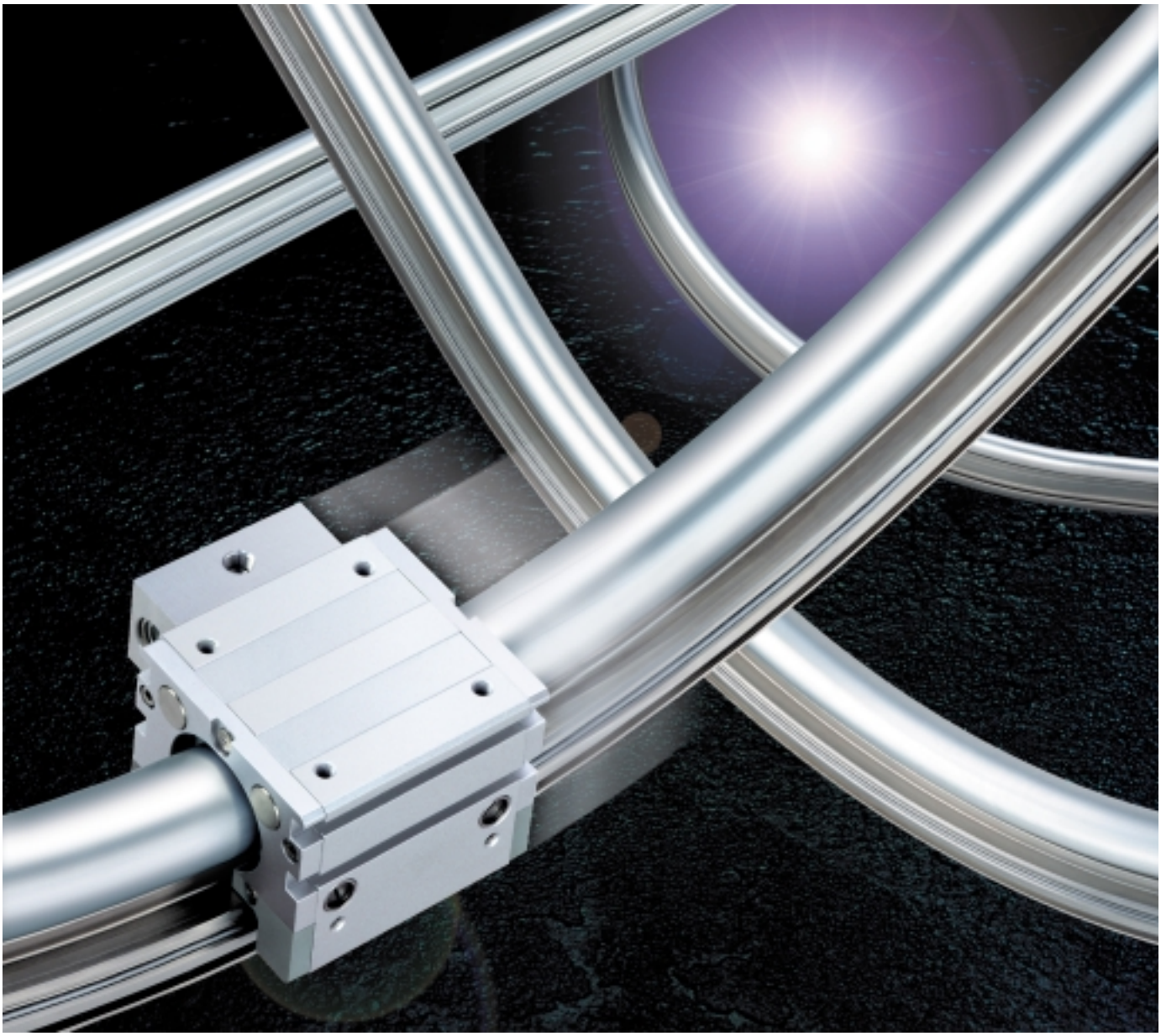
CAT.E279-A

SMC

Pneumatic Transfer System

Series MF

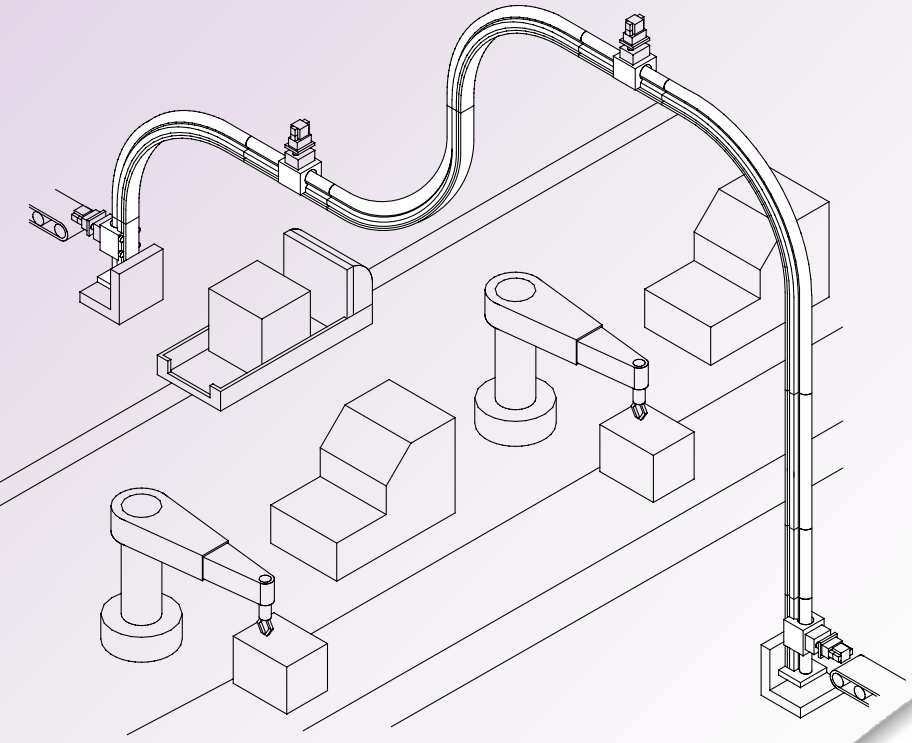


Curvilinear operation makes flexible transfer possible.

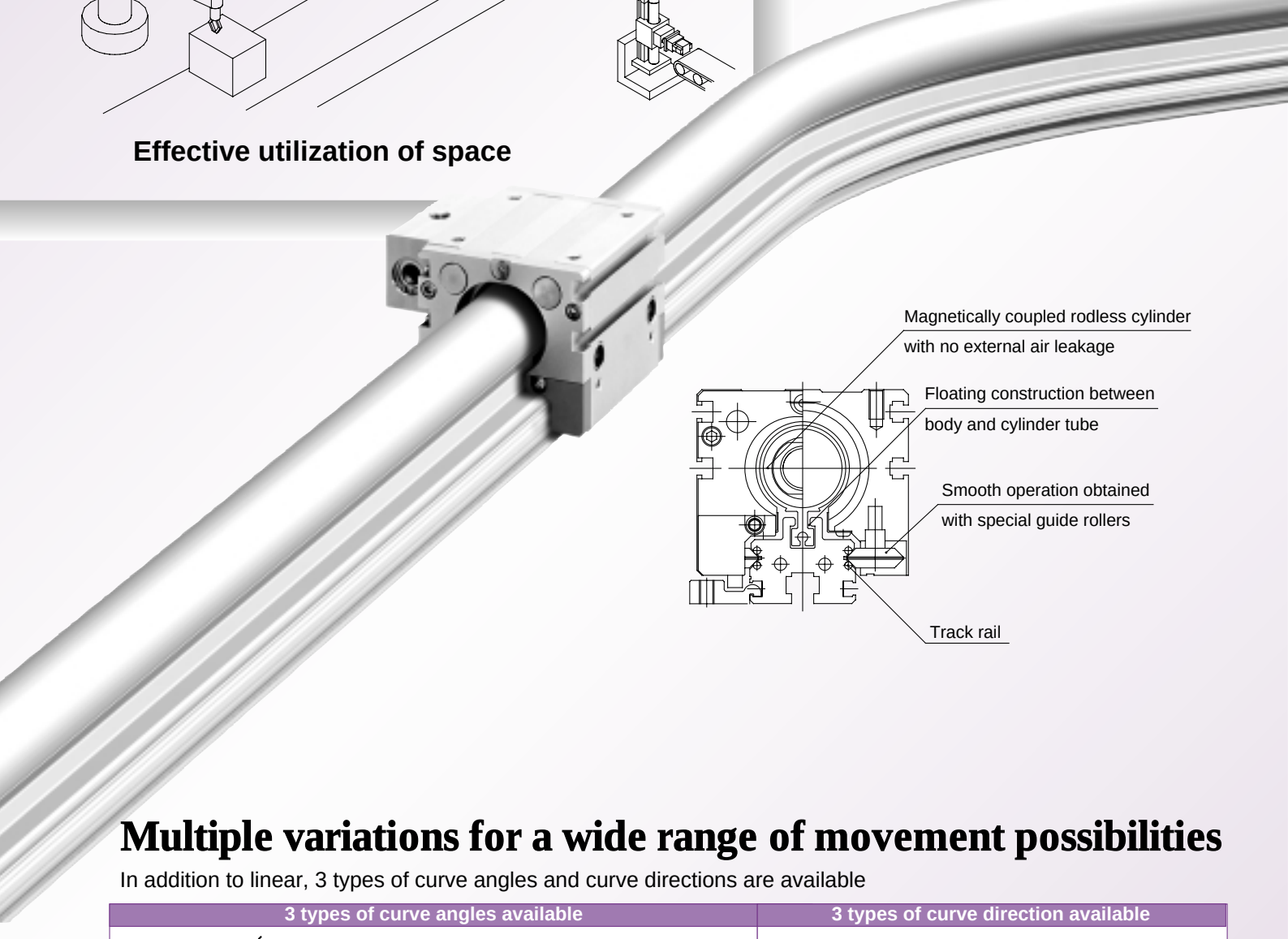
3-Dimensional Pneumatic Transfer System

Series MF

Curvilinear ope



Effective utilization of space



Magnetically coupled rodless cylinder with no external air leakage

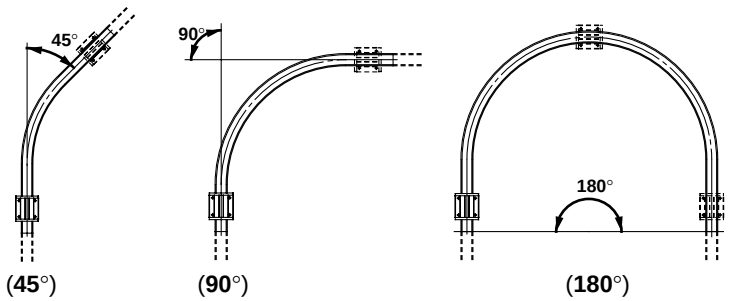
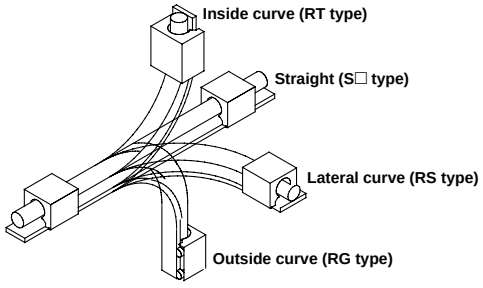
Floating construction between body and cylinder tube

Smooth operation obtained with special guide rollers

Track rail

Multiple variations for a wide range of movement possibilities

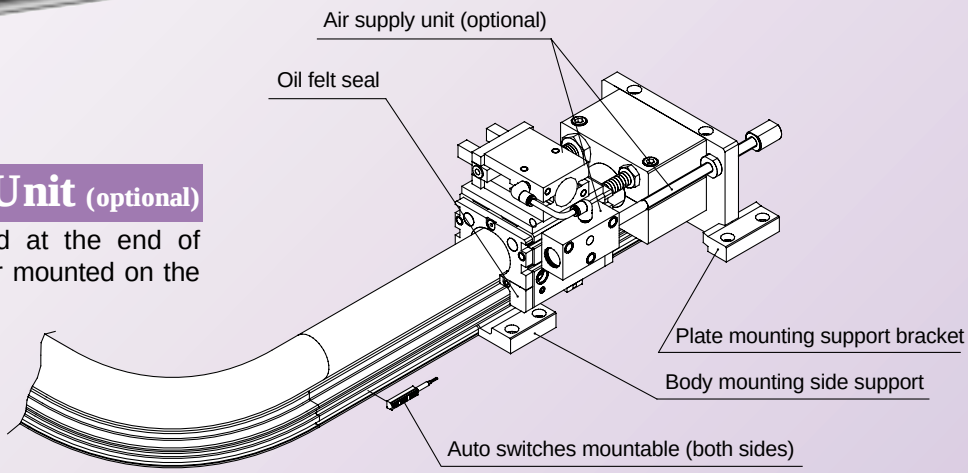
In addition to linear, 3 types of curve angles and curve directions are available

3 types of curve angles available	3 types of curve direction available
 (45°) (90°) (180°)	

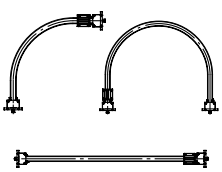
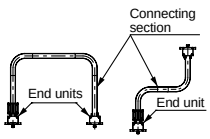
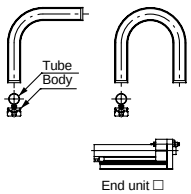
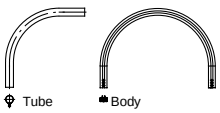
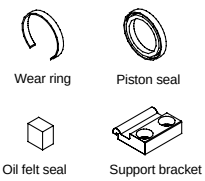
ration makes flexible transfer possible.

Air Supply Unit (optional)

Air can be supplied at the end of stroke to an actuator mounted on the slide table.



Types of Units and Parts

Type of units and parts	Type of units		Type of parts		
Catalog pages	**Single units** P.1 to P.9	**Combination units** P.11 to P.18	**Set parts** P.11 to P.14	**Parts** P.16	**Spare parts** P.4 & 5 **Optional parts** P.2
Content	• 2 types are available, curved and straight. • Mounting and piping methods are the same as for existing products.	• 2 types of construction are available. 2 dimensional structures are created by combining curved and straight units, and long strokes are created by combining straight type units only.	• Parts for combination units. • These consist of combinations of cylinder tube and body parts, and "combination units" are made by linking these set parts. • Curved units, straight units, maintenance units and end units, etc. are available. • Set parts can also be used as service parts (for unit replacement of cylinder tubes and bodies).	• Service parts. • These are service parts for each of the cylinder tubes and bodies included in the set parts.	Spare parts … (seal list) Service parts consisting of various seals and wear rings, etc. Optional parts … [Support brackets & side supports] Support brackets for attaching cylinders are available as optional parts.
Configuration					
Model	MF Bore size — 3-dimensional transfer: Single units	MFT Bore size — 3-dimensional transfer: Connecting units (set parts)		MFP T/G Bore size — Cylinder tube Body 3-dimensional transfer: Parts	Spare parts MF Bore size — PS Spare parts 3-dimensional transfer Optional parts MF-S32 A/B (side support A/B) MY-S□ A/B (support bracket A/B)

Pneumatic Transfer System

3-Dimensional Transfer/Single Units

Series MF

How to Order

Curved Type

MF **32** — **RS** **45** □ — **Y59B** □

3-dimensional transfer single unit

Bore size

15	15mm
32	32mm

Curved type

RS	Lateral curve
RT	Inside curve
RG	Outside curve

Angle

45	45°
90	90°
180	180°

Air supply unit Note 1)

Description	Symbol	Qty.
—	**Nil**	None
A unit (Air system 1)	**AS**	1 set
	AW	2 sets

Note 1) Air supply unit, 1 set breakdown: Supply block (slide table side) 1pc. Supply ring (plate side) 2pcs.

Auto switch type

Nil	Without auto switch

∗ Refer to the table below for auto switch part numbers.

Number of auto switches

Nil	2pcs.
S	1pc.
n	"n" pcs.

Straight Type

MF **32** — **SA** **200** □ — **Y59B** □

3-dimensional transfer single unit

Bore size

15	15mm
32	32mm

Straight type

Stroke

200	200mm
250	250mm
300	300mm
350	350mm
400	400mm
450	450mm
500	500mm
600	600mm
1000	1000mm

The maximum produceable stroke is 5000mm.
Long strokes exceeding a 2000mm straight type will be produced with the order made specifications (-XB11).

Air supply unit Note 1)

Description	Symbol	Qty.
—	**Nil**	None
A unit (Air system 1)	**AS**	1 set
	AW	2 sets

Note 1) Air supply unit, 1 set breakdown: Supply block (slide table side) 1pc. Supply ring (plate side) 2pcs.

Auto switch type

Nil	Without auto switch

∗ Refer to the table below for auto switch part numbers.

Number of auto switches

Nil	2pcs.
S	1pc.
n	"n" pcs.

Applicable Auto Switches

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage			Auto switch part no.		Lead wire length (m) ∗			Applicable load		Detailed specifications
					DC		AC	Electrical entry direction		0.5 (Nil)	3 (L)	5 (Z)			
								Perpendicular	In-line						
Reed switch	–	Grommet	Yes	3 wire (NPN) equiv.	–	5V	–	–	**Z76**	●	●	–	IC circuit	Relay, PLC	Page 20
				2 wire	24V	12V	100V	–	**Z73**	●	●	●	–		
			No			5V, 12V	100V or less	–	**Z80**	●	●	–	IC circuit		
Solid state switch	–	Grommet	Yes	3 wire (NPN)	24V	5V, 12V	–	**Y69A**	**Y59A**	●	●	○	IC circuit	Relay, PLC	Page 21
				3 wire (PNP)				**Y7PV**	**Y7P**	●	●	○			
				2 wire		12V		**Y69B**	**Y59B**	●	●	○	–		
	Diagnostic indication (2 color indicator)			3 wire (NPN)		5V, 12V		**Y7NWV**	**Y7NW**	●	●	○	IC circuit		Page 22
				3 wire (PNP)				**Y7PWV**	**Y7PW**	●	●	○			
				2 wire		12V		**Y7BWV**	**Y7BW**	●	●	○	–		

∗ Lead wire length symbols 0.5m …… Nil (Example) Y59A
3m …… L (Example) Y59AL
5m …… Z (Example) Y59AZ

∗ Solid state switches marked with a "○" are produced upon receipt of order.

∗ Refer to pages 20 through 24 for detailed auto switch specifications.

Specifications

Bore size (mm)	15	32
Fluid	Air	
Proof pressure	1.05MPa	
Maximum operating pressure	0.7MPa	
Minimum operating pressure	0.18MPa	
Ambient & fluid temperature	– 10 to 60 °C	
Magnetic holding force	70N	316N
Cushion	Both sides, Shock absorber	
Lubrication	Non-lube	
Mounting orientation	Unrestricted	
Stroke length tolerance mm	0 to 250st: $^{+1.0}_{0}$, 251 to 1000st: $^{+1.4}_{0}$, 1001st to : $^{+1.8}_{0}$	
Piston speed	50 to 2000mm/s	
Options	Air supply unit	

Weight

1) Weight of curved types

(Unit:kg)

Bore size (mm) \ Angle	45°	90°	180°
15	2.6	3.6	4.5
32	5.3	7.1	9.1

2) Weight of straight types

(Unit: kg)

Bore size (mm)	15	32
Basic weight (for 0 stroke)	2.3	4.0
Additional weight per 50mm of stroke	0.1	0.15

Calculation/example MF32-SA300

4.0 + 0.15 x 300/50 = 4.9 (kg)
(Basic weight) (50st additional weight) (Stroke)

3) Supply unit weight

(Unit: kg/pc.)

Bore size (mm)	15	32
Weight	0.15	0.35

Note) Including plate side supply unit 0.15kg (ø32), 0.08kg (ø15)

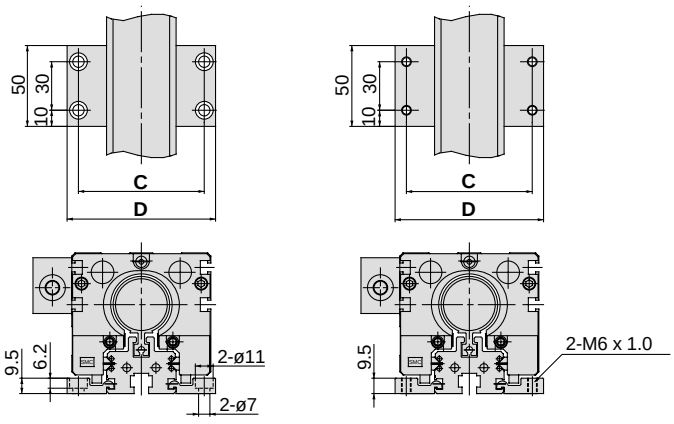
Shock Absorber Specifications

Bore size		15	32
Shock absorber type		RB0806	RB1412
Energy: J		2.94	19.6
Maximum stroke absorption: mm		6	12
Maximum collision speed: m/sec		0.05 to 5	0.05 to 5
Maximum operating frequency: cycle/min		80	45
Ambient temperature range: °C		–10 to 80	–10 to 80
Spring force: N	When expanded	1.96	6.86
	When compressed	4.22	15.98

Option Specifications: Air supply unit (Supply Block Section) Specifications

Bore size	15, 32
Fluid	Air
Maximum operating pressure	1.0MPa
Minimum operating pressure	0.05MPa
Ambient and fluid temperature	0 to 60°C
Effective sectional area (Cv factor)	7mm² (0.38)

Side Support Mounting Dimensions



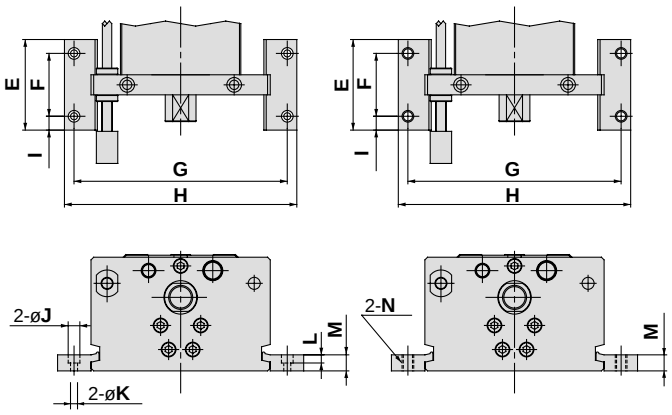
Side support A part no.: MF-S32A

Side support B part no.: MF-S32B

Part No.	Applicable cylinder	C	D
MF-S32 A/B	MF15	68	82
	MF32	78	92

Note) The side supports are common to the MF15 and MF32.

Support Bracket Mounting Dimensions

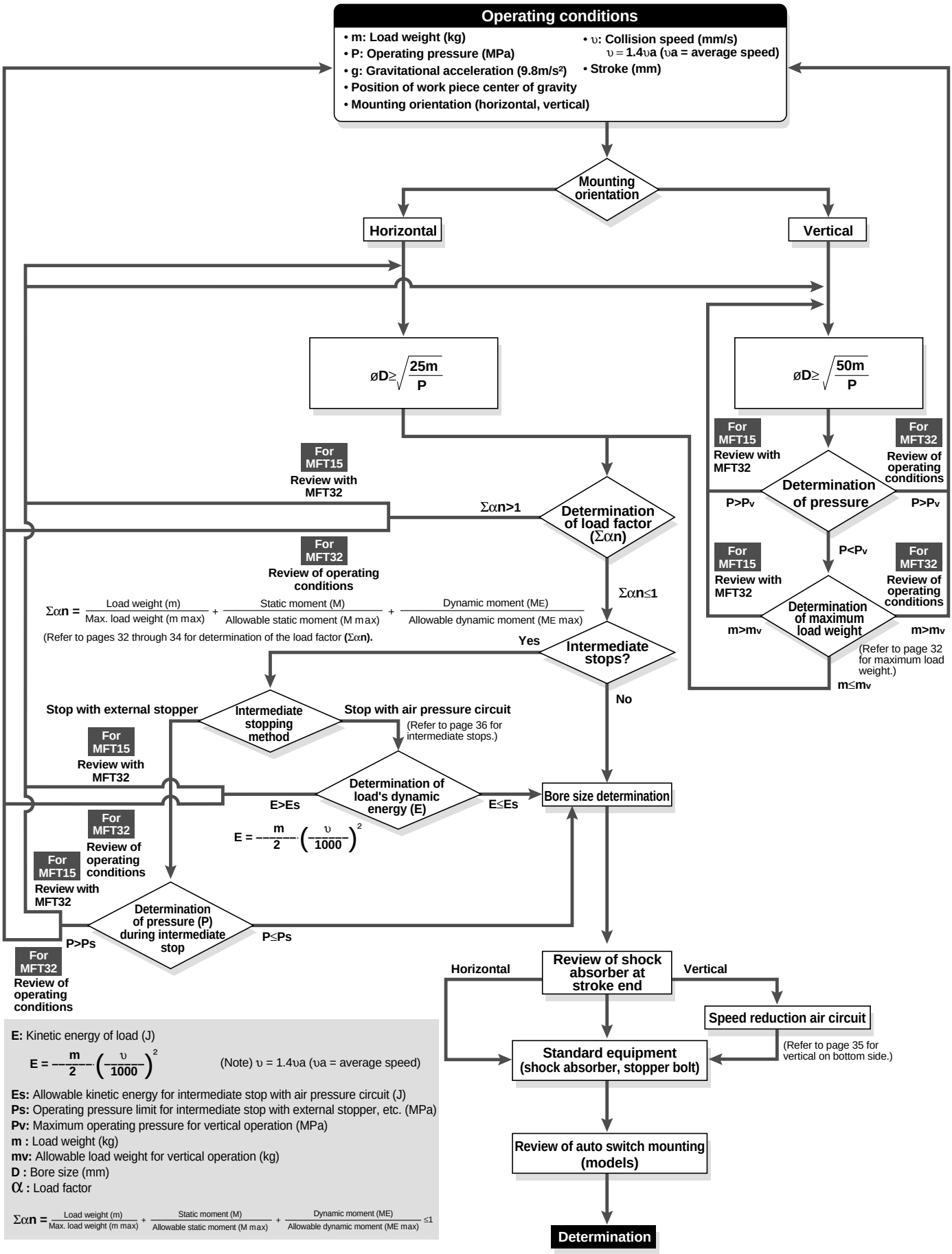


Support bracket A part no.: MY-S□A

Support bracket B part no.: MY-S□B

Part No.	Applicable cylinder	E	F	G	H	I	J	K	L	M	N
MY-S25 A/B	MF15	50	35	97	111	7.5	9.5	5.5	5	8	M6 x 1
MY-S32 A/B	MF32	64	45	154	172	9.5	11	6.6	6	11.7	M8 x 1.25

Series MF
Model Selection Method



E: Kinetic energy of load (J)

$$E = \frac{m}{2} \cdot \left(\frac{\upsilon}{1000}\right)^2$$

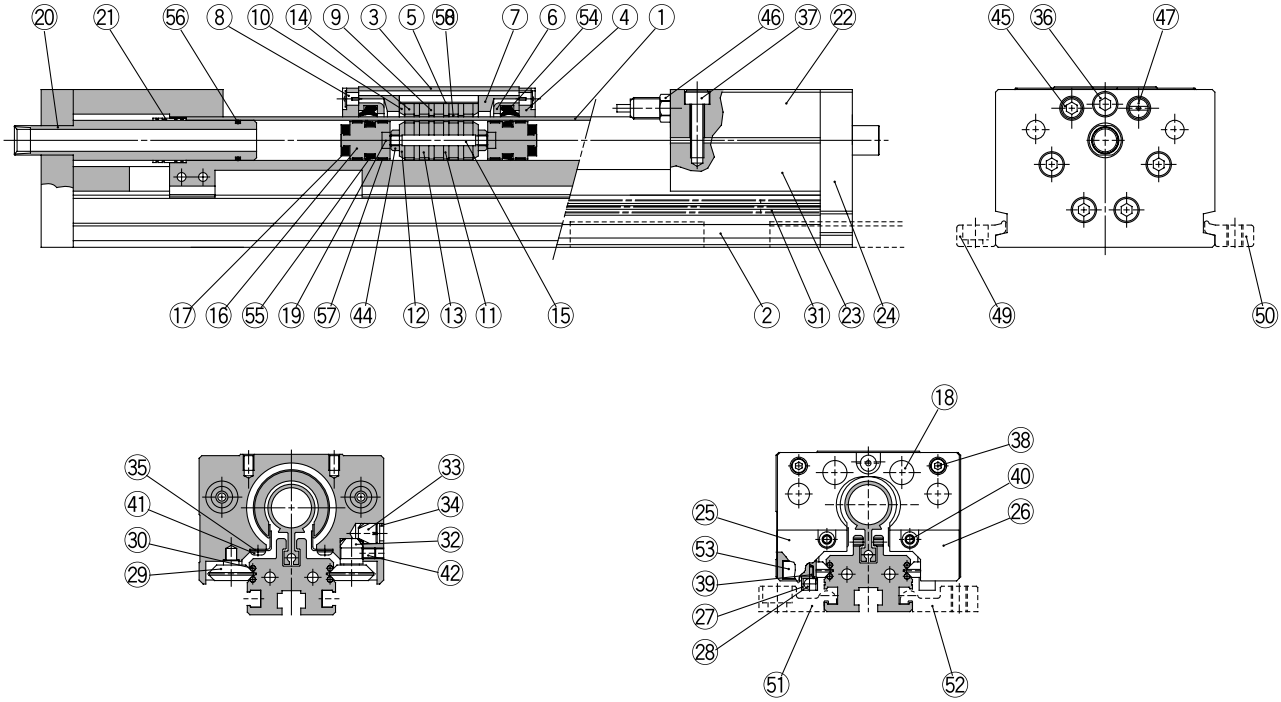
(Note) υ = 1.4υa (υa = average speed)

Es: Allowable kinetic energy for intermediate stop with air pressure circuit (J)
Ps: Operating pressure limit for intermediate stop with external stopper, etc. (MPa)
Pv: Maximum operating pressure for vertical operation (MPa)
m : Load weight (kg)
mv: Allowable load weight for vertical operation (kg)
D : Bore size (mm)
α : Load factor

$$\Sigma\alpha n = \frac{\text{Load weight (m)}}{\text{Max. load weight (m max)}} + \frac{\text{Static moment (M)}}{\text{Allowable static moment (M max)}} + \frac{\text{Dynamic moment (ME)}}{\text{Allowable dynamic moment (ME max)}} \leq 1$$

Construction

MF15



Parts list

No.	Description	Material	Qty.	Note
1	**Cylinder tube**	Aluminum alloy	1	Hard anodized
2	**Body**	Aluminum alloy	1	Staight section: Hard anodized Curved section: Electroless nickel plated
3	**Slide table**	Aluminum alloy	1	Hard anodized
4	**End plate**	Aluminum alloy	2	Hard anodized
5	**External slider tube**	Stainless steel	1	
6	**Scraper holder**	Aluminum alloy	2	Anodized
7	**Spacer**	Aluminum alloy	2	Anodized
8	**Cup with ball**	Brass	2	
9	**External yoke A**	Rolled steel plate	4	Zinc chromated
10	**External yoke B**	Rolled steel plate	2	Zinc chromated
11	**Piston side yoke A**	Rolled steel plate	4	Zinc chromated
12	**Piston side yoke B**	Rolled steel plate	2	Zinc chromated
13	**Magnet A**	Rare earth magnet	5	
14	**Magnet B**	Rare earth magnet	5	
15	**Shaft**	Stainless steel	1	
16	**Piston**	Aluminum alloy	2	Chromated
17	**Bumper**	Urethane rubber	2	
18	**Parallel pin A**	Carbon steel	4	Nickel plated, quenched
19	**Parallel pin**	Carbon steel	2	Nickel plated, quenched
20	**Head cover**	Aluminum alloy	2	Hard anodized
21	**Tube fitting**	Stainless steel	2	
22	**Plate A**	Aluminum alloy	2	Hard anodized
23	**Plate B**	Aluminum alloy	2	Hard anodized
24	**Plate C**	Aluminum alloy	2	Hard anodized
25	**Felt holder A**	Special resin	2	
26	**Felt holder B**	Special resin	2	
27	**Magnet holder**	Special resin	2	
28	**Magnet**	Rare earth magnet	2	
29	**V roller bearing**	Carbon steel	4	

Parts list

No.	Description	Material	Qty.	Note
30	**Track**	Spring steel	4	
31	**Guide spacer**	Special resin	8	
32	**Eccentric bearing holder**	Stainless steel	2	
33	**Adjustment gear**	Stainless steel	2	
34	**Snap ring**	Stainless steel	2	
35	**Detent fitting**	Stainless steel	2	
36	**Hexagon socket head screw**	Chromium molybdenum steel	10	Nickel plated
37	**Hexagon socket head screw**	Chromium molybdenum steel	4	Nickel plated
38	**Hexagon socket head screw**	Chromium molybdenum steel	4	Nickel plated
39	**Hexagon socket head screw**	Chromium molybdenum steel	2	Nickel plated
40	**Hexagon socket head button bolt**	Chromium molybdenum steel	4	Nickel plated
41	**Hexagon socket head button bolt**	Chromium molybdenum steel	4	Nickel plated
42	**Hexagon socket head set screw**	Chromium molybdenum steel	4	Nickel plated
44	**Piston nut**	Carbon steel	2	Zinc chromated
45	**Adjustment bolt**	Chromium molybdenum steel	2	Nickel plated
46	**Hexagon nut**	Carbon steel	4	Nickel plated
47	**Shock absorber**	–	2	RB0806
* 49	**Support bracket A**	Aluminum alloy	–	Hard anodized
* 50	**Support bracket B**	Aluminum alloy	–	Hard anodized
* 51	**Side support A**	Aluminum alloy	–	Hard anodized
* 52	**Side support B**	Aluminum alloy	–	Hard anodized
53	**Felt seal**	Felt	4	
54	**Scraper**	NBR	2	
55	**Piston seal**	NBR	2	
56	**O-ring**	NBR	2	
57	**Wear ring A**	Special resin	9	
58	**Wear ring B**	Special resin	5	

Note 1) The * symbol indicates optional parts.

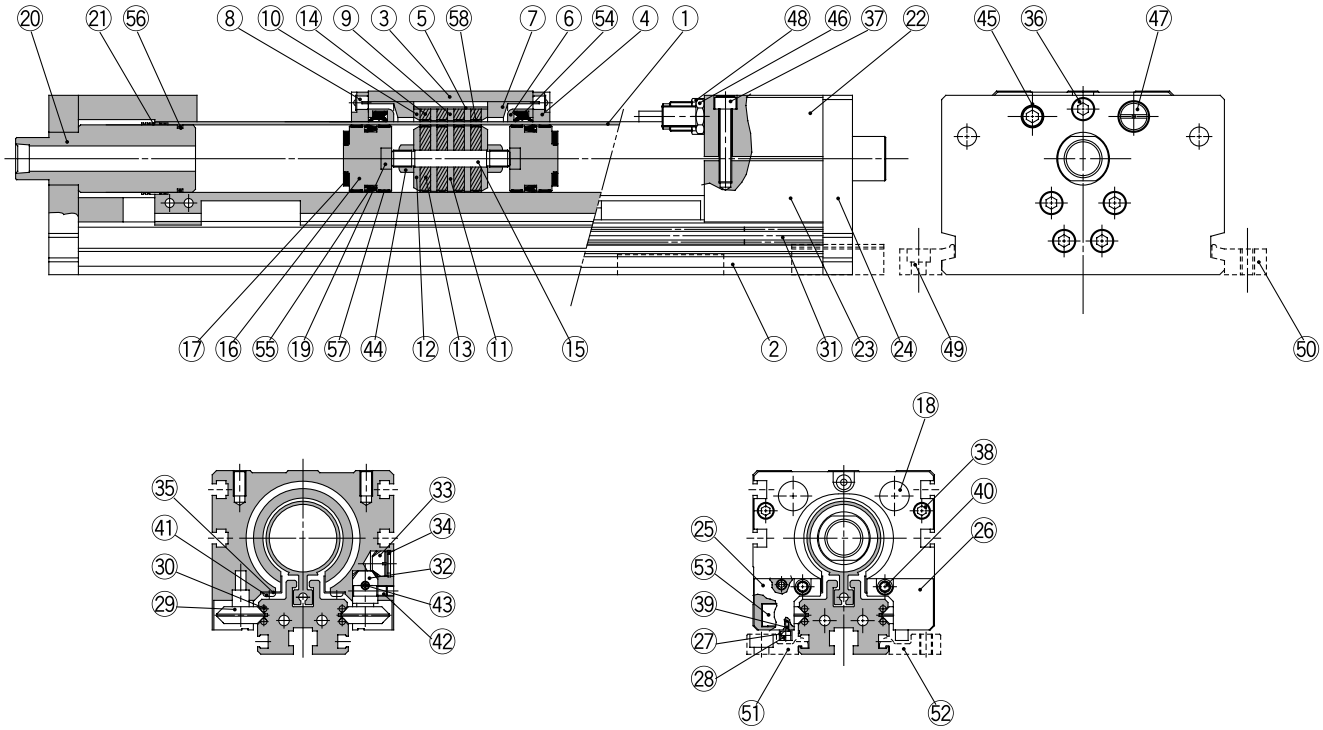
Replacement parts: Seal kits

Bore size (mm)	Seal kit No.	Contents
15	MF15-PS	A set of above Nos. 53 through 58

Note 2) Seal kits are sets consisting of items 53 through 58, which can be ordered using the above seal kit number.

Construction

MF32



Parts list

No.	Description	Material	Qty.	Note
1	Cylinder tube	Aluminum alloy	1	Hard anodized
2	Body	Aluminum alloy	1	Staight section: Hard anodized Curved section: Electroless nickel plated
3	Slide table	Aluminum alloy	1	Hard anodized
4	End plate	Aluminum alloy	2	Hard anodized
5	External slider tube	Stainless steel	1	
6	Scraper holder	Aluminum alloy	2	Anodized
7	Spacer	Aluminum alloy	2	Anodized
8	Cup with ball	Brass	2	
9	External yoke A	Rolled steel plate	3	Zinc chromated
10	External yoke B	Rolled steel plate	2	Zinc chromated
11	Piston side yoke A	Rolled steel plate	3	Zinc chromated
12	Piston side yoke B	Rolled steel plate	2	Zinc chromated
13	Magnet A	Rare earth magnet	4	
14	Magnet B	Rare earth magnet	4	
15	Shaft	Stainless steel	1	
16	Piston	Aluminum alloy	2	Chromated
17	Bumper	Urethane rubber	2	
18	Parallel pin A	Carbon steel	4	Nickel plated, quenched
19	Parallel pin	Carbon steel	2	Nickel plated, quenched
20	Head cover	Aluminum alloy	2	Hard anodized
21	Tube fitting	Stainless steel	2	
22	Plate A	Aluminum alloy	2	Hard anodized
23	Plate B	Aluminum alloy	2	Hard anodized
24	Plate C	Aluminum alloy	2	Hard anodized
25	Felt holder A	Special resin	2	
26	Felt holder B	Special resin	2	
27	Magnet holder	Special resin	2	
28	Magnet	Rare earth magnet	2	
29	V roller bearing	Carbon steel	4	

Parts list

No.	Description	Material	Qty.	Note
30	Track	Spring steel	4	
31	Guide spacer	Special resin	8	
32	Eccentric bearing holder	Stainless steel	2	
33	Adjustment gear	Stainless steel	2	
34	Snap ring	Stainless steel	2	
35	Detent fitting	Stainless steel	2	
36	Hexagon socket head screw	Chromium molybdenum steel	10	Nickel plated
37	Hexagon socket head screw	Chromium molybdenum steel	4	Nickel plated
38	Hexagon socket head screw	Chromium molybdenum steel	4	Nickel plated
39	Hexagon socket head screw	Chromium molybdenum steel	2	Nickel plated
40	Hexagon socket head button bolt	Chromium molybdenum steel	4	Nickel plated
41	Hexagon socket head button bolt	Chromium molybdenum steel	4	Nickel plated
42	Hexagon socket head set screw	Chromium molybdenum steel	4	Nickel plated
43	Hexagon socket head set screw	Chromium molybdenum steel	2	Nickel plated
44	Piston nut	Carbon steel	2	Zinc chromated
45	Adjustment bolt	Chromium molybdenum steel	2	Nickel plated
46	Hexagon nut	Carbon steel	2	Nickel plated
47	Shock absorber	–	2	RB1412
48	Hexagon nut	Carbon steel	2	Nickel plated
* 49	Support bracket A	Aluminum alloy	–	Hard anodized
* 50	Support bracket B	Aluminum alloy	–	Hard anodized
* 51	Side support A	Aluminum alloy	–	Hard anodized
* 52	Side support B	Aluminum alloy	–	Hard anodized
53	Felt seal	Felt	4	
54	Scraper	NBR	2	
55	Piston seal	NBR	2	
56	O-ring	NBR	2	
57	Wear ring A	Special resin	8	
58	Wear ring B	Special resin	4	

Note 1) The * symbol indicates optional parts.

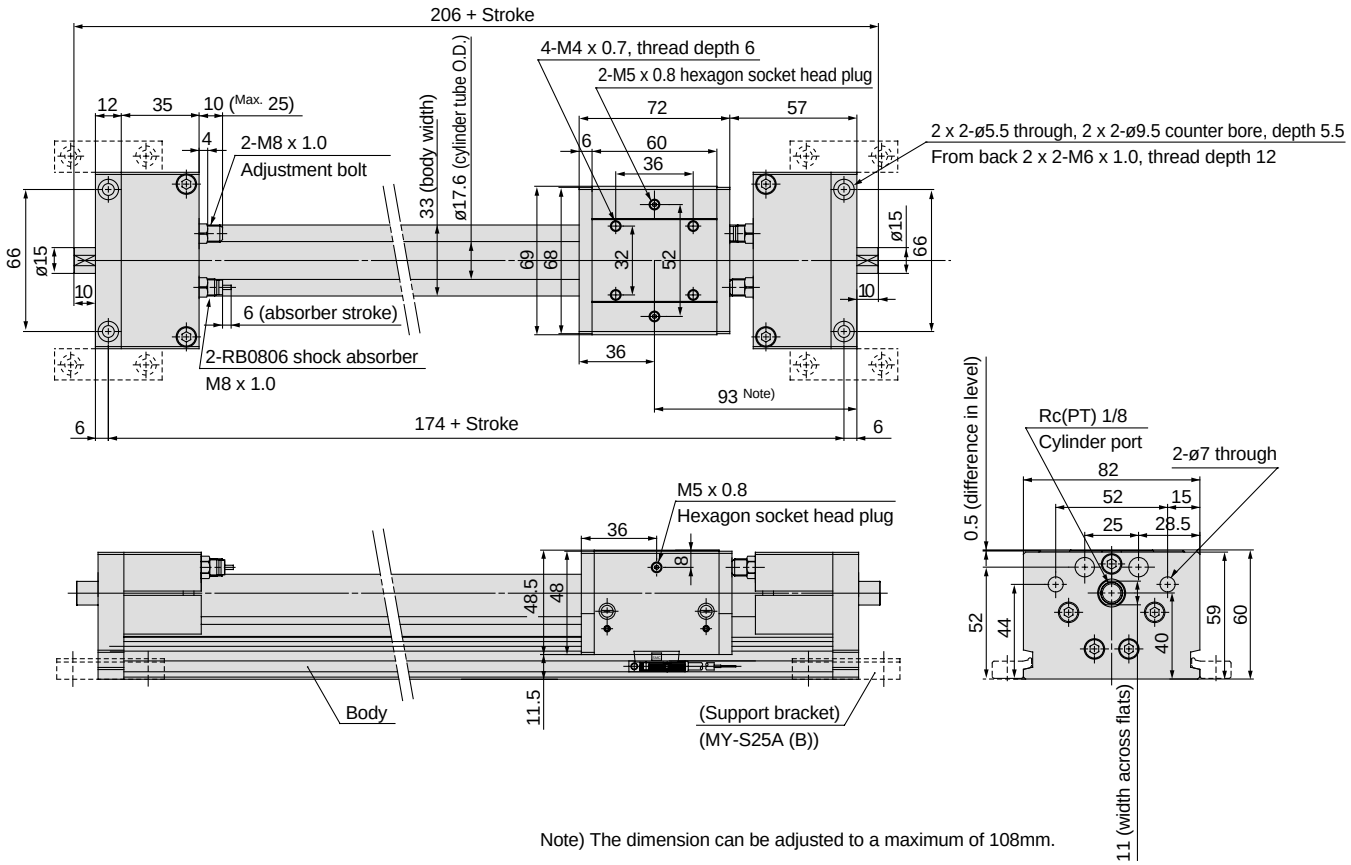
Replacement parts: Seal kits

Bore size (mm)	Seal kit No.	Contents
32	MF32-PS	A set of above Nos. 53 through 58

Note 3) Seal kits are sets consisting of items 53 through 58, which can be ordered using the above seal kit number.

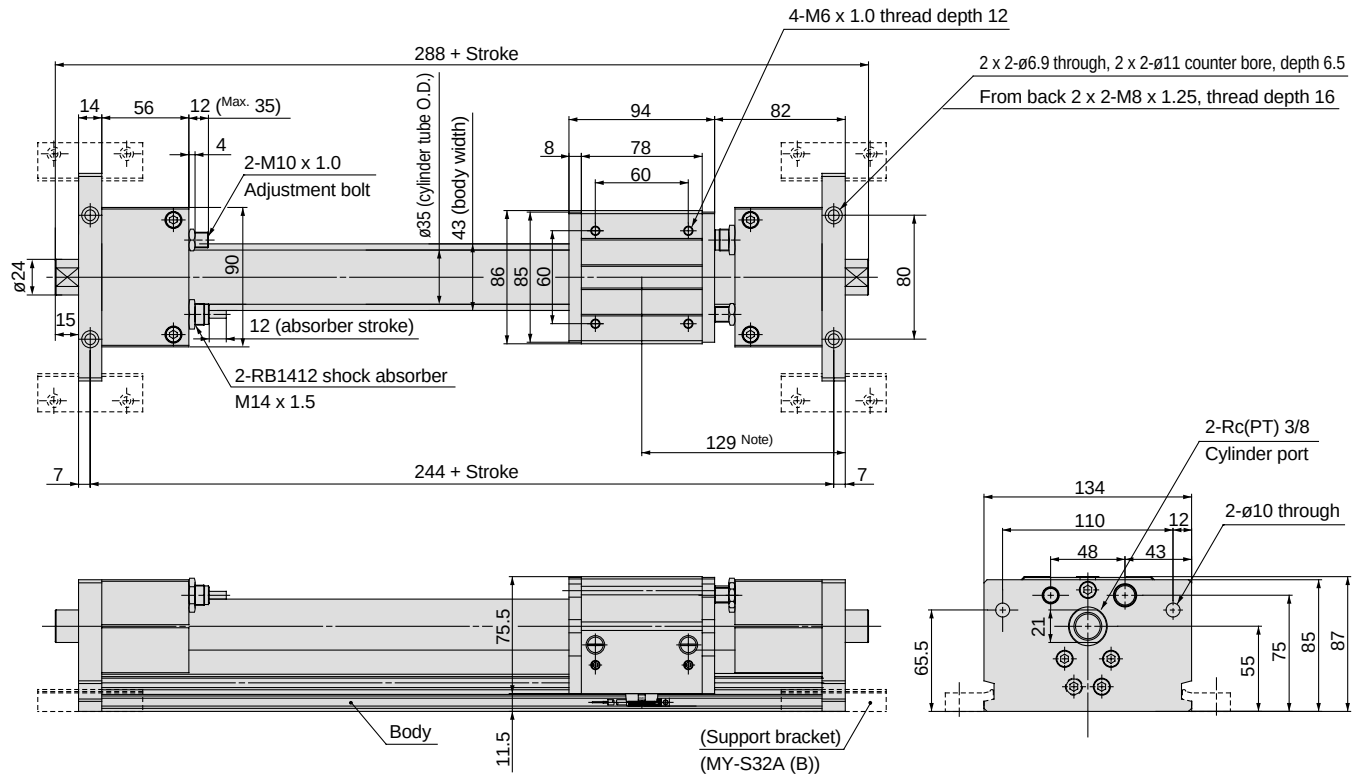
Dimensions Straight Type

MF15-SA Stroke



Note) The dimension can be adjusted to a maximum of 108mm.

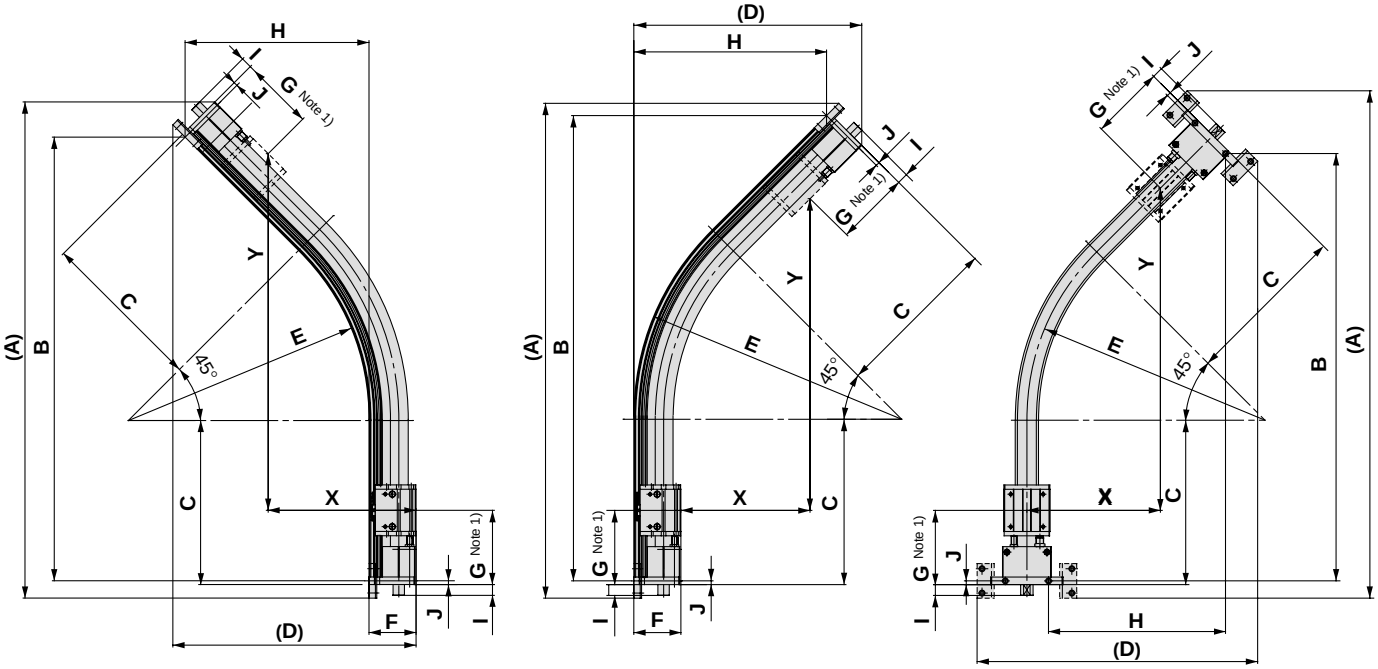
MF32-SA Stroke



Note) The dimension can be adjusted to a maximum of 152mm.

Dimensions Curved Type

MF$^{15}_{32}$-□45



RG

	A	B	C	D	E	F	G
ø15	791	720	300	376	R310	60	93
ø32	916	819	303	449	R445	87	129

	H	I	J	X	Y Note 2)
ø15	298	10	6	244 to 254	589 to 614
ø32	339	15	7	262 to 279	633 to 673

RT

	A	B	C	D	E	F	G
ø15	823	780	301	369	R390	60	93
ø32	906	851	300	418	R495	87	129

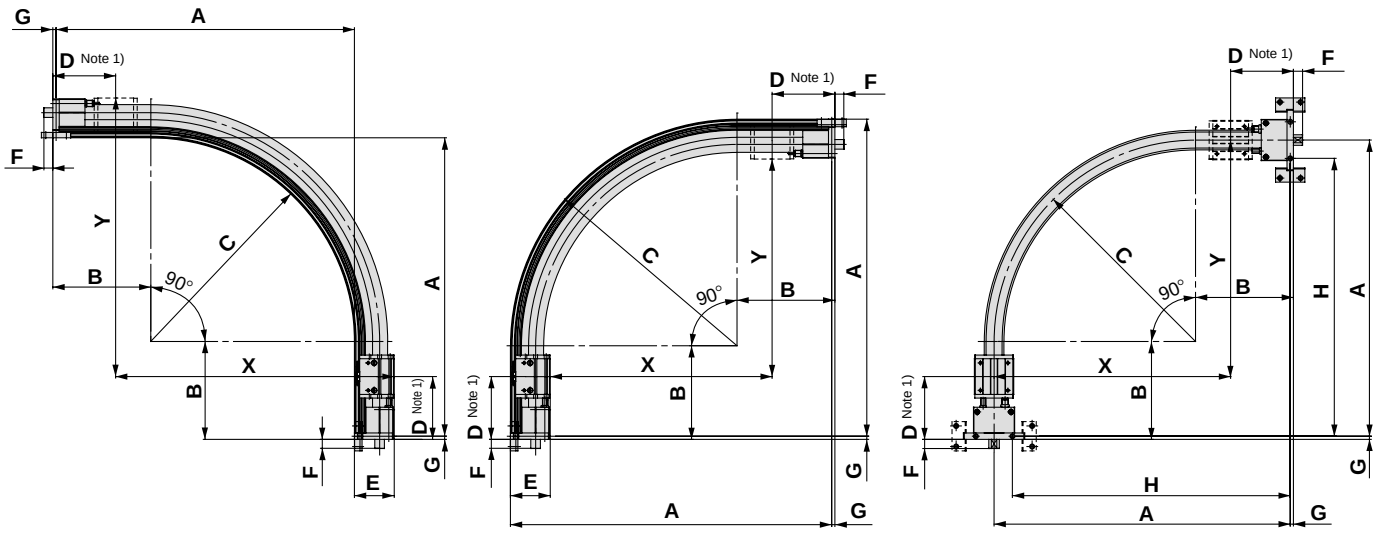
	H	I	J	X	Y Note 2)
ø15	323	10	6	233 to 244	564 to 589
ø32	352	15	7	224 to 241	542 to 581

RS

	A	B	C	D	E	G	H
ø15	835	730	302	424	R350	93	302
ø32	934	790	304	508	R440	129	327

	I	J	X	Y Note 2)
ø15	10	6	240 to 251	579 to 605
ø32	15	7	236 to 253	571 to 610

MF$^{15}_{32}$-□90



RG

	A	B	C	D	E	F	G
ø15	600	296	R310	93	60	10	6
ø32	743	305	R445	129	87	15	7

	X	Y Note 2)
ø15	558 to 573	558 to 573
ø32	685 to 708	685 to 708

RT

	A	B	C	D	E	F	G
ø15	680	296	R390	93	60	10	6
ø32	797	309	R495	129	87	15	7

	X	Y Note 2)
ø15	518 to 533	518 to 533
ø32	558 to 581	558 to 581

RS

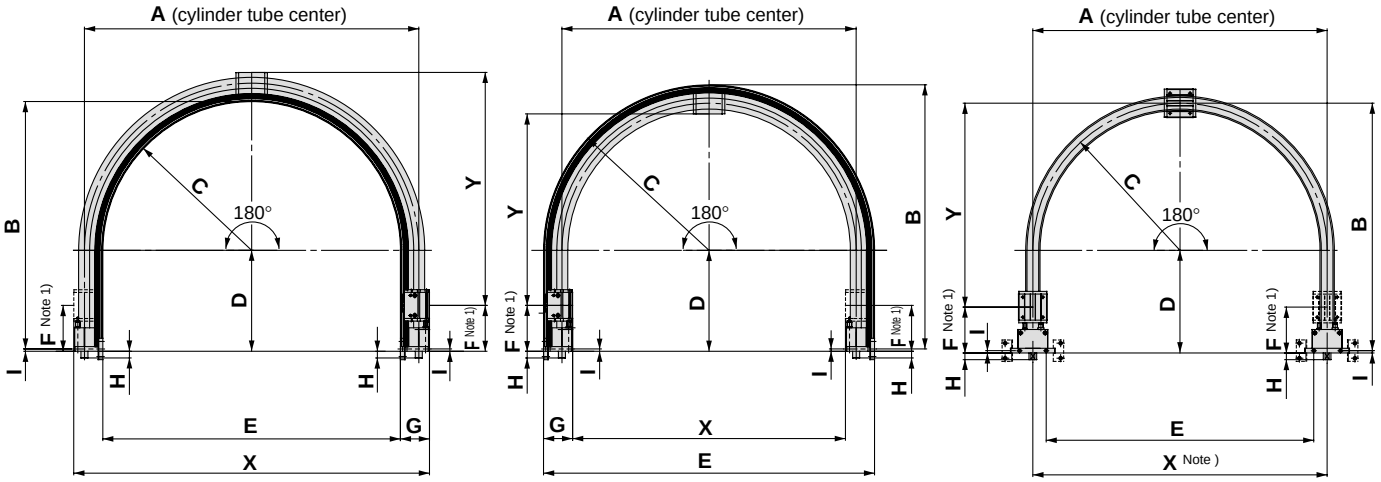
	A	B	C	D	F	G	H
ø15	643	299	R350	93	10	6	610
ø32	740	307	R440	129	15	7	700

	X	Y Note 2)
ø15	541 to 556	541 to 556
ø32	595 to 618	595 to 618

Refer to the detailed dimensions for mounting of the slide table and end unit, which are included with the SA (straight type) dimensions.

Note 1) The dimension can be adjusted to a maximum of 108mm for MF15 and 152mm for MF32.
Note 2) The dimension is a value based on adjustment of the adjustment bolt.

MF$^{15}_{32}$-□180



RG

	A	B	C	D	E	F	G
ø15	700	600	R310	296	620	93	60
ø32	1000	740	R445	302	890	129	87

	H	I	X	Y Note 2)
ø15	10	6	740	558 to 573
ø32	15	7	1064	682 to 705

RT

	A	B	C	D	E	F	G
ø15	700	680	R390	296	780	93	60
ø32	880	790	R495	302	990	129	87

	H	I	X	Y Note 2)
ø15	10	6	660	518 to 533
ø32	15	7	816	558 to 581

RS

	A	B	C	D	E	F	H
ø15	700	640	R350	296	634	93	10
ø32	880	740	R440	307	800	129	15

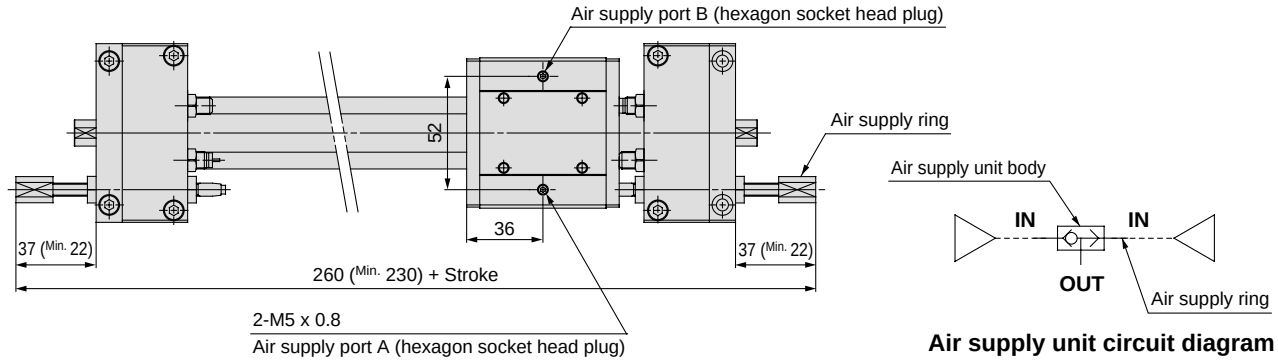
	I	X	Y Note 2)
ø15	6	700	538 to 553
ø32	7	880	595 to 618

Refer to the detailed dimensions for mounting of the slide table and end unit, which are included with the SA (straight type) dimensions.

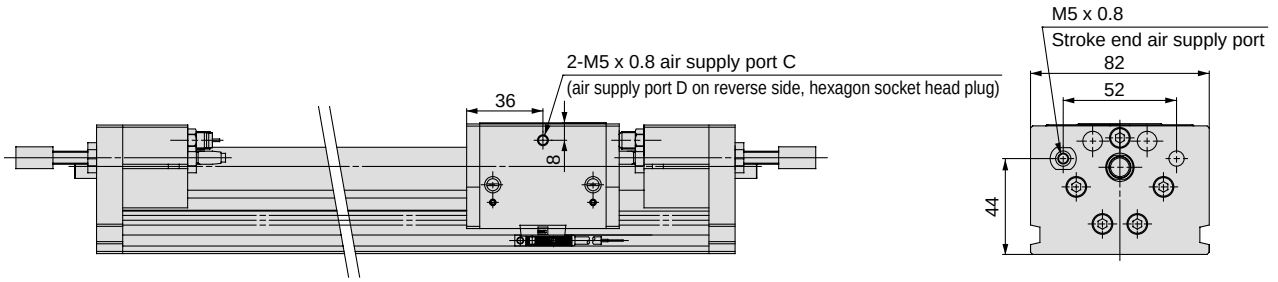
Note) The X dimension is the same as the cylinder tube center dimension.
Note 1) The dimension can be adjusted to a maximum of 108mm for MF15 and 152mm for MF32.
Note 2) The dimension is a value based on adjustment of the adjustment bolt.

Dimensions Air Supply Unit

ø15

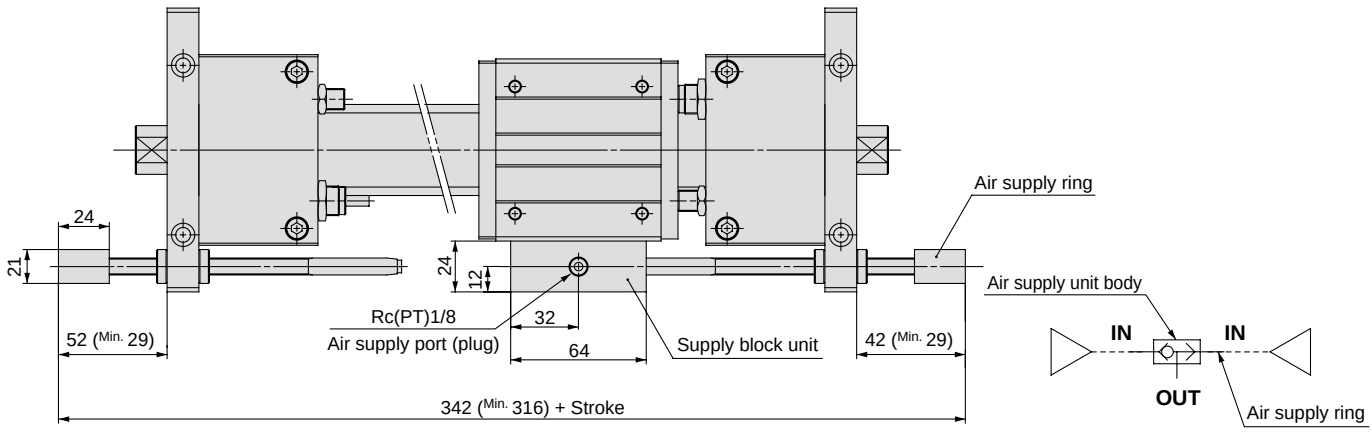


Air supply unit circuit diagram

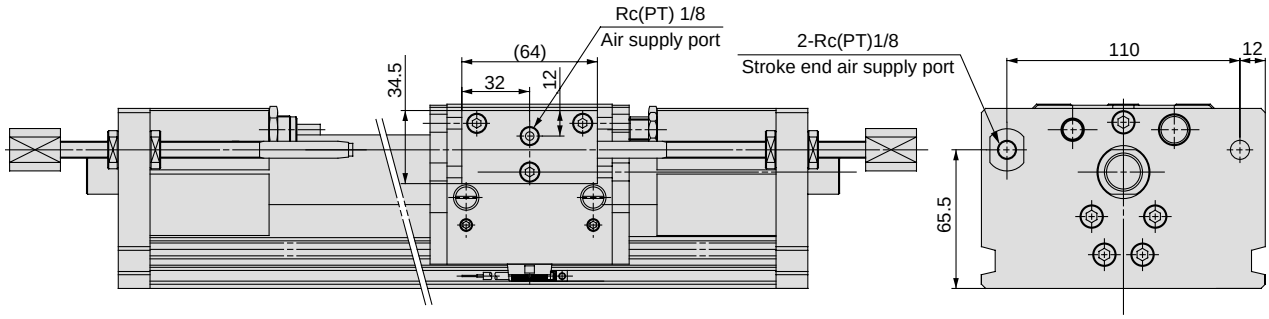


∗ When equipped with air supply unit system 1, there are two supply ports, A and C.
When equipped with system 2, there are four supply ports, A through D.

ø32



Air supply unit circuit diagram



Pneumatic Transfer System

3-Dimensional Transfer/Set Parts for Combination Units

Series MFT

How to Order

Curved Unit

MFT 32 — RS 45

3-dimensional transfer combination unit set parts

Bore size

15	15mm
32	32mm

Curved unit

RS	Lateral curve
RT	Inside curve
RG	Outside curve

Angle

45	45°
90	90°
180	180°

Straight Unit

MFT 32 — SA 300

3-dimensional transfer combination unit set parts

Bore size

15	15mm
32	32mm

Straight unit

SA	Straight unit A
SB	Straight unit B
SC	Straight unit C

Stroke

300	300mm
350	350mm
400	400mm
450	450mm
500	500mm
600	600mm
1000	1000mm

The maximum standard stroke is 2000mm.

End Unit

MFT 32 — EA — Y59B □

3-dimensional transfer combination unit set parts

Bore size

15	15mm
32	32mm

End unit

EA	End unit A
EB	End unit B
EM	Maintenance unit
AS	Air supply unit (1 set)
AW	Air supply unit (2 sets)

Auto switch type

Nil	Without auto switch

Number of auto switches

Nil	2pcs.
S	1pc.
n	"n" pcs.

*1) Auto switch orders apply only to end units A and B.
*2) Refer to the table below for auto switch part numbers.

Applicable Auto Switches

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage DC		Load voltage AC	Auto switch part no. Electrical entry direction: Perpendicular	Auto switch part no. Electrical entry direction: In-line	Lead wire length (m)* 0.5 (Nil)	3 (L)	5 (Z)	Applicable load		Detailed specifications
Reed switch	–	Grommet	Yes	3 wire (NPN) equiv.	–	5V	–	–	Z76	●	●	–	IC circuit	Relay, PLC	Page 20
				2 wire	24V	12V	100V	–	Z73	●	●	●	–		
			No			5V, 12V	100V or less	–	Z80	●	●	–	IC circuit		
Solid state switch	–	Grommet	Yes	3 wire (NPN)	24V	5V, 12V	–	Y69A	Y59A	●	●	○	IC circuit	Relay, PLC	Page 21
				3 wire (PNP)				Y7PV	Y7P	●	●	○			
				2 wire		12V		Y69B	Y59B	●	●	○	–		
	Diagnostic indication (2 color indicator)			3 wire (NPN)		5V, 12V		Y7NWV	Y7NW	●	●	○	IC circuit		Page 22
				3 wire (PNP)				Y7PWV	Y7PW	●	●	○			
				2 wire		12V		Y7BWV	Y7BW	●	●	○	–		

∗ Lead wire length symbols 0.5m …… Nil (Example) Y59A
3m …… L (Example) Y59AL
5m …… Z (Example) Y59AZ

∗ Solid state switches marked with a "○" are produced upon receipt of order.

∗ Refer to pages 20 through 24 for detailed auto switch specifications.

Set Parts/R Unit Weight

(Units: kg)

	RS45	RG45	RT45	RS90	RG90	RT90	RS180	RG180	RT180
MFT15	1.3	1.3	1.4	1.7	1.7	1.8	2.6	2.6	2.8
MFT32	2.5	2.5	2.6	3.5	3.6	3.7	5.5	5.7	5.7

Note 1) Indicates the total weight of the cylinder tube and body.

Set Parts/Straight Unit Weight

(Units: kg)

	Model	SA	SB	SC
Basic weight (for 300mm stroke)	**MFT15**	0.6		
	MFT32	0.9		
Additional weight per 50mm of stroke	**MFT15**	0.1		
	MFT32	0.15		

Note 1) Indicates the total weight of the cylinder tube and body.
Note 2) Strokes under 300mm are not available.
Calculation method/Example: MFT-SA1000

$0.9 + 0.15 \times (1000-300)/50 = 3.0\text{kg}$

- Stroke
- Additional weight per 50st
- Basic weight: 300mm stroke

Set Parts/End Units A & B Maintenance Unit Weight

(Units: kg)

Model	EA	EB	EM
MFT15	1.5	1.1	0.4
MFT32	2.8	1.4	0.6

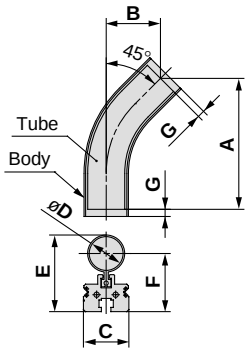
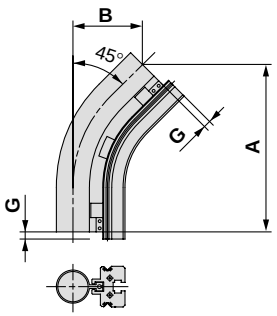
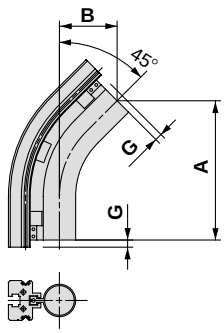
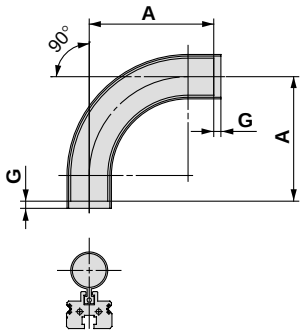
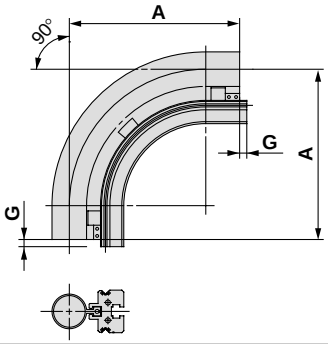
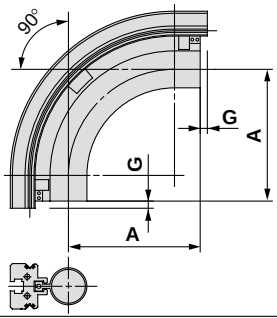
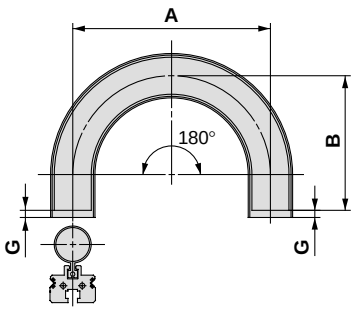
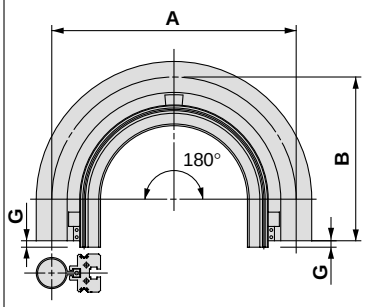
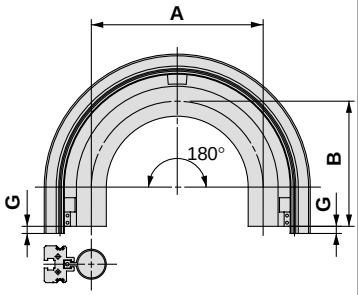
Set Parts/Air Supply Unit Weight

(Units: kg/pc.)

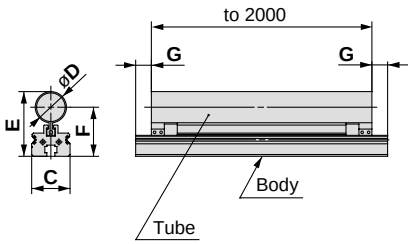
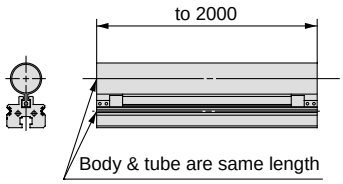
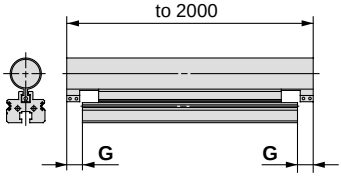
Model	**A** unit
MFT15	0.15
MFT32	0.35

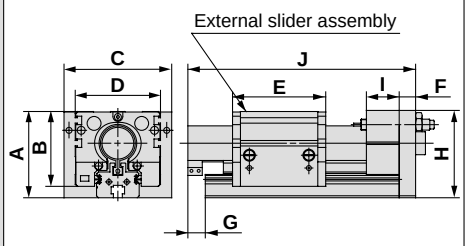
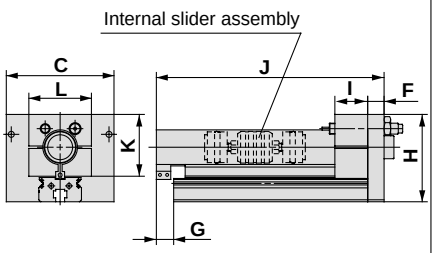
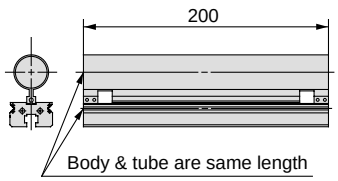
Combination Unit Matrix

R Unit Variations

		Set parts/Curved units		
		Lateral curve unit	**Outside curve unit**	**Inside curve unit**
Part No.		**MFT□-RS45**	**MFT□-RG45**	**MFT□-RT45**
Curve angle	**45°**			
Dimensions		Model / A / B / C / D / E / F / G MFT15-RS45: 700 / 290 / 33 / 17.6 / 48.8 / 40 / 25 MFT32-RS45: 745 / 309 / 43 / 35 / 72.5 / 55 / 36	Model / A / B / G MFT15-RG45: 696 / 288 / 25 MFT32-RG45: 785 / 325 / 36	Model / A / B / G MFT15-RT45: 699 / 290 / 25 MFT32-RT45: 739 / 306 / 36
Note		For lateral curve single & combination units	For outside curve single & combination units	For inside curve single & combination units
Part No.		**MFT□-RS90**	**MFT□-RG90**	**MFT□-RT90**
Curve angle	**90°**			
Dimensions		Model / A / G MFT15-RS90: 612 / 25 MFT32-RS90: 697 / 36	Model / A / G MFT15-RG90: 609 / 25 MFT32-RG90: 755 / 36	Model / A / G MFT15-RT90: 609 / 25 MFT32-RT90: 699 / 36
Note		For lateral curve single & combination units	For outside curve single & combination units	For inside curve single & combination units
Part No.		**MFT□-RS180**	**MFT□-RG180**	**MFT□-RT180**
Curve angle	**180°**			
Dimensions		Model / A / B / G MFT15-RS180: 700 / 609 / 25 MFT32-RS180: 880 / 697 / 36	Model / A / B / G MFT15-RG180: 700 / 609 / 25 MFT32-RG180: 1000 / 752 / 36	Model / A / B / G MFT15-RT180: 700 / 609 / 25 MFT32-RT180: 880 / 692 / 36
Note		For lateral curve single & combination units	For outside curve single & combination units	For inside curve single & combination units

Straight Unit Variations

	Set parts/Straight Units		
	Straight unit A	**Straight unit B**	**Straight unit C**
Part No.	**MFT□-SA** Stroke	**MFT□-SB** Stroke	**MFT□-SC** Stroke
Configuration	 * Up to 2000 for both MFT15 and 32.	 * Up to 2000 for both MFT15 and 32.	 * Up to 2000 for both MFT15 and 32.
Dimensions	Model / C / D / E / F / G **MFT15-SA** Stroke: 33 / 17.6 / 48.8 / 40 / 25 **MFT32-SA** Stroke: 43 / 35 / 72.5 / 55 / 36		Model / G **MFT15-SC** Stroke: 25 **MFT32-SC** Stroke: 36
Note	Used for linear transfer only. For straight single & combination units. Connected between end units A and B or between maintenance units.	Required when connecting end units or maintenance units with R units. Used for stroke extension in an existing 3-dimensional transfer system.	Required in one location when connecting two R units in a space.

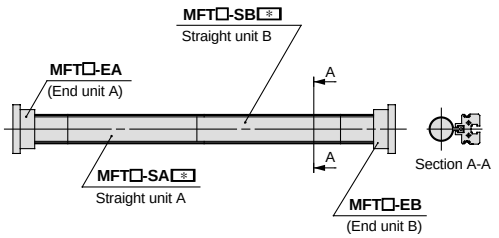
	Set parts/End units		
	End unit A	**End unit B**	**Maintenance unit**
Part No.	**MFT□-EA**	**MFT□-EB**	**MFT□-EM**
Configuration			 *200 for both MFT15 and 32.
Dimensions	Model / A / B / C / D / E / F / G **MFT15-EA**: 60 / 48.5 / 82 / 69 / 72 / 12 / 25 **MFT32-EA**: 87 / 75.5 / 134 / 86 / 94 / 14 / 36 Model / H / I / J **MFT15-EA**: 59 / 35 / 200 **MFT32-EA**: 85 / 56 / 250	Model / C / F / G / H / I / J **MFT15-EB**: 82 / 12 / 25 / 59 / 35 / 200 **MFT32-EB**: 134 / 14 / 36 / 85 / 56 / 250 Model / K / L **MFT15-EB**: 38 / 82 **MFT32-EB**: 60 / 90	
Note	Mounted at the stroke end on one side of a combination unit. This type has only an external slide terminal assembly.	Mounted at the stroke end on one side of a combination unit. This type has only an internal slide terminal assembly.	Connected in front of the end unit for combination units (at both ends or one side). This combination with end units allows easy replacement operations during maintenance.

Note) Straight units A, B and C are available in 300mm strokes and longer for both MFT15 and 32.

Combination Unit Configuration Examples

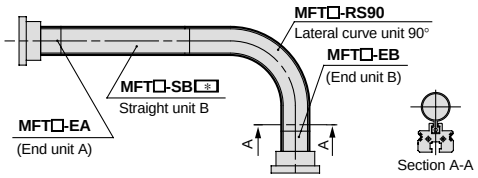
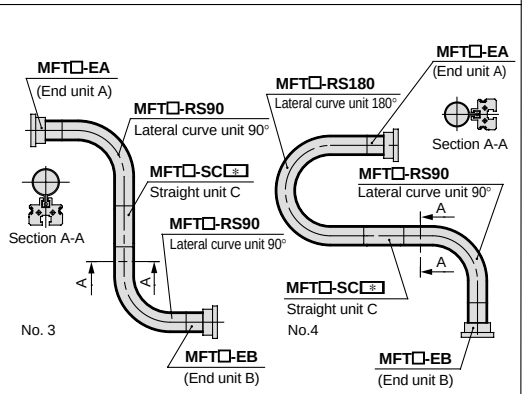
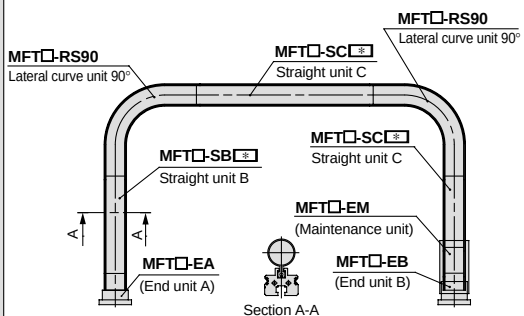
Symbols in the tables: □ – cylinder bore size, ✻ – stroke

Straight Units

No.	Content	Combination No.	Assembled configuration	Other combinations
1	Straight long stroke divided into 2 sections	**MFT□-EA + MFT□-SA✻ + MFT□-SB✻ + MFT□-EB**		○—directly connectable X—not directly connectable

Part No.	MFT□-SA✻	MFT□-SB✻	MFT□-SC✻	MFT□-EA	MFT□-EB
MFT□-SA✻	X	○	○	○	○
MFT□-SB✻	○	○	○	○	○
MFT□-SC✻	○	○	X	X	X
MFT□-EA	○	○	X	X	X
MFT□-EB	○	○	X	X	X
MFT□-EM	○	○	X	○	○

R Units

No.	Content	Combination No.	Assembled configuration	Other combinations
2	Straight unit attached on one side of an R unit	**MFT□-EA + MFT□-SB✻ + MFT□-RS90 + MFT□-EB**		
3	Two R unit sets connected to one another	**MFT□-EA + MFT□-RS90 + MFT□-SC90 + MFT□-RS90 + MFT□-EB**		○ — directly connectable X — not directly connectable
4		**MFT□-EA + MFT□-RS180 + MFT□-SC✻ + MFT□-RS90 + MFT□-EB**		
5	Two R unit sets connected in a gate type configuration	**MFT□-EA + MFT□-SB✻ + MFT□-RS90 + MFT□-SC✻ + MFT□-RS90 + MFT□-SC✻ + MFT□-EM + MFT□-EB**		

Part No.	MFT□-SA✻	MFT□-SB✻	MFT□-SC✻	MFT□-EA	MFT□-EB	MFT□-EM
MFT□-RS45	X	○	○	○	○	○
MFT□-RG45	X	○	○	○	○	○
MFT□-RT45	X	○	○	○	○	○
MFT□-RS90	X	○	○	○	○	○
MFT□-RG90	X	○	○	○	○	○
MFT□-RT90	X	○	○	○	○	○
MFT□-RS180	X	○	○	○	○	○
MFT□-RG180	X	○	○	○	○	○
MFT□-RT180	X	○	○	○	○	○

Note) R units cannot be connected directly to one another. When connecting R units to one another, a **MFT□-SC✻** unit (straight unit C) is required.

Note) Refer to page 3 for the model selection method.

How to Order Parts

Parts for Curved Units

MFP T 32 — RS 45

Parts for 3-dimensional transfer

Type

T	Cylinder tube
G	Body

Bore size

15	15mm
32	32mm

Curved type

RS	Lateral curve
RT	Inside curve
RG	Outside curve

Angle

45	45°
90	90°
180	180°

Parts for Straight Units

MFP T 32 — SA 300

Parts for 3-dimensional transfer

Type

T	Cylinder tube
G	Body

Bore size

15	15mm
32	32mm

Straight unit

SA	Straight unit A
SB	Straight unit B
SC	Straight unit C
* **EA**	End unit A
* **EB**	End unit B
* **EM**	Maintenance unit

Units marked with a "∗" do not require a stroke.

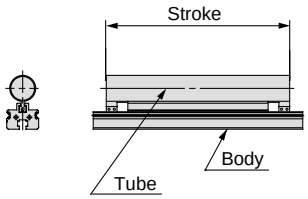
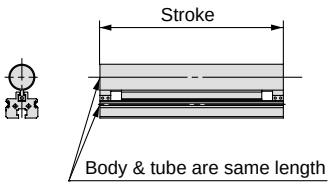
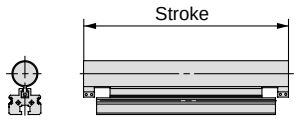
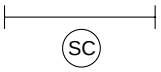
Stroke

300	300mm
350	350mm
400	400mm
450	450mm
500	500mm
600	600mm
1000	1000mm

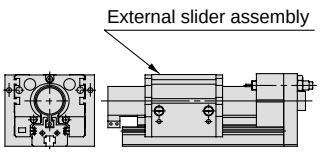
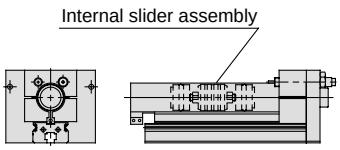
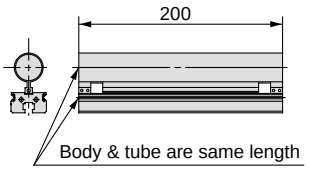
∗ The maximum standard stroke is 2000mm.

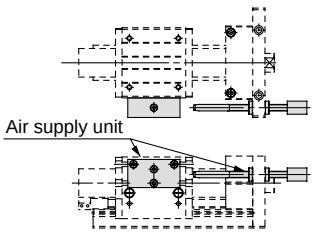
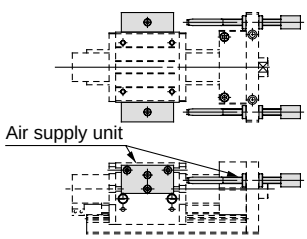
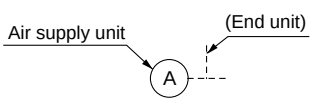
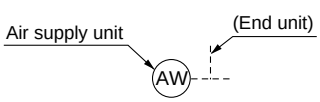
Unit Schematic Symbols and Part Number Correspondence for Order Card Entries

Straight Units

	Straight unit A	Straight unit B	Straight unit C
Unit part no.	**MFT□-SA** Stroke	**MFT□-SB** Stroke	**MFT□-SC** Stroke
Configuration			
Unit schematic symbol			

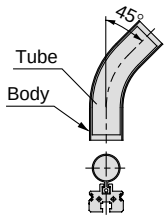
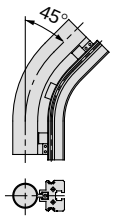
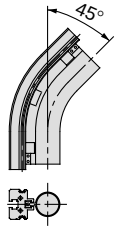
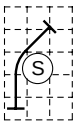
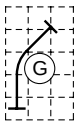
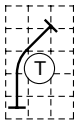
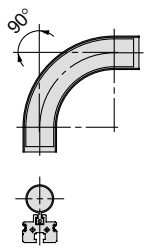
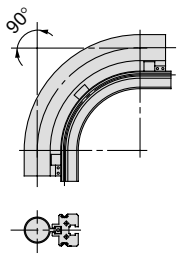
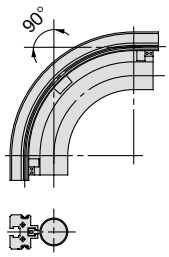
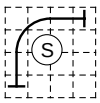
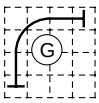
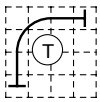
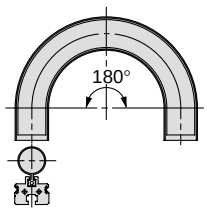
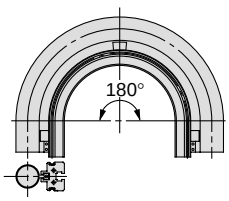
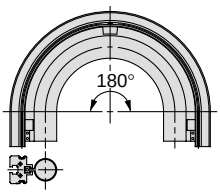
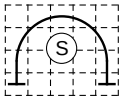
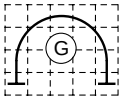
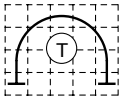
End Units

	End unit A	End unit B	Maintenance unit
Unit part no.	**MFT□-EA**	**MFT□-EB**	**MFT□-EM**
Configuration			 ∗ 200 for both MFT15 and 32.
Unit schematic symbol			

	Air supply unit (System 1)	Air supply unit (System 2)
Unit part no.	**MFT□-A**	**MFT□-AW**
Configuration		
Unit schematic symbol		

Refer to the following page 19 for order sheet entry instructions. ▶

Curved Units

	Lateral curve unit	Outside curve unit	Inside curve unit
Unit part no.	**MFT□-RS45**	**MFT□-RG45**	**MFT□-RT45**
Curve angle **45°**			
Unit schematic symbol			
Unit part no.	**MFT□-RS90**	**MFT□-RG90**	**MFT□-RT90**
Curve angle **90°**			
Unit schematic symbol			
Unit part no.	**MFT□-RS180**	**MFT□-RG180**	**MFT□-RT180**
Curve angle **180°**			
Unit schematic symbol			

Note) Use the size of the unit schematic symbols as a guide when drawing a schematic diagram.

Order Card Entry Example

A blank copy of the form below is provided on the last page to be copied for use.

[Entry Example]

▲ Please copy for use without removing. ▲

Issue date: July 1, 1998

Pneumatic Transfer System

☑ Production Review
☑ Quotation Request
☐ Order Request

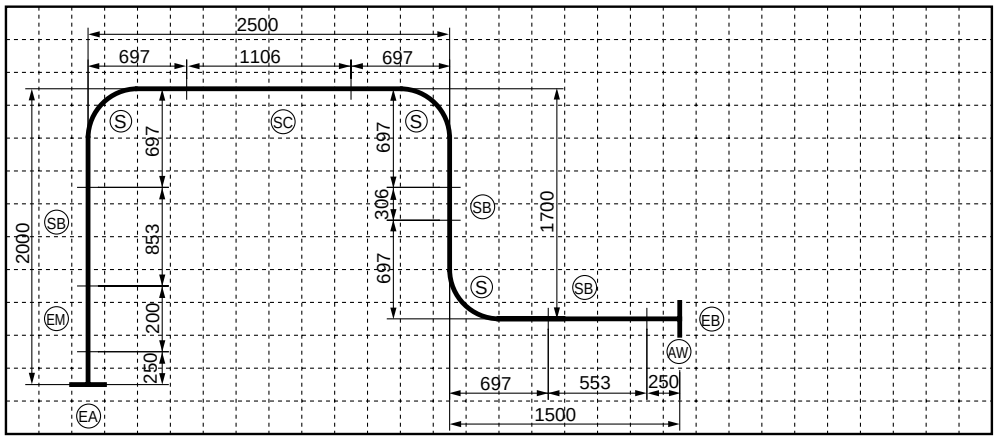
Sheet

Check the applicable item(s) to the right.

Cylinder size: MFT 32

Company Name	ABC Corp.	Quantity	1 Set(s)
Contact	Mr. Smith	Need by date	July 31, 1998
Equipment Name	Shaft conveyor		

Schematic Diagram



Cautions • Use the combination units with the secondary pressure source. Indicate the air supply unit only on the end unit B side.
• Curved units cannot be directly connected to one another. An MFT□-SC[2] (Straight unit C) is required in between curved units.
• The capability for direct mounting of each unit is presented in a matrix form on page 15 for reference.
• The available stroke range for both straight units A, B, C and MFT 15, 32 is 300 to 2000mm.

Order List

Enter in order starting from End Unit A

• Enter the cylinder size in the box □.
• Enter the stroke and quantity.

No.	Unit name	Unit part no.	Quantity
①	**End unit A**	**MFT** 32 **-EA-** Y59B	**1**
②	Maintenance unit	MFT32-EM	1
③	Straight unit B	MFT32-SB853	1
④	Lateral curve unit	MFT32-RS90	1
⑤	Straight unit C	MFT32-SC1106	1
⑥	Lateral curve unit	MFT32-RS90	1
⑦	Straight unit B	MFT32-SB306	1
⑧	Lateral curve unit	MFT32-RS90	1

No.	Unit name	Unit part no.	Quantity
⑨	Straight unit B	MFT32-SB553	1
⑩			
⑪			
⑫			
⑬	Side support A	MF-S32A	12
⑭	Air supply unit	MFT32-AW	1
⑮	Connection parts Note)	MFT32-CP	9
⑯	**End unit B**	**MFT** 32 **-EB-** Y59B	**1**

• Enter the required quantities of side supports A/B and support brackets A/B in the order list. (Refer to page 2 regarding part numbers for ordering.)
• Indicate auto switch orders in the last box □ for end unit A and end unit B. (Do not order with other units.)
Note) The connection parts in No.15 are required on the connecting section of each unit. Enter the number of connecting sections (unit joints) in No.15 of the order list.

Space below for SMC use only

Technical dept. confirmation

No.	Check box
1	

Shipping confirmation (entered by production dept.)

No.	1	2	3	4	5	6	7	8
Check box								

No.	9	10	11	12	13	14	15	16
Check box								

Responsible sales representative entries

Order No.	
Responsible party	
Responsible party code No.	
Department code	

39

Reed Switches/Direct Mounting Type
D-Z73/Z76/Z80

Auto Switch Specifications

With Indicator Light			
Auto switch part no.	**D-Z73**		**D-Z76**
Electrical entry direction	In-line		
Applicable load	Relay, PLC		IC circuit
Load voltage	24VDC	100VAC	4 to 8VDC
Maximum load current or current range	5 to 40mA	5 to 20mA	20mA
Contact protection circuit	None		
Internal voltage drop	2.4V or less		0.8V or less
Indicator light	Red LED lights up when ON		

Without Indicator Light			
Auto switch part no.	**D-Z80**		
Electrical entry direction	In-line		
Applicable load	Relay, PLC, IC circuit		
Load voltage	24V AC/DC or less	48V AC/DC	100V AC/DC
Maximum load current	50mA	40mA	20mA
Contact protection circuit	None		
Internal resistance	1Ω or less (including lead wire length of 3m)		

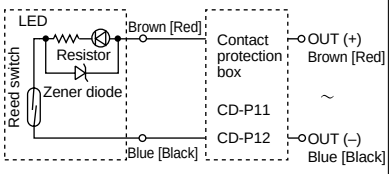
- **Leakage current**……. None
- **Operating time**……..... 1.2ms
- **Lead wires**…….....Heavy duty oil resistant vinyl cord, ø3.4,
  0.2mm², 2 wire (Brown, Blue [Red, Black])
  3 wire (Brown, Black, Blue [Red, White, Black]), 0.5m*
- **Impact resistance**…… 300m/s² {30.6G}
- **Insulation resistance**….. 50MΩ or more at 500VDC (between lead wire & case)
- **Withstand voltage**……1500VAC for 1min. (between lead wire & case)
- **Ambient temperature**…. – 10 to 60°C
- **Enclosure**……..... IEC529 standard IP67, watertight (JISC0920)

* **For a lead wire length of 3m, "L" is shown at the end of the part number.** Example) D-Z73L

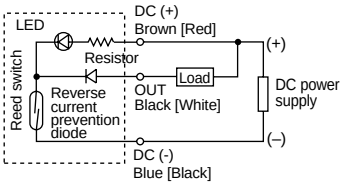
Auto Switch Internal Circuits

Lead wire colors inside [ ] are old colors prior to conformity with IEC standards.

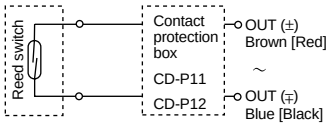
D-Z73



D-Z76



D-Z80



Note) 1. The load is an induction load
2. The lead wire length to the load is 5m or more
3. The load voltage is 100VAC

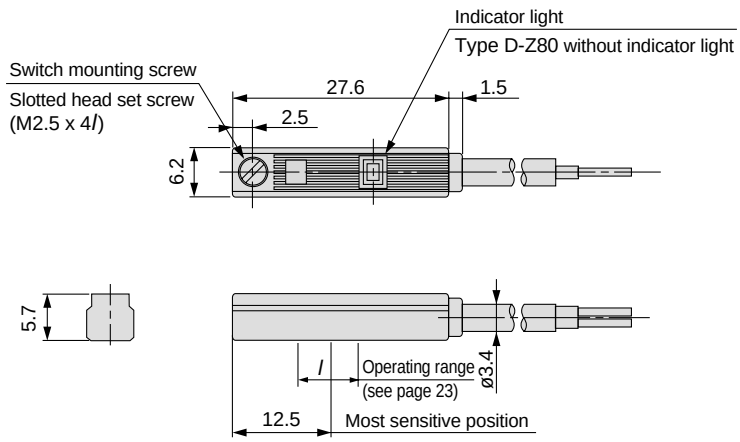
Use a contact protection box in any of the above situations, as the life of the contacts may otherwise be reduced. Refer to page 23 for detailed specifications of the contact protection boxes.

Auto Switch Weight Table

Unit: g

Model	Lead wire length 0.5m	Lead wire length 3m
D-Z73	9	49
D-Z76	10	55
D-Z80	9	49

Auto Switch Dimensions



Solid State Switches/Direct Mounting Type
D-Y59$^{A}_{B}$, D-Y69$^{A}_{B}$, D-Y7P (V)

Auto Switch Specifications

D-Y5, D-Y6, D-Y7P, D-Y7PV (With Indicator Light)						
Auto switch part no.	**D-Y59A**	**D-Y69A**	**D-Y7P**	**D-Y7PV**	**D-Y59B**	**D-Y69B**
Electrical entry direction	Perpendicular	In-line	Perpendicular	In-line	Perpendicular	In-line
Wiring	3 wire				2 wire	
Output	NPN type		PNP type		–	
Applicable load	IC circuit, Relay, PLC				24VDC Relay, PLC	
Power supply voltage	5, 12, 24VDC (4.5 to 28VDC)				–	
Current consumption	10mA				–	
Load voltage	28VDC or less		–		24VDC (10 to 28VDC)	
Load current	40mA or less		80mA or less		5 to 40mA or less	
Internal voltage drop	1.5V or less (0.8V or less at load current of 10mA)		0.8V or less		4V or less	
Leakage current	100μA or less at 24VDC				0.8mA or less at 24VDC	
Indicator light	Red LED lights up when ON					

- **Operating time**..... 1ms or less
- **Lead wires**.....Heavy duty oil resistant flexible vinyl cord, ø3.4 , 0.15mm², 3 wire (Brown, Black, Blue [Red, White, Black]), 2 wire (Brown, Blue [Red, Black]) 0.5m ＊

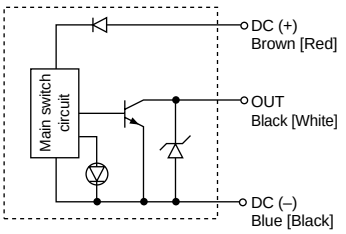
＊ **For a lead wire length of 3m, "L" is shown at the end of the part number.** (Example) D-Y59AL

- **Impact resistance**.....1,000m/s² (102G)
- **Insulation resistance**..... 50MΩ or more at 500VDC (between lead wire & case)
- **Withstand voltage**.....1000VAC for 1min. (between lead wire & case)
- **Ambient temperature**..... – 10 to 60°C
- **Enclosure**..... IEC529 standard IP67, watertight (JISC0920)

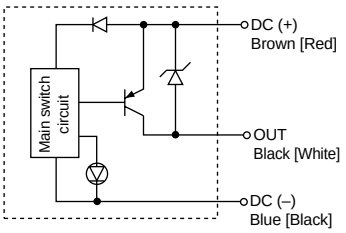
Auto Switch Internal Circuits

Lead wire colors inside [ ] are old colors prior to conformity with IEC standards.

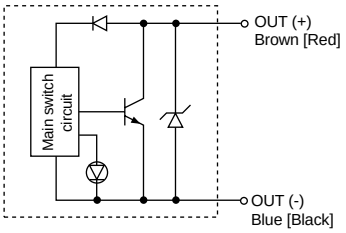
D-Y59A, Y69A



D-Y7P (V)



D-Y59B, Y69B



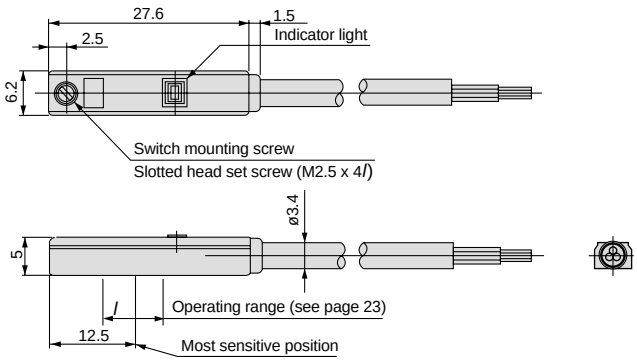
Weight Table

Unit: g

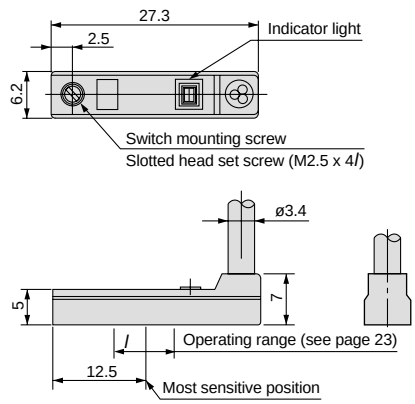
Model	Lead wire length	
	0.5m	3m
D-Y59A, Y69A, Y7P	10	53
D-Y59B, Y69B, Y7PV	9	50

Dimensions

D-Y59A, Y59B
D-Y7P



D-Y69A, Y69B
D-Y7PV



2 Color Indication Type Solid State Switches D-Y7NW/Y7PW, D-Y7BW

Auto Switch Specifications

D-Y7□W, D-Y7□WV (With Indicator Light)						
Auto switch part nos.	**D-Y7NW**	**D-Y7NWV**	**D-Y7PW**	**D-Y7PWV**	**D-Y7BW**	**D-Y7BWV**
Electrical entry direction	In-line	Perpendicular	In-line	Perpendicular	In-line	Perpendicular
Wiring	3 wire				2 wire	
Output	NPN type		PNP type		–	
Applicable load	IC circuit, Relay, PLC				24VDC Relay, PLC	
Power supply voltage	5, 12, 24VDC (4.5 to 28VDC)				–	
Current consumption	10mA or less				–	
Load voltage	28VDC or less		–		24VDC (10 to 28VDC)	
Load current	40mA or less		80mA or less		5 to 40mA	
Internal voltage drop	1.5V or less (0.8V or less at load current of 10mA)		0.8V or less		4V or less	
Leakage current	100μA or less at 24VDC				0.8mA or less at 24VDC	
Indicator light	Operating position …….... Red LED lights up Optimum operating position …… Green LED lights up					

- **Operating time**…….....1ms or less
- **Lead wires**…..... Heavy duty oil resistant flexible vinyl cord, ø3.4 , 0.15mm², 3 wire (Brown, Black, Blue [Red, White, Black]), 2 wire (Brown, Blue [Red, Black]) 0.5m*

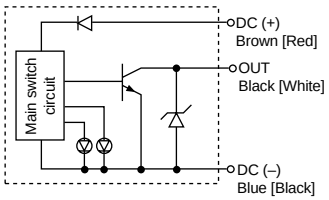
* **For a lead wire length of 3m, "L" is shown at the end of the part number.** (Example) D-Y7NWL

- **Impact resistance**…..... 1,000m/s² (102G)
- **Insulation resistance**…. 50MΩ or more at 500VDC (between lead wire & case)
- **Withstand voltage**……. 1000VAC for 1min. (between lead wire & case)
- **Ambient temperature**… – 10 to 60°C
- **Enclosure**…….....IEC529 standard IP67, watertight (JISC0920)

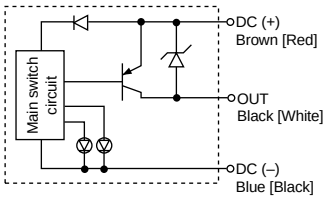
Auto Switch Internal Circuits

Lead wire colors inside [ ] are old colors prior to conformity with IEC standards.

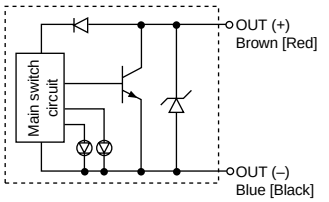
D-Y7NW(V), 3 wire NPN output



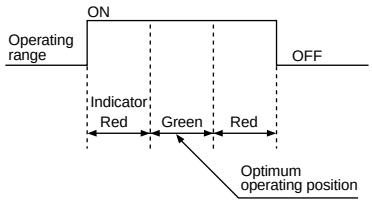
D-Y7PW(V), 3 wire PNP output



D-Y7BW(V), 2 wire



Indicator lights/Display method



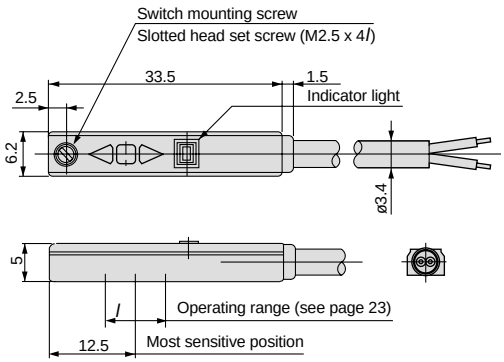
Auto Switch Weight Table

Unit: g

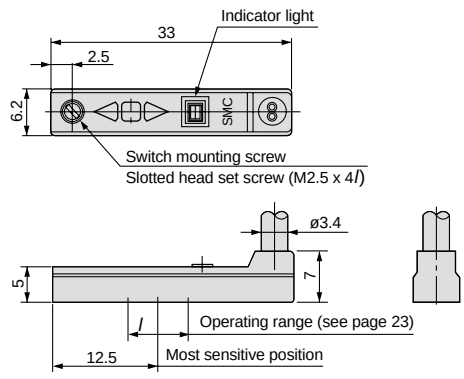
Model	Lead wire length	
	0.5m	3m
D-Y7N, Y7P	11	54
D-Y7B	9	50

Auto Switch Dimensions

D-Y7□W

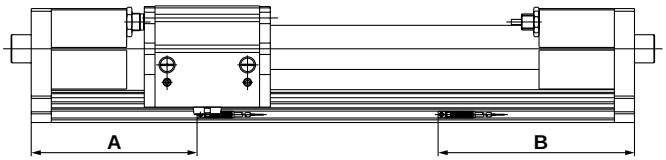


D-Y7□WV



Auto Switch Mounting Positions

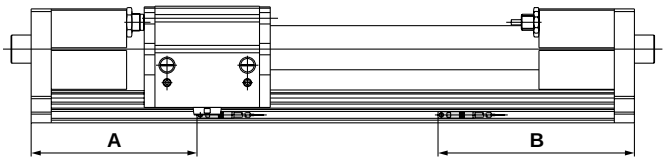
D-Z7□, D-Z80



(mm)

Mounting position	MF□15	MF□32
A	103.5	124.5
B	134.5	149.5
Operating range Note)	8	

D-Y5, D-Y6, D-Y7P(V)

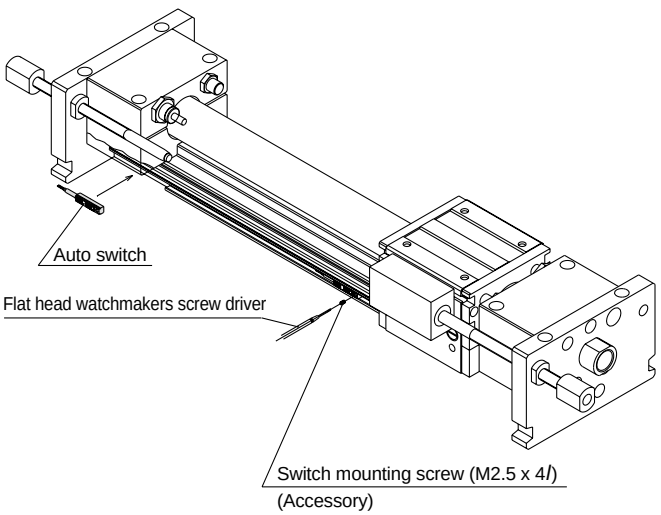


(mm)

Mounting position	MF□15	MF□32
A	103.5	124.5
B	134.5	149.5
Operating range Note)	3	

Note) The operating range is a standard including hysteresis, but is not guaranteed (variation ±30%). There may be large changes depending on the ambient environment.

Auto Switch Mounting



⚠Caution

When tightening the auto switch mounting screw, use a flat head watchmakers screw driver with a handle about 5 to 6mm in diameter. Tighten the screw to a torque of about 0.05 to 0.1N·m. As a rule, it can be turned approximately 90° past the position at which tightening can be felt.

Contact Protection Boxes/CD-P11, CD-P12

(Applicable switch models)

D-Z73, Z80

The above auto switches do not have built-in contact protection circuits.

1. The load is an induction load.

2. The lead wire length to the load is 5m or more.

3. The load voltage is 100V or 200VAC.

Use a contact protection box in any of the above situations, as the life of the contacts may otherwise be reduced (they stay ON continuously).

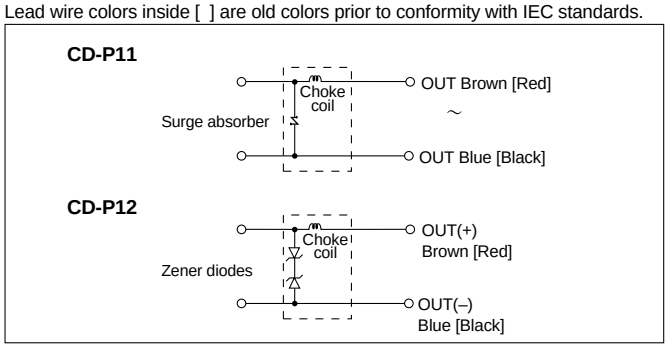
Contact Protection Box Specifications

Part No.	CD-P11		CD-P12
Load voltage	100VAC or less	200VAC	24VDC
Max. load current	25mA	12.5mA	50mA

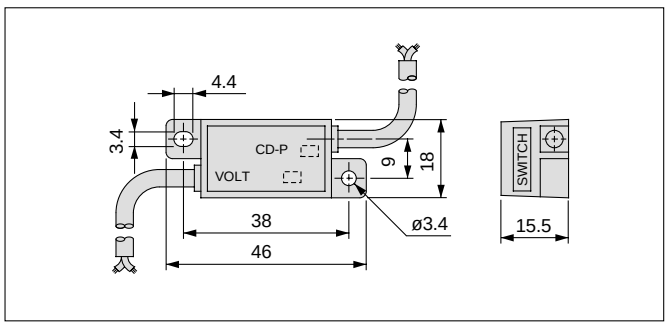
∗ Lead wire length……Switch connection side 0.5m
Load connection side 0.5m

Contact Protection Box Internal Circuits

Lead wire colors inside [ ] are old colors prior to conformity with IEC standards.



Contact Protection Box/Dimensions



Contact Protection Box/Connection

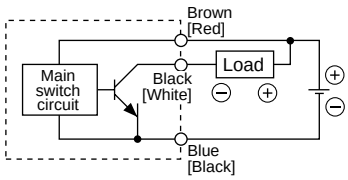
To connect a switch unit and contact protection box, connect the lead wire on the side of the contact protection box marked SWITCH to the lead wire coming out of the switch unit.

In addition, place the switch unit and contact protection box as close together as possible, with a lead wire length of no more than 1 meter.

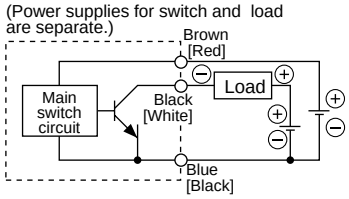
Series MF
Auto Switch Connections and Examples

Basic Wiring

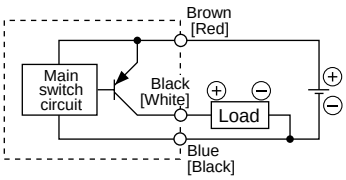
Solid state 3 wire, NPN



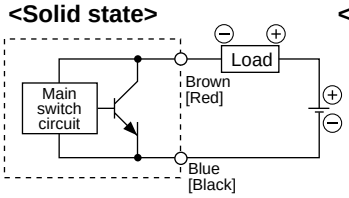
(Power supplies for switch and load are separate.)

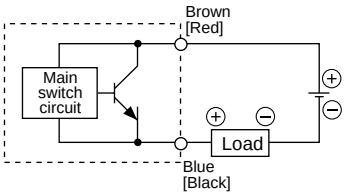


Solid state 3 wire, PNP

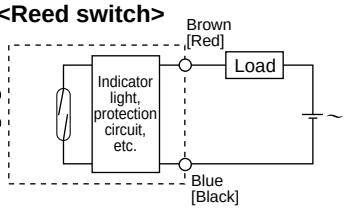


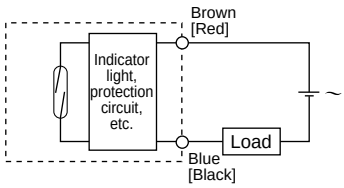
2 wire <Solid state>





2 wire <Reed switch>

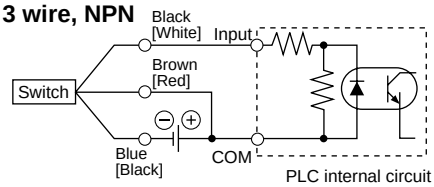




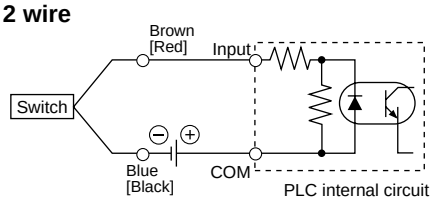
Examples of Connection to PLC

Specification for sink input

3 wire, NPN

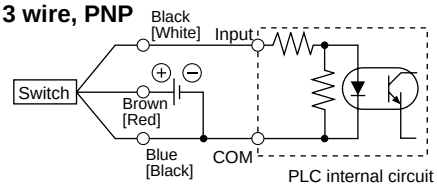


2 wire

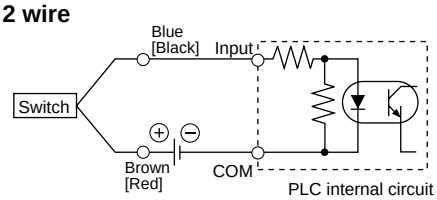


Specification for source input

3 wire, PNP



2 wire

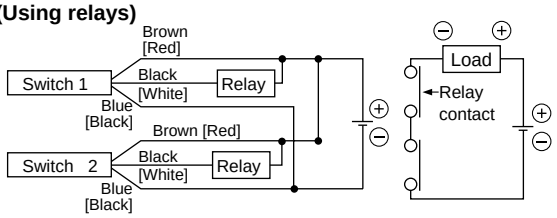


Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

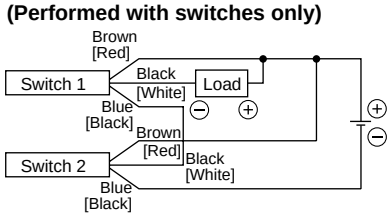
Connection Examples for AND (Series) and OR (Parallel)

3 wire

AND connection for NPN output (Using relays)

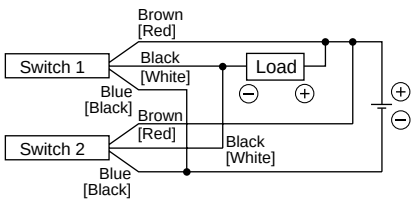


AND connection for NPN output (Performed with switches only)

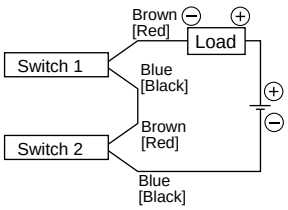


The indicator lights will light up when both switches are turned ON.

OR connection for NPN output



2 wire with 2 switch AND connection



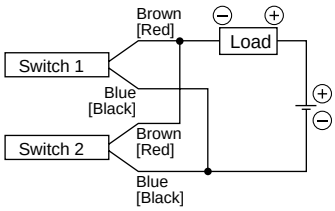
When two switches are connected in series, a load may malfunction because the load voltage will decline when in the ON state.
The indicator lights will light up if both of the switches are in the ON state.

Load voltage at ON = $\frac{\text{Power supply voltage}}{} - \frac{\text{Residual voltage}}{}$ x 2 pcs.

= 24V – 4V x 2 pcs.
= 16V

Example: Power supply is 24VDC
Voltage decline in switch is 4V

2 wire with 2 switch OR connection



<Solid state>
When two switches are connected in parallel, malfunction may occur because the load voltage will increase when in the OFF state.

Load voltage at OFF = $\frac{\text{leakage current}}{}$ x 2 pcs. x $\frac{\text{load impedance}}{}$

= 1mA x 2 pcs. x 3kΩ
= 6V

Example: Load impedance is 3kΩ
Leakage current from switch is 1mA

<Reed switch>
Because there is no current leakage, the load voltage will not increase when turned OFF, but due to the number of switches in the ON state, the indicator lights will sometimes get dark or not light up, because of dispersion and reduction of the current flowing to the switches.

Series MF

Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of **"Caution", "Warning" or "Danger"**. To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

⚠ Caution : Operator error could result in injury or equipment damage.

⚠ Warning : Operator error could result in serious injury or loss of life.

⚠ Danger : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power – Recommendations for the application of equipment to transmission and control systems.

Note 2) JIS B 8370: Pneumatic system axiom.

⚠ Danger

Persons using medical devices such as a pacemaker should stay at least 1 meter away from the product, as magnetism from powerful magnets inside the product may cause the device to malfunction.

⚠ Warning

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

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

2. Only trained personnel should operate pneumatically operated machinery and equipment.

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

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

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is re-started, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back-pressure.)

4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjuction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

Series MF
Actuator Precautions 1
Be sure to read before handling.

Precautions on Design

⚠Warning

1. There is a danger of sudden action by air cylinders if sliding parts of machinery are twisted, etc. and changes in forces occur.

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be designed to avoid such dangers.

2. A protective cover is recommended to minimize the risk of personal injury.

If a stationary object and moving parts of a cylinder are in close proximity, personal injury may occur. Design the structure to avoid contact with the human body.

3. Securely tighten all stationary parts and connected parts so that they will not become loose.

Especially when a cylinder operates with high frequency or a cylinder is installed where there is a lot of vibration, ensure that all parts remain secure.

4. A deceleration circuit or shock absorber, etc., may be required.

When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the impact. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the impact. In this case, the rigidity of the machinery should also be examined.

5. Consider a possible drop in operating pressure due to a power outage, etc.

When a cylinder is used in a clamping mechanism, there is a danger of work dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage, etc. Therefore, safety equipment should be installed to prevent damage to machinery and human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

6. Consider a possible loss of power source.

Measures should be taken to protect against human injury and equipment damage in the event that there is a loss of power to equipment controlled by air pressure, electricity or hydraulics, etc.

7. Design circuitry to prevent sudden lurching of driven objects.

When a cylinder is driven by an exhaust center type directional control valve or when starting up after residual pressure is exhausted from the circuit, etc., the piston and its driven object will lurch at high speed if pressure is applied to one side of the cylinder because of the absence of air pressure inside the cylinder. Therefore, equipment should be selected and circuits designed to prevent sudden lurching because, there is a danger of human injury and/or damage to equipment when this occurs.

Precautions on Design

⚠Warning

8. Consider emergency stops.

Design so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions, a power outage or a manual emergency stop.

9. Consider the action when operation is restarted after an emergency stop or abnormal stop.

Design the machinery so that human injury or equipment damage will not occur upon restart of operation. When the cylinder has to be reset at the starting position, install manual safety equipment.

Selection

⚠Warning

1. Confirm the specifications.

The products advertised in this catalog are designed according to use in industrial compressed air systems. If the products are used in conditions where pressure, temperature, etc., are out of specification, damage and/or malfunction may be caused. Do not use in these conditions. (Refer to specifications.)

Consult SMC if you use a fluid other than compressed air.

2. Intermediate stops.

When intermediate stopping of a cylinder piston is performed with a 3 position closed center type directional control valve, it is difficult to achieve stopping positions as accurate and minute as with hydraulic pressure due to the compressibility of air.

Furthermore, since valves and cylinders, etc. are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Contact SMC in case it is necessary to hold a stopped position for an extended period.

⚠Caution

1. Operate the piston within a range such that collision damage will not occur at the stroke end.

Operate within a range such that damage will not occur when the piston having inertial force stops by striking the cover at the stroke end. Refer to the cylinder model selection procedure for the range within which damage will not occur.

2. Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.

Series MF
Actuator Precautions 2
Be sure to read before handling.

Mounting

⚠Caution

1. Do not use until you verify that the equipment can operate properly.

After mounting, repair or modification, etc., connect the air supply and electric power, and then confirm proper mounting by means of appropriate function and leak inspections.

2. Instruction manual.

The product should be mounted and operated after thoroughly reading the manual and understanding its contents.

Keep the instruction manual where it can be referred to as needed.

Piping

⚠Caution

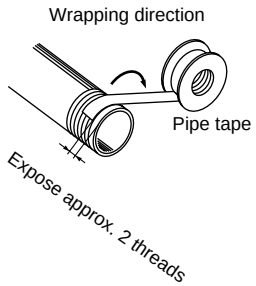
1. Preparation before piping.

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove cutting chips, cutting oil and other debris from inside the pipe.

2. Wrapping of pipe tape.

When screwing together pipes and fittings, etc., be certain that cutting chips from the pipe threads and sealing material do not get inside the piping.

Also, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the pipe.



Lubrication

⚠Caution

1. Lubrication of cylinder.

The cylinder is lubricated at the factory and can be used without any further lubrication.

However, in the event that it will be lubricated, use turbine oil class 1 (with no additives) ISO VG32.

Stopping lubrication later may lead to malfunction due to the loss of the original lubricant. Therefore, lubrication must be continued once it has been started.

Air Supply

⚠Warning

1. Use clean air.

If compressed air includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., it can cause damage or malfunction.

⚠Caution

1. Install air filters.

Install air filters at the upstream side of valves. The filtration degree should be 5μm or less.

2. Install an air dryer, after cooler or Drain Catch , etc.

Air that includes much condensate causes malfunction of valves and other pneumatic equipment. To prevent this, install an air dryer, after cooler or Drain Catch, etc.

3. Use the product within the range of specifications for fluid and ambient temperature.

Take measures to prevent freezing, since moisture in circuits can freeze under 5°C, and this may cause damage to seals and lead to malfunction.

Refer to the "Air Cleaning Equipment" catalog for details on compressed air quality.

Operating Environment

⚠Warning

1. Do not use in environments where there is a danger of corrosion.

Refer to the construction drawings regarding cylinder materials.

Maintenance

⚠Warning

1. Maintenance should be done according to the procedure indicated in the instruction manual.

If handled improperly, malfunction and damage of machinery or equipment may occur.

2. Removal of machinery and supply and exhaust of compressed air.

When machinery is removed, first check measures to prevent dropping of driven objects and run-away of equipment, etc. Then cut off the supply pressure and electric power, and exhaust all compressed air from the system.

When machinery is restarted, proceed carefully after confirming measures to prevent lurching of actuators.

⚠Caution

1. Removal of drainage.

Remove drainage from air filters regularly. (Refer to specifications.)

Series MF
Auto Switch Precautions 1
Be sure to read before handling.

Design & Selection

⚠ Warning

1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications of load current, voltage, temperature or impact.

2. Take precautions when multiple cylinders are used close together.

When multiple auto switch cylinders are used in close proximity, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40mm.

3. Pay attention to the length of time that a switch is ON at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate, but if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

$$V(mm/s) = \frac{\text{Auto switch operating range (mm)}}{\text{Time load applied (ms)}} \times 1000$$

4. Wiring should be kept as short as possible.

<Reed switch>

As the length of the wiring to a load gets longer, the rush current at switching ON becomes greater, and this may shorten the product's life. (The switch will stay ON all the time.)

1) For an auto switch without a contact protection circuit, use a contact protection box when the wire length is 5m or longer.
2) Even if an auto switch has a built-in contact protection circuit, when the wiring is more than 30m long, it is not able to adequately absorb the rush current and its life may be reduced. It is again necessary to connect a contact protection box in order to extend its life. Please contact SMC in this case.

<Solid state switch>

3) Although wire length should not affect switch function, use a wire 100m or shorter.

5. Take precautions for the internal voltage drop of the switch.

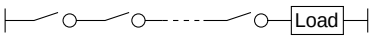
<Reed switch>

1) Switches with an indicator light (Except D-Z76)

- If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diodes. (Refer to internal voltage drop in the auto switch specifications.)

  [The voltage drop will be "n" times larger when "n" auto switches are connected.]

  Even though an auto switch operates normally, the load may not operate.



- Similarly, when operating under a specified voltage, although an auto switch may operate normally, the load may not operate. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Supply voltage} - \text{Internal voltage drop of switch} > \text{Minimum operating voltage of load}$$

2) If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light.

<Solid state switch>

3) Generally, the internal voltage drop will be greater with a 2 wire solid state auto switch than with a reed switch. Take the same precautions as in 1).

   Also, note that a 12VDC relay is not applicable.

6. Pay attention to leakage current.

<Solid state switch>

With a 2 wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the OFF state.

$$\text{Operating current of load (OFF condition)} > \text{Leakage current}$$

If the criteria given in the above formula are not met, it will not reset correctly (stays ON). Use a 3 wire switch if this specification will not be satisfied.

Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

7. Do not use a load that generates surge voltage.

<Reed switch>

If driving a load such as a relay that generates a surge voltage, use a switch with a built-in contact protection circuit or use a contact protection box.

<Solid state switch>

Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load, such as a relay or solenoid, which generates surge is directly driven, use a type of switch with a built-in surge absorbing element.

8. Cautions for use in an interlock circuit.

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch. Also perform periodic maintenance and confirm proper operation.

9. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance and inspections.

Series MF
Auto Switch Precautions 2
Be sure to read before handling.

Mounting & Adjustment

⚠Warning

1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300m/s² or more for reed switches and 1000m/s² or more for solid state switches) while handling.

Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

2. Do not carry a cylinder by the auto switch lead wires.

Never carry a cylinder by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the switch to be damaged by the stress.

3. Mount switches using the proper fastening torque.

When a switch is tightened beyond the range of fastening torque, the mounting screws, mounting bracket or switch may be damaged. On the other hand, tightening below the range of fastening torque may allow the switch to slip out of position. (Refer to page 23 regarding switch mounting, moving, and fastening torque, etc.)

4. Mount a switch at the center of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is ON).

(The mounting position shown in a catalog indicates the optimum position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable.

Wiring

⚠Warning

1. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from applying bending stress or stretching force to the lead wires.

2. Be sure to connect the load before power is applied.

<2 wire type>

If the power is turned ON when an auto switch is not connected to a load, the switch will be instantly damaged because of excess current.

3. Confirm proper insulation of wiring.

Be certain that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a switch.

4. Do not wire with power lines or high voltage lines.

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits including auto switches may malfunction due to noise from these other lines.

5. Do not allow short circuit of loads.

<Reed switch>

If the power is turned ON with a load in a short circuited condition, the switch will be instantly damaged because of excess current flow into the switch.

<Solid state switch>

All models of PNP output type switches do not have built-in short circuit prevention circuits. If loads are short circuited, the switches will be instantly damaged, just as in the case of reed switches.

∗ Take special care to avoid reverse wiring with the power supply line (brown) and the output line (black) on 3 wire type switches.

6. Avoid incorrect wiring.

<Reed switch>

A 24VDC switch with indicator light has polarity. The brown lead wire is (+) and the blue lead wire is (–).

1) If connections are reversed, a switch will operate, however, the light emitting diode will not light up.

Also note that a current greater than that specified will damage a light emitting diode and it will no longer operate.

Applicable models:
D-Z73

<Solid state switch>

1) If connections are reversed on a 2 wire type switch, the switch will not be damaged if protected by a protection circuit, but the switch will always stay in an ON state. However, it is still necessary to avoid reversed connections, since the switch could be damaged by a load short circuit in this condition.

∗ 2) If connections are reversed (power supply line + and power supply line –) on a 3 wire type switch, the switch will be protected by a protection circuit. However, if the power supply line (+) is connected to the blue wire and the power supply line (–) is connected to the black wire, the switch will be damaged.

∗ Lead wire color changes

Lead wire colors of SMC switches and related products have been changed in order to meet NECA (Nippon Electric Control Equipment Industries Association) Standard 0402 for production beginning September, 1996 and thereafter. Please refer to the tables provided.
Special care should be taken regarding wire polarity during the time that the old colors still coexist with the new colors.

2 wire

	Old	New
Output (+)	Red	Brown
Output (–)	Black	Blue

3 wire

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black

Solid state with diagnostic output

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black
Diagnostic output	Yellow	Orange

Solid state with latch type diagnostic output

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black
Latch type diagnostic output	Yellow	Orange

Series MF
Auto Switch Precautions 3
Be sure to read before handling.

Operating Environment

⚠Warning

1. Never use in an atmosphere of explosive gases.

The structure of auto switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

2. Do not use in an area where a magnetic field is generated.

Auto switches will malfunction or magnets inside cylinders will become demagnetized. (Consult SMC regarding the availability of a magnetic field resistant auto switch.)

3. Do not use in an environment where the auto switch will be continually exposed to water.

Although switches, satisfy IEC standard IP67 construction (JIS C 0920: watertight construction), do not use switches in applications where continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

4. Do not use in an environment with oil or chemicals.

Consult SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

5. Do not use in an environment with temperature cycles.

Consult SMC if switches are used where there are temperature cycles other than normal temperature changes, as they may be adversely affected.

6. Do not use in an environment where there is excessive impact shock.

<Reed switch>

When excessive impact (300m/s² or more) is applied to a reed switch during operation, the contact point will malfunction and generate or cut off a signal momentarily (1ms or less). Consult SMC regarding the need to use a solid state switch depending upon the environment.

7. Do not use in an area where surges are generated.

<Solid state switch>

When there are units (solenoid type lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surge in the area around cylinders with solid state auto switches, this may cause deterioration or damage to the switches. Avoid sources of surge generation and disorganized lines.

8. Avoid accumulation of iron powder or close contact with magnetic substances.

When a large amount of ferrous powder such as machining chips or spatter is accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with an auto switch cylinder, it may cause the auto switch to malfunction due to a loss of the magnetic force inside the cylinder.

Maintenance

⚠Warning

1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.

1) Secure and tighten switch mounting screws.

   If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.

2) Confirm that there is no damage to lead wires.

   To prevent faulty insulation, replace switches or repair lead wires, etc., if damage is discovered.

3) Confirm the lighting of the green light on the 2 color indicator type switch.

   Confirm that the green LED is on when stopped at the established position. If the red LED is on, the mounting position is not appropriate. Readjust the mounting position until the green LED lights up.

Other

⚠Warning

1. Consult SMC concerning water resistance, elasticity of lead wires, and usage at welding sites, etc.

Series MF
Specific Product Precautions 1

Be sure to read before handling. Refer to Pages 25 through 30 for safety instructions, actuator precautions and auto switch precautions.

Precautions on Use

⚠ Warning

1. Use caution at the end of the slide table stroke.

Take sufficient care as fingers or hands, etc. may be caught when the cylinder is in operation.

⚠ Caution

1. When piping is performed, be careful that foreign matter such as dust or steel chips does not get inside the cylinder.

When piping is performed, thoroughly flush out parts such as fittings and nylon tubing with clean air, so that dust and steel chips, etc. do not get into the cylinder.

2. When lubrication will be provided, take note of the type of turbine oil.

The product has non-lube specifications, but in the event lubrication will be provided, use class 1 turbine oil (without additives) ISO VG32. However, if lubrication is later stopped, malfunction may result due to loss of the original lubricant. Therefore, be sure to continue lubrication of the product.

3. Be careful not to apply an excessive load to the slide table.

Since the slide table is supported by precision bearings, do not apply strong impacts or excessive moment, etc. when mounting work pieces.

4. Be careful with the alignment when providing an external guide mechanism.

The product can be used with a direct load applied within the allowable range, but careful alignment is necessary for connection with a load having an external guide mechanism. Since variations in shaft alignment will increase as the stroke becomes longer, operate the product using a connection method which can adequately absorb the discrepancies.

5. Perform ordinary intermediate stops with an air circuit.

Perform intermediate stops using an air circuit with a closed center or pressure center. However, since zero air leakage is not guaranteed, intermediate stops may not be possible for extended periods of time. Contact SMC in case this is necessary.

6. Do not operate in the following kinds of environment.

Avoid operation in environments where there will be exposure to cutting chips, dust (paper scraps, thread scraps, etc.) and cutting oil (gas oil, water, warm water). Contact SMC if this type of use is unavoidable.

7. In case the magnetic coupling becomes disconnected, return it at the stroke end.

If the magnetic coupling is disconnected by an external force greater than the magnetic holding force, apply pressure of approximately 0.4MPa to the piston slider, and return it to the proper position at the stroke end.

⚠ Caution

8. Never disassemble the magnet components (the piston slider and external slider).

This can cause a loss of holding force or other malfunction.

9. When mounting a cylinder, it can be secured by using a support bracket.

The cylinder is a direct mount type, but the adjustment range will increase and the cylinder can be mounted with relative ease if the plate on one side is secured by tightening the bolt and the plate on the opposite side is secured with a support bracket. (Refer to page 2.)

10. In case of a long stroke, secure with side supports to prevent deflection.

When used with long strokes, deflection will occur in the body due to the weight of the cylinder and the load. In this case, use with side supports at intermediate positions so that the support intervals shown in the drawing (= *l*) are no more than the values shown on the graph. (Refer to page 36.)

11. Mount the unit (body) on a machined surface or the equivalent.

If the cylinder is mounted to a surface which is not precise, malfunction may be caused by attaching the support brackets and side supports. Therefore, mount the unit on a machined or other equivalent surface. Furthermore, when using long strokes which are subject to vibration or impact, etc., the use of side supports within the graph (page 36) tolerances is recommended.

12. When using R□180 (180° curve) units, secure their mounting in at least 3 locations.

When mounting R□180 (180° curve) units, secure at least 3 intermediate points on the body with side supports.

Specific Product Precautions 2

Be sure to read before handling. Refer to Pages 25 through 30 for safety instructions, actuator precautions and auto switch precautions.

Selection

⚠ Caution

1. Use the combination units in 2 dimensions.

These cylinders can be freely used in vertical or horizontal positions, but use each one in a 2 dimensional plane. Consult with SMC in case of 3 dimensional use.

2. The total load factor varies depending on the operating direction and speed.

In making a selection, the load factor is reviewed with the maximum load weight and maximum allowable moment, etc. indicated below. However, the dynamic load factor based on operating direction and speed should also be considered, and selection made using the total load factor.

The selection calculation is as follows.
In the selection calculation, (a) maximum load weight, (b) static moment and (c) dynamic moment (stopper collision) must be reviewed.
∗ Evaluate (a) and (b) at υa (average speed), and (c) at υ (collision speed $\upsilon=1.4\upsilon a$), find Wmax for (a) from W in the maximum movable load graph, and find Mmax for (b) and (c) from (M_1, M_2, M_3) in the allowable moment graph.
In determining the allowable range, do not allow the total ($\Sigma\alpha n$) of the load factors (αn) for each of the above (a), (b) and (c) to exceed 1.

(1) Formula

$$\text{Sum of load factors } \Sigma\alpha n = \frac{\text{Load weight (m)}}{\text{Max. load weight (m max)}} + \frac{\text{Static moment (M)}^{\text{Note 1)}}}{\text{Allowable static moment (M max)}} + \frac{\text{Dynamic moment (ME)}^{\text{Note 2)}}}{\text{Allowable dynamic moment (ME max)}} \leq 1$$

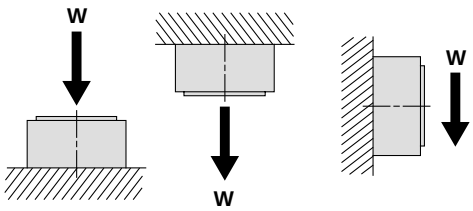
Note 1) Moment generated by the load, etc. when the cylinder is in a stopped condition
Note 2) Moment from the load equivalent to the impact generated at the stroke end (when colliding with the stopper)
Note 3) Multiple moments may be generated depending on the shape of the work pieces, and the load factor is the total of all of these (total $\Sigma\alpha n$).

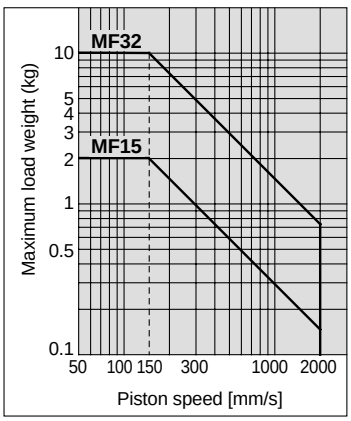
Maximum Load Weight

The relationship of the maximum load weight and piston speed is shown below. Operate at no more than the maximum load weight for the applicable piston speed.

(kg)

Bore size	Max. load weight
ø**15**	2
ø**32**	10





Specific Product Precautions 3

Be sure to read before handling. Refer to Pages 25 through 30 for safety instructions, actuator precautions and auto switch precautions.

Selection

Allowable Moment

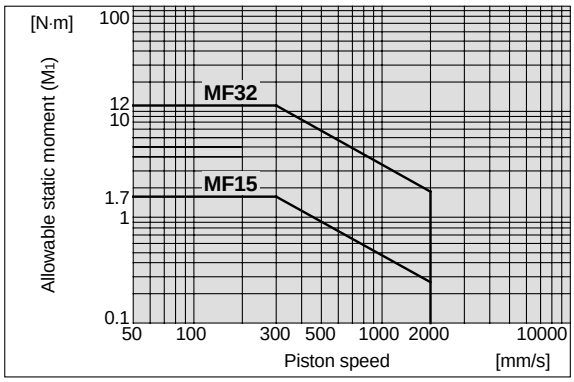
The relationship of the allowable static and dynamic moments to the piston speed is shown below.
Operate at no more than the allowable moment for the applicable piston speed.

(N·m)

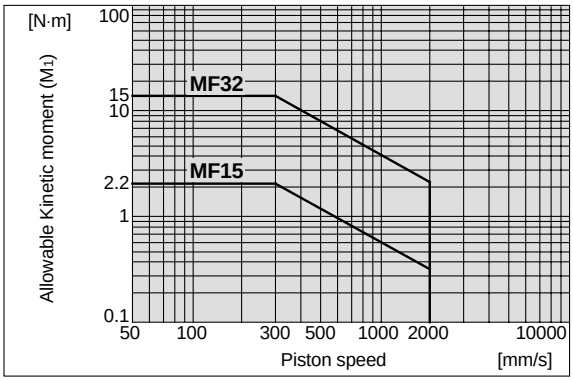
Allowable moment \ Bore size (mm)	M_1		M_2		M_3	
	15	**32**	**15**	**32**	**15**	**32**
Static moment (M max)	1.7	12	1.4	8	2.5	15
Dynamic moment (M_E max)	2.2	15	—	—	3.1	18

Note) Refer to page 34 to confirm the direction of moments M_1, M_2 and M_3.

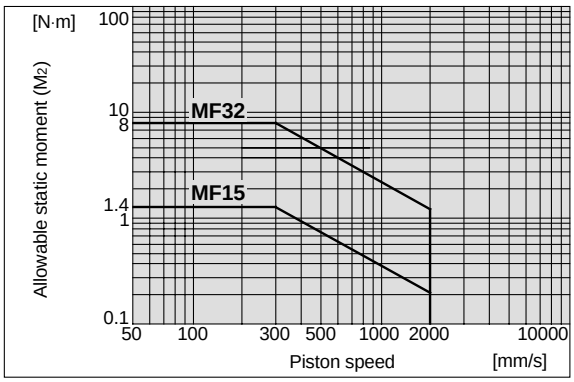
Allowable Static Moment (M_1)



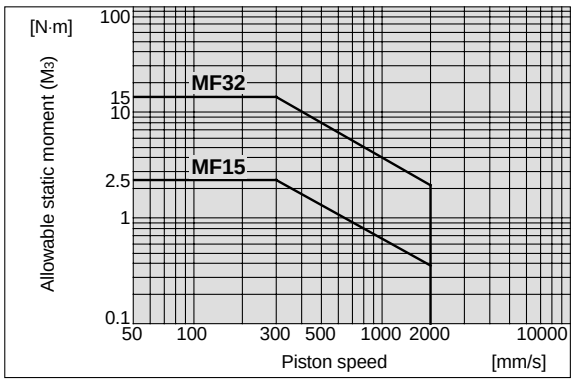
Allowable Kinetic Moment (M_1)



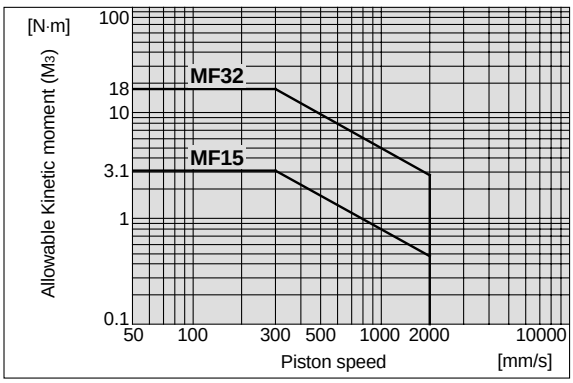
Allowable Static Moment (M_2)



Allowable Static Moment (M_3)



Allowable Kinetic Moment (M_3)



Series MF
Specific Product Precautions 4

Be sure to read before handling. Refer to Pages 25 through 30 for safety instructions, actuator precautions and auto switch precautions.

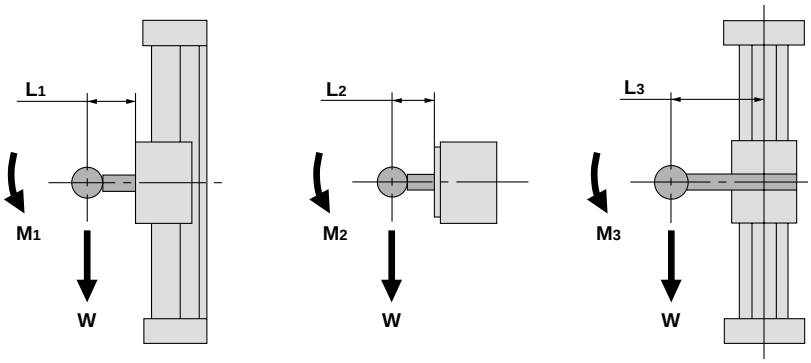
Selection

Static Moment

Moment generated by the weight of a work piece when the cylinder is in a stopped condition

$M_1 = mg \cdot (L_1 + a)$
$M_2 = mg \cdot (L_2 + a)$
$M_3 = mg \cdot L_3$

m : Load weight (kg)
g : Gravitational acceleration (9.8m/s²)
Ln : Offset [m] (n = 1, 2, 3)
a : MF15 = 0.05, MF32 = 0.07 [m]



Dynamic Moment

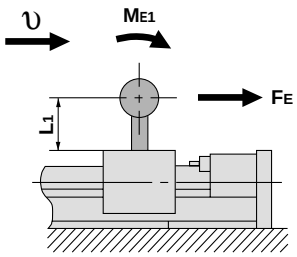
Moment generated by the load equivalent to the impact at the stroke end

$F_E = \delta \cdot m \cdot g \cdot \upsilon$
$\upsilon = 1.4\upsilon a$

m : Load weight (kg)
FE : Load equivalent to impact [N]
δ : Bumper coefficient
With shock absorber = 1/100
L1, L3: Offset [m]
υ : Impact speed [mm/s]
υa : Average speed [mm/s]
g : Gravitational acceleration (9.8m/s²)
a : MF15 = 0.05, MF32 = 0.07 [m]

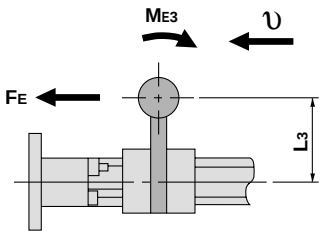
■ **Pitch moment**

$M_{E1} = 1/3F_E \cdot (L_1 + a)$



■ **Yaw moment**

$M_{E3} = 1/3 \cdot F_E \cdot L_3$



Precautions on Use of Cylinder Mounting Frame

⚠ Caution

1. Mount cylinders to a frame having high rigidity.

In case of vertical mounting, cylinders must be mounted to a frame having sufficient rigidity.

Furthermore, do not install cylinders by hanging them with wire, as this will cause deflection of the cylinders when in operation.

2. Install a protective cover (of acrylic, etc.) in the area where the slide table is moving.

There is a danger of causing an unexpected accident if workers enter the area where the slide table is moving.

In addition, particularly in case of vertical mounting, there is a danger of workers being injured or equipment damaged by dropping of a load, and therefore, a protective cover (of acrylic, etc.) should be installed in the area of slide table movement.

3. Do not allow twisting or bending, etc. in the mounting frame.

Since twisting or bending in the mounting frame can cause malfunction, caution is required.

4. When installing cylinders, ensure space for maintenance activities.

Ensure maintenance space to facilitate easy performance of work such as replacement of the slide table unit and internal slider unit, movement of the slide table, replacement of connecting sections and seals, and the application of grease.

Series MF
Specific Product Precautions 5

Be sure to read before handling. Refer to Pages 25 through 30 for safety instructions, actuator precautions and auto switch precautions.

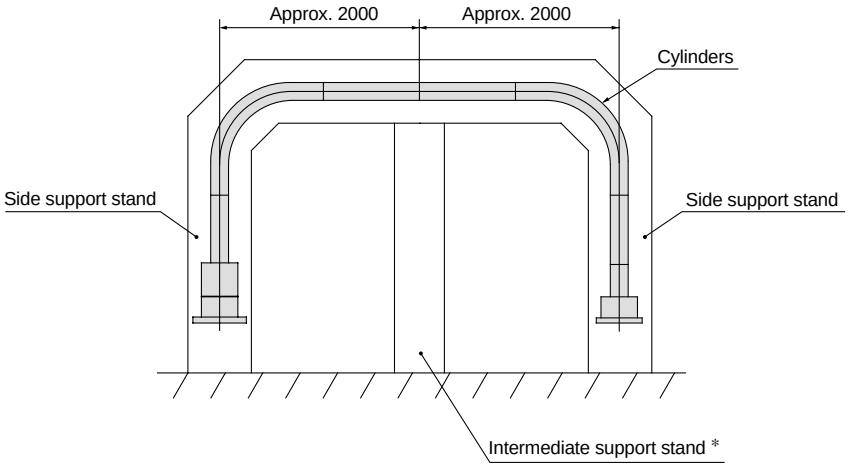
Precautions on Design of Mounting Frame

⚠Caution

1. An installation example for vertical mounting in a gate shaped unit is shown below.

Please refer to the installation example.

∗ Intervals of 2000mm or less are ideal for the intermediate support stands, but if this is impossible due to a passageway, etc., consult with SMC, or be sure to give adequate consideration to the rigidity of the structure.



2. Provide a mechanism which will allow vertical leveling of the mounting frame.

Provide a mechanism (using a leveling bolt, etc.) which will allow vertical leveling of the mounting frame after installation of the cylinders, and secure it with an anchor bolt, etc. after the final adjustments have been made.

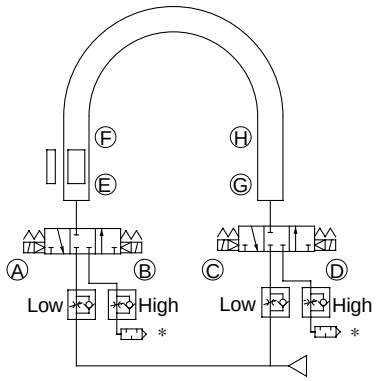
Precautions on Design of a Speed Control Circuit

⚠Caution

1. Provide a deceleration circuit when performing stops in a vertical downward direction.

When performing a stop in a vertical downward direction, provide a deceleration circuit on the vertical downward side, as there is a danger of damaging the slide table due to inertial force. A deceleration circuit is necessary when operating at a piston speed of 500mm/s or more.

2. When a deceleration circuit is provided, thoroughly review the rigidity of the mechanical installation also.



∗ A silencer is required for non-lubricated air, and an exhaust cleaner is required for lubricated air.

Solenoid / Operating state	Ⓐ	Ⓑ	Ⓒ	Ⓓ
Ⓔ→ Ⓗ	OFF	ON	ON	OFF
Ⓗ→ Ⓖ	OFF	ON	OFF	ON
Stops with Ⓖ	OFF	ON	ON	OFF
Ⓖ → Ⓕ	ON	OFF	OFF	ON
Ⓕ → Ⓔ	OFF	ON	OFF	ON
Stops with Ⓔ	ON	OFF	OFF	ON
Emergency stop	OFF	OFF	OFF	OFF

Note 1) Since intermediate stops are performed by the containment of air pressure, precision stops and long term stops, etc. cannot be expected.

Consider it to be an emergency stop only.

Note 2) (E), (F), (G) and (H) indicate sensors.

Series MF
Specific Product Precautions 6

Be sure to read before handling. Refer to Pages 25 through 30 for safety instructions, actuator precautions and auto switch precautions.

Necessary Conditions for a Speed Control Circuit

⚠ Caution

1. After confirming the sum of the load factors in formula (1) as $\Sigma\alpha n \leq 1$, a deceleration circuit will be required when operating with a piston speed of 500mm/s or more in a vertical downward direction. Refer to page 35 regarding deceleration circuits.

Precautions on Use of Side Supports

⚠ Caution

1. Side supports A and B (see page 2) can be used for intermediate stroke support in the MF series.

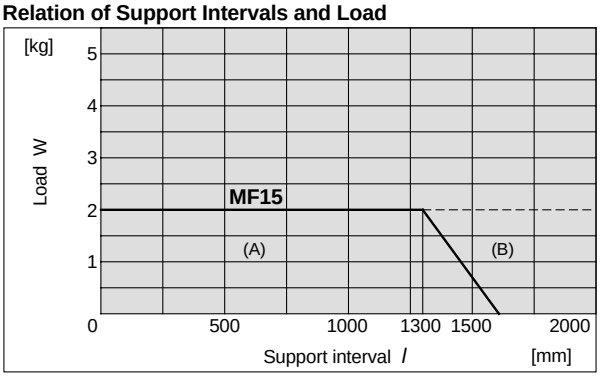
2. When cylinders are subjected to vibration and impact, etc., this can have a large effect on their durability, and therefore, they should be well secured using side supports.

Side Support Mounting Positions

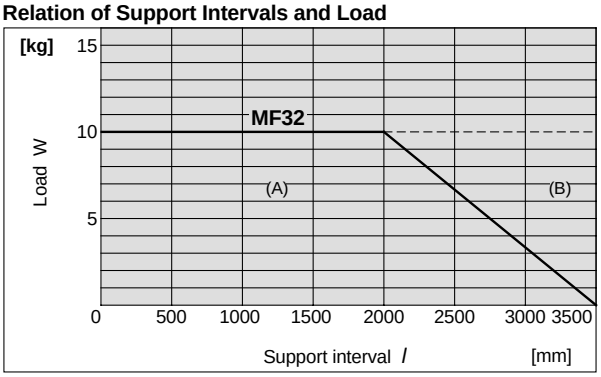
⚠ Caution

1. Refer to the drawing below for side support intervals applicable to long strokes.

Relation of Support Intervals and Load



Relation of Support Intervals and Load



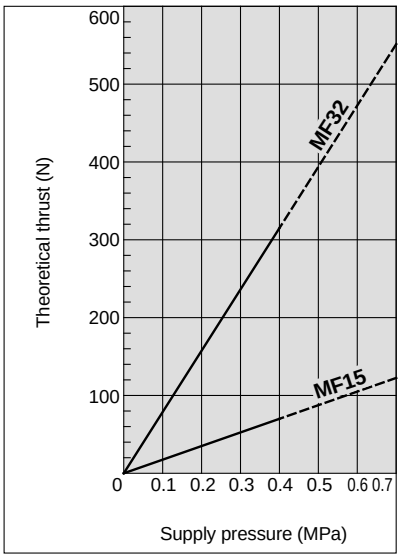
(A): The use of supports in this range is basically unnecessary, but when cylinders are subjected to vibrations or impacts, etc., secure them with side supports.

(B): Since there is a danger of malfunction in this range due to deflection, secure cylinders with side supports at the positions shown in the graph within range (A).

Theoretical Cylinder Thrust

⚠ Caution

When calculating the actual thrust, consider the minimum operating pressure in the design.



Intermediate Stops

1. Intermediate stop of load with an external stopper, etc.

When stopping a load in the middle of a stroke with an external stopper, etc., operate at no more than the operating pressure limit shown in the table below. Use caution, as the magnetic coupling may be broken if used at a pressure exceeding the operating pressure limit.

Bore size (mm)	Model	Operating pressure limit for intermediate stop (Ps)(MPa)
15	MF□15	0.38
32	MF□32	0.38

2. Intermediate stop of load with an air pressure circuit

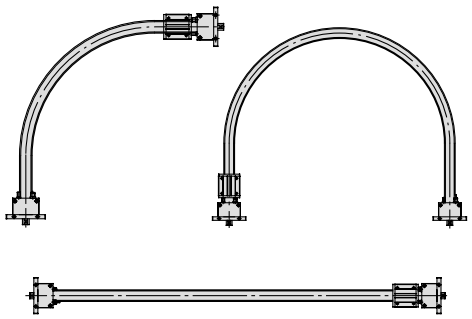
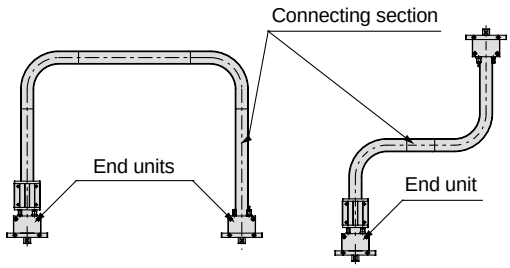
When performing an intermediate stop of a load with an air pressure circuit, operate with a kinetic energy no more than that shown in the table below. Use caution, as the magnetic coupling may be broken if operated at more than the allowed value.

Bore size (mm)	Model	Allowable kinetic energy for intermediate stop (Es)(J)
15	MF□15	0.076
32	MF□32	0.53

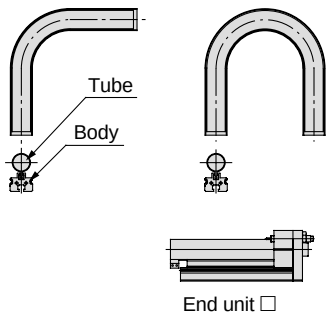
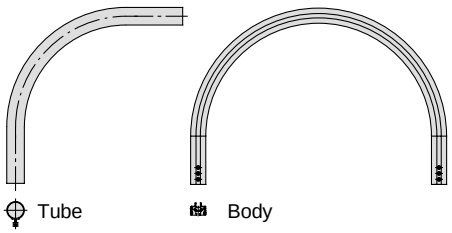
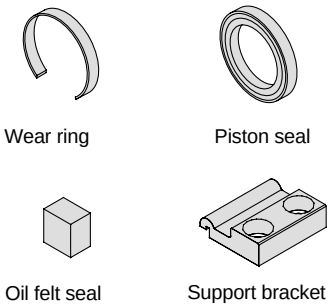
∗ Find the allowable kinetic energy value for intermediate stopping from E: Kinetic energy of load (J) on page 3.

Series MF
Model Selection

Types of Units and Parts

Type of units and parts	Type of units	
Catalog pages	**Single units P.1 to P.9**	**Combination Units P.11 to P.18**
Content	• 2 types are available, curved type and straight type. • Mounting and piping methods are the same as for existing products.	• 2 types of construction are available. 2 dimensional structures are created by combining curved and straight type units, and long strokes are created by combining straight type units only.
Configuration		
Model	**MF** **Bore size** □ **3-dimensional transfer: Single units**	**MFT** **Bore size** □ **3-dimensional transfer: Combination units**

Type of parts

Set parts P.11 to P.14	Parts P.16	Spare parts P. 4, 5 Optional parts P. 2 Connecting parts Note 1)
• Parts for combination units. • These consist of combinations of cylinder tube and body parts, and "combination units" are made by linking these set parts. • Curved units, straight units, maintenance units and end units, etc. are available. • Set parts can also be used as service parts (for unit replacement of cylinder tubes and bodies).	• Service parts. • These are service parts for each of the cylinder tubes and bodies included in the set parts.	**Spare parts** (seal list) … Service parts consisting of various seals and wear rings, etc. **Optional parts** [Support brackets & side supports] … Support brackets for attaching cylinders are available as optional parts. **Connecting parts** … Required for connection of the set parts.
		
MFT [Bore size] [ ] ● **3-dimensional transfer: Connecting units (set parts)**	**MFP** [T / G] [Bore size] [ ] ● **Cylinder tube** ● **Body** ● **3-dimensional transfer: Parts**	■ **Spare parts** **MF** [Bore size] **– PS** ● **3-dimensional transfer: single unit** ● **Spare parts** ■ **Optional parts** **MF-S32 $^{A}_{B}$ (side support)$^{A}_{B}$** **MY-S□ $^{A}_{B}$ (support bracket)$^{A}_{B}$** ■ **Connecting parts** **MFT $^{15}_{32}$-CP** ● **Connecting parts**

Note 1) Since the connecting parts (MFT $^{15}_{32}$–CP) are required for connection of the set parts, order in accordance with the number of connecting sections (unit joints).
Note 2) Connecting parts are also available for the cylinder tube section and body section parts only.

Model
MFPT $^{15}_{32}$– CP (For cylinder tube)
Cylinder tube ● ● Connecting parts

MFPG $^{15}_{32}$– CP (For body)
Body ● ● Connecting parts

▲ Please copy for use without removing. ▲

Issue date: _____

Pneumatic Transfer System

☐ Production Review
☐ Quotation Request
☐ Order Request

Sheet

∗ Refer to page 19 for instructions. Check the applicable item(s) to the right.

Cylinder size: MFT ☐

Company Name		Quantity	Set(s)
Contact		Need by Date	
Equipment Name			

Schematic Diagram

Cautions • Use the combination units with the secondary pressure source. Indicate the air supply unit only on the end unit B side.
• Curved units cannot be directly connected to one another. An MFT☐-SC※ (Straight unit C) is required in between curved units.
• The capability for direct mounting of each unit is presented in a matrix form on page 15 for reference.
• The available stroke range for both straight units A, B, C and MFT 15, 32 is 300 to 2000mm.

Order List

Enter in order starting from End Unit A.

• Enter the cylinder size in the box ☐.
• Enter the stroke and quantity.

No.	Unit name	Unit part no.	Quantity
①	**End Unit A**	**MFT☐-EA-☐**	**1**
②			
③			
④			
⑤			
⑥			
⑦			
⑧			

No.	Unit name	Unit part no.	Quantity
⑨			
⑩			
⑪			
⑫			
⑬			
⑭			
⑮	**Connection parts**Note)	**MFT☐-CP**	
⑯	**End Unit B**	**MFT☐-EB-☐**	**1**

• Enter the required quantities of side supports $\frac{A}{B}$ and support brackets $\frac{A}{B}$ in the order list. (Refer to page 2 regarding part numbers for ordering.)
• Indicate auto switch orders in the last box ☐ for end unit A and end unit B. (Do not order with other units.)
• Indicate air supply units in No.14.
Note) The connection parts in No.15 are required on the connecting section of each unit. Enter the number of connecting sections (unit joints) in No.15 of the order list.

Space below is for SMC use only.

Technical dept. confirmation

No.	Check box
1	

Shipping confirmation (entered by production dept.)

No.	1	2	3	4	5	6	7	8
Check box								

No.	9	10	11	12	13	14	15	16
Check box								

Responsible sales representative entries

Order No.	
Responsible party	
Responsible party Code No.	
Department code	

▲ Please copy for use without removing. ▲

Issue date: _____

Pneumatic Transfer System

☐ Production Review
☐ Quotation Request
☐ Order Request

Sheet

∗ Refer to page 19 for instructions. Check the applicable item(s) to the right.

Cylinder size: MFT ☐

Company Name		Quantity	Set(s)
Contact		Need by Date	
Equipment Name			

Schematic Diagram

Cautions • Use the combination units with the secondary pressure source. Indicate the air supply unit only on the end unit B side.
• Curved units cannot be directly connected to one another. An MFT☐-SC☒ (Straight unit C) is required in between curved units.
• The capability for direct mounting of each unit is presented in a matrix form on page 15 for reference.
• The available stroke range for both straight units A, B, C and MFT 15, 32 is 300 to 2000mm.

Order List

Enter in order starting from End Unit A.

• Enter the cylinder size in the box ☐.
• Enter the stroke and quantity.

No.	Unit name	Unit part no.	Quantity
①	**End Unit A**	**MFT☐-EA-☐**	**1**
②			
③			
④			
⑤			
⑥			
⑦			
⑧			

No.	Unit name	Unit part no.	Quantity
⑨			
⑩			
⑪			
⑫			
⑬			
⑭			
⑮	**Connection parts**[Note)]	**MFT☐-CP**	
⑯	**End Unit B**	**MFT☐-EB-☐**	**1**

• Enter the required quantities of side supports $\frac{A}{B}$ and support brackets $\frac{A}{B}$ in the order list. (Refer to page 2 regarding part numbers for ordering.)
• Indicate auto switch orders in the last box ☐ for end unit A and end unit B. (Do not order with other units.)
• Indicate air supply units in No.14.

Note) The connection parts in No.15 are required on the connecting section of each unit. Enter the number of connecting sections (unit joints) in No.15 of the order list.

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1	

Shipping confirmation (entered by production dept.)

No.	1	2	3	4	5	6	7	8
Check box								

No.	9	10	11	12	13	14	15	16
Check box								

Responsible sales representative entries

Order No.	
Responsible party	
Responsible party Code No.	
Department code	

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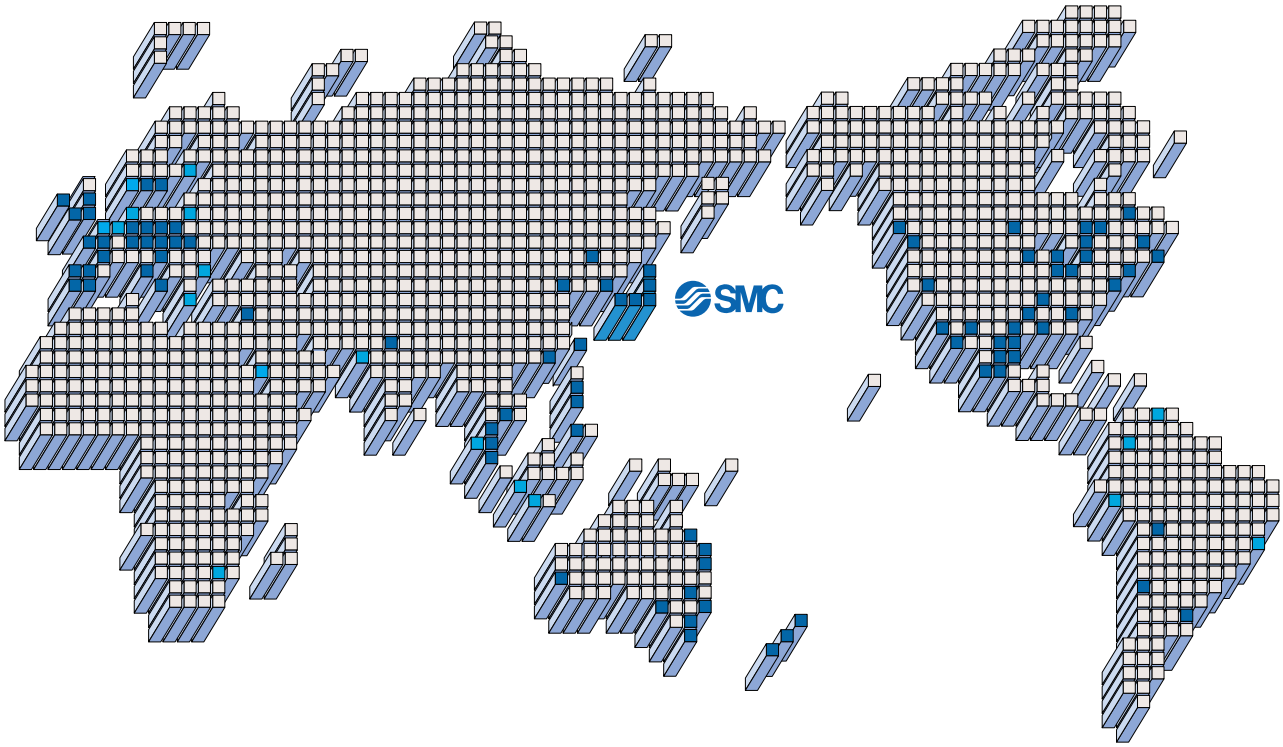

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