

SELECTING THE CYLINDER

To select the proper size cylinder for the job, you must first determine the maximum push and/or pull force needed to accomplish its task. Add an additional 10% to both the push and pull force for friction in the cylinder and also pressure drop in the lines. Using the charts below, select the proper bore and rod combination to best suit your application.

PULL FORCES AND DISPLACEMENT

ROD (INCHES)	ROD AREA (SQ. IN.)	ROD DIAMETER FORCE IN POUNDS (AT VARIOUS PRESSURES)										DISPLACEMENT PER INCH OF STROKE (GALLONS)
		25	50	65	80	100	250	500	1000	2000	3000	
0.625	0.31	8	16	20	25	31	78	155	310	620	9130	0.0013
1.000	0.79	20	40	51	65	79	198	395	790	1580	2370	0.0034
1.375	1.49	37	75	97	119	149	373	745	1490	2980	4470	0.0065
1.750	2.41	60	121	157	193	241	603	1205	2410	4820	7230	0.0104
2.000	3.14	79	157	204	251	314	785	1570	3140	6280	9420	0.0136
2.500	4.91	123	245	319	393	491	1228	2455	4910	9820	14730	0.0213
3.000	7.07	177	354	460	566	707	1767	3535	7070	14140	21210	0.0306
3.500	9.62	241	481	625	770	962	2405	4810	9620	19240	28860	0.0416
4.000	12.57	314	628	817	1006	1257	3143	6285	12570	25140	37710	0.0544
4.500	15.90	398	795	1034	1272	1590	3976	7950	15900	31800	47700	0.0688
5.000	19.63	491	982	1276	1570	1963	4908	9815	19630	39260	58890	0.0850
5.500	23.76	594	1188	1544	1901	2376	5940	11880	23760	47520	71280	0.1028
7.000	38.48	962	1924	2501	3078	3848	9620	19240	38480	76960	115440	0.1666
8.000	50.27	1257	2513	3267	4021	5027	12568	25135	50270	100540	150810	0.2176
9.000	63.62	1590	3181	4135	5090	6362	15905	31810	63620	127240	190860	0.2754
10.000	78.54	1964	3927	5105	6283	7854	19635	39270	78540	157080	235620	0.3400

NOTE: TO DETERMINE CYLINDER PULL FORCE OR DISPLACEMENT SUBTRACT THE FORCE OR DISPLACEMENT OF THE ROD SIZE FROM SELECTED PUSH FORCE OR DISPLACEMENT OF THE BORE SIZE IN CHART ABOVE

PUSH FORCES AND DISPLACEMENT

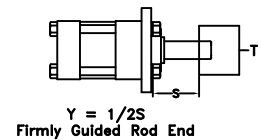
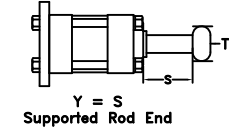
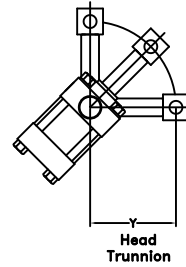
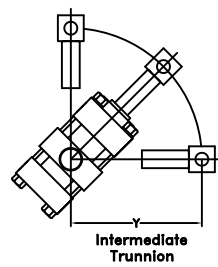
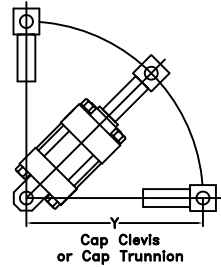
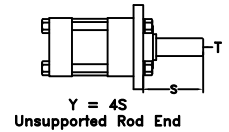
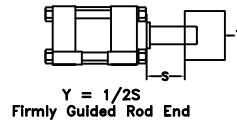
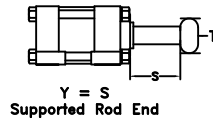
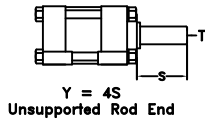
CYLINDER BORE SIZE (INCHES)	PISTON AREA (SQ. IN.)	CYLINDER PUSH FORCE IN POUNDS (AT VARIOUS PRESSURES)										DISPLACEMENT PER INCH OF STROKE (GALLONS)
		25	50	65	80	100	250	500	1000	2000	3000	
1.50	1.77	44	88	115	142	177	443	885	1770	3540	5310	0.0077
2.00	3.14	79	157	204	251	314	785	1570	3140	6280	9420	0.0136
2.50	4.91	123	245	319	393	491	1228	2455	4910	9820	14730	0.0213
3.25	8.30	208	415	540	664	830	2075	4150	8300	16600	24900	0.0359
4.00	12.57	314	628	817	1006	1257	3143	6285	12570	25140	37710	0.0544
5.00	19.64	491	982	1277	1571	1964	4910	9820	19640	39280	58920	0.0850
6.00	28.27	707	1414	1838	2262	2827	7068	14135	28270	56540	84810	0.1224
7.00	38.49	962	1924	2502	3079	3849	9623	19245	38490	76980	115470	0.1666
8.00	50.26	1257	2513	3267	4021	5026	12565	25130	50260	100520	150780	0.2176
10.00	78.54	1964	3927	5105	6283	7854	19635	39270	78540	157080	235620	0.3400
12.00	113.10	2828	5655	7352	9048	11310	28275	56550	113100	226200	339300	0.4896
14.00	153.94	3849	7697	10006	12315	15394	38485	76970	153940	307880	461820	0.6664
16.00	201.06	5027	10053	13069	16085	20106	50265	100530	201060	402120	603180	0.8704
18.00	254.46	6362	12724	16541	20358	25447	63618	127235	254470	508940	763410	1.1016
20.00	314.16	7854	15708	20420	25133	31416	78540	157080	314160	628320	942480	1.3600

PNEUMATIC AND FLUID POWER FORMULAS

FORMULA FOR:	EXPLANATION	FORMULA
FLUID PRESSURE <i>Pounds/ Square Inch</i>	PRESSURE = $\frac{\text{FORCE (Pounds)}}{\text{UNIT AREA (Square Inches)}}$	$P = \frac{F}{A}$ OR $PSI = \frac{F}{A}$
CYLINDER PISTON AREA <i>Square Inches</i>	AREA = $\pi \times \text{RADIUS}^2 (\text{Inches})$	$A = \pi r^2$
CYLINDER OUTPUT FORCE <i>Pounds, Push or Pull</i>	FORCE = PRESSURE (psi) x NET AREA (Square Inches)	$F = \text{psi} \times A$ OR $F=PA$
CYLINDER VELOCITY OR SPEED <i>Feet/Second</i>	VELOCITY = $\frac{231 \times \text{FLOW RATE (GPM)}}{12 \times 60 \times \text{NET AREA (SQUARE INCHES)}}$	$V = \frac{231Q}{720A}$ OR $V = \frac{.3208Q}{A}$
CYLINDER VOLUME CAPACITY <i>Gallons of Fluid</i>	VOLUME = $\frac{\text{PISTON AREA (Square Inches)} \times \text{STROKE (Inches)}}{231}$	$V = \frac{A \times L}{231}$ OR Length of Stroke
CYLINDER FLOW RATE <i>Gallons Per Minute</i>	FLOW RATE = $\frac{12 \times 60 \times \text{VELOCITY (Feet/Sec.)} \times \text{NET AREA (Square Inches.)}}{231}$	$Q = \frac{720vA}{231}$ OR $Q = 3.117vA$
PUMP OUTLET FLOW <i>Gallons/Minute</i>	FLOW = $\frac{\text{RPM} \times \text{PUMP DISPLACEMENT (Cu. In.Rev.)}}{231}$	$Q = \frac{nd}{231}$
PUMP INPUT POWER <i>Horsepower Required</i>	HORSEPOWER INPUT = $\frac{\text{FLOW RATE OUTPUT (GPM)} \times \text{PRESSURE}}{1714 \times \text{EFFICIENCY (Overall)}}$	$HP_{IN} = \frac{QP}{1714Eff}$ OR $GPM \times \text{psi}$ $1714Eff$
FLOW RATE THROUGH PIPING <i>Ft./Sec. Velocity</i>	VELOCITY = $\frac{.3208 \times \text{FLOW RATE THROUGH I.D. (GPM)}}{\text{INTERNAL AREA (Square Inches)}}$	$v = \frac{3208Q}{A}$
COMPRESSIBILITY OF OIL <i>Additional Required Oil To Reach Pressure</i>	ADDITIONAL VOLUME = PRESSURE (psi) x VOLUME OF OIL UNDER PRESSURE	$V_A = \frac{PV}{250,000}$ (APPROXIMATELY 1/2% Per 1,000 psi.)
AIR USAGE-CFM <i>In Cubic Feet Per Minute of Pressure Air (PSIG) Displaced Per Stroke</i>	CFM = Cyl. Piston Area Sq. In. x Cyl. Stroke In. x In./Min. Piston Speed	$CFM = \frac{A \times \text{Stroke} \times \text{Speed}}{1728}$
FREE AIR USAGE <i>(Output Volume of Free Air in Cubic Ft.) Used to size a compressor</i>	FREE AIR (psia) = Cyl. Piston Area Sq. In. x Cyl. Stroke In. x In./Min. Piston Speed	$FA (\text{Cu. Ft.}) = A \times \text{Stroke} \times (\text{Force} + 14.7) \times 14.7 \times 1728$



SELECTING THE CYLINDER



STOP TUBE

Stop tubes are installed between the piston and front head on long stroke cylinders. The stop tube lengthens the distance between the piston and the rod bearing and reduces load when fully extended. To determine if a stop tube is required and the length, first determine the value of "Y" from one of the illustrations above.

If "Y" is less than 40", no stop tube is needed. If "Y" is over 40", a one inch stop tube is recommended for every 10" or fraction thereof over 40". (see Chart 27-A)

ROD DIAMETER SELECTION

In most applications the standard rod size is suitable. On long stroke or high thrust applications, an oversized rod may be required.

To arrive at the minimum rod size for your application, first determine the bore size, stroke, and thrust (See Page 106). Now select from the above illustration the type of mounting and determine the length "Y" with the piston rod in the fully extended position.

NOTE: "Y" or "S" are calculated from mounting point with rod extended.

CHART 27-A
STOP TUBE TABLE

"Y" (Inches)	Stop Tube Length (Inches)	"Y" (Inches)	Stop Tube Length (Inches)
0-40	0	101-110	7
41-50	1	111-120	8
51-60	2	121-130	9
61-70	3	131-140	10
71-80	4	141-150	11
81-90	5	151-160	12
91-100	6	161-170	13

Using Chart 27-B look for the maximum thrust for your cylinder, then look across for the "Y" length determined from the illustrations. If the exact value is not shown, continue to the next larger number. Now go to the top of the column and you will find the recommended rod size for your application.

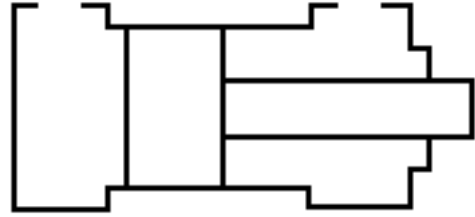
CHART 27-B VALUE OF COLUMN LENGTH "Y" IN INCHES																			
Thrust in lbs.	PISTON ROD DIAMETER																		
	5/8"	1"	1 3/8"	1 3/4"	2"	2 1/2"	3"	3 1/2"	4"	4 1/2"	5"	5 1/2"	7"	8"	9"	10"			
50	62																		
100	55	112																	
200	47	99																	
250	43	94	146																
300	44	88	142																
400	37	83	134	186															
500	38	75	130	180															
700	30	68	118	168	202	275													
1,000	25	60	103	156	190	257	330												
1,400	24	53	92	142	174	244	308	385											
1,800	23	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	12	31	62	96	119	175	240	310	378	446									
5,000	9	34	60	87	110	163	225	289	360	426	494								
6,000	5	30	56	82	102	152	208	274	342	410	476								
8,000	5	22	45	75	93	137	188	245	310	375	447								
10,000	4	21	40	67	89	125	172	222	279	349	412	482							
12,000	3	17	41	65	84	118	155	210	269	326	388	454							
16,000		9	34	57	75	110	142	188	235	292	350	420							
20,000			27	48	68	103	136	172	218	270	326	385							
30,000			12	40	55	87	120	156	189	230	285	330							
40,000				22	43	74	108	142	177	210	248	294							
50,000					15	30	66	96	130	165	200	234	269	408					
60,000						18	57	88	119	154	190	225	256	384					
80,000						16	36	71	104	137	170	204	240	336					
100,000							22	57	90	120	154	189	222	324	400				
120,000								21	45	77	108	140	175	207	313	377			
140,000								19	27	64	98	128	160	194	301	365			
160,000									26	47	86	118	148	182	279	350	421		
200,000										31	67	98	131	161	260	330	402		
250,000										28	36	72	109	141	236	301	375		
300,000										25	34	42	86	120	212	281	351	420	
350,000												39	52	100	195	261	328	396	
400,000													45	77	182	241	309	374	
500,000														41	49	152	212	274	341
600,000														45	114	183	247	310	
700,000															70	162	221	280	
800,000															63	118	197	260	



TYPES OF CYLINDERS

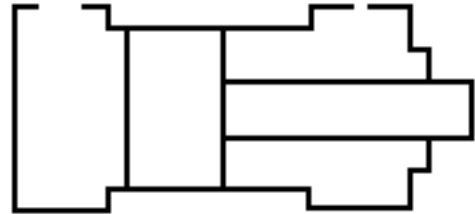
DOUBLE ACTING CYLINDERS

This is the most common type of cylinder. This type of cylinder is for use in applications where force is needed in both directions.



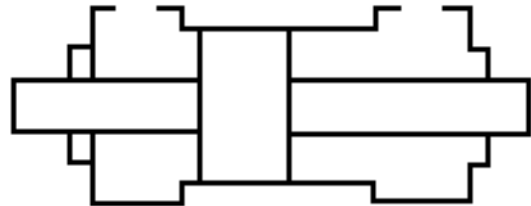
SINGLE ACTING CYLINDERS

This type of cylinder is used when force is needed in only one direction either extend or retract. Commonly the opposite end of the cylinder is vented to atmosphere, or in a hydraulic application the opposite port can be vented back to the tank. Depending on the application either gravity or the weight of the load will retract the cylinder.



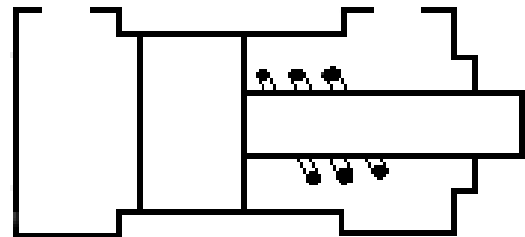
DOUBLE ROD CYLINDERS

These cylinders can have load attached to both ends of the cylinder and work in both directions. Other applications for double rod cylinders include equal displacement on both sides of the cylinder, or operating switches or cams.



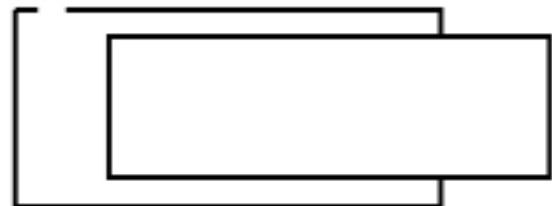
SPRING CYLINDERS

Spring cylinders have a spring built inside to extend, retract, or center the cylinder on its own or to assist pneumatic or hydraulic pressure. These cylinders are commonly used as clamp cylinders. Note that the addition of a spring can increase the length of a cylinder as much as 3 times or more.



RAM CYLINDERS

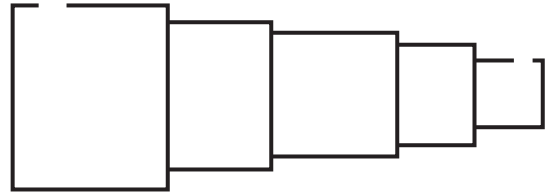
Ram cylinders are commonly known as displacement cylinders. Mainly used for long strokes where gravity or the weight of the load can retract the cylinder and are almost always mounted vertically.



TYPES OF CYLINDERS

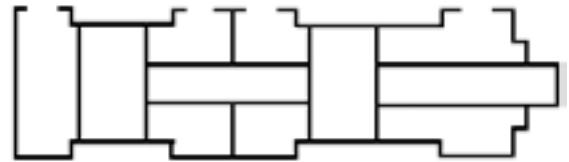
TELESCOPIC CYLINDERS

Telescopic cylinders are commonly used in mobile equipment and machinery. The multiple “stages” of the cylinders allow applications to get long strokes with short retracted lengths and are available in single or double acting configurations.



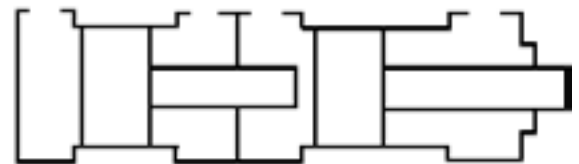
TANDEM CYLINDERS

Tandem cylinders consist of two cylinders mounted inline together with one piston rod connecting both pistons together with one working rod end to gain increased output forces while having a compact design.



DUPLEX CYLINDERS

Duplex cylinders are sometimes known as three position cylinders. They consist of two cylinders mounted inline together without having the pistons connected together by one common piston rod.

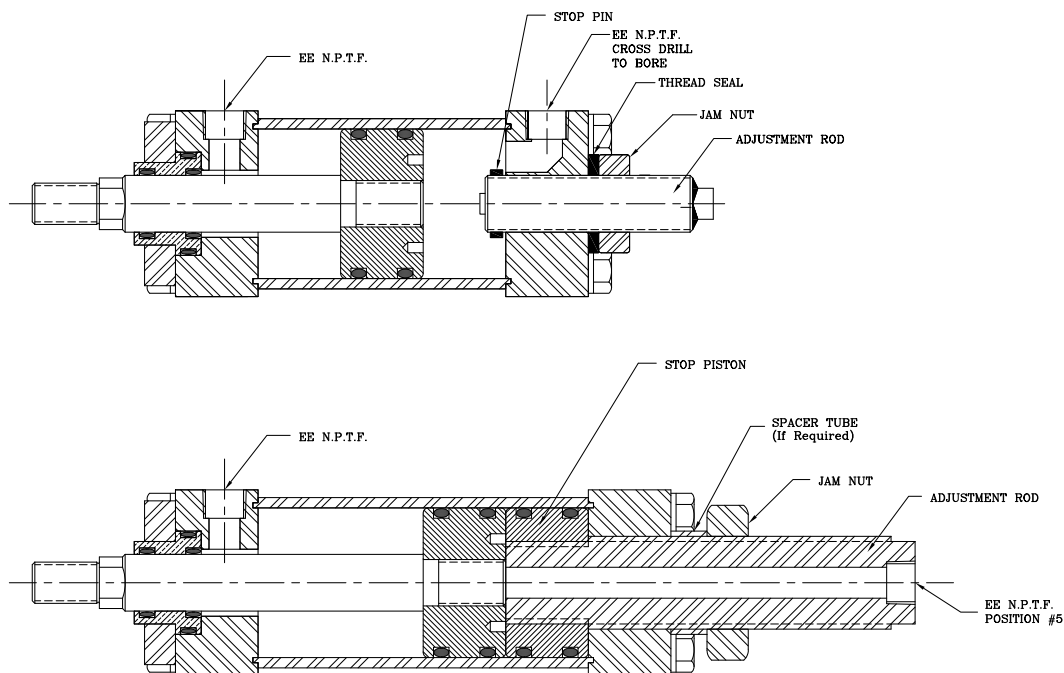


BACK TO BACK CYLINDERS

Back to back cylinders consist of two cylinders mounted together on the cap or blind end. This lets both cylinders act separately from each other or together as in a double rod cylinder application.



ADJUSTABLE STROKE CYLINDERS



For style #1 adjustable stroke cylinders, adjustment stroke available up to a maximum of 6".

For Style #2 adjustable stroke cylinders, a stop piston is furnished to allow full face, piston-to-piston contact and to allow stability for longer strokes.

- Available in all Yates series cylinders.
- A longer spacer tube may be required on L & N mounts for style # 2.
- Cushions not available at cap end.
- Not available in double rod cylinders.
- Other designs are available based on application needs. For adjustable stroke cylinders that require frequent adjustment, contact factory for details.
- Available with an extended key plate.

ORDERING INSTRUCTIONS

When ordering adjustable stroke cylinders, complete the part number then place an "S" in the part number. Under specials, specify length of adjustment and type of adjustable stroke (Style #1 or Style #2) and any other required specials.

AVAILABLE MOUNTING STYLES		
STYLE	NAME	N.F.P.A. CODE
A	SIDE LUGS	MS2
B	SIDE TAPPED	MS4
F	HEAD RECTANGULAR FLANGE	MF1
G	HEAD RECTANGULAR INTEGRAL FLANGE	ME5
H	CENTER-LINE LUGS	MS3
J	HEAD SQUARE FLANGE	MF5
X	HEAD INTEGRAL FLANGE	ME3
K	NO TIE RODS EXTENDED	MX0
L	BOTH ENDS TIE RODS EXTENDED	MX1
M	HEAD TIE RODS EXTENDED	MX3
N	CAP TIE RODS EXTENDED	MX2
U	HEAD TRUNNION	MT1
W	CAP TRUNNION	MT2
T	INTERMEDIATE FIXED TRUNNION	MT4

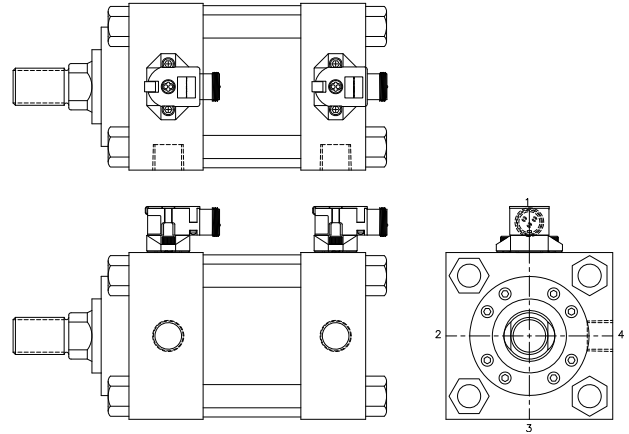
PROXIMITY SWITCHES

FEATURES AND OPTIONS

- Factory installation. No adjustments needed.
- Hydraulic rating up to 3,000 psi.
- Stainless steel probe
- LED indicators
- False pulse protection
- UL listed
- Shock and vibration resistant
- Weld Field and electrical noise immunity
- Series and parallel wiring
- Rotatable switches to ease cable routing
- Optional intrinsically safe
- Optional hi-temp up to 400°F (204°C)
- Optional underwater service to 2,000 foot depths
- Optional solid state operation
- Optional heavy duty operation up to 5,000 psi.

Yates Prox Switch option is available on A4, L4, H4 and H6 series cylinders.

Please consult factory for switch specifications



REED & HALL EFFECT SWITCH DATA

Yates Cylinders Reed and Hall effect switches are designed for use on all types of cylinders with aluminum and non-ferrous barrels. A magnetic band is installed on the cylinder's piston which the Reed and Hall effect switches read through the non ferrous cylinder barrel. The switches then send a signal to programmable controllers and other various electrical circuits.

YATES CYLINDERS REED SWITCH FEATURES:

- Available for 1 1/2" bore through 8" bores.
- Easy to adjust switch bracket mounts to tie rod of cylinder and can be adjusted anywhere along entire stroke.
- Multiple switches may be used on one cylinder to control or sequence several functions.
- LED indicator light for trouble shooting and easy installation.
- Voltage range of 5 to 240 VAC/VDC. (Normally Open)
- 9' Wire Lead is standard.
- Economical sensing solution.
- Zero maintenance.

Part Number	(1 1/2" Bore Only)	(2"-8" Bores)
	YRS-015	YRS-028
Switch Type	Reed Switch MOV & LED	Reed Switch MOV & LED
Function	Normally Open	Normally Open
Working Temp.	-30C - +80C	-30C - +80C
Magnetic Sensitivity	85 GA.	85 GA.
Switching Voltage	5-120 VAC/VDC 50/60 Hz	5-240 VDC/VAC
Switching Current	.5 Amps Max. .005 Amp Min.	1 Amp Max. .005 Amp Min.
Switching Power	10 Watts Max.	30 Watts Max.
Voltage Drop	3.5 Volts	3 Volts

YATES CYLINDERS HALL EFFECT SWITCH FEATURES:

- Available for 1 1/2" to 8" bores.
- Easy to adjust switch bracket mounts to tie rod of cylinder and may be adjusted anywhere along the entire stroke.
- LED indicator light for trouble shooting and easy installation.
- Solid state construction; no moving parts to wear out which provides longer switch life.
- Voltage range of 6-24 VDC
- Available normally open, sinking or sourcing
- 9' wire lead is standard.
- Voltage range of 5 to 240 VAC/VDC. (Normally Open)
- 9' Wire Lead is standard.
- Economical sensing solution.
- Zero maintenance.

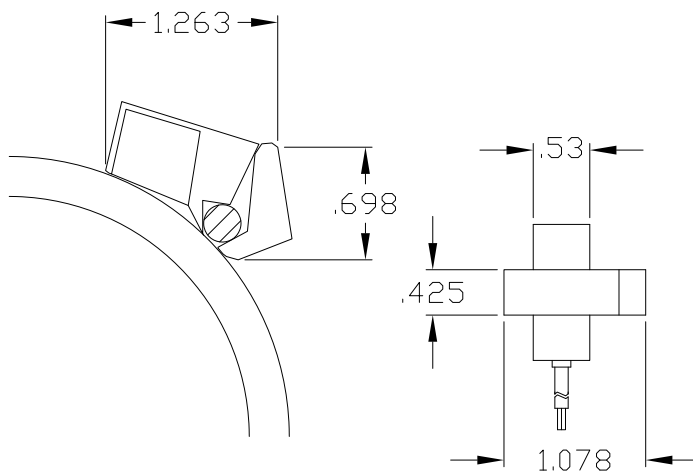
Part Number	1 1/2" Bore Only YHS-015-1	1 1/2" Bore Only YHS-015-2	2"-8" Bores YHS-028-1	2"-8" Bores YHS-028-2
Switch Type	Hall Effect LED Sourcing	Hall Effect LED Sinking	Hall Effect LED Sourcing	Hall Effect LED Sinking
Function	Normally Open	Normally Open	Normally Open	Normally Open
Working Temp.	-30°C - +80°C	-30°C - +80°C	-30°C - +80°C	-30°C - +80°C
Magnetic Sensitivity	85 GA.	85 GA.	85 GA.	85 GA.
Switching Voltage	6-24 VDC	6-24 VDC	6-24 VDC	6-24 VDC
Switching Current	.5 Amp Max.	.5 Amp Max.	1 Amp Max.	1 Amp Max.
Switching Power	12 Watts Max.	12 Watts Max.	24 Watts Max.	24 Watts Max.
Voltage Drop	.5 Volts	.5 Volts	.5 Volts	.5 Volts

REED & HALL EFFECT SWITCH DATA

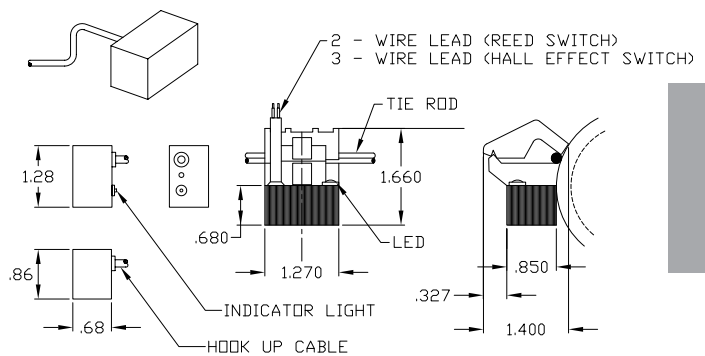
YATES SWITCH INSTALLATION TIPS:

1. Never exceed the current and voltage of the load with the selected switch. Failure to use proper load will ruin the switch. For DC Voltages always observe polarity.
2. On two-wire versions, do not connect directly across the power supply without a series load. Failure to use a series load will damage the switch and possibly the power supply.
3. Never use a filament light bulb as a load test to the switch. Severe inrush currents will damage the switch or cause premature failure.
4. Keep wire runs to a minimum. Longer wire runs will increase capacitive loading which may effect the life of the switch.
5. When actuating a solenoid with a switch, always use an external surge suppression.
6. At all times keep the area around the switch clean and free of potentially magnetic debris.
7. Be sure the sensing area of the switch is installed against the cylinder tube.
8. Consult factory if you have any additional questions regarding Reed and Hall Effect switches.

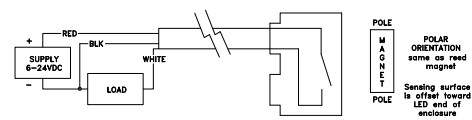
SWITCH & BRACKET FOR 1 1/2" BORE



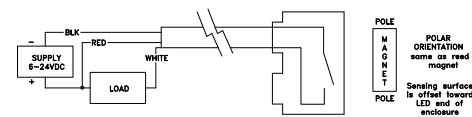
SWITCH & BRACKET FOR 2-8" BORE



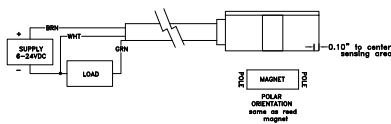
YHS-028-1



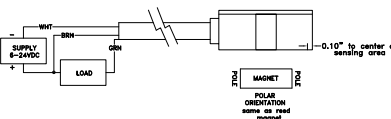
YHS-028-2



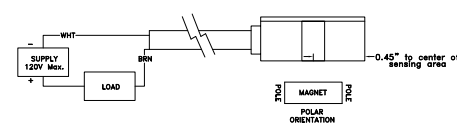
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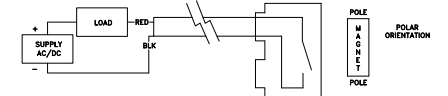
YHS-015-2



YHS-015



YHS-0028

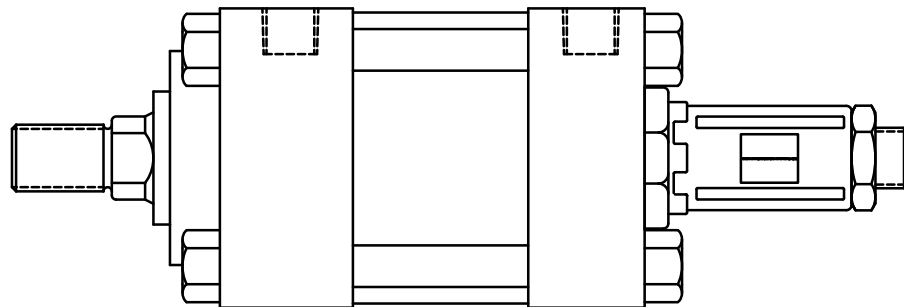
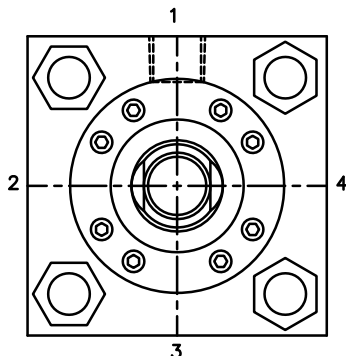
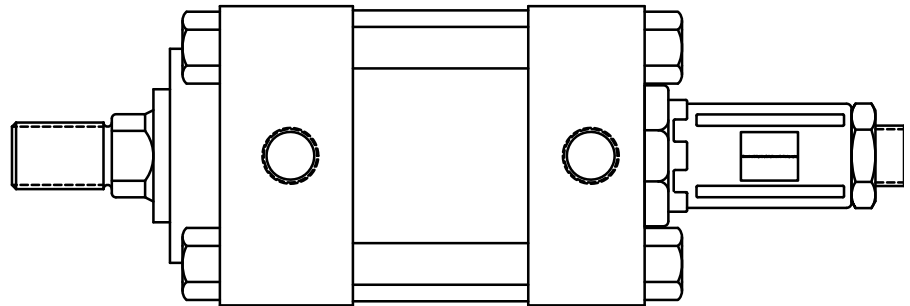


LDT

MAGNETOSTRICTIVE LINEAR DISPLACEMENT TRANSDUCER FOR HIGH SHOCK AND VIBRATION APPLICATIONS.

Standard LDT is lab tested and field proven to survive high shock and vibration. With tested results of 2,000 G's of shock and 30 G's of random vibration with no false signals or mechanical damage , it can survive in the most rugged and demanding applications.

Sensing tube construction is welded stainless steel, suitable for 5000 PSI hydraulic cylinders. The electronics are enclosed inside an aluminum housing with o-ring seals for IP67 indoor applications. Type NEMA 6 rating and stainless steel housings and connectors are available as a special option.



LDT ELECTRICAL INFORMATION

INPUT VOLTAGE	15 VDC to 26 VDC
CURRENT DRAW	<200 mA at 15 VDC
OUTPUT	
ANALOG	Absolute Analog Position via Digital-to-Analog Converter -10 to 10 VDC 16-Bit (65,535) Resolution 0 to 10 VDC 15-Bit (32,768) Resolution -5 to 5 VDC 15-Bit (32,768) Resolution 0 to 5 VDC 14-Bit (16,384) Resolution 4 to 20 mA 16-Bit (65,535) Resolution
DIGITAL	TTL Level Pulse/Pulse, RS422 Pulse/Pulse RS422 Pulse Width Modulated
RESOLUTION	
INTERNAL	.001"
ANALOG OUTPUT	16-Bit (one part in 65,535)
NON-LINEARITY/ ACCURACY	Less than 0.05% of Full Stroke with +/-0.002" (+/-0.05 mm) Maximum
REPEATABILITY	+/- 0.001% of Full Scale or +/-0.0004" (0.102 mm) Maximum
HYSTERESIS	.001" (.025 mm) Maximum
OPERATING TEMPERATURE	
HEAD ELECTRONICS	-40° to 155°F (-40° to 70° C
GUIDE TUBE	-40° to 220°F (-40° to 105° C)
OPERATING PRESSURE	5000 psi Operational, 10,000 psi Spike
SPAN LENGTH	1" - 300"
NULL ZONE	1.5"
DEAD ZONE	2.25"
CONNECTORS	1/4 Turn MS Style Connector Standard Potted Pigtail Assembly Available Optionally
UPDATE TIME	2 MS Typically
ENCLOSURE	IP67

**SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.
 OTHER OPTIONS AVAILABLE. CONSULT FACTORY.**



AIR OIL TANKS

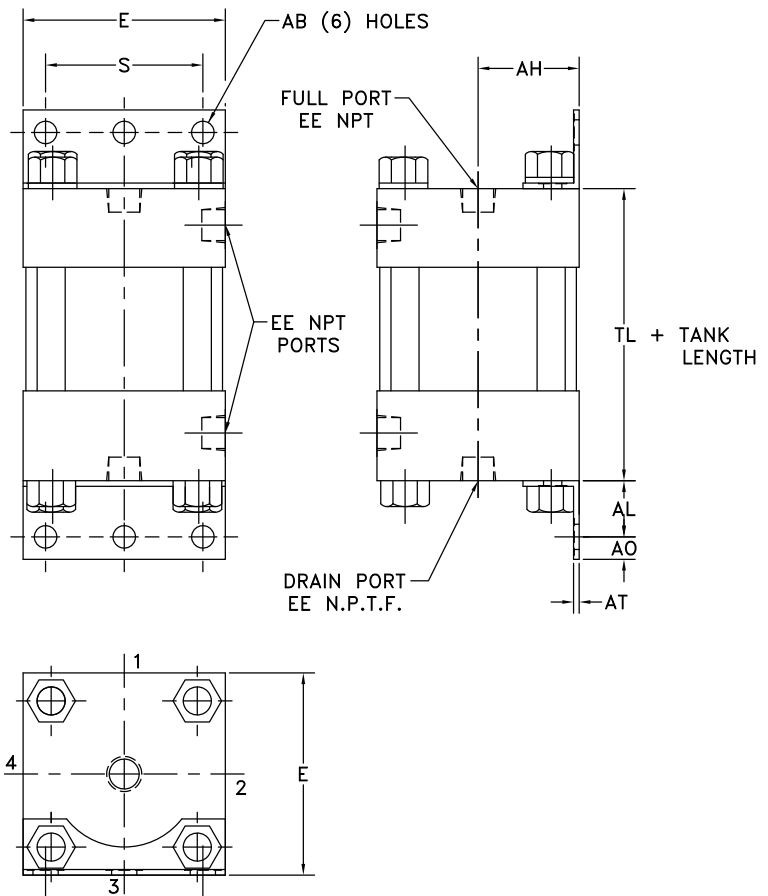
Yates air/oil tanks are used to obtain smooth hydraulic pressure without the high cost of hydraulic systems. Shop air pressure is applied into the top of the air/oil tanks and then dispenses the oil into the work cylinder. The hydraulic pressure generated is in a 1 to 1 ratio. 80 PSI shop air produces 80 PSI hydraulic pressure (see figure 25-1)

BORE SIZES: 3 1/4, 4, 5, 6, & 8

PRESSURES: up to 200 PSI

CONSTRUCTION AND FEATURES:

- Lightweight aluminum end caps
- High-strength composite tube is also translucent and provides oil level indication without the use of expensive sight gauges
- Two air/oil baffles, one installed on both end caps, eliminates oil foaming and provides smooth oil flow into the work cylinder
- Tube and O-ring seal positively seals end caps to tube
- Side end angle mounts come standard (other mounts available)



BORE	TANK DIMENSIONS									
	E	J	S	AB	AH	AL	AO	AT	EE	TL
3 1/4	3 3/4	1 1/4	2 3/4	1/2	1 15/16	1 1/4	1/2	1/8	1/2	2 1/2
4	4 1/2	1 1/4	3 1/2	1/2	2 1/4	1 1/4	1/2	1/8	1/2	2 1/2
5	5 1/2	1 1/4	4 1/4	5/8	2 3/4	1 3/8	5/8	3/16	1/2	2 1/2
6	6 1/2	1 1/2	5 1/4	3/4	3 1/4	1 3/8	5/8	1/4	3/4	3
8	8 1/2	1 1/2	7 1/8	3/4	4 1/4	1 7/16	11/16	1/4	3/4	3

AIR OIL TANKS

SELECTING THE AIR/OIL TANKS

1. Determine the volume of oil necessary to fill the work cylinder when at full stroke. This can be determined by multiplying the piston area by the stroke length.
2. Next, select the bore and tank length from Chart 25-2 which is equal to or greater than the volume determined in step 1.

NOTE: Smaller bore sizes with longer lengths are generally more economical than larger bores with shorter lengths.

WHEN ORDERING SPECIFY: Quantity, mounting, bore and length

FIGURE 25-1

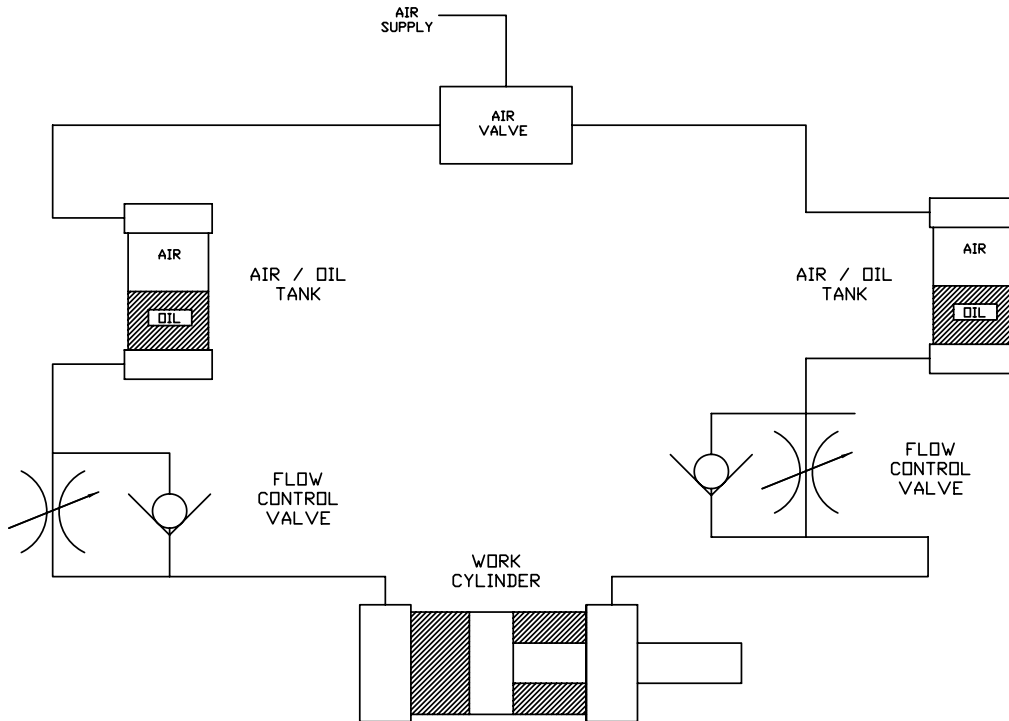
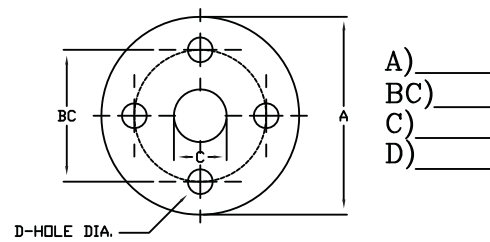
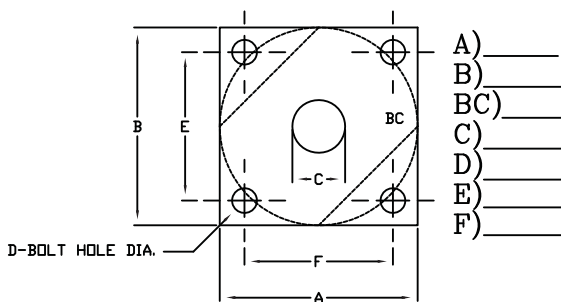
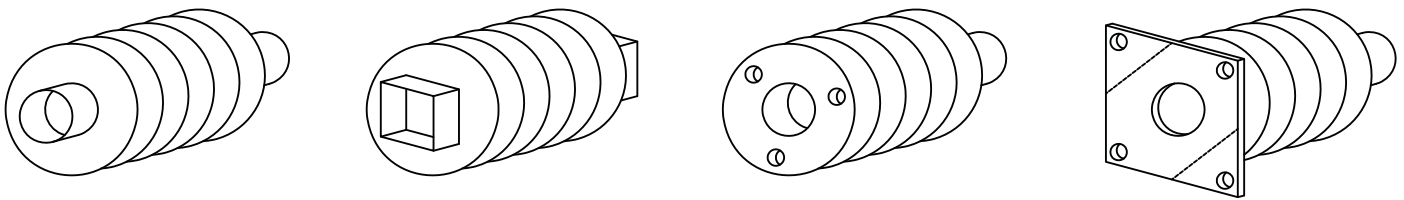
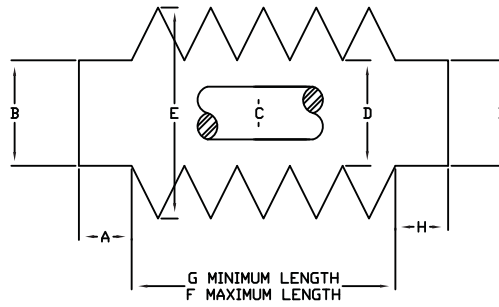


CHART 25-2

BORE	TANK LENGTH (INCHES)														
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3 1/4	25	32	39	46	53	60	68	75	82	90	97	104	111	119	126
4	37	48	59	70	81	92	104	115	126	137	149	160	171	182	194
5	56	73	90	107	124	142	159	176	193	211	229	246	263	282	299
6	81	106	131	156	181	206	231	256	281	306	332	357	382	407	432
8	145	190	235	280	324	368	412	456	500	544	588	634	678	724	768

ROD BOOT



ROD BOOT

ORDERING INSTRUCTIONS

When ordering rod boots with a cylinder, under "specials" state that "S" equals rod boot along with any additional specials that may be required. Complete the rod boot order form and return with cylinder specifications to your Yates Cylinders sales representative.

When ordering a rod boot without a cylinder, complete the rod boot order form and return to your Yates Cylinders sales representative.

ROD BOOT ORDER FORM

- A)** Length of Cuff _____
- B)** Inside Diameter of Cuff _____
- C)** Rod Diameter _____
- D)** Inside Diameter of Boot _____
- E)** Max. Outside Diameter of Boot _____
- F)** Max. Length Excluding Cuff _____
- G)** Min. Length Excluding Cuff _____
- H)** Length of Cuff _____
- I)** Inside Diameter of Cuff _____

QUANTITY: _____

Please check box for material specification:

- | | |
|--|--|
| <input type="checkbox"/> Neoprene-Coated Nylon .022" thick -60°F to +250°F | <input type="checkbox"/> Neoprene-Coated Nylon .033" thick -60°F to +250°F |
| <input type="checkbox"/> PVC-Coated Nylon .022" thick -20°F to +180°F | <input type="checkbox"/> Aluminized Fiberglass .025" thick -100°F to +650°F |
| <input type="checkbox"/> Hypalon-Coated Nylon .022" thick -60°F to +350°F | <input type="checkbox"/> PTFE-Coated Fiberglass .018" thick -100°F to +550°F |

Please circle style end type:

- Round Cuff Square Cuff Round Flange Style Square Flange Style

Phone: (586) 778-7680

Fax: (586) 778-6565

Email: sales@yatesind.com



OPERATING FLUIDS AND SEALS

STANDARD SEALS

Standard seals are what is normally provided unless otherwise specified. Seals provided are generally Nitrile intended for use with: air, mineral-based hydraulic oils, nitrogen within normal operating temperatures of -10°F to +165°F. P.T.F.E. back ups are used where required.

FLUOROCARBON SEALS

Provided when higher temperature service is intended. Used with some Phosphate Ester fluids (with exception of Skydrols) and many fire resistant formulas. Fluorocarbon seals can be operated within -10°F to +250°F. They may also be used to +400°F with shorter seal life expectancy. For applications over +250°F, cylinders must be ordered with the piston set screwed to piston rod. P.T.F.E. back ups will be provided as needed.

HI-LOAD SEALS

Seal combination of one or two bronze filled Teflon rings with elastomer expander underneath, with a pair of wear bands on the outer edges. This configuration is virtually leak-free under static conditions and compatible with high pressures. The configuration is also capable of handling high sideload applications.

CAST IRON PISTON RINGS

Offering the widest operating conditions in temperatures, pressures and fluids, this configuration can be used in many applications. Note: cast iron rings do allow a small amount of bypass that increases with bore size and pressures used.

LOW FRICTION OR NON-LUBED SEALS

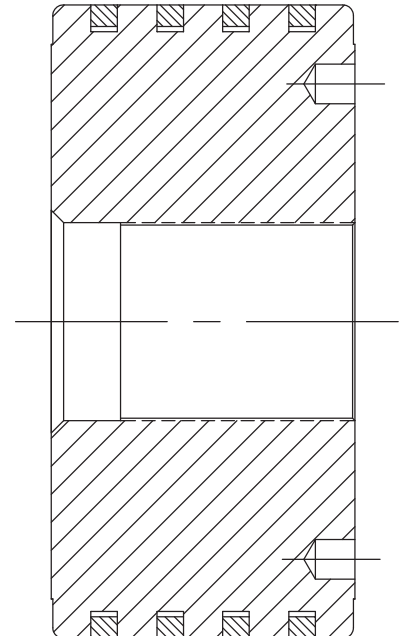
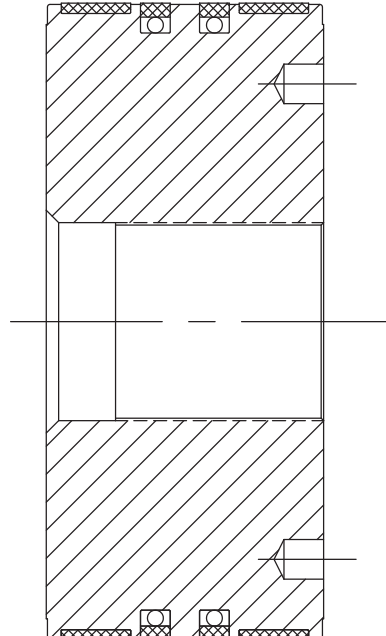
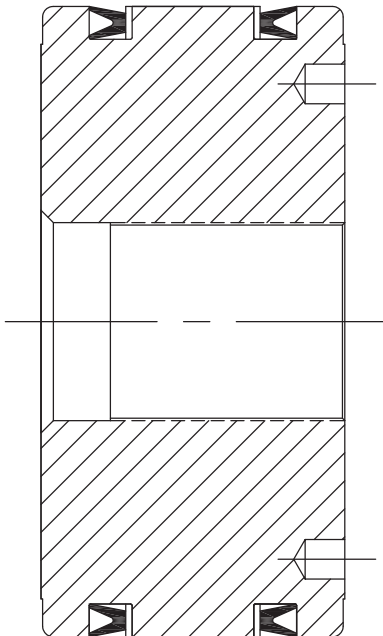
Standard for the A2/H2 series and suitable for most low friction applications, the standard lip seal piston seals and rod seals are offered in Carboxylated nitrile with Teflon® compound ensuring low friction and long seal life in both lubed and non-lubed applications.

PISTON CONFIGURATIONS

STANDARD PISTON
U CUPS WITH
TEFLON® BACK-UPS

HI LOAD PISTON
TEFLON® GLIDE RINGS
AND ORING EXPANDERS
WITH WEAR BANDS

CAST IRON RING PISTON
STEP CUT
CAST IRON RINGS



CORROSIVE RESISTANT CYLINDERS

Water processing, food processing, marine, waste water treatment, etc.

STAINLESS STEEL CYLINDERS

- All external components manufactured from series 300 stainless steel
- Flash hard chrome plated stainless steel piston rod standard on all stainless steel cylinders. Available in 303 or 17-4 ph.
- An extra long, high strength bronze gland provides maximum bearing support and wear resistance.
- Electroless nickel plated, flush mounted captive cushion adjustment allows safe cushion adjustment under pressure
- One piece fine grained cast iron piston provides maximum strength and protection against shock loads (optional stainless steel piston with wear band)
- Pressure rated to 250 psi air service. Consult factory for hydraulic pressure service.
- Available in most mounting styles.

ELECTROLESS NICKEL PLATED CYLINDERS

- Electroless nickel plated cylinders are an economical alternative to stainless steel cylinders in many corrosive applications.
- All external components are electroless nickel plated (optional stainless steel fasteners are available depending on pressure rating)
- Chrome plated stainless steel piston rod standard on all electroless nickel plated cylinders.
- Available in most mounting styles.

ADDITIONAL CORROSIVE RESISTANT OPTIONS

- Epoxy paint (food grade, marine grade, etc.)
- Composite components available: heads, caps, pistons, tubes and glands.
- Nitrotec piston rods
- Black oxide of all external components

STATIC ROD LOCKS

Yates new YRL series rod locks offer the next generation in holding/locking devices with superior performance. These spring engaged, air-released rod locks supplement air cylinders and guide rods for holding in emergency stop or power off conditions. High pressure clamping forces ensure positive holding with minimal air required for lock release.

LONG LASTING PERFORMANCE

Designed for millions of trouble free cycles, the YRL rod lock offers a sealed design to withstand even the harshest wash down applications. Spring engaged design offers operation even in loss of power situations. The fast spring response also increases positioning accuracy.

BENEFITS

- No rod displacement
- Large clamping surface
- 2,000,000+ life cycles
- Sealed internal components
- Extremely low backlash
- NFPA sizes

APPLICATIONS

- Automation equipment
- Injection molding machines
- Hydraulic presses
- Machine tools
- Elevators/ scissor lifts

OPERATIONAL SPECIFICATIONS:

All YRL rod locks will operate in both directions, engaging with the same holding force. Rod locks can be mounted in any position. Rod rotation is not allowed when lock is engaged (not intended for torsional braking).

Release pressure can range from 60-120 psi.

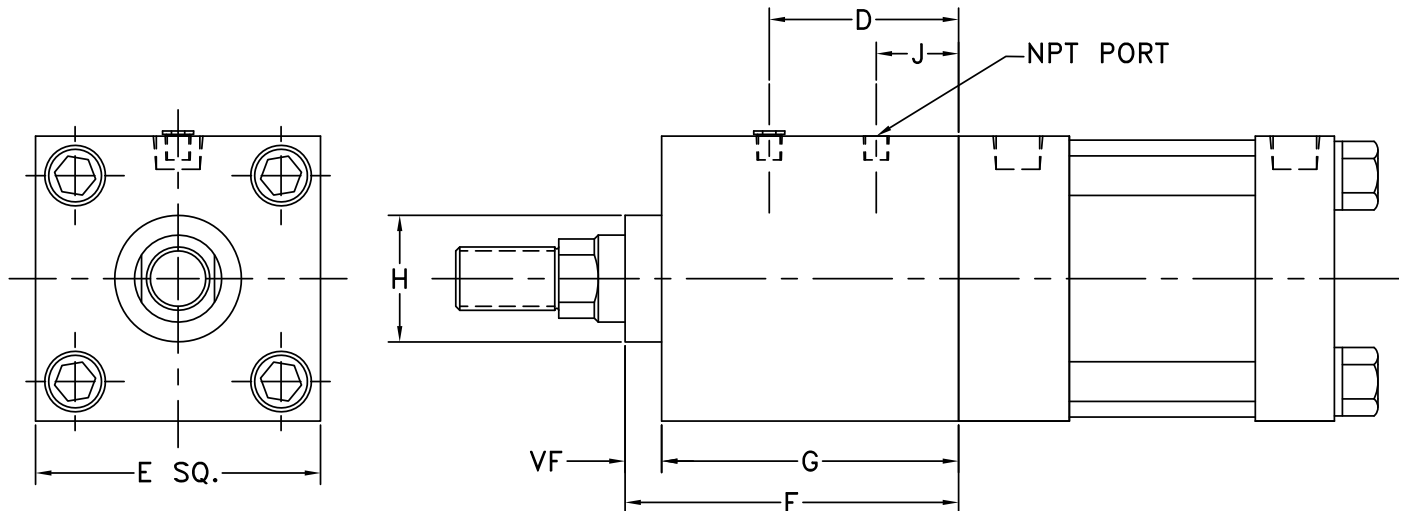
Buna-N seals are rated to 212°F.

Operating temperatures range from 33°F-150°F. Units are capable of intermittent use at temperatures up to 212°F.

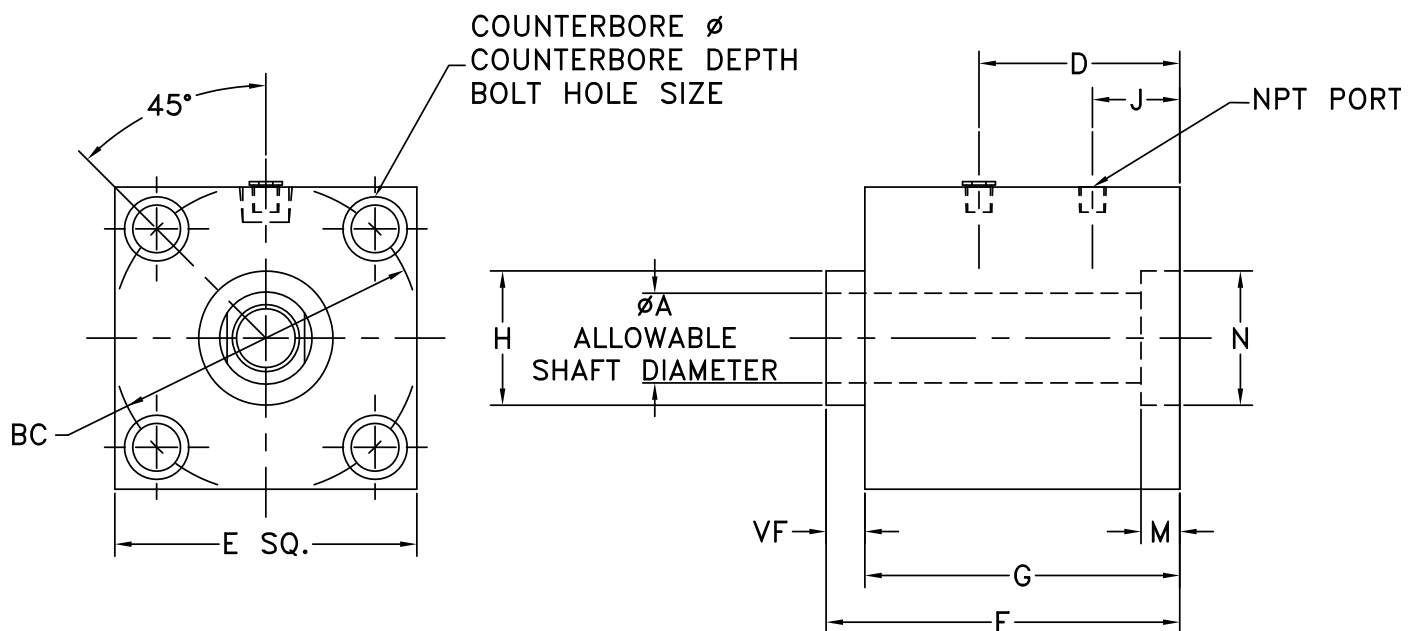


ROD LOCKS

CYLINDER MOUNTED



STAND ALONE



ROD LOCK DIMENSIONS

ROD LOCKS FOR NFPA CYLINDERS

MODEL#	ØA*	D	E	F	VF	G	ØH*	J	HOLDING FORCE	NPT Air Inlet
YRL-150-0625	0.625	1.95	2.00	2.77	0.375	2.397	1.125	0.91	180 LBS	1/8-27
YRL-200-0625	0.626	2.08	2.50	2.80	0.375	2.422	1.125	1.02	314 LBS	1/8-27
YRL-200-1000	1.000	2.58	2.50	3.88	0.500	3.375	1.500	1.58	325 LBS	1/8-27
YRL-250-0625	0.625	2.13	3.00	2.91	0.375	2.540	1.125	1.02	491 LBS	1/8-27
YRL-325-1000	1.000	2.99	3.75	4.48	0.500	3.976	1.500	1.56	830 LBS	1/4-18
YRL-400-1000	1.000	2.99	4.50	4.48	0.500	3.976	1.500	1.56	1300 LBS	1/4-18
YRL-400-1375	1.375	3.16	4.50	4.92	0.750	4.165	2.000	1.76	1300 LBS	1/4-18
YRL-500-1000	1.000	3.34	5.50	4.94	0.500	4.443	1.500	1.35	2000 LBS	1/4-18
YRL-600-1375	1.375	4.43	6.50	5.93	0.625	5.306	2.000	1.89	2850 LBS	1/4-18
*HØ -.001/-.003" AØ +.000/-.002"										

STAND ALONE ROD LOCK FOR GUIDE RODS

MODEL#	ØA*	B	ØBC	E	D	G	F	VF	ØH*	J
YRL-150-0625-SA	0.625	1.00	2.022	2.00	1.95	2.397	2.77	0.375	1.125	0.91
YRL-200-0625-SA	0.626	1.25	2.602	2.50	2.08	2.422	2.80	0.375	1.125	1.02
YRL-200-1000-SA	1.000	1.25	2.602	2.50	2.58	3.375	3.88	0.500	1.500	1.58
YRL-250-0625-SA	0.625	1.50	3.097	3.00	2.13	2.540	2.91	0.375	1.125	1.02
YRL-325-1000-SA	1.000	1.88	3.903	3.75	2.99	3.976	4.48	0.500	1.500	1.56
YRL-400-1000-SA	1.000	2.25	4.695	4.50	2.99	3.976	4.48	0.500	1.500	1.56
YRL-500-1000-SA	1.000	2.75	5.798	5.50	2.99	4.443	4.94	0.500	1.500	1.35
YRL-600-1375-SA	1.375	3.25	6.901	6.50	3.54	5.306	5.93	0.625	2.000	1.89
*HØ -.001/-.003" AØ +.000/-.002" N+.003/+.001"										

YATES "YS" SERIES ROUND BODY CYLINDERS

YS-2500 SERIES SUITABLE FOR AIR OR MEDIUM DUTY HYDRAULIC SERVICE.

- Ductile iron head and piston are made from fine grained centrifugally cast bar stock.
- O-ring boss ports supplied standard, NPTF available at no extra charge.
- Piston rod is ground, polished and chrome plated medium carbon steel.
- Polypak piston seals with glass-filled nylon bearing is standard.
Viton or Teflon piston seals are optional.
- Polypak rod seal with a Urethane rod wiper are standard.
High temperature rod seals are optional.
- Head gland retained with internal retaining ring is standard on medium duty.

YS-3000 SERIES FOR HEAVY DUTY USE IN HIGH PRESSURE APPLICATIONS.

- Ductile iron head and piston are made from fine grained centrifugally cast bar stock.
- O-ring boss ports supplied standard, NPTF available at no extra charge.
- Piston rod is ground, polished and chrome plated steel.
- Polypak piston seals with glass-filled nylon bearing is standard.
Viton or Teflon piston seals are optional.
- Polypak rod seal with a Urethane rod wiper are standard.
High temperature rod seals are optional.

YATES "YS" SERIES ROUND BODY CYLINDERS

CUSTOM BUILT CYLINDER APPLICATION

ROD END
VIEW COLUMN

BASE END
VIEW COLUMN

NAME: _____

SINGLE OR DOUBLE ACTING: _____ BORE DIA.: _____ ROD DIA.: _____

SYSTEM OPERATING PRESSURE: _____ FLUID TYPE: _____

"A" RETRACTED LEN: _____ "B" STROKE: _____ "C" TUBE O.D.: _____

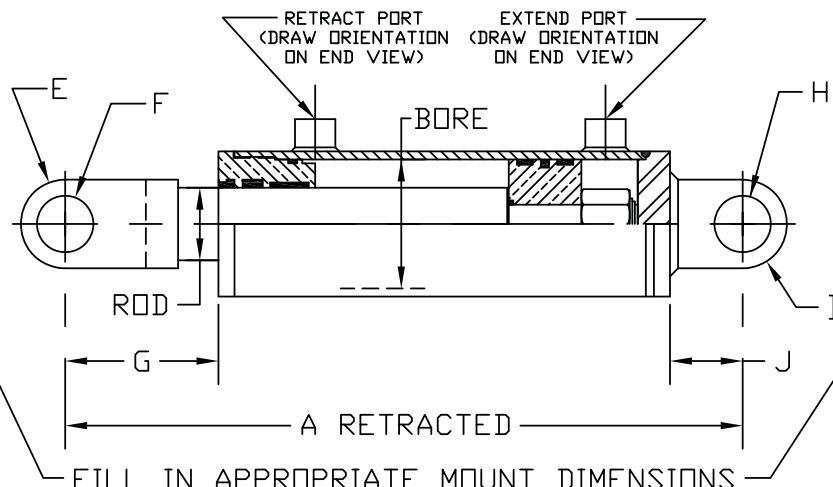
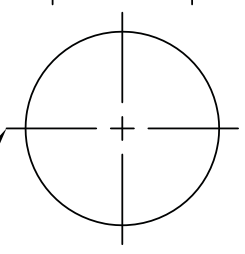
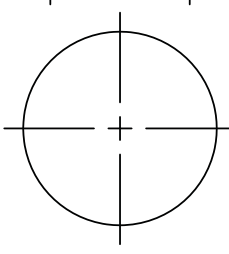
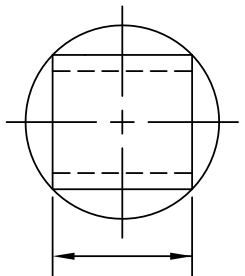
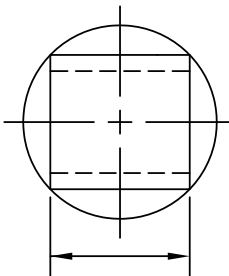
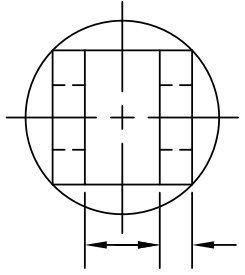
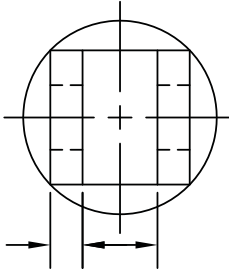
"E" ROD MOUNT: _____ "F" ROD PIN DIA.: _____ "G" ROD EXTENSION: _____

"H" BASE MOUNT: _____ "I" BASE PIN DIA.: _____ "J" MOUNT: _____

COMMENTS: _____

PORTS TYPE: _____ RETRACT SIZE: _____ EXTENDED SIZE: _____

QUOTE QTY: _____



DRAW SPECIAL MOUNT

DRAW SPECIAL MOUNT



YATES INDUSTRIES YS-MIL MILL CYLINDERS

YS-MIL-A AIR SERVICE/ 200 PSI HYDRAULIC MILL CYLINDERS SPECIFICATIONS:

- 1. CYLINDER BODY**- honed to a micro finish with ends chamfered for assembly purposes. All flanges and mounting trunnions are rigidly welded to the cylinder tube. Chrome plating is available as an option.
- 2. HEAD AND CAP**- rugged construction, heads provide long male pilots for proper alignment with body.
- 3. PISTON**- one piece cast iron construction threaded on rod and positively locked. Optional bronze overlay pistons available on request.
- 4. PISTON ROD** - 100,000 psi tensile steel, turned, ground and polished with .001" hard chrome plating is standard. Heavy chrome is available as an option.
- 5. CUSHIONS** - floating rod end cushion, integral cap end spear. Needle valve and ball check provide a wide range of cushion adjustment while allowing quick break away.
- 6. IN-BOARD AND OUT-BOARD ROD BUSHINGS** - precision machined from bronze for long life. Allows easy removal of rod packing without disassembly.
- 7. PISTON SEALS** - standard u-cup design is suitable for most applications. Optional teflon glide ring and double wear bands are optional.
- 8. ROD SEALS** - v-ring packing provides leak proof operation at all pressures. Polyurethane rod wiper is standard; metallic rod scraper is available.
- 9. HEAD & CAP BOLTS** - thru bolt construction with high strength socket head screws and nuts.

YS-MIL-H HEAVY DUTY HYDRAULIC MILL CYLINDERS TO 3000 PSI SPECIFICATIONS:

- 1. CYLINDER BODY** - honed to a micro finish with ends chamfered for assembly purposes. All flanges and mounting trunnions are rigidly welded to the cylinder tube. Chrome plating is available as an option.
- 2. HEAD AND CAP** - rugged construction, heads provide long male pilots for proper alignment with body.
- 3. PISTON** - one piece cast iron construction threaded on rod and positively locked. Optional bronze overlay pistons available on request.
- 4. PISTON ROD** - 100,000 psi tensile steel, turned, ground and polished with .001" hard chrome plating is standard. Heavy chrome is available as an option.
- 5. CUSHIONS** - Bronze rod end cushion sleeve, integral cap end spear. Needle valve and ball check provide a wide range of cushion adjustment while allowing quick break away.
- 6. IN-BOARD AND OUT-BOARD ROD BUSHINGS** - precision machined from bronze for long life. Allows easy removal of rod packing without disassembly.
- 7. PISTON SEALS** - polypak piston seal design is suitable for most applications. Optional teflon glide ring and double wear bands or cast iron rings are optional.
- 8. ROD SEALS** - v-ring packing provides leak proof operation at all pressures or polypak seals available in optional materials based on application. Polyurethane rod wiper is standard; metallic rod scraper is available.
- 9. HEAD & CAP BOLTS** - thru bolt construction with high strength socket head screws and nuts.

MILL CYLINDER HOW TO ORDER INFORMATION

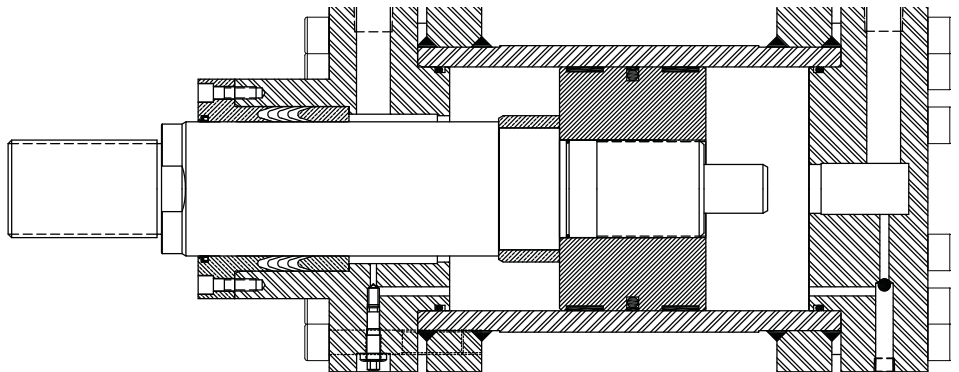
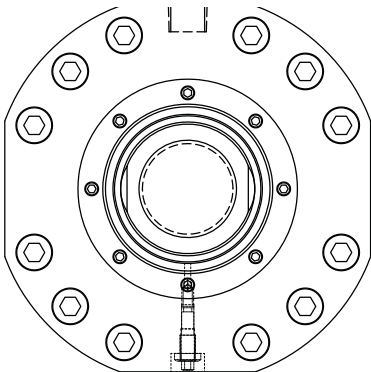
Unlike the N.F.P.A. tie rod cylinders that are made to certain specifications that ensures all manufacturers' mounting will be interchangeable, mill cylinders have no such standard. Each manufacturer has their own dimensions and designs so care must be taken when replacing an existing cylinder. Please fill out the information on page 127 and our factory will provide a blank dimensional drawing for the particular mount that will need to be filled in with appropriate dimensions to allow us to match the original cylinder.

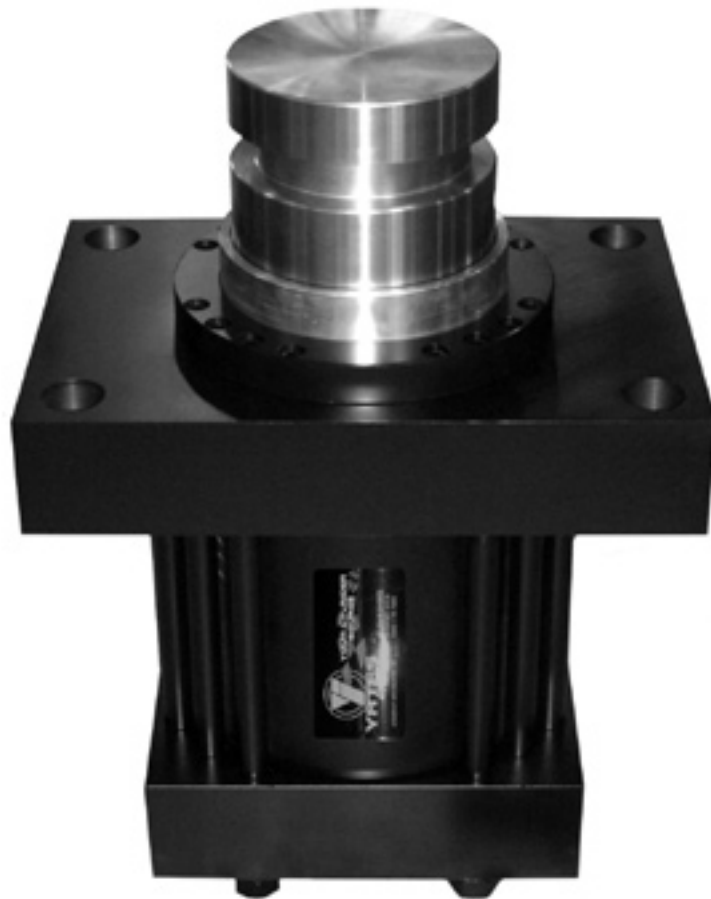
YATES INDUSTRIES YS-MIL MILL CYLINDERS

PLEASE CHECK THE APPROPRIATE DESIGNATIONS OR FILL IN INFORMATION WHERE REQUIRED.

Air service _____ Low pressure Hyd _____ High pressure hydraulic _____
If hydraulic indicate working pressure _____ Max rated pressure _____
Bore Diameter: _____ Stroke Length _____ Rod Diameter _____
Mounting style: _____
Rod end style: Male _____ Female _____ Other _____
Specify thread dia., pitch and length (i.e. 1 1/4-14 male x 1 5/8" long.) _____
Cushion on rod end _____ Cushion on cap end _____ Location of adjustments _____
Type of Port: NPTF _____ SAE _____ 4 bolt flange _____ Other (specify) _____
Port size rod end _____ Port size cap end _____ Location of ports _____
Operating fluid used _____ Operating temp _____
Special features required: _____

**SUPPLY ALL PERTINENT INFORMATION FROM EXISTING CYLINDER TAGS OR DESCRIPTIONS
AS WELL AS ANY DRAWINGS, SKETCHES OR PHOTOS AVAILABLE.**





YOUR CYLINDER SOURCE

Maintenance, Service, & Installation Manual



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REPAIR INFORMATION

INTRODUCTION

This manual will help users store, install, maintain and, if needed, repair Yates cylinders.

CYLINDER IDENTIFICATION

Yates N.F.P.A. series cylinders can be identified by Yates serial number or Model number. Cylinders are tagged with bore, stroke, and serial number on a metal tag attached to the head. In addition, the serial number is stamped into the steel of the front head. These numbers should always be referenced when requesting parts or for general service inquiries.

STORING OF CYLINDERS

If there is a need to store the cylinders for any period of time, please follow these simple instructions to help keep the cylinder in ready condition.

1. Coat the interior of the cylinder with oil and leave half filled if practical.
2. Plug all ports to ensure foreign matter is kept out of the cylinder.
3. Try to store the cylinder in a vertical position if at all possible; if not, regularly rotate the cylinder 90 degrees to ensure seals maintain proper shape and elasticity.
4. Keep all mounting surfaces and threads either covered or coated with protective lubricant.
5. Try to store components in a clean, dry area that maintains a relatively constant temperature.

**IF STORING FOR LONGER THAN ONE MONTH,
ALWAYS THOROUGHLY LUBRICATE THE CYLINDER. STROKE NUMEROUS TIMES
BEFORE INSTALLATION OR USING UNDER LOAD.**

REPAIR INFORMATION

INSTALLATION

The preferred method of mounting the cylinder to a machine is to have the equipment machined to fit the cylinder's exact dimensions with proper alignment already taken into account so that mounting the cylinder ensures perfect alignment. Unfortunately, this is not always an option from a cost or design aspect so alignment must be ensured at time of installation. On fixed mount cylinders that are secured in one position, it is always best to bolt the cylinder down as the last step in installation.

When attaching the piston rod end to the load, the piston rod must be attached and held squarely to ensure the centerline is parallel to the guides of the attached load or parallel to the line of movement along the entire stroke. Torque piston rod to load. Insert mounting bolts securely enough to cycle cylinder but do not tighten.

The application operation should be cycled with low pressure air under reduced or no load to ensure that all components are operating freely. Finish torque mounting bolts and recheck.

Piping: All fittings should be free of burrs and sealed with either o-ring or appropriate pipe tape. Make sure all hoses are properly flushed of contaminants before attachment. Do not overtighten fittings. On oversized rods, beware of shallow tapped ports.

Hydraulic filtration should be to power unit manufacturer's specifications. Pneumatic systems should have a water separator, 50 micron or smaller filter, and a lubricator as close to the cylinder as possible.

REPAIR INFORMATION

TROUBLESHOOTING

Cylinders that are properly installed and maintained should have millions of trouble free cycles. Most failures are due to application or system problems that could be prevented. Some problems, possible causes and solutions follow:

BROKEN ROD END

Cause: Misalignment or load in excess of cylinder capability.

Solution: Make sure that load is properly aligned. Select larger rod end threads or stud rod end for greater strength.

2. BROKEN OR BENT ROD

Cause: Misalignment or load in excess of cylinder capability.

Solution: Make sure that rod is aligned properly through entire stroke.
Consult a Yates sales representative to select proper rod size for application.

3. SEAL DAMAGE

Cause: Improper seal selection or system contamination.

Solution: Consult a Yates sales engineer for proper seal for temperature or fluid media.
Use proper filtration from system manufacturers spec.

4. EXCESSIVE PISTON ROD WEAR

Cause: Side load or long stroke and improper stop tube selection.

Solution: Check alignment of rod and load along entire stroke.
Consult Yates catalog for proper stop tube configuration.

5. BROKEN PARTS

Cause: Exceeding cylinder pressure rating. Need for system speed controls or improperly adjusted cylinder cushions.

Solution: Lower system pressure to minimum required to accommodate application.
Adjust speed controls or cushions to lower shock.

REPAIR INFORMATION

REPLACEMENT PARTS

If needed, any cylinder component can be replaced. When contacting a Yates sales representative, please have the following information: model number, bore, stroke, or Yates serial number (as found on the metal tag attached to the cylinder or stamped into the front head) and part description from diagram on page 135.

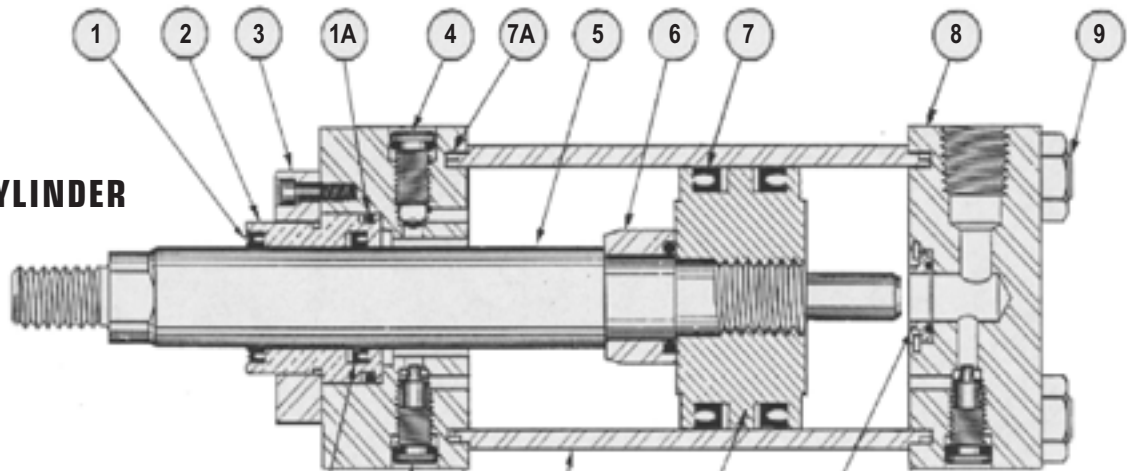
If repair becomes necessary due to seal leakage, a complete rebuild set should be obtained. This set includes piston seals, barrel to head seals, rod seals and bronze rod gland. For seal replacement instruction, refer to pages 136 & 137. (For seal orientation, refer to diagram on page 135.)



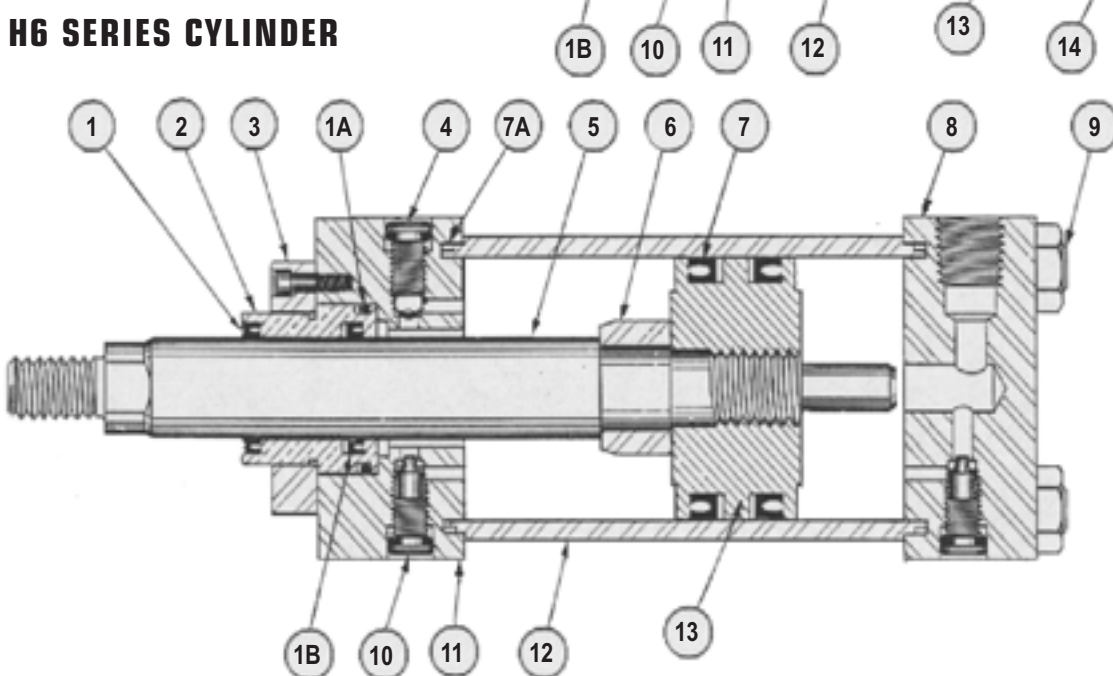
REPAIR INFORMATION

REPLACEMENT PARTS

A4/H4 SERIES CYLINDER



H6 SERIES CYLINDER



REPLACEMENT PARTS

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1, 1A, & 1B	ROD SEAL KIT	8	REAR CAP
1, 1A, 1B, & 2	ROD GLAND KIT	9	TIE RODS AND NUTS
3	RETAINER RING/PLATE	10	CUSHION NEEDLE ASSEMBLY
4	BALL CHECK ASSEMBLY	11	FRONT HEAD
5	PISTON ROD	12	CYLINDER TUBE
6	CUSHION SPUD ASSEMBLY	13	PISTON
7 & 7A	PISTON SEAL KIT	14	CUSHION STAR ASSEMBLY

**WHEN ORDERING REPLACEMENT PARTS,
SPECIFY SERIAL NUMBER, MODEL NUMBER, BORE, STROKE, AND PISTON ROD DIAMETER.**



REPAIR INFORMATION

PISTON REPLACEMENT

1. To remove Loctited® piston from rod, heat piston and rod to 450 degrees.
2. Using a spanner wrench, remove piston (while hot) by turning counter clockwise.
3. Allow piston & rod to air cool before cleaning and reassembling.
4. Clean threads of piston and rod with Loctite® cleaner and degreaser. Spray threads with Loctite® #7649 primer and allow to air dry (DO NOT BLOW DRY).
5. Screw piston to rod making sure of a good fit, then back the piston off about 3/4 of the way.
6. Apply (high strength) grade 680 Loctite® to rod thread and into piston thread on top of rod. Screw the piston clockwise all the way down.
7. Use spanner wrench to torque down piston.
8. Prick punch rod with center punch (2 places) so rod thread protrudes into piston thread. Clean any loose material and Loctite®.
9. Install new seals on piston; lubricate with grease or equivalent.
10. Install piston into tube without damaging.

NOTE: Allow Loctite® to cure for 3 hours before applying test pressure to assembled cylinder.

ROD CARTRIDGE REPLACEMENT

1. There will be a circular retainer or a square retainer at the rod end. If there is a circular retainer, remove the socket head cap screws. If it is a square retainer, remove the tie rod nuts.
2. Remove the circular retainer as shown in Fig. 2
3. Remove the rod cartridge by inserting a screwdriver in the external groove. Pry carefully. See Fig. 3
4. Clean cartridge recess in the head.
5. Lubricate new rod cartridge and seals with grease of equivalent inside and out before assembly.
6. (Caution) Place new cartridge on the rod end being sure to use a "screwing motion".
7. Insert cartridge (now mounted on rod) into head recess.
8. Replace circular retainer plate, tie rod nuts or socket head cap screws, and tighten to original torque specs. See Fig.1 for Torque Specs or see Fig 4 for tie rod nut tightening pattern.

RETAINER RING	
SCREW SIZE	TORQUE FT/LBS.
1/4-20	15
5/16-18	32
3/8-16	60

FIG. 1



FIG. 2



FIG. 3

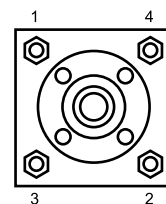


FIG. 4

REPAIR INFORMATION

1. Remove tie rod, nuts and washers.
2. Remove head and cap from cylinder.
3. Discard old seals and clean all parts, including inside tube, grooves in head and cap.
4. For all A2 series cylinders install o-ring seal in bottom of groove in head and cap.
5. When installing PTFE continuous ring type seals for series A4, H4, and H6 (1 1/2" through 6" Bore) avoid stretching seals.
6. For A4 and H4 series (8" Bore and up) insert seals in bottom of groove in the head and cap.
7. When installing PTFE noncontinuous ring type seal for series H6 (7" Bore and up) insert seal carefully to avoid stretching. (See Fig. 1 and Fig. 2)
8. Assemble cylinder and tighten tie rod nuts hand tight.
9. Torque Tie Rod Nuts in order shown in Fig. 3 (using chart below for Torque specifications)



FIG. 1

Be sure to butt ends of seal together as you begin to seat seal in groove



FIG. 2

Hold the ends together and in place with one finger while seating the rest of the seal with your other hand.

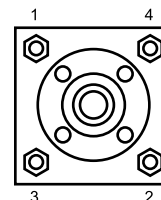


FIG. 3

SERIES H6			SERIES A4			SERIES A2		
BORE	TIE ROD DIA. (IN.)	TORQUE (FT./LB.)	BORE	TIE ROD DIA. (IN.)	TORQUE (FT./LB.)	BORE	TIE ROD DIA. (IN.)	TORQUE (FT./LB.)
1 1/2	3/8	27 ±2	1 1/2	1/4	10 ±2	1 1/2	1/4	8 ±2
2	1/2	33 ±3	2	5/16	16 ±2	2	5/16	12 ±2
2.5	1/2	65 ±5	2.5	5/16	16 ±2	2.5	5/16	12 ±2
3.25	5/8	155 ±10	3.25	3/8	26 ±3	3.25	3/8	19 ±2
4	5/8	180 ±10	4	3/8	26 ±3	4	3/8	19 ±2
5	7/8	435 ±20	5	1/2	65 ±5	5	1/2	45 ±4
6	1	545 ±20	6	1/2	65 ±5	6	1/2	45 ±4
7	1 1/8	755 ±30	8	5/8	155 ±10	8	5/8	115 ±6
8	1 1/4	980 ±40	10	3/4	235 ±10			
10	1 1/8	750 ±30	12	3/4	235 ±10			
12	1 1/4	980 ±40	14	7/8	435 ±20			
14	1 1/4	980 ±40	16	1	545 ±20			
16	1 1/2	1400 ±50	18	1.125	745 ±30			
18	1 1/2	1400 ±50	20	1.25	980 ±40			
20	1 1/2	1400 ±50						