Doc.No.MH*-OMY0017

Operation Manual

PRODUCT NAME

Magnet Gripper Unit for Collaborative Robots

MODEL / Series / Product Number

MHM-25D-X7400A-TM

SMC Corporation

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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: Manipulating industrial robots -Safety.
etc.

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

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1.The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2.When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4.Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Safety Instructions

⚠ Caution

The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.
Read and accept them before using the product.

Limited warranty and Disclaimer

1.The warranty period of the product is 1 year in service or 1.5 years after the product is delivered,whichever is first.□2)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.
□□2) Vacuum pads are excluded from this 1 year warranty.
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

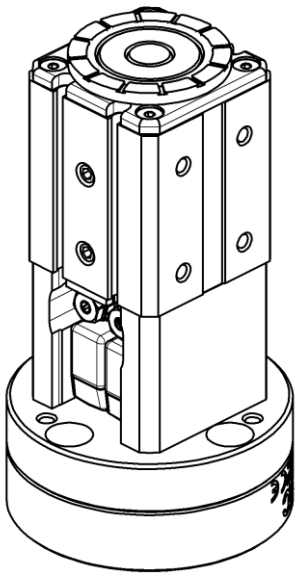
Compliance Requirements

1. **The use of SMC products with production equipment for the manufacture of weapons of mass destruction(WMD) or any other weapon is strictly prohibited.**
2. **The export of SMC products or technology from one country to another is governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of an SMC product to another country, ensure that all local rules governing that export are known and followed.**

⚠ Caution

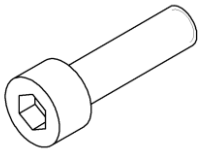
SMC products are not intended for use as instruments for legal metrology.
Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.
Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

1.List of included items

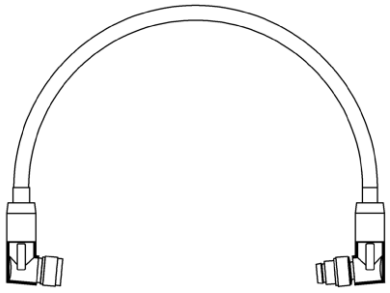


Magnet gripper unit 1pc.

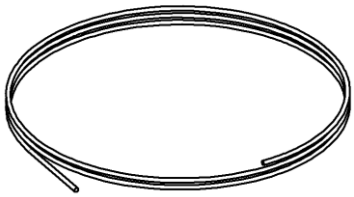
Positioning pin (6×10) 1pc.
For positioning the product.



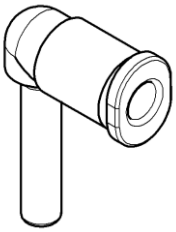
Hexagon socket head cap screw (M6×23) 4pcs.
For mounting the product.



M8 8 Pin connector 1pc.

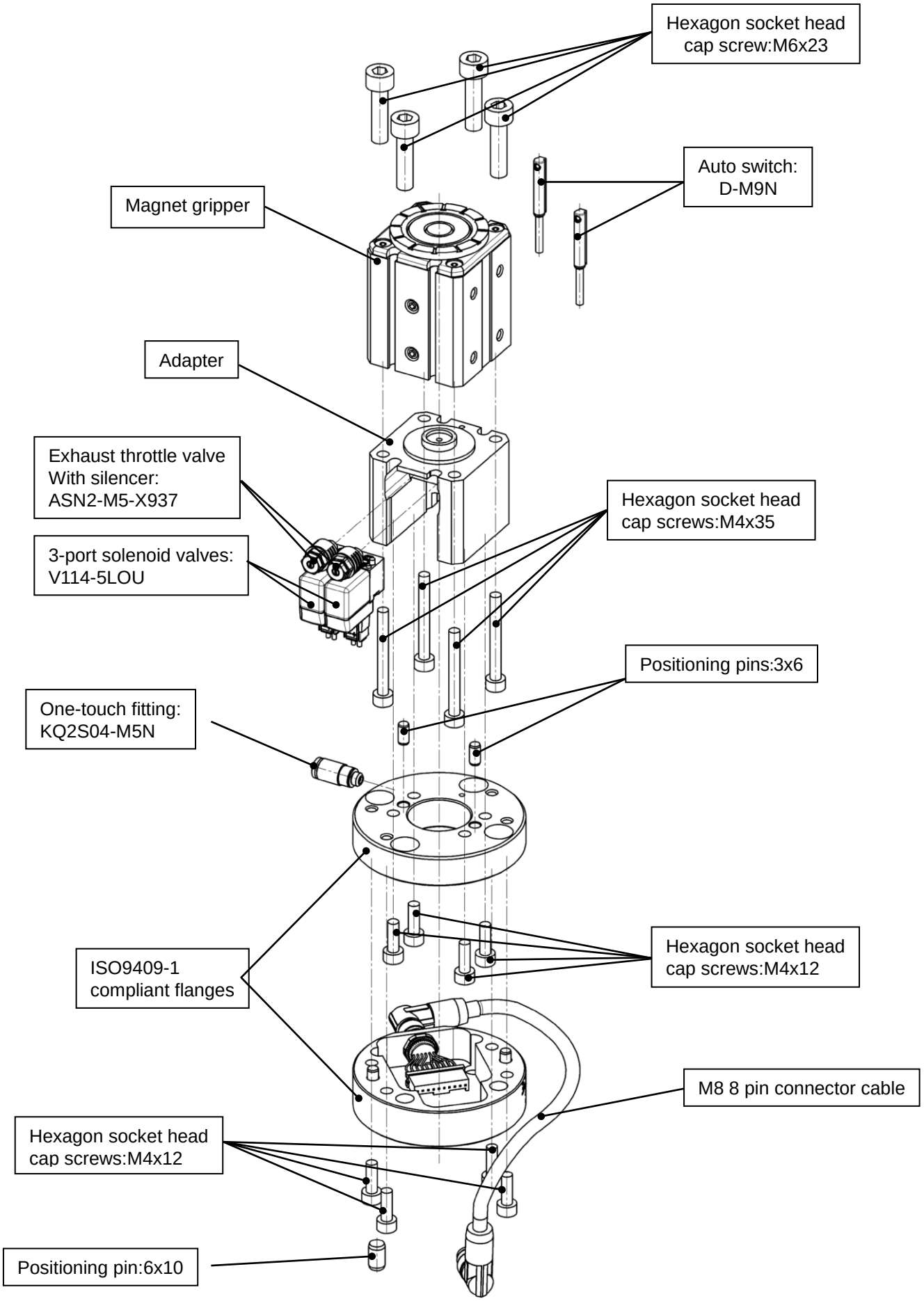


Polyurethane tube for piping (TU0425) 2m



One-touch fittings
(KQ2L01-99A1) 1pc.

2.Parts description of the magnet gripper



3.Product Specifications

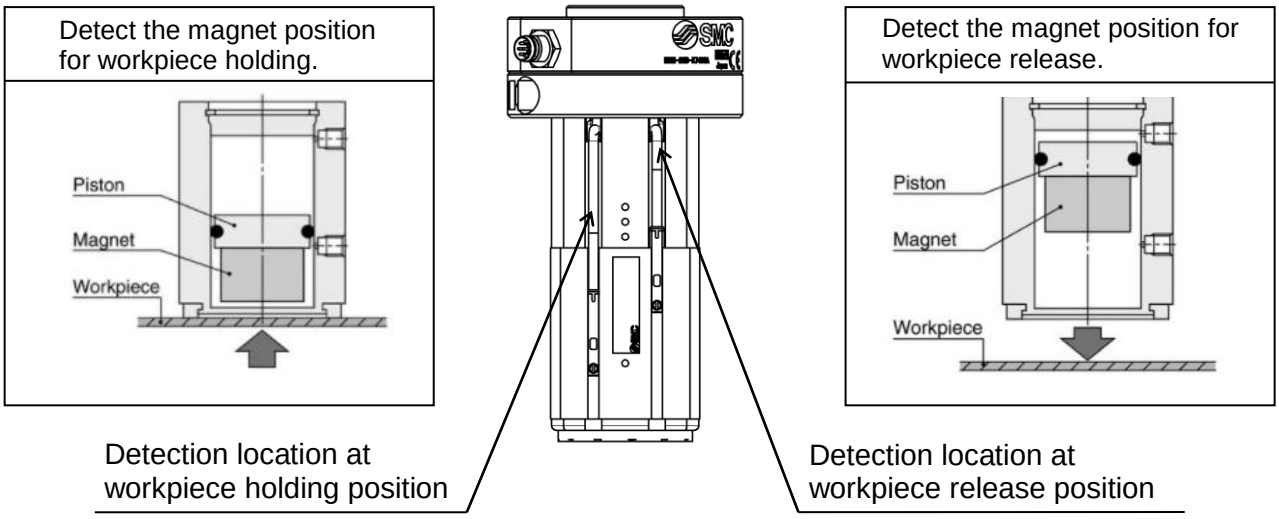
3-1. Specifications

Specifications

Model No.		MHM-25D-X7400A-TM
Fluid		Air
Operating method		Double acting
Operating pressure (MPa)		0.2 to 0.6MPa
Proof pressure		0.9MPa
Ambient and operating fluid temperature(°C)		-10 to 50
Gripping Force *	Workpiece thickness:2mm	160N
	Workpiece thickness:6mm	200N
Residual holding force		0.3 N or less
Lubrication		Non-lube
Weight (g)		590g
Auto switch model		D-M9N
Standard for mounting onto the robot		ISO9409-1-50-4-M6
Connector configuration of the accessory		M8 8 pin connector(Socket) M8 8 pin connector(Plug)

*1 Theoretical holding force (reference value) when a low carbon steel plate is held by entire surface attraction surface

In the default setting, the auto switch is fixed at the workpiece release position.



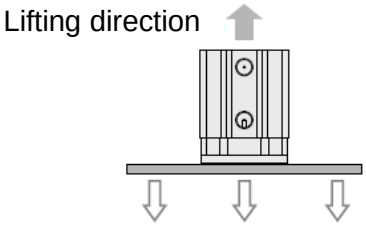
* For examples of setting auto switch and setting of mounting position of auto switches, please refer to the MHM Series catalogue P.12 onwards on our website (www.smcworld.com).

* Auto switches are used for checking the operation of the magnet gripper. They do not guarantee the actual holding and release of the workpiece. For checking the holding / release of the workpiece, a proximity sensor should be mounted separately.

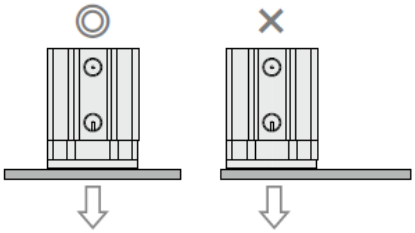
3-2. Gripping force

Holding conditions.

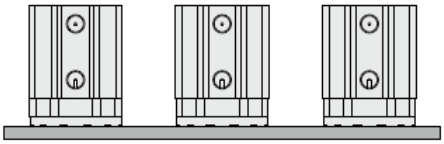
- To lift workpieces vertically, be sure to take into consideration the acceleration rate, air pressure, impact etc., in addition to the mass of the workpieces.



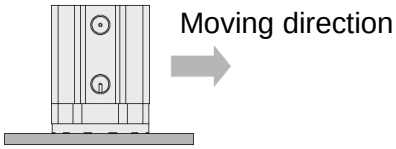
- Consider the center of gravity of the workpiece to avoid moments being applied the magnet gripper as much as possible.



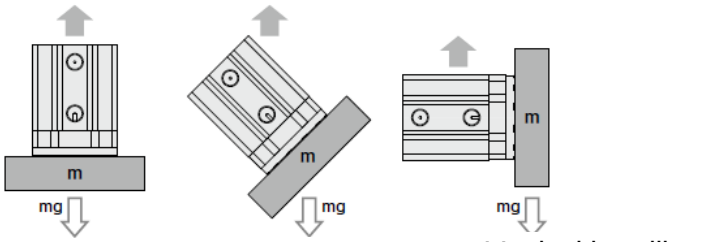
- If multiple magnet grippers are used for transferring a workpiece with a large surface area, properly allocate the magnet grippers to maintain balance.



- Horizontal movement of the magnet gripper may cause sideslip of the workpiece depending on the acceleration or friction coefficient between the pad and workpiece. Therefore, the acceleration rate of the lateral movement must be minimized.



- Use the magnet gripper for horizontal handling. Adequate safety factor needs to be considered for inclined handling or vertical



Horizontal handling
Basic orientation

Inclined handling

Vertical handling

Thin workpieces may be deformed during transportation. It is recommended to use multiple magnet grippers for scenarios such as this.

Calculate the required holding force.

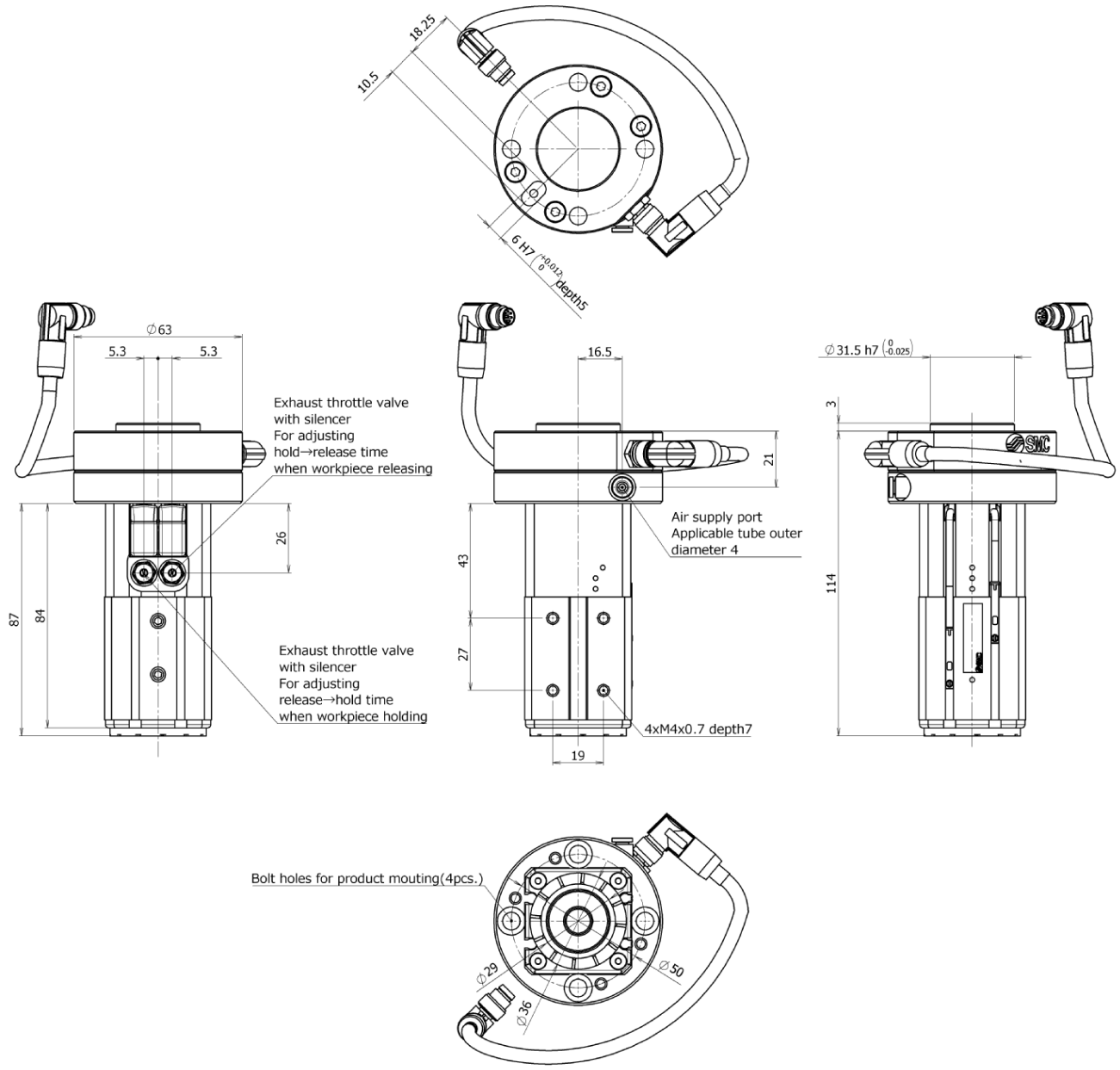
$$W = S\frac{mg}{n}$$

W: Required holding force
n : Number of magnet grippers [pcs.]
m: Workpiece mass [kg]
g : Gravitational acceleration [= 9.8 m/s^2]
S : Safety factor Horizontal lifting: 4 or more

The holding force graph shows the theoretical value for low carbon steel plate. Holding forces very depending on the material and shape of the workpiece. Please perform a holding test referring to the value selected based on the graph.

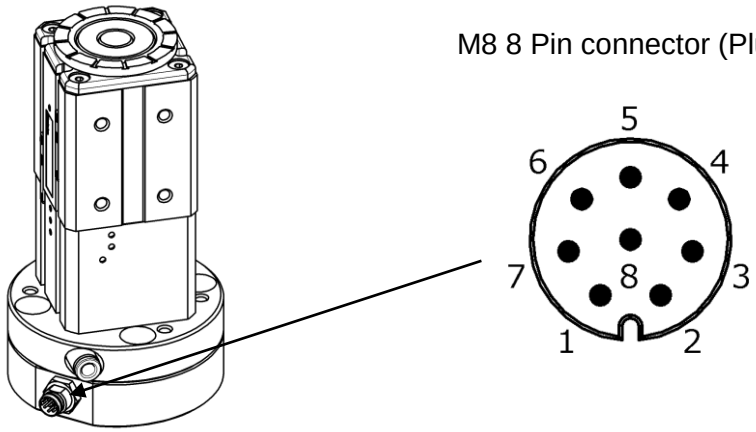
3-3. Dimensions

Refer to P12, P13 and P14 for the dimensions of the magnet gripper, valves and auto switches.



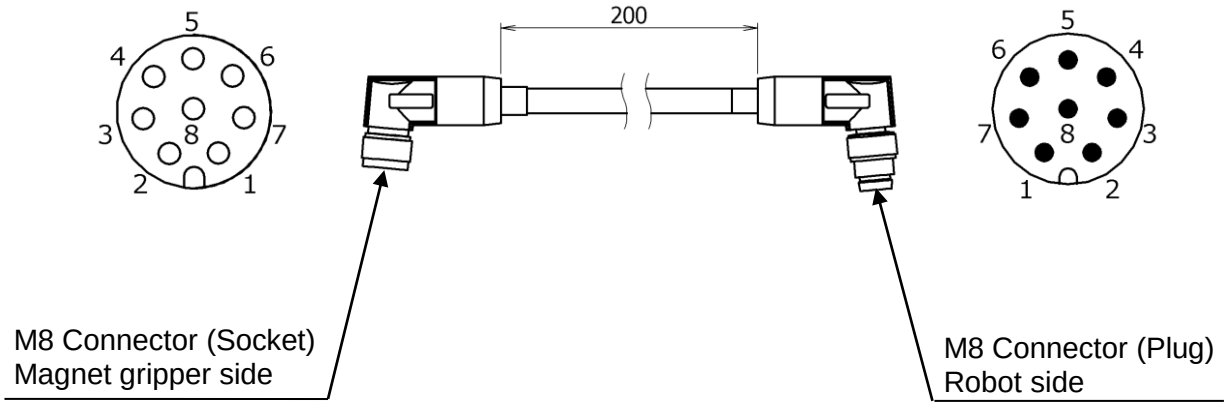
3-4. Connector and pin layout

Attached cable is fixed to the product.
Connect the communication cable correctly. Refer to P.17 for assembling method.

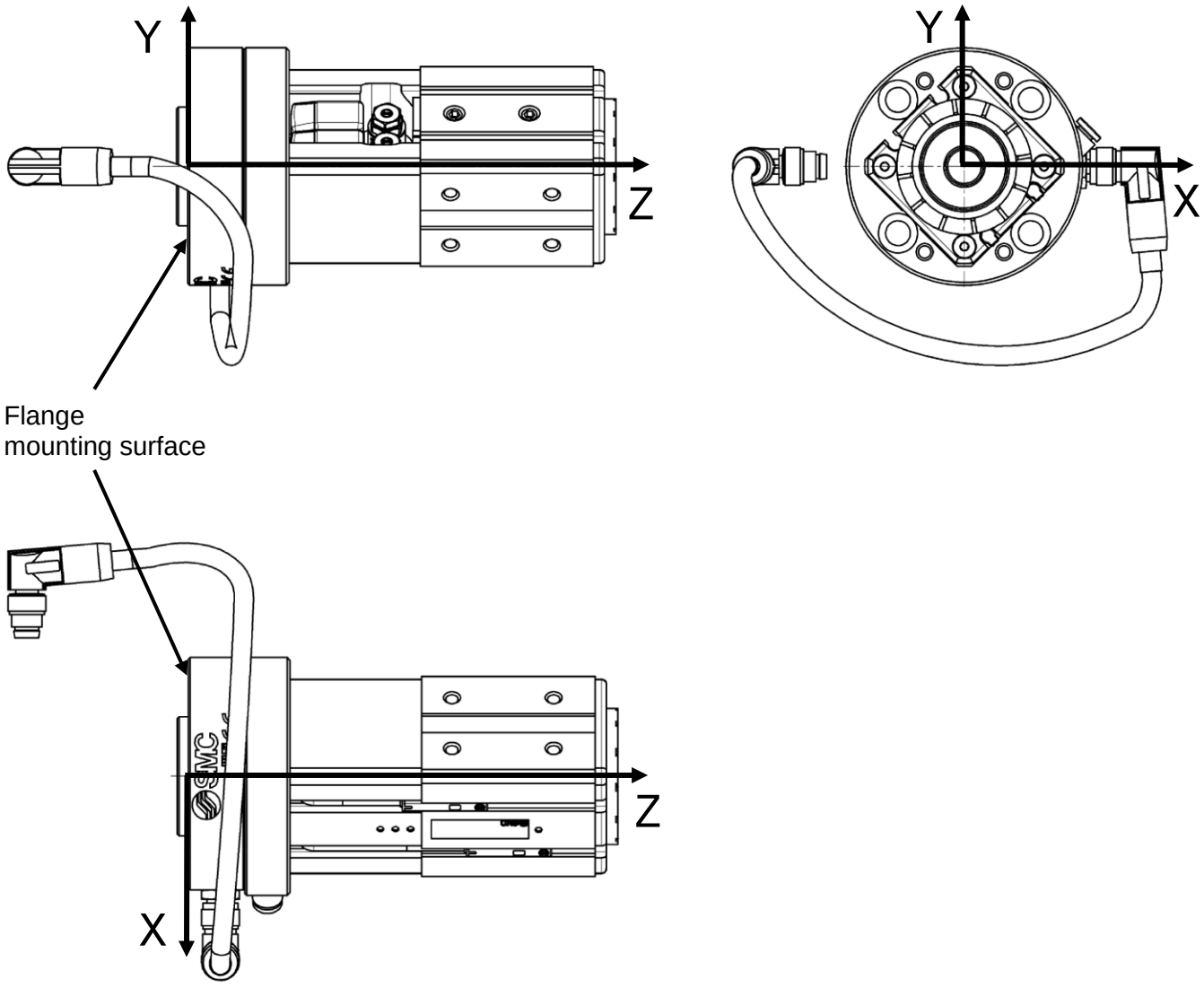


PIN No.	Function	Description
1	+24V	Power supply for 24VDC
2	Auto switch(Finger releasing direction)	-
3	Auto switch (Finger holding direction)	-
4	-	-
5	Valve ON/OFF(Finger releasing direction)	-
6	Valve ON/OFF(Finger holding direction)	-
7	-	-
8	GND	Power supply for 0VDC

Conversion cable



3-5. Center of gravity



Center of gravity		
X	Y	Z
-0.1	-0.5	55.8

4.Product Specifications

* For detailed specifications not included in this document, please refer to the our website (www.smcworld.com) or operation manual.

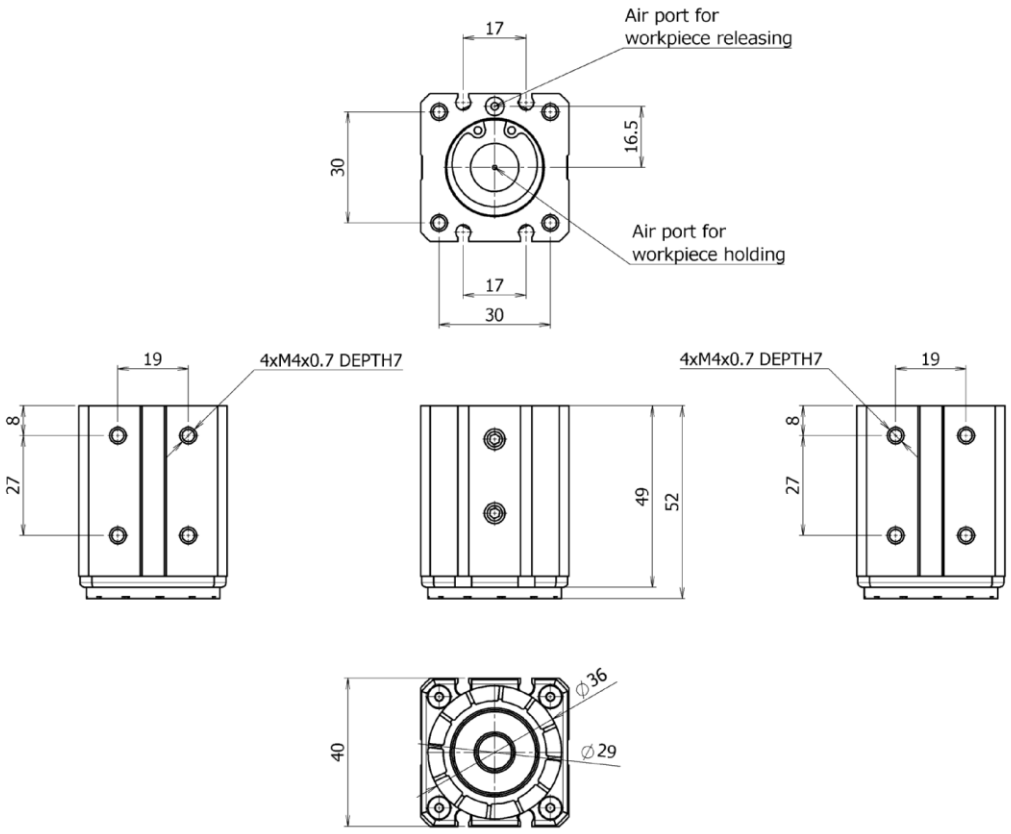
4-1. Magnet gripper

Specifications

Fluid		Air
Operating pressure [MPa]		0.2 to 0.6
Operating method		Double acting
Proof pressure		0.9MPa
Ambient and operating fluid temperature(°C)		-10 to 60
Gripping force *	Workpiece thickness:2mm	160N
	Workpiece thickness:6mm	200N
Residual holding force		0.3 N or less
Lubrication		Non-lube
Weight (g)		244

*1 Theoretical holding force (reference value) when a low carbon steel plate is held by entire surface attraction surface

Dimensions.



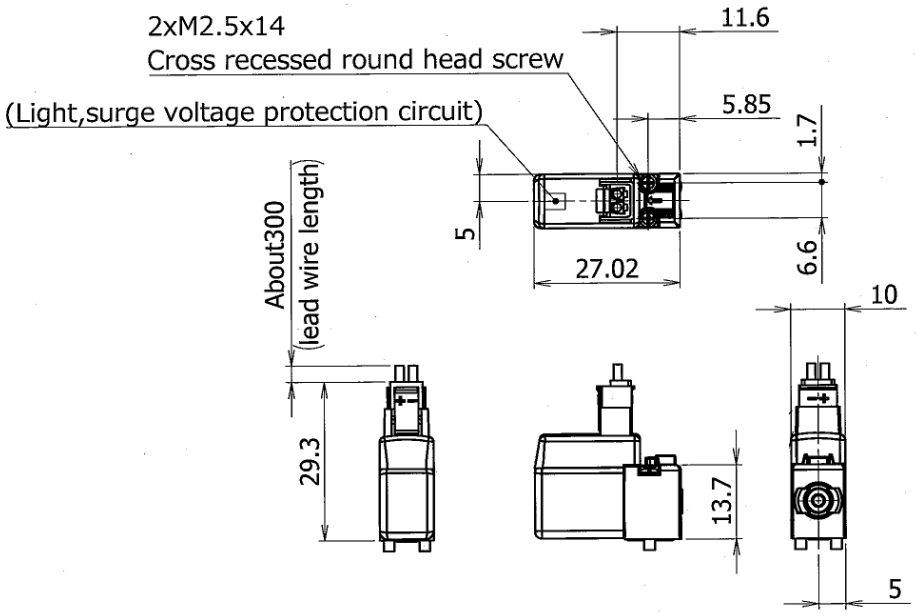
4-2. 3-port solenoid valve

Specifications

Model No.	V114-5LOU
Fluid	Air
Ambient and operating fluid temperature(°C)	-10 to 50 (No freezing)
Response time [ms]	ON：5 or less OFF：4 or less
Minimum operation frequency [Hz]	20
Lubrication	No
Mounting orientation	Free
Impact resistance/Vibration resistance (m/s^2)	150／30
Enclosure rating	Dustproof

Solenoid specifications

Model No.	V114-5LOU
Electrical entry	L shaped plug connector (L)
Coil rated voltage [V]	24
Allowable voltage fluctuation	-10 to 10%
Power consumption [W]	0.4 [Starting 0.4,Holding 0.1]
Surge voltage suppressor	Please refer to page 1367 of the Best Pneumatics catalogue.
Indicator LED	LED

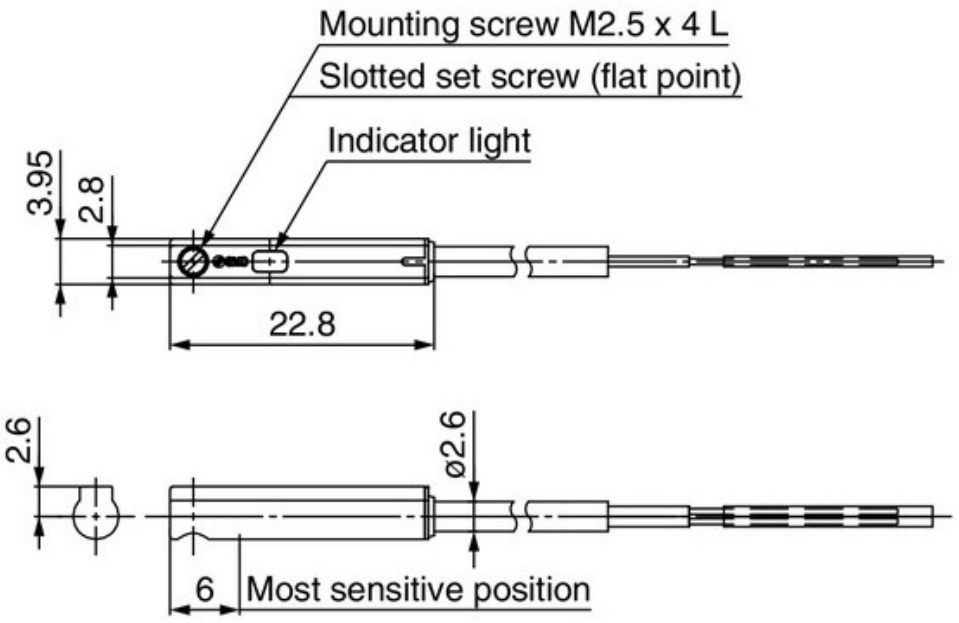


4-3. Auto switch

Auto Switch Specifications

D-M9N(With indicator light)	
Auto switch model	D-M9N
Electrical entry direction	In-line
Wiring	3-wire
Output	NPN type
Applicable load	IC circuit,Relay,PLC
Power supply voltage	DC5・12・24V(4.5 to 28V)
Current consumption	10 mA or less
Load voltage	-
Load current	40 mA or less
Internal voltage drop	0.8 V or less at 10 mA (2 V or less at 40 mA)
Current leakage	100 μA or less at 24 VDC
Indicator LED	Red LED illuminates when turned ON.
Standard	CE marking、RoHS

Dimensions
D-M9N



5.Operating method or operation

5-1. Precautions for Design

⚠ Warning

1.The product is designed for use only in compressed air systems. Do not operate at pressures or temperatures, etc., beyond the range of the specifications, as this can cause damage or malfunction of the cylinder and other equipment. (Refer to the specifications.)
Please contact SMC if using fluids other than compressed air. The product cannot be guaranteed if is used outside of the specification range.
2.Take safety measures (e.g. mounting protective covers) when there is a danger of fingers being caught in a gripper or workpieces causing damage, etc.
3.There is a danger of workpieces dropping if there is a decrease in gripping force due to a drop in circuit pressure caused by a power failure, etc. It is necessary to take measures such as drop prevention so that injury and damage to machinery or equipment can be prevented.
4. If the product is used for a purpose other than the transportation of a workpiece such as positioning or clamping, please consult SMC.

⚠Caution

1. Finite orbit type guide is used in the actuator finger part. By using this, when there are inertial force which cause by movements or rotation to the actuator, steel ball will move to one side and this will cause a large resistance degrade the accuracy. When there are inertial force which cause by movements or rotation to the actuator, operate the finger to full stroke.

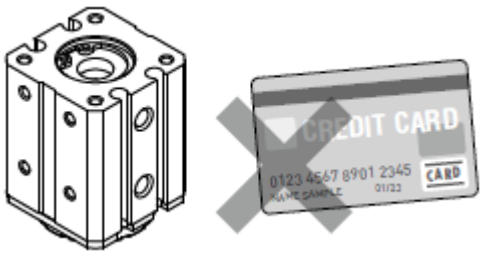
5-2. Installation

⚠Warning

1. Install and operate the product only after reading the Operation Manual carefully and understanding its contents. Also, keep the manual where it can be referred to as necessary.
2. When installing the products, allow access for maintenance.
3. Do not scratch or dent the air gripper by dropping or bumping it when mounting.
Slight deformation can cause inaccuracies or a malfunction.
4. Tighten the screw within the specified torque range when mounting the attachment.
Tightening with a torque above the limit can cause malfunction, while insufficient tightening can cause slippage and dropping.

How to mount attachment to the finger

Make sure to mount the attachments on fingers with the tightening torque in the table below by using bolts, etc., for the female threads on fingers.



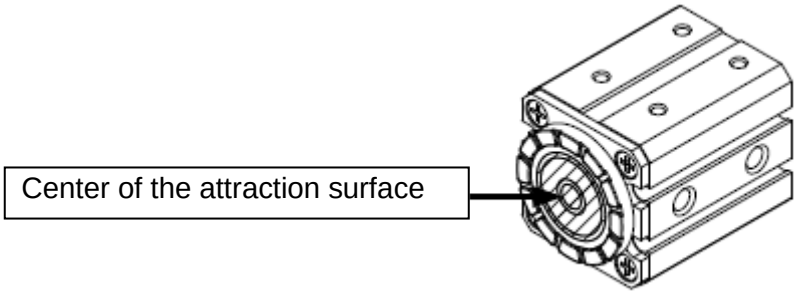
⚠Warning

1. Install and operate the product only after reading the Operation Manual carefully and understanding its contents. Also, keep the manual where it can be referred to as necessary.
2. Allow sufficient space for maintenance and inspection.

3.When the magnet moves toward the magnetic attraction surface, holding force is generatedonthe attraction surface, Make sure that holding force is not generated when working around the magnet gripper so the your fingers do not get caught in the magnet gripper.

⚠ Warning

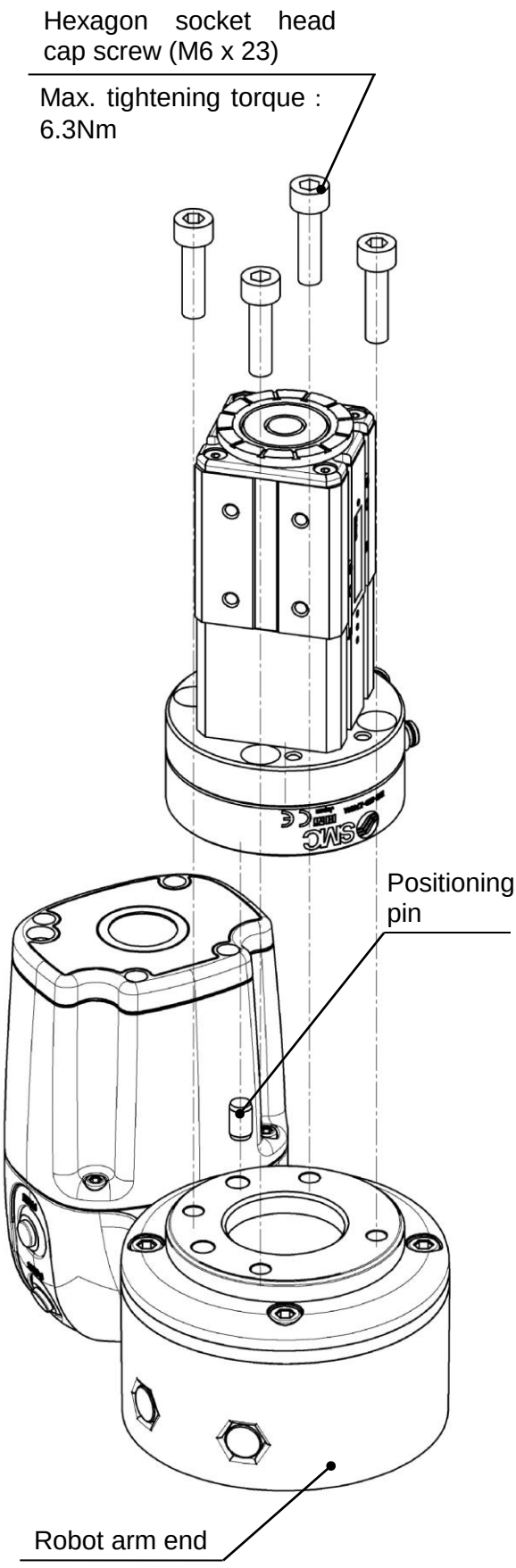
1. Do not scratch or dent the magnet gripper by dropping or bumping it when mounting. Even a slight deformation can cause malfunction.
2. Be careful with the magnetic attraction of parts of objects around the magnet gripper when mounting the magnet gripper while it is in its holding position (the piston is on the attraction side). They may cause injury.
3. When mounting the product, tighten it with screws of appropriate length at an appropriate torque. Tightening with a torque greater than the specified torque can cause malfunction, while 規 insufficient tightening can cause slippage and dropping.
4. Do not apply impact load to the center of the magnetic attraction surface. Otherwise, it may result in a breakage or malfunction.



How to Mount Magnet Gripper

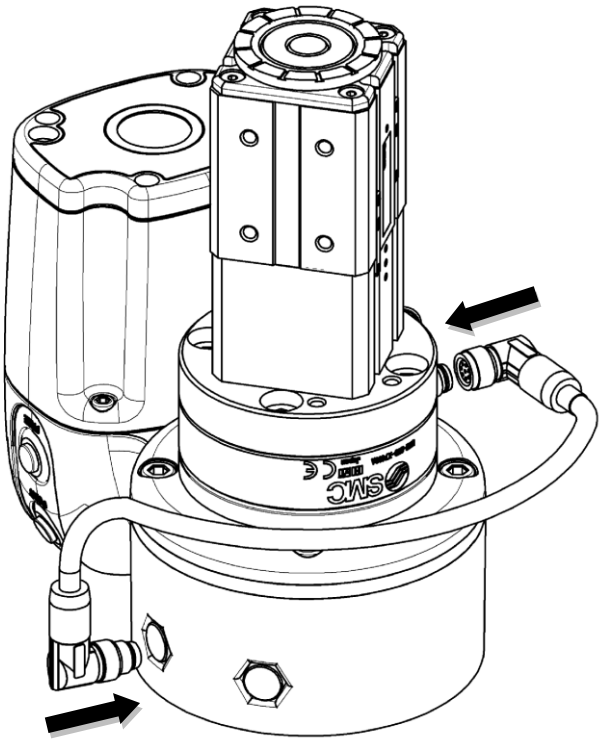
Adjust the robot arm position before mounting so that the mounting is easy.

(1)Mounting to the robot arm



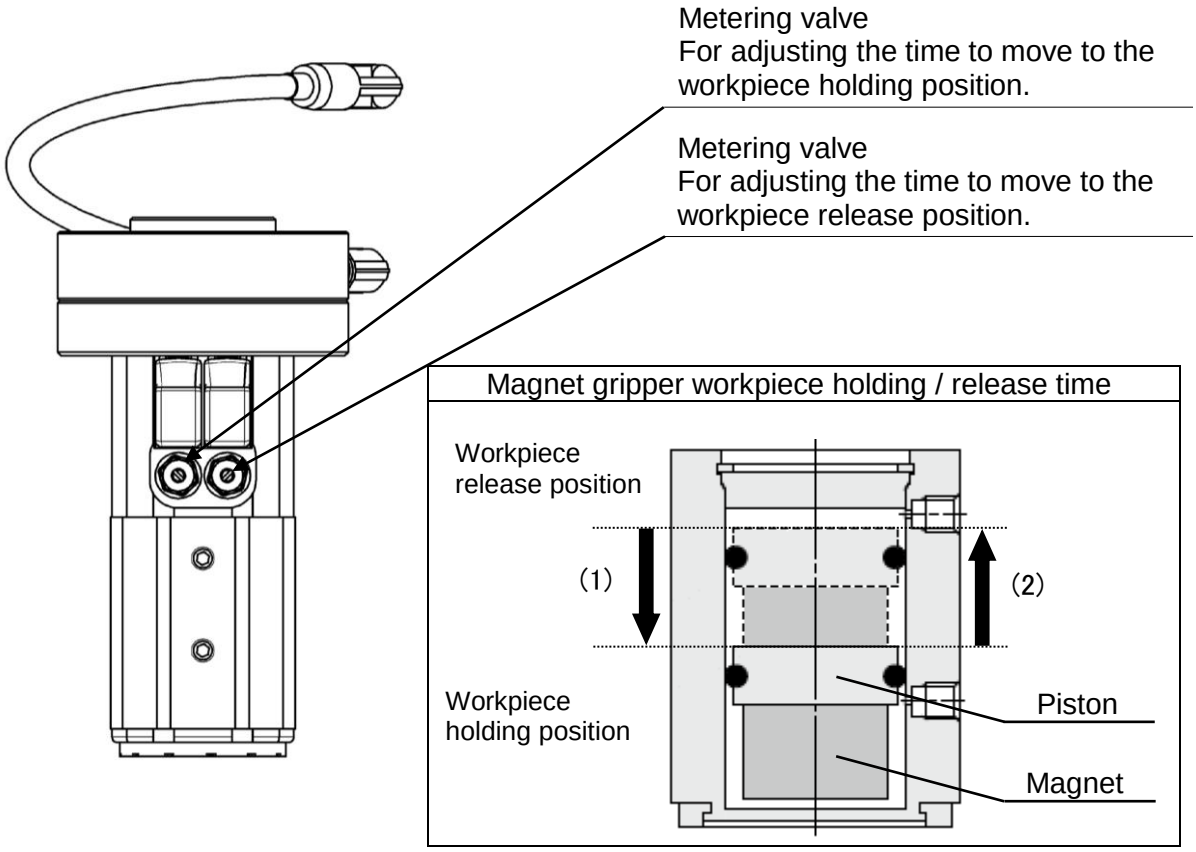
(2)Connecting the M8 connector

* Do not energize while securing the connector.
* Check that the connector is not loose.

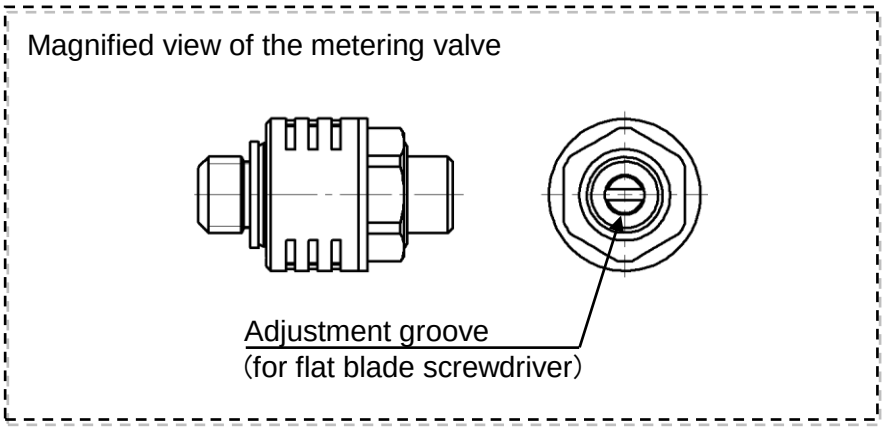


Operation time adjustment method for holding / releasing the workpiece

The piston operation time during workpiece holding / release can be adjusted by adjusting the opening of the metering speed controller valve.



* (1) Workpiece holding time: Time required when the piston and magnet travel from the workpiece release position to the workpiece holding position
* (2) Workpiece release time: Time required when the piston and magnet travel from the workpiece holding position to the workpiece release position



* Use a flat blade screwdriver for adjusting the restriction of the metering valves.
* Keep the restriction of the 2 metering valves approximately the same. If they are different too much, the operation may become unstable.

5-3.TMComponent

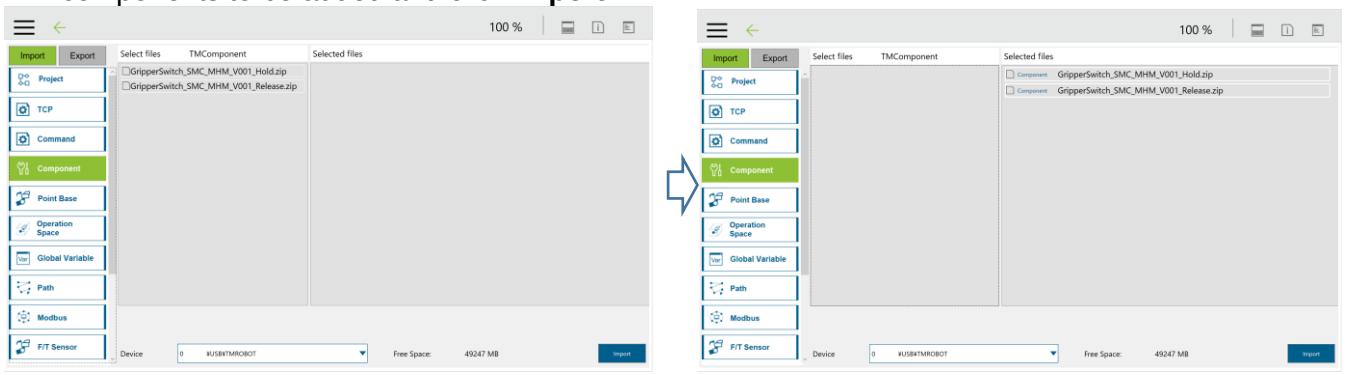
TMComponent is an independent software package for the robot applications and you need to import the software package to use in TMflow (robot software) directly.
Here is the list of the SMC Magnet Gripper TMComponents.

- GripperSwitch_SMC_MHM_V***_Hold (The gripper operates to hold the workpiece)
- GripperSwitch_SMC_MHM_V***_Release (The gripper operates to release the workpiece)

Note) *** is the version number starting from 001.

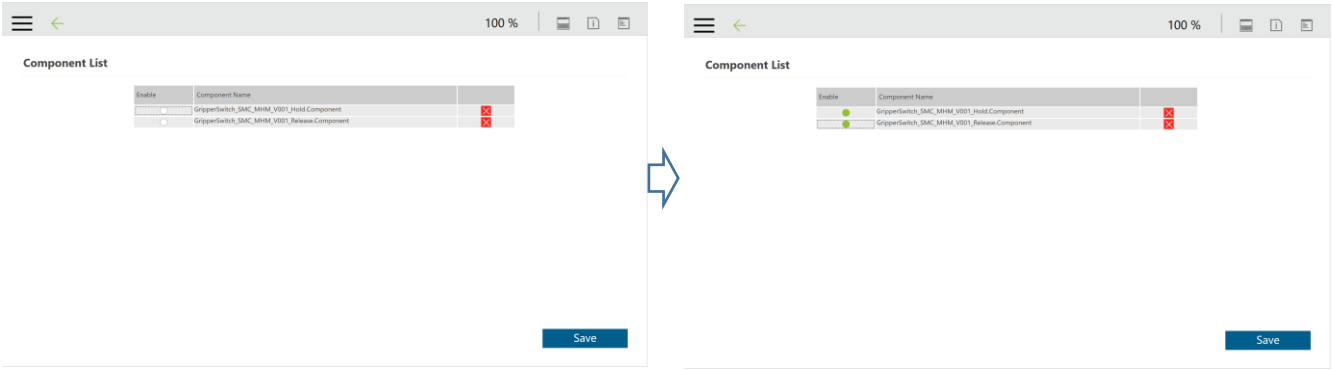
Import TMComponent

1. Download the TMComponent from the SMC website.
2. Label the USB drive with “TMROBOT”.
3. Place the downloaded the zipped component files in the USB with the folder directory TMROBOT:¥TM_Export¥TMComponent¥ComponentObject¥.
4. Insert the USB storage device in the robot controller
5. In TMflow, click the **triple bar** icon and select **System**
6. Select **Import/Export** and click **Import**. Then select the TMComponent in the Robot List window and click on **OK**.
7. Click on the **Component** button of the Import navigation panel. Then select the relevant SMC components to be added and click **Import**.



Enable TMComponent

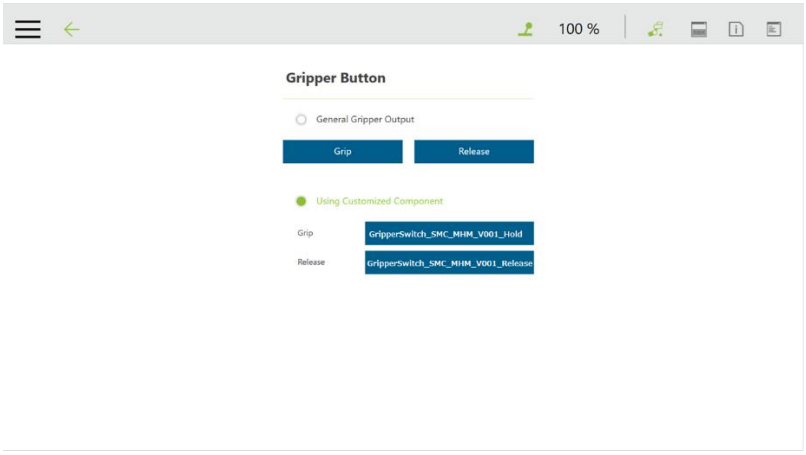
8. Click the **triple bar** icon and go back to the main menu. Then select **Setting** to display the System Setting window.
9. Click on the **Component** icon
10. Enable required Components in the Component List by ticking the radio button beside each of them.
    A Component that is enabled displays a green radio button. Then click on the **Save** button.



Configure gripper button

The user can assign SMC Gripper Components to the Gripper button and use to release and hold the gripper.

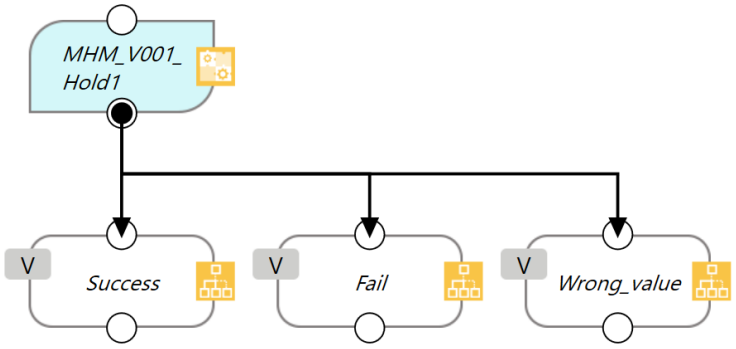
1. Click the **triple bar** icon and go back to the main menu. Then select **Setting** icon.
2. Click on **Gripper Button** icon.
3. In the Gripper Button window, tick the **Using Customized Component** radio button and select the Component you want to assign to either one of the Gripper actions.



Use TMComponent

Component Hold node

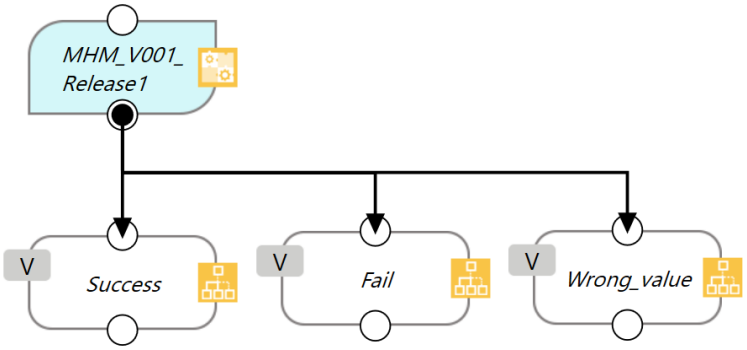
This component is used to hold the workpiece by the gripper.



- Success : The magnet moves to the position to hold the workpiece (When Hold_and_CheckSignal is set to false), or auto switch signal at the magnet position for workpiece holding is ON (Hold_and_CheckSignal is set to true).
- Fail : Auto switch signal at the magnet position for workpiece holding is not detected (when Hold_and_CheckSignal is set to true).
- Wrong_value : Set value of WaitTime_Setting or TimeoutVal_Setting is out of range.

Function	Type	Default	Description
Hold_and_CheckSignal	bool	false	**CheckSignal function enable/disable setting** When set to true, after the magnet moves to the position to hold the workpiece, the auto switch signal is checked, and if the signal is on, the next operation is performed. When set to false, the magnet moves to the position to hold the workpiece then proceed to the next operation without checking the autoswitch signal.
WaitTime_Setting	int	500	**WaitTime setting after valve operation** **(Unit: ms, Range: 0..1000ms)** It is a wait time value after setting the signal to energize the valve for gripper holding. Adjust the releasing and holding of the metering valve and set an appropriate value according to the holding operation speed of the gripper.
TimeOutVal_Setting	int	500	**Timeout setting of checking the auto switch signal** **(Unit: ms, Range: 0..1000ms)** Note) It will only be appeared when the Advanced setting is selected.

Component Release node
This component is used to release the workpiece by the gripper.



- Success : The magnet moves to the position to release the workpiece (When Release_and_CheckSignal is set to false), or auto switch signal at the magnet position for workpiece releasing is ON (Release_and_CheckSignal is set to true).
- Fail : Auto switch signal at the magnet position for workpiece releasing is not detected (when Release_and_CheckSignal is set to true).
- Wrong_value : Set value of WaitTime_Setting or TimeoutVal_Setting is out of range.

Function	Type	Default	Description
Release_and_CheckSignal	bool	false	**CheckSignal function enable/disable setting** When set to true, after the magnet moves to the position to release the workpiece, the auto switch signal is checked, and if the signal is on, the next operation is performed. When set to false, the magnet moves to the position to release the workpiece then proceed to the next operation without checking the autoswitch signal.
WaitTime_Setting	int	500	**WaitTime setting after valve operation** **(Unit: ms, Range: 0..1000ms)** It is a wait time value after setting the signal to energize the valve for gripper releasing. Adjust the releasing and holding of the metering valve and set an appropriate value according to the release operation speed of the gripper.
TimeOutVal_Setting	int	500	**Timeout setting of checking the auto switch signal** (Unit: ms, Range: 0..1000ms) Note) It will only be appeared when the Advanced setting is selected.

5-4. Air supply

⚠ Warning

1. Please contact SMC when using the product in applications other than with compressed air.
2. Compressed air containing a large amount of condensate can cause malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.
3. If condensate in the drain bowl is not emptied on a regular basis, the condensate will overflow into the compressed air lines. This will cause a malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, the installation of a drain bowl with an auto drain option is recommended.
4. Use clean air.
   Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction of equipment.

Refer to "SMC Air Preparation System" for further details on compressed air quality.

⚠ Caution

1. When extremely dry air is used as the fluid, degradation of the lubrication properties inside the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Please consult with SMC.
2. Install air filters.
   Install an air filter at the upstream side of valve. A filtration degree of 5μm or less should be selected.
3. Install an aftercooler, air dryer or drain catch before the filter and take appropriate measures.
   Compressed air that contains excessive foreign material may cause malfunction of valves and other pneumatic equipment.
   Therefore, take appropriate measures to ensure air quality, such as by providing an aftercooler, air dryer or water separator.
4. Use the product within the specified fluid and ambient temperature range.
   If the fluid temperature is 5°C or less, the moisture in the circuit could freeze, causing damage to the seals and leading to equipment malfunction. Therefore, take appropriate measures to prevent freezing.

Refer to "SMC Air Preparation System" for further details on compressed air quality.

5-5. Piping

⚠ Caution

1. Refer to the Fittings and Tubing Precautions (Best Pneumatics) for handling one touch fittings.
2. Before piping
   Before piping, blow air (flush) or clean the piping to remove any cutting chips, cutting oil, dust, etc.

5-6. Operating environment

⚠ Warning

1. Do not use in an environment where corrosive gases, chemicals, sea water, water or steam are present.
2. Do not use in direct sunlight.
3. Do not operate in a location subject to vibration or impact.
4. Do not mount the product in locations where it is exposed to radiant heat.
5. Do not use this product in an area that is dusty, or in an environment in which water or oil splashes on to the cylinder.

5-7. Lubrication

⚠ Caution

1. The non-lube type air gripper is lubricated at the factory and can be used without any further lubrication.
   If a lubricant is used in the system, use turbine oil Class 1 (with no additive) ISO VG32.
   Furthermore, once lubrication is applied, it must be continued.
   If lubrication is later stopped, malfunction can occur due to loss of the original lubricant.
   Refer to the Material Safety Data Sheet (MSDS) of the hydraulic fluid when supplying the fluid

6. Maintenance

⚠ Warning

1. If handled improperly, compressed air can be dangerous. Assembly, handling, repair and element replacement of pneumatic systems should be performed by a knowledgeable and experienced person.
2. Remove drainage moisture from air filters regularly.
3. When air grippers are removed, first confirm that measures are in place to prevent any workpieces from dropping, run-away of equipment, etc. Then cut off the supply pressure and electric power and exhaust all compressed air from the system using the residual pressure release function. When the equipment is restarted, proceed with caution after confirming that appropriate measures are in place to prevent cylinders from sudden movement.
4. Do not allow people to enter or place objects in the carrying path of the air gripper.
   Otherwise, injury or an accident may occur.
5. Do not put hands, etc. in between the air gripper fingers or attachments
6. When removing the air gripper, first confirm that no workpieces are being held and then release the compressed air before removing the air gripper.
   If a workpiece is still being held, there is a danger of it being dropped.

Revision history

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