



Installation and Maintenance Manual

Process Pump

56-PA3###/PA5###

Process Pump



56-PA3### II 3GD c T6 0°C ≤ Ta ≤ +60°C  
 56-PA5### II 3GD c T6 0°C ≤ Ta ≤ +60°C

1 Safety Instructions

- This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.
- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- These instructions indicate the level of potential hazard by label of "Caution", "Warning" or "Danger", followed by important safety information which must be carefully followed.
- To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

	<b>Caution</b>	Indicates a hazard with a low level of risk, which if not avoided, could result in minor or moderate injury.
	<b>Warning</b>	Indicates a hazard with a medium level of risk, which if not avoided, could result in death or serious injury.
	<b>Danger</b>	Indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury.

**Warning**

- 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. Trained and experienced personnel should perform assembly, handling or repair of pneumatic systems.
- 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. Contact SMC if it is to be used in any of the following conditions:**  
 1) Conditions and environments beyond the given specifications, or if the product is to be used outdoors.  
 2) Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.  
 3) An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

1 Safety Instructions (continue)

- CLEAN ONLY WITH DAMP CLOTH!**
- AVOID HITTING THE PRODUCT WITH METALLIC OBJECTS!**
- DO NOT RUN THE PUMP WITHOUT FLUID!**

**Caution**

- Ensure that the air supply system is filtered to 5 microns.
- Marking description  
 Suitable for Gas and Dust environments (Zones 1, 21, 2 & 22)



2 Specifications

2.1 Specifications

56-PA Series Process Pump Specifications

Model	Automatically operated type				Air operated type			
	56-PA31#0	56-PA32#0	56-PA51#0	56-PA52#0	56-PA3113	56-PA3213	56-PA5113	56-PA5213
Port sizes	Rc, NPT, G, NPTF 3/8"				Rc, NPT, G, NPTF 1/2", 3/4"			
Main fluid suction / discharge port	Rc, NPT, G, NPTF 1/4"							
Pilot air supply / exhaust port	Rc, NPT, G, NPTF 1/4"							
Liquid contact areas	ADC12	SCS14	ADC12	SCS14	ADC12	SCS14	ADC12	SCS14
Diaphragm	PTFE, NBR				PTFE, PFA			
Check valve	PTFE							
Discharge rate	1 to 20L/min		5 to 45L/min		0.1 to 12L/min		1 to 24L/min	
Average discharge pressure	0 to 0.6MPa							
Pilot air consumption	Maximum 200L/min (ANR)		Maximum 300L/min (ANR)		Maximum 150L/min (ANR)		Maximum 200L/min (ANR)	
Suction lifting range	Up to 1m (interior of pump dry)		Up to 2m (interior of pump dry)		Up to 1m (interior of pump dry)		Up to 0.5m (interior of pump dry)	
Fluid temperature	Up to 6m (liquid inside pump)							
Ambient temperature	0 to 60°C (no freezing)							
Pilot air pressure	0.2 to 0.7 MPa				0.1 to 0.5 MPa			
Withstand pressure	1.05 MPa				0.75 MPa			
Mounting position	Horizontal (with mounting foot at bottom)							
Weight	1.7kg	2.2kg	3.5kg	6.5kg	1.7kg	2.2kg	3.5kg	6.5kg
Recommended operating cycles	--				1 to 7Hz (0.2 to 1Hz also possible depending on conditions) Note2			
Pilot air solenoid valve recommended Cv factor	--				0.20		0.45	

\*Each of the values above indicates use at ordinary temperatures with tap water.

Note 1: With cycles at 2Hz or more

Note 2: After initial suction of liquid operation at 1 to 7Hz, it can be used with operation at lower cycles. Since a large quantity of liquid will be pumped out, use a suitable throttle in the discharge port if problems occur to control the flow.

Note 3: With low number of operating cycles, even a valve with a small Cv factor can be operated.

2.2 Examples of Performance Curves

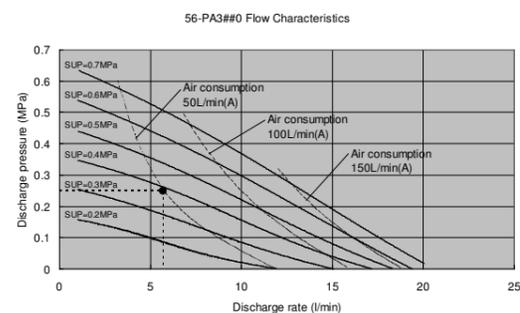


Fig.1 Automatically operated type flow rate characteristic graph

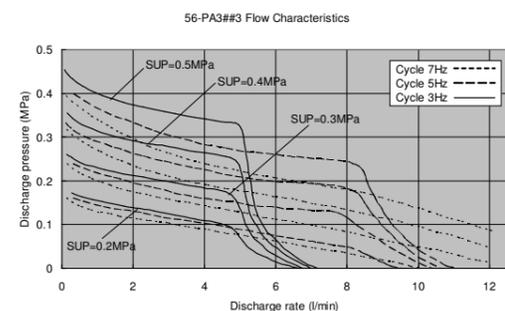


Fig.2 Air operated type flow rate characteristic graph

3 Specifications (continue)

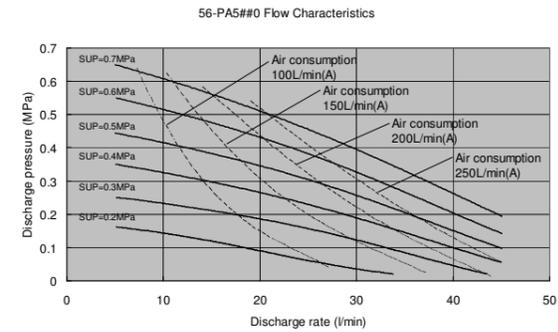


Fig.3 Automatically operated type flow rate characteristic graph

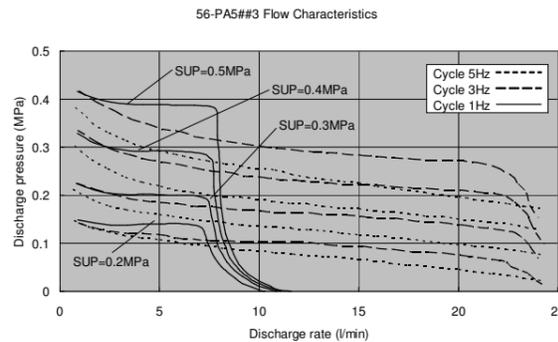


Fig.4 Air operated type flow rate characteristic graph

Example of how to use the performance curves:

Example for PA3##0 (Automatically operated type):

Find the pilot air pressure and pilot air consumption rate for a discharge rate of 6L/min and a total lifting range of 0.25MPa. [The transfer fluid is tap water (viscosity 1mPa·s, specific gravity 1.0).]

- First mark the intersection point for a discharge rate of 6L/min and a lifting range of 0.25MPa.
- Find the pilot air pressure for the mark point. In this case, the point is between the discharge curves (solid lines) for SUP=0.3MPa and SUP=0.4MPa, and based on the proportional relationship to these lines, the pilot air pressure for this point is approximately 0.38MPa.
- Next find the air consumption rate. Since the marked point is below the curve for 50L/min (ANR), the maximum rate will be about 50L/min (ANR).

**Caution**

- These flow rate characteristics are for tap water (viscosity 1mPa·s, specific gravity 1.0).
- The discharge rate differs greatly depending on properties (viscosity, specific gravity) of the fluid being transferred and operating conditions (lifting range, transfer distance), etc.
- Use 0.75kW per 100L/min (ANR) of air consumption as a guide for the relationship of the air consumption rate to the compressor.

Example of how to use the viscosity characteristics graph:

Find the pilot air pressure and pilot air consumption rate for a discharge rate of 2.7L/min, a total lifting range of 0.25MPa, and a viscosity of 100mPa·s.

- First find the ratio of the discharge rate to tap water when viscosity is 100mPa·s from the graph (see Fig.5). It is determined to be 45%.
- Next in the required specification example, the viscosity is 100mPa·s and the discharge rate is 2.7L/min. Since this is equivalent to 45% of the discharge rate for tap water, 2.7L/min ÷ 0.45 = 6L/min, indicating that a discharge rate 6L/min is required.
- Finally find the pilot air pressure and pilot air consumption rate based on selections from the flow rate characteristic graphs.

2 Specifications (continue)

3.1 Selection from Viscosity Characteristic Graph

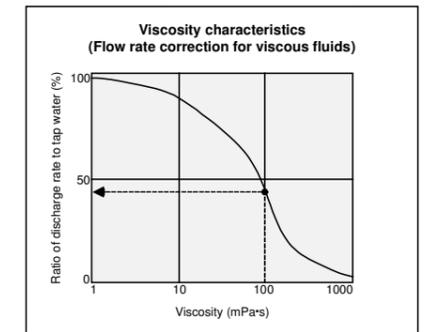


Fig.5 Viscosity characteristic

**Caution**

- Viscosities up to 1000mPa·s can be used.

3.2 Production batch code

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

Year	Month											
	2003	2004	2005	---	2021	2022	2023	---				
Month	H	i	J	---	Z	A	B	---				
Jan	o	Ho	io	Jo	---	Zo	Ao	Bo	---			
Feb	P	HP	iP	JP	---	ZP	AP	BP	---			
Mar	Q	HQ	iQ	JQ	---	ZQ	AQ	BQ	---			
Apr	R	HR	iR	JR	---	ZR	AR	BR	---			
May	S	HS	iS	JS	---	ZS	AS	BS	---			
Jun	T	HT	iT	JT	---	ZT	AT	BT	---			
Jul	U	HU	iU	JU	---	ZU	AU	BU	---			
Aug	V	HV	iV	JV	---	ZV	AV	BV	---			
Sep	W	HW	iW	JW	---	ZW	AW	BW	---			
Oct	X	HX	iX	JX	---	ZX	AX	BX	---			
Nov	y	Hy	iy	Jy	---	Zy	Ay	By	---			
Dec	Z	HZ	iZ	JZ	---	ZZ	AZ	BZ	---			

4 Construction

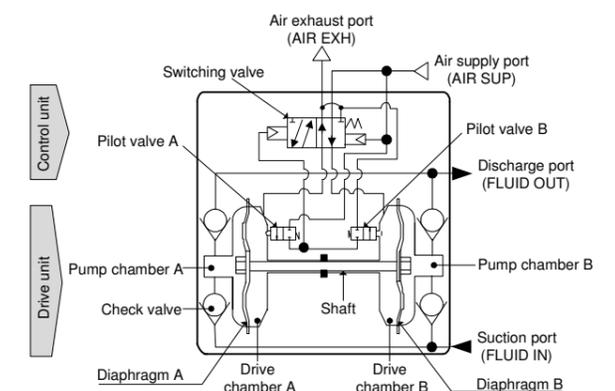


Fig.6 Automatically operated type

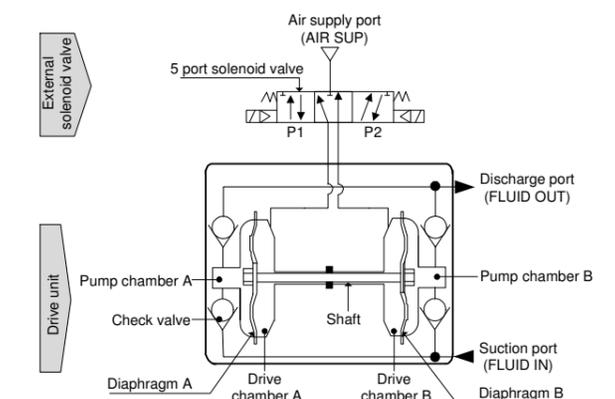


Fig.7 Air operated type

## 5 Installation

### Warning

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

### 5.1 Operating Environment

### Warning

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

- Locations with an atmosphere of corrosive gases, organic solvents or chemical solutions.
  - Locations where there is contact with sea spray, water or steam.
  - Locations where ultraviolet deterioration or overheating of resin may occur due to direct sunlight.
  - Locations near heat sources with poor ventilation (heat sources should be shielded by heat insulating material).
  - Locations with impact or vibration.
  - Locations with excessive moisture and dust.
- Do not use the product submersed in water (liquid). Otherwise, liquid will enter the openings inside the product resulting in malfunction.
- Using very dry compressed air as the pilot air may affect the reliability (service life) of the equipment, because the lubrication characteristics inside the equipment will deteriorate. Please consult with SMC when using very dry compressed air as the pilot air.

### Caution

#### Fluid leakage

- Take measures to deal with leakage. Fluid may leak when the pump is in operation due to aging of the diaphragm, etc. Take measures so that leakage in this type of situation will not have an adverse effect on equipment or personnel.
- Be careful not to touch fluid that has leaked. Depending on the operation conditions there is a danger of burns or other injury to the skin if hot fluids or chemicals, etc., are touched.

#### Perform periodic inspections to confirm normal operation.

It may otherwise become impossible to assure safety in the event of unexpected malfunction or miss operation.

### 5.2 Mounting

### Warning

- Mount the pump horizontally with the mounting foot at the bottom.
- Secure all specified mounting positions when using this product because the reciprocal motion of the diaphragm propagates.
- If the propagation of the vibration of the pump is not acceptable, insert vibrating-isolating rubber when mounting.

## 4 Installation (continue)

#### Ensure sufficient maintenance space.

- When installing and mounting, be sure to allow the space required for maintenance and inspections.
- Do not drop, bump or apply impact when handling.
- Never mount in a place that will be used as a scaffold during piping work.
- Damage can be caused if subjected to an excessive load.

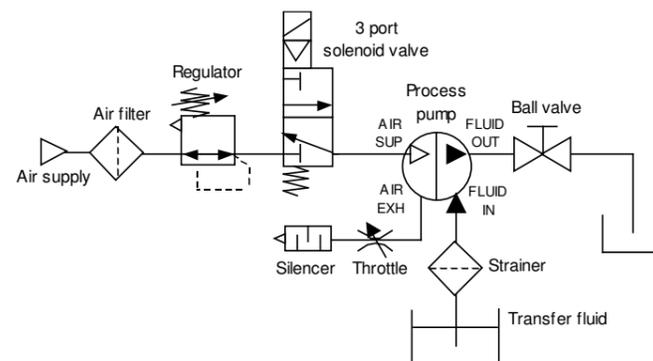
### 5.3 Piping

#### Automatically operated type (Fig. 8)

<Starting and Stopping> Refer to circuit example (1) Fig.8

- Connect air piping to the air supply port <AIR SUP> and connect piping for the fluid to be transferred to the suction port <FLUID IN> and the discharge port <FLUID OUT>.
- Using a regulator set the pilot air pressure within the range of 0.2 to 0.7MPa. Then the pump operates when power is applied to the 3 port solenoid valve of the air supply port <AIR SUP>, the sound of exhaust begins from the air exhaust port <AIR EXH> and fluid flows from the suction port <FLUID IN> to the discharge port <FLUID OUT>. The ball valve on the discharge side should be open for the pump to operate. The pump performs suction even without priming (Dry state suction lifting range: max. 1 m). To restrict exhaust noise, attach a silencer (AN20-02: option) to the air exhaust port <AIR EXH>.
- To stop the pump, exhaust the air pressure being supplied to the pump by the 3 port solenoid valve of the air supply port <AIR SUP>. The pump will also stop if the ball valve on the discharge side is closed.

Circuit example (1)



Circuit example (2)

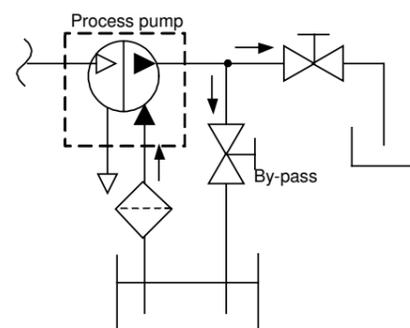


Fig.8 Piping diagram of automatically operated type

## 4 Installation (continue)

#### <Discharge flow rate adjustment>

- Adjustment of the flow rate from the discharge port <FLUID OUT> is performed with the ball valve connected on the discharge side or the throttle connected on the air exhaust side. For adjustment from the airside, use of the silencer with throttle ASN2 (port size 1/4") connected to the air exhaust port <AIR EXH> is effective. Refer to circuit example (1).
- When operating with a discharge flow rate below the specification range, provide a by-pass circuit from the discharge side to the suction side to ensure the minimum flow rate inside the process pump. With a discharge flow rate below the minimum flow rate, the process pump may stop due to unstable operation. Refer to circuit example (2) (Minimum flow rates: 56-PA3##0 1L/min, 56-PA5##0 5L/min).

#### <Reset button>

- When the pump stops during operation, press the reset button. This makes it possible to restore operation in case the switching valve becomes clogged due to foreign matter in the supply air.

#### Air operated type (Fig. 9a & Fig. 9b)

< Starting and Stopping > Refer to circuit examples

- Connect air piping <sup>Note 1</sup> to the pilot air supply ports <P1>, <P2> and connect piping for the fluid to be transferred to the suction port <FLUID IN> and the discharge port <FLUID OUT>.
- Using a regulator set the pilot air pressure within the range of 0.1 to 0.5MPa. Then, the pump operates when power is applied to the solenoid valve <sup>Note 2</sup> of the pilot air supply port and fluid flows from the suction port <FLUID IN> to the discharge port <FLUID OUT>. At this time, the ball valve on the discharge side is in an open state. The pump performs suction with its own power even without priming. (Dry state suction lifting range: 56-PA3##3 up to 1m, 56-PA5##3 up to 0.5m <sup>Note 3</sup>) To restrict

exhaust noise, attach a silencer to the solenoid valve air exhaust port.

- To stop the pump, exhaust the air pressure being supplied to the pump with the solenoid valve of the air supply port.

Note 1: When used for highly permeable fluids, the solenoid valve may malfunction due to the gas contained in the exhaust. Implement measures to keep the exhaust from going to the solenoid valve side.

Note 2: For the solenoid valve, use an exhaust centre 5 port valve, or a combination of residual exhaust 3 port valve and a pump drive 4 port valve. If air in the drive chamber is not released when the pump is stopped, the diaphragm will be subjected to pressure and its life will be shortened.

Note 3: When the pump is dry, operate the solenoid valve at a switching cycle of 1 to 7Hz. If operated outside of this range, the suction lifting height may not reach the prescribed value.

#### <Discharge flow rate adjustment>

- 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.

Circuit example (1)

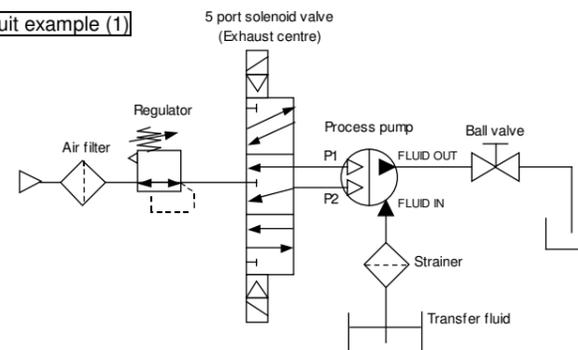


Fig. 9a Piping diagram of air operated type

## 4 Installation (continue)

Circuit example (2)

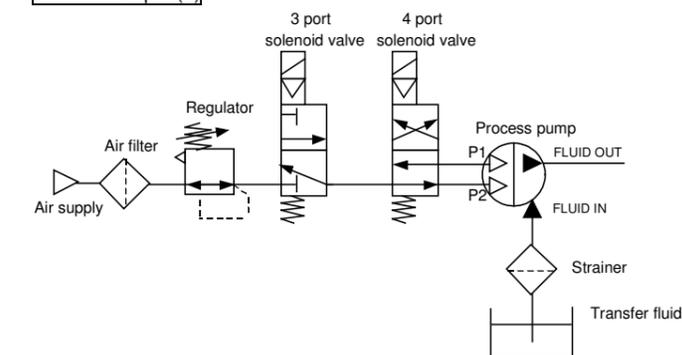


Fig. 9b Piping diagram of air operated type

### Caution

- Before 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 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Exhaust: When using automatically operated type ensure that a metal silencer is used. If the silencer is not directly connected to the body, the silencer must be grounded.

#### Connection of piping to products

When connecting piping to a product, refer to catalogue or Installation and maintenance manual to avoid mistakes regarding the supply port, etc.

#### Always fasten threads with the correct tightening torque

Connection threads	Proper tightening torque N*m
1/4"	12 to 14
3/8"	22 to 24
1/2"	28 to 30
3/4"	28 to 30

### 5.4 Air supply

### Warning

- Use clean air. Do not use compressed air that contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as these can cause malfunction or damage the equipment.
- Compressed air that includes a large amount of condensate water can cause malfunction of valves and other pneumatic equipment. As a counter measure install an air dryer upstream of the pump.
- In situations where a large amount of carbon dust is generated from the compressor, install a filter (5 microns) at the upstream side of valves to remove it otherwise, it can adhere to the interior of valves and cause malfunctions.
- Refer to the SMC "Air Cleaning Equipment" catalogue for further details on air quality.
- Use within the operating pressure range. The equipment being used determines the operating pressure range. Operation beyond this range can cause damage, failure or malfunction, etc.

### 5.5 Storage

### Caution

In case of long term storage after use with water, etc., first thoroughly remove all moisture to prevent rust and deterioration of rubber materials.



## 9 Contacts

<b>AUSTRIA</b>	(43) 2262 62280-0	<b>LATVIA</b>	(371) 781 77 00
<b>BELGIUM</b>	(32) 3 355 1464	<b>LITHUANIA</b>	(370) 5 264 8126
<b>BULGARIA</b>	(359) 2 974 4492	<b>NETHERLANDS</b>	(31) 20 531 8888
<b>CZECH REP.</b>	(420) 541 424 611	<b>NORWAY</b>	(47) 67 12 90 20
<b>DENMARK</b>	(45) 7025 2900	<b>POLAND</b>	(48) 22 211 9600
<b>ESTONIA</b>	(372) 651 0370	<b>PORTUGAL</b>	(351) 21 471 1880
<b>FINLAND</b>	(358) 207 513513	<b>ROMANIA</b>	(40) 21 320 5111
<b>FRANCE</b>	(33) 1 6476 1000	<b>SLOVAKIA</b>	(421) 2 444 56725
<b>GERMANY</b>	(49) 6103 4020	<b>SLOVENIA</b>	(386) 73 885 412
<b>GREECE</b>	(30) 210 271 7265	<b>SPAIN</b>	(34) 945 184 100
<b>HUNGARY</b>	(36) 23 511 390	<b>SWEDEN</b>	(46) 8 603 1200
<b>IRELAND</b>	(353) 1 403 9000	<b>SWITZERLAND</b>	(41) 52 396 3131
<b>ITALY</b>	(39) 02 92711	<b>UNITED KINGDOM</b>	(44) 1908 563888

## SMC Corporation

URL : <http://www.smcworld.com> (Global) <http://www.smceu.com> (Europe)

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