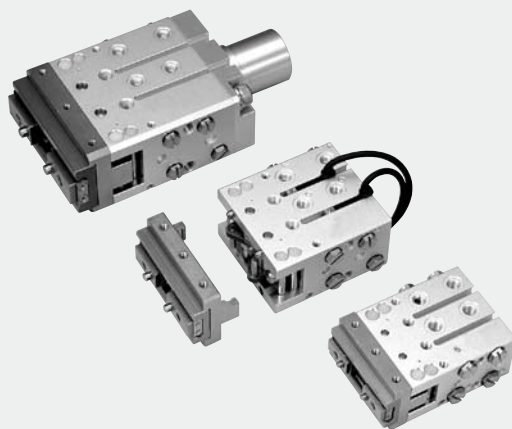


FINGER CHANGER®

AFC Series

AFC

FINGER CHANGER



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FINGER CHANGER

AFC Sreise

The tool changer function is installed in Air-chuck. Automatic attaching/detaching and exchange of the finger plate alone is possible.

Linear Guide



High Accuracy, High Rigidity
Linear Guide is built-in.

Highly Free Mounting Direction

Mountable in axial, longitudinal or lateral direction

Positioning Pin Holes are provided on Four Surfaces

Repeatability of mounting/dismounting

Switch for Checking Opening/Closing of the Fingers

Provision of a switch for checking opening/closing of the fingers is possible.

Highly Free Piping Arrangement

Selectable from the front and two sides.

Non-contact Switch for Checking Attaching Detaching

Provision of a non-contact switch for checking attaching/detaching of the finger plate is possible.

Fail-safe Mechanism

Finger plate will not come off even when pneumatic pressure drops.

Secure and Swift Separation

The finger plate will be separated securely from the changer proper by ejecting operation of the locking pistons.

Large Opening/Closing Stroke

AFC10 10mm
AFC16 10mm
AFC20 14mm

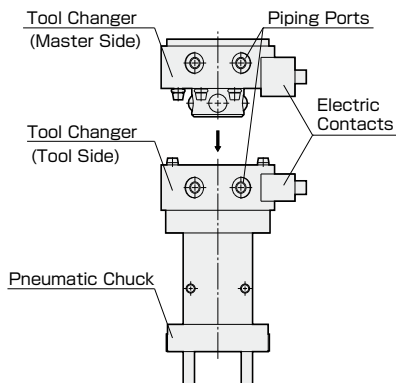
High-precision and High-rigidity Linear Guide

Finger plate is provided with a high precision and high-rigidity linear guide. Repeatability: ± 0.01 mm

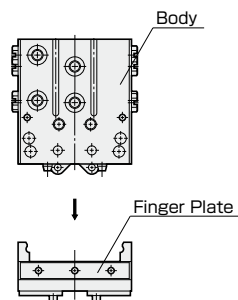
Summary of The FINGER CHANGER

As for automatic exchange of robot hand tools, a system to exchange the tools by means of pneumatic hands mounted on a tool changer has been generally adopted. However, this system inherently involved such disadvantages as complicated pneumatic piping/switches, shorter life of electric contacts and reduced load-carrying capacity of the robot due to larger and heavier construction of the system as a whole. What was created under a completely new development concept of incorporating the function of a tool changer into a pneumatic chuck is this finger changer. This new finger changer allows exchange of only the essential module, namely the finger plate mounted on the tip of the robot hand. This new principle makes it possible to realize a tool changer not larger than conventional pneumatic hands, resulting in a drastic reduction both in weight and size. Other features of this finger changer include a high-precision and high-rigidity linear guide provided in the finger plate, switches for checking attaching/detaching of the finger plate and opening/closing of the fingers provided as optional devices, positioning pin holes provided on four surfaces and piping ports on three surfaces and so forth.

Combination of a conventional tool changer and a pneumatic chuck

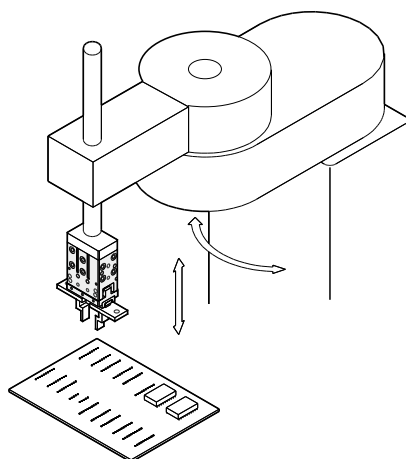


Finger changer: AFC series



- Lightweight and compact construction
- Reduced cost

Application Examples : FINGER CHANGER



Application

Automatic exchange of hand tools for odd-shaped parts placing device
Exchange of fixtures for setup change

Model Code Example

AFCS-SD10-FPRX-RB42LA

Series Name

● Cable Length

No Code	1 m
LA	3m

● Number of Switches

1	1
2	2

Magnet

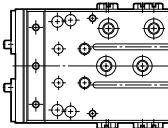
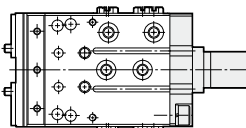
No Code	None
S	With Magnet

A magnet is required when RB (RC) mounting switches.

● Bore Size

10	φ10
16	φ16
20	φ20

Supporting Type

SD	Basic
	
HB	With End Boss Adapter
	

● Switch (for checking opening/closing)

No Code	None		
RB4	Straight	DC12~24V 2 Wires Solid State Switch	With Indicator Light
RC4	Angle		
RB5	Straight	DC5~24V 3 Wires Solid State Switch	With Indicator Light
RC5	Angle		

Direction of Cable Outlet


RB.... RC....
Straight Outlet Cable Angle Outlet Cable



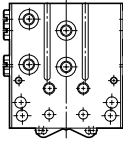
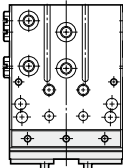
For details  Page 1066, 1067

● Switch (for checking attaching/detaching)

No Code	Without Switch
RX	Proximity Switch(DC12-24V)

Can be used for the finger changer without magnet as well.
For details  Page 1069

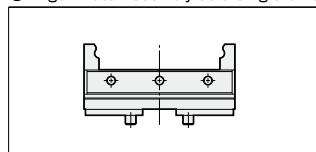
● Finger Plate Assembly

No Code	Without Finger Plate Assembly
	
FP	With Finger Plate Assembly
	

Model Code Example

FPA-AFC10

● Finger Plate Assembly as a Single Unit



● Bore Size

10	φ10
16	φ16
20	φ20

Specification

Holding Area	Bore Size		φ10mm	φ16mm	φ20mm
	Opening/closing Stroke		10mm	10mm	14mm
	Note: Holding Force in Closing Dir. (Effective Value)		10.5N	33N	51N
	Pipe Bore		M5×0.8		
	Guide mechanism		Linear Guide		
	Type of Operation		Double Acting		
	Fluid		Air		
	Maximum Operating Pressure		0.7MPa		
	Minimum Operating Pressure		0.2MPa	0.1MPa	
	Proof Pressure		1.05MPa		
Operating Temperature		5~60℃			
Maximum Frequency of Operation		90c.p.m			
Lubrication		Not required			
Attaching/detaching Area	Bore Size		φ10mm×2	φ12mm×2	φ16mm×2
	Pipe Bore		M5×0.8		
	Type of Operation		Double Acting		
	Fluid		Air		
	Maximum Operating Pressure	Connecting Side	0.7 MPa		
		Separating Side	0.6 MPa		
	Minimum Operating Pressure	Connecting Side	0.3 MPa		
		Separating Side	0.25MPa		
	Proof Pressure		1.05MPa		
	Operating Temperature		5~60℃		
Lubrication		Not required			

Note: Values in the table are those when pressure is 0.5MPa (5kgf/cm²) and the span of holding points L=30mm.

Guide Employed in the Finger Plate (Linear Guide)

Model	Type
AFC10	Rail Size 7
AFC16	Rail Size 9
AFC20	Rail Size 12

Pre-load:Zero or slightly pre-loaded

Mass

Unit: g				
Model	Body	Finger Plate Assy	Additional Mass to be added	Additional Mass of End Boss Adaptor
AFC10	145	65	3	35
AFC16	225	110	6	60
AFC20	380	210	7	115






Unit: g	
Switch Type	Mass
RB4, RC4, RB5, RC5	15
RB4LA, RC4LA, RB5LA, RC5LA	35
RX	30

METHOD TO CALCULATE THE MASS

Ex. AFCS-HB10-FPRX-RC42LA

Body Mass..... 145g
 Additional Mass with Magnet.....3g
 Additional Mass with End Boss Adaptor..... 5g
 Mass of Finger Plate Assy..... 65g
 Mass of RX Switch..... 30g
 Mass of RC4LA Switch..... 35×2=70g
 145+3+35+65+30+35×2=348g

OPTIONAL PARTS CODES

Name	Plug	Plug	End Boss Adaptor	Proximity Switch	RX Switch Fixture
<div>PARTS CODE</div> <div>Note</div> <div>PARTS CODE</div> <div>Note</div>	<div>BS-M5</div> <div>with gasket</div>	<div>BR-M5</div> <div>Coat BR-M5 with seal tapes or sealing liquid when using it.</div>	<div>HB(AFC□)</div> <div>Fill in □ as bore size.</div>	<div>RX(AFC)</div> <div>SUNX GX3S</div>	<div>BD(AFCRX)</div> <div>Sim, Screw</div>
Content			 with Bolt	 with Bolt	



●RB, RC Switch

Conventional RG1, RG2 switches can be replaced to RB, RC switch



Switch Fixture

<div>BE(AFC)</div> <div>Screw, Nut</div>


Solid State Switch(2 Wires, with Indicator Light)

Straight Outlet Cable	Angle Outlet Cable
<div>RB4(AFC)</div> <div>Cable Length:1m</div> <div>RB4LA(AFC)</div> <div>Cable Length:3m</div>	<div>RC4(AFC)</div> <div>Cable Length:1m</div> <div>RC4LA(AFC)</div> <div>Cable Length:3m</div>
 with fixture	 with fixture

Solid State Switch(3 Wires, with Indicator Light)

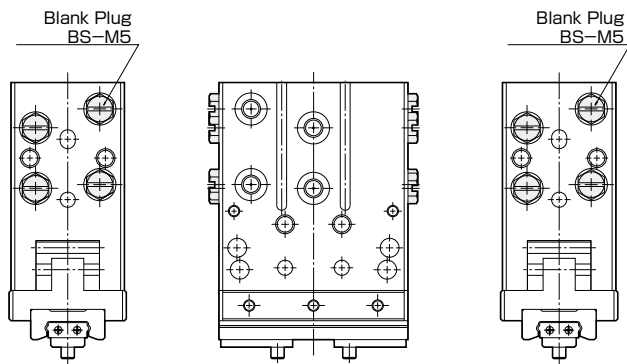
Straight Outlet Cable	Angle Outlet Cable
<div>RB5(AFC)</div> <div>Cable Length:1m</div> <div>RB5LA(AFC)</div> <div>Cable Length:3m</div>	<div>RC5(AFC)</div> <div>Cable Length:1m</div> <div>RC5LA(AFC)</div> <div>Cable Length:3m</div>
 with fixture	 with fixture

CHANGE OF THE PIPING POSITION

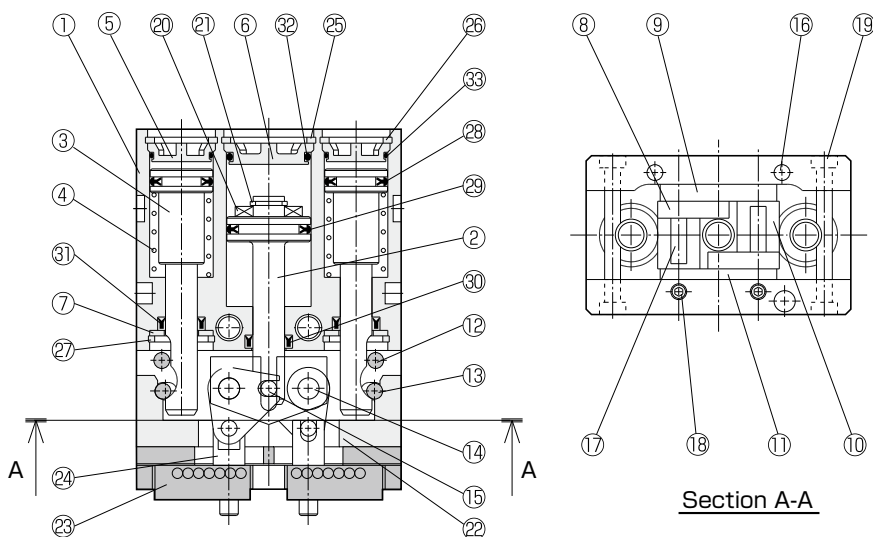
When the finger changer is delivered, the blank plugs BS-M5 are provided on both sides (four pieces on each side: eight pieces in total) out of three surfaces provided with ports.

Since the blank plug BS-M5 is provided with gasket on its seating surface, mounting/dismounting of this plug can be conducted easily with a flat-tip screwdriver or a wrench.

Use blank plugs BR-M5 (hexagonal socket set screw) sold separately when protrusion of plugs from the body is not permissible. In this case, apply seal tape or sealant on the screw.



STRUCTURE AND PRINCIPAL COMPONENTS



These components cannot be disassembled.

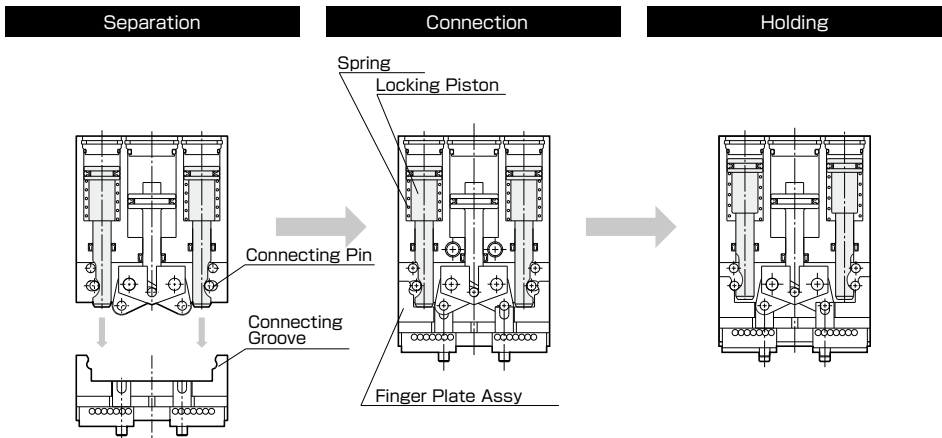
⚠ Caution

Conventional function will be lost if disassembled.

PRINCIPAL COMPONENTS

No.	Name	Material	Remarks	No.	Name	Material	Remarks
1	Body	Aluminum Alloy	Alumite Treatment	18	Hexagonal Socket Set Screw	Steel	Nickel Plating
2	Piston Rod	Stainless Steel		19	Plug	Resin	
3	Locking Piston	Stainless Steel		20	Magnet	Magnetic Substance	
4	Spring	Stainless Steel		21	C-ring	Steel	
5	End Cover	Resin		22	Finger Plate	Carbon Steel	Electroless Nickel Plating
6	End Cover	Resin	AFC20 only: Aluminum Alloy	23	Linear Guide	Stainless Steel	Heat Treatment
7	Rod Seal Holder	Aluminum Alloy	Alumite Treatment	24	Action Pin	Steel	Electroless Nickel Plating
8	Action Lever	Steel	Nitriding	25	C-ring	Steel	Nickel Plating
9	Guide Plate	Steel	Electroless Nickel Plating	26	C-ring	Steel	Nickel Plating
10	Spacer Collar	Aluminum Alloy	Alumite Treatment	27	C-ring	Steel	Nickel Plating
11	Plate	Steel	Electroless Nickel Plating	28	Piston Seal	NBR	
12	Rotation Prevention Pin	Steel	Heat Treatment	29	Piston Seal	NBR	
13	Connecting Pin	Steel	Heat Treatment	30	Rod Seal	NBR	
14	Fulcrum Pin	Steel	Heat Treatment	31	Rod Seal	NBR	
15	Driving Pin	Steel	Heat Treatment	32	O-ring	NBR	
16	Positioning Pin	Steel	Heat Treatment	33	O-ring	NBR	
17	Lever Pin	Steel	Heat Treatment				

OPERATION PRINCIPLE OF A FINGER CHANGER



Move the locking pistons to pushing-down side by supplying the air to the separating port. Then, the holding by means of the holding grooves and the holding pins will be canceled. By this procedure, the locking pistons will be moved downward, pushing the finger plate downward and separating it from the body.

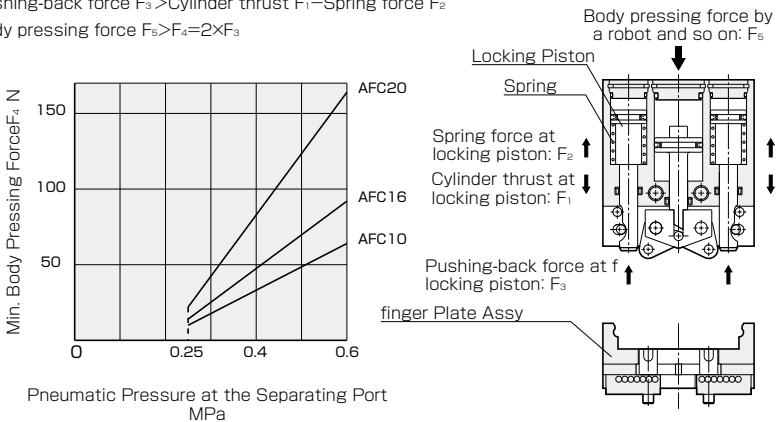
Move the body by means of robot and so on with air supplied to the separating port and make the ends of the locking pistons contact with the finger plate. Keep moving the body thereafter to press the body against the finger plate. By means of this procedure, locking pistons are pushed back to bring the finger plate into close contact with the body.

Move the locking pistons to retracting side by supplying air to the connecting port. Then, the connecting pins will be pressed onto the connecting grooves and hold the finger plate. Holding strength is determined by pneumatic pressure supplied to the connecting port.

SETTING OF PNEUMATIC PRESSURE AT THE SEPARATING PORT

Body pressing force by the robot and the like at the time of connection needs to be larger than the force to push back the two locking pistons. Pushing-back force (minimum pressing force of body: F_4) of the locking piston is determined by the pneumatic pressure at the separating port. Do not set the pressure larger than necessary to avoid adverse effect to performance, life and so on.

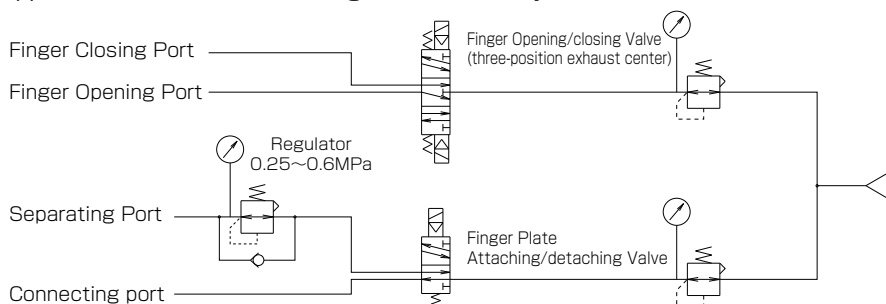
Pushing-back force $F_3 > \text{Cylinder thrust } F_1 - \text{Spring force } F_2$
 Body pressing force $F_5 > F_4 = 2 \times F_3$



PNEUMATIC CIRCUIT

■ In the case of automatic exchange

Applications: automatic exchange of hand tool by a robot or the like, etc.



● Be sure to use a three-position exhaust center for the finger opening/closing valve.

If a twoposition valve, a closed center or a three-position valve of pressured center type is used, air from the finger opening/closing cylinders cannot be discharged at both sides, resulting in improper attaching/detaching of the finger plate.

● To the separating port side, supply air whose pressure is reduced to a proper level by regulator.

If regulator is not used, attaching/detaching of the finger plate may become impossible.

Air Pressure Setting Page 812

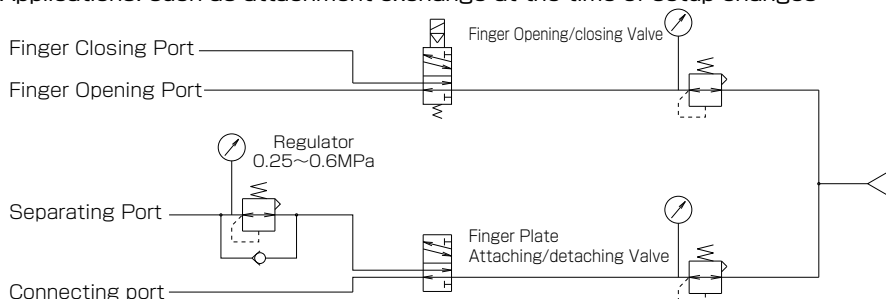
⚠ Warning

● Be sure to supply Air to the connecting port

Drop of pneumatic pressure at the connecting port to below the specified level may cause coming off of the finger plate. Take safety measures against this. One example of these measures is to design the system so that the system will stop when the pressure drops. Take another measures so that damages may not be given to human bodies/facilities even if the finger plate comes off.

■ In the case of manual exchange

Applications: such as attachment exchange at the time of setup changes



● For supplying air to the separating port side, reducing the pressure to an appropriate level using a regulator is recommended.

For manual change, the separating port does not necessarily require a regulator. However, use of a regulator is recommended when the finger plate assembly is difficult to mount.

Air Pressure Setting page 812

⚠ Warning

● Be sure to supply Air to the connecting port

Drop of pneumatic pressure at the connecting port to below the specified level may cause coming off of the finger plate. Take safety measures against this. One example of these measures is to design the system so that the system will stop when the pressure drops. Take another measures so that damages may not be given to human bodies/facilities even if the finger plate comes off.

ALIGNMENT AT THE TIME OF CONNECTION

Alignment at the following two places are necessary when the body and the finger plate are to be connected.

①Alignment between the body and the finger plate

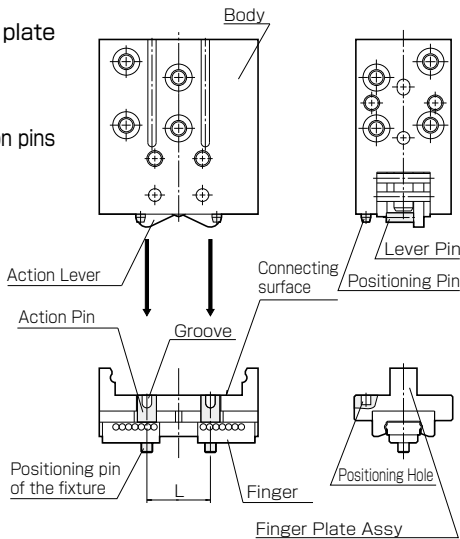
Align the two positioning pins of the body with the positioning holes of the finger plate.

②Alignment between the action levers and the action pins

Align the lever pins of the action lever with the groove of the action pins. Connect the body and the finger plate with the action lever open to its maximum and setting the pitch of the finger pins as shown below. Failure to follow this procedure may cause connection failure/improper engagement of the groove of action pins with the lever pins, resulting in malfunction of the fingers.

Parallelism between the connecting surfaces of the body and the finger plate is to be set at 5/100mm or better.

Accuracy of the center position of the body and the finger plate is to be set at 5/100mm or better.

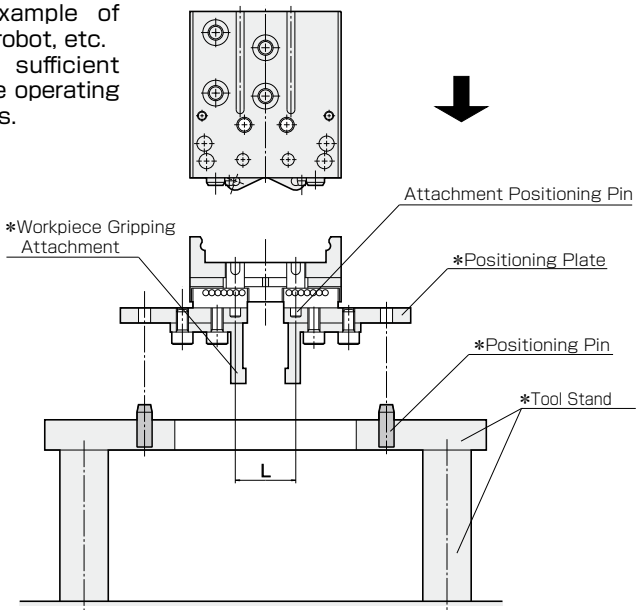


TOOL STAND FOR AUTOMATIC CHANGE (EXAMPLE)

The figure shows an example of automatic change using a robot, etc. For actual use, give sufficient consideration in view of the operating conditions and other factors.

Ensure that the pitch between the attachment positioning pins is as shown in the table below.

Model	L(mm)
AFC10	18 ^{+0.05}
AFC16	20 ^{+0.05}
AFC20	25 ^{+0.05}



PRECAUTIONS FOR DESIGN AND USE

Warning

Safety Cover

It is dangerous to bring the hand, finger, face, etc. close to moving parts such as the fingers and attachments. Provide a safety cover if there is any possibility of injury during operation of the equipment or the chuck.

Power Source Failure and Supply Pressure Drop

If any power source such as electricity and air pressure fails or the supply pressure abnormally increases or decreases due to trouble, etc., the gripping force of the fingers and the connecting axial force of the finger plate also vary. For that reason, the workpiece may be damaged due to the increased gripping force, the workpiece may fall due to decreased gripping force or connecting axial force or the finger plate may fall off. Take measures for preventing injury or damage to human body or equipment even if such situations occur.

Gripping Force

Refer to the page on effective gripping force and select a model with a margin taken into consideration.

Gripping Point

Use beyond the limit range of the gripping point may increase the moment load applied to the finger, causing failure.

Secure Gripping

Ensure that workpiece is gripped at a point close to the center of gravity of the workpiece securely and stably. Grip the workpiece near the midpoint of the opening/closing stroke as much as possible.

Attachment

When the attachment for workpiece gripping is long and large or the mass is large, the inertial force from opening/closing operation and the moment load generated in the fingers may become large, possibly affecting the performance.

Opening/Closing Stroke

Ensure that the design takes into account variation in the workpiece dimensions and gripping position. If no margin is provided, inadequate gripping of the workpiece, falling, etc. may result. When using a switch, consider the opening/closing stroke with the hysteresis of the switch taken into account. Set the opening/closing stroke as large as possible. Setting a small stroke may cause inadequate lubrication of the fingers and cylinder sliding part, leading to malfunction. If it is not possible to set a large opening/closing stroke, operate with a large stroke periodically in order to maintain good lubrication.

Opening/Closing Operation

Do not operate the action lever without the finger plate. It may cause failure.

Rolling Feel in Linear Guide

When the fingers are moved by hand, rolling of balls in the linear guide may cause slight feel of operation discontinuity or difference in the rolling resistance between products. This is due to preload of the linear guide and does not affect the performance.

Actuator Precaution  page 1055

Adjustment of Finger Opening/Closing Speed

Large impact by gripping the workpiece may increase the moment generated in the fingers, causing failure. Use a speed controller to ensure that the workpiece is gripped as softly as possible. During commissioning, operate the product manually or at a low speed by reducing the supply pressure to make sure that no impact is applied to the fingers.

Removal of Product

When removing the device from the equipment for purposes such as remodeling and maintenance, make sure that no workpiece is gripped, shut off the supply of compressed air and discharge the residual pressure.

During Operation

Inadvertently bringing the finger, hand, tool, etc. in any moving part of the equipment or device while the device is in operation or the power source is not cut off may lead to accidents.

Provision of Cover

If any dust, water, oil, machining oil, iron powder, spatter, etc. is attached to the rod, sliding part or finger linear guide, the bearing or packing may be damaged, causing air leakage or malfunction. Provide a cover to prevent attachment.

Periodical Greasing

The linear guide of the fingers has lubricating oil applied initially but regrease regularly.

Mounting and Adjustment

When mounting an attachment on the fingers, tighten the mounting screws while supporting the attachment by using a spanner, etc. to prevent any load or impact from being applied to the guide. Ensure that no force other than the workpiece gripping is applied to the fingers. Provide clearance to prevent any hitting of workpiece or attachment in finger opening/closing operation or at the stroke end of air chuck movement, which may cause load or impact to be applied to the fingers.

Mitigation of Impact of Stopping

When a robot or other actuator is used for movement of the body of the product such as straight and revolving movements, the workpiece may project or fall or the finger plate may fall off. Ensure that the design takes into account impact absorption by a cushion, absorber, etc.

Lock Piston

The spring in the lock piston is intended for preventing the finger plate assembly from falling off due to air pressure drop. For ordinary use, be sure to supply compressed air to the return side (connecting port side) for holding it. Otherwise, the finger plate assembly may fall off from the body.

Positioning Pin Hole in Body

Press-fitting a pin into a positioning pin hole may cause failure due to deformation of or damage to the press-fitting part or excessive load applied during press-fitting. Ensure that the fit allows for a clearance between the hole and the pin (clearance fit: tolerance class position g max.).

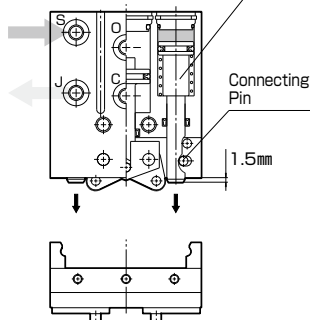
CONNECTING PROCEDURES

Step 1

Initial state (separation)

Supply air to the separating port to push the locking piston downward. This procedure frees the connecting pins.

Supply air to the separating port S.



Port Name	Finger Area		Attaching/detaching Area	
	Opening Port	Closing Port	Connecting Port	Separating Port
State of the Air Supply	x	x	x	●

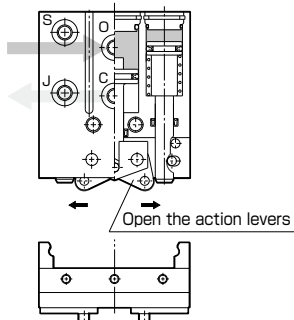
● Air Supply
x Exhaust

Step 2

To open the levers

Supply air to the finger opening port to open the action levers to their maximum.

Supply air to the opening port O.



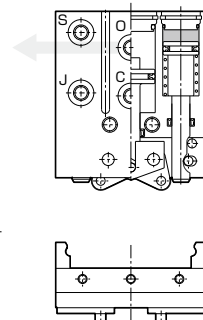
Port Name	Finger Area		Attaching/detaching Area	
	Opening Port	Closing Port	Connecting Port	Separating Port
State of the Air Supply	●	x	x	●

Step 3

To get the levers ready

Discharge the air inside the cylinders for finger opening/closing. This procedure discharges the air at both sides of the pistons.

Discharge the air from the opening port O.

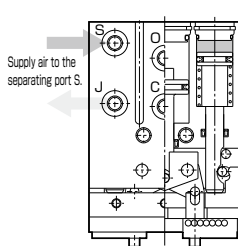


Port Name	Finger Area		Attaching/detaching Area	
	Opening Port	Closing Port	Connecting Port	Separating Port
State of the Air Supply	x	x	x	●

Step 4

Connection

Move the body downward till the tips of the locking pistons touch the finger plate by means of the robot and the like. After the body touches the finger plate, continue moving the body so that the locking pistons are pushed back to bring the

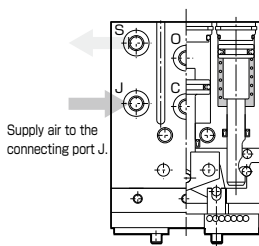


Port Name	Finger Area		Attaching/detaching Area	
	Opening Port	Closing Port	Connecting Port	Separating Port
State of the Air Supply	x	x	x	●

Step 5

Holding

Supply air to the connecting port to hold the finger plate.

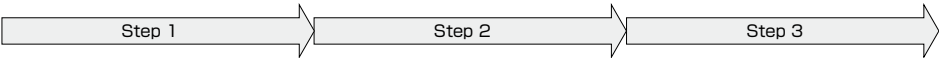


Port Name	Finger Area		Attaching/detaching Area	
	Opening Port	Closing Port	Connecting Port	Separating Port
State of the Air Supply	x	x	x	●

Code for Piping Ports

O : Finger opening port (Open)
C : Finger closing port (Close)
J : Finger plate connecting port (Joint)
S : Finger plate separating port (Separate)

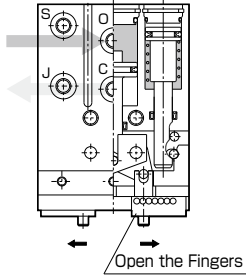
SEPARATING PROCEDURES



●To open the fingers

Supply air to the finger opening port to open the fingers to their maximum.

Supply air to the opening port O.

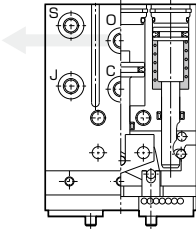


Port Name	Finger Area		Attaching/detaching Area	
	Opening Port	Closing Port	Connecting Port	Separating Port
State of the Air Supply	●	x	●	x

●To get the fingers ready

Discharge the air inside the cylinders for finger opening/closing. This procedure discharges the air at both sides of the pistons.

Discharge the air from the opening port O.

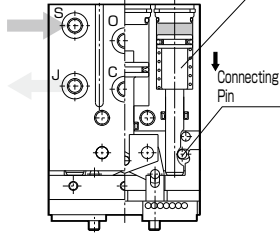


Port Name	Finger Area		Attaching/detaching Area	
	Opening Port	Closing Port	Connecting Port	Separating Port
State of the Air Supply	x	x	●	x

●To cancel connection

Supply air to the separating port to push the locking pistons downward. This procedure frees the connecting pins.

Supply air to the separating port S.



Port Name	Finger Area		Attaching/detaching Area	
	Opening Port	Closing Port	Connecting Port	Separating Port
State of the Air Supply	x	x	x	●

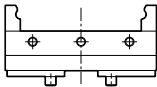
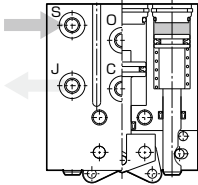


●Separation

Move the body by 15mm MIN. by means of robot and so on with the locking piston pressed.

Move

Supply air to the separating port S.



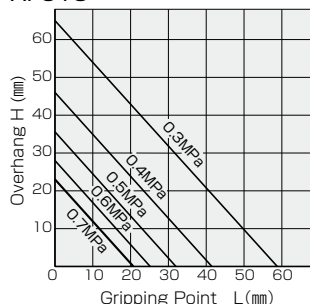
Port Name	Finger Area		Attaching/detaching Area	
	Opening Port	Closing Port	Connecting Port	Separating Port
State of the Air Supply	x	x	x	●

Code for Piping Ports

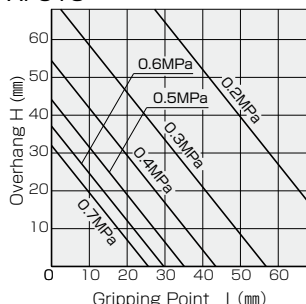
- O : Finger opening port (Open)
- C : Finger closing port (Close)
- J : Finger plate connecting port (Joint)
- S : Finger plate separating port (Separate)

LIMIT RANGE OF GRIPPING POINT

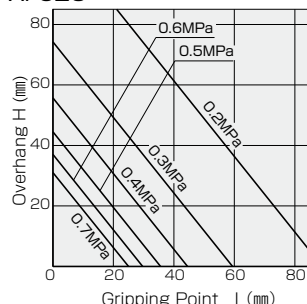
AFC10



AFC16



AFC20



⚠ Caution

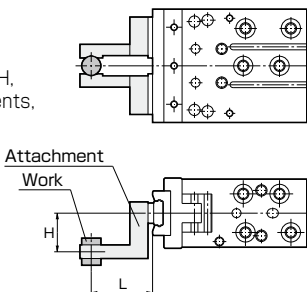
● Attachment

Ensure that the distance of the gripping point L and overhang H , which show the position of workpiece gripping by the attachments, are within the ranges shown in the graphs.

Exceeding the limit range may cause excessive moment to be applied to the guide, which may generate looseness of the fingers or otherwise adversely affect the service life.

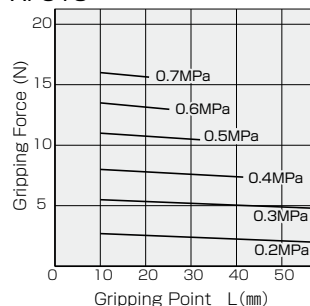
Attachments should be as small and lightweight as possible even within the limit range.

Long and heavy attachments increase the inertial force from opening/closing, which may adversely affect the fingers.

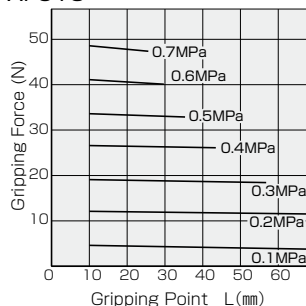


CLOSING DIRECTION EFFECTIVE GRIPPING FORCE

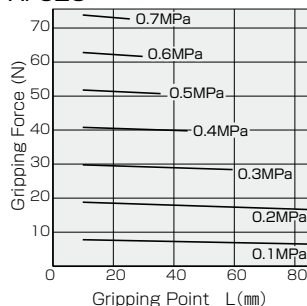
AFC10



AFC16



AFC20

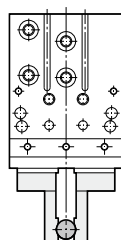


⚠ Warning

● Selection of Model according to Work Mass

The mass of the workpiece to be gripped should be 5 to 10% of the effective gripping force as a rough guide, although it depends on the material, shape, surface condition, etc. of the workpiece or attachments.

When large acceleration or impact is applied due to high-speed movement by a robot, etc. while the workpiece is gripped, allow for a larger margin.



ALLOWABLE MOMENT AND CONNECTING AXIAL FORCE

⚠ Warning

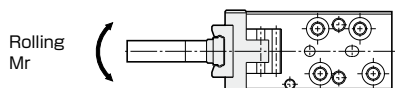
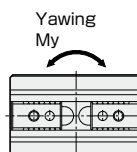
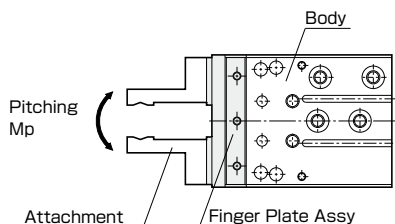
■ Allowable Moment

In cases as shown below, the finger plate assembly may fall off if the fingers and the finger plate assembly are subjected to moment above the allowable value.

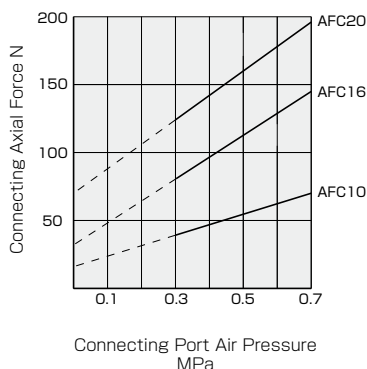
Ensure that moment above the allowable value is not applied.

- Moment due to inertial force from high-speed movement by a robot, etc.
- Contact with attack or workpiece during equipment assembly or commissioning.
- Displacement of the workpiece gripping position from the gripping position of the attachments.
- Generation of moment due to insertion, press-fitting, assembly, etc.

Model	Allowable Moment N·m		
	Mp	My	Mr
AFC10	0.35	0.4	0.6
AFC16	0.8	1	0.7
AFC20	1.6	2	1



■ Connecting Axial Force



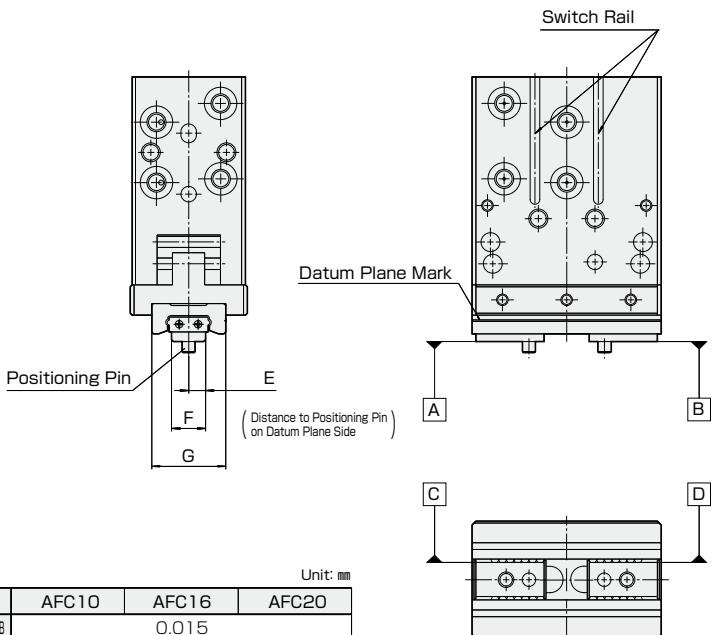
- Connecting axial force is the force in axial direction applied by the lock piston in the body to hold the finger plate assembly by pressing the connecting pin against the connecting groove. The holding force depends on the air pressure supplied to the connecting port.

- The spring in the lock piston is intended for preventing the finger plate assembly from falling off due to air pressure drop while the finger changer is stationary. For ordinary use, be sure to supply air to the connecting port.

- If the air pressure supplied to the connecting port is low, the finger plate assembly may fall off during use. Supply as high pressure as possible to the connecting port.

Accuracy

■ Bearing Accuracy



Unit: mm

Model	AFC10	AFC16	AFC20
Mutual Difference	Between Sides A and B	0.015	
	Between Sides C and D	0.02	
Tolerance of Dimension E		±0.1	
Tolerance of Dimension F		±0.025	
Tolerance of Dimension G		0 -0.03	

Caution
The datum plane mark is always on the switch rail side of the body.

DESIGN OF ATTACHMENT

Positioning the attachments only by the finger positioning pin is not sufficient for correct positioning because the attachment rotates around the finger positioning pin. Even if it is positioned correctly by adjustment, it may be displaced by inertial force or vibration during operation.

In addition, a mutual difference between the left and right fingers may be generated within the range of tolerance of dimension E (see p. 820).

Accordingly, consider the mutual difference and tolerance of dimension E when positioning the attachments. For high-accuracy attachment positioning or high mounting repeatability, position the attachment at two points, or positioning pin and finger side, which is described below.


●Positioning in Opening/Closing Direction

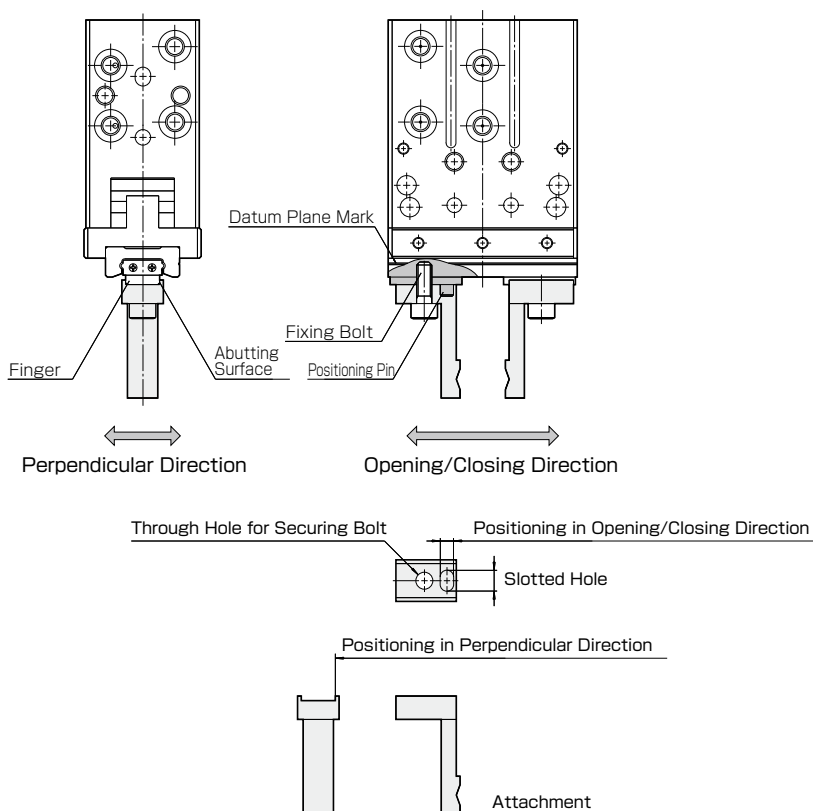
Positioning in the opening/closing direction can be achieved by providing the attachment with a slotted hole for the positioning pin in the perpendicular direction and putting it around the finger positioning pin.

●Positioning in Perpendicular Direction

Positioning in the perpendicular direction can be achieved by providing a projection on one side of the attachment and pressing it against the side of the finger on the datum plane side.

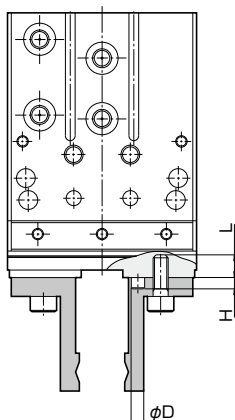
If displacement during operation causes a problem, provide a projection on each side of the attachment and fit it on the finger.

Finger Mutual Difference and Tolerance  page 820



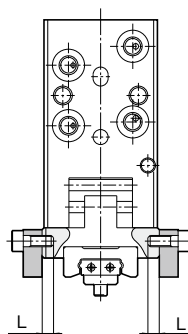
MOUNTING OF FIXTURE AND WORK

Attachment Mounting



Model	Bolt Size	Screw Depth L(mm)	Fastening Torque N·m	Pin Holes for Positioning $\phi D \times H$ (mm)
AFC10	M3×0.5	4.5	1.1	$\phi 2.5_{-0.03}^{0}$ length2
AFC16	M4×0.7	6	2.5	$\phi 3.5_{-0.03}^{0}$ length3
AFC20	M5×0.8	8	5.1	$\phi 4.5_{-0.03}^{0}$ length3

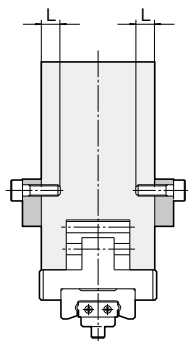
Side Mounting Type(tapped holes on body)



Note: Do not use these tapped holes for fixing the finger changer proper.

Model	Bolt Size	Screw Depth L(mm)	Fastening Torque N·m
AFC10	M3×0.5	3	1.1
AFC16	M3×0.5	4	1.1
AFC20	M3×0.5	5	1.1

Side Mounting Type(through holes on body)



Note: As for AFC 16 and 20, two tapped holes are provided on each surface, therefore, a total of four tapped holes are provided, while as for AFC 10, one hole on one surface, a total of three holes.

Do not use these tapped holes for fixing the finger changer proper.

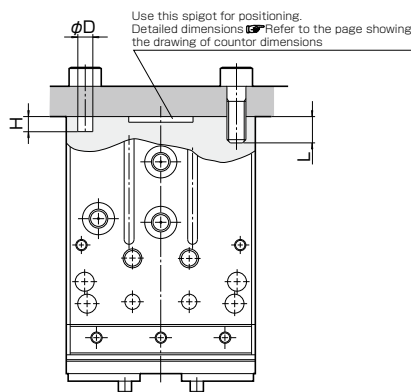
Model	Bolt Size	Screw Depth L(mm)	Fastening Torque N·m
AFC10	M3×0.5	4	1.1
AFC16	M3×0.5	5	1.1
AFC20	M3×0.5	5	1.1

MAIN BODY MOUNTING PROCEDURES

AFC

FINGER CHANGER

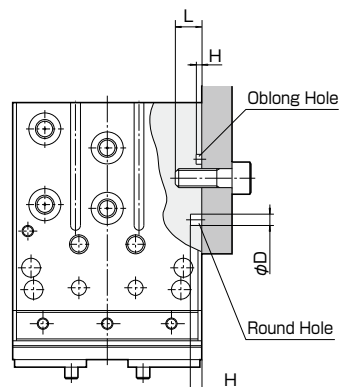
Axial Mounting Type(tapped holes on body)



End Boss Adapter (option) Refer to the page showing the drawing of contour dimensions.

Model	Bolt Size	Screw Depth L(mm)	Fastening Torque N·m	Pin Holes for Positioning $\phi D \times H$ (mm)
AFC10	M4×0.7	5	2.5	$\phi 3^{+0.04}_0$ depth3
AFC16	M5×0.8	7	5.1	$\phi 4^{+0.04}_0$ depth4
AFC20	M6×1	9	8.6	$\phi 5^{+0.04}_0$ depth4.5

Vertical Mounting Type(tapped holes on body)

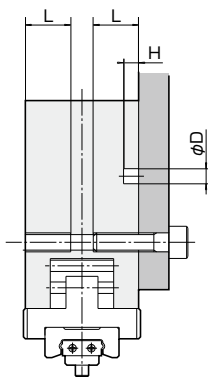


Note: In the case of this vertical mounting, the depth of the oblong hole is small. Therefore, use a pin with smaller chamfering for this hole.

Model	Bolt Size	Screw Depth L(mm)	Fastening Torque N·m	Pin Holes for Positioning $\phi D \times H$ (mm)
AFC10	M4×0.7	5.5	2.5	$\phi 3^{+0.04}_0$ depth1.2(2)
AFC16	M5×0.8	7	5.1	$\phi 4^{+0.04}_0$ depth1.5(3)
AFC20	M6×1	9	8.6	$\phi 5^{+0.04}_0$ depth1.5(3.5)

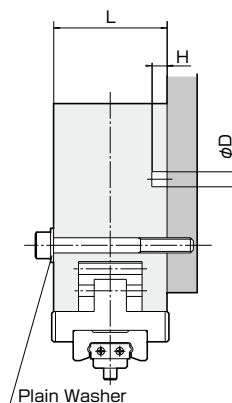
Depth of pin hole shows that of the oblong hole.
The figure in () shows round hole depth.

Side Mounting Type(tapped holes on body)



Model	Bolt Size	Screw Depth L(mm)	Fastening Torque N·m	Pin Holes for Positioning $\phi D \times H$ (mm)
AFC10	M4×0.7	10	2.5	$\phi 3^{+0.04}_0$ depth3
AFC16	M5×0.8	12	5.1	$\phi 4^{+0.04}_0$ depth4
AFC20	M6×1	14	8.6	$\phi 5^{+0.04}_0$ depth5

Side Mounting Type(through holes on body)



Note: Use plain washers for fixing.

Model	Bolt Size	Thru Hole Length L(mm)	Fastening Torque N·m	Pin Holes for Positioning $\phi D \times H$ (mm)
AFC10	M3	24	1.1	$\phi 3^{+0.04}_0$ depth3
AFC16	M4	30	2.5	$\phi 4^{+0.04}_0$ depth4
AFC20	M5	36	5.1	$\phi 5^{+0.04}_0$ depth5

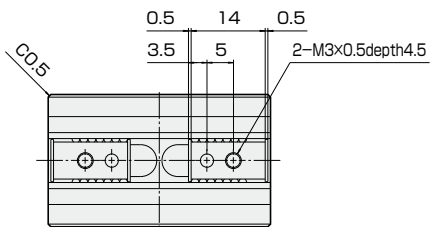
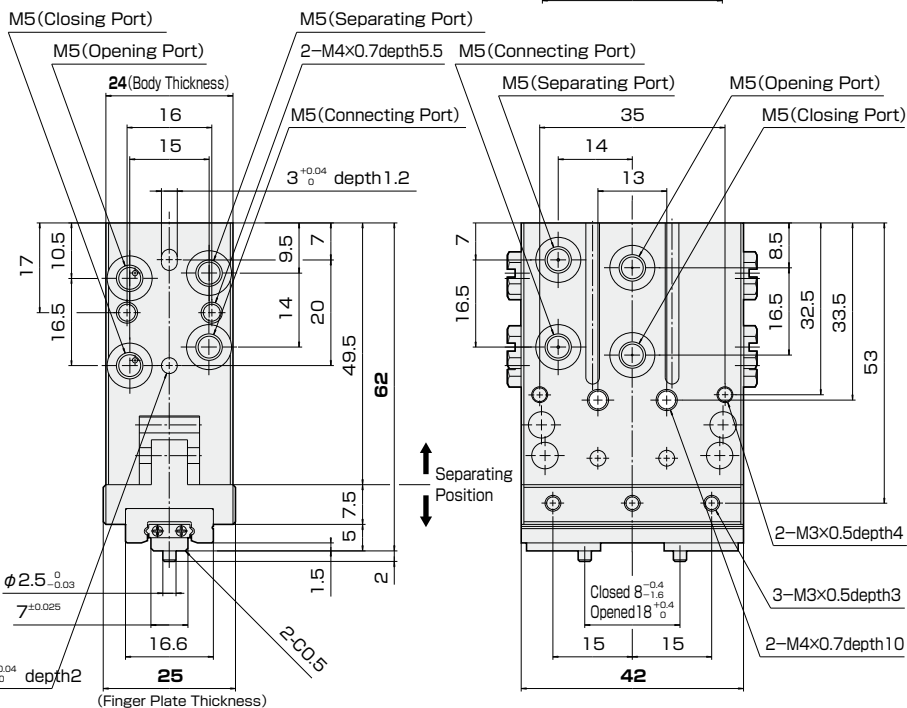
FINGER CHANGER

Type
SD...Standard
HB...with End Boss Adapter

with Finger Plate Assy

SD...Standard

HB...with End Boss Adapter



824



825

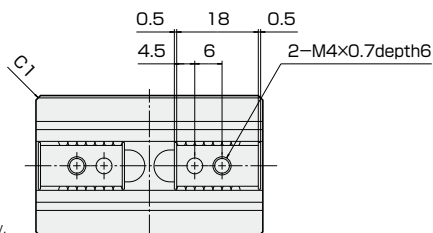
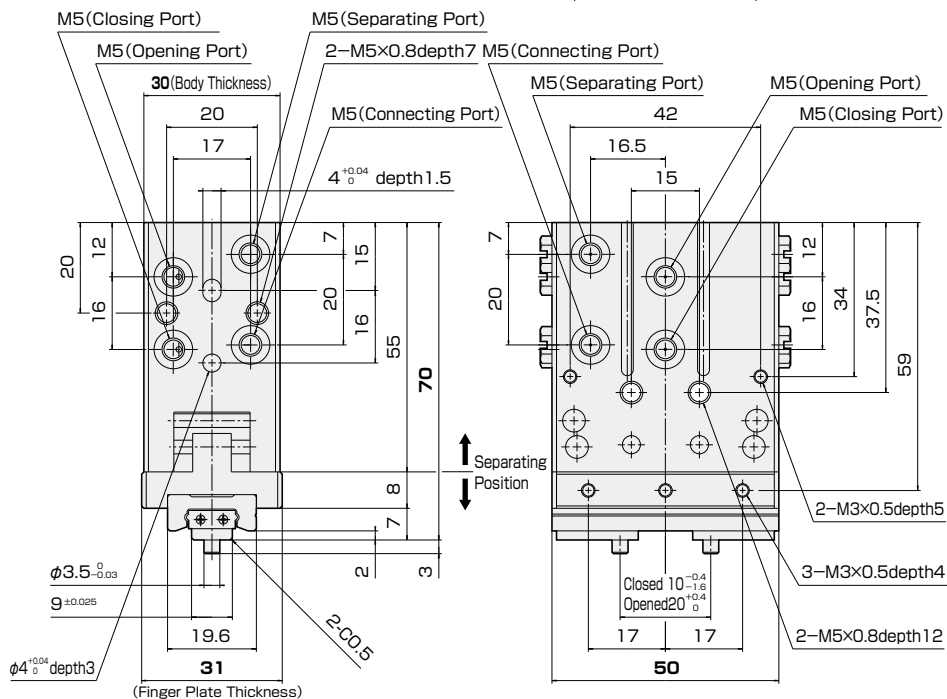
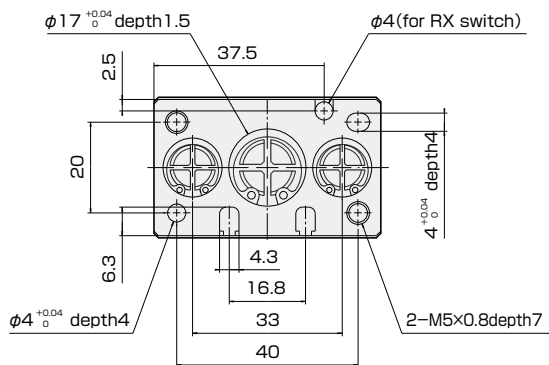
DIMENSIONS(mm) AFC16

AFC(S)-SD-16-FP

with Finger Plate Assy

Bore Size

Type
SD...Standard
HB...with End Boss Adapter



Note: The switch for checking the closing position projects from the body.
Mount so as to avoid the projection. Projection page 831



827

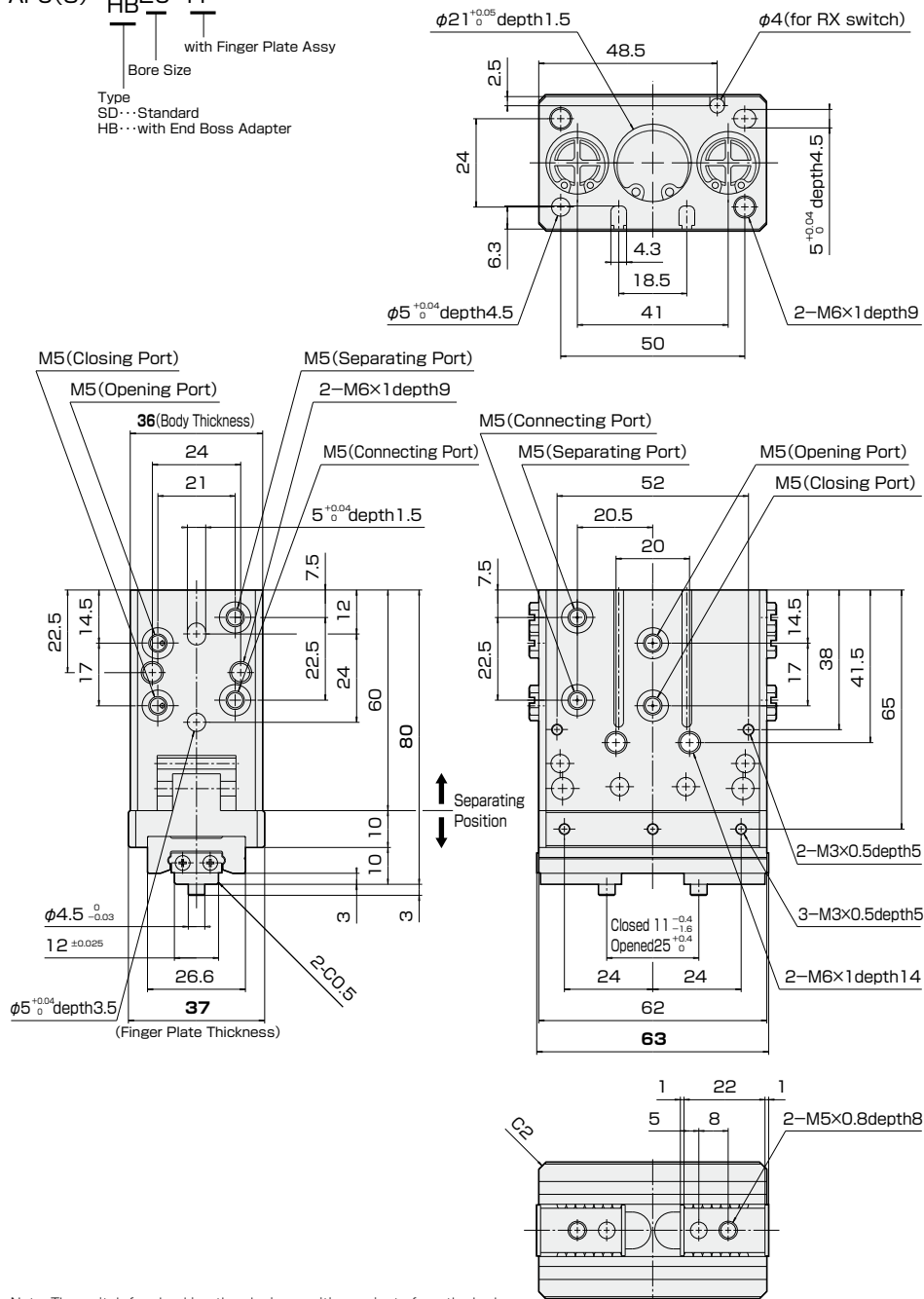
DIMENSIONS(mm) AFC20


AFC(S)-SD_{HB}20-FP

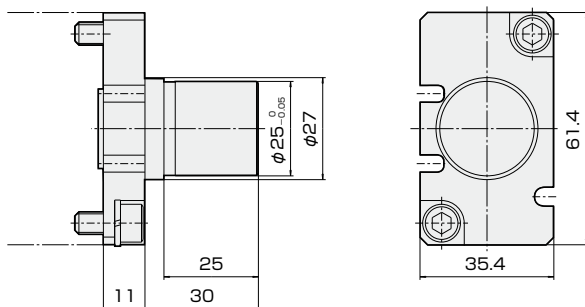
with Finger Plate Assy

Bore Size

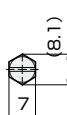
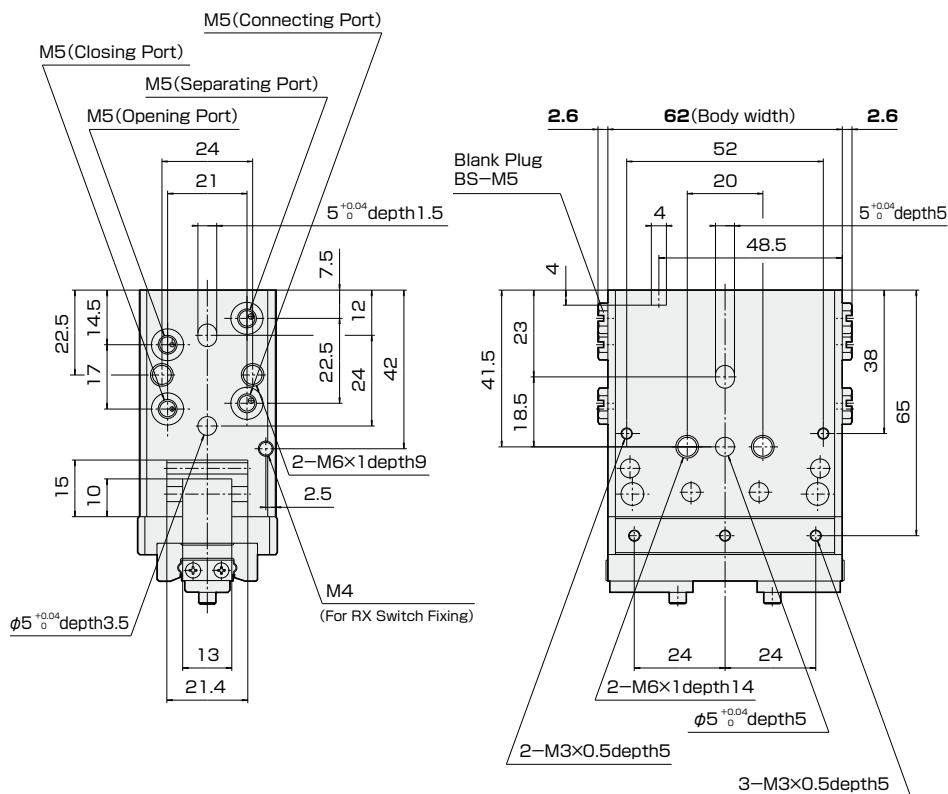
Type
SD...Standard
HB...with End Boss Adapter



Note: The switch for checking the closing position projects from the body.
Mount so as to avoid the projection. Projection  page 831



With End Boss Adapter



Front View of Blank Plug BS-MS

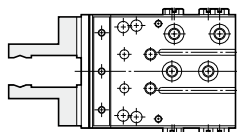
Note: If projection of the blank plug BS-M5 is not permitted, use BR-M5 separately offered.  page 810

PROCEDURES FOR SETTING THE SWITCH MOUNTING POSITION

To confirm the return of the fingers

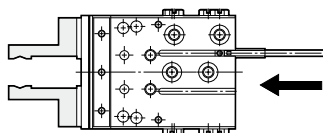
Step 1

Align the fingers with their return positions (full open).



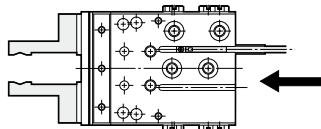
Step 2

Insert the switch into the switch mounting groove in the arrowed direction and continue moving the switch till the indicator lamp is turned on.



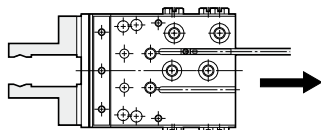
Step 3

Continue moving the switch in the arrowed direction further from the position where the indicator lamp is turned on till the lamp is turned off.



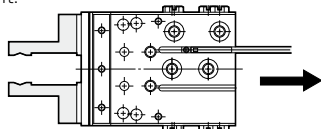
Step 4

Move the switch in the opposite direction from the position where the indicator lamp is turned off till the indication lamp is turned on again.



Step 5

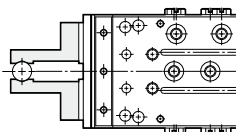
Continue moving the switch approx. 0.3mm in the arrowed direction from the position where the indicator lamp is turned on and fix the switch at this point.



To check the holding of a work

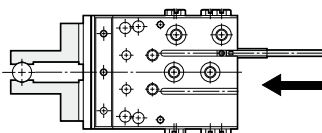
Step 1

Align the fingers with their holding positions.



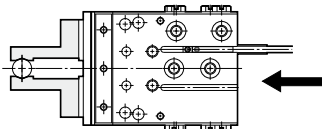
Step 2

Insert the switch into the switch mounting groove in the arrowed direction and continue moving the switch till the indicator lamp is turned on.



Step 3

Continue moving the switch approx. 0.3mm in the arrowed direction from the position where the indicator lamp is turned on and fix the switch at this point.



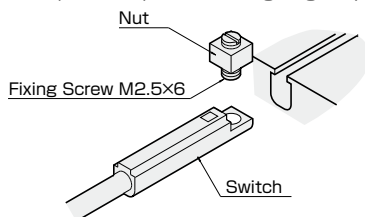
Note

Hold the work at around the middle of the opening/closing stroke as far as possible. If the work is held near opening/closing stroke end, switch detection may be restricted due to response difference of switch and so on.

INSTALLATION OF SWITCH

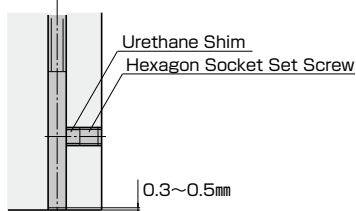
■ Installation Method

Switch (RB, RC4) for checking finger opening/closing



Insert the switch into the groove.
After setting the position, fasten the screw by a screwdriver.
Fastening torque of fixing screw must be 0.1N·m.

Switch (RX) for checking attaching/detaching of the finger plate

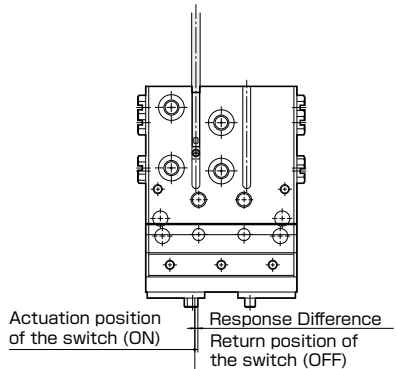


Insert the switch into the mounting hole.
Screw in the urethane shim and the hexagon socket set screw. After setting the mounting position, tighten the fixing screw with a hexagon socket driver of size 2.
Tightening torque is to be 0.3N·m {3kgf·cm}.

⚠ Caution

Use urethane shim for fixing the switch without fail. If the switch is tightened without providing the shim, switch may be damaged.

■ Response Difference



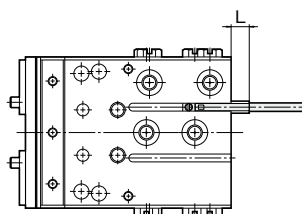
Unit: mm

Model	RB(RC)4, 5
	Maximum Response Difference(c)
AFC10	0.5
AFC16	0.8
AFC20	0.8

Response difference(c)

Response difference means the distance between the position where the switch is turned on after the magnet starts moving and the position where the switch is turned off after the magnet starts moving in the opposite direction.

■ Switch Protrusion Distance



Unit: mm

Model	Finger Position	Protrusion Distance (L)
AFC10	open	—
	close	5
AFC16	open	—
	close	2
AFC20	open	—
	close	1

Note: The projections shown are those observed when the fingers are most closed. Projection may not occur depending on the gripping position.

CUSTOM MADE

■To change grease

- Change the grease of bearing part to the other grease.
- There is a case might not be handled depends on kind of grease or request.
- Cylinder part is lithium soap grease or fluorine grease.
- Grease of purchased item can not be exchanged.

Please ask us for more detailed information.

■ MEMO ■

■ MEMO ■