow) throughout the system.
Oil must be introduced through the filling orifice; it should be properly filtered in accordance with cleanliness standards in force.
The filter must have the ability to accommodate the high flow rates required for turbulent flow flushing.
The required cleanliness class must be minimum ISO 18/15 according to ISO 4406 standards (equivalent to NAS 1638 class 9).

SYSTEM FILLING
During the filling operations, the flowmeter must be protected, therefore:
- after flushing connect the hydraulic pipes to the components
- open the flow restrictors F,

- connect the flexible connector R471–10200 to the hydraulic block fitted on the actuator, valve V closed.
- disconnect flexible connector from the closed connection,
- open the valve V,
- operate the solenoid valve (4 way 3 position see note) to open direction,

- when the oil flows out of the flexible connector
  Close the valve V,

- connect the flexible connector to the open connection and disconnect it from closed connection,
- Open the valve V,

- operate the solenoid valve (4 way 3 position see note) to closing direction,
- when the oil flows out of flexible connector close the valve V,
- disconnect the flexible connector from the hydraulic block.

NOTE:
- Before operating the 4 way 2 position solenoid valve before operating in the required position, close the valve rack pressure isolating valve
- To supply oil to the hydraulic pipe open the pressure isolating valve.

DRAINING
- connect the flexible R471-10200 to the actuator, valve V closed,
- open the valve V,
- open the flow restrictors F,
- operate the solenoid valve to opening direction,
- let the oil circulate for a 15 minute minimum period,
- operate the solenoid valve to closing direction,
- let the oil circulate for a 15 minute minimum period,
- close the valve V,
- disconnect the flexible from the actuator.
ADJUSTMENT OF STANDARD CLOSING ADJUSTABLE END STOPS

Adjustment amplitude: +/- 2°

Adjustable end stops are adjusted in the factory and do not need further adjustment at site.

This is of utmost importance for the perfect tightness of the valve.

After any intervention on the actuator, the correct adjustment of the adjustable end stops must be verified. If need be, this adjustment will be modified as per the following procedure.

These operations are carried out on the two sides of the actuator.

- Disconnect the air supply,
- Remove the plug 916.2 and the sealing washer 411, unscrew by one turn the screw 904
- Screw or unscrew the cylinder cover 916.1 to increase or decrease the stroke of the rack.

The correspondence between +/- 2° and the length between the face of the mounting plate and the housing cylinder is the following:

- ACTO 25: X = +/- 0.70mm (approx. 1/3 turn of plug)
- ACTO 50: X = +/- 0.90mm (approx. 1/2 turn of plug)
- ACTO 100: X = +/- 1.10mm (approx. 1/2 turn of plug)
- ACTO 200: X = +/- 1.40mm (approx. 2/3 turn of plug)

For a good operation of the equipment, never exceed these values.

- Regularly check by putting under pressure the actuator until the adequate adjustment position is found.

- Tighten the socket screw 904 then replace the sealing washer 411 and the plug 916.2
ACTUATOR DISASSEMBLY

- Disconnect the air supply
- Remove the actuator and accessories from the valve and place on a work bench
- Remove the accessories of the actuator
- Remove the position plate 970.2 and the lip seal ring 415.2

- Remove the circlips 932

- Extract the sub-unit pinion 877, O-rings 412.2 and 412.3, self-lubricating bearings 310.2 and 310.3 (ACTO 25-50 and 100)
- Extract plugs 916.2, sealing washers 411 and unscrew by 5 turns the screws 904

- Unscrew cylinder covers 916.1 and extract O-rings 412.1 and 412.5
- Remove the rack 87-15:
  - by pushing on the extremity
  - or in case of ACTO 100 and 200 (rack with threaded hole M12)
    by pulling using a threaded rod M12 screwed in the rack

- Extract the 2 lip seal rings 415.1 of the housing.
ACTUATOR RE-ASSEMBLY

PREPARATION OF PARTS

All constitutive parts of the spare kits must be used.
- Check the internal cleanliness of the housing 103 and eliminate all the dirt
- Mount the self-lubricating bearing 310.3 in the housing 103.

For this operation, it is advised to use tools as defined below.

This operation is not carried out on ACTO 200, the self-lubricating bearing 310.4 is not in the kit.

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<tbody>
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<td>25</td>
<td>46.5</td>
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<td>-0.025</td>
<td>-0.05</td>
<td>48</td>
<td>112</td>
<td>31</td>
<td>-0.025</td>
<td>-0.064</td>
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<tr>
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<td>59</td>
<td>43</td>
<td>+0.062</td>
<td>61</td>
<td>-0.025</td>
<td>-0.05</td>
<td>61.5</td>
<td>140</td>
<td>41</td>
<td>-0.025</td>
<td>-0.064</td>
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<td>+0.062</td>
<td>74.5</td>
<td>-0.025</td>
<td>-0.05</td>
<td>91</td>
<td>186</td>
<td>48</td>
<td>-0.025</td>
<td>-0.064</td>
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<td>+0.074</td>
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<td>105.5</td>
<td>207</td>
<td>65</td>
<td>-0.03</td>
<td>-0.076</td>
</tr>
</tbody>
</table>

Material: Aluminium
- Brush clean the pinion 877, the rack 87-15 and cylinder covers 916.1. Ensure constantly these are free from shocks or scores on the sealing surfaces and bearings. Lightly sand-paper if necessary.

Any shocks or scores not eliminated on the lip sealing surfaces of the rack make it unusable.

- Grease and mount O-rings

- O-rings 412.2 and 412.3 on pinion 877
  ==> sub-unit pinion

- O-rings 412.1 and 412.5 on cylinder cover 916.1
  ==> sub-unit cylinder cover

- Lip seal ring 415.2 on position plate 970.2 ==> sub-unit position plate
RE-ASSEMBLY

Strictly follow the order of operations

1 - Tighten of a few turns the first cylinder cover sub-unit until the overlap dimension Y of cylinder cover face compared to the end of the housing cylinder is obtained.

   ACTO 25 : Y = 12 mm
   ACTO 50 : Y = 13 mm
   ACTO 100 : Y = 16.5 mm
   ACTO 200 : Y = 21 mm

2 - Lubricate the rack 87-15 and slide it cautiously in the opposite end (using a flat rod M12 for ACTO 100 and 200) until it contacts the cylinder cover 916.1.
   Extract the threaded rod.

3 - Mount 1st lip seal ring 415.1 in its groove
   Special care:
   lips outwards direction.
   Lightly lubricate the lips.
   Check the perfect insertion into its groove

4 - Tighten of a few turns the second cylinder cover sub-unit and proceed as for the first one.

5 - Extract the first cylinder cover sub-unit and slide the rack cautiously until it contacts second cylinder cover 916.1.

6 - Mount the second lip seal 415.1 – and proceed in the same way as operation 3

7 - Tighten the first cylinder cover sub-unit until Y = 0 (use preferably the spur spanner Ø 7)
8 - Carry out the operation 7 for the 2nd sub-unit cylinder cover.

9 - Test the functional tightness by putting under pressure each chamber:

- Oil pressure between 120 and 160 bar
- Duration: 5 minutes per chamber

Check the perfect tightness at the level of:
- lip seal ring 415.1: leakage inside the housing
- O-rings of cylinder cover 12.1: leakage at the orifice of screws 904

Should leakage occur, disassemble all parts and:
- Check the surface of the rack and lip seal rings (415.1 in particular) and replace if found faulty.
- Start again very carefully the assembly from operation N° 1 until perfect tightness is obtained as per operation Nr 9
- Go to next step

10 - Tighten screw 904 until blocked and fit plugs 916.2 with their corresponding washers 411.

11 - Manually drive the rack in closed position.

12 - Grease abundantly the pinion teeth 877 and self-lubricating bearing face.

13 - Fit the self-lubricating bearing 310.2 on pinion sub-unit.

14 - Progressively insert the sub-unit pinion into the actuator following the initial indexes.

15 - Put in place the circlips 932.

16 - Mount the sub-unit position plate following the initial indexes.

17 - Pressurize the actuator and check the good operation.

18 - Adjust end stops as described in the § Adjustment of opening or closing adjusting screws.

19 - Fully reassemble the actuator in its initial construction.
### TROUBLE SHOOTING

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<th>Issue</th>
<th>Solution</th>
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<td>Damaged O-rings 412.1 and 412.5</td>
<td>Change O-rings 412.1 and 412.5</td>
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<tr>
<td>Damaged check valve 486.2</td>
<td>Change the sub-unit cylinder cover 916.1 + O-rings 412.1 and 412.5</td>
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<tr>
<td>Damaged lip seal ring 415.1</td>
<td>Change O-rings 415.1 and/or 412.3 and/or 412.2 and 415.2 + check the cleanliness of the oil in the actuator</td>
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<tr>
<td>Damaged O-rings of the interface</td>
<td>Change O-rings of the interface</td>
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<tr>
<td>Mechanical override clutch on or opened by-pass</td>
<td>Disconnect the hydraulic pressure Clutch the manual override and/or close the by-pass</td>
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<tr>
<td>Absence or insufficient pressure</td>
<td>Check the hydraulic power pack and its components</td>
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<tr>
<td>Blocked valve</td>
<td>Check the valve and/or the interface with the pipe</td>
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<tr>
<td>Internal leakages</td>
<td>Change the lip seal ring 415.1</td>
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<tr>
<td>Corrosion : pinion 877 seized Mechanical components broken</td>
<td>Change the actuator</td>
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<tr>
<td>Check valve seized or damaged</td>
<td>Check the hydraulic block</td>
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<tr>
<td>Wrong applicabilities</td>
<td>Consult leaflet 8506</td>
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<tr>
<td>Wrong interface</td>
<td>Check the driving and/or the adapter flange Consult technical leaflet 8506 or contact the manufacturer</td>
</tr>
<tr>
<td>Wrong adjustment of travel stops</td>
<td>Refer to § &quot;Adjustment of travel stops&quot; of the maintenance manual</td>
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<tr>
<td>System improperly drained</td>
<td>Drain the actuator according to the procedure of the maintenance manual</td>
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<tr>
<td>Closed actuator / Valve opened or Valve closed / Actuator opened</td>
<td>Put valve and actuator in the same position</td>
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<td>Loss of air pressure</td>
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<tr>
<td>Wrong assembly of the actuator onto the valve</td>
<td>Turn the actuator or the pinion 877 by 90°</td>
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**Related Item**

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