Industrial Hydraulics | Electric Drives and Controls | Linear Motion and Assembly Technologies | Pneumatics | Service Automation | Mobile Hydraulics

Rexroth
Bosch Group

Cylinder Catalog

The Drive & Control Company

Rexroth
Bosch Group

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RA 17 000/08.05

The Drive & Control Company

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Section 1

CDT1-CDT4 Series
NFPA Hydraulic Cylinders

The Drive & Control Company

Rexroth NFPA Hydraulic Cylinders

Technical Data

Standards:	Meets or exceeds JIC and NFPA Standards
Nominal Pressure:	up to 1,500 psi for CDT1 (see chart) up to 3,000 psi for CDT4
Bore Diameter:	1" to 8" diameter
Piston Rod Diameter:	1/2" to 5-1/2" for CDT1 5/8" to 5-1/2" for CDT4
Mounting:	18 standard NFPA mountings
Stroke:	up to 120"
Connection Port:	SAE straight thread standard (ISO 11926-1) other options on request
Hydraulic Fluid:	Mineral oil (HL, HLP) Phosphate Ester (HFD-R, HFA) Water glycol (HFC)
Fluid Temp. Range:	-4°F up to 176°F standard
Stroke Velocity:	up to 20 in/s (consult factory for higher velocity applications)
Further Information:	RA 17 038 for CDT1 Series RA 17 041 for CDT4 Series

Pressure Ratings

CDT1

Cyl. Bore	Std. Rod	Max. PSI Max. Duty Severe Service
1	1/2	1,500†
1-1/2	1	1,500†
2	1	1,500†
2-1/2	1	1,500* †
3-1/4	1	1,500†
4	1-3/8	1,000
5	1-3/4	750
6	1-3/4	750
8	2	500

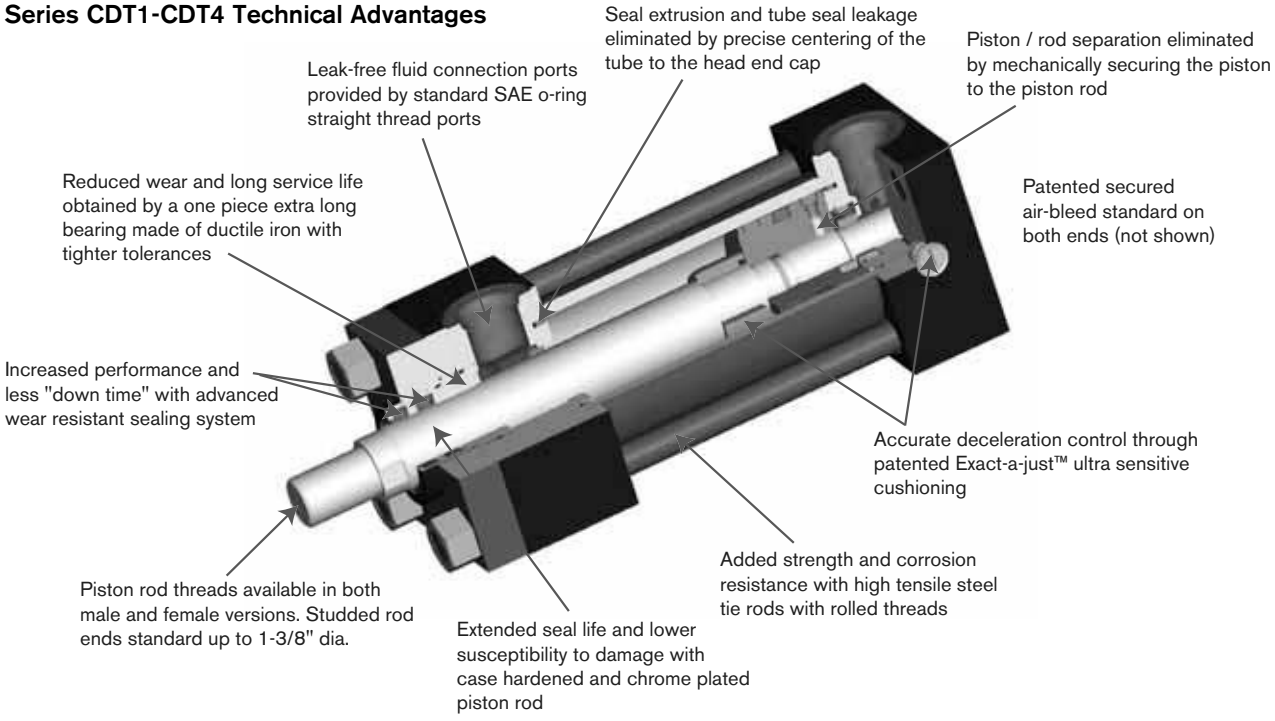
* With 5/8" rod, 1,000 psi
† MF1 & MF2 max. operating pressure 1,000 psi

CDT4

Cyl. Bore	Std. Rod	Nominal	Non-Shock**
1-1/2	5/8	3,000	5,000
2	1		
2-1/2	1		
3-1/4	1-3/8		
4	1-3/4		
5	2		
6	2-1/2		
7	3		
8	3-1/2		

** See data sheet RA 17 041 for exceptions to 5,000 psi ratings

Series CDT1-CDT4 Technical Advantages



Rexroth Hydraulic Cylinders offer Optimum Reliability for all Applications

Cylinder Series	Rexroth Catalogs	Iron & Steel Industry			Foundry Machinery			Machine Tool Automotive			Presses		
		Coiler	Trimming	Walking Beam	Segment	Level Adjust	Pusher	Feed	Clamping	Transfer	Eject	Cushion	Traverse
Tie Rod													
CDT1	RA 17 038							X	X	X			
CDT3	RA 17 032							X	X	X			
CDT4	RA 17 041							X	X	X	X	X	X
Mill Type													
CDL1	RA 17 325									X			
CDM1	RA 17 328		X				X				X		
CDH2	RA 17 334	X	X	X	X	X	X						

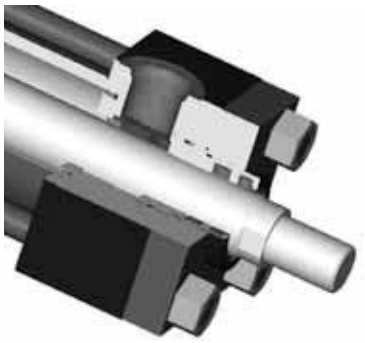
Cylinder Series	Rexroth Catalogs	Plastics Machinery			Civil Engineering			Material Handling			Wood and Paper Industry		
		Injection	Nozzle	Ejection	Bridge Lift	Butterfly Valve	Gate	Ship Unloading	Mining Equipment	Container Cranes	Infeed	Conveyor	Cutter
Tie Rod													
CDT1	RA 17 038		X										
CDT3	RA 17 032												
CDT4	RA 17 041	X		X	X	X		X			X	X	X
Mill Type													
CDL1	RA 17 325					X							
CDM1	RA 17 328												
CDH2	RA 17 334				X		X	X	X	X			

Cylinder Differential Tie Rod Series CDT1/CDT4

Rexroth Hydraulic Cylinders Provide Important Advantages to Meet Your Demanding Needs

Removable Rod Bearing

- One piece extra long rod bearing made of ductile iron offers extended life when compared to bronze
- Reduced guide clearance provides uniform load distribution
- Easily removable for maintenance and service without special tools
- Spiral groove in the rod bearing keeps the bearing lubricated and also automatically compensates for pressure changes



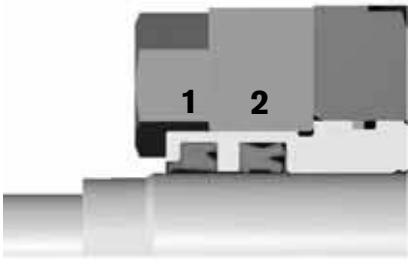
Cylinder Head with Removable Rod Bearing

Cylinder Differential Tie Rod Series CDT1/CDT4

Sealing System

- "M" Polyurethane seal system (standard)
- "T"* Seal system for low friction applications (available)
- "F"* Standard seal system for HFC (water glycol) (available)
- "V"* Seal system for (phosphate ester) (available)

* - *not recommended for load holding applications.*



1 Double lip wiper
2 U-cup rod seal

3 Double acting piston seal
4 Wear bands
5 Mechanically secured piston assembly

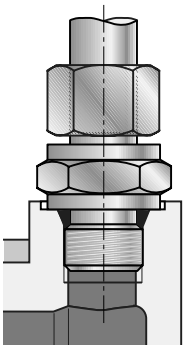
Cushioning System (optional)

- Patented Exact-a-just™ cushioning provides accurate micrometer adjustment
- Exact-a-just™ cushioning permits adjustment over a wide range of settings for faster cycle times
- Results in reduced maintenance costs, reduced internal and external shock, and softer cushioning stops
- May be supplied at head, cap, or both ends

Exact-a-just™ cushioning

Connection Port

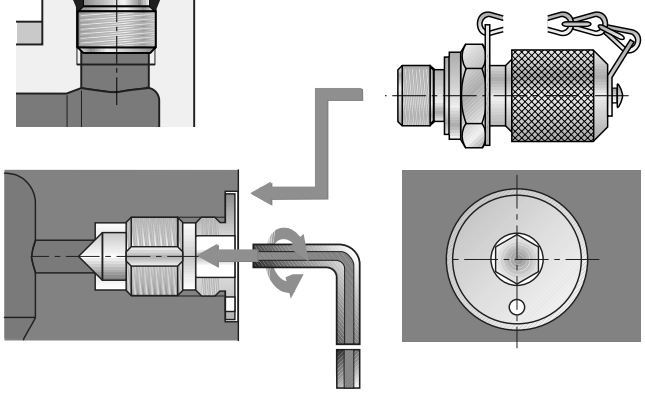
- ISO 11926-1 SAE straight thread (standard)
- For other port options consult factory



Secured Air Bleed (standard)

- To provide safety and prevent accidents, patented air bleed is secured against unscrewing (standard)
- Air bleed ports can become an alternate connection for a pressure test fitting (optional)

Alternate pressure test fitting



Rexroth Worldwide Cylinder Manufacturing Facilities

Provide International Support and Product Knowledge on a Global Basis

Bosch Rexroth AG
Lohr, Germany
Hydraulic Mill Type, Special Application Cylinders

Bosch Rexroth Technik AB
Stockholm, Sweden
Hydraulic Mill Type, ISO Tie Rod Cylinders

Bosch Rexroth BV
Boxtel, Netherland
Large Size Ceramax ABS Cylinders

Bosch Rexroth Corporation
Bethlehem, PA
Hydraulic NFPA, ISO Tie Rod Cylinders

Bosch Rexroth AG
Bonneville, France
Hydraulic ISO Tie Rod Cylinders, Pneumatic Cylinders

Bosch Rexroth Corporation
Lexington, KY
Pneumatic Cylinders

Rexroth
Bosch Group

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RA 17 036/11.02

Printed in the United States

Section 2

Hydraulic Cylinder NFPA Industrial Type

RA 17 038/07.05 **1**/44
Replaces: 02.04

Model CDT1/CGT1

Series 1X
Nominal pressure: Up to 1,500 psi maximum

Contents

Features

- Duty, up to 1,500 psi (see chart on page 2)
- Standards, meets or exceeds all JIC and NFPA requirements
- Bore Sizes, 1” - 8”
- Piston Rods, 1/2" - 5-1/2”
- Mountings,18 standard NFPA mountings
- Ports, SAE o-ring straight thread ports
- Stroke, standard strokes furnished in 1/8” increments. Normal stroke tolerance + 1/16” / -0”. Closer stroke tolerances available; consult factory.
- Rod End Threads, standard KK1 male and female threads plus KK2 oversize male thread. Other rod end styles optional.
- Cushions, available for all bore sizes, at either or both ends.

Technical Data (for applications outside these parameters, please consult factory)

Standards:

Meets or exceeds all JIC and NFPA requirements.

Nominal pressure: up to 1,500 psi

With extreme shock loads the mounting styles and piston rod threads have to be considered, taking the fatigue limits into account.

Maximum operating pressure up to: 1,500 psi

Installation position: Various

Pressure fluid:

Mineral oils (HL, HLP)
Phosphate ester (HFD-R) (–4°F to 300°F)
HFA (41°F to 131°F)
Water glycol HFC (–4°F to 140°F)

Hydraulic fluid temperature range: (-4°F to 176°F)

Viscosity range: 32 to 1760 ssu

Degree of contamination:

Max. permissible degree of contamination of the pressure fluid is to NAS 1638 class 10.

We therefore recommend a filter with a minium retention rate of $\beta_{10} \geq 75$.

Stroke speed: 20 in/sec

(dependent on the connection port)

Air bleed standard: Secured against removal

2" - 8" bore sizes only

Acceptance:

Each cylinder is tested to Bosch Rexroth standards.

Cylinders, outside the above parameters are also available. Consult factory

For applications above 230°F specify a non studded piston rod end and advise operating temperature before ordering.

Operating Pressures (PSI) by Cylinder Bore Sizes*

Cylinder Bore Ø (inches)	Standard Rod Ø (inches)	Max. psi (max duty servere service)
1	1/2	1,500
1-1/2	1	1,500
2	1	1,500
2-1/2	1	1,500
3-1/4	1	1,500
4	1-3/8	1,000
5	1-3/4	750
6	1-3/4	750
8	2	500

*1) For double rod cylinders, see page 26.

*2) Exceptions to 1,500 psi rating:

a) MF1 and MF2 have maximum operating pressures of 1,000 psi for 1" through 4" bore sizes

b) A 2.5" bore with a 5/8" rod has a maximum pressure rating of 1,000 psi

3) Consult factory for other pressure ratings than shown above.

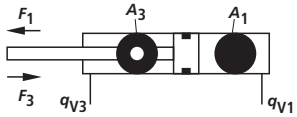
Approximate Uncrated CDT1 Hydraulic Cylinder Weights (lbs.)*

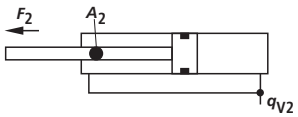
Cylinder Bore	1	1.5	2	2.5	3.25	4	5	6	8
Zero Stroke	3	5	7	12	20	30	45	70	100
Add Per Inch of Stroke	.2	.3	.4	.6	.8	.9	1.0	1.5	2.0

* Weights based on standard (first) rod sizes. Add 10% to cover additional weight for crating.

Areas, Forces, Flows (dimensions in inches)

Bore	Piston rod	Area ratio	Areas			Force at 500 psi [1]			Flow at 4"/s [2]		
			Piston	Rod	Annulus	Push	Regen.	Pull	Out	Regen.	In
		j	A_1	A_2	A_3	F_1	F_2	F_3	q_{V1}	q_{V2}	q_{V3}
Ø in.	Ø in.	A_1/A_3	in.^{2}	in.^{2}	in.^{2}	Lb.	Lb.	Lb.	gpm	gpm	gpm
1.000	0.500	0.31	0.79	0.20	0.59	392	98	294	0.82	0.20	0.62
	0.625	1.65		0.31	0.48		154	238		0.32	0.50
1.500	0.625	1.21	1.77	0.31	1.46	885	154	731	1.84	0.32	1.52
	1.000	1.80		0.79	0.98		392	493		0.82	1.02
	0.625	1.11		0.31	2.83		154	1,416		0.32	2.94
2.000	1.000	1.33	3.14	0.79	2.35	1,570	392	1,178	3.26	0.82	2.44
	1.375	1.89		1.48	1.66		745	825		1.54	1.72
	0.625	1.07		0.31	4.60		154	2,301		0.32	4.78
2.500	1.000	1.19	4.91	0.79	4.12	2,455	392	2,063	5.10	0.82	4.28
	1.375	1.43		1.48	3.43		745	1,710		1.54	3.56
	1.750	1.96		2.40	2.51		1,205	1,250		2.49	2.61
	1.000	1.11		0.79	7.51		392	3,758		0.82	7.80
3.250	1.375	1.21	8.30	1.48	6.82	4,150	745	3,405	8.62	1.54	7.08
	1.750	1.40		2.40	5.90		1,205	2,945		2.49	6.13
	2.000	1.60		3.14	5.16		1,570	2,580		3.26	5.36
	1.000	1.07		0.79	11.78		392	5,893		0.82	12.23
	1.375	1.13		1.48	11.09		745	5,540		1.54	11.51
4.000	1.750	1.24	12.57	2.40	10.17	6,285	1,205	5,080	13.05	2.49	10.56
	2.000	1.33		3.14	9.43		1,570	4,715		3.26	9.79
	2.500	1.64		4.91	7.66		2,455	3,830		5.10	7.95
	1.000	1.04		0.79	18.85		392	9,428		0.82	19.58
	1.375	1.08		1.48	18.16		745	9,075		1.54	18.86
	1.750	1.13		2.40	17.24		1,205	8,615		2.49	17.91
5.000	2.000	1.19	19.64	3.14	16.50	9,820	1,570	8,250	20.40	3.26	17.14
	2.500	1.33		4.91	14.73		2,455	7,365		5.10	15.30
	3.000	1.56		7.07	12.57		3,535	6,285		7.35	13.05
	3.500	1.96		9.62	10.02		4,810	5,010		9.99	10.41
	1.375	1.06		1.48	26.77		745	13,390		1.54	27.81
	1.750	1.09		2.40	25.85		1,205	12,930		2.49	26.86
	2.000	1.13		3.14	25.11		1,570	12,565		3.26	26.09
6.000	2.500	1.21	28.25	4.91	23.34	14,135	2,455	11,680	29.35	5.10	24.25
	3.000	1.33		7.07	21.18		3,535	10,600		7.35	22.00
	3.500	1.51		9.62	18.63		4,810	9,325		9.99	19.36
	4.000	1.80		12.57	15.68		6,285	7,850		13.05	16.30
	1.375	1.03		1.48	48.79		745	24,390		1.54	50.68
	1.750	1.05		2.40	47.87		1,205	23,930		2.49	49.73
	2.000	1.06		3.14	47.13		1,570	23,565		3.26	48.96
	2.500	1.11		4.91	45.36		2,455	22,680		5.10	47.12
8.000	3.000	1.16	50.27	7.07	43.20	25,135	3,535	21,600	52.22	7.35	44.87
	3.500	1.23		9.62	40.65		4,810	20,325		9.99	42.23
	4.000	1.33		12.57	37.70		6,285	18,850		13.05	39.17
	4.500	1.49		15.91	34.36		7,950	17,185		16.53	35.69
	5.000	1.64		19.63	30.64		9,820	15,315		20.39	31.83
	5.500	1.89		23.76	26.51		11,880	13,255		24.68	27.54





Note

[1] Theoretical force (efficiency not taken into account)
[2] Stroke velocity

Stroke Tolerances

Stroke tolerances result from the cylinder head, cylinder base, cylinder tube, piston and piston rod. The stroke tolerance for all piston diameters and stroke lengths is +1/16" / -0". Tighter stroke tolerances can be requested, however, details regarding the operating pressure and operating temperature must be stated.

Stroke lengths	Stroke tolerances
≤ 120" (refer to pg. 40 for buckling loads)	+1/16" / -0"

Ordering Details

	T1	/	/	/	Z	1X/									*

Single rod cylinder = **CD**
Double rod cylinder = **CG**

Series = **T1**

Mounting types
Rectangular flange at head = **MF1**
Rectangular flange at cap = **MF2**
Square flange at head = **MF5**
Square flange at cap = **MF6**
Clevis mounting = **MP1**
Fixed pivot = **MP3**
Pivot Mount w/spherical bearing = **MP5**
Side lug = **MS2**
Centerline lugs mountings = **MS3**
Side tapped = **MS4**
End lugs = **MS7**
Trunnion at head = **MT1**
Trunnion at cap = **MT2**
Trunnion at intermediate position [3] = **MT4**
Basic version = **MX0**
Extended tie rods, both ends = **MX1**
Extended tie rods, at cap = **MX2**
Extended tie rods, at head = **MX3**

Bore Dia. Ø 1.00 to 8.00 inch

Piston rod Ø 0.50 to 5.50 inch

Stroke length in inches (ex. 12.00)

Design principle
Head and cap connected by tie rods = **Z**

Series
10 to 19 unchanged installation and connection dimensions = **1X**

Port connections/ types
SAE straight thread port (ISO 11926-1) = **S**
Special (specify) = **X**

Further details in clear text

Option 2
W = Without options
K = Thrust key
S = Stop tube (specify length)
Y = Additional piston rod ext.
state length in inches in clear text

Option 1
W = Without options
E = Proximity switch, both ends [4]
A = Test point, both sides [5]

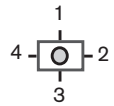
Seal version
Suitable for mineral oil to DIN 51 524 HL, HLP and HFA
M = Polyurethane seal system
T* = Servo quality/reduced friction
F* = BUNA-N seal system for HFC
Suitable for phosphate ester HFD-R
V* = Flourocarbon seal system

End position cushioning [6]
U = Without
D = Both sides, adjustable
S = Rod side, adjustable
K = Cap side, adjustable

Piston rod end [2]
H = Small male thread KK1
D = Intermediate male thread KK2
E = Female thread KK1
T = S.A.F.E., rod end
X = Special (specify)

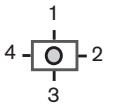
Piston rod version
H = Case hardened and hard chromium plated [1]
S = 17-4 PH stainless steel

Port connection / location at cap
1 =
2 =
3 =
4 =



Viewed on piston rod

Port connection / location at head
1 =
2 =
3 =
4 =



Viewed on piston rod

Remarks:

[1] Only 5/8" to 4" diameter piston rods are case hardened and hard chrome plated. Above 4" diameter piston rods are chrome plated only.

[2] With extreme shock loads the piston rod threads have to be selected, taking the fatigue limits into account. Rod end clevis, installed parts, etc. must always be firmly clamped against the piston rod shoulder.

[3] State XV dimensions in inches in clear text.

[4] Not available on 1"-2-1/2" bore size.

[5] See page 33 for exceptions.

[6] Fixed cushions on all 1" and 1-1/2" bore sizes both ends.
Fixed cushions on 2" bore / 1-3/8" rod, 2-1/2" bore / 1-3/4" rod and 3-1/4" bore / 2" rod sizes both ends

* Not recommended for load holding applications. Consult factory for load holding options.

Sealing System

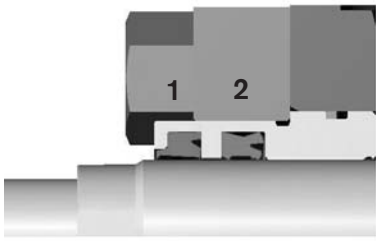
"M" Polyurethane seal system (standard)

"T"* Seal system for low friction applications (available)

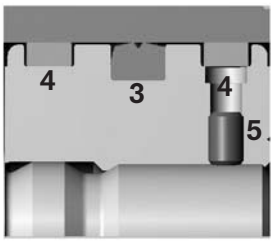
"F"* Standard seal system for HFC (water glycol) (available)

"V"* Seal system for (phosphate ester) (available)

* - Not recommended for load holding applications. Consult factory for load holding options.



1. Double lip wiper
2. U-cup rod seal



3. Double acting piston seal
4. Wear bands
5. Piston threaded and sealed to piston rod with permanent adhesive and mechanically secured with a set screw.

Cushioning System (optional) *

Patented Exact-a-just™ cushioning provides accurate micro-meter adjustment

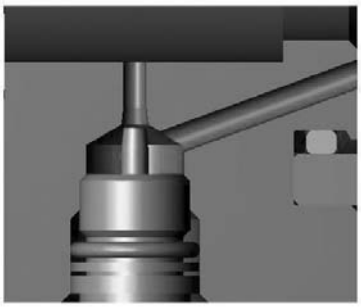
Exact-a-just™ cushioning permits adjustment over a wide range of settings for faster cycle times

Results in reduced maintenance costs, reduced internal and external shock, and softer cushioning stops

May be supplied at head, cap, or both ends

* Fixed cushions on all 1" and 1-1/2" bore sizes both ends.

Fixed cushions on 2" bore / 1-3/8" rod, 2-1/2" bore / 1-3/4" rod and 3-1/4" bore / 2" rod sizes both ends



Exact-a-just™ cushioning

Connection Port and Secured Air Bleed (standard)

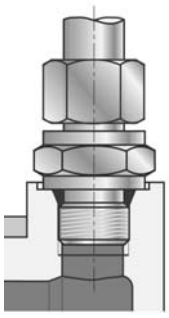
ISO 11926-1 SAE straight thread (standard)

For other port options consult factory

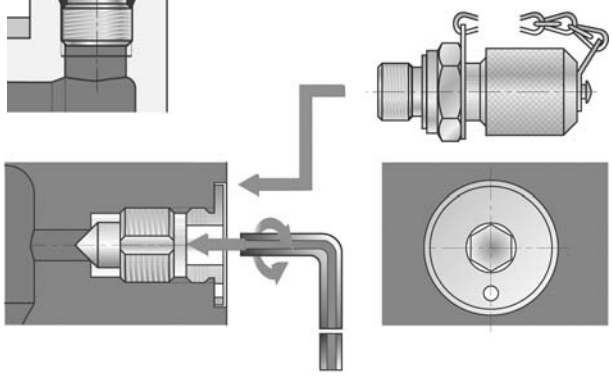
To provide safety and prevent accidents, patented air bleed is secured against unscrewing (standard on 2" - 8" bore sizes, not available on 1" - 1-1/2" bore sizes)

Air bleed ports can become an alternate connection for a pressure test fitting (optional) (not available on 1" - 1-1/2" bore sizes)

Also not available on head end of 2" bore / 1-3/8" rod and 2-1/2" bore / 1-3/4" rod sizes



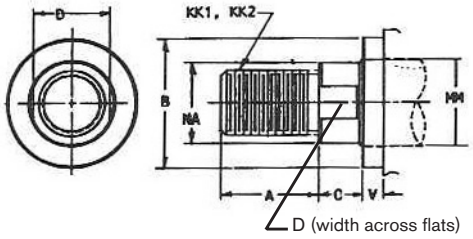
Alternate pressure test fitting



Piston Rod Versions

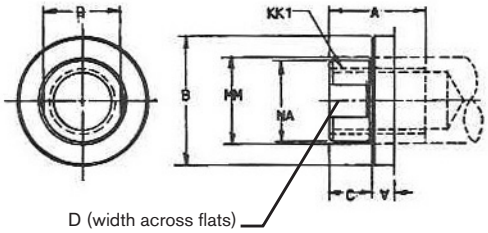
Male Rod End

Option H & D



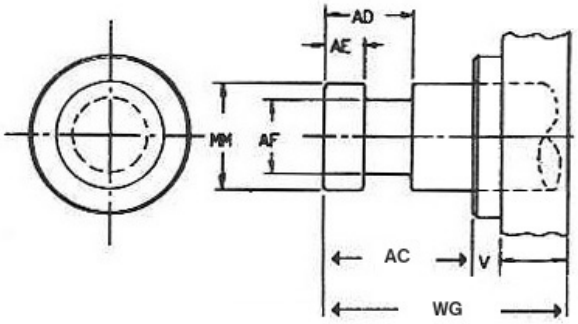
Female Rod End

Option E



S.A.F.E. Rod End

Option T



Rod Thread Options:

Standard KK1 Male furnished when not specified.

Male thread available in KK1 and KK2 thread sizes.

KK1 studded male rod end standard for 5/8", 1" & 1-3/8" rod dia.

Female thread available in KK1 thread size only.

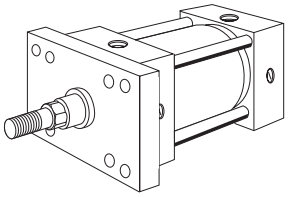
Piston Rod End

MM Rod Diameter	A	B +0.000 -0.002	C	D	KK1	KK2	NA	AC	AD	AE	AF	WG
0.500	0.63	0.99	0.38	0.38	5/16 - 24	7/16 - 20	0.44	-	-	-	-	-
0.625	0.75	1.124	0.38	0.50	7/16 - 20	1/2 - 20	0.56	1.13	0.63	0.250	0.375	1.75
1.000	1.13	1.499	0.50	0.88	3/4 - 16	7/8 - 14	0.94	1.63	0.94	0.375	0.688	2.38
1.375	1.63	1.999	0.63	1.13	1 - 14	1-1/4 - 12	1.31	1.75	1.06	0.375	0.875	2.75
1.750	2.00	2.374	0.75	1.50	1-1/4 - 12	1-1/2 - 12	1.69	2.00	1.31	0.500	1.125	3.13
2.000	2.25	2.624	0.88	1.69	1-1/2 - 12	1-3/4 - 12	1.94	2.63	1.69	0.625	1.375	3.75
2.500	3.00	3.124	1.00	2.06	1-7/8 - 12	2-1/4 - 12	2.38	3.25	1.94	0.750	1.750	4.50
3.000	3.50	3.749	1.00	2.63	2-1/4 - 12	2-3/4 - 12	2.88	3.63	2.44	0.875	2.250	4.88
3.500	3.50	4.249	1.00	3.00	2-1/2 - 12	3-1/4 - 12	3.38	4.38	2.69	1.000	2.500	5.63
4.000	4.00	4.749	1.00	3.38	3 -12	3-3/4 - 12	3.88	4.50	2.69	1.000	3.000	5.75
4.500	4.50	5.249	1.00	SH1*	3-14 - 12	4-1/4 - 12	4.38	5.25	3.19	1.500	3.500	6.50
5.000	5.00	5.749	1.00	SH1*	3-1/2 - 12	4-3/4 - 12	4.88	5.38	3.19	1.500	3.875	6.63
5.500	5.50	6.249	1.00	SH1*	4 - 12	5-1/4 - 12	5.38	6.25	3.94	1.875	4.375	7.50

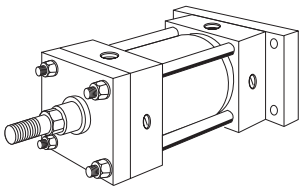
Note*: Spanner wrench holes: SH1 = 0.56" dia. For "F and V" dimensions, see respective mounting dimensions shown on pages 8 thru 27.

Mounting Type Overview

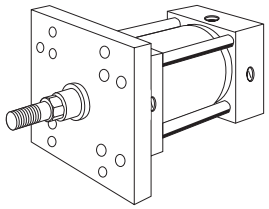
MF1 (see Page 8, 9)



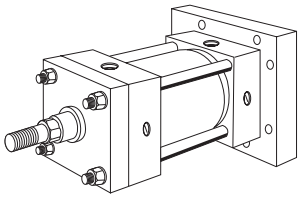
MF2 (see Page 8, 9)



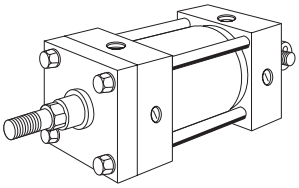
MF5 (see Page 8, 9)



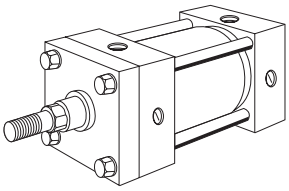
MF6 (see Page 8, 9)



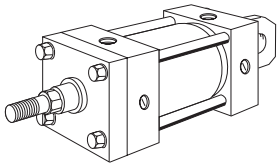
MP1 (see Page 10, 11)



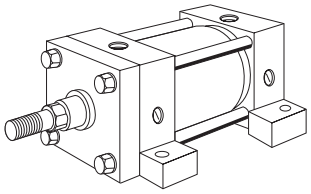
MP3 (see Page 10, 11)



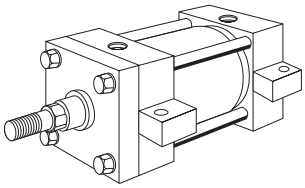
MP5 (see Page 12, 13)



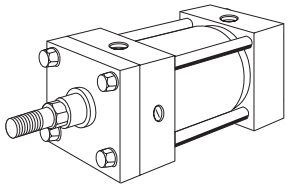
MS2 (see Page 14, 15)



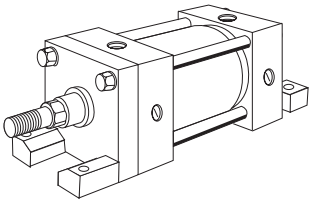
MS3 (see Page 16, 17)



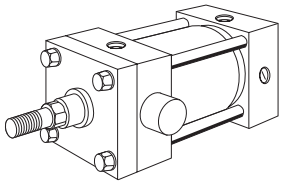
MS4 (see Page 14, 15)



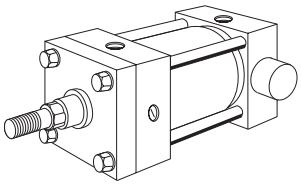
MS7 (see Page 16, 17)



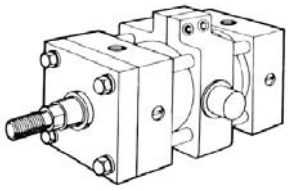
MT1 (see Page 18, 19)



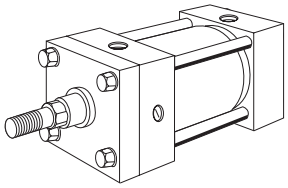
MT2 (see Page 18, 19)



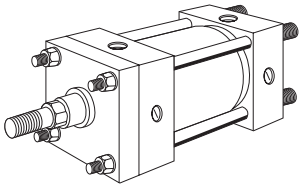
MT4 (see Page 20, 21)



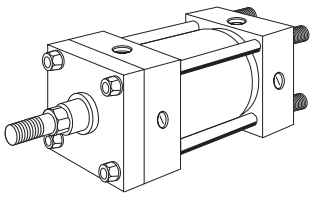
MX0 (see Page 22, 23)



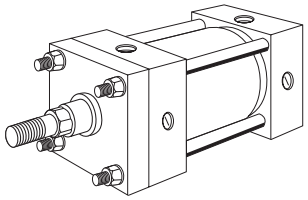
MX1 (see Page 24, 25)



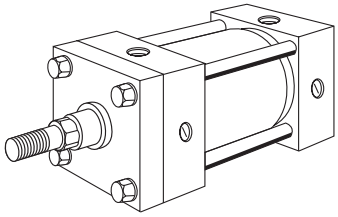
MX2 (see Page 24, 25)



MX3 (see Page 24, 25)

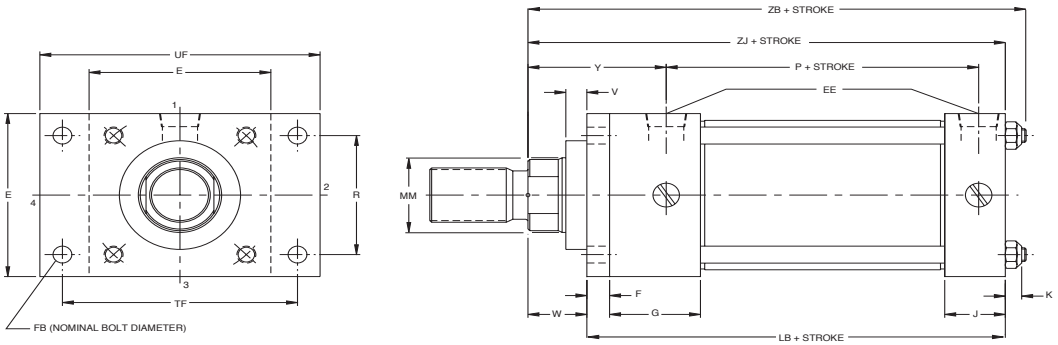


CGT1 (see Page 26, 27)

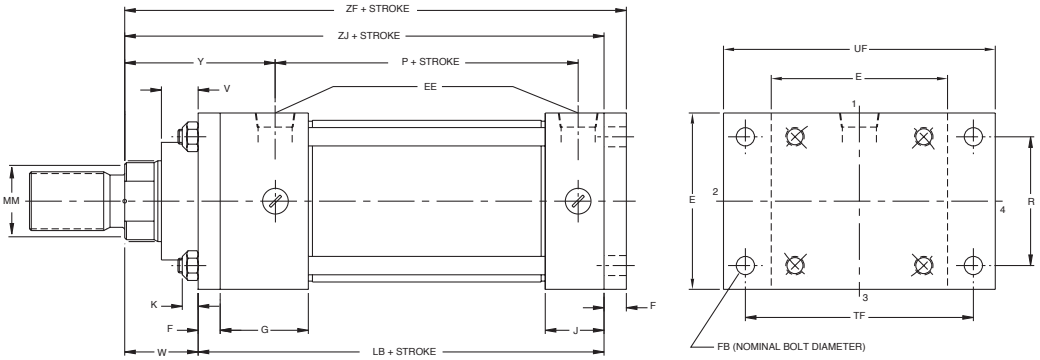


Mounting MF1, MF2, MF5, MF6

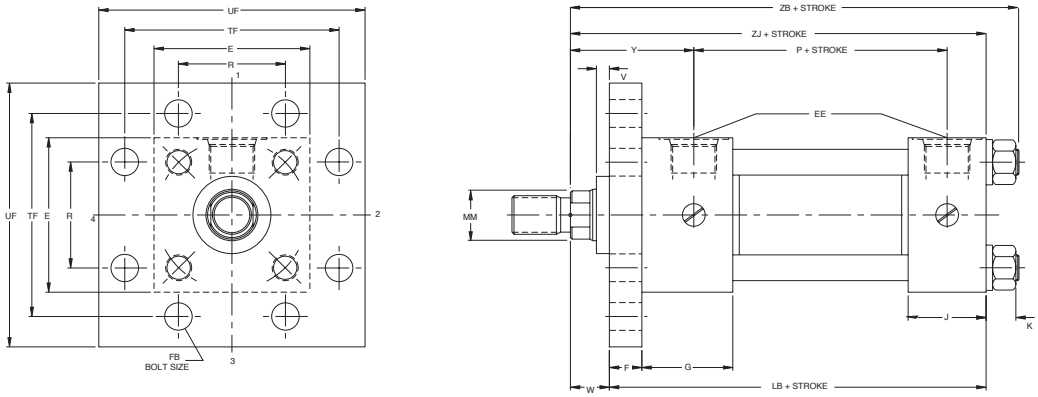
CDT1 MF1



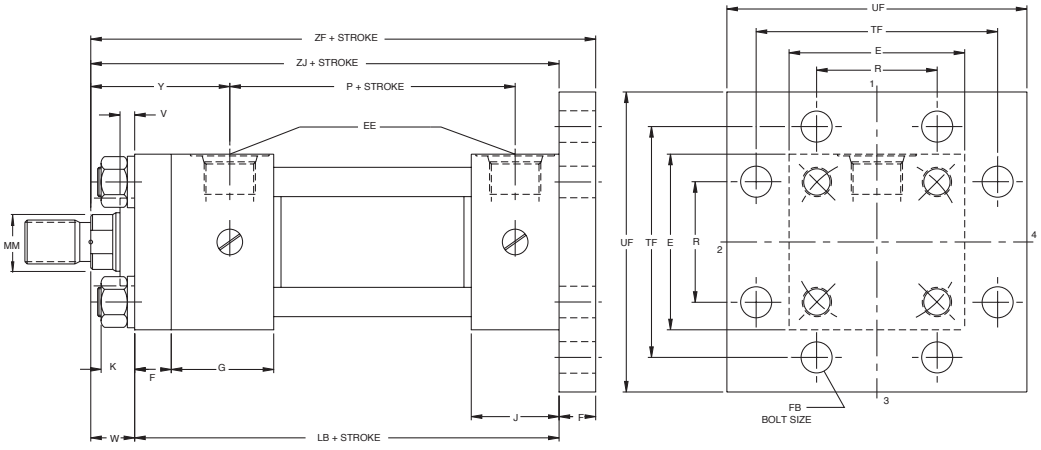
CDT1 MF2



CDT1 MF5



CDT1 MF6



Dimensions MF1, MF2, MF5, MF6

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	ZB	ZF	ZJ
1.000	0.500	0.25	0.63	1.94	4.69	4.88	4.50
	0.625	0.25	0.63	1.94	4.69	4.88	4.50
1.500	0.625	0.25	0.63	1.94	4.88	5.00	4.63
	1.000	0.50	1.00	2.31	5.25	5.38	5.00
2.000	0.625	0.25	0.63	1.94	4.94	5.00	4.63
	1.000	0.50	1.00	2.31	5.31	5.38	5.00
	1.375	0.63	1.25	2.56	5.56	5.63	5.25
2.500	0.625	0.25	0.63	1.94	5.06	5.31	4.75
	1.000	0.50	1.00	2.31	5.44	5.50	5.13
	1.375	0.63	1.25	2.56	5.69	5.75	5.38
	1.750	0.75	1.50	2.81	5.94	6.00	5.63
3.250	1.000	0.25	0.75	2.44	6.00	6.25	5.63
	1.375	0.38	1.00	2.63	6.25	6.50	5.88
	1.750	0.50	1.25	2.88	6.50	6.75	6.13
	2.000	0.50	1.38	3.06	6.63	6.88	6.25
4.000	1.000	0.25	0.75	2.38	6.00	6.25	5.63
	1.375	0.38	1.00	2.63	6.25	6.50	5.88
	1.750	0.50	1.25	2.88	6.50	6.75	6.13
	2.000	0.50	1.38	3.00	6.63	6.88	6.25
	2.500	0.63	1.63	3.25	6.88	7.13	6.50
5.000	1.000	0.25	0.75	2.38	6.31	6.50	5.88
	1.375	0.38	1.00	2.63	6.56	6.75	6.13
	1.750	0.50	1.25	2.88	6.81	7.00	6.38
	2.000	0.50	1.38	3.00	6.94	7.13	6.50
	2.500	0.63	1.63	3.25	7.19	7.38	6.75
	3.000	0.63	1.63	3.25	7.19	7.38	6.75
	3.500	0.63	1.63	3.25	7.19	7.38	6.75
6.000	1.375	0.25	0.88	2.78	7.06	7.38	6.63
	1.750	0.38	1.13	3.03	7.31	7.63	6.88
	2.000	0.38	1.25	3.16	7.44	7.75	7.00
	2.500	0.50	1.50	3.41	7.69	8.00	7.25
	3.000	0.50	1.50	3.41	7.69	8.00	7.25
	3.500	0.50	1.50	3.41	7.69	8.00	7.25
	4.000	0.50	1.50	3.41	7.69	8.00	7.25

Flange mounts are one of the strongest, most rigid methods of mounting. With this type of mount, there is little allowance for misalignment, so when long strokes are required, the free end opposite the mounting should be supported to prevent sagging and possible binding of the cylinder. Blind or cap end mounts are best for thrust load applications, and rod or head end mounts are best in tension applications. If an application exceeds the rectangular flange rating, a solid head or cap flange mount is available.

When a less rigid mount can be used and the cylinder can be attached to a panel or bulkhead, an extended tie rod mount could be considered.

Note: The bearing retainer plate is the same as the “E” dimension for the 1.5” – 6” bore sizes. Removable bearing retainer is not available in the 1.5” – 6” bore sizes.

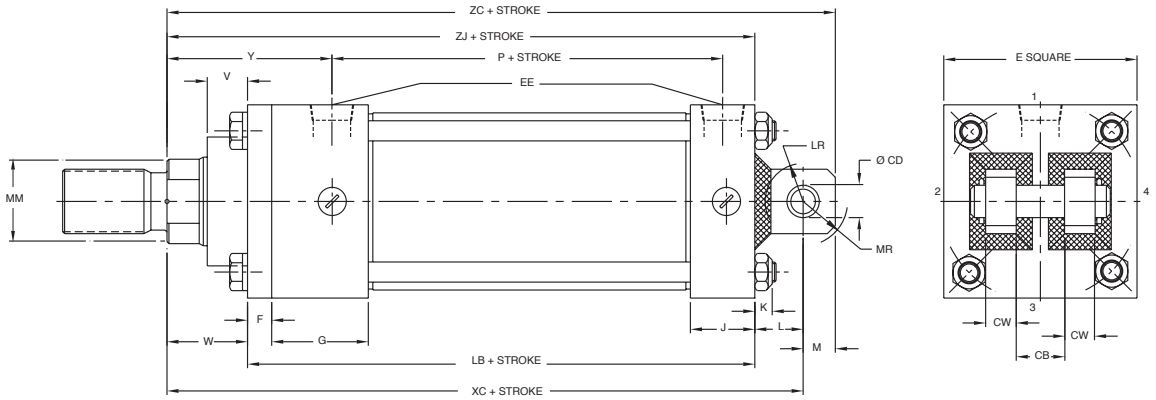
Rod end options shown on page 6.

Table 2 - Dimensions not affected by rod diameter

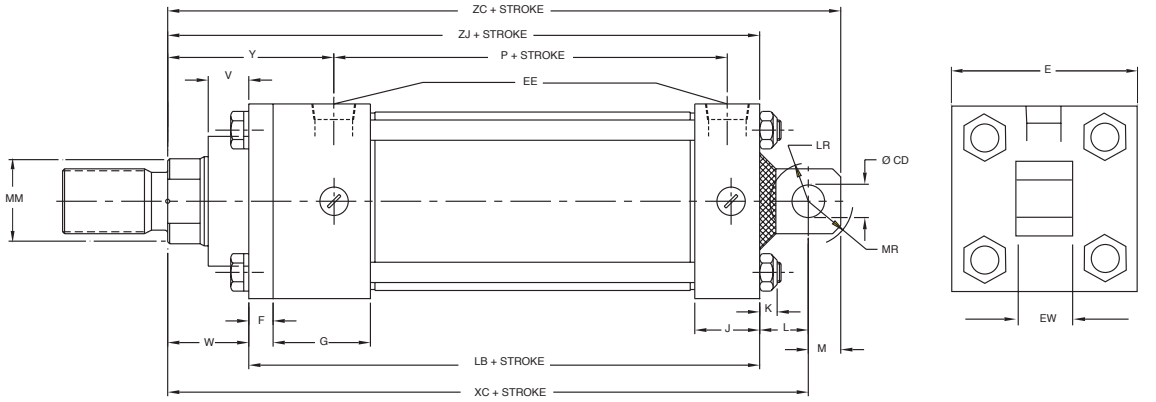
Bore Ø In.	E	SAE Port EE	F	FB	G	J	K	R	TF	UF	LB	P
1.000	1.50	4	0.38	0.25	1.50	1.00	0.19	1.08	2.00	2.50	3.88	2.13
1.500	2.00	6	0.38	0.31	1.50	1.00	0.25	1.43	2.75	3.38	4.00	2.25
2.000	2.50	6	0.38	0.38	1.50	1.00	0.31	1.84	3.38	4.13	4.00	2.25
2.500	3.00	6	0.38	0.38	1.50	1.00	0.31	2.19	3.88	4.63	4.13	2.38
3.250	3.75	10	0.63	0.44	1.75	1.25	0.38	2.76	4.69	5.50	4.88	2.63
4.000	4.50	10	0.63	0.44	1.75	1.25	0.38	3.32	5.44	6.25	4.88	2.63
5.000	5.50	10	0.63	0.56	1.75	1.25	0.44	4.10	6.63	7.63	5.13	2.94
6.000	5.50	12	0.75	0.56	2.00	1.50	0.44	4.88	7.63	8.63	5.75	3.13

Mounting MP1, MP3

CDT1 MP1



CDT1 MP3



Dimensions MP1, MP3

Table 1 - Dimensions affected by rod diameter

Bore Ø In.	Rod Ø In.	V	W	Y	XC	XD	ZC	ZD	ZJ	XN
1.000	0.500	0.25	0.63	1.94	5.00	5.38	5.44	5.81	4.50	-
	0.625	0.25	0.63	1.94	5.00	5.38	5.44	5.81	4.50	-
1.500	0.625	0.25	0.63	1.94	5.38	5.75	5.88	6.25	4.63	-
	1.000	0.50	1.00	2.31	5.75	6.13	6.25	6.63	5.00	-
2.000	0.625	0.25	0.63	1.94	5.38	5.75	5.08	6.25	4.63	-
	1.000	0.50	1.00	2.31	5.75	6.13	6.25	6.63	5.00	-
	1.375	0.63	1.25	2.56	6.00	6.38	6.50	6.88	5.25	-
2.500	0.625	0.25	0.63	1.94	5.50	5.88	6.00	6.38	4.75	-
	1.000	0.50	1.00	2.31	5.88	6.25	6.38	6.75	5.13	-
	1.375	0.63	1.25	2.56	6.13	6.50	6.63	7.00	5.38	-
	1.750	0.75	1.50	2.81	6.38	6.75	6.88	7.25	5.63	-
3.250	1.000	0.25	0.75	2.38	6.88	7.50	7.63	8.25	5.63	-
	1.375	0.38	1.00	2.63	7.13	7.75	7.88	8.50	5.88	-
	1.750	0.50	1.25	2.88	7.38	8.00	8.13	8.75	6.13	-
	2.000	0.50	1.38	3.00	7.50	8.13	8.25	8.88	6.25	-
4.000	1.000	0.25	1.00	2.38	6.88	7.50	7.63	8.25	5.63	-
	1.375	0.38	1.00	2.63	7.13	7.75	7.88	8.50	5.88	-
	1.750	0.50	1.38	2.88	7.38	8.00	8.13	8.75	6.13	-
	2.000	0.50	1.63	3.00	7.50	8.13	8.25	8.88	6.25	-
	2.500	0.63	1.63	3.25	7.75	8.38	8.50	9.13	6.50	-
5.000	1.000	0.25	0.75	2.38	7.13	6.63	7.88	8.50	5.88	-
	1.375	0.38	1.00	2.63	7.38	7.75	8.13	8.75	6.13	-
	1.750	0.50	1.25	2.88	7.63	8.00	8.38	9.00	6.38	-
	2.000	0.50	1.38	3.00	7.75	8.25	8.50	9.13	6.50	-
	2.500	0.63	1.63	3.25	8.00	8.38	8.75	9.38	6.75	-
	3.000	0.63	1.63	3.25	8.00	8.63	8.75	9.38	6.75	-
	3.500	0.63	1.63	3.25	8.00	8.63	8.75	9.38	6.75	-
6.000	1.375	0.25	0.88	2.78	8.13	8.88	9.13	9.88	6.63	-
	1.750	0.38	1.13	3.03	8.38	9.13	9.38	10.13	6.88	-
	2.000	0.38	1.25	3.16	8.50	9.25	9.50	10.25	7.00	-
	2.500	0.50	1.50	3.41	8.75	9.50	9.75	10.50	7.25	-
	3.000	0.50	1.50	3.41	8.75	9.50	9.75	10.50	7.25	-
	3.500	0.50	1.50	3.41	8.75	9.50	9.75	10.50	7.25	-
	4.000	0.50	1.50	3.41	8.75	9.50	9.75	10.50	7.25	-
8.000	1.375	0.25	0.88	2.78	8.25	-	9.25	-	6.75	4.00
	1.750	0.38	1.13	3.03	8.50	-	9.50	-	7.00	4.00
	2.000	0.38	1.25	3.16	8.63	-	9.63	-	7.13	4.00
	2.500	0.50	1.50	3.41	8.88	-	9.88	-	7.38	4.00
	3.000	0.50	1.50	3.41	8.88	-	9.88	-	7.38	5.50
	3.500	0.50	1.50	3.41	8.88	-	9.88	-	7.38	5.50
	4.000	0.50	1.50	3.41	8.88	-	9.88	-	7.38	5.50
	4.500	0.50	1.50	3.41	8.88	-	9.88	-	7.38	6.50
	5.000	0.50	1.50	3.41	8.88	-	9.88	-	7.38	6.50
	5.500	0.50	1.50	3.41	8.88	-	9.88	-	7.38	7.25

MP3 not available in 8" bore.

The Clevis or Pin mounted cylinder is probably the most widely used of all mounts. For short strokes, medium or small cylinder applications, the clevis mounts are recommended. If this mount is applied where stroke requirements cause the overall length to be excessive, the Cap Trunnion mount can be used. Pivot mounts must always be used with a pivot type rod end attachment.

The bearing retainer plate is the same as the “E” dimension for 1-1/2”–6” bore sizes and the “XN” dimension for the 8” bore sizes. Rod end options shown on page 6.

MP1 mount includes pivot pin. MP3 does not include pivot pin.

MP1 mount not available on 1" bore size.

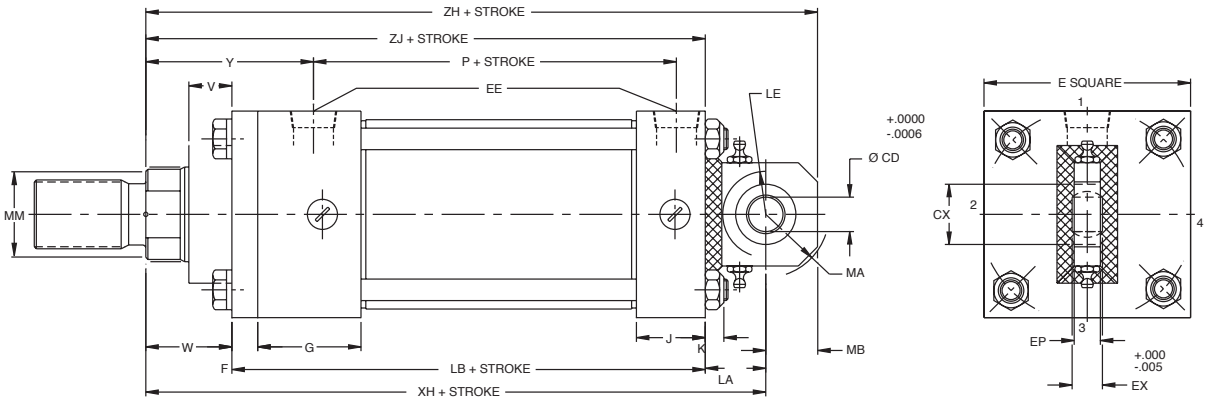
Table 2 - Dimensions not affected by rod diameter

Bore In.	EW/ CB	CD +.000 -.002	CW	E	SAE Port EE	F	G	J	K	L	LR	M	MR	LB	P
1.000	*	0.441*	*	1.50	4	0.38	1.50	1.00	0.19	0.50*	0.50*	0.44*	.50*	3.88	2.13
1.500	0.75	0.501	0.50	2.00	6	0.38	1.50	1.00	0.25	0.75	0.75	0.50	0.63	4.00	2.25
2.000	0.75	0.501	0.50	2.50	6	0.38	1.50	1.00	0.31	0.75	0.75	0.50	0.63	4.00	2.25
2.500	0.75	0.501	0.50	3.00	6	0.38	1.50	1.00	0.31	0.75	0.75	0.50	0.63	4.13	2.38
3.250	1.25	0.751	0.63	3.75	10	0.63	1.75	1.25	0.38	1.25	1.00	0.75	0.94	4.88	2.63
4.000	1.25	0.751	0.63	4.50	10	0.63	1.75	1.25	0.38	1.25	1.00	0.76	0.94	4.88	2.63
5.000	1.25	0.751	0.63	5.50	10	0.63	1.75	1.25	0.44	1.25	1.00	0.75	0.94	5.13	2.94
6.000	1.50	1.001	0.75	6.50	12	0.75	2.00	1.50	0.44	1.50	1.25	1.00	1.19	5.75	3.13
8.000	1.50	1.001	0.75	8.50	12	0.75	2.00	1.50	0.56	1.50	1.25	1.00	1.19	5.88	3.25

* = 1" bore model has 7/16" single fixed eye mount: (MP3) CD = .441"

Mounting MP5

CDT1 MP5



Dimensions MP5

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	XH	ZH	ZJ
1.500	0.625	0.25	0.63	1.94	5.50	6.13	4.63
	1.000	0.50	1.00	2.31	5.88	6.50	5.00
2.000	0.625	0.25	0.63	1.94	5.50	6.13	4.63
	1.000	0.50	1.00	2.31	5.88	6.50	5.00
	1.375	0.63	1.25	2.56	6.13	6.75	5.25
2.500	0.625	0.25	0.63	1.94	5.63	6.25	4.75
	1.000	0.50	1.00	2.31	6.00	6.63	5.13
	1.375	0.63	1.25	2.56	6.25	6.88	5.38
	1.750	0.75	1.50	2.81	6.50	7.13	5.63
3.250	1.000	0.25	0.75	2.38	6.88	7.88	5.63
	1.375	0.38	1.00	2.63	7.13	8.13	5.88
	1.750	0.50	1.25	2.88	7.38	8.38	6.13
	2.000	0.50	1.38	3.00	7.50	8.50	6.25
4.000	1.000	0.25	0.75	2.38	6.88	7.88	5.63
	1.375	0.38	1.00	2.63	7.13	8.13	5.88
	1.750	0.50	1.25	2.88	7.38	8.38	6.13
	2.000	0.50	1.38	3.00	7.50	8.50	6.25
	2.500	0.63	1.63	3.25	7.75	8.75	6.50
5.000	1.000	0.25	0.75	2.38	7.13	8.13	5.88
	1.375	0.38	1.00	2.63	7.38	8.38	6.13
	1.750	0.50	1.25	2.88	7.63	8.63	6.38
	2.000	0.50	1.38	3.00	7.75	8.75	6.50
	2.500	0.63	1.63	3.25	8.00	9.00	6.75
	3.000	0.63	1.63	3.25	8.00	9.00	6.75
	3.500	0.63	1.63	3.25	8.00	9.00	6.75
6.000	1.375	0.25	0.88	2.78	8.25	9.38	6.63
	1.750	0.38	1.13	3.03	8.50	9.63	6.88
	2.000	0.38	1.25	3.16	8.63	9.75	7.00
	2.500	0.50	1.50	3.41	8.88	10.00	7.25
	3.000	0.50	1.50	3.41	8.88	10.00	7.25
	3.500	0.50	1.50	3.41	8.88	10.00	7.25
	4.000	0.50	1.50	3.41	8.88	10.00	7.25

The MP5 (Universal) type mount is a pivot mount with a spherical bearing fitted into the pivot to permit 5 to 10 degrees of movement in a plane perpendicular to the major plane of pivot movement. It is probably the most serviceable of the pivoted centerline mounts. For maximum effectiveness, a spherical rod end fitting should be utilized at the same time.

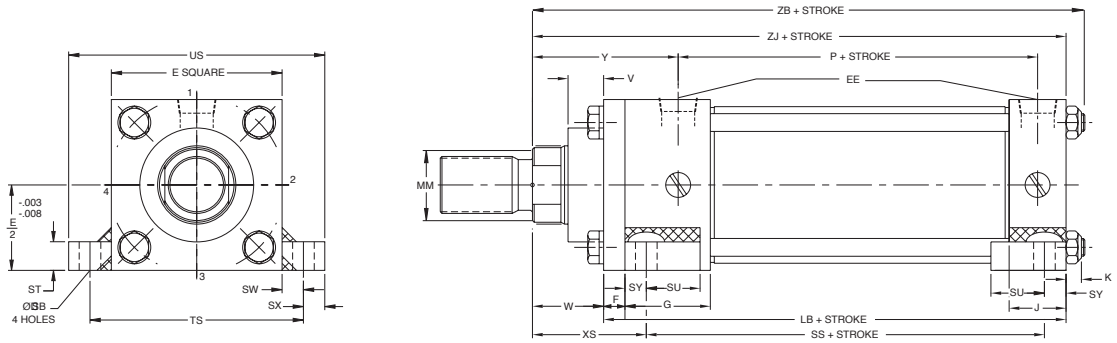
Rod end options shown on page 6.

Table 2 - Dimensions not affected by rod diameter

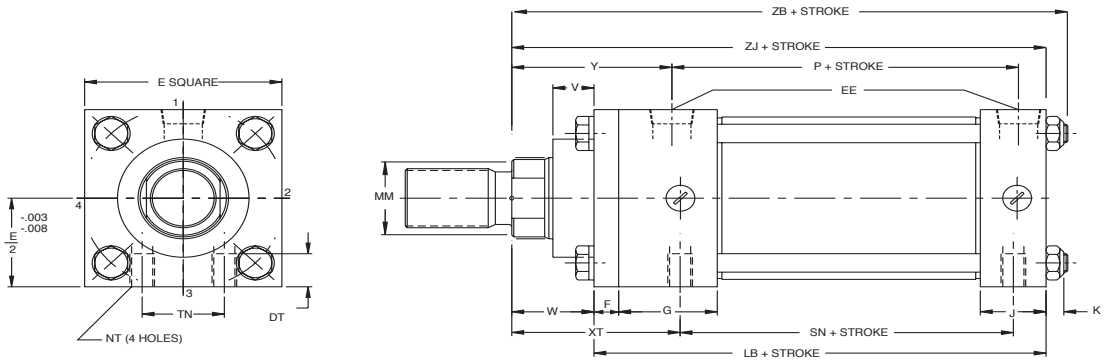
Bore In.	E	EE (SAE)	F	G	J	K	LB	P	CD	CX	EP	EX	LA	LE	MA	MB
1.500	2.00	6	0.38	1.50	1.00	0.25	4.00	2.25	0.50	0.88	0.38	0.44	0.88	0.75	0.75	0.75
2.000	2.50	6	0.38	1.50	1.00	0.31	4.00	2.25	0.50	0.88	0.38	0.44	0.88	0.75	0.75	0.75
2.500	3.00	6	0.38	1.50	1.00	0.31	4.13	2.38	0.50	0.88	0.38	0.44	0.88	0.75	0.75	0.75
3.250	3.75	10	0.63	1.75	1.25	0.38	4.88	2.69	0.50	0.88	0.38	0.66	0.88	1.06	1.00	0.75
4.000	4.50	10	0.63	1.75	1.25	0.38	4.88	2.69	0.75	1.25	0.56	0.66	1.25	1.06	1.00	1.25
5.000	5.50	10	0.63	1.75	1.25	0.44	5.13	2.94	0.75	1.25	0.56	0.66	1.25	1.06	1.00	1.25
6.000	6.50	12	0.75	2.00	1.50	0.44	5.75	3.13	1.00	1.62	0.75	0.88	1.62	1.44	1.25	1.50

Mounting MS2, MS4

CDT1 MS2



CDT1 MS4



The side or lug mounted cylinder provides a fairly rigid mount. These type mounts can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly, the mounting bolts are either in simple shear or tension without any compound stresses. An extended key plate option is available to eliminate the need for fitted bolts or external keys to carry the thrust load.

Note:
When specifying an MS2 mount with ports in the 2 or 4 quandrant, be sure to see that sufficient clearance between the port fitting and the lug is available to insert a bolt or cap screw into the lug.

Rod end options shown on page 6.

Dimensions MS2, MS4

Table 1 - Dimensions affected by rod diameter

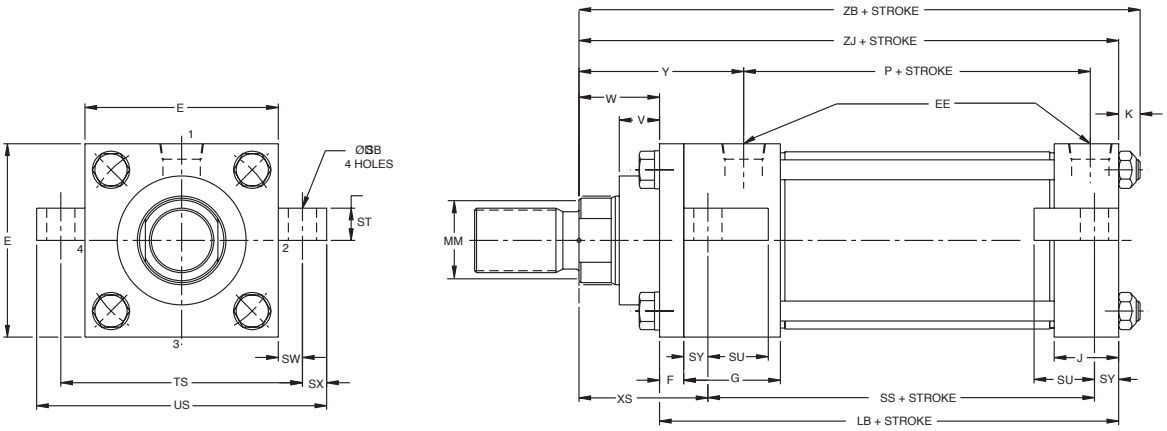
Bore In.	MM Rod	V	W	Y	XS	XT	ZB	ZJ
1.000	0.500	0.25	0.63	1.94	1.31	1.94	4.69	4.50
	0.625	0.25	0.63	1.94	1.31	1.94	4.69	4.50
1.500	0.625	0.25	0.63	1.94	1.38	1.94	4.88	4.63
	1.000	0.50	1.00	2.31	1.75	2.31	5.25	5.00
2.000	0.625	0.25	0.63	1.94	1.38	1.94	4.94	4.63
	1.000	0.50	1.00	2.31	1.75	2.31	5.31	5.00
	1.375	0.63	1.25	2.56	2.00	2.56	5.56	5.25
2.500	0.625	0.25	0.63	1.94	1.38	1.94	5.06	4.75
	1.000	0.50	1.00	2.31	1.75	2.31	5.44	5.13
	1.375	0.63	1.25	2.56	2.00	2.56	5.69	5.38
	1.750	0.75	1.50	2.81	2.25	2.81	5.94	5.63
3.250	1.000	0.25	0.75	2.38	1.88	2.44	6.00	5.63
	1.375	0.38	1.00	2.63	2.13	2.69	6.25	5.88
	1.750	0.50	1.25	2.88	2.38	2.94	6.50	6.13
	2.000	0.50	1.38	3.00	2.50	3.06	6.63	6.25
4.000	1.000	0.25	0.75	2.38	1.88	2.44	6.00	5.63
	1.375	0.38	1.00	2.63	2.13	2.69	6.25	5.88
	1.750	0.50	1.25	2.88	2.38	2.94	6.50	6.13
	2.000	0.50	1.38	3.00	2.50	3.06	6.63	6.25
	2.500	0.63	1.63	3.25	2.75	3.31	6.88	6.50
5.000	1.000	0.25	0.75	2.38	2.06	2.44	6.31	5.88
	1.375	0.38	1.00	2.63	2.31	2.69	6.56	6.13
	1.750	0.50	1.25	2.88	2.56	2.94	6.81	6.38
	2.000	0.50	1.38	3.00	2.69	3.06	6.94	6.50
	2.500	0.63	1.63	3.25	2.94	3.31	7.19	6.75
	3.000	0.63	1.63	3.25	2.94	3.31	7.19	6.75
	3.500	0.63	1.63	3.25	2.94	3.31	7.19	6.75
6.000	1.375	0.25	0.88	2.78	2.31	2.81	7.06	6.63
	1.750	0.38	1.13	3.03	2.56	3.06	7.31	6.88
	2.000	0.38	1.25	3.16	2.69	3.19	7.44	7.00
	2.500	0.50	1.50	3.41	2.94	3.44	7.69	7.25
	3.000	0.50	1.50	3.41	2.94	3.44	7.69	7.25
	3.500	0.50	1.50	3.41	2.94	3.44	7.69	7.25
	4.000	0.50	1.50	3.41	2.94	3.44	7.69	7.25
8.000	1.375	0.25	0.88	2.78	2.31	2.81	7.31	6.75
	1.750	0.38	1.13	3.03	2.56	3.06	7.56	7.00
	2.000	0.38	1.25	3.16	2.69	3.19	7.69	7.13
	2.500	0.50	1.50	3.41	2.94	3.44	7.94	7.38
	3.000	0.50	1.50	3.41	2.94	3.44	7.94	7.38
	3.500	0.50	1.50	3.41	2.94	3.44	7.94	7.38
	4.000	0.50	1.50	3.41	2.94	3.44	7.94	7.38
	4.500	0.50	1.50	3.41	2.94	3.44	7.94	7.38
	5.000	0.50	1.50	3.41	2.94	3.44	7.94	7.38
	5.500	0.50	1.50	3.41	2.94	3.44	7.94	7.38

Table 2 - Dimensions not affected by rod diameter

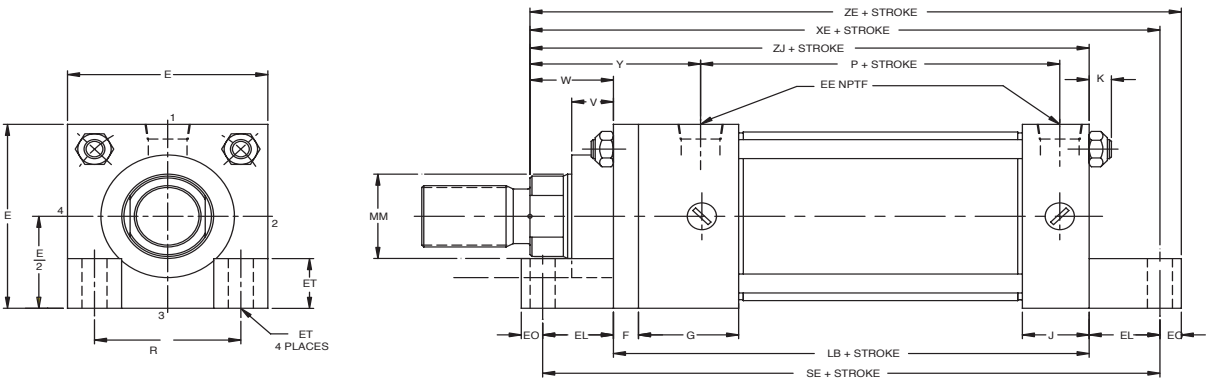
Bore In.	E	SAE Port EE	F	G	J	K	NT	TN	SB	SN	SS	ST	SU	SW	SX	SY	TS	US	LB	P
1.000	1.50	4	0.38	1.50	1.00	0.19	10 - 24	0.56	0.28	2.13	2.88	0.31	0.75	0.31	0.38	0.38	2.13	2.75	3.88	2.13
1.500	2.00	6	0.38	1.50	1.00	0.25	1/4 - 20	0.63	0.44	2.25	2.88	0.50	0.94	0.38	0.38	0.38	2.75	3.50	4.00	2.28
2.000	2.50	6	0.38	1.50	1.00	0.31	5/16 - 18	0.88	0.44	2.25	2.88	0.50	0.94	0.38	0.38	0.38	3.25	4.00	4.00	2.28
2.500	3.00	6	0.38	1.50	1.00	0.31	3/8 - 16	1.25	0.44	2.38	3.00	0.50	0.94	0.38	0.50	0.50	3.75	4.50	4.13	2.38
3.250	3.75	10	0.63	1.75	1.25	0.38	1/2 - 13	1.50	0.56	2.63	3.25	0.75	1.25	0.50	0.50	0.50	4.75	5.75	4.88	2.69
4.000	4.50	10	0.63	1.75	1.25	0.38	1/2 - 13	2.06	0.56	2.63	3.25	0.75	1.25	0.50	0.50	0.50	5.50	6.50	4.88	2.69
5.000	5.50	10	0.63	1.75	1.25	0.44	5/8 - 11	2.69	0.81	2.88	3.13	1.00	1.56	0.69	0.69	0.69	6.88	8.25	5.13	2.94
6.000	6.50	12	0.75	2.00	1.50	0.44	3/4 - 10	3.25	0.81	3.13	3.63	1.00	1.56	0.69	0.69	0.69	9.63	9.25	5.75	3.16
8.000	8.50	12	0.75	2.00	1.50	0.56	3/4 - 10	4.50	0.94	3.25	3.75	1.00	1.56	0.69	0.88	0.88	9.88	11.25	5.88	3.28

Mounting MS3, MS7

CDT1 MS3



CDT1 MS7



The side or lug mounted cylinder provides a fairly rigid mount. These type mounts can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves towards the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly, the mounting bolts are in simple shear or tension without any compound stresses. An extended key plate option is available to eliminate the ened for fitted bolts or external keys to carry the thrust load (seep age 31)

When specifying an MS7 mount, carefully check the distance between the rod and lug to determine if there is sufficient clearance for the rod end attachment. It may be necessary to add a plain rod extension to move the threaded rod end out beyond the lug. The lugs serve as nuts on the bottom two tie rods, therefore making it necessary to loosen the tie rods to remove the rod bearing.

Rod end options shown on page 6.

Dimensions MS3, MS7

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	XE	XS	ZB	XE	ZJ	ZE
1.500	0.625	0.25	0.63	1.94	5.38	1.38	4.88	5.63	4.63	5.63
	1.000	0.50	1.00	2.31	5.75	1.75	5.25	6.00	5.00	6.00
2.000	0.625	0.25	0.63	1.94	5.56	1.38	4.94	5.88	4.63	5.88
	1.000	0.50	1.00	2.31	5.94	1.75	5.31	6.25	5.00	6.25
	1.375	0.63	1.25	2.56	6.19	2.00	5.56	6.50	5.25	6.50
2.500	0.625	0.25	0.63	1.94	5.81	1.38	5.06	6.13	4.75	6.13
	1.000	0.50	1.00	2.31	6.19	1.75	5.44	6.50	5.13	6.50
	1.375	0.63	1.25	2.56	6.44	2.00	5.69	6.75	5.38	6.75
	1.750	0.75	1.50	2.81	6.69	2.25	5.94	7.00	5.63	7.00
3.250	1.000	0.25	0.75	2.38	6.50	1.88	6.00	6.88	5.63	6.88
	1.375	0.38	1.00	2.63	6.75	2.13	6.25	7.13	5.88	7.13
	1.750	0.50	1.25	2.88	7.00	2.38	6.50	7.38	6.13	7.38
	2.000	0.50	1.38	3.00	7.13	2.50	6.63	7.50	6.25	7.50
4.000	1.000	0.25	1.00	2.38	6.63	1.88	6.00	7.00	5.63	7.00
	1.375	0.38	1.00	2.63	6.88	2.13	6.25	7.25	5.88	7.25
	1.750	0.50	1.38	2.88	7.13	2.38	6.50	7.50	6.13	7.50
	2.000	0.50	1.63	3.00	7.25	2.50	6.63	7.63	6.25	7.63
	2.500	0.63	1.63	3.25	7.50	2.75	6.88	7.88	6.50	7.88
5.000	1.000	0.25	0.75	2.38	6.94	2.06	6.31	7.44	5.88	7.43
	1.375	0.38	1.00	2.63	7.19	2.31	6.56	7.69	6.13	7.69
	1.750	0.50	1.25	2.88	7.44	2.56	6.87	7.94	6.38	7.94
	2.000	0.50	1.38	3.00	7.56	2.69	6.94	8.06	6.50	8.06
	2.500	0.63	1.63	3.25	7.81	2.94	7.19	8.31	6.75	8.31
	3.000	0.63	1.63	3.25	7.81	2.94	7.19	8.31	6.75	8.31
	3.500	0.63	1.63	3.25	7.81	2.94	7.19	8.31	6.75	8.31
6.000	1.375	0.25	0.88	2.78	7.63	2.31	7.06	8.13	6.63	8.13
	1.750	0.38	1.13	3.03	7.88	2.56	7.31	8.38	6.88	8.38
	2.000	0.38	1.25	3.16	8.00	2.69	7.44	8.50	7.00	8.50
	2.500	0.50	1.50	3.41	8.25	2.94	7.69	8.75	7.25	8.75
	3.000	0.50	1.50	3.41	8.25	2.94	7.69	8.75	7.25	8.75
	3.500	0.50	1.50	3.41	8.25	2.94	7.69	8.75	7.25	8.75
	4.000	0.50	1.50	3.41	8.25	2.94	7.69	8.75	7.25	8.75
8.000	1.375	0.25	0.88	2.78	7.88	2.69	7.31	8.50	6.75	8.25
	1.750	0.38	1.13	3.03	8.13	2.94	7.56	8.75	7.00	8.75
	2.000	0.38	1.25	3.16	8.25	2.94	7.69	8.88	7.13	8.88
	2.500	0.50	1.50	3.41	8.50	2.94	7.94	9.13	7.38	9.13
	3.000	0.50	1.50	3.41	#	2.94	7.94	#	7.38	#
	3.500	0.50	1.50	3.41	#	2.94	7.94	#	7.38	#
	4.000	0.50	1.50	3.41	#	2.31	7.94	#	7.38	#
	4.500	0.50	1.50	3.41	#	2.56	7.94	#	7.38	#
	5.000	0.50	1.50	3.41	#	2.94	7.94	#	7.38	#
	5.500	0.50	1.50	3.41	#	2.94	7.94	#	7.38	#

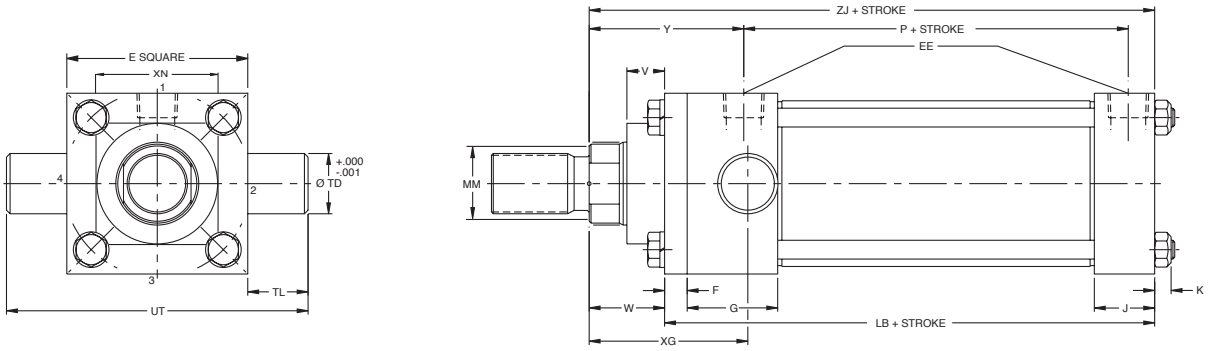
= MS7 not available in this rod size

Table 2 - Dimensions not affected by rod diameter

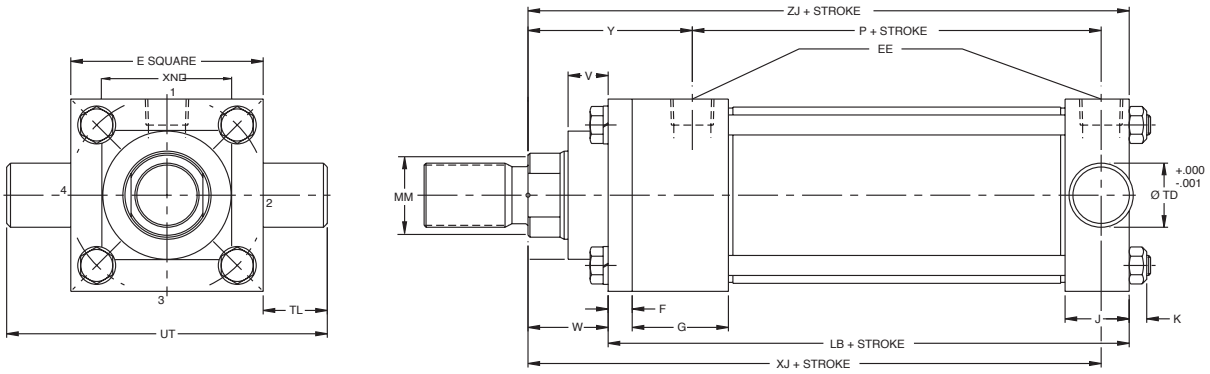
Bore in.	E	EB	EE SAE	EL	EO	ET	F	G	J	K	R	SB	S	SS	ST	SU	SW	SX	SY	TS	US	LB	P	SE
1.500	2.00	0.38	6	0.75	0.25	0.53	0.38	1.50	1.00	0.25	1.43	0.44	5.50	2.88	0.50	0.94	0.38	0.38	0.38	2.75	3.50	4.00	2.28	5.50
2.000	2.50	0.38	6	0.94	0.31	0.63	0.38	1.50	1.00	0.31	1.84	0.44	5.88	2.88	0.50	0.94	0.38	0.38	0.38	3.25	4.00	4.00	2.28	5.88
2.500	3.00	0.38	6	1.06	0.31	0.78	0.38	1.50	1.00	0.31	2.19	0.44	6.25	3.00	0.50	0.94	0.38	0.50	0.50	3.75	4.50	4.13	2.38	6.25
3.250	3.75	0.50	10	0.88	0.38	0.94	0.63	1.75	1.25	0.38	2.76	0.56	6.63	3.25	0.75	1.25	0.50	0.50	0.50	4.75	5.75	4.88	2.69	6.63
4.000	4.50	0.50	10	1.00	0.38	1.16	0.63	1.75	1.25	0.38	3.32	0.56	6.88	3.25	0.75	1.25	0.50	0.50	0.50	5.50	6.50	4.88	2.69	6.88
5.000	5.50	0.50	10	1.06	0.50	1.38	0.63	1.75	1.25	0.44	4.10	0.81	7.25	3.13	1.00	1.56	0.69	0.69	0.69	6.88	8.25	5.13	2.94	7.25
6.000	6.50	0.75	12	1.00	0.50	1.59	0.75	2.00	1.50	0.44	4.88	0.81	7.75	3.63	1.00	1.56	0.69	0.69	0.69	7.88	9.25	5.75	3.16	7.75
8.000	8.50	0.69	12	1.13	0.63	1.94	0.75	2.00	1.50	0.56	6.44	0.81	7.38	3.75	1.00	1.56	0.69	0.88	0.88	9.88	11.25	5.88	3.28	7.38

Mounting MT1, MT2

CDT1 MT1



CDT1MT2



Dimensions MT1, MT2

Table 1 - Dimensions affected by rod diameter

Bore In.	Rod mm	V	W	Y	XG	XJ	XN	ZJ
1.000	0.500	0.25	0.63	1.94	1.75	4.00	-	4.50
	0.625	0.25	0.63	1.94	1.75	4.00	-	4.50
1.500	0.625	0.25	0.63	1.94	1.75	4.13	-	4.63
	1.000	0.50	1.00	2.31	2.13	4.50	-	5.00
2.000	0.625	0.25	0.63	1.94	1.75	4.13	-	4.63
	1.000	0.50	1.00	2.31	2.13	4.50	-	5.00
	1.375	0.63	1.25	2.56	2.38	4.75	-	5.25
2.500	0.625	0.25	0.63	1.94	1.75	4.25	-	4.75
	1.000	0.50	1.00	2.31	2.13	4.63	-	5.13
	1.375	0.63	1.25	2.56	2.38	4.88	-	5.38
	1.750	0.75	1.50	2.81	2.63	5.13	-	5.63
3.250	1.000	0.25	0.75	2.38	2.25	5.00	-	5.63
	1.375	0.38	1.00	2.63	2.50	5.25	-	5.88
	1.750	0.50	1.25	2.88	2.75	5.50	-	6.13
	2.000	0.50	1.38	3.00	2.88	5.63	-	6.25
4.000	1.000	0.25	0.25	2.38	2.25	5.00	-	5.63
	1.375	0.38	0.38	2.63	2.50	5.25	-	5.88
	1.750	0.50	0.50	2.88	2.75	5.50	-	6.13
	2.000	0.50	0.50	3.00	2.88	5.63	-	6.25
	2.500	0.63	0.63	3.25	3.13	5.88	-	6.50
5.000	1.000	0.25	0.75	2.38	2.25	5.25	-	5.88
	1.375	0.38	1.00	2.63	2.50	5.50	-	6.13
	1.750	0.50	1.25	2.88	2.75	5.75	-	6.38
	2.000	0.50	1.38	3.00	2.88	5.88	-	6.50
	2.500	0.63	1.63	3.25	3.13	6.13	-	6.75
	3.000	0.63	1.63	3.25	3.13	6.13	-	6.75
	3.500	0.63	1.63	3.25	3.13	6.13	-	6.75
6.000	1.375	0.25	0.88	2.78	2.63	5.88	-	6.63
	1.750	0.38	1.13	3.03	2.88	6.13	-	6.88
	2.000	0.38	1.25	3.16	3.00	6.25	-	7.00
	2.500	0.50	1.50	3.41	3.25	6.50	-	7.25
	3.000	0.50	1.50	3.41	3.25	6.50	-	7.25
	3.500	0.50	1.50	3.41	3.25	6.50	-	7.25
	4.000	0.50	1.50	3.41	3.25	6.50	-	7.25
8.000	1.375	0.25	0.88	2.78	2.63	6.00	4.00	6.75
	1.750	0.38	1.13	3.03	2.88	6.25	4.00	7.00
	2.000	0.38	1.25	3.16	3.00	6.38	4.00	7.13
	2.500	0.50	1.50	3.41	3.25	6.63	4.00	7.38
	3.000	0.50	1.50	3.41	3.25	6.63	5.50	7.38
	3.500	0.50	1.50	3.41	3.25	6.63	5.50	7.38
	4.000	0.50	1.50	3.41	3.25	6.63	5.50	7.38
	4.500	0.50	1.50	3.41	3.25	6.63	6.50	7.38
	5.000	0.50	1.50	3.41	3.25	6.63	6.50	7.38
	5.500	0.50	1.50	3.41	3.25	6.63	7.25	7.38

All trunnion mount cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

Head or rod end trunnions should be carefully applied to either short strokes or to applications where the weight of the cylinder falls vertically below the pin.

NOTE: The “XG” and “XJ” dimensions for MT1 and MT2 mounts are not NFPA Standard.

NOTE: The bearing retainer plate is the same as the “E” dimension for the 1.5” – 6” bore sizes and the “XN” dimension for the 8” bore size.

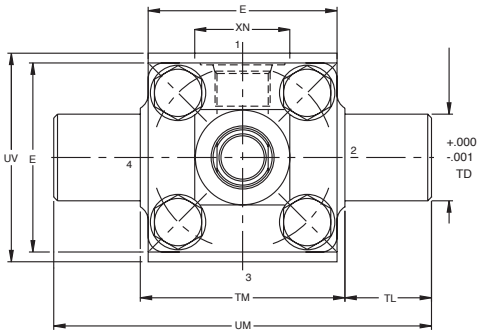
Rod end options shown on page 6.

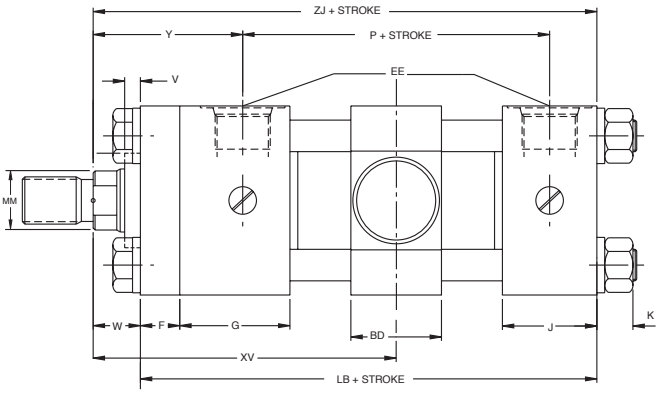
Table 2 - Dimensions not affected by rod diameter

Bore In.	E	SAE Port EE	F	G	J	K	TD +.000 -.001*	TL	UT	UB	P	LB
1.000	1.50	4	0.38	1.50	1.00	0.19	0.750	0.75	3.00	3.88	2.13	3.88
1.500	2.00	6	0.38	1.50	1.00	0.25	1.000	1.00	4.00	4.00	2.28	4.00
2.000	2.50	6	0.38	1.50	1.00	0.31	1.000	1.00	4.50	4.00	2.28	4.00
2.500	3.00	6	0.38	1.50	1.00	0.31	1.000	1.00	5.00	4.13	2.38	4.13
3.250	3.75	10	0.63	1.75	1.25	0.38	1.000	1.00	5.75	4.88	2.69	4.88
4.000	4.50	10	0.63	1.75	1.25	0.38	1.000	1.00	6.50	4.88	2.69	4.88
5.000	5.50	10	0.63	1.75	1.25	0.44	1.000	1.00	7.50	5.13	2.94	5.13
6.000	6.50	12	0.75	2.00	1.50	0.44	1.375	1.38	9.25	5.75	3.16	5.75
8.000	8.50	12	0.75	2.00	1.50	0.56	1.375	1.38	11.25	5.88	3.28	5.88

Mounting MT4

CDT1 MT4





All trunnion mounted cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

Specify “XV” dimension when ordering MT4 Intermediate Fixed Trunnnion mounts. If not specified, trunnion will be located at the center of the tube.

NOTE: The bearing retainer plate is the same as the “E” dimension for the 1.5” – 6” bore sizes and the “XN” dimension for the 8” bore size.

Rod end options shown on page 6.

Dimensions MT4

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	XV Min.	ZJ	XN
1.500	0.625	0.25	0.63	1.94	3.19	4.63	-
	1.000	0.50	1.00	2.31	3.56	5.00	-
2.000	0.625	0.25	0.63	1.94	3.31	4.63	-
	1.000	0.50	1.00	2.31	3.69	5.00	-
	1.375	0.63	1.25	2.56	3.94	5.25	-
2.500	0.625	0.25	0.63	1.94	3.31	4.75	-
	1.000	0.50	1.00	2.31	3.69	5.13	-
	1.375	0.63	1.25	2.56	3.94	5.38	-
	1.750	0.75	1.50	2.81	4.19	5.63	-
3.250	1.000	0.25	0.75	2.38	4.19	5.63	-
	1.375	0.38	1.00	2.63	4.44	5.88	-
	1.750	0.50	1.25	2.88	4.69	6.13	-
	2.000	0.50	1.38	3.00	4.81	6.25	-
4.000	1.000	0.25	0.25	2.38	4.19	5.63	-
	1.375	0.38	0.38	2.63	4.44	5.88	-
	1.750	0.50	0.50	2.88	4.69	6.13	-
	2.000	0.50	0.50	3.00	4.81	6.25	-
	2.500	0.63	0.63	3.25	5.06	6.50	-
5.000	1.000	0.25	0.75	2.38	4.19	5.88	-
	1.375	0.38	1.00	2.63	4.44	6.13	-
	1.750	0.50	1.25	2.88	4.69	6.38	-
	2.000	0.50	1.38	3.00	4.81	6.50	-
	2.500	0.63	1.63	3.25	5.06	6.75	-
	3.000	0.63	1.63	3.25	5.06	6.75	-
	3.500	0.63	1.63	3.25	5.06	6.75	-
6.000	1.375	0.25	0.88	2.78	4.94	6.63	-
	1.750	0.38	1.13	3.03	5.19	6.88	-
	2.000	0.38	1.25	3.16	5.31	7.00	-
	2.500	0.50	1.50	3.41	5.56	7.25	-
	3.000	0.50	1.50	3.41	5.56	7.25	-
	3.500	0.50	1.50	3.41	5.56	7.25	-
	4.000	0.50	1.50	3.41	5.56	7.25	-
8.000	1.375	0.25	0.88	2.78	4.94	6.75	4.00
	1.750	0.38	1.13	3.03	5.19	7.00	4.00
	2.000	0.38	1.25	3.16	5.31	7.13	4.00
	2.500	0.50	1.50	3.41	5.56	7.38	4.00
	3.000	0.50	1.50	3.41	5.56	7.38	5.50
	3.500	0.50	1.50	3.41	5.56	7.38	5.50
	4.000	0.50	1.50	3.41	5.56	7.38	5.50
	4.500	0.50	1.50	3.41	5.56	7.38	6.50
	5.000	0.50	1.50	3.41	5.56	7.38	6.50
	5.500	0.50	1.50	3.41	5.56	7.38	7.25

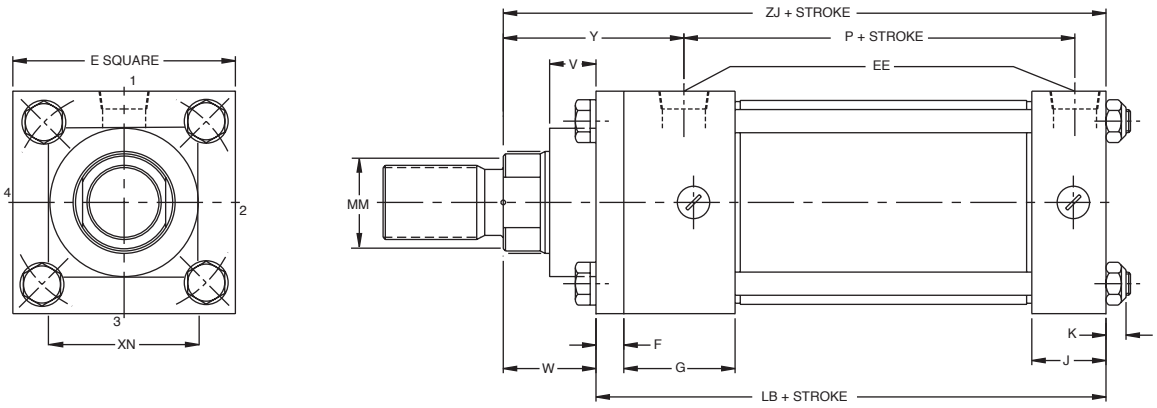
~ = Exact XV value to be specified by customer when ordering.

Table 2 - Dimensions not affected by rod diameter

Bore In.	BD	E	SAE Port EE	F	G	J	K	LT	TM	UM	UV	LB	P	Min. Stroke
1.500	1.25	2.00	6	0.38	1.50	1.00	0.25	1.00	2.50	4.50	2.50	4.00	2.28	0.25
2.000	1.50	2.50	6	0.38	1.50	1.00	0.31	1.00	3.00	5.00	3.00	4.00	2.28	0.50
2.500	1.50	3.00	6	0.38	1.50	1.00	0.31	1.00	3.50	5.50	3.50	4.13	2.38	0.38
3.250	2.00	3.75	10	0.63	1.75	1.25	0.38	1.00	4.50	6.50	4.25	4.88	2.69	0.88
4.000	2.00	4.50	10	0.63	1.75	1.25	0.38	1.00	5.25	7.25	5.00	4.88	2.69	0.88
5.000	2.00	5.50	10	0.63	1.75	1.25	0.44	1.00	6.25	8.25	6.00	5.13	2.94	0.63
6.000	2.50	6.50	12	0.75	2.00	1.50	0.44	1.38	7.63	10.38	7.38	5.75	3.16	1.13
8.000	2.50	8.50	12	0.75	2.00	1.50	0.56	1.38	9.75	12.50	9.50	5.88	3.28	0.88

Mounting MX0

CDT1 MX0



Dimensions MX0

Table 1 - Dimensions affected by rod diameter

Bore Ø In.	Rod Ø In.	V	W	Y	ZJ	XN
1.000	0.500	0.25	0.63	1.94	4.50	-
	0.625	0.25	0.63	1.94	4.50	-
1.500	0.625	0.25	0.63	1.94	4.63	-
	1.000	0.50	1.00	2.31	5.00	-
2.000	0.625	0.25	0.63	1.94	4.63	-
	1.000	0.50	1.00	2.31	5.00	-
	1.375	0.63	1.25	2.56	5.25	-
2.500	0.625	0.25	0.63	1.94	4.75	-
	1.000	0.50	1.00	2.31	5.13	-
	1.375	0.63	1.25	2.56	5.38	-
	1.750	0.75	1.50	2.81	5.63	-
3.250	1.000	0.25	0.75	2.38	5.63	-
	1.375	0.38	1.00	2.63	5.88	-
	1.750	0.50	1.25	2.88	6.13	-
	2.000	0.50	1.38	3.00	6.25	-
4.000	1.000	0.25	0.75	2.38	5.63	-
	1.375	0.38	1.00	2.63	5.88	-
	1.750	0.50	1.25	2.88	6.13	-
	2.000	0.50	1.38	3.00	6.25	-
	2.500	0.63	1.63	3.25	6.50	-
5.000	1.000	0.25	0.75	2.38	5.88	-
	1.375	0.38	1.00	2.63	6.13	-
	1.750	0.50	1.25	2.88	6.38	-
	2.000	0.50	1.38	3.00	6.50	-
	2.500	0.63	1.63	3.25	6.75	-
	3.000	0.63	1.63	3.25	6.75	-
	3.500	0.63	1.63	3.25	6.75	-
6.000	1.375	0.25	0.88	2.78	6.63	-
	1.750	0.38	1.13	3.03	6.88	-
	2.000	0.38	1.25	3.16	7.00	-
	2.500	0.50	1.50	3.41	7.25	-
	3.000	0.50	1.50	3.41	7.25	-
	3.500	0.50	1.50	3.41	7.25	-
	4.000	0.50	1.50	3.41	7.25	-
8.000	1.375	0.25	0.88	2.78	6.75	4.00
	1.750	0.38	1.13	3.03	7.00	4.00
	2.000	0.38	1.25	3.16	7.13	4.00
	2.500	0.50	1.50	3.41	7.38	4.00
	3.000	0.50	1.50	3.41	7.38	5.50
	3.500	0.50	1.50	3.41	7.38	5.50
	4.000	0.50	1.50	3.41	7.38	5.50
	4.500	0.50	1.50	3.41	7.38	6.50
	5.000	0.50	1.50	3.41	7.38	6.50
	5.500	0.50	1.50	3.41	7.38	7.25

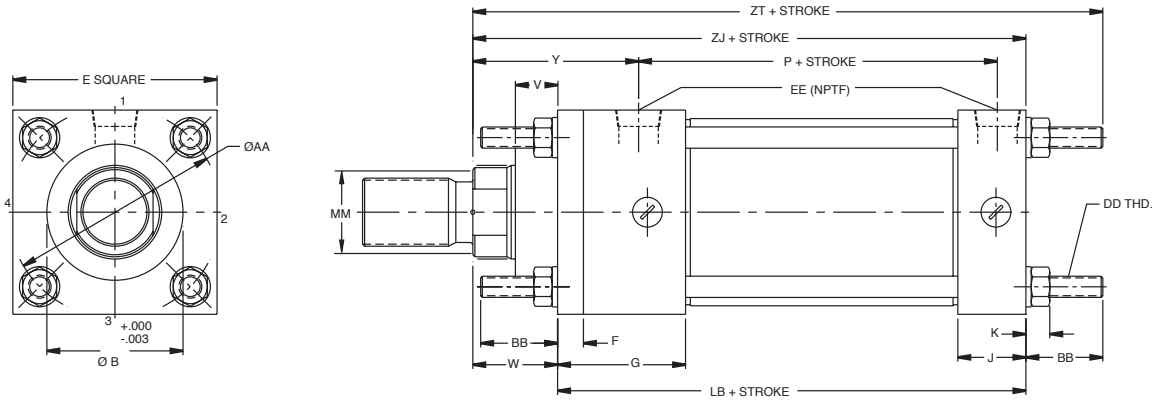
Rod end options shown on page 6.

Table 2 - Dimensions not affected by rod diameter

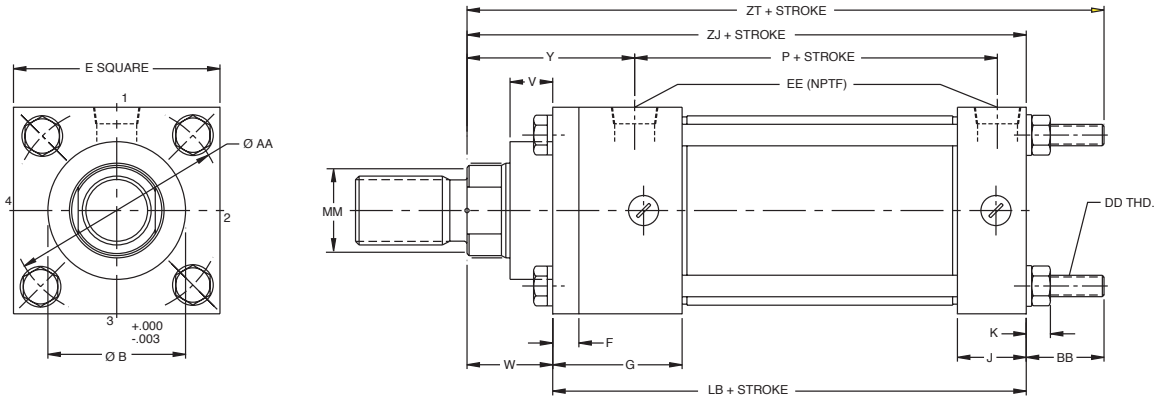
Bore In.	E	SAE Port EE	F	G	J	K	LB	P
1.000	1.50	4	0.38	1.50	1.00	0.19	3.88	2.13
1.500	2.00	6	0.38	1.50	1.00	0.25	4.00	2.28
2.000	2.50	6	0.38	1.50	1.00	0.31	4.00	2.28
2.500	3.00	6	0.38	1.50	1.00	0.31	4.13	2.38
3.250	3.75	10	0.63	1.75	1.25	0.38	4.88	2.69
4.000	4.50	10	0.63	1.75	1.25	0.38	4.88	2.69
5.000	5.50	10	0.63	1.75	1.25	0.44	5.13	2.94
6.000	6.50	12	0.75	2.00	1.50	0.44	5.75	3.16
8.000	8.50	12	0.75	2.00	1.50	0.56	5.88	3.28

Mounting MX1, MX2, MX3

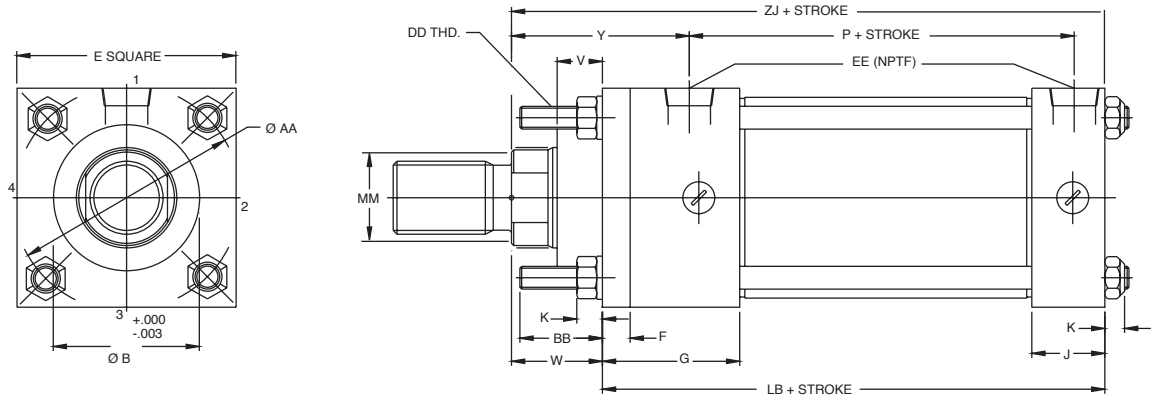
CDT1 MX1



CDT1 MX2



CDT1 MX3



Dimensions MX1, MX2, MX3

Table 1 - Dimensions affected by rod diameter

Bore In.	Rod In.	V	W	Y	ZJ	ZT
1.000	0.500	0.25	0.63	1.94	4.50	5.25
	0.625	0.25	0.63	1.94	4.50	5.25
1.500	0.625	0.25	0.63	1.94	4.63	5.62
	1.000	0.50	1.00	2.31	5.00	6.00
2.000	0.625	0.25	0.63	1.94	4.63	5.75
	1.000	0.50	1.00	2.31	5.00	6.12
	1.375	0.63	1.25	2.56	5.25	6.38
2.500	0.625	0.25	0.63	1.94	4.75	5.88
	1.000	0.50	1.00	2.31	5.13	6.25
	1.375	0.63	1.25	2.56	5.38	6.50
	1.750	0.75	1.50	2.81	5.63	6.75
3.250	1.000	0.25	0.75	2.38	5.63	7.00
	1.375	0.38	1.00	2.63	5.88	7.25
	1.750	0.50	1.25	2.88	6.13	7.50
	2.000	0.50	1.38	3.00	6.25	7.62
4.000	1.000	0.25	0.75	2.38	5.63	7.00
	1.375	0.38	1.00	2.63	5.88	7.25
	1.750	0.50	1.25	2.88	6.13	7.50
	2.000	0.50	1.38	3.00	6.25	7.62
	2.500	0.63	1.63	3.25	6.50	7.88
5.000	1.000	0.25	0.75	2.38	5.88	7.69
	1.375	0.38	1.00	2.63	6.13	7.94
	1.750	0.50	1.25	2.88	6.38	8.19
	2.000	0.50	1.38	3.00	6.50	8.31
	2.500	0.63	1.63	3.25	6.75	8.56
	3.000	0.63	1.63	3.25	6.75	8.56
	3.500	0.63	1.63	3.25	6.75	8.56
6.000	1.375	0.25	0.88	2.78	6.63	8.44
	1.750	0.38	1.13	3.03	6.88	8.69
	2.000	0.38	1.25	3.16	7.00	8.81
	2.500	0.50	1.50	3.41	7.25	9.06
	3.000	0.50	1.50	3.41	7.25	9.06
	3.500	0.50	1.50	3.41	7.25	9.06
	4.000	0.50	1.50	3.41	7.25	9.06

Tie Rod and Flange Mounts are basically the same except that the tie rods are extended and used to mount the cylinder. To prevent misalignment, sagging or binding of the cylinder when long strokes are required, the free end of the cylinder should be supported. For thrust load applications, blind or cap end tie rod extensions are best. For tension load applications, rod or head end extensions are best. Tie rod mounts are suited form any applications, however it should be noted that they are not as rigid as the flange mountings.

NOTE: The bearing retainer plate is the same as the “E” dimension for the 1.5” – 6” bore sizes.

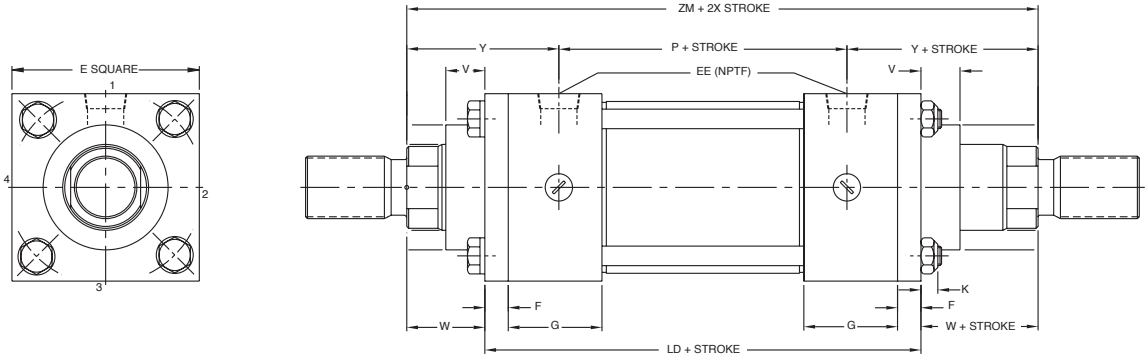
Rod end options shown on page 6.

Table 2 - Dimensions not affected by rod diameter

Bore In.	E	SAE EE	F	G	J	K	AA	BB	DD	LB	P
1.000	1.50	4	0.38	1.50	1.00	0.19	1.53	.75	10 - 24	3.88	2.13
1.500	2.00	6	0.38	1.50	1.00	0.25	2.02	1.00	1/4 - 28	4.00	2.28
2.000	2.50	6	0.38	1.50	1.00	0.31	2.60	1.13	5/16 - 24	4.00	2.28
2.500	3.00	6	0.38	1.50	1.00	0.31	3.10	1.13	5/16 - 24	4.13	2.38
3.250	3.75	10	0.63	1.75	1.25	0.38	3.90	1.38	3/8 - 24	4.88	2.69
4.000	4.50	10	0.63	1.75	1.25	0.38	4.70	1.38	3/8 - 24	4.88	2.69
5.000	5.50	10	0.63	1.75	1.25	0.44	5.80	1.81	1/2 - 20	5.13	2.94
6.000	6.50	12	0.75	2.00	1.50	0.44	6.90	1.81	1/2 - 20	5.75	3.16

Mounting CGT1

CGT1



Pressure Ratings for Double Rod End

Bore Size	Rod Size	Cushion Rod end or Non-Cushion	Cushion Both Ends or Ext. (psi)
1.000	0.500	500	n/a
	0.625	500	n/a
1.500	0.625	1,000	750
	1.000	1,000	1,000
2.000	0.625	800	450
	1.000	1,000	500
	1.375	1,000	1,000
2.500	0.625	500	250
	1.000	1,000	500
	1.375	1,000	1,000
	1.750	1,000	1,000
3.250	1.000	500	n/a
	1.375	1,000	1,000
	1.750	1,000	1,000
	2.000	1,000	1,000
4.000	1.000	400	n/a
	1.375	1,000	1,000
	1.750	1,000	1,000
	2.000	1,000	1,000
	2.500	1,000	1,000

Bore Size	Rod Size	Cushion Rod end or Non-Cushion	Cushion Both Ends or Ext. (psi)
5.000	1.000	250	n/a
	1.375	750	750
	1.750	750	750
	2.000	750	750
	2.500	750	750
	3.000	750	750
	3.500	750	750
6.000	1.375	250	n/a
	1.750	750	750
	2.000	750	750
	2.500	675	675
	3.000	750	750
	3.500	750	750
	4.000	750	750
8.000	1.375	200	n/a
	1.750	500	450
	2.000	500	500
	2.500	500	500
	3.000	500	500
	3.500	500	500
	4.000	500	500
	4.500	500	500
	5.000	500	500
	5.500	500	500

Mounting CGT1

Table 1 - Dimensions affected by rod diameter

Bore In.	Rod In.	V	W	Y	ZL	ZM
1.000	0.500	0.25	0.63	1.94	5.63	6.00
	0.625	0.25	0.63	1.94	5.63	6.00
1.500	0.625	0.25	0.63	1.94	5.73	6.13
	1.000	0.50	1.00	2.31	6.10	6.88
2.000	0.625	0.25	0.63	1.94	5.78	6.13
	1.000	0.50	1.00	2.31	6.15	6.88
	1.375	0.63	1.25	2.56	6.40	7.38
2.500	0.625	0.25	0.63	1.94	5.90	6.25
	1.000	0.50	1.00	2.31	6.27	7.00
	1.375	0.63	1.25	2.56	6.52	7.50
	1.750	0.75	1.50	2.81	6.77	8.00
3.250	1.000	0.25	0.75	2.38	7.09	7.50
	1.375	0.38	1.00	2.63	7.34	8.00
	1.750	0.50	1.25	2.88	7.59	8.50
	2.000	0.50	1.38	3.00	7.72	8.75
4.000	1.000	0.25	0.75	2.38	7.09	7.50
	1.375	0.38	1.00	2.63	7.34	8.00
	1.750	0.50	1.25	2.88	7.59	8.50
	2.000	0.50	1.38	3.00	7.72	8.75
	2.500	0.63	1.63	3.25	7.97	9.25
5.000	1.000	0.25	0.75	2.38	7.44	7.75
	1.375	0.38	1.00	2.63	7.69	8.25
	1.750	0.50	1.25	2.88	7.94	8.75
	2.000	0.50	1.38	3.00	8.07	9.00
	2.500	0.63	1.63	3.25	8.32	9.50
	3.000	0.63	1.63	3.25	8.32	9.50
	3.500	0.63	1.63	3.25	8.32	9.50
6.000	1.375	0.25	0.88	2.78	8.32	8.75
	1.750	0.38	1.13	3.03	8.57	9.25
	2.000	0.38	1.25	3.16	8.69	9.50
	2.500	0.50	1.50	3.41	8.94	10.00
	3.000	0.50	1.50	3.41	8.94	10.00
	3.500	0.50	1.50	3.41	8.94	10.00
	4.000	0.50	1.50	3.41	8.94	10.00
8.000	1.375	0.25	0.88	2.78	7.82	8.88
	1.750	0.38	1.13	3.03	8.07	9.38
	2.000	0.38	1.25	3.16	8.19	9.63
	2.500	0.50	1.50	3.41	8.44	10.13
	3.000	0.50	1.50	3.41	8.44	10.13
	3.500	0.50	1.50	3.41	8.44	10.13
	4.000	0.50	1.50	3.41	8.44	10.13
	4.500	0.50	1.50	3.41	8.44	10.13
	5.000	0.50	1.50	3.41	8.44	10.13
	5.500	0.50	1.50	3.41	8.44	10.13

Double rod end cylinders are available in every mounting style except MP1, MP3 and MP5. For dimensions on specific mounting styles, consult the page showing the required mounting. On cylinders where the rod ends are not the same, be sure to specify where each rod end is located in relation to the mounting requirements.

Note that bore sizes 1.0" – 6" have square retainers, the same square size as the head on both ends. One of these retainers is held in place by the tie rod nuts, and therefore cannot be removed without loosening the tie rods.

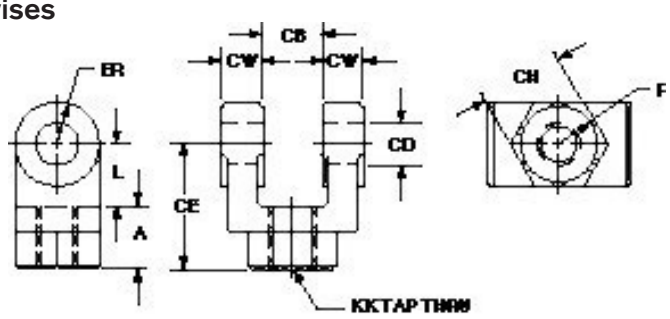
Rod end options shown on page 6.

Table 2 - Dimensions not affected by rod diameter

Bore In.	E	SAE EE	F	G	K	LD	LB	P
1.000	1.50	4	0.38	1.50	0.19	4.75	3.88	2.13
1.500	2.00	6	0.38	1.50	0.25	4.88	4.00	2.28
2.000	2.50	6	0.38	1.50	0.31	4.88	4.00	2.28
2.500	3.00	6	0.38	1.50	0.31	5.00	4.13	2.38
3.250	3.75	10	0.63	1.75	0.38	6.00	4.88	2.69
4.000	4.50	10	0.63	1.75	0.38	6.00	4.88	2.69
5.000	5.50	10	0.63	1.75	0.44	6.25	5.13	2.94
6.000	6.50	12	0.75	2.00	0.44	7.00	5.75	3.16
8.000	8.50	12	0.75	2.00	0.56	5.63	5.88	3.28

Rexroth Cylinder Accessories

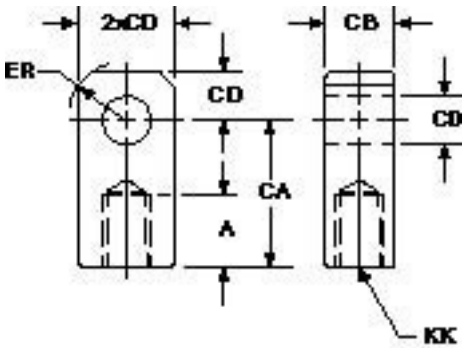
Rod Clevises

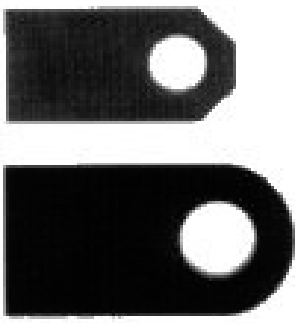


Part No.	CB	CD	CE	CH	CW	F	L	A	KK	ER
R978935057	.765	0.50	1.00	1.00	0.50	1.00	0.75	0.75	7/16-20	0.50
R978935058	1.265	0.75	2.38	1.25	0.63	1.25	1.25	1.13	3/4-16	0.75
R978935059	1.265	0.75	2.17	1.38	0.63	1.25	1.00	1.13	3/4-16	0.75
R978935060	1.515	1.00	3.13	1.50	0.75	1.50	1.50	1.83	1-14	1.00
R978935061	2.032	1.13	4.13	2.00	1.00	2.00	2.13	2.00	1-1/4-12	1.38
R978935062	2.531	1.75	4.50	2.38	1.25	2.38	2.25	2.25	1-1/2-12	1.75
R978935063	2.531	2.00	5.50	2.94	1.25	2.94	2.50	3.00	1-7/8-12	2.00
R978935064	3.032	2.50	6.50	3.50	1.50	3.50	3.00	3.50	2-1/4-12	2.50
R978935065	3.032	3.00	6.75	3.88	1.50	3.88	3.25	3.50	2-1/2-12	2.75

Note: Pins must be ordered separately, see Page 31 for dimensions and part numbers.

Rod Eyes

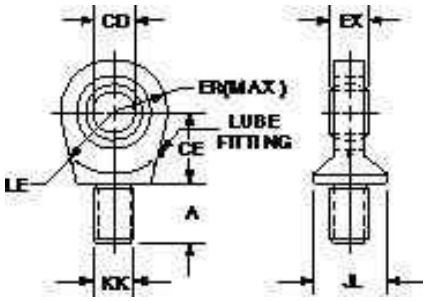




Part No.	A	CA	CB	CD	ER	KK
R978935066	0.75	1.50	0.75	0.50	0.63	7/16-20
R978935067	1.13	2.06	1.25	0.75	0.88	3/4-16
R978935068	1.13	2.81	1.50	1.00	1.19	3/4-16
R978935069	1.83	2.38	1.50	1.00	1.44	1-14
R978935070	2.00	3.44	2.00	1.38	1.56	1-1/4-12
R978935071	2.25	4.00	2.50	1.75	2.00	1-1/2-12
R978935072	3.00	5.00	2.50	2.00	2.50	1-7/8-12
R978935073	3.50	5.81	3.00	2.50	2.81	2-1/4-12
R978935074	3.50	6.13	3.00	3.00	3.25	2-1/2-12

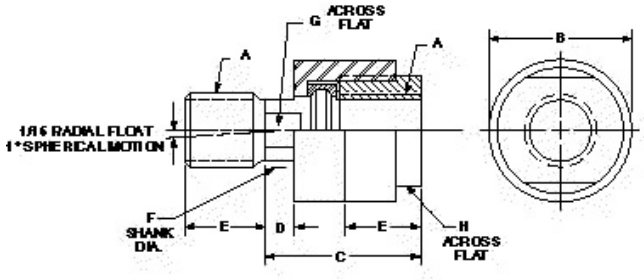
Rexroth Cylinder Accessories

Spherical Rod Eyes



Part No.	CD -.0005	A	CE	EX	ER	LE	KK	JL
R978935075	0.500	1.06	0.88	0.44	0.88	0.75	7/16-20	0.88
R978935076	0.750	1.00	1.25	2.03	1.25	1.06	3/4-16	1.31
R978935077	1.000	1.50	1.88	0.88	1.38	1.44	1-14	1.50
R978935078	1.375	2.00	2.13	1.19	1.81	1.88	1-1/4-12	2.00
R978935079	1.750	2.13	2.50	1.53	2.19	2.13	1-1/2-12	2.25
R978935081	2.000	2.88	2.75	1.75	2.63	2.50	1-7/8-12	2.75

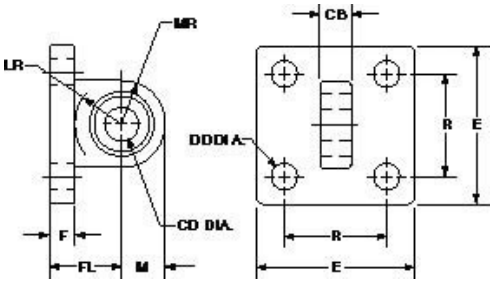
Alignment Couplers



Part No.	A	B	C	D	E	F	O	H	Max. Pull at Yield
R978935082	7/16-20	1.25	2.00	0.50	0.75	0.63	0.56	1.13	10,000
R978935080	1/2-20	1.25	2.00	0.50	0.75	0.63	0.56	1.13	14,000
R978935083	3/4-16	1.75	2.31	0.31	1.13	3.03	0.88	1.50	34,000
R978935084	7/8-14	1.75	2.31	0.31	1.13	3.03	0.88	1.50	34,000
R978935085	1-14	2.50	2.94	0.50	1.63	1.38	1.25	2.25	64,000
R978935086	1-1/4-12	2.50	2.94	0.50	1.63	1.38	1.25	2.25	64,000
R978935087	1-1/2-12	3.25	4.38	0.81	2.25	1.75	1.50	3.00	120,000
R978935088	1-3/4-12	3.25	4.38	0.81	2.25	1.75	1.50	3.00	120,000
R978935089	1-7/8-2	3.75	5.44	0.69	3.00	2.25	1.88	3.50	240,000
R978935099	2-12	3.75	5.44	0.69	3.00	2.25	1.88	3.50	240,000

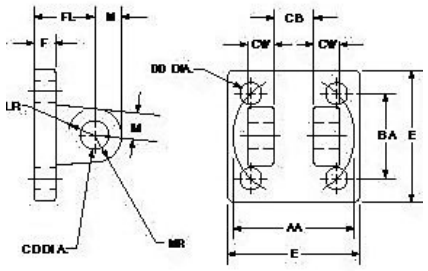
Rexroth Cylinder Accessories

Eye Brackets



Part No.	CB	CD	DD	E	F	FL	LR	M	MR	R
R978935036	0.75	0.50	1.09	2.50	0.38	1.13	0.75	0.50	0.56	1.63
R978935037	1.25	0.75	1.22	3.50	0.63	1.88	1.25	0.75	0.88	2.56
R978935038	1.50	1.00	2.03	4.50	0.75	2.25	1.50	1.00	1.25	3.25
R978935039	2.00	1.38	2.03	5.00	0.88	3.00	1.13	1.38	1.63	3.81
R978935040	2.50	1.75	2.28	6.50	0.88	3.13	2.25	1.75	2.13	4.95
R978935041	2.50	2.00	1.17	7.50	1.00	3.50	2.50	2.00	2.44	5.75
R978935042	3.00	2.50	1.19	8.50	1.00	4.00	3.00	2.50	3.00	6.59
R978935043	3.00	3.00	1.31	9.50	1.00	4.25	3.25	3.00	3.25	7.50
R978935044	4.00	3.50	1.81	12.63	1.06	5.69	4.00	3.50	4.13	9.62
R978935045	4.50	4.00	2.06	14.88	1.31	6.44	4.50	4.00	5.25	11.50

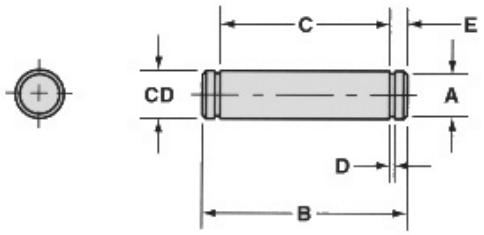
Clevis Brackets



Part No.	AA	BA	CB	CD	CW	DD	E	F	FL	LR	M	MR
R978935047	2.9	2.06	1.265	0.75	0.63	1/2 - 20	3.00	0.63	1.88	1.00	0.75	1.06
R978935048	3.6	2.56	1.265	0.75	0.63	1/2 - 20	3.50	0.63	1.88	1.06	0.75	1.06
R978935049	4.6	3.25	1.515	1.00	0.75	5/8 - 18	4.50	0.75	2.25	1.25	1.00	1.13
R978935050	5.4	3.81	2.032	1.38	1.00	5/8 - 16	5.00	0.88	3.00	1.88	1.38	1.75
R978935051	7.0	4.94	2.531	1.75	1.25	7/8 - 14	6.50	0.88	3.13	2.00	1.75	1.88
R978935052	8.1	5.75	2.531	2.00	1.25	1 - 14	7.50	1.00	3.50	2.13	2.00	2.13
R978935053	9.3	6.59	3.032	2.50	1.50	1 1/8 - 12	8.50	1.00	4.00	2.63	2.50	2.50
R978935054	10.6	7.50	3.032	3.00	1.50	1/4 - 12	9.50	1.00	4.25	2.88	2.75	2.75
R978935055	13.6	9.63	4.032	3.50	2.00	1 3/4 - 12	12.63	1.69	5.69	3.63	3.50	3.50
R978935056	16.2	11.50	4.532	4.00	2.25	2 - 12	14.88	1.94	6.44	4.00	4.00	4.00

Rexroth Cylinder Accessories

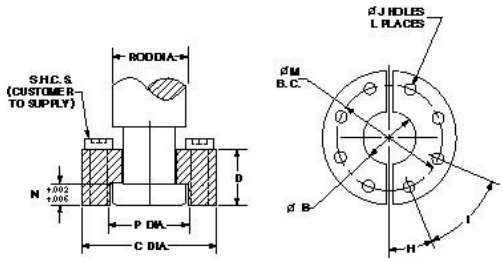
Pivot Pins-Grooved



Pivot Pins							C-Rings	
Part No.	CD	A	B	C	D	E	Part No.	CD
R978935026	0.500	0.468	2.094	1.875	0.041	0.109	R978000049	0.500
R978935027	0.750	0.704	2.875	2.625	0.048	0.125	R978000189	0.750
R978935028	1.000	0.940	3.375	3.125	0.048	0.125	R978000190	1.000
R978935029	1.375	1.291	4.485	4.187	0.056	0.149	R978000191	1.375
R978935030	1.750	1.650	5.547	5.188	0.068	0.180	R978000192	1.750
R978935031	2.000	1.886	5.547	5.188	0.068	0.180	R978000206	2.000
R978935032	2.500	2.360	6.625	6.188	0.086	0.219	R978000193	2.500
R978935033	3.000	2.838	6.780	6.250	0.103	0.265	R978000194	3.000

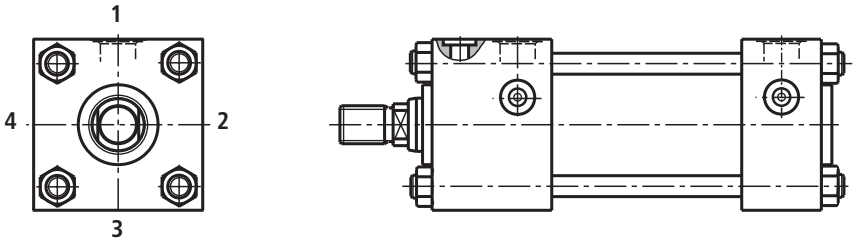
Note: When ordering pivot pins, two C-rings must also be ordered for each pin. Pivot pins do not automatically ship with C-rings. Additional C-rings are available in any quantity.

Safe Rod End Coupler



Part No.	Rod. Dia.	B	C	D	H	I	J	L	M	N	P	Material
R978007008	0.625	0.406	1.500	0.562	45°	90°	0.218	4	1.125	0.250	0.656	AISI 1144 CD
R978007009	1.000	0.750	2.000	0.875	30°	60°	0.218	6	1.500	0.375	1.063	AISI 1144 CD
R978007010	1.375	0.938	2.500	1.000	30°	60°	0.343	6	2.000	0.375	1.438	AISI 1018 CD
R978007011	1.750	1.187	3.000	1.250	22.5°	45°	0.343	8	2.375	0.500	1.813	AISI 1018 CD
R978007012	2.000	1.438	3.500	1.625	15°	30°	0.406	12	2.688	0.625	2.063	AISI 1018 CD
R978007013	2.500	1.875	4.000	1.875	15°	30°	0.406	12	3.188	0.750	2.625	AISI 1018 CD
R978007014	3.000	2.375	5.000	2.375	15°	30°	0.531	12	4.000	0.875	3.125	AISI 1018 CD
R978007015	3.500	2.625	5.875	2.625	15°	30°	0.656	12	4.688	1.000	3.625	C1119 MOD
R978007016	4.000	3.125	6.375	2.625	15°	30°	0.656	12	5.188	1.000	4.125	C1119 MOD
R978007017	4.500	3.625	6.875	3.125	15°	30°	0.656	12	5.688	1.500	4.625	C1119 MOD
R978007018	5.000	4.000	7.375	3.125	15°	30°	0.656	12	6.188	1.500	5.125	C1119 MOD
R978007019	5.500	4.500	8.250	3.875	15°	30°	0.781	12	6.875	1.875	5.625	C1119 MOD

Port Connection Locations

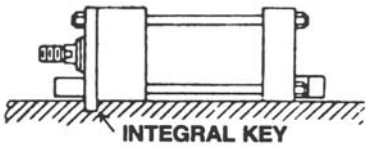


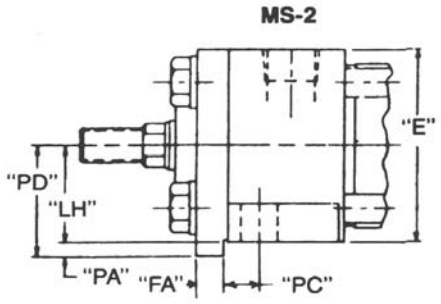
Mount Style	Port Location Head	Port Location Cap	Cushion Adjustment Head	Cushion Adjustment Cap	Air Bleed Head	Air Bleed Cap	Prox. Switch Loc. Head	Prox. Swith Loc. Cap
MX0, MF1, MF2, MF5	1	1	2	2	4	4	3	3
MF6, MP1, MP5,	2	2	3	3	1	1	4	4
MS7, MT4, MX1,	3	3	4	4	2	2	1	1
MX2, MX3	4	4	1	1	3	3	2	2
MT1	1	1	3	2	3	4	C/F	3
	3	3	1	4	1	1	C/F	1
MT2	1	1	2	3	4	3	3	C/F
	3	3	4	1	2	1	1	C/F
MS2	1	1	2	2	4	4	3	3
	3	3	4	4	2	2	1	1
MS3	1	1	3	3	3	3	C/F	C/F
	3	3	1	1	1	1	C/F	C/F
MS4	1	1	2	2	4	4	C/F	C/F
	2	2	4	4	1	1	C/F	C/F
	4	4	2	2	1	1	C/F	C/F

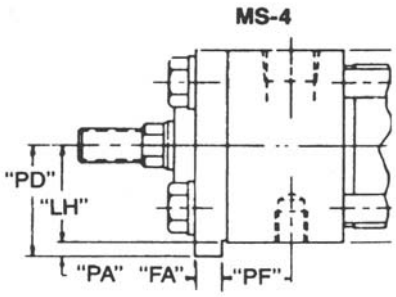
Note: Air bleed valves and piston rod cushions not available on Head or Cap ends of 1" and 1.5" bore cylinders. Air bleed valves and cushioning not available on head end of 2" bore with 1.38" rod and 2.5" bore with 1.75" rod.

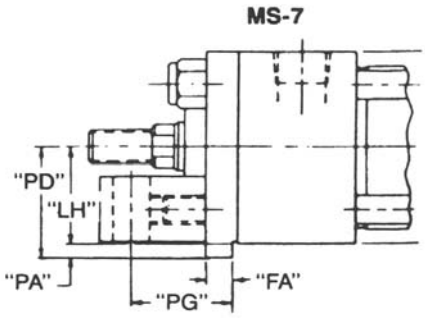
Extended Key Plates

Rexroth offers a standard arrangement of Thrust Key Mountings on the MS2, MS4 and MS7 CDT1 cylinders. This option eliminates the need for fitted bolts or external keys to carry the thrust load. The normal headplate is extended below the head surface of the cylinder and is fitted in a keyway milled into the mounting surface of the machine member. See drawing for details.









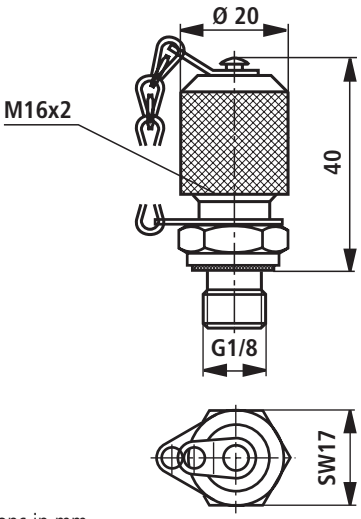
Bore	E	FA + 0.00	LH + 0.00	PA	PC	PD	PF	PG
1.50″	2.00	.313 - .002	0.994 - .002	0.19	0.44	1.18	1.00	1.06
2.00″	2.50	.313 - .002	1.244 - .002	0.19	0.44	1.43	1.00	1.25
2.50″	3.00	.313 - .002	1.494 - .002	0.19	0.44	1.68	1.00	1.38
3.25″	3.75	.563 - .002	1.869 - .002	0.31	0.56	2.18	1.13	1.44
4.00″	4.50	.563 - .002	2.244 - .002	0.31	0.56	2.56	1.13	1.56
5.00″	5.50	.563 - .002	2.744 - .002	0.31	0.56	3.06	1.13	1.63
6.00″	6.50	.688 - .002	3.244 - .002	0.38	0.75	3.62	1.38	1.69

Notes:

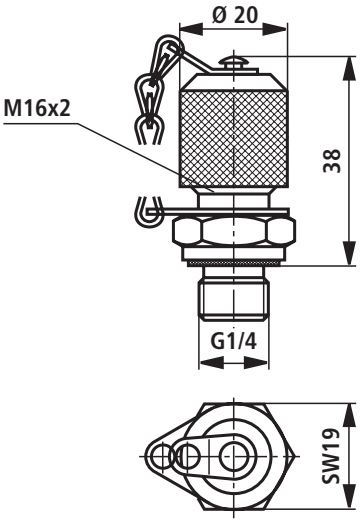
1. Use mounting bolts 0.06 smaller in diameter than hole size.
2. Fitted bolts or dowel pins are not needed with the thrust key headplate.
3. All dimensions not shown are NFPA standard.
4. PD, PA, FA dimensions typical for all mounts.

Test Point Coupling

*** For bore sizes - 2“ - 2-1/2“**



For Bore Sizes - 3-1/4“-8“



Above dimensions in mm.

Notes

For pressure measurement or bleeding.

For installation in the bleed/measuring port. Coupling with check valve function, i.e. it can also be connected under pressure.

Scope of supply for bore sizes - 2" to 2-1/2"

Coupling AB-E 20-11/K3, G 1/8
with NBR seal, Material no. 00014363

Coupling AB-E 20-11/K3V, G 1/8
with FPM seal, Material no. 00024710

Scope of supply for bore sizes - 3-1/4" to 8"

Coupling AB-E 20-11/K1, G 1/4
with NBR seal, Material no. 00009090

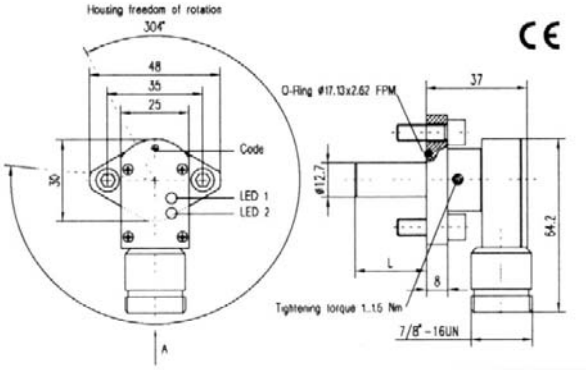
Coupling AB-E 20-11/K1V, G 1/4
with FPM seal. Material no. 00001264

* N/A on head end of 2" bore with 1-3/8" rod and 2-1/2" bore with 1-3/4" rod

CDT1 Proximity Switch

High Pressure - 3000 psi (207 bar) Cylinder Sensors 2 wire AC/ DC Mini-Style Quick Disconnect

Dimensions (in mm)

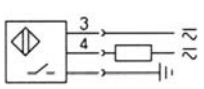


Ordering Code	Shielded (Flush Mounting)
Sensing Distance Sn	**2 mm**
Function	
Normally Open	
Electrical	
Operating distance S_A	0...1.6 mm
Supply voltage	20 - 250 V AC/DC
Supply frequency	50 / 60 Hz
Load current capacity	5 - 400 mA
Inrush current	3A (t = 20 ms)
Leakage current	≤ 1.7 mA
Voltage drop	≤ 6 V
Switching frequency	50 Hz
Start up delay	≤ 150 ms
Switch hysteresis	≤ 15% of Sn
Repeatability	≤ 5% of Sn
Ambient temperature range	-25°C to +70°C
Output function LED	yes
Short circuit & overload protected	yes
Mechanical	
Housing material	Nickel plated brass housing
Electrical connection	AC Mini Syle Connector
Protection class	IP 67
Housing, freedom of rotation	304°

Probe Length	Part Number	Code
1.025	R978008781	Blue
1.250	R978008793	White
2.062	R978002203	Red
2.875	R978002204	Orange
3.775	R978008792	Silver
4.560	R978009001	Gold

Wiring Connections

2 Wire AC/DC Normally Open



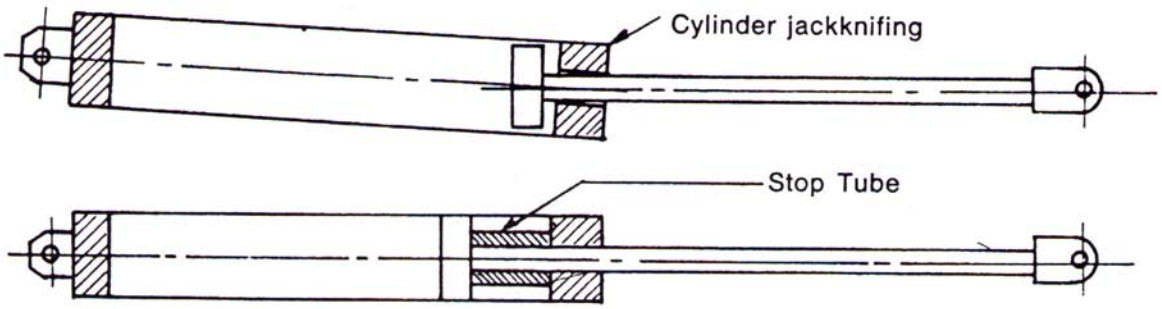
View of male connector pins

Stop Tube

In long cylinders which are pushing a load, internal stop tubes are used to prevent excessive bearing wear and jackknifing of the cylinder. They are installed between the piston and the head, providing additional bearing support by increasing the distance between the piston and the head in the fully extended position.

For long, trouble free bearing service, the bearing loads should not exceed about 200 psi. Standard cylinders are not designed for heavy eccentric loads.

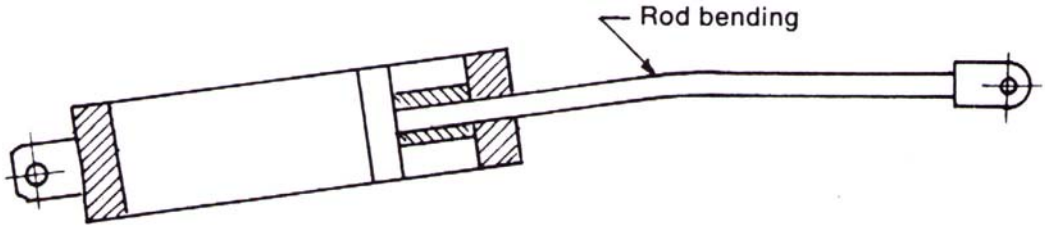
The use of oversize rods to reduced bearing loads is not recommended. They are not as effective as stop tubes, and if misalignment occurs the additional rod stiffness will actually increase bearing loads. For long push stroke cylinders, a stop tube may be required to limit radial bearing loads to a safe value and prevent jackknifing. They are especially desirable in long stroke pivoted centerline style mountings. The effect of a stop tube may be duplicated by providing additional unused stroke and stopping the cylinder extension by external means.



Column Strength Considerations

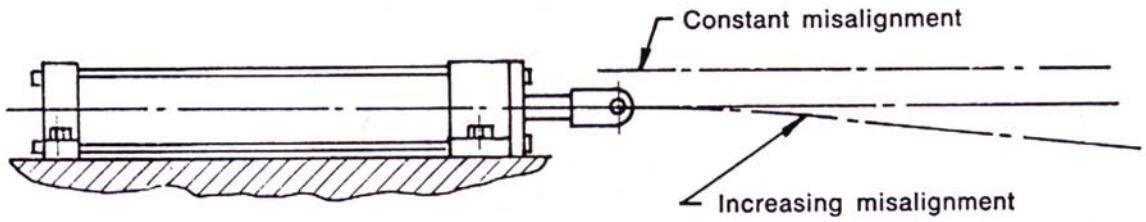
Standard size rods are recommended for use in cylinder applications where column strength, rod sag, or rate of cylinder return do not require an oversize rod. Being more flexible, standard rods absorb shock loads and minimize bearing loads caused by misalignments.

For long push stroke cylinders, an oversize rod may be required to prevent column failure and rod bending. Total cylinder length, extended is considered in column strength. Refer to the tables on the following pages for calculations regarding the column strength and stop tube required for a cylinder application.



Mounting Considerations for Cylinders - Fixed Non-Centerline Mountings

Fixed mount cylinders can tolerate a slight misalignment that is zero at full retraction and increases slightly with stroke. With other than very large rods, a misalignment of about .003" to .005" per foot of stroke is usually permissable. Rigid mounted cylinders cannot tolerate a fixed misalignment, particularly at full retraction.



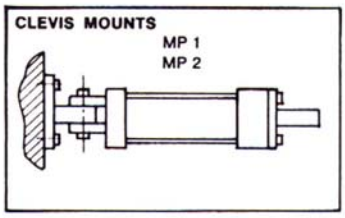
Mounting Considerations for Cylinders - Pivoted Centerline Mountings

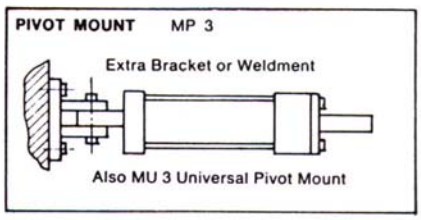
If the path of the load is curved or misalignment is a problem, a pivoted centerline mounting should be used. This compensation of nonlinear travel is in one plane only, as would occur during the operation of a lever. Pivot mounts require the rod end attachment to also be a pivot type. Close tolerance pins should be used and it is recommended that the cylinder manufacturer's accessory brackets be used to maintain good fits.

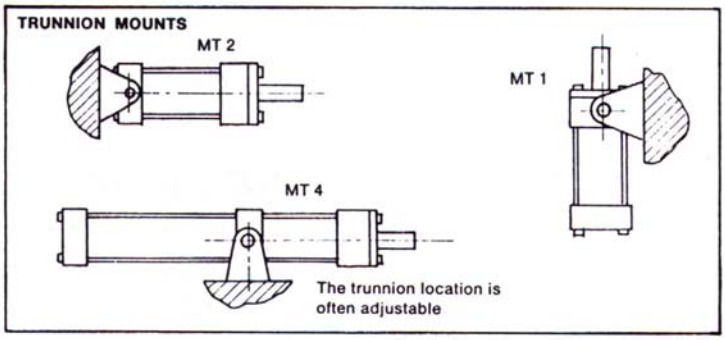
For short strokes, medium or smaller bore cylinder applications, the clevis mount is recommended. This is probably the most widely used cylinder mounting. Where the clevis mount should normally be used, but would cause the overall length of the cylinder to be excessive, the cap trunnion mount can be used. Head end trunnions should be carefully applied to either short strokes or to application where the weight of the cylinder falls vertically below the pin.

For long stroke cylinders and/or heavy cylinders, the center or intermediate trunnion mount is recommended. This mount supports the weight of the cylinder and should be located near the balance point of the cylinder at the time of maximum thrust. For general applications, a good estimate for the location of the intermediate trunnion is 1/3 back from the head end.

The MP5 (universal) type mount is a pivot mount with a spherical bearing fitted into the pivot to permit 5 to 10 degrees of movement in a plane perpendicular to the major plane of pivot movement. It is probably the most serviceable of the pivoted centerline mounts. For maximum effectiveness, a spherical bearing type rod end fitting should be utilized at the same time.

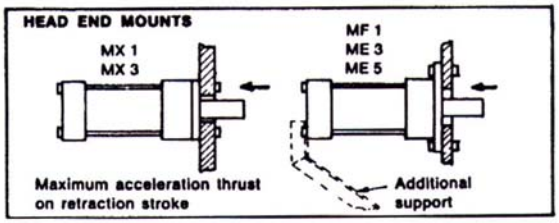


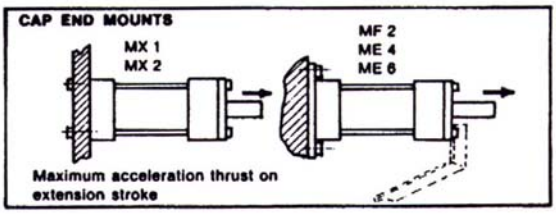


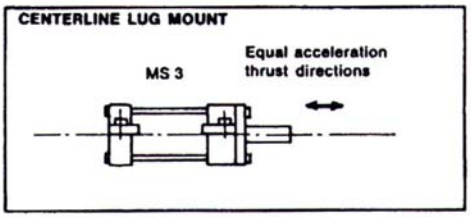


Mounting Considerations for Cylinders - Fixed Centerline Mountings

These mounting styles, illustrated below, tend to be more stable against sway on the power extension stroke. Rigid machine frame members are required to prevent misalignment under loads. The travel path of the rod end should be linear and be guided if at all possible. Long supported extension of the rod end must be avoided. Refer to the stop tube calculation data which shows the advantages of supporting and using reliable guiding on the rod end. Long stroke cylinders with fixed end mounts may require additional support at the free end of the cylinder body. This is illustrated in dotted outlines in the sketches below.



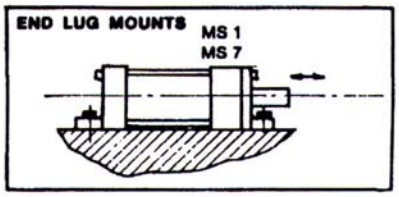


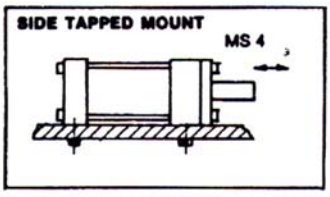


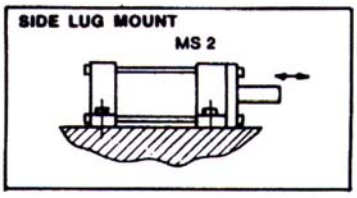
Mounting Considerations for Cylinders - Fixed Non-Centerline Mountings

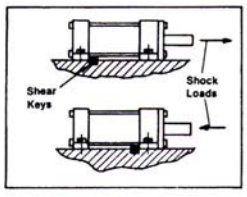
These types of mounts are perhaps the easiest to use for mounting and replacement ease. The offset thrust line introduces bending stresses and additional loads on the mounting bolts. This type should be very well aligned for maximum service life. The load must travel in a very linear path and be supported and guided both horizontally and vertically as the data for calculating stop tube and column strength illustrates.

When applying these mounts with offset thrust under high pressure or shock loads, properly located shear pins or keys can be used. These provide positive location and prevent slight movement of the cylinder under shock conditions, which the normal clearance in the mounting bolt holes would allow. Very close tolerances (.001") should be maintained between keys and keyways. Keys should be located as illustrated below, at one end of the cylinder. When using dowel pins, do no pin across opposite corners, as serious twisting stresses will result.









Mounting Considerations for Cylinders

Selection of mounting style depends primarily upon the operating specifications of the application. Mountings are generally one of the following three types:

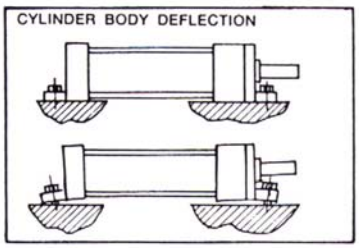
1. Fixed Centerline Mountings
   Where the thrust of the cylinder is focused on the centerline of the cylinder rod.
2. Fixed Non-Centerline Mountings
   Where the thrust of the cylinder is aligned parallel to, but not on, the centerline of the cylinder rod.
3. Pivoted Centerline Mountings
   Where the centerline of the cylinder may swing in one or more directions. Usually major movement is in one plane.

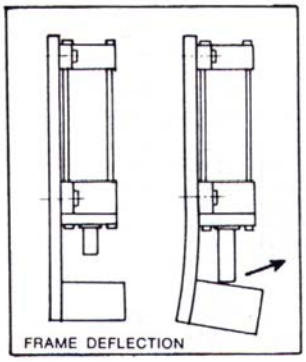
A very important general consideration is to keep the cylinder thrust as close as possible to the centerline of the piston rod and free from misalignment or side thrust. Off-center thrust or side loads subtract substantially from the anticipated rod bearing and rod seal service life.

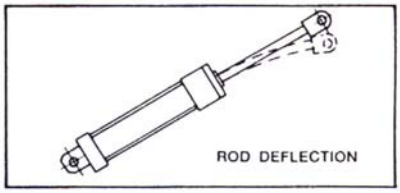
Off-center thrust and side loading can be caused by cylinder deflection under load, machine frame deflection, rod bending or sagging, cylinder pivot binding, nonlinear load movement, shifting of load; some of which are shown below.

In addition to the mounting styles, several other factors should be considered when mounting a cylinder. Care should be taken to avoid painting or damaging the exposed portion of the piston rod during construction. Threaded pieces should be pulled tight against thread shoulders to minimize bending and reduce fatigue stress. Rotation of the piston rod within the cylinder should be avoided to prevent possible scoring of the cylinder tube and damage to piston seals. Long cylinders may require additional body support to prevent damaging sag.

Major consideration must be given to the factors which might cause premature failure of the cylinder: unusual acceleration, unusual deceleration, alignment, support of cylinder weight, linear or curvilinear travel path of the load being moved, jackknifing of the cylinder, and the column strength of the rod. Some mounting styles are more suited than others to each of the above application factors.







Buckling

The permissible stroke with a flexible guided load and a 3.5 factor of safety against buckling can be obtained from the relevant table. For deviating cylinder installation positions, the permissible stroke length has to be interpolated. Permissible strokes for non-guided loads on request.

Calculations for buckling are determined using the following formulas:

1. Calculation according to Euler

$$F = \frac{\pi^2 \bullet E \bullet I}{\nu \bullet L_K^2} \quad \text{if } \lambda > \lambda g$$

2. Calculation according to Tetmajer

$$F = \frac{d^2 \bullet \pi\,(335 - 0.62 \bullet \lambda)}{4 \bullet \nu} \quad \text{if } \lambda \leq \lambda g$$

Explanation:

E = Modulus of elasticity in psi

= 30×10^6 for steel

I = Moment of inertia in inches^4 for circular cross-sectional area

$$= \frac{d^4 \bullet \pi}{64} = 0.0491 \bullet d^4$$

ν = 3.5 (safety factor)

L_K = Free buckling length in inches (depending on mounting type, see sketches A, B, C)

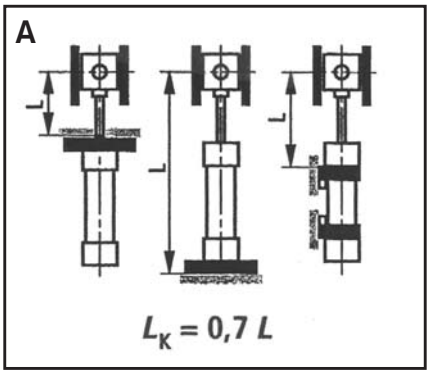
d = Piston rod Ø in inches

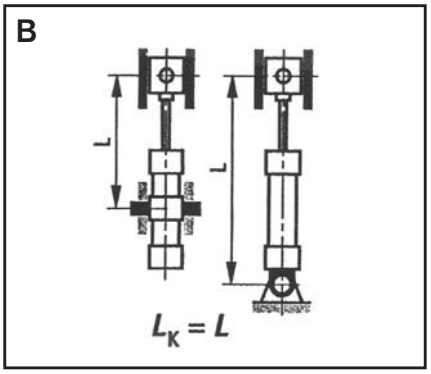
λ = Slenderness ratio

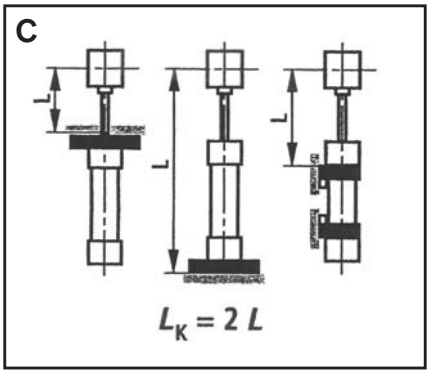
$$= \frac{4 \bullet L_K}{d} \qquad \lambda g = \pi \sqrt{\frac{E}{0.8 \bullet R_e}}$$

R_e = Yield strength of the piston rod material

Influence of the mounting type on buckling length:







Stop Tube

To determine whether a stop is required on push stroke cylinders:

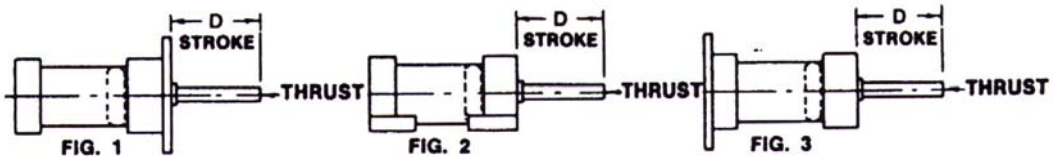
Step 1 - Determine which example below corresponds to your application.

Step 2 - Determine the value of "L" from the instructions given. The find "L" dimension in the table at the right for the required stop tube length. (Specify the effective stroke plus the stop tube length when ordering).

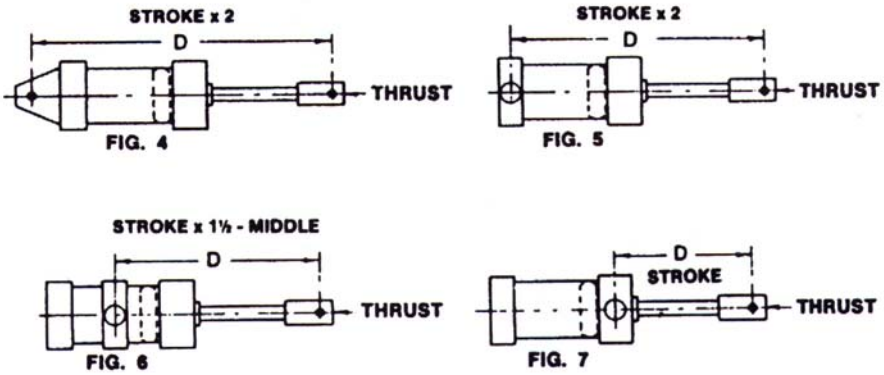
Step 3 - Add stop tube length to original "L" dimension to obtain your adjusted "L" dimension.

Example: "L" = 96", therefore, Stop Tube = 6"
Adjusted L = 102" (96+6)

Step 4 - Use adjusted "L" to figure rod column strength at maximum pressure rating of the cylinder, page 34.

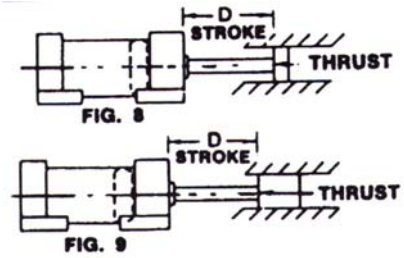


Typical rigidly mounted cylinders with rod unsupported at free end. May be mounted either horizontally or vertically. Use the equation L = 4D to determine values of "L" for all cylinder mountings in this category.



"L" Inches	Stop Tube Length (inches)
0-40	0
41-50	1
51-60	2
61-70	3
71-80	4
81-90	5
91-100	6
101-110	7
111-120	8

Typical trunnion mounted cylinders may be mounted either horizontally or vertically. Use the equation L = D to determine values of "L" for all cylinder mountings in this category. For center trunnion mounted cylinders (Figure 6), the position of the trunnion for most favorable bearing loads is obtained when "D" dimension with the rod retracted is approximately 1/3 overall length of cylinder with rod retracted.



Typically rigidly mounted cylinder with free end of rod supported with short guide. May be mounted either horizontally or vertically. Use the equation L = D to determine values of "L" for all cylinder mountings in this category.

Typical rigidly mounted cylinder with free end of rod supported with long closely-fitted guide. May be mounted either horizontally or vertically. Use the equation L = 1/2 D to determine values of "L" for all cylinder mountings in this category.

Column Strength and Oversize Rod Selection

Standard rod diameters are recommended for all Pull Stroke applications. To determine the correct rod diameter required for Push Stroke application, follow these simple steps:

Step 1 – Determine the value of "L_K" from the illustrations shown on page 40. (Use Adjusted "L_K" dimension for cylinder with Stop Tube).

Step 2 – From your cylinder size and maximum operating pressure, determine your Push Stroke Thrust.

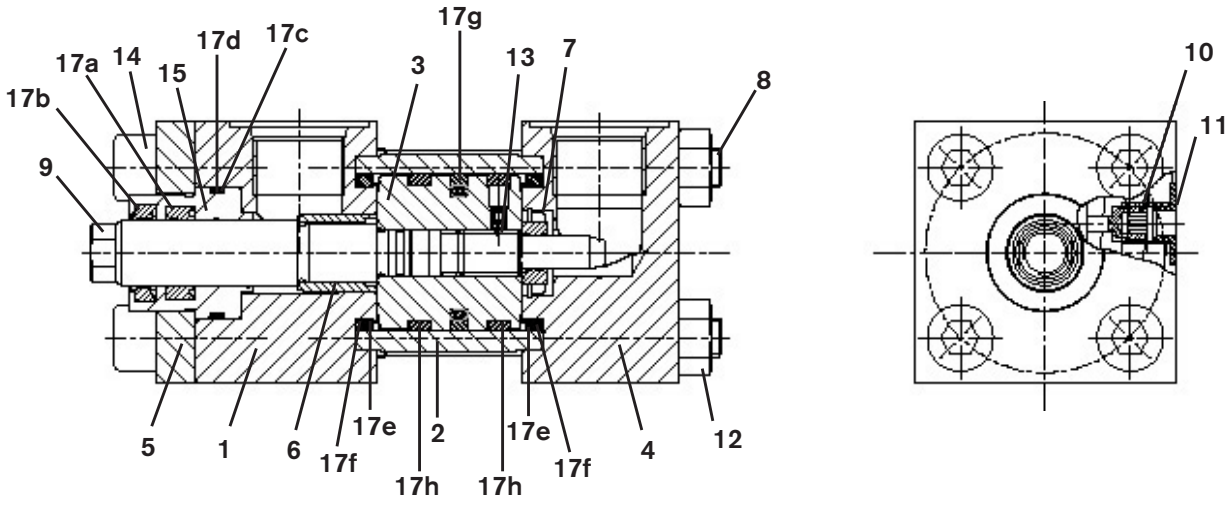
Step 3 – Find your thrust in the left hand column and located your "L_K" dimension (or Adjusted "L_K" dimension in the same horizontal line to the right; (if your exact "L_K" or adjusted "L_K" dimension is not shown, move to the right in the same horizontal column to the next larger number). Read vertically up from this number to the rod diameter shown. This is the required rod diameter for your application.

Example: Adjusted L_K of 80" at 16,000# would required 2-1/2" rod in the cylinder.

Thrust in Pounds Force at End of Rod	Rod Diameters												
	0.500	0.625	1.000	1.375	1.750	2.000	2.500	3.000	3.500	4.000	4.500	5.000	5.500
50	60	67											
100	43	58	110										
150	35	53	103										
250	27	43	94	146									
400	21	37	83	134	186								
700	16	30	68	118	168	202	275						
1,000	13	27	60	105	155	190	257	330					
1,400	11	24	53	92	142	174	244	308	385				
1,800	10	22	48	82	127	160	230	296	366	440			
2,400	9	19	45	75	114	145	213	281	347	415	488		
3,200	8	16	41	67	103	130	194	261	329	400	461		
4,000	7	13	38	63	94	119	175	240	310	378	446		
5,000	6	9	34	60	87	110	163	225	289	360	426	494	
6,000			30	56	82	102	152	208	274	342	410	476	
8,000			26	50	76	93	137	188	245	310	375	447	
10,000			21	45	70	89	125	172	222	279	349	412	485
12,000			17	41	65	84	118	152	210	269	326	388	454
16,000				34	57	75	110	142	188	235	292	350	420
20,000				28	52	68	103	136	172	218	270	326	385
30,000					39	55	87	120	156	189	230	285	330

Values of "LK" (inches)

Spare Parts CDT1



1	Head	**14**	Hex head bolt
2	Tube	**15**	Rod bearing
3	Piston	**16**	Cushion valve (not shown)
4	Cap	**17**	Seal kit:
5	Flange		**a.** Wiper
6	Cushion bushing		**b.** Rod seal
7	Cushion insert w/retainer		**c.** Bearing o-ring
8	Tie rod		**d.** Bearing back-up ring
9	Piston rod		**e.** Tube o-ring
10	Bleed screw		**f.** Tube back-up ring
11	Securing plate		**g.** Piston seal
12	Tie rod nut		**h.** Wear bands
13	Set screw		

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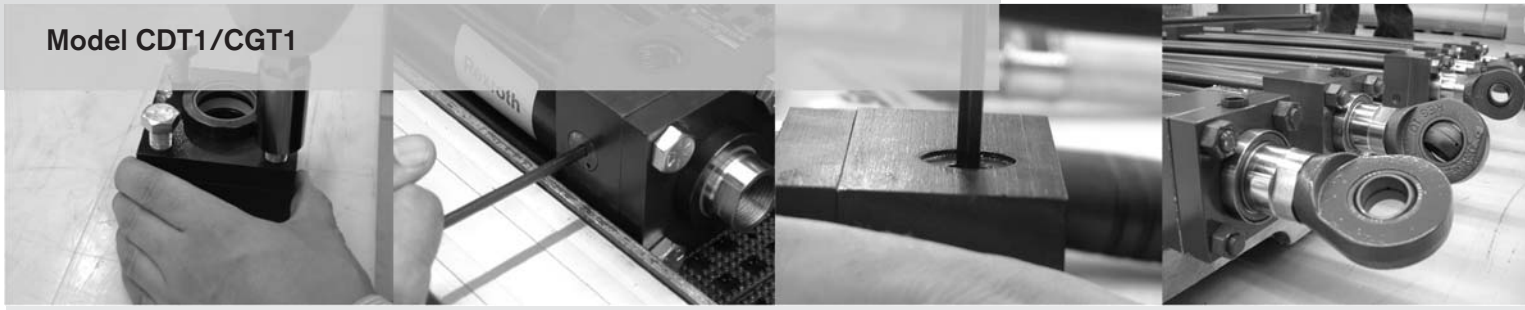
Rexroth
Bosch Group

Section 2

Service Manual for Hydraulic Cylinder

RA 17 038-DT1SM/03.05 1/8
Replaces: 03.04

Model CDT1/CGT1



Contents

Seal Replacement

General:

1. Always drain the pressure from a hydraulic system before performing any service work. Disconnect hydraulic lines from head and cap ports of cylinder.

2. Completely disassemble the cylinder using the exploded and assembly views as reference. No special tools are required except internal snap ring pliers. The piston rod assembly consisting of piston, piston rod and head cushion bushing (where used) are locktited and secured at the factory and are not to be disassembled.

3. After disassembling the cylinder, wash all metal parts in a non-flammable solvent. Rinse each part thoroughly and blow dry with a low-pressure air jet. Arrange the parts on a clean surface. Examine each part carefully. Replace all seals and any other worn or damaged parts.

4. Particular attention should be given to the piston rod (item 10) since cylinder leakage can result from a damaged rod. A scored rod might damage the rod bearing and, subsequently, the rod packing. Rod cartridge kits come with a new rod bearing plus seals (see Seal Kit table on page 6 of this manual.)

Old Rod Cartridge Kit Removal

1. Remove the hex head bolts (item 15) from the head end (item 1).

2. Remove the retainer plate or flange (item 5) from the head end. Locate the screwdriver slot along the top of the rod bearing (item 16). Using a flathead screwdriver, carefully pry the rod cartridge loose from the head in a fashion similar to opening a can of paint. The rod bearing assembly includes the wiper (item 19a), the rod seal (item 19b), the bearing o-ring and backup ring (items 19c-d), and the rod bearing (item 16) itself.

New Rod Cartridge Kit Installation:

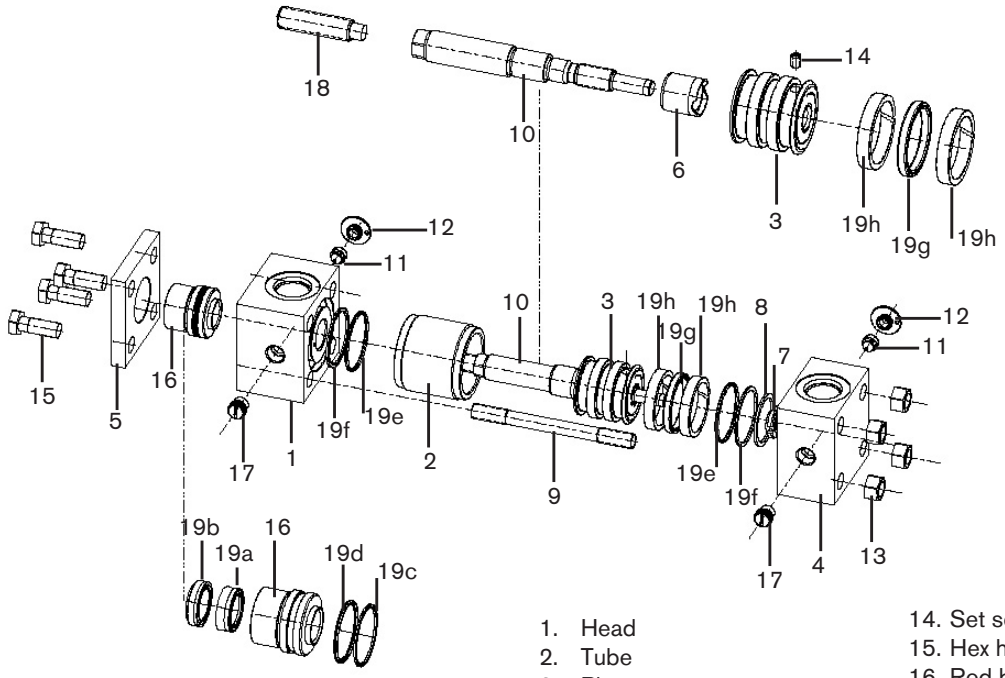
1. Lubricating the new rod bearing will ease installation into the head end. A rubber mallet may be required to push the rod bearing into the head end. Caution must be taken to not cut the new seals when passing the bearing over a male threaded rod.

2. Once the rod bearing is completely seated in the head end, the flange or retainer plate and tie rod nuts / hex head cap screws can be replaced onto the head end. Torque the bolts / screws to the specifications on page 3.

Piston Seal Installation:

1. Insert the energized piston seal o-ring onto the piston in the center groove. Do not roll the o-ring; rather, slide it into place. Slide piston seal into the center groove, directly over top of the o-ring. Heating the piston seal in 175°F to 212°F warm oil or water would assist in installation by hand. While still warm, the piston seal can be reshaped by means of a ring compressor or other aid.

Exploded View Drawing



1. Head
2. Tube
3. Piston
4. Cap
5. Flange
6. Cushion bushing
7. Cushion insert
8. Cushion insert retainer ring
9. Tie rod
10. Piston rod
11. Bleed screw
12. Securing plate
13. Tie rod nut
14. Set screw
15. Hex head bolt
16. Rod bearing
17. Cushion valve
18. Threaded stud
19. Seals
    a. Wiper
    b. Rod seal
    c. Bearing o-ring
    d. Bearing backup ring
    e. Tube o-ring
    f. Tube backup ring
    g. Piston seal
    h. Wear bands

CDT1 Weight/Torque Values

Approx. Uncrated CDT1 Hyd. Cyl. Weights (lbs).		
Bore Size (inches)	Zero Stroke	Add Per Inch of Stroke
1.00	3	0.2
1.50	5	0.3
2.00	7	0.4
2.50	12	0.6
3.25	20	0.8
4.00	30	0.9
5.00	45	1.0
6.00	70	1.5
8.00	100	2.0

Tie Rod Nuts and Bolts		
Bore Size (inches)	Tie Rod Threads	Torque Lubricated (pound-ft)
1.000	10 - 24	2
1.500	1/4 - 28	4.5
2.000	5/16 - 24	9
2.500	5/16 - 24	12
3.250	3/8 - 24	22
4.000	3/8 - 24	22
5.000	1/2 - 20	45
6.000	1/2 - 20	45
8.000	5/8 - 18	90

Socket Head Cap Screw (all 8" bore sizes)		
Rod Size	SHCS Size	Torque Lubricated (pound-ft)
All	1/2 - 13	74

* Note: Weights are based upon a standard rod diameter. With multiple rod sizes and mounting options available, these weights may vary.

Seal Replacement - continued

2. Install the split wear bands (item 19h) onto the piston in the outer grooves.

End Cap Seal Installation:

1. Install the backup ring (item 19f) by pulling it over the face lip (head and cap ends). Be sure the groove of the backup ring is facing forward (barrel side). Do not drag the o-ring (item 19e) over the face, this will twist the o-ring; rather, pull the o-ring over the face lip, making sure it is against the groove of the backup ring.

2. Lubricate the chamfer ends and ID of the tube. Line up the cap end to be perpendicular with the tube. A twisting movement might be necessary to seat the cap end against the tube. Caution must be taken not to cut the o-ring.

3. Lubricate the piston seal and guide rings. Install the piston and rod assembly into the tube by applying force to the end of the piston rod. With the aid of a ring compressor, this will allow the rod assembly to seat itself into the cylinder tube.

4. After the piston and rod assembly is completely bottomed against the cap end, lubricate the top of the piston rod wrench flats. This will assist in installing the head end. Make sure the cylinder head and piston rod are perpendicular to one another. Place your hands on top of the head and push downwards in a twisting motion. A small rubber mallet may be needed to assist during installation. Caution must be taken not to tear any seals. Seat the head end into the tube using the same process as seating the cap end.

CAUTION: KEEP FINGERS CLEAR BETWEEN HEAD AND TUBE DURING INSTALLATION.

5. Install the tie rods and tighten the tie rod nuts in an X pattern to avoid uneven loading. All threads must be torqued to the required specification in order to ensure functional reliability of the cylinder. For exact torque measurements, see the table on page 3.

Testing

After the cylinder has been completely reassembled, it should be tested, either on a test bench or in the regular installation. The cylinder should be tested for cushioning, travel and leakage.

CAUTION: BE SURE AIR BLEED SCREW ON BOTH ENDS (ITEM 11) ARE COMPLETELY CLOSED.

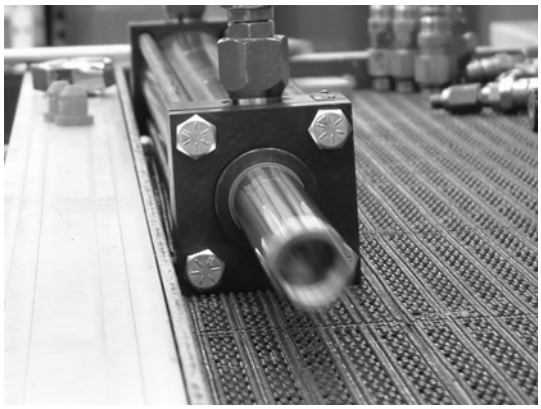
Cushioning:

1. Turn both cushioning valves completely in and then turn counterclockwise one (1) full turn.

2. Cycle cylinder a few times by alternating supply pressure to head and cap ports.

3. Apply supply pressure to the head port. Rod should retract, decelerate and may stop before completion of the stroke.

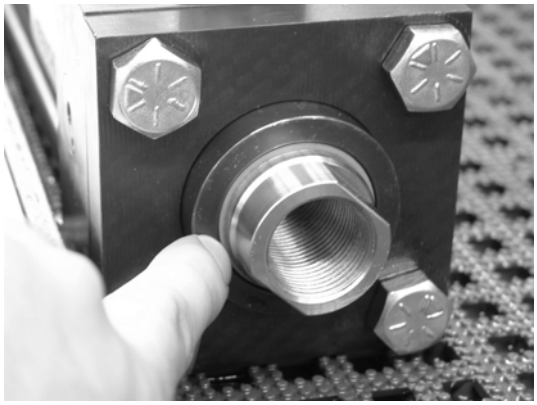
4. Apply supply pressure to the cap port. Rod should extend, decelerate and may stop before completion of the stroke.



Travel and Leakage

1. Apply supply pressure to the head port. Rod should retract smoothly without binding. Cylinder should retract, have less cushioning and make full stroke. Check leakage at the cap end, no leakage permitted. Check leakage around the rod bearing. No leakage permitted.

2. Apply supply pressure to the cap port. Rod should extend smoothly without binding. Cylinder should extend, have less cushioning and make full stroke. Check leakage at head end, no leakage permitted.



3. Return piston rod to retract position by applying supply pressure to head port. Remove supply pressure and install cylinder into service if satisfactory.

Cushion Adjustment

Turn the cushioning valve clockwise to increase the amount of cushioning and counterclockwise to decrease cushioning. To obtain the most effective cushioning, final adjustment must be made while the cylinder is operating under normal conditions at normal operating pressure.

Spare Parts

Piston and Tube Seal Kits (Items 19e, f, g, h) ~

Bore Ø (inches)	M	T *	F *	V *
1.000	R978006829	R978006849	R978006859	R978006839
1.500	R978006830	R978006850	R978006860	R978006840
2.000	R978006831	R978006851	R978006861	R978006841
2.500	R978006832	R978006852	R978006862	R978006842
3.250	R978006833	R978006853	R978006863	R978006843
4.000	R978006834	R978006854	R978006864	R978006844
5.000	R978006835	R978006855	R978006865	R978006845
6.000	R978006836	R978006856	R978006866	R978006846
8.000	R978006838	R978006858	R978006868	R978006848

Rod Cartridge Seal Kits w/Rod Bearing (Items 19a, b, c, d and Item 16) †§

Rod Ø (inches)	M	T *	F *	V *
0.50	R978009780	R978009782	R978009783	R978009781
0.625	R978006773	R978006801	R978006815	R978006787
1.000 (1.500" bore)	R978006774	R978006802	R978006816	R978006788
1.000 (2.000"-2.500" bore)	R978006775	R978006803	R978006817	R978006789
1.375 (2.000" bore)	R978006776	R978006804	R978006818	R978006790
1.375 (2.500"-3.250" bore)	R978006777	R978006805	R978006819	R978006791
1.750	R978006778	R978006806	R978006820	R978006792
2.000	R978006779	R978006807	R978006821	R978006793
2.500	R978006780	R978006808	R978006822	R978006794
3.000	R978006781	R978006809	R978006823	R978006795
3.500	R978006782	R978006810	R978006824	R978006796
4.000	R978006783	R978006811	R978006825	R978006797
4.500	R978006784	R978006812	R978006826	R978006798
5.000	R978006785	R978006813	R978006827	R978006799
5.500	R978006786	R978006814	R978006828	R978006800

M = Polyurethane seal system (standard)
T = Seal system for low frction applicatios (available)
F = Standard seal system for HFC (water glycol) (available)
V = Seal system for (phosphate ester) (available)

Note:
* = not recommended for load holding applications
§ = CGT1 (double-rod) version requires two Rod Cartridge Kits

~ Piston/Tube Seal Kits include: one (1) double-acting piston seal; two (2) wear bands; two (2) o-rings and two (2) back-up rings

† Rod Cartridge Seal Kits include: one (1) double-lip wiper set; one (1) u-cup rod seal; one (1) rod bearing; one (1) back-up ring

Cushion Valve (Item 17)

Bore Size**	M, T, F	V
1-1/2", 2", 2-1/2"	R978053909	R978006424
3-1/4", 4", 5"	R978904325	R978006436
6", 8"	R978000579	R978006437

** adjustable cushions are not available on 1" bore size cylinders.

Spare Parts

Tube (Item 2)*

Bore Size	Part No.
1.000	R978007816
1.500	R978007817
2.000	R978007818
2.500	R978007819
3.250	R978007820
4.000	R978007821
5.000	R978007822
6.000	R978007823
8.000	R978007824

Tie Rods (Item9)*

Bore Size	MX0, MS2, MT1 MT2, MP1	MF1, MF5	MF2, MF6	MX1	MX2	MX3
1.000	R978008229	R978010028	R978010035	R978010042	R978010050	R978010058
1.500	R978008230	R978010029	R978010036	R978010043	R978010051	R978010059
2.000	R978008231	R978010030	R978010037	R978010044	R978010052	R978010060
2.500	R978008232	R978010031	R978010038	R978010045	R978010053	R978010061
3.250	R978008233	R978010032	R978010039	R978010046	R978010054	R978010062
4.000	as above	as above	as above	as above	as above	as above
5.000	R978008234	R978010033	R978010457	R978010047	R978010055	R978010063
6.000	R978008235	R978010034	R978010041	R978010048	R978010056	R978010064
8.000	R978008236	n/a	n/a	R978010049	R978010057	R978010065

Piston and Rod Assemblies (Items 3, 6, 10, 14, 19e, f, g, h)*

Consult Factory for Part Numbers and Pricing.

* specify complete cylinder part number and stroke length when ordering.

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Section 2

Technical Specifications

Model CDT1/CGT1

CDT1 Technical Specifications

Background

The CDT1 is based upon a newly developed Bosch Rexroth and NFPA-design hydraulic cylinder.

CDT1 is designed as a standard product in the Bosch Rexroth Hydraulic Cylinder Program, and will be exclusively manufactured by Bosch Rexroth Industrial Hydraulics Division. It will be marketed in the United States as well as internationally by the Bosch Rexroth Industrial Hydraulics division.

The CDT1 is designed according to the NFPA Standard.

The CDT1 is designed as a **domestic product**, meaning it will be manufactured within the United States using standard English measurements.

Standard

CDT1 complies with:
National Fluid Power Association (NFPA)
ANSI/T3.6.7R2-1996

Pressure Rating

The CDT1 is primarily intended for up to 1,500 psi continuous duty. Depending on bore size.

Since the overall dimensions of the CDT1 are determined by ANSI/T3.6.7R2-1996, the dimension of the mounting styles cannot be deviated. The CDT1 has been calculated and verified through laboratory tests for a maximum static pressure of 2,250 psi.

Note: See data sheet RA 17 038 for pressure limitations.

Fluid Compatibility

The CDT1 in its basic design is intended for use with mineral oil, according to NFPA Standard.

NOTE: Phosphate ester, HFA, and Water glycol HFC may be used if seal materials, such as polyurethane and thermoplastic polyester, are avoided. See information under “Options”.

Design

The CDT1 is a hydraulic cylinder of tie rod design, meaning the head and cap are secured to the cylinder tube with tie rods that are tightened with nuts.

A listing of the individual parts of the basic cylinder can be found on page 2 and 3. The item numbers refer to the detailed parts drawing on page 6.

Item	Description
1	Head – steel 1117 – The head has fluid connection, port air-bleed and cushion valve if required.
2	Tube – steel – honed or polished to a surface finish 16µin or better.
3	Piston – ductile iron 65-45-12 – with separate seal and bearing grooves. The piston has “anti-stick” grooves to prevent piston from sticking to the head or cap. This is especially a risk for vertical cylinders under high external loads. The piston is held to the piston rod with a seizing compound applied to the piston thread. The piston is also secured to the rod by means of a set screw, which is tightened and secured with a seizing compound. The set screw is located in one of the wear band grooves, so any surface which could potentially chafe the inside of the tube is protected by the wear band.
4	Cap – steel 1117 – The cap has fluid connection port air-bleed and cushion valve if required.
5	Flange – steel 1117 – held directly to head by hex head bolts. Also retains rod bearing. This also applies to 8" bore sizes, all mounts.
6	Cushion bushing (head end) – ductile iron 65-45-12 – The bushing is retained between a shoulder on the piston rod and the piston itself.
7	Cushion insert (cap end) – 660 bronze floating insert held in place by retainer ring (Item 8).
8	Cushion insert retainer ring (cap end only) – steel – retains cushion insert on cap end.
9	Tie-rod – 1045 steel – high tensile, stress-proof.
10	Piston rod – steel 1050 – with chrome layer 0.5-1.0µin and surface finish 16µin Ra or better. Induction hardened end to 50 - 55 HRC up to 4" diameter.
11	Air-bleed screw – steel – seals without elastomeric seals in head and cap. Standard on 2" - 8" bores. Not available on 1" or 1-1/2" bore sizes.
12	Securing screw – steel – for air-bleed screw. Prevents unintentional loosening of the air-bleed screw. Not available on 1" or 1-1/2" bore sizes.
13	Tie rod nuts – steel – grade 8, zinc-plated.
14	Set screw – steel – used to mechanically lock piston to the piston rod.
15	Hex Head bolt – steel - grade 8, zinc plated.

16 Rod bearing – 65-45-12 ductile iron – extra-long rod bearing provides for maximum support against side-loads including external misalignment. Ductile iron has superior non-scoring properties and dimensional stability. Bearing is pilot fitted into the head assuring true concentricity. Rod bearing can be changed without special tools. Internal spiral groove ensures lubricity and compensates for pressure changes. The rod bearing contains grooves for rod wiper and rod seal.

17 "Exact-a-Just" cushioning valve – provides an accurate micrometer adjustment for cushioning, permitting a wide range of settings. May be supplied at head, cap, or both ends. The combination needle and check valve eliminates the need for separate ball checks, thus leaving a quadrant free for other possible use. Not available on 1" bore sizes.

18 Threaded stud – ASTM A19 – fits into female threaded piston rod.

19 Seals (listed individually)

a. Double-acting wiper – polyurethane – acts also as secondary piston rod seal. Other materials are available for special applications. See “Options” on page 5 for more information.

b. Piston rod seal – polyurethane – U-cup shaped. Other materials are available for special applications. See “Options” on page 5 for more information.

c. Bearing o-ring – nitrile rubber – standard

d. Bearing backup o-ring – PTFE – split ring.

e. O-ring – nitrile rubber. One at each end of the tube.

f. Backup o-ring – PTFE – asymmetric shape fitting o-ring radius. One at each end of the tube.

g. Piston seal – Polyurethane with o-ring energizer. Nitrile rubber is the standard configuration. Other seal systems are available for special applications. See “Options” on page 5 for more information.

h. Piston wear bands – fabric reinforced phenolic resin.

20 Socket Head Cap Screws – steel – Secures retainer plate to head end (not shown). Also standard on 8" bore sizes – all mounts

Mounting Styles

MX0 Basic version – no mounting

MF1 Rectangular flange at head

MF2 Rectangular flange at cap

MF5 Square flange at head

MF6 Square flange at cap

MP1 Clevis mounting

MP3 Pivot mount

MP5 Pivot mount with spherical bearing

MS2 Side lug

MS3 Centerline lug

MS4 Side tapped

MS7 End lugs

MT1 Trunnion at head

MT2 Trunnion at cap

MT4 Trunnion at intermediate position

MX1 Extended tie rods at both ends

MX2 Extended tie rods at cap

MX3 Extended tie rods at head

Sizes

The following are included in the CDT1:

Bore Ø (inches)	**Rod Ø** (inches)
1.000	0.500
	0.625
1.500	0.625
	1.000
2.000	0.625
	1.000
	1.375
2.500	0.625
	1.000
	1.375
	1.750
3.250	1.000
	1.375
	1.750
	2.000
4.000	1.000
	1.375
	1.750
	2.000
	2.500
5.000	1.000
	1.375
	1.750
	2.000
	2.500
	3.000
	3.500
6.000	1.375
	1.750
	2.000
	2.500
	3.000
	3.500
	4.000
8.000	1.375
	1.750
	2.000
	2.500
	3.000
	3.500
	4.000
	4.500
	5.000
	5.500

Piston Rod Seal / Bearing

There are normally very high demands on the sealing function between the piston rod and the head. Polyurethane seals are well proven with regards to wear resistance. In order to maximize the wear life of the piston rod seal, it is necessary to maintain the piston rod in a concentric position. By using a bearing that is separate from the head, the cylinder is able to hold a tight seal on the internal pressure. Replacement of the piston rod bearing does not require replacement of the entire head and complete disassembly of the cylinder.

Piston

The piston utilizes spiral grooves on each side to reduce break away force and prevent it from “sticking” to the end cover during operation.

CDT1 – Options

Port Connections / Types

Option S

Standard SAE straight thread ports according to ISO 11926-1.

Port Connections / Location

Location 1, 2, 3, and 4

Port location at 12,3, 6, and 9 o’clock, respectively, as seen from the piston rod side of the cylinder. Location 1 is standard.

Piston Rod Version

Option H

Case-hardened to 50-55 Rockwell “C” and hard chrome plated. Hardening thickness 50µin. Surface finished to 16µin or better. Rod diameters above 4” are not case hardened.

Option S

17-4 PH stainless steel, chrome plated.

Piston Rod End

Option H

Small male thread KK1. Studded rod end standard up to 1" - 14 male thread

Option D

Intermediate male thread KK2.

Option E

Female thread KK1.

Option T

Self-Aligning Flange End (S.A.F.E.) rod end.

Cushioning

Option U

Cylinder without cushioning.

Option D

Adjustable cushioning at both the cap and head ends of the cylinder. Not available on 1" bore size.

Option S

Adjustable cushioning at head end only.
Not available on 1" bore size

Option K

Adjustable cushioning at cap end only.
Not available on 1" bore size

Seal Version

All seals utilize the same seal grooves. The piston or rod bearing does not have to be replaced if changing from one seal material to another.

Option M

Standard seal version – wiper, rod seal and piston seal – are made of polyurethane. Recommended for mineral oil applications. Water glycol type fluid is not compatible with this material.

Recommended temperature range: -4°F - +176°F.

Option T

Low friction seal version differs from version **M**, only at the piston. Includes a glide ring of bronze-filled PTFE with a NBR o-ring energizer (nitrile rubber).

This option also fits into the same seal gooves as the standard version.

NOTE: The glide ring on the piston cannot be considered completely leak tight. Static loads on the piston should be avoided.

Recommended temperature range: -4°F - +176°F.

Option F

Intended for use with water glycol type fluids. The piston rod seal and wiper are made of NBR and the piston seal is the same as Option T with a NBR o-ring energizer (nitrile rubber).

NOTE: The glide ring on the piston cannot be considered completely leak tight. Static loads on the piston should be avoided.

Recommended temperature range: -4°F - +140°F.

Option V

Version for use with phosphate ester type fluids or for high temperature applications. The piston rod seal and wiper are made of FPM and the piston seal is the same as in option **T**, with the difference being an FPM o-ring energizer.

NOTE: The glide ring on the piston cannot be considered completely leak tight. Static loads on the piston should be avoided.

Recommended temperature range: -4°F - +300°F.

For applications above 250°F specify a non studded rod end and advise operating temperature

Option 1

Option W

Select this if no options are required.

Option E

Proximity switch.

Option A

Test point, both sides. Not available on 1" bore size.

(See data sheet RA 17 038 for further details on above options)

Option 2

Option W

Select this if no options are required.

Option K

Thrust key. For use with the MS2 mount.

Option S

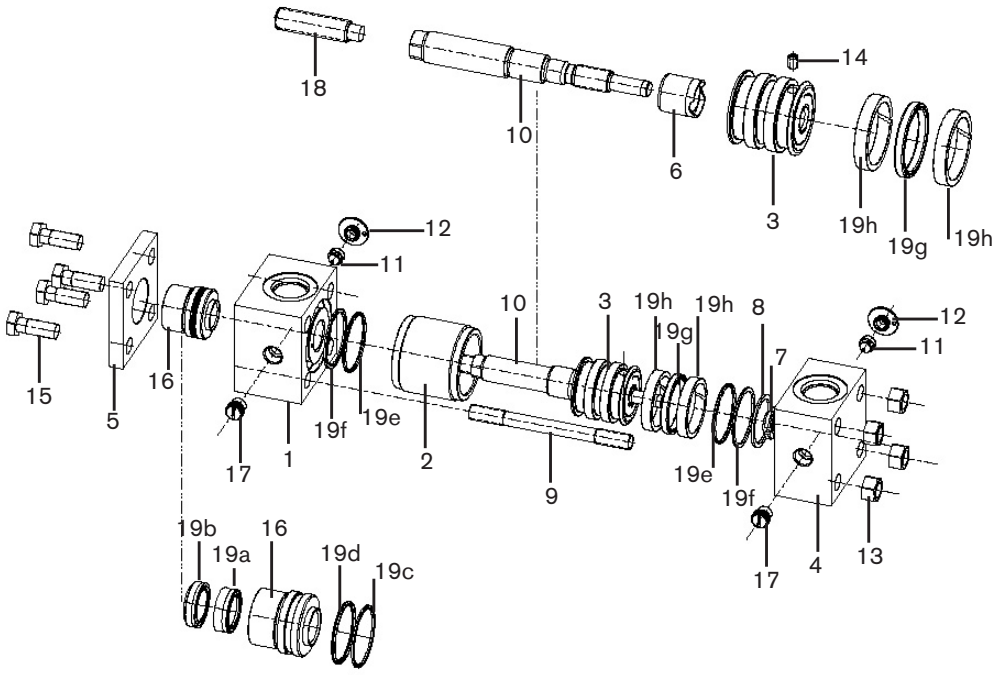
Stop tube.

Option Y

Piston rod extension. Customer-specified length is added to overall piston rod length.

(See data sheet RA 17 038 for further details on above options)

Exploded View Drawing



1. Head
2. Tube
3. Piston
4. Cap
5. Flange
6. Cushion bushing
7. Cushion insert
8. Cushion insert retainer ring
9. Tie rod
10. Piston rod
11. Bleed screw
12. Securing plate
13. Tie rod nut
14. Set screw
15. Hex head bolt
16. Rod bearing
17. Cushion valve
18. Threaded stud
19. Seals
    a. Wiper
    b. Rod seal
    c. Bearing o-ring
    d. Bearing backup ring
    e. Tube o-ring
    f. Tube backup ring
    g. Piston seal
    h. Wear bands

CDT1 Weight/Torque Values

Approx. Uncrated CDT1 Hyd. Cyl. Weights (lbs).		
Bore Size (inches)	**Zero Stroke**	**Add Per Inch of Stroke**
1.00	3	0.2
1.50	5	0.3
2.00	7	0.4
2.50	12	0.6
3.25	20	0.8
4.00	30	0.9
5.00	45	1.0
6.00	70	1.5
8.00	100	2.0

Tie Rod Nuts and Bolts		
Bore Size (inches)	**Tie Rod Threads**	**Torque Lubricated (pound-ft)**
1.000	10 - 24	2
1.500	1/4 - 28	4.5
2.000	5/16 - 24	9
2.500	5/16 - 24	12
3.250	3/8 - 24	22
4.000	3/8 - 24	22
5.000	1/2 - 20	45
6.000	1/2 - 20	45
8.000	5/8 - 18	90

Socket Head Cap Screw (all 8" bore sizes)		
Rod Size	**SHCS Size**	**Torque Lubricated (pound-ft)**
All	1/2 - 13	74

* Note: Weights are based upon a standard rod diameter. With multiple rod sizes and mounting options available, these weights may vary.

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Section 3

Hydraulic cylinders
Tie rod design

RE 17039/03.05 1/62
Replaces: 05.04

Series **CDT3...F / CGT3...F**
CST3...F


00001473


HAD 7316/04

Component series 1X
Nominal pressure 160 bar (16 MPa)

Table of contents

Features

- Installation dimensions to ISO 6020/2, DIN 24554 and NF/ISO 6020/2
- 13 mounting types
- Piston Ø 25 to 200 mm
- Piston rod Ø 12 to 140 mm
- Stroke lengths up to 2700 mm
- Integrated guide bushing for simple and easy maintenance
- Self-adjusting or adjustable end position cushioning optional
- Patented safety bleeding system for simple and reliable bleeding
- Ease of installation due to freely selectable position of pipe connections on head and cap

Planning software IHC Designer by Rexroth

Online www.boschrexroth.com/Rexroth-IHD

Download www.boschrexroth.com/business_units/bri/de/downloads/ihc

General notes

Maximum pressure:
These series are designed in accordance with standards for a dynamic continuous pressure of 160 bar for all mounting types. Under certain conditions, a higher pressure may be permitted. To confirm this, we require a detailed application description on the basis of a technical data sheet in line with the ISO 9001 quality standard. In the case of a regenerative circuit or a meter-out throttle, pressure intensification must be taken into account. When used in conjunction with a meter-out throttle, the dynamic pressure in the cylinder must not exceed 420 bar.

Minimum pressure:
Depending on the application, a certain minimum pressure is required to ensure correct operation of the cylinder. Under no-load condition, a minimum pressure of 10 bar is recommended for single rod cylinders. In the case of lower pressures or double rod cylinders, please consult us.

Installation of cylinder:
The cylinder may only be installed or the piston rod end screwed into the machine part or into a self-aligning clevis while the cylinder is depressurised.

Piston rod:
The piston rod material used as a standard is hard chromium-plated, hardened steel with a high elasticity value. This ensures high resistance against mechanical impacts and an optimum service life.

The end of the thread is reduced in its diameter and hence protected.

Standards DIN 24554 and NF/ISO 6020/2 provide only one thread size per piston rod diameter. This ensures the full transmission of dynamic forces within the framework of the standard. ISO 6020/2 additionally provides a second, larger thread for the largest piston rod per piston diameter. Male threads differing from DIN 24554 and NF/ISO 6020/2 as well as female threads, extended piston rods or thread ends are available. However, it must be noted that when a thread smaller than that provided in the standard is used, the permissible maximum pressure is restricted and, with larger threads, the limits of mounting options must be taken into account. Spigot end “T” according to NF/ISO 6020/2 goes along with pressure restrictions, see page 41.

Double rod cylinder with through piston rod:
The dimensions specified in the catalogue comply with the proposal in the standard.

This type of design involves much higher friction than the “CD version” with single piston rod.

In the standard version, both piston rod diameters are of the same size. If the cylinder is used in applications, where the piston rods are statically mounted and the cylinder body is traversed, transverse forces that are caused by the cylinder’s own weight and act on the guide bushing must be taken into account.

Seal versions:
As a standard, 3 seal versions are available: “M” (standard), “T“ (low friction) and “V“ (high-temperature applications). For information about the use of seals for various temperature and velocity ranges, see page 3.

The seal installation spaces comply with ISO 5597 for “M“ piston rod seals, ISO 7425-1 for all piston seals and ISO 6195-C for all piston rod wipers.

Seal version “M“ is provided with a hydrolysis-resistant wiper and can be operated at higher velocities, if the pressure is lower than 100 bar and the frequency is less than 3 Hz.

Long-stroke cylinders are preferably fitted with seal version “M“.

Piston rod guide bushing:
From piston diameters of 40 mm on, the piston rod guide bush is made of grey cast iron grade GGG-50 to DIN 1693 and designed as screw-in cartridge. Smaller diameters are of screwed, open design to ensure ease of installation. Guide bushes with seals installed are available for spare parts purposes, see page 43.

Pistons:
Version with integrated damping nose, which is screwed onto the piston rod, glued on and secured mechanically by means of a grub screw.

The seal installation spaces are identical for seal versions “M”, “T” and “V” in accordance with ISO 7425-1, that is, the seals can be replaced without requiring a piston change.

Seals between barrel, head and cap:
The enclosed design of seal installation spaces with centring of the barrel to both sides of the seal ensures optimum sealing, especially for cylinders with long strokes.

Stroke tolerances:
According to ISO 8131, for strokes up to 1250 mm a stroke tolerance of 0/+2 mm is permitted; in the case of longer strokes, please consult us.

A tolerance of ±0.3 mm is optionally possible; smaller tolerances are not useful for tie rod cylinders.

Recommended maximum strokes:
The strokes recommended on page 3 ensure proper operation under all operating conditions at a maximum pressure of 160 bar. The buckling load must be verified in all cases.

At lower pressures or pulling loads only, longer strokes are possible on request.

Minimum strokes:
For mounting type “MT4“ observe the minimum stroke due to the trunnion width, see page 14.

When using end position cushioning, also observe the minimum stroke (see page 3). In the case of stroke lengths shorter than the cushioning length, we recommend the use of a cylinder without end position cushioning.

Stop tube extensions and tie rod supports are possible on request.

Pipe connections:
Cylinders of type CDT3/CGT3 are available with BSP thread and enlarged BSP thread to ISO 8138 and with metric ISO threads to DIN/ISO 6149-1.
Cylinders of series CST3 are available with BSP thread to ISO 8138 or with a subplate.

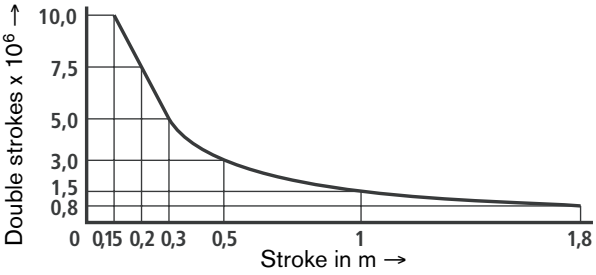
Counterbores to ISO 1179/1.

Primer coating:
As a standard, hydraulic cylinders are primered with one coat (colour: gentian blue, RAL 5010) of max. 80 µm. Other colours on enquiry.

General notes

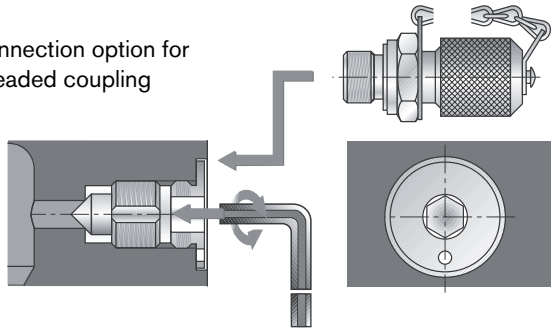
Service life:
Rexroth cylinders comply with reliability recommendations for industrial applications.

≥ 10 000 000 double strokes in no-load continuous operation or 3000 km travel at 70% of the maximum operating pressure, without loading of the piston rod and at a maximum velocity of 0.5 m/s, with a failure rate of less than 5%.



Bleeding:
As a standard, a patented safety bleeding feature is provided against unintentional turning out in the head and the cap (for piston diameters greater than 32 mm), while adhering to the dimensions in accordance with ISO 6020/2. The connection allows the installation of a threaded coupling with check valve for pressur measurements or dirt-free bleeding.

Connection option for threaded coupling

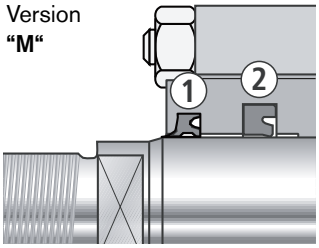


Piston Ø (mm)		25	32	40	50	63	80	100	125	160	200
Min. **recommended**	Without cushioning	–	–	–	–	–	–	–	–	–	–
stroke in mm	With cushioning	31	33	50	52	43	57	56	68	73	106
Max. **recommended**	ME5, MS2, MX1/2/3/5	300	380	480	600	750	800	1000	1250	1280	1400
stroke in mm	ME6, MP1/3/5, MT 1/2/4	200	250	320	400	500	530	660	830	850	930
Max permissible radial force[1] N		25	40	63	100	160	250	400	680	1000	1600
Maximum	Seal version M; 160 bar	0.50				0.40		0.30		0,25	
velocity	Seal version M; 100 bar	0.70				0.60		0.40		0,35	
(m/s)	Seal version T, V; 160 bar	1.00				0.80		0.60		0,50	
Recommended min.	Seal version M	30									
velocity (mm/s)	Seal version T, V	1									
Viscosity	mm²/s	2.8...380									
Cleanliness class to ISO		Max. permissible degree of contamination of the hydraulic fluid to ISO 4406 (c) class 20/18/15.									

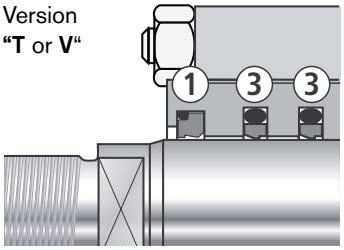
[1] on piston rod guide bushing

Piston rod seal

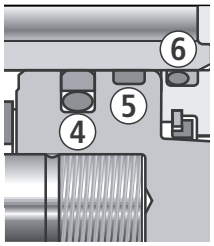
Version **"M"**



Version **"T** or **V"**



Piston seal "M", "T", "V"



Medium	Seal version	Compatibility with media / seal materials			
		① Double scraper	② ③ Piston rod seal	④ ⑤ Piston seal	⑥ O-ring
HL, HLP, HFA	M	AU	EU	EU / NBR / POM	NBR
HL, HLP, HFA, HFC	T	PTFE/NBR	PTFE / NBR	PTFE / NBR	
HFD-R, HFA	V	FKM	PTFE / FKM	PTFE / FKM	FKM

HL, HLP: –20 °C to +80 °C HFA: +5 °C to +55 °C HFC: –20 °C to +60 °C HFD-R: –20 °C to +150 °C

Planning software IHC Designer

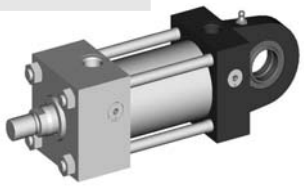
The IHC Designer (Interactive Hydraulics Cylinder Designer) offers a selection and planning aid for hydraulic cylinders. With the help of the IHC Designer, designers of plant and machinery can quickly and easily find the optimum cylinder solution thanks to logic-guided type code queries. The software helps to master designing and engineering tasks faster and more efficiently. After having navigated through the product selection, the user gets the exact technical details of the selected component as well as 2D and 3D-CAD files in the suitable file format for all common CAD systems in a swift and reliable manner.

The user can save costs and hence increase his competitiveness.

Overview of mounting types: Series CDT3...F; CGT3...F

Mounting types DIN / ISO

MP5 see page 10
ISO/DIN/NF



ME5 see page 8
ISO/DIN/NF

ME6 see page 8
ISO/DIN/NF

MT4 see page 14
ISO/DIN/NF

MS2 see page 12
ISO/DIN/NF

Mounting types ISO

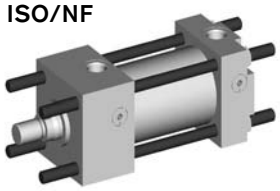
MP1 see page 24
ISO/NF

MP3 see page 24
ISO/NF

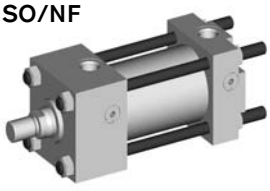
MT1 see page 16
ISO/NF

MT2 see page 16
ISO/NF

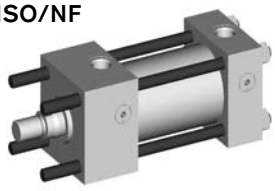
MX1 see page 18
ISO/NF



MX2 see page 20
ISO/NF



MX3 see page 20
ISO/NF



MX5 see page 22
NF

Comparisons ISO / DIN / NF

- ISO 6020/2 comprises 12 mounting types
- DIN 24 554 comprises 5 mounting types
- NF/ISO 6020-2 comprises 12 mounting types
- Mounting types MP5, ME5, ME6, MT4 and MS2 to ISO, DIN and NF E are interchangeable.
- In addition to single rod cylinders CD.., double rod cylinders CG.. were also included in this series.

Ordering code

Preferred cylinder versions are shown on a grey background.

	T3	/	/	/	F	1X	/			H							*

Single rod cylinder = CD
Double rod cylinder[1] = CG

Series: = T3

Mounting types DIN / ISO

Rectangular flange at head	**= ME5**
Rectangular flange at cap	**= ME6**
Self-aligning clevis at head	**= MP5**
Foot mounting	**= MS2**
Central trunnion [2]	**= MT4**

Mounting types ISO

Fork clevis at head	**= MP1**
Plain clevis at head	**= MP3**
Trunnion at head	**= MT1**
Trunnion at cap	**= MT2**
Extended tie rods, both sides	**= MX1**
Extended tie rod,, at cap	**= MX2**
Extended tie rod,, at head	**= MX3**
Theaded bores at head [6]	**= MX5**

Piston Ø (AL) 25 to 200 mm

Piston rod Ø (MM) 12 to 140 mm

Stroke length in mm

Design principle

Head and cap connected by tie rod with guide bush **= F**

Component series = 1X

10 to 19: unchanged installation and connection dimensions

Pipe connection / version

BSP thread (ISO 8138)	**= B**
Metric ISO thread (DIN / ISO 6149-1)	**= R**
Enlarged BSP thread (ISO 8138)	**= S**

Pipe connection / position at head

see page 27

View to piston rod **= 1 / = 2 / = 3 / = 4**

Piston rod version

H = Hardened and hard chromium-plated

Pipe connection / position at cap

see page 27

View to piston rod **1 = / 2 = / 3 = / 4 =**

End position cushioning

see page 33

U =	Without
D =	Both sides, self-adjusting
S =	Head side, self-adjusting
K =	Cap side, self-adjusting
L = [3]	Both sides, self-adjusting "Low Energy"
E = [5]	Both sides, adjustable

Piston rod end

see page 9 to 25

H =	Thread (DIN / ISO) for self-aligning clevis CGKA
D =	Thread (ISO) for self-aligning clevis CGKA
E =	Female thread
F = [8]	With self-aligning clevis CGKA mounted (DIN / ISO)
K = [8]	With self-aligning clevis CGKA mounted (ISO)
T = [7; 9]	With spigot

Seal version

see page 3

M =	Standard seal system
T =	Reduced friction
V =	High temperature with reduced friction

Option 1

W =	No option
B = [5]	Drain port
A = [4]	Threaded coupling, both sides

Option 2

W =	No option
Y =	Indicate piston rod extension LY in mm in clear text

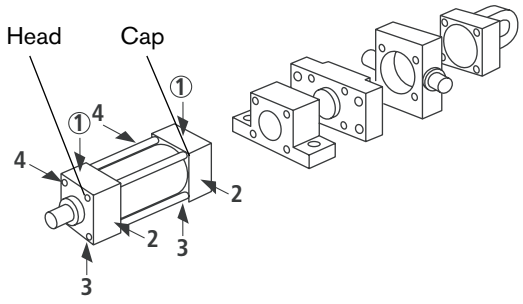
*Further details in clear text

Remarks:

[1] = ME5; MT1; MT4; MS2; MX1; MX3; MX5 only, not standardized
[2] = Indicate XV in mm in clear text
[3] = Piston Ø 25 to 125 mm
[4] = Piston Ø 40 to 200 mm
[5] = For DIN mounting types and pipe connection "B"
[6] = Not standardised to ISO
[7] = See page 41 (piston rod Ø 22 to 140 mm only)
[8] = Not possible with mounting types MX1 and MX3
[9] = Not possible for CG version

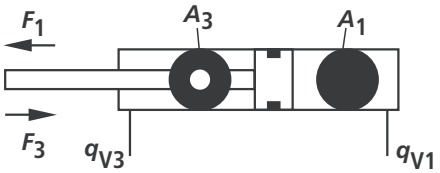
When making your selection, observe the restrictions given on the relevant pages in the catalogue!

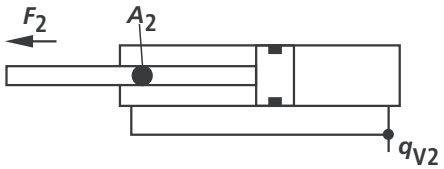
Order examples: CDT3MP5/50/36/300F1X/B11HHDMWW
CGT3ME5/80/56/400F1X/B11HHDMWW



Areas, forces, flow

Piston	Piston rod	Area ratio	Areas			Force at 160 bar [1]			Flow at 0.1 m/s [2]		
			Piston	Rod	Annulus	Pushing	Diff.	Pulling	Out	Diff.	In
AL Ø mm	**MM** Ø mm	φ **A_1/A_3**	**A_1** cm^2	**A_2** cm^2	**A_3** cm^2	**F_1** kN	**F_2** kN	**F_3** kN	**q_{V1}** L/min	**q_{V2}** L/min	**q_{V3}** L/min
25	**12**	1.30	4.91	1.13	3.78	7.85	1.81	6.04	2.9	0.7	2.3
	18	2.08		2.54	2.37		4.07	3.78		1.5	1.4
32	**14**	1.25	8.04	1.54	6.50	12.87	2.46	10.40	4.8	0.9	3.9
	22	1.90		3.80	4.24		6.08	6.79		2.3	2.5
40	**18**	1.25	12.56	2.54	10.02	20.11	4.07	16.03	7.5	1.5	6.0
	22 [12]	1.43		3.80	8.77		6.08	14.02		2.3	5.3
	28	1.96		6.16	6.40		9.85	10.25		3.7	3.8
50	**22**	1.25	19.63	3.80	15.83	31.42	6.08	25.33	11.8	2.3	9.5
	28 [12]	1.46		6.16	13.48		9.85	21.56		3.7	8.1
	36	2.08		10.18	9.45		16.29	15.13		6.1	5.7
63	**28**	1.25	31.17	6.16	25.01	49.88	9.85	40.02	18.7	3.7	15.0
	36 [12]	1.48		10.18	20.99		16.29	33.59		6.1	12.6
	45	2.04		15.90	15.27		25.45	24.43		9.5	9.2
80	**36**	1.25	50.26	10.18	40.08	80.42	16.29	64.14	30.2	6.1	24.0
	45 [12]	1.46		15.90	34.36		25.45	54.98		9.5	20.6
	56	1.96		24.63	25.63		39.41	41.02		14.8	15.4
100	**45**	1.25	78.54	15.90	62.64	125.66	25.45	100.21	47.1	9.5	37.6
	56 [12]	1.46		24.63	53.91		39.41	86.26		14.8	32.3
	70	1.96		38.48	40.06		61.58	64.09		23.1	24.0
125	**56**	1.25	122.72	24.63	98.09	196.35	39.41	156.94	73.6	14.8	58.9
	70 [12]	1.46		38.48	84.23		61.58	134.77		23.1	50.5
	90	2.08		63.62	59.10		101.79	94.56		38.2	35.5
160	**70**	1.25	201.06	38.48	162.58	321.70	61.58	260.12	120.6	23.1	97.5
	110	1.90		95.03	106.03		152.05	169.64		57.0	63.6
200	**90**	1.25	314.16	63.62	250.54	502.65	101.79	400.86	188.5	38.2	150.3
	140	1.96		153.94	160.22		246.30	256.35		92.4	96.1





Remarks

1) Theoretical force (without consideration of efficiency)

2) Stroke velocity

12) Piston rod Ø not standardised

Cylinder weights (in kg)

CDT3

Ø AL	Ø MM	MX1, ME5, MS2	ME6, MP3, MP1	MP5	MT4	MX2, MX3, MX5	MT1, MT2	Stroke 100 mm
25	12	1.1	1.1	1.0	1.3	1.0	1.1	0.4
	18	1.2	1.2	1.1	1.4	1.1	1.2	0.6
32	14	1.5	1.6	1.4	1.8	1.4	1.5	0.5
	22	1.6	1.7	1.5	1.9	1.5	1.6	0.6
40	18	3.4	3.4	3.2	4.1	3.1	3.2	0.8
	22 [12)]	3.4	3.4	3.2	4.1	3.1	3.2	0.9
	28	3.5	3.5	3.3	4.2	3.2	3.3	1.1
50	22	5.3	5.3	4.9	6.6	4.8	4.9	1.1
	28 [12)]	5.4	5.4	5	6.7	4.9	5	1.3
	36	5.5	5.5	5.1	6.8	5.0	5.1	1.6
63	28	7.7	7.7	7.3	9.2	7.0	7.3	1.4
	36 [12)]	7.9	7.8	7.4	9.3	7.1	7.4	1.7
	45	8.2	8.0	7.6	9.5	7.3	7.6	2.2
80	36	14	14	14	18	12	15	2.2
	45 [12)]	14	14	14	17	13	14	2.6
	56	15	15	15	19	14	15	3.3
100	45	20	20	20	24	19	22	3.3
	56 [12)]	20	20	19	24	18	22	4.1
	70	21	21	21	25	19	23	5.1
125	56	38	39	38	46	35	43	6.3
	70 [12)]	38	39	38	46	35	43	7.3
	90	39	40	39	48	37	44	9.3
160	70	62	67	63	78	59	64	8.7
	110	64	69	65	80	61	67	13.2
200	90	112	120	115	147	107	114	13.4
	140	115	123	117	149	109	117	20.5

For self-aligning clevis, fork-type mounting block and trunnion mounting block, see page 28 and 29

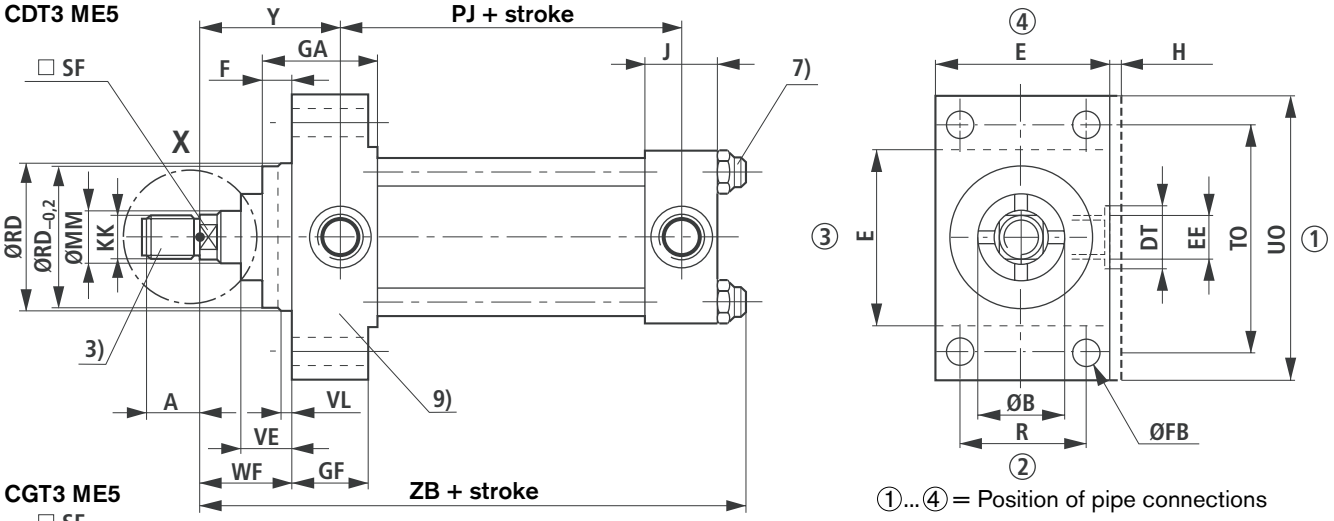
CGT3

Ø AL	Ø MM	MX1, ME5, MS2	MT4	MX3, MX5	MT1	Stroke 100 mm
25	12	1.2	1.4	1.1	1.2	0.5
	18	1.4	1.6	1.3	1.4	0.8
32	14	1.6	1.9	1.5	1.6	0.6
	22	1.9	2.2	1.8	1.9	0.9
40	18	3.6	4.3	3.3	3.4	1.0
	22 [12)]	3.8	4.5	3.5	3.6	1.2
	28	4.0	4.7	3.7	3.8	1.6
50	22	5.7	7.0	5.2	5.3	1.4
	28 [12)]	6.0	7.3	5.5	5.6	1.8
	36	6.4	7.7	5.9	6.0	2.4
63	28	8.3	9.8	7.6	7.9	1.9
	36 [12)]	8.8	10.3	8.1	8.4	2.5
	45	9.7	11	8.8	9.1	3.4
80	36	15	19	13	15	3.0
	45 [12)]	16	20	14	16	3.8
	56	17	21	16	17	5.2
100	45	22	26	20	24	4.5
	56 [12)]	23	27	21	25	6.1
	70	25	29	23	27	8.1
125	56	41	49	39	46	8.2
	70 [12)]	43	51	41	48	10.3
	90	46	55	44	51	14
160	70	68	83	65	69	12
	110	75	91	72	79	21
200	90	124	158	118	126	18
	140	137	171	131	138	33

[12)] Piston rod Ø not standardised

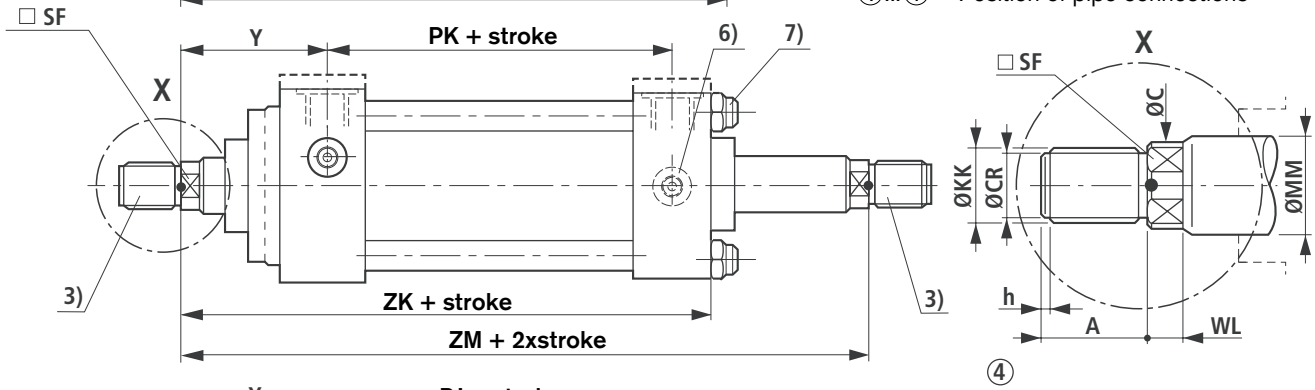
Mounting types ME5, ME6 (nominal dimensions in mm)

CDT3 ME5

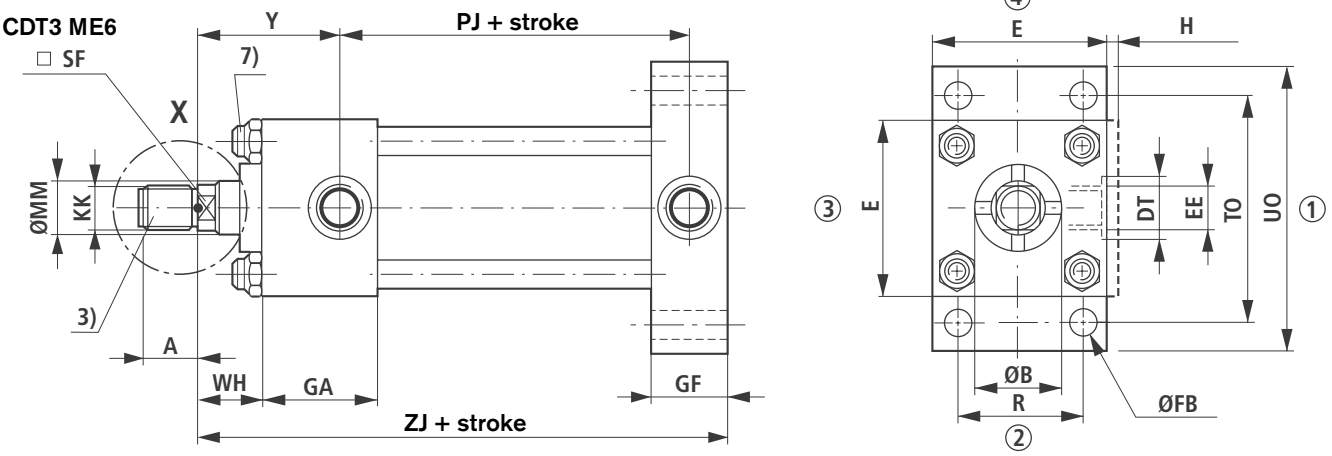


①...④ = Position of pipe connections

CGT3 ME5



CDT3 ME6



AL Ø	F max	FB H13	GF 9)	PK 10) ± 1.25	PK 11) ± 1.25	R JS13	TO JS13	UO max	VE max	VL min	ZB max	ZJ ± 1	ZK ± 1	ZM ± 2
25	10	5.5	25	54	65.5	27	51	65	16	3	121	114	139	154
32	10	6.6	25	58	70.5	33	58	70	22	3	137	128	153	178
40	10	11	38	71	75	41	87	110	22	3	166	153	170	195
50	16	14	38	73	77	52	105	130	25	4	176	159	182	207
63	16	14	38	81	82.5	65	117	145	29	4	185	168	191	223
80	20	18	45	92	92	83	149	180	29	4	212	190	215	246
100	22	18	45	101	101	97	162	200	32	5	225	203	230	265
125	22	22	58	117	117	126	208	250	32	5	260	232	254	289
160	25	26	58	130	130	155	253	300	32	5	279	245	270	302
200	25	33	76	160	160	190	300	360	32	5	336	299	324	356

Dimensions ME5, ME6 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]								
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9	RE f8
25	12	M10x1.25	14	11	10	5	1	7.5	–	–						24	38
	18	M10x1.25	14	15	13	5	1	8	M14x1.5	18	15	13	5	2	11	30	38
32	14	M12x1.25	16	13	11	5	2.5	9.5	–	–						26	42
	22	M12x1.25	16	19	17	5	3	10	M16x1.5	22	19	17	5	3	13	34	42
40	18	M14x1.5	18	15	13	5	2	11	–	–						30	62
	22 [12]								M16x1.5	22	19	17	5	3	13	34	62
	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42	62
50	22	M16x1.5	22	19	17	5	3	13	–	–						34	74
	28 [12]								M20x1.5	28	25	22	7	3	17	42	74
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50	74
63	28	M20x1.5	28	25	22	7	3	17	–	–						42	75
	36 [12]								M27x2	36	33	30	8	3	23.5	50	88
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60	88
80	36	M27x2	36	33	30	8	3	23.5	–	–						50	82
	45 [12]								M33x2	45	42	36	10	4	29.5	60	105
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72	105
100	45	M33x2	45	42	36	10	4	29.5	–	–						60	92
	56 [12]								M42x2	56	53	46	10	5	38.5	72	125
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88	125
125	56	M42x2	56	53	46	10	5	38.5	–	–						72	105
	70 [12]								M48x2	63	67	60	15	3	44.5	88	150
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108	150
160	70	M48x2	63	67	60	15	3	44.5	–	–						88	125
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133	170
200	90	M64x3	85	86	75	15	4.5	59	–	–						108	150
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163	210

AL Ø	E	EE	DT	EE	DT	GA	H [5]	J	PJ [10] ± 1.25	PJ [11] ± 1.25	WF ± 2	WH ± 2	Y [10] ± 2	Y [11] ± 2
25	40 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	22.5	53	64.5	25	15	50	38.5
32	45± 1.5	G 1/4	25	M14x1.5	21	46.5	5	23.5	56	68.5	35	25	60	47.5
40	63 ± 1.5	G 3/8	28	M18x1.5	26	52	–	33	73	77	35	25	62	58
50	75 ± 1.5	G 1/2	34	M22x1.5	29	57.8	–	33.8	74	78	41	25	67	63
63	90 ± 1.5	G 1/2	34	M22x1.5	29	55.8	–	33.8	80	81.5	48	32	71	69.5
80	115 ± 1.5	G 3/4	42	M27x2	34	65	–	39	93	93	51	31	77	77
100	130 ± 2	G 3/4	42	M27x2	34	67	–	40	101	101	57	35	82	82
125	165 ± 2	G 1	47	M33x2	43	73.5	–	51.5	117	117	57	35	86	86
160	205 ± 2	G 1	47	M33x2	43	80.5	–	55.5	130	130	57	32	86	86
200	245 ± 2	G 1 1/4	58	M42x2	52	101	–	76	165	165	57	32	98	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

[3] For piston rod ends “E“ and “T“, see page 41

[5] Dimension “H“ always at the position of the pipe connection

[6] For the position of pipe connections and bleed point, see page 27

[7] For tightening torque, see page 43

[9] Flange thickness to DIN 24554

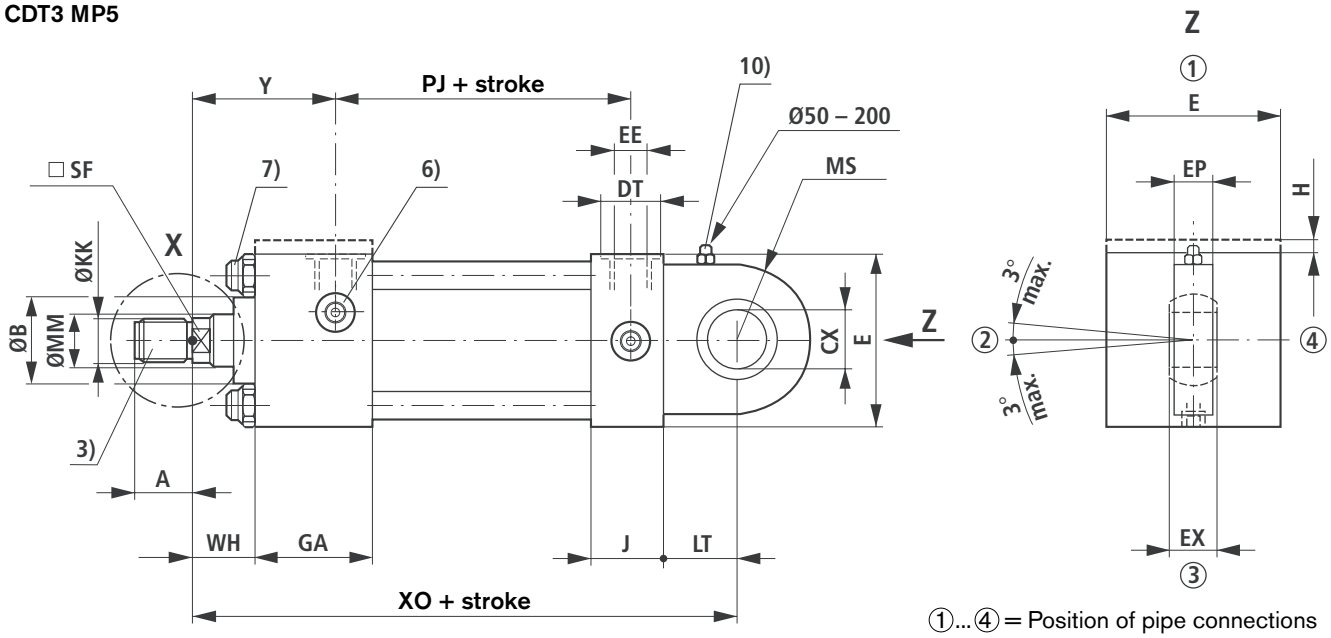
[10] ME5: for pipe connection position “1“ and “3“ at head

[11] ME5: for pipe connection position “2“ and “4“ at head

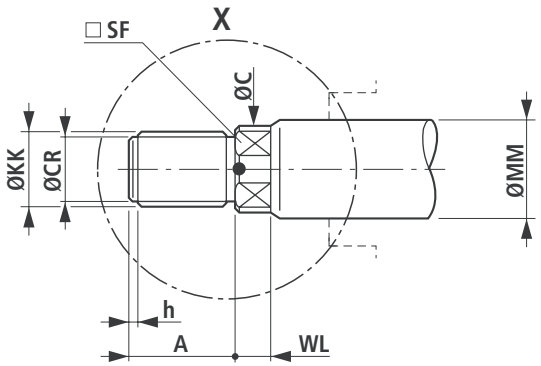
[12] Piston rod Ø not standardised

Mounting type MP5 (nominal dimensions in mm)

CDT3 MP5



①...④ = Position of pipe connections



AL Ø	CX	EP h15	EX	LT min	XO ± 1.25	MS max
25	12 – 0.008	8	10 – 0.12	16	130	20
32	16 – 0.008	11	14 – 0.12	20	148	22.5
40	20 – 0.012	13	16 – 0.12	25	178	29
50	25 – 0.012	17	20 – 0.12	31	190	33
63	30 – 0.012	19	22 – 0.12	38	206	40
80	40 – 0.012	23	28 – 0.12	48	238	50
100	50 – 0.012	30	35 – 0.12	58	261	62
125	60 – 0.015	38	44 – 0.15	72	304	80
160	80 – 0.015	47	55 – 0.15	92	337	100
200	100 – 0.020	57	70 – 0.20	116	415	120

Dimensions MP5 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
25	12	M10x1.25	14	11	10	5	1	7.5	–	–						24
	18	M10x1.25	14	15	13	5	1	8	M14x1.5	18	15	13	5	2	11	30
32	14	M12x1.25	16	13	11	5	2.5	9.5	–	–						26
	22	M12x1.25	16	19	17	5	3	10	M16x1.5	22	19	17	5	3	13	34
40	18	M14x1.5	18	15	13	5	2	11	–	–						30
	22 [12]								M16x1.5	22	19	17	5	3	13	34
	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	22	M16x1.5	22	19	17	5	3	13	–	–						34
	28 [12]								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	28	M20x1.5	28	25	22	7	3	17	–	–						42
	36 [12]								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	36	M27x2	36	33	30	8	3	23.5	–	–						50
	45 [12]								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	45	M33x2	45	42	36	10	4	29.5	–	–						60
	56 [12]								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	56	M42x2	56	53	46	10	5	38.5	–	–						72
	70 [12]								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5	–	–						88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59	–	–						108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	E	EE	DT	EE	DT	GA	H [5]	J	PJ ± 1.25	WH ± 2	Y ± 2
25	40 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	22.5	53	15	50
32	45± 1.5	G 1/4	25	M14x1.5	21	46.5	5	23.5	56	25	60
40	63 ± 1.5	G 3/8	28	M18x1.5	26	52	–	33	73	25	62
50	75 ± 1.5	G 1/2	34	M22x1.5	29	57.8	–	33.8	74	25	67
63	90 ± 1.5	G 1/2	34	M22x1.5	29	55.8	–	33.8	80	32	71
80	115 ± 1.5	G 3/4	42	M27x2	34	65	–	39	93	31	77
100	130 ± 2	G 3/4	42	M27x2	34	67	–	40	101	35	82
125	165 ± 2	G 1	47	M33x2	43	73.5	–	51.5	117	35	86
160	205 ± 2	G 1	47	M33x2	43	80.5	–	55.5	130	32	86
200	245 ± 2	G 1 1/4	58	M42x2	52	101	–	76	165	32	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

[3] For piston rod ends “E“ and “T“, see page 41

[5] Dimension “H“ always at the position of the pipe connection

[6] For the position of pipe connections and bleed point, see page 27

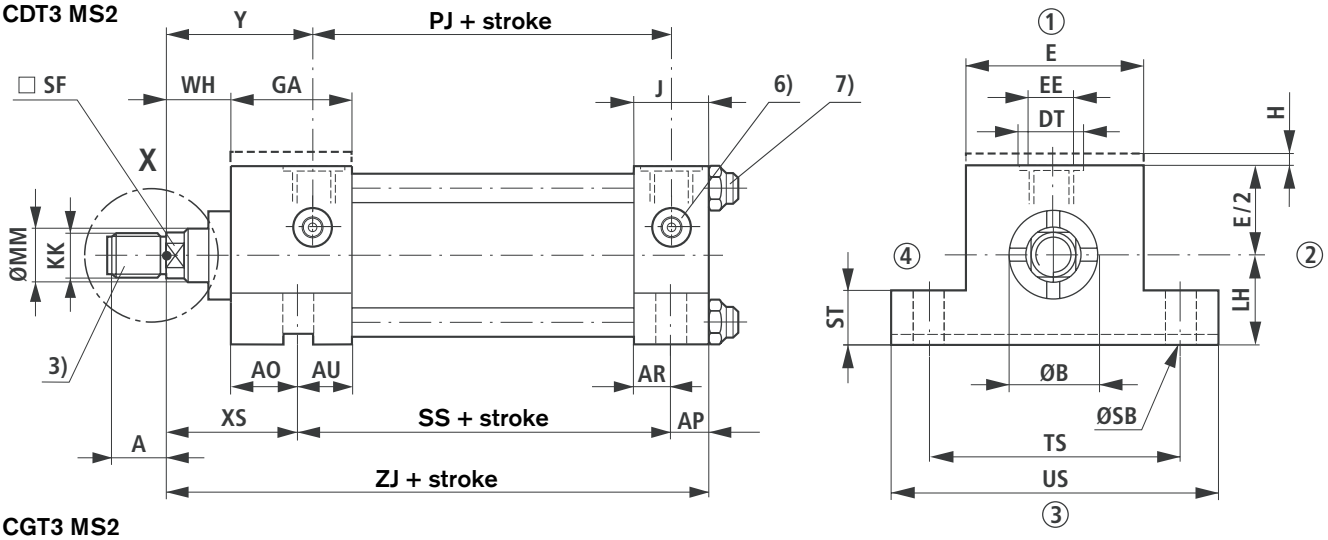
[7] For tightening torque, see page 43

[10] Grease nipple M6 DIN 71412 from piston Ø 40 mm

[12] Piston rod Ø not standardised

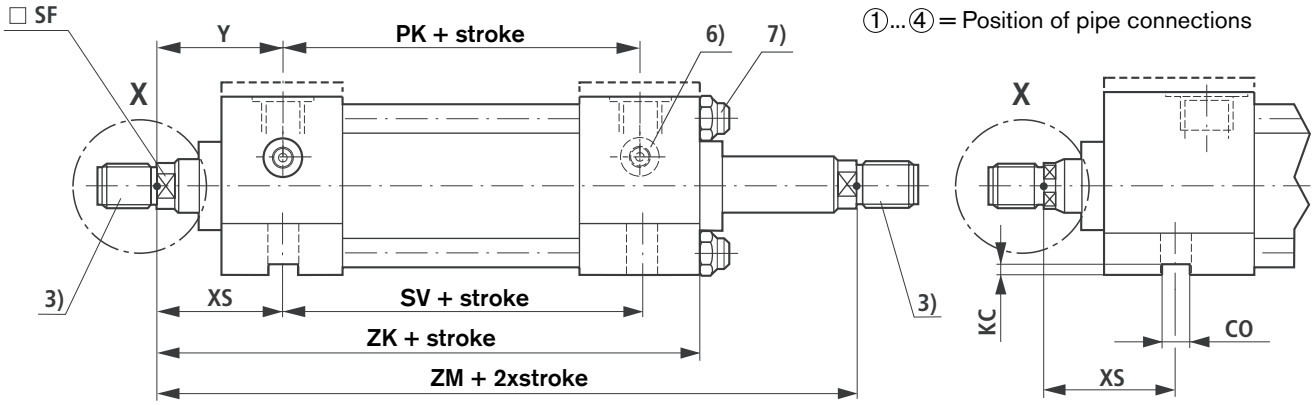
Mounting type MS2 (nominal dimensions in mm)

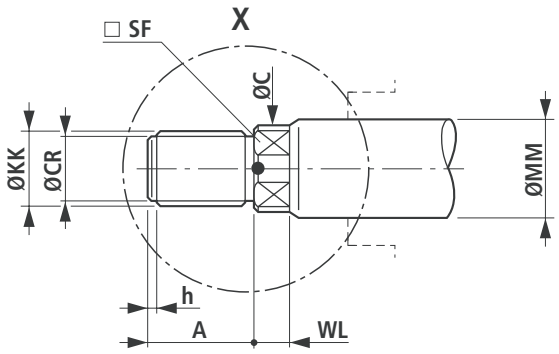
CDT3 MS2



CGT3 MS2

①...④ = Position of pipe connections





AL Ø	CO H8	KC	LH h10	PK ± 1.25	SB H13	SS ± 1.25	ST	SV ± 1	TS JS13	US + 2	XS ± 2	ZJ ± 1	ZK ± 1	ZM ± 2	AO	AU
25	12	4	19	54	6.6	73	8.5	88	54	72	33	114	139	154	18	28.5
32	12	4	22	58	9	73	12.5	88	63	84	45	128	153	178	20	26.5
40	12	4	31	71	11	98	12.5	105	83	103	45	153	170	195	20	32
50	12	4	37	73	14	92	19	99	102	127	54	159	182	207	29	28.8
63	16	4	44	81	18	86	26	93	124	161	65	168	191	223	33	22.8
80	16	5	57	92	18	105	26	110	149	186	68	190	215	246	37	28
100	16	5	63	101	26	102	32	107	172	216	79	203	230	265	44	23
125	20	5	82	117	26	131	32	131	210	254	79	232	254	289	44	29.5
160	–	–	101	130	33	130	38	130	260	318	86	245	270	302	54	26.5
200	–	–	122	160	39	172	44	172	311	381	92	299	324	356	60	41

Dimensions MS2 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
25	12	M10x1.25	14	11	10	5	1	7.5	–	–						24
	18	M10x1.25	14	15	13	5	1	8	M14x1.5	18	15	13	5	2	11	30
32	14	M12x1.25	16	13	11	5	2.5	9.5	–	–						26
	22	M12x1.25	16	19	17	5	3	10	M16x1.5	22	19	17	5	3	13	34
40	18	M14x1.5	18	15	13	5	2	11	–	–						30
	22 [12]								M16x1.5	22	19	17	5	3	13	34
	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	22	M16x1.5	22	19	17	5	3	13	–	–						34
	28 [12]								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	28	M20x1.5	28	25	22	7	3	17	–	–						42
	36 [12]								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	36	M27x2	36	33	30	8	3	23.5	–	–						50
	45 [12]								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	45	M33x2	45	42	36	10	4	29.5	–	–						60
	56 [12]								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	56	M42x2	56	53	46	10	5	38.5	–	–						72
	70 [12]								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5	–	–						88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59	–	–						108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	E	EE	DT	EE	DT	GA	H [5]	J	PJ ± 1.25	WH ± 2	Y ± 2	AP	AR
25	40 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	22.5	53	15	50	8	14.5
32	45± 1.5	G 1/4	25	M14x1.5	21	46.5	5	23.5	56	25	60	10	13.5
40	63 ± 1.5	G 3/8	28	M18x1.5	26	52	–	33	73	25	62	10	23
50	75 ± 1.5	G 1/2	34	M22x1.5	29	57.8	–	33.8	74	25	67	13	20.8
63	90 ± 1.5	G 1/2	34	M22x1.5	29	55.8	–	33.8	80	32	71	17	16.8
80	115 ± 1.5	G 3/4	42	M27x2	34	65	–	39	93	31	77	17	22
100	130 ± 2	G 3/4	42	M27x2	34	67	–	40	101	35	82	22	18
125	165 ± 2	G 1	47	M33x2	43	73.5	–	51.5	117	35	86	22	29.5
160	205 ± 2	G 1	47	M33x2	43	80.5	–	55.5	130	32	86	29	26.5
200	245 ± 2	G 1 1/4	58	M42x2	52	101	–	76	165	32	98	35	41

[1] Thread for pston rod ends “F“ and “H“

[2] Thread for pston rod ends “D“ and “K“

[3] For piston rod ends “E“ and “T“, see page 41

[5] Dimension “H“ always at the position of the pipe connection

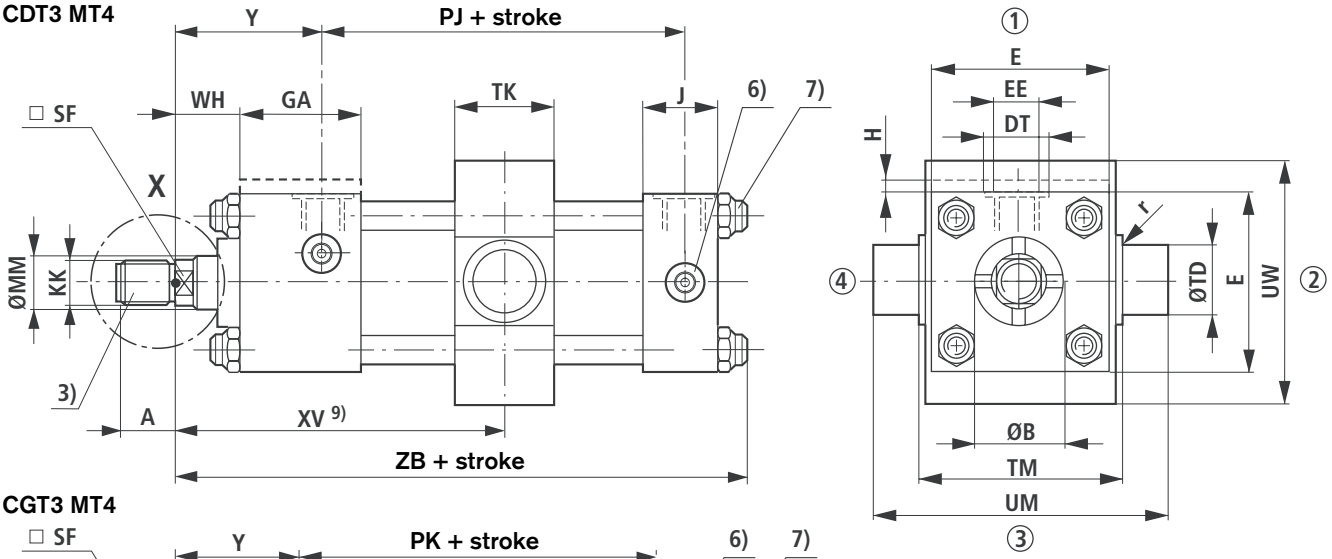
[6] For the position of pipe connections and bleed point, see page 27

[7] For tightening torque, see page 43

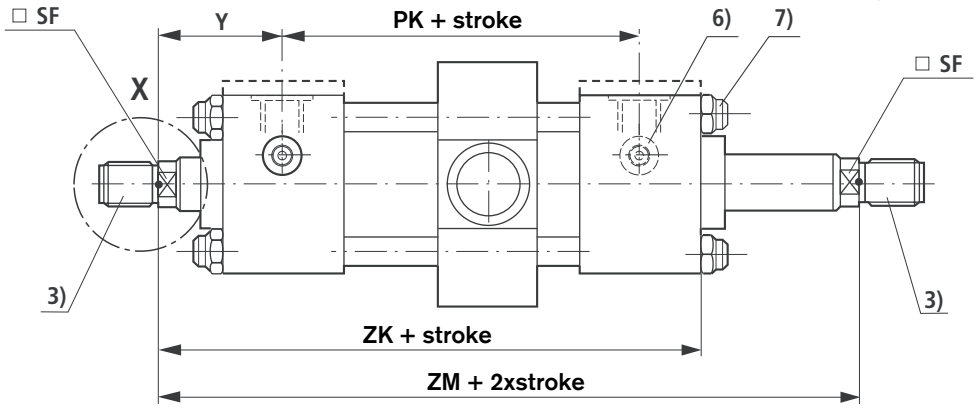
[12] Piston rod Ø not standardised

Mounting type MT4 (nominal dimensions in mm)

CDT3 MT4



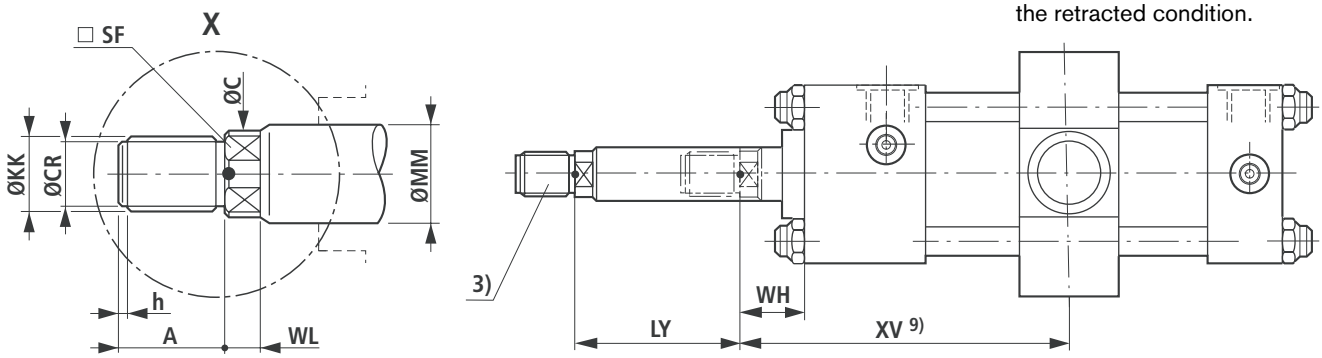
CGT3 MT4



①...④ = Position of pipe connection

The trunnions should be lubricated at regular intervals.

Dimensions for cylinder with piston rod extension “LY“ in the retracted condition.



AL Ø	PK ± 1.25	r	TD f8	TK max	TM h14	UM h15	UW max	Stroke min	XV min	XV max	ZB max	ZK ± 1	ZM ± 2
25	54	0.8	12	20	48	68	63	0	74	79 + stroke	121	139	154
32	58	0.8	16	25	55	79	75	10	93	83 + stroke	137	153	178
40	71	1.2	20	30	76	108	92	15	106	91 + stroke	166	170	195
50	73	1.6	25	40	89	129	112	4	106	102 + stroke	176	182	207
63	81	1.6	32	50	100	150	126	10	116	106 + stroke	185	191	223
80	92	2.4	40	60	127	191	160	11	129	118 + stroke	212	215	246
100	101	2.4	50	70	140	220	180	17	141	124 + stroke	225	230	265
125	117	3.2	63	90	178	278	215	25	157	132 + stroke	260	254	289
160	130	3.2	80	110	215	341	260	40	171	131 + stroke	279	270	302
200	160	3.2	100	130	279	439	365	48	202	154 + stroke	336	324	356

Dimensions MT4 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
25	12	M10x1.25	14	11	10	5	1	7.5	–	–						24
	18	M10x1.25	14	15	13	5	1	8	M14x1.5	18	15	13	5	2	11	30
32	14	M12x1.25	16	13	11	5	2.5	9.5	–	–						26
	22	M12x1.25	16	19	17	5	3	10	M16x1.5	22	19	17	5	3	13	34
40	18	M14x1.5	18	15	13	5	2	11	–	–						30
	22 [12]								M16x1.5	22	19	17	5	3	13	34
	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	22	M16x1.5	22	19	17	5	3	13	–	–						34
	28 [12]								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	28	M20x1.5	28	25	22	7	3	17	–	–						42
	36 [12]								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	36	M27x2	36	33	30	8	3	23.5	–	–						50
	45 [12]								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	45	M33x2	45	42	36	10	4	29.5	–	–						60
	56 [12]								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	56	M42x2	56	53	46	10	5	38.5	–	–						72
	70 [12]								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5	–	–						88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59	–	–						108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	E	EE	DT	EE	DT	GA	H [5); 11)]	J	PJ ± 1.25	WH ± 2	Y ± 2
25	40 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	22.5	53	15	50
32	45± 1.5	G 1/4	25	M14x1.5	21	46.5	5	23.5	56	25	60
40	63 ± 1.5	G 3/8	28	M18x1.5	26	52	–	33	73	25	62
50	75 ± 1.5	G 1/2	34	M22x1.5	29	57.8	–	33.8	74	25	67
63	90 ± 1.5	G 1/2	34	M22x1.5	29	55.8	–	33.8	80	32	71
80	115 ± 1.5	G 3/4	42	M27x2	34	65	–	39	93	31	77
100	130 ± 2	G 3/4	42	M27x2	34	67	–	40	101	35	82
125	165 ± 2	G 1	47	M33x2	43	73.5	–	51.5	117	35	86
160	205 ± 2	G 1	47	M33x2	43	80.5	–	55.5	130	32	86
200	245 ± 2	G 1 1/4	58	M42x2	52	101	–	76	165	32	98

1) Thread for piston rod ends “F“ and “H“

2) Thread for piston rod ends “D“ and “K“

3) For piston rod ends “E“ and “T“, see page 41

5) Dimension “H“ always at the position of the pipe connection

6) For the position of pipe connections and bleed point, see page 27

7) For tightening torque, see page 43

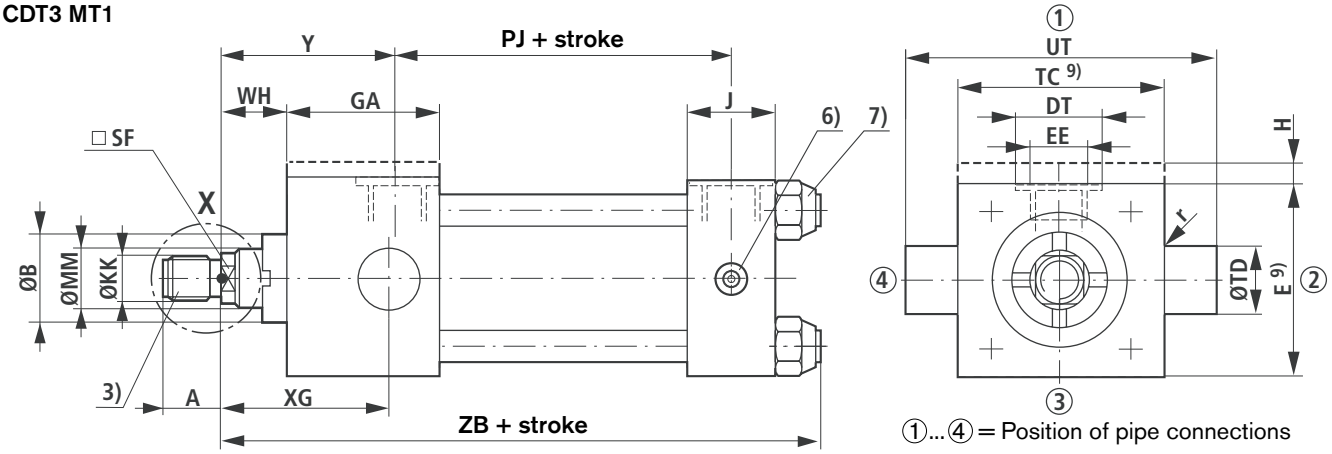
9) Always indicate dimension “XV“ in mm in clear text

11) Piston Ø 25 and 32 mm: Observe dimension “H“ with pipe connection positions “2” and “4“

12) Piston rod Ø not standardised

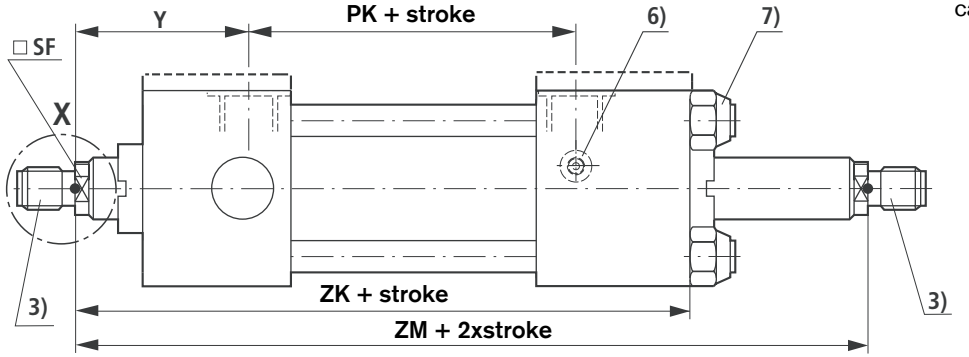
Mounting types MT1, MT2 (nominal dimensions in mm)

CDT3 MT1

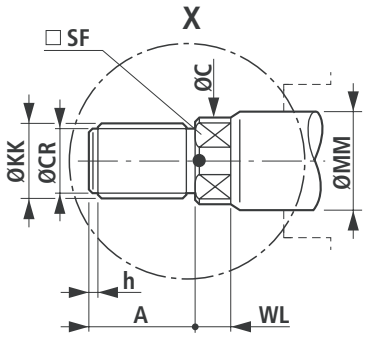


①...④ = Position of pipe connections

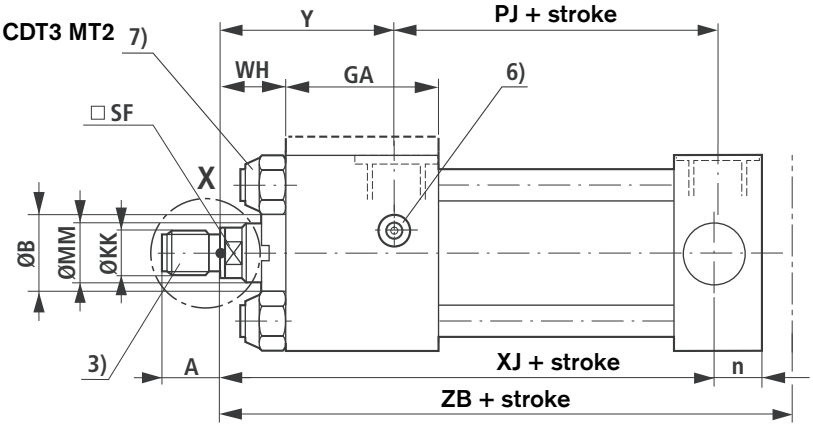
CGT3 MT1

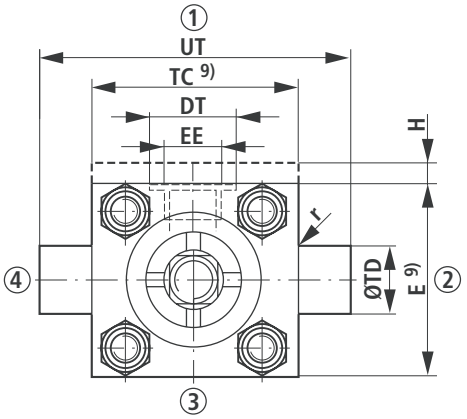


The trunnions should be lubricated at regular intervals.



CDT3 MT2





The trunnions should be lubricated at regular intervals.

AL Ø	n	PK ± 1.25	r	TC h14	TD f8	UT h15	XG ± 2	XJ ± 1.25	ZB max	ZK ± 1	ZM ± 2
25	13	54	1	38	12	58	44	101	121	139	154
32	13	58	1	44	16	68	54	115	137	153	178
40	19	71	1.6	63	20	95	57	134	166	170	195
50	19	73	1.6	76	25	116	64	140	176	182	207
63	19	81	2	89	32	139	70	149	185	191	223
80	22	92	2.4	114	40	178	76	168	212	215	246
100	38	101	2.4	127	50	207	71	187	225	230	265
125	51	117	3.2	165	63	265	75	209	260	254	289
160	49	130	3.2	203	80	329	75	230	279	270	302
200	53	160	4.5	241	100	401	85	276	336	324	356

Dimensions MT1, MT2 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
25	12	M10x1.25	14	11	10	5	1	7.5	–	–						24
	18	M10x1.25	14	15	13	5	1	8	M14x1.5	18	15	13	5	2	11	30
32	14	M12x1.25	16	13	11	5	2.5	9.5	–	–						26
	22	M12x1.25	16	19	17	5	3	10	M16x1.5	22	19	17	5	3	13	34
40	18	M14x1.5	18	15	13	5	2	11	–	–						30
	22 [12]								M16x1.5	22	19	17	5	3	13	34
	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	22	M16x1.5	22	19	17	5	3	13	–	–						34
	28 [12]								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	28	M20x1.5	28	25	22	7	3	17	–	–						42
	36 [12]								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	36	M27x2	36	33	30	8	3	23.5	–	–						50
	45 [12]								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	45	M33x2	45	42	36	10	4	29.5	–	–						60
	56 [12]								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	56	M42x2	56	53	46	10	5	38.5	–	–						72
	70 [12]								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5	–	–						88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59	–	–						108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	E	EE	DT	EE	DT	GA	H [5]	J	PJ ± 1.25	WH ± 2	Y ± 2
25	40 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	22.5	53	15	50
32	45± 1.5	G 1/4	25	M14x1.5	21	46.5	5	23.5	56	25	60
40	63 ± 1.5	G 3/8	28	M18x1.5	26	52	–	33	73	25	62
50	75 ± 1.5	G 1/2	34	M22x1.5	29	57.8	–	33.8	74	25	67
63	90 ± 1.5	G 1/2	34	M22x1.5	29	55.8	–	33.8	80	32	71
80	115 ± 1.5	G 3/4	42	M27x2	34	65	–	39	93	31	77
100	130 ± 2	G 3/4	42	M27x2	34	67	–	40	101	35	82
125	165 ± 2	G 1	47	M33x2	43	73.5	–	51.5	117	35	86
160	205 ± 2	G 1	47	M33x2	43	80.5	–	55.5	130	32	86
200	245 ± 2	G 1 1/4	58	M42x2	52	101	–	76	165	32	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

[3] For piston rod ends “E“ and “T“, see page 41

[5] Dimension “H“ always at the position of the pipe connection

[6] For the position of pipe connections and bleed point, see page 27

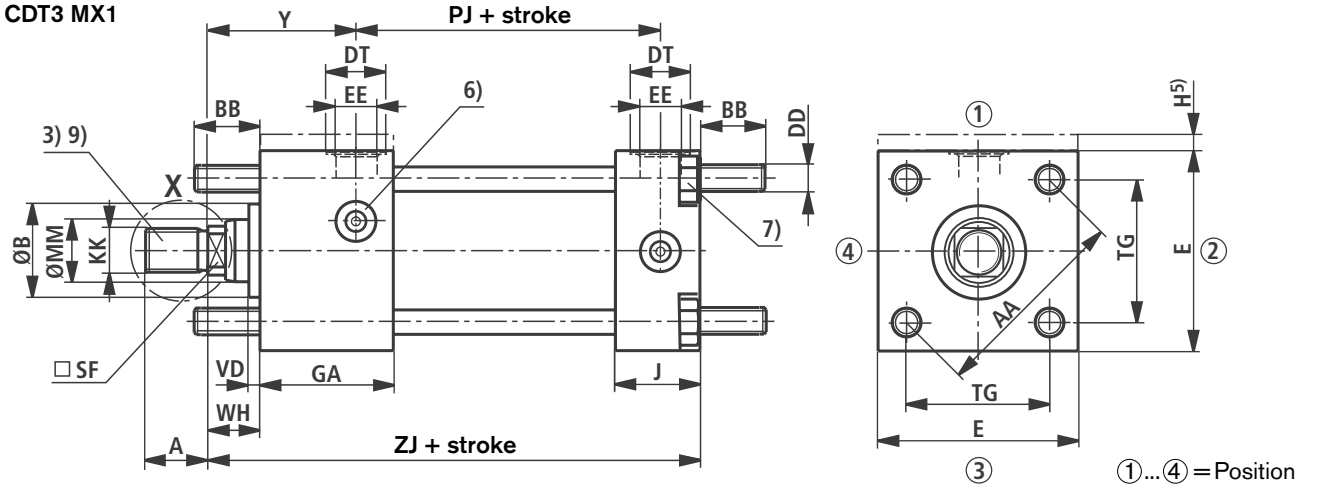
[7] For tightening torque, see page 43

[9] Observe “TC” and “E” for short strokes

[12] Piston rod Ø not standardised

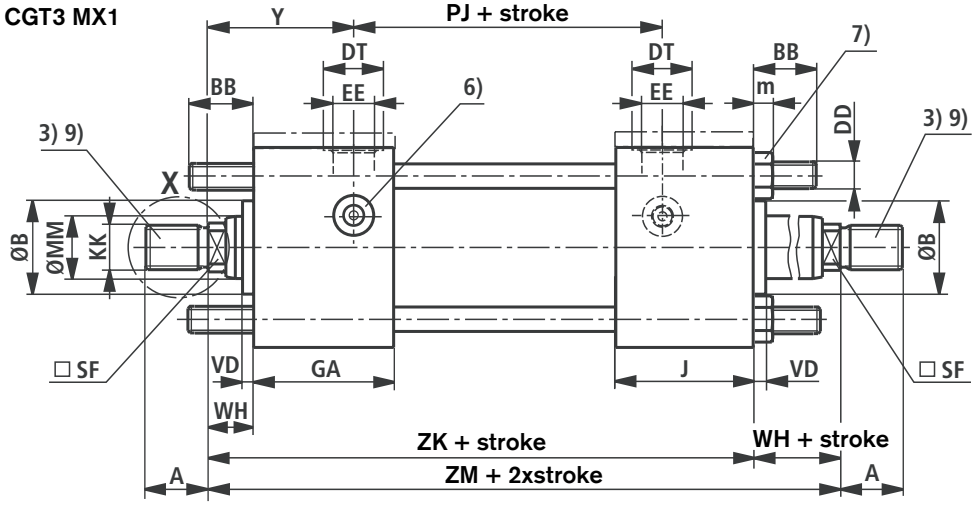
Mounting type MX1 (nominal dimensions in mm)

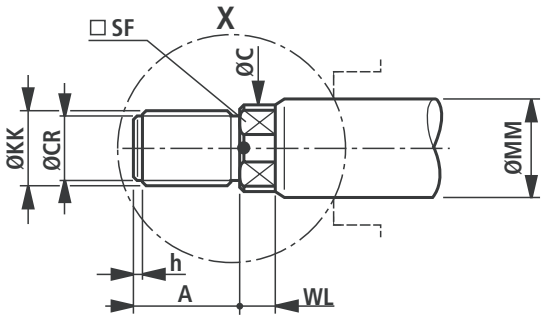
CDT3 MX1



①...④ = Position of pipe connections

CGT3 MX1





AL Ø	AA	BB 9) + 3	PK ± 1.25	TG js13	VD	ZB max	ZJ ± 1.25	ZK ± 1	ZM ± 2
25	40	19	54	28.3	6	121	114	139	154
32	47	24	58	33.2	12	137	128	153	178
40	59	35	71	41.7	12	166	153	170	195
50	74	46	73	52.3	9	176	159	182	207
63	91	46	81	64.3	13	185	168	191	223
80	117	59	92	82.7	9	212	190	215	246
100	137	59	101	96.9	10	225	203	230	265
125	178	81	117	125.9	9	260	232	254	289
160	219	92	130	154.9	7	279	245	270	302
200	269	115	160	190.2	7	336	299	324	356

Dimensions MX1 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
25	12	M10x1.25	14	11	10	5	1	7.5	–	–						24
	18	M10x1.25	14	15	13	5	1	8	M14x1.5	18	15	13	5	2	11	30
32	14	M12x1.25	16	13	11	5	2.5	9.5	–	–						26
	22	M12x1.25	16	19	17	5	3	10	M16x1.5	22	19	17	5	3	13	34
40	18	M14x1.5	18	15	13	5	2	11	–	–						30
	22 [12]								M16x1.5	22	19	17	5	3	13	34
	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	22	M16x1.5	22	19	17	5	3	13	–	–						34
	28 [12]								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	28	M20x1.5	28	25	22	7	3	17	–	–						42
	36 [12]								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	36	M27x2	36	33	30	8	3	23.5	–	–						50
	45 [12]								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	45	M33x2	45	42	36	10	4	29.5	–	–						60
	56 [12]								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	56	M42x2	56	53	46	10	5	38.5	–	–						72
	70 [12]								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5	–	–						88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59	–	–						108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	DD	E	EE	DT	EE	DT	GA	H [5]	J	m	PJ ± 1.25	WH ± 2	Y ± 2
25	M5x0.8	40 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	22.5	4	53	15	50
32	M6x1	45 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	23.5	5	56	25	60
40	M8x1	63 ± 1.5	G 3/8	28	M18x1.5	26	52	–	33	6.5	73	25	62
50	M12x1.25	75 ± 1.5	G 1/2	34	M22x1.5	29	57.8	–	33.8	10	74	25	67
63	M12x1.25	90 ± 1.5	G 1/2	34	M22x1.5	29	55.8	–	33.8	10	80	32	71
80	M16x1.5	115 ± 1.5	G 3/4	42	M27x2	34	65	–	39	13	93	31	77
100	M16x1.5	130 ± 2	G 3/4	42	M27x2	34	67	–	40	13	101	35	82
125	M22x1.5	165 ± 2	G 1	47	M33x2	43	73.5	–	51.5	18	117	35	86
160	M27x2	205 ± 2	G 1	47	M33x2	43	80.5	–	55.5	22	130	32	86
200	M30x2	245 ± 2	G 1 1/4	58	M42x2	52	101	–	76	24	165	32	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

[3] For piston rod ends “E“ and “T“, see page 41

[5] Dimension “H“ always at the position of the pipe connection

[6] For positions of pipe connections and bleed point, see page 27

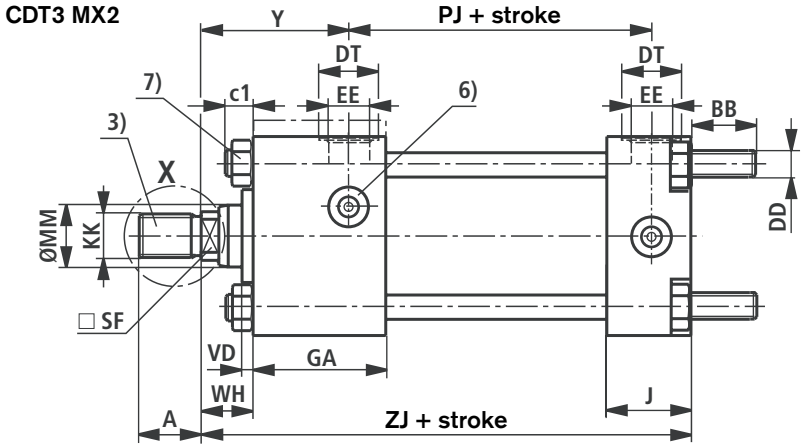
[7] For tightening torque, see page 43

[9] When mounting self-aligning clevis, observe dimension “BB”

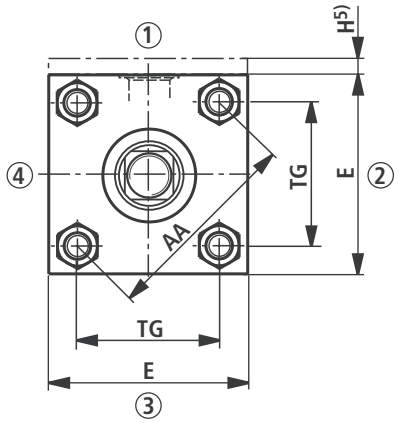
[12] Piston rod Ø not standardised

Mounting types MX2, MX3 (nominal dimensions in mm)

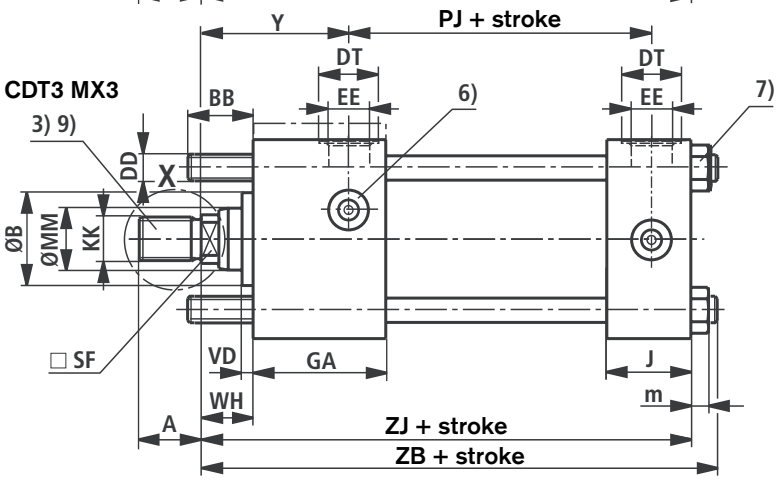
CDT3 MX2

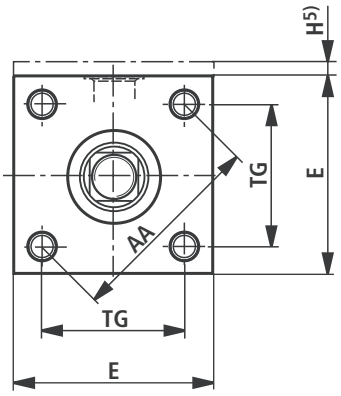


①...④ = Position of pipe connections

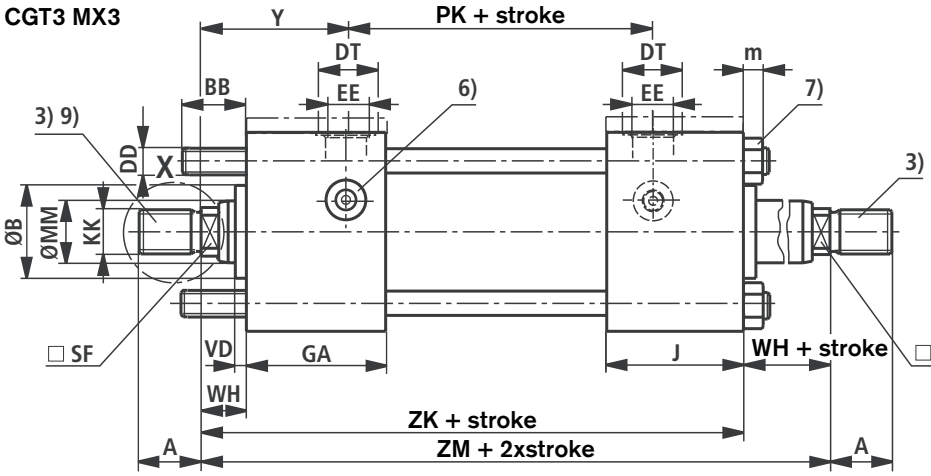


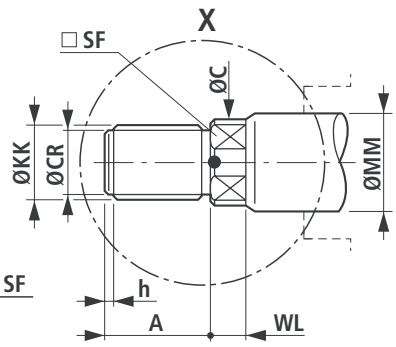
CDT3 MX3





CGT3 MX3





AL Ø	c1 max	AA	BB 9) + 3	PK ± 1.25	TG js13	VD	ZB max	ZJ ± 1	ZK ± 1	ZM ± 2
25	7	40	19	54	28.3	6	121	114	139	154
32	9	47	24	58	33.2	12	137	128	153	178
40	13	59	35	71	41.7	12	166	153	170	195
50	17	74	46	73	52.3	9	176	159	182	207
63	17	91	46	81	64.3	13	185	168	191	223
80	22	117	59	92	82.7	9	212	190	215	246
100	22	137	59	101	96.9	10	225	203	230	265
125	28	178	81	117	125.9	9	260	232	254	289
160	34	219	92	130	154.9	7	279	245	270	302
200	37	269	115	160	190.2	7	336	299	324	356

Dimensions MX2, MX3 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
25	12	M10x1.25	14	11	10	5	1	7.5	–	–						24
	18	M10x1.25	14	15	13	5	1	8	M14x1.5	18	15	13	5	2	11	30
32	14	M12x1.25	16	13	11	5	2.5	9.5	–	–						26
	22	M12x1.25	16	19	17	5	3	10	M16x1.5	22	19	17	5	3	13	34
40	18	M14x1.5	18	15	13	5	2	11	–	–						30
	22 [12]								M16x1.5	22	19	17	5	3	13	34
	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	22	M16x1.5	22	19	17	5	3	13	–	–						34
	28 [12]								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	28	M20x1.5	28	25	22	7	3	17	–	–						42
	36 [12]								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	36	M27x2	36	33	30	8	3	23.5	–	–						50
	45 [12]								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	45	M33x2	45	42	36	10	4	29.5	–	–						60
	56 [12]								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	56	M42x2	56	53	46	10	5	38.5	–	–						72
	70 [12]								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5	–	–						88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59	–	–						108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	DD	E	EE	DT	EE	DT	GA	H [5]	J	m	PJ ± 1.25	WH ± 2	Y ± 2
25	M5x0.8	40 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	22.5	4	53	15	50
32	M6x1	45 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	23.5	5	56	25	60
40	M8x1	63 ± 1.5	G 3/8	28	M18x1.5	26	52	–	33	6.5	73	25	62
50	M12x1.25	75 ± 1.5	G 1/2	34	M22x1.5	29	57.8	–	33.8	10	74	25	67
63	M12x1.25	90 ± 1.5	G 1/2	34	M22x1.5	29	55.8	–	33.8	10	80	32	71
80	M16x1.5	115 ± 1.5	G 3/4	42	M27x2	34	65	–	39	13	93	31	77
100	M16x1.5	130 ± 2	G 3/4	42	M27x2	34	67	–	40	13	101	35	82
125	M22x1.5	165 ± 2	G 1	47	M33x2	43	73.5	–	51.5	18	117	35	86
160	M27x2	205 ± 2	G 1	47	M33x2	43	80.5	–	55.5	22	130	32	86
200	M30x2	245 ± 2	G 1 1/4	58	M42x2	52	101	–	76	24	165	32	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

[3] For piston rod ends “E“ and “T“, see page 41

[5] Dimension “H“ always at the position of the pipe connection

[6] For positions of pipe connections and bleed point, see page 27

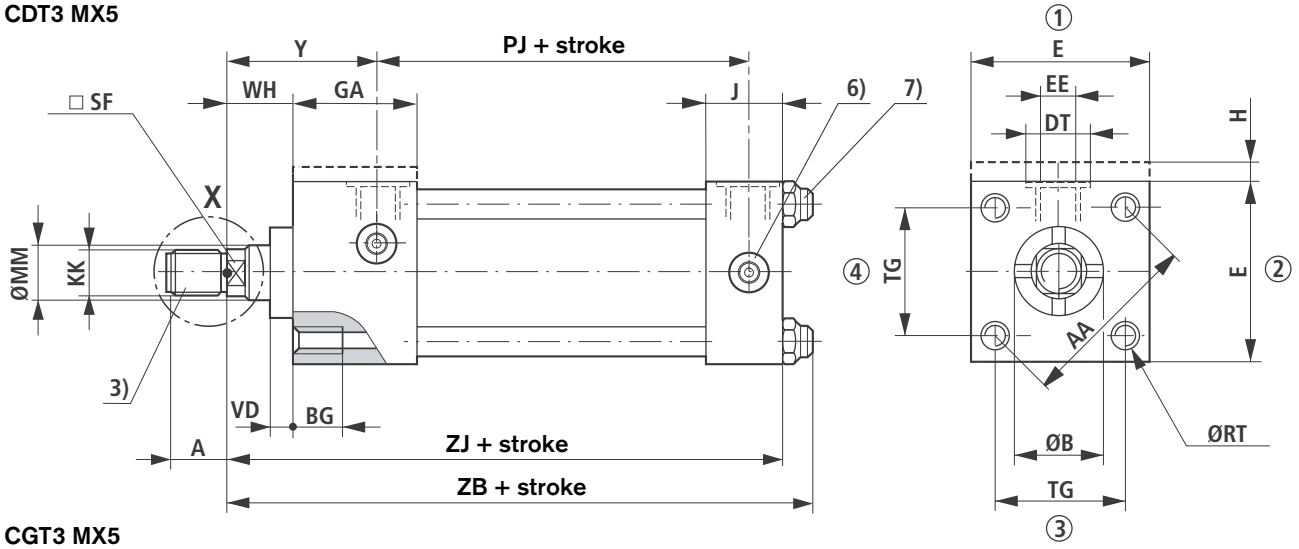
[7] For tightening torque, see page 43

[9] When mounting self-aligning clevis, observe dimension “BB“

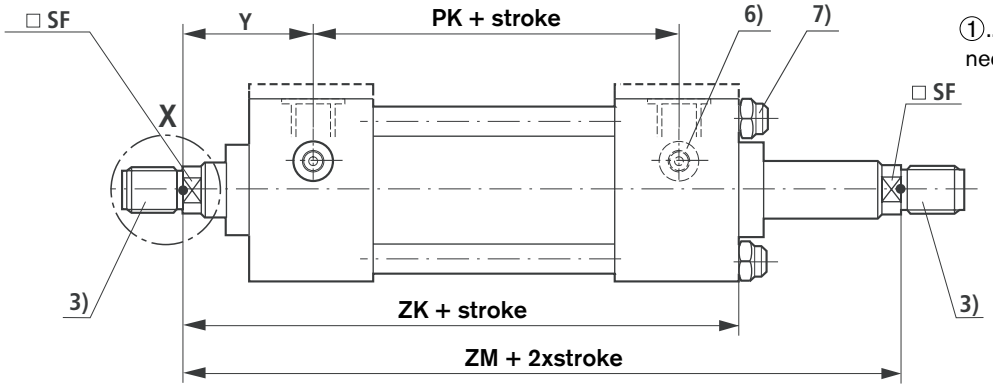
[12] Piston rod Ø not standardised

Mounting type MX5 (nominal dimensions in mm)

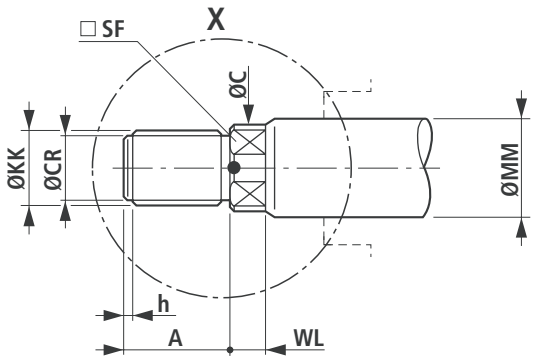
CDT3 MX5



CGT3 MX5



①...④ = Position of pipe connections



AL Ø	AA	BG min	PK ± 1.25	RT 6H	TG js13	VD	ZB max	ZJ ± 1.25	ZK ± 1	ZM ± 2
25	40	8	54	M5x0.8	28.3	6	121	114	139	154
32	47	9	58	M6x1	33.2	12	137	128	153	178
40	59	12	71	M8x1.25	41.7	12	166	153	170	195
50	74	18	73	M12x1.75	52.3	9	176	159	182	207
63	91	18	81	M12x1.75	64.3	13	185	168	191	223
80	117	24	92	M16x2	82.7	9	212	190	215	246
100	137	24	101	M16x2	96.9	10	225	203	230	265
125	178	27	117	M22x2.5	125.9	9	260	232	254	289
160	219	32	130	M27x3	154.9	7	279	245	270	302
200	269	40	160	M30x3.5	190.2	7	336	299	324	356

Dimensions MX5 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
25	12	M10x1.25	14	11	10	5	1	7.5	–	–						24
	18	M10x1.25	14	15	13	5	1	8	M14x1.5	18	15	13	5	2	11	30
32	14	M12x1.25	16	13	11	5	2.5	9.5	–	–						26
	22	M12x1.25	16	19	17	5	3	10	M16x1.5	22	19	17	5	3	13	34
40	18	M14x1.5	18	15	13	5	2	11	–	–						30
	22 [12]								M16x1.5	22	19	17	5	3	13	34
	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	22	M16x1.5	22	19	17	5	3	13	–	–						34
	28 [12]								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	28	M20x1.5	28	25	22	7	3	17	–	–						42
	36 [12]								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	36	M27x2	36	33	30	8	3	23.5	–	–						50
	45 [12]								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	45	M33x2	45	42	36	10	4	29.5	–	–						60
	56 [12]								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	56	M42x2	56	53	46	10	5	38.5	–	–						72
	70 [12]								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5	–	–						88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59	–	–						108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	E	EE	DT	EE	DT	GA	H [5]	J	PJ ± 1.25	WH ± 2	Y ± 2
25	40 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	22.5	53	15	50
32	45± 1.5	G 1/4	25	M14x1.5	21	46.5	5	23.5	56	25	60
40	63 ± 1.5	G 3/8	28	M18x1.5	26	52	–	33	73	25	62
50	75 ± 1.5	G 1/2	34	M22x1.5	29	57.8	–	33.8	74	25	67
63	90 ± 1.5	G 1/2	34	M22x1.5	29	55.8	–	33.8	80	32	71
80	115 ± 1.5	G 3/4	42	M27x2	34	65	–	39	93	31	77
100	130 ± 2	G 3/4	42	M27x2	34	67	–	40	101	35	82
125	165 ± 2	G 1	47	M33x2	43	73.5	–	51.5	117	35	86
160	205 ± 2	G 1	47	M33x2	43	80.5	–	55.5	130	32	86
200	245 ± 2	G 1 1/4	58	M42x2	52	101	–	76	165	32	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

[3] For piston rod ends “E“ and “T“, see page 41

[5] Dimension “H“ always at the position of the pipe connection

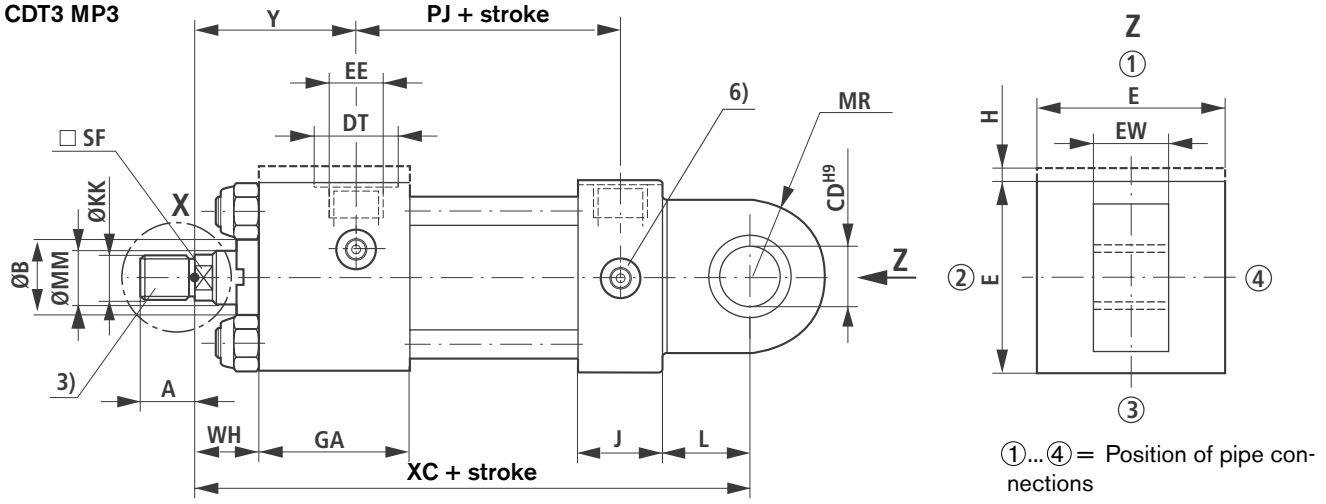
[6] For positions of pipe connections and bleed point, see page 27

[7] For tightening torque, see page 43

[12] Piston rod Ø not standardised

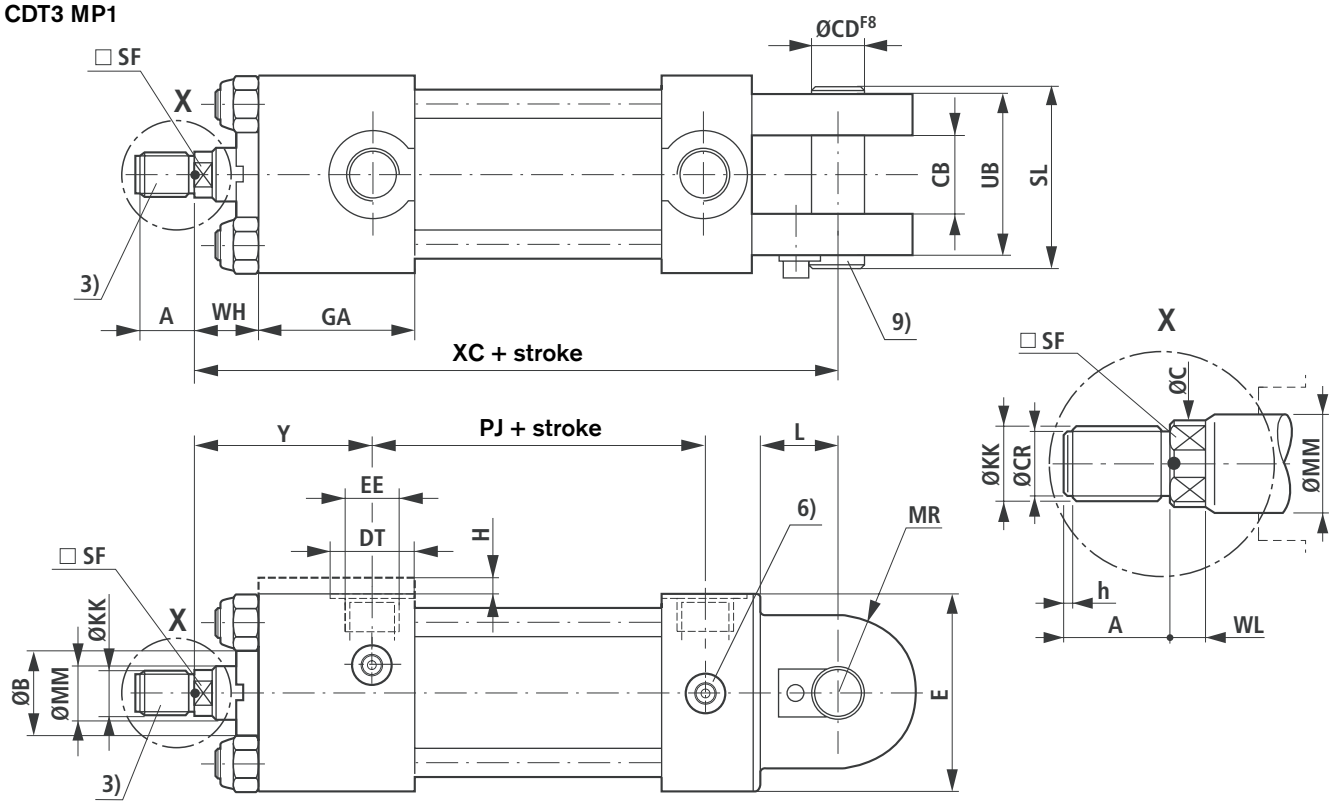
Mounting types MP1, MP3 (nominal dimensions in mm)

CDT3 MP3



①...④ = Position of pipe connections

CDT3 MP1



AL Ø	CB A16	CD H9	EW h14	L min	MR max	UB max	SL	XC ± 1.25
25	12	10	12	13	12	24	33	127
32	16	12	16	19	17	32	42	147
40	20	14	20	19	17	40	50	172
50	30	20	30	32	29	60	69	191
63	30	20	30	32	29	60	69	200
80	40	28	40	39	34	80	89	229
100	50	36	50	54	50	100	110	257
125	60	45	60	57	53	120	132	289
160	70	56	70	63	59	140	155	308
200	80	70	80	82	78	160	175	381

Dimensions MP1, MP3 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
25	12	M10x1.25	14	11	10	5	1	7.5	–	–						24
	18	M10x1.25	14	15	13	5	1	8	M14x1.5	18	15	13	5	2	11	30
32	14	M12x1.25	16	13	11	5	2.5	9.5	–	–						26
	22	M12x1.25	16	19	17	5	3	10	M16x1.5	22	19	17	5	3	13	34
40	18	M14x1.5	18	15	13	5	2	11	–	–						30
	22 [12]								M16x1.5	22	19	17	5	3	13	34
	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	22	M16x1.5	22	19	17	5	3	13	–	–						34
	28 [12]								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	28	M20x1.5	28	25	22	7	3	17	–	–						42
	36 [12]								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	36	M27x2	36	33	30	8	3	23.5	–	–						50
	45 [12]								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	45	M33x2	45	42	36	10	4	29.5	–	–						60
	56 [12]								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	56	M42x2	56	53	46	10	5	38.5	–	–						72
	70 [12]								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5	–	–						88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59	–	–						108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	E	EE	DT	EE	DT	GA	H [5]	J	PJ ± 1.25	WH ± 2	Y ± 2
25	40 ± 1.5	G 1/4	25	M14x1.5	21	46.5	5	22.5	53	15	50
32	45± 1.5	G 1/4	25	M14x1.5	21	46.5	5	23.5	56	25	60
40	63 ± 1.5	G 3/8	28	M18x1.5	26	52	–	33	73	25	62
50	75 ± 1.5	G 1/2	34	M22x1.5	29	57.8	–	33.8	74	25	67
63	90 ± 1.5	G 1/2	34	M22x1.5	29	55.8	–	33.8	80	32	71
80	115 ± 1.5	G 3/4	42	M27x2	34	65	–	39	93	31	77
100	130 ± 2	G 3/4	42	M27x2	34	67	–	40	101	35	82
125	165 ± 2	G 1	47	M33x2	43	73.5	–	51.5	117	35	86
160	205 ± 2	G 1	47	M33x2	43	80.5	–	55.5	130	32	86
200	245 ± 2	G 1 1/4	58	M42x2	52	101	–	76	165	32	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

[3] For piston rod ends “E“ and “T“, see page 41

[5] Dimension “H“ always at the position of the pipe connection

[6] For positions of pipe connections and bleed point, see page 27

[7] For tightening torque, see page 43

[9] Spigot included in the scope of supply

[12] Piston rod Ø not standardised

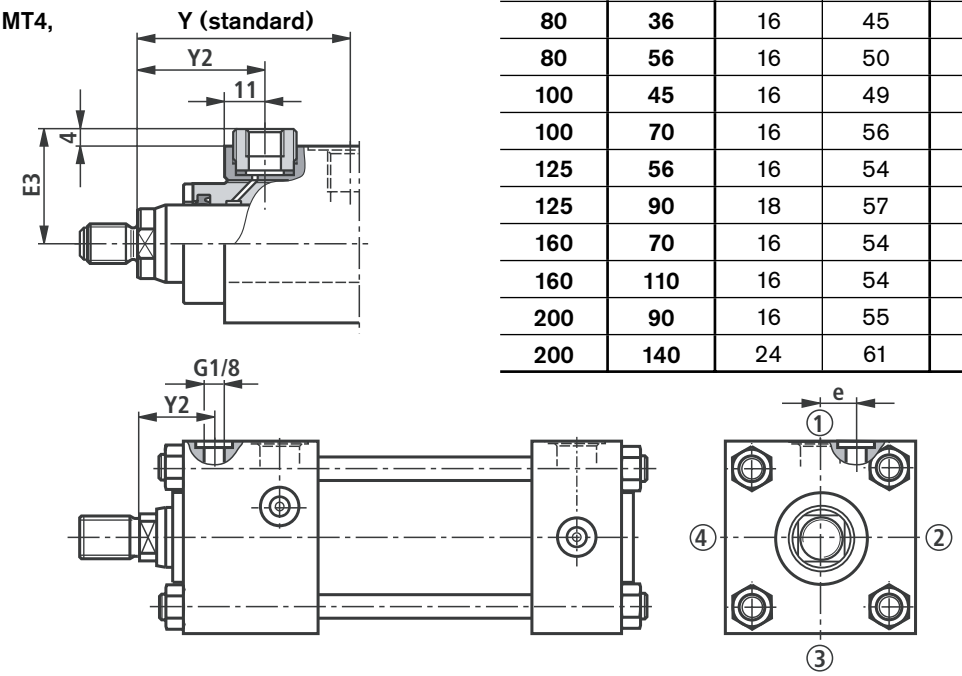
Drain port / enlarged pipe connection (nominal dimensions in mm)

Drain port

When high-quality seals are employed, the use of a drain port is usually not necessary. Only in special cases, e.g. when the extension velocity is more than 2 x the retraction velocity with larger strokes, continuous pressurisation or similar, a drag oil collection connection is recommended. For extension velocities greater than 5 x the retraction velocity, consult us!

		MS2, MT4 ME6, MP5		ME5	
Ø AL	**Ø MM**	**e**	**Y2**	**e**	**Y2**
25		0	21	17	35
32		0	32	18	45
40		0	38	22	47
50		15	39	34	52
63		16	46	43	59
80	**36**	16	45	27	62
80	**56**	16	50	27	62
100	**45**	16	49	30	68
100	**70**	16	56	30	68
125	**56**	16	54	45	68
125	**90**	18	57	45	68
160	**70**	16	54	45	68
160	**110**	16	54	47	68
200	**90**	16	55	45	68
200	**140**	24	61	45	72

ME6, MP5, MS2, MT4, Ø 25, 32, 40

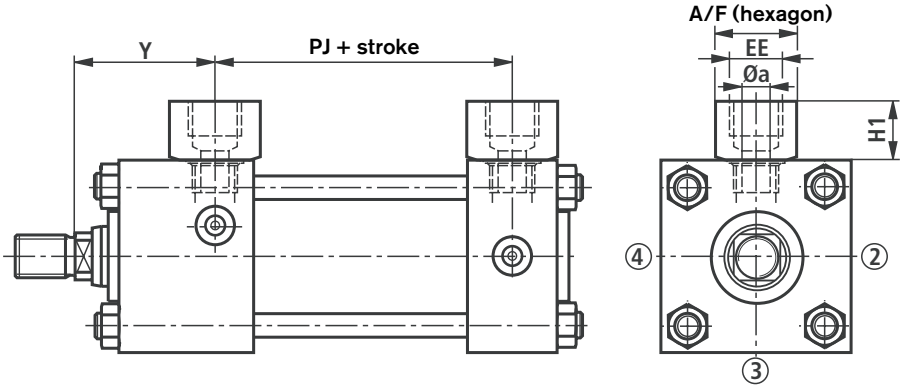


Enlarged pipe connection

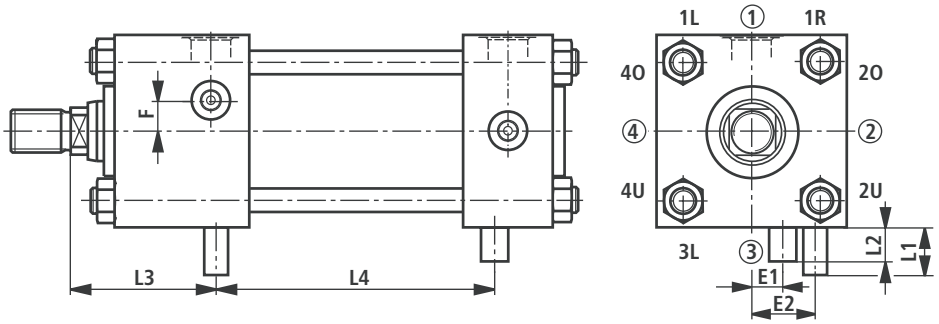
The oil ports of this series are generously dimensioned in accordance with standards; at high velocity, pressure drop Δp can be reduced by using larger oil connections, but in some cases, standard dimensions cannot be complied with, see table.

Not feasible for mounting types ME 5 / 6 with connection position 2 or 4 .

Ø AL	**EE**	**H1**	**Y**	**PJ**	**SW**	**Ø a**
25	G3/8	20	50	53	27	9
32	G3/8	20	60	56	27	9
40	G1/2	23	62	73	32	11
50	G3/4	29	67	74	41	14
63	G3/4	29	71	80	41	14
80	G1	33	77	93	46	18
100	G1	33	82	101	46	18
125	G11/4	39	86	117	60	23
160	G11/4	–	86	130	–	–
200	G11/2	–	86	165	–	–



Position of pipe connections / bleed point / leakage oil / throttle valve



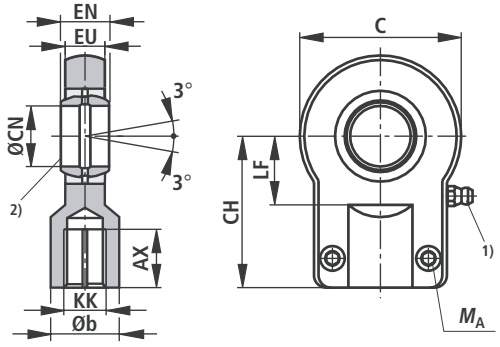
		CDT3 / CST3					CGT3						
Mounting type	Pipe connection	Bleeding Head 1	Bleeding Cap	Leakage Head 1	Throttle valve Head 1	Throttle valve Cap		Head 1	Head 2	Head 1	Head 2	Head 1	Head 2
MP5, MT4	1	2	2	1	3R	3R	MT4	2	4	1	1	3R	3L
	2	3	3	2	4U	4U		3	1	2	2	4U	4O
	3	4	4	3	1L	1L		4	2	3	3	1L	1R
	4	1	1	4	2O	2O		1	3	4	4	2O	2U
ME5	1	2	2	1	3R	3R	ME5	2	4	1	1	3R	3L
	2	3R	3	1	1L	4U		3R	1	1	2	1L	4O
	3	4	4	3	1L	1L		4	2	3	3	1L	1R
	4	1L	1	3	3R	2O		1L	3	3	3	3R	2U
ME6	1	2	2	1	3R	3R		–	–	–	–	–	–
	2	3	3	2	4U	1L		–	–	–	–	–	–
	3	4	4	3	1L	1L		–	–	–	–	–	–
	4	1	1	4	2O	3R		–	–	–	–	–	–
MS2	1	2	2	1	4O	4O	MS2	2	4	1	1	4O	2O
MP1, MP3, MX1, MX2, MX3, MX5	1	2	2	–	–	–	MX1, MX2, MX3	2	4	–	–	–	–
	2	3	3	–	–	–		3	1	–	–	–	–
	3	4	4	–	–	–		4	2	–	–	–	–
	4	1	1	–	–	–		1	3	–	–	–	–
MT1	1	3R	2	–	–	–	MT1	3R	4	–	–	–	–
	3	1L	4	–	–	–		1L	2	–	–	–	–
MT2	1	2	3R	–	–	–		–	–	–	–	–	–
	3	4	1L	–	–	–		–	–	–	–	–	–

	Bleeding			Throttle valve adjustable on both sides						
AL Ø	Head offset F	ME5, connection 1/3	A/F socket	Projection L1 (head)	Projection L2 (cap)	Offset from centre E1 (head)	Offset from centre E2 (cap)	Dimension L3	Dimension L4	
25	–	–	–	12	12	6	6	46.5	60 + stroke	
32	–	–	–	12	8.5	9	4	55	66 + stroke	
40	10	0	5	6.5	2	8	8	56.5	79 + stroke	84 + stroke [1]
50	10	0	5	4.5	–	10	10	60	82 + stroke	88 + stroke [1]
63	14	0	5	–	–	15	11	70	82 + stroke	
80	20	0	6	–	–	14	18	73.5	100 + stroke	
100	24	0	6	–	–	13	20	84.5	100 + stroke	
125	0	0	6	–	–	22	22	91.5	109 + stroke	
160	0	0	6	4	–	30	30	93.5	115 + stroke	
200	0	0	6	4	–	30	30	114	128 + stroke	

[1] Dimension L4 for mounting type MS2

Self-aligning clevis (with locking screws): **CGKA** (nominal dimensions in mm) **- AP 6**

ISO 8133
DIN 24555

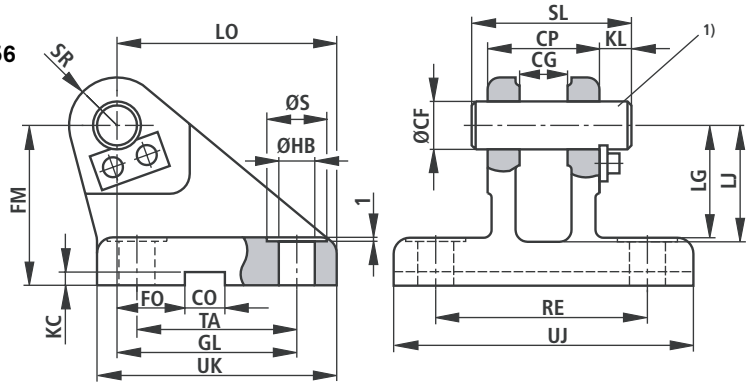


1) Grease nipple, tapered head, form A to DIN 71412
2) Associated pin Ø h6
3) Cannot be lubricated
4) Can be lubricated via lubricating hole
5) Self-aligning clevis to ISO 6982, DIN 24338, associated spigot Ø h6
7) Self-aligning clevis weight

KK	Type	Material no.	AX min.	b	C max.	CH js13	CN Ø	EN	EU h13	LF min.	M_A Nm	m 7) kg
M10 x1.25	**CGKA 12** 3)	R900327186	15	17	40	42	12 –0.008	10 –0.12	8	16	9.5	0.15
M12x1.25	**CGKA 16** 4)	R900327192	17	21	45	48	16 –0.008	14 –0.12	11	20	9.5	0.25
M14x1.5	**CGKA 20** 4)	R900306874	19	25	55	58	20 –0.012	16 –0.12	13	25	23	0.43
M16x1.5	**CGKA 25**	R900327191	23	30	65	68	25 –0.012	20 –0.12	17	30	23	0.73
M20x1.5	**CGKA 30**	R900327187	29	36	80	85	30 –0.012	22 –0.12	19	35	46	1.3
M27x2	**CGKA 40**	R900327188	37	45	100	105	40 –0.012	28 –0.12	23	45	46	2.3
M33x2	**CGKA 50**	R900327368	46	55	125	130	50 –0.012	35 –0.12	30	58	80	4.4
M42x2	**CGKA 60**	R900327369	57	68	160	150	60 –0.012	44 –0.12	38	68	195	8.4
M48x2	**CGKA 80**	R900327370	64	90	205	185	80 –0.015	55 –0.15	47	92	385	15.6
M64x3	**CGKA 100**	R900327371	86	110	240	240	100 –0.02	70 –0.2	57	116	660	28
M80x3	**CGKD 100** 5)	R900322030	96	110	210	210	100 H7	100 h12	84	98	385	28
M100x3	**CGKD 125** 5)	R900322026	113	135	262	260	125 H7	125 h12	102	120	385	43

Fork-type mounting block (with locking screws): **CLCB** (nominal dimensions in mm) **- AB 5**

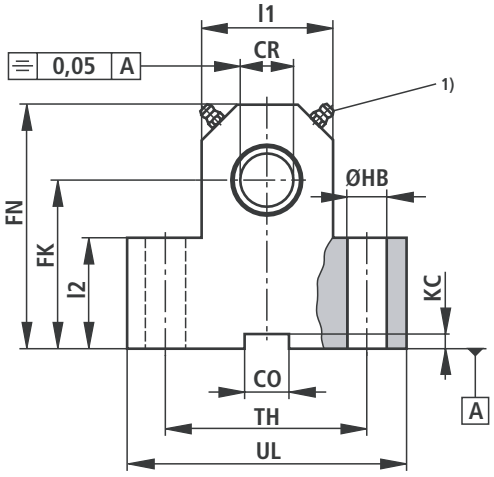
ISO 8133
DIN 24 556

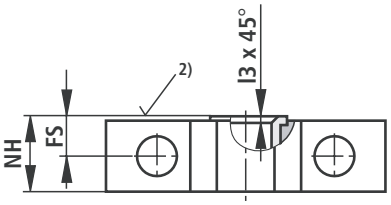


1) Associated spigot Ø h6, which suits self-aligning clevis CGKA... (pin and pin locking element included in the scope of supply)
2) Weight of fork-type mounting block

Piston Ø	Type	Material no.	m 2) kg	CF Ø K7	CP h14	CG +0.1 +0.3	CO N9	FO js14	FM js11	GL js13	HB Ø	KC +0.3 0	KL	LG	LJ	LO	RE js13	SL	SR max.	TA js13	UJ	UK	S Ø
25	**CLCB 12**	R900326960	0.6	12	30	10	10	16	40	46	9	3.3	8	28	29	56	55	40	12	40	75	60	15
32	**CLCB 16**	R900327372	1.3	16	40	14	16	18	50	61	11	4.3	8	37	38	74	70	50	16	55	95	80	18
40	**CLCB 20**	R900327373	2.1	20	50	16	16	20	55	64	14	4.3	10	39	40	80	85	62	20	58	120	90	20
50	**CLCB 25**	R900326961	3.2	25	60	20	25	22	65	78	16	5.4	10	48	49	98	100	72	25	70	140	110	24
63	**CLCB 30**	R900327374	6.5	30	70	22	25	24	85	97	18	5.4	13	62	63	120	115	85	30	90	160	135	26
80	**CLCB 40**	R900327375	12.0	40	80	28	36	24	100	123	22	8.4	16	72	73	148	135	100	40	120	190	170	33
100	**CLCB 50**	R900327376	23.0	50	100	35	36	35	125	155	30	8.4	19	90	92	190	170	122	50	145	240	215	48
125	**CLCB 60**	R900327377	37.0	60	120	44	50	35	150	187	39	11.4	20	108	110	225	200	145	60	185	270	260	60
160	**CLCB 80**	R900327378	79.0	80	160	55	50	35	190	255	45	11.4	26	140	142	295	240	190	80	260	320	340	80
200	**CLCB 100**	R900327379	140.0	100	200	70	63	35	210	285	48	12.4	30	150	152	335	300	235	100	300	400	400	80

Trunnion mounting block CLTA (nominal dimensions in mm) - AT 4





1) Grease nipple, cone form A to DIN 71412

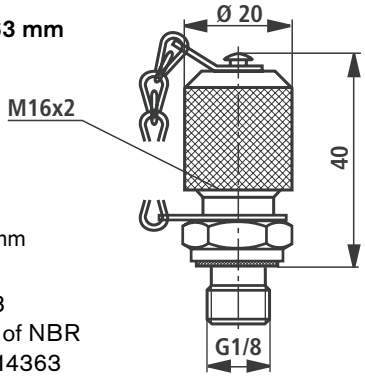
2) Inner side

3) Weight per pair, mounting blocks are always supplied in pairs

Piston Ø	Type	Material no	*m* 3) kg	CR H7	CO N9	FK js12	FN max.	FS js14	HB Ø H13	KC + 0.3	NH max.	TH js14	UL max.	l1	l2	l3
25	**CLTA 12**	R901071355	0.5	12	10	38	55	8	9	3.3	17	40	63	25	25	1
32	**CLTA 16**	R901071364	0.9	16	16	45	65	10	11	4.3	21	50	80	30	30	1
40	**CLTA 20**	R901071365	1.35	20	16	55	80	10	11	4.3	21	60	90	40	38	1.5
50	**CLTA 25**	R901071368	2.4	25	25	65	90	12	14	5.4	26	80	110	56	45	1.5
63	**CLTA 32**	R901071377	5.0	32	25	75	110	15	18	5.4	33	110	150	70	52	2
80	**CLTA 40**	R901071380	8.5	40	36	95	140	16	22	8.4	41	125	170	88	60	2.5
100	**CLTA 50**	R901071385	15	50	36	105	150	20	26	8.4	51	160	210	90	72	2.5
125	**CLTA 63**	R901071395	30	63	50	125	195	25	33	11.4	61	200	265	136	87	3
160	**CLTA 80**	R901071398	59	80	50	150	230	31	39	11.4	81	250	325	160	112	3.5
200	**CLTA 100**	R901071400	131	100	63	200	300	42	52	12.4	101	320	410	200	150	4.5

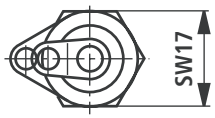
Threaded coupling

For piston Ø 40 - 63 mm



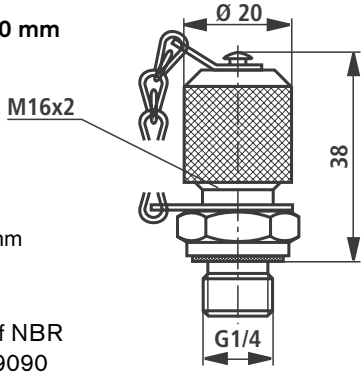
Scope of supply for piston Ø 40 to 63 mm

Threaded coupling
AB 20-11/K3, G 1/8
with seal ring made of NBR
Material no. R900014363



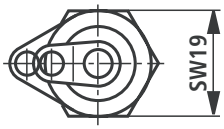
Threaded coupling
AB 20-11/K3V, G 1/8
with seal ring made of FKM
Material no. R900024710

For piston Ø 80 - 200 mm



Scope of supply for piston Ø 80 to 200 mm

Threaded coupling
AB 20-11/K1, G 1/4
with seal ring made of NBR
Material no. R900009090



Threaded coupling
AB 20-11/K1V, G 1/4
with seal ring made of FKM
Material no. R900001264

Remarks

For pressure measurement or bleeding.
For installation in the bleeding/measuring connection. Threaded coupling with check valve function, i.e. all measuring instruments can also be connected under pressure.

Buckling

The permissible stroke lengths for a flexibly guided load and 3.5-fold safety against buckling can be found in the relevant table. In the case of a differing installation orientation of the cylinder, the permissible stroke length has to be interpolated. Permissible stroke lengths for non-guided loads on enquiry.

Buckling can be calculated according to the following formula:

1. Calculation according to Euler

$$F = \frac{\pi^2 \cdot E \cdot I}{\nu \cdot L_B{}^2} \quad \text{when } \lambda > \lambda g$$

2. Calculation according to Tetmajer

$$F = \frac{d^2 \cdot \pi \,(335\text{-}0.62 \cdot \lambda)}{4 \cdot \nu} \quad \text{when } \lambda \le \lambda g$$

Explanation:

E = Modulus of elasticity in N/mm²
= 2.1 x 10^5 for steel

I = Moment of inertia in mm⁴ for circular cross-sectional area: $= \frac{d^4 \cdot \pi}{64} = 0.0491 \cdot d^4$

ν = 3.5 (safety factor)

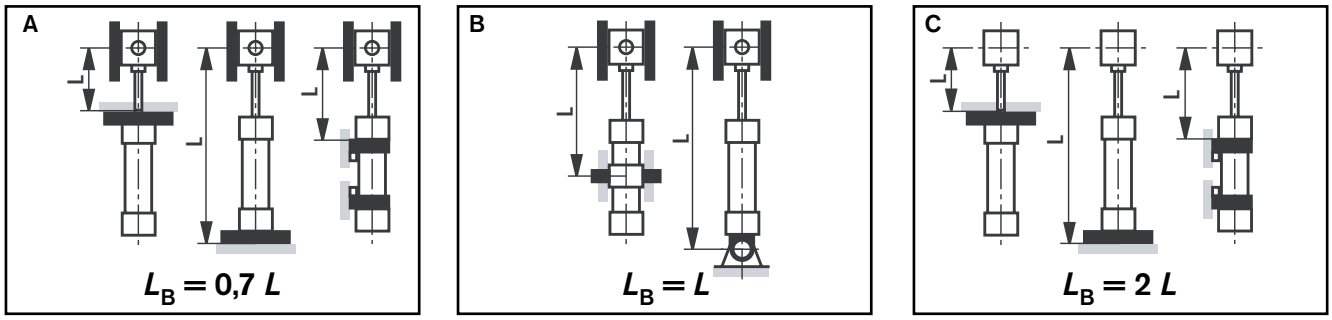
L_K = Free buckling length in mm (depending on mounting style, see sketches A, B, C)

d = Piston rod Ø in mm

λ = Slenderness ratio $= \frac{4 \cdot L_B}{d}$ $\quad \lambda g = \pi \sqrt{\frac{E}{0.8 \cdot R_e}}$

R_e = Yield strength of the piston rod material

Influence of the mounting style on the buckling length:

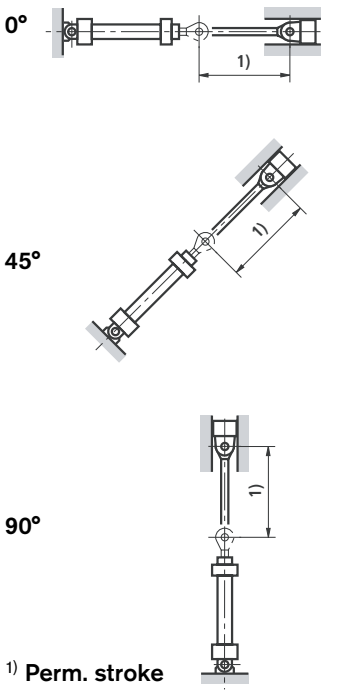


Permissible stroke length (nominal dimensions in mm)

Mounting type MP1, MP3, MP5

AL Ø	MM Ø	Permissible stroke length at 70 bar 0°	70 bar 45°	70 bar 90°	100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	Max. available stroke length
25	12	115	120	125	85	85	90	50	50	55	600
	18	315	330	375	270	275	300	205	210	220	
32	14	115	120	125	85	85	90	50	50	55	800
	22	370	385	440	315	325	350	240	245	255	
40	18	160	165	175	120	125	130	75	75	80	1000
	22	310	320	350	260	265	290	195	200	205	
	28	465	485	580	400	415	465	315	320	340	
50	22	205	210	220	155	160	165	100	100	105	1200
	28	420	430	475	355	360	380	270	275	280	
	36	620	650	790	545	565	640	435	445	475	
63	28	280	285	305	220	225	230	150	150	155	1400
	36	560	580	645	480	490	520	375	380	390	
	45	770	810	995	680	710	805	555	565	605	
80	36	380	390	415	305	310	320	210	215	220	1700
	45	695	715	800	600	610	650	470	475	490	
	56	945	995	1225	840	870	995	685	670	745	
100	45	480	495	540	390	400	420	280	285	290	2000
	56	850	880	1000	740	760	820	590	600	625	
	70	1150	1210	1550	1030	1075	1260	855	875	955	
125	56	595	615	685	490	500	535	360	365	375	2300
	70	1065	1105	1290	940	965	1060	765	775	810	
	90	1445	1535	2110	1315	1380	1690	1115	1150	1285	
160	70	730	755	850	610	625	670	455	460	475	2600
	110	1715	1815	2450	1565	1640	2015	1335	1380	1540	
200	90	945	985	1140	800	825	900	610	620	645	2700
	140	2120	2255	2700	1955	2060	2625	1690	1755	2010	

Installation orientation



[1] **Perm. stroke**

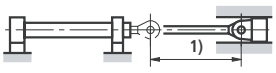
Permissible stroke length (nominal dimensions in mm)

Mounting type MS2

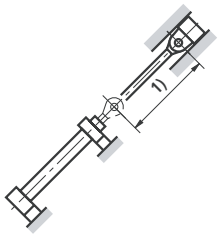
AL Ø	MM Ø	Permissible stroke length at 70 bar 0°	70 bar 45°	70 bar 90°	100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	Max. available stroke length
25	12	500	510	530	420	425	435	325	325	330	600
	18	600	600	600	600	600	600	600	600	600	
32	14	525	535	555	435	440	450	335	335	340	800
	22	800	800	800	800	800	800	800	800	800	
40	18	700	715	750	590	595	610	455	460	465	1000
	22	975	1000	1000	855	875	940	690	700	720	
	28	1000	1000	1000	1000	1000	1000	1000	1000	1000	
50	22	835	850	895	705	710	730	545	550	555	1200
	28	855	1200	1200	1100	1130	1200	895	910	945	
	36	1200	1200	1200	1200	1200	1200	1200	1200	1200	
63	28	1060	1086	1160	900	915	950	705	710	720	1400
	36	1400	1400	1400	1400	1400	1400	1185	1200	1255	
	45	1400	1400	1400	1400	1400	1400	1400	1400	1400	
80	36	1370	1405	1525	1175	1195	1250	930	935	955	1700
	45	1700	1700	1700	1700	1700	1700	1460	1480	1555	
	56	1700	1700	1700	1700	1700	1700	1700	1700	1700	
100	45	1685	1735	1910	1460	1485	1570	1165	1175	1205	2000
	56	2000	2000	2000	2000	2000	2000	1800	1835	1950	
	70	2000	2000	2000	2000	2000	2000	2000	2000	2000	
125	56	2075	2140	2300	1810	1845	1970	1455	1470	1515	2300
	70	2300	2300	2300	2300	2300	2300	2240	2290	2300	
	90	2300	2300	2300	2300	2300	2300	2300	2300	2300	
160	70	2515	2595	2600	2200	2245	2415	1780	1800	1855	2600
	110	2600	2600	2600	2600	2600	2600	2600	2600	2600	
200	90	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700
	140	2700	2700	2700	2700	2700	2700	2700	2700	2700	

Installation orientation

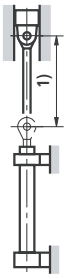
0°



45°



90°



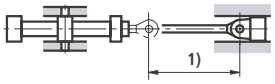
1) Perm. stroke

Mounting type MT4 (trunnion position at the centre of the cylinder)

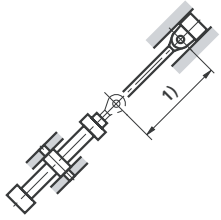
AL Ø	MM Ø	Permissible stroke length at 70 bar 0°	70 bar 45°	70 bar 90°	100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	Max. available stroke length
25	12	190	190	200	150	150	155	105	105	105	600
	18	455	470	535	395	405	435	310	315	325	
32	14	195	200	205	150	155	155	105	105	105	800
	22	535	555	625	460	470	510	365	365	380	
40	18	265	270	290	215	215	225	150	155	155	1000
	22	430	445	480	360	370	385	275	280	285	
	28	670	700	825	590	605	670	475	480	505	
50	22	330	335	355	265	270	280	190	195	195	1200
	28	570	590	645	485	495	520	375	380	390	
	36	885	925	1115	785	810	910	640	655	690	
63	28	435	445	470	355	360	375	265	265	270	1400
	36	755	780	865	650	660	700	510	575	530	
	45	1095	1145	1390	975	1010	1140	800	815	870	
80	36	585	595	630	480	485	505	340	360	365	1700
	45	890	920	1025	760	775	830	590	595	615	
	56	1340	1400	1700	1195	1240	1405	1000	1010	1075	
100	45	725	745	805	605	615	645	415	440	475	2000
	56	1090	1130	1295	940	965	1045	740	750	782	
	70	1615	1700	2000	1460	1515	1770	1225	1255	1355	
125	56	900	925	1015	760	775	820	485	520	605	2300
	70	1340	1395	1640	1170	1205	1330	940	955	1000	
	90	2035	2150	2300	1860	1945	2300	1590	1635	1815	
160	70	1100	1300	1255	935	955	1015	730	735	760	2600
	110	2410	2550	2600	2210	2315	2600	1905	1960	2180	
200	90	1420	1470	1680	1225	1255	1360	770	830	1020	2700
	140	2700	2700	2700	2700	2700	2700	2415	2495	2700	

Installation orientation

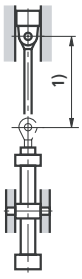
0°



45°



90°

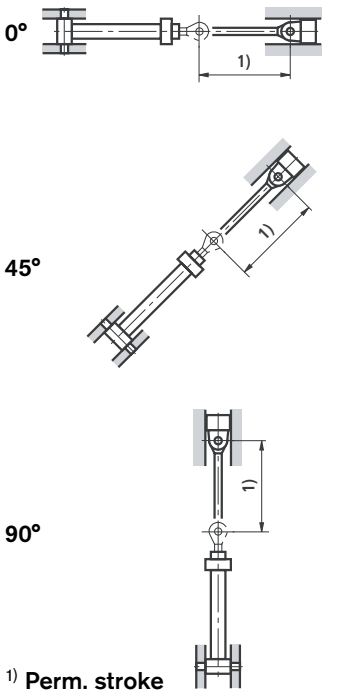


1) Perm. stroke

Permissible stroke length (nominal dimensions in mm)

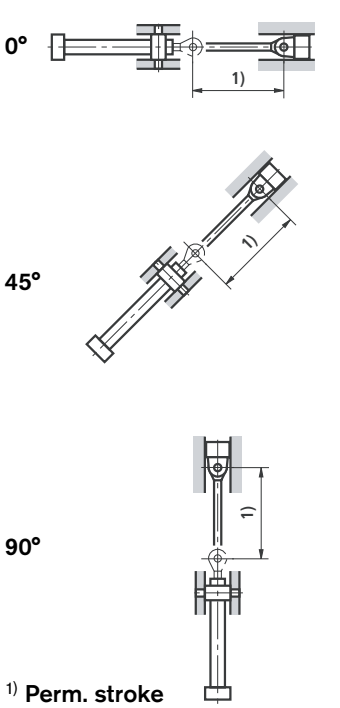
Mounting type MT2

AL Ø	MM Ø	Permissible stroke length at 70 bar 0°	70 bar 45°	70 bar 90°	100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	Max. available stroke length	Installation orientation
25	12	130	130	135	100	100	105	65	65	65	600	
	18	330	340	390	285	290	315	220	225	230		
32	14	135	135	140	100	100	105	65	65	65	800	
	22	390	405	455	335	340	370	260	260	270		
40	18	180	185	200	145	145	150	95	95	100	1000	
	22	305	315	340	250	260	270	185	190	195		
	28	485	505	600	425	435	485	335	345	360		
50	22	230	235	245	180	185	190	125	125	125	1200	
	28	410	425	465	345	350	370	260	265	270		
	36	645	675	815	570	590	665	460	470	500		
63	28	310	315	335	250	250	260	180	180	180	1400	
	36	550	565	630	465	475	505	360	365	375		
	45	800	840	1025	710	735	835	580	595	630		
80	36	415	425	450	340	345	355	250	250	255	1700	
	45	675	700	780	580	590	630	450	455	470		
	56	980	1030	1260	875	905	1030	720	735	780		
100	45	515	530	575	430	435	455	320	320	330	2000	
	56	825	855	980	710	730	795	565	570	595		
	70	1185	1245	1585	1065	1110	1300	890	915	990		
125	56	640	660	730	540	550	580	410	410	425	2300	
	70	1015	1060	1240	890	915	1010	715	725	760		
	90	1495	1580	2110	1365	1425	1735	1160	1195	1330		
160	70	785	810	905	665	675	720	505	515	530	2600	
	110	1770	1870	2505	1620	1695	2070	1390	1430	1595		
200	90	1015	1055	1210	870	895	970	680	685	715	2700	
	140	2190	2325	2700	2025	2125	2695	1760	1825	2080		



Mounting type MT1

AL Ø	MM Ø	Permissible stroke length at 70 bar 0°	70 bar 45°	70 bar 90°	100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	Max. available stroke length	Installation orientation
25	12	325	325	330	260	260	265	190	190	190	600	
	18	600	600	600	600	600	600	500	510	520		
32	14	335	335	345	265	270	270	190	190	190	800	
	22	800	800	800	735	750	800	580	590	605		
40	18	460	465	475	370	375	375	270	270	275	1000	
	22	690	705	760	585	595	620	455	460	465		
	28	1000	1000	1000	945	970	1000	760	770	800		
50	22	550	555	570	450	450	455	330	330	335	1200	
	28	905	930	1015	775	790	830	615	620	630		
	36	1200	1200	1200	1200	1200	1200	1010	1025	1075		
63	28	715	725	750	590	590	600	440	440	445	1400	
	36	1175	1210	1335	1015	1035	1100	805	810	835		
	45	1400	1400	1400	1400	1400	1400	1245	1270	1345		
80	36	940	955	995	780	785	805	590	590	600	1700	
	45	1465	1510	1675	1270	1300	1375	1015	1025	1055		
	56	1700	1700	1700	1700	1700	1700	1525	1555	1655		
100	45	1190	1210	1270	995	1005	1030	740	760	770	2000	
	56	1790	1850	2000	1570	1600	1730	1270	1285	1330		
	70	2000	2000	2000	2000	2000	2000	1900	1945	2000		
125	56	1480	1505	1595	1245	1260	1300	965	970	980	2300	
	70	2190	2270	2300	1935	1990	2175	1585	1605	1675		
	90	2300	2300	2300	2300	2300	2300	2300	2300	2300		
160	70	1805	1840	1965	1525	1545	1600	1185	1195	1210	2600	
	110	2600	2600	2600	2600	2600	2600	2600	2600	2600		
200	90	2340	2400	2610	2000	2035	2135	1575	1585	1620	2700	
	140	2700	2700	2700	2700	2700	2700	2700	2700	2700		



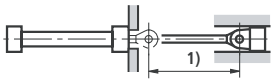
Permissible stroke length (nominal dimensions in mm)

Mounting types ME5, MX3, MX5

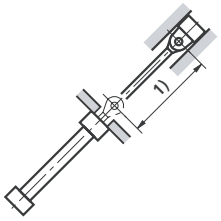
AL Ø	MM Ø	Permissible stroke length at 70 bar 0°	70 bar 45°	70 bar 90°	100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	Max. available stroke length
25	12	510	520	540	430	435	445	335	335	340	600
	18	600	600	600	600	600	600	600	600	600	
32	14	535	545	565	445	450	460	345	345	350	800
	22	800	800	800	800	800	800	800	800	800	
40	18	710	725	755	600	605	620	465	470	475	1000
	22	990	1000	1000	870	890	955	705	715	735	
	28	1000	1000	1000	1000	1000	1000	1000	1000	1000	
50	22	850	865	910	720	725	750	560	565	570	1200
	28	1200	1200	1200	1125	1150	1200	920	930	965	
	36	1200	1200	1200	1200	1200	1200	1200	1200	1200	
63	28	1080	1100	1170	920	930	965	720	725	740	1400
	36	1400	1400	1400	1400	1400	1400	1205	1225	1280	
	45	1400	1400	1400	1400	1400	1400	1400	1400	1400	
80	36	1390	1425	1545	1195	1215	1270	950	955	975	1700
	45	1700	1700	1700	1700	1700	1700	1485	1510	1580	
	56	1700	1700	1700	1700	1700	1700	1700	1700	1700	
100	45	1710	1760	1935	1480	1510	1590	1185	1195	1225	2000
	56	2000	2000	2000	2000	2000	2000	1815	1850	1965	
	70	2000	2000	2000	2000	2000	2000	2000	2000	2000	
125	56	2100	2165	2300	1830	1865	1990	1200	1280	1540	2300
	70	2300	2300	2300	2300	2300	2300	2255	2300	2300	
	90	2300	2300	2300	2300	2300	2300	2300	2300	2300	
160	70	2540	2600	2600	2225	2275	2440	1805	1825	1885	2600
	110	2600	2600	2600	2600	2600	2600	2600	2600	2600	
200	90	2700	2700	2700	2700	2700	2700	2360	2395	2510	2700
	140	2700	2700	2700	2700	2700	2700	2700	2700	2700	

Installation orientation

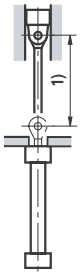
0°



45°



90°



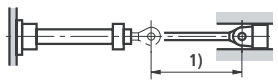
1) Perm. stroke

Mounting types ME6, MX1, MX2

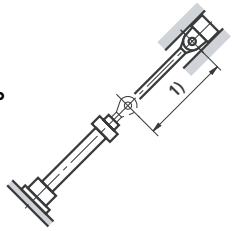
AL Ø	MM Ø	Permissible stroke length at 70 bar 0°	70 bar 45°	70 bar 90°	100 bar 0°	100 bar 45°	100 bar 90°	160 bar 0°	160 bar 45°	160 bar 90°	Max. available stroke length
25	12	195	200	220	160	160	170	115	115	120	600
	18	445	465	585	395	410	475	325	330	360	
32	14	205	210	230	165	170	180	120	120	120	800
	22	525	550	685	465	485	560	385	390	420	
40	18	270	280	315	225	230	245	165	165	170	1000
	22	435	455	520	375	385	420	295	300	310	
	28	645	680	895	580	605	730	485	500	555	
50	22	335	350	390	280	285	305	210	210	220	1200
	28	580	600	700	505	515	565	400	405	425	
	36	845	895	1200	770	805	990	655	675	755	
63	28	445	460	520	375	385	415	285	290	300	1400
	36	760	795	940	670	690	765	540	550	580	
	45	1045	1105	1400	955	1140	1240	815	845	955	
80	36	590	610	690	505	515	555	390	395	410	1700
	45	940	980	1160	830	855	950	675	685	720	
	56	1275	1350	1700	1170	1225	1520	1005	1035	1175	
100	45	725	755	885	630	645	710	495	505	530	2000
	56	1145	1200	1465	1025	1060	1205	850	865	920	
	70	1530	1625	2000	1415	1485	1925	1230	1280	1485	
125	56	885	925	1110	775	800	900	620	635	670	2300
	70	1380	1450	1835	1245	1290	1500	1040	1065	1155	
	90	1900	2025	2300	1770	1875	2300	1570	1640	1980	
160	70	1080	1130	1370	950	985	1110	770	785	835	2600
	110	2250	2395	2600	2105	2225	2600	1870	1950	2360	
200	90	1375	1445	1825	1225	1275	1485	1010	1035	1120	2700
	140	2700	2700	2700	2605	2700	2700	2340	2450	2700	

Installation orientation

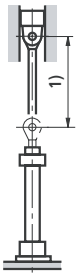
0°



45°



90°



1) Perm. stroke

End position cushioning

End position cushioning:

The objective is to reduce the speed of a moving mass, whose centre of gravity is on the cylinder axis, to a level, at which neither the cylinder nor the machine, into which the cylinder is installed, can be damaged.

For velocities above 20 mm/s we recommend the use of end position cushioning, so that the energy can be absorbed without the use of additional means.

Series CDT3 / CGT3 is provided with a progressive cushioning system.

The advantages of this cushioning system are:

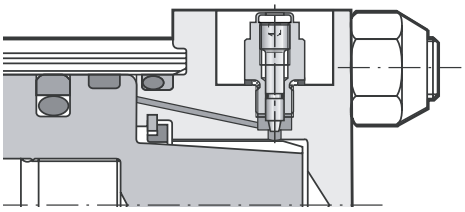
- Progressive deceleration.
- Short cushioning times.
- Cushioning length depends on velocity.
- Low cushioning pressures and no pressure peaks, hence increase safety and longer service life of the cylinder and the machine.
- Insusceptible to changes in pressure, temperature and moved mass.
- Controlled limitation of the piston's end stop velocity – increased safety and reliability.
- Faster acceleration from the end position due to special check valve and floating bush.

Cylinders with end position cushioning can only achieve their full cushioning capacity when the entire stroke length is utilised.

The adjustable end position cushioning type "E" is the same as type "D", but incorporates and additional throttle valve. End position cushioning type "E" allows optimising of the cycle times. The maximum cushioning capacity can only be achieved when the throttle valve is closed. However, care must be taken to ensure that the max. recommended end stop speed is not exceeded.

For special applications with very short stroke times, high speeds or great masses, the cylinders can also be provided with special end position cushioning types on request.

When using fixed or adjustable limit stops, special measures must be taken!

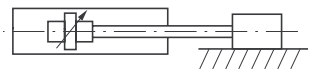


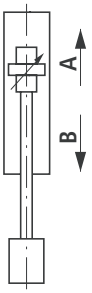
Cushioning capacity:

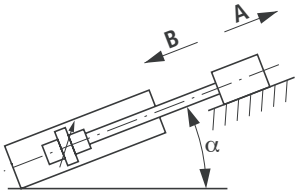
When decelerating masses via the end position cushioning, the maximum design cushioning capacity must not be exceeded.

In conjunction with this, the kinetic energy and potential energy of the moved mass must be calculated and compared with the permissible values specified in the diagrams on pages 36 to

Determination of energy







$E = \frac{1}{2} m \cdot v^2$

Retracting (A): $E = \frac{1}{2} mv^2 - mg \cdot l_a$

Extending (B): $E = \frac{1}{2} mv^2 + mg \cdot l_a$

Extending (A): $E = \frac{1}{2} mv^2 - mg \cdot l_a \cdot \sin \alpha$

Retracting (B): $E = \frac{1}{2} mv^2 + mg \cdot l_a \cdot \sin \alpha$

E	[Nm] [joule]	For maximum value, see pages 36-39
m	[kg]	Total moved mass, including piston and piston rod
v	[m/s]	Max. velocity
g	[m/s^2]	9.81
l_a	[m]	Cushioning length, see page 35

End position cushioning

Cushioning lenghts and weights

Cylinder Ø		25		32		40			50			63		
		12	18	14	22	18	22 [12]	28	22	28 [12]	36	28	36 [12]	45
l_a in mm	Head	20	20	20	20	31	31	31	33	33	33	33	33	33
	Cap	19	19	19	19	29	29	29	29	29	29	29	29	29
m in kg	Piston	0.15	0.2	0.25	0.4	0.6	0.6	0.7	0.8	1	1.2	1.4	1.7	2.0
(kg/100 mm)	Piston rod	0.1	0.2	0.12	0.3	0.2	0.3	0.5	0.3	0.5	0.8	0.5	0.8	1.2
v_{max} [1]	(m/s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4

Cylinder Ø		80			100			125			160		200	
		36	45 [12]	56	45	56 [12]	70	56	70 [12]	90	70	110	90	140
l_a in mm	Head	33	33	33	33	33	33	33	33	33	38	38	57	57
	Cap	34	34	34	33	33	33	46	46	46	46	46	64	64
m in kg	Piston	2.6	3	3.6	4.7	5.3	6.3	8.0	9.2	11	16	20	30	38
(kg/100 mm)	Piston rod	0.8	1.2	2.0	1.2	2	3.0	2.0	3	5.0	3.0	7.5	5.0	12
v_{max} [1]	(m/s)	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.25	0.25	0.25	0.25

[1] In the case of values higher than v_{max}, please consult us.

[12] Piston rod Ø not standardised

The diagrams on pages 36-39 are based on the above table, the specified maximum velocities related to seal “M” and a closed throttle screw.

At lower velocities, the absorbed energy reduces according to the following formula:

$$E_U = E_{max} \bullet \frac{v_U}{v_{max}}$$

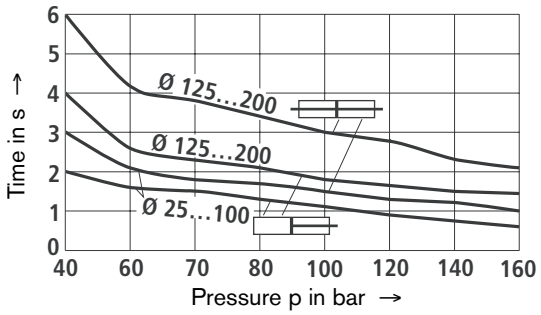
E_U = Energy absorbed

E_{max} = For max. energy, see characteristic curve

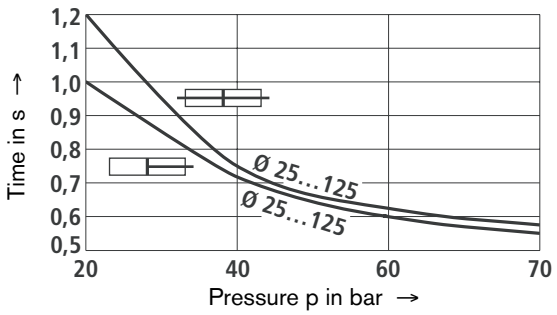
v_U = Stroke velocity

v_{max} = Max. velocity for seal version “M“

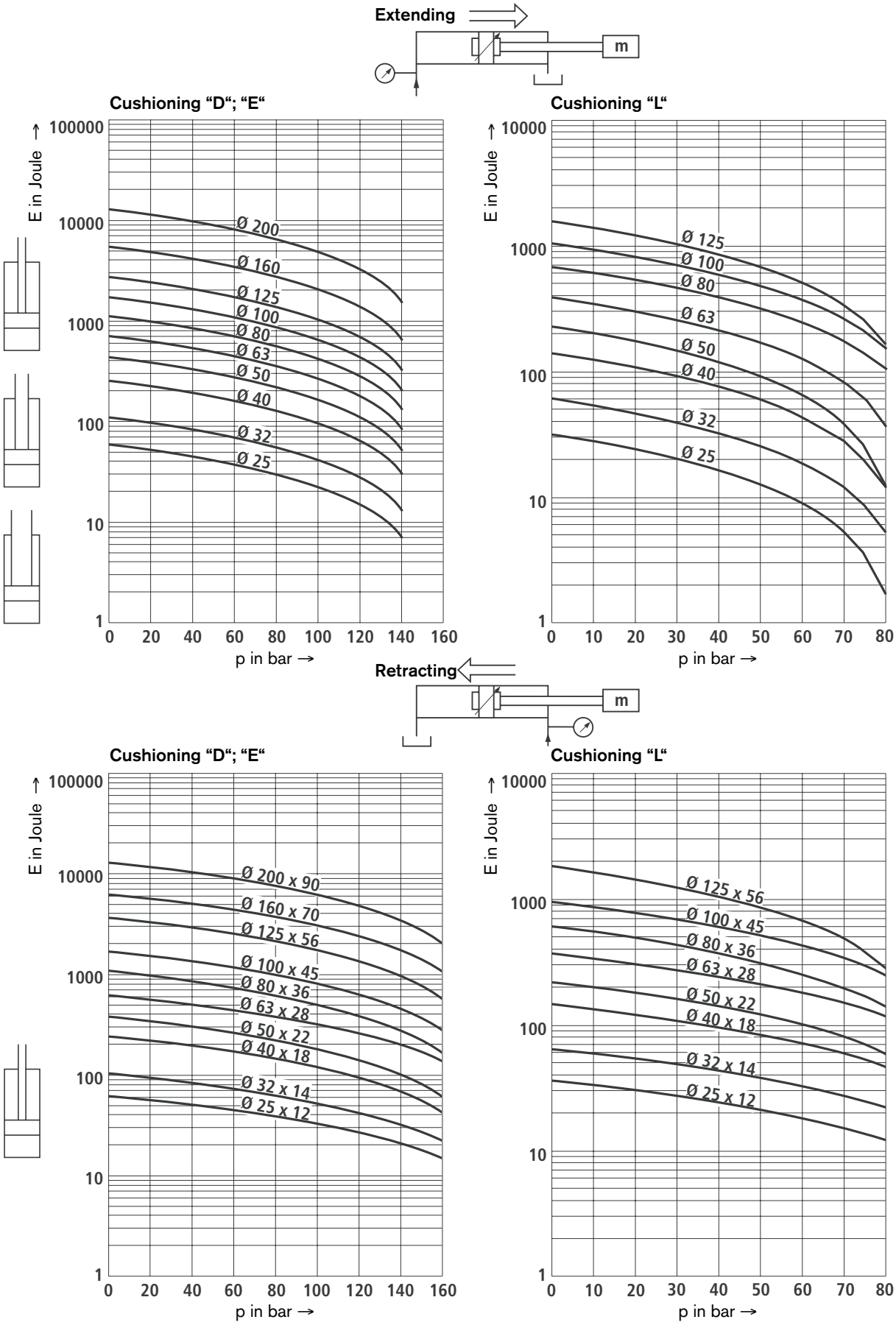
Max. cushioning time “D“; “E“



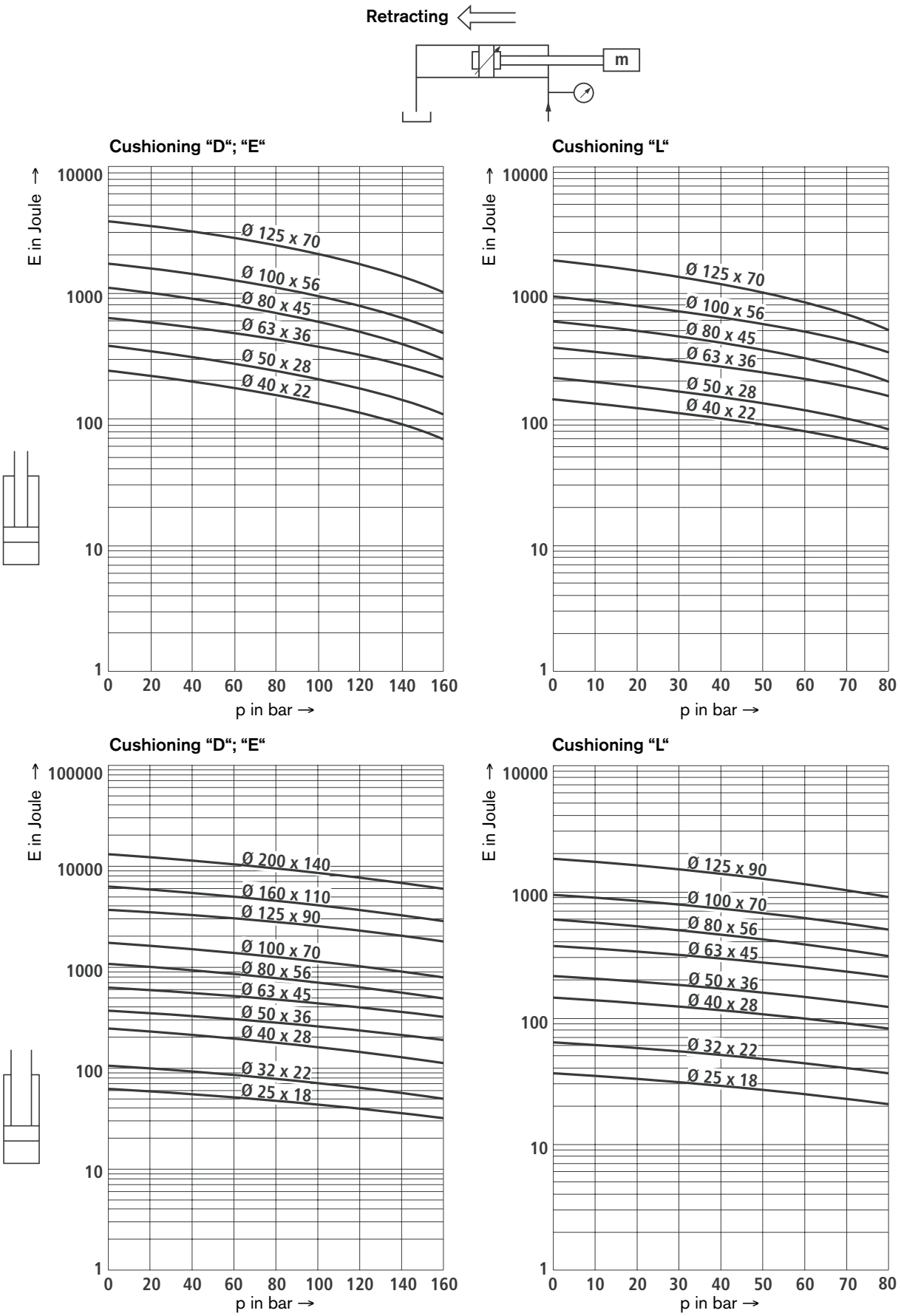
Max. cushioning time “L“



End position cushioning

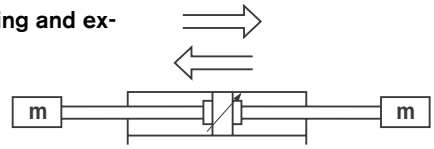


End position cushioning

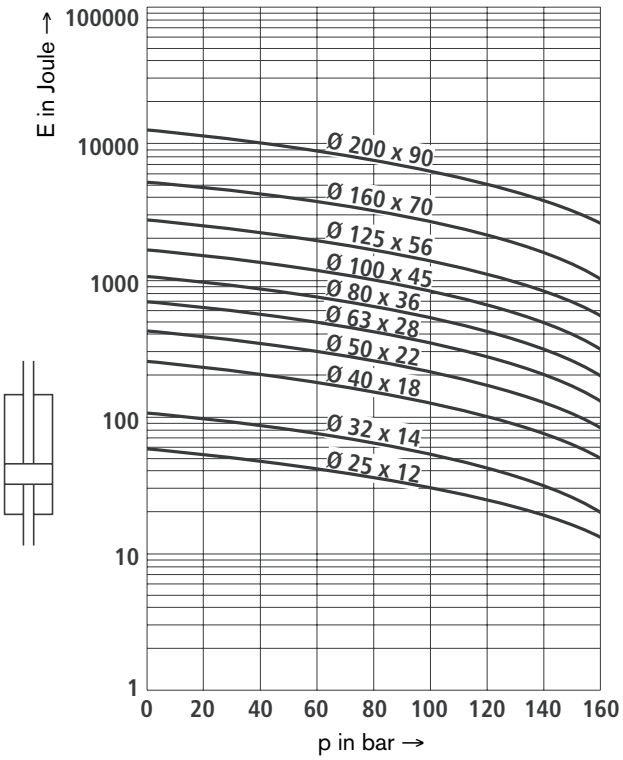


End position cushioning

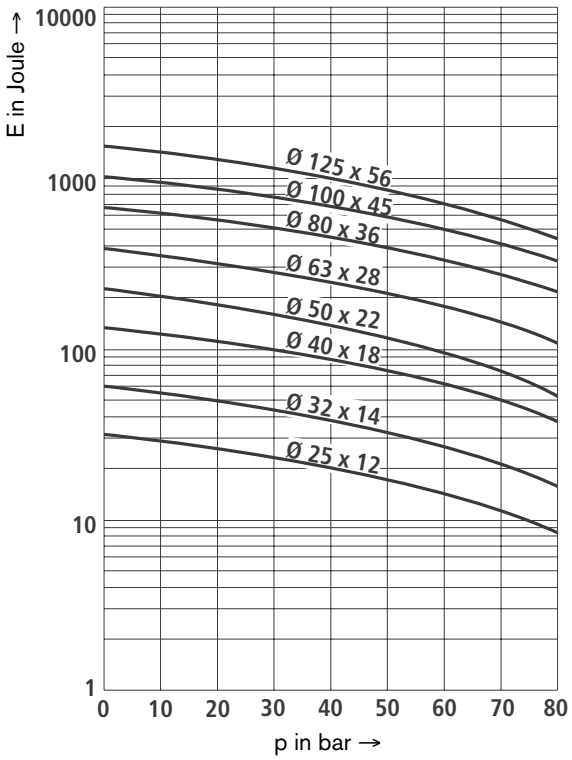
Retracting and extending



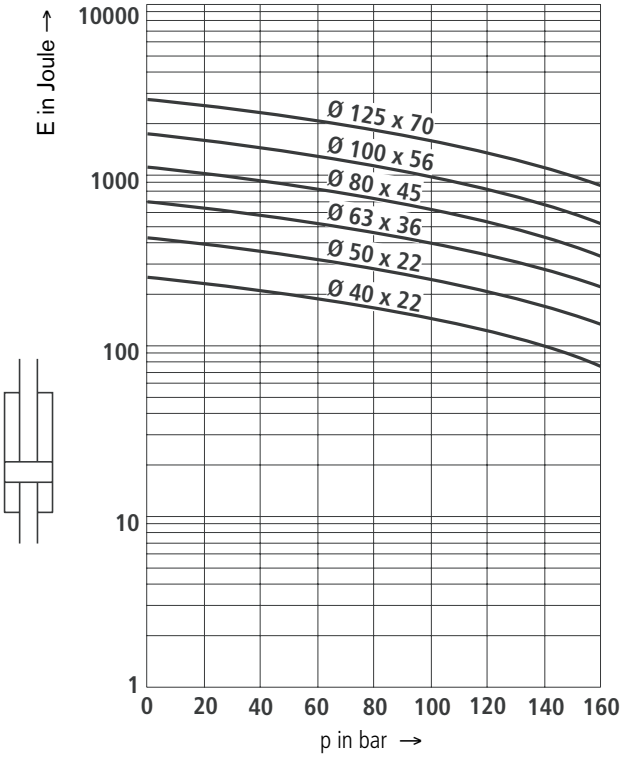
Cushioning “D“; “E“



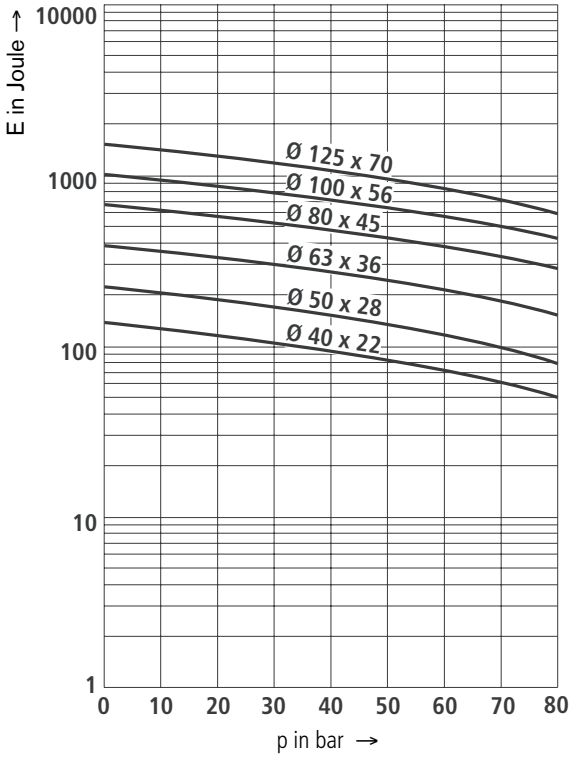
Cushioning “L“



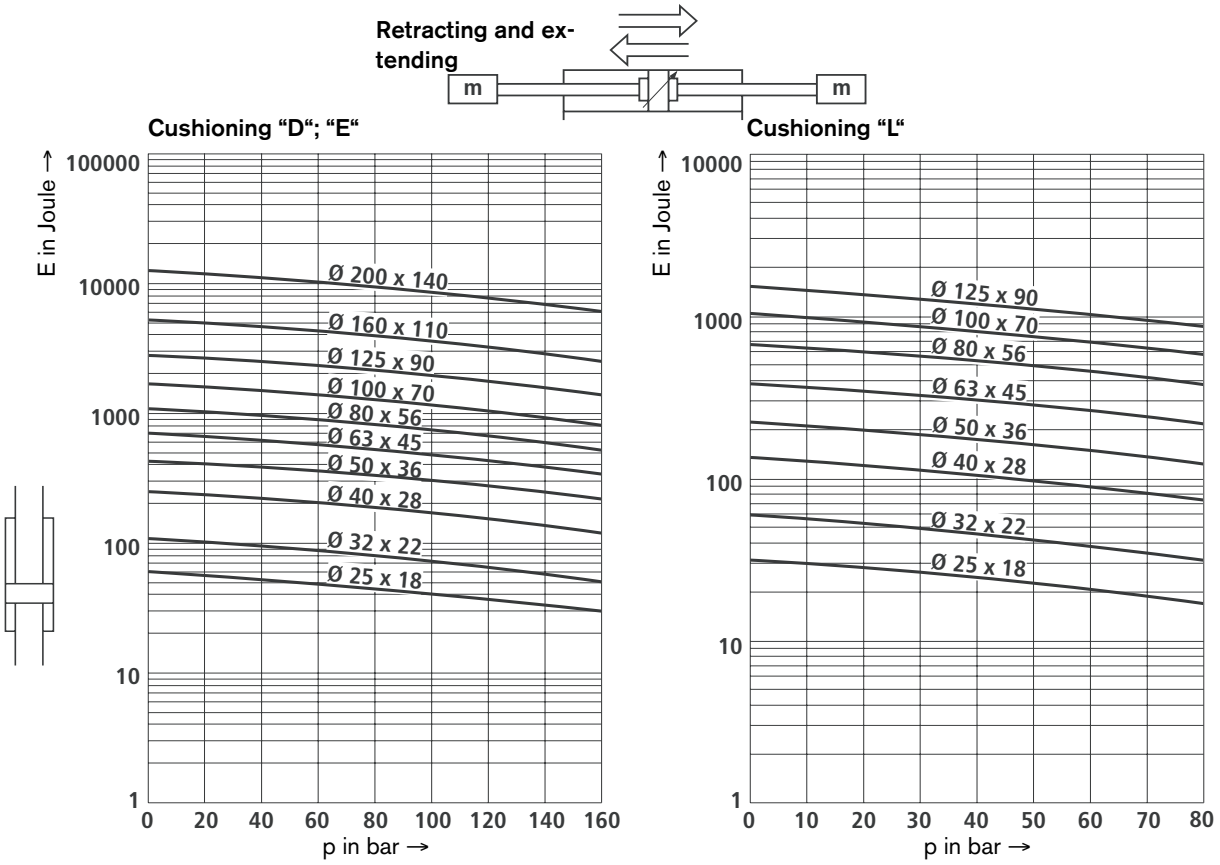
Cushioning “D“; “E“



Cushioning “L“

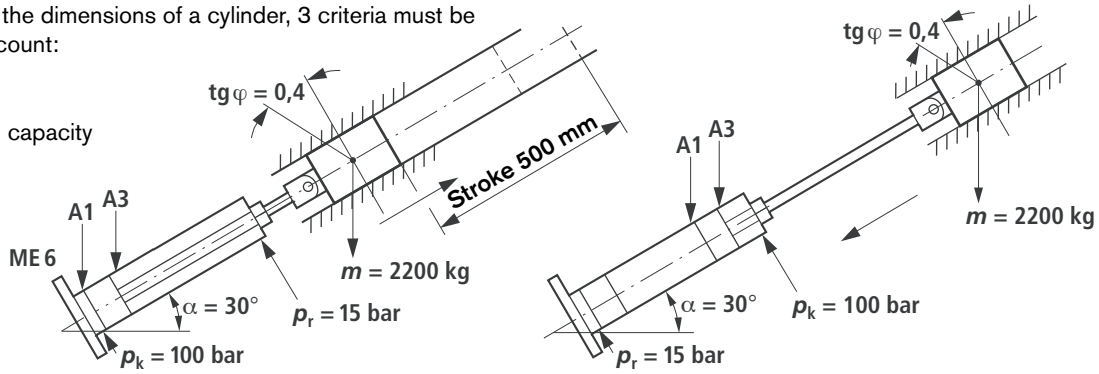


End position cushioning



Calculation example

To determine the dimensions of a cylinder, 3 criteria must be taken into account:
– Force
– Buckling
– Cushioning capacity



Example:
Stroke time = 2 seconds
Load friction coefficient = tg φ = 0.4 (estimated)
Available pressure p_k = 100 bar
Return pressure p_r = 15 bar
A1 = piston area, A3 = piston annulus area
φ = area ratio A1 / A3, see page 6
m = total moved mass, v = velocity
La = cushioning length, see page 35

To be determined:
Piston and piston rod diameter

Piston rod, extending:
Total efficiency η = η1 • η2
η1 = cylinder efficiency = 0.9 (estimated)
η2 = system efficiency

$$\eta 2 = \frac{p_k \cdot A1 - p_r \cdot A3}{p_k \cdot A1} = 1 - \frac{p_r}{p_k \cdot \varphi\ ^{1)}} = \frac{15}{100 \cdot 1.25} = 0.88$$

$$\eta = 0.9 \cdot 0.88 = 0.79$$

[1] Assuming the smallest "φ"

Force required to move a mass:
F = frictional force plus potential energy
= tg φ • m • g • cos α + m • g • sin α
= 0.4 • 2200 • 9.81 • 0.866 + 2200 • 9.81 • 0.5 = 18270 N
= 18.27 kN
This theoretical force of 18.27 kN at η = 0.79 results in a required force = 23.13 kN, and consequently, for p_k = 100 bar a cylinder piston diameter = 63 mm is required, see page 6

Piston rod, retracting:
F = frictional force minus potential energy
= tg φ • m • g • cos α – m • g • sin α
= 0.4 • 2200 • 9.81 • 0.866 – 2200 • 9.81 • 0.5
= – 3315 N = – 3.3 kN No force problem when retracting

Verification of buckling length:
The table on page 33 shows for p_k = 100 bar and for cylinder 63 / 28 a permissible maximum stroke = 385 mm: The cylinder therefore buckles.

There are 2 possibilities:
– Select piston rod diameter 45, max. permissible stroke = 1140 mm, hence buckling-proof
– Change mounting type, e.g. MS2 with a permissible maximum stroke = 915 mm

Verification of end position cushioning

Average velocity 0.5 / 2 = 0.25 m/s
Max. velocity v_u = 0.275 m/s
(estimated correction coefficient = 1.1 due to start-up and braking)

Cushioning capacity required for extending the piston rod =

$$\frac{m \cdot v_u^2}{2} - m \cdot g \cdot La \cdot \sin\alpha = \frac{2200 \cdot 0.275^2}{2} - 2200 \cdot 9.81 \cdot 0.033 \cdot 0.5 = -272 \text{ joules}$$

No cushioning problems when the piston rod is extending

Cushioning capacity required for retracting the piston rod =

$$\frac{m \cdot v_u^2}{2} + m \cdot g \cdot La \cdot \sin\alpha = \frac{2200 \cdot 0.275^2}{2} + 2200 \cdot 9.81 \cdot 0.029 \cdot 0.5 = 396 \text{ joules}$$

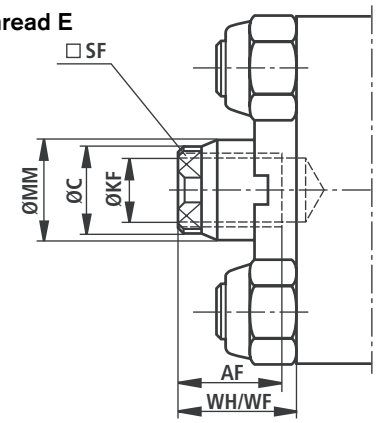
The diagram on page 37 shows 445 joules for pk = 100 bar and v_{max} = 0.4 m/s, i.e. for 0.275 m/s the cylinder can absorb energy (see page 35):

$$E_u = E_{max} \cdot \frac{v_u}{v_{max}} = 445 \cdot \frac{0.275}{0.4} = 306 \text{ joules}$$

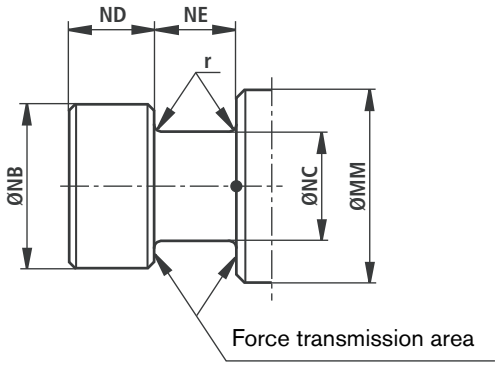
The cylinder cannot absorb the required cushioning capacity:
Select the next larger diameter 80 / 56.

Piston rod ends E and T (nominal dimensions in mm)

Female thread E



Spigot T



AL Ø	MM Ø	Stroke [2] min	KF	AF	C	SF	NB h13	NC h13	ND / NE h13 / H11	r	p max.[1] bar
25	12	0	M8x1	14	11	10	–	–	–	–	–
	18	0	M12x1.25	18	17	15	–	–	–	–	–
32	14	0	M10x1.25	16	13	11	–	–	–	–	–
	22	0	M16x1.5	22	21	18	18	11.2	8	0.5	160
40	18	0	M12x1.25	18	17	15	–	–	–	–	–
	28	0	M20x1.5	28	25	22	22.4	14	10	0.5	160
50	22	0	M16x1.5	22	21	18	18	11.2	8	0.5	105
	36	0	M27x2	36	33	30	28	18	12.5	0.8	190
63	28	0	M20x1.5	28	25	22	22.4	14	10	0.5	95
	45	0	M33x2	45	42	36	35.5	22.4	16	0.8	160
80	36	0	M27x2	36	33	30	28	18	12.5	0.8	105
	56	6	M42x2	56	53	46	45	28	20	1.2	160
100	45	0	M33x2	45	42	36	35.5	22.4	16	0.8	90
	70	8	M48x2	63	67	60	56	35.5	25	1.2	160
125	56	0	M42x2	56	53	46	45	28	20	1.2	100
	90	30	M64x3	85	86	75	78	45	30	1.5	160
160	70	5	M48x2	63	67	60	56	35.5	25	1.5	90
	110	45	M80x3	95	106	92	106	65	35	1.5	160
200	90	35	M64x3	85	86	75	78	45	30	1.5	90
	140	67	M100x3	112	136	125	136	70	45	1.5	160

[1] for pulling load

[2] = minimum stroke length for piston rod end "E"

Supplementary information

Mounting types:

MX5:
This mounting type, see ISO 6099, to NFE 48.016, allows mounting by means of 4 threaded holes in the head.

MS2:
- With key: a key according to DIN 6885 T1, form A, which has to be provided by the buyer, is to be inserted in a groove below the mounting foot in order to relieve the 4 fixing screws, see page 12; standard in preparation.
- Plate mounting: an oil connection via the supporting plate with O-ring and counterbore at connection position 3 is available on request.
- Positions of connections: positions 2 and 4 can cause mounting problems (connection fitting / fixing screws) and are therefore not offered in the standard product range.

Fixing screws:
To fix cylinders with mounting types MX..-/ME..-/MS.. use screws of class 12.9 and nuts of at least class 10. The tightening torques are stated on the relevant pages relating to dimensions.

Commissioning:
Observe the cylinder-specific operating instructions for mounting, commissioning and maintenance of hydraulic cylinders.
A cylinder can only perform its function in an optimum way, if the following basic rules are observed during mounting and prior to commissioning:
- A correct alignment of the cylinder prevents alignment errors, jamming of the piston rod, premature wear.
- Avoid side loads on the piston rod.
- Thoroughly clean the pipes and connection threads before assembly.
- Bleed the system and use a clean, well filtered oil. It is recommended that you install the cylinder when the piston rod is completely retracted , adjust the zero stroke of the load mechanically, extend the piston rod completely and to adjust the stroke position by means of the fixing points between the mass to be moved and the piston rod end.

Repair:
Spare parts kits are to be fitted in accordance with Rexroth guidelines.

Cylinder surface protection:
The cylinders are primered before being shipped, which ensures protection against corrosion. Other paints can be subsequently applied without any problems. On request, a white epoxy paint coat can be provided, which is recommended, e.g. for use in humid and aggressive environments.

Accessories:
The cylinder can be supplied with the CGKA self-aligning clevis fitted. Any other accessory parts can only be ordered as loose supply.

Mounting play:
Due to tolerances, movable mounts have a mechanical play and are therefore not suitable for use in closed control loops that require high positioning accuracy.

Metal wiper:
A metal wiper is recommended, where, due to adhesive dirt, standard wipers could be destroyed.

End position switch:
Inductive end position switches on enquiry.

Piston rod clamping unit:
To hold the piston rod mechanically over a longer period of time in a fixed position in the depressurised condition or for safety reasons, a piston rod clamping unit can be mounted to the cylinder head. However, it must in no case be used as braking unit.

Special applications:
Special applications such as three-position cylinders (cap to cap), single acting cylinders, air-pressurised on one end, on enquiry.

CD-ROM:
CD-ROM with cylinder calculation and 2 D and 3 D (files) on enquiry.

Internet:
Further information can be obtained at the Internet:
www.boschrexroth.de

Standard description:

ISO 6020/2:
Installation dimensions for 160 bar cylinders with a single piston rod – Part 2: Compact series for piston diameters 25 to 200 mm.

DIN 24554:
As ISO 6020/2, but restricted selection of mounting types and piston rod threads. Contained in many OEM and automotive specifications.

NFE 48.016:
As DIN 24 554, but additionally with mounting type MX 5, spigot at the piston rod end and cylinders with through piston rod.

ISO 6020/3:
Installation dimensions for 160 bar cylinders with a single piston rod – Part 2: Compact series for piston diameters 250 to 500 mm.

ISO 6099:
Description and coding of mounting types and their dimensions.

ISO 6195:
Installation spaces for piston rod wipers with linear movement – dimensions and tolerances.

ISO 5597:
Installation spaces for piston seals and piston rod seals – dimensions and tolerances.

ISO 7425/1:
Installation spaces for seals made of plastic-reinforced elastomers – Part 1: Installation dimensions for piston seals.

ISO 8131:
160 bar cylinders with a single piston rod, compact series, tolerances.

ISO 8133:
160 bar cylinders with a single piston rod, compact series – accessories interchangeability dimensions.

ISO/FDIS 8138:
160 bar cylinders with a single piston rod, compact series – oil connection dimensions.

ISO 6547:
Installation dimensions for piston seals and guide strips – dimensions and tolerances.

ISO 3320:
Piston and piston rod diameters – metric version.

ISO 3322:
Nominal pressures.

ISO 4393:
Piston strokes, basic series / preferred series

ISO 4395:
Types of threads and dimensions for piston rod ends.

DIN:
Standardisation organisation in Germany.

Afnor:
Standardisation organisation in France.

NF:
Standard issued by Afnor.

Spare parts – material no.

Complete seal kit

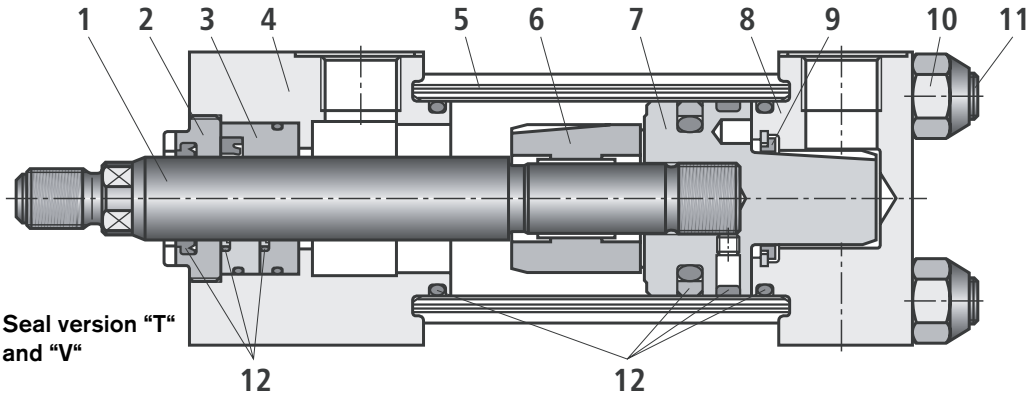
Ø AL	Ø MM	CDT3 M	CDT3 T	CDT3 V	CGT3 M	CGT3 T	CGT3 V
25	12	7 472 D02 046	7 472 D02 066	7 472 D02 086	7 472 D02 106	7 472 D02 126	7 472 D02 146
	18	7 472 D02 047	7 472 D02 067	7 472 D02 087	7 472 D02 107	7 472 D02 127	7 472 D02 147
32	14	7 472 D02 048	7 472 D02 068	7 472 D02 088	7 472 D02 108	7 472 D02 128	7 472 D02 148
	22	7 472 D02 049	7 472 D02 069	7 472 D02 089	7 472 D02 109	7 472 D02 129	7 472 D02 149
40	18	7 472 D02 050	7 472 D02 070	7 472 D02 090	7 472 D02 110	7 472 D02 130	7 472 D02 150
	22	7 472 D03 187	7 472 D03 193	7 472 D03 199	7 472 D03 205	7 472 D03 211	7 472 D03 217
	28	7 472 D02 051	7 472 D02 071	7 472 D02 091	7 472 D02 111	7 472 D02 131	7 472 D02 151
50	22	7 472 D02 052	7 472 D02 072	7 472 D02 092	7 472 D02 112	7 472 D02 132	7 472 D02 152
	28	7 472 D03 188	7 472 D03 194	7 472 D03 200	7 472 D03 206	7 472 D03 212	7 472 D03 218
	36	7 472 D02 053	7 472 D02 073	7 472 D02 093	7 472 D02 113	7 472 D02 133	7 472 D02 153
63	28	7 472 D02 054	7 472 D02 074	7 472 D02 094	7 472 D02 114	7 472 D02 134	7 472 D02 154
	36	7 472 D03 189	7 472 D03 195	7 472 D03 201	7 472 D03 207	7 472 D03 213	7 472 D03 219
	45	7 472 D02 055	7 472 D02 075	7 472 D02 095	7 472 D02 115	7 472 D02 135	7 472 D02 155
80	36	7 472 D02 056	7 472 D02 076	7 472 D02 096	7 472 D02 116	7 472 D02 136	7 472 D02 156
	45	7 472 D03 190	7 472 D03 196	7 472 D03 202	7 472 D03 208	7 472 D03 214	7 472 D03 220
	56	7 472 D02 057	7 472 D02 077	7 472 D02 097	7 472 D02 117	7 472 D02 137	7 472 D02 157
100	45	7 472 D02 058	7 472 D02 078	7 472 D02 098	7 472 D02 118	7 472 D02 138	7 472 D02 158
	56	7 472 D03 191	7 472 D03 197	7 472 D03 203	7 472 D03 209	7 472 D03 215	7 472 D03 221
	70	7 472 D02 059	7 472 D02 079	7 472 D02 099	7 472 D02 119	7 472 D02 139	7 472 D02 159
125	56	7 472 D02 060	7 472 D02 080	7 472 D02 100	7 472 D02 120	7 472 D02 140	7 472 D02 160
	70	7 472 D03 192	7 472 D03 198	7 472 D03 204	7 472 D03 210	7 472 D03 216	7 472 D03 222
	90	7 472 D02 061	7 472 D02 081	7 472 D02 101	7 472 D02 121	7 472 D02 141	7 472 D02 161
160	70	7 472 D02 062	7 472 D02 082	7 472 D02 102	7 472 D02 122	7 472 D02 142	7 472 D02 162
	110	7 472 D02 063	7 472 D02 083	7 472 D02 103	7 472 D02 123	7 472 D02 143	7 472 D02 163
200	90	7 472 D02 064	7 472 D02 084	7 472 D02 104	7 472 D02 124	7 472 D02 144	7 472 D02 164
	140	7 472 D02 065	7 472 D02 085	7 472 D02 105	7 472 D02 125	7 472 D02 145	7 472 D02 165

Ø AL	Ø MM	Guide bush kit assembled with seals M	Guide bush kit assembled with seals T	Guide bush kit assembled with seals V	Tie rod nut for mounting types ME5/6, MP1/3/5, MS2, MT1/2/4, MX5	Tie rod nut for mounting types MX1, MX2, MX3	Tightening torque in Nm for mounting types ME5/6, MP1/3/5, MS2, MT1/2/4, MX3/5	Tightening torque in Nm for mounting types MX1/2
25	12	7 472 D02 166	7 472 D02 183	7 472 D02 200	7 472 D02 379	7 472 D02 379	5,5	3
	18	7 472 D02 167	7 472 D02 184	7 472 D02 201				
32	14	7 472 D02 168	7 472 D02 185	7 472 D02 202	7 472 D02 380	7 472 D02 380	8	6,5
	22	7 472 D02 169	7 472 D02 186	7 472 D02 203				
40	18	7 472 D02 170	7 472 D02 187	7 472 D02 204	2 915 062 005	7 472 D02 381	20	12
	22	7 472 D03 223	7 472 D03 229	7 472 D03 235				
	28	7 472 D02 171	7 472 D02 188	7 472 D02 205				
50	22	7 472 D02 172	7 472 D02 189	7 472 D02 206	1 813 300 820	7 472 D02 382	50	37
	28	7 472 D03 224	7 472 D03 230	7 472 D03 236				
	36	7 472 D02 173	7 472 D02 190	7 472 D02 207				
63	28	7 472 D02 174	7 472 D02 191	7 472 D02 208	1 813 300 820	7 472 D02 382	60	40
	36	7 472 D03 225	7 472 D03 231	7 472 D03 237				
	45	7 472 D02 175	7 472 D02 192	7 472 D02 209				
80	36	7 472 D02 173	7 472 D02 190	7 472 D02 207	1 813 300 821	7 472 D02 383	125	90
	45	7 472 D03 226	7 472 D03 232	7 472 D03 238				
	56	7 472 D02 176	7 472 D02 193	7 472 D02 210				
100	45	7 472 D02 177	7 472 D02 194	7 472 D02 211	1 813 300 821	7 472 D02 383	190	100
	56	7 472 D03 227	7 472 D03 233	7 472 D03 239				
	70	7 472 D02 178	7 472 D02 195	7 472 D02 212				
125	56	7 472 D02 176	7 472 D02 193	7 472 D02 210	7 472 Z76 723	7 472 D02 384	400	240
	70	7 472 D03 228	7 472 D03 234	7 472 D03 240				
	90	7 472 D02 179	7 472 D02 196	7 472 D02 213				
160	70	7 472 D02 180	7 472 D02 197	7 472 D02 214	1 813 300 824	7 472 D02 385	800	450
	110	7 472 D02 181	7 472 D02 198	7 472 D02 215				
200	90	7 472 D02 179	7 472 D02 196	7 472 D02 213	7 472 Z76 719	7 472 D02 386	1250	600
	140	7 472 D02 182	7 472 D02 199	7 472 D02 216				

If spares for head, cap, barrel, piston rod, etc. are required, state the material number of the cylinder.

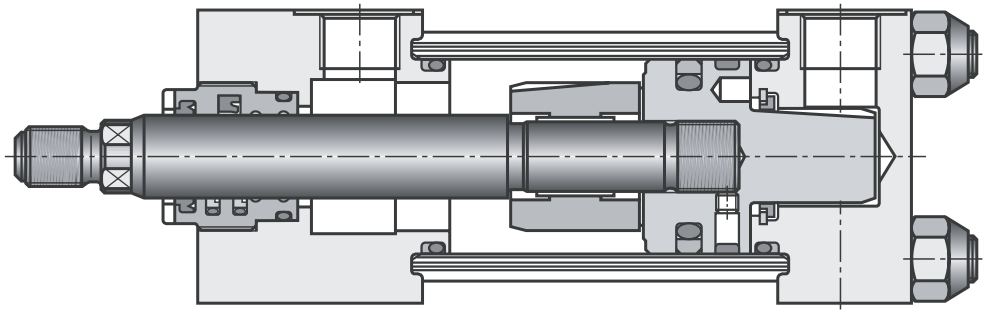
Spare parts

CDT3 Ø25, Ø32
Seal version “M“



Seal version “T“ and “V“

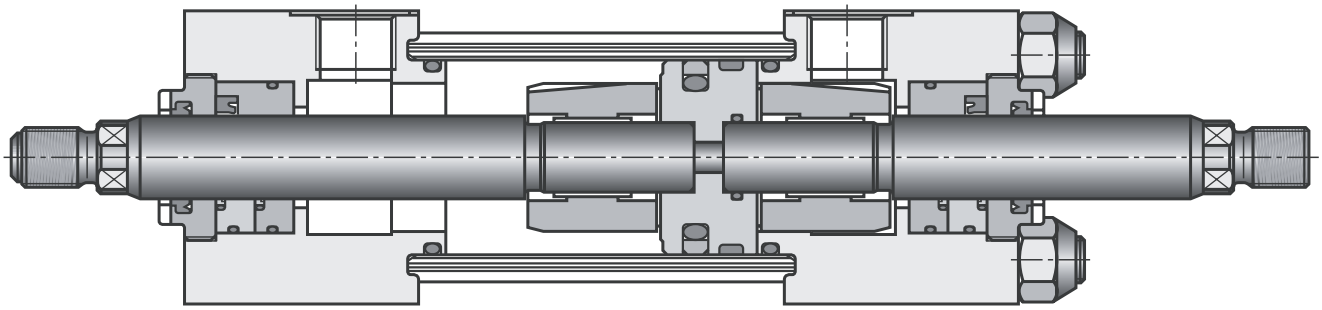
CDT3 Ø40 ... 200
Seal version “M“



Seal version “T“ and “V“

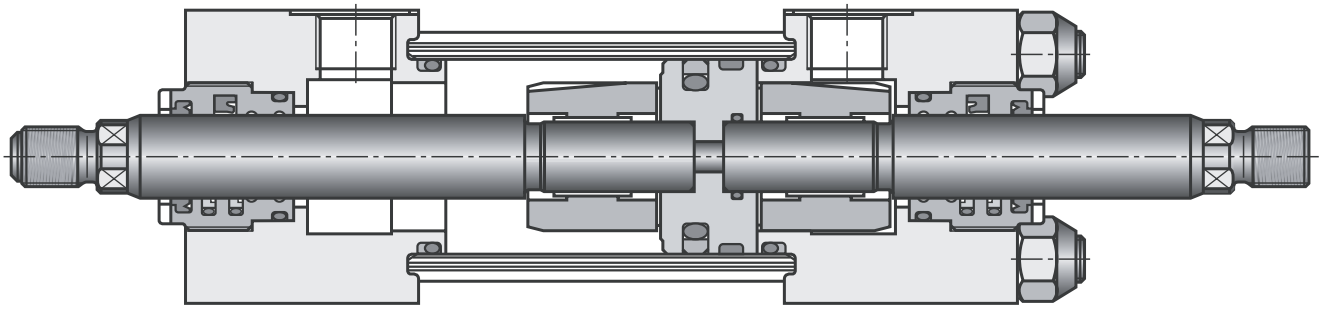
1 Piston rod
2 Cover
3 Guide bush
4 Cylinder head
5 Cylinder barrel
6 Cushioning bush
7 Piston
8 Cylinder cap
9 Damping ring
10 Nut
11 Tie rod
12 Seal kit
- Wiper
- Piston rod seal
- Piston seal
- O-ring
- Guide ring

CGT3 Ø25, Ø32
Seal version “M“



Seal version “T“ and “V“

CGT3 Ø40 ... 200
Seal version “M“



Seal version “T“ and “V“

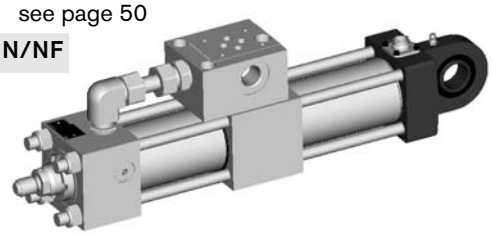
General notes

Series CST3... is based on series CDT3.
(According to ISO 6020 /2)
For series CST3... the same general notes are valid as for series CDT3.

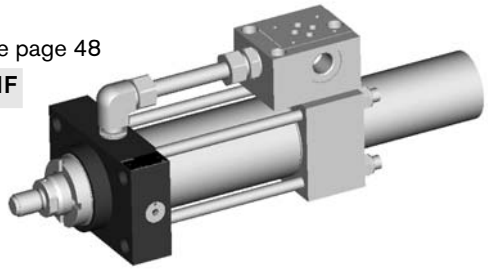
Deviations in tolerances or in the type code that result from the integrated position measuring system are given on the following pages.

Overview of mounting types: Series CST3...F

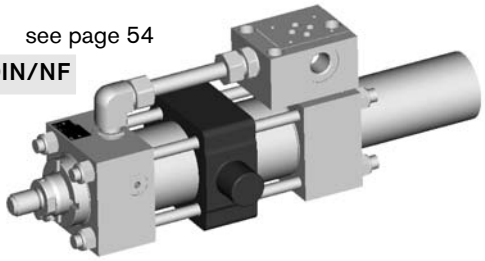
MP5 see page 50
ISO/DIN/NF



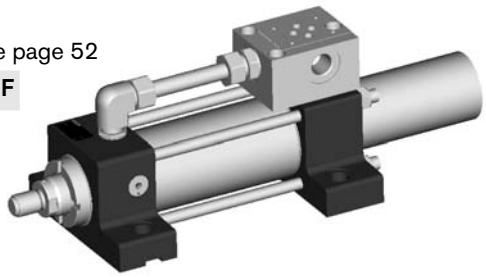
ME5 see page 48
ISO/DIN/NF



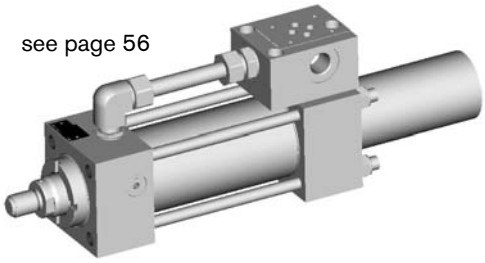
MT4 see page 54
ISO/DIN/NF



MS2 see page 52
ISO/DIN/NF



MX5 see page 56
NF



Stroke lengths

Maximum stroke length

AL-Ø	40	50	63	80	100	125	160	200
Mounting type	max. stroke length in mm							
ME5, MS2, MX5	480	600	750	800	1000	1250	1280	1400
MT4, MP5	320	400	500	530	660	830	850	930

Minimum stroke length without subplate

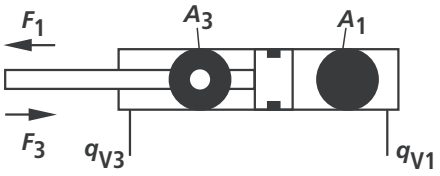
AL-Ø	40	50	63	80	100	125	160	200
Mounting type	min. stroke length in mm							
ME5, MS2, MX5, MP5	0						20	
MT4	15	4	10	11	17	25	40	48

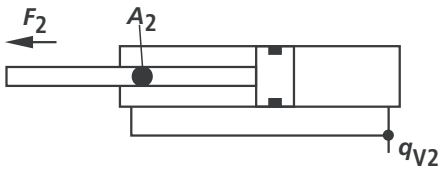
Minimum stroke length with subplate

AL-Ø	40	50	63	80	100	125	160	200
Mounting type	max. stroke length in mm							
ME5, MS2, MX5, MP5	50	50	45	30	50	35	20	20
MT4	70	50	45	35	57	63	74	73

Aras, forces, flow

Piston	Piston rod	Area ratio	Areas			Force at 160 bar [1]			Flow at 0.1 m/s [2]		
			Piston	Rod	Annulus	Pushing	Diff.	Pulling	Out	Diff.	In
AL Ø mm	**MM** Ø mm	φ A_1/A_3	A_1 cm²	A_2 cm²	A_3 cm²	F_1 kN	F_2 kN	F_3 kN	q_{V1} L/min	q_{V2} L/min	q_{V3} L/min
40	**28**	1.96	12.56	6.16	6.40	20.11	9.85	10.25	7.5	3.7	3.8
50	**28** [12)] **36**	1.46 2.08	19.63	6.16 10.18	13.48 9.45	31.42	9.85 16.29	21.56 15.13	11.8	3.7 6.1	8.1 5.7
63	**36** [12)] **45**	1.48 2.04	31.17	10.18 15.90	20.99 15.27	49.88	16.29 25.45	33.59 24.43	18.7	6.1 9.5	12.6 9.2
80	**45** [12)] **56**	1.46 1.96	50.26	15.90 24.63	34.36 25.63	80.42	25.45 39.41	54.98 41.02	30.2	9.5 14.8	20.6 15.4
100	**56** [12)] **70**	1.46 1.96	78.54	24.63 38.48	53.91 40.06	125.66	39.41 61.58	86.26 64.09	47.1	14.8 23.1	32.3 24.0
125	**70** [12)] **90**	1.46 2.08	122.72	38.48 63.62	84.23 59.10	196.35	61.58 101.79	134.77 94.56	73.6	23.1 38.2	50.5 35.5
160	**70** **110**	1.25 1.90	201.06	38.48 95.03	162.58 106.03	321.70	61.58 152.05	260.12 169.64	120.6	23.1 57.0	97.5 63.6
200	**90** **140**	1.25 1.96	314.16	63.62 153.94	250.54 160.22	502.65	101.79 246.30	400.86 256.35	188.5	38.2 92.4	150.3 96.1





Remarks

[1)] Theoretical force (without consideration of efficiency)

[2)] Stroke velocity

[12)] Piston rod Ø not standardised

Weights of cylinders without subplate (in kg)

CST3

Ø AL	Ø MM	ME5, MS2	MP5	MT4	MX5	Stroke 100 mm
40	**28**	3.5	3.8	4.2	3.2	1.1
50	**28** [12)]	5.4	5.8	6.7	4.9	1.3
	36	5.5	5.9	6.8	5.0	1.6
63	**36** [12)]	7.9	8.5	9.3	7.1	1.7
	45	8.2	8.7	9.5	7.3	2.2
80	**45** [12)]	14	16.1	17	13	2.6
	56	15	17.3	19	14	3.3
100	**56** [12)]	20	21.8	24	18	4.1
	70	21	24.1	25	19	5.1
125	**70** [12)]	38	43.7	46	35	7.3
	90	39	44.8	48	37	9.3
160	**70**	62	72.5	78	59	8.7
	110	64	74.8	80	61	13.2
200	**90**	112	132	147	107	13.4
	140	115	134.5	149	109	20.5

For self-aligning clevis, fork-type mounting block and trunnion mounting block, see pages 28 and 29

For subplates, see page 58

[12)] Piston rod Ø not standardised

Ordering code

CS	T3	/	/	/	F	1X	/			H		U		T		*

Single rod cylinder with position measuring system = **CS**

Series: = **T3**

Mounting types DIN / ISO
Rectangular flange at head = **ME5**
Self-aligning clevis at cap [5] = **MP5**
Foot mounting [3] = **MS2**
Trunnion [1] = **MT4**
Threaded bore at head [2] = **MX5**

Piston Ø (AL) 40 to 200 mm

Piston rod Ø (MM) 28 to 140 mm

Stroke length in mm

Design principle
Head and cap connected by tie rod with guide bush = **F**

Component series = **1X**
10 to 19: unchanged installation and connection dimensions

Pipe connection / version
BSP thread (ISO 8138) = **B**
Connection plaate size 6 [3; 4] = **P**
Connection plaate size 10 [3] = **T**

Pipe connection / position at head
see page 27 = **1**
= **2**
View to piston rod = **3**
= **4**

Pipe connection / position at cap
1 =
2 =
3 =
4 =
see page 27
View to piston rod

Piston rod version
H = Hardened and hard chromium-plated

Piston rod end
see pages 48 to 57
H = Thread (DIN/ISO) for self-aligning clevis CGKA/CGKD
D = Thread (ISO) for self-aligning clevis CGKA/CGKD
F = With self-aligning clevis CGKA/CGKD mounted (DIN/ISO)
K = With self-aligning clevis CGKA/CGKD mounted (ISO)

End position cushioning
U = None

Seal version
see page 3
M = Standard seal system
T = Reduced friction
V = High temperature with reduced friction

Option 1
T = Position measuring system (magnetostrictive) without cable socket
Cable socket – separate order, see page 60

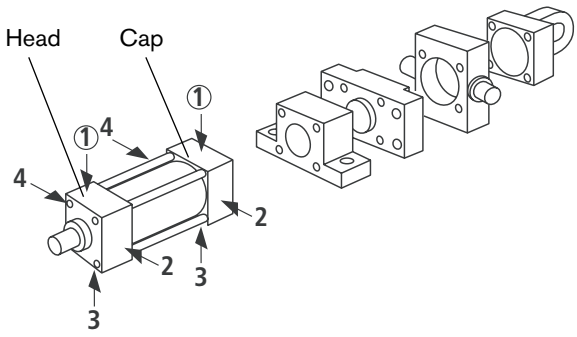
Option 2
V = Prepeared for position measuring system
C = Analogue output 4-20 mA
F = Analogue output 0-10 V
D = Digital output SSI

*Further details in clear text

Remarks:
[1] = Optional position of trunnion, always indicate dimensionn “XV“ in mm in clear text on the order
[2] = Not standardised to DIN / ISO
[3] = Only position 11 possible
[4] = Only up to piston Ø 80 mm
[5] = Piston Ø 40 mm not possible

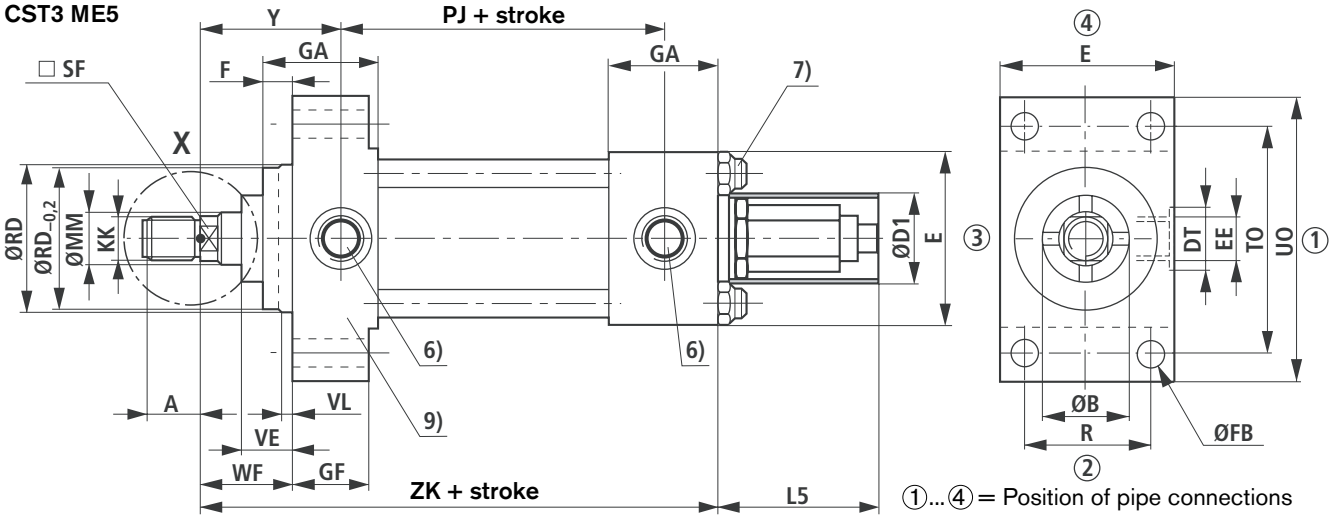
When making your selection, observe the restrictions on the relevant pages in the catalogue!

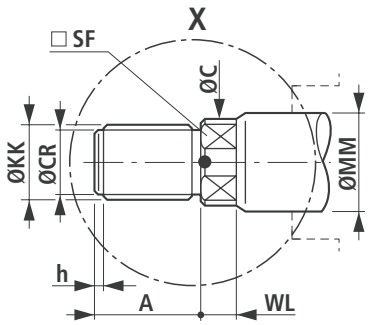
Order example: CST3ME5/50/36/300F1X/P11HDUTTD



Mounting type ME5 (nominal dimensions in mm)

CST3 ME5





AL Ø	F max	FB H13	GF [9]	PJ [10] ± 1,25	PJ [11] ± 1,25	R JS13	TO JS13	UO max	VE max	VL min	ZK ± 1	L5	Ø D1 max
40	10	11	38	73	77	41	87	110	22	3	172	95	51
50	16	14	38	74	78	52	105	130	25	4	183	102	51
63	16	14	38	80	81,5	65	117	145	29	4	190	105	60
80	20	18	45	93	93	83	149	180	29	4	216	82	100
100	22	18	45	101	101	97	162	200	32	5	230	82	100
125	22	22	58	117	117	126	208	250	32	5	254	82	120
160	25	26	58	130	130	155	253	300	32	5	270	82	120
200	25	33	76	160	160	190	300	360	32	5	329	82	120

Dimensions ME5 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]								
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9	RE f8
40	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42	62
50	28								M20x1.5	28	25	22	7	3	17	42	74
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50	74
63	36								M27x2	36	33	30	8	3	23.5	50	88
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60	88
80	45								M33x2	45	42	36	10	4	29.5	60	105
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72	105
100	56								M42x2	56	53	46	10	5	38.5	72	125
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88	125
125	70								M48x2	63	67	60	15	3	44.5	88	150
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108	150
160	70	M48x2	63	67	60	15	3	44.5								88	125
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133	170
200	90	M64x3	85	86	75	15	4.5	59								108	150
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163	210

AL Ø	E	EE	DT	GA	WF ± 2	WH ± 2	Y [10] ± 2	Y [11] ± 2
40	63 ± 1.5	G 3/8	28	52	35	25	63	58
50	75 ± 1.5	G 1/2	34	57.8	41	25	67	63
63	90 ± 1.5	G 1/2	34	55.8	48	32	71	69.5
80	115 ± 1.5	G 3/4	42	65	51	31	77	77
100	130 ± 2	G 3/4	42	67	57	35	82	82
125	165 ± 2	G 1	47	73.5	57	35	86	86
160	205 ± 2	G 1	47	80.5	57	32	86	86
200	245 ± 2	G 1 1/4	58	101	57	32	98	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

[6] Positions of pipe connections and bleed point, see page 27

[7] For tightening torque, see page 43

[9] Flange thickness to DIN 24554

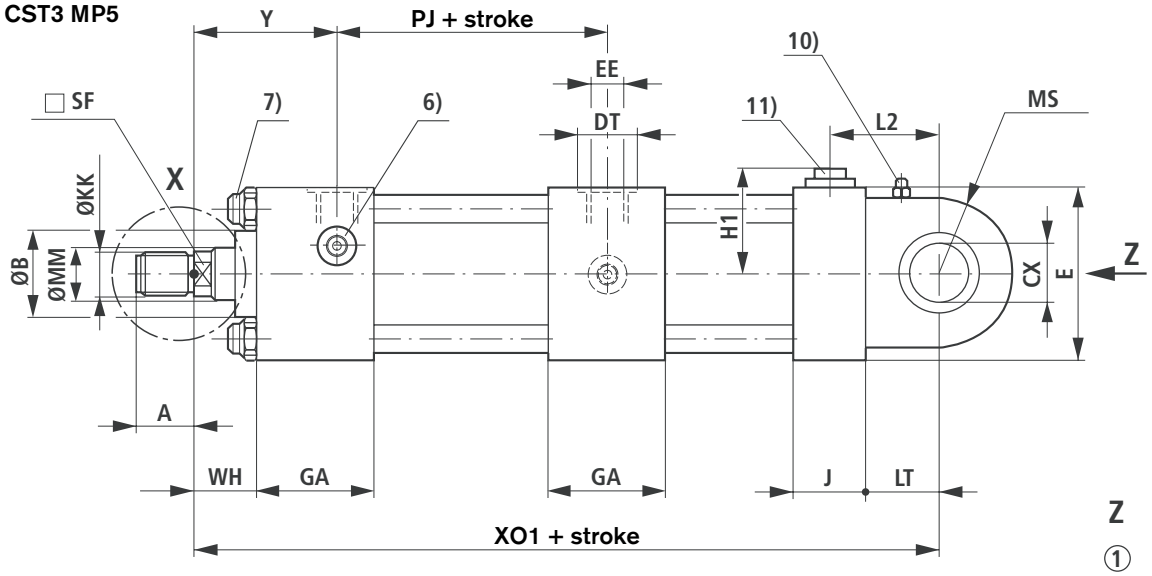
[10] ME5: for pipe connection positions “1” and “3” at head

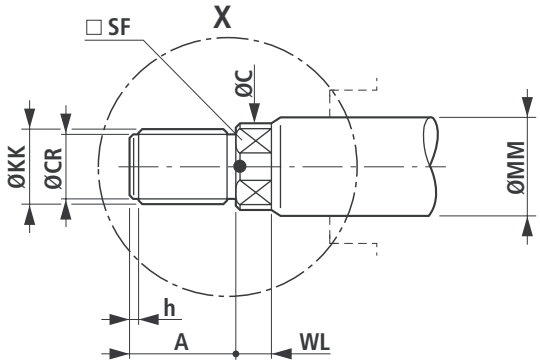
[11] ME5: for pipe connection positions “2“ and “4“ at head

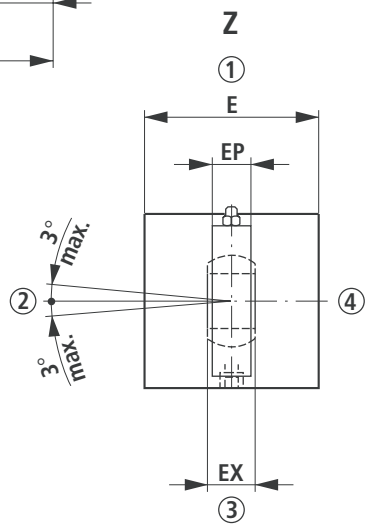
[12] Piston rod Ø not standardised

Mounting type MP5 (nominal dimensions in mm)

CST3 MP5







①...④ = Position of pipe connections

AL Ø	CX	EP h15	EX	LT min	XO1 ± 1.25	MS max	H1	L2
50	25 – 0.012	17	20 – 0.12	31	365	33	45.5	49
63	30 – 0.012	19	22 – 0.12	38	383	40	53	55
80	40 – 0.012	23	28 – 0.12	48	410	50	65.5	68
100	50 – 0.012	30	35 – 0.12	58	436	62	73	78
125	60 – 0.015	38	44 – 0.15	72	487	80	90.5	101
160	80 – 0.015	47	55 – 0.15	92	528	100	110.5	120.5
200	100 – 0.020	57	70 – 0.20	116	632	120	130.5	157

Dimensions MP5 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	**MM** Ø	**KK** [1]	**A** [1] max	**C** Ø	**SF**	**WL**	**h**	**CR**	**KK** [2]	**A** [2] max	**C** Ø	**SF**	**WL**	**h**	**CR**	**B** f9
40	**28**	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	**28**								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	**36**								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	**45**								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	**56**								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	**70**								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	**70**	M48x2	63	67	60	15	3	44.5								88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	**90**	M64x3	85	86	75	15	4.5	59								108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	**E**	**EE**	**DT**	**GA**	**J**	**PJ** ± 1.25	**WH** ± 2	**Y** ± 2
50	75 ± 1.5	G 1/2	34	57.8	33.8	74	25	67
63	90 ± 1.5	G 1/2	34	55.8	33.8	80	32	71
80	115 ± 1.5	G 3/4	42	65	39	93	31	77
100	130 ± 2	G 3/4	42	67	40	101	35	82
125	165 ± 2	G 1	47	73.5	51.5	117	35	86
160	205 ± 2	G 1	47	80.5	55.5	130	32	86
200	245 ± 2	G 1 1/4	58	101	76	160	32	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

[6] For positions of pipe connections and bleed point, see page 27

[7] For tightening torque, see page 43

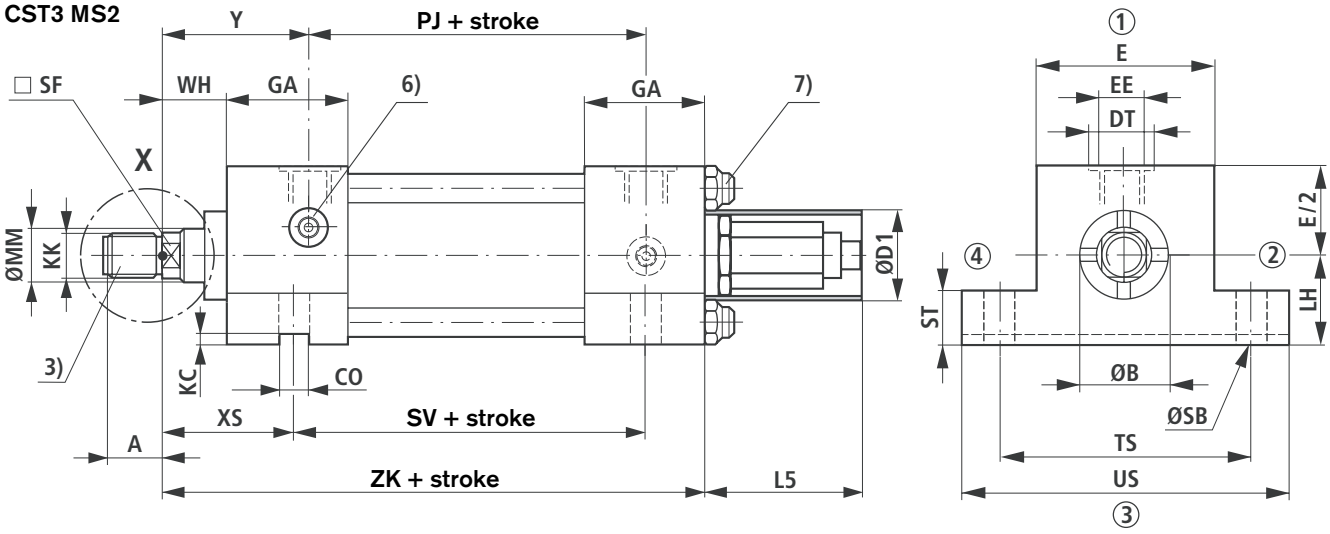
[10] Grease nipple M6 DIN 71412

[11] At position 1 only

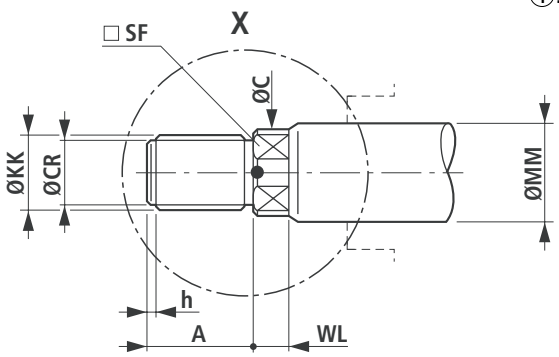
[12] Piston rod Ø not standardised

Mounting type MS2 (nominal dimensions in mm)

CST3 MS2



①...④ = Position of pipe connections



AL Ø	CO H8	KC	LH h10	PJ ± 1,25	SB H13	ST	SV ± 1	TS JS13	US + 2	XS ± 2	ZK ± 1	L5	ØD1 max
40	12	4	31	73	11	12.5	107.5	83	103	45	172	95	51
50	12	4	37	74	14	19	100.5	102	127	54	183	102	51
63	16	4	44	80	18	26	92.5	124	161	65	190	105	60
80	16	5	57	93	18	26	111.5	149	186	68	216	82	100
100	16	5	63	101	26	32	107.5	172	216	79	230	82	100
125	20	5	82	117	26	32	131.5	210	254	79	254	82	120
160	–	–	101	130	33	38	130.5	260	318	86	270	82	120
200	–	–	122	160	39	44	172.5	311	381	92	329	82	120

Dimensions MS2 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	**MM Ø**	**KK** [1]	**A** [1] max	**C Ø**	**SF**	**WL**	**h**	**CR**	**KK** [2]	**A** [2] max	**C Ø**	**SF**	**WL**	**h**	**CR**	**B** f9
40	**28**	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	**28**								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	**36**								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	**45**								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	**56**								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	**70**								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	**70**	M48x2	63	67	60	15	3	44.5								88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	**90**	M64x3	85	86	75	15	4.5	59								108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	**E**	**EE**	**DT**	**GA**	**WH ± 2**	**Y ± 2**
40	63 ± 1.5	G 3/8	28	52	25	62
50	75 ± 1.5	G 1/2	34	57.8	25	67
63	90 ± 1.5	G 1/2	34	55.8	32	71
80	115 ± 1.5	G 3/4	42	65	31	77
100	130 ± 2	G 3/4	42	67	35	82
125	165 ± 2	G 1	47	73.5	35	86
160	205 ± 2	G 1	47	80.5	32	86
200	245 ± 2	G 1 1/4	58	101	32	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

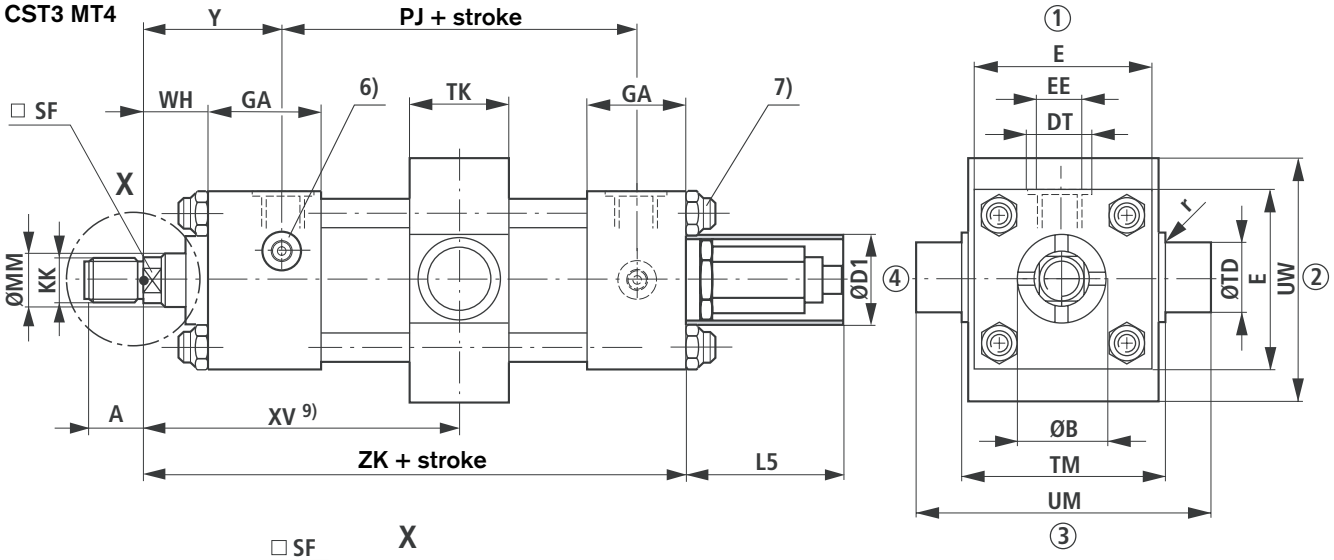
[6] For positions of pipe connections and bleed point, see page 27

[7] For tightening torque, see page 43

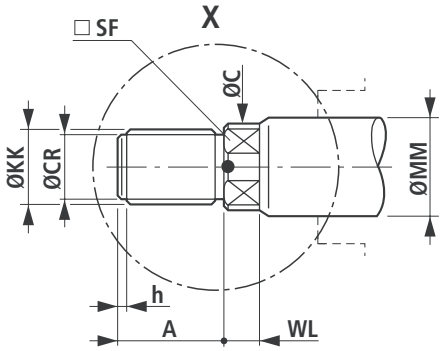
[12] Piston rod Ø not standardised

Mounting type MT4 (nominal dimensions in mm)

CST3 MT4

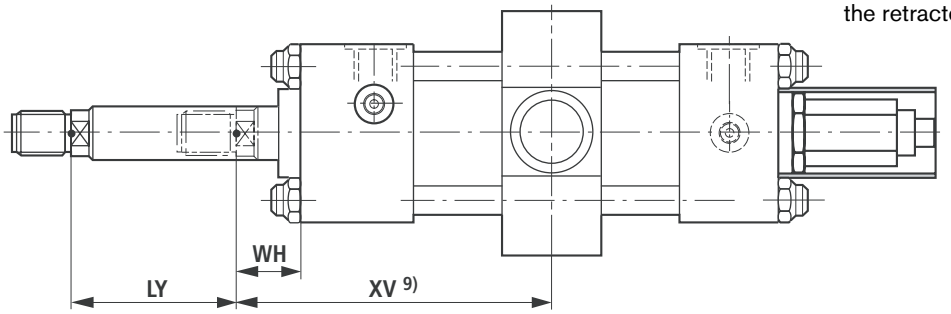


①...④ = Position of pipe connections



Trunnions should be lubricated at regular intervals.

Dimensions for cylinder with piston rod extension "LY" in the retracted condition.



AL Ø	PJ ±1.25	TK max	TM h14	UM h15	UW max	BSP thread Stroke min	BSP thread XV min 1) ± 2	BSP thread XV max 1) ± 2	Subplate Stroke min	Subplate XV min 2) ± 2	Subplate XV max 2) ± 2	ZK ± 1	L5	ØD1 max
40	73	30	76	108	92	15	106	91 + stroke	70	116	46 + stroke	172	95	51
50	74	40	89	129	112	4	106	102 + stroke	50	106	75 + stroke	183	102	51
63	80	50	100	150	126	10	116	106 + stroke	45	116	80 + stroke	190	105	60
80	93	60	127	191	160	11	129	118 + stroke	35	129	94 + stroke	216	82	100
100	101	70	140	220	180	17	141	124 + stroke	57	141	84 + stroke	230	82	100
125	117	90	178	278	215	25	157	132 + stroke	63	157	94 + stroke	254	82	120
160	130	110	215	341	260	40	171	131 + stroke	74	171	97 + stroke	270	82	120
200	160	130	279	439	365	48	202	154 + stroke	73	202	129 + stroke	329	82	120

Dimensions MT4 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
40	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	28								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	36								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	45								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	56								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	70								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5								88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59								108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	r	TD f8	E	EE	DT	GA	WH ± 2	Y ± 2
40	1.2	20	63 ± 1.5	G 3/8	28	52	25	62
50	1.6	25	75 ± 1.5	G 1/2	34	57.8	25	67
63	1.6	32	90 ± 1.5	G 1/2	34	55.8	32	71
80	2.4	40	115 ± 1.5	G 3/4	42	65	31	77
100	2.4	50	130 ± 2	G 3/4	42	67	35	82
125	3.2	63	165 ± 2	G 1	47	73.5	35	86
160	3.2	80	205 ± 2	G 1	47	80.5	32	86
200	3.2	100	245 ± 2	G 1 1/4	58	101	32	98

1) For pipe connection/version "B"

2) For pipe connection/versions "P" and "T"

6) For positions of pipe connections and bleed point, see page 27

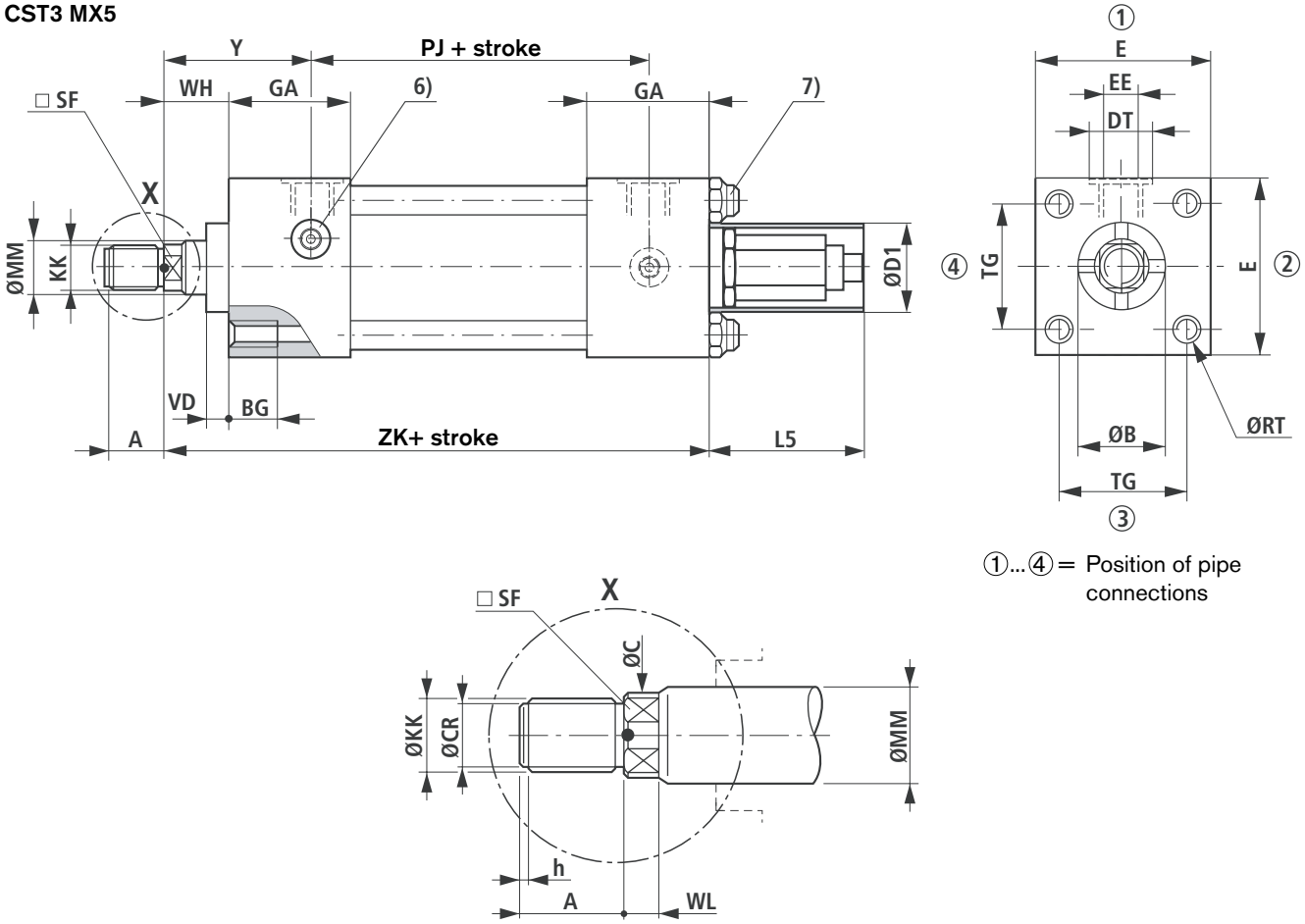
7) For tightening torque, see page 43

9) Always indicate dimension "XV" in mm in clear text

12) Piston rod Ø not standardised

Mounting type MX5 (nominal dimensions in mm)

CST3 MX5



AL Ø	BG min	PJ ± 1.25	RT 6H	TG js13	VD	ZK ± 1	L5	ØD1 max
40	12	73	M8x1.25	41.7	12	172	95	51
50	18	74	M12x1.75	52.3	9	183	102	51
63	18	80	M12x1.75	64.3	13	190	105	60
80	24	93	M16x2	82.7	9	216	82	100
100	24	101	M16x2	96.9	10	230	82	100
125	27	117	M22x2.5	125.9	9	254	82	120
160	32	130	M27x3	154.9	7	270	82	120
200	40	160	M30x3.5	190.2	7	329	82	120

Dimensions MX5 (nominal dimensions in mm)

		DIN / ISO [1]							ISO [2]							
AL Ø	MM Ø	KK [1]	A [1] max	C Ø	SF	WL	h	CR	KK [2]	A [2] max	C Ø	SF	WL	h	CR	B f9
40	28	M14x1.5	18	25	22	7	2	11	M20x1.5	28	25	22	7	3	17	42
50	28								M20x1.5	28	25	22	7	3	17	42
	36	M16x1.5	22	33	30	8	3	13	M27x2	36	33	30	8	3	23.5	50
63	36								M27x2	36	33	30	8	3	23.5	50
	45	M20x1.5	28	42	36	10	3	17	M33x2	45	42	36	10	4	29.5	60
80	45								M33x2	45	42	36	10	4	29.5	60
	56	M27x2	36	53	46	10	3	24	M42x2	56	53	46	10	5	38.5	72
100	56								M42x2	56	53	46	10	5	38.5	72
	70	M33x2	45	67	60	15	4	30	M48x2	63	67	60	15	3	44.5	88
125	70								M48x2	63	67	60	15	3	44.5	88
	90	M42x2	56	86	75	15	5	39	M64x3	85	86	75	15	4.5	59	108
160	70	M48x2	63	67	60	15	3	44.5								88
	110	M48x2	63	106	92	18	3	45	M80x3	95	106	92	18	4.5	75	133
200	90	M64x3	85	86	75	15	4.5	59								108
	140	M64x3	85	136	125	18	5	59	M100x3	112	136	125	18	4.5	95	163

AL Ø	E	EE	DT	GA	WH ± 2	Y ± 2
40	63 ± 1.5	G 3/8	28	52	25	62
50	75 ± 1.5	G 1/2	34	57.8	25	67
63	90 ± 1.5	G 1/2	34	55.8	32	71
80	115 ± 1.5	G 3/4	42	65	31	77
100	130 ± 2	G 3/4	42	67	35	82
125	165 ± 2	G 1	47	73.5	35	86
160	205 ± 2	G 1	47	80.5	32	86
200	245 ± 2	G 1 1/4	58	101	32	98

[1] Thread for piston rod ends “F“ and “H“

[2] Thread for piston rod ends “D“ and “K“

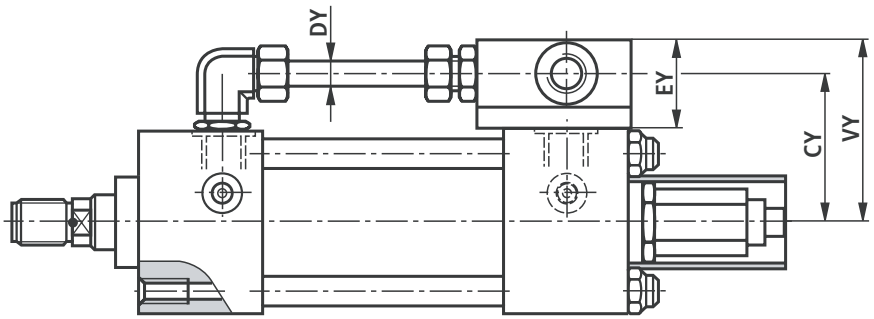
[6] For positions of pipe connections and bleed point, see page 27

[7] For tightening torque, see page 43

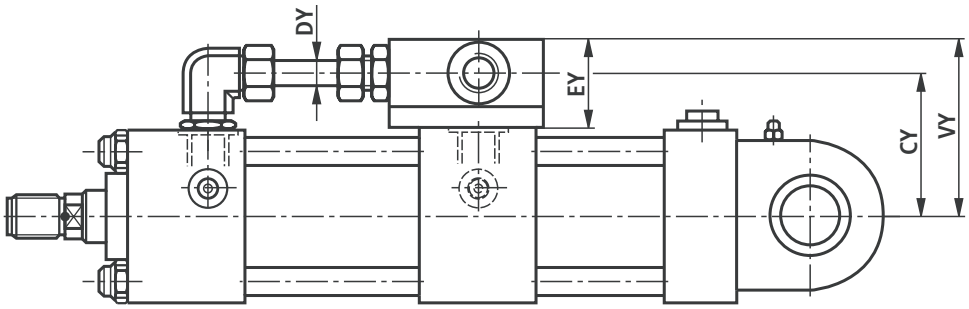
[12] Piston rod Ø not standardised

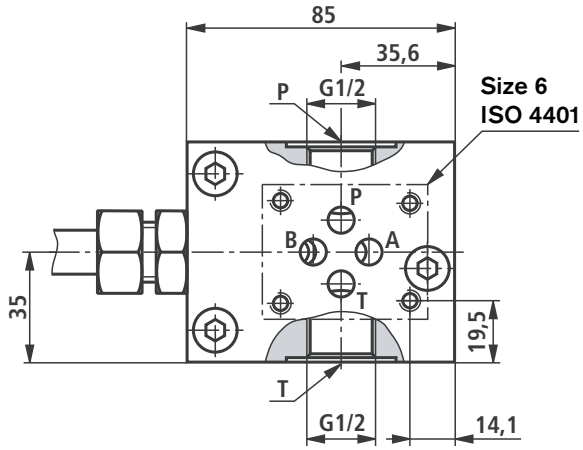
Subplates for valve mounting – dimensions and porting patterns (nominal dimensions in mm)

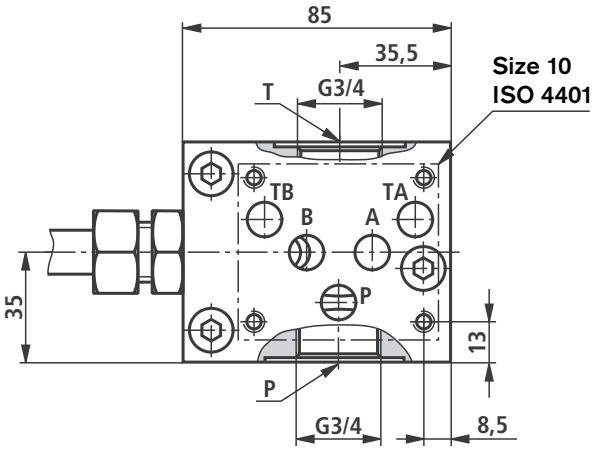
MX5
ME5, MS2, MT4



MP5







AL Ø	CY	EY	VY	DY Ø
40	62	50	80	15
50	68	50	86	15
63	76	50	94	15
80	89	50	107	15
100	103	65	128	20
125	120.5	65	146	20
160	140.5	65	166	20
200	160.5	65	186	20

Position measuring system

The position measuring system that is pressure-proof up to 500 bar operates contact-free and is an absolute measuring system. This position measuring system is based on the magetostrictive effect. A torsion impulse is triggered when two magnetic fields coincide.
This impulse is directed through the waveguide inside the scale from the place of measurement to the sensor head. The running time is constant and almost independent of temperature. It is proportional to the position of the magnet and hence a dimension for the actual position value and is converted into an analogue or digital output in the sensor.

Technical data (for applications outside these parameters, please consult us!)

Operating pressure		bar	160
Analogue output		V	0 to 10
	Load resistance	kΩ	≥ 5
	Resolution		Infinite
Analogue output		mA	4 to 20
	Load resistance	Ω	0 to 500
	Resolution		Infinite
Digital output			SSI 24 bit Gray-coded
	Resolution	µm	5
	Direction of measurement		Forward
Linearity (absolute accuracy)	Analogue	% mm	≤ ±0.02 % (referred to measuring length) min. ±0.05
	Digital	% mm	≤ ±0.01 % (referred to measuring length) min. ±0.04
Reproducibility		% mm	±0.001 (referred to measuring length) min. ±0.0025
Hysteresis		mm	≤ 0.004
Supply voltage		V DC	24 (± 10 % for analogue output)
	Current consumption	mA	100
	Residual ripple content	% s-s	≤ 1
	 Current consumption	V DC mA	24 (+ 20 %/– 15 % for digital output) 70
	Residual ripple content	% s-s	≤ 1
Type of protection	Tube and flange		IP 67
	Sensor electronics		IP 65
Operating temperature	Sensor electronics	°C	– 40 to + 75
Temperature coefficient	Voltage	ppm/°C	70
	Current	ppm/°C	90

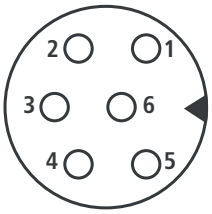
Position measuring system

For analogue output:
6-pin Amphenol cable socket
Material no **R900072231**
(cable socket **not** included in the scope of supply, must be ordered separately)

For digital output:
7-pin Amphenol cable socket
Material no. **R900079551**
(cable socket **not** included in the scope of supply, must be ordered separately)

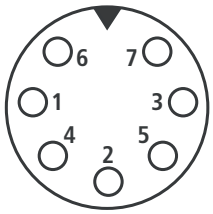
Pin assignment

Position measuring system (analogue output)
Component plug (viewed to pin side)



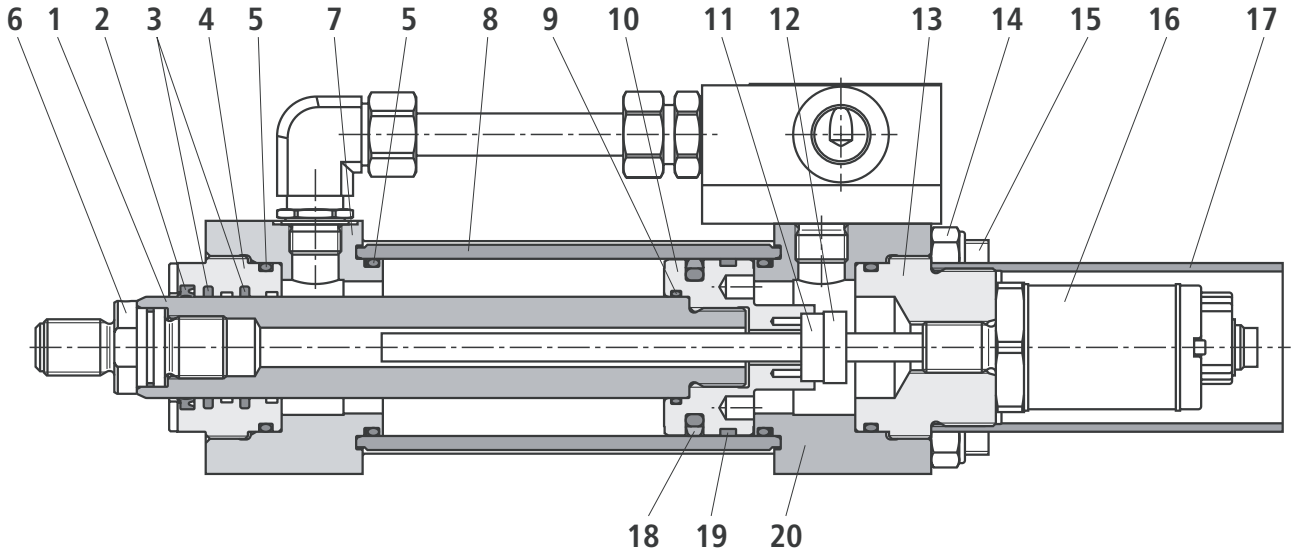
Pin	Cable	Signal / current	Signal / voltage
1	Grey	4 to 20 mA	0 - 10 V
2	Pink	Gnd	Gnd
3	Yellow	n. c.	10 - 0 V
4	Green	n. c.	Gnd
5	Brown	+24 V DC (±10%)	+24 V DC (±10%)
6	White	Gnd	Gnd

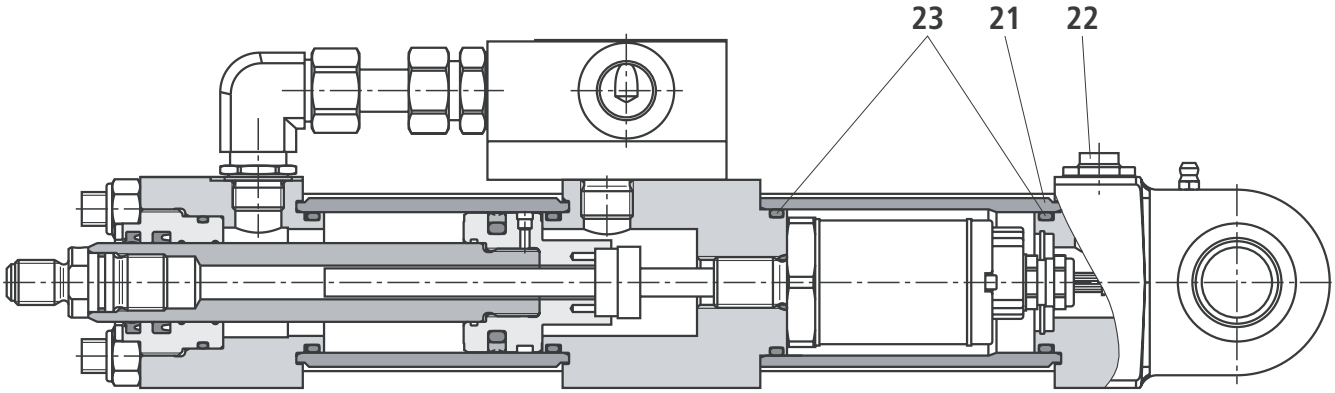
Position measuring system (digital output)
Component plug (viewed to pin side)



Pin	Cable	Signal / SSi
1	Grey	Data (–)
2	Pink	Data (+)
3	Yellow	Clock-pulse (+)
4	Green	Clock-pulse (–)
5	Brown	+24 V DC (+20%/–15%)
6	White	0 V
7	–	n. c.

Spare parts





1 Piston rod
2 Wiper
3 Piston seal
4 Guide bush
5 O-ring
6 Piston rod end
7 Cylinder head
8 Cylinder barrel
9 O-ring
10 Piston
11 Isolation bush
12 Magnet
13 Cover
14 Nut
15 Tie rod
16 Position transducer
17 Protective tube
18 Piston seal
19 Guide ring
20 Cylinder cap
21 Connecting tube
22 Socket
23 O-ring

Notes

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Section 4

Hydraulic Cylinder NFPA Industrial Type

RA 17 041/07.05 **1/**72
Replaces: 06.04

Model CDT4/CGT4 NFPA Cylinders
Model CST4 Linear Positioning Cylinders

Series 1X
Nominal pressure: 3,000 psi
Non shock rating: 5,000 psi

Table of Contents

Features

- Duty, nominal 3,000 psi hydraulic, non-shock 5,000 psi
- Standards, meets or exceeds all JIC and NFPA requirements
- Bore Sizes, 1-1/2" - 8" (CDT4/CGT4)
- Piston Rods, 5/8" - 5-1/2" (CDT4/CGT4)
- Mountings,19 standard NFPA mountings (CDT4/CGT4)
- Ports, SAE o-ring straight thread ports
- Stroke, standard strokes furnished in 1/8" increments. Normal stroke tolerance + 1/16" / -0". Closer stroke tolerances available; consult factory.
- Rod End Threads, standard KK1 male and female threads plus KK2 oversize male thread. Other rod end styles optional.
- Cushions, available for all bore sizes, at either or both ends.

Technical Data (for applications outside these parameters, please consult factory)

Standards:

Meets or exceeds all J.I.C. and NFPA requirements.

Nominal pressure: 3,000 psi

Static proof pressure: 5,000 psi

With extreme shock loads the mounting styles and piston rod threads have to be considered, taking the fatigue limits into account.

Maximum operating pressure up to: 3,000 psi

Static non-shock: 5,000 psi

Installation position: Various

Pressure fluid:

Mineral oils (HL, HLP)
Phosphate ester (HFD-R) (-4°F to +300°F)
HFA (41°F to 131°F)
Water glycol HFC (–4°F to 140°F)

Hydraulic fluid temperature range: (-4°F to 176°F)

Viscosity range: 32 to 1760 ssu

Degree of contamination:

Max. permissible degree of contamination of the pressure fluid is to NAS 1638 class 10.

We therefore recommend a filter with a minium retention rate of $\beta_{10} \geq 75$.

Stroke speed: 20 in/sec
(dependent on the connection port)

Air bleed standard: Secured against removal

Acceptance:

Each cylinder is tested to Bosch Rexroth standards.

Cylinders, outside the above parameters are also available. Consult factory

For applications above 230°F specify a non studded piston rod end and advise operating temperature before ordering.

Operating Pressures (PSI) by Cylinder Bore Sizes*

Cylinder Bore	Standard Rod	Nominal	Non-Shock
1-1/2	5/8	3,000 psi	5,000 psi
2	1		
2-1/2	1		
3-1/4	1-3/8		
4	1-3/4		
5	2		
6	2-1/2		
7	3		
8	3-1/2		

*1) For flange mounted and double rod cylinders, see pages 12 and 26.

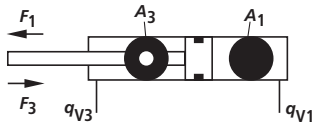
2) Exceptions to 5,000 psi non-shock rating:

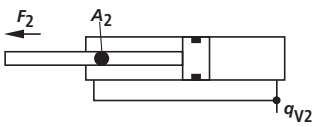
a) 1-1/2” bore with 5/8” rod, all mounts.
b) All bore sizes using the following mounts:
MT1, MT2, MT4, MF1, MF2, ME5, ME6, MS7

c) The following mounts for bore sizes listed:
MP1: 2-1/2”
MP5: 2-1/2”, 3-1/4”
MF5 & MF6: 6” thru 8”

Areas, Forces, Flows (dimensions in inches)

Bore	Piston rod	Area ratio	Areas			Force at 3000 psi [1]			Flow at 4"/s [2]		
			Piston	Rod	Annulus	Push	Regen.	Pull	Out	Regen.	In
		j	A_1	A_2	A_3	F_1	F_2	F_3	q_{V1}	q_{V2}	q_{V3}
Ø in.	Ø in.	A_1/A_3	in.^{2}	in.^{2}	in.^{2}	Lb.	Lb.	Lb.	gpm	gpm	gpm
	5/8"	1.21		0.31	1.46		920	4390		.32	1.52
1-1/2"	1"	1.80	1.77	0.79	0.98	5,310	2370	2940	1.84	.82	1.02
	1"	1.33		0.79	2.35		2370	7050		.82	2.44
2"	1-3/8"	1.89	3.14	1.48	1.66	9,420	4440	4980	3.26	1.54	1.72
	1"	1.19		0.79	4.12		2370	12,360		.82	4.28
2-1/2"	1-3/8"	1.43	4.91	1.48	3.43	14,730	4440	10,290	5.10	1.54	3.56
	1-3/4"	1.96		2.40	2.51		7200	7530		2.49	2.60
	1-3/8"	1.21		1.48	6.82		4440	20,460		1.54	7.08
3-1/4"	1-3/4"	1.40	8.30	2.40	5.90	24,900	7,200	17,700	8.62	2.49	6.13
	2"	1.60		3.14	5.16		9,420	15,480		3.26	5.36
	1-3/4"	1.24		2.40	10.17		7,200	30,510		2.49	10.56
4"	2"	1.33	12.57	3.14	9.43	37,710	9,420	28,290	13.05	3.26	9.79
	2-1/2"	1.64		4.91	7.66		14,730	22,980		5.10	7.95
	2"	1.19		3.14	16.50		9420	49,500		3.26	17.14
	2-1/2"	1.33		4.91	14.73		14,730	44,190		5.10	15.30
5"	3"	1.56	19.64	7.07	12.57	58,920	21,210	37,710	20.40	7.35	13.05
	3-1/2"	1.96		9.62	10.02		28,860	30,060		9.99	10.41
	2-1/2"	1.21		4.91	23.34		14,730	70,020		5.10	24.25
	3"	1.33		7.07	21.18		21,210	63,540		7.35	22.00
6"	3-1/2"	1.51	28.25	9.62	18.63	84,750	28,860	55,890	29.35	9.99	19.36
	4"	1.80		12.57	15.68		37,710	47,040		13.05	16.30
	3"	1.22		7.07	31.42		21,210	94,260		7.35	32.65
	3-1/2"	1.33		9.62	28.87		28,860	86,610		9.99	30.01
7"	4"	1.48	38.49	12.57	25.92	115,470	37,710	77,760	40.00	13.05	26.95
	4-1/2"	1.70		15.91	22.58		47,730	67,740		16.53	23.46
	5"	2.04		19.63	18.86		58,890	56,580		20.39	19.61
	3-1/2"	1.23		9.62	40.65		28,860	121,950		9.99	42.23
	4"	1.33		12.57	37.70		37,710	113,100		13.05	39.17
8"	4-1/2"	1.46	50.27	15.91	34.37	150,810	47,730	103,110	52.22	16.53	35.70
	5"	1.64		19.63	30.64		58,890	91,920		20.39	31.83
	5-1/2"	1.89		23.76	26.51		71,280	79,530		24.68	27.54





Note

[1] Theoretical force (efficiency not taken into account)
[2] Stroke velocity

Stroke tolerances

Stroke tolerances result from the cylinder head, cylinder base, cylinder tube, piston and piston rod. The stroke tolerance for all piston diameters and stroke lengths is +1/16" / -0". Tighter stroke tolerances can be requested, however, details regarding the operating pressure and operating temperature must be stated.

Stroke lengths	Stroke tolerances
≤ 120" (refer to pg. 42 for buckling loads)	+1/16" / -0"

Approximate Uncrated CDT4 Hydraulic Cylinder Weights (lbs.)*

Cylinder Bore	1-1/2	2	2-1/2	3-1/4	4	5	6	7	8
Zero Stroke	7.5	10	16	31	41	73	138	180	310
Add Per Inch of Stroke	.5	.7	1.17	1.75	2.5	4.0	5.2	6.2	8.7

* Weights based on standard (first) rod sizes. Add 10% to cover additional weight for crating.

Ordering Details

	T4	/	/	/	Z	1X	/									*

Single rod cylinder = **CD**
Double rod cylinder = **CG**

Series = **T4**

Mounting types

Rectangular head	= **ME5**
Rectangular cap	= **ME6**
Rectangular flange at head	= **MF1**
Rectangular flange at cap	= **MF2**
Square flange at head	= **MF5**
Square flange at cap	= **MF6**
Clevis mounting	= **MP1**
Pivot mount w/spherical bearing	= **MP5**
Side lug	= **MS2**
Side tapped	= **MS4**
Centerline lugs	= **MS3**
End lugs	= **MS7**
Trunnion at head	= **MT1**
Trunnion at cap	= **MT2**
Trunnion at intermediate position [3]	= **MT4**
Basic version	= **MX0**
Extended tie rods, both ends	= **MX1**
Extended tie rods, at cap	= **MX2**
Extended tie rods, at head	= **MX3**

Bore Dia. Ø 1.50 to 8.00 inch

Piston rod Ø 0.63 to 5.50 inch

Stroke length in inches (ex. 12.00)

Design principle
Head and cap connected by tie rods = **Z**

Series
10 to 19 unchanged installation and connection dimensions = **1X**

Port connections/ types

SAE straight thread port (ISO 11926-1)	= **S**
SAE Code 61 - 3000 psi 4-bolt flange	= **F**
Special (specify), see pg. 32	= **X**

Further details in clear text

Option 2

W =	Without options
K =	Thrust key
S =	Stop tube (specify length)
Y =	Additional piston rod ext. state length in inches in clear text

Option 1

W =	Without options
E =	Proximity switch, both ends
B =	Gland drain connection
A =	Test point, both sides

Seal version
Suitable for mineral oil to DIN 51 524 HL, HLP and HFA

M =	Polyurethane seal system
T* =	Servo quality/reduced friction
F* =	BUNA-N seal system for HFC

Suitable for phosphate ester HFD-R

V* =	Flourocarbon seal system [4]

End position cushioning

U =	Without
D =	Both sides, adjustable
S =	Rod sides, adjustable
K =	Cap sides, adjustable

Piston rod end [2]

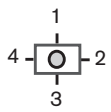
H =	Small male thread KK1
D =	Intermediate male thread KK2
E =	Female thread KK1
T =	S.A.F.E., rod end
X =	Special (specify)

Piston rod version

H =	Case hardened and hard chromium plated [1]
S =	17-4 PH stainless steel

Port location at cap

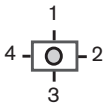
1 = **2** = **3** = **4** =



Viewed on piston rod

Port location at head

1 = **2** = **3** = **4** =



Viewed on piston rod

Remarks:

[1] Only 5/8" to 4" diameter piston rods are case hardened and hard chrome plated. Above 4" diameter piston rods are chrome plated only.

[2] With extreme shock loads the piston rod threads have to be selected, taking the fatigue limits into account. Rod and clevis, installed parts, etc. must always be firmly clamped against the piston rod shoulder.

[3] State XV dimensions in inches in clear text.

[4] Maximum working pressure limited to 2,000 psi when using flourocarbon seal system option "V". Consult factory for higher pressures.

* Not recommended for load holding applications. Consult factory for load holding options.

Sealing System

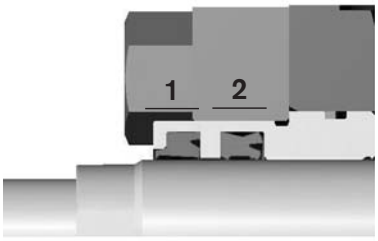
"M" Polyurethane seal system (standard)

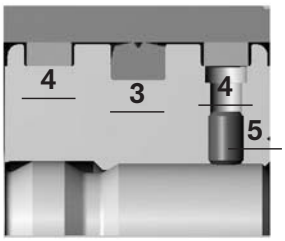
"T"* Seal system for low friction applications (available)

"F"* Standard seal system for HFC (water glycol) (available)

"V"* Seal system for (phosphate ester) (available)

** - not recommended for load holding applications. Consult factory for load holding options*





1. Double lip wiper
2. U-cup rod seal
3. Double acting piston seal
4. Wear bands
5. Piston threaded and sealed to piston rod with permanent adhesive and mechanically secured with a set screw

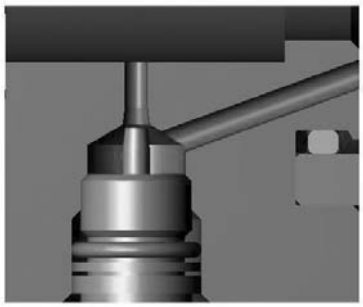
Cushioning System (optional)

Patented Exact-a-just™ cushioning provides accurate micro-meter adjustment

Exact-a-just™ cushioning permits adjustment over a wide range of settings for faster cycle times

Results in reduced maintenance costs, reduced internal and external shock, and softer cushioning stops

May be supplied at head, cap, or both ends



Exact-a-just™ cushioning

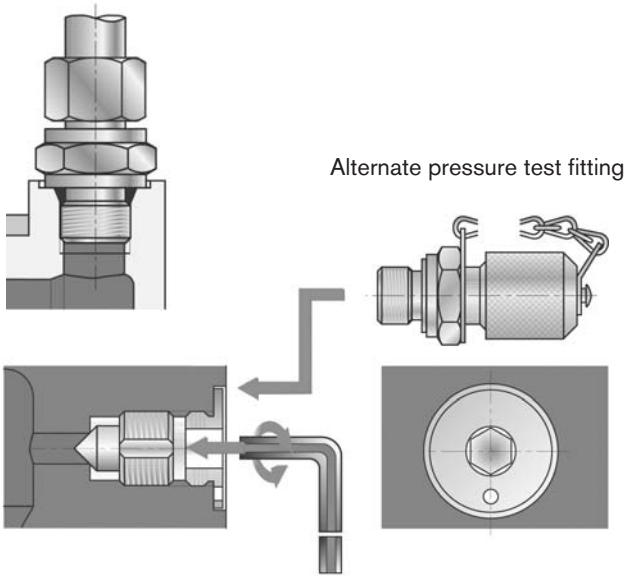
Connection Port and Secured Air Bleed (standard)

ISO 11926-1 SAE straight thread (standard)

For other port options consult factory

To provide safety and prevent accidents, patented air bleed is secured against unscrewing (standard)

Air bleed ports can become an alternate connection for a pressure test fitting (optional)

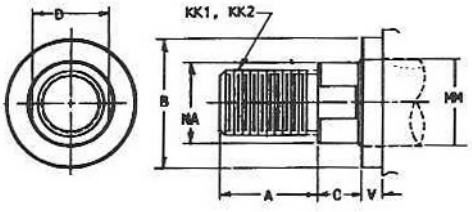


Alternate pressure test fitting

Piston Rod Versions

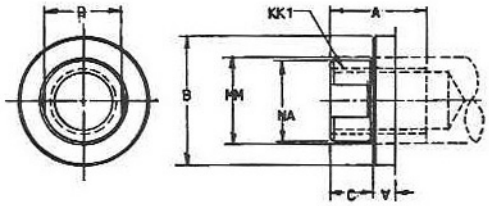
Male Rod End

Option H & D



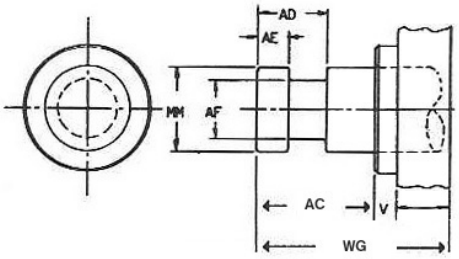
Female Rod End

Option E



S.A.F.E. Rod End

Option T



F or RT depending on mounting

Rod Thread Options:

Standard KK1 Male furnished when not specified.

Male thread available in KK1 and KK2 thread sizes.

KK1 studded male rod end standard for 5/8", 1" & 1-3/8" rod dia.

Female thread available in KK1 thread size only.

Piston Rod End

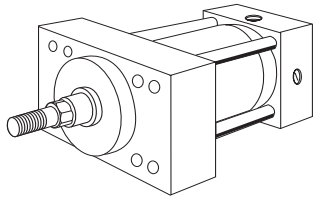
MM Rod Diameter	A	B +0.000 -0.002	C	D	AC	AD	AE	AF	KK1	KK2	NA	WG
0.625	0.750	1.124	0.38	0.50	1.13	0.63	0.250	0.375	7/16-20	1/2-20	0.54	1.75
1.000	1.125	1.499	0.50	0.88	1.50	0.94	0.375	0.688	3/4-16	7/8-14	0.94	2.38
1.375	1.625	1.999	0.63	1.13	1.75	1.06	0.375	0.875	1-14	1-1/4-12	1.32	2.75
1.750	2.000	2.374	0.75	1.50	2.00	1.31	0.500	1.125	1-1/4-12	1-1/2-12	1.69	3.13
2.000	2.250	2.624	0.88	1.69	2.63	1.69	0.625	1.375	1-1/2-12	1-3/4-12	1.94	3.75
2.500	3.000	3.124	1.00	2.06	3.25	1.94	0.750	1.750	1-7/8-12	2-1/4-12	2.44	4.50
3.000	3.500	3.749	1.00	2.63	3.63	2.44	0.875	2.250	2-1/4-12	2-3/4-12	2.94	4.88
3.500	3.500	4.249	1.00	3.00	4.38	2.69	1.000	2.500	2-1/2-12	3-1/4-12	3.44	5.63
4.000	4.000	4.749	1.00	3.38	4.50	2.69	1.000	3.000	3-12	3-3/4-12	3.94	5.75
4.500	4.500	5.249	1.00	SH 1	5.25	3.19	1.500	3.500	3-1/4-12	4-1/4-12	4.44	6.50
5.000	5.000	5.749	1.00	SH 1	5.38	3.19	1.500	3.875	3-1/2-12	4-3/4-12	4.94	6.63
5.500	5.500	6.249	1.00	SH 1	6.25	3.94	1.875	4.375	4-12	5-1/4-12	5.44	7.50

Note: Spanner wrench holes: SH1 = 0.56” dia.

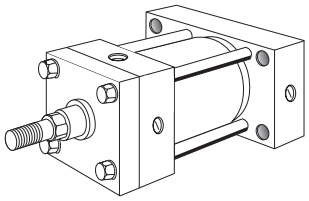
For "F, RT and V" dimensions, see respective mounting dimensions shown on pages 8 thru 27

Mounting Type Overview

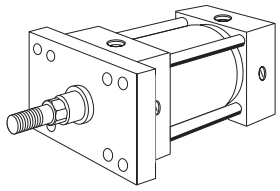
ME5 (see Page 8, 9)



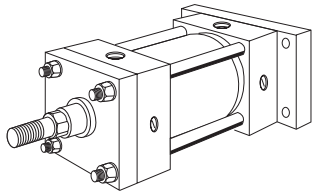
ME6 (see Page 8, 9)



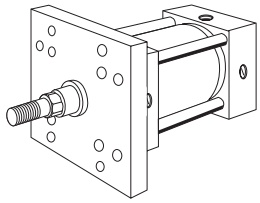
MF1 (see Page 10, 11, 12)



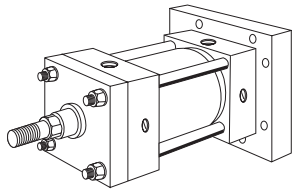
MF2 (see Page 10, 11, 12)



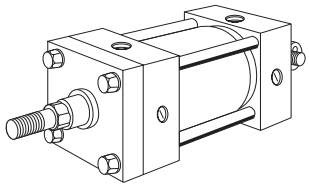
MF5 (see Page 10, 11, 12)



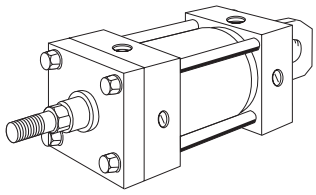
MF6 (see Page 10, 11, 12)



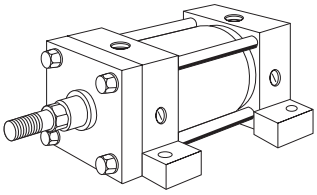
MP1 (see Page 13)



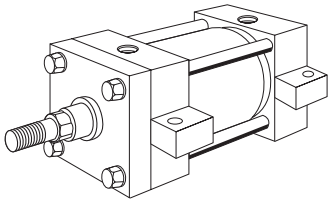
MP5 (see Page 14)



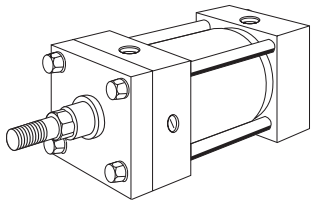
MS2 (see Page 16, 17)



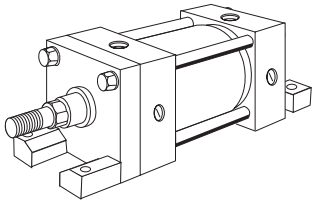
MS3 (see Page 18, 19)



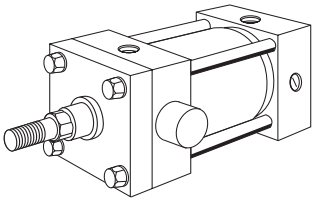
MS4 (see Page 16, 17)



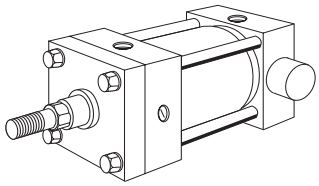
MS7 (see Page 18, 19)



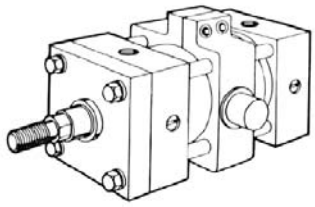
MT1 (see Page 20, 21)



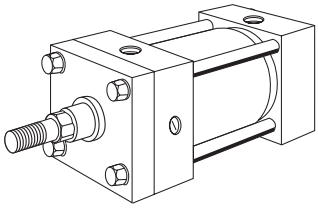
MT2 (see Page 20, 21)



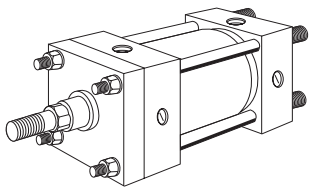
MT4 (see Page 22, 23)



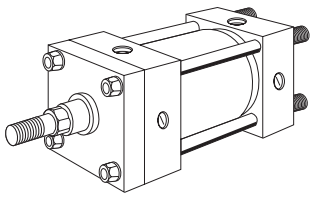
MX0 (see Page 24, 25)



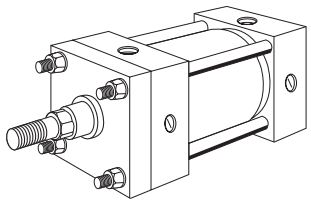
MX1 (see Page 24, 25)



MX2 (see Page 24, 25)

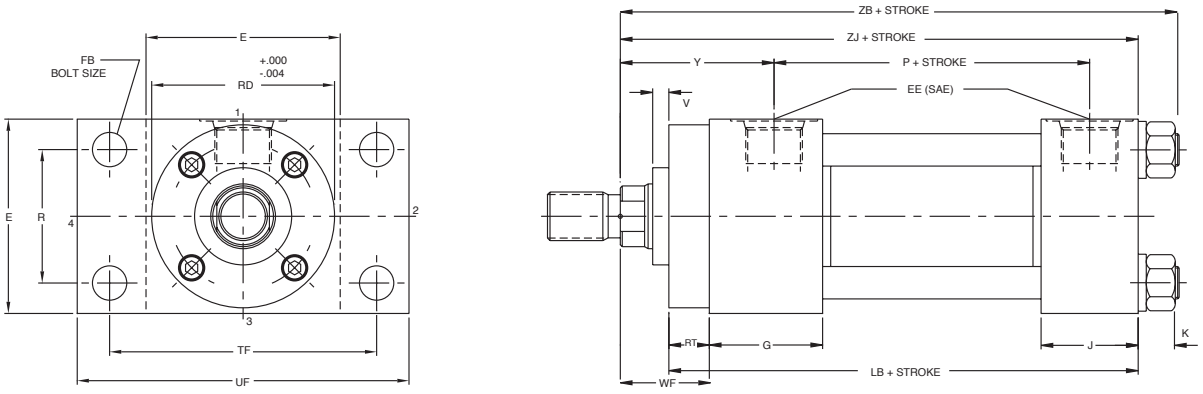


MX3 (see Page 24, 25)

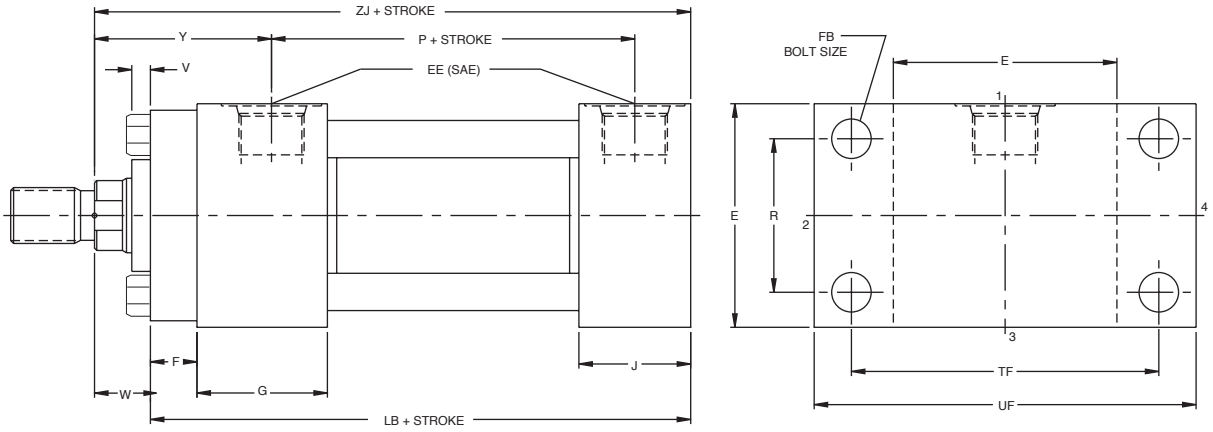


Mounting ME5, ME6

CDT4 ME5



CDT4 ME6



Dimensions ME5, ME6

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	Y	RD*	W	WF	ZB	ZJ	RT
1.500	0.625	0.25	2.00	2.125	0.63	1.00	6.06	5.63	.38
	1.000	0.50	2.38	2.500	1.00	1.38	6.43	6.00	.38
2.000	1.000	0.50	2.38	2.500	0.75	1.38	6.57	6.00	.38
	1.375	0.62	2.63	3.000	1.00	1.63	6.82	6.25	.38
2.500	1.000	0.50	2.38	2.500	0.75	1.38	6.70	6.13	.38
	1.375	0.62	2.63	3.000	1.00	1.63	6.95	6.38	.38
	1.750	0.75	2.88	3.500	1.25	1.88	7.20	6.63	.38
3.250	1.375	0.62	2.75	3.000	0.88	1.63	7.85	7.13	.38
	1.750	0.75	3.00	3.500	1.13	1.88	8.10	7.38	.38
	2.000	0.50	3.13	4.000	1.25	2.00	8.22	7.50	.63
4.000	1.750	0.75	3.00	3.500	1.00	1.88	8.35	7.63	.38
	2.000	0.50	3.13	4.000	1.13	2.00	8.48	7.75	.63
	2.500	0.63	3.38	4.500	1.38	2.25	8.73	8.00	.63
5.000	2.000	0.50	3.13	4.000	1.13	2.00	9.26	8.25	.63
	2.500	0.63	3.38	4.500	1.38	2.25	9.51	8.50	.63
	3.000	0.63	3.38	5.250	1.38	2.25	9.51	8.50	.63
	3.500	0.63	3.38	5.750	1.38	2.25	9.51	8.50	.63
6.000	2.500	0.63	3.50	4.500	1.25	2.25	10.77	9.63	.63
	3.000	0.63	3.50	5.250	1.25	2.25	10.77	9.63	.63
	3.500	0.63	3.50	5.750	1.25	2.25	10.77	9.63	.63
	4.000	0.50	3.50	6.500	1.25	2.25	10.77	9.63	.75
7.000	3.000	0.63	3.75	5.250	1.63	2.25	12.03	10.75	.63
	3.500	0.63	3.75	5.750	1.63	2.25	12.03	10.75	.63
	4.000	0.50	3.75	6.500	1.50	2.25	12.03	10.75	.75
	4.500	0.50	3.75	7.000	1.50	2.25	12.03	10.75	.75
	5.000	0.25	3.75	7.250	1.25	2.25	12.03	10.75	1.00
8.000	3.500	0.63	3.88	5.750	1.63	2.25	13.16	11.75	.63
	4.000	0.50	3.88	6.500	1.50	2.25	13.16	11.75	.75
	4.500	0.50	3.88	7.000	1.50	2.25	13.16	11.75	.75
	5.000	0.50	3.88	7.250	1.25	2.25	13.16	11.75	1.00
	5.500	0.25	3.88	8.250	1.25	2.25	13.16	11.75	1.00

Solid head and cap flange mounts are some of the strongest, most rigid methods of mounting cylinders. The head flange type mounting is best in a tension application. The cap flange type mounting is best in a thrust application.

Rod end options shown on page 6.

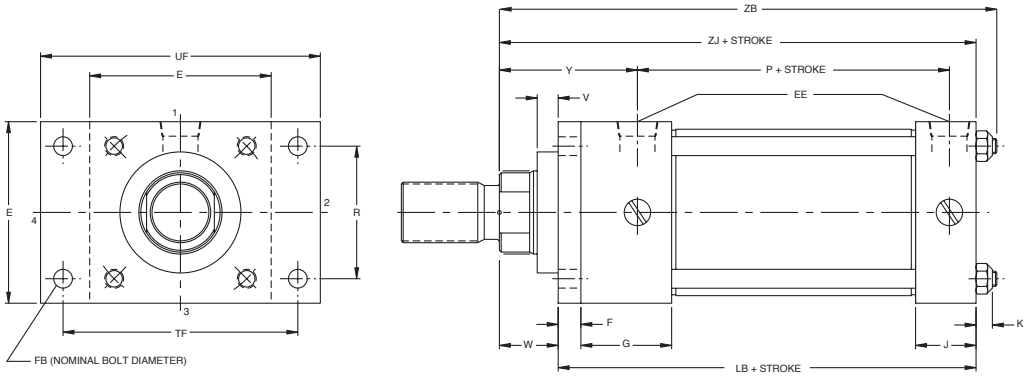
***Note:** "RD" dimension is not specified by NFPA. Please verify this dimension for retrofit or replacement applications.

Table 2 - Dimensions not affected by rod diameter

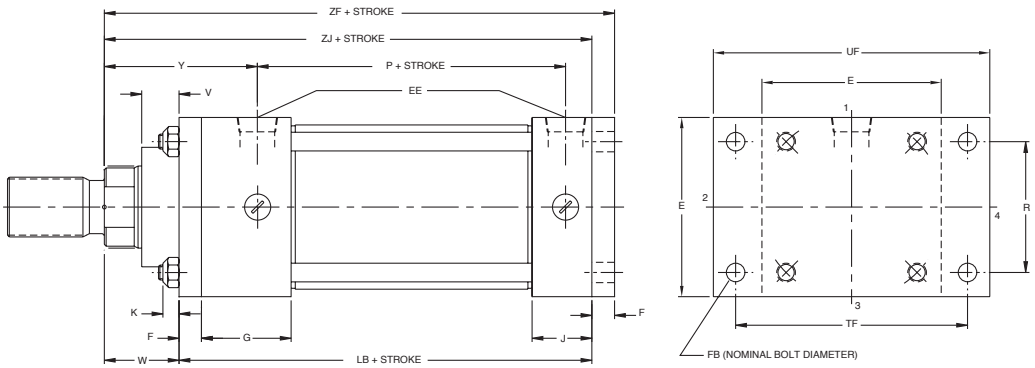
Bore In.	E	F	G	J	K	P	R	SAE Port EE	FB Bolt	LB	TF	UF
1.500	2.50	0.38	1.75	1.50	0.33	2.88	1.63	-10	0.38	5.00	3.44	4.25
2.000	3.00	0.63	1.75	1.50	0.44	2.88	2.06	-10	0.50	5.25	4.13	5.13
2.500	3.50	0.63	1.75	1.50	0.44	3.00	2.56	-10	0.50	5.38	4.63	5.63
3.250	4.50	0.75	2.00	1.75	0.55	3.50	3.25	-12	0.63	6.25	5.88	7.13
4.000	5.00	0.88	2.00	1.75	0.55	3.75	3.81	-12	0.63	6.63	6.38	7.63
5.000	6.50	0.88	2.00	1.75	0.77	4.25	4.94	-12	0.88	7.13	8.19	9.75
6.000	7.50	1.00	2.25	2.25	0.85	4.88	5.72	-16	1.00	8.38	9.44	11.25
7.000	8.50	1.00	2.75	2.75	0.95	5.50	6.58	-20	1.13	9.50	10.63	12.63
8.000	9.50	1.00	3.00	3.00	1.05	6.25	7.50	-24	1.25	10.50	11.81	14.00

Mounting MF1, MF2, MF5, MF6

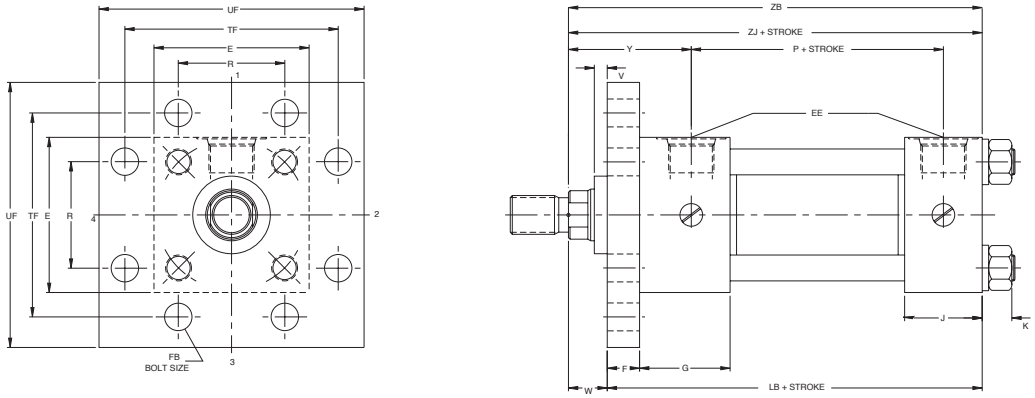
CDT4 MF1



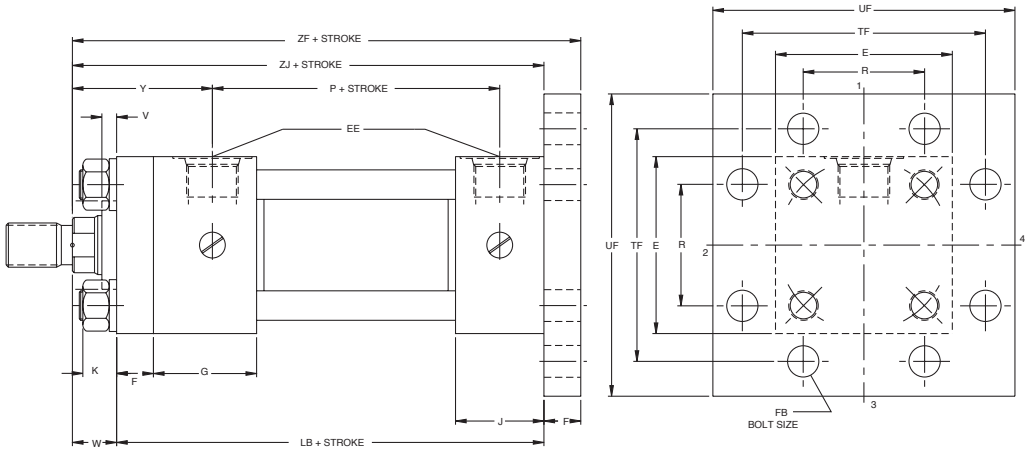
CDT4 MF2



CDT4 MF5



CDT4 MF6



Dimensions MF1, MF2, MF5, MF6

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	RT	ZB	ZF	ZJ	WF
1.500	0.625	0.25	0.63	2.00	-	-	6.06	6.00	5.63	-
	1.000	0.50	1.00	2.38	-	-	6.43	6.38	6.00	-
2.000	1.000	0.25	0.75	2.38	-	-	6.57	6.63	6.00	-
	1.375	0.38	1.00	2.63	-	-	6.82	6.88	6.25	-
2.500	1.000	0.25	0.75	2.38	-	-	6.70	6.75	6.13	-
	1.375	0.38	1.00	2.63	-	-	6.95	7.00	6.38	-
	1.750	0.50	1.25	2.88	-	-	7.20	7.25	6.63	-
3.250	1.375	0.25	0.88	2.75	-	-	7.85	7.88	7.13	-
	1.750	0.38	1.13	3.00	-	-	8.10	8.13	7.38	-
	2.000	0.38	1.25	3.13	-	-	8.22	8.25	7.50	-
4.000	1.750	0.25	1.00	3.00	-	-	8.35	8.50	7.63	-
	2.000	0.25	1.13	3.13	-	-	8.48	8.63	7.75	-
	2.500	0.38	1.38	3.38	-	-	8.73	8.88	8.00	-
5.000	2.000	0.25	1.13	3.13	-	-	9.26	9.13	8.25	-
	2.500	0.38	1.38	3.38	-	-	9.51	9.38	8.50	-
	3.000	0.38	1.38	3.38	-	-	9.51	9.38	8.50	-
	3.500	0.38	1.38	3.38	-	-	9.51	9.38	8.50	-
6.000	2.500	0.25	1.25	3.50	-	-	10.77	10.63	9.63	-
	3.000	0.25	1.25	3.50	-	-	10.77	10.63	9.63	-
	3.500	0.25	1.25	3.50	-	-	10.77	10.63	9.63	-
	4.000	0.25	1.25	3.50	-	-	10.77	10.63	9.63	-
7.000	3.000	0.63	1.63	3.75	5.25	.63	12.00	11.75	10.75	2.63
	3.500	0.63	1.63	3.75	5.75	.63	12.00	11.75	10.75	2.63
	4.000	0.50	1.50	3.75	6.50	.75	12.00	11.75	10.75	2.50
	4.500	0.50	1.50	3.75	6.50	.75	12.00	11.75	10.75	2.50
	5.000	0.25	1.25	3.75	7.75	1.00	12.00	11.75	10.75	2.25
8.000	3.500	0.63	1.63	3.88	5.75	.63	13.25	12.75	11.75	2.63
	4.000	0.50	1.50	3.88	6.50	.75	13.25	12.75	11.75	2.50
	4.500	0.50	1.50	3.88	7.00	.75	13.25	12.75	11.75	2.50
	5.000	0.25	1.25	3.88	7.25	1.00	13.25	12.75	11.75	2.25
	5.500	0.25	1.25	3.88	8.25	1.00	13.25	12.75	11.75	2.25

"RT" dimension replaces "F" dimension on 7" - 8" bore sizes, except MF1 & MF5 mounts
"WF" dimension equals "W" + "F" on 7" - 8" bore sizes

Table 2 - Dimensions not affected by rod diameter

Bore In.	E	SAE Port EE	F	FB Bolt	G	J	K	LB	P	R	TF	UF
1.500	2.50	-10	0.38	0.38	1.75	1.50	0.34	5.00	2.88	1.63	3.44	4.25
2.000	3.00	-10	0.63	0.50	1.75	1.50	0.44	5.25	2.88	2.06	4.13	5.13
2.500	3.50	-10	0.63	0.50	1.75	1.50	0.44	5.38	3.00	2.56	4.63	5.63
3.250	4.50	-12	0.75	0.63	2.00	1.75	0.55	6.25	3.50	3.25	5.88	7.13
4.000	5.00	-12	0.88	0.63	2.00	1.75	0.55	6.63	3.75	3.81	6.38	7.63
5.000	6.50	-12	0.88	0.88	2.00	1.75	0.77	7.13	4.25	4.94	8.19	9.75
6.000	7.50	-16	1.00	1.00	2.25	2.25	0.85	8.38	4.88	5.72	9.44	11.25
7.000	8.50	-20	1.00	1.13	2.75	2.75	0.95	9.50	5.50	6.58	10.63	12.63
8.000	9.50	-24	1.00	1.25	3.00	3.00	1.05	10.50	6.25	7.50	11.81	14.00

Dimensions MF1, MF2

Table 1 - Maximum pressure rating for flange mounted cylinders.

Bore Size	Rod Dia.	Push MF1*	Pull MF2*
1.500	0.625	2,500	3,000
	1.000	1,500	3,000
2.000	1.000	2,500	3,000
	1.375	1,500	3,000
2.500	1.000	2,500	3,000
	1.375	1,900	3,000
	1.750	1,500	3,000
3.250	1.375	2,500	3,000
	1.750	2,100	3,000
	2.000	1,500	3,000
4.000	1.750	2,500	3,000
	2.000	1,800	3,000
	2.500	1,500	3,000
5.000	2.000	2,200	2,000
	2.500	1,650	2,500
	3.000	1,200	2,800
	3.500	750	3,000
6.000	2.500	1,800	2,000
	3.000	1,450	2,500
	3.500	1,100	2,800
	4.000	750	3,000
7.000	3.000		
	3.500	Order	Order
	4.000	ME5	ME6
	4.500	Mount	Mount
	5.000		
8.000	3.500		
	4.000	Order	Order
	4.500	ME5	ME6
	5.000	Mount	Mount
	5.500		

* Maximum pressure rating for MF1 Push applications

* Maximum pressure rating for MF2 Pull applications

Flange mounts are one of the strongest, most rigid methods of mounting. With this type of mount, there is little allowance for misalignment, so when long strokes are required, the free end opposite the mounting should be supported to prevent sagging and possible binding of the cylinder. Blind end mounts are best in a thrust load application and rod end mounts are best in tension applications. If an application exceeds the rectangular flange rating, a solid head or cap flange mount ME5 or ME6 is available (refer to page 8). When a less rigid mount can be used and the cylinder can be attached to a panel or bulkhead, an extended tie rod mount could be considered.

Notes: The bearing retainer plate is the same as the “E” dimension for 1-1/2”–6” bore sizes and the “RD” dimension for the 7”–8” bore sizes. Removable bearing retainer is not available in the 1-1/2”–6” bore sizes.

Rod end options shown on page 6.

Mounting and Dimensions MP1

CDT4 MP1

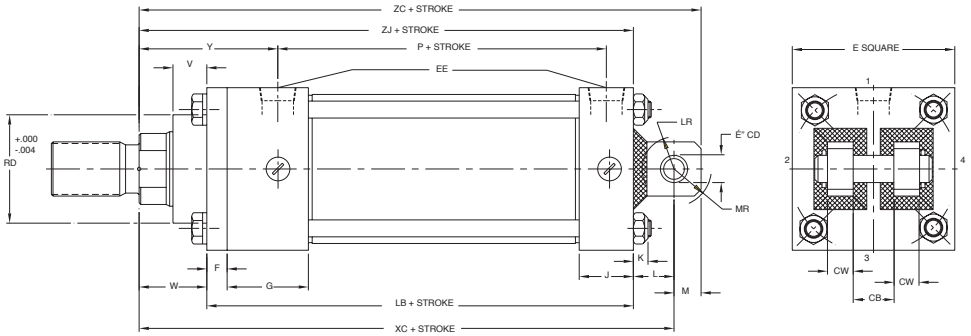


Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	RT	XC	ZC	ZJ
1.500	0.625	0.25	0.63	2.00	-	-	6.38	6.88	5.63
	1.000	0.50	1.00	2.38	-	-	6.75	7.25	6.00
2.000	1.000	0.25	0.75	2.38	-	-	7.25	8.00	6.00
	1.375	0.38	1.00	2.63	-	-	7.50	8.25	6.25
2.500	1.000	0.25	0.75	2.38	-	-	7.38	8.13	6.13
	1.375	0.38	1.00	2.63	-	-	7.63	8.38	6.38
	1.750	0.50	1.25	2.88	-	-	7.88	8.63	6.63
3.250	1.375	0.25	0.88	2.75	-	-	8.63	9.63	7.13
	1.750	0.38	1.13	3.00	-	-	8.88	9.88	7.38
	2.000	0.38	1.25	3.13	-	-	9.00	10.00	7.50
4.000	1.750	0.25	1.00	3.00	-	-	9.75	11.13	7.63
	2.000	0.25	1.13	3.13	-	-	9.88	11.25	7.75
	2.500	0.38	1.38	3.38	-	-	10.13	11.50	8.00
5.000	2.000	0.25	1.13	3.13	-	-	10.50	12.25	8.25
	2.500	0.38	1.38	3.38	-	-	10.75	12.50	8.50
	3.000	0.38	1.38	3.38	-	-	10.75	12.50	8.50
	3.500	0.38	1.38	3.38	-	-	10.75	12.50	8.50
6.000	2.500	0.25	1.25	3.50	-	-	12.13	14.13	9.63
	3.000	0.25	1.25	3.50	-	-	12.13	14.13	9.63
	3.500	0.25	1.25	3.50	-	-	12.13	14.13	9.63
	4.000	0.25	1.25	3.50	-	-	12.13	14.13	9.63
7.000	3.000	0.63	1.63	3.75	5.25	.63	13.75	16.25	10.75
	3.500	0.63	1.63	3.75	5.75	.63	13.75	16.25	10.75
	4.000	0.50	1.50	3.75	6.50	.75	13.75	16.25	10.75
	4.500	0.50	1.50	3.75	6.50	.75	13.75	16.25	10.75
	5.000	0.25	1.25	3.75	7.75	1.00	13.75	16.25	10.75
8.000	3.500	0.63	1.63	3.88	5.75	.63	15.00	17.75	11.75
	4.000	0.50	1.50	3.88	6.50	.75	15.00	17.75	11.75
	4.500	0.50	1.50	3.88	7.00	.75	15.00	17.75	11.75
	5.000	0.25	1.25	3.88	7.25	1.00	15.00	17.75	11.75
	5.500	0.25	1.25	3.88	8.25	1.00	15.00	17.75	11.75

"RT" dimension replaces "F" dimension on 7" - 8" bore sizes

The Clevis or Pin mounted cylinder is probably the most widely used of all mounts. For short strokes, medium or small cylinder applications, the clevis mounts are recommended. If this mount is applied where stroke requirements cause the overall length to be excessive, the Cap Trunnion mount can be used. Pivot mounts must always be used with a pivot type rod end attachment. Pivot pin and retainer rings included with MP1 mount.

The bearing retainer plate is the same as the “E” dimension for 1-1/2”–6” bore sizes and the “RD” dimension for the 7”–8” bore sizes. Rod end options shown on page 6.

Table 2 - Dimensions not affected by rod diameter

Bore In.	CB	CD	CW	E	SAE Port EE	F	G	J	K	L	LB	LR	M	MR	P
1.500	0.75	0.500	0.50	2.50	-10	0.38	1.75	1.50	0.33	0.75	5.00	0.59	0.50	0.69	2.88
2.000	1.25	0.750	0.63	3.00	-10	0.63	1.75	1.50	0.44	1.25	5.25	0.88	0.75	0.94	2.88
2.500	1.25	0.750	0.63	3.50	-10	0.63	1.75	1.50	0.44	1.25	5.38	0.88	0.75	0.94	3.00
3.250	1.50	1.000	0.75	4.50	-12	0.75	2.00	1.75	0.55	1.50	6.25	1.13	1.00	1.25	3.50
4.000	2.00	1.375	1.00	5.00	-12	0.88	2.00	1.75	0.55	2.13	6.63	1.75	1.38	1.63	3.75
5.000	2.50	1.750	1.25	6.50	-12	0.88	2.00	1.75	0.77	2.25	7.13	1.88	1.75	2.00	4.25
6.000	2.50	2.000	1.25	7.50	-16	1.00	2.25	2.25	0.85	2.50	8.38	2.13	2.00	2.38	4.88
7.000	3.00	2.500	1.50	8.50	-20	-	2.75	2.75	0.95	3.00	9.50	2.38	2.50	2.88	5.50
8.000	3.00	3.000	1.50	9.50	-24	-	3.00	3.00	1.05	3.25	10.50	2.63	2.75	3.13	6.25

Mounting MP5

CDT4 MP5

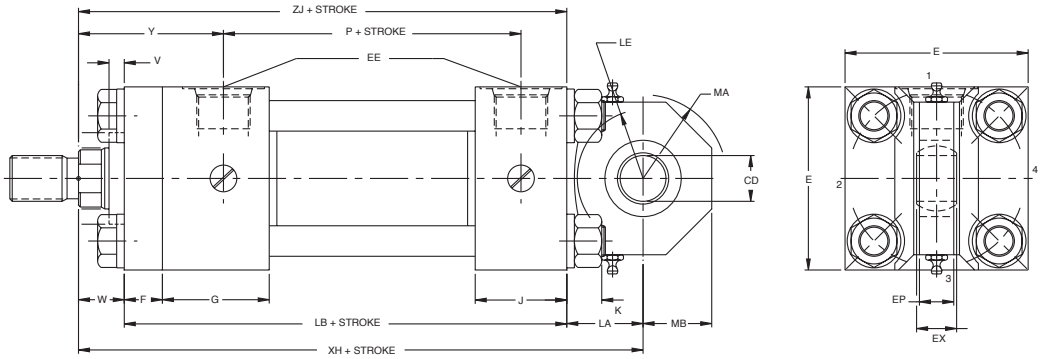


Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	XH	ZH	ZJ
1.500	0.625	0.25	0.63	2.00	6.38	7.13	5.63
	1.000	0.50	1.00	2.38	6.75	7.50	6.00
2.000	1.000	0.25	0.75	2.38	7.25	8.34	6.00
	1.375	0.38	1.00	2.63	7.50	8.63	6.25
2.500	1.000	0.25	0.75	2.38	7.38	8.50	6.13
	1.375	0.38	1.00	2.63	7.63	8.75	6.38
	1.750	0.50	1.25	2.88	7.88	9.00	6.63
3.250	1.375	0.25	0.88	2.75	8.63	10.13	7.13
	1.750	0.38	1.13	3.00	8.88	10.38	7.38
	2.000	0.38	1.25	3.13	9.00	10.50	7.50
4.000	1.750	0.25	1.00	3.00	9.75	11.69	7.63
	2.000	0.25	1.13	3.13	9.88	11.94	7.75
	2.500	0.38	1.38	3.38	10.13	12.19	8.00
5.000	2.000	0.25	1.13	3.13	10.50	13.19	8.25
	2.500	0.38	1.38	3.38	10.75	13.44	8.50
	3.000	0.38	1.38	3.38	10.75	13.44	8.50
	3.500	0.38	1.38	3.38	10.75	13.44	8.50
6.000	2.500	0.25	1.25	3.50	12.13	15.31	9.63
	3.000	0.25	1.25	3.50	12.13	15.31	9.63
	3.500	0.25	1.25	3.50	12.13	15.31	9.63
	4.000	0.25	1.25	3.50	12.13	15.31	9.63

The MP5 (Universal) type mount is a pivot mount with a spherical bearing fitted into the pivot to permit 5 to 10 degrees of movement in a plane perpendicular to the major plane of pivot movement. It is probably the most serviceable of the pivoted centerline mounts. For maximum effectiveness, a spherical rod end fitting should be utilized at the same time.

Rod end options shown on page 6.

Bore	Max. Operating Pressure *
1.500	1,800
2.000	2,250
2.500	1,450
3.250	1,500
4.000	1,850
5.000	1,950
6.000	1,800

* Maximum operating pressure at 4:1 design factor based on tensile strength of material. Pressure ratings are based on standard commercial bearing ratings.

Table 2 - Dimensions not affected by rod diameter

Bore In.	CD	E	SAE Port EE	EX	EP	F	G	J	K	LA	LB	LE	MA	MB	P
1.500	0.500	2.50	-10	0.44	0.38	0.38	1.75	1.50	0.325	0.75	5.00	0.63	0.88	0.75	2.88
2.000	0.750	3.00	-10	0.66	0.56	0.63	1.75	1.50	0.437	1.25	5.25	1.13	1.38	1.13	2.88
2.500	0.750	3.50	-10	0.66	0.56	0.63	1.75	1.50	0.437	1.25	5.38	1.13	1.38	1.13	3.00
3.250	1.000	4.50	-12	0.88	0.75	0.75	2.00	1.75	0.547	1.50	6.25	1.38	1.84	1.50	3.50
4.000	1.375	5.00	-12	1.19	1.03	0.88	2.00	1.75	0.547	2.13	6.63	1.94	2.25	2.06	3.75
5.000	1.750	6.50	-12	1.53	1.31	0.88	2.00	1.75	0.766	2.25	7.13	2.06	2.88	2.69	4.25
6.000	2.000	7.50	-16	1.75	1.50	1.00	2.25	2.25	0.845	2.50	8.38	2.31	3.31	3.06	4.88

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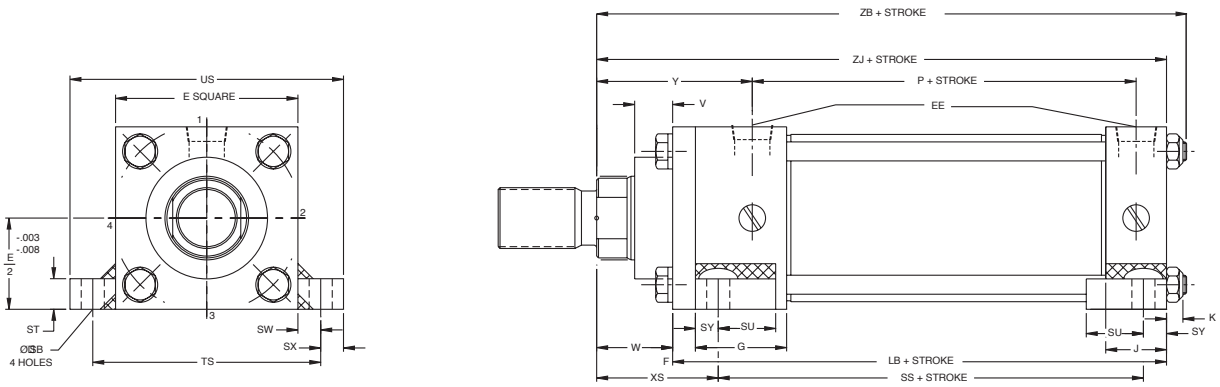
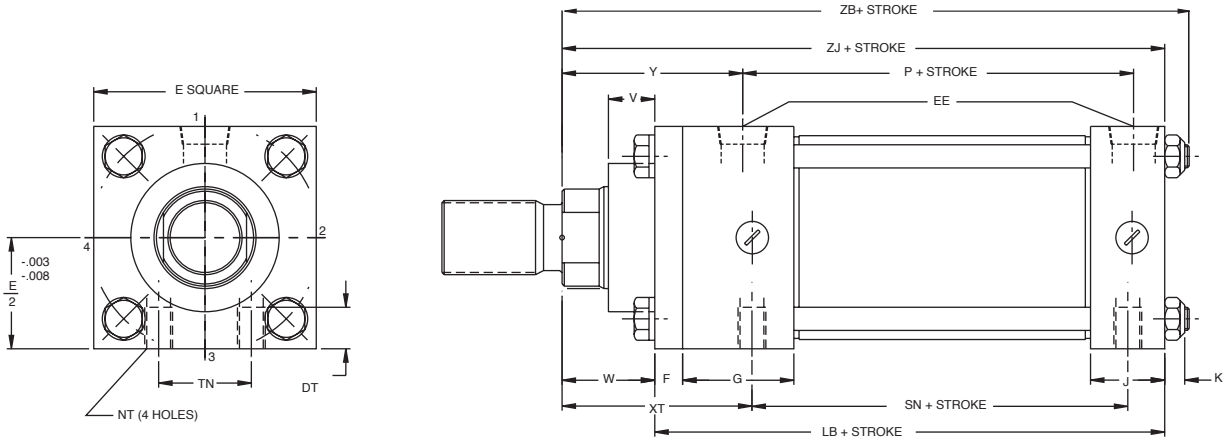
Mounting MS2, MS4

CDT4 MS2



CDT4 MS4



The side or lug mounted cylinder provides a fairly rigid mount. These type mounts can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly, the mounting bolts are either in simple shear or tension without any compound stresses. An extended key plate option is available to eliminate the need for fitted bolts or external keys to carry the thrust load.

Note:
When specifying an MS2 mount with ports in the 2 or 4 quandrant, be sure to see that sufficient clearance between the port fitting and the lug is available to insert a bolt or cap screw into the lug.

Rod end options shown on page 6.

Dimensions MS2, MS4

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	RT	XS	XT	ZB	ZJ
1.500	0.625	0.25	0.63	2.00	-	-	1.38	2.00	6.06	5.63
	1.000	0.50	1.00	2.38	-	-	1.75	2.38	6.43	6.00
2.000	1.000	0.25	0.75	2.38	-	-	1.88	2.38	6.57	6.00
	1.375	0.38	1.00	2.63	-	-	2.13	2.63	6.82	6.25
2.500	1.000	0.25	0.75	2.38	-	-	2.06	2.38	6.70	6.13
	1.375	0.38	1.00	2.63	-	-	2.31	2.63	6.95	6.38
	1.750	0.50	1.25	2.88	-	-	2.56	2.88	7.20	6.63
3.250	1.375	0.25	0.88	2.75	-	-	2.31	2.75	7.85	7.13
	1.750	0.38	1.13	3.00	-	-	2.56	3.00	8.10	7.38
	2.000	0.38	1.25	3.13	-	-	2.68	3.13	8.22	7.50
4.000	1.750	0.25	1.00	3.00	-	-	2.75	3.00	8.35	7.63
	2.000	0.25	1.13	3.13	-	-	2.88	3.13	8.48	7.75
	2.500	0.38	1.38	3.38	-	-	3.13	3.38	8.73	8.00
5.000	2.000	0.25	1.13	3.13	-	-	2.88	3.13	9.26	8.25
	2.500	0.38	1.38	3.38	-	-	3.13	3.38	9.51	8.50
	3.000	0.38	1.38	3.38	-	-	3.13	3.38	9.51	8.50
	3.500	0.38	1.38	3.38	-	-	3.13	3.38	9.51	8.50
6.000	2.500	0.25	1.25	3.50	-	-	3.38	3.50	10.77	9.63
	3.000	0.25	1.25	3.50	-	-	3.38	3.50	10.77	9.63
	3.500	0.25	1.25	3.50	-	-	3.38	3.50	10.77	9.63
	4.000	0.25	1.25	3.50	-	-	3.38	3.50	10.77	9.63
7.000	3.000	0.63	1.63	3.75	5.250	.63	3.63	3.81	12.00	10.75
	3.500	0.63	1.63	3.75	5.750	.63	3.63	3.81	12.00	10.75
	4.000	0.50	1.50	3.75	6.500	.75	3.63	3.81	12.00	10.75
	4.500	0.50	1.50	3.75	6.500	.75	3.63	3.81	12.00	10.75
	5.000	0.25	1.25	3.75	7.750	1.00	3.63	3.81	12.00	10.75
8.000	3.500	0.63	1.63	3.88	5.750	.63	3.63	3.93	13.25	11.75
	4.000	0.50	1.50	3.88	6.500	.75	3.63	3.93	13.25	11.75
	4.500	0.50	1.50	3.88	7.000	.75	3.63	3.93	13.25	11.75
	5.000	0.25	1.25	3.88	7.250	1.00	3.63	3.93	13.25	11.75
	5.500	0.25	1.25	3.88	8.250	1.00	3.63	3.93	13.25	11.75

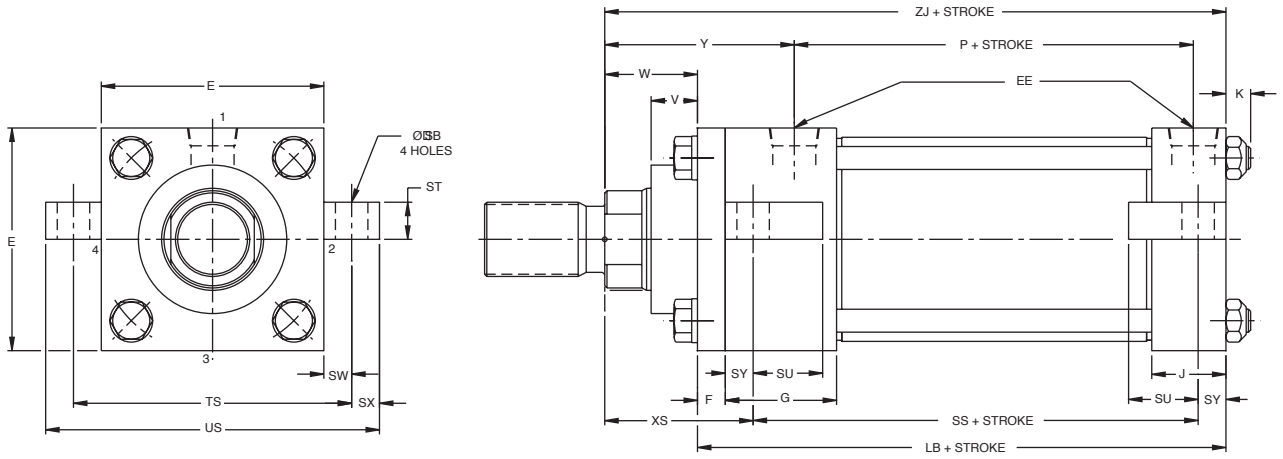
"RT" dimension replaces "F" dimension on 7" - 8" bore sizes

Table 2 - Dimensions not affected by rod diameter

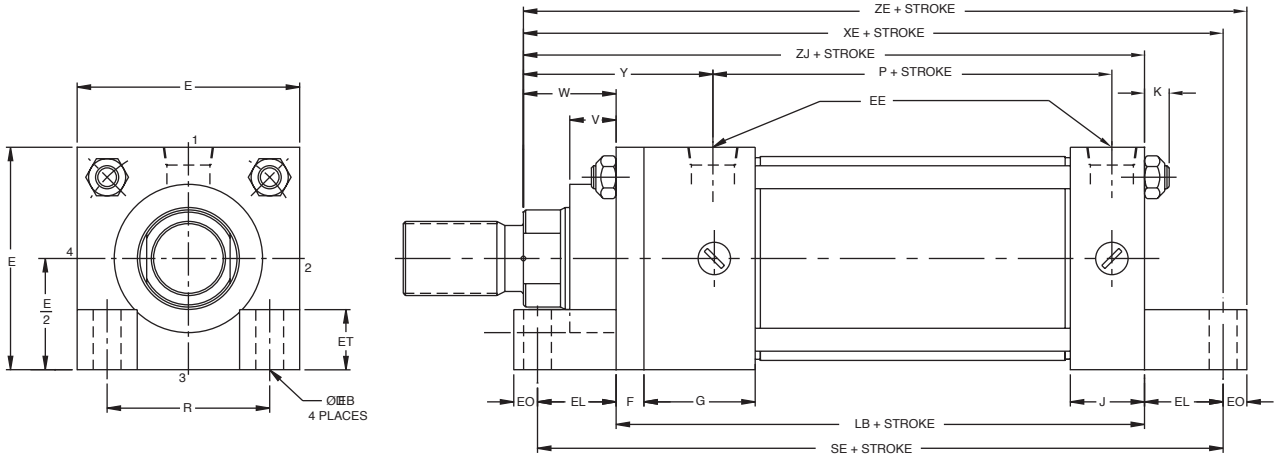
Bore In.	DT	E	SAE Port EE	F	G	J	K	LB	NT-THD	P	SB Bolt	SN	SS	ST	SU	SW	SX	SY	TN	TS	US
1.500	0.41	2.50	-10	0.38	1.75	1.50	0.33	5.00	0.38-16	2.88	0.38	2.88	3.88	0.50	0.94	0.38	0.38	0.38	0.75	3.25	4.00
2.000	0.50	3.00	-10	0.63	1.75	1.50	0.44	5.25	0.50-13	2.88	0.50	2.88	3.63	0.75	1.25	0.50	0.50	0.50	0.94	4.00	5.00
2.500	0.50	3.50	-10	0.63	1.75	1.50	0.44	5.38	0.63-11	3.00	0.75	3.00	3.38	1.00	1.56	0.69	0.69	0.69	1.31	4.88	6.25
3.250	0.75	4.50	-12	0.75	2.00	1.75	0.55	6.25	0.75-10	3.50	0.75	3.50	4.12	1.00	1.56	0.69	0.69	0.69	1.50	5.88	7.25
4.000	0.75	5.00	-12	0.88	2.00	1.75	0.55	6.63	1.00-8	3.75	1.00	3.75	4.00	1.25	2.00	0.88	0.88	0.88	2.06	6.75	8.50
5.000	0.75	6.50	-12	0.88	2.00	1.75	0.76	7.13	1.00-8	4.25	1.00	4.25	4.50	1.25	2.00	0.88	0.88	0.88	2.94	8.25	10.00
6.000	1.00	7.50	-16	1.00	2.25	2.25	0.85	8.38	1.25-7	4.88	1.25	5.13	5.13	1.50	2.50	1.13	1.13	1.13	3.31	9.75	12.00
7.000	1.13	8.50	-20	-	2.75	2.75	0.95	9.50	1.50-6	5.50	1.50	5.88	5.75	1.75	2.88	1.38	1.38	1.38	3.75	11.25	14.00
8.000	1.50	9.50	-24	-	3.00	3.00	1.05	10.50	1.50-6	6.25	1.50	6.63	6.75	1.75	2.88	1.38	1.38	1.38	4.25	12.25	15.00

Mounting MS3, MS7

CDT4 MS3



CDT4 MS7



The side or lug mounted cylinder provides a fairly rigid mount. These type mounts can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly, the mounting bolts are either in simple shear or tension without any compound stresses. An extended key plate option is available to eliminate the need for fitted bolts or external keys to carry the thrust load (see page 34).

Notes: The MS3 and MS7 mounts are only offered in 1-1/2"–6" bore sizes and have a square retainer the same size as the head.

When specifiying an MS7 mount, carefully check the distance between the rod and lug to determine sufficient clearnace for the rod end attachment. It may be necessary to add extra plain rod extension to move the threaded rod end out beyond the lug. The lugs serve as nuts on the bottom two tie rods therefore making it necessary to loosen the tie rods to remove the rod bearing.

Rod end options shown on page 6.

Dimensions MS3, MS7

Table 1 - Dimensions affected by rod diameter

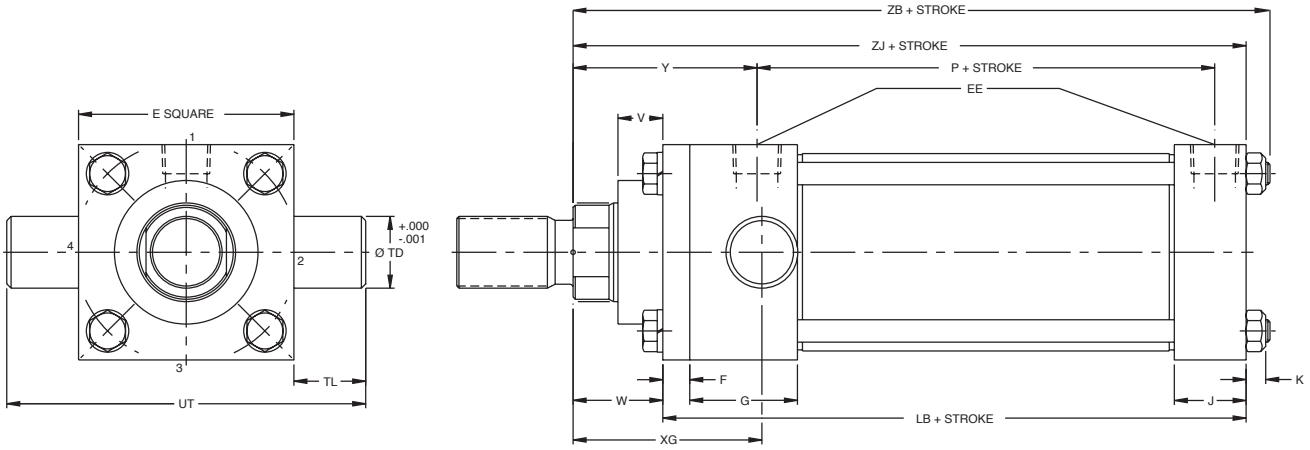
Bore In.	MM Rod	V	W	Y	XS	ZJ	XE	ZE
1.500	0.625	0.25	0.63	2.00	1.38	5.63	6.50	6.88
	1.000	0.25	1.00	2.38	2.38	6.00	6.88	7.25
2.000	1.000	0.25	0.75	2.38	1.88	6.00	6.94	7.44
	1.375	0.38	1.00	2.63	2.13	6.25	7.18	7.69
2.500	1.000	0.25	0.75	2.38	2.06	6.13	7.06	7.56
	1.375	0.38	1.00	2.63	2.31	6.38	7.31	7.81
	1.750	0.50	1.25	2.88	2.56	6.63	7.56	8.06
3.250	1.375	0.25	0.88	2.75	2.31	7.13	8.25	8.88
	1.750	0.38	1.13	3.00	2.56	7.38	8.50	9.13
	2.000	0.38	1.25	3.13	2.68	7.50	8.63	9.25
4.000	1.750	0.25	1.00	3.00	2.75	7.63	8.75	9.38
	2.000	0.25	1.13	3.13	2.88	7.75	8.88	9.50
	2.500	0.38	1.38	3.38	3.13	8.00	9.13	9.75
5.000	2.000	0.25	1.13	3.13	2.88	8.25	9.75	10.50
	2.500	0.38	1.38	3.38	3.13	8.50	10.00	10.75
	3.000	0.38	1.38	3.38	3.13	8.50	10.00	10.75
	3.500	0.38	1.38	3.38	3.13	8.50	10.00	10.75
6.000	2.500	0.25	1.25	3.50	3.38	9.63	11.31	12.19
	3.000	0.25	1.25	3.50	3.38	9.63	11.31	12.19
	3.500	0.25	1.25	3.50	3.38	9.63	11.31	12.19
	4.000	0.25	1.25	3.50	3.38	9.63	11.31	12.19

Table 2 - Dimensions not affected by rod diameter

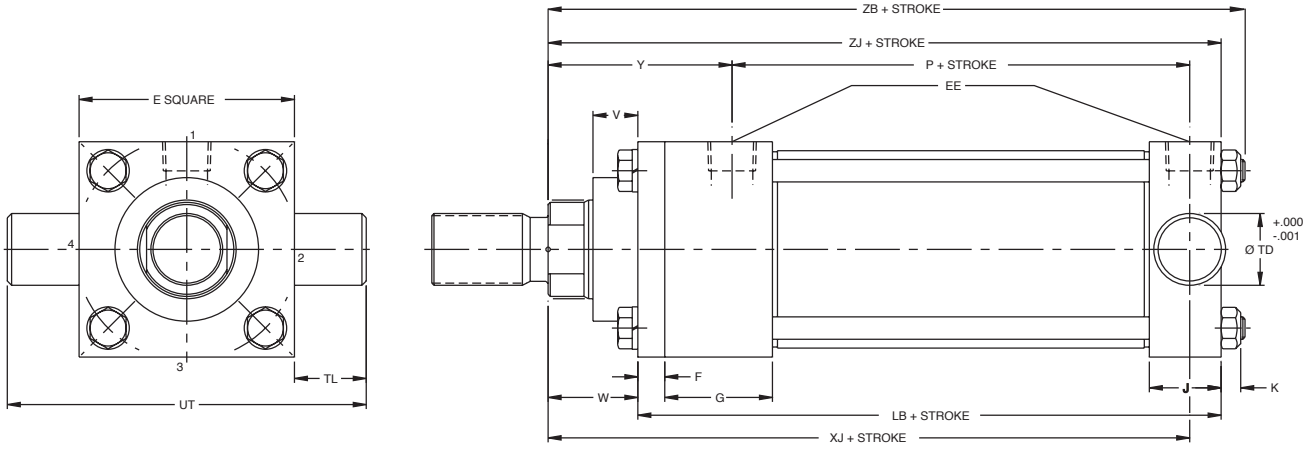
Bore In.	E	EB Bolt	SAE Port EE	EL	EO	ET	F	G	J	K	LB	NT THD	P	R	SB Bolt	SE	SS	ST	SU	SW	SX	SY	TN	TS	US
1.500	2.50	0.38	-10	0.88	0.38	0.81	0.38	1.75	1.50	0.33	5.00	0.38-16	2.88	1.63	0.38	6.75	3.88	0.50	0.94	0.38	0.38	0.38	0.75	3.25	4.00
2.000	3.00	0.50	-10	0.94	0.50	0.88	0.63	1.75	1.50	0.44	5.25	0.50-13	2.88	2.05	0.50	7.13	3.63	0.75	1.25	0.50	0.50	0.50	0.94	4.00	5.00
2.500	3.50	0.50	-10	0.94	0.50	0.88	0.63	1.75	1.50	0.44	5.38	0.63-11	3.00	2.55	0.75	7.25	3.38	1.00	1.56	0.69	0.69	0.69	1.31	4.88	6.25
3.250	4.50	0.62	-12	1.13	0.63	1.19	0.75	2.00	1.75	0.55	6.25	0.75-10	3.50	3.25	0.75	8.50	4.12	1.00	1.56	0.69	0.69	0.69	1.50	5.88	7.25
4.000	5.00	0.62	-12	1.13	0.63	1.13	0.88	2.00	1.75	0.55	6.63	1.00-8	3.75	3.82	1.00	8.88	4.00	1.25	2.00	0.88	0.88	0.88	2.06	6.75	8.50
5.000	6.50	0.88	-12	1.50	0.75	1.47	0.88	2.00	1.75	0.77	7.13	1.00-8	4.25	4.95	1.00	10.13	4.50	1.25	2.00	0.88	0.88	0.88	1.94	8.25	10.00
6.000	7.50	1.00	-16	1.69	0.88	1.69	1.00	2.25	2.25	0.85	8.38	1.25-7	4.88	5.73	1.25	11.75	5.13	1.50	2.50	1.13	1.13	1.13	3.31	9.75	12.00

Mounting MT1, MT2

CDT4 MT1



CDT4 MT2



Dimensions MT1, MT2

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	RT	XG	XJ	ZB	ZJ
1.500	0.625	0.25	0.63	2.00	-	-	1.88	4.88	6.06	5.63
	1.000	0.50	1.00	2.38	-	-	2.25	5.25	6.43	6.00
2.000	1.000	0.25	0.75	2.38	-	-	2.25	5.25	6.57	6.00
	1.375	0.38	1.00	2.63	-	-	2.50	5.50	6.82	6.25
2.500	1.000	0.25	0.75	2.38	-	-	2.25	5.38	6.70	6.13
	1.375	0.38	1.00	2.63	-	-	2.50	5.63	6.95	6.38
	1.750	0.50	1.25	2.88	-	-	2.75	5.88	7.20	6.63
3.250	1.375	0.25	0.88	2.75	-	-	2.63	6.25	7.85	7.13
	1.750	0.38	1.13	3.00	-	-	2.88	6.50	8.10	7.38
	2.000	0.38	1.25	3.13	-	-	3.00	6.63	8.22	7.50
4.000	1.750	0.25	1.00	3.00	-	-	2.88	6.75	8.35	7.63
	2.000	0.25	1.13	3.13	-	-	3.00	6.88	8.48	7.75
	2.500	0.38	1.38	3.38	-	-	3.25	7.13	8.73	8.00
5.000	2.000	0.25	1.13	3.13	-	-	3.00	7.38	9.26	8.25
	2.500	0.38	1.38	3.38	-	-	3.25	7.63	9.51	8.50
	3.000	0.38	1.38	3.38	-	-	3.25	7.63	9.51	8.50
	3.500	0.38	1.38	3.38	-	-	3.25	7.63	9.51	8.50
6.000	2.500	0.25	1.25	3.50	-	-	3.38	8.38	10.77	9.63
	3.000	0.25	1.25	3.50	-	-	3.38	8.38	10.77	9.63
	3.500	0.25	1.25	3.50	-	-	3.38	8.38	10.77	9.63
	4.000	0.25	1.25	3.50	-	-	3.38	8.38	10.77	9.63
7.000	3.000	0.63	1.63	3.75	5.250	.63	3.63	9.38	12.00	10.75
	3.500	0.63	1.63	3.75	5.750	.63	3.63	9.38	12.00	10.75
	4.000	0.50	1.50	3.75	6.500	.75	3.63	9.38	12.00	10.75
	4.500	0.50	1.50	3.75	6.500	.75	3.63	9.38	12.00	10.75
	5.000	0.25	1.25	3.75	7.750	1.00	3.63	9.38	12.00	10.75
8.000	3.500	0.63	1.63	3.88	5.750	.63	3.75	10.25	13.25	11.75
	4.000	0.50	1.50	3.88	6.500	.75	3.75	10.25	13.25	11.75
	4.500	0.50	1.50	3.88	7.000	.75	3.75	10.25	13.25	11.75
	5.000	0.25	1.25	3.88	7.250	1.00	3.75	10.25	13.25	11.75
	5.500	0.25	1.25	3.88	8.250	1.00	3.75	10.25	13.25	11.75

"RT" dimension replaces "F" dimension on 7" - 8" bore sizes

All trunnion mount cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of
the pin.

The bearing retainer plate is the same as the “E” dimension for
1-1/2”—6” bore sizes and the “RD” dimension for the 7”—8” bore sizes.

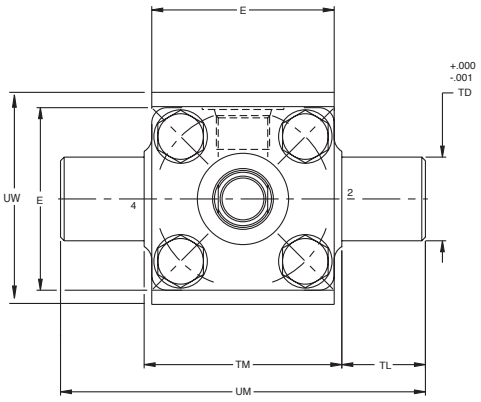
Rod end options shown on page 6.

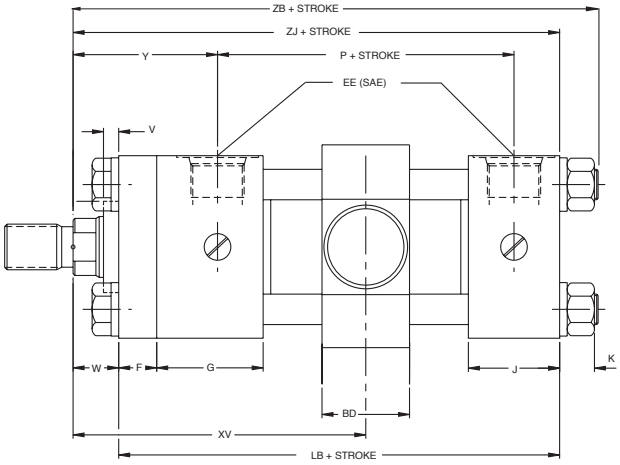
Table 2 - Dimensions not affected by rod diameter

Bore In.	E	SAE Port EE	F	G	J	K	LB	P	TD	TL	UT
1.500	2.50	-10	0.38	1.75	1.50	0.33	5.00	2.88	1.000	1.00	4.50
2.000	3.00	-10	0.63	1.75	1.50	0.44	5.25	2.88	1.375	1.38	5.75
2.500	3.50	-10	0.63	1.75	1.50	0.44	5.38	3.00	1.375	1.38	6.25
3.250	4.50	-12	0.75	2.00	1.75	0.55	6.25	3.50	1.750	1.75	8.00
4.000	5.00	-12	0.88	2.00	1.75	0.55	6.63	3.75	1.750	1.75	8.50
5.000	6.50	-12	0.88	2.00	1.75	0.77	7.13	4.25	1.750	1.75	10.00
6.000	7.50	-16	1.00	2.25	2.25	0.85	8.38	4.88	2.000	2.00	11.50
7.000	8.50	-20	-	2.75	2.75	0.95	9.50	5.50	2.500	2.50	13.50
8.000	9.50	-24	-	3.00	3.00	1.05	10.50	6.25	3.000	3.00	15.50

Mounting MT4

CDT4 MT4





All trunnion mount cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

Specify “XV” dimension when ordering MT4 Intermediate Fixed Trunnion mounts. If not specified, trunnion will be located at the center of the tube.

The bearing retainer plate is the same as the “E” dimension for 1-1/2”—6” bore sizes and the “RD” dimension for the 7”—8” bore sizes.

Rod end options shown on page 6.

Dimensions MT4

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	RT	XV Min.	ZB	ZJ
1.500	0.625	0.25	0.63	2.00	-	-	3.66	6.06	5.63
	1.000	0.50	1.00	2.38	-	-	4.03	6.43	6.00
2.000	1.000	0.25	0.75	2.38	-	-	4.03	6.57	6.00
	1.375	0.38	1.00	2.63	-	-	4.28	6.82	6.25
2.500	1.000	0.25	0.75	2.38	-	-	4.16	6.70	6.13
	1.375	0.38	1.00	2.63	-	-	4.41	6.95	6.38
	1.750	0.50	1.25	2.88	-	-	4.66	7.20	6.63
3.250	1.375	0.25	0.88	2.75	-	-	4.78	7.85	7.13
	1.750	0.38	1.13	3.00	-	-	5.03	8.10	7.38
	2.000	0.38	1.25	3.13	-	-	5.16	8.22	7.50
4.000	1.750	0.25	1.00	3.00	-	-	5.16	8.35	7.63
	2.000	0.25	1.13	3.13	-	-	5.28	8.48	7.75
	2.500	0.38	1.38	3.38	-	-	5.53	8.73	8.00
5.000	2.000	0.25	1.13	3.13	-	-	5.53	9.26	8.25
	2.500	0.38	1.38	3.38	-	-	5.72	9.51	8.50
	3.000	0.38	1.38	3.38	-	-	5.72	9.51	8.50
	3.500	0.38	1.38	3.38	-	-	5.72	9.51	8.50
6.000	2.500	0.25	1.25	3.50	-	-	6.16	10.77	9.63
	3.000	0.25	1.25	3.50	-	-	6.16	10.77	9.63
	3.500	0.25	1.25	3.50	-	-	6.16	10.77	9.63
	4.000	0.25	1.25	3.50	-	-	6.16	10.77	9.63
7.000	3.000	0.63	1.63	3.75	5.25	.63	6.91	12.00	10.75
	3.500	0.63	1.63	3.75	5.75	.63	6.91	12.00	10.75
	4.000	0.50	1.50	3.75	6.50	.75	6.91	12.00	10.75
	4.500	0.50	1.50	3.75	6.50	.75	6.91	12.00	10.75
	5.000	0.25	1.25	3.75	7.75	1.00	6.91	12.00	10.75
8.000	3.500	0.63	1.25	3.88	5.75	.63	7.16	13.25	11.75
	4.000	0.50	1.25	3.88	6.50	.75	7.16	13.25	11.75
	4.500	0.50	1.25	3.88	7.00	.75	7.16	13.25	11.75
	5.000	0.25	1.25	3.88	7.25	1.00	7.16	13.25	11.75
	5.500	0.25	1.25	3.88	8.25	1.00	7.16	13.25	11.75

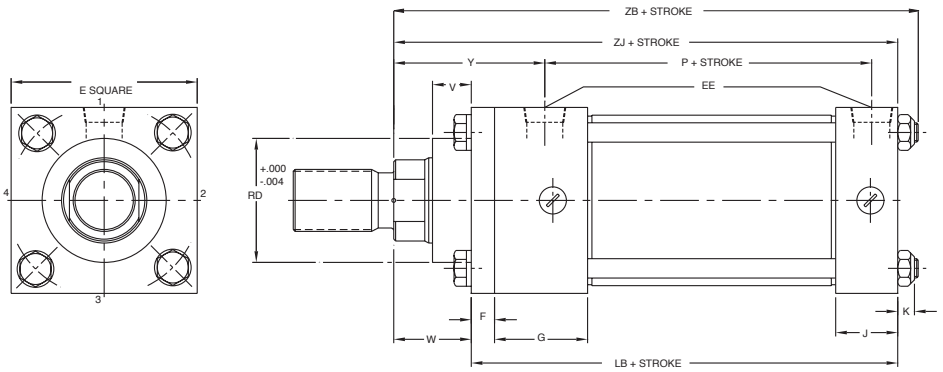
"RT" dimension replaces "F" dimension on 7" - 8" bore sizes

Table 2 - Dimensions not affected by rod diameter

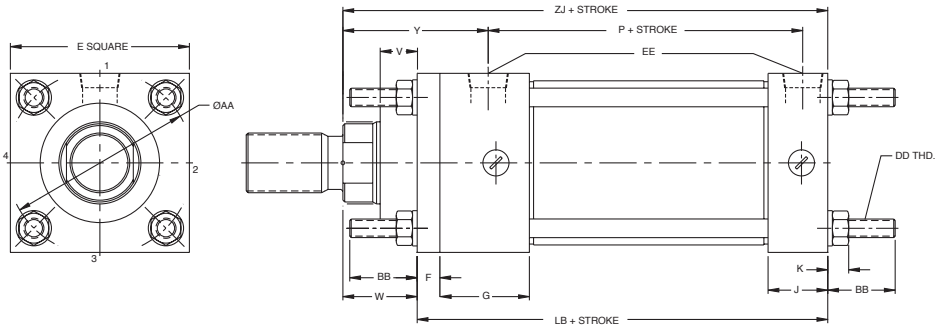
Bore In.	B	E	SAE Port EE	F	G	J	K	LB	P	TD	TL	TM	UM	UT	UW	BD
1.500	1.44	2.50	-10	0.38	1.75	1.50	0.33	5.00	2.88	1.000	1.00	3.00	5.00	4.50	3.38	1.25
2.000	1.44	3.00	-10	0.63	1.75	1.50	0.44	5.25	2.88	1.375	1.38	3.50	6.25	5.75	4.13	1.50
2.500	1.69	3.50	-10	0.63	1.75	1.50	0.44	5.38	3.00	1.380	1.38	4.00	6.75	6.25	4.63	1.50
3.250	1.94	4.50	-12	0.75	2.00	1.75	0.55	6.25	3.50	1.750	1.75	5.00	8.50	8.00	5.81	2.00
4.000	2.19	5.00	-12	0.88	2.00	1.75	0.55	6.63	3.75	1.750	1.75	5.50	9.00	8.50	6.38	2.00
5.000	2.69	6.50	-12	0.88	2.00	1.75	0.77	7.13	4.25	1.750	1.75	7.00	10.50	10.00	7.75	2.00
6.000	2.94	7.50	-16	1.00	2.25	2.25	0.85	8.38	4.88	2.000	2.00	8.50	12.50	11.50	10.38	3.00
7.000	3.44	8.50	-20	-	2.75	2.75	0.95	9.50	5.38	2.500	2.50	9.75	14.75	13.50	11.50	3.00
8.000	3.44	9.50	-24	-	3.00	3.00	1.05	10.50	6.13	3.000	3.00	11.00	17.00	15.50	13.38	3.50

Mounting MX0, MX1, MX2, MX3

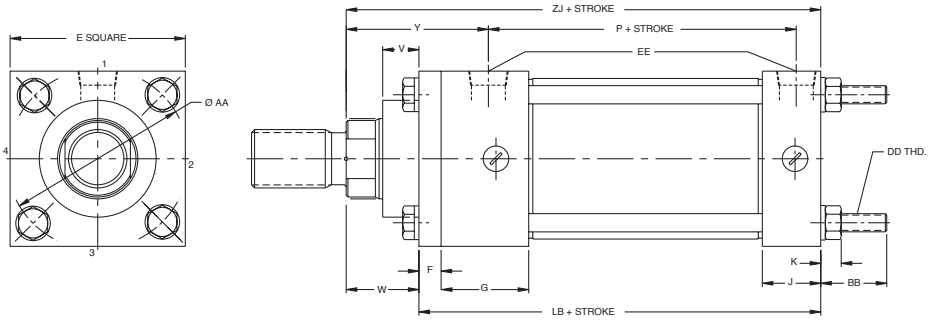
CDT4 MX0



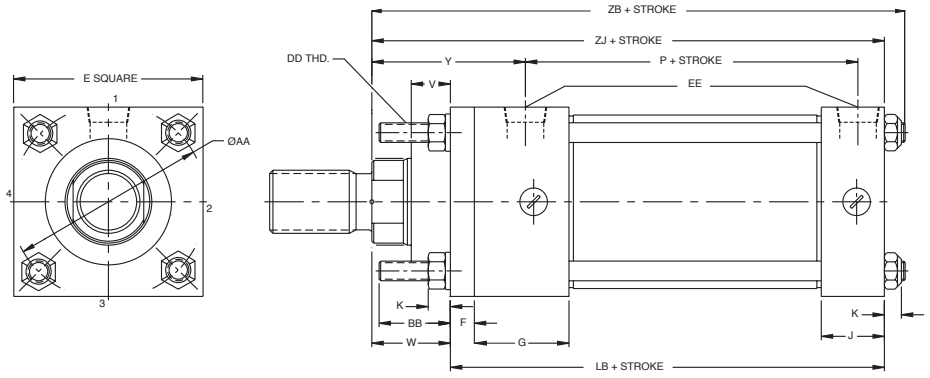
CDT4 MX1



CDT4 MX2



CDT4 MX3



Dimensions MX0, MX1, MX2, MX3

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	ZB	RD	RT	ZJ
1.500	0.625	0.25	0.63	2.00	6.06	-	-	5.63
	1.000	0.50	1.00	2.38	6.43	-	-	6.00
2.000	1.000	0.25	0.75	2.38	6.57	-	-	6.00
	1.375	0.38	1.00	2.63	6.82	-	-	6.25
2.500	1.000	0.25	0.75	2.38	6.70	-	-	6.13
	1.375	0.38	1.00	2.63	6.95	-	-	6.38
	1.750	0.50	1.25	2.88	7.20	-	-	6.63
3.250	1.375	0.25	0.88	2.75	7.85	-	-	7.13
	1.750	0.38	1.13	3.00	8.10	-	-	7.38
	2.000	0.38	1.25	3.13	8.22	-	-	7.50
4.000	1.750	0.25	1.00	3.00	8.35	-	-	7.63
	2.000	0.25	1.13	3.13	8.48	-	-	7.75
	2.500	0.38	1.38	3.38	8.73	-	-	8.00
5.000	2.000	0.25	1.13	3.13	9.26	-	-	8.25
	2.500	0.38	1.38	3.38	9.51	-	-	8.50
	3.000	0.38	1.38	3.38	9.51	-	-	8.50
	3.500	0.38	1.38	3.38	9.51	-	-	8.50
6.000	2.500	0.25	1.25	3.50	10.77	-	-	9.63
	3.000	0.25	1.25	3.50	10.77	-	-	9.63
	3.500	0.25	1.25	3.50	10.77	-	-	9.63
	4.000	0.25	1.25	3.50	10.77	-	-	9.63
7.000	3.000	0.63	1.25	3.75	12.00	5.25	.63	10.75
	3.500	0.63	1.25	3.75	12.00	5.75	.63	10.75
	4.000	0.50	1.25	3.75	12.00	6.50	.75	10.75
	4.500	0.50	1.25	3.75	12.00	6.50	.75	10.75
	5.000	0.25	1.25	3.75	12.00	7.75	1.00	10.75
8.000	3.500	0.63	1.25	3.88	13.25	5.75	.63	11.75
	4.000	0.50	1.25	3.88	13.25	6.50	.75	11.75
	4.500	0.50	1.25	3.88	13.25	7.00	.75	11.75
	5.000	0.25	1.25	3.88	13.25	7.25	1.00	11.75
	5.500	0.25	1.25	3.88	13.25	8.25	1.00	11.75

"RT" dimension replces "F" dimenion on 7" - 8" bore sizes

Tie Rod and Flange Mounts are basically the same except that the tie rods are extended and used to mount the cylinder. To prevent misalignment, sagging or binding of the cylinder when long strokes are required, the free end of the cylinder should be supported. For thrust load applications, blind or cap end tie rod extensions are best. For tension load applications, rod or head end tie rod extensions are best. Tie rod mounts are suited for many applications, however, it should be noted that they are not as rigid as the flange mountings.

Notes: The bearing retainer plate is the same as the “E” dimension for 1-1/2”–6” bore sizes and the "RD" dimensions for the 7"-8" bore sizes.

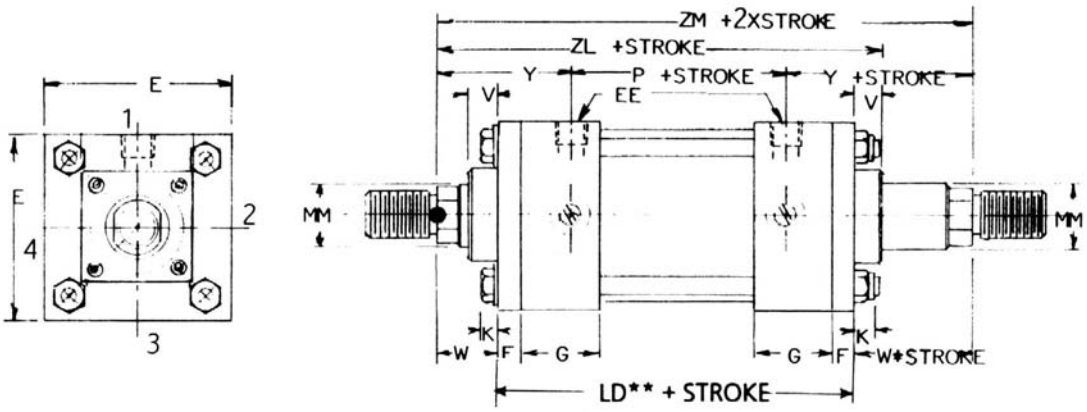
Rod end options shown on page 6.

Table 2 - Dimensions not affected by rod diameter

Bore In.	AA	BB	DD THD	E	SAE Port EE	F	G	J	K	LB	P
1.500	2.30	1.38	0.38-24	2.50	-10	0.38	1.75	1.50	0.33	5.00	2.88
2.000	2.90	1.81	0.50-20	3.00	-10	0.63	1.75	1.50	0.44	5.25	2.88
2.500	3.60	1.81	0.50-20	3.50	-10	0.63	1.75	1.50	0.44	5.38	3.00
3.250	4.60	2.31	0.63-18	4.50	-12	0.75	2.00	1.75	0.55	6.25	3.50
4.000	5.40	2.31	0.63-18	5.00	-12	0.88	2.00	1.75	0.55	6.63	3.75
5.000	7.00	3.19	0.88-14	6.50	-12	0.88	2.00	1.75	0.77	7.13	4.25
6.000	8.10	3.63	1.00-14	7.50	-16	1.00	2.25	2.25	0.85	8.38	4.88
7.000	9.30	4.13	1.13-12	8.50	-20	-	2.75	2.75	0.95	9.50	5.50
8.000	10.60	4.50	1.25-12	9.50	-24	-	3.00	3.00	1.05	10.50	6.25

Mounting CGT4

CGT4



Pressure Ratings for Double Rod End

Bore Size	Rod Size	Cushion Rod end or Non-Cushion	Cushion Both Ends	Remarks
1.500	0.625 1.000	1,500 psi 3,000 psi	750 psi 3,000 psi	
2.000	1.000 1.375	2,250 psi 3,000 psi	800 psi 3,000 psi	
2.500	1.000 1.375 1.750	1,300 psi 3,000 psi 3,000 psi	None 3,000 psi 3,000 psi	Non-Cush Ext.
3.250	1.375 1.750 2.000	1,500 psi 3,000 psi 3,000 psi	1,000 psi 3,000 psi 3,000 psi	
4.000	1.750 2.000 2.500	2,000 psi 3,000 psi 3,000 psi	1,300 psi 2,000 psi 3,000 psi	
5.000	2.000 2.500 3.000 3.500	1,300 psi 3,000 psi 3,000 psi 3,000 psi	1,000 psi 3,000 psi 1,250 psi 3,000 psi	
6.000	2.500 3.000 3.500 4.000	1,300 psi 3,000 psi 2,250 psi 3,000 psi	750 psi 2,250 psi 1,000 psi 3,000 psi	

Consult factory where 3,000 psi rating must be maintained.

Double rod end cylinders are available in every mounting style except MP1, MP5. For dimensions on specific mounting styles, consult the page showing the required mounting. On cylinders where the rod ends are not the same, be sure to specify where each rod end is located in relation to the mounting requirements.

Note that bore sizes 1-1/2" = 6" have square retainers, the same square size as the head on both ends. One of these retainers is held in place by the tie rod nuts, and therefore cannot be removed without loosening the tie rods.

Rod end options shown on page 6.

Mounting CGT4

Table 1 - Dimensions affected by rod diameter

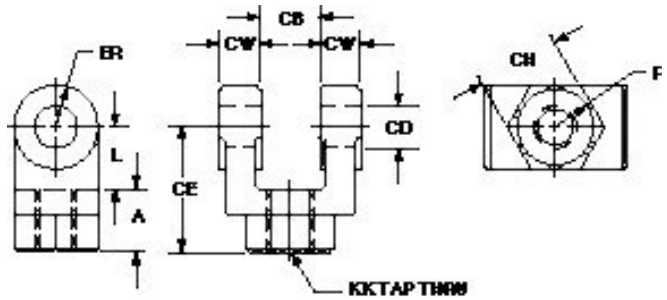
Bore In.	MM Rod	V	W	Y	ZL	ZM
1.500	0.625	0.25	0.63	2.00	6.69	6.88
	1.000	0.50	1.00	2.38	7.06	7.63
2.000	1.000	0.25	0.75	2.38	7.45	7.63
	1.375	0.38	1.00	2.63	7.70	8.13
2.500	1.000	0.25	0.75	2.38	7.57	7.75
	1.375	0.38	1.00	2.63	7.82	8.25
	1.750	0.50	1.25	2.88	8.07	8.75
3.250	1.375	0.25	0.88	2.75	8.85	9.00
	1.750	0.38	1.13	3.00	9.10	9.50
	2.000	0.38	1.25	3.13	9.22	9.75
4.000	1.750	0.25	1.00	3.00	9.47	9.75
	2.000	0.25	1.13	3.13	9.60	10.00
	2.500	0.38	1.38	3.38	9.85	10.50
5.000	2.000	0.25	1.13	3.13	10.38	10.50
	2.500	0.38	1.38	3.38	10.63	11.00
	3.000	0.38	1.38	3.38	10.63	11.00
	3.500	0.38	1.38	3.38	10.63	11.00
6.000	2.500	0.63	1.63	3.50	11.77	11.88
	3.000	0.63	1.63	3.50	11.77	11.88
	3.500	0.63	1.63	3.50	11.77	11.88
	4.000	0.50	1.50	3.50	11.77	11.88

Table 2 - Dimensions not affected by rod diameter

Bore In.	E	F	G	J	K	P	R	SAE EE	LD
1.500	2.50	0.38	1.75	1.50	0.33	2.88	1.63	7/8-14	5.63
2.000	3.00	0.63	1.75	1.50	0.44	2.88	2.06	7/8-14	6.13
2.500	3.50	0.63	1.75	1.50	0.44	3.00	2.56	7/8-14	6.25
3.250	4.50	0.75	2.00	1.75	0.55	3.50	3.25	1-1/16-12	7.25
4.000	5.00	0.88	2.00	1.75	0.55	3.75	3.81	1-1/16-12	7.75
5.000	6.50	0.88	2.00	1.75	0.77	4.25	4.94	1-1/16-12	8.25
6.000	7.50	1.00	2.25	2.25	0.85	4.88	5.72	1-5/16-12	9.38

Rexroth Cylinder Accessories

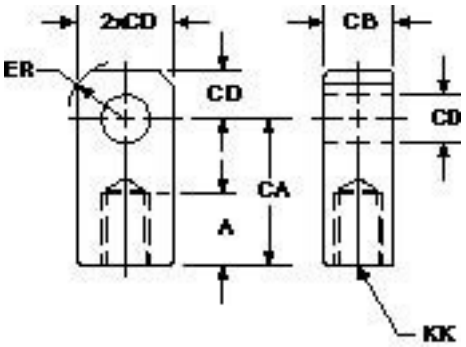
Rod Clevises

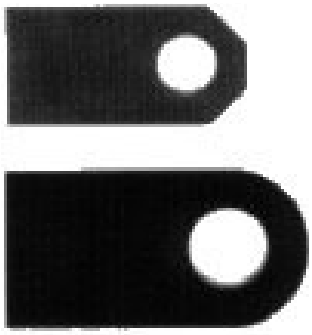


Part No.	CB	CD	CE	CH	CW	F	L	A	KK	ER
R978935057	.765	1/2	1-1/2	1	1/2	1	3/4	3/4	7/16-20	1/2
R978935058	1.265	3/4	2-3/8	1-1/4	5/8	1-1/4	1-1/4	1-1/8	3/4-16	3/4
R978935059	1.265	3/4	2-1/8	1-3/8	5/8	1-1/4	1	1-1/8	3/4- 16	3/4
R978935060	1.515	1	3-1/8	1-1/2	3/4	1-1/2	1-1/2	1-5/6	1- 14	1
R978935061	2.032	1-3/8	4-1/8	2	1	2	2-1/8	2	1-1/4 - 12	1-3/8
R978935062	2.531	1-3/4	4-1/2	2-3/8	1-1/4	2-3/8	2-1/4	2-1/4	1-1/2-12	1-3/4
R978935063	2.531	2	5-1/2	2-15/16	1-1/4	2-15/16	2-1/2	3	1-7/8-12	2
R978935064	3.032	2-1/2	6-1/2	3-1/2	1-1/2	3-1/2	3	3-1/2	2-1/4-12	2-1/2
R978935065	3.032	3	6-3/4	3-7/8	1-1/2	3-7/8	3-1/4	3-1/2	2-1/2-12	2-3/4

Note: Pins must be ordered separately, see Page 31 for dimensions and part numbers.

Rod Eyes

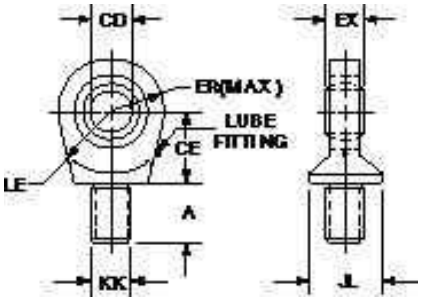




Part No.	A	CA	CB	CD	ER	KK
R978935066	3/4	1-1/2	3/4	1/2	5/8	7/16 -20
R978935067	1-1/8	2-1/16	1-1/4	3/4	7/8	3/4 -16
R978935068	1-5/8	2-13/16	1-1/2	1	1-3/16	1 -14
R978935069	1-1/8	2-3/8	1-1/2	1	1-7/16	7/8 -14
R978935070	2	3-7/16	2	1-3/8	1-9/16	1-1/4 -12
R978935071	2-1/4	4	2-1/2	1-3/4	2	1-1/2 -12
R978935072	3	5	2-1/2	2	2-1/2	1-7/8 -12
R978935073	3-1/2	5-13/16	3	2-1/2	2-13/16	2-1/4 -12
R978935074	3-1/2	6-1/8	3	3	3-1/4	2-1/2-12

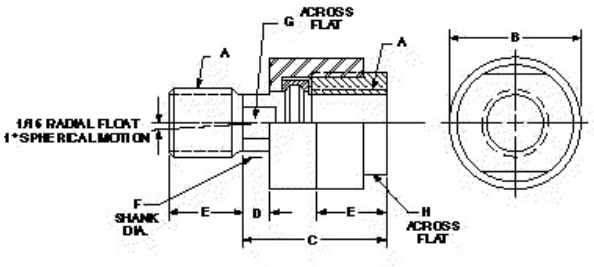
Rexroth Cylinder Accessories

Spherical Rod Eyes



Part No.	CD -.0005	A	CE	EX	ER	LE	KK	JL
R978935075	.500	1-1/16	7/8	7/16	7/8	3/4	7/16 - 20	7/8
R978935076	.750	1	1-1/4	21/32	1-1/4	1-1/16	3/4 - 16	1-5/16
R978935077	1.000	1-1/2	1-7/8	7/8	1-3/8	1-7/16	1 - 14	1-1/2
R978935078	1.375	2	2-1/8	1-3/16	1-13/16	1-7/8	1-1/4 - 12	2
R978935079	1.750	2-1/8	2-1/2	1-17/32	2-3/16	2-1/8	1-1/2 - 12	2-1/4
R978935081	2.000	2-7/8	2-3/4	1-3/4	2-5/8	2-1/2	1-7/8 - 12	2-3/4

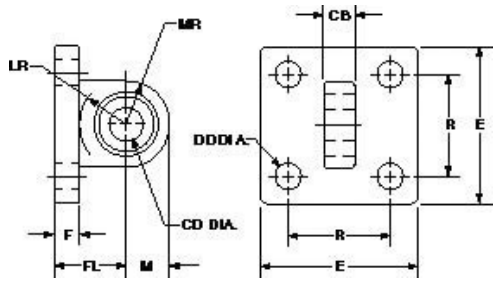
Alignment Couplers



Part No.	A	B	C	D	E	F	0	H	Max. Pull at Yield
R978935082	7/16-20	1-1/4	2	1/2	3/4	5/8	9/16	1-1/8	10,000
R978935080	1/2 - 20	1-1/4	2	1/2	3/4	5/8	9/16	1-1/8	14,000
R978935083	3/4- 16	1-3/4	2-5/16	5/16	1-1/8	3-1/32	7/8	1-1/2	34,000
R978935084	7/8- 14	1-3/4	2-5/16	5/16	1-1/8	3-1/32	7/8	1-1/2	34,000
R978935085	1 - 14	2-1/2	2-15/16	1/2	1-5/8	1-3/8	1-1/4	2-1/4	64,000
R978935086	1-1/4- 12	2-1/2	2-15/16	1/2	1-5/8	1-3/8	1-1/4	2-1/4	64,000
R978935087	1-1/2- 12	3-1/4	4-3/8	13/16	2-1/4	1-3/4	1-1/2	3	120,000
R978935088	1-3/4 - 12	3-1/4	4-3/8	13/16	2-1/4	1-3/4	1-1/2	3	120,000
R978935089	1-7/8 - 12	3-3/4	5-7/16	11/16	3	2-1/4	1-7/8	3-1/2	240,000
R978935090	2 -12	3-3/4	5-7/16	11/16	3	2-1/4	1-7/8	3-1/2	240,000

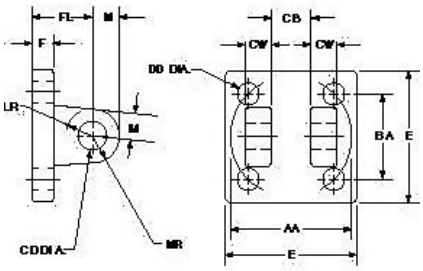
Rexroth Cylinder Accessories

Eye Brackets



Part No.	CB	CD	DD	E	F	FL	LR	M	MR	R
R978935036	3/4	1/2	13/32	2-1/2	3/8	1-1/8	3/4	1/2	9/16	1.63
R978935037	1-1/4	3/4	17/32	3-1/2	5/8	1-7/8	1-1/4	3/4	7/8	2.56
R978935038	1-1/2	1	21/32	4-1/2	3/4	2-1/4	1-1/2	1	1-1/4	3.25
R978935039	2	1-3/8	21/32	5	7/8	3	2-1/8	1-3/8	1-5/8	3.81
R978935040	2-1/2	1-3/4	29/32	6-1/2	7/8	3-1/8	2-1/4	1-3/4	2-1/8	4.95
R978935041	2-1/2	2	11/16	7-1/2	1	3-1/2	2-1/2	2	2-7/16	5.75
R978935042	3	2-1/2	13/16	8-1/2	1	4	3	2-1/2	3	6.59
R978935043	3	3	15/16	9 -1/2	1	4-1/4	3-1/4	3	3-1/4	7.50
R978935044	4	3-1/2	1-13/16	12-5/8	11-1/16	5-11/16	4	3-1/2	4-1/8	9.62
R978935045	4-1/2	4	2-1/16	14-7/8	11-5/16	6-7/16	4-1/2	4	5-1/4	11.50

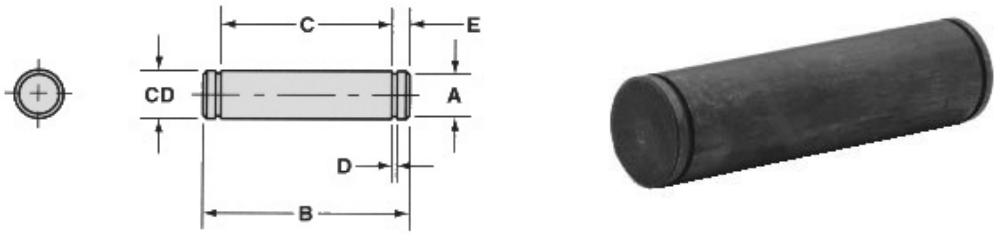
Clevis Brackets



Part No.	AA	BA	CB	CD	CW	DD	E	F	FL	LR	M	MR
R978935046	2.3	1-5/8	.765	1/2	1/2	3/8-24	2-1/2	3/8	1-1/8	1/2	1/2	9/16
R978935047	2.9	2-1/16	1.265	3/4	5/8	1/2-20	3	5/8	1-7/8	1	3/4	1-1/16
R978935048	3.6	2-9/16	1.265	3/4	5/8	1/2-20	3-1/2	5/8	1-7/8	1-1/16	3/4	1-1/16
R978935049	4.6	3-1/4	1.515	1	3/4	5/8-18	4-1/2	3/4	2-1/4	1-1/4	1	1-1/8
R978935050	5.4	3-13/16	2.032	1-3/8	1	5/8-16	5	7/8	3	1-7/8	1-3/8	1-3/4
R978935051	7.0	4 15/16	2.531	1-3/4	1-1/4	7/8-14	6-1/2	7/8	3-1/8	2	1-3/4	1-7/8
R978935052	8.1	5-3/4	2.531	2	1-1/4	1-14	7-1/2	1	3-1/2	2-1/8	2	2-1/8
R978935053	9.3	6 -19/32	3.032	2-1/2	1-1/2	1-1/8-12	8-1/2	1	4	2-5/8	2-1/2	2-1/2
R978935054	10.6	7-1/2	3.032	3	1-1/2	1/4-12	9-1/2	1	4-1/4	2-7/8	2-3/4	2-3/4
R978935055	13.6	9-5/8	4.032	3-1/2	2	1-3/4-12	12-5/8	1-11/16	5-11/16	3-5/8	3-1/2	3-1/2
R978935056	16.2	11-1/2	4.532	4	2-1/4	2-12	14-7/8	1-15/16	6-7/16	4	4	4

Rexroth Cylinder Accessories

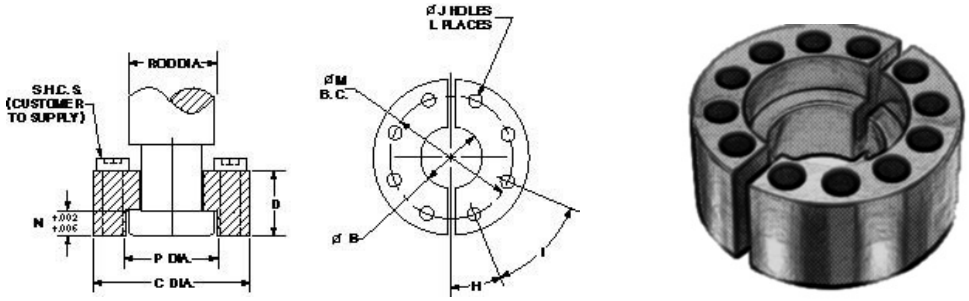
Pivot Pins-Grooved



Pivot Pins							C-Rings	
Part No.	CD	A	B	C	D	E	Part No.	CD
R978935026	.500	.468	2.094	1.875	.041	.109	R978000049	0.500
R978935027	.750	.704	2.875	2.625	.048	.125	R978000189	0.750
R978935028	1.000	.940	3.375	3.125	.048	.125	R978000190	1.000
R978935029	1.375	1.291	4.485	4.187	.056	.149	R978000191	1.375
R978935030	1.750	1.650	5.547	5.188	.068	.180	R978000192	1.750
R978935031	2.000	1.886	5.547	5.188	.068	.180	R978000206	2.000
R978935032	2.500	2.360	6.625	6.188	.086	.219	R978000193	2.500
R978935033	3.000	2.838	6.780	6.250	.103	.265	R978000194	3.000

Note: When ordering pivot pins, two C-rings must also be ordered for each pin. Pivot pins do not automatically ship with C-rings. Additional C-rings are available in any quantity.

Safe Rod End Coupler

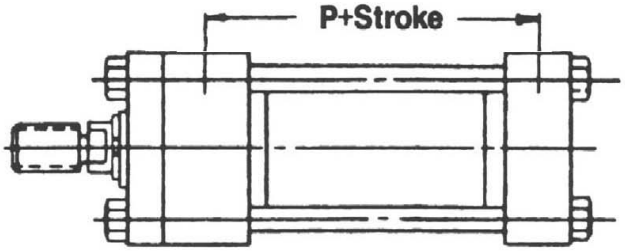


Part No.	Rod. Dia.	B	C	D	H	I	J	L	M	N	P	S.H.C.S. Size *
R978007008	.625	.406	1.500	.562	45°	90°	.218	4	1.125	.250	.656	10-24
R978007009	1.000	.750	2.000	.875	30°	60°	.281	6	1.500	.375	1.063	1/4-20
R978007010	1.375	.938	2.500	1.000	30°	60°	.343	6	2.000	.375	1.438	5/16-18
R978007011	1.750	1.187	3.000	1.250	22.5°	45°	.343	8	2.375	.500	1.813	5/16-18
R978007012	2.000	1.438	3.500	1.625	15°	30°	.406	12	2.688	.625	2.063	3/8-16
R978007013	2.500	1.875	4.000	1.875	15°	30°	.406	12	3.188	.750	2.625	3/8-16
R978007014	3.000	2.375	5.000	2.375	15°	30°	.531	12	4.000	.875	3.125	1/2-13
R978007015	3.500	2.625	5.875	2.625	15°	30°	.656	12	4.688	1.000	3.625	5/8-11
R978007016	4.000	3.125	6.375	2.625	15°	30°	.656	12	5.188	1.000	4.125	5/8-11
R978007017	4.500	3.625	6.875	3.125	15°	30°	.656	12	5.688	1.500	4.625	5/8-11
R978007018	5.000	4.000	7.375	3.125	15°	30°	.656	12	6.188	1.500	5.125	5/8-11
R978007019	5.500	4.500	8.250	3.875	15°	30°	.781	12	6.875	1.875	5.625	3/4-10

* = High tensile socket head cap screw size for reference only. S.H.C.S. to be supplied by customer.

Cylinder Options

Oversize Ports



Port Dimensions

Bore Size	Rod Dia.	Std. SAE St. Thread Port	Oversize SAE Thread Port		Max. SAE Flg. Port
			Head	Cap	
1.5	5/8 Std.	-10	-10	-10	-
	1	-10	-10	-10	-
2	1 Std.	-10	-12*	-12*	-
	1-3/8	-10	-12*	-12*	-
2.5	1 Std.	-10	-12	-12	-
	1-3/8	-10	-12*	-12*	-
	1-3/4	-10	-12*	-12*	-
3.25	1-3/8 Std.	-12	-12	-16*	1/2" - 3,000 psi
	1-3/4	-12	-12	-16*	1/2" - 3,000 psi
	2	-12	-16*	-16*	1/2" - 3,000 psi
4	1-3/4 Std.	-12	-14	-16*	1/2" - 3,000 psi
	2	-12	-14	-16*	1/2" - 3,000 psi
	2-1/2	-12	-14	-16*	1/2" - 3,000 psi
5	2 Std.	-12	-16*	-16*	1/2" - 3,000 psi
	2-1/2	-12	-16*	-16*	1/2" - 3,000 psi
	3	-12	-16*	-16*	1/2" - 3,000 psi
	3-1/2	-12	-16*	-16*	1/2" - 3,000 psi
6	2-1/2 Std.	-16	-20*	-20*	1" - 3,000 psi
	3	-16	-20*	-20*	1" - 3,000 psi
	3-1/2	-16	-20*	-20*	1" - 3,000 psi
	4	-16	-20*	-20*	1" - 3,000 psi
7	3 Std.	-20	-24*	-24	1-1/4" - 3,000 psi
	3-1/2	-20	-24*	-24	1-1/4" - 3,000 psi
	4	-20	-24*	-24	1-1/4" - 3,000 psi
	4-1/2	-20	-24*	-24	1-1/4" - 3,000 psi
	5	-20	-24*	-24	1-1/4" - 3,000 psi
8	3-1/2 Std.	-20	-32*	-32*	1-1/2" - 3,000 psi
	4	-24	-32*	-32*	1-1/2" - 3,000 psi
	4-1/2	-24	-32*	-32*	1-1/2" - 3,000 psi
	5	-24	-32*	-32*	1-1/2" - 3,000 psi
	5-1/2	-24	-32*	-32*	1-1/2" - 3,000 psi

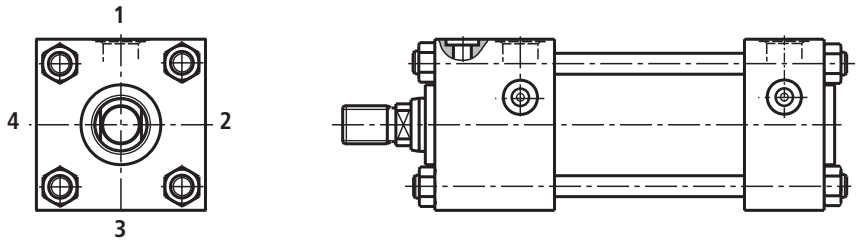
* - Y and P dimensions on dimensional pages must change to accommodate these port sizes.

Gland Drain Connection

For cylinders with long stroke lengths or constant pressure (differential circuit), on the annular side, it is possible to drain to tank via a drain line, the fluid which collects between the wiper and rod seal .

Additionally, within the automotive industry, the drain connection is used to monitor seal wear.

To avoid back pressure in the drain line, the tank should be located below the cylinder.



Note: Standard NFPA dimensions shown in this catalog will need to be modified to allow for a gland drain port. Contact factory for further information.

Port / Proximity Switch Locations

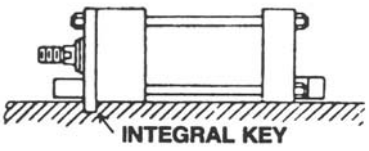
Mount Style	Port Location Head	Port Location Cap	Cushion Adjustment Head	Cushion Adjustment Cap	Air Bleed Head	Air Bleed Cap	Drain Port Head	Prox. Switch Loc. Head	Prox. Switch Loc. Cap
MXO, MF1, MF2,	1	1	2	2	4	4	1	3	3
MF5, MF6, MP1,	2	2	3	3	1	1	2	4	4
MP5, MT4, MX1,	3	3	4	4	2	2	3	1	1
MX2, MX3, MS7	4	4	1	1	3	3	4	2	2
	1	1	3	2	4	4		2	3
ME5	2	2	3	3	1	1	C/F	4	4
	3	3	1	4	2	2		4	1
	4	4	1	1	3	3		2	2
	1	1	2	3	4	4	1	3	2
ME6	2	2	3	3	1	1	2	4	4
	3	3	4	1	2	2	3	1	4
	4	4	1	1	3	3	4	2	2
MT1	1	1	3	2	3	4	1	C/F	3
	3	3	1	4	1	1	3	C/F	1
MT2	1	1	2	3	4	3	1	3	C/F
	3	3	4	1	2	1	3	1	C/F
MS2	1	1	2	2	4	4	1	3	3
	3	3	4	4	2	2	3	1	1
MS3	1	1	3	3	3	3	1	C/F	C/F
	3	3	1	1	1	1	3	C/F	C/F
MS4	1	1	2	2	4	4	1	C/F	C/F
	2	2	4	4	1	1	2	C/F	C/F
	4	4	2	2	1	1	4	C/F	C/F

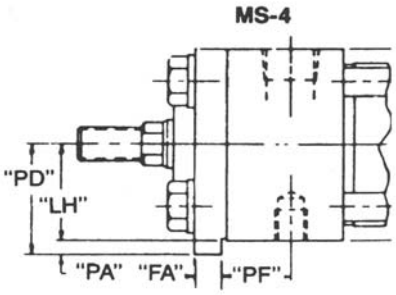
[1]) Drain ports are SAE 4 (7/16" - 20) on all mounting styles and bore sizes.

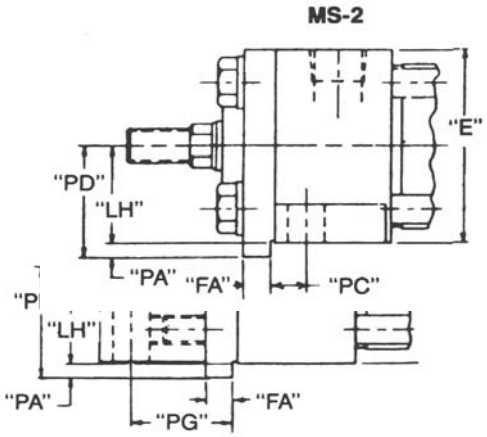
C/F = Consult Factory

Extended Key Plates

Rexroth offers a standard arrangement of Thrust Key Mountings on the MS2, MS4 and MS7 CDT4 cylinders. This option eliminates the need for fitted bolts or external keys to carry the thrust load. The normal headplate is extended below the head surface of the cylinder and is fitted in a keyway milled into the mounting surface of the machine member. See drawing for details.







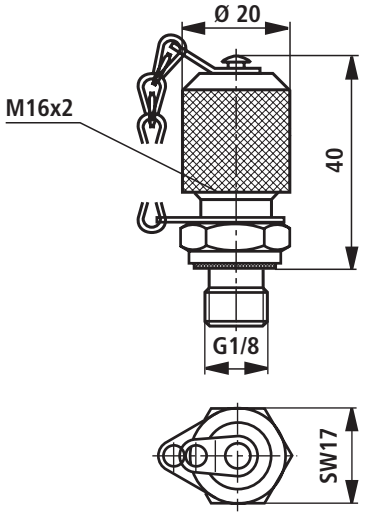
Bore	E	FA		LH		PA	PC	PD	PF	PG
1.50″	2.50	.312	+.000 -.002	1.244	+.000 -.002	.19	.44	1.44	1.06	1.19
2.00″	3.00	.562	+.000 -.002	1.494	+.000 -.002	.31	.56	1.81	1.06	1.50
2.50″	3.50	.562	+.000 -.002	1.744	+.000 -.002	.31	.75	2.06	1.06	1.50
3.25″	4.50	.687	+.000 -.003	2.244	+.000 -.003	.38	.75	2.62	1.19	1.84
4.00″	5.00	.812	+.000 -.003	2.494	+.000 -.003	.44	.94	2.94	1.19	1.94
5.00″	6.50	.812	+.000 -.003	3.244	+.000 -.003	.44	.94	3.69	1.19	2.31
6.00″	7.50	.937	+.000 -.003	3.744	+.000 -.003	.50	1.19	4.25	1.31	2.62

Notes:

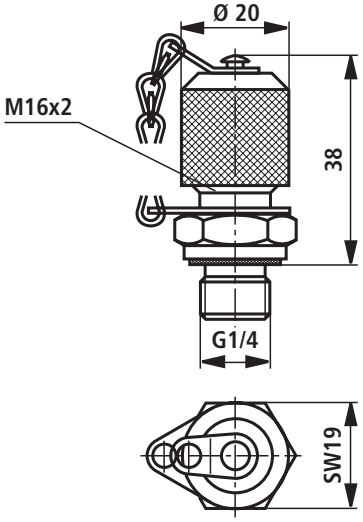
1. Use mounting bolts 0.06 smaller in diameter than hole size.
2. Fitted bolts or dowel pins are not needed with the thrust key headplate.
3. All dimensions not shown are NFPA standard.
4. PD, PA, FA dimensions typical for all mounts.

Test Point Coupling

For bore sizes - 1-1/2“ - 2-1/2“



For Bore Sizes - 3-1/4“-8“



Above dimensions in mm.

Notes

For pressure measurement or bleeding.

For installation in the bleed/measuring port. Coupling with check valve function, it can also be connected under pressure.

Scope of supply for bore sizes - 1-1/2" to 2-1/2"

Coupling AB-E 20-11/K3, G 1/8
with NBR seal, Material No. R900014363

Coupling AB-E 20-11/K3V, G 1/8
with FPM seal, Material No. R900024710

Scope of supply for bore sizes - 3-1/4" to 8"

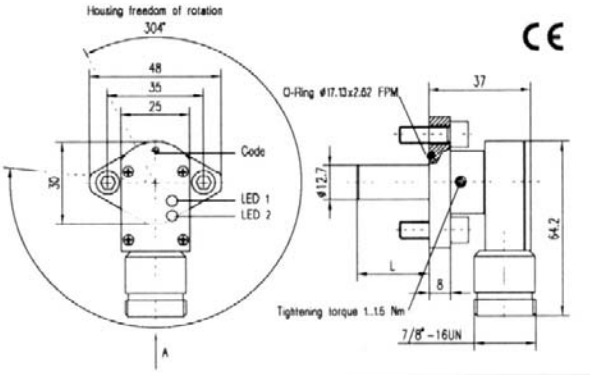
Coupling AB-E 20-11/K1, G 1/4
with NBR seal, Material No. R900009090

Coupling AB-E 20-11/K1V, G 1/4
with FPM seal. Material No. R900001264

CDT4 Proximity Switch

High Pressure - 3000 psi (207 bar) Cylinder Sensors 2 wire AC/ DC Mini-Style Quick Disconnect

Dimensions (in mm)

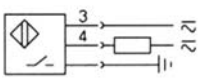


Ordering Code	Shielded (Flush Mounting)
Sensing Distance Sn	**2 mm**
Function	
Normally Open	
Electrical	
Operating distance S_A	0...1.6 mm
Supply voltage	20 - 250 V AC/DC
Supply frequency	50 / 60 Hz
Load current capacity	5 - 400 mA
Inrush current	3A (t = 20 ms)
Leakage current	≤ 1.7 mA
Voltage drop	≤ 6 V
Switching frequency	50 Hz
Start up delay	≤ 150 ms
Switch hysteresis	≤ 15% of Sn
Repeatability	≤ 5% of Sn
Ambient temperature range	-25°C to +70°C
Output function LED	yes
Short circuit & overload protected	yes
Mechanical	
Housing material	Nickel plated brass housing
Electrical connection	AC Mini Syle Connector
Protection class	IP 67
Housing, freedom of rotation	304°

Probe Length	Part Number	Code
1.025	R978008781	Blue
1.250	R978008793	White
2.062	R978002203	Red
2.875	R978002204	Orange
3.775	R978008792	Silver
4.560	R978009001	Gold

Wiring Connections

2 Wire AC/DC Normally Open



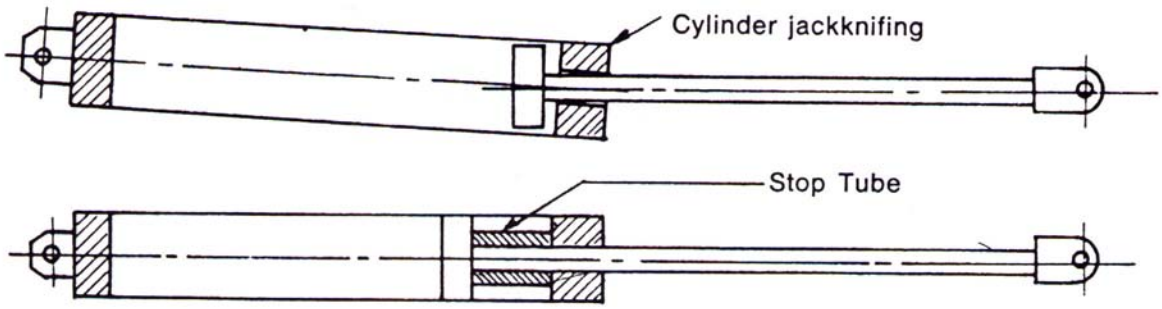
View of male connector pins

Stop Tube

In long cylinders which are pushing a load, internal stop tubes are used to prevent excessive bearing wear and jackknifing of the cylinder. They are installed between the piston and the head, providing additional bearing support by increasing the distance between the piston and the head in the fully extended position.

For long, trouble free bearing service, the bearing loads should not exceed about 200 psi. Standard cylinders are not designed for heavy eccentric loads.

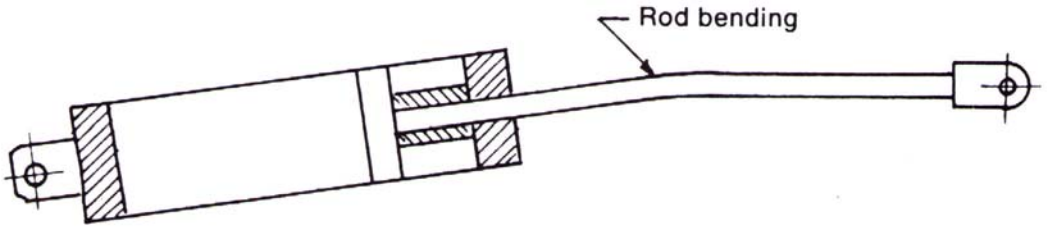
The use of oversize rods to reduced bearing loads is not recommended. They are not as effective as stop tubes, and if misalignment occurs the additional rod stiffness will actually increase bearing loads. For long push stroke cylinders, a stop tube may be required to limit radial bearing loads to a safe value and prevent jackknifing. They are especially desirable in long stroke pivoted centerline style mountings. The effect of a stop tube may be duplicated by providing additional unused stroke and stopping the cylinder extension by external means.



Column Strength Considerations

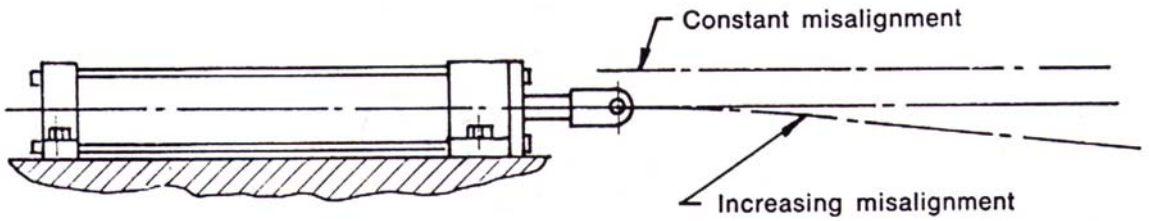
Standard size rods are recommended for use in cylinder applications where column strength, rod sag, or rate of cylinder return do not require an oversize rod. Being more flexible, standard rods absorb shock loads and minimize bearing loads caused by misalignments.

For long push stroke cylinders, an oversize rod may be required to prevent column failure and rod bending. Total cylinder length, extended is considered in column strength. Refer to the tables on the following pages for calculations regarding the column strength and stop tube required for a cylinder application.



Mounting Considerations for Cylinders - Fixed Non Centerline Mountings

Fixed mount cylinders can tolerate a slight misalignment that is zero at full retraction and increases slightly with stroke. With other than very large rods, a misalignment of about .003" to .005" per foot of stroke is usually permissable. Rigid mounted cylinders cannot tolerate a fixed misalignment, particularly at full retraction.



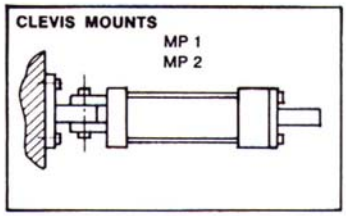
Mounting Considerations for Cylinders - Pivoted Centerline Mountings

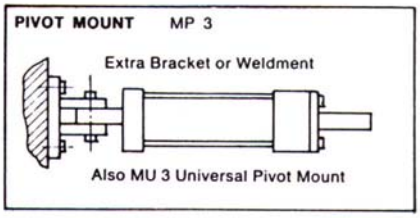
If the path of the load is curved or misalignment is a problem, a pivoted centerline mounting should be used. This compensation of nonlinear travel is in one plane only, as would occur during the operation of a lever. Pivot mounts require the rod end attachment to also be a pivot type. Close tolerance pins should be used and it is recommended that the cylinder manufacturer's accessory brackets be used to maintain good fits.

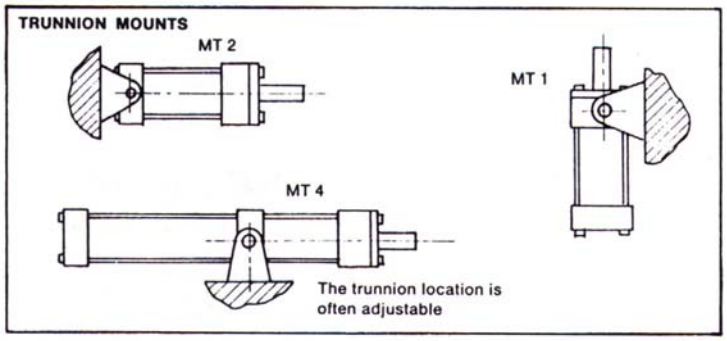
For short strokes, medium or smaller bore cylinder applications, the clevis mount is recommended. This is probably the most widely used cylinder mounting. Where the clevis mount should normally be used, but would cause the overall length of the cylinder to be excessive, the cap trunnion mount can be used. Head end trunnions should be carefully applied to either short strokes or to application where the weight of the cylinder falls vertically below the pin.

For long stroke cylinders and/or heavy cylinders, the center or intermediate trunnion mount is recommended. This mount supports the weight of the cylinder and should be located near the balance point of the cylinder at the time of maximum thrust. For general applications, a good estimate for the location of the intermediate trunnion is 1/3 back from the head end.

The MP5 (universal) type mount is a pivot mount with a spherical bearing fitted into the pivot to permit 5 to 10 degrees of movement in a plane perpendicular to the major plane of pivot movement. It is probably the most serviceable of the pivoted centerline mounts. For maximum effectiveness, a spherical bearing type rod end fitting should be utilized at the same time.

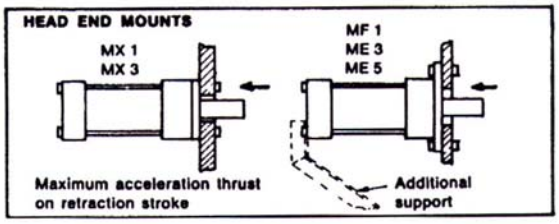


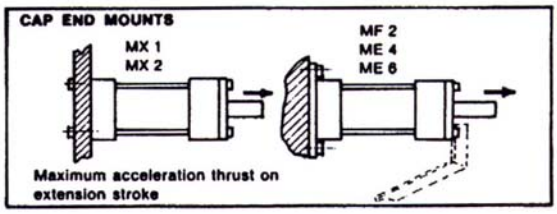


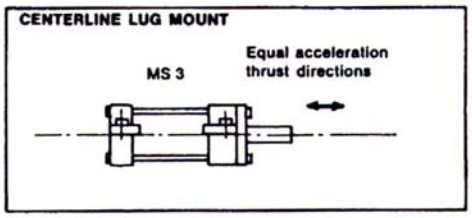


Mounting Considerations for Cylinders - Fixed Centerline Mountings

These mounting styles, illustrated below, tend to be more stable against sway on the power extension stroke. Rigid machine frame members are required to prevent misalignment under loads. The travel path of the rod end should be linear and be guided if at all possible. Long supported extension of the rod end must be avoided. Refer to the stop tube calculation data which shows the advantages of supporting and using reliable guiding on the rod end. Long stroke cylinders with fixed end mounts may require additional support at the free end of the cylinder body. This is illustrated in dotted outlines in the sketches below.



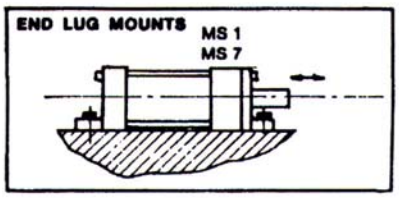


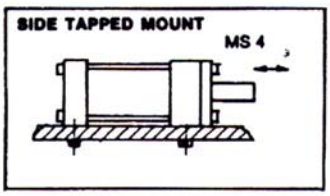


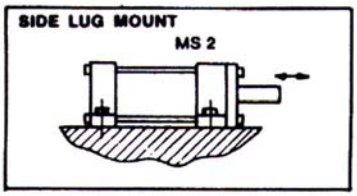
Mounting Considerations for Cylinders - Fixed Non Centerline Mountings

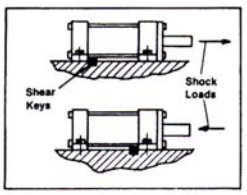
These types of mounts are perhaps the easiest to use for mounting and replacement ease. The offset thrust line introduces bending stresses and additional loads on the mounting bolts. This type should be very well aligned for maximum service life. The load must travel in a very linear path and be supported and guided both horizontally and vertically as the data for calculating stop tube and column strength illustrates.

When applying these mounts with offset thrust under high pressure or shock loads, properly located shear pins or keys can be used. These provide positive location and prevent slight movement of the cylinder under shock conditions, which the normal clearance in the mounting bolt holes would allow. Very close tolerances (.001") should be maintained between keys and keyways. Keys should be located as illustrated below, at one end of the cylinder. When using dowel pins, do no pin across opposite corners, as serious twisting stresses will result.









Mounting Considerations for Cylinders

Selection of mounting style depends primarily upon the operating specifications of the application. Mountings are generally one of the following three types:

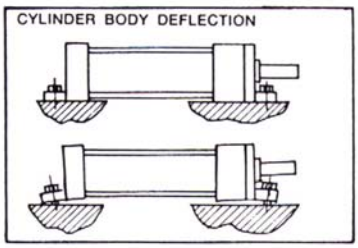
1. Fixed Centerline Mountings
   Where the thrust of the cylinder is focused on the centerline of the cylinder rod.
2. Fixed Non-Centerline Mountings
   Where the thrust of the cylinder is aligned parallel to, but not on, the centerline of the cylinder rod.
3. Pivoted Centerline Mountings
   Where the centerline of the cylinder may swing in one or more directions. Usually major movement is in one plane.

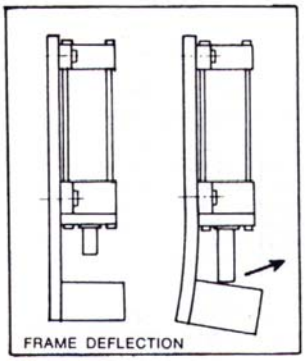
A very important general consideration is to keep the cylinder thrust as close as possible to the centerline of the piston rod and free from misalignment or side thrust. Off-center thrust or side loads subtract substantially from the anticipated rod bearing and rod seal service life.

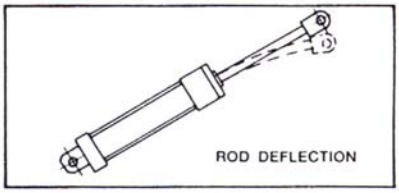
Off-center thrust and side loading can be caused by cylinder deflection under load, machine frame deflection, rod bending or sagging, cylinder pivot binding, nonlinear load movement, shifting of load; some of which are shown below.

In addition to the mounting styles, several other factors should be considered when mounting a cylinder. Care should be taken to avoid painting or damaging the exposed portion of the piston rod during construction. Threaded pieces should be pulled tight against thread shoulders to minimize bending and reduce fatigue stress. Rotation of the piston rod within the cylinder should be avoided to prevent possible scoring of the cylinder tube and damage to piston seals. Long cylinders may require additional body support to prevent damaging sag.

Major consideration must be given to the factors which might cause premature failure of the cylinder: unusual acceleration, unusual deceleration, alignment, support of cylinder weight, linear or curvilinear travel path of the load being moved, jackknifing of the cylinder, and the column strength of the rod. Some mounting styles are more suited than others to each of the above application factors.







Buckling

The permissible stroke with a flexible guided load and a 3.5 factor of safety against buckling can be obtained from the relevant table. For deviating cylinder installation positions, the permissible stroke length has to be interpolated. Permissible strokes for non-guided loads on request.

Calculations for buckling are determined using the following formulas:

1. Calculation according to Euler

$$F = \frac{\pi^2 \bullet E \bullet I}{\nu \bullet L_K^2} \quad \text{if } \lambda > \lambda g$$

2. Calculation according to Tetmajer

$$F = \frac{d^2 \bullet \pi\,(335 - 0.62 \bullet \lambda)}{4 \bullet \nu} \quad \text{if } \lambda \leq \lambda g$$

Explanation:

E = Modulus of elasticity in psi

= 30 x 10^6 for steel

I = Moment of inertia in inches^4 for circular cross-sectional area

$$= \frac{d^4 \bullet \pi}{64} = 0.0491 \bullet d^4$$

ν = 3.5 (safety factor)

L_K = Free buckling length in inches (depending on mounting type, see sketches A, B, C)

d = Piston rod Ø in inches

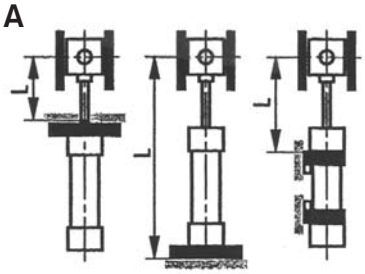
λ = Slenderness ratio

$$= \frac{4 \bullet L_K}{d} \qquad \lambda g = \pi \sqrt{\frac{E}{0.8 \bullet R_e}}$$

R_e = Yield strength of the piston rod material

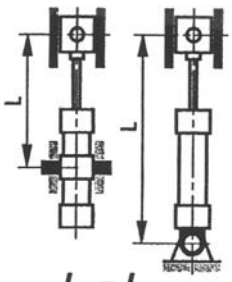
Influence of the mounting type on buckling length:

A



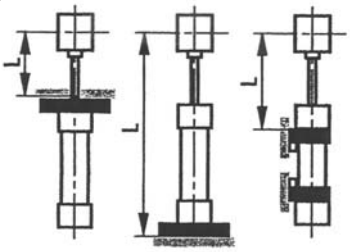
$L_K = 0{,}7\ L$

B



$L_K = L$

C



$L_K = 2\ L$

Stop Tube

To determine whether a stop is required on push stroke cylinders:

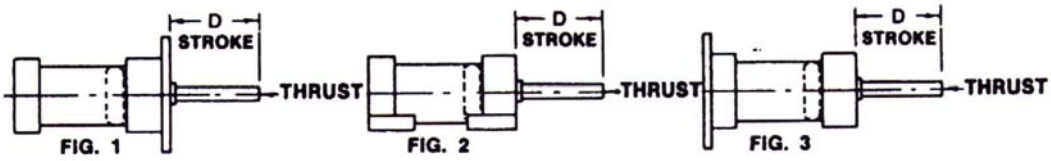
Step 1 - Determine which example below corresponds to your application.

Step 2 - Determine the value of "L" from the instructions given. The find "L" dimension in the table at the right for the required stop tube length. (Specify the effective stroke plus the stop tube length when ordering).

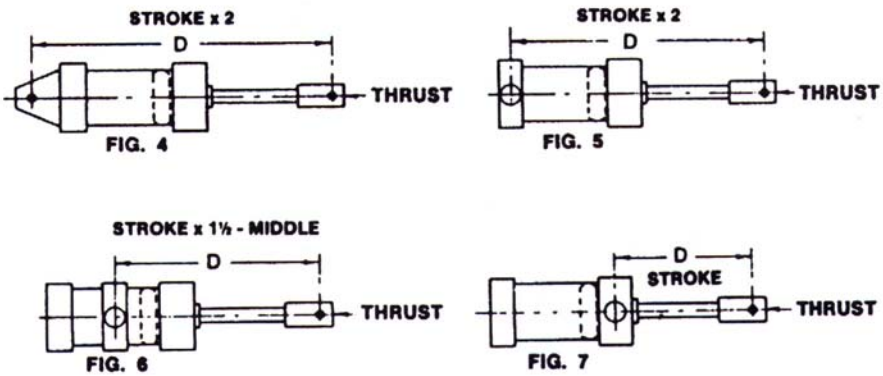
Step 3 - Add stop tube length to original "L" dimension to obtain your adjusted "L" dimension.

Example: "L" = 96", therefore, Stop Tube = 6"
Adjusted L = 102" (96+6)

Step 4 - Use adjusted "L" to figure rod column strength at maximum pressure rating of the cylinder, page 34.

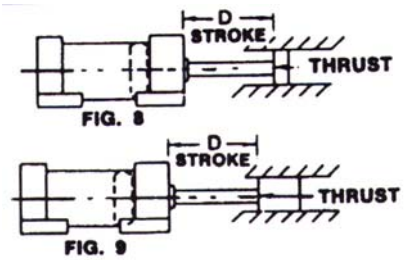


Typical rigidly mounted cylinders with rod unsupported at free end. May be mounted either horizontally or vertically. Use the equation L = 4D to determine values of "L" for all cylinder mountings in this category.



"L" Inches	Stop Tube Length (inches)
0-40	0
41-50	1
51-60	2
61-70	3
71-80	4
81-90	5
91-100	6
101-110	7
111-120	8

Typical trunnion mounted cylinders may be mounted either horizontally or vertically. Use the equation L = D to determine values of "L" for all cylinder mountings in this category. For center trunnion mounted cylinders (Figure 6), the position of the trunnion for most favorable bearing loads is obtained when "D" dimension with the rod retracted is approximately 1/3 overall length of cylinder with rod retracted.



Typically rigidly mounted cylinder with free end of rod supported with short guide. May be mounted either horizontally or vertically. Use the equation L = D to determine values of "L" for all cylinder mountings in this category.

Typical rigidly mounted cylinder with free end of rod supported with long closely-fitted guide. May be mounted either horizontally or vertically. Use the equation L = 1/2 D to determine values of "L" for all cylinder mountings in this category.

Column strength and oversize rod selection

Standard rod diameters are recommended for all Pull Stroke applications. To determine the correct rod diameter required for Push Stroke application, follow these simple steps:

Step 1 – Determine the value of "L_K" from the illustrations shown on page 40. (Use Adjusted "L_K" dimension for cylinder with Stop Tube).

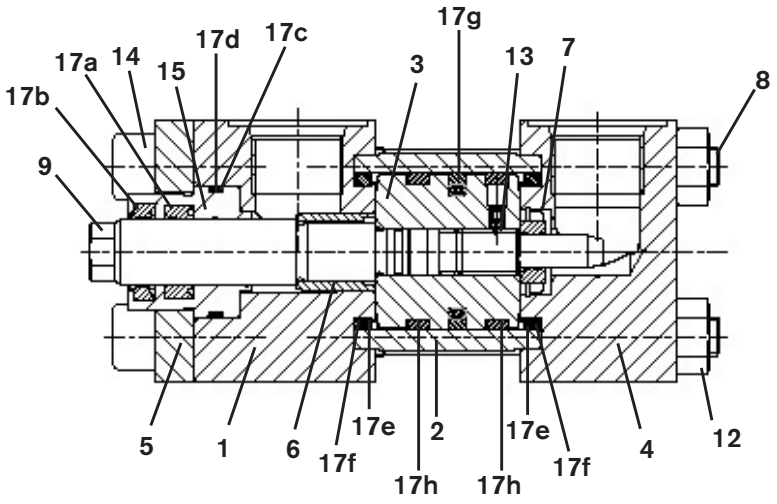
Step 2 – From your cylinder size and maximum operating pressure, determine your Push Stroke Thrust.

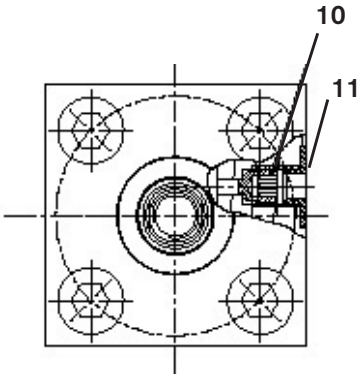
Step 3 – Find your thrust in the left hand column and located your "L_K" dimension (or Adjusted "L_K" dimension in the same horizontal line to the right; (if your exact "L_K" or adjusted "L_K" dimension is not shown, move to the right in the same horizontal column to the next larger number). Read vertically up from this number to the rod diameter shown. This is the required rod diameter for your application.

Example: Adjusted L_K of 80" at 16,000# would required 2-1/2" rod in the cylinder.

Thrust in Pounds Force at End of Rod	Rod Diameters											
	5/8	1	1-38	1-34	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2
50	67											
100	58	110										
150	53	103										
250	43	94	146									
400	37	83	134	186								
700	30	68	118	168	202	275					Values of "L_K"	
1,000	27	60	105	155	190	257	330					
1,400	24	53	92	142	174	244	308	385				
1,800	22	48	82	127	160	230	296	366	440			
2,400	19	45	75	114	145	213	281	347	415	488		
3,200	16	41	67	103	130	194	261	329	400	461		
4,000	13	38	63	94	119	175	240	310	378	446		
5,000	9	34	60	87	110	163	225	289	360	426	494	
6,000		30	56	82	102	152	208	274	342	410	476	
8,000		26	50	76	93	137	188	245	310	375	447	
10,000		21	45	70	89	125	172	222	279	349	412	485
12,000		17	41	65	84	118	152	210	269	326	388	454
16,000			34	57	75	110	142	188	235	292	350	420
20,000			28	52	68	103	136	172	218	270	326	385
30,000				39	55	87	120	156	189	230	285	330
40,000				22	43	74	108	142	177	210	248	294
50,000					30	66	96	130	165	200	234	269
60,000						57	88	119	154	190	225	256
80,000						36	71	104	137	170	204	240
100,000							57	90	120	154	199	222
120,000							45	77	108	146	175	207
140,000								64	98	128	160	194

Spare Parts CDT4





Tie Rods Torque Values		
Bore Size Inches	**Tie Rod Diameter (inches)**	**Torque - Lubricated (pound / foot)**
1.500	0.38	19
2.000	0.50	45
2.500	0.50	45
3.250	0.63	90
4.000	0.63	125
5.000	0.88	295
6.000	1.00	480
7.000	1.13	720
8.000	1.25	1050

1 Head
2 Tube
3 Piston
4 Cap
5 Flange
6 Cushion bushing
7 Cushion insert w/retainer
8 Tie rod
9 Piston rod
10 Bleed screw
11 Securing plate
12 Tie rod nut
13 Set screw
14 Hex head bolt
15 Rod bearing
16 Cushion valve (not shown)
17 Seal kit:
- **a.** Wiper
- **b.** Rod seal
- **c.** Bearing o-ring
- **d.** Bearing back-up ring
- **e.** Tube o-ring
- **f.** Tube back-up ring
- **g.** Piston seal
- **h.** Wear bands

For complete spare parts and service information, refer to service manual RA 17 041-T4SM/03.05

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CST4 Liniear Positioning Cylinders

Technical Data (for applications outside these parameters, please consult factory)

Standards:

Meets or exceeds all J.I.C. and NFPA requirements.

Nominal pressure: 3,000 psi

Static proof pressure: 5,000 psi

With extreme shock loads the mounting styles and piston rod threads have to be considered, taking the fatigue limits into account.

Maximum operating pressure up to: 3,000 psi

Static non-shock: 5,000 psi

Installation position: Various

Pressure fluid:

Mineral oils (HL, HLP)
Phosphate ester (HFD-R) (-4°F to +300°F)
HFA (41°F to 131°F)
Water glycol HFC (–4°F to 140°F)

Hydraulic fluid temperature range: (-4°F to 176°F)

Viscosity range: 32 to 1760 ssu

Degree of contamination:

Max. permissible degree of contamination of the pressure fluid is to NAS 1638 class 10.

We therefore recommend a filter with a minium retention rate of $\beta_{10} \geq 75$.

Stroke speed: 20 in/sec
(dependent on the connection port)

Air bleed standard: Secured against removal

Acceptance:

Each cylinder is tested to Bosch Rexroth standards.

Cylinders, outside the above parameters are also available. Consult factory

For applications above 250°F specify a non studded piston rod end and advise operating temperature before ordering.

Operating Pressures (PSI) by Cylinder Bore Sizes

Cylinder Bore	Standard Rod	4 to 1 Design Factor *
2	1-3/8	3,000 psi
2-1/2	1-3/8	3,000 psi
3-1/4	1-3/8	2,100 psi
4	1-3/4	2,500 psi
5	2	2,500 psi
6	2-1/2	2,500 psi

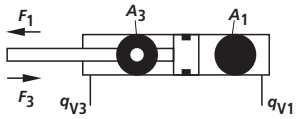
Cylinders with larger rod diameters rated at 3,000 psi.

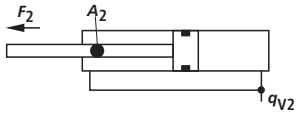
1) Exceptions to 5,000 psi non-shock rating:
   a) All bore sizes using the following mounts: MT4, ME5
   b) The following mounts for bore sizes listed: MP1: 2-1/2"

* The 4 to 1 design factor is based on the tensile strength of the piston to rod connection.

Areas, Forces, Flows (dimensions in inches)

Bore	Piston rod	Area ratio	Areas Piston	Areas Rod	Areas Annulus	Force at 3000 psi [1] Push	Force at 3000 psi [1] Regen.	Force at 3000 psi [1] Pull	Flow at 4"/s [2] Out	Flow at 4"/s [2] Regen.	Flow at 4"/s [2] In
		j	A_1	A_2	A_3	F_1	F_2	F_3	q_{V1}	q_{V2}	q_{V3}
Ø in.	Ø in.	A_1/A_3	in.^{2}	in.^{2}	in.^{2}	Lb.	Lb.	Lb.	gpm	gpm	gpm
2"	1-3/8"	1.89	3.14	1.48	1.66	9,420	4440	4980	3.26	1.54	1.72
2-1/2"	1-3/8"	1.43	4.91	1.48	3.43	14,730	4440	10,290	5.10	1.54	3.56
	1-3/4"	1.96		2.40	2.51		7200	7530		2.49	2.60
	1-3/8"	1.21		1.48	6.82		4440	20,460		1.54	7.08
3-1/4"	1-3/4"	1.40	8.30	2.40	5.90	24,900	7,200	17,700	8.62	2.49	6.13
	2"	1.60		3.14	5.16		9,420	15,480		3.26	5.36
	1-3/4"	1.24		2.40	10.17		7,200	30,510		2.49	10.56
4"	2"	1.33	12.57	3.14	9.43	37,710	9,420	28,290	13.05	3.26	9.79
	2-1/2"	1.64		4.91	7.66		14,730	22,980		5.10	7.95
	2"	1.19		3.14	16.50		9420	49,500		3.26	17.14
	2-1/2"	1.33		4.91	14.73		14,730	44,190		5.10	15.30
5"	3"	1.56	19.64	7.07	12.57	58,920	21,210	37,710	20.40	7.35	13.05
	3-1/2"	1.96		9.62	10.02		28,860	30,060		9.99	10.41
	2-1/2"	1.21		4.91	23.34		14,730	70,020		5.10	24.25
	3"	1.33		7.07	21.18		21,210	63,540		7.35	22.00
6"	3-1/2"	1.51	28.25	9.62	18.63	84,750	28,860	55,890	29.35	9.99	19.36
	4"	1.80		12.57	15.68		37,710	47,040		13.05	16.30





Note

[1] Theoretical force (efficiency not taken into account)

[2] Stroke velocity

Stroke tolerances

Stroke tolerances result from the cylinder head, cylinder base, cylinder tube, piston and piston rod. The stroke tolerance for all piston diameters and stroke lengths is +1/16" / -0". Tighter stroke tolerances can be requested, however, details regarding the operating pressure and operating temperature must be stated.

Stroke lengths	Stroke tolerances
2"- 60" (refer to pg. 42 for buckling loads)	+1/16" / -0"

Approximate Uncrated CST4 Hydraulic Cylinder Weights (lbs.)*

Cylinder Bore	2	2-1/2	3-1/4	4	5	6
Zero Stroke	10	16	31	41	73	138
Add Per Inch of Stroke	.7	1.17	1.75	2.5	4.0	5.2

* Weights based on standard (first) rod sizes. Add 10% to cover additional weight for crating.

Ordering Details

	T4	/	/	/	Z	1X/									*

Linear Positioning Cylinder = **CS**

Series = **T4**

Mounting types
Rectangular head = **ME5**
Clevis mounting = **MP1**
Side lug = **MS2**
Trunnion at intermediate position [3] = **MT4**

Bore Dia. Ø 2.00 to 6.00 inch [5]

Piston rod Ø 1.38 to 4.00 inch

Stroke length in inches (min. stroke length 2")

Design principle
Head and cap connected by tie rods = **Z**

Series
10 to 19 unchanged installation and connection dimensions = **1X**

Port connections/ types
SAE straight thread port (ISO 11926-1) = **S**
SAE Code 61 - 3000 psi 4-bolt flange = **F**
Integrated NG 6/D03 mount on cap at pos. 1 ONLY = **P**
Integrated NG 10/D05 mount on cap at pos. 1 ONLY = **T**
Integrated NG 16/D07 mount on cap at pos. 1 ONLY = **U**
Special (specify) = **X**

Further details in clear text

Option 2
W = Without options
K = Thrust key
S = Stop tube (specify length)
Y = Additional piston rod ext. state LY dimensions in clear text
B = Gland drain connection
F = Analog 0 - 10 VDC output
C = Analog 4 - 20 mA output
G = Start/stop, RS422
H = Digital pulse width modulated, RS422
D = 5µ SSI output
X = Other outputs (specify in clear text)

Option 1
A = Test point, both sides
B = Balluff BTL-5 transducer installed [7]
T = MTS transducer installed [7]
G = Provisions only for Balluff [8] BTL-5 transducer
H = Provisions only for MTS transducer [8]

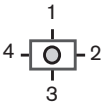
Seal version
Suitable for mineral oil to DIN 51 524 HL, HLP and HFA
T = Servo quality/reduced friction
Suitable for phosphate ester HFD-R
V = Flourocarbon seal system [4]

End position cushioning
U = Without
S = Rod sides, adjustable

Piston rod end [2]
H = Small male thread KK1
D = Intermediate male thread KK2
E = Female thread KK1
T = S.A.F.E., rod end
X = Special (specify)

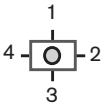
Piston rod version
H = Surface hardened and hard chromium plated [1]

Port location at cap
1 =
2 = [6]
3 = [6]
4 = [6]



Viewed on piston rod

Port location at head
1 =
2 = [6]
3 = [6]
4 = [6]



Viewed on piston rod

Remarks:

[1] Only 5/8" to 4" diameter piston rods are case hardened and hard chrome plated.

[2] With extreme shock loads the piston rod threads have to be selected, taking the fatigue limits into account. Rod and clevis, installed parts, etc. must always be firmly clamped against the piston rod shoulder.

[3] State XV dimensions in inches in clear text.

[4] Maximum working pressure limited to 2,000 psi when using flourocarbon seal system option "V". Consult factory for higher pressures.

[5] Other bore sizes available on request.

[6] Port connections "P", "T" and "U" not possible.

[7] Includes protective transducer cover installed on cap end of cylinder (except 2" bore).

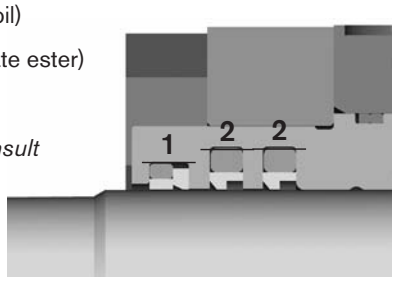
[8] Protective transducer cover not included as a standard feature when cylinder is provided with provisions only. Can be ordered as a separate item. (see page 27)

Sealing System

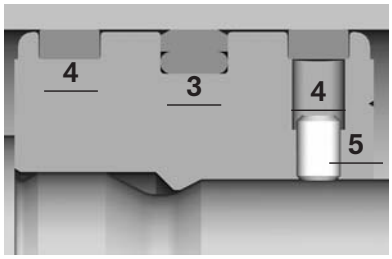
"T"* Seal system for low friction applications (mineral oil)

"V"* Seal system for low friction applications (phosphate ester)

** - not recommended for load holding applications. Consult factory for load holding options*



1. Double lip wiper
2. PTFE step seals



3. Low friction piston seal
4. Wear bands
5. Piston threaded and sealed to piston rod with permanent adhesive and mechanically secured with a set screw

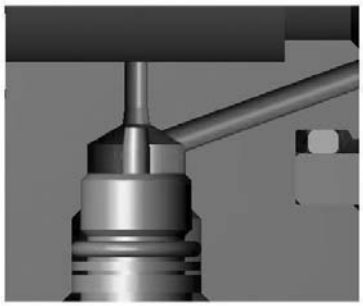
Cushioning System (optional)

Patented Exact-a-just™ cushioning provides accurate micro-meter adjustment

Exact-a-just™ cushioning permits adjustment over a wide range of settings for faster cycle times

Results in reduced maintenance costs, reduced internal and external shock, and softer cushioning stops

Available on rod side only



Exact-a-just™ cushioning

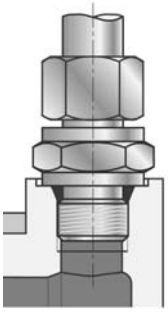
Connection Port and Secured Air Bleed (standard)

ISO 11926-1 SAE straight thread (standard)

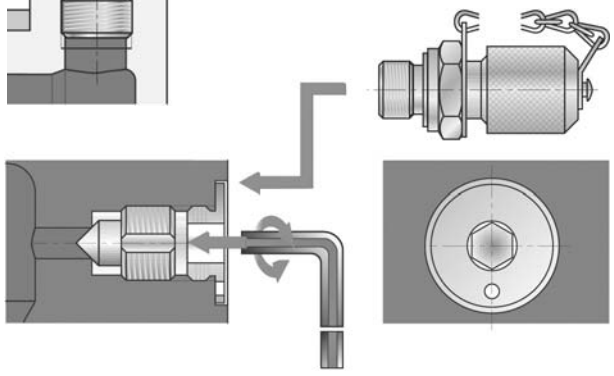
For other port options consult factory

To provide safety and prevent accidents, patented air bleed is secured against unscrewing (standard)

Air bleed ports can become an alternate connection for a pressure test fitting (optional)



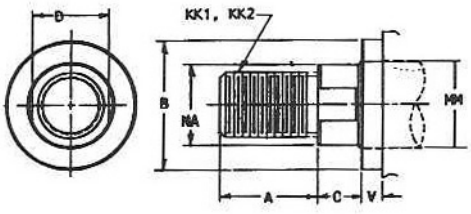
Alternate pressure test fitting



Piston Rod Versions

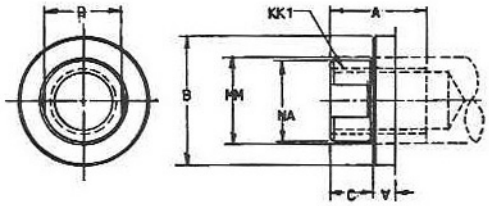
Male Rod End

Option H & D



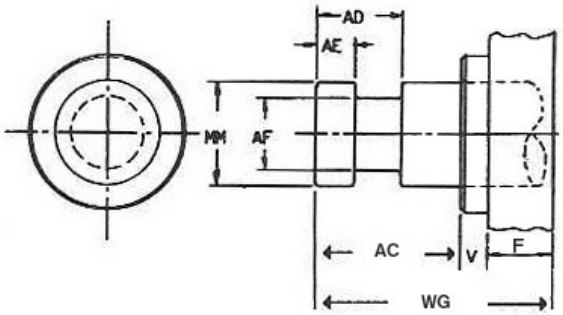
Female Rod End

Option E



S.A.F.E. Rod End

Option T



Rod Thread Options:

Standard KK1 Male furnished when not specified.
Male thread available in KK1 and KK2 thread sizes.
KK1 studded male rod end standard for 1-3/8" rod dia.
Female thread available in KK1 thread size only.

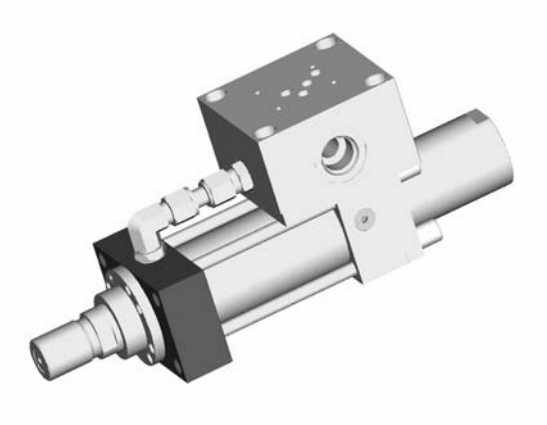
Piston Rod End

MM Rod Diameter	A	B +0.000 -0.002	C	D	AC	AD	AE	AF	KK1	KK2	NA	WG
1.375	1.625	1.999	0.63	1.13	1.75	1.06	0.375	0.875	1-14	1-1/4-12	1.32	2.75
1.750	2.000	2.374	0.75	1.50	2.00	1.31	0.500	1.125	1-1/4-12	1-1/2-12	1.69	3.13
2.000	2.250	2.624	0.88	1.69	2.63	1.69	0.625	1.375	1-1/2-12	1-3/4-12	1.94	3.75
2.500	3.000	3.124	1.00	2.06	3.25	1.94	0.750	1.750	1-7/8-12	2-1/4-12	2.44	4.50
3.000	3.500	3.749	1.00	2.63	3.63	2.44	0.875	2.250	2-1/4-12	2-3/4-12	2.94	4.88
3.500	3.500	4.249	1.00	3.00	4.38	2.69	1.000	2.500	2-1/2-12	3-1/4-12	3.44	5.63
4.000	4.000	4.749	1.00	3.38	4.50	2.69	1.000	3.000	3-12	3-3/4-12	3.94	5.75

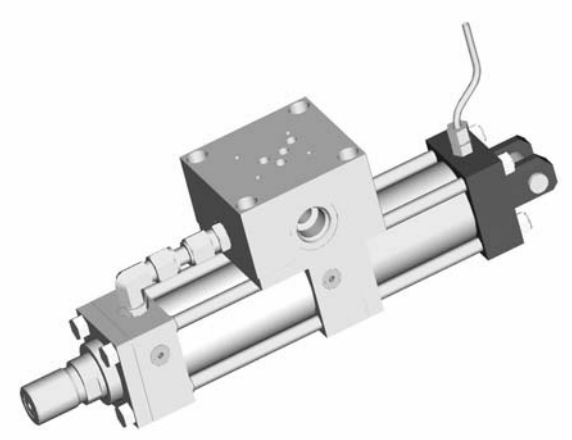
Note: For "F, RT and V" dimensions, see respective mounting dimensions shown on pages 52 thru 57.

Mounting Type Overview

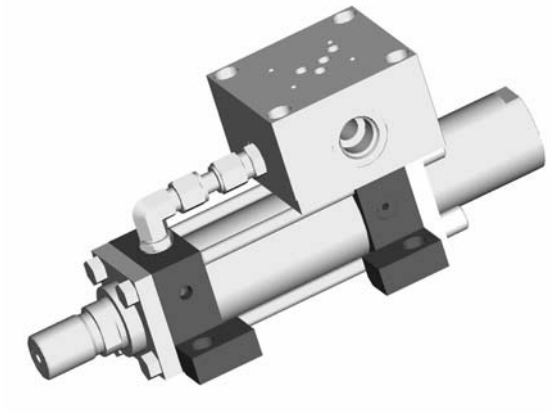
ME5 (see Page 52)



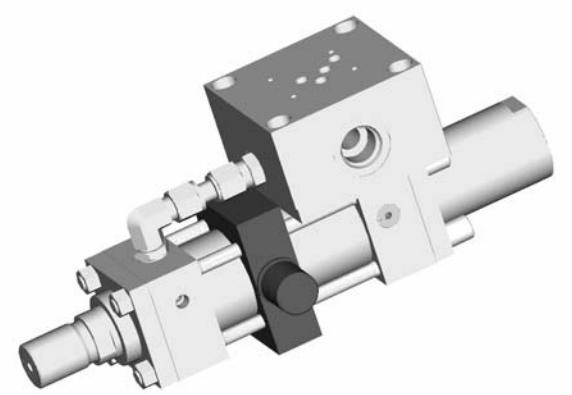
MP1 (see Page 53)



MS2 (see Page 54, 55)



MT4 (see Page 56, 57)



Mounting and Dimensions ME5

CST4 ME5

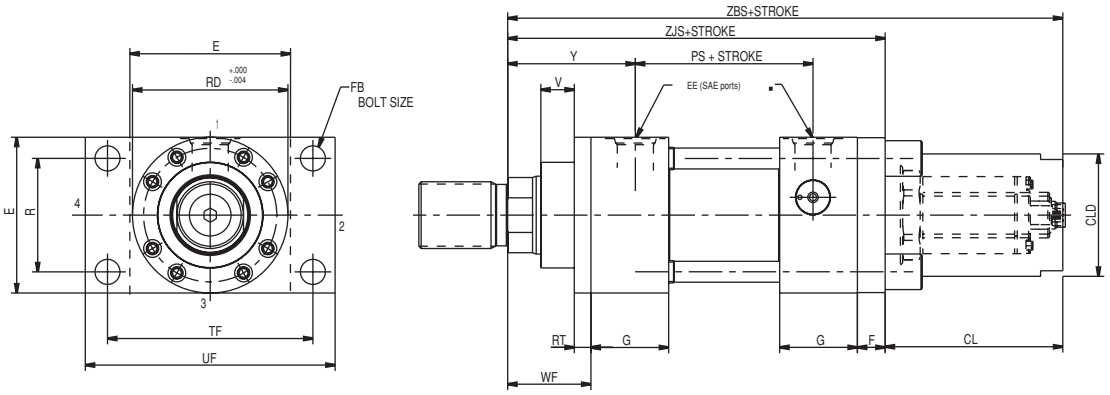


Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	Y	RD*	WF	ZBS	ZJS	RT
2.000	1.375	0.62	2.63	3.000	1.63	– *	7.13	.38
2.500	1.375	0.62	2.63	3.000	1.63	13.25	7.25	.38
	1.750	0.75	2.88	3.500	1.88	13.50	7.50	.38
3.250	1.375	0.62	2.75	3.000	1.63	14.13	8.13	.38
	1.750	0.75	3.00	3.500	1.88	14.38	8.38	.38
	2.000	0.50	3.13	4.000	2.00	14.50	8.50	.63
4.000	1.750	0.75	3.00	3.500	1.88	14.75	8.75	.38
	2.000	0.50	3.13	4.000	2.00	14.88	8.88	.63
	2.500	0.63	3.38	4.500	2.25	15.13	9.13	.63
5.000	2.000	0.50	3.13	4.000	2.00	15.38	9.38	.63
	2.500	0.63	3.38	4.500	2.25	15.63	9.63	.63
	3.000	0.63	3.38	5.250	2.25	15.63	9.63	.63
	3.500	0.63	3.38	5.750	2.25	15.63	9.63	.63
6.000	2.500	0.63	3.50	4.500	2.25	16.63	10.63	.63
	3.000	0.63	3.50	5.250	2.25	16.63	10.63	.63
	3.500	0.63	3.50	5.750	2.25	16.63	10.63	.63
	4.000	0.50	3.50	6.500	2.25	16.63	10.63	.75

Solid head flange mounts are some of the strongest, most rigid methods of mounting cylinders. The head flange type mounting is best in a tension application.

Rod end options shown on page 6.

***Note:** "RD" dimension is not specified by NFPA. Please verify this dimension for retrofit or replacement applications.

Table 2 - Dimensions not affected by rod diameter

Bore In.	E	F	G	K	PS	R	SAE Port EE	FB Bolt	LB	TF	UF	*CL	*CLD
2.000	3.00	0.63	1.75	0.44	2.88	2.06	-10	0.50	5.25	4.13	5.13	–	–
2.500	3.50	0.63	1.75	0.44	3.00	2.56	-10	0.50	5.38	4.63	5.63	6.00	2.75
3.250	4.50	0.75	2.00	0.55	3.50	3.25	-12	0.63	6.25	5.88	7.13	6.00	2.75
4.000	5.00	0.88	2.00	0.55	3.75	3.81	-12	0.63	6.63	6.38	7.63	6.00	2.75
5.000	6.50	0.88	2.00	0.77	4.25	4.94	-12	0.88	7.13	8.19	9.75	6.00	2.75
6.000	7.50	1.00	2.25	0.85	4.88	5.72	-16	1.00	8.38	9.44	11.25	6.00	2.75

* Dimensions for protective transducer cover. Included in scope of supply when cylinder is ordered with transducer installed. (not available on 2" bore size)

Mounting and Dimensions MP1

CST4 MP1

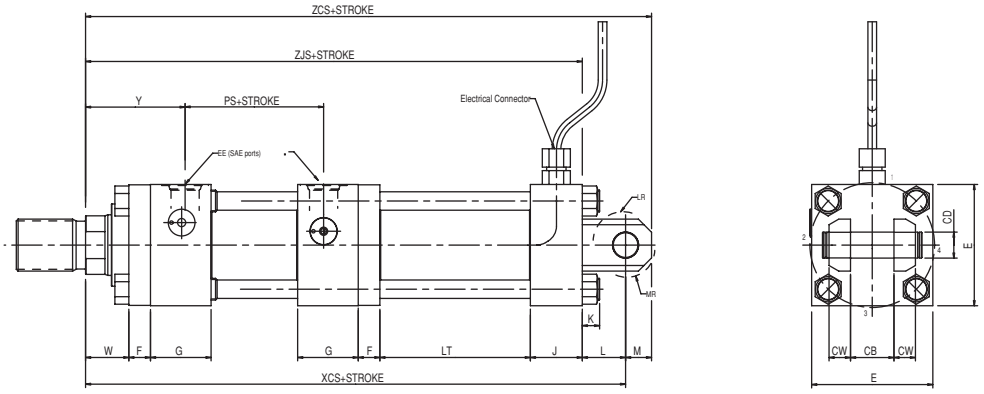


Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	XCS	ZCS	ZJS
2.000	1.375	0.38	1.00	2.63	15.88	16.63	14.63
2.500	1.375	0.38	1.00	2.63	16.00	16.75	14.75
	1.750	0.50	1.25	2.88	16.25	17.00	15.00
3.250	1.375	0.25	0.88	2.75	17.38	18.38	15.88
	1.750	0.38	1.13	3.00	17.63	18.63	16.13
	2.000	0.38	1.25	3.13	17.75	18.75	16.25
4.000	1.750	0.25	1.00	3.00	18.63	20.00	16.50
	2.000	0.25	1.13	3.13	18.75	20.13	16.63
	2.500	0.38	1.38	3.38	19.00	20.38	16.88
5.000	2.000	0.25	1.13	3.13	19.38	21.13	17.33
	2.500	0.38	1.38	3.38	19.63	21.38	17.38
	3.000	0.38	1.38	3.38	19.63	21.38	17.38
	3.500	0.38	1.38	3.38	19.63	21.38	17.38
6.000	2.500	0.25	1.25	3.50	21.38	23.38	18.88
	3.000	0.25	1.25	3.50	21.38	23.38	18.88
	3.500	0.25	1.25	3.50	21.38	23.38	18.88
	4.000	0.25	1.25	3.50	21.38	23.38	18.88

The Clevis or Pin mounted cylinder is probably the most widely used of all mounts. For short strokes, medium or small cylinder applications, the clevis mounts are recommended. Pivot mounts must always be used with a pivot type rod end attachment. Pivot pin and retainer rings included with MP1 mount.

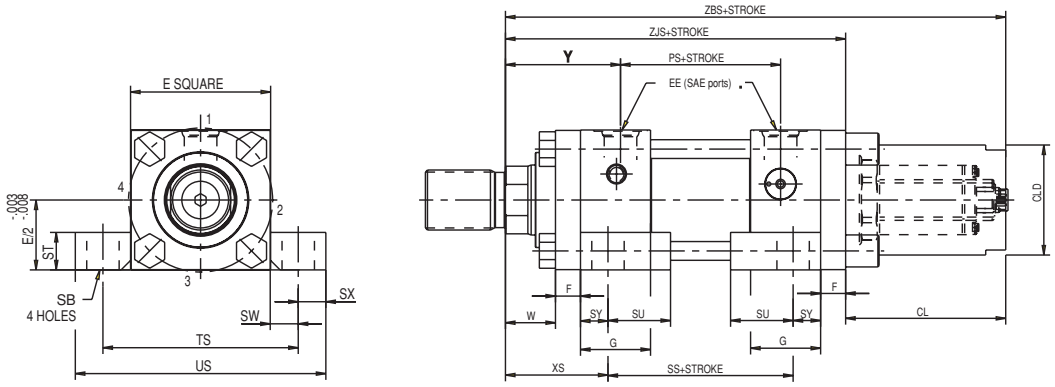
The bearing retainer plate is the same as the “E” dimension for
2”–6” bore sizes. Rod end options shown on page 50.

Table 2 - Dimensions not affected by rod diameter

Bore In.	CB	CD	CW	E	SAE Port EE	F	G	J	K	L	LB	LR	M	MR	PS	LT
2.000	1.25	0.750	0.63	3.00	-10	0.63	1.75	1.50	0.44	1.25	5.25	0.88	0.75	0.94	2.88	6.00
2.500	1.25	0.750	0.63	3.50	-10	0.63	1.75	1.50	0.44	1.25	5.38	0.88	0.75	0.94	3.00	6.00
3.250	1.50	1.000	0.75	4.50	-12	0.75	2.00	1.75	0.55	1.50	6.25	1.13	1.00	1.25	3.50	6.00
4.000	2.00	1.375	1.00	5.00	-12	0.88	2.00	1.75	0.55	2.13	6.63	1.75	1.38	1.63	3.75	6.00
5.000	2.50	1.750	1.25	6.50	-12	0.88	2.00	1.75	0.77	2.25	7.13	1.88	1.75	2.00	4.25	6.00
6.000	2.50	2.000	1.25	7.50	-16	1.00	2.25	2.25	0.85	2.50	8.38	2.13	2.00	2.38	4.88	6.00

Mounting MS2

CST4 MS2



The side or lug mounted cylinder provides a fairly rigid mount. These type mounts can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly, the mounting bolts are either in simple shear or tension without any compound stresses. An extended key plate option is available to eliminate the need for fitted bolts or external keys to carry the thrust load.

Note:
When specifying an MS2 mount with ports in the 2 or 4 quandrant, be sure to see that sufficient clearance between the port fitting and the lug is available to insert a bolt or cap screw into the lug.

Rod end options shown on page 50.

Dimensions MS2

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	XS	ZBS	ZJS
2.000	1.375	0.38	1.00	2.63	2.13	– *	7.13
2.500	1.375	0.38	1.00	2.63	2.31	13.25	7.25
	1.750	0.50	1.25	2.88	2.56	13.50	7.50
3.250	1.375	0.25	0.88	2.75	2.31	14.13	8.13
	1.750	0.38	1.13	3.00	2.56	14.38	8.38
	2.000	0.38	1.25	3.13	2.68	14.50	8.50
4.000	1.750	0.25	1.00	3.00	2.75	14.75	8.75
	2.000	0.25	1.13	3.13	2.88	14.88	8.88
	2.500	0.38	1.38	3.38	3.13	15.13	9.13
5.000	2.000	0.25	1.13	3.13	2.88	15.38	9.38
	2.500	0.38	1.38	3.38	3.13	15.63	9.63
	3.000	0.38	1.38	3.38	3.13	15.63	9.63
	3.500	0.38	1.38	3.38	3.13	15.63	9.63
6.000	2.500	0.25	1.25	3.50	3.38	16.63	10.63
	3.000	0.25	1.25	3.50	3.38	16.63	10.63
	3.500	0.25	1.25	3.50	3.38	16.63	10.63
	4.000	0.25	1.25	3.50	3.38	16.63	10.63

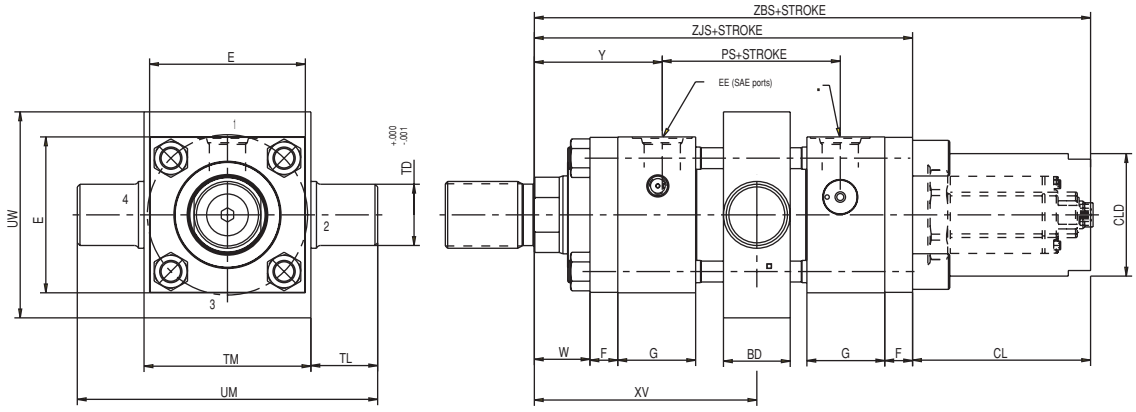
Table 2 - Dimensions not affected by rod diameter

Bore In.	E	SAE Port EE	F	G	K	LB	PS	SB Bolt	SS	ST	SU	SW	SX	SY	TS	US	*CL	*CLD
2.000	3.00	-10	0.63	1.75	0.44	5.25	2.88	0.50	3.63	0.75	1.25	0.50	0.50	0.50	4.00	5.00	–	–
2.500	3.50	-10	0.63	1.75	0.44	5.38	03.00	0.75	3.38	1.00	1.56	0.69	0.69	0.69	4.88	6.25	6.00	2.75
3.250	4.50	-12	0.75	2.00	0.55	6.25	3.50	0.75	4.12	1.00	1.56	0.69	0.69	0.69	5.88	7.25	6.00	2.75
4.000	5.00	-12	0.88	2.00	0.55	6.63	3.75	1.00	4.00	1.25	2.00	0.88	0.88	0.88	6.75	8.50	6.00	2.75
5.000	6.50	-12	0.88	2.00	0.76	7.13	4.25	1.00	4.50	1.25	2.00	0.88	0.88	0.88	8.25	10.00	6.00	2.75
6.000	7.50	-16	1.00	2.25	0.85	8.38	4.88	1.25	5.13	1.50	2.50	1.13	1.13	1.13	9.75	12.00	6.00	2.75

* Dimensions for protective transducer cover. Included in scope of supply when cylinder is ordered with transducer installed. (not available on 2" bore size)

Mounting MT4

CST4 MT4



All trunnion mount cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

Specify “XV” dimension when ordering MT4 Intermediate Fixed Trunnion mounts. If not specified, trunnion will be located at the center of the tube.

The bearing retainer plate is the same as the “E” dimension for 2”— 6” bore sizes.

Rod end options shown on page 50.

Dimensions MT4

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	XV Min.	ZBS	ZJS
2.000	1.375	0.38	1.00	2.63	4.28	– *	7.13
2.500	1.375	0.38	1.00	2.63	4.41	13.25	7.25
	1.750	0.50	1.25	2.88	4.66	13.50	7.50
3.250	1.375	0.25	0.88	2.75	4.78	14.13	8.13
	1.750	0.38	1.13	3.00	5.03	14.38	8.38
	2.000	0.38	1.25	3.13	5.16	14.50	8.50
4.000	1.750	0.25	1.00	3.00	5.16	14.75	8.75
	2.000	0.25	1.13	3.13	5.28	14.88	8.88
	2.500	0.38	1.38	3.38	5.53	15.13	9.13
5.000	2.000	0.25	1.13	3.13	5.53	15.38	9.38
	2.500	0.38	1.38	3.38	5.72	15.63	9.63
	3.000	0.38	1.38	3.38	5.72	15.63	9.63
	3.500	0.38	1.38	3.38	5.72	15.63	9.63
6.000	2.500	0.25	1.25	3.50	6.16	16.63	10.63
	3.000	0.25	1.25	3.50	6.16	16.63	10.63
	3.500	0.25	1.25	3.50	6.16	16.63	10.63
	4.000	0.25	1.25	3.50	6.16	16.63	10.63

Table 2 - Dimensions not affected by rod diameter

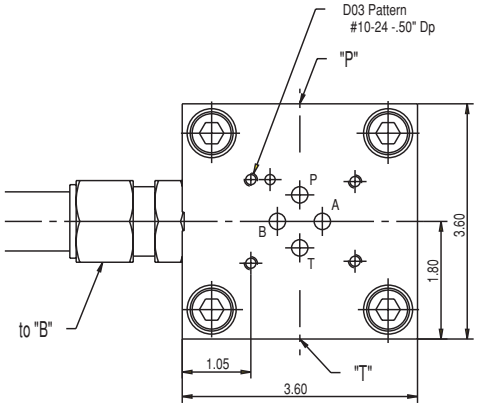
Bore In.	B	E	SAE Port EE	F	G	J	K	LB	PS	TD	TL	TM	UM	UT	UW	BD	*CL	*CLD
2.000	1.44	3.00	-10	0.63	1.75	1.50	0.44	5.25	2.88	1.375	1.38	3.50	6.25	5.75	4.13	1.50	–	–
2.500	1.69	3.50	-10	0.63	1.75	1.50	0.44	5.38	3.00	1.380	1.38	4.00	6.75	6.25	4.63	1.50	6.00	2.75
3.250	1.94	4.50	-12	0.75	2.00	1.75	0.55	6.25	3.50	1.750	1.75	5.00	8.50	8.00	5.81	2.00	6.00	2.75
4.000	2.19	5.00	-12	0.88	2.00	1.75	0.55	6.63	3.75	1.750	1.75	5.50	9.00	8.50	6.38	2.00	6.00	2.75
5.000	2.69	6.50	-12	0.88	2.00	1.75	0.77	7.13	4.25	1.750	1.75	7.00	10.50	10.00	7.75	2.00	6.00	2.75
6.000	2.94	7.50	-16	1.00	2.25	2.25	0.85	8.38	4.88	2.000	2.00	8.50	12.50	11.50	10.38	3.00	6.00	2.75

* Dimensions for protective transducer cover. Included in scope of supply when cylinder is ordered with transducer installed. (not available on 2" bore size)

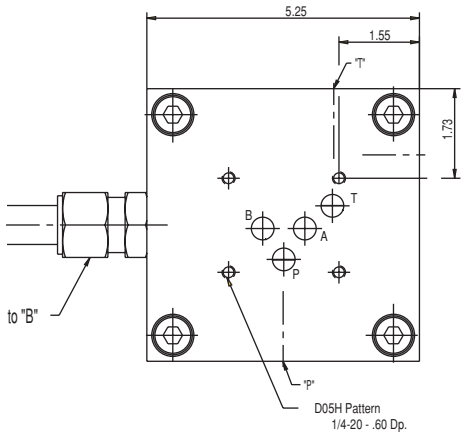
Valve Connection Plates, Dimensions and Porting Patterns

Valve spool parallel to the cylinder axis

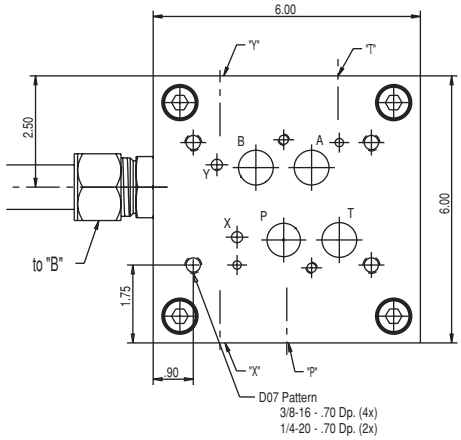
NG 6 (D03)



NG 10 (D05)



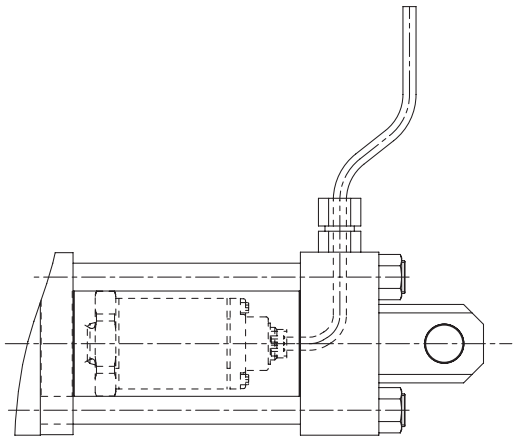
NG 16 (D07)



Nominal Size	Part No.	SAE Str. Thd. Connections A	B	P	T	X	Y
NG 6	R978015401	-12	-10	-12	-12	–	–
NG 10	R978019288	-12	-10	-16	-16	–	–
NG 16	R978017315	-20	-16	-20	-20	-6	-6

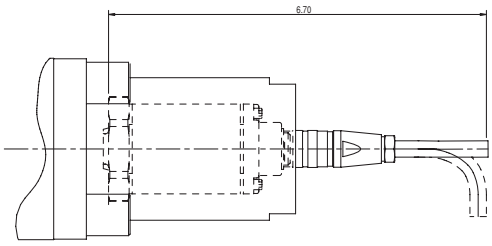
Position Transducer

Mounting style MP1 with integral connector



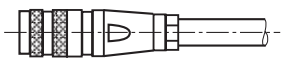
5 meter integral cable with pigtail termination

Mounting styles ME5, MS2 and MT4 with plug in connector



1) Included with the scope of supply

1) For analogue output:
8-pin Amphenol plug-in connector
Material No. R978885023



Position Transducer

Functional Description

The position transducer which is pressure-tight up to 5,000 psi operates without mechanical contact and is absolute. The basis for this position transducer is the magneto-strictive effect. Thus a torsion impulse is released through the contact of two magnetic fields. This impulse runs on the wave guide inside the transducer from the measuring point to the sensor head. The running time is constant and nearly termperature-independent.

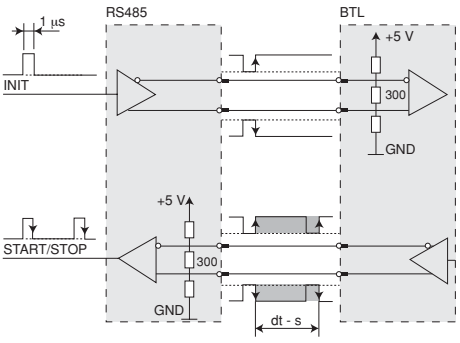
It is proportional to the position of the magnets and thus a measure for the actual position value and is converted into a direct analogue or digital output in the sensor.

Micropulse BTL-5 - Electrical Options

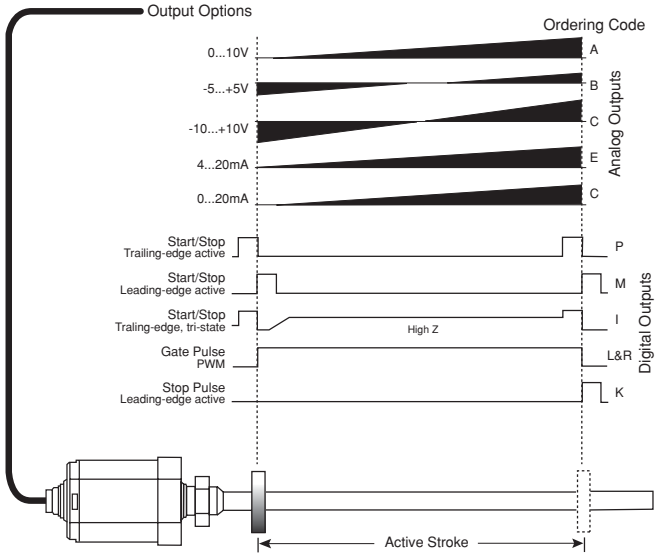
Electrical Interface	Anlog	Analog	Digital
Electrical Type	Voltage	Current	StartStop & PWM
Output	0...+10 V	4...20 mA	Start/Stop or Pulse-width-modulated (RS422/RS485)
Output Load	>2kΩ (5 mA max)	≤ 500Ω	per sec
Resolution	≤ 500	≤ 0.66 µA	Controller dependent
Non-Linearity	±100 mm to 500 mm stroke, ±0.02% over 500 mm stroke	±100 mm to 500 mm stroke, ±0.02% over 500 mm stroke	±100 mm to 500 mm stroke, ±0.02% over 500 mm stroke
Repeatability	Resolution / min 2 µm	Resolution / min 2 µm	Resolution / min 2 µm
Hysteresis	≤ 5 µm	≤ 5 µm	≤ 5 µm
Sampling Rate	2 KHz	2 KHz	500 Hz stroke > 2000 mm 1 KHz stroke < 2000 mm
Temperature Coefficient*	[150 µV / °C + (5 pmm / °C*P*V/NL)] * ΔT	[0.6 µA / °C + (10 pmm / °C*P*V/NL)] * ΔT	[0.6 µA / °C + (10 pmm / °C*P*V/NL)] * ΔT
Operating Voltage	24 V DC ± 20% or 15 V DC ± 2%	24 V DC ± 20% or 15 V DC ± 2%	24 V DC ± 20% or 15 V DC ± 2%
Operating Current	< 150 mA (at 1K Hz sampling rate)	< 150 mA (at 1K Hz sampling rate)	< 150 mA (at 1K Hz sampling rate)

Notes:
Analog voltage output versions incorporate both rising and falling outputs. Analog current version must be ordered as rising or falling outputs.

***Temperature coefficient variables**
V = output range in V
I = output range in [mA]
ΔT = temperature change
P = magnet position



RS-485 signal transmission with digital outputs



Analog and digital output options for the Micropulse BTL-5

Micropulse BTL-5 - Specialized Interfaces

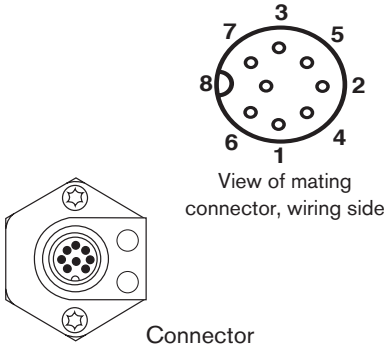
SSI

The SSI (synchronous serial interface) output interfaces with control systems from Bosch Rexroth and many others. Cable spans can be up to 400 m with noise-free operation. The internal linearization of this interface makes it ideal for applications requiring the best accuracy available.

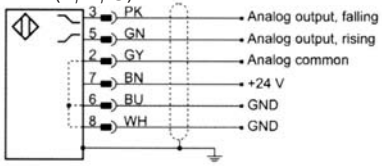
Resolution	5 µm
Non-linearity	± 30 µm or ± 2 LSBs, whichever is greater
Repeatabilty (resolution + hysteresis)	± 1 digit
Hysteresis	≤ 1 digit
Resolution	≤ 500
Sampling Rate	2 K Hz
Temperature Coefficient *	(6 µm + 5 ppm xL) / °C
Communication Speeds	100, 200, 400, 500, 1,000 k Hz
Output Modes	24 or 25 bits (binary or gray code)
Operating Voltage	24 V DC ± 20%
Operating Current	≤ 80 mA
Output	Standard RS-485 / 422 levels

Micropulse BTL-5 - Wiring Diagrams

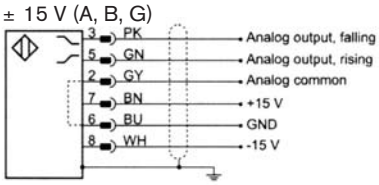
Analog Wiring Diagrams



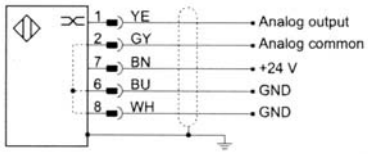
Analog Voltage
24 V (A, B, G)



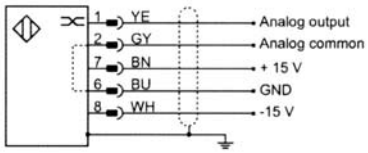
Analog Voltage
± 15 V (A, B, G)



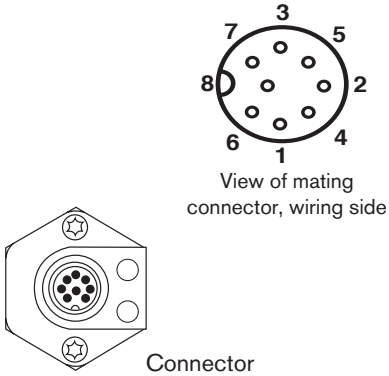
Analog Voltage
24 V (E, C)



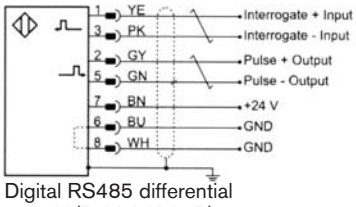
Analog Voltage
± 15 V (E, C)



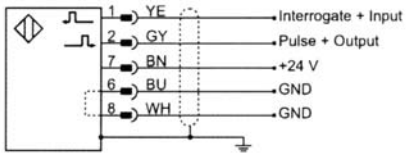
Digital Wiring Diagrams



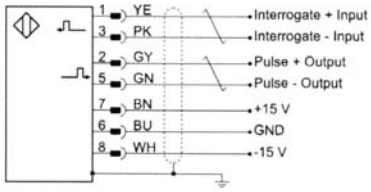
Digital RS485 differential
24 V (P, M, I, K, L, R)



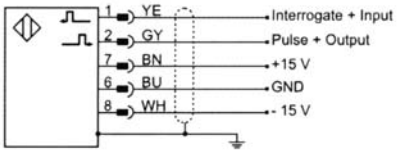
Digital, Single-ended
24 V (N)



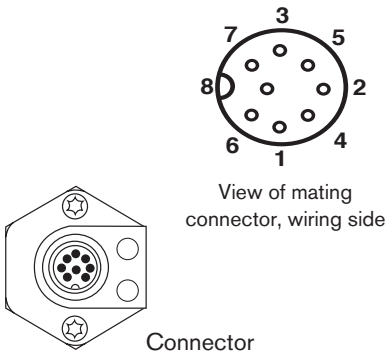
Digital RS485 differential
± 15 V (P, M, I, K, L, R)



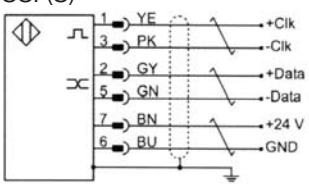
Analog Voltage
± 15 V (E, C)



SSI Wiring Diagrams



SSI (S)



Temposonics® G Series

Product Specifications

G-Series position sensors feature a microprocessor-based design with enhanced diagnostics and programmability to maximize backwards compatibility.

Backwards compatibility is one of the primary benefits of the new G-Series position sensor. G-Series position sensors provided the same functionality as Tempo II and L-Series sensors making them an ideal direct replacement for these products.

In addition to providing advanced programming and diagnostic capabilities in a rugged package, G-Series position sensors also include the following features:

• Electronics housing small enough to allow for drop in replacements of legacy Temposonics products

• Standard 24 Vdc and extended input power supply options for compatibility with older controller interfaces.

• Fully adjustable voltage and current outputs within:

-10 to +10 Vdc or +10 to -10 Vdc

0 to 20 mA or 20 to 0 mA

Parameter	Specifications
Measured Variable:	Displacement
Resolution:	Analog: Infinite Digital: 1 ÷ [gradient x cyrstal freq. (mHz) x circulations]
Non-Linearity:	± 0.02% or ± 0.05 mm (± 0.002 in.), whichever is greater.
Repeatability:	± 0.01% of full stroke or ± 0.0001 in (± 0.025 mm), whichever is greater.
Outputs:	Analog: Voltage or Current Digital: Start/Stop or PWM
Measuring Range: Hydraulic-rod style:	 Analog: 50 to 2540 mm (2 to 100 in.)* Digital: 50 to 7620 mm (2 to 300 in.)
Operating Voltage:	+ 24 Vdc (20.4 - 28.8 Vdc) standard
Operating Temperature:	-40 to 85° C (-40 to -185° F)
EMC Test:	Emmissions IEC/EN 61000-6-3, Immunity IEC/EN 61000-4-2/3/4/5/6/8, level 3/4 criterium A, CE qualified
Shock Rating:	100 g (single hit) / IEC standard 68-2-27 (survivability)
Vibration Rating:	5 g / 10-150 Hz / IEC standard 68-2-6
Adjustability:	Field adjustable zero and span (for analog sensors only)
Update TIme:	Analog: < 1 ms (typical) Digital (external inerrogate): Minimum = (2.5 + null + stroke) x 10.0 µs/in. x (number of recirculations)
Electronic Head:	Aluminum housing
Sealing:	IP 67
Sensor rod:	304L Stainless steel
Operating Pressure:	350 bar static, 690 bar spike (5,000 psi static, 10,000 psi spike)
Mounting:	Threaded flange 3/4-16 UNF-3A
Typical Mounting Torque:	45 N-m (33 ft.-lbs.)
Magnet Type:	Ring magnet

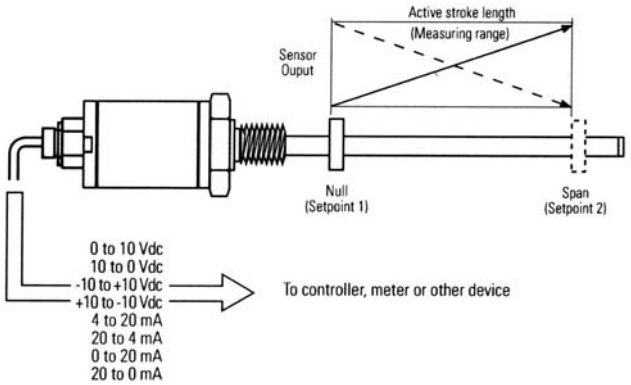
* Stroke lengths longer than 2,540 mm (100 in.) for analog output are available on a custom basis. The above specifications for analog output sensors are basaed on the assumption that output ripple is averaged by the mesuring device as with any typical analog device.

Temposonics® G Series - Analog or Digital Outputs

Analog Outputs

The Temposonics G Series position sensors provide direct analog outputs, including voltage (0 to 10 Vdc, forward or reverse acting) and current (4 to 20 MA, or 0 to 20 mA, forward or reverse acting). Both voltage and current outputs allow full adjustments of zero and span setpoints.

Since the outputs are direct, no signal-conditioning electronics are needed when interfacing with controllers or meters.

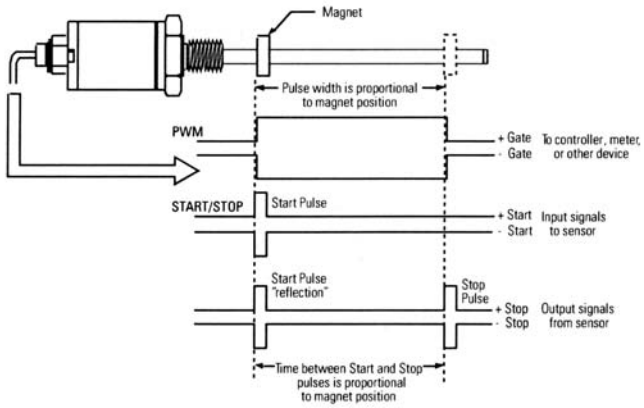


Features

- Voltage or Current Outputs
- Full Adjustment on Zero and Span
- Direct Outputs – No Signal-conditioning Required
- Infinite Resolution

Digital Outputs

The Temposinics G Series position sensors provide direct Start/Stop and PWM outputs. Standard resolution is 0.004 inches (when using a 28 MHz counter). Higher resolutions are possible with increased circulations or with the use of higher resolution counters.



Features

- Start/Stop or PWM outputs
- High Resolution
- Direct Outputs – No Signal-conditioning Required

Temposonics® R Series - SSI Output

Product Specifications

SSI (Synchronous Serial Interface)

The sensors fulfill all requirements of the SSI standard for absolute encoders. It's displacement value is encloded in a 24/25/26 code formate and transmitted at hight speed in SSI standard formate to the control device. Main feature of the SSI is the synchronized data transfer. Synchronization in a closed-loop control system is made simple. A clock pulse train from a controller is used to gate out sensor data: one bit of position data is transmitted to the controller per one clock pulse received by the sensor. The absolute, parallel position data is continually updated by the sensor and converted by the shift-register into serial information.

Parameter	Specifications
Measured Variable:	Displacement
Resolution:	1 µm, 2 µm, 5 µm, 10 µm
Non-Linearity*:	< ±0.01% of full stroke or ± 0.04 mm (0.0016 in.), whichever is greater*
Repeatability:	< ± 0.001% of full scale or ± 0.0025 mm (0.0001 in.), whichever is greater
Hysteresis (Magnetic**):	< 0.004 mm (0.00016 in.)
Output Format:	Binary or Gray code
Measuring Range:	Rod Style Sensors (RH): 25 to 7620 mm (1 to 300 in.)
Operating Voltage:	+24 Vdc (+ 20%, -15%)
Power Consumption:	100 mA typical
Operating Temperature:	-40 to 75°C (-40 to 167°F)
EMC Test:	EN61000-4-2/3/4/6 level 3/4 DIN EN 500081-1 (Emissions) DIN EN 500082-2 (Immunity)
Shock Rating:	100 g (single hit) / IEC standard 68-2-27 (survivability)
Rod Style (RH Model) Electronic Head:	Alminum housing
Sensor Rod with Flange:	304L stainless steel
Operating Pressure:	350 bar static, 690 bar spike (5000 psi static; 10,000 psi spike)
Maximum Hex Torque:	45 N-m (33 ft.-lbs)
Sealing:	IP 67
Mounting:	3/4-16 UNF-3A
Magnet Type:	Ring Magnet

* Varies with sensor model.

Features

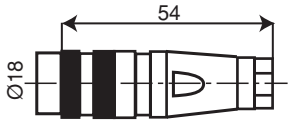
- Rugged industrial sensor
- Linear and absolute measurement
- LEDs for sensor diagnostics
- Contactless sensing with highest durability
- Superior accuracy: Resoltuion up to 1 µm
- Linearity better 0.01%
- Repeatability 0.001%
- Direct 24/25/26 bit SSI output, gray/binary
- Synchronous measurement for real-time sensing
- Field replaceable sensor cartridge

Wiring Connections

Wiring	Pin	Cable	Function
	1	grey	Data (-)
	2	pink	Data (+)
	3	yellow	Clock (+)
	4	green	Clock (-)
	5	brown	+24 VDC
	6	white	0 V (gnd)
	7	n.c.	

Male insert sensor plug rear or cable connector

Cable connector (optional)

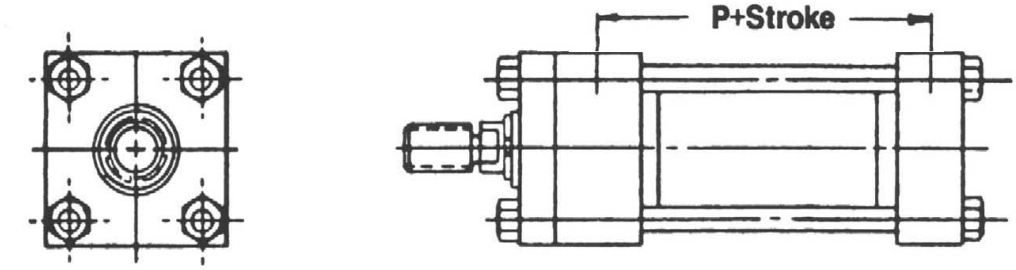


6 pin female connector - analog
Part No. R900072231

7 pin female connector - digital, SSI
Part No. R900079551

Cylinder Options

Oversize Ports (Option X)



Port Dimensions

Bore Size	Rod Dia.	Std. SAE St. Thread Port	Oversize SAE Thread Port		Max. SAE Flg. Port
			Head	Cap	
2	1-3/8	-10	-12*	-12*	-
2.5	1-3/8	-10	-12*	-12*	-
	1-3/4	-10	-12*	-12*	-
	1-3/8 Std.	-12	-12	-16*	1/2" - 3,000 psi
3.25	1-3/4	-12	-12	-16*	1/2" - 3,000 psi
	2	-12	-16*	-16*	1/2" - 3,000 psi
	1-3/4 Std.	-12	-14	-16*	1/2" - 3,000 psi
4	2	-12	-14	-16*	1/2" - 3,000 psi
	2-1/2	-12	-14	-16*	1/2" - 3,000 psi
	2 Std.	-12	-16*	-16*	1/2" - 3,000 psi
5	2-1/2	-12	-16*	-16*	1/2" - 3,000 psi
	3	-12	-16*	-16*	1/2" - 3,000 psi
	3-1/2	-12	-16*	-16*	1/2" - 3,000 psi
	2-1/2 Std.	-16	-20*	-20*	1" - 3,000 psi
6	3	-16	-20*	-20*	1" - 3,000 psi
	3-1/2	-16	-20*	-20*	1" - 3,000 psi
	4	-16	-20*	-20*	1" - 3,000 psi

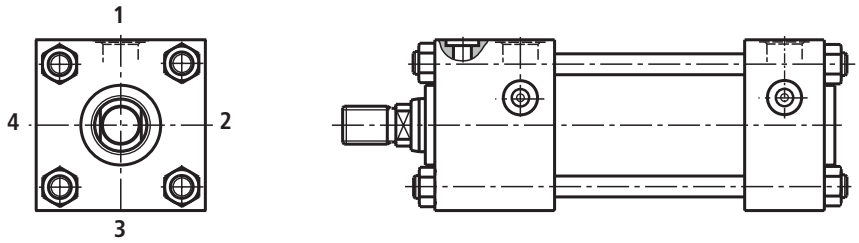
* - Y and P dimensions on dimensional pages must change to accommodate these port sizes.

Gland Drain Connection (Option B)

For cylinders with long stroke lengths or constant pressure (differential circuit), on the annular side, it is possible to drain to tank via a drain line, the fluid which collects between the wiper and rod seal .

Additionally, within the automotive industry, the drain connection is used to monitor seal wear.

To avoid back pressure in the drain line, the tank should be located below the cylinder.



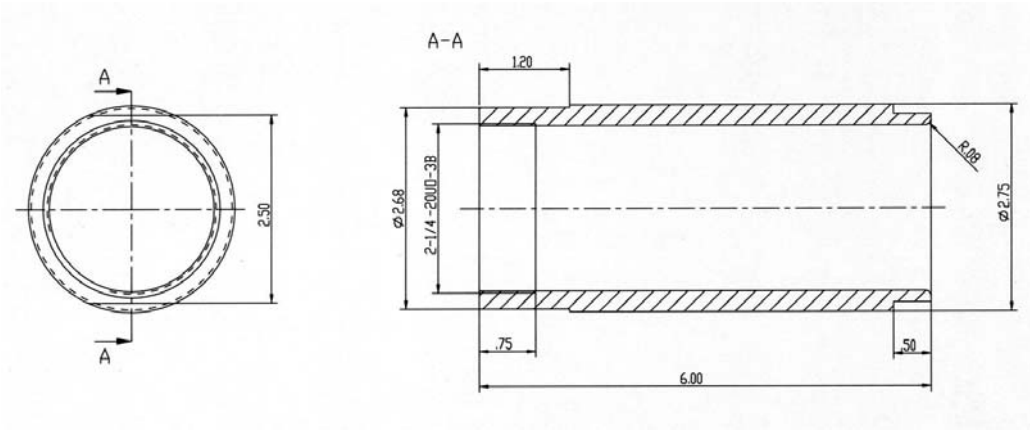
Note: Standard NFPA dimensions shown in this catalog will need to be modified to allow for a gland drain port. Contact factory for further information.

Port / Proximity Switch Locations

Mount Style	Port Location Head	Port Location Cap	Cushion Adjustment Head	Cushion Adjustment Cap	Air Bleed Head	Air Bleed Cap	Drain Port Head	Prox. Switch Loc. Head	Prox. Switch Loc. Cap
MP1, MT4	1	1	2	2	4	4	1	3	3
	2	2	3	3	1	1	2	4	4
	3	3	4	4	2	2	3	1	1
	4	4	1	1	3	3	4	2	2
ME5	1	1	3	2	4	4		2	3
	2	2	3	3	1	1	C/F	4	4
	3	3	1	4	2	2		4	1
	4	4	1	1	3	3		2	2
MS2	1	1	2	2	4	4	1	3	3
	3	3	4	4	2	2	3	1	1

[1]) Drain ports are SAE 4 (7/16" - 20) on all mounting styles and bore sizes.

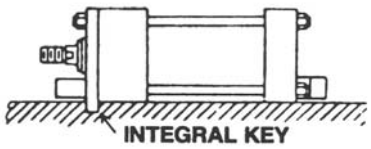
Transducer Cover - Part #R978016905

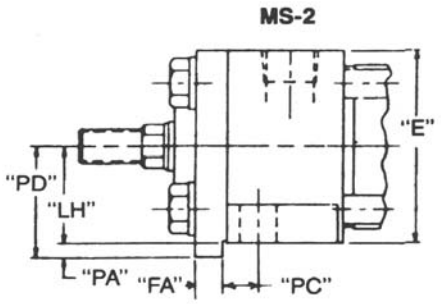


Standard when cylinder is ordered with transducer installed by Bosch Rexroth. If cylinder is ordered with provisions only for a transducer, cover is not included but may be ordered as a separate loose supply item. (Not available on 2" bore)

Thrust Key Plates (Option K)

Rexroth offers a standard arrangement of Thrust Key Mountings on the MS2 CST4 cylinders. This option eliminates the need for fitted bolts or external keys to carry the thrust load. The normal headplate is extended below the head surface of the cylinder and is fitted in a keyway milled into the mounting surface of the machine member. See drawing for details.





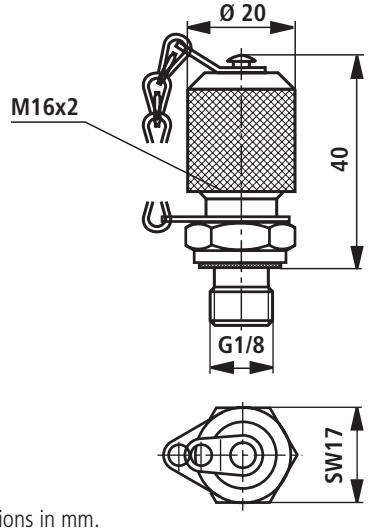
Bore	E	FA		LH		PA	PC	PD	PF	PG
2.00″	3.00	.562	+.000 -.002	1.494	+.000 -.002	.31	.56	1.81	1.06	1.50
2.50″	3.50	.562	+.000 -.002	1.744	+.000 -.002	.31	.75	2.06	1.06	1.50
3.25″	4.50	.687	+.000 -.003	2.244	+.000 -.003	.38	.75	2.62	1.19	1.84
4.00″	5.00	.812	+.000 -.003	2.494	+.000 -.003	.44	.94	2.94	1.19	1.94
5.00″	6.50	.812	+.000 -.003	3.244	+.000 -.003	.44	.94	3.69	1.19	2.31
6.00″	7.50	.937	+.000 -.003	3.744	+.000 -.003	.50	1.19	4.25	1.31	2.62

Notes:

1. Use mounting bolts 0.06 smaller in diameter than hole size.
2. Fitted bolts or dowel pins are not needed with the thrust key headplate.
3. All dimensions not shown are NFPA standard.
4. PD, PA, FA dimensions typical for all mounts.

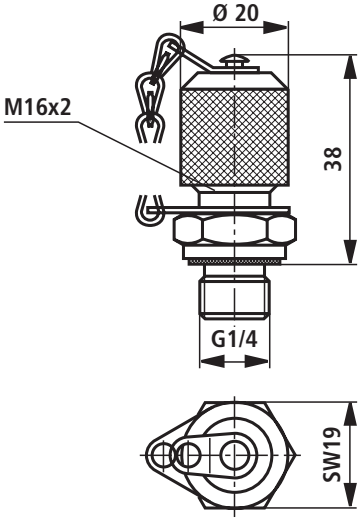
Test Point Coupling (Option A)

For bore sizes - 2“ - 2-1/2“



Above dimensions in mm.

For Bore Sizes - 3-1/4“-6“



Notes

For pressure measurement or bleeding.

For installation in the bleed/measuring port. Coupling with check valve function, it can also be connected under pressure.

Scope of supply for bore sizes - 2" to 2-1/2"

Coupling AB-E 20-11/K3, G 1/8
with NBR seal, Material No. R900014363

Coupling AB-E 20-11/K3V, G 1/8
with FPM seal, Material No. R900024710

Scope of supply for bore sizes - 3-1/4" to 6"

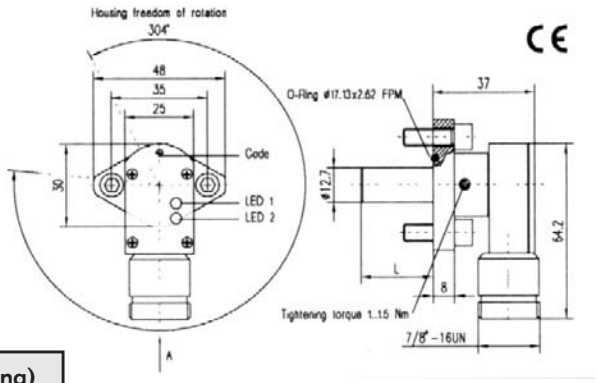
Coupling AB-E 20-11/K1, G 1/4
with NBR seal, Material No. R900009090

Coupling AB-E 20-11/K1V, G 1/4
with FPM seal. Material No. R900001264

CST4 Proximity Switch

High Pressure - 3000 psi (207 bar) Cylinder Sensors 2 wire AC/ DC Mini-Style Quick Disconnect

Dimensions (in mm)

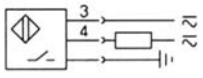


Ordering Code	Shielded (Flush Mounting)
Sensing Distance Sn	**2 mm**
Function	
Normally Open	
Electrical	
Operating distance S_A	0...1.6 mm
Supply voltage	20 - 250 V AC/DC
Supply frequency	50 / 60 Hz
Load current capacity	5 - 400 mA
Inrush current	3A (t = 20 ms)
Leakage current	≤ 1.7 mA
Voltage drop	≤ 6 V
Switching frequency	50 Hz
Start up delay	≤ 150 ms
Switch hysteresis	≤ 15% of Sn
Repeatability	≤ 5% of Sn
Ambient temperature range	-25°C to +70°C
Output function LED	yes
Short circuit & overload protected	yes
Mechanical	
Housing material	Nickel plated brass housing
Electrical connection	AC Mini Syle Connector
Protection class	IP 67
Housing, freedom of rotation	304°

Probe Length	Part Number	Code
1.025	R978008781	Blue
1.250	R978008793	White
2.062	R978002203	Red
2.875	R978002204	Orange
3.775	R978008792	Silver
4.560	R978009001	Gold

Wiring Connections

2 Wire AC/DC Normally Open



View of male connector pins

CST4 Seal Kits

Piston and Tube Seal Kits ~

Bore Ø (inches)	T	V
2.000	R978006851	R978006841
2.500	R978006852	R978006842
3.250	R978006853	R978006843
4.000	R978006854	R978006844
5.000	R978006855	R978006845
6.000	R978006856	R978006846

Rod Cartridge Seal Kits w/Rod Bearing †

Rod Ø (inches)	T	V
1.375 (2.000" bore)	R978021089	R978021098
1.375 (2.500"-3.250" bore)	R978021090	R978021099
1.750	R978021091	R978021100
2.000	R978021092	R978021101
2.500	R978021093	R978021102
3.000	R978021094	R978021103
3.500	R978021095	R978021104
4.000	R978021096	R978021105

T = Low friction seal system (std)
V = Low friction seal system for (phosphate ester) (optional)

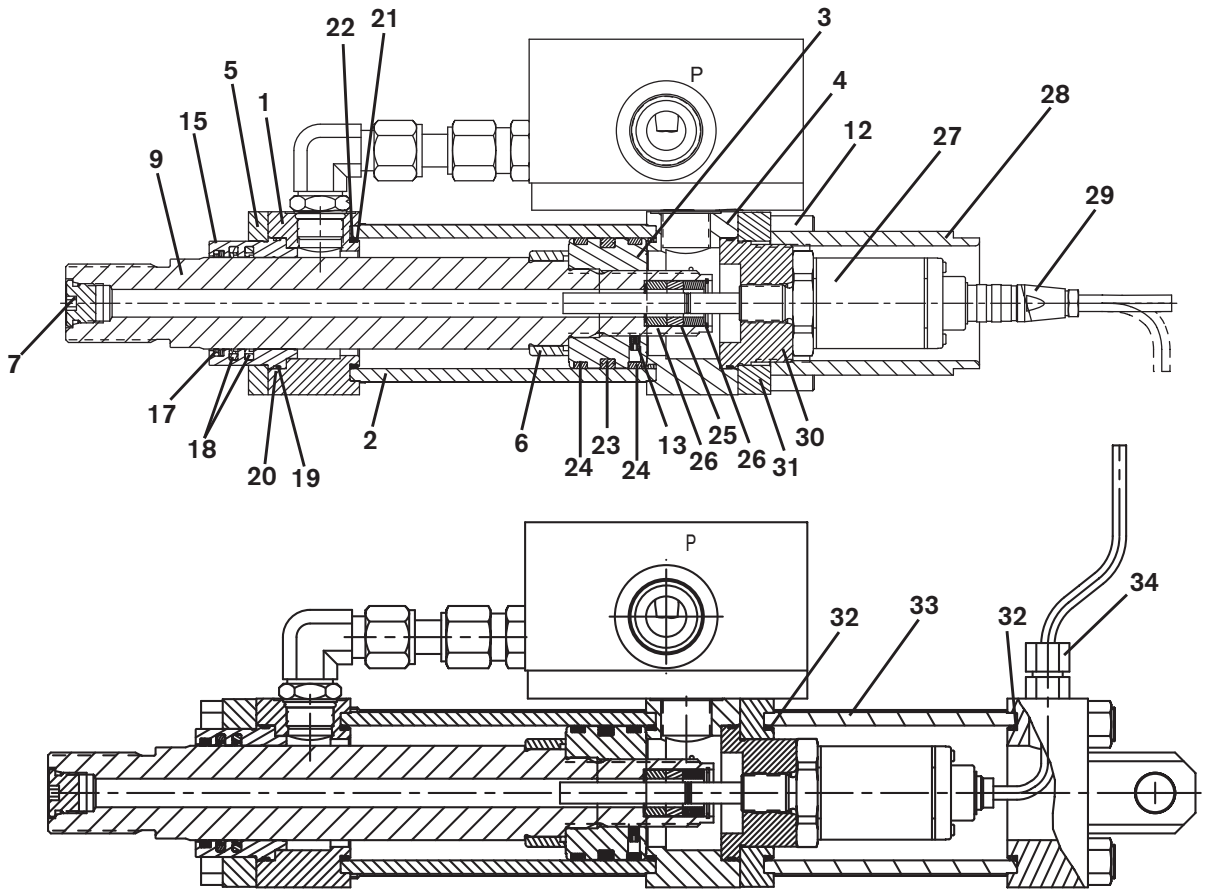
~ Piston/Tube Seal Kits include: one (1) double-acting piston seal;
two (2) wear bands; two (2) o-rings and two (2) back-up rings

† Rod Cartridge Seal Kits include: one (1) excluder wiper; two (2) step rod seal; one (1) rod bearing; one (1) o-ring and one (1) back-up ring

Cushion Valve (Item 17)

Bore Size	T	V
2", 2-1/2"	R978053909	R978006424
3-1/4", 4", 5"	R978904325	R978006436
6"	R978000579	R978006437

Spare Parts CST4



Tie Rods Torque Values		
Bore Size Inches	**Tie Rod Diameter (inches)**	**Torque - Lubricated (pound / foot)**
2.000	0.50	45
2.500	0.50	45
3.250	0.63	90
4.000	0.63	125
5.000	0.88	295
6.000	1.00	480

1 Head
2 Tube
3 Piston
4 Cap
5 Flange
6 Cushion bushing
7 Plug
8 Tie rod (not shown)
9 Piston rod
10 Bleed screw (not shown)
11 Securing plate (not shown)
12 Tie rod nut
13 Set screw
14 Hex head bolt
15 Rod bearing
16 Cushion valve (not shown)
17 Wiper
18 Rod seals
19 Bearing o-ring
20 Bearing back-up ring
21 Tube o-ring
22 Tube back-up ring
23 Piston seal
24 Wear bands
25 Magnet
26 Spacer
27 Transducer
28 Transducer cover
29 Connector
30 Transducer adaptor
31 Adaptor flange
32 O-ring
33 Extension tube
34 Pigtail connector

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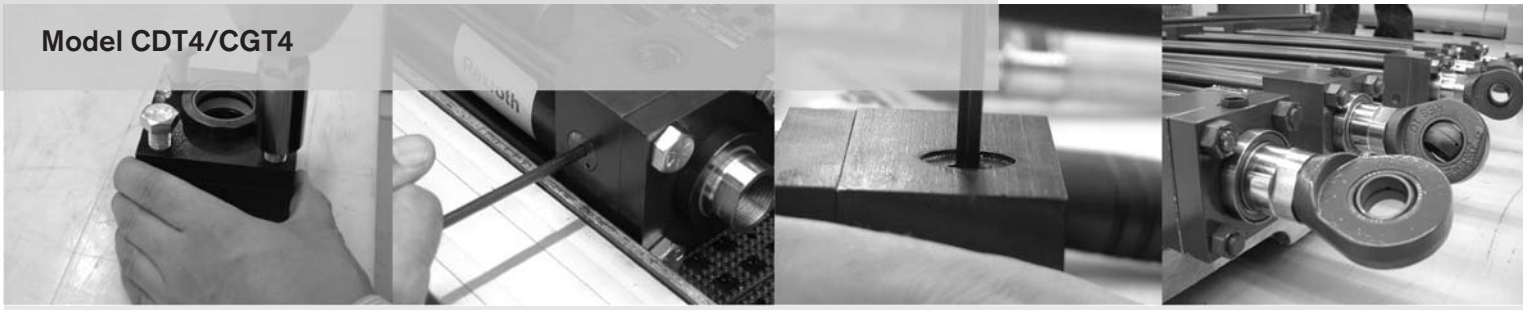
Rexroth
Bosch Group

Section 4

Service Manual for Hydraulic Cylinder

RA 17 041-DT4SM/03.05 1/8
Replaces: 09.03

Model CDT4/CGT4



Contents

Seal Replacement

General:

1. Always drain the pressure from a hydraulic system before performing any service work. Disconnect hydraulic lines from head and cap ports of cylinder.

2. Completely disassemble the cylinder using the exploded and assembly views as reference. No special tools are required except internal snap ring pliers. The piston rod assembly consisting of piston, piston rod and head cushion bushing (where used) are locktited and secured at the factory and are not to be disassembled.

3. After disassembling the cylinder, wash all metal parts in a non-flammable solvent. Rinse each part thoroughly and blow dry with a low-pressure air jet. Arrange the parts on a clean surface. Examine each part carefully. Replace all seals and any other worn or damaged parts.

4. Particular attention should be given to the piston rod (item 10) since cylinder leakage can result from a damaged rod. A scored rod might damage the rod bearing and, subsequently, the rod packing. Rod cartridge kits come with a new rod bearing plus seals (see Seal Kit table on page 6 of this manual.)

Old Rod Cartridge Kit Removal

1. Remove the hex head bolts (item 15) from the head end (item 1). On the ME5 mount only, the rod cartridge retainer plate is held in place by socket head cap screws, which must also be removed.

2. Remove the retainer plate or flange (item 5) from the head end. Locate the screwdriver slot along the top of the rod bearing (item 16). Using a flathead screwdriver, carefully pry the rod cartridge loose from the head in a fashion similar to opening a can of paint. The rod bearing assembly includes the wiper (item 19a), the rod seal (item 19b), the bearing o-ring and backup ring (items 19c-d), and the rod bearing (item 16) itself.

New Rod Cartridge Kit Installation:

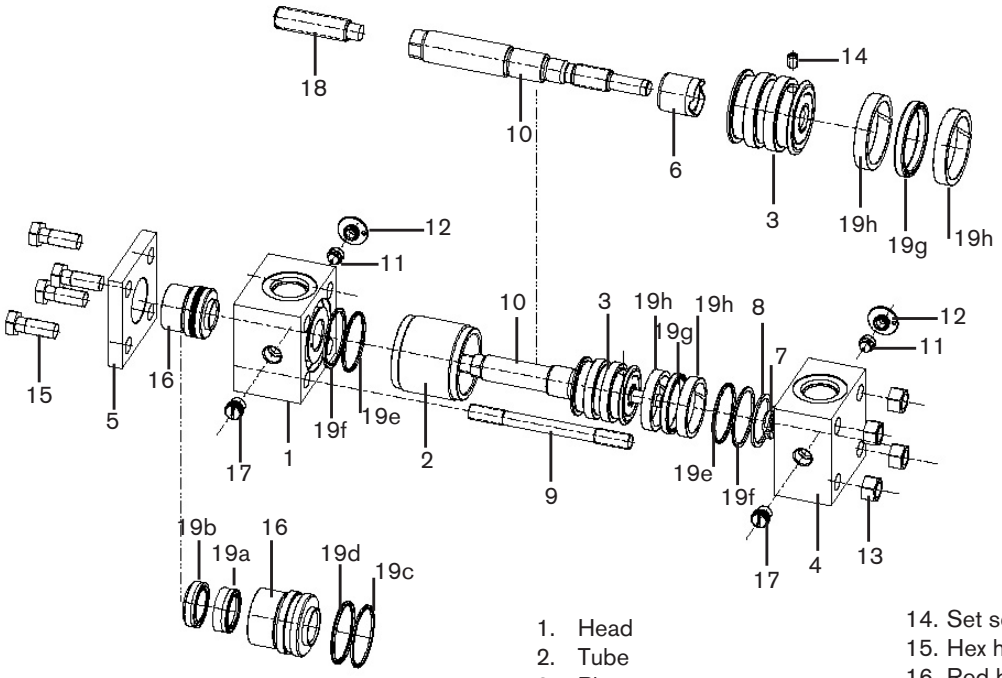
1. Lubricating the new rod bearing will ease installation into the head end. A rubber mallet may be required to push the rod bearing into the head end. Caution must be taken to not cut the new seals when passing the bearing over a male threaded rod.

2. Once the rod bearing is completely seated in the head end, the flange or retainer plate and tie rod nuts / hex head cap screws can be replaced onto the head end. Torque the bolts / screws to the specifications on page 3.

Piston Seal Installation:

1. Insert the energized piston seal o-ring onto the piston in the center groove. Do not roll the o-ring; rather, slide it into place. Slide piston seal into the center groove, directly over top of the o-ring. Heating the piston seal in 175°F to 212°F warm oil or water would assist in installation by hand. While still warm, the piston seal can be reshaped by means of a ring compressor or other aid.

Exploded view drawing



1. Head
2. Tube
3. Piston
4. Cap
5. Flange
6. Cushion bushing
7. Cushion insert
8. Cushion insert retainer ring
9. Tie rod
10. Piston rod
11. Bleed screw
12. Securing plate
13. Tie rod nut
14. Set screw
15. Hex head bolt
16. Rod bearing
17. Cushion valve
18. Threaded stud
19. Seals
    a. Wiper
    b. Rod seal
    c. Bearing o-ring
    d. Bearing backup ring
    e. Tube o-ring
    f. Tube backup ring
    g. Piston seal
    h. Wear bands

CDT4 Weight/Torque Values

Approx. Uncrated CDT4 Hyd. Cyl. Weights (lbs).	
Zero Stroke	Add Per Inch of Stroke
7.5	0.5
10	0.7
16	1.2
31	1.8
41	2.5
73	4.0
138	5.2
180	6.2
310	8.7

Tie Rod Nuts and Bolts		
Bore Size (inches)	Tie Rod Threads	Torque Lubricated (pound-ft)
1.500	3/8 - 24	19
2.000	1/2 - 20	45
2.500	1/2 - 20	45
3.250	5/8 - 18	90
4.000	5/8 - 18	125
5.000	7/8 - 14	295
6.000	1 - 14	480
7.000	1-1/8 - 12	720
8.000	1-1/4 - 12	1050

Socket Head Cap Screw (ME5 mount and all 7" - 8" bore sizes)		
Rod Size	SHCS Size	Torque Lubricated (pound-ft)
0.625	#10 - 24	3.5
1.000	#10 - 24	3.5
1.375	#10 - 24	3.5
1.750	1/4 - 20	8
2.000	5/16 - 18	17
2.500	5/16 - 18	17
3.000	3/8 - 16	30
3.500	3/8 - 16	30
4.000	7/16 - 14	48
5.000	3/8 - 16	30
5.500	1/2 - 13	74

* Note: Weights are based upon a standard rod diameter. With multiple rod sizes and mounting options available, these weights may vary.

Seal Replacement - continued

2. Install the split wear bands (item 19h) onto the piston in the outer grooves.

End Cap Seal Installation:

1. Install the backup ring (item 19f) by pulling it over the face lip (head and cap ends). Be sure the groove of the backup ring is facing forward (barrel side). Do not drag the o-ring (item 19e) over the face, this will twist the o-ring; rather, pull the o-ring over the face lip, making sure it is against the groove of the backup ring.

2. Lubricate the chamfer ends and ID of the tube. Line up the cap end to be perpendicular with the tube. A twisting movement might be necessary to seat the cap end against the tube. Caution must be taken not to cut the o-ring.

3. Lubricate the piston seal and guide rings. Install the piston and rod assembly into the tube by applying force to the end of the piston rod. With the aid of a ring compressor, this will allow the rod assembly to seat itself into the cylinder tube.

4. After the piston and rod assembly is completely bottomed against the cap end, lubricate the top of the piston rod wrench flats. This will assist in installing the head end. Make sure the cylinder head and piston rod are perpendicular to one another. Place your hands on top of the head and push downwards in a twisting motion. A small rubber mallet may be needed to assist during installation. Caution must be taken not to tear any seals. Seat the head end into the tube using the same process as seating the cap end.

CAUTION: KEEP FINGERS CLEAR BETWEEN HEAD AND TUBE DURING INSTALLATION.

5. Install the tie rods and tighten the tie rod nuts in an X pattern to avoid uneven loading. All threads must be torqued to the required specification in order to ensure functional reliability of the cylinder. For exact torque measurements, see the table on page 3.

Testing

After the cylinder has been completely reassembled, it should be tested, either on a test bench or in the regular installation. The cylinder should be tested for cushioning, travel and leakage.

CAUTION: BE SURE AIR BLEED SCREW ON BOTH ENDS (ITEM 11) ARE COMPLETELY CLOSED.

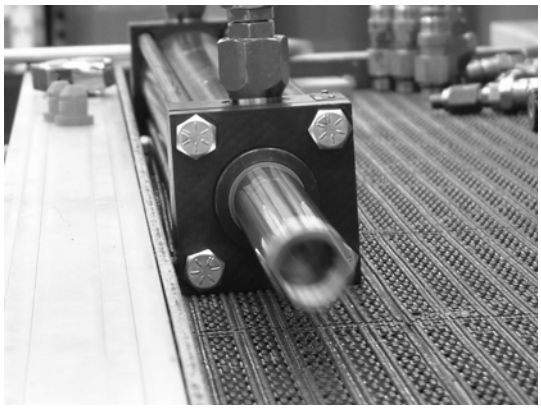
Cushioning:

1. Turn both cushioning valves completely in and then turn counterclockwise one (1) full turn.

2. Cycle cylinder a few times by alternating supply pressure to head and cap ports.

3. Apply supply pressure to the head port. Rod should retract, decelerate and may stop before completion of the stroke.

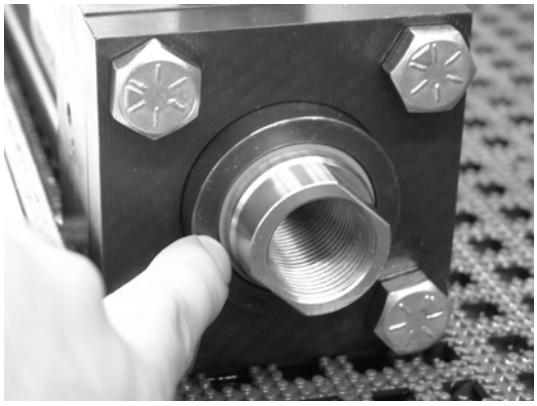
4. Apply supply pressure to the cap port. Rod should extend, decelerate and may stop before completion of the stroke.



Travel and Leakage

1. Apply supply pressure to the head port. Rod should retract smoothly without binding. Cylinder should retract, have less cushioning and make full stroke. Check leakage at the cap end, no leakage permitted. Check leakage around the rod bearing. No leakage permitted.

2. Apply supply pressure to the cap port. Rod should extend smoothly without binding. Cylinder should extend, have less cushioning and make full stroke. Check leakage at head end, no leakage permitted.



3. Return piston rod to retract position by applying supply pressure to head port. Remove supply pressure and install cylinder into service if satisfactory.

Cushion Adjustment

Turn the cushioning valve clockwise to increase the amount of cushioning and counterclockwise to decrease cushioning. To obtain the most effective cushioning, final adjustment must be made while the cylinder is operating under normal conditions at normal operating pressure.

Spare Parts

Piston and Tube Seal Kits (Items 19e, f, g, h) ~

Bore Ø (inches)	M	T *	F *	V *
1.500	R978006830	R978006850	R978006860	R978006840
2.000	R978006831	R978006851	R978006861	R978006841
2.500	R978006832	R978006852	R978006862	R978006842
3.250	R978006833	R978006853	R978006863	R978006843
4.000	R978006834	R978006854	R978006864	R978006844
5.000	R978006835	R978006855	R978006865	R978006845
6.000	R978006836	R978006856	R978006866	R978006846
7.000	R978006837	R978006857	R978006867	R978006847
8.000	R978006838	R978006858	R978006868	R978006848

Rod Cartridge Seal Kits w/Rod Bearing (Items 19a, b, c, d, Item 16) †§

Rod Ø (inches)	M	T *	F *	V *
0.625	R978006773	R978006801	R978006815	R978006787
1.000 (1.500" bore)	R978006774	R978006802	R978006816	R978006788
1.000 (2.000"-2.500" bore)	R978006775	R978006803	R978006817	R978006789
1.375 (2.000" bore)	R978006776	R978006804	R978006818	R978006790
1.375 (2.500"-3.250" bore)	R978006777	R978006805	R978006819	R978006791
1.750	R978006778	R978006806	R978006820	R978006792
2.000	R978006779	R978006807	R978006821	R978006793
2.500	R978006780	R978006808	R978006822	R978006794
3.000	R978006781	R978006809	R978006823	R978006795
3.500	R978006782	R978006810	R978006824	R978006796
4.000	R978006783	R978006811	R978006825	R978006797
4.500	R978006784	R978006812	R978006826	R978006798
5.000	R978006785	R978006813	R978006827	R978006799
5.500	R978006786	R978006814	R978006828	R978006800

M = Polyurethane seal system (standard)
T = Seal system for low frction applicatios (available)
F = Standard seal system for HFC (water glycol) (available)
V = Seal system for (phosphate ester) (available)

Note:
* = not recommended for load holding applications
§ = CGT4 (double-rod) version requires two Rod Cartridge Kits

~ Piston/Tube Seal Kits include: one (1) double-acting piston seal;
two (2) wear bands; two (2) o-rings and two (2) back-up rings

† Rod Cartridge Seal Kits include: one (1) double-lip wiper set;
one (1) u-cup rod seal; one (1) rod bearing; one (1) back-up ring

Cushion Valve (Item 17)

Bore Size	M, T, F	V
1-1/2", 2", 2-1/2"	R978053909	R978006424
3-14", 4", 5"	R978904325	R978006436
6", 7", 8"	R978000579	R978006437

Spare Parts

Tube (Item 2) ~

Bore Size	Std. Part No.	MT4 Part No.
1.500	R978930575	R978003871
2.000	R978930576	R978003872
2.500	R978930577	R978003873
3.250	R978930578	R978003874
4.000	R978930579	R978003875
5.000	R978930580	R978003876
6.000	R978930581	R978003877
7.000	R978930582	R978003878
8.000	R978930583	R978003879

Tie Rods (Item9)*

Bore Size	MX0, MP1, MS2, MS4 MT1, MT2 MP5	ME6	MF1, MF5	MF2, MF6	MX1	MX2	MX3	ME5	ME7
1.500	R978002212	R978930584	R978005941	R978006900	R978930592	R978002213	R978002238	R978002212	R978006900
2.000	R978002217	R978930585	R978005942	R978006901	R978930591	R978002219	R978002243	R978002217	R978006901
2.500	R978009743	R978930586	R978005943	R978006902	R978018915	R978002220	R978002233	R978009743	R978006902
3.250	R978004471	R978930587	R978005944	R978006903	R978002221	R978002229	R978002234	R978004471	R978014299
4.000	R978002228	R978930588	R978005945	R978006904	R978002222	R978002231	R978002240	R978002228	R978014298
5.000	R978002237	R978930589	R978005946	R978006905	R978002230	R978002239	R978002245	R978002237	R978006905
6.000	R978002242	R978930590	R978005947	R978006906	R978002232	R978002244	R978006630	R978002242	R978014297
7.000	R978002250	R978013657	R978005948	R978002250	n/a	n/a	n/a	R978013657	n/a
8.000	R978002255	R978013658	R978005949	R978002255	n/a	n/a	n/a	R978013658	n/a

Piston and Rod Assemblies (Items 3, 6, 10, 14, 19e, f, g, h)*

Consult Factory for Part Numbers and Pricing.

* specify complete cylinder part number and stroke length when ordering.

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Section 4

Technical Specifications

Model CDT4/CGT4

CDT4 Technical Specification

Background

The CDT4 is based upon a newly developed Bosch Rexroth and NFPA-design hydraulic cylinder.

CDT4 is designed as a standard product in the Bosch Rexroth Hydraulic Cylinder Program, and will be exclusively manufactured by Bosch Rexroth Industrial Hydraulics Division. It will be marketed in the United States as well as internationally by the Bosch Rexroth Industrial Hydraulics division.

The CDT4 is designed according to the NFPA Standard.

The CDT4 is designed as a **domestic product**, meaning it will be manufactured within the United States using standard English measurements.

Standard

CDT4 complies with:
National Fluid Power Association (NFPA)
ANSI/T3.6.7R2-1996

Pressure Rating

The CDT4 is primarily intended for up to 3,000 psi continuous duty. The basic pressure vessel of the CDT4 withstands a minimum of 1 million pressure cycles at 3,000 psi

A maximum static pressure level of 5,000 psi has been established in the market. Considerations in design have been taken to also allow the CDT4 to meet this level. Since the overall dimensions of the CDT4 are determined by ANSI/T3.6.7R2-1996, the dimension of the mounting styles cannot be deviated. The CDT4 has been calculated and verified through laboratory tests for a maximum static pressure of 5,000 psi.

Note: See data sheet RA 17 041 for pressure limitations.

Fluid Compatibility

The CDT4 in its basic design is intended for use with mineral oil, according to NFPA Standard.

NOTE: Phosphate ester, HFA, and Water glycol HFC may be used if seal materials, such as polyurethane and thermoplastic polyester, are avoided. See information under “Options”.

Design

The CDT4 is a hydraulic cylinder of tie rod design, meaning the head and cap are secured to the cylinder tube with tie rods that are tightened with nuts.

A listing of the individual parts of the basic cylinder can be found on page 2 and 3. The item numbers refer to the detailed parts drawing on page 6.

Item	Description
1	Head – steel 1117 – The head has fluid connection, port air-bleed and cushion valve if required.
2	Tube – steel – honed or polished to a surface finish 16µin or better.
3	Piston – ductile iron 65-45-12 – with separate seal and bearing grooves. The piston has “anti-stick” grooves to prevent piston from sticking to the head or cap. This is especially a risk for vertical cylinders under high external loads. The piston is held to the piston rod with a seizing compound applied to the piston thread. The piston is also secured to the rod by means of a set screw, which is tightened and secured with a seizing compound. The set screw is located in one of the wear band grooves, so any surface which could potentially chafe the inside of the tube is protected by the wear band.
4	Cap – steel 1117 – The cap has fluid connection port air-bleed and cushion valve if required.
5	Flange – steel 1117 – held directly to head by hex head bolts. Also retains rod bearing. On ME5, the flange is replaced by a round retainer plate which is held to the head with by socket head cap screws. This also applies to 7" - 8" bore sizes, all mounts.
6	Cushion bushing (head end) – ductile iron 65-45-12 – The bushing is retained between a shoulder on the piston rod and the piston itself.
7	Cushion insert (cap end) – 660 bronze floating insert held in place by retainer ring (Item 8).
8	Cushion insert retainer ring (cap end only) – steel – retains cushion insert on cap end.
9	Tie-rod – 1045 steel – high tensile, stress-proof.
10	Piston rod – steel 1050 – with chrome layer 0.5-1.0µin and surface finish 16µin Ra or better. Induction hardened end to 50 - 55 HRC up to 4" diameter.
11	Air-bleed screw – steel – seals without elastomeric seals in head and cap. Standard on all size bores.
12	Securing screw – steel – for air-bleed screw. Prevents unintentional loosening of the air-bleed screw.
13	Tie rod nuts – steel – grade 8, zinc-plated.
14	Set screw – steel – used to mechanically lock piston to the piston rod.
15	Hex Head bolt – steel - grade 8, zinc plated.

16 Rod bearing – 65-45-12 ductile iron – extra-long rod bearing provides for maximum support against side-loads including external misalignment. Ductile iron has superior non-scoring properties and dimensional stability. Bearing is pilot fitted into the head assuring true concentricity. Rod bearing can be changed without special tools. Internal spiral groove ensures lubricity and compensates for pressure changes. The rod bearing contains grooves for rod wiper and rod seal.

17 "Exact-a-Just" cushioning valve – provides an accurate micrometer adjustment for cushioning, permitting a wide range of settings. May be supplied at head, cap, or both ends. The combination needle and check valve eliminates the need for separate ball checks, thus leaving a quadrant free for other possible use.

18 Threaded stud – ASTM A19 – fits into female threaded piston rod.

19 Seals (listed individually)

a. Double-acting wiper – polyurethane – acts also as secondary piston rod seal. Other materials are available for special applications. See “Options” on page 5 for more information.

b. Piston rod seal – polyurethane – U-cup shaped. Other materials are available for special applications. See “Options” on page 5 for more information.

c. Bearing o-ring – nitrile rubber – standard

d. Bearing backup o-ring – PTFE – split ring.

e. O-ring – nitrile rubber. One at each end of the tube.

f. Backup o-ring – PTFE – asymmetric shape fitting o-ring radius. One at each end of the tube.

g. Piston seal – Polyurethane with o-ring energizer. Nitrile rubber is the standard configuration. Other seal systems are available for special applications. See “Options” on page 5 for more information.

h. Piston wear bands – fabric reinforced phenolic resin.

20 Socket Head Cap Screws – steel – Secures retainer plate to head end, on ME5 mount. (not shown). Also standard on 7" - 8" bore sizes – all mounts

Mounting Styles

MX0 Basic version – no mounting

ME5 Rectangular head

ME6 Rectangular cap

MF1 Rectangular flange at head

MF2 Rectangular flange at cap

MF5 Square flange at head

MF6 Square flange at cap

MP1 Clevis mounting

MP5 Pivot mount with spherical bearing

MS2 Side lug

MS3 Centerline lug

MS4 Side tapped

MS7 End lugs

MT1 Trunnion at head

MT2 Trunnion at cap

MT4 Trunnion at intermediate position

MX1 Extended tie rods at both ends

MX2 Extended tie rods at cap

MX3 Extended tie rods at head

Sizes

The following are included in the CDT4:

Bore Ø (inches)	**Rod Ø** (inches)
1.500	0.625
	1.000
2.000	1.000
	1.375
2.500	1.000
	1.375
	1.750
3.250	1.375
	1.750
	2.000
4.000	1.750
	2.000
	2.500
5.000	2.000
	2.500
	3.000
	3.500
6.000	2.500
	3.000
	3.500
	4.000
7.000	3.000
	3.500
	4.000
	4.500
	5.000
8.000	3.500
	4.000
	4.500
	5.000
	5.500

Piston Rod Seal / Bearing

There are normally very high demands on the sealing function between the piston rod and the head. Polyurethane seals are well proven with regards to wear resistance. In order to maximize the wear life of the piston rod seal, it is necessary to maintain the piston rod in a concentric position. By using a bearing that is separate from the head, the cylinder is able to hold a tight seal on the internal pressure. Replacement of the piston rod bearing does not require replacement of the entire head and complete disassembly of the cylinder.

Piston

The piston utilizes spiral grooves on each side to reduce break away force and prevent it from “sticking” to the end cover during operation.

CDT4 – Options

Port Connections / Types

Option S

Standard SAE straight thread ports according to ISO 11926-1.

Option F

SAE Code 61 - 3000 psi 4-bolt flange. Available on 2” bore and larger.

Port Connections / Location

Location 1, 2, 3, and 4

Port location at 12,3, 6, and 9 o’clock, respectively, as seen from the piston rod side of the cylinder. Location 1 is standard.

Piston Rod Version

Option H

Case-hardened to 50-55 Rockwell “C” and hard chrome plated. Hardening thickness 50µin. Surface finished to 16µin or better. Rod diameters above 4” are not case hardened.

Option S

17-4 PH stainless steel, chrome plated.

Piston Rod End

Option H

Small male thread KK1. Studded rod end standard up to 1" - 14 male thread

Option D

Intermediate male thread KK2.

Option E

Female thread KK1.

Option T

Self-Aligning Flange End (S.A.F.E.) rod end.

Cushioning

Option U

Cylinder without cushioning.

Option D

Adjustable cushioning at both the cap and head ends of the cylinder.

Option S

Adjustable cushioning at head end only.

Option K

Adjustable cushioning at cap end only.

Seal Version

All seals utilize the same seal grooves. The piston or rod bearing does not have to be replaced if changing from one seal material to another.

Option M

Standard seal version – wiper, rod seal and piston seal – are made of polyurethane. Recommended for mineral oil applications. Water glycol type fluid is not compatible with this material.

Recommended temperature range: -4°F - +176°F.

Option T

Low friction seal version differs from version **M**, only at the piston. Includes a glide ring of bronze-filled PTFE with a NBR o-ring energizer (nitrile rubber).

This option also fits into the same seal gooves as the standard version.

NOTE: The glide ring on the piston cannot be considered completely leak tight. Static loads on the piston should be avoided.

Recommended temperature range: -4°F - +176°F.

Option F

Intended for use with water glycol type fluids. The piston rod seal and wiper are made of NBR and the piston seal is the same as Option T with a NBR o-ring energizer (nitrile rubber).

NOTE: The glide ring on the piston cannot be considered completely leak tight. Static loads on the piston should be avoided.

Recommended temperature range: -4°F - +140°F.

Option V

Version for use with phosphate ester type fluids or for high temperature applications. The piston rod seal and wiper are made of FPM and the piston seal is the same as in option **T**, with the difference being an FPM o-ring energizer.

NOTE: The glide ring on the piston cannot be considered completely leak tight. Static loads on the piston should be avoided.

Recommended temperature range: -4°F - +300°F.

For applications above 250°F specify a non studded rod end and advise operating temperature

Option 1

Option W

Select this if no options are required.

Option E

Proximity switch.

Option B

Gland drain connection.

Option A

Test point, both sides.

(See data sheet RA 17 041 for further details on above options)

Option 2

Option W

Select this if no options are required.

Option K

Thrust key. For use with the MS2 mount.

Option S

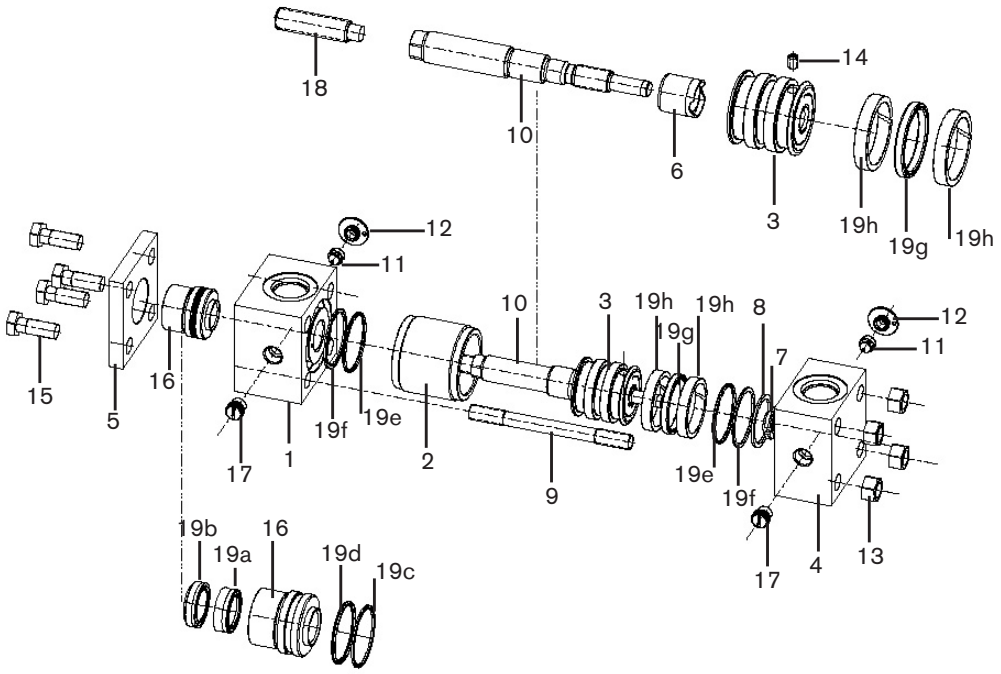
Stop tube.

Option Y

Piston rod extension. Customer-specified length is added to overall piston rod length.

(See data sheet RA 17 041 for further details on above options)

Exploded view drawing



1. Head
2. Tube
3. Piston
4. Cap
5. Flange
6. Cushion bushing
7. Cushion insert
8. Cushion insert retainer ring
9. Tie rod
10. Piston rod
11. Bleed screw
12. Securing plate
13. Tie rod nut
14. Set screw
15. Hex head bolt
16. Rod bearing
17. Cushion valve
18. Threaded stud
19. Seals
    a. Wiper
    b. Rod seal
    c. Bearing o-ring
    d. Bearing backup ring
    e. Tube o-ring
    f. Tube backup ring
    g. Piston seal
    h. Wear bands

CDT4 Weight/Torque Values

Approx. Uncrated CDT4 Hyd. Cyl. Weights (lbs).	
Zero Stroke	Add Per Inch of Stroke
7.5	0.5
10	0.7
16	1.2
31	1.8
41	2.5
73	4.0
138	5.2
180	6.2
310	8.7

Tie Rod Nuts and Bolts		
Bore Size (inches)	Tie Rod Threads	Torque Lubricated (pound-ft)
1.500	3/8 - 24	19
2.000	1/2 - 20	45
2.500	1/2 - 20	45
3.250	5/8 - 18	90
4.000	5/8 - 18	125
5.000	7/8 - 14	295
6.000	1 - 14	480
7.000	1-1/8 - 12	720
8.000	1-1/4 - 12	1050

Socket Head Cap Screw (ME5 mount and all 7" - 8" bore sizes)		
Rod Size	SHCS Size	Torque Lubricated (pound-ft)
0.625	#10 - 24	3.5
1.000	#10 - 24	3.5
1.375	#10 - 24	3.5
1.750	1/4 - 20	8
2.000	5/16 - 18	17
2.500	5/16 - 18	17
3.000	3/8 - 16	30
3.500	3/8 - 16	30
4.000	7/16 - 14	48
5.000	3/8 - 16	30
5.500	1/2 - 13	74

* Note: Weights are based upon a standard rod diameter. With multiple rod sizes and mounting options available, these weights may vary.

Notes

Bosch Rexroth Corporation
Industrial Hydraulics
2315 City Line Road
Bethlehem, PA 18017-2131
USA
Telephone (610) 694-8300
Facsimile (610) 694-8467
www.boschrexroth-us.com

Notes

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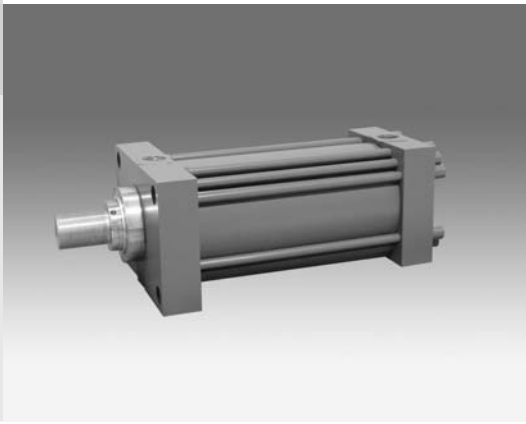
Section 5

Large Bore Hydraulic Cylinders NFPA Industrial Type

RA 17 399/09.04 1/24

Model HH Series - 10", 12" and 14" Bore Sizes



Nominal pressure: 3,000 psi
Non shock rating: 5,000 psi

Contents

Features

- Duty, nominal 3,000 psi hydraulic, non-shock 5,000 psi
- Standards, meets or exceeds all JIC and NFPA requirements
- Bore Sizes, 10” - 14”
- Piston Rods, 4-1/2” - 10”
- Mountings, standard NFPA mountings
- Ports, SAE o-ring straight thread ports
- Stroke, standard strokes furnished in 1/8” increments. Normal stroke tolerance + 1/16” / -0”. Closer stroke tolerances available; consult factory.
- Rod End Threads, standard KK1 male and female threads plus KK2 oversize male thread. Other rod end styles optional.
- Cushions, available for all bore sizes, at either or both ends.

Technical Data (for applications outside these parameters, please consult factory)

Standards:

Meets or exceeds all J.I.C. and NFPA requirements.

Nominal pressure: 3,000 psi

Static proof pressure: 5,000 psi

With extreme shock loads the mounting styles and piston rod threads have to be considered, taking the fatigue limits into account.

Maximum operating pressure up to: 3,000 psi

Static non-shock: 5,000 psi

Installation position: Various

Pressure fluid:

Mineral oils (HL, HLP)
Phosphate ester (HFD-R) (-4°F to +300°F)
HFA (41°F to 131°F)
Water glycol HFC (–4°F to 140°F)

Hydraulic fluid temperature range: (-4°F to 200°F)

Viscosity range: 32 to 1760 ssu

Degree of contamination:

Max. permissible degree of contamination of the pressure fluid is to NAS 1638 class 10.

We therefore recommend a filter with a minium retention rate of $\beta_{10} \geq 75$.

Stroke speed: 20 in/sec
(dependent on the connection port)

Acceptance:

Each cylinder is tested to Bosch Rexroth standards.

Cylinders, outside the above parameters are also available. Consult factory

Operating Pressures (PSI) by Cylinder Bore Sizes*

Cylinder Bore	Standard Rod	Nominal	Non-Shock
10	5	3,000 psi	5,000 psi
12	5-1/2		
14	7		

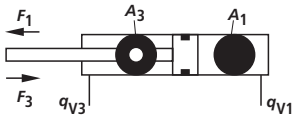
*1) Exceptions to 5,000 psi non-shock rating:

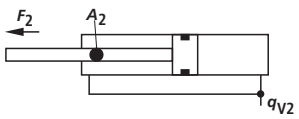
a) All bore sizes using the following mounts:
MT1, MT2, MT4, ME5, ME6

b) The following mounts for bore sizes listed:
MP1: 12”, 14"
MF5 & MF6: 10”
MS2: 10", 12", 14"
MX0, MX1, MX2, MX3, MX4: for 10" and above, consult factory

Areas, Forces, Flows (dimensions in inches)

Bore	Piston rod	Area ratio	Piston	Areas Rod	Annulus	Force at 3000 psi Push	Regen.	Pull	Flow at 4"/s Out	Regen.	In
Ø in.	Ø in.	A_1/A_3	A_1 in.^{2}	A_2 in.^{2}	A_3 in.^{2}	F_1 Lb.	F_2 Lb.	F_3 Lb.	q_{V1} gpm	q_{V2} gpm	q_{V3} gpm
10"	4-1/2"	1.25	78.54	15.91	62.64	235,620	47,730	187,920	81.6	16.53	65.08
	5"	1.33		19.63	58.91		58,890	175,830		20.39	61.20
	5-1/2"	1.43		23.76	54.78		71,280	164,340		24.68	56.91
	7"	1.96		38.48	40.06		115,440	120,180		39.98	41.62
12"	5-1/2"	1.26	113.10	23.76	89.34	339,300	71,280	268,020	117.5	24.68	92.82
	7"	1.52		38.48	74.62		115,440	223,860		39.98	77.52
	8"	1.80		50.26	62.84		150,780	188,520		52.21	65.29
14"	7"	1.33	153.94	38.48	115.46	461,820	115,440	346,380	159.94	39.98	119.96
	10"	2.04		78.53	75.40		235,590	226,200		81.59	78.34





Stroke tolerances

Stroke tolerances result from the cylinder head, cylinder base, cylinder tube, piston and piston rod. The stroke tolerance for all piston diameters and stroke lengths is +1/16" / -0". Tighter stroke tolerances can be requested, however, details regarding the operating pressure and operating temperature must be stated.

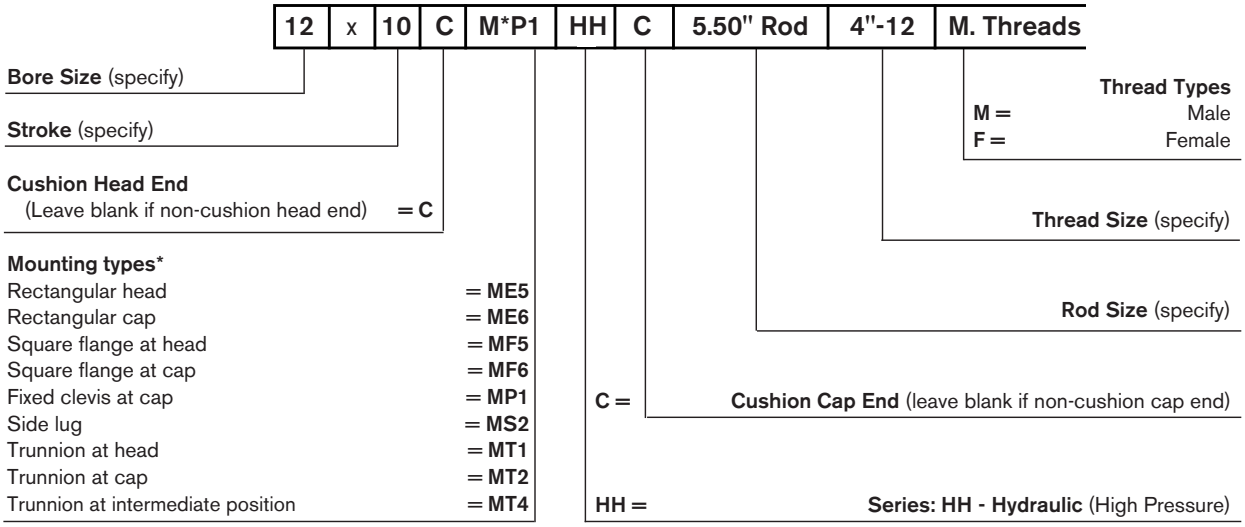
Stroke lengths	Stroke tolerances
(refer to pg. 21 for buckling loads)	+1/16" / -0"

Approximate Uncrated HH Hydraulic Cylinder Weights

Cylinder Bore	10	12	14
Zero Stroke	610	970	1520
Add Per Inch of Stroke	15.2	21.6	28.5

* Weights based on standard (first) rod sizes. Add 10% to cover additional weight for crating.

Ordering Details

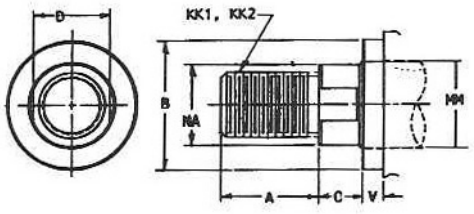


* Double Rod End (Example: MDE3) (Specify only when required, available in most mountings)

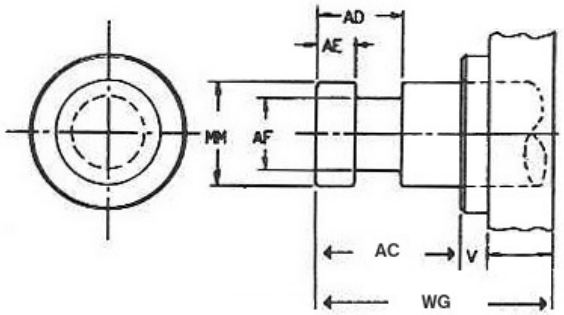
Options (specify)
Seals – Standard, viton
Cast Iron Piston Rings
Piston Rod Studs
Rod Extension ("W" dimension)
Thread Extension ("A" dimension)
Stop Tube (specify effective stroke)
Piston Rod Material (stainless steel)
Port Location & Number of Ports
Cushion Location & Number of Cushions
Rod Boot
Stroke Admustment
Port Style: NPTF, SAE O-ring, SAE 4 bolt flange
Thrust Key Head Plate
Proximity Switches
Epoxy Paint
Special Items as required

Piston Rod Versions

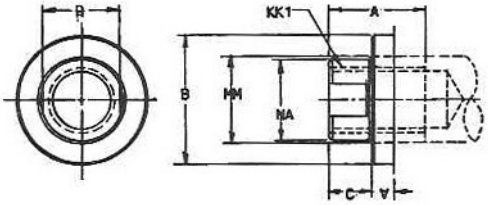
Male Rod End



S.A.F.E. Rod End (n/a on 7" and large rod dia.)



Female Rod End



Rod Thread Options:

Standard KK1 Male furnished when not specified.

Male thread available in KK1 and KK2 thread sizes.

Female thread available in KK1 thread size only.

Piston Rod End

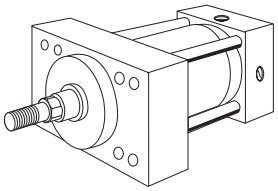
MM Rod Diameter	A	B +0.000 -0.002	C	D	AC	AD	AE	AF	KK1	KK2	NA	WG
4.000	4.000	4.749	1.00	3.38	4.50	2.69	1.000	3.000	3-12	3-3/4-12	3.94	5.75
4.500	4.500	5.249	1.00	SH 1	5.25	3.19	1.500	3.500	3-1/4-12	4-1/4-12	4.44	6.50
5.000	5.000	5.749	1.00	SH 1	5.38	3.19	1.500	3.875	3-1/2-12	4-3/4-12	4.94	6.63
5.500	5.500	6.249	1.00	SH 1	6.25	3.94	1.875	4.375	4-12	5-1/4-12	5.44	7.50
7.000	7.000	7.749	1.00	SH 2	–	–	–	–	5-1/2-12	6-12	6.94	–
8.000	8.000	8.749	1.00	SH 2	–	–	–	–	5-3/4-12	7-1/2-12	7.94	–
10.000	10.000	10.749	1.00	SH 2	–	–	–	–	7-1/4-12	9-1/2-12	9.88	–

Note: Spanner wrench holes: SH1 = 0.56" dia., SH2 = 0.66" dia.

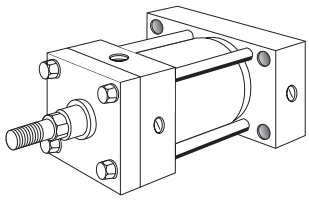
For "F and V" dimensions, see respective mounting dimensions shown on pages 7 thru 14

Mounting Type Overview

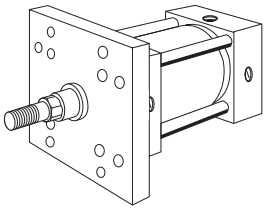
ME5 (see Page 7)



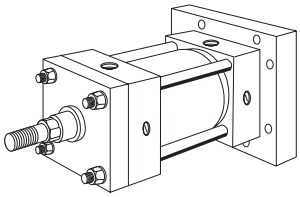
ME6 (see Page 7)



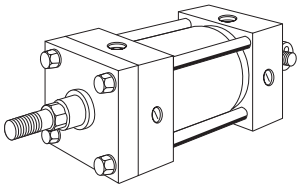
MF5 (see Page 8, 9)



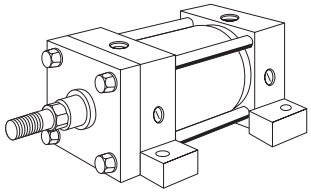
MF6 (see Page 8, 9)



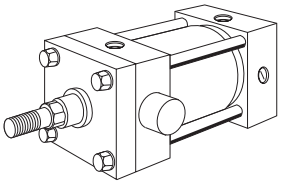
MP1 (see Page 10)



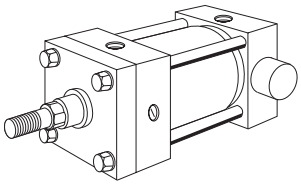
MS2 (see Page 11)



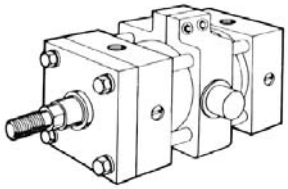
MT1 (see Page 12, 13)



MT2 (see Page 12, 13)

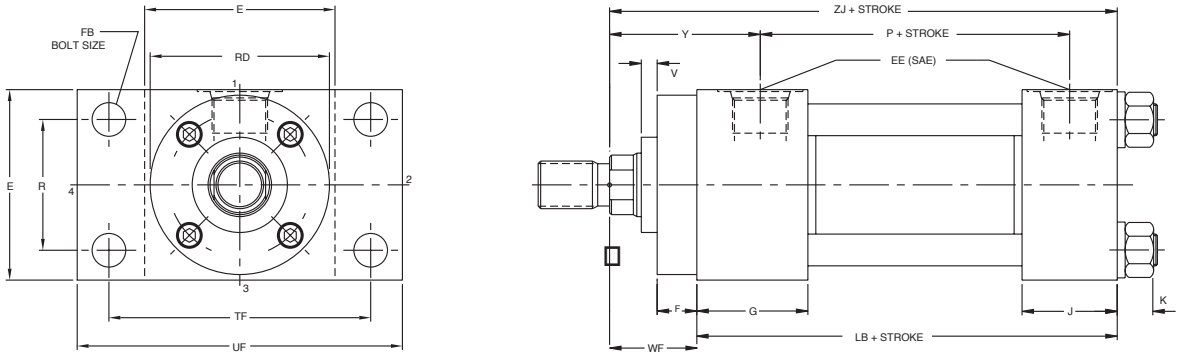


MT4 (see Page 14)



Mounting and Dimensions ME5, ME6

ME5



ME6

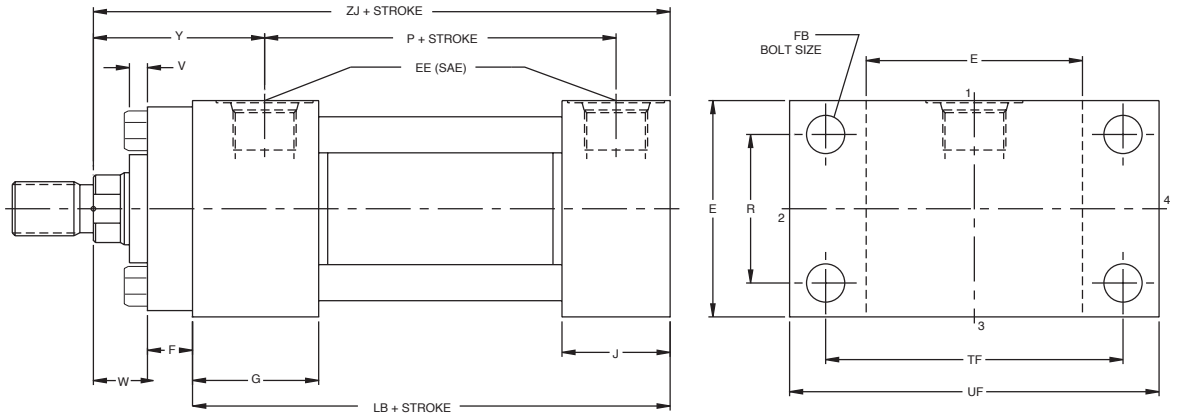


Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD*	WF	ZB	ZJ	ZM
10.000	4.500	0.25	1.25	5.00	7.625	2.94	16.60	15.06	18.00
	5.000	0.25	1.25	5.00	7.625	2.94	16.60	15.06	18.00
	5.500	0.25	1.25	5.00	9.000	2.94	16.60	15.06	18.00
	7.000	0.25	1.25	5.00	10.500	2.94	16.60	15.06	18.00
12.000	5.500	0.25	1.25	5.75	9.000	3.19	19.23	17.69	20.88
	7.000	0.25	1.25	5.75	10.500	3.19	19.23	17.69	20.88
	8.000	0.25	1.25	5.75	11.500	3.19	19.23	17.69	20.88
14.000	7.000	0.25	1.25	6.06	10.500	3.44	20.60	19.06	22.50
	10.000	0.50	1.25	6.06	13.250	3.44	20.60	19.06	22.50

* - RD tolerence (10" - 14") ± .015

Solid head and cap flange mounts are some of the strongest, most rigid methods of mounting cylinders. The head flange type mounting is best in a tension application. The cap flange type mounting is best in a thrust application.

Rod end options shown on page 5.

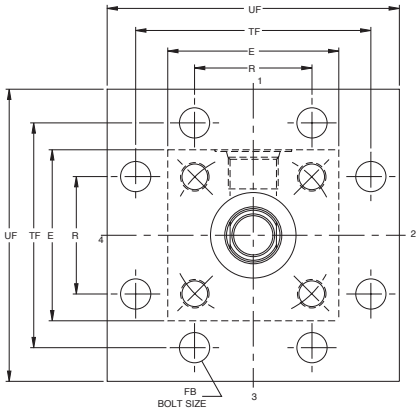
***Note:** "RD" dimension is not specified by NFPA. Please verify this dimension for retrofit or replacement applications.

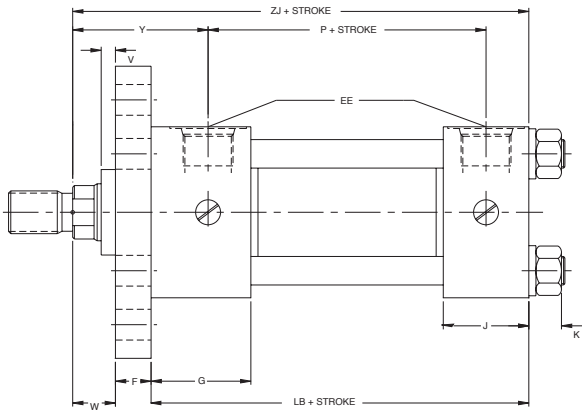
Table 2 - Dimensions not affected by rod diameter

Bore In.	E	F	G	J	K	P	R	SAE Port EE	FB Bolt	LB	TF	UF
10.000	12.63	1.69	3.69	3.69	1.53	8.00	9.63	1-5/16-12	1.75	12.13	15.88	19.00
12.000	14.88	1.94	4.44	4.44	1.53	9.38	11.45	1-5/8-12	2.00	14.51	18.50	22.00
14.000	17.25	2.19	4.88	4.88	1.53	10.38	13.22	1-7/8-12	2.25	15.63	21.38	25.25

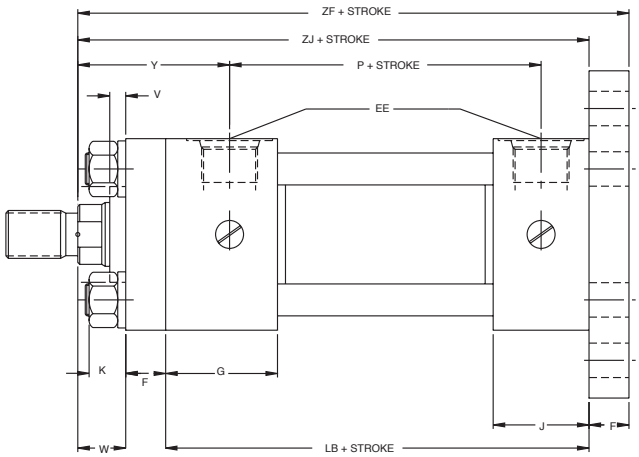
Mounting MF5, MF6

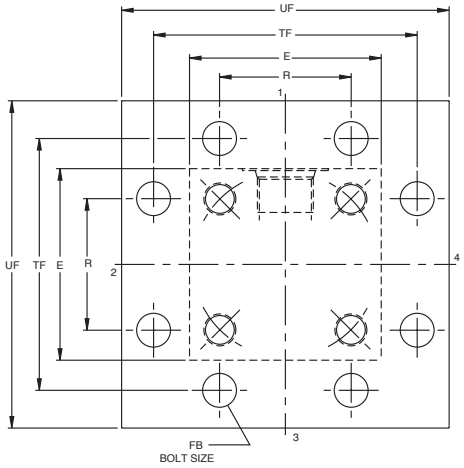
MF5





MF6





Dimensions MF5, MF6

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	ZB	ZF	ZJ
10.000	4.500	0.25	1.25	5.00	7.63	16.60	16.75	15.06
	5.000	0.25	1.25	5.00	7.63	16.60	16.75	15.06
	5.500	0.25	1.25	5.00	9.00	16.60	16.75	15.06
	7.000	0.25	1.25	5.00	10.50	16.60	16.75	15.06
12.000	5.500	0.25	1.25	5.75	9.00	19.23	19.63	17.69
	7.000	0.25	1.25	5.75	10.50	19.23	19.63	17.69
	8.000	0.25	1.25	5.75	11.50	19.23	19.63	17.69
14.000	7.000	0.25	1.25	6.06	10.50	20.60	21.25	19.06
	10.000	0.50	1.25	6.06	13.25	20.60	21.25	19.06

Table 2 - Dimensions not affected by rod diameter

Bore In.	E	SAE Port EE	F	FB Bolt	G	J	K	LB	P	R	TF	UF
10.000	12.63	2-1/2-12	1.69	1.75	3.69	3.69	1.53	12.13	8.00	9.63	15.88	19.00
12.000	14.88	2-1/2-12	1.94	2.00	4.44	4.44	1.53	14.51	9.38	11.45	18.50	22.00
14.000	17.25	2-1/2-12	2.19	2.25	4.88	4.88	1.53	15.63	10.38	13.22	21.38	25.25

Flange mounts are one of the strongest, most rigid methods of mounting. With this type of mount, there is little allowance for misalignment, so when long strokes are required, the free end opposite the mounting should be supported to prevent sagging and possible binding of the cylinder. Blind end mounts are best in a thrust load application and rod end mounts are best in tension applications. If an application exceeds the rectangular flange rating, a solid head or cap flange mount ME5 or ME6 is available (refer to page 7). When a less rigid mount can be used and the cylinder can be attached to a panel or bulkhead, an extended tie rod mount could be considered.

Notes: The bearing retainer plate is the same as the “RD” dimension for the 10”–14” bore.

Rod end options shown on page 5.

Mounting and Dimensions MP1

MP1

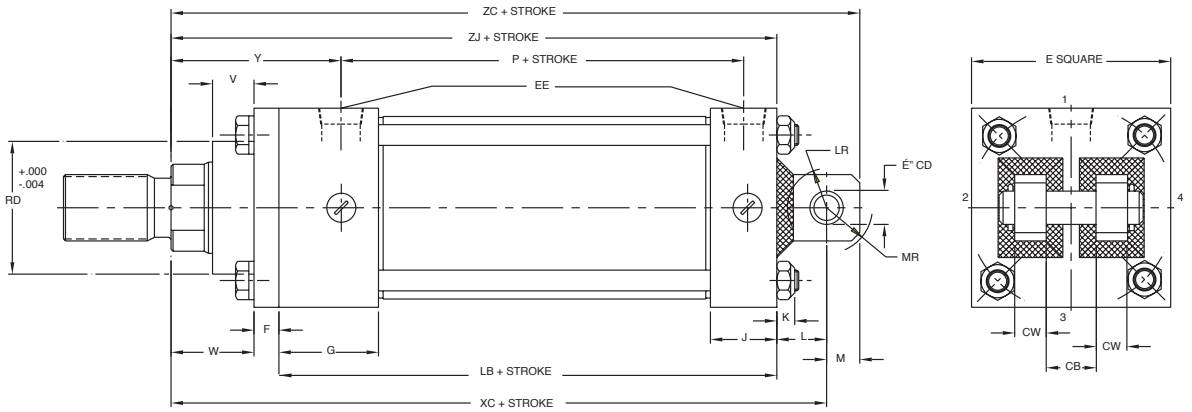


Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	XC	ZC	ZJ
10.000	4.500	0.25	1.25	5.00	7.63	19.06	22.56	15.06
	5.000	0.25	1.25	5.00	7.63	19.06	22.56	15.06
	5.500	0.25	1.25	5.00	9.00	22.19	22.56	15.06
	7.000	0.25	1.25	5.00	10.50	19.06	22.56	15.06
12.000	5.500	0.25	1.25	5.75	9.00	22.19	26.19	17.69
	7.000	0.25	1.25	5.75	10.50	22.19	26.19	17.69
	8.500	0.50	1.25	5.75	11.50	22.19	26.19	17.69
14.000	7.000	0.25	1.25	6.06	10.50	24.81	29.81	19.06
	10.000	0.50	1.25	6.06	13.25	24.81	29.81	19.06

The Clevis or Pin mounted cylinder is probably the most widely used of all mounts. For short strokes, medium or small cylinder applications, the clevis mounts are recommended. If this mount is applied where stroke requirements cause the overall length to be excessive, the Cap Trunnion mount can be used. Pivot mounts must always be used with a pivot type rod end attachment. Pivot pin and retainer rings included with MP1 mount.

The bearing retainer plate is the same as the “RD” dimension for the 10”–14” bore sizes.

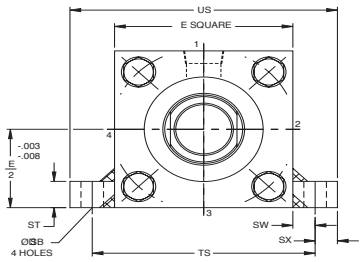
Rod end options shown on page 5.

Table 2 - Dimensions not affected by rod diameter

Bore In.	CB	CD	CW	E	SAE Port EE	EW	F	G	J	K	L	LB	LR	M	MR	P
10.000	4.00	3.500	2.00	12.63	2-1/2-12	4.00	1.69	3.69	3.69	1.53	4.00	12.13	3.25	3.50	4.25	8.00
12.000	4.50	4.000	2.25	14.88	2-1/2-12	4.50	1.94	4.44	4.44	1.53	4.50	14.51	3.75	4.00	4.38	9.38
14.000	6.00	5.000	3.00	17.25	2-1/2-12	6.00	2.19	4.88	4.88	1.53	5.75	15.63	4.75	5.00	5.38	10.38

Mounting and Dimensions MS2

MS2



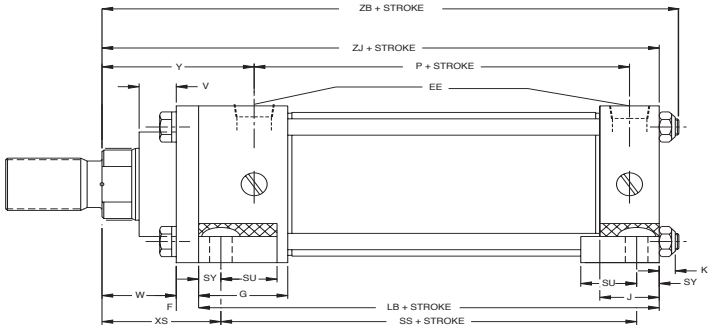


Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	XS	ZB	ZJ
10.000	4.500	0.25	1.25	5.00	7.63	4.56	16.50	15.06
	5.000	0.25	1.25	5.00	7.63	4.56	16.50	15.06
	5.500	0.25	1.25	5.00	9.00	4.56	16.50	15.06
	7.000	0.25	1.25	5.00	10.50	4.56	16.50	15.06
12.000	5.500	0.25	1.25	5.75	9.00	5.19	19.21	17.69
	7.000	0.25	1.25	5.75	10.50	5.19	19.21	17.69
	8.500	0.50	1.25	5.75	12.00	5.19	19.47	17.69
14.000	7.000	0.25	1.25	6.06	10.50	5.94	20.59	19.06
	10.000	0.50	1.25	6.06	13.25	5.94	20.59	19.06

The side or lug mounted cylinder provides a fairly rigid mount. These type mounts can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly, the mounting bolts are either in simple shear or tension without any compound stresses. An extended key plate option is available to eliminate the need for fitted bolts or external keys to carry the thrust load.

Note:
When specifying an MS2 mount with ports in the 2 or 4 quandrant, be sure to see that sufficient clearance between the port fitting and the lug is available to insert a bolt or cap screw into the lug.

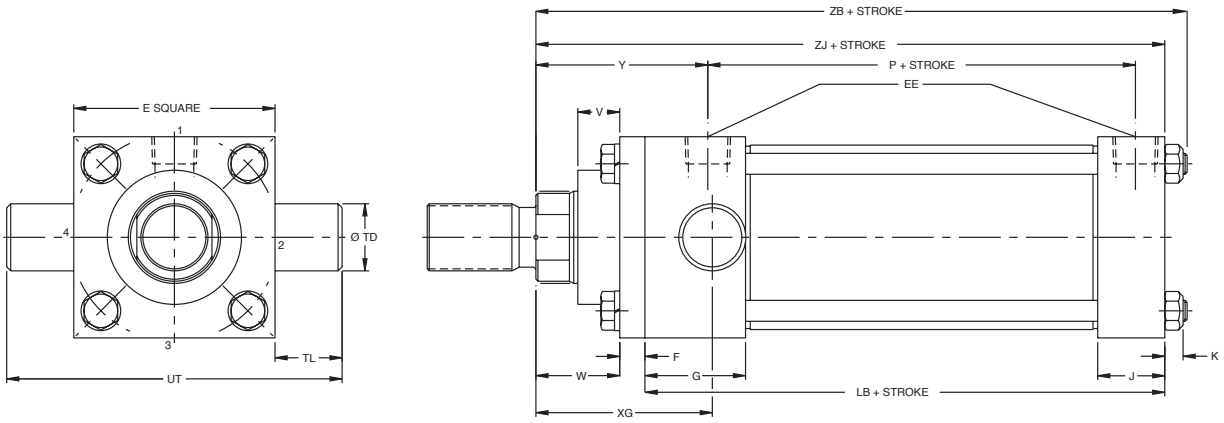
Rod end options shown on page 5.

Table 2 - Dimensions not affected by rod diameter

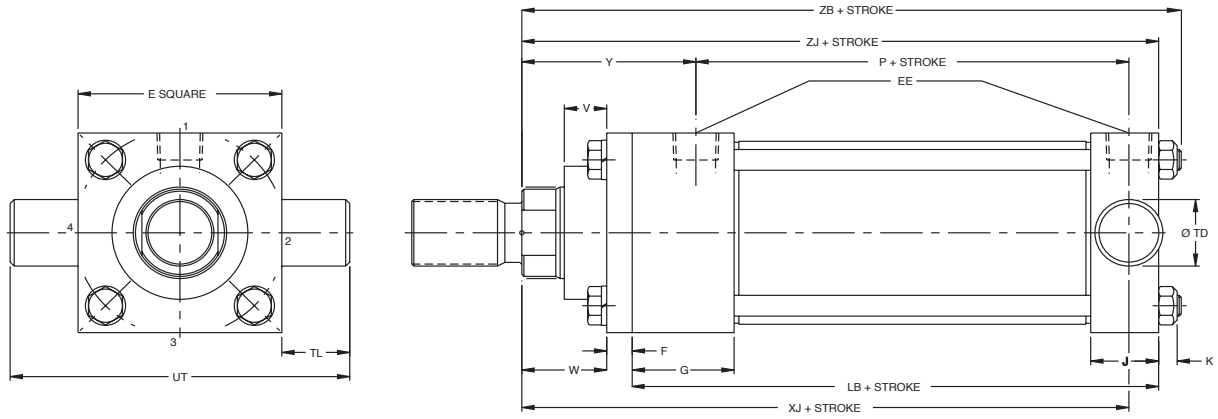
Bore In.	E	SAE Port EE	F	G	J	K	LB	P	R	SB Bolt	SS	ST	SU	SW	SX	SY	TS	US
10.000	12.63	2-1/2-12	1.69	3.69	3.69	1.53	12.13	8.00	9.63	1.50	8.88	2.25	3.50	1.63	1.63	1.63	15.88	19.13
12.000	14.88	2-1/2-12	1.94	4.44	4.44	1.53	14.51	9.38	11.45	1.50	10.50	3.00	4.25	2.00	2.00	2.00	18.88	22.88
14.000	17.25	2-1/2-12	2.19	4.88	4.88	1.53	15.63	10.38	13.22	1.50	10.63	4.00	5.00	2.50	2.50	2.50	22.25	27.25

Mounting MT1, MT2

MT1



MT2



Dimensions MT1, MT2

Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	WF	XG	XI Min.	XJ	ZB	ZJ
10.000	4.500	0.25	1.25	5.00	7.63	2.94	4.75	9.13	13.25	16.60	15.06
	5.000	0.25	1.25	5.00	7.63	2.94	4.75	9.13	13.25	16.60	15.06
	5.500	0.25	1.25	5.00	9.00	2.94	4.75	9.13	13.25	16.60	15.06
	7.000	0.25	1.25	5.00	10.50	2.94	4.75	9.13	13.25	16.60	15.06
7.000	5.500	0.25	1.25	5.75	9.00	3.19	5.38	10.75	15.50	19.23	17.69
	7.000	0.25	1.25	5.75	10.50	3.19	5.38	10.75	15.50	19.23	17.69
	8.000	0.50	1.25	5.75	11.50	3.19	5.38	10.75	15.50	19.23	17.69
8.000	7.000	0.25	1.25	6.06	10.50	3.44	5.81	11.94	16.69	20.60	19.06
	10.000	0.50	1.25	6.06	13.25	3.44	5.81	11.94	16.69	20.60	19.06

All trunnion mount cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

The bearing retainer plate is the same as the “RD” dimension for the 10”—14” bore sizes.

Rod end options shown on page 5.

Caution Note:

Rod end trunnion mount cylinders in bore sizes 10"-14" with all rod diameters should not be used over 1,500 psi. If your application requires higher presures, consult the factory.

Table 2 - Dimensions not affected by rod diameter

Bore In.	BD	E	SAE Port EE	F	G	J	K	LB	P	TD	TL	TM	UB	UM	UT
10.000	4.66	12.63	2-1/2-12	1.69	3.69	3.69	1.53	12.13	8.00	3.500	3.50	14.00	17.75	21.00	19.63
12.000	5.91	8.50	2-1/2-12	1.94	4.44	4.44	1.53	14.51	9.38	4.000	4.00	17.00	20.50	25.00	22.88
14.000	6.91	9.50	2-1/2-12	2.19	4.88	4.88	1.53	15.63	10.38	4.500	4.50	19.00	23.50	28.00	27.25

Mounting and Dimensions MT4

MT4

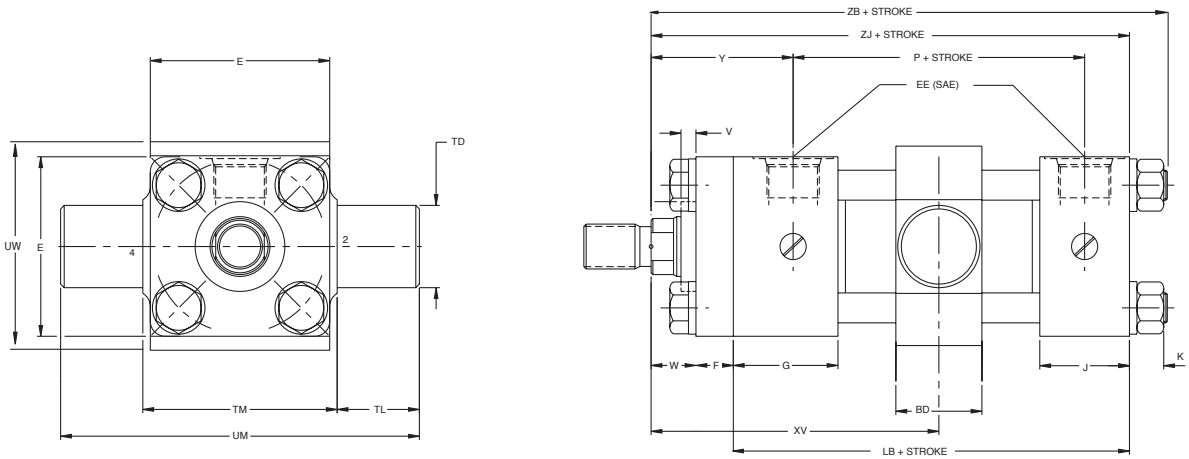


Table 1 - Dimensions affected by rod diameter

Bore In.	MM Rod	V	W	Y	RD	WF	XG	XI Min	XJ	ZB	ZJ
10.000	4.500	0.25	1.25	5.00	7.63	2.94	4.75	9.13	13.25	16.60	15.06
	5.000	0.25	1.25	5.00	7.63	2.94	4.75	9.13	13.25	16.60	15.06
	5.500	0.25	1.25	5.00	9.00	2.94	4.75	9.13	13.25	16.60	15.06
	7.000	0.25	1.25	5.00	10.50	2.94	4.75	9.13	13.25	16.60	15.06
12.000	5.500	0.25	1.50	5.75	9.00	3.19	5.38	10.75	15.50	19.23	17.69
	7.000	0.25	1.50	5.75	10.50	3.19	5.38	10.75	15.50	19.23	17.69
	8.000	0.50	1.25	5.75	11.50	3.19	5.38	10.75	15.50	19.23	17.69
14.000	5.000	0.25	1.25	6.06	10.50	3.44	5.81	11.94	16.69	20.60	19.06
	5.500	0.50	1.25	6.06	13.25	3.44	5.81	11.94	16.69	20.60	19.06

All trunnion mount cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

Specify “XV” dimension when ordering MT4 Intermediate Fixed Trunnion mounts. If not specified, trunnion will be located at the center of the tube.

The bearing retainer plate is the same as the “RD” dimension for the 10”—14” bore sizes.

Rod end options shown on page 5.

Table 2 - Dimensions not affected by rod diameter

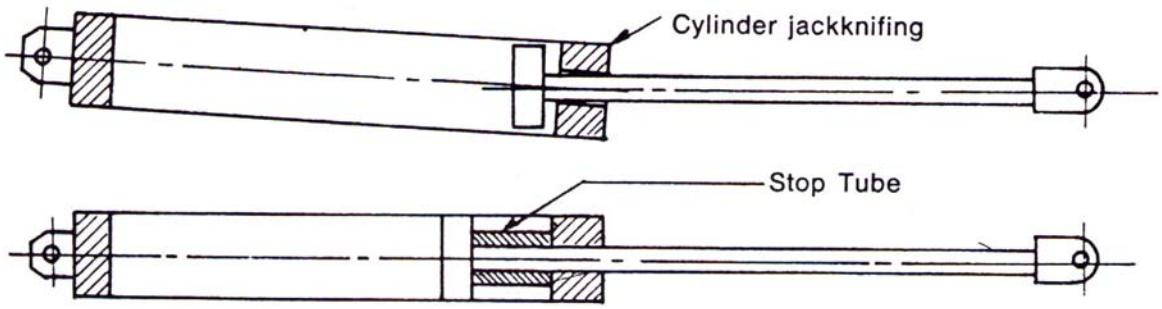
Bore In.	BD	E	SAE Port EE	F	G	J	K	LB	P	TD	TL	TM	UB	UM	UT
10.000	4.66	12.63	2-1/2-12	1.69	3.69	3.69	1.53	12.13	8.00	3.500	3.50	14.00	17.75	21.00	19.63
12.000	5.91	14.88	2-1/2-12	1.94	4.44	4.44	1.53	14.51	9.38	4.000	4.00	17.00	20.50	25.00	22.88
14.000	6.91	17.25	2-1/2-12	2.19	4.88	4.88	1.53	15.63	10.38	4.500	4.50	19.00	23.50	28.00	27.25

Stop Tube

In long cylinders which are pushing a load, internal stop tubes are used to prevent excessive bearing wear and jackknifing of the cylinder. They are installed between the piston and the head, providing additional bearing support by increasing the distance between the piston and the head in the fully extended position.

For long, trouble free bearing service, the bearing loads should not exceed about 200 psi. Standard cylinders are not designed for heavy eccentric loads.

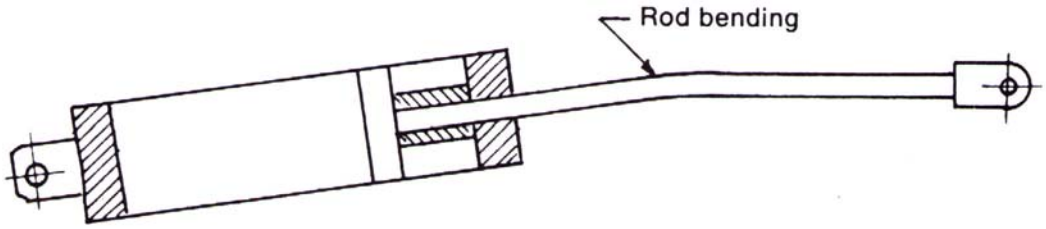
The use of oversize rods to reduced bearing loads is not recommended. They are not as effective as stop tubes, and if misalignment occurs the additional rod stiffness will actually increase bearing loads. For long push stroke cylinders, a stop tube may be required to limit radial bearing loads to a safe value and prevent jackknifing. They are especially desirable in long stroke pivoted centerline style mountings. The effect of a stop tube may be duplicated by providing additional unused stroke and stopping the cylinder extension by external means.



Column Strength Considerations

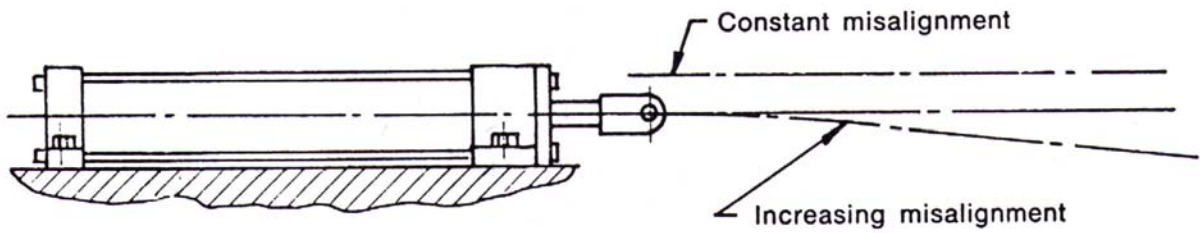
Standard size rods are recommended for use in cylinder applications where column strength, rod sag, or rate of cylinder return do not require an oversize rod. Being more flexible, standard rods absorb shock loads and minimize bearing loads caused by misalignments.

For long push stroke cylinders, an oversize rod may be required to prevent column failure and rod bending. Total cylinder length, extended is considered in column strength. Refer to the tables on the following pages for calculations regarding the column strength and stop tube required for a cylinder application.



Mounting Considerations for Cylinders - Fixed Non Centerline Mountings

Fixed mount cylinders can tolerate a slight misalignment that is zero at full retraction and increases slightly with stroke. With other than very large rods, a misalignment of about .003" to .005" per foot of stroke is usually permissable. Rigid mounted cylinders cannot tolerate a fixed misalignment, particularly at full retraction.



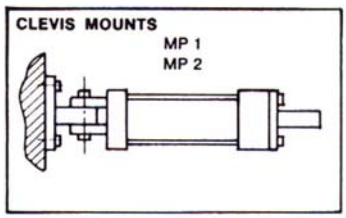
Mounting Considerations for Cylinders - Pivoted Centerline Mountings

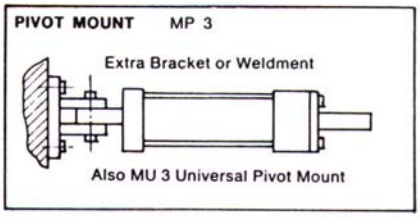
If the path of the load is curved or misalignment is a problem, a pivoted centerline mounting should be used. This compensation of nonlinear travel is in one plane only, as would occur during the operation of a lever. Pivot mounts require the rod end attachment to also be a pivot type. Close tolerance pins should be used and it is recommended that the cylinder manufacturer's accessory brackets be used to maintain good fits.

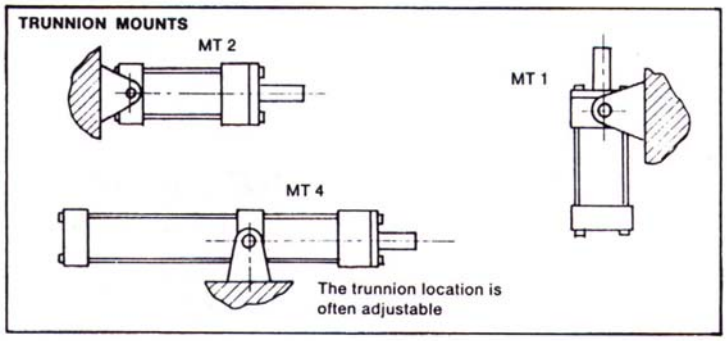
For short strokes, medium or smaller bore cylinder applications, the clevis mount is recommended. This is probably the most widely used cylinder mounting. Where the clevis mount should normally be used, but would cause the overall length of the cylinder to be excessive, the cap trunnion mount can be used. Head end trunnions should be carefully applied to either short strokes or to application where the weight of the cylinder falls vertically below the pin.

For long stroke cylinders and/or heavy cylinders, the center or intermediate trunnion mount is recommended. This mount supports the weight of the cylinder and should be located near the balance point of the cylinder at the time of maximum thrust. For general applications, a good estimate for the location of the intermediate trunnion is 1/3 back from the head end.

The MP5 (universal) type mount is a pivot mount with a spherical bearing fitted into the pivot to permit 5 to 10 degrees of movement in a plane perpendicular to the major plane of pivot movement. It is probably the most serviceable of the pivoted centerline mounts. For maximum effectiveness, a spherical bearing type rod end fitting should be utilized at the same time.

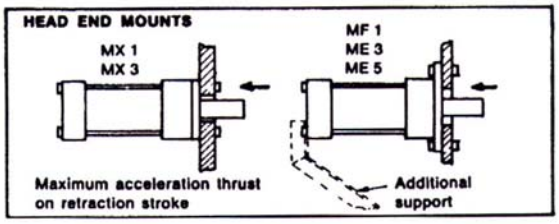


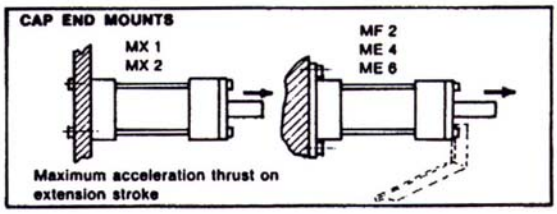


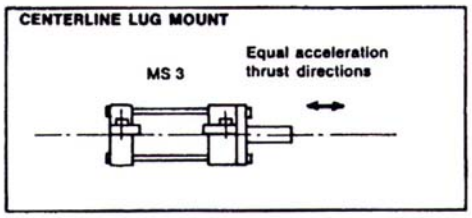


Mounting Considerations for Cylinders - Fixed Centerline Mountings

These mounting styles, illustrated below, tend to be more stable against sway on the power extension stroke. Rigid machine frame members are required to prevent misalignment under loads. The travel path of the rod end should be linear and be guided if at all possible. Long supported extension of the rod end must be avoided. Refer to the stop tube calculation data which shows the advantages of supporting and using reliable guiding on the rod end. Long stroke cylinders with fixed end mounts may require additional support at the free end of the cylinder body. This is illustrated in dotted outlines in the sketches below.



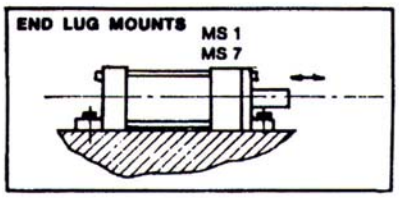


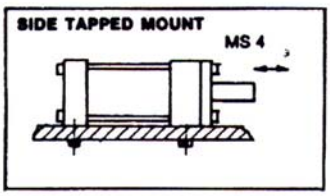


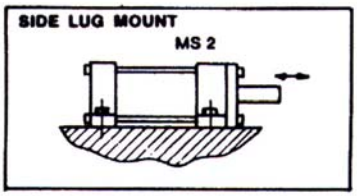
Mounting Considerations for Cylinders - Fixed Non Centerline Mountings

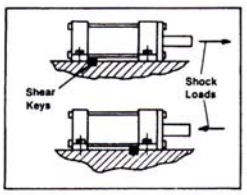
These types of mounts are perhaps the easiest to use for mounting and replacement ease. The offset thrust line introduces bending stresses and additional loads on the mounting bolts. This type should be very well aligned for maximum service life. The load must travel in a very linear path and be supported and guided both horizontally and vertically as the data for calculating stop tube and column strength illustrates.

When applying these mounts with offset thrust under high pressure or shock loads, properly located shear pins or keys can be used. These provide positive location and prevent slight movement of the cylinder under shock conditions, which the normal clearance in the mounting bolt holes would allow. Very close tolerances (.001") should be maintained between keys and keyways. Keys should be located as illustrated below, at one end of the cylinder. When using dowel pins, do no pin across opposite corners, as serious twisting stresses will result.









Mounting Considerations for Cylinders

Selection of mounting style depends primarily upon the operating specifications of the application. Mountings are generally one of the following three types:

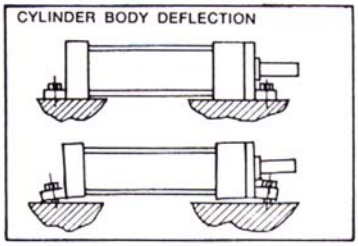
1. Fixed Centerline Mountings
   Where the thrust of the cylinder is focused on the centerline of the cylinder rod.
2. Fixed Non-Centerline Mountings
   Where the thrust of the cylinder is aligned parallel to, but not on, the centerline of the cylinder rod.
3. Pivoted Centerline Mountings
   Where the centerline of the cylinder may swing in one or more directions. Usually major movement is in one plane.

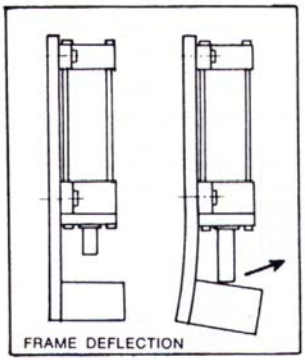
A very important general consideration is to keep the cylinder thrust as close as possible to the centerline of the piston rod and free from misalignment or side thrust. Off-center thrust or side loads subtract substantially from the anticipated rod bearing and rod seal service life.

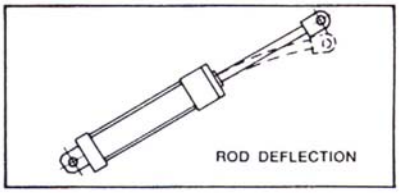
Off-center thrust and side loading can be caused by cylinder deflection under load, machine frame deflection, rod bending or sagging, cylinder pivot binding, nonlinear load movement, shifting of load; some of which are shown below.

In addition to the mounting styles, several other factors should be considered when mounting a cylinder. Care should be taken to avoid painting or damaging the exposed portion of the piston rod during construction. Threaded pieces should be pulled tight against thread shoulders to minimize bending and reduce fatigue stress. Rotation of the piston rod within the cylinder should be avoided to prevent possible scoring of the cylinder tube and damage to piston seals. Long cylinders may require additional body support to prevent damaging sag.

Major consideration must be given to the factors which might cause premature failure of the cylinder: unusual acceleration, unusual deceleration, alignment, support of cylinder weight, linear or curvilinear travel path of the load being moved, jackknifing of the cylinder, and the column strength of the rod. Some mounting styles are more suited than others to each of the above application factors.







Buckling

The permissible stroke with a flexible guided load and a 3.5 factor of safety against buckling can be obtained from the relevant table. For deviating cylinder installation positions, the permissible stroke length has to be interpolated. Permissible strokes for non-guided loads on request.

Calculations for buckling are determined using the following formulas:

1. Calculation according to Euler

$$F = \frac{\pi^2 \bullet E \bullet I}{\nu \bullet L_K^2} \quad \text{if } \lambda > \lambda g$$

2. Calculation according to Tetmajer

$$F = \frac{d^2 \bullet \pi\,(335 - 0.62 \bullet \lambda)}{4 \bullet \nu} \quad \text{if } \lambda \leq \lambda g$$

Explanation:

E = Modulus of elasticity in psi

= 30×10^6 for steel

I = Moment of inertia in inches^4 for circular cross-sectional area

$$= \frac{d^4 \bullet \pi}{64} = 0.0491 \bullet d^4$$

ν = 3.5 (safety factor)

L_K = Free buckling length in inches (depending on mounting type, see sketches A, B, C)

d = Piston rod Ø in inches

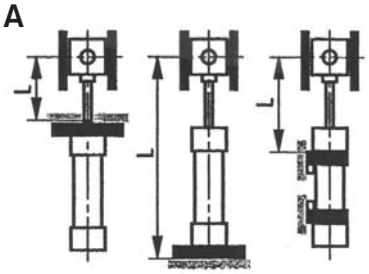
λ = Slenderness ratio

$$= \frac{4 \bullet L_K}{d} \qquad \lambda g = \pi \sqrt{\frac{E}{0.8 \bullet R_e}}$$

R_e = Yield strength of the piston rod material

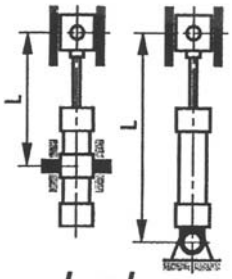
Influence of the mounting type on buckling length:

A



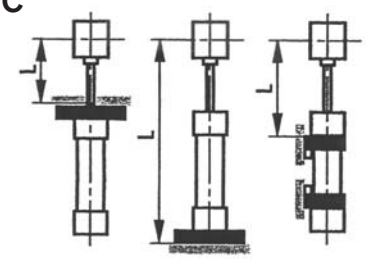
$L_K = 0{,}7\ L$

B



$L_K = L$

C



$L_K = 2\ L$

Stop Tube

To determine whether a stop is required on push stroke cylinders:

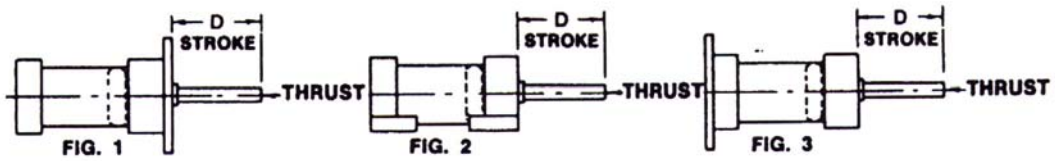
Step 1 - Determine which example below corresponds to your application.

Step 2 - Determine the value of "L" from the instructions given. The find "L" dimension in the table at the right for the required stop tube length. (Specify the effective stroke plus the stop tube length when ordering).

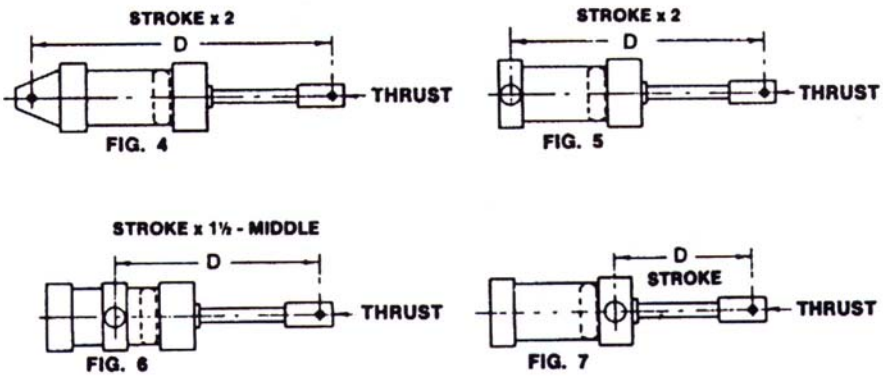
Step 3 - Add stop tube length to original "L" dimension to obtain your adjusted "L" dimension.

Example: "L" = 96", therefore, Stop Tube = 6"
Adjusted L = 102" (96+6)

Step 4 - Use adjusted "L" to figure rod column strength at maximum pressure rating of the cylinder, page 21.

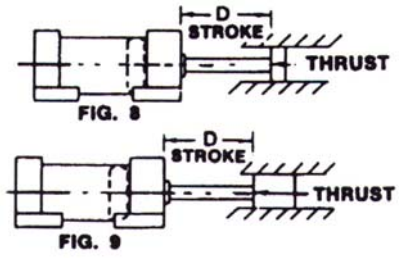


Typical rigidly mounted cylinders with rod unsupported at free end. May be mounted either horizontally or vertically. Use the equation L = 4D to determine values of "L" for all cylinder mountings in this category.



"L" Inches	Stop Tube Length (inches)
0-40	0
41-50	1
51-60	2
61-70	3
71-80	4
81-90	5
91-100	6
101-110	7
111-120	8

Typical trunnion mounted cylinders may be mounted either horizontally or vertically. Use the equation L = D to determine values of "L" for all cylinder mountings in this category. For center trunnion mounted cylinders (Figure 6), the position of the trunnion for most favorable bearing loads is obtained when "D" dimension with the rod retracted is approximately 1/3 overall length of cylinder with rod retracted.



Typically rigidly mounted cylinder with free end of rod supported with short guide. May be mounted either horizontally or vertically. Use the equation L = D to determine values of "L" for all cylinder mountings in this category.

Typical rigidly mounted cylinder with free end of rod supported with long closely-fitted guide. May be mounted either horizontally or vertically. Use the equation L = 1/2 D to determine values of "L" for all cylinder mountings in this category.

Column Strength and Oversize Rod Selection

Standard rod diameters are recommended for all Pull Stroke applications. To determine the correct rod diameter required for Push Stroke application, follow these simple steps:

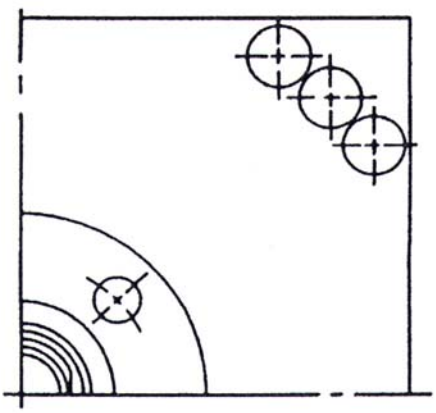
Step 1 – Determine the value of "L" from the illustrations shown on page 20. (Use Adjusted "L" dimension for cylinder with Stop Tube).

Step 2 – From your cylinder size and maximum operating pressure, determine your Push Stroke Thrust.

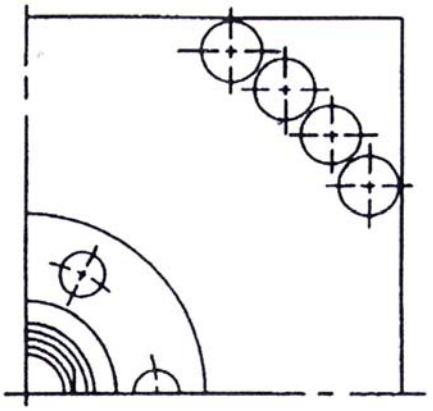
Step 3 – Find your thrust in the left hand column and located your "L" dimension (or Adjusted "L" dimension in the same horizontal line to the right; (if your exact "L" or adjusted "L" dimension is not shown, move to the right in the same horizontal column to the next larger number). Read vertically up from this number to the rod diameter shown. This is the required rod diameter for your application.

Thrust "T" in Pounds Force at End of Rod	Rod Diameters						
	4	4-1/2	5	5-1/2	7	8-1/2	10
50,000	165	200	234	269	408		
60,000	154	190	225	256	384		
80,000	137	170	204	240	348		
100,000	120	154	199	222	324	435	605
120,000	108	146	175	207	313	396	551
140,000	98	128	160	194	301	365	510
160,000	86	118	148	182	279	345	476
200,000	67	98	131	161	260	306	428
250,000		72	109	141	236	275	380
300,000			86	120	212	251	350
350,000			52	100	195	234	324
400,000				77	182	216	301
500,000					152	194	269

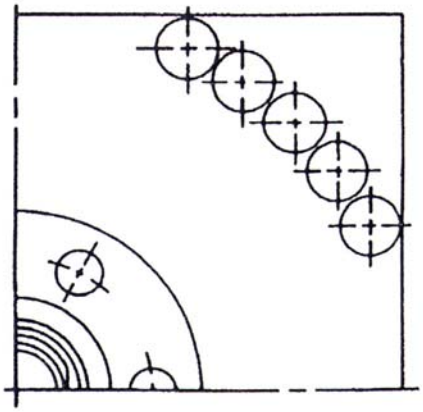
Multiple Tie Rod Construction



3 tie rods are added to each corner for cylinder bore sizes of 10 inches



4 tie rods are added to each corner for cylinder bore sizes of 12 inches



5 tie rods are added to each corner for cylinder bore sizes of 14 inches

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Section 6

IHC-Designer from Rexroth

Engineering Software – Fast, Reliable, with Logical User Guidance

Main menu

Faster and More Reliable Planing, Designing and Engineering!

Quick start selection

As a designer of plant and machinery you can quickly and reliably find the optimum hydraulic cylinder solution with logical user guidance.

Select the optimum component for your application from any of our cylinder types and a comprehensive accessories product range. Cylinders and accessories comply with ISO, DIN, CETOP or Rexroth standards.

With the IHC Designer from Rexroth you can handle your designing and engineering tasks faster and more efficiently.

Quick start selection
When type designations are known you can find dimensional drawings, 2d/3d files and accessories fast and reliably.

Type code selection
Type code query with logical guidance.

Technical selection
The system generates product proposals on the basis of your specification of typical cylinder data. In addition, you get comprehensive information about technical data and basics for dimensioning.

Selection results
After guidance through the product selection you obtain the exact technical data of the components selected.

Individual cylinder data
After the selection, technical documentation (catalogs), a list of accessories as well as 2d and 3d CAD data are made available for the configured cylinder. The complete information can be printed or saved. CAD models can be directly visualized with the integrated viewers.

For all CAD systems
Thanks to its own CAD kernel, the IHC Designer always offers the suitable file format for all commercial CAD systems. The models are compact and feature an intact model structure. You save time and get highest model quality.
3d: IGES, STEP, VDA, CATIA, SAT, PARASOLID
2d: DXF

Tested in conjunction with
CATIA V4&5, SolidWorks, SolidEdge, IDEAS, UniGraphics, PRO/Engineer, AutoCAD, Autodesk Mechanical, Inventor.

Inquiry function by e-mail

Type code selection

Technical selection

Selection results

The Drive & Control Company
Rexroth offers an unique and comprehensive range of products and services across technologies from a single source in its six fields of technology and service areas.

Intelligent hydraulics in new dimensions
At Rexroth you can select from the worlds' largest standard product range in the field of hydraulics, application-specific and customized special system solutions of high quality. With advanced micro-electronics Rexroth has made hydraulics even more powerful. Benefit from our application specialists' expertise – from engineering to the hand-over of turnkey systems. Thanks to the use of hydraulic drive and control technology from Rexroth you will be more competitive than ever.

System requirements
Minimum system requirements:
- IBM or compatible computer
- Pentium 500 MHz or higher
- 128 MB RAM
- 2 MB free hard disk space
- MS Windows 98 and NT 4.0 or higher

Recommended system configuration:
- IBM or compatible computer
- Pentium 1.4 GHz or higher
- 256 MB RAM
- 170 MB free hard disk space
- MS-Windows 2000 oder XP

Installation
The software guides you automatically through installation after the CD-ROM was inserted. Should your PC be configured so that this is impossible, please click the buttons "Start" and "Run" in your operating system. Then enter the identification of the CD drive and ":/Setup.exe".

Rely on service across technologies
Rexroth integrates all services for the entire product spectrum in the field of factory and industrial automation into a single organization: from immediate support, spare parts service, field and repair service, retrofit/modernization through to training.

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