



Application Guide



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Common Hydraulic Formulas

Property	Word Formula	Mathematic Equation
Cylinder Force lbs. (<i>Pounds of Force</i>)	Force =Pressure (psi) x Net Area (in ²)	F =PA
Fluid Motor Speed RPM (<i>Revolutions per Minute</i>)	Speed = $\frac{231 \times \text{Flow Rate (GPM)}}{\text{F.M. Displacement (in}^3/\text{rev.)}}$	n = $\frac{231 Q}{d}$
Fluid Pressure psi (<i>Pounds per Square Inch</i>)	Pressure = $\frac{\text{Force (lbs)}}{\text{Area (in}^2)}$	P = $\frac{F}{A}$
Fluid Motor Torque lb-in (<i>Inch Pounds</i>)	Torque = $\frac{\text{Pressure (psi)} \times \text{F.M. Displacement (in}^3/\text{rev.)}}{2\pi}$	T = $\frac{Pd}{2\pi}$
	Torque = $\frac{\text{Horsepower} \times 63025}{\text{RPM}}$	T = $\frac{63025 \text{ hp}}{n}$
	Torque = $\frac{\text{Flow Rate (GPM)} \times \text{Pressure (psi)} \times 36.77}{\text{RPM}}$	T = $\frac{36.77 Q P}{N}$
Fluid Motor Power hp (<i>Horsepower</i>)	Horsepower = $\frac{\text{Torque (lbs-in)} \times \text{RPM}}{63025}$	hp = $\frac{Tn}{63025}$
Cylinder Area Extend in ² (<i>Square Inches</i>)	Area = $\pi/(4 \times \text{Bore Diameter}^2)$	A = .7854 D ²
Cylinder Area Retract (w/rod) in ² (<i>Square Inches</i>)	Area = $(\pi/4 \times \text{Bore Diameter}^2) - (\pi/4 \times \text{Rod Diameter}^2)$	A = (.7854 Db ²)– (.7854 Dr ²)
Cylinder Volume G (<i>Gallons of Fluid</i>)	Volume = $\frac{\text{Net Area (in}^2) \times \text{Stroke (in)}}{231}$	V = $\frac{AL}{231}$
Cylinder Power hp (<i>Horsepower</i>)	Horsepower = $\frac{\text{Pressure (psi)} \times \text{Flow Rate (GPM)}}{1714}$	hp = $\frac{P Q}{1714}$
Cylinder Velocity ft/s (<i>Feet per Second</i>)	Velocity = $\frac{231 \times \text{Flow Rate (GPM)}}{12 \times 60 \times \text{Net Area (in}^2)}$	v = $\frac{.3208 Q}{A}$
Pump Outlet Flow GPM (<i>Gallons per Minute</i>)	Flow = $\frac{\text{RPM} \times \text{Pump Displacement (in}^3/\text{rev.)}}{231}$	Q = $\frac{nd}{231}$
Flow Rate Through Piping ft/s Velocity (<i>Feet per Second</i>)	Velocity = $\frac{.3208 \times \text{Flow Rate Through I.D. (GPM)}}{\text{Internal Area (in}^2)}$	v = $\frac{.3208Q}{A}$



Common Pneumatic Formulas

Air Valves help to regulate pressure in the cylinder and are sized for flow capacity (**Cv**). **Cv** is based on the specific cylinder stroke & travel time requirements, as well as piston size. **Cv** is a coefficient that measures the quantity of air a device can pass.

$$Cv = \frac{\text{Area (in}^2\text{)} \times \text{Length (ins.)} \times \text{Compression Factor}}{\text{Pressure Drop Factor} \times \text{Time (secs)} \times 29}$$

Area= Effective cylinder piston area (*square inches*)
A= πr^2 (3.14 x radius²)

PLEASE NOTE: The same formulas apply for the rod end of the cylinder. However, to make precise calculations, one must take the cylinder area (in²) minus the rod end area (in²) when utilizing this valve sizing formula to determine return stroke Cv rating.

Length= The total cylinder stroke length in inches (in.)

Compression Factor= Taken from the table (based on supply pressure rating).

Pressure drop factor= 10 or 15 psi drop is a good guideline for using this formula (refer to Table 20 for further details)

Time= Required cylinder stroke time (in seconds)

Pressure Drop Factor PD for Various Pressure Drops						
Supply Pressure	Compression Factor	2	5	10	15	20
PSI	CF	<u>PSID</u>				
40	3.7	9.9	15.3	20.5	23.6	N/A
50	4.4	10.8	16.7	22.6	26.4	29
60	5.1	11.7	18.1	24.6	29	32
70	5.8	12.5	19.3	26.5	31.3	34.8
80	6.4	13.2	20.5	28.2	33.5	37.4
90	7.1	13.9	21.6	29.8	35.5	39.9
100	7.8	14.5	22.7	31.3	37.4	42.1
110	8.5	15.2	23.7	32.8	39.3	44.3
120	9.2	15.8	24.7	34.2	41	46.4
130	9.8	16.4	25.6	35.5	42.7	48.4
140	10.5	16.9	26.5	36.8	44.3	50.3
150	11.2	17.5	27.4	38.1	45.9	52.1

Table 20

Compression Factor= Taken from Table 20 (based on supply pressure rating).



Common Pneumatic Formulas (cont'd)

Sizing Example

- 6 inches bore cylinder with 2-inch rod thickness and 15-inch total stroke
- Travel time=2 seconds
- 100 psi supply pressure
- 15 psi pressure drop factor to be used

Calculate the 6” diameter piston bore area (in square inches) for extend calculations

$$A = 6 \text{ ins.} \times 6 \text{ ins.} \times .7854 = 28.27 \text{ (in}^2\text{)}$$

PLEASE NOTE: This is for the cylinder extend area. To calculate the cylinder return area, the rod area must be calculated (in²) and then this value must be subtracted from the piston bore area (in²).

Calculate the 2” diameter rod end area in square inches

$$A = 2 \text{ ins.} \times 2 \text{ ins.} \times .7854 = 3.1416 \text{ (in}^2\text{)}$$

Thus, Cylinder Return Area is $28.27 \text{ in}^2 - 3.1416 \text{ in}^2 = 25.12 \text{ in}^2$

Apply these application variables to the Cv sizing formula:

$$Cv = \frac{28.27 \text{ in}^2 \times 15 \text{ ins.} \times 7.8}{37.4 \times 2 \text{ secs.} \times 29} = \frac{3,307}{2169} = 1.52 \text{ Cv (to extend)}$$

$$Cv = \frac{25.12 \text{ in}^2 \times 15 \text{ in} \times 7.8}{37.4 \times 2 \text{ secs} \times 29} = \frac{2939}{2169} = 1.52 \text{ Cv (to extend)}$$

Select a valve that meets this 1.52 Cv rating

Air Flow Rates

SCFM - Standard Cubic Feet per Minute – One cubic foot of gas (air) per minute at conditions of:

14.69 Pounds per Square Inch (psi)

68 degrees F

Relative humidity of 36%

Cubic Feet Per Minute (CFM): A particular unit of measurement for airflow volume. It’s determined by how many cubic feet of air passes by a stationary point per minute.

Free Air Flow: How much flow is actually generated (in standard condition).

Operating Pressure Safety Factors

HP Safety Factors

Bore Size (in.)	Operating Pressures @ Estimated Safety Factors (based on yield) Shown			
	Recommended	4/1	2/1	Proof*
1.50	3000	2030	4060	5000
2.00	3000	2340	4680	5000
2.50	3000	2130	4260	5000
3.25	3000	2375	4750	5000
4.00	3000	1910	3820	5000
5.00	3000	2300	4600	5000
6.00	3000	2125	4250	5000
7.00	3000	1960	3920	5000
8.00	3000	1980	3960	5000
10.00	3000	2190	4380	5000
12.00	3000	2100	4200	5000
14.00	3000	2010	4020	5000
16.00	3000	1980	3965	5000
18.00	3000	2000	3995	5000
20.00	3000	1570	3140	5000

*Proof pressures may also be considered as maximum operating pressure under non-shock conditions.

For applications where operating pressures exceed 3000 psi, consult factory for recommendations, also see appropriate mounting styles for operating pressure limitations.

LH Safety Factors

Bore Size (in.)	Operating Pressures @ Estimated Safety Factors (based on yield) Shown		
	4/1	3/1	2/1
1.50	2030	2710	
2.00	1045	1395	2090
2.50	1115	1485	2230
3.25	990	1320	1980
4.00	700	935	1400
5.00	680	910	1360
6.00	575	765	1150
8.00	510	680	1020
10.00	345	460	690
12.00	330	440	660
14.00	330	440	660



Cylinder Forces

HP Series

Heavy Duty Hydraulic Construction

- 1.5" to 18" Bore
- 24 NFPA Mounting Styles Available
- 3000 PSI Rating, 5000 PSI Non-Shock

HP series cylinders are designed and constructed for heavy duty applications which require higher operating pressures. The HP series is rated at 3000 psi, 5000 psi non-shock.

"PUSH" (EXTENDED STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Hydraulic Working Line Pressure (PSI)									Line Pressure ←
	500	750	1000	1250	1500	2000	2500	3000	5000	
1 1/2	884	1325	1767	2209	2651	3534	4418	5301	8836	
2	1571	2356	3142	3927	4712	6283	7854	9425	15708	
2 1/2	2454	3682	4909	6136	7363	9818	12272	14726	24544	
3 1/4	4148	6222	8296	10370	12444	16592	20739	24887	41479	
4	6283	9425	12566	15708	18850	25133	31416	37699	62832	
5	9818	14726	19635	24544	29453	39270	49088	58905	98175	
6	14137	21206	28274	35343	42412	56549	70686	84823	141372	
8	25133	37699	50266	62832	75398	100531	125664	150797	251328	
10	39270	58905	78540	98175	117810	157080	196350	235620	392700	
12	56549	84823	113098	141372	169646	226195	282744	339293	565488	
14	76969	115454	153938	192423	230908	307877	384846	461815	769692	

Note: "Push" Forces in Pounds = (Cylinder Bore Diameter)² x .7854 x Line Pressure

"PULL" (RETRACTED STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Cylinder Rod DIA	Hydraulic Working Line Pressure (PSI)									Line Pressure ←
		500	750	1000	1250	1500	2000	2500	3000	5000	
1 1/2	5/8	730	1095	1460	1825	2191	2921	3651	4381	7302	
	1	491	736	982	1227	1473	1964	2454	2945	4909	
2	1	1178	1767	2356	2945	3534	4712	5891	7069	11781	
	1 3/8	828	1243	1657	2071	2485	3313	4142	4970	8284	
2 1/2	1	2062	3093	4123	5154	6185	8247	10308	12370	20617	
	1 3/8	1712	2568	3424	4280	5136	6848	8560	10272	17119	
	1 3/4	1252	1878	2503	3129	3755	5007	6259	7510	12517	
3 1/4	1 3/8	3405	5108	6811	8514	10216	13622	17027	20433	34054	
	1 3/4	2945	4418	5891	7363	8836	11781	14726	17672	29453	
	2	2577	3866	5154	6443	7731	10308	12885	15463	25771	
4	1 3/4	5081	7621	10161	12701	15242	20322	25403	30483	50806	
	2	4712	7069	9425	11781	14137	18850	23562	28274	47124	
	2 1/2	3829	5743	7658	9572	11486	15315	19144	22973	38288	
5	2	8247	12370	16493	20617	24740	32987	41234	49480	82467	
	2 1/2	7363	11045	14726	18408	22089	29453	36816	44179	73631	
	3	6283	9425	12566	15708	18850	25133	31416	37699	62832	
	3 1/2	5007	7510	10014	12517	15021	20028	25035	30042	50069	

See next page for additional bore sizes.



Cylinder Forces

HP Series

- 1.5” to 18” Bore
- 24 NFPA Mounting Styles Available
- 3000 PSI Rating, 5000 PSI Non-Shock

HP series cylinders are designed and constructed for heavy duty applications which require higher operating pressures. The HP series is rated at 3000 psi, 5000 psi non-shock.

continued "PULL" (RETRACTED STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Cylinder Rod DIA	Hydraulic Working Line Pressure (PSI)									Line Pressure ←
		500	750	1000	1250	1500	2000	2500	3000	5000	
6	2 1/2	11683	17524	23366	29207	35048	46731	58414	70097	116828	
	3	10603	15904	21206	26507	31809	42412	53015	63617	106029	
	3 1/2	9327	13990	18653	23317	27980	37307	46633	55960	93266	
	4	7854	11781	15708	19635	23562	31416	39270	47124	78540	
8	3 1/2	20322	30483	40644	50806	60967	81289	101611	121933	203222	
	4	18850	28274	37699	47124	56549	75398	94248	113098	188496	
	4 1/2	17181	25771	34361	42952	51542	68723	85903	103084	171806	
	5	15315	22973	30631	38288	45946	61261	76577	91892	153153	
10	5 1/2	13254	19880	26507	33134	39761	53015	66268	79522	132536	
	4 1/2	31318	46977	62636	78295	93953	125271	156589	187907	313178	
	5	29453	44179	58905	73631	88358	117810	147263	176715	294525	
	5 1/2	27391	41086	54782	68477	82172	109563	136954	164345	273908	
12	6	25133	37699	50266	62832	75398	100531	125664	150797	251328	
	7	20028	30042	40055	50069	60083	80111	100139	120166	200277	
	5 1/2	44670	67004	89339	111674	134009	178679	223348	268018	446696	
	6	42412	63617	84823	106029	127235	169646	212058	254470	424116	
14	7	37307	55960	74613	93266	111920	149226	186533	223839	373065	
	8	31416	47124	62832	78540	94248	125664	157080	188496	314160	
	7	57727	86590	115454	144317	173181	230908	288635	346361	577269	
	8	51836	77755	103673	129591	155509	207346	259182	311018	518364	
14	9	45161	67741	90321	112901	135482	180642	225803	270963	451605	
	10	37699	56549	75398	94248	113098	150797	188496	226195	376992	

Note:

"Pull" Forces in Pounds = (Cylinder Bore Diameter)² - (Cylinder Rod Diameter)² x .7854 x Line Pressure

** For operating conditions exceeding the recommended operating pressure, please contact Peninsular Cylinder Company and request an enhanced design. Also, please note that operating pressures are for the cylinder vessel only. Some mounting selections may decrease the recommended operating pressure. Please view our catalog for maximum pressure ratings on your selected mounting style.*



Cylinder Forces

LH Series

Pressure Rated Hydraulic Construction

- 1.5" to 6.00" Bore
- 22 NFPA Mounting Styles Available
- Working pressure up to 1500 psi, Rated pressure up to 2500 psi

LH series cylinders are designed and constructed for medium duty applications which require lower operating pressures. The LH series is pressure rated per bore size.

NFPA, Low Pressure (1500 PSI)

"PUSH" (EXTENDED STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Hydraulic Working Line Pressure (PSI)									Line Pressure ←
	150	200	300	400	600	800	1000	1250	1500	
1 1/2	265	353	530	707	1060	1414	1767	2209	2651	
2	471	628	942	1257	1885	2513	3142	3927	4712	
2 1/2	736	982	1473	1964	2945	3927	4909			
3 1/4	1244	1659	2489	3318	4977	6637	8296			
4	1885	2513	3770	5027	7540	10053	12566			
5	2945	3927	5891	7854	11781	15708				
6	4241	5655	8482	11310	16965	22620				

Note: "Push" Forces in Pounds = (Cylinder Bore Diameter)² x .7854 x Line Pressure

"PULL" (RETRACTED STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Cylinder Rod DIA	Hydraulic Working Line Pressure (PSI)									Line Pressure ←
		150	200	300	400	600	800	1000	1250	1500	
1 1/2	5/8	219	292	438	584	876	1168	1460	1825	2191	
	1	147	196	295	393	589	785	982	1227	1473	
2	5/8	425	567	850	1134	1701	2268	2835	3544	4252	
	1	353	471	707	942	1414	1885	2356	2945	3534	
	1 3/8	249	331	497	663	994	1325	1657	2071	2485	
2 1/2	5/8	690	920	1381	1841	2761	3682	4602			
	1	619	825	1237	1649	2474	3299	4123			
	1 3/8	514	685	1027	1370	2054	2739	3424			
	1 3/4	376	501	751	1001	1502	2003	2503			
3 1/4	1	1127	1502	2253	3004	4506	6008	7510			
	1 3/8	1022	1362	2043	2724	4087	5449	6811			
	1 3/4	884	1178	1767	2356	3534	4712	5891			
	2	773	1031	1546	2062	3093	4123	5154			
	2 1/2	11767	2356	3534	4712	7069	9425	11781			
4	1 3/8	1662	2216	3324	4433	6649	8865	11082			
	1 3/4	1524	2032	3048	4064	6097	8129	10161			
	2	1414	1885	2827	3770	5655	7540	9425			
	2 1/2	1149	1532	2297	3063	4595	6126	7658			
	1	2827	3770	5655	7540	11310	15080				
	1 3/8	2723	3630	5445	7260	10890	14520				
	1 3/4	2584	3446	5169	6892	10338	13784				
	2	2474	3299	4948	6597	9896	13195				
5	2 1/2	2209	2945	4418	5891	8836	11781				
	3	1885	2513	3770	5027	7540	10053				
	3 1/2	1502	2003	3004	4006	6008	8011				
	1 3/8	4018	5358	8037	10716	16074	21432				
	1 3/4	3880	5174	7761	10348	15521	20695				
6	2	3770	5027	7540	10053	15080	20106				
	2 1/2	3505	4673	7010	9346	14019	18693				
	3	3181	4241	6362	8482	12723	16965				
	3 1/2	2798	3731	5596	7461	11192	14923				
	4	2356	3142	4712	6283	9425	12566				

Note: "Pull" Forces in Pounds = (Cylinder Bore Diameter)² - (Cylinder Rod Diameter)² x .7854 x Line Pressure

* For operating conditions exceeding the recommended operating pressure, please contact Peninsular Cylinder Company and request an enhanced design. Also, please note that operating pressures are for the cylinder vessel only. Some mounting selections may decrease the recommended operating pressure. Please view our catalog for maximum pressure ratings on your selected mounting style.



Cylinder Forces

MH Series

- 1.5” to 14.00” Bore
- 24 NFPA Mounting Styles Available
- Pre-Lubricated 250 psi Heavy Duty Service

MH series cylinders are designed and constructed from steel for heavy duty air applications. Maximum operating pressure is 250 psi.

NFPA Air Cylinders (250 PSI)

"PUSH" - (EXTENDED CYLINDER STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Air Line Pressure (PSI)												Line Pressure ←
	60	65	70	75	80	85	90	95	100	105	110	115	
1 1/2	106	115	124	133	141	150	159	168	177	186	194	203	212
2	188	204	220	236	251	267	283	298	314	330	346	361	377
2 1/2	295	319	344	368	393	417	442	466	491	515	540	565	589
3 1/4	498	539	581	622	664	705	747	788	830	871	913	954	995
4	754	817	880	942	1005	1068	1131	1194	1257	1319	1382	1445	1508
5	1178	1276	1374	1473	1571	1669	1767	1865	1964	2062	2160	2258	2356
6	1696	1838	1979	2121	2262	2403	2545	2686	2827	2969	3110	3252	3393
8	3016	3267	3519	3770	4021	4273	4524	4775	5027	5278	5529	5781	6032
10	4712	5105	5498	5891	6283	6676	7069	7461	7854	8247	8639	9032	9425
12	6786	7351	7917	8482	9048	9613	10179	10744	11310	11875	12441	13006	13572
14	9236	10006	10776	11545	12315	13085	13854	14624	15394	16164	16933	17703	18473

Note: "Push" Forces in Pounds = (Cylinder Bore Diameter)² x .7854 x Line Pressure

"PULL" - (RETRACTED CYLINDER STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Cylinder Rod DIA	Air Line Pressure (PSI)												Line Pressure ←
		60	65	70	75	80	85	90	95	100	105	110	115	
1 1/2	5/8	88	95	102	110	117	124	131	139	146	153	161	168	175
	1	59	64	69	74	79	83	88	93	98	103	108	113	118
2	5/8	170	184	198	213	227	241	255	269	283	298	312	326	340
	1	141	153	165	177	188	200	212	224	236	247	259	271	283
	1 3/8	99	108	116	124	133	141	149	157	166	174	182	191	199
2 1/2	5/8	276	299	322	345	368	391	414	437	460	483	506	529	552
	1	247	268	289	309	330	350	371	392	412	433	454	474	495
	1 3/8	205	223	240	257	274	291	308	325	342	360	377	394	411
	1 3/4	150	163	175	188	200	213	225	238	250	263	275	288	300
3 1/4	1	451	488	526	563	601	638	676	713	751	789	826	864	901
	1 3/8	409	443	477	511	545	579	613	647	681	715	749	783	817
	1 3/4	353	383	412	442	471	501	530	560	589	619	648	677	707
	2	309	335	361	387	412	438	464	490	515	541	567	593	619
	1	707	766	825	884	942	1001	1060	1119	1178	1237	1296	1355	1414
4	1 3/8	665	720	776	831	887	942	997	1053	1108	1164	1219	1274	1330
	1 3/4	610	660	711	762	813	864	915	965	1016	1067	1118	1169	1219
	2	565	613	660	707	754	801	848	895	942	990	1037	1084	1131
	2 1/2	459	498	536	574	613	651	689	727	766	804	842	881	919
5	1	1131	1225	1319	1414	1508	1602	1696	1791	1885	1979	2073	2168	2262
	1 3/8	1089	1180	1271	1361	1452	1543	1634	1724	1815	1906	1997	2087	2178
	1 3/4	1034	1120	1206	1292	1378	1465	1551	1637	1723	1809	1895	1981	2068
	2	990	1072	1155	1237	1319	1402	1484	1567	1649	1732	1814	1897	1979
	2 1/2	884	957	1031	1104	1178	1252	1325	1399	1473	1546	1620	1694	1767
	3	754	817	880	942	1005	1068	1131	1194	1257	1319	1382	1445	1508
	3 1/2	601	651	701	751	801	851	901	951	1001	1051	1102	1152	1202

This "PULL" Chart is continued on the next page



Cylinder Forces

MH Series (cont'd)

- 1.5" to 14.00" Bore
- 24 NFPA Mounting Styles Available
- Pre-Lubricated 250 psi Heavy Duty Service

MH series cylinders are designed and constructed from steel for heavy duty air applications. Maximum operating pressure is 250 psi.

This "PULL" Chart is continued from the previous page

"PULL" - (RETRACTED CYLINDER STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Cylinder Rod DIA	Air Line Pressure (PSI)												Line Pressure ←
		60	65	70	75	80	85	90	95	100	105	110	115	
6	1 3/8	1607	1741	1875	2009	2143	2277	2411	2545	2679	2813	2947	3081	3215
	1 3/4	1552	1681	1811	1940	2070	2199	2328	2458	2587	2716	2846	2975	3104
	2	1508	1634	1759	1885	2011	2136	2262	2388	2513	2639	2765	2890	3016
	2 1/2	1402	1519	1636	1752	1869	1986	2103	2220	2337	2453	2570	2687	2804
	3	1272	1378	1484	1590	1696	1802	1909	2015	2121	2227	2333	2439	2545
	3 1/2	1119	1212	1306	1399	1492	1586	1679	1772	1865	1959	2052	2145	2238
8	4	942	1021	1100	1178	1257	1335	1414	1492	1571	1649	1728	1806	1885
	1 3/8	2927	3171	3415	3659	3902	4146	4390	4634	4878	5122	5366	5610	5854
	1 3/4	2872	3111	3350	3590	3829	4068	4307	4547	4786	5025	5265	5504	5743
	2	2827	3063	3299	3534	3770	4006	4241	4477	4712	4948	5184	5419	5655
	2 1/2	2721	2948	3175	3402	3629	3855	4082	4309	4536	4762	4989	5216	5443
	3	2592	2808	3024	3240	3456	3672	3888	4104	4320	4536	4752	4968	5184
	3 1/2	2439	2642	2845	3048	3252	3455	3658	3861	4064	4268	4471	4674	4877
	4	2262	2450	2639	2827	3016	3204	3393	3581	3770	3958	4147	4335	4524
	4 1/2	2062	2233	2405	2577	2749	2921	3093	3264	3436	3608	3780	3952	4123
10	5	1838	1991	2144	2297	2450	2604	2757	2910	3063	3216	3369	3523	3676
	5 1/2	1590	1723	1856	1988	2121	2253	2386	2518	2651	2783	2916	3048	3181
	1 3/4	4568	4949	5329	5710	6091	6471	6852	7233	7613	7994	8375	8755	9136
	2	4524	4901	5278	5655	6032	6409	6786	7163	7540	7917	8294	8671	9048
	2 1/2	4418	4786	5154	5522	5891	6259	6627	6995	7363	7731	8099	8468	8836
	3	4288	4646	5003	5360	5718	6075	6432	6790	7147	7504	7862	8219	8577
	3 1/2	4135	4480	4824	5169	5514	5858	6203	6547	6892	7236	7581	7926	8270
	4	3958	4288	4618	4948	5278	5608	5938	6267	6597	6927	7257	7587	7917
	4 1/2	3758	4071	4384	4698	5011	5324	5637	5950	6264	6577	6890	7203	7516
12	5	3534	3829	4123	4418	4712	5007	5301	5596	5891	6185	6480	6774	7069
	5 1/2	3287	3561	3835	4109	4383	4656	4930	5204	5478	5752	6026	6300	6574
	2	6597	7147	7697	8247	8796	9346	9896	10446	10996	11545	12095	12645	13195
	2 1/2	6491	7032	7573	8114	8655	9196	9737	10278	10819	11360	11901	12442	12983
	3	6362	6892	7422	7952	8482	9012	9543	10073	10603	11133	11663	12193	12723
	3 1/2	6209	6726	7243	7761	8278	8795	9313	9830	10348	10865	11382	11900	12417
	4	6032	6535	7037	7540	8042	8545	9048	9550	10053	10556	11058	11561	12064
	4 1/2	5832	6318	6804	7289	7775	8261	8747	9233	9719	10205	10691	11177	11663
	5	5608	6075	6542	7010	7477	7944	8412	8879	9346	9814	10281	10748	11216
14	5 1/2	5360	5807	6254	6700	7147	7594	8041	8487	8934	9381	9827	10274	10721
	2 1/2	8942	9687	10432	11177	11922	12668	13413	14158	14903	15648	16393	17138	17884
	3	8812	9547	10281	11015	11750	12484	13218	13953	14687	15421	16156	16890	17624
	3 1/2	8659	9381	10102	10824	11545	12267	12989	13710	14432	15153	15875	16596	17318
	4	8482	9189	9896	10603	11310	12017	12723	13430	14137	14844	15551	16258	16965
	4 1/2	8282	8972	9662	10353	11043	11733	12423	13113	13803	14494	15184	15874	16564
14	5	8058	8730	9401	10073	10744	11416	12087	12759	13430	14102	14773	15445	16116
	5 1/2	7811	8462	9113	9764	10414	11065	11716	12367	13018	13669	14320	14971	15622

Note: "Pull" Forces in Pounds = (Cylinder Bore Diameter)² - (Cylinder Rod Diameter)² x .7854 x Line Pressure

** For operating conditions exceeding the recommended operating pressure, please contact Peninsular Cylinder Company and request an enhanced design. Also, please note that operating pressures are for the cylinder vessel only. Some mounting selections may decrease the recommended operating pressure. Please view our catalog for maximum pressure ratings on your selected mounting style.*



Cylinder Forces

LM Series

Standard Duty Pneumatic Aluminum Construction

- 1.5” to 12.00” Bore
- 24 NFPA Mounting Styles Available

LM series cylinders are designed and constructed from aluminum for Standard duty air applications. Maximum operating pressure is 250 psi.

LM, NFPA Air Cylinders (250 PSI)

"PUSH" - (EXTENDED CYLINDER STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Air Line Pressure (PSI)												Line Pressure ←
	60	65	70	75	80	85	90	95	100	105	110	115	
1 1/2	106	115	124	133	141	150	159	168	177	186	194	203	212
2	188	204	220	236	251	267	283	298	314	330	346	361	377
2 1/2	295	319	344	368	393	417	442	466	491	515	540	565	589
3 1/4	498	539	581	622	664	705	747	788	830	871	913	954	995
4	754	817	880	942	1005	1068	1131	1194	1257	1319	1382	1445	1508
5	1178	1276	1374	1473	1571	1669	1767	1865	1964	2062	2160	2258	2356
6	1696	1838	1979	2121	2262	2403	2545	2686	2827	2969	3110	3252	3393
8	3016	3267	3519	3770	4021	4273	4524	4775	5027	5278	5529	5781	6032
10	4712	5105	5498	5891	6283	6676	7069	7461	7854	8247	8639	9032	9425
12	6786	7351	7917	8482	9048	9613	10179	10744	11310	11875	12441	13006	13572
14	9236	10006	10776	11545	12315	13085	13854	14624	15394	16164	16933	17703	18473

Note: "Push" Forces in Pounds = (Cylinder Bore Diameter)² x .7854 x Line Pressure

"PULL" - (RETRACTED CYLINDER STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Cylinder Rod DIA	Air Line Pressure (PSI)												Line Pressure ←
		60	65	70	75	80	85	90	95	100	105	110	115	
1 1/2	5/8	88	95	102	110	117	124	131	139	146	153	161	168	175
	1	59	64	69	74	79	83	88	93	98	103	108	113	118
2	5/8	170	184	198	213	227	241	255	269	283	298	312	326	340
	1	141	153	165	177	188	200	212	224	236	247	259	271	283
	1 3/8	99	108	116	124	133	141	149	157	166	174	182	191	199
2 1/2	5/8	276	299	322	345	368	391	414	437	460	483	506	529	552
	1	247	268	289	309	330	350	371	392	412	433	454	474	495
	1 3/8	205	223	240	257	274	291	308	325	342	360	377	394	411
3 1/4	1 3/4	150	163	175	188	200	213	225	238	250	263	275	288	300
	1	451	488	526	563	601	638	676	713	751	789	826	864	901
	1 3/8	409	443	477	511	545	579	613	647	681	715	749	783	817
4	1 3/4	353	383	412	442	471	501	530	560	589	619	648	677	707
	2	309	335	361	387	412	438	464	490	515	541	567	593	619
	1	707	766	825	884	942	1001	1060	1119	1178	1237	1296	1355	1414
	1 3/8	665	720	776	831	887	942	997	1053	1108	1164	1219	1274	1330
5	1 3/4	610	660	711	762	813	864	915	965	1016	1067	1118	1169	1219
	2	565	613	660	707	754	801	848	895	942	990	1037	1084	1131
	2 1/2	459	498	536	574	613	651	689	727	766	804	842	881	919
	1	1131	1225	1319	1414	1508	1602	1696	1791	1885	1979	2073	2168	2262
5	1 3/8	1089	1180	1271	1361	1452	1543	1634	1724	1815	1906	1997	2087	2178
	1 3/4	1034	1120	1206	1292	1378	1465	1551	1637	1723	1809	1895	1981	2068
	2	990	1072	1155	1237	1319	1402	1484	1567	1649	1732	1814	1897	1979
	2 1/2	884	957	1031	1104	1178	1252	1325	1399	1473	1546	1620	1694	1767
	3	754	817	880	942	1005	1068	1131	1194	1257	1319	1382	1445	1508
	3 1/2	601	651	701	751	801	851	901	951	1001	1051	1102	1152	1202

This "PULL" Chart is continued on the next page

* For operating conditions exceeding the recommended operating pressure, please contact Peninsular Cylinder Company and request an enhanced design. Also, please note that operating pressures are for the cylinder vessel only. Some mounting selections may decrease the recommended operating pressure. Please view our catalog for maximum pressure ratings on your selected mounting style



Cylinder Forces

LM Series (cont'd)

Standard Duty Pneumatic Aluminum Construction

- 1.5" to 12.00" Bore
- 24 NFPA Mounting Styles Available

LM series cylinders are designed and constructed from aluminum for Standard duty air applications. Maximum operating pressure is 250 psi.

This "PULL" Chart is continued from the previous page

"PULL" - (RETRACTED CYLINDER STROKE) CYLINDER FORCES IN POUNDS

Cylinder Bore Size	Cylinder Rod DIA	Air Line Pressure (PSI)													Line Pressure ←
		60	65	70	75	80	85	90	95	100	105	110	115	120	
6	1 3/8	1607	1741	1875	2009	2143	2277	2411	2545	2679	2813	2947	3081	3215	
	1 3/4	1552	1681	1811	1940	2070	2199	2328	2458	2587	2716	2846	2975	3104	
	2	1508	1634	1759	1885	2011	2136	2262	2388	2513	2639	2765	2890	3016	
	2 1/2	1402	1519	1636	1752	1869	1986	2103	2220	2337	2453	2570	2687	2804	
	3	1272	1378	1484	1590	1696	1802	1909	2015	2121	2227	2333	2439	2545	
	3 1/2	1119	1212	1306	1399	1492	1586	1679	1772	1865	1959	2052	2145	2238	
	4	942	1021	1100	1178	1257	1335	1414	1492	1571	1649	1728	1806	1885	
8	1 3/8	2927	3171	3415	3659	3902	4146	4390	4634	4878	5122	5366	5610	5854	
	1 3/4	2872	3111	3350	3590	3829	4068	4307	4547	4786	5025	5265	5504	5743	
	2	2827	3063	3299	3534	3770	4006	4241	4477	4712	4948	5184	5419	5655	
	2 1/2	2721	2948	3175	3402	3629	3855	4082	4309	4536	4762	4989	5216	5443	
	3	2592	2808	3024	3240	3456	3672	3888	4104	4320	4536	4752	4968	5184	
	3 1/2	2439	2642	2845	3048	3252	3455	3658	3861	4064	4268	4471	4674	4877	
	4	2262	2450	2639	2827	3016	3204	3393	3581	3770	3958	4147	4335	4524	
	4 1/2	2062	2233	2405	2577	2749	2921	3093	3264	3436	3608	3780	3952	4123	
	5	1838	1991	2144	2297	2450	2604	2757	2910	3063	3216	3369	3523	3676	
5 1/2	1590	1723	1856	1988	2121	2253	2386	2518	2651	2783	2916	3048	3181		
10	1 3/4	4568	4949	5329	5710	6091	6471	6852	7233	7613	7994	8375	8755	9136	
	2	4524	4901	5278	5655	6032	6409	6786	7163	7540	7917	8294	8671	9048	
	2 1/2	4418	4786	5154	5522	5891	6259	6627	6995	7363	7731	8099	8468	8836	
	3	4288	4646	5003	5360	5718	6075	6432	6790	7147	7504	7862	8219	8577	
	3 1/2	4135	4480	4824	5169	5514	5858	6203	6547	6892	7236	7581	7926	8270	
	4	3958	4288	4618	4948	5278	5608	5938	6267	6597	6927	7257	7587	7917	
	4 1/2	3758	4071	4384	4698	5011	5324	5637	5950	6264	6577	6890	7203	7516	
	5	3534	3829	4123	4418	4712	5007	5301	5596	5891	6185	6480	6774	7069	
	5 1/2	3287	3561	3835	4109	4383	4656	4930	5204	5478	5752	6026	6300	6574	
12	2	6597	7147	7697	8247	8796	9346	9896	10446	10996	11545	12095	12645	13195	
	2 1/2	6491	7032	7573	8114	8655	9196	9737	10278	10819	11360	11901	12442	12983	
	3	6362	6892	7422	7952	8482	9012	9543	10073	10603	11133	11663	12193	12723	
	3 1/2	6209	6726	7243	7761	8278	8795	9313	9830	10348	10865	11382	11900	12417	
	4	6032	6535	7037	7540	8042	8545	9048	9550	10053	10556	11058	11561	12064	
	4 1/2	5832	6318	6804	7289	7775	8261	8747	9233	9719	10205	10691	11177	11663	
	5	5608	6075	6542	7010	7477	7944	8412	8879	9346	9814	10281	10748	11216	
	5 1/2	5360	5807	6254	6700	7147	7594	8041	8487	8934	9381	9827	10274	10721	
14	2 1/2	8942	9687	10432	11177	11922	12668	13413	14158	14903	15648	16393	17138	17884	
	3	8812	9547	10281	11015	11750	12484	13218	13953	14687	15421	16156	16890	17624	
	3 1/2	8659	9381	10102	10824	11545	12267	12989	13710	14432	15153	15875	16596	17318	
	4	8482	9189	9896	10603	11310	12017	12723	13430	14137	14844	15551	16258	16965	
	4 1/2	8282	8972	9662	10353	11043	11733	12423	13113	13803	14494	15184	15874	16564	
	5	8058	8730	9401	10073	10744	11416	12087	12759	13430	14102	14773	15445	16116	
	5 1/2	7811	8462	9113	9764	10414	11065	11716	12367	13018	13669	14320	14971	15622	

Note: "Pull" Forces in Pounds = (Cylinder Bore Diameter)² - (Cylinder Rod Diameter)² x .7854 x Line Pressure

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Rod Strength & Support

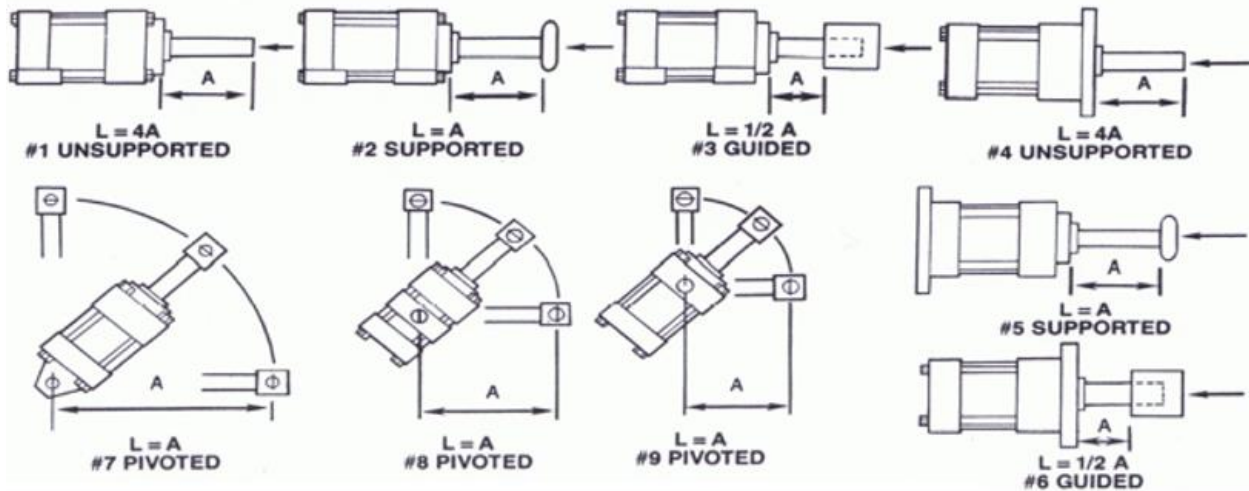


Figure 7

Stop tubes are used to reduce the bearing load encountered in long stroke cylinders when the piston rod is extended.

By separating the piston and rod bearing with a stop tube, the life of the bearing cartridge will be increased and the tendency of the rod to buckle will be reduced.

To determine the length of stop tube required, locate the application in the drawings above and calculate "L" from the cylinder "A" dimension with the piston rod extended. For an "L" longer than 40": one inch of stop is required for every 10" over 40" plus one inch for any remainder.

EXAMPLE: An MP1 Rear Clevis Mount Cylinder with Rod Eye, 4" Bore, 34" Stroke, 2" Rod is operating at 500 PSI.

This application matches Fig. 7 and $L = A$.
 $L = XC \text{ dim.} + 2 \times \text{stroke} + \text{Rod Eye CA dim.}$
 $L = 7.5 + [2 \times 34] + 3.44 = 78.94"$
 $78.94" - 40 = 38.94 = [3 \times 10] + 8.94$

Therefore a 4" stop tube is required.

The required length of stop tube should be added to the cylinder stroke when ordering.

The above cylinder example would be ordered as 38" Gross Stroke

34" Working Stroke with 4" Stop Tube.

This is usually written **38" [34"]w/4" Stop Tube.**

Rod Strength & Support (Column Strength)

To select the optimum rod diameter required for **PUSH STROKE** cylinders:

1. Determine the push stroke thrust using the cylinder forces chart on page 3.
2. Calculate the "L" value as for a stop tube and add stop tube length to given Working Stroke to obtain the Gross Stroke
3. Locate the push stroke thrust in the left-hand column of the table below. If the exact thrust is not shown, use the next higher value.
4. Locate the calculated "L" length in the row across from the thrust value selected. If the exact "L" length is not shown use the next longer value.
5. Find the minimum rod diameter for the application at the top of the column in which the "L" value is located.

Using the same cylinder as in the stop tube example, where "L" = 82.94" including 4" stop tube.

1. Find 6285 lbs. force or the next higher value in first column. Use 8000 lbs. as the nearest higher value.
2. Move across the row to 92, the next higher entry to 82.94. At the top of the column is found the optimum rod diameter for the application. A 2" dia. piston rod is required. By changing the cylinder mounting to a MT1 Head Trunnion which reduces the "L" dimension a standard 1 3/8" piston rod may be used.



THRUST "T" IN POUNDS FORCE AT END OF ROD	Maximum "L" lengths for 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	6	7	7 1/2	8	8 1/2
100	58	110															
250	43	94	146														
400	37	83	134	186													
700	30	68	118	168	202												
1000	27	60	105	155	190	257											
1400	24	53	92	142	174	244	308										
1800	22	48	82	127	160	230	296	366	440								
2400	19	45	75	114	145	213	281	347	415								
3200	16	41	67	103	130	194	261	329	400	451							
4000	13	38	63	94	119	175	240	310	378	446							
5000	9	34	60	87	110	163	225	289	360	426	494						
6000		30	56	82	102	152	208	274	342	410	476						
8000		26	50	76	93	137	188	245	310	375	447						
10000		21	45	70	89	125	172	222	279	349	412	482					
12000		17	41	65	84	118	152	210	269	326	388	454					
16000			34	57	75	110	142	180	235	292	350	420	488				
20000			28	52	68	103	136	172	218	270	326	385	442				
30000				39	55	87	120	156	189	230	285	330	377	484			
40000				22	43	74	108	142	177	210	248	294	341	441			
50000					30	66	96	130	165	200	234	269	316	408	447		
60000						57	88	119	154	190	225	256	298	384	422		
80000						36	71	104	137	170	204	240	274	348	382	420	
100000							57	90	120	154	189	222	258	324	363	400	435
120000							45	77	108	146	175	207	245	313	347	377	417
140000								64	98	128	160	194	230	301	331	365	402
160000								47	86	118	148	182	216	279	319	350	386
200000									67	98	131	161	191	260	296	330	366
250000										72	109	141	170	236	270	301	340
300000											86	120	150	212	247	281	315
350000											52	100	132	195	228	261	294
400000												77	113	182	212	241	273
500000													84	152	182	212	240
600000														114	159	183	217

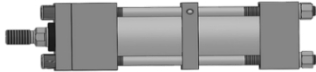
The information herein supplied is a cylinder industry accepted theoretical value only and may or may not represent actual results. The sole responsibility for application design suitability is with the purchaser or entities other than Peninsular Cylinders LLC, and does not supersede any published warranties by Peninsular Cylinder LLC.

Tie Rod Support

When considering long stroke, long bodied cylinders, it is recommended to use intermediate supports to resist cylinder sag and excessive vibration. Both may contribute to greatly reduce the life of cylinder seals and excessive wear of cylinder components. Depending upon bore size and mounting configuration, an intermediate mount or an intermediate tie rod support may be used.

Tie rod supports (Fig. 4) can be used for pivoting mounts such as clevis (G-mount), pivot (D-mount) and end cover trunnion mounts (ER/EB-mount) to support tie rods.

Figure 4 Tie Rod Support



The chart below may be used as a guide to determine whether supports are necessary for the application under consideration.

Intermediate Support Table

Bore Size (by Series)		Minimum Stroke Lengths for Support
HP	LH-MH	
	1.50	50
	2.00	60
	2.50	60
1.5	3.25	75
	4.00	75
2.00	5.00	90
2.50	6.00	90
3.25	8.00	90
4.00		90
	10.00	160
	12.00	160
5.00 or larger	14.00 or larger	220



Cylinder Piston Speed

Bore Size	Rod	Effective Area	Theoretic Hydraulic Piston Speeds in Inches Per Minute (IN/M)									
			1 GPM	5 GPM	10 GPM	15 GPM	20 GPM	25 GPM	30 GPM	40 GPM	50 GPM	75 GPM
1.50	EXTEND	1.77	131	653								
	0.63	1.46	159	792								
	0.75	1.33	174									
	1.00	0.98	236									
2.00	EXTEND	3.14	74	368	736							
	0.63	2.83	82	409	817							
	0.75	2.70	86	428	856							
	1.00	2.36	98	490								
	1.38	1.66	140	696								
2.50	EXTEND	4.91	48	236	471	706	941					
	0.63	4.60	51	252	503	754						
	1.00	4.12	57	281	561	842						
	1.38	3.42	68	338	676							
	1.75	2.50	93	462	924							
3.00	EXTEND	7.07	33	164	327	491	654	817	981			
	1.00	6.28	37	184	368	552	736	920				
3.25	EXTEND	8.30	28	140	279	418	557	696	835			
	1.00	7.51	31	154	308	462	616	769	923			
	1.38	6.81	34	170	340	509	679	849				
	1.75	5.89	40	197	393	589	785	981				
	2.00	5.15	45	225	449	673	898	1122				
3.50	EXTEND	9.62	25	121	241	361	481	601	721	961		
	1.25	8.39	28	138	276	413	551	689	826			
4.00	EXTEND	12.57	19	92	184	276	368	460	552	736	919	
	1.00	11.78	20	99	197	295	393	491	589	785	981	
	1.25	11.34	21	102	204	306	408	510	612	815		
	1.38	11.08	21	105	209	313	417	522	626	834		
	1.75	10.16	23	114	228	342	455	569	683	910		
	2.00	9.42	25	123	246	368	491	614	736	981		
	2.50	7.66	31	151	302	453	604	754	905			
5.00	EXTEND	19.64	12	59	118	177	236	295	353	471	589	883
	1.00	18.85	13	62	123	184	246	307	368	491	613	920
	1.38	18.15	13	64	128	191	255	319	382	510	637	955
	1.50	17.87	13	65	130	194	259	324	388	518	647	970
	1.75	17.23	14	68	135	202	269	336	403	537	671	
	2.00	16.49	15	71	141	211	281	351	421	561	701	
	2.50	14.73	16	79	157	236	314	393	471	628	785	
	3.00	12.57	19	92	184	276	368	460	552	736	919	
6.00	EXTEND	28.27	9	41	82	123	164	205	246	327	409	613
	1.38	26.79	9	44	87	130	173	216	259	345	432	647
	1.75	25.87	9	45	90	134	179	224	268	358	447	670
	2.00	25.13	10	46	92	138	184	230	276	368	460	690
	2.50	23.37	10	50	99	149	198	248	297	396	495	742
	3.00	21.21	11	55	109	164	218	273	327	436	545	817
7.00	EXTEND	38.48	7	31	61	91	121	151	181	241	301	451
	3.00	31.42	8	37	74	111	148	184	221	295	368	552
	3.50	28.86	9	41	81	121	161	201	241	321	401	601
	4.00	25.92	9	45	90	134	179	223	268	357	446	669
	4.50	22.58	11	52	103	154	205	256	307	410	512	768
	5.00	18.85	13	62	123	184	246	307	368	491	613	920
8.00	EXTEND	50.27	5	23	46	69	92	115	138	184	230	345
	1.38	48.78	5	24	48	72	95	119	143	190	237	356
	1.75	47.86	5	25	49	73	97	121	145	194	242	362
	2.00	47.12	5	25	50	74	99	123	148	197	246	368
	2.50	45.36	6	26	51	77	102	128	153	204	255	382
	3.00	43.20	6	27	54	81	107	134	161	214	268	402
	3.50	40.64	6	29	57	86	114	143	171	228	285	427
	4.00	37.70	7	31	62	92	123	154	184	246	307	460
	4.50	34.36	7	34	68	101	135	169	202	269	337	505
	5.00	30.63	8	38	76	114	151	189	227	302	378	566
	5.50	26.51	9	44	88	131	175	218	262	349	436	654



Flow & Porting

Hydraulic Flow Rates

A major factor in determining the speed of a hydraulic cylinder piston is the flow through the connecting lines, generally expressed in gallons per minute (GPM), and measured as the input/exhaust flow through the cylinder cap end cover port. Due to fluid displacement of the piston rod, flow through the head end cover port will be less than the cap end cover port. Fluid velocity or line velocity, should be limited to 15 feet per second (ft/s) to minimize fluid turbulence, pressure drop, and hydraulic shock. Hydraulic flow velocity is determined by dividing the flow in GPM required by application speed, by the effective area of the port or supply line.

$$\text{VELOCITY} = \frac{\text{FLOW (GPM)}}{\text{PORT}} \quad \text{or} \quad v = \frac{Q}{A}$$

The Hydraulic Flow Rate Chart in conjunction with the Hydraulic Piston Speed Chart can be used as a guide in determining whether standard cylinder ports are adequate for the application. The Hydraulic Flow Rate Chart returns flow rates in feet per second (ft/s), by flow in GPM and port size in inches, with connecting lines using Schedule 80 pipe.

If piston speed results in fluid flow in excess of 15 ft/s for port sizes listed, consider the use of larger lines with oversized welded half coupling ports, or utilize two ports per end cover connected to provide the fluid flow required.

“This information should be used as a guide for your consideration, investigation, and verification. This information does not constitute a warranty or representation and we assume no legal responsibility or obligation with respect thereto, and the use to which such information may be put.”

Port Size	Effective Area	Theoretic Hydraulic Flow Velocity in Feet Per Second (ft/s)											
		1 GPM	5 GPM	10 GPM	15 GPM	20 GPM	25 GPM	30 GPM	40 GPM	50 GPM	75 GPM	100 GPM	
0.38	0.141	2.30	11.40										
0.50	0.234	1.40	6.90	13.70									
0.75	0.432		3.70	7.40	11.10	14.90							
1.00	0.719		2.20	4.50	6.70	8.90	11.20	13.40					
1.25	1.282		1.30	2.50	3.80	5.00	6.30	7.50	10.00	12.50			
1.50	1.766			1.80	2.70	3.60	4.50	5.50	7.30	9.10	13.60		
2.00	2.951			1.10	1.60	2.20	2.70	3.30	4.30	5.40	8.20	10.90	
2.50	4.236				1.10	1.50	1.90	2.30	3.00	3.80	5.70	7.60	
3.00	6.600					1.00	1.20	1.50	1.90	2.40	3.60	4.90	



Port Sizes & Options

Peninsular will locate a port in any position specified. When observing the cylinder from the rod end port location starts at 1. Rotating clockwise to 2, 3 and 4. Depending on the mounting style a port can also be located in the axial center of the cap end or port position 5. Port positions must be identified in the ordering code. Oversized ports can be accomplished by either welding a coupling on the end cover or increasing the width of the end cover.

NOTE: Alternate port positions specifically in the 2 and 4 position may interfere with mounts or mounting bolts, please review catalog dimensions and/or a cad generated drawing for dimensions.

Bore	NPTF*		SAE		BSPP		BSPT		SAE Code 61	SAE Code 62
	HP	MH, LH, LM	HP	MH, LH, LM	HP	MH, LH, LM	HP	MH, LH, LM	HP	HP
1.50	1/2	3/8	8	6	1/2	3/8	1/2	3/8		
2.00	1/2	3/8	8	6	1/2	3/8	1/2	3/8		
2.50	1/2	3/8	8	6	1/2	3/8	1/2	3/8	1/2	1/2
3.00										
3.25	3/4	1/2	12	10	3/4	1/2	3/4	1/2	3/4	3/4
3.50										
4.00	3/4	1/2	12	10	3/4	1/2	3/4	1/2	3/4	3/4
5.00	3/4	1/2	12	10	3/4	1/2	3/4	1/2	3/4	3/4
6.00	1	3/4	16	12	1	3/4	1	3/4	1	1
7.00	1 1/4		20		1 1/4		1 1/4		1 1/4	1 1/4
8.00	1 1/2	3/4	24	12	1 1/2	3/4	1 1/2	3/4	1 1/2	1 1/2
10.00	2	1	24	16	2	1	2	1	2	2
12.00	2 1/2	1	24	16	2 1/2	1	2 1/2	1	2 1/2	2 1/2
14.00	2 1/2	1 1/4	24	20	2 1/2	1 1/4	2 1/2	1 1/4	2 1/2	2 1/2
16.00	3	1 1/4			3	1 1/4	3	1 1/4	3	3
18.00	3	1 1/2			3	1 1/2	3	1 1/2	3	3
20.00	3	2			3	2	3	2	3	3

*Standard port issued if no port type is specified.



Temperature & Fluid Types

Temperature

Peninsular standard cylinders are designed to operate between -20 degrees F to + 200 degrees F.

Please consult your local authorized distributor or contact the factory regarding seal requirements that will operate outside the defined range.

Fluid Types

Peninsular standard cylinders incorporate polyurethane and/or carboxylated nitrile seals. These seals are compatible with any quality grade petroleum based hydraulic fluid.

Below please find a compatibility chart for temperatures and fluid compatibility which is best suited for your application.

Fluid Compatibility Reference

Fluid Type	Trade Name	Buna-N -30°F to 250°F	Polyurethane -40°F to 180°F	Viton® -15°F to 400°F	Teflon® -300°F to 400°F	Ethylene- Propylene -70°F to 250°F
Brake Fluid		3	4	4	1	1
Gasoline		1	3	1	1	4
Transmission Fluid (ATF)		1	1	1	1	4
Petroleum Base Oil	Preservative Oil	1	1	1	1	1
Petroleum Base Oil	Aircraft Hydraulic Fluid	1	1	1	1	1
HWBF (95-5)		1	4	1	1	1
Water Glycol	Houghto-Safe 600	1	4	2	1	1
	Houghto-Safe 500	1	4	4	1	1
	Houghto-Safe 271	1	4	2	1	1
	Unicon Hydrolube J4	1	4	1	1	1
	Celluguard	1	4	1	1	1
Water/Oil Emulsions	Houghto-Safe 5000	1	4	1	1	4
	Gulf FR	1	1	1	1	4
	Pyrogard C & D	1	1	4	1	4
Phosphate-Ester	Houghto-Safe 1000	4	4	1	1	1
	Houghto-Safe 1120	4	4	1	1	2
	Fryquell (Cellulube)	4	4	4	1	4
	Pyrogard 42,43,53,55,190,600	4	4	1	1	1
	Skydrol 500 Type 2	4	4	4	1	1
	Skydrol 7000 Type 2	4	4	2	1	1
	Pydraul 312C,230C,540C	4	4	1	1	4
	Pydraul 10E	4	4	4	1	1
	Pydraul 29ELT,30E,50E,65E	4	4	1	1	1
Silicate Ester	OS-45 Type 3 & 4	2	4	1	1	4
	Oronite 8200	2	1	1	1	4
	Oronite 8515	2	1	1	1	4
	Brayco 846	2	3	4	1	1

1=Recommended

2=Satisfactory

3=Doubtful

4=Not recommended

Cylinder Options

Cylinder Construction

Peninsular Cylinder offers a large amount of variations in cylinder construction.

Descriptions of the more common variations are described below, however Peninsular Cylinder Company's engineering staff are capable of designing many more special applications at your request.

Multi-stage Cylinders

Multi-stage cylinders combine multiple cylinders at different stroke lengths.

Piston rods between the cylinders are not connected. This allows each cylinder to be energized independently in sequence to produce multiple stroke levels out of the foremost cylinder.

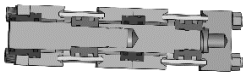
MULTI-STAGE CYLINDER



Tandem Cylinders

Tandem cylinders are a combination of two cylinders of the same stroke length used in tandem to double cylinder force output. The pistons between the two cylinders are connected with a common rod. For proper results, cylinders in the tandem arrangement should be energized simultaneously.

Tandem Cylinder



Duplex Cylinder

Duplex cylinders are two independent cylinders combined together back-to-back. They share common tie rods.

Duplex Cylinder



Double Rod End Cylinder

Double rod end cylinders have two rods exiting at either end of the cylinder attached to a single piston. The advantage of double rod end cylinders is that they produce equal force and equal speed in either direction, while performing two operations with one stroke.

Double Rod End Cylinder



Rod Gland Options

Metallic Rod Scrapers

Metallic rod scrapers should be used in place of synthetic wiper seals in applications where contaminants may cling or stick to the extended piston rod. Metallic rod scrapers are available upon request.

Rod Gland Drains

In applications where external weepage from the piston rod in hydraulic cylinder cannot be tolerated, rod gland drains offer a path for trapped fluid, between the rod seal and the rod wiper, to be drained back to tank. Monitoring the amount of fluid being drained can help gauge the wear of rod seals to determine if replacement is necessary.

Rod Gland Drain



Other Options and Add-ons

Stainless Steel Piston Rods

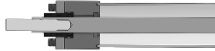
In applications where the piston rod may be subjected to water, special wash-downs, or weather, stainless steel piston rods should be considered. Peninsular stocks, but is not limited to, 303 and 17-4 ph stainless steel rod stock. Other commonly used stainless materials, such as 304 and 316, are available upon request.

Cylinder Options (cont'd)

Studded Rod Ends

Peninsular Cylinder Company offers studded rod ends for applications held in high tension where it may be possible to break or shear standard machined rod ends. For rod sizes 5/8" to 2 1/2", a rolled thread stud can be threaded into a standard female rod end. Studded rod ends offer higher resistance to thread shear and are more economical to replace in case of fracture.

Rod Stud (studded rod ends)



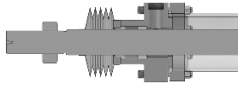
Rod Boots

For applications where the piston rod may be exposed to contaminants with air hardening properties, such as tar, a rod boot or bellows may be suggested. Rod boots are a collapsible cover over the piston rod. The addition of a rod boot will increase rod extension lengths to accommodate the collapsed boot length. To calculate WF with a rod boot, use the table below to determine the collapsed boot length by multiplying the cylinder stroke by the "Boot Factor" (BF), add 1 1/8" and then add C.

$$WF = (BF \times \text{stroke}) + C + 1 \frac{1}{8}"$$

Rod Boot Factor Table

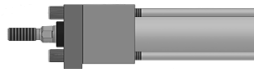
Rod Diameter	5/8	1	1 3/8	1 1/4	2	2 1/2	3	3 1/2	4
BF	.10	.10	.10	.10	.10	.10	.09	.09	.09
OD	2 1/4	2 5/8	3	3 3/8	3 7/8	4 3/8	5 1/8	5 5/8	6 1/4
C	3/8	1/2	5/8	3/4	7/8	1	1	1	1



Rod Boot

Extended Key Retainer Plates

Extended key retainer plates are extended, full-faced rod bearing retainer plates with a mill cut to form a key. The key should be fitted to a milled slot in the mounting surface of the application. Used with side and foot mounted cylinders, extended key retainer plates assure the cylinder will not shift while in operation.



Extended Key Retainer Plate

Air Bleeds

Air bleeds are used for bleeding air out of a hydraulic cylinder. Peninsular places air bleeds in the tube at the highest point. Air is bled from the cylinder by backing out the threaded plug to allow air to pass by the threads and applying slight pressure to the opposite side of the cylinder. Air bleeds can be ordered at either end or both ends of a cylinder.

Stroke Adjusts

Stroke adjusters can be used for applications where the stroke or travel may need to vary. Stroke adjustment is accomplished by threading a post through the end cover of the cylinder and locking it in place with a seal nut. Threading the post in or backing the post out will vary the piston travel.



Stroke adjust on retract

Approximate Cylinder Weights



Bore Size	Rod Code	Basic Weight (in lbs.)	Model HP NFPA High Pressure Cylinder											Per in stroke (in lbs.)
			Mount Style											
			5	4	6	3	1&15	12	8,11	18	17	14	2&7	
1.50	1	7	8	8	9	8	8	7	7	9	9	8	8	1
	1	8	9	8	10	8	8	8	8	9	9	9	8	1
2.00	1	12	14	13	16	13	13	12	12	16	15	13	13	1
	1	12	15	14	17	13	14	13	13	16	15	14	13	1
2.50	1	16	19	17	22	17	19	17	17	21	19	18	17	1
	1	17	20	18	23	18	20	17	17	21	20	19	18	2
	2	18	21	19	24	19	21	19	18	23	21	20	19	2
3.25	1	33	39	35	42	36	36	34	33	43	40	37	35	2
	2	34	40	36	43	37	37	35	34	43	40	38	36	3
	2	34	40	37	43	38	37	35	35	44	41	39	37	3
4.00	2	44	53	47	54	50	50	45	45	57	53	49	46	3
	2	45	54	48	55	51	51	46	46	58	54	49	47	3
	3	47	55	50	56	52	53	48	47	60	56	51	49	4
5.00	2	79	93	83	93	87	85	82	80	100	92	88	81	5
	3	81	95	86	96	89	87	84	83	102	95	91	83	5
	3	84	99	89	99	92	91	88	86	105	98	94	87	7
	4	85	100	90	100	93	92	89	87	106	99	95	88	8
6.00	3	124	145	131	143	137	136	128	126	152	145	138	127	7
	3	126	147	133	145	139	138	130	128	158	147	140	129	8
	4	128	149	135	147	141	140	132	130	160	149	142	131	9
	4	132	153	139	151	145	144	136	134	164	151	146	135	11
7.00	3	186	214	195	218	209	206	193	190	227	213	205	193	9
	4	187	215	196	219	210	207	194	191	228	214	206	194	10
	4	192	220	201	224	215	212	199	196	233	219	211	199	12
	5	195	223	204	227	218	215	202	199	236	222	214	202	14
	5	200	228	209	232	223	220	207	204	241	227	219	207	16
8.00	4	255	289	265	287	280	276	264	259	304	284	279	262	12
	4	260	294	270	292	285	281	269	264	309	289	284	267	13
	5	264	298	274	296	289	285	273	268	313	293	288	271	14
	5	268	302	278	300	293	289	277	272	317	297	292	275	18
	6	275	309	285	307	300	296	284	279	324	304	299	282	20
10.00	5	533	647	583	667	614	562	—	—	706	682	-	552	20
	5	540	655	628	674	621	569	—	—	713	686	-	559	22
	6	551	665	635	695	632	580	—	—	724	694	-	570	25
	7	588	703	690	722	669	618	—	—	761	718	-	607	33
12.00	6	882	1061	1026	1105	984	967	—	—	1137	1102	-	910	29
	7	921	1100	1051	1144	1024	1006	—	—	1176	1127	-	950	37
	9	981	1160	1090	1204	1083	1066	—	—	1236	1166	-	1009	47
14.00	7	1391	1681	1620	1748	1637	1561	—	—	1816	1755	-	1446	45
	9	1453	1743	1658	1811	1700	1623	—	—	1878	1793	-	1509	55
	10	1525	1815	1708	1882	1771	1695	—	—	1950	1843	-	1580	68

To Calculate Approximate Cylinder Weight:
 Find the "Base Weight" with mount.
 Multiply the inches of stroke by "Per Inch Stroke" weight.
 Add the Base and Per Inch Stroke weights together.

To Calculate for Double Rod End Cylinders:
 Multiply the "Base Weight" by 1.16
 Multiply the inches of stroke by "Per Inch Stroke" weight
 Add the Base and Per Inch Stroke weights together.

To estimate for Packaging Weight:
 Add 10% of the total cylinder weight.

Cylinder weight is difficult to accurately estimate due to variations in stroke, cylinder construction, and modifications. Our weight charts provide a good estimate of basic cylinder weights. Peninsular cannot be held responsible for differences in freight charges based upon estimated weight. Accurate weight and dimension can be made available from Peninsular sales on the day of shipment



Bore Size	Rod Code	Basic Weight (in lbs.)	Model MH Heavy Duty Steel Air Cylinder & Model LH Pressure Rated Hydraulic Cylinder											Per in. Stroke (in lbs.)
			Mount Style											
			5	4	6	3	1&15	12	8&11	18	17	14	2&7	
1.50	1	4	5	5	6	4	5	4	4	5	5	5	5	0.5
	1	4	5	5	6	5	5	4	4	6	5	5	5	1
2	1	7	8	7	9	7	7	7	7	8	8	7	7	1
	1	7	8	7	10	7	8	7	7	9	8	8	7	1
2.5	1	10	11	10	13	10	10	10	10	12	11	11	10	1
	2	11	12	11	14	11	11	11	11	13	12	12	11	2
3.25	1	18	22	18	23	19	19	18	18	23	20	20	18	1
	2	19	22	20	24	20	20	19	19	24	21	21	19	2
4	1	26	30	28	34	27	27	26	26	32	29	29	26	1
	2	27	32	29	36	28	29	28	27	33	31	30	28	2
	3	29	34	30	38	30	31	30	30	35	33	32	30	3
5	1	41	48	42	56	42	44	42	41	50	45	46	41	1
	2	42	49	44	57	43	46	43	42	51	46	47	42	2
	3	44	51	46	59	45	48	45	45	53	48	49	45	2
	4	48	55	50	63	49	52	49	48	57	52	53	48	4
6	1	64	75	66	90	66	67	65	64	78	69	71	65	2
	2	66	77	68	92	68	69	66	66	80	71	72	67	3
	3	69	80	71	96	72	73	70	70	84	75	76	71	4
	4	75	86	77	101	77	78	76	75	89	80	81	76	5
8	1	100	—	—	146	103	104	102	101	100	100	113	101	3
	3	105	—	—	151	108	109	107	106	105	105	118	106	4
	4	112	—	—	158	115	116	114	113	112	111	125	113	5
	5	121	—	—	168	124	125	123	122	121	121	134	123	7
	5	127	—	—	173	129	130	128	128	126	126	139	128	8
	6	133	—	—	179	135	136	135	134	132	132	145	134	9
10	2	189	—	—	266	195	196	191	190	188	187	212	191	4
	3	193	—	—	270	199	200	195	194	192	191	216	195	5
	4	200	—	—	277	206	207	202	201	199	198	223	202	6
	5	209	—	—	286	215	216	211	210	208	207	232	211	8
	5	215	—	—	292	221	222	217	216	214	213	238	217	9
	6	221	—	—	298	227	228	223	222	220	220	244	224	10
12	2	289	—	—	406	299	296	291	290	288	287	323	291	8
	4	299	—	—	416	309	306	301	300	298	297	333	301	10
	5	308	—	—	425	318	315	310	309	307	306	342	310	11
	5	314	—	—	431	324	321	316	315	313	312	348	316	12
	6	320	—	—	437	330	327	322	321	319	319	355	322	14
14	3	454	—	—	625	467	467	458	456	453	452	509	457	7
	4	461	—	—	632	474	474	465	463	460	459	516	464	8
	5	471	—	—	642	484	484	475	473	470	469	526	474	10
	5	477	—	—	648	490	490	481	479	476	475	532	480	11
6	484	—	—	655	496	497	488	486	482	482	538	487	12	

To Calculate Approximate Cylinder Weight:
 Find the "Base Weight" with mount.
 Multiply the inches of stroke by "Per Inch Stroke" weight.
 Add the Base and Per Inch Stroke weights together.

To Calculate for Double Rod End Cylinders:
 Multiply the "Base Weight" by 1.16
 Multiply the inches of stroke by "Per Inch Stroke" weight
 Add the Base and Per Inch Stroke weights together.

To estimate for Packaging Weight:
 Add 10% of the total cylinder weight.

Cylinder weight is difficult to accurately estimate due to variations in stroke, cylinder construction, and modifications. Our weight charts provide a good estimate of basic cylinder weights. Peninsular cannot be held responsible for differences in freight charges based upon estimated weight. Accurate weight and dimension can be made available from Peninsular sales on the day of shipment.



Bore Size	Basic Weight (in lbs.)	LM Series Cylinder Weights Mounting Styles			
		5,4	1,14	3, 25	Per Inch Stroke (in lbs.)
1.50	2	3	2	2	0.5
2.00	2	3	3	3	0.5
2.50	3	4	5	5	0.5
3.25	6	9	7	7	1
4.00	8	12	9	9	1

<p>To Calculate Approximate Cylinder Weight: Find the "Base Weight" with mount. Multiply the inches of stroke by "Per Inch Stroke" weight. Add the Base and Per Inch Stroke weights together.</p>	<p>To Calculate for Double Rod End Cylinders: Multiply the "Base Weight" by 1.16 Multiple the inches of stroke by "Per Inch Stroke" weight Add the Base and Per Inch Stroke weights together.</p>	<p>To estimate for Packaging Weight: Add 10% of the total cylinder weight.</p>	<p>Cylinder weight is difficult to accurately estimate due to variations in stroke, cylinder construction, and modifications. Our weight charts provide a good estimate of basic cylinder weights. Peninsular cannot be held responsible for differences in freight charges based upon estimated weight. Accurate weight and dimension can be made available from Peninsular sales on the day of shipment</p>
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Seal & Repair Kits



Standard Cylinder Seal & Repair Kits HP Series-High Pressure Hydraulic, 1.5" Through 8.0" Bore Sizes				
		Complete Cylinder Seal Kits	Complete Cylinder Repair Kits	Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Standard Seals	Standard Seals	Standard Seals
		Part #	Part #	Part #
1.50	A = .62	SKHP1506	RKHP1506	CKHP5601
	B = 1.00	SKHP1510	RKHP1510	CKHP5602
2.00	A = 1.00	SKHP2010	RKHP2010	CKHP5602
	B = 1.38	SKHP2013	RKHP2013	CKHP5603
2.50	A = 1.00	SKHP2510	RKHP2510	CKHP5602
	B = 1.38	SKHP2513	RKHP2513	CKHP5603
	C = 1.75	SKHP2517	RKHP2517	CKHP5604
3.25	A = 1.38	SKHP3213	RKHP3213	CKHP5603
	B = 1.75	SKHP3217	RKHP3217	CKHP5604
	C = 2.00	SKHP3220	RKHP3220	CKHP5605
4.00	A = 1.75	SKHP4017	RKHP4017	CKHP5604
	B = 2.00	SKHP4020	RKHP4020	CKHP5605
	C = 2.50	SKHP4025	RKHP4025	CKHP5606
5.00	A = 2.00	SKHP5020	RKHP5020	CKHP5605
	B = 2.50	SKHP5025	RKHP5025	CKHP5606
	C = 3.00	SKHP5030	RKHP5030	CKHP5610
	D = 3.50	SKHP5035	RKHP5035	CKHP5607
6.00	A = 2.50	SKHP6025	RKHP6025	CKHP5606
	B = 3.00	SKHP6030	RKHP6030	CKHP5610
	C = 3.50	SKHP6035	RKHP6035	CKHP5607
	D = 4.00	SKHP6040	RKHP6040	CKHP5608
7.00	A = 3.00	SKHP7030	RKHP7030	CKHP5610
	B = 3.50	SKHP0735	RKHP0735	CKHP5607
	C = 4.00	SKHP0740	RKHP0740	CKHP5608
	D = 4.50	SKHP0745	RKHP0745	CKHP5613
	A = 5.00	SKHP0750	RKHP0750	CKHP5617
8.00	A = 3.50	SKHP8035	RKHP8035	CKHP5607
	B = 4.00	SKHP8040	RKHP8040	CKHP5608
	D = 4.50	SKHP8045	RKHP8045	CKHP5613
	E = 5.00	SKHP8050	RKHP8050	CKHP5617
	C = 5.50	SKHP8055	RKHP8055	CKHP5618



Viton Cylinder Seal & Repair Kits HP Series-High Pressure Hydraulic 1.5" Through 8.0" Bore Sizes				
		Complete Cylinder Seal Kits	Complete Cylinder Repair Kits	Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Viton Seals	Viton Seals	Viton Seals
		Part #	Part #	Part #
1.50	A = .62	SKHP1506V	RKHP1506V	CKHP5601V
	B = 1.00	SKHP1510V	RKHP1510V	CKHP5602V
2.00	A = 1.00	SKHP2010V	RKHP2010V	CKHP5602V
	B = 1.38	SKHP2013V	RKHP2013V	CKHP5603V
2.50	A = 1.00	SKHP2510V	RKHP2510V	CKHP5602V
	B = 1.38	SKHP2513V	RKHP2513V	CKHP5603V
	C = 1.75	SKHP2517V	RKHP2517V	CKHP5604V
3.25	A = 1.38	SKHP3213V	RKHP3213V	CKHP5603V
	B = 1.75	SKHP3217V	RKHP3217V	CKHP5604V
	C = 2.00	SKHP3220V	RKHP3220V	CKHP5605V
4.00	A = 1.75	SKHP4017V	RKHP4017V	CKHP5604V
	B = 2.00	SKHP4020V	RKHP4020V	CKHP5605V
	C = 2.50	SKHP4025V	RKHP4025V	CKHP5606V
5.00	A = 2.00	SKHP5020V	RKHP5020V	CKHP5605V
	B = 2.50	SKHP5025V	RKHP5025V	CKHP5606V
	C = 3.00	SKHP5030V	RKHP5030V	CKHP5610V
	D = 3.50	SKHP5035V	RKHP5035V	CKHP5607V
6.00	A = 2.50	SKHP6025V	RKHP6025V	CKHP5606V
	B = 3.00	SKHP6030V	RKHP6030V	CKHP5610V
	C = 3.50	SKHP6035V	RKHP6035V	CKHP5607V
	D = 4.00	SKHP6040V	RKHP6040V	CKHP5608V
7.00	A = 3.00	SKHP7030V	RKHP7030V	CKHP5610V
	B = 3.50	SKHP0735V	RKHP0735V	CKHP5607V
	C = 4.00	SKHP0740V	RKHP0740V	CKHP5608V
	D = 4.50	SKHP0745V	RKHP0745V	CKHP5613V
	A = 5.00	SKHP0750V	RKHP0750V	CKHP5617V
8.00	A = 3.50	SKHP8035V	RKHP8035V	CKHP5607V
	B = 4.00	SKHP8040V	RKHP8040V	CKHP5608V
	D = 4.50	SKHP8045V	RKHP8045V	CKHP5613V
	E = 5.00	SKHP8050V	RKHP8050V	CKHP5617V
	C = 5.50	SKHP8055V	RKHP8055V	CKHP5618V

Standard Cylinder Seal & Repair Kits				
HP-High Pressure Hydraulic Cylinder 10.00" through 14.00" Bore Sizes				
		Standard Complete Cylinder Seal Kits	Standard Complete Cylinder Repair Kits	Standard Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Standard Seals	Standard Seals	Standard Seals
		Part #	Part #	Part #
10.00	D = 4.50	SKHP10045	RKHP10045	CKHP5613
	E = 5.00	SKHP10050	RKHP10050	CKHP5617
	B = 5.50	SKHP10055	RKHP10055	CKHP5618
	C = 7.00	SKHP10070	RKHP10070	CKHP5615
12.00	A = 5.50	SKHP12055	RKHP12055	CKHP5618
	C = 7.00	SKHP12070	RKHP12070	CKHP5615
	D = 8.50	SKHP12080	RKHP12080	CKHP5616
14.00	A = 7.00	SKHP14070	RKHP14070	CKHP5615
	B = 8.50	SKHP14085	RKHP14085	CKHP5616
	D = 10.00	SKHP14100	RKHP14100	CKHP5617
Viton Seal & Repair Kits, 10.00" through 14.00" Bore Sizes for HP-High Pressure Hydraulic Cylinder				
		Viton Complete Cylinder Seal Kits	Viton Complete Cylinder Repair Kits	Viton Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Standard Seals	Standard Seals	Standard Seals
		Part #	Part #	Part #
10.00	D = 4.50	SKHP10045V	RKHP10045V	CKHP5613V
	E = 5.00	SKHP10050V	RKHP10050V	CKHP5617V
	B = 5.50	SKHP10055V	RKHP10055V	CKHP5618V
	C = 7.00	SKHP10070V	RKHP10070V	CKHP5615V
12.00	A = 5.50	SKHP12055V	RKHP12055V	CKHP5618V
	C = 7.00	SKHP12070V	RKHP12070V	CKHP5615V
	D = 8.50	SKHP12080V	RKHP12080V	CKHP5616V
14.00	A = 7.00	SKHP14070V	RKHP14070V	CKHP5615V
	B = 8.50	SKHP14085V	RKHP14085V	CKHP5616V
	D = 10.00	SKHP14100V	RKHP14100V	CKHP5617V



Standard Cylinder Seals & Repair Kits
MH Series-Heavy Duty Steel Air Cylinder
1.5 " through 8.0" Bore Sizes

		Complete Cylinder Seal Kits	Complete Cylinder Repair Kits	Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Standard Seals	Standard Seals	Standard Seals
		Part #	Part #	Part #
1.50	A = .62	SKMH1506	RKMH1506	CKMH0507
	B = 1.00	SKMH1510	RKMH1510	CKMH0508
2.00	A = .62	SKMH2006	RKMH2006	CKMH0507
	B = 1.00	SKMH2010	RKMH2010	CKMH0508
	C = 1.38	SKMH2013	RKMH2013	CKMH0509
2.50	A = .62	SKMH2506	RKMH2506	CKMH0513
	B = 1.00	SKMH2510	RKMH2510	CKMH0508
	C = 1.38	SKMH2513	RKMH2513	CKMH0509
	D = 1.75	SKMH2517	RKMH2517	CKMH0515
3.25	A = 1.00	SKMH3210	RKMH3210	CKMH0514
	B = 1.38	SKMH3213	RKMH3213	CKMH0509
	C = 1.75	SKMH3217	RKMH3217	CKMH0515
	D = 2.00	SKMH3220	RKMH3220	CKMH0517
4.00	A = 1.00	SKMH4010	RKMH4010	CKMH0514
	B = 1.38	SKMH4013	RKMH4013	CKMH0509
	C = 1.75	SKMH4017	RKMH4017	CKMH0515
	D = 2.00	SKMH4020	RKMH4020	CKMH0517
	E = 2.50	SKMH4025	RKMH4025	CKMH0512
5.00	A = 1.00	SKMH5010	RKMH5010	CKMH0514
	B = 1.38	SKMH5013	RKMH5013	CKMH0509
	C = 1.75	SKMH5017	RKMH5017	CKMH0515
	D = 2.00	SKMH5020	RKMH5020	CKMH0517
	E = 2.50	SKMH5025	RKMH5025	CKMH0512
	F = 3.00	SKMH5030	RKMH5030	CKMH0520
	G = 3.50	SKMH5035	RKMH5035	CKMH0521
6.00	A = 1.38	SKMH6013	RKMH6013	CKMH0516
	B = 1.75	SKMH6017	RKMH6017	CKMH0515
	C = 2.00	SKMH6020	RKMH6020	CKMH0517
	D = 2.50	SKMH6025	RKMH6025	CKMH0512
	E = 3.00	SKMH6030	RKMH6030	CKMH0520
	F = 3.50	SKMH6035	RKMH6035	CKMH0521
	G = 4.00	SKMH6040	RKMH6040	CKMH0522
8.00	A = 1.38	SKMH8013	RKMH8013	CKMH0516
	B = 1.75	SKMH8017	RKMH8017	CKMH0515
	C = 2.00	SKMH8020	RKMH8020	CKMH0517
	D = 2.50	SKMH8025	RKMH8025	CKMH0512
	E = 3.00	SKMH8030	RKMH8030	CKMH0520
	F = 3.50	SKMH8035	RKMH8035	CKMH0521
	G = 4.00	SKMH8040	RKMH8040	CKMH0522
	H = 4.50	SKMH8045	RKMH8045	CKMH0523
	J = 5.00	SKMH8050	RKMH8050	CKMH0524
K = 5.50	SKMH8055	RKMH8055	CKMH0525	



**Viton Cylinder Seals & Repair Kits
MH Series-Heavy Duty Steel Air Cylinder
1.5 " through 8.0" Bore Sizes**

		Complete Cylinder Seal Kits	Complete Cylinder Repair Kits	Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Viton Seals	Viton Seals	Viton Seals
		Part #	Part #	Part #
1.50	A = .62	SKMH1506V	RKMH1506V	CKMH0507V
	B = 1.00	SKMH1510V	RKMH1510V	CKMH0508V
2.00	A = .62	SKMH2006V	RKMH2006V	CKMH0507V
	B = 1.00	SKMH2010V	RKMH2010V	CKMH0508V
	C = 1.38	SKMH2013V	RKMH2013V	CKMH0509V
2.50	A = .62	SKMH2506V	RKMH2506V	CKMH0513V
	B = 1.00	SKMH2510V	RKMH2510V	CKMH0508V
	C = 1.38	SKMH2513V	RKMH2513V	CKMH0509V
	D = 1.75	SKMH2517V	RKMH2517V	CKMH0515V
3.25	A = 1.00	SKMH3210V	RKMH3210V	CKMH0514V
	B = 1.38	SKMH3213V	RKMH3213V	CKMH0509V
	C = 1.75	SKMH3217V	RKMH3217V	CKMH0515V
	D = 2.00	SKMH3220V	RKMH3220V	CKMH0517V
4.00	A = 1.00	SKMH4010V	RKMH4010V	CKMH0514V
	B = 1.38	SKMH4013V	RKMH4013V	CKMH0509V
	C = 1.75	SKMH4017V	RKMH4017V	CKMH0515V
	D = 2.00	SKMH4017V	RKMH4017V	CKMH0517V
	E = 2.50	SKMH4020V	RKMH4020V	CKMH0512V
5.00	A = 1.00	SKMH5010V	RKMH5010V	CKMH0514V
	B = 1.38	SKMH5013V	RKMH5013V	CKMH0509V
	C = 1.75	SKMH5017V	RKMH5017V	CKMH0515V
	D = 2.00	SKMH5020V	RKMH5020V	CKMH0517V
	E = 2.50	SKMH5025V	RKMH0525V	CKMH0512V
	F = 3.00	SKMH5030V	RKMH0530V	CKMH0520V
	G = 3.50	SKMH5035V	RKMH0535V	CKMH0521V
6.00	A = 1.38	SKMH6013V	RKMH6013V	CKMH0516V
	B = 1.75	SKMH6017V	RKMH6017V	CKMH0515V
	C = 2.00	SKMH6020V	RKMH6020V	CKMH0517V
	D = 2.50	SKMH6025V	RKMH6025V	CKMH0512V
	E = 3.00	SKMH6030V	RKMH6030V	CKMH0520V
	F = 3.50	SKMH6035V	RKMH6035V	CKMH0521V
	G = 4.00	SKMH6040V	RKMH6040V	CKMH0522V
8.00	A = 1.38	SKMH8013V	RKMH8013V	CKMH0516V
	B = 1.75	SKMH8017V	RKMH8017V	CKMH0515V
	C = 2.00	SKMH8020V	RKMH8020V	CKMH0517V
	D = 2.50	SKMH8025V	RKMH8025V	CKMH0512V
	E = 3.00	SKMH8030V	RKMH8030V	CKMH0520V
	F = 3.50	SKMH8035V	RKMH8035V	CKMH0521V
	G = 4.00	SKMH8040V	RKMH8040V	CKMH0522V
	H = 4.50	SKMH8045V	RKMH8045V	CKMH0523V
	J = 5.00	SKMH8050V	RKMH8050V	CKMH0524V
K = 5.50	SKMH8055V	RKMH8055V	CKMH0525V	



**MH Series-Heavy Duty Steel Air Cylinder
Repair Kits, 10” through 14” bore size**

		Complete Cylinder Seal Kits	Complete Cylinder Repair Kits	Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Standard Seals	Standard Seals	Standard Seals
		Part #	Part #	Part #
10.00	A = 1.75	SKMH10017	RKMH10017	CKMH0515
	B = 2.00	SKMH10020	RKMH10020	CKMH0517
	C = 2.50	SKMH10025	RKMH10025	CKMH0512
	D = 3.00	SKMH10030	RKMH10030	CKMH0520
	E = 3.50	SKMH10035	RKMH10035	CKMH0521
	F = 4.00	SKMH10040	RKMH10040	CKMH0522
	G = 4.50	SKMH10045	RKMH10045	CKMH0523
	H = 5.00	SKMH10050	RKMH10050	CKMH0524
	J = 5.50	SKMH10055	RKMH10055	CKMH0525
12.00	A = 2.00	SKMH12020	RKMH12020	CKMH0517
	B = 2.50	SKMH12025	RKMH12025	CKMH0512
	C = 3.00	SKMH12030	RKMH12030	CKMH0520
	D = 3.50	SKMH12035	RKMH12035	CKMH0521
	E = 4.00	SKMH12040	RKMH12040	CKMH0522
	F = 4.50	SKMH12045	RKMH12045	CKMH0523
	G = 5.00	SKMH12050	RKMH12050	CKMH0524
	H = 5.50	SKMH12055	RKMH12055	CKMH0525
14.00	A = 2.50	SKMH14025	RKMH14025	CKMH0512
	B = 3.00	SKMH14030	RKMH14030	CKMH0520
	C = 3.50	SKMH14035	RKMH14035	CKMH0521
	D = 4.00	SKMH14040	RKMH14040	CKMH0522
	E = 4.50	SKMH14045	RKMH14045	CKMH0523
	F = 5.0	SKMH14050	RKMH14050	CKMH0524
	G = 5.50	SKMH14055	RKMH14055	CKMH0525



LM Series Aluminum Air Cylinder Standard Cylinder Seal & Repair Kits				
		Complete Cylinder Seal Kits	Complete Cylinder Repair Kits	Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Standard Seals	Standard Seals	Standard Seals
		Part #	Part #	Part #
1.50	A = .62	SKMH1506	RKMH1506	CKMH0507
	B = 1.00	SKMH1510	RKMH1510	CKMH0508
2.00	A = .62	SKMH2006	RKMH2006	CKMH0507
	B = 1.00	SKMH2010	RKMH2010	CKMH0508
	C = 1.38	SKMH2013	RKMH2013	CKMH0509
2.50	A = .62	SKMH2506	RKMH2506	CKMH0513
	B = 1.00	SKMH2510	RKMH2510	CKMH0508
	C = 1.38	SKMH2513	RKMH2513	CKMH0509
	D = 1.75	SKMH2517	RKMH2517	CKMH0515
3.25	A = 1.00	SKMH3210	RKMH3210	CKMH0514
	B = 1.38	SKMH3213	RKMH3213	CKMH0509
	C = 1.75	SKMH3217	RKMH3217	CKMH0515
	D = 2.00	SKMH3220	RKMH3220	CKMH0517
4.00	A = 1.00	SKMH4010	RKMH4010	CKMH0514
	B = 1.38	SKMH4013	RKMH4013	CKMH0509
	C = 1.75	SKMH4017	RKMH4017	CKMH0515
	D = 2.00	SKMH4020	RKMH4020	CKMH0517
	E = 2.50	SKMH4025	RKMH4025	CKMH0512
5.00	A = 1.00	SKMH5010	RKMH5010	CKMH0514
	B = 1.38	SKMH5013	RKMH5013	CKMH0509
	C = 1.75	SKMH5017	RKMH5017	CKMH0515
	D = 2.00	SKMH5020	RKMH5020	CKMH0517
	E = 2.50	SKMH5025	RKMH5025	CKMH0512
	F = 3.00	SKMH5030	RKMH5030	CKMH0520
	G = 3.50	SKMH5035	RKMH5035	CKMH0521
6.00	A = 1.38	SKMH6013	RKMH6013	CKMH0516
	B = 1.75	SKMH6017	RKMH6017	CKMH0515
	C = 2.00	SKMH6020	RKMH6020	CKMH0517
	D = 2.50	SKMH6025	RKMH6025	CKMH0512
	E = 3.00	SKMH6030	RKMH6030	CKMH0520
	F = 3.50	SKMH6035	RKMH6035	CKMH0521
	G = 4.00	SKMH6040	RKMH6040	CKMH0522
8.00	A = 1.38	SKMH8013	RKMH8013	CKMH0516
	B = 1.75	SKMH8017	RKMH8017	CKMH0515
	C = 2.00	SKMH8020	RKMH8020	CKMH0517
	D = 2.50	SKMH8025	RKMH8025	CKMH0512
	E = 3.00	SKMH8030	RKMH8030	CKMH0520
	F = 3.50	SKMH8035	RKMH8035	CKMH0521
	G = 4.00	SKMH8040	RKMH8040	CKMH0522
	H = 4.50	SKMH8045	RKMH8045	CKMH0523
	J = 5.00	SKMH8050	RKMH8050	CKMH0524
	K = 5.50	SKMH8055	RKMH8055	CKMH0525



LM Series-Aluminum Air Cylinder Viton Cylinder Seal & Repair Kits				
		Complete Cylinder Seal Kits	Complete Cylinder Repair Kits	Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Viton Seals	Viton Seals	Viton Seals
		Part #	Part #	Part #
1.50	A = .62	SKMH1506V	RKMH1506V	CKMH0507V
	B = 1.00	SKMH1510V	RKMH1510V	CKMH0508V
2.00	A = .62	SKMH2006V	RKMH2006V	CKMH0507V
	B = 1.00	SKMH2010V	RKMH2010V	CKMH0508V
	C = 1.38	SKMH2013V	RKMH2013V	CKMH0509V
2.50	A = .62	SKMH2506V	RKMH2506V	CKMH0513V
	B = 1.00	SKMH2510V	RKMH2510V	CKMH0508V
	C = 1.38	SKMH2513V	RKMH2513V	CKMH0509V
	D = 1.75	SKMH2517V	RKMH2517V	CKMH0515V
3.25	A = 1.00	SKMH3210V	RKMH3210V	CKMH0514V
	B = 1.38	SKMH3213V	RKMH3213V	CKMH0509V
	C = 1.75	SKMH3217V	RKMH3217V	CKMH0515V
	D = 2.00	SKMH3220V	RKMH3220V	CKMH0517V
4.00	A = 1.00	SKMH4010V	RKMH4010V	CKMH0514V
	B = 1.38	SKMH4013V	RKMH4013V	CKMH0509V
	C = 1.75	SKMH4017V	RKMH4017V	CKMH0515V
	D = 2.00	SKMH4017V	RKMH4017V	CKMH0517V
	E = 2.50	SKMH4020V	RKMH4020V	CKMH0512V
5.00	A = 1.00	SKMH5010V	RKMH5010V	CKMH0514V
	B = 1.38	SKMH5013V	RKMH5013V	CKMH0509V
	C = 1.75	SKMH5017V	RKMH5017V	CKMH0515V
	D = 2.00	SKMH5020V	RKMH5020V	CKMH0517V
	E = 2.50	SKMH5025V	RKMH0525V	CKMH0512V
	F = 3.00	SKMH5030V	RKMH0530V	CKMH0520V
	G = 3.50	SKMH5035V	RKMH0535V	CKMH0521V
6.00	A = 1.38	SKMH6013V	RKMH6013V	CKMH0516V
	B = 1.75	SKMH6017V	RKMH6017V	CKMH0515V
	C = 2.00	SKMH6020V	RKMH6020V	CKMH0517V
	D = 2.50	SKMH6025V	RKMH6025V	CKMH0512V
	E = 3.00	SKMH6030V	RKMH6030V	CKMH0520V
	F = 3.50	SKMH6035V	RKMH6035V	CKMH0521V
	G = 4.00	SKMH6040V	RKMH6040V	CKMH0522V
8.00	A = 1.38	SKMH8013V	RKMH8013V	CKMH0516V
	B = 1.75	SKMH8017V	RKMH8017V	CKMH0515V
	C = 2.00	SKMH8020V	RKMH8020V	CKMH0517V
	D = 2.50	SKMH8025V	RKMH8025V	CKMH0512V
	E = 3.00	SKMH8030V	RKMH8030V	CKMH0520V
	F = 3.50	SKMH8035V	RKMH8035V	CKMH0521V
	G = 4.00	SKMH8040V	RKMH8040V	CKMH0522V
	H = 4.50	SKMH8045V	RKMH8045V	CKMH0523V
	J = 5.00	SKMH8050V	RKMH8050V	CKMH0524V
	K = 5.50	SKMH8055V	RKMH8055V	CKMH0525V



LH-Pressure Rated Hydraulic Cylinder Standard Cylinder Seal & Repair Kits				
		Complete Cylinder	Complete Cylinder	Rod Cartridge Assembly
		Seal Kits	Repair Kits	Repair Kits
Bore Size	Rod Diameter	Standard Seals	Standard Seals	Standard Seals
		Part #	Part #	Part #
1.50	A = .62	SKLH1506	RKLH1506	CKLH0507
	B = 1.00	SKLH1510	RKLH1510	CKLH0508
2.00	A = .62	SKLH2006	RKLH2006	CKLH0507
	B = 1.00	SKLH2010	RKLH2010	CKLH0508
	C = 1.38	SKLH2013	RKLH2013	CKLH0509
2.50	A = .62	SKLH2506	RKLH2506	CKLH0513
	B = 1.00	SKLH2510	RKLH2510	CKLH0508
	C = 1.38	SKLH2513	RKLH2513	CKLH0509
	D = 1.75	SKLH2517	RKLH2517	CKLH0521
3.25	A = 1.00	SKLH3210	RKLH3210	CKLH0514
	B = 1.38	SKLH3213	RKLH3213	CKLH0509
	C = 1.75	SKLH3217	RKLH3217	CKLH0515
	D = 2.00	SKLH3220	RKLH3220	CKLH0519
4.00	A = 1.00	SKLH4010	RKLH4010	CKLH0514
	B = 1.38	SKLH4013	RKLH4013	CKLH0509
	C = 1.75	SKLH4017	RKLH4017	CKLH0515
	D = 2.00	SKLH4020	RKLH4020	CKLH0517
	E = 2.50	SKLH4025	RKLH4025	CKLH0512
5.00	A = 1.00	SKLH5010	RKLH5010	CKLH0514
	B = 1.38	SKLH5013	RKLH5013	CKLH0509
	C = 1.75	SKLH5017	RKLH5017	CKLH0515
	D = 2.00	SKLH5020	RKLH5020	CKLH0517
	E = 2.50	SKLH5025	RKLH5025	CKLH0512
	F = 3.00	SKLH5030	RKLH5030	CKLH0520
	G = 3.50	SKLH5035	RKLH5035	CKLH0521
6.00	A = 1.38	SKLH6013	RKLH6013	CKLH0516
	B = 1.75	SKLH6017	RKLH6017	CKLH0515
	C = 2.00	SKLH6020	RKLH6020	CKLH0517
	D = 2.50	SKLH6025	RKLH6025	CKLH0512
	E = 3.00	SKLH6030	RKLH6030	CKLH0520
	F = 3.50	SKLH6035	RKLH6035	CKLH0521
	G = 4.00	SKLH6040	RKLH6040	CKLH0522



LH Series-Pressure Rated Hydraulic Cylinder Viton Cylinder Seal & Repair Kits				
		Complete Cylinder Seal Kits	Complete Cylinder Repair Kits	Rod Cartridge Assembly Repair Kits
Bore Size	Rod Diameter	Viton Seals	Viton Seals	Viton Seals
		Part #	Part #	Part #
1.50	A = .62	SKLH1506V	RKLH1506V	CKLH0507V
	B = 1.00	SKLH1510V	RKLH1510V	CKLH0508V
2.00	A = .62	SKLH2006V	RKLH2006V	CKLH0507V
	B = 1.00	SKLH2010V	RKLH2010V	CKLH0508V
	C = 1.38	SKLH2013V	RKLH2013V	CKLH0509V
2.50	A = .62	SKLH2506V	RKLH2506V	CKLH0513V
	B = 1.00	SKLH2510V	RKLH2510V	CKLH0508V
	C = 1.38	SKLH2513V	RKLH2513V	CKLH0509V
	D = 1.75	SKLH2517V	RKLH2517V	CKLH0521V
3.25	A = 1.00	SKLH3210V	RKLH3210V	CKLH0514V
	B = 1.38	SKLH3213V	RKLH3213V	CKLH0509V
	C = 1.75	SKLH3217V	RKLH3217V	CKLH0515V
	D = 2.00	SKLH3220V	RKLH3220V	CKLH0519V
4.00	A = 1.00	SKLH4010V	RKLH4010V	CKLH0514V
	B = 1.38	SKLH4013V	RKLH4013V	CKLH0509V
	C = 1.75	SKLH4017V	RKLH4017V	CKLH0515V
	D = 2.00	SKLH4020V	RKLH4020V	CKLH0517V
	E = 2.50	SKLH4025V	RKLH4025V	CKLH0512V
5.00	A = 1.00	SKLH5010V	RKLH5010V	CKLH0514V
	B = 1.38	SKLH5013V	RKLH5013V	CKLH0509V
	C = 1.75	SKLH5017V	RKLH5017V	CKLH0515V
	D = 2.00	SKLH5020V	RKLH5020V	CKLH0517V
	E = 2.50	SKLH5025V	RKLH5025V	CKLH0512V
	F = 3.00	SKLH5030V	RKLH5030V	CKLH0520V
	G = 3.50	SKLH5035V	RKLH5035V	CKLH0521V
6.00	A = 1.38	SKLH6013V	RKLH6013V	CKLH0516V
	B = 1.75	SKLH6017V	RKLH6017V	CKLH0515V
	C = 2.00	SKLH6020V	RKLH6020V	CKLH0517V
	D = 2.50	SKLH6025V	RKLH6025V	CKLH0512V
	E = 3.00	SKLH6030V	RKLH6030V	CKLH0520V
	F = 3.50	SKLH6035V	RKLH6035V	CKLH0521V
	G = 4.00	SKLH6040V	RKLH6040V	CKLH0522V