ORIGINAL INSTRUCTIONS

Refer to Declaration of Conformity for relevant Directives

Instruction Manual

Cylinder Positioner

*56-IP2*0 Series*

II 3GD	Ex h IIC T6 Gc	-5°C ≤ Ta ≤ +60°C
	Ex h IIIC T65°C Dc	

Product marking shown above is for the standard product.

ATEX Marking Description:

Ex	Specific Marking for Explosion Protection
II	Equipment Group
3	Equipment Category
GD	Environment (Gas/Dust)
Ex h	General Protection Level Symbols
IIC	Gas Sub-Division
IIIC	Dust Sub-Division
T	Temp. Classification
Gc/Dc	Equipment Protection Level
X	Special Conditions of Use
Ta	Ambient Temperature Range

The intended use of this ATEX Category 3 Cylinder Positioner is to convert potential energy provided by compressed air into a force which holds a cylinder piston rod in a controlled position.

Certifcate Number:	SMC.19.0028 X

Note 1: The X at the end of the certificate number represents that this product is subject to “Special Conditions of Use”, please see Section 2.3.

1 Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC) *1), and other safety regulations.

*1) ISO 4414: Pneumatic fluid power - General rules relating to systems.
ISO 4413: Hydraulic fluid power - General rules relating to systems.
IEC 60204-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots -Safety. etc.

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

⚠ **Caution**	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
⚠ **Warning**	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ **Danger**	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠ Warning

- **Always ensure compliance with relevant safety laws and standards.**
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.

2 Specifications

This product is certified to ATEX Category 3GD and therefore is suitable for use in Zones 2 & 22 only.

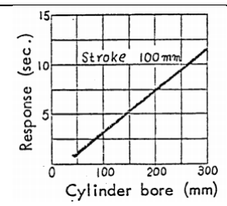
2.1 Product Specifications:

Refer to the operation manual for this product;

2.1.1 Specifications:

Fluid		Air (no lubrication) 5µm filtration degree
Supply Pressure		0.3 to 0.7 MPa
Signal Pressure		0.02 to 0.10 MPa
Port Size		Rc 1/4
Pressure Gauge Port Size		Rc 1/8
Linearity		Less than ± 2% F.S.
Hysteresis		Less than 1% F.S.
Repeatability		Less than 1% F.S.
Sensitivity		Less than 0.5% F.S.
Air Consumption (at 0.5MPa Supply)		18 L/min (ANR) or less
Maximum Air Flow (at 0.5 MPa Supply)		200 L/min (ANR) or more
Supply pressure variation (at 0.5 MPa Supply ± 0.05 MPa)		1%
Applicable cylinder bore size		Ø50 to 300mm
Applicable cylinder stroke		25 to 300mm
Operating Temperature	Standard	-5°C to +60°C
	Low Temp.	-30°C to +60°C
	High Temp.	-5°C to +100°C

2.1.2 Response Time:



2.2 Production Batch Code:

The batch code printed on the label indicates the month and the year of production as per the following table;

Production Batch Codes

Year		2017	2018	2019	…	2021	2022	2023	…
Month		V	W	X	…	Z	A	B	…
Jan	o	Vo	Wo	Xo	…	Zo	Ao	Bo	…
Feb	P	VP	WP	XP	…	ZP	AP	BP	…
Mar	Q	VQ	WQ	XQ	…	ZQ	AQ	BQ	…
Apr	R	VR	WR	XR	…	ZR	AR	BR	…
May	S	VS	WS	XS	…	ZS	AS	BS	…
Jun	T	VT	WT	XT	…	ZT	AT	BT	…
Jul	U	VU	WU	XU	…	ZU	AU	BU	…
Aug	V	VV	WV	XV	…	ZV	AV	BV	…
Sep	W	VW	WW	XW	…	ZW	AW	BW	…
Oct	X	VX	WX	XX	…	ZX	AX	BX	…
Nov	y	Vy	Wy	Xy	…	Zy	Ay	By	…
Dec	Z	VZ	WZ	XZ	…	ZZ	AZ	BZ	…

2.3 Special Conditions of Use:

- Products are suitable for sub-divisions IIC & IIIC.
- Products are suitable for Zones 2 & 22 only.

2.3.1 Temperature Marking:

2.3.1.1 Standard Product:

- In the special ambient temperature range (-5°C to +60°C) the product is rated to temperature class T6 and has a maximum surface temperature of 65°C.

2.3.1.2 Low Temperature Variant:

- In the special ambient temperature range (-30°C to +60°C) the product is rated to temperature class T6 and has a maximum surface temperature of 65°C.

2.3.1.3 High Temperature Variant:

- In the special ambient temperature range (-5°C to +60°C) the product is rated to temperature class T6 and has a maximum surface temperature of 65°C.
- In the special ambient temperature range (+60°C to +80°C) the product is rated to temperature class T6 and has a maximum surface temperature of 85°C.
- In the special ambient temperature range (+80°C to +100°C) the product is rated to temperature class T4 and has a maximum surface temperature of 105°C.

3 Installation

3.1 Installation

⚠ Warning

- Do not install the product unless the safety instructions have been read and understood.
- Do not twist or bend the cylinder or mount the product when subject to tension.
- Do not use in an application where the product is stopped mid-stroke, via an external stop.
- Ensure the piston velocity does not exceed the corresponding allowable speed controlled by the minimum stroke time indicated in the response time diagram. The stroke position and instability can occur if these speeds are exceeded

3.1.1 Speed adjustment method:

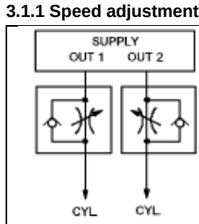


Fig. 1

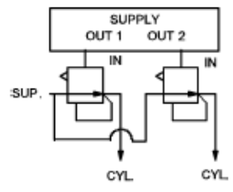


Fig. 2

- When the speed is too fast (2 seconds/stroke), attach a meter-out type speed controller in the output side as indicated in Figure 1, as it may cause overshooting or hunting.
- When the speed is too slow, attach booster relays on the output side of the positioner, as indicated in Figure 2.
- The positioner should be protected from vibration as it may cause oscillation of the feedback spring and unstable behaviour. The sensitivity to these vibrations increases in proportion to the total development of the cylinder capacity. Naturally, they can be dampened by reducing the working pressure or by using regulation valves.
- Use copper or brass tubes for pipe line arrangement and ensure they are clean before installation.

⚠ Caution

- Do not apply pressure on the protection cover. Install the cylinder rod without twisting (See Figure 3). If the cylinder rod is subject to twisting, there is a special anti-rotation device that will restrict such twisting from being transmitted to the positioner. Ask for further information.
- This positioner cannot be used to cause cylinder to compress when input signal pressure is increased. It will be necessary to replace with a double rod cylinder or install a reversing relay for the input pressure signal.
- Ensure that the product is installed to keep the lateral load on cylinder within its allowable limit.

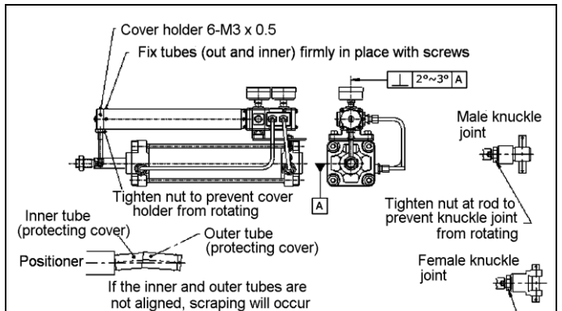


Fig. 3

3.2 Environment

⚠ Warning

- Do not use in an environment where corrosive gases, chemicals, water, salt water or steam are present.
- Do not use in an explosive atmosphere except within the specified rating.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product’s specifications.
- Do not use in a place subject to heavy vibration and/or shock.
- Do not use in wet environments, where water can remove the presence of the lubrication.
- Do not use in case of heavy dusty environments where dust can penetrate into the cylinder and dry the grease.
- Do not allow dust layers to build up on the cylinder surface and insulate the product.
- When this product is shipped from the factory it is protected by dust proof sealing (vinyl) against infiltration of dust into the positioner. Leave sealing in place after unpacking until ready to connect to the circuit.
- If this product has been purchased and is stored for a period of time after unpacking, place in an area which is free from humidity and corrosive gases. Be careful of the storage environment, when the product leaves the factory the surfaces are painted and treated according to the product specifications, however in unfavourable storage conditions corrosion may appear.

3.3 Piping

⚠ Caution

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave *1 thread* exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.

Thread	Tightening Torque
Rc 1/4	12 ~ 14 Nm

- If the operating air supply contains dust or there is rust, metal filings or oil in the piping, they can cause clogging in the fixed orifice and faulty spool movements.
- Use copper piping for air supply and transmission of force to avoid corrosion. When connecting piping to positioner, carry out adequate air purging beforehand. Be careful to make correct connections. If using high air pressure is inadvertently connected to the input pressure connecting port, the diaphragm will be damaged.

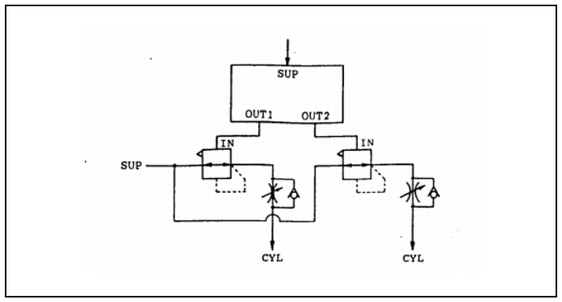
3.4 Lubrication

⚠ Caution

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, refer to catalogue for details.

- The nozzle flapper system has been adopted for the pilot valve and a lubricator should not be used in the supply airline.

3.5 Basic Circuit



- Plugging one or both of the exhaust ports on the actuator is considered a non-intended use, and could relate to an increase in maximum surface temperature above what the product specification declares.

3.6 Electrical Connection

- Ground the product in accordance with applicable regulations.
- Do not pass an electrical current through the product.

4 Settings

4.1 Adjusting method

Span adjustment

- In order to obtain a cylinder stroke corresponding to the pressure signal of 0.02~0.1MPa, the winding number of feedback spring (2) is varied by the span adjusting device (1). When the winding number is increased, the span will expand and when decreased, it will compress. When adjusting span, refer to Fig. 4 and check the winding number to a given stroke.
- Take out the feedback spring (2) and adjust the winding number by adjusting device (1). With the cylinder installed, adjust the zero adjusting screw (3) so that the cylinder will start moving at an input signal pressure of 0.02MPa and increase to 0.1MPa.
- If the cylinder does not reach full extension, increase the number of winding, and if it over extends, decrease the number of winding. When changing the number of winding, remove the small screw (4) and shift cover (5) toward the left side with the signal pressure increased to 0.1MPa. Zero adjustment must be made when the winding number is changed.

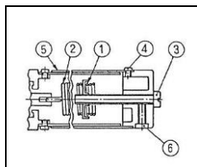
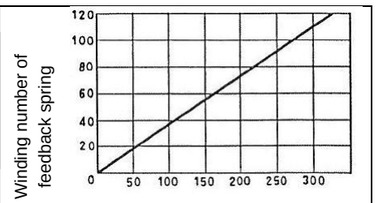


Fig. 4



- **Zero adjustment:**
  Loosen lock screw (6). When the zero adjustment screw (3) is turned right, the cylinder will retract and when turned left, it will extend.

5 How to Order

Refer to the standard product catalogue for ‘How to Order’.

6 Outline Dimensions (mm)

Refer to the standard product catalogue for general dimensions.

7 Maintenance

7.1 General Maintenance

Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous.
- Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.
- Do not use a product which looks or contains damage, this will invalidate the certification. If damage is seen, please replace the product immediately.
- Periodically check the product for any damage or rust appearing. This could result in an increase in friction and lead to dangerous conditions. Replace the whole actuator if any of these conditions appear.

7.2 Troubleshooting

Fluid	Possible causes	Corrective actions
Cylinder does not move when pressure signal is raised or lowered.	The fixed orifice in positioner is clogged.	Remove orifice and clean with a 0.4 mm pin.
	Piston seal in cylinder is worn.	Replace the product
When pressure signal is raised or lowered, operation is jerky.	1. Action is not smooth due to object caught in spool.	1. Clean out the spool.
	2. Fixed orifice in positioner is clogged.	2. Remove fixed orifice and clean out with 0.4mm pin.
Cylinder will not move at pressure signal of 0.02MPa. or Cylinder moves at pressure signal below 0.02 MPa.	The zero adjustment screw is loosened and is out of place.	Loosen lock screw and adjust zero point with zero adjusting screw.
Cylinder movement corresponding to pressure signal of 0.02~0.1 MPa cannot be obtained.	Position of span adjusting device is positioner is not proper.	Remove screw from protection cover and adjust span adjustment device to best position with pressure signal at about 0.06MPa. If span is overextended, decrease spring winding, and if too short, increase spring winding. This adjustment should be made together with zero adjustment.

7.3 Periodic Check Procedure

7.3.1 Positioner Pressure Gauge

Apply an input pressure into a controlled/calibrated gauge and the gauge being investigated and ensure the reading is correct.

Check for the following:

- If the difference between the two values is one graduation or more, then this should be replaced.

7.3.2 Supply Diaphragm Assembly

Remove the Cover (Part 1), visually check the diaphragm (Part 13).

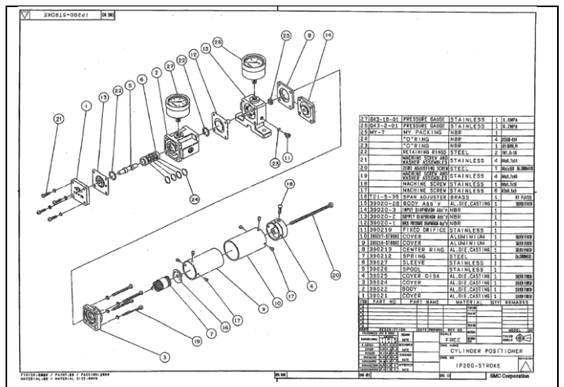


Fig.5: IP2*0 Layout and Part References

Check for the following:

- If there are any visible cracks or damage, then this should be replaced.

7.3.3 Input Diaphragm Assembly

Remove the Cover (Part 3), visually check the Input Diaphragm Assembly (Part 14).

Check for the following:

- If there are any visible cracks or damage, then this product should be replaced.

7.3.4 Back Pressure Diaphragm Assembly

Remove the Cover (Part 3) and the Body Assembly (Part 15), then visually check the Back Pressure Diaphragm assembly (Part 12).

Check for the following:

- If there are any visible cracks or damage, then this should be replaced.
- Wipe out the grease from the part shown in Fig.6 and re-grease with **Silcone Grease [Type H45 by Toray Industry Inc.].**

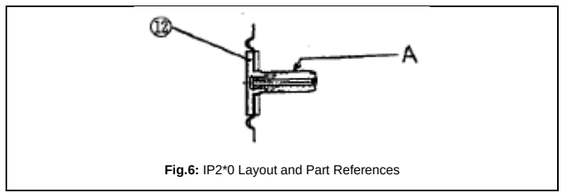


Fig.6: IP2*0 Layout and Part References

7.3.5 Spool Sleeve Assembly

Remove the Cover (Part 1), the Supply Diaphragm Assembly (Part 13) and the Retaining Rings (Part 22). Take the spool out from inside and check the sliding surface of the spool and inspect the sleeve visually.

Check for the following:

- If there are flaws on the sliding section, replace the product.

7.3.6 Fixed Orifice

Remove the fixed orifice (Part 11), and check the tip of the Ø0.4mm hole visually.

Check for the following:

- When the hole is clogged, clean it with a fine pin of less than Ø0.4mm.

7.3.7 Feedback Spring

Remove the Machine Screw (Part 17) and Covers (Parts 9 and 10) and visually inspect the Feedback Spring.

Check for the following:

- If any deformation, cracks or visual damage can be identified then replace the product.

7.3.8 Exhaust Noise

Supply pressure to the product and listen to the exhaust noise from the positioner.

Check for the following:

- If there is any abnormal noises detected from the product, the check the Diaphragm, and if it does not improve replace the product.

8 Limitations of Use

8.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products located on www.smcworld.com .

8.2 Obligations of the end-user

- Ensure the product is used within the specification outlined.
- Ensure that the maintenance periods are suitable for the application.
- Ensure any cleaning processes to remove dust layers are made with the atmosphere in mind (e.g. using a damp cloth to avoid static build up).
- Ensure that the application does not introduce additional hazards by mounting, loading, impacts or other methods.
- Ensure that there is sufficient ventilation and air circulation around the product.
- If the product is subject to direct heat sources in the application, they should be shielded so that the actuator temperature stays within the stated operating range.

Caution

- **SMC products are not intended for use as instruments for legal metrology.**

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.

Danger

- Do not exceed any of the specifications listed in Section 2 of this document as this will be deemed improper use.
- Air equipment has an air leakage during operation within certain limits. Do not use this equipment when the air itself introduces additional hazards and could lead to an explosion.
- Use only ATEX certified auto switches. These should be ordered separately.
- Do not use this product in the presence of strong magnetic fields that could generate a surface temperature higher than the product specification.
- Avoid applications where the shaft and the adjoining part in the application can create a possible ignition source.
- Do not install or use these actuators where there is the possibility for the shaft and adjoining parts to impact foreign objects.
- In the event of damage or failure of any parts located in the vicinity where this product has been installed, it is the responsibility of the user to determine whether or not this has compromised the safety and condition of this product and/or the application.
- External impact on the cylinder body could result in a spark and/or cylinder damage. Avoid any application where foreign objects can hit

or impact the cylinder. In such situations the application should install a suitable guard to prevent this occurrence.
- Do not use this equipment where vibration could lead to failure.

9 Contacts

Refer to Declaration of Conformity and www.smcworld.com for contacts.

SMC Corporation

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