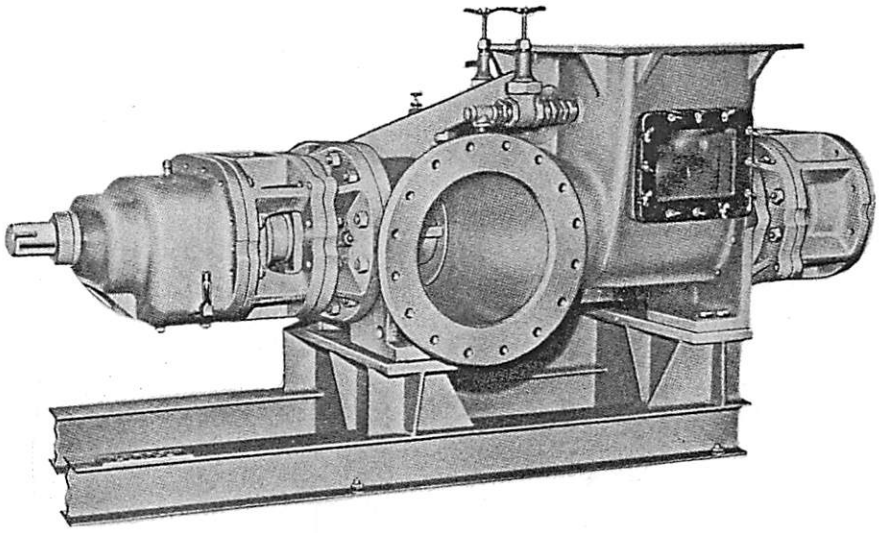
Item No.	Qty.	Description	No. 6 Part No. Dwg. No.	Warren Mat'l. Spec. C. I.	C.I.N.I-1 Resist	316 St. Stl.	Qty.	Description	No. 8 Part No. Dwg. No.	Warren Mat'l. Spec. C. I.	C.I.N.I-1 Resist	316 St. Stl.	Qty.	Description	No. 11 Part No. Dwg. No.	Warren Mat'l. Spec. C. I.	C.I.N.I-1 Resist	316 St. Stl.	Qty.	Description	No. 125 Part No. Dwg. No.	Warren Mat'l. Spec. C. I.	C.I.N.I-1 Resist	316 St. Stl.	Qty.	Description	No. 160 Part No. Dwg. No.	Warren Mat'l. Spec. C. I.	C.I.N.I-1 Resist	316 St. Stl.
1	1	Body	001A0492	A010G	A010G	B407G	1	Body	001A0574	A010G	A010G	B407G	1	Body	001A0573	A010G	A010G	B407G	1	Body	001A0733	A010G	A010G	B407G	1	Body	001A0799	A010G	A010G	B407G
2	1	Front Head	002A0205	A010A	A010A	A010A	1	Front Head	002A0156	A010A	A010A	A010A	1	Front Head	002A0176	A010A	A010A	A010A	1	Front Head	002Z0287	A010A	A010A	A010A	1	Front Head	002A0370	A010A	A010A	A010A
3	1	Rear Head	006B0157	A010A	A010A	A010A	1	Rear Head	006B0133	A010A	A010A	A010A	1	Rear Head	006A0143	A010A	A010A	A010A	1	Rear Cover	051A0075	A010A	A010A	A010A	1	Rear Head	006B0251	A010A	A010A	A010A
4	1	Front Brg. Bracket	029A0170	A010A	A010A	B407A	1	Front Brg. Bracket	029A0125	A010A	A010A	B407A	1	Front Brg. Bracket	029A0150	A010A	A010A													
5	1	Rear Brg. Bracket	029A0171	A010A	A010A	B407A	1	Rear Brg. Bracket	029A0208	A010A	A010A	B407A	1	Rear Brg. Bracket	029A0149	A010A	A010A													
6													1	Front Brg. Housing	027A0188			A010A	1	Front Brg. Housing	027A0186	A010A	A010A	A010A	1	Front Brg. Housing	027A0218	A010A	A010A	A010A
7													1	Rear Brg. Housing	027A0189			A010A	1	Rear Brg. Housing	027A0187	A010A	A010A	A010A	1	Rear Brg. Housing	027A0217	A010A	A010A	A010A
8	1	Long Shaft	016B0630	F084A	F084A	G232A	1	Long Shaft	016A0631	F084A	F084A	G232A	1	Long Shaft	016A0632	F084A	F084A				016A0776	F084A	F084A		1	Long Shaft	016A0870	F084A	F084A	
9	1	Short Shaft	017B0560	F084A	F084A	G232A	1	Short Shaft	017A0561	F084A	F084A	G232A	1	Short Shaft	017A0562	F084A	F084A				017A0676	F084A	F084A		1	Short Shaft	017A0750	F084A	F084A	
10													1	Long Shaft	016A0856			F120Y	1	Long Shaft	016A0860			F120Y	1	Long Shaft	016A0874			F120Y
11													1	Short Shaft	017A0737			F120Y	1	Short Shaft	017A0741			F120Y	1	Short Shaft	017A0754			F120Y
12	1	Screw(on long shaft)	010B0057	A010U	A621U	B407U	1	Screw (on long shaft)	010B0055	A010U	A621U	B407U	1	Screw (on long shaft)	010B0042	A010U	A621U	B407U	1	Screw (on long shaft)	010B0049	A010U	A321U	B407U	1	Screw (on long shaft)	010B0671	A010U		
13	1	Screw (on short shaft)	010B0058	A010U	A621U	B407U	1	Screw (on short shaft)	010B0056	A010U	A621U	B407U	1	Screw (on short Shaft)	010B0043	A010U	A621U	B407U	1	Screw (on short shaft)	010B0048	A010U	A621U	B407U	1	Screw (on short shaft)	010B0672	A010U		
14																										Screw (on long shaft)	010B0710		A621U	B407U
15																										Screw (on short shaft)	010B0709		A621U	B407U
16	1	Feeder (on long shaft)	168B0011	A010A	A010A	B407A	1	Feeder (on long shaft)	168B0009	A010A	A010A	B407A	1	Feeder (on long shaft	168B0005	A010A	A010A		1	Feeder (on long shaft)	168B0002	A010A	A010A		1	Feeder (on long shaft)	168B0028	A010A	A010A	
17	1	Feeder (on short shaft)	168B0010	A010A	A010A	B407A	1	Feeder (on short shaft)	168B0008	A010A	A010A	B407A	1	Feeder (on short shaft)	168B0004	A010A	A010A		1	Feeder (on short shaft)	168B0001	A010A	A010A		1	Feeder (on sort shaft)	168B0029	A010A	A010A	
18													1	Feeder (on long shaft)	168B0026			B407A	1	Feeder (on long shaft)	168B0024			B407A	1	Feeder (on long shaft)	168B0035			B407A
19													1	Feeder (on short shaft)	168B0023			B407A	1	Feeder (on short shaft)	168B0025			B407A	1	Feeder (on short shaft)	168B0030			B407A
20	1	Discharge Feeder	168A0012	A422A	A422A	B407A	1	Discharge Feeder	168A0007	A422A	A422A	B407A	1	Discharge Feeder	168A0006	A422A	A422A	B407A	1	Discharge Feeder	168C0003	L020A	L020A	L020A	1	Discharge Feeder	168C0027	L020A	L020A	L210A
21	2	Lg. Sh. Frt. & Sh. Sh. Rear Shaft Sleeve	063C0050	A060A	A060A	B407A	2	Lg. Sh. Frt. & Sh. Sh. Rear Shaft Sleeve	063C0043	A060A	A060A	B407A	2	Lg. Sh. Frt. & Sh. Sh. Rear Shaft Sleeve	063C0049	A060A	A060A	B407A	1	Lg. Sh. Frt. Shaft Sleeve	063C0065	A060A	A060A	B407A	1	Lg. Sh. Frt. Shaft Sleeve	063C0109	A060A	A060A	B407A
22	2	Lg. Sh. Rear & Sh. Shaft Front Shaft Sleeve	063C0051	A060A	A060A	B407A	2	Lg. Sh. Rear & Sh. Shaft Front Shaft Sleeve	063C0042	A060A	A060A	B407A	2	Lg. Sh. Rear & Sh. Shaft Front Shaft Sleeve	063C0048	A060A	A060A	B407A	1	Short Sh. Frt. Shaft Sleeve	063C0064	A060A	A060A	B407A	1	Short Sh. Frt. Shaft Sleeve	063C0110	A060A	A060A	B407A
23																			1	Lg. Sh. Rear Shaft Sleeve	063C0068	A060A	A060A	B407A	1	Lg. Sh. Rear Shaft Sleeve	063C0107	A060A	A060A	B407A
24																			1	Sh. Sh. Rear Shaft Sleeve	063C0067	A060A	A060A	B407A	1	Sh. Sh. Rear Shaft Sleeve	063C0108	A060A	A060A	B407A
25	4	Split Gland (8 halves)	034C0085	C060A	C060A	B407A	4	Split Gland (8 halves)	034C0070	C060A	C060A	B407A	4	Split Gland (8 halves)	034C0075	C060A	C060A	8407A	4	Split Gland (8 halves)	034C0110	C060A	C060A	B407A	4	Split Glands (8 halves)	034C0135	C060A	C060A	B407A
26	4	Lantern Ring	055D0113	P051A	P051A	P051A	4	Lantern Ring	055D0106	P051A	P051A	P051A	4	Lantern Ring	055D0107	P051A	P051A	P051A	4	Lantern Ring	055D0143	P051A	P051A	P051A	4	Lantern Ring	055D0172	P051A	P051A	P051A
27	4	Stuff Box Bushing	075D0134	A010A	A010A	G232A	4	Stuffing Box Bushing	075D0107	A010A	A010A	G232A	4	Stuffing Box Bushing	075D0121	A010A	A010A	B407A	4	Stuffing Box Bushing	075C0174	A010A	A010A	B407A	4	Stuffing Box Bushing	075C0217	A010A	A010A	B407A
28	1	Handhole Cover	108C0020	L021A	L021A	L210A	1	Handhole Cover	108C0015	L021A	L021A	L210A	1	Handhole Cover	108C0017	L021A	L021A	L210A	1	Handhole Cover	108C0017	L021A	L021A	L210A	1	Handhole Cover	108C0017	L021A	L021A	L210A
29	1	Handhole Cover	108C0023	Plexi	Plexi	Plexi	1	Handhole Cover	108C0019	Plexi	Plexi	Plexi	1	Handhole Cover	108C0021	Plexi	Plexi	Plexi	1	Handhole Cover	108C0021	Plexi	Plexi	Plexi	1	Handhole Cover	108C0021	Plexi	Plexi	Plexi
30	8	Gland Swing Bolt	093D0035	N081A	N081A	N081A	8	Gland Swing Bolt	093D0021	N081A	N081A	N081A	8	Gland Swing Bolt	093D0033	N081A	N081A													
31													8	Gland Stud 5/8-11 x 4 1/8				N082A	8	Gland Stud 5/8-11 x 3 1/2		N081A	N081A	N082A	8	Gland Stud 3/4-10 x 4 Lg.		N081A	N081A	N081A
32	8	Swing Bolt Pin	091D0019	N081A	N081A	N081A	8	Swing Bolt Pin	091D0014	N081A	N081A	N081A	8	Swing Bolt Pin	091D0018	N081A	N081A													
33	2	Timing Gear	014C0140	F120D	F120D	F120D	2	Timing Gear	014C0113	F120D	F120D	F120D	2	Timing Gear	014C0132	F120D	F120D	F120D	2	Timing Gear	014C0187	F120D	F120D	F120D	2	Timing Gear	014C0214	F120D	F120D	F120D
34	2	Frt. Hd. Brg. to T. Gr. Gear & Brg. Spacer	032D0166	M030A	M030A	M030A	2	Frt. Hd. Brg. to T. Gr. Gear & Brg. Spacer	032D0117	M030A	M030A	M030A	2	Frt. Hd. Brg. to T. Gr. Gear & Brg. Spacer	032D0148	M030A	M030A	M030A	2	Frt. Hd. Brg. to T. Gr. Gear & Brg. Spacer	032D0216	M030A	M030A	M030A	2	Frt. Hd. Brg. to T. Gr. Gear & Brg. Spacer	032D0301	M030A	M030A	M030A
35	2	Brkt. Brg. to T. Gear Gear & Brg. Spacer	032D0167	M030A	M030A	M030A	2	Brkt. Brg. to T. Gear Gear & Brg. Spacer	032D0116	M030A	M030A	M030A	2	Brkt. Brg. to T. Gear Gear & Brg. Spacer	032D0149	M030A	M030A	M030A	2	Brkt. Brg. to T. Gear Gear & Brg. Spacer	032D0217	M030A	M030A	M030A	2	Brkt. Brg. to T. Gear Gear & Brg. Spacer	032D0302	M030A	M030A	M030A
36	2	Thrust Bearing Shaft Sleeve	063C0073	F051A	F051A	F051A	2	Thrust Bearing Shaft Sleeve	063C0071	F051A	F051A	F051A	2	Thrust Bearing Shaft Sleeve	063C0070	F060A	F060A	F060A	2	Thrust Bearing Shaft Sleeve	063C0063	F060A	F060A	F060A	2	Thrust Bearing Shaft Sleeve	063C0106	F060A	F060A	F060A
37	1	Frt. Hd Bushing	075D0135	M030A	M030A	M030A	1	Frt.Hd. Bushing	075D0128	M030A	M030A	M030A	1	Frt. Hd. Bushing	075D0126	M030A	M030A	M030A	1	Frt. Hd. Bushing	075D0177	M030A	M030A	M030A	1	Frt. Hd. Bushing	075D0216	M030A	M030A	M030A
38	2	Frt. Brkt. Bushing	075D0136	M030A	M030A	M030A	2	Frt. Brkt. Bushing	075D0129	M030A	M030A	M030A	4	Frt. & Rear Brkt. Bushing	075D0127	M030A	M030A	M030A	4	Frt. & Rear Brkt. Bushing	075D0176	M030A	M030A	M030A	4	Frt. & Rear Brkt. Bushing	075D0215	M030A	M030A	M030A
39	2	Rear Brkt. Bushing	075D0161	M030A	M030A	M030A	2	Rear Brkt. Bushing	075D0162	M030A	M030A	M030A																		
40	1	Frt. Hd. Flinger	049D0049	C090A	C090A	C090A	1	Frt. Hd. Flinger	049D0046	C090A	C090A	C090A	1	Frt. Hd. Flinger	049D0044	C090A	C090A	C090A	1	Frt. Hd. Flinger	049D0071	C090A	C090A	C090A	1	Frt. Hd. Flinger	049D0086	C090A	C090A	C090A
41	4	Brkts. Flinger	049D0050	C090A	C090A	C090A	4	Brkts. Flinger	049D0047	C090A	C090A	C090A	4	Brkts Flinger	049D0045	C090A	C090A	C090A	4	Brkts. Flinger	049D0070	C090A	C090A	C090A	4	Brkts. Flinger	049D0085	C090A	C090A	C090A
42	1	Shaft Sleeve	063D0072	M030A	M030A	M030A	1	Shaft Collar	057D0036	M030A	M030A	M030A	1	Shaft Sleeve	063D0069	M030A	M030A	M030A	1	Shaft Collar	057D0035	M030A	M030A	M030A	1	Shaft Collar	057D0044	F060A	F060A	F060A
43	2	Front Locknut (lg. & sh. shaft)	048D0136	Steel	Steel	Steel	2	Locknut (lg. & sh. shaft)	048D0097	Steel	Steel	Steel	1	Locknut (long shaft)	048D0123	F060A	F060A	F060A	1	Locknut	048D0181	F060A	F060A	F060A	2	Locknut (lg. & sh. shaft)	048D0230	Steel	Steel	Steel
44													1	Locknut (short shaft)	048D0122	F060A	F060A	F060A												
45	6	Thrust Soc. Hd. Capscr. 1/4-20 x 1" Lg.		N022A	N022A	N022A	6	Locknut	048D0187	N022A	N022A	N022A	6	Locknut	048D0186	N011A	N011A	N011A	1	Locknut	048D0182	F060A	F060A	F060A						
																			6	Shaft Sleeve Screw	063D0066	N022A	N022A	N022A	6	Shaft Sleeve Screw	063D0066	N022A	N022A	N022A
46	2	Frt. Hd. Roller Brg. — Hyatt	A-5210-TS	Steel	Steel	Steel	2	Roller Brg. — Hyatt	A-5212-TS	Steel	Steel	Steel	2	Roller Brg. — Hyatt	A-5219-TS	Steel	Steel	Steel	2	Roller Brg. — Hyatt	A-5222-TS	Steel	Steel	Steel	2	Roller Brg. — Hyatt	A-5224-TS	Steel	Steel	Steel
47	2	Frt. Brkt. Roller Brg. — Hyatt	A-5211-TS	Steel	Steel	Steel	2	Roller Brg. — Hyatt	A-5213-TS	Steel	Steel	Steel	2	Roller Brg. — Hyatt	A-5220-TS	Steel	Steel	Steel	2	Roller Brg. — Hyatt	A-5224-TS	Steel	Steel	Steel						
48	2	Thrust Brg. Assy.	023Z0070	Steel	Steel	Steel	2	Thrust Brg. Assy.	023Z0077	Steel	Steel	Steel	2	Thrust Brg. Assy.	023Z0071	Steel	Steel	Steel	2	Thrust Brg. Assy.	023Z0080	Steel	Steel	Steel	2	Thrust Brg. Assy.	023Z0084	Steel	Steel	Steel
49	2	Vent Plug Assy.	155D0005	Steel	Steel	Steel	2	Vent Plug Assy.	155D0005	Steel	Steel	Steel	2	Vent Plug Assy.	155D0005	Steel	Steel	Steel	2	Vent Plug Assy.	155D0005	Steel	Steel	Steel	2	Vent Plug Assy.	155D0005	Steel	Steel	Steel
50	1	Sight Gage	154D0007	Brass	Brass	Brass	1	Sight Gage	154D0007	Brass	Brass	Brass	1	Sight Gage	154D0007	Brass	Brass	Brass	1	Sight Gage	154D0007	Brass	Brass	Brass	1	Sight Gage	154D0007	Brass	Brass	Brass
51																			2	Pipe Plug	D-4417	Steel	Steel	Steel						
52																			2	Connector-Imperial Eastman	1/4 768FB	Brass	Brass	Brass						
53																			2	Pipe Clamp Imp. Eastman	128D0003	L020A	L020A	L020A						
54																			1	Tubing	1/4x.035x108	M010A	M010A	M010A						
55	1	Sight Glass Gits	BW-4042	Brass	Brass	Brass	1	Sight Glass Gits	BW-4042	Brass	Brass	Brass	1	Sight Glass Gits	BW-4042	Brass	Brass	Brass	1	Sight Glass Gits	BW-4042	Brass	Brass	Brass	1	Sight Glass Gits	BW-4042	Brass	Brass	Brass
56	1	Disch. Feeder Taper Pin No. 9 x 3 3/4 Lg.		Steel	SS316	SS316	1	Taper Pin No. 8x4 3/4 Lg.		Steel	Steel	SS316	1	Disch. Feeder on Lg. Sh. Pin 7/8 Dia. x 7 1/4 Lg.		F031A	F031A		1	Disch. Feeder on Lg. Sh. Pin 1" Dia. x 8 1/4 Lg.		F031A	F031A		1	Disch. Feeder on Lg. Sh. Pin 1" Dia. x 9" Lg.		F031A	F031A	
57	1	Taper Pin No. 9x3 1/4 Lg.		Steel	SS316	SS316	1	Taper Pin No. 8x4 1/4 Lg.		Steel	Steel	SS316	1	Pin 7/8 Dia. x 6 1/4 Lg.		F031A	F031A		1	Pin 1" Dia. x 7" Lg.		F031A	F031A		1	Pin 1" Dia. x 8 1/4 Lg.		F031A	F031A	
58													1	Body Fit Bolt (lg. shaft)	076D0051			G231A	1	Body Fit Bolt (Lg. Shaft)	076D0050			G231A	1	Body Fit Bolt (lg. shaft)	076D0052			G231A
59													1	Body Fit Bolt (sh. shaft)	076D0053			G231A	1	Body Fit Bolt (Sh. Shaft)	076D0062			G231A	1	Body Fit Bolt (sh. shaft)	076D0061			G231A
60	4	Shaft Sleeves "O" Ring Linear	11-331	BUNA-N	BUNA-N	BUNA-N	4	'O' Ring Linear	11-336	BUNA-N	BUNA-N	BUNA-N	4	'O' Ring Linear	11-246	BUNA-N	BUNA-N	BUNA-N	4	'O' Ring Linear	11-252	BUNA-N	BUNA-N	BUNA-N	4	'O' Ring Linear	11-257	BUNA-N	BUNA-N	BUNA-N
61													4	Body Fit Bolt 'O' Ring Linear	11-115			BUNA-N	4	'O' Ring Linear	11-117			BUNA-N	4	'O' Ring Linear	11-117			BUNA-N
62													4	Butting Scrs. & Shafts 'O' Ring Linear	11-255			BUNA-N	4	'O' Ring Linear	11-259			BUNA-N	4	'O' Ring Linear	11-262			BUNA-N
63	1	Oil Seal Victor	60728	BUNA-N	BUNA-N	BUNA-N	1	Oil Seal Victor	60783	BUNA-N	BUNA-N	BUNA-N	1	Oil Seal Victor	63427	BUNA-N	BUNA-N	BUNA-N	4	Oil Seal Victor	61174	BUNA-N	BUNA-N	BUNA-N	1	Oil Seal-John Crane Style	450-600-20	BUNA-N	BUNA-N	BUNA-N
64	4	Oil Seal Victor	60872	BUNA-N	BUNA-N	BUNA-N	4	Oil Seal Victor	63044	BUNA-N	BUNA-N	BUNA-N	4	Oil Seal Victor	63199	BUNA-N	BUNA-N	BUNA-N	4	Oil Seal Victor	61359	BUNA-N	BUNA-N	BUNA-N	4	Oil Seal Victor	61384	BUNA-N	BUNA-N	BUNA-N
65																									1	Heat Exchanger	171A0002	E110A	E110A	E110A
66																									1	Cover	052B0030	L020A	L020A	L020A
67	2	Shim	163D0057	Plast	Plast	Plast	2	Shim	163D0056	Plast	Plast	Plast	2	Shim Timken	T50608-09-10	Steel	Steel	Steel	2	Shim Timken	T50611-12-13	Steel	Steel	Steel	2	Shim Timken	T50614-15-16	Steel	Steel	Steel
68													2	Stuffing Box Housing	149B0015	B407A			2	Stuffing Box Housing	149A0014	A010A			2	Stuffing Box Housing	149A0024	A010A		
69	20	Packing	3/8 S x 2 5/8 I. D.	JCC59	JCC59	JCC59	24	Packing	1/2 S x 3 1/4 I. D.	JCC59	JCC59	JCC59	32	Packing	3/8 S x 5 I. D.	JCC59	JCC59	JCC59	28	Packing	5/8 S x 5 7/8 I. D.	JCC59	JCC59	JCC59	28	Packing	3/4 S x 6 5/8 I. D.	JCC59	JCC59	JCC59
70	2	Washer Timken	K91510	Steel	Steel	Steel	2	Washer Timken	K91512	Steel	Steel	Steel																		
71	1	Air Bleed	155B0018	B407A	B407A	B407A	1	Air Bleed	155B0018	B407A	B407A	B407A	1	Air Bleed	155B0018	B407A	B407A	B407A							2	Ball Valve-Economiser	34228151	Diron	Diron	
72	1	Pipe Nipple	2" x 8 Lg.	Steel	Steel	SS	1	Pipe Nipple	2" x 8 Lg.	Steel	Steel	SS	1	Pipe Nipple	2" x 8 Lg.	Steel	Steel	SS							4	Half Nipple 3"x4 1/2 Lg.	130D0014	Steel	Steel	SS304
73	1	Ball Valve Rockwood	2" No. 204	SS316	SS316	SS316	1	Ball Valve Rockwood	2" No. 204	SS316	SS316	SS316	1	Ball Valve Rockwood	2" No. 204	SS316	SS316	SS316							4	Hose Clamp	4"	SS	SS	SS
74	2	Pipe 2"Sch40x31/4Lg.	130D0013	Steel	Steel	SS304	2	Pipe 2"Sch40x31/4Lg.	130D0013	Steel	Steel	SS304	2	Pipe 2"Sch40x31/4Lg.	130D0013	Steel	Steel	SS304	4	Pipe 2"Sch40 x 3 1/4 Lg.	130D0013	Steel	Steel	SS304	2	Tubing	3 1/2 x 12"	Vinyl	Vinyl	Vinyl
75	2	Hose Clamp	2 1/2"	SS	SS	SS	2	Hose Clamp	2 1/2"	SS	SS	SS	2	Hose Clamp	2 1/2"	SS	SS	SS	4	Hose Clamp	2 1/2"	SS	SS	SS	2	Globe Valve Crane	1/4" No. 88	Brass	Brass	Brass
76	1	Tubing	2"x48"Lg.	Vinyl	Vinyl	Vinyl	1	Tubing	2" x 48" Lg.	Vinyl	Vinyl	Vinyl	1	Tubing	2" x 54"	Vinyl	Vinyl	Vinyl	2	Tubing	2" x 7 1/2	Vinyl	Vinyl	Vinyl	2	Pipe Nipple	1/4"Sch40 x 3 3/4	Steel	Steel	SS
77	1	Globe Valve Crane	1/4" No. 88	Brass	Brass	Brass	1	Globe Valve Crane	1/4" No. 88	Brass	Brass	Brass	1	Globe Valve Crane	1/4" No. 88	Brass	Brass	Brass	2	Globe Valve Crane	1/4" No. 88	Brass	Brass	Brass						
78	1	Pipe Nipple	1/4"Sch40 x 1 1/2	Steel	Steel	SS	1	Pipe Nipple	1/4" Sch 40 x 1 1/2	Steel	Steel	SS	1	Pipe Nipple	1/4" Sch 40 x 1 1/2	Steel	Steel	SS	2	Pipe Nipple	1/4"Sch40 x 3 3/4	Steel	Steel	SS						
79																														
80																														
81																			2	Male Union Walworth	1" No. 7714	Iron	Iron	SS						
																			4	Close Nipple	1"	Steel	Steel	SS						
82																			2	Side Outlet Elbow Walworth	1" No. 7111	Iron	Iron							
83																			2	Pipe Nipple	1/4Sch40x2	Steel	Steel	SS						
84																			2	Reducing Bushing	1/4 x 1	Iron	Iron	SS						
85																			2	Gate Valve Walworth	2" No. 3	Bze.	Bze.	SS						
																			2	Reducing Bushing	1" x 2"	Iron	Iron	SS						
86																			2	Tee Walworth	1" No. 7117			SS						
87																									2	Screwed Flange	3"-125 lb.	Iron	Iron	SS304
88																									2	Street Elbow	3"-90°	Iron	Iron	SS
89																									2	Ball Valve - Economiser	3466T151			SS316
90	2	Snap Ring Truarc	5108-215	Steel	Steel	Steel													2	Spacer	058D0062	L020A	L020A	L020A	2	Spacer	058D0077	L020A	L020A	L020A

INSTALLATION

OPERATION

MAINTENANCE



HIGH DENSITY STOCK PUMPS

SIZE 11 HIGH DENSITY
SERIAL NO. 65909
ORDER NO. A-43511

Warren

CENTRIFUGAL
RECIPROCATING
SCREW AND
GEAR PUMPS

HYDRAULIC INSTITUTE 1917

PLEASE READ THESE INSTRUCTIONS BEFORE INSTALLING PUMP

WARREN PUMPS, INC.

WARREN, MASSACHUSETTS

PEACE DALE, RHODE ISLAND

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INTRODUCTION

This manual is intended to assist those concerned with installation, operation and maintenance of Warren High Density Stock Pumps. It is the manufacturer's hope that the following discussions will be clearly and easily understood.

Should questions arise that cannot be answered by the material contained in this manual, we suggest that the Warren Service Department be contacted directly or through your local Warren representative.

SECTION 1 – GENERAL INFORMATION

The Warren High Density Stock Pump is a positive displacement screw pump specifically designed for pumping high density paper stock.

Basically the pump consists of two counter-rotating shafts located in intersecting body bores. Each shaft includes a suction feeder screw, a pressure generating or pumping screw, a discharge feeder, a timing gear and various sleeves, seals and bearings.

The two shafts are arranged so that the pumping screws are meshed together and rotate in opposite directions in the intersecting pump bores. This arrangement in effect creates sealed cavities within the pressure generating section of the pump. The basic principle of operation is as follows: High density stock free falls from a washer or decker through a closed chute into the pump suction and onto the suction feeder screws. These feeder screws immediately move the stock into the pumping screws. With each rotation of the shafts, incoming stock is picked up in the first cavity of the pumping screws. Then, because of the advancing pitch, or threading action, of the pumping screws, the stock is trapped in the sealed cavity and is pushed towards the discharge side of the pump. Stock is discharged first from one screw then the other, creating a steady, practically pulseless flow of stock into the system. Close clearances and wide screw lands minimize slippage and make it possible to pump water at the same rate as high density stock.

The lands (outside surfaces) of the pumping screws are hard surfaced with colmonoy. Body bores are lined with industrial hard chrome. These hard surfaces resist abrasion and permit the use of similar materials that normally could not be used because of their galling characteristics.

The inclusion of close operating clearances into the design of Warren High Density Stock Pumps is made possible through the use of timing gears since the "timing" or placement of the gears on the shafts prevents rotational contact of the pumping screws. Timing gears incorporate helical, herringbone teeth for strength and smoothness in operation. Gear teeth are also hardened and crush lapped to insure proper tooth contact.

Radial loading is handled by four heavy duty roller bearings and two double roll, tapered bearings which also asborb axial thrust. All bearings are oil lubricated and are protected by lip type oil seals and labyrinthed slingers. Shafts are protected from packing wear by threaded shaft sleeves. Right and left hand threads are used on each shaft to preclude the possibility of sleeves being backed off due to packing drag.

Most high density stock contains considerable amounts of air entrained within the stock fibers. At pressures above 50 psi, this entrained air is often forced or squeezed out of the stock and forms air pockets which can cause severe pressure pulses in the discharge pipe line. To combat this, the Warren High Density Pump is fitted with an air bleed device that operates on the following principal: Inherent to the screw pump design is the tendency to compress stock on the screws to a higher density than the incoming stock. This compression of stock causes the liberation of much of the entrained air from the stock fibers. The air bleed device permits this liberated air to pass out of the pump before it enters the discharge system thereby preventing the vibration and hammering that would otherwise be present.

Warren High Density Pumps are normally belt driven through a universal joint coupling. Other types of drive arrangement can

be furnished if requested. The coupling includes a shear pin to protect the unit from damage in the event of jamming by foreign material. Zero motion switches can be provided as an option to interlock and shut down adjacent equipment if desired. Zero motion switches supplied by Warren Pumps, Inc. are shown at the rear of this manual.

SHIPPING — STORAGE AND PRESERVATION

Units are shipped on skids and are suitably boxed or crated to prevent damage from normal handling. All exterior, unpainted surfaces subject to corrosion are coated with a rust preventive compound. Pump openings are covered with blank flanges.

A packing list is furnished itemizing the contents of the shipment. When received, check the contents against the packing list. Report any descrepancies to Warren or your local Warren agent immediately.

If pump is not to be immediately installed and operated or if pump is not to be operated for some time after installation, the unit should be cared for as follows:

1. Select a clean, dry storage location.
2. Be certain that blank flanges covering pump openings are in place and intact.
3. Rotate pump shaft through several turns at least weekly.
4. If area where pump is stored or installed in a moist or dusty atmosphere:
   a) Recoat all exterior, unpainted surfaces subject to corrosion with a rust inhibiting compound.
   b) Fill oil reservoirs completely full of oil.
   c) Protect pump and driver with a plastic or canvas covering.

SECTION 2 — INSTALLATION

INSTALLATION

NOTE — Protect your investment. A properly planned and executed installation is necessary for trouble free pump performance.

HANDLING

Take care when moving the unit about prior to installation. This is particularly important with the large, heavy units. Rough handling and thoughtless selection of points from which to lift these units may cause permanent distortion of the base.

LOCATION

When used under a washer or decker, the pump should be located so that the suction is directly under the washer or decker discharge. This arrangement will permit the stock to free fall directly into the pump through the suction chute.

Provide ample space around the pump to permit routing work. The overhead should be fitted with pads from which lifting devices may be hung. Allow sufficient room to facilitate front pullout of the rotating assembly. Allow 30″ from the outboard end of the jackshaft for this purpose.

CONSTRUCTION OF POURED CONCRETE FOUNDATIONS

Foundations should be a suitable mass to provide a rigid support for the unit. Use reinforcing steel as necessary.

A template should be made to position and hold the foundation bolts in place while pouring the concrete. Location and sizes of bolt holes are shown on the certified outline drawing supplied to the purchaser. Each bolt is installed in a pipe sleeve, the inside diameter of which should be three times the outside diameter of the bolt. The pipe sleeve allows for minor adjustments in bolt spacing after foundation is in place (Fig. 1). Two methods commonly used to secure and prevent bolts from turning are:

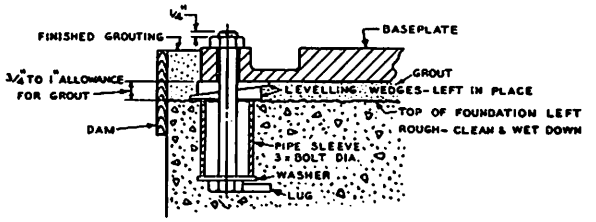


Fig. 1

Verso Paper Corp., Bucksport Facility
2 River Road, Bucksport, ME 04416

Linda Stevens-Olsen, Purchasing Coordinator
Phone 207 469 1267
Fax 207 469 1714
E-Mail Linda.Olsen@versopaper.com

August 4, 2011

URGENT

CAN-AM Machinery, Inc.
Att: Daniel Nigrosh
44 Old Princeton Road
Fitchburg, MA 01420

⇨ **Forwarding this letter and attached insurance policy to your insurance company as soon as possible helps to assure their prompt and accurate processing of our insurance requirements.**

Some vendor companies may receive forms to be signed by them (i.e., Scheduled Auto form or Sole-Proprietorship form). If you do receive these, please be sure that YOUR COMPANY signs, dates, and mails these forms directly back to me asap. You do not need to forward these on to your insurance company.

Following the above avoids possible delays in processing your purchase orders.

To Whom It May Concern:

We have a purchase order ready to issue for your company to supply one refurbished Goulds 3175 centrifugal pump (Quote 32722) but cannot do so until we receive your updated insurance information.

- As of January 1, 2011, the newest insurance coverage requirements that we need for all vendors performing work on site are listed below.
- Please prepare only one certificate of insurance for the information we request.

1. **Commercial General Liability**

   On an occurrence form, with limits of not less than:
   $1,000,000 Bodily Injury and Property Damage
   (combined single limit per each occurrence);
   $1,000,000 Products / Completed Operations Aggregate; and
   $1,000,000 Personal and Advertising Injury

2. **Automobile Liability**

   Limits not less than:
   $1,000,000 for Bodily Injury and Property Damage
   (combined single limit per each occurrence)
   Coverage must be for:
   Any Auto or it must be for
   All Owned Autos + Hired Autos + Non-Owned Autos

   - **Scheduled Autos + Hired Autos + Non-Owned Autos** may be acceptable if a "Scheduled Auto Warranty" contract amendment or certification is agreed to by the contractor or service provider. **(If "Scheduled Autos" is checked on the policy, Verso Paper will supply this form to the said contractor for signature and return.)**
   - Please tell us if you do not use your automobile on site (meaning you only park it in our parking lot).
   - Please tell us if you do not own any autos.

Sorry please disregard — supplying pump only — not work on site.

Verso simple. Linda

3. Workers' Compensation and Employer's Liability

As required by statute. Since Verso Paper's risk of assuming liabilities for contractor and employee-related injuries is increased substantially if workers' compensation insurance is not maintained, Verso Paper requires that all contractors provide workers' compensation and employer's liability coverage regardless of state-allowed exceptions or "opt out" provisions.

Workers' compensation policies should include coverage for owners / partners / proprietors / executive officers. **Please tell us if you are a sole proprietorship. If you are, Verso Paper will supply an insurance option agreement to the contractor / vendor for signature and return to Verso Paper.)**

Employer's Liability Coverage Limits **Not less than $100,000 each accident; $100,000 Disease Each Employee; and $500,000 Disease Policy Limit**

- Limits within any of the above categories can be obtained using any combination of primary and excess / umbrella policies totaling the minimum limits required.
- Excess / Umbrella coverage must be shown on the same certificate or must list all policies on the certificate showing the excess coverage.

4. Additional Insureds

The following names must be listed exactly as shown in the description of operations box as additional insureds "with respect to liability arising out of the contractor's or service provider's operations or services being performed".

Verso Paper Corp. and **Verso Bucksport LLC**

(If this is listed incorrectly, the policy will be returned.)

5. Cancellation Clause

Insurance provider to notify Bucksport's Purchasing Coordinator with at least 30 days' notice of policy cancellation except for 10 days' notice for cancellation of premium.

6. Certificate Holder

The certificate holder should be written exactly as follows:

Verso Paper Corp., PO Box 1200, Bucksport, ME 04416

(If this is listed incorrectly, the policy will be returned.)

Please inform your insurance company to not list us as Champion or International Paper. These are no longer valid names for our company location in Bucksport.

7. Coverage

Current (unexpired) dates must be on the certificate.

8. Safety Qualification

In order to update our Safety Management records, please note that **maintenance / construction contractors only** may be receiving an Appendix B of our Bucksport Mill Contractor Safety Management Program with this letter. **If your company has received an Appendix B, please complete and return the safety information to Robin Faulkner, CSP, Verso Paper Corp., PO Box 1200, Bucksport, ME 04416. All questions regarding this safety form only should be addressed to Robin at 207 469-1540.**

Sincerely,

Linda

Linda Stevens-Olsen
Purchasing Coordinator

a) A washer is placed between the bolt head and pipe sleeve with a lug welded to the bolt head (Fig. 1).

b) The bolt may be of rod construction, bent 90° below the pipe sleeve.

Stuff waste between foundation bolts and sleeves to prevent concrete from entering while foundation is being poured. Foundation bolts must be long enough to allow from ¾" to 1" for grouting under the baseplate (Fig. 1). When pump is level the bolts should extend ¼" through the nuts.

CAUTION: Since baseplate leveling is done after bolts are installed, it is better to have bolts too long and then cut to proper length.

Leave top surface of foundations rough for adherence of grout.

LEVELING THE BASEPLATE

Move pump next to foundation. The surface of the foundation should be thoroughly cleaned and roughed. Set leveling wedges (Fig. 1) adjacent to foundation bolts and remove waste from pipe sleeves. Lift pump from skids and clean underside of baseplate. Lower pump over foundation bolts onto wedges. Adjust wedges to allow for ¾" to 1" of grout, being sure pump flanges are plumb. Care must be taken at all times to prevent damage or distortion of the pump.

GROUTING IN THE BASEPLATE

Build a board dam around the foundation to the desired height for finished grouting (See Fig. 1). A mixture of one part portland cement to two parts clean sand with just enough water to mix to a thick creamy consistency should be made for grout. Wet the underside of the baseplate and foundation top, then pour the grout through the holes in the baseplate. Thoroughly puddle the grout during pouring to prevent air pockets and hollow spots. After grout has set sufficiently, remove the board dam and finish off the grout as desired. When grout has hardened, usually in about 48 hours, pull up on foundation bolts.

PIPING — GENERAL

Piping runs should be as direct as possible. Use long radius fittings to change piping direction. Piping should be adequately supported and properly anchored with allowance for expansion. Piping should not be supported by the pump flanges nor should piping stresses be transmitted to the pump. When connecting piping to the pump, flanges should line up square so that it is not necessary to spring piping into place with flange bolts.

SUCTION CHUTE

There are several points that should be considered concerning design of the suction chute:

Configuration — the suction chute should be straight if at all possible. Angles or slops in the suction chute tend to block the free fall of stock and slug feed the pump. If the pump is fed in this manner, it will pump in a like manner causing fluctuations in discharge pressure and motor amperage. If it occurs, this type of operation will not affect the pump but it is not consistent with good system operation. The suction chute should not be tapered towards the pump or otherwise constricted as the stock may tend to bridge the chute preventing further feeding. This design offers an ever increasing area to the stock as it falls and eliminates stock bridging in normal operating circumstances.

Smoothness — the inner walls of the suction chute should present a smooth surface. Projections into the chute and jagged welds should be avoided.

Strength — the suction chute design must incorporate sufficient strength to contain 100% capacity of stock and water. Should the pump stop for any reason without a corresponding shutdown of the washer or decker, the suction chute will be quickly filled. Also, by designing sufficient strength into the chute, it may be used as a surge area to compensate for load fluctuations.

DISCHARGE PIPING

Discharge piping for high consistency stock piping requires specific data. Generally, avoid short radius fittings and avoid low spots in the line which will not flush or drain. Inclusion of a discharge value for use when the pump is not operating is desirable. The

discharge system should also include a valve located adjacent to the pump that can be opened to drain the discharge line.

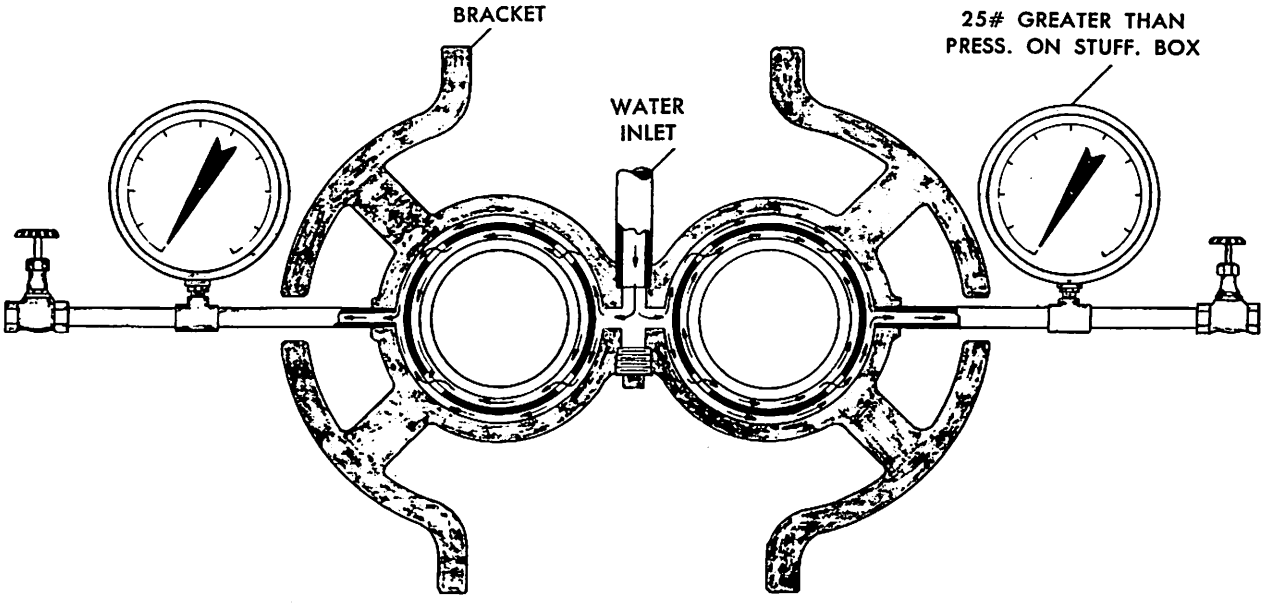
FLUSHING AND DILUTION

It is recommended that a combination flushing and dilution line be installed in the pump suction chute as it is necessary to flush the piping and pump of any high consistency stock prior to shutdown to prevent plugging due to dewatered stock. (Power required to move extremely high consistency stock through a long transfer line may be beyond the capabilities of the driver). The flushing and dilution line may also be used for stock dilution during start-up until the pump is handling normal load and the system has been leveled out.

STUFFING BOX FLUSHING WATER

High Density pump stuffing boxes required the injection of clean, cool water for flushing and lubrication of the packing rings.

Suction end stuffing boxes required 2 GPM of water per gland at 25 psi. Discharge end stuffing boxes required 2 GPM of water per gland at 25 psi higher than the pump discharge pressure as specified on the pump nameplate. See Fig. 2 for location of fittings for standard IN & OUT flushing water arrangement.



SECTIONAL VIEW THROUGH LANTERN RINGS

Fig. 2

LUBE OIL COOLING WATER

No. 125 and 160 High Density pumps include lube oil coolers located inside the timing gear housing. Connections for piping water to the cooler is shown on the certified outline drawing provided with the pump.

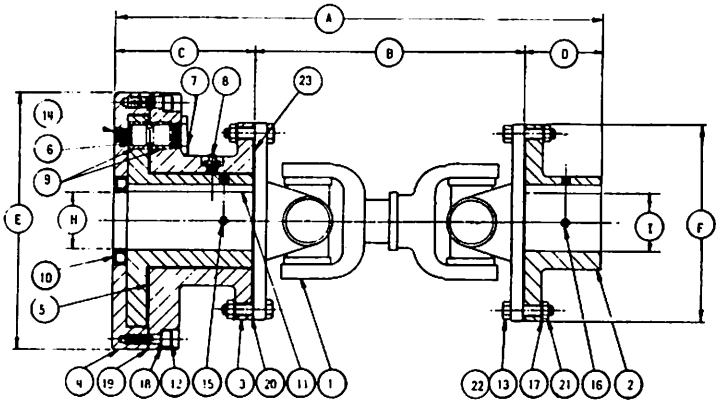
AIR BLEED SYSTEM

Flushing connections are provided for the air bleed system to prove 2-3 GPM flow. This flow is required to dilute stock carried over into the bleed system and flush it back to the pump suction. These connections are shown on the certified outline drawing provided with the pump.

PROTECTIVE DEVICES

Shear Pin Coupling (See Fig. 3)

Warren High Density pumps are furnished with a standard shear pin coupling. The shear pin is sized for each application to offer protection against motor overload and pump damage due to foreign material entering the pump.



COUPLINGS		DIMENSIONS						KEY-WAY	MAX. BORE ON PC. #5 H ± .001 .000	MAX. BORE ON PC. #2 I ± .001 .000	KEYWAY
SIZE	PART NO.	A	B	C	D	E	F	PC. 5			PC. #2
#6	95-161	16-3/4	9-7/8	4-1/8	2-3/4	8-1/2	4-5/8	1/2x1/4	1.8750	1.8750	1/2 x 1/4
#8	95-160	17-1/4	9-1/2	5"	2-3/4	9"	4-7/8	1/2x1/4	2.0000	2.0000	5/8 x 5/16
#11	95-162	23-21/32	13-29/32	5"	3-3/4	10-1/2	6"	3/4x3/8	3.0000	3.5000	7/8 x 7/16
#125	95-233	28-3/8	16-1/4	5-1/2	4-9/16	14-1/2	6-5/8	7/8x7/16	3.375	4.000	1 x 1/2

SHEAR PIN DATA

TORQUE IN LBS	NECK DIA.	PART NO.	COUPLING SIZE
3020	.187	112-16	95-161 #6 WARREN SHEAR PIN
5400	.150	112-17	
8400	.312	112-18	
12150	.375	112-08	
13270	.375	112-13	95-160 #8 WARREN SHEAR PIN
18000	.437	112-14	
23550	.500	112-09	
29800	.562	112-15	
36900	.625	112-19	
21400	.312	112-11	95-162 #11 WARREN SHEAR PIN
30900	.375	112-10	
42000	.437	112-12	
53750	.250	112-20	
7700	.187	112-21	
6050	0.187	112-21	095A0233 #125 WARREN SHEAR PIN
10800	0.250	112-20	
16800	0.312	112-11	
24300	0.375	112-10	
33000	0.437	112-12	

GENERAL NOTES

1. MAX. PERMISSIBLE PARALLEL MISALIGNMENT FOR THE #125 CPLG. IS 9/16".
2. SHEAR PIN MATERIAL -STEEL (AISI 1215 COLD DRAWN) AVERAGE SHEARING STRESS.
3. TO DETERMINE ULTIMATE HORSEPOWER CAPACITY OF SHEAR PIN HP = TORQUE (RPM) / 63025
   SIZE SHEAR PIN FOR 1.5 X MOTOR HORSEPOWER.

LIST OF MATERIAL

PC NO.	MATERIAL	#6 WARREN SHEAR PIN COUPLING DESCRIPTION	QUAN.	SERVICE PART NO.	#8 WARREN SHEAR PIN COUPLING DESCRIPTION	QUAN.	SERVICE PART NO.	#11 WARREN SHEAR PIN COUPLING DESCRIPTION	QUAN.	SERVICE PART NO.	#125 WARREN SHEAR PIN COUPLING DESCRIPTION	QUAN.	SERVICE PART NO.	REMARKS
1		#61 WS WATSON SPICER	1		#81 WS WATSON SPICER	1		#8 WS WATSON SPICER	1		DOUBLE UNIV. JT. (TWIN DISC)	1	J-310-CS	
2	DUCTILE IRON	COUPLING HUB (PUMP HALF)	1	164C0006A422A	COUPLING HUB (PUMP HALF)	1	164C0005A422A	COUPLING HUB (PUMP HALF)	1	164C0006A422A	COUPLING HUB PUMP HALF	1	164B0028D IRON	
3	GRAY IRON	COUPLING COVER (REAR)	1	051C0061A010A	COUPLING COVER (REAR)	1	051C0062A010A	COUPLING COVER (REAR)	1	051C0063A010A	COUPLING COVER REAR	1	051B0119A010A	
4	GRAY IRON	COUPLING COVER (FRONT)	1	052C0017A010A	COUPLING COVER (FRONT)	1	052C0018A010A	COUPLING COVER (FRONT)	1	052C0019A010A	COUPLING COVER FRONT	1	052B0029A010A	
5	DUCTILE IRON	COUPLING HUB (JACKSHAFT)	1	164C0007A422A	COUPLING HUB (JACKSHAFT)	1	164C0008A422A	COUPLING HUB (JACKSHAFT)	1	164C0009A422A	COUPLING HUB (JACKSHAFT)	1	164B0027A416A	
6	SCREW STOCK	SHEAR PIN	1	F051A	SHEAR PIN	1	F051A	SHEAR PIN	2	F061A	SHEAR PIN	1	F051A	
7	PARKER	HEX HEAD PLUG	1	BP50N-S	HEX HEAD PLUG	1	076D0026F051A	HEX HEAD PLUG	2	BP50N-S	HEX HEAD PLUG	1	BP50N-S	
8	ALEMITE	LUBE FITTING 1/8	1	1610-BL	LUBE FITTING 1/8	1	1610-B	LUBE FITTING 1/8	1	1610-BL	LUBE FITTING 1/8	1	1610-BL	
9	UNIVERSAL ENGR.	BUSHING	2	GM-961	BUSHING	2	45-63	BUSHING	4	GU-961	BUSHING	2	GU-961	
10	VICTOPOREX	OIL SEAL	1	60736	OIL SEAL	1	60796	OIL SEAL	1	60967	OIL SEAL	1	61083	
11	LOW CARBON BAR	KEY(JACKSHAFT)1/2SQ. X 3"LG.	1	F021A	KEY(JACKSHAFT) 1/2SQ. X 6"LG.	1	F021A	KEY(JACKSHAFT) 3/4SQ. X 6"LG.	1	F021A	KEY(JACKSHAFT)7/8SQ.X 4-1/4	1	F021A	
12	ALLOY STEEL	SOC.HD.CAPSCR. 3/8-16 X 1-1/4	6	H022K	SOC.HD.CAPSCR. 3/8-16 X 1"LG.	6	H022K	SOC.HD.CAPSCR. 3/8-16 X 1-1/2	8	H022K	SOCK.HD.CAPSCR. 3/8-16 X 1-1/2	8	H022A	
13	LOW CARBON STL.	HEX HD.BOLTS 7/16-14 X 1"LG.	8	H011K	HEX HD.BOLT 3/8-16 X 1-1/2	16	H011K	HEX HD.BOLT 7/16-14 X 1-3/4	20	H011K	STUD 3/8-16 X 1-3/4	12	H022A	
14	STEEL	SOC. HD. PIPE PLUG 1/4	1		SOC. HD. PIPE PLUG 1/4	1		SOC. HD. PIPE PLUG 1/4	2		SOCK. HD. PIPE PLUG 1/4	1		
15	ALLOY STEEL	SOC.HD.SETSCR. 1/4-20 X 1/2	2	H022A	SOC.HD. SETSCR. 1/4-20 X 1/2	2	H022A	SOC.CUP PT.SETSCR. 3/8-16x3/8	2	H022A	SOCK.HD.SETSCR, 1/4-20X3/8	2	H022A	
16	ALLOY STEEL	SOC.HD.SETSCR. 1/4-20 X 3/4	2	H022A	SOC.HD.SETSCR. 1/4-20 X 7/8	2	H022A	SOC.CUP PT.SETSCR. 3/8-16X3/4	2	H022A	SOCK.HD.SETSCR. 1-8 X 1	2	H022A	
17	SHAKEPROOF	LOCKWASHER	6	1222-00	LOCKWASHER	22	1220-00	LOCKWASHER	24	1222-00	LOCKWASHER 3/8	12	1220-00	
18	SHAKEPROOF	LOCKWASHER	6	1220-00				LOCKWASHER	8	1220-00				
19	YELLOID	GASKET .007 X 8-1/2	1		GASKET .007 X 9" LG.	1		GASKET .007 X 10-1/2	1		GASKET .010 X 14-1/2 DIA.	1	163D0090YELLW	
20	YELLOID	GASKET .007 X 6-3/4	1		GASKET .007 X 6-5/8	1		GASKET .007 X 7-3/4	1		GASKET .010 X 6-3/4 DIA.	1	163D0091YELLW	
21	NAVAL BRASS				HEX NUT 3/8-16	16	H071A	HEX NUT 7/16-14	24	H071A	HEX NUT 3/8-16	12	H022A	
22	LOW CARBON STL.							HEX HD.BOLT 7/16-14 X 1-1/2	4	H011A				
23											SEALING PLATE GALVANIZED	1	056D0076 GALST.	

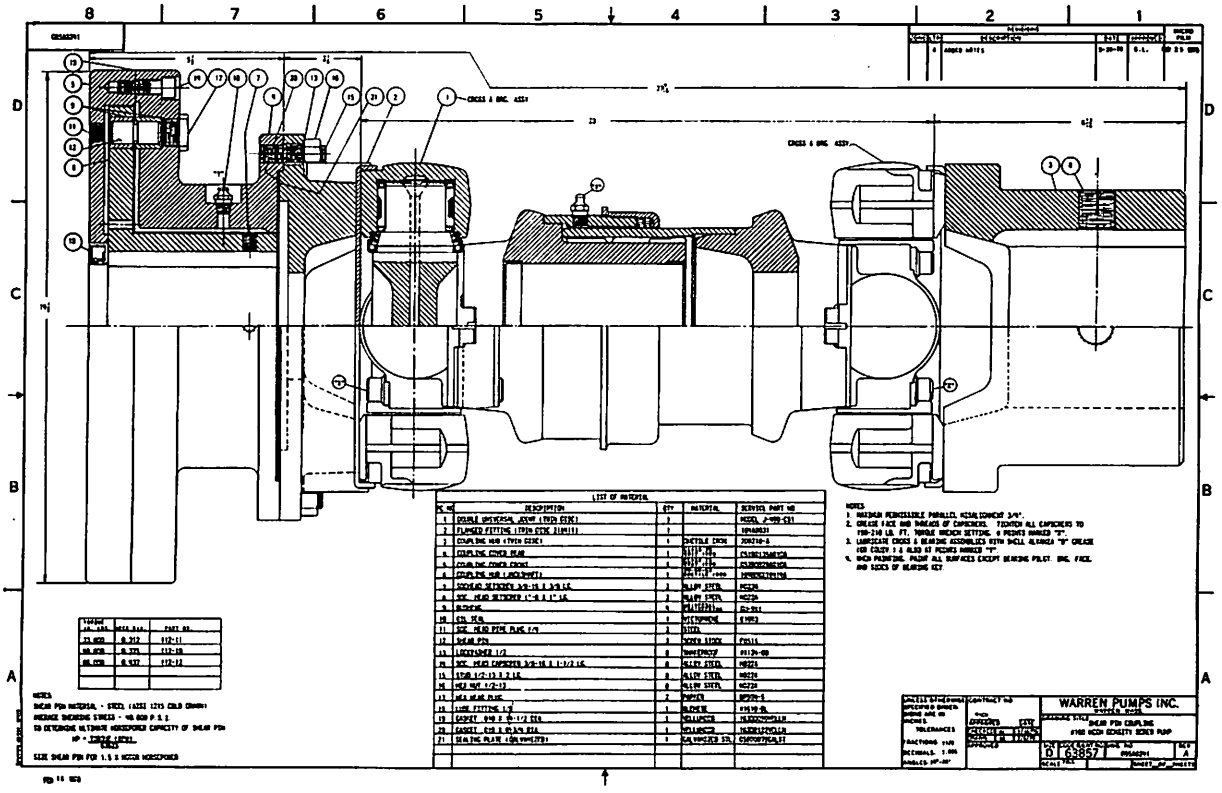


Fig. 3

AMMETER

It is suggested that an indicating ammeter be installed near the operators station so the operator will have an indication of pump loading during pump operation. The ammeter will provide an immediate indication of any change in stock consistency, blockage in the pump, broken shear pin or driver failure.

RUPTURE DISC

On high pressure pipe line transfer, it is suggested that a pressure relief device (rupture disc) be installed adjacent to the pump discharge to protect the pipeline from excessive pressure.

SECTION 3 – OPERATION

PREPARING UNIT FOR INITIAL START-UP

1. Check motor for correct rotation. Do this with the drive belts off the motor sheave or with the universal coupling disconnected. Before replacing the drive belts or reconnecting the coupling, accomplish the following items.
2. Since a construction site is generally dusty, etc., it is recommended that the timing gear and thrust bearing housings be flushed and refilled to the proper levels with clean oil. See "Lubrication".
3. Install a screen in the suction chute just above the pump inspection doors. The screen mesh should be ⅛" or smaller. Simply wedge the screen against the sides of the suction chute using pieces of wood cut to fit tightly. Remove drain plug from the bottom of the pump suction also.
4. Flush the system ahead of the pump thoroughly permitting the flushing water to fall through the suction chute. Leave both pump inspection doors off for flushing water to drain. Also flush through all of the permanent flushing and dilution lines into the pump suction. After all flushing has been completed, remove the screen from the suction chute.
5. Using a magnet, go over the bottom of the pump suction carefully and completely to remove weld heads or scale that may have passed through the screen.
6. Replace the drain plug and the metal inspection door. Leave the plastic inspection door off until pre-start up preparations have been completed.
7. Open flushing water valves to the air bleed system to ascertain that the bleed lines are open and sufficient water (2-3 GPM) is available.
8. Obtain the design discharge pressure from the pump nameplate, then determine that there is sufficient stuffing box flushing water pressure available at the discharge end packing glands to provide gland seal water at 15 psi greater than the design discharge pressure. If pressure regulators are installed in the gland seal water system, determine that these devices will produce the desired pressure.
9. Adjust packing glands with seal water turned on to obtain a moderate leakage (60 drops/minute) from the packing glands.
10. Turn the rotor through several rotations by hand (use a bar through the universal coupling or a pipe wrench on the pipe wrench collar).
11. Replace the drive belts or reconnect the universal coupling.
12. With all of the above steps completed, the unit is now ready for operation.

STARTING

1. Check all levels in both bearing housings.
2. Open flush water valves in the air bleed system.
3. Open valves in the stuffing box flushing water system. Set discharge end pressure at 25 psi higher than pump discharge pressure. Set suction end pressure at 25 psi.

4. Open valves in lube oil cooling water system (No. 125 and 160 units only).
5. Open all valves on the discharge side of the pump.
6. Start the pump. Note: Water entering the pumps through the air bleed system and suction end glands is sufficient for operation of the pump.
7. Start stock off the washer or decker into the pump.

OPERATIONAL NOTES

1. Discharge pressure and motor amperage is affected by:
   a) Amount of stock being pumped (TPD)
   b Consistency of stock being pumped
2. Pump capacity is determined by pump speed.
3. The pump will carry away a specific amount of stock per revolution. If the amount of stock fed into the pump exceeds the pump's volumetric capacity, the excess stock will accumulate in the suction chute. When the flow rate is reached, it is necessary to reduce slightly the amount of stock coming off the washer or decker. It is possible to increase the pumps capacity by raising the pump speed; however, this MUST NOT be attempted without first contacting Warren Pumps, Inc.
4. Stock consistency off the washer or decker may be raised until the amperage drawn by the motor indicates the motor has reached its full load capability. This will generally be reached prior to raising the discharge pressure sufficiently to effect the safety of operation; however, discharge pressure must be monitored while raising consistency and the pressure should not be allowed to exceed the pump nameplate pressure.
5. If desired, the pump will easily pump water for line flushing purposes.

SHUTDOWN

1. Stop flow of stock to the pump.
2. Open dilution water to pump and allow pump to operate pumping water for a sufficient length of time to move the stock out of the discharge line. This will prevent dewatering of the stock in the discharge piping.
3. Secure dilution water.
4. Stop pump.
5. If static head on pump is greater than 60 feet, stop pump leaving bleed water on to pump bores (close 2" bleed valves). Close discharge valve, drain discharge line, drain suction — then shut off bleed water and open 2" bleed valves.
6. Secure valves supplying water to the air bleed device, stuffing box flushing water, and the lube oil cooler.

START-UP AFTER FORCED SHUTDOWN

If the pump is unexpectedly shut down because of jamming by foreign material or by a power failure, the following procedure may be used to get the unit back into operation as quickly as possible.

A) Shear Pin Failure (foreign material)

1. If installed, close the pump discharge valve as quickly as possible to prevent the stock from dewatering.
2. Open pump inspection door and remove the drain plug from the pump suction, then flush stock out of the suction area.
3. Use a pipe wrench on the pipe wrench collar located on the long shaft to turn the pump backwards. This should dislodge the foreign material and back it into the pump suction where it can be picked out.
4. Replace the shear pin in the universal coupling. See Fig. 3.
5. Replace the pump inspection door.
6. Open dilution water valves to allow water to flow into the pump suction.
7. Open the discharge line drain valve and start the pump.
8. If a discharge valve is installed, open this valve and close the drain valve. The water pressure developed by the pump should be sufficient to start the stock in the line moving. If there is a high discharge head working against the pump, it may be necessary to partially drain

the discharge line before the pump will start.

B) Start-up After Power Failure

1. The start-up procedure in this case is the same as outlined under Shear Pin Failure except eliminate steps 3 and 4 as they will not apply.

SECTION 4 — PREVENTIVE MAINTENANCE

PERIODIC INSPECTION

DAILY

1. Check oil level in bearing housings.
2. Check stuffing boxes to see if excessive leakage exists. If excessive leakage is observed but gland travel is used up, packing rings must be considered as worn and should be replaced.
3. Adjust stuffing box flushing water flow to provide sufficient flushing and cooling water.
4. Check and adjust as necessary cooling water to timing gear housing (No. 125 and 160 High Density only).
5. Check and adjust flow of water as necessary for proper operation of air bleed system (when installed.)
6. Visually inspect piping, driver coupling, V-belts and associated equipment for proper operation.
7. Record average amperage, discharge pressure, consistency, and tonnage daily. This record is useful in determining pipeline buildup of pitch or other composition which may tend to reduce the effective discharge pipe diameter.

WEEKLY

1. Run idle pump under power and dilution water.
2. Check proper operation of automatic controls and regulators.
3. Inspect V-belt tension. Adjust as necessary.

QUARTERLY

1. Check all foundation bolts and holddown bolts for tightness.
2. Check alignment of V-belts since wear, vibration and constant temperature changes may cause serious misalignment.

ANNUALLY

1. Check existing pump capacity and power requirements against pump nameplate data. A Warren High Density Stock Pump is a positive displacement pump. With a constant system and stock consistency, pump wear is indicated when capacity is off or if sufficient pressure cannot be developed. If capacity is off 10% or more, or if pump will not develop sufficient discharge pressure, pump should be disassembled and worn parts replaced. (This is meant only as a guide line and the exact time for disassembly and inspection is left to the discretion of the customer.) If pump performance is satisfactory, the pump need not be disassembled for inspection. It may, however, be desirable to check the amount of wear taken place within the pump. By removing the inspection covers at either side of the pump suction, feeler gages can be inserted between screw outside diameter and the body bores, (See Fig. 4). In addition, the flank clearances, or clearance between the sides of the meshed screws can be checked in the same manner, (See Fig. 5.)

The pump was furnished with the following original measurements:

Pump Size	**Total** Screws to body clearance	**Total** Flank or side clearance
No. 6	.030 — .034	.030 — .034
No. 8	.038 — .043	.038 — .043
No. 11	.038 — .043	.038 — .043
No. 125	.034 — .046	.034 — .046
No. 160	.034 — .046	.034 — .046

Fig. 4

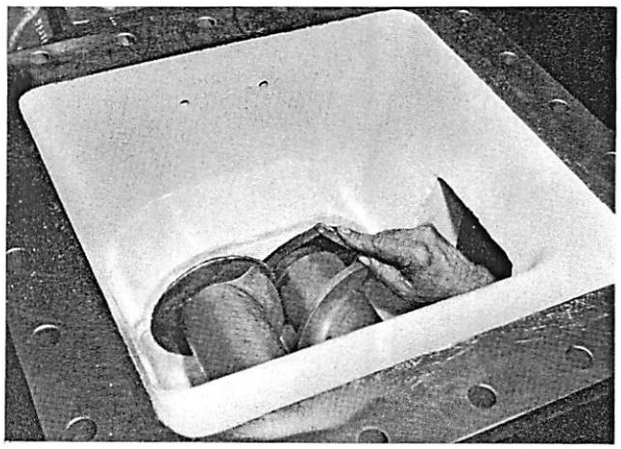


Fig. 5

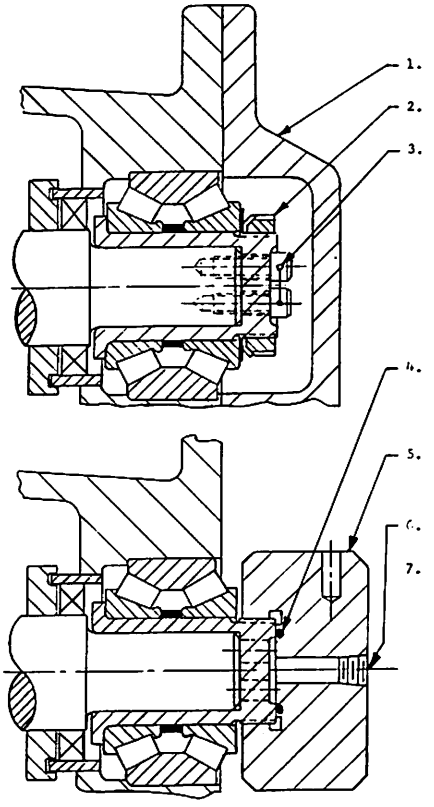
SECTION 5 – MAINTENANCE

DISASSEMBLY

NOTE: Part numbers inside ( ) refer to parts shown on drawing No. E-790.

TO REMOVE ROTOR FROM BODY:

1. Isolate pump hydraulically and driver electrically.
2. Drain oil from front head (2) and rear head (3). Pipe plugs are provided for this purpose.
3. Disconnect cooling water tubing from inlet and outlet connections located on front head (2). Size No. 125 and 160 only.)
4. Disconnect flexible coupling, then remove jackshaft and jackshaft bearing supports from baseplate.
5. Remove rear head (3) from rear bearing bracket (5).
6. Remove lockwire from thrust bearing adjusting sleeve lockscrews (45), then remove these lockscrews.
7. Remove thrust bearing locknuts and lockwashers (70) from adjusting sleeves (36).
8. Pull thrust bearings (48) and adjusting sleeves (36) from the shafts and rear bearing brackets. There are three ways to accomplish this:
   a) Drawings (Fig. 6 thru 6-D) included in this manual detail the construction of a bearing puller which will greatly facilitate removal of thrust bearings and adjusting sleeves. Steps outlining the use of this tool are shown in Fig. 6.
   b) Another type puller that may be constructed is detailed following.
      1. Locate a bearing locknut identical to the locknut presently installed on adjusting sleeve (36).
      2. Select a ½" to ¾" thick piece of flat stock approximately 2" wide and long enough to overlap the bearing bore 1" to 2" on each side.
      3. Drill and tap the flat stock near each end for a ⅝" bolt.
      4. Weld the flat stock to the bearing locknut obtained in Step 1.
      5. Screw this assembly onto the adjusting sleeve (36) then by tightening the bolts against the bearing bracket, the adjusting sleeve and thrust bearing will be pulled.
   c) Adjusting sleeves (36) and thrust bearings (48) may be removed by pulling the complete rear bearing bracket (5). If this method is elected, it will be necessary to remove split glands (25) from the shafts and loosen rear bearing bracket slingers (41) so that they will slide on the shafts prior to pulling the bearing bracket. After pulling the bearing bracket, the adjusting sleeves and thrust bearings may be pushed out of the bearing



1. Drain oil from rear head and remove rear head.
2. Remove bearing locknuts and locknut washers.
3. Remove tie wire and six Allen head cap screws.
4. Place the O-ring in the bearing removal tool. It is advisable to place a small amount of grease on the O-ring to hold it in position.
5. Thread the removal tool onto the adjusting sleeve threads and tighten enough to seat O-ring properly.
6. Connect hand hydraulic pump to the removal tool.
7. The hydraulic fluid will enter through the holes in the adjusting sleeve and apply pressure on the end of the shaft forcing the adjusting sleeve and bearing off the shaft.

Drawings for machining the removal tool are enclosed in this book (QP Tool can be purchased for a nominal fee.)

FIG. 6 — THRUST BEARING & ADJUSTING SLEEVE REMOVAL

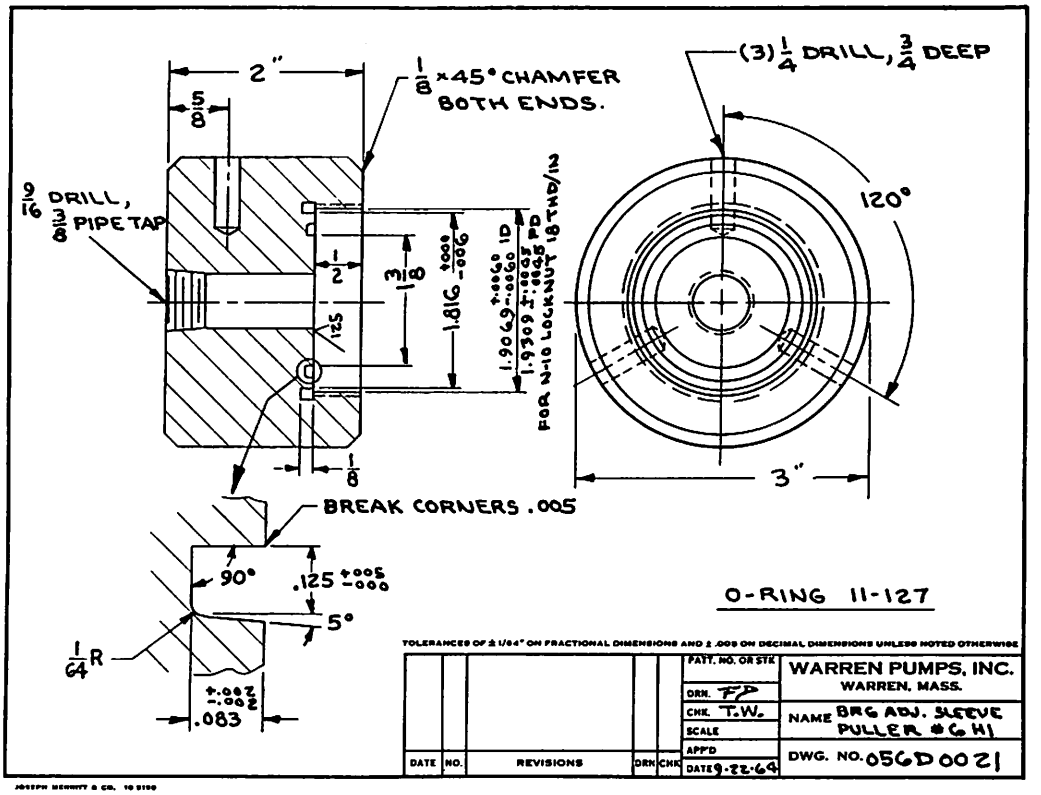


Fig. 6A

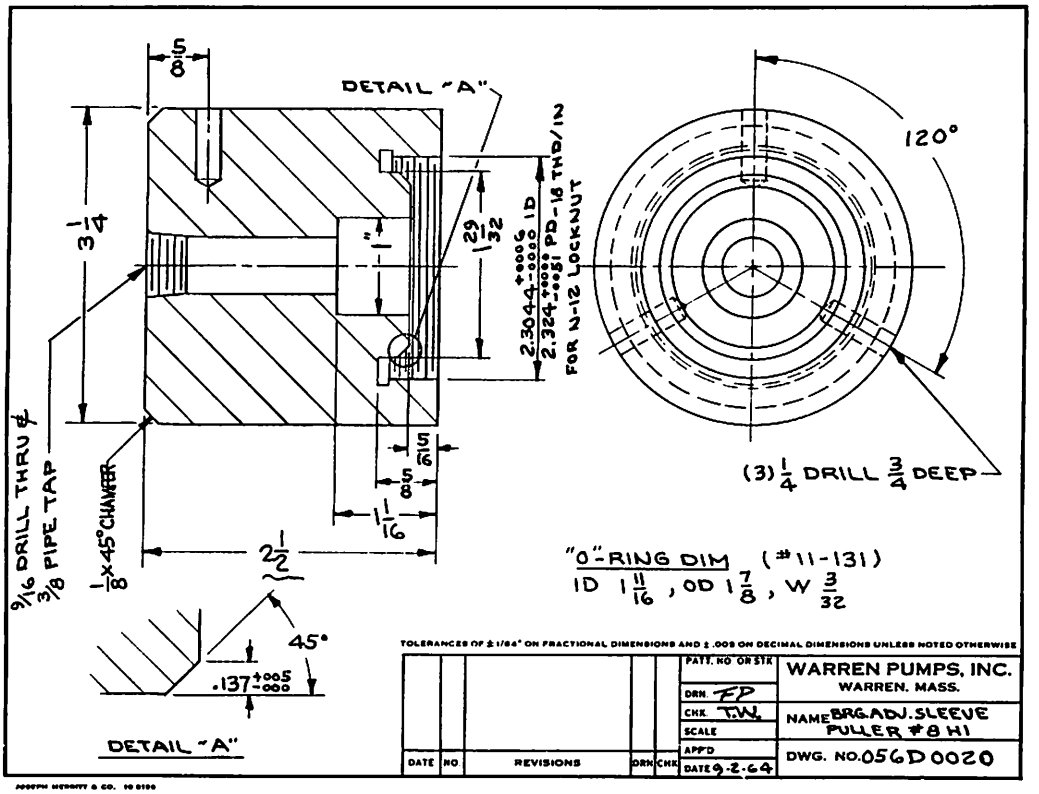

DETAIL "A"
120°
(3) 1/4 DRILL 3/4 DEEP
"O"-RING DIM (#11-131)
ID 1 11/16 , OD 1 7/8 , W 3/32
45°
DETAIL "A"
TOLERANCES OF ± 1/64" ON FRACTIONAL DIMENSIONS AND ± .005 ON DECIMAL DIMENSIONS UNLESS NOTED OTHERWISE
WARREN PUMPS, INC.
WARREN. MASS.
NAME BRG. ADJ. SLEEVE PULLER #8 HI
DWG. NO. 056D0020
DATE 9-2-64
REVISIONS

Fig. 6B

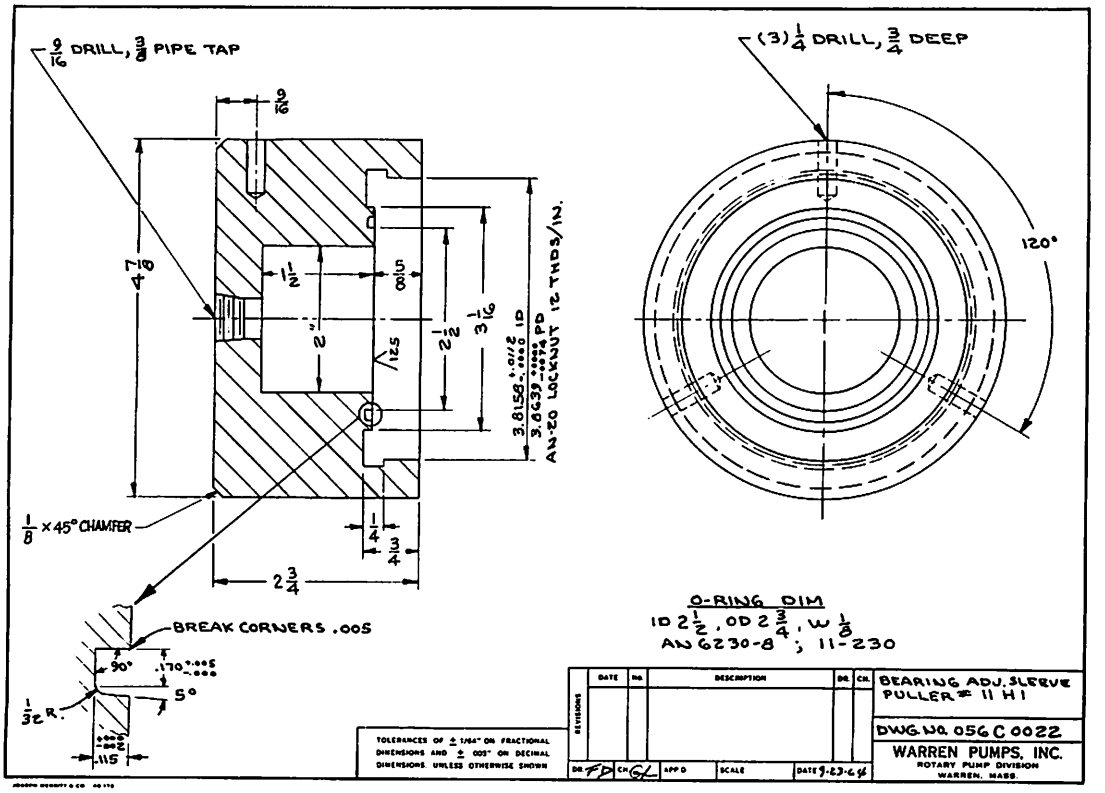

9/16 DRILL, 3/8 PIPE TAP
(3) 1/4 DRILL, 3/4 DEEP
120°
1/8 x 45° CHAMFER
BREAK CORNERS .005
O-RING DIM
ID 2 1/2 , OD 2 3/4 , W 1/8
AN 6230-8 ; 11-230
TOLERANCES OF ± 1/64" ON FRACTIONAL DIMENSIONS AND ± .005" ON DECIMAL DIMENSIONS UNLESS OTHERWISE SHOWN
BEARING ADJ. SLEEVE PULLER # 11 HI
DWG. NO. 056C0022
WARREN PUMPS, INC.
ROTARY PUMP DIVISION
WARREN, MASS.
DATE 9-23-64

Fig. 6C

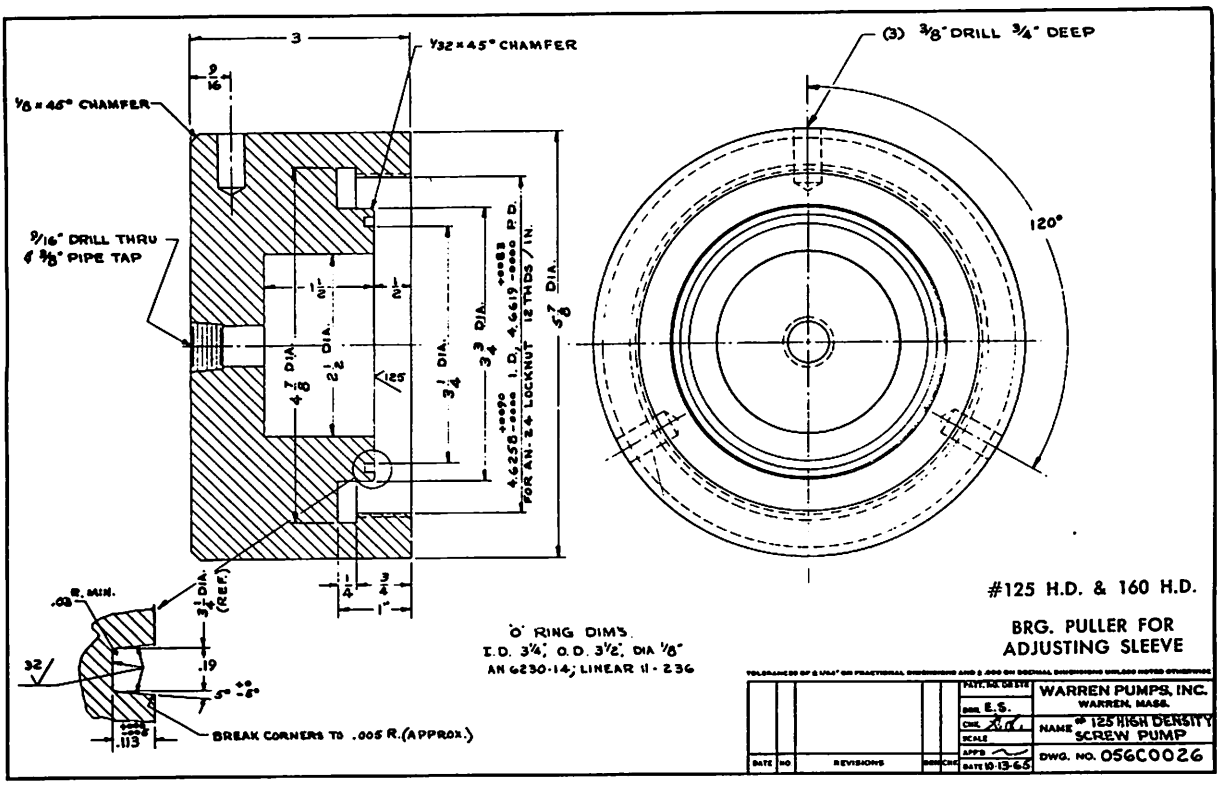


Fig. 6D

bracket from the inside.

NOTE: When a thrust bearing adjusting sleeve is removed, check the end of the shaft and also the inside of the adjusting sleeve for the presence of bearing shims. If shims are present, retain them and note which shaft that the shims and the thrust bearing adjusting sleeve was removed from for proper reassembly.

9. Loosen setscrews located in rear bearing bracket end flingers (41), then check that these flingers are free to slide on the shafts.
10. Remove nuts securing the front bearing bracket (4) to body (1). Also remove taper pins from front head and body flanges.
11. Take up on the three jackscrews located in the front bearing bracket flange. This will break the casing joint after which the rotor may be slid out of the body.

Disassembly of Rotor & Removal of Bearings

(See Sectional Drawings)

1. Remove pump half coupling hub from long shaft (8).
2. Loosen set screws located in pipe wrench collar (42) and remove this part from the long shaft.
3. Remove coupling key.
4. Loosen set screws located in front head flinger (40), then remove this part from the long shaft.
5. Remove front head (2) from front bearing bracket (4). Oil seal (63) and outer races and rollers of front head roller bearings (46) will come off with the front head.
6. Remove bearing locknuts (43) from timing gear end of the shafts. On No. 6, No. 8 & No. 11 pumps, the long shaft locknut has L.H. threads and the short shaft has R.H. threads. On the No. 125 & No. 160 pump, threading is opposite.
7. Remove inner rings of roller bearings (46) from the shafts. If these parts cannot be removed by hand, they may be removed easily by applying heat lightly or they may be removed by pulling the timing gears. See Step 8.
8. Remove timing gears (33) from the shafts. This is most easily accomplished using two sets of pulling gear, one set connected to each timing gear. Pull gears as evenly as possible. Before re-

moving gears, match mark the gear teeth at point of mesh. Also, mark one gear to indicate which shaft it was removed from.

9. Remove timing gear keys from the shafts. Mark one key to indicate which shaft it was removed from.
10. Remove gear and bearing spacers (35) Mark one spacer to indicate which shaft it was removed from.
11. Remove split glands (25) from the shafts.
12. Loosen setscrews located in the front flingers (41). After loosening, check that the flingers are free to move on the shafts.

    NOTE: Bearing brackets on No. 125 & No. 160 pumps and stainless steel No. 11 pumps are split construction. This construction is for manufacturing purposes only. For maintenance purposes, the two-piece bearing bracket should be treated as a single piece.
13. Slide the front bearing bracket toward the end of the shafts so that the inner rings of roller bearings (46) are exposed. Insert a steel drift pin or punch into the open area of the bearing bracket so as to contact the edge of the inner bearing ring, then knock these inner rings from the shafts. (See Fig. 7). Complete removal of the bracket.
14. Separate the pumping rotors.
15. If required, outer roller bearing rings may be removed from the front head or front bearing bracket as follows:
    a) Castings are cored out behind the bearing rings so as to accept puller legs of inside pullers.
    b) Engage puller legs behind the bearing ring (be sure jaws contact bearing ring only and not the actual casting).
    c) Pull bearing from its seat.

Screw Replacement (See Sectional Drawings)

1. Disassemble pump as per previous instructions.
2. Remove the shaft sleeves (21 & 22). The sleeves are threaded opposite hand from the shaft rotation. It may be necessary to apply heat to the sleeves for removal or to machine them off in a lathe.
3. Remove the discharge feeder (20). Nos. 6, 8 and 11 High Density pumps have only one discharge feeder which is installed on the long shaft. Nos. 125 & 160 pumps have a discharge feeder on each shaft.
   Discharge feeders are secured by either a) a taper pin or b) a fitted through bolt. Remove the taper pins or through bolts. Apply heat to the discharge feeder then pull from the shaft.
   If feeders were secured by a taper pin, replace the pin in the shaft, drive it in tightly, then grind the pin ends flush with the shaft.
4. Taper pins and keys hold the pumping screws (12 & 13) to the shafts. The pump-

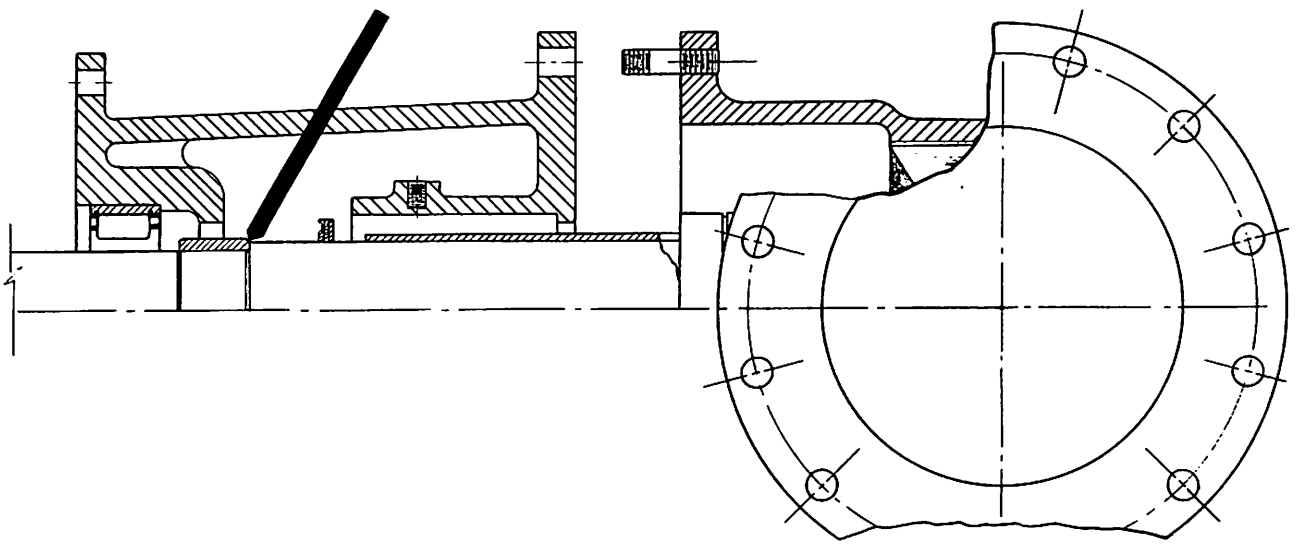


Fig. 7 — Removal of Bearing Inner Race

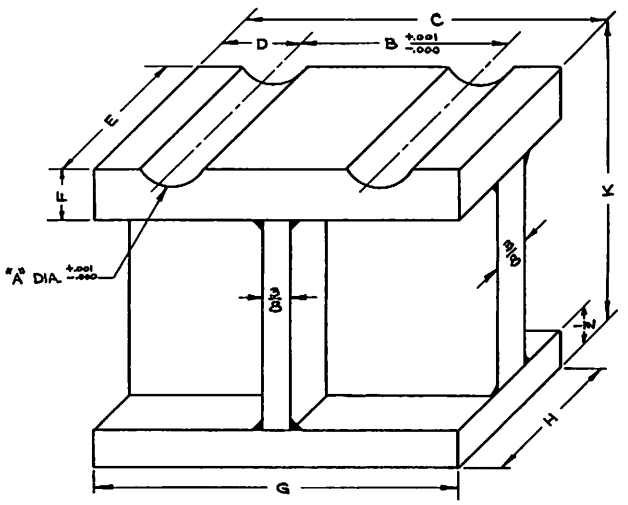
ing screws on pumps built after 1963 are also glued to the shafts with epoxy resin. Grind the small end of the pins flush with the screws to remove the peened over portion and drive the pins out. Heat the pumping screw roots to approximately 900°F. to destroy the adhesive strength of the epoxy. Immediately apply hydraulic pressure (usually about 25 tons) to the pumping screw or to the shaft to force the screw off the shaft.

5. Remove the pumping screw keys from the shaft.

   NOTE: DO NOT REMOVE THE SUCTION FEEDERS (16 & 17), FROM THE SHAFTS UNLESS NEW SHAFTS ARE TO BE USED.

6. After the screws have been removed, place each shaft in a lathe and check the shaft runout which should not exceed .002".
7. Place the pumping screw taper pins into the holes drilled in the shafts, drive them tight, and grind them off flush with the shafts.
8. Measure the bore diameter of the new pumping screws (12 & 13) and machine or grind the shafts in the pumping screw areas to allow .002" to .004" clearance.
9. Slide the pumping screws (12 & 13) onto the shafts so that the end of the pumping screw flight lines up with the end of the suction feeder flight (16).
10. Mark the pumping screws (12 & 13) for the new taper pin holes making sure they will not be in the same position as the old pins in the shafts.
11. Place the pumping screw keys in the shaft keyways.
12. Apply epoxy to the shaft per directions furnished with the epoxy.
13. Place the pumping screws (12 & 13) on the shafts so that the keyways line up with the keys. Force the pumping screws into position with a press. Work on one screw assembly at a time.
    Use care to keep O ring free of epoxy on stainless steel rotor.
14. Drill and ream holes for new taper pins, install pins, and machine them flush with the pumping screw hub.
15. Place the discharge feeder (20) on shaft. Position one of the feeder blades so that its flight lines up with the end of the pumping screw flight. On the No. 125 & 160 pumps with two feeders place the discharge feeders so that the blades are 90° apart. Note the position of the old taper pins or through bolts so that the new holes will not be in the same position.
16. Drill and ream taper pin holes in the discharge feeders (20), install the taper pins and peen them over on both sides. If fitted with through bolts, drill and ream new holes. These are fitted bolts, therefore, the holes provided for them should be only .002" to .003" larger than the bolt O.D. Install the through bolts, using new "O" rings. Use loctite to secure the nut.
17. Install new "O" rings (60) in the shaft sleeves (21 & 22) and place shaft sleeves on the shafts. Tighten them into position.
18. Check shaft sleeve and pumping screw runout on a lathe. Grind if necessary to true up the assembly to .0015" maximum runout at the pumping screws.

See Installation of Replacement Timing Gears for timing instructions.



PUMP SIZE		A	B	C	D	E	F	G	H	K
#160	1	4.002	12.005	18¾	3⅜	3	2¾	20	5	12
	2	4.727								
#11	1	3.250	8.500	13¾	2⅝	2¼	2¼	15	4	8
	2	3.940								
#8	1	1.938	6.000	11	2½	2	2	12½	3½	8
	2	2.561								
#6	1	1.501	4.500	10	2¾	2	2	12	3½	8
	2	2.168								

(#1 & 2) Indicate front and rear stands

Fig. 8 — Timing Stands

INSTALLATION OF REPLACEMENT TIMING GEARS

NOTE: Replacement timing gears are furnished as a matched set. However, only one gear will have a keyway. The keyway for the unsplined gear must be located and machined in the field.

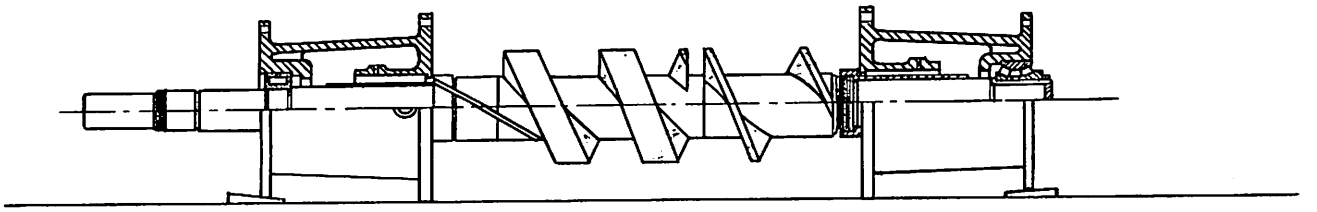


Fig. 9

1. To locate the keyway in the unsplined gear, the rotors must be removed from the body, then held in a steady and level position. This may be accomplished by using specially constructed timing stands (See Fig. 8) or by setting the rotors up in their bearings in the bearing brackets (See Fig. 9).

2a. If timing stands are to be used, install thrust bearings and adjusting sleeves on the shafts. Replace and tighten adjusting sleeves capscrews, then mesh rotors together and set into the timing stands.

2b. If bearing brackets are to be used, mesh the rotors, then set them up in the bearing brackets as shown in the above sketch. Thrust bearing adjusting sleeves must be secured with capscrews.

3. Level the shafts, both lengthwise and across.

4. Place a straight edge across outside race of the thrust bearings. The straight edge must contact both bearings evenly. If necessary, hold one shaft stationary and turn the other to move the thrust bearing either ahead or back so as to make the bearings flush with each other.

5. Determine the total existing flank clearance between meshed screws. Rotate one screw slightly to equalize the flank clearance, then insert sufficient shim stock into all flank clearance areas to fill the clearance gap and hold the screws in this position.

6. Recheck Step 4.

7. Install timing gear key in the long shaft keyway.

8. Mesh timing gears together and slide onto the shafts so that one-half of the long shaft key is covered by the gear. Install gears so that the tapped puller holes are towards the end of the shafts.

9. Lay straightedge across inside faces of the timing gears. Make these faces flush.

10. Recheck Step 4 to be certain that installing the gears did not alter the relative position of the shafts. If any readjustment is made, recheck Step 9.

11. Blue the inside surface of the gear that is to be cut (just that area over the keyway).

12. Stand the remaining gear key on end in the empty keyway. The key must be touching the face of the gear. Scribe a line down both sides of this key.

13. Remove the gears and cut the keyway as scribed. Before cutting the keyway take extra care when setting the gear up to insure the keyway will be cut straight through and not at an angle.

To Install Rotor in Body

(See Sectional Drawings)

1. Replace rear bearing bracket to body gasket. Use 1/64" thick material.
2. Replace rear bearing bracket (5). Align this part to the body with the two taper pins, then install and tighten all nuts.
3. Before installing the rotor, body bores should be wiped clean, then swabbed with light lube oil. This will ease installation and prevent scoring as the rotor is slid in.

4. Mesh the long and short shaft pumping screws. Then determine the total flank clearance between meshed screws. Record this clearance for later reference.
5. Lift the meshed rotor and carefully insert into the body from the discharge end. The long shaft is to be inserted in the bore that is opposite the pump discharge nozzle.
   NOTE: It will be necessary to install two flingers (41) when the shafts have penetrated the rear bearing bracket stuffing boxes and before the shafts enter oil seals.
6. Replace front bearing bracket to body gasket. Use 1/64" thick material.
7. Replace front bearing bracket (4). As the shafts penetrate the stuffing boxes, install a flinger (41). Align the bracket to the body with the two taper pins, then install and tighten all nuts.
8. Install spacers on each shaft. (Size No. 125 & No. 160 only).
9. Install inner rings of front bearing bracket roller bearings (46). Take care that these bearing rings are fully seated against the shaft shoulder (or spacer ring for size No. 125 & 160).
10. Install thrust bearing assemblies (thrust bearings (48) and adjusting sleeves (36) as follows:
    a) Obtain three pieces of threaded rod 8" to 10" long and thread into the three holes located in the end of each shaft. Replace necessary shims.
    b) Install one thrust bearing assembly over the rods and start onto the shaft.
    c) Place a nut of each of the rods. Tighten these nuts evenly to push the bearing assembly into place.
    d) Install the second thrust bearing assembly in the same manner.
    e) Insure that adjusting sleeves are hard up against the ends of the shaft, then replace and tighten adjusting sleeve cap bolts.
11. Check screw to body clearance (See Fig. 4). The clearance table, page 6 will give the design clearance. If necessary, the rotating element can be centralized in the body as follows:
    a) Remove taper pins located in both bearing bracket-to-body flanges.
    b) Loosen bearing bracket nuts sufficiently to allow the rotors to drop and rest on the body bores.
    c) Determine total clearance between pumping screws and body bores (See Fig. 5).
    d) Select shim stock equal to one-half the total clearance.
    e) Jack rotors up sufficiently to insert the shim stock between screws and bores on the bottom, then set rotors down on the shims.
    f) Check side clearance between screws and bores. If necessary, pump bearing brackets sideways to equalize this clearance.
    g) Tighten bearing bracket bolts to hold this position, then drill and ream for new taper pins.

CAUTION: BE CERTAIN TO REMOVE ALL SHIM STOCK.

12. Install gear and bearing spacers (35). If original spacers are being used, be sure they are returned to their original positions.
13. Check that timing gear keys are free of nicks or burrs, then install in their keyways.
14. Mesh timing gears together at the match marks.
15. Install timing gears approximately half way over the timing gear keys. Be sure that each gear is installed on the proper shaft.
16. Return to the thrust end and lay a straightedge across the outer thrust bearing races (See Fig. 10). Thrust bearings must be flush. If necessary, bump one shaft to bring bearings flush.

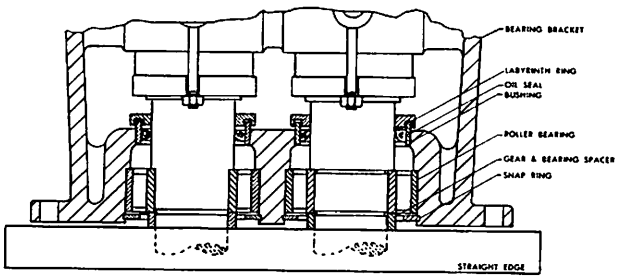


Fig. 10

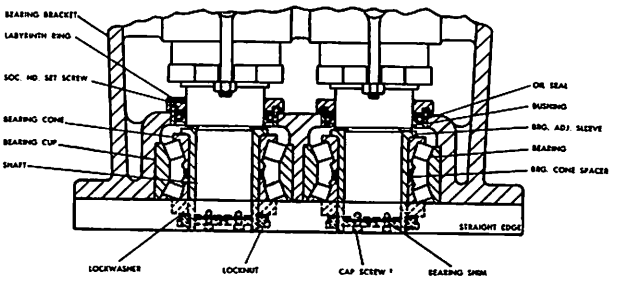


Fig. 11

17. Turn rotors by hand so that the end flight of the short shaft screw overlaps end flight of the long shaft screw. This is the position shown in Fig. 5. Check flank clearance between meshed pumping screws. Existing clearance should be one-half ± .005" the total flank clearance as determined in Step 4. If existing clearance is other than this, it will be necessary to adjust the clearance as follows:
    a) If existing flank clearance is less than one-half the total clearance, remove the long shaft thrust bearing and adjusting sleeve.
    b) If existing flank clearance is more than one-half the total clearance, remove the short shaft thrust bearing and adjusting sleeve.
    c) Select a shim or shims of sufficient thickness to make up the difference between the existing clearance and the clearance needed. Cut these shims to the same diameter as the end of the shaft and punch holes for the adjusting screw bolts.
    d) Install shims and the adjusting sleeve as outlined in Step 10.
    e Repeat Step 16.
18. Check that gear and bearing spacers (35) are flush. See Fig. 11. If necessary, grind one spacer to bring spacer faces flush.
19. Push timing gears all the way onto the shafts.
20. Install outboard gear and bearing spacers (34).
21. Install front head roller bearing inner races (46).
22. Replace and tighten roller bearing locknuts. (No. 6, 8 and No. 11 sizes also include lockwashers). Tighten locknuts firmly to insure all bearing rings are securely locked. Secure the locknut.
23. Turn pump by hand. Rotor must turn freely at this point.
24. Replace rear head gasket and rear head (3).
25. Replace front head gasket and front head (2).
26. Replace front head flinger (40). Allow the flinger to contact the front head, then move back about 1/16". Secure in this position.
27. Position and secure the other four flingers (41).
28. Install pump packing. See Sketch No. 7 for installation instructions.
29. Add lubricant to the pump bearing brackets. See Lubrication.

Lubrication

Warren High Density screw pumps are oil lubricated and require lubricants for extreme pressure. We recommend oils similar to:

Bemoil Oil Co.	Moly 120
Gulf	EP 5
Shell	Macona 68
Texaco	Meropa Lubricant 2
Tydol	Avalon 72

The operating level of the lubricant should be maintained approximately midway in the oil level sight glass located in each bearing case.

Cooling water is recommended for the No.

125 and 160 timing gear boxes.
Cooling water flow would be dependent upon many factors, therefore, the amount required for a particular pump would necessarily be decided by experimentation. It is recommended that the gear case lube oil temperature be held between 140° and 170°F. Except in cases of unusual circumstances, thrust end lube oil temperature should not exceed 180°F. The shear pin coupling must be filled with grease. Any good ball bearing grease that may be used in other mill applications is satisfactory for the coupling. Greasing interval depends upon the pump environment. Unusually moist or dusty location would require more frequent applications. Consider 6 months periods as the greasing interval for normal installations.

Packing

Warren High Density pump packing is provided in sets properly arrange for installation.

Packing sets are made up as follows:

No. 6 Size
20 rings (5 rings/set — 4 sets)
⅜" sq. x 2⅝" I.D.

No. 8 Size
24 rings (6 rings/set — 4 sets)
½" sq. x 3¼" I.D.

No. 11 Size
32 rings (8 rings/set — 4 sets)
⅝" sq. x 5" I.D.

No. 125 Size
28 rings (7 rings/set — 4 sets)
⅝" sq. x 5⅞" I.D.

No. 160 Size
28 rings (7 rings/set — 4 sets)
¾" sq. x 6⅝" I.D.

In all sizes of Warren High Density pumps, the lantern ring follows the first ring of packing. This is then followed by the remaining rings of packing contained in the set.

Warren High Density pumps are packed with John Crane Style C-58 (ring form C-59) packing. This is braided of high quality white asbestos yarns and impregnated throughout with Teflon suspensoid and a special lubricant.

It is a dense resilient packing design especially for paper mill use. Temperature range −100°F. to +600°F.

SECTION 6 – REPLACEMENT PARTS

Warren maintains a complete inventory of parts for its High Density pumps ranging from completely assembled rotors to miscellaneous parts. All in-plant stock is available for quick shipment.

When placing an order for repair parts, please include the following data to avoid delay through inadequate information.

1. List serial number of pump (example 63000)
2. Type of pump (Example No. 125 High Density)
3. Name of part(s) and the part number(s) from drawing (Example Shaft Sleeve — part 13.)
4. Quantity required.
5. Your purchase order number.
6. Complete shipping and invoicing instructions.

Warren is aware of the critical nature of paper mill pumps. For this reason, listed following are parts which might be required on an emergency basis and obtainable from local sources.

	Pump Size				
Part Name	**No. 6**	**No. 8**	**No. 11**	**No. 125**	**No. 160**
Oil Seal* Front Head	Victor (1) No. 60728	Victor (1) No. 63072	Victor (1) No. 63427	Victor (1) No. 61174	Victor (1) No. 61281
Oil Seal* Bearing Brackets	Victor (4) No. 60872	Victor (4) No. 63044	Victor (4) No. 63199	Victor (4) No. 61359	Victor (4) No. 61384
Roller Bearing* Front Head	Hyatt (2) A-5210-TS	Hyatt (2) A-5212-TS	Hyatt (2) A-5219-TS	Hyatt (2) A-5222-TS	Hyatt (2) A-5224-TS
Roller Bearing* Front Bearing Bracket	Hyatt (2) A-5211-TS	Hyatt (2) A-5213-TS	Hyatt (2) A-5220-TS	Hyatt (2) A-5224-TS	Hyatt (2) A-5226-TS
Thrust Bearing*	Timken (2) 023Z0070	Timken (2) 023Z0077	Timken (2) 023Z0071	Timken (2) 023Z0080	Timken (2) 023Z0084
Cone	Timken (2) 55206	Timken (2) 78250	Timken (2) 98400	Timken (2) HM926747	Timken (2) HH932132
Cup	Timken (1) 55433-D	Timken (1) 78549-D	Timken (1) 98789-D	Timken (1) HM926710-D	Timken (2) HH932110
Spacer	Timken (1) 55206	Timken (1) X1578250	Timken (1) X1598400	Timken (1) HM926747-XA	Timken (1) HH932132-XA
Spacer					Timken (1) HH932110-EB

*Stocked at Warren

DAZIC ZERO SPEED SWITCH

General

The DAZIC Zero Speed Switch Model CI-2130, Type F is designed for general industrial service and is particularly adaptable to Warren's High Density Pumps. Switches are constructed with cast iron housings and have flange mounts to mount to the thrust bearing housings on the high density pumps.

Operation

On clockwise direction of shaft rotation one set of contacts is actuated to make or break an electrical circuit as soon as in-put shaft speed, on acceleration, reaches approximately 15 to 18RPM. The other set of contacts remains dormant. The actuated contacts remain in the actuated position as long as the shaft speed is maintained at or in excess of the trip-point speed on acceleration. On slow drifting speed loss these contacts will drop out at approximately 10 RPM. On rapid or instant speed loss these contacts will drop out at approximately 0 speed.
On counter-clockwise direction of shaft rotation the above action takes place with the set of contacts that remain dormant while the shaft is rotating in clockwise direction, and the clockwise direction contacts remain dormant.

Unit indicates shaft rotation in either direction, and the direction of shaft rotation. Also indicates zero speed. This model is not adjustable in field. Unit contains silicone oil which lends stability to its operation over a wide temperature range. (From approximately −20°F to +250°F.)

Electrical

These switches are equipped with two sets of totally enclosed type S.P.D.T. snap action contacts rated as follows:

AC — 10 Amps., 125-250-460 Volts
DC — ½ Amp., 125 Volts, ¼ Amp., 250 Volts

Each set of contacts operates independently of the other set. The accompanying drawing shows which set of contacts are to be used with the different sizes of pumps. The switches can be wired for either open circuit at 0 RPM or closed circuit at 0 RPM. If the switch is to be open at 0 RPM and thus closed during operation, the top and center connection should be used. Conversely, if the switch is to be closed at 0 RPM and thus open during operation, the top and bottom connections should be used.

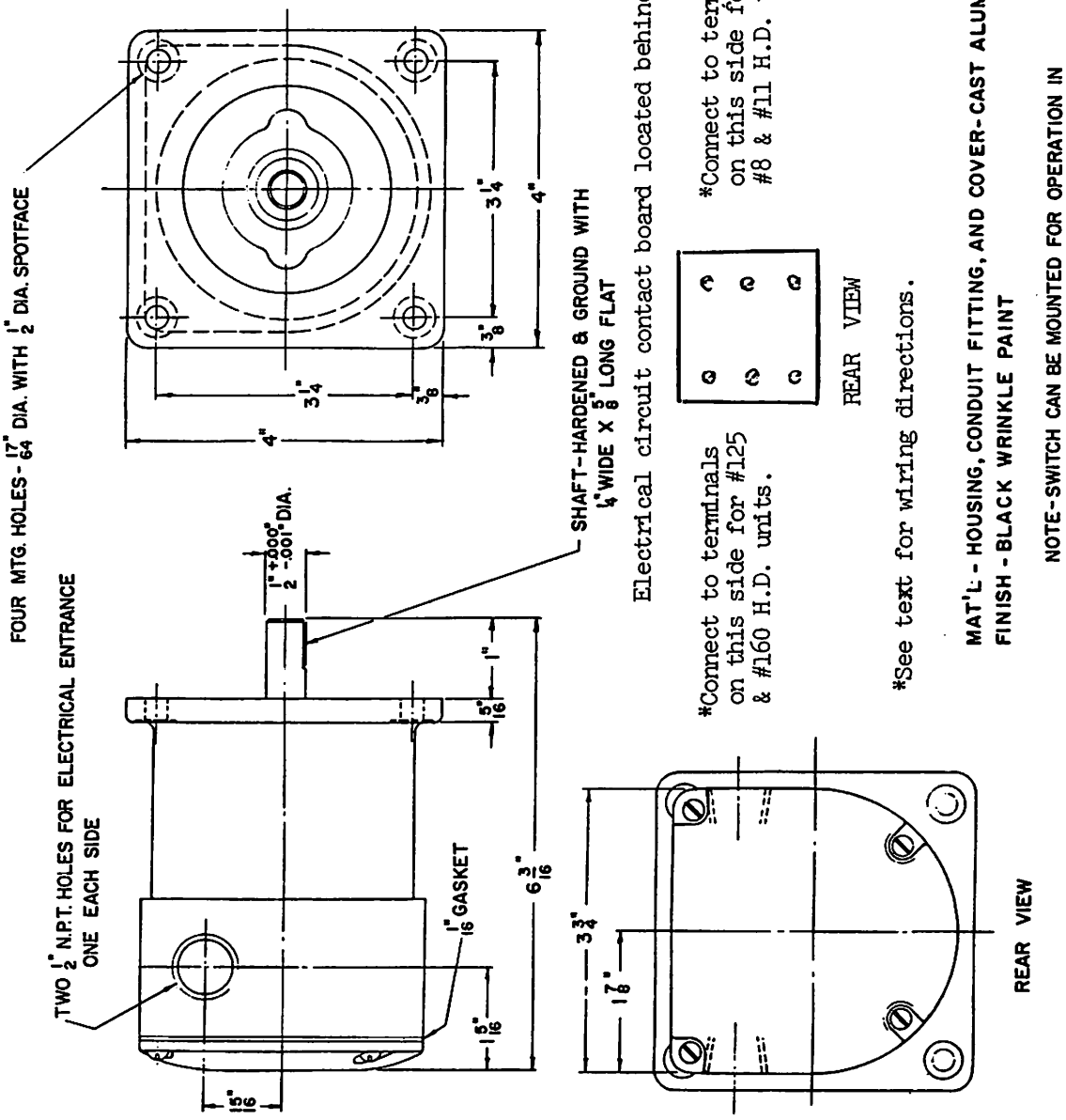
NOTE:

Directions on the accompanying drawing are for switch mounted on the long shaft of the pump. If the switch is ever mounted on the short shaft, the sets of terminals used for the different sizes of pumps would be reversed.

Driving

The switches supplied by Warren are driven by a 3 pronged collar set screwed to the shaft of the switch and mated with 3 holes drilled in the end of the pump shaft.
Caution: This arrangement leaves ample room to insure that there is never end pressure on the switch shaft. Never allow any end pressure on the shaft of the switch.

THE WINTERBURN MFG. CO.
PUTNAM, CONN.



Electrical circuit contact board located behind rear cover.

*Connect to terminals on this side for #125 & #160 H.D. units.

*Connect to terminals on this side for #6, #8 & #11 H.D. units.

REAR VIEW

*See text for wiring directions.

MAT'L - HOUSING, CONDUIT FITTING, AND COVER-CAST ALUMINUM
FINISH - BLACK WRINKLE PAINT

NOTE-SWITCH CAN BE MOUNTED FOR OPERATION IN ANY POSITION

DR	DIMENSION DRAWING - DAZIC SPEED SWITCH	DRAWING NO.
DATE 9-5-60	FLANGE MOUNT TYPE - MODEL	8100 - 2B

E-790

AIR BLEED DEVICE FOR #160 HIGH DENSITY SCREW PUMP

AIR BLEED DEVICE FOR #125 HIGH DENSITY SCREW PUMP

SEE SKETCH A

SEE NOTE 4

SEE SKETCH B

SKETCH A FOR STAINLESS STEEL CONSTRUCTION ONLY LOCTITE NUT. 1.000-.002 DIA. DRILL & REAM THRU DISCHARGE FEEDER AT ASSY. FOR #125 & #160 HIGH PUMPS .875-.002 DIA. DRILL & REAM THRU DISCH. FEEDER AT ASSY. FOR #11 HIGH PUMPS

56 LONG SHAFT
59 SHORT SHAFT

SKETCH B
FOR STAINLESS STEEL CONSTRUCTION ONLY

NOTES:
1. SCREW THREADS FOR THE 125 & 160 HIGH DENSITY PUMPS TO BE OPPOSITE FROM SHOWN.
2. PRIOR TO INSTALLING SHAFT SLEEVES & THRUST BEARINGS ON SHAFTS. COAT BOTH THE OUTSIDE DIAMETERS & BORES WITH A PASTE MADE UP OF 3 PARTS BY VOLUME OF WHITE LEAD & 1 PART BY VOLUME OF BUTTERCUT OIL. BUTTERCUT OIL IS THE PRODUCT OF
BAL TRACTION CO.
1813 WINONA STREET
CHICAGO, ILLINOIS 60640
OR OTHER SUITABLE ANTI-SEIZE COMPOUND.
3. BEARINGS TO BE SECURED WITH LOCTITE.
4. DRILL & SPOT SET SCREW ON SHAFT SLEEVES INTO SHAFTS AT ASSEMBLY.

REVISIONS					MICRO FILM
ZONE	LTR	DESCRIPTION	DATE	APPROVED	
D-3	A	ADDED REVISION TO NOTE 2.	2/31/70	AZ	JAN 4 1971

AIR BLEED DEVICE FOR #6, 8 & 11 HIGH DENSITY SCREW PUMPS

THIS PUMP IS PROTECTED BY THE FOLLOWING PATENTS: U.S. 3,057,665
2,994,562
3,196,582
3,198,132
3,408,114
CANADA: 651,029
OTHER PATENTS PENDING

CHECKED	AG	9/29/70
DRAWN	KS	9/15/70

WARREN PUMPS, INC.
WARREN, MASS.
DRAWING TITLE: SECTIONAL ASSEMBLY FOR HIGH DENSITY SCREW PUMPS
CORE TOOL NO. 63857
DWG. NO. E-790
REV. A
SHT 1 OF 2