



No.

CNG*-OM0002C

OPERATION MANUAL

SERIES CNG

CYLINDER WITH LOCK

- Read this manual thoroughly before mounting and operation.
- Especially, carefully read the description concerning safety.
- Keep this manual where accessible when necessary.

SMC CORPORATION



Series CNG

Safety Instructions

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



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



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



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

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

Note 2) JIS B 8370: General Rule for Pneumatic Systems




Warning

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

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. Ensuring the initial performance and safety is the responsibility of the person who decides the compatibility of pneumatic system. Pneumatic systems should be constructed after full review on the details of the products other than specifications and possibilities of failures by checking the latest product information.

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

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

 Warning

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

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

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

- (1) Conditions and environments beyond the given specifications, or if product is used outdoors.
- (2) Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.

An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

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Series CNG

Cylinder with Lock

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1. Model

Series	Type	Action	Bore size (mm)	Locking action
CNG	Non-lube type	Double acting	20, 25, 32 40	Spring locking

2. Specifications

2-1. Cylinder Specifications

Type	Non-lube type
Fluid	Air
Proof pressure	1.5 MPa {15.3 kgf/ cm ² }
Maximum operating pressure	1.0 MPa {10.2 kgf/ cm ² }
Minimum operating pressure	0.08 MPa {0.82 kgf/ cm ² }
Piston speed	(Note) 50 to 1000 mm/ s
Ambient and fluid temperature	Without auto switch: -10°C to +70°C With auto switch : -10°C to +60°C (With no freezing)
Cushion	Rubber bumper, Air cushion
Stroke length tolerance (mm)	to 800st: +1.4/ 0
Thread tolerance	JIS class 2
Mounting brackets	Basic type, Axial foot type, Front flange type, Rear flange type, Front trunnion type, Rear trunnion type, Clevis type

Note: There is a limit to the load weight depending on the piston speed when locked, mounting position and operating pressure.

2-2. Lock Specifications

Bore size (mm)	20	25	32	40
Locking action	Spring locking (exhaust locking)			
Unlocking pressure	0.20 MPa {2.0 kgf/ cm ² } or more	0.25 MPa {2.5 kgf/ cm ² }		
Locking pressure	0.15 MPa {1.5 kgf/ cm ² } or less	0.20 MPa {2.0 kgf/ cm ² }		
Operating pressure range	0.2 to 1.0 MPa {2.0 to 10.2 kgf/ cm ² } or more	0.25 to 1.0 MPa {2.5 to 10.2 kgf/ cm ² }		
Locking direction	Both directions			
Holding force (Maximum static load)	215N {22kgf}	335N {34kgf}	550N {56kgf}	860N {88kgf}
(Note 1) Allowable kinetic energy when locked	0.35J {3.57 kgf·cm}	0.55J {5.61 kgf·cm}	0.90J {9.18 kgf·cm}	1.41J {14.3 kgf·cm}
(Note 2) Relation between the speed and stopping accuracy when locked	100 mm/ s	+/- 0.3 mm		
	300 mm/ s	+/- 0.6 mm		
	500 mm/ s	+/- 1.0 mm		
	1000 mm/ s	+/- 2.0 mm		

Note 1: There is a limit to the load weight depending on the mounting position, operating pressure and maximum speed.

Note 2: The values do not include variations of the control system.

Conditions : Horizontal, supply pressure of 0.5 MPa {5.1 kgf/cm²}, upper limit of allowable load weight.

Locking solenoid valve: Direct mount to the unlocking port

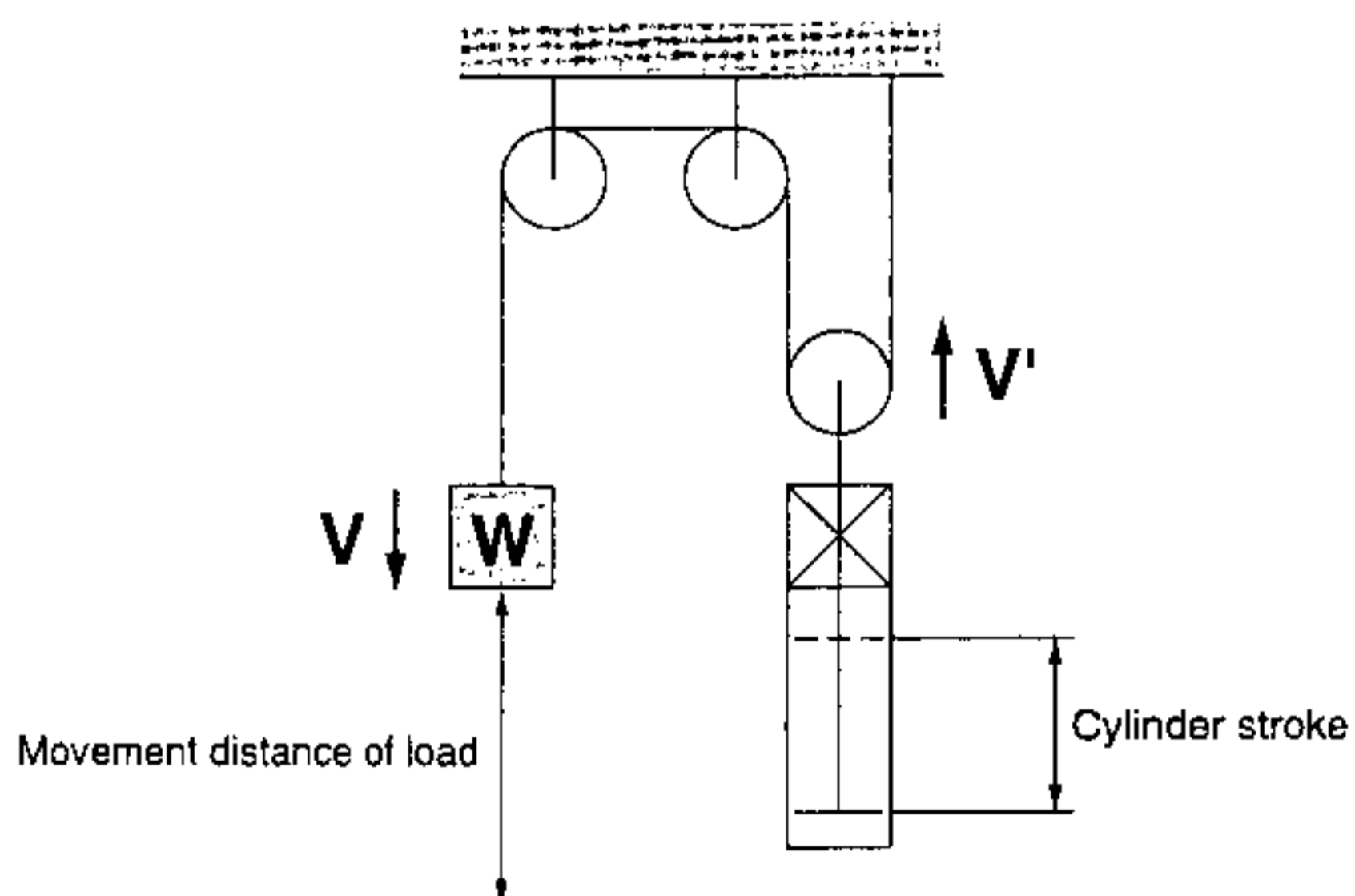
Measurement: Variations in the initial stop position (up to 100 times).

2-3. Precautions on Model Selection

⚠ Caution

- (1) Select an optimum cylinder bore size based on each condition of load weight, movement distance (stroke), mounting position and operating pressure.
- (2) Use the cylinder so that the originally selected maximum speed is not exceeded. Be certain to use a speed controller to adjust the total movement distance (stroke) of the load so that movement takes place in no less than the applicable movement time (that is, not exceeding the originally selected maximum speed).
- (3) The movement time is the time that is necessary for the load to travel the total movement distance (stroke) from the start without any intermediate stops.
- (4) In cases where the cylinder stroke and the movement distance of the load are different (double speed mechanism, etc. Example: Refer to the sketch below.), use the movement distance of the load for selection purposes.

Example)



Selection Example

- Load weight: $m = 12\text{kg}$
- Movement distance: $st = 200\text{mm}$
- Movement time: $t = 0.8\text{s}$
- Load condition: Vertical downward = Load in direction of rod extension
- Operating pressure: $P = 0.4\text{MPa}$

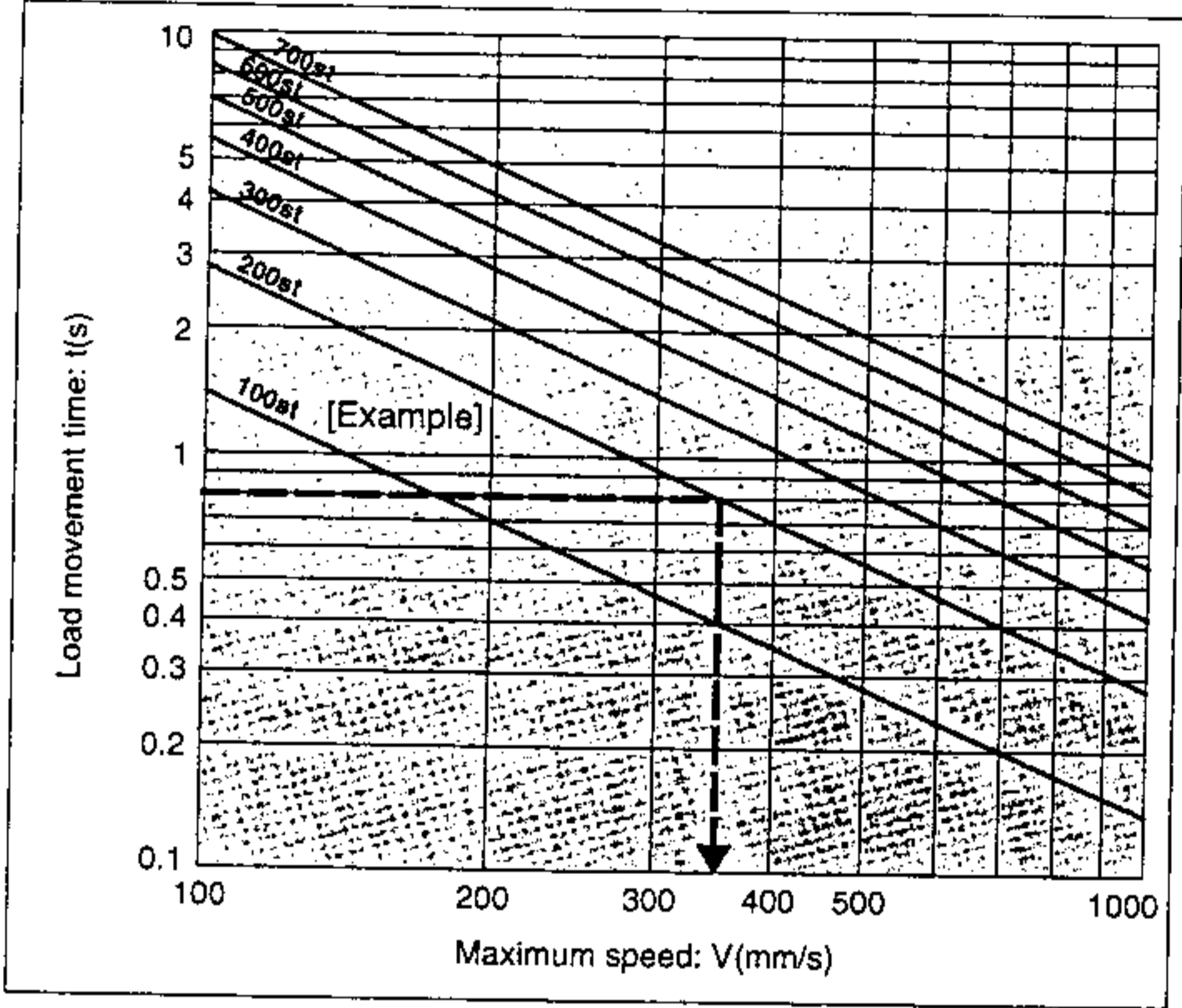
Step 1: From graph 1 find the maximum movement speed of the load
∴ Maximum speed V : approx. 350mm/s

Step 2: Select Graph 6 based upon the load condition and operating pressure, and then from the intersection of the maximum speed $V = 350\text{mm/s}$ found in Step 1, and the load weight $m = 12\text{kg}$
∴ $\phi 32 \rightarrow$ select a CNG32 or larger bore size.

Step 1 Find the maximum load speed: V.

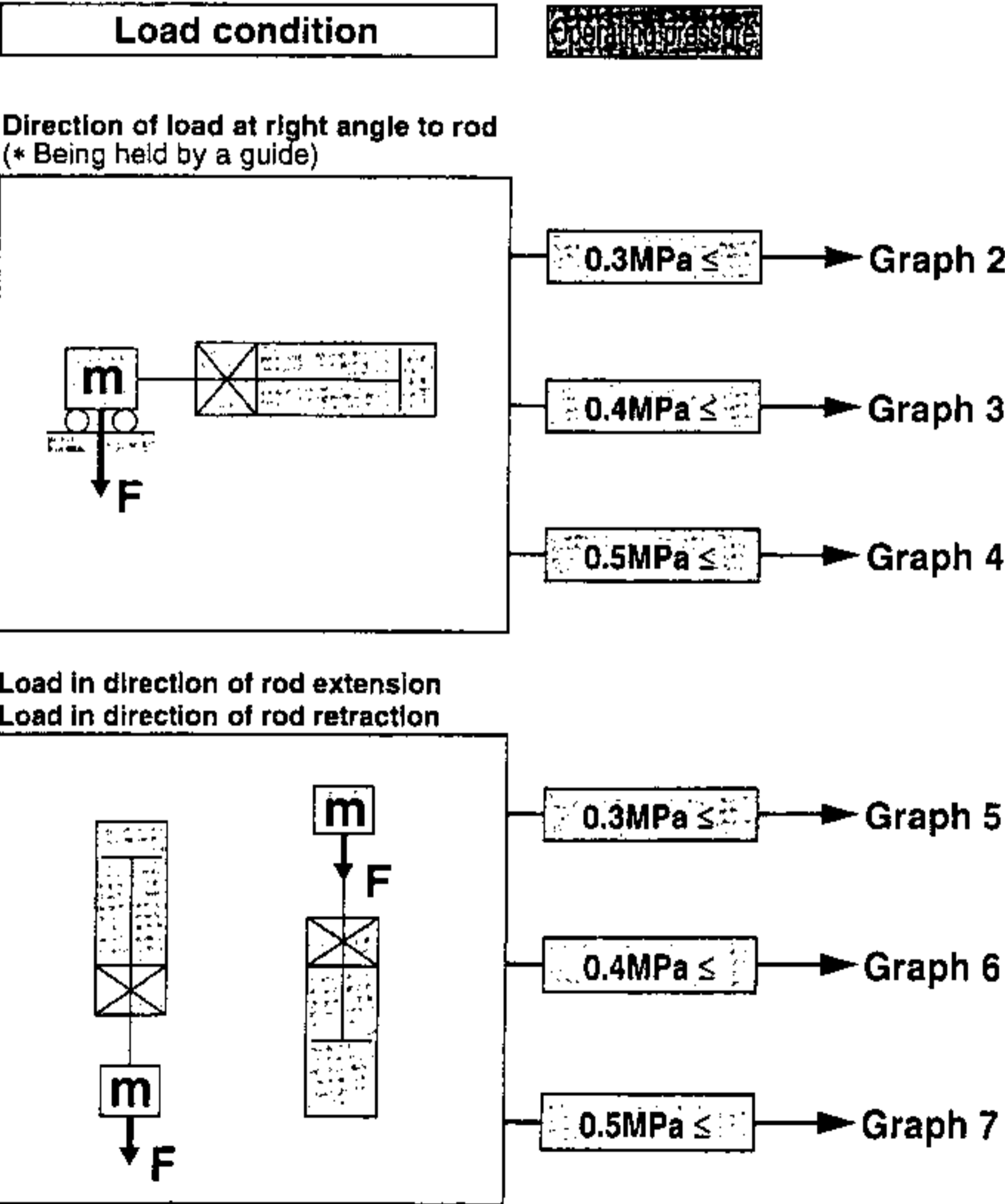
Find the maximum load speed: V(mm/s) from the load movement time: t(s) and the movement distance: st(mm).

Graph 1



Step 2 Find the cylinder bore size.

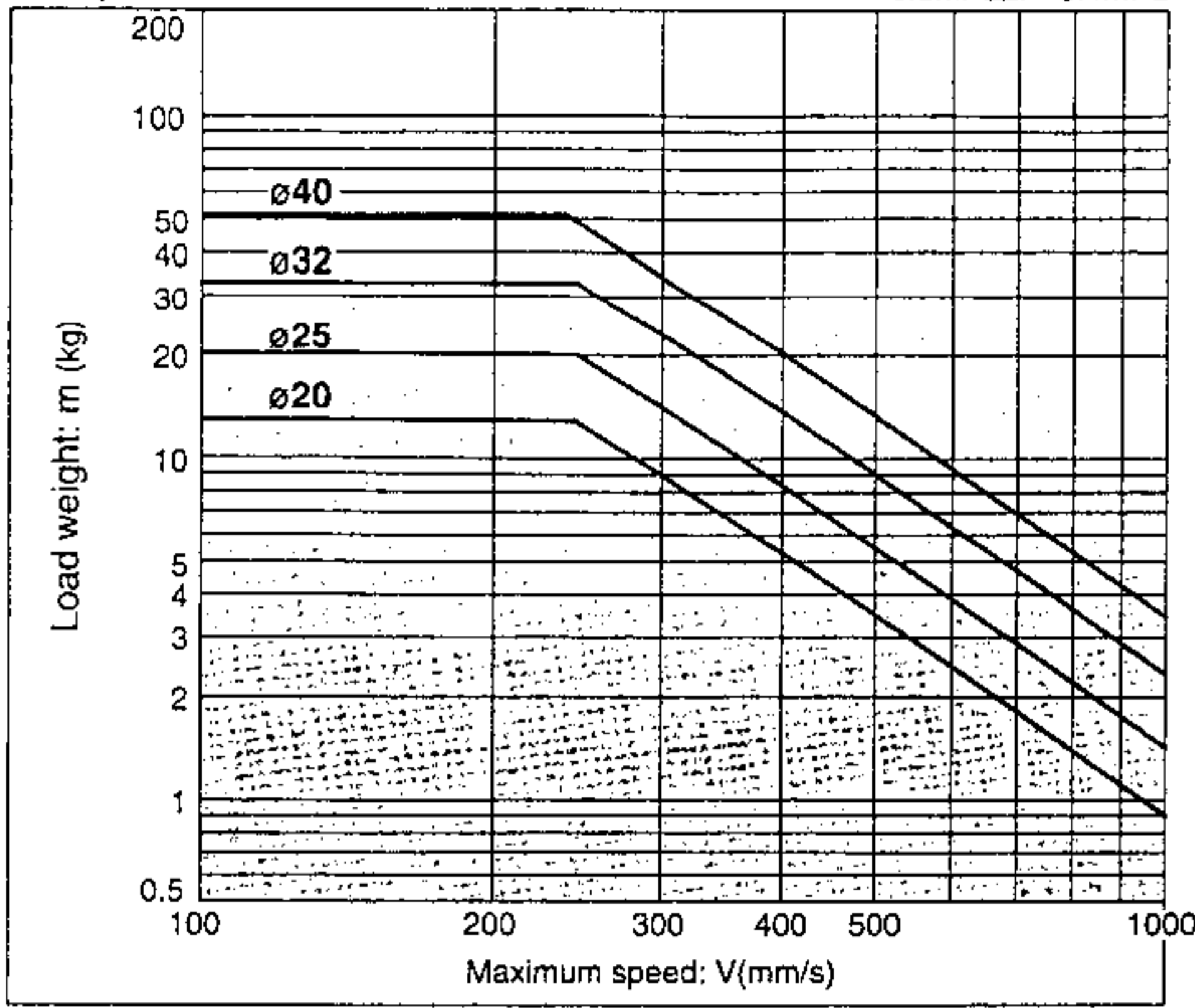
Select a graph based upon the load condition and operating pressure, and then find the point of intersection for the maximum speed found in Step 1 and the load weight. Select the bore size on the line above the point of intersection.



Selection Graphs

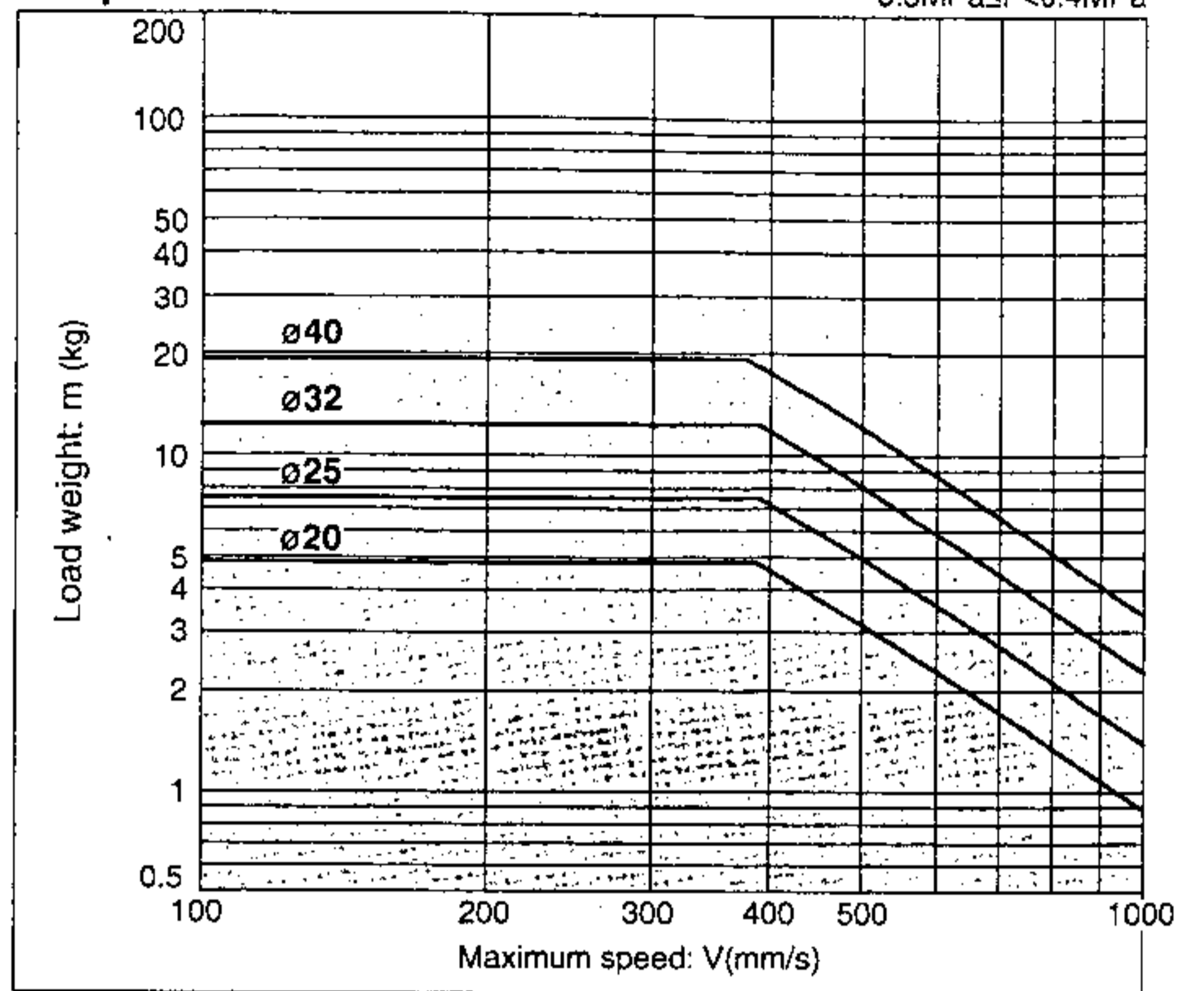
Graph 2

0.3MPa ≤ P < 0.4MPa



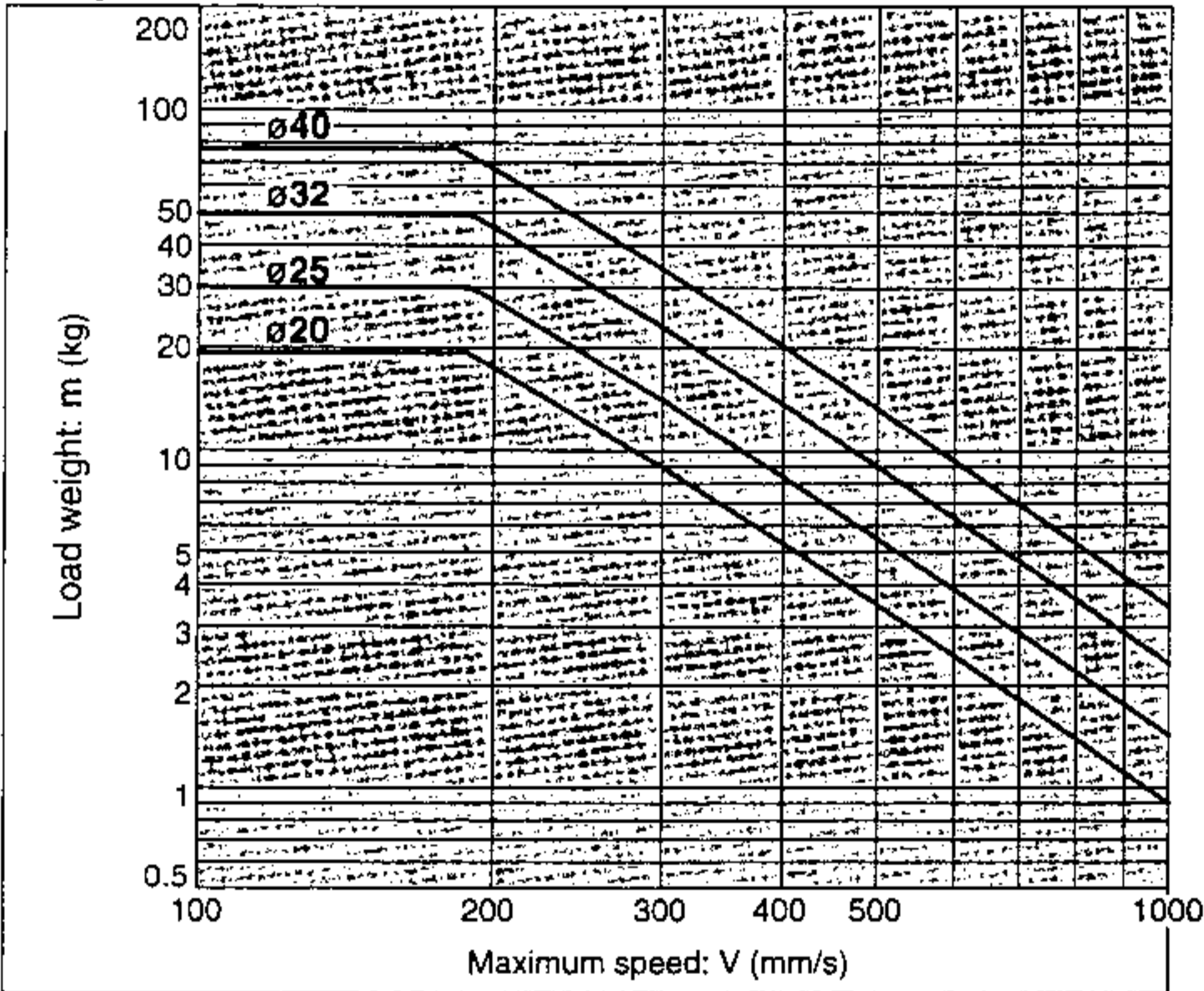
Graph 5

0.3MPa ≤ P < 0.4MPa



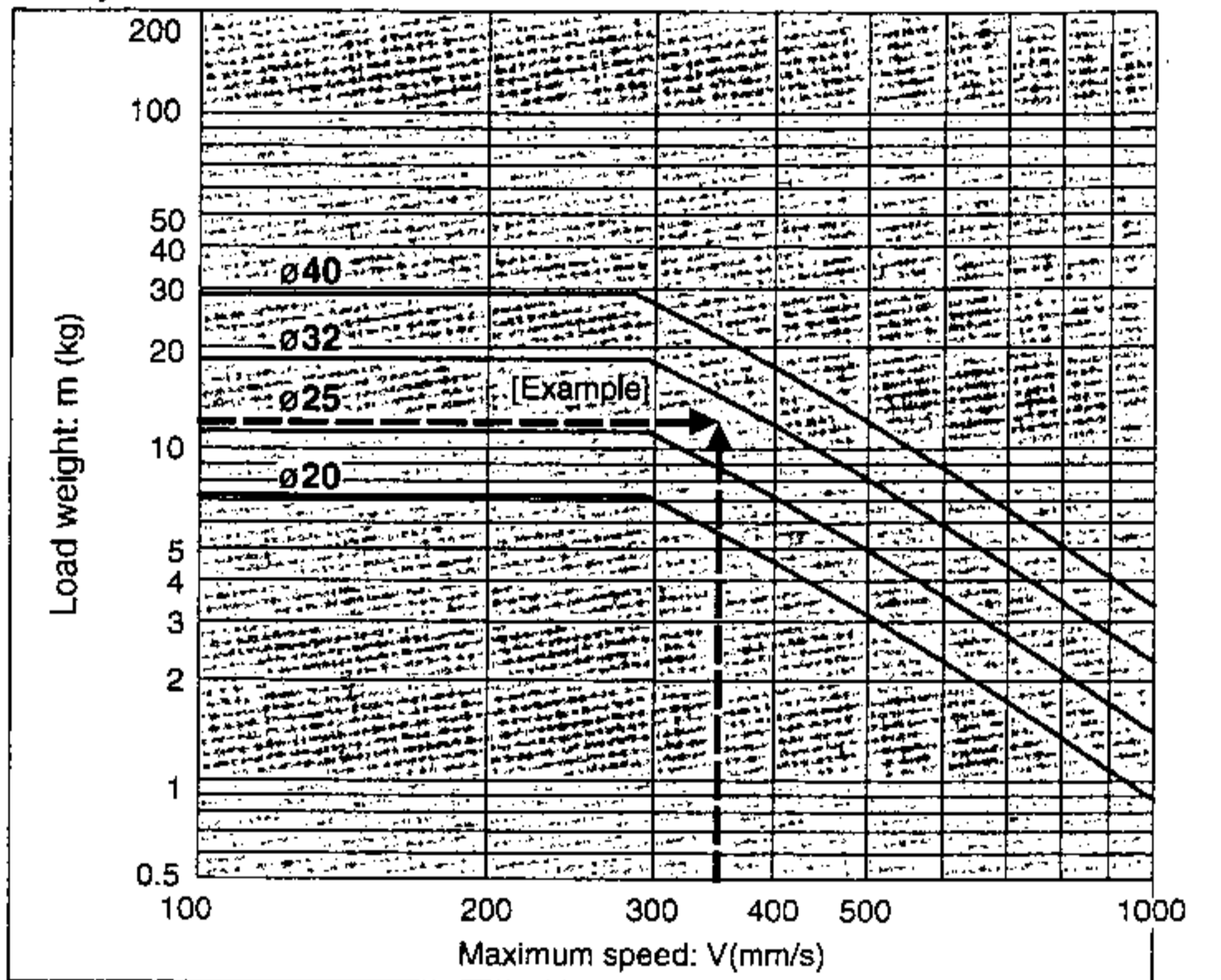
Graph 3

0.4MPa ≤ P < 0.5MPa



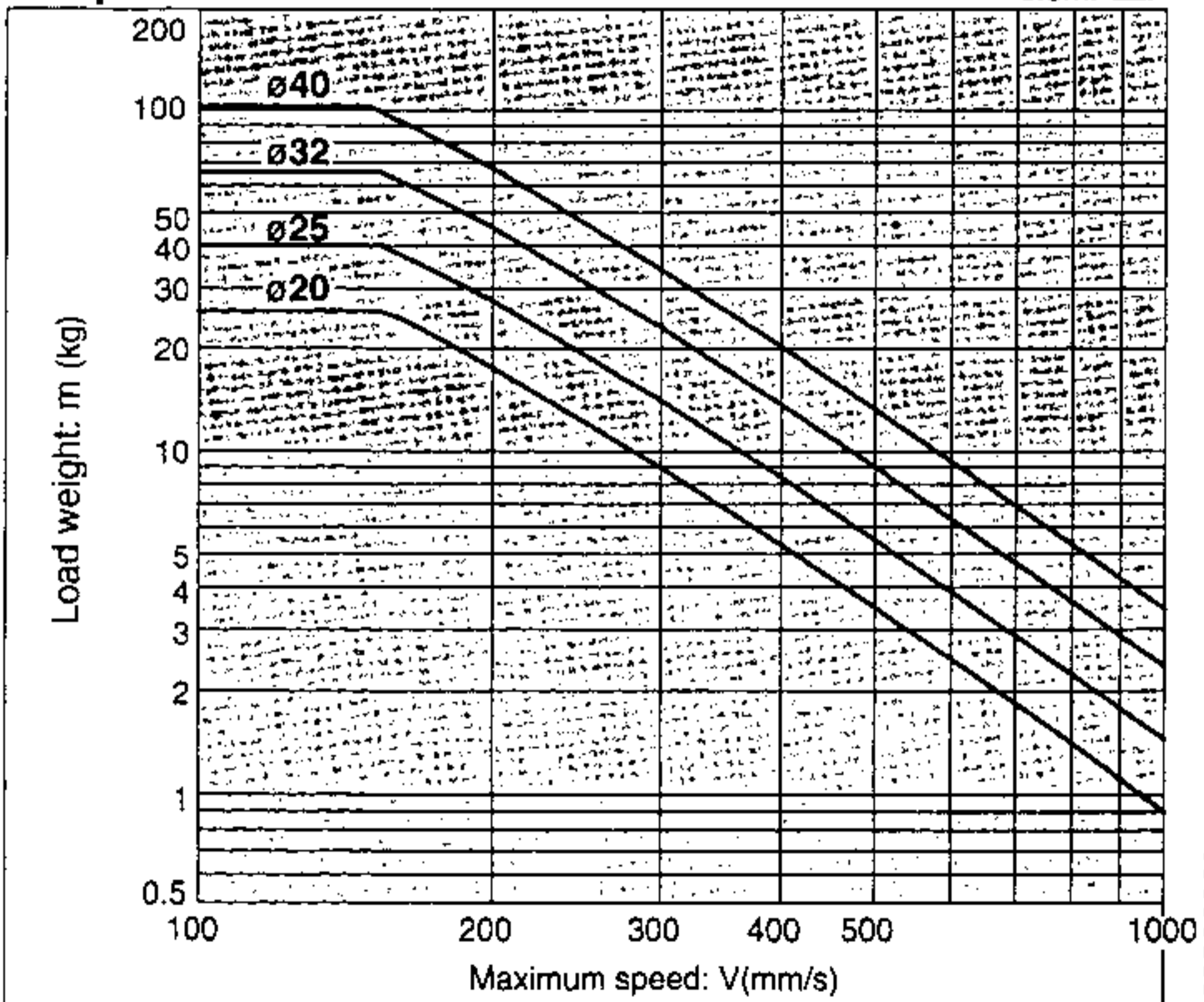
Graph 6

0.4MPa ≤ P < 0.5MPa



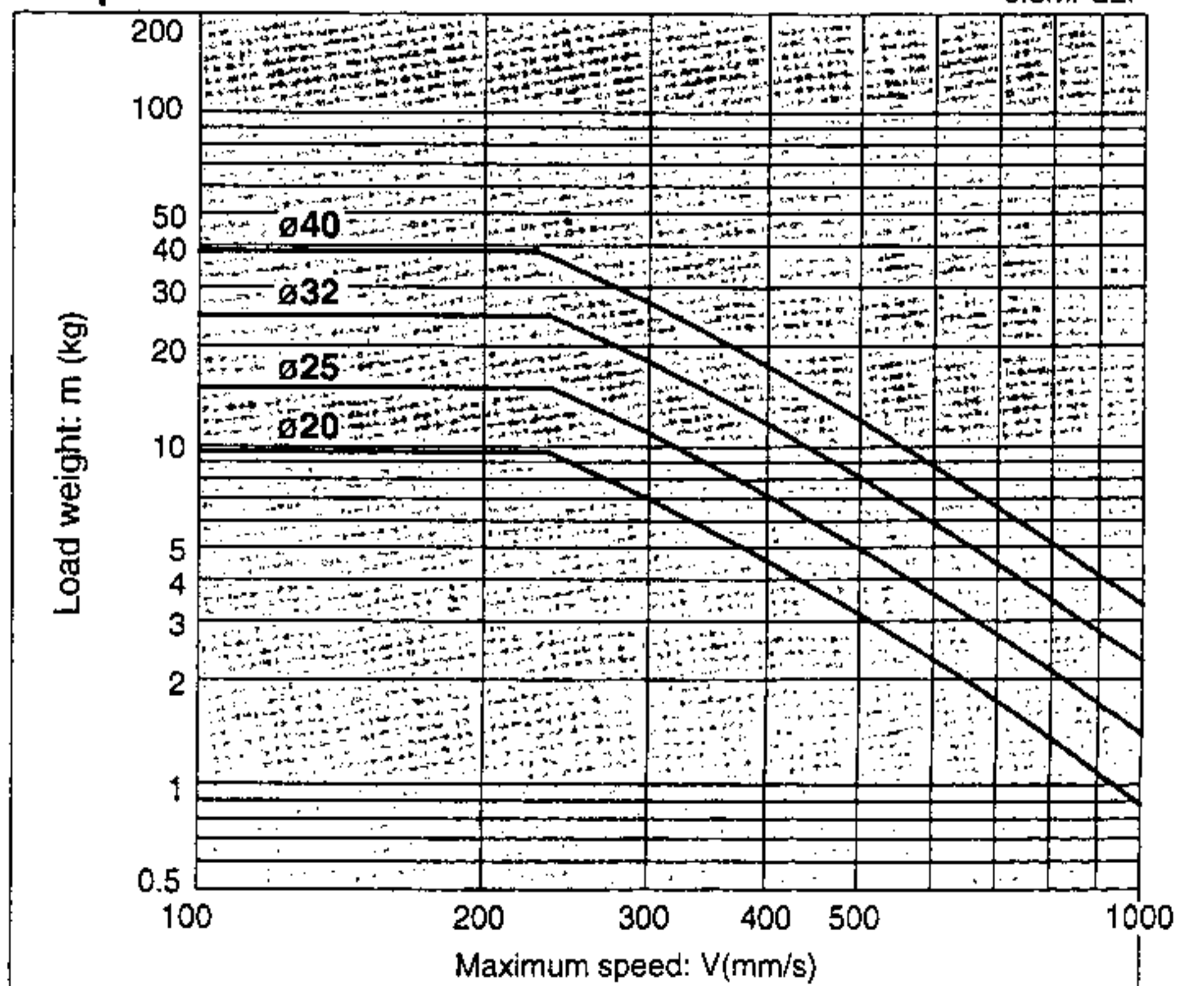
Graph 4

0.5MPa ≤ P



Graph 7

0.5MPa ≤ P



3. Installation

3-1. Operating Air

Air supplied to the cylinder should be filtered by SMC AF series Air Filter and regulated by AR series regulator to the specified pressure.

Warning

(1) Use clean air.

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

Caution

(1) Install air filters.

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

(2) Install an air dryer, or after cooler, etc.

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

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

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

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

(4) Lubrication of non-lube type cylinder

This cylinder is non-lube type and can be used without any further lubrication. However, in the event that it will be lubricated, integrate a lubricator in the circuit and use turbine oil class 1 (with no additives) ISO VG32. Stopping lubrication later may lead to malfunction due to the loss of the original lubricant. Therefore, lubrication must be continued once it has been started.

3-2. Operating Environment

Warning

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

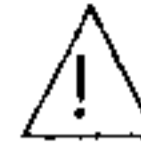
Refer to 5-1. Structural drawing regarding cylinder materials.

(2) In dirty areas, such as dusty locations or where water, oil, etc. splash on the equipment, take suitable measures to protect the rod.

(3) Avoid high humidity in cylinder storage.

Store the cylinder with the rod retracted and in places where humidity is low to prevent rusts.

3-3. Piping

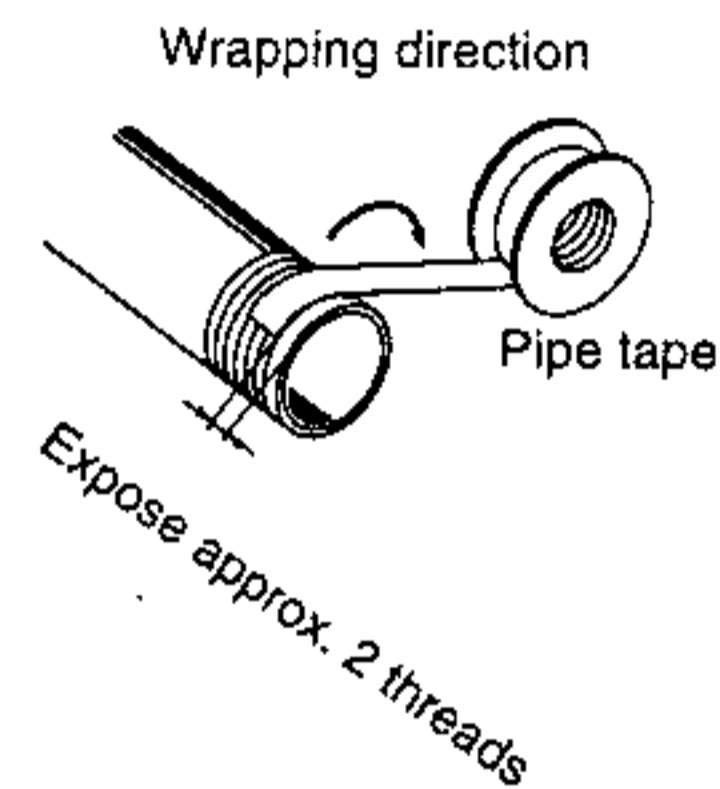
 Caution

(1) Preparation before piping

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

(2) Wrapping of pipe tape

When screwing together pipes and fittings, etc., be certain that chips from the pipe threads and sealing material do not get inside the piping. Also, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the pipe.



3-4. Cushion

3-4-1. With Rubber Bumper: Series CNG*N

Rubber bumpers installed on the both sides of the piston reduce impacts at stroke end and absorb impact noises during operation, allowing high speed and frequency operation of the cylinder.

 Caution

(1) For the cylinder with rubber bumpers, bounce may occur at stroke end.

3-4-2. With Air Cushion: Series CNG*A

Air cushions absorb impact by utilizing compression of air and eliminate vibration to the surroundings when a large kinetic energy generated with large load in high speed operation is stopped at stroke end.

 Caution

- (1) Cushions are adjusted at the time of shipment, however, the cushion needle on the cover should be readjusted when the product is put into service, based on factors such as the size of the load and the operating speed.
- (2) When the cushion needle is turned clockwise, the restriction becomes smaller and the cushion's effectiveness is increased. Turning counterclockwise reverses the condition.
- (3) Within a long-term use, cushion packing wears and the originally adjusted cushion effectiveness changes. In such cases, cushions should be readjusted.
- (4) Do not operate with the cushion needle in a fully closed condition. This will cause problems such as bounce at stroke end, incomplete movement (stroke) and seal damage due to excessive pressure.
- (5) When the cylinder operates with the cushion needle in a fully open condition, impact becomes considerably large, as with the cylinder without cushions.
- (6) Air cushions are not designed to achieve low speed piston movement near the stroke end.

3-4-3. Cylinder Cushion Mechanism Absorbable Energy

There is a limit to the relation between the piston speed and load weight depending on the cylinder cushion mechanism.

Cylinder Cushion Mechanism Absorbable Energy

Bore size (mm)	Rubber bumper (N)	Air cushion (A)	
	Absorbable energy E _{max} (J)	Effective cushion length (mm)	Absorbable energy E _{max} (J)
20	0.28	R: 7.0, H: 7.5	R: 0.35, H: 0.42
25	0.41	R: 7.0, H: 7.5	R: 0.56, H: 0.65
32	0.66	7.5	0.91
40	1.20	8.7	1.80

R: Rod side, H: Head side

Formula

$$E = \frac{1}{2}mV^2 \quad \text{Here, the range of } E \leq E_{\max} \text{ should be satisfied.}$$

E: Kinetic energy (J)

m: Load weight (kg)

V: Maximum piston speed (m/ s)

 Warning

(1) Use the product within the range of specifications for absorbable energy.

When the cylinder is used exceeding the cylinder cushion mechanism absorbable energy, the cylinder will break and it may lead to human injury or machinery damage. Cases where the cylinder is used with energy exceeding the absorbable range, be certain to install an external shock absorber to relieve the impact on the cylinder body. In such cases, the rigidity of the machinery should also be examined.

3-5. Precautions on Mounting

 Warning

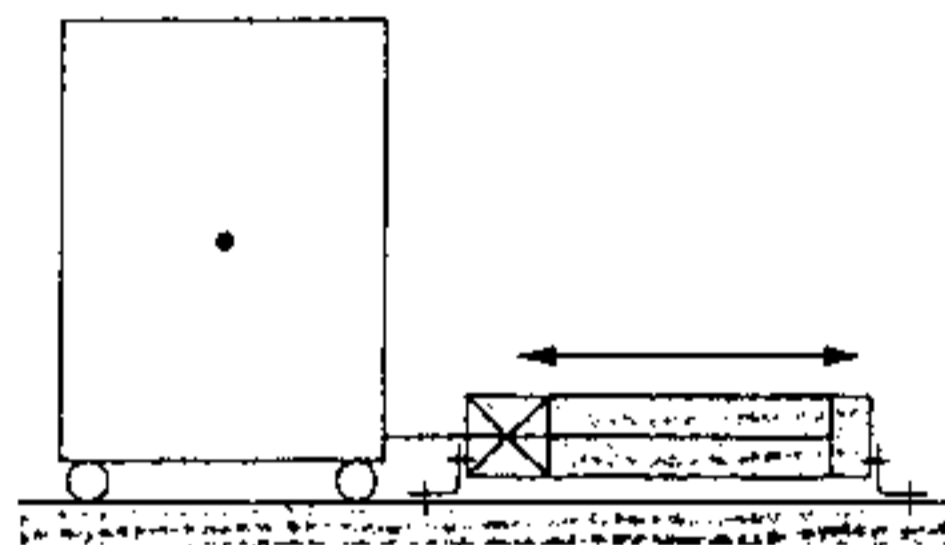
(1) Be certain to connect the rod end to the load with the lock released.

- (a) If connected when in the locked condition, a load greater than the turning force or holding force may operate on the piston rod and cause damage to the lock mechanism.
- (b) The CNG 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 by simply connecting an air line to the unlocking port and supplying air pressure of 0.25 MPa {2.5 kgf/cm²} or more.

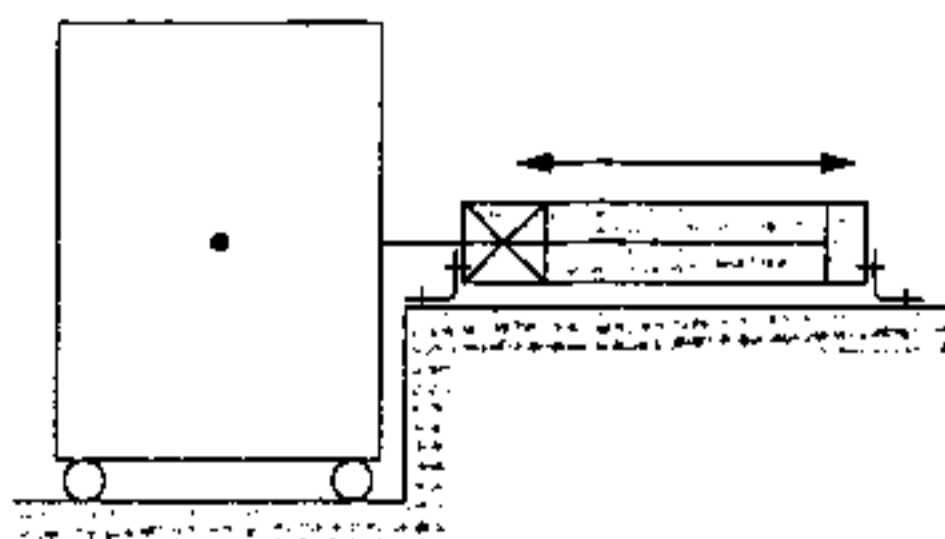
 Caution

(1) Do not apply an offset load 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.

- (2) **Do not scratch or gouge the sliding parts of the cylinder tube or piston rod, etc., by striking or grasping them with other objects.**

Cylinder bores are manufactured to precise tolerances, so that even a slight deformation may cause faulty operation. Moreover, scratches or dents, etc. in the piston rod may lead to damaged seals and cause air leakage and locking failure.

- (3) **When in a locked condition, 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.

- (4) **Prevent the seizure of rotating parts.**

Prevent the seizure of rotating parts (pins, etc.) by applying grease.

- (5) **Do not use until you verify that the equipment can operate properly.**

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

- (6) **At mounting cylinder at site with available parts, give ample care to prevent dust and contaminants in atmosphere from entering ports.**

- (7) **When assembling mounting brackets (such as foot, flange, clevis and trunnion) to the cylinder, use the torque shown in the table below.**

Fastening Torque

Bore size (mm)	Foot, Flange, Clevis	Trunnion	Head side cushion valve (retainer nut)	Head side cushion valve (lock nut)
20	1.0 N·m {10.2 kgf·cm}	1.5 N·m {15.3 kgf·cm}	2.0 N·m {20.4 kgf·cm}	0.5 N·m {5.1 kgf·cm}
25	2.0 N·m {20.4 kgf·cm}	2.5 N·m {25.5 kgf·cm}	2.0 N·m {20.4 kgf·cm}	0.5 N·m {5.1 kgf·cm}
32	2.0 N·m {20.4 kgf·cm}	5.9 N·m {60.2 kgf·cm}	2.0 N·m {20.4 kgf·cm}	0.5 N·m {5.1 kgf·cm}
40	3.4 N·m {34.7 kgf·cm}	10.8 N·m {110 kgf·cm}	2.0 N·m {20.4 kgf·cm}	0.5 N·m {5.1 kgf·cm}

3-6. Air Pressure Circuit

Warning

- (1) **Be certain to use an air pressure 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 locked stop, when restarting or when manually unlocking, a circuit should be used 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) **Use a solenoid valve for unlocking which has a large effective area, as a rule 50% or more of the effective area of the cylinder drive solenoid valve.**

The larger the effective area is, the shorter the locking time will be (the overrun amount will be shorter), and stopping accuracy will be improved.

- (3) **Place the solenoid valve for unlocking close to the cylinder, and no farther than the cylinder drive solenoid valve.**

The less distance there is from the cylinder (the shorter the piping), the shorter the overrun amount will be, and stopping accuracy will be improved.

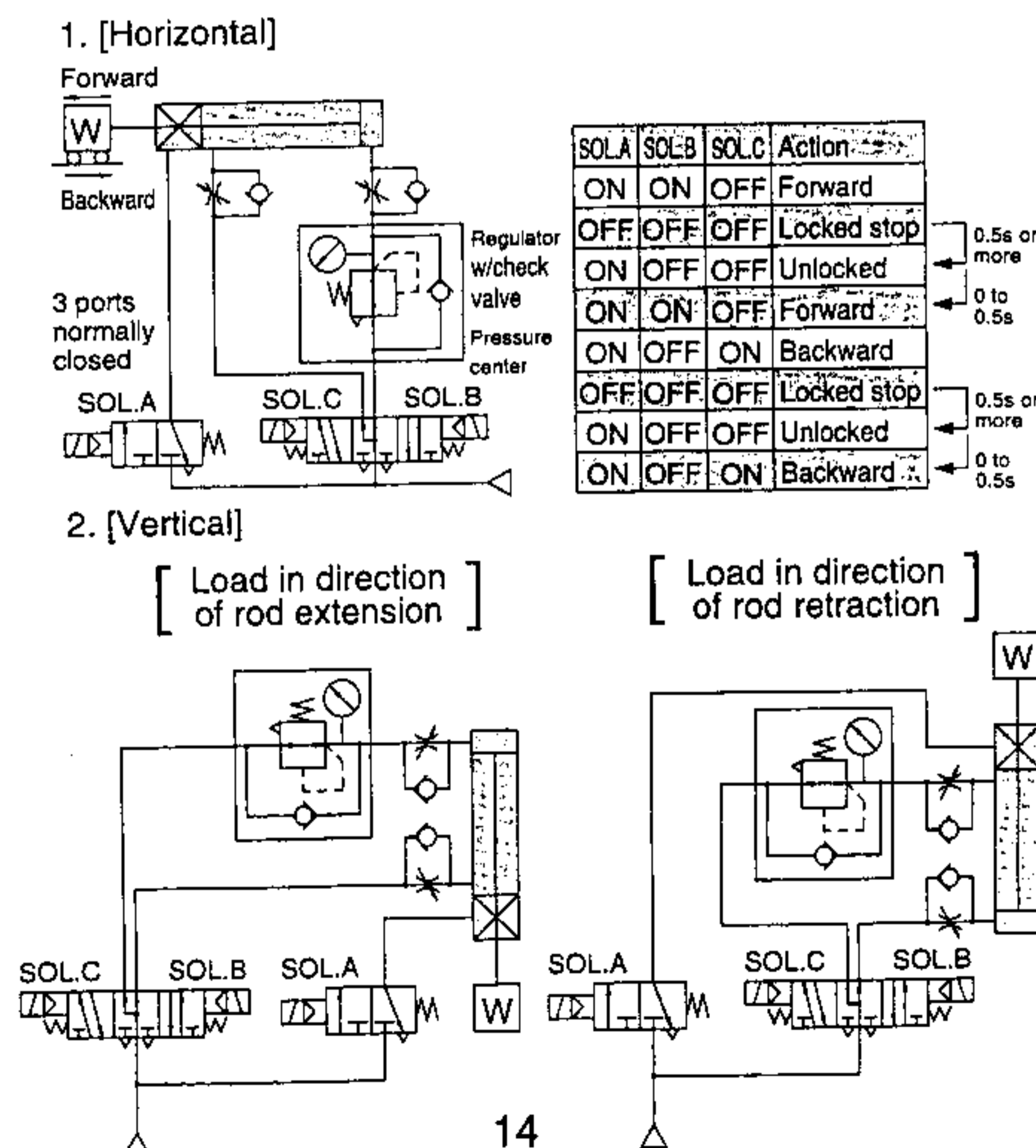
- (4) **Allow at least 0.5 seconds from a locked stop (intermediate stop of the cylinder) until release of the lock.**

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.**

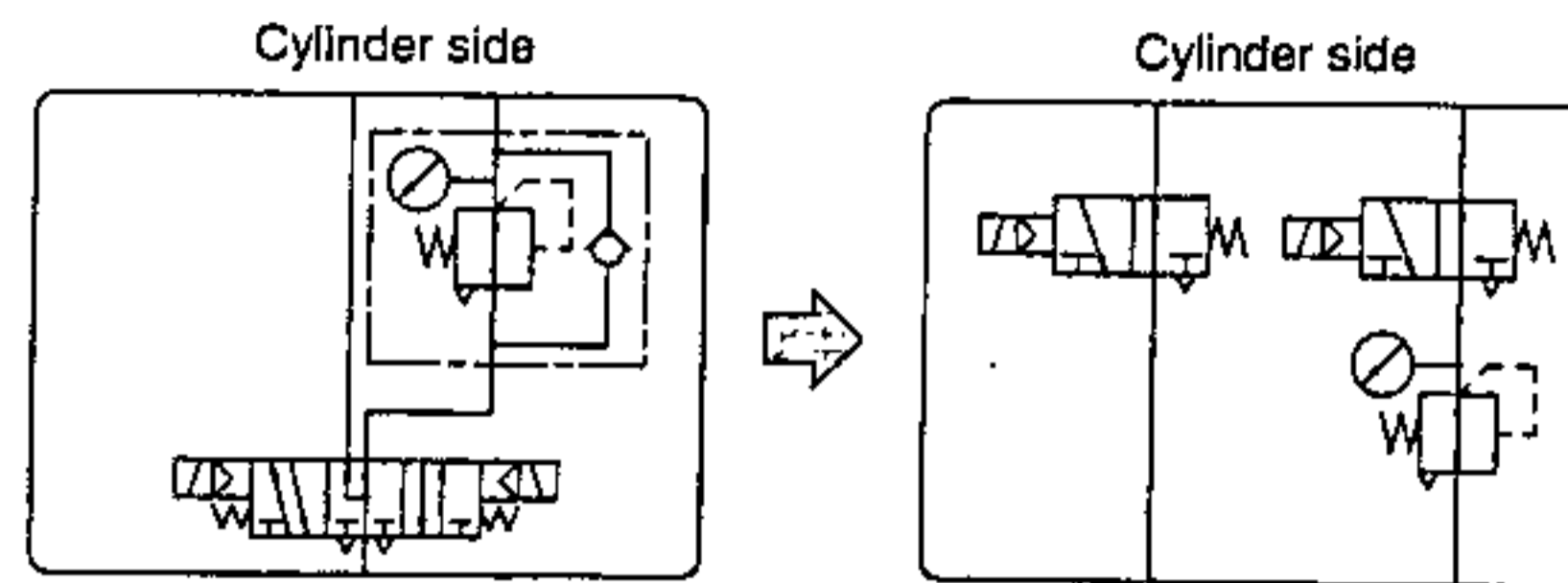
If the signal is delayed, the piston rod (and load) may lurch at a speed greater than the control speed of the speed controller.

- (6) **Basic circuits.**



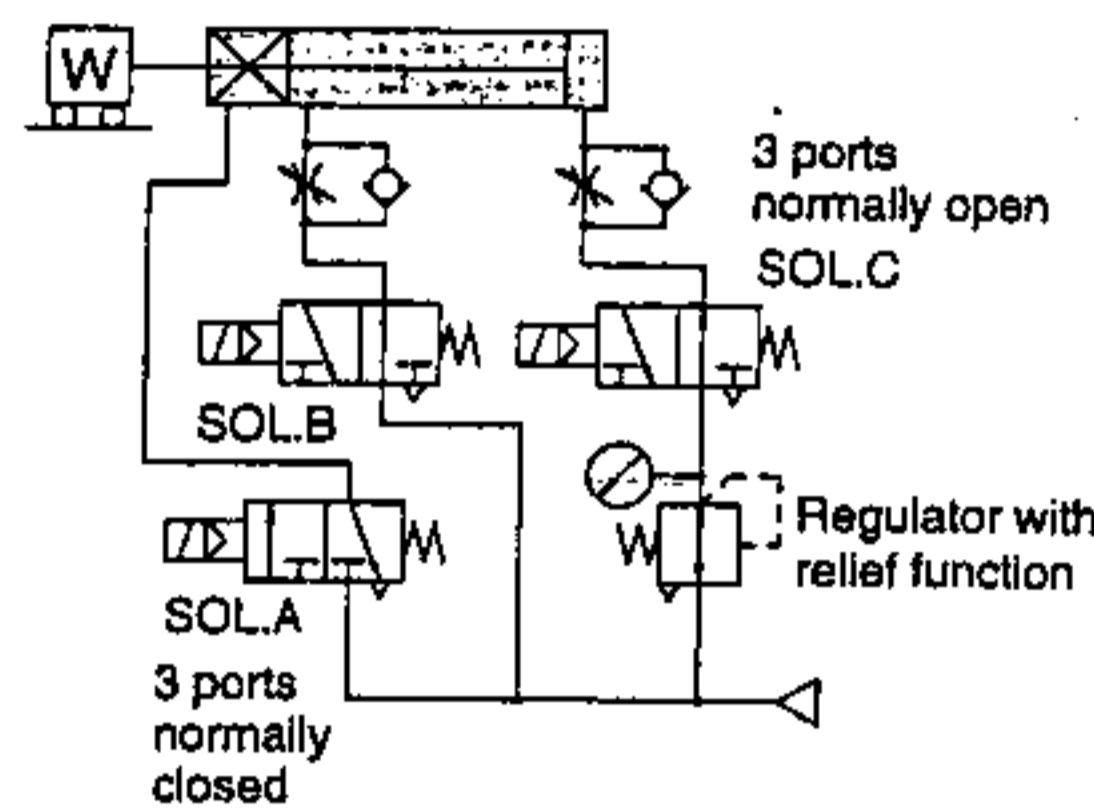
! Caution

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



[Example]

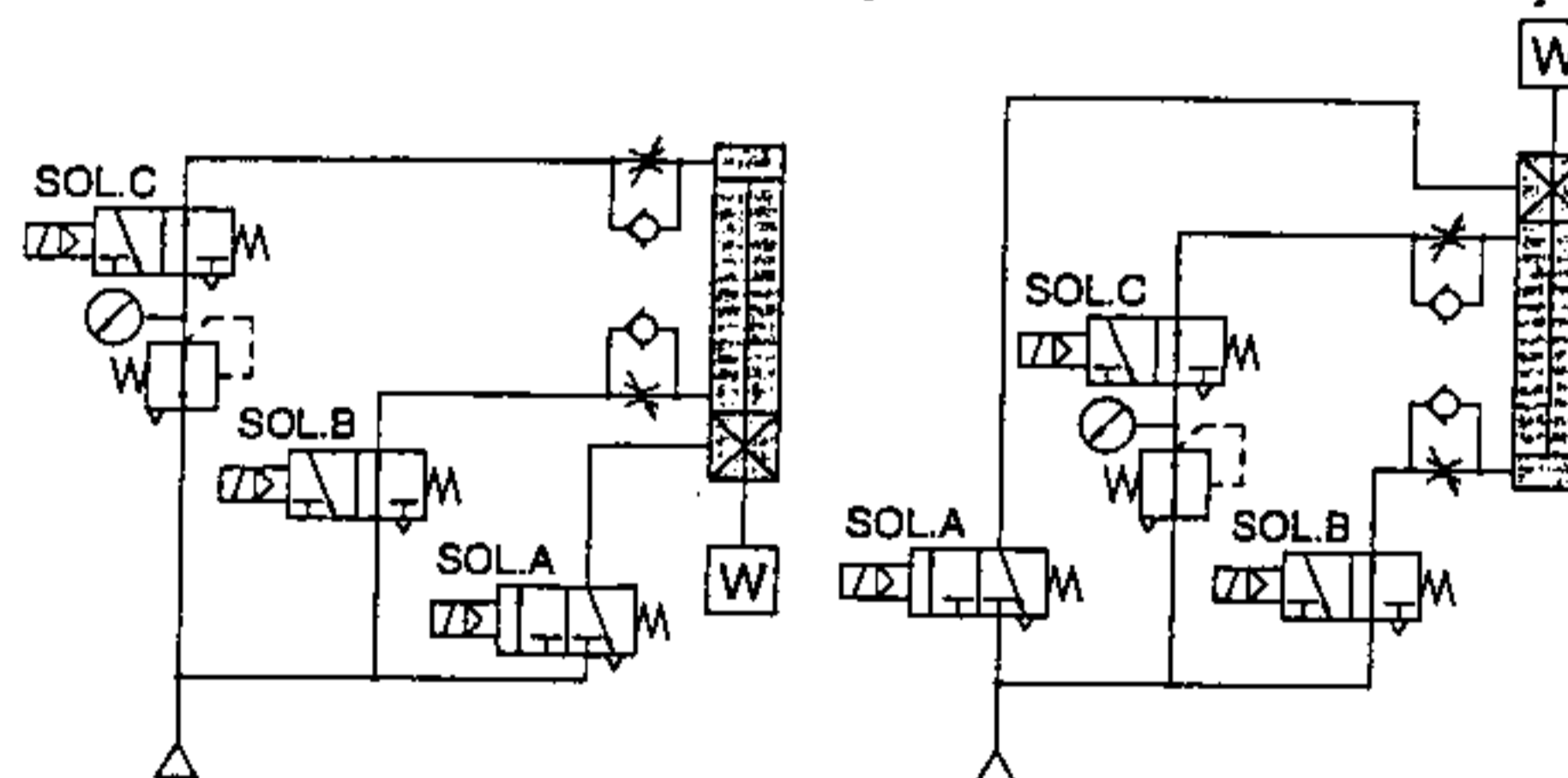
1. [Horizontal]



2. [Vertical]

[Load in direction of rod extension]

[Load in direction of rod retraction]



3-7. Adjustment

! Caution

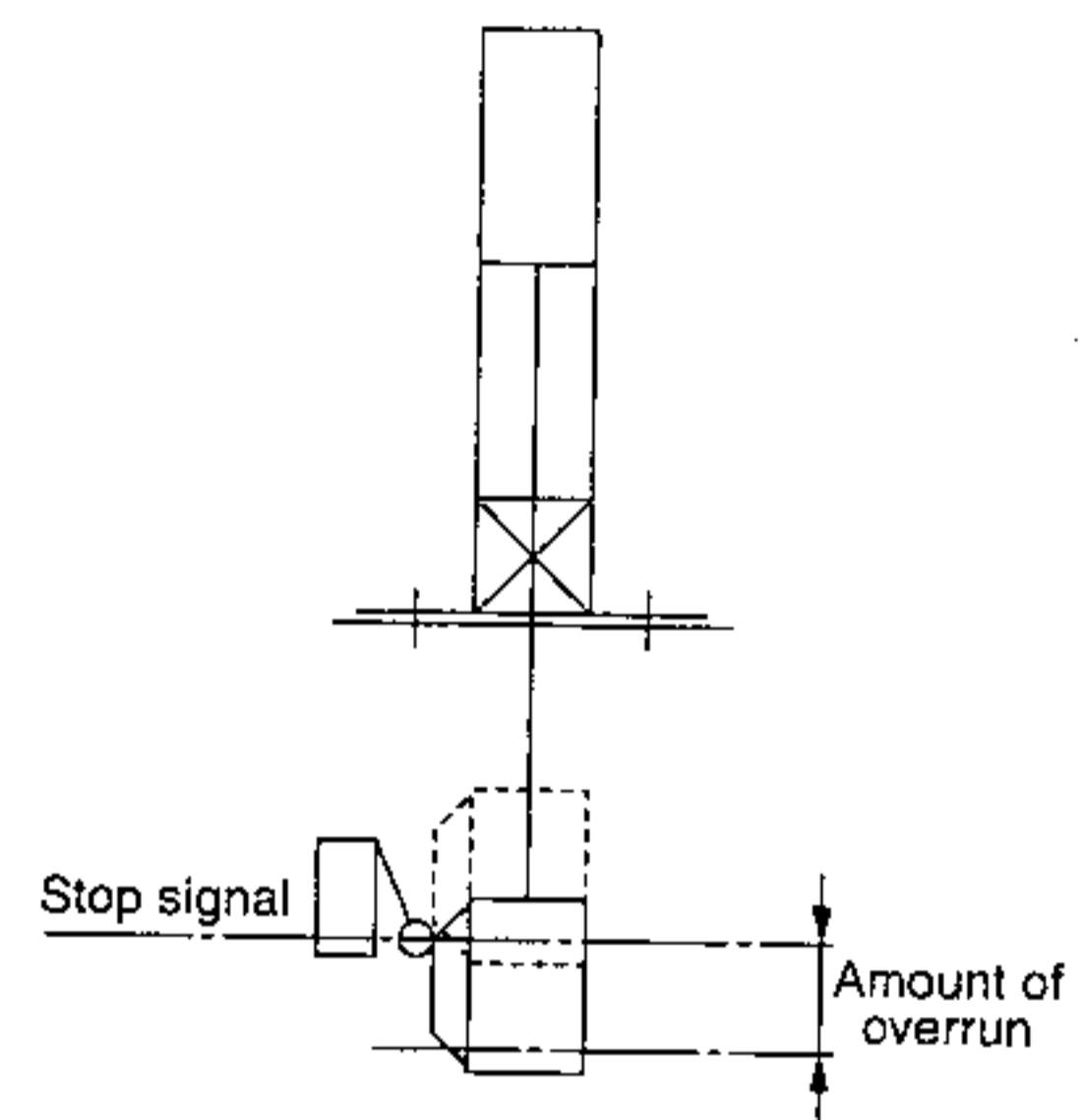
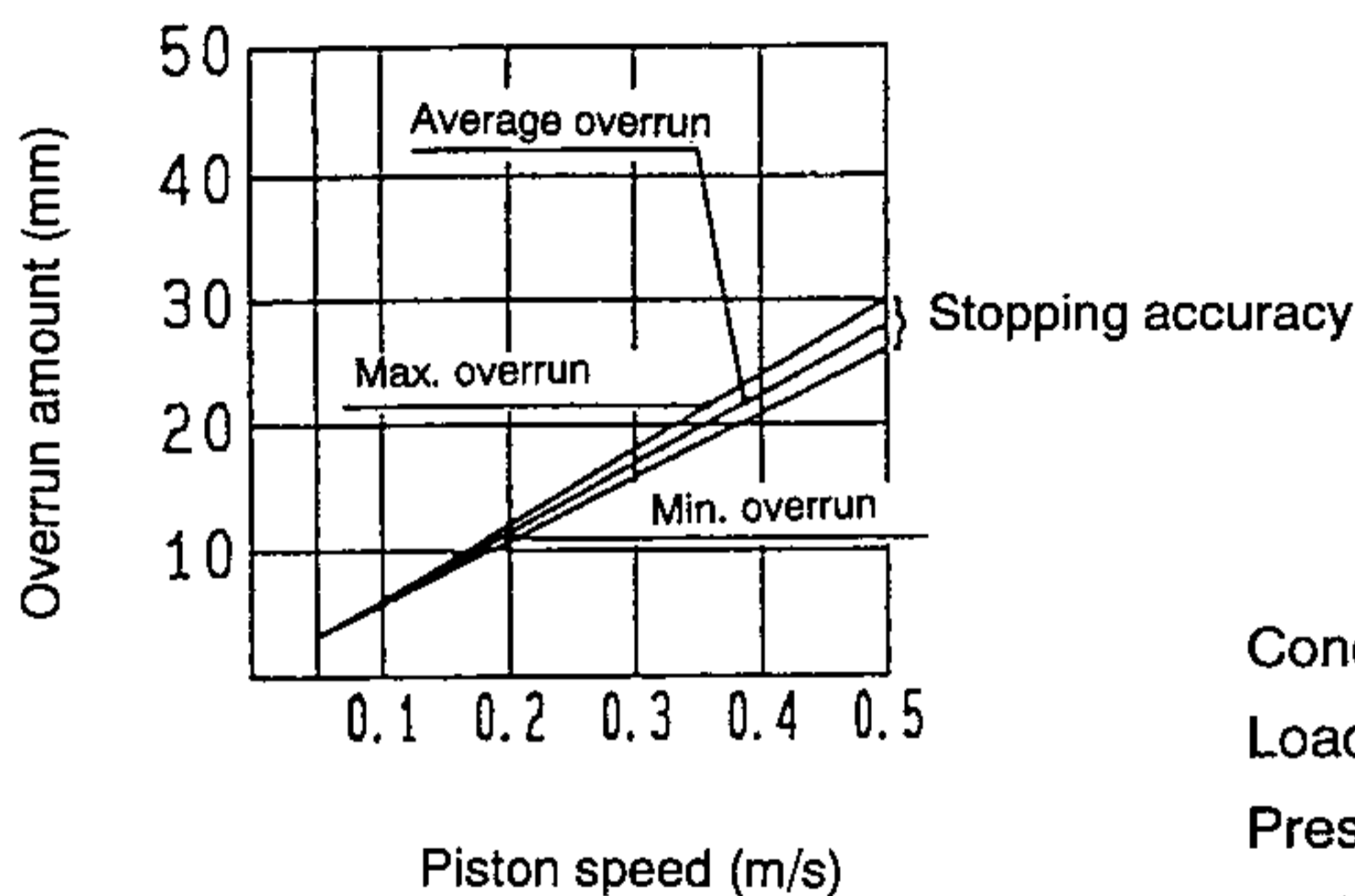
- (1) **Adjust the cylinder's air balance.** Balance the load by adjusting the air pressure in the front and rear sides of the cylinder with the load connected to the cylinder and the lock released. Lurching of the cylinder when unlocked can be prevented by carefully adjusting this air balance.
- (2) **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.

4. Operation

4-1. Proper Usage

(1) Consider stopping accuracy and the amount of overrun 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. This relation is shown below.



Condition

Load factor: 50%

Pressure: 0.5 MPa {5.1 kgf/cm²}

Locking solenoid valve: Mounted to SY5120
locking port

Unlocking pressure: 0.5 MPa {5.1 kgf/cm²}

Cylinder bore size: \varnothing 40

- 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 + α .
- SMC's auto switches have operating ranges from 8 to 14 mm (depending on the switch model and cylinder bore size). When the overrun amount exceeds this range, self-holding of the contact should be performed at the switch load side.

(2) Reduce the overrun amount. 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 electric control circuit and solenoid valve driven by direct current (DC).
- Use a highly responsive solenoid valve.
- Place the solenoid valve as close as possible to the cylinder.

(3) Note that stopping accuracy will be influenced by changes in piston speed.

- a. 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.
- b. 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.

4-2. Manual Unlocking

 **Warning**

- (1) Never operate the unlocking cam until safety has been confirmed (Do not turn to the FREE side).**
 - a. 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.
 - b. 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.**
 - a. Perform work with the load in its lowest position.
 - b. Use supports, etc. to prevent the load from dropping.

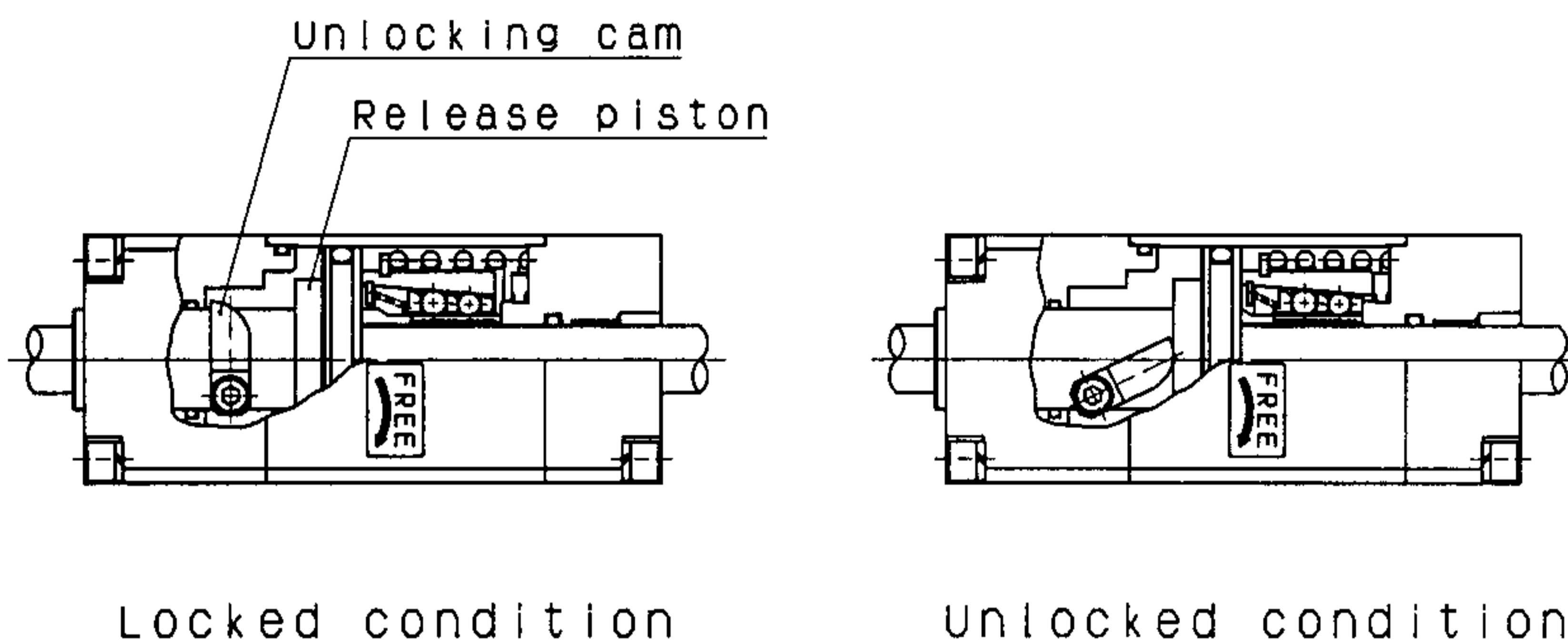
 **Caution**

- (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 normal unlocking with air pressure.**

Unlocking Cam Operating Torque

Bore size (mm)	Cylinder internal resistance N {kgf}	Cam operating torque (standard) N·m {kgf·cm}	Max. cam operating torque N·m {kgf·cm}	Applicable hex. Wrench size
20	24.6 {2.5}	1.0 {10.2}	2.3 {23.7}	Size 3
25	38.2 {3.9}	2.5 {25.5}	4.7 {47.8}	Size 3
32	62.7 {6.4}	3.0 {30.6}	4.7 {47.8}	Size 3
40	98 {10}	4.0 {40.8}	8.2 {83.7}	Size 4

- (4) Be sure to operate the unlocking cam on the FREE side (clockwise direction), and do not turn with a torque greater than the maximum cam operating torque. There is a danger of damaging the unlocking cam if it is turned excessively.
- (5) For safety reasons, the unlocking cam is constructed so that it cannot be fixed in the unlocked condition.

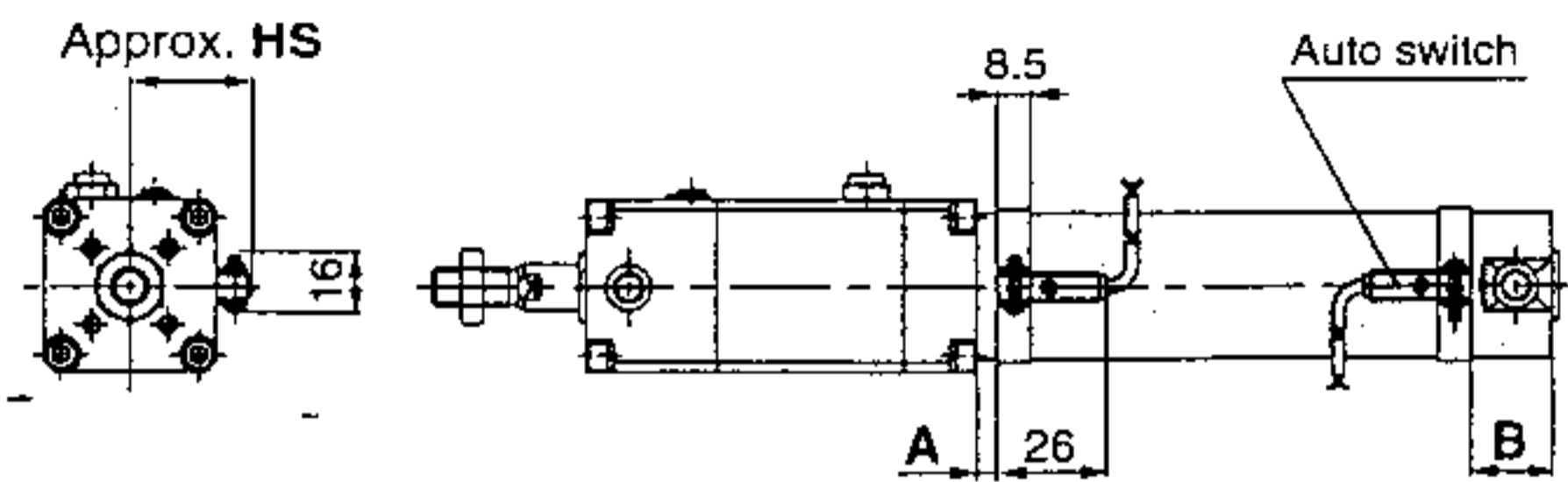


[Principle]

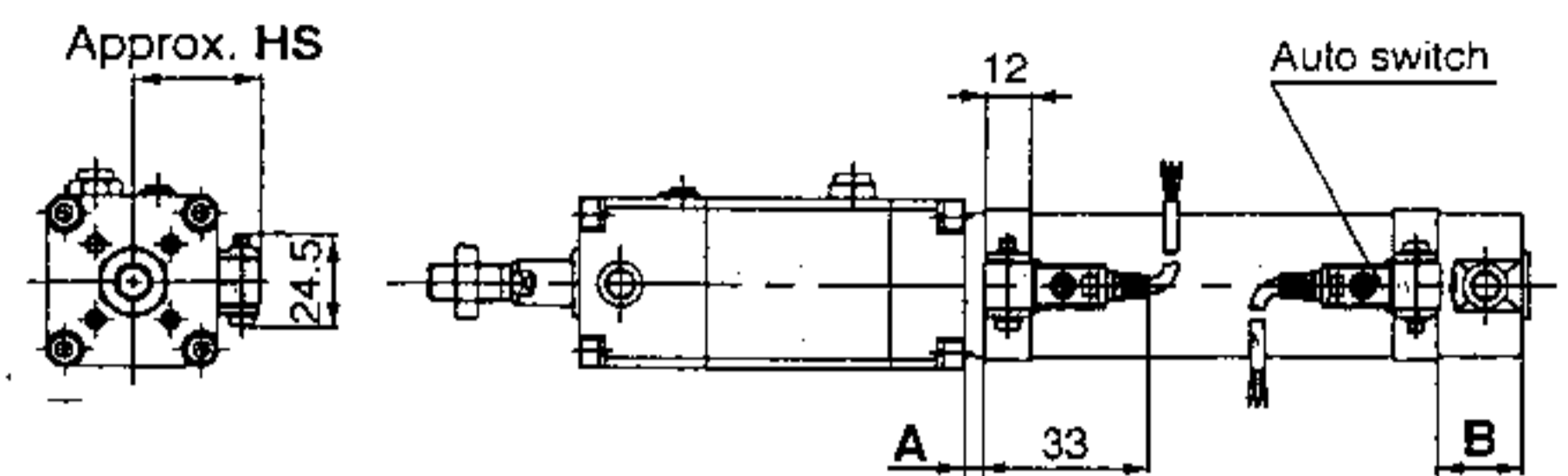
If the unlocking cam is turned in a clockwise direction with a hexagon wrench, the release piston is pushed back and the lock is released. Further, if the unlocking cam is not held it will return to its original position and the unit will lock again. Therefore, the unlocking cam must be held in position for as long as unlocking is required.

4-3. Auto Switch Proper Mounting Position and Height for Stroke End Detection

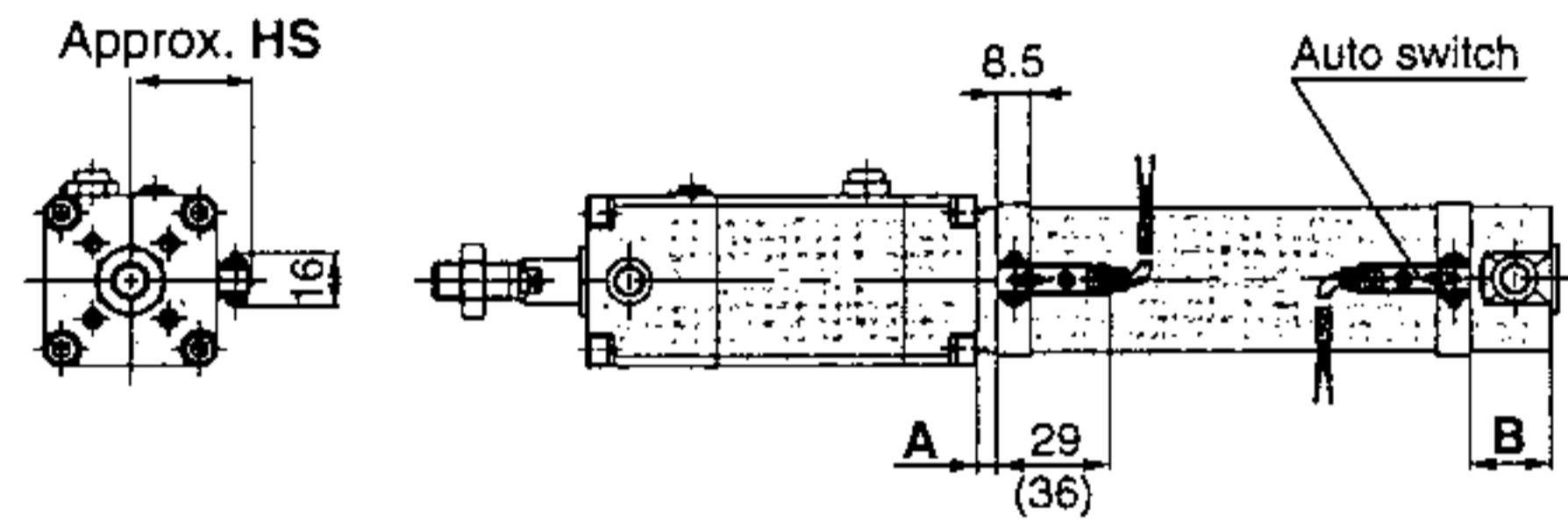
D-C7, D-C8



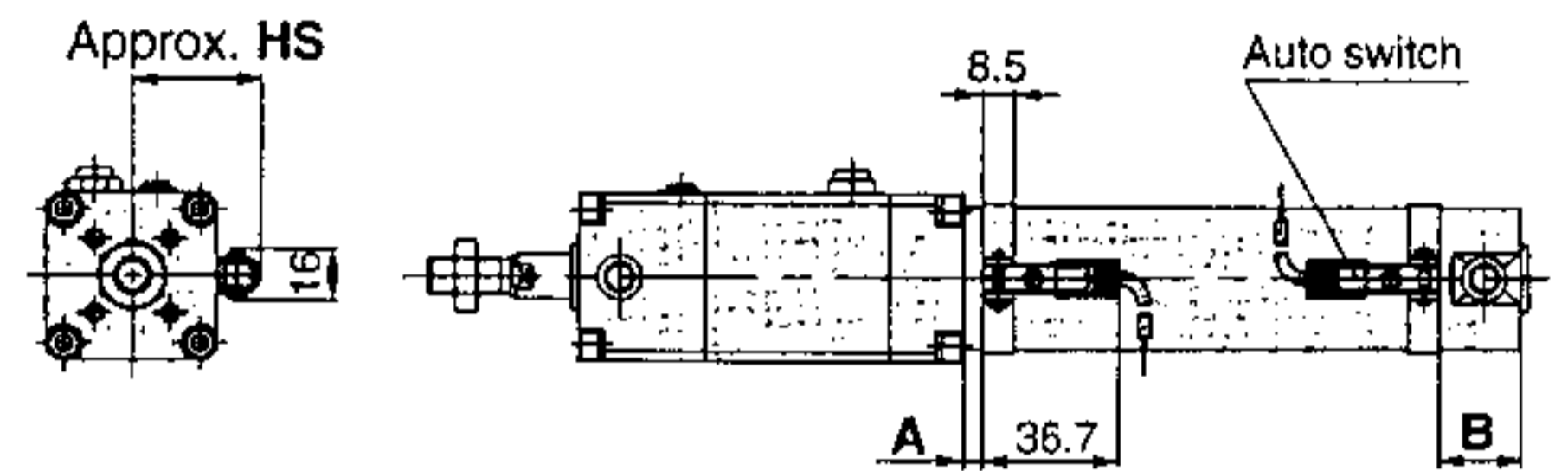
D-G5NT



D-H7, D-H7□W
D-H7□F, D-H7BA

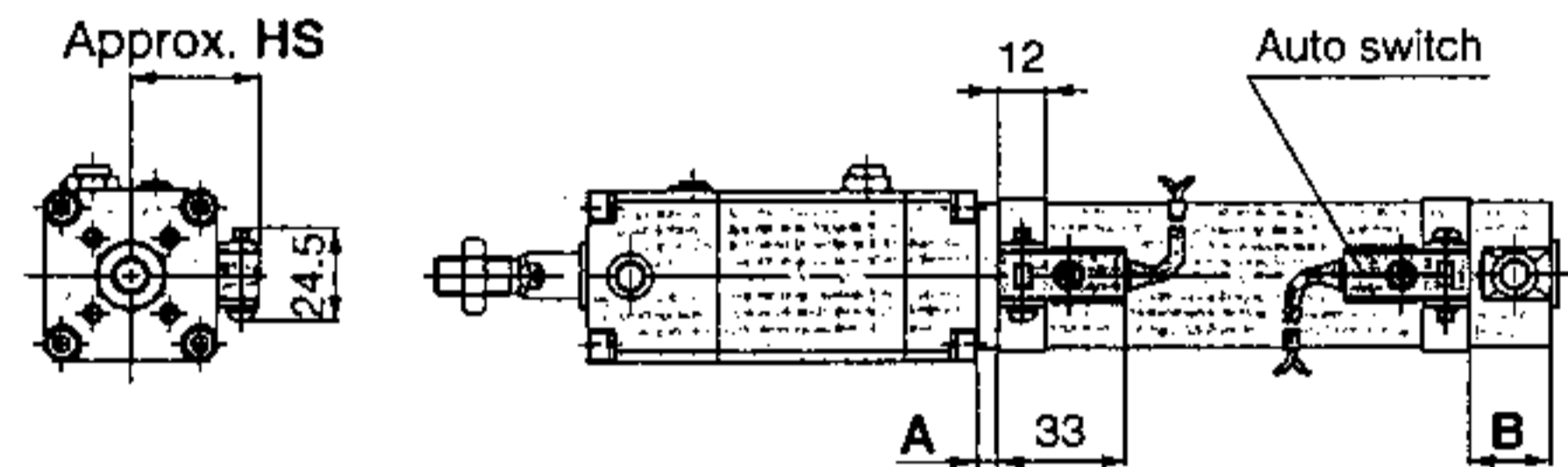


D-C73C, D-C80C

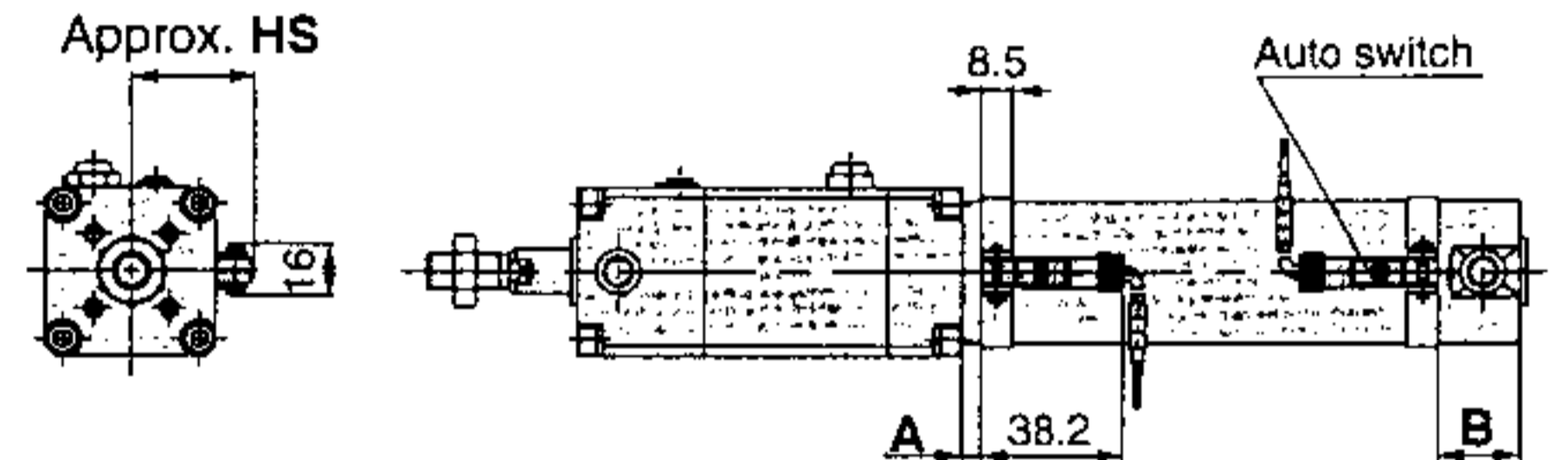


* Numbers inside () are for type D-H7LF.

D-B5, D-B6, D-B59W



D-H7C



Auto switch mounting position

Auto switch model	(mm)																			
	D-C7, C8		D-C73C		D-C80C		D-B5, B6		D-B59W		D-H7□		D-H7□W		D-H7□F		D-H7BA		D-G5NT	
Bore size (mm)	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
20	8.5	20.5 (28.5)	2.5	14.5 (22.5)	5.5	17.5 (25.5)	7.5	19.5 (27.5)	6	18 (26)	4	16 (24)								
25	8.5	20.5 (28.5)	2.5	14.5 (22.5)	5.5	17.5 (25.5)	7.5	19.5 (27.5)	6	18 (26)	4	16 (24)								
32	9.5	21.5 (29.5)	3.5	15.5 (23.5)	6.5	18.5 (26.5)	8.5	20.5 (28.5)	7	19 (27)	5	17 (25)								
40	14.5	23.5 (33)	8.5	17.5 (27)	11	20.5 (30)	13.5	22.5 (32)	12	21 (30.5)	10	19 (28.5)								

Dimensions inside () are for long strokes.

Auto switch mounting height

(mm)		
Auto switch model	HS	HS
D-C7, C8	24.5	27
D-H7□	27	29.5
D-H7□W	30.5	33
D-H7□F	35	37.5
D-H7BA	27.5	30
D-C73C	27	33
D-C80C	30.5	33
D-B5, B6	27.5	30
D-B59W	27.5	30
D-G5NT	27.5	30
D-H7C	27.5	30

Auto Switch Mountable Stroke

Number of auto switches	1 pc. (Rod cover side)	2 pcs. (mounted on different sides)	2 pcs. (mounted on same side)
Switch model			
D-C7, C8	10st or more	15 to 49st	50st or more
D-H7□, H7□W, D-H7BA, H7NF	10st or more	15 to 59st	60st or more
D-C73C, C80C, H7C	10st or more	15 to 64st	65st or more
D-H7LF	10st or more	20 to 64st	65st or more
D-B5, B6, G5NT	10st or more	15 to 74st	75st or more
D-B59W	15st or more	20 to 74st	75st or more

4-4. How to Mount & Move Auto Switch

Refer to the following instructions and sketches for mounting or changing the position of auto switches.

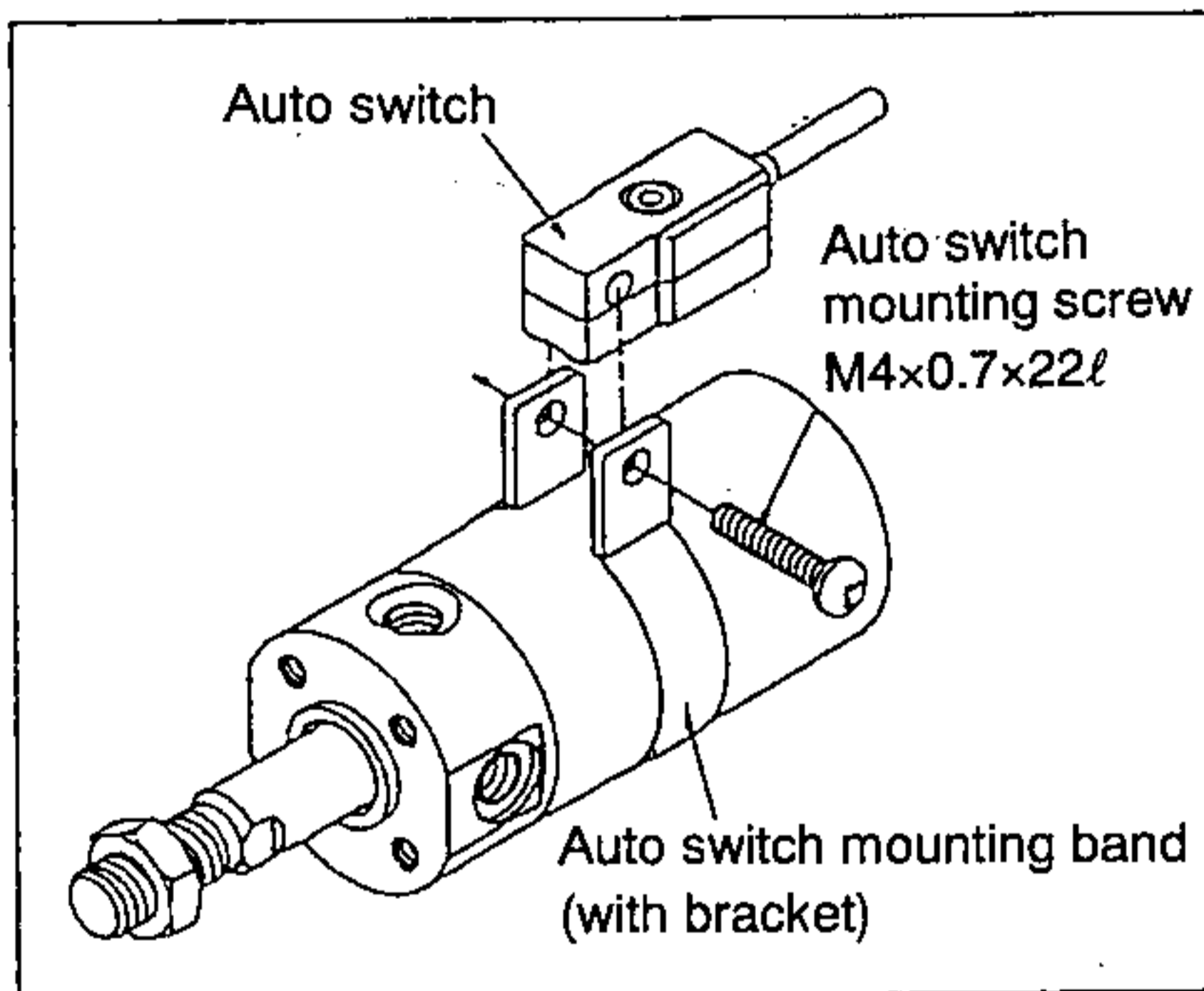
⚠ Caution

- (1) Use applicable mounting brackets and mount them so that auto switch mounting band is right-angled to the direction of cylinder stroke.
- (2) Tighten auto switch mounting screws using the proper fastening torque.
- (3) Use auto switches only for cylinders with a built-in magnet (CDNG, etc.).
- (4) There is a limit to switch mounting depending on the stroke (Refer to the table of auto switch mountable stroke range in 4-3).

[Applicable Auto Switch]

Reed switch : D-B53, 54, 64, 59W

Solid state switch: D-G5NTL



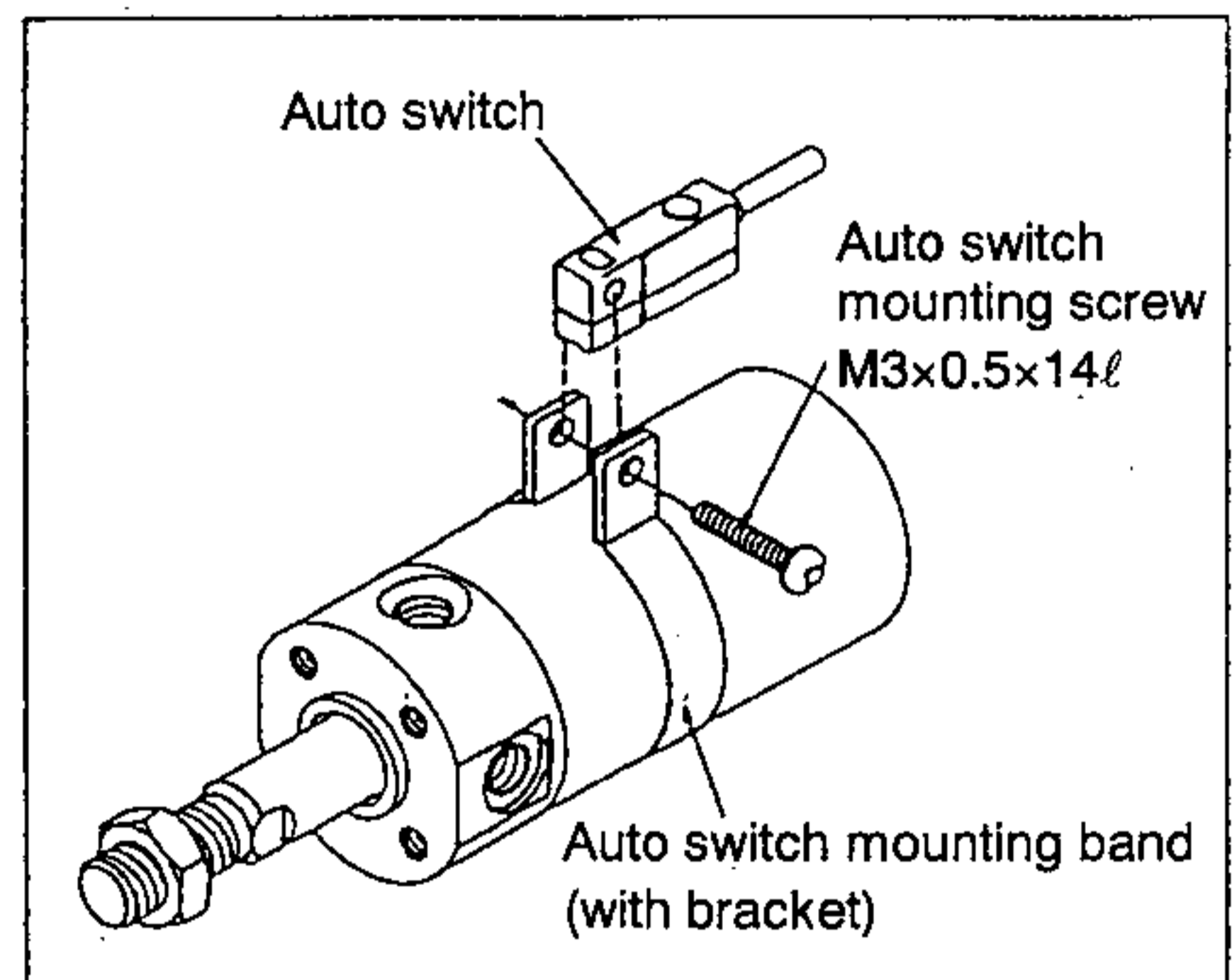
How to Mount & Move Auto Switch

- (1) Attach mounting band to cylinder tube and set it to an approximate auto switch mounting position.
- (2) Fit auto switch mounting part in between mounting bracket and match mounting hole with a hole on the bracket.
- (3) Through the mounting hole, screw in auto switch mounting screw to the bracket.

[Applicable Auto Switch]

Reed switch : D-C73, 76, 80, 73C, 80C

Solid state switch: D-H7A1, 7A2, 7B, 7BA, 7C
7NF, 7LF, 7NW, 7PW, 7BW



How to Mount & Move Auto Switch

- (1) Attach mounting band to cylinder tube and set it to an approximate auto switch mounting position.
- (2) Fit auto switch mounting part in between mounting bracket and match mounting hole with a hole on the bracket.
- (3) Through the mounting hole, screw in auto switch mounting screw to the bracket.

- (4) Confirm the detecting position and tighten the mounting screw to secure the auto switch (For M4 screws, use fastening torque of 1 to 1.2 N·m).
- (5) Changing the detecting position should be done in the condition of (3).

Auto Switch Mounting Bracket Part Number
(including band and screw)

Bore size (mm)	20	BA-01
	25	BA-02
	32	BA-32
	40	BA-04

- (4) Shift the whole mounting unit to the detecting position and tighten the mounting screw to secure the auto switch (For M3 screws, use fastening torque of 0.8 to 1 N·m).
- (5) Changing the detecting position should be done in the condition of (3).

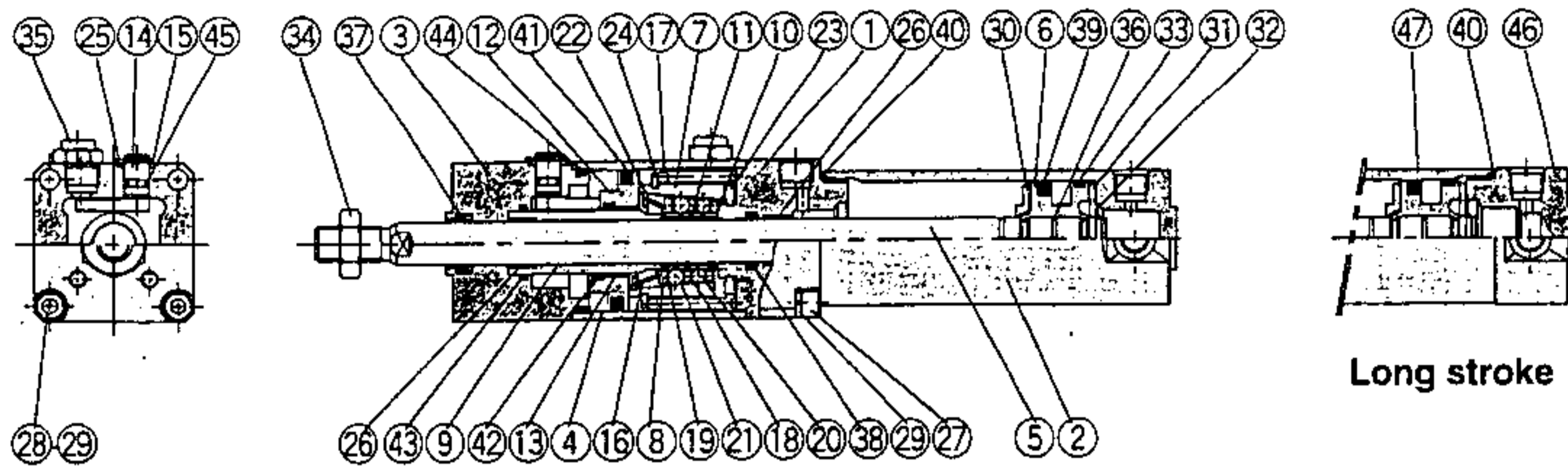
Auto Switch Mounting Bracket Part Number
(including band and screw)

Bore size (mm)	20	BMA2-020
	25	BMA2-025
	32	BMA2-032
	40	BMA2-040

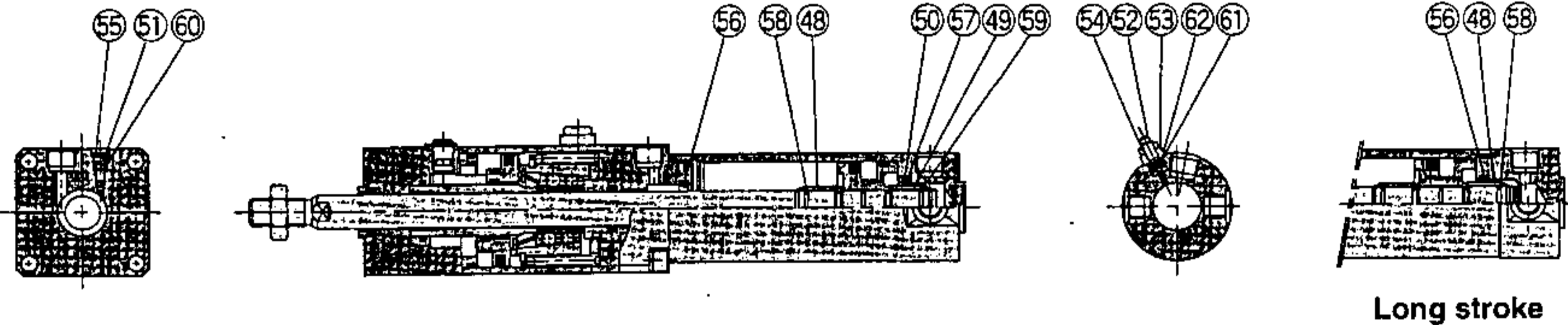
5. Maintenance and Checkup

5-1. Structure & Parts List

With rubber bumper/CNGBN



With air cushion/CNGBA



Parts list

No.	Description	Material	Note
1	Rod cover	Aluminum alloy	White hard anodized
2	Tube cover	Aluminum alloy	White hard anodized
3	Cover	Aluminum alloy	White hard anodized
4	Intermediate cover	Aluminum alloy	White 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	Brake shoe	Special friction material	
12	Release piston	Carbon steel	Zinc chromated
13	Release piston bushing	ø20	Sintered oil containing alloy
		ø25, ø32, ø40	Steel + Special resin
14	Unlocking cam	Chromium molybdenum steel	Electroless nickel plated
15	Washer	Rolled steel	Electroless nickel plated
16	Retainer pre-load spring	Steel wire	Zinc chromated
17	Brake spring	Steel wire	Zinc chromated
18	Clip A	Stainless steel	ø25, ø32 only
19	Clip B	Stainless steel	ø25, ø32 only
20	Steel ball A	Carbon steel	
21	Steel ball B	Carbon steel	
22	Tooth ring	Stainless steel	
23	Damper	Urethane	
24	C type snap ring for taper ring	Carbon steel	
25	C type snap ring for unlocking cam shaft	Carbon steel	
26	Bushing	Sintered oil containing alloy	ø40 is lead bronze casting
27	Hexagon socket head screw	Chromium molybdenum steel	Nickel plated
28	Hexagon socket head screw	Chromium molybdenum steel	Nickel plated
29	Spring washer for hexagon socket head screw	Steel wire	Nickel plated
30	Damper A	Urethane	
31	Damper B	Urethane	ø40 is the same as damper A
32	Snap ring	Stainless steel	
33	Wear ring	Resin	
34	Rod end nut	Rolled steel	Nickel plated
35	BC element	Bronze	
36	Piston gasket	NBR	

Parts list

No.	Description	Material	Note
37	Rod seal A	NBR	
38	Rod seal B	NBR	
39	Piston seal	NBR	
40	Cylinder tube gasket	NBR	
41	Release piston seal	NBR	
42	Rod seal C	NBR	
43	Piston guide gasket	NBR	
44	Intermediate cover gasket	NBR	
45	Unlocking cam gasket	NBR	
46	Head cover	Aluminum alloy	White hard anodized
47	Cylinder tube	Aluminum alloy	Hard anodized
48	Cushion ring A	Brass	
49	Cushion ring B	Brass	Same as cushion ring A except for ø20, 25 standard strokes
50	Seal retainer	Rolled steel	Zinc chromated long strokes not available
51	Cushion valve A	Chromium molybdenum steel	Electroless nickel plated
52	Cushion valve B	Rolled steel	Electroless nickel plated
53	Valve retainer	Rolled steel	Electroless nickel plated
54	Lock nut	Rolled steel	Nickel plated
55	Snap ring	Stainless steel	
56	Cushion seal A	Urethane	
57	Cushion seal B	Urethane	Same as cushion seal A except for ø20, 25 standard strokes
58	Cushion ring gasket A	NBR	
59	Cushion ring gasket B	NBR	Same as cushion ring gasket A except for ø20, 25 standard strokes
60	Valve seal A	NBR	
61	Valve seal B	NBR	
62	Valve retainer gasket	NBR	

Note) In the case of cylinders equipped with auto switches, magnets are installed in the piston.
 * The material for ø20 and ø25 cylinders equipped with auto switches is stainless steel.

5-2. Checkup

Perform the following checkups periodically in order to use the Cylinder with Lock at the best condition.

- (1) Loosening of set bolts at the lock section.
- (2) Operation of the lock section (change in the overrun amount and stopping accuracy).
- (3) Loosening of cylinder and bracket mounting bolts.
- (4) Connection and loosening of piston rod end bracket and load.
- (5) Loosening or warping of cylinder mounting frame.
- (6) Smooth operation of cylinder (cylinder operation in the unlocked condition).
- (7) External and internal leakage (output changes).
- (8) Scratches, dents or deformations of piston rod sliding faces.
- (9) Unusual changes in cylinder stroke.
- (10) Corrosions of cylinder ports and unlocking port.
- (11) Draining of air filter.
- (12) Lubrication of rotary parts (double knuckle joint, trunnion pin, clevis pin, etc.).
- (13) Mounting position of auto switch.

Check and confirm the above. If there is a problem, clear the cause and take corrective actions such as tightening reinforcement and grease application. If repair is required, contact SMC sales representatives.

Warning

- (1) **Maintenance and checkup should be done for the above check items. Further, necessary checkups should be done according to the situation.**

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

- (2) **Removal of machinery and supply and exhaust of compressed air.**

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

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

Caution

- (1) **Avoid application of oil or grease to the piston rod surfaces as much as possible.**

5-3. Replacement Parts

Series CNG lock units (except long stroke) and seals (rod packing A, piston packing and cylinder tube gasket) are replaceable .

Contact SMC for replacement parts other than the above.

 **Warning**

(1) Only trained personnel should perform replacement.

Ensuring the safety of the cylinder after disassembling and reassembling is the responsibility of the person who performed such work.

 **Caution**

(1) Give ample care not to cut hands or fingers with the edge of parts during replacement.

5-3-1. Replacement Parts (Seal kits)

Bore size (mm)	20	25	32	40
Rod packing A	PDU-8Z	PDU-10Z	PDU-12LZ	PDU-16Z
Piston packing	PPD-20	PPD-25-19	PPD-32	PPD-40
Cylinder tube gasket	CM-020-16-123	CM-025-16-124	CM-032-16-126	CM-040-16-127
Grease package	GR-S-010 (containing 10 grams)			
Seal kit No.	CG1N20-PS	CG1N25-PS	CG1N32-PS	CG1N40-PS

- Since the lock section for Series CNG is normally replaced as a unit, replacement seal kits are for the cylinder section only. Order using the seal kit number for each bore size.

5-3-2. How to Replace Lock Units

! Caution

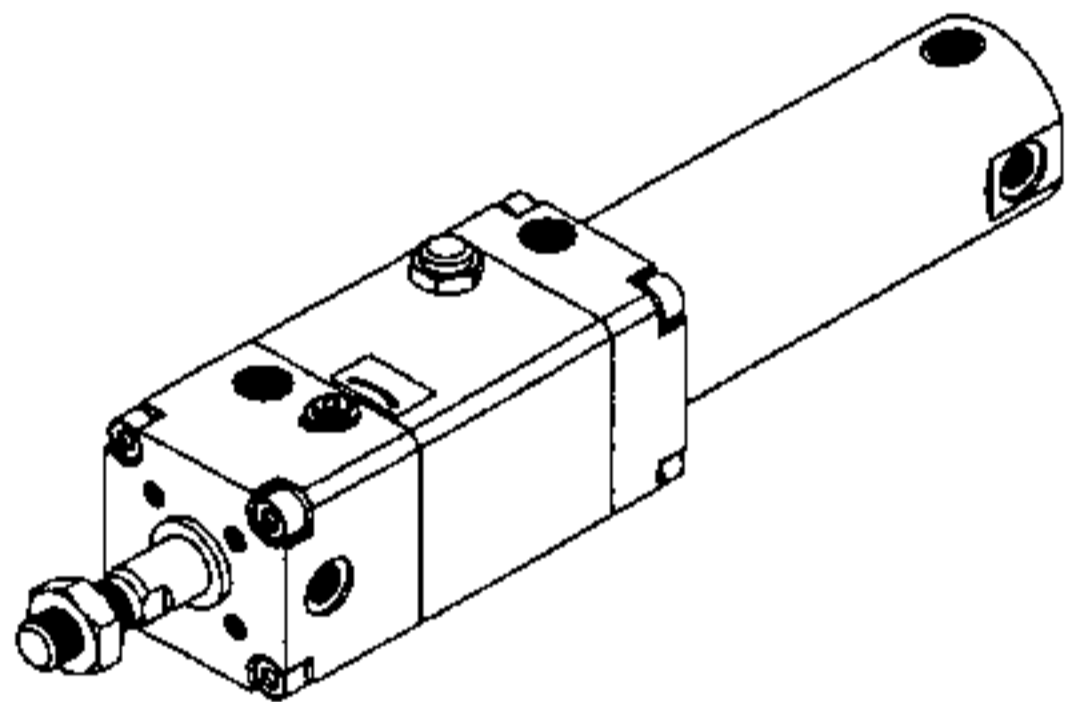
- Series CNG lock units are replaceable.
(However, please note that lock units cannot be replaced in the case of long stroke specifications.)
To order replacement lock units for the CNG series, use the order numbers given in the table below.

Bore size (mm)	Lock unit order number	
	Rubber bumper type	Air cushion type
20	CNGN20D-UA	CNGA20D-UA
25	CNGN25D-UA	CNGA25D-UA
32	CNGN32D-UA	CNGA32D-UA
40	CNGN40D-UA	CNGA40D-UA

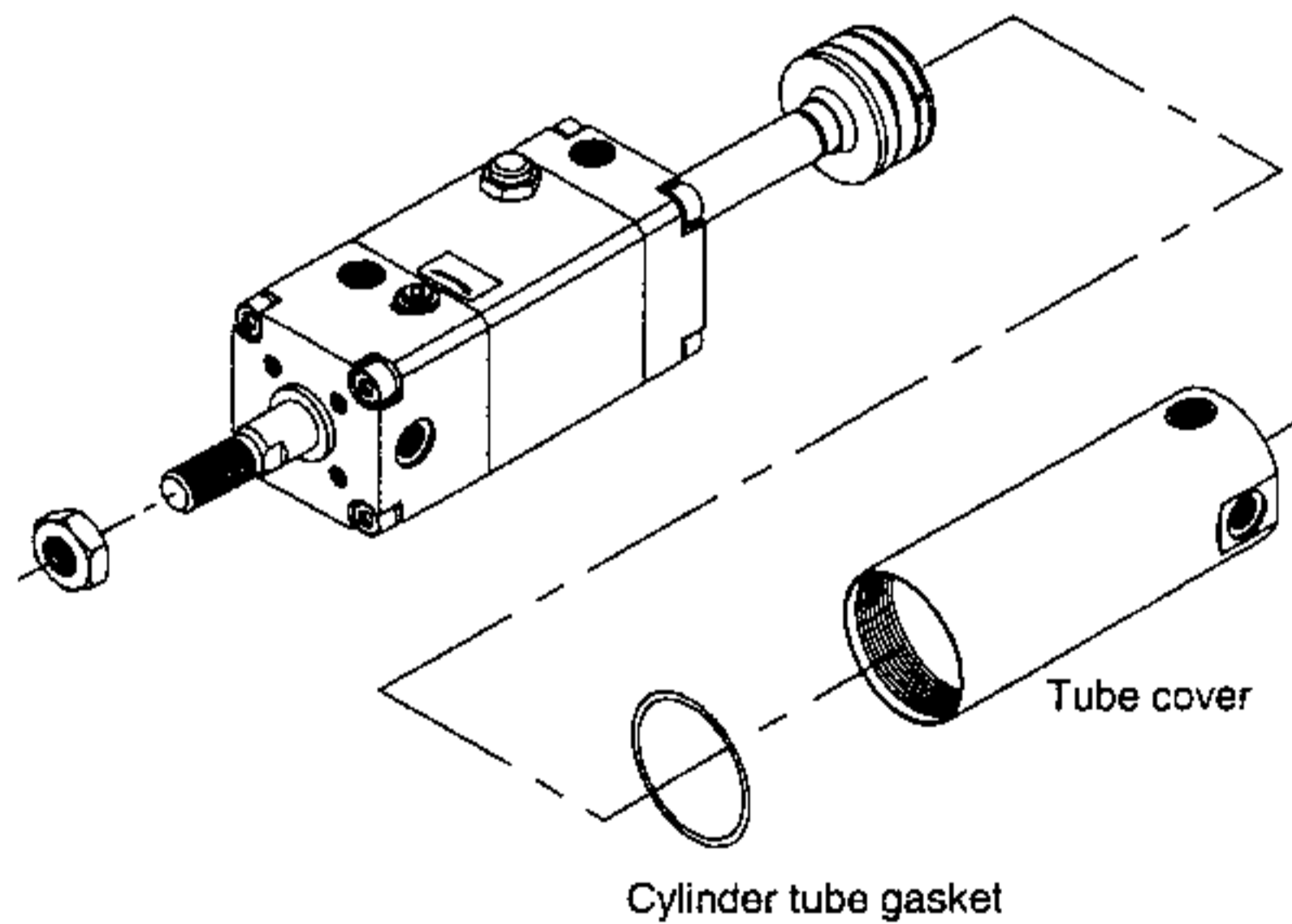
2. Replacement of lock units.

- Remove the lock unit by securing the square section of the rod cover or the wrench flats of the tube cover in an apparatus such as a vice, and then loosening the other end with a spanner or adjustable angle wrench, etc.
See the table below for the dimensions of the square section and the wrench flats.

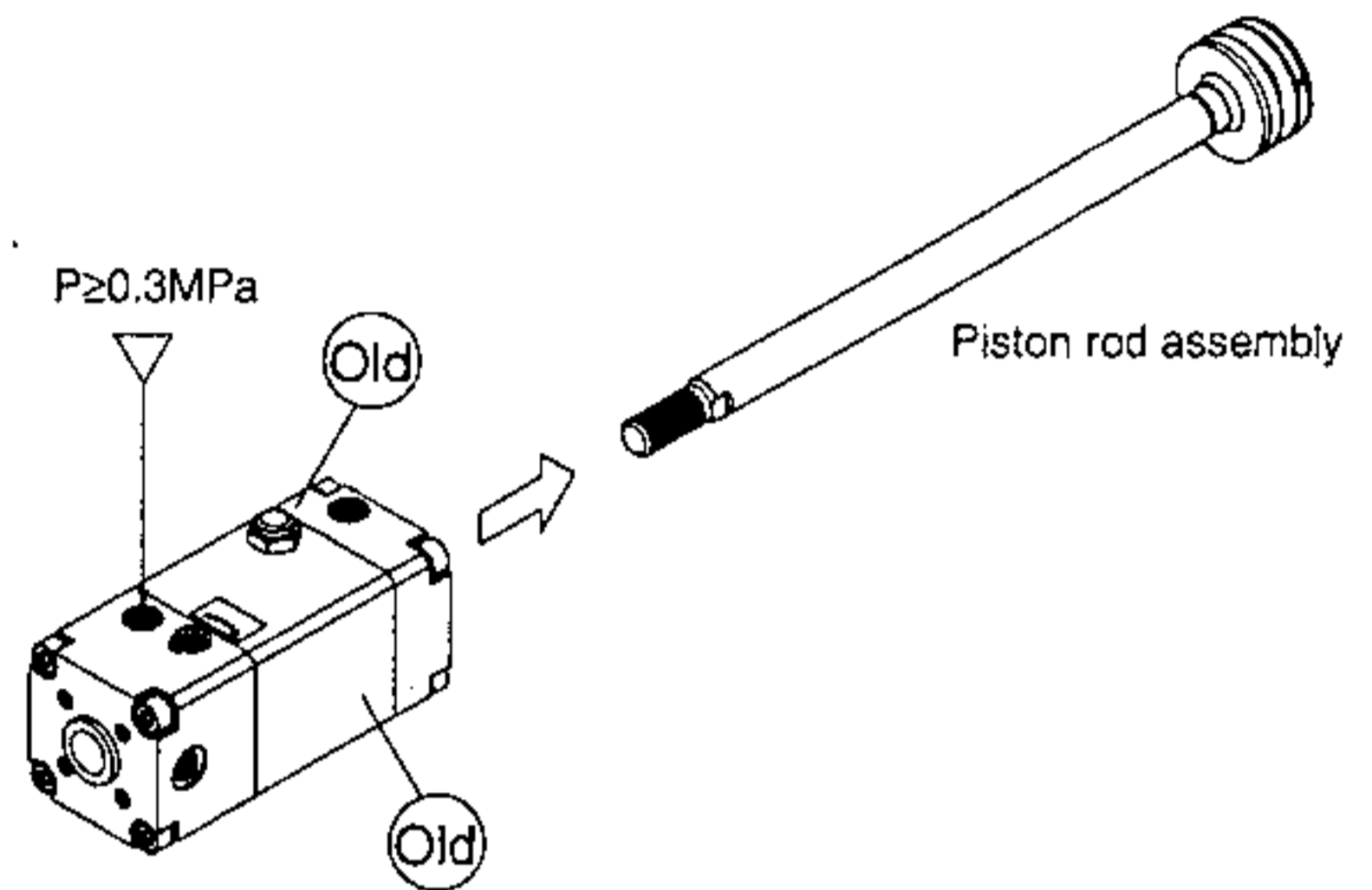
Bore size (mm)	Rod cover square section (mm)	Tube cover wrench flats (mm)
20	38	24
25	45	29
32	45	35.5
40	52	44



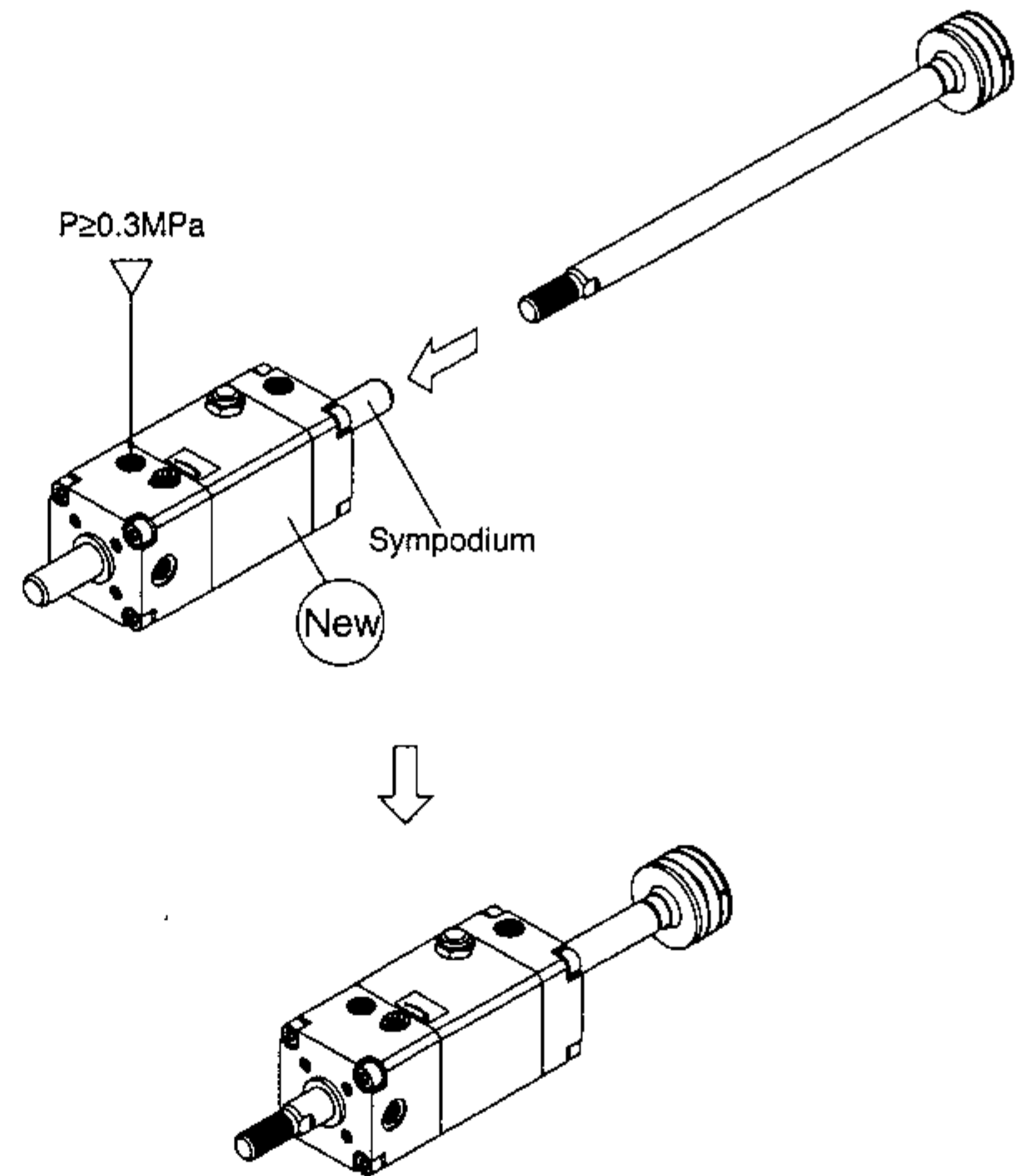
- Remove the tube cover.



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



- Similarly apply compressed air of 0.3MPa or more to the unlocking port of the new lock unit, and replace the symposium with the previous piston rod assembly.



- Reassemble by reversing the procedure in steps 1) and 2).
When retightening the sections, turn approximately 2° past their position prior to disassembly.

! Caution

When replacing piston rod assembly with a new lock unit, care should be taken not to cut rod packing B with threads or wrench flats.

6. Troubleshooting

Symptom	Probable Cause		Remedy
Unlocking is ineffective [Cylinder does not move].	Other causes than lock section	a. Incorrect piping to the cylinder. b. Speed controller is fully closed. c. Rubbed guide section d. Load is too large.	Remove other cause(s) than lock section.
	Causes originated in lock section	No or insufficient air pressure in lock section.	Keep pressure of 0.25 MPa {2.5 kgf/cm ² } or more (With Ø20, pressure of 0.20MPa {2.0 kgf/cm ² } or more).
		Signal is not sent to locking solenoid valve (Signal is sent to NO type of solenoid valve).	Check wiring and send a signal (Check wiring and cut off the signal to NO type solenoid valve).
		Connection error with locking solenoid valve piping.	Operate manual override of solenoid valve and check its switching.
		Locking solenoid valve does not operate.	Check wiring and repair or replace solenoid valve.
		Damage of unlocking piston packing.	Replace lock unit.
Locking is ineffective [Cylinder does not stop].	Other causes than lock section	Cylinder speed is too fast.	Reduce the speed with speed controller.
		Locking signal limit switch dog is exceeded (Outside of auto switch operation range).	<ul style="list-style-type: none"> ● Change to self-holding circuit. ● Change dog design (Check operation range → review auto switch with a built-in timer).
		Load weight is too large (Load factor is too high).	Check allowable kinetic energy (Refer to Selection Graphs).
		Malfunction of locking signal switch.	Check wiring and replace switch.
	Causes originated in lock section	Air pressure remains in lock section.	Check connection and piping of solenoid valve (breakage or bending).
		Signal is sent to locking solenoid valve (For NO type, signal is not sent to solenoid valve).	Check wiring and cut off the signal (Check wiring and send a signal to NO type solenoid valve).
		Malfunction of lock section.	Replace lock unit.
Overrun amount is large [Poor stopping accuracy].	Other causes than lock section	Effective area of unlocking solenoid valve is too small.	Replace with solenoid valve having larger effective area.
		Piping between unlocking port and unlocking solenoid valve is too long (or small).	Shorten the distance as much as possible or directly connect them. Or, mount a quick exhaust valve to unlocking port.
		Poor response of unlocking solenoid valve.	Change to solenoid valve with better response.
		Poor response of sensor detecting signal to unlocking solenoid valve.	Change to sensor with better response.
		Rattle or play of locking signal dog. Bad shape of locking signal dog.	<ul style="list-style-type: none"> ● Eliminate rattle. ● Change dog design.
		AC is used for electric circuit.	Change to DC specification.
	Cylinder speed change	a. Misalignment of piston rod and guide. b. High load factor of cylinder c. Short stop intervals (pitch). d. Stop during or right after cushioning.	a. Match the centers of piston rod and guide, and use a floating joint. b. Use larger cylinder. c. Allow 40mm or more for stop intervals. d. Change to cylinder without cushion.

Symptom		Possible Cause	Remedy
Overrun amount is large [Poor stopping accuracy].	Rod lurching in a unlocked condition	a. Circuit is not balancing pressure. b. Pressure balancing regulator is not adjusted. c. Line pressure fluctuates. d. Timing of unlocking is not good.	a. Change air pressure circuit. b. Adjust regulator. Check pressure balance in a unlocked condition. c. Keep supply pressure. d. Allow 0.5 seconds or more.
	Load fluctuation	a. Load continuously changes with rotary movement. b. Load changes with vertical weight, etc., (change in stages).	Where load changes in stages for stacking, etc., use a large number of pressure balancing regulators and regulate pressures in stages. Review the applicability of regulator valve and electro-pneumatic regulator.
Piston rod does not move smoothly.	Piston rod is not aligned.		Align and adjust the piston rod. Change support bracket.
	Side load is applied.		<ul style="list-style-type: none"> ● Place a proper guide. ● Modify mounting conditions and change support bracket.
	Product is operated below the low speed limit. Load factor is high.		Remove causes of load change. <ul style="list-style-type: none"> ● Raise pressure. ● Use larger cylinder.
	Speed controller is set to meter-in control.		Change to meter-out control.
Breakage and deformation	Impact due to high speed operation.		<ul style="list-style-type: none"> ● Adjust cushions. ● Reduce the speed. ● Reduce the load. ● Place external shock absorbing mechanism (Review shock absorber).
	Side load is applied.		<ul style="list-style-type: none"> ● Place a proper guide. ● Modify mounting conditions.