

2 : HC Tie-rod hydraulic cylinders

TÜV ISO-9001 : 2000 quality certified

working pressure : 70 、 140kgf/cm²

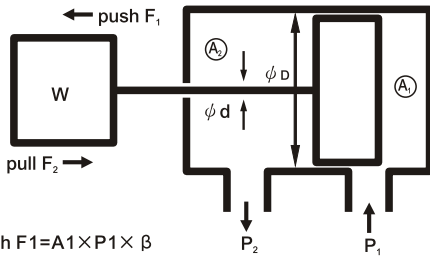
Tie-rod hydraulic cylinders



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Calculation of theoretical output force



- push $F_1 = A_1 \times P_1 \times \beta$
- pull $F_2 = A_2 \times P_2 \times \beta$

A_1 : push side pressed area (cm^2)

$$A_1 = \pi D^2 / 4 = 0.785 D^2$$

A_2 : pull side pressed area (cm^2)

$$A_2 = \pi (D^2 - d^2) / 4 = 0.785 (D^2 - d^2)$$

D : piston diameter (cm)

d : rod diameter (cm)

P_1 : input pressure for pushing forward (kgf/cm^2)

P_2 : input pressure for pulling backward (kgf/cm^2)

β : load ratio

note : 1. the practical output force of a cylinder is less than theoretical force.

2. when a cylinder is moving regularly, load ratio is usually chosen as 0.8, otherwise 0.6 is used.

example :

assume output force is 1000 kgs and working pressure is 70 kgf/cm^2

What is the suitable bore of the cylinder?

Ans:

output force $F = 1000 \text{ kg}$

working pressure $P = 70 \text{ kgf/cm}^2$

load ratio $\beta = 0.8$

$$F_1 = A_1 \times P_1 \times \beta$$

$$A_1 = F_1 / (P_1 \times \beta) = 1000 / (70 \times 0.8)$$

$$= 17.86 \text{ cm}^2$$

$$A = \pi D^2 / 4 = 0.785 D^2$$

$$\text{so.. } D^2 = 17.86 / 0.785 = 22.75 \text{ cm}^2$$

$$D = \sqrt{22.75} = 4.8 \text{ cm} = 48 \text{ mm}$$

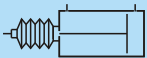

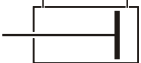

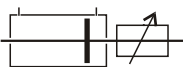
the suitable bore size is 50mm

Tie-rod hydraulic cylinders

theoretical force

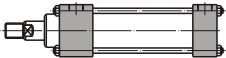
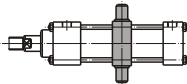
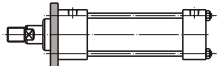
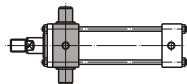
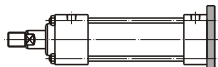

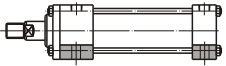
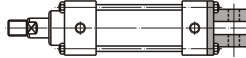
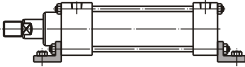
		bore(mm)													
		32	40	50	63	80	100	125	150	180	200	224	250		
pressed piston area (cm^2)	push	8.0	12.6	19.6	31.2	50.3	78.5	122.7	176.7	254.5	314.2	394.1	490.9		
	pull (a_1)	rod bore	C	6.0	9.4	14.7	24.1	40.6	66	98.1	141.5	204.2	250.5	315.5	392.4
B			4.9	7.7	12.6	21.6	38	53.9	83.1	120	175.9	215.6	271.4	336.9	
output force (kg)	working pressure 70 kg/cm^2	push		560	880	1375	2182	3519	5498	8590	12370	17813	21991	27586	34361
			pull	C	420	660	1301	1687	2838	4618	6867	9902	14295	17538	22088
	B	343		536	880	1508	2660	3774	5819	8398	12315	15095	18995	23585	
	working pressure 140 kg/cm^2	Push		1120	1760	2750	4343	7038	10995	17181	24741	35626	43982	55171	68721
			pull	C	840	1320	2062	3374	5676	9236	13734	19804	28590	35076	44176
	B	686		1072	1760	3016	5320	7548	11638	16796	24630	30190	37990	47172	
working pressure 210 kg/cm^2	push		1680	2646	4116	6552	10563	16485	25767	37107	53445	65982	82761	103089	
		pull	C	1260	1974	3087	5061	8526	13860	20601	29715	42882	52605	66255	82404
B	1029		1617	2646	4536	7980	11319	17451	25200	36939	45276	56994	70749		

Type

type	symbol	drawing	with bellow	heat proof	bore(mm)
					
double acting	HCA		HCA-H	HCA-J	32,40,50 63,80,100 125,150 180,200 224,250
double rod	HCC		HCC-H	HCC-J	
double rods with alignment	HCD		HCD-H	HCD-J	

Tie-rod hydraulic cylinders

Installation

symbol	name	drawing	symbol	name	drawing
SD	basic		TC	intermediate trunnion	
FA	rod flange		TA	head trunnion	
FB	head flange		CA	clevis	
LA	foot		CB	dual clevis	
LB	end angles				

Stroke calculation

(table 1)

type	condition	coeff icient	type	condition	coeff icient
LA LB		1/4	FB		1/4
		2			2
		4			4
FA		1/4	TC CA		1
		2			
		4			

$S = L - l$
 S : stroke (mm)
 L : max. length of stroke (mm)
 l : min. length of stroke (mm)

example : a cylinder has 80 mm bore, 45mm rod , rod end with FA type ,and working pressure 100kgf/cm²

Please find the max. stroke.

ans : 1. based on FA type, table 1 shows n=2

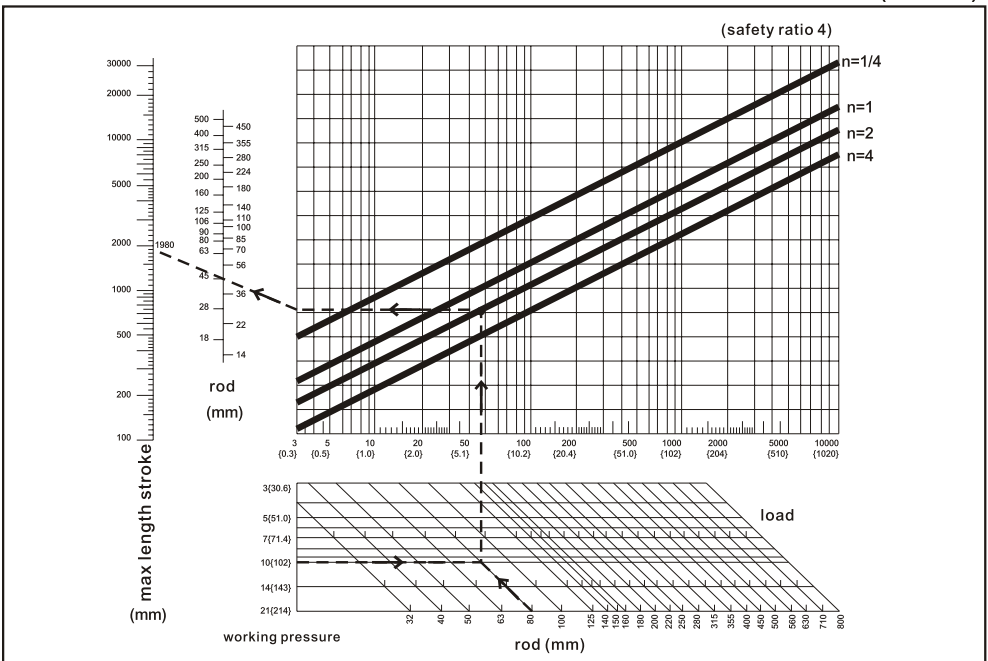
2. with n=2 and table 2, L can be found as 1980mm

3. based on FA type and external dimensions (P2.13)

$$l = F + W + H + CA = 24 + 35 + 18 + 75 = 152 \text{ mm}$$

$$4. \text{ max. storke } S = L - l = 1980 - 152 = 1828 \text{ mm}$$

(table 2)



Tie-rod hydraulic cylinders

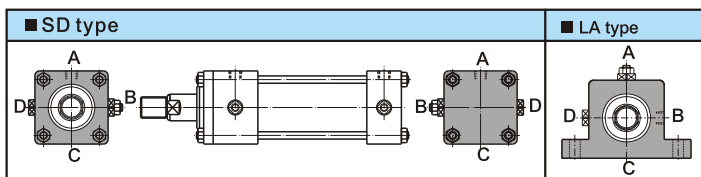
Seals materials with corresponding oil and temperature

material oil symbol	(PU)	(NBR)	(FPM)
	1	2	3
mineral	○	○	○
water solutions	×	○	○
soluble	×	○	○
phosphate ester	×	×	○
temperature	-10°C~+80°C		-10°C~+200°C
	20~400mm ² /s(cSt)		

note :

- 1.mineral oil (e.g:CPC-R68.)
- 2.If mineral oil is used,"PU"seals will be used on standard hydraulic products with no need to specify selections of materials.
- 3.FPM must be selected should phosphate ester oil or high temperature(>80°C) is applied
- 4.note ○ =O.K. × = cannot be used

Port and cushion positions



e.g : position expression
HCA70-LA-C-100×200-B-B-A
input port= B position
cushion= A position

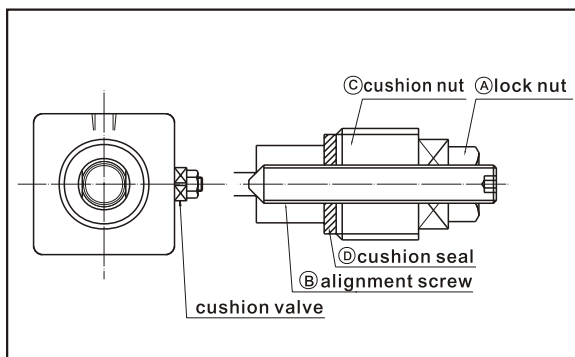
standard product= A : input port B : cushion position D : check valve position

Cushion length

bore(mm)	L	ℓ
32~63	20	10
80~160	25	15
180~224	30	27
250	35	32

- Should the movement of a cylinder with loading is above 500mm/sec., cushion device needs to be used.
- If the moving speed is much higher than 500mm/sec, external reducing speed valves should be used.

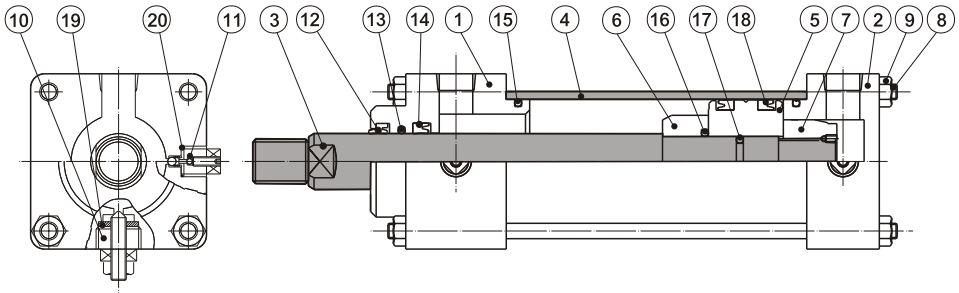
Use of cushion valves



■alignment steps:

1. Turn lock nut (A) toward counter clockwise with 1/4circle by wrench.
2. Using hex . Wrench to adjust the alignment screw (B)
 - ① clockwise...rod speed will be slow down
 - ② counter clockwise-rod speed will be up.
3. After alignment ,use hex. wrench to fix the alignment screw (B), and then tighten the cushion nut (C) to prevent possible leakage from cushion seal (D)
4. Tighten the lock nut (A)

Internal structure and part names



Tie-rod hydraulic cylinders

item	part name	q'ty	item	part name	q'ty
①	rod cover	1	⑪	check and vent valve	2
②	head cover	1	⑫	dust seal	1
③	piston rod	1	⑬	rod o-ring	1
④	tube	1	⑭	rod packing	1
⑤	piston	1	⑮	cover o-ring	2
⑥	rod cushion	1	⑯	cushion o-ring	1
⑦	head cushion	1	⑰	piston o-ring	1
⑧	tie-rod	4	⑱	piston packing	2
⑨	tie-rod nut	8	⑲	cushion washer	2
⑩	cushion aligning valve	2	⑳	valve o-ring	2

Seal spec.

item name bore rod	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	
	dust seal (PU)	rod o-ring (1B)	rod packing (PU)	cover o-ring (1B)	cushion o-ring (1A)	piston o-ring (1A)	piston packing (PU)	cushion washer	valve o-ring (1A)	
	1	1	1	2	1	1	2	2	2	
32	C	DH16	P16	UHS16	G25 (cushion type SM32×1.5)	SM12.5	P10A	UHS23.5	13×5×3 ^t	—
	B	DH20	P20	UHS20						
40	C	DH20	P20	UHS20	G35 (cushion type SM40)	SM14	P10A	UHS30	13×5×3 ^t	—
	B	DH25	P25	UHS25						
50	C	DH25	P25	UHS25	G45	SM18	P14	UHS40	13×5×3 ^t	P9
	B	DH30	P30	UHS30						
63	C	DH30	P30	UHS30	G55	P24	P20	UHS53	13×5×3 ^t	P9
	B	DH35	P35	UHS35						
80	C	DH35	P35	UHS35	G75	G30	G25	UHS70	13×5×3 ^t	P9
	B	DH40	P40	UHS40						
100	C	DH40	P40	UHS40	G95	G35	G30	UHS85	19×6.5×4 ^t	P15
	B	DH56	P56	UHS56		G45	G40			
125	C	DH56	P56	UHS56	G120	G45	G40	UHS112	19×6.5×4 ^t	P15
	B	DH70	P70	UHS70		G50	G45			
150	C	DH65	P65	UHS65	G145	G55	G50	UHS136	19×6.5×4 ^t	P15
	B	DH85	P85	UHS85		G65	G60			
180	C	DH80	P80	UHS80	G170	G70	G65	UHP180	19×6.5×4 ^t	P15
	B	DH100	P100	UHS100		G80	G75			
200	C	DH90	P90	UHS90	G190	G80	G75	UHP200	19×6.5×4 ^t	P15
	B	DH112	P112	UHS112		G95	G90			
224	C	DH100	—	UHS100	G210	G90	G85	UHP224	19×6.5×4 ^t	P15
	B	DH125	—	UHS125		G105	G100			
250	C	DH112	—	UHS112	G240	G95	G90	UHP250	19×6.5×4 ^t	P15
	B	DH140	—	UHS140		G110	G105			

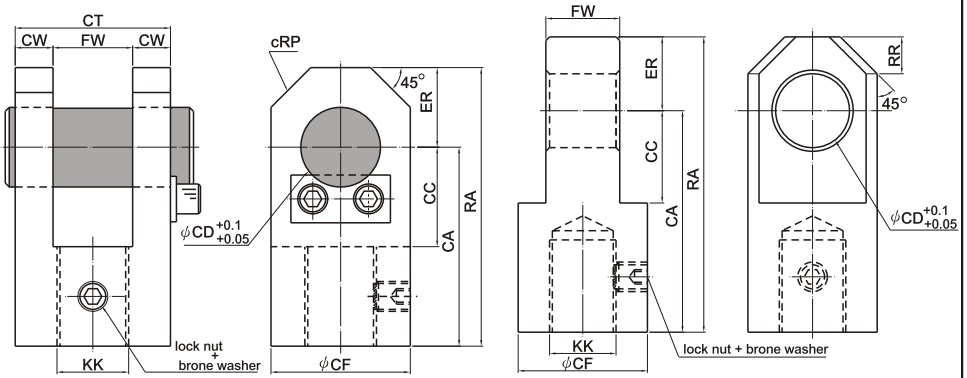
Connectors

Y connector

I connector

Order form	HC-Y- $\phi 63 \times M24 \times 1.5$	Order form	HC-I- $\phi 50 \times M20 \times 1.5$
	1 2		1 2

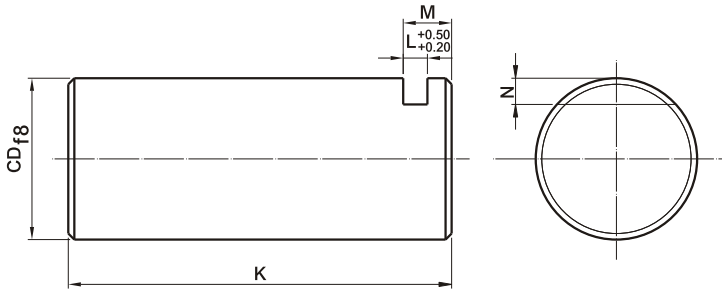
1 : fitted bore (mm) **2** : thread used



Symbol bore	KK		FW		CA		RA		CF		CD ^{H9}	CT	CC		ER	CW	RP	RR
	C rod	B rod	Y	I	Y	I	Y	I	Y	I			Y	I				
32	M12×1.5	M16×1.5	20 ^{+0.40} _{+0.10}	20 ^{-0.10} _{-0.40}	49	69	65	85	32	38	16	45	24	24	16	12.5	8	8
40	M16×1.5	M20×1.5	20 ^{+0.40} _{+0.10}	20 ^{-0.10} _{-0.40}	49	69	65	85	32	38	16	45	24	24	16	12.5	8	8
50	M20×1.5	M24×1.5	25 ^{+0.40} _{+0.10}	25 ^{-0.10} _{-0.40}	60	80	80	100	40	44	20	55	35	30	20	15	10	10
63	M24×1.5	M30×1.5	30 ^{+0.40} _{+0.10}	30 ^{-0.10} _{-0.40}	75	105	105	135	60	60	31.5	63	40	45	30	16.5	15	15
80	M30×1.5	M36×1.5	30 ^{+0.40} _{+0.10}	30 ^{-0.10} _{-0.40}	75	105	105	135	60	60	31.5	63	40	45	30	16.5	15	15
100	M36×1.5	M48×1.5	40 ^{+0.40} _{+0.10}	40 ^{-0.10} _{-0.40}	100	120	140	160	70	70	40	78	50	50	40	19	20	20
125	M48×1.5	M64×2.0	63 ^{+0.40} _{+0.10}	63 ^{-0.10} _{-0.40}	180	180	230	230	100	100	50	126	70	65	50	31.5	25	25
140	M56×2.0	M72×2.0	80 ^{+0.60} _{+0.10}	80 ^{-0.10} _{-0.60}	225	225	290	290	120	120	63	160	90	85	65	40	32	32
150	M60×2.0	M76×2.0	80 ^{+0.60} _{+0.10}	80 ^{-0.10} _{-0.60}	225	225	290	290	120	120	63	160	90	85	65	40	32	32
160	M64×2.0	M80×2.0	80 ^{+0.60} _{+0.10}	80 ^{-0.10} _{-0.60}	240	240	310	310	140	140	71	160	100	90	70	40	35	35
180	M72×2.0	M95×2.0	100 ^{+0.60} _{+0.10}	100 ^{-0.10} _{-0.60}	270	270	350	350	160	160	80	200	110	100	80	50	40	40
200	M80×2.0	M100×2.0	125 ^{+0.60} _{+0.10}	125 ^{-0.10} _{-0.60}	210	210	300	300	180	180	90	225	115	115	90	50	45	45
224	M95×2.0	M120×2.0	125 ^{+0.60} _{+0.10}	125 ^{-0.10} _{-0.60}	235	235	335	335	200	200	100	251	125	125	100	63	50	50
250	M100×2.0	M130×2.0	125 ^{+0.60} _{+0.10}	125 ^{-0.10} _{-0.60}	245	245	345	345	200	200	100	251	125	125	100	63	50	50

Tie-rod hydraulic cylinders

Pin

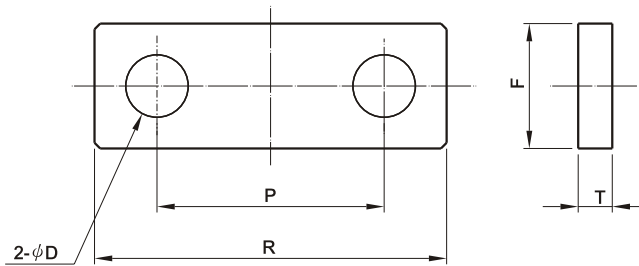


■ bore 70/140kgf/cm²

unit : mm

bore symbol	32	40	50	63	80	100	125	140	150	160	180	200	224	250
CD	16	16	20	31.5	31.5	40	50	63	63	71	80	90	100	100
K	57	57	68	76	76	95	143	183	183	183	225	250	280	280
M	7	7	7	9	9	12	12	18	18	19	20	20	24	24
N	3.5	3.5	3.5	5.5	5.5	6.5	7.5	10	10	11	12	15	15.5	15.5
L	3	3	3	6	6	6	6	9	9	9	12	12	12	12

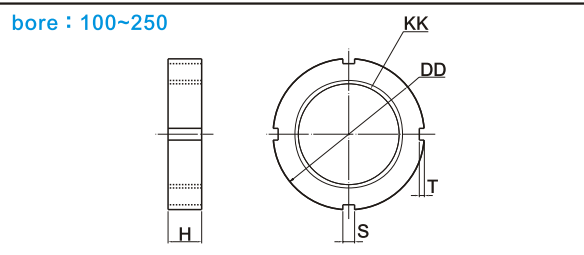
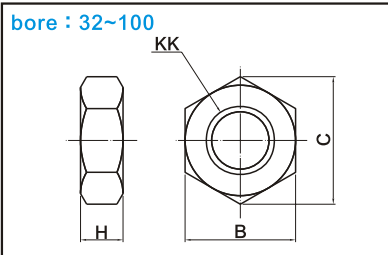
Keeper



unit : mm

bore symbol	32	40	50	63	80	100	125	140	150	160	180	200	224	250
D	6.5	6.5	6.5	11	11	11	11	14	14	14	16	16	18	18
F	16	16	16	25	25	25	25	32	32	38	38	38	38	38
T	3	3	3	6	6	6	6	9	9	9	12	12	12	12
P	18	18	18	33	33	40	50	63	63	71	80	90	100	100
R	28	28	28	55	55	62	72	93	93	101	115	125	140	140
steel bolt	M6			M10			M12			M14			M16	

Rod nuts



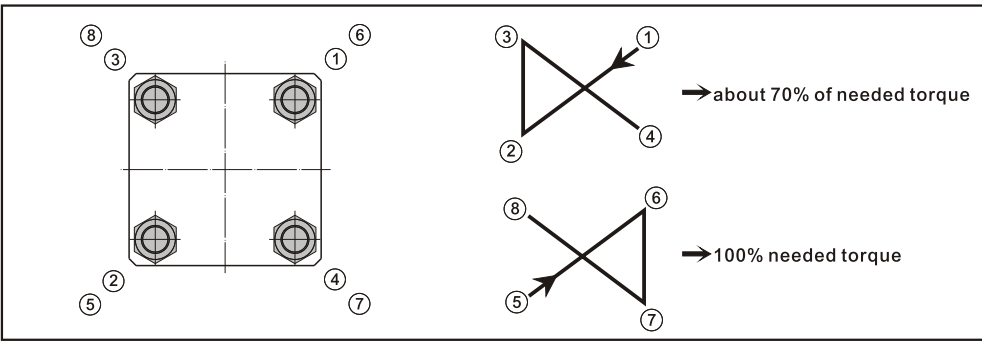
KK	B	C	H
M12×1.5	19	22	10
M16×1.5	24	27	8
M20×1.5	30	34	9
M24×1.5	36	41	12
M30×1.5	41	47	15
M36×1.5	50	57	18
M39×1.5	50	57	18

KK	DD	H	S	T	KK	DD	H	S	T
M48×1.5	70	18	6	2.5	M80×2.0	115	30	8	3.5
M60×2.0	90	20	7	3	M95×2.0	135	35	10	4
M64×2.0	95	20	7	3	M100×2.0	150	35	10	4
M72×2.0	105	25	8	3.5	M120×2.0	180	40	12	5
M76×2.0	110	30	8	3.5	M130×2.0	200	40	12	5

Tie-rod hydraulic cylinders

Notes of tie-rod assembly

1. sequences of tie-rod assembly



2. needed torque values for assembling tie-rods (carbon steel) and nuts (carbon steel)

bore(mm)	32.40.50	63	80	100	125	150	180	200	224	250	
thread	M10×1.5	M12×1.5	M16×1.5	M18×1.5	M22×1.5	M26×1.5	M30×1.5	M33×1.5	M39×1.5	M42×1.5	
needed torque (kgf-cm)	C class	210	350	870	1300	2400	4500	6300	8300	12000	18000
	B class	210	350	870	1800	3400	6400	8900	12000	20000	25000

Order form

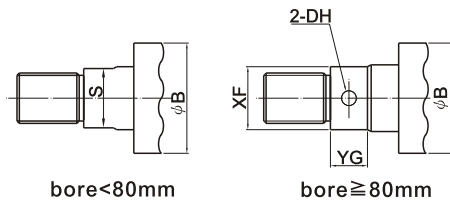
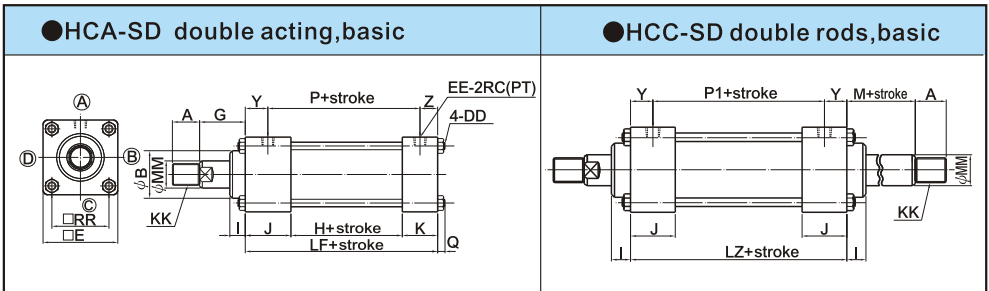
HC **A** - **70** - **H** - **FA** - **C** - **100** × **200** - **B** - **Y** - **25mm** - **A** - **B** - **1**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬

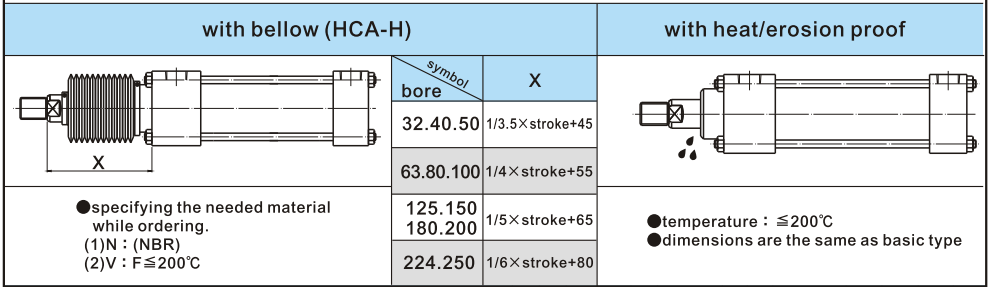
HC : HC Tie-rod cylinders

①	type	(1) A : double acting (2) C : double rods (3) D : double rods with stroke alignment
②	working pressure	(1)70 : 70kgf/cm ² (2)140 : 140kgf/cm ²
③	options	(1)H : with bellow (2)J : with heat/erosion proof (note : "space"if not be used)
④	mounting type	SD,FA,FB,CA,CB,LA,LB,TA,TC
⑤	rod size	(1)C : C class (2)B : B class note : 1.standard : HC-70+C class rod. 2.standard : HC-140+B class rod. 3.Please specify when HC-70+B class rod or HC-140+C class rod.
⑥	tube bore(mm)	32,40,50,63,80,100,125,150,180,200,224,250
⑦	stroke(mm)	max. stroke refer to P2.4
⑧	cushion	(1)space : no cushion (2)B : cushions on both ends (3)R : cushion on rod cover (4)H : cushion on head cover
⑨	connectors	(1)Y connector (2)I connector
⑩	stroke alignment	only forward alignment and aligned length ≤ stroke length
⑪	port position	refer to p2.5
⑫	cushion position	refer to p2.5
⑬	packing material	(1)1 : (PU)(standard usage) (2)2 : (NBR) (3)3 : (FPM)

External dimensions



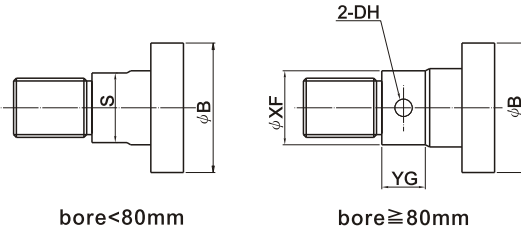
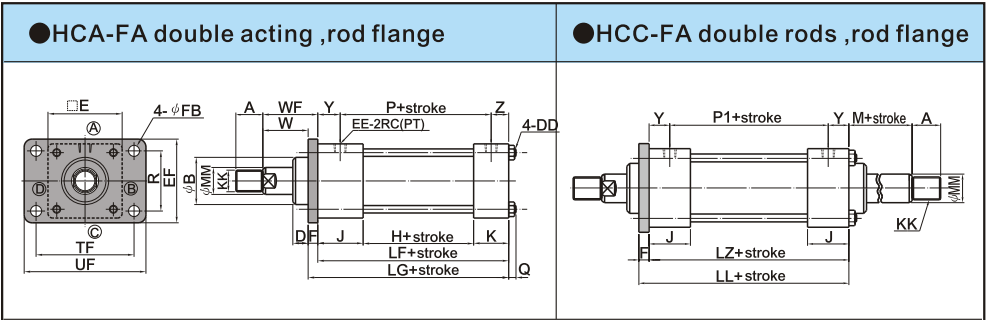
symbol bore	DH	XF	YG
80	$\phi 10$	79	20
85	$\phi 10$	84	20
90	$\phi 10$	89	20
100	$\phi 12$	99	24
112	$\phi 12$	111	24
125	$\phi 12$	124	24
140	$\phi 12$	139	24



symbol bore	bore C class			bore B class			B	E	G	H	I	J	K	M	P	P1	Q	S		Y	Z	DD	EE	LF	LZ	RR
	MM	KK	A	MM	KK	A												C	B							
32	16	M12×1.5	18	20	M16×1.5	25	35	55	41	50	25	36	26	30	80	84	10	14	17	19	14	M10×1.5	3/8	112	122	40
40	20	M16×1.5	25	25	M20×1.5	30	40	65	41	50	25	36	26	30	78	80	10	17	21	21	13	M10×1.5	3/8	112	122	45
50	25	M20×1.5	30	30	M24×1.5	35	46	75	44	58	28	42	34	33	88	88	10	21	27	27	19	M10×1.5	3/8	134	142	52
63	30	M24×1.5	35	35	M30×1.5	45	55	90	50	58	29	42	34	34	88	88	12	27	32	27	19	M12×1.5	1/2	134	142	63
80	35	M30×1.5	45	40	M36×1.5	55	65	110	53	62	32	46	40	37	98	98	15	32	37	28	22	M16×1.5	1/2	148	154	80
100	40	M36×1.5	60	56	M48×1.5	70	80	135	60	74	34	50	40	39	114	114	17	37	51	30	20	M18×1.5	3/4	164	174	102
125	56	M48×1.5	75	70	M64×2.0	90	95	165	69	83	41	58	48	46	123	123	20	50	65	38	28	M22×1.5	3/4	189	199	122
150	65	M60×2.0	85	85	M76×2.0	110	110	196	78	89	47	58	48	52	129	129	24	62	-	38	28	M26×1.5	3/4	195	205	148
180	80	M72×2.0	110	100	M95×2.0	130	125	220	88	95	56	68	58	61	151	151	26	-	-	40	30	M30×1.5	1	221	231	168
200	90	M80×2.0	120	112	M100×2.0	150	140	245	92	100	61	68	58	66	158	158	27	-	-	38	30	M33×1.5	1	226	236	190
224	100	M95×2.0	130	125	M120×2.0	170	150	292	101	105	68	68	58	78	161	161	34	-	-	40	30	M39×1.5	1 1/4	231	241	225
250	112	M100×2.0	140	140	M130×2.0	190	170	325	111	105	75	68	58	85	161	161	39	-	-	40	30	M42×1.5	1 1/4	231	241	250

External dimensions

Tie-rod hydraulic cylinders

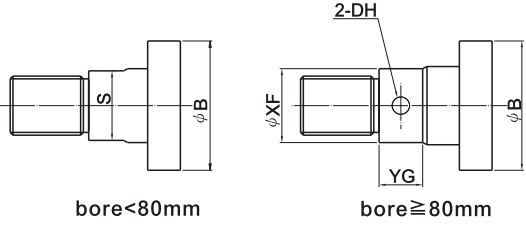
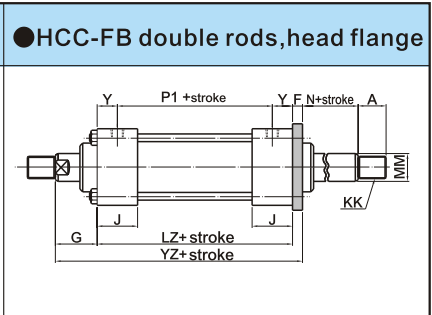
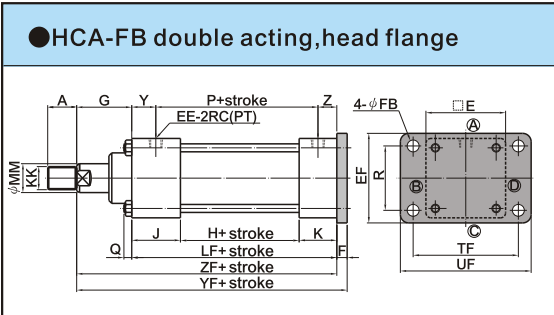


Symbol bore	DH	XF	YG
80	φ 10	79	20
85	φ 10	84	20
90	φ 10	89	20
100	φ 12	99	24
112	φ 12	111	24
125	φ 12	124	24
140	φ 12	139	24

Symbol bore	bore C class			bore B class			B	D		E	F		H	J	K	M	P	P1	Q	R
	MM	KK	A	MM	KK	A		C	B		C	B								
32	16	M12×P1.5	18	20	M16×P1.5	25	35	14	14	55	11	11	50	36	26	30	80	84	10	40
40	20	M16×P1.5	25	25	M20×P1.5	30	40	14	14	65	11	11	50	36	26	30	78	80	10	46
50	25	M20×P1.5	30	30	M24×P1.5	35	46	14	10	75	14	18	58	42	34	33	88	88	10	58
63	30	M24×P1.5	35	35	M30×P1.5	45	55	14	9	90	15	20	58	42	34	34	88	88	12	65
80	35	M30×P1.5	45	40	M36×P1.5	55	65	14	8	110	18	24	62	46	40	37	98	98	15	87
100	40	M36×P1.5	60	56	M48×P1.5	70	80	14	6	135	20	28	74	50	40	39	114	114	17	109
125	56	M48×P1.5	75	70	M64×P2.0	90	95	17	8	165	24	33	83	58	48	46	123	123	20	130
150	65	M60×P2.0	85	85	M76×P2.0	110	110	19	8	196	28	39	89	58	48	52	129	129	24	155
180	80	M72×P2.0	110	100	M95×P2.0	130	125	23	10	220	33	46	95	68	58	61	151	151	26	185
200	90	M80×P2.0	120	112	M100×P2.0	150	140	24	10	245	37	51	100	68	58	66	158	158	27	206
224	100	M95×P2.0	130	125	M120×P2.0	170	150	27	10	292	41	58	105	68	58	78	161	161	34	230
250	112	M100×P2.0	140	140	M130×P2.0	190	170	29	10	325	46	65	105	68	58	85	161	161	39	250

Symbol bore	S		W	Y	Z	DD	EE	EF	FB	LL		LG		LF	LZ	TF	UF	WF	
	C	B								C	B	C	B						
32	14	17	30	19	14	M10×P1.5	3/8	63	11	133	133	123	123	112	122	88	109	41	41
40	17	21	30	21	13	M10×P1.5	3/8	69	11	133	133	123	123	112	122	95	118	41	41
50	21	27	30	27	19	M10×P1.5	3/8	85	14	156	160	148	152	134	142	115	145	44	48
63	27	32	35	27	19	M12×P1.5	1/2	98	18	157	162	149	154	134	142	132	165	50	55
80	32	37	35	28	22	M16×P1.5	1/2	118	18	172	178	166	172	148	154	155	190	53	59
100	37	51	40	30	20	M18×P1.5	3/4	150	22	194	202	184	192	164	174	190	230	60	68
125	50	65	45	38	28	M22×P1.5	3/4	175	26	223	232	213	222	189	199	224	272	69	78
150	62	—	50	38	28	M26×P1.5	3/4	210	30	233	244	223	234	195	205	270	320	78	89
180	—	—	55	40	30	M30×P1.5	1	243	33	264	277	254	267	221	231	315	375	88	101
200	—	—	55	38	30	M33×P1.5	1	272	36	273	287	263	277	226	236	355	425	92	106
224	—	—	60	40	30	M39×P1.5	1 1/4	300	42	282	299	272	289	231	241	395	475	101	118
250	—	—	65	40	30	M42×P1.5	1 1/4	335	45	287	306	277	296	231	241	425	515	111	130

External dimensions



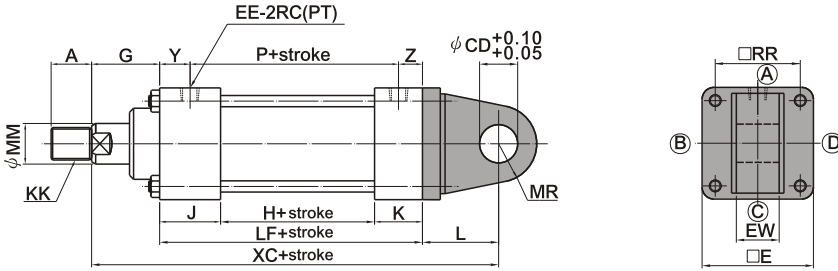
Symbol bore	DH	XF	YG
80	φ 10	79	20
85	φ 10	84	20
90	φ 10	89	20
100	φ 12	99	24
112	φ 12	111	24
125	φ 12	124	24
140	φ 12	139	24

Symbol bore	bore C class			bore B class			E	F		G	H	J	K	N		P	P1	Q	R
	MM	KK	A	MM	KK	A		C	B					C	B				
32	16	M12×P1.5	18	20	M16×P1.5	25	55	11	11	41	50	36	26	19	19	80	84	10	40
40	20	M16×P1.5	25	25	M20×P1.5	30	65	11	11	41	50	36	26	19	19	78	80	10	46
50	25	M20×P1.5	30	30	M24×P1.5	35	75	14	18	44	58	42	34	19	15	88	88	10	58
63	30	M24×P1.5	35	35	M30×P1.5	45	90	15	20	50	58	42	34	19	14	88	88	12	65
80	35	M30×P1.5	45	40	M36×P1.5	55	110	18	24	53	62	46	40	19	13	98	98	15	87
100	40	M36×P1.5	60	56	M48×P1.5	70	135	20	28	60	74	50	40	19	11	114	114	17	109
125	56	M48×P1.5	75	70	M64×P2.0	90	165	24	33	69	83	58	48	22	13	123	123	20	130
150	65	M60×P2.0	85	85	M76×P2.0	110	196	28	39	78	89	58	48	24	13	129	129	24	155
180	80	M72×P2.0	110	100	M95×P2.0	130	220	33	46	88	95	68	58	28	15	151	151	26	185
200	90	M80×P2.0	120	112	M100×P2.0	150	245	37	51	92	100	68	58	29	15	158	158	27	206
224	100	M95×P2.0	130	125	M120×P2.0	170	292	41	58	101	105	68	58	37	20	161	161	34	230
250	112	M100×P2.0	140	140	M130×P2.0	190	325	46	65	111	105	68	58	39	20	161	161	39	250

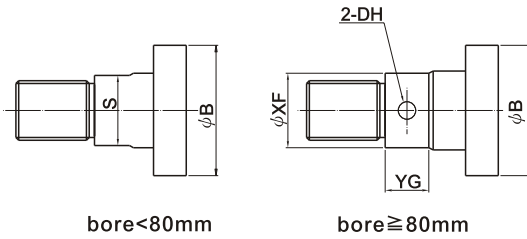
Symbol bore	S		Y	Z	EE	EF	FB	LF	LZ	TF	UF	YF		YZ		ZF
	C	B										C	B	C	B	
32	14	17	19	14	3/8	63	11	112	122	88	109	164	164	174	174	153
40	17	21	21	13	3/8	69	11	112	122	95	118	164	164	174	174	153
50	21	27	27	19	3/8	85	14	134	142	115	145	192	196	200	204	178
63	27	32	27	19	1/2	98	18	134	142	132	165	199	204	207	212	184
80	32	37	28	22	1/2	118	18	148	154	155	190	219	225	225	231	201
100	37	51	30	20	3/4	150	22	164	174	190	230	244	252	254	262	224
125	50	65	38	28	3/4	175	26	189	199	224	272	282	291	292	301	258
150	62	—	38	28	3/4	210	30	195	205	270	320	301	312	311	322	273
180	—	—	40	30	1	243	33	221	231	315	375	342	355	352	365	309
200	—	—	38	30	1	272	36	226	236	355	425	355	369	365	379	318
224	—	—	40	30	1 1/4	300	42	231	241	395	475	373	390	383	400	332
250	—	—	40	30	1 1/4	335	45	231	241	425	515	388	407	398	417	342

External dimensions

●HCA-CA double acting, clevis



EW tolerance : 1. $\phi 32 \sim \phi 100$ $:-0.10 \sim -0.40$
 2. $\phi 125 \sim \phi 280$ $:-0.1 \sim -0.60$

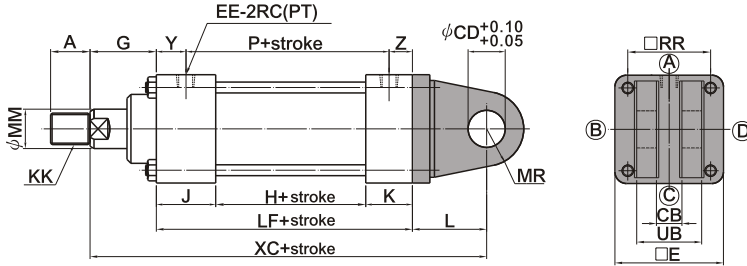


Symbol bore	DH	XF	YG
	80	$\phi 10$	79
85	$\phi 10$	84	20
90	$\phi 10$	89	20
100	$\phi 12$	99	24
112	$\phi 12$	111	24
125	$\phi 12$	124	24
140	$\phi 12$	139	24

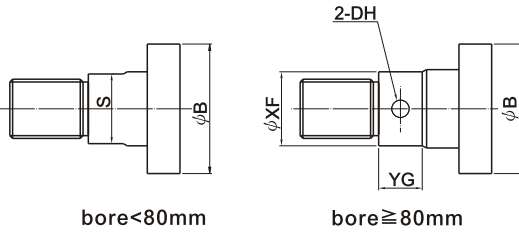
Symbol bore	bore C class			bore B class							S													
	MM	KK	A	MM	KK	A	E	G	H	J	K	L	P	C	B	Y	Z	CD	EE	EW	LF	MR	RR	XC
	32	16	M12×P1.5	18	20	M16×P1.5	25	55	41	50	36	26	38	80	14	17	19	14	16	3/8	25	112	16	40
40	20	M16×P1.5	25	25	M20×P1.5	30	65	41	50	36	26	38	78	17	21	21	13	16	3/8	25	112	16	45	191
50	25	M20×P1.5	30	30	M24×P1.5	35	75	44	58	42	34	45	88	21	27	27	19	20	3/8	31.5	134	20	52	223
63	30	M24×P1.5	35	35	M30×P1.5	45	90	50	58	42	34	63	88	27	32	27	19	31.5	1/2	40	134	31.5	63	247
80	35	M30×P1.5	45	40	M36×P1.5	55	110	53	62	46	40	72	98	32	37	28	22	31.5	1/2	40	148	31.5	80	273
100	40	M36×P1.5	60	56	M48×P1.5	70	135	60	74	50	40	84	114	37	51	30	20	40	3/4	50	164	40	102	308
125	56	M48×P1.5	75	70	M64×P2.0	90	165	69	83	58	48	100	123	50	65	38	28	50	3/4	63	189	50	122	358
150	65	M60×P2.0	85	85	M76×P2.0	110	196	78	89	58	48	122	129	62	—	38	28	63	3/4	80	195	63	148	395
180	80	M72×P2.0	110	100	M95×P2.0	130	220	88	95	68	58	150	151	—	—	40	30	80	1	100	221	80	168	459
200	90	M80×P2.0	120	112	M100×P2.0	150	245	92	100	68	58	170	158	—	—	38	30	90	1	125	226	90	190	488
224	100	M95×P2.0	130	125	M120×P2.0	170	292	101	105	68	58	185	161	—	—	40	30	100	1 1/4	125	231	100	225	517
250	112	M100×P2.0	140	140	M130×P2.0	190	325	111	105	68	58	185	161	—	—	40	30	100	1 1/4	125	231	100	250	527

External dimensions

●HCA-CB double acting, dual clevis



CB tolerance :
 1. φ 32~φ 125: +0.10~+0.40
 2. φ 150~φ 250: +0.10~+0.60



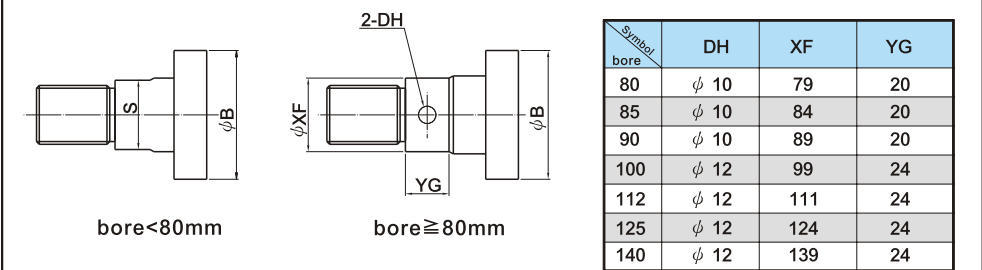
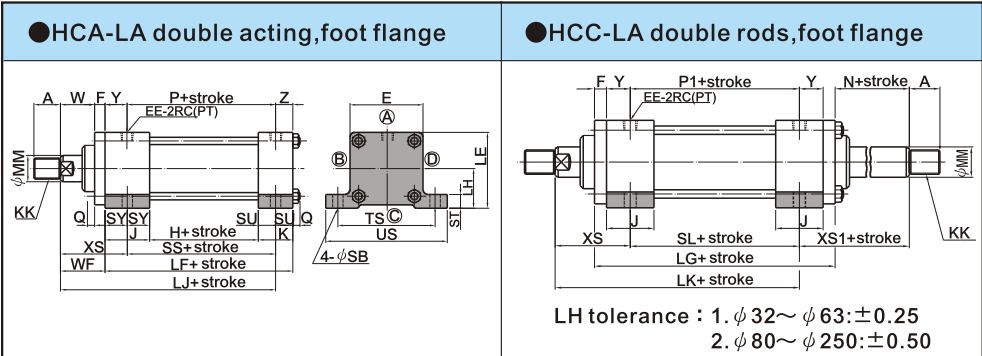
Symbol	DH	XF	YG
bore 80	φ 10	79	20
85	φ 10	84	20
90	φ 10	89	20
100	φ 12	99	24
112	φ 12	111	24
125	φ 12	124	24
140	φ 12	139	24

Symbol	bore C class			bore B class			E	G	H	J	K	L	P	S		Y	Z	CB	CD	EE	LF	MR	RR	UB	XC
	MM	KK	A	MM	KK	A								C	B										
32	16	M12×P1.5	18	20	M16×P1.5	25	55	41	50	36	26	38	80	14	17	19	14	25	16	3/8	112	16	40	50	191
40	20	M16×P1.5	25	25	M20×P1.5	30	65	41	50	36	26	38	78	17	21	21	13	25	16	3/8	112	16	45	50	191
50	25	M20×P1.5	30	30	M24×P1.5	35	75	44	58	42	34	45	88	21	27	27	19	31.5	20	3/8	134	20	52	63.5	223
63	30	M24×P1.5	35	35	M30×P1.5	45	90	50	58	42	34	63	88	27	32	27	19	40	31.5	1/2	134	31.5	63	80	247
80	35	M30×P1.5	45	40	M36×P1.5	55	110	53	62	46	40	72	98	32	37	28	22	40	31.5	1/2	148	31.5	80	80	273
100	40	M36×P1.5	60	56	M48×P1.5	70	135	60	74	50	40	84	114	37	51	30	20	50	40	3/4	164	40	102	100	308
125	56	M48×P1.5	75	70	M64×P2.0	90	165	69	83	58	48	100	123	50	65	38	28	63	50	3/4	189	50	122	126	358
150	65	M60×P2.0	85	85	M76×P2.0	110	196	78	89	58	48	122	129	62	—	38	28	80	63	3/4	195	63	148	160	395
180	80	M72×P2.0	110	100	M95×P2.0	130	220	88	95	68	58	150	151	—	—	40	30	100	80	1	221	80	168	200	459
200	90	M80×P2.0	120	112	M100×P2.0	150	245	92	100	68	58	170	158	—	—	38	30	125	90	1	226	90	190	225	488
224	100	M95×P2.0	130	125	M120×P2.0	170	292	101	105	68	58	185	161	—	—	40	30	125	100	1 1/4	231	100	225	251	517
250	112	M100×P2.0	140	140	M130×P2.0	190	325	111	105	68	58	185	161	—	—	40	30	125	100	1 1/4	231	100	250	251	527

Tie-rod hydraulic cylinders

External dimensions

Tie-rod hydraulic cylinders

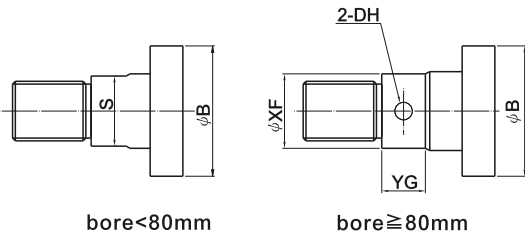
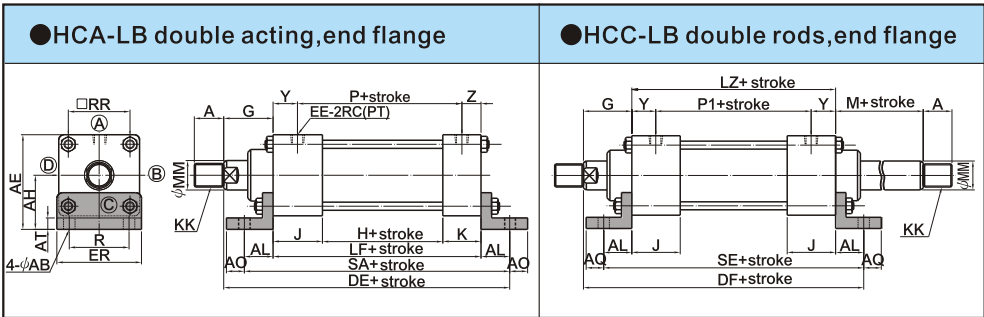


Symbol bore	bore C class			bore B class					E	F	H	J	K	N	P	P1	Q	S		
	MM	KK	A	MM	KK	A	C	B										17		
32	16	M12×P1.5	18	20	M16×P1.5	25	55	11	50	36	26	19	80	84	10	14	17			
40	20	M16×P1.5	25	25	M20×P1.5	30	65	11	50	36	26	19	78	80	10	17	21			
50	25	M20×P1.5	30	30	M24×P1.5	35	75	14	58	42	34	19	88	88	10	21	27			
63	30	M24×P1.5	35	35	M30×P1.5	45	90	15	58	42	34	19	88	88	12	27	32			
80	35	M30×P1.5	45	40	M36×P1.5	55	110	18	62	46	40	19	98	98	15	32	37			
100	40	M36×P1.5	60	56	M48×P1.5	70	135	20	74	50	40	19	114	114	17	37	51			
125	56	M48×P1.5	75	70	M64×P2.0	90	165	24	83	58	48	22	123	123	20	50	65			
150	65	M60×P2.0	85	85	M76×P2.0	110	196	28	89	58	48	24	129	129	24	62	—			
180	80	M72×P2.0	110	100	M95×P2.0	130	220	33	95	68	58	28	151	151	26	—	—			
200	90	M80×P2.0	120	112	M100×P2.0	150	245	37	100	68	58	29	158	158	27	—	—			
224	100	M95×P2.0	130	125	M120×P2.0	170	292	41	105	68	58	37	161	161	34	—	—			
250	112	M100×P2.0	140	140	M130×P2.0	190	325	46	105	68	58	39	161	161	39	—	—			

Symbol bore	Y	Z	EE	LE	LF	LG	LH	LK	LJ	SB	SL	SS	ST	SU	SY	TS	US	W	WF	XS	XS1
32	19	14	3/8	62.5	112	144	35	145	140	11	86	81	14	13	18	88	109	30	41	59	48
40	21	13	3/8	70	112	144	37.5	145	140	11	86	81	14	13	18	95	118	30	41	59	48
50	27	19	3/8	82.5	134	170	45	165	161	14	100	96	17	17	21	115	145	30	44	65	54
63	27	19	1/2	95	134	172	50	171	167	18	100	96	19	17	21	132	165	35	50	71	55
80	28	22	1/2	115	148	190	60	184	181	18	108	105	25	20	23	155	190	35	53	76	60
100	30	20	3/4	138.5	164	214	71	209	204	22	124	119	27	20	25	190	230	40	60	85	64
125	38	28	3/4	167.5	189	247	85	239	234	26	141	136	32	24	29	224	272	45	69	98	75
150	38	28	3/4	204	195	261	106	254	249	30	147	142	37	24	29	270	320	50	78	107	81
180	40	30	1	242.5	221	297	125	285	280	33	163	158	47	29	34	315	375	55	88	122	95
200	38	30	1	271	226	308	140	294	289	36	168	163	52	29	34	355	425	55	92	126	100
224	40	30	1 1/4	296	231	323	150	308	303	42	173	168	52	29	34	395	475	60	101	135	112
250	40	30	1 1/4	332.5	231	333	170	318	313	45	173	168	57	29	34	425	515	65	111	145	119

External dimensions

Tie-rod hydraulic cylinders



Symbol bore	DH	XF	YG
80	φ 10	79	20
85	φ 10	84	20
90	φ 10	89	20
100	φ 12	99	24
112	φ 12	111	24
125	φ 12	124	24
140	φ 12	139	24

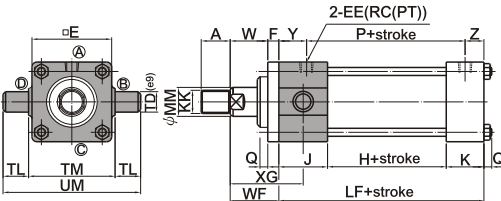
Symbol bore	bore C class			bore B class					ER	G	H	J	K	M	P	P1	R	S	
	MM	KK	A	MM	KK	A	C	B											
32	16	M12×P1.5	18	20	M16×P1.5	25	55	41	50	36	26	30	80	84	35	14	17		
40	20	M16×P1.5	25	25	M20×P1.5	30	65	41	50	36	26	30	78	80	45	17	21		
50	25	M20×P1.5	30	30	M24×P1.5	35	75	44	58	42	34	33	88	88	50	21	27		
63	30	M24×P1.5	35	35	M30×P1.5	45	90	50	58	42	34	34	88	88	58	27	32		
80	35	M30×P1.5	45	40	M36×P1.5	55	110	53	62	46	40	37	98	98	78	32	37		
100	40	M36×P1.5	60	56	M48×P1.5	70	135	60	74	50	40	39	114	114	96	37	51		
125	56	M48×P1.5	75	70	M64×P2.0	90	165	69	83	58	48	46	123	123	120	50	65		
150	65	M60×P2.0	85	85	M76×P2.0	110	196	78	89	58	48	52	129	129	146	62	—		
180	80	M72×P2.0	110	100	M95×P2.0	130	235	88	95	68	58	61	151	151	180	—	—		
200	90	M80×P2.0	120	112	M100×P2.0	150	262	92	100	68	58	66	158	158	200	—	—		
224	100	M95×P2.0	130	125	M120×P2.0	170	310	101	105	68	58	78	161	161	222	—	—		
250	112	M100×P2.0	140	140	M130×P2.0	190	335	111	105	68	58	85	161	161	250	—	—		

Symbol bore	Y	Z	AB	AE	AH	AL	AO	AT	DE	DF	RR	EE	LF	LZ	SA	SE
32	19	14	11	67.5	40	32	13	6	185	195	40	3/8	112	122	176	186
40	21	13	11	75.5	43	32	13	6	185	195	45	3/8	112	122	176	186
50	27	19	14	87.5	50	35	15	6	213	221	52	3/8	134	142	204	212
63	27	19	18	105	60	42	18	8	226	234	63	1/2	134	142	218	226
80	28	22	18	127	72	50	20	9	251	257	80	1/2	148	154	248	254
100	30	20	22	152.5	85	55	20	10	279	289	102	3/4	164	174	274	284
125	38	28	26	187.5	105	66	29	13	324	334	122	3/4	189	199	321	331
150	38	28	30	221	123	75	30	18	348	358	148	3/4	195	205	345	355
180	40	30	33	258	148	85	40	18	394	404	168	1	221	231	391	401
200	38	30	36	287.5	165	98	40	25	416	424	190	1	226	234	422	430
224	40	30	42	331	185	115	45	30	447	457	225	1 1/4	231	241	461	471
250	40	30	45	370.5	208	130	50	35	472	482	250	1 1/4	231	241	491	501

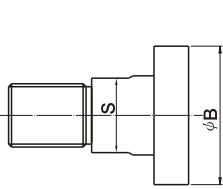
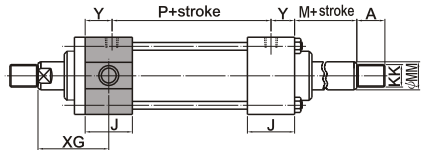
External dimensions

Tie-rod hydraulic cylinders

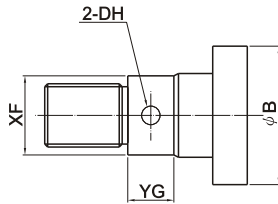
●HCA-TA double acting,rod trunnion



●HCC-TA double rods,rod trunnion



bore < 80mm



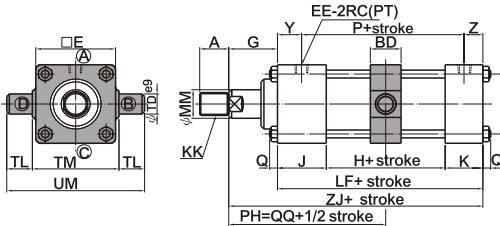
bore ≥ 80mm

Symbol bore	DH	XF	YG
80	φ 10	79	20
85	φ 10	84	20
90	φ 10	89	20
100	φ 12	99	24
112	φ 12	111	24
125	φ 12	124	24
140	φ 12	139	24

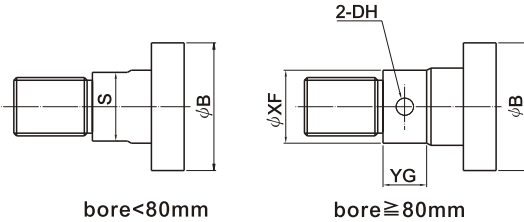
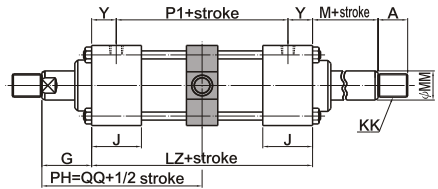
Symbol bore	bore C class				bore B class				E	F	H	J	K	M	P	P1	Q	S		W	Y	Z	EE	LF	TD	TL	TM	UM	XG
	MM	KK	A	MM	KK	A	C	B																					
	32	16	M12×P1.5	18	20	M16×P1.5	25	55	11	50	36	26	30	80	84	10	14	17	30	19	14	3/8	112	20	20	58 ^{-0.3} ₀	98	59	
40	20	M16×P1.5	25	25	M20×P1.5	30	65	11	50	36	26	30	78	80	10	17	21	30	21	13	3/8	112	20	20	69 ^{-0.3} ₀	109	59		
50	25	M20×P1.5	30	30	M24×P1.5	35	75	14	58	42	34	33	88	88	10	21	27	30	27	19	3/8	134	25	25	85 ^{-0.35} ₀	135	65		
63	30	M24×P1.5	35	35	M30×P1.5	45	90	15	58	42	34	34	88	88	12	27	32	35	27	19	1/2	134	31.5	31.5	98 ^{-0.35} ₀	161	71		
80	35	M30×P1.5	45	40	M36×P1.5	55	110	18	62	46	40	37	98	98	15	32	37	35	28	22	1/2	148	31.5	31.5	118 ^{-0.35} ₀	181	76		
100	40	M36×P1.5	60	56	M48×P1.5	70	135	20	74	50	40	39	114	114	17	37	51	40	30	20	3/4	164	40	40	145 ^{-0.40} ₀	225	85		
125	56	M48×P1.5	75	70	M64×P2.0	90	165	24	83	58	48	46	123	123	20	50	65	45	38	28	3/4	189	50	50	175 ^{-0.40} ₀	275	98		
150	65	M60×P2.0	85	85	M76×P2.0	110	196	28	89	58	48	52	129	129	24	62	—	50	38	28	3/4	195	63	63	206 ^{-0.46} ₀	332	107		

External dimensions

●HCA-TC double acting, mid. trunnion



●HCC-TC double rods, mid. trunnion



Symbol bore	DH	XF	YG
80	φ 10	79	20
85	φ 10	84	20
90	φ 10	89	20
100	φ 12	99	24
112	φ 12	111	24
125	φ 12	124	24
140	φ 12	139	24

Symbol bore	bore C class			bore B class			E	G	H	J	K	M	P	P1
	MM	KK	A	MM	KK	A								
32	16	M12×P1.5	18	20	M16×P1.5	25	55	41	50	36	26	30	80	84
40	20	M16×P1.5	25	25	M20×P1.5	30	65	41	50	36	26	30	78	80
50	25	M20×P1.5	30	30	M24×P1.5	35	75	44	58	42	34	33	88	88
63	30	M24×P1.5	35	35	M30×P1.5	45	90	50	58	42	34	34	88	88
80	35	M30×P1.5	45	40	M36×P1.5	55	110	53	62	46	40	37	98	98
100	40	M36×P1.5	60	56	M48×P1.5	70	135	60	74	50	40	39	114	114
125	56	M48×P1.5	75	70	M64×P2.0	90	165	69	83	58	48	46	123	123
150	65	M60×P2.0	85	85	M76×P2.0	110	196	78	89	58	48	52	129	129
180	80	M72×P2.0	110	100	M95×P2.0	130	220	88	95	68	58	61	151	151
200	90	M80×P2.0	120	112	M100×P2.0	150	245	92	100	68	58	66	158	158
224	100	M95×P2.0	130	125	M120×P2.0	170	292	101	105	68	58	78	161	161
250	112	M100×P2.0	140	140	M130×P2.0	190	325	111	105	68	58	85	161	161

Symbol bore	Q	S		Y	Z	BD	EE	LF	LZ	QQ	TD	TL	TM	UM	ZJ
		C	B												
32	10	14	17	19	14	28	3/8	112	122	102	20	20	58 ^{0.3}	98	153
40	10	17	21	21	13	28	3/8	112	122	102	20	20	69 ^{0.3}	109	153
50	10	21	27	27	19	33	3/8	134	142	115	25	25	85 ^{0.35}	135	178
63	12	27	32	27	19	43	1/2	134	142	121	31.5	31.5	98 ^{0.35}	161	184
80	15	32	37	28	22	43	1/2	148	154	130	31.5	31.5	118 ^{0.35}	181	201
100	17	37	51	30	20	53	3/4	164	174	147	40	40	145 ^{0.40}	225	224
125	20	50	65	38	28	58	3/4	189	199	168.5	50	50	175 ^{0.40}	275	258
150	24	62	—	38	28	78	3/4	195	205	180.5	63	63	206 ^{0.46}	332	273
180	26	—	—	40	30	98	1	221	231	203.5	80	80	243 ^{0.46}	403	309
200	27	—	—	38	30	108	1	226	236	210	90	90	272 ^{0.52}	452	318
224	34	—	—	40	30	117	1 1/4	231	241	221.5	100	100	308 ^{0.52}	500	332
250	39	—	—	40	30	117	1 1/4	231	241	231.5	100	100	335 ^{0.57}	535	342