



Telescopic Cylinders

Series TS - Single Acting

Series TD - Double Acting



Pressure: 3,000 psi Working
3,000 psi Non-Shock

Bore Sizes: 2" to 8"

Rod Sizes: 1" to 6 3/4"

Ports: #6, to #20 ORB

Attachments: Tube

Cross Hole

Sph. Brg

Front Flange

Rear Flange

Male Mid Trunnion

Female Mid Trunnion

Telescopic Cylinder – Introduction

A telescopic cylinder is essentially a series of cylinders (called stages) nesting inside one another. It is normally used where space is a constraint.

Each stage is the rod of the larger stage and the barrel of that stage. e.g. A 3-stage cylinder is 3 stages or rods that move in and out. It consists of the barrel (the largest tube) followed by the first stage and then the second stage and finally the smallest stage (called the rod).

There are two types of telescopic cylinders. Single acting and double acting.

Single Acting - S/A

A S/A telescopic is essentially a displacement cylinder. It extends by hydraulic power and retracts by gravity or any external force. The oil pressure acts on the outside diameter of the various rods. When retracted, the various stages are immersed in oil, thus protecting them from rusting. These cylinders do not leak unless the rod seals are damaged. The port is located at the barrel end and a bleed port at the rod. The cylinder is sealed at the rod end.

Double Acting - D/A

D/A telescopic is powered both ways. Oil acts on the bore area to extend and on the annulus area between the bore and rod to retract. The extend force is typically 5 times the retract force. Because of this intensification, it is critical that the retract port is not restricted. D/A cylinders will slowly drift due to seal leakage; the leakage rate is

dependent on the surface finishes of the cast iron piston seals and the barrel surface. The ports are located at the rod end. The first stage extends first, when extending the cylinder; on retracting, the rod stage retracts first.

Design & Selection Considerations

- The forces given in the charts are theoretical; friction and back pressure are ignored.
- Since the size of each stage is different, the speed and force of a cylinder will vary as the cylinder extends and retract. For a variable load application (e.g. dump truck), the force at each stage must be examined for overall suitability.
- Overlap “A” should be maximum for strength. We recommend a minimum of 15% to 20% of the stroke per stage. A telescopic cylinder should be designed to use the fewest number of stages, for economy and strength.
- As the customer is aware of all aspects of the application, he is responsible for sizing the cylinder according to his needs. Our products are not warranted express or by implication for any specific purpose, notwithstanding any disclosure to us of the use to which the product is to be put.
- Stroke is the same for each stage. The rod stroke can be different to accommodate an odd stroke.

Telescopic Cylinder – Introduction

Features

- Designed for 3,000 PSI non-shock pressure.
- Designed for easy maintenance. Unscrew the barrel end cap and each stage can be removed from the blind end.
- All stages have 0.001 inches thick hard chrome on the O.D. to resist corrosion. This smooth surface reduces wear on the rod, wear ring, seal and wiper.
- No external threaded ring at the rod. Each stage protrudes only ¼” resulting in maximum overlap.
- The tube of each stage is re-inforced by the gland and piston, making the stages considerably stronger.
- Wide selection of standard mounting. The following charts show the standard size (hole diameter, CD) and x-hole and tube eye style. Any other style and size (shown in the accessories section ‘02’) are available. The limitation is that the rod end accessory must be smaller than the rod for welded type. If this is not possible, then a threaded type must be selected.
- The annulus space between each stage is 1/8” this gives a smoother transition between stages when extending and retracting. Also, the cylinder diameter is smaller.
- The rod seal is “U-Cup” (Parker or equivalent) and not Vee packing which can be over-tightened causing increased friction and premature failure.
- Normally three wear rings, strategically placed, support each stage. Two wear rings style is available but is only recommended for short stroke cylinders (less than 10” of S/S). Call our Engineering Department for details.
- SAE ORB (O’ring Boss) ports are standard.

Cylinder Attachments

Blind End

- The following charts show the blind end with standard tube eye.
- Any size and type of welded cylinder accessories can be ordered.
- Front flange, rear flange, male trunnion and female trunnion are also available see page **13-13, 14** for details.

Rod End

- The following charts show X-hole mounting as the shortest and simplest style.
- Any other types or sizes can be supplied. The only restriction is, the attachments must be smaller than the rod diameter.
- If a bigger accessory is necessary, it must be threaded on. Consult our Engineering Department for details.

Selection

First, decide on the following:

- Working pressure.
- Single or double acting cylinder.
- Force and stroke requirements.
- Space available.
- Type and size of attachments at both ends to support the load and minimize side loads.

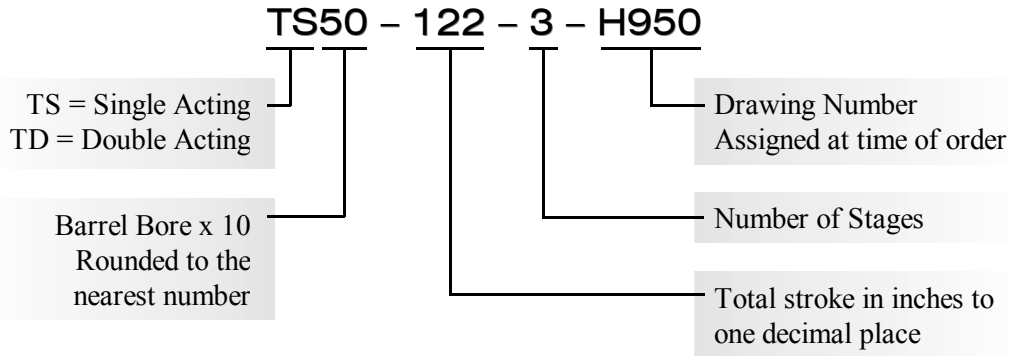
From the following charts work out:

- Number of stages.
- S/S – stroke per stage
- A – overlap

Telescopic Cylinder – Introduction

Model Number

A model number will be assigned at the time of order. Please refer to this number when re-ordering or ordering parts.



Specifications

The forces given in the following charts are theoretical. Losses due to friction etc. are neglected.

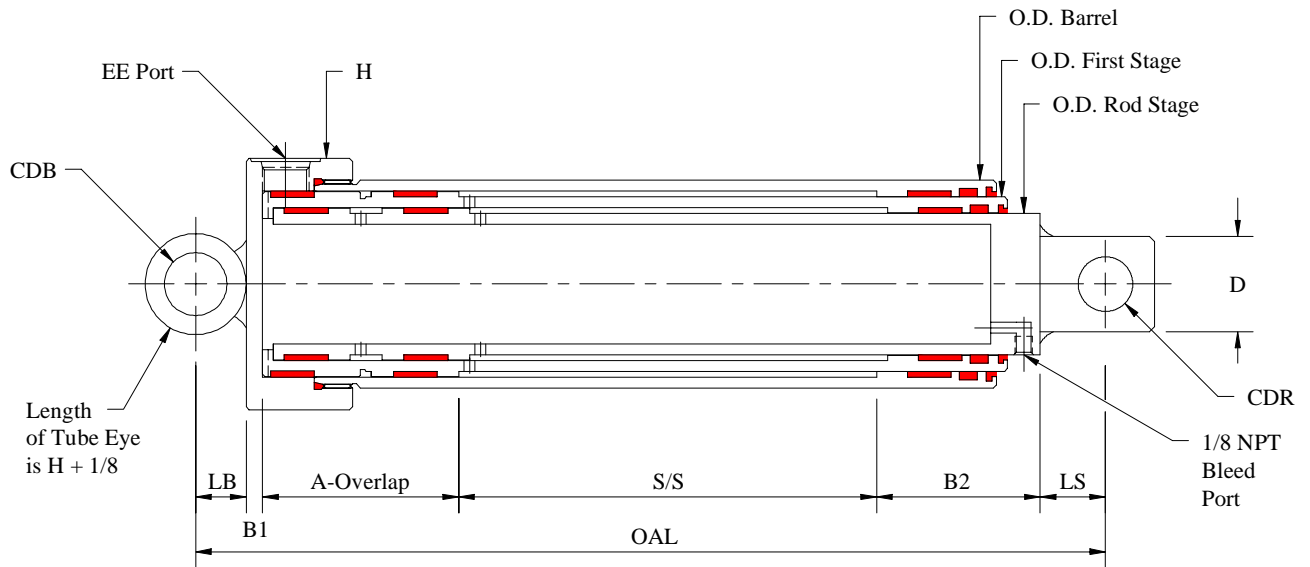
Forces:	$F = P \times A$
F = force in lbs. either push or pull (see charts)	
P = pressure, lbs / inch ² , 3000psi maximum	
A = area in square inch	
	- rod area for single acting in push
	- piston area for double acting in push
	- accumulated area for double acting in pull

Lengths:	$OAL = S/S + A + B + LB + LS$
OAL = overall length of the cylinder in inches, centre of pin to centre of pin fully retracted	
S/S = stroke per stage in inches = total stroke ÷ number of stages	
A = overlap of stage, either specified by the customer or obtained from OAL	

Volume:	$V = FV \times \text{stroke}$
V = volume of oil displaced in U.S. gallons. or the difference between volume of oil in the cylinder when fully extended and retracted.	
= total stroke in inches	

Weight:	$W = \text{Basic} + FW \times (OAL-L)$
W = Dry weight of cylinder in lbs. for standard mounting as per chart.	

Telescopic Cylinder – 2 Stage, Single Acting

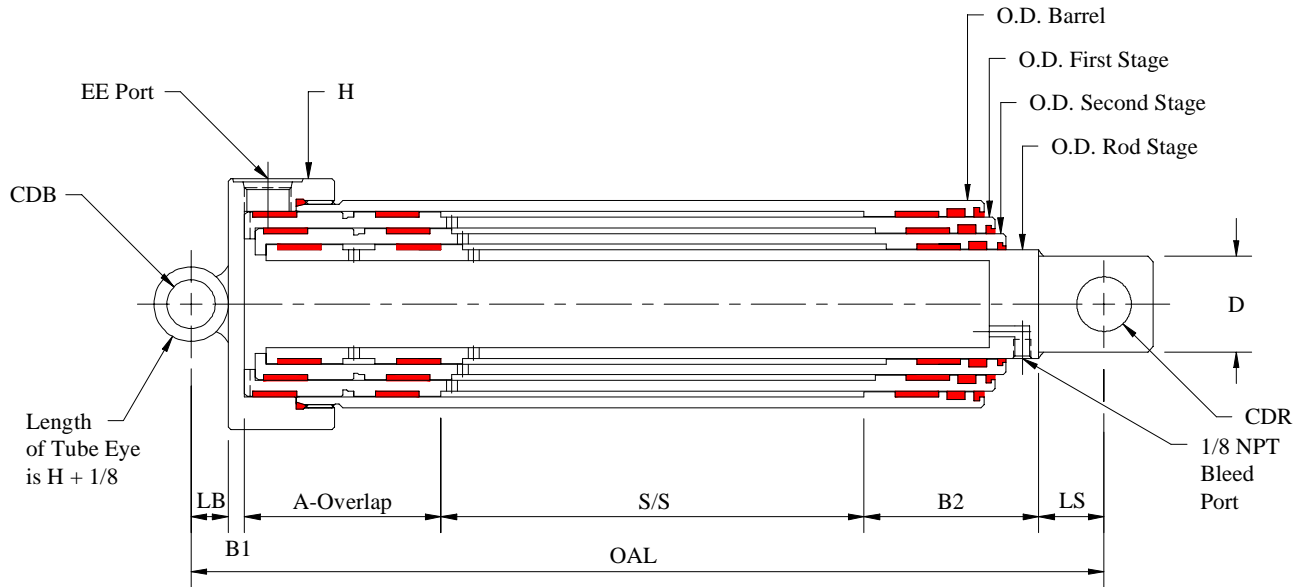


A-Overlap Minimum is 4 1/2 for all Stages.

BARREL BORE	O.D. IN INCHES			B= B1+B2	H Dia	EE ORB	MOUNTING ACCESSORIES				
	BARREL	1 ST STAGE	ROD				BLIND END		ROD END		D
							CDB ϕ	LB	CDR ϕ	LS	
2	2 1/2	1 3/4	1	4.13	3.25	#6	0.75	0.63	0.63	0.75	1.00
2 3/4	3 1/4	2 1/2	1 3/4	4.13	4.00	#8	0.75	0.63	0.75	1.00	1.44
3 1/2	4	3 1/4	2 1/2	4.13	5.00	#12	1.00	0.88	1.00	1.13	1.69
4 1/4	4 3/4	4	3 1/4	4.13	5.75	#12	1.25	1.00	1.25	1.50	2.19
5	5 3/4	4 3/4	4	4.25	6.50	#12	1.50	1.13	1.50	1.75	2.44
6	6 3/4	5 3/4	4 3/4	4.25	7.50	#16	1.75	1.25	1.75	2.00	3.19
7	7 3/4	6 3/4	5 3/4	4.25	8.50	#20	2.00	1.50	2.00	2.25	3.44
8	8 3/4	7 3/4	6 3/4	4.38	9.75	#20	2.50	1.75	2.50	2.75	3.94

BARREL BORE	PUSH FORCE @ 3000 PSI IN lbs		VOLUME FACTOR FV	WEIGHT FACTORS			SEAL KIT
	1 ST STAGE	ROD STAGE		BASIC	FW	L	
2	7,220	2,360	0.007	12	1.62	10.0	12491
2 3/4	14,700	7,220	0.016	21	1.85	10.3	12459
3 1/2	24,900	14,700	0.029	26	2.00	10.6	12460
4 1/4	37,700	24,900	0.045	35	2.50	11.1	12461
5	53,200	37,700	0.066	49	3.62	11.6	12462
6	77,900	53,200	0.095	68	4.91	12.0	12463
7	107,000	77,900	0.134	90	6.37	12.5	12464
8	142,000	107,000	0.180	116	7.37	13.4	12465

Telescopic Cylinder – 3 Stage, Single Acting

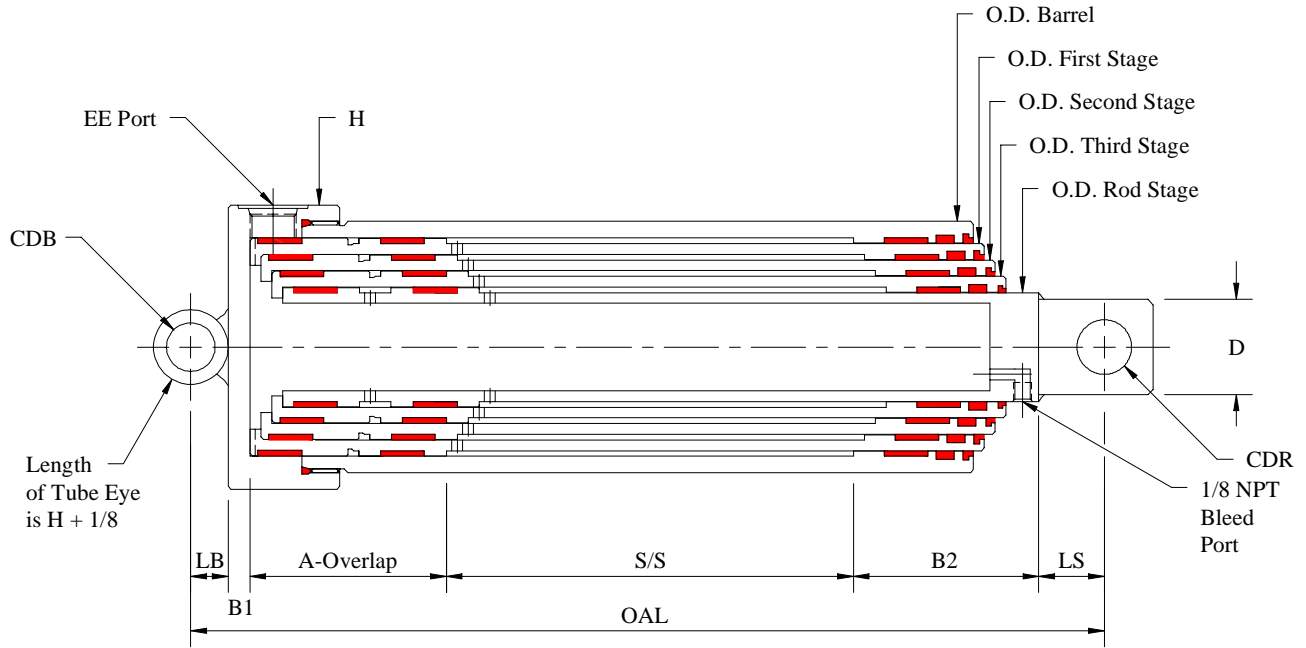


A-Overlap Minimum is 4 1/2 for all Stages.

BARREL BORE	O.D. IN INCHES				B= B1+B2	H Dia	EE ORB	MOUNTING ACCESSORIES				
	BARREL	1 ST STAGE	2 ND STAGE	ROD				BLIND END		ROD END		D
								CDB ϕ	LB	CDR ϕ	LS	
2 3/4	3 1/4	2 1/2	1 3/4	1	4.38	4.00	#8	0.75	0.63	0.63	0.75	1.00
3 1/2	4	3 1/4	2 1/2	1 3/4	4.38	5.00	#12	1.00	0.88	1.00	1.13	1.69
4 1/4	4 3/4	4	3 1/4	2 1/2	4.38	5.75	#12	1.25	1.00	1.25	1.50	2.19
5	5 3/4	4 3/4	4	3 1/4	4.50	6.50	#12	1.50	1.13	1.50	1.75	2.44
6	6 3/4	5 3/4	4 3/4	4	4.50	7.50	#16	1.75	1.25	1.75	2.00	3.19
7	7 3/4	6 3/4	5 3/4	4 3/4	4.50	8.50	#20	2.00	1.50	2.00	2.25	3.44
8	8 3/4	7 3/4	6 3/4	5 3/4	4.63	9.75	#20	2.50	1.75	2.50	2.75	3.94

BARREL BORE	PUSH FORCE @ 3000 PSI IN lbs			VOLUME FACTOR FV	WEIGHT FACTORS			SEAL KIT
	1 ST STAGE	2 ND STAGE	ROD STAGE		BASIC	FW	L	
2 3/4	14,700	7,220	2,360	0.012	20	2.28	10.3	12492
3 1/2	24,900	14,700	7,220	0.023	32	2.68	10.9	12466
4 1/4	37,700	24,900	14,700	0.037	40	3.00	11.4	12467
5	53,200	37,700	24,900	0.056	56	4.29	11.9	12468
6	77,900	53,200	37,700	0.081	76	5.75	12.3	12469
7	107,000	77,900	53,200	0.115	99	7.37	12.8	12470
8	142,000	107,000	77,900	0.157	131	9.16	13.6	12471

Telescopic Cylinder – 4 Stage, Single Acting

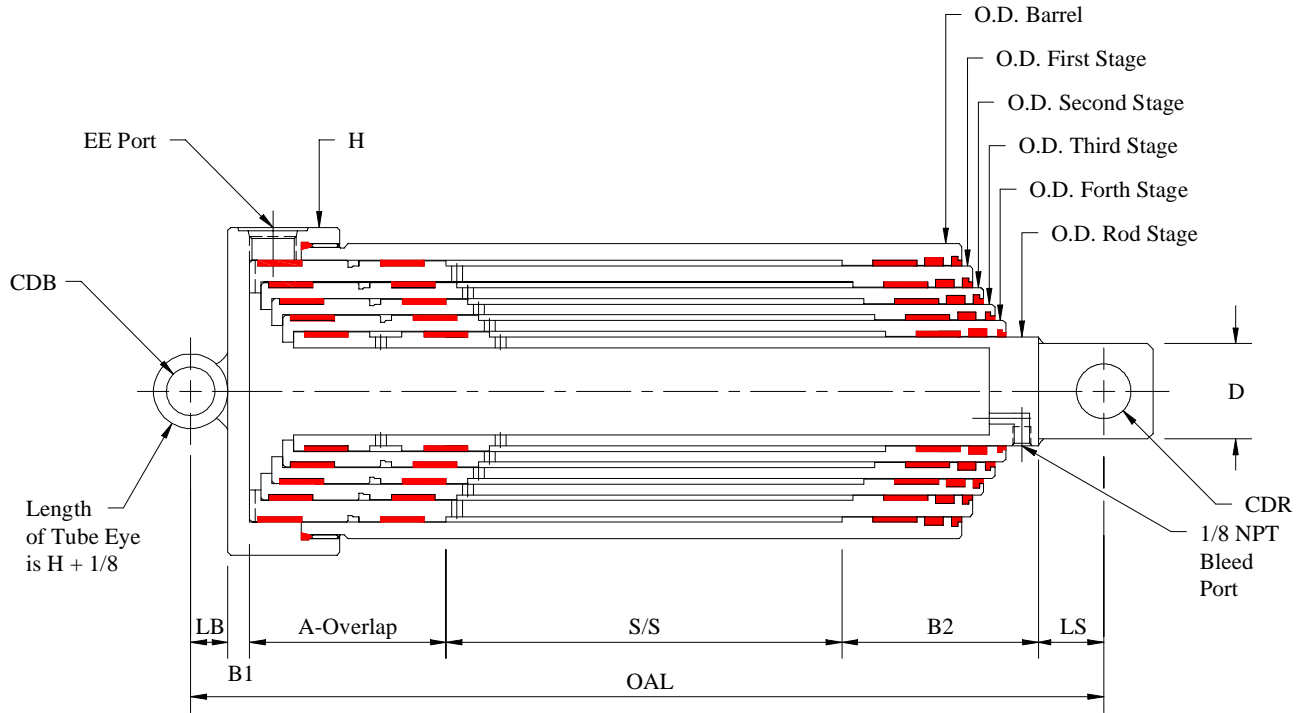


A-Overlap Minimum is 4 1/2 for all Stages.

BARREL BORE	O.D. IN INCHES					B= B1+B2	H Dia	EE ORB	MOUNTING ACCESSORIES				
	BARREL	1 ST STAGE	2 ND STAGE	3 RD STAGE	ROD				BLIND END		ROD END		D
									CDB ϕ	LB	CDR ϕ	LS	
3 1/2	4	3 1/4	2 1/2	1 3/4	1	4.63	5.00	#12	1.00	0.88	0.63	0.75	1.00
4 1/4	4 3/4	4	3 1/4	2 1/2	1 3/4	4.63	5.75	#12	1.25	1.00	1.00	1.13	1.69
5	5 3/4	4 3/4	4	3 1/4	2 1/2	4.75	6.50	#12	1.50	1.13	1.50	1.75	2.44
6	6 3/4	5 3/4	4 3/4	4	3 1/4	4.75	7.50	#16	1.75	1.25	1.75	2.00	3.19
7	7 3/4	6 3/4	5 3/4	4 3/4	4	4.75	8.50	#20	2.00	1.50	2.00	2.25	3.44
8	8 3/4	7 3/4	6 3/4	5 3/4	4 3/4	4.88	9.75	#20	2.50	1.75	2.50	2.75	3.94

BARREL BORE	PUSH FORCE @ 3000 PSI IN lbs				FV	WEIGHT FACTORS			SEAL KIT
	1 ST STAGE	2 ND STAGE	3 RD STAGE	ROD STAGE		BASIC	FW	L	
3 1/2	24,900	14,700	7,220	2,360	0.018	31	3.12	10.8	12493
4 1/4	37,700	24,900	14,700	7,220	0.030	44	3.68	11.3	12472
5	53,200	37,700	24,900	14,700	0.047	61	4.79	12.1	12473
6	77,900	53,200	37,700	24,900	0.070	83	6.41	12.5	12474
7	107,000	77,900	53,200	37,700	0.100	107	8.20	13.0	12475
8	142,000	107,000	77,900	53,200	0.137	141	10.16	13.9	12476

Telescopic Cylinder – 5 Stage, Single Acting

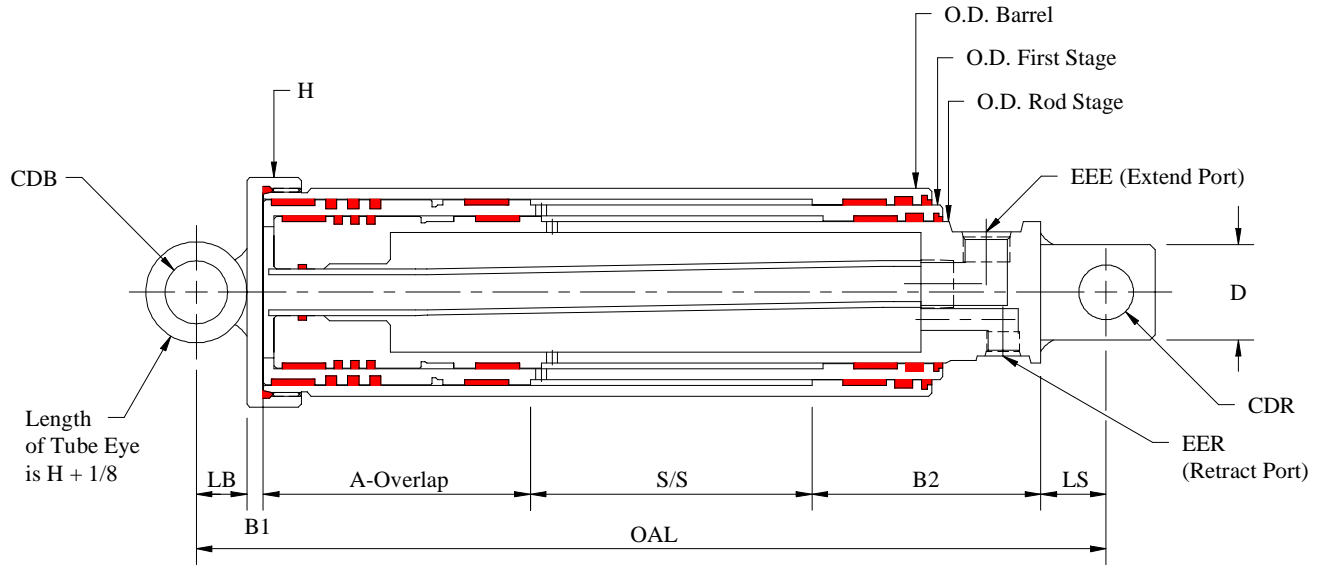


A-Overlap Minimum is 4 1/2 for all Stages.

BARREL BORE	O.D. IN INCHES						B= B1+B2	H Dia	EE ORB	MOUNTING ACCESSORIES				
	BARREL	1 ST STAGE	2 ND STAGE	3 RD STAGE	4 TH STAGE	ROD				BLIND END		ROD END		D
										CDBØ	LB	CDRØ	LS	
4 1/4	4 3/4	4	3 1/4	2 1/2	1 3/4	1	4.88	5.75	#12	1.25	1.00	0.63	0.75	1.00
5	5 3/4	4 3/4	4	3 1/4	2 1/2	1 3/4	5.00	6.50	#12	1.50	1.13	1.00	1.13	1.69
6	6 3/4	5 3/4	4 3/4	4	3 1/4	2 1/2	5.00	7.50	#16	1.75	1.25	1.50	1.75	2.44
7	7 3/4	6 3/4	5 3/4	4 3/4	4	3 1/4	5.00	8.50	#20	2.00	1.50	1.75	2.00	3.19
8	8 3/4	7 3/4	6 3/4	5 3/4	4 3/4	4	5.13	9.75	#20	2.50	1.75	2.50	2.75	3.94

BARREL BORE	PUSH FORCE @ 3000 PSII IN lbs					VOLUME FACTOR FV	WEIGHT FACTORS			SEAL KIT
	1 ST STAGE	2 ND STAGE	3 RD STAGE	4 TH STAGE	ROD STAGE		BASIC	FW	L	
4 1/4	37,700	24,900	14,700	7,220	2,360	0.025	43	4.12	11.1	12494
5	53,200	37,700	24,900	14,700	7,220	0.040	64	5.47	11.8	12477
6	77,900	53,200	37,700	24,900	14,700	0.060	84	6.91	12.5	12478
7	107,000	77,900	53,200	37,700	24,900	0.087	112	8.87	13.0	12479
8	142,000	107,000	77,900	53,200	37,700	0.121	154	10.99	14.1	12480

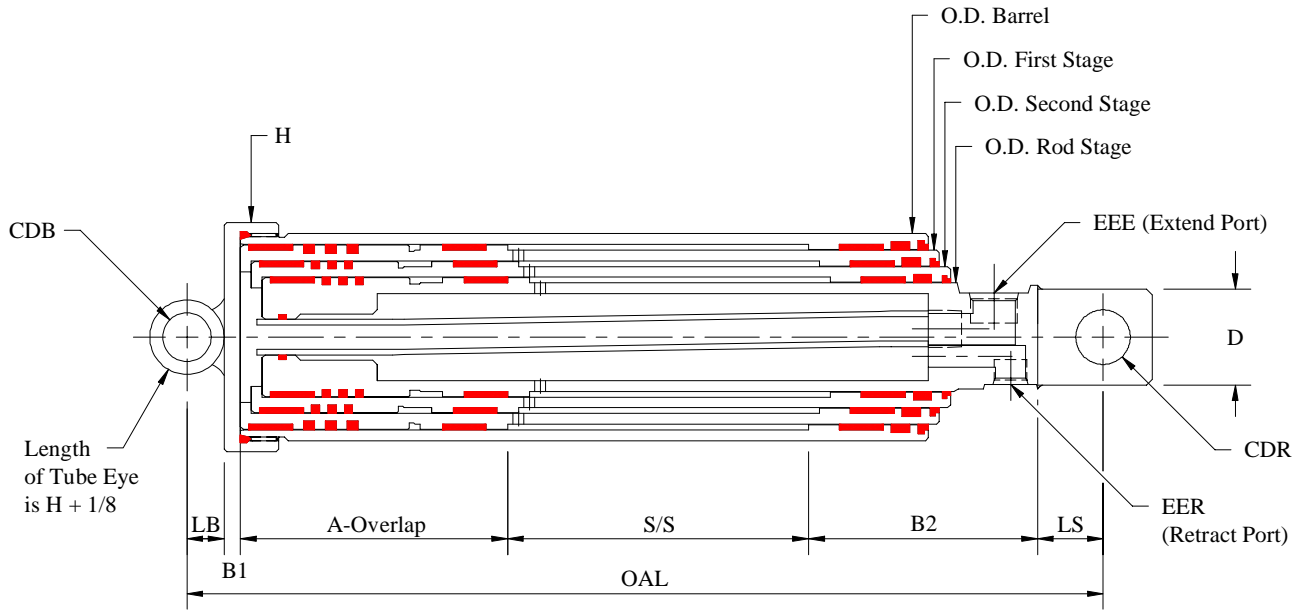
Telescopic Cylinder – 2 Stage, Double Acting



BARREL BORE	O.D. IN INCHES			A O'LAP (MIN)	B= B1+B2	H Dia	PORTS		MOUNTING ACCESSORIES				
	BARREL	1 ST STAGE	ROD				EEE ORB	EER ORB	BLIND END		ROD END		D
									CDB ϕ	LB	CDR ϕ	LS	
2 3/4	3 1/4	2 1/2	1 3/4	5.63	5.25	3.75	#8	#6	0.75	0.63	0.75	1.00	1.44
3 1/2	4	3 1/4	2 1/2	5.63	5.38	4.50	#12	#8	1.00	0.88	1.00	1.13	1.69
4 1/4	4 3/4	4	3 1/4	6.13	5.63	5.25	#16	#8	1.25	1.00	1.25	1.50	2.19
5	5 3/4	4 3/4	4	6.13	5.75	6.25	#16	#12	1.50	1.13	1.50	1.75	2.44
6	6 3/4	5 3/4	4 3/4	6.13	6.00	7.38	#20	#12	1.75	1.25	1.75	2.00	3.19
7	7 3/4	6 3/4	5 3/4	6.13	6.13	8.38	#20	#16	2.00	1.50	2.00	2.25	3.44
8	8 3/4	7 3/4	6 3/4	6.13	6.25	9.75	#20	#16	2.50	1.75	2.50	2.75	3.94

BARREL BORE	FORCE @ 3000 PSI IN lbs FOR STAGES				VOLUME FACTOR FV	WEIGHT FACTORS			SEAL KIT
	PUSH FORCE		PULL FORCE			BASIC	FW	L	
	1 ST	ROD	1 ST	ROD					
2 3/4	17,800	9,420	3,090	2,210	0.016	16	1.50	6.9	12438
3 1/2	28,900	17,800	3,980	3,090	0.029	27	2.00	7.8	12439
4 1/4	42,600	28,900	4,860	3,980	0.045	39	2.50	8.5	12402
5	58,900	42,600	5,740	4,860	0.066	61	3.62	9.5	12441
6	84,800	58,900	6,920	5,740	0.095	87	4.91	10.1	12442
7	115,000	84,800	8,100	6,920	0.134	119	6.37	10.8	12443
8	151,000	115,000	9,280	8,100	0.180	157	7.37	11.6	12440

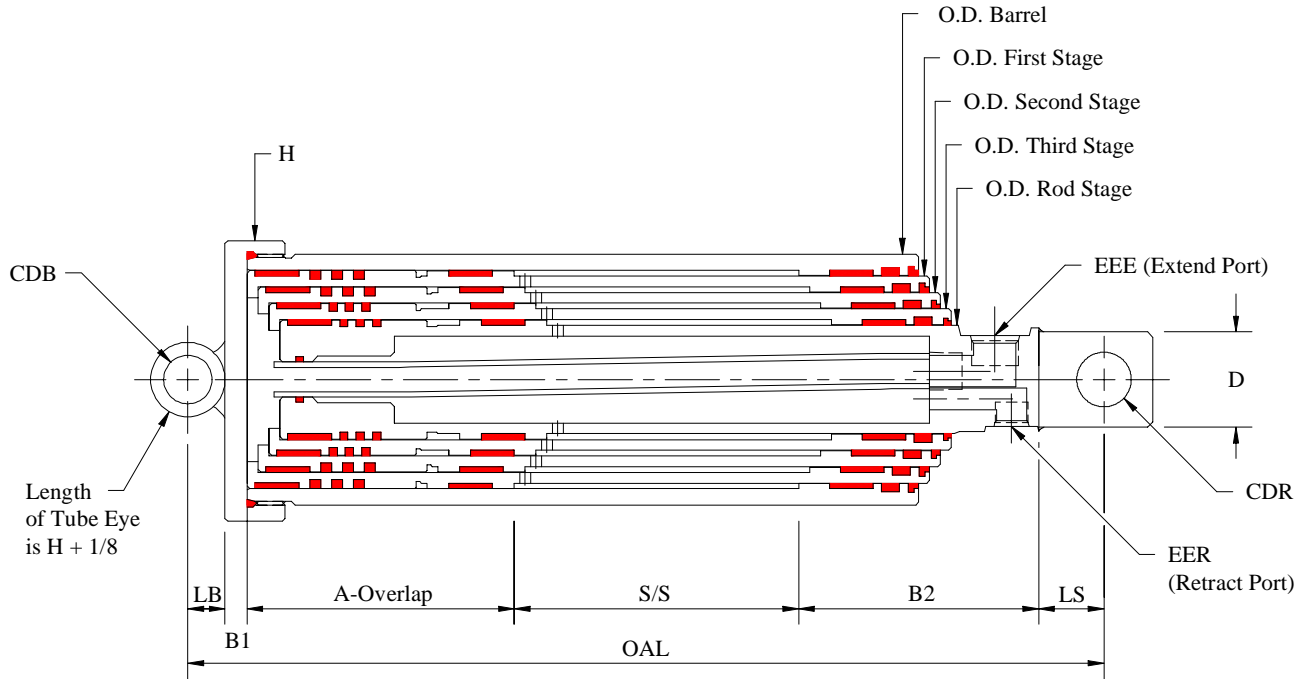
Telescopic Cylinder – 3 Stage, Double Acting



BARREL BORE	O.D. IN INCHES				A O'LAP (MIN)	B= B1+B2	H Dia	PORTS		MOUNTING ACCESSORIES				
	BARREL	1 ST STAGE	2 ND STAGE	ROD				EEE ORB	EER ORB	BLIND END		ROD END		D
										CDB ϕ	LB	CDR ϕ	LS	
3 1/2	4	3 1/4	2 1/2	1 3/4	5.63	5.50	4.50	#12	#8	1.00	0.88	1.00	1.13	1.69
4 1/4	4 3/4	4	3 1/4	2 1/2	6.13	5.63	5.25	#16	#8	1.25	1.00	1.25	1.50	2.19
5	5 3/4	4 3/4	4	3 1/4	6.13	6.00	6.25	#16	#12	1.50	1.13	1.50	1.75	2.44
6	6 3/4	5 3/4	4 3/4	4	6.13	6.00	7.38	#20	#12	1.75	1.25	1.75	2.00	3.19
7	7 3/4	6 3/4	5 3/4	4 3/4	6.13	6.25	8.38	#20	#16	2.00	1.50	2.00	2.25	3.44
8	8 3/4	7 3/4	6 3/4	5 3/4	6.13	6.50	9.75	#20	#16	2.50	1.75	2.50	2.75	3.94

BARREL BORE	FORCE @ 3000 PSI IN lbs FOR STAGES						VOLUME FACTOR FV	WEIGHT FACTORS			SEAL KIT
	PUSH FORCE			PULL FORCE				BASIC	FW	L	
	1 ST	2 ND	ROD	1 ST	2 ND	ROD					
3 1/2	28,900	17,800	9,420	3,980	3,090	2,210	0.023	30	2.33	7.6	12444
4 1/4	42,600	28,900	17,800	4,860	3,980	3,090	0.037	39	3.00	8.3	12445
5	58,900	42,600	28,900	5,740	4,860	3,980	0.056	61	4.29	9.5	12446
6	84,800	58,900	42,600	6,920	5,740	4,860	0.081	86	5.75	9.9	12447
7	115,000	84,800	58,900	8,100	6,920	5,740	0.115	116	7.37	10.6	12448
8	151,000	115,000	84,800	9,280	8,100	6,920	0.157	157	9.16	11.6	12449

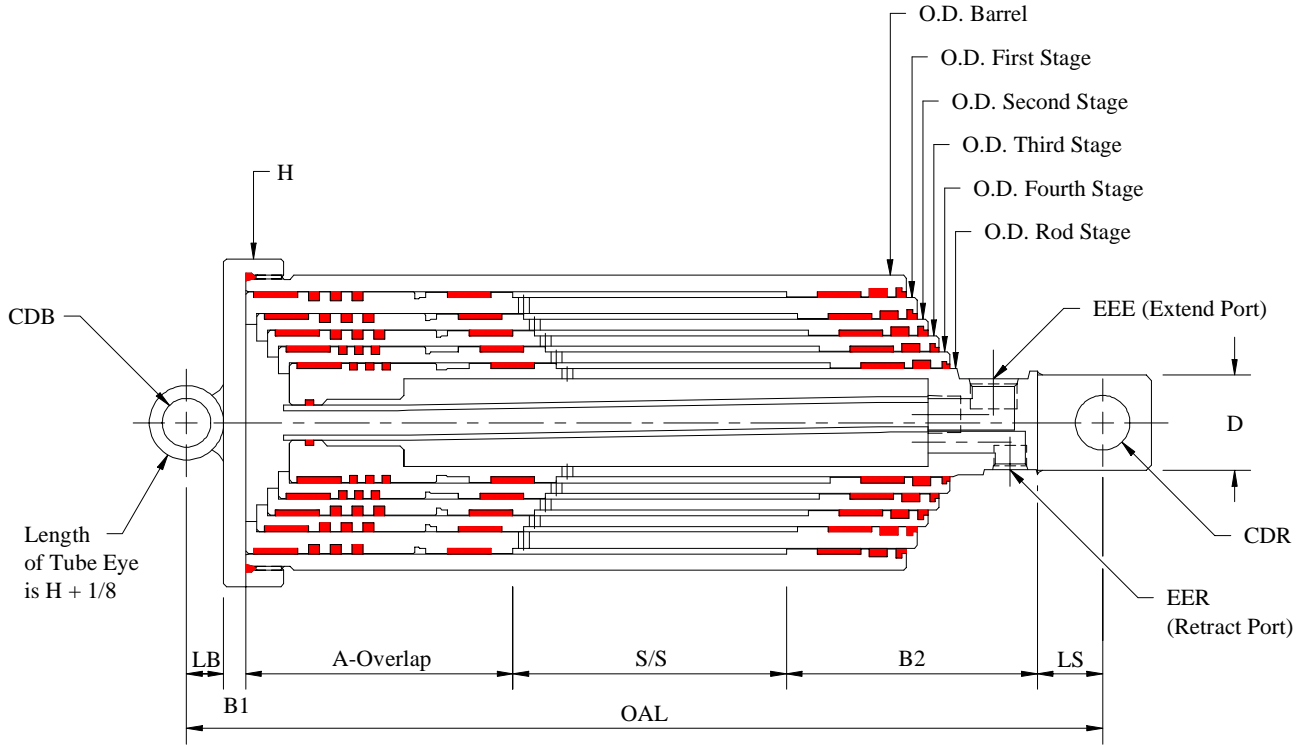
Telescopic Cylinder – 4 Stage, Double Acting



BARREL BORE	O.D. IN INCHES								PORTS		MOUNTING ACCESSORIES				
	BARREL	1 ST STAGE	2 ND STAGE	3 RD STAGE	ROD	A O'LAP (MIN)	B= B1+B2	H Dia	EEE ORB	EER ORB	BLIND END		ROD END		D
											CDB ϕ	LB	CDR ϕ	LS	
4 1/4	4 3/4	4	3 1/4	2 1/2	1 3/4	6.13	5.75	5.25	#16	#8	1.25	1.00	1.00	1.13	1.69
5	5 3/4	4 3/4	4	3 1/4	2 1/2	6.13	6.00	6.25	#16	#12	1.50	1.13	1.50	1.75	2.44
6	6 3/4	5 3/4	4 3/4	4	3 1/4	6.13	6.25	7.38	#20	#12	1.75	1.25	1.75	2.00	3.19
7	7 3/4	6 3/4	5 3/4	4 3/4	4	6.13	6.25	8.38	#20	#16	2.00	1.50	2.00	2.25	3.44
8	8 3/4	7 3/4	6 3/4	5 3/4	4 3/4	6.13	6.63	9.75	#20	#16	2.50	1.75	2.50	2.75	3.94

BARREL BORE	FORCE @ 3000 PSI IN lbs FOR STAGES									VOLUME FACTOR FV	WEIGHT FACTORS			SEAL KIT
	PUSH FORCE				PULL FORCE				BASIC		FW	L		
	1 ST	2 ND	3 RD	ROD	1 ST	2 ND	3 RD	ROD						
4 1/4	42,600	28,900	17,800	9,420	4,860	3,980	3,090	2,210	0.030	37	3.33	7.8	12450	
5	58,900	42,600	28,900	17,800	5,740	4,860	3,980	3,090	0.047	61	4.79	9.3	12451	
6	84,800	58,900	42,600	28,900	6,920	5,740	4,860	3,980	0.070	86	6.41	9.9	12452	
7	115,000	84,800	58,900	42,600	8,100	6,920	5,740	4,860	0.100	115	8.20	10.4	12453	
8	151,000	115,000	84,800	58,900	9,280	8,100	6,920	5,740	0.137	154	10.16	11.5	12454	

Telescopic Cylinder – 5 Stage, Double Acting

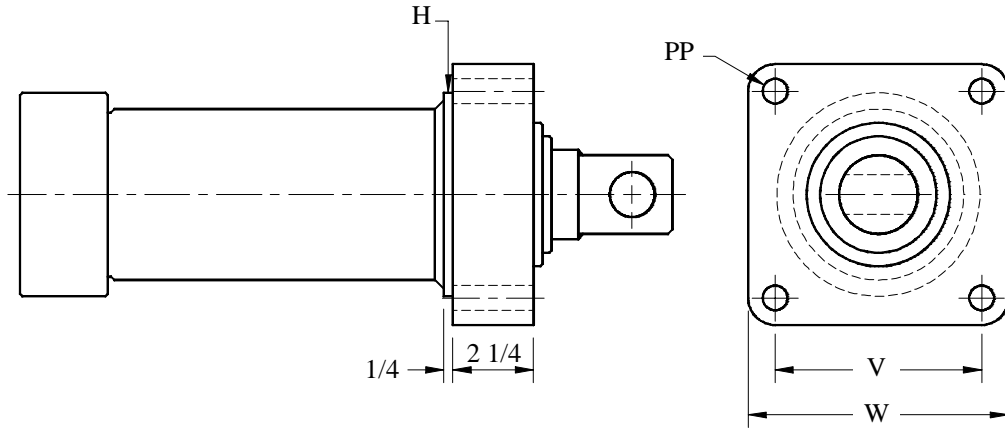


BARREL BORE	O.D. IN INCHES						A O'LAP (MIN)	B= B1+B2	H Dia	PORTS		MOUNTING ACCESSORIES				D
	BARREL	1 ST STAGE	2 ND STAGE	3 RD STAGE	4 TH STAGE	ROD				EEE ORB	EER ORB	BLIND END		ROD END		
												CDB ϕ	LB	CDR ϕ	LS	
5	5 3/4	4 3/4	4	3 1/4	2 1/2	1 3/4	6.13	6.13	6.25	#16	#12	1.50	1.13	1.00	1.13	1.69
6	6 3/4	5 3/4	4 3/4	4	3 1/4	2 1/2	6.13	6.25	7.38	#20	#12	1.75	1.25	1.50	1.75	2.44
7	7 3/4	6 3/4	5 3/4	4 3/4	4	3 1/4	6.13	6.50	8.38	#20	#16	2.00	1.50	1.75	2.00	3.19
8	8 3/4	7 3/4	6 3/4	5 3/4	4 3/4	4	6.13	6.63	9.75	#20	#16	2.50	1.75	2.50	2.75	3.94

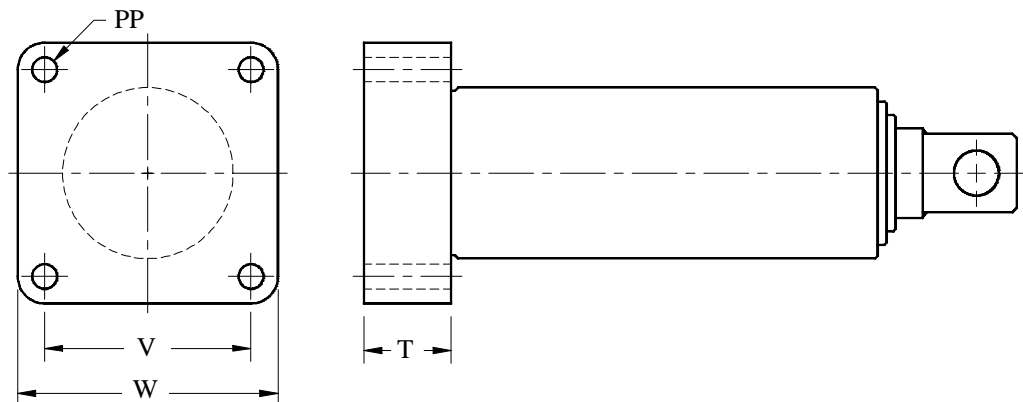
BARREL BORE	FORCE @ 3000 PSI IN lbs FOR STAGES										VOLUME FACTOR FV	WEIGHT FACTORS			SEAL KIT
	PUSH FORCE					PULL FORCE						BASIC	FW	L	
	1 ST	2 ND	3 RD	4 TH	ROD	1 ST	2 ND	3 RD	4 TH	ROD					
5	58,900	42,600	28,900	17,800	9,420	5,740	4,860	3,980	3,090	2,210	0.040	58	5.12	8.5	12455
6	84,800	58,900	42,600	28,900	17,800	6,920	5,740	4,860	3,980	3,090	0.060	82	6.91	9.4	12456
7	115,000	84,800	58,900	42,600	28,900	8,100	6,920	5,740	4,860	3,980	0.087	113	8.87	10.1	12457
8	151,000	115,000	84,800	58,900	42,600	9,280	8,100	6,920	5,740	4,860	0.121	153	10.99	11.3	12458

Telescopic Cylinder – Flange Mount S/A & D/A

Flange Mount – Front



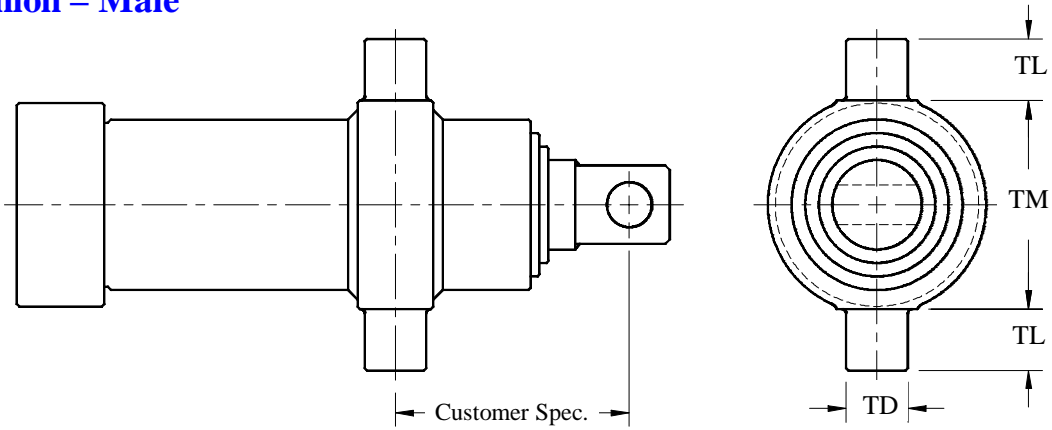
Flange Mount – Rear



BARREL BORE	V	W	T		PP Dia	H Dia
			S/A	D/A		
2	3.38	4.50	1.94	—	0.56	3.25
2 3/4	3.88	5.13	2.13	1.25	0.56	4.00
3 1/2	5.25	6.50	2.44	1.25	0.69	5.00
4 1/4	5.50	7.00	2.44	1.25	0.69	5.75
5	7.00	8.50	2.56	1.38	0.94	6.50
6	8.00	10.00	2.81	1.38	1.06	7.50
7	8.50	11.00	3.13	1.38	1.31	8.50
8	9.50	12.00	3.25	1.50	1.31	9.75

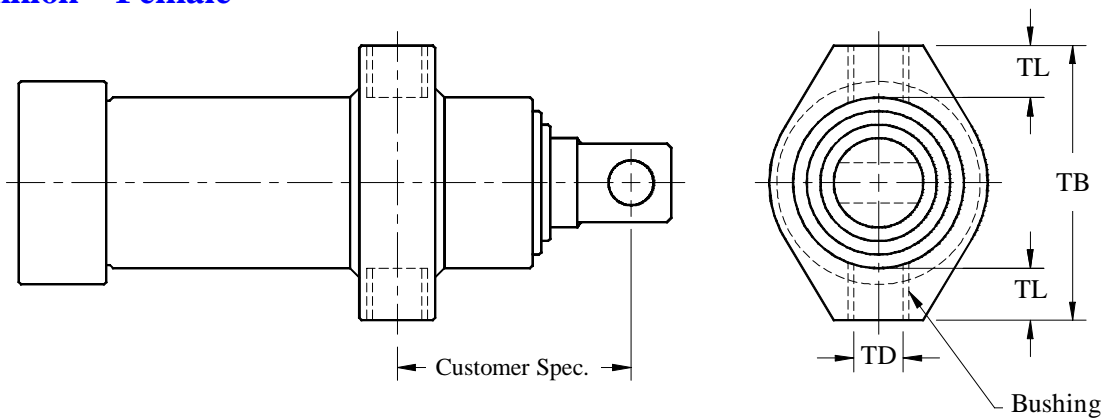
Telescopic Cylinder – Trunnion S/A & D/A

Trunnion – Male



BARREL BORE	TD	TL	TM
3 1/2	1.75	1.75	5.25
5	1.75	1.75	7.00
6	2.00	2.00	8.50
7	2.50	2.50	9.75
8	3.00	3.00	11.00

Trunnion – Female



BARREL BORE	TD	TL	TB
3 1/2	1.00	0.88	5.88
5	1.75	1.56	9.00
6	1.75	1.56	10.00
7	2.00	1.81	11.50
8	2.50	2.25	13.50