Air Cylinder

Series CS2

Large bore sizes ø125, ø140, ø160
Max. 50% mass reduction (Basic: ø125-100st)

■Rod and head covers are aluminum die-casted.

■Rod size

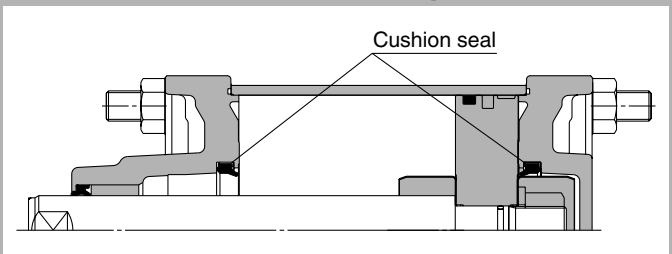
(mm)

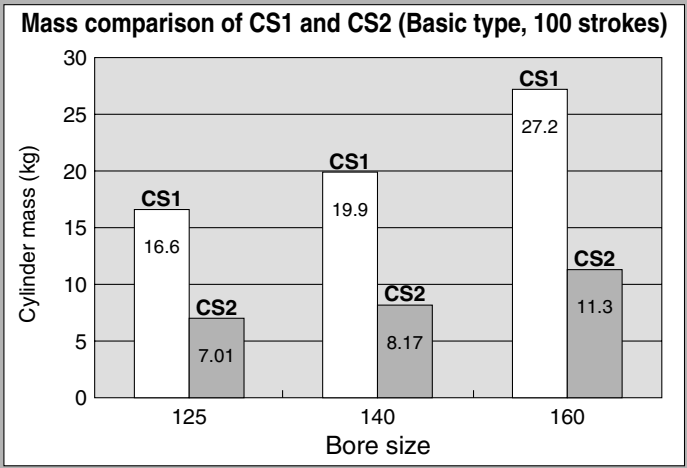
Bore size	Rod size
ø125, ø140	ø32 (ø36)
ø160	ø38 (ø40)

( ): Width for Series CS1

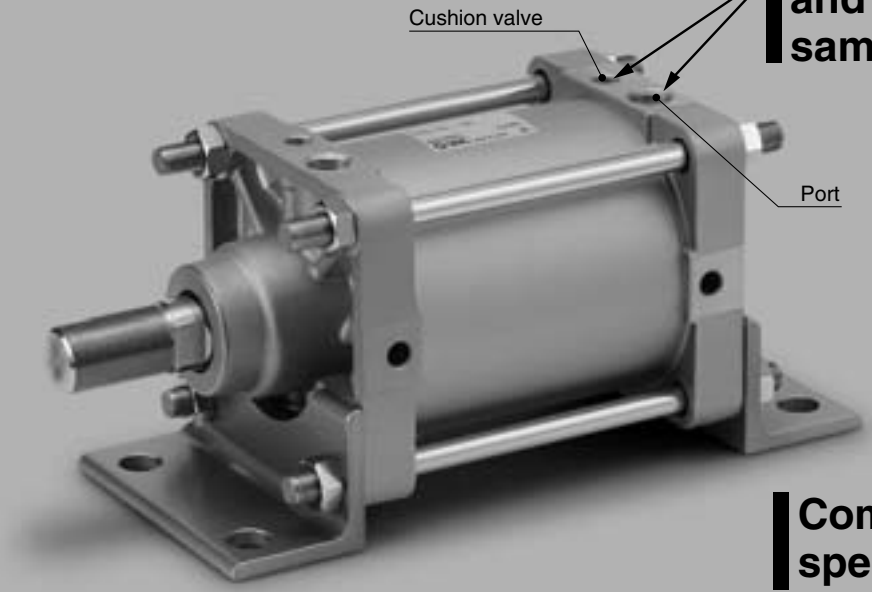
■The cushion ring is pressed.

■Cushion seals can be replaced.





Possible to mount a port and cushion valve on the same side.



Interchangeable with Series CS1

Compatible with non-lube specifications.

Variation

Series	Actuation	Model	Standard variations		Bore size (mm)	Stroke (mm)
CS2	Double acting	Single rod, Non-lube	With rod boot	Air cushion	125, 140, 160	Max. 1600

Air Cylinder
Series CS2
ø125, ø140, ø160

How to Order

CS2 **L** **125** □ – **300** □

With auto switch **CDS2** **L** **125** □ – **300** □ – **M9BW** □

With auto switch (Built-in magnet)

Mounting

B	Basic
L	Foot
F	Rod flange
G	Head flange
C	Single clevis
D	Double clevis
T	Center trunnion

Bore size

125	125 mm
140	140 mm
160	160 mm

Port thread type

Nil	Rc
TN	NPT
TF	G

Cylinder stroke (mm)
(Maximum stroke → Refer to page 449.)

Suffix for cylinder

Rod boot	**Nil**	None
	J	Nylon tarpaulin
	K	Heat resistant tarpaulin

∗ With air cushions on both sides only.

Auto switch

Nil	Without auto switch

∗ Refer to the table below for the applicable auto switch model.

Number of auto switches

Nil	2 pcs.
3	3 pcs.
S	1 pc.
n	"n" pcs.

Built-in Magnet Cylinder Model

If a built-in magnet cylinder without auto switch is required, there is no need to enter the symbol for auto switch.
(Example) CDS2B125-200

Applicable Auto Switches / For detailed auto switch specifications, refer to pages 1263 to 1371.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC	Load voltage DC	Load voltage AC	Auto switch model: Tie-rod mounting	Auto switch model: Band mounting	Lead wire length (m): 0.5 (Nil)	1 (M)	3 (L)	5 (Z)	Pre-wired connector	Applicable load	
Solid state switch	——	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	**M9N**	—	●	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)				**M9P**	—	●	●	●	○	○		
				2-wire	—	12 V		**M9B**	—	●	●	●	○	○	—	
					24 V	—	100 V, 200 V	**J51**	—	●	—	●	○	—		
		Terminal conduit		3-wire (NPN)		5 V, 12 V	—	—	**G39**	—	—	—	—	—	IC circuit	
				2-wire		12 V		—	**K39**	—	—	—	—	—	—	
	Diagnostic indication (2-color indication)	Grommet		3-wire (NPN)		5 V, 12 V	—	**M9NW**	—	●	●	●	○	○	IC circuit	
				3-wire (PNP)				**M9PW**	—	●	●	●	○	○		
				2-wire		12 V		**M9BW**	—	●	●	●	○	○	—	
	Water resistant (2-color indication)			3-wire (NPN)		5 V, 12 V		**M9NA**	—	○	○	●	○	○	IC circuit	
				3-wire (PNP)				**M9PA**	—	○	○	●	○	○		
				2-wire		12 V		**M9BA**	—	○	○	●	○	○	—	
	Diagnostic indication (2-color indication)			4-wire (NPN)		5 V, 12 V		**F59F**	—	●	—	●	○	○	IC circuit	
Reed switch	——	Grommet	Yes	3-wire (NPN equivalent)	—	5 V	—	**A96**	—	●	—	●	—	—	IC circuit	—
				2-wire	24 V	12 V	100 V	**A93**	—	●	—	●	—	—	—	
			No			5 V, 12 V	100 V or less	**A90**	—	●	—	●	—	—	IC circuit	Relay, PLC
			Yes			12 V	100 V, 200 V	**A54**	—	●	—	●	●	—	—	
			No				200 V or less	**A64**	—	●	—	●	—	—		
		Terminal conduit	Yes				—	—	**A33**	—	—	—	—	—	—	PLC
							100 V, 200 V	—	**A34**	—	—	—	—	—		Relay, PLC
		DIN terminal						—	**A44**	—	—	—	—	—		
	Diagnostic indication (2-color indication)	Grommet				—	—	**A59W**	—	●	—	●	—	—		

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

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

∗ Since there are applicable auto switches other than listed, refer to page 460 for details.
∗ For details about auto switches with pre-wired connector, refer to pages 1328 to 1329.
∗ D-A9□, M9□, M9□W, F9□AL are shipped together (but not assembled). (Only auto switch mounting bracket is assembled at the time of shipment.)

Specifications

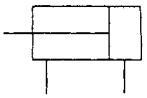
Bore size (mm)	125	140	160
Action	Double acting, Single rod		
Fluid	Air		
Proof pressure	1.57 MPa		
Maximum operating pressure	0.97 MPa		
Minimum operating pressure	0.05 MPa		
Piston speed	50 to 500 mm/s		
Cushion	Air cushion		
Ambient and fluid temperature	0 to 70°C (No freezing) (Built-in magnet / With auto switch: 0 to 60°C)		
Lubrication	Not required (Non-lube)		
Stroke length tolerance (mm)	Stroke	Tolerance	
	250 or less	$^{+1.0}_{0}$	
	251 to 1000	$^{+1.2}_{0}$	
	1001 to 1200	$^{+1.4}_{0}$	
	1201 to 1400	$^{+1.6}_{0}$	
	1401 to 1600	$^{+1.8}_{0}$	
Mounting	Basic, Foot, Rod flange, Head flange, Single clevis, Double clevis, Center trunnion		

Accessory

Mounting		Basic	Foot	Rod flange	Head flange	Single clevis	Double clevis	Center trunnion
Standard equipment	Clevis pin	—	—	—	—	—	●	—
Option	Rod end nut	●	●	●	●	●	●	●
	Single knuckle joint	●	●	●	●	●	●	●
	Double knuckle joint (Knuckle pin, Cotter pin)	●	●	●	●	●	●	●
	Rod boot	●	●	●	●	●	●	●

JIS Symbol

Double acting



Rod Boot Material

Symbol	Material	Max. ambient temperature
J	Nylon tarpaulin	70°C
K	Heat resistant tarpaulin	110°C*

* Maximum ambient temperature for the rod boot itself.

Maximum Stroke

(mm)

Mounting bracket / Bore size	Maximum stroke	
	Basic, Head flange, Single clevis, Double clevis, Center trunnion	Foot, Rod flange
125	1000 or less	1600 or less
140		
160	1200 or less	

Mounting Bracket Part No.

Bore size (mm)	125	140	160
Foot*	CS2-L12	CS2-L14	CS2-L16
Flange	CS2-F12	CS2-F14	CS2-F16
Single clevis	CS2-C12	CS2-C14	CS2-C16
Double clevis**	CS2-D12	CS2-D14	CS2-D16

* Order two foot brackets per cylinder.

** When ordering the double clevis style, the clevis pin and 2 cotter pins are included as accessories.

Mass

(kg)

Bore size (mm)		125	140	160
Basic mass	Basic	5.46	6.50	9.07
	Foot	7.49	9.50	12.45
	Rod flange	8.51	12.03	15.80
	Head flange	8.51	12.03	15.80
	Single clevis	8.53	10.79	14.56
	Double clevis	8.99	11.54	15.41
	Trunnion	9.59	12.23	15.47
Additional mass with magnet (With built-in magnet and auto switch)		0.07	0.07	0.08
Additional mass per each 100 mm of stroke		1.55	1.67	2.23
Accessory bracket	Single knuckle	0.91	1.16	1.56
	Double knuckle (With Knuckle pin, Cotter pin)	1.37	1.81	2.48
	Rod end nut	0.16	0.16	0.23

Calculation: (Example)

CS2L160-500

- Basic mass ····· 12.45 (kg)
- Additional mass ····· 2.23 (kg/100 mm)
- Cylinder stroke ····· 500 (mm)

[Calculation] 12.45 + 2.23 x 500/100 = 23.60 (kg)

⚠ Precautions

Be sure to read before handling. Refer to front matters 54 and 55 for Safety Instructions and pages 3 to 11 for Actuator and Auto Switch Precautions.

⚠ Warning

1. **Do not use the cylinder as a shock absorber.**
   Using the cylinder as a shock absorber may cause damage.
2. **Do not open the cushion valve beyond the stopper. As a retaining mechanism for the cushion valve, retaining ring is installed, and the cushion valve should not be opened beyond that point.**
   If not operated in accordance with the above precautions, the cushion valve may be ejected from the cover when air pressure is supplied.
3. **Use the air cushion at the end of cylinder stroke.**

⚠ Caution

1. **Regarding the installation of a knuckle joint**
   Please contact SMC if a knuckle joint must be installed on the piston rod by using the rod end nut.
2. **Regarding the screw-in of fittings when piping**
   When ports and fittings are screwed in, tighten them with the proper tightening torque below.

Bore size (mm)	Connecting thread nominal size	Proper tightening torque N·m
125, 140	1/2	28 to 30
160	3/4	

3. **Do not deform cushion rings when removing and assembling.**
   Cushion rings are press molded products. If a cushion ring bumps with something when removing and assembling, the air cushion may not function properly due to cushion ring deformation.

Theoretical Output / Double Acting

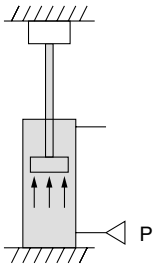
Unit: N

Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm^2)	Operating pressure (MPa)								
				0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
125	32	OUT	12300	2460	3690	4920	6150	7380	8610	9840	11100	12300
		IN	11500	2300	3450	4600	5750	6900	8050	9200	10400	11500
140	32	OUT	15400	3080	4620	6160	7700	9240	10800	12300	13900	15400
		IN	14600	2920	4380	5840	7300	8760	10200	11700	13100	14600
160	38	OUT	20100	4020	6030	8040	10100	12100	14100	16100	18100	20100
		IN	19000	3800	5700	7600	9500	11400	13300	15200	17100	19000

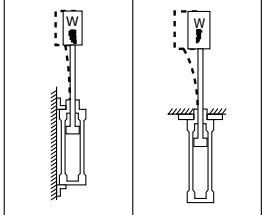
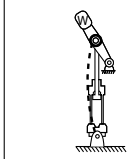
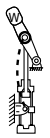
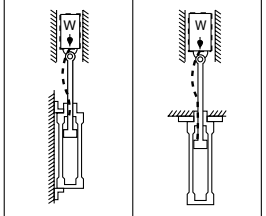
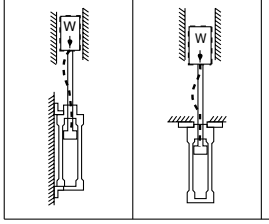
Relation between Cylinder Size and Maximum Stroke

The below table shows the applicable maximum stroke (in cm units), found by calculation assuming the case where the force generated by the cylinder itself acts as buckling force on the piston rod, or piston rod and cylinder tube.
Therefore, it is possible to find the applicable maximum stroke for each cylinder size using the relationship between the size of the operating pressure and the cylinder support type, regardless of the load ratio.

[Reference] If it is stopped with the external stopper on the cylinder extension side, even with a light load, the maximum generated force of the cylinder will act on the cylinder itself.

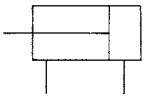


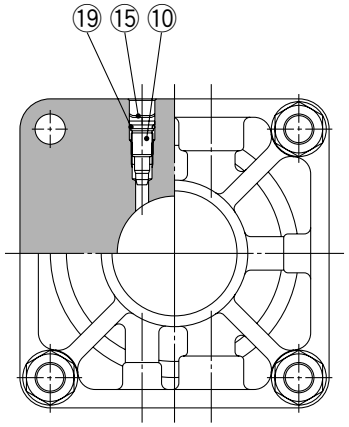
(cm)

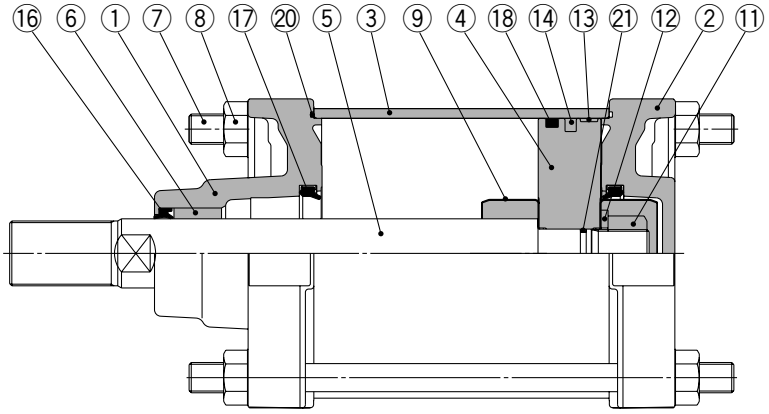
Mounting				Operating pressure (MPa)	Applicable max. stroke according to buckling strength		
Support bracket nominal symbol and schematic diagram			Nominal symbol		**125**	**140**	**160**
Foot: **L**	Rod flange: **F**	Head flange: **G**	**L, F**	0.3	103	92	113
				0.5	79	70	86
				0.7	66	58	72
			G	0.3	45	38	47
				0.5	33	27	34
				0.7	26	22	27
Head side trunnion: **U**		Center trunnion: **U**	**C, D**	0.3	96	83	106
		CA1, CS1 type only 		0.5	71	61	76
				0.7	59	50	62
			T	0.3	135	119	147
				0.5	101	89	111
				0.7	84	74	91
Foot: **L**	Rod flange: **F**	Head flange: **G**	**L, F**	0.3	301	267	330
				0.5	231	207	253
				0.7	193	172	212
			G	0.3	144	126	156
				0.5	109	94	118
				0.7	90	78	97
Foot: **L**	Rod flange: **F**	Head flange: **G**	**L, F**	0.3	433	386	476
				0.5	334	297	367
				0.7	281	250	309
			G	0.3	210	185	229
				0.5	160	141	175
				0.7	134	117	129

Construction

JIS Symbol







Component Parts

No.	Description	Material	Note
1	**Rod cover**	Aluminum die-cast	
2	**Head cover**	Aluminum die-cast	
3	**Cylinder tube**	Aluminum alloy	Hard anodized
4	**Piston**	Aluminum alloy	Chromated
5	**Piston rod**	Carbon steel	Hard chrome plated
6	**Bushing**	Oil-impregnated sintered alloy	
7	**Tie-rod**	Carbon steel	Zinc chromated
8	**Tie-rod nut**	Rolled steel	Nickel plated
9	**Cushion ring**	Stainless steel	
10	**Cushion valve**	Rolled steel	Electroless nickel plated
11	**Piston nut**	Carbon steel	Nickel plated
12	**Flain washer**	Carbon steel	Nickel plated
13	**Wear ring**	Resin	
14	**Magnet***	—	
15	**Retaining ring**	Spring steel	Phosphate coated

* Built-in magnet type with auto switch

No.	Description	Material	Note
16	**Rod seal**	NBR	
17	**Cushion seal**	Urethane	
18	**Piston seal**	NBR	
19	**Valve seal**	NBR	
20	**Tube gasket**	NBR	
21	**Piston gasket**	NBR	

Replacement Parts: Seal Kit

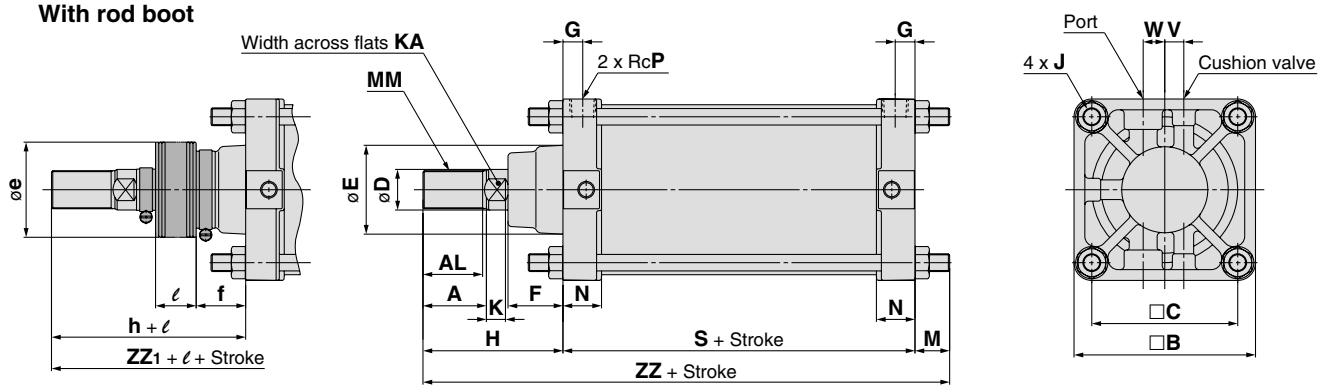
Bore size (mm)	Kit no.	Content
125	CS2-125A-PS	Set of nos. above ⑯, ⑰, ⑱, ⑳.
140	CS2-140A-PS	
160	CS2-160A-PS	

* Seal kit includes a grease pack (40 g).
Order with the following part number when only the grease pack is needed.
Grease park part number: GR-S-010 (10 g), **GR-S-020** (20 g)

Dimensions

Basic: CS2B

With rod boot



(mm)

Bore size (mm)	Stroke range (mm)	A	AL	□B	□C	D	E	F	G	J	V	W	K	KA	M	MM
125	Up to 1000	50	47	143	115	32	71	43	15	M14 x 1.5	15	17	15	27	27	M30 x 1.5
140	Up to 1000	50	47	157	128	32	71	43	15	M14 x 1.5	15	17	15	27	27	M30 x 1.5
160	Up to 1200	56	53	177	144	38	78.5	42	18	M16 x 1.5	15	20	17	34	30.5	M36 x 1.5

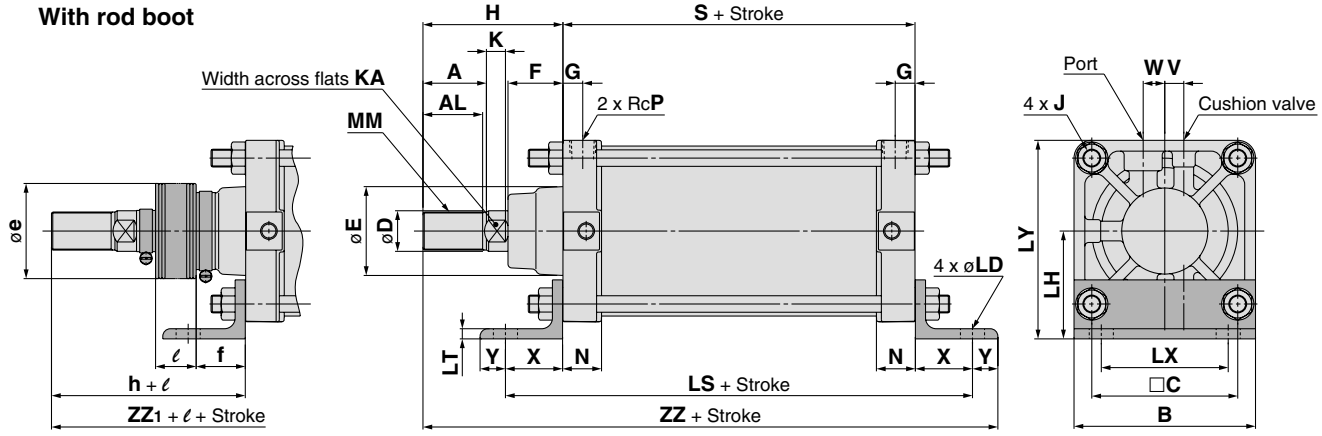
(mm)

Bore size (mm)	N	P	S	Without rod boot		With rod boot				
				H	ZZ	e	f	h	ℓ	ZZ1
125	30.5	1/2	98	110	235	75	40	133	0.2 stroke	258
140	30.5	1/2	98	110	235	75	40	133	0.2 stroke	258
160	34.5	3/4	106	120	256.5	75	40	141	0.2 stroke	277.5

∗ The minimum stroke with rod boot is 30 mm or more.
∗∗ For auto switch mounting position and its mounting height, refer to page 458.
∗∗∗ Refer to “Minimum Stroke for Auto Switch Mounting” on page 459.

Foot: CS2L

With rod boot



(mm)

Bore size (mm)	Stroke range (mm)	A	AL	B	□C	D	E	F	G	J	V	W	K	KA	LD	LH	LS
125	Up to 1600	50	47	145	115	32	71	43	15	M14 x 1.5	15	17	15	27	19	85	188
140	Up to 1600	50	47	161	128	32	71	43	15	M14 x 1.5	15	17	15	27	19	100	188
160	Up to 1600	56	53	182	144	38	78.5	42	18	M16 x 1.5	15	20	17	34	19	106	206

(mm)

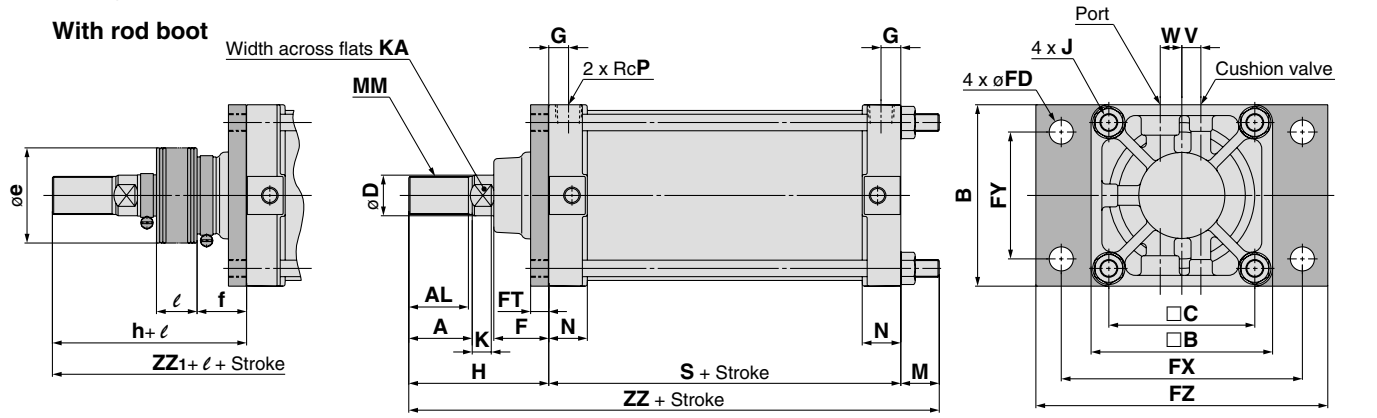
Bore size (mm)	LT	LX	LY	MM	N	P	S	X	Y	Without rod boot		With rod boot				
										H	ZZ	e	f	h	ℓ	ZZ1
125	8	100	156.5	M30 x 1.5	30.5	1/2	98	45	20	110	273	75	40	133	0.2 stroke	296
140	9	112	178.5	M30 x 1.5	30.5	1/2	98	45	30	110	283	75	40	133	0.2 stroke	306
160	9	118	194.5	M36 x 1.5	34.5	3/4	106	50	25	120	301	75	40	141	0.2 stroke	322

∗ The minimum stroke with rod boot is 30 mm or more.
∗∗ For auto switch mounting position and its mounting height, refer to page 458.
∗∗∗ Refer to “Minimum Stroke for Auto Switch Mounting” on page 459.

Dimensions

Rod flange: CS2F

With rod boot



(mm)

Bore size (mm)	Stroke range (mm)	A	AL	□B	B	□C	D	E	F	FD	FT	FX	FY	FZ	G	J	V
125	Up to 1600	50	47	143	145	115	32	71	43	19	14	190	100	230	15	M14 x 1.5	15
140	Up to 1600	50	47	157	160	128	32	71	43	19	20	212	112	255	15	M14 x 1.5	15
160	Up to 1600	56	53	177	180	144	38	78.5	42	19	20	236	118	275	18	M16 x 1.5	15

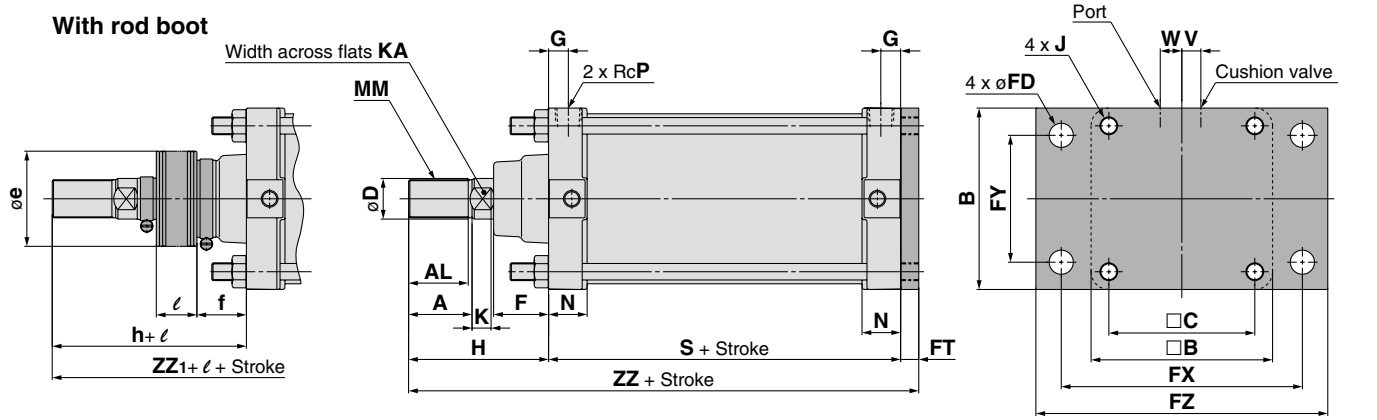
(mm)

Bore size (mm)	W	K	KA	M	MM	N	P	S	Without rod boot		With rod boot				
									H	ZZ	e	f	h	ℓ	ZZ1
125	17	15	27	13	M30 x 1.5	30.5	1/2	98	110	221	75	40	133	0.2 stroke	244
140	17	15	27	13	M30 x 1.5	30.5	1/2	98	110	221	75	40	133	0.2 stroke	244
160	20	17	34	15	M36 x 1.5	34.5	3/4	106	120	241	75	40	141	0.2 stroke	262

∗ The minimum stroke with rod boot is 30 mm or more.
∗∗ For auto switch mounting position and its mounting height, refer to page 458.
∗∗∗ Refer to “Minimum Stroke for Auto Switch Mounting” on page 459.

Head flange: CS2G

With rod boot



(mm)

Bore size (mm)	Stroke range (mm)	A	AL	□B	B	□C	D	E	F	FD	FT	FX	FY	FZ	G	J	V
125	Up to 1000	50	47	143	145	115	32	71	43	19	14	190	100	230	15	M14 x 1.5	15
140	Up to 1000	50	47	157	160	128	32	71	43	19	20	212	112	255	15	M14 x 1.5	15
160	Up to 1200	56	53	177	180	144	38	78.5	42	19	20	236	118	275	18	M16 x 1.5	15

(mm)

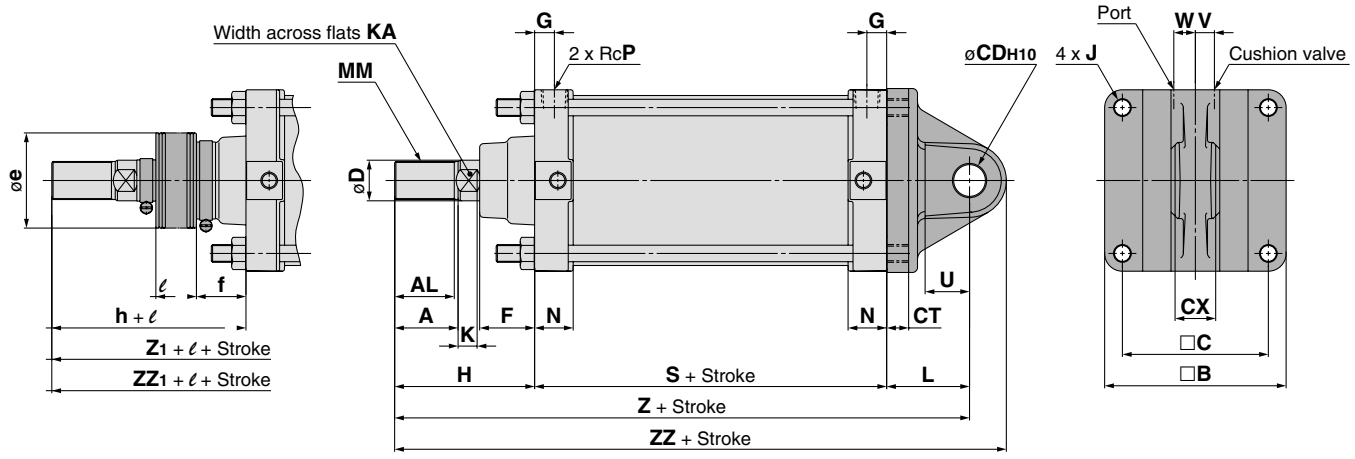
Bore size (mm)	W	K	KA	MM	N	P	S	Without rod boot		With rod boot				
								H	ZZ	e	f	h	ℓ	ZZ1
125	17	15	27	M30 x 1.5	30.5	1/2	98	110	222	75	40	133	0.2 stroke	245
140	17	15	27	M30 x 1.5	30.5	1/2	98	110	228	75	40	133	0.2 stroke	251
160	20	17	34	M36 x 1.5	34.5	3/4	106	120	246	75	40	141	0.2 stroke	267

∗ The minimum stroke with rod boot is 30 mm or more.
∗∗ For auto switch mounting position and its mounting height, refer to page 458.
∗∗∗ Refer to “Minimum Stroke for Auto Switch Mounting” on page 459.

Dimensions

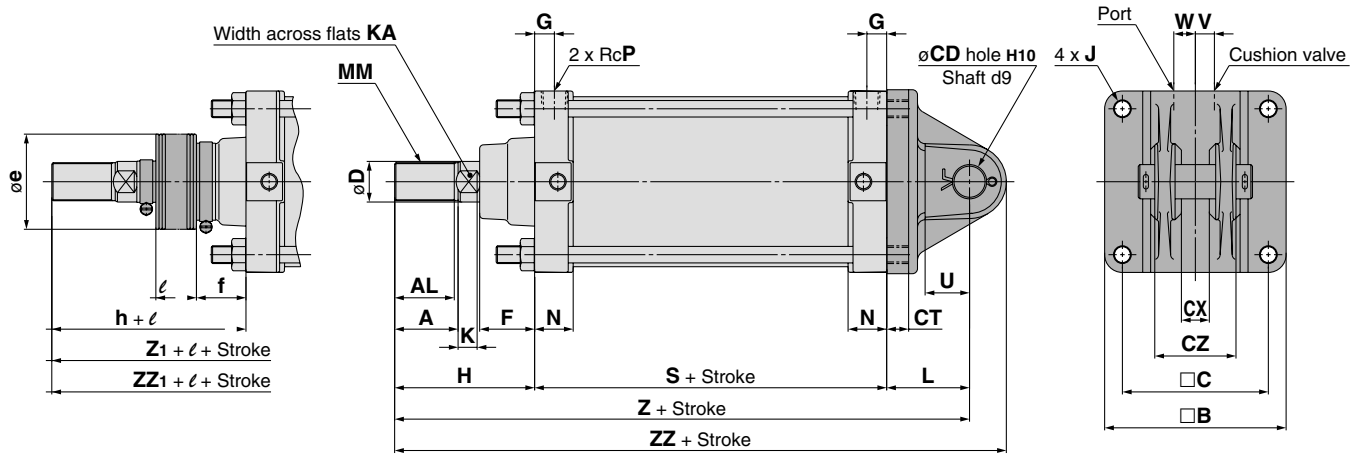
Single clevis: CS2C

With rod boot



Double clevis: CS2D

With rod boot



(mm)

Bore size (mm)	Stroke range (mm)	A	AL	□B	□C	CDH10	CT	Single clevis	Double clevis		D	E	F	G	J	V	W
								CX	CX	CZ							
125	Up to 1000	50	47	143	115	$25^{+0.084}_{0}$	17	$32^{-0.1}_{-0.3}$	$32^{+0.3}_{+0.1}$	$64^{0}_{-0.2}$	32	71	43	15	M14 x 1.5	15	17
140	Up to 1000	50	47	157	128	$28^{+0.084}_{0}$	17	$36^{-0.1}_{-0.3}$	$36^{+0.3}_{+0.1}$	$72^{0}_{-0.2}$	32	71	43	15	M14 x 1.5	15	17
160	Up to 1200	56	53	177	144	$32^{+0.100}_{0}$	20	$40^{-0.1}_{-0.3}$	$40^{+0.3}_{+0.1}$	$80^{0}_{-0.2}$	38	78.5	42	18	M16 x 1.5	15	20

(mm)

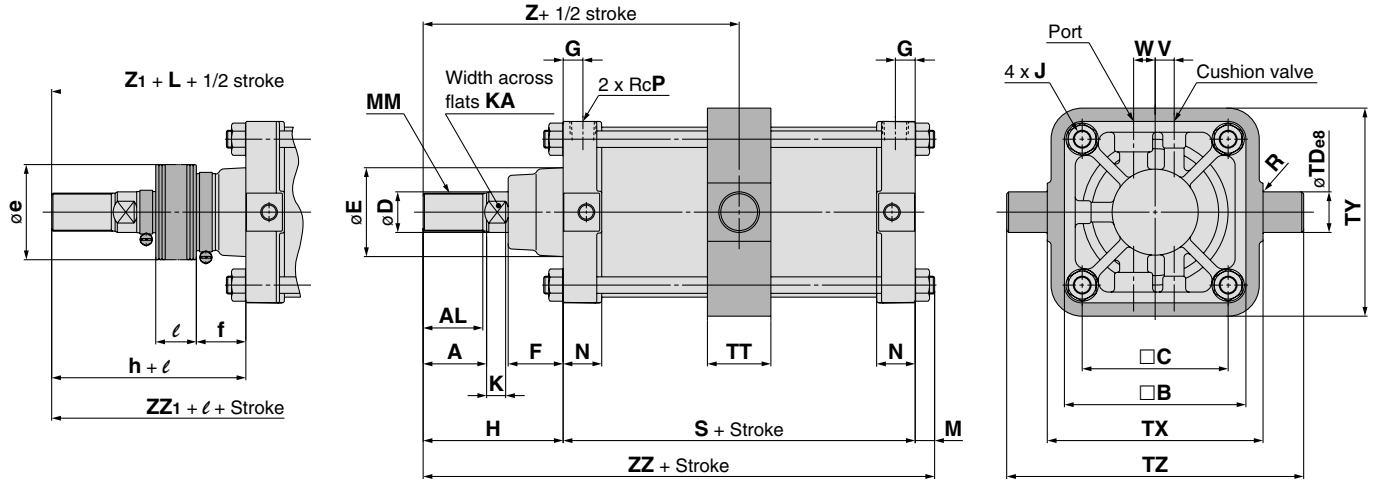
Bore size (mm)	K	KA	L	MM	N	P	S	U	RR	Without rod boot			With rod boot					
										H	Z	ZZ	e	f	h	ℓ	Z1	ZZ1
125	15	27	65	M30 x 1.5	30.5	1/2	98	35	29	110	273	302	75	40	133	0.2 stroke	296	325
140	15	27	75	M30 x 1.5	30.5	1/2	98	40	32	110	283	315	75	40	133	0.2 stroke	306	338
160	17	34	80	M36 x 1.5	34.5	3/4	106	45	36	120	306	342	75	40	141	0.2 stroke	327	363

∗ The minimum stroke with rod boot is 30 mm or more.
∗∗ For auto switch mounting position and its mounting height, refer to page 458.
∗∗∗ Refer to “Minimum Stroke for Auto Switch Mounting” on page 459.

Dimensions

Center trunnion: CS2T

With rod boot



(mm)

Bore size (mm)	Stroke range (mm)	A	AL	□B	□C	D	E	F	G	J	V	W	K	KA	M	MM	N
125	25 to 1000	50	47	143	115	32	71	43	15	M14 x 1.5	15	17	15	27	13	M30 x 1.5	30.5
140	30 to 1000	50	47	157	128	32	71	43	15	M14 x 1.5	15	17	15	27	13	M30 x 1.5	30.5
160	35 to 1200	56	53	177	144	38	78.5	42	18	M16 x 1.5	15	20	17	34	15	M36 x 1.5	34.5

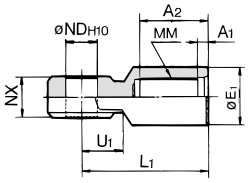
(mm)

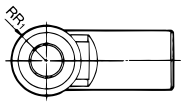
Bore size (mm)	P	R	S	TDe8	TT	TX	TY	TZ	Without rod boot			With rod boot					
									H	Z	ZZ	e	f	h	ℓ	Z1	ZZ1
125	1/2	1	98	32 $^{-0.050}_{-0.089}$	50	170	164	234	110	159	221	75	40	133	0.2 stroke	182	244
140	1/2	1.5	98	36 $^{-0.050}_{-0.089}$	55	190	184	262	110	159	221	75	40	133	0.2 stroke	182	244
160	3/4	1.5	106	40 $^{-0.050}_{-0.089}$	60	212	204	292	120	173	241	75	40	141	0.2 stroke	194	262

∗ The minimum stroke with rod boot is 30 mm or more for ø125, ø140, and 35 mm or more for ø160.
∗∗ For auto switch mounting position and its mounting height, refer to page 458.
∗∗∗ Refer to “Minimum Stroke for Auto Switch Mounting” on page 459.

Air Cylinder / *Series CS2*
Accessory Bracket

I Type Single Knuckle Joint*

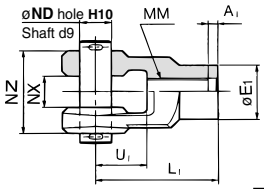


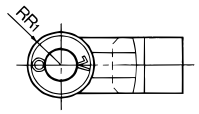


Material: Cast iron

Part no.	Applicable bore size (mm)	A_1	A_2	E_1	L_1	MM	ND_{H10}	NX	RR_1	U_1
I-12A	**125**	8	54	46	100	M30 x 1.5	$25^{+0.084}_{0}$	$32^{-0.1}_{-0.3}$	27	33
I-14A	**140**	8	54	48	105	M30 x 1.5	$28^{+0.084}_{0}$	$36^{-0.1}_{-0.3}$	30	39
I-16A	**160**	8	60	55	110	M36 x 1.5	$32^{+0.1}_{0}$	$40^{-0.1}_{-0.3}$	34	39

Y Type Double Knuckle Joint*



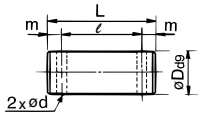


Material: Cast iron

Part no.	Applicable bore size (mm)	A_1	E_1	L_1	MM	ND_{H10}	NX	NZ	RR_1	U_1
Y-12A	**125**	8	46	100	M30 x 1.5	$25^{+0.084}_{0}$	$32^{+0.3}_{+0.1}$	$64^{-0.1}_{-0.3}$	27	42
Y-14A	**140**	8	48	105	M30 x 1.5	$28^{+0.084}_{0}$	$36^{+0.3}_{+0.1}$	$72^{-0.1}_{-0.3}$	30	47
Y-16A	**160**	8	55	110	M36 x 1.5	$32^{+0.1}_{0}$	$40^{+0.3}_{+0.1}$	$80^{-0.1}_{-0.3}$	34	46

∗ Use a single knuckle joint or a double knuckle joint individually.
(Screw it entirely over the rod end threads and tighten it.)
∗ Extend the dimensions of **A**, **H**. when using a single/double knuckle joint together with a rod end nut.
(To extend dimensions **A**, **H**, refer to the below table, and specify the product as made-to-order **-XAO**.)
∗ A pin and cotter pin are included with the double knuckled joint.

Knuckle Pin / Clevis Pin

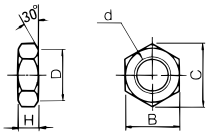


Material: Carbon steel

Part no.	Applicable bore size (mm)	D_{d9}	L	ℓ	m	d (Drill through)	Applicable cotter pin
IY-12	**125**	$25^{-0.065}_{-0.117}$	79.5	69.5	5	4	ø4 x 40
IY-14	**140**	$28^{-0.065}_{-0.117}$	86.5	76.5	5	4	ø4 x 40
IY-16	**160**	$32^{-0.080}_{-0.142}$	94.5	84.5	5	4	ø4 x 40

∗ Cotter pin is included.

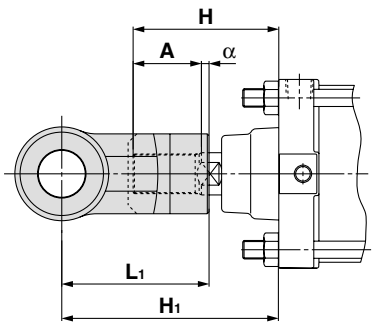
Rod End Nut



Material: Rolled steel

Part no.	Applicable bore size (mm)	d	H	B	C	D
NT-12	**125/140**	M30 x 1.5	18	46	53.1	44
NT-16	**160**	M36 x 1.5	21	55	63.5	53

Single/Double Knuckle Joint



Bore size (mm) \ Symbol	H	A	α	L_1	H_1	Applicable knuckle joint part number	
						I type single knuckle	Y type double knuckle
125	110	50	3.5	100	156.5	I-12A	Y-12A
140	110	50	3.5	105	161.5	I-14A	Y-14A
160	120	56	3.5	110	170.5	I-16A	Y-16A

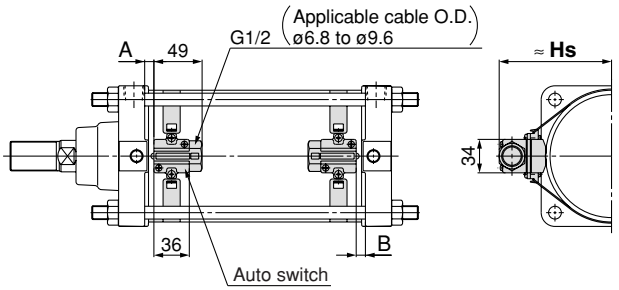
A, H Dimensions when Mounting a Single/Double Knuckle Joint together with a Rod End Nut

Bore size (mm)	A	H
125	65	125
140	65	125
160	76	140

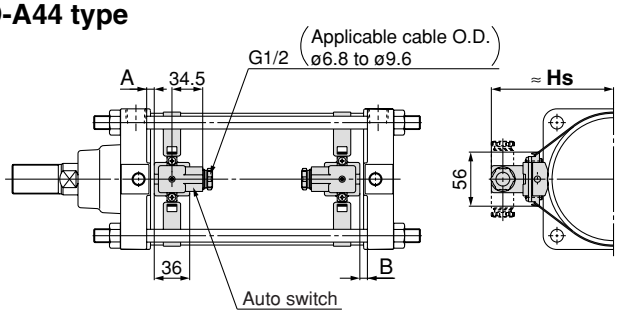
Auto Switch Proper Mounting Position (Detection at stroke end) and Its Mounting Height

<Band mounting>

D-A3□ type
D-G3/K3 type



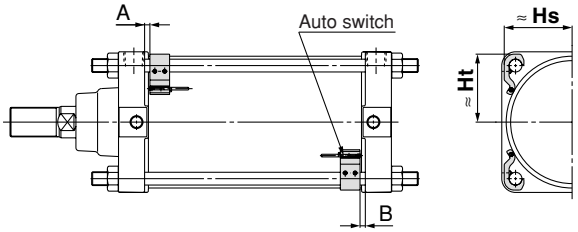
D-A44 type



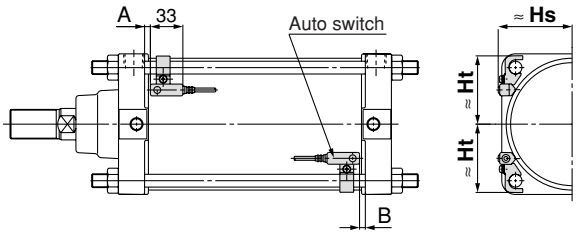
∗ The indicator light faces the inside.

<Tie-rod mounting>

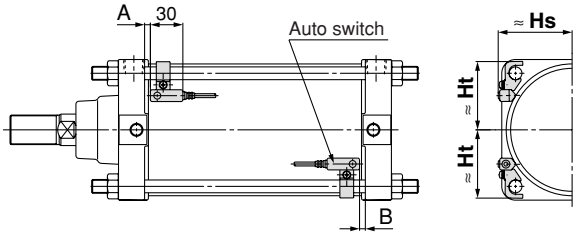
D-A9□/A9□V type
D-M9□/M9□V type
D-M9□W/M9□WV type
D-M9□AL/M9□AVL type
D-Z7□/Z80 type
D-Y59□/Y69□/Y7P/Y7PV type
D-Y7□W/Y7□WV type
D-Y7BAL type



D-A5□/A6□ type



D-F5□/J5□/D-F5NTL type
D-F5BAL/F59F type
D-F5□W/J59W type



Auto Switch Proper Mounting Position

(mm)

Auto switch model / Bore size	D-A9□ D-A9□V		D-M9□ D-M9□V D-M9□W D-M9□WV D-M9□AL D-M9□AVL		D-Z7□/Z80 D-Y5□/Y6□ D-Y7P/Y7PV D-Y7□W D-Y7□WV D-Y7BAL		D-A5□ D-A6□ D-A3□ D-A44 D-G39 D-K39		D-A59W		D-F5□W D-J59W D-F5BAL D-F5□ D-J5□ D-F59F		D-F5NTL	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
125	4	4	8	8	1.5	1.5	0	0	2	2	4.5	4.5	9.5	9.5
140	4	4	8	8	1.5	1.5	0	0	2	2	4.5	4.5	9.5	9.5
160	4	4	8	8	1.5	1.5	0	0	2	2	4.5	4.5	9.5	9.5

∗ Provided as guidelines for auto switch proper mounting position (detection at stroke end). When setting an auto switch, confirm the operation and adjust its mounting position.

Auto Switch Mounting Height

(mm)

Auto switch model / Bore size	D-A9□ D-A9□V D-M9□ D-M9□W D-M9□AL		D-M9□V D-M9□WV D-M9□AVL		D-Z7□/Z80 D-Y5□/Y6□ D-Y7P D-Y7PV D-Y7□W D-Y7□WV D-Y7BAL		D-A3□ D-G39 D-K39	D-A44	D-A5□ D-A6□ D-A59W		D-F5□ D-J5□ D-F5□W D-J59W D-F5BAL D-F59F D-F5NTL	
	Hs	Ht	Hs	Ht	Hs	Ht	Hs	Hs	Hs	Ht	Hs	Ht
125	69	69.5	71.5	69.5	69	69.5	116	126	75.5	69.5	74.5	70
140	76	76	77.5	76	76	76	124	134	81	76.5	80	76.5
160	85	85	86	85	85	85	134.5	144.5	89	87.5	88	87.5

Minimum Stroke for Auto Switch Mounting

n: Number of auto switches (mm)

Auto switch model	Number of auto switches mounted		Mounting brackets other than center trunnion	Center trunnion		
				ø125	ø140	ø160
D-A9□	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		15	100	105	110
	With n pcs.		$15 + 40\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$100 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$105 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$110 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)
D-A9□V	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		10	75	80	85
	With n pcs.		$10 + 30\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$75 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$80 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$85 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)
D-M9□ **D-M9□W**	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		15	105	110	115
	With n pcs.		$15 + 40\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$105 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$110 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$115 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)
D-M9□V **D-M9□WV**	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		10	80	85	90
	With n pcs.		$10 + 30\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$80 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$85 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$90 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)
D-M9□AL	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		20	115	120	
	With n pcs.		$20 + 40\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$115 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$120 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	
D-M9□AVL	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		15	90	95	
	With n pcs.		$15 + 30\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$90 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$95 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	
D-A5□/A6□ **D-A59W** **D-F5□/J5□** **D-F5□W** **D-J59W** **D-F5BAL** **D-F59F**	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		25	125	135	
	With n pcs. (Same surface)		$25 + 55\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$125 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$135 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	
D-F5NTL	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		35	145	155	
	With n pcs. (Same surface)		$35 + 55\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$145 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$155 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	
D-A3□ **D-G39** **D-K39**	With 2 pcs.	Different surfaces	35	110		
		Same surface	100			
	With n pcs.	Different surfaces	35 + 30(n – 2)	110 + 30(n – 2) (n = 2, 4, 6, 8···)		
		Same surface	100 + 100(n – 2)	110 + 100(n – 2) (n = 2, 4, 6, 8···)		
	With 1 pc.		15	110		
D-A44	With 2 pcs.	Different surfaces	35	110		
		Same surface	55			
	With n pcs.	Different surfaces	35 + 30(n – 2)	110 + 30(n – 2) (n = 2, 4, 6, 8···)		
		Same surface	55 + 55(n – 2)	110 + 50(n – 2) (n = 2, 4, 6, 8···)		
	With 1 pc.		15	110		
D-Z7□ **D-Z80** **D-Y59□** **D-Y7P** **D-Y7□W**	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		15	105	110	115
	With n pcs.		$15 + 40\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$105 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$110 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$115 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)
D-Y69□ **D-Y7PV** **D-Y7□WV**	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		10	90	95	100
	With n pcs.		$10 + 30\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$90 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$95 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$100 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)
D-Y7BAL	With 2 pcs. (Different surfaces, Same surface), With 1 pc.		20	115	120	125
	With n pcs.		$20 + 45\frac{(n-2)}{2}$ (n = 2, 4, 6, 8···)	$115 + 45\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$120 + 45\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)	$125 + 45\frac{(n-4)}{2}$ (n = 4, 8, 12, 16···)

Operating Range

(mm)

Auto switch model	Bore size		
	125	140	160
D-A9□/A9□V	12	12.5	11.5
D-M9□/M9□V D-M9□W/M9□WV D-M9□AL/M9□AVL	6	6.5	6.5
D-Z7□/Z80	14	14.5	13
D-A3□/A44 D-A5□/A6□	10	10	10
D-A59W	17	17	17
D-Y59□/Y69□ D-Y7P/Y7PV D-Y7□W/Y7□WV D-Y7BAL	12	13	7
D-F5□/J5□/F5□W D-J59W/F5BAL D-F5NTL/F59F	5	5	5.5
D-G39/K39	11	11	10

∗ Since this is a guideline including hysteresis, not meant to be guaranteed.
(Assuming approximately ±30% dispersion.)
There may be the case it will vary substantially depending on an ambient environment.

Auto Switch Mounting Bracket Part No.

Auto switch model	Bore size (mm)		
	ø125	ø140	ø160
D-A9□/A9□V D-M9□/M9□V D-M9□W/M9□WV D-M9□AL/M9□AVL	BS5-125	BS5-125	BS5-160
D-A5□/A6□ D-A59W D-F5□/J5□ D-F5NTL D-F5□W/J59W D-F5BAL/F59F	BT-12	BT-12	BT-16
D-A3□/A44 D-G39/K39	BS1-125	BS1-140	BS1-160
D-Z7□/Z80 D-Y59□/Y69□ D-Y7P/Y7PV D-Y7□W/Y7□WV D-Y7BAL	BS4-125	BS4-125	BS4-160

[Mounting screws set made of stainless steel]

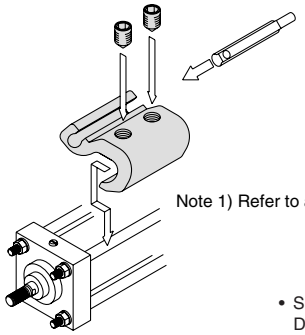
The following set of mounting screws made of stainless steel (including set screws) is also available. Use it in accordance with the operating environment. (Please order the auto switch mounting bracket separately, since it is not included.)

BBA1: For D-A5, A6, F5, J5 type

"D-F5BAL" auto switch is set on the cylinder with the stainless steel screws above when shipped.

When only an auto switch is shipped independently, "BBA1" screws are attached.

Note) When using the D-M9□AL/M9□AVL or Y7BAL model, do not use the steel set screw which is included with the auto switch mounting bracket in the above table (BS5-□□□, BS4-□□□). Please separately prepare the stainless steel screw set (BBA1), and select and use the M4 x 8L stainless steel set screw included in BBA1.



Note 1) Refer to age 1365 for the details of BBA1 screws.

• Shows an example of mounting the D-A9□(V), M9□(V), M9□W(V), M9□A(V)L model.

Other than the applicable auto switches listed in "How to Order", the following auto switches can be mounted.
For detailed specifications, refer to pages 1263 to 1371.

Type	Model	Electrical entry (Direction)	Features
Reed auto switch	D-A90V	Grommet (Perpendicular)	Without indicator light
	D-A93V, A96V	Grommet (in-line)	—
	D-Z73, Z76		
	D-A53, A56		
	D-A67		Without indicator light
	D-Z80		
Solid state auto switch	D-F59, F5P, J59	Grommet (in-line)	—
	D-Y59A, Y59B, Y7P		
	D-F59W, F5PW, J59W		2-color indication
	D-Y7NW, Y7PW, Y7BW		
	D-F5BAL, Y7BAL		Water resistant (2-color indication)
	D-F5NTL		With timer
	D-M9NV, M9PV, M9BV	Grommet (Perpendicular)	—
	D-Y69A, Y69B, Y7PV		
	D-M9NWV, M9PWV, M9BWV		2-color indication
	D-Y7NWV, Y7PWV, Y7BWV		
	D-M9NAVL, M9PAVL, M9BAVL		Water resistant (2-color indication)

∗ With pre-wired connector is available for solid state auto switches. For details, refer to pages 1328 to 1329.
∗ Normally closed (NC = b contact), solid state switches (D-F9G, F9H, Y7G, Y7H type) are also available. For details, refer to pages 1290 to 1292.