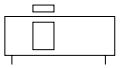
Series variation

High precision guided Rodless cylinder SRG series

Discontinue

●: Standard, ◎: Option, ■: Not available

Variation	Model No. JIS symbol	Bore size (mm)	Stroke length (mm) 200	300	400	500	600	700	800	900	1000		Max. stroke length (mm)	Mounting style: Basic type 00	Axial foot type LB	Axial foot type LB1	Cushion: No cushion N	Both sides cushion B	R side cushion R	L side cushion L	Option: Adjustable full-stroke both sides with shock absorber A	Adjustable full-stroke R side with shock absorber A1	Adjustable full-stroke L side with shock absorber A2	Adjustable full-stroke bracket later installation A3	Increasing table mounting screw size H	Switch	Page
Double acting	SRG 	12	●	●	●	■	■	■	■	■	■		450	●	●	●	●	●	●	●	◎	◎	◎	◎	◎	◎	1574
		16, 20	●	●	●	●	●	●	●	■	■		800	●	●	●	●	●	●	●	◎	◎	◎	◎	◎		
		25	●	●	●	●	●	●	●	●	●		1000	●	●	●	●	●	●	●	◎	◎	◎	◎	■		

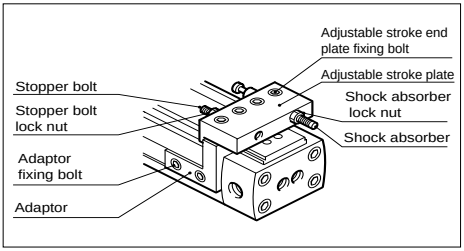
Safety precautions

Read this before starting use.
Refer to Intro 45 about cylinder in general, while refer to Intro 52 about cylinder switch.

High precision guided rodless cylinder SRG series

WARNING Installation & Adjustment

1 How to adjust adjustable stroke unit



(1) Movement of adjustable stroke unit

• Loosening adaptor fixing bolt and adjustable stroke end plate fixing bolt allows to move the adjustable stroke unit.

(2) Fixing adjustable stroke unit

• After moving adjustable stroke unit to the specified position, fix the adaptor fixing bolt and the adjustable stroke end plate fixing bolt with the torque on Table 9. Tightening torque less than the value on the table below may lead to misallocating the adjustable stroke unit.

Table 9 Tightening torque of adaptor fixing bolt, adjustable stroke end plate fixing bolt

Tightening torque / Model	Adaptor fixing bolt (N·cm)	Adjustable stroke end plate fixing bolt (N·cm)
SRG-12/16	100 to 120	50 to 70
SRG-20	250 to 270	
SRG-25	520 to 560	250 to 270

(3) Stroke adjustment by stopper bolt

For 12 to 20 mm bore, the small clearance between table and adjustable stroke plate may lead to pinching finger. Basically, adjust the stroke by moving adjustable stroke unit.

Loosen the stopper bolt fixing nut, turn the stopper bolt, then adjust the stroke.

Fix the stopper bolt fixing nut with the torque on Table 10 after adjusting stroke.

Table 10 Tightening torque of stopper bolt lock nut and shock absorber lock nut

Tightening torque / Model	Stopper bolt lock nut (N·cm)	Shock absorber fixing nut (N·cm)
SRG-12/16	110 to 120	130 to 180
SRG-20	250 to 270	290 to 390
SRG-25	880 to 950	450 to 600

(4) Shock absorber adjustment

• When standard shock absorber is provided

Absorbed energy of shock absorber is adjusted by changing operational stroke length of shock absorber.

For operation stroke length adjustment of shock absorber, loosen the shock absorber fixing nut, then turn the shock absorber. After adjustment, fix the shock absorber fixing nut with the torque on Table 10.

(5) Cautions on use

• The rated stroke length of shock absorber absorbs the rated energy. A shock absorber is installed at the position where the shock absorber has some safety margin to its stroke limit when the cylinder reached the stroke limit.

Therefore, absorbed energy is smaller than allowable energy absorption of discrete shock absorber (refer to Table 11.) When the rated absorbed energy is necessary, adjust the shock absorber so as its stroke reaches the stroke limit.

Fig.5

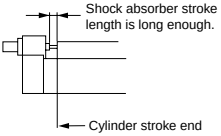
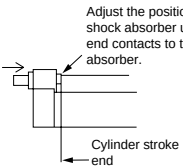


Fig.6



(Note) this is the explanation of shock absorber attached to a type with adjustable full-stroke.

• Absorbed energy varies depending on colliding speed. When colliding speed is 2000mm/s, the value should not be greater than 1/3 of maximum energy absorption on Table 11, while when colliding speed is 1000mm/s, the value should not be greater than 1/2.

Table 11 Adjustable full-stroke shock absorber specifications (initial set value)

Type	Absorbed energy (J)	Effective stroke length (mm)
SRG-12/16	2.4	5.5
SRG-20	5.7	7
SRG-25	10	8

When designing a braking control circuit, observe following matters.

For slit method rodless cylinder represented by SRL2, in the structural point, some external air leakage should occur. This poses the problem that braking control by 3-position all ports closed valve may not hold the stop position of table. Therefore, please use a both sides pressurizing control circuit including a 3-position valve with PAB connection.

However, when restart after once pressure dropped, supplying compressed air in de-energized state may lead to table movement, and the table may slide from the origin.

2 Basic circuit diagram

• When horizontal load

When piping as Fig.1, the same pressure is applied to both sides of piston at stop. This prevents the table sliding suddenly at re-start.

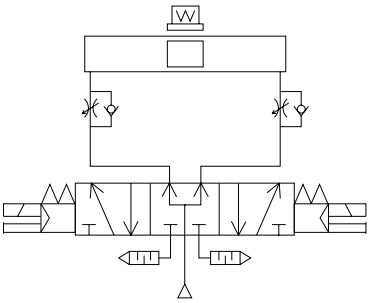


Fig.1

• When vertical load

As Fig.2, when vertical load is applied, the table is moved to load direction. Please install a regulator with check valve on the upper side, and reduce thrust to load direction to balance load.

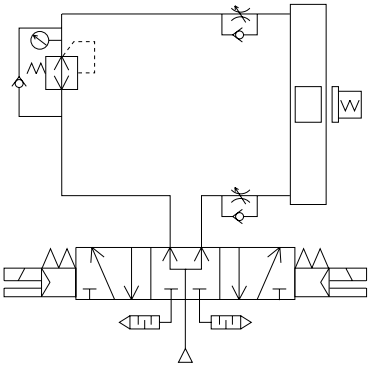


Fig.2

Safety precautions

Read this before starting use.
Refer to Intro 45 about cylinder in general, while refer to Intro 52 about cylinder switch.

High precision guided rodless cylinder SRG series

WARNING Installation & Adjustment

1 Avoid an electric welding after a rodless cylinder was installed.

Current flowing to the cylinder sparks between dust-proof belt and cylinder tube, then dust-proof belt is damaged.

2 Operating units etc. which have too much large inertia may cause damage of cylinder and malfunctions. Please use this product within the range of specifications.

3 Do not apply strong impact and large moment to the table.

4 When connecting this to a load with an external guide, secure the alignment accurate enough.

- Longer stroke length results in larger displacement of center of axis. Please consider the connection method (floating joint) to absorb misalignment.

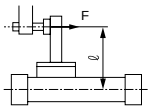
5 When making a load move or stop, the moment including inertia force should not be greater than the allowable load. If this value is exceeded, the product is damaged.

(When overhang is too much.)

- When overhang is large and stopped at both ends with the piston, even in the range not greater than absorbed energy of internal cushion, bending moment acts by load inertia force.
  When kinetic energy is large, and an external cushion etc. is used, install a cushion at the place where the cushion hits the center of gravity of work piece.

(When using external stopper)

- When an external stopper is used, consider bending moment generated by cylinder thrust to select the product.



M1=F · ℓ

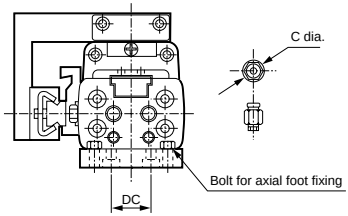
F: Cylinder thrust
ℓ: Distance from cylinder center

6 Common port piping used

- Applicable joints for common port (option symbol R and T) are limited. Please refer to Table 12.

Table 12

Mounting style / Bore size (mm)	Applicable joint outer diameter C dia. 00	LB	LB1
12 dia.	11 or less	Common port piping cannot be used.	11 or less
16 dia.	12 or less		12 or less
20 dia.	16 or less		16 or less
25 dia.	26 or less		26 or less



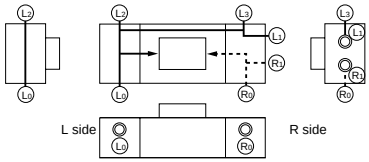
- When mounting style is axial foot type (LB1), and option symbol R or T, the joint interferes with the axial foot fixing bolt. Fix the cylinder main body with (axial foot fixing bolt) before pipe joint installation.
  (If a joint is installed at first, the interfered joint prevents fixing with an axial foot fixing bolt.)

⚠ WARNING Installation & Adjustment

7 Piping port position and operational direction

Bore size 12 to 20 mm bore

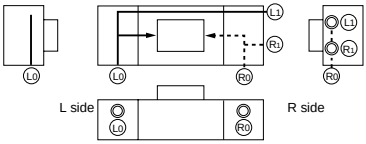
• When option symbol (blank, R, B, T)



(R) shows R side pressure port, and (L) shows L side pressure port. Ports other than (R_0) and (L_0) are plugged at shipment. Removing a plug enables piping to another port. Option symbol (D, S) is not available.

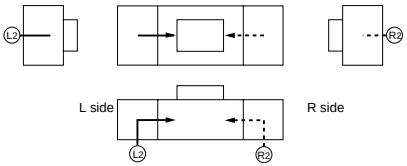
Bore size 25 mm

• When option symbol (blank, R, B, T)



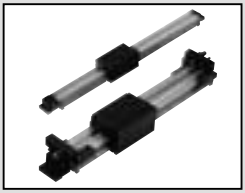
(R) shows R side pressure port, while (L) shows L side pressure port. Ports other than (R_0) and (L_0) are plugged at shipment. Removing a plug enables piping to another port. However, bottom side porting is impossible. When bottom side porting is necessary, select option (D, S).

• When option (D, S), (bottom side piping)



(R) shows R side pressure port, while (L) shows L side pressure port. No port other than (R_2) and (L_2) can be piped.

8 Do not make a nick and a scratch etc. that deteriorates flatness on main body (tube) fixing surface and end plate surface.

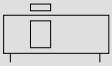


Discontinue

Rodless cylinder, high precision guided

SRG Series

• Bore size: 12, 16, 20, 25 mm



CAD DATA AVAILABLE.

Specifications

Descriptions	SRG (standard type/with switch)			
Bore size	12 dia.	16 dia.	20 dia.	25 dia.
Actuation	Double acting			
Working fluid	Compressed air			
Max. working pressure MPa	0.7			
Min. working pressure MPa	0.2			0.1
Withstanding pressure MPa	1.05			
Ambient temperature °C	5 to 60			
Port size	M5		Rc1/8	
Stroke length tolerance mm	$^{+2.0}_{0}$			
Working piston speed mm/s	50 to 1000 (Note 1)			
Repeat stop speed mm/s	±0.05 (with shock absorber) (Note 2)			
Cushion	Air cushion			
Lubrication	Not required	Turbine oil Class 1 IS0 VG32 should be used. Continue to lubricate once lubricated.		

Note 1: Working piston speed for common port piping varies depending on stroke length. Consult with CKD.
Note 2: When no shock absorber, table clearance up to 0.1mm is created.

Allowable energy absorption

Bore size (mm)	Cushioned		No cushion	With shock absorber (Initial set value)	
	Allowable energy absorption (J)	Cushion stroke length (mm)	Allowable energy absorption (J)	Absorbed energy (J)	Effective stroke length (mm)
12 dia.	0.03	14.5	0.003	2.4	5.5
16 dia.	0.22	19.2	0.007	2.4	5.5
20 dia.	0.59	22.2	0.010	5.7	7
25 dia.	1.40	20.9	0.015	10	9

Stroke length

Bore size (mm)	Standard stroke length (mm)	Max. stroke length (mm)	Min. stroke length (mm)
12 dia.	200, 300, 400	450	The value varies depending on switch model No. and installation quantity. Please refer to the below table about details.
16 dia.	200, 300, 400, 500	800	
20 dia.	600, 700, 800		
25 dia.	200, 300, 400 500, 600, 700 800, 900, 1000	1000	

• Custom stroke length is available per 1 mm increment.

M type switch installation quantity and minimum stroke length (mm)

Switch quantity	1		2		3		4		5		6		7		8		9	
Switch model No. / Bore size (mm)	M*V	M*H	M*V	M*H	M*V	M*H	M*V	M*H	M*V	M*H	M*V	M*H	M*V	M*H	M*V	M*H	M*V	M*H
12 dia.	10	10	30	45	60	90	90	135	120	180	150	225	180	270	210	315	240	360
16 dia.	10	10	30	45	60	90	90	135	120	180	150	225	180	270	210	315	240	360
20 dia.	10	10	30	45	60	90	90	135	120	180	150	225	180	270	210	315	240	360
25 dia.	10	10	30	45	60	90	90	135	120	180	150	225	180	270	210	315	240	360

T type switch installation quantity and minimum stroke length (mm)

Switch quantity	1		2		3		4		5		6		7		8		9	
Switch model No. / Bore size (mm)	T*Y*V	T*Y*H	T*Y*V	T*Y*H	T*Y*V	T*Y*H	T*Y*V	T*Y*H	T*Y*V	T*Y*H	T*Y*V	T*Y*H	T*Y*V	T*Y*H	T*Y*V	T*Y*H	T*Y*V	T*Y*H
12 dia.	5	5	45	50	90	100	135	150	180	200	225	250	270	300	315	350	360	400
16 dia.	5	5	45	50	90	100	135	150	180	200	225	250	270	300	315	350	360	400
20 dia.	5	5	45	50	90	100	135	150	180	200	225	250	270	300	315	350	360	400
25 dia.	10	10	45	50	90	100	135	150	180	200	225	250	270	300	315	350	360	400

Switch specifications

• One color/bi-color indicator

Descriptions	Proximity 2 wire		Proximity 3 wire	
	M2V, M2H	M2WV (2 color)	M3V, M3H	M3WV (2 color indicator)
Applications	Programmable controller		Programmable controller, relay, IC circuit, small solenoid valve	
Power voltage	-		DC4.5 to 28V	DC10 to 28V
Load voltage	DC10 to 30V		DC30V or less	DC30V or less
Load current	5 to 20mA		200mA or less	150mA or less
Light	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)

Descriptions	Reed 2 wire			
	M0V, M0H		M5V, M5H	
Applications	Programmable controller, relay		Programmable controller, relay, IC circuit (without indicator light), serial connection	
Power voltage	-		-	
Load voltage	DC12/24V	AC110V	DC24V or less	AC110V or less
Load current	5 to 50mA	7 to 20mA	50mA or less	20mA or less
Light	LED (ON lighting)		Without indicator light	

Note 1: When load current range is within 7 to 20mA, M0 * switch can be used with AC24V, and AC48V.
Note 2: Please refer to Ending 1 about other switch specifications.

• With preventive maintenance output

Descriptions		Proximity 3 wire	Proximity 4 wire	Proximity 3 wire	Proximity 4 wire
		T2YFH/V	T3YFH/V	T2YFH/V	T3YFH/V
Applications		Programmable controller	Programmable controller, relay	Programmable controller	Programmable controller, relay
Light	Installation position adjustment	Red/green LED (ON lighting)			
	Preventive maintenance output	-		Yellow LED (ON lighting)	
Output	Current voltage	-	DC10 to 28V	-	DC10 to 28V
	Load voltage	DC10 to 30V	DC30V or less	DC10 to 30V	DC30V or less
	Load current	DC5 to 20mA	DC50mA or less	DC5 to 20mA	DC50mA or less
Preventive maintenance output	Load voltage	DC30V or less			
	Load current	DC20mA or less	DC50mA or less	DC5 to 20mA	DC50mA or less

• Strong magnetic field

Descriptions	Proximity 2 wire
	T2YD
Applications	Programmable controller
Light	Red/green LED (ON lighting)
Load voltage	DC24V±10%
Load current	5 to 20mA
Internal voltage drop	6V or less
Leakage current	1.0mA or less

Cylinder mass

Unit: kg

Bore size (mm)	Mass when 0 mm stroke				Additional mass per stroke length = 100mm
	Basic type (00)	Foot type (LB)	Foot type (LB1)	Mass per switch (Including bracket)	
12 dia.	0.46	0.25	0.26	0.02	0.23
16 dia.	0.61	0.33	0.35		0.28
20 dia.	0.96	0.54	0.58		0.33
25 dia.	1.73	1.1	1.1		0.54

Discontinue

How to order

Without switch

SRG - 00 - 25 B - 200 ——— A

With switch

SRG - 00 - 25 B - 200 - M0H - R - A

Ⓐ Mounting style
Ⓑ Bore size
Ⓒ Cushion
Ⓓ Stroke length
Ⓔ Switch model No. Note 1 Note 2
Ⓕ Switch quantity
Ⓖ Option Note 3 Note 4 Note 5 Note 6

Symbol	Descriptions
Ⓐ Mounting style	
00	Basic type
LB	Axial foot type
LB1	Axial foot type
Ⓑ Bore size (mm)	
12	12 dia.
16	16 dia.
20	20 dia.
25	25 dia.
Ⓒ Cushion	
B	Both sides cushion
R	R side cushion
L	L side cushion
N	No cushion
Ⓓ Stroke length (mm)	
200, 300, 400, 500, 600, 700, 800, 900, 1000	

Ⓔ Switch model No.

Axial lead wire	Radial lead wire	Contact	Display	Lead wire
M0H *	M0V *	Reed	1 color indicator	2 wire
M5H *	M5V *			
M2H *	M2V *	Proximity	1 color indicator	2 wire
-	M2WV *		2 color indicator	
M3H*	M3V*		1 color indicator	3 wire
-	M3WV*		2 color indicator	
T2YFH*	T2YFV*		With preventive maintenance output	3 wire
T3YFH*	T3YFV*			4 wire
T2YMH*	T2YMV*			3 wire
T3YMH *	T3YMV *			4 wire
T2YD *	-		Strong magnetic field proof switch	2 wire
T2YDT *	-			

*Lead wire length	
Blank	1m (standard)
3	3m (option)
5	5m (option)

Ⓕ Switch quantity	
R	One on R side
L	One on L side
D	Two
T	Three
4	4 (when more than 4 switches, indicate switch quantity.)

Ⓖ Option

Bore size (mm)				12	16	20	25
A	Adjustable full-stroke both ends, with shock absorbers			●	●	●	●
A1	Adjustable full-stroke at R end, with shock absorber			●	●	●	●
A2	Adjustable full-stroke at L end, with shock absorber			●	●	●	●
A3	Adjustable full-stroke bracket later installation			●	●	●	●
H	Increasing table mounting screw size			●	●	●	
Blank	Port position	F	Cushion needle position	F (standard)	●	●	●	●
R		R		F (common port)	●	●	●	●
B		F		B	●	●	●	
T		R		B (common port)	●	●	●	
D		D		F				●
S		D		D				●

⚠ Cautions for model No. selection

Note 1: Not available in the environment where welding spatter is applied to cylinders.
When using T2YD and T2YDT, pay attentions.
Note 2: Available other than listed Ⓔ switch model No. (custom order)
Please refer to Ending 1 about details.
Note 3: Please refer to dimensions about ports and cushion needle position indicating symbols.
Note 4: For option symbol "R" and "T", mounting style "00" or "LB1" is used.
(For option symbol "R" and "T", mounting style "LB" is not available because cannot be piped.)
Note 5: Option symbol "A3" is an option that has a mounting plate nut to install adjustable full-stroke bracket later.
Note 6: In nominal designation of screw thread of option symbol "H", for 12 and 16 mm bore, M4, while for 20 mm bore, M5.

<Example of model number>

SRG-00-25B-200-M0H-R-A

Model: Rodless cylinder, high precision guided
Ⓐ Mounting style : Basic type
Ⓑ Bore size : 25 mm
Ⓒ Cushion : Both sides cushion
Ⓓ Stroke length : 200 mm
Ⓔ Switch model No. : Reed switch M0H
Ⓕ Switch quantity : One on R side
Ⓖ Option : Adjustable full-stroke both sides, with shock absorber

How to order switch

(Common to SRL2).

• Switch main body + mounting bracket

SRL2 - M0H * (E)

Switch model No.
(Previous page (E))

• Switch only

SW - M0H * (E)

Switch model No.
(Previous page (E))

• Mounting bracket (Note 2)

M type switch

SRL2 - M

T type switch

SRL2 - T

• Lead wire holder (Note 3)

SRL2 - MH

(Note 1): Switch main body + mounting bracket doesn't include any lead wire holder.
When lead wire holder is necessary, place an order separately.
(Note 2): For M and T types switches, these brackets are different.
(Note 3): For lead wire holder, 10 pieces/set.

How to order discrete shock absorber

SRL2 - (B) Bore size - NCK

(One shock absorber, one shock absorber fixing hex. nut)

Applicable shock absorber model No.

How to order	Applicable model
NCK-00-0.3-C	SRG-12/16
NCK-00-0.7-C	SRG-20
NCK-00-1.2	SRG-25

How to order repair parts

SRL2 - Bore size K - Stroke length

How to order mounting bracket

SRL2 - Mounting style (LB,LB1) - Bore size

(Two brackets, 4 mounting bolts)

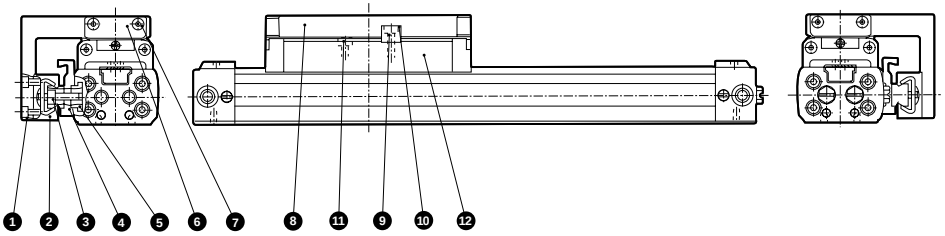
How to order adjustable full-stroke bracket kit

(Applied to option symbol A3).

SRG - Bore size - A (Adjustable full-stroke bracket kit provided on both sides)
- A1 (Adjustable full-stroke bracket kit provided on R side)
- A2 (Adjustable full-stroke bracket kit provided on L side)

Discontinue

Internal structure and parts list



No.	Parts name	Material	Remarks	No.	Parts name	Material	Remarks
1	Hexagon socket head cap screw	Alloy steel	Blackening	7	Hexagon socket head cap screw	Alloy steel	Blackening
2	High precision guide	Stainless steel		8	Connection plate	Aluminum alloy	Black alumite
3	Hexagon socket head cap screw	Alloy steel	Blackening	9	Key	Steel	Blackening
4	Guide holder	Aluminum alloy	Alumite	10	Hexagon socket head cap screw	Alloy steel	Blackening
5	Plate nut (B)	Steel	Blackening	11	Hexagon socket head cap screw	Alloy steel	Blackening
6	Stopper plate	Steel	Blackening	12	Table	Aluminum alloy	Black alumite

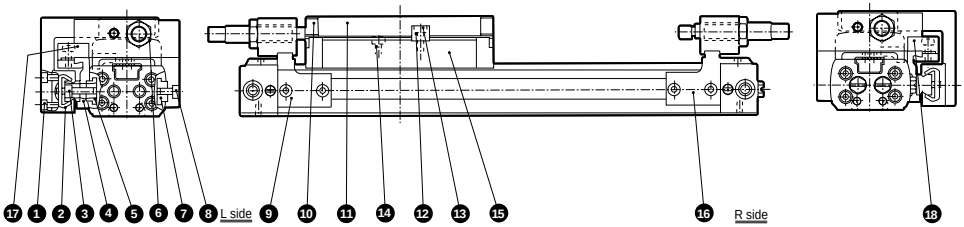
Repair kits

Bore size (mm)	Kit number	Repair parts number
12 dia.	SRL2-12K- *	Repair parts of Rodless cylinder are as same as SRL2 series. Refer to Page 1493.
16 dia.	SRL2-16K- *	
20 dia.	SRL2-20K- *	
25 dia.	SRL2-25K- *	

Note 1: When placing an order, indicate kit number. Indicate stroke length at *.

Internal structure and parts list

• Adjustable full-stroke shock absorber

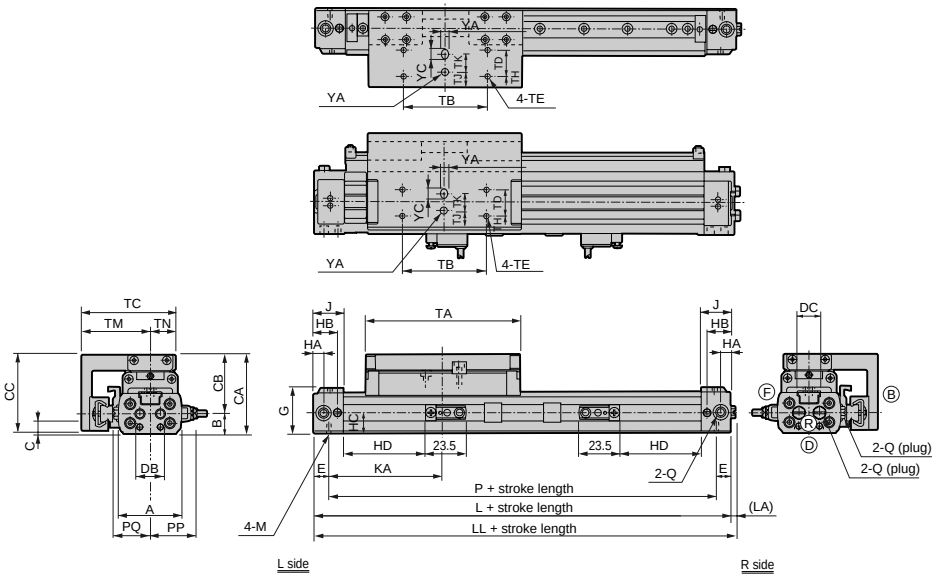


No.	Parts name	Material	Remarks	No.	Parts name	Material	Remarks
1	Hexagon socket head cap screw	Alloy steel	Blackening	10	Stopper plate	Steel	Blackening
2	High precision guide	Stainless steel		11	Connection plate	Aluminum alloy	Black alumite
3	Hexagon socket head cap screw	Alloy steel	Blackening	12	Key	Steel	Blackening
4	Guide holder	Aluminum alloy	Alumite	13	Hexagon socket head cap screw	Alloy steel	Blackening
5	Plate nut (B)	Steel	Blackening	14	Hexagon socket head cap screw	Alloy steel	Blackening
6	Plate nut	Steel		15	Table	Aluminum alloy	Black alumite
7	Hexagon socket head cap screw	Alloy steel	Blackening	16	Adaptor (L)	Steel	Galvanizing
8	Hexagon socket head cap screw	Alloy steel	Blackening	17	Adaptor (LG)	Steel	Galvanizing
9	Adaptor (R)	Steel	Galvanizing	18	Adaptor (RG)	Steel	Galvanizing

Discontinue

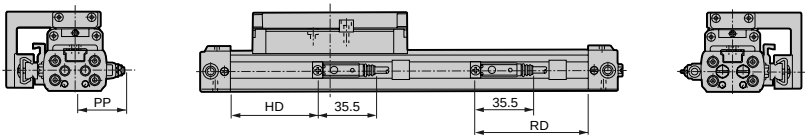
Dimensions

• SRG- ** - ** - *** - M * V * with cylinder switch (File name: Page 1591 or Ending 151)
(Radial lead wire)



HC: Needle position

• SRG- ** - ** - *** - M * H * with cylinder switch
(Axial lead wire)

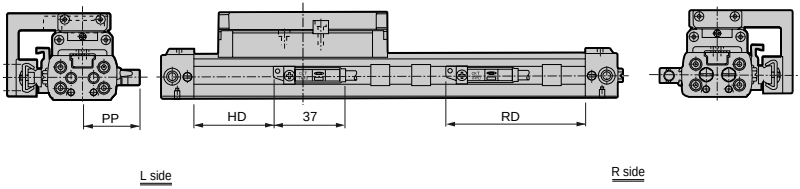


Symbol / Bore size (mm)	A	B	CA	CB	CC	DB	DC	E	G	HA	HB	HC	J	KA	L	LL	LA	M	P	PQ	Q	TA	TB	TC
12 dia.	33	10.5	43	32.5	40.5	10	11	8.5	24	6	14	10.5	17.5	59.5	136	139	3	M3 depth 5	119	19	M5	81	42	49
16 dia.	37	12	47	35	45	14	12	8.5	27	6	14	12	17.5	66	149	152	3	M3 depth 5	132	21	M5	88	48	54.5
20 dia.	44	14	54	40	50	16	16	10.5	31	8.5	18.5	14	22	74	169	171.5	2.5	M4 depth 6.5	148	24.5	RC1/8	100	60	61.5
25 dia.	53	17	67	50	63.5	20	26	14	40.5	7.5	20	18.9	24	81	190	192	2	M6 depth 9	162	–	RC1/8	122	70	80

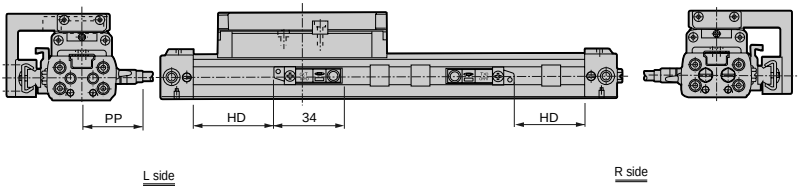
Note: Also refer to the right table.

Dimensions

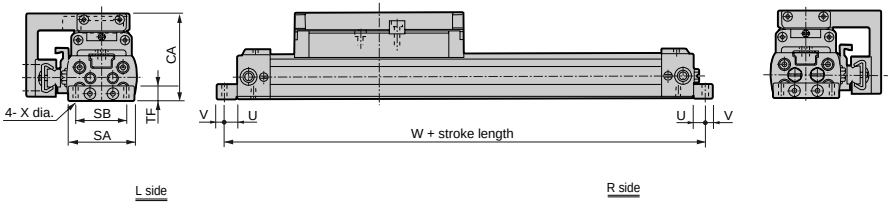
• SRG- ** - ** - *** - T * Y * H with cylinder switch (T * YF, T * YM, T *YD)



• SRG- ** - ** - *** - T * Y * V with cylinder switch (T * YF, T *YM)



• SRG-LB- ** - *** with foot bracket



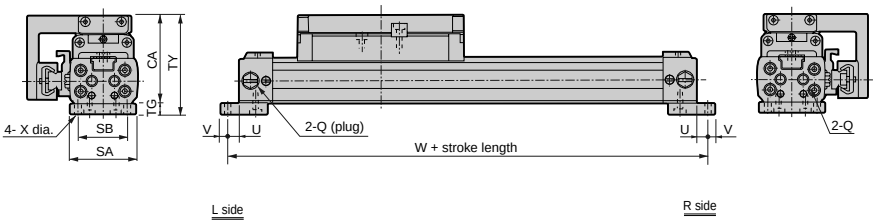
Symbol / Bore size (mm)	TD	TE	TH	TJ	TK	TM	TN	YA	YC	With switch								With foot bracket (LB)						
										HD		RD		PP										
										M type	T type	M type	T type	M * V	M * H	T * V	T * H	SA	SB	TF	U	V	W	X
12 dia.	13	M3 depth 5	6.5	8	10	36	13	4 depth 4	5	40.5	36	60.5	65	24.5	26	31	28	32	24	8	6	4	148	3.4
16 dia.	15	M3 depth 6	7	9.5	10	40	14.5	4 depth 4	5	47	42	67	72	26.5	28	33	30	35	26	8	6	4	161	3.4
20 dia.	18	M4 depth 6	8.5	10	15	44	17.5	6 depth 6	7	52.4	48	72.5	77	29.5	31	36	33	43	33	10	6	6	181	4.5
25 dia.	20	M5 depth 8	12	14.5	15	58	22	6 depth 6	7	60	56	82	88	34.5	36	41	38	52	20	12	9	11	208	7

Note: Also refer to the left table.

Discontinue

Dimensions

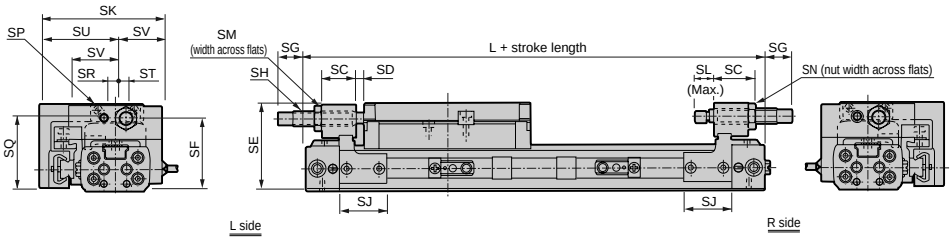
• SRG-LB1- ** - *** with foot bracket CAD (File name: Page 1591 or Ending 151)



Symbol / Bore size (mm)	With foot bracket (LB1)									
	Q	SA	SB	TG	TY	CA	U	V	W	X
12 dia.	M5	32	24	6	49	43	6	4	148	3.4
16 dia.	M5	35	26	6	53	47	6	4	161	3.4
20 dia.	RC1/8	43	33	8	62	54	6	6	181	4.5
25 dia.	RC1/8	50	20	10	77	67	9	11	208	7

Dimensions: With options

• With adjustable full-stroke shock absorber (SRG) CAD (File name: Page 1591 or Ending 151)

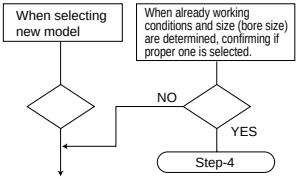


Symbol / Bore size (mm)	SC	SD	SE	SF	SG			SH		SJ	SK	SL	SM	SN	SP	SQ	SR	ST	SU	SV
					Max.	Min.	Adjust range	Thread O.D.	Max. energy absorb (J)											
12 dia.	19.5	2.5	42	35	17.5	7.5	10	M8 X 0.75	3	25	58.5	8.5	12	7	M4	35.5	6	3	36	22.5
16 dia.	18	4	46	39	14.5	4.5	10	M8 X 0.75	3	25	64.5	10	12	7	M4	40	6	4	40	24.5
20 dia.	22.5	3.5	53	45	14.5	4.5	10	M10 X 1.0	7	39	72.5	11.5	14	8	M5	48	8	5	44	28.5
25 dia.	20	2.5	65.5	54.5	14.5	4.5	10	M12 X 1.0	12	50	96.5	11.5	17	10	M6	56	12	10	58	38.5

SRG series, selection guide

Selecting conditions are different from general cylinders. Please check if the proper product is selected according to selection guide.

1 Step-1



2 Step-2 Confirming working conditions

1. Working pressure (P) (MPa)
2. Load mass (M) (kg)
3. Load (F_L) (N)
4. Installation attitude
5. Stroke length (L) (mm)
6. Moving time (t) (s)
7. Operation speed (V) (m/s)

Formula of cylinder average operation speed V

$$V = \frac{L}{t} X \frac{1}{1000} (m/s)$$

<Load mass>

The value shows (Load mass + jig mass).

<Installation attitude>

Operational direction	horizontal, vertical-up, vertical-down
Installation attitude	table upward, table downward

3 Step-3 Roughly selecting cylinder size

• When finding the value according to theoretical thrust value on Table 1.

Rough required thrust ≧ load X 2

("X 2" in "load X 2" is a safety factor, when load factor is 50%.)

(E.g.) Working pressure 0.5MPa

Load 5N

• Required thrust is 5N X 2 = 10N

12 mm bore are selected to meet theoretical thrust more than 10N at working pressure 0.5MPa according to Table 1.

D = 12 dia.

<Cylinder theoretical thrust>

Table 1 Cylinder theoretical thrust value

Unit: N

Bore size (mm)	Pressurized area (mm^2)	Working pressure MPa							
		0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7
12 dia.	138	-	-	28	41	55	69	83	97
16 dia.	216	-	-	43	65	86	108	130	151
20 dia.	315	-	-	63	94	126	157	189	220
25 dia.	542	-	54	108	163	217	271	325	380

Note: Values on Table 1 do not include thrust coefficient.

4 Step-4 Calculation of load (W), each moment values

• Calculate static load (W), and moment (M1M2, M3) according to cylinder installation conditions of load.

W = W (N) (W = M X 9.8)

$M1 = F_1 X \ell_1$ (N·m)

$M2 = F_2 X \ell_2$ (N·m)

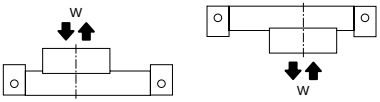
$M3 = F_3 X \ell_3$ (N·m)

Substitute the loads applied on Fig.1 to the values of F_1, F_2, F_3.

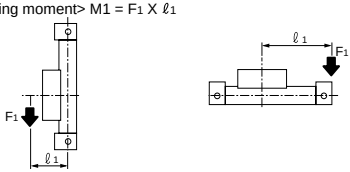
Fig.1 Formula of each moment

<Vertical load>

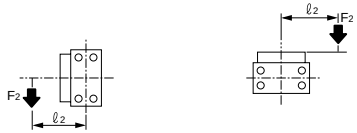
Downward Upward



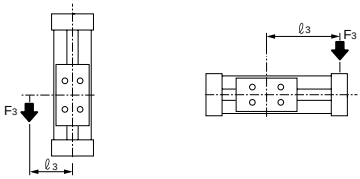
<Bending moment> $M1 = F_1 X \ell_1$



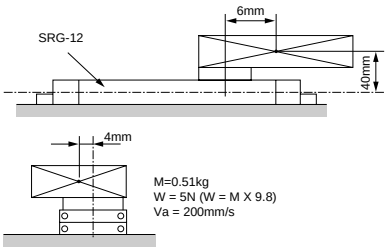
<Radial moment> $M2 = F_2 X \ell_2$



<Twist moment> $M3 = F_3 X \ell_3$



<E.g.>



Working pressure P = 0.5MPa

M1 = 5 X 0.006 = 0.03 (N·m)

M2 = 5 X 0.004 = 0.02 (N·m)

M3 = 0

W = 5N	M_1 = 0.03N·m	M_2 = 0.02N·m	M_3 = 0

5 Step-5 Confirming load and composite moment

• Divide each load by the value on Table 2 to find moment ratio, and confirm if the total is 1.0 or less.

• Formula

$$\frac{W}{Wmax}+\frac{M1}{M1max}+\frac{M2}{M2max}+\frac{M3}{M3max} \leqq 1.0$$

• When the total is larger than 1.0

1. Reexamining load
2. Review cylinder bore size etc. as selecting larger bore size.

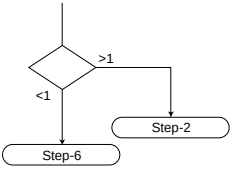


Table 2 Allowable load/moment

Descriptions / Bore size (mm)	Vertical load W: N	Bending moment M1: N·m	Radial moment M2: N·m	Twist moment M3: N·m
12 dia.	20	1	0.5	3
16 dia.	40	2.5	1	5.5
20 dia.	40	2.5	1	5.5
25 dia.	90	6.5	2.5	17

<E.g.>

W = 5(N), M = 0.03(N·m), M2 = 0.02(N·m), M3 = 0(N·m)

Applicable cylinder size: For 12 mm bore

$$\frac{5}{20}+\frac{0.03}{1.0}+\frac{0.02}{0.5}+\frac{0}{3}=0.32 \leqq 1.0$$

Since the total of load, moment ratio is 1.0 or less, this is OK.

6 Step-6 Calculating required thrust

• Calculate the cylinder required thrust (F_N) according to each moment.

1. At horizontal operation

$F_N = F_W + F_{M1} + F_{M2} + F_{M3} + F_L$ (N)

F_W =WX0.2 (N)

F_{M1} =M1XC1 (N)

F_{M2} =M2XC2 (N)

F_{M3} =M3XC3 (N)

F_L: Load (N)

C1: Frictional force coefficient of moment M1 (Table 3)

C2: Frictional force coefficient of moment M2 (Table 3)

C3: Frictional force coefficient of moment M3 (Table 3)

2. At vertical operation

$F_N = W + F_{M1} + F_{M3} + F_L$ (N)

F_N = ☐ (N)

<Frictional force coefficient per moment>

• Since frictional force varies depending on the moment applied to cylinder, calculate frictional force per moment according to Table 3.

Table 3 Friction force coefficient per moment

1/m

Bore size (mm)	C1	C2	C3
12 dia.	8	27	8
16 dia.	7	24	7
20 dia.	6	21	6
25 dia.	5	16	5

<E.g.>

W = 5(N), M1 = 0.03(N·m), M2 = 0.02(N·m), M3 = 0(N·m)

Applicable cylinder size: For 12 mm bore

F_W = 5 X 0.2 = 1 (N)

F_{M1} = 0.03 X 8 = 0.24 (N)

F_{M2} = 0.02 X 27 = 0.54 (N)

F_{M3} =0

F_L =0

F_N = 1 + 0.24 + 0.54 + 0 + 0 = 1.78(N)

7 Step-7 Confirming load factor

- Load factor is determined according to stability of cylinder operation speed, safety factor, and service life etc.
- Formula of load factor (α)

$$\alpha = \frac{\text{Required thrust } (F_N)}{\text{Cylinder thrust } (F)} \times 100\ (\%)$$

$$F = A \times P \times \frac{a}{100}\ (N)$$

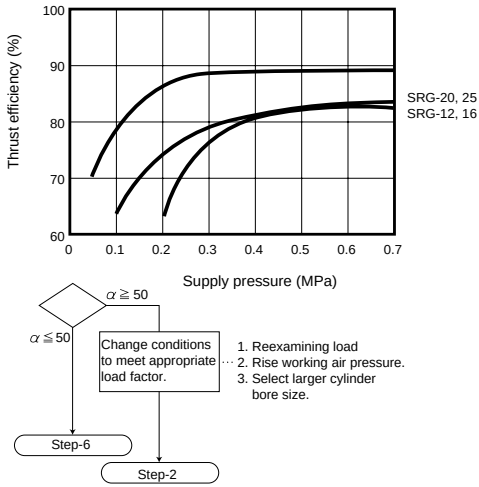
A = pressurized area (mm^2) (refer to Table 1.)

- As value of A X P, cylinder theoretical thrust value on Table 1 can be used.

P : Working pressure (MPa)

a : Thrust efficiency Use the value on Fig.2.

Fig.2 Thrust efficiency of tendency of SRG



<Adequate range of load factor>

- Speed of piston varies depending on load factor. It is advisable hat the speed should be within the range of the following Table 4 for general use.

Table 4 (adequate range of load factor - reference value)

Working pressure MPa	Load ratio
0.2 to 0.3	$\alpha \leqq 0.4$
0.3 to 0.6	$\alpha \leqq 0.5$
0.6 to 0.7	$\alpha \leqq 0.6$

<E.g.> Applicable cylinder size: 12 mm bore

Required thrust 1.78 (N)

When working pressure 0.5 (MPa)

$$\alpha = \frac{1.78}{138 \times 0.5 \times \frac{95}{100}} \times 100$$

= 2.7%

Since $\alpha \leqq$ 50%, this value is OK.

8 Step-8 Confirming cushion faculty

Check if the kinetic energy of actual load can be absorbed according to cushion faculty of cylinder.

- The allowable energy absorption of cylinder (E_1) is the characteristic value of cylinder. For SRG, use the values on Table 5.
- Formula of piston kinetic energy (E2)

$$E_2 = \frac{1}{2} \times M \times V^2\ (J)$$

M : Load mass (kg)

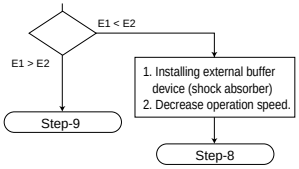
V : Piston speed rush into cushion (m/s)

$$V = \frac{L}{t} \times \left(1 + 1.5 \times \frac{\alpha}{100}\right)$$

L : Stroke length (m)

t : Operation time (s)

α : Load factor (%)



<Cylinder allowable energy absorption>

- For cylinder cushion mechanism, value of kinetic energy absorbing faculty varies depending on cylinder bore size. For SRG, refer to the value on Table 5.

Table 5 Allowable energy absorption of SRG (E_1)

Bore size (mm)	Allowable energy absorption (J)
12 dia.	0.03
16 dia.	0.22
20 dia.	0.59
25 dia.	1.40

9 Step-9 Confirming inertia load

- Check if the inertia force applied to load generated by piston operation should be within the range of cylinder faculty.

(1) Calculate inertia force (F_1) according to speed rush into cushion part (V) and inertia force coefficient of SRG on Fig.3.

$F_1 = 10 \times M \times G$ (N)

M: Load mass (kg)

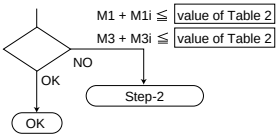
G: Inertia force coefficient

(2) Find bending moment (M1i) and twist moment (M3i) according to inertia force (F_1).

$M1i = F1 \times \ell 1$

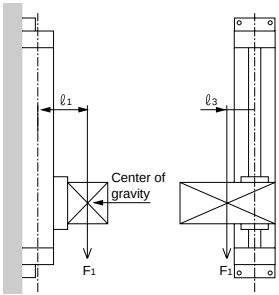
$M3i = F3 \times \ell 3$

(3) Add static load moment (M1 andM3) to inertia load moment (M1i andM3i). Confirm if the composite value is not greater than value on Table 2.



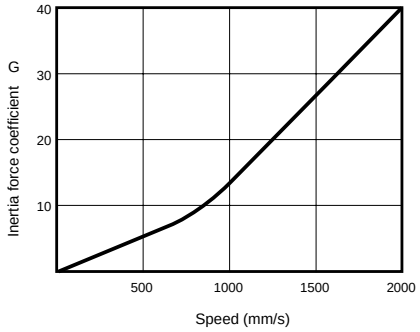
<When M1 and M3 are generated at the same time>

$M1i = F_1 \times \ell_1$
$M3i = F_1 \times \ell_3$



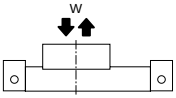
<Tendency of SRG inertia force>

Fig.3 Tendency of inertia force coefficient of SRG

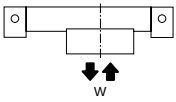


1 Other moment types and formulas

• Vertical load (upward)

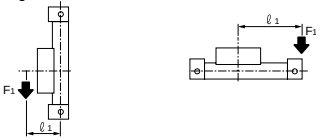


• Vertical load (downward)



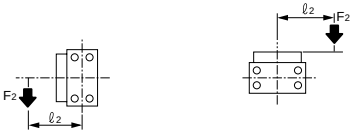
• Bending moment M1

M1 = F1 X ℓ1



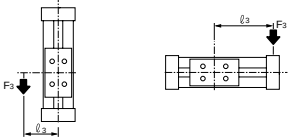
• Radial moment M2

M2 = F2 X ℓ2



• Twist moment M3

M3 = F3 X ℓ3



2 Cushioning characteristics and kinetic energy

• Cushion

Cushion is a function to prevent that a piston and a cover collide with large impact at the stoke end with using air compressibility to absorb the piston kinetic energy, but not decelerate the piston speed at the point close to the stroke end. Table 6 shows the kinetic energy absorbed by cushion. When a kinetic energy exceeds this value, or bound by air compressibility should be avoided, select a type with shock absorber or install an external shock absorber.

• SRG cushioning characteristics value

Table 6 Cushion allowable energy absorption (E_1)

Bore size (mm)	Effective cushion Length (mm)	Allowable energy absorption (J)	
		Cushioned	No cushion
12 dia.	14.5	0.03	0.003
16 dia.	19.2	0.22	0.007
20 dia.	22.2	0.59	0.010
25 dia.	20.9	1.40	0.015

• Formula of kinetic energy (E_2)

$E_2 = \frac{1}{2} X M X V^2$ (J)

M : Load mass (kg)

V : Operation time (m/s)

$V = \frac{L}{t} X (1 + 1.5 X \frac{\alpha}{100})$

L : Cylinder stroke length (m)

t : Operation time of piston (s)

α : Cylinder load factor (%)

$\alpha = \frac{\text{Load mass}}{\text{Cylinder thrust}} X 100$

3 Max. load value

• The maximum allowable moment per moment of SRG is shown on Table 7.

Table 7 Allowable load/moment

Descriptions / Bore size (mm)	Vertical load W: N	Bending moment M1: N·m	Radial moment M2: N·m	Twist moment M3: N·m
12 dia.	20	1	0.5	3
16 dia.	40	2.5	1	5.5
20 dia.	40	2.5	1	5.5
25 dia.	90	6.5	2.5	17

4 Air cylinder air consumption

• Used to determine pneumatics source capacity.

$Q_1 = 2 X \frac{\pi}{4} X D^2 X L X N X (\frac{P + 0.1013}{0.1013}) X \frac{1}{1000}$

Q_1 : Air consumption (ℓ/min (ANR))

D : Cylinder bore size (cm)

L : Stroke length (cm)

N : Reciprocating operation cycle (cycle/min.)

P : Working air pressure (MPa)

Table 8 One reciprocating air consumption per stroke length 100mm (Vo: ℓ) (standard condition)

Bore size (mm)	Prrsrz'd area (mm^2)	Working pressure MPa						
		0.1	0.2	0.3	0.4	0.5	0.6	0.7
12 dia.	138	-	0.08	0.11	0.14	0.16	0.19	0.22
16 dia.	216	-	0.13	0.17	0.21	0.26	0.30	0.34
20 dia.	315	-	0.19	0.25	0.31	0.37	0.44	0.50
25 dia.	542	0.22	0.32	0.43	0.54	0.65	0.75	0.86

• Add air consumption used for piping.

5 Required air capacity of air cylinder

• Use this to decide the size of components.

$Q_2 = \frac{\pi}{4} X D^2 X \frac{60}{t} X L X (\frac{P + 0.1013}{0.1013}) X \frac{1}{1000}$

Q_2 : Air consumption (ℓ/min (ANR))

D : Cylinder bore size (cm)

L : Stroke length (cm)

t : Stroke moving time (S)

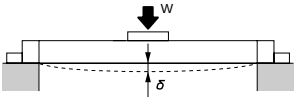
P : Working pressure (MPa)

• Add the required air capacity used for piping.

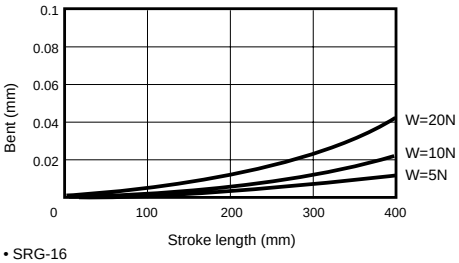
Discontinue

Technical data

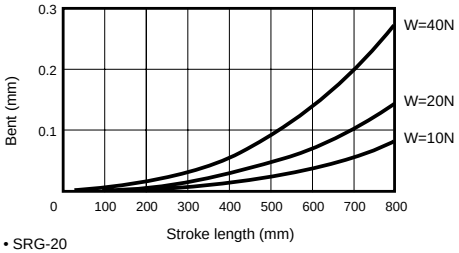
1 Deflection of cylinder tube δ



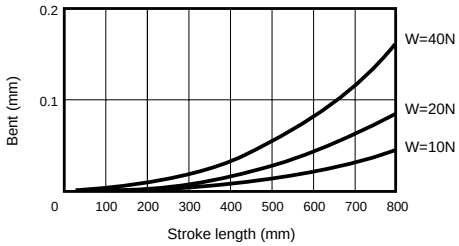
• SRG-12



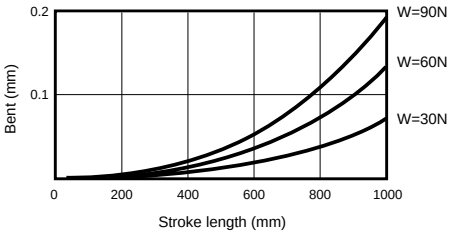
• SRG-16



• SRG-20



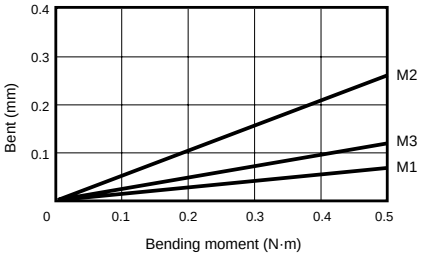
• SRG-25



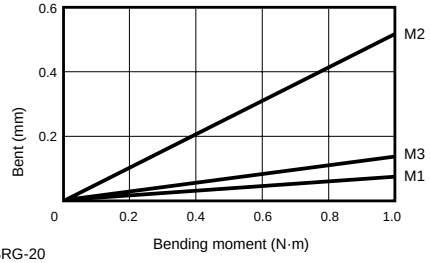
2 Deflection of table

(Deflection at the position of 70mm from cylinder center)

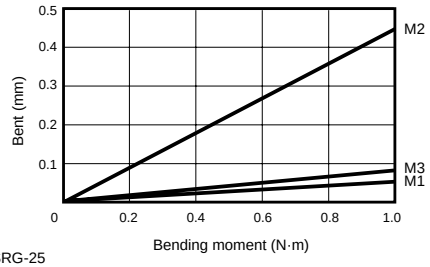
• SRG-12



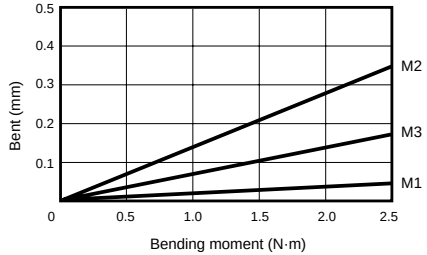
• SRG-16



• SRG-20



• SRG-25



9 How to adjust adjustable full-stroke unit

(1) Calculate mass equivalent to colliding object Me, and colliding energy E according to the formula on the table below, and confirm if Me and E should not be greater than the allowable value of Fig.4. Also, refer to Table 11 to check if specifications of repeat frequency and colliding speed etc. should be allowable values or less.
Allowable value of mass equivalent to colliding object Me and colliding energy E may vary depending on colliding speed.

• Symbol
E : Colliding energy (J)
Me : Mass equivalent to colliding object (kg)
m : Mass of work piece (kg)
F : Cylinder thrust (N)
V : Colliding speed (m/s)
St : Stroke length of shock absorber (m)
g : Gravity acceleration 9.8 (m/s^2)

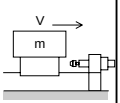
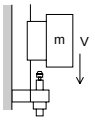
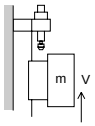
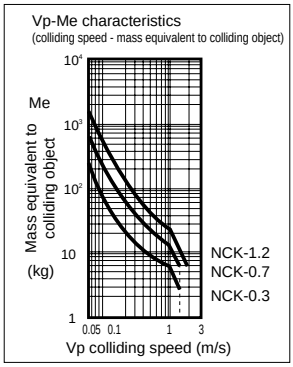
	Horizontal movement	Moving downward	Moving upward
Applications			
Colliding object Equivalent to mass Me(kg)	$Me = m + \frac{2F \cdot St}{V^2}$	$Me = m + \frac{2 \cdot St\,(F + mg)}{V^2}$	$Me = m + \frac{2 \cdot St\,(F - mg)}{V^2}$
Energy E (J)	$E = \frac{mV^2}{2} + F \cdot St$	$E = \frac{mV^2}{2} + (F + mg) \cdot St$	$E = \frac{mV^2}{2} + (F - mg) \cdot St$

Fig.4 Allowable value of mass equivalent to colliding object



(3) Shock absorber

Table 12 specifications

Type			SRG-12/16	SRG-20	SRG-25
Shock absorber model No. / Descriptions			NCK-00-0.3-C	NCK-00-0.7-C	NCK-00-1.2
Type/classification			No adjuster, spring return type		
Max. energy absorption		J	3	7	12
Stroke length		mm	6	8	10
Max. energy absorption per hour		kJ/hour	6,300	12,600	21,600
Max. colliding speed		m/s	1.5		2.0
Max. repeating cycle		cycle/min	35	30	
Ambient temperature		°C	-10 to 80		
Required strength of mounting bracket		N	3,540	6,150	8,400
Recoiling time		S	0.3 or less		
Product mass		kg	0.012	0.02	0.04
Recoiling force	Extended	N	3.0	2.0	2.9
	Compressed	N	4.6	4.3	5.9

(4) Example of calculation (for SRG-20)

• Example of calculation (1) when lifting up, down

Working conditions

• Load M 1 (kg)

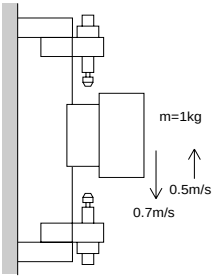
• Colliding speed

When lifting up 0.5 (m/s)

When lifting down 0.7 (m/s)

• Working pressure 0.5 (MPa)

(157N)



(1) Kinetic energy when lifting up (E_1)

$$E_1 = \frac{1 \times 0.5^2}{2} + (157 - 1 \times 9.8) \times 0.008$$

$$= 1.30(J)$$

The value is not greater than half of max. energy absorption on Table 12. Kinetic energy (E_1) can be absorbed.

$$Me = 1 + \frac{2 \times 0.008\ (157\text{-}1 \times 9.8)}{0.5^2}$$

$$= 10.42(kg)$$

Me of shock absorber used for SRG- 20, as Fig.4 shows, is 18 (kg) when V = 0.5 (m/s). The value can be absorbed.

(2) Kinetic energy when lifting down (E_1)

$$E1 = \frac{1 \times 0.7^2}{2} + (157 + 1 \times 9.8) \times 0.008$$

$$= 1.58(J)$$

The value is not greater than half of max. energy absorption on Table 12. Kinetic energy (E_1) can be absorbed.

$$Me = 1 + \frac{2 \times 0.008\ (157 + 1 \times 9.8)}{0.7^2}$$

$$= 6.45\ (kg)$$

Me of shock absorber used for SRG- 20, as Fig.4 shows, is 16kg when V = 0.7m/s. The value can be absorbed.

• Example of calculation (2) horizontal

Working conditions

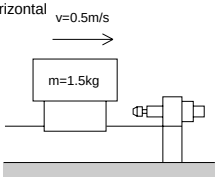
Load mass M 1.5 (kg)

Colliding speed

Horizontal 0.5 (m/s)

Working pressure 0.3 (MPa)

(94N)



Horizontal kinetic energy (E_1)

$$E1 = \frac{1.5 \times 0.5^2}{2} + 94 \times 0.08$$

$$= 0.94(J)$$

The value is not greater than half of max. energy absorption on Table 12. Kinetic energy (E_1) can be absorbed.

$$Me = 1.5 + \frac{2 \times 94 \times 0.008}{0.5^2}$$

$$= 1.53(kg)$$

Fig.4 shows , Me value of shock absorber for SRG-20 as 18kg when V = 0.5 (m/s). Since 1.53 < 18, this can be absorbed.

(Note) Refer to "Confirming inertia load 9 " at Step-9 about inertia load. The value should not be beyond allowable value.