



ORIGINAL INSTRUCTIONS

Instruction Manual
PB1011A
Process Pump



The intended use of this process pump is to convert the potential energy provided by compressed air into a force which causes mechanical linear motion. The mechanical linear motion is then used to pump liquid through a system.

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 and safety requirements for systems and their components.

ISO 4413: Hydraulic fluid power — General rules and safety requirements for systems and their components

IEC 60204-1: Safety of machinery - Electrical equipment of machines. Part 1: General requirements

ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots

- 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.

1 Safety Instructions (continued)

	Danger	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	Warning	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Caution	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate 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.
- The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.
Since the products specified here can be used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and/or tests to meet specific requirements.

- **Only trained personnel should operate pneumatically operated machinery and equipment.**

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced personnel.

- **Do not service machinery/equipment or attempt to remove components until safety is confirmed.**

- 1) Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
- 2) When equipment is to be removed, confirm the safety process as mentioned above. Switch off air and electrical supplies and exhaust all residual compressed air in the system.
- 3) Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of cylinders etc. (Supply air into the system gradually to create back pressure, i.e. incorporate a soft-start valve).

- **Do not use this product outside of the specifications.**

2 Specifications

2.1 Specifications

PB1011A Process Pump Specifications

Each of the values below are for normal temperatures and for transferred fluid fresh water.

Type	PB1011A
Type of operation	Solenoid valve built-in type
Port	Main fluid Rc, NPT, G 1/8 Female thread
size	Pilot Supply port Rc, NPT, G 1/8 Female thread
	air Exhaust port M5 x 0.8 Female thread
Material	Body wetted areas Polypropylene (PP), Stainless Steel (SUS316)
	Diaphragm PTFE
	Check valve PTFE, Polypropylene (PP)
	Liquid contact seals FKM
Maximum discharge rate ¹	2000 mL/min
Average discharge pressure	0 to 0.6 MPa
Pilot Air Pressure	0.2 to 0.7 MPa
Air consumption	40 L/min (ANR) or less
Suction head	Up to 2.5 m (dry state inside the pump)
Noise	64 dB(A) or less (option: with silencer AN120-
Withstand pressure	1.05MPa
Diaphragm life (Reference) ²	30 million times (One time per cycle)
Operating fluid temperature	0 to 50°C (No freezing, heat cycle is not applied)
Ambient temperature	0 to 50°C (No freezing, heat cycle is not applied)
Recommended operating	1 to 10 Hz
Weight	0.18 kg
Mounting orientation	FLUID OUT port at top
Maximum operating viscosity	100 mPa·s
Power supply voltage	DC24 V
Power consumption	0.35 W
Packaging environment	General environment

Note 1: When the piping length of both the suction side and the discharge side is almost 0m. It may not be possible to obtain the discharge in the specification depending on the piping conditions.
Note 2: These are reference values and are not guaranteed. For details, refer to operation manual.

Warning

Special products (-X) might have specifications different from those shown in this section. Contact SMC for specific drawings.

2 Specifications (continued)

2.2 Performance Curves

Cycle 1Hz

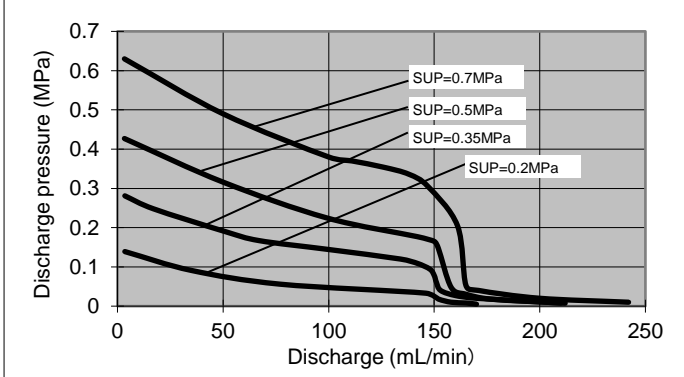


Fig 1a. Flow rate characteristic graph for Cycle (1Hz)

Cycle 5Hz

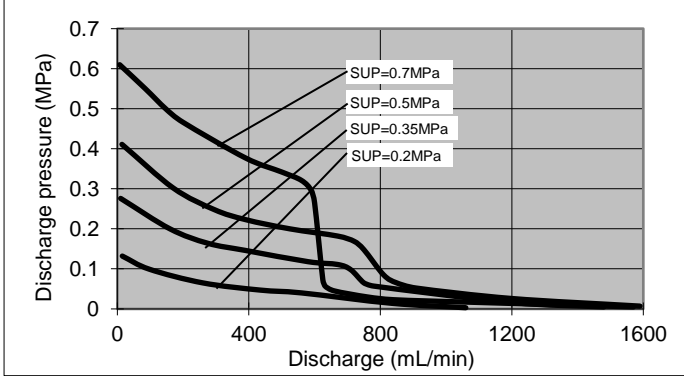


Fig 1b. Flow rate characteristic graph for Cycle (5Hz)

Specifications (continued)

Cycle 7Hz

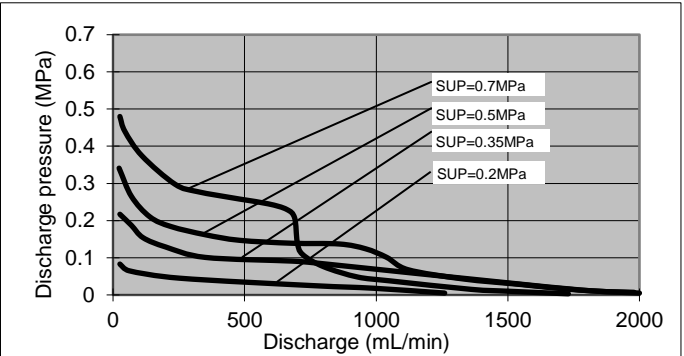


Fig 1c. Flow rate characteristic graph for Cycle (7Hz)

2.3 Air Consumption and Viscosity

Refer to the information in the PB1000 web catalogue for air consumption calculation and selection of viscosity characteristic.

2.4 Production Batch Code

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

Table 1. Construction date and batch codes

Construction Year/Month	Production Batch Codes											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2023	Bo	BP	BQ	BR	BS	BT	BU	BV	BW	BX	By	BZ
2024	Co	CP	CQ	CR	CS	CT	CU	CV	CW	CX	Cy	CZ
...
2028	Go	GP	GQ	GR	GS	GT	GU	GV	GW	GX	Gy	GZ

Specifications (continued)

2.5 Construction

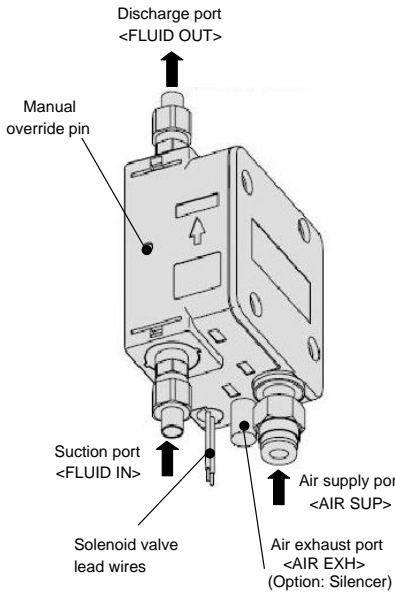


Fig.2 Name and function of parts (see Table 1)

Table 2. Name and function of parts

Name	Functions
Suction port (FLUID IN)	Sucks the fluid to be transferred.
Discharge port (FLUID OUT)	Discharges the fluid taken in the pump.
Air supply port (AIR SUP)	Supplies air of set pressure.
Air exhaust port (AIR EXH)	Exhausts pilot air
Manual override pin	The pump operates one time per push.
Lead wires	Solenoid lead wires

3 Installation

3.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.

3.2 Operating Environment

Warning

- **Do not use in the following environments, as this can cause failure.**

- a) Locations with an atmosphere of corrosive gases, organic solvents or chemical solutions, and where there may be contact with the same.
- b) Locations where there is contact with sea spray, water or steam.
- c) Locations where ultraviolet deterioration or overheating of resin may occur due to direct sunlight.
- d) Locations near heat sources with poor ventilation (heat sources should be shielded by heat insulating material).
- e) Locations with impact or vibration.
- f) Locations with excessive moisture and dust.

- Do not use the product immersing it in water (liquid). Otherwise, liquid will enter the openings inside the product resulting in a malfunction.
- If compressed air with an atmospheric pressure dew point below -40°C is used, the lubrication properties inside the product can deteriorate prematurely, affecting the life of the product. In these cases, it is recommended that customers test the product under their own specific operating conditions.

Caution

- **Fluid leakage**

- a) There are some cases where the operating fluid will leak outside the pump, for example when the diaphragm reaches the end of its life. Measures should be taken to avoid leakage, such as installing a drain pan, so that people and equipment will not be adversely affected.
- b) When dangerous fluid is used, take measures to isolate humans from the pump. External leakage of pumping fluid could cause serious injury.

- **Perform periodic inspections to confirm normal operation.**
- It may otherwise become impossible to assure safety in the event of unexpected malfunction or miss operation.

3 Installation (continued)

3.3 Mounting

Warning

- a) Only vertical mounting is possible. Mount the pump so that the FLUID OUT port is at the top. Otherwise suction failure may occur.
- b) Fix the pump securely by inserting two screws into the two M4 threaded mounting holes. If using the foot (option B) fix it securely using the two Ø4.5 mm mounting holes.
- c) Secure all specified mounting positions when using the product.
- d) If the propagation of the vibration of the pump is not acceptable, insert vibrating-isolating rubber when mounting.

- **Ensure sufficient maintenance space.**

3.4 Piping

- 1) Connect air piping to air supply port “AIR SUP”, and fluid transfer piping to suction port “FLUID IN” and discharge port “FLUID OUT”. See Fig. 3.

- Connect the solenoid valves lead wire to DC24V signal wire. Red is for positive (+) and Black is for negative (-).
- 2) Set pilot air pressure within the range 0.2 to 0.7MPa.
 - The diaphragm starts moving by inputting a ON/OFF DC24V signal repeatedly. Exhaust noise can be heard from air exhaust AIR EXH
 - Pump will suck by itself without priming (Suction pump head: 2.5m Normal temp / clean water)
- 3) To stop the pump
 - Turn off the solenoid valve to exhaust the air from the pump.

<Discharge flow rate adjustment>

1. The flow rate from the discharge port <FLUID OUT> can be adjusted easily by changing the switching cycle of the solenoid valve on the air supply port. See figure 3.

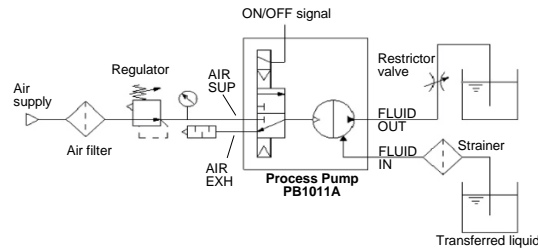


Fig 3. Circuit Example

3 Installation (continued)

Caution

- Flush and clean up chips, cutting oil, dust etc. from the piping before connecting the product.
- Any dirt or scale left in the piping may cause a malfunction or failure. Ensure sealant material does not enter the ports.
- Only use fittings with resin threads when using a product with resin threads at the ports. Using metal fittings may damage the product. 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.
- **Always fasten threads with the correct tightening torque**
When screwing fittings into the product, tighten them with the appropriate torque as shown in the table below. If loose, liquid or air leakage may occur. If overtightened, the threaded parts may be damaged.

Table 3. Connection type and tightening torque

Connection thread	Tightening torque N·m
Rc, NPT, G 1/8	0.8 to 1.0

3.5 Air Supply

Warning

- **Use clean air.** Do not use compressed air that includes chemicals, synthetic oils containing organic solvents, salinities or corrosive gases, etc., as these can cause damage or malfunction.
- **Avoid freezing in low temperatures.** The equipment operates while expanding compressed air. Temperature inside decreases due to adiabatic expansion. If ambient temperature is low, use of humid compressed air can cause freezing. Take prevention measures such as the use of a membrane dryer (such as IDG series).

Caution

- **Quality of operating air.**
 - Only use air filtrated by a micro mist separator (such as AMD series). Use of a super mist separator (such as AME series) is recommended to extend maintenance intervals.
 - Use of humid air may cause condensation inside the pump. Use air which has been treated by a refrigerated air dryer (such as IDF series).
 - If the pump is operated with N₂ gas, the deterioration of the gaskets in the switching valve will be accelerated and may shorten the life of the product.

3 Installation (continued)

3.6 Storage

Warning

- In case of long-term storage after use, first thoroughly remove all the liquid and clean and dry the inside to prevent deterioration to the pump materials.
- After a long period of non-use, perform a trial run prior to operation.
- Ensure that the bolts are not loose before operating the process pump.

3.7 Lubrication

Caution

- **Do not lubricate the compressed air supplied as pilot air.**
- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.

3.8 Fluid

Warning

- Always take countermeasures against static electricity.
- Check the fluid compatibility check list. Consider that the compatibility may change with type, additives, concentration, temperature, etc.
- Foreign matter in the fluid may cause abrasion. The use of a strainer with 80 to 100 mesh (150 to 180 μm) is recommended.
- When transferring coagulable liquids, take measures to prevent coagulation inside the pump.
- Take measures to prevent fluid getting on the body of the pump.
- **Do not allow pump to idle for a long time.**
If the pump is operated for a long time without any fluid inside or in a gas-fluid mixed state, the diaphragm may be damaged, or the life may be shortened. Dry operation is only allowed during self-priming.
- **Flammable fluids cannot be used with the process pump with built-in solenoid valve. Do not use in an environment where flammable fumes are present or where flammable liquid may get stuck to the product.**
- **The pump cannot transfer gas.**
- **Liquid seal.** To ensure that fluid does not become sealed in the pump, relieve the discharge pressure when stopping the pump. Include a pressure relief valve on your system.

3 Installation (continued)

Warning

- **Be sure to observe the maximum operating pressure.**
Operation above the maximum operating pressure can cause damage. Avoid application of pressure above the specifications caused by water hammer, for example when a valve is operated abruptly. Take measures to prevent pressures higher than specified, such as:
 1. Use a water hammer relief valve or reduce the valve's closing speed.
 2. Absorb impact pressure by using elastic piping material such as rubber, or an accumulator, etc.

4 How to Order

Refer to the information in the PB1000 web catalogue for 'How to Order'.

5 Outline Dimensions

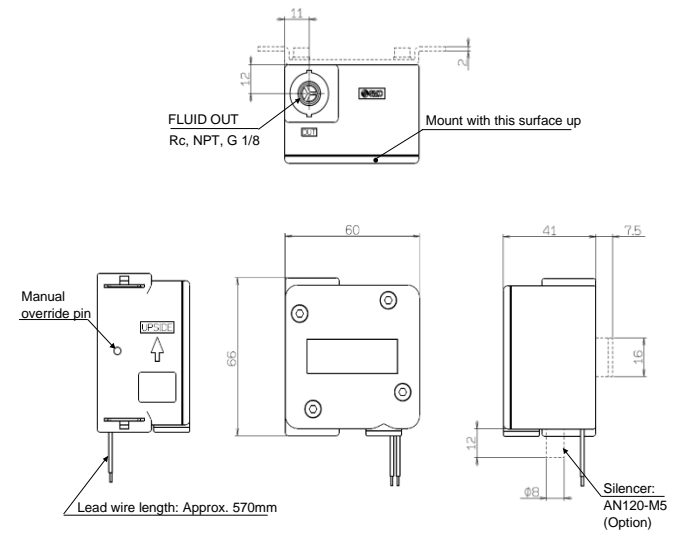


Fig 4. Outline dimensions

5 Outline Dimensions (continued)

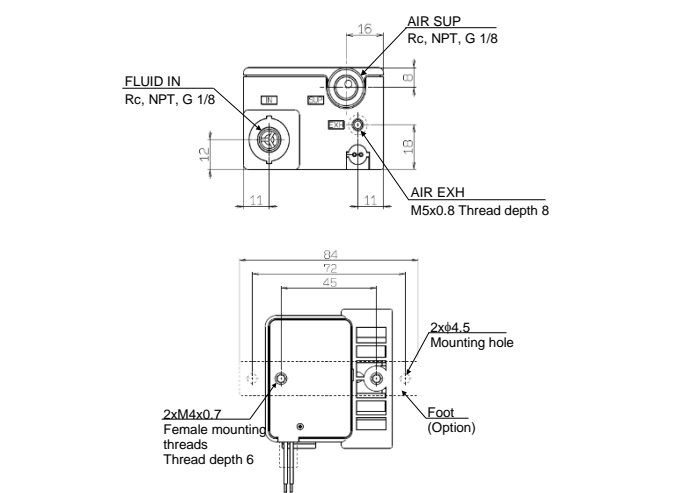


Fig 5. Outline dimensions

6 Maintenance

6.1 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.
- Do not disassemble the product. Disassembly will void the warranty.
- Even when maintenance is the reason for disassembly, the warranty will be void. In such cases, carry out the procedures in accordance with the maintenance manual specific to each 'Process Pump' model. If handled improperly, it can cause injuries or damage/malfunction to machines and equipment.

7 Maintenance (continued)

Caution

- After maintenance apply operating pressure and power to the equipment and check for proper operation and possible air leaks. If operation is abnormal, verify product set-up parameters.
- If any electrical connections are disturbed during maintenance, ensure that they are reconnected and that safety checks are carried out.
- Do not make any modification to the product.
- Do not step on or place heavy objects on the unit. The equipment may be deformed or damaged.
- **Discharge drainage regularly from components and filters.**
Operating the system with accumulated drain in equipment or piping may cause malfunctions, downstream splashes or unexpected accidents.
- **Only perform maintenance work after confirming system safety.**
 1. Turn off the compressed air and power supply. Exhaust any residual air pressure.
 2. Discharge any residual liquid or displace it as necessary.
- **Confirm system safety after reinstallation, prior to operation.**
- **Use appropriate protective equipment.**
When handling the product for maintenance, wear equipment such as gloves and goggles compatible with the fluid being used.
- The bolts in this product may become loose over time due to creep of the PP housing. Retighten the bolts before operation to prevent fluid or air leakage. Refer to the maintenance manual for the required tightening torque.

7.1 Service life and replacement of consumable parts

- When the pump exceeds the number of service life cycles, the diaphragm deteriorates, and malfunction may occur. When this occurs, fluid will leak into the air pilot exhaust port and air will enter the liquid circuit. Consider the pump operating conditions and reference service life to replace the pump or conduct maintenance as necessary.
- Items such as check valves, solenoid valve and other components may experience malfunction earlier than the diaphragm depending on operation conditions. Replace damaged parts as soon as possible.
- Obtain the necessary parts as indicated in the maintenance parts list and only perform work according to maintenance and operation manuals.

7.2 Calculation of reference service life (days) of diaphragm

The amount of discharge per cycle for the air operated type depends on the piping resistance. Therefore, service life (days) is calculated using the operating frequency of the solenoid valve.

7 Maintenance (continued)

Reference service life (days) = $\frac{A(\text{Reference number of cycles in service life})}{\text{Operating frequency of solenoid valve (Hz)} \times \text{Operating time per day (hours)} \times 3600}$

Table 4. Reference service life

Model	Diaphragm Material	Amount of discharge per cycle	Ref. Number of cycles in service life A	Volume inside of pump (wetted parts)
PB1011A	PTFE	4 mL	30 million cycles	Approx. 9 mL

Note 1: The amount of discharge for the air operated type is indicated assuming no piping resistance.
Note 2: These are reference values given for rated temperature and tap water and are not guaranteed.

Example 1:

Frequency solenoid valve 5 Hz and operating 8 hours per day.

Reference service life (days) = $\frac{30,000,000}{5 \text{ (Hz)} \times 8 \text{ (hour)} \times 3600 \text{ (sec/hour)}} = 208 \text{ days}$

7.4 PB1011A Spare Parts List

Table 5. Spare part number and description

Spare Part No.	Description
KT-PB1A-9	Diaphragm set
KT-PB1A-1	Check valve set
KT-PB1A-7	Port set (Rc screw)
KT-PB1A-7N	Port set (NPT screw)
KT-PB1A-7F	Port set (G screw)
KT-PB1A-4	Seal set
KT-PB1-3	Foot set
SYJ314M-5H-Q	Kit for integrated solenoid valve

Note 1: Refer to the part number in the maintenance manual to check the parts.
Note 2: After performing maintenance confirm that the process pump is operating normally and ensure there is no leakage.

7.5 Inability to repair the product

In order to enable the process pump to be used with various fluids, and regarding workers and facilities safety, please understand that SMC is unable to carry out repairs on customer units.9 Limitations of Use

8 Applicable Fluids

Caution

- **Flammable fluids cannot be used with the process pump with built-in solenoid valve. Do not use in an environment where flammable fumes are present or where flammable liquid may get stuck to the product.**
- Select the wetted parts materials according to the transfer liquid you will use.
- These products are not suitable for use with medical or food products.
- Applicability will change depending on additives and impurities. Take note of additives and impurities.
- Applicability may vary with operating conditions, be sure to check with testing.
- Compatibility shown in the table is for a fluid temperature within specification.

Material and fluid compatibility - PB1011A

Table symbols O: Can be used. X: Cannot be used

Model		PB1011A
Body material		PP, Stainless Steel 316
Diaphragm material		PTFE
Examples of applicable liquids	Tap water	O
	Neutral detergent	O
	Kerosene	X
	Oils	X
	Ethyl alcohol	X
	Isopropyl alcohol	X
	Thinners	X
	Flammable liquids	X
	Acids	X
	Alkalis	X

Note: These pumps could be penetrated by fluids, and penetrating fluids may affect internal parts of other materials.

9 Limitations of Use

Danger

8.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

Caution

8.2 Obligations of the end-user

- Ensure the product is used within the specification outlined.

9 Limitations of Use (continued)

Caution

- Ensure that the maintenance periods are suitable for the application.
- Ensure that the application does not introduce additional hazards by mounting, loading, impacts or other methods.
- Use caution so that the operating fluid does not adhere to the product's outer surface. Never use the product with the operating fluid adhering to the product's outer surface.
- **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.
- 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.
- 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.
- Do not use this equipment where vibration could lead to failure.

10 Product Disposal

This product shall not be disposed of as municipal waste. Check your local regulations and guidelines to dispose this product correctly, in order to reduce the impact on human health and the environment.

11 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor/importer.

SMC Corporation

URL: [https:// www.smcworld.com](https://www.smcworld.com) (Global), <https:// www.smc.eu> (Europe)
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