



USER INSTRUCTIONS

Automax Valve Automation Systems

APEX 7000 Pneumatic Positioner

Installation Operation Maintenance

FCD AXENIOM0125-00

Principles of Operation:

The Apex 7000 positioner causes rotation (or linear movement) of valve actuator in proportion to an input signal. This signal may take the form of pneumatic pressure (Model 7000 and 7600) or electric current (Models 7100, 7200, 7400, 7500). Supply pressure is directed to the actuator through a precision spool valve. As input pressure is varied, the balance beam shifts away from its neutral position. The spool also shifts and a differential pressure is created across the actuator causing rotation (or linear movement). Actuator motion is fed back through the positioner shaft and cam. Cam rotation causes movement of the feedback arm, changing compression in the feedback spring, forcing the balance beam and spool back to their neutral position. This shuts off the flow of air to the actuator and rotation stops.

Installation:

The Apex 7000 positioner can be installed on rotary and linear actuators. Actuators can be either double acting or spring return. Positioners can be set up for rotation in either direction (direct or reverse acting).

Supply Air Requirements:

Air pressure must be limited to 150 psi for supply and 30 psi for instrument signal to avoid damage to the positioner. Supply air must be clean, dry and oil free instrument quality air in accordance with ISA S7.3 specifications (dew point >18 degrees below ambient temperature, particle size <5 microns, oil content <1ppm).

Mounting:

The following instructions apply to rotary actuators only. Linear applications require special mounting and coupling (consult factory).

1. Mount bracket to actuator. Tighten bolts finger tight only at this time. A standard bracket is available for mounting to NAMUR compliant actuators.
2. Install coupler (not required if installing to a NAMUR compliant actuator) on actuator shaft making sure it is centered.
3. Verify that orientation of actuator (and coupler) flats match positioner shaft flats. If necessary, rotate the cam before installing positioner (see "Cam Installation"). **NOTE:** *Actuator should be in orientation corresponding to zero input signal.*
4. Install positioner onto bracket. Make sure positioner shaft and coupler are engaged and centered. Tighten bolts finger tight only at this time.

Pneumatic Connections: All pneumatic connections, the supply, both output ports, and instrument ports are female 1/4" NPT. All connections require user-supplied tubing fittings. **Caution:** *Do not use Teflon tape as a pipe thread sealant. Use only a liquid or paste non-hardening pipe sealant on the threads.*

5. Connect positioner ports C1 and C2 to actuator. Port C2 is **always** connected to the actuator port used to drive actuator away from its start or fail position (the factor cam setting is full clockwise at minimum input). Port C1 is connected to the opposite port or may be plugged for spring return actuators. **Note:** *For fail counterclockwise applications, the cam must be flipped over so the "R" side is facing upwards (see "Cam Installation").*



6. Connect supply air to port marked "S".
7. Connect instrument signal air to the port marked "I" for model 7000 and 7600. For models 7100, 7200, or 7500, connect 4-20 mA and ground (-). For intrinsically-safe applications (Model 7400 only), see separate intrinsically-safe I/P IOM for barrier requirements and schematics. The I-P is factory calibrated and cannot be adjusted.
8. Stroke actuator/valve two or three times to align positioner, coupler and actuator. With 50% input (actuator at 45 degrees), tighten all mounting bolts. Stroke actuator/valve again to verify there is no misalignment throughout stroke.

Calibration:

The unit is shipped from the factory pre-calibrated for 90 degree travel (± 0.5 degrees rotation – can also be 30/45/60 degrees, see installed cam). For most applications, the valve closed position is much more critical than the valve open position. Most attention should be made to the valve closed position. Always start calibration procedure by applying 0% input signal, then adjusting zero position.

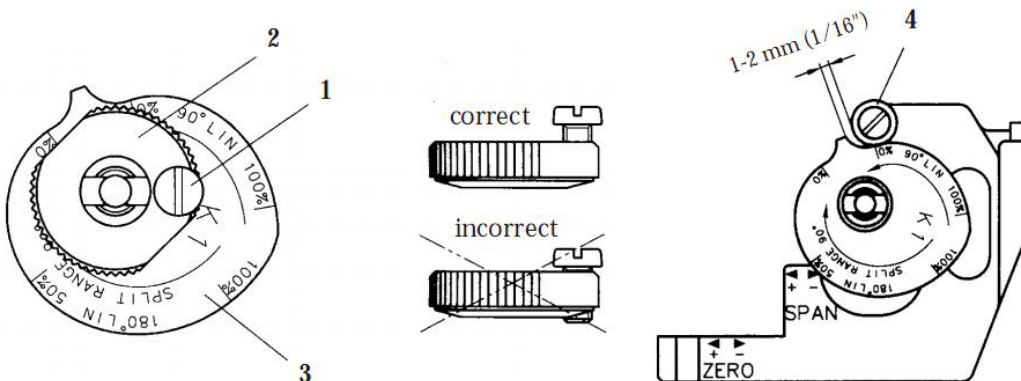
Caution: Cam pinch points may injure fingers. Be sure to avoid placing fingers and other objects in cam pinch points. Also avoid touching balance bean and spool while making adjustments as an unpredictable cam rotation may result. Finally, maintain control of input signal while making adjustments.

After mounting the positioner on the actuator, check cam setting and if needed, perform a cam adjustment:

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Cam Adjustment:

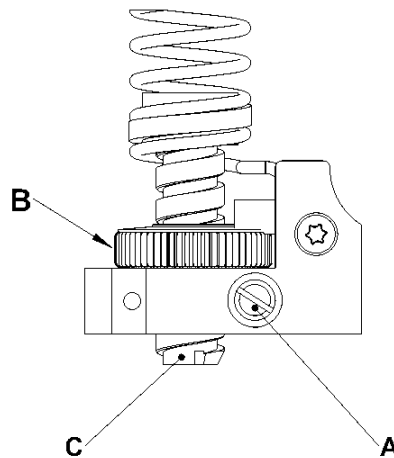
1. Remove cove and indicator.
2. Loosen the screw (1) and turn the cam locking nut (2) counter-clockwise until the cam loosens.
3. Adjust the cam (3) as desired making sure that the ball bearing (4) is riding on an active lobe on the cam.
4. To secure the cam, make sure that the screw (1) is backed out from the locking nut (2) then finger tighten the locking nut and tighten screw (1).
5. Install and adjust the indicator and re-install cover.





Calibration Procedure:

1. Apply 0% input signal (0% = 20 kPa, 3 psi, or 4 mA).
2. Wait for steady state. It is important to wait for steady state. On very large actuators, it can take minutes to establish.
3. Loosen locking screw **A** about 1 turn, if it is looser, you risk introducing unwanted movement.
4. Adjust "ZERO" position using thumbwheel **B**
5. Apply 100% input signal (100% = 100 kPa, 15 psi, or 20 mA).
6. Wait for steady state.
7. With a screw drive, adjust the "SPAN" setting by turning screw **C**, while doing so, keep the zero screw **B** in position by applying pressure with your thumb.
8. Lock the calibration mechanism in place by tightening locking screw **A**
9. Apply 0% signal and verify zero position.



Cam Installation:

Introduction: The standard cam (labeled "K1" features linear, 90 degree operation for full 3-15 psi input, 3-9 and 9-15 psi split ranges, and 3-15 psi 180 degree operation. The factory setting is 3-15 psi, 90 degrees, with "D: (direct) side up for full clockwise position at 3 psi for 90 degree operation.

Caution: Be sure supply air pressure is removed and no pressure exists in the actuator before adjusting cam.



Cam Adjustment/Replacement:

1. Remove cover and indicator.
2. Loosen the cam lock screw (1) and turn the cam locking nut (2) counter-clockwise until the cam is loose. It may be necessary to brace the output shaft while loosening the cam locking nut.
3. Adjust the cam (3) as desired, making sure that the cam follower (4) always rides on an active lobe on the cam.
4. Secure the cam by finger tightening the cam locking nut (2) and then tighten the camlock screw (1) see below

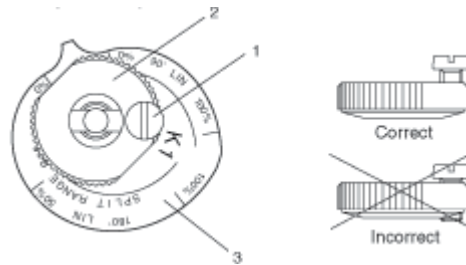


Figure below shows cam setting for Direct Action increasing signal 0-100% (20 – 100 kPa, 3-15 psi) to open. Cam follower to ride on lobe D, 0-100%

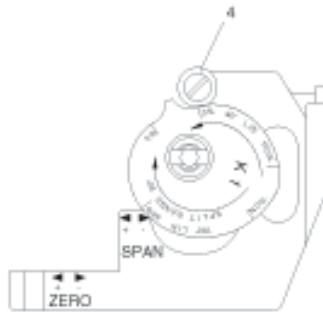
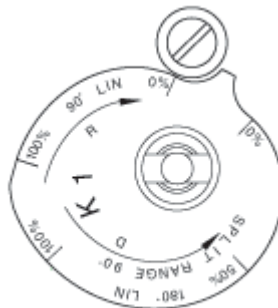


Figure below shows cam setting for reverse action, decreasing signal 100 – 0% (100 – 20 kPa, 15-3 psi) to open. Flip cam over, cam follower to ride on lobe R, 0-100%



Split Range lobe is used to achieve high resolution in split range applications, where only a portion of the signal is used to obtain 90 degrees valve travel. For example, to operate 0 to 90 degrees rotation with 0-50% input signal (20 – 60 kPa, 3-9 psi), adjust cam follower to ride on Split Range 0-50% lobe D. **Note:** to obtain reverse action, flip cam over and use lobe R.



Spool Valve Installation:

To change out or inspect spool valve, air supply to the positioner must be removed.

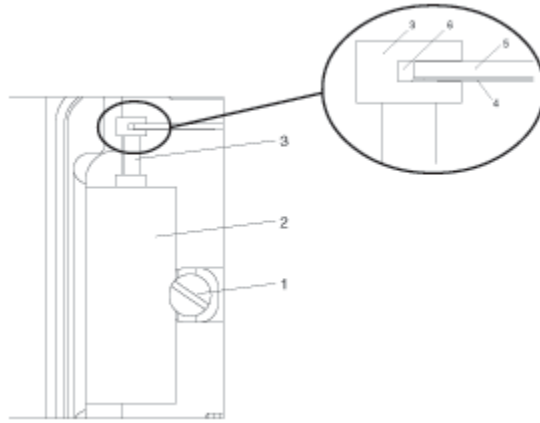
To remove spool valve:

1. Remove screw (1).
2. Carefully lift out entire spool valve assembly (2), disengaging spool (3) from balance arm (5).

To maintain highest performance, do not mix spool and block. Do not lubricate valve.

To Install new spool valve:

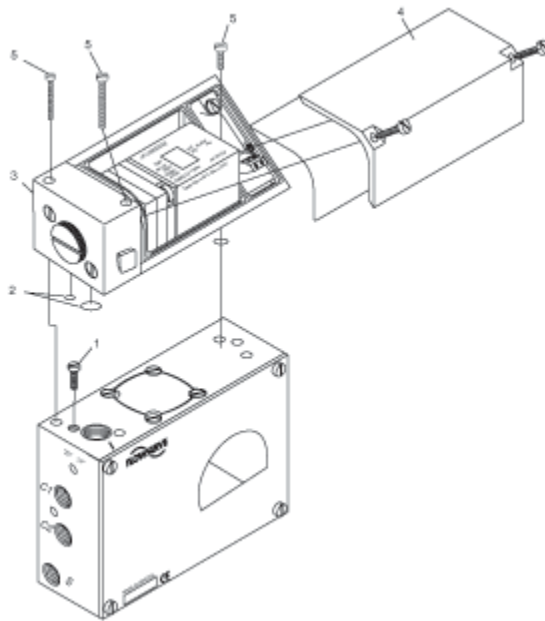
1. Check that O-rings are in place.
2. Insert spool valve assembly (2), making sure that the leaf spring (4) and balance arm (5) engage the slot in spool (6).
3. Tighten screw (1).
4. Check for smooth operation of assembly.



I-P Installation:

All I-O modules are factory calibrated and cannot be adjusted. Kits are available to allow easy field installation of various input options. Kits include modules, mounting hardware, fasteners, and O-rings.

1. Disconnect signal and supply air from positioner.
2. Remove screw (1) from positioner housing.
3. Make sure O-rings (2) are seated correctly in I-P housing.
4. For weatherproof or intrinsically-safe I-P module, remove cover (4) to allow access to third mounting screw (5).
5. Attach I-P module (3) to positioner housing with three mounting screws (5) provided.



Electrical Specifications

Model	Agency Approvals	Hazardous Location Rating ¹	Max Voltage (vdc)	Min. Voltage (vdc)	Max. Current (mA)
7000	None	None	N/A	N/A	N/A
7100	None	None	30 vdc	6 vdc	150 mA
7200	FM	(EX) Cl. I Div 1, Gr. B-D	30 vdc	6 vdc	150 mA
	CSA	(EX) Cl. I Div. 1 Gr. B-D	30 vdc	6 vdc	150 mA
	ATEX/IECEX	(EX) Ex d IIC T4-T6 ³	30 vdc ⁴	6 vdc	50 mA ⁴
7400 ²	FM	(IS) Cl. I Div. 1 Gr. A-D	28 vdc ⁴	6 vdc	50 mA ⁴
	CSA	(IS) Cl. I Div. 1 Gr. A-D	28 vdc ⁴	6 vdc	50 mA ⁴
	ATEX/IECEX	(IS) Ex ia IIC T6 ³	30 vdc ⁴	6 vdc	110 mA ⁴
7500					
7600	None	None	N/A	N/A	N/A

Warning: These instruments must be installed in accordance with local national electrical codes, especially for hazardous locations. Consult unit label to determine specific unit certifications.

Notes:

- 1 See hazardous location certificate for detailed temperature ratings. All Apex 7000 units comply with ATEX directive for non-electric equipment intended for use in hazardous locations to Ex II 2 G.
- 2 Additional information regarding entity parameters and instructions for wiring to intrinsically-safe I-P may be found in separate IOM, as well as in the hazardous location certificate.
- 3 See hazardous location certificate for special conditions for safe use.
- 4 Maximum voltage and current considerations may be affected by application specifics, such as choice of barrier, ambient temperatures, etc. See hazardous location certificate for additional information.

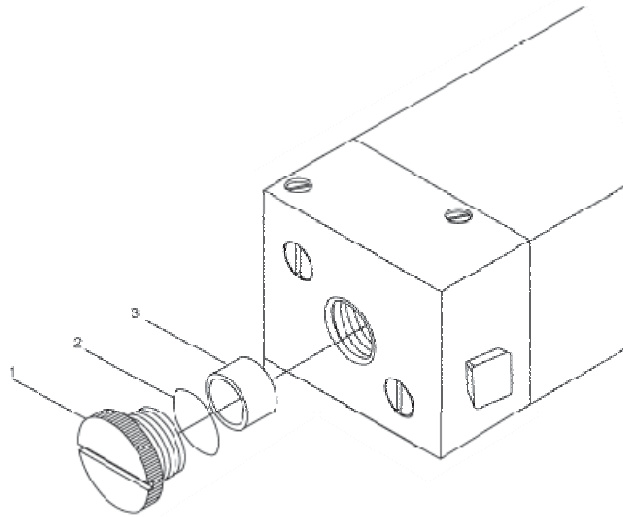
Filter Plug Replacement:

Caution: Do not operate the unit without filter and filter plug installed. Do not attempt to unscrew filter plug while positioner is pressurized.

Note: This filter is not designed to act as a permanent source of clean, dry air.



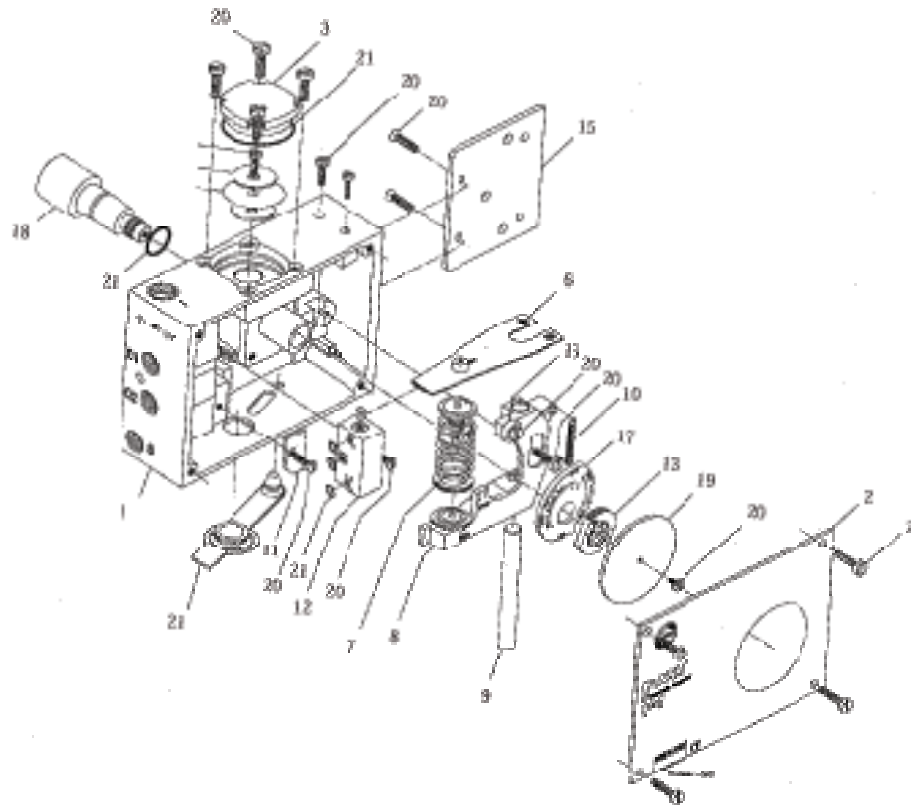
1. Remove air supply pressure from positioner.
2. Unscrew filter plug (1) and O-ring.
3. Remove filter (3) and inspect filter and filter compartment. If moisture is found, check upstream filters and oil-water separators. Moisture can cause I-P failure.
4. Replace filter if necessary and reinstall.



Maintenance:

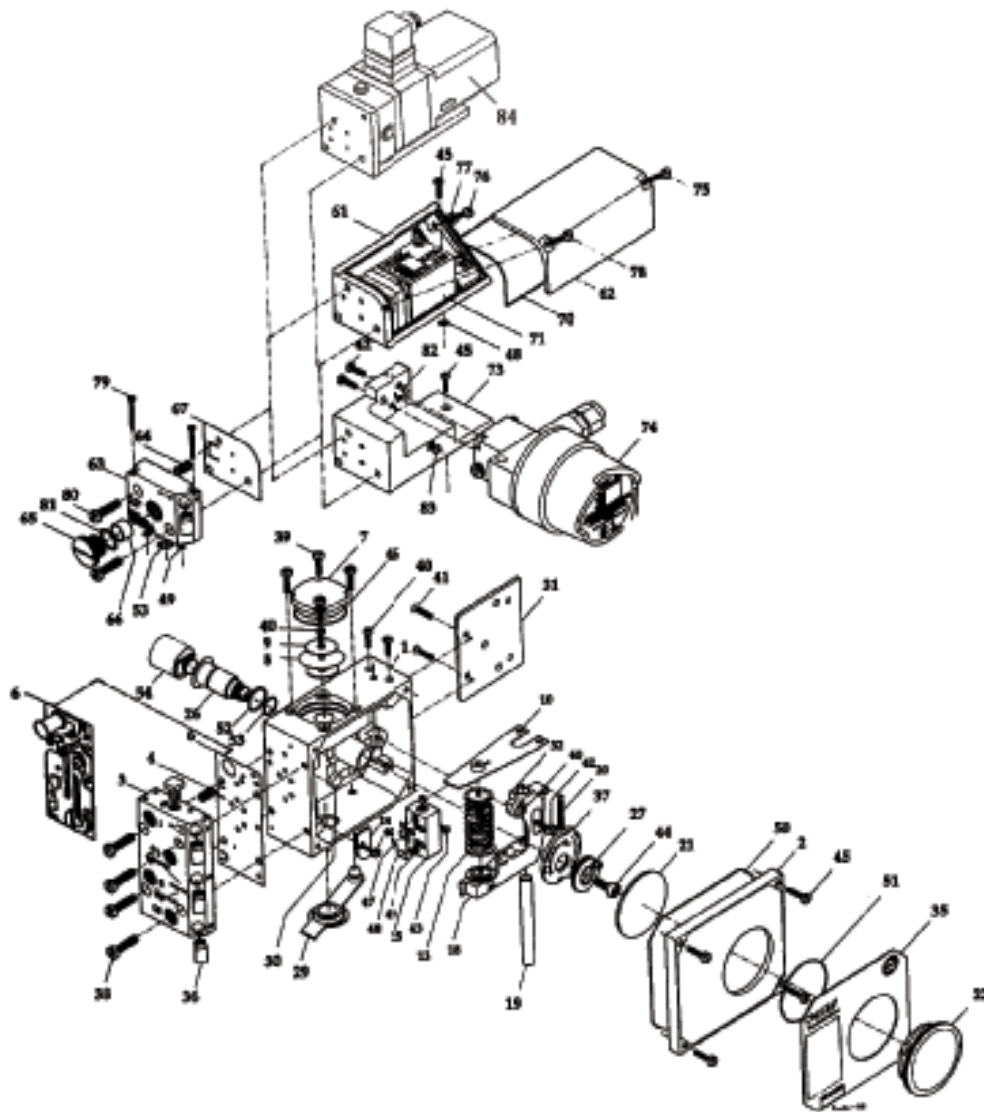
The Apex 7000 positioner is designed for long life and trouble-free operation. The following steps should be followed every six months to assure proper operation.

1. Check air supply and associated filtration equipment. See "Supply Air Requirements."
2. Make sure arms, bearings, and adjustment screws move freely. **Caution:** *Moving parts to check freedom with supply pressure connected will cause rotation of cam. Be sure to keep fingers away from cam pinch points.* If parts do not move freely disassemble and lubricate with a light, instrument grade grease (Lubriplate MAG 1 or equivalent).
3. Check for smooth operation of the spool valve. If it sticks or feels "gummy", remove and clean both spool and valve bore with solvent. Make sure both parts are clean and dry before reinstalling. Do **NOT** apply grease to these parts.
4. Check for air leaks in air supply.
5. Refer to "Troubleshooting" sections if maintenance does not cure problem.



Spare Parts APEX 7000, 7600

No.	Part No	Qty	Description	Remarks
1		1	Housing 1 N/A	
2		1	Front Cover	
3		1	Diaphragm cover incl. O-ring	
4		1	Diaphragm	
5		2	Diaphragm washer	
6		1	Balance Arm	
7		1	Feedback spring 3-15 psi assembly	
7		1	Feedback spring 6-30 psi assembly	Green
8		1	Lower arm assembly	
9		1	Rod	
10		1	Spring	
11		1	Twist Stop	
12		1	Pilot valve incl. O-rings	
13		1	Cam locking nut incl. screw	
15		1	Mounting adapter incl. screws	
16		1	Ball bearing	
17		1	Cam K1 90°/180° Linear 0-100%, split range 0-50-100% 1	
17		1	Cam special, K2-K10 (Consult Factory)	
18		1	Spindle	
19		1	Indicator Arrow	
20		1	Set Screw set	
21		1	Seal and O-ring set NBR, Nitrile rubber (4,21)	



Spare Parts APEX 7100,7200,7300, 7400

No	Part No.	Qty	Description	Remarks
1		1	Housing	
2		1	Front Cove incl. O-ring	
3		1	Connecting block NPT 1/4" assembly	
3		1	Connecting block G 1/4" assembly	
4		1	Relief valve spring	
6		1	Gasket for Apex 7000	
6		1	Gasket for Apex 7100	
7		1	Diaphragm cover incl. O-ring	
8		1	Diaphragm	
9		2	Diaphragm washer	
10		1	Balance Arm	
13		1	Feedback Spring 3-15 psi assembly	
13		1	Feedback Spring 6-30 psi assembly	
18		1	Lower arm assembly	



No	Part No.	Qty	Description	Remarks
19		1	Rod	
20		1	Spring	
21		1	Indicator Arrow	
21		1	Indicator Flag	
21		1	Indicator Pointer	
22		1	Indicator cover transparent incl. O-ring	
22		1	Indicator cover flag incl. O-ring	
22		1	Indicator cover blind incl. O-ring	
24		1	Twist stop	
25		1	Pilot valve incl. O-ring	
26		1	Shaft incl. O-rings, screws	
27		1	Cam locking nut incl. screw	
29		1	Zero Cover	
30		1	Cover	
31		1	Mounting adapter incl. screw	
32		1	Ball bearing	
35		1	Identification cover	
36		4	Plug NPT 1/8"	
36		4	Plug 1/8" G	
37		1	Cam	
38-45,75-80		1	Screw set Apex 7000/7100	
6,46-53,67,70,75-80		1	O-ring set Apex 7000/7100, Nitrile NBR	
6,46-53,67,70,75-80		1	O-ring set Apex 7000/7100, Silicone, Q	
54		1	Spindle adapter	
61		1	I/P box	
62		1	I/P cover incl. screws	
63		1	I/P nose NPT 1/4" assembly	
63		1	I/P nose G 1/4" assembly	
64		1	Relief valve spring	
65		1	Filter plug incl. filter (66), O-ring (81)	
66		1	Filters (5 per package)	
67		1	Gasket I/P	
71		1	I/P converter	
73		1	Mounting bracket round I/P	
74		1	Enclosure incl. I/P converter std.	
74		1	Enclosure incl. I/P converter, flameproof (Cenelec)	
74		1	Enclosure incl. I/P converter, Explosionproof (FM,CSA)	
84		1	I/P converter fail in last position incl. bracket	



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