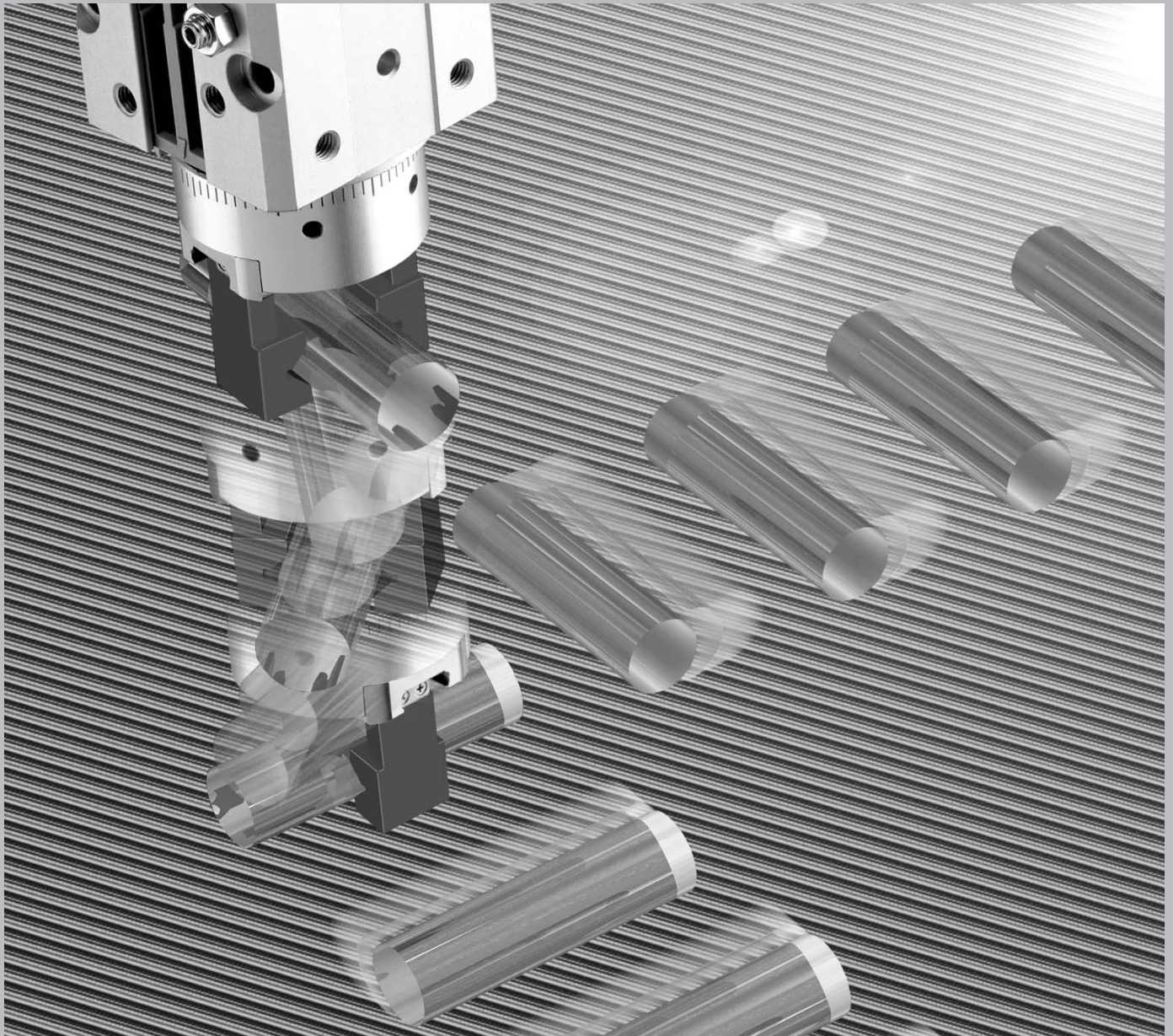
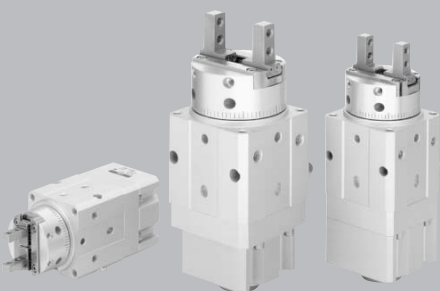


Rotary Gripper *Series MRHQ*



MHZ
MHF
MHL
MHR
MHK
MHS
MHC
MHT
MHY
MHW
MRHQ
Misc.
D-
20-

Sizes 10 and 16 updated!



Rotary gripper suitable for holding and reversing workpieces on transfer lines

- Compact integration of gripping and rotating functions
- Eliminates the peripheral piping and wiring of the previous product (rotary table + adapter + air gripper)
- Length reduced by approx. 20% compared with the previous product
- 2 standard rotation angles of 90° and 180°
- Equipped with standard magnet for auto switch retrofitting



Rotary Gripper MRHQ 10/16/20/25

Modular construction

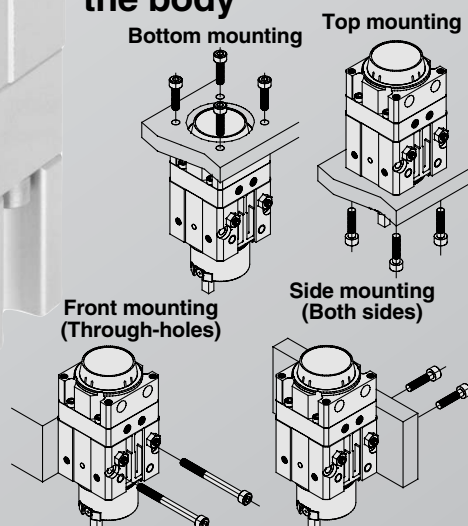
Gripper section is unitized for simple replacement.

Compact bearings add to a light weight and compact design

Simple alignment when mounting body

Provided with reference diameters at the top and bottom of the body, and mounting guide pin holes on three sides of the body along its center axis (aligned with center of body).

**Easily mounted from 5 directions:
2 ends and 3 sides of the body**



Easy adjustment of rotating range

A scale indicator on the side of the gripper unit allows easy angle adjustments and is useful for verification of rotating positions.

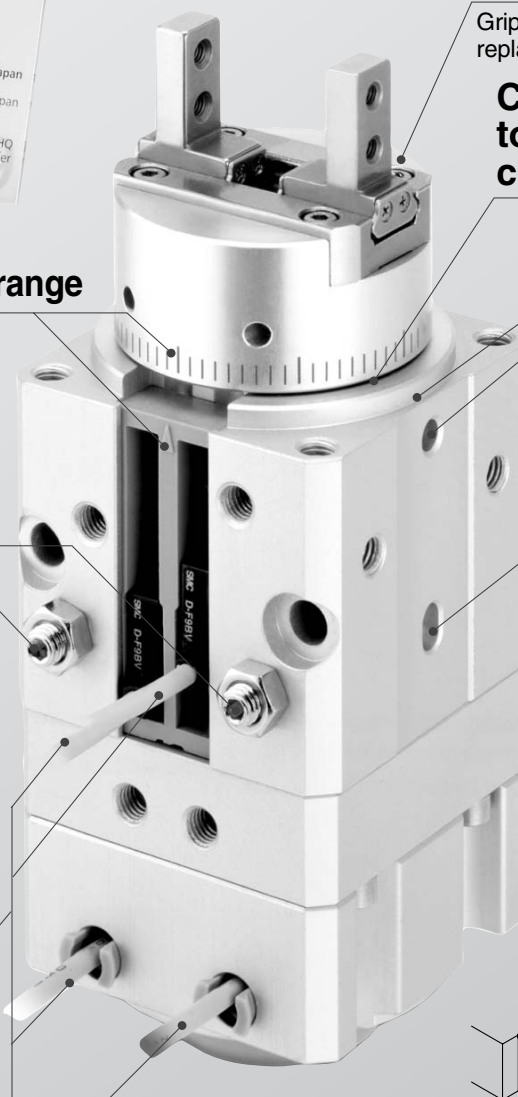
Angle adjustment bolts are standard

Angle adjustment bolts allow the rotation range of the gripper unit to be adjusted by $\pm 10^\circ$ for both 90° and 180° rotation angles. ($\pm 5^\circ$ at the end of rotation)

All piping and wiring centralized on one side for easy work operations

Auto switch capable

Switches can be installed to verify positions for opening and closing of the gripper and the end of rotation.



Rotary Gripper

Series *MRHQ*

Size: 10, 16, 20, 25

How to Order

Lead wire length

Nil	0.5 m
L	3 m
Z	5 m

Number of auto switches

Nil	2 pcs.
S	1 pc.

Type of auto switch for detecting rotation

Nil	Without auto switch
-----	---------------------

Applicable Auto Switch

Type	Electrical entry	Indicator light	Wiring (output)	Load voltage	Auto switch model	Lead wire length* (m)			Applicable load	
						Electrical entry	0.5 (Nil)	3 (L)	5 (Z)	IC circuit
Solid state switch	Grommet	Yes	3-wire (NPN)	5 V	M9N	●	●	○	IC circuit	Relay PLC
			3-wire (PNP)	24 V	M9P	●	●	○		
			2-wire	12 V	M9B	●	●	○		

* Lead wire length symbols: 0.5 m Nil (Example) M9N
3 m L M9NL

* Refer to page 12-13-1 for further information on auto switches.

* Auto switches marked with a "○" are made upon receipt of order.

Type of auto switch for gripper opening/closing

N	Without auto switch
---	---------------------

Applicable Auto Switch

Type	Electrical entry	Indicator light	Wiring (output)	Load voltage	Auto switch model	Lead wire length* (m)			Applicable load	
						Electrical entry	0.5 (Nil)	3 (L)	5 (Z)	IC circuit
Solid state switch	Grommet	Yes	3-wire (NPN)	5 V	M9NV	●	●	○	IC circuit	Relay PLC
			3-wire (PNP)	24 V	M9PV	●	●	○		
			2-wire	12 V	M9BV	●	●	○		

* Lead wire length symbols: 0.5 m Nil (Example) M9NV
3 m L M9NVL

* Refer to page 12-13-1 for further information on auto switches.

* Auto switches marked with a "○" are made upon receipt of order.

Rotary gripper

Gripper

Q Parallel type: 2 fingers

Gripper bore

10	10 mm
16	16 mm
20	20 mm
25	25 mm

Action

D	Double acting
S	Single acting (Normally open)
C	Single acting (Normally closed)

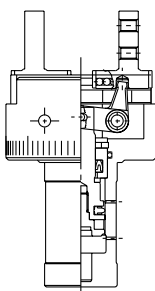
Rotation angle

90	90°
180	180°

Single vane

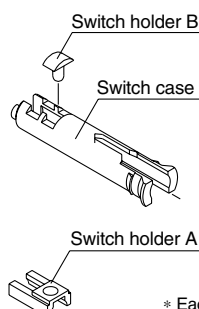
Unit list

Gripper unit



Model	Unit part no.
MRHQ10D	P407090-3D
MRHQ10S	P407090-3S
MRHQ10C	P407090-3C
MRHQ16D	P407060-3D
MRHQ16S	P407060-3S
MRHQ16C	P407060-3C
MRHQ20D	P407080-3D
MRHQ20S	P407080-3S
MRHQ20C	P407080-3C
MRHQ25D	P408080-3D
MRHQ25S	P408080-3S
MRHQ25C	P408080-3C

Switch mounting unit



Model	Unit part no.
MRHQ10□	P407090-1
MRHQ16□	P407060-1
MRHQ20□	
MRHQ25□	

* Each unit includes two of each of the parts indicated left.
* Switches are not included with a unit.

Rotary Gripper Series **MRHQ**

Specifications



Model			MRHQ10	MRHQ16	MRHQ20	MRHQ25
Fluid			Air			
Operating pressure	Rotary unit		0.25 to 0.7 MPa		0.25 to 1.0 MPa	
	Gripper unit	Double acting	0.25 to 0.7 MPa	0.1 to 0.7 MPa		
		Single acting	0.35 to 0.7 MPa	0.25 to 0.7 MPa		
Rotation angle			90° ±10°, 180° ±10°			
Gripper action			Double acting, Single acting			
Finger opening/closing repeatability			±0.01mm			
Gripper maximum operating frequency			180 c.p.m			
Ambient and fluid temperature			5 to 60°C			
Adjustable rotation time ^{Note)}			0.07 to 0.3 s/90° (at 0.5 MPa)			
Allowable kinetic energy			0.0046 J	0.014 J	0.034 J	0.074 J
Auto switch	Rotary unit		Solid state switch (2-wire, 3-wire)			
	Gripper unit		Solid state switch (2-wire, 3-wire)			

Note) Operate within the speed adjustment range, as speed control exceeding the limit value of the low speed may cause sticking or failure to operate.

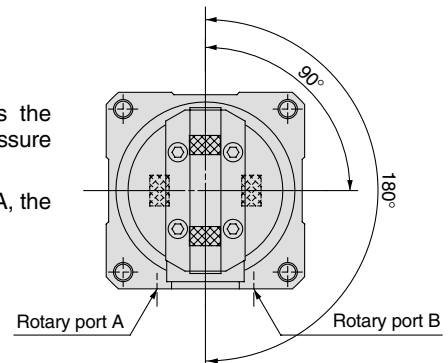
Model

Action	Model	Cylinder bore (mm)	Opening/Closing stroke (mm)	Rotating angle (°)	^{Note)} Weight (g)
Double acting	MRHQ10D	10	4	90	306
				180	305
	MRHQ16D	16	6	90	593
				180	591
	MRHQ20D	20	10	90	1055
				180	1052
	MRHQ25D	25	14	90	1561
				180	1555
Single acting	MRHQ10S MRHQ10C	10	4	90	307
				180	306
	MRHQ16S MRHQ16C	16	6	90	594
				180	592
	MRHQ20S MRHQ20C	20	10	90	1060
				180	1057
	MRHQ25S MRHQ25C	25	14	90	1566
				180	1560

Note) Values do not include auto switch weight.

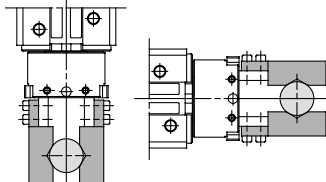
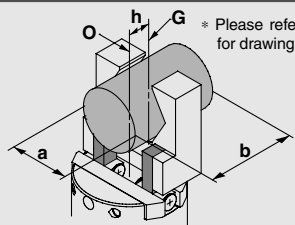
Gripper Rotation Range/View from Gripper Side

- The figure at the right indicates the position of the gripper when pressure is applied to port B.
- When pressure is applied to port A, the gripper rotates clockwise.



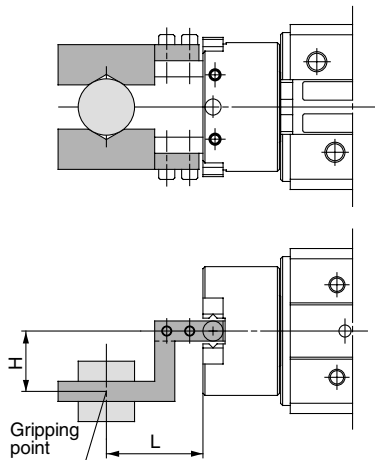
Series MRHQ

Model Selection

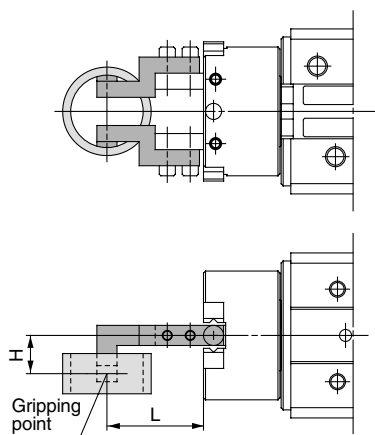
Procedure	Calculation	Example
1 Operating conditions Enumerate the operating conditions according to the mounting position and workpiece configuration.  Vertical mounting Horizontal mounting	<ul style="list-style-type: none"> • Model used • Operating pressure • Mounting position • Rotation time t (s) • Overhang H (mm) • Gripping point distance L (mm) • Distance between central axis and center of gravity h (mm) • Load weight m_1 (kg) • Weight of 2 attachments m_2 (kg) 	 * Please refer to page 12-11-12 for drawing dimensions. Rotary gripper: MRHQ16D-90S Pressure: 0.4 MPa Mounting position: Horizontal Rotation time (t): 0.2 s/90° Overhang (H): 10 mm Gripping point distance (L): 20 mm Distance between central axis and center of gravity (h): 10 mm Load weight (m₁): 0.07 kg Weight of 2 attachments (m₂): 0.05 kg
2 Rotation time Confirm that it is within the adjustable rotation time range.	0.07 to 0.3 s/90°	0.2 s/90° OK
3 Overhang and gripping point distance Confirm that the overhang (H) and the gripping point distance (L) are within the operating pressure range limit.	Graph (1) Gripping point range limit	Within the range limit OK
4 Load weight Confirm that the load converted from the load weight is less than 1/20 of the effective gripping force. (A greater margin must be allowed if large impacts will be applied when work pieces are transported.)	Graph (2) $20 \times 9.8 \times m_1 < \text{Effective gripping force (N)}$	$20 \times 9.8 \times 0.07 = 13.72$ $13.72 \text{ N} < \text{Effective gripping force}$ OK
5 External force on finger Make sure that the vertical load and each moment on finger are within allowable value. (Refer to page 12-11-11 for the lateral load allowable value and each moment value)	Less than allowable value	Downward vertical load by load and attachment: $f = (0.07 + 2 \times 0.05) \times 9.8 = 1.67 \text{ (N)} < \text{Vertical allowable value}$ OK
6 Rotational torque (horizontal mounting only) Convert the weight of the load and attachments (2 pcs.) into a load value and multiply by the overhang (H). Confirm that this value is less than 1/20 of the effective torque.	Graph (3) $20 \times 9.8 \times (m_1 + m_2) \times H/1000 < \text{Effective torque (N·m)}$	$20 \times 9.8 \times (0.07 + 0.05) \times 10/1000 = 0.24$ $0.24 \text{ N·m} < \text{Effective torque}$ OK
7 Find the moment of inertia, "I_R" for the load + attachments (2 pcs.)	$I_R = K \times (a^2 + b^2 + 12h^2) \times (m_1 + m_2)/(12 \times 10^6)$ (K = 2: Safety factor)	$I_R = 2 \times (20^2 + 30^2 + 12 \times 10^2) \times (0.07 + 0.05)/(12 \times 10^6)$ $= 0.00005 \text{ kg·m}^2$
8 Kinetic energy Confirm that the kinetic energy of the load + attachments (2 pcs.) is no more than the allowable value. { Refer to "Moment of Inertia Calculation and Allowable Kinetic Energy" on page 12-11-12. }	$1/2 \times I_R \times \omega^2 < \text{Allowable energy (J)}$ $\omega = 2\theta/t$ (ω : Angular speed at the end) θ : Rotation angle (rad) t : Rotation time (s)	$1/2 \times 0.00005 \times (2 \times (3.14/2)/0.2)^2 = 0.0062$ $0.0062 \text{ J} < \text{Allowable energy}$ OK

Gripping Point

External gripping



Internal gripping



L: Gripping point distance
H: Overhang

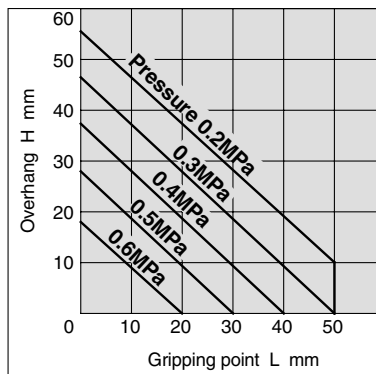
- Operate so that the workpiece gripping point distance "L" and the amount of overhang "H" stay within the range shown for each operating pressure given in the graphs to the right.
- If operated with the workpiece gripping point outside of the range limit, an excessive eccentric load will be applied to the fingers and guide section, causing play in the fingers and adversely affecting the gripper's life.

Gripping Point Range Limit

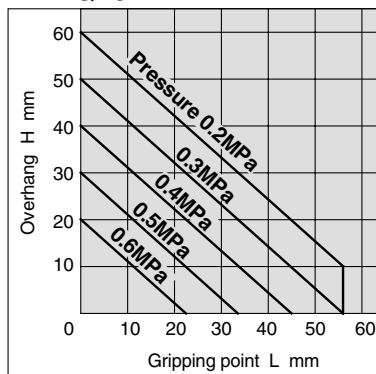
Graph (1)

External Gripping

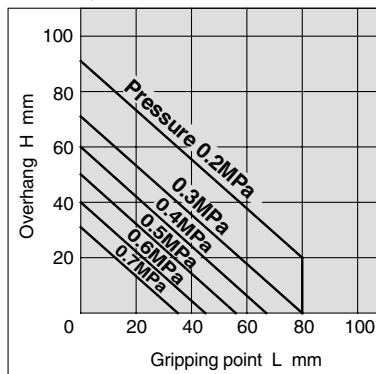
MRHQ10



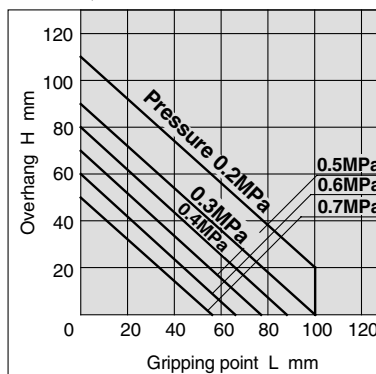
MRHQ16



MRHQ20

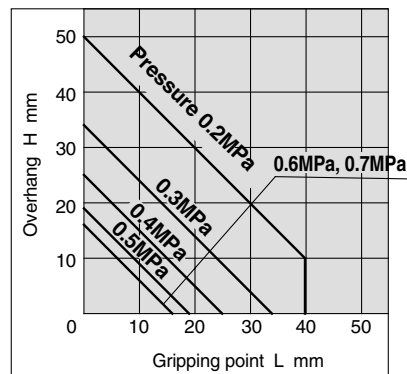


MRHQ25

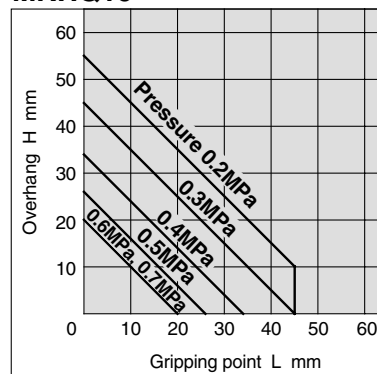


Internal Gripping

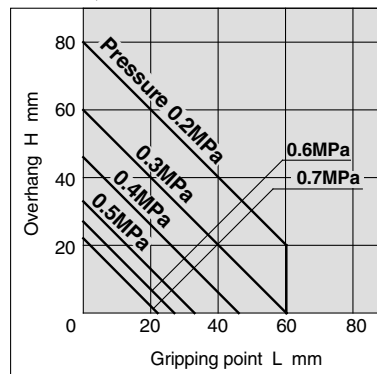
MRHQ10



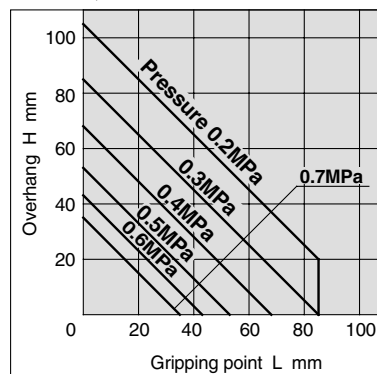
MRHQ16



MRHQ20



MRHQ25



MHZ

MHF

MHL

MHR

MHK

MHS

MHC

MHT

MHY

MHW

MRHQ

Misc.

D-

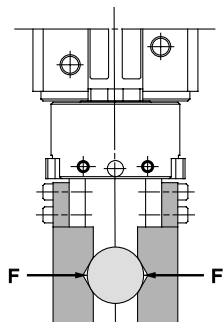
20-

Series MRHQ

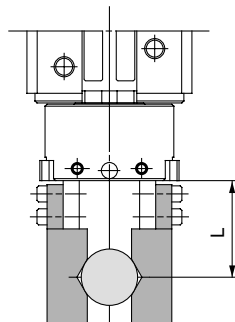
Effective Gripping Force

Expressing the effective gripping force

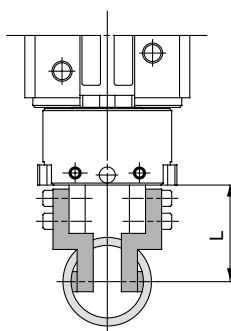
The effective gripping force shown in the graphs to the right is expressed as F , which is the impelling force of one finger, when both fingers and attachments are in full contact with the workpiece as shown in the figure below.



External gripping



Internal gripping



L: Gripping point distance

Model Selection Guidelines by Workpiece Weight

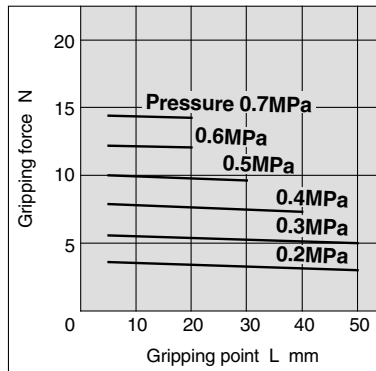
- Although conditions differ according to the workpiece shape and the coefficient of friction between the attachments and the workpiece, select a model that can provide a gripping force of 10 to 20 times the workpiece weight, or more.
- A greater margin of safety is required when high acceleration or impact occurs during workpiece transfer.

Effective Gripping Force

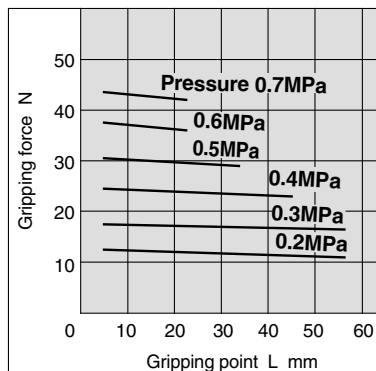
Graph (2)

External Gripping/Double Acting

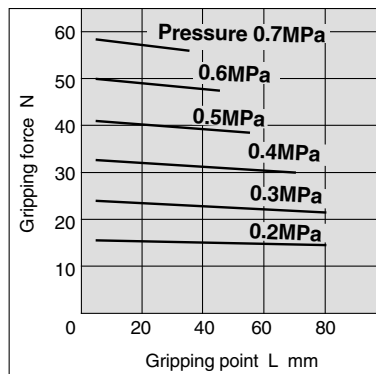
MRHQ10D



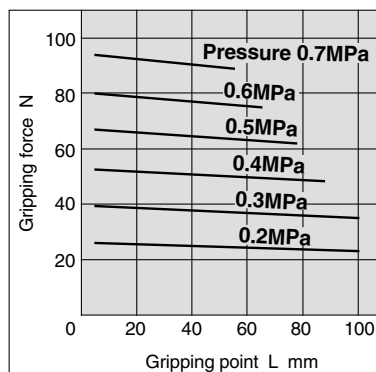
MRHQ16D



MRHQ20D

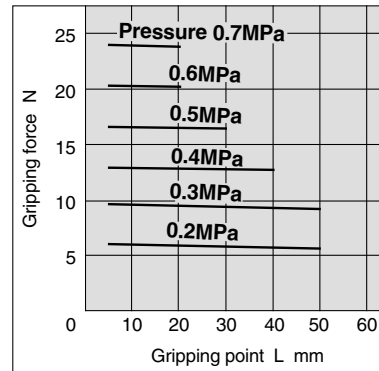


MRHQ25D

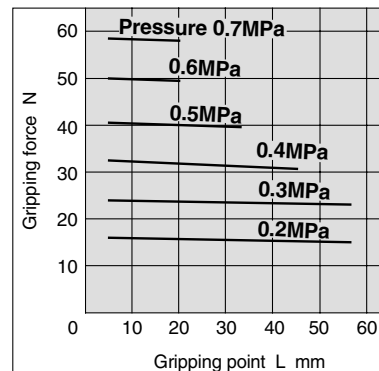


Internal Gripping/Double Acting

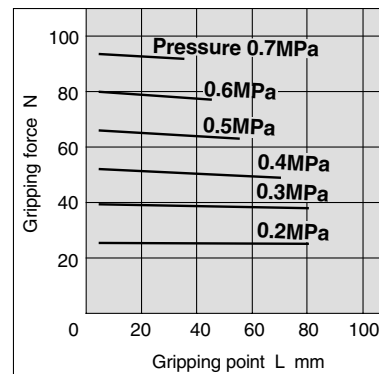
MRHQ10D



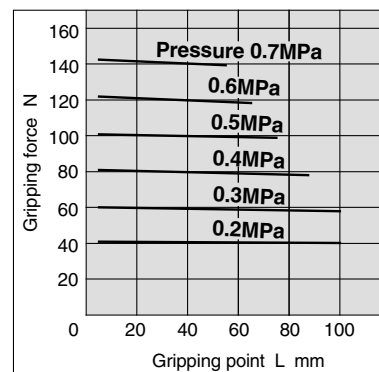
MRHQ16D



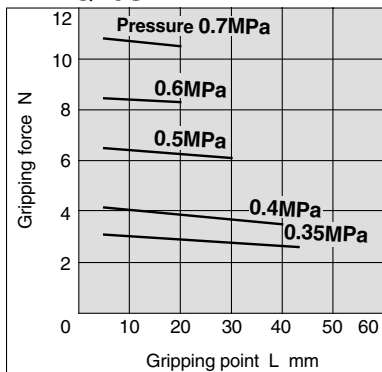
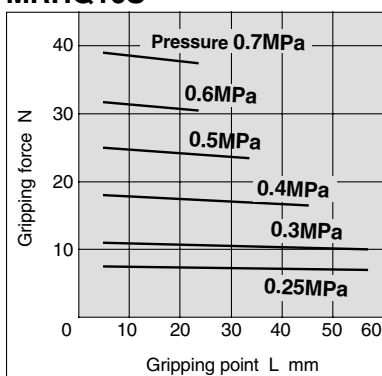
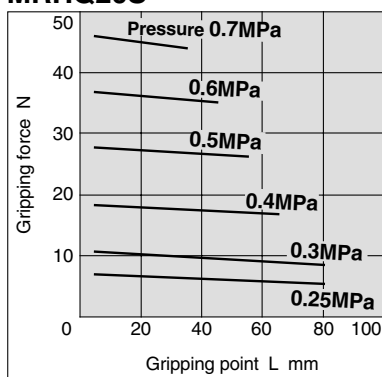
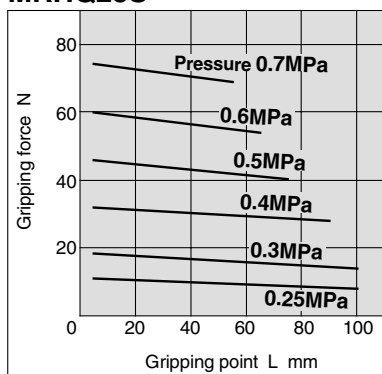
MRHQ20D



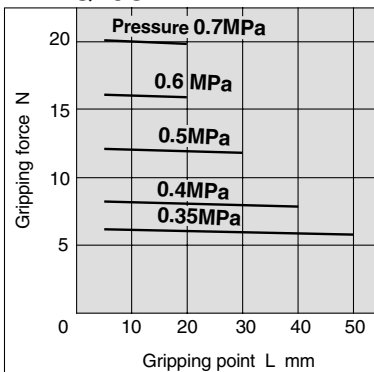
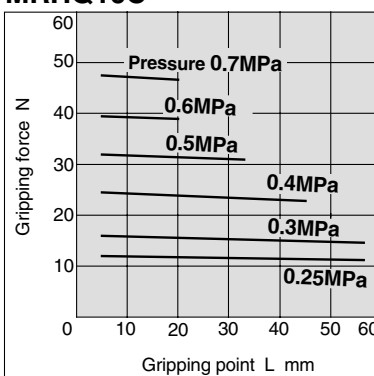
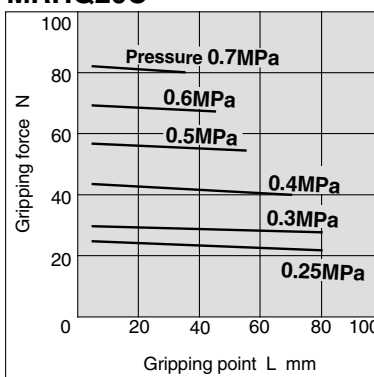
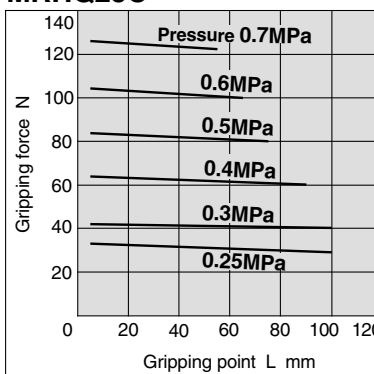
MRHQ25D



External Gripping Force/Single Acting

MRHQ10S**MRHQ16S****MRHQ20S****MRHQ25S**

Internal Gripping Force/Single Acting

MRHQ10C**MRHQ16C****MRHQ20C****MRHQ25C**

MHZ

MHF

MHL

MHR

MHK

MHS

MHC

MHT

MHY

MHW

MRHQ

Misc.

D-

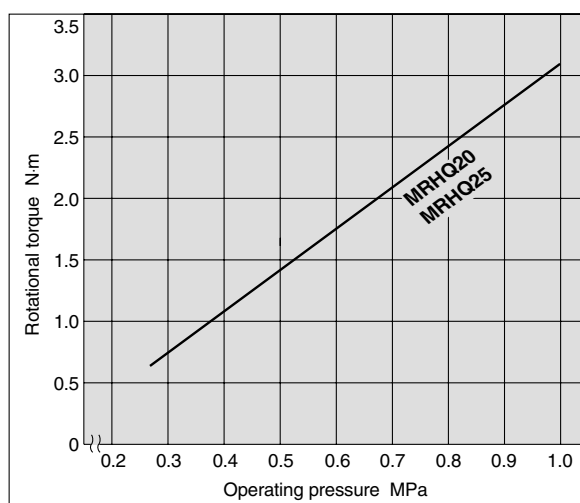
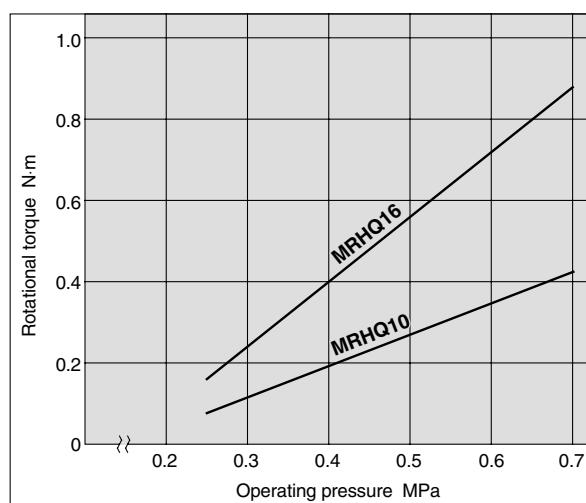
20-

Series **MRHQ**

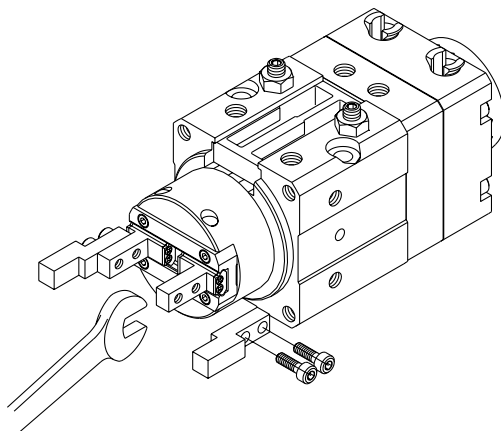
Rotational Torque and Gripping Point

Rotational Torque

Graph (3)

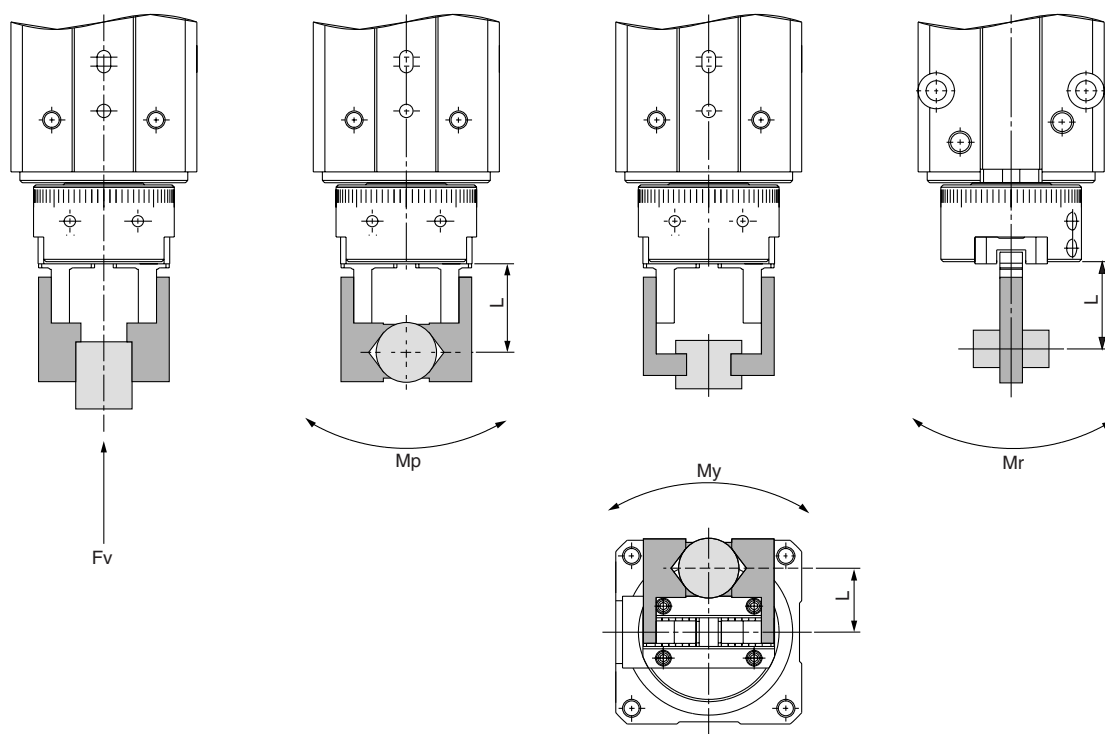


How to Mount Attachment on Fingers



When mounting attachments on fingers, support the fingers with a tool such as a spanner to prevent them from twisting. Refer to the table on the right for the tightening torques of finger mounting bolts.

Model	Bolt	Max. tightening torque N·m
MRHQ10	M2.5 x 0.45	0.31
MRHQ16	M3 x 0.5	0.59
MRHQ20	M4 x 0.7	1.4
MRHQ25	M5 x 0.8	2.8

Allowable Value of External Force on Fingers

L: Distance to the point at which a load is applied (mm)

Model	Allowable vertical load Fv (N)	Maximum allowable moment		
		Pitch moment Mp (N-m)	Yaw moment My (N-m)	Roll moment Mr (N-m)
MRHQ10 □	58	0.26	0.26	0.53
MRHQ16 □	98	0.68	0.68	1.36
MRHQ20 □	147	1.32	1.32	2.65
MRHQ25 □	255	1.94	1.94	3.88

Note) Values of load and moment in the above table are static values.

Calculation for allowable external force (with moment load)	Calculation example
$\text{Allowable load } F \text{ (N)} = \frac{M \text{ (Maximum allowable moment) (N-m)}}{L \times 10^{-3} *}$ <p>* Unit conversion factor</p>	<p>When static load $f = 10 \text{ N}$, which produces pitch moment to the point $L = 30 \text{ mm}$ from MRHQ16D guide, is applied. Operable condition requires that F be bigger than f.</p> <p>Example:</p> $\text{Allowable load } F = \frac{0.68}{30 \times 10^{-3}}$ $= 22.7 \text{ (N)} > 10$ <p>Since load $F > f$, it is operable.</p>

MHZ

MHF

MHL

MHR

MHK

MHS

MHC

MHT

MHY

MHW

MRHQ

Misc.

D-

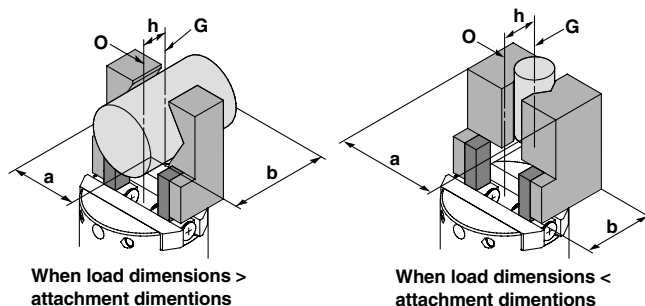
20-

Series MRHQ

Moment of Inertia and Allowable Kinetic Energy

Moment of Inertia Calculation and Allowable Kinetic Energy

Calculate the moment of inertia as shown below, and confirm that the operating conditions are within the allowable kinetic energy shown in the graph "Moment of inertia and rotation time" on the right.



Description

- O Center of rotation
 G Center of gravity of attachment and load
- Gripper fingers
 Attachments
 Load

Moment of inertia I : $\text{kg} \cdot \text{m}^2$

$$I = \frac{(a^2 + b^2 + 12h^2)(m_1 + m_2)}{12 \times 10^6}$$

Practical moment of inertia I_R : $\text{kg} \cdot \text{m}^2$

$$I_R = K \times I$$

* Use I_R for this product.

m_1 : Mass of two attachments (kg)

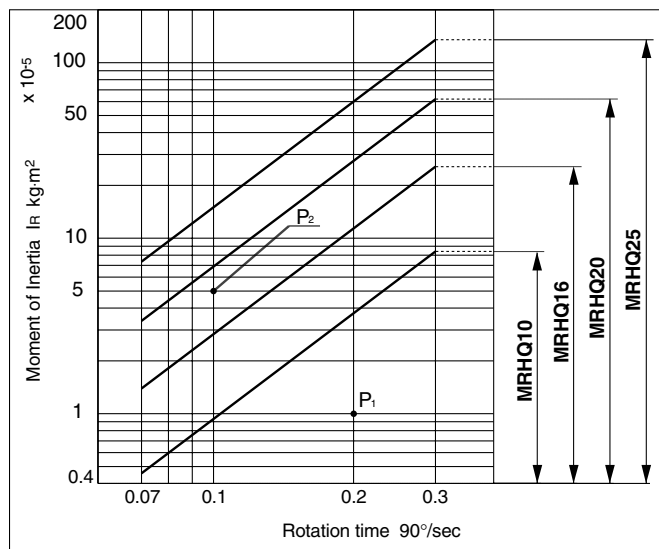
m_2 : Mass of load (kg)

h : Distance between O and G (mm)

a, b : Dimensions of load or attachment (mm)

$K = 2$ (Coefficient)

Graph (Moment of inertia and rotation time)



How to Use the Graph

[Example 1]

- Moment of Inertia: $1 \times 10^{-5} \text{ kg} \cdot \text{m}^2$
- Rotation time: $0.2 \text{ s}/90^\circ$
- To select model **MRHQ10**



It can be used because the point of intersection P_1 on the graph is within the limiting range.

[Example 2]

- Moment of Inertia: $5 \times 10^{-5} \text{ kg} \cdot \text{m}^2$
- Rotation time: $0.1 \text{ s}/90^\circ$
- To select model **MRHQ16**



It cannot be used because the point of intersection P_2 on the graph is outside the range limit. (Review is necessary.)

To confirm by calculation, use formula (1) on the right and check that the kinetic energy of load E is within the allowable values below.

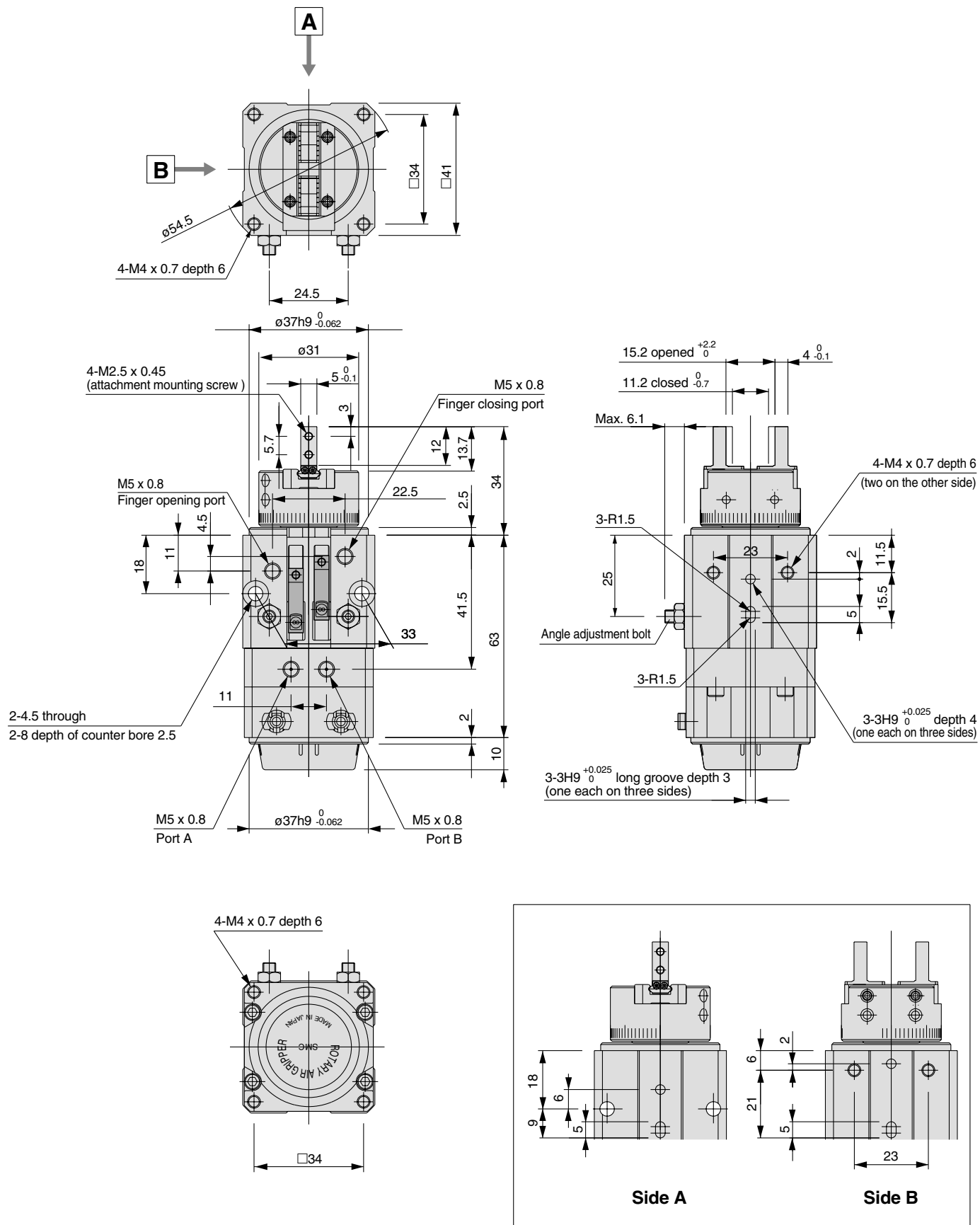
Kinetic energy of load E : J

$$E = 1/2 \times I_R \times \omega^2 \dots (1)$$

$\omega = 2\theta/t$
 (ω : Angular speed at the end)
 θ : Rotating angle (rad)
 t : Rotation time (s)

Allowable Kinetic Energy

Model	Allowable value J
MRHQ10□	0.0046
MRHQ16□	0.014
MRHQ20□	0.034
MRHQ25□	0.074

Dimensions**MRHQ10**

MHZ

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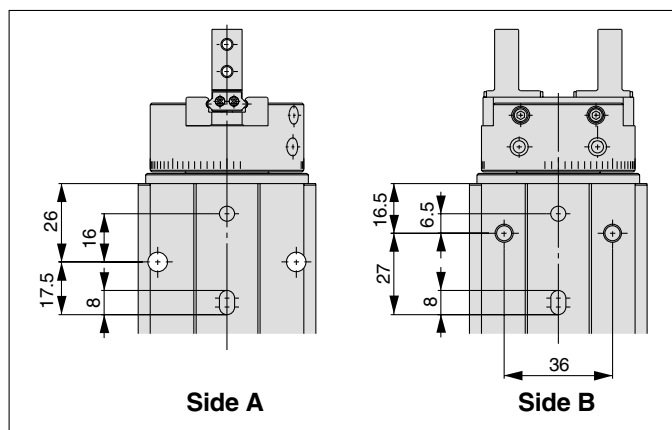
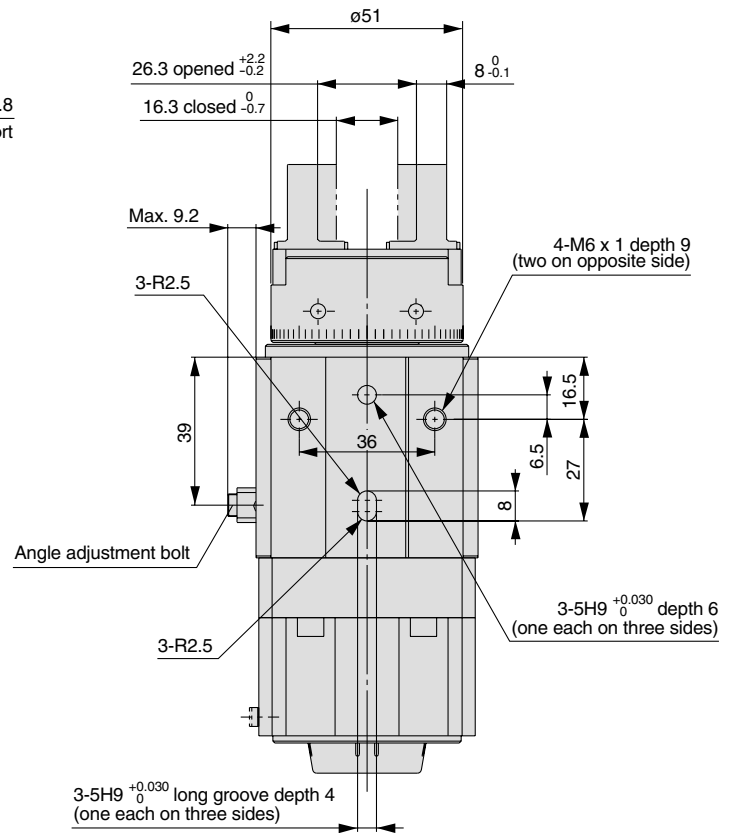
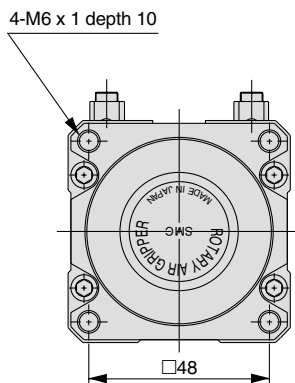
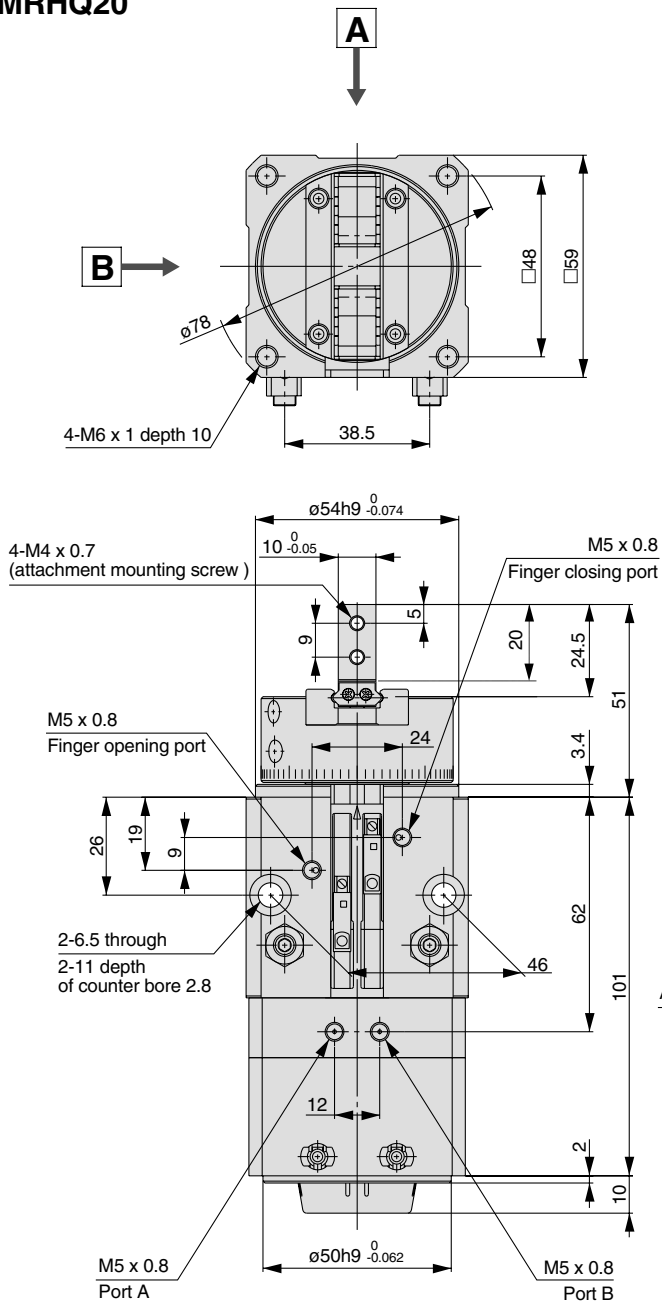
MHW

MRHQ

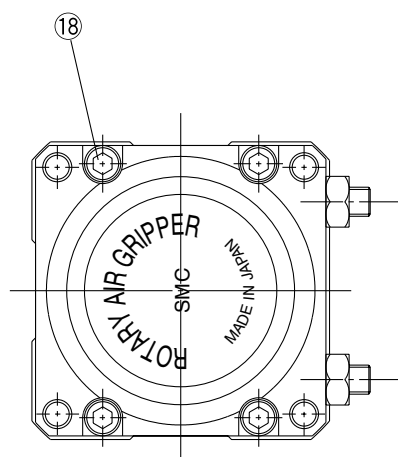
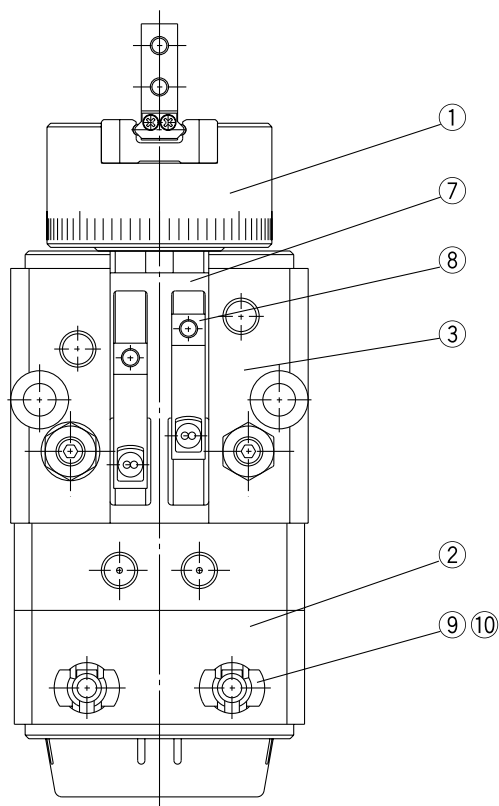
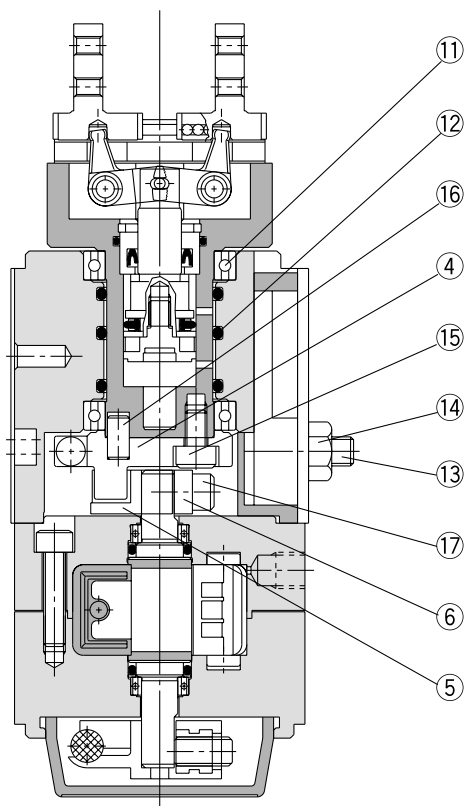
Misc.

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MRHQ20

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MRHQ
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Construction**Component Parts**

No.	Description	Material	Note
①	Gripper unit	—	
②	Rotary unit	—	Two types for 90° and 180°
③	Body C	Aluminum alloy	Gray-White
④	Stopper lever	Carbon steel	Two types for 90° and 180°
⑤	Stopper guide	Stainless steel	
⑥	Retainer	Carbon steel	
⑦	Switch guide	Resin	
⑧	Switch holder A	Resin	
⑨	Switch case	Resin	
⑩	Switch holder B	Resin	
⑪	Bearing	High carbon bearing steel	
⑫	O-ring	NBR	
⑬	Adjustment bolt	Carbon steel	
⑭	Nut	Carbon steel	
⑮	Hexagon socket head cap screw	Carbon steel	
⑯	Parallel pin	Stainless steel	
⑰	Hexagon socket head cap screw	Stainless steel	
⑱	Hexagon socket head cap screw	Stainless steel	

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Series **MRHQ**

Auto Switch Specifications

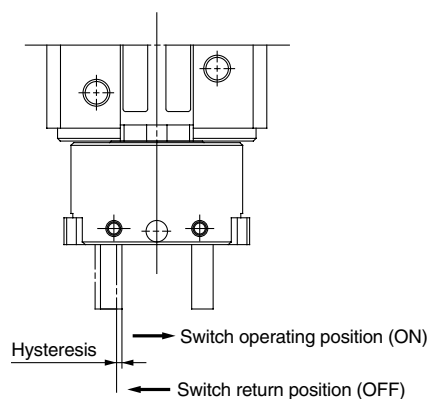


Applicable Series

Series	Application	Auto switch model		Electrical entry
MRHQ10	Gripper opening/ closing verification	Solid state	D-M9BV	Grommet/2-wire
MRHQ16			D-M9NV, M9PV	Grommet/3-wire
MRHQ20	Rotation verification	Solid state	D-M9B	Grommet/2-wire
MRHQ25			D-M9N, M9P	Grommet/3-wire

Auto Switch Hysteresis

Auto switches have hysteresis similar to micro switches. Use the table below as a guide when adjusting auto switch positions, etc.

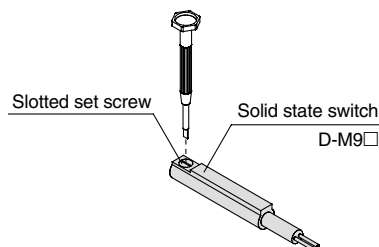


Model	Hysteresis (mm)
MRHQ10	0.5
MRHQ16	0.5
MRHQ20	1.0
MRHQ25	1.0

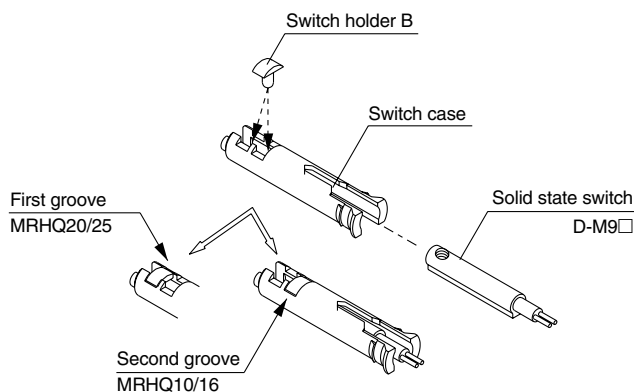
Mounting of Auto Switch

Mounting Switches to Verify Rotation

1. First, remove the slotted set screw installed in a standard switch.



2. Insert the switch into the switch case, and install switch holder B into the first groove (MRHQ20/25) or the second groove (MRHQ10/16) and secure the switch.



3. Install the switch case, with a switch attached securely in the hole, in the direction indicated in Figure (1).

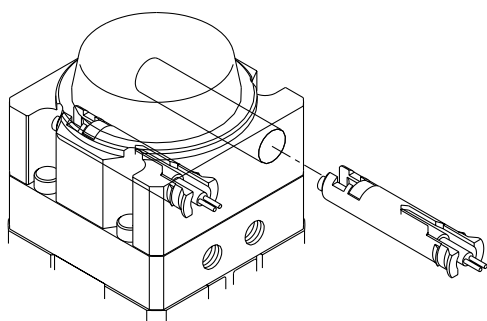


Figure (1)

Mounting Switches to Verify Opening/Closing of Gripper

1. Position switch holder A in the groove of the switch guide in the direction indicated in Figure (2).



2. Insert an auto switch into the switch guide and align the set screw with the hole of switch holder A.

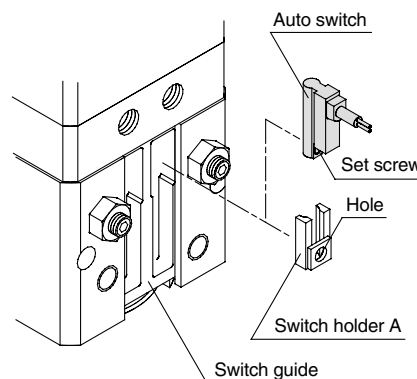


Figure (2)

3. Secure the switch at an appropriate position with a flat head watchmakers screwdriver as indicated in Figure (3).

Tightening torque: 0.05 to 0.1 N·m

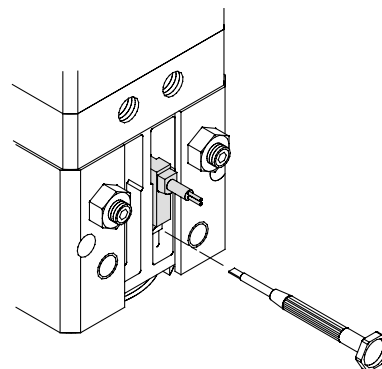


Figure (3)

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MRHQ

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Series MRHQ

Specific Product Precautions 1

Be sure to read before handling.

Selection

⚠ Warning

1. Keep the load energy within the product's allowable energy value.

Operation with a load kinetic energy exceeding the allowable value can cause human injury and/or damage to equipment or machinery. (Refer to "Model Section" procedures in this catalog.)

⚠ Caution

1. When there are load fluctuations, allow a sufficient margin in the actuator torque.

In the case of horizontal mounting (operation with product facing sideways), malfunction may occur due to load fluctuations.

Mounting

⚠ Caution

1. Adjust the rotation angle within the prescribed ranges: $90^\circ \pm 10^\circ$; $180^\circ \pm 10^\circ$ ($\pm 5^\circ$ at end of rotation).

Adjustment outside the prescribed ranges may cause malfunction of the product or failure of switches to operate.

2. Adjust the opening/closing speed of the fingers with a speed controller so that they do not operate any faster than necessary.

When fingers open and close faster than necessary, impact on the fingers and other parts increases, causing poor repeatability when gripping workpieces and danger of an adverse effect on the product's life.

Adjustment of Finger Opening/Closing Speed

Double acting	Install two speed controllers and adjust with meter-out throttling.
Single acting	Install one speed controller and adjust with meter-in throttling. For external gripping – connect to closing port For internal gripping – connect to opening port

3. Adjust the rotation time within the prescribed values using a speed controller. (0.07 to 0.3 s/90°)

The product is provided with a fixed orifice and is designed not to operate faster than 0.07 s/90° (at 0.5 MPa). However, in cases such as a large load inertia, it can exceed the allowable energy causing damage to equipment. (Refer to "Model Selection" procedures in this catalog.)

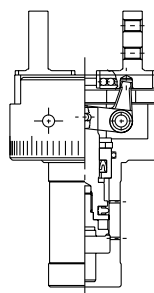
Furthermore, adjustment to a speed slower than 0.3 s/90° can cause sticking and slipping or stopping of operation.

Maintenance

⚠ Caution

1. When replacing a gripper unit, follow the gripper unit replacement procedures on the next page. Confirm the correct unit part number.

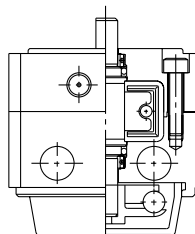
Gripper unit



Model	Unit part no.
MRHQ10D	P407090-3D
MRHQ10S	P407090-3S
MRHQ10C	P407090-3C
MRHQ16D	P407060-3D
MRHQ16S	P407060-3S
MRHQ16C	P407060-3C
MRHQ20D	P407080-3D
MRHQ20S	P407080-3S
MRHQ20C	P407080-3C
MRHQ25D	P408080-3D
MRHQ25S	P408080-3S
MRHQ25C	P408080-3C

2. In case a rotary unit is required for maintenance, order with the unit part numbers shown below.

Rotary unit



Model	Unit part no.
MRHQ10□-90S	P406090-2A
MRHQ10□-180S	P406090-2B
MRHQ16□-90S	P406060-2A
MRHQ16□-180S	P406060-2B
MRHQ20□-90S	P407080-2A
MRHQ20□-180S	P407080-2B
MRHQ25□-90S	P408080-2A
MRHQ25□-180S	P408080-2B

* Note that the rotation angle cannot be changed even though the rotary unit has been changed.

For maintenance, order units with a part number suitable for the model being used.



Series **MRHQ**

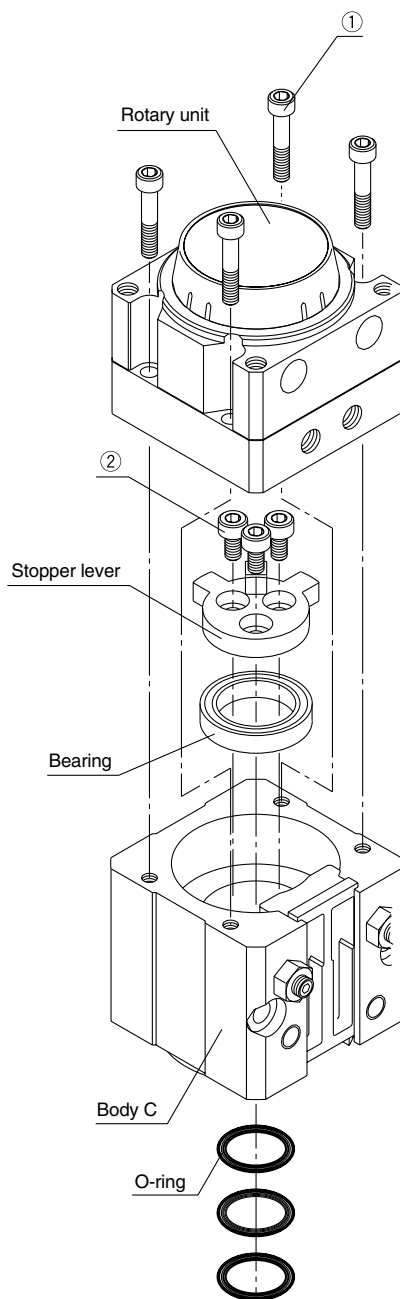
Specific Product Precautions 2

Be sure to read before handling.

Maintenance

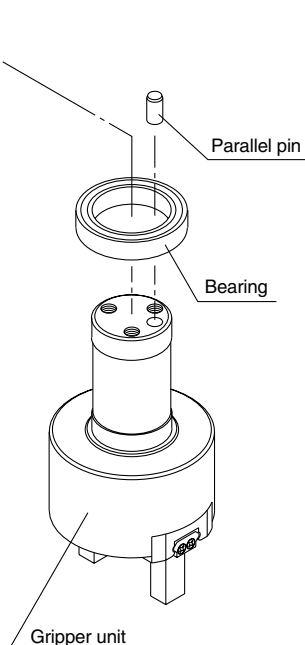
⚠ Caution

Gripper Unit Replacement Procedure



1. Loosen the four bolts ① and remove the rotary unit.
2. Loosen the three bolts ②, remove the stopper lever and pull out the gripper unit.
3. Replace the three O-rings inside body C.
4. Reinstall the two bearings securely in their original positions.
5. Insert a new gripper unit into body C. Then reinstall the stopper lever and parallel pin in their original positions and secure in place by tightening with the three bolts ②.
6. Reinstall the rotary unit in its original position and secure in place by tightening with the four bolts ①.

Model	Tightening torque N·m	
	①	②
MRHQ10	0.9 to 1.2	1.4 to 1.7
MRHQ16	2.5 to 3.0	3.2 to 3.7
MRHQ20	4.5 to 5.0	6.5 to 7.0
MRHQ25	4.5 to 5.0	10.0 to 10.5



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Misc.

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