

Cylinder with Lock

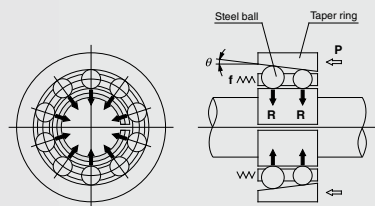
MNB Series

ø32, ø40, ø50, ø63, ø80, ø100

A locking cylinder ideal for intermediate stops, emergency stops and drop prevention.

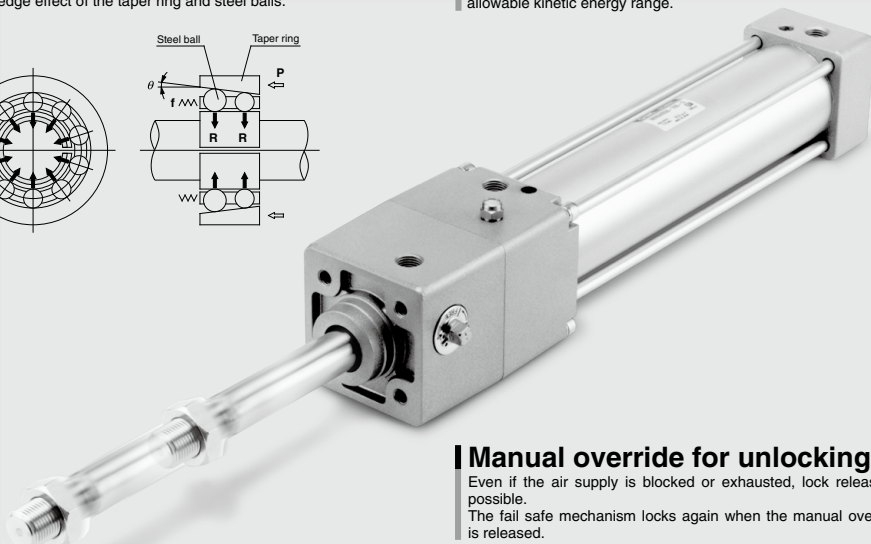
Simple construction

A force magnifying mechanism is employed based on the wedge effect of the taper ring and steel balls.



Maximum piston speed: 1000 mm/s

It can be used at 50 to 1000 mm/s provided that it is within the allowable kinetic energy range.



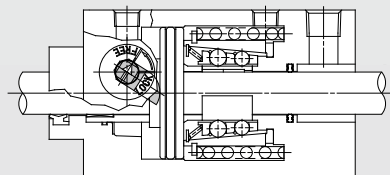
Manual override for unlocking

Even if the air supply is blocked or exhausted, lock release is possible.

The fail safe mechanism locks again when the manual override is released.

High locking efficiency

Greater locking efficiency as well as stable locking and unlocking operation has been achieved by arranging a large number of steel ball bearings in circular rows. (Unlocking pressure of 0.25 MPa 0.05 MPa lower than conventional SMC products) In addition, both alignability and stable locking force with respect to piston rod eccentricity are obtained by allowing the taper ring to float.



High reliability and stable holding force

Outstanding durability and stable holding force are maintained by the use of a brake shoe having superior wear resistance, which has also been substantially lengthened (double the conventional SMC product).

Design minimizes the influences of unlocking air quality

A construction which is strong against moisture and drainage in the compressed air has been realized by separating the locking mechanism and the unlocking chamber.

Can be locked in both directions

An equal holding force can be obtained on either reciprocating stroke of the cylinder.

Series Variations

| Series | Action | Type | Standard variations With rod boot | Bore size (mm) | Lock holding force (N) | Max. stroke (mm) |
|-------------------------------|---------------|------------------------|--------------------------------------|----------------|------------------------|------------------|
| Cylinder with lock MNB series | Double acting | Single rod MNB series | | 32 | 552 | 700 |
| | | | | 40 | 882 | 800 |
| | | Double rod MNBW series | | 50 | 1370 | 1000 |
| | | | | 63 | 2160 | |
| | | | | 80 | 3430 | |
| | | | | 100 | 5390 | 1000 |

MNB Series

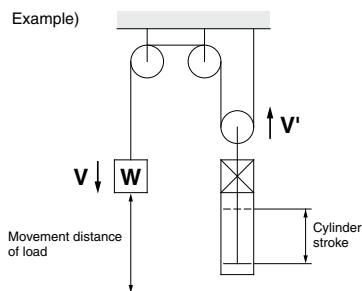
Model Selection

Precautions on Model Selection

⚠ Caution

1. In order that the originally selected maximum speed shall not be exceeded, be certain to use a speed controller to adjust the total movement distance of the load so that movement takes place in no less than the applicable movement time.
The movement time is the time that is necessary for the load to travel the total movement distance from the start without any intermediate stops.
2. In cases where the cylinder stroke and the movement distance of the load are different (double speed mechanism, etc.), use the movement distance of the load for selection purposes.

Example)



3. The following selection example and procedures are based on use at the intermediate stop (including emergency stops during operation). However, when the cylinder is in a locked state, kinetic energy does not act upon it. Under these conditions, use the load mass at the maximum speed (V) of 100 mm/s shown in graphs (5) to (7) on page 889 depending on the operating pressure and select models.

Selection Example

- Load mass : $m = 50 \text{ kg}$
- Movement distance : $st = 500 \text{ mm}$
- Movement time : $t = 2 \text{ s}$
- Load condition : Vertical downward = Load in direction of rod extension
- Operating pressure : $P = 0.4 \text{ MPa}$

Step (1): From graph (1) find the maximum movement speed of the load

∴ Maximum speed $V \approx 350 \text{ mm/s}$.

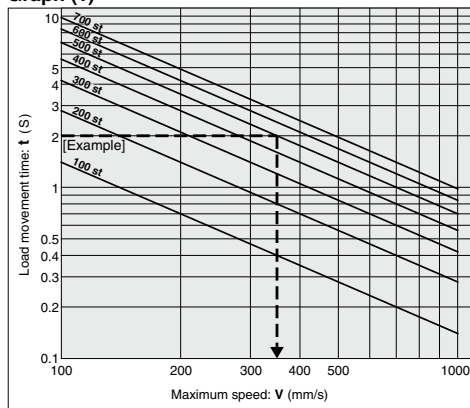
Step (2): Select graph (6) based upon the load conditions and operating pressure, and then from the intersection of the maximum speed $V = 350 \text{ mm/s}$ found in Step (1), and the load mass $m = 50 \text{ kg}$.

∴ $\phi 63 \rightarrow$ select a MNB63 or larger bore size.

Step (1) Find the maximum load speed V.

Find the maximum load speed: V (mm/s) from the load movement time: t (s) and the movement distance: st (mm).

Graph (1)



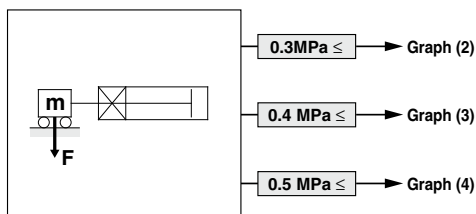
Step (2) Find the bore size.

Select a graph based upon the load condition and operating pressure, and then find the point of intersection for the maximum speed found in Step (1) and the load mass. Select the bore size on the above the point of intersection.

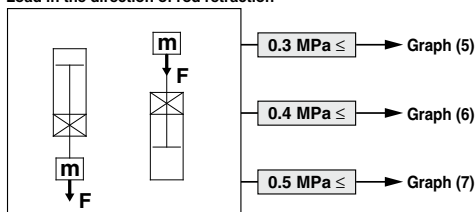
Load Condition

Operating pressure

Load in the direction at the right angle to rod
(* Being held by a guide)



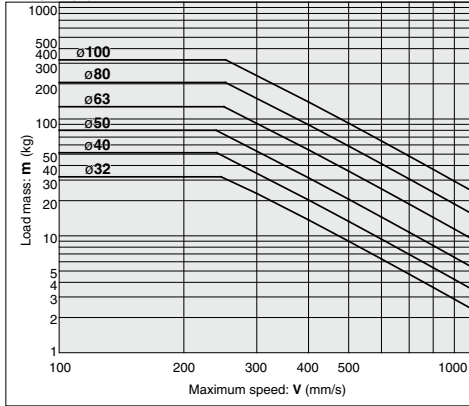
Load in the direction of rod extension
Load in the direction of rod retraction



Selection Graph

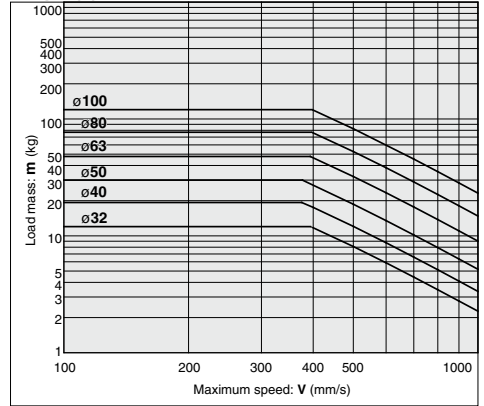
Graph (2)

$0.3 \text{ MPa} \leq P < 0.4 \text{ MPa}$



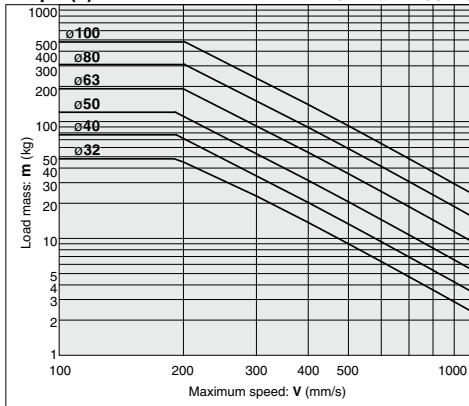
Graph (5)

$0.3 \text{ MPa} \leq P < 0.4 \text{ MPa}$



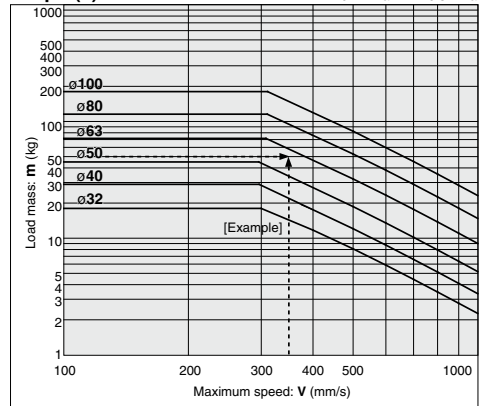
Graph (3)

$0.4 \text{ MPa} \leq P < 0.5 \text{ MPa}$



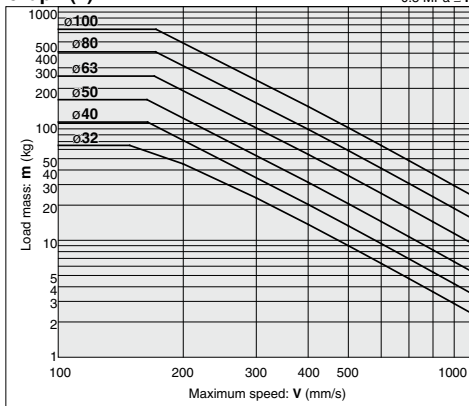
Graph (6)

$0.4 \text{ MPa} \leq P < 0.5 \text{ MPa}$



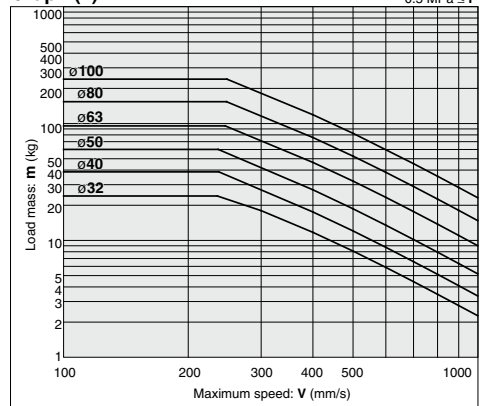
Graph (4)

$0.5 \text{ MPa} \leq P$



Graph (7)

$0.5 \text{ MPa} \leq P$



CLJ2

CLM2

CLG1

CL1

MLGC

CNG

MNB

CNA2

CNS

CLS

CLQ

RLQ

MLU

MLGP

ML1C

D-☐

-X☐

Cylinder with Lock Double Acting, Single Rod **MNB Series** ø32, ø40, ø50, ø63, ø80, ø100

How to Order

MNB **L** **50** **-100** **-D-**

With auto switch **MDNB** **L** **50** **-100** **-D-** **M9BW**

With auto switch
(Built-in magnet)
Mounting type

| | |
|----------|-----------------------|
| B | Basic type |
| L | Axial foot type |
| F | Rod side flange type |
| G | Head side flange type |
| C | Single clevis type |
| D | Double clevis type |

Bore size

| | |
|------------|--------|
| 32 | 32 mm |
| 40 | 40 mm |
| 50 | 50 mm |
| 63 | 63 mm |
| 80 | 80 mm |
| 100 | 100 mm |

Port thread type

| | |
|------------|-----|
| Nil | Rc |
| TN | NPT |
| TF | G |

Cylinder stroke (mm)
Refer to page 891 for the standard stroke.

Locking direction
D Both directions

Auto switch
Nil Without auto switch
* For the applicable auto switch model, refer to the table below.

Number of auto switch

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

Made to Order
Refer to page 891 for details.

With rod boot

| | |
|------------|--------------------------|
| Nil | None |
| J | Nylon tarpaulin |
| K | Heat resistant tarpaulin |

Built-in Magnet Cylinder Model
If a built-in magnet cylinder without an auto switch is required, there is no need to enter the symbol for the auto switch.
(Example) MDNBL40-100-D

Applicable Auto Switches/Refer to pages 1119 to 1245 for further information on auto switches.

| Type | Special function | Electrical entry | Indicator light | Wiring (Output) | Load voltage | | | Auto switch model | | Lead wire length (m) | | | | | Pre-wired connector | Applicable load | | |
|--|--|-------------------------------------|-----------------|-------------------------|--------------------|-----------|-----------|-------------------|--------------------|----------------------|-------|-------|------------|------------|---------------------|-----------------|---|---|
| | | | | | DC | | AC | Tie-rod mounting | Band mounting | 0.5 (Nil) | 1 (M) | 3 (L) | 5 (Z) | | | | | |
| Solid state auto switch | — | Grommet | Yes | 3-wire (NPN) | 24 V | 5 V, 12 V | — | M9N | — | ● | ● | ● | ○ | ○ | IC circuit | Relay, PLC | | |
| | | 3-wire (PNP) | | M9P | | | | — | ● | ● | ● | ○ | ○ | | | | | |
| | | 2-wire | | M9B | | | | — | ● | ● | ● | ○ | ○ | | | | | |
| | | Terminal conduit | | 3-wire (NPN) | 24 V | 5 V, 12 V | — | — | G39 | — | — | — | — | — | — | | | |
| | 2-wire | | | — | | | | K39 | — | — | — | — | | | | | | |
| | Diagnostic indication (2-color indicator) | 3-wire (NPN) | | 24 V | | | | 5 V, 12 V | — | M9NW | — | ● | ● | ● | | | ○ | ○ |
| | | 3-wire (PNP) | | | M9PW | — | ● | | | ● | ● | ○ | ○ | | | | | |
| | | 2-wire | | | M9BW | — | ● | | | ● | ● | ○ | ○ | | | | | |
| | | Water resistant (2-color indicator) | | Grommet | 3-wire (NPN) | 24 V | 5 V, 12 V | — | M9NA ^{*1} | — | ○ | ○ | ○ | ○ | IC circuit | | | |
| | 3-wire (PNP) | | | | M9PA ^{*1} | | | | — | ○ | ○ | ● | ○ | ○ | | | | |
| 2-wire | M9BA ^{*1} | — | ○ | | ○ | | | | ● | ○ | ○ | | | | | | | |
| With diagnostic output (2-color indicator) | Magnetic field resistant (2-color indicator) | 4-wire (NPN) | 24 V | 5 V, 12 V | — | F59F | — | ● | — | ● | ○ | ○ | IC circuit | | | | | |
| 2-wire (Non-polar) | | P3DWA | | | | — | ● | — | ● | ● | ○ | — | | | | | | |
| | | P4DW | | | | — | — | — | ● | ● | ○ | | | | | | | |
| Reed auto switch | — | Grommet | Yes | 3-wire (NPN equivalent) | — | 5 V | — | A96 | — | ● | — | ● | — | IC circuit | Relay, PLC | | | |
| | | | | 2-wire | | | | 24 V | 12 V | 100 V | A93 | — | ● | | | ● | ● | — |
| | | 100 V or less | | | | | | | | A90 | — | ● | — | | | ● | — | |
| | | 100 V, 200 V | | | A54 | — | ● | | | — | ● | — | | | | | | |
| | 200 V or less | A64 | | | — | ● | — | | | ● | — | | | | | | | |
| | Terminal conduit | — | | — | A33 | — | — | — | — | — | — | | | | | | | |
| | | 100 V, 200V | | — | A34 | — | — | — | — | PLC | | | | | | | | |
| | DIN terminal | Grommet | | — | — | — | — | A44 | — | | — | — | — | Relay, PLC | | | | |
| | | | | — | | | | A59W | — | ● | — | ● | — | | | | | |

*1 Water resistant type auto switches can be mounted on the above models, but in such case SMC cannot guarantee water resistance. Consult with SMC regarding water resistant types with the above model numbers.

* Lead wire length symbols: 0.5 m Nil (Example) M9NW
1 m M (Example) M9NWM
3 m L (Example) M9NWL
5 m Z (Example) M9NWX

* Solid state auto switches marked with "○" are produced upon receipt of order.

* Since there are other applicable auto switches than listed, refer to page 911 for details.

* D-A9□/M9□/P3DWA□ auto switches are shipped together (not assembled). (Only auto switch brackets are assembled at the time of shipment for D-A9□ and M9□.)

Cylinder Specifications



| Bore size (mm) | 32 | 40 | 50 | 63 | 80 | 100 |
|--------------------------------------|--|----|----|----|----|-----|
| Lubrication | Not required (Non-lube) | | | | | |
| Fluid | Air | | | | | |
| Proof pressure | 1.5 MPa | | | | | |
| Max. operating pressure | 1.0 MPa | | | | | |
| Min. operating pressure | 0.08 MPa | | | | | |
| Piston speed | 50 to 1000 mm/s* | | | | | |
| Ambient and fluid temperature | Without auto switch: -10 to 70°C (No freezing) With auto switch: -10 to 60°C (No freezing) | | | | | |
| Cushion | Air cushion on both ends | | | | | |
| Stroke length tolerance | Up to 250: $^{+1.0}_0$; 251 to 1000: $^{+1.4}_0$ | | | | | |
| Mounting | Basic type, Axial foot type, Rod side flange type, Head side flange type, Single clevis type, Double clevis type | | | | | |

* Load limits exist depending upon piston speed when locked, mounting direction and operating pressure.



Made to Order Specifications

[Click here for details](#)

| Symbol | Specifications |
|--------|-------------------------|
| -XA□ | Change of rod end shape |
| -XC35 | With coil scraper |

Refer to pages 908 to 911 for cylinders with auto switches.

- Minimum auto switch mounting stroke
- Proper auto switch mounting position (detection at stroke end) and mounting height
- Operating range
- Auto switch mounting bracket: Part no.

Lock Specifications

| Bore size (mm) | 32 | 40 | 50 | 63 | 80 | 100 |
|---|----------------------------------|-----|------|------|------|------|
| Locking action | Spring locking (Exhaust locking) | | | | | |
| Unlocking pressure | 0.25 MPa or more | | | | | |
| Lock starting pressure | 0.20 MPa or less | | | | | |
| Max. operating pressure | 1.0 MPa | | | | | |
| Locking direction | Both directions | | | | | |
| Holding force (maximum static load) N* | 552 | 882 | 1370 | 2160 | 3430 | 5390 |

* The holding force (max. static load) shows the maximum capability and does not show the normal holding capability. So, select an appropriate cylinder while referring to page 888.

For cases with auto switches, refer to the table of minimum strokes for /mounting of auto switches (page 910).

Standard Stroke

| Bore size (mm) | Standard stroke (mm) ⁽¹⁾ | Maximum manufacturable stroke (mm) |
|----------------|--|------------------------------------|
| 32, 40 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500 | ø32 : 700 ø40 : 800 |
| 50, 63 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500, 600 | 1000 |
| 80, 100 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800 | 1000 |

Note 1) Intermediate strokes other than the above are produced upon receipt of order. Spacers are not used for intermediate strokes.

Note 2) When exceeding the stroke range for each bracket, determine the maximum strokes referring to the Selection Table (Best Pneumatics No. 2-1).

Stopping Accuracy

| Lock type | Piston speed (mm/s) | | | |
|----------------|---------------------|------|------|------|
| | 100 | 300 | 500 | 1000 |
| Spring locking | ±0.3 | ±0.6 | ±1.0 | ±2.0 |

Condition: Lateral, Supply pressure P = 0.5 MPa

Load mass Upper limit of allowed value

Solenoid valve for locking mounted on the unlocking port

Maximum value of stopping position dispersion from 100 measurements

CLJ2

CLM2

CLG1

CL1

MLGC

CNG

MNB

CNA2

CNS

CLS

CLQ

RLQ

MLU

MLGP

ML1C

D-□

-X□

MNB Series

Mounting Bracket Part No.

| Bore size (mm) | 32 | 40 | 50 | 63 | 80 | 100 |
|---------------------|----------|----------|----------|----------|--------|--------|
| Foot ⁽¹⁾ | MB-L03 | MB-L04 | MB-L05 | MNB-L06* | MB-L08 | MB-L10 |
| Flange | MNB-F03* | MNB-F04* | MNB-F05* | MNB-F06* | MB-F08 | MB-F10 |
| Single clevis | MB-C03 | MB-C04 | MB-C05 | MB-C06 | MB-C08 | MB-C10 |
| Double clevis | MB-D03 | MB-D04 | MB-D05 | MB-D06 | MB-D08 | MB-D10 |

Note 1) When ordering foot bracket, order 2 pieces per cylinder.

Note 2) Accessories for each mounting bracket are as follows.

Foot, Flange, Single clevis: Body mounting bolts

Double clevis: Clevis pin, Cotter pin, Flat washer, Body mounting bolts

Note 3) All are common to the MB series air cylinders, except the sections marked with a "*".

Rod Boot Material

| Symbol | Rod boot material | Max. ambient temperature |
|----------|--------------------------|--------------------------|
| J | Nylon tarpaulin | 20°C |
| K | Heat resistant tarpaulin | 110°C * |

* Maximum ambient temperature for the rod boot itself.

Accessory

| Mounting | | Basic type | Foot type | Rod side flange type | Head side flange type | Single clevis type | Double clevis type |
|--------------------|---------------------------------|------------|-----------|----------------------|-----------------------|--------------------|--------------------|
| Standard equipment | Rod end nut | ● | ● | ● | ● | ● | ● |
| | Clevis pin | — | — | — | — | — | ● |
| Option | Single knuckle joint | ● | ● | ● | ● | ● | ● |
| | Double knuckle joint (With pin) | ● | ● | ● | ● | ● | ● |
| | With rod boot | ● | ● | ● | ● | ● | ● |

Single Rod Weight/Aluminum Tube

| Bore size (mm) | | 32 | 40 | 50 | 63 | 80 | 100 |
|--|---------------------------|------|------|------|------|------|-------|
| Basic weight | Basic type | 1.20 | 1.72 | 2.76 | 4.06 | 6.85 | 10.26 |
| | Foot type | 1.30 | 1.84 | 2.94 | 4.32 | 7.28 | 10.85 |
| | Flange type | 1.44 | 2.04 | 3.29 | 4.80 | 8.30 | 12.09 |
| | Single clevis type | 1.45 | 1.98 | 3.10 | 4.69 | 7.96 | 11.84 |
| | Double clevis type | 1.46 | 1.99 | 3.19 | 4.85 | 8.25 | 12.11 |
| Additional weight per each 50 mm of stroke | | | | | | | |
| Accessory | All mounting brackets | 0.11 | 0.16 | 0.26 | 0.27 | 0.42 | 0.56 |
| | Single knuckle | 0.15 | 0.23 | 0.26 | 0.26 | 0.60 | 0.83 |
| | Double knuckle (with pin) | 0.22 | 0.37 | 0.43 | 0.43 | 0.87 | 1.27 |

Calculation:

(Example) **MNBB32-100-D** (Basic type, ø32, 100 st)

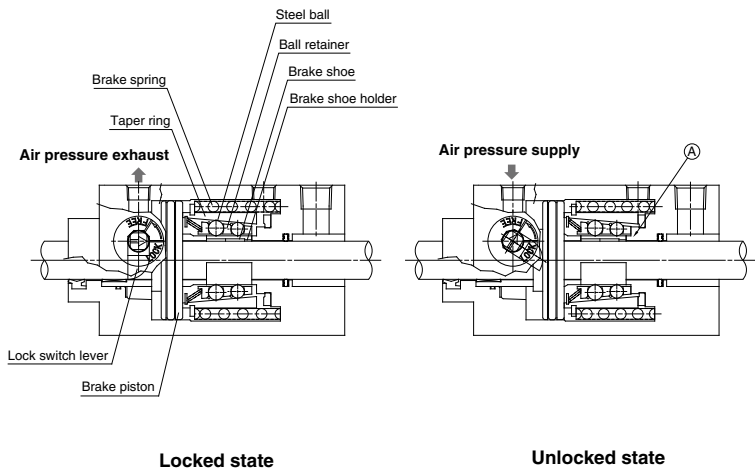
• Basic weight.....1.20 (Basic type, ø32)

• Additional weight 0.11/50 stroke

• Cylinder stroke 100 stroke

1.20 + 0.11 x 100/50 = 1.42 kg

Construction Principle



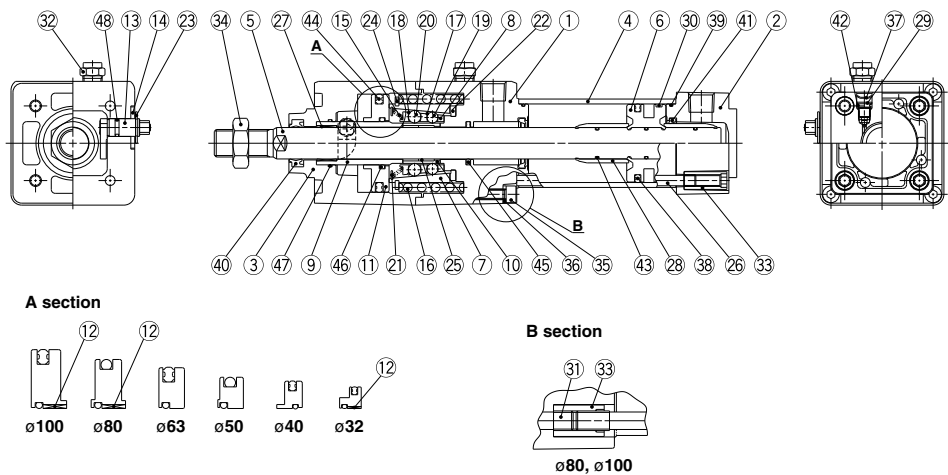
Spring locking (Exhaust locking)

The spring force which acts upon the taper ring is magnified by a wedge effect, and is conveyed to all of the numerous steel balls which are arranged in two circles. These act on the brake shoe holder and brake, which locks the piston rod by tightening against it with a large force. Unlocking is accomplished when air pressure is supplied to the unlocking port. The brake piston and taper ring oppose the spring force, moving to the right side, and the ball retainer strikes the cover section A. The braking force is released as the steel balls are removed from the taper ring by the ball retainer.

| |
|------------|
| CLJ2 |
| CLM2 |
| CLG1 |
| CL1 |
| MLGC |
| CNG |
| MNB |
| CNA2 |
| CNS |
| CLS |
| CLQ |
| RLQ |
| MLU |
| MLGP |
| ML1C |

| |
|-----|
| D-□ |
| -X□ |

Construction



Component Parts

| No. | Description | Material | Note |
|-----|---|---------------------------|------------------------------------|
| ① | Rod cover | Aluminum alloy | Hard anodized and metallic painted |
| ② | Head cover | Aluminum die-casted | Chromated and metallic painted |
| ③ | Cover | Aluminum alloy | Hard anodized and metallic painted |
| ④ | Cylinder tube | Aluminum alloy | Hard anodized |
| ⑤ | Piston rod | Carbon steel | Hard chrome plated |
| ⑥ | Piston | Aluminum alloy | Chromated |
| ⑦ | Taper ring | Carbon steel | Heat treated |
| ⑧ | Ball retainer | Special resin | |
| ⑨ | Piston guide | Carbon steel | Zinc chromated |
| ⑩ | Brake shoe holder | Special steel | Heat treated |
| ⑪ | Release piston | Aluminum alloy | Chromated |
| | ø32, ø80, ø100 | | Hard anodized |
| ⑫ | Release piston bushing | Steel + Special resin | ø32, ø80, ø100 only |
| ⑬ | Unlocking cam | Chromium molybdenum steel | Glossy chromated |
| ⑭ | Washer | Carbon steel | Colorless zinc chromated |
| ⑮ | Retainer pre-load spring | Steel wire | Zinc chromated |
| | ø32 | | |
| | ø40 to ø100 | Stainless steel wire | |
| ⑯ | Brake spring | Steel wire | Zinc chromated |
| ⑰ | Clip A | Stainless steel | |
| ⑱ | Clip B | Stainless steel | |
| ⑲ | Steel ball A | Carbon steel | |
| ⑳ | Steel ball B | Carbon steel | |
| ㉑ | Tooth ring | Stainless steel | |
| ㉒ | Bumper | Polyurethane rubber | |
| ㉓ | Type C retaining ring for unlocking cam shaft | Carbon steel | |
| ㉔ | Type C retaining ring for taper ring | Carbon steel | |
| ㉕ | Brake shoe | Babbitt | |
| ㉖ | Tie-rod | Carbon steel | Zinc chromated |
| ㉗ | Bushing | Bearing alloy | |
| ㉘ | Cushion ring | Aluminum alloy | Anodized |

Component Parts

| No. | Description | Material | Note |
|-----|--|---------------------------|--------------------------|
| ㉙ | Cushion valve | Steel wire | |
| ㉚ | Wear ring | Resin | |
| ㉛ | Unit holding tie-rod | Carbon steel | Chromated ø80, ø100 only |
| ㉜ | BC element | | |
| ㉝ | Tie-rod nut | Carbon steel | |
| ㉞ | Rod end nut | Carbon steel | |
| ㉟ | Hexagon socket head cap screw | Chromium molybdenum steel | ø32 to ø63 |
| ㊱ | Spring washer for hex. socket head cap screw | Steel wire | ø32 to ø63 |
| ㊲ | Retaining ring | Spring steel | |
| ㊳ | Piston seal | NBR | |
| ㊴ | Cylinder tube gasket | NBR | |
| ㊵ | Rod seal A | NBR | |
| ㊶ | Cushion seal | NBR | |
| ㊷ | Rod seal B | NBR | |
| ㊸ | Release piston gasket | NBR | |
| ㊹ | Piston guide gasket | NBR | |
| ㊺ | Unlocking cam gasket | NBR | |

Replacement Parts: Seal Kit

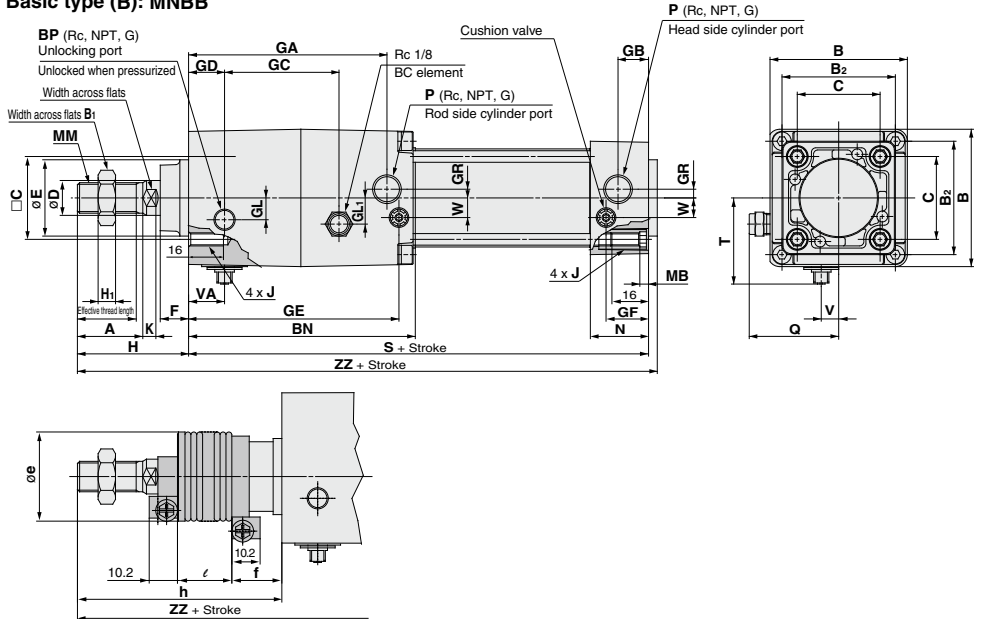
| Bore size (mm) | Kit no. | Contents |
|----------------|-------------|------------------------------|
| 32 | MB32Z-PS | A set of ㉙, ㉚, ㉛ and ㉜ above |
| 40 | MB1-40Z-PS | |
| 50 | MB1-50Z-PS | |
| 63 | MB1-63Z-PS | |
| 80 | MB1-80Z-PS | |
| 100 | MB1-100Z-PS | |

* Since the lock section for the MNB series is normally replaced as a unit, kits are for the cylinder section only. These can be ordered using the order number for each bore size.

* Seal kit includes a grease pack (ø32 to ø50: 10 g, ø63 and ø80: 20 g, ø100: 30 g). Order with the following part number when only the grease pack is needed.
Grease pack part number: GR-S-010 (10 g), GR-S-020 (20 g)

Dimensions

Basic type (B): MNBB



With rod boot

| Bore size (mm) | Stroke range (mm) | Effective thread length (mm) | Width across flats | A | B | B ₁ | H ₁ | B ₂ | BN | BP | C | D | Ee ₁₁ | F | GA | GB | GC | GD | GL | GL ₁ |
|----------------|-------------------|------------------------------|--------------------|----|-----|----------------|----------------|----------------|-------|-----|------|----|------------------|----|-------|------|------|------|------|-----------------|
| 32 | Up to 500 | 19.5 | 10 | 22 | 54 | 17 | 6 | 46 | 97 | 1/8 | 32.5 | 12 | 30 | 13 | 83 | 13 | 45.5 | 13 | 8.5 | 12 |
| 40 | Up to 500 | 27 | 14 | 30 | 63 | 22 | 8 | 52 | 104 | 1/8 | 38 | 16 | 35 | 13 | 91 | 14 | 52.5 | 16.5 | 10 | 12 |
| 50 | Up to 600 | 32 | 18 | 35 | 75 | 27 | 11 | 65 | 120.5 | 1/4 | 46.5 | 20 | 40 | 14 | 104.5 | 15.5 | 58.5 | 19 | 12.5 | 15 |
| 63 | Up to 600 | 32 | 18 | 35 | 90 | 27 | 11 | 75 | 134.5 | 1/4 | 56.5 | 20 | 45 | 14 | 119.5 | 16.5 | 68 | 23 | 17.5 | 12 |
| 80 | Up to 800 | 37 | 22 | 40 | 102 | 32 | 13 | 95 | 169 | 1/4 | 72 | 25 | 45 | 20 | 150 | 19 | 81 | 33 | 22 | 18 |
| 100 | Up to 800 | 37 | 26 | 40 | 116 | 41 | 16 | 114 | 189 | 1/4 | 89 | 30 | 55 | 20 | 170 | 19 | 96 | 37.5 | 25 | 20 |

| Bore size (mm) | GR | GE | GF | J | MB | K | MM | N | P | Q | H | S | T | V | VA | W | ZZ |
|----------------|------|-------|------|-----------|----|----|------------|------|-----|------|----|-----|------|------|------|------|-----|
| 32 | 4 | 88.5 | 18.3 | M6 x 1.0 | 4 | 6 | M10 x 1.25 | 27 | 1/8 | 37 | 47 | 154 | 34 | 6.5 | 13 | 6.5 | 205 |
| 40 | 4 | 96.5 | 19.5 | M6 x 1.0 | 4 | 6 | M14 x 1.5 | 27 | 1/4 | 41.5 | 51 | 161 | 39.5 | 8 | 16.5 | 9 | 216 |
| 50 | 5 | 111.2 | 22.4 | M8 x 1.25 | 5 | 7 | M18 x 1.5 | 31.5 | 1/4 | 47.5 | 58 | 183 | 47 | 9 | 20 | 10.5 | 245 |
| 63 | 9 | 123.5 | 20.7 | M8 x 1.25 | 5 | 7 | M18 x 1.5 | 31.5 | 3/8 | 55 | 58 | 197 | 55.5 | 8.5 | 23 | 12 | 259 |
| 80 | 11.5 | 157 | 26 | M10 x 1.5 | 5 | 10 | M22 x 1.5 | 38 | 3/8 | 61 | 72 | 245 | 61.5 | 10.5 | 33 | 14 | 321 |
| 100 | 17 | 177 | 26 | M10 x 1.5 | 5 | 10 | M26 x 1.5 | 38 | 1/2 | 68 | 72 | 265 | 69.5 | 10.5 | 37.5 | 15 | 341 |

With Rod Boot

| Bore size (mm) | e | f | 1 to 50 | 51 to 100 | 101 to 150 | 151 to 200 | 201 to 300 | 301 to 400 | 401 to 500 | 501 to 600 | 601 to 700 | 701 to 800 | 1 to 50 | 51 to 100 | 101 to 150 | 151 to 200 | 201 to 300 | 301 to 400 | 401 to 500 | 501 to 600 | 601 to 700 | 701 to 800 |
|----------------|----|----|---------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|---------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|
| 32 | 36 | 23 | 12.5 | 25 | 37.5 | 50 | 75 | 100 | 125 | — | — | — | 73 | 86 | 98 | 111 | 136 | 161 | 186 | — | — | — |
| 40 | 41 | 23 | 12.5 | 25 | 37.5 | 50 | 75 | 100 | 125 | — | — | — | 81 | 94 | 106 | 119 | 144 | 169 | 194 | — | — | — |
| 50 | 51 | 25 | 12.5 | 25 | 37.5 | 50 | 75 | 100 | 125 | 150 | — | — | 89 | 102 | 114 | 127 | 152 | 177 | 202 | 227 | — | — |
| 63 | 51 | 25 | 12.5 | 25 | 37.5 | 50 | 75 | 100 | 125 | 150 | — | — | 89 | 102 | 114 | 127 | 152 | 177 | 202 | 227 | — | — |
| 80 | 56 | 29 | 12.5 | 25 | 37.5 | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 101 | 114 | 126 | 139 | 164 | 189 | 214 | 239 | 264 | 289 |
| 100 | 61 | 29 | 12.5 | 25 | 37.5 | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 101 | 114 | 126 | 139 | 164 | 189 | 214 | 239 | 264 | 289 |

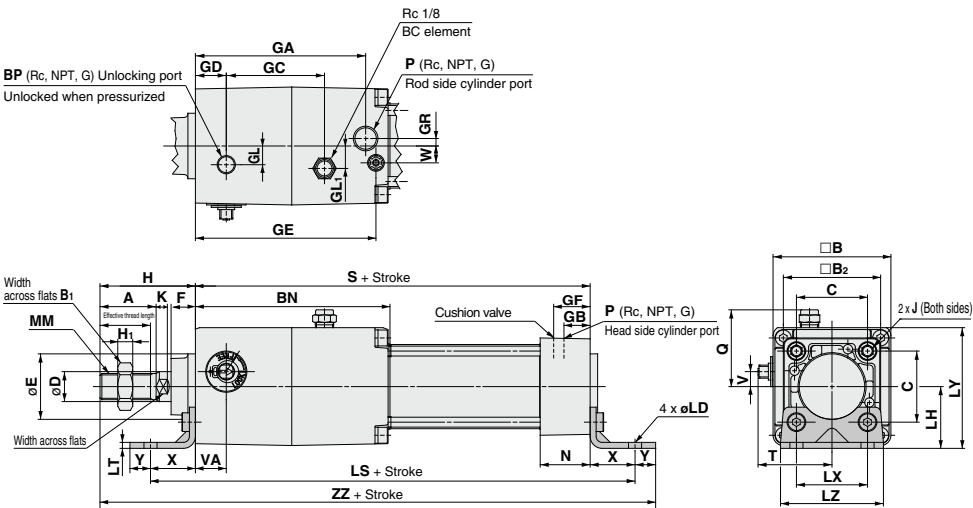
| Bore size (mm) | ZZ |
|----------------|---|
| 32 | 231 244 256 269 294 319 344 — — — |
| 40 | 246 259 271 284 309 334 359 — — — |
| 50 | 276 289 301 314 339 364 389 414 — — — |
| 63 | 290 303 315 328 353 378 403 428 — — — |
| 80 | 350 363 375 388 413 438 463 488 513 538 |
| 100 | 370 383 395 408 433 458 483 508 533 558 |

CLJ2
CLM2
CLG1
CL1
MLGC
CNG
MNB
CNA2
CNS
CLS
CLQ
RLQ
MLU
MLGP
ML1C

D-□
-X□

Dimensions

Axial foot type (L): MNBL

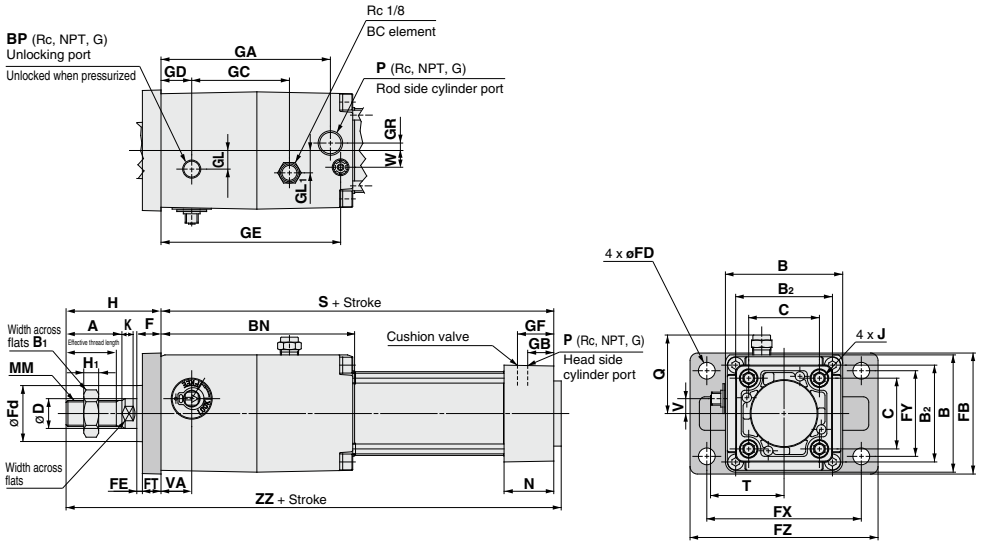


| (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|----------------|-------------------|------------------------------|--------------------|----|-----|----------------|----------------|----------------|-------|-----|------|----|------------------|----|-------|------|------|------|------|-----------------|------|-------|------|
| Bore size (mm) | Stroke range (mm) | Effective thread length (mm) | Width across flats | A | B | B ₁ | H ₁ | B ₂ | BN | BP | C | D | Ee ₁₁ | F | GA | GB | GC | GD | GL | GL ₁ | GR | GE | GF |
| 32 | Up to 700 | 19.5 | 10 | 22 | 54 | 17 | 6 | 46 | 97 | 1/8 | 32.5 | 12 | 30 | 13 | 83 | 13 | 45.5 | 13 | 8.5 | 12 | 4 | 88.5 | 18.3 |
| 40 | Up to 800 | 27 | 14 | 30 | 63 | 22 | 8 | 52 | 104 | 1/8 | 38 | 16 | 35 | 13 | 91 | 14 | 52.5 | 16.5 | 10 | 12 | 4 | 96.5 | 19.5 |
| 50 | Up to 1000 | 32 | 18 | 35 | 75 | 27 | 11 | 65 | 120.5 | 1/4 | 46.5 | 20 | 40 | 14 | 104.5 | 15.5 | 58.5 | 19 | 12.5 | 15 | 5 | 111.2 | 22.4 |
| 63 | Up to 1000 | 32 | 18 | 35 | 90 | 27 | 11 | 75 | 134.5 | 1/4 | 56.5 | 20 | 45 | 14 | 119.5 | 16.5 | 68 | 23 | 17.5 | 12 | 9 | 123.5 | 20.7 |
| 80 | Up to 1000 | 37 | 22 | 40 | 102 | 32 | 13 | 95 | 169 | 1/4 | 72 | 25 | 45 | 20 | 150 | 19 | 81 | 33 | 22 | 18 | 11.5 | 157 | 26 |
| 100 | Up to 1000 | 37 | 26 | 40 | 116 | 41 | 16 | 114 | 189 | 1/4 | 89 | 30 | 55 | 20 | 170 | 19 | 96 | 37.5 | 25 | 20 | 17 | 177 | 26 |

| Bore size (mm) | J | LD | LH | LS | LT | LX | LY | LZ | K | MM | N | P | Q | H | S | T | V | VA | W | X | Y | ZZ |
|----------------|-----------|----|----|-----|-----|----|------|-----|----|------------|------|-----|------|----|-----|------|------|------|------|----|----|-----|
| 32 | M6 x 1.0 | 7 | 30 | 198 | 3.2 | 32 | 57 | 50 | 6 | M10 x 1.25 | 27 | 1/8 | 37 | 47 | 154 | 34 | 6.5 | 13 | 6.5 | 22 | 9 | 232 |
| 40 | M6 x 1.0 | 9 | 33 | 209 | 3.2 | 38 | 64.5 | 55 | 6 | M14 x 1.5 | 27 | 1/4 | 41.5 | 51 | 161 | 39.5 | 8 | 16.5 | 9 | 24 | 11 | 247 |
| 50 | M8 x 1.25 | 9 | 40 | 237 | 3.2 | 46 | 77.5 | 70 | 7 | M18 x 1.5 | 31.5 | 1/4 | 47.5 | 58 | 183 | 47 | 9 | 20 | 10.5 | 27 | 11 | 279 |
| 63 | M8 x 1.25 | 12 | 48 | 251 | 3.6 | 56 | 93 | 80 | 7 | M18 x 1.5 | 31.5 | 3/8 | 55 | 58 | 197 | 55.5 | 8.5 | 23 | 12 | 27 | 14 | 296 |
| 80 | M10 x 1.5 | 12 | 55 | 305 | 4.5 | 72 | 106 | 100 | 10 | M22 x 1.5 | 38 | 3/8 | 61 | 72 | 245 | 61.5 | 10.5 | 33 | 14 | 30 | 14 | 361 |
| 100 | M10 x 1.5 | 14 | 65 | 329 | 4.5 | 89 | 123 | 120 | 10 | M26 x 1.5 | 38 | 1/2 | 68 | 72 | 265 | 69.5 | 10.5 | 37.5 | 15 | 32 | 16 | 385 |

* Refer to page 895 for cylinders with a rod boot.

Rod side flange type (F): MNB



| Bore size (mm) | Stroke range (mm) | Effective thread length (mm) | Width across flats | A | FB | B | B ₁ | H ₁ | B ₂ | BN | BP | C | D | F | Fd | FD | FE | FT | FX | FY | FZ | GA | GB |
|----------------|-------------------|------------------------------|--------------------|----|-----|-----|----------------|----------------|----------------|-------|-----|------|----|----|------|----|----|----|-----|----|-----|-------|------|
| 32 | Up to 700 | 19.5 | 10 | 22 | 56 | 54 | 17 | 6 | 46 | 97 | 1/8 | 32.5 | 12 | 13 | 25 | 7 | 3 | 10 | 72 | 38 | 87 | 83 | 13 |
| 40 | Up to 800 | 27 | 14 | 30 | 65 | 63 | 22 | 8 | 52 | 104 | 1/8 | 38 | 16 | 13 | 31 | 9 | 3 | 10 | 83 | 46 | 101 | 91 | 14 |
| 50 | Up to 1000 | 32 | 18 | 35 | 77 | 75 | 27 | 11 | 65 | 120.5 | 1/4 | 46.5 | 20 | 14 | 38.5 | 9 | 2 | 12 | 100 | 52 | 120 | 104.5 | 15.5 |
| 63 | Up to 1000 | 32 | 18 | 35 | 92 | 90 | 27 | 11 | 75 | 134.5 | 1/4 | 56.5 | 20 | 14 | 39.5 | 9 | 2 | 12 | 115 | 62 | 135 | 119.5 | 16.5 |
| 80 | Up to 1000 | 37 | 22 | 40 | 100 | 102 | 32 | 13 | 95 | 169 | 1/4 | 72 | 25 | 20 | 45.5 | 12 | 4 | 16 | 126 | 63 | 153 | 150 | 19 |
| 100 | Up to 1000 | 37 | 26 | 40 | 120 | 116 | 41 | 16 | 114 | 189 | 1/4 | 89 | 30 | 20 | 54 | 14 | 4 | 16 | 150 | 75 | 178 | 170 | 19 |

| Bore size (mm) | GC | GD | GL | GL ₁ | GR | GE | GF | J | K | MM | N | P | Q | H | S | T | V | VA | W | ZZ |
|----------------|------|------|------|-----------------|------|-------|------|-----------|----|------------|------|-----|------|----|-----|------|------|------|------|-----|
| 32 | 45.5 | 13 | 8.5 | 12 | 4 | 88.5 | 18.3 | M6 x 1.0 | 6 | M10 x 1.25 | 27 | 1/8 | 37 | 47 | 154 | 34 | 6.5 | 13 | 6.5 | 205 |
| 40 | 52.5 | 16.5 | 10 | 12 | 4 | 96.5 | 19.5 | M6 x 1.0 | 6 | M14 x 1.5 | 27 | 1/4 | 41.5 | 51 | 161 | 39.5 | 8 | 16.5 | 9 | 216 |
| 50 | 58.5 | 19 | 12.5 | 15 | 5 | 111.2 | 22.4 | M8 x 1.25 | 7 | M18 x 1.5 | 31.5 | 1/4 | 47.5 | 58 | 183 | 47 | 9 | 20 | 10.5 | 245 |
| 63 | 68 | 23 | 17.5 | 12 | 9 | 123.5 | 20.7 | M8 x 1.25 | 7 | M18 x 1.5 | 31.5 | 3/8 | 55 | 58 | 197 | 55.5 | 8.5 | 23 | 12 | 259 |
| 80 | 81 | 33 | 22 | 18 | 11.5 | 157 | 26 | M10 x 1.5 | 10 | M22 x 1.5 | 38 | 3/8 | 61 | 72 | 245 | 61.5 | 10.5 | 33 | 14 | 321 |
| 100 | 96 | 37.5 | 25 | 20 | 17 | 177 | 26 | M10 x 1.5 | 10 | M26 x 1.5 | 38 | 1/2 | 68 | 72 | 265 | 69.5 | 10.5 | 37.5 | 15 | 341 |

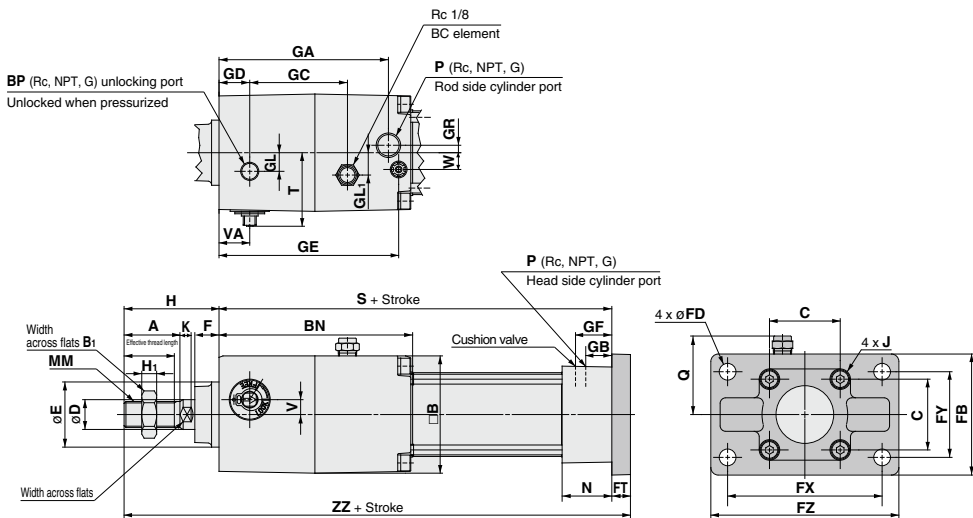
* Refer to page 895 for cylinders with a rod boot.

CLJ2
CLM2
CLG1
CL1
MLGC
CNG
MNB
CNA2
CNS
CLS
CLQ
RLQ
MLU
MLGP
ML1C

D-□
-X□

Dimensions

Head side flange type (G): MNBG

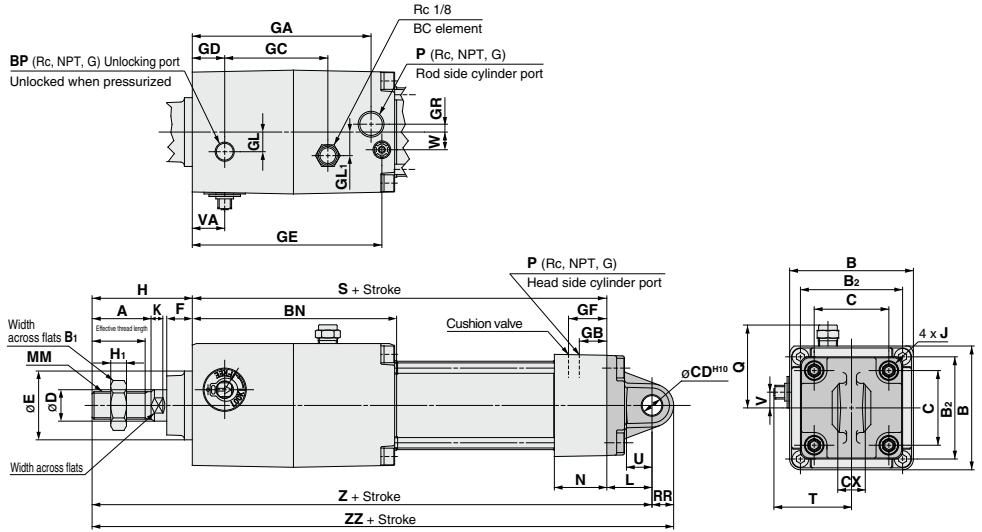


| (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------|----------------------|---------------------------------|-----------------------|----|-----|-----|----------------|----------------|-------|-----|------|----|------------------|----|----|----|-----|----|-----|-------|------|------|------|
| Bore size (mm) | Stroke range (mm) | Effective thread length (mm) | Width across flats | A | FB | B | B ₁ | H ₁ | BN | BP | C | D | Ee ₁₁ | F | FD | FT | FX | FY | FZ | GA | GB | GC | GD |
| 32 | Up to 500 | 19.5 | 10 | 22 | 56 | 54 | 17 | 6 | 97 | 1/8 | 32.5 | 12 | 30 | 13 | 7 | 10 | 72 | 38 | 87 | 83 | 13 | 45.5 | 13 |
| 40 | Up to 500 | 27 | 14 | 30 | 65 | 63 | 22 | 8 | 104 | 1/8 | 38 | 16 | 35 | 13 | 9 | 10 | 83 | 46 | 101 | 91 | 14 | 52.5 | 16.5 |
| 50 | Up to 600 | 32 | 18 | 35 | 77 | 75 | 27 | 11 | 120.5 | 1/4 | 46.5 | 20 | 40 | 14 | 9 | 12 | 100 | 52 | 120 | 104.5 | 15.5 | 58.5 | 19 |
| 63 | Up to 600 | 32 | 18 | 35 | 92 | 90 | 27 | 11 | 134.5 | 1/4 | 56.5 | 20 | 45 | 14 | 9 | 12 | 115 | 62 | 135 | 119.5 | 16.5 | 68 | 23 |
| 80 | Up to 800 | 37 | 22 | 40 | 100 | 102 | 32 | 13 | 169 | 1/4 | 72 | 25 | 45 | 20 | 12 | 16 | 126 | 63 | 153 | 150 | 19 | 81 | 33 |
| 100 | Up to 800 | 37 | 26 | 40 | 120 | 116 | 41 | 16 | 189 | 1/4 | 89 | 30 | 55 | 20 | 14 | 16 | 150 | 75 | 178 | 170 | 19 | 96 | 37.5 |

| Bore size (mm) | GL | GL ₁ | GR | GE | GF | J | K | MM | N | P | Q | H | S | T | V | VA | W | ZZ |
|----------------|------|-----------------|------|-------|------|-----------|----|------------|------|-----|------|----|-----|------|------|------|------|-----|
| 32 | 8.5 | 12 | 4 | 88.5 | 18.3 | M6 x 1.0 | 6 | M10 x 1.25 | 27 | 1/8 | 37 | 47 | 154 | 34 | 6.5 | 13 | 6.5 | 211 |
| 40 | 10 | 12 | 4 | 96.5 | 19.5 | M6 x 1.0 | 6 | M14 x 1.5 | 27 | 1/4 | 41.5 | 51 | 161 | 39.5 | 8 | 16.5 | 9 | 222 |
| 50 | 12.5 | 15 | 5 | 111.2 | 22.4 | M8 x 1.25 | 7 | M18 x 1.5 | 31.5 | 1/4 | 47.5 | 58 | 183 | 47 | 9 | 20 | 10.5 | 253 |
| 63 | 17.5 | 12 | 9 | 123.5 | 20.7 | M8 x 1.25 | 7 | M18 x 1.5 | 31.5 | 3/8 | 55 | 58 | 197 | 55.5 | 8.5 | 23 | 12 | 267 |
| 80 | 22 | 18 | 11.5 | 157 | 26 | M10 x 1.5 | 10 | M22 x 1.5 | 38 | 3/8 | 61 | 72 | 245 | 61.5 | 10.5 | 33 | 14 | 333 |
| 100 | 25 | 20 | 17 | 177 | 26 | M10 x 1.5 | 10 | M26 x 1.5 | 38 | 1/2 | 68 | 72 | 265 | 69.5 | 10.5 | 37.5 | 15 | 353 |

* Refer to page 895 for cylinders with a rod boot.

Single clevis type (C): MNBC



| Bore size (mm) | Stroke range (mm) | Effective thread length (mm) | Width across flats | A | B | B ₁ | H ₁ | B ₂ | BN | BP | C | CD ^{H10} | CX $\frac{d-1}{4}$ | D | Ee ₁₁ | F | GA | GB | GC | GD | GL | GL ₁ | GR |
|-------------------|----------------------|---------------------------------|-----------------------|----|-----|----------------|----------------|----------------|-------|-----|------|-------------------|--------------------|----|------------------|----|-------|------|------|------|------|-----------------|------|
| 32 | Up to 500 | 19.5 | 10 | 22 | 54 | 17 | 6 | 46 | 97 | 1/8 | 32.5 | 10 | 14 | 12 | 30 | 13 | 83 | 13 | 45.5 | 13 | 8.5 | 12 | 4 |
| 40 | Up to 500 | 27 | 14 | 30 | 63 | 22 | 8 | 52 | 104 | 1/8 | 38 | 10 | 14 | 16 | 35 | 13 | 91 | 14 | 52.5 | 16.5 | 10 | 12 | 4 |
| 50 | Up to 600 | 32 | 18 | 35 | 75 | 27 | 11 | 65 | 120.5 | 1/4 | 46.5 | 14 | 20 | 20 | 40 | 14 | 104.5 | 15.5 | 58.5 | 19 | 12.5 | 15 | 5 |
| 63 | Up to 600 | 32 | 18 | 35 | 90 | 27 | 11 | 75 | 134.5 | 1/4 | 56.5 | 14 | 20 | 20 | 45 | 14 | 119.5 | 16.5 | 68 | 23 | 17.5 | 12 | 9 |
| 80 | Up to 800 | 37 | 22 | 40 | 102 | 32 | 13 | 95 | 169 | 1/4 | 72 | 22 | 30 | 25 | 45 | 20 | 150 | 19 | 81 | 33 | 22 | 18 | 11.5 |
| 100 | Up to 800 | 37 | 26 | 40 | 116 | 41 | 16 | 114 | 189 | 1/4 | 89 | 22 | 30 | 30 | 55 | 20 | 170 | 19 | 96 | 37.5 | 25 | 20 | 17 |

| Bore size (mm) | GE | GF | J | K | L | MM | N | P | Q | RR | H | S | T | U | V | VA | W | Z | ZZ |
|-------------------|-------|------|-----------|----|----|------------|------|-----|------|------|----|-----|------|----|------|------|------|-----|-------|
| 32 | 88.5 | 18.3 | M6 x 1.0 | 6 | 23 | M10 x 1.25 | 27 | 1/8 | 37 | 10.5 | 47 | 154 | 34 | 13 | 6.5 | 13 | 6.5 | 224 | 234.5 |
| 40 | 96.5 | 19.5 | M6 x 1.0 | 6 | 23 | M14 x 1.5 | 27 | 1/4 | 41.5 | 11 | 51 | 161 | 39.5 | 13 | 8 | 16.5 | 9 | 235 | 246 |
| 50 | 111.2 | 22.4 | M8 x 1.25 | 7 | 30 | M18 x 1.5 | 31.5 | 1/4 | 47.5 | 15 | 58 | 183 | 47 | 17 | 9 | 20 | 10.5 | 271 | 286 |
| 63 | 123.5 | 20.7 | M8 x 1.25 | 7 | 30 | M18 x 1.5 | 31.5 | 3/8 | 55 | 15 | 58 | 197 | 55.5 | 17 | 8.5 | 23 | 12 | 285 | 300 |
| 80 | 157 | 26 | M10 x 1.5 | 10 | 42 | M22 x 1.5 | 38 | 3/8 | 61 | 23 | 72 | 245 | 61.5 | 26 | 10.5 | 33 | 14 | 359 | 382 |
| 100 | 177 | 26 | M10 x 1.5 | 10 | 42 | M26 x 1.5 | 38 | 1/2 | 68 | 23 | 72 | 265 | 69.5 | 26 | 10.5 | 37.5 | 15 | 379 | 402 |

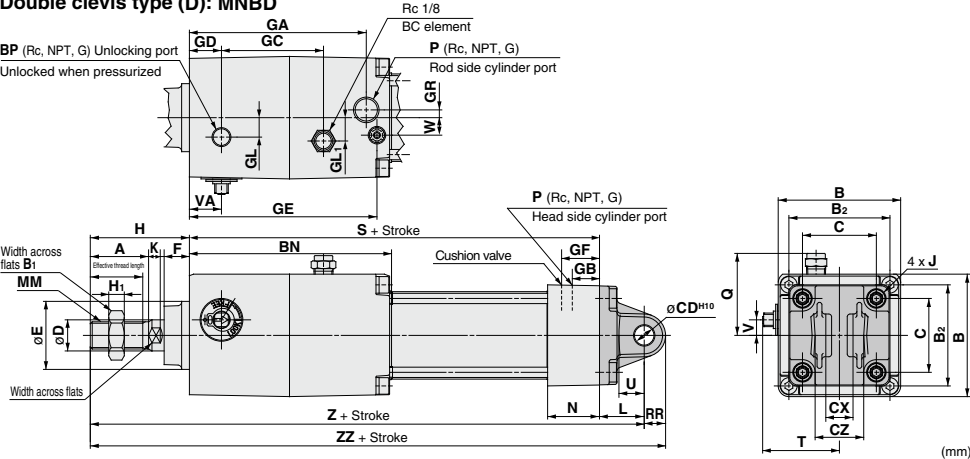
* Refer to page 895 for cylinders with a rod boot.

CLJ2
CLM2
CLG1
CL1
MLGC
CNG
MNB
CNA2
CNS
CLS
CLQ
RLQ
MLU
MLGP
ML1C

D-□
-X□

Dimensions

Double clevis type (D): MNBD

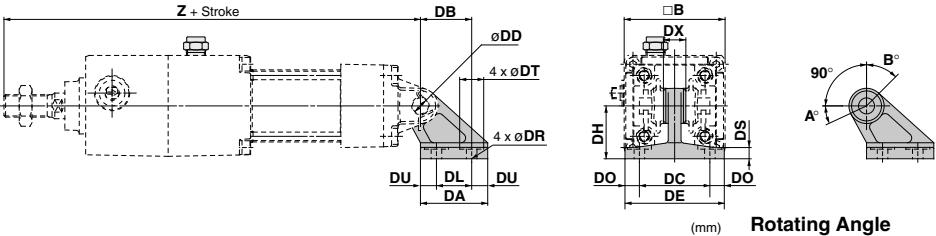


| Bore size (mm) | Stroke range (mm) | Effective thread length (mm) | Width across flats (mm) | A | B | B ₁ | H ₁ | B ₂ | BN | BP | C | C _d ^{M10} | CX ^{0.3 A1} | CZ | D | Ee ₁ | F | GA | GB | GC | GD | GL | GL ₁ |
|----------------|-------------------|------------------------------|-------------------------|----|-----|----------------|----------------|----------------|-------|-----|------|-------------------------------|----------------------|----|----|-----------------|----|-------|------|------|------|------|-----------------|
| 32 | Up to 500 | 19.5 | 10 | 22 | 54 | 17 | 6 | 46 | 97 | 1/8 | 32.5 | 10 | 14 | 28 | 12 | 30 | 13 | 83 | 13 | 45.5 | 13 | 8.5 | 12 |
| 40 | Up to 500 | 27 | 14 | 30 | 63 | 22 | 8 | 52 | 104 | 1/8 | 38 | 10 | 14 | 28 | 16 | 35 | 13 | 91 | 14 | 52.5 | 16.5 | 10 | 12 |
| 50 | Up to 600 | 32 | 18 | 35 | 75 | 27 | 11 | 65 | 120.5 | 1/4 | 46.5 | 14 | 20 | 40 | 20 | 40 | 14 | 104.5 | 15.5 | 58.5 | 19 | 12.5 | 15 |
| 63 | Up to 600 | 32 | 18 | 35 | 90 | 27 | 11 | 75 | 134.5 | 1/4 | 56.5 | 14 | 20 | 40 | 20 | 45 | 14 | 119.5 | 16.5 | 68 | 23 | 17.5 | 12 |
| 80 | Up to 800 | 37 | 22 | 40 | 102 | 32 | 13 | 95 | 169 | 1/4 | 72 | 22 | 30 | 60 | 25 | 45 | 20 | 150 | 19 | 81 | 33 | 22 | 18 |
| 100 | Up to 800 | 37 | 26 | 40 | 116 | 41 | 16 | 114 | 189 | 1/4 | 89 | 22 | 30 | 60 | 30 | 55 | 20 | 170 | 19 | 96 | 37.5 | 25 | 20 |

| Bore size (mm) | GR | GE | GF | J | K | L | MM | N | P | Q | RR | H | S | T | U | V | VA | W | Z | ZZ |
|----------------|------|-------|------|-----------|----|----|------------|------|-----|------|------|----|-----|------|----|------|------|------|-----|-------|
| 32 | 4 | 88.5 | 18.3 | M6 x 1.0 | 6 | 23 | M10 x 1.25 | 27 | 1/8 | 37 | 10.5 | 47 | 154 | 34 | 13 | 6.5 | 13 | 6.5 | 224 | 234.5 |
| 40 | 4 | 96.5 | 19.5 | M6 x 1.0 | 6 | 23 | M14 x 1.5 | 27 | 1/4 | 41.5 | 11 | 51 | 161 | 39.5 | 13 | 8 | 16.5 | 9 | 235 | 246 |
| 50 | 5 | 111.2 | 22.4 | M8 x 1.25 | 7 | 30 | M18 x 1.5 | 31.5 | 1/4 | 47.5 | 15 | 58 | 183 | 47 | 17 | 9 | 20 | 10.5 | 271 | 286 |
| 63 | 9 | 123.5 | 20.7 | M8 x 1.25 | 7 | 30 | M18 x 1.5 | 31.5 | 3/8 | 55 | 15 | 58 | 197 | 55.5 | 17 | 8.5 | 23 | 12 | 285 | 300 |
| 80 | 11.5 | 157 | 26 | M10 x 1.5 | 10 | 42 | M22 x 1.5 | 38 | 3/8 | 61 | 23 | 72 | 245 | 61.5 | 26 | 10.5 | 33 | 14 | 359 | 382 |
| 100 | 17 | 177 | 26 | M10 x 1.5 | 10 | 42 | M26 x 1.5 | 38 | 1/2 | 68 | 23 | 72 | 265 | 69.5 | 26 | 10.5 | 37.5 | 15 | 379 | 402 |

* Refer to page 895 for cylinders with a rod boot.

Double Clevis Pivot Bracket



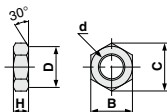
| Part no. | Bore size (mm) | B | DA | DB | DL | DU | DC | DX | DE | DO | DR | DT | DS | DH | Z | DD _{M10} (Hole) |
|----------|----------------|-----|----|----|----|------|----|----|-----|------|-----|----|----|----|-----|-----------------------------------|
| MB-B03 | 32 | 54 | 42 | 32 | 22 | 10 | 44 | 14 | 62 | 9 | 6.6 | 15 | 7 | 33 | 224 | 10 ^{+0.058} ₀ |
| | 40 | 63 | 42 | 32 | 22 | 10 | 44 | 14 | 62 | 9 | 6.6 | 15 | 7 | 33 | 235 | 10 ^{+0.058} ₀ |
| MB-B05 | 50 | 75 | 53 | 43 | 30 | 11.5 | 60 | 20 | 81 | 10.5 | 9 | 18 | 8 | 45 | 271 | 14 ^{+0.070} ₀ |
| | 63 | 90 | 53 | 43 | 30 | 11.5 | 60 | 20 | 81 | 10.5 | 9 | 18 | 8 | 45 | 285 | 14 ^{+0.070} ₀ |
| MB-B08 | 80 | 102 | 73 | 64 | 45 | 14 | 86 | 30 | 111 | 12.5 | 11 | 22 | 10 | 65 | 359 | 22 ^{+0.084} ₀ |
| | 100 | 116 | 73 | 64 | 45 | 14 | 86 | 30 | 111 | 12.5 | 11 | 22 | 10 | 65 | 379 | 22 ^{+0.084} ₀ |

Rotating Angle

| Bore size (mm) | A° | B° | A° + B° + 90° |
|----------------|-----|-----|---------------|
| 32, 40 | 25° | 45° | 160° |
| 50, 63 | 40° | 60° | 190° |
| 80, 100 | 30° | 55° | 175° |

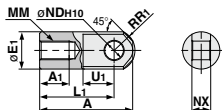
Accessory Bracket Dimensions

Rod End Nut
(Standard equipment)



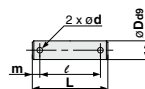
| Part no. | Bore size (mm) | B | C | D | H | d |
|----------|----------------|----|------|------|----|------------|
| NT-03 | 32 | 17 | 19.6 | 16.5 | 6 | M10 x 1.25 |
| NT-04 | 40 | 22 | 25.4 | 21 | 8 | M14 x 1.5 |
| NT-05 | 50, 63 | 27 | 31.2 | 26 | 11 | M18 x 1.5 |
| NT-08 | 80 | 32 | 37.0 | 31 | 13 | M22 x 1.5 |
| NT-10 | 100 | 41 | 47.3 | 39 | 16 | M26 x 1.5 |

I Type Single Knuckle Joint



| Part no. | Bore size (mm) | A | A ₁ | E ₁ | L ₁ | MM | R ₁ | U ₁ | NDH10 | NX |
|----------|----------------|----|----------------|----------------|----------------|------------|----------------|----------------|-----------------------------------|----------------------------------|
| I-03M | 32 | 40 | 14 | 20 | 30 | M10 x 1.25 | 12 | 16 | 10 ^{+0.058} ₀ | 14 ^{+0.10} ₀ |
| I-04M | 40 | 50 | 19 | 22 | 40 | M14 x 1.5 | 12.5 | 19 | 10 ^{+0.058} ₀ | 14 ^{+0.10} ₀ |
| I-05M | 50, 63 | 64 | 24 | 28 | 50 | M18 x 1.5 | 16.5 | 24 | 14 ^{+0.070} ₀ | 20 ^{+0.10} ₀ |
| I-08M | 80 | 80 | 26 | 40 | 60 | M22 x 1.5 | 23.5 | 34 | 22 ^{+0.084} ₀ | 30 ^{+0.10} ₀ |
| I-10M | 100 | 80 | 26 | 40 | 60 | M26 x 1.5 | 23.5 | 34 | 22 ^{+0.084} ₀ | 30 ^{+0.10} ₀ |

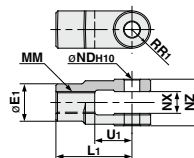
Knuckle Joint Pin,
Clevis Pin



| Part no. | Bore size (mm) Clevis Knuckle | D _{φ8} | L | ℓ | m | d (Drill through) | Cotter pin |
|----------|------------------------------------|--|----|----|-----|----------------------|------------|
| CD-M03 | 32, 40 | 10 ^{+0.040} _{-0.076} | 44 | 36 | 4 | 3 | φ3 x 18 ℓ |
| CD-M05 | 50, 63 | 14 ^{+0.060} _{-0.093} | 60 | 51 | 4.5 | 4 | φ4 x 25 ℓ |
| CD-M08 | 80, 100 | 22 ^{+0.085} _{-0.117} | 82 | 72 | 5 | 4 | φ4 x 35 ℓ |

Note) Cotter pins and flat washers are included.

Y Type Double Knuckle Joint



| Part no. | Bore size (mm) | E ₁ | L ₁ | MM | R ₁ | U ₁ | NDH10 | NX | NZ |
|----------|----------------|----------------|----------------|------------|----------------|----------------|-----------------------------------|--------------------------------------|--------------------------------------|
| Y-03M | 32 | 20 | 30 | M10 x 1.25 | 10 | 16 | 10 ^{+0.058} ₀ | 14 ^{+0.30} _{+0.10} | 28 ^{+0.10} _{+0.30} |
| Y-04M | 40 | 22 | 40 | M14 x 1.5 | 11 | 19 | 10 ^{+0.058} ₀ | 14 ^{+0.30} _{+0.10} | 28 ^{+0.10} _{+0.30} |
| Y-05M | 50, 63 | 28 | 50 | M18 x 1.5 | 14 | 24 | 14 ^{+0.070} ₀ | 20 ^{+0.30} _{+0.10} | 40 ^{+0.10} _{+0.30} |
| Y-08M | 80 | 40 | 65 | M22 x 1.5 | 20 | 34 | 22 ^{+0.084} ₀ | 30 ^{+0.30} _{+0.10} | 60 ^{+0.10} _{+0.30} |
| Y-10M | 100 | 40 | 65 | M26 x 1.5 | 20 | 34 | 22 ^{+0.084} ₀ | 30 ^{+0.30} _{+0.10} | 60 ^{+0.10} _{+0.30} |

Note) Pin, cotter pin and plain washer are attached with double knuckle joint.

CLJ2

CLM2

CLG1

CL1

MLGC

CNG

MNB

CNA2

CNS

CLS

CLQ

RLQ

MLU

MLGP

ML1C

D-□

-X□

Cylinder with Lock Double Acting, Double Rod **MNBW Series** ø32, ø40, ø50, ø63, ø80, ø100

How to Order

MNBW L 50 - 100 - D

With auto switch
MDNBW L 50 - 100 - D - M9BW

With auto switch
(Built-in magnet)

Mounting type

| | |
|---|----------------------|
| B | Basic type |
| L | Axial foot type |
| F | Rod side flange type |

Bore size

| | |
|-----|--------|
| 32 | 32 mm |
| 40 | 40 mm |
| 50 | 50 mm |
| 63 | 63 mm |
| 80 | 80 mm |
| 100 | 100 mm |

Port thread type

| | |
|-----|-----|
| Nil | Rc |
| TN | NPT |
| TF | G |

Cylinder stroke (mm)

Refer to page 903 for the standard stroke.

Locking direction

| | |
|---|-----------------|
| D | Both directions |
|---|-----------------|

Number of auto switches

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

Auto switch

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

* For the applicable auto switch model, refer to the table below.

Built-in Magnet Cylinder Model

If a built-in magnet cylinder without an auto switch is required, there is no need to enter the symbol for the auto switch.
(Example) MDNBWL40-100-D

With rod boot

| | | |
|----------|-----|--------------------------|
| | Nil | None |
| Rod boot | J | Nylon tarpaulin |
| | K | Heat resistant tarpaulin |

* Rod boot comes with both sides. If only single-sided is required, please consult with SMC.

Applicable Auto Switches

Refer to pages 1119 to 1245 for further information on auto switches.

| Type | Special function | Electrical entry | Indicator light | Wiring (Output) | Load voltage | | Auto switch model | | Lead wire length (m) | | | Pre-wired connector | Applicable load | | | | | | | | | |
|--|---|-------------------------------------|-----------------|-------------------------|--------------|-----------|-------------------|------------------|----------------------|-----------|-------|---------------------|-----------------|---------------|------------|------------|------------|---|---|---|-----|---|
| | | | | | DC | | AC | Tie-rod mounting | Band mounting | 0.5 (Nil) | 1 (M) | | | 3 (L) | 5 (Z) | | | | | | | |
| Solid state auto switch | — | Grommet | Yes | 3-wire (NPN) | 24 V | 5 V, 12 V | — | M9N | — | ● | ● | ● | ○ | IC circuit | Relay, PLC | | | | | | | |
| | | 3-wire (PNP) | | M9P | | | | — | ● | ● | ● | ○ | ○ | | | | | | | | | |
| | 2-wire | M9B | | — | | | | ● | ● | ● | ○ | ○ | | | | | | | | | | |
| | Diagnostic indication (2-color indicator) | Terminal conduit | | 3-wire (NPN) | 24 V | 5 V, 12 V | — | — | G39 | — | — | — | — | — | | — | | | | | | |
| | | 2-wire | | — | | | | K39 | — | — | — | — | — | | | | | | | | | |
| | | Water resistant (2-color indicator) | | Grommet | | | | 3-wire (NPN) | M9NW | — | ● | ● | ● | ○ | | ○ | IC circuit | | | | | |
| | | | | | | | | 3-wire (PNP) | M9PW | — | ● | ● | ● | ○ | | ○ | | | | | | |
| | 2-wire | | | | M9BW | — | ● | ● | ● | ○ | ○ | — | | | | | | | | | | |
| | 3-wire (NPN) | | | | M9NA*1 | — | ○ | ○ | ● | ○ | ○ | | IC circuit | | | | | | | | | |
| | 3-wire (PNP) | M9PA*1 | | — | ○ | ○ | ● | ○ | ○ | | | | | | | | | | | | | |
| 2-wire | M9BA*1 | — | ○ | ○ | ● | ○ | ○ | — | | | | | | | | | | | | | | |
| 4-wire (NPN) | F59F | — | ● | — | ● | ○ | ○ | | IC circuit | | | | | | | | | | | | | |
| Magnetic field resistant (2-color indicator) | Grommet | 2-wire (Non-polar) | — | — | — | — | — | — | | — | — | | | | | | | | | | | |
| | | 2-wire (Non-polar) | P3DWA | — | ● | — | ● | ● | ○ | ○ | | | | | | | | | | | | |
| Reed auto switch | — | Grommet | Yes | 3-wire (NPN equivalent) | — | 5 V | — | A96 | — | ● | — | ● | — | IC circuit | Relay, PLC | | | | | | | |
| | | | | — | | | | A93 | — | ● | ● | ● | — | | | — | | | | | | |
| | Diagnostic indication (2-color indicator) | Terminal conduit | No | 2-wire | 24 V | 12 V | — | 100 V or less | A90 | — | ● | — | ● | — | | IC circuit | | | | | | |
| | | | | | | | | 100 V, 200 V | A54 | — | ● | — | ● | — | | | | | | | | |
| | | | | | | | | Grommet | Yes | 2-wire | 24 V | 12 V | — | 200 V or less | | A64 | — | ● | — | ● | — | — |
| | | | | | | | | | | | | | | — | | — | A33 | — | — | — | — | |
| | DIN terminal | No | 2-wire | 24 V | 12 V | — | 100 V, 200 V | | | | | | | — | | A34 | — | — | — | — | PLC | |
| | | | | | | | — | | | | | | | — | | A44 | — | — | — | — | | — |
| | Grommet | Yes | 2-wire | 24 V | 12 V | — | — | A59W | — | ● | — | ● | — | Relay, PLC | | | | | | | | |
| | | | | | | | — | — | — | — | — | — | — | | | — | | | | | | |

*1 Water resistant type auto switches can be mounted on the above models, but in such case SMC cannot guarantee water resistance. Consult with SMC regarding water resistant types with the above model numbers.

* Lead wire length symbols: 0.5 m.....Nil (Example) M9NW
1 m.....M (Example) M9NWM
3 m.....L (Example) M9NWL
5 m.....Z (Example) M9NWZ

* Solid state auto switches marked with "○" are produced upon receipt of order.

* Since there are other applicable auto switches than listed, refer to page 911 for details.

* D-A9□/M9□/P3DWA□ auto switches are shipped together (not assembled). (Only auto switch brackets are assembled at the time of shipment for D-A9□ and M9□.)



Cylinder Specifications

| Bore size (mm) | 32 | 40 | 50 | 63 | 80 | 100 |
|--------------------------------------|---|----|----|----|----|-----|
| Lubrication | Not required (Non-lube) | | | | | |
| Fluid | Air | | | | | |
| Proof pressure | 1.5 MPa | | | | | |
| Max. operating pressure | 1.0 MPa | | | | | |
| Min. operating pressure | 0.08 MPa | | | | | |
| Piston speed | 50 to 1000 mm/s* | | | | | |
| Ambient and fluid temperature | Without auto switch: -10 to 70°C (No freezing) With auto switch: -10 to 60°C (No freezing) | | | | | |
| Cushion | Air cushion on both ends | | | | | |
| Stroke length tolerance | Up to 250: $^{+1.0}_0$, 251 to 1000: $^{+1.4}_0$ | | | | | |
| Mounting | Basic type, Axial foot type, Rod side flange type | | | | | |

* Load limits exist depending upon piston speed when locked, mounting direction and operating pressure.

Lock Specifications

| Bore size (mm) | 32 | 40 | 50 | 63 | 80 | 100 |
|---|----------------------------------|-----|------|------|------|------|
| Locking action | Spring locking (Exhaust locking) | | | | | |
| Unlocking pressure | 0.25 MPa or more | | | | | |
| Lock starting pressure | 0.20 MPa or less | | | | | |
| Max. operating pressure | 1.0 MPa | | | | | |
| Locking direction | Both directions | | | | | |
| Holding force (maximum static load) N* | 552 | 882 | 1370 | 2160 | 3430 | 5390 |

* The holding force (max. static load) shows the maximum capability and does not show the normal holding capability. So, select an appropriate cylinder while referring to page 888.

For cases with auto switches, refer to the table of minimum strokes for /mounting of auto switches (page 910).

Standard Stroke

| Bore size (mm) | Standard stroke (mm) |
|----------------|--|
| 32 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500 |
| 40 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500 |
| 50 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500, 600 |
| 63 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500, 600 |
| 80 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800 |
| 100 | 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800 |

* Intermediate strokes other than the above are produced upon receipt of order. Spacers are not used for intermediate strokes.

Stopping Accuracy

| Lock type | Piston speed (mm/s) | | | |
|-----------------------|---------------------|------|------|------|
| | 100 | 300 | 500 | 1000 |
| Spring locking | ±0.3 | ±0.6 | ±1.0 | ±2.0 |

Condition: Lateral, Supply pressure P = 0.5 MPa

Load mass Upper limit of allowed value

Solenoid valve for locking mounted on the unlocking port

Maximum value of stopping position dispersion from 100 measurements

Refer to pages 908 to 911 for cylinders with auto switches.

- Minimum auto switch mounting stroke
- Proper auto switch mounting position (detection at stroke end) and mounting height
- Operating range
- Auto switch mounting bracket: Part no.

CLJ2

CLM2

CLG1

CL1

MLGC

CNG

MNB

CNA2

CNS

CLS

CLQ

RLQ

MLU

MLGP

ML1C

D-□

-X□

Mounting Bracket Part No.

| Bore size (mm) | 32 | 40 | 50 | 63 | 80 | 100 |
|---------------------|----------|----------|----------|----------|--------|--------|
| Foot ⁽¹⁾ | MB-L03 | MB-L04 | MB-L05 | MNB-L* | MB-L08 | MB-L10 |
| Flange | MNB-F03* | MNB-F04* | MNB-F05* | MNB-F06* | MB-F08 | MB-F10 |

Note 1) When ordering foot bracket, order 2 pieces per cylinder.

Note 2) Accessories for each mounting bracket are as follows.

Foot, Flange: Body mounting bolts

Note 3) All are common to the MB series air cylinders, except the sections marked with a *.

Rod Boot Material

| Symbol | Rod boot material | Max. ambient temperature |
|--------|--------------------------|--------------------------|
| J | Nylon tarpaulin | 70°C |
| K | Heat resistant tarpaulin | 110°C * |

* Maximum ambient temperature for the rod boot itself.

Accessory

| Mounting | | Basic type | Foot type | Rod side flange type |
|--------------------|---------------|------------|-----------|----------------------|
| Standard equipment | Rod end nut | ● | ● | ● |
| Option | With rod boot | ● | ● | ● |

Double Rod Weight/Aluminum Tube

| Bore size (mm) | | 32 | 40 | 50 | 63 | 80 | 100 |
|--|---------------------------|------|------|------|------|------|-------|
| Basic weight | Basic type | 1.26 | 1.82 | 2.91 | 4.24 | 7.23 | 10.70 |
| | Foot type | 1.36 | 1.94 | 3.09 | 4.50 | 7.66 | 11.29 |
| | Flange type | 1.50 | 2.14 | 3.44 | 4.98 | 8.68 | 12.53 |
| Additional weight per each 50 mm of stroke | All mounting brackets | 0.15 | 0.24 | 0.34 | 0.35 | 0.61 | 0.84 |
| Accessory | Single knuckle | 0.15 | 0.23 | 0.26 | 0.26 | 0.60 | 0.83 |
| | Double knuckle (With pin) | 0.22 | 0.37 | 0.43 | 0.43 | 0.87 | 1.27 |

Calculation:

(Example) **MNBWB32-100-D** (Basic type, ø32, 100 st)

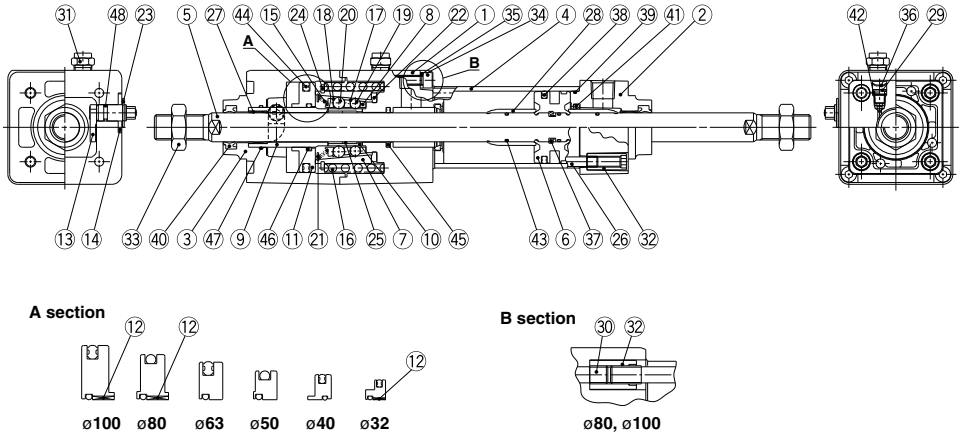
• Basic weight 1.26 (Basic type, ø32)

• Additional weight 0.11/50 stroke

• Cylinder stroke 100 stroke

1.26 + 0.11 x 100/50 = 1.48 kg

Construction



Component Parts

| No. | Description | Material | Note |
|-----|---|---------------------------|------------------------------------|
| 1 | Rod cover A | Aluminum alloy | Hard anodized and metallic painted |
| 2 | Rod cover B | Aluminum die-casted | Chromated and metallic painted |
| 3 | Cover | Aluminum alloy | Hard anodized and metallic painted |
| 4 | Cylinder tube | Aluminum alloy | Hard anodized |
| 5 | Piston rod | Carbon steel | Hard chrome plated |
| 6 | Piston | Aluminum alloy | Chromated |
| 7 | Taper ring | Carbon steel | Heat treated |
| 8 | Ball retainer | Special resin | |
| 9 | Piston guide | Carbon steel | Zinc chromated |
| 10 | Brake shoe holder | Special steel | Heat treated |
| 11 | Release piston | Aluminum alloy | Chromated Hard anodized |
| 12 | Release piston bushing | Steel + Special resin | ø32, ø80, ø100 only |
| 13 | Unlocking cam | Chromium molybdenum steel | Glossy chromated |
| 14 | Washer | Carbon steel | Colorless zinc chromated |
| 15 | Retainer pre-load spring | Steel wire | Zinc chromated |
| 16 | Brake spring | Steel wire | Zinc chromated |
| 17 | Clip A | Stainless steel | |
| 18 | Clip B | Stainless steel | |
| 19 | Steel ball A | Carbon steel | |
| 20 | Steel ball B | Carbon steel | |
| 21 | Tooth ring | Stainless steel | |
| 22 | Bumper | Polyurethane rubber | |
| 23 | Type C retaining ring for unlocking cam shaft | Carbon steel | |
| 24 | Type C retaining ring for taper ring | Carbon steel | |
| 25 | Brake shoe | Babbitt | |
| 26 | Tie-rod | Carbon steel | Zinc chromated |
| 27 | Bushing | Bearing alloy | |
| 28 | Cushion ring | Aluminum alloy | Anodized |

Component Parts

| No. | Description | Material | Note |
|-----|--|---------------------------|----------------|
| 29 | Cushion valve | Steel wire | |
| 30 | Unit holding tie-rod | Carbon steel | ø80, ø100 only |
| 31 | BC element | | |
| 32 | Tie-rod nut | Carbon steel | |
| 33 | Rod end nut | Carbon steel | |
| 34 | Hexagon socket head cap screw | Chromium molybdenum steel | ø32 to ø63 |
| 35 | Spring washer for hex. socket head cap screw | Steel wire | ø32 to ø63 |
| 36 | Retaining ring | Spring steel | |
| 37 | Piston holder | Urethane | |
| 38 | Piston seal | NBR | |
| 39 | Cylinder tube gasket | NBR | |
| 40 | Rod seal A | NBR | |
| 41 | Cushion seal | NBR | |
| 42 | Cushion valve seal | NBR | |
| 43 | Piston gasket | NBR | |
| 44 | Release piston seal | NBR | |
| 45 | Rod seal B | NBR | |
| 46 | Release piston gasket | NBR | |
| 47 | Piston guide gasket | NBR | |
| 48 | Unlocking cam gasket | NBR | |

Replacement Parts: Seal Kit

| Bore size (mm) | Kit no. | Contents |
|----------------|-----------|----------------------------------|
| 32 | MBW32-PS | A set of 38, 39, 40 and 41 above |
| 40 | MBW40-PS | |
| 50 | MBW50-PS | |
| 63 | MBW63-PS | |
| 80 | MBW80-PS | |
| 100 | MBW100-PS | |

* As a general rule, the lock section of the MNBW series is replaced as a unit, and therefore, the replacement seal kits are for the cylinder section only. These can be ordered using the order number for each bore size.

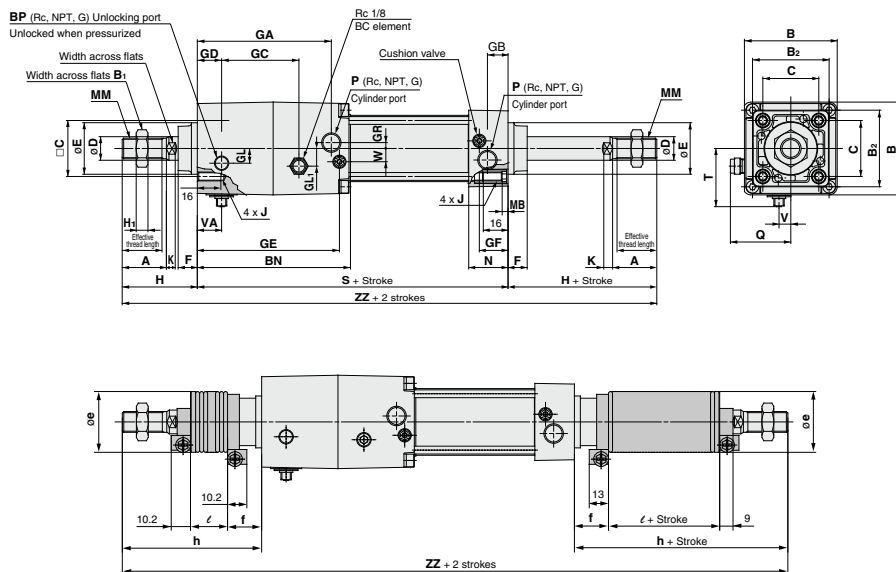
* Seal kit includes a grease pack (ø32 to ø50: 10 g, ø63 and ø80: 20 g, ø100: 30 g). Order with the following part number when only the grease pack is needed.
Grease pack part number: GR-S-010 (10 g), GR-S-020 (20 g)

CLJ2
CLM2
CLG1
CL1
MLGC
CNG
MNB
CNA2
CNS
CLS
CLQ
RLQ
MLU
MLGP
ML1C

D-☐
-X☐

Dimensions

Basic type (B): MNBWB



With rod boot

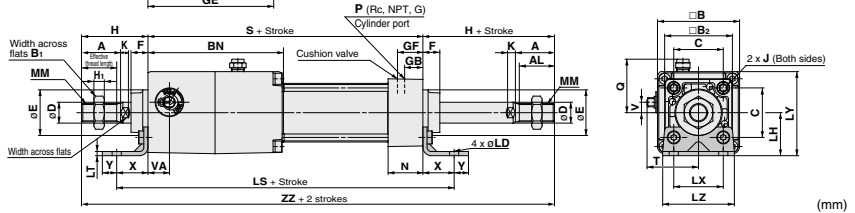
| (mm) | | | | | | | | | | | | | | | | | | | | |
|-------------------|----------------------|---------------------------------|----------------------|----|-----|----------------|----------------|----------------|-------|-----|------|----|------------------|----|-------|------|------|------|------|-----------------|
| Bore size (mm) | Stroke range (mm) | Effective thread length (mm) | With across flats | A | B | B ₁ | H ₁ | B ₂ | BN | BP | C | D | Ee ₁₁ | F | GA | GB | GC | GD | GL | GL ₁ |
| 32 | Up to 500 | 19.5 | 10 | 22 | 54 | 17 | 6 | 46 | 97 | 1/8 | 32.5 | 12 | 30 | 13 | 83 | 13 | 45.5 | 13 | 8.5 | 12 |
| 40 | Up to 500 | 27 | 14 | 30 | 63 | 22 | 8 | 52 | 104 | 1/8 | 38 | 16 | 35 | 13 | 91 | 14 | 52.5 | 16.5 | 10 | 12 |
| 50 | Up to 600 | 32 | 18 | 35 | 75 | 27 | 11 | 65 | 120.5 | 1/4 | 46.5 | 20 | 40 | 14 | 104.5 | 15.5 | 58.5 | 19 | 12.5 | 15 |
| 63 | Up to 600 | 32 | 18 | 35 | 90 | 27 | 11 | 75 | 134.5 | 1/4 | 56.5 | 20 | 45 | 14 | 119.5 | 16.5 | 68 | 23 | 17.5 | 12 |
| 80 | Up to 800 | 37 | 22 | 40 | 102 | 32 | 13 | 95 | 169 | 1/4 | 72 | 25 | 45 | 20 | 150 | 19 | 81 | 33 | 22 | 18 |
| 100 | Up to 800 | 37 | 26 | 40 | 116 | 41 | 16 | 114 | 189 | 1/4 | 89 | 30 | 55 | 20 | 170 | 19 | 96 | 37.5 | 25 | 20 |

| Bore size (mm) | GR | GE | GF | J | MB | K | MM | N | P | Q | H | S | T | V | VA | W | ZZ |
|-------------------|------|-------|------|-----------|----|----|------------|------|-----|------|----|-----|------|------|------|------|-----|
| 32 | 4 | 88.5 | 18.3 | M6 x 1.0 | 4 | 6 | M10 x 1.25 | 27 | 1/8 | 37 | 47 | 154 | 34 | 6.5 | 13 | 6.5 | 248 |
| 40 | 4 | 96.5 | 19.5 | M6 x 1.0 | 4 | 6 | M14 x 1.5 | 27 | 1/4 | 41.5 | 51 | 161 | 39.5 | 8 | 16.5 | 9 | 263 |
| 50 | 5 | 111.2 | 22.4 | M8 x 1.25 | 5 | 7 | M18 x 1.5 | 31.5 | 1/4 | 47.5 | 58 | 183 | 47 | 9 | 20 | 10.5 | 299 |
| 63 | 9 | 123.5 | 20.7 | M8 x 1.25 | 5 | 7 | M18 x 1.5 | 31.5 | 3/8 | 55 | 58 | 197 | 55.5 | 8.5 | 23 | 12 | 313 |
| 80 | 11.5 | 157 | 26 | M10 x 1.5 | 5 | 10 | M22 x 1.5 | 38 | 3/8 | 61 | 72 | 245 | 61.5 | 10.5 | 33 | 14 | 389 |
| 100 | 17 | 177 | 26 | M10 x 1.5 | 5 | 10 | M26 x 1.5 | 38 | 1/2 | 68 | 72 | 265 | 69.5 | 10.5 | 37.5 | 15 | 409 |

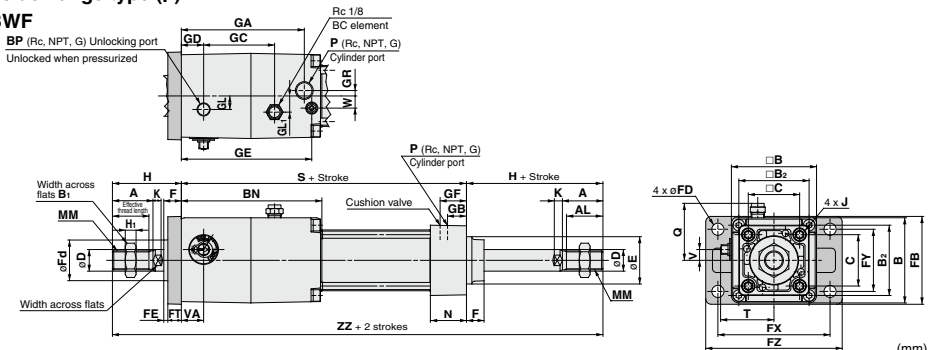
With Rod Boot

Note) ZZ: Dimensions for cylinders with a rod boot on both sides.

| Bore size (mm) | e | f | c | | | | | | | | | | | | | | | | h | | | | | | | | | | | | | | | | zz ^(Notes) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | 1 to 50 | 51 to 100 | 101 to 150 | 151 to 200 | 201 to 250 | 251 to 300 | 301 to 350 | 351 to 400 | 401 to 450 | 451 to 500 | 501 to 550 | 551 to 600 | 601 to 650 | 651 to 700 | 701 to 750 | 751 to 800 | 1 to 50 | 51 to 100 | 101 to 150 | 151 to 200 | 201 to 250 | 251 to 300 | 301 to 350 | 351 to 400 | 401 to 450 | 451 to 500 | 501 to 550 | 551 to 600 | 601 to 650 | 651 to 700 | 701 to 750 | 751 to 800 | 1 to 50 | 51 to 100 | 101 to 150 | 151 to 200 | 201 to 300 | 301 to 400 | 401 to 500 | 501 to 600 | 601 to 700 | 701 to 800 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 36 | 23 | 12.5 | 25 | 37.5 | 50 | 75 | 100 | 125 | — | — | — | — | — | — | — | — | 73 | 86 | 98 | 111 | 136 | 161 | 186 | — | — | — | — | — | — | — | — | — | 300 | 326 | 350 | 376 | 426 | 476 | 526 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | |

MNBWL

* Refer to page 906 for cylinders with a rod boot.

MNBWF

* Refer to page 906 for cylinders with a rod boot.

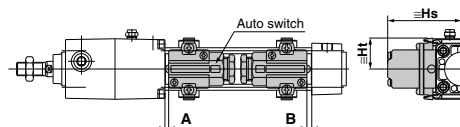
-X□

Auto Switch Mounting 1

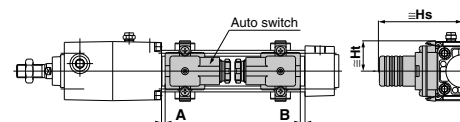
Auto Switch Proper Mounting Position (Detection at Stroke End) and Its Mounting Height

<Band mounting type>

D-A3□/G39/K39



D-A44



<Tie-rod mounting type>

D-M9□/M9□V

D-M9□W/M9□WV

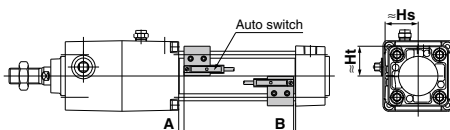
D-M9□A/M9□AV

D-A9□/A9□V

D-Z7□/Z80

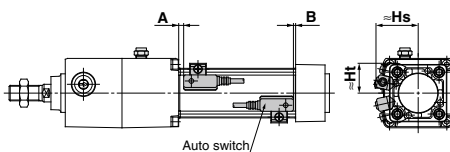
D-Y59/Y69/Y7P/Y7PV

D-Y7□W/Y7□WV/Y7BA



D-A5□/A6□

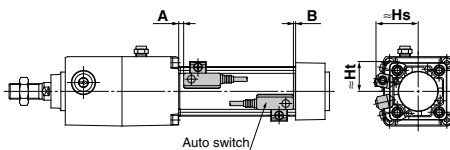
D-A59W



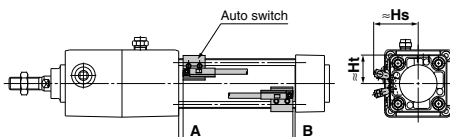
D-F5□/J59

D-F5□W/J59W/F5BA

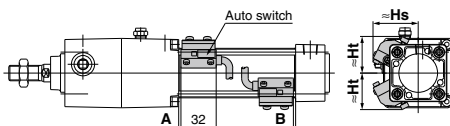
D-F59F/F5NT



D-P3DWA



D-P4DW



Auto Switch Proper Mounting Position (Detection at Stroke End) and Mounting Height**Auto Switch Proper Mounting Position**

(mm)

| Auto switch model Bore size (mm) | D-M9□ D-M9□V D-M9□W D-M9□WV D-M9□A D-M9□AV | | D-A9□ D-A9□V | | D-A5□ D-A6□ | | D-A59W | | D-F5□W D-J59W D-F5□ D-J59 D-F5BA D-F59F | | D-F5NT | | D-A3□ D-A44 D-G39 D-K39 | | D-Z7□ D-Z80 D-Y59□ D-Y69□ D-Y7P D-Y7PV D-Y7□W D-Y7□WV D-Y7BA | | D-P3DWA | | D-P4DW | |
|-------------------------------------|---|------|-----------------|-----|----------------|-----|--------|-----|--|-----|--------|-----|----------------------------------|-----|--|-----|---------|-----|--------|-----|
| | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B |
| 32 | 10.5 | 8 | 6.5 | 4 | 0.5 | 0 | 4.5 | 2 | 7 | 4.5 | 12 | 9.5 | 0.5 | 0 | 4 | 1.5 | 6 | 3 | 3.5 | 1 |
| 40 | 10.5 | 8 | 6.5 | 4 | 0.5 | 0 | 4.5 | 2 | 7 | 4.5 | 12 | 9.5 | 0.5 | 0 | 4 | 1.5 | 6 | 3.5 | 3.5 | 1 |
| 50 | 11 | 8.5 | 7 | 4.5 | 1 | 0 | 5 | 2.5 | 7.5 | 5 | 12.5 | 10 | 1 | 0 | 4.5 | 2 | 6.5 | 4 | 4 | 1.5 |
| 63 | 11 | 8.5 | 7 | 4.5 | 1 | 0 | 5 | 2.5 | 7.5 | 5 | 12.5 | 10 | 1 | 0 | 4.5 | 2 | 6.5 | 4 | 4 | 1.5 |
| 80 | 14 | 12.5 | 10 | 8.5 | 4 | 2.5 | 8 | 6.5 | 10.5 | 9 | 15.5 | 14 | 4 | 2.5 | 7.5 | 6 | 9.5 | 8 | 7 | 5.5 |
| 100 | 14 | 12.5 | 10 | 8.5 | 4 | 2.5 | 8 | 6.5 | 10.5 | 9 | 15.5 | 14 | 4 | 2.5 | 7.5 | 6 | 9.5 | 8 | 7 | 5.5 |

(Note) Adjust the auto switch after confirming the operating conditions in the actual setting.

Auto Switch Mounting Height

(mm)

| Auto switch model Bore size (mm) | D-M9□ D-M9□W D-M9□A D-A9□ | | D-M9□V D-M9□WV D-M9□AV | | D-A9□V | | D-A5□ D-A6□ D-A59W | | D-F5□ D-J59 D-F59F D-F5□W D-J59W D-F5BA D-F5NT | | D-A3□ D-G39 D-K39 | | D-A44 | | D-Z7□ D-Z80 D-Y59□ D-Y7P D-Y7□W D-Y7BA | | D-Y69□ D-Y7PV D-Y7□WV | | D-P3DWA | | D-P4DW | |
|-------------------------------------|------------------------------------|------|------------------------------|------|--------|------|--------------------------|------|--|------|-------------------------|------|-------|------|---|------|-----------------------------|------|---------|------|--------|------|
| | Hs | Ht | Hs | Ht | Hs | Ht | Hs | Ht | Hs | Ht | Hs | Ht | Hs | Ht | Hs | Ht | Hs | Ht | Hs | Ht | Hs | Ht |
| 32 | 24.5 | 23 | 30.5 | 23 | 27.5 | 23 | 35 | 24.5 | 32.5 | 25 | 67 | 27.5 | 77 | 27.5 | 25.5 | 23 | 26.5 | 23 | 38 | 31 | 38 | 31 |
| 40 | 28.5 | 25.5 | 34 | 25.5 | 31.5 | 25.5 | 38.5 | 27.5 | 36.5 | 27.5 | 71.5 | 27.5 | 81.5 | 27.5 | 29.5 | 26 | 30 | 26 | 39 | 25.5 | 42 | 33 |
| 50 | 33.5 | 31 | 38.5 | 31 | 36 | 31 | 43.5 | 34.5 | 41 | 34 | 77 | — | 87 | — | 33.5 | 31 | 34.5 | 31 | 43 | 31 | 46.5 | 39 |
| 63 | 38.5 | 36 | 43 | 36 | 40.5 | 36 | 48.5 | 39.5 | 46 | 39 | 83.5 | — | 93.5 | — | 39 | 36 | 40 | 36 | 48 | 36 | 51.5 | 44 |
| 80 | 46.5 | 45 | 52 | 45 | 49 | 45 | 55 | 46.5 | 52.5 | 46.5 | 92.5 | — | 103 | — | 47.5 | 45 | 48.5 | 45 | 56.5 | 45 | 58 | 51.5 |
| 100 | 54 | 53.5 | 59.5 | 53.5 | 57 | 53.5 | 62 | 55 | 59.5 | 55 | 103 | — | 113.5 | — | 55.5 | 53.5 | 56.5 | 53.5 | 64.5 | 53.5 | 65.5 | 60.5 |

Operating Range

(mm)

| Auto switch model | Bore size (mm) | | | | | |
|---|----------------|-----|-----|-----|-----|------|
| | 32 | 40 | 50 | 63 | 80 | 100 |
| D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV | 4 | 4.5 | 5 | 6 | 6 | 6 |
| D-A9□/A9□V | 7 | 7.5 | 8.5 | 9.5 | 9.5 | 10.5 |
| D-Z7□/Z80 | 7.5 | 8.5 | 7.5 | 9.5 | 9.5 | 10.5 |
| D-A5□/A6□ | 9 | 9 | 10 | 11 | 11 | 11 |
| D-A59W | 13 | 13 | 13 | 14 | 14 | 15 |
| D-A3□/A44 | 9 | 9 | 10 | 11 | 11 | 11 |
| D-Y59□/Y69□ D-Y7P/Y7□V D-Y7□W/Y7□WV D-Y7BA | 5.5 | 5.5 | 7 | 7.5 | 6.5 | 5.5 |
| D-F5□/J59 D-F5□W/J59W D-F5BA/F5NT D-F59F | 3.5 | 4 | 4 | 4.5 | 4.5 | 4.5 |
| D-G39/K39 | 9 | 9 | 10 | 11 | 11 | 11 |
| D-P3DWA | 3 | 4.5 | 4.5 | 5 | 5 | 5.5 |
| D-P4DW | 4 | 4 | 4 | 4.5 | 4 | 4.5 |

* Since this is a guideline including hysteresis, not meant to be guaranteed.

(Assuming approximately ±30% dispersion.)

There may be the case it will vary substantially depending on an ambient environment.

CLJ2

CLM2

CLG1

CL1

MLGC

CNG

MNB

CNA2

CNS

CLS

CLQ

RLQ

MLU

MLGP

ML1C

D-□

-X□

Auto Switch Mounting 2

Minimum Stroke for Auto Switch Mounting

| Auto switch model | No. of auto switches mounted | ø32, ø40, ø50, ø63, ø80, ø100 |
|---|---|---|
| D-M9□ D-M9□W D-M9□A | 2 (Different surfaces, same surface), 1 | 15 |
| | n | $15 + 40 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note |
| D-M9□V D-M9□WV D-M9□AV | 2 (Different surfaces, same surface), 1 | 10 |
| | n | $10 + 30 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note |
| D-A9□ | 2 (Different surfaces, same surface), 1 | 15 |
| | n | $15 + 40 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note |
| D-A9□V | 2 (Different surfaces, same surface), 1 | 10 |
| | n | $10 + 30 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note |
| D-A3□ D-G39 D-K39 | 2 (Different surfaces) | 35 |
| | 2 (Same surface) | 100 |
| | n (Different surfaces) | $35 + 30 (n-2)$ (n = 2, 3, 4...) |
| | n (Same surface) | $100 + 100 (n-2)$ (n = 2, 3, 4...) |
| | 1 | 10 |
| D-A44 | 2 (Different surfaces) | 35 |
| | 2 (Same surface) | 55 |
| | n (Different surfaces) | $35 + 30 (n-2)$ (n = 2, 3, 4...) |
| | n (Same surface) | $55 + 50 (n-2)$ (n = 2, 3, 4...) |
| | 1 | 10 |

Note) When "n" is an odd number, an even number that is one larger than this odd number is used for the calculation.

| n: No. of auto switches (mm) | | | |
|---|---|---|---|
| Auto switch model | No. of auto switches mounted | ø32, ø40, ø50, ø63 | ø80, ø100 |
| D-A5□ D-A6□ | 2 (Different surfaces, same surface), 1 | 15 | 20 |
| | n (Same surface) | $15 + 55 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note | $20 + 55 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note |
| D-A59W | 2 (Different surfaces, same surface) | 20 | 25 |
| | n (Same surface) | $20 + 55 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note | $25 + 55 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note |
| | 1 | 15 | 25 |
| D-F5□/J59 D-F5□W D-J59W D-F5BA D-F59F D-F5NT | 2 (Different surfaces, same surface) | 15 | 25 |
| | n (Same surface) | $15 + 55 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note | $25 + 55 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note |
| | 1 | 10 | 25 |
| D-Z7□ D-Z80 D-Y59□ D-Y7P D-Y7□W | 2 (Different surfaces, same surface), 1 | 15 | |
| | n | $15 + 40 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note | |
| D-Y69□ D-Y7PV D-Y7□WV | 2 (Different surfaces, same surface), 1 | 10 | |
| | n | $10 + 30 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note | |
| D-Y7BA | 2 (Different surfaces, same surface), 1 | 20 | |
| | n | $20 + 45 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note | |
| D-P3DWA | 2 (Different surfaces, same surface), 1 | 15 | |
| | n | $15 + 50 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note | |
| D-P4DW | 2 (Different surfaces, same surface), 1 | 15 | |
| | n | $15 + 65 \frac{(n-2)}{2}$ (n=2, 4, 6, 8...) Note | |

Auto Switch Mounting Bracket Part No.

| Auto switch model | Bore size (mm) | | | | | |
|---|----------------|-----------|-----------|-----------|-----------|-----------|
| | ø32 | ø40 | ø50 | ø63 | ø80 | ø100 |
| D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV D-A9□/A9□V | BMB5-032 | BMB5-032 | BA7-040 | BA7-040 | BA7-063 | BA7-063 |
| D-A3□/A44 D-G39/K39 | BMB2-032 | BMB2-040 | BMB1-050 | BMB1-063 | BMB1-080 | BMB1-100 |
| D-A5□/A6□ D-A59W D-F5□/J59 D-F5□W/J59W D-F5□F D-F5BA D-F5NT | BT-03 | BT-03 | BT-05 | BT-05 | BT-06 | BT-06 |
| D-P3DWA | BA10-032S | BA10-040S | BA10-050S | BA10-050S | BA10-063S | BA10-063S |
| D-P4DW | BMB3T-040 | BMB3T-040 | BMB3T-050 | BMB3T-050 | BMB3T-080 | BMB3T-080 |
| D-Z7□/Z80 D-Y59□/Y69□ D-Y7P/Y7PV D-Y7□W D-Y7□WV D-Y7BA | BMB4-032 | BMB4-032 | BMB4-050 | BMB4-050 | BA4-063 | BA4-063 |

[Mounting screws set made of stainless steel]

The following set of mounting screws made of stainless steel is also available. Use it in accordance with the operating environment. (Please order the auto switch mounting bracket separately, since it is not included.)

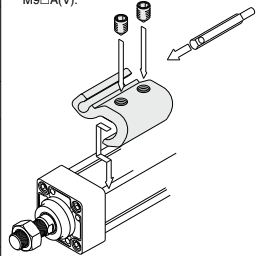
BBA1: For D-A5/A6/F5/J5 types

D-F5BA auto switch is set on the cylinder with the stainless steel screws above when shipped. When an auto switch is shipped independently, BBA1 is attached.

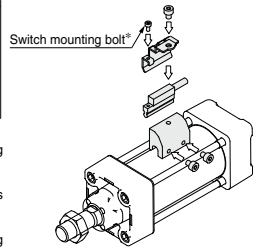
Note 1) Refer to page 1233 for the details of BBA1.

Note 2) When using D-M9□A(V)/Y7BA, do not use the steel set screws which is included with the auto switch mounting brackets above (BMB5-032, BA7-□□□, BMB4-□□□, BA4-□□□). Order a stainless steel screw set (BBA1) separately, and select and use the M4 x 6L stainless steel set screws included in the BBA1.

* The above figure shows the mounting example of D-A9□(V)/M9□(V)/M9□W(V)/M9□A(V).



◀Mounting example for ø32, D-P3DWA▶



* The switch mounting bolt is supplied with the switch.

CLJ2
CLM2
CLG1
CL1
MLGC
CNG
MNB
CNA2
CNS
CLS
CLQ
RLQ
MLU
MLGP
ML1C

Besides the models listed in How to Order, the following auto switches are applicable.
For detailed specifications, refer to pages 1119 to 1245.

| Auto switch type | Model | Electrical entry (Fetching direction) | Features |
|------------------|-----------------------|---------------------------------------|--|
| Reed | D-A93V, A96V | Grommet (Perpendicular) | — |
| | D-A90V | | Without indicator light |
| | D-A53, A56, Z73, Z76 | Grommet (In-line) | — |
| | D-A67, Z80 | | Without indicator light |
| Solid state | D-M9NV, M9PV, M9BV | Grommet (Perpendicular) | — |
| | D-Y69A, Y69B, Y7PV | | — |
| | D-M9NWV, M9PWV, M9BWV | | Diagnostic indication (2-color indicator) |
| | D-Y7NWV, Y7PWV, Y7BWV | | Water resistant (2-color indicator) |
| | D-M9NAV, M9PAV, M9BAV | Grommet (In-line) | — |
| | D-F59, F5P, J59 | | — |
| | D-Y59A, Y59B, Y7P | | — |
| | D-F59W, F5PW, J59W | | Diagnostic indication (2-color indicator) |
| | D-Y7NW, Y7PW, Y7BW | | Water resistant (2-color indicator) |
| | D-F5BA, Y7BA | | With timer |
| | D-F5NT | | — |
| | D-P5DW | | Magnetic field resistant (2-color indicator) |

* With pre-wired connector is available for solid state auto switches. For details, refer to pages 1192 and 1193.

* Normally closed (NC = b contact), solid state auto switch (D-F9G/F9H/Y7G/Y7H type) are also available. For details, refer to pages 1137 and 1139.

D-□
-X□



MNB Series

Specific Product Precautions 1

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.

Design of Equipment and Machinery

⚠ Warning

1. Construct so that the human body will not come into direct contact with driven objects or the moving parts of the cylinders with lock.

Devise a safe structure by attaching protective covers that prevent direct contact with the human body, or in cases where there is a danger of contact, provide sensors or other devices to perform an emergency stop, etc., before contact occurs.

2. Use a balance circuit, taking cylinder lurching into consideration.

In cases such as an intermediate stop, where a lock is operated at a desired position within the stroke and air pressure is applied from only one side of the cylinder, the piston will lurch at high speed when the lock is released. In such situations, there is a danger of causing human injury by having hands or feet, etc. caught, and also a danger for causing damage to the equipment. In order to prevent this lurching, a balance circuit such as the recommended pneumatic circuits (pages 914 and 915) should be used.

Selection

⚠ Warning

1. When in the locked state, do not apply a load accompanied by an impact shock, strong vibration or turning force, etc.

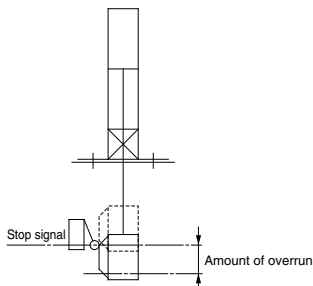
Use caution, because an external action such as an impacting load, strong vibration or turning force, may damage the locking mechanism or reduce its life.

2. Consider stopping accuracy and the amount of over-run when an intermediate stop is performed.

Due to the nature of a mechanical lock, there is a momentary lag with respect to the stop signal, and a time delay occurs before stopping. The cylinder stroke resulting from this delay is the overrun amount. The difference between the maximum and minimum overrun amounts is the stopping accuracy.

- Place a limit switch before the desired stopping position, at a distance equal to the overrun amount.
- The limit switch must have a detection length (dog length) of the overrun amount + Δ .
- SMC's auto switches have operating ranges from 8 to 14 mm (depending on the auto switch model).
When the overrun amount exceeds this range, self-holding of the contact should be performed at the auto switch load side.

* For stopping accuracy, refer to page 891.



Selection

⚠ Warning

3. In order to further improve stopping accuracy, the time from the stop signal to the operation of the lock should be shortened as much as possible.

To accomplish this, use a device such as a highly responsive electric control circuit or solenoid valve driven by direct current, and place the solenoid valve as close as possible to the cylinder.

4. Note that the stopping accuracy will be influenced by changes in piston speed.

When piston speed changes during the course of the cylinder stroke due to variations in the load or disturbances, etc., the dispersion of stopping positions will increase. Therefore, consideration should be given to establishing a standard speed for the piston just before it reaches the stopping position.

Moreover, the dispersion of stopping positions will increase during the cushioned portion of the stroke and during the accelerating portion of the stroke after the start of operation, due to the large changes in piston speed.

5. The holding force (max. static load) indicates the maximum capability to hold a static load without loads, vibration and impact. This does not indicate a load that can be held in ordinary conditions.

Select the most suitable bore sizes for the operating conditions in accordance with the selection procedures. The Model Selection (pages 888 and 889) is based on use at the intermediate stop (including emergency stops during operation). However, when the cylinder is in a locked state, kinetic energy does not act upon it. Under these conditions, use the load mass at the maximum speed (V) of 100 mm/s shown in graphs (5) to (7) on page 889 depending on the operating pressure and select models.

Mounting

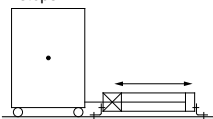
⚠ Warning

1. Be certain to connect the rod end to the load with the lock released.

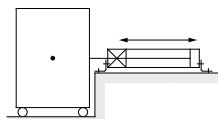
If connected in the locked state, a load greater than the turning force or holding force, etc. may operate on the piston rod and cause damage to the lock mechanism. MNB series is equipped with an emergency unlocking mechanism, however, when connecting the rod end to the load, this should be done with the lock released. This can be accomplished by simply connecting an air line to the unlocking port and supplying air pressure of 0.25 MPa or more.

2. Do not apply offset loads to the piston rod.

Particular care should be taken to match the load's center of gravity with the center of the cylinder shaft. When there is a large discrepancy, the piston rod may be subjected to uneven wear or damage due to the inertial moment during locking stops.



X Load center of gravity and cylinder shaft center are not matched.



O Load center of gravity and cylinder shaft center are matched.

Note) Can be used if all of the generated moment is absorbed by an effective guide.



MNB Series

Specific Product Precautions 2

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.

Mounting

⚠ Caution

1. Use the hexagon wrenches shown below when replacing brackets.

| Bore size (mm) | | Bolt | Width across flats | Tightening torque (N·m) |
|----------------|--------|----------------|--------------------|-------------------------|
| 32, 40 | | MB-32-48-C1247 | 4 | 5.1 |
| 50, 63 | | MB-50-48-C1249 | 5 | 11 |
| 80, 100 | Foot | MB-80-48AC1251 | 6 | 25 |
| | Others | MB-80-48BC1251 | | |

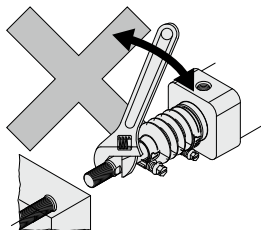
2. When replacing the head side bracket, the tie-rod nut on the cylinder body also loosens.

After retightening the tie-rod nut at the proper tightening torque (Refer to Adjustment 1. below.), install the bracket.

3. Do not turn the piston rod with the rod boot kept locked.

When turning the piston rod, loosen the band once and do not twist the rod boot.

Set the breathing hole in the rod boot downward or in the direction that prevents entry of dust or water content.



Adjustment

⚠ Warning

1. Do not open the cushion valve beyond the stopper.

As a retaining mechanism for the cushion valve, a crimped section (ø32 head cover) or retaining ring is installed (ø40 to ø100), and the cushion valve should not be opened beyond that point.

If not operated in accordance with the above precautions, the cushion valve may be ejected from the cover when air pressure is supplied.

| Bore size (mm) | Cushion valve | Hexagon wrench |
|----------------|---------------|---------------------------------|
| 32, 40 | 2.5 | JIS 4648 Hexagon wrench key 2.5 |
| 50, 63 | 3.0 | JIS 4648 Hexagon wrench key 3 |
| 80, 100 | 4.0 | JIS 4648 Hexagon wrench key 4 |

2. Use the air cushion at the end of cylinder stroke.

If this is not done, the tie-rod or piston assembly will be damaged.

⚠ Caution

1. Adjust the cylinder's air balance.

Balance the load by adjusting the air pressure in the rod and head sides of the cylinder with the load connected to the cylinder and the lock released. Lurching of the cylinder when unlocked can be prevented by carefully adjusting this air balance.

2. Adjust the mounting positions of the detectors on auto switches, etc.

When intermediate stops are to be performed, adjust the mounting positions of detectors on auto switches, etc., taking into consideration the overrun amount with respect to the desired stopping positions.

CLJ2

CLM2

CLG1

CL1

MLGC

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CNA2

CNS

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CLQ

RLQ

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MLGP

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D-□

-X□



MNB Series

Specific Product Precautions 3

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.

Pneumatic Circuit

Warning

1. Be certain to use a pneumatic circuit which will apply balancing pressure to both sides of the piston when in a locked stop.

In order to prevent cylinder lurching after a lock stop, when restarting or when manually unlocking, a circuit should be used to which will apply balancing pressure to both sides of the piston, thereby canceling the force generated by the load in the direction of piston movement.

2. The effective area of the unlocking solenoid valve should be at least 50% of the effective area of the cylinder driving solenoid valve, and it should be installed as close to the cylinder as possible so that it is closer than the cylinder driving solenoid valve.

If the effective area of the unlocking solenoid valve is small or if it is installed at a distance from the cylinder, the time required for exhausting air for unlocking will be longer, which may cause a delay in the locking operation.

The delay in the locking operation may result in problems such as increase of overrun when performing intermediate stop or emergency stop during operation, or if maintaining position from the operation stop state such as drop prevention, workpieces may be dropped depending on the timing of the lock action to the operation delay of the lock.

3. Avoid backflow of the exhaust pressure when there is a possibility of interference of exhaust air, for example for a common exhaust type valve manifold.

The lock may not operate properly when the exhaust air pressure backflows due to interference of the exhaust air when exhausting air for lock release. It is recommended to use an individual exhaust type manifold or individual valves.

4. Allow at least 0.5 seconds from a locked stop (intermediate stop of the cylinder) until release of the lock.

When the locked stop time is too short, the piston rod (and load) may lurch at a speed greater than the control speed of the speed controller.

5. When restarting, control the switching signal for the unlocking solenoid valve so that it acts before or at the same time as the cylinder drive solenoid valve.

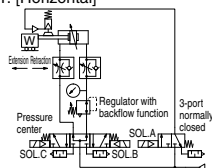
If the signal is delayed, the piston rod (and load) may lurch at a speed greater than the control speed of the speed controller.

6. Carefully check for dew condensation due to repeated air supply and exhaust of the locking solenoid valve.

The operating stroke of the lock part is very small. So, if the piping is long and the air supply and exhaust are repeated, the dew condensation caused by the adiabatic expansion accumulates in the lock part. This may corrode internal parts, causing air leak or lock release fault.

7. Basic circuit

1. [Horizontal]



| SOLA | SOLB | SOLC | Action |
|------|------|------|-------------|
| ON | ON | OFF | Extension |
| OFF | OFF | OFF | Locked stop |
| ON | OFF | OFF | Unlocked |
| ON | ON | OFF | Extension |
| ON | OFF | ON | Retraction |
| OFF | OFF | OFF | Locked stop |
| ON | OFF | OFF | Unlocked |
| ON | ON | ON | Retraction |

0.5 s or more

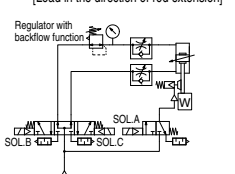
0 to 0.5 s

0.5 s or more

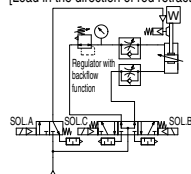
0 to 0.5 s

2. [Vertical]

[Load in the direction of rod extension]



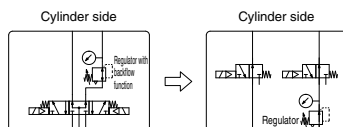
[Load in the direction of rod retraction]



* The symbol for the cylinder with lock in the basic circuit uses SMC original symbol.

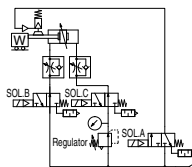
Caution

1. 3-position pressure center solenoid valve and regulator with backflow function can be replaced with two 3-port normally open valves and a regulator with relief function.



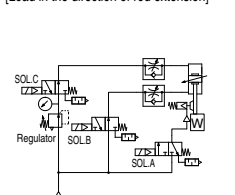
[Example]

1. [Horizontal]

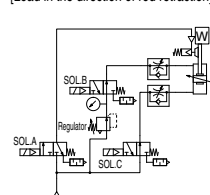


2. [Vertical]

[Load in the direction of rod extension]



[Load in the direction of rod retraction]



* The symbol for the cylinder with lock in the pneumatic circuit uses SMC original symbol.



MNB Series

Specific Product Precautions 4

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.

Manually Unlocking

⚠ Warning

1. **Never operate the unlocking cam until safety has been confirmed. (Do not turn to the FREE side.)**
 - When unlocking is performed with air pressure applied to only one side of the cylinder, the moving parts of the cylinder will lurch at high speed causing a serious hazard.
 - When unlocking is performed, be sure to confirm that personnel are not within the load movement range and that no other problems will occur if the load moves.
2. **Before operating the unlocking cam, exhaust any residual pressure which is in the system.**
3. **Take measures to prevent the load from dropping when unlocking is performed.**
 - Perform work with the load in its lowest position.
 - Take measures for drop prevention by strut, etc.

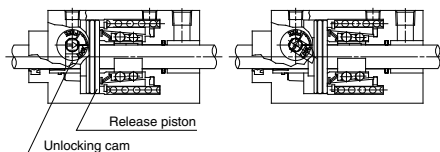
⚠ Caution

1. **The unlocking cam is an emergency unlocking mechanism only.**
During an emergency when the air supply is stopped or cut off, this is used to alleviate a problem by forcibly pushing back the release piston and brake spring to release the lock.
2. **When installing the cylinder into equipment or performing adjustments, etc., be sure to apply air pressure of 0.25 MPa or more to the unlocking port, and do not perform work using the unlocking cam.**
3. **When releasing the lock with the unlocking cam, it must be noted that the internal resistance of the cylinder will be high, unlike normally unlocking with air pressure.**

| Bore size (mm) | Cylinder internal resistance (N) | Cam unlocking torque (standard) (N·m) | Width across flats (mm) |
|----------------|----------------------------------|---------------------------------------|-------------------------|
| 32 | 69 | 2.0 | 5.5 |
| 40 | 108 | 5.9 | 7 |
| 50 | 275 | 11.8 | 8 |
| 63 | 432 | 12.8 | 10 |
| 80 | 686 | 20.6 | 10 |
| 100 | 765 | 23.5 | 12 |

⚠ Caution

5. **For safety reasons, the unlocking cam is constructed so that it cannot be fixed in the unlocked condition.**



Locked state

Manually unlocked state

[Principle]

If the unlocking cam is turned counterclockwise with a tool such as an adjustable angle wrench, the release piston is pushed back and the lock is released. Since the lever will return to its original position when released and become locked again, it should be held in this position for as long as unlocking is needed.

4. **Do not turn the unlocking cam (the arrow or mark on the unlocking cam head) past the position marked FREE.**

If it is turned too far there is a danger of damaging the unlocking cam.

CLJ2

CLM2

CLG1

CL1

MLGC

CNG

MNB

CNA2

CNS

CLS

CLQ

RLQ

MLU

MLGP

ML1C

D-□

-X□



MNB Series

Specific Product Precautions 5

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.

Maintenance

⚠ Caution

1. The lock units for MNB series are replaceable.

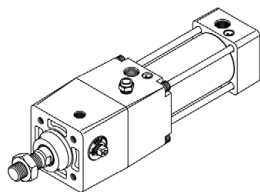
To order replacement lock units for MNB series, use the order numbers given in the table below.

| Bore size (mm) | Lock unit part no. |
|----------------|--------------------|
| 32 | MNB 32D-UA |
| 40 | MNB 40D-UA |
| 50 | MNB 50D-UA |
| 63 | MNB 63D-UA |
| 80 | MNB 80D-UA |
| 100 | MNB100D-UA |

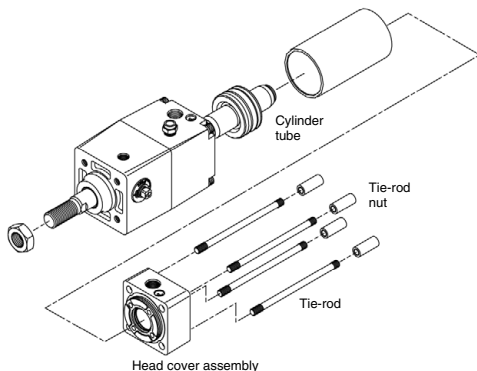
2. How to replace lock unit

- 1) Loosen the tie-rod nuts (4 pcs.) on the cylinder head cover side by using a hexagon wrench.
For the applicable hexagon wrench, refer to the table below.

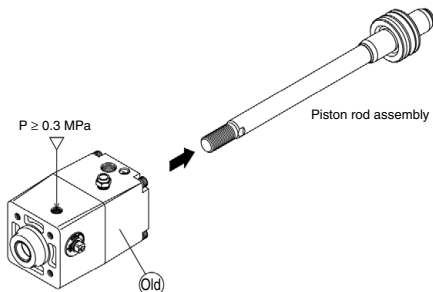
| Bore size (mm) | Tie-rod nut socket width across flats (mm) |
|----------------|--|
| 32, 40 | 6 |
| 50, 63 | 8 |
| 80, 100 | 10 |



- 2) Remove the tie-rods, head cover and cylinder tube.

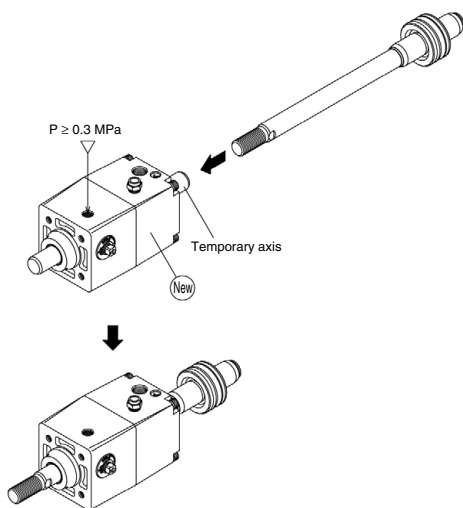


- 3) Apply 0.3 MPa or more of compressed air to the unlocking port, and pull out the piston rod assembly.



- 4) Similarly, apply 0.3 MPa or more of compressed air to the unlocking port of the new lock unit, and replace the new lock unit's temporary axis with the previous piston rod assembly.

Note) Be sure to keep applying compressed air with a pressure of at least 0.3 MPa to the lock releasing port when replacing the temporary axis of a new lock unit and a piston rod assembly.
If the compressed air applied to the unlocking port is released (when it is in the lock condition) while the temporary axis and the piston rod assembly are removed from the lock unit, the brake shoe will be deformed and it will become impossible to insert the piston rod assembly, which will make the lock unit impossible to use.



- 5) Reassemble in reverse order from steps 2) and 1).