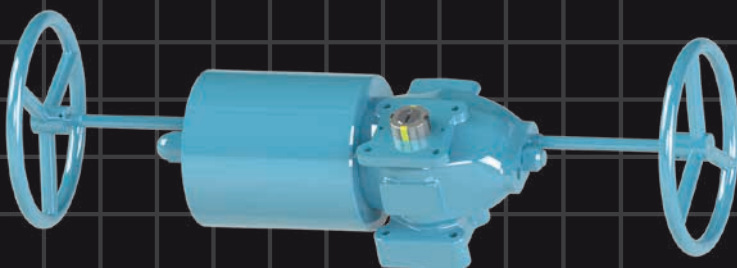
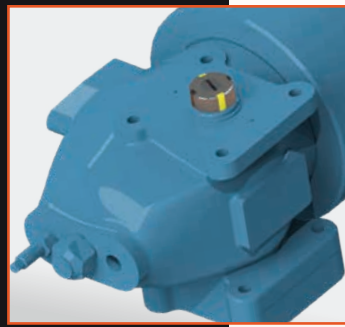
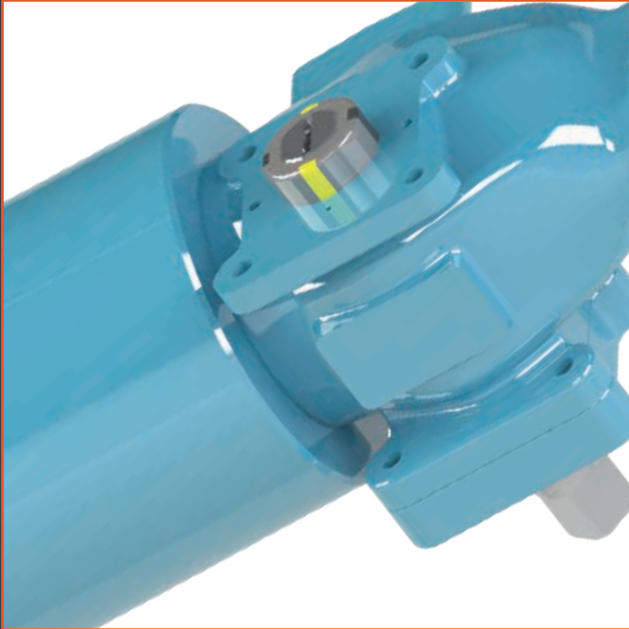


TORQTURN®

QUARTER TURN SCOTCH YOKE ACTUATORS PNEUMATIC ACB



**AUSTRALIAN
PIPELINE VALVE®**



AUSTRALIAN PIPELINE VALVE®

COMPLETE PRODUCT LINE

“Australian Pipeline Valve produces isolation, control and flow reversal protection products for severe and critical service media in utility, steam, pipelines, oil & gas and process industries. APV valves and pipeline products form the most competitive portfolio in the market.”



SUPER-CHECK®



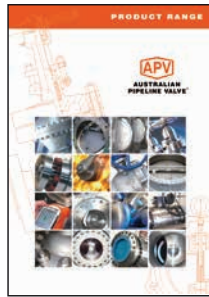
TORQTURN®

TWIN-LOK®

UNIFLO®



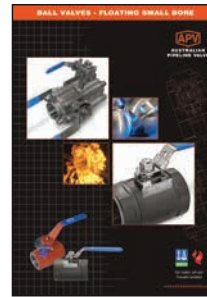
AUSTRALIAN PIPELINE VALVE BRAND RANGE - CATALOGUES



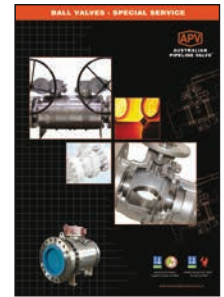
Product Brochure



Ball Valves Floating & Trunnion Mounted



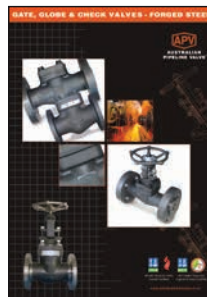
Ball Valves Floating Small Bore



Ball Valves Special Service



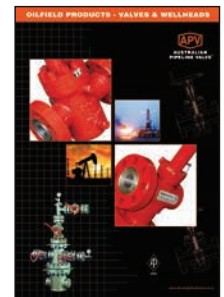
Gate, Globe & Check Valves - Cast Steel



Gate, Globe & Check Valves - Forged Steel



Plug Valves Lubricated, Sleeved & Lined



Oilfield Products - Valves & Wellheads

APV FAMILY OF BRANDS RANGE - CATALOGUES



Diamond Gear Gearboxes



Flowturn Ball Valves Multiway & Deadman



Flowturn Gate, Globe & Check Valves



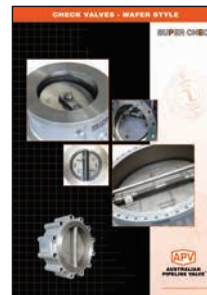
Flowturn Instrument Valves



Flowturn Strainers & Sight Glasses



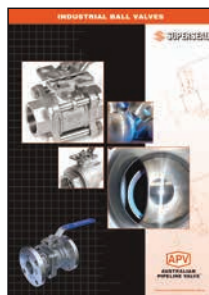
Steamco Steam Valves



Supercheck Wafer Check Valves



Superseal Butterfly Valves



Superseal Industrial Ball Valves



Torqturn Actuators



TwinLok Tube Fittings



Uniflo Check Valves

Contact us for your local stockist/distributor

INDEX



Introduction	3-4
Safety Information	4
1.0 Storage & Handling	5
2.0 Installation Notes	5-7
2.1 Actuator sizing	6-7
3.0 Commissioning	8
4.0 Maintenance Instructions	8-9
4.1 Repairs	9
5.0 Operation Notes	9-11
5.1 Operation types	10
5.2 Manual over-ride operation	10-11
5.3 Stroke adjustments	11
6.0 Spare Parts Supply	11
7.0 Repair Instructions	12-14
7.1 General maintenance information	12-13
7.2 Abbreviations used (options)	13
7.3 General safety information	13
7.4 APV references	13
7.5 Maintenance support items	13-14
7.6 Lubricant requirement	14
7.7 General tool information	14
7.8 Weight of the actuator	14

INDEX CONT'D



8.0 Disassembly	15-18
8.1 General disassembly	15
8.2 Further disassembly	16-17
8.3 Remove the drive housing	17-18
9.0 Reassembly	18-23
9.1 General reassembly	18-19
9.2 Reassembly of the main drive box	19-21
9.3 Reassemble the spring barrel	21-23
10.0 Testing	24
10.1 Test actuator	24
10.2 Putting the device back into use	24
11.0 Common Faults	25
11.1 Common faults of actuator and solutions	25
Appendix A - Actuator disassembly & reassembly	26-30
Appendix B - Air supply operation	31
Appendix C - ACB Sample bill of materials	32-34
Appendix D - Travel stop adjustment	35
Appendix E - Symmetrical torque charts	36-37
Warranty	38



Catalogues, photos, brochures and technical publications are the exclusive property of Australian Pipeline Valve. Any unauthorised reproduction in total or in part, shall result in prosecution. Products and data sheets in this publication are subject to change at anytime without notice. Australian Pipeline Valve reserves the right to carry out amendments to products and materials.

INTRODUCTION

APV-Torqturn actuators are extremely strong, compact and can be specified for services with a wide range of pressures, temperatures and environments, for use in various valve sizes and types.

The majority of this information is common knowledge to experienced valve & actuator users. When properly installed in applications for which they were designed, Australian Pipeline Valve (APV) - Torqturn actuators will give long reliable service. This instruction is only a guide for installation and operation on standard service and covers general maintenance and minor repairs. A professional APV approved actuator engineering facility should be utilised for reconditioning or major repairs.



Note

We recommend that this entire document be read prior to proceeding with any installation. Do not attempt to repair this actuator, send it to APV or an APV approved repair facility. Australian Pipeline Valve and its parent company take no responsibility for damage or injury to people, property or equipment. It is the sole responsibility of the user to ensure only specially trained actuator repair experts perform repairs under the supervision of a qualified supervisor.

RESPONSIBILITY FOR VALVE & ACTUATOR APPLICATION

The User is responsible for ordering the correct valves & actuators. The user is responsible for ensuring APV Valves & Actuators are selected and installed in conformance with the current pressure rating and design temperature requirements. Prior to installation, the nameplates and drawings should be checked for proper identification to ensure the valve & actuator is of the proper type, material and is of a suitable pressure class and temperature rating to satisfy the requirements of the service application.



Caution

Do not use valves & actuators in applications where either the pressure or temperature is higher than the allowable working values. Also, actuators should not be used in service media if not compatible with the material of construction, as this will cause chemical attacks, leakage and failure.

RECEIVING INSPECTION AND HANDLING

Valves & Actuators should be inspected upon receipt to ensure:

- Conformance with all purchase order requirements.
- Correct type, rating, size, body and materials and end connections.
- Any damage caused during shipping.

**Caution**

The User is advised that specifying an incorrect valve or actuator for the application may result in injuries or property damage. Selecting the correct valve and actuator type, rating, material and connections, in conformance with the required performance requirements is important for proper application and is the sole responsibility of the user.

SAFETY INFORMATION

The following general safety information should be taken in account in addition to the specific warnings and cautions specified in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered in this I.O.M.

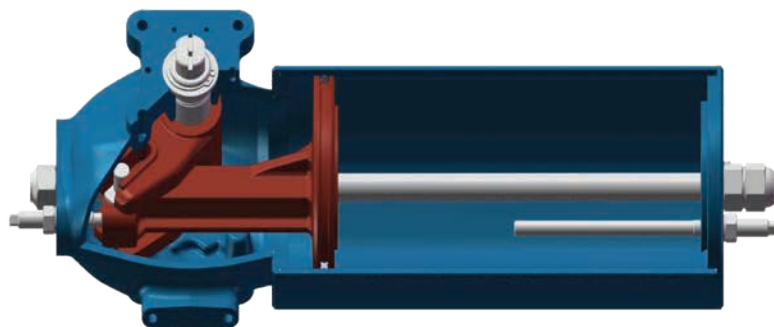
**Caution**

To avoid injury, never attempt disassembly while there are pressures either upstream or downstream. Furthermore, actuators with spring packs can rapidly close or open the valve on failure of air supply with extreme force.

**Caution**

Spring packs are factory sealed and can be dangerous. Do not attempt to disassemble spring pack, send to an APV approved repairer. Never put your hand inside the valve bore while the actuator spring is energised.

This manual provides instructions for storing, general servicing, installation and removal of actuators. APV and its re sellers refuses any liability for damage to people, property or plant as well as loss of production and loss of income under any circumstances but especially if caused by: Incorrect installation or utilisation of the actuator or if the actuator installed is not fit for intended purpose. It is the sole responsibility of the user to ensure the valve type and materials are correctly specified.



1.0 STORAGE & HANDLING

To ensure the seals remain flexible, and the actuator itself free moving during times of storage or intermediate services, air or nitrogen pressure should be cycled through the actuator at a minimum of three (3) times a month. Indoor storage is recommended for actuators in an environment where resilient seals can be preserved. To help keep out foreign particles and moisture; cylinder ports, control valve parts and body parts should be kept sealed.

2.0 INSTALLATION NOTES

Remove any existing manual gearing from the valve and move into the same position as the actuator (either both open or both closed). Inspect the stem adapter, valve stem, valve and actuator mounting surfaces for proper direction and any inconsistencies. In cases where the valve includes a lubricator fitting, this should be removed and a lubricator extension nipple installed. Refit the lubricator fitting into the extension nipple. If furnished loose, install the bushing for the stem adaptor over the valve stem, correctly position the set screw and mount actuator over bushing (parallel to the pipe). All nuts and bolts should be fastened evenly, ensuring the actuator is centred on the valve stem. Note: whilst the mounting bolts are loose, the actuator can be cycled to help centre itself.

There are many actuator and valve variations, therefore it's not practical to list instructions for all kinds. The design of the mountings are kept simple for ease of installation. Actuators are factory shipped with the travel stops regulated for 90° revolution. However once the actuator is installed on the valve it will still require further stop adjustments. Reference should be made back to the valve manufacturer's recommendations for particular requirements. For valves that contain internal stops, the actuator must be adjusted at the same points. The "stopping" should be performed by the actuator itself. For valve without internal stops, adjust the actuator to the full open setting. Using this as a reference point, position the valve closed and adjust to the specifications recommended by the valve manufacturer for total rotation. High strength grades of steel like 410, F6, F51, 303, S31803, XM-19, Nitronic 50, 4140 and 17-4 PH are preferred for stem adaptors.



Caution

All factors shown in section 2.1.1 to 2.1.3 are an estimating guide only and are based on more common smaller size valves. It is impossible to accurately estimate the effect on torque all the below factors will have. However, sections 2.1.1 to 2.1.3 provide a rough guide and serve as a warning to ensure users are aware of the dramatic effect all the given factors can have on torque.

2.1 ACTUATOR SIZING

2.1.1 General Sizing Rules for Soft Seated Ball Valves

Valve and actuator torque values published are theoretical, however where required APV will perform a torque test prior to despatch. The real valve torque value can be higher depending upon the following listed factors as these factors can drastically increase (or decrease) the torque of soft seated ball valves. These factors will have a similar effect on soft seated butterfly valves. Metal to metal seated ball, butterfly and plug valves will also be effected but the torque implications will vary.

- 1) Fluid carrying dust, powder, abrasive particles (+50% to 125%). In extreme cases can be higher. i.e. Up to 200%.
- 1a) Slurry, pulp, resins, paste (+50%) can be much higher in some cases.
- 2) Dry service (Dry Gas) (+30%).
- 3) High or low temperature (consult us).
- 4) Infrequent use (+30-50%) *1 - *2.
- 5) If a higher minimum air supply than used in the calculation is available more torque will be produced in the air operation phase, (do not exceed maximum air capacity of the actuator).
- 6) Torque is based on a maximum Delta P for class. If your actual working pressure is lower please advise as a smaller actuator may be possible.
- 7) Lubricated service (clean oil or other high lubricity fluid) (+15%).

*1 PTFE/RPTFE seats can require more torque to unseat after a period of time due to it's fluidity & memory. For Devlon/Nylon Seat the valve torque is higher and PEEK® is even higher (of course this should be factored into torque of valve where applicable), however as these are harder materials (especially PEEK®) infrequent use has a lesser effect on the increase in torque.

*2 Where set fail closed, additional infrequent use safety factor only needs to be applied to spring stroke torques. Allow additional 50% safety factor if valve is being operated less than once per month.

2.1.2 Actuator Sizing for Ball Valves

The following 'ready reckoner' is only a rough estimating guide* to calculate the torque values required to turn a ball valve through it's 90° travel. Consider torque requirements at these five basic positions:

- BTO - Break open torque: the torque required to unseat the closed valve. 100% of the stated torque.
- RTO - Opening torque: the torque needed to move the valve to the fully open position. Average 70% of stated BTO torque*.
- ETO - Open breakout torque: the torque required to move the valve from the fully open position. 70% of stated BTO torque*.
- ETC - Closing torque: the torque required to reseat a closing valve. 85% of stated BTO torque*.
- RTC - Running torque: the torque needed to keep the ball moving through it's travel. 50% of stated BTO torque*.
- MAST- Maximum stem torque - refer to manufacturer.

*Average guide based on floating ball and smaller size trunnion ball valves. Large trunnion ball valves have slightly different ratios. Butterfly and plug valves have totally different ratios.

2.1.3 Elements that Affect Soft Seated Ball Valve Operating Torque

The below factors are only for use as a rough estimating guide only and apply to smaller diameter ball valves. Furthermore, the effects the following factors have will vary for trunnion ball valves, even in smaller sizes. For trunnion ball valves it is impossible to provide accurate multipliers however, the below factors will affect all types of soft seated valves in all sizes to a certain degree and should be taken into account when specifying safety factors.

For a particular size and differential pressure, the torque of soft seated ball valves depend on many factors. Use the torque multipliers stated below with the selected valve's stated 'break', 'end to close' and 'end to open' torques as needed for your application.

Seat Material: The friction force or degree of holding force depends on the seat material type.

Seat Material	Seat Type Multiplier *1
15% - 25% Glass RPTFE	1.0
Virgin PTFE	0.8
Carbon Graphite RPTFE	1.0
PEEK	2.3
Delrin	2.0

*1 - For floating ball valves up to 175 NM. For larger valves consult us.

Fluid Type: Torque values depend on media type. Torque will become higher with dry, gasses or liquids with solids and lower with oils. Torque multipliers are shown in the table (based on normal temperatures).

Fluid	Fluid Type Multiplier
Gas or superheated steam, clean/dry	1.2 - 1.3
Viscous fluid	1.4 - 1.6
Liquids containing abrasive solids	1.3 - 2.0*2
Clean/non-lubricating	1.0
Clean/lubricating	0.8

*2 - Can be higher

Frequency of Operation: When a valve remains in closed position for extended periods of time, the breakout torque increases.

Frequency	Frequency Multiplier
Once per day or greater	1.0
Once per week or greater	1.3
Once per month or greater	1.4
Once per 4 months or greater	1.5
Critical ESD services	1.8

Temperature Effect: For operating temperature from 100°C to 218°C, use the torque multiplier given. For 0°C to 99°C no temperature multiplier is required. For operating temperatures less than 0°C and above 218°C consult Australian Pipeline Valve.

Temperature Multiplier = Temp °C ÷ 100

The above is an approximate guide only, for estimating purposes.

3.0 COMMISSIONING

If the unit has been left in the same position for long periods, the packings and seals may have set. This means that when the actuator is again operated, possible leakage may come from the piston seals or rod packings. Cycling the unit several times will activate the packings and seals to work efficiently.

Many factors will effect the rate of operation:

- a) how far away it is from the source of pressure
- b) the diameter and pressure of the supply line
- c) the size of the airline supply valve orifice
- d) the torque requirements of the valve
- e) the actuator size
- f) impurities in the valve stem seat
- g) temperature and viscosity of media

As any one of these factors effects the other, a typical operating time is difficult to forecast. However, operating time can be reduced as follows:

- a) larger diameter and higher pressure of the supply line
- b) larger airline control valve orifice size
- c) high speed exhaust valves

Flow control valves may be used to indicate the flow of exhaust however this will reduce running time. We do not recommend measuring the incoming source or exhaust flow to great lengths as this may cause inconsistent operation.

4.0 MAINTENANCE INSTRUCTIONS

Once the APV-Torqturn actuator has been correctly assembled and installed it is ready for operation. Lubricants used at the time of adjustment along with the durable design of the actuator mean routine maintenance is not usually required.

To ensure long service life, trouble free operation and minimal maintenance, components of actuators both pneumatic & hydraulic are lubricated. These include the gearing surfaces and bearings which are commonly covered with a teflon dry-film lubricant and corrosion inhibitor. Major internal components such as piston rods and tie bars are usually coated in electroless nickel or are stainless steel. All threaded fasteners, rollers, tracks, yoke bores, pins, gaskets and seals are coated with petroleum grease. The actuator should be re-lubricated at the beginning of each service interval.

In addition to lubricants, correct instrument practices are also important. Foreign particles and debris can damage components such as seals, the solenoid and control valves, etc. Clean, dry air, gas or hydraulic fluid should be of high priority for acceptable operation and longevity. To assist with unit

protection an in-line filter may be fitted to help prevent particles penetrating the cylinders of the actuator.

4.1 REPAIRS

Only a specialist actuator repairer should attempt repairs, if doing so take note of the following:

- a- The actuator's internal parts and external fitments shall be handled with care avoiding scratches or surface damage.
- b- All tools and equipment for handling the internal parts shall be soft coated.
- c- Actuators can be fitted with gaskets or seals in PTFE, Buna, Viton, etc., Hence high temperatures will damage sealing components.

For all operations make reference to position number on part list of the applicable drawing listed.

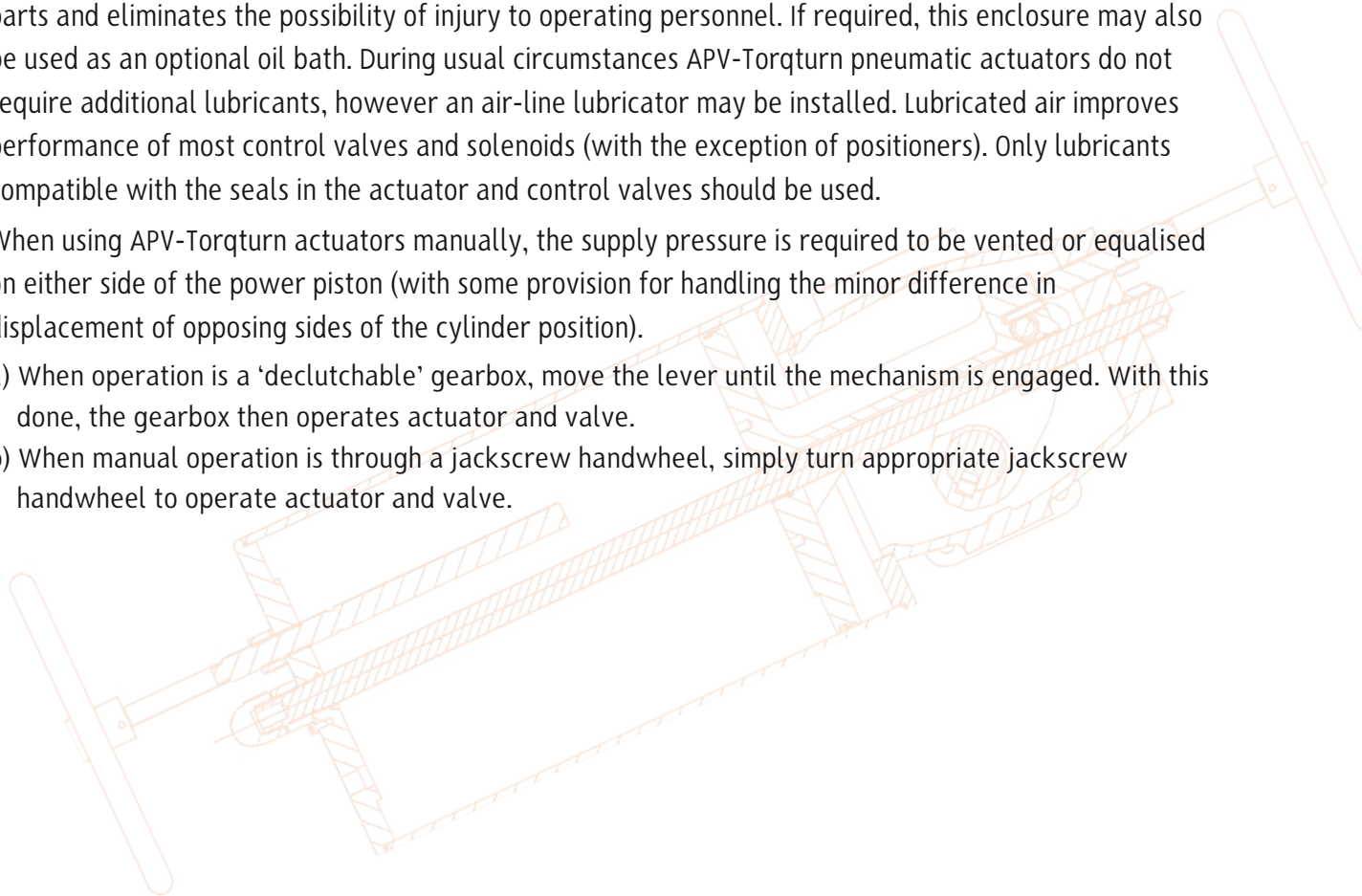
5.0 OPERATION NOTES

Typical operation of the actuator involves applying pressure to the appropriate pressure inlet(s) of a double acting or spring return cylinder by means of a suitable control valve. APV-Torqturn actuators are sized to ensure the required valve torque is produced at the supply pressure selected by the customer.

All APV-Torqturn actuators feature a fully enclosed body cavity which ensures protection for all moving parts and eliminates the possibility of injury to operating personnel. If required, this enclosure may also be used as an optional oil bath. During usual circumstances APV-Torqturn pneumatic actuators do not require additional lubricants, however an air-line lubricator may be installed. Lubricated air improves performance of most control valves and solenoids (with the exception of positioners). Only lubricants compatible with the seals in the actuator and control valves should be used.

When using APV-Torqturn actuators manually, the supply pressure is required to be vented or equalised on either side of the power piston (with some provision for handling the minor difference in displacement of opposing sides of the cylinder position).

- a) When operation is a 'declutchable' gearbox, move the lever until the mechanism is engaged. With this done, the gearbox then operates actuator and valve.
- b) When manual operation is through a jackscrew handwheel, simply turn appropriate jackscrew handwheel to operate actuator and valve.



5.1 OPERATION TYPES

5.1.1 Auto-Operation on/off

On/off operation for pneumatic & hydraulic actuated valve:

- A) The valve is open when solenoid valve is energised (fail close type)
- B) The valve is close when solenoid valve is de-energised (fail close type)
- C) The valve is close when solenoid valve is energised (fail open type)
- D) The valve is open when solenoid valve is de-energised (fail open type)

Refer to air inlet/exhaust points and operational diagrams in Appendix 1 to 3.

5.1.2 Modulating-Control Operation

Modulating control pneumatic & hydraulic actuated control valve:

- a) Input 4~20mA electric signals to the electro-pneumatic positioner, valve's open degree is proportionally regulated in 0°~90° stroke through different current size the positioner achieves.
- b) Input 0.02~0.1MPa air signals to the pneumatic-pneumatic positioner, valve's open degree is proportionally regulated on 0°~90° stroke through different air pressures the positioner supplies.

5.2 MANUAL OVER-RIDE OPERATION

5.2.1 Manual Over-ride

The following are manual types of over-rides available.

a. Declutchable Worm Gear Manual Over-ride

Double acting & spring return actuators are optionally available with a declutchable worm gear manual over-ride (refer Figure 1 & 2). Manual operating steps: firstly open the equalising valve on the pneumatic actuator, draw out the pull pin of the gear operator with one hand, simultaneously, use another hand to turn the clutch lever counter clockwise, until the worm and the worm gear engages, then release the pull pin. After the pin has returned into the eccentric sleeve, you can then operate the valve manually. Turn the handwheel clockwise to close the valve, turn the handwheel counterclockwise to open the valve. To return to automatic mode, first draw out the pull pin in the gear operator with one hand, simultaneously use another hand to turn the clutch lever clockwise until the worm and worm gear engages, then release the pull pin. After the pin has returned into the eccentric sleeve, close the equalising valve.

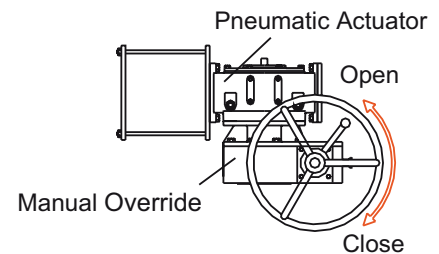


Figure 1

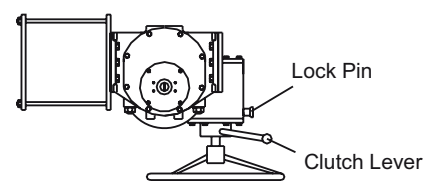


Figure 2

b. Jackscrew Operator Manual Over-ride

The jackscrew over-ride only available to suit single acting (spring return) and double acting (1 on each end) pneumatic actuators. The jackscrew handwheel over-ride operator (refer Appendix C) is a side mounted operator. Turning the handwheel, controls the valve position by screwing the trapezoid

screw into and out of the spring case (by compressing & decompressing the spring). To turn the valve, turn the jackscrew handwheel clockwise to compress the spring and move the valve one direction, counter-clockwise to decompress the spring and the valve will move in the other direction. If the actuator is set 'fail close' then compressing the spring will open the valve.

After manual operation, screw out the trapezoid screw until the spring is disengaged toward the actuator to return to auto-operation, check to ensure the spring can open fully and the spring is totally disengaged from the jackscrew. Avoid fully screwing out integral the trapezoid screw, as the screws also act as a position stop to ensure the valve is correctly returned to the full open or close position.

5.3 STROKE ADJUSTMENTS

The stroke adjustment (travel stop adjustment, refer Appendix D) can be made for double acting and spring return actuators from 80° to 100° as follows:

Loosen the stroke nut then:

- a. Screw out the limit screw increase the open position, screw in the open direction to decrease the open position.
- b. Screw out the close position stroke stop limit screw to increase the closed position, screw in the close direction to decrease the closed position.

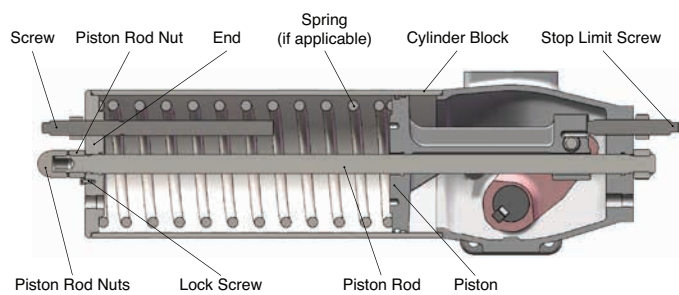


Figure 3



Note

Spring return actuators can be supplied “fail open” or “fail closed” hence open/close direction can be either way. If a manual over-ride jack screw is fitted in lieu of a stop limit screw it can also be adjusted to limit travel in the same way.



Note

Tighten the lock nut after adjusting the appropriate on/off position. Different models & sizes will have adjusting nuts located in different positions.

6.0 SPARE PARTS SUPPLY

Replacement parts are available for all APV-Torqturn actuators. Published parts list drawings include recommended spare parts. It should be remembered that these parts are of resilient material and have a limited shelf life. Other parts are generally not required as spares.



Caution

The spring pack is energised. Do not attempt to open the outer casing while spring is compressed. Only an APV approved repair facility should attempt repairs.

When ordering replacement parts, it is important to include the complete actuator model number and serial number along with the part numbers required.

7.0 REPAIR INSTRUCTIONS



This section only recommended to be performed by APV approved repair facility. Special custom tools are required.



The highly compressed spring of “spring return” SR model remains partially energised even when the actuator is removed and is dangerous if released accidentally.

7.1 GENERAL MAINTENANCE INFORMATION

7.1.1 Model repair

Table 1

Model (DA)	Model (DA)	Model (SR)	Model (SR)
ACB-VTS01-080	ACB-VTS01-080-XX	ACB-VTS01-080-SR	ACB-VTS01-080-SR-XX
ACB-VTS01-100	ACB-VTS01-100-XX	ACB-VTS01-100-SR	ACB-VTS01-100-SR-XX
ACB-VTS02-100	ACB-VTS02-100-XX	ACB-VTS02-100-SR	ACB-VTS02-100-SR-XX
ACB-VTS02-125	ACB-VTS02-125-XX	ACB-VTS02-125-SR	ACB-VTS02-125-SR-XX
ACB-VTS03-125	ACB-VTS03-125-XX	ACB-VTS03-125-SR	ACB-VTS03-125-SR-XX
ACB-VTS03-160	ACB-VTS03-160-XX	ACB-VTS03-160-SR	ACB-VTS03-160-SR-XX
ACB-VTS03-180	ACB-VTS03-180-XX	ACB-VTS03-180-SR	ACB-VTS03-180-SR-XX
ACB-VTS04-180	ACB-VTS04-180-XX	ACB-VTS04-180-SR	ACB-VTS04-180-SR-XX
ACB-VTS04-200	ACB-VTS04-200-XX	ACB-VTS04-200-SR	ACB-VTS04-200-SR-XX
ACB-VTS04-220	ACB-VTS04-220-XX	ACB-VTS04-220-SR	ACB-VTS04-220-SR-XX
ACB-VTS04-260	ACB-VTS04-260-XX	ACB-VTS04-260-SR	ACB-VTS04-260-SR-XX

XX = Options:- **MS** = jack screw, **HW** = hand wheel, **EX** = limit screw

7.1.2

The maintenance interval of this actuator can be as often as every four years depending on service conditions.

7.1.3

Always ensure all power and air pressure have been removed from the actuator.

7.1.4

Remove all fittings and mounting accessories that may interfere with the module.

7.1.5

This process should only be carried out by competent technical personnel who should be recognised as having scotch yoke spring return actuator repair training & experience. Refer to Appendix A for visual instructions.

7.1.6

When removing the seals from the sealing slots, use a general sealing ring removal tool or a small screwdriver with rounded corners.

7.1.7

Use a non-hardening thread sealant on all pipe threads.

7.2 ABBREVIATIONS USED (OPTIONS)

MS - Threaded screw or screw assemblies

HW - Hand wheel over-ride

EX - Extended stroke limit screw

7.3 GENERAL SAFETY INFORMATION



Caution

Failure to comply with these instructions may expose the user to the risk damage to the actuator and/or fatal injury to staff.



Note

Advice and information notes are provided to assist maintenance personnel in carrying out the repair process.

7.3.1

Products supplied by APV in “factory ready” condition are inherently safe if the contents of this instruction manual are strictly followed and performed by qualified personnel who are well trained, equipped, and prepared.



Caution

With regard to the protection of persons operating ACB actuators, this procedure should be reviewed and the words “warning”, “caution” and “note” for safe disassembly and reassembly should be used. This procedure shall not supercede or replace any customer’s plant safety procedures or operating procedures. In the event of a conflict between this process and the Customer’s procedures, such a disagreement shall be resolved in writing between the Customer’s authorised representative and the APV authorised representative.

7.4 APV REFERENCES

7.4.1

Refer to as-built assembly drawing supplied with order. ACB-VTS01-XXXXX-XX Assembly drawing . (Examples in Appendix C).

7.5 MAINTENANCE SUPPORT ITEMS

7.5.1

APV repair kit.

7.5.2

Leak test solutions.

7.5.3

Non-hardening thread sealant.


7.5.4

APV spring removal tools

7.6 LUBRICANT REQUIREMENT

7.6.1

After each service, the actuator should be re-lubricated with the recommended lubricant.



Lubricants and liquids beyond those listed in Section 7.6.2 may not be used without the prior written approval of the APV Product Engineer Department.

7.6.2

All temperature-related repairs (-40°C to 130°C) are performed with APV SPR-C-1 lubricants. SPR-C-1 lubricants are packaged in the APV module repair kit.

7.7 GENERAL TOOL INFORMATION

7.7.1

All threads of the actuator series are uniform metric threads (for air source, taper pipe threads NPT).

7.7.2

All tools/hexagon tools are national standard dimensions. Two adjustable wrenches, Allen wrenches, small spiral knives with rounded corners, medium standard screwdrivers, diagonal pliers, external circlip pliers, flat file, drive ratchet/long sleeve assembly and torque wrench (up to 200NM).


7.7.3

Spring removal custom tools order from APV.

7.8 WEIGHT OF THE ACTUATOR

Table 2

Model (DA)	Weight (kg)	Model (SR)	Weight (kg)
ACB-VTS01-080	9.1	ACB-VTS01-080-SR	11
ACB-VTS01-100	9.5	ACB-VTS01-100-SR	13
ACB-VTS02-100	10	ACB-VTS02-100-SR	18
ACB-VTS02-125	12.7	ACB-VTS02-125-SR	22
ACB-VTS03-125	21	ACB-VTS03-125-SR	27
ACB-VTS03-160	28	ACB-VTS03-160-SR	37
ACB-VTS03-180	32	ACB-VTS03-180-SR	45
ACB-VTS04-180	44	ACB-VTS04-180-SR	61
ACB-VTS04-200	48	ACB-VTS04-200-SR	69
ACB-VTS04-220	59	ACB-VTS04-220-SR	78
ACB-VTS04-260	66	ACB-VTS04-260-SR	90



ACB (DA) If the actuator is equipped with MS, the weight will increase by 4.5kg
ACB (SR) The actuator is equipped with MW, the weight will increase by 4.5kg
ACB (SR) If the actuator is equipped with MS, the weight will increase by 1.8kg

8.0 DISASSEMBLY

8.1 GENERAL DISASSEMBLY



Caution

Ensure that all appropriate measures have been taken to prevent the exposure or release of such contaminants.

First, refer to Appendix A for visual instructions.



Caution

The pressure applied on the actuator shall not exceed the actuator mark: sign the rated operating pressure.



Note

Before commencing general disassembly of the actuator, it is a good practise to operate the actuator using the pressure applied by the customer during normal operation. Use symbols to record any abnormal symptoms, such as erratic operation.



Caution

CAUTION: SPRINGS ARE PRELOADED

The spring in ACB Series Spring Return Actuators are preloaded.



Warning

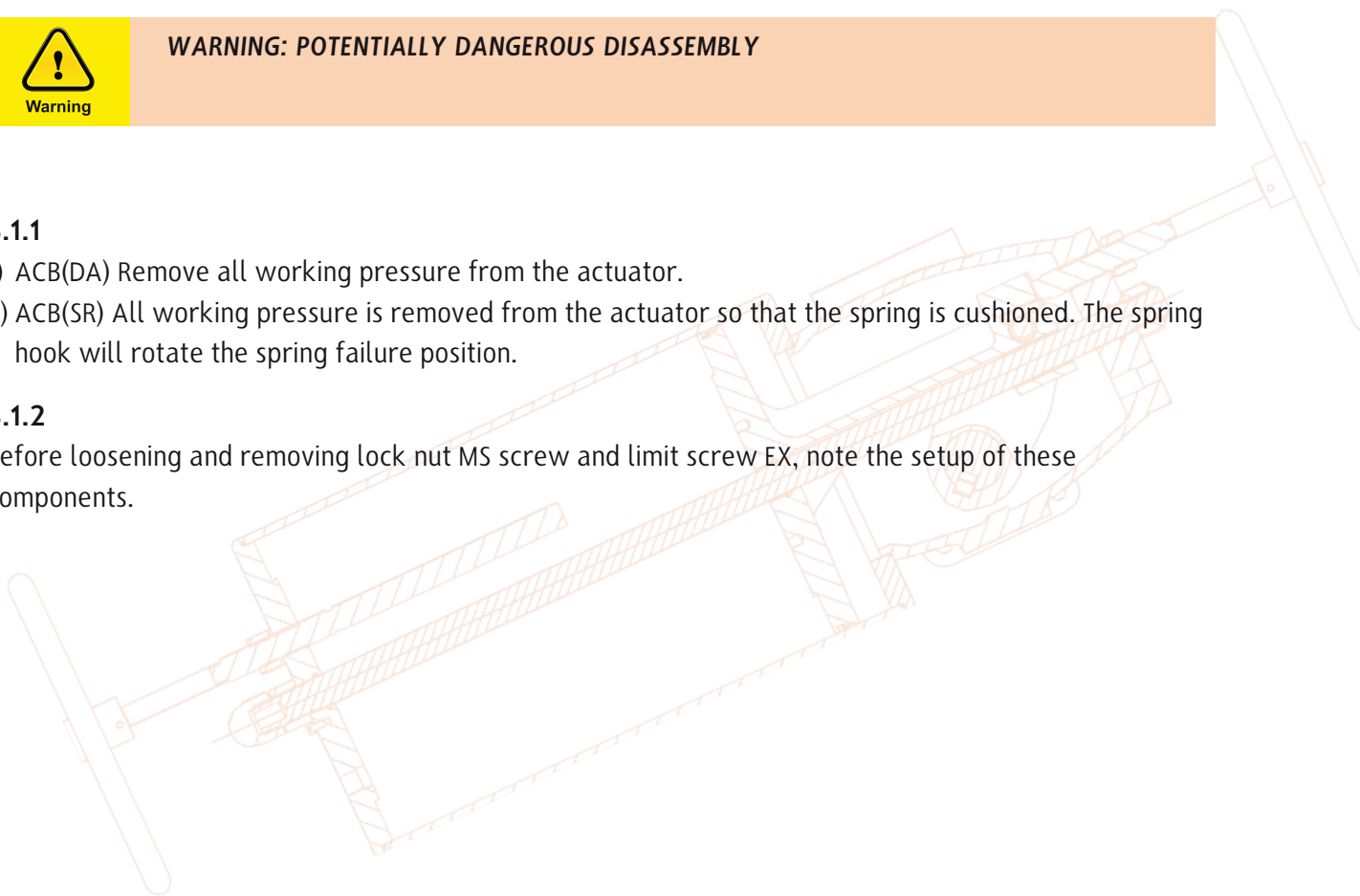
WARNING: POTENTIALLY DANGEROUS DISASSEMBLY

8.1.1

- 1) ACB(DA) Remove all working pressure from the actuator.
- 2) ACB(SR) All working pressure is removed from the actuator so that the spring is cushioned. The spring hook will rotate the spring failure position.

8.1.2

Before loosening and removing lock nut MS screw and limit screw EX, note the setup of these components.



8.2 FURTHER DISASSEMBLY



Note

ACB(DA) Please refer to section 8.1.1 to 8.1.2 and Appendix A instructions before proceeding with cylinder body removal.

ACB(SR) Please refer to section 8.1.1 to 8.1.2 and Appendix A instructions before proceeding with the removal of the spring cartridge.



Caution

ACB(SR) The full range of spring return actuators described in this operation have pre-tightened springs.

ACB(SR) The actuator must be disassembled as follows.

8.2.1

- 1) ACB(DA) The method of removing the hex nut is as follows: Use the ACB housing standard limit screw of the extended limit screw (EX, perform section 8.2.1.1).
- 2) ACB(SR) Remove the hex nut as follows: For ACB housing standard limit screws or extended limit screws (EX), perform section 8.2.1.1.

8.2.1.1 ACB(SR)-MS (Option jack screw, if applicable)

- 1) Remove the snap ring and slot pin from the optional hex socket or ratchet handle.
- 2) Remove the optional hexagonal hub sleeve or hand wheel from the MS screw.

8.2.1.2 ACB(SR)-MS

- 1) Loosen and remove the hexagon nut on the MS lead screw.



Note

The MS screw used in the actuator cannot be removed at this time. The MS lead screw used in the above model can be removed at a later stage in the process.

8.2.2

Loosen and remove the hex nut and gasket on the end cap limit screw or end cap extension limit screw.



Note

It is not necessary to remove the extension limit screw or end cap limit screw from the end cap unless these parts are replaced with a new extension limit screw or limit screw.

8.2.3

Remove the exhaust valve from the outer end cover.

8.2.4

Remove the cover nut and sealing ring from the outer end cover.

8.2.5

Turn the centre rod assembly (8-10) counterclockwise using the ratchet and sleeve on the weld nut located at the end of the tie rod assembly housing. This causes the outer end cover to gradually loosen from the centre rod assembly.



Note

End caps can be placed by holding them in place with an adjustable wrench.

8.2.6

- 1) ACB(DA) Remove the pad from the tie rod assembly.
- 2) ACB(SR) Continue to turn the tie rod assembly counterclockwise until the pretension of the spring is eliminated. When the preload of the spring is gradually eliminated, the rotation of the outer end cover should be avoided.

8.2.7

- 1) ACB(DA) Pull the piston out of the housing and carefully slide it down the rod assembly.



Note

The piston is composed of a drive pin and a DU bearing; Do not attempt to remove the piston assembly.

- 2) ACB(SR) Remove the end cap from the tie rod assembly after the preload of the spring is removed.
 - 2.1) Remove the spring from the spring barrel.
 - 2.2) Fix the output shaft and pull the spring barrel away from the shell; Remove it from the piston by sliding the spring barrel.
 - 2.3) Remove the pad from the tie rod assembly.
 - 2.4) Pull the piston out of the housing and carefully slide it down the rod assembly.



Note

The piston is composed of a drive pin and a DU bearing; Do not attempt to remove the piston assembly.

8.3 REMOVE THE DRIVE HOUSING

8.3.1

Remove the tie rod assembly from the box.

8.3.2

Remove the two clasp rings from the output shaft. Remove the gasket (1-65) from the housing.

8.3.3

To continue the disassembly, the following steps may be required.

- 1) If the output shaft has an upturned burr or sharp edge, it shall be removed.



Note

When removing burrs or sharp edges, do not remove metal as much as possible.

- 2) If excessive paint accumulates on the output shaft, it should be removed. On actuators, this paint must be removed before the gasket can be removed.

8.3.4

Remove the output shaft by pushing it out of the box side.

8.3.5

Remove the fork key and fork key spring from the output shaft.

8.3.6

Removing the fork from the container.

8.3.7

The actuator equipped with MS is installed at the outer end of the box and can be used to remove the MS screw from the box.



Note

The MS screw should be removed from the inside of the housing.

9.0 REASSEMBLY

9.1 GENERAL REASSEMBLY



Caution

Only new seals that have not exceeded their expected service life can be installed into the actuator under repair.

First, refer to Appendix A for visual instructions.

9.1.1

Remove and discard all old seals and rings.

9.1.2

Before inspecting all parts, dirt and other foreign objects should be removed from them.

9.1.3

All components shall be thoroughly inspected to ensure that they are free from excessive wear, stress cracking, wear and erosion. Focus on spirals, sealing surfaces, and areas that are prone to sliding or rotating motion. The sealing surface of the cylinder, torque shaft and centre rod assembly shall be free of any deep scratching, erosion, corrosion, and blistering or peeling of coating. On the ACB-VTS03 actuator, there are two O-rings on the torque shaft and another two O-rings under the gasket of its housing. These parts must be replaced after reassembly.



Note

Before installing the new seals, install the torque shaft stop ring groove for the mounting ring supplied with the ACB service kit. These mounting rings help guide the torque shaft through the housing and seal, preventing damage to the seal ring. Take out the two older seals, then attach the rings to the shaft and then attach the seals to the housing. Once this is done, remove the mounting ring and proceed with the other operations.



Note

After applying lubricant to the output shaft seal, install it into a groove in the output shaft hole in the housing. The gasket of the delivery shaft seal shall be mounted facing the housing. For ACB-VTS03, grease the O-ring of the output shaft after installation.



Caution

If any of the above problems occur with the parts of the actuator, a new part may need to be replaced.

9.1.4

Installation lubrication instructions: Please use the appropriate lubricant as specified in section 7.6.

- 1) Lubricant should be applied to all moving parts before installation.
- 2) All seals are coated with lubricant before being installed in the sealing slot.

9.2 REASSEMBLY OF THE MAIN DRIVE BOX



Note

When performing the steps described in Section 9.2 to “apply or use lubricant”, be sure to apply the lubricant specified in section 7.6 to the parts you are preparing for installation.



Note

See section 9.1 through 9.1.4 before reassembling the box. When installing MS box, ACB-DA(SR)-MS actuator applies to section 9.2.1.

9.2.1

Suitable for MS screw installation of ACB-DA(SR)-MS actuator.

- 1) Apply a thin layer of lubricant to the threads of the MS lead screw.



Note

MS screw should be installed from the inside of the box.

- 2) Insert the MS lead rod and screw it into the box.



Screw the MS screw jack into the housing until the MS screw is facing the inside of the housing.

- 3) Install the O-seal on the MS screw until it is flush with the housing.
- 4) Install the hexagon nut on the MS lead screw until the nut is manually tightened.

9.2.2

Coat the output shaft holes on each side of the housing with a layer of lubricant.

9.2.3

After applying lubricant to the torque shaft dust-proof gasket, install it in a groove in the output shaft hole on the box.



The sealing gasket of the dust proof gasket of the output shaft shall be mounted facing the housing.

9.2.4

Apply lubricant to the fork before installing it into the box. Apply a thick coat of lubricant to the groove in the fork arm.

9.2.5

Insert the fork key spring piece end down into the slot in the output shaft, then place the key on top of the spring piece with its conical face facing outward.



If the fork key is not installed correctly, the housing may be damaged the next time you remove it. Refer to the assembly diagram for the correct fork key spring and fork key orientation.

9.2.6

Press and hold the fork key with your thumb; Gently rotate the output shaft and insert it into the housing and fork on the side of the dust proof gasket of the installed output shaft.



The fork key should be rotated 180 degrees in the reverse direction of the fork key way when installing the output shaft.

When the output shaft is flush with the housing, pass the output shaft through until the empty sealing slot is exposed. Install another output shaft dust proof gasket in the groove.



The gasket of the output shaft seal must be mounted facing the housing. Two clasp rings are included in the ACB repair kit.

9.2.7

Install a clasp on the exposed end of the output shaft and ensure that it is properly fitted into the groove of the output shaft. Gently push and rotate the output shaft until the clasp is against the housing. Install the other clasp on the other side of the output shaft.



Rotate the output shaft until the fork key snaps into the fork key way.

9.2.8

Rotate the output shaft so that the fork arm faces outward.

9.2.9

Apply the lubricant to the O-shaped seal and install it in the inner sealing groove of the centre rod hole of the housing.

9.2.10

Apply lubricant to all parts of the tie rod assembly, including threads.

9.2.11

Insert the tie rod assembly into the middle hole of the container. Slide the centre rod on the housing until the nut of the centre rod assembly is tightly attached to the housing.



Be careful when installing the centre rod to prevent it from being scratched.

9.2.12

Apply another coat of lubricant to the centre rod.

9.2.13

After applying the lubricant to an O-shaped seal, install it to the outer diameter of the flange at the joint end of the box.

9.3 REASSEMBLE THE SPRING BARREL

9.3.1

Apply lubricant to outer diameter of sealing groove, inner diameter of sealing groove, piston top and exposed part of yoke pin of piston.

9.3.2

After applying lubricant to the O-seal, install it in the inner seal groove on the top of the piston.

9.3.3

After applying lubricant to the seal, install it in the outer diameter of the seal groove of the piston. There is a lot of space left after the piston seal is placed in the outer diameter of the sealing groove.

9.3.4

Install the bushing between the arms of the fork.

9.3.5

Ensure the piston head is not facing the box and the transmission pin is facing up, and install the piston on tie rod assembly.

9.3.6

Slide the piston along the tie rod carefully until the drive pin is engaged in the yoke drive pin slot.



Note

Make sure the tie rod assembly is snug against the housing and push the piston as deep into the housing as possible.

9.3.7

- 1) ACB(DA) Apply a layer of lubricant to the inner chamber of the cylinder.
- 2) ACB(SR) Apply a layer of lubricant to the inner cavity of the spring barrel.

9.3.8

- 1) ACB(DA) Install cylinder: Install the lubricated cylinder above the piston and hold it against the O-shaped seal of the flange on the diameter of the cylinder joint class.
- 2) ACB(SR) Install the spring barrel: Install the lubricated spring barrel above the piston and hold it against the O-shaped seal of the flange on the cylinder joint class diameter.

9.3.9

Install the pad to the centre rod assembly.

9.3.10

ACB(SR) Apply a layer of lubricant to the spring. Install the spring into the spring cylinder by carefully sliding the spring into the open spring cylinder until the spring touches the piston head.

9.3.11

Install end cover seals. For ACB(SR) actuators, the O-seal shall be installed on the end cap.

9.3.12

If the end cap seal has been removed, install the limit screw EX in the end cap and set the limit screw to the approximate setting recorder tin section 8.1.2.



Note

ACB(SR) Secure the spring barrel and ensure that the spring label is close to the mounting gasket attachment on the actuator housing.

9.3.13

ACB(SR) Install the end cover to the tie rod assembly by turning it counterclockwise.

9.3.14

When placing the end cap, ensure that the air intake is located at the bottom of the actuator and the limit screw or EX is located at the top.



Caution

Do not rotate the end cap while fixing the pull rod. The end cap must remain in the position described in section 9.3.14.

9.3.15

Secure the end cover with an adjustable wrench to prevent it from turning.

9.3.16

Use the ratchet and sleeve on the rod assembly nut to rotate the rod assembly clockwise. This causes end cap to gradually release from the tie rod assembly.

9.3.17

ACB(SR) Continue to turn the pull rod clockwise until the spring is fully compressed, the spring barrel is tight against the housing flange or joint, and the end cap is properly installed in the spring cylinder.

9.3.18

Tighten the tie rod assembly until it meets the requirements for suitable torques specified in the following table.

Table 3

Model	Model	Max. Nm
ACB-VTS01-080 ~ 01-100-DA	ACB-VTS01-080-SR ~ 01-100-SR	80
ACB-VTS02-100 ~ 02-125-DA	ACB-VTS02-100-SR ~ 02-125-SR	100
ACB-VTS03-125 ~ 03-180-DA	ACB-VTS03-125-SR ~ 03-180-SR	140
ACB-VTS04-180 ~ 04-260-DA	ACB-VTS04-180-SR ~ 04-260-SR	180

9.3.19

Place the sealing ring on the exposed end of the centre rod assembly.

9.3.20

Place the cap nut on the exposed end of the centre rod assembly and tighten it.

9.3.21

Install the limit screw MS for ACB actuator by following the steps below.

- 1) Install the MS lead screw of the limit screw into the housing and tighten it until the limit screw touches the piston.
- 2) Install the O-shaped seal on the MS screw of the limit screw until it is flush with the box.
- 3) Install the hexagon nut on the limit screw until the nut is manually tightened.

9.3.22

Install the O-seal on the limit screw MS until it is flush with the end cover.

9.3.23

Install the new gasket on the limit screw until it is close to the end cap.

9.3.24

Install the hexagon nut on the limit screw until the nut is manually tightened.

9.3.25

Adjust the limit screw MS and limit screw EX back to its original position as stated in Section 8.1.2 . Tighten the limit screw hexagon nut and fix the limit screw.

10.0 TESTING

10.1 TEST ACTUATOR

10.1.1

Leak testing - general testing - allows for small leaks. In general, small bubbles are allowed to self-form until they burst for about three seconds.

10.1.2

Areas where leaks may occur should be inspected using a commercial-grade leak test solution.



The test pressure must not exceed the maximum rated operating pressure indicated on the serial number label. Also refer M.O.P. shown Appendix D.

10.1.3

All leak tests shall use the customer's normal operating pressure or the normal operating pressure (NOP) on the actuator nameplate.



When testing the actuator, use a properly calibrated regulator to apply pressure to the actuator.

10.1.4

Apply and release the pressure listed in section 10.1.3 to the housing side of the piston before performing the leak test. This test is repeated approximately five times. This allows the new seals to be adapted to operating conditions.

10.1.5

Apply the pressure listed in section 10.1.3 to the piston housing and hold the actuator in a steady state.

10.2 PUTTING THE DEVICE BACK INTO USE

10.2.1

Install the air vent valve on the end cover.

10.2.2

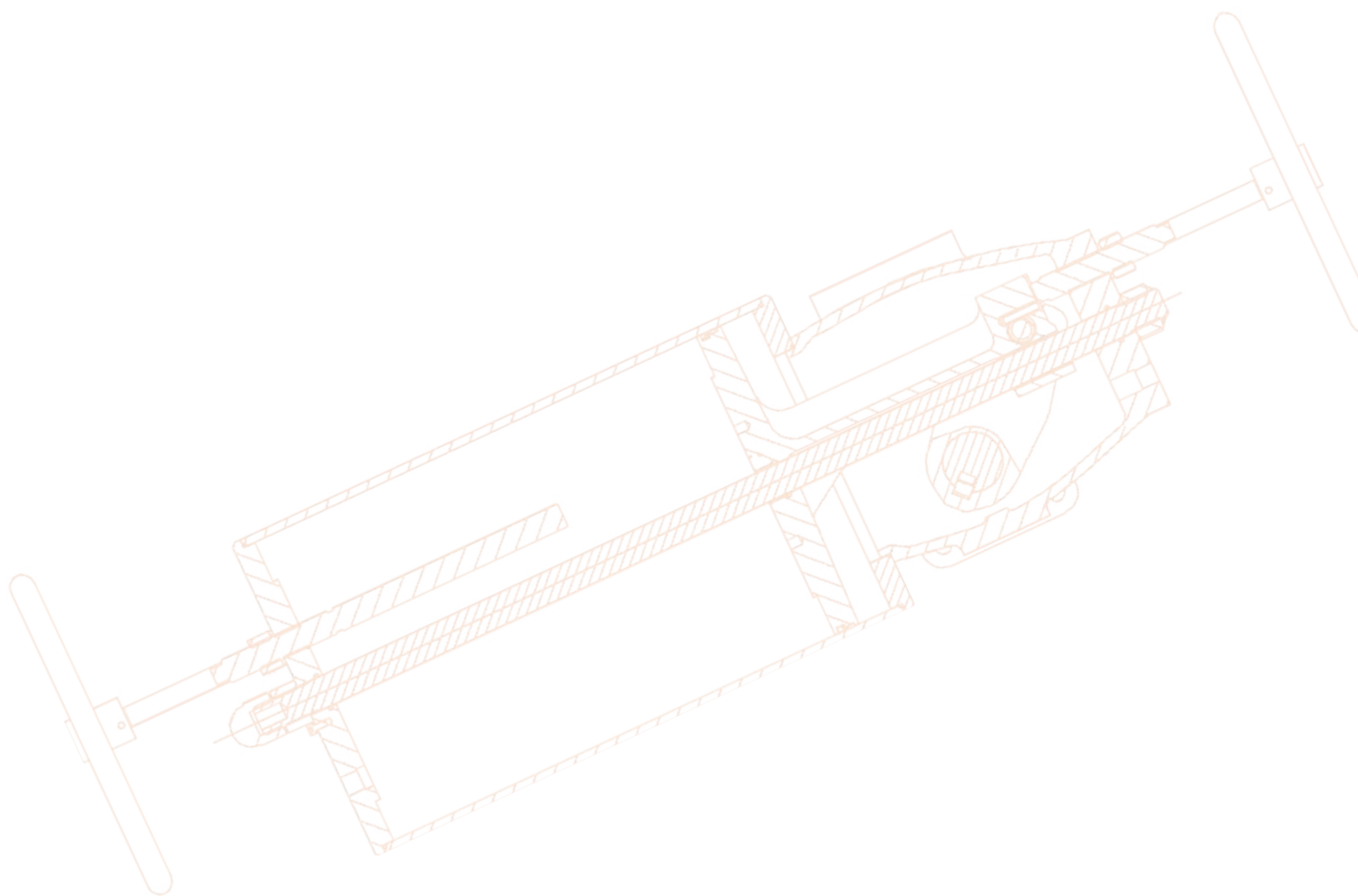
After reinstalling the actuator to the valve, all accessories should be connected to the corresponding position and tested for normal operation. If a fault is found, replace it.

11.0 COMMON FAULTS

11.1 COMMON FAULTS OF ACTUATOR AND SOLUTIONS

Table 4

Phenomenon	Fault cause	Solution
Either side of the actuator inlet air and the other side of the air source hole.	<ol style="list-style-type: none"> 1. Disassemble the actuator and check whether the X-type sealing ring at the piston is damaged or there are impurities. 2. Check whether the sealing ring at the tie rod is damaged or contains impurities. 	<ol style="list-style-type: none"> 1. Seal intact, clean cylinder and all seals, reinstall. 2. Replace the worn or damaged seal directly and reinstall it.
The switch valve with MS (screw manual) actuator is not in place.	The MS manual mechanism is not completely removed.	Turn the hand wheel counterclockwise to completely withdraw the lead screw.
There is an air leak at the limit screw.	The nut at the limit screw is not locked or the assembly washer is broken.	Tighten the nut at the limit screw, and replace the washer with a new washer if it is damaged.
Manual mechanism copper nut slip.	Customer misoperation, will tighten the screw to slip the wire.	Disassemble actuator and replace with new copper nut.



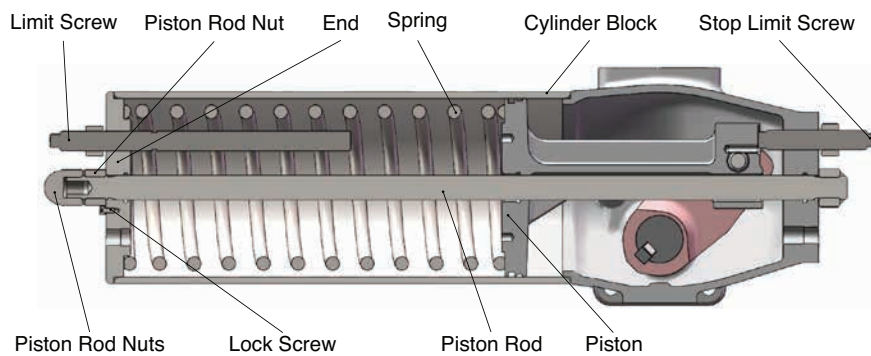
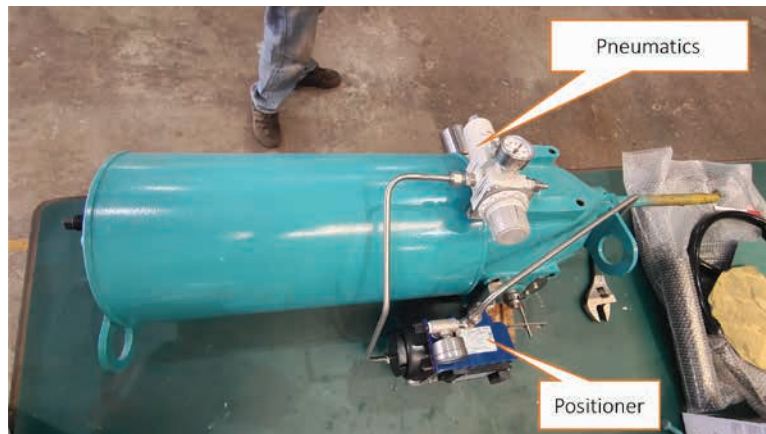
APPENDIX A

ACTUATOR DISASSEMBLY & REASSEMBLY INSTRUCTIONS WITH ACCESSORIES

This instruction is for disassembling and assembling an ACB actuator.



Only an approved APV service facility should perform repairs.



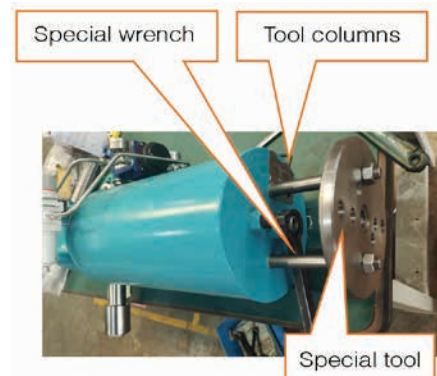
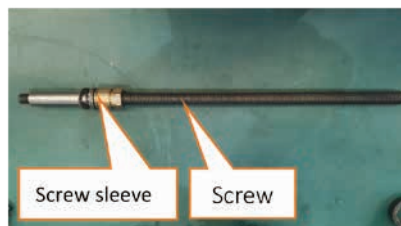
The main functional parts of the actuator are shown.

PROCEDURE FOR DISASSEMBLING ACB ACTUATOR

Tools

1. Adjustable wrench x 2
2. Special hex wrench x 1
3. Allen wrench x 1
4. Special disassembly tool
5. 4-20mA signal source
6. Instrument Air

Special tool plate system can be ordered from APV



APPENDIX A CONT'D.

PROCEDURE FOR DISASSEMBLING ACB ACTUATOR CONT'D.



Turn off the air source so that the actuator is fully closed.



Remove regulator, tubing & accessories



Removing the ring, lock screw, piston rod nut and weather cap.



Install the special custom tool.



Install the pressure plate part of special custom tool, then attach the special Allen wrench to the piston rod nut.



Caution

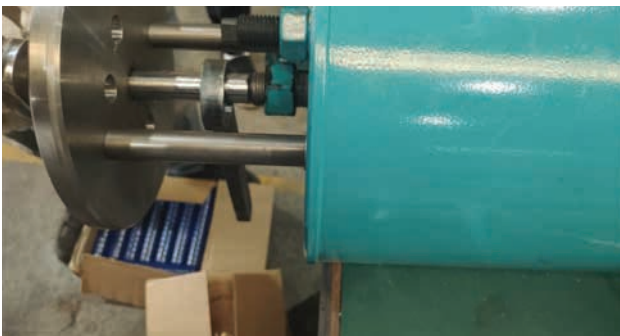
When installing the custom tool pressure plate, the step holes of the pressure plate should face outward, as shown in the figure on the right. Do not turn the wrench at this time, otherwise the spring may release causing injury.

APPENDIX A CONT'D.

PROCEDURE FOR DISASSEMBLING ACB ACTUATOR CONT'D.



Install the screw, screw one end of the screw screw completely screw into the inner screw of the piston rod, and then press the screw sleeve completely into the step hole of the pressure plate part of custom tool.



Remove the piston rod nut so that it is completely detached from the end cap.

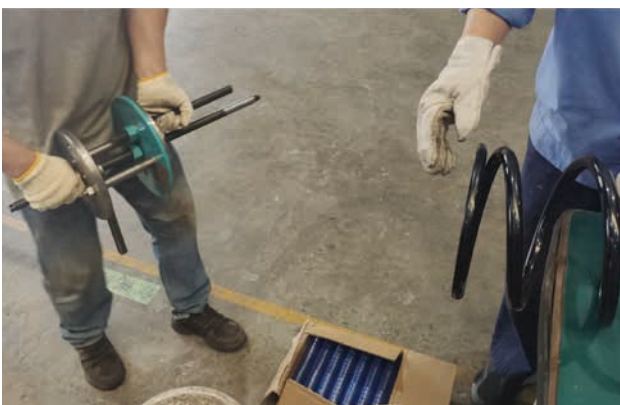


Use a wrench to turn the screw sleeve counterclockwise so that the end cap is gradually withdrawn.



Caution

When rotating the screw sleeve, it must be ensured that the screw does not rotate with the screw sleeve.



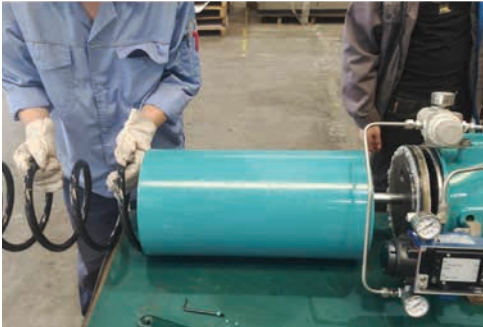
When the spring is restored to the free state, the screw and the piston rod is then separated, and the end cover and special tooling can be removed together.



Take out the spring and cylinder block, check the cylinder parts, and replace or repair relevant parts.

APPENDIX A CONT'D.

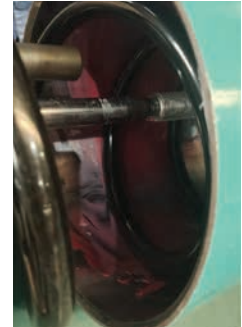
PROCEDURE FOR REASSEMBLING ACB ACTUATOR



Insert the cylinder block and spring back into the actuator.



Install tooling, connect screw and piston rod.



Turn the screw sleeve clockwise so that the spring is pressed against the end cover and piston face



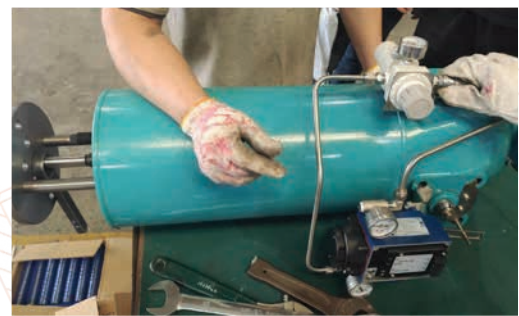
Continue to turn the screw sleeve clockwise, and the other person needs to constantly adjust the spring position during this process to ensure that the spring and the piston are concentric at all times until the spring is compressed to the point that it is not affected by other forces and the piston is eccentric.



Continue to turn the screw sleeve clockwise until the end cover and the cylinder body contact surface are completely overlapped.



Install the piston rod nut



Connect the air source to the pressure reducing valve inlet, and set the pressure to about 0.4Mpa.



The positioner is connected to a 4-20mA signal source, and controls the actuator through the positioner to check the operation of the actuator.



Remove the special tooling.

APPENDIX A CONT'D.

PROCEDURE FOR REASSEMBLING ACB ACTUATOR CONT'D

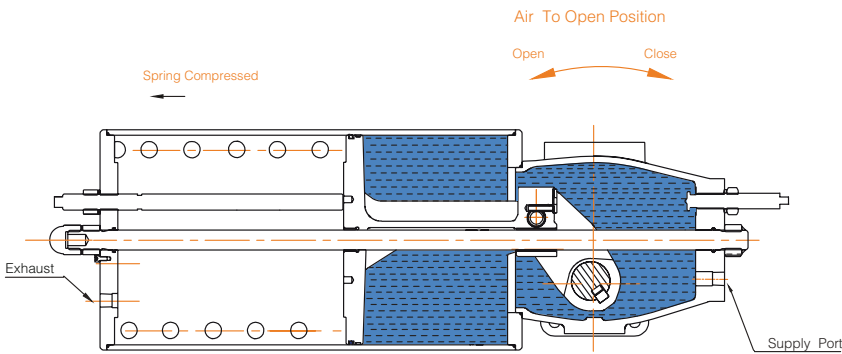
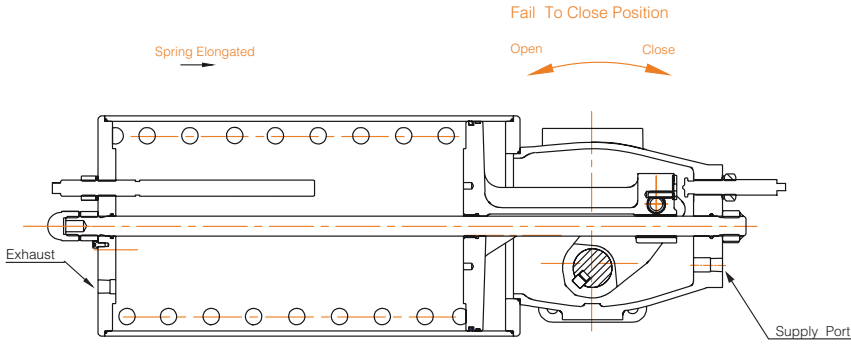


Install lock screws, piston rod nuts, ring and rain caps.

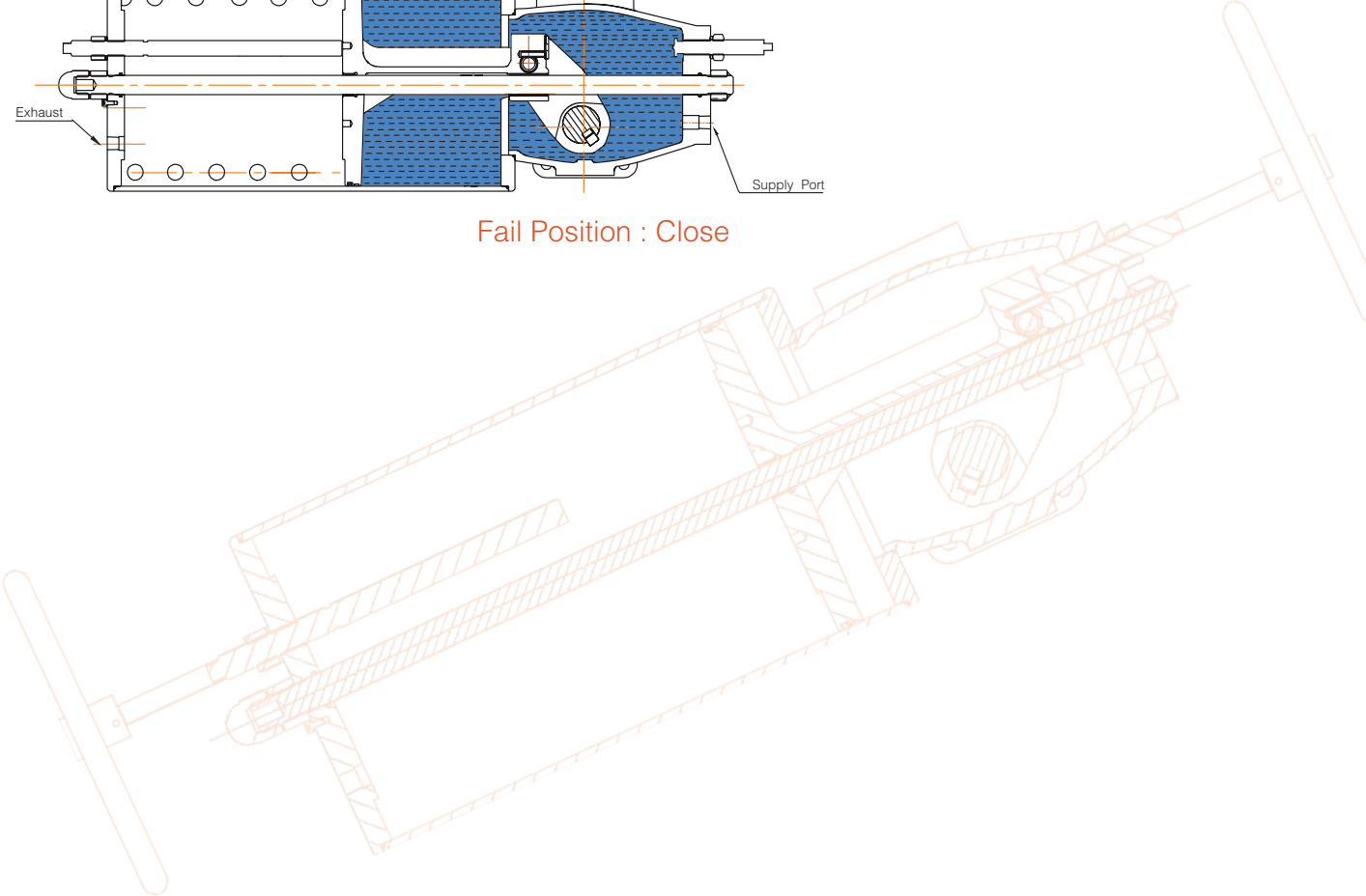
APPENDIX B

ACB SERIES AIR SUPPLY OPERATION

ACB SERIES AIR SUPPLY OPERATION (FAIL CLOSED)



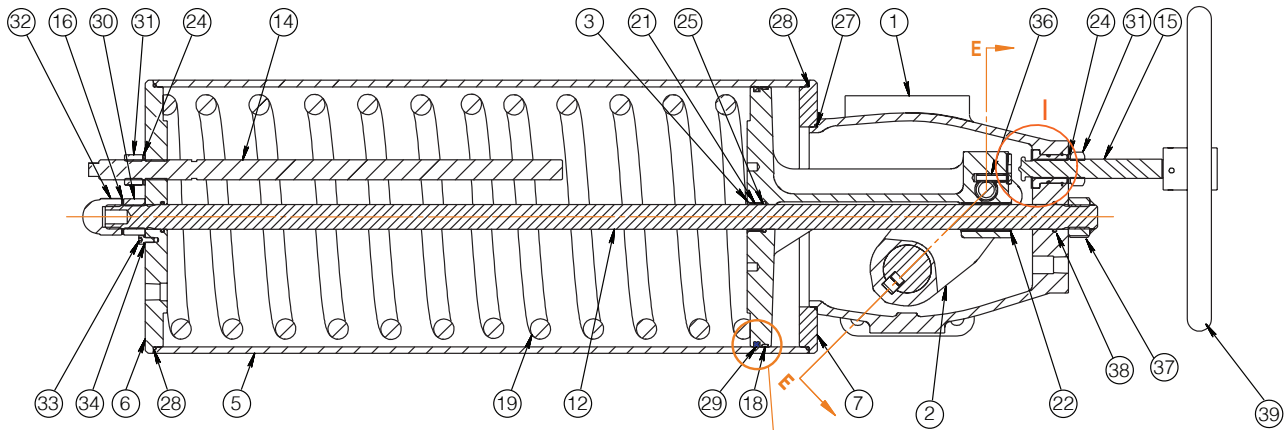
Fail Position : Close



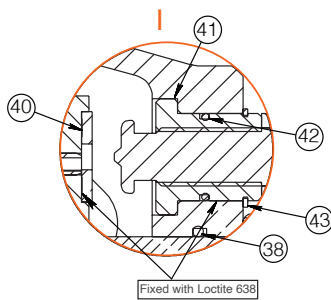
APPENDIX C

ACB SPRING RETURN C/W OVER-RIDE - SAMPLE BILL OF MATERIALS

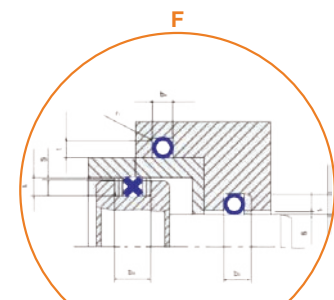
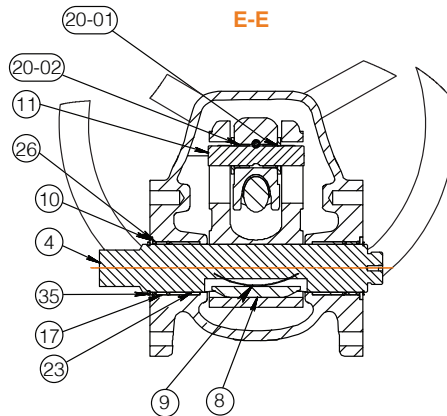
Indicative only, minor differences between model variations, refer to as-built drawing supplied with order.



Note:
1. The thrust washer (No.40), the piston (No.3), the spacer sleeve (No.17) and the drive unit (No.1) are fixed with Loctite 638 glue. Before applying glue, use detergent to remove grease from the surface of the parts



Fixed with Loctite 638



Piston Quad Seal

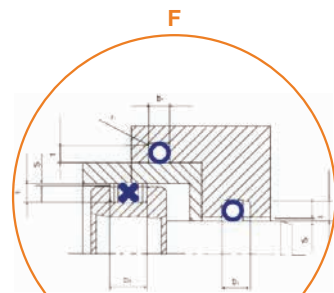
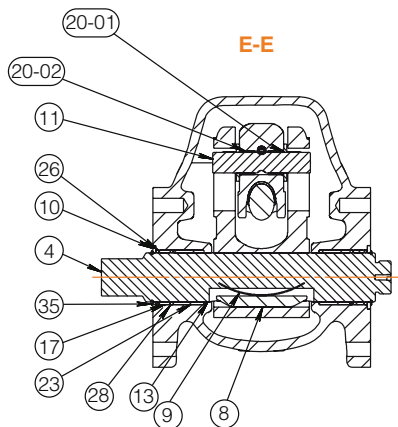
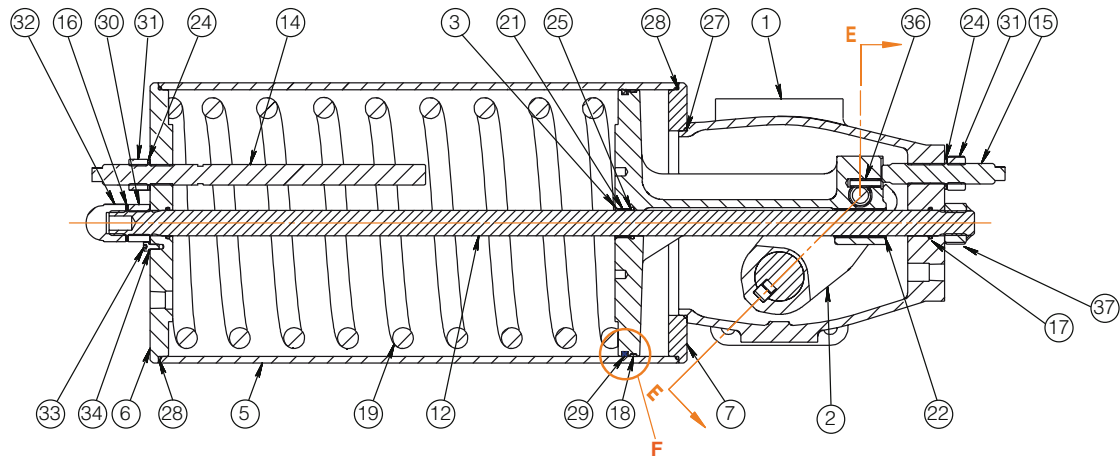
No.	Part Name	Material	Remark	Note	Qty.	No.	Part Name	Material	Remark	Note	Qty.
1	Main drive unit	Ductile iron	ASTM A536 60-42-10	1	1	24	Washer	Stainless steel	ASME B 18.21.1		2
2	Yoke	Ductile iron	ASTM A536 60-42-10	4	1	25	O-ring	NBR			3
3	Piston	Ductile iron	ASTM A536 60-42-10	4	1	26	O-ring	NBR			4
4	Output shaft	Alloy steel	AISI 4140	1	1	27	O-ring	NBR			1
5	Cylinder	Carbon steel	Seamless	3, 5	1	28	O-ring	NBR			2
6	Cylinder end cover	Ductile iron		3	1	29	Piston seal	NBR	Quad seal		1
7	Connecting plate	Ductile iron		3	1	30	Nut	Alloy steel	AISI 4130+ZP	3	1
8	Key	Alloy steel		3	1	31	Nuts	Alloy steel	AISI 4130+ZP	3	2
9	Leaf spring	Alloy steel		2	1	32	Cap nut	Stainless steel	DIN 1587	3	1
10	Washer	Stainless steel			2	33	Screws	Stainless steel	ASME B 18.3		1
11	Roller	Alloy steel	AISI 4140	1	1	34	Washer	Stainless steel	ASME B 18.21.1		1
12	Tension rod	Alloy steel	AISI 4140	1	1	35	Washers	Alloy steel	ASME B 27.1 (T6)		2
13	Washer	Nylon			2	36	Flex pin	Alloy steel	AISI 4140+ZP	1	1
14	Jack screw	Alloy steel	AISI 4130+ZP	3, 6	1	37	Nut	Alloy steel	AISI 4130+ZP	3	1
15	Jack screw	Alloy steel	AISI 4130+ZP	3, 6	1	38	O-ring	NBR			1
16	Gasket	Nylon			1	39	Hand wheel	Carbon steel		3	1
17	Spacer sleeve	Nylon			2	40	Thrust washer	Alloy bronze			1
18	Glyde ring	RPTFE			1	41	Guide bush	Alloy bronze			1
19	Spring	Alloy steel			2	42	O-ring	NBR			1
20-1/2	DU-bearings	Bronze + PTFE	SF-1		2	43	Retaining ring	Alloy steel	AISI 1566		1
21	DU-bearing	Bronze + PTFE	SF-1		1						
22	DU-bearing	Bronze + PTFE	SF-1		1						
23	DU-bearings	Bronze + PTFE	SF-1		2						

1. Hard chromed
2. Spring protected with Tectyl 50 & greased for life
3. Multi coated paint ISO 12944 C4 external 2 coats internal
4. Quenched & tempered
5. PTFE/Xylan coated
6. Blow out proof

APPENDIX C CONT'D.

ACB SPRING RETURN - SAMPLE BILL OF MATERIALS

Indicative only, minor differences between model variations, refer to as-built drawing supplied with order.



Piston Quad Seal

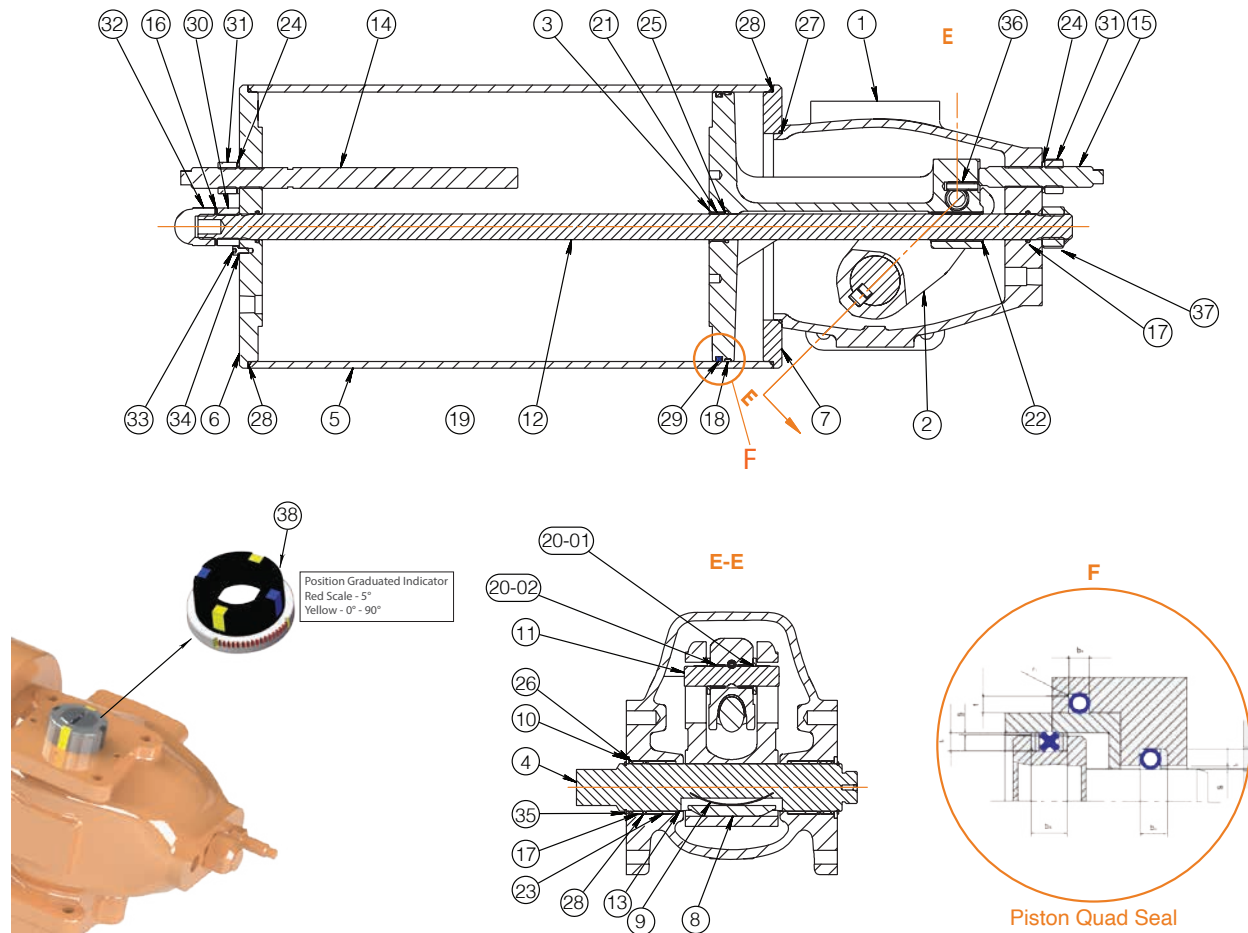
No.	Part Name	Material	Remark	Note	Qty.	No.	Part Name	Material	Remark	Note	Qty.
1	Main drive unit	Alloy steel	AISI 4140	1	1	22	Du-bearings	Bronze + PTFE	SF-1		1
2	Yoke	Ductile iron	ASTM A536 60-42-10	4	1	23	Du-bearings	Bronze + PTFE	SF-1		2
3	Piston	Ductile iron	ASTM A356 60-42-10	4	1	24	Washer	Stainless steel	ASME B 18.21.1		2
4	Output shaft	Alloy steel	AISI 4140	1	1	25	O-ring	NBR			3
5	Cylinder	Carbon steel	Seamless	3, 5	1	26	O-ring	NBR			4
6	Cylinder end cover	Ductile iron	ASTM A536 60-42-10	3	1	27	O-ring	NBR			1
7	Connecting plate	Ductile iron	ASTM A536 60-42-10	3	1	28	O-ring	NBR			2
8	Key	Alloy steel	AISI 4140	3	1	29	Piston seal	NBR	Quad seal		1
9	Leaf spring	Alloy steel	AISI 4140	2	1	30	Nut	Alloy steel	AISI 4130 + ZP	3	1
10	Washer	Stainless steel	AISI 304		2	31	Stop lock nuts	Alloy steel	AISI 4130 + ZP	3	2
11	Roller	Alloy steel	AISI 4140	1	1	32	Cap nut	Alloy steel	Zinc plated	3	1
12	Tension rod	Alloy steel	AISI 4140	1	1	33	Screws	Carbon steel	ASME B 18.3		1
13	Spring washer	Stainless steel	AISI 303		2	34	Washer	Carbon steel	ASME B 18.21.1		1
14	Limit screw - travel stop	Alloy steel	AISI 4130+ZP	3, 6	1	35	Washers	Alloy steel	ASME B 27.1 (T6)		2
15	Limit screw - travel stop	Alloy steel	AISI 4130+ZP	3, 6, 7	1	36	Flex pin	Alloy steel	AISI 4140 + ZP	1	1
16	Gasket	Nylon			1	37	Nut	Alloy steel	AISI 4130 + ZP	3	1
17	O-ring	NBR			1	38	Position indicator	Polypropylene			1
18	Glyde ring	RPTFE			1						
19	Spring	Alloy steel	AISI 4140		1						
20-1/2	Du-bearings	Bronze + PTFE	SF-1		2						
21	Du-bearings	Bronze + PTFE	SF-1		1						

1. Hard chromed
 2. Spring protected with Tectyl 50 & greased for life
 3. Multi coated paint ISO 12944 C4 external 2 coats internal
 4. Quenched & tempered
 5. PTFE/Xylan coated
 6. Blow out proof
 7. Optional handwheel over-ride assembly

APPENDIX C CONT'D.

ACB DOUBLE ACTING - SAMPLE BILL OF MATERIALS

Indicative only, minor differences between model variations, refer to as-built drawing supplied with order.



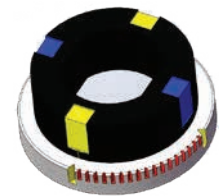
No.	Part Name	Material	Remark	Note	Qty.	No.	Part Name	Material	Remark	Note	Qty.
1	Main drive unit	Alloy steel	AISI 4140		1	22	Du-bearings	Bronze + PTFE	SF-1		1
2	Yoke	Ductile iron	ASTM A536 60-42-10		4	23	Du-bearings	Bronze + PTFE	SF-1		2
3	Piston	Ductile iron	ASTM A356 60-42-10		4	24	Washer	Stainless steel	ASME B 18.21.1		2
4	Output shaft	Alloy steel	AISI 4140		1	25	O-ring	NBR			3
5	Cylinder	Carbon steel	Seamless	3, 5	1	26	O-ring	NBR			4
6	Cylinder end cover	Ductile iron	ASTM A536 60-42-10		3	27	O-ring	NBR			1
7	Connecting plate	Ductile iron	ASTM A536 60-42-10		3	28	O-ring	NBR			2
8	Key	Alloy steel	AISI 4140		3	29	Piston seal	NBR	Quad seal		1
9	Leaf spring	Alloy steel	AISI 4140		2	30	Nut	Alloy steel	AISI 4130 + ZP	3	1
10	Washer	Stainless steel	AISI 304		2	31	Stop lock nut	Alloy steel	AISI 4130 + ZP	3	2
11	Roller	Alloy steel	AISI 4140		1	32	Cap nut	Alloy steel	Zinc plated	3	1
12	Tension rod	Alloy steel	AISI 4140		1	33	Screws	Carbon steel	ASME B 18.3		1
13	Spring washer	Stainless steel	AISI 303		2	34	Washer	Carbon steel	ASME B 18.21.1		1
14	Limit screw-travel stop	Alloy steel	AISI 4130+ZP	3, 6, 7	1	35	Retainer rings	Alloy steel	ASME B 27.1 (T6)		2
15	Limit screw-travel stop	Alloy steel	AISI 4130+ZP	3, 6, 7	1	36	Flex pin	Alloy steel	AISI 4140 + ZP	1	1
16	Gasket	Nylon			1	37	Nut	Alloy steel	AISI 4130 + ZP	3	1
17	O-ring	NBR			1	38	Position indicator	Polypropylene			1
18	Glyde ring	RPTFE			1						
19	Spring	Alloy steel	AISI 4140		1						
20-1/2	Du-bearings	Bronze + PTFE	SF-1		2						
21	Du-bearings	Bronze + PTFE	SF-1		1						

- 1. Hard chromed
- 2. Spring protected with Tectyl 50 & greased for life
- 3. Multi coated paint ISO 12944 C4 external 2 coats internal
- 4. Quenched & tempered
- 5. PTFE/Xylan coated
- 6. Blow out proof
- 7. Optional handwheel over-ride assembly

APPENDIX D

TRAVEL STOP ADJUSTMENT

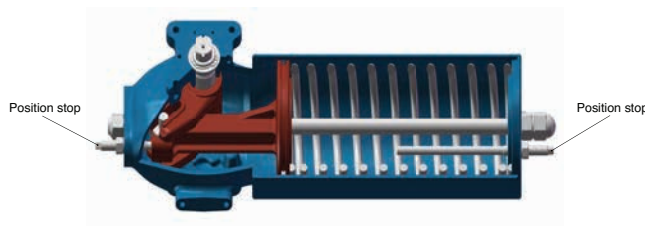
The red scale on the dial is 5° per graduation and the yellow is 0° to 90° Double acting and spring return actuators without over-rides can be set +/- 10° 90 degrees turn if required but we factory set at 90°. When one or two handwheel over-rides are fitted only 0 to 90° travel range is possible unless a larger (wider) range is requested. Actuators with hand wheel over-ride are factory set to operate 0-90°. Check position indicator to verify open, close position.



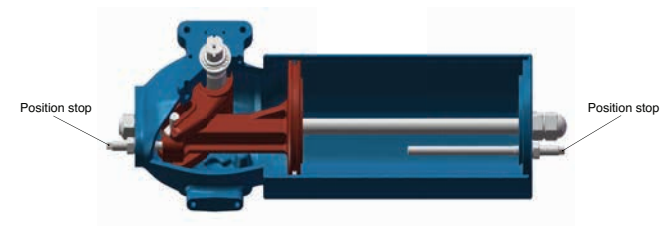
ACB graduated indicator cap

ACB Spring Return & Double Acting Actuator no over-ride

There is an adjustable travel position stop at both ends. It should be factory set at 0-90°. Check the position indicator and adjust if required (up to +/- 10° beyond 0-90° is possible most sizes).



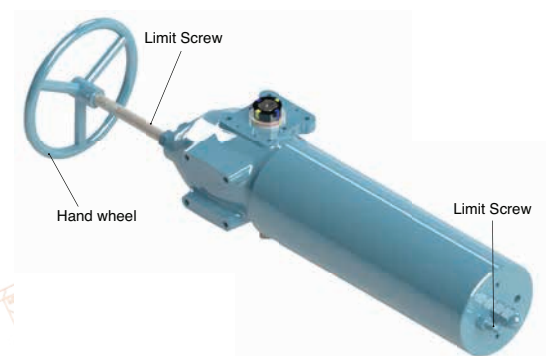
Spring return



Double acting

ACB Spring Return Actuator with Handwheel over-ride and Travel Stop device

With the spring return ACB actuator fitted with a manual over-ride, the manual over-ride when fully dis-engaged in the full open position allows 0-90° travel which can be vertical byt the position indicated. The position is factory set at 0 to 90°. The limit adjustment screw on the cylinder end is also factory set but can be adjusted if required.



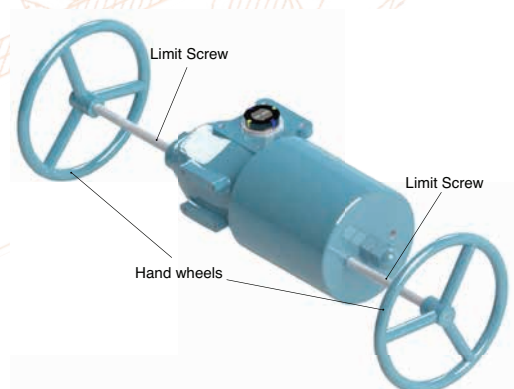
Hand wheel

Limit Screw

Limit Screw

ACB Double Acting with two Manual over-rides

When it is necessary to open or cloase the valve, both handwheel over-rides also act as limit screw stops. Ensure both handwheels are in full open position (dis-engaged, not in over-ride position).



Limit Screw

Hand wheels

Limit Screw

APPENDIX E

ACB-VTSO SYMMETRICAL TORQUE CHART (NM) SPRING RETURN FAIL CLOSED

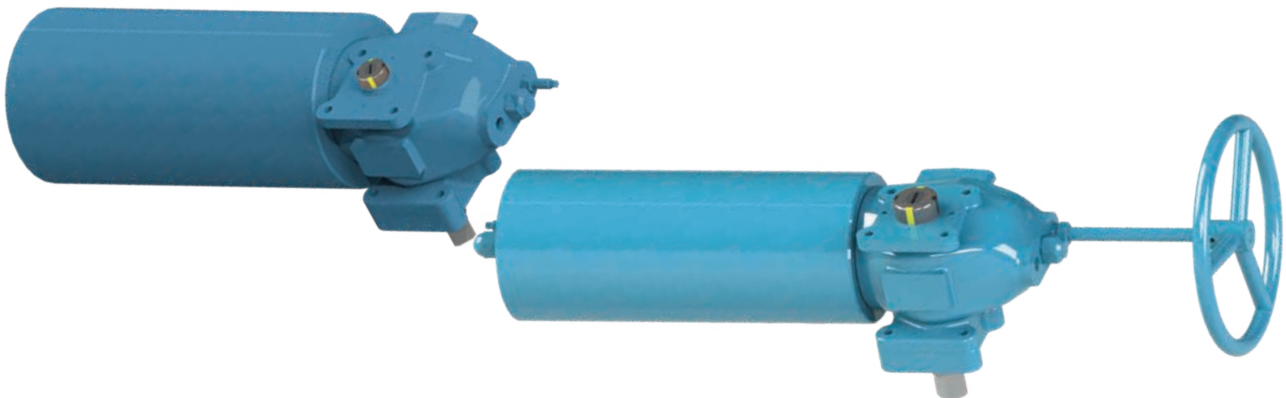
Model	3 Bar			3.5 Bar			4 Bar			4.5 Bar			Spring return			ISO	Max Torque	Air Cylinder Nominal Bore
	BTO	RTO	ETO	BTO	RTO	ETO	BTO	RTO	ETO	BTO	RTO	ETO	BTC	RTC	ETC			
ACB-VTS01-080-SR3	48	16	15	67	26	33	85	36	52	104	45	70	88	38	57	F07	250	80
ACB-VTS01-100-SR3	77	26	24	106	41	53	135	57	82	164	72	111	138	60	90	F07	250	100
ACB-VTS02-100-SR3	100	33	26	135	51	62	170	69	97	205	88	132	169	71	102	F10	500	100
ACB-VTS02-125-SR3	161	54	47	217	83	103	273	112	158	328	141	214	264	110	159	F10	500	125
ACB-VTS03-125-SR1	0	0	0	0	0	0	0	0	0	237	66	18	559	239	358	F12	1000	125
ACB-VTS03-160-SR1	0	0	0	0	0	0	0	0	0	391	109	27	928	396	594	F12	1000	160
ACB-VTS03-180-SR1	0	0	0	0	0	0	0	0	0	0	0	0	1170	498	742	F12	1000	180
ACB-VTS03-125-SR2	0	0	0	0	0	0	0	0	0	300	121	166	423	188	301	F12	1000	125
ACB-VTS03-160-SR2	0	0	0	0	0	0	378	137	150	493	197	266	709	315	500	F12	1000	160
ACB-VTS03-180-SR2	0	0	0	0	0	0	481	171	175	627	247	321	915	403	634	F12	1000	180
ACB-VTS03-125-SR3	0	0	0	235	101	152	305	137	222	375	173	292	308	140	232	F12	1000	125
ACB-VTS03-160-SR3	277	109	140	392	169	255	507	229	371	623	289	486	507	231	381	F12	1000	160
ACB-VTS04-180-SR3	353	138	178	499	214	324	646	291	471	792	367	617	643	293	483	F12	1000	180
ACB-VTS04-180-SR1	0	0	0	0	0	0	0	0	0	0	0	0	1487	606	843	F14	2000	180
ACB-VTS04-200-SR1	0	0	0	0	0	0	0	0	0	0	0	0	1897	767	1048	F14	2000	200
ACB-VTS04-220-SR1	0	0	0	0	0	0	0	0	0	0	0	0	2309	925	1245	F14	2000	220
ACB-VTS04-180-SR2	0	0	0	0	0	0	0	0	0	0	0	0	1154	493	739	F14	2000	180
ACB-VTS04-200-SR2	0	0	0	0	0	0	0	0	0	0	0	0	1434	609	906	F14	2000	200
ACB-VTS04-220-SR2	0	0	0	0	0	0	0	0	0	0	0	0	1751	738	1083	F14	2000	220
ACB-VTS04-260-SR2	0	0	0	0	0	0	0	0	0	0	0	0	2497	1040	1498	F14	2000	260
ACB-VTS04-180-SR3	0	0	0	637	264	378	818	358	559	999	452	739	816	363	578	F14	2000	180
ACB-VTS04-200-SR3	573	212	243	797	329	467	1022	446	691	1246	563	915	1012	448	709	F14	2000	200
ACB-VTS04-220-SR3	700	260	301	972	402	573	1244	544	845	1516	685	1117	1222	541	856	F14	2000	220
ACB-VTS04-260-SR3	989	362	402	1370	561	784	1751	759	1165	2132	958	1546	1731	761	1193	F14	2000	260

Model	Output Torque (NM)									Spring return			ISO	Max Torque	Air Cylinder Nominal Bore						
	5 Bar			5.5 Bar			6 Bar			7 Bar						8 Bar					
	BTO	RTO	ETO	BTO	RTO	ETO	BTO	RTO	ETO	BTO	RTO	ETO	BTO	RTO	ETO	BTC	RTC	ETC			
ACB-VTS01-080-SR3	122	55	89	140	64	107	159	74	125	196	93	162	0	0	0	88	38	57	F07	250	80
ACB-VTS01-100-SR3	193	87	141	222	102	170	251	117	199	0	0	0	0	0	0	138	60	90	F07	250	100
ACB-VTS02-100-SR3	240	106	167	276	124	202	311	143	238	381	179	308	0	0	0	169	71	102	F10	500	100
ACB-VTS02-125-SR3	384	170	270	440	199	326	496	228	381	607	286	493	0	0	0	264	110	159	F10	500	125
ACB-VTS03-125-SR1	307	103	88	376	139	157	446	175	227	585	248	366	725	320	505	559	239	358	F12	1000	125
ACB-VTS03-160-SR1	506	169	142	621	229	258	737	289	373	967	409	604	1198	529	834	928	396	594	F12	1000	160
ACB-VTS03-180-SR1	0	0	0	803	296	336	949	373	483	1242	525	775	0	0	0	1170	498	742	F12	1000	180
ACB-VTS03-125-SR2	369	158	236	439	194	305	509	230	375	648	303	514	787	375	654	423	188	301	F12	1000	125
ACB-VTS03-160-SR2	608	258	381	724	318	496	839	378	611	1070	498	842	1300	618	1073	709	315	500	F12	1000	160
ACB-VTS03-180-SR2	773	323	468	920	399	614	1066	476	761	0	0	0	0	0	0	915	403	634	F12	1000	180
ACB-VTS03-125-SR3	444	210	361	514	246	431	584	282	500	723	355	640	862	427	779	308	140	232	F12	1000	125
ACB-VTS03-160-SR3	738	349	601	853	409	716	969	469	832	1199	589	1062	0	0	0	507	231	381	F12	1000	160
ACB-VTS03-180-SR3	938	443	764	987	519	910	1231	595	1056	0	0	0	0	0	0	643	293	483	F12	1000	180
ACB-VTS04-180-SR1	0	0	0	0	0	0	1252	470	552	1614	658	914	1976	846	1275	1487	606	843	F14	2000	180
ACB-VTS04-200-SR1	0	0	0	0	0	0	1549	566	624	1997	799	1072	2445	1032	1521	1897	767	1048	F14	2000	200
ACB-VTS04-220-SR1	0	0	0	0	0	0	1908	692	750	2451	975	1294	0	0	0	2309	925	1245	F14	2000	220
ACB-VTS04-180-SR2	1004	405	552	1185	499	733	1366	594	914	1728	782	1276	2090	970	1637	1154	493	739	F14	2000	180
ACB-VTS04-200-SR2	1255	504	680	1479	620	904	1703	737	1128	2152	970	1577	2600	1204	2025	1434	609	906	F14	2000	200
ACB-VTS04-220-SR2	1541	613	813	1813	754	1085	2085	896	1357	2628	1179	1901	0	0	0	1751	738	1083	F14	2000	220
ACB-VTS04-260-SR2	2181	853	1094	2563	1051	1475	0	0	0	0	0	0	0	0	0	2497	1040	1498	F14	2000	260
ACB-VTS04-180-SR3	1180	547	920	1361	641	1101	1542	735	1282	1903	923	1644	2365	1112	2005	816	363	578	F14	2000	180
ACB-VTS04-200-SR3	1470	679	1139	1694	796	1364	1918	913	1588	2366	1146	2036	0	0	0	1012	448	709	F14	2000	200
ACB-VTS04-220-SR3	1787	827	1388	1992	968	1660	2331	1110	1932	0	0	0	0	0	0	1222	541	856	F14	2000	220
ACB-VTS04-260-SR3	2514	1156	1927	0	0	0	0	0	0	0	0	0	0	0	0	1731	761	1193	F14	2000	260

BTO: Break to Open RTO: Run to Open ETO: End to Open
 BTC: Break to Close RTC: Run to Close ETC: End to Close



**Do not surpass maximum torque shown for long term use.
 Torque limit is based on ISO 5211 mount pad maximum.**



APPENDIX E CONT'D

ACB-VTSO SYMMETRICAL TORQUE CHART (NM) DOUBLE ACTING

Model	3 Bar			3.5 Bar			4 Bar			4.5Bar			ISO	Max Torque	Air Cylinder Nominal Bore
	BTO/ETC	RTO/RTC	ETO/BTC	BTO/ETC	RTO/RTC	ETO/BTC	BTO/ETC	RTO/RTC	ETO/BTC	BTO/ETC	RTO/RTC	ETO/BTC			
ACB-VTS01-080	110	58	110	129	67	129	147	77	147	166	86	166	F07	250	80
ACB-VTS01-100	175	91	175	204	106	204	233	121	233	262	137	262	F07	250	100
ACB-VTS02-100	211	110	211	246	128	246	281	146	281	317	165	317	F10	500	100
ACB-VTS02-125	335	174	335	390	203	390	446	232	446	502	261	502	F10	500	125
ACB-VTS03-125	418	218	418	488	254	488	557	290	557	627	326	627	F12	1000	125
ACB-VTS03-160	692	360	692	807	420	807	922	480	922	1038	540	1038	F12	1000	160
ACB-VTS03-180	878	457	878	1025	534	1025	1171	610	1171	0	0	0	F12	1000	180
ACB-VTS04-180	1085	565	1085	1266	659	1266	1447	753	1447	1628	847	1628	F14	2000	180
ACB-VTS04-200	1345	700	1345	1569	817	1569	1793	933	1793	2017	1050	2017	F14	2000	200
ACB-VTS04-220	1632	849	1632	1904	991	1904	2176	1133	2176	2447	1274	2447	F14	2000	220
ACB-VTS04-260	2287	1191	2287	2669	1389	2669	0	0	0	0	0	0	F14	2000	260

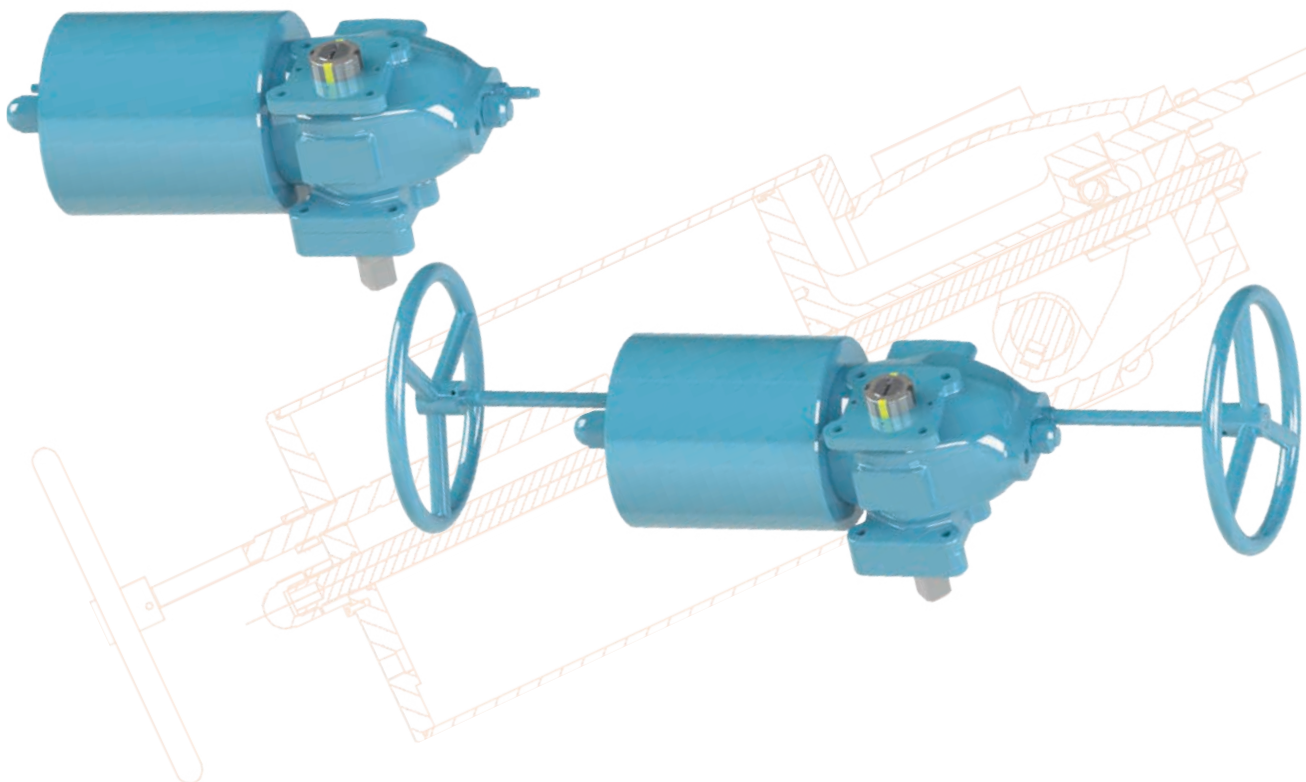
Model	Output Torque (NM)															ISO	Max Torque	Air Cylinder Nominal Bore	
	5 Bar			5.5 Bar			6 Bar			7 Bar			8 Bar						
	ETO/BTC	BTO/ETC	RTO/RTC	ETO/BTC	BTO/ETC	RTO/RTC	ETO/BTC	BTO/ETC	RTO/RTC	ETO/BTC	BTO/ETC	RTO/RTC	ETO/BTC	BTO/ETC	RTO/RTC	ETO/BTC			
ACB-VTS01-080	166	184	96	184	202	105	202	221	115	221	258	134	258	295	153	295	F07	250	80
ACB-VTS01-100	262	291	152	291	0	0	0	0	0	0	0	0	0	0	0	0	F07	250	100
ACB-VTS02-100	317	352	183	352	387	201	387	422	220	422	492	256	492	0	0	0	F10	500	100
ACB-VTS02-125	502	558	290	558	614	319	614	0	0	0	0	0	0	0	0	0	F10	500	125
ACB-VTS03-125	627	697	363	697	766	399	766	836	435	836	975	508	975	1115	580	1115	F12	1000	125
ACB-VTS03-160	1038	1153	600	1153	1268	660	1268	0	0	0	0	0	0	0	0	0	F12	1000	160
ACB-VTS03-180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	F12	1000	180
ACB-VTS04-180	1628	1809	942	1809	1990	1036	1990	2170	1130	2170	2532	1318	2532	0	0	0	F14	2000	180
ACB-VTS04-200	2017	2241	1167	2241	2465	1283	2465	2690	1400	2690	0	0	0	0	0	0	F14	2000	200
ACB-VTS04-220	2447	2719	1416	2719	0	0	0	0	0	0	0	0	0	0	0	0	F14	2000	220
ACB-VTS04-260	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	F14	2000	260

BTO: Break to Open RTO: Run to Open ETO: End to Open
 BTC: Break to Close RTC: Run to Close ETC: End to Close



Caution

*Do not surpass maximum torque shown for long term use.
 Torque limit is based on ISO 5211 mount pad maximum.*



WARRANTY

- 1. LIMITED WARRANTY:** Subject to the limitations expressed herein, Seller warrants that products manufactured by Seller shall be free from defects in design, material and workmanship under normal use for a period of one (1) year from installation but in no case shall the warranty period extend longer than eighteen months from the date of sale. This warranty is void for any damage caused by misuse, abuse, neglect, acts of God, or improper installation. For the purpose of this section, "Normal Use" means in strict accordance with the installation, operation and maintenance manual. The warranty for all other products is provided by the original equipment manufacturer.
- 2. REMEDIES:** Seller shall repair or replace, at its option, any non-conforming or otherwise defective product, upon receipt of notice from Buyer during the Manufacturer's warranty period at no additional charge. SELLER HEREBY DISCLAIMS ALL OTHER EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OR FITNESS FOR A PARTICULAR PURPOSE.
- 3. LIMITATION OF LIABILITY:** UNDER NO CIRCUMSTANCES SHALL EITHER PARTY BE LIABLE TO THE OTHER FOR INCIDENTAL, PUNITIVE, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND. BUYER HEREBY ACKNOWLEDGES AND AGREES THAT UNDER NO CIRCUMSTANCES, AND IN NO EVENT, SHALL SELLER'S LIABILITY, IF ANY, EXCEED THE NET SALES PRICE OF THE DEFECTIVE PRODUCT(S) PURCHASED DURING THE PREVIOUS CONTRACT YEAR.
- 4. LABOUR ALLOWANCE:** Seller makes NO ADDITIONAL ALLOWANCE FOR THE LABOUR OR EXPENSE OF REPAIRING OR REPLACING DEFECTIVE PRODUCTS OR WORKMANSHIP OR DAMAGE RESULTING FROM THE SAME.
- 5. RECOMMENDATIONS BY SELLER:** Seller may assist Buyer in selection decisions by providing information regarding products that it manufactures and those manufactured by others. However, Buyer acknowledges that Buyer ultimately chooses the product's suitability for its particular use, as normally signified by the signature of Buyer's technical representative. Any recommendations made by Seller concerning the use, design, application or operation of the products shall not be construed as representations or warranties, expressed or implied. Failure by Seller to make recommendations or give advice to Buyer shall not impose any liability upon Seller.
- 6. EXCUSED PERFORMANCE:** Seller will make a good faith effort to complete delivery of the products as indicated by Seller in writing, but Seller assumes no responsibility or liability and will accept no back-charge for loss or damage due to delay or inability to deliver, caused by acts of God, war, labour difficulties, accidents, inability to obtain materials, delays of carriers, contractors or suppliers or any other causes of any kind whatever beyond the control of Seller. Under no circumstances shall Seller be liable for any special, consequential, incidental, or indirect damages, losses, or expense (whether or not based on negligence) arising directly or indirectly from delays or failure to give notice of delay.

APV AUSTRALIAN PIPELINE VALVE®



AUSTRALIAN PIPELINE VALVE® HEAD OFFICE
70-78 Stanbel Road Salisbury Plain South Australia 5109 Telephone +61 (0)8 8285 0033
email: admin@australianpipelinevalve.com.au

www.australianpipelinevalve.com.au

LOCAL DISTRIBUTOR/AGENT

If you have any requirements in the field of valves, please contact us for a prompt response. Continuous development of Australian Pipeline Valve products may necessitate changes in the design or manufacture process. Australian Pipeline Valve reserves the right to effect any such changes without prior notice.

