Discharge Head and Accessories

INDEX

Blank

General Discharge Head Assembly Data

The Standard Head Assembly Includes The Following:

Discharge head casting or fabricated welded steel head, stuffing box or tube nut assembly, top column flange and gasket. Fasteners for motor to head (only when complete pump is ordered), stuffing box or tube nut assembly to head and top column flanged to head. Steel metal mesh hand hole covers

Special Information Required When Ordering:

Motor BD, BX and CD dimensions, discharge piping size, well or floor opening size, head room clearance. On underground discharge, distance between bottom of motor pedestal to centerline of discharge. Clearance under head to accommodate top column flange and clearance for below base elbow.

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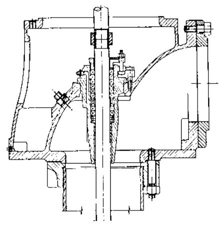
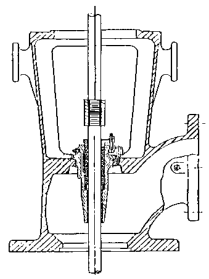
Discharge Head and Accessories Information



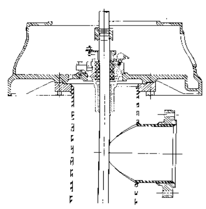
TYPE S and SHP

This is a very stable, low profile cast iron head especially suited for using vertical hollow shaft drivers for both close coupled industrial and deep well pump applications. This line of heads is available with 250-psi discharge flange in the 6-inch and larger sizes.



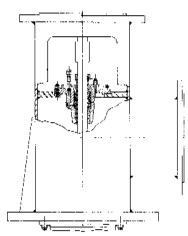
TYPE C and CHP

This is a very versatile line of cast iron heads. These are suited for both vertical hollow shaft and vertical solid shaft drivers. Sizes through 8 inch are available with 250-psi discharge flanges. This line is designed mainly for industrial applications with a setting limitation of 200 feet except for the 4-inch head, which is designed for a 1,000-foot setting. The base of these heads is machined to match ANSI flanges making them particularly suited for can pump applications where the suction is in the can. These heads are considerably less expensive then fabricated heads for can pump applications.



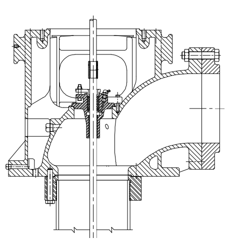
TYPE UG

For these specialized applications requiring below grade discharge we can offer a cast iron base with steel flanged discharge in both threaded and flanged column pipe construction.



TYPE FA, FR and FRA

This line of standardized fabricated steel heads is available with 150-psi discharge flanges for either vertical hollow shaft or vertical solid shaft drives for applications in the industrial markets. The Type FA heads have a conventional square mounting base; the Type FR heads have a circular mounting base and the Type FRA heads have ANSI drilled mounting base for tank or can mounting. These heads are also available in stainless steel construction.



TYPE G & GHP

Our newest line of cast iron discharge heads, primarily made to take over responsibilities of some of our “S” and “C” type heads, are well suited for using vertical hollow shaft drivers for both close coupled industrial and deep well pump applications. This line of heads is available with 250-psi discharge flange in the 6-inch and larger sizes.

Type S and SHP
Cast Iron Surface Discharge Heads

APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	Discharge Data①		Stuffing Box Register	Column Data								Motor Flange Base Sizes (B.D.)
	Size & ANSI Lb. Rating	Maximum Operating Pressure (Psig)		Line Shaft Dia.				Oil Tube Dia.		Column Pipe Dia.		
				Minimum	Maximum							
					ELS	OLS	OLS with Sleeve	Min.	Max.	Min.	Max.	
2-1/2x2-/2x10S	2-1/2NPT	175	Cast in Head	3/4	-	1	-	-	-	2-1/2	2-1/2	10 or 12
2-1/2x3x10S	2-1/2NPT	175	Cast in Head	3/4	-	1	-	-	-	3	3	10 or 12
6x6x12S	6-125	200	3.88	3/4	1-3/16	1-1/2	1	1-1/4	2	3	6	10 or 12
6x8x16-1/2S	6-125	200	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	4	8	16 - 20
6x8x16-1/2SHP	6-250	400	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	4	8	16 - 20
8x8x12S	8-125	200	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	4	8	10 - 12
8x8x16-1/2S	8-125	200	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	4	8	16-1/2, 20
8x8x 16-1/2SHP	8-250	400	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	4	8	16-1/2, 20
10x10x16-1/2S	10-125	200	5.56	1-3/16	2-3/16	2-7/16	1-15/16	2	3-1/2	4	10	16-1/2, 20,-24-1/2
10x10x16-1/2SHP	10-250	400	5.56	1-3/16	2-3/16	2-7/16	1-15/16	2	3-1/2	4	10	16-1/2, 20,-24-1/2
10x10x20S	10-125	200	5.56	1-3/16	2-3/16	2-7/16	1-15/16	2	3-1/2	4	10	16-1/2, 20,-24-1/2
10x10x20SHP	10-250	400	5.56	1-3/16	2-3/16	2-7/16	1-15/16	2	3-1/2	4	10	16-1/2, 20,-24-1/2
12x12x20S	12-125	200	5.56	1-3/16	2-3/16	2-7/16	1-15/16	2	3-1/2	5	12	16-1/2, 20,-24-1/2
12x12x20SHP	12-250	400	5.56	1-3/16	2-3/16	2-7/16	1-15/16	2	3-1/2	5	12	16-1/2, 20,-24-1/2
14x14x24-1/2S	14-125	150	5.56	1-3/16	2-3/16	2-7/16	1-15/16	2	3-1/2	10	14	16-1/2, 20,-24-1/2
14x14x24-1/2SHP	14-250	300	5.56	1-3/16	2-3/16	2-7/16	1-15/16	2	3-1/2	10	14	16-1/2, 20,-24-1/2
16x16x30-1/2S	16-125	150	6.38	1-11/16	2-7/16	2-7/16	1-15/16	3	4	10	16	30-1/2
16x16x30-1/2SHP	16-250	300	6.38	1-11/16	2-7/16	2-7/16	1-15/16	3	4	10	16	30-1/2

Maximum setting for standard heads Feet				
Head Size	Column Size			
	6" & Smaller	8"	10"	12" & Larger
2-1/2x2-1/2 x10 through 6x6x12	1000	-	-	-
6x8x16-1/2 and 8x8x 16-1/2	1000	800	-	-
10x10x16-1/2 and 10x10x20	1000	800	600	-
12x12x20	100’	800	600	500
14x14x24-1/2 and 16x16x30-1/2	-	-	600	500

LIFTING LUG LOADING		
Head Size	Load Applied Lbs	
	Gradually	Suddenly
2-1/2x2-1/2x 10 &2-1/2x3x10	12000	3000
6x6x12	24000	6000
6x8x16-1/2 through 12x12x20	37500	9400
14x14x24-1/2 through 16x16x30-1/2	53000	13250

① Flange rating is limited to 150^{0}F maximum water temperature.

Peerless Pump Company
Indianapolis, IN 46207-7026

Type C & CHP

Cast Round Base Surface Discharge Heads

APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	Discharge Data①		Stuffing Box Register	Column Data								Motor Flange Base Sizes B. D.
	Size & ANSI Lb Rating	Maximum Operating Pressure (Psig) ②		Line Shaft Dia.				Oil Tube Dia.		Column Pipe Dia.		
				Min. Dia.	Maximum ELS	Maximum OLS	Maximum OLS with Sleeve	Min.	Max.	Min.	Max.	
4x4x10C	4-125	200	3.88	3/4	1-3/16	1-1/2	1	1-1/4	2	4" Threaded Only as Standard		10 -12
4x4x10CHP	4-250	400	3.88	3/4	1-3/16	1-1/2	1	1-1/4	2			
4x6x12C	4-125	200	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	4	6	10 -12
4x6x12CHP	4-250	400	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	4	6	10 -12
6x6x12C	6-125	200	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	5	6	10 -12
6x8x16-1/2C	6-125	200	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	6	8	16-1/2-20
6x8x16-1/2CHP	6-250	400	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	6	8	16-1/2-20
8x8x12C	8-125	200	4.69	1	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	6	8	10 -12
8x8x16-1/2C	8-125	200	5.56	1-3/16	1-15/16	2-7/16	1-15/16	2	3	6	8	16-1/2, 20, 24-1/2
8x8x16-1/2CHP	8-250	400	5.56	1-3/16	1-15/16	2-7/16	1-15/16	2	3	6	8	16-1/2, 20, 24-1/2
10x10x20C	10-125	200	5.56	1-3/16	1-15/16	2-7/16	1-15/16	2	3	8	10	16-1/2, 20, 24-1/2
12x12x20C	12-125	200	5.56	1-3/16	1-15/16	2-7/16	1-15/16	2	3	10	12	16-1/2, 20, 24-1/2

Maximum Setting For Round Base Heads Feet

Head Size	Column Size			
	6" & Smaller	8"	10"	12" & Larger
4x4x10C and 4x4x10CHP	1000	-	-	-
4x6x12C through 12x12x20C	200	200	200	200

Lifting Lug Loading Lbs

Head Size	Load Applied	
	Gradually	Suddenly
4x4x10	13500	3400
4x6x12 and 6x8x16-1/2	24000	6000
6x8x16-1/2 through 12x12x20	37500	9400

① Flange rating is limited to 150^{0}F maximum water temperature.
② Maximum suction pressure for can mounted heads – 100 Psig

Subject to change without notice

APPLICATION DATA

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

HEAD SIZE & TYPE	DISCHARGE DATA ①		STUFFING BOX REGISTER	COLUMN DATA					TUBE SIZE DIA.		COLUMN PIPE DIA.		MOTOR FLANGE B.D.
				LINE SHAFT DIA									
				ELS		OLS							
	SIZE	MAX OPERATING PRESSURE		MIN	MAX	MIN	MAX	MAX W/SLV	MIN	MAX	MIN	MAX	
2.5x2.5x10S	2.5 NPT	175#	Cast in Head	-----	-----	0.75	1.00	-----	-----	-----	2.5 THRD ONLY	2.50	10.0-12.0
2.5x3.0x10S											3.00	3.00	
4x4x10C	4 - 125#	200#	3.88	0.75	1.19	0.75	1.50	1.00	1.25	2.00	4.00 Threaded only as Std		10.0-12.0
4x4x10CHP	4 - 250#	400#											
6x6x12G &	6 - 125#	200#	3.88	0.75	1.19	0.75	1.50	1.00	1.25	2.00	4.00	6.00	10.0-12.0
6x6x12GHP	6 - 250#	400#											
8x8x16.5G	8 - 125#	200#	5.56	1.19	2.19	1.00	2.19	1.69	2.00	3.50	6.00	8.00	10.0-16.5
8x8x16.5GHP	8 - 250#	400#											
10x10x20G	10 - 125#	200#	5.56	1.19	2.19	1.00	2.44	1.94	2.00	3.50	8.00	10.00	16.5-20.0
10x10x20GHP	10 - 250#	400#											
12x12x20G	12 - 125#	200#	5.56	1.19	2.19	1.00	2.44	1.94	2.00	3.50	10.00	12.00	16.5-20.0
12x12x20GHP	12 - 250#	400#											
14x14x24.5S	14 - 125#	150#	5.56	1.19	2.19	1.19	2.44	1.94	2.00	3.50	10.00	14.00	16.5-20.0 24.5
14x14x24.5SHP	14 - 250#	300#											
16x16x30.5S	16 - 125#	200#	6.38	1.69	2.44	1.69	2.44	1.94	3.00	4.00	10.00	16.00	30.50
30x30x30.5SHP	16 - 250#	400#											

① Flange rating is limited to 150 deg F max water temp.

MAXIMUM SETTINGS FOR STANDARD HEADS

HEAD SIZE & TYPE	COLUMN SIZE			
	6" & SMALLER	8"	10"	12" & LARGER
2.5x2.5x10S 2.5x3.0x10S	1000'	-----	-----	-----
4x4x10C 4x4x10CHP	1000'	-----	-----	-----
6x6x12G & 6x6x12GHP	1000'	-----	-----	-----
8x8x16.5G 8x8x16.5GHP	1000'	800'	-----	-----
10x10x20G 10x10x20GHP	1000'	800'	600'	-----
12x12x20G 12x12x20GHP	1000'	800'	600'	500'
14x14x24.5S 14x14x24.5SHP	-----	-----	600'	500'
16x16x30.5S 30x30x30.5SHP	-----	-----	600'	500'

MAXIMUM LIFTING LUG LOADING

HEAD SIZE & TYPE	LOAD APPLIED	
	GRADUALLY	SUDDENLY
2.5x2.5x10S 2.5x3.0x10S	12000#	3000#
4x4x10C 4x4x10CHP	13500#	3400#
6x6x12G & 6x6x12GHP	21000#	5200#
8x8x16.5G 8x8x16.5GHP	22500#	5625#
10x10x20G 10x10x20GHP	33000#	8200#
12x12x20G 12x12x20GHP	42000#	10500#
14x14x24.5S 14x14x24.5SHP	53000#	13250#
16x16x30.5S 30x30x30.5SHP	53000#	13250#

Type UG
Cast Iron Underground Discharge Heads

APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	Discharge Data Size & ANSI Lb. Rating ①		Stuffing Box Register	Column Data								Motor Flange Base Sizes B.D.
				Line Shaft Dia.				Oil Tube Dia.		Column Pipe Dia.		
					Maximum							
	Minimum	Maximum		Min.	ELS	OLS	OLS with Sleeve	Min.	Max.	Min.	Max.	
6x10UG	4-150	6-150	3.88	3/4	1-3/16	1-1/2	1	1-1/4	2	4	6	10-12
12x16-1/2UG	4-150	10-150	4.69	3/4	1-1/2	1-15/16	1-1/2	1-1/2	2-1/2	4	12	16-1/2-20
12x24-1/2UG	6-150	16-150	5.66	1-3/16	2-3/16	2-7/16	1-15/16	2	3-1/2	6	12	20-24-1/2
16x30-1/2	10-150	16-150	6.38	1-11/16	2-7/16	2-7/16	1-15/16	3	4	10	16	30-1/2

① Maximum operating pressure is 175 psig limited to 150^{0}F maximum water temperature.

Fabricated Surface Discharge Heads
Type FA & FRA

Type FA Head has square base
Type FRA Head has base to match ANSI Flange

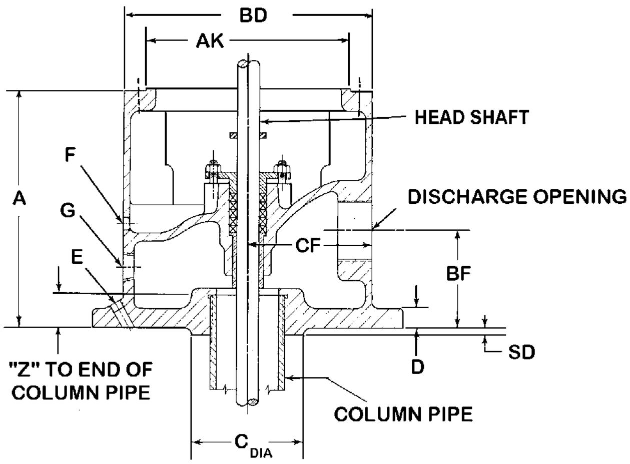
APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

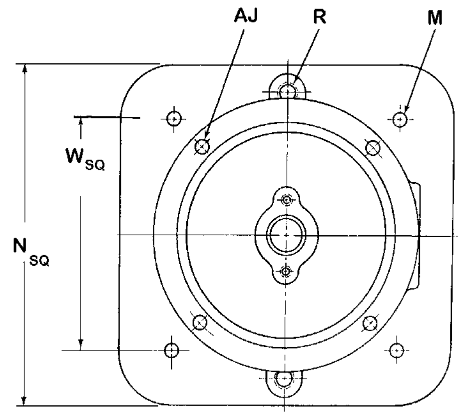
Head Size	Discharge Data		Stuffing Box Register	Column Data					Motor Flange Base Sizes B.D.
				Line Shaft Dia.			Column Pipe Dia.		
				Minimum	Maximum				
	Size - ANSI Flg Rating	Maximum Operating Pressure (Psig)		OLS	OLS	OLS w/Sleeve	Minimum	Maximum	
6x6x12F	6 - 150/300	275	3.88	0.75	1.50	1.00	4	6	10, 12
6x6x16.5F	6 - 150/300	275	5.56	1.00	2.19	1.69	4	6	16.5, 20.0
8x8x12F	8 - 150/300	275	3.88	0.75	1.50	1.00	6	8	10, 12
8x8x16.5F	8 - 150/300	275	5.56	1.00	2.19	1.69	6	8	16.5, 20.0
10x10x16.5F	10 - 150/300	275	5.56	1.00	2.44	1.94	8	10	16.5
10x10x20F	10 - 150/300	275	5.56	1.00	2.44	1.94	8	10	20.0
12x12x16.5F	12 - 150/300	275	5.56	1.00	2.44	1.94	10	12	16.5
12x12x20F	12 - 150/300	275	5.56	1.00	2.44	1.94	10	12	20.0
14x14x20F	14 - 150/300	275	5.56	1.00	2.44	1.94	12	14	20.0
14x14x24.5F	14 - 150/300	275	5.56	1.00	2.44	1.94	12	14	24.5
16x16x20F	16 - 150/300	275	5.56	1.00	2.44	1.94	14	16	20.0
16x16x24.5F	16 - 150/300	275	5.56	1.00	2.44	1.94	14	16	24.5
16x16x30.5F	16 - 150/300	275	8.50	2.19	2.94	2.44	14	16	30.5
18x18x24.5F	18 - 150/300	275	5.56	1.00	2.44	1.94	16	18	24.5
18x18x30.5F	18 - 150/300	275	8.50	2.19	3.19	2.69	16	18	30.5
20x20x24.5F	20 - 150/300	275	5.56	1.00	2.44	1.94	18	20	24.5
20x20x30.5F	20 - 150/300	275	8.50	2.19	3.19	2.69	18	20	30.5
24x24x24.5F	20 - 150/300	275	5.56	1.00	2.44	1.94	20	24	24.5
24x24x30.5F	20 - 150/300	275	8.50	2.19	3.19	2.69	20	24	30.5

Custom sizes are available

Vertical Turbine Pumps
Cast Iron Surface Discharge
Heads Treaded Type S Open Line
Shaft Construction Only

Peerless Pump Company
Indianapolis, IN 46207-7026

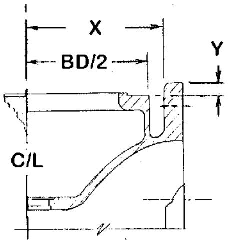


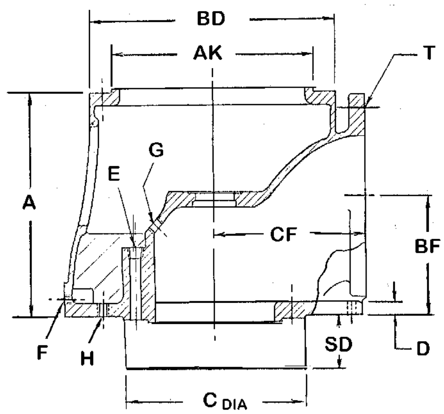


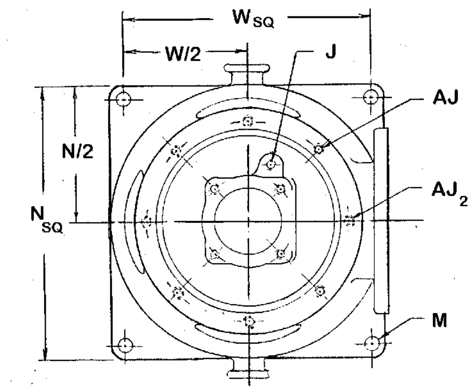
HEAD SIZE & TYPE	NOTE	BF	CF	A	D	Z	DISCHARGE SIZE	BASE MOUNTING 4 HOLES: M	BASE MOUNTING 4 HOLES: N_{SQ}	BASE MOUNTING 4 HOLES: W_{SQ}	NEMA DRIVER MOUNTING: BD	NEMA DRIVER MOUNTING: AK	NEMA DRIVER MOUNTING: AJ DRILLING 4 HOLES STRADDLE CENTERLINE: DIA	NEMA DRIVER MOUNTING: AJ DRILLING 4 HOLES STRADDLE CENTERLINE: BOLT CIRCLE	BELOW BASE CLEARANCE REQUIRED (NOTE 3): C_{DIA}	BELOW BASE CLEARANCE REQUIRED (NOTE 3): SD	AUXILLIARY CONNECTIONS SEE NOTE 2: E-NPS	AUXILLIARY CONNECTIONS SEE NOTE 2: F-NPT	AUXILLIARY CONNECTIONS SEE NOTE 2: G-NPT	AUXILLIARY CONNECTIONS SEE NOTE 2: R -2 Holes
2-1/2x2-1/2x10S	1	3.81	5.00	9.25	0.75	1.56	2-1/2 NPT	0.56	12.5	9.25	10.0	8.25	0.44	9.12	5.00	1.00	1/4	1/4	3/4	3/4-10UNC
2-1/2x3x10S	1	3.81	5.00	9.25	0.75	1.56	2-1/2 NPT	0.56	12.5	9.25	10.0	8.25	0.44	9.12	5.00	1.00	1/4	1/4	3/4	3/4-10UNC

NOTES: 1: MAXIMUM WORKING PRESSURE 175 PSI @ 150 DEG F MAX TEMPERATURE
2: E - AIR LINE
F - STUFFING BOX DRAIN
G - PRELUBE
R - HOLES FOR LIFTING EYE BOLTS
3: THIS IS THE CLEARANCE FOR COLUMN PIPE OTHER FACTORS MAY DICTATE THE MINIMUM FLOOR OPENING SIZE REQUIRED.
ALL DIMENSIONS ARE IN INCHES

Vertical Turbine Pumps
Cast Iron Surface Discharge Heads
S & SHP







HEAD SIZE & TYPE	NOTE	BF	CF	A	D	DISCHARGE FLANGE ANSI FLAT FACED: SIZE & ANSI RATING	T HOLE DRILLING & TAPPING STRADDLE CENTERLINE: NO.	T HOLE DRILLING & TAPPING STRADDLE CENTERLINE: THREAD	T HOLE DRILLING & TAPPING STRADDLE CENTERLINE: BOLT CIRCLE	BASE MOUNTING 4 HOLES: M	BASE MOUNTING 4 HOLES: NSQ	BASE MOUNTING 4 HOLES: WSQ	NEMA DRIVER MOUNTING: BD	NEMA DRIVER MOUNTING: AK	AJ DRILLING/TAPPING 4 HOLES STRADDLE CTRLINE (AJ2 DRILLING 4 HOLES ON CTRLINE WHERE SHOWN ONLY): THREAD	AJ: BOLT CIRCLE	BELOW BASE CLEARANCE REQUIRED NOTE 6: C DIA	BELOW BASE CLEARANCE REQUIRED NOTE 6: SD	DISCHG FLANGE CLEAR.: X	DISCHG FLANGE CLEAR.: Y	AUXILLIARY CONNECTIONS SEE NOTE 5: E-NPS	F-NPT	G-NPT	H-NPS	J-NPT
6x6x12S	1	6.50	8.00	13.69	0.75	6-125 LB	8	3/4-10UNC	9.50	0.75	15	13.25	12.0	8.25	(AJ) 0.44 DIA (AJ2) 3/8-16UNC	9.12	9.94	3.38	-	-	3/4	1/2	3/4	N.A.	1/4
6x8x16.5S	1	7.75	10.25	14.75	1.25	6-125 LB	8	3/4-10UNC	9.50	1.00	20	18.00	16.5	13.50	5/8-11UNC	14.75	12.25	3.75	-	-	3/4	3/8	3/4	1/2	1/4
6x8x16.5SHP	2	7.75	10.78	14.75	1.25	6-250 LB	12	3/4-10UNC	10.62	1.00	20	18.00	16.5	13.50	5/8-11UNC	14.75	12.25	3.75	-	-	3/4	3/8	3/4	1/2	1/4
8x8x12S	1	7.00	9.00	14.75	0.88	8-125 LB	8	3/4-10UNC	11.75	0.88	17	15.00	12.0	8.25	(AJ) 0.44 DIA (AJ2) 3/8-16UNC	9.12	12.25	3.75	-	-	3/4	1/2	3/4	1/2	1/4
8x8x16.5S	1	7.75	10.25	14.75	1.25	8-125 LB	8	3/4-10UNC	11.75	1.00	20	18.00	16.5	13.50	5/8-11UNC	14.75	12.25	3.75	-	-	3/4	3/8	3/4	1/2	1/4
8x8x16.5SHP	2	7.75	10.88	14.75	1.25	8-250 LB	12	7/8-9UNC	13.00	1.00	20	18.00	16.5	13.50	5/8-11UNC	14.75	12.25	3.75	9.19	0.25	3/4	3/8	3/4	1/2	1/4
10x10x16.5S	1	9.00	10.25	18.00	1.50	10-125 LB	12	7/8-9UNC	14.25	1.00	20	18.00	16.5	13.50	5/8-11UNC	14.75	14.25	4.50	-	-	3/4	3/8	3/4	1/2	1/4
10x10x16.5SHP	2	9.00	11.12	18.00	1.50	10-250 LB	16	1-8UNC	15.25	1.00	20	18.00	16.5	13.50	5/8-11UNC	14.75	14.25	4.50	-	-	3/4	3/8	3/4	1/2	1/4
10x10x20S	1	9.00	10.25	18.00	1.50	10-125 LB	12	7/8-9UNC	14.25	1.00	20	18.00	20.0	13.50	5/8-11UNC & 5/8-11UNC	14.75 & 18.25	14.25	4.50	-	-	3/4	3/8	3/4	1/2	1/4
10x10x20SHP	2	9.00	11.12	18.00	1.50	10-250 LB	16	1-8UNC	15.25	1.00	20	18.00	20.0	13.50	5/8-11UNC & 5/8-11UNC	14.75 & 18.25	14.25	4.50	-	-	3/4	3/8	3/4	1/2	1/4
12x12x20S	1	10.50	12.25	21.00	1.75	12-125 LB	12	7/8-9UNC	17.00	1.00	23	21.00	20.0	13.50	5/8-11UNC	14.75	16.25	4.44	-	-	3/4	3/8	1	1/2	1/4
12x12x20SHP	2	10.50	13.12	21.00	1.75	12-250 LB	16	1-1/8-7UNC	17.75	1.00	23	21.00	20.0	13.50	5/8-11UNC	14.75	16.25	4.44	-	-	3/4	3/8	1	1/2	1/4
14x14x24.5S	3	11.50	14.75	22.25	1.75	14-125 LB	12	1-8UNC	18.75	1.00	28	25.00	24.5	13.50	5/8-11UNC	14.75	18.25	5.88	-	-	3/4	3/8	1	1/2	1/4
14x14x24.5SHP	4	11.50	15.62	22.25	1.75	14-250 LB	20	1-1/8-7UNC	20.25	1.00	28	25.00	24.5	13.50	5/8-11UNC	14.75	18.25	5.88	13.5	0.50	3/4	3/8	1	1/2	1/4

NOTES:
1. MAXIMUM WORKING PRESSURE 200 PSI @ 150 DEG F MAX TEMPERATURE
2. MAXIMUM WORKING PRESSURE 400 PSI @ 150 DEG F MAX TEMPERATURE
3. MAXIMUM WORKING PRESSURE 150 PSI @ 150 DEG F MAX TEMPERATURE
4. MAXIMUM WORKING PRESSURE 300 PSI @ 150 DEG F MAX TEMPERATURE
5. E - AIR LINE, F- STUFFING BOX DRAIN, G- PRELUBE OR PRESSURE TAP, H-DRAIN, J-PRESSURE TAP

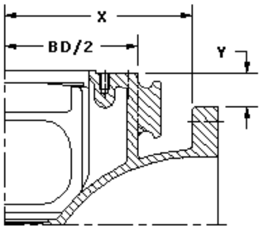
NOTE: 6 THIS IS THE CLEARANCE FOR TOP COLUMN FLANGE. OTHER FACTORS MAY DICTATE THE MINIMUM FLOOR OPENING SIZE REQUIRED.

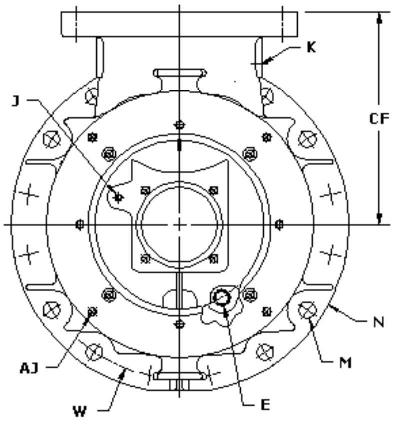
ALL DIMENSIONS ARE IN INCHES

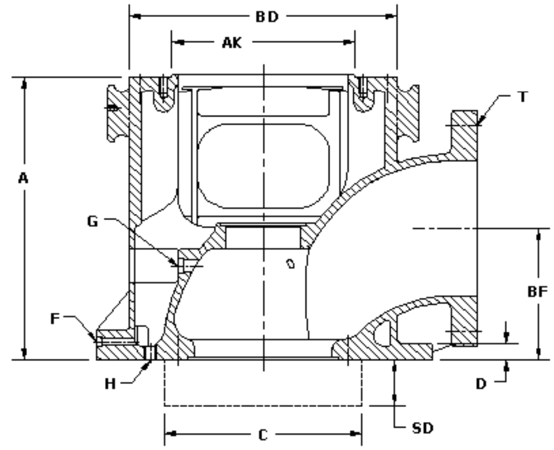
Vertical Turbine Pumps
Cast Iron Surface Discharge Heads
Type C, CHP, S, SHP, G & GHP

Peerless Pump Company
Indianapolis, IN 46207-7026

10x10x20 G head Shown







HEAD SIZE & TYPE SEE NOTE 8	NOTE	BF	CF	A	D	DISCHARGE FLANGE ANSI FLAT FACED: SIZE & ANSI RATING	T HOLE DRILLING & TAPPING STRADDLE C'LINE: #	T HOLE DRILLING & TAPPING STRADDLE C'LINE: THD	BOLT CIRC	BASE MOUNTING 4 HOLES: M	STD QTY	ANSI QTY	N DIA	W DIA	NEMA DRIVER MOUNTING: BD	AK	AJ DRILLING/TAPPING (4) HOLES: THREAD	BOLT CIRCLE	ANGULAR POSITION	BELOW BASE CLEARANCE REQUIRED NOTE 7: CDIA	SD	DISCHG FLANGE CLEARANCE: X	Y	AUXILLIARY CONNECTIONS SEE NOTE 6: E-NPS	F-NPT	G-NPT	H-NPS	J-NPT	K-NPT
2.5x2.5x10S	5	3.81	5.00	9.25	0.75	2.5 NPT	--	---	---	0.56	4	--	12.5 Sq	9.25 Sq	10.0	8.25	3/8-16 UNC	9.12	STR CL	6.25	1.00	-	-	1/4	1/4	3/4	--	--	--
2.5x3x10S	5	3.81	5.00	9.25	0.75	2.5 NPT	--	---	---	0.56	4	--	12.5 Sq	9.25 Sq	10.0	8.25	3/8-16 UNC	9.12	STR CL	6.25	1.00	-	-	1/4	1/4	3/4	--	--	--
4x4x10C	1	5.75	8.50	16.38	1.12	4-125 LB	8	5/8-11UNC	7.50	0.88	8	8	13.5	11.75	10.0	8.25	3/8-16 UNC	9.12	STR CL	8.00	1.25	-	-	1/4	1/4	3/4	3/4	--	1/4
4x4x10CHP	2	5.75	8.50	16.38	1.12	4-250 LB	8	3/4-10UNC	7.88	0.88	8	8	13.5	11.75	10.0	8.25	3/8-16 UNC	9.12	STR CL	8.00	1.25	-	-	1/4	1/4	3/4	3/4	--	1/4
6x6x12G	1	7.50	11.44	17.00	1.00	6-125 LB	8	3/4-10UNC	9.50	1.00	4	12	19.0	17.00	12.0	8.25	3/8-16 UNC	9.12	ON CL & STR CL	11.00	4.00	-	-	3/4	3/8	-	3/8	1/4	1/4
6x6x12GHP	2					6-250 LB	12		10.62																				
8x8x16.5G	1	8.25	14.25	18.12	1.12	8-125 LB	8	3/4-10UNC	11.75	1.12	8	16	23.5	21.25	12.0 & 16.5	8.25 & 13.5	3/8-16 UNC & 5/8-11 UNC	@9.12 ON CL & @14.75 ON/STR CL		13.25	4.25	-	-	3/4	3/8	3/4	1/2	1/4	1/4
8x8x16.5GHP	2					8-250 LB	12	7/8-9 UNC	13.00																				
10x10x20G	1	9.75	15.75	21.00	1.25	10-125 LB	12	7/8-9 UNC	14.25	1.25	8	16	25.0	22.75	20.0	13.50	5/8-11UNC	14.75 ON/STR CL & 18.25 STR CL		15.25	5.00	-	-	3/4	3/8	3/4	1/2	1/4	1/4
10x10x20GHP	2					10-250 LB	16	1-8UNC	15.25																				
12x12x20G	1	12.00	17.50	22.75	1.25	12-125 LB	12	7/8-9 UNC	17.00	1.25	4	20	27.5	25.00	20.0	13.50	5/8-11UNC	14.75 ON/STR CL & 18.25 STR CL		17.50	5.00	-	-	3/4	3/8	1	1/2	1/4	1/4
12x12x20GHP	2					12-250 LB	16	1 1/8-7UNC	17.75																				
14x14x24.5S	3	11.50	14.75	22.25	1.75	14-125 LB	12	1-8 UNC	18.75	1.00	4	--	28.0 Sq	25.00 Sq	24.5	13.50	5/8-11UNC @ 14.75 & 5/8-11UNC @ 18.25 & 3/4-10UNC @ 23.00		STR CL	19.25	6.00	-	-	3/4	3/8	1	1/2	1/4	--
14x14x24.5SH	4		15.62			14-250 LB	20	1-1/8-7 UNC	20.25													13.5	0.5						
16x16x30.5S	3	12.75	20.00	21.50	3.50	16-125 LB	16	1-8 UNC	21.25	1.00	4	--	38.0 Sq	32.00 Sq	30.5	22.00	3/4-10 UNC	26.00 & 28.75	STR CL	21.25	4.00	18.6	3.0	3/4	1/2	2.00	1.00	1/4	--
16x16x30.5SH	4					16-250 LB	20	1-1/4-7 UNC	22.50											22.25	4.50		4.0						

MAXIMUM WORKING PRESSURE @ 150 DEG F MAX TEMPERATURE

NOTE 1 = 200 PSI
NOTE 2 = 400 PSI
NOTE 3 = 150 PSI
NOTE 4 = 300 PSI
NOTE 5 = 175 PSI

NOTE 6 E - AIR LINE, F- STUFFING BOX DRAIN, G- PRELUBE OR PRESSURE TAP, H-DRAIN J -PRESSURE TAP (OR PRELUBE ON 6x6x12), K-PRESSURE TAP

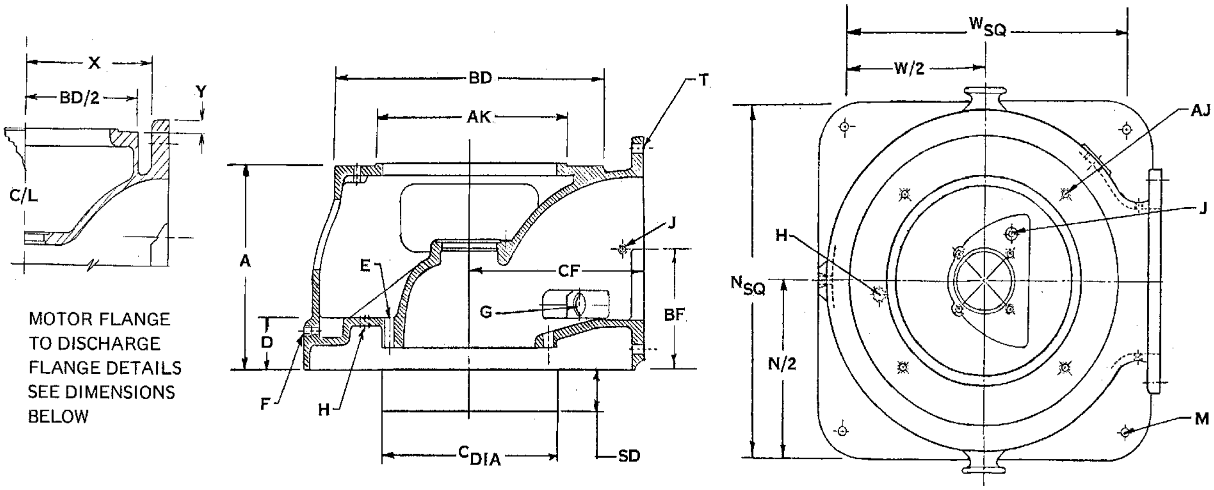
NOTE 7 THIS IS THE CLEARANCE FOR TOP COLUMN FLANGE. OTHER FACTORS MAY DICTATE THE MINIMUM FLOOR OPENING SIZE REQUIRED.

NOTE 8 S & C HEAD & 6x6x12 G HEAD CONFIGURATIONS MAY VARY VISUALLY FROM DIAGRAM.

MODEL# DEFINITION: DISCHARGE x COLUMN x DRIVER BD

ALL DIMENSIONS ARE IN INCHES

VERTICAL TURBINE PUMP)S
Cast Iron Surface Discharge Heads
16 x16 x30-1/2
Type S - 125 Lb ANSI Discharge Flange
Type SHP - 250Lb ANSI Discharge Flange



HEAD SIZE & TYPE	NOTE	BF	CF	A	D	DISCHARGE FLANGE ANSI FLAT FACED				BASE MOUNTING 4 HOLES			NEMA DRIVER MOUNTING				BELOW BASE CLEARANCE REQUIRED	
						SIZE & ANSI	T HOLE DRILLING & TAPPING STRADDLE CENTERLINE			M	NSQ	WSQ	BD	AK	AJ DRILLING/TAPPING 4 HOLES STRADDLE CENTERLINE		NOTE 3	
						RATING	NO.	THREAD	BOLT CIRCLE						THREAD	BOLT CIRCLE	C DIA	SD
16 x 16 x 30-1/2S	1	12.75	20.00	21.50	3.50	16-125 LB	16	1-8UNC	21.25	1.00	38	32.00	30.5	22	3/4-10UNC	26.00	20.12	2.88
16 x16 x 30-1/2SHP	1	12.75	20.00	21.50	3.50	16-125 LB	20	1-1/4-7UNC	22.50	1.00	38	32.00	30.5	22	3/4-10UNC	26.00	20.12	2.88

Available Clearance for Motor Base to Discharge Flange			AUXILLIARY CONNECTIONS SEE NOTE 2				
BD/2	X	Y	E Dia	F-NPT	G-NPT	H-NPS	J-NPT
15.25	18.62	3.00	0.922	1/2	2	1	1/4
15.25	18.62	4.00	0.922	3/8	2	1	1/4

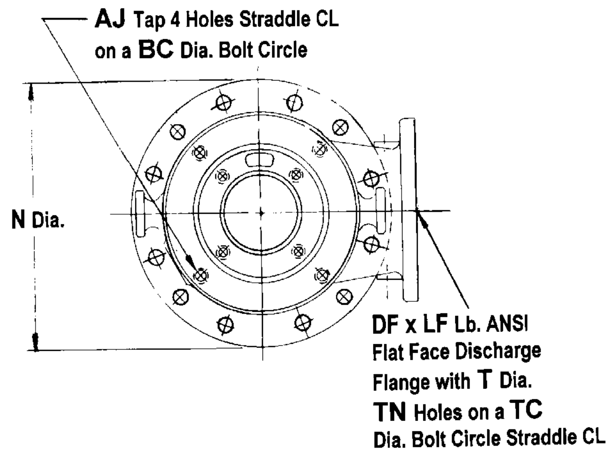
NOTES: 1: MAXIMUM WORKING PRESSURE 175 PSI @ 150 DEG F MAX TEMPERATURE
Type S Head 125 Lb ANSI Dischage Flange - 150 PSI
Type SHP Head 250 Lb ANSI Dischage Flange - 300 PSI
2: E - AIR LINE
F - STUFFING BOX DRAIN
G - PRELUBE
R - HOLES FOR LIFTING EYE BOLTS
3: THIS IS THE CLEARANCE FOR COLUMN PIPE OTHER FACTORS MAY DICTATE THE MINIMUM FLOOR OPENING SIZE REQUIRED.
ALL DIMENSIONS ARE IN INCHES

VERTICAL TURBINE PUMPS
Type C and CHP Cast Iron Round Base Discharge Heads

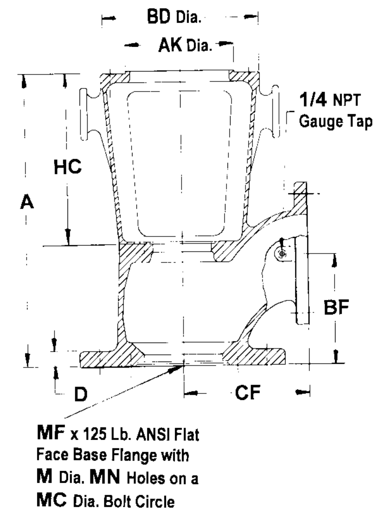
Peerless Pump Company
Indianapolis, IN 46207-7026

General Dimensions (all dimensions are in inches unless otherwise noted)

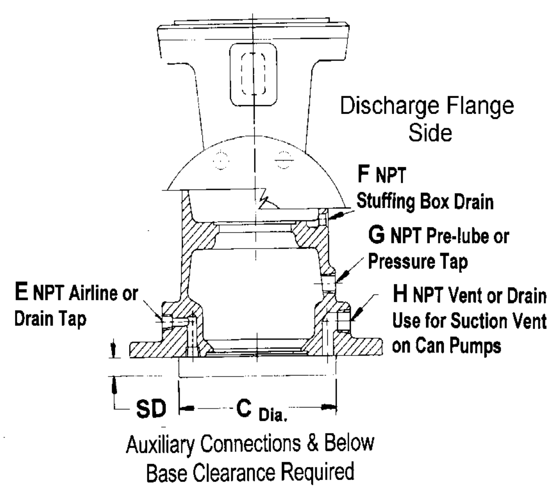
✓	Head Size	DF x LF	A	AJ	AK	BC	BD	BF
	4x4x10C	4x125	16.38	3/8-16UNC	8.25	9.12	10.0	5.75
	4x4x10CHP	4x250	16.38	3/8-16UNC	8.25	9.12	10.0	5.75
	4x6x12C	4x125	21.88	3/8-16UNC	8.25	9.12	12.0	8.00
	4x6x12CHP	4x250	21.88	3/8-16UNC	8.25	9.12	12.0	8.00
	6x6x12C	6x125	22.75	3/8-16UNC	8.25	9.12	12.0	8.62
	6x8x16-1/2C	6x125	25.81	5/8-11UNC	13.50	14.75	16.5	9.00
	6x8x16-1/2CHP	6x250	25.81	5/8-11UNC	13.50	14.75	16.5	9.00
	8x8x12C	8x125	24.50	3/8-16UNC	8.25	9.12	12.0	10.00
	8x8x16-1/2C	8x125	26.81	5/8-11UNC	13.50	14.75	16.5	10.00
	8x8x16-1/2CHP	8x250	26.81	5/8-11UNC	13.50	14.75	16.5	10.00
	10x10x20C	10x125	30.12	5/8-11UNC	13.50	14.75	20.0	12.00
	12x12x20C	12x125	32.12	5/8-11UNC	13.50	14.75	20.0	13.00



✓	Head Size	C	CF	D	E	F	G	H	HC	M	MC
	4x4x10C	8.00	8.50	1.12	1/4	1/4	3/4	3/4	9.62	0.88	11.75
	4x4x10CHP	8.00	8.50	1.12	1/4	1/4	3/4	3/4	9.62	0.88	11.75
	4x6x12C	10.00	11.00	1.19	1/4	1/4	3/4	3/4	13.19	1.00	17.00
	4x6x12CHP	10.00	11.00	1.19	1/4	1/4	3/4	3/4	13.19	1.00	17.00
	6x6x12C	10.00	12.00	1.31	1/4	1/4	3/4	3/4	13.19	1.12	18.75
	6x8x16-1/2C	12.25	14.00	1.38	1/4	3/8	1	1	15.50	1.12	21.25
	6x8x16-1/2CHP	12.25	14.00	1.38	1/4	3/8	1	1	15.50	1.12	21.25
	8x8x12C	12.25	14.25	1.25	1/4	3/8	1	1	13.19	1.25	22.75
	8x8x16-1/2C	12.25	14.75	1.38	1/4	3/8	1	1	15.50	1.25	22.75
	8x8x16-1/2CHP	12.25	14.75	1.38	1/4	3/8	1	1	15.50	1.25	22.75
	10x10x20C	14.25	14.50	1.38	1/4	3/8	1	1	17.31	1.25	22.75
	12x12x20C	16.50	15.50	1.44	1/4	3/8	1	1	17.31	1.25	25.00



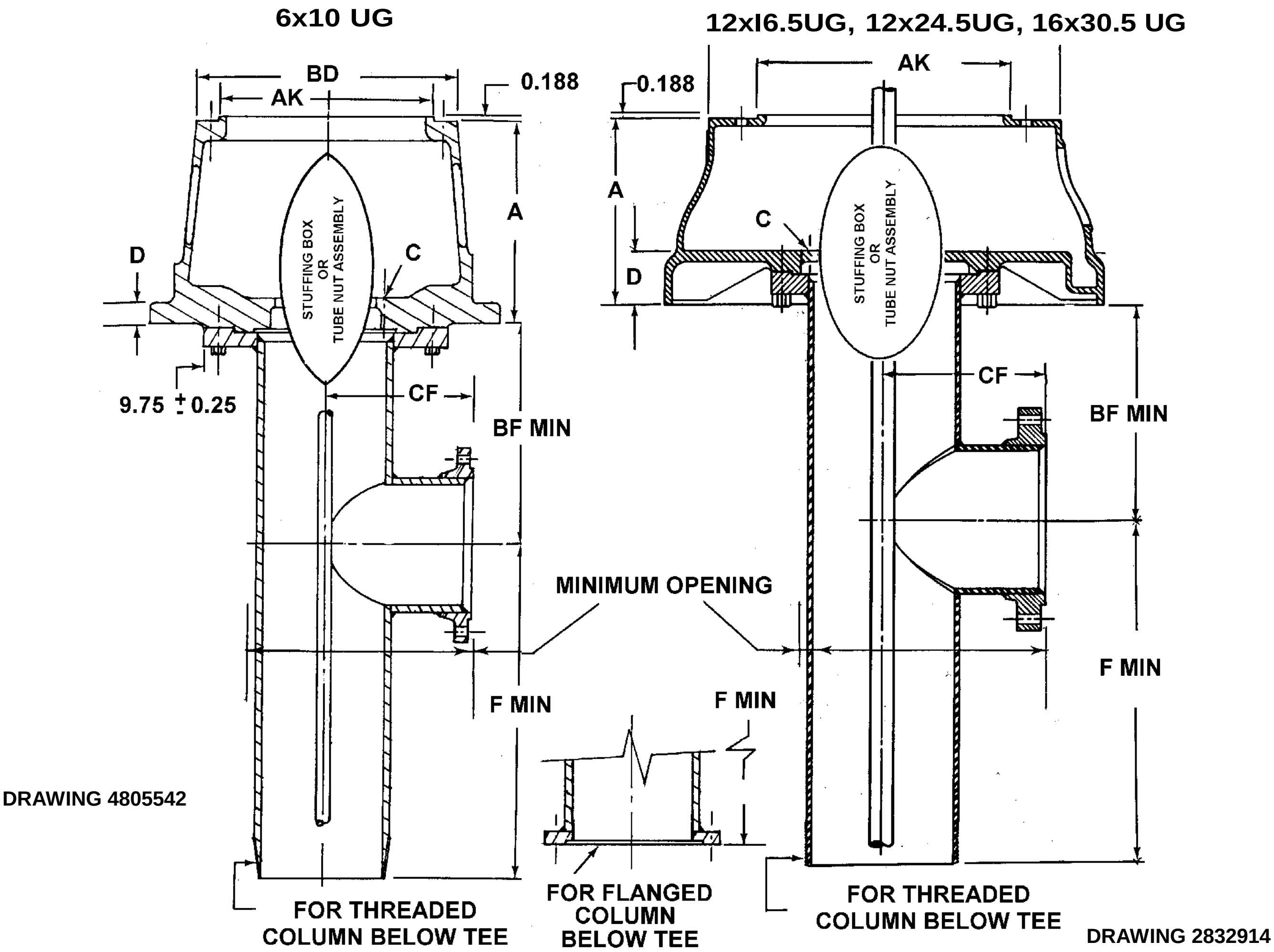
✓	Head Size	MF	MN	N	SD	T	TN	TC	Wt. Lb.
	4x4x10C	8	8	13.5	1.25	0.75	8	7.50	145
	4x4x10CHP	8	8	13.5	1.25	0.88	8	7.88	145
	4x6x12C	12	12	19.0	3.50	0.75	8	7.50	240
	4x6x12CHP	12	12	19.0	3.50	0.88	8	7.88	240
	6x6x12C	14	12	21.0	3.50	0.88	8	9.50	285
	6x8x16-1/2C	16	16	23.5	3.75	0.88	8	9.50	390
	6x8x16-1/2CHP	16	16	23.5	3.75	0.88	12	10.62	390
	8x8x12C	18	16	25.0	3.75	0.88	8	11.75	425
	8x8x16-1/2 C	18	16	25.0	3.75	0.88	8	11.75	445
	8x8x16-1/2CHP	18	16	25.0	3.75	1.00	12	13.00	445
	10x10x20C	18	16	25.0	4.50	1.00	12	14.25	600
	12x12x20C	20	20	27.5	4.69	1.00	12	17.00	720

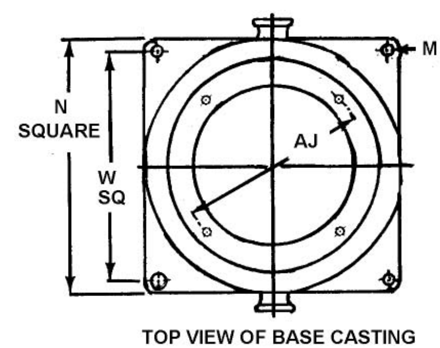


Notes: 1. The 4x4x10C and CHP heads are threaded for 4 inch column. All other sizes are machined for top column flanges.
2. Maximum operating pressures are :
Type C 125 Lb. Discharge Flange - ***200 psi***
Type CHP 250 Lb. Discharge Flange - ***400 psi***
3. Maximum suction pressure for ANSI flange mounted pump is ***100 psi***

Drawing No. 4853643

VERTICAL TURBINE PUMPS
Type UG Cast Iron Underground Discharge Heads
STANDARD – 150 LB RAISED FACE DISCHARGE FLANGE





GENERAL DIMENSIONS All dimensions are in inches unless otherwise noted

Column Pipe Size Inches		4	5	6	8	10	12	14	16
BF Minimum		8.5	9.5	10	11	13	14.0	16.0	17
CF Dimension		5.5	5.5	6	9	10	10.5	14.0	15
F Minimum	Flanged	8.0	9.0	10	11	14	14.0	15.0	16
	Threaded	12.0	15.0	18	24	30	30.0	31.0	31
Minimum Opening		12.5	12.5	14	19	21	25.0	27.5	31

Base Size	A	D	C NPT ①	N	W	M	AK	AJ	BD	HEAD SHAFT		COLUMN ②	
										MIN.	MAX.	MIN.	MAX.
6x10UG	7.94	0.75	1/2	13.5	10.5	0.69	8.25	9.12	10.0	0.75	1.19	4	6
12x16.5UG	13.31	3.75	1	23.0	19.0	0.88	13.5	14.75	18.0	1.0	1.50	4	12
12x24.5UG	15.31	3.75	1	31.0	26.0	1.00	13.5	14.75	25.0	1.19	2.19	6	12
16x30.5UG	17.06	4.50	1	38.0	32.0	1.00	22.0	26.0	30.25	1.94	2.44	10	16

① This pipe tap is for connection of air and vacuum valve to vent column of air.

② Column above tee must be flanged. Column below tee can be threaded or flanged.

VERTICAL TURBINE PUMPS
Top Column Flange Data for Type S & SHP Standard Cast Iron Discharge Heads

Peerless Pump Company
Indianapolis, IN 46207-7026

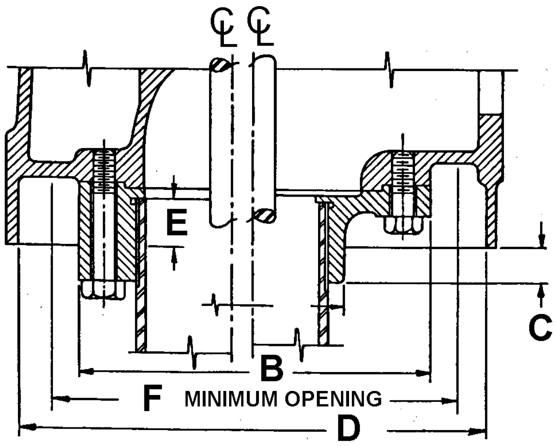


FIGURE 1

DRAWING 2828122

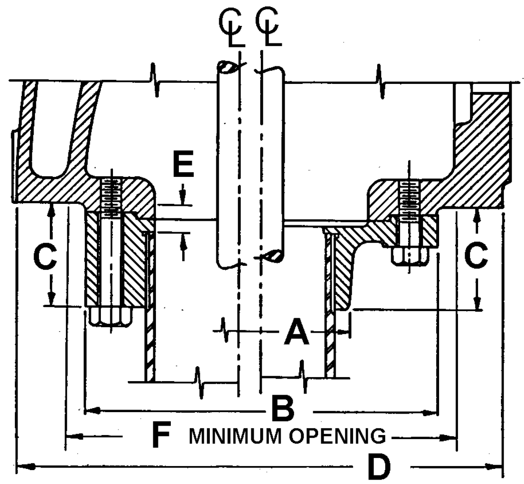


FIGURE 2

Column	Fig.	A③	B③	C	D	E②	F
6 x 6 x 12S							
3Std.	2	4-3/8	9-3/4	1-1/2	15Sq.	13/16	11
4Std.	2	5-3/8	9-3/4	1-1/2	15Sq.		
5Std.	2	①	9-3/4	3-1/4	15Sq.		
6Std.	2		9-3/4	3-1/4	15Sq.		
6 x 8 X 16-1/2S							
4Std.	2	5-1/2	12	1-15/16	20Sq.	7/8	13-1/4
5Std.	2	6-9/16	12	1-15/16	20Sq.		
6Std.	2	7-5/8	12	1-15/16	20Sq.		
8Std.	2	①	12	3-5/8	20Sq.		
8 x 8 x 12S							
4Std.	2	5-1/2	12	1-15/16	17Sq.	7/8	13-1/4
5Std.	2	6-9/16	12	1-15/16	17Sq.		
6Std.	2	7-5/8	12	1-15/16	17Sq.		
8Std.	2	①	12	3-5/8	17Sq.		
8 x 8 X 16-1/2S							
4Std.	2	5-1/2	12	1-15/16	20Sq.	15/16	13-1/4
5Std.	2	6-9/16	12	1-15/16	20Sq.		
6Std.	2	7-5/8	12	1-15/16	20Sq.		
8Std.	2	①	12	3-5/8	20Sq.		

① Construction of top column flange is as shown on left half drawing. Use B dimension only.
② E dimension is the distance from end of column pipe to bottom of discharge head.

Column	Fig.	A③	B③	C	D	E ②	F
10 x 10 X 16-1/2S and 10 x 10 x 20S							
4Std.	2	5-1/2	14	1-15/16	20Sq.	15/16	15-1/4
5Std.	2	6-9/16	14	1-15/16	20Sq.		
6Std.	2	7-5/8	14	1-15/16	20Sq.		
8Std.	2	9-5/8	14	1-15/16	20Sq.		
10Std.	2	①	14	4-3/8	20Sq.		
12 x 12 x 20S							
5Std.	2	6-9/16	16-1/4	2-1/16	23Sq.	1	17-1/2
6Std.	2	7- 7/8	16-1/4	2-1/16	23Sq.		
8Std.	2	9-7/8	16-1/4	2-1/16	23Sq.		
10Std.	2	12-1/4	16-1/4	2-1/16	23Sq.		
12Std.	2	16-1/4	16-1/4	4-5/16	23Sq.		
14 x 14 x 24-1/2S							
10Std.	2	12-1/4	18	2	28Sq.	7/8	19-1/4
12Std.	2	18	18	5-1/4	28Sq.		
14Std.	2	18	18	5-3/4	28Sq.		
16 x 16 x 30-1/2S							
10Std.	1	12-1/4	20	2	36-3/4 Sq.	1-1/2	21-1/4
12Std.	1	14-1/4	20	2	36-3/4 Sq.		
14 O.D.	1	15-1/2	20	2	36-3/4 Sq.		
16 O.D.	1	①	20	2-3/4	36-3/4 Sq.		

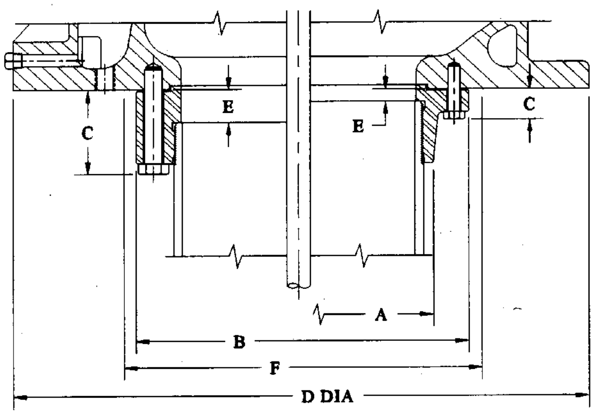
③ Dimensions A & B are "AS CAST"; 1/4" minimum allowance must be made for casting variation

All dimensions are in inches unless otherwise noted

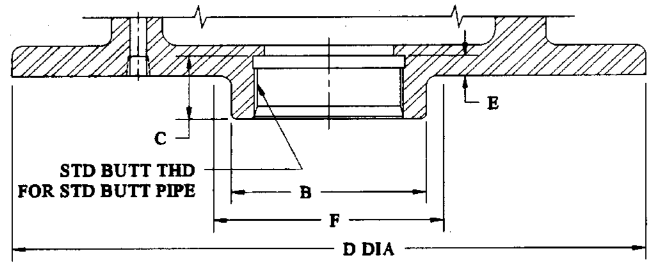
Subject to change without notice

Top Column Flange Data
for Type C, CHP, S, SHP, G AND GHP
Cast Iron Discharge Heads

Configuration #1



Configuration #2



Head Size	Column Size	Config-uration	A ③	B ③	C	D	E ②	F
2.5x2.5x10S	2.5 Std	#2	5.00	5.00	1.00	12.5 Sq.	0.25	6.25
2.5x3x10S	3 Std		5.00	5.00	1.00	12.5 Sq.	0.25	6.25
4x4x10C	4 Std	#2	7.75	7.75	1.81	13.5 Dia	0.81	9.00
6x6x12G	5 Std	#1	①	9.75	4.00	19.0 Dia.	0.62	11.00
	6 Std		①	9.75	4.00	19.0 Dia.	0.62	11.00
8x8x16.5G	6 Std	#1	7.62	12.00	2.75	23.5 Dia.	0.62	13.25
	8 Std		①	12.00	4.25	23.5 Dia.	0.50	13.25
10x10x20G	8 Std	#1	9.62	14.00	2.75	25.0 Dia.	0.62	15.25
	10 Std		①	14.00	5.00	25.0 Dia	0.62	15.25
12x12x20G	10 Std	#1	12.25	16.25	2.75	27.5 Dia.	0.62	17.50
	12 Std		①	16.25	5.00	27.5 Dia.	0.88	17.50
④ 14x14x24.5S	10 Std	#1	12.25	18.00	2.00	28.0 Sq.	0.88	19.25
	12 Std		18.00	18.00	5.25	28.0 Sq.	0.88	19.25
	14 Std		18.00	18.00	5.75	28.0 Sq.	0.88	19.25
④ 16x16x30.5S	10 Std	#1	12.25	20.00	2.00	36.8 Sq.	1.50	21.25
	12 Std		14.25	20.00	2.00	36.8 Sq.	1.50	21.25
	14 Std		15.50	20.00	2.00	36.8 Sq.	1.50	21.25
	16 Std		①	20.00	2.75	36.8 Sq.	1.50	21.25

① Construction of top column flange is as shown on left half drawing. Use B dimension only.

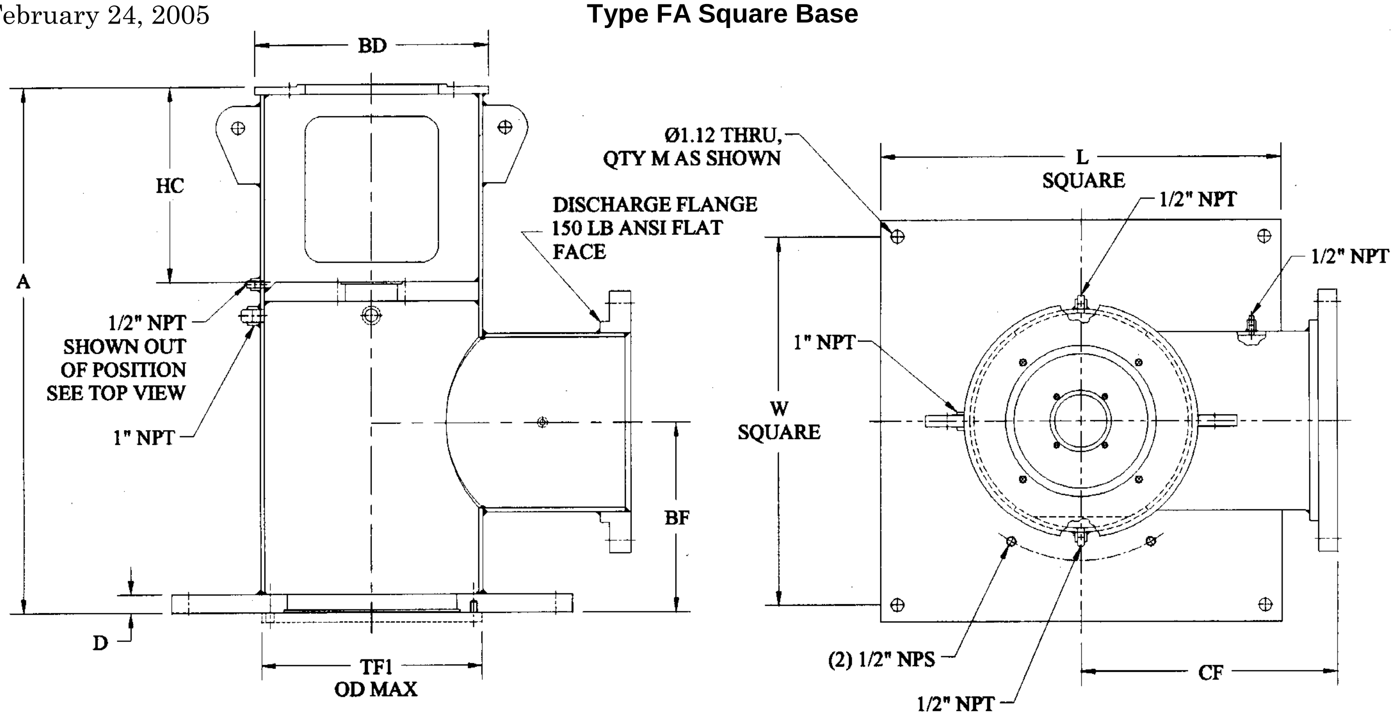
② E dimension is the distance from end of column pipe to bottom of discharge head.

③ Dimensions A & B are "AS CAST"; 0.25" minimum allowance must be made for casting variation.

④ 14x14x24.5 & 16x16x30.5 S heads have male registers (not shown).

VERTICAL TURBINE PUMPS
Discharge Heads
Type FA Square Base

Peerless Pump Company
Indianapolis, IN 46207-7026

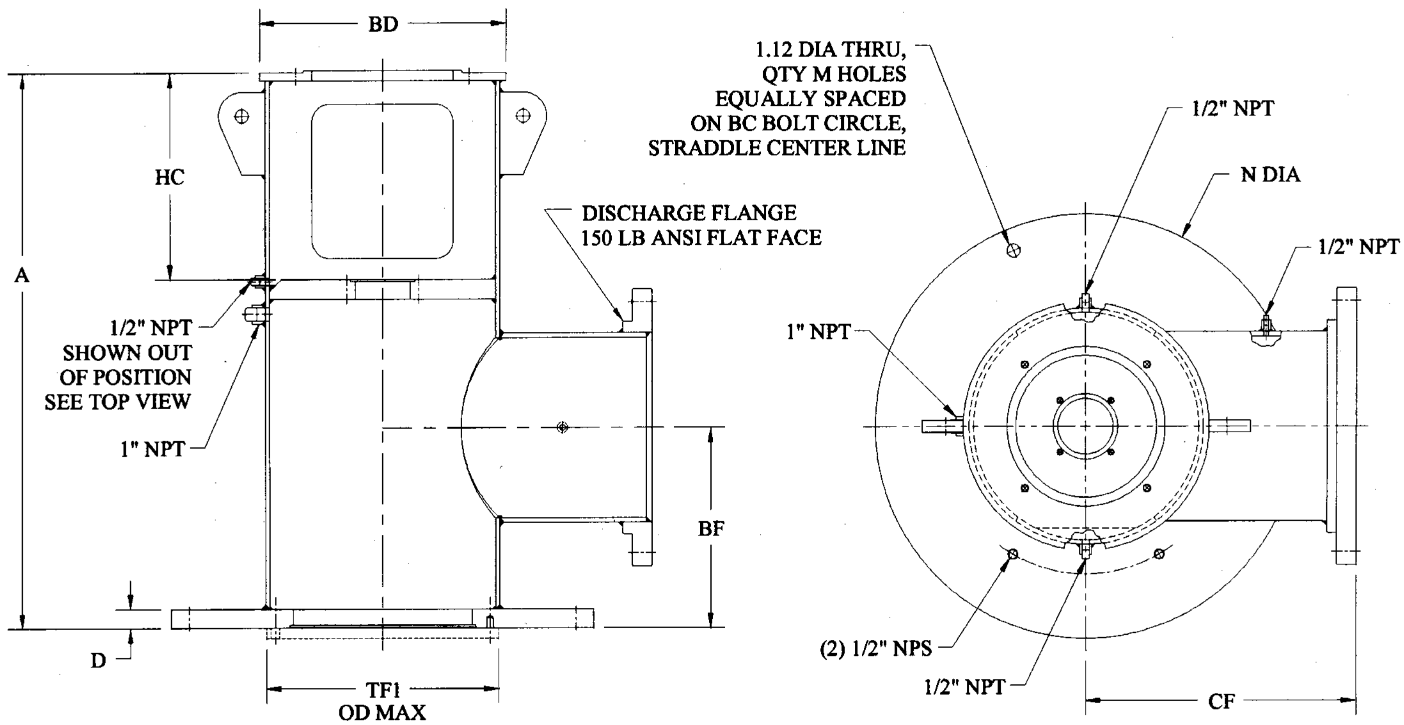


All dimensions are in inches

300# Flanges are optional

Type FA Fabricated Head Dimensional Data

Discharge Head Size Disch x Col x Mtr BD	VHS Discharge Head				VSS Discharge Head				VHS And VSS Discharge Heads			VHS And VSS Base Plates				Column Data	
	VHS Head Part No.	Overall Height A	Stand Height HC	VHS Max Wt. Lb.	VSS Head Part Number	Overall Height A	Stand Height HC	VSS Max Wt. Lb.	Motor BD	Nozzle Height BF	Head Width CF	Base Square L	Bolt Hole Square W	Hole Qty. M	Thick Max D	Nominal Column Size	Flange OD Max TF1
6X6X12 FA	4605540H	24.25	11.57	283	4605540S	34.50	21.82	306	12.00	7.50	13.00	18.00	15.00	4	1.50	6.00	9.62
6X6X16.5 FA	4605541H	28.25	15.31	376	4605541S	37.82	24.88	450	16.50	7.50	13.00	20.00	17.00	4	1.50	6.00	9.62
8X8X12 FA	4605542H	27.25	11.57	422	4605542S	37.50	21.82	446	12.00	9.50	15.00	22.00	19.00	4	1.75	8.00	12.12
8X8X16.5 FA	4605543H	31.25	15.31	471	4605543S	40.88	24.94	546	16.50	9.50	15.00	22.00	19.00	4	1.75	8.00	12.12
10X10X16.5 FA	4605544H	34.25	15.75	551	4605544S	43.38	24.88	622	16.50	11.00	15.00	24.00	21.00	4	1.75	10.00	14.12
10X10X20 FA	4605545H	34.25	15.75	617	4605545S	45.25	26.75	655	20.00	11.00	15.00	24.00	21.00	4	1.75	10.00	14.12
12X12X16.5 FA	4605546H	36.75	15.75	631	4605546S	45.88	24.88	663	16.50	12.50	16.00	24.00	21.00	4	1.75	12.00	16.25
12X12X20 FA	4605547H	36.75	15.75	776	4605547S	47.75	26.75	814	20.00	12.50	16.00	28.00	25.00	4	1.75	12.00	16.25
14X14X20 FA	4605548H	37.88	15.76	889	44605548S	48.88	26.76	927	20.00	13.00	19.00	30.00	27.00	4	1.75	14.00	18.31
14X14X24.5 FA	4605549H	37.88	15.76	980	4605549S	53.75	31.63	1163	24.50	13.00	19.00	30.00	27.00	4	1.75	14.00	18.31
16X16X20 FA	4605550H	40.88	15.76	945	4605550S	51.88	26.76	984	20.00	15.00	20.00	30.00	27.00	4	1.75	16.00	20.31
16X16X24.5 FA	4605551H	40.88	15.76	1031	4605551S	56.88	31.76	1219	24.50	15.00	20.00	30.00	27.00	4	1.75	16.00	20.31
16X16X30.5 FA	4605552H	42.00	16.38	1501	4605552S	58.63	33.01	1618	30.50	15.00	23.00	36.00	33.00	12	1.75	16.00	20.31
18X18X24.5 FA	4605553H	41.88	15.76	1350	4605553S	57.88	31.76	1543	24.50	15.00	23.00	36.00	33.00	12	2.00	18.00	23.31
18X18X30.5 FA	4605554H	43.00	16.38	1609	4605554S	59.63	33.01	1725	30.50	15.00	23.00	36.00	33.00	12	2.00	18.00	23.31
20X20X24.5 FA	4605555H	45.00	15.88	1452	4605555S	60.88	31.76	1544	24.50	17.00	23.00	36.00	33.00	12	1.75	20.00	25.31
20X20X30.5 FA	4605556H	46.00	16.38	1671	4605556S	62.63	33.01	1787	30.50	17.00	23.00	36.00	33.00	12	2.00	20.00	25.31
24X24X24.5 FA	4605557H	49.00	15.88	2031	4605557S	64.88	31.76	2142	24.50	19.00	26.00	42.00	39.00	12	2.00	24.00	29.69
24X24X30.5 FA	4605558H	50.00	16.38	2101	4605558S	66.63	33.01	2252	30.50	19.00	26.00	42.00	39.00	12	2.00	24.00	29.69



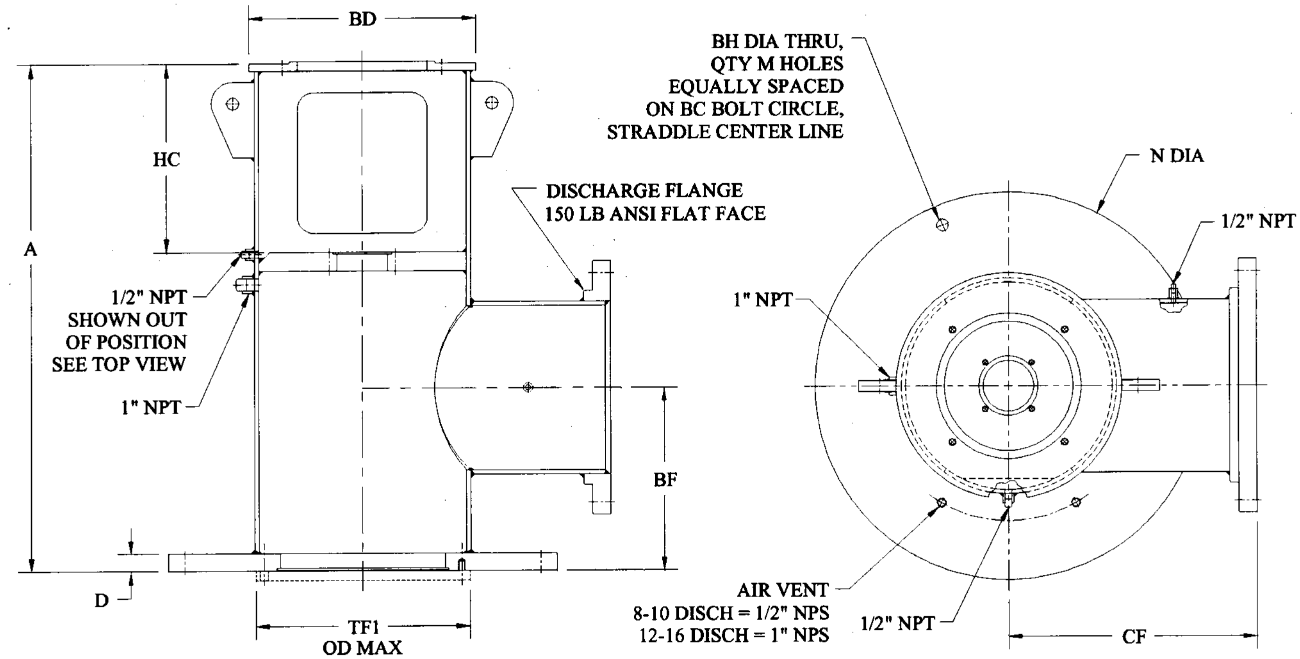
All dimensions are in inches

300# Flanges are optional

Type FR Fabricated Head Dimensional Data

Discharge Head Size Disch x Col x Mtr BD	VHS Discharge Head				VSS Discharge Head				VHS And VSS Discharge Heads			VHS And VSS Base Plates				Column Data	
	VHS Head Part No.	Overall Height A	Stand Height HC	VHS Max Wt. Lb.	VSS Head Part No.	Overall Height A	Stand Height HC	VSS Max Wt. Lb.	Motor BD	Nozzle Height BF	Head Width CF	Base Dia. N	Bolt Circle BC	Hole Qty. M	Thick Max D	Nominal Column Size	Flange OD Max TF1
18X18X24.5 FR	RTF	41.88	15.76	1230	RTF	57.88	31.75	1400	24.50	15.00	23.00	36.50	34.00	8	2.00	18.00	23.31
18X18X30.5 FR	RTF	43.00	16.38	1350	RTF	59.63	33.00	1530	30.50	15.00	23.00	36.50	34.00	8	2.00	18.00	23.31
20X20X24.5 FR	RTF	45.00	15.88	1390	RTF	60.88	31.75	1470	24.50	17.00	23.00	36.50	34.00	8	2.00	20.00	25.31
20X20X30.5 FR	RTF	46.00	16.38	1500	RTF	62.63	33.00	1600	30.50	17.00	23.00	36.50	34.00	8	2.00	20.00	25.31
24X24X24.5 FR	RTF	49.00	15.88	1670	RTF	64.88	31.75	1770	24.50	19.00	25.00	36.50	34.00	8	2.25	24.00	29.69
24X24X30.5 FR	RTF	50.00	16.38	1740	RTF	66.63	33.00	1830	30.50	19.00	25.00	36.50	34.00	8	2.25	24.00	29.69

VERTICAL TURBINE PUMPS
VHS Discharge Heads
Type FRA ANSI Flange Base



All dimensions are in inches

300# Discharge flanges are optional

FRA Fabricated Discharge Head Dimensional Data

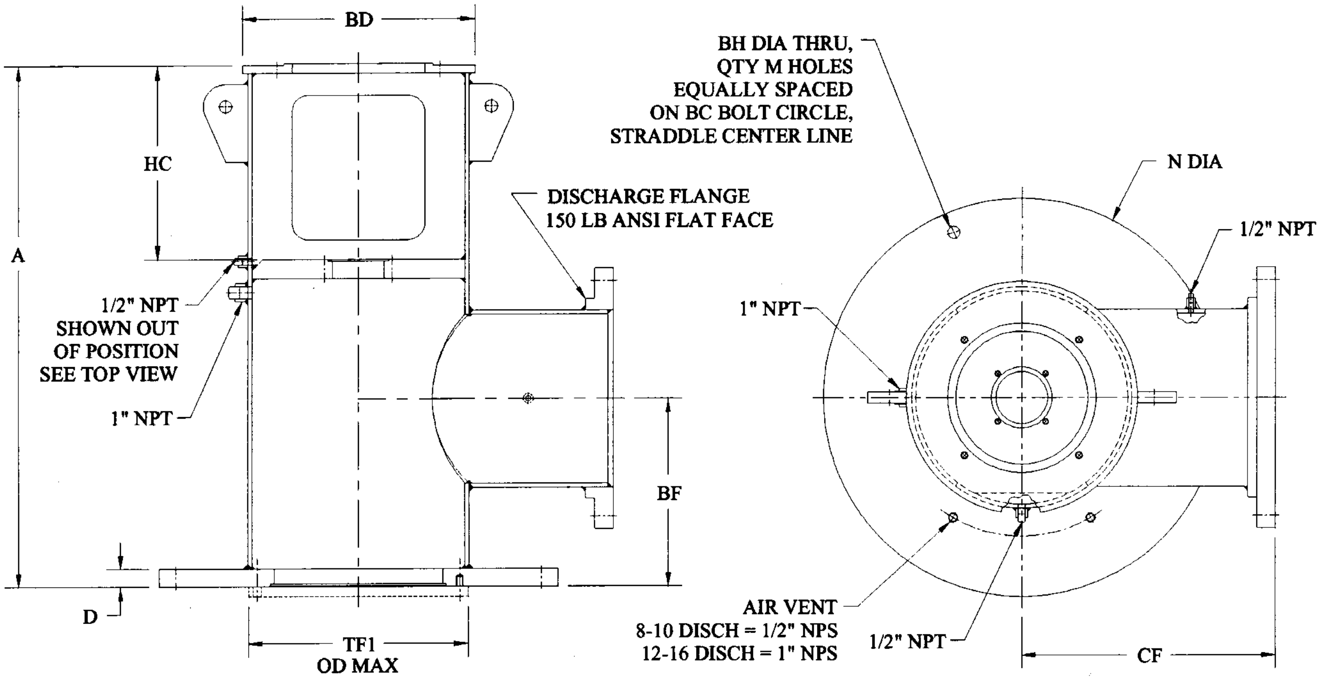
Discharge Head Size Dish x Col x BD x Ansi Base	VHS Discharge Head													
	Head Part No.	Nominal Column Size	Max. Wt. Lb.	Overall Height	Stand Height	Motor	Nozzle Height	Head Width	Base Dia.	Base Thick	Hole Dia.	Hole Qty.	Bolt Circle	Top Flange OD Max
				A	HC	BD	BF ①	CF ①	N	D	BH	M	BC	TF1
6X6X12 FRA12	4605559H	6	266	24.25	11.57	12.00	7.50	14.00	19.00	1.50	1.00	12	17.00	9.62
6X6X12 FRA14	4605560H	6	294	24.25	11.57	12.00	7.50	14.00	21.00	1.50	1.12	12	18.75	9.62
6X6X16.5 FRA14	4605561H	6	347	28.25	15.31	16.50	7.50	15.00	21.00	1.50	1.12	12	18.75	9.62
6X6X16.5 FRA16	4605562H	6	384	28.25	15.31	16.50	7.50	15.00	23.50	1.50	1.12	16	21.25	9.62
8X8X12 FRA16	4605563H	8	391	27.00	11.32	12.00	9.50	16.00	23.50	1.75	1.12	16	21.25	12.12
8X8X12 FRA18	4605564H	8	419	27.00	11.32	12.00	9.50	16.00	25.00	1.75	1.25	16	22.75	12.12
8X8X16.5 FRA16	4605565H	8	449	31.25	15.31	16.50	9.50	16.00	23.50	1.75	1.12	16	21.25	12.12
8X8X16.5 FRA18	4605566H	8	479	31.25	15.31	16.50	9.50	17.00	25.00	1.75	1.25	16	22.75	12.12
8X8X16.5 FRA20	4605567H	8	530	31.25	15.31	16.50	9.50	17.00	27.50	1.75	1.25	20	25.00	12.12
10X10X16.5 FRA18	4605568H	10	518	33.75	15.25	16.50	11.00	18.00	25.00	1.75	1.25	16	22.75	14.12
10X10X16.5 FRA20	4605569H	10	568	33.75	15.25	16.50	11.00	18.00	27.50	1.75	1.25	20	25.00	14.12
10X10X20 FRA18	4605570H	10	585	34.25	15.25	20.00	11.00	18.00	25.00	1.75	1.25	16	22.75	14.12
10X10X20 FRA20	4605571H	10	635	34.25	15.75	20.00	11.00	18.00	27.50	1.75	1.25	20	25.00	14.12
12X12X16.5 FRA20	4605573H	12	614	36.25	15.25	16.50	12.50	18.00	27.50	1.75	1.25	20	25.00	16.25
12X12X20 FRA20	4605574H	12	675	36.75	15.75	20.00	12.50	18.00	27.50	1.75	1.25	20	25.00	16.25
12X12X20 FRA24	4605575H	12	786	36.75	15.75	20.00	12.50	20.00	32.00	1.75	1.38	20	29.50	16.25
14X14X20 FRA20	4605576H	14	728	37.88	15.76	20.00	13.00	20.00	27.50	1.75	1.25	20	25.00	18.31
14X14X20 FRA24	4605577H	14	831	37.88	15.76	20.00	13.00	20.00	32.00	1.75	1.38	20	29.50	18.31
14X14X20 FRA30	4605578H	14	1032	37.88	15.76	20.00	13.00	24.00	38.75	1.75	1.38	28	36.00	18.31
14X14X24.5 FRA20	4605579H	14	815	37.88	15.76	24.50	13.00	20.00	27.50	1.75	1.25	20	25.00	18.31
14X14X24.5 FRA24	4605580H	14	918	37.88	15.76	24.50	13.00	20.00	32.00	1.75	1.38	20	29.50	18.31
14X14X24.5 FRA30	4605581H	14	1120	37.88	15.76	24.50	13.00	24.00	38.75	1.75	1.38	28	36.00	18.31
14X14X24.5 FRA36	4605582H	14	1480	37.88	15.76	24.50	13.00	28.00	46.00	2.00	1.62	32	42.75	18.31
16X16X20 FRA24	4605583H	16	887	40.88	15.76	20.00	15.00	21.00	32.00	1.75	1.38	20	29.50	20.31
16X16X20 FRA30	4605584H	16	1087	40.88	15.76	20.00	15.00	24.00	38.75	1.75	1.38	28	36.00	20.31
16X16X20 FRA36	4605585H	16	1446	40.88	15.76	20.00	15.00	28.00	46.00	2.00	1.62	32	42.75	20.31
16x16x24.5 FRA24	4605586H	16	970	40.88	15.76	24.50	15.00	21.00	32.00	1.75	1.38	20	29.50	20.31
16X16X24.5 FRA30	4605587H	16	1170	40.88	15.76	24.50	15.00	24.00	38.75	1.75	1.38	28	36.00	20.31
16X16X24.5 FRA36	4605588H	16	1529	40.88	15.76	24.50	15.00	28.00	46.00	2.00	1.62	32	42.75	20.31

① For 3 Piece segmented elbows refer to the factory for these dimensions

Subject to change without notice

Drawing No. 4854231
Rev 02-05

VERTICAL TURBINE PUMPS
VSS Discharge Heads
Type FRA ANSI Flange Base



All dimensions are in inches

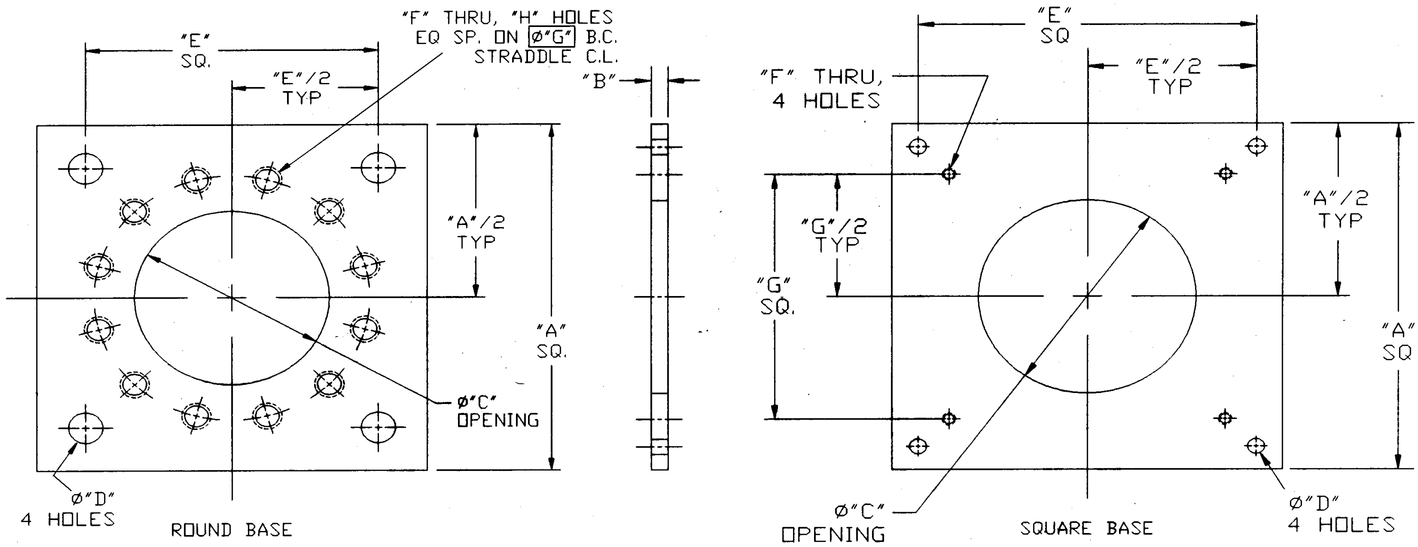
300# Discharge flanges are optional

FRA Fabricated Discharge Head Dimensional Data

Discharge Head Size Disch x Col x BD x ANSI Base	VSS Discharge Head													
	Head Part No.	Nominal Column Size	Max. Wt. Lb.	Overall Height	Stand Height	Motor	Nozzle Height	Head Width	Base		Hole		Bolt Circle	Top Flange OD Max.
									Dia.	Thick	Dia.	Qty.		
				A	HC	BD	BF ①	CF ①	N	D	BH	M	BC	TF1
6X6X12 FRA12	4605559SC	6	290	34.50	21.82	12.00	7.50	14.00	19.00	1.50	1.00	12	17.00	9.62
6X6X12 FRA14	4605560SC	6	318	34.50	21.82	12.00	7.50	14.00	21.00	1.50	1.12	12	18.75	9.62
6X6X16.5 FRA14	4605561SC	6	403	37.88	24.94	16.50	7.50	15.00	21.00	1.50	1.12	12	18.75	9.62
6X6X16.5 FRA16	4605562SC	6	440	37.88	24.94	16.50	7.50	15.00	23.50	1.50	1.12	16	21.25	9.62
8X8X12 FRA16	4605563SC	8	414	37.13	21.45	12.00	9.50	16.00	23.50	1.75	1.12	16	21.25	12.12
8X8X12 FRA18	4605564SC	8	442	37.13	21.45	12.00	9.50	16.00	25.00	1.75	1.25	16	22.75	12.12
8X8X16.5 FRA16	4605565SC	8	506	40.88	24.94	16.50	9.50	16.00	23.50	1.75	1.12	16	21.25	12.12
8X8X16.5 FRA18	4605566SC	8	536	40.88	24.94	16.50	9.50	17.00	25.00	1.75	1.25	16	22.75	12.12
8X8X16.5 FRA20	4605567SC	8	605	40.88	24.94	16.50	9.50	17.00	27.50	1.75	1.25	20	25.00	12.12
10X10X16.5 FRA18	4605568SC	10	573	43.38	24.88	16.50	11.00	18.00	25.00	1.75	1.25	16	22.75	14.12
10X10X16.5 FRA20	4605569SC	10	623	43.38	24.88	16.50	11.00	18.00	27.50	1.75	1.25	20	25.00	14.12
10X10X20 FRA18	4605570SC	10	623	45.25	26.75	20.00	11.00	18.00	25.00	1.75	1.25	16	22.75	14.12
10X10X20 FRA20	4605571SC	10	674	45.25	26.75	20.00	11.00	18.00	27.50	1.75	1.25	20	25.00	14.12
12X12X16.5 FRA20	4605573SC	12	680	45.88	24.88	16.50	12.50	18.00	27.50	1.75	1.25	20	25.00	16.25
12X12X20 FRA20	4605574SC	12	713	47.75	26.75	20.00	12.50	18.00	27.50	1.75	1.25	20	25.00	16.25
12X12X20 FRA24	4605575SC	12	824	47.75	26.75	20.00	12.50	20.00	32.00	1.75	1.38	20	29.50	16.25
14X14X20 FRA20	4605576S	14	766	48.88	26.76	20.00	13.00	20.00	27.50	1.75	1.25	20	25.00	18.31
14X14X20 FRA24	4605577S	14	869	48.88	26.76	20.00	13.00	20.00	32.00	1.75	1.38	20	29.50	18.31
14X14X20 FRA30	4605578S	14	1071	48.88	26.76	20.00	13.00	24.00	38.75	1.75	1.38	28	36.00	18.31
14X14X24.5 FRA20	4605579S	14	1002	53.88	31.76	24.50	13.00	20.00	27.50	1.75	1.25	20	25.00	18.31
14X14X24.5 FRA24	4605580S	14	1005	53.88	31.76	24.50	13.00	20.00	32.00	1.75	1.38	20	29.50	18.31
14X14X24.5 FRA30	4605581S	14	1306	53.88	31.76	24.50	13.00	24.00	38.75	1.75	1.38	28	36.00	18.31
14X14X24.5 FRA36	4605582S	14	1665	53.88	31.76	24.50	13.00	28.00	46.00	2.00	1.62	32	42.75	18.31
16X16X20 FRA24	4605583S	16	926	51.88	26.76	20.00	15.00	21.00	32.00	1.75	1.38	20	29.50	20.31
16X16X20 FRA30	4605584S	16	1125	51.88	26.76	20.00	15.00	24.00	38.75	1.75	1.38	28	36.00	20.31
16X16X20 FRA36	4605585S	16	1484	51.88	26.76	20.00	15.00	28.00	46.00	2.00	1.62	32	42.75	20.31
16X16X24.5 FRA24	4605586S	16	1160	56.88	31.76	24.50	15.00	21.00	32.00	1.75	1.38	20	29.50	20.31
16X16X24.5 FRA30	4605587S	16	1360	56.88	31.76	24.50	15.00	24.00	38.75	1.75	1.38	28	36.00	20.31
16X16X24.5 FRA36	4605588S	16	1718	56.88	31.76	24.50	15.00	28.00	46.00	2.00	1.62	32	42.75	20.31

① For 3 Piece segmented elbows refer to the factory for these dimensions

Sole Plate Data
for Type C, CHP, S, SHP, G AND GHP
Cast Iron Discharge Heads

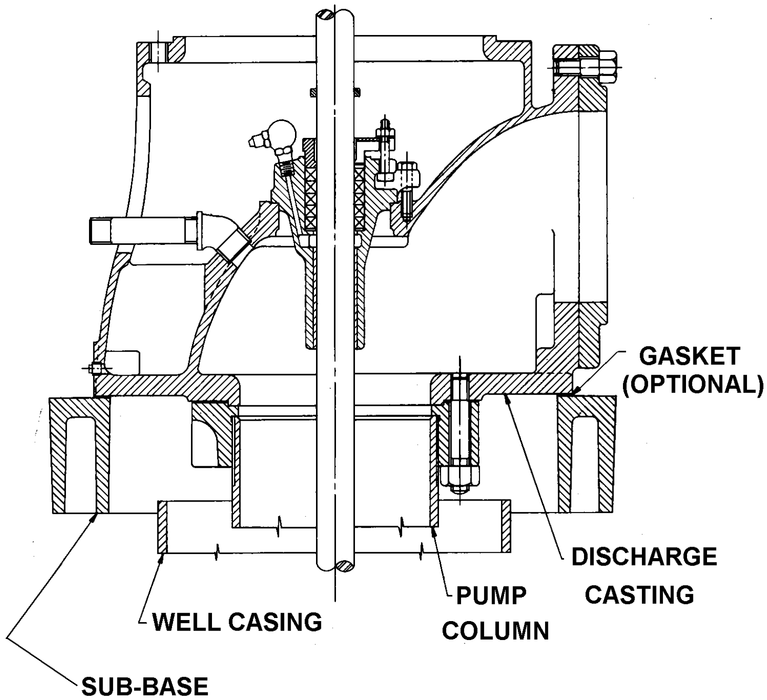


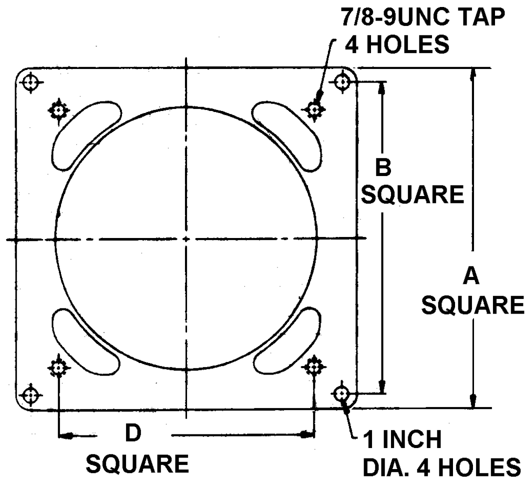
All Dimensions are in inches

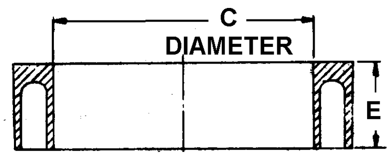
Sole Plates Dimensional Data

Discharge Head Size	Sole Plate		Anchor Bolt		Base Plate Hole				Sole Plate Part Number
	LxW	Thick	Id	Qty	Pattern	Tap	Pattern	Qty	
	A	B	C	D	E	F	G	H	
2.5x2.5x10S	14.50	0.50	9.00	0.75	13.00	.375-16 UNC	9.25 SQ	4	2629916
2.5x3x10S	14.50	0.50	9.00	0.75	13.00	.375-16 UNC	9.25 SQ	4	2629916
4x4x10C	18.00	0.88	9.00	0.88	16.00	.750-10 UNC	11.75	8	2634417
6x6x12G	22.00	0.88	14.00	1.12	19.00	.875-9 UNC	17.00	12	4603250
8x8x16.5G	26.00	1.12	16.50	1.12	23.00	1.000-8 UNC	21.25	16	4602124
10x10x20G	30.00	1.12	20.00	1.12	27.00	1.125-7 UNC	22.75	16	4602127
12x12x20G	32.00	1.12	22.00	1.12	29.00	1.125-7 UNC	25.00	20	4602126
14x14x24.5S	36.00	1.00	24.50	1.25	32.00	.750-10 UNC	25.00 SQ	4	2629927
16x16x30.5S	42.00	1.00	28.00	1.25	39.00	.750-10 UNC	32.00 SQ	4	2629928

Cast Iron Sub-Base for Type S Cast Iron Heads



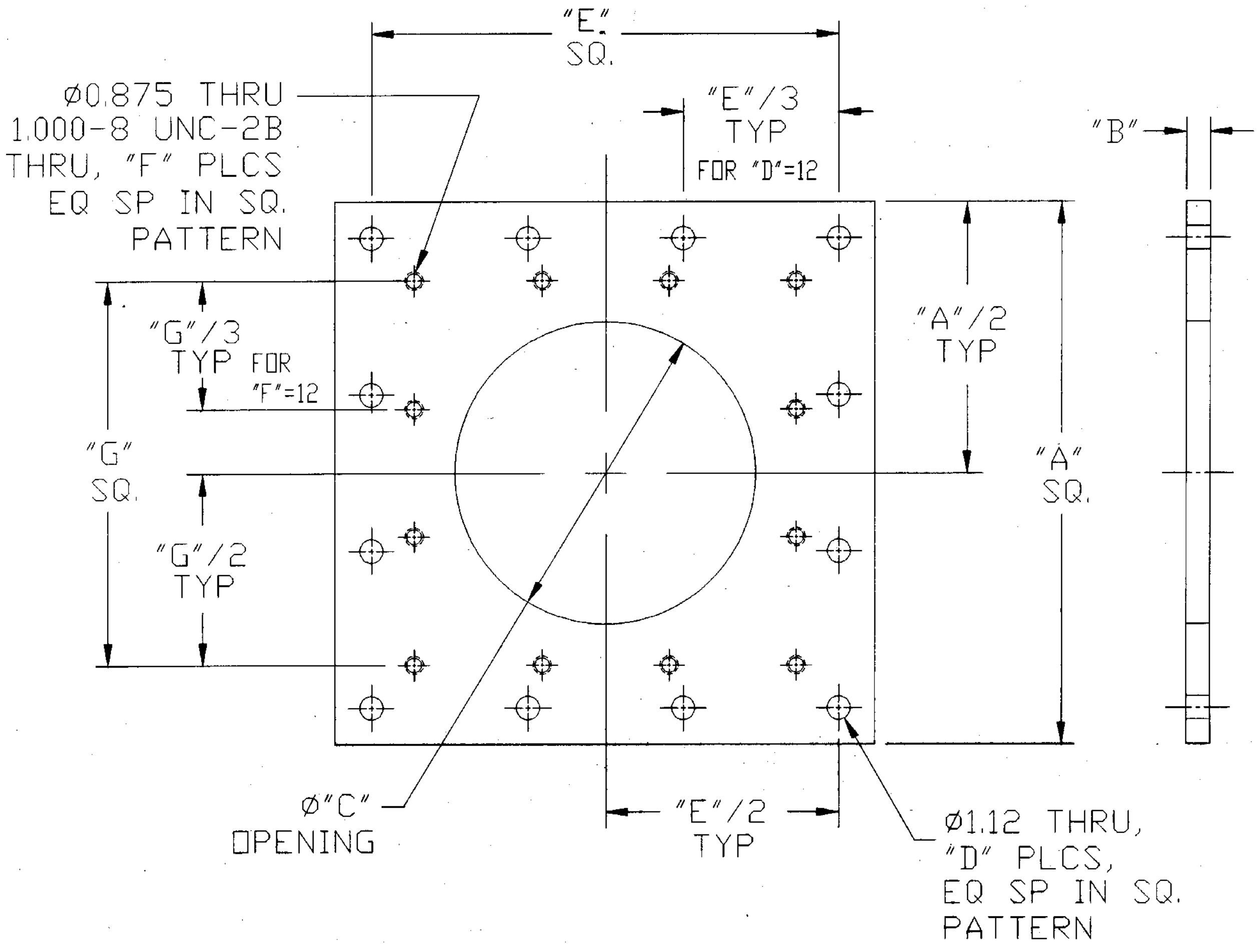




GENERAL DIMENSIONS All dimensions are in inches unless otherwise noted

For Head Size S and SHP	A	B	C	D	E	Sub-Base Part Number
6x8x16-1/2	24	21.25	18.5	18	3.75	2622459
8x8x16-1/2	24	21.25	18.5	18	3.75	2622459
10x10x16-1/2	24	21.25	18.5	18	3.75	2622459
10x10x20	24	21.25	18.5	18	3.75	2622459
12x12x20	27	24.00	22.0	21	3.75	2622456
14x14x24-1/2	32	29.00	26.5	25	3.75	2622452

Drawing Number 2832533



All Dimensions are in Inches

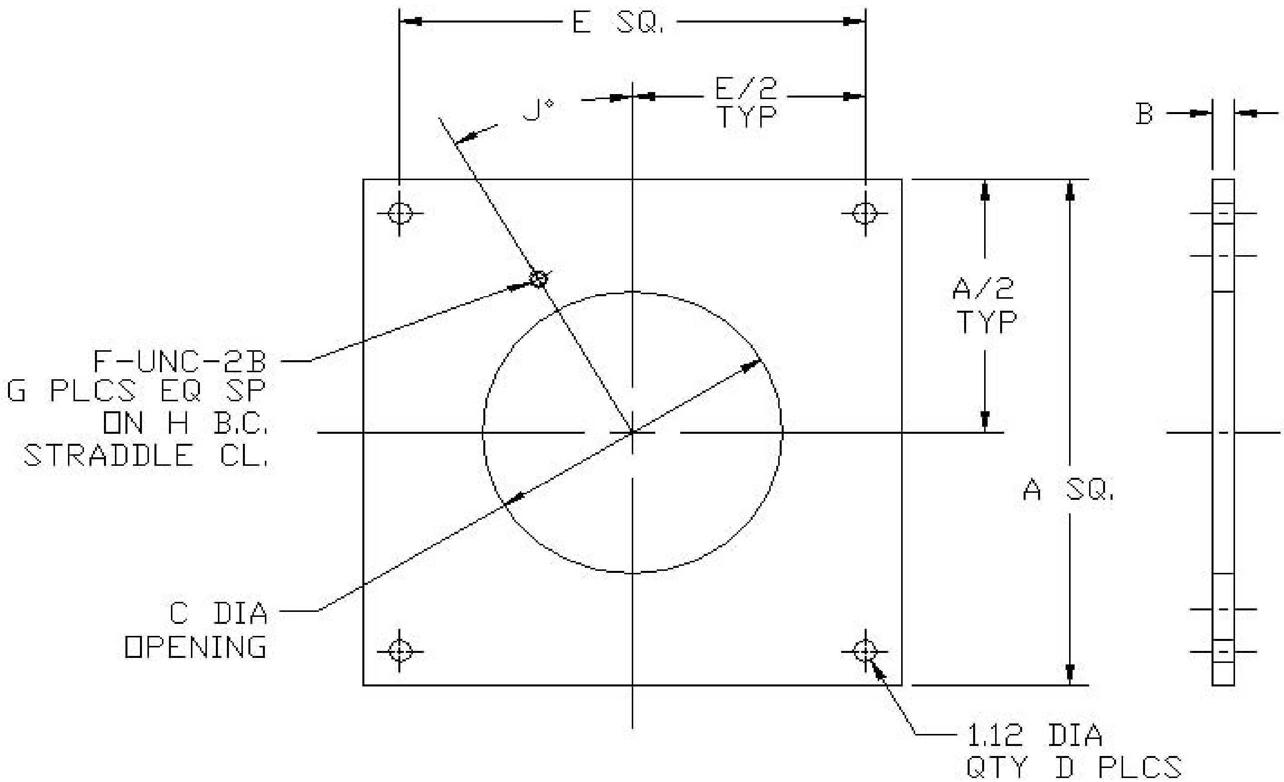
FA Sole Plates Dimensional Data

Discharge Head Size	Sole Plate Part Number	Sole Plate			Anchor Bolt		Base Plate Hole		Sole Plate Approximate Weight Lb.
		L x W	Thick	Id	Qty	Pattern	Qty	Dim	
		A	B	C	D	E	F	G	
6x6x12 FA	4601774	24.00	1.12	16.00	4	20.50	4	15.00	118
6x6x16.5 FA	4601776	26.00	1.12	19.00	4	22.50	4	17.00	124
8x8x12 FA 8x8x16.5 FA	4601778	28.00	1.12	19.00	4	24.50	4	19.00	157
10x10x16.5 FA 10x10x20 FA 12x12x16.5 FA	4601780	30.00	1.12	21.50	4	26.50	4	21.00	168
12x12x20 FA	4601782	34.00	1.12	24.00	4	30.50	4	25.00	221
14x14x20 FA 14x14x24.5 FA 16x16x20 FA 16x16x24.5 FA	4605598	36.00	1.12	27.00	4	32.50	4	27.00	229
16x16x30.5 FA 18x18x24.5 FA 18x18x30.5 FA 20x20x24.5 FA 20x20x30.5 FA	4605599	42.50	1.25	29.00	12	39.00	12	33.00	405
24x24x24.5 FA 24x24x30.5 FA	4605600	48.50	1.25	35.00	12	45.00	12	39.00	487

Subject to change without notice

Drawing No. 4605600

Sole Plate Dimensions for FRA Discharge Heads



Discharge Head Size	Sole Plate Part Number	Sole Plate			Anchor Bolt		Base Plate Hole				Sole Plt Approx. Wt. Lb.
		L x W	Thick	Id	Qty	Pattern	Thd Size	Qty	BC	Angle	
		A	B	C	D	E	F	G	H	J	
6x6x12 FRA12	4604400	22	1.12	11.75	4	18.50	0.88-9	12	17.00	15.00	118
6x6x12 FRA14	4604401	22	1.12	11.75	4	18.50	1.00-8	12	18.75	15.00	118
6x6x16.5 FRA14	4604402	24	1.12	11.75	4	20.50	1.00-8	12	18.75	15.00	147
6x6x16.5 FRA16	4604403	24	1.12	11.75	4	20.50	1.00-8	16	21.25	11.25	147
8x8x12 FRA16 8x8x16.5 FRA16	4604404	26	1.12	14.50	4	22.50	1.00-8	16	21.25	11.25	160
8x8x12 FRA18 8x8x16.5 FRA18	4604405	26	1.12	14.50	4	22.50	1.12-7	16	22.75	11.25	160
10x10x16.5 FRA18 10x10x20 FRA18	4604406	28	1.12	18.50	4	24.50	1.12-7	16	22.75	11.25	162
8x8x16.5 FRA20 10x10x16.5 FRA20 10x10x20 FRA20 12x12x16.5 FRA20	4604407	28	1.12	19.25	4	24.50	1.12-7	20	25.00	9.00	155

Continued on page 23

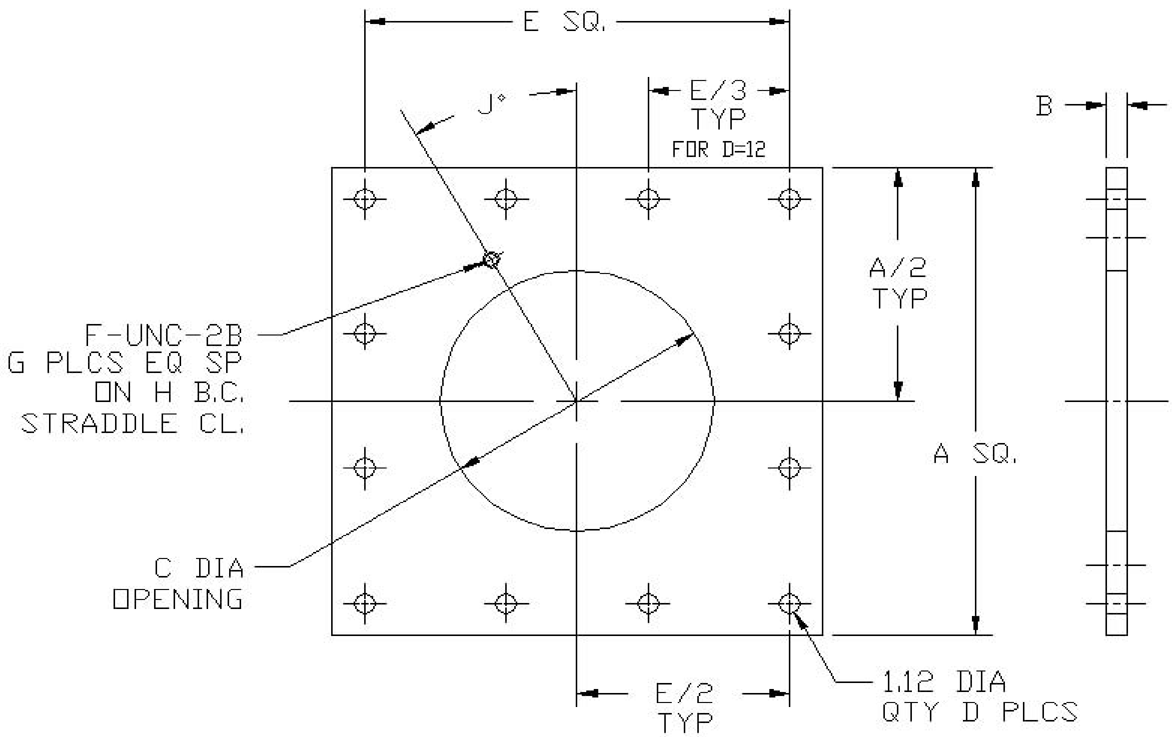
All dimensions are in inches

Subject to change without notice

Ref. Drawing No. 4604400

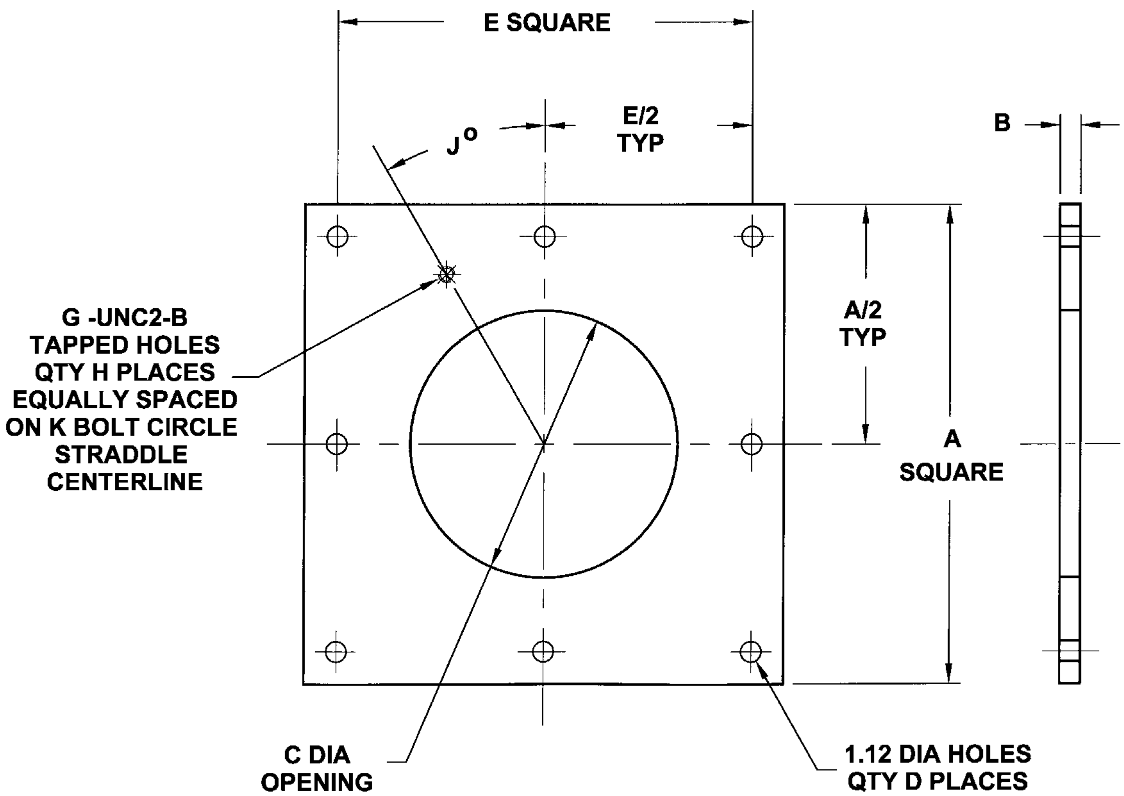
Sole Plate Dimensions for FRA Discharge Heads

Continued from page 22



Discharge Head Size	Sole Plate Part Number	Sole Plate			Anchor Bolt		Base Plate Hole				Sole Plt Approx. Wt. Lb.
		L x W	Thick	Id	Qty	Pattern	Thd Size	Qty	BC	Angle	
		A	B	C	D	E	F	G	H	J	
12x12x20 FRA20 14x14x20 FRA20 14x14x24.5 FRA20	4604408	32	1.12	20.25	4	28.50	1.12-7	20	25.00	9.00	218
12x12x20 FRA24	4604409	32	1.12	19.25	4	28.50	1.25-7	20	29.50	9.00	230
14x14x20 FRA24 14x14x24.5 FRA24	4604410	36	1.12	20.25	4	32.50	1.25-7	20	29.50	9.00	303
16x16x20 FRA24 16x16x24.5 FRA24	4605640	36	1.25	22.50	4	32.50	1.25-7	20	29.50	9.00	318
14x14x20 FRA30 14x14x24.5 FRA30 16x16X20 FRA30 16x16x24.5 FRA30	4605641	46	1.50	22.50	12	42.00	1.25-7	28	36.00	6.43	730
14x14x24.5FRA36 16x16x20 FRA36 16x16x24.5 FRA36	4605642	53	1.50	22.50	12	49.00	1.50-6	32	42.75	5.63	1024

All dimensions are in inches



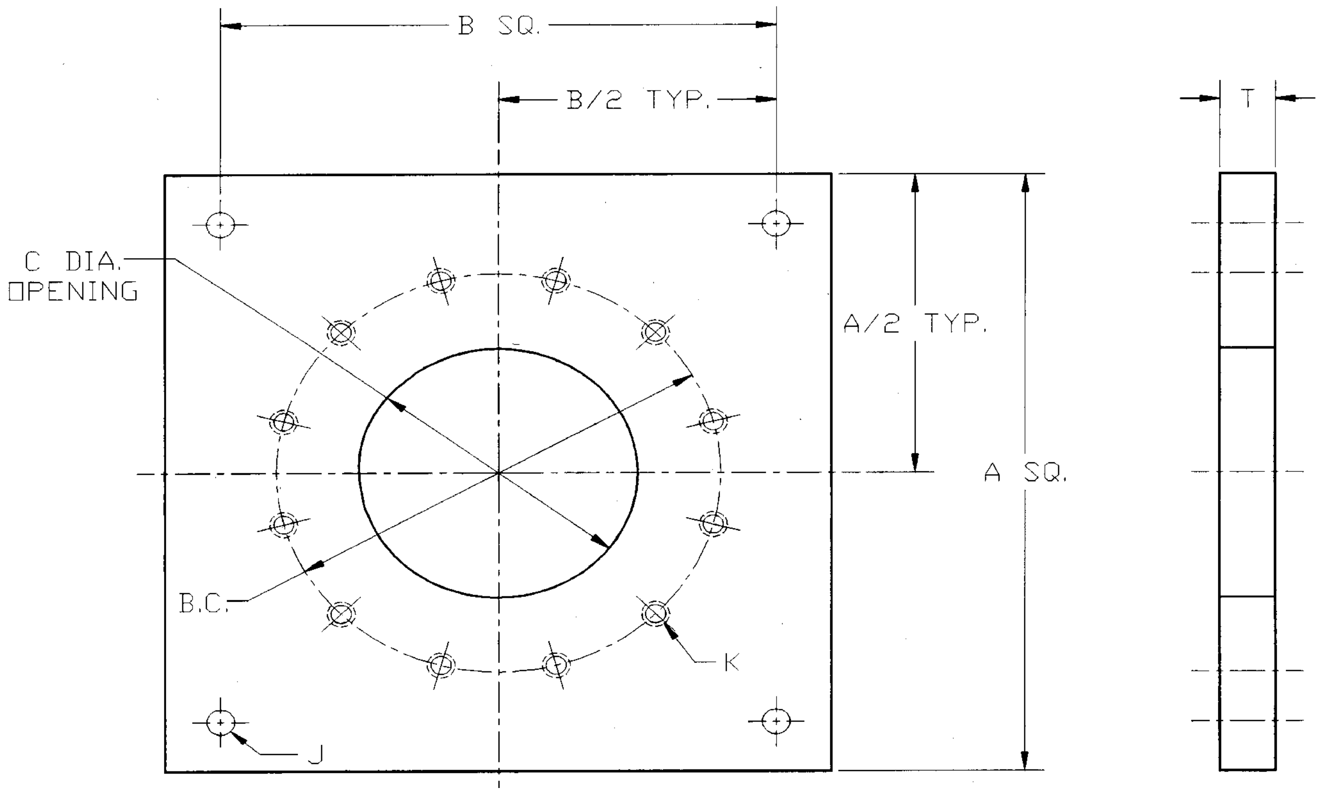
All dimensions are in inches

FR Sole Plates Dimensional Data

Discharge Head Size	Sole Plate Part No.	Sole Plate L x W A	Sole Plate Thick B	Sole Plate Id C	Anchor Bolt Qty D	Anchor Bolt Dim E	Base Plate Hole Bolt Thd G	Base Plate Hole Qty H	Base Plate Hole Angle J	Base Plate Hole BC K	Sole Plate Approx Wt Lb
18X18X24.5 FR	4604413	43.00	1.25	31.00	8	39.50	1.00	8	22.5	34.00	383
18X18X30.5 FR	4604413	43.00	1.25	31.00	8	39.50	1.00	8	22.5	34.00	383
20X20X24.5 FR	4604413	43.00	1.25	31.00	8	39.50	1.00	8	22.5	34.00	383
20X20X30.5 FR	4604413	43.00	1.25	31.00	8	39.50	1.00	8	22.5	34.00	383
24X24X24.5 FR	4604413	43.00	1.25	31.00	8	39.50	1.00	8	22.5	34.00	383
24X24X30.5 FR	4604413	43.00	1.25	31.00	8	39.50	1.00	8	22.5	34.00	383

Drawing No. 4853840

Steel Sole Plates for Type C and CHP for Cast Iron Discharge Heads



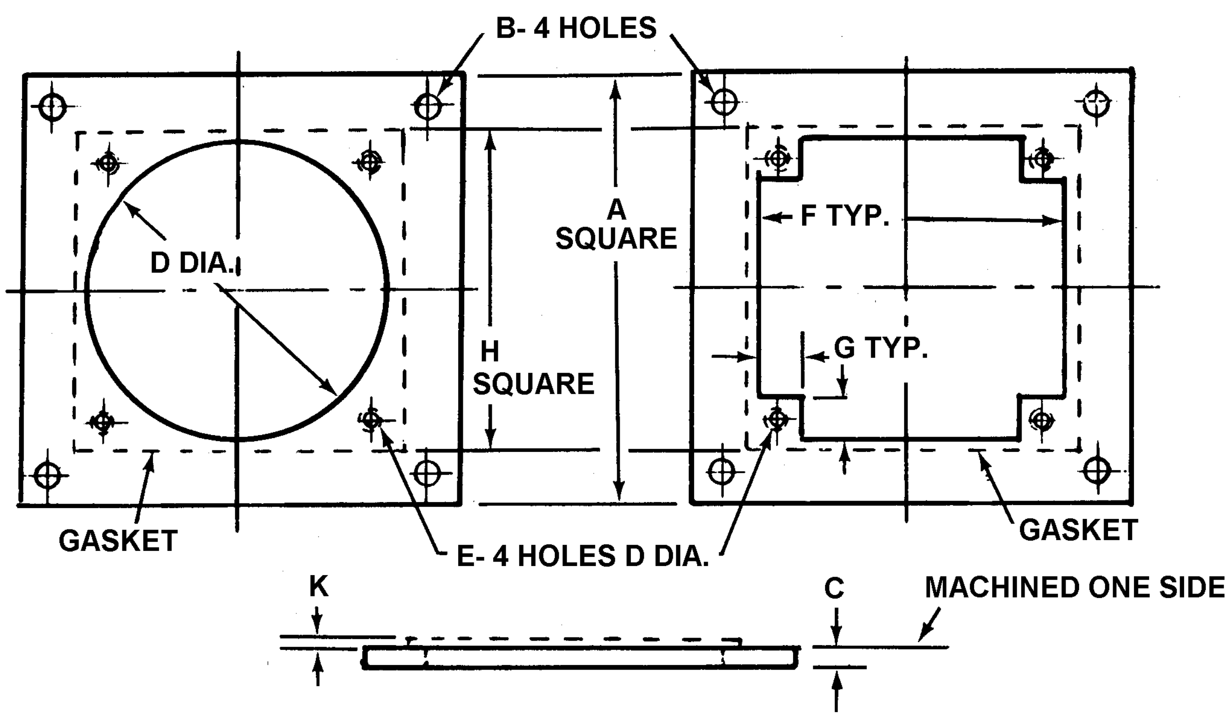
GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

BASIC HEAD SIZE	A	B	C DIA. OPENING	J		K STRADDLE CL.		BC	T	SOLE PLATE PART NO.	WT. LB.
				NO. OF HOLES	HOLE DIA.	NO. OF HOLES	TAP SIZE				
4X4X10C & CHP	18.00	16.00	9.00	4	0.88	8	3/4"-10UNC	11.75	0.88	2634417	65
4X6X12C & CHP	22.00	19.00	14.00	4	1.12	12	7/8"-9UNC	17.00	0.88	4603250	82
6X6X12C	24.00	21.00	14.00	4	1.12	12	1"-8UNC	18.75	0.88	4602123	105
6X8X16-1/2C & CHP	26.00	23.00	16.50	4	1.12	16	1"-8UNC	21.25	1.12	4602124	147
8X8X12C	30.00	27.00	20.00	4	1.12	16	1-1/8"-7UNC	22.75	1.12	4602127	187
8X8X16-1/2C & CHP	30.00	27.00	20.00	4	1.12	16	1-1/8"-7UNC	22.75	1.12	4602127	187
10X10X20C	30.00	27.00	20.00	4	1.12	16	1-1/8"-7UNC	22.75	1.12	4602127	187
12X12X20C	32.00	29.00	22.00	4	1.12	20	1-1/8"-7UNC	25.00	1.12	4602126	205

VERTICAL TURBINE PUMPS
Steel Sole Plates for Type UG
Under grade Discharge Heads

Peerless Pump Company
Indianapolis, IN 46207-7026

TYPE I **TYPE II**



GENERAL DIMENSIONS **All dimensions are in inches unless otherwise noted.**

UG Base Size	Tee Size	Type	A	B		C	D	E		F	G	H	K	Foundation Dia. Opening ①			Sole Plate Part Number
				Dia.	Sq.			Size	Sq.					Min.	Nom.	Max.	
6x10UG	4	I	16.5	0.75	14.5	0.50	12.5	5/8-11UNC	10.5	-	-	14.00	0.06	12.5	13	13	4600231
	5	I	16.5	0.75	14.5	0.50	12.5	5/8-11UNC	10.5	-	-	14.00	0.06	12.5	13	13	4600231
	6	II	16.5	0.75	14.5	0.50	-	5/8-11UNC	10.5	12.25	1.75	14.00	0.06	14.0	14	14	4600235
12x16-1/2UG	4	I	29.0	1.12	25.5	0.88	21.0	5/8-11UNC	19.0	-	-	23.75	0.06	12.5	21	23	4600232
	5	I	29.0	1.12	25.5	0.88	21.0	¾-10UNC	19.0	-	-	23.75	0.06	12.5	21	23	4600232
	6	I	29.0	1.12	25.5	0.88	21.0	¾-10UNC	19.0	-	-	23.75	0.06	14.0	21	23	4600232
	8	I	29.0	1.12	25.5	0.88	21.0	¾-10UNC	19.0	-	-	23.75	0.06	19.0	21	23	4600232
	10	I	29.0	1.12	25.5	0.88	21.0	¾-10UNC	19.0	-	-	23.75	0.06	21.0	21	23	4600232
	12	II	29.0	1.12	25.5	0.88	-	¾-10UNC	19.0	20.50	2.25	23.75	0.06	25.0	25	25	4600236
12x24-1/2UG	6	I	37.0	1.25	33.5	1.00	25.0	7/8-9UNC	26.0	-	-	31.75	0.12	14.0	25	31	4600233
	8	I	37.0	1.25	33.5	1.00	25.0	7/8-9UNC	26.0	-	-	31.75	0.12	19.0	25	31	4600233
	10	I	37.0	1.25	33.5	1.00	25.0	7/8-9UNC	26.0	-	-	31.75	0.12	21.0	25	31	4600233
	12	I	37.0	1.25	33.5	1.00	25.0	7/8-9UNC	26.0	-	-	31.75	0.12	25.0	25	31	4600233
16x30-1/2	10	I	46.0	1.25	41.5	1.00	31.0	7/8-9UNC	32.0	-	-	38.75	0.12	21.0	31	38	4600234
	12	I	46.0	1.25	41.5	1.00	31.0	7/8-9UNC	32.0	-	-	38.75	0.12	25.0	31	38	4600234
	14	I	46.0	1.25	41.5	1.00	31.0	7/8-9UNC	32.0	-	-	38.75	0.12	27.5	31	38	4600234
	16	I	46.0	1.25	41.5	1.00	31.0	7/8-9UNC	32.0	-	-	38.75	0.12	31.0	31	38	4600234

① **The MINIMUM diameter allows the following to pass through:**

(A) The standard tee as shown on page 55, Section 115 including the distance from centerline to face of the discharge flange (dim E) and the flange OD.

(B) The largest bowl unit the column (tee) will take as shown on pages 4 and 5, Section 125 and the std basket strainer for that size bowl unit.

The NOMINAL opening is the same diameter as the Type I sole plate (dim D) and in some cases allows extra clearance over the minimum diameter opening.

The MAXIMUM diameter opening provides adequate support for the pump and should not be exceeded.

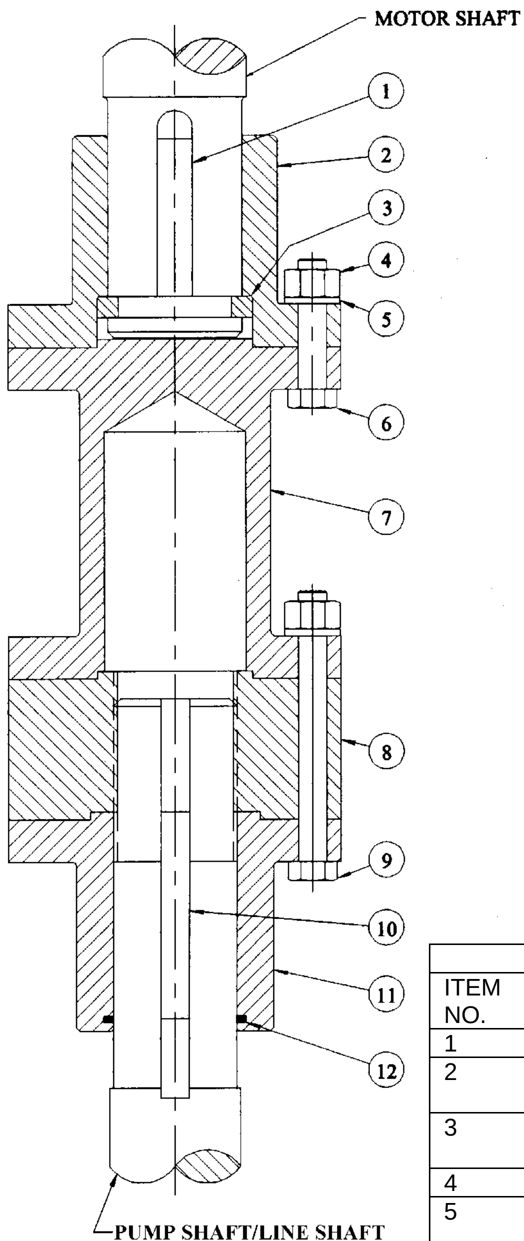
Square foundation openings that have the same dimensions as D or F above when measured across the sides are acceptable.

NOTE: When the discharge flange location is close to the bottom of the base, check the foundation thickness for possible interference.

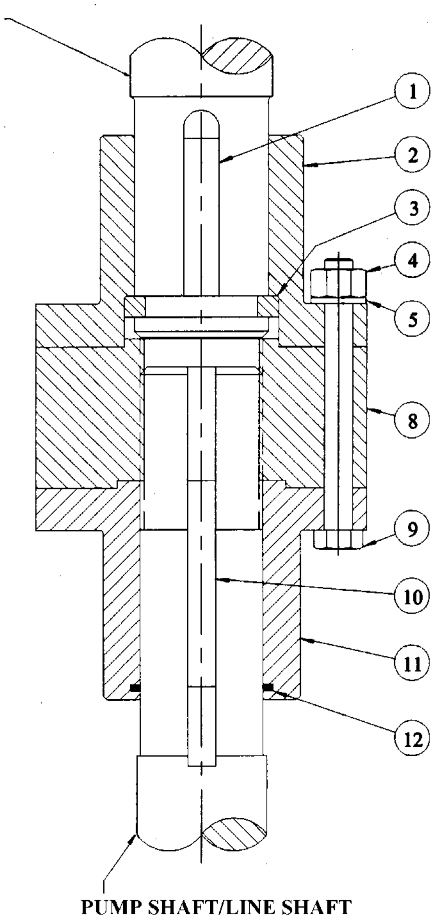
Subject to change without notice

Flanged Drive Shaft Couplings

Spacer Type



Standard Type



PART LIST			
ITEM NO.	MATERIAL	QUANTITY	DESCRIPTION
1	1018 C. D. STEEL	1	KEY, SQUARE
2	1022 H.R. STEEL	1	COUPLING, HALF MOTOR SHAFT
3	1045 H.R. STEEL	1	RING, SPLIT RETAINING
4	GRADE 2 STEEL	16	NUT, HEX
5	CARBON STEEL	16	WASHER, LOCK SPRING
6	GRADE 5 STEEL	8	SCREW, HEX HEAD CAP
7	1022 H.R. STEEL	1	COUPLING, SPACER
8	1022 H.R. STEEL	1	NUT, ADJUSTING
9	GRADE 5 STEEL	8	SCREW, HEX HEAD CAP
10	1018 C. D. STEEL	1	KEY, SQUARE
11	1022 H.R. STEEL	1	COUPLING, HALF PUMP SHAFT
12	SPRING STEEL	1	RING, RETAINING

VERTICAL TURBINE PUMPS
Discharge Heads

Peerless Pump Company
Indianapolis, IN 46207-7026

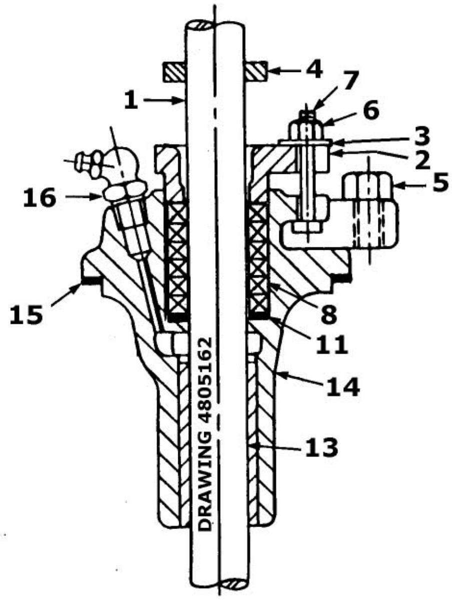
Stuffing Box Data

Discharge Head Size	Stuffing Box Register	Type	Shaft or Sleeve Size	Quantity Rings	Size Square
2.5x2.5x10S 2.5x3x10S	Integrally Cast	-	0.75	5	0.38
			1.00		0.25
4x4x10C 6x10UG 6x6x12G 6x6x12F 8x8x12F	3.88	II	0.75	6	0.38
			1.00		
			1.19		
		VI	1.50	5	0.50
12x16.5UG	4.69	VI	0.75	5	0.38
		II	1.00	6	
			1.19		
		VI	1.50		0.50
			1.69	5	
			1.94		
6x6x16.5F 8x8x16.5G 8x8x16.5F 10x10x16.5F 10x10x20F 10x10x20G 12x12x16.5F 12x12x20F 12x12x20G 12x24.5UG 14x14x20F 14x14x24.5F 14x14x24.5S 16x16x20F 16x16x24.5F 18x18x24.5F 20x20x24.5F 24x24x24.5F	5.56	II	1.00	6	0.38
			1.19		
			1.50		0.50
			1.69		
			1.94		
			2.19		0.62
		VI	2.44	5	
16x16x30.5S 16x30.5UG	6.38	III or IV	1.69	8	0.50
			1.94		
			2.19		0.62
			2.44		
16x16x30.5F 18x18x30.5F 20x20x30.5F 24x24x30.5F	8.50	VI	2.69	8	0.62
			2.94	7	0.62
			3.19	7	0.75

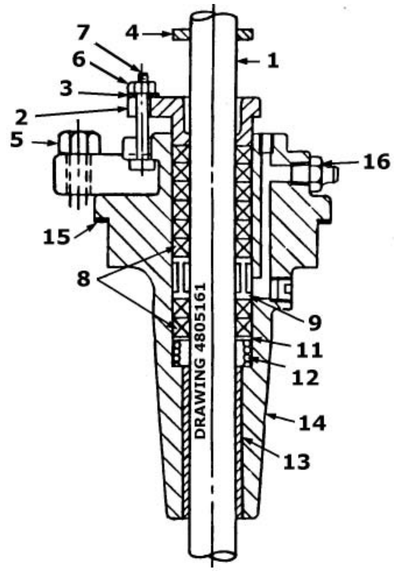
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

"F" designates standard FA or FRA type fabricated head

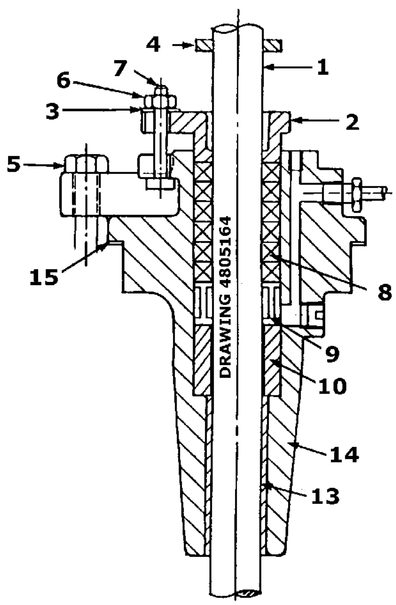
Subject to change without notice



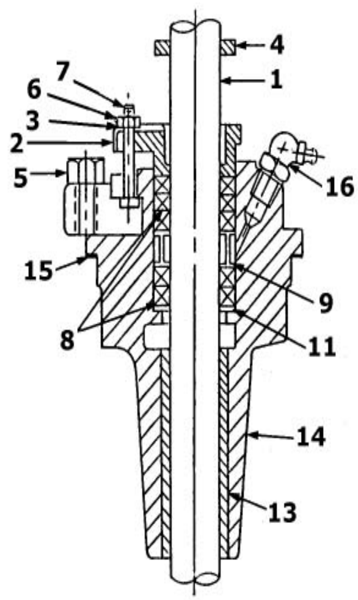
TYPE II
0 to 175 psig
Uses graphited synthetic fiber packing. For 176 to 400 psig the grease fitting is replaced by a by-pass fitting and line as shown in Type IV and special synthetic fiber packing is used.



TYPE III
0 to 175 psig
Graphited synthetic fiber packing is used.



TYPE IV
176 to 400 psig
Same as Type III except with a by- pass fitting and line, special synthetic fiber packing and bottom ring below seal lantern.



TYPE VI
0 to 175 psig
Uses graphited synthetic fiber packing. For 176 to 400 psig the grease fitting and are replaced by a by-pass fitting and line and special synthetic fiber packing is used.

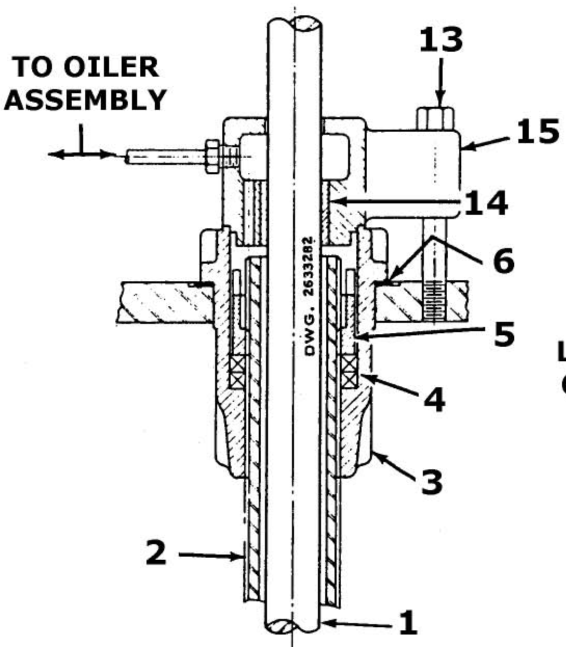
Item No.	Part Description	Material
1	Head or Line Shaft	416 Stainless Steel or Carbon Steel
2	Packing Gland - Split Type	Bronze
3	Clamp, Packing Gland	Stainless Steel
4	Ring, Top Shaft Seal	Neoprene
5	Screw, Hex Head Cap	Steel
6	Hex Nut	Brass
7	T-Bolt, Packing Gland	Steel
8	Packing	Graphited Synthetic Fiber
9	Lantern Seal	Brass
10	Ring, Bottom	Bronze
11	Washing, Packing	Brass
12	Spring, Packing	Stainless Steel
13	Bearing. Sleeve	Bronze
14	Box, Stuffing	Cast Iron
15	Gasket, Stuffing Box	Vegetable Fiber
16	Fitting, Grease	Steel

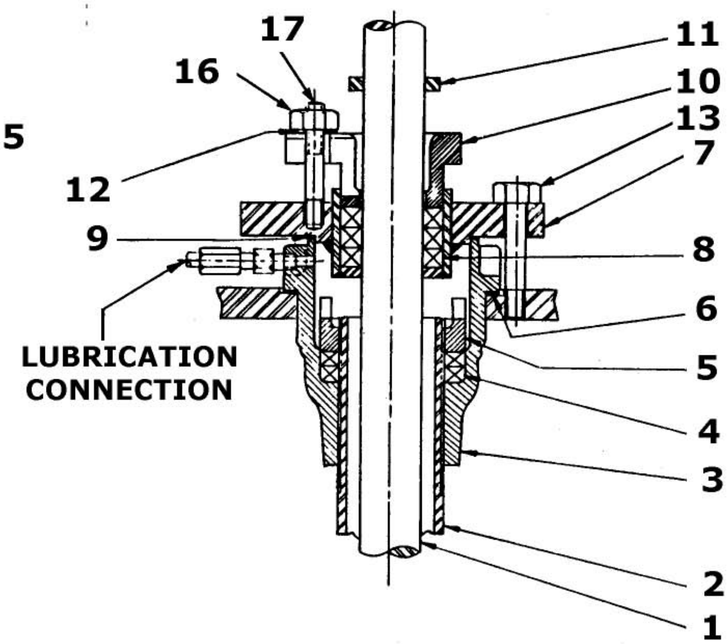
STANDARD TUBE NUT ASSEMBLY

Standard gravity feed oil lubricated pump with enclosed line shaft construction require an oiler assembly.

PACKED TUBE NUT ASSEMBLY

The packed type tube nut is required for pressure lubrication. Lubricating fluid can be clean water, oil or grease.

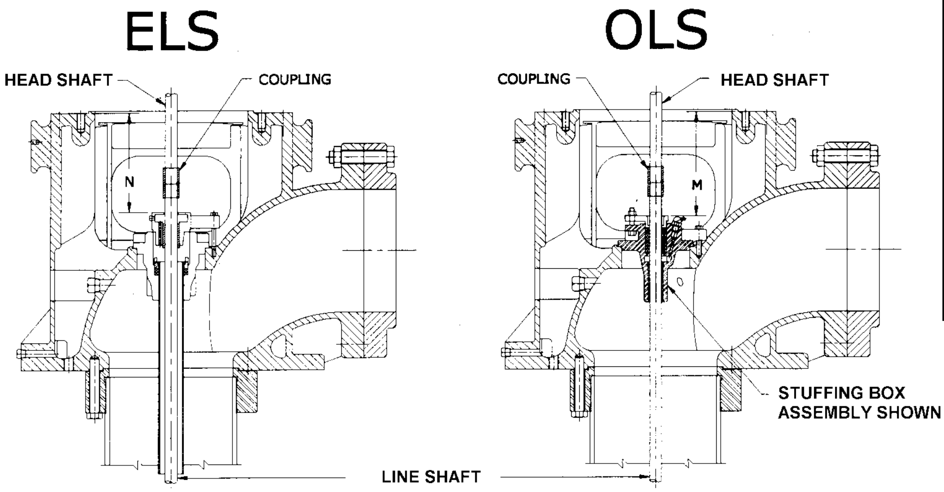




Item No.	Part Description	Material
1	Head or Line Shaft	416 Stainless Steel or Carbon Steel
2	Top tube	Carbon Steel
3	Tubing tension nut	Cast Iron
4	Packing for tubing tension nut	Graphited Fiber
5	Packing follower for tubing tension nut	Cast Iron
6	Gasket for tubing tension nut	Copper
7	Stuffing Box	Carbon Steel
8	Packing	Graphited Fiber
9	Gasket	Vegetable Fiber
10	Packing gland (pair of halves)	Bronze or Cast Iron
11	Water slinger	Neoprene
12	Clamp for packing gland	Stainless Steel
13	Hex head cap screw	Steel
14	Sleeve bearing	Bronze
15	Tube nut cap	Cast Iron
16	Hex nut	Brass
17	T-Bolt, packing gland	Steel

VERTICAL TURBINE PUMPS
Discharge Heads

Two- Piece Head Shaft
For Type C, G, & S Discharge Assemblies
With Threaded Coupling and VHS Drivers
(G Head Shown)



CONSTRUCTION
FACTORY OR WAREHOUSE OLS
Head Shaft AISI 416 Stainless Steel
Line Shaft – AISI 416 Stainless Steel

FACTORY ONLY ELS
Head Shaft – – AISI 416 Stainless Steel
Line Shaft – – AISI 416 Stainless Steel

WAREHOUSE ONLY ELS
Head Shaft – – AISI C1045 Carbon Steel
Line Shaft – – AISI C1045 Carbon Steel

HEAD SIZE & TYPE	LINE SHAFT SIZE	SPACE AVAILABLE		COUPLING TO BE USED	
		OLS "M"	ELS "N"	STD COUPLING PART #	STD COUPLING * LENGTH
2.5x2.5x10S 2.5x3x10S	ALL	NONE	NONE	NONE	NONE
4x4x10C	.75	6.88	6.25	2601104	2.25
	1.00	6.88	6.25	T90170	2.50
	1.19	6.88	6.25	T92091	3.50
	1.50	6.00	5.88	T92092	3.50
6x6x12G &6x6x12GHP	0.75	6.07	5.75	2601104	2.25
	1.00	5.94	5.75	T90170	2.50
	1.19	5.81	5.75	T92091	3.50
	1.50	5.49	----	T92092	3.50
8x8x16.5G & 8x8x16.5GHP	1.00	6.68	----	T90170	2.50
	1.19	6.62	6.50	T92091	3.50
	1.50	6.49	6.50	T92092	3.50
	1.69	6.37	6.50	T92093	4.25
	1.94	6.37	6.50	T92094	5.00
	2.19	6.19	6.50	T92095	5.50
10x10x20G 10x10x20GHP	1.00	7.56	----	T90170	2.50
	1.19	7.50	7.38	T92091	3.50
	1.50	7.37	7.38	T92092	3.50
	1.69	7.25	7.38	T92093	4.25
	1.94	7.25	7.38	T92094	5.00
	2.19	7.07	7.38	T92095	5.50
	2.44	6.82	----	T92096	6.00
12x12x20G 12x12x20GHP	1.00	7.68	----	T90170	2.50
	1.19	7.62	7.50	T92091	3.50
	1.50	7.49	7.50	T92092	3.50
	1.69	7.37	7.50	T92093	4.25
	1.94	7.37	7.50	T92094	5.00
	2.19	7.19	7.50	T92095	5.50
	2.44	6.94	----	T92096	6.00
14x14x24.5S 14x14x24.5SHP	1.19	7.00	6.69	T92091	3.50
	1.50	6.88	6.69	T92092	3.50
	1.69	6.88	6.69	T92093	4.25
	1.94	6.88	6.69	T92094	5.00
	2.19	6.75	6.69	T92095	5.50
16x16x30.5S 16.16.30.5SHP	ALL	NONE	NONE	NONE	NONE

LIMITATIONS:
Maximum setting before customer machining of line shaft in the field is required is 50 ft.

*Short couplings may have to be used with mechanical seals to allow for removal of coupling without removing motor.

For long column settings, packed type tube nuts, outside type mechanical seals, or steady bushings, short couplings and/or motor yokes may be required.

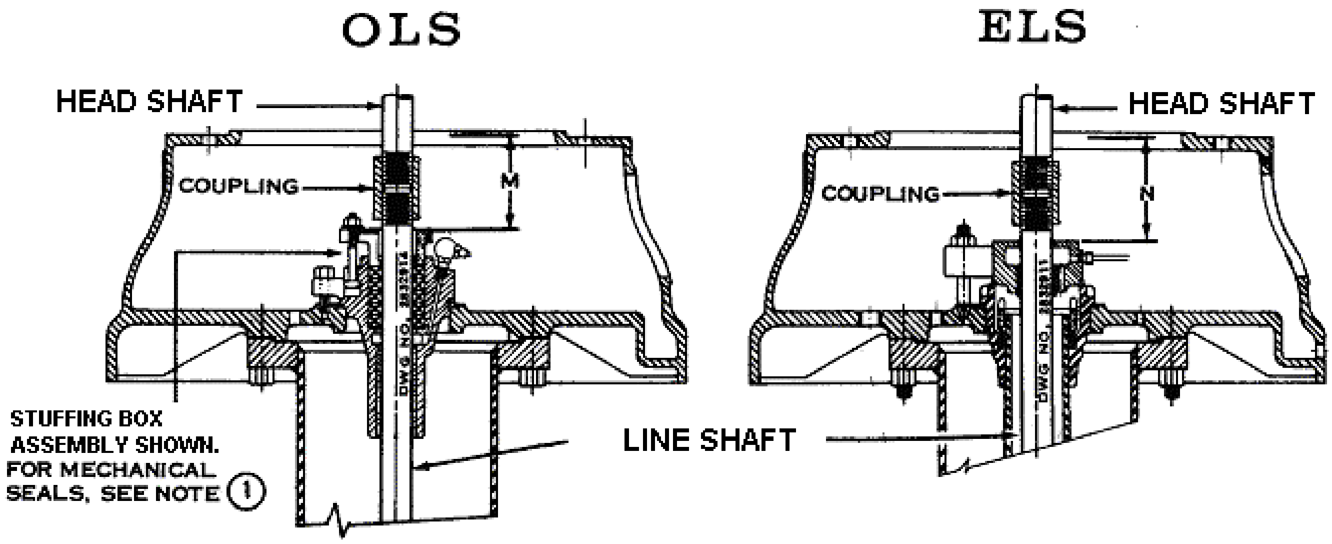
Dimensions given do not allow any stick down of driver below flange face.

For a 2-piece head shaft with threaded coupling below a VHS motor, a steady bushing is required in the motor for:
A) All pumps with mechanical seal;
B) Pumps operating at 2900 rpm and faster.
C) Refer to the motor manufacturer f

Yokes are required when head is used with VSS motors.

Peerless Pump Company
Indianapolis, IN 46207-7026

FOR TYPE UG DISCHARGE ASSEMBLIES WITH THREADED COUPLINGS & VHS DRIVERS



LIMITATIONS

Maximum setting is 50 feet for 6x10UG without custom machining line shaft in the field. The other bases may allow the 50 feet to be exceeded - refer to the factory for actual limitations, when required.

A coupling cannot be used in a 6x10UG when a packed type tube nut or shaft sleeve is used unless a yoke is furnished. Refer to factory for other size bases since they have more available space.

Dimensions given do not allow any steady bushing or other driver stick down below flange face.

When a 2-piece head shaft with a threaded coupling below a VHS driver is used a steady bushing is required in the driver for:

1) all pumps with mechanical seals
2) pumps operating at 2900 rpm or faster

CONSTRUCTION

FACTORY & WAREHOUSE - OLS
Head Shaft – AISI 416 Stn. Steel
Line Shaft – AISI Stn. Steel
Coupling - Carbon Steel

FACTORY ONLY- ELS-
Head Shaft – AISI 416 Stn. Steel
Line Shaft – AISI Stn. Steel
Coupling - Carbon Steel

WAREHOUSE ONLY - ELS
Head Shaft – Carbon Steel
Line Shaft – Carbon Steel
Coupling - Carbon Steel

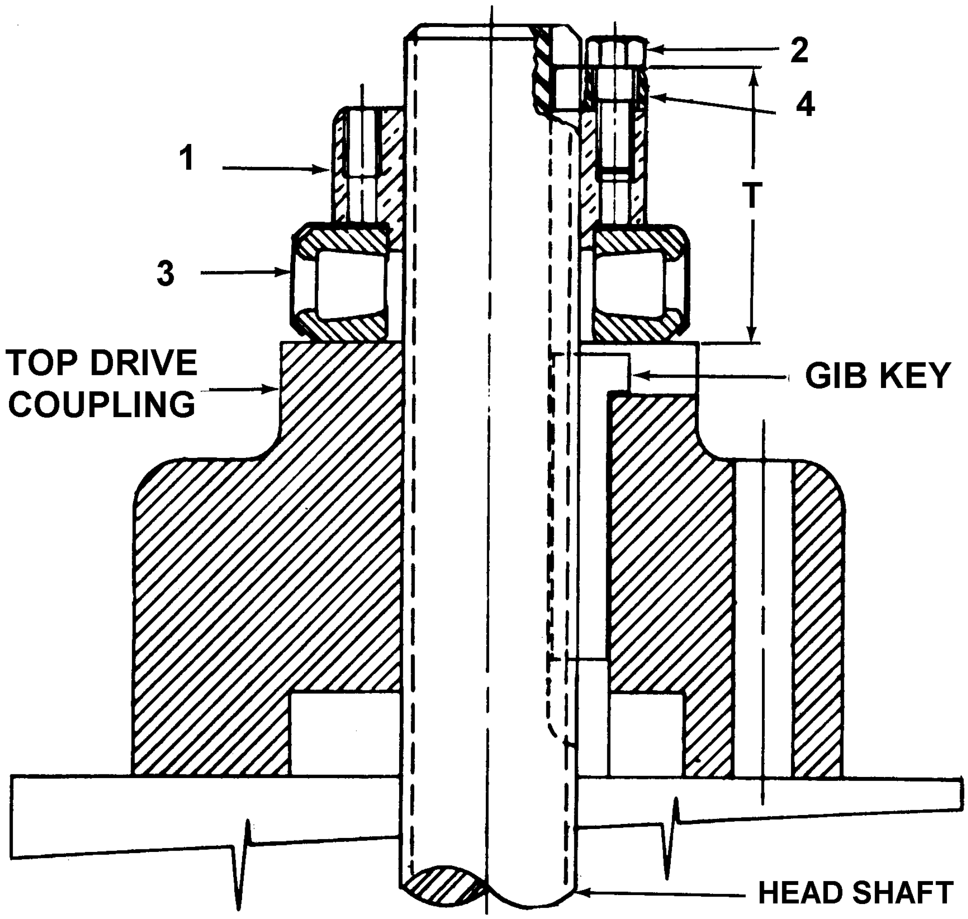
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Base Size	Shaft Size	Space Available ②		Coupling To Be Used		
		ELS "N"	OLS "M"	Short Length	Coupling Part No	Standard Length
6x10UG	.75	3.32	3.94	1.75	2622695	–
	1.00	3.32	3.94	1.88	2622696	–
	1.19	3.32	3.69	2.25	2622697	–
12x16.5UG	1.00	5.32	6.06	–	T90170	2.50
	1.19	5.32	6.00	2.25	2622697	-
	1.50	5.32	5.88	2.38	2622698	–
12x24.5UG	1.19	7.69	8.00	–	T92091	3.50
	1.50	7.69	7.88	-	T92092	3.50
	1.69	7.69	7.88	3.19	2622700	–
	1.94	7.69	7.88	3.75	2622701	-
	2.19	7.69	7.75	3.75	2622702	-
16x30.5UG	1.69	8.69	8.88	–	T92093	4.25
	1.94	8.69	8.88	–	T92094	5.00
	2.19	8.69	8.88	–	T92095	5.50
	2.44	8.69	8.50	-	T92096	6.00

Except for the 6x10UG with 1.19 diameter shaft, the base castings will accommodate most types of mechanical seals without the addition of a yoke; contact the factory for this application.

Use 1/2 of M or N dimension to place the coupling in the center of the available space for the construction shown.

Head Shaft Nut with Roller Thrust Bearing ①



T Dimension (inches)	
Shaft Size	**T**
1.69	3.00
1.94	3.12
2.19	3.38
2.44	3.38

Parts List Standard Construction		
Item Number	**Description**	**Material**
1	Head Shaft Nut	Bronze
2	Hex. Head Cap Screw	Steel
3	Roller Thrust Bearing	Steel
4	Locking Pin	Steel

① This option is primarily used on pumps with settings 600 feet or over. Not to be used on close coupled pumps or where momentary or continuous upthrust may occur. Head shaft nut cannot be locked down.

Peerless Pump Company offers components for on site assembly of the configuration described in Figure A only. These drawings represent suggested configurations only. Actual configurations can be different as long as functional requirements are met.

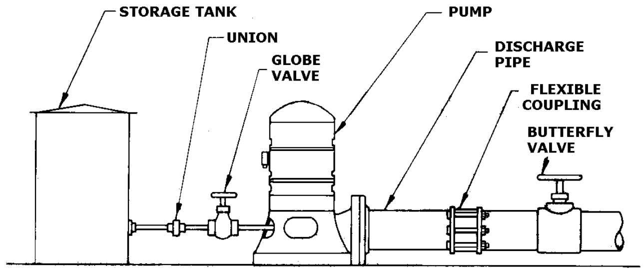


FIGURE A MANUAL CONTROL
4805077

Figure A Manual Control

Shaft Diameter Inches	Depth to Standing Water Level Feet	Tank Capacity Gallons	Pre-Lubrication Pipe Size	Pre-Lubrication Valve Size
0.75, 1.0,1.19, 1.5	100 or less	30	3/4	3/4
	101 to 200	50	1	1
	201 to 500	100	1-1/2	1-1/2
1.69, 1.94	100 or less	50	1	1
	101 to 200	100	1-1/2	1-1/2
	201 to 500	200	2	2

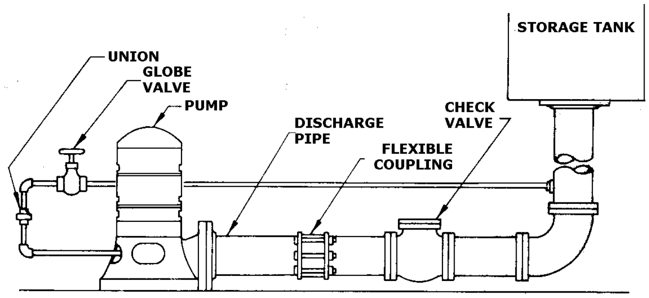


FIGURE B MANUAL CONTROL
4805078

Figure B Manual Control

Shaft Diameter Inches	Depth to Standing Water Level Feet	Tank Capacity Gallons	Pre-Lubrication Pipe Size	Pre-Lubrication Valve Size
0.75, 1.0,1.19, 1.5	100 or less	30	3/4	3/4
	101 to 200	50	1	1
	201 to 500	100	1	1-1/2
1.69, 1.94	100 or less	50	1	1
	101 to 200	100	1-1/2	1-1/2
	201 to 500	200	1-1/2	1-1/2

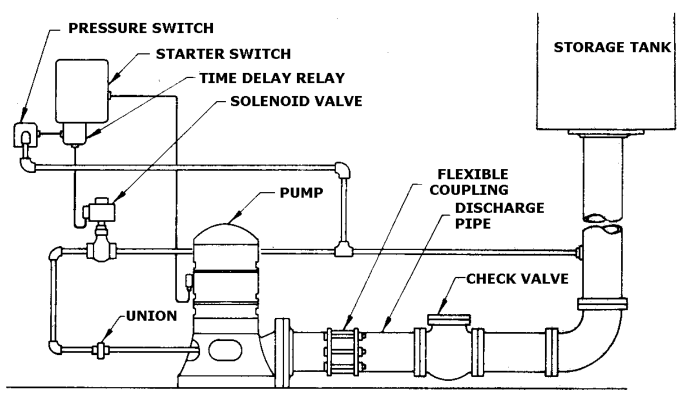


FIGURE C AUTOMATIC CONTROL
4805079

Figure C Automatic Control

Shaft Diameter Inches	Depth to Standing Water Level Feet	Tank Capacity Gallons	Adjustable Time Delay Relay	Pre-Lubrication Pipe Size	Solenoid Valve Size
0.75, 1.0,1.19, 1.5	100 or less	30	15 Seconds to 5 Minutes	3/4	3/4
	101 to 200	50		3/4	3/4
	201 to 500	100		1	1
1.69, 1.94	100 or less	50		3/4	3/4
	101 to 200	100		3/4	3/4
	201 to 500	200		1-1/4	1-1/4

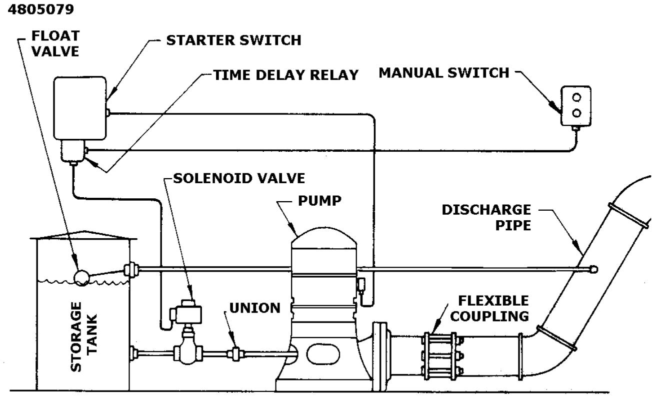


FIGURE D REMOTE CONTROL
4805080

Figure D Remote Control

Shaft Diameter Inches	Depth to Standing Water Level Feet	Tank Capacity Gallons	Float Valve Size	Float Valve Pipe Size	Solenoid Valve Size	Pre-Lubrication Pipe Size	Adjustable Time Delay Relay
0.75, 1.0,1.19, 1.5	100 or less	30	1/2	1/2	3/4	3/4	15 Seconds to 5 Minutes
	101 to 200	50	1/2	1/2	1	1	
	201 to 500	100	1/2	1/2	1-1/2	1-1/2	
1.69, 1.94	100 or less	50	1/2	1/2	1	1	
	101 to 200	100	1/2	1/2	1-1/2	1-1/2	
	201 to 500	200	3/4	3/4	1-1/2	2	

Subject to change without notice

VERTICAL TURBINE PUMPS
Oiler Assemblies with Container for Enclosed Line Shaft (ELS)

PARTS LIST (STANDARD CONSTRUCTION)			
ITEM NO. FIGURE 1	ITEM NO. FIGURE 2	NAME	MATERIAL
1	1	BRACKET, OIL CONTAINER	STEEL
2	2	CONDUIT, FLEXIBLE	STEEL
3	3	2 GAL. CONTAINER, OIL-WITH CAP ②	STEEL
-	4	COUPLING, PIPE	GALV. STEEL
-	5	ELBOW, STREET	GALV. STEEL
4	6	NIPPLE, PIPE	GALV. STEEL
5	7	NUT, HEX (QTY 2)	STEEL
6	8	NUT, HEX	STEEL
7	9	SCREW HEX HEAD CAP (QTY 2)	STEEL
8	10	SCREW, ROUND HEAD	STEEL
9	11	TUBE, OILER	COPPER
-	12	TUBE, WATER INLET	COPPER
-	13	TUBE, WATER OUTLET ③	COPPER
10	14	VALVE, SIGHT FEED OIL	ASSEMBLY (BRASS)
11	15	VALVE, SOLENOID	ASSEMBLY (BRASS & STEEL)
12	16	CONNECTOR, CONDUIT	STEEL
13	17	FITTING, TUBE CONNECTOR	BRASS
-	18	FITTING, TUBE ELBOW ③	BRASS
-	19	FITTING, TUBE ELBOW	BRASS
-	20	FITTING, TUBE ELBOW	BRASS

FIGURE 1 STANDARD TYPE MANUAL OR AUTOMATIC

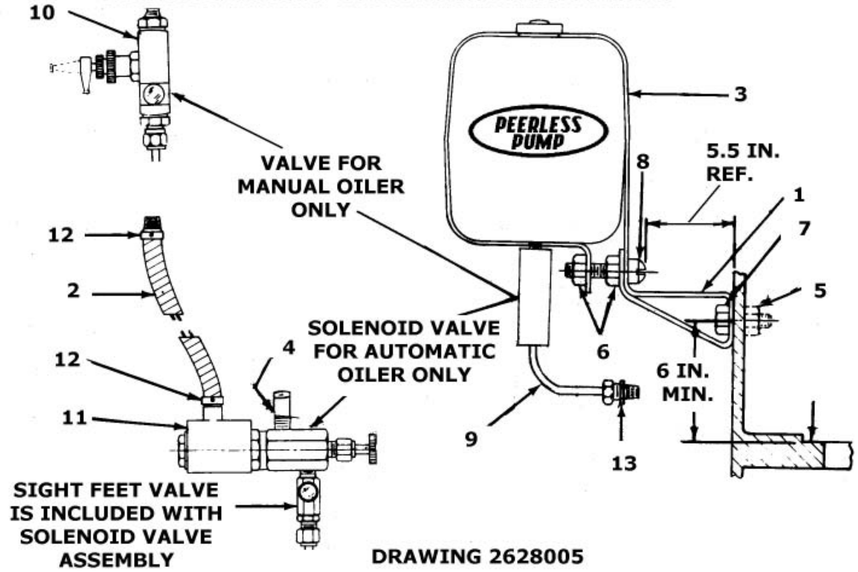
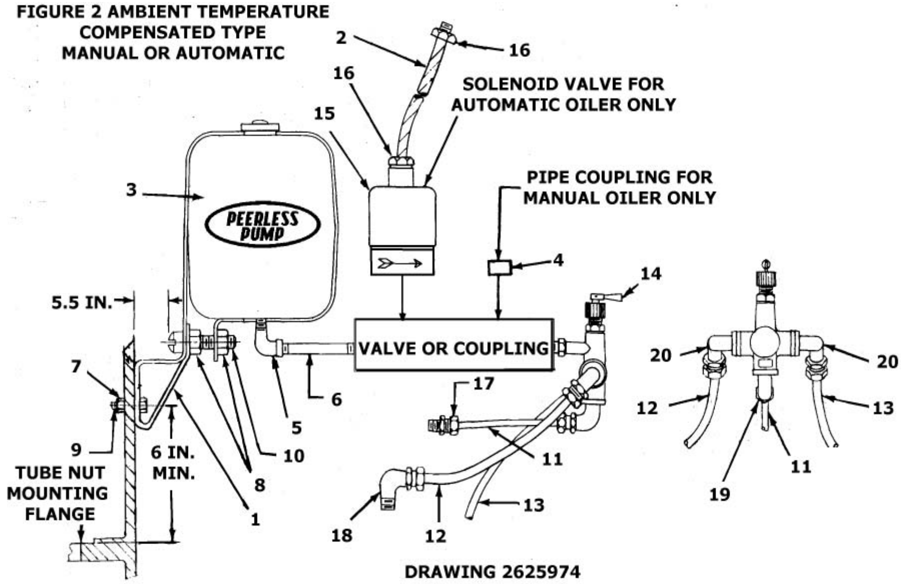


FIGURE 2 AMBIENT TEMPERATURE COMPENSATED TYPE MANUAL OR AUTOMATIC



RECOMMENDED DRIP RATE PER MINUTE			
SHAFT SIZE INCHES	PER 100 FEET OF COLUMN		TOTAL COLUMN LENGTH FEET.
	FIRST 2 WEEKS	AFTER 2 WEEKS	
0.75 TO 2.19	5 TO 6 DROPS	3 DROPS	ALL
ABOVE 2.19 ①	10 TO 12 DROPS	6 DROPS	20FT

① Add one drop per minute for each 10 Ft. of column over 20 Feet.

② Oil container has a 2 gallon capacity which will last approximately 60 days (24 hours per day) based on a drip rate of 3 drops per minute.Drip rate may require adjustment if temperature varies.

③ To connect to water supply, install item 18 in 1 /4 NPT pressure tap in discharge head next to tube nut, use item 13 to conduct water back to well.

VERTICAL TURBINE PUMPS
Oiler Assemblies Less Container for Enclosed Line Shaft (ELS)

Peerless Pump Company
Indianapolis, IN 46207-7026

PARTS LIST (STANDARD CONSTRUCTION)			
ITEM NO. FIGURE 1	ITEM NO. FIGURE 2	NAME	MATERIAL
1	1	CONDUIT, FLEXIBLE	STEEL
	2	COUPLING, PIPE	GALV. STEEL
2	-	ELBOW, STREET	GALV. STEEL
3	3	NIPPLE, PIPE	GALV. STEEL
4	-	NIPPLE, PIPE	GALV. STEEL
5	4	NUT, HEX	STEEL
6	5	SCREW HEX HEAD CAP (QTY 2)	STEEL
7	6	TUBE, OILER	COPPER
-	7	TUBE, WATER INLET	COPPER
-	8	TUBE, WATER OUTLET ②	COPPER
8	9	VALVE, SIGHT FEED OIL	ASSEMBLY (BRASS)
9	10	VALVE, SOLENOID	ASSEMBLY (BRASS & STEEL)
10	11	CONNECTOR, CONDUIT	STEEL
11	12	FITTING, TUBE CONNECTOR	BRASS
12	13	FITTING, TUBE CONNECTOR	BRASS
13	14	STUD, OILER MTG.	ALUMINUM
14	15	BRACKET, OILER MTG.	STEEL
-	16	FITTING, TUBE ELBOW ②	BRASS
-	17	FITTING, TUBE ELBOW	BRASS
-	18	FITTING, TUBE ELBOW	BRASS

FIGURE 1
STANDARD TYPE

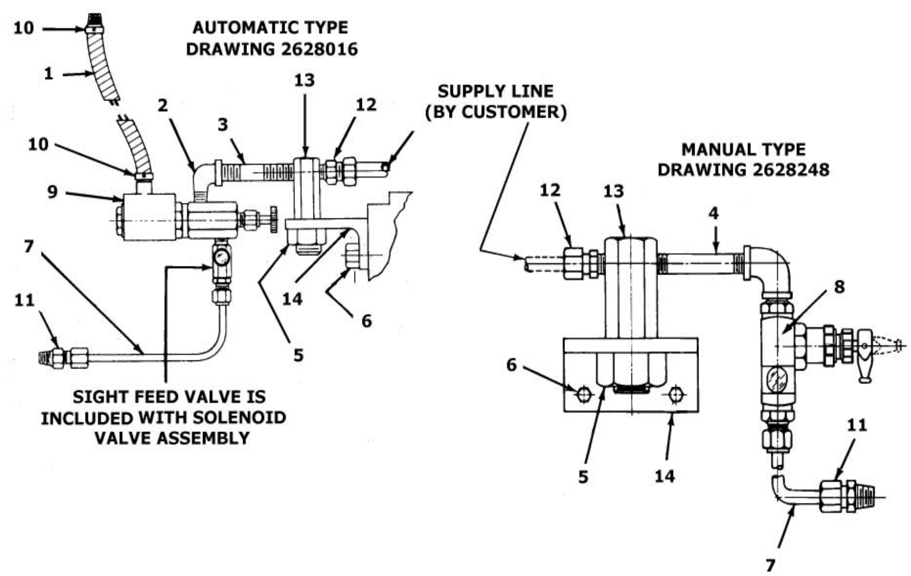
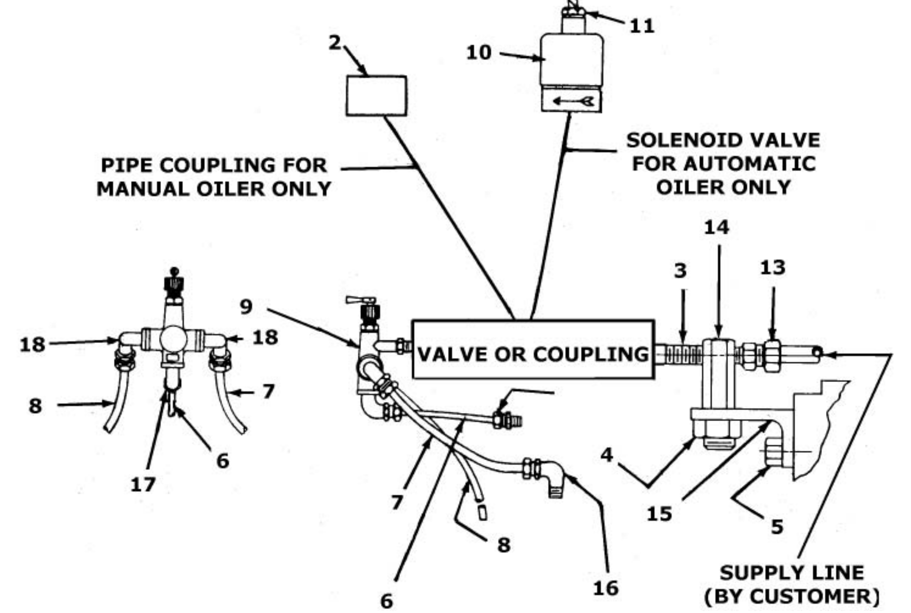


FIGURE 2
AMBIENT TEMPERATURE
COMPENSATED TYPE
MANUAL OR AUTOMATIC

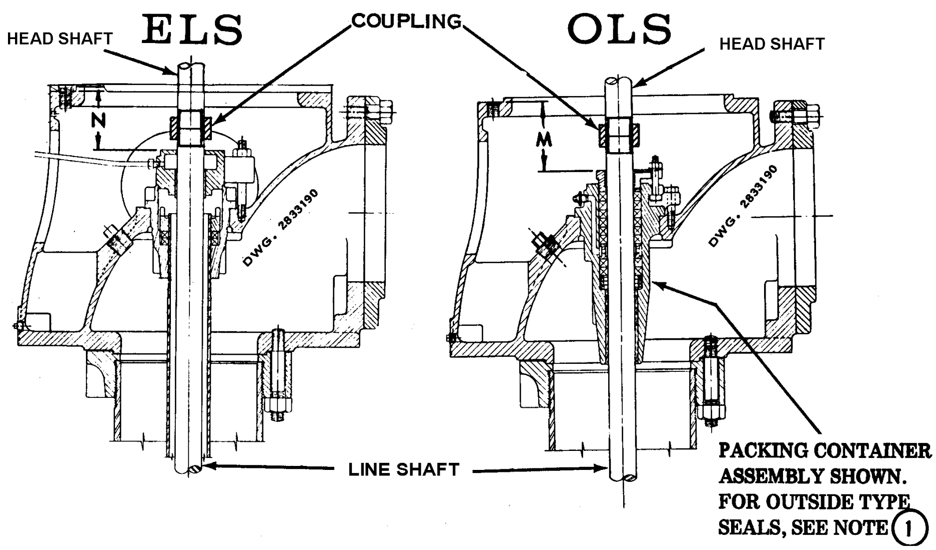


RECOMMENDED DRIP RATE PER MINUTE			
SHAFT SIZE INCHES	PER 100 FEET OF COLUMN		TOTAL COLUMN LENGTH FEET.
	FIRST 2 WEEKS	AFTER 2 WEEKS	
0.75 TO 2.19	5 TO 6 DROPS	3 DROPS	ALL
ABOVE 2.19 ①	10 TO 12 DROPS	6 DROPS	20FT

① Add one drop per minute for each 10 Ft. of column over 20 Feet.
② To connect to water supply, install item 16 in 1 /4 NPT pressure tap in discharge head next to tube nut, use item 8 to conduct water back to well.

Two- Piece Head Shaft

For Type S and SHP Discharge Assemblies
With Threaded Coupling and VHS Drivers



Standard Construction
OLS
Head Shaft AISI 416 Stainless Steel
Line Shaft – AISI 416 Stainless Steel
Coupling – Carbon Steel
ELS
Top Shaft – – AISI 416 Stainless Steel
Line Shaft – – AISI 416 Stainless Steel
Coupling – Carbon Steel

Head Size	Shaft Size	Space Available Note 2		Coupling to be used		
		ELS "N"	OLS "M"	Short Length	Coupling Part Number	Standard Length
2.5x2.5x10S 2.5x3x10S	Coupling cannot be used due to space limitations					
6x6x12S	0.75	3.32	3.94	1.75	2622695	-
	1.00	3.32	3.94	1.88	2622696	-
	1.19	3.32	3.69	2.25	2622697	-
6x8x16.5S 8x8x12S 8x8x16.5S	1.00	3.44	3.82	1.88	2622696	-
	1.19	3.44	3.82	2.25	2622697	-
	1.50	3.44	3.63	2.38	2622698	-
10x10x16.5S 10x10x20S	1.19	4.82	5.13	-	T92091	3.50
	1.50	4.82	5.00	-	T92092	3.50
	1.69	4.82	5.00	3.19	2622700	-
	1.94	4.82	5.00	3.75	2622701	-
12x12x20S	1.19	5.94	6.25	-	T92091	3.50
	1.50	5.94	6.13	-	T92092	3.50
	1.69	5.94	6.13	-	T92093	4.25
	1.94	5.94	6.13	3.75	2622701	-
	2.19	5.94	6.00	3.75	2622702	-
14x14x24.5S	1.19	6.69	7.00	-	T92091	3.50
	1.50	6.69	6.88	-	T92092	3.50
	1.69	6.69	6.88	-	T92093	4.25
	1.94	6.69	6.88	-	T92094	5.00
	2.19	6.69	6.75	-	T92095	5.50
16x16x30.5S	Coupling cannot be used					

LIMITATIONS

Maximum setting before customer machining of line shaft in the field is required is 50 ft.
Coupling cannot be used when packed type tube nuts or shaft sleeves are used on the head.
Dimensions given do not allow any stick down of driver below flange face.
For a 2-piece head shaft with threaded coupling below a VHS motor, a steady bushing is required in the motor for:

(A) All pumps with mechanical seal;
(B) Pumps operating at 2900 rpm and faster.
(C) Refer to the motor manufacturer for pricing

Note 1:

Type RA and 8B2 outside type mechanical seals can be used with two-piece head shaft **with the following exceptions**:

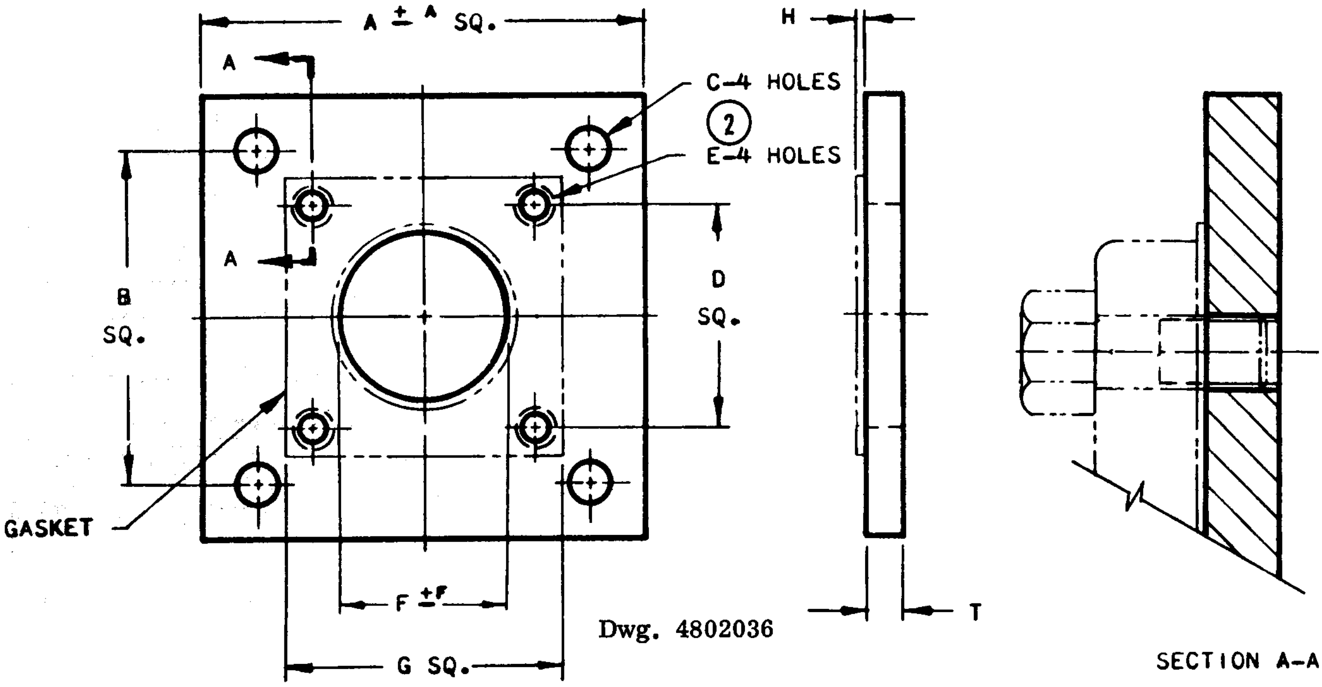
(A) 6x6x12 Head with 1.19 Shaft.
(B) 10x10x16.5 and 10x10x20 Heads with 1.69 and 1.94 Shafts.
(C) Seal container is required.
(D) Short length coupling may be required when using outside type seals.

For inside type mechanical seals refer to factory.

Note 2:

Use 1/2 of N or M dimensions for break between head and line shaft.

STEEL SOLE PLATES



GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

HEAD 8IZE	A	B	C	D	E	F	G	H	T
2-1/2 x 2-1/2 x 10S	14-1/2	13	3/4	9-1/4	3/8-16 UNC	9	13	1/16	1/2
2-1/2 x 3 x 10S	14-1/2	13	3/4	9-1/4	3/8-16 UNC	9	13	1/16	1/2
6 x 6 x 12S	21	18	7/8	13-1/4	5/8-11 UNC	13	15-1/2	1/16	5/8
8 x 8 x 12S	24	21-1/4	7/8	15	5/8-11 UNC	14-1/2	17-1/2	1/16	3/4
6 x 8 x 16-1/2S	26	23	1-1/8	18	3/4-10 UNC	16-1/2	20-1/2	1/16	7/8
8 x 8 x 16-1/2S	26	23	1-1/8	18	3/4-10 UNC	16-1/2	20-1/2	1/16	7/8
10 x 10 x 16-1/2S	28	25	1-1/8	18	3/4-10 UNC	18	20-1/2	1/16	7/8
10 x 10 x 20S	28	25	1-1/8	18	3/4-10 UNC	18	20-1/2	1/16	7/8
12 x 12 x 20S	32	29	1-1/4	21	3/4-10 UNC	20-1/2	23-1/2	1/16	7/8
14 x 14 x 24-1/2S	36	32	1-1/4	25	3/4-10 UNC	24-1/2	28-3/4	1/8	1
16 x 16 x 30-1/2S	42	39	1-1/4	32	3/4-10 UNC	28	38-3/4	1/8	1

NOTE: Standard soleplate is machined on one side.

Standard Column Construction Data

PIPE, SHAFT AND OIL TUBE

Speed	Item	Standard Construction	Section Length
2200 RPM and UNDER	**OLS - 10' SECTIONS - OPEN LINESHAFT CONSTRUCTION (115°F max. liquid temperature)**		
	Column Pipe	T & C 2-1/2" thru 16" O.D.	10'
		Flanged 3" Std. thru 24" O.D.	10'
	Lineshaft	3/4" dia. - 400 Series stainless steel without sleeves	
		1" thru 1-15/16" dia. AISI 1045 steel with one Chrome plated sleeve or flame sprayed journal	10'
		2-3/16" dia. (only) AISI 1045 steel with one chrome plated journal	10'
		2-7/16" thru 3-15/16" dia. 400 Series stainless steel	10'
	ELS - 10' SECTIONS - ENCLOSED LINESHAFT CONSTRUCTION		
	Column Pipe	T & C 4" Std. thru 16" O.D.	10'
		Flanged 4" Std. thru 24" O.D.	10'
	Lineshaft	1" thru 3-15/16" dia. AISI 1045 steel (3/4" is 400 Series stainless steel)	10'
	Oil Tube	1-1/4" thru 6" nom. i.d. low carbon steel	2 ea. x5'
	ELS - 20' SECTIONS - ENCLOSED LINESHAFT CONSTRUCTION		
	Column Pipe	T & C 4" Std. thru 12" Std.	20'
	Lineshaft	1-3/16" thru 2-7/16" dia AISI 1045 steel	20'
	Oil Tube	2" thru 4" nom. i.d. AISI low carbon steel	3 ea. x6'8"
		or	4 ea. x5'
OVER 2200 RPM	**OLS - 10' SECTIONS - OPEN LINESHAFT CONSTRUCTION (115°F max. liquid temperature)**		
	Column Pipe	T & C 2-1/2" thru 8" Std.	5'
		Flanged 4" thru 8" Std.	5'
	Lineshaft	3/4" thru 1-1/2" dia. 400 Series stainless steel without sleeves	10'
	ELS - 10' SECTIONS - ENCLOSED LINESHAFT CONSTRUCTION		
	Column Pipe	T & C 4" thru 8" Std.	10'
		Flanged 4" thru 8" Std.	10'
	Lineshaft	1" thru 1-1/2" dia. AISI 1045 steel (3/4" is 400 Series stainless steel)	10'
	Oil Tube	1-1/4" thru 2-1/2" nom. i.d. low carbon steel	3 ea. x3'4"

NOTE Maximum setting for Type F flanged column is 150 feet. Refer to factory if working pressure exceeds 150 PSI.
Maximum setting for Type TFC flanged column is 100 feet. Refer to factory if working pressure exceeds 100 PSI.
For maximum settings of threaded column. See Section 115, Page 41.

BEARING RETAINERS, SHAFT COUPLINGS, OIL TUBE BEARINGS, AND SHAFT STABILIZING SPIDERS

Speed	Item	Standard Construction
All Pump Speeds	Bearing Retainers	SAE 40 bronze thru 16" O.D.; fabricated steel 18" O.D. and larger. Neoprene bearings, one per column flange break. Note: A pump with a 10' or shorter setting may not require a bearing retainer. See "Maximum Bearing Spacing", Section 120, Page 2 for details.
	Shaft Couplings	All sizes, carbon steel
	Tube Bearings	SAE 40 bronze, one per tube section, except top tube.
	Tube Stabilizing Spiders	Neoprene. One per 50' of column. See Section 120, Page 41, for recommended spacing.

PEERLESS PUMP Peerless Pump Company
Indianapolis, IN 46207-7025

Maximum Bearing Spacing for Standard Column Construction

OLS - OPEN LINESHAFT CONSTRUCTION

Maximum Bearing Spacing	RPM - Driver Speed											
	Over 2200 RPM			1201 to 2200 RPM			901 to 1200 RPM			900 RPM or less (1-15/16" or larger shaft req'd)		
Top Section	5'			5'			5'			10'		
Intermed. Section	5'			10'			10'			10'		
Bottom Section	5'			10'			10'			10'		
	Quantities of Pipes and Bearing Retainers (Bearing Spacing)											
Column Length (1)	Pipe Length		Brg. Rets.	Pipe Length		Brg. Rets.	Pipe Length		Brg. Rets.	Pipe Length		Brg. Rets.
	5'	10'		5'	10'		5'	10'		5'	10'	
5'	1	0	0	1	0	0	1	0	0	1	0	0
10'	2	0	1	2	0	1	2	0	1	0	1	0
(2) 10' One-Piece Column				0	1	0	0	1	0			
15'	3	0	2	1	1	1	1	1	1	1	1	1
20'	4	0	3	2	1	2	2	1	2	0	2	1
25'	5	0	4	1	2	2	1	2	2	1	2	2
30'	6	0	5	2	2	3	2	2	3	0	3	2
35'	7	0	6	1	3	3	1	3	3	1	3	3
40'	8	0	7	2	3	4	2	3	4	0	4	3
45'	9	0	8	1	4	4	1	4	4	1	4	4
50'	10	0	9	2	4	5	2	4	5	0	5	4

(1) Shorter lengths (that is, shorter than a full 5' or a full 10') can be used for settings not evenly divisible by 5 or 10.

(2) One piece column construction is used when the shaft diameter is (a) 1-3/16" and larger for 1201 to 2200 RPM and (b) 1-1/2" and larger for 901 to 1200 RPM.

ELS - ENCLOSED LINESHAFT CONSTRUCTION, OIL LUBRICATED

(3) Column Length	RPM - Driver Speed													
	Under 2200 RPM										2200 RPM and Faster			
	Ten Foot Sections				20 Foot Sections (4)						Ten Foot Sections			
	Lgths, Pipe & Inner Column		Max. Brg. Spacing for Section of:		Lgths, Pipe & Inner Column			Max. Brg. Spacing for Section of:			Lgths, Pipe & Inner Column		Max. Brg. Spacing for Section of:	
	5'	10'	5'	10'	5'	10'	20'	5'	10'	20' (5)	5'	10'	5'	10'
5'	1	0	5'	—	Not Available						1	0	5'	—
10'	0	1	—	5'							0	1	—	3'4"
15'	1	1	5'	5'							1	1	5'	3'4"
20'	0	2	—	5'							0	2	—	3'4"
25'	1	2	5'	5'	1	0	1	5'	—	6'8"	1	2	5'	3'4"
30'	0	3	—	5'	0	1	1	—	5'	6'8"	0	3	—	3'4"
35'	1	3	5'	5'	1	1	1	5'	5'	6'8"	1	3	5'	3'4"
40'	0	4	—	5'	0	2	1	—	—	6'8"	0	4	—	3'4"
45'	1	4	5'	5'	1	0	2	5'	—	6'8"	1	4	5'	3'4"
50'	0	5	—	5'	0	1	2	—	5'	6'8"	0	5	—	3'4"

(3) ELS oil lubricated construction is NOT recommended when the discharge pressure at the tube nut exceeds 58 ft. (25 psig). Refer to factory.

(4) 20' ELS column requires 1-3/16" dia. or larger shaft.

(5) 20' sections are standard with either 6'8" bearing spacing or 5' bearing spacing.

Subject to change without notice

Before quoting or pricing any Column Assemblies for units having any type of *Variable Speed Driver*. Please refer to the factory for application review. Some applications may require 5 foot bearing spacing.
The full operating speed range of the variable speed drive must be given for proper application evaluation.

Standard Column Pipe Data

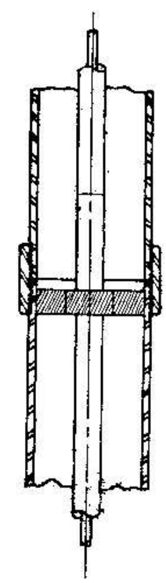
Pipe Size	Schedule	Nominal Wall Thickness	(1) Weight Lbs/Ft	Pipe Coupling Weight	Threading (2) T.P.I.	Threading (3) Taper	Coupling (O.D.)	Flange O.D. Type F	Flange O.D. Type TFC
2.500" Std.	40	0.203	5.79	2.000#	8	0.188	3.250	—	—
3.000" Std.	40	0.216	7.57	3.000	8	0.188	3.938	6.250	—
4.000" Std.	40	0.237	10.79	4.000	8	0.188	5.094	7.250	—
5.000" Std.	40	0.258	14.61	8.500	8	0.188	6.313	8.375	—
6.250" 6.000" Std.	— 40	0.250 0.280	17.02 18.97	9.000	8	0.188	7.375	9.625	9.750
8.250" 8.000" Std.	20 30	0.250 0.277	22.36 24.69	13.500	8	0.188	9.438	11.625	12.000
10.250" 10.000" Std.	20 —	0.250 0.279	28.04 31.20	28.000	8	0.188	11.750	14.000	14.000 (4)
12.000" Std.	30	0.330	43.77	42.500	8	0.188	13.938	16.250	16.250 (5)
14.000" O.D.	30	0.375	54.57	40.000	8	0.188	15.438	18.000	—
16.000" O.D.	30	0.375	62.58	56.000	8	0.188	17.438	20.000	—
18.000" O.D.	—	0.375	70.59	—	—	—	—	23.250	—
20.000" O.D.	20	0.375	78.60	—	—	—	—	25.250	—
24.000" O.D.	20	0.375	94.62	—	—	—	—	29.750	—

(1) Weight does not include couplings or flanges.
(2) T.P.I. = threads per inch.
(3) Pipe couplings have straight thread.
(4) Bottom Flange O.D. for 15LC, 15.125".
(5) Bottom Flange O.D. for 18HXB, 18.000"

RECOMMENDED
Spacing of Tube Stabilizing Spiders
ON ENCLOSED LINESHAFT COLUMN

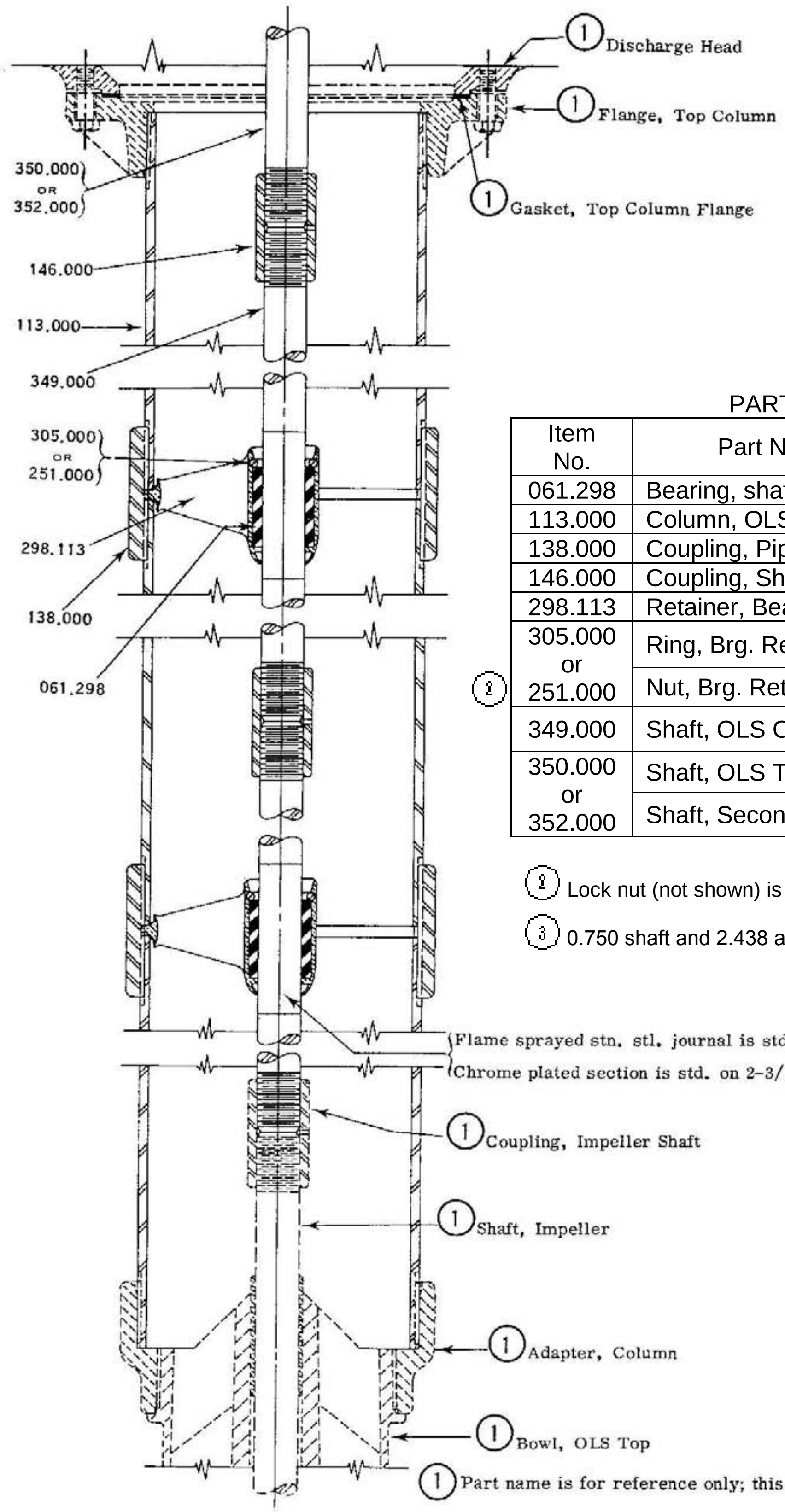
Length of Pump Column	Number of Stabilizers Furnished	Stabilizers are to be spaced at The top of column sections number:
to 40 ft.	None	
50 to 80 ft.	1	4
90 to 120 ft.	2	4 & 8
130 to 160 ft.	3	4, 8 & 12
170 to 200 ft.	4	4, 8, 12 & 16
210 to 240 ft.	5	4, 8, 12, 16 & 20
250 to 280 ft.	6	4, 8, 12, 16, 20 & 24
290 to 320 ft.	7	4, 8, 12, 16, 20, 24 & 28
330 to 360 ft.	8	4, 8, 12, 16, 20, 24, 28 & 32
370 to 400 ft.	9	4, 8, 12, 16, 20, 24, 28, 32 & 36
410 to 440 ft.	10	4, 8, 12, 16, 20, 24, 28, 32, 36 & 40
450 to 480 ft.	11	4, 8, 12, 16, 20, 24, 28, 32, 36, 40 & 44

The first section is considered as adjacent to the bowl unit.



Showing a tube stabilizer in
Place at top of column pipe.

Open Line Shaft Column Assembly
Threaded and Coupled



Dwg. No. 4805264

PARTS LIST (standard construction)

Item No.	Part Name	Standard Material	Mat'l Code
061.298	Bearing, shaft	Neoprene	118
113.000	Column, OLS Threaded	Steel, low carbon	056
138.000	Coupling, Pipe	Steel, low carbon	056
146.000	Coupling, Shaft	Steel, AISI 1215	444
298.113	Retainer, Bearing	Brz., ASTM B-145 Modified	386
305.000 or	Ring, Brg. Retainer lock	302 Stainless Steel	082
(2) 251.000	Nut, Brg. Retainer lock	Bronze, SAE 63	020
349.000	Shaft, OLS Column	Steel, SAE C-1045 (3)	188
350.000 or	Shaft, OLS Top	416 Stainless Steel	093
352.000	Shaft, Second Top	416 Stainless Steel	093

(2) Lock nut (not shown) is used on retainers for 2.438 and larger shafts only.

(3) 0.750 shaft and 2.438 and larger shafts are standard in 416S.S., mat'l code 093

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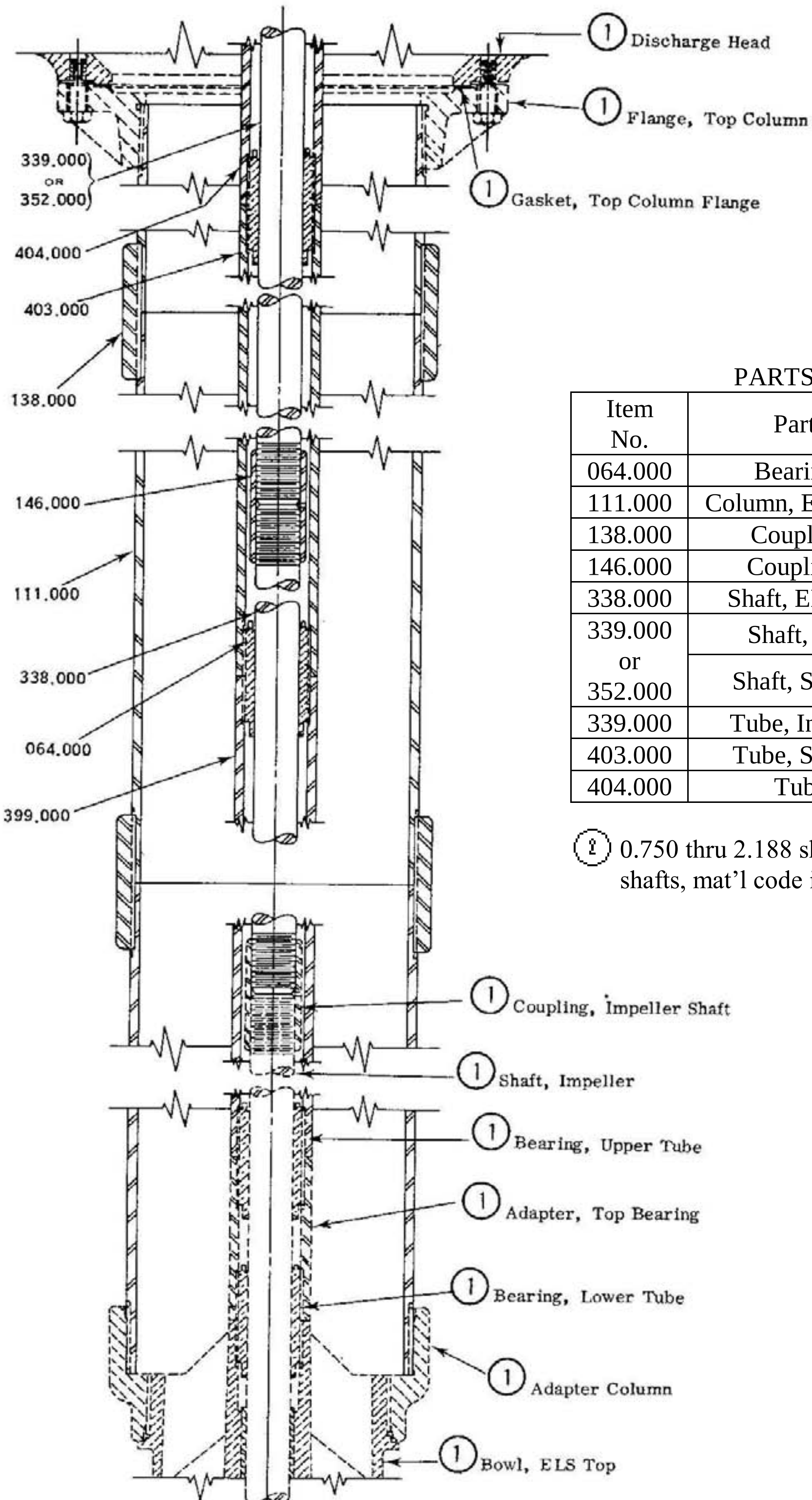
Indianapolis, IN 46207-7026

Enclosed Line Shaft Column Assembly
Threaded and Coupled



PARTS LIST (standard construction)

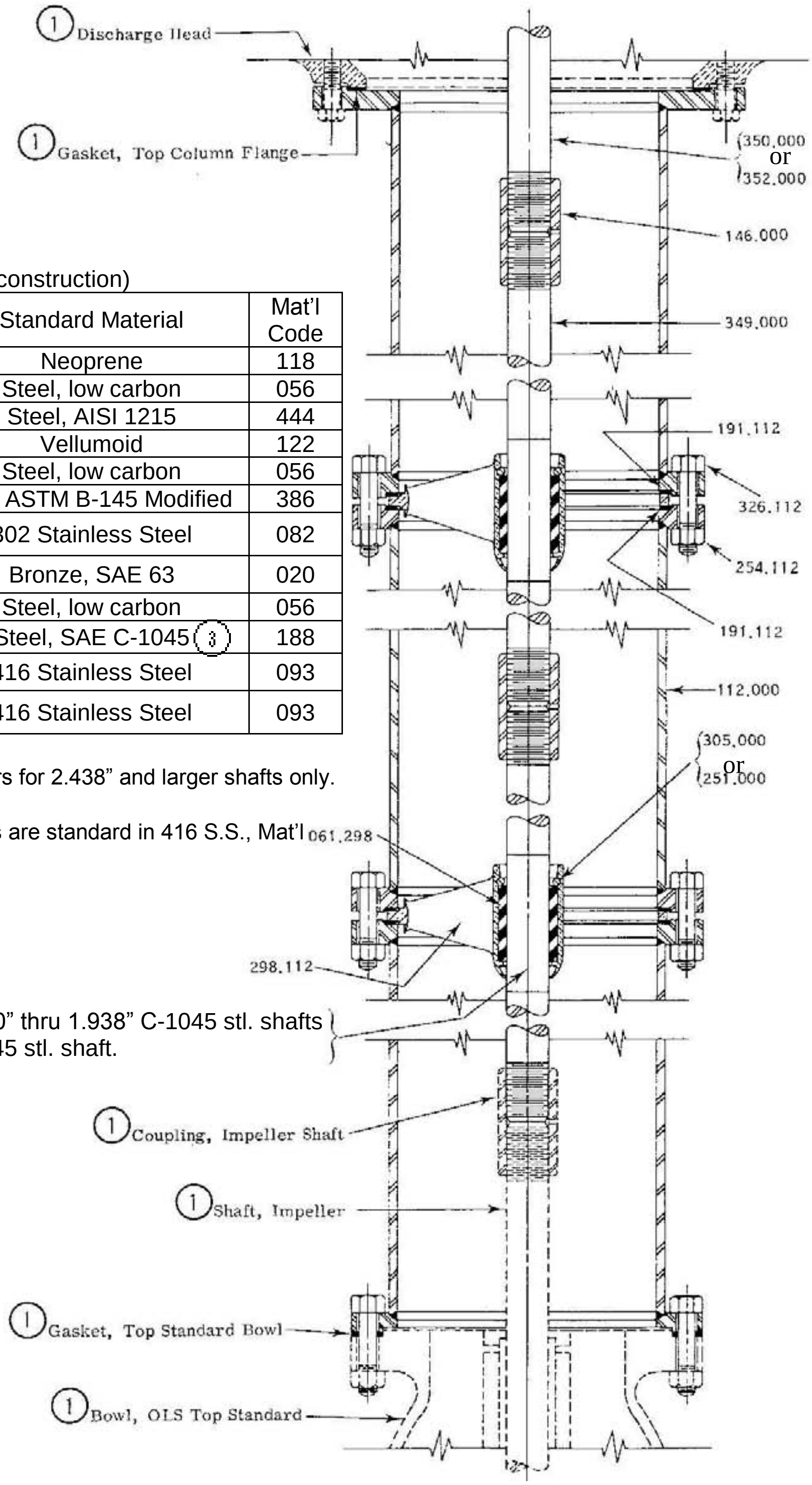
Item No.	Part Name	Standard Material	Mat'l Code
064.000	Bearing, Tube	Bronze, SAE 40	011
111.000	Column, ELS Threaded	Steel, low carbon	056
138.000	Coupling, Pipe	Steel, low carbon	056
146.000	Coupling, Shaft	Steel, AISI 1215	444
338.000	Shaft, ELS Column	Steel, SAE 1045	188 (2)
339.000 or 352.000	Shaft, ELS Top	Steel, SAE 1045	188 (2)
	Shaft, Second Top	Steel, SAE 1045	188 (2)
339.000	Tube, Intermediate	Steel, low carbon	056
403.000	Tube, Second Top	Steel, low carbon	056
404.000	Tube, Top	Steel, low carbon	056

(2) 0.750 thru 2.188 shaft mat'l code is 188. For 2.438 and larger shafts, mat'l code is 069.

(1) Part name is for reference only; this part is not included with column assembly.

Dwg. No. 4805263

Open Line Shaft Column Assembly
Flanged Type F



PARTS LIST (standard construction)

Item No.	Part Name	Standard Material	Mat'l Code
061.298	Bearing, Shaft	Neoprene	118
112.000	Column, OLS Flanged	Steel, low carbon	056
146.000	Coupling, Shaft	Steel, AISI 1215	444
191.112	Gasket, Column Flange	Vellumoid	122
254.112	Nut, Hex	Steel, low carbon	056
298.112	Retainer, Bearing	Brz., ASTM B-145 Modified	386
305.000 or	Ring, Brg. Retainer lock	302 Stainless Steel	082
(2) 251.000	Nut, Brg. Retainer lock	Bronze, SAE 63	020
326.112	Screw, Hex Head Cap	Steel, low carbon	056
349.000	Shaft, OLS Column	Steel, SAE C-1045 (3)	188
350.000 or	Shaft, OLS Top	416 Stainless Steel	093
352.000	Shaft, Second Top	416 Stainless Steel	093

(2) Lock nut (not shown) is used on retainers for 2.438" and larger shafts only.

(3) 0.750" shaft and 2.438" and larger shafts are standard in 416 S.S., Mat'l Code 093.

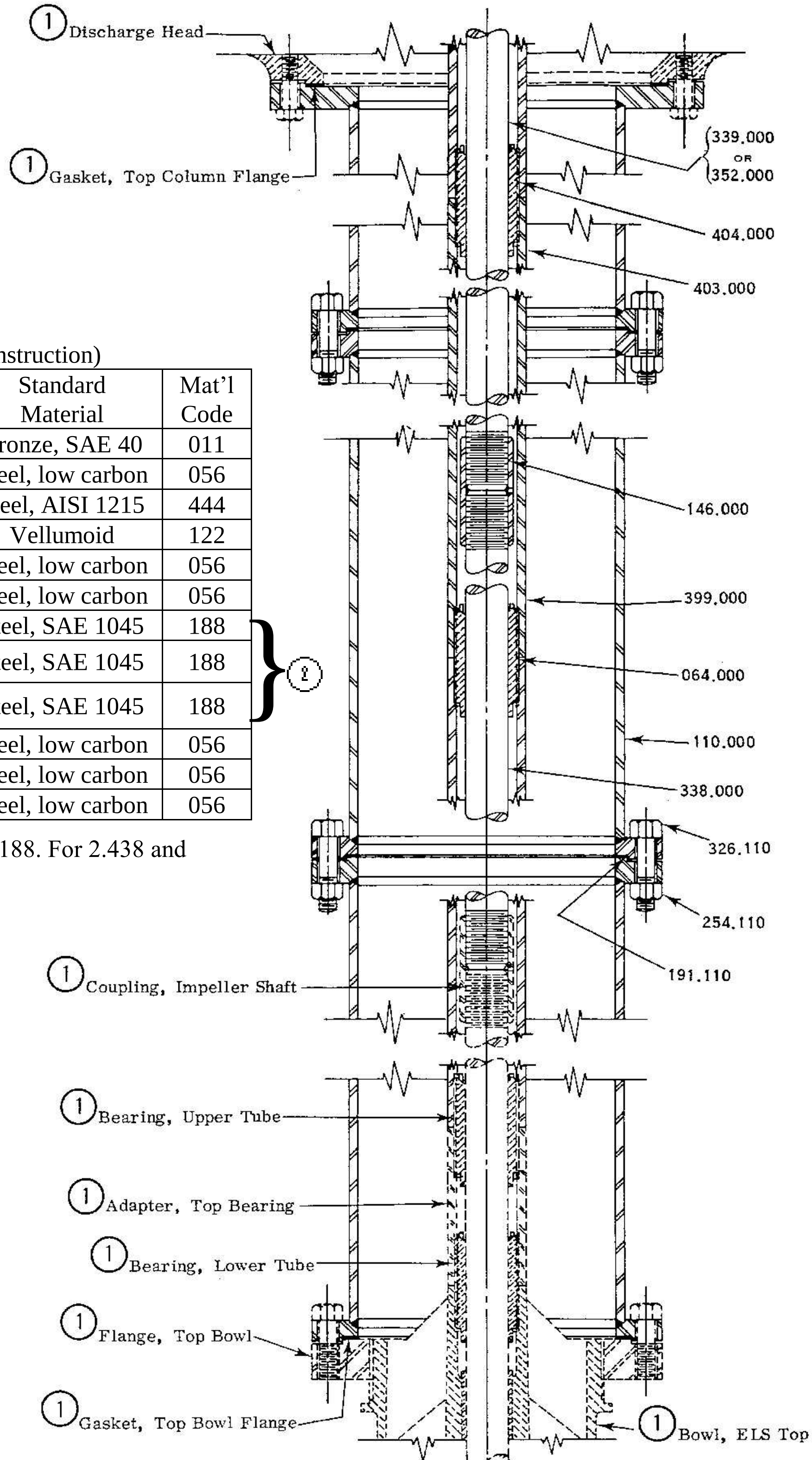
Flame sprayed stn. stl. journal is std. on 1.000" thru 1.938" C-1045 stl. shafts
Chrome plated section is std. on 2.188" C-1045 stl. shaft.

Dwg. No. 4805265

(1) Part name is for reference only; this part is not included with column assembly.

Subject to change without notice

Enclosed Line Shaft Column Assembly
Flanged Type F



PARTS LIST (standard construction)

Item No.	Part Name	Standard Material	Mat'l Code
064.000	Bearing, Tube	Bronze, SAE 40	011
110.000	Column, ELS Flanged	Steel, low carbon	056
146.000	Coupling, Shaft	Steel, AISI 1215	444
191.110	Gasket, Column Flange	Vellumoid	122
254.110	Nut, Hex	Steel, low carbon	056
326.110	Screw, Hex Head Cap	Steel, low carbon	056
338.000	Shaft, ELS Column	Steel, SAE 1045	188 (2)
339.000 or	Shaft, ELS Top	Steel, SAE 1045	188 (2)
352.000	Shaft, Second Top	Steel, SAE 1045	188 (2)
399.000	Tube, Intermediate	Steel, low carbon	056
403.000	Tube, Second Top	Steel, low carbon	056
404.000	Tube, Top	Steel, low carbon	056

(2) .750 thru 2.188 shaft Mat'l Code is 188. For 2.438 and larger shafts, Mat'l Code is 069.

Dwg. No. 4805262

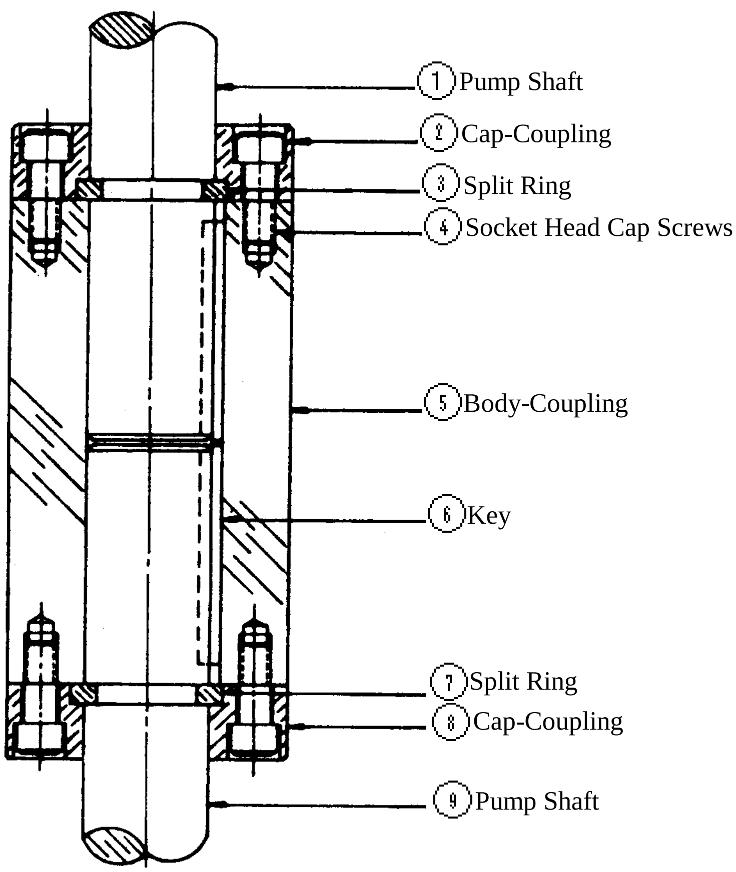
(1) Part name is for reference only; this part is not included with column assembly.

Keyed-Type Shaft Couplings

NOTE: This coupling must not be used between the shaft extension Of a VSS driver and the pump top shaft. A flanged or spacer Coupling must be used at this location.

These couplings are primarily used on large shafts where Threaded couplings may be impractical.

For pricing, contact the factory.

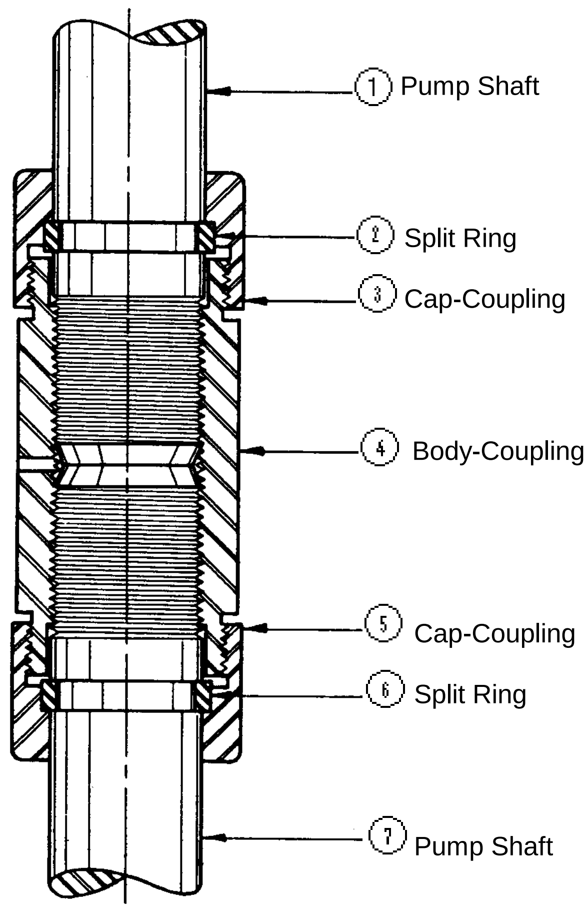


Drawing No. 2625061

Locked Type Shaft Couplings

NOTE: This coupling must not be used between the shaft extension of a VSS driver and the pump top shaft. A flanged or spacer coupling must be used at this location.

The primary use of this coupling is to prevent unthreading of lineshaft couplings due to accidental reverse rotation.



Drawing No. 2805075

General Bowl Assembly Information and Data

Standard First Stage Price Includes:

Cast iron-enameled top bowl, with bronze bearings, bronze impellers, steel impeller collets, cast iron suction casing with extra long bronze bearings and neoprene/steel core lateral bowl rings (Group A), 416 SS impeller shaft, adapted for Peerless Pump standard column.

Standard Additional Stage Includes:

Cast iron-enameled standard bowl with dual bearings bronze and neoprene rubber (Group A) or all bronze bearings (Group B), bronze impeller, steel impeller collets, neoprene/steel core lateral bowl ring (Group A) and additional 416SS shaft length.

Data Required With Order
Maximum total head.
Maximum capacity in GPM.
Driver Full Load Speed (rpm)
Well diameter

Where special adaptation is required to column other than Peerless Pump standard, the following data must also be included with the order.
Column size.
Column threading.
Column tube stick-up.
Shaft stick-up.

The hydraulic guarantee is limited to clear water, 80° F or less.
Standard construction with neoprene bearings is mechanically limited to 131° F.

Group Construction Code	A	B	C	D	E	F
Part Description	**Standard ①**	**Standard Industrial ①**	**All Iron with Iron Sleeve Bearings②**	**Cast Iron Bowls & 316 SS Impellers**	**Cast Iron Bowls & Ni-Resist Impellers**	**Bronze Bowls & Bronze Impellers**
Coupling Shaft Enclosed Line Shaft (ELS)	ASTM A108 Grade 1215	ASTM A108 Grade 1215	ASTM A108 Grade 1215	ASTM A276 Type 316	ASTM A276 Type 410	ASTM A276 Type 410
Coupling Shaft Open Line Shaft (OLS)	ASTM A276 Type 410	ASTM A276 Type 410	ASTM A276 Type 410	ASTM A276 Type 316	ASTM A276 Type 410	ASTM A276 Type 410
Impeller Shaft	ASTM A582 Condition T	ASTM A582 Condition T	ASTM A582 Condition T	ASTM A276 Type 316	ASTM A582 Condition T	ASTM A582 Condition T
Top Bowl	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	*(Top Std Bowl Furnished)*
Top Std Bowl	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM B584 C83600 Bronze
Standard Bowl	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM A48 Cl. 30 Enameled	ASTM B584 C83600 Bronze
Suction Casing Threaded	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM B584 C83600 Bronze
Suction Bell Casing	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM B584 C83600 Bronze
Suction Casing Plug	ASTM A126 Class B	ASTM A126 Class B	ASTM A126 Class B	ASTM A126 Class B	ASTM A126 Class B	ASTM A743 Grade CF-8M
Impeller (Peerless Pump Standard Bronze varies by hydraulic selection; verify using RAPID)	ASTM B584 C83600 or ASTM B148 C95200 Bronze	ASTM B584 C83600 or ASTM B148 C95200 Bronze	ASTM A48 Class 30	ASTM A743 Grade CF-8M	ASTM A436 Type 1	Bronze ASTM B584 C83600
Impeller Collets	ASTM A108 Grade 1215	ASTM A108 Grade 1215	ASTM A108 Grade 1215	ASTM A276 Type 316	ASTM A582 Type 303	ASTM A582 Type 303
Top Bowl Bearing	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM A159 Grade G1800 ②	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200
Top Std Bowl Bearing	ASTM B584 Alloy C93200 & Neoprene	ASTM B584 Alloy C93200	ASTM A159 Grade G1800 ②	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200
Standard Bowl Bearing	ASTM B584 C93200 & Neoprene	ASTM B584 Alloy C93200	ASTM A159 Grade G1800 ②	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200
Suction Casing Bearing	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM A159 Grade G1800 ②	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200
Caps Screws Or Studs and Nuts For Bowl Flanges	ASTM A449 Grade 5	ASTM A449 Grade 5	ASTM A449 Grade 5	ASTM A449 Grade 5	ASTM A449 Grade 5	ASTM A582 Condition A
Lateral Bowl Ring	Neoprene with Steel Core	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	Not Furnished	Not Furnished
Sand Collar	ASTM A108 Grade 1215	Not Furnished	Not Furnished	Not Furnished	Not Furnished	Not Furnished
Sand Collar Set Screw	ASTM A582 Type 303	Not Furnished	Not Furnished	Not Furnished	Not Furnished	Not Furnished
Upper Tube Bearing	ASTM B584 C83600 Bronze	ASTM B584 C83600 Bronze	Not Furnished	ASTM B584 C83600 Bronze	ASTM B584 C83600 Bronze	ASTM B584 C83600 Bronze
Lower Tube Bearing	ASTM B584 C83600 Bronze	ASTM B584 C83600 Bronze	Not Furnished	ASTM B584 C83600 Bronze	ASTM B584 C83600 Bronze	ASTM B584 C83600 Bronze
Top Bearing Adapter	Steel	Steel	Steel	Steel	Steel	Steel
Reducing or Increasing Bearing Adapter	ASTM A48 Class 30	ASTM A48 Class 30	Not Furnished	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30
Column Adapter Straight Type	Steel	Steel	Steel	Steel	Steel	Steel
Reducing or Increasing Column Adapter	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	Not Furnished
Suction Adapter Straight Type	Steel	Steel	Steel	Steel	Steel	Steel
Reducing or Increasing Suction Adapter	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30	ASTM A48 Class 30

Notes:
① 4LE 6HXB, 7HXB, 8HXB, 8MFH and 10MFH impellers are available in ASTM B584 C83600 Bronze only.
② At factory option ASTM B584 C93200 Bronze bearings may be substituted for ASTM 159 Grade G1800 Cast Iron Bearings when pumping hydrocarbons.

Continued on page 2.01 of Section 125

Group Construction Code	**G**	**H**	**J**	**K**	**L**	**M**
Part Description	**All Zinc less ASTM B30 Bronze Bowls & Impellers**	**Zinc less ASTM B30 Bowls & 316 S. S. Impellers**	**Cast Steel Bowls & Bronze Impellers**	**Cast Steel Bowls & 410 S. S. Impellers** ①	**12% Cr. Steel Bowls & 12% Cr. Steel Impellers** ①	**304 S. S. Bowls & 304 S. S. Impellers**
Coupling Shaft	ASTM A582 Type 303	ASTM A276 Type 316	ASTM A276 Type 410	ASTM A276 Type 410	ASTM A582 Type 303	ASTM A582 Type 303
Impeller Shaft	ASTM A276 Type 316	ASTM A276 Type 316	ASTM A582 Condition T	ASTM A582 Condition T	ASTM A582 Condition T	ASTM A582 Type 303
Top Bowl	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*
Top Std Bowl	ASTM B30	ASTM B30	ASTM A216 Grade WCB	ASTM A216 Grade WCB	ASTM A743 Grade CA-15	ASTM A743 Grade CF-8
Standard Bowl	ASTM B30	ASTM B30	ASTM A216 Grade WCB	ASTM A216 Grade WCB	ASTM A743 Grade CA-15	ASTM A743 Grade CF-8
Suction Casing Threaded	ASTM B30	ASTM B30	ASTM A216 Grade WCB	ASTM A216 Grade WCB	ASTM A743 Grade CA-15	ASTM A743 Grade CF-8
Suction Bell Casing	ASTM B30	ASTM B30	ASTM A216 Grade WCB	ASTM A216 Grade WCB	ASTM A743 Grade CA-15	ASTM A743 Grade CF-8
Suction Casing Plug	ASTM A276 Grade CF-8M	ASTM A276 Grade CF-8M	By Application	By Application	By Application	By Application
Impeller	ASTM B30	ASTM A743 Grade CF-8M	ASTM B584 Alloy C83600	ASTM A743 Grade CA-15	ASTM A743 Grade CA-15	ASTM A743 Grade CF-8
Impeller Collets	ASTM A582 Type 303	ASTM A276 Type 316	ASTM A108 Grade 1215	ASTM A582 Type 303	ASTM A582 Type 303	ASTM A582 Type 303
Top Bowl Bearing	ASTM B584	ASTM B584	Not Furnished	Not Furnished	Not Furnished	Not Furnished
Top Std Bowl Bearing	ASTM B584 Alloy C93800	ASTM B584 Alloy C93800	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200
Standard Bowl Bearing	ASTM B584 Alloy C93800	ASTM B584 Alloy C93800	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200
Suction Manifold Bearing	ASTM B584 Alloy C93800	ASTM B584 Alloy C93800	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200
Caps Screws Or Studs and Nuts For Bowl Flanges	ASTM A582	ASTM A582	ASTM A449 Grade 5	ASTM A449 Grade 5	ASTM A582 Condition A	ASTM A582 Condition A
Lateral Bowl Ring	Not Furnished					
Sand Collar	Not Furnished					
Sand Collar Set Screw	Not Furnished					
Upper Tube Bearing	ASTM B30	ASTM B30	Open Line Shaft Construction Is Recommended Refer to the factory for Enclosed Line Shafting			
Lower Tube Bearing	ASTM B30	ASTM B30				
Top Bearing Adapter	ASTM A582 Type 303	ASTM A582 Type 303				
Reducing or Increasing Bearing Adapter	ASTM B30	ASTM B30				
Column Adapter Straight Type	Not Furnished (Flanged Column Standard)					
Reducing or Increasing Column Adapter	Not Furnished (Flanged Column Standard)					
Suction Adapter Straight Type	ASTM B30	ASTM B30	Bell Type Suction is Standard			
Reducing or Increasing Suction Adapter	ASTM B30	ASTM B30	Threaded Type Suction Casing is Optional at Additional Cost			

Notes:

① Castings will be ASTM A743 Grades CA15 or CA6NM at factory option.

Continued on page 2.02 of Section 125

VERTICAL TURBINE PUMPS
Materials of Construction

Peerless Pump Company
Indianapolis, IN 46207-7026

Group Construction Code	N	P	Q	R	S	U	V
Part Description	**Ni-Resist Bowls & Ni-Resist Impellers**	**Ni-Resist Bowls & 304 S. S. Impellers**	**28-9 S. S. Bowls & 28-9 S. S. Impellers**	**316 S. S. Bowls & 316 S. S. Impellers**	**20 S. S. Bowls & 20 S. S. Impellers**	**Monel Bowls & Monel Impellers**	**Ni-Al-Bronze Bowls & Ni-Al-Bronze Impellers**
Coupling Shaft	ASTM A582 Type 303	ASTM A582 Type 303	ASTM A276 Type 316	ASTM A276 Type 316	ASTM B473 Alloy N08020	K Monel	ASTM A276 S21800 Cond A
Impeller Shaft	ASTM A582 Type 303	ASTM A582 Type 303	ASTM A276 Type 316	ASTM A276 Type 316	ASTM B473 Alloy N08020	K Monel	ASTM A276 S20910 XM-19
Top Bowl	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*	*(Top Std Bowl Furnished)*
Top Std Bowl	ASTM A436 Type 2	ASTM A436 Type 2	ASTM A743 Grade CE-30	ASTM A743 Grade CF-8M	ASTM A743 Grade CN-7M	ASTM A494 Grade M-35-1	ASTM B148 Alloy C95800
Standard Bowl	ASTM A436 Type 2	ASTM A436 Type 2	ASTM A743 Grade CE-30	ASTM A743 Grade CF-8M	ASTM A743 Grade CN-7M	ASTM A494 Grade M-35-1	ASTM B148 Alloy C95800
Suction Casing Threaded	ASTM A436 Type 2	ASTM A436 Type 2	ASTM A743 Grade CE-30	ASTM A743 Grade CF-8M	ASTM A743 Grade CN-7M	ASTM A494 Grade M-35-1	ASTM B148 Alloy C95800
Suction Bell Casing	ASTM A436 Type 2	ASTM A436 Type 2	ASTM A743 Grade CE-30	ASTM A743 Grade CF-8M	ASTM A743 Grade CN-7M	ASTM A494 Grade M-35-1	ASTM B148 Alloy C95800
Suction Casing Plug	By Application	By Application	By Application	By Application	By Application	By Application	ASTM A743 Grade CF-8M
Impeller	ASTM A436 Type 2	ASTM A743 Grade CF-8	ASTM A743 Grade CE-30	ASTM A743 Grade CF-8M	ASTM A743 Grade CN-7M	ASTM A494 Grade M-35-1	ASTM B148 Alloy C95800
Impeller Collets	ASTM A582 Type 303	ASTM A582 Type 303	ASTM A276 Type 316	ASTM A276 Type 316	ASTM B473 Alloy N08020	K Monel	ASTM A276 Type 316
Top Bowl Bearing	Not Furnished						
Top Std Bowl Bearing	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584	Graphitar #80 or equal	ASTM B584 Alloy C93200	ASTM B584
Standard Bowl Bearing	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584	Graphitar #80 or equal	ASTM B584 Alloy C93200	ASTM B584
Suction Manifold Bearing	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584 Alloy C93200	ASTM B584	Graphitar #80 or equal	ASTM B584 Alloy C93200	ASTM B584
Caps Screws Or Studs & Nuts For Bowl Flange	ASTM A582	ASTM A582	ASTM A276 Type 316	ASTM A276 Type 316	ASTM B473 Alloy N08020	ASTM B164	ASTM A276 Type 316
Lateral Bowl Ring	Not Furnished						
Sand Collar	Not Furnished						
Sand Collar Set Screw	Not Furnished						
Upper Tube Bearing	Not Applicable in OLS Design						
Lower Tube Bearing	Open Line Shaft Construction Is Recommended						
Top Bearing Adapter	Refer to the factory for Enclosed Line Shafting						
Reducing or Increasing Bearing Adapter	Not Applicable in OLS Design						
Column Adapter Straight Type	Not Furnished (Flanged Column Standard)						
Reducing or Increasing Column Adapter	Not Furnished (Flanged Column Standard)						
Suction Adapter Straight Type	Bell Type Suction is Standard						
Reducing or Increasing Suction Adapter	Threaded Type Suction Casing is Optional at Additional Cost						

Subject to change without notice

Blank

VERTICAL TURBINE PUMPS
Bowls

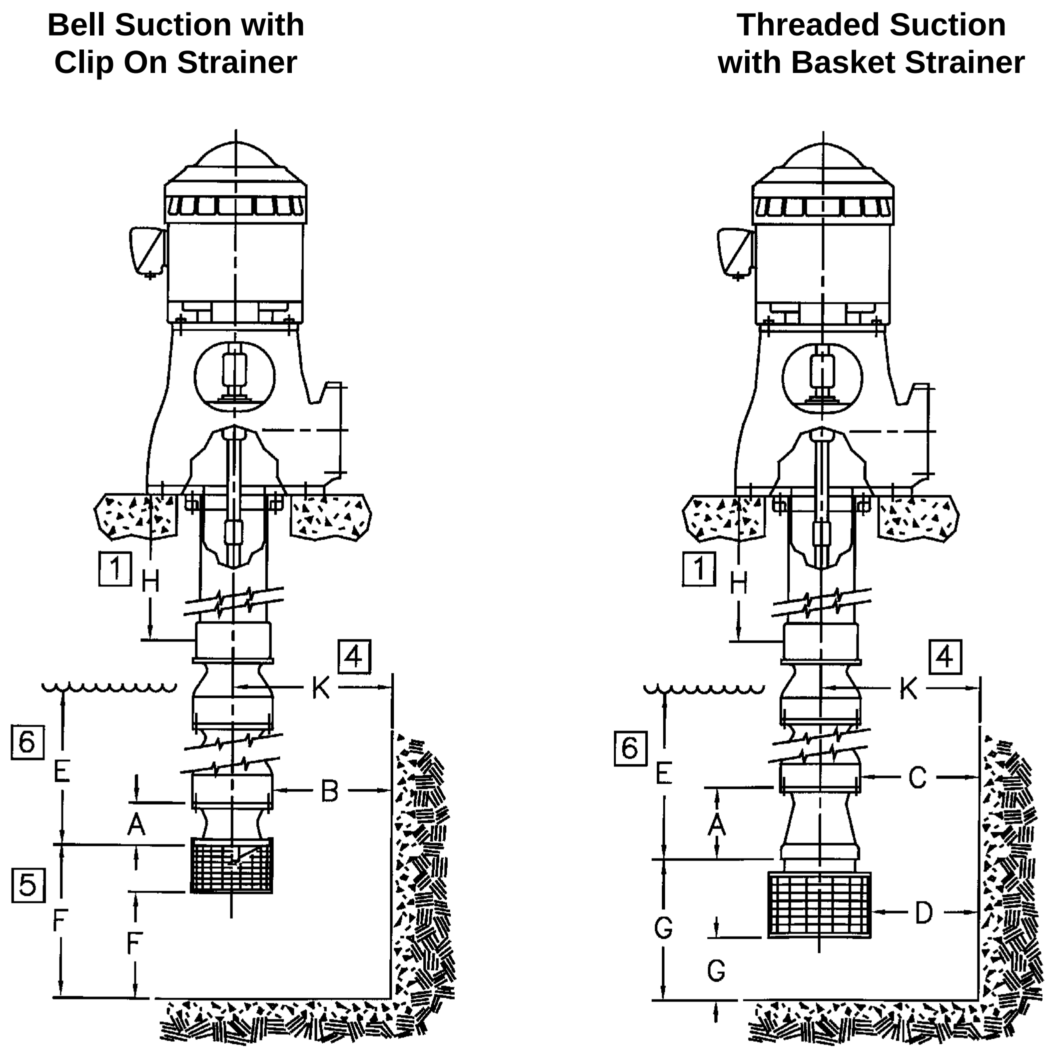


Figure 1.1

1	Minimum length of column to allow for placement of coupling between top shaft and impeller shaft.
2	Sump clearance dimensions (distance to wall) are based on threaded column sizes shown. Column to bowl combinations not listed must be referred to factory.
3	Sump wall clearance dimensions shown are minimum - for maximum, based on flow rates above 3000 gpm, see Section 133 pages 31 through 34.
4	"K" dimension (pump centerline to wall) has been adjusted for largest component to maintain minimum wall clearance (B,C or D) for each type of pump assembly.
5	For bell suctions (less strainer) with hub extended below bell, "F" dimension allows for 2.00" minimum clearance below hub.
6	"E" dimension positions liquid level above first impeller for priming considerations only. Minimum safe operating submergence must be determined from NPSH and vortex considerations. In many cases this will be greater than "E".

See *Dimensional Table for specific* dimensions located on page 3 of Section *125*

Subject to change without notice

VERTICAL TURBINE PUMPS
Bowls Data

Open Line Shaft Standard Construction

Refer to the factory for oil lube construction on close coupled pumps
GENERAL DIMENSIONS: All dimensions are in inches unless otherwise noted

Pump Bowl Size	H Disch. Head to Top Bowl		Col. Size [2]	RECOMMENDED SUMP CLEARANCE [3]												E [6] Min. Submergence for Priming		A Eye of Impeller to Bottom of Suction	
				Threaded Suction						Bell Suction									
				Without Strainer			With Strainer			Without Strainer			With Strainer						
	Std.	Min. [1]		C	K	G	D	K	G	B	K	F	B	K	F	Thd. Suct.	Bell Suct.	Thd. Suct.	Bell Suct.
6LB	18	18	4	1	4.00	4.5	1	5	2.0	1.0	4.00	4.50	1.5	4.50	2.0	9.00	6.50	6.50	4.50
6MA	18	18	4	1	4.00	3.0	1	5	2.0	1.0	4.00	3.00	1.5	4.50	2.0	12.00	8.50	8.94	4.12
6HXB	18	18	4	1	4.00	4.0	1	5	2.0							11.00		7.69	
7LB	18	8	5	1	4.50	4.5	1	6	2.0	1.0	4.50	4.50	1.5	5.00	2.0	12.00	8.00	11.50	7.00
7HXB	18	8	5	1	4.50	4.0	1	6	2.5							12.00		9.00	
8LB	18	8	5	1	5.00	5.0	1	6	2.5	1.0	5.00	5.00	1.5	5.50	2.0	10.50	8.00	8.25	5.38
8MA	18	8	6	1	5.00	5.0	1	6	2.5	1.0	5.00	5.00	1.5	5.50	2.0	13.00	10.75	12.12	5.38
8HXB	18	8	6	1	5.00	5.0	1	6	2.5							11.38		9.31	
8HDX	18	8	6	1	5.00	5.0	1	6	2.5							13.25		9.69	
8MFH	18	8	6	1	5.00	5.0	1	6	2.5							9.06		7.62	
9LA	18	8	6	1	5.50	5.0	1	6	2.5	1.5	6.00	5.00	2.0	6.50	2.5	15.00	10.50	12.31	6.50
10LB	18	8	6	1	6.00	5.5	1	6	2.5	1.0	6.00	5.75	1.5	6.50	2.5	14.38	8.56	11.50	7.00
10MA	18	9	6	1	6.00	5.0	1	7	2.5	1.5	6.50	5.00	1.5	6.50	2.5	14.00	10.00	12.31	6.00
10HXB	18	9	8	1	5.75	4.5	1	10	3.5	1.0	5.75	4.50	1.5	6.25	2.5	14.00	12.50	11.38	6.62
10HH	18	9	8	1	6.00	7.5	1	7	3.0	1.5	6.50	7.50	2.0	7.00	3.0	16.50	9.75	13.12	6.44
10HHA	18	9	8	1	6.00	7.5	1	7	3.0	1.5	6.50	7.50	2.0	7.00	3.0	16.44	9.69	13.19	6.88
10MFH	18	9	8	1	6.00	6.0	1	7	3.0	1.5	6.00	5.25	2.0	6.50	3.0	10.50	6.88	8.50	4.88
11MB	18	10	8	1	6.75	6.0	1	7	3.0							17.00		13.25	
12LD	18	9	8	1	7.00	6.0	1	7	3.0	1.0	7.00	6.00	1.5	7.50	3.0	13.25	10.88	9.00	6.50
12LDT	18	12	6	1	7.00	5.0	1	7	2.5	1.0	7.00	6.00	1.5	7.50	2.5	14.19	9.19	11.88	6.88
12MB	18	9	8	1	7.00	6.0	1	10	3.5	1.0	7.00	6.00	1.5	7.50	3.0	16.00	9.75	14.00	5.75
12HXB	18	10	10	1	7.00	6.5	1	10	4.5	1.0	7.00	5.50	1.5	7.50	3.0	16.00	13.25	13.12	6.69
12HXH	18	10	10	1	6.75	8.0	1	10	4.5	2.5	8.25	8.00	2.5	8.25	3.5	17.00	10.00	13.94	6.19
12HD	18	18	10	1	7.25	6.5	1	10	4.5							17.00		12.75	
14LD	18	10	10	1	8.00	6.5	1	10	4.5	1.0	8.00	6.50	2.0	8.75	3.5	14.88	11.88	10.00	7.00
14MC	18	10	10	1	8.00	6.5	1	10	4.5	1.0	8.00	6.50	1.5	8.50	3.5	16.62	11.88	12.62	7.88
14MD	18	10	10	1	8.00	6.5	1	10	4.5	1.0	8.00	5.50	1.5	8.50	3.5	18.00	12.50	13.38	8.00
14HXB	18	10	10	1	8.00	6.5	1	10	4.5	1.0	8.00	6.50	1.5	8.50	3.5	18.00	9.19	13.44	4.75
14HH	18	10	12	1	8.00	7.5	1	10	4.5	1.5	8.50	7.50	2.0	9.00	4.0	18.00	11.00	11.25	6.75
15LC	18	10	10	1	8.75	7.5	1	10	4.5							17.00		12.38	
15MA	18	10	10	1	8.75	8.0	1	10	4.5	1.0	8.75	8.00	1.5	9.25	4.0	18.00	11.00	13.06	6.38
16MC	18	11	12	1	8.75	7.0	1	11	5.0	1.0	8.75	7.25	1.0	8.75	3.5	17.62	12.75	12.44	11.25
16HXB	18	11	14	1	8.75	7.5	1	11	5.0	1.0	8.75	7.75	1.5	9.25	4.0	19.00	11.00	14.25	6.38
16HH	18	11	14	1	8.75	9.0	1	11	5.0	2.5	10.25	9.00	3.0	10.75	4.5	21.00	11.00		5.06

See Figure 1.1 for dimensional locations and additional notes located on page 2.2 of Section 125

GENERAL DIMENSIONS

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Bowl Model	Length of One Stage Bowl Unit								Lgth. Each Add'l Stage	Bowl O.D. [5] [6]		Suction Bell	
	L1	L2	L3 OLS ONLY [12]	L4	L5	L6	L7 [11] OLS ONLY [12]	L8 [11] OLS ONLY [12]		Nom. as Cast	Turned O.D. [2]	Bell O.D.	Hub Stick [3] Down
4LE [4]	12.62	FOR 2.50 OLS COLUMN ONLY					-	-	3.50	-	3.75	-	-
4LE [4]	14.00	FOR 3.00 OLS COLUMN ONLY					-	-	3.50		3.75 [9]	-	-
6LB [1] [4]	-	14.88	-	-	11.16	-	-	-	4.88	5.88	5.62	5.31	2.31
6LB [4]	14.88	-	-	11.16	-	-	-	-	4.88	5.88	5.62	5.31	2.31
6MA [4]	17.88	-	-	13.06	-	-	-	-	4.88	5.88	5.62	5.62	0.50
6HXB [4]	15.25	-	-		-	-	-	-	4.69	5.88	5.62		
7LB [4]	20.00	-	-	16.00	-	-	-	-	5.81	7.00	-	6.19	2.50
7HXB [4]	18.38	-	-		-	-	-	-	5.56	7.00	-	-	-
8LB	18.66	-	14.91	13.94	-	10.19	-	-	6.31	7.81	7.56	7.09	2.88
8MA	22.50	-	15.12	13.38	-	8.75	-	-	5.75	7.75	7.50	7.50	3.25
8HXB [4]	20.62	-	-	-	-	-	-	-	5.94	7.75	7.50	-	-
8HDX [4]	-	27.94	-	-	-	-	-	-	8.88	8.38	8.19	-	-
8MFH [4]	-	18.88	-	-	-	-	-	-	6.12	7.75	7.50	-	-
9LA	23.38	-	19.75	17.56	-	13.94	-	-	7.44	8.81		9.50	0.38
10LB	24.56	-	20.56	19.25	-	15.25	21.75	16.44	8.25	9.75	9.50	9.25	3.69
10MA	23.12	-	19.81	16.81	-	13.50	21.00	14.69	7.50	9.75	9.50	10.00	0.38
10HXB	23.50	-	18.88	16.94	-	12.31	20.06	13.50	7.50	9.44		9.25	1.56
10HH	27.50	-	23.12	20.75	-	16.38	24.31	17.56	9.88	9.75	9.50	10.62	5.31
10HHA	27.50	-	23.12	20.75	-	16.38	24.31	17.56	9.88	9.75	9.50	10.62	4.88
10MFH [4]	-	21.50	-	-	17.88	-	-	-	7.25	9.69	9.44	9.38	3.88
11MB	-	34.12	24.75	-	-	-	26.00	-	10.50	11.25	-	-	-
12LD	26.75	-	22.25	24.31	-	19.81	23.50	21.06	11.50	11.75	-	11.69	2.38
12LDT	-	29.06	21.00	-	24.06	16.00	21.94	16.94	9.00	11.62	-	11.50	3.00
12MB	27.81	-	23.50	19.56	-	15.25	24.75	16.50	9.50	11.75	11.50 [7]	11.50	0.12
12HXB	27.44	-	22.44	17.94	-	12.94	23.94	14.44	9.31	11.75	11.50 [9]	10.91	0.81
12HXH	29.81	-	25.38	22.00	-	17.44	26.88	18.94	11.44	11.50 [7]	-	14.00	5.62
12HD	29.75	-	25.50	-	-		27.00		11.75	12.25	-	-	-
14LD	31.06	-	25.31	28.00	-	22.25	26.37	23.31	13.00	13.56	-	13.38	3.19
14MC	30.00	-	26.12	25.25	-	21.38	27.18	22.44	12.62	13.62	-	13.00	4.31
14MD	-	36.75	27.75	-	31.25	22.25	-	-	13.25	14.38	-	14.00	3.50
14HXB	28.00	-	24.44	19.19	-	15.62	-	-	11.00	13.62	-	13.00	2.25
14HH	34.75	-	28.12	27.31	-	20.69	-	-	13.88	14.00 [8]	-	15.00	5.31
15LC	-	36.38	27.44	-	-		-	-	13.44	15.44	-	-	-
15MA	-	34.06	26.25	-	27.94	19.00	-		11.75	15.25	-	15.00	5.75
16MC	33.50	-	28.00	27.88	-	22.38	-	-	14.50	15.50	-	13.75	5.19
16HXB	33.50	-	27.38	25.75	-	19.62	-	-	12.12	15.25	-	15.00	5.62
16HH-OLS	-	-	31.25 [10]	-	-	22.38	33.25	24.38	15.50	15.75	-	17.88	6.69
16HH-ELS	-	43.12	-	-	34.25	-	-	-	15.50	15.75	-	17.88	6.69

[1] A discharge case is used with 3.00 OLS column only. 3.00 ELS is not available with a 6LB bowl unit.

[2] Bowls will be supplied turned to these dimensions only when specified on order. Some bowls are stocked turned to these dimensions in cast iron material only (refer to factory for specifics) all other bowl materials will be furnished in "as cast" dimensions.

[3] Hub stick-down includes pipe plug.

[4] These models have threaded connected bowls and are not normally used with flanged column.

[5] These bowl O.D. dimensions do not include bell diameter of suction bell which in some cases are larger.

[6] Increasing column adapter may exceed bowl unit O.D. except for 6LB, 6HXB, 8LB, 15LC, & 15MA.

[7] 12MB & 12HXH suction cases for 10.00 suction pipe are 11.75 dia. However, if requested & no suction pipe is used the dia. can be turned to 11.50.

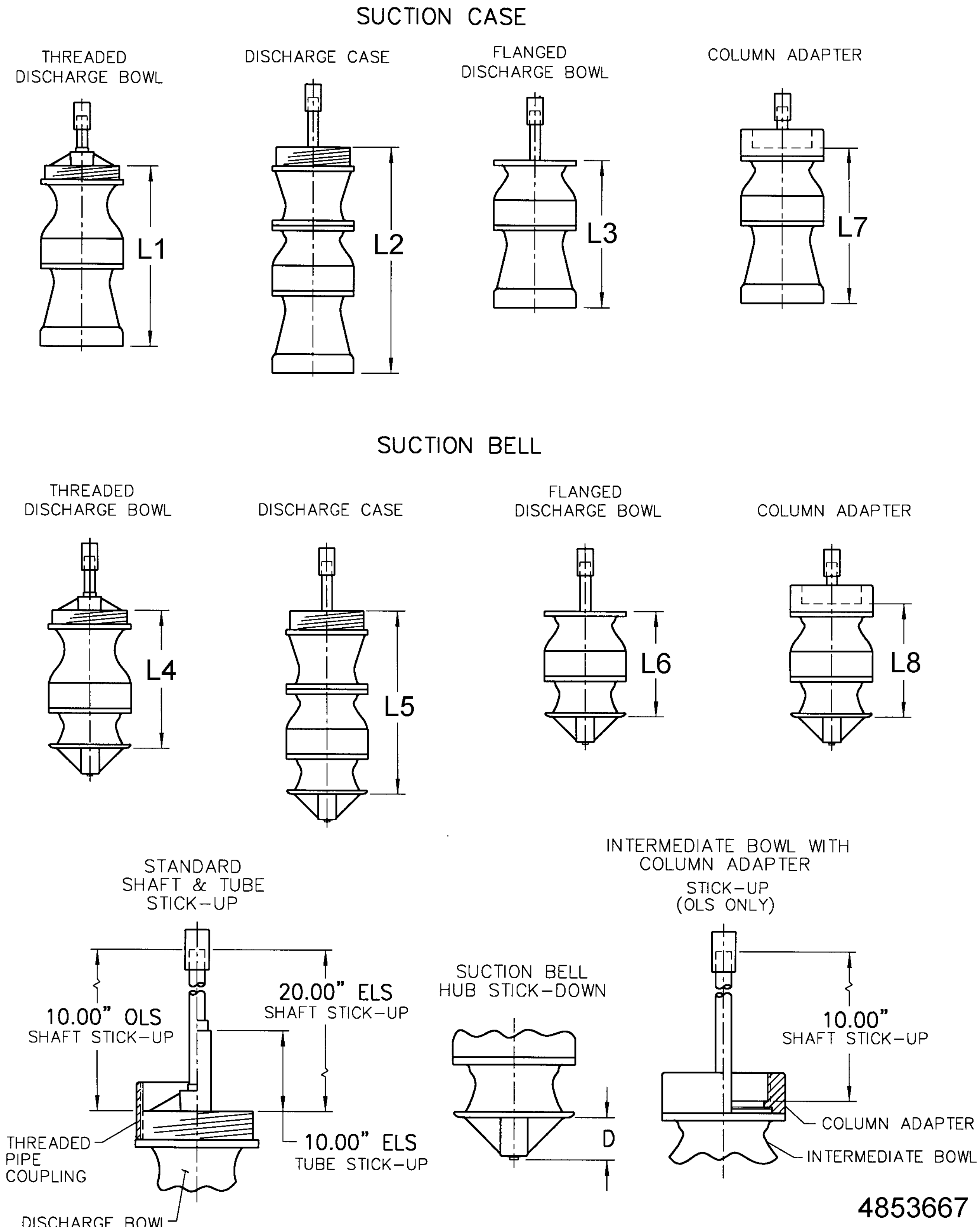
[8] The nominal "as cast" O.D. for 14HH items are: threaded discharge bowl 13.88 dia., intermediate bowl 13.75 dia, & suction case 14.00 dia.. The suction case can be machined to 13.88 dia. if requested & no suction pipe is used.

[9] Straight steel column &/or suction pipe couplings exceeds bowl O.D.. Couplings can be turned to a smaller diameter. When required, refer to factory for actual diameter & cost.

[10] For 16HH OLS threaded column construction add 2.00 for flange adapter.

[11] Column adapters are available only for the nominal column pipe size as shown in section 125, page 5 table.

[12] Maximum length of first column shaft and maximum spacing of first line shaft bearings above the pump must be 5 feet when flanged discharge bowl or intermediate bowl to flanged column and intermediate bowl with column adapter to threaded column constructions are used.


SUCTION CASE
THREADED DISCHARGE BOWL
L1
DISCHARGE CASE
L2
FLANGED DISCHARGE BOWL
L3
COLUMN ADAPTER
L7
SUCTION BELL
THREADED DISCHARGE BOWL
L4
DISCHARGE CASE
L5
FLANGED DISCHARGE BOWL
L6
COLUMN ADAPTER
L8
STANDARD SHAFT & TUBE STICK-UP
10.00" OLS SHAFT STICK-UP
20.00" ELS SHAFT STICK-UP
10.00" ELS TUBE STICK-UP
THREADED PIPE COUPLING
DISCHARGE BOWL
SUCTION BELL HUB STICK-DOWN
D
INTERMEDIATE BOWL WITH COLUMN ADAPTER
STICK-UP (OLS ONLY)
10.00" SHAFT STICK-UP
COLUMN ADAPTER
INTERMEDIATE BOWL
4853667

Blank

APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Bowl Unit Size	Type	Max. Size of Column less Than Bowl Dia.	Column Pipe (All Top Bowls & Discharge Casings have Butt Threads)			Suction Pipe (Butt pipe threads except where noted) (3)		Std Dia. of Impeller Shaft (5 d.)	Column Shaft Size		Nominal Size of Oil Tubing		Maximum Working Pressure of Bowl Psi (5)	
		Std Pipe Actual Pipe O. D.	Min.	Nom.	Max.	Min.	Max.	(Ref. to Fact. for Avail. of	Min.	Max.	Min.	Max.	Cl. 30 C.I.	High Strength Ductile Iron
4	LE	3 (1)	2.5	2.5-3	3	2.5	2.5	0.750	0.750	1.000	N.A.	N.A.	368	N.A.
6	LB	4	3	4	5	4	4	0.875	0.750	1.000	1.25	1.50	627	714
6	MA	4	4	4	5	4	4	0.880	0.750	1.000	1.25	1.50	606	708
6	HXB	4	4	4	5	4	4	0.880	0.750	1.000	1.25	1.50	346	399
7	LB	5	4	5	6	5	5	1.000	0.750	1.188	1.25	2.00	410	478
7	HXB	5	4	5	6	5	5	1.000	0.750	1.188	1.25	2.00	410	477
8	LB	6	4	5	6	5	5	1.188	0.750	1.500	1.25	2.50	390	622
8	MA	6	5	6	8	6	6	1.188	0.750	1.500	1.25	2.50	627	766
8	HXB	6	5	6	8	6	6	1.188	0.750	1.500	1.25	2.50	550	671
8	HDX	6	5	6	8	6	6	1.500	1.188	1.688	2.00	2.50	-	750 (D.I. Std)
8	MFH	6	5	6	8	6	6	1.188	1.188	1.500	1.25	2.50	321	-
9	LA	6	5	6	8	6	6	1.188	0.750	1.500	1.25	2.50	390	471
10	LB	8	5	6	8	6	6	1.188	0.750	1.500	1.25	2.50	325	400
10	MA	8	5	6	8	6	8	1.188	0.750	1.500	1.25	2.50	497	765
10	HXB	8	8	8	10	8	10	1.500	1.000	1.938	1.50	3.00	368	452
10	HH	8	8	8	10	8	8	1.500	1.000	1.938	1.50	3.00	346	446
10	HHA	8	8	8	10	8	8	1.500	1.000	1.938	1.50	2.50	300	385
10	MFH	8	8	8	10	8	8	1.500	1.000	1.938	1.50	3.00	241	-
11	MB	8	8	8	10	8	8	1.938	1.500	2.188	2.50	3.50	497	612
12	LD	10	6	8	10	8	8	1.500	1.000	1.688	1.50	3.00	385	498
12	LDT	8	5	6	8	6	6	1.500	1.000	1.688	1.50	2.50	255	312
12	MB	8	8	8	10	8	10	1.500	1.000	1.938	1.50	3.00	357	439
12	HXB	10 (2)	8	10	12	10	12	1.500	1.000	1.938	1.50	3.00	433	548
12	HXH	10 (2)	8	10	12	10	10	1.938	1.188	2.188	2.00	3.50	355	433
12	HD	10	8	10	12	10	10	1.938	1.500	2.188	2.50	3.50	540	650
14	LD	10	8	10	12	10	10	1.938	1.500	2.188	2.50	3.50	325	498
14	MC	10	8	10	12	10	12	1.938	1.188	2.188	2.00	3.50	303	366
14	MD	12	10	10	12	12	12	1.938	1.500	2.188	2.50	3.50	365	475
14	HXB	10	10	10	12	10	12	1.938	1.500	2.188	2.50	3.50	295	378
14	HH	12	10	12	14	12	12	1.688	1.188	1.938	2.00	3.00	200	236
15	LC	12	8	10	12	10 (4)	12 (4)	2.188	1.688	2.438	2.50	4.00	475	575
15	MA	12	8	10	12	10 (4)	12 (4)	2.188	1.188	2.438	2.00	4.00	330	422
16	MC	12	10	12	14	12 (4)	14* (4)	1.938	1.188	2.188	2.00	3.50	325	389
16	HXB	14*	12	14*	16*	14* (4)	14* (4)	1.938	1.188	2.188	2.00	3.50	303	366
16	HH (3)	14*	12	14*	16*	14* (4)	14* (4)	1.938	1.188	2.188	2.00	3.50	271	319

NOTES: (1) Max column length for 4LE is 400 ft.

(2) Straight steel column and/or suction pipe couplings exceeds bowl diameter. Couplings can be turned to a smaller diameter. When required, refer to factory for actual diameter and price addition.

(3) 16HH is available for threaded column: OLS 12 & 14 "; ELS 12"

(4) 3/4" taper threads

(5) a. Pressure ratings are for bowls in CL30 C.I. (Groups A thru E) or High Strength Iron Construction. .
THESE ARE MAXIMUM PRESSURES INCLUDING SHUT OFF CONDITIONS. For other materials and/or groups of construc
for limitations consult the factory.

(5) b. Pressure ratings are based on 0° to 150° F. operating temperature range and bowl rings (if used) with standard length and diameter.

(5) c. To change these ratings to HEAD IN FEET of Water multiply by 2.31.

(5) d. Impeller shaft HP carrying capacity must be checked when using upper pressure limits. If not adequate refer to factory for special material or larger diameter shaft.

(5) d. For long pipe column well applications at the deeper settings check bowl lateral requirements.

Impeller Data and Best Lateral Settings off bottom for Maximum Efficiency Bowls - 6 thru 10 Inch

1. Net impeller eye area - square inches.
2. Maximum sphere size that will pass impellers.- inches.
3. WR^2 in Lbs.- IN^2 - (Multiply by number of stages for WR^2 of bowl assembly - Divide by 144 for Lb - FT^2)

GENERAL DIMENSIONS All dimensions are in inches unless otherwise noted

Pump Size	Impeller Number	Net Eye Area IN^2	Sphere Size	WR^2 in Lbs - In	Best Lateral	Impeller Lateral Setting Standard	Impeller Lateral Setting Maximum①
	2616324	3.375	1/4	5.85	1/8	.281	.656
6LB	2618292	3.375	1/8	5.85	1/8	.281	.656
	2616318	3.375	1/8	5.80	1/8	.281	.656
6MA	V850B	5.072	5/16	5.09	1/16	.250	.625
6HXB	2607800	6.891	3/8	7.00	1/8	.281	.656
7LB	2626207	4.890	9/32	12.10	1/8	.500	.875
	2626208	4.890	1/4	12.80	1/8	.375	.750
7HXB	2607926	8.496	7/16	16.70	1/8	.313	.688
	2607921	8.496	1/2	16.70	1/8	.313	.688
8LB	2616464	6.920	1/4	22.30	1/4	.281	.656
	2616465	6.920	3/16	25.80	1/8	.281	.656
8MA	T84229	8.513	1/2	19.30	3/16	.406	.781
	T84234	8.513	7/16	19.30	1/8	.406	.781
8HXB	2616348	10.592	9/16	29.20	1/16	.281	.656
8HDX	4602048	19.380	15/16	55.40	1/16	.875	1.125②
8MFH	2606032	REFER TO FACTORY					
9LA	T84391	9.032	7/16	47.60	1/8	.594	.968
	T84323	9.032	7/16	47.60	1/8	.406	.781
10LB	2625032	9.572	3/8	76.80	1/8	.313	.688
	2625033	9.572	3/8	76.80	1/8	.313	.688
10MA	T84363	12.256	5/8	64.20	1/8	.406	.781
	2624288	12.256	11/16	64.20	1/8	.344	.718
10HXB	T82337	15.954	1/2	82.50	3/16	.313	.688
	T82366	15.954	5/8	82.50	3/16	.313	.688
10HH	2622864	26.121	1/2	60.90	1/16	.469	.843
	2626818	26.121	15/16	63.20	1/16	.500	.875
10HHA	4601873	28.224		100.10		.468	
10MFH	2602101		REFER TO FACTORY				

① Maximum lateral with extra lateral maching.

② Without lateral seal ring and without machining.

Subject to change without notice

Impeller Data and Best Lateral Settings off bottom for Maximum Bowls - 11 thru 16 Inch

1.) Net impeller eye area ---- In^2.

2.) Maximum sphere size that will pass impellers ----- inches.

3.) WR^2 in Lb.- In^2----(Multiply by number of stages for WR^2 of bowl assembly----Divide by 144 for $Lb\text{-}Ft^2$)

GENERAL DIMENSIONS All dimensions are in inches unless otherwise noted

Pump Size	Impeller Number	Net Eye Area In^2	Sphere Size	WR^2 in $Lbs\text{-}In^2$	Best Lateral	Impeller Lateral Setting Standard	Maximum Note 1	Group A without Lateral Seal Ring- No Extra Machining
11MB	2622504	16.687	13/16	118	3/16	.844	1.50	-
12LD	2634820	18.025	7/8	166	1/16	.687	1.25	1.00
	2649365	18.025	7/8	187	1/16	.687	1.25	1.00
12LDT	4602394	15.00	3/4	164	1/8	.75	1.00	1.00
12MB	2624331	17.868	7/8	188	3/16	.406	.844	-
	2626936	17.868	1/2	188	3/16	.625	1.073	-
	2624332	17.868	13/16	188	3/16	.469	.916	-
12HXB	2608100	27.401	7/8	219	1/16	.469	.916	-
	2608379	26.214	5/8	214	1/8	.313	.761	-
	2608368	26.214	3/4	275	1/16	.344	.791	-
12HXH	2629933	32.837	1-1/2	185	1/16	.375	.813	-
12HD	4601450	32.837	29/32	266	1/16	1.500	1.750	1.75
14LD	2634704	22.142	15/16	303	1/16	.938	1.250	-
	2634705	22.142	7/8	303	1/16	.938	1.250	-
14MC	2626082	25.326	1	340	1/16	.625	1.063	-
	2626083	26.053	1	340	1/16	.500	.938	-
14MD	4602279	38.155	1-5/16	504	1/8	.562	.938	-
	4602280	38.155	1-5/16	598	1/8	.562	.938	
14HXB	V4399C	35.152	13/16	305	1/8	.594	1.031	-
	V4400C	35.152	13/16	305	1/8	.594	1.031	-
14HH	2621973	48.029	11/16	450	1/16	.375	.813	-
	2621959	56.190	11/16	472	1/16	.281	.719	-
15LC	2625920	24.049	1-3/16	545	1/8	.906	1.062	-
15MA	2617049	28.161	1	334	1/8	.938	1.062	-
	2617046	28.161	1-1/16	334	1/8	.844	.906	-
16MC	2626756	34.514	1-3/16	741	1/16	.563	1.062	-
	2626757	35.537	1-5/16	684	1/16	.438	.937	-
16HXB	2617216	52.140	3/4	958	1/8	0.72	1.22	1.03
	2617215	52.140	3/4	958	1/8	0.44	0.94	-
	4601399	52.140	1-1/8	641	1/8	0.5	1	-
16HH	2621593	74.9	3/4	900	1/32	.438	.937	-
	2620735	74.9	3/4	1250	1/16	.438	.937	-

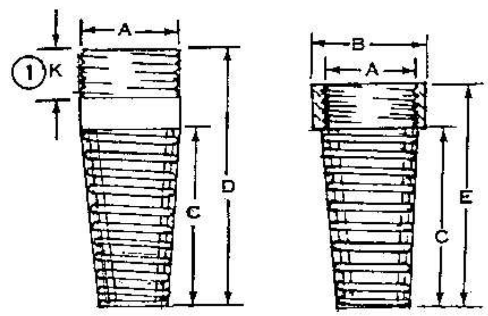
Notes: (1) Maximum lateral with extra lateral machining.

Subject to change without notice

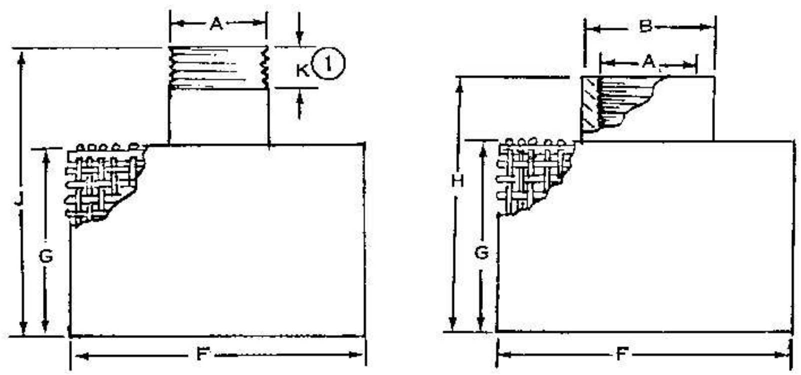
STRAINERS

CONE AND BASKET TYPE FOR THREADED SUCTION MANIFOLDS.

CONE TYPE



BASKET TYPE



(1) THREAD ENGAGEMENT INTO SUCTION MANIFOLD.

DIMENSIONS														
SIZE	A	B	C	D	E	F		G		H		J		K
	THREAD DATA	CPLG OD				STL OR STN STL	BRZ OR BRASS	STL OR STN STL	BRZ OR BRASS	STL OR STN STL	BRZ OR BRASS	STL OR STN STL	BRZ OR BRASS	(1)
2.5"	2.5"-8 THD, BUTT	3.25	9.75	12.75	11.75	6.00	6.00	3.00	5.00	4.50	6.50	6.00	8.00	1.00
3.0"	3.0"-8 THD, BUTT	4.00	9.75	12.75	11.75	6.00	6.00	3.00	5.00	4.50	6.50	6.00	8.00	1.63
4.0"	4.0"-8 THD, BUTT	5.00	9.75	12.75	11.75	8.00	8.00	4.00	5.00	6.00	7.00	7.00	8.00	1.81
5.0"	5.0"-8 THD, BUTT	6.25	10.75	13.75	12.75	10.00	9.00	5.00	5.00	7.00	7.00	8.00	8.00	2.06
6.0"	6.0"-8 THD, BUTT	7.25	13.75	16.75	15.75	10.00	9.00	6.00	7.50	8.00	9.50	9.00	10.50	2.06
8.0"	8.0"-8 THD, BUTT	9.25	20.00	23.00	22.00	12.00	12.00	8.00	10.00	10.00	12.00	11.00	13.00	2.31
10.0"	10.0"-8 THD, BUTT	11.50	27.50	31.50	30.00	18.00	18.00	10.00	10.00	12.50	12.50	14.00	14.00	3.06
12.0"	12.0"-8 THD, BUTT	13.50	29.50	33.50	32.00	18.00	18.00	12.00	12.50	14.50	15.00	16.00	16.50	3.06
14.0"	14.0"-8 THD, 0.75 TAPER	14.625	38.50	42.50	41.50	20.00	20.00	12.00	12.50	15.00	15.50	16.00	16.50	1.81
16.0"	16.0"-8 THD, 0.75 TAPER	16.625	42.50	46.50	45.50	24.00	25.00	12.00	12.50	15.00	15.50	16.00	16.50	2.06

MESH SIZE FOR BASKET STRAINERS	
2.5" THRU 5.0" = .25	10.0" THRU 14.0" = 0.5
6.0" THRU 8" = .38	16.0" = 0.75

SLOT WIDTH FOR CONE STRAINERS
STEEL – ALL SIZES = 0.31
BRONZE – ALL SIZES = 0.25

NOTE: ALL STRAINERS HAVE A NET WATER PASSAGE AREA OF AT LEAST FOUR TIMES PIPE SIZE.

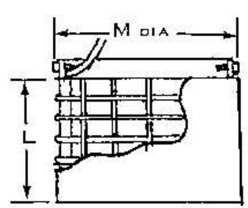
STRAINERS

CLIP ON TYPE FOR BELL TYPE SUCTION MANIFOLDS (3)

Bowls 6.000 thru 16.000 Inch

DIMENSIONS (ALL MATERIALS)							
BOWL SIZE	L	M (2)	MESH SIZE	BOWL SIZE	L	M (2)	MESH SIZE
6 LB	4.750	6.750	0.250	12 LD	9.250	12.938	0.500
6 MA	4.750	6.750	0.250	12 LDT	9.688	12.938	0.500
7 LB	5.500	7.750	0.250	12 MB	9.750	12.875	0.375
8 LB	6.000	8.500	0.250	12 HXB	9.250	12.375	0.500
8 MA	6.000	8.500	0.250	12 HXH	11.625	15.375	0.500
				14 LD	11.000	14.750	0.500
9 MA	8.000	10.875	0.375	14 MC	11.000	14.375	0.500
				14 MD	15.375	15.500	0.500
10 LB	8.000	10.625	0.250	14 HXB	11.000	14.375	0.500
10 MA	8.500	11.375	0.500	14 HH	12.625	16.375	0.500
10 HXB	8.000	10.625	0.250	15 MA	12.625	16.875	0.500
10 HH	9.000	12.000	0.375	16 MC	11.625	15.125	0.500
10 HHA	9.000	12.000	0.375	16 HXB	12.750	16.500	0.500
10 MFH	8.000	10.625	0.250	16 HH	15.000	19.875	0.500

(2) M DIM IS DIA OF STRAINER INCLUDING CLIPS AND/OR SCREWS FOR FASTENING TO SUCTION MANIFOLD. WIRE MESH WILL BE APPROXIMATELY 1/2" TO 1" SMALLER IN DIA.



(3) THE FOLLOWING PUMPS ARE NOT AVAILABLE WITH BELL SUCTION: 6HXB, 7HXB, 8HXB, 8HDX, 8MFH, 11MB, 12HD, 15LC. IF BASKET STRAINER REQUIRED USE THREADED BASKET STRAINER.

OPEN LINE SHAFT STANDARD CONSTRUCTION
General Dimensions All Dimensions Are In Inches Unless Otherwise Noted

Pump Bowl Size		H Disch. Head to Top Bowl Std	H Min ①	Col. Size ⑦	RECOMMENDED SUMP CLEARANCE ③ Threaded Suction Figure A without Strainer C	K	G	with Strainer D	K	G	Bell Type Suction Figure B without Strainer B	K	F	with Strainer B	K	F	E Minimum Submergence for Priming Thd. Suct.	Bell Suct.	A Eye of Impeller to Bottom of Suction Manifold Thd. Suct.	Bell Suct.
18	MA	18	10	12	1.5	10.25	7	1.5	10.5	4.5							20.00		15.25	
18	HXB	18	11	14	1.0	9.50	8	1.0	10.0	5.0	1.0	9.50	8.0	1.5	10.00	4.5	13.75	14.50	11.38	7.00
18	HH	18	11	14							1.5	10.50	10.0	2.0	11.00	5.0		13.88		8.50
20	MA	18	11	14	1.5	11.25	9	1.5	11.5	5.0	1.5	11.25	9.0	1.5	11.25	5.0	18.25	19.75	15.00	10.88
20	HXB	18	11	16	1.5	11.25	9	1.5	14.0	6.0	1.5	11.25	9.0	1.5	11.25	5.0	22.00	14.00	16.00	8.50
20	HH	18	11	16							2.0	12.00	10.0	2.5	13.00	5.0		15.00		6.50
24	MA	18	12	18							1.5	13.50	9.5	1.5	13.50	5.0		16.00		7.00
24	HXB	18	12	18							1.5	12.50	10.5	1.5	12.50	5.0		19.00		10.06
24	HXC	18	12	18							1.5	12.50	10.5	1.5	12.50	5.0		19.00		10.06
24	H H	18	12	18							2.5	13.75	12.0	3.0	14.25	6.0		15.50		7.25
24	HH-OH	18	12	18							2.5	13.75	12.0	3.0	14.25	6.0		15.50		7.25
26	HXB	18	12	20							1.5	14.25	12.0	1.5	14.25	6.0		18.50		8.75
26	HH	18	12	20							2.5	15.75	14.0	3.0	16.25	7.0		17.88		7.94
26	HH-OH	18	12	20							2.5	15.75	14.0	3.0	16.25	7.0		17.88		7.94
27	MA	18	12	20							2.0	15.25	13.5	2.5	15.75	7.0		16.25		9.50
28	HX8	18	12	20							2.0	15.50	13.0	2.0	15.50	7.0		15.75		8.00
30	LA	is	12	20							2.0	17.00	14.5	2.0	17.00	7.0		23.00		15.25
30	HH	18	12	24							3.5	19.50	17.5	4.0	20.00	9.0		14.75		11.25
30	HH-OH	18	12	24							3.5	19.50	17.5	4.0	20.00	9.0		14.75		11.25
32	HXB	18	12	24							2.0	17.50	15.0	2.0	17.50	8.0		20.62		8.62
36	MA	18	12	24							2.0	20.00	16.0	2.0	20.00	8.0		20.50		13.62
36	HXB	18	12	30							2.0	20.00	17.5	2.0	20.00	9.0		24.00		10.19
36	HH	18	12	30							2.5	21.00	19.0	3.0	21.50	10.0		18.12		12.00
36	HH-OH	24	18	30							2.5	21.00	19.0	3.0	21.50	10.0		18.12		12.00
42	HXB .	18	12	30							2.5	23.50	20.0	2.5	23.50	10.0		26.00		10.69
42	HH	RF	RF	RF							RF	RF	RF	RF	RF	RF		RF		RF
48	HXB	18	12	42							3.0	27.00	24.0	3.0	27.00	12.0		31.00		14.56
48	HH	18	12	42							4.5	28.00	25.0	5.0	28.50	13.0		31.00		13.25
48	HH-OH	24		42							4.5	28.00	25.0	5.0	28.50	13.0		31.00		13.25
56	HH	48	36	48							4.5	34.50	30.0	4.0	20.00	9.0		43.25		20.25
56	HH-0H	48	36	48							4.5	34.50	30.0	4.0	20.00	9.0		43.25		20.25
66	HH	RF	RF	RF							RF	RF	RF	RF	RF	RF		RF		RF

① Minimum length of column to allow for placement of coupling between top and impeller shaft.

② Sump clearance dimensions (distance to wall) are based on the column sizes shown and qualified below:
A - Threaded column through 20MA.
B - Flanged column for 20HXB through 66HH.
C - Column to bowl combinations not included in "A" and "B" above must be referred to factory to maintain minimum wall clearance without possible interference.

③ Sump wall clearance dimensions shown are minimum - for maximum, based on flow rates above 3000gpm, see Section 133. pages 31 through 34.

④ "K" dimension (pump centerline to wall) has been adjusted for largest component to maintain minimum wall clearance (B, C or D) for each type of pump assembly.

⑤ For bell type suctions (less strainer) with hub extending below bell, "F" dimension allows for a 2" minimum clearance below hub.

⑥ E" dimension positions liquid level above first impeller for priming consideration only. Minimum safe operating submergence must be determined from NPSH and vortex considerations. In many cases this will be greater than "E".

Fig. A

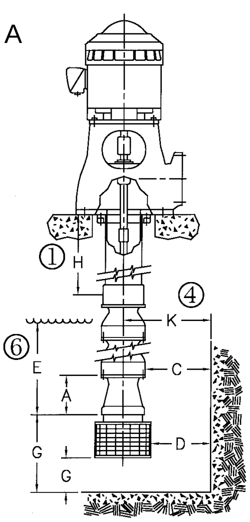
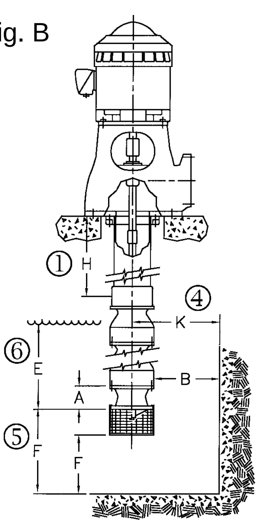


Fig. B



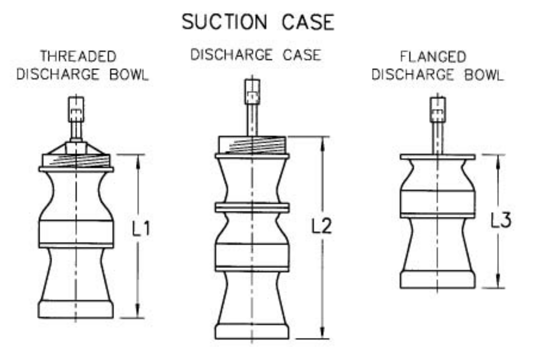
Subject to change without notice

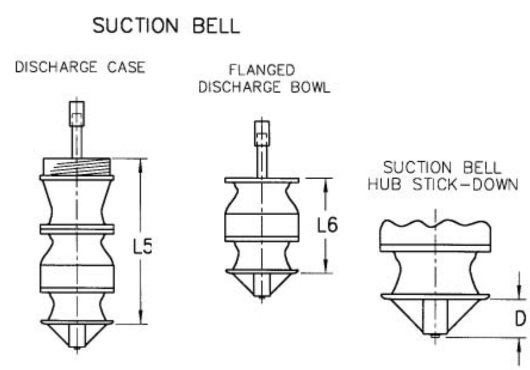
VERTICAL TURBINE PUMPS
Bowl Assemblies

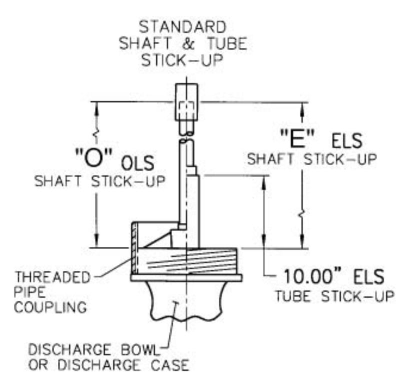
Peerless Pump Company
Indianapolis, IN 46207-7026

General Dimensions All Dimensions Are In Inches Unless Otherwise Noted

Bowl Model	Length. Each Add'l Stage	**O** OLS Stick-Up	**E** ELS Stick-Up	Bowl O.D. [1] [2] Nominal as Cast	Suction Bell: Bell O.D.	Suction Bell: "**D**" Hub Stick Down (Includes Plug)	Length of One Stage Bowl Unit: **L6**	**L1**	**L2**	**L3**	**L5**
18MA	13.50	10.00	20.00	17.50	16.00	0.00		35.62		28.75	
18HXB	13.25	10.00	20.00	16.88	16.50	4.00	21.69		36.50	24.62	33.56
18HH	18.62	10.00	20.00	18.12	18.75	7.81	27.12				
20MA-OLS	15.00	10.00	20.00	19.50	18.00	6.94	23.50		40.12	30.00	33.62
20MA-ELS	15.00	10.00	20.00	19.50	18.00	6.94			40.12		33.62
20HXB	15.00	10.00	20.00	19.50	17.50	4.62	23.75			31.00	
20HXB w/ Low NPSH Suction Casing	15.00	10.00	20.00	19.50	18.81	6.75	21.62			31.00	
20HH	20.00	10.00	20.00	20.12	20.25	5.56	28.69				
24MA	18.75	10.00	20.00	24.00	18.75	6.56	25.88				
24HXB	16.75	10.00	20.00	22.00	21.00	8.25	25.69				
24HXC	16.75	10.00	20.00	22.00	21.00	8.25	25.69				
24HH	22.00	10.00	20.00	22.62	24.25	6.06	31.31				
24HH-OH	22.75	10.00	20.00	22.62	24.25	6.06	32.06				
26HXB	19.75	10.00	20.00	25.50	24.62	7.56	29.25				
26HH	25.50	10.00	20.00	26.38	28.00	3.19	36.25				
26HH-OH	26.50	10.00	20.00	26.38	28.00	3.19	37.25				
27MA	21.38	10.00	20.00	26.38	27.00	4.44	32.38				
28HXB	22.00	10.00	20.00	27.25	26.00	6.81	32.00				
30LA-OLS	23.75	10.00	20.00	29.75	29.00	0.44	39.00				
30LA-ELS [3]	23.75	10.00	20.00	29.75	29.00	0.44	53.00				
30HH	31.12	10.00	20.00	31.62	34.62	1.44	45.88				
30HH-OH	32.12	10.00	20.00	31.62	34.62	1.44	46.88				
32HXB	26.62	10.00	20.00	31.25	30.00	0.00	38.62				
36MA	27.00	10.00	20.00	36.00	32.00	0.00	40.62				
36HXB	29.31	10.00	20.00	36.00	34.62	0.00	43.31				
36HH	37.00	10.00	20.00	36.19	38.00	0.00	48.06				
36HH-OH	38.25	15.00	25.00	36.19	38.00	0.00	49.31				
42HXB	33.62	10.00	20.00	41.50	40.00	0.00	48.62				
42HH	RF	10.00	20.00	RF	RF	RF	RF				
48HXB	36.00	10.00	20.00	48.12	48.12	0.00	53.44				
48HH	46.50	10.00	20.00	47.00	50.00	1.06	59.00				
48HH-OH	46.50	10.00	20.00	47.00	50.00	1.06	59.00				
56HH	58.00	10.00	20.00	57.88	60.00	0.00	75.00				
56HH-OH	58.00	10.00	20.00	57.88	60.00	0.00	75.00				
66HH	RF	10.00	20.00	RF	RF	RF	RF				







[1] These bowl O.D. dimensions do not include bell of bell type suction casing which in some cases are larger

[2] Except for 18MA column increase coupling may exceed bowl unit diameter O.D.

[3] 30LA ELS Version uses a flanged top bowl design (L4)

Application Data All Dimensions Are In Inches Unless Otherwise Noted

Bowl Unit Size/Type		Maximum Size of Column less than bowl dia.	Column Pipe Size ①			Suction Pipe Size		Diameter of Impeller Shaft ②	Column Shaft Size Diameter		Nominal Size of Oil Tubing		Maximum Head Psi ③	
		O.D.	Min.	Nominal	Max	Min	Max.		Min (OLS)	Max.	Min	Max.	Cl. 30 Cast Iron	High Strength Ductile Iron
18	MA	14	10 STD	12 STD	14 OD	10 STD	12 STD	1.94	1.19	2.31	2.0	3.5	295	390
18	HXB	14	12 STD	14 OD	16 OD	14 OD	14 OD	1.94	1.50	2.31	2.5	3.5	334	440
18	HH	14	14 OD	16 OD	18 OD			2.19	1.50	2.44	2.5	4.0	314	415
20	MA	14	12 STD	14 OD	16 OD	12 STD	14 OD	2.19	1.50	2.31	2.5	3.5	195	258
20	HXB	14	14 OD	16 OD	16 OD	16 OD	16 OD	2.19	1.50	2.31	2.5	3.5	217	286
20	HH	18	14 OD	16 OD	18 OD			2.19	1.50	2.44	2.5	4.0	200	264
24	MA	18	16 OD	18 OD	18 OD			2.44	1.94	2.44	3.0	4.0	250	330
24	HXB	16	14 OD	18 OD	18 OD			2.19	1.50	2.31	2.5	3.5	195	258
24	HXC	16	14 OD	18 OD	18 OD			2.19	1.50	2.31	2.5	3.5	195	258
24	HH	16	16 OD	18 OD	20 OD			2.44	1.69	2.44	3.0	4.0	195	258
24	HH-0H	16	16 OD	18 OD	20 OD			2.44	1.69	2.44	3.0	4.0	195	258
26	HXB	20	16 OD	20 OD	24 OD			2.94	2.19	2.94	3.5	5.0	152	200
26	HH	20	18 OD	20 OD	20 OD			2.94	2.69	2.94	5.0	5.0	152	200
26	HH-0H	20	18 OD	20 OD	20 OD			2.94	2.69	2.94	5.0	5.0	152	200
27	MA	20	16 OD	20 OD	24 OD			2.94	2.19	2.94	3.5	5.0	303	400
28	HXB	20	16 OD	20 OD	24 OD			2.94	2.19	2.94	5.0	5.0	130	172
30	LA	24	24 OD	20 OD	20 OD			2.69	2.19	2.94	3.5	5.0	195	258
30	HH	24	24 OD	24 OD	30 OD			2.94	2.19	2.94	3.5	5.0	130	172
30	HH-OH	24	24 OD	24 OD	30 OD			2.94	2.19	2.94	3.5	5.0	130	172
32	HXB	24	24 OD	24 OD	24 OD			3.69	2.69	2.94	5.0	6.0	195	258
36	MA	30	30 OD	24 OD	24 OD			3.69	2.69	3.69	5.0	6.0	173	230
36	HXB	30	30 OD	30 OD	30 OD			3.94	2.69	3.94	5.0	6.0	173	230
36	HH	30	30 OD	30 OD	30 OD			3.69	2.69	3.69	5.0	6.0	140	185
36	HH-0H	30	24 OD	30 OD	30 OD			3.69	2.69	3.69	5.0	6.0	140	185
42	HXB	36	24 OD	30 OD	30 OD			3.94	2.94	3.94	5.0	6.0	130	172
42	HH	RF	RF	RF	RF			RF	RF	RF	RF	RF	RF	RF
48	HXB	42	36 OD	42 OD	42 OD			3.94	3.44	3.94	6	6.0	130	172
48	HH	42	36 OD	42 OD	48 OD			3.94	3.44	3.94	5	6.0	173	230
48	HH-OH	42	36 OD	42 OD	48 OD			3.94	3.44	3.94	5	6.0	173	230
56	HH	RF	RF	54	RF	RF	RF	4.25	4.25	4.25	8.0	RF	173	230
56	HH-OH	RF	RF	54	RF	RF	RF	4.25	4.25	4.25	8.0	RF	173	230
66	HH	RF	RF	RF	RF	RF	RF	RF	RF	RF	RF	RF	RF	RF

① 20 Inch and larger bowls are available with Flanged Column connection only.

② Standard impeller shaft sizes are shown In this column. Refer to factory for availability of other sizes.

③ a. Pressure ratings are for bowls in CL 30 C. I. (Groups A through E) or High Strength Iron Construction. **THESE ARE MAXIMUM PRESSURES INCLUDING SHUT OFF CONDITIONS**. For other materials and/or groups of construction and higher pressures consult the factory for limitations.

b. Pressure ratings are based on 0° to 150° F. operating temperature ranges and bowl rings (if used) with standard length and diameter.

c. To change these ratings to **HEAD IN FEET of water** multiply by **2.31**.

d. Impeller shaft HP carrying capacity must be checked when using upper pressure limits. If not adequate refer to factory for special material or larger diameter shaft.

e. For long pipe column and well applications at the deeper settings check bowl lateral requirements.

Subject to change without notice

Bowls-18 Through 27 Inch

Impeller Data and Best Lateral Settings off bottom for Maximum Efficiency

1. Net impeller eye area - square inches.
2. Maximum sphere size that will pass impellers.- inches.
3. WR^2 in Lbs.- In^2 - (Multiply by number of stages for WR^2 of bowl assembly - Divide by 144 for Lb - Ft^2)

General Dimensions in inches unless otherwise noted						
Bowl Size	Impeller Number	Net Eye Area In^2	Sphere Size	WR^2 in Lbs-In^2	Best Lateral Setting	Standard Lateral Setting
18MA	T84489	41.231	1.2500	925	0.1250	0.406
18MA	2606879	41.231	1.2500	925	0.1250	0.406
18HXB	2617433	64.708	0.7500	1430	0.0625	0.625
18HXB	2618937	66.437	1.3875		0.0625	0.315
18HH	2621974	84.906	0.8750	1900	0.0625	0.594
18HH	2621975	97.862	0.8750	1900	0.0625	0.469
20MA	2605012	49.698	1.1250	2350	0.0625	0.281
20HXB	2607495	73.148	1.2500	2720	0.0625	0.406
20HXB	2607491	83.642	0.8750	2720	0.0625	0.906
20HXB	2607492	73.148	1.1250	2720	0.0625	0.406
20HH	4600652	124.000	1.0000	2700	0.0625	0.625
20HH	4600653	111.000	1.0000	2224	0.0625	0.625
24MA	2617890	79.100	1.1250	5460	0.0625	0.281
24MA	2603427	79.100	1.1250	5460	0.1250	0.281
24MA	2605615	79.100	1.1250	5460	0.0625	0.281
24HXB	2615491	103.532	0.9688	3060	0.0625	0.812
24HXB	2616866	104.912	1.0312	3060	0.1250	0.750
24HXC	4602026	107.310	1.8750	3650	0.1250	0.375
24HH	2621597	152.040	1.1250	5220	0.1250	0.475
24HH	2620986	152.040	1.1250	6750	0.0312	0.714
24HH-OH	2633415	152.040	1.1250	5075	0.0312	0.020
26HXB	2607148	143.820	1.8750	9050	0.0625	0.344
26HH	2621599	202.220	1.3125		0.1250	0.813
26HH	2620629	203.830	1.3438	13200	0.1250	0.563
26HH-OH	2629638	203.800	1.3438	9543	0.0312	0.022
27MA	2621402	179.280	1.4375	12305	0.0625	0.563
27MA	2621565	147.170	1.1875	12305	0.0625	0.563

Bowls-28 Through 66 Inch

Impeller Data and Best Lateral Settings off bottom for Maximum Efficiency

1. Net impeller eye area - square inches.
2. Maximum sphere size that will pass impellers.- inches.
3. WR^2 in Lbs.- In^2 - (Multiply by number of stages for WR^2 of bowl assembly - Divide by 144 for Lb - Ft^2)

General Dimensions in inches unless otherwise noted						
Bowl Size	Impeller Number	Net Eye Area In^2	Sphere Size	WR^2 in Lbs-In^2	Best Lateral Setting	Standard Lateral Setting
28HXB	2617403	168.220		14850	0.12500	0.719
28HXB	2617422	168.220		14850	0.03125	0.531
30LA	T84305	105.120		10400	0.06250	0.531
30LA	V655C	106.323				0.531
30HH	2621977	295.710	1.625	21000	0.12500	0.969
30HH	2621978	299.570	1.625	30000	0.12500	0.656
30HH-OH	2633416	299.600	1.625		0.03125	0.026
32HXB	2622117	222.340		21700	0.03125	1.156
32HXB	2618419	222.340	2.75	24700	0.12500	0.594
36MA	2606023	182.320	3.25	48000	0.12500	0.656
36MA	2604215	182.320		48000	0.12500	0.656
36HXB	2620664	296.060		50000	0.12500	1.563
36HXB	2618436	296.060	3.125	51500	0.25000	0.688
36HH	2621980	348.160	1.844	45000	0.12500	0.906
36HH	2621981	404.800	1.844	64000	0.12500	0.656
36HH-OH	2633417	404.800	1.844		0.03125	0.029
42HXB	2618460	399.840		95000	0.25000	0.969
42HXB	2621920	399.840		101000	0.12500	0.651
42HH	Refer To Factory					
48HXB	2608562	553.440	4.562	129000	0.12500	0.531
48HH	2621983	587.190		203052		0.781
48HH	2621984	682.940	2.250	289000		0.781
48HH-OH	2633418	682.900	2.250		0.04688	0.042
56HH	2621987	989.610	2.844	444000		0.406
56HH-OH	2633419	989.600			0.04688	0.052
66HH	Refer To Factory					

Clip on Type for Bell Type Suction Casings

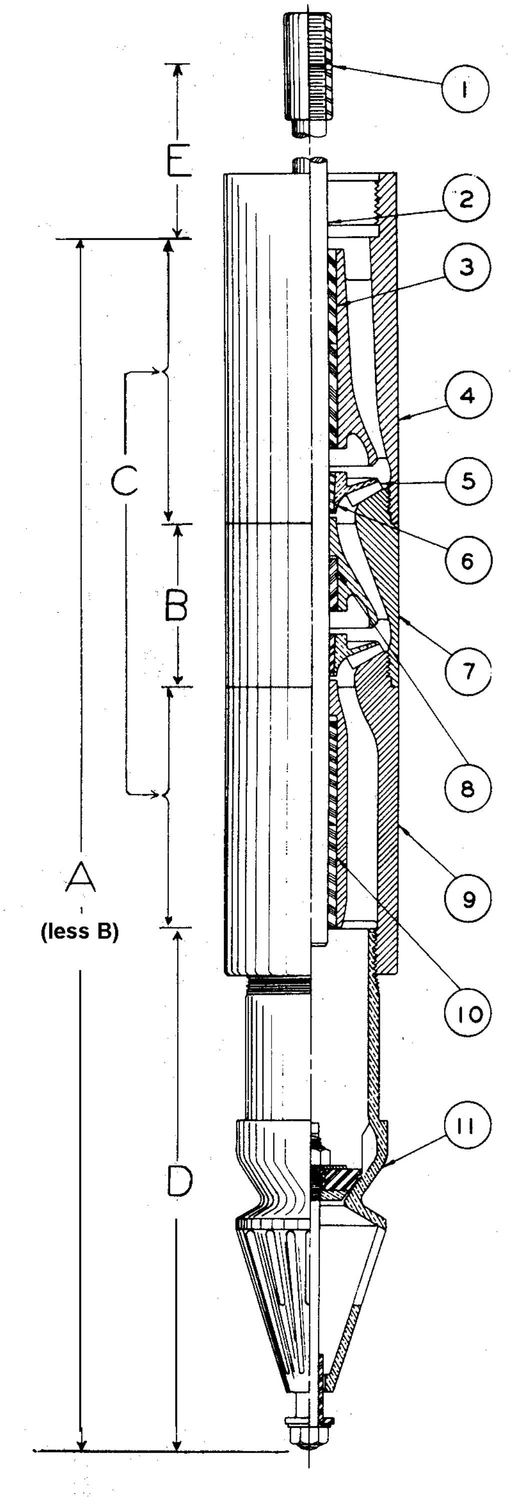
Dimensions in inches All Materials											
Bowl Size	**L**	**M ①**	**Mesh Size**	**Bowl Size**	**L**	**M ①**	**Mesh Size**	**Bowl Size**	**L**	**M ①**	**Mesh Size**
18HXB	14.00	18.00	0.50	24HH-OH	20.25	26.50	1.00	32HXB	25.50	32.00	1.50
18HH	16.00	20.88	0.75	26HXB	21.00	27.00	1.00	36MA	27.00	34.38	1.50
20MA	15.25	19.50	1.00	26HH	23.62	30.38	1.00	36HXB	29.50	37.00	1.50
20HXB ②	14.75	19.00	0.75	26HH-OH	23.62	30.38	1.00	36HH	32.25	40.38	1.50
20HH	16.00	22.25	1.00	27MA	23.00	29.38	1.00	36HH-OH	32.25	40.38	1.50
24MA	16.00	21.00	1.00	28HXB	22.00	28.38	1.00	42HXB	34.00	42.75	1.50
24HXB	17.75	23.25	1.00	30LA	Refer to the factory			48HXB	40.75	50.88	1.50
24HXC	17.75	23.25	1.00	30HH	29.25	37.25	1.50	48HH	42.25	52.75	1.50
24HH	20.25	26.50	1.00	30HH-0H	29.25	37.25	1.50	48HH-OH	42.25	52.75	1.50
								56HH	Refer to the factory		

Notes:

① M dimension is the diameter of strainer including clips and /or screws for fastening to suction casing. Wire mesh with be approximately 0.5 to 1 inch smaller in diameter.

② The 20HXB with low NPSH first stage impeller is 16 x 21 inches with 1 inch mesh (same a 24MA).

Type 4LE Enclosed Impeller Design



Line Shaft Coupling

Impeller Shaft

Fluted Rubber Bearing
(Bronze bearings are not

Top Bowl

Impeller

Impeller Collet

Intermediate Bowl

Fluted Rubber Bearing (Bronze bearings are not avaliable)

Suction Casing

Fluted Rubber Bearing (Bronze bearings are not avaliable)

Foot Valve and Strainer Assembly

Note:
The top bowl is threaded internally for 2-1/2 standard column as shown. For 3 inch column the threading is external for 3 inch standard pipe coupling

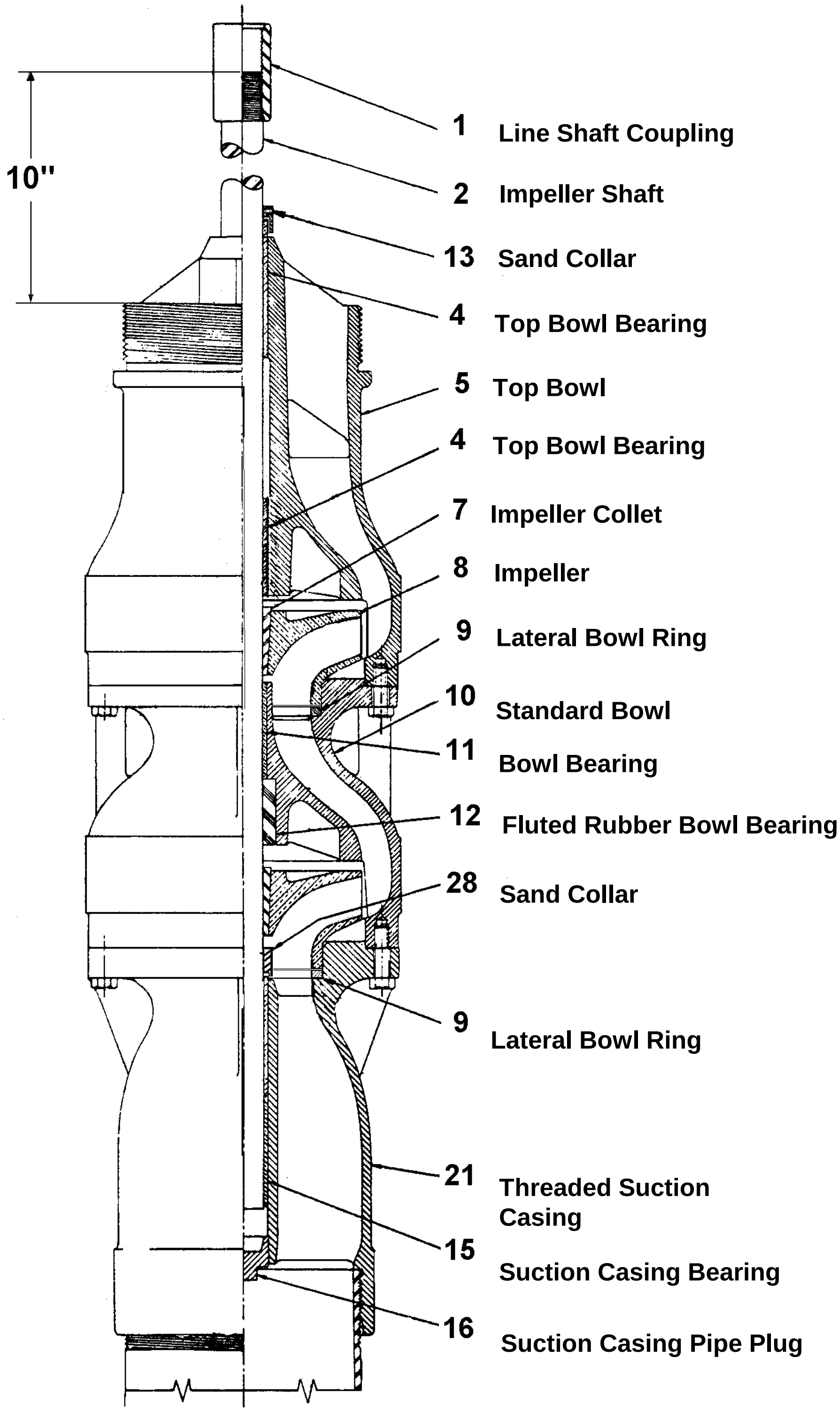
Dimensions in Inches

A	One Stage Bowl Unit Including Foot Valve & Strainer	24.00
B	Each Additional Stage	3.50
C	Top Bowl & Suction Casing	14.00
D	Foot Valve & Strainer	10.00
E	Shaft Stickup (Peerless Pump Standard)	10.00

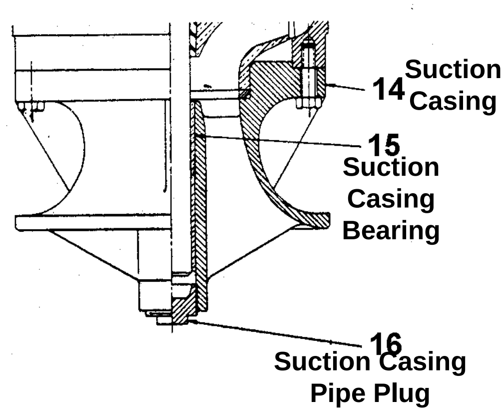
Subject to change without notice

Open Line Shaft Assemblies with Top Bowl

Bowl Sizes **6LB, 6MA, 6HXB, 7LB, 7HXB, 8HXB (Threaded Bowls)**
Bowl Sizes **8LB, 9LA, 10LB, 10HH 12LD, 12MB, 12HXH, 14LD, 14MC, 14HXB, 14HH, 16MC, 16HXB, 18MA (Flanged Bowls Fastened with Cap Screws)**
Bowl Sizes **8MA, 10MA, 10HXB, 12HXB (Flanged Bowls Fastened with Studs and Hex Nuts)**

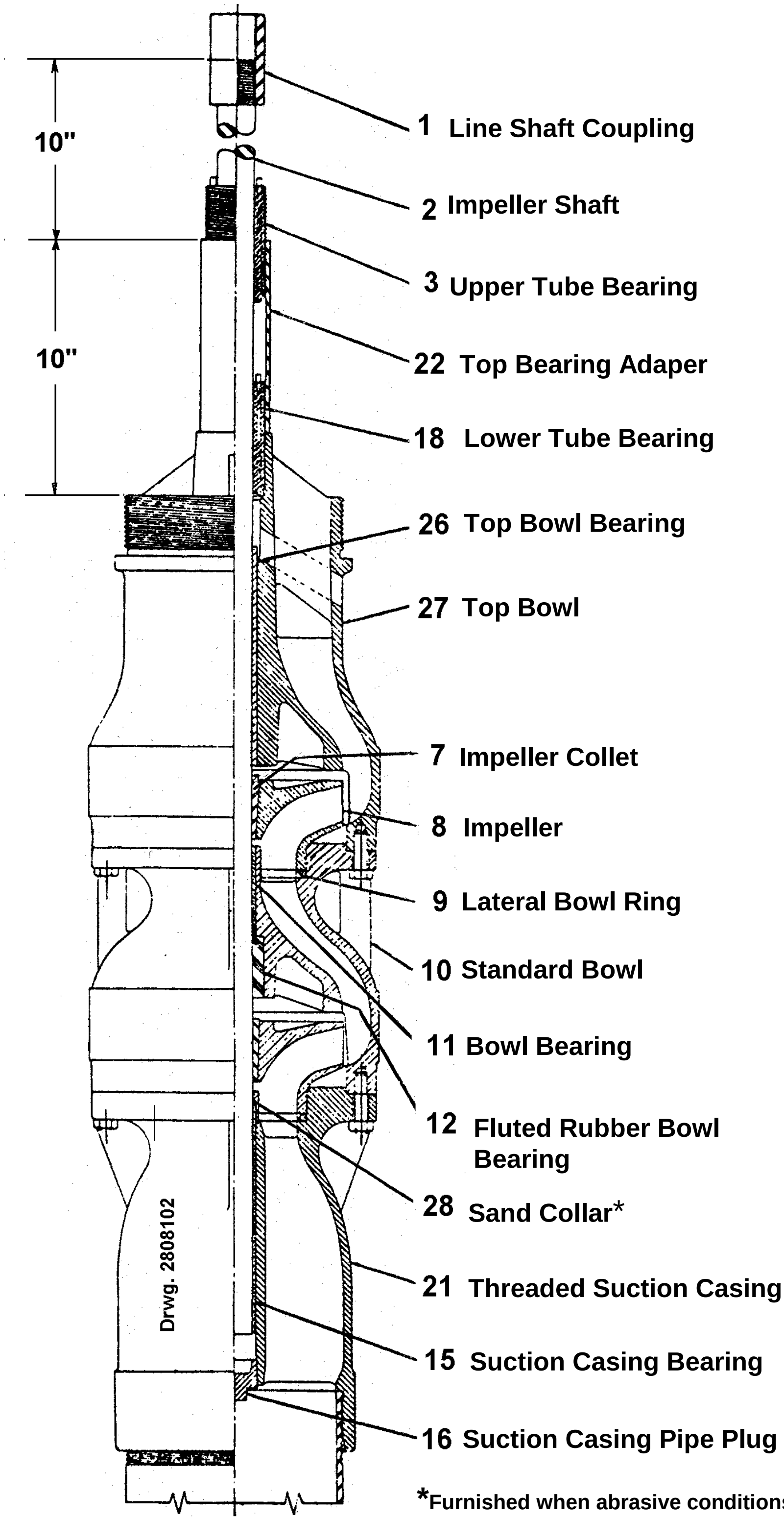


Optional Bell Suction Casing (Not available on 6HXB, 7HXB, 8HXB or 18MA)

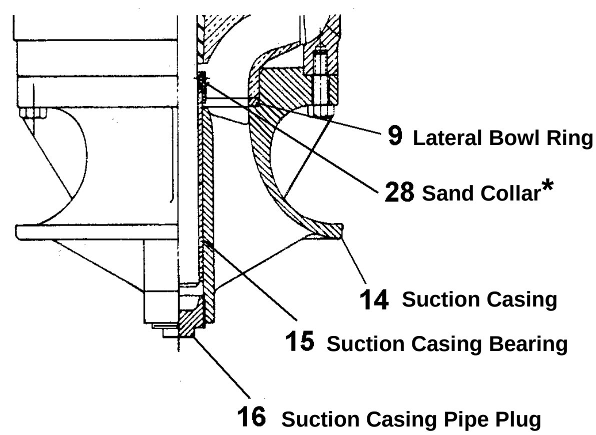


Enclosed Line Shaft Assemblies with Top Bowl

Bowl Sizes **6LB, 6MA, 6HXB, 7LB, 7HXB, 8HXB (Threaded Bowls)**
Bowl Sizes **8LB, 9LA, 10LB, 10HH 12LD, 12MB, 12HXH, 14LD, 14MC, 14HXB, 14HH, 16MC, 16HXB, 18MA (Flanged Bowls Fastened with Cap Screws)**
Bowl Sizes **8MA, 10MA, 10HXB, 12HXB (Flanged Bowls Fastened with Studs and Hex Nuts)**



Optional Bell Suction Casing (Not available on 6HXB, 7HXB, 8HXB 12HD or 18MA)

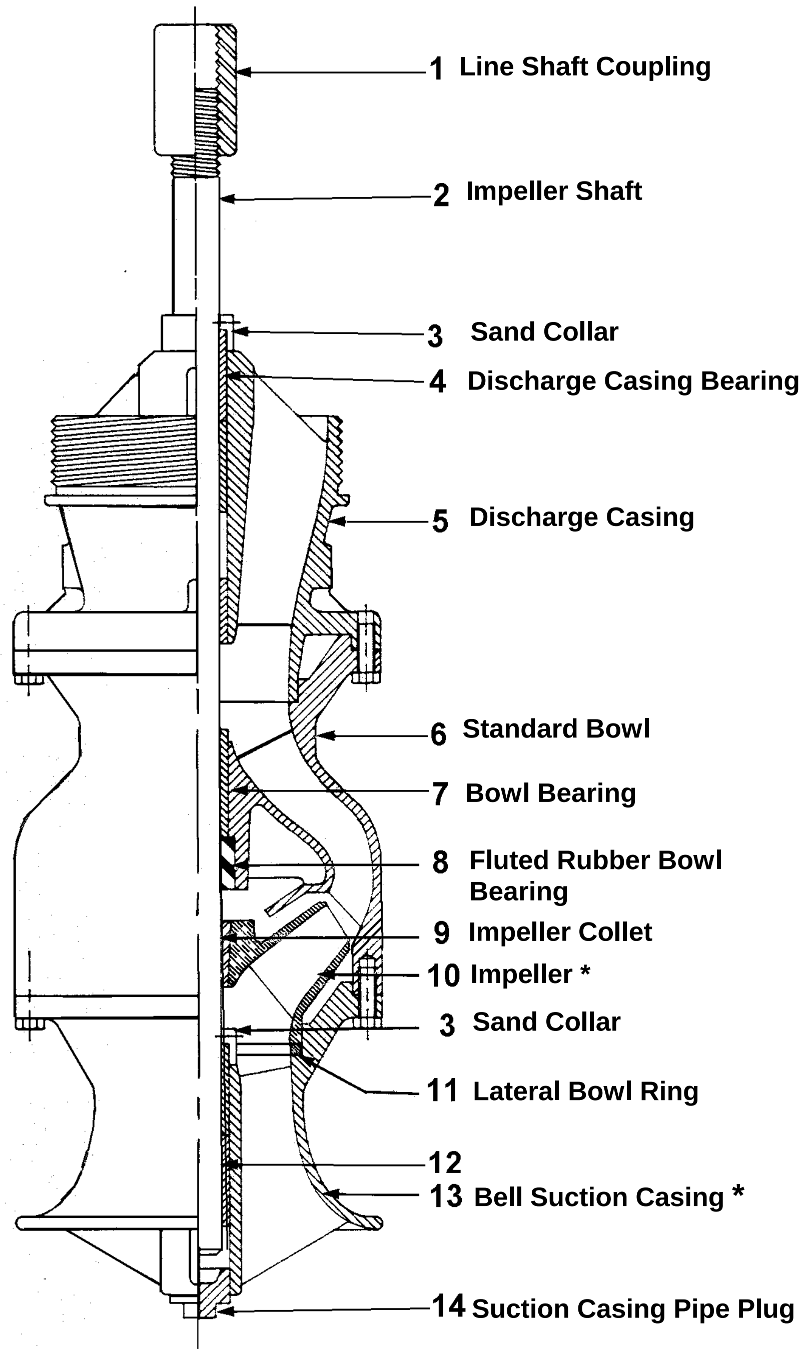


***Furnished when abrasive conditions require.**

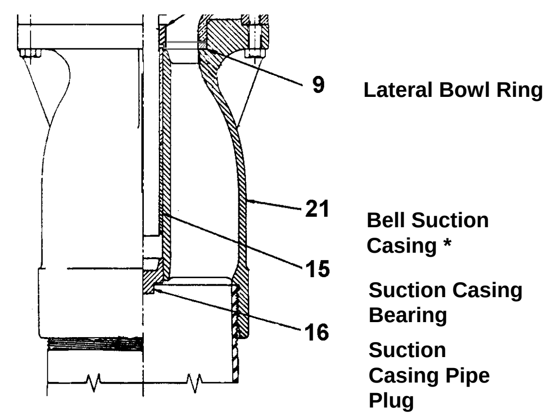
Subject to change without notice

Open Line Shaft Assemblies with Discharge Casing

Bowl Sizes
6LB, 6MA, 6HXB, 7LB, 7HXB, 8HDXB
12LDT, 14MD, 15MA, 18HXB, 20MA (Typical 11MB, 15LC)



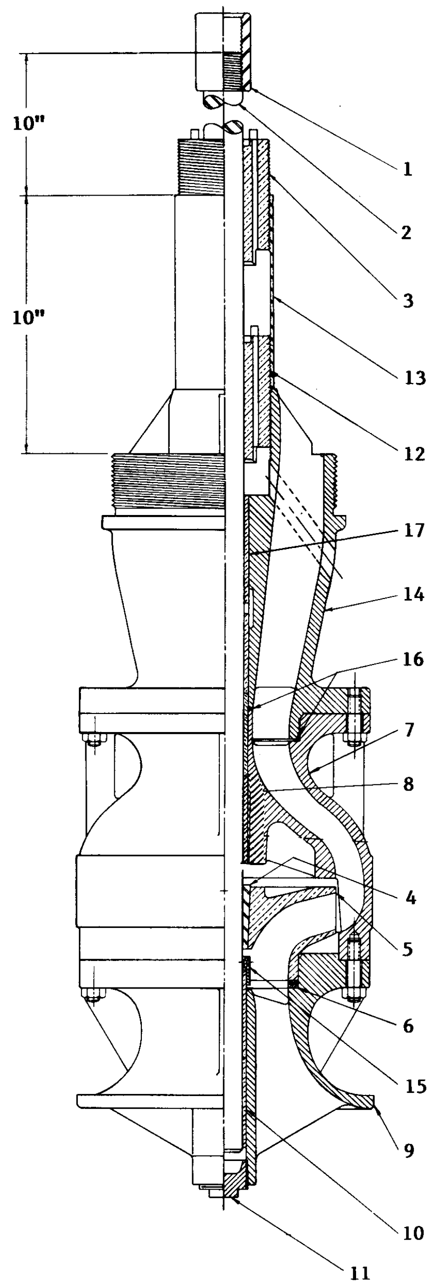
Threaded Suction
(Standard 11MB, 15LC Only)



* 8MFH and 10MFH have semi-open impellers

Enclosed Line Shaft Construction
With Discharge Case For Threaded Column
Sizes 8HXD, 8MFH, 10MFH, 11MB, 12LDT, 14MD, 15LC, 15MA, 16HH, 18HXB. 20MA

1 Shaft Coupling
2 Impeller Shaft
3 Upper Tube Bearing
4 Impeller Collet
5 Impeller
6 Lateral Bowl Ring
7 Standard Bowl
8 Standard Bowl Bearing
9 Bell Type Suction Case ① ②
10 Suction Case Bearing
11 Suction Case Plug
12 Lower Tube Bearing
13 Top Bearing Adapter
14 E.L.S. Discharge Case
15 Sand Collar
16 O-Ring ③
17 Discharge Case Bearing



① **8HDX, 8MFH, 11MB and 15LC are available with threaded suction case only.**

② **Bell suction is shown, threaded suction case is available.**

③ **8HDX, 8MFH, 10MFH, 14MD, 16HH and 18HXB do not require any O-rings. 20MA uses an O-ring at the center hub only.**

DWG. No. 2827896

Subject to change without notice

Blank

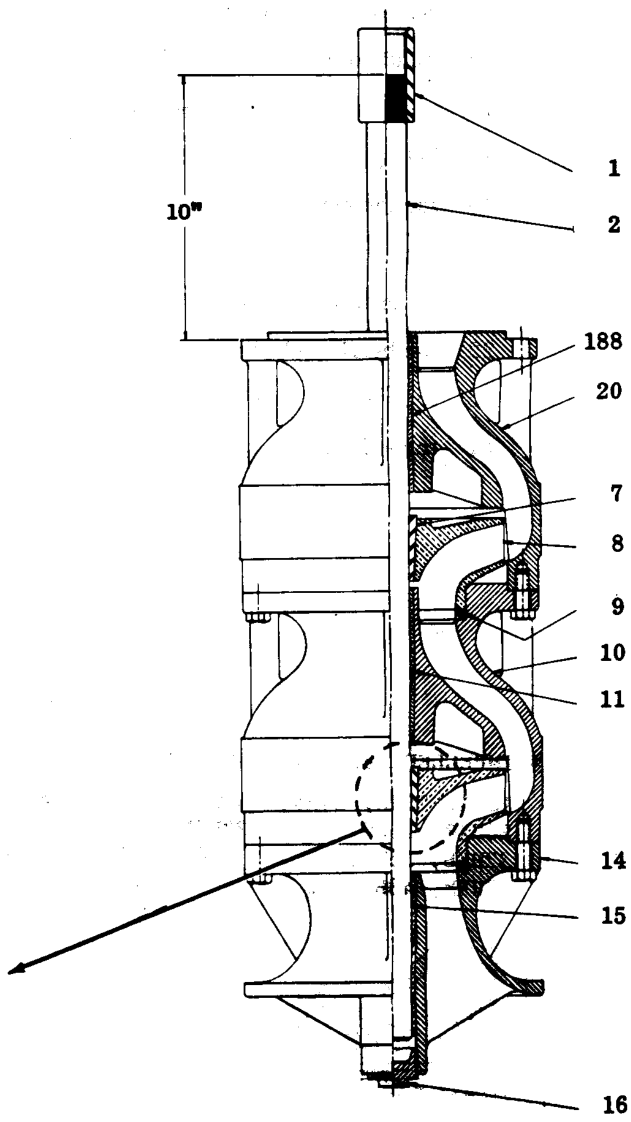
Open Line Shaft Construction
with Top Standard Bowl

Sizes 11MB*, 15MA*, 15LC*, 16HH, 18HXB*, 18HH, 20MA,20HXB, 20HH, 24MA, 24HXB, 24HXC, 24HH, 26HXB, 26HH, 27MA, 28HXB, 30LA, 30HH, 32HXB, 36MA, 36HXB, 36HH, 42HXB, 42HH, 48HXB, 48HH, 56HH, 66HH

*** Discharge manifold and impeller taper lock bushing construction on 11MB, 15MA, 15LC and 18HXB.**

1 shaft coupling
2 impeller shaft
7 impeller taper lock bushing
8 impeller
9 lateral bowl wear ring
10 standard bowl
11 standard bowl bearing
14 bell type suction manifold (1)
15 suction manifold bearing
16 suction manifold plug
20 top standard bowl
188 top standard bowl bearing

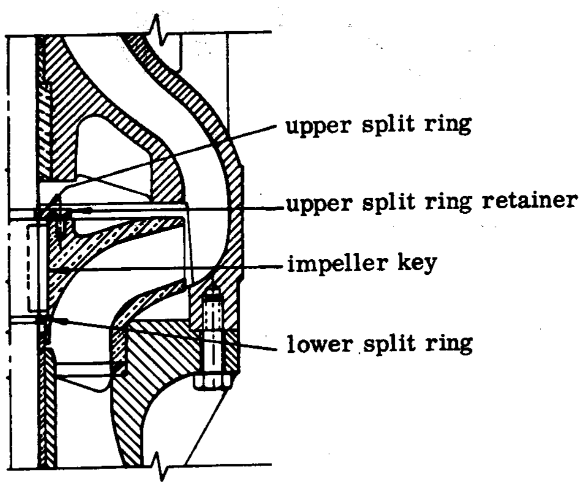
(1) 11MB and 15LC are available with threaded suction manifolds only.



Dwg No. 2808101

IMPELLER KEY CONSTRUCTION:

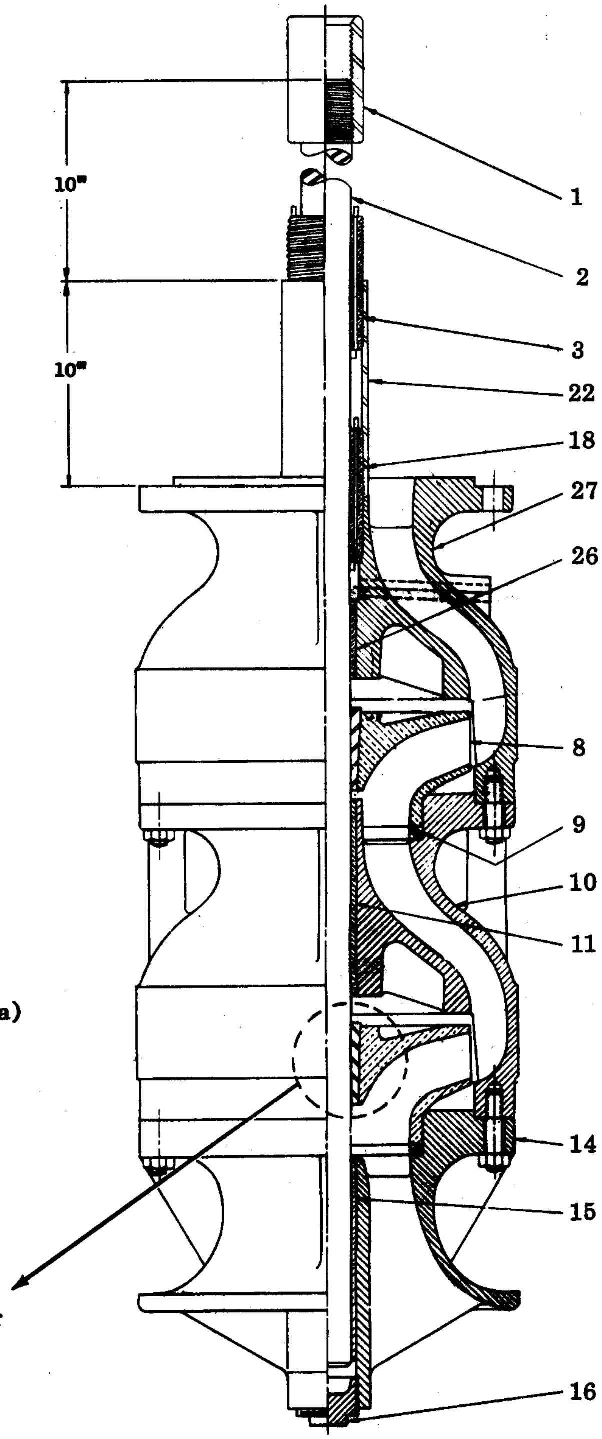
18HH, 20HH, 24MA, 24HXB, 24HXC, 24HH, 26HXB, 26HH, 27MA, 28HXB, 30LA, 30HH, 32HXB, 36MA, 36HXB, 36HH, 42HXB, 42HH, 48HXB, 48HH, 56HH, 66HH



Enclosed Line Shaft Construction With Top Standard Bowl

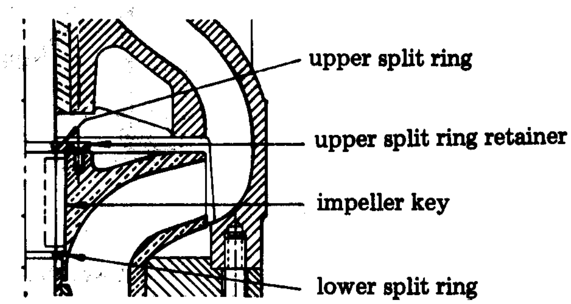
Sizes 18HH*, 20HXB*, 20HH*, 24MA*, 24HXB*, 24HXC*, 24HH*, 26HXB*, 26HH*, 27MA*, 28HXB*, 30LA*, 30HH*, 32HXB*, 36MA*, 36HXB*, 36HH*, 42HXB, 42HH, 48HXB*, 48HH*, 56HH*, 66HH*

1 shaft coupling
2 impeller shaft
3 upper tube bearing
8 impeller
9 lateral bowl wear ring
10 standard bowl
11 standard bowl bronze bearing
14 bell type suction manifold
15 suction manifold bearing
16 suction manifold plug
18 lower tube bearing
22 top bearing adapter
26 top standard bowl bearing
27 top standard bowl



*** IMPELLER KEY CONSTRUCTION (circled area)**

18HH, 20HH, 24MA, 24HXB, 24HXC, 24HH, 26HXB, 26HH, 27MA, 28HXB, 30LA, 30HH, 32HXB, 36MA, 36HXB, 36HH, 42HXB, 42HH, 48HXB, 48HH, 56HH and 66HH.



Dwg. No. 2826723

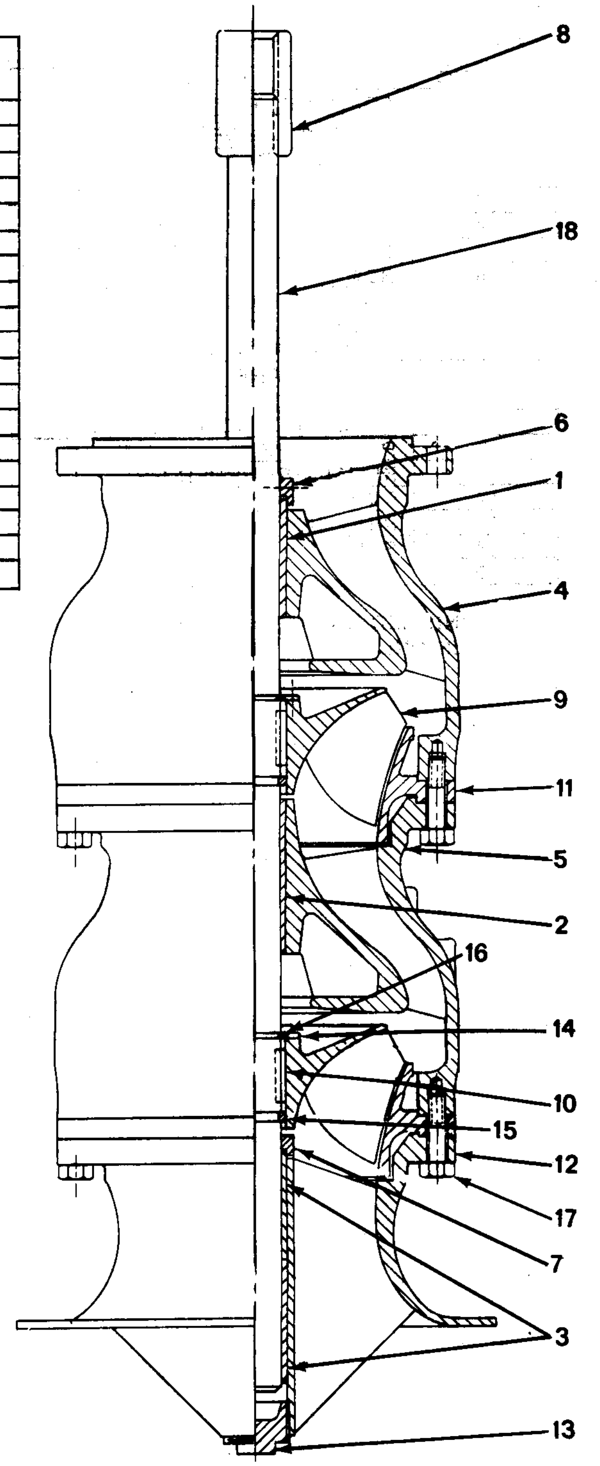
Open Line Shaft Construction

with Open Line Shaft Construction
Semi-Open Impeller and Top Standard Bowl
24HH-OH, 26HH-OH, 30HH-OH and 36HH-0H

PARTS LIST (STANDARD CONSTRUCTION)

ITEM NO.	NAME
1	BEARING, SLEEVE
2	BEARING, SLEEVE
3	BEARING, SLEEVE
4	BOWL, OLS TOP STANDARD
5	BOWL, STANDARD
6	COLLAR, SAND (TOP STANDARD BOWL)
(1) 7	COLLAR, SAND (SUCTION MANIFOLD)
8	COUPLING, SHAFT
9	IMPELLER (SEMI OPEN)
10	KEY, SQUARE
11	LINER, BOWL
12	MANIFOLD, BELL SUCTION
13	PLUG, PIPE
14	RETAINER, UPPER SPLIT RING
15	RING, LOWER SPLIT
16	RING, UPPER SPLIT
17	SCREW, HEX HEAD CAP
18	SHAFT, IMPELLER

(1) FURNISHED ON 24HH–OH AND 36HH–OH SIZES ONLY.



Dwg. No. 4805471

Subject to change without notice

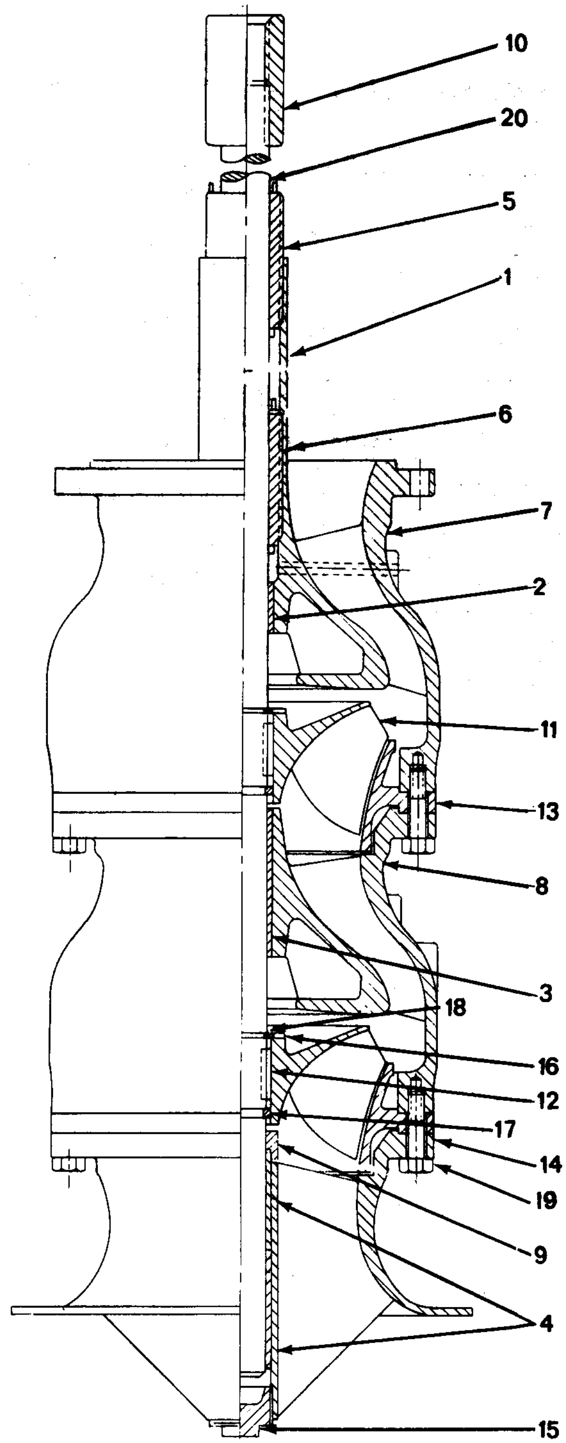
Peerless Pump Company
Indianapolis, IN 46207-7026

Enclosed Line Shaft Construction With Semi-Open Impeller and Top Standard Bowl 24HH-OH, 26HH-OH, 30HH-OH and 36HH-0H

PARTS LIST (STANDARD CONSTRUCTION)

ITEM NO.	NAME
1	ADAPTER, TOP BEARING
2	BEARING, SLEEVE
3	BEARING, SLEEVE
4	BEARING, SLEEVE
5	BEARING, TUBE (UPPER)
6	BEARING, TUBE (LOWER)
7	BOWL, ELS TOP STANDARD
8	BOWL, STANDARD
(1) 9	COLLAR, SAND
10	COUPLING, SHAFT
11	IMPELLER (SEMI OPEN)
12	KEY, SQUARE
13	LINER, BOWL
14	MANIFOLD, BELL SUCTION
15	PLUG, PIPE
16	RETAINER, UPPER SPLIT RING
17	RING, LOWER SPLIT
18	RING, UPPER SPLIT
19	SCREW, HEX HEAD CAP
20	SHAFT, IMPELLER

(1) FURNISHED ON 24HH–OH AND 36HH–OH SIZES ONLY.



Dwg. No. 4805472

VERTICAL TEST LABORATORY FACILITIES AND EQUIPMENT

The vertical test laboratory facility is used for testing vertical turbine pumps. The test sump is 24 feet wide x 80 feet long x 30 feet deep. The total test sump capacity is approximately 400,000 US gallons. Elevation of sump is 713 feet above sea level.

Structural anchors permit the installation of walls to simulate various sump configurations. Consult the factory for all sump configuration requirements.

Head measurements are made with mercury manometers and/or calibrated Bourdon tube type gauges. Capacity measurements are made with venturi /Magnetic meters. Speed measurements are made with both electrical or hand tachometers, depending on driver set-up.

Horsepower measurements are made with dynamometers or calibrated motors. All dynamometers are suitable for vertical pump drivers only.

Maximum power available is dependent on voltage and torque characteristics of the motor. Dynamometers and calibrated factory test motors are available for tests up to 920 hp. For tests at higher horsepower, the use of motors which will be used in the actual installation (customer's motor) may be required. Consult the factory for all power requirements above those covered by the factory test motors and dynamometers listed below.

Pump test can be made with customer's motor, up to power/voltage limits in chart below.

AC Power Available
(Factory Calibrated or Customer's Motor)

Voltage 60 Hertz	Phase	No. of wires	Maximum Motor Hp
240	3	3	25
480	3	3	500
2300	3	3	1000
4160	3	3	2500

Factory Test Motors Available

Nominal Rpm	Nominal Hp	Maximum Hp Allowable	Type	Power Measured By
355	800	920	VSS	Calibrated Motor
440	200	300	VHS	Dynamometer
585	300	500	VHS	Dynamometer
885	300	500	VHS	Dynamometer
700	125	175	VHS	Calibrated Motor
1185	150	200	VHS	Calibrated Motor
1185	300	400	VHS	Calibrated Motor
1770	300	400	VHS	Calibrated Motor
1785	700	805	VSS	Calibrated Motor

Venturi/ Magnetic Flow Meters

Size	US GPM Range	Maximum System Pressure psi
16	0-20,000	250
24	2,500 - 25,000	250
36	0 - 100,000	125

Pressure Test

Type	Psi Maximum
Hydrostatic (water)	3000

Crane Capacity

Capacity US Tons	Hook to Floor
20	35 ft - 9 in.
10	35 ft - 9 in.

Subject to change without notice

Peerless Pump Company

Handbook of Engineering Data

Brochure EM77

DEFINITION OF PUMP TERMS

A2.1 *A line shaft vertical turbine* pump is a vertical-shaft centrifugal or mixed-flow pump with rotating impeller or impellers, and with discharge from the pumping element coaxial with the shaft. The pumping element is suspended by the conductor system which encloses a system of vertical shafting used to transmit power to the impellers, the prime mover being external to the flow stream. A basic pump consists of three elements, defined as follows:

A2.1.1 *The pump bowl assembly* is either a single or multistage, centrifugal or mixed- flow vertical pump with discharge coaxial with the shaft. It has open, semi open, or enclosed impellers. Assemblies are constructed for use with either open or enclosed line shafts.

A2. 1.2 *The column-and-shaft assembly* consists of the column pipe which suspends the pump bowl assembly from the head assembly and serves as a conductor for the fluid from the pump bowl assembly to the discharge head. Contained within the column pipe is the line shaft which transmits the power from the driver to the pump shaft. The line shaft is supported throughout its length by means of bearings and may be enclosed in a shaft-enclosing tube and generally lubricated with oil, or it may be open and lubricated with the fluid being pumped.

A2. 1.3 *The head assembly* consists of the base from which the column and shaft assembly and the bowl assembly are suspended, and may include the discharge head, which directs the fluid into the desired piping system, and the driver.

A2.3 *The datum* shall be taken as the elevation of that surface from which the weight of the pump is supported. This is normally the elevation of the underside of the discharge head or head base plate.

A2.4 *The setting* is the nominal vertical distance in feet from the datum to the column pipe connection at the bowl assembly.

A2.5 *The static water level* is the vertical distance in feet from the datum to the level of the free pool while no water is being drawn from the pool.

A2.6 The *pumping water level* is the vertical distance in feet from the datum to the level of the free pool while the specified fluid flow is being drawn from the pool.

A2.7 *Drawdown* is the difference in feet between the pumping water level and the static water level.

A2.9 *The capacity of the pump* is the volume rate of flow (*Q*), expressed in gpm, produced by the pump, calculated for specified conditions.

A2.10 *The pump speed of rotation* (*N*) is the rate of rotation of the pump shaft, expressed in rpm (revolutions per minute).

A2.11 *Head* is a quantity used to express the energy content of the liquid per unit weight of the liquid, referred to any arbitrary datum. In terms of foot- pounds of energy of per pound of liquid being pumped, all head quantities have the dimension of feet of liquid.

A2. 11.1 *Head below datum* (h_b) is the vertical distance in feet between the datum and the pumping level.

A2.11.2 *Head above datum* (h_a) is the head measured above the datum, expressed in feet of liquid, plus the velocity head (sec. A2.11.3) at the point of measurement.

A2.11.3 *Velocity head* (h_v) is the kinetic energy per unit weight of the liquid at a given section expressed in feet of liquid. Velocity head is specifically defined by the expression:

$$hv = \frac{v^2}{2g}$$

A2. 11.4 *Suction head* (h_8) (closed system) is the algebraic sum of the pressure in feet of fluid (measured at the pump suction connection) and the velocity head at that point. Pump suction connection is that point at which the suction piping is attached to the pump bowl assembly or its enclosing vessel.

A2.11.5 *Pump total head* (*H*) is the bowl assembly head (sec. A2.11.6) minus the column loss (sec. A2.12) and discharge head loss. This is the head generally called for in pump specifications.

A2. 11.5.1 *On open-suction installations*, it is the sum of the head below datum and the head above datum.

A2.11.5.2 *On closed-suction installations*, it is the algebraic difference of the suction head, the distance between the suction connection, and the datum and the head above the datum.

A2.11.6 *Bowl assembly head* (h_l) is the energy imparted to the liquid by the pump, expressed in feet of liquid. It is the head of a pump developed at the discharge connection of the bowl assembly.

A2.12 *The column loss* (h_c) is the value of the head loss (expressed in feet) due to the flow friction in the column pipe. This value, together with the discharge head loss, is subtracted from the bowl assembly head to predict the pump total head.

A2.13 *The line shaft loss* (hp_1) is the power (expressed in horsepower) required because of the rotation friction of the line shaft. This value is added to the bowl assembly input (sec. A2.14.3) to predict the pump input (sec. A2.14.1).

A2.14 *Power* is expressed in units of horsepower. One horsepower is equivalent to 550 ft-lb per second, 33,000 ft-lb per minute, 2,545 Btu per hour, or 0.746 kW.

A2.14.1 *Pump input* is the power delivered to the top shaft by the driver, expressed in horsepower.

A2.14.2 *Driver power input* is the power input to the driver, expressed in horsepower.

A2.14.3 *Bowl assembly input* is the power delivered to the pump shaft, expressed in horsepower.

A2.15 *Pump output* is defined as $\frac{QH}{3,960}$ for water having a specific weight of 62.4 lb per cubic foot. It is expressed in horsepower.

A2.16 *Bowl output* is defined as $\frac{Qh_1}{3,960}$ for water having a specific weight of 62.4 lb per cubic foot. It is expressed in horsepower.

A2.17 *Pump efficiency* (E_p) is the ratio of pump output to pump input, expressed in percent.

A2.18 *Overall efficiency* (*E*) is a ratio of pump output to the prime mover input, expressed in percent.

A2.19 *Driver efficiency* (E_g) is the ratio of the driver output to the driver input, expressed in percent.

A2.20 *Bowl assembly efficiency* (E_l), is the ratio of the bowl output to the bowl assembly input, expressed in percent.

INDEX

Engineering Information Section

DETERMINATION OF PUMPING HEAD

The operating conditions of a pump should be determined as accurately as possible. If there is a variation in head, both maximum and minimum heads should be allowed for in the pump selection.

The total head developed by a pump, or total dynamic head, is made up of the following:

1. **Static Head**. The total change in elevation of the liquid, from suction level to discharge level, plus the pressure difference of suction and discharge reservoirs of different from atmospheric.
2. **Pipe Friction**. The friction head loss in the suction and discharge line, elbows and valves, and the suction pipe entrance loss.
3. **Velocity Head**. The velocity head at the end of the discharge pipe.

SYSTEM HEAD CURVES

In addition to knowing the head for the design capacity, it is, for many installations, desirable to know the piping system head-capacity characteristic. When operating conditions are variable, a plot of the system head curve imposed on the pump curves enables the best pump selection for the operating range.

In any piping system, the pipe friction and velocity head varies with capacity. Thus, for any fixed static head conditions, the system head increases from static head at zero flow for any increase in capacity. Also, the static head may be variable. Then, the pipe friction and velocity head losses can be added separately to the maximum and minimum static heads, respectively, and the maximum and minimum system head curves can be plotted.

When the system curve is superimposed on the pump curve, the operating points are the intersections of the system curve; the operating points are the intersections of the system curve with the pump curves. Thus, the operating range for the pump is established and its suitability for the application is determined.

PUMPING LIQUIDS OTHER THAN WATER

HEAD

The head of a pump is generally expressed in feet and is so plotted on pump curves. This head developed, expressed in feet, is the same irrespective of the fluid pumped. However, the head expressed in pounds per square inch (psi) will be different for fluids of different specific gravity. The heavier the fluid, the greater will be the head expressed in psi for a pump. The relation of feet head and psi are:

$$\frac{\text{ft x sp-gr}}{2.31} = \text{psi}$$

$$\frac{\text{psi x 2.31}}{\text{sp-gr}} = \text{ft}$$

HORSEPOWER

Pump horsepower is changed with any change in specific gravity. Pump horsepower curves, unless otherwise noted, are plotted for water, which has a specific gravity of 1.00 at normal temperatures. Any increase or decrease in specific gravity will proportionately increase or decrease the horsepower. The general formula for calculating horsepower is:

$$\text{bhp} = \frac{\text{gpm x total head in feet}}{\text{3960 x efficiency}}$$

is based upon water, i.e., a specific gravity of 1.00. When the sp-gr is other than 1.00, the formula should be:

$$\text{bhp} = \frac{\text{gpm x total head in feet}}{\text{3960 x efficiency}} \text{ x sp-gr}$$

VISCOUS LIQUIDS

Centrifugal pumps can satisfactorily handle many oils and other viscous liquids. Applications of pumps to viscous liquids should be referred to the factory. When pumping viscous liquids, centrifugal pump characteristics are radically altered. The pump head, capacity, and efficiency all decrease when pumping viscous liquids. The variation is more pronounced as the liquid becomes more viscous, and is not a linear function.

NPSH
(*NET POSITIVE SUCTION HEAD*)

A major problem encountered in many pumping applications, particularly those involving fluids at or near their boiling points, is a lack of net positive suction head (NPSH). Net positive suction head is the absolute pressure, above the vapor pressure of the fluid pumped, available at the entrance or eye of an impeller, to move and accelerate the fluid entering the eye. If the NPSH available in an installation is insufficient, the pump will cavitate and serious operational difficulties may develop. These troubles can include serious reduction in capacity and efficiency, excessive vibration, reduced life of pump parts due to cavitation erosion, and damage to the pump from possible vapor lock and running dry.

A centrifugal pump has a minimum required NPSH to prevent cavitation, which varies with capacity. This characteristic is inherent in the design of a pump and is just as much a performance characteristic as its head-capacity relationship. For a pump to operate cavitation free, the available NPSH of an installation must exceed the NPSH required by the pump for operating conditions.

The NPSH required by a pump can be supplied by the pump manufacturer. It is expressed in feet of fluid pumped as is total head developed.

The system NPSH available in a proposed installation can be calculated by the formula:

$$H_{sv} = H_p \pm H_z - H_f - H_{vp}$$

Where:

H_{sv} = NPSH expressed in feet of fluid
H_p = Absolute pressure on the surface of the liquid where the pump takes suction, expressed in feet of fluid.
H_z = Static elevation of the liquid above or below the centerline of the impeller (on vertical pumps, the correction should be made to the entrance eye of the impeller) expressed in feet.
H_f = Friction and entrance head losses in the suction piping expressed in feet.
H_{vp} = Absolute vapor pressure of fluid at the pumping temperature expressed in feet of fluid.

The system NPSH available in an existing installation can be measured as follows:

$$H_{sv} = P_a \pm P_s + \frac{V_s^2}{2g} - H_{vp}$$

Where:

P_a = Atmospheric pressure for the elevation of the installation expressed in feet of fluid.
P_s = Gage pressure at the suction flange of the pump corrected to the pump centerline and expressed in feet of fluid.
$\frac{V_s^2}{2g}$ = Velocity head at the point of measurement of Ps.
H_{vp} = Absolute vapor pressure expressed in feet of fluid.

NPSH as explained defines suction conditions of a pump installation and suction characteristic of a pump. Naturally, NPSH and suction lift are related for suction lift also indicates suction conditions. When the NPSH is known, the suction lift can be determined by the formula:

$$H_s = H_p - H_{sv} - H_{vp} - H_f$$

Where:

H_s = Total suction lift.

EFFECT ON CENTRIFUGAL PUMPS OF CHANGE OF SPEED OR SLIGHT CHANGE OF IMPELLER DIAMETER

H = Head in feet. d = Dia. of impeller.

Total head varies as the square of the speed or diameter:

$$H_2 = H_1 \left(\frac{rpm_2}{rpm_1}\right)^2 \text{ or } H_2 = H_1 \left(\frac{d_2}{d_1}\right)^2$$

Capacity varies directly as the speed or diameter:

$$gpm_2 = gpm_1 \text{ x } \frac{rpm^2}{rpm^1} \text{ or } gpm_2 = gpm_1 \text{ x } \frac{d_2}{d_1}$$

Brake horsepower varies as the cube of the speed or diameter:

$$bhp_2 = bhp_1 \text{ x } \left(\frac{rpm_2}{rpm_1}\right)^3 \text{ or } bhp_2 = bhp_1 \text{ x } \left(\frac{d_2}{d_1}\right)^3$$

With efficiency of pump and motor known, proportionate cost of power can be predetermined on a basis common to all pumps, regardless of size or capacity. By using units of capacity and head, comparisons can be made in pumps having different capacities.

Power cost of pumping varies inversely with overall plant efficiency (Eo). Thus, power cost per gallon for each foot head on a pump of 30% overall plant efficiency is double that of a pump of 60% overall plant efficiency. (Assuming power rate the same in both cases).

To pump one gallon of water in one minute (1 gpm) against one foot head with 100% overall plant efficiency, requires .0001 89 kilowatts. Pumping 1000 gallons per minute (1000 gpm) per foot head at 100% (Eo) requires .189 kilowatts.

The following formulae can be used for determining power costs of pumping under any conditions:

COST PER 1000 GALLONS

(not gallons per minute) for each foot of head

$$= \frac{.00315 \times R}{Eo} \quad \text{or} \quad \frac{.189 \times R}{Ep \times Em \times 60}$$

Where:
.189 = Theoretical kw as stated above.
R = Power cost per kwh.
Ep = Pump efficiency.
Em = Motor efficiency.
Eo = Overall plant efficiency.
60 = Minutes.

Example: Find the cost per 1000 gallons (not gpm) per foot head, of a pumping plant whose overall plant efficiency (Eo) is 60% (.60), power rate, five cents ($0.05) per kwh.
Substituting in formula:
Cost per 1000 gallons per foot head =

$$\frac{.00315 \times .05}{.60} = \frac{.0001575}{.60} = \$.0002625$$

If the pump is lifting water over a 120-foot head, then the cost per 1000 gallons (not gpm) delivered would be: $.0002625 x 120 = $.0315

Pumping costs per any given condition of capacity or head may be determined by using the following formula:

COST PER HOUR

$$= \frac{.000189 \times \text{gpm} \times \text{Total Head} \times \text{Power Rate}}{\text{Overall Plant Efficiency}}$$

Example: Find the cost per hour of a pump delivering 500 gpm against a 120-foot head, overall plant efficiency of pump 60% (.60), power rate five cents ($0.05) per kwh. Substituting in formula we have:

$$\text{Cost per hour} = \frac{.000189 \times 500 \times 120 \times .05}{.60}$$

$$= \$0945$$

COST PER ACRE-FOOT

$$= \frac{1.023 \times \text{Total Head} \times \text{Power Rate}}{Eo}$$

Example: Find the cost per acre-foot of a pump delivering 500 gpm against a 120-foot head, overall

Formulae for Determining
COST OF ELECTRICAL PUMPING

plant efficiency of pump 60% (.60), power rate five cents ($0.05) per kwh. Substituting in formula:

$$\text{Cost per acre-foot} = \frac{1.023 \times 120 \times .05}{.60}$$

$$= \$10.23$$

Kilowatt Hours Required

$$\text{per 1000 gallons} = \frac{\text{kw} \times 16.66}{\text{gpm}}$$

kw = Kilowatts input to meter, based on plane efficiency (wire to water).
kw = hp to pump x .746, based on pump efficiency (water to water).

$$\text{Pump efficiency} = \frac{\text{gpm} \times \text{head}}{2960 \times \text{bhp (to pump)}}$$

$$\text{1 Horsepower} \begin{cases} = 33{,}000 \text{ ft lbs per minute} \\ = 550 \text{ ft lbs per second} \\ = 0.746 \text{ kw} \end{cases}$$

bhp to pump = motor efficiency x hp at meter.

H.P. AT METER
(DISK CONSTANT METHOD)

$$\text{hp (at meter)} = \frac{R \times K \times M}{.2072 \times t}$$

R= Rev. of disk.
K = Disk constant. Do not confuse disk constant with dial constant. Dial constant is not used to calculate meter horsepower. The disk constant is the watt hours per revolution of disk and can usually be found either on the nameplate or painted on the face of the disk.
M = Multiplier = Ratio of current transformers used to rating of mete. When current and potential transformers are used, M equals the product of the current transformer ratio times the potential transformer ratio. If neither type of transformer is used, there is no multiplier required in the above formula.
(M=1).
Example: (No current or potential transformers used). Generally, the meter nameplate states what the multiplier is if the size of the motor requires that a transformer be used. Disk K = 4.8 Turning 20 revolutions in 54.5 seconds.

$$\text{Hp at meter} = \frac{20 \times 4.8}{.2072 \times 54.5} = 8.5 \text{ hp}$$

Example: (Current transformers used).
Disk K = 4,8 Turning 20 revolutions in 54.5 seconds.
Multiplier = M = 10

$$\text{hp at meter} = \frac{20 \times 4.8 \times 10}{.2072 \times 54.5} = 85.0 \text{ hp}$$

The term “Efficiency” as used in pumping would be of no practical value if it could not be reduced to terms of actual pumping costs, expressed in dollars.

ELECTRICAL FORMULAE

REQUIRED	DIRECT CURRENT	ALTERNATING CURRENT Single-phase	ALTERNATING CURRENT 3-phase
Amperes when hp is known	$\frac{746\ (hp)}{(E)\ (eff)}$	$\frac{746\ (hp)}{(E)\ (eff)\ (pf)}$	$\frac{746\ (hp)}{1.73\ (E)\ (eff)\ (pf)}$
Amperes when kilowatts are known	$\frac{1000\ (kw)}{E}$	$\frac{1000\ (kw)}{(E)\ (pf)}$	$\frac{1000\ (kw)}{1.73\ (E)\ (pf)}$
Amperes when kva is known		$\frac{1000\ (kva)}{E}$	$\frac{1000\ (kva)}{1.73\ (E)}$
Kilowatts	$\frac{(I)\ (E)}{1000}$	$\frac{(E)\ (I)\ (pf)}{1000}$	$\frac{1.73\ (I)\ (E)\ (pf)}{1000}$
kva		$\frac{(I)\ (E)}{1000}$	$\frac{1.73\ (I)\ (E)}{1000}$
Horsepower Output	$\frac{(I)\ (E)\ (eff)}{746}$	$\frac{(I)\ (E)\ (pf)\ (eff)}{746}$	$\frac{1.73\ (I)\ (E)\ (pf)\ (eff)}{746}$

I = amperes
E = volts
eff = efficiency (as a decimal)
hp = horsepower
pf = power factor
kw = kilowatts
kva = kilovolt amperes

MOTOR CHARACTERISTICS

General purpose open motors (drip-proof) are designed to give the best operation at their normal voltage and frequency (this information included on motor name-plate).

Some variation from normal is allowable, the voltage limits being approximately plus or minus 10% and the frequency limits plus or minus 5%. The voltage and frequency should never be varied simultaneously in opposite directions, and both should not be varied at the same time to the extreme limits allowed.

These motors will operate with an ambient temperature of 40° C. (surrounding temperature 104° F.) with a temperature rise of 40° C. (rise of 72° F.) when carrying the rated load at an altitude of not over 3300 feet.

These same motors are capable of carrying a 15% overload continuously providing the total temperature rise does not exceed 50° C. (122° F.) However, the total temperature cannot exceed 90° C., and thus if the ambient temperature is 122° F. this 15% service factor cannot be used. When operating a motor above 3300 feet the motor temperature rise increases approximately 1% for each 330 feet rise and this must be allowed for in computing the total allowable temperature rise.

SYNCHRONOUS AND FULL LOAD SPEED OF INDUCTION MOTORS—230-460 VOLTS

Number of Poles	50 Cycle Synch. Speed	50 Cycle Full Load Speed	60 Cycle Synch. Speed	60 Cycle Full Load Speed
2	3000	2900	3600	3460
4	1500	1460	1800	1760
6	1000	970	1200	1160
8	750	730	900	870
10	600	585	720	700
12	500	485	600	580
14	428	420	514	500

The following tabulation shows the approximate effects of variations in voltage and frequency on motor characteristics. These values should in no way be considered as guarantees.

	Characteristic	Alternating-current (Induction) Motors			
		Voltage		Frequency	
		110%	90%	105%	95%
Torque*	Starting and Max Running	Increase 21%	Decrease 19%	Decrease 10%	Increase 11%
Speed†	Synchronous	No change	No change	Increase 5%	Decrease 5%
	Full Load	Increase 1%	Decrease 1.5%	Increase 5%	Decrease 5%
	Per Cent Slip	Decrease 17%	Increase 23%	Little change	Little change
Efficiency	Full Load	Increase 0.5 to 1 Point	Decrease 2 Points	Slight increase	Slight decrease
	¾ Load	Little change	Little change	Slight increase	Slight decrease
	½ Load	Decrease 1 to 2 Points	Increase 1 to 2 Points	Slight increase	Slight decrease
Power Factor	Full Load	Decrease 3 Points	Increase 1 Point	Slight increase	Slight decrease
	¾ Load	Decrease 4 Points	Increase 2 to 3 Points	Slight increase	Slight decrease
	½ Load	Decrease 5 to 6 Points	Increase 4 to 5 Points	Slight increase	Slight decrease
Current	Starting	Increase 10 to 12%	Decrease 10 to 12%	Decrease 5 to 6%	Increase 5 to 6%
	Full Load	Decrease 7%	Increase 11%	Slight decrease	Slight increase
Temperature Rise	ac Motors	Decrease 3 to 4° C	Increase 6 to 7° C	Slight decrease	Slight increase
	Maximum Overload Capacity	Increase 21%	Decrease 19%	Slight decrease	Slight increase
	Magnetic Noise	Slight increase	Slight decrease	Slight decrease	Slight increase

* The starting and maximum running torque of ac induction motors will vary as the square of the voltage.

† The speed of ac induction motors will vary directly with the frequency.

3 – PHASE SQUIRREL – CAGE INDUCTION MOTORS

	230 – Volt				460 – Volt			
hp	Full Load (amp)	† Min. Size Wire AWG	Size Conduit (inches)	# Max. Rating of Branch Circuit Fuses	Full Load (amp)	† Min. Size Wire AWG	Size Conduit (inches)	# Max. Rating of Branch Circuit Fuses
1.000	3.600	14	0.500	‡ 15	1.800	14	0.500	‡ 15
1.500	5.200	14	0.500	‡ 15	2.600	14	0.500	‡ 15
2.000	6.600	14	0.500	‡ 20	3.400	14	0.500	‡ 15
3.000	9.600	14	0.500	‡ 25	4.800	14	0.500	‡ 15
5.000	15.200	12	0.500	‡ 45	7.600	14	0.500	‡ 20
7.500	22.000	10	0.750	° 60	11.000	14	0.500	° 30
10.000	28.000	8	0.750	° 80	14.000	12	0.500	° 40
15.000	42.000	6	1.000	° 125	21.000	10	0.750	° 60
20.000	54.000	4	1.250	° 150	27.000	8	0.750	° 80
25.000	68.000	3	1.250	° 200	34.000	8	0.750	° 100
30.000	80.000	1	1.500	° 225	40.000	6	1.000	° 125
40.000	104.000	00	2.000	° 300	52.000	4	1.000	° 150
50.000	130.000	000	2.000	° 350	65.000	3	1.250	° 175
60.000	154.000	200,000CM	2.500	° 450	77.000	2	1.250	° 225

SINGLE-PHASE INDUCTION MOTORS

	115 – Volt				230 – Volt			
0.500	9.800	14.000	0.500	25.000	4.900	14.000	0.500	15.000
0.750	13.800	12.000	0.500	40.000	6.900	14.000	0.500	20.000
1.000	16.000	12.000	0.500	45.000	8.000	14.000	0.500	25.000
1.500	20.000	10.000	0.750	60.000	10.000	14.000	0.500	30.000
2.000	24.000	10.000	0.750	70.000	12.000	14.000	0.500	35.000
3.000	34.000	6.000	0.750	100.000	17.000	10.000	0.750	50.000
5.000	56.000	4.000	1.250	150.000	28.000	8.000	0.750	80.000

† In order to avoid excessive voltage drop where long runs are involved, it may be necessary to use conductors and conduit of sizes larger than the minimum sizes listed above.

Branch-circuit fuses must be large enough to carry the starting current, hence they protect against short-circuit only. Additional protection of an approved type must be provided to protect each motor against operating overloads.

‡ For full-voltage starting of normal torque, normal starting current motors.

° For reduced-voltage starting of normal torque, normal starting current-motors and full-voltage, starting of high-reactance, low starting current squirrel-cage motors.

METHOD OF DETERMINATION OF ELECTRICAL LINE LOSS

Used when meter is located an appreciable distance from the pump motor

Watts equals I^2 R per line.

Kilowatts or kw equals I^2 R, divided by 1,000. R equals the resistance of one line.

For 3-phase circuit kw equals 3 I^2 R, divided by 1,000.

R equals the resistance in ohms for wire size used.

I equals the full load current of the motor.

Full load current of the motor should be obtained from the name plate on the motor.

See tabulations at right for values of R.

For more accurate determination, use the same value of R and determine I by use of an ammeter in the circuit.

After determining the total kw loss, subtract this figure from the kw input to the motor.

DIAMETER AND RESISTANCE OF STANDARD ANNEALED COPPER WIRE

(Round Solid Conductor)
(Based on U.S. Bureau of Standards)

No.	Diameter Circ. Mils	Resistance at 25° C (77° F) Ohms per 1,000 Feet
A.W.D.	460	0.04998
0000	410	0.06302
000	365	0.07947
00	325	0.1002
0	289	01 264
2	258	0.1593
3	229	0.2009
4	204	0.2533
6	162	0.4028
8	129	0.6405
10	102	1.018
12	81	1.619
14	64	2.575

MECHANICAL AND ELECTRICAL EQUIVALENTS

FLOWING WATER

1 cubic foot per minute = 7.4805 gallons per minute.
1 second foot =
  1 cubic foot per second.
  448.83 gallons per minute.
1 second - foot - day = 2 acre feet.

WEIGHTS AND MEASURES

LENGTH
1 millimeter = .03937 inch.
1 centimeter = 3.937 inch.
1 meter =
  39.37 inches.
  3.2808 feet.
Circumference of a circle = 3.1416 x diameter.

1 mile =
  5280 feet.
  1.60935 kilometers.
  .868 knots
  8 furlongs

AREA
1 acre = 43560 square feet

1 acre foot =
  43560 cubic feet.
  325900 gallons.

Area of a circle = 3. 1416 x $\frac{diam^2}{4}$

VOLUME

1 barrel = 42 gallons.

Volume of a sphere = 3.1416 x $\frac{diam^3}{6}$

WEIGHT
1 gram
  1 cubic centimeter of distilled water.
  15.43 grains troy.
  .0353 ounce.
1 kilogram = 2.20462 pounds avoirdupois.
1 metric ton 2204.6 pounds.
1 cubic foot of concrete (1:2:4) = 146 pounds
1 cubic foot of sea water = 63.9 pounds.
1 cubic inch of bronze = .32 pound.
1 cubic inch of cast iron = .26 pound.
1 cubic inch of steel = .28 pound.

TEMPERATURE

Degrees C = $\frac{5}{9}$ x (F - 32)   Degrees F= $\frac{9}{5}$ x C+32

PRESSURE

1 atmosphere =
  760 millimeters of mercury at 32° F.
  14.7 pounds per square inch.
  29.921 inches of mercury at 32° t.
  2116 pounds per square foot.
  1.033 kilograms per square centimeter.
  33.947 feet of water at 62° F.
  10.33 meters of water at 20° C.
  1.013 bar.
1 foot of air at 32° F and barometer 29.92 =
  .0761 pound per square foot.
  .0146 inch of water at 62° F.
1 foot of water at 62° F =
  .433 pound per square inch
  62.355 pounds per square foot.
  .883 inch of mercury at 62° F.
  821.2 feet of air at 62° F and barometer 29.92.
1 inch of water 62° F =
  .0361 pound per square inch.
  5.196 pounds per square foot
  .5776 ounce per square inch
  .073 5 inch of mercury at 62° F
  68.44 feet of air at 62° F and barometer 29.92.
1 pound per square inch =
  2.0355 inches of mercury at 32° F
  2.0416 inches of mercury at 62° F.
  2.309 feet of water at 62° F.
  .07031 kilograms per square centimeter
  .06804 atmosphere.
  51.7 millimeters of mercury at 32° F.

EQUIVALENTS OF CAPACITY OR VOLUME FACTORS

1-U.S. Gallon of Water	231	Cu. inches
1-U.S. Gallon of Water	.1337	Cu. foot
1-U.S. Gallon of Water	8.326	Lbs. at 39° F or 1.00 Sp. Gr.
1-U.S. Gallon of Water	.833	Imperial gallon
1-U.S. Gallon of Water	3.7853	Litres
1-Imperial Gallon of Water	1.201	U.S. Gallons
1-Imperial Gallon of Water	277.418	Cu. inches
1-Imperial Gallon of Water	9.988	Lbs. at 39° F or 1.00 Sp. Gr.
1-Cubic Foot of Water	7.48	U.S. Gallons
1-Cubic Foot of Water	62.428	Lbs. at 39° F
1-Cubic Foot of Water	28.316	Litres
1-Cubic Foot of Water	.0283	Cubic meter
1-Lb. of Water	27.71	Cu. inches
1-Lb. of Water	.12	U.S. Gallon
1-Lb	.4536	Kilogram
1-Litre	.2642	U.S. Gallon
1-Litre	.22	Imperial Gallon
1-Litre	61.025	Cu. inches
1-Litre	.0353	Cu. foot
1-Cubic Meter	264	U.S. Gallons
1-Cubic Meter	220	Imperial Gallons
1-Cubic Meter	1.308	Cu. yards
1-Cubic Meter	61,028	Cu. inches
1-Cubic Meter	35.31	Cu. feet
1-Ton of Water (2000 lbs.)	240 2	U.S. Gallons at 39° F
1-Ton of Water (2000 lbs.)	199.8	Imperial Gallons at 39° F
1-Second-foot	7.48	U.S. Gallons per Second
1-Second-foot	448.8	U.S Gallons per Minute
1-Second-foot	646,272	U.S. Gallons per Day
1-Second-foot	1	Acre inch per hour approximately
100-U.S. Gallons per Minute	223	Second-fool
1,000,000-US. Gallons per Day	1.547	Second-feet
1,000,000-U.S. Gallons	3.07	Acre feet
1,000,000-U.S. Gallons per Day	694.4	Gallons per Minute
1-Acre foot	325,851	Gallons
1-Inch deep on 1 sq. Mile	2,323,200	Cu. ft.
		Boiler HP x .072

MECHANICAL AND ELECTRICAL UNITS

1 btu =
  1054 joules.
  777.5 foot pounds.
  107.5 kilogram-meters.
  .0003927 horsepower hour.
1 foot pound =
  1.3558 joules.
  .13826 kilogram-meter.
  .001286 btu.
  .03241 gram calorie.
  .000000505 horsepower hour.
1 horsepower =
  745.7 watts.
  .736 Kw (metric)
  33,000 foot pounds per minute.
  641,700 gram calories per hour.
  273,743 kilogram-meters per hour.
  2,547 btu per hour.
  75 kg m/s
1 joule =
  1 Nm
  .10197 kilogram-meter.
  .73756 foot pound.
  .239 gram calorie.
  .0009486 btu.
1 kilogram-meter =
  7.233 foot pounds.
  9.806 joules.
  2.344 gram calories.
  .0093 btu.
1 kilowatt =
  1000 watts.
  1.341 horsepower.
  2,655,200 foot pounds per hour.
  860,500 gram calories per hour.
  367,000 kilogram-meters per hour.
  3,415 btu per hour.
  .102 boiler horsepower.

METRICATION

LENGTH

1 km	= 1000 m	1 m	= 1000mm = 100 cm
cm	= 0.3937 in	in	= 2.54 cm = 25.4 mm
m	= 3.28 ft	ft	= 0.3048 m
m	= 1.094 yd	yd	= 0.9144 mm
km	= 0.621mi	mi	= 1.61 km

CAPACITY

1L	= 1000 cc	1L	= 1000 mL
1L	= 0.0353 ft^3	cu ft	= 28.32 L
1L	= 0.2642 gal (U.S.)	gal	= 3.785 L
1L	= 61.023 in^3	cu in	= 0.0164

AREA

sq cm	= 0.155 sq in	sq in	= 6.45 sq cm
sq m	= 10.76 sq ft	sq ft	= .0929 sq m
sq m	= 1.196 sq yd	sq yd	= .836 sq m
ha	= 2.47 acres	acre	= .405 ha
sq km	= 0.386 sq mi	sq mi	= 259 sq km

PRESSURE

1 kg per sq cm	= 14.2233 psi
1 kg per cm^2	= .96784 std atm
1 kg per cm^2	= .98l bar
1 psi	= .0703l kg per cm^2
1 kg per m^2	= .20482 lbs/ft^2
1 lb per ft^2	= 4.8824 kg per m^2
1 std atm	= 1.033228 kg per cm^2
1 metric atm	= 1.033228 kg per cm^2
1 st atm	= 14.6959 psi
1 N/m^2	= 1.0194 x 10-6 kg/cm^2

CENTIGRADE/FAHRENHEIT CONVERSION FORMULAE

F = 9/5 x © + 32 = 1.8 (C + 17.8)
C=5/9(F—32)

WEIGHT

one kg	= 1000 g	one g	= 1000 mg
g	= 15.432 grains	oz	= 28.35 g
g	= .0353 oz	lb	= .454 kg
kg	= 2.2046 lbs.	ton (short)	= 907.18 kg
kg	= .0011 ton (short)	ton (short)	= .907 metric
		ton (short)	= 2000 lbs
metric ton	= 1.1025 ton (short)		
grain	= .0648 g		

VOLUME

one cu m	= $(100)^3$ cm	one L	= 1000 cc = 1000 mL
cu cm	= .061 cu in	cu in	= 16.38 cm^3
cu m	= 35.315 cu ft	cu ft	= .0283 m^3
cu m	= 1.308 cu yd	cu yd	= .7645 m^3

CONVERSION

CONVERT FROM	TO	MULTIPLY BY
gal (U.S.) per min	m^3/hr	.2272
m	ft	3.28
ft	m	.3048
m^3/hr	U.S. gpm	4.4021
m^3/hr	L/sec	.2278
hp (mech.)	hp (metric)	1.01387
hp (metric)	hp (mech.)	.986320
kg/cm^2	psi	14.2233
psi	kg/cm^2	.07031

HORSEPOWER* FORMULAE °1 hp = 33,000 ft lb/min

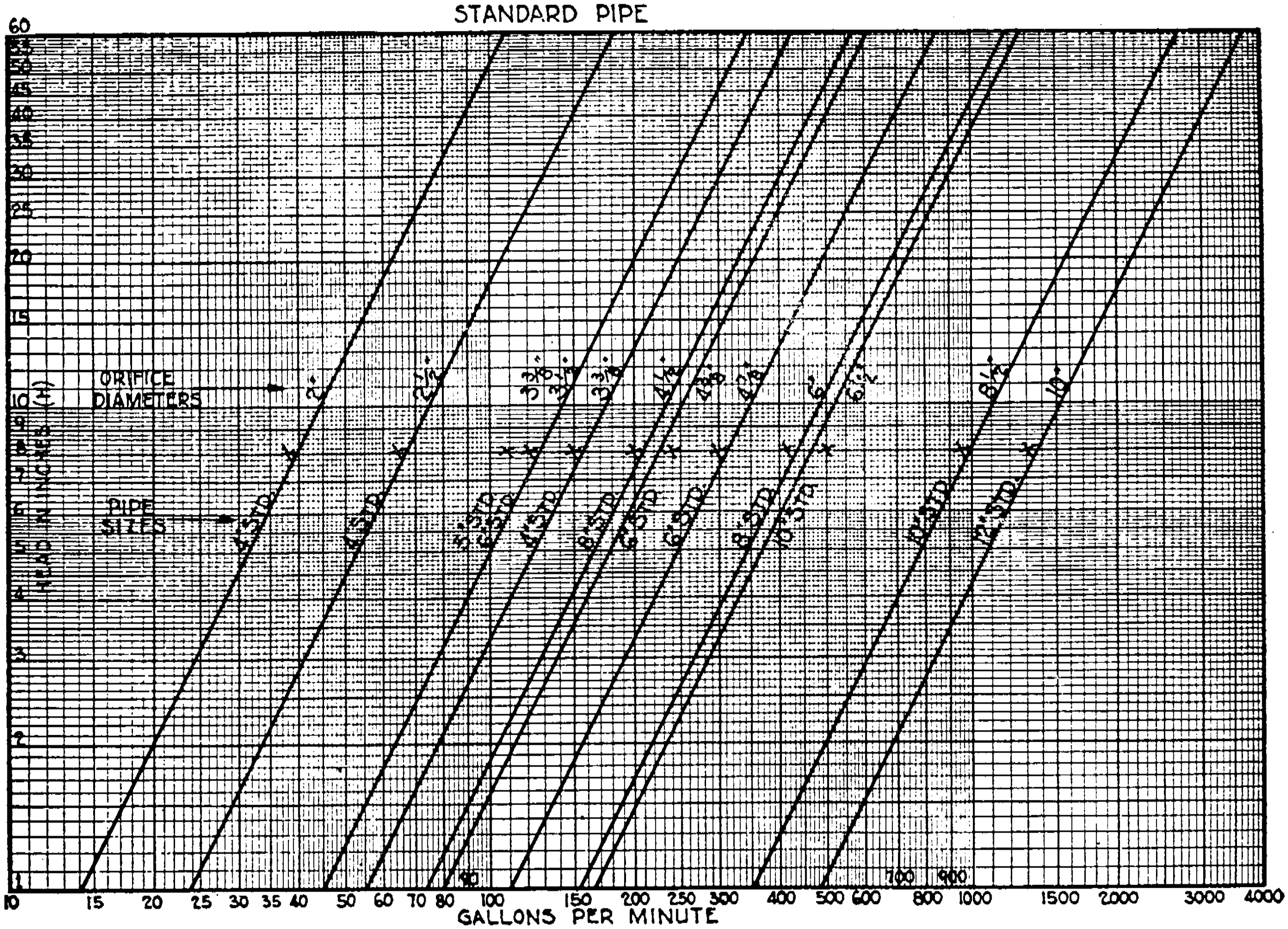
bhp = .7460 kw
= 550 ft lb/sec.
1 hp = .7355 kw (metric)
= 75 kg/m/sec.
mhp = .9863 x bhp

$$bhp = \frac{Q\ (gpm) \times H\ (ft) \times Sp.\ Gr.}{3960 \times E} = \frac{m^3/hr \times H\ (m) \times Sp.\ Gr.}{274.23217 \times E} = \frac{m^3/hr \times H\ (m) \times Sp.\ Gr.}{278.04134}$$

ABBREVIATIONS

acre-spell out	ft-foot	kPa-kilopascal	N-Newton
atm-atmosphere	g-gram	L-liter	oz-ounce
bar-spell out	gal-gallon	lb-pound	P-Pascal
bhp-brake horsepower C-	gpm-gal per min	m-meter	psi-pounds per square inch
Centigrade (Celsius)	grain-spell out	m^3-cubic meters	Sp. Gr.-Specific Gravity
cc-cm^3	ha-hectare	metric-spell out	ton-spell out
cm-centimeter	hp-horsepower	mhp-metric horsepower	yd-yard
cu-cubic	in-inch	mi-mile	
F-Fahrenheit	km-kilometer	mm-millimeter	

STANDARD PIPE



STANDARD PIPE

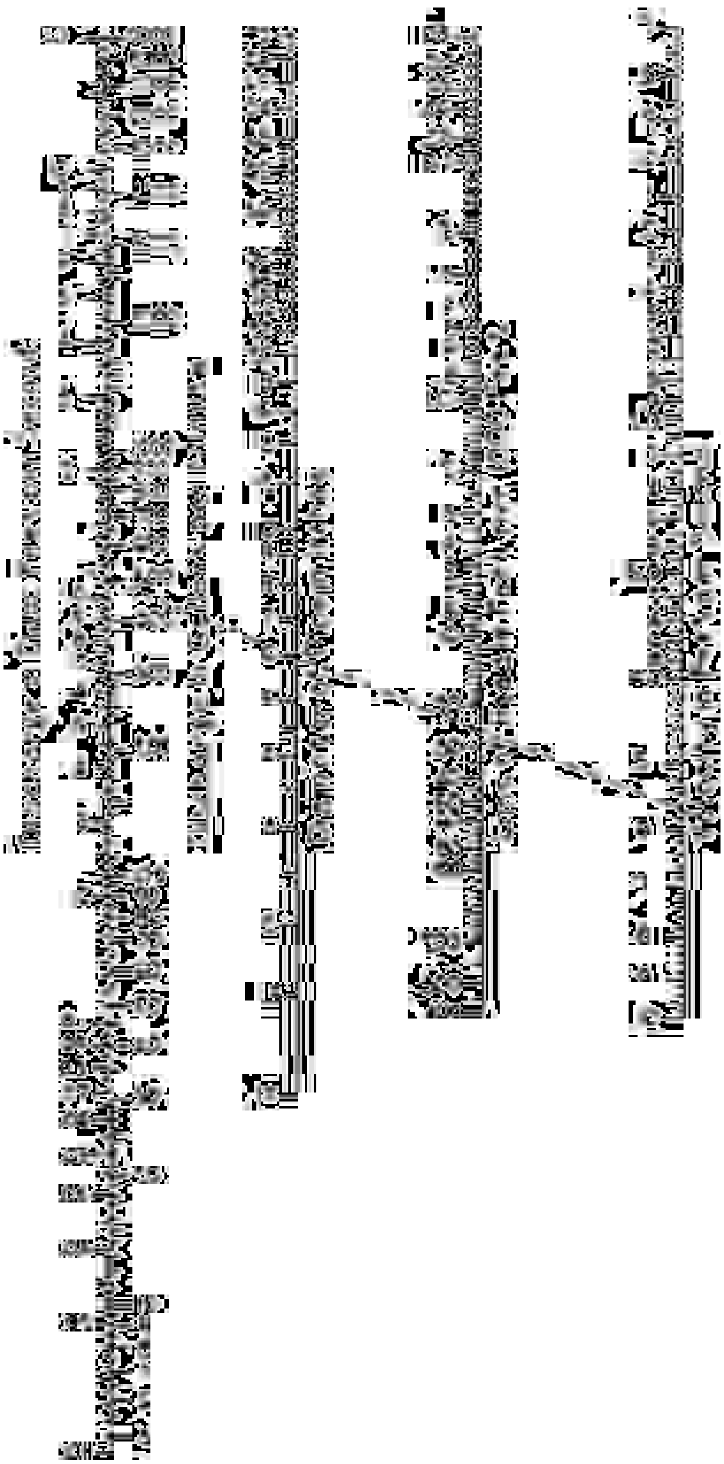
All weights and dimensions are nominal

Size	Weight per foot		Pipe			Threads per inch	Couplings			Test pressure		
	Threads and couplings	Plain ends	Thickness	Diameters: External	Diameters: Internal		Length	External diameter	Weight	Butt-welded	Lap-welded	Seamless
Ins.	Lbs.	Lbs.	Ins.	Ins.	Ins.		Ins.	Ins.	Lbs.	Lbs. per sq. in.		
1/8	.24	.24	.068	.405	.269	27	13/16	.563	.03	700	....	1000
1/4	.42	.42	.088	.540	.364	18	1 3/16	.719	.07	700	....	1000
3/8	.57	.57	.091	.675	.493	18	1 3/16	.875	.09	700	....	1000
1/2	.85	.85	.109	.840	.622	14	1 9/16	1.063	.17	700	....	1000
3/4	1.13	1.13	.113	1.050	.824	14	1 5/8	1.313	.24	700	....	1000
1	1.68	1.68	.133	1.315	1.049	11 1/2	2	1.576	.38	700	....	1000
1 1/4	2.28	2.27	.140	1.660	1.380	11 1/2	2 1/16	1.900	.44	700	....	2500
1 1/2	2.73	2.72	.145	1.900	1.610	11 1/2	2 1/16	2.200	.60	700	....	2300
2	3.67	3.65	.154	2.375	2.067	11 1/2	2 1/8	2.750	.93	700	1000	1900
2 1/2	5.81	5.79	.203	2.875	2.469	8	3 1/8	3.250	1.82	800	1000	2100
3	7.61	7.58	.216	3.500	3.068	8	3 1/4	4.000	2.98	800	1000	1900
3 1/2	9.20	9.11	.226	4.000	3.548	8	3 3/8	4.625	4.20	...	1000	1700
4	10.88	10.79	.237	4.500	4.026	8	3 1/2	5.000	4.51	...	1000	1600
5	14.81	14.62	.258	5.563	5.047	8	3 3/4	6.296	8.25	...	1000	1500
6	19.18	18.97	.280	6.625	6.065	8	4	7.390	10.88	...	1000	1500
8	25.00	24.70	.277	8.625	8.071	8	5 1/4	9.625	23.46	...	800	1000
8	28.80	28.55	.322	8.625	7.981	8	5 1/4	9.625	23.46	...	1000	1200
10	32.00	31.20	.279	10.750	10.192	8	5 3/4	11.750	32.02	...	600	800
10	35.00	34.24	.307	10.750	10.136	8	5 3/4	11.750	32.02	...	800	900
10	41.13	40.48	.365	10.750	10.020	8	5 3/4	11.750	32.02	...	900	1000
12	45.00	43.77	.330	12.750	12.090	8	6 1/8	14.000	49.92	...	600	800
12	50.70	49.56	.375	12.750	12.000	8	6 1/8	14.000	49.92	...	800	900

The permissible variation in weight is 5 per cent above and 5 per cent below.

DIAGRAM FOR CALCULATING PIPE SIZES, DISCHARGE VELOCITIES AND LOSS OF HEAD IN STANDARD STEEL PIPE

(For Cast Iron and Concrete Pipes See Note at Right)



Lay a straightedge on scales at the points for any two known quantities and the unknown quantities will lie at aitersection of the straightedge with the other scales.

Example: To discharge 500 gals. per minute through 6.000" pipe, following dotted line would show loss of head in a thousand feet of approximately 25 feet head and velocity of 5.7 feet per second.

Note: Loss of head in Cast Iron Pipe — loss of head in steel pipe multiplied by 1.5. Loss of head in Concrete Pipe loss of head in steel pipe multiplied by 2. When pipe is somewhat rough, add 10% to loss of head; when very rough add 25%.

FRICTION OF WATER IN SMALL PIPES

Loss of Head in Feet due to Friction
Per 100 Feet of Smooth Straight Pipe.

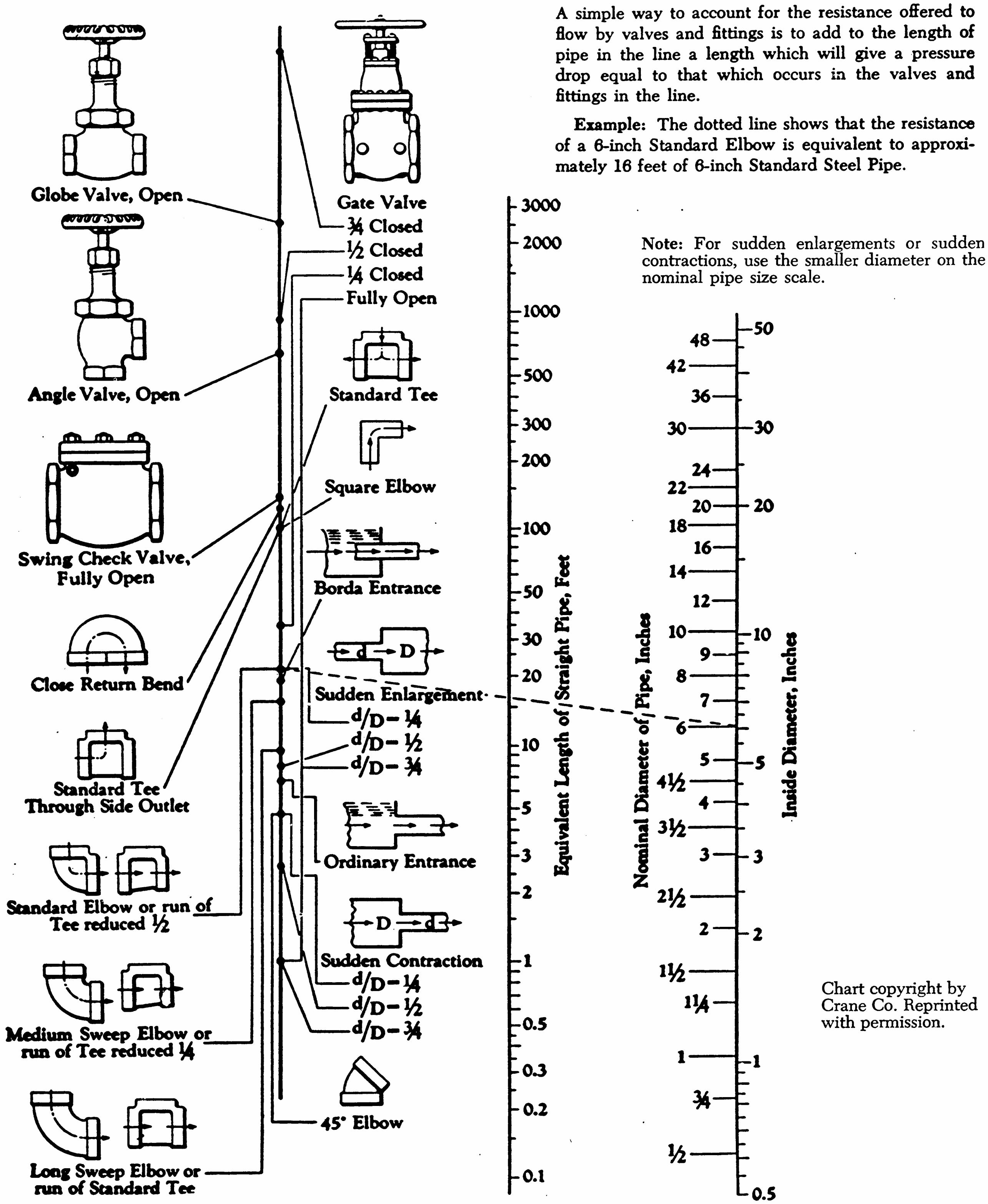
gpm	0.500 Inch Pipe	0.750 Inch Pipe	1.000 Inch Pipe
2	7.57	1.93	0.595
3	16.0	4.08	1.26
4	27.3	6.94	2.14
5	41.2	10.5	3.24

RESISTANCE OF VALVES AND FITTINGS TO FLOW OF FLUIDS

A simple way to account for the resistance offered to flow by valves and fittings is to add to the length of pipe in the line a length which will give a pressure drop equal to that which occurs in the valves and fittings in the line.

Example: The dotted line shows that the resistance of a 6-inch Standard Elbow is equivalent to approximately 16 feet of 6-inch Standard Steel Pipe.

Note: For sudden enlargements or sudden contractions, use the smaller diameter on the nominal pipe size scale.



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GENERAL SPECIFICATION FORM
WATER LUBRICATED DEEP WELL TURBINE PUMP

GENERAL REQUIREMENTS:
These specifications are intended to cover the furnishing (and deliver) of a complete vertical motor-driven deep well turbine pump for
____ at ____. Installation will be made by (owner) (others).

OPERATING CONDITIONS: The following are the operating conditions:

(1) Size of well (inside diameter) __________ inches
(2) Depth of well __________ feet
(3) Standing water level below top of well __________ feet
(4) Pumping level below top of well at rated pump capacity __________ feet
(5) Pumping head or pressure above top of well __________ feet
(6) Total pumping head (4 and 5) __________ feet
(7) Capacity of pump __________ GPM

The total pumping head does not include losses in the pump, which must be allowed by the bidder. The efficiency of the pumping unit shall be as high as correct design and good engineering will permit. All things being equal, consideration will be given to overall pumping costs.

MOTORS:
The motor thrust bearing shall have ample capacity to carry the weight of all the rotating parts plus the hydraulic thrust of the pump impellers, and have an ample safety factor. This factor should be based on an average life expectancy of five years operation at 24 hours per day. The motor shall be of the full voltage starting, vertical hollow shaft, squirrel cage induction type and shall conform to the standard of the American Institute of Electrical Engineers.

The motor shall be a ____ volt, ____ phase, ____ cycle, not more than ____ RPM at no load shall be of proper size to drive the pump continuously under the total head specified with a temperature rise not exceeding 900 C by resistance at service factor load above ambient temperature. (General practice in the pump industry is to operate pumps 1800 RPM for capacities up to 7000 GPM, and at 1200 RPM for capacities from 7000 GPM to 15000 GPM.)

PUMP HEAD:
A pump head of high grade cast iron or fabricated steel shall be provided for mounting the motor, with an above-ground flanged discharge outlet and a companion flange threaded for ____ inch standard pipe.

Alternate for underground discharge: An underground discharge tee with flanged discharge outlet for ____ inch standard connection below the base plate shall be provided.

PUMP COLUMN ASSEMBLY:
The total length of the discharge column shall be ____ feet. The column pipe shall be not less than ____ inches inside diameter and weight not less than ____ pounds per foot. The pipe shall be furnished in interchangeable sections not over ten (10) feet in length, and shall be connected with threaded, sleeve type couplings. The joints are to be butted to insure perfect alignment after assembly.

The line shafting shall be turned, ground and polished precision shafting of ample size to operate the pump without distortion or vibration. The shaft shall be furnished in interchangeable sections not over ten (10) feet in length, and shall be coupled with strong steel couplings machined from solid bar steel. A non-corrosive flame sprayed stainless steel journal shall be placed on each shaft at the bearing point. The stainless steel journal O.D. will be substantially flush with the shaft CD. (recess not to be deeper than diameter corresponding to the root diameter of shaft threads).

The column assembly shall have bronze bearing retainers threaded into the pipe couplings and retained by the butted pipe ends. Each bearing retainer shall contain a water lubricated, cutless rubber bearing designed for vertical turbine pump service.

PUMP BOWL ASSEMBLY:
The pump bowls shall be of close grained cast iron having a minimum tensile strength of 30,000 pounds per square inch, free from blow holes, sand holes, and all other faults; accurately machined and fitted to close dimensions.

The impeller shaft shall be of stainless steel of not less than 12% chrome. The impeller shaft shall be supported by a combination of water lubricated, fluted rubber and bronze bearings.

The impeller shall be of (bronze) (cast iron), accurately machined and finished, and mechanically balanced. They shall be securely fastened to the impeller shaft with a tapered bushing.

Each bowl shall have an impeller seal ring to prevent slippage of water between bowl and impeller. The impellers shall be adjustable by means of a top shaft nut at the top of the motor.

SUCTION PIPE AND STRAINER:
A suction pipe ten (10) feet in length and of proper diameter and same material as pump column shall be provided. A strainer having a net inlet opening area of not less than four times the area of the suction pipe shall be provided.

WATER LEVEL INDICATOR:
A suitable air line of galvanized iron pipe, copper or plastic tubing of sufficient length to extend from the surface to the top of the bowl assembly, with altitude gage reading in feet, and connections for air pump, shall be furnished.

DESCRIPTIVE MATTER:
The bidder shall submit with each proposal complete dimensional prints and descriptive matter, including performance characteristics, to clearly cover the equipment offered.

Motor efficiencies and power factors for one-half (1/2), three-quarters (3/4), and full load conditions shall be submitted.

VARIATIONS AND EXCEPTIONS:
Variations from the above specifications will be considered providing the bidder calls particular attention to such exceptions and explains in detail the reasons and advantages for the exceptions.

The City / Purchaser reserves the right to reject any or all bids

The specifications on pages 1 and 2 for a standard water lubricated turbine pump are non-restrictive and will permit most vertical pump manufacturers to quote and meet the requirements of these specifications.

It is not the desire or intent of Peerless Pump to prohibit open competitive bidding and for that reason none of the special features of the modern Peerless Pump are incorporated in these specifications.

A Peerless water lubricated pump quotation would meet all the requirements of the foregoing specifications and, in addition, would include the following special features.

PUMP COLUMN ASSEMBLY: The pump column assembly conforms to the foregoing specifications but with the advantage of the following special features.

(1) The bowl provides a side seal at the impeller skirt and, in addition, a resilient neoprene ring reinforced with an embedded steel core is installed in the bowl directly below the impeller skirt. This "lateral bowl wear ring" is very durable and, being resilient, does not wear the impeller skirt. Original capacities and efficiencies can be maintained by a simple adjustment of the top shaft nut at the top of the motor. If the side seal wears, the bottom neoprene seal ring retains its form and dimension and restricts the leakage flow at the impeller skirt.

(2) Peerless Pump bowls are coated inside with a smooth vitreous enamel which reduces friction losses in the water passages and thus gives better efficiency. The enameling also reduces corrosion and sand wear.

(3) Each Peerless Pump intermediate bowl is constructed by using a bronze bearing and neoprene bearing to support the impeller shaft which gives the longest possible life based in the widest range of pumping conditions.

We do not recommend that any of these special features be incorporated in your specifications because they may tend to be restrictive for other manufacturers, but a Peerless Pump will have these features whether they are specified or not.

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GENERAL SPECIFICATION FORM
OIL LUBRICATED DEEP WELL TURBINE PUMP

GENERAL REQUIREMENTS:

These specifications are intended to cover the furnishing (and delivery) of a complete vertical motor-driven deep well turbine pump for ________________________________ at _____________________________
Installation will be made by (owner) (others).

OPERATING CONDITIONS: The following are the operating conditions:

(1)	Size of well (inside diameter)	________________________	inches
(2)	Depth of well	________________________	feet
(3)	Standing water level below top of well	________________________	feet
(4)	Pumping level below top of well at rated pump capacity	________________________	feet
(5)	Pumping head or pressure above top of well	________________________	feet
(6)	Total pumping head (4 and 5)	________________________	feet
(7)	Capacity of pump	________________________	GPM

The total pumping head does not include losses in the pump, which must be allowed by the bidder. The efficiency of the pumping unit shall be as high as correct design and good engineering will permit. Al things being equal, consideration will be given to overall costs.

MOTOR:
The motor thrust bearing shall have ample capacity to carry the weight of all the rotating parts plus the hydraulic thrust of the pump impellers, and have an ample safety factor. This factor should be based on an average life expectancy of five years operation at 24 hours per day. The motor shall be of the full voltage starting, vertical hollow shaft, squirrel cage induction type and shall conform to the standard of the American Institute of Electrical Engineers.

The motor shall be a ____ volt, ____ phase, ____ cycle, not more than ____ RPM at no load and shall be of proper size to drive the pump continuously under the total head specified with a temperature rise not exceeding 90° C by resistance at service factor load above ambient temperature. (General practice in the pump industry is to operate pumps 1800 RPM for capacities up to 7000 GPM and at 1200 RPM for capacities from 7000 GPM to 15,000 GPM.)

PUMP HEAD:
A pump head of high grade cast iron or fabricated steel shall be provided for mounting the motor, with an above-ground flanged discharge outlet and a companion flange threaded for ____ inch standard pipe.

Alternate for underground discharge: An underground discharge tee with flanged discharge outlet for ____ inch standard connection below the base plate shall be provided.

PUMP COLUMN ASSEMBLY:
The total length of the discharge column shall be ____ feet. The column pipe shall be not less than ____ inches inside diameter and weight not less than ____ pounds per foot. The pipe shall be furnished in interchangeable sections not over ten feet in length, and shall be connected with threaded steel sleeve type couplings. The joints are to be butted to insure perfect alignment after assembly.

The line shaft shall be turned, ground and polished precision shafting of ample size to operate the pump without distortion or vibration. The shaft shall be furnished in interchangeable sections not over ten feet in length and shall be coupled with strong steel couplings machined from solid bar steel.

The shaft enclosing tube shall be interchangeable sections, not over five feet in length, of extra strong pipe to receive bronze couplings, which will also act as line shaft bearings. Bearings shall be lubricated by an oiler assembly located on the pump head.

PUMP BOWL ASSEMBLY:
The pump bowls shall be of close grained cast iron having a minimum tensile strength of 30,000 pounds per square inch, free from blow holes, sand holes, and all other faults; accurately machined and fitted to close dimensions.

The impeller shaft shall be of stainless steel of not less than 12% chrome. No so-called rustless iron will be considered. The impeller shaft shall be supported by water lubricated bronze bearings.

The impeller shall be of (bronze) (cast iron), accurately machined and finished, and mechanically balanced. They shall be securely fastened to the impeller shaft with a tapered bushing.

Each bowl shall provide a side and bottom seal at the impeller skirt to prevent slippage of water between bowl and impeller. The impellers shall be adjustable by means of a top shaft nut at the top of the motor.

SUCTION PIPE AND STRAINER:
A suction pipe ten feet in length and of proper diameter and same material as pump column shall be provided. A strainer having a net inlet opening of not less than four times the area of the suction pipe shall be provided.

WATER LEVEL INDICATOR:
A suitable air line of galvanized iron pipe, copper or plastic tubing of sufficient length to extend from the surface to the top of the bowl assembly, with altitude gage reading in feet, and connections for air pump, shall be furnished.

DESCRIPTIVE MATTER:
The bidder shall submit with each proposal complete dimensional prints and descriptive matter, including performance characteristics, to clearly cover the equipment offered.

Motor efficiencies and power factors for one-half, three-quarters and full load conditions shall be submitted.

VARIATIONS AND EXCEPTIONS:
Variations from the above specifications will be considered provided the bidder calls particular attention to such exceptions and explains in detail the reasons and advantages for the exceptions.

The (City) (Purchaser) reserves the right to reject any or all bids.

The specifications on pages 5 and 6 for a standard oil lubricated turbine pump are non-restrictive and will permit most vertical pump manufacturers to quote and meet the requirements of these specifications.

It is not the desire or intent of Peerless Pump to prohibit open competitive bidding and for that reason, none of the special features of the modern Peerless Pump are incorporated in these specifications.

A Peerless oil lubricated pump quotation would meet all the requirements of the foregoing specifications and, in addition, would include the following special features.

TUBE NUT ASSEMBLY: The tube nut assembly has a bronze sleeve bearing in the tube nut cap. This bearing, which is lubricated by the oiler assembly, gives additional support to the top shaft before it enters the motor.

PUMP COLUMN ASSEMBLY: The pump column assembly conforms to the foregoing specifications, but with the advantage of the following special feature. Since each tube bearing in the enclosing tube receives lubrication from the oiler assembly at the pump head, a spiral groove is provided in each bearing to allow the oil to feed from each bearing to the one below. The spiral groove helps maintain a film of oil between the shaft and the close bearing bore, thereby reducing the wear factor.

PUMP BOWL ASSEMBLY: Peerless Pump bowls conform to the specifications as written, but they also include the following special features.

(1) The bowl provides a side seal at the impeller skirt and, in addition, a resilient neoprene ring reinforced with an embedded steel core is installed in the bowl directly below the impeller skirt. This “lateral bowl wear ring” is very durable and, being resilient, does not wear the impeller skirt. Original capacities and efficiencies can be maintained by a simple adjustment of the top shaft nut at the top of the motor. If the side seal wears, the bottom neoprene seal ring retains its form and dimension and restricts leakage flow at the impeller skirt.

(2) Peerless Pump bowls are coated inside with a smooth vitreous enamel which reduces friction losses in the water passages and thus gives better efficiency. The enameling also reduces corrosion and sand wear.

(3) Each Peerless Pump intermediate bowl is constructed by using a bronze bearing and a neoprene bearing to support the impeller shaft which gives the longest possible life based on the widest range of pumping conditions.

We do not recommend that any of these special features be incorporated in your specifications because they may tend to be restrictive for other manufacturers, but a Peerless Pump will have these features whether they are specified or not.

Bearing Temperature Limitations and Recommendations

For Bowls, Line shaft and Container

Material	Temp. Range °F	Specific Gravity Minimum	Remarks
Neoprene	32 to 131°F.	1.0	Good for abrasive service. Do not use where H_2S is present.
Bronze: SAE 660 (In Bronze or class 30 cast iron retainer)	-60 to 170° F.	0.5	General purpose bearing successfully applied on non-abrasive fresh or salt water and hydro-carbons.
Carbon	-300 to 450° F.	0.3	Good for extreme temperatures and non-abrasive fluids. Also excellent where fluid has poor lubricating qualities.
Teflon® fluoropolymer	31 to 170° F.	0.3	Settings longer than 50 feet. Non-abrasive fluids. Not to be used on pump speeds more than 2900 RPM.
Cast Iron with ground and electro-filmed I.D. (In class 30 cast iron retainer.)	32 to 180° F.	0.8	Factory may substitute bronze at its option where fluids are hydrocarbons.

① Neoprene lateral bowl wear rings can be used where H_2S is present.

Teflon® is a registered trademark of Dupont Dow Elastomers

MATERIAL SPECIFICATION CHART

MATERIAL	DESIGNATION	APPROXIMATE CHEMICAL ANALYSIS %	APPROXIMATE PHYSICAL PROPERTIES	APPLICATION AND REMARKS
Leaded Red Brass	SAE 40 ASTM B584 ALLOY 836 UNS-C83600	Copper 85.0 Tin 4.5 Lead 4.5 Iron 0.25 Nickel 0.75 Antimony 0.25	Tensile Strength 30,000 psi Brinell Hardness 50	Because of its excellent castings & machine characteristic, this alloy is the most commonly used bronze alloy. It is used for awide variety of parts such as impellers, tube bearings, shaft sleeves, glands, water slingers, etc.
Leaded Tin Bronze	SAE 621 ASTM B143 ALLOY 923 UNS-C92300	Copper 86.0 Tin 8.0 Lead 1.0 Zinc 4.0 Nickel 1.0	Tensile Strength 36,000 psi Brinell Hardness 72	Where impeller vanes are such that a metal easy to cast is required, SAE 621 is used.
Aluminum Bronze	SAE J461 ASTM B148 Alloy 955 UNS-C95500	Copper 78.0 Aluminum 10.0-11.5 Iron 3.0-5.0 Manganese 3.5 Nickel 3.0-5.5	Tensile Strength 90,000 psi Brinell Hardness 190	Good corrosion resistance and high strength. More difficult to machine than other bronzes.
Nickel Aluminum Bronze	ASTM B148 ALLOY 958 UNS-C95800	Copper 81.5 Aluminum 9.0 Iron 4.0 Nickel 4.5 Manganese 1.0	Tensile Strength 100,000 psi Brinell Hardness 179	A high strength, ductile, extra tough corrosion and cavitation resisting material. Especially well suited for marine and sea water applications.
Zinc-less Bronze	SAE 63 ASTM-B505 ALLOY 927 UNS-C92700	Copper 87.5 Tin 9.5 Lead 1.5 Zinc 0.75	Tensile Strength 35,000 psi Brinell Hardness 65	This bronze has its greatest application on bowl and impeller castings where a corrosive such as acid mine water or salt water is being pumped. It is not used unless specifically required for a job.
High Leaded Tin (Phosphor) Bronze	SAE 64 ASTM B584 ALLOY 937 UNS-C93700	Copper 79.0 Tin 9.5 Lead 9.5 Zinc 0.75 Nickel 0.75 Antimony 0.55	Tensile Strength 25,000 psi Brinell Hardness 55	Because of its excellent anti-friction properties this bronze alloy commonly used for bearings & wear rings.
Bearing Bronze High Leaded Tin Bronze	SAE 660 ASTM B584 ALLOY 932 UNS-C93200	Copper 83.0 Tin 7.0 Lead 7.0 Zinc 3.0	Tensile Strength 30,000 psi Brinell Hardness 58	The excellent anti-frictional and corrosion resistant properties of this bronze made it well suited for general purpose bearing applications.
Babbitt (Nickel Babbitt)	ASTM B-23 ALLOY 2 UNS-None	Tin 88.5 Antimony 7.5 Copper 3.5 Nickel 0.5 Lead 0.1	Tensile Strength 11, 200 psi Brinell Hardness 25	Used as a sleeve bearing material and especially applicable where corrosion is a problem such as acid mine water.

MATERIAL SPECIFICATION CHART

MATERIAL	DESIGNATION	APPROXIMATE CHEMICAL ANALYSIS%	APPROXIMATE PHYSICAL PROPERTIES	APPLICATION AND REMARKS
Cast Iron (Gray Iron)	ASTM A-48 SAE-None CL50-UNS-F12101 CL40-UNS-F12801 CL50-UNS-F13501	Rarely is ever classified by chemical analysis. For example the ASTM gives no specified required analysis.	Class 30 Tensile Strength 30,000 psi Class 40 Tensile Strength 40,000 psi Class 50 Tensile Strength 50,000 psi	Most commonly used general purpose pump casting materials. Easy to cast used rarely if there is a corrosion problem, has been successfully used in salt water, dry chlorine and other fluids. Class 30 used most often. Other classes available if higher strength and wear resistance is required.
Ductile Iron	ASTM A536 GR. 80-55-06 UNS-F33800	Rarely if ever classified by chemical analysis	Tensile Strength 80,000 psi Yield Strength 55,000 psi	Most commonly used for castings.
Carbon Steel Shafting 2-7/16" and larger	AISI-C1045 ASTM A576 SAE 1045 UNS-G104500	Carbon .48-.50 Manganese .60-.90 Phosphorous .040 Sulfur .050	Tensile Strength 80,000 psi Brinell Hardness 183	This carbon steel alloy is the standard material for turbine pump lineshaft. For this use it is ground and polished and held to close diameter and straightness tolerances. It has relatively poor corrosion resistance.
Carbon Steel (188) Shafting ¾" thru 2-3/16	AISI 1045 ASTM A576 SAE 1045 UNS-G104500	Carbon .43-.50 Manganese .60-.90 Phosphorous .040 Sulfur .050	Tensile Strength 95,000 psi Brinell Hardness 150	This carbon steel alloy is the standard material for turbine pump line shaft.
Cast Steel	AISI 1030 ASTM A-16 GR. WCB UNS-J03002	Carbon .30 Manganese 1.0 Phosphorous .04 Sulfur .045 Silicon .6	Tensile Strength 70,000 psi	This alloy is used on application where the strength of cast iron is insufficient.
Column Pipe	ASTM A53 GR. B UNS-K03005	Carbon .3 Manganese 1.2 Phosphorous .05 Sulfur .06	Tensile Strength 60,000 psi	Used for deep well turbine column pipe. In general has poor corrosion resistance properties.
Steel Plate	ASTM A36 UNS-K02600	Carbon .25-.27 Manganese.80-1.20 Sulfur .05 Silicon .15-.04	Tensile Strength 58,000 psi Yield Strength 36,000 psi	Used in column flanges, base plates and sole plates. In general has poor corrosion resistance properties.

MATERIAL SPECIFICATION CHART

MATERIAL	DESIGNATION	APPROXIMATE CHEM. ANALYSIS %	APPROXIMATE PHYSICAL PROPERTIES	APPLICATION AND REMARKS
Stainless Steel (11.5-13.5% Chromium) Casting Note: Often Specified as "11-13% Chrome"	AIAI-410 ASTM A-743 GR. CA-15 UNS-J91150	Chromium 12.5 Silicon 1.0 Manganese 1.0 Carbon 0.15 Molybdenum 0.39 Sulfur .022 Iron 85.	Tensile Strength 90,000 psi	One of the least corrosion resistant stainless steels, this alloy has excellent high strength physical properties which are obtained by heat treatment. It has excellent corrosion resistance to atmospheric corrosion. Available in cast and wrought form.
Stainless Steel (12-14% Chromium) Note: Often Specified as "11-13% Chrome"	AISI-416 ASTM A582 Cond. A SAE 51416 UNS-S41600	Chromium 13. Silicon 1.0 Manganese 1.25 Carbon 0.15 Sulfur 0.25 Phosphorous .06 Max.	Tensile Strength 100,000 psi	The addition of sulfur makes alloy highly machinable. Like AISI-410 its corrosion resistance is superior to mild steel but in general does not compare favorably with the 18-8 type stainless steel. Type 416 has excellent mechanical properties obtained by heat treatment and is used almost exclusively in wrought form.
Stainless Steel (Type 18-8) Hot Finished	AISI-302 ASTM A-276 Cond. A SAE 30302 UNS-S30200	Chromium 18. Nickel 9. Manganese 2. Silicon 1. Carbon 0.15 Max. Phosphorous .045 Max.	Tensile Strength 75,000 psi	Has excellent corrosion resistance to a wide variety of substances which would attack cast iron and bronze alloys. Strength cannot be increased by heat treatment. Available in cast and wrought form.
Stainless Steel (Type 18-8) Precision Shafting	AISI-303 ASTM A582 Cond. A UNS-S30300	Chromium 18. Nickel 9. Manganese 2. Silicon 1. Carbon 0.2 Sulfur 0.27	Tensile Strength 75,000 psi	This alloy is a comparatively free machining type 18-8 stainless. Like all other 18-8 series steels, strength cannot be increased by heat treatment. It is available in wrought form.
Stainless Steel (Type 18-8) Casting	AISI-304 ASTM A-743 GR CF-8 UNS-J92600	Chromium 18. Nickel 10. Manganese 1.5 Silicon 2.0 Carbon .08 Max.	Tensile Strength 65,000 psi	Due to slightly different chemical analysis this alloy is less susceptible to loss of corrosion resistance resulting from welding than type 302. However, it is generally interchangeable with type 302. Strength cannot be increased by heat treatment. It is available in cast and wrought form.
Stainless Steel Type 304 Shafting	ASTM A276 AISI-304 SAE 30304 UNS-S30400	Chromium 18.0-20.0 Nickel 8.0-12.0 Silicon 1.0 Carbon .08 Max. Manganese 2.0 Phosphorous .045 Sulfur .03	Tensile Strength 85,000 psi	Type 304 is comparable to type 302, but is less susceptible to loss of corrosion resistance resulting from welding. Can be cold worked to greater tensile strength and hardness.

MATERIAL SPECIFICATION CHART

MATERIAL	DESIGNATION	APPROXIMATE CHEM. ANALYSIS %	APPROXIMATE PHYSICAL PROPERTIES	APPLICATION AND REMARKS
Stainless Steel (Type 18-8) Casting	AISI-316 ASTM A-743 GR. CF-8M UNS-J92900	Chromium 18. Nickel 10.5 Manganese 1.5 Molybdenum 2.0 Carbon .08 Silicon 2.0	Tensile Strength 70,000 psi	The addition of molybdenum makes 316 more resistant to corrosive attack for some applications than the other 18-8 steels. Strength cannot be increased by heat treatment. It is available in cast and wrought form.
Stainless Steel Type 316 Shafting	ASTM A276 Cond. A AISI-316 SAE 30316 UNS-S31600	Chromium 16.0-18.0 Nickel 10.0-14.0 Silicon 1.0 Carbon .08 Max. Manganese 2.0 Phosphorous .045 Sulfur .03 Molybdenum 2.0	Tensile Strength 75,000 psi	Used for shafting where good corrosion resistance is required. Type 316 has superior corrosion resistance to other chromium nickel steels when exposed to sea water and many types of chemicals.
Stainless Steel 17-4PH	ASTM-A564 Type 630 Cond. H-1150 UNS-S17400	Chromium 15.0-17.5 Nickel 3.0-5.0 Copper 3.0-5.0 Carbon .07 Max. Sulfur .03 Max. Manganese 1.0 Silicon 1.0	Tensile Strength 135,000 psi	Used on pump shaft requiring high strength and corrosion resistance. Corrosion resistance is similar to 304 stainless steel.
Stainless Steel Ferralium 255	ASTM-A479 UNS-S32550	Chromium 24.0-27.0 Nickel 4.5-6.5 Molybdenum 2.0-4.0 Copper 1.5-2.5	Tensile Strength 110,000 psi Brinell Hardness 297 (annealed bar)	Used on pump shafts requiring high strength and corrosion resistance. especially good in marine and sea water applications.
Stainless Steel (Type 29-9) Casting	ASTM-A743 GR. CE-30 UNS-J93423	Carbon 0.3 Silicon 2.0 Chromium 29.0 Nickel 9.0 Manganese 1.5	Tensile Strength 80,000 psi	Used extensively for bowl and impeller castings where corrosion is a problem and a chromium-nickel alloy must be used, such as in acid mine water.
20 Stainless Steel (Alloy 20) Casting	ASTM-A743 GR. CN-7M UNS-J95150	Chromium 20.0 Nickel 29.0 Molybdenum 2.0 Copper 3.0 Silicon 1.5 Manganese 1.5	Tensile Strength 62,500 psi Brinell Hardness 130	Completely corrosion resistant to many acids.
20M06 Stainless Steel Wrought	ASTM-B463 UNS-N08026	Chromium 20.0 Nickel 29.0 Molybdenum 2.0 Copper 3.0	Tensile Strength 85,000 psi Brinell Hardness 160	Completely corrosion resistant to many acids including sulphuric acid. Not recommended for halogen acid. Used in wrought form only.

MATERIAL SPECIFICATION CHART

MATERIAL	DESIGNATION	APPROXIMATE CHEM. ANALYSIS	APPROXIMATE PHYSICAL PROPERTIES	APPLICATION AND REMARKS
20CB3 Stainless Steel	ASTM-B463 UNS-N08020	Chromium 19.0-21.0 Nickel 30.0-38.0 Molybdenum 2.0-3.0 Copper 3.0-4.0 Carbon .70 max. Columbium and Tantalum- 8 x C min./1.0070	Tensile Strength 90,000 psi Brinell Hardness 160	The presence of columbium minimizes the precipitation to carbides during welding so that assemblies can be placed in service in the as-weld condition.
Monel Alloy K-500	ASTM-None FED-QQ-N-286 AMS4676 UNS-N05500	Nickel 65.0 Copper 29.5 Iron 1.0 Manganese 0.6 Aluminum 2.8	Tensile Strength 100,000 psi Brinell Hardness 160 (cold drawn and annealed)	In addition to having corrosion resistance equal to that of monel, this alloy can be heat treated to obtain better mechanical properties. It is available in wrought form only.
Inconel Alloy 600	ASTM-B166 UNS-N06600	Nickel 72.0 Chromium 15.8 Iron 7.2 Carbon 0.04 Manganese 0.20 Copper 0.10	Tensile Strength 90,000 psi Brinell Hardness 145 (cold drawn and annealed)	Has a wide range of corrosion resistance to many acids and alkalies. Inconel does not respond to head treatment. It is available in cast and wrought form including spring temper.
Ni-resist Type I	ASTM A-436 UNS-F41000	Chromium 2.0 Nickel 13.5-17.5 Carbon 3.0 Silicon 1.0- 2.5 Copper 5.5- 7.5 Manganese 1.- 1.5	Tensile Strength 25,000-30,000 psi Brinell Hardness 130-160	Substitute Ni-resist Type II for Ni-resist Type I.
Ni-resist Type II	ASTM A-436 UNS-F53002	Chromium 1.75-2.5 Nickel 18.- 22. Carbon 3.0 Silicon 1.0-2.8 Copper 0.5 Manganese .8-1.5	Tensile Strength 25,000-30,000 psi Brinell Hardness 130-170	Ni-resist is a comparatively moderately Priced alloy which finds application in many Corrosive media which do not permit use of Standard materials, yet do not require use of The expensive high alloy materials. Available In cast form only.
Ni-resist, Ductile Type D-2c	ASTM A-439 Type D-2c UNS-F53002	Chromium .50 Molybdenum 1.8- 2.4 Nickel 21.0-24.0 Silicon 2.0- 3.0 Carbon 2.9	Tensile Strength 55,000-60,000 psi Brinell Hardness 130-170	Better corrosion resistance than standard ni-Resist. Good machinability. Non-magnetic. Available in cast form only.

MATERIAL SPECIFICATION CHART

MATERIAL	DESIGNATION	APPROXIMATE CHEM. ANALYSIS %	APPROXIMATE PHYSICAL PROPERTIES	APPLICATION AND REMARKS
Stellite #1	ASTM – None AISI – None SAE – None	Chromium 30. Tungsten 12.0 Carbon 2.5 Cobalt 53.5	Tensile Strength 47,000 psi Brinell Hardness 534 (Gas welded as deposited)	Used in similar applications as satellite #6. Main difference is that #1 alloy is harder and less resistant to shock loads. Used mostly in form of weld rod to deposit hard faces.
Stellite #6	ASTM – None AISI – None SAE – None	Chromium 28. Tungsten 4. Carbon 1. Cobalt 67.	Tensile Strength 105,000 psi Brinell Hardness 370 (Gas welded as deposited)	Excellent resistance to abrasive wear. Used for hard facing on wearing surfaces. Also has good corrosion resistance to many acids. Used mostly in form of weld rod to deposit hard faces.
Colmonoy #6	ASTM – None AISI – None SAE – None	Nickel 65-75 Chromium 13-20 Boron 2.75-4.75 Iron, Silicon and Carbon 10 max.	Rockwell Hardness C Scale 56-62	Excellent resistance to abrasive wear. Used for hard facing on wearing surfaces. Also has good corrosion resistance to many acids.

ANSI Standard Flange Dimensions

all dimensions are in inches

125 lb and 250 lb flanges are CI.
150 lb and 300 lb flanges are steel.
125 lb CI flanges are flat face.
150 lb, 250 lb and 300 lb flanges have 1/16" raised face, which is included in the flange thickness.
150 lb and 300 lb ANSI flanges for 24 O.D. and larger pipe conform to dimension and drilling of 125 lb and 250 lb CI ANSI flanges.

Nominal Pipe Size	125# and 150# ANSI Standard Flanges					250# and 300# ANSI Standard Flanges				
	Flange O.D.	Thickness	Bolt Circle	No. Bolts	Size Bolts	Flange O.D.	Thickness	Bolt Circle	No. Bolts	Size Bolts
2.0 Std.	6.000	0.625	4.750	4	0.625	6.500	0.875	5.000	8	0.625
2.5 "	7.000	0.688	5.500	4	0.625	7.500	1.000	5.875	8	0.750
3.0 "	7.500	0.750	6.000	4	0.625	8.250	1.125	6.625	8	0.750
4.0 "	9.000	0.938	7.500	8	0.625	10.000	1.250	7.875	8	0.750
5.0 "	10.00	0.938	8.500	8	0.750	11.000	1.375	9.250	8	0.750
6.0 "	11.00	1.000	9.500	8	0.750	12.500	1.438	10.625	12	0.750
8.0 "	13.50	1.125	11.750	8	0.750	15.000	1.625	13.000	12	0.875
10 "	16.00	1.188	14.250	12	0.875	17.500	1.875	15.250	16	1.000
12 "	19.00	1.250	17.000	12	0.875	20.500	2.000	17.750	16	1.125
14 O.D.	21.00	1.375	18.750	12	1.000	23.000	2.125	2.250	20	1.125
16 "	23.50	1.438	21.250	16	1.000	25.500	2.250	22.500	20	1.250
18 "	25.00	1.563	22.750	16	1.125	28.000	2.375	24.750	24	1.250
20 "	27.50	1.688	25.000	20	1.125	30.500	2.500	27.000	24	1.250
24 "	32.00	1.875	29.500	20	1.250	36.000	2.750	32.000	24	1.500
30 "	38.75	2.125	36.000	28	1.250	43.000	3.000	39.250	28	1.750
36 "	46.00	2.375	42.750	32	1.500	50.000	3.375	46.000	32	2.000
42 "	53.00	2.625	49.500	36	1.500	57.000	3.688	52.750	36	2.000
48 "	59.50	2.750	56.000	44	1.500	65.000	4.000	60.750	40	2.000
54 "	66.25	3.000	62.750	44	1.750					
60 "	73.00	3.125	69.250	52	1.750					

THE DETERMINATION OF NPSH REQUIREMENTS OF PUMPS HANDLING HYDROCARBON LIQUIDS*

The NPSH requirements of centrifugal pumps are normally determined on the basis of handling water. It is recognized that when pumping hydrocarbons, the NPSH, to obtain satisfactory operation, can be reduced for certain conditions. The permissible reduction in NPSH is a function of the vapor pressure and the specific gravity of the particular hydrocarbon being pumped.

It is the purpose of the chart on the next page to provide a means of estimating the NPSH required by a centrifugal pump when handling hydrocarbons of various gravities and vapor pressures in percentages of that required by the same pump when handling water. The correction charts are based on data obtained primarily from field experiences. While this data had considerable spread, it has been correlated to what is considered a usable guide. The chart has the further purposes of providing a means of comparing future experience and to stimulate the accumulation of additional information.

LIMITATIONS FOR USE

1. Do not use this chart for liquids other than hydrocarbons.
2. Unusual operating conditions, such as pumping hydrocarbons close to the cracking temperature, may require additional NPSH.
3. This chart does not apply to viscous liquids.

INSTRUCTIONS FOR USING CHART

Enter chart at bottom with the specific gravity at pumping temperature of the particular hydrocarbon to be handled and proceed upward to the sloped line corresponding to the absolute vapor pressure in psi at the pumping temperature. The left hand scale of the chart will then show the percent of the water NPSH that will be required to pump the particular hydrocarbon satisfactorily.

EXAMPLE: A pump that has been selected for a given capacity and head requires 6 ft NPSH to pump water. The Pump is to handle commercial isobutene at 110° F which has a vapor pressure of 85.1 psi absolute , and a specific gravity of 0.53. What NPSH is required?

Enter chart at specific gravity (at 110° F) of 0.53 and go upward to the point corresponding to a vapor pressure of 85.1 psi absolute (at 110° F). This is found by interpolation between the lines labeled 50 psi and 100 psi of the fan-shaped family of absolute vapor pressure lines in the chart. Read on the left scale the value of the correction factor to be applied to the water NPSH as 0.91.

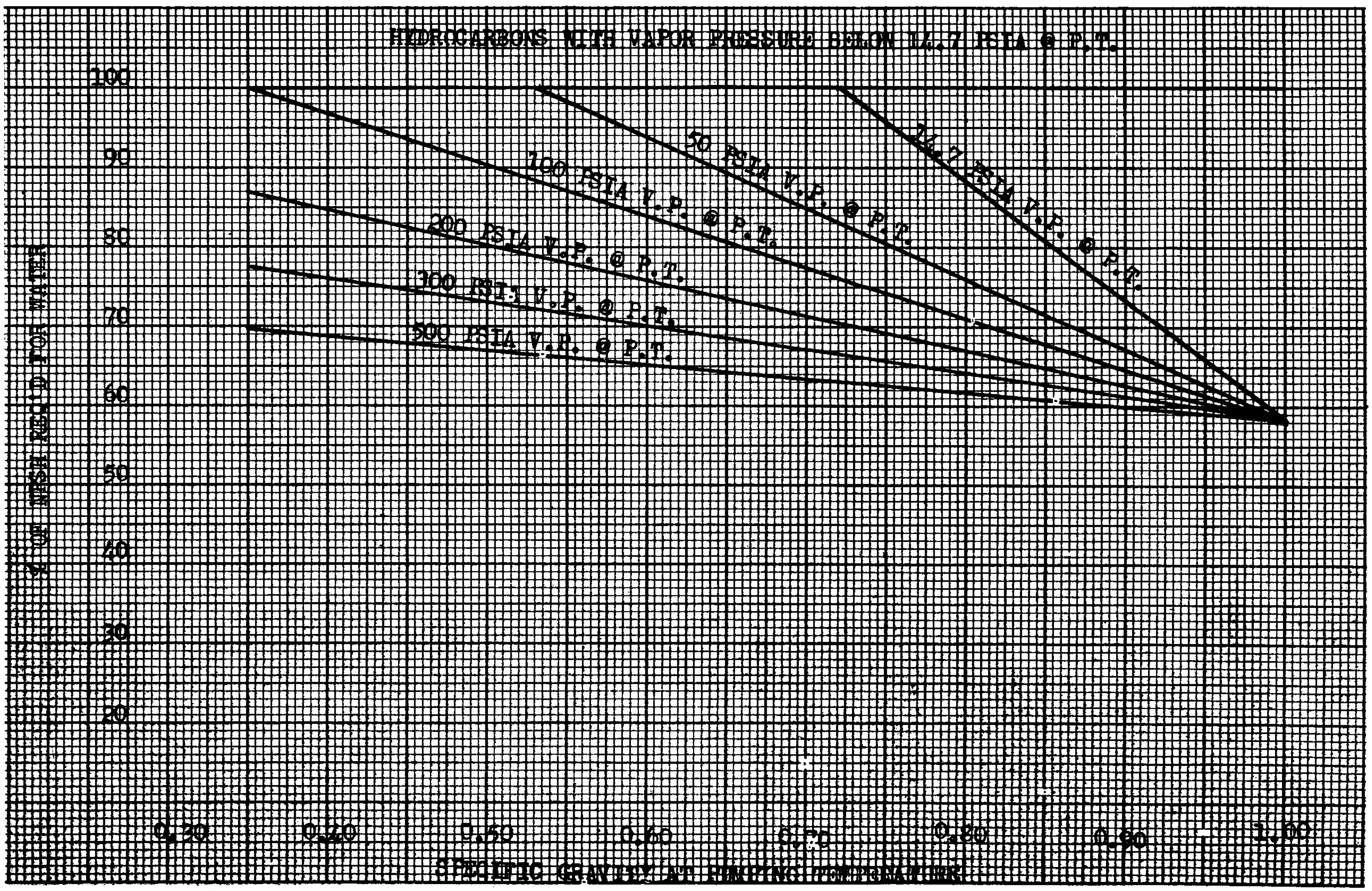
The pump in question when pumping isobutene at 110° F will require 0.91 x 6 = 5.5 ft NPSH.

If the isobutene were to be pumped at a temperature of 60° F, the vapor pressure will be 38.7 psi absolute and the specific gravity will be 0.56. It will be found in this case that the same NPSH is required as for water, ie, 6 ft.
* Proposed Hydraulic Institute procedure.

NPSH CORRECTION CHART FOR HYDROCARBONS *

Not to be used for other liquids

See preceding page



*** Proposed Hydraulic Institute Chart**

Drawing No. 2804834

ATMOSPHERIC PRESSURE IN FEET OF WATER (75° F) AT VARIOUS ALTITUDES

Altitude	Feet of Water
0	34.0
500	33.4
1000	32.8
1500	32.2
2000	31.6
2500	31.0
3000	30.5
3500	29.9
4000	29.4
4500	28.8
5000	28.3
5500	27.8
6000	27.3
6500	26.7
7000	26.2
7500	25.7
8000	25.2
8500	24.8
9000	24.3
9500	23.8
10000	23.4

PROPERTIES OF WATER AT SATURATION PRESSURE

Temp ° F	Vapor PSIA	Press Ft. Hd.	Specific Gravity	Temp ° F	Vapor PSIA	Press. Ft. Hd.	Specific Gravity
32	.0885	0.20	0.9999	100	.949	2.21	0.9931
33	.0922	0.21	0.9999	110	1.275	2.98	0.9906
34	.0960	0.22	0.9999	120	1.692	3.96	0.9888
35	.1000	0.23	1.0000	130	2.223	5.21	0.9857
36	.1040	0.24	1.0000	140	2.889	6.79	0.9833
37	.1082	0.25	1.0000	150	3.718	8.75	0.9803
38	.1126	0.26	1.0000	160	4.741	11.20	0.9773
39	.1171	0.27	1.0000	170	5.992	14.2	0.9738
40	.1217	0.28	1.0000	180	7.510	17.9	0.9702
41	.1265	0.29	1.0000	190	9.339	22.3	0.9667
42	.1315	0.30	1.0000	200	11.53	27.7	0.9632
43	.1367	0.32	1.0000	210	14.12	34	0.9592
44	.1420	0.33	0.9999	220	17.19	42	0.9552
45	.1475	0.34	0.9999	230	20.78	50	0.9512
46	.1532	0.35	0.9999	240	24.97	61	0.9467
47	.1591	0.37	0.9999	250	29.83	73	0.9423
48	.1653	0.38	0.9998	260	35.43	87	0.9373
49	.1716	0.40	0.9998	270	41.85	104	0.9331
50	.1781	0.41	0.9997	280	49.20	123	0.9281
51	.1849	0.43	0.9997	290	57.56	144	0.9232
52	.1918	0.44	0.9996	300	67.01	169	0.9180
53	.1990	0.46	0.9996	310	77.68	197	0.9127
54	.2064	0.48	0.9995	320	89.66	228	0.9076
55	.2141	0.50	0.9994	330	103.1	264	0.9019
56	.2220	0.51	0.9994	340	118	304	0.8964
57	.2302	0.53	0.9993	350	135	350	0.8904
58	.2386	0.55	0.9992	360	153	400	0.8845
59	.2473	0.57	0.9991	370	173	455	0.8787
60	.2563	0.59	0.9990	380	196	519	0.8725
62	.2751	0.64	0.9989	390	220	587	0.8659
64	.2951	0.68	0.9987	400	247	664	0.8594
66	.3164	0.73	0.9985	410	277	750	0.8529
68	.3390	0.79	0.9982	420	309	845	0.8457
70	.3631	0.84	0.9980	430	344	948	0.8387
75	.4298	0.99	0.9974	440	382	1061	0.8317
80	.5069	1.17	0.9966	450	423	1182	0.826
85	.5959	1.39	0.9959	460	467	1319	0.817
90	.6982	1.62	0.9950	470	515	1472	0.809
95	.8153	1.89	0.9941	480	566	1632	0.801

PROPERTIES OF ISO-BUTANE
AT SATURATION PRESSURE

Temp ° F	PSI Abs	Vapor Pressure Ft. Hd.	Specific Gravity
0	11.6	44.6	.602
5	13.1	50.5	.599
10	14.6	56.5	.596
15	16.3	63.5	.593
20	18.2	71.4	.589
25	20.2	79.7	.586
30	22.3	88.4	.583
35	24.6	98	.580
40	26.9	108	.576
45	29.5	119	.573
50	32.5	132	.570
55	35.5	145	.567
60	38.7	159	.564
65	42.2	174	.560
70	45.8	190	.557
75	49.7	207	.554
80	53.9	226	.550
85	58.6	248	.546
90	63.3	269	.543
95	68.4	293	.540
100	73.7	318	.536
105	79.3	344	.532
110	85.1	372	.528
115	91.4	402	.525
120	98.0	435	.521
125	104.8	468	.517
130	112.0	505	.513
135	119.3	542	.509
140	126.8	580	.505
145	136.0	626	.502
150	145.0	674	.497
155	155.0	728	.492
160	165.0	782	.487
165	175.0	837	.483
170	186.0	899	.478
175	198.0	968	.473
180	210.0	1040	.468

2801900

PROPERTIES OF PROPANE
AT SATURATION PRESSURE

Temp ° F	PSI Abs	Vapor Pressure Ft. Hd.	Specific Gravity
0	38.2	160	.553
5	41.9	176	.550
10	46.0	195	.546
15	50.6	215	.543
20	55.5	238	.539
25	60.9	263	.536
30	66.3	288	.532
35	72.0	315	.528
40	78.0	344	.524
45	84.6	376	.520
50	91.8	411	.516
55	99.3	447	.512
60	107.1	488	.508
65	115.4	529	.504
70	124.0	573	.500
15	133.2	620	.496
80	142.8	670	.492
85	153.1	725	.487
90	164.0	785	.483
95	175.0	844	.479
100	187.0	911	.474
105	200.0	985	.469
110	212.0	1055	.464
115	226.0	1140	.459
120	240.0	1225	.453
125	254.0	1310	.448
130	272.0	1420	.443
135	288.0	1520	.438
140	305.0	1630	.432

2801898

PROPERTIES OF BUTANE AT SATURATION PRESSURE

Temp	Vapor Press.		Specific
° F	PSI abs	Ft. Hd.	Gravity
0	7.3	27.3	.618
5	8.2	30.8	.615
10	9.2	34.6	.613
15	10.4	39.4	.610
20	11.6	44.2	.607
25	13.0	49.7	.604
30	14.4	55.3	.602
35	16.0	61.7	.599
40	17.7	68.6	.596
45	19.6	76.4	.593
50	21.6	84.6	.590
55	23.8	94	.587
60	26.3	104	.584
65	28.9	115	.581
70	31.6	126	.578
75	34.5	139	.574
80	37.6	152	.571
85	40.9	166	.568
90	44.5	182	.564
95	48.2	198	.562
100	52.2	216	.558
105	56.4	235	.555
110	60.8	255	.551
115	65.6	277	.548
120	40.8	301	.544
125	76.1	325	.541
130	81.4	350	.538
135	87.0	376	.534
140	92.6	403	.531
145	100.0	438	.528
150	108.0	477	.524
155	115.0	511	.520
160	122.0	547	.515
165	130.0	588	.511
170	140.0	640	.506
175	150.0	691	.502
180	160.0	742	.498

Chart 2801899

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VERTICAL TURBINE OUTLINE DRAWINGS

Order by number from your FMC Pump Regional Office.

Drawing	Driver		Head	Inner Column	Pipe	Suction	Strainer	Other
	Motor	Gear						
DRIVES								
2831130	VHS							
2832276	VSS							
4805526		X						Gear, Flex drive and engine.
DEEP WELL TURBINE PUMPS								
2829002	X		Cast	ELS	Thd'd	Thd'd	Cone	
2829003		X	Cast	ELS	Thd'd	Thd'd	Cone	
2829004	①	①	Cast	ELS	Thd'd	Thd'd	Cone	①Combination Drive w/ gear & motor.
DEEP WELL PUMPS WITH TYPE G HEADS								
2826134	X		Cast	ELS	Thd'd	Thd'd	Cone	
2826135	X		Cast	OLS	Thd'd	Thd'd	Cone	
DEEP SETTING TURBINE PUMPS								
2831697	X		Fab	OLS	Thd'd	Thd'd	Cone	
2831698		X	Fab	ELS	Thd'd	Thd'd	Cone	
2831701		X	Fab	OLS	Thd'd	Thd'd	Cone	
2831699	X		Fab	OLS	Thd'd	Thd'd	Cone	} With casing head furnished by others.
2831702		X	Fab	ELS	Thd'd	Thd'd	Cone	
2831700		X	Fab	OLS	Thd'd	Thd'd	Cone	
CLOSE COUPLED TURBINE PUMPS								
4805509	X		Cast	OLS	Thd'd	Bell	None	
4805511	X		Cast	OLS	Flg'd	Bell	None	
4805517	X		②	OLS	Thd'd	Bell	None	②Round base, cast, e.g. 4x4x10C
4805510	X		Cast	OLS	Flg'd	Bell	Clip-on	
4805516	X		②	OLS	Thd'd	Bell	Clip-on	②Round base, cast, e.g. 4x4x10C
4805508	X		Cast	OLS	Thd'd	Thd'd	Basket	
4805513		X	Cast	OLS	Thd'd	Bell	None	
4805515		X	Cast	OLS	Flg'd	Bell	None	
4805514		X	Cast	OLS	Flg'd	Bell	Clip-on	
4805512		X	Cast	OLS	Thd'd	Thd'd	Basket	
4805519	X		Fab	OLS	Thd'd	Bell	None	
4805521	X		Fab	OLS	Flg'd	Bell	None	
4805520	X		Fab	OLS	Flg'd	Bell	Clip-on	
4805518	X		Fab	OLS	Thd'd	Thd'd	Basket	
4805523		X	Fab	OLS	Thd'd	Bell	None	
4805525		X	Fab	OLS	Flg'd	Bell	None	
4805524		X	Fab	OLS	Flg'd	Bell	Clip-on	
4805522		X	Fab	OLS	Thd'd	Thd'd	Basket	
CLOSE COUPLED TURBINE PUMPS WITH UNDERGROUND DISCHARGE								
2829009	X		Cast	OLS	③	Bell	None	③Flanged above tee; threaded below tee.
2529010	X		Cast	OLS		Thd'd	Basket	
2529011		X	Cast	OLS		Bell	None	
2829012		X	Cast	OLS		Thd'd	Basket	
CLOSE COUPLED TURBINE PUMPS WITH TYPE TF CAST HEADS								
2823387	VHS		TF	OLS	Thd'd	Bell	None	
2823055	VHS		TF	OLS	Flg'd	Bell	None	} Mechanical Seal.
2823388	VSS		TFY	OLS	Thd'd	Bell	None	
2823056	VSS		TFY	OLS	Flg'd	Bell	None	

LUBRICATION CHARTS
Bulletin 2633121, Table 13-1: Greases for lubrication of lineshaft bearings, Suction manifold bearings, and shaft packings.④
Bulletin 2633121, Table 13-2: Turbine oils for lubrication of lineshaft bearings, suction manifold bearings, and similar applications.④
Bulletin 2633121, Table 13-3: Turbine oils for, lubrication of gear drives for vertical pumps.④
④These three pages comprise Section 13 of the Modular Service Instructions Bulletin 2633121.

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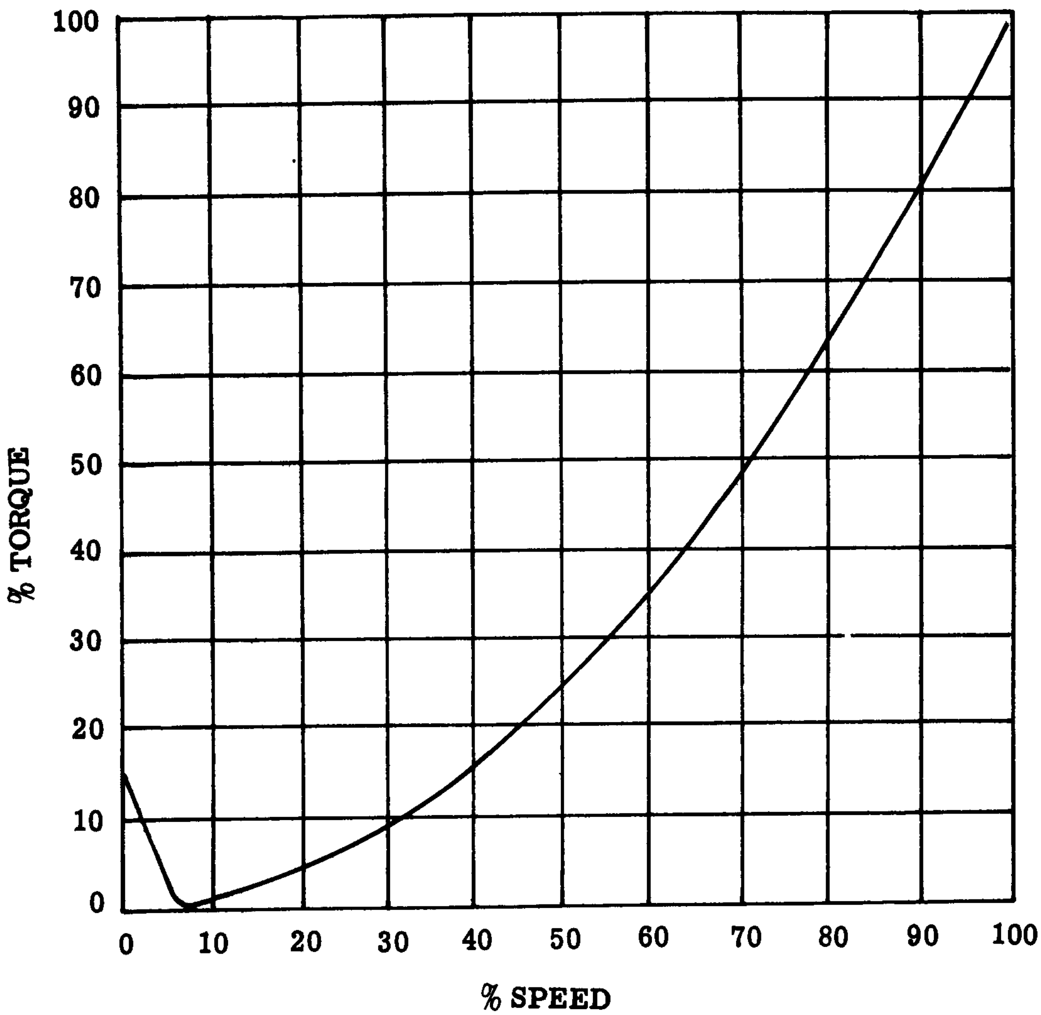
SPEED – TORQUE CURVE
(VERTICAL PUMPS)

Pump Model/Size ___________
Pump No. _________________



INFORMATION REQUIRED TO USE SPEED TORQUE CURVE

1 – 100% of torque = _________ Ft. Lbs.

2 – 100% of speed = _________ RPM (true running speed)

To determine 100% of torque in Ft. LBS. – use the following formula:

100% torque (in Ft. Lbs.) = (1)BHP x 5250

RPM (true running speed)

(1)For open valve starting – use BHP at design point.
(1)For close valve starting – use BHP at shut-off point.

POLICY ON SUMP DESIGN RECOMMENDATION

WITHOUT ANY GUARANTEE, ASSUMED OR IMPLIED, PEERLESS PUMP WILL COMMENT, WITHOUT CHARGE, ON PROPOSED OR EXISTING SUMP DESIGNS. THESE COMMENTS WILL BE BASED ON ADEQUATE CUSTOMER-FURNISHED DATA, AND WILL REFLECT PEERLESS PUMP'S EXPERIENCE AND JUDGEMENT, AS WELL AS INFORMATION FROM OTHER QUALIFIED SOURCES.

PEERLESS PUMP WILL NOT GUARANTEE ANY SUMP DESIGN OR SUMP CONFIGURATION. WHERE DETAILED SCALE MODEL TESTS ARE CONDUCTED IN PEERLESS PUMP'S HYDRAULIC LABORATORY, A SOUND BASIS FOR FULL-SCALE SUMP PERFORMANCE PREDICTION IS AVAILABLE TO THE CUSTOMER.

PEERLESS PUMP CAN COMMENT ON HYDRAULIC DESIGNS ONLY. NO COMMENT ON STRUCTURAL DESIGN WILL BE MADE.

SUMP DESIGN DATA

Note: The following information has to do with vortexing and eddy formation only and does not imply sufficient submergence to meet other requirements such as NPSH.

Intake Design

The function of the intake, whether it be an open channel or a tunnel having 100 percent wetted perimeter, is to supply an evenly distributed flow of water to the suction bell. An uneven distribution of flow, characterized by strong local currents, favors formation of vortices and with certain low values of submergence, will introduce air into the pump with reduction of capacity, accompanied by noise. Uneven distribution can also increase or decrease the power consumption with a change in total developed head. There can be vortices which do not appear on the surface, and these also may have adverse effects.

Uneven velocity distribution leads to rotation of portions of the mass of water about a centerline called vortex motion. This centerline may also be moving. Uneven distribution of flow is caused by the geometry of the intake and the manner in which water is introduced into the intake from the primary source.

Calculated low *average* velocity is not always a proper basis for judging the excellence of an intake. High *local* velocities in currents and in swirls may be present in intakes which have very low *average* velocity. Indeed, the uneven distribution which they represent occurs less in a higher velocity flow with sufficient turbulence to discourage the gradual build-up of a larger and larger vortex in any region. Numbers of small surface eddies may be present without causing any trouble.

The ideal approach is a straight channel coming directly to the pump. Turns and obstructions are detrimental since they may cause eddy currents and tend to initiate deep-cored vortices.

Water should not flow past one pump to reach the next if this can be avoided. If the pumps must be in the line of flow, it may prove necessary to construct an open front cell around each pump or to put turning vanes under the pump to deflect the water upward.

All possible streamlining should be used to reduce the trail of alternating vortices in the wake of the pump or of other obstructions in the stream flow.

Successful proportions of the amount of submergence per se (See Suction Limitations, page 67), will depend greatly on the approaches to the intake and the size of the pump. The pump manufacturer will generally render advice on specific problems while the intake design is still preliminary if he is provided with the necessary intake layout drawings reflecting the physical imitations of the site.

Complete analysis of intake structures is best accomplished by scale model tests (See Model Tests of Intakes, page 36).

Subject to the qualifications of the foregoing statements, Figs. 64, 65 & 66 have been constructed for single and simple multiple pump arrangements to show suggestions for basic sump dimensions. They are for pumps normally operating in the capacity range of approximately 3,000 to 300,000 GPM. Since these values are composite averages from a great many pump types and cover the entire range of specific speeds, they must not be thought of as absolute values but rather as basic guides subject to some possible variations. For pumps normally operating at capacities below approximately 3,000 GPM, refer to Sump or Pit Designs (small pumps) page 36.

All of the dimensions in Figs. 64, 65 & 66 are based on the rated capacity of the pump at the design head. Any increase in capacity above these values should be momentary or very limited in time. If operation at an increased capacity is to be undertaken for considerable periods of time, the maximum capacity should be used for the design value in obtaining sump dimensions.

The Dimension C is an average, based on an analysis of many pumps. Its final value should be specified by the pump manufacturer.

Dimension B is a suggested maximum dimension which may be less depending on actual suction bell or bowl diameters in use by the pump manufacturer. The edge of the bell should be close to the back wall of the sump. When the position of the back wall is determined by the driving equipment or the discharge piping, Dimension B may become excessive and a "false" back wall should be installed.

Dimension S is a minimum for the sump width for a single pump installation. This dimension can be increased, but if it is to be made smaller, the manufacturer should be consulted or a sump model test should be run to determine its adequacy.

Dimension H is a minimum value based on the "normal low water level" at the pump suction bell, taking into consideration friction losses through the inlet screen and approach channel. This dimension can be considerably less momentarily or infrequently without excessive damage to the pump. It should be remembered, however, that this does not represent "submergence." Submergence is normally quoted as dimension "H" minus "C." This represents the physical height of water level above the bottom of the suction inlet. The actual submergence of the pump is something less than this, since the impeller eye is some distance above the bottom of the suction bell, possibly as much as 3 to 4 feet. For the purposes of sump design in connection with this chart, it is understood that the pump has been selected in accordance with specific speed charts, Figs. 54, 55, 56, and 57, the submergence referred to herein having to do only with vortexing and eddy formations.

Dimensions Y and A are recommended minimum values. These dimensions can be as large as desired but should be limited to the restrictions indicated on the curve. If the design does not include a screen, Dimension A should be considerably longer. The screen or gate widths should not be substantially less than S, and heights should not be less than H. If the main stream velocity is more than 2 feet per second, it may be necessary to construct straightening vanes in the approach channel, increase Dimension A, conduct a sump model test of the installation, or work out some combination of these factors.

Dimension S becomes the width of an individual pump cell or the center-to-center distance of two pumps if no division walls are used.

On multiple pump installations, the recommended dimensions in Figs. 64, 65 and 66 also apply as noted above, and the following additional determinants should be considered:

Fig. 67a. Low velocity and straight-line flow to all units simultaneously is the first recommended style of pit. Velocities in pump area should be approximately one foot per second. Some sumps with velocities of 2 feet per second and higher have given good results. This is particularly true where the design resulted from a model study. Not recommended would be an abrupt change in size of inlet pipe to sump or inlet from one side introducing eddying.

Fig. 67b. A number of pumps in the same sump will operate best without separating walls unless all pumps are always in operation at the same time, in which case the use of separating walls may be beneficial. If walls must be used for structural purposes, and pumps will operate intermittently, leave flow space behind each wall from the pit floor up to at least the minimum water level and the wall should not extend upstream beyond the rim of the suction bell. If walls are used, increase dimension "S" by the thickness of the wall for correct centerline spacing. Round or "ogive" ends of walls. NOT recommended is the placement of a number of pumps around the edge of a sump with or without dividing walls.

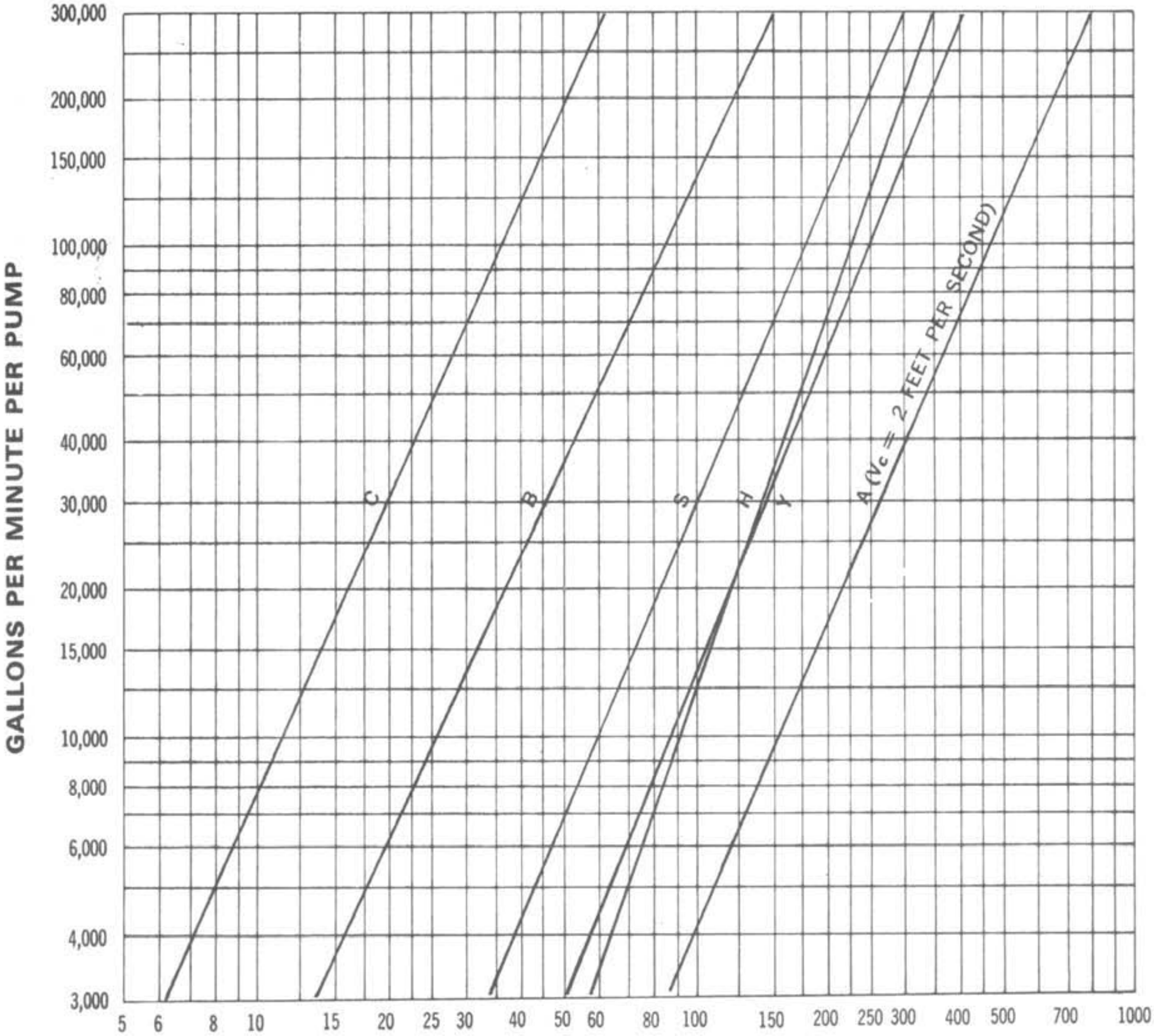
Fig. 67c. Abrupt changes in size from inlet pipe or channel to pump bay are not desirable. A relatively small pipe emptying into a large pump pit should connect to the pit with a gradually increasing taper section. The angel should be as large as possible, preferably not less than 45 degrees. With this arrangement, pit velocities much less than one foot per second are desirable. Especially not recommended is a small pipe directly connected to a large pit with pumps close to the inlet. Flow will have excessive change of direction to get to most of the pumps. Centering pumps in the pit leaves large "vortex areas" behind the pumps which will cause operational trouble.

Fig. 67d. If the pit velocity can be kept low enough (below one foot per second, an abrupt change from inlet pipe to pit can be accommodated if the length equals or exceeds the values shown. It is assumed that as ratio W/P increases, the inlet velocity at "P" will increase up to an allowed maximum of eight feet per second at W/P=10. Pumps "in line" are not recommended unless the ratio of pit to pump size is quite large, and pumps are separated by a generous margin longitudinally. A pit can generally be constructed at much less cost by using a recommended design.

Fig. 67e. It is sometimes desirable to install pumps in tunnels or pipe lines. A drop pipe or false well to house the pump with vaned inlet ell facing upstream will be satisfactory in flows up to eight feet per second. Without the inlet ell, the pump section bell should be positioned at least two pipe (vertical) diameters above the top of the tunnel, not hung into the tunnel flow, especially with tunnel velocities two feet per second or more. There should be no signs of air along the top of tunnel. It may be necessary to lower the scoop or insist on minimum water level in vertical well.

Note: The foregoing statements apply to sumps for clear liquid. For fluid-solids mixtures, refer to the pump manufacturer.

SUMP DIMENSIONS VERSUS FLOW



RECOMMENDED SUMP DIMENSIONS IN INCHES

See explanatory notes in Text, Pages **31** and **32**. Figures apply to sumps for clear liquid. For fluid-solids Mixtures refer to the pump manufacture.

Fig. 64

SUMP DIMENSIONS VERSUS FLOW

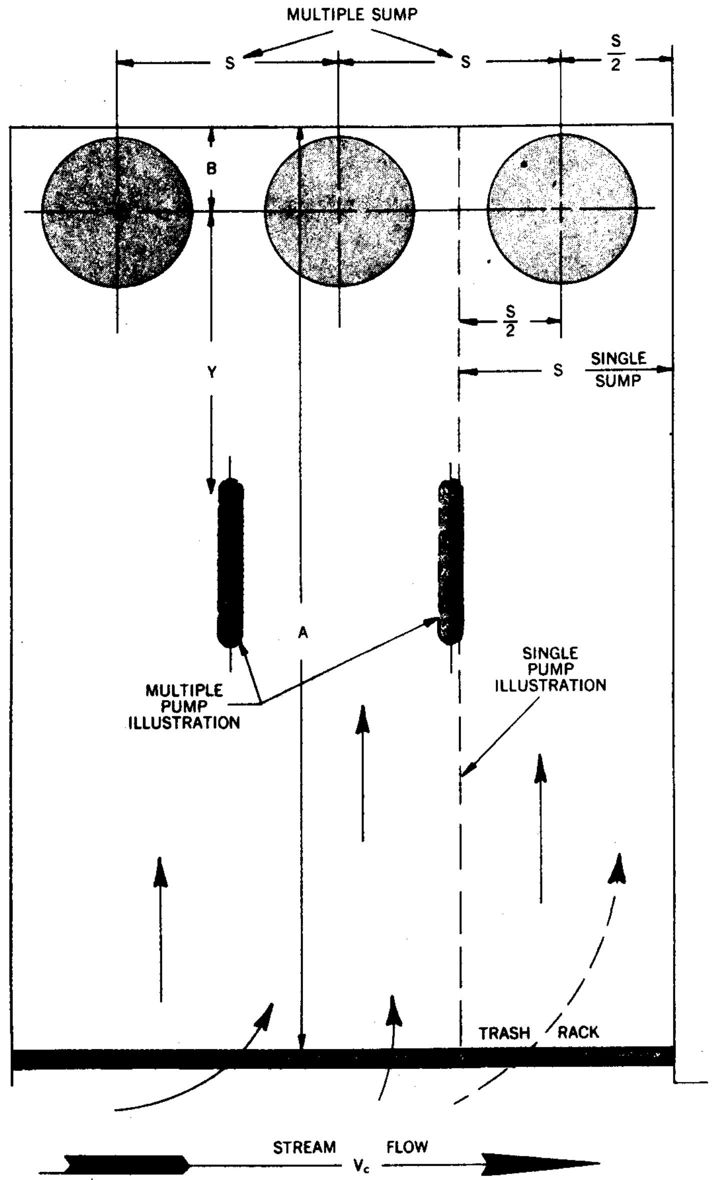


Fig. 65

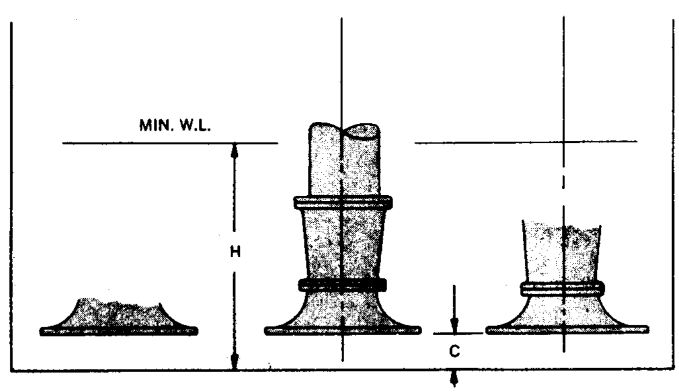


Fig. 66

MULTIPLE PUMP PITS

RECOMMENDED | NOT RECOMMENDED

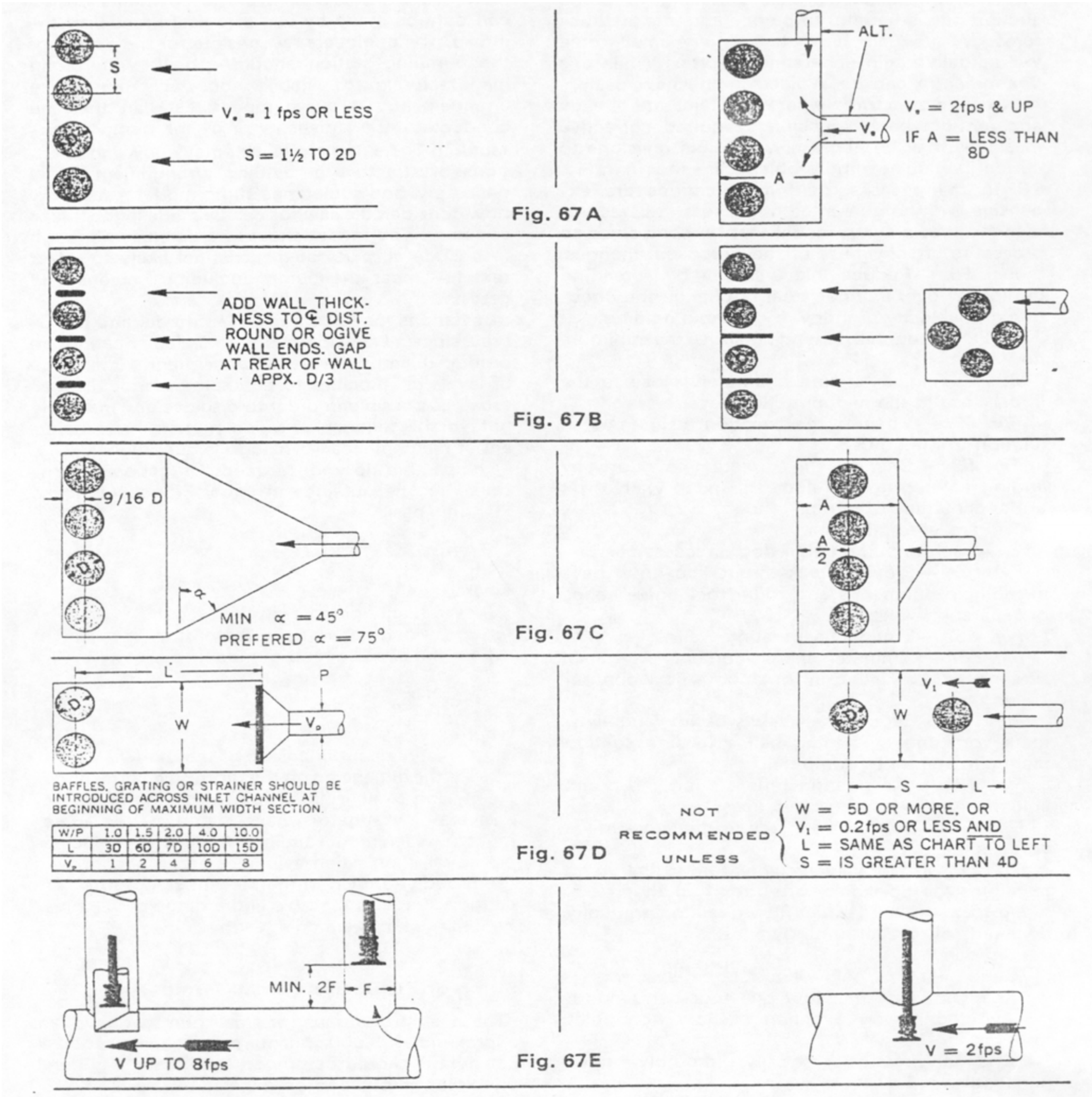


Fig. 67 A

Fig. 67 B

Fig. 67 C

Fig. 67 D

Fig. 67 E

The Dimension “D” is generally the diameter of the Suction bell measured at the inlet. This dimension may vary depending upon pump design. Refer to the pump manufacturer for specific dimensions.

Note: Figures apply to sumps for clear liquid. For fluid-solids mixtures refer to the pump manufacturer.

Correction of Existing Sumps

It is well established that vortexing in pump suction pits is harmful to pumps and intake structures. It is equally true that a very small force will actually begin generating a vortex. While this phenomenon can be avoided in the new design, for existing structures where problems are already apparent or where expansion is required, corrective measures may be necessary. Possible revisions to correct particular sump problems are shown in Fig. 68. In many cases, field modifications are expensive with no guarantee of success. It is recommended that a sump model test be considered to prove the effectiveness of the proposed changes.

Fig. 68a – Reduce inlet velocity by spreading the inflow over a larger area, or change the direction and velocity of inflow by suitable baffling.

1. Floor mounted, extending above the minimum flow level.
2. Hanging, extending alternately close to the floor, close to the minimum flow level.

Fig.68b – Change the location of pumps in relation to the inflow.

Fig. 68c – Change the direction of flow by adding splitters to the floor and back wall of pit under centerline of pump.

1. Parallel to inlet flow.
2. Attach to pump bell if floor inaccessible.

Fig. 68d – Provide break-thru to "no-flow" bays in multiple pump pits and round or "ogive" ends of separating walls, *or*

Fig. 68e – Eliminate separating walls.

Fig. 68f – Eliminate sharp corners at gates, screens, etc., by filling in for smooth flow contour (fairing).

Fig. 68g – Reduce the velocity of flow and eliminate vortexing by adding bell extension suction plate and splitter to pump bell.

Fig. 68h – Use floating rafts around the pump column to prevent surface vortices.

Fig. 68I – Use large spheres to prevent surface vortices.

Fig. 68j – Improve velocity pattern to the pump to reduce the possibility of vortex formation.

Fig. 68k – Change inlet flow direction gradually by means of parallel turning vanes.

In general:

Keep inlet flow below two feet per second.

Keep flow in pit below one foot per second.

Avoid changing direction of flow from inlet to pump, *or*

Change direction gradually, smoothly, independently.

Any of these alterations, singly or in combination, may help to create a better flow pattern in the sump. If troubles persist, it may be necessary to limit the total flow or change pump size and speed.

Model Tests of Intakes

Often the analysis of a proposed intake design can only be use of a scale model of the intake. The engineers responsible for the design of the pumping station should consult with pump manufacturers to establish one or more intake arrangements. A sump model test can then be conducted by a University or by the pump modifications of structure or baffling arrangement to be necessary, and sometimes sump model tests show how considerable savings can be made in the intake structure. The model should be extensive enough to include all parts of the channel likely to affect the flow near the pump, including screens and gates.

Deviations may occur between model and prototype, since all considerations of similarity cannot be produced simultaneously. Consequently, the range of levels in velocities to be explored should be as broad as possible in order to disclose any markedly unfavorable tendencies which might only be incipient at mathematically analogous conditions.

Comparable flow in the model is generally considered to be obtained at equal Froude numbers.

On the basis,

Where

Vm = velocity of water in the model
Vp = velocity of water in the prototype
R = linear scale ratio of model to prototype

or $\frac{Lm}{Lp}$

Where

Lm = any linear dimension of the model
Lp = the dimensions on the prototype Corresponding to any dimension
Lm = on the model.

Several investigators have found better agreement between model and prototype when velocities are equal, than when velocities are equal, than when velocities are in accord with the Froude number. In the present stage of the art, caution suggests that this entire range of velocities be explored in the model test.

Sump or Pit Design (Small Pumps)

The design of sumps for small pumps (less than approximately 3,000 gpm normal discharge capacity per pump) should be guided by the same general principles as outlined on pages 31-36.

However, since there is a large variety of geometric configurations for these small units, recommended limiting dimensions, such as shown in Fig. 64-66, cannot be sufficiently generalized and so presented. Where specific pit or sump dimensions are required, the manufacturer's recommended should be requested.

In addition to the general design principles outlined on pages 31-36, for single and multiple pump settings in larger sump designs,, the following factors are pertinent to the design of small sumps or pits:

Inlet Openings (Pit Type Sumps)

The sump inlet should be below the minimum liquid level, and as far away from the pump as the sump geometry will permit. The influent should not impinge against the pump, jet directly into the pump inlet, or enter the pit in such a way as to cause rotation of the liquid in the pit. Where required, a distribution nozzle can be used to pre-
vent jetting, and baffling can be used to prevent rotation.

Sump Volume (Pit Type Sumps)

The usable pit volume in gallons should equal or exceed two times the maximum capacity in gpm to be pumped. If units operate on float switch control, pit should be sized to allow no more than three or four starts per hour per pump. These guides generally insure pits of adequate size to dissipate the inflow turbulence and to assure reasonable life of starting equipment.

Minimum Liquid Level

Minimum liquid level should be adequate to satisfy the particular pump design. The pump manufacturer's specific dimensions should be used.

CORRECTION OF EXISTING SUMPS

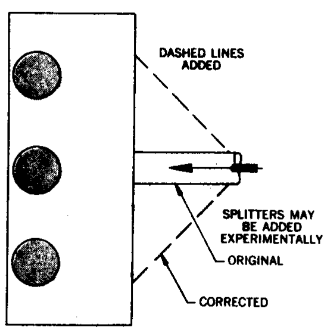


Fig. 68A

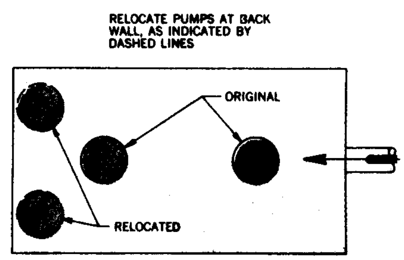


Fig. 68B

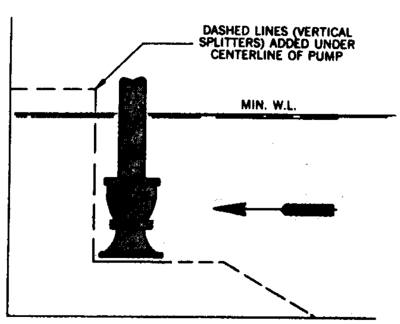


Fig. 68C

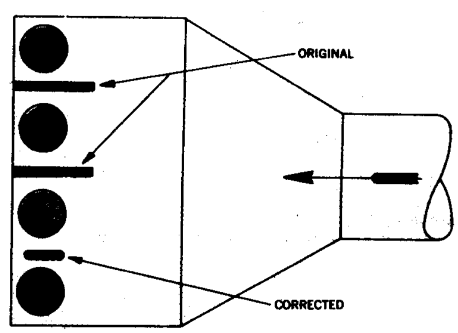


Fig. 68D

Fig. 68

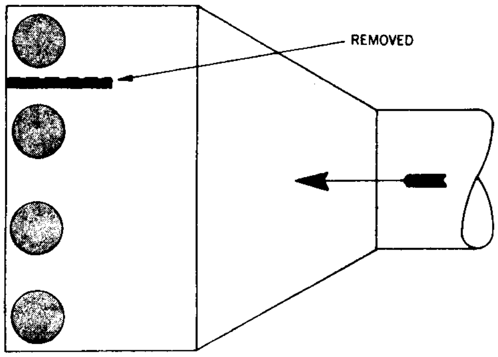


Fig. 68 E

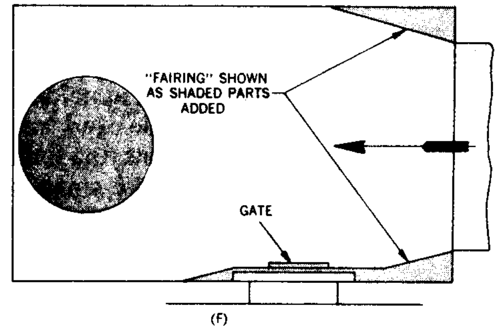


Fig. 68 F

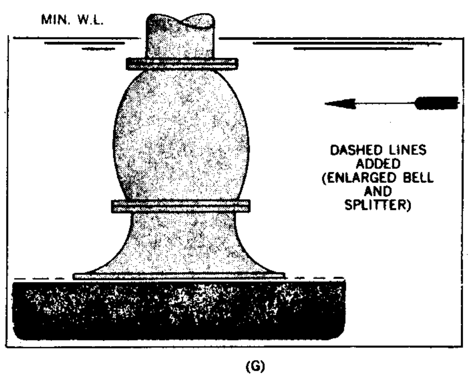


Fig. 68 G

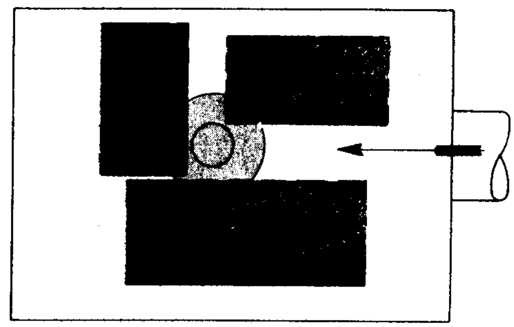


Fig. 68 H

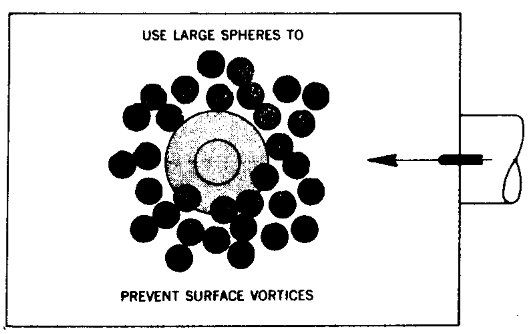


Fig. 68 I

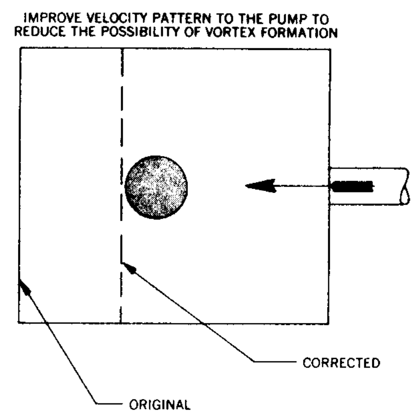


Fig. 68 J

Note: Figures apply to sumps for clear liquid.
For fluid-solids mixtures refer to the pump manufacturer.

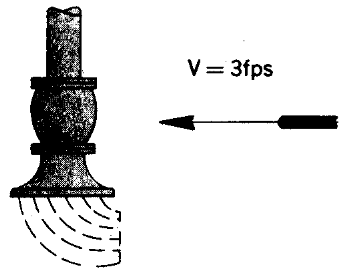


Fig. 68 K

(CONT.)
Fig. 68

CONVERSION CHARTS

WATER FLOW (From ↓ / To →)	U. S. GALLONS Per Minute	U. S. GALLONS Per Day	BARRELS Per Day	CUBIC FEET Per Second	CUBIC FEET Per Minute	LITERS Per Second	LITERS Per Minute	LITERS Per Hour	LITERS Per Day	CUBIC METERS Per Second	CUBIC METERS Per Minute	CUBIC METERS Per Hour	CUBIC METERS Per Day
U. S. Gallon Per Minute	1.0	1440	34.3	.00223	.13368	.063084	3.7854	227.272	5455	.0000631	.0038	.227	5.455
U. S. Gallon Per Day	.000694	1.0	.0245		.0000927		.002625	.1577	3.782			.00016	.0038
Barrel Per Day	.0292	42	1.0		.0039		.1106	6.62	159.1			.00662	.1591
Cubic Foot Per Second	448.8	646317	15370	1.0	599	28.22	1699	101800	2442000	.0282	1.699	101.8	2442
Cubic Foot Per Minute	7.4805	10770	256	.01667	1.0	.472	28.28	1698	40800	.00047	.0283	1.7	40.8
Liter Per Second	15.852	22800	544	.0353	2.015	1.0	60	3600	86400	.001	.06	3.6	86.4
Liter Per Minute	.2642	380.2	9.06	.00059	.03524	.01667	1.0	60	1440	.000017	.001	.06	1.44
Liter Per Hour	.004403	6.34	0.1509		.000588	.0002778	.01667	1.0	24			.001	.024
Liter Per Day	.0001832	.264	.00629		.00002448		.000694	.0416	1.0			.000042	.001
Cubic Meter Per Second	15852	22800000	544000	35.3	2015	1000	60000	3600000	86400000	1.0	60	3600	86400
Cubic Meter Per Minute	264.2	380200	9060	.59	35.24	16.67	1000	60000	1440000	.01667	1.0	60	1440
Cubic Meter Per Hour	4.403	6340	150.9	.00983	.588	.2778	16.67	1000	24000	.00028	.01667	1.0	24
Cubic Meter Per Day	.1832	264	6.29	.000409	.02448	.01159	.694	41.6	1000	.0000116	.00069	.0416	1.0

LINEAR & PRESSURE

From ↓ / To →	Feet (Water)	Inches (Mercury)	PSI	Meters	Kilograms / Sq Centimeters
Foot (Water)	1.0	.883	.433	.305	.0303
Inch (Mercury)	1.133	1.0	.49	.346	.0344
P S I	2.309	2.04	1.0	.705	.07031
Meter (Water)	3.28	2.885	1.415	1.0	.0995
Kilogram / Sq Centimeter	33	29	14.2	10.05	1.0

WEIGHT & VOLUME

From ↓ / To →	U. S. Gallons	Cubic Feet	Pounds (sp gr 1.0)	Liters	Cubic Meters	Barrels	Imperial Gallons
U. S. Gallon	1.0	.13368	8.345	3.785	.00378	.0238	.8327
Cubic Foot	7.4805	1.0	62.425	28.317	.0283	.178	6.232
Pound (sp gr 1.0)	.1198	.01602	1.0	.454	.000454	.00286	.0998
Liter	.2642	.0353	2.205	1.0	.001	.0063	.22
Cubic Meter	264.2	35.314	2204.5	1000	1.0	6.3	220
Barrel	42	5.61	350	159	.159	1.0	34.9
Imperial Gallon	1.201	.1605	10.02	4.546	.00455	0.2438	1.0

FORMULAE

$$\text{bhp} = \frac{\text{gpm} \times \text{hd} \times \text{sp gr}}{3960 \text{ eff}}$$

$$\text{hp} = .746 \text{ kw}$$

$$\text{kw} = 1.34 \text{ hp}$$

$$\text{kwh per 1000 gal} = \frac{.00315 \times \text{hd} \times \text{sp gr}}{\text{overall eff}}$$

$$\text{specific speed} = \frac{\text{rpm} \sqrt{\text{gpm}}}{\text{hd}^{3/4}}$$

$$\text{area} = \pi r^2 = \pi \frac{d^2}{4} = .784 d^2$$

$$\text{circumference} = \pi d = 3.1416 d$$

$$\text{velocity in ft/sec} = \frac{.321 \times \text{gpm}}{\text{area in sq in}}$$

$$\text{centistokes} = \frac{\text{centipoise}}{\text{sp gr}}$$

$$\text{temperature: } C = \frac{5}{9} \times (F - 32), \quad F = 32 + \frac{9}{5} \times C$$

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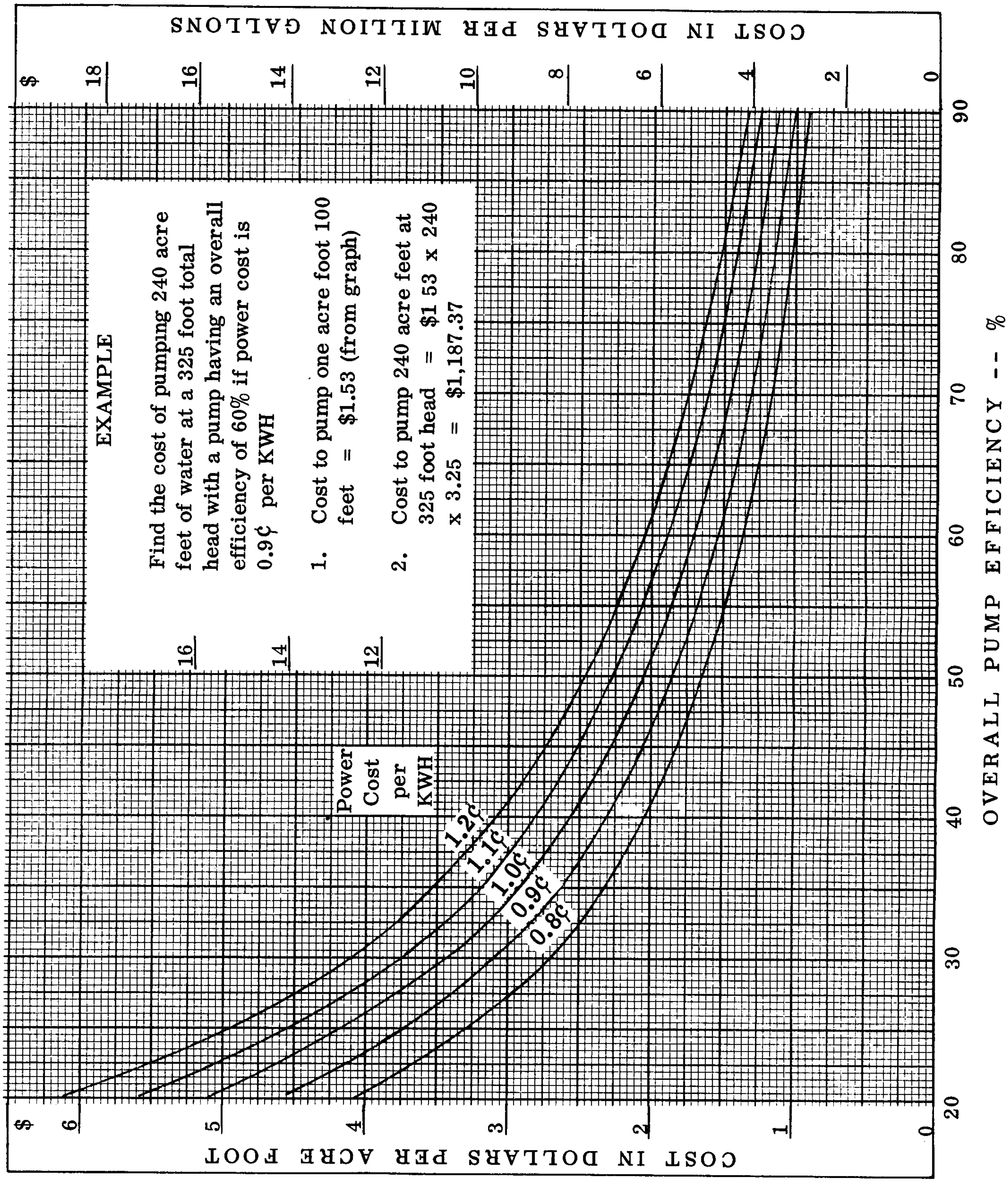
COST OF PUMPING WATER WITH A TOTAL HEAD OF 100 FEET



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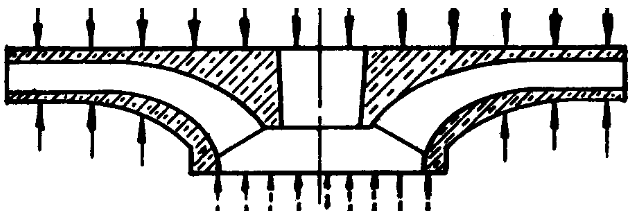
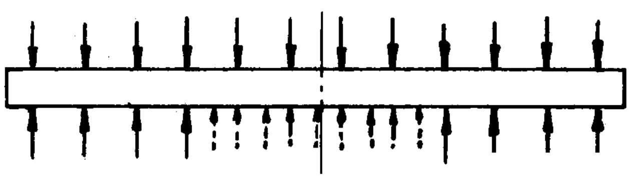
Thrust Application Data

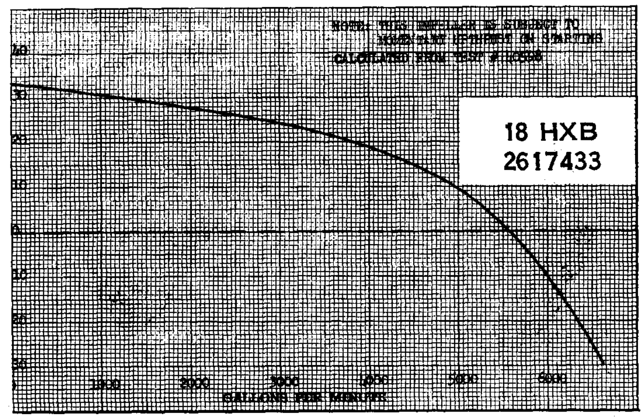
The standard vertical turbine is subjected to axial forces which act in a direction parallel to the shaft. These forces are referred to as hydraulic thrust loads, which are taken by thrust bearings in the driver. The hydraulic thrust load can be either up or down in direction, but in vast majority of applications there is only down thrust. To understood why there thrust, it is only necessary to know the pressure forces acting on each impeller.



The solid lines represent the force exerted by the discharge. The dotted lines show the comparatively lesser force (suction pressure) acting across the eye of the impeller. In essence, there exists a situation s follows:



It can be seen that he load down is greater than the load up, the resulting in down thrust. Designers can calculate these loads, but it is more accurate to run lab tests and actually measure the load. Results of such tests are normally expressed not as pounds, but as pounds per foot of head. Although it is usually assumed that this value of pounds thrust per foot of head is the same at any capacity, lab tests show that this is not true. Tests as well as experience in the field show that when pumps are operated at abnormally high capacities, the direction of the thrust changes from what is normally down, to up. The column shaft, normally in tension from down thrust, is actually pushed up or put in compression from up thrust.

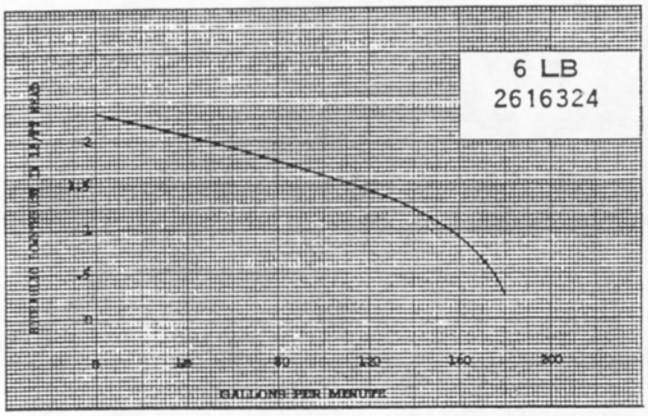


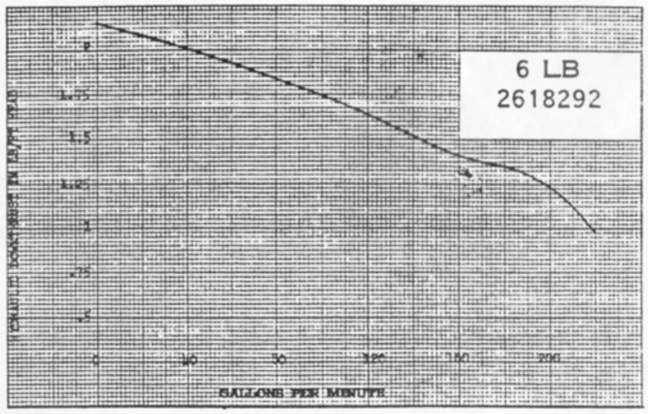
To determine the total thrust load in the driver, the weight of rotating parts (column shaft and impellers) should be considered. These weights are added to the hydraulic thrust if the thrust is down and are subtracted if the hydraulic thrust is acting up. When a pump is first started, it usually comes up to full speed in micro-seconds and is thus operating at an abnormally high capacity until the head builds up. This causes a “starting up thrust” which is momentary only because the unit (in most cases) very quickly starts operating in a more normal part of the curve.

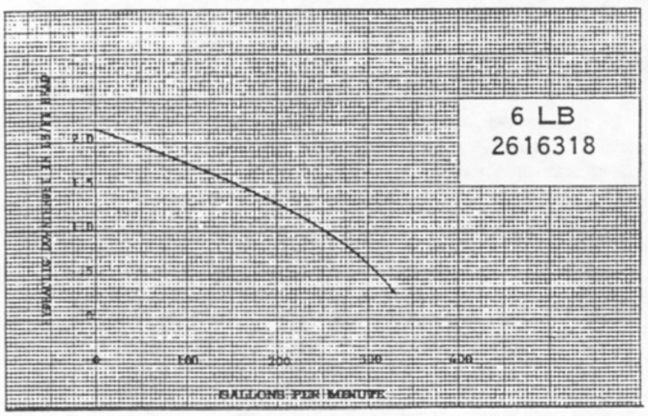
Bearings in the driver must be designed to take the thrust loads imposed by the pump. These loads are usually downward, but can be upward either momentarily or continuously, depending both on the specific impeller and the operation of the pump. Driver manufacturers usually publish only down thrust values. However, momentary up thrust protection is obtainable at no additional cost and is usually furnished as a standard. Pumps set at 25 feet or less must always be furnished with drivers having a momentary up thrust capacity equal to 30% of the down thrust rating and must have the top drive coupling bolted down. Drivers which must take continuous up thrust must be referred to the factory, since both motor and pump require special design.

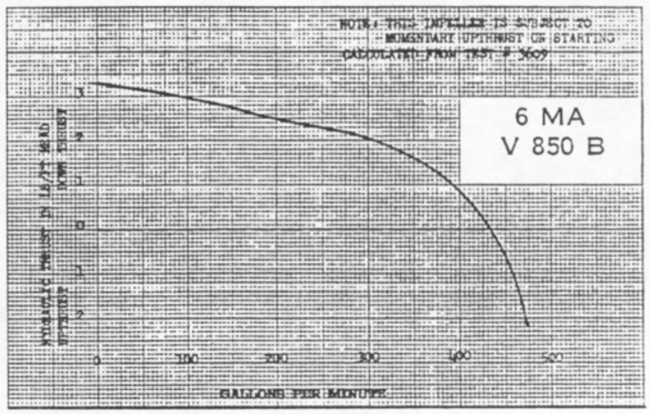
In general, spherical roller bearings are used on motors of 300 hp at 1800 rpm (or equivalent size) and larger, for thrusts in excess of 100% of the normal high thrust rating. Where spherical roller bearings are furnished, a minimum down thrust is required. Also, water cooling may be required in the larger ratings. Approximately 4 GPM of cool, fresh water is required where water cooling is necessary. The minimum down thrust values range from 1000 lb on smaller frame motors to as high as 6,900 lb or larger. Request the motor vendor to give the exact value for any hp-speed-thrust combination when obtaining a motor quotation.

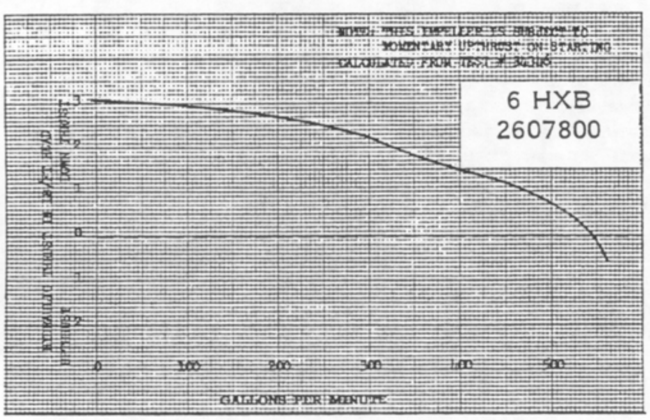
THRUST DATA BY SIZE AND IMPELLER NUMBER

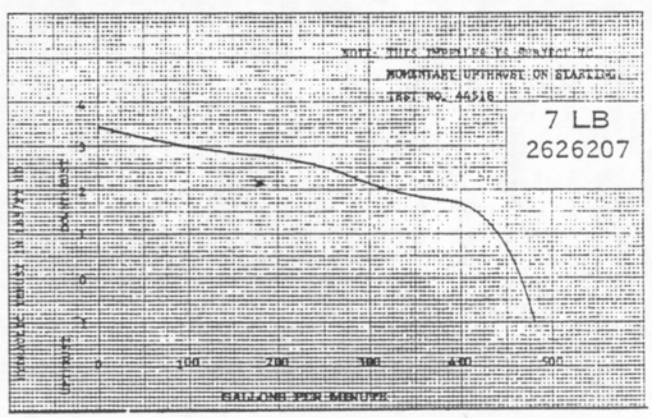


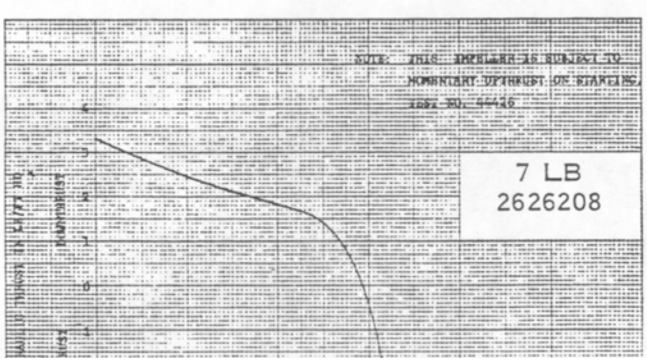


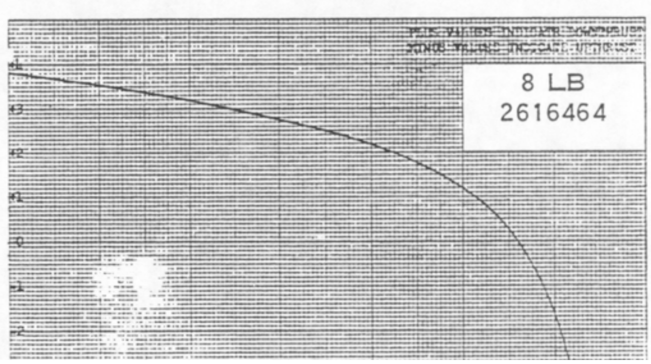




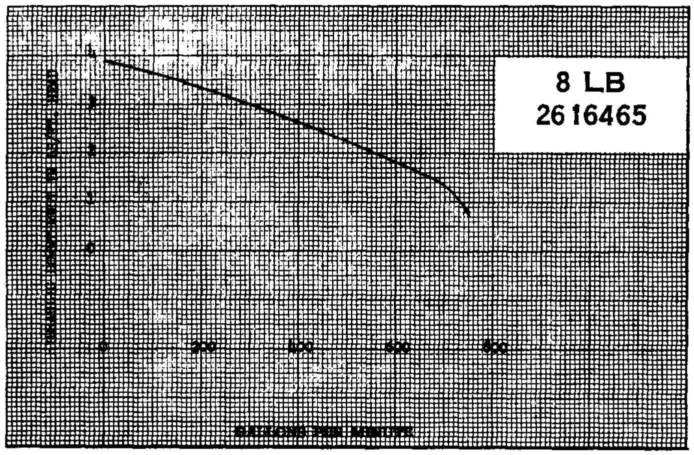


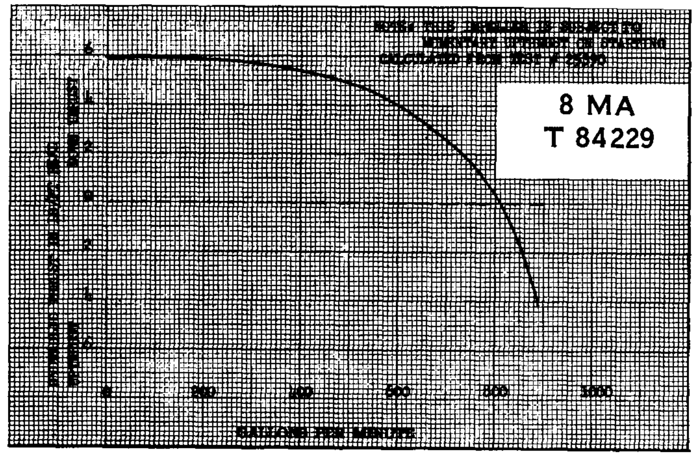


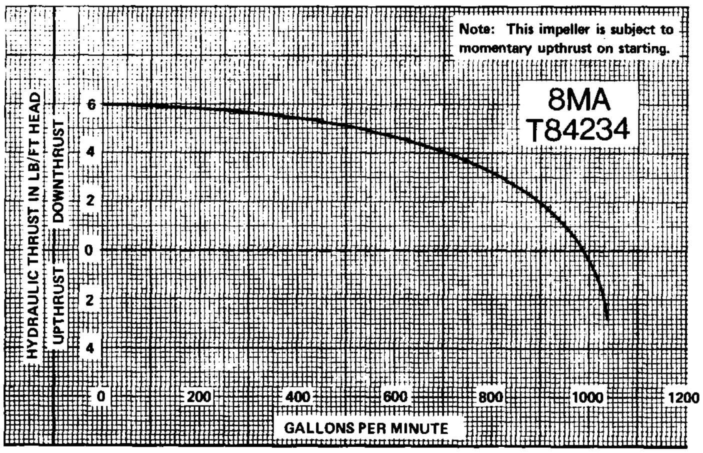


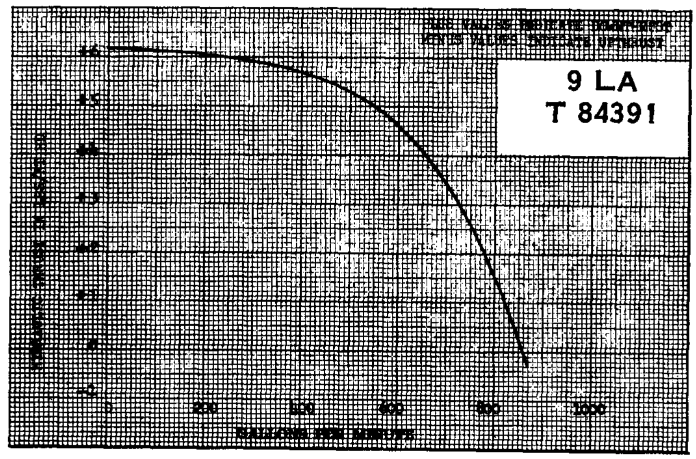


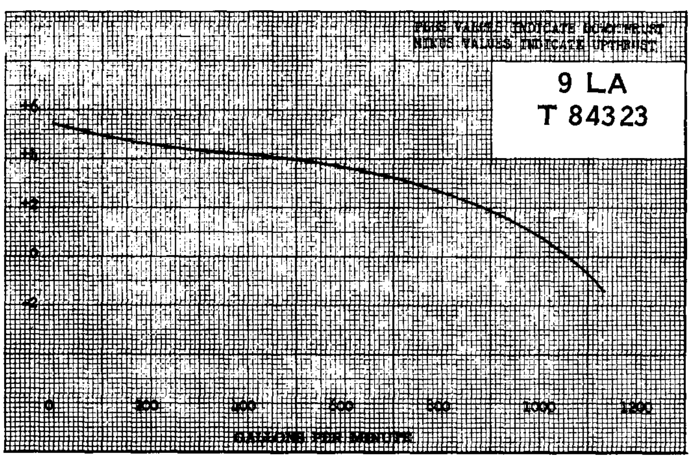
Thrust Data by Size and Impeller Number





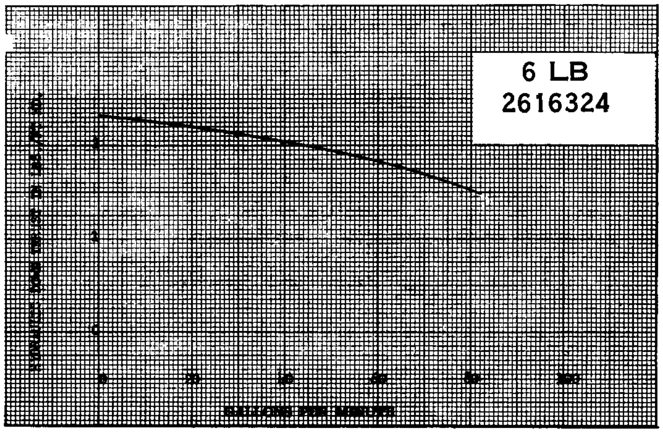


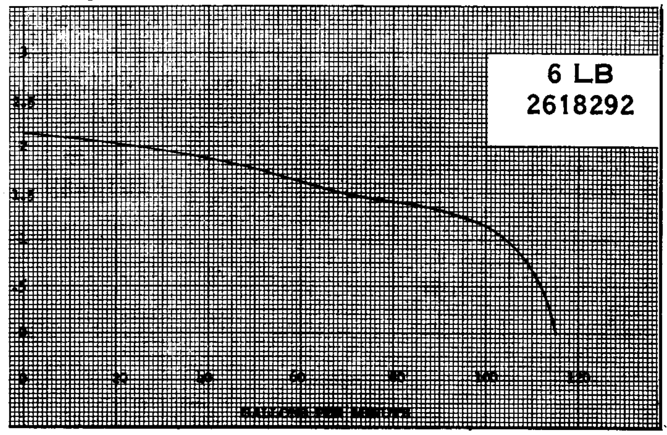


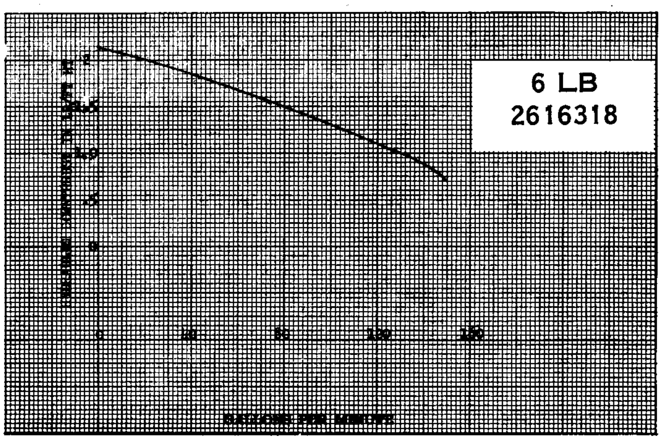


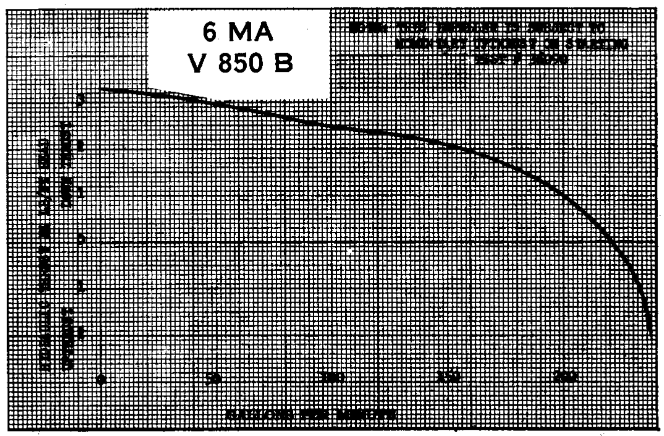
Peerless Pump Company
Indianapolis, IN 46207-7026

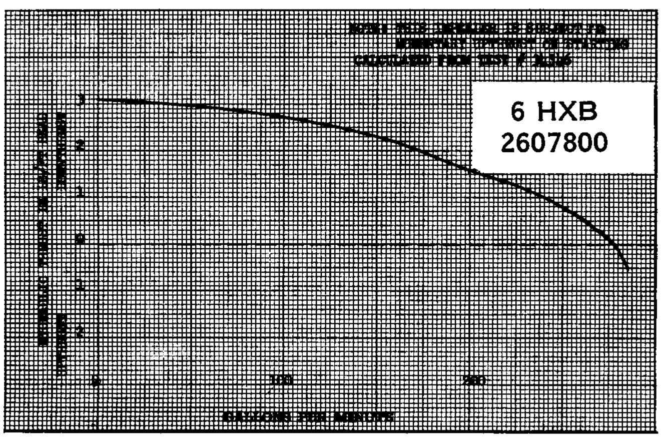
Thrust Data by Size and Impeller Number

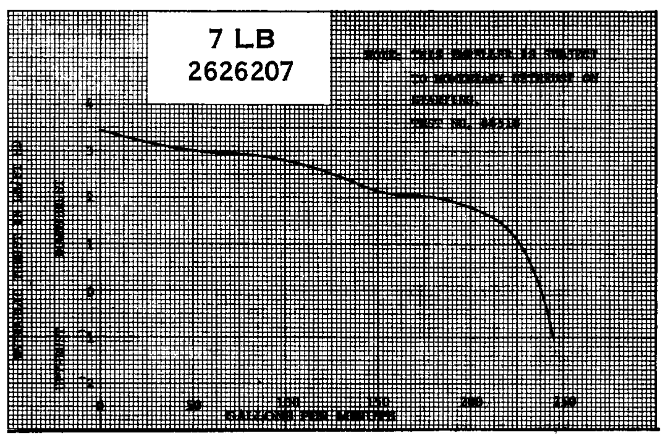


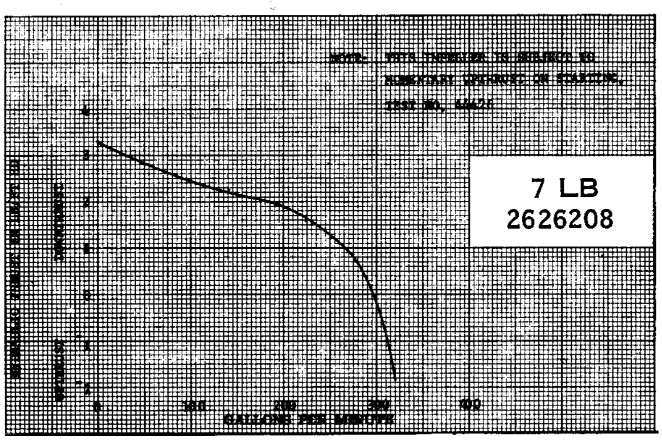


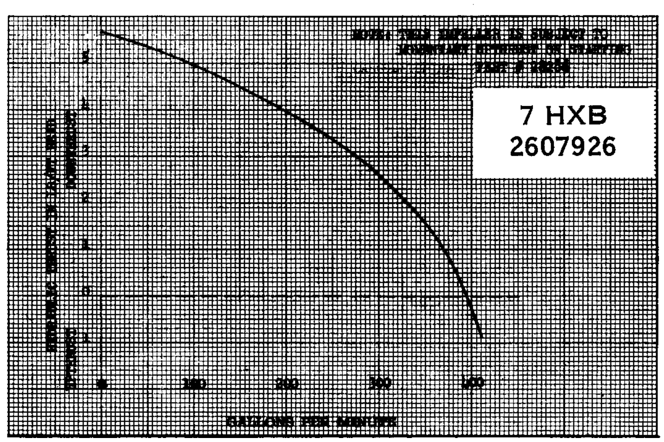






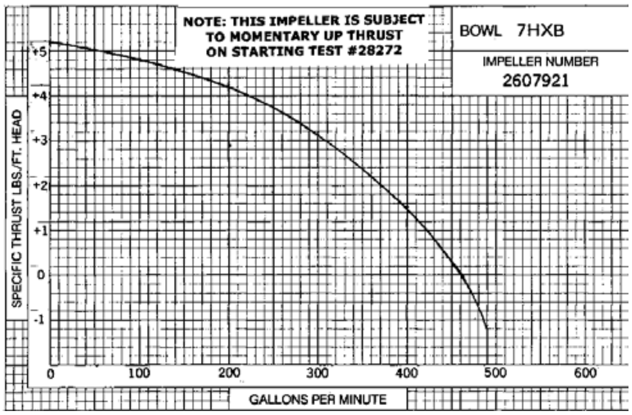


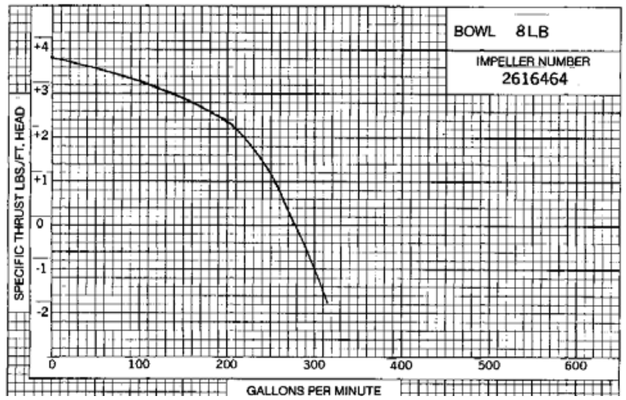


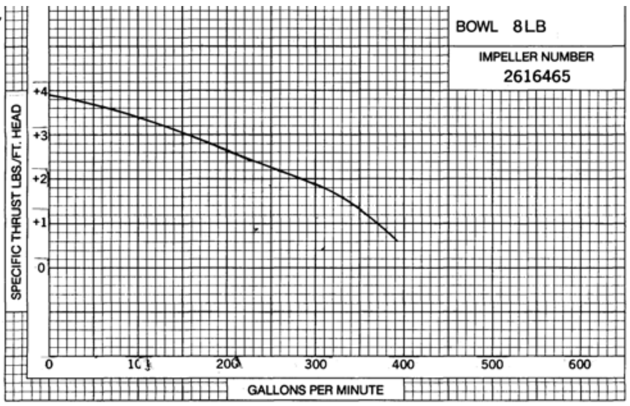


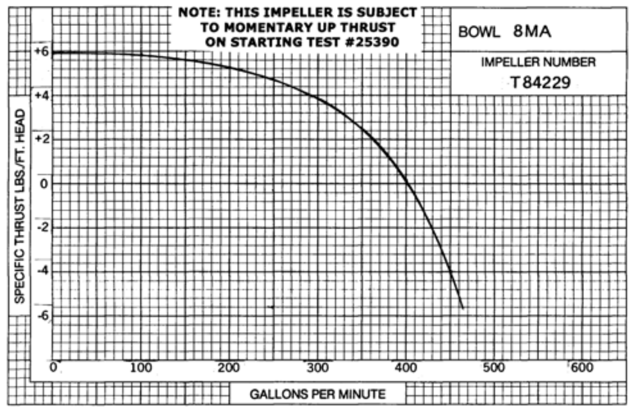
Thrust Data by Size and Impeller Number

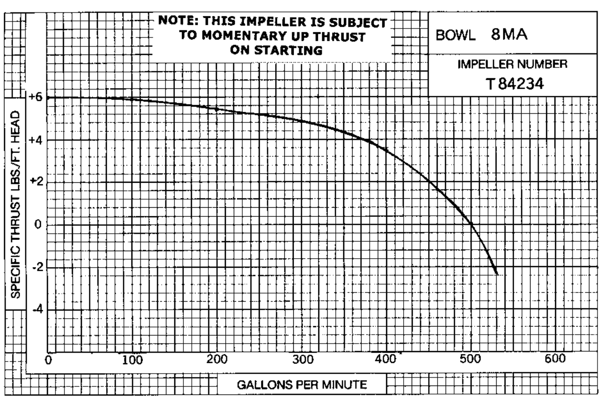
(+ plus values=Down Thrust, - negative values=Up Thrust)

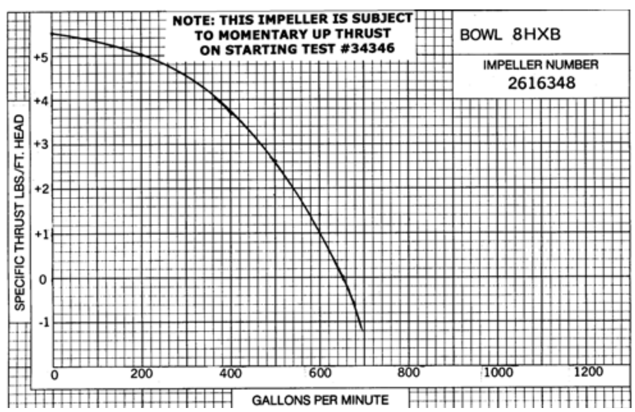


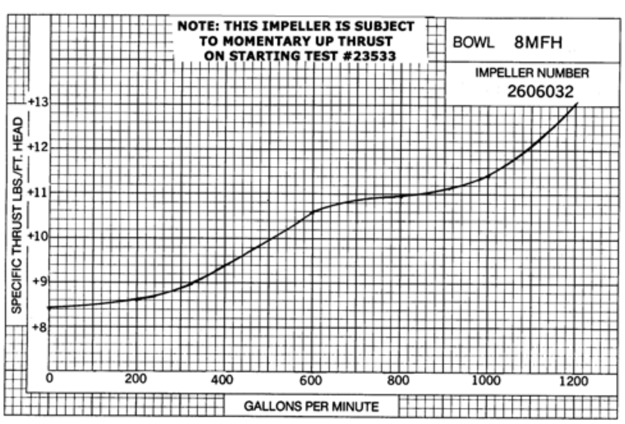


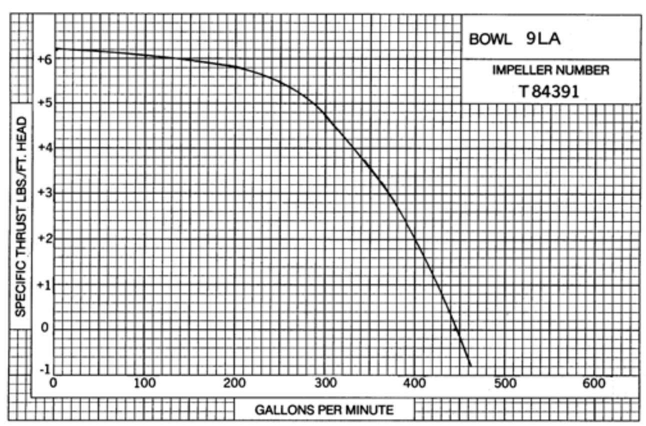




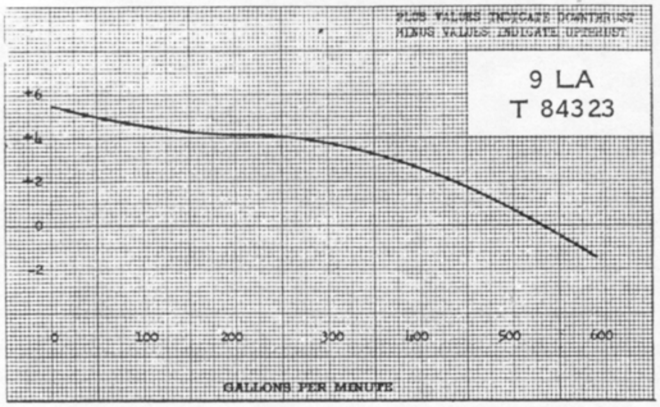


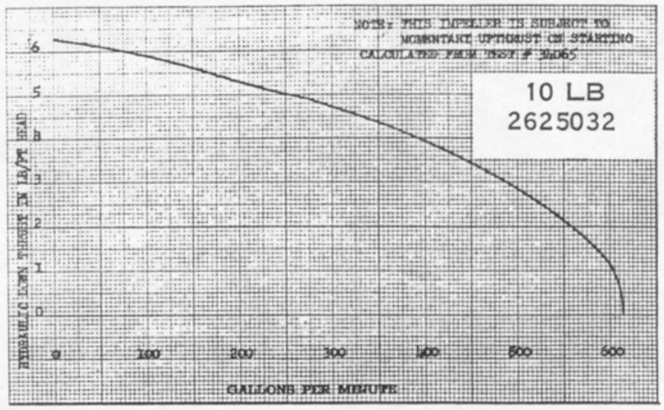


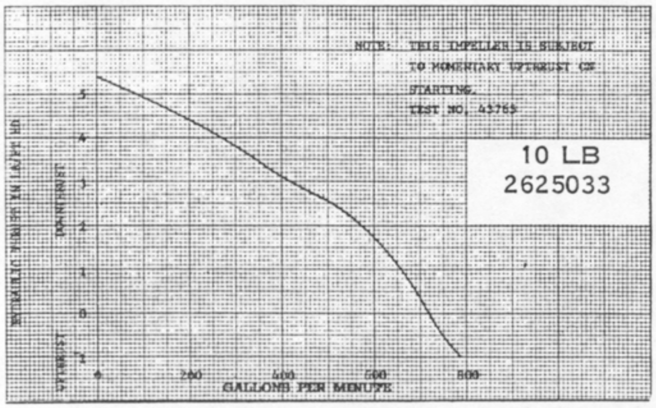


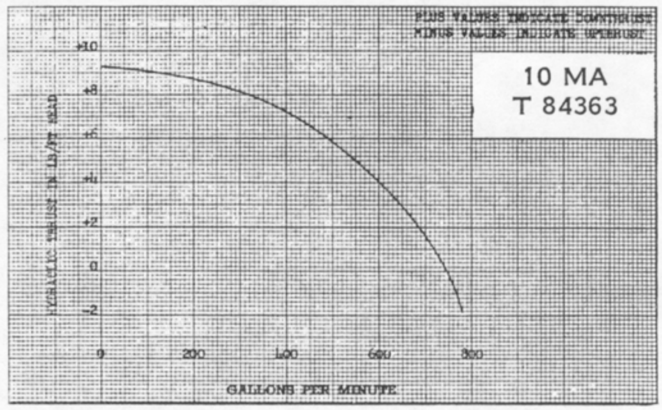


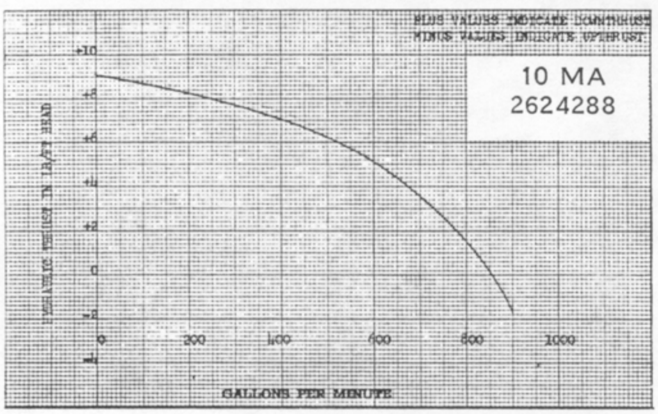
1760 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER

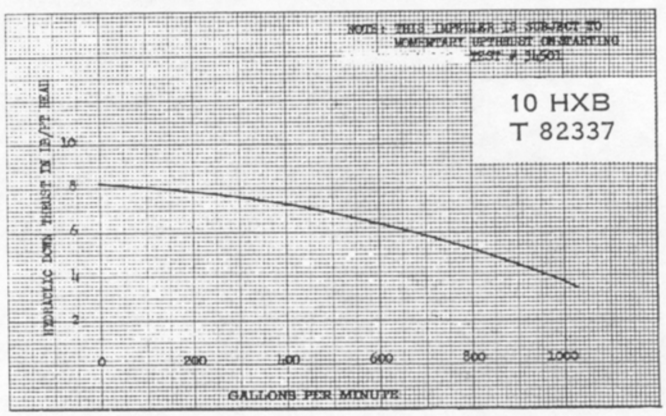


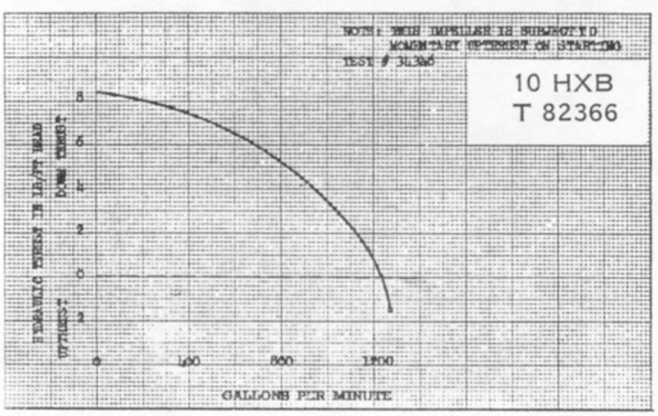


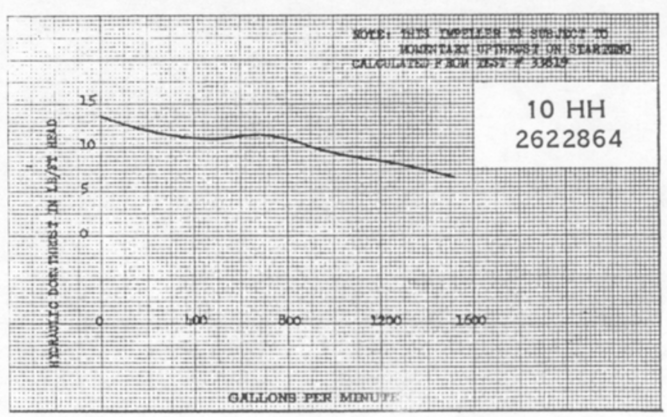




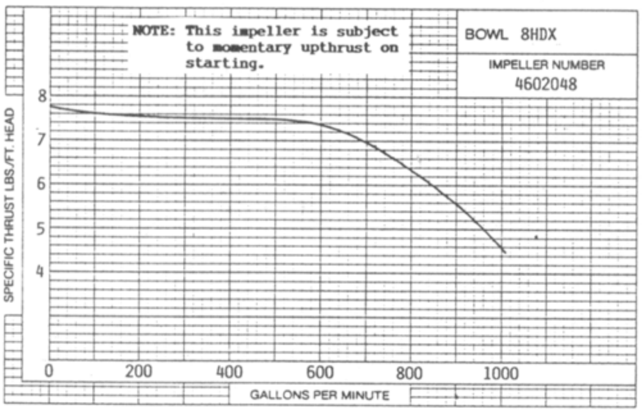


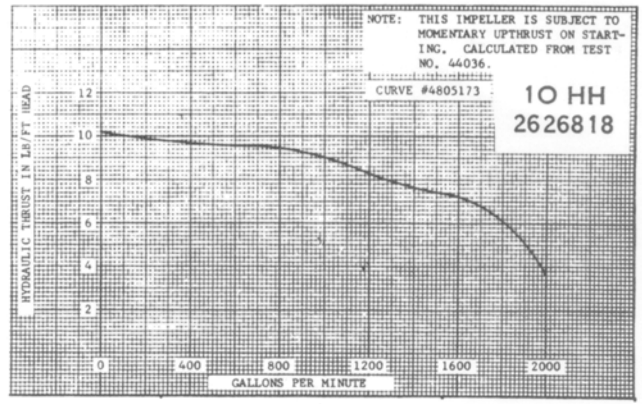


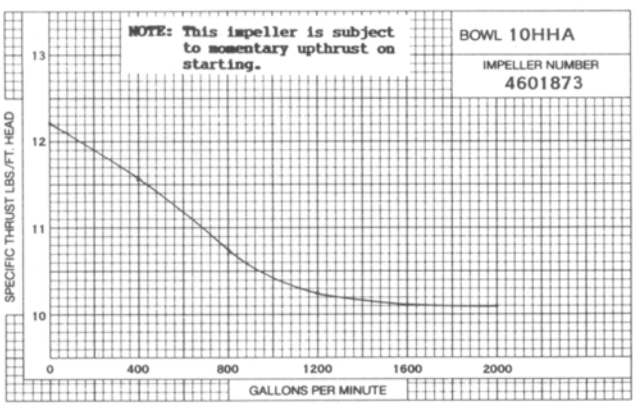




1760 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER







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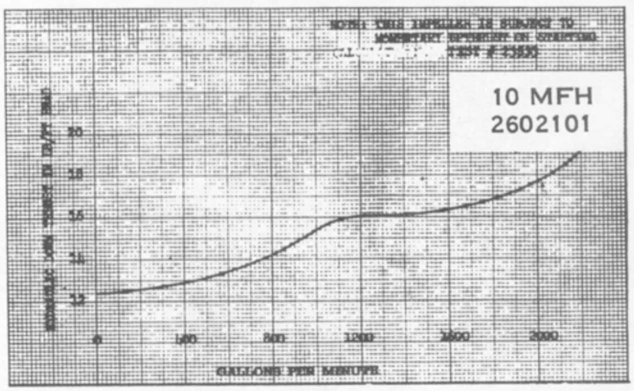

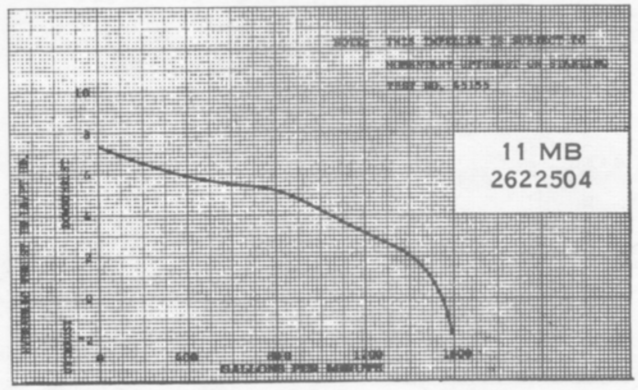

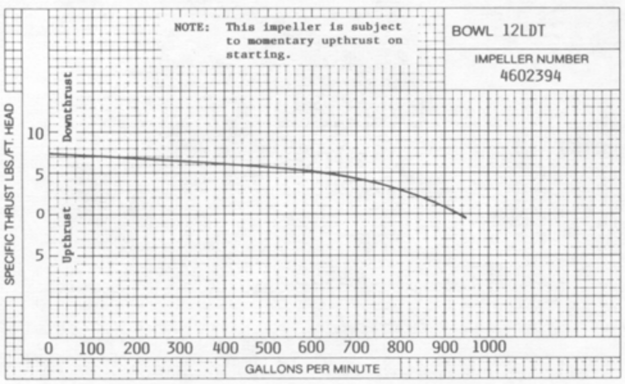

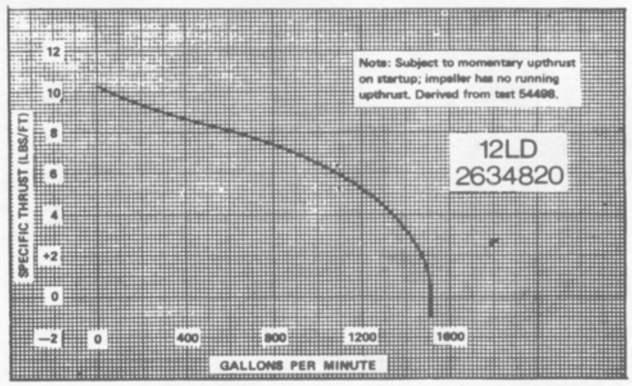

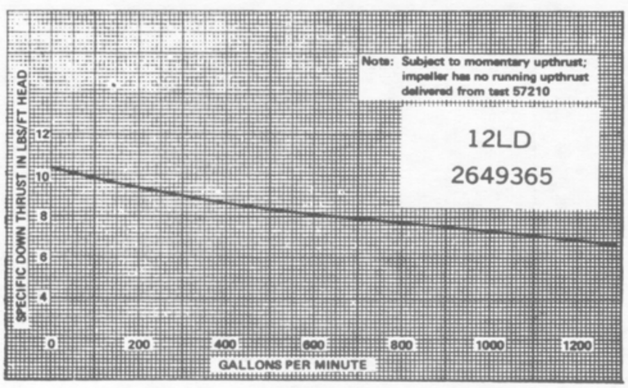

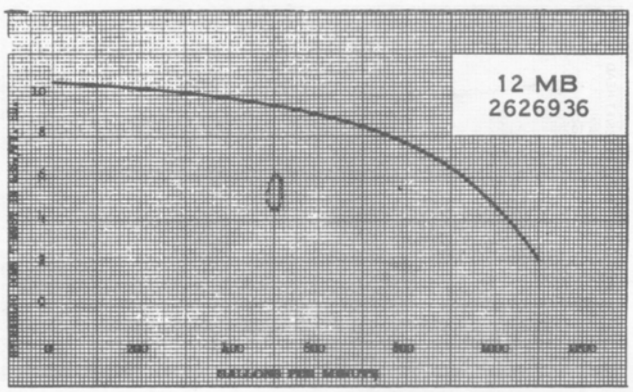

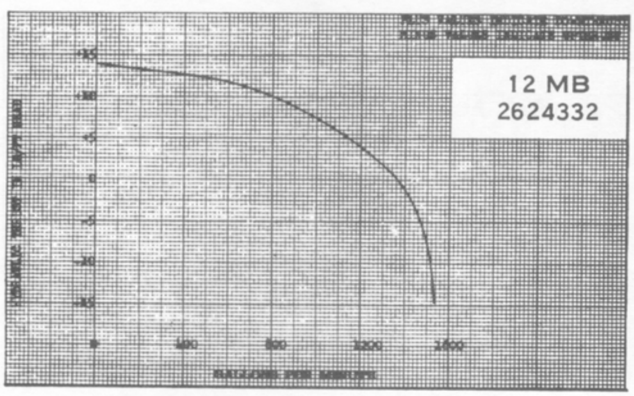

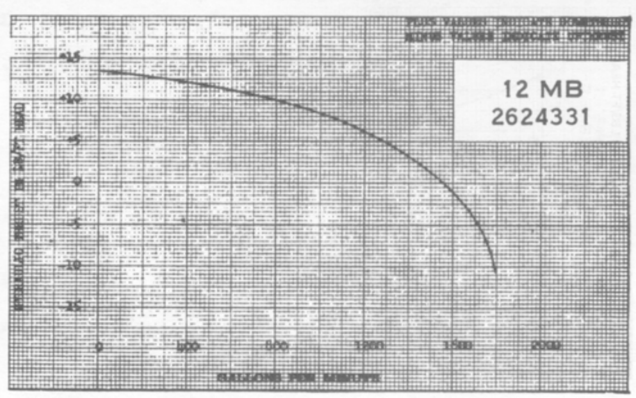

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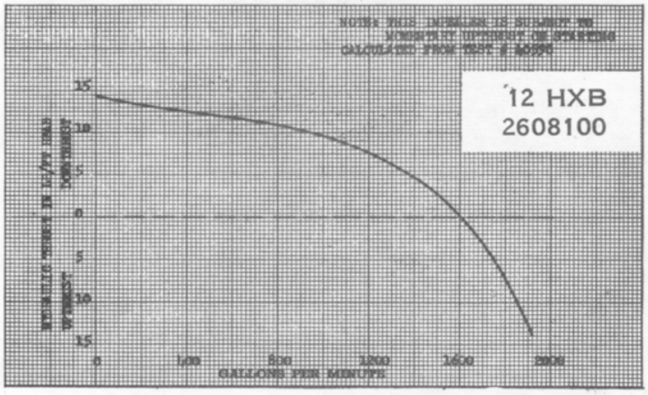

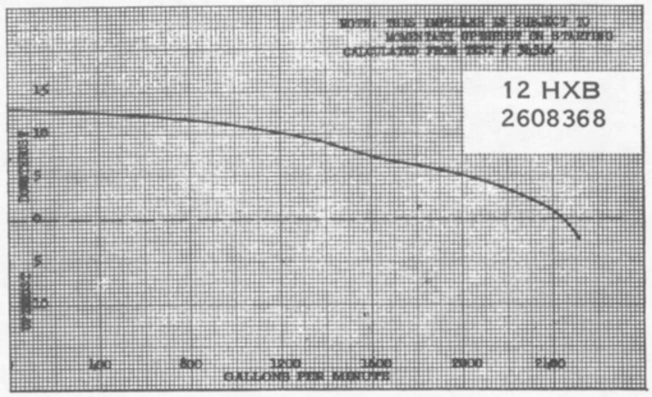

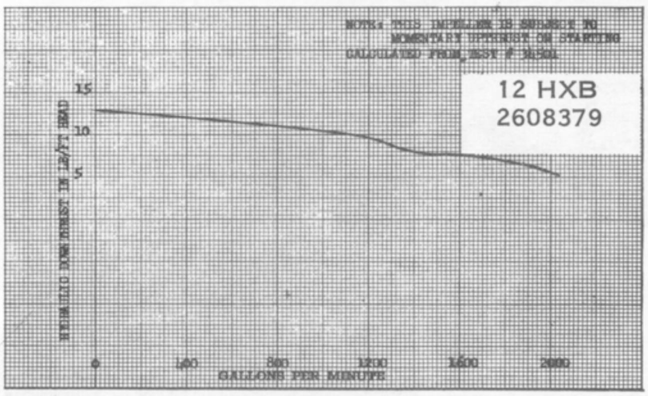

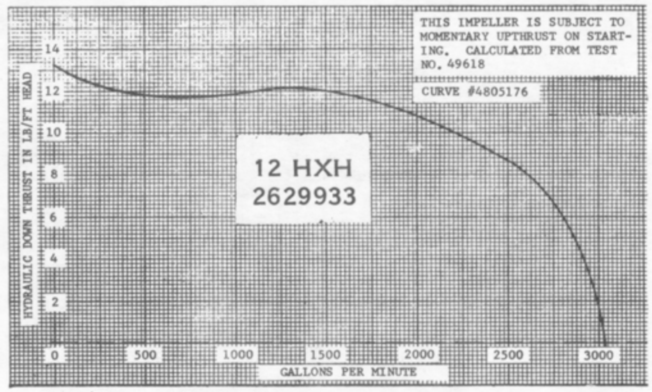

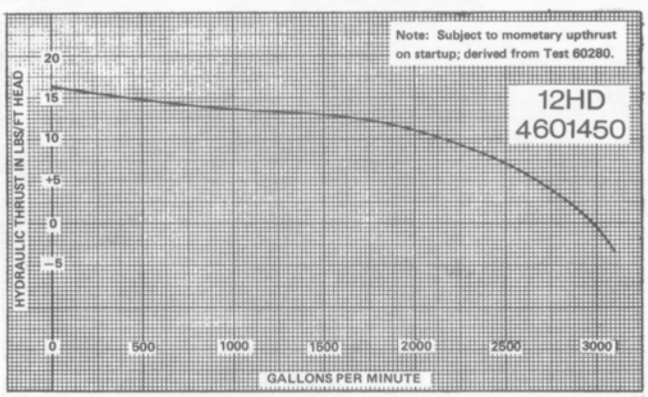

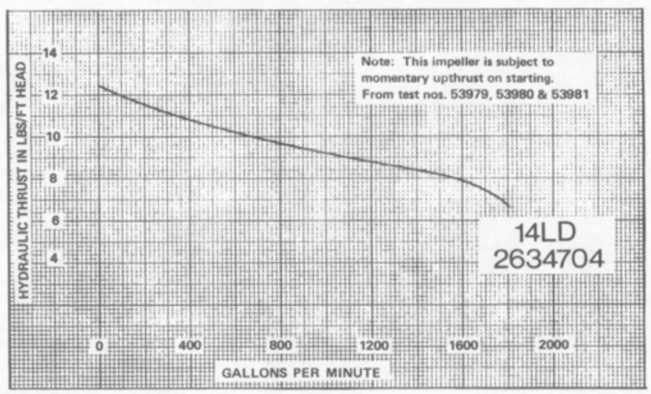

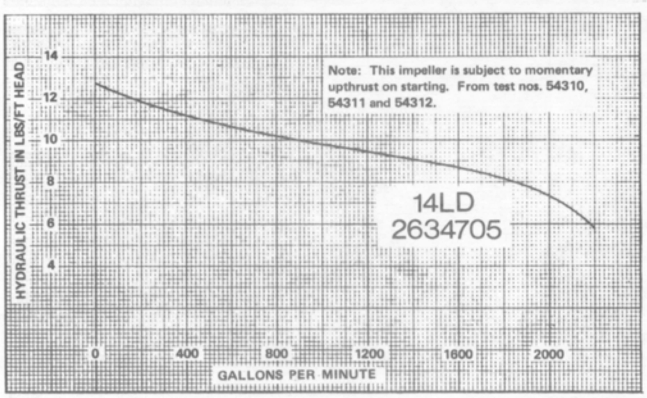

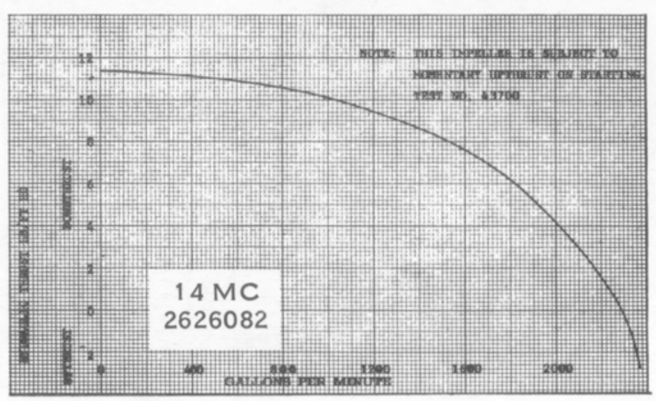

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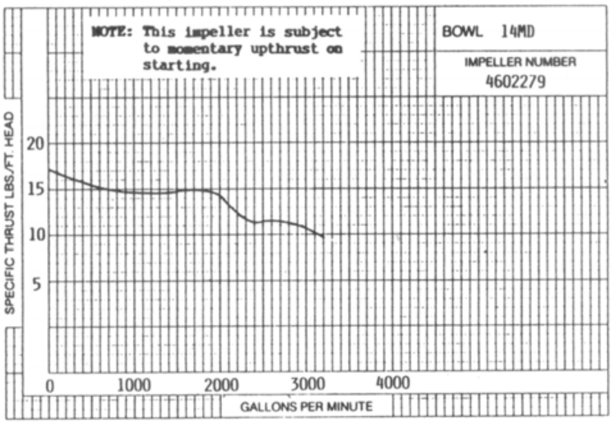

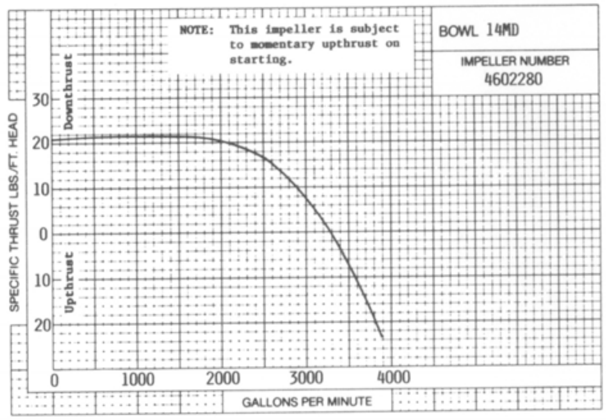

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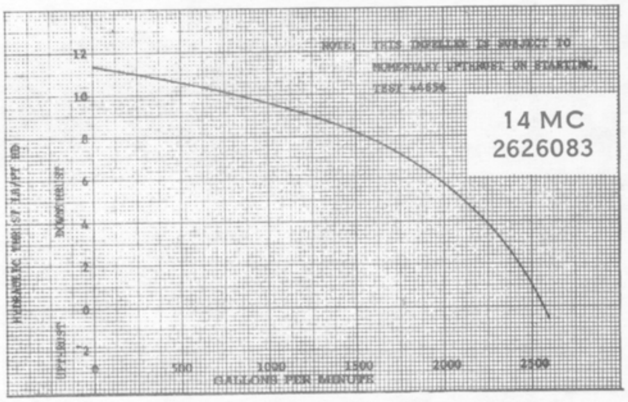
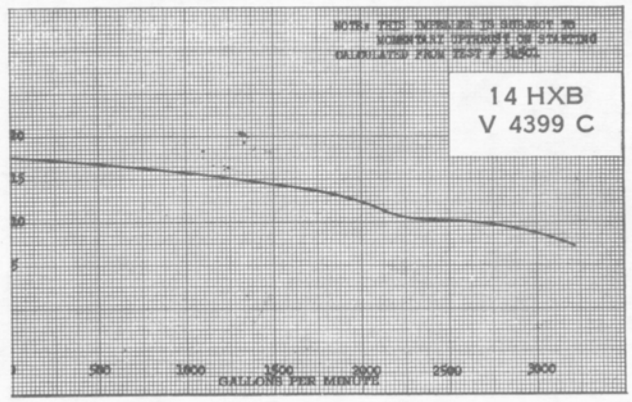
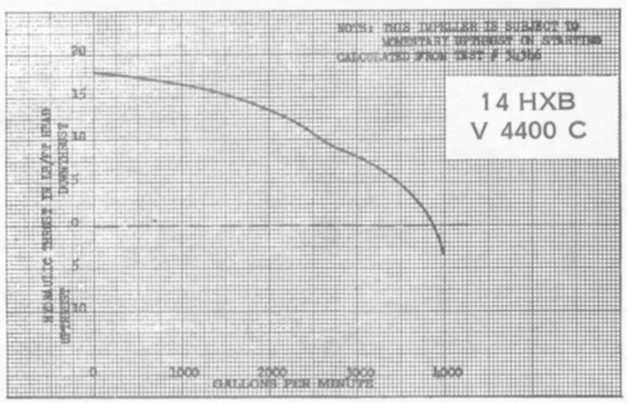
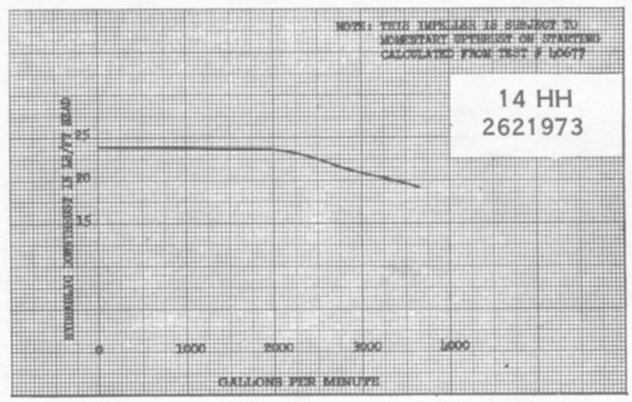
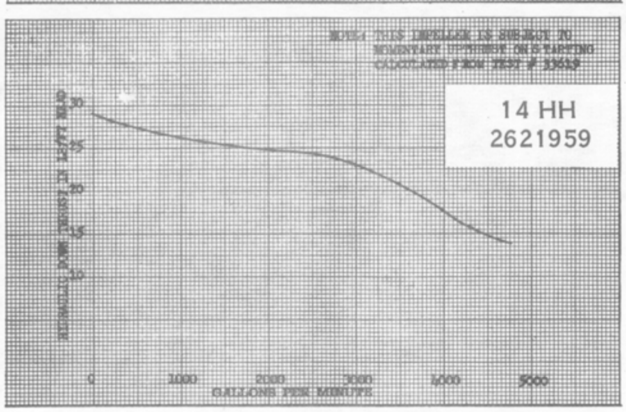
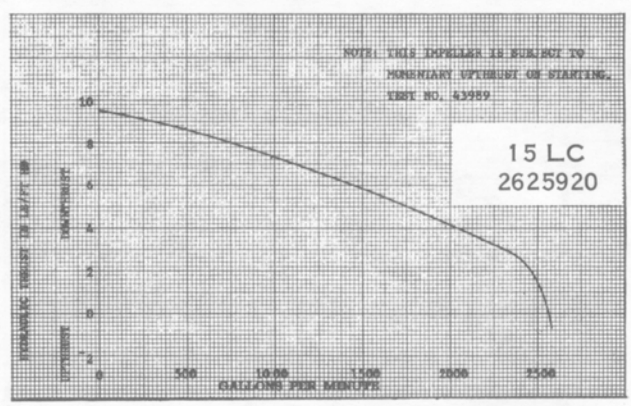


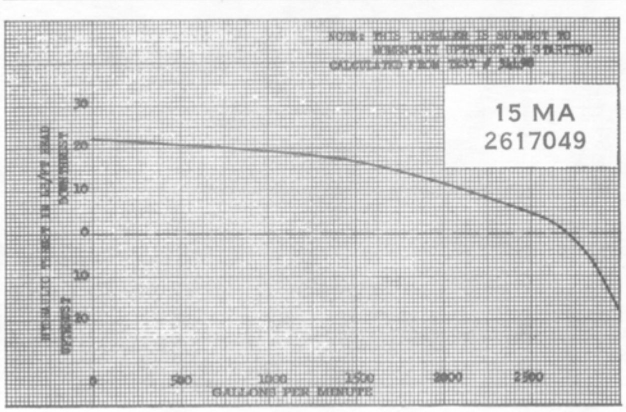


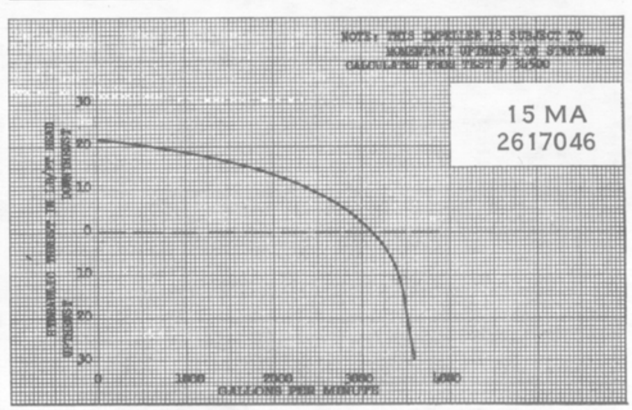






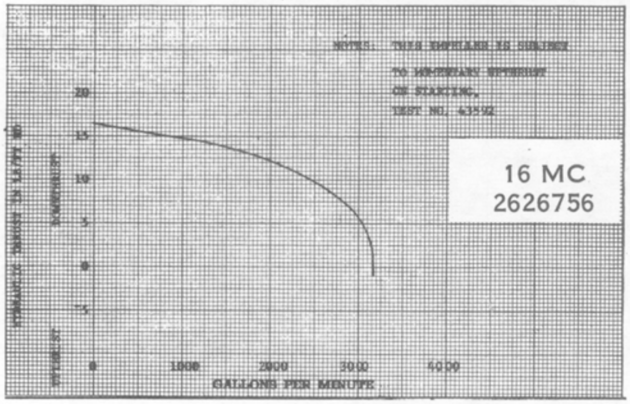


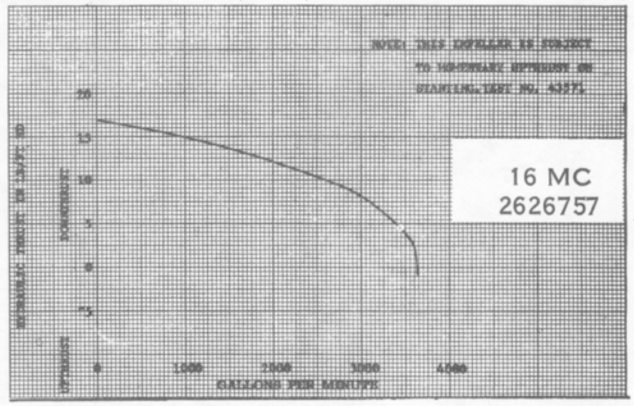


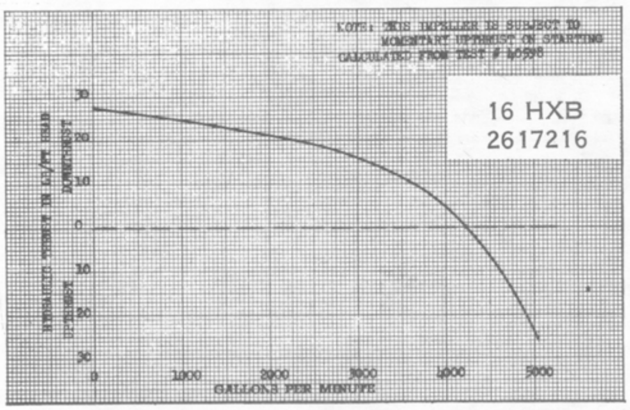


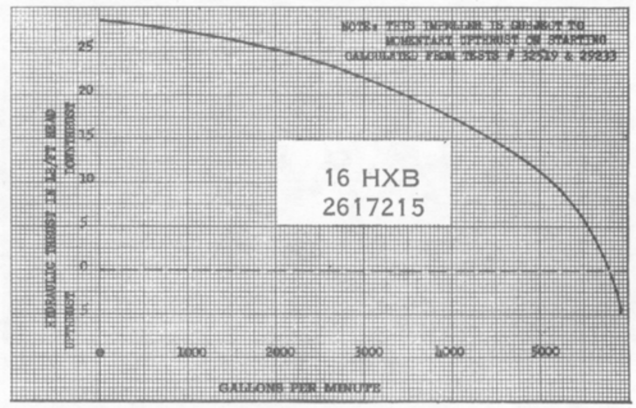
VERTICAL TURBINE PUMPS

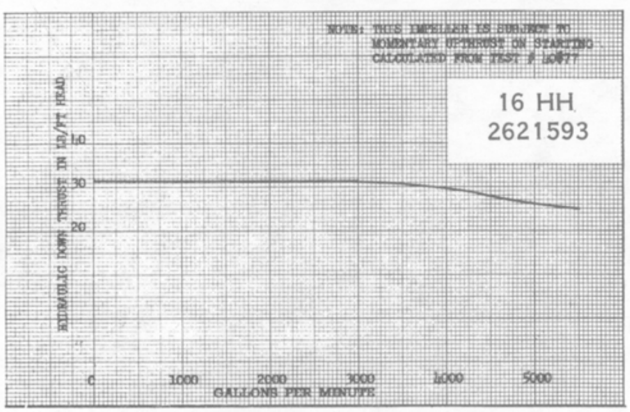
1760 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER

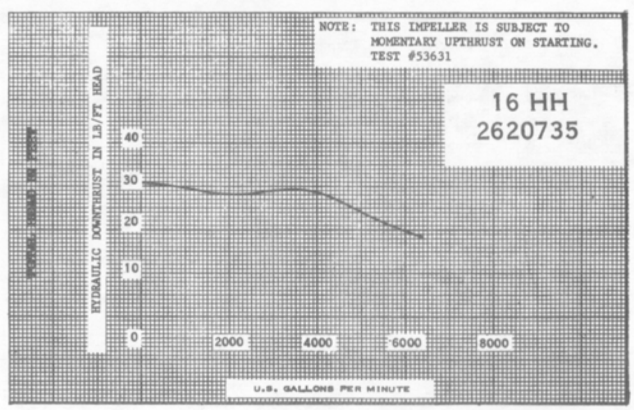


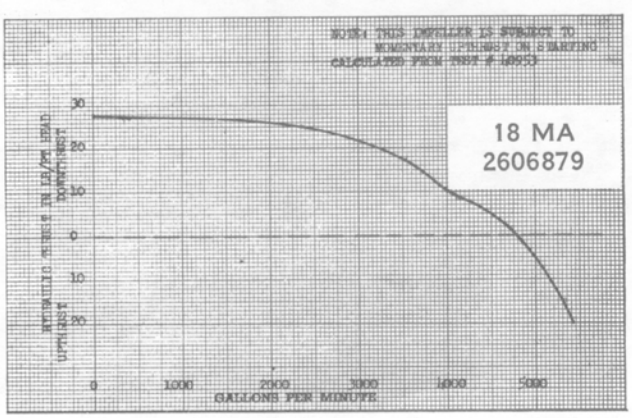


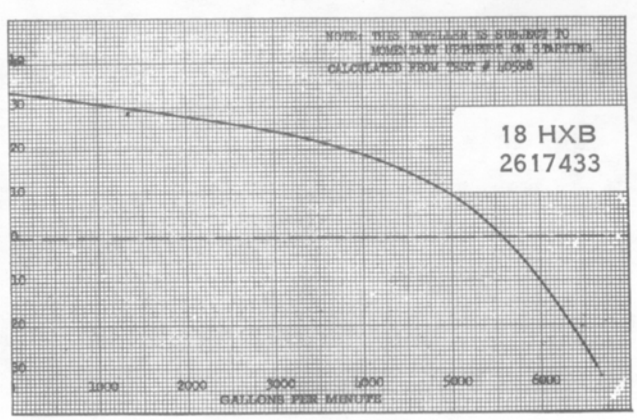












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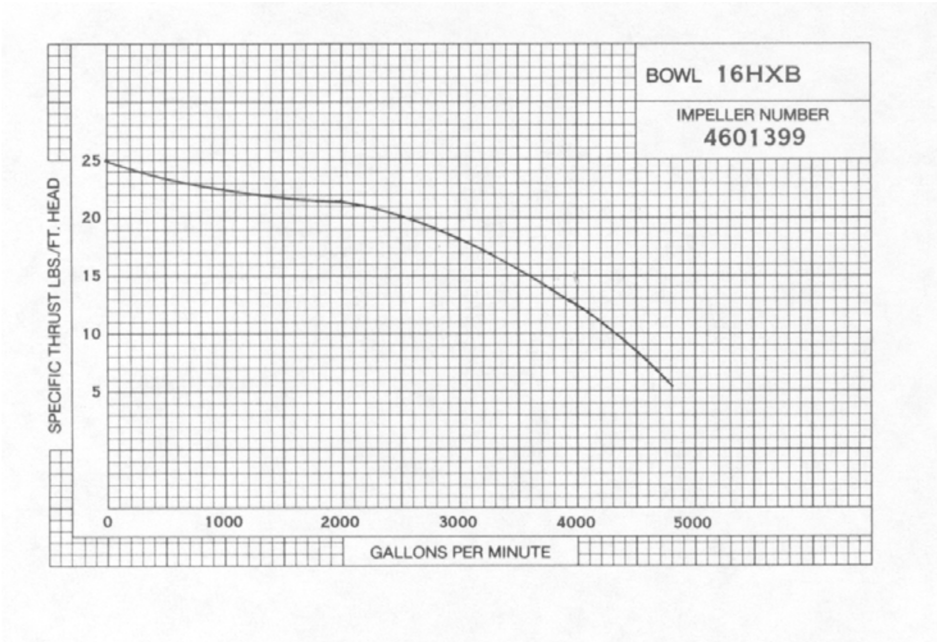

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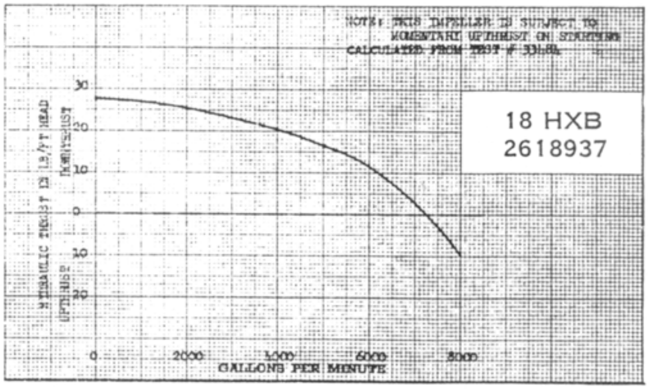

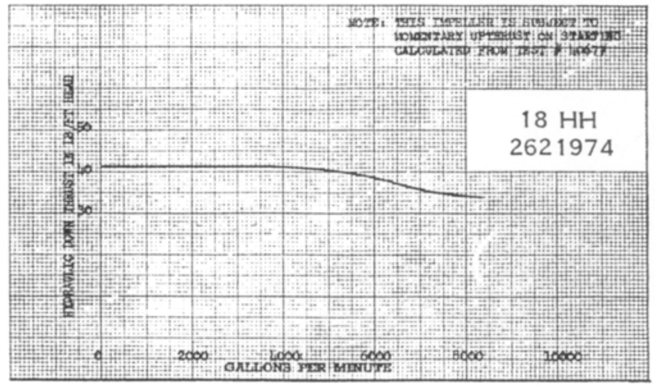

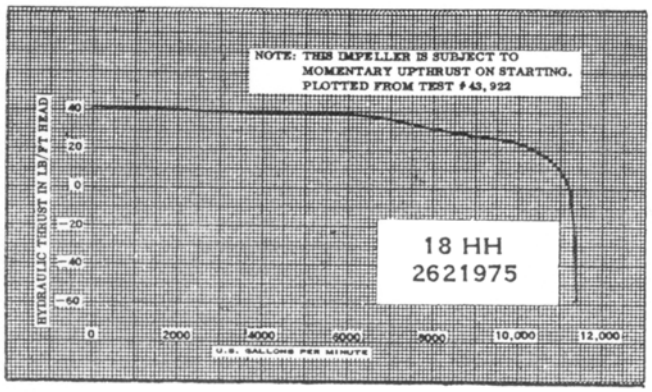

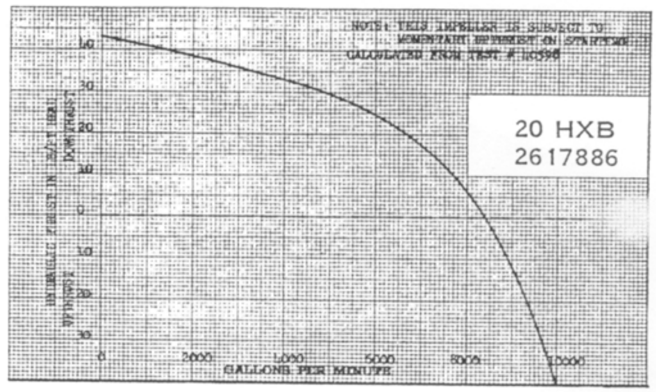

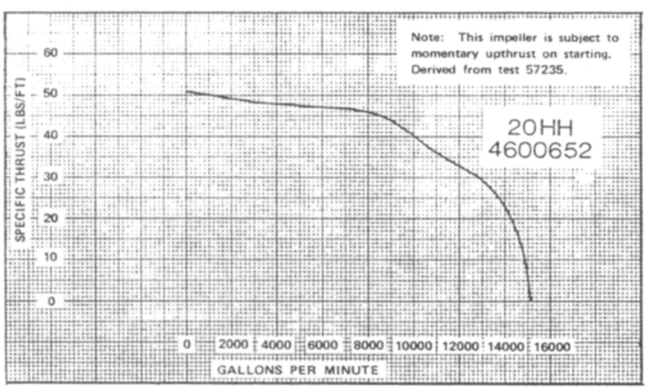

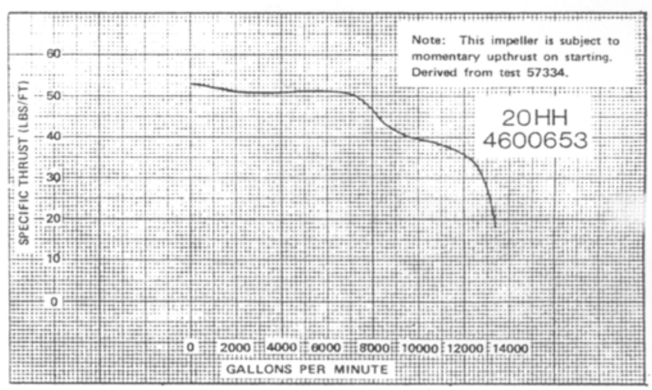

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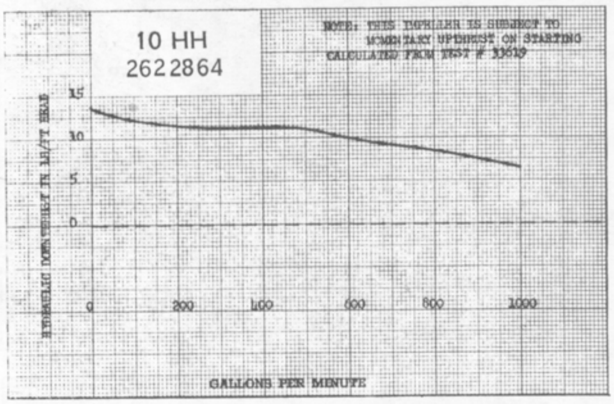

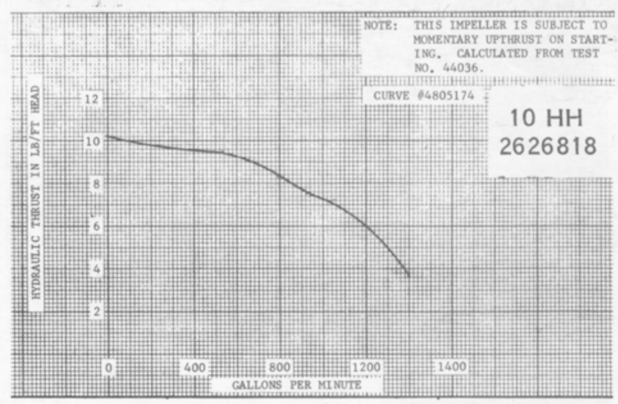

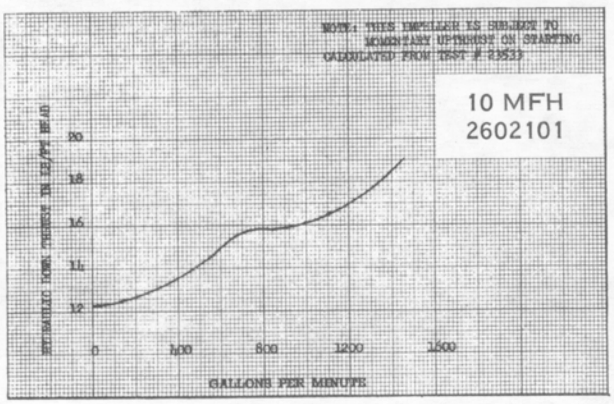

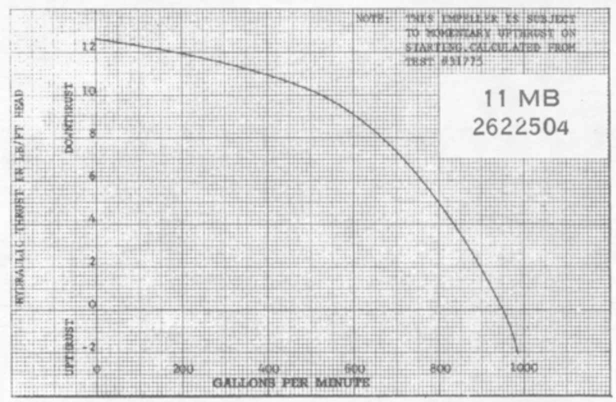

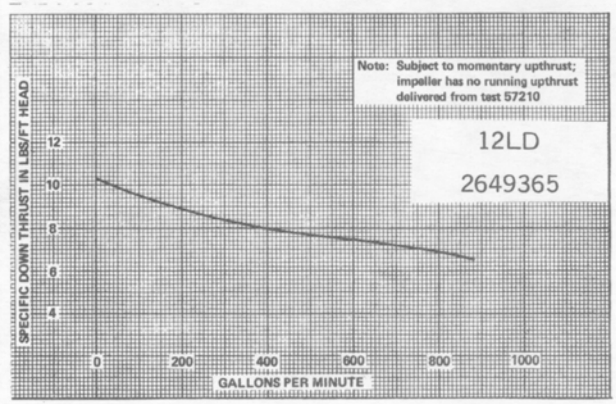

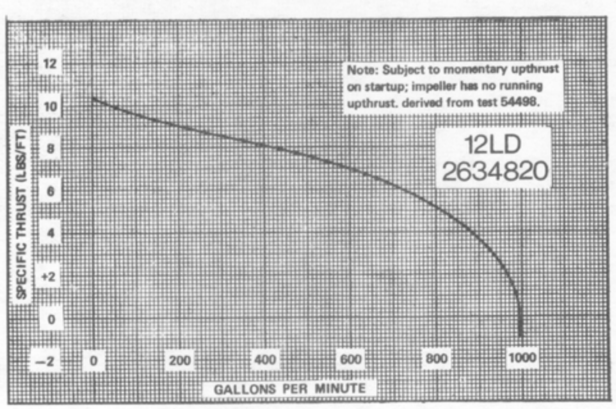

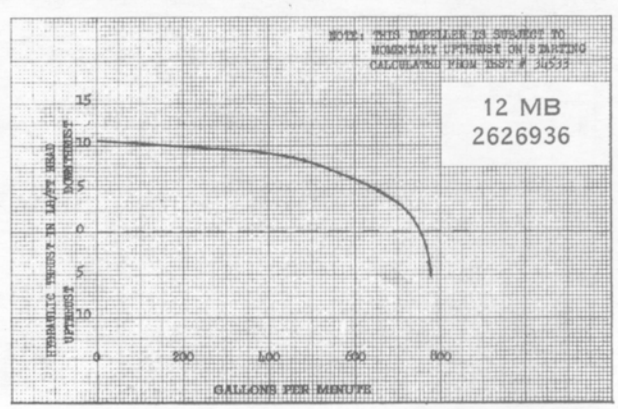

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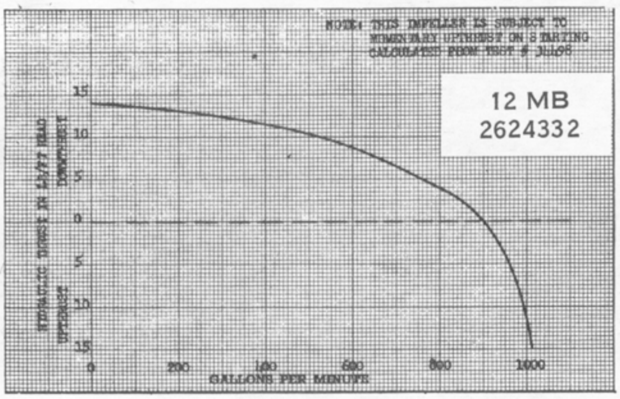

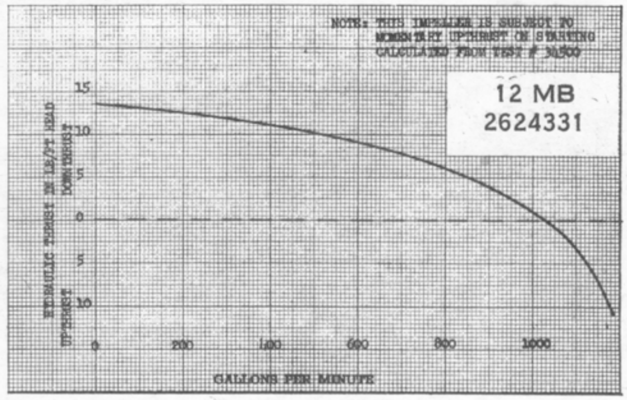

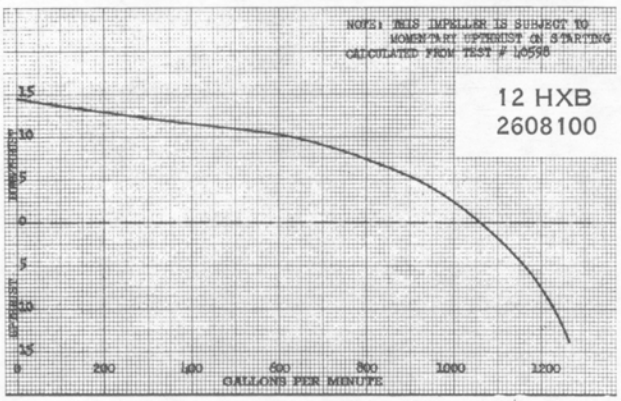

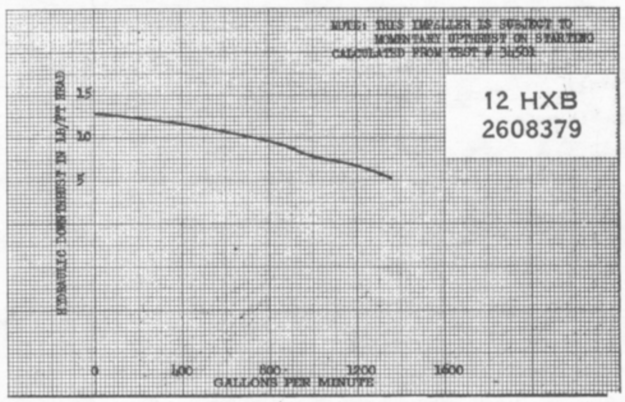

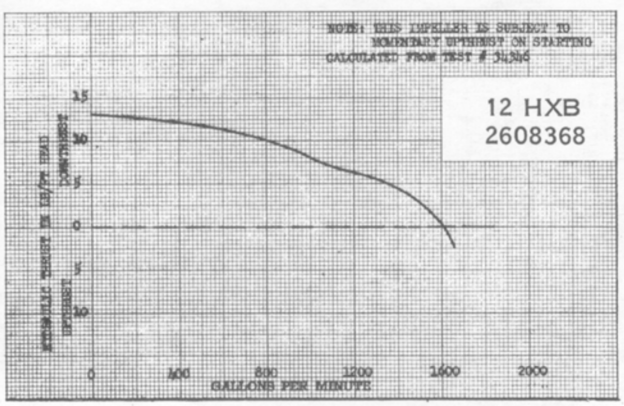

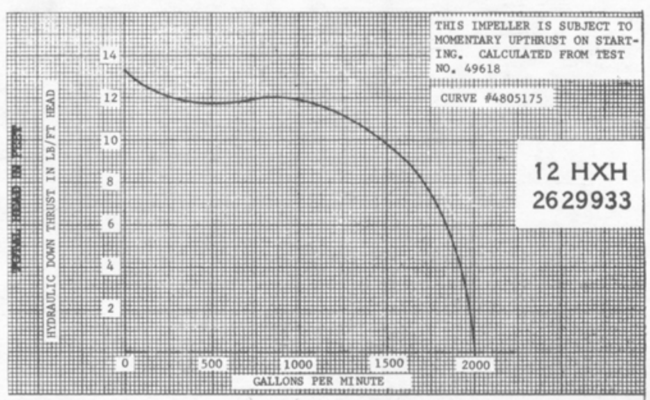

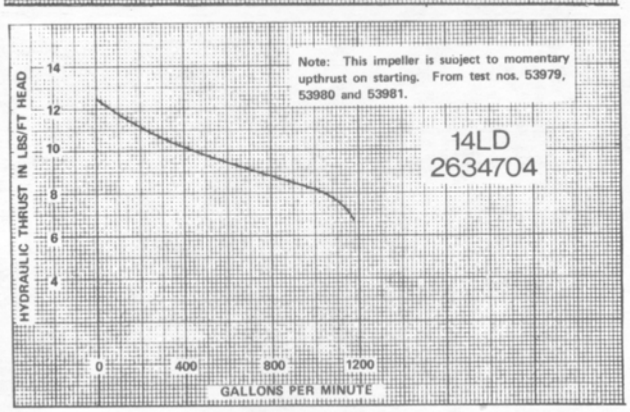

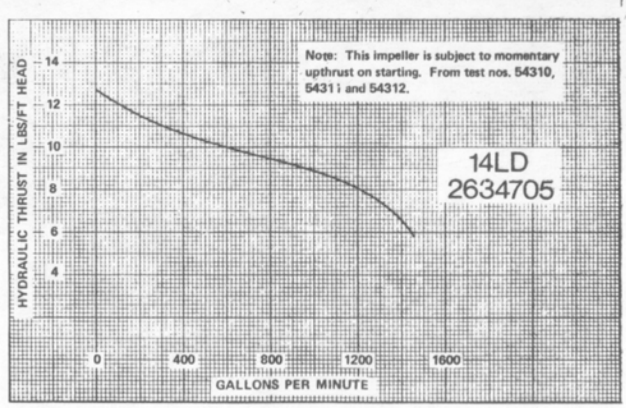

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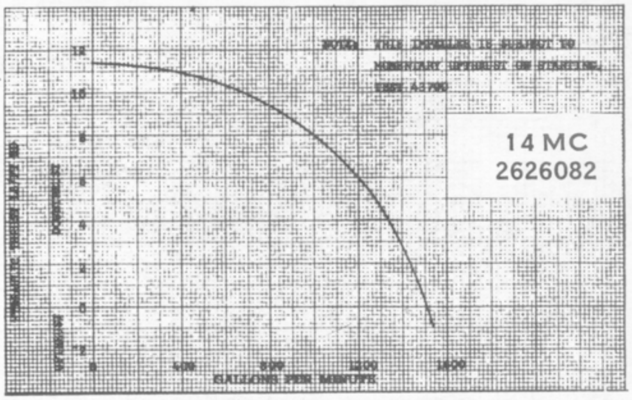

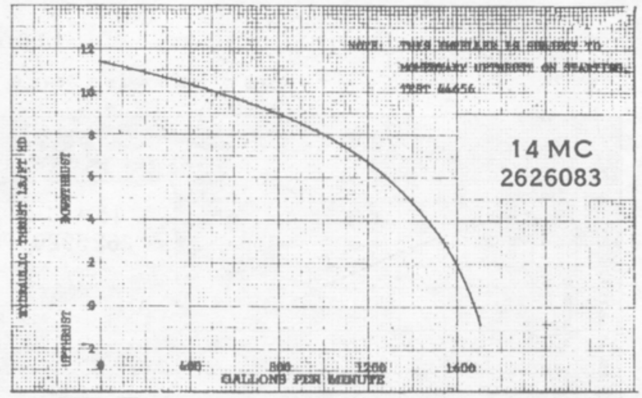

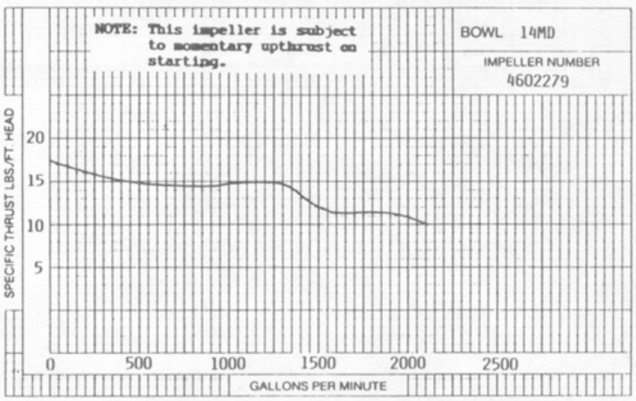

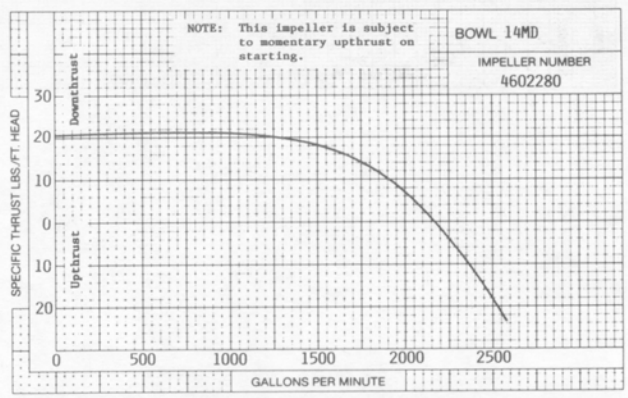

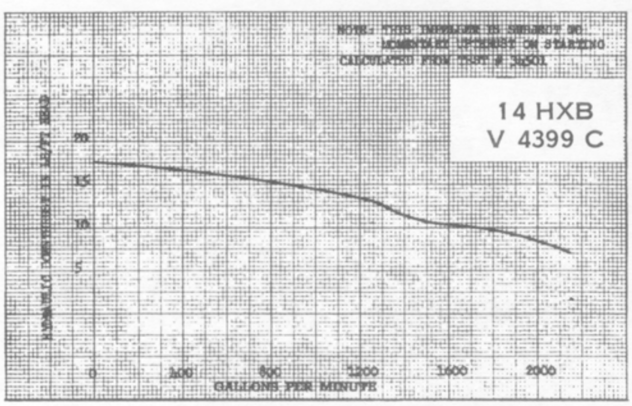

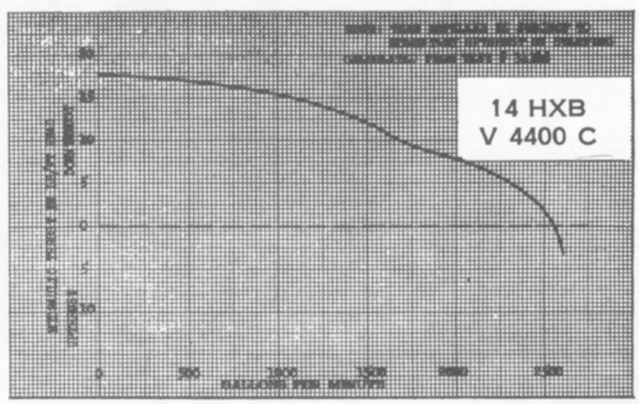

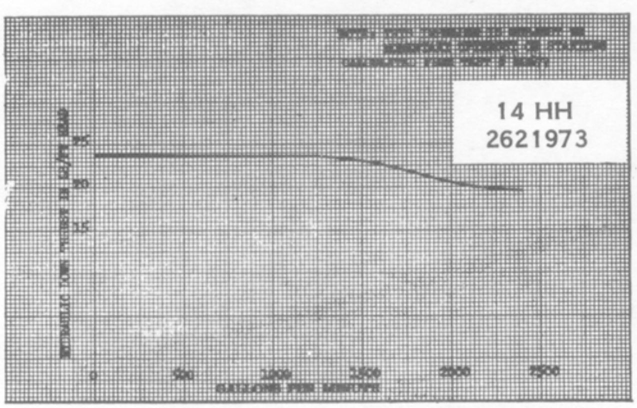

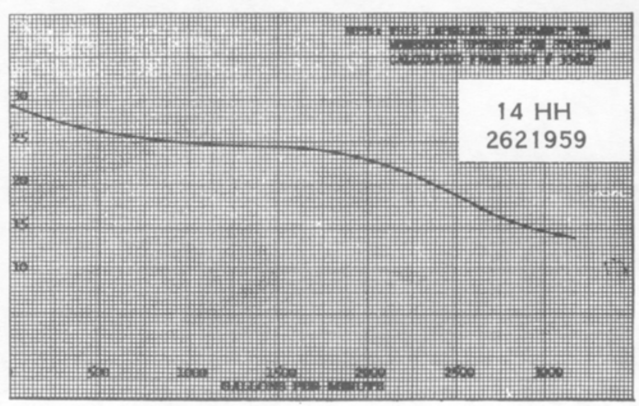

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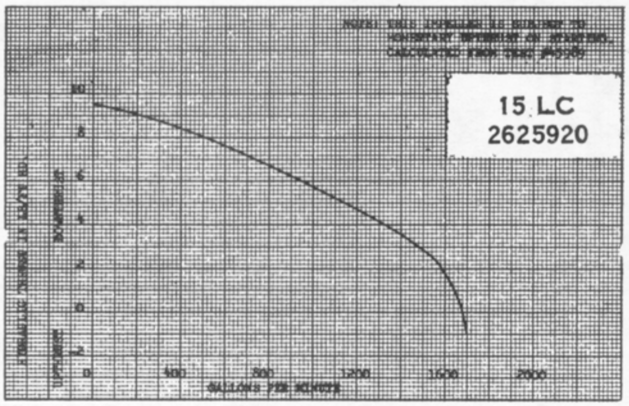
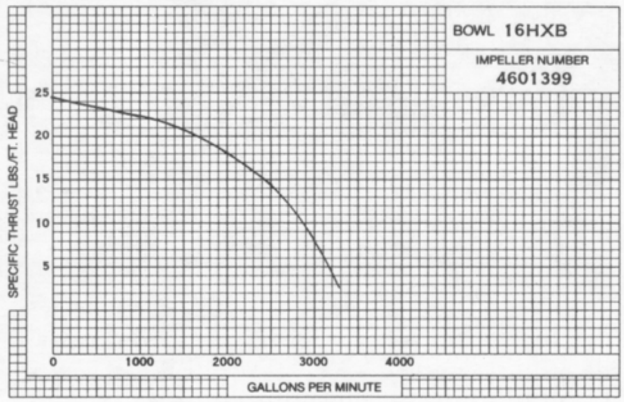
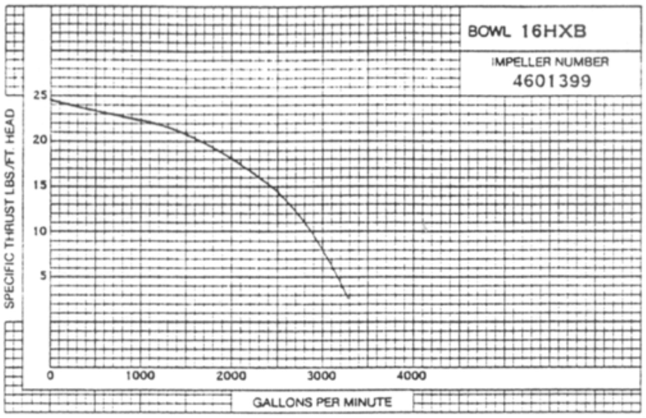




1160 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER



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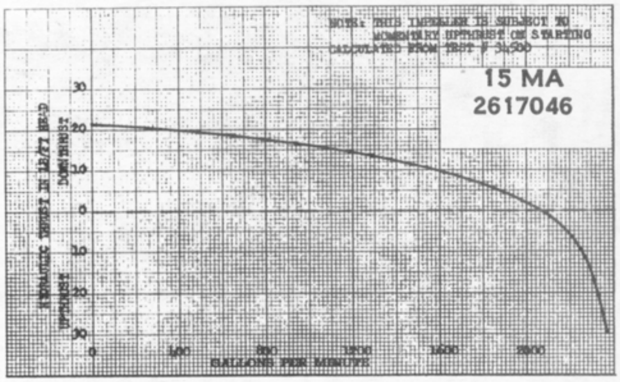
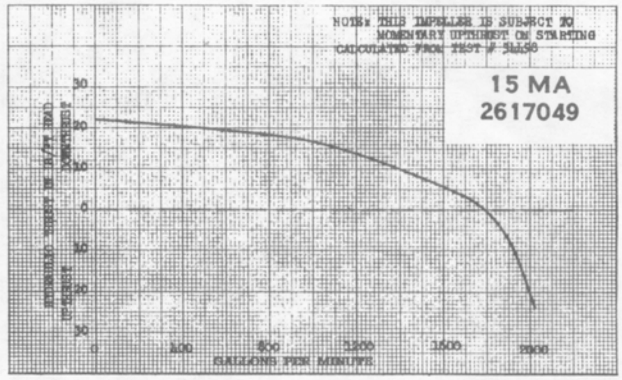
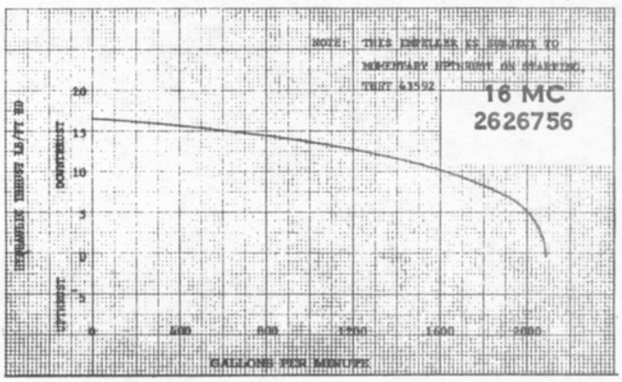
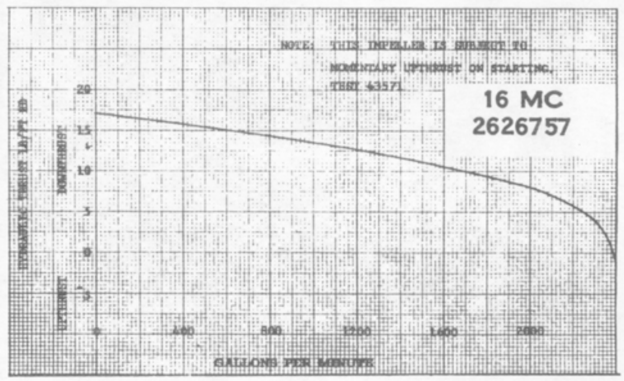
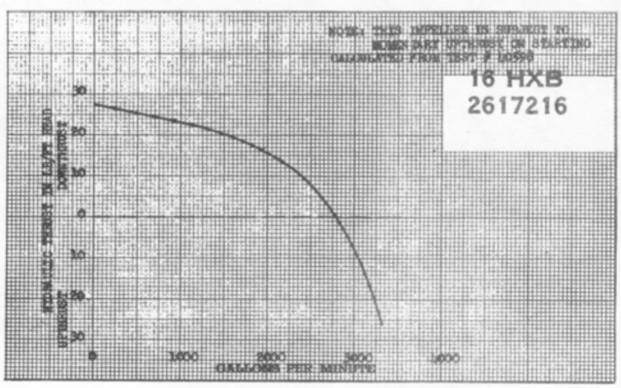
1160 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER

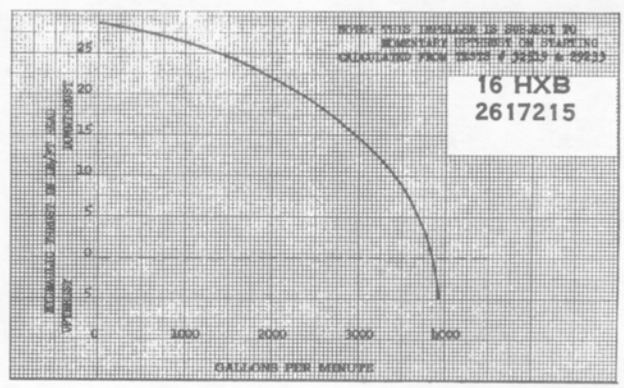


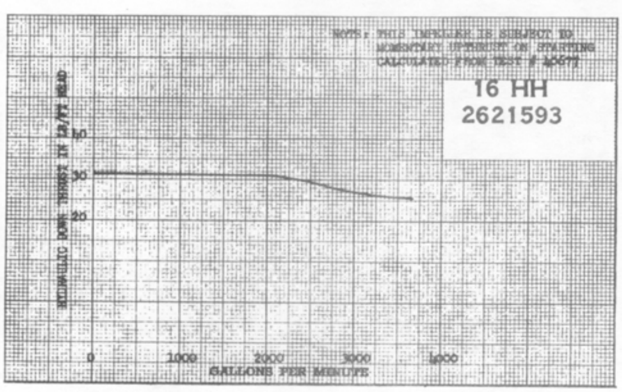


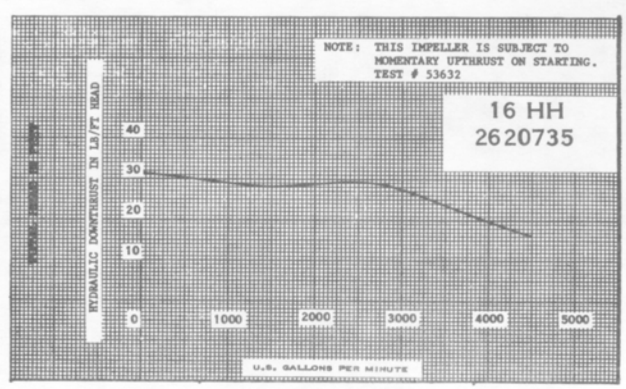






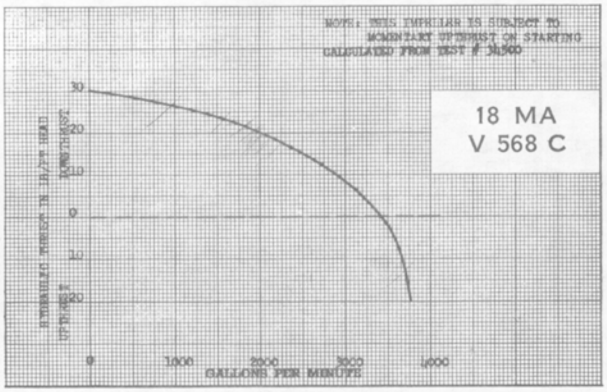


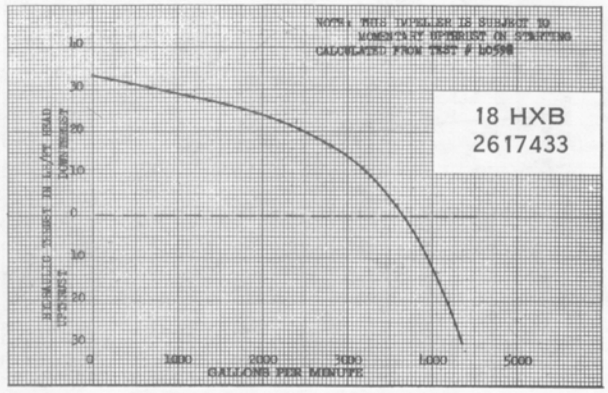


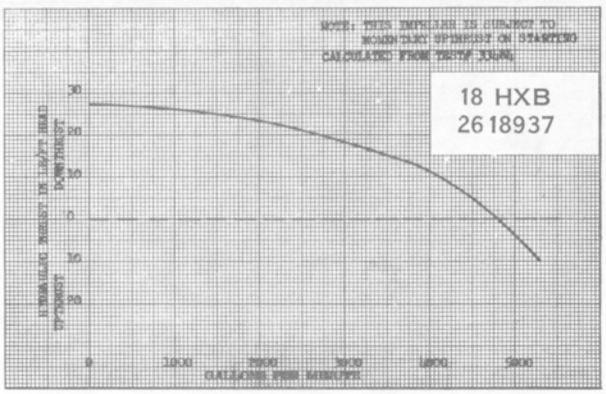


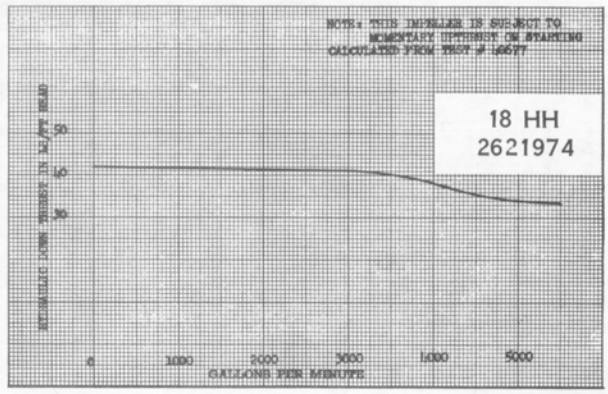
VERTICAL TURBINE PUMPS

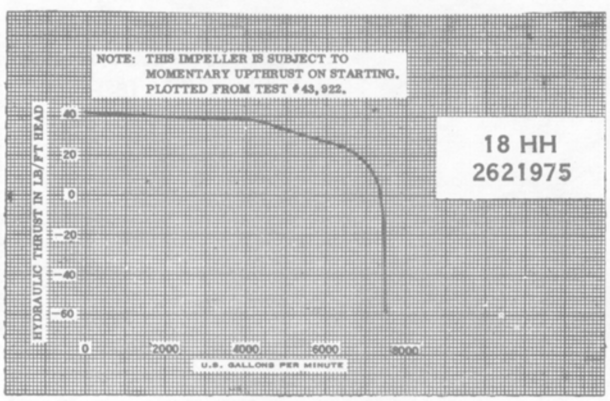
1160 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER

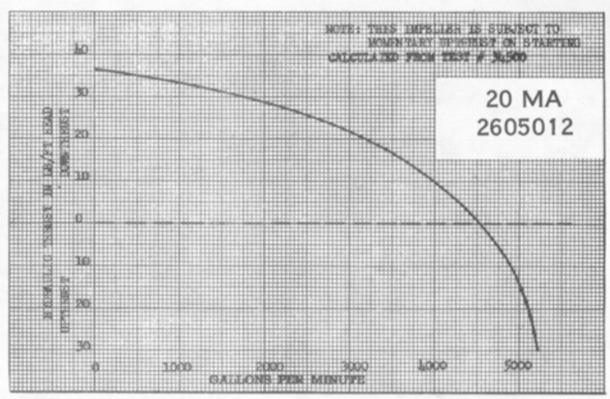


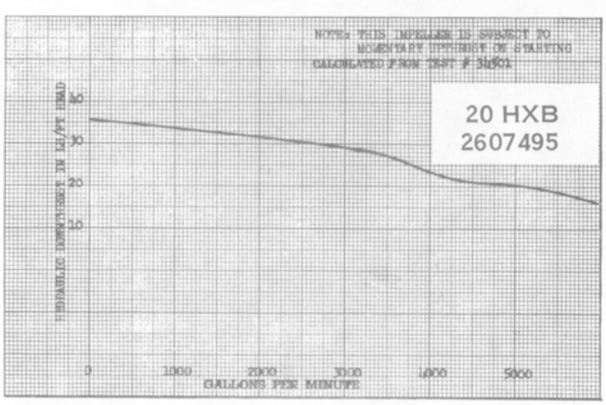


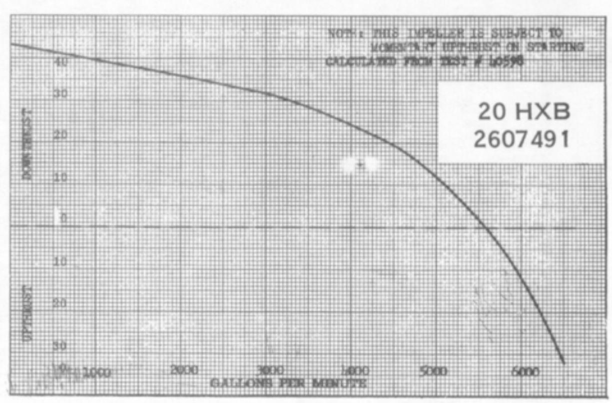












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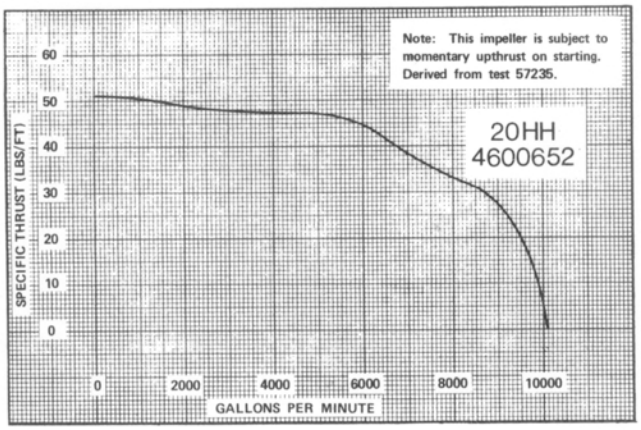

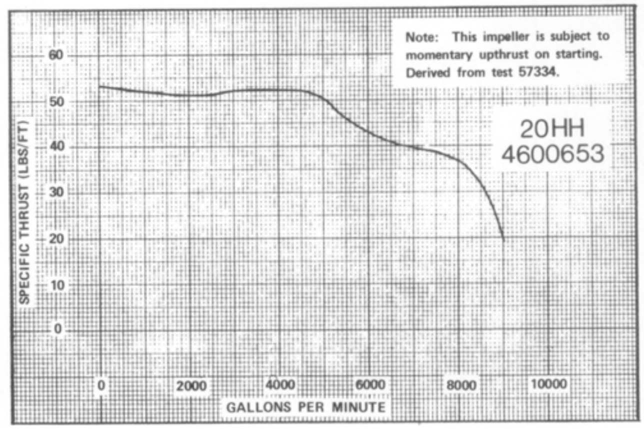

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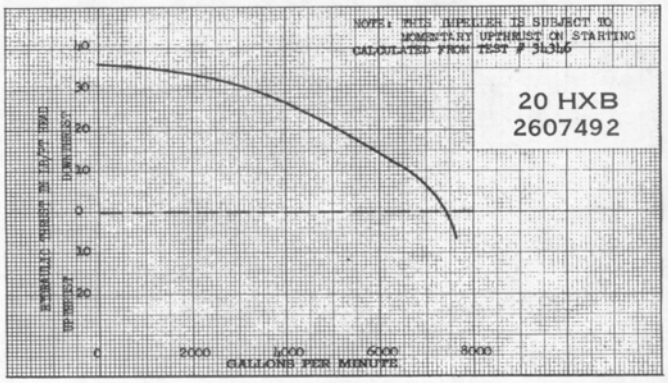
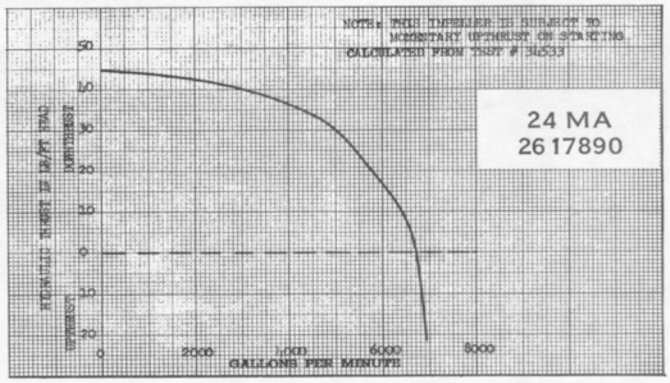
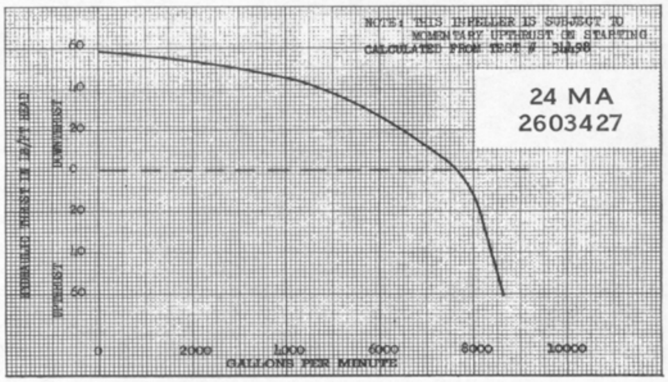
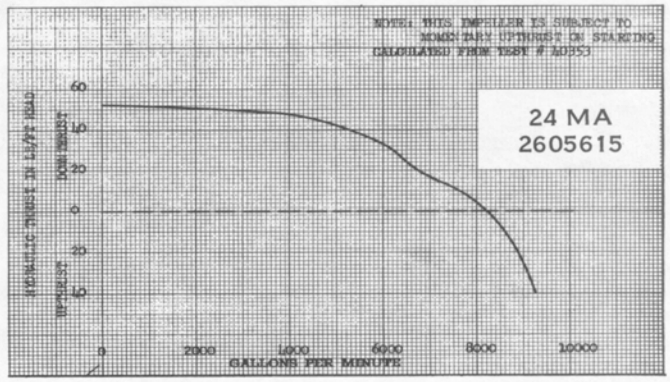
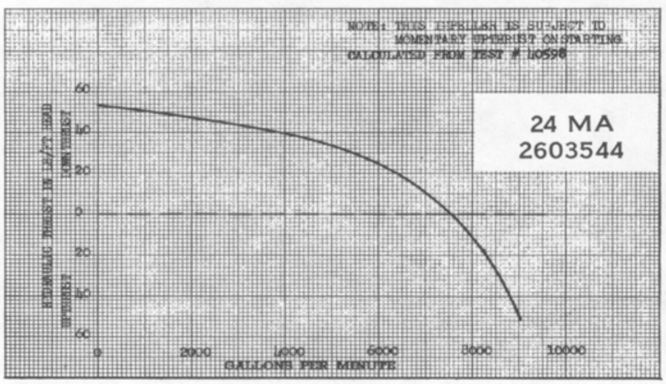
THRUST DATA BY SIZE AND IMPELLER NUMBER

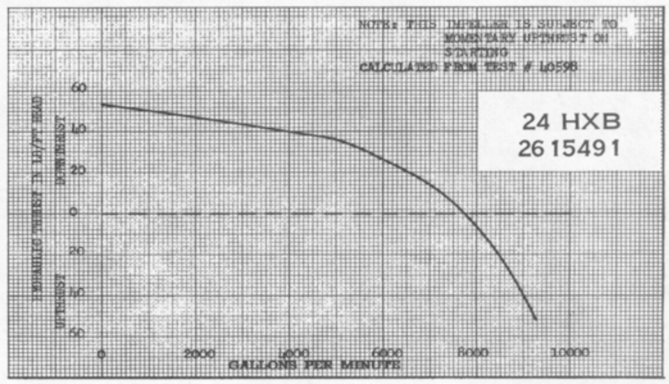


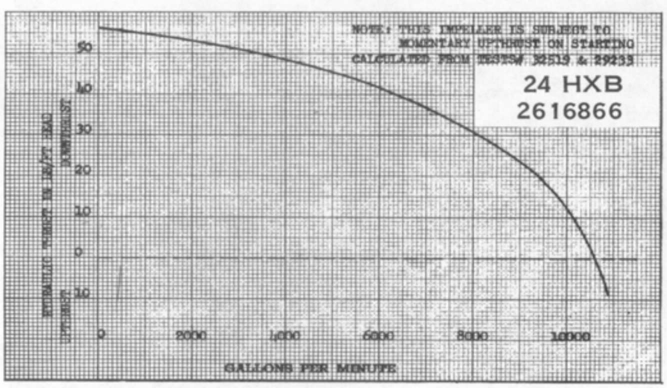


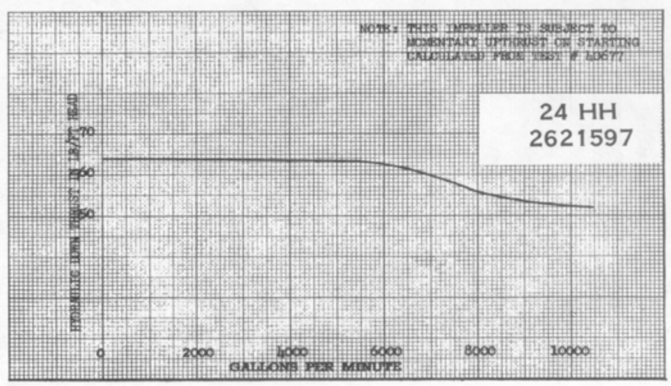




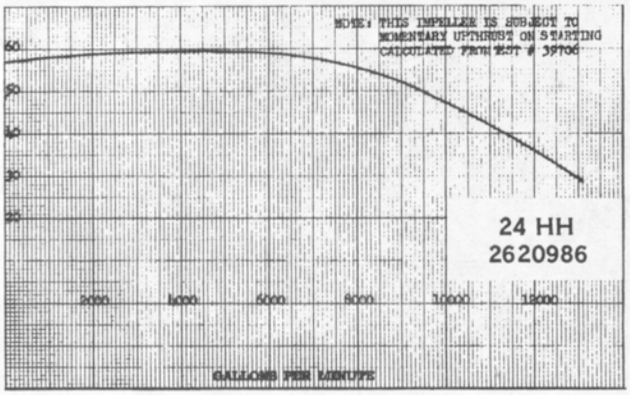


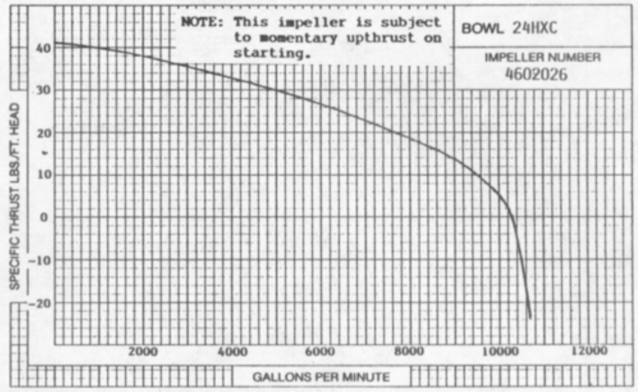


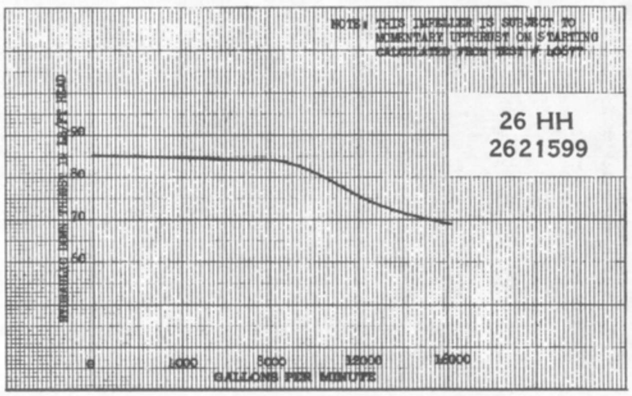


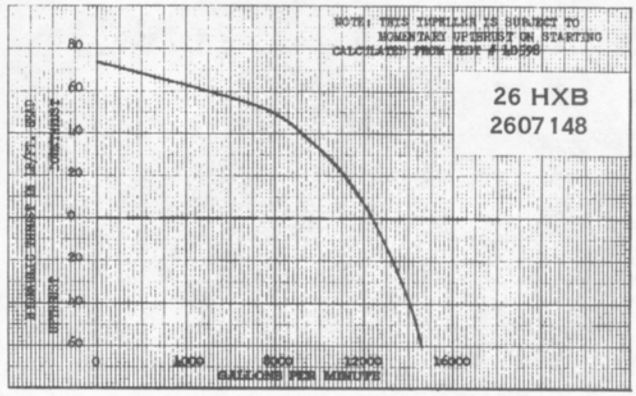


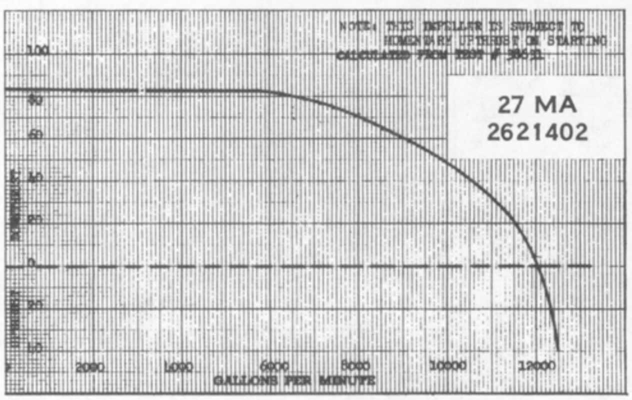
1160 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER

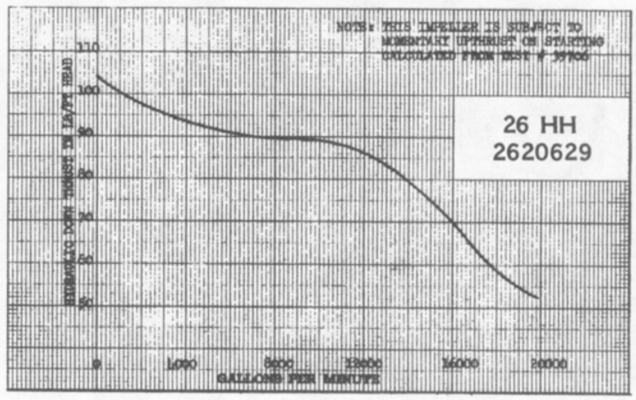


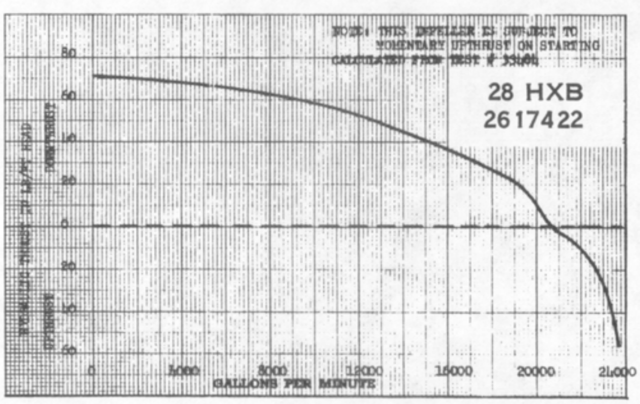


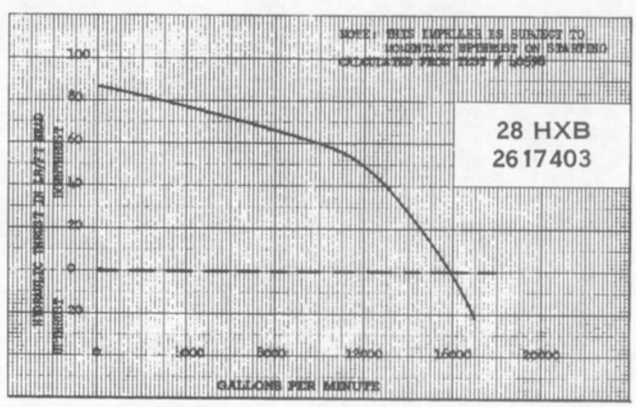




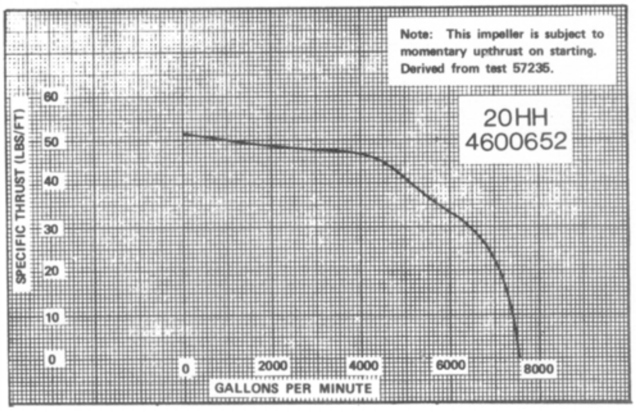


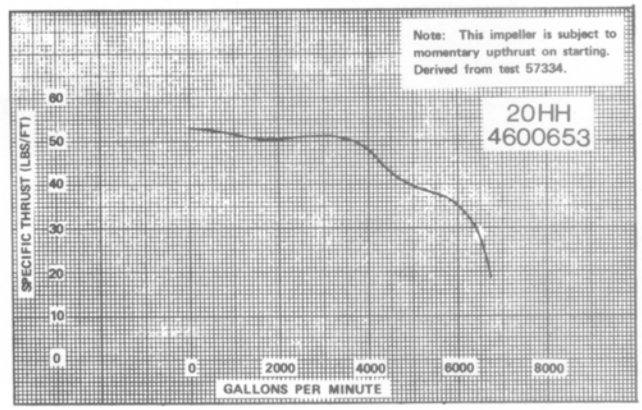


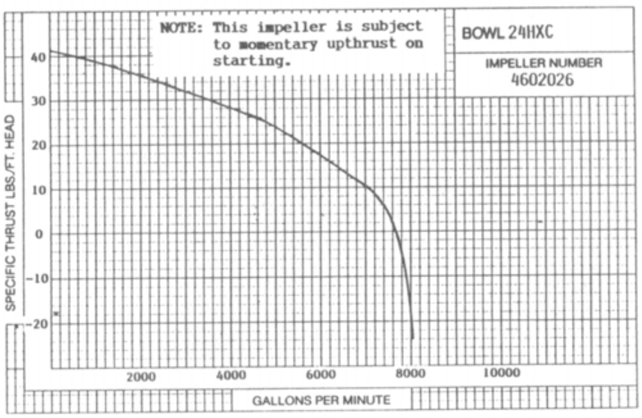




870 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER







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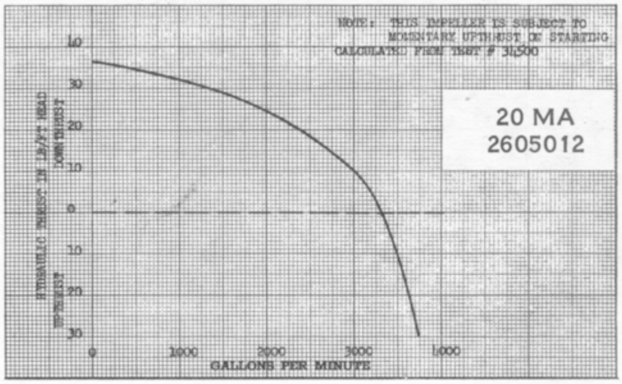
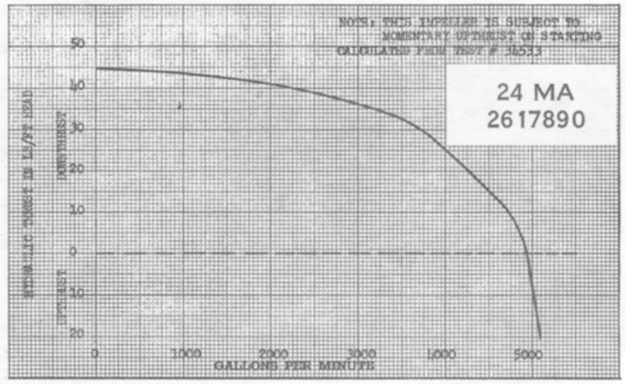
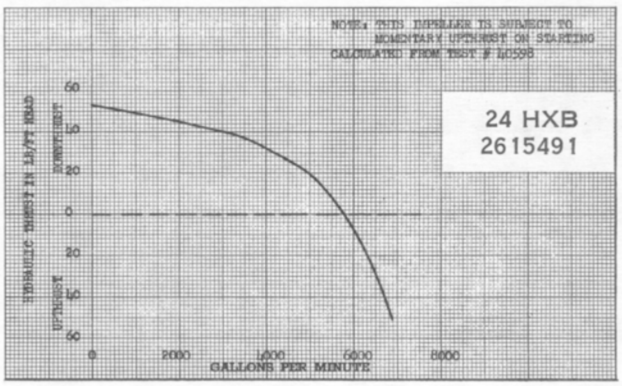
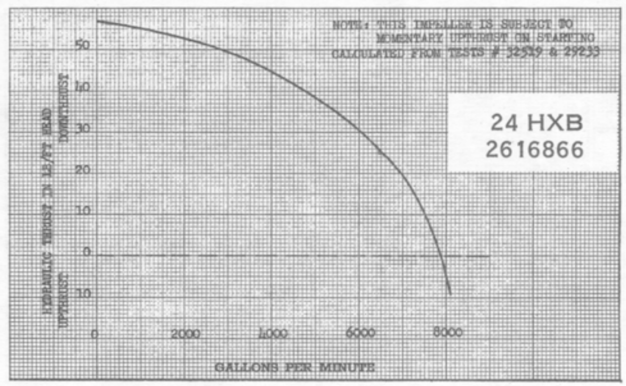
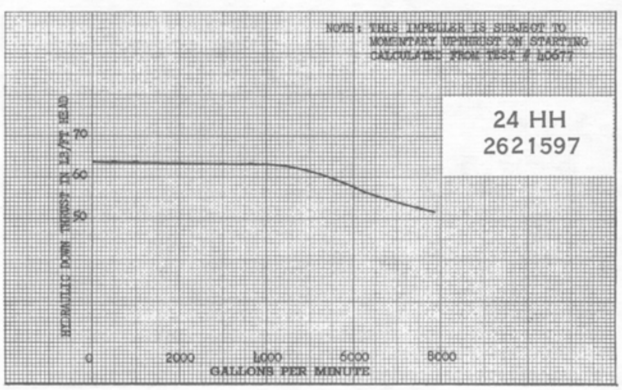
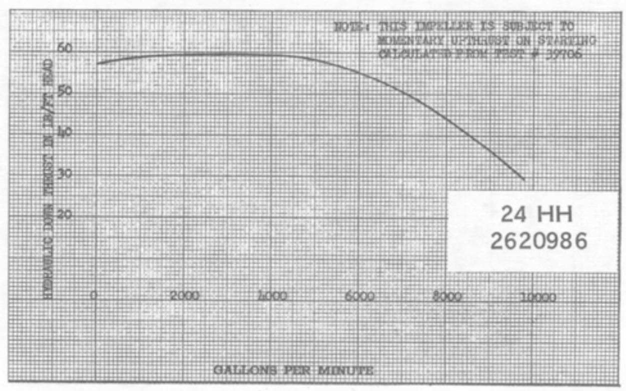


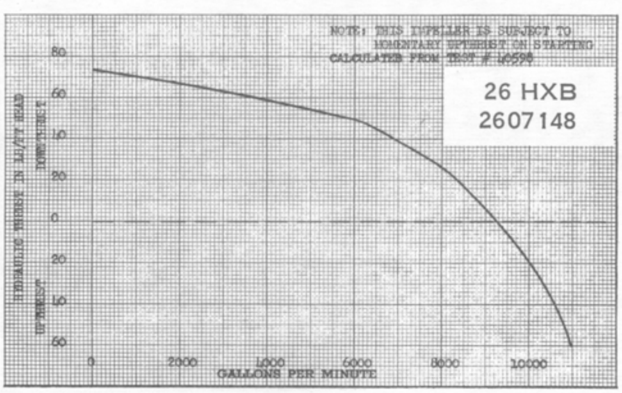


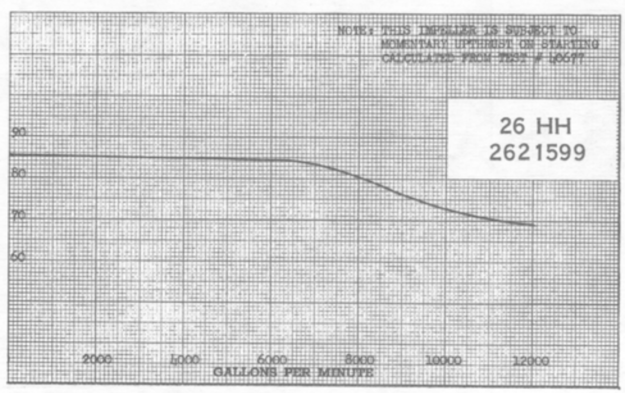




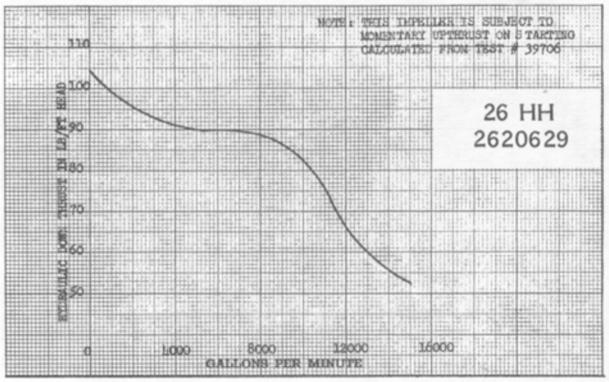


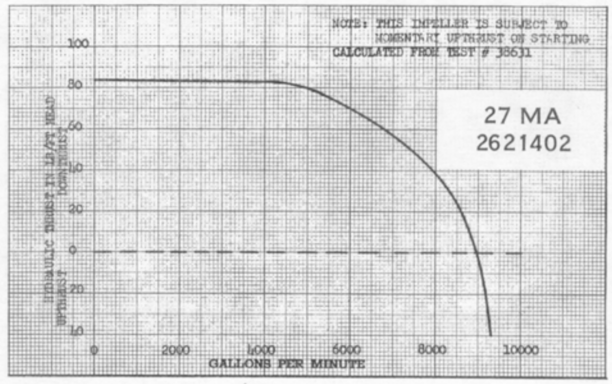


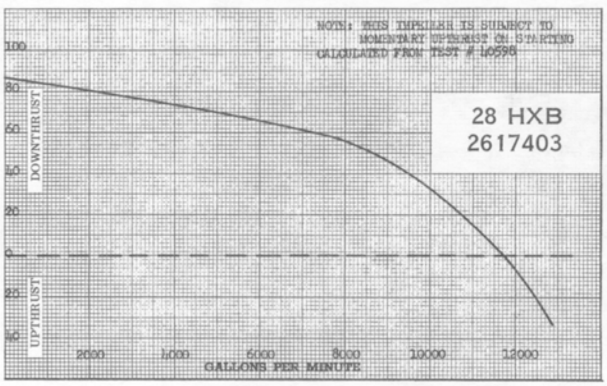


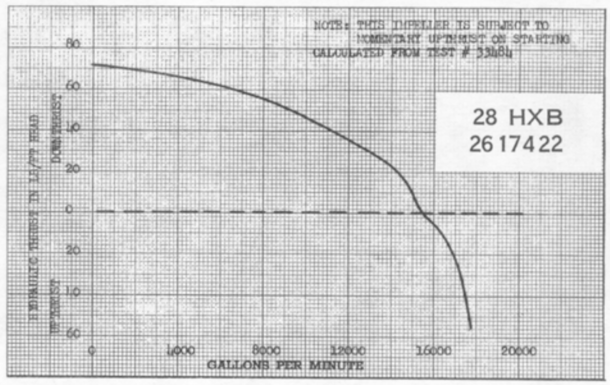


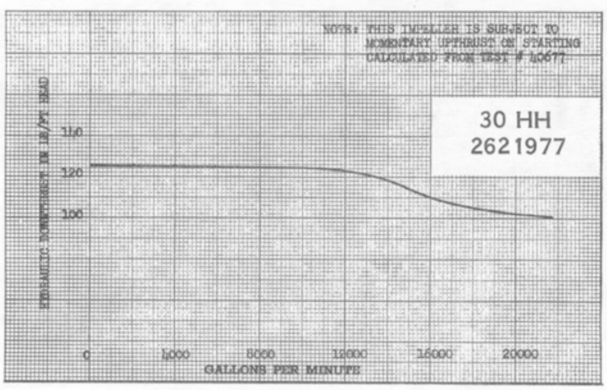
870 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER

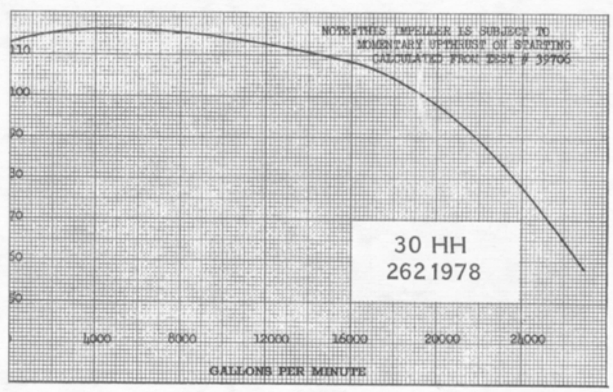


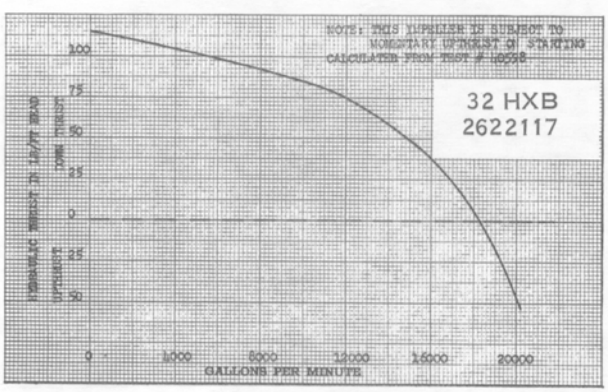


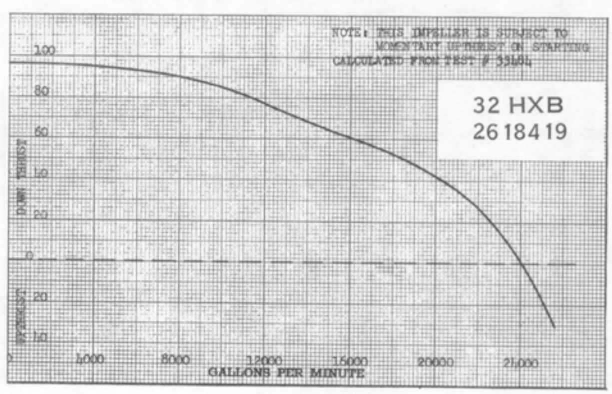




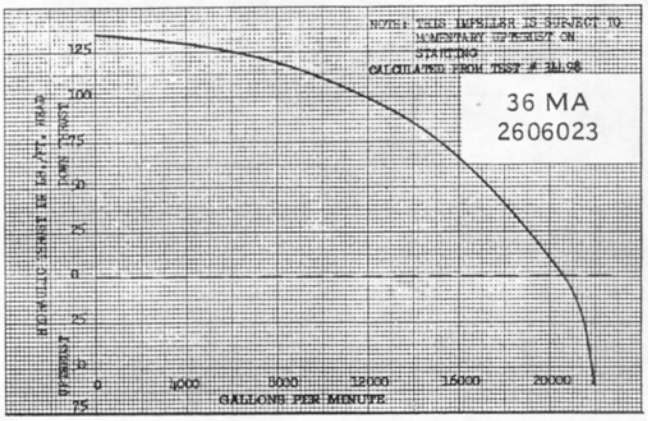


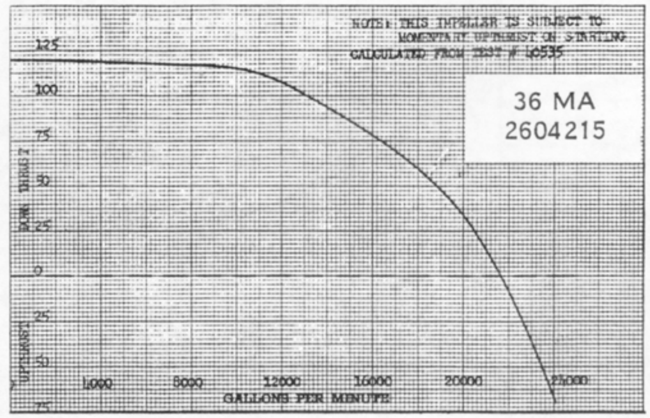


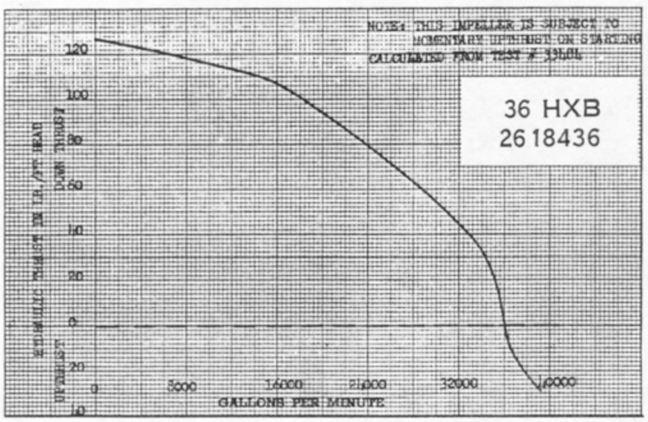


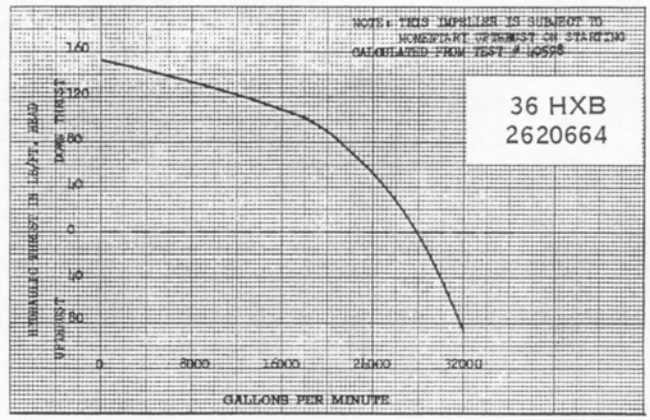


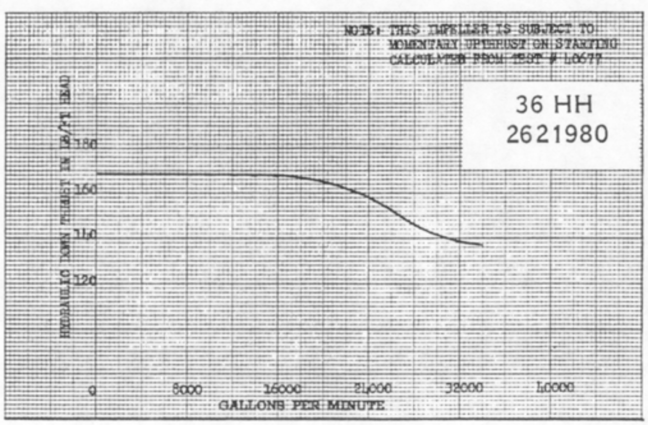
870 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER

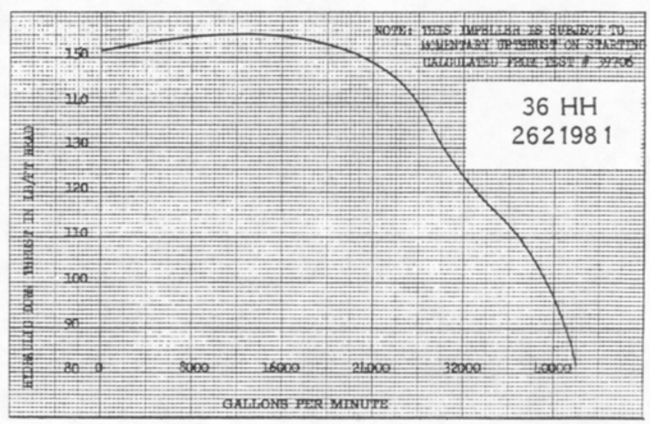




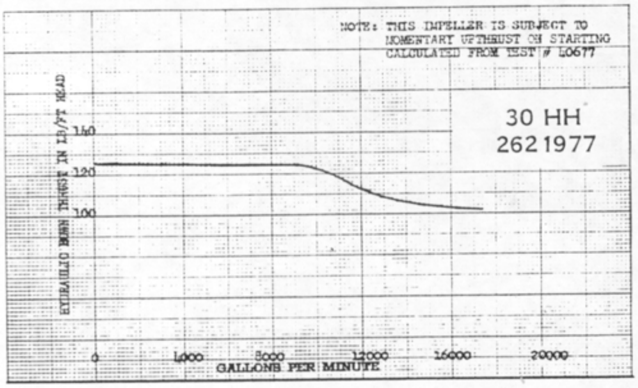


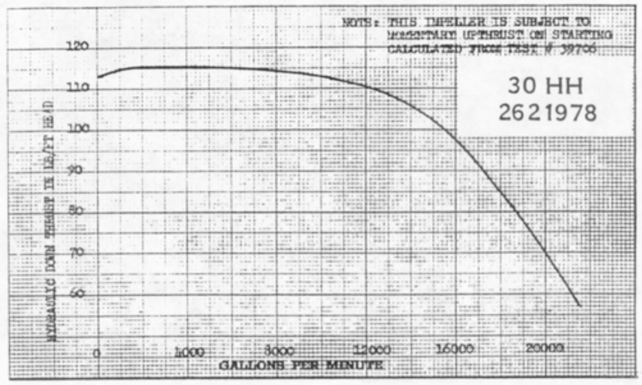


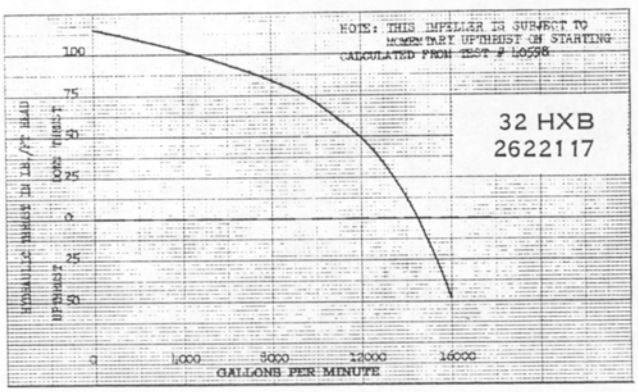


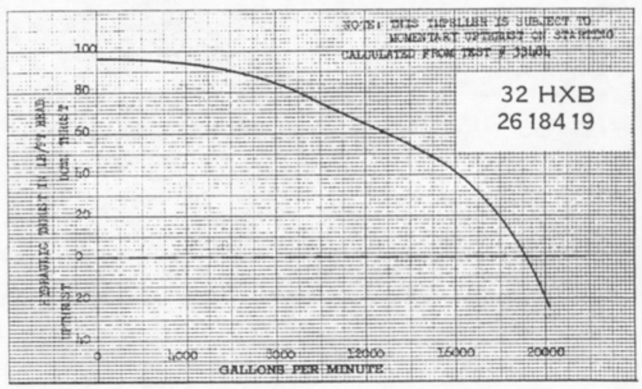


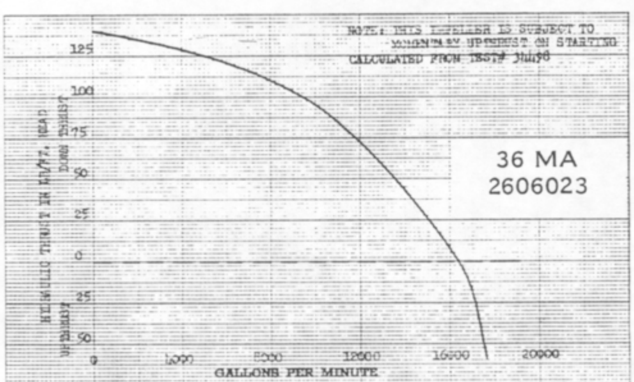
690 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER

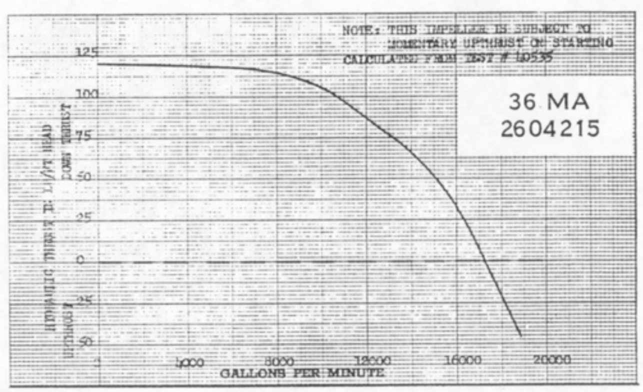


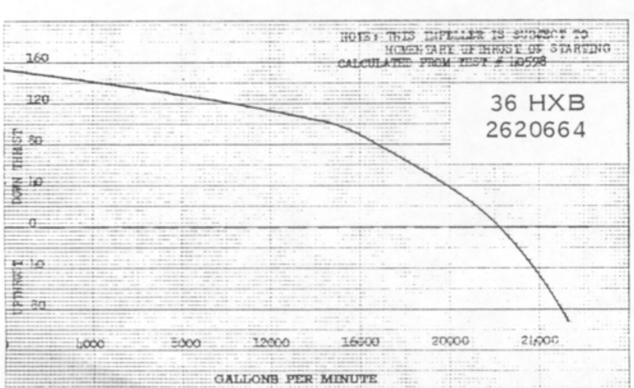


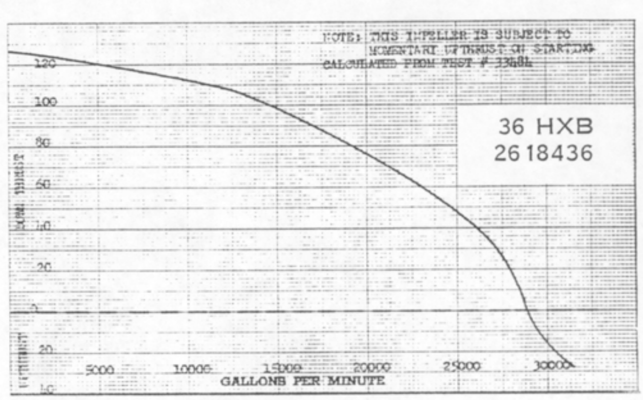




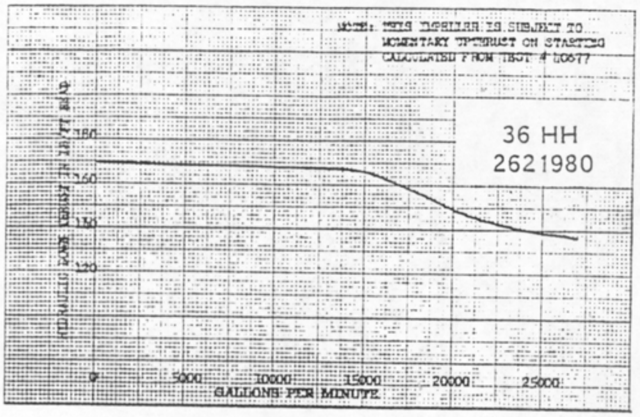


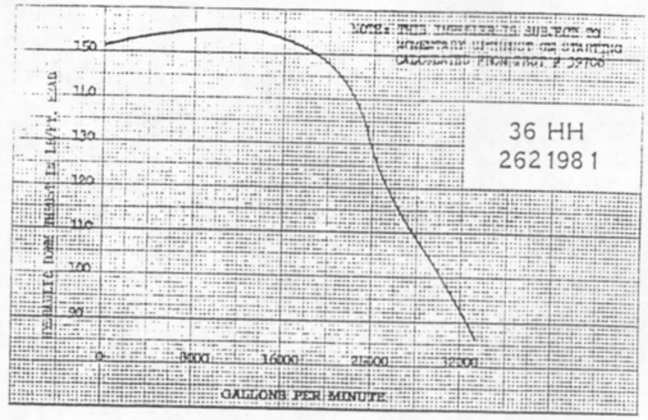


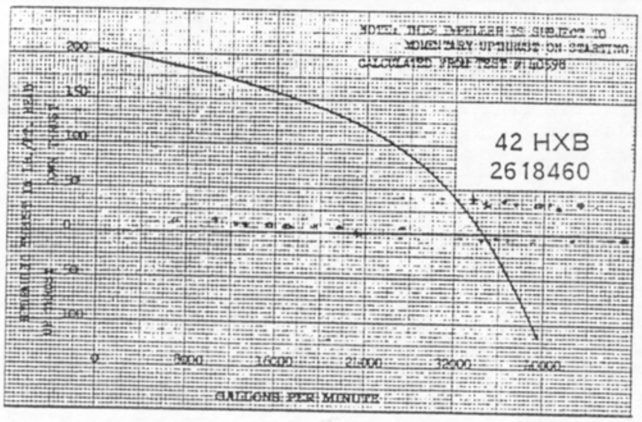


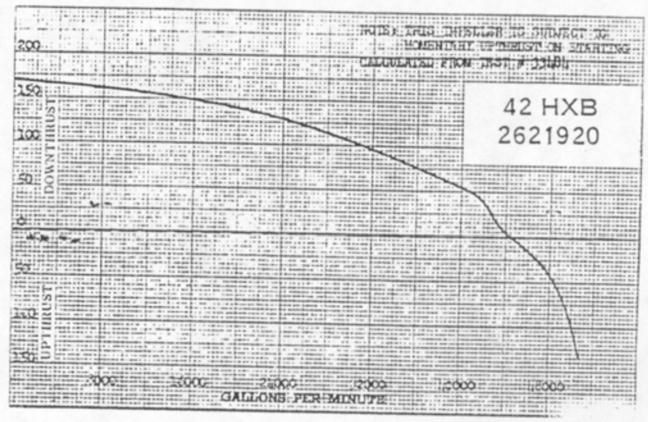


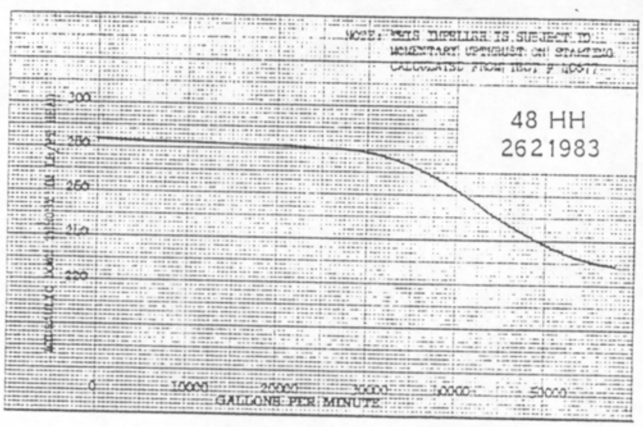
690 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER

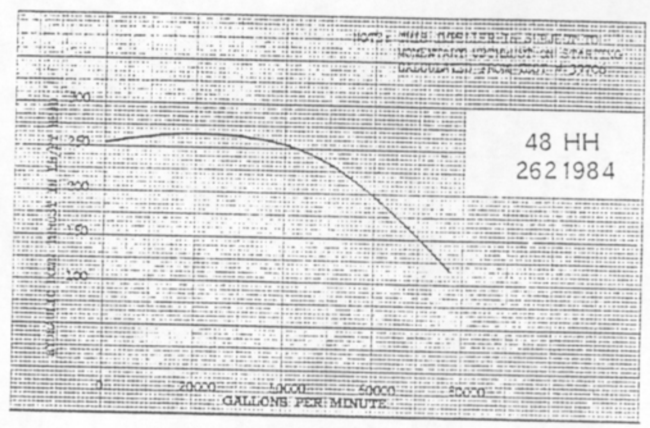




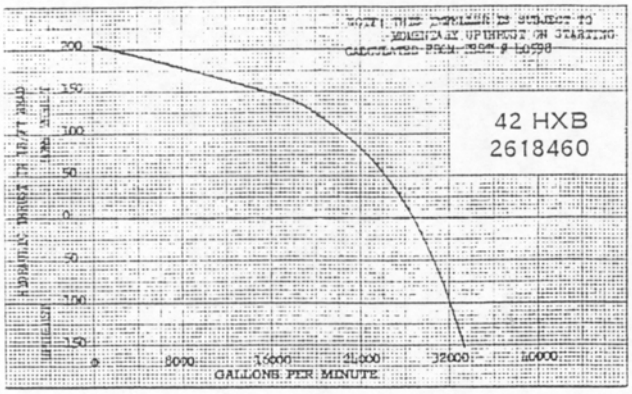


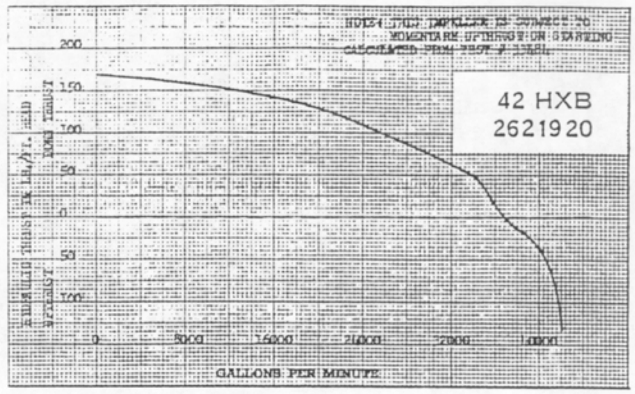


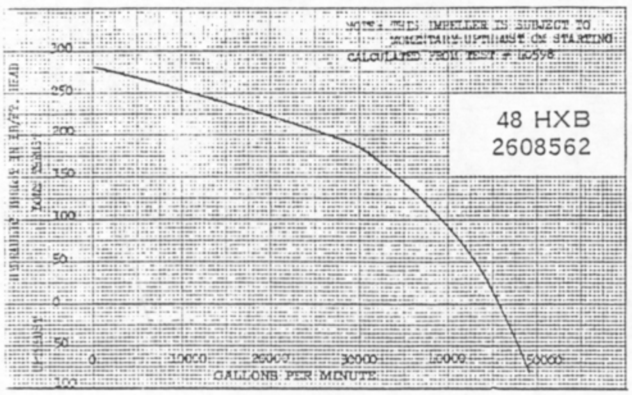


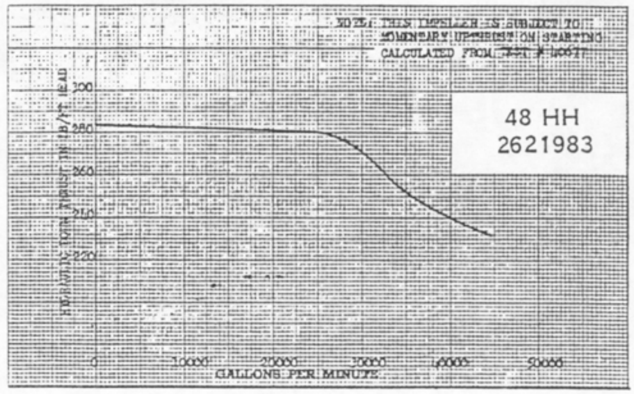


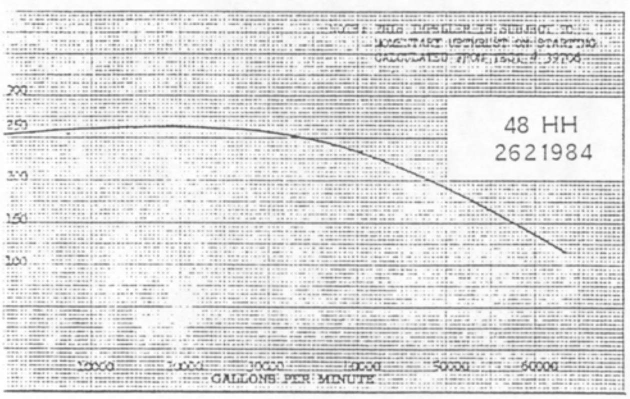
590 RPM
THRUST DATA BY SIZE AND IMPELLER NUMBER











490 RPM