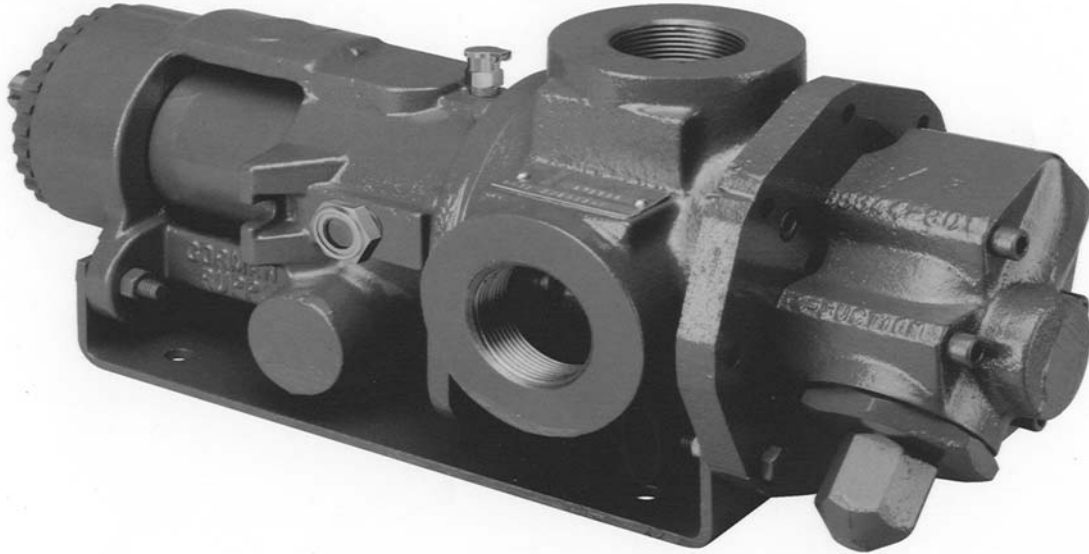


GHA SERIES
EXTREME DUTY ABRASIVE
G, J, N, R & S HYD SIZE
ROTARY GEAR PUMP



The GHA series is designed for applications in the operating ranges noted below. These units are available with head and backhead jackets for temperature control, and packing or carbide mechanical seal options described on the following pages.

This abrasive handling, extreme duty series, provides superior wear resistance. The design also provides superior rotor shaft support and an integral, maintenance-free radial/thrust bearing for reduced deflection and wear. Reduced speeds enable service over extended periods. Information such as percentage, size and hardness of solids present in the liquid are useful to estimate pump life.

FEATURES

*HARDENED, WEAR RESISTANT GEARS,
 HOUSING, HEAD, PIN, AND BUSHING*
*HARD FACE, WEAR RESISTANT
 MECHANICAL SEAL*
OVERSIZED TAPERED SEAL CAVITY
*HEAVY DUTY NEEDLE ROLLER
 BEARING*
*ROTOR END CLEARANCE EXTERNALLY
 ADJUSTABLE*
*FLEXIBLE SEAL DESIGN ALLOWS FOR
 A VARIETY OF INDUSTRY
 STANDARD SEALS OR PACKING*
BALL BEARING THRUST CONTROL

OPERATING RANGE

CAPACITY (GPM) : (8 TO 325)
 [LPM] : [25 TO 1020]

PRESSURE (PSI) : [0 TO 200]
 [BAR] : [0 TO 14]

VISCOSITY (SSU) : (28 TO 250,000)
 [cSt] : [1 TO 55,000]

TEMPERATURE (F) : (-60° TO 500°)
 [C] : [-51° TO 260°]

APPLICATIONS

USE WITH ANY LIQUID
 COMPATIBLE WITH
 CAST IRON

- ★ PAINTS
- ★ INKS
- ★ ADHESIVES
- ★ WASTE LIQUIDS
- ★ EMULSIONS
- ★ FILTERING

EXTER- IOR	ROTOR & IDLER	HSG PORTS	IDLER BUSHING	BACKHD BEARING	IDLER PIN	SHAFT	SHAFT SEALING		ROTA- TION	INTERNAL RELIEF VALVE	
							MECHANICAL SEAL ●	PACKING ■		MATERIAL	SETTING
CAST IRON	HARD IRON	90° TAPPED/ FLNG'D	SILICON CARBIDE	① NEEDLE BEARING	TUNGSTEN CARBIDE	HARD. STEEL	SILICON CARB. SILICON CARB. VITON	ARAMID FIBER W/GRAPHITE	C.W.	DUCTILE IRON	75 PSI [5 BAR]

Standard Models

G H A 2 NK 3 - B
 | | | | | | |
 GEAR DUTY DESIGN PORT SIZE HYDRAULIC SEAL STYLE
 SIZE SIZE

MODEL NUMBER	NOM. CAPACITY-SPEED		MAXIMUM				SHIPPING DATA		
	MAXIMUM		DIFFERENTIAL PRESSURE - PSI [BAR]			TEMP.	② Weight	Volume	
	GPM [LPM]	RPM 60 Hz [50 HZ]	BELOW 38 SSU [4 cSt]	38 TO 100 SSU [21 cSt]	100 TO 250,000 SSU [55,000 cSt]	°F [°C]			LBS [KG]
GHA 1-1/2 GC 3-B ● GHA 1-1/2 GC 4-B ■	8 [25]	870 [720]						57 [25,9]	2.9
GHA 1-1/2 GF 3-B ● GHA 1-1/2 GF 4-B ■	11 [36]							57 [25,9]	
GHA 1-1/2 GH 3-B ● GHA 1-1/2 GH 4-B ■	15 [49]							57 [25,9]	
GHA 1-1/2 GJ 3-B ● GHA 1-1/2 GJ 4-B ■	19 [60]							57 [25,9]	
GHA 2 JJ 3-B ● GHA 2 JJ 4-B ■	28 [88]		100 [7]	150 [10]	200 [14]	● 250 [119]		144 [65,5]	5.3
GHA 2 JL 3-B ● GHA 2 JL 4-B ■	38 [121]							144 [65,5]	
GHA 2 JP 3-B ● GHA 2 JP 4-B ■	54 [169]							144 [65,5]	
GHA 2 NK 3-B ● GHA 2 NK 4-B ■	60 [188]	580 [480]				■ 500 [260]		180 [81,6]	5.3
GHA 3 NK 3-B ● GHA 3 NK 4-B ■								180 [81,6]	
GHA 2 NM 3-B ● GHA 2 NM 4-B ■	80 [251]							180 [81,6]	
GHA 3 NM 3-B ● GHA 3 NM 4-B ■								180 [81,6]	
GHA 2 NP 3-B ● GHA 2 NP 4-B ■	99 [313]							180 [81,6]	
GHA 3 NP 3-B ● GHA 3 NP 4-B ■								180 [81,6]	10.7

STANDARD MODELS CONT.

① EXCEPT "S" SIZE AND 4-B MODELS (SILICON CARBIDE BUSHING).

② FOR 4-B UNIT WEIGHT, REFER TO GHS SECTION

● MECHANICAL SEAL
■ PACKING

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO
GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA

MODEL NUMBER	NOM. CAPACITY-SPEED		MAXIMUM				SHIPPING DATA		
	MAXIMUM		DIFFERENTIAL PRESSURE - PSI [BAR]			TEMP.	Weight	Volume	
	GPM [LPM]	RPM 60 Hz [50 HZ]	BELOW 38 SSU [4 cSt]	38 TO 100 SSU [21 cSt]	100 TO 250,000 SSU [55,000 cSt]	°F [°C]	LBS [KG]	CU. FT.	
GHA 2 RM 3-B ● GHA 2 RM 4-B ■	85 [271]	350 [290]	100 [7]	150 [10]	200 [14]	● 250 [119] ■ 500 [260]	357 [162]	10.7	
GHA 2-1/2 RM 3-B ● GHA 2-1/2 RM 4-B ■							357 [162]		
GHA 3 RM 3-B ● GHA 3 RM 4-B ■							357 [162]		
GHA 3 RP 3-B ● GHA 3 RP 4-B ■							105 [339]		357 [162]
GHA 3 RR 3-B ● GHA 3 RR 4-B ■							125 [402]		357 [162]
GHA 3 RS 3-B ● GHA 3 RS 4-B ■							146 [465]		357 [162]
GHA 4 RS 3-B ● GHA 4 RS 4-B ■							146 [465]		357 [162]
GHA 3 SR 3-B ● GHA 3 SR 4-B ■	210 [660]	350 [290]	100 [7]	150 [10]	200 [14]	● 400 [204] ■ 500 [260]	530 [240]	17.3	
GHA 4 SR 3-B ● GHA 4 SR 4-B ■							530 [240]		
GHA 3 SU 3-B ● GHA 3 SU 4-B ■							325 [1020]		530 [240]
GHA 4 SU 3-B ● GHA 4 SU 4-B ■									530 [240]

■ PORTS ARE COMPATIBLE WITH 125# ANSI CAST IRON FLANGES. ALL OTHER PORTS ARE TAPPED NPT FOR ANSI PIPE.

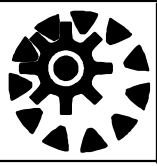
NOTE: PROPER PUMP APPLICATION REQUIRES CONSIDERATION OF ADDITIONAL FACTORS. PLEASE REVIEW APPLICATION GUIDE IN SECTION 500 OR CONSULT THE FACTORY.

GHA

**FOR GHA DRIVE OPTIONS
AND DIMENSIONS**

SEE

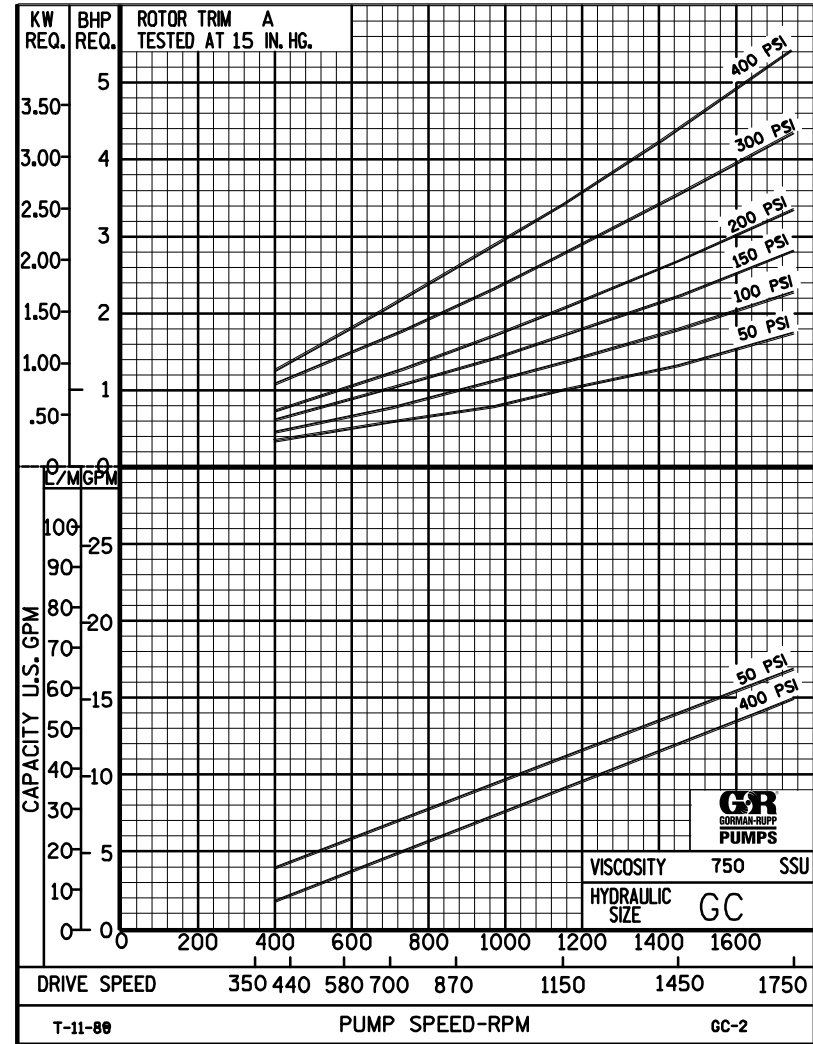
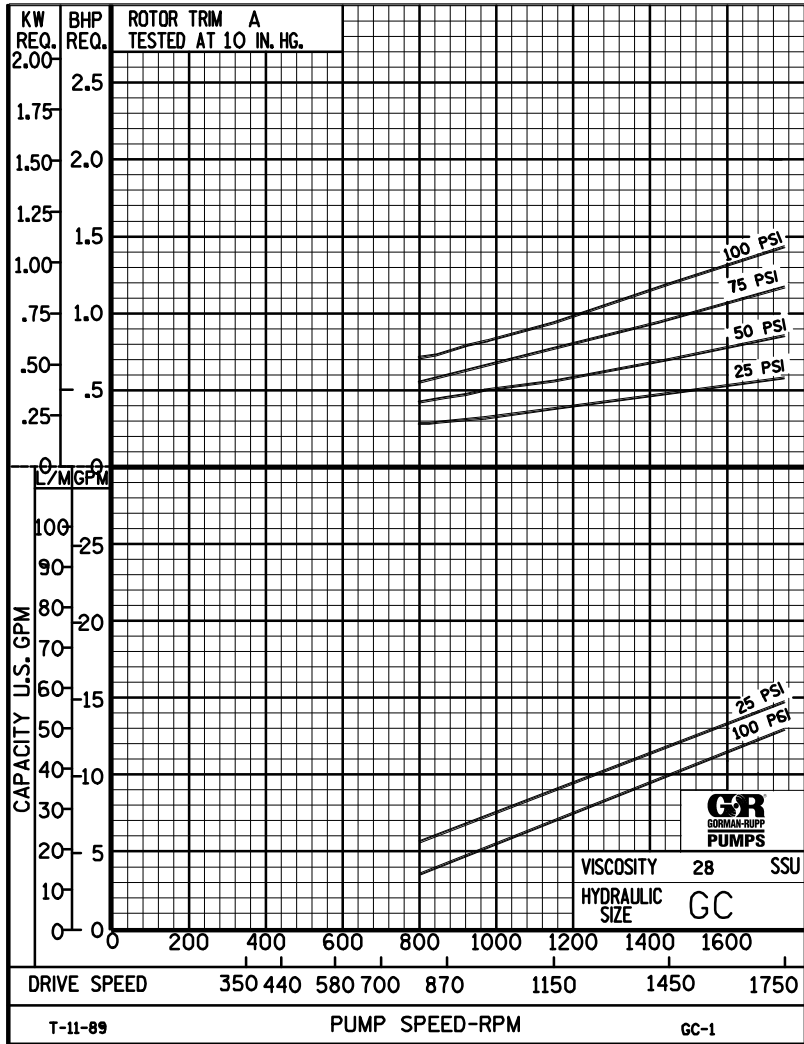
SECTION 545



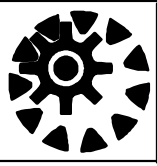
PERFORMANCE CURVES

SPEED VS. CAPACITY/HORSEPOWER

GC Hydraulic Size



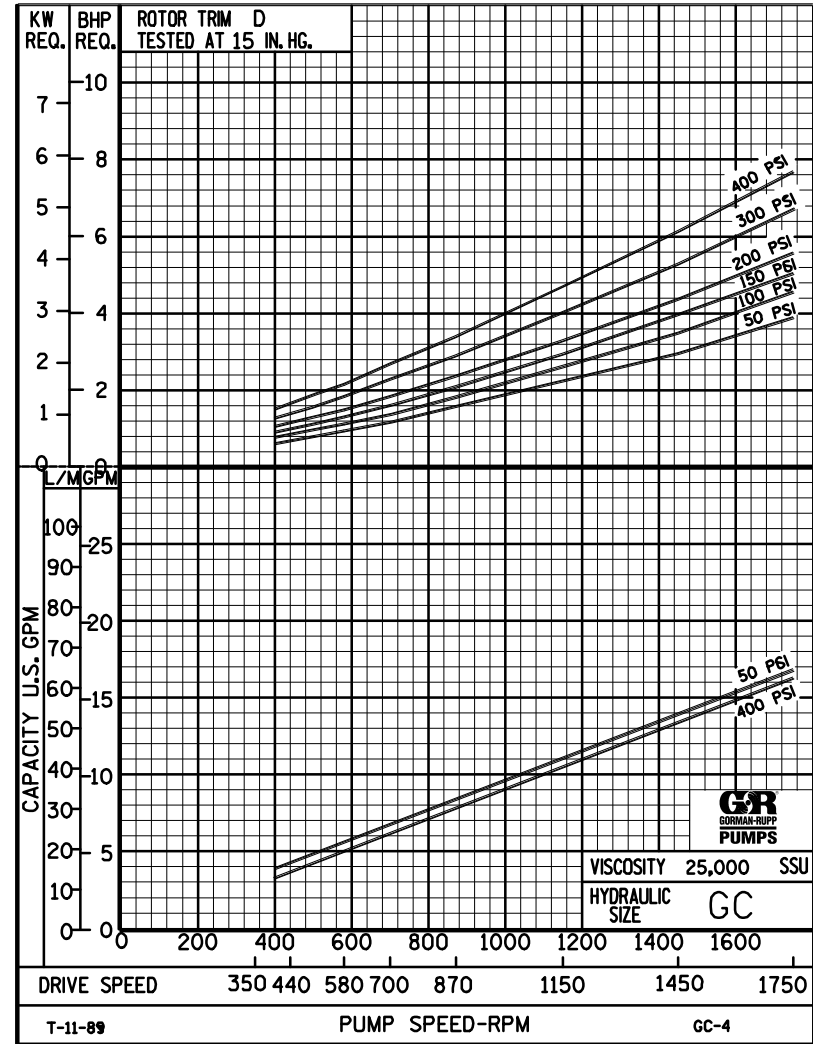
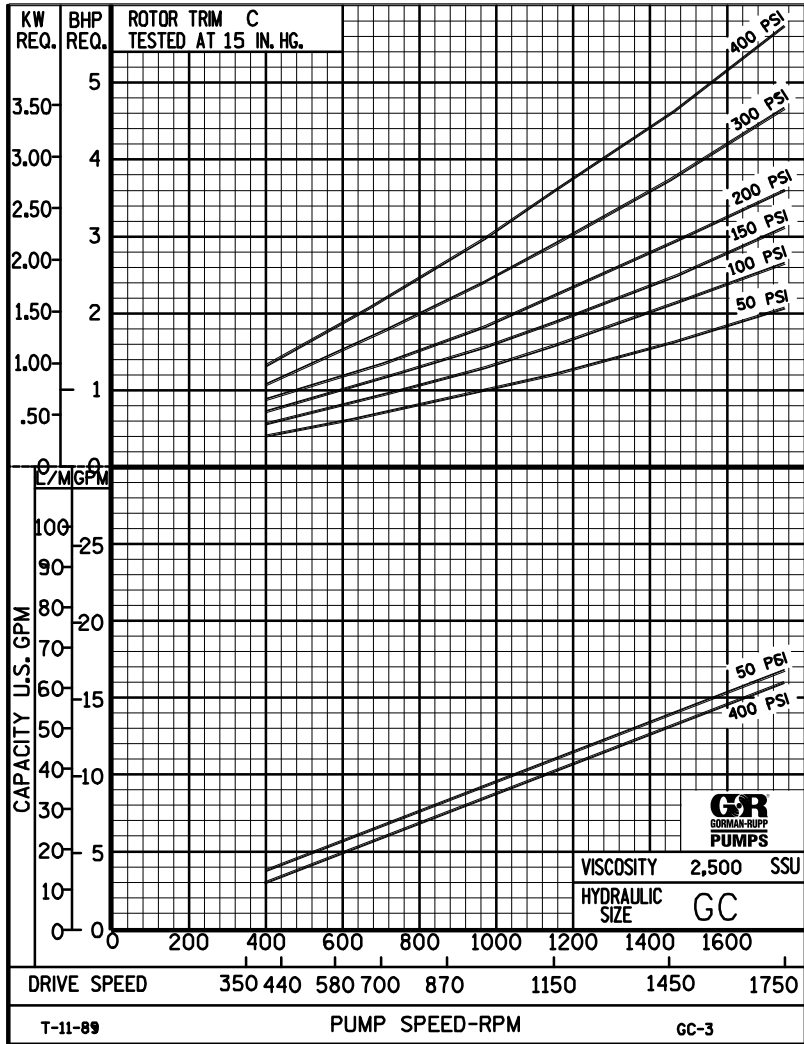
THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO
 GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA



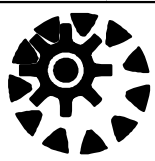
PERFORMANCE CURVES

SPEED VS. CAPACITY/HORSEPOWER

GC Hydraulic Size



THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO
 GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA



GC

PUMP HYDRAULIC SIZE CHART

SEC. 500

Page 40

January 2010

**16 GPM
1750 RPM**

NOMINAL		ROTOR TRIM	VISCOSITY (SSU)	N.I.P.R. (PSIA)	FRICTION PIPE LOSS (PSI/FT) <small>(Based on Sch 40 Steel Pipe)</small>					FULL BYPASS RELIEF VALVE PRESSURE (PSI)					CAPACITY (GPM) / H.P. REQUIRED													
CAP. GPM	SPEED RPM				PIPE DIAMETER					CRACKING PRESS. (PSI)					DIFFERENTIAL PRESSURE (PSI)													
					3/4"	1"	1 1/4"	1 1/2"	2"	LOW PRES R/V			HI PRES R/V		MEDIUM DUTY AND HEAVY DUTY				HEAVY DUTY ONLY									
16	1750	STD	28	3.6	.01	.01	.01	.01	.01	60	87	112			14.0	13.0	13.0	12.0										
			32		.19	.06	.02	.01	.01						.58	.85	1.2	1.4										
			38	3.6	.24	.08	.02	.01	.01	60	87	112	162			15.0	14.0	14.0	13.0	12.0								
			50		.30	.10	.03	.01	.01							.88	1.0	1.3	1.6	2.2								
			70	3.6	.35	.11	.03	.02	.01	61	88	114	164	216			16.0	15.0	15.0	14.0	14.0	13.0						
			100		.40	.13	.03	.02	.01								1.1	1.2	1.5	1.8	2.3	2.8						
			150	3.6	.45	.16	.04	.02	.01	61	88	114	164	218			16.0	16.0	16.0	15.0	15.0	14.0	14.0	12.0				
			200		.50	.19	.06	.04	.01								1.2	1.4	1.7	2.0	2.5	3.1	4.1	5.2				
			300	3.6	.62	.24	.08	.04	.02	61	88	116	166	220			16.0	16.0	16.0	16.0	15.0	15.0	15.0	13.0				
			500		1.02	.39	.13	.07	.03								1.4	1.6	2.0	2.2	2.8	3.3	4.2	5.4				
		750	3.6	1.53	.59	.20	.11	.04	61	88	116	166	223			17.0	17.0	16.0	16.0	16.0	16.0	15.0	15.0					
		1,000		2.04	.78	.26	.14	.05								1.5	1.8	2.0	2.3	2.8	3.3	4.3	5.5					
		2,000	4.5	4.08	1.56	.52	.28	.11	63	91	116	166	223			17.0	16.0	16.0	16.0	16.0	16.0	16.0	15.0					
		3,500		7.14	2.72	.91	.49	.18								1.8	2.1	2.4	2.7	3.1	3.6	4.7	5.7					
		5,000	5.0	10.2	3.89	1.30	.70	.26	66	93	118	168	225			17.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0					
		7,500		15.3	5.83	1.95	1.05	.39								2.2	2.6	3.0	3.2	3.7	4.1	5.2	6.2					
		10,000	5.7	20.4	7.77	2.60	1.40	.52	69	95	120	170	225			17.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0					
		15,000		30.6	11.7	3.89	2.10	.78								2.8	3.2	3.5	3.8	4.3	4.8	5.9	6.9					
		20,000	6.1	40.8	15.6	5.19	2.80	1.03	73	98	123	173	225			16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0					
		25,000		51.0	19.4	6.49	3.50	1.29								3.4	3.9	4.2	4.6	5.0	5.6	6.6	7.7					
50,000																												
75,000																												
100,000																												
150,000																												
200,000																												
250,000																												

(NOTE) For speeds not shown on the pump hydraulic charts, consult factory.



GC

PUMP HYDRAULIC SIZE CHART

SEC. 500

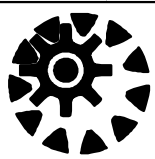
Page 41

January 2010

**10 GPM
1150 RPM**

NOMINAL		ROTOR TRIM	VISCOSITY (SSU)	N.I.P.R. (PSIA)	FRICTION PIPE LOSS (PSI/FT) <small>(Based on Sch 40 Steel Pipe)</small>					FULL BYPASS RELIEF VALVE PRESSURE (PSI)					CAPACITY (GPM) / H.P. REQUIRED													
CAP. GPM	SPEED RPM				PIPE DIAMETER					CRACKING PRESS. (PSI)					DIFFERENTIAL PRESSURE (PSI)													
					3/4"	1"	1 1/4"	1 1/2"	2"	LOW PRES R/V			HI PRES R/V		MEDIUM DUTY AND HEAVY DUTY				HEAVY DUTY ONLY									
10	1150	STD	28	2.0	.01	.01	.01	.01	.01	56	81	106			9.0	8.0	7.0	6.0										
			32		.08	.03	.01	.01	.01						.38	.56	.77	.94										
			38	2.0	.11	.04	.01	.01	.01	56	81	106	157			9.5	8.5	8.5	7.5	6.0								
			50		.13	.04	.01	.01	.01							.43	.62	.82	.99	1.6								
			70	2.0	.14	.05	.02	.01	.01	56	81	107	158	209			10.0	9.5	9.5	9.0	8.0	7.5						
			100		.14	.05	.02	.01	.01								.54	.78	1.0	1.2	1.7	1.9						
			150	2.0	.17	.07	.03	.02	.01	57	82	108	158	211			10.0	10.0	10.0	10.0	9.5	8.5	7.5	6.0				
			200		.30	.12	.04	.02	.01								.58	.82	1.0	1.2	1.7	2.0	2.7	3.4				
			300	2.0	.39	.15	.05	.02	.01	57	82	109	159	212			11.0	10.0	10.0	10.0	10.0	10.0	9.0	7.5				
			500		.64	.24	.08	.05	.02								.66	.95	1.2	1.4	1.8	2.0	2.8	3.5				
		750	2.0	.96	.36	.12	.07	.03	57	82	111	161	214			11.0	11.0	11.0	11.0	10.0	10.0	9.5	9.0					
		1,000		1.28	.49	.16	.09	.03								.73	1.0	1.2	1.4	1.8	2.1	2.9	3.5					
		2,000	2.5	2.55	.97	.33	.18	.07	58	85	112	162	214			11.0	11.0	11.0	11.0	10.0	10.0	10.0	10.0					
		3,500		4.46	1.70	.57	.31	.12								.91	1.3	1.5	1.7	2.0	2.3	3.0	3.7					
		5,000	2.9	6.38	2.43	.81	.44	.16	60	85	112	162	214			11.0	11.0	11.0	11.0	11.0	10.0	10.0	10.0					
		7,500		9.57	3.64	1.22	.66	.24								1.1	1.5	1.8	1.9	2.4	2.6	3.3	3.9					
		10,000	3.2	12.8	4.86	1.62	.88	.32	63	88	114	166	216			11.0	11.0	11.0	11.0	11.0	11.0	10.0	10.0					
		15,000		19.2	7.29	2.43	1.31	.49								1.3	1.9	2.1	2.2	2.7	2.9	3.6	4.3					
		20,000	3.5	25.5	9.71	3.24	1.75	.65	66	91	116	168	218			11.0	11.0	11.0	11.0	11.0	11.0	10.0	10.0					
		25,000		31.9	12.2	4.05	2.19	.81								1.7	2.3	2.4	2.6	2.9	3.3	4.0	4.7					
50,000	5.4	63.8	24.3	8.11	4.38	1.61	69	94	122	172	224			11.0	11.0	11.0	11.0	11.0	11.0	10.0	10.0							
75,000		95.7	36.4	12.2	6.56	2.42								2.6	3.6	3.8	4.0	4.5	5.2	6.0	6.8							
100,000																												
150,000																												
200,000																												
250,000																												

(NOTE) For speeds not shown on the pump hydraulic charts, consult factory.



GC

PUMP HYDRAULIC SIZE CHART

SEC. 500

Page 42
January 2010

**8 GPM
870 RPM**

NOMINAL		ROTOR TRIM	VISCOSITY (SSU)	N.I.P.R. (PSIA)	FRICTION PIPE LOSS (PSI/FT) <small>(Based on Sch 40 Steel Pipe)</small>					FULL BYPASS RELIEF VALVE PRESSURE (PSI)					CAPACITY (GPM) / H.P. REQUIRED															
CAP. GPM	SPEED RPM				PIPE DIAMETER					CRACKING PRESS. (PSI)					DIFFERENTIAL PRESSURE (PSI)															
					3/4"	1"	1 1/4"	1 1/2"	2"	LOW PRES R/V			HI PRES R/V		MEDIUM DUTY AND HEAVY DUTY				HEAVY DUTY ONLY											
8	870	STD	28	1.4	.01	.01	.01	.01	.01	56	81	106					6.5	5.5	4.5	4.0										
			32		.06	.02	.01	.01	.01								.28	.45	.61	.77										
			38	1.4	.07	.03	.01	.01	.01	56	81	106	157						7.0	6.5	6.0	5.5	4.5							
			50		.09	.03	.01	.01	.01										.39	.49	.65	.79	1.2							
			70	1.4	.10	.04	.01	.01	.01	56	81	107	158	209					7.5	7.5	7.0	6.5	6.0	5.5						
			100		.10	.04	.01	.01	.01										.42	.53	.71	.83	1.2	1.4						
			150	1.4	.15	.05	.02	.01	.01	57	82	108	158	211					8.0	8.0	7.5	7.5	7.5	7.0	6.0	4.5				
			200		.24	.08	.03	.02	.01										.44	.55	.74	.90	1.2	1.5	2.0	2.6				
			300	1.4	.31	.12	.04	.02	.01	57	82	109	159	212					8.5	8.0	8.0	8.0	7.5	7.0	6.5	5.5				
			500		.51	.19	.07	.04	.01										.52	.64	.80	.97	1.3	1.5	2.1	2.6				
			750	1.4	.77	.29	.10	.05	.02	57	82	111	161	214					8.5	8.5	8.0	8.0	8.0	8.0	7.0	6.5				
			1,000		1.02	.39	.14	.07	.03										.62	.71	.86	1.0	1.3	1.5	2.1	2.6				
		2,000	1.8	2.04	.78	.26	.14	.05	58	85	112	162	214					8.5	8.0	8.0	8.0	8.0	8.0	7.5	7.5					
		3,500		3.57	1.36	.46	.25	.09										.76	.90	1.0	1.4	1.5	1.6	2.2	2.7					
		5,000	2.1	5.01	1.94	.65	.35	.13	60	85	112	162	214					8.5	8.0	8.0	8.0	8.0	8.0	8.0	7.5					
		7,500		7.65	2.91	.97	.53	.19										.92	1.2	1.3	1.4	1.6	1.9	2.3	2.9					
		10,000	2.4	10.2	3.88	1.30	.70	.26	63	88	114	166	216					8.5	8.0	8.0	8.0	8.0	8.0	8.0	7.5					
		15,000		15.3	5.83	1.95	1.05	.39										1.1	1.4	1.5	1.6	1.8	2.1	2.6	3.2					
		20,000	2.7	20.4	7.77	2.59	1.40	.52	66	91	116	168	218					8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0					
		25,000		25.5	9.71	3.24	1.75	.65										1.2	1.6	1.7	1.8	2.1	2.3	2.9	3.4					
		50,000	4.3	51.1	19.4	6.50	3.50	1.29	68	93	120	170	222					8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0					
		75,000		76.5	29.1	9.73	5.25	1.93										1.8	2.5	2.6	2.7	3.0	3.3	3.8	4.3					
		100,000	6.2	102	38.9	13.0	7.00	2.58	70	95	122	172	224					8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0					
		150,000		153	58.0	19.5	10.5	3.87										2.3	3.1	3.3	3.4	3.6	3.9	4.4	5.0					
200,000																														
250,000																														

(NOTE) For speeds not shown on the pump hydraulic charts, consult factory.



GC

PUMP HYDRAULIC SIZE CHART

SEC. 500

Page 43

January 2010

**5 GPM
580 RPM**

NOMINAL		ROTOR TRIM	VISCOSITY (SSU)	N.I.P.R. (PSIA)	FRICTION PIPE LOSS (PSI/FT) <small>(Based on Sch 40 Steel Pipe)</small>					FULL BYPASS RELIEF VALVE PRESSURE (PSI)					CAPACITY (GPM) / H.P. REQUIRED													
CAP. GPM	SPEED RPM				PIPE DIAMETER					CRACKING PRESS. (PSI)					DIFFERENTIAL PRESSURE (PSI)													
					3/4"	1"	1 1/4"	1 1/2"	2"	LOW PRES R/V			HI PRES R/V		MEDIUM DUTY AND HEAVY DUTY				HEAVY DUTY ONLY									
5	580	STD	28	1.0	.01	.01	.01	.01	.01	55	80	105			4.0	3.5	3.0	2.5										
			32		.03	.01	.01	.01	.01						.19	.29	.40	.50										
			38	1.0	.04	.01	.01	.01	.01	55	80	105	156			4.5	4.0	3.5	3.0	2.5								
			50		.05	.02	.01	.01	.01							.21	.32	.45	.52	.76								
			70	1.0	.06	.02	.01	.01	.01	55	80	106	157	208			5.0	4.5	4.0	4.0	3.5	3.5						
			100		.07	.03	.01	.01	.01								.25	.34	.46	.54	.78	.93						
			150	1.0	.09	.04	.01	.01	.01	56	81	107	157	210			5.0	5.0	4.5	4.5	4.5	4.0	3.5	3.0				
			200		.17	.06	.02	.01	.01								.28	.36	.48	.59	.78	.95	1.3	1.3				
			300	1.0	.22	.08	.03	.02	.01	56	81	108	158	211			5.5	5.0	5.0	5.0	4.5	4.5	4.0	3.5				
			500		.35	.14	.05	.03	.01								.34	.42	.52	.63	.80	.97	1.3	1.6				
		750	1.0	.53	.20	.07	.04	.02	56	81	110	160	213			5.5	5.5	5.5	5.5	5.0	5.0	4.5	4.0					
		1,000		.70	.27	.09	.05	.02								.41	.46	.56	.65	.82	.99	1.4	1.7					
		2,000	1.3	1.40	.54	.18	.10	.04	57	84	111	161	213			5.5	5.5	5.5	5.5	5.0	5.0	5.0	4.5					
		3,500		2.46	.94	.31	.17	.06								.49	.59	.67	.77	.92	1.1	1.4	1.7					
		5,000	1.6	3.51	1.34	.45	.24	.09	59	84	111	161	213			5.5	5.5	5.5	5.5	5.5	5.5	5.0	5.0					
		7,500		5.26	2.00	.67	.36	.13								.61	.75	.84	.93	1.1	1.2	1.5	1.9					
		10,000	1.9	7.01	2.67	.89	.48	.18	62	87	113	165	215			5.5	5.5	5.5	5.5	5.5	5.5	5.0	5.0					
		15,000		10.5	4.00	1.34	.72	.27								.70	.89	.96	1.1	1.2	1.4	1.7	2.1					
		20,000	2.1	14.1	5.34	1.78	.96	.36	65	90	115	167	217			5.5	5.5	5.5	5.5	5.5	5.5	5.0	5.0					
		25,000		17.6	6.68	2.23	1.20	.44								.75	.94	1.0	1.1	1.3	1.5	1.9	2.2					
50,000	3.6	35.0	13.4	4.46	2.41	.89	67	92	119	169	221			5.5	5.5	5.5	5.5	5.5	5.5	5.0	5.0							
75,000		52.6	20.0	6.69	3.61	1.33								1.3	1.6	1.7	1.7	1.9	2.1	2.4	2.8							
100,000	5.4	70.2	26.7	8.92	4.81	1.77	69	94	121	171	223			5.5	5.5	5.5	5.5	5.5	5.5	5.0	5.0							
150,000		105	40.1	13.4	7.22	2.66								1.6	2.1	2.1	2.2	2.4	2.5	2.8	3.2							
200,000	8.6	140	53.4	17.8	9.63	3.54	75	100	129	179	235			5.5	5.5	5.5	5.5	5.5	5.5	5.0	5.0							
250,000		175	66.8	22.3	12.1	4.43								1.9	2.5	2.5	2.6	2.8	2.9	3.2	3.6							

(NOTE) For speeds not shown on the pump hydraulic charts, consult factory.