7MPa double acting ununiform speed rod action 2-stage telescopic cylinders

- Double acting ununiform speed rod action telescopic cylinders
- 2-stage stroke cylinders require shorter installation space in the axial direction.
- Fixed cushions at both stroke ends
- Uniform rod action is available to configure hydraulic circuit.

Cylinder Specifications

Type		Type 10	Type 20	Type 30	Type 40	Type 50
Cylinder bore (mm)	1st stage	ϕ63	ϕ90	ϕ110	ϕ125	ϕ140
	2nd stage	ϕ45	ϕ65	ϕ80	ϕ90	ϕ100
Nominal pressure		7 MPa				
Maximum allowable pressure		Rod cover side: 15 MPa Cap cover side: 9 MPa				
Proof pressure		Rod cover side: 21 MPa Cap cover side: 14 MPa				
Minimum operating pressure		Rod cover side: 0.6 MPa Cap cover side: 0.3 MPa				
Working speed range		10 to 166mm/s	10 to 150mm/s	10 to 140mm/s	10 to 128mm/s	10 to 118mm/s
Working temperature range		Ambient temperature: −10 to −50℃ Fluid temperature: −5 to +80℃ (no freezing)				
Structure of cushioning		Fixed cushions at both ends				
Applicable fluid		Petroleum-based fluid (When using another fluid, refer to the table of fluid adaptability.)				
Tolerance for thread		JIS 6g/6H				
Tolerance of stroke		0 to 1000 mm $^{+2.8}_{0}$ 1001 to 1600mm $^{+3.2}_{0}$ 1601 to 2500mm $^{+3.6}_{0}$ 2501 to 3100mm $^{+4.0}_{0}$				
Mounting style		LA, LT, FA, FB, CA, TA, TB				

- For the internal structure, refer to the sectional drawings at the end of this catalog.
- For the calculation of the cylinder force, refer to the page of calculation of cylinder force of 70T-2.

Terminologies

Nominal pressure
Pressure given to a cylinder for convenience of naming
It is not always the same as the working pressure (rated pressure) that guarantees performance under the specified conditions.

Maximum allowable pressure
Maximum allowable pressure generated in a cylinder (surge pressure, etc.)

Proof pressure
Test pressure against which a cylinder can withstand without unreliable performance at the return to nominal pressure.

Minimum operating pressure
Minimum pressure at which cylinder installed horizontally operates under no load.

Notes)
- The hydraulic pressure generated in a cylinder due to the inertia of load must be lower than the maximum allowable pressure.
- When the cylinder works while it is on pulling side, the pressure should be 6 MPa or more.
- If the cylinder speed is less than the working speed range, it may cause stick-slip or rattling. If the speed exceeds the working speed range, the seals may wear earlier, and the cushioning effect may be lost.

Standard Stroke Range

Unit: mm

Type	Stroke
Type 10	50 to 1700
Type 20	50 to 2500
Type 30	50 to 3100
Type 40	50 to 3100
Type 50	50 to 3100

- The above strokes indicate the maximum available strokes for the standard type.
- For the rod buckling, check with the buckling chart in the selection materials. Contact us for longer strokes.

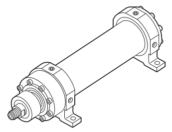
Adaptability of Fluid to Seal Material

Seal material	Applicable hydraulic fluid: Petroleum-based fluid	Water-glycol fluid	Phosphate ester fluid	Water in oil fluid	Oil in water fluid	Fatty acid ester
1 Nitride rubber	○	○	×	○	○	○
3 Fluorocarbon	○	×	○	○	○	○

Note) ○: Applicable ×: Inapplicable

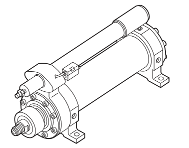
Type of telesco® cylinders

Standard type



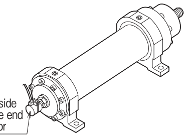
Mounting style: LA, LT, FA, FB, CA, TA, TB

With telescopic rod sensor (semi-standard)



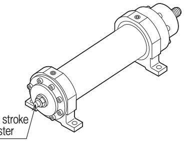
For detection of stroke end in the most extended state

With cap side stroke end sensor (semi-standard)



It can be fitted to all mounting styles except CA. For detection of stroke end in the most retracted state

With stroke adjuster (semi-standard)



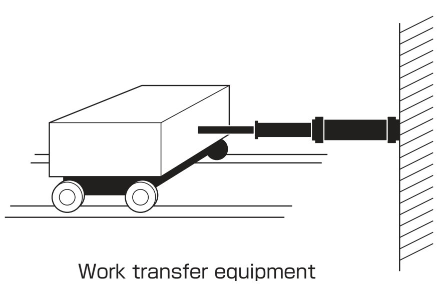
It can be fitted to all mounting styles except CA. Adjustment range: 0 to 3 mm

- An orifice type attenuation mechanism is used as the standard cushioning mechanism. Semi-standard models with longer cushioning stroke are available.

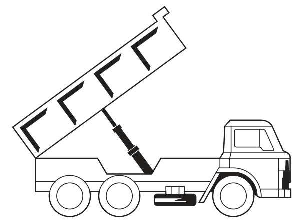
Cushion (fixed cushion)

- An orifice type attenuation mechanism (shock absorber) with a short stroke is used at both stroke ends. A simple cushion is used between the 1st and 2nd stages in the extending direction and between the 2nd and 1st stages in the retracting direction.
- The S cushion (semi-standard) has a cushion stroke longer than the standard cushion.
- The cushions are not available to be adjusted.

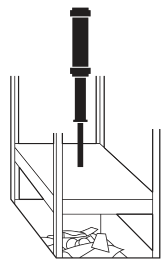
Application examples



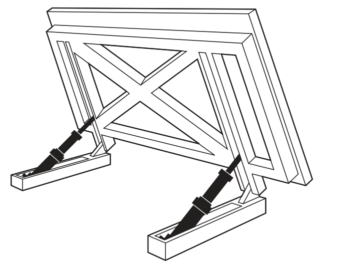
Work transfer equipment



Platform hoisting machine

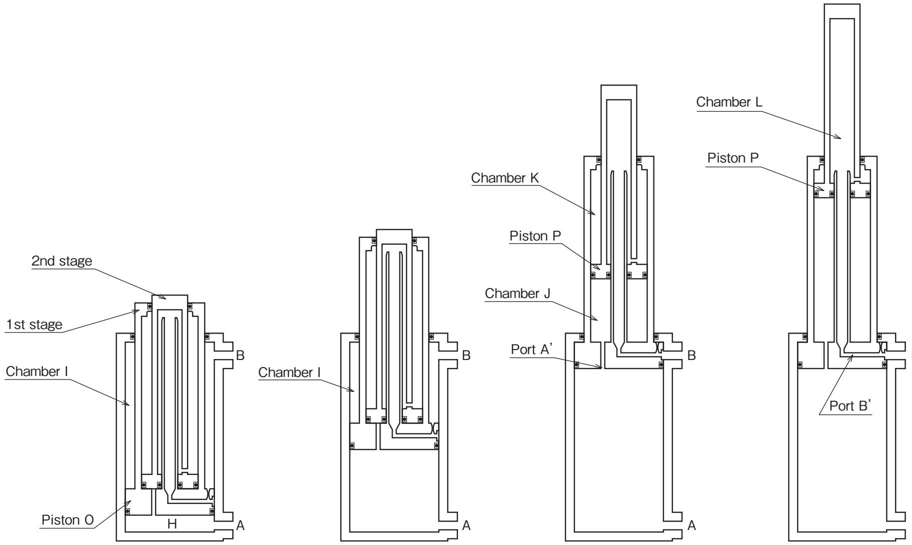


Pressing machine



Building material hoisting machine

Principle of Operation



Extension side

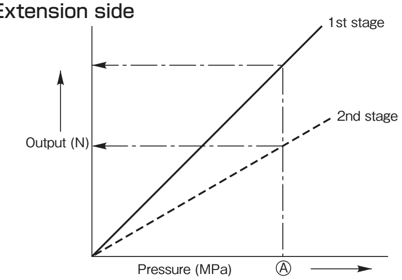
The hydraulic fluid flowing through port A enters chamber H and gives pushing force to piston O to actuate the 1st stage. At the same time, the fluid in chamber I is discharged through port B.
When piston O reaches the end on the rod cover side, the hydraulic fluid enters chamber J through port A' of piston O and gives force to piston P to actuate the 2nd stage. At the same time, the fluid in chamber K flows into chamber L through the hole in the rod connected to piston P and is discharged to port B as return fluid through port B' of piston O.

Retraction side

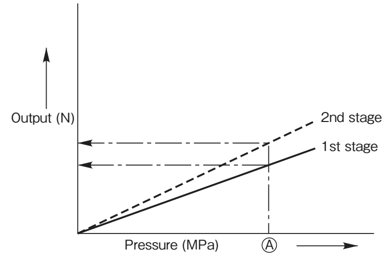
The hydraulic fluid flowing through port B enters chamber L through port B' of piston O and flows into chamber K through the hole in the rod connected to piston P. The hydraulic fluid flowing into chamber K gives force to the rod cover side of piston P to actuate the 2nd stage. At the same time, the fluid in chamber J is discharged from port A through port A'.
When piston P reaches the cap cover side, the hydraulic fluid enters chamber I and gives force to the rod cover side of piston O to actuate the 1st stage. At the same time, the fluid in chamber H is discharged from port A.

Output Characteristic Diagrams

Extension side



Retraction side



The left diagrams show the output at the 1st and 2nd stages on the extension side and retraction side.
At the pressure point Ⓐ, there is an obvious difference in output between the 1st and 2nd stages. This difference is caused by a difference in sectional area. It is clear that the output at the 1st stage is larger on the extension side and the output at the 2nd stage is larger on the retraction side. Therefore, the cylinder operations can be confirmed. On the extension side, the 1st stage operates, and then the 2nd stage operates. On the retraction side, the 2nd stage operates, and then the 1st stage operates.

● How to order

The item enclosed by broken line needs not to be entered, if unnecessary.

Semi-standard specification

Type ❶ · Seal material ❷ · Mounting style ❸ · Series type ❹ · Rod end thread length ❺ · Cushioning ❻ · Stroke ❼ · Port position ❽ · Air vent position ❾ · Accessories ❿

70T-2 1 LA 10 A B 300 – C G A T

- 1 Nitride rubber (standard)
- 3 Fluorocarbon (semi-standard)

Mounting style

- 10 Type 10
- 20 Type 20
- 30 Type 30
- 40 Type 40
- 50 Type 50

- A Standard A
- B Semi-standard B

- B Fixed cushions at both ends
- S Semi-standard (with cushion stroke longer than standard)

Cylinder stroke (mm)

Port position(A, B, C, D, E, F, G, H)

Air vent position (A, B, C, D, E, F, G, H)

- T With telescopic rod sensor (Types 10 to 30)
- L With cap side stroke end sensor
- B With telescopic rod sensor and cap side stroke end sensor (Types 10 to 30)

★ Standard specifications

- Seal material   Nitride rubber
- Cushioning   Fixed cushion on both ends (with orifice type attenuation mechanism)
- Port position, air vent position
  Mounting style   LA, LT
  Port positions ⒸⒼ   Air vent position Ⓐ
  Mounting style   FA, FB, CA, TA, TB
  Port positions ⒶⒺ   Air vent position Ⓒ

★ Rod end thread length (dimension A)

Piston rods with longer thread length (dimension A) can be manufactured according to semi-standard dimension B.

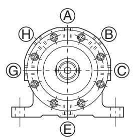
Rod end thread length (dimension A)   Unit: mm

Type	Standard A	Semi-standard B
Type 10	25	35
Type 20	35	45
Type 30	40	55
Type 40	45	60
Type 50	52	72

<Notes>
- When a lock nut is required, contact us.
- The rod end may have a special shape depending on the working conditions.
- When a stroke adjuster is required, give us such instructions. (Semi-standard)

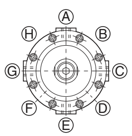
★ Specification of port and air vent positions

Mounting style   LA, LT



The standard port positions are Ⓒ and Ⓖ, and the standard air vent position is Ⓐ.
When modifying the positions, enter the symbol shown in the dimensional drawings.
When the telescopic rod sensor is provided, the ports are positioned at Ⓒ and Ⓖ, and the air vent is position at Ⓑ.

Mounting style   FA, FB, CA, TA, TB

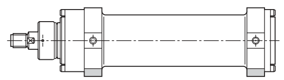


The standard port positions are Ⓐ and Ⓔ, and the standard air vent position is Ⓒ.
When modifying the positions, enter the symbol shown in the dimensional drawings.
When the telescopic rod sensor is provided, the ports are positioned at Ⓒ and Ⓖ, and the air vent is position at Ⓔ.

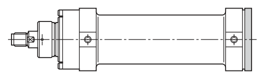
<Note>
Locate the ports and air vent at a distance of 90° or 180° from one another.

Mounting Style

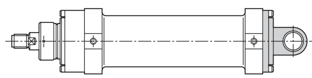
LA LA style(side lugs)



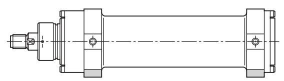
FB FB style (cap flange)



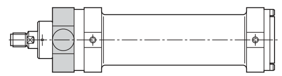
CA CA style (cap eye)



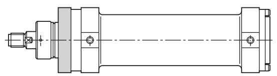
LT LT style (side lugs)



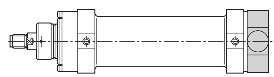
TA TA style (rod trunnion)



FA FA style (rod flange)



TB TB style (cap trunnion)



Weight Table

Unit: kg

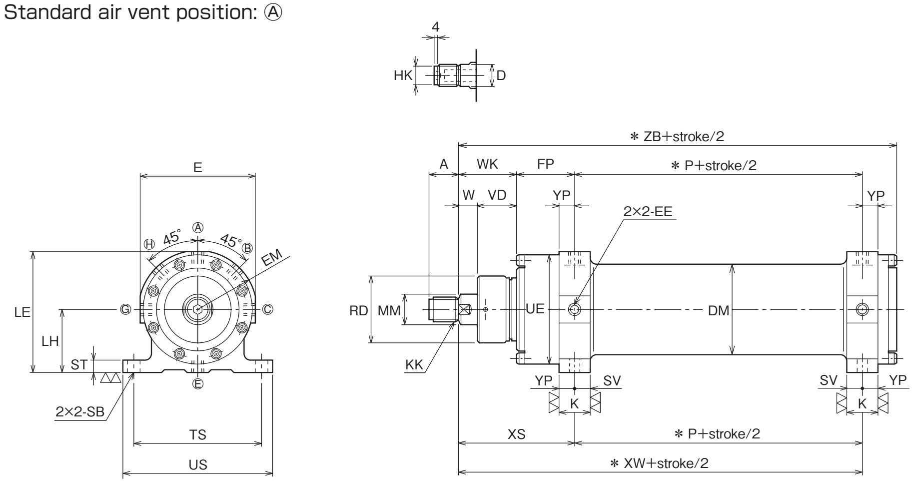
Type	Basic weight	Mounting accessory weight							Additional weight per mm of stroke
		LA	LT	TA	TB	FA	FB	CA	
Type 10	5.7	0.44	0.37	1.08	1.08	0.93	0.93	0.32	0.0084
Type 20	15.4	1.25	1.05	3.06	3.06	2.85	2.85	0.91	0.0169
Type 30	27.0	2.29	1.93	5.61	5.61	4.88	4.88	1.66	0.0212
Type 40	41.4	3.52	2.22	8.64	8.64	7.43	7.43	2.56	0.0313
Type 50	57.2	4.92	4.14	11.99	11.99	10.24	10.24	3.55	0.0431

Calculation example: Telescopic cylinder, type 30, mounting style FB, stroke 1500 mm
Cylinder weight (kg) = basic weight+mounting accessory weight+(stroke×additional weight per mm of stroke)
27.0+4.88+(1500×0.0212)=63.68kg

LA

70T-2 1 LA Series type A B Stroke – C G A

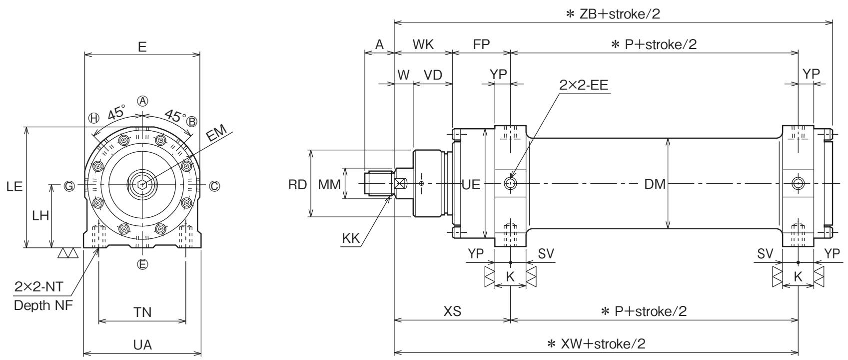
Standard port positions : ©Ⓖ
Standard air vent position: Ⓐ



LT

70T-2 1 LT Series type A B Stroke – C G A

Standard port positions : ©Ⓖ
Standard air vent position: Ⓐ



Dimensional Table

Type \ Symbol	A	D	DM	E	EE	EM	FP	HK	K
Type 10	25	24	φ73	98	Rc3/8	51	48	φ21h9	$26_{-0.1}^{0}$
Type 20	35	32	φ105	138	Rc1/2	71	67	φ30h9	$34_{-0.1}^{0}$
Type 30	40	41	φ125	158	Rc1/2	81	80	φ36h9	$42_{-0.1}^{0}$
Type 40	45	46	φ145	178	Rc3/4	92	93	φ42h9	$47_{-0.1}^{0}$
Type 50	52	55	φ165	196	Rc3/4	100	107	φ49h9	$48_{-0.1}^{0}$

Type \ Symbol	KK	LE	LH	MM	NF	NT	＊P	RD	SB	ST
Type 10	M24×2	99	50 ± 0.2	φ27	18	M12	25	φ59	φ13.5	10
Type 20	M33×2	139	70 ± 0.2	φ38	24	M16	35	φ84	φ18	16
Type 30	M39×2	164	85 ± 0.2	φ45	30	M20	40	φ100	φ22	20
Type 40	M45×2	184	95 ± 0.2	φ52	36	M24	45	φ112	φ24	22
Type 50	M52×2	203	105 ± 0.2	φ59	36	M24	50	φ128	φ26	24

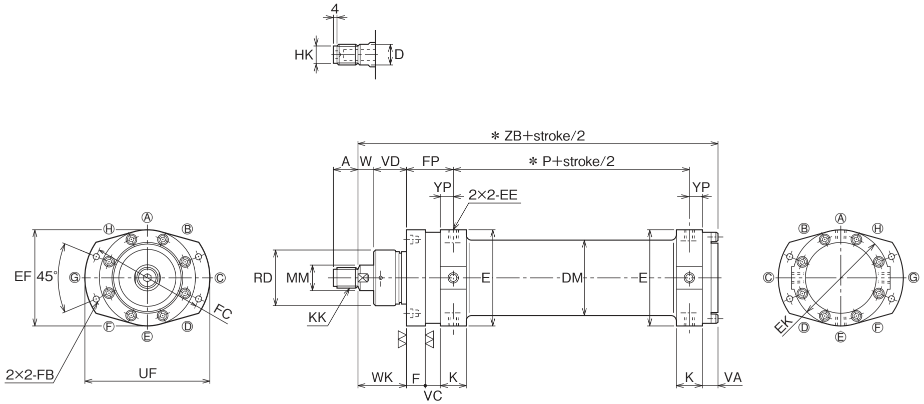
Type \ Symbol	SV	TN	TS	UA	UE	US	VD	W	WK	XS	＊XW	YP	＊ZB
Type 10	13	75	110	98	φ89.5	130	32	13	45	93	118	13	145
Type 20	17	105	150	138	φ129	180	43	17	60	127	162	17	200
Type 30	22	115	175	158	φ155	210	50	20	70	150	190	20	235
Type 40	23	130	205	178	φ177	240	57	23	80	173	218	24	270
Type 50	23	150	230	196	φ193	270	65	25	90	197	247	25	303

Note) In the case of the cushion type S, the asterisked dimension is increased by 5 mm.

FA

70T-2 [1] FA [Series type] [A] [B] [Stroke] – [A] [E] [C]

Standard port positions : Ⓐ Ⓔ
Standard air vent position: Ⓒ

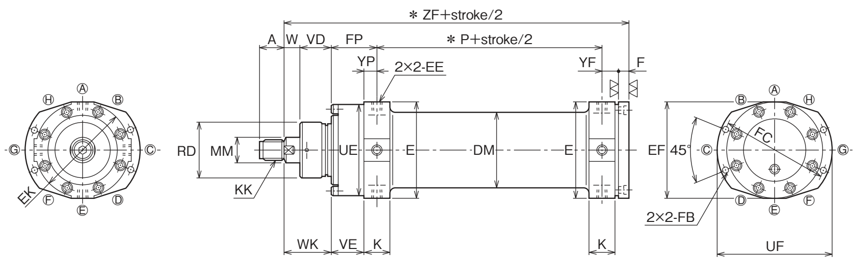


●Use a mount and mounting bolts of strength class of JIS8.8 or more.

FB

70T-2 [1] FB [Series type] [A] [B] [Stroke] – [A] [E] [C]

Standard port positions : Ⓐ Ⓔ
Standard air vent position: Ⓒ



●Use a mount and mounting bolts of strength class of JIS8.8 or more.

Dimensional Table

Symbol / Type	A	D	DM	E	EE	EF	EK	F	FB	FC
Type 10	25	24	ϕ73	98	Rc3/8	98	95	20	ϕ9	ϕ120
Type 20	35	32	ϕ105	138	Rc1/2	138	136	30	ϕ13.5	ϕ170
Type 30	40	41	ϕ125	158	Rc1/2	165	161	35	ϕ16	ϕ195
Type 40	45	46	ϕ145	178	Rc3/4	190	183	40	ϕ18	ϕ225
Type 50	52	55	ϕ165	196	Rc3/4	205	200	45	ϕ20	ϕ245

Symbol / Type	FP	HK	K	KK	MM	＊P	RD	UE	UF
Type 10	48	ϕ21h9	26	M24×2	ϕ27	25	ϕ59	ϕ89.5	135
Type 20	67	ϕ30h9	34	M33×2	ϕ38	35	ϕ84	ϕ129	195
Type 30	80	ϕ36h9	42	M39×2	ϕ45	40	ϕ100	ϕ155	225
Type 40	93	ϕ42h9	47	M45×2	ϕ52	45	ϕ112	ϕ177	260
Type 50	107	ϕ49h9	48	M52×2	ϕ59	50	ϕ128	ϕ193	285

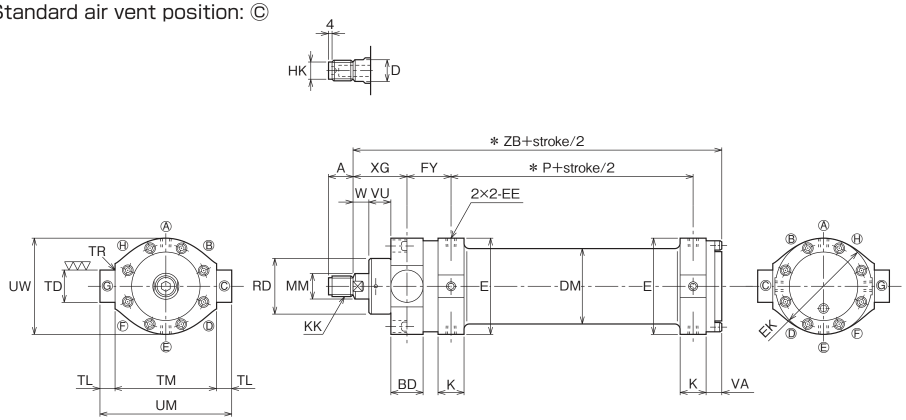
Symbol / Type	VA	VC	VD	VE	W	WK	YF	YP	＊ZB	＊ZF
Type 10	14	15	32	35	13	45	17	13	145	155
Type 20	21	20	43	50	17	60	23	17	200	215
Type 30	25	25	50	60	20	70	30	20	235	255
Type 40	28	29	57	69	23	80	32	24	270	290
Type 50	31	37	65	82	25	90	33	25	303	325

Note) In the case of the cushion type S, the asterisked dimension is increased by 5 mm.

TA

70T-2 [1] TA [Series type] [A] [B] [Stroke] – [A] [E] [C]

Standard port positions : Ⓐ Ⓔ
Standard air vent position: Ⓒ

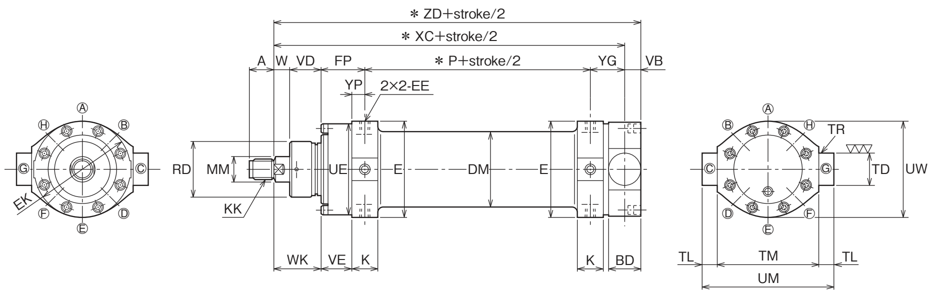


Note) When installing the cylinder horizontally, support the cylinder weight on the cap cover side.
(Reference stroke: 600 mm or more)

TB

70T-2 [1] TB [Series type] [A] [B] [Stroke] – [A] [E] [C]

Standard port positions : Ⓐ Ⓔ
Standard air vent position: Ⓒ



Note) When installing the cylinder horizontally, support the cylinder weight on the rod cover side.
(Reference stroke: 1200 mm or more)

Dimensional Table

Symbol / Type	A	BD	D	DM	E	EE	EK	FP	FY	HK	K
Type 10	25	31	24	ϕ73	98	Rc3/8	95	48	43	ϕ21h9	26
Type 20	35	38	32	ϕ105	138	Rc1/2	136	67	55	ϕ30h9	34
Type 30	40	48	41	ϕ125	158	Rc1/2	161	80	68	ϕ36h9	42
Type 40	45	58	46	ϕ145	178	Rc3/4	183	93	81	ϕ42h9	47
Type 50	52	63	55	ϕ165	196	Rc3/4	200	107	93	ϕ49h9	48

Symbol / Type	KK	MM	＊P	RD	TD	TL	TM	TR	UE	UM	UW
Type 10	M24×2	ϕ27	25	ϕ59	ϕ28e9	20	$100^{0}_{-0.35}$	R3	ϕ89.5	140	95
Type 20	M33×2	ϕ38	35	ϕ84	ϕ35e9	25	$145^{0}_{-0.4}$	R3	ϕ129	195	135
Type 30	M39×2	ϕ45	40	ϕ100	ϕ45e9	30	$175^{0}_{-0.4}$	R3	ϕ155	235	160
Type 40	M45×2	ϕ52	45	ϕ112	ϕ55e9	30	$200^{0}_{-0.46}$	R3	ϕ177	260	185
Type 50	M52×2	ϕ59	50	ϕ128	ϕ60e9	35	$220^{0}_{-0.46}$	R3	ϕ193	290	205

Symbol / Type	VA	VB	VD	VE	VU	W	WK	＊XC	XG	YG	YP	＊ZB	＊ZD
Type 10	14	16	32	35	21	13	45	150	50	32	13	145	166
Type 20	21	20	43	50	35	17	60	205	72	43	17	200	225
Type 30	25	25	50	60	37	20	70	240	82	50	20	235	265
Type 40	28	30	57	69	39	23	80	280	92	62	24	270	310
Type 50	31	32	65	82	47	25	90	315	104	68	25	303	347

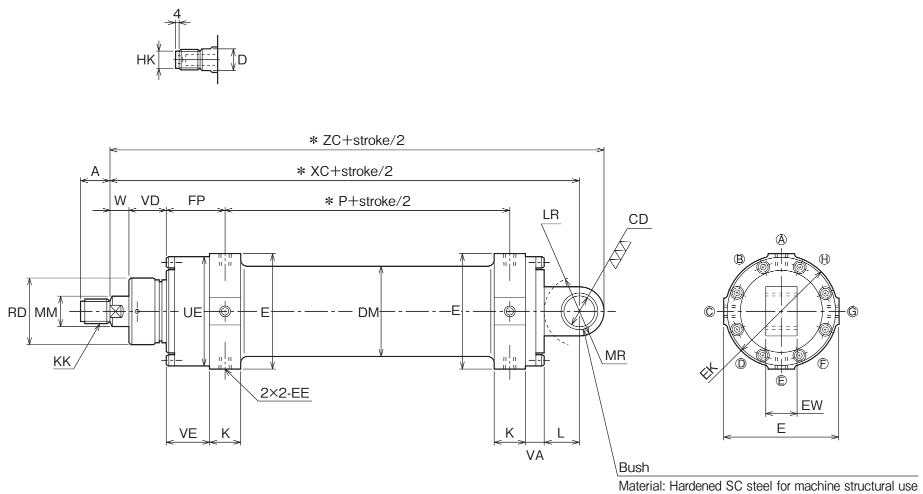
Note) In the case of the cushion type S, the asterisked dimension is increased by 5 mm.

Unit: mm

CA

70T-2 [1] CA [Series type] [A] [B] [Stroke] – [A] [E] [C]

Standard port positions : Ⓐ Ⓔ
Standard air vent position: Ⓒ



Note) When installing the cylinder horizontally, support the cylinder weight on the rod cover side.
(Reference stroke: 1200 mm or more)

Dimensional Table

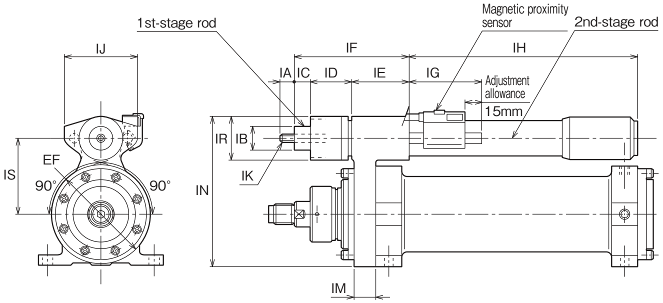
Type \ Symbol	A	CD	D	DM	E	EE	EK	EW	FP	HK	K	KK
Type 10	25	φ25H10	24	φ73	98	Rc3/8	95	28_{-1}^{0}	48	φ21h9	26	M24×2
Type 20	35	φ35H10	32	φ105	138	Rc1/2	136	40_{-1}^{0}	67	φ30h9	34	M33×2
Type 30	40	φ45H10	41	φ125	158	Rc1/2	161	50_{-1}^{0}	80	φ36h9	42	M39×2
Type 40	45	φ55H10	46	φ145	178	Rc3/4	183	55_{-1}^{0}	93	φ42h9	47	M45×2
Type 50	52	φ60H10	55	φ165	196	Rc3/4	200	63_{-1}^{0}	107	φ49h9	48	M52×2

Type \ Symbol	L	LR	MM	MR	＊P	RD	UE	VA	VD	VE	W	＊XC	＊ZC
Type 10	30	R29	φ27	R22	25	φ59	φ89.5	14	32	35	13	175	197
Type 20	45	R44	φ38	R30	35	φ84	φ129	21	43	50	17	245	275
Type 30	55	R54	φ45	R38	40	φ100	φ155	25	50	60	20	290	328
Type 40	65	R64	φ52	R45	45	φ112	φ177	28	57	69	23	335	380
Type 50	70	R69	φ59	R50	50	φ128	φ193	31	65	82	25	373	423

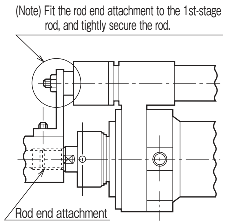
Note) In the case of the cushion type S, the asterisked dimension is increased by 5 mm.

Semi-standard/Cylinder with telescopic rod sensor (for detection of position in the most extended state)

The sensor can be fitted to each mounting style.



Reference Drawing



The rod end attachment should be manufactured by the user.

Maximum Stroke

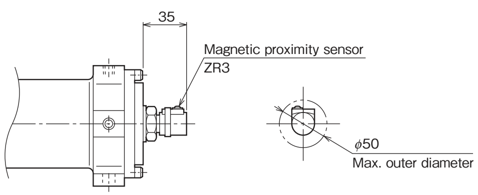
Type 10	1300
Type 20	2200
Type 30	2200

- The detection rod is a telescopic rod.
- Fit the 1st-stage detection rod to the rod end attachment, and secure it tightly.
- The sensor is used to detect the cylinder position in the most extended state. To detect it in the most retracted state, install optional cap side stroke end sensor.
- The telescopic rod angle and the sensor position can be changed to the right and left. (Only LA and LT, 90°)
- The standard sensor type is SR101. When using another sensor, specify the sensor type. However, only SR type sensors can be used. (For the sensor specifications, refer to the sensor specification column at the end of this catalog.)

Type \ Symbol	EF	IA	IB	IC	ID	IE	IF	IG	IH	IJ	IK	IM	IN	IR	IS
Type 10	MAX.106	20	25±0.1	5	47	60	112	85	(Stroke−66)/2+66	MAX.74	M8×1.25	27	MAX.147	42	75±0.1
Type 20	MAX.142	30	37±0.1	3	54	105	162	85	(Stroke−86)/2+70	MAX.86	M10×1.5	35	MAX.199	52	100±0.1
Type 30	MAX.172	35	37±0.1	13	54	105	172	85	(Stroke−86)/2+70	MAX.86	M10×1.5	35	MAX.229	52	115±0.1

Semi-standard/cap side stroke end sensor (for detection of backward limit position) Patent registered

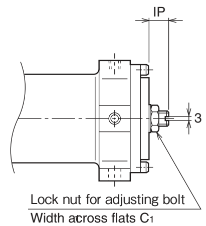
It can be fitted to all mounting styles except CA.



- For detection of telescopic cylinder backward limit position
- Types 10 to 50 have the same external dimensions.

Semi-standard/Stroke adjuster (e.g., Mounting style LA)

It can be fitted to all mounting styles except CA.



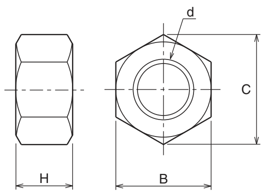
Adjustment range: 0 to 3 mm

- The following dimensions are increased by the adjusted stroke.

LA/LT style ································ VD·WK·XS·XW·ZB
FA style ··VD·WK·ZB
FB style ··VD·WK·ZF
TA style ··VU·XG·ZB
TB style ··VD·WK·XC·ZD

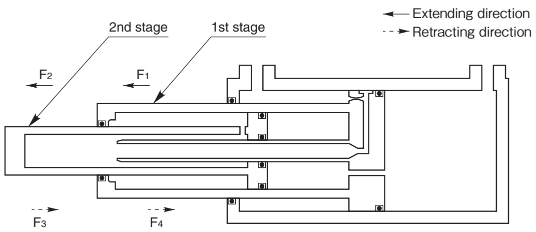
Type \ Symbol	C_1	IP
Type 10	19	15
Type 20	24	18
Type 30	30	21
Type 40	36	23
Type 50	36	23

Lock nut



Symbol \ d	M24×2	M33×2	M39×2	M45×2	M52×2
B	36	50	60	70	80
C	41.6	57.7	69.3	80.8	92.4
H	14	20	23	27	31

Calculation of cylinder force



Cylinder operation

●Extending direction	●Retracting direction
1st stage	2nd stage
↓	↓
2nd stage	1st stage

Note) For the details of the cylinder operation, see the principle of operation.

- ●Cylinder force in extending direction
  - 1st stage $F_1=A_1 \times P \times \beta$ (N)
  - 2nd stage $F_2=A_2 \times P \times \beta$ (N)
- ●Cylinder force in retracting direction
  - 1st stage $F_3=A_3 \times P \times \beta$ (N)
  - 2nd stage $F_4=A_4 \times P \times \beta$ (N)

A_1: Effective sectional area at 1st stage in extending direction (mm²)
A_2: Effective sectional area at 2nd stage in extending direction (mm²)
A_3: Effective sectional area at 1st stage in retracting direction (mm²)
A_4: Effective sectional area at 2nd stage in retracting direction (mm²)
P: Working pressure (MPa) β: Load rate

The actual cylinder output should be determined in consideration of the resistance of cylinder sliding sections and the pressure loss of the piping and equipment.
The load rate refers to the ratio of the actual force applied to the cylinder to the theoretical force (theoretical cylinder force) calculated from the circuit set pressure. Generally, the load rate should be in the following range.

When the inertia force is low: 60 to 80%
When the inertia force is high: 25 to 35%

For the calculation examples shown in this catalog, a load rate of 80% is used.

Table of Piston Effective Sectional Area

Unit: mm²

Type \ Direction	Extending direction		Retracting direction	
	1st stage	2nd stage	1st stage	2nd stage
Type 10	3117	1512	911	939
Type 20	6362	3142	1944	2007
Type 30	9503	4772	3142	3182
Type 40	12272	6107	3940	3984
Type 50	15394	7600	4825	4866

<Example>
Determine the cylinder force at the 1st and 2nd stages in the extending and retracting directions when type 10 double acting telescopic cylinder is used at a set pressure of 7 MPa.

<Answer>
Cylinder force in extending direction (N)

1st stage=Set pressure (MPa)×Piston effective sectional area at 1st stage in extending direction (mm²)×Load rate
=7×3117×0.8≒17455 (N)
2nd stage=Set pressure (MPa)×Piston effective sectional area at 2nd stage in extending direction(mm²)×Load rate
=7×1512×0.8≒8467 (N)

Cylinder force on retracting direction (N)

2nd stage=Set pressure (MPa)×Piston effective sectional area at 2nd stage in retracting direction (mm²)×Load rate
=7×939×0.8≒5258 (N)
1st stage=Set pressure (MPa)×Piston effective sectional area at 1st stage in retracting direction (mm²)×Load rate
=7×911×0.8≒5102 (N)

<Example>
Select an optimum type of double acting telescopic cylinder to obtain a cylinder force of 10000 N at the 1st stage in the retracting direction at a set pressure of 7 MPa.
Determine the cylinder force at the 1st and 2nd stages in the extending and retracting directions when the selected cylinder is used.

<Answer>

$$\text{Piston effective sectional area(mm}^2\text{)} = \frac{\text{cylinder force (N) / Load rate}}{\text{Set pressure (MPa)}}$$

$$= \frac{10000/0.8}{7} \fallingdotseq 1786$$

When you select a cylinder bore larger than 1786 from the rod cover side 1st stage column in the table of piston effective sectional area, then type 20 is selected.

Cylinder force at each stage

Extending direction
Cylinder force at 1st stage=7×6362×0.8≒35627 N
Cylinder force at 2nd stage=7×3142×0.8≒17595 N

Retracting direction
Cylinder force at 2nd stage=7×2007×0.8≒11239 N
Cylinder force at 1st stage=7×1944×0.8≒10886 N

How to read the buckling chart

How to determine the max. working load according to the telescopic cylinder type

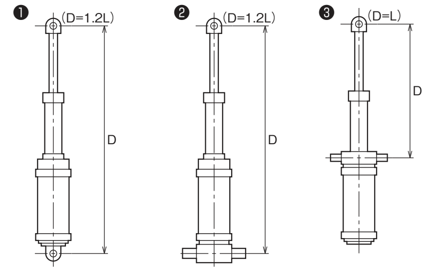
1. Determine in which condition the telescopic cylinder is mounted among ❶ to ❾ shown below.
2. After determining the mounting condition, obtain the value L for the condition.
3. Determine the max. working load according to the value L and the telescopic cylinder type from the buckling chart.

How to determine the max. stroke according to the telescopic cylinder type

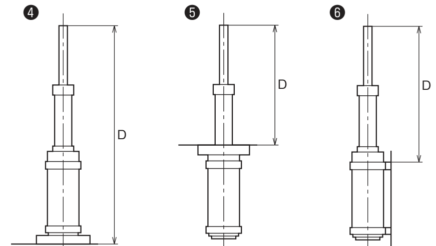
1. Determine in which condition the telescopic cylinder is mounted among ❶ to ❾ shown below.
2. Determine the value L according to the max. working load and the telescopic cylinder type from the buckling chart.
3. After the mounting condition is determined, the stroke can be obtained from the value L.

Mounting conditions of telescopic cylinder

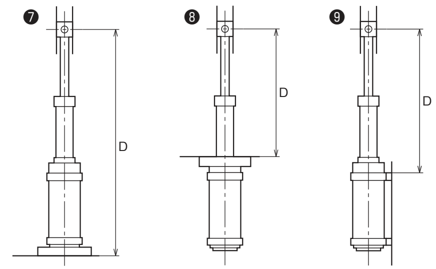
●Pin joint at both ends



●Fixed telescopic cylinder and free rod end (D=L/1.45)



●Fixed telescopic cylinder and rod end guide (D=1.6L) (in the case of pin joint)

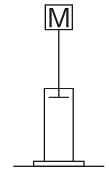


Notes on calculation of piston rod buckling

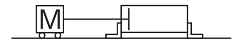
Before calculating the piston rod buckling, it is necessary to examine the method of stopping the cylinder. There are two ways to stop a cylinder: the cylinder stopping method, where the cylinder is stopped at the cylinder stroke end, and the external stopping method, where the cylinder is stopped by an external stopper. The way of determining the load varies depending on the method.

●Way of determining the load in the case of cylinder stopping method

In the case of ❶



In the case of ❷

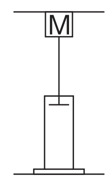


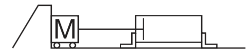
The cylinder is stopped at the stroke end as shown in the figure.
Determine the load necessary for buckling calculation as stated below.

In the case of ❶ Load=M·g
In the case of ❷ Load=μ·M·g

μ: Friction coefficient
g: Acceleration of gravity 9.8m/s²

●Way of determining the load in the case of external stopping method

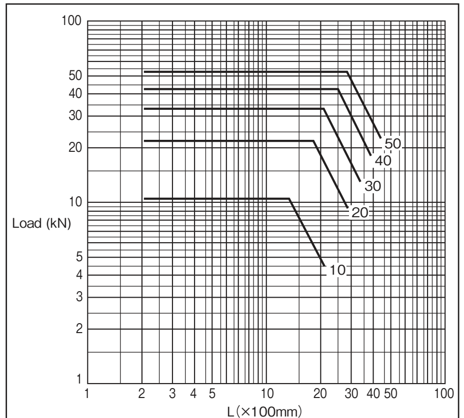




The cylinder is stopped in the middle by an external stopper as shown in the figure.
In this case, the load necessary for buckling calculation is not W, but the theoretical cylinder force (Set relief pressure (MPa)×Piston area (mm²)).

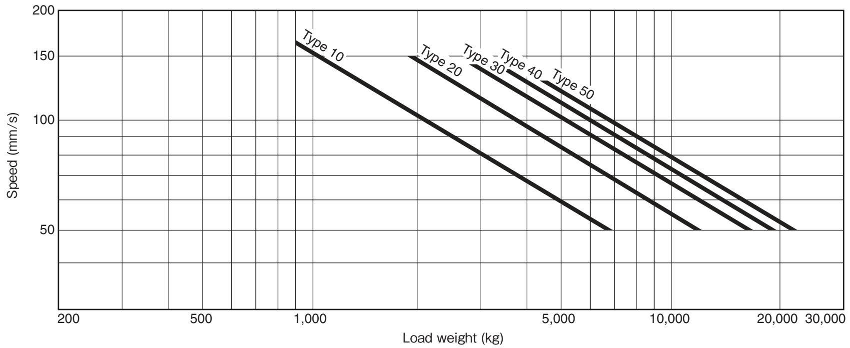
●Buckling chart

1kN=102kgf



Load weight—speed diagram of each series based on cushioning characteristics

Load weight—speed diagram (in the case of horizontal transfer)



The above diagram shows the target speed on a uniform speed circuit in the extending direction. On an ununiform speed circuit, the speed of the 2nd stage piston rod conforms to the above diagram. In the retracting direction, a load weight 1.5 times higher can be applied at the speed of the 1st stage piston rod.

For selection of a hydraulic cylinder, the relationship between load weight and speed is a key point.
The above diagram is a speed diagram based on the characteristics of the rod cover side cushion in the telescopic cylinder.

Calculation of cylinder stroke and most retracted size

The cylinder stroke and most retracted size can be calculated from the most extended size of a telescopic cylinder.

Calculation formula

(Most extended size−Fixed length)/3+(Fixed length)
=Most retracted size (mm)

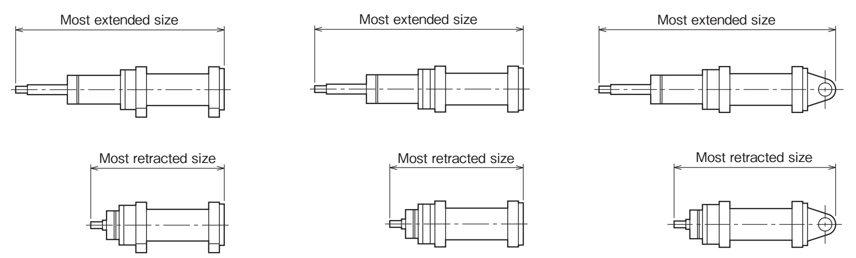
(Most retracted size−Fixed length)×2
=Cylinder stroke (mm)

Fixed Length

Unit: mm

Type \ Mounting style	LA·LT·FA·TA	FB	TB	CA
Type 10	170	180	191	222
Type 20	235	250	260	310
Type 30	275	295	305	368
Type 40	315	335	355	425
Type 50	355	377	399	475

The fixed length is obtained by subtracting the stroke/2 from the maximum external size of the cylinder in a retracted state.



●For LT, FB, TA and TB styles, calculate the size in the same method.

Confirmation of port diameter according to cylinder speed

The cylinder speed depends on the amount of fluid flowing into the cylinder. Therefore, it is necessary to confirm that the standard port diameter is appropriate. The cylinder speed V is determined by the following formula.

$$V=1.67\times10^4\times Qc/A\ (mm/s)$$

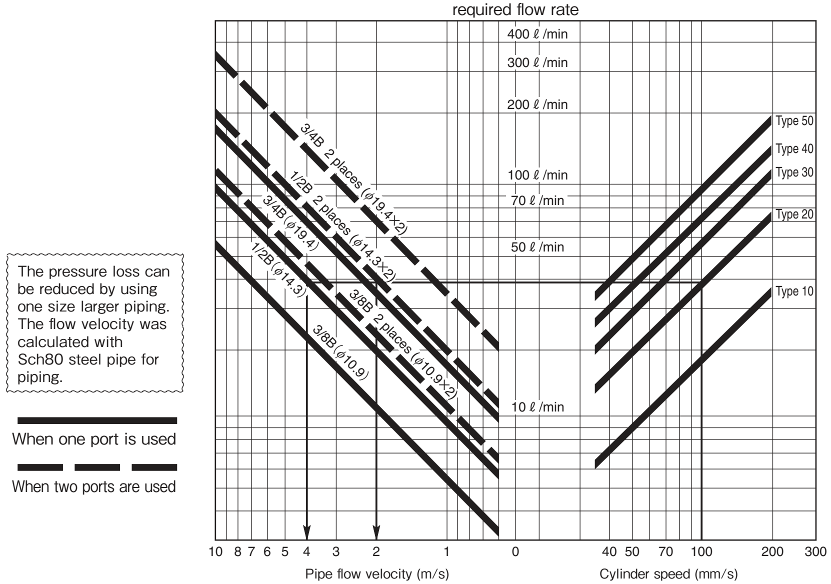
Qc: Amount of fluid supplied into cylinder (ℓ/min)
A: Piston effective sectional area (mm²) — 1st stage in extending direction; 2nd stage in retracting direction

The following diagram shows the relationship between speed and required flow rate for each size of double acting telescopic cylinder and the relationship between required flow rate and pipe flow velocity for each port diameter.

<Example>
Ascertain whether type 20 double acting telescopic cylinder with the standard port diameter can be used when the speed in the extending direction is 100 mm/s. Determine the pipe flow velocity (m/s). Ascertain whether the said cylinder can be used when the speed in the retracting direction is 100 mm/s.

<Answer>
Draw a line parallel to the horizontal axis from the intersection of the line of cylinder speed of 100 mm/s with the line of type 20, and connect the line with the line of port 1/2B (Type 20 double acting telescopic cylinder with standard port diameter).
Since the intersection of the port diameter with the cylinder speed and type is within the usable range, the cylinder can be used. The pipe flow velocity indicated by the vertical line from the intersection of the port diameter is 4.0 m/s. In the retracting direction, the velocity is 2.0 m/s when two ports are used.

Cylinder speed—required flow rate—pipe flow velocity diagram



Min. required amount of fluid for cylinder

Unit: ℓ

Type	Minimum Required Amount of Fluid
Type 10	$1.39\times10^{-3}\times$stroke (mm)
Type 20	$2.78\times10^{-3}\times$stroke (mm)
Type 30	$3.98\times10^{-3}\times$stroke (mm)
Type 40	$5.23\times10^{-3}\times$stroke (mm)
Type 50	$6.65\times10^{-3}\times$stroke (mm)

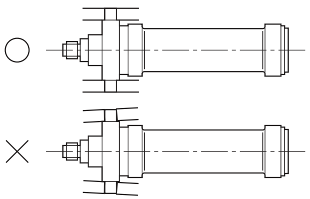
- The minimum required amount of fluid for cylinder refers to the amount of fluid obtained by subtracting the amount of fluid on the outlet side of the cylinder from the amount of fluid on the supply side at the maximum cylinder stroke.
- In the usable range, the pipe flow velocity is less than 7 m/s. Normally, when the pipe flow velocity exceeds 7 m/s, the piping resistance and the pressure loss are increased, and, as the result of this, the output is decreased when the cylinder operates, and the speed is reduced.
- When the cylinder is used at 6 MPa in the retracting direction, the discharge flow rate on the cap cover side should be less than 3.5 m/s. When it is used at 14 MPa in the retracting direction, the discharge flow rate should be less than 5.5 m/s.

Telescopic Cylinder Port Diameter

Series	Type 10	Type 20	Type 30	Type 40	Type 50
Port dia.	Rc3/8	Rc1/2	Rc1/2	Rc3/4	Rc3/4

Precautions for use

- Do not apply load to the ram tube end at the 1st stage. Doing so may cause operation failure.
- Avoid applying side load to the piston rod during use.
  Doing so can cause operation failure or damage the cylinder. If side load is applied, provide guides, or protect the rod end threads. In such a case, consult us.
- Correctly center the piston rod axis in the load moving direction. Incomplete centering can cause operation failure and damage the cylinder.
- In the case of mounting style TA, TB or CA, center the rotation axis and the mating mount.
- Correctly fit the mounting bracket of mounting style TA or TB as shown below.



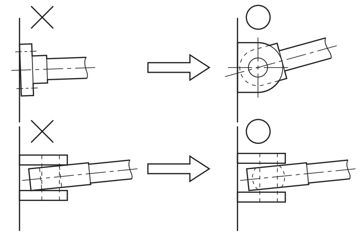
- Ensure that the mounting block has a sufficient rigidity to prevent occurrence of deflection from the cylinder thrust force.
- Use mounting bolts of strength class of JIS8.8 or more. For the tightening torque, see the following table.
  Incomplete tightening can cause looseness and damage of the bolts.

Tightening Torque Table

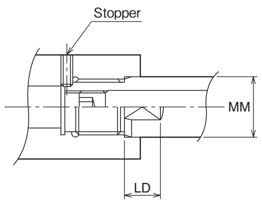
Unit: N·m

Thread dia.	Strength class	M8	M10	M12	M14	M16	M18	M20	M22	M24
Tightening torque	10.9	36	72	125	198	305	420	590	800	1020
	8.8	25	51	89	141	216	290	410	560	720

- Take care that eccentric load is not applied to the piston rod when connecting the rod end attachment and load.
- As a rod end attachment, the rod eye (T-end), rod eye with spherical bearing (S-end) and rod clevis (Y-end) are recommended as a rule. When using another rod end attachment, contact us.



- The piston rod is made from a hollow pipe. Therefore, when fitting a rod end attachment, provide a stopper on the spigot (4 mm) of the thread end as shown in the figure.
- If side load may be applied, connect the rod as a spigot joint as shown in the figure to protect the neck.
  In this case, specify dimension LD of the spanner fitting part and dimension W. (Semi-standard)



Notes on piping

- When the cylinder is used by meter-out control on the rod side, the pressure resistance of the piping (rubber hose, etc.) used on the rod side should be three times or more higher than the max. working pressure on the cap side.
- Before connecting the piping, flush the inside of the piping.
- When connecting with a rubber hose, do not bend the hose at an angle less than the specified radius.
- Take care that air is not collected in the middle of the piping.

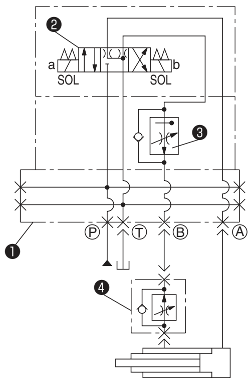
Uniform speed circuit

- On 70T-2 Series, the pressure receiving areas at the 1st and 2nd stages in the retracting direction are almost identical. Therefore, the cylinder can be operated successively at an almost uniform speed by meter-out control of amount of fluid on the outlet side when the rod is extended and by meter-in control of amount of fluid on the inlet side when the rod is retracted.
- Use a pressure compensation flow control valve.
- When back pressure may be applied from the solenoid valve T port, use a T port check valve or a B line pilot check valve.
- When the piping between the valve and the telescopic cylinder is long and the cylinder is stopped in the middle in the rod extending direction (particularly at the 1st stage), the rod may return one to several millimeters. In this case, reduce the pressure on the cap side, or connect a meter-out flow control valve near the cylinder.
- Note that the cylinder may not operate at a uniform speed if the pressure difference between the inlet (port P) and outlet (port B) of the hydraulic circuit is not more than 1 MPa when the rod is retracted.
  Note) The operation may slightly differ depending on the flow control valve used.
- To increase the rod retracting speed, increase the diameter of the piping of port T to reduce the back pressure. Provision of a bypass circuit is also effective.
- To reduce the shock given when the cylinder operates in the extending direction, use a circuit with a pressure reducing valve.
- When the cylinder operates at a uniform speed with the rod upward, the lowering speed cannot be controlled by the basic speed control circuit. Provide a counterbalance valve on the cap side to cause back pressure.

Example of circuit configuration

Basic speed control

Basic circuit for speed control to successively operate cylinder at a uniform speed

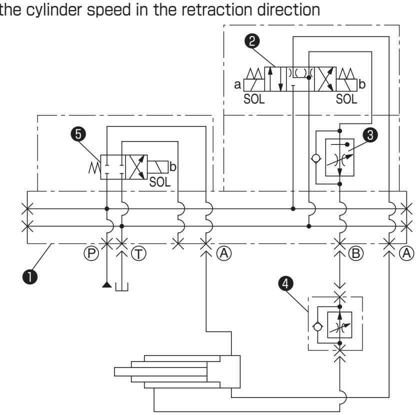


Equipment Configuration

No.	Name
❶	Manifold
❷	Solenoid valve
❸	Flow control valve (pressure compensation)
❹	Flow control valve (pressure compensation)

Speed control with bypass circuit

Speed control circuit provided with a bypass circuit on the retraction side of the basic speed control circuit to increase the cylinder speed in the retraction direction



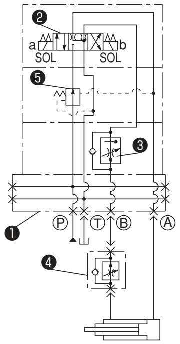
Equipment Configuration

No.	Name
❶	Manifold
❷	Solenoid valve
❸	Flow control valve (pressure compensation)
❹	Flow control valve (pressure compensation)
❺	Solenoid valve (for bypass)

Speed control with pressure reducing valve

Speed control circuit provided with a pressure reducing valve between port P and the solenoid valve of the basic speed control circuit to add a function to prevent application of excessive pressure to the cap cover side

- Use this circuit when the pressure on the rod side is 7 to 15 MPa.
- It can be used as a shock-less circuit for operation in the extending direction.



Equipment Configuration

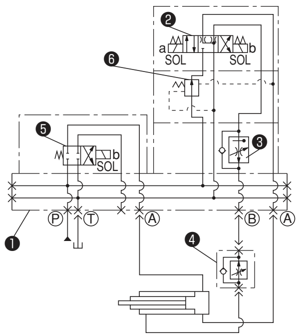
No.	Name
❶	Manifold
❷	Solenoid valve
❸	Flow control valve (pressure compensation)

No.	Name
❹	Flow control valve (pressure compensation)
❺	Pressure reducing valve

Speed control with bypass circuit and pressure reducing valve

Speed control circuit with a bypass circuit and a pressure reducing valve

- Use this circuit when the pressure on the rod side is 7 to 15 MPa.
- It can be used as a shock-less circuit for operation in the extending direction.



Equipment Configuration

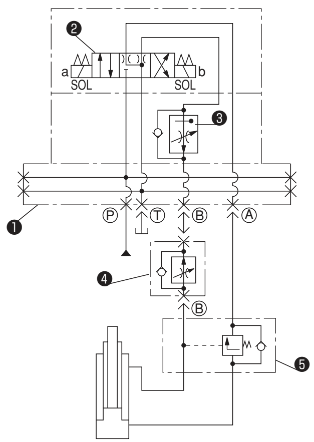
No.	Name
❶	Manifold
❷	Solenoid valve
❸	Flow control valve (pressure compensation)

No.	Name
❹	Flow control valve (pressure compensation)
❺	Solenoid valve (for bypass)
❻	Pressure reducing valve

Speed control with counterbalance valve

Speed control circuit provided with a counterbalance valve on the cap side

- To be used for operation at a uniform speed with the rod upward



Equipment Configuration

No.	Name
❶	Manifold
❷	Solenoid valve
❸	Flow control valve (pressure compensation)

No.	Name
❹	Flow control valve (pressure compensation)
❺	Counterbalance valve