

FLUID POWER Design Data Sheet



Revised Sheet 77 - Womack Design Data File

HYDRAULIC CYLINDER SPEEDS – EXTENSION AND RETRACTION

Lines in bold type show cylinder piston extension speeds in "Inches per Minute". Lines in italic type show piston retraction speeds in "Inches per Minute" with various size piston rods. The smallest diameter rod for each bore is the standard size rod. The largest diameter rod is a "2:1" rod in which piston

area is approximately twice rod and net areas. Since speed is directly proportional to GPM, for flows not shown, multiply speed in the "1 GPM" column times the desired GPM. For cylinders of larger bore, see chart on back side of this sheet.

Piston Diam.	Rod Diam.	1 GPM	3 GPM	5 GPM	8 GPM	12 GPM	15 GPM	20 GPM	25 GPM	30 GPM	40 GPM	50 GPM	60 GPM	75 GPM	100 GPM
1-1/2	None*	131	392	654	----	----	----	----	----	----	----	----	----	----	----
	<i>5/8"</i>	158	475	791	----	----	----	----	----	----	----	----	----	----	----
	<i>1</i>	235	706	----	----	----	----	----	----	----	----	----	----	----	----
2	None*	74	221	368	588	882	----	----	----	----	----	----	----	----	----
	<i>3/4"</i>	86	257	428	684	----	----	----	----	----	----	----	----	----	----
	<i>1</i>	98	295	490	784	----	----	----	----	----	----	----	----	----	----
	<i>1-3/8</i>	139	418	697	----	----	----	----	----	----	----	----	----	----	----
2-1/2	None*	47	141	235	376	565	706	941	----	----	----	----	----	----	----
	<i>1"</i>	56	168	280	448	672	840	----	----	----	----	----	----	----	----
	<i>1-3/8</i>	67	202	337	540	810	----	----	----	----	----	----	----	----	----
	<i>1-3/4</i>	92	277	461	738	----	----	----	----	----	----	----	----	----	----
3-1/4	None*	28	84	139	223	334	418	557	696	835	----	----	----	----	----
	<i>1-3/8"</i>	34	102	170	271	407	509	678	848	----	----	----	----	----	----
	<i>1-3/4</i>	39	118	196	314	471	588	784	980	----	----	----	----	----	----
	<i>2</i>	45	134	224	359	538	672	896	----	----	----	----	----	----	----
	<i>2-1/4</i>	53	160	267	428	642	802	----	----	----	----	----	----	----	----
4	None*	18	55	92	147	221	276	368	460	551	735	919	----	----	----
	<i>1-1/4"</i>	20	61	102	163	244	306	407	509	611	815	----	----	----	----
	<i>1-3/4</i>	23	68	114	182	273	341	455	568	682	909	----	----	----	----
	<i>2</i>	25	74	123	196	294	368	490	613	735	980	----	----	----	----
	<i>2-1/2</i>	30	91	151	241	362	453	603	754	905	----	----	----	----	----
	<i>2-3/4</i>	35	105	174	279	418	523	697	872	----	----	----	----	----	----
5	None*	12	35	59	94	141	176	235	294	353	471	598	706	882	----
	<i>1-1/2"</i>	13	39	65	103	155	194	259	323	388	517	646	776	970	----
	<i>2</i>	14	42	70	112	168	210	280	350	420	560	700	840	----	----
	<i>2-1/2</i>	16	47	78	125	188	235	314	392	471	627	784	941	----	----
	<i>3</i>	18	55	92	147	221	276	368	460	551	735	919	----	----	----
	<i>3-1/2</i>	23	69	115	185	277	346	461	577	692	923	----	----	----	----
6	None*	8	25	41	65	98	123	163	204	245	327	409	490	613	817
	<i>1-3/4"</i>	9	27	45	71	107	134	179	223	268	357	446	538	670	893
	<i>2-1/2</i>	10	30	49	79	119	148	198	247	297	395	494	593	741	989
	<i>3</i>	11	33	54	87	131	163	218	272	327	436	545	654	817	----
	<i>3-1/2</i>	12	37	62	99	149	186	248	310	372	495	619	743	929	----
	<i>4</i>	15	44	74	118	176	221	294	368	441	588	735	882	----	----
7	None*	6	18	30	48	72	90	120	150	180	240	300	360	450	600
	<i>3"</i>	7	22	37	59	88	110	147	184	221	294	368	441	551	735
	<i>3-1/2</i>	8	24	40	64	96	120	160	200	240	320	400	480	600	800
	<i>4</i>	9	27	45	71	107	134	178	223	267	356	446	535	668	891
	<i>4-1/2</i>	10	31	51	82	123	153	205	256	307	409	512	614	767	----
	<i>5</i>	12	37	61	98	147	184	245	306	368	490	613	735	919	----

*These lines are for extension speeds. No piston rod area is involved. See back side of sheet for larger bore cylinders.

(See front side of sheet for smaller bore cylinders)

Piston Diam.	Rod Diam.	10 GPM	20 GPM	30 GPM	40 GPM	50 GPM	60 GPM	70 GPM	80 GPM	90 GPM	100 GPM	125 GPM	150 GPM	175 GPM	200 GPM
8	None*	46	92	138	184	230	276	322	368	414	460	575	690	804	919
	3-1/2"	57	114	170	227	284	341	398	455	511	568	710	852	994	1,137
	4	61	122	184	245	306	367	429	490	551	612	765	918	1,071	1,224
	4-1/2	67	134	202	269	336	403	471	538	605	672	840	1,008	1,176	1,344
	5	76	151	227	302	378	453	529	604	680	755	944	1,133	1,322	1,511
	5-1/2	87	174	261	348	435	523	610	697	784	871	1,089	1,306	1,524	1,742
10	None*	29	59	88	117	147	176	205	235	264	293	367	440	513	587
	4-1/2"	37	74	111	148	185	222	259	296	333	370	462	554	647	739
	5	39	79	118	157	196	236	275	314	353	393	491	589	687	785
	5-1/2	42	85	127	169	211	254	296	338	380	423	528	634	740	845
	7	58	116	173	231	289	347	404	462	520	578	722	866	1,011	1,155
12	None*	20	41	61	82	102	123	143	163	184	204	255	306	357	408
	5-1/2"	26	52	78	103	129	155	181	207	233	258	323	388	452	517
	7	31	62	93	124	155	186	217	248	279	310	387	464	542	619
	8-1/2	41	82	123	164	204	245	286	327	368	409	511	613	715	818
14	None*	15	30	45	60	75	90	105	120	135	150	188	225	263	300
	7"	20	40	60	80	100	120	140	160	180	200	250	300	350	400
	8-1/2	24	48	71	95	119	143	167	190	214	238	297	357	416	476
	10	31	61	92	123	154	184	215	246	277	307	384	461	538	614

*These lines are for extension speeds. No piston rod area is involved.

EQUIVALENT MEASUREMENTS

U.S. Gallon = 231 Cubic Inches = 4 Quarts; or 8 Pints = 8.3356 Pounds = 3.785 Liters	1 Horsepower = 33,000 Ft. Lbs. per Minute = 550 Ft. Lbs. per Second = 42.4 BTU per Minute = 2545 BTU per Hour = 746 Watts, or 0.746 Kilowatts
1 Imperial Gallon = 1.2 U.S. Gallons	1 PSIG = 2.0416" Hg = 27.71" Water
1 Litre = 0.2642 U. S. Gallons	1 Foot Column of Water = 0.433 PSI
1 Cubic Foot = 7.48 Gallons = 1,728 Cubic Inches	1 Foot Column of Oil = 0.390 PSI
1 Cubic Foot of Water Weighs 62.4 Pounds	1" Hg = 0.491 PSI = 1.132 Ft. Water
1 Bar (at Sea Level) = 14.5 PSI (Approx. 1 Atmos.) = 33.8 Foot Water Column = 42 Foot Oil Column = 29.92" Hg.	1 Barrel of Oil = 42 Gallons
Approximately 1/2 PSI Decrease Each 1,000 Ft. Altitude	1 Micro-meter = 1 Millionth of a Meter (Micron) = 1 Thousandth of a Centimeter = 0.00004 Inch 25 Micro-meters = 0.001 Inch

APPROXIMATE MEASUREMENTS

1 Pint = 2 cups = 16 fluid ounces = 1 pound	2 Tablespoons = 1 fluid ounce
1 Pint = 96 teaspoons = 32 tablespoons = 16 fluid ounces	1 Fluid ounce (volume) = 660 drops (hydraulic oil)
1 Quart = 4 cups = 2 pints = 32 fluid ounces = 2 pounds	1 Cubic inch = 330 drops
1 Quart = 192 teaspoons = 64 tablespoons = 32 fluid ounces	Published by: WOMACK EDUCATIONAL PUBLICATIONS Womack Machine Supply Co. 13835 Senlac Dr. Farmers Branch, TX 75234 Tel: 800-859-9801 Fax: 214-630-5314 www.womack-educational.com
1 Gallon = 16 cups = 4 quarts = 8 pints	
1 Gallon = 768 teaspoons = 256 tablespoons = 128 fl. oz.	
1 Gallon = 231 cubic inches = 76,800 drops	
1 Cup = 16 tablespoons = 48 teaspoons	
1 Tablespoon = 3 teaspoons	