10 MPa single acting uniform speed rod action 2-stage telescopic cylinders

- Single acting uniform speed telescopic cylinders
- 2-stage stroke cylinders require smaller installation space in the axial direction.
- Since the stages operate simultaneously, the rod end speed is uniform.
- Both stroke ends are provided with fixed cushions.
- The structure with high rigidity is suitable for lifting long articles.

Cylinder Specifications

Type	Type 15	Type 31	Type 47	Type 61	Type 77	Type 100	Type 127	Type 173	Type 245
Cylinder bore (mm)	ϕ63	ϕ90	ϕ110	ϕ125	ϕ140	ϕ160	ϕ180	ϕ210	ϕ250
Nominal pressure	10 MPa								
Maximum allowable pressure	Cap side: 10 MPa								
Proof pressure	Cap side: 14 MPa								
Minimum operating pressure	0.3 MPa								
Working speed range	20 to 333 mm/s	20 to 300 mm/s	20 to 280 mm/s	20 to 257 mm/s	20 to 250 mm/s	20 to 220mm/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 $^{+7.8}_{+5.0}$ 1001 to 1600mm $^{+8.2}_{+5.0}$ 1601 to 2500mm $^{+8.6}_{+5.0}$ 2501 to 4000mm $^{+9.0}_{+5.0}$ 4001 to 6300mm $^{+11.3}_{+5.0}$ 6301 to 8900mm $^{+13.0}_{+5.0}$								
Mounting style	LA, FA, FB, CA, TA, TB								

- For the calculation of cylinder force, refer to the page of calculation of cylinder force of TTC-1.

Rod End Load

Unit: N

Type	Type 15	Type 31	Type 47	Type 61	Type 77	Type 100	Type 127	Type 173	Type 245
Rod end load	3750	7750	11750	15250	19250	25000	31750	43250	61250

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 contracting, the rod end load should be more than the reference value shown in the following table to obtain an internal pressure of 2.5 MPa on the cap side. If the load is less than the value shown in the table, the cylinder lowering speed may be reduced, or the cylinder may not lower.
- 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.
- For the internal structure, refer to the sectional drawings at the end of this catalog.
- The above table shows stroke allowances obtained under no load. (They include the excess stroke at the 2nd stage of 5 mm.) If there is a sufficient load, the stroke may be a minus value (Up to about stroke×0.3%).

Standard Stroke Range

Unit: mm

Type	Type 15	Type 31	Type 47	Type 61	Type 77	Type 100	Type 127	Type 173	Type 245
Stroke	50 to 2900	50 to 4400	50 to 4800	50 to 5100	50 to 5400	50 to 5900	50 to 6800	50 to 7700	50 to 8900

- 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.

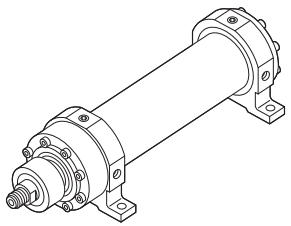
Adaptability of Fluid to Seal Material

Seal material	Applicable fluid		
	Petroleum-based fluid	Water-glycol fluid	Phosphate ester fluid
1 Nitride rubber	○	○	×
3 Fluorocarbon	○	×	○

Note) ○: Applicable ×: Inapplicable

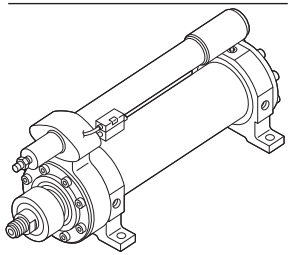
Type of telesco® cylinders

Standard type



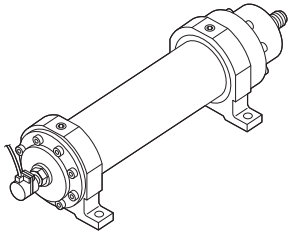
Mounting style: LA, FA, FB, CA, TA, TB

With telescopic rod sensor (semi-standard)



For detection of stroke end in the most extended state

With cap side stroke end sensor (semi-standard)

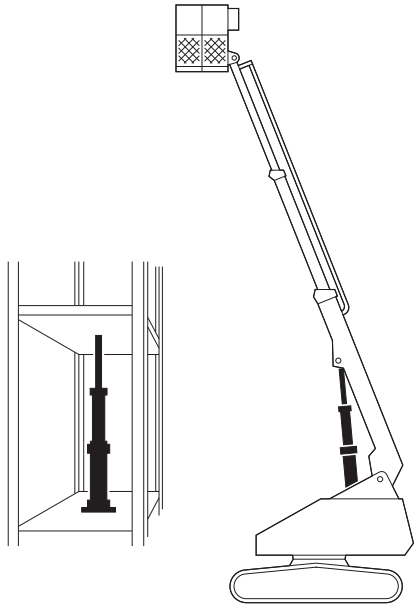


It can be fitted to all mounting styles except CA. For detection of the stroke end position in the most retracted state.

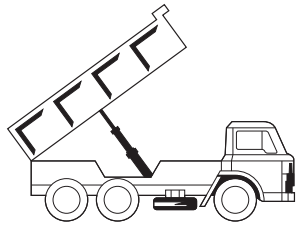
- An orifice type attenuation mechanism is used as the standard cushioning mechanism.

Cushion (fixed cushion)
- An orifice type attenuation mechanism (shock absorber) with a short stroke is used at both stroke ends.
- The cushions are not available to be adjusted.

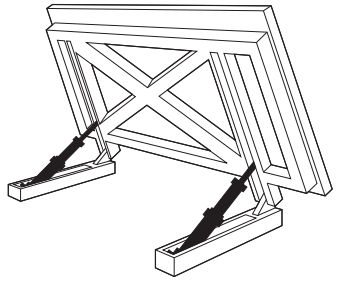
Application examples TTC-1 Series single acting telescopic cylinders suitable for lifting



Various kinds of lifting equipment



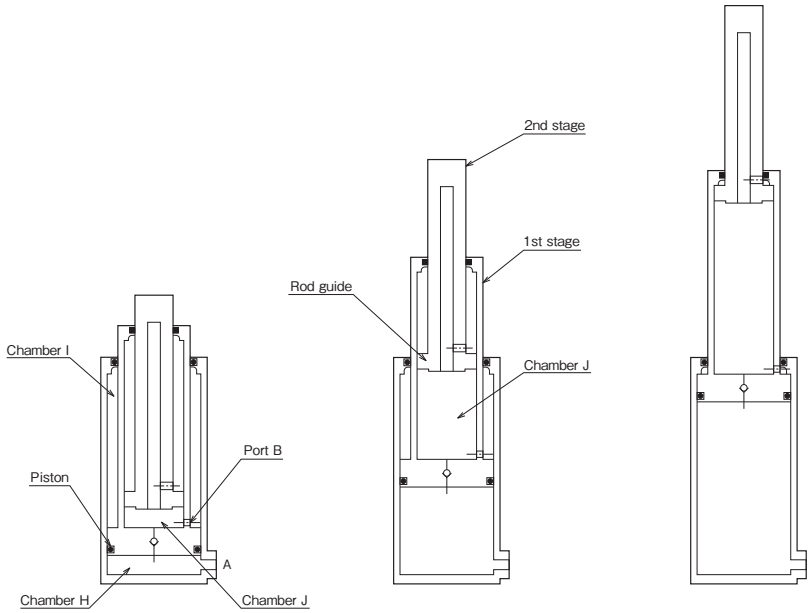
Platform hoisting machine



Building material hoisting machine

Telescopic Cylinder TTC-1

Principle of Operation



Extension

The hydraulic fluid flowing through port A enters chamber H and gives pushing force to the piston to actuate the 1st stage. At the same time, the hydraulic fluid in chamber I flows into chamber J through port B and gives pushing force to the rod to simultaneously actuate the 2nd stage.

Retraction

The rod is depressed by the end load to actuate the 2nd stage. At the same time, the hydraulic fluid in chamber J enters chamber I through port B and gives depressing force to the piston to simultaneously actuate the 1st stage. The fluid in chamber H is discharged from port A.

Weight Table

Unit: kg

Type	Basic weight	Mounting accessory weight						Additional weight per mm of stroke	Moving part weight per mm of stroke
		LA	TA	TB	FA	FB	CA		
Type 15	5.9	0.44	1.08	1.08	0.93	0.93	0.32	0.0101	2.3+0.0059×St
Type 31	15.7	1.25	3.06	3.06	2.85	2.85	0.91	0.0210	6.0+0.0120×St
Type 47	27.8	2.29	5.61	5.61	4.88	4.88	1.66	0.0286	13+0.0177×St
Type 61	41.9	3.52	8.64	8.64	7.43	7.43	2.56	0.0395	20.9+0.0229×St
Type 77	57.9	4.92	11.99	11.99	10.24	10.24	3.55	0.0522	32+0.0287×St
Type 100	81.2	6.8	17.1	22.9	15.18	8.9	3.95	0.0709	35+0.0377×St
Type 127	118.5	9.8	23.2	30.8	20.91	11.6	5.24	0.0933	52+0.0490×St
Type 173	180	15.2	36.9	49.7	36.07	21.2	9.07	0.1100	82+0.0657×St
Type 245	292	24	61.2	84.1	54.22	29.9	13.84	0.1750	135+0.0930×St

Note) The weight table is used to calculate the total cylinder weight. The moving part weight is used to calculate the total weight of the rod guide assembly and the ram tube piston assembly. (The values in the asterisked columns include the working fluid weight.)

Calculation example) TTC-1 Series, type 31, mounting style FB, stroke 1500 mm

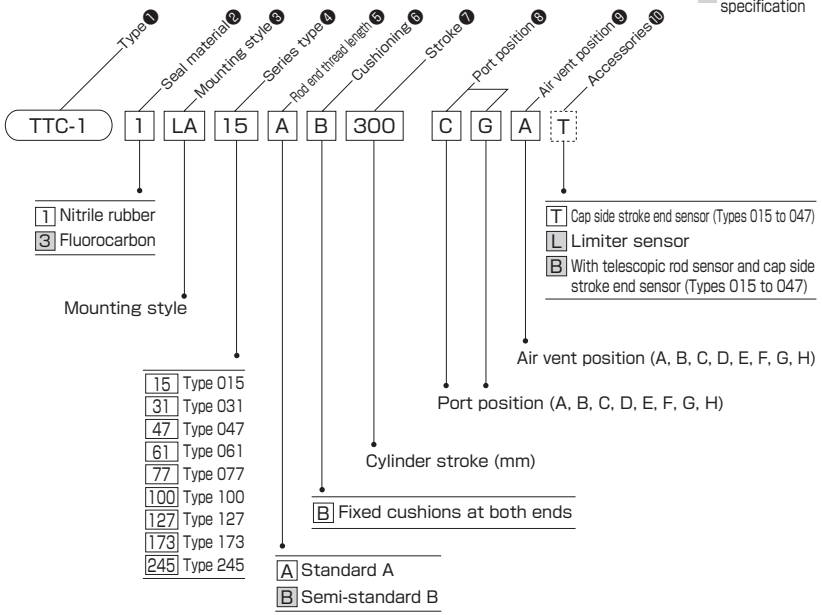
Cylinder weight (kg) = basic weight+mounting accessory weight+stroke×additional weight

=15.7+2.85+1500×0.0210=50.05 kg

Moving part weight (kg)=6.0+0.0120×1500=24 kg

● How to order

The item enclosed by broken line needs not to be entered, if unnecessary. Semi-standard specification



✪ 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
  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.

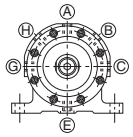
Rod end thread length (dimension A) Unit: mm

Type	Standard A	Semi-standard B
Type 15	20	40
Type 31	30	60
Type 47	35	75
Type 61	40	85
Type 77	47	95
Type 100	55	105
Type 127	61	120
Type 173	70	140
Type 245	95	165

<Note>
- When a lock nut is required, contact us.

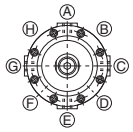
✪ Specification of port and air vent positions

Mounting style LA



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.

Mounting style FA, FB, CA, TA, TB



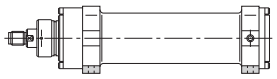
The standard port positions are Ⓐ and Ⓔ, and the standard air vent position is ⓒ. When modifying the positions, enter the symbol shown in the dimensional drawings.

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

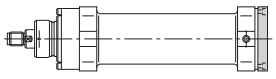
This series of cylinders are produced by order. For the leadtime, contact us in each case.

Mounting Style

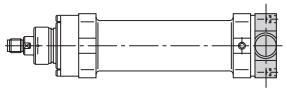
LA LA style (side lugs)



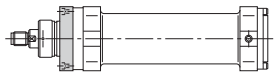
FB FB style (cap flange)



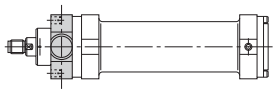
TB TB style (cap flange)



FA FA style (rod flange)



TA TA style (rod trunnion)

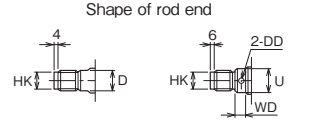


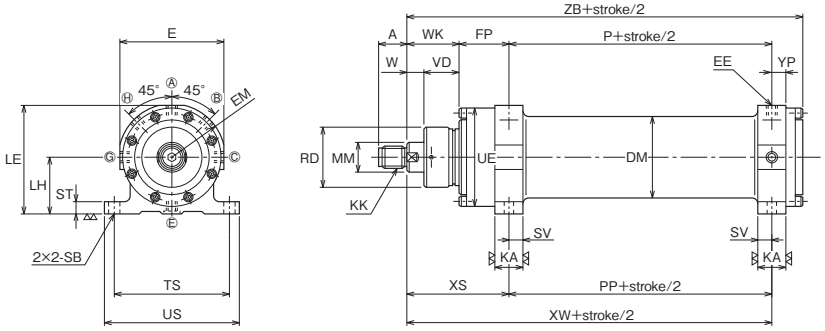
CA CA style (cap eye)

LA

TTC-1 [1] LA [Series type] [A] [B] [Stroke] – [C] [G] [A]

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



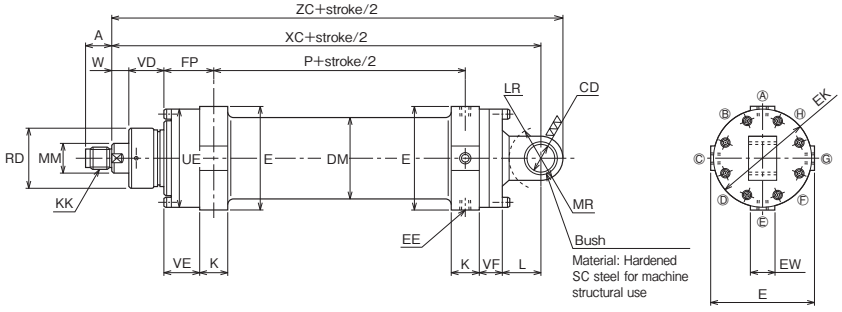


- Dimension MM of the rod is a reference nominal dimension. Contact us for details.
- For the port of type 245, see the page of "Shape of port".

CA

TTC-1 [1] CA [Series type] [A] [B] [Stroke] – [A] [E] [C]

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



- Dimension MM of the rod is a reference nominal dimension. Contact us for details.
- For the port of type 245, see the page of "Shape of port".

Dimensional Table

Symbol / Type	A	CD	D	DD	DM	E	EE	EK	EM	EW	FP	HK
Type 15	20	ϕ25H10	30	–	ϕ73	98	Rc3/8	95	51	28_{-1}^{0}	48	ϕ27h9
Type 31	30	ϕ35H10	46	–	ϕ105	138	Rc1/2	136	71	40_{-1}^{0}	67	ϕ42h9
Type 47	35	ϕ45H10	56	–	ϕ125	158	Rc3/4	161	81	50_{-1}^{0}	80	ϕ53h9
Type 61	40	ϕ55H10	65	–	ϕ145	178	Rc3/4	183	92	55_{-1}^{0}	93	ϕ60h9
Type 77	47	ϕ60H10	75	–	ϕ165	196	Rc3/4	200	100	63_{-1}^{0}	107	ϕ68h9
Type 100	55	ϕ65H10	85	–	ϕ190.7	225	Rc1	230	115	70_{-1}^{0}	120	ϕ76h9
Type 127	61	ϕ70H10	–	ϕ12	ϕ216.3	254	Rc1	257	129	80_{-1}^{0}	143	ϕ86h9
Type 173	70	ϕ85H10	–	ϕ15	ϕ244.5	290	Rc1 1/4	295	147	90_{-1}^{0}	169	ϕ101h9
Type 245	95	ϕ100H10	–	ϕ15	ϕ298.5	340	40A	352	176	110_{-1}^{0}	203	ϕ120h9

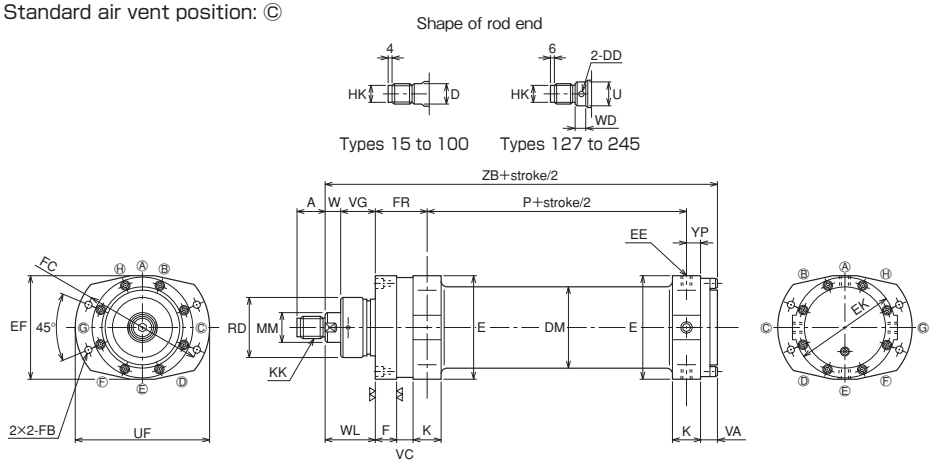
Symbol / Type	K	KA	KK	L	LE	LH	LR	MM	MR	P	PP	RD	SB	ST	SV
Type 15	26	$26_{-0.1}^{0}$	M30×2	35	99	50±0.2	R29	ϕ34	R22	25	25	ϕ59	ϕ13.5	10	13
Type 31	34	$34_{-0.1}^{0}$	M45×2	52	139	70±0.2	R44	ϕ50	R30	35	35	ϕ84	ϕ18	16	17
Type 47	42	$42_{-0.1}^{0}$	M56×2	64	164	85±0.2	R54	ϕ63	R38	40	40	ϕ100	ϕ22	20	22
Type 61	47	$47_{-0.1}^{0}$	M64×3	75	184	95±0.2	R64	ϕ71	R45	45	45	ϕ112	ϕ24	22	23
Type 77	48	$48_{-0.1}^{0}$	M72×3	81	203	105±0.2	R69	ϕ79	R50	50	50	ϕ128	ϕ26	24	23
Type 100	60	$60_{-0.1}^{0}$	M80×3	87	233	120±0.2	R74	ϕ90	R60	50	60	ϕ150	ϕ30	27	30
Type 127	66	$66_{-0.1}^{0}$	M90×3	94	262	135±0.2	R80	ϕ100	R65	55	65	ϕ166	ϕ33	30	33
Type 173	74	$74_{-0.1}^{0}$	M105×3	115	295	150±0.2	R99	ϕ116	R80	56	70	ϕ192	ϕ39	36	37
Type 245	84	$84_{-0.1}^{0}$	M125×4	133	350	180±0.2	R114	ϕ136	R90	73	80	ϕ230	ϕ45	42	42

Symbol / Type	TS	U	UE	US	VD	VE	VF	W	WD	WK	XC	XS	XW	YP	ZB	ZC
Type 15	110	–	ϕ89.5	130	43	35	23	17	–	60	204	108	133	13	160	226
Type 31	150	–	ϕ129	180	43	50	35	22	–	65	271	132	167	17	205	301
Type 47	175	–	ϕ155	210	50	60	42	25	–	75	321	155	195	20	240	359
Type 61	205	–	ϕ177	240	57	69	46	28	–	85	368	178	223	24	275	413
Type 77	230	–	ϕ193	270	65	82	51	30	–	95	409	202	252	25	308	459
Type 100	260	–	ϕ219	310	80	85	59	35	–	115	466	230	290	35	355	526
Type 127	295	ϕ99	ϕ248	350	90	105	66	43	28	133	529	271	336	38	409	594
Type 173	340	ϕ115	ϕ285	405	95	125	77	40	35	135	596	297	367	44	450	676
Type 245	400	ϕ135	ϕ335	480	108	154	86	39	35	147	684	343	423	42	515	774

FA

TTC-1 [1] FA [Series type] [A] [B] [Stroke] – [A] [E] [C]

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

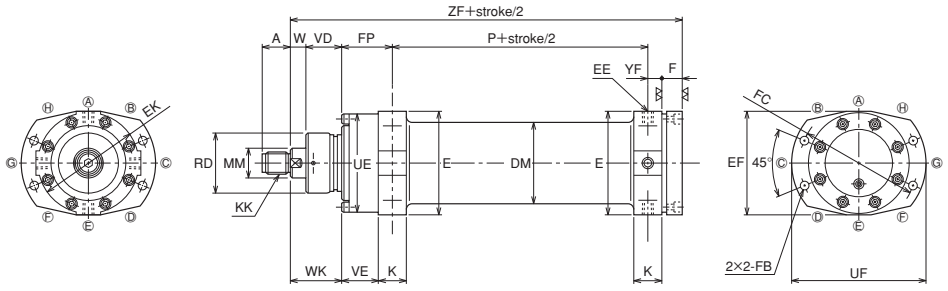


- Use a mount and mounting bolts of strength class of JIS8.8 or more.
- Dimension MM of the rod is a reference nominal dimension. Contact us for details.
- For the port of type 245, see the page of "Shape of port".

FB

TTC-1 [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.
- Dimension MM of the rod is a reference nominal dimension. Contact us for details.
- For the port of type 245, see the page of "Shape of port".

Dimensional Table

Symbol / Type	A	D	DD	DM	E	EE	EF	EK	F	FB	FC	FD
Type 15	20	30	–	ϕ73	98	Rc3/8	98	95	20	ϕ9	ϕ120	20
Type 31	30	46	–	ϕ105	138	Rc1/2	138	136	30	ϕ13.5	ϕ170	30
Type 47	35	56	–	ϕ125	158	Rc3/4	165	161	35	ϕ16	ϕ195	35
Type 61	40	65	–	ϕ145	178	Rc3/4	190	183	40	ϕ18	ϕ225	40
Type 77	47	75	–	ϕ165	196	Rc3/4	205	200	45	ϕ20	ϕ245	45
Type 100	55	85	–	ϕ190.7	225	Rc1	235	230	48	ϕ22	ϕ290	35
Type 127	61	–	ϕ12	ϕ216.3	254	Rc1	260	257	56	ϕ24	ϕ320	40
Type 173	70	–	ϕ15	ϕ244.5	290	Rc1¼	300	295	68	ϕ30	ϕ380	46
Type 245	95	–	ϕ15	ϕ298.5	340	40A	350	352	77	ϕ33	ϕ440	50

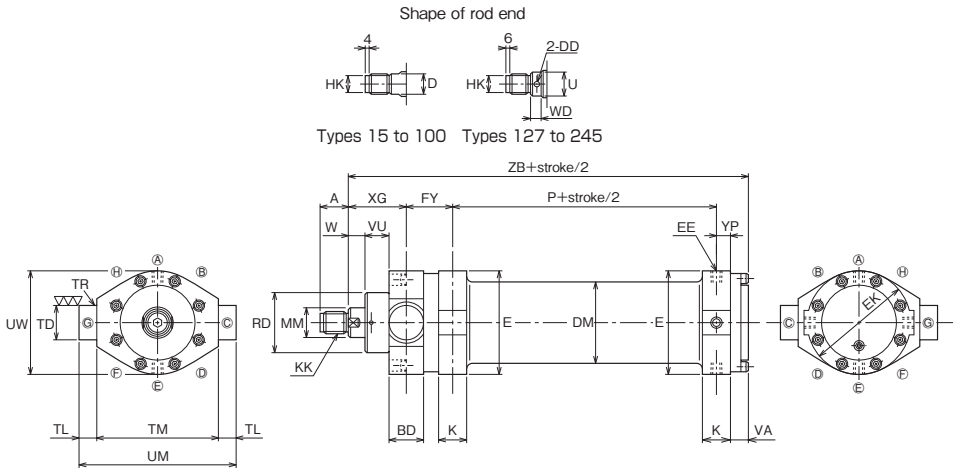
Symbol / Type	FP	FR	HK	K	KK	*MM	P	RD	U	UE	UF	VA
Type 15	48	48	ϕ27h9	26	M30×2	ϕ34	25	ϕ59	–	ϕ89.5	135	14
Type 31	67	67	ϕ42h9	34	M45×2	ϕ50	35	ϕ84	–	ϕ129	195	21
Type 47	80	80	ϕ53h9	42	M56×2	ϕ63	40	ϕ100	–	ϕ155	225	25
Type 61	93	93	ϕ60h9	47	M64×3	ϕ71	45	ϕ112	–	ϕ177	260	28
Type 77	107	107	ϕ68h9	48	M72×3	ϕ79	50	ϕ128	–	ϕ193	285	31
Type 100	120	123	ϕ76h9	60	M80×3	ϕ90	50	ϕ150	–	ϕ219	335	35
Type 127	143	146	ϕ86h9	66	M90×3	ϕ100	55	ϕ166	ϕ99	ϕ248	365	40
Type 173	169	174	ϕ101h9	74	M105×3	ϕ116	56	ϕ192	ϕ115	ϕ285	440	46
Type 245	203	205	ϕ120h9	84	M125×4	ϕ136	73	ϕ230	ϕ135	ϕ335	510	50

Symbol / Type	VC	VD	VE	VG	W	WD	WK	WL	YF	YP	ZB	ZF
Type 15	15	43	35	43	17	–	60	60	17	13	160	170
Type 31	20	43	50	43	22	–	65	65	23	17	205	220
Type 47	25	50	60	50	25	–	75	75	30	20	240	260
Type 61	29	57	69	57	28	–	85	85	32	24	275	295
Type 77	37	65	82	65	30	–	95	95	33	25	308	330
Type 100	40	80	85	77	35	–	135	112	35	35	355	355
Type 127	52	90	105	87	43	28	133	130	38	38	409	409
Type 173	62	95	125	90	40	35	135	130	44	44	450	450
Type 245	79	108	154	106	39	35	147	145	42	42	515	515

TA

TTC-1 [1] TA [Series type] [A] [B] [Stroke] – [A] [E] [C]

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

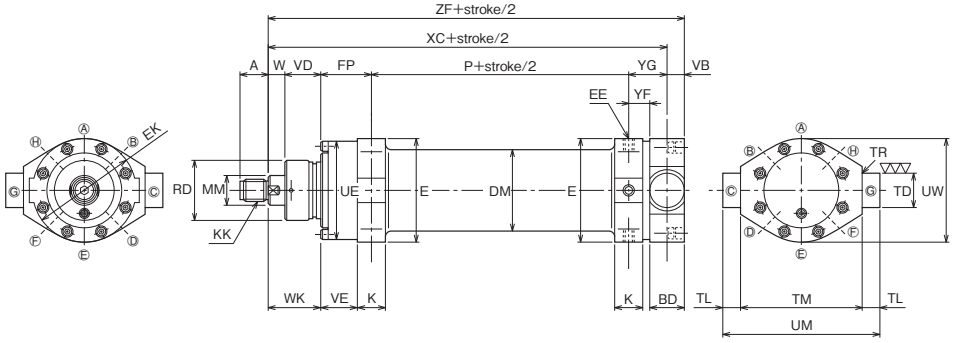


- Dimension MM of the rod is a reference nominal dimension. Contact us for details.
- For the port of type 245, see the page of "Shape of port".

TB

TTC-1 [1] TB [Series type] [A] [B] [Stroke] – [A] [E] [C]

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



- Dimension MM of the rod is a reference nominal dimension. Contact us for details.
- For the port of type 245, see the page of "Shape of port".

Dimensional Table

Symbol / Type	A	BD	D	DD	DM	E	EE	EK	FP	FY	HK	K
Type 15	20	31	30	–	ϕ73	98	Rc3/8	95	48	43	ϕ27h9	26
Type 31	30	38	46	–	ϕ105	138	Rc1/2	136	67	55	ϕ42h9	34
Type 47	35	48	56	–	ϕ125	158	Rc3/4	161	80	68	ϕ53h9	42
Type 61	40	58	65	–	ϕ145	178	Rc3/4	183	93	81	ϕ60h9	47
Type 77	47	63	75	–	ϕ165	196	Rc3/4	200	107	93	ϕ68h9	48
Type 100	55	68	85	–	ϕ190.7	225	Rc1	230	120	108	ϕ76h9	60
Type 127	61	74	–	ϕ12	ϕ216.3	254	Rc1	257	143	126	ϕ86h9	66
Type 173	70	89	–	ϕ15	ϕ244.5	290	Rc1¼	295	169	149	ϕ101h9	74
Type 245	95	105	–	ϕ15	ϕ298.5	340	40A	352	203	180	ϕ120h9	84

Symbol / Type	KK	*MM	P	RD	TD	TL	TM	TR	U	UE	UM	UW
Type 15	M30×2	ϕ34	25	ϕ59	ϕ28e9	20	$100_{-0.35}^{0}$	R3	–	ϕ89.5	140	95
Type 31	M45×2	ϕ50	35	ϕ84	ϕ35e9	25	$145_{-0.4}^{0}$	R3	–	ϕ129	195	135
Type 47	M56×2	ϕ63	40	ϕ100	ϕ45e9	30	$175_{-0.4}^{0}$	R3	–	ϕ155	235	160
Type 61	M64×3	ϕ71	45	ϕ112	ϕ55e9	30	$200_{-0.46}^{0}$	R3	–	ϕ177	260	185
Type 77	M72×3	ϕ79	50	ϕ128	ϕ60e9	35	$220_{-0.46}^{0}$	R3	–	ϕ193	290	205
Type 100	M80×3	ϕ90	50	ϕ150	ϕ65e9	45	$250_{-0.46}^{0}$	R4	–	ϕ219	340	230
Type 127	M90×3	ϕ100	55	ϕ166	ϕ70e9	50	$280_{-0.52}^{0}$	R4	ϕ99	ϕ248	380	257
Type 173	M105×3	ϕ116	56	ϕ192	ϕ85e9	60	$320_{-0.57}^{0}$	R4	ϕ115	ϕ285	440	295
Type 245	M125×4	ϕ136	73	ϕ230	ϕ100e9	70	$380_{-0.57}^{0}$	R4	ϕ135	ϕ335	520	350

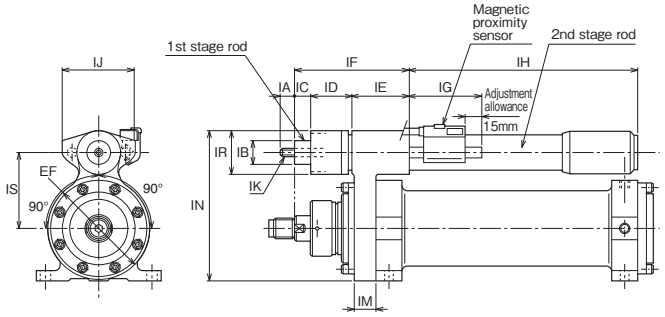
Symbol / Type	VA	VB	VD	VE	VU	W	WD	WK	XC	XG	YF	YG	YP	ZB	ZF
Type 15	14	16	43	35	32	17	–	60	165	65	17	32	13	160	181
Type 31	21	20	43	50	35	22	–	65	210	77	25	43	17	205	230
Type 47	25	25	50	60	37	25	–	75	245	87	27	50	20	240	270
Type 61	28	30	57	69	39	28	–	85	285	97	34	62	24	275	315
Type 77	31	32	65	82	47	30	–	95	320	109	37	68	25	308	352
Type 100	35	35	80	85	57	35	–	115	353	127	35	68	35	355	388
Type 127	40	38	90	105	69	43	28	133	405	150	38	74	38	409	443
Type 173	46	46	95	125	69	40	35	135	447	155	44	87	44	450	493
Type 245	50	53	108	154	78	39	35	147	517	170	42	94	42	515	570

Single Acting Uniform Speed 2-stage Telescopic Cylinder

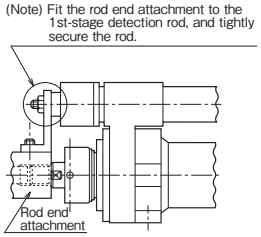
Unit: mm

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

The sensor can be fitted to types 15, 31 and 47 of any mounting style.



Reference drawing



- The rod end attachment should be manufactured by the user.

Maximum Stroke

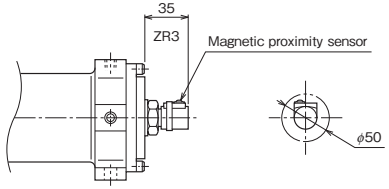
	Horizontal form	Vertical form
Type 15	1300	2000
Type 31	2200	3300
Type 47	2200	3300

- 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.)
- The telescopic rod angle and the sensor position can be changed to the right and left. (90° only in the case of LA)

Symbol / Type	EF	IA	IB	IC	ID	IE	IF	IG	IH	IR	IJ	IK	IM	IN	IS
Type 15	MAX.106	20	25±0.1	20	47	60	127	85	(Stroke−66)/2+66	42	MAX.74	M8×1.25	27	MAX.147	75±0.2
Type 31	MAX.142	30	37±0.1	8	54	105	167	85	(Stroke−86)/2+70	52	MAX.86	M10×1.5	35	MAX.199	100±0.2
Type 47	MAX.172	35	37±0.1	18	54	105	177	85	(Stroke−86)/2+70	52	MAX.86	M10×1.5	35	MAX.229	115±0.2

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

It can be fitted to all mounting styles except CA.



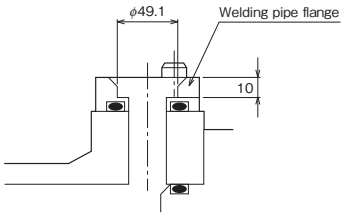
- For the sensor specifications, refer to the sensor specification column at the end of this catalog.
- All types from 15 to 245 have the same dimensions.

Single Acting Uniform Speed 2-stage Telescopic Cylinder

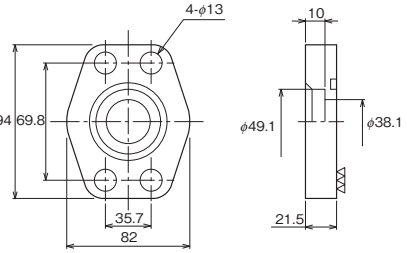
Unit: mm

Shape of port

- Shape of port

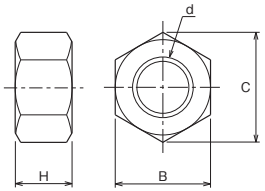


- Shape of welding pipe flange

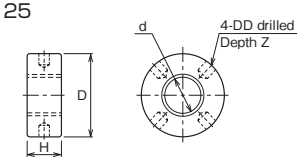


Lock nut

M30 to M90



M105 to M125



M30 to M90

Symbol / d	M30×2	M45×2	M56×2	M64×3	M72×3	M80×3	M90×3
B	46	70	85	95	105	115	130
C	53.1	80.8	98.1	110	121	133	150
H	18	27	34	38	42	48	54

M105 to M125

Symbol / d	M105×3	M125×3
D	ϕ 160	ϕ 190
DD	ϕ 15	ϕ 15
H	63	72
Z	18	18

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)

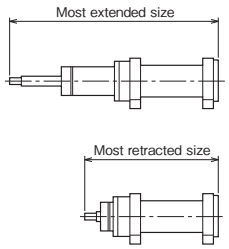
Fixed Length

Unit: mm

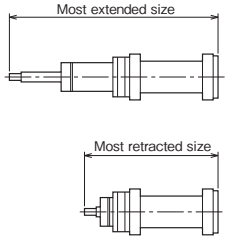
Mounting style / Type	LA·FA·TA	FB	TB	CA
Type 15	180	190	201	246
Type 31	235	250	260	331
Type 47	275	295	305	394
Type 61	315	335	355	453
Type 77	355	377	399	506
Type 100	410	410	443	581
Type 127	470	470	504	655
Type 173	520	520	563	746
Type 245	610	610	665	869

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

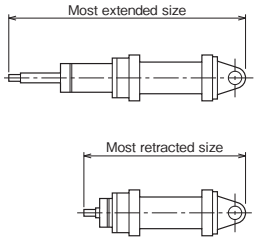
LA style



FA style



CA style



● In the case of mounting style FB, TA or TB, calculate the size in the same method.

Calculation of cylinder force

Cylinder force

$F=A\times P\times\beta(N)$

A: Effective sectional area (mm^2)
P: Set 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
: Around 50%
For the calculation examples shown in this catalog, a load rate of 80% is used.

The piston effective sectional area refers to the calculated area corresponding to the rod end output. The nominal of each type indicates the piston effective sectional area.

Table of Piston Effective Sectional Area

Unit: mm^2

Type	Type 15	Type 31	Type 47	Type 61	Type 77	Type 100	Type 127	Type 173	Type 245
Effective sectional area	1559	3181	4752	6163	7697	10053	12723	17318	24544

<Example>
Determine the cylinder force obtained when type 15 single acting telescopic cylinder is used at a set pressure of 10 MPa.
<Answer>
Cylinder force (N)
=Set pressure (MPa)×Effective sectional area (mm^2)×Load rate
=10×1559×0.8
=12472(N)

<Example>
Determine the type of single acting telescopic cylinder to be used to lift a load of 25000 N vertically 2500 mm at a set pressure of 10 MPa.
Also, determine the cylinder force in this case.
<Answer>

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

$$=\frac{25000/0.8}{10}$$

$$=3125(mm^2)$$

Temporarily select type 31 based on the effective sectional area.
Then, obtain the sum of the load and the cylinder moving part weight as the total load, and confirm that type 31 is applicable to the load.

$$\text{Required effective sectional area } (mm^2)=\frac{\text{Load (N)+Moving part weight (N)/0.8}}{\text{Set pressure (MPa)}}$$

$$=\frac{\{25000+9.81\times(6.0+0.0120\times2500)\}/0.8}{10}$$

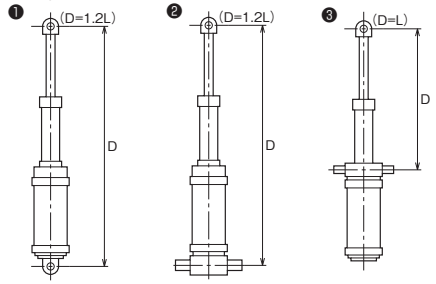
$$=3169(mm^2)<3181(mm^2)$$

Therefore, type 31 is usable.
Cylinder force (N)=Set pressure (MPa)×Effective sectional area (mm^2)×Load rate
=10×3181×0.8
=25448 (N)

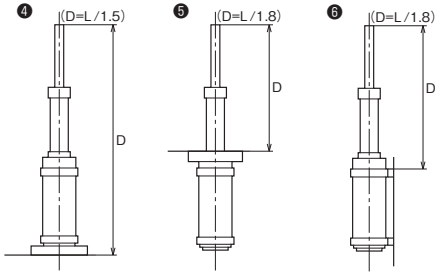
How to read the buckling chart

- 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 determined from the value L.

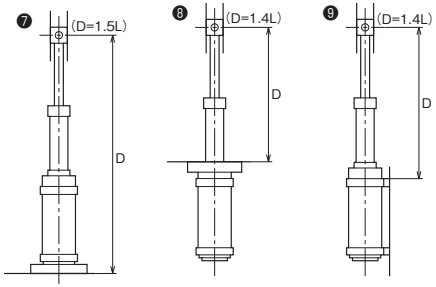
- Mounting conditions of telescopic cylinder
  - Pin joint at both ends



  - Fixed telescopic cylinder and free rod end



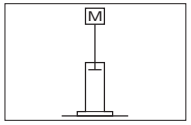
  - Fixed telescopic cylinder and rod end guide (in the case of pin joint)



Notes on rod buckling

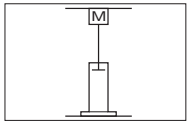
Before calculating the rod buckling, it is necessary to examine the method of stopping the cylinder. There are two ways to stop a cylinder: the cylinder stopping method, where the cylinder is stopped at the cylinder stroke end, and the external stopping method, where the cylinder is stopped by an external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

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



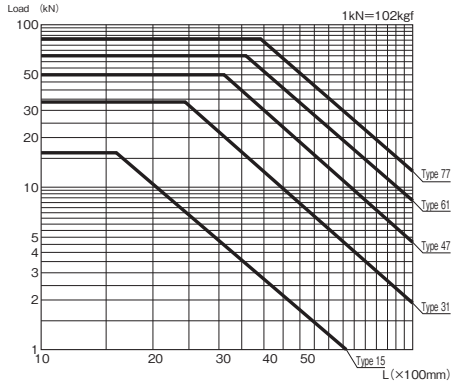
The cylinder is stopped at the stroke end as shown in the figure.
Determine the load necessary for buckling calculation as stated below.
Load = M·g
g: Acceleration of gravit 9.8 m/s²

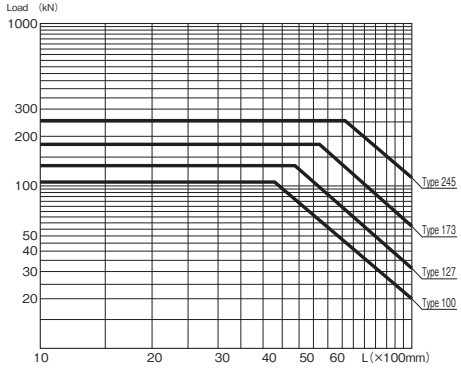
- Way of determining the load in the case of external stopping method



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 effective sectional area (mm²)).

- Buckling Charts





Confirmation of port diameter according to piston rod end speed

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

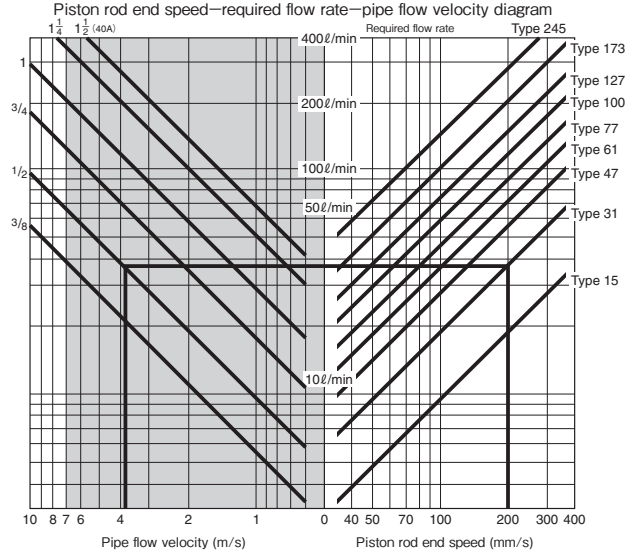
$$V = 1.67 \times 10^4 \times Qc/A \ (mm/s)$$

Qc: Amount of fluid supplied into cylinder (ℓ/min)
A: Piston effective sectional area (mm²)

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

<Example>
Ascertain whether type 31 single acting telescopic cylinder with the standard port diameter can be used when the piston rod end speed in the extending direction is 200 mm/s.
Determine the pipe flow velocity (m/s).
<Answer>
Draw a line parallel to the horizontal axis from the intersection of the line of piston rod end speed of 200 mm/s with the line of type 31, and connect the line with the line of port 1/2B (type 31 single acting telescopic cylinder with standard port diameter).
Since the intersection of the port diameter with the piston rod end 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 approx. 4 m/s.

Piston rod end speed—required flow rate—pipe flow velocity diagram



Telescopic Cylinder Port Diameter

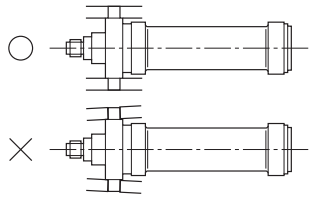
Series	Type 15	Type 31	Type 47	Type 61	Type 77	Type 100	Type 127	Type 173	Type 245
Port dia.	Rc3/8	Rc1/2	Rc3/4	Rc3/4	Rc3/4	Rc1	Rc1	Rc1 1/4	40A

- 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 pipe flow velocity exceeds 7 m/s, use two ports.
- To use the cylinder at the nominal speed in a retracted state, the discharge flow rate should be less than 3.5 m/s.

TTC-1 Single Acting Uniform Speed 2-stage Telescopic Cylinder

Precautions for use

- These cylinders are of the single acting type. In the contracting direction, the cylinders operate with their own weight and the rod end load. These cylinders are delivered after they are filled with a working fluid (petroleum-based fluid equivalent to ISO VG32).
- Discharge air sufficiently.
- 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 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.
- If the cylinder is used frequently in the middle of the stroke, it may not be able to operate full stroke for reasons of the cylinder structure. Occasionally operate the cylinder to the contracting stroke end. Then, it will automatically correct the end position.
- These cylinders have a stroke allowance of 5 mm at the 2nd stage in addition to the specified stroke. Therefore, when the load is smaller for the working pressure, the cylinder may work for the allowance after operating the specified cylinder stroke.
- For reasons of the principle of the operation, the cylinder stroke may become a minus value (Up to about stroke×0.3%). If it is required to obtain the specified accuracy at the stroke end, provide the cylinder with an excess stroke, and take measures, such as an external stopper.
- Correctly center the 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 rotating axis and the mating mount.
- Correctly fit the mounting bracket of mounting style TA or TB as shown below.



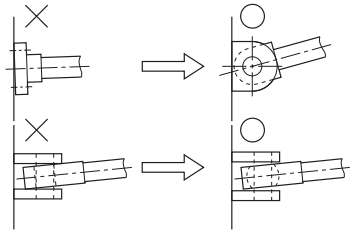
- When using any of these cylinders horizontally, consult us.
- Ensure that the mounting block has a sufficient rigidity to prevent occurrence of deflection from the cylinder thrust force.
- Use mounting bolts of strength class of JIS8.8 or more. For the tightening torque, see the following table.
-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

Tightening Torque Table

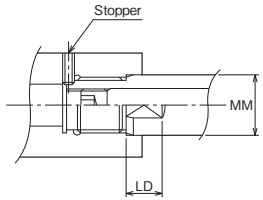
Unit: N·m

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, consult us.



- The 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)



* Dimension MM of the rod is a reference nominal dimension. Contact us for details.

Notes on piping

- 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.