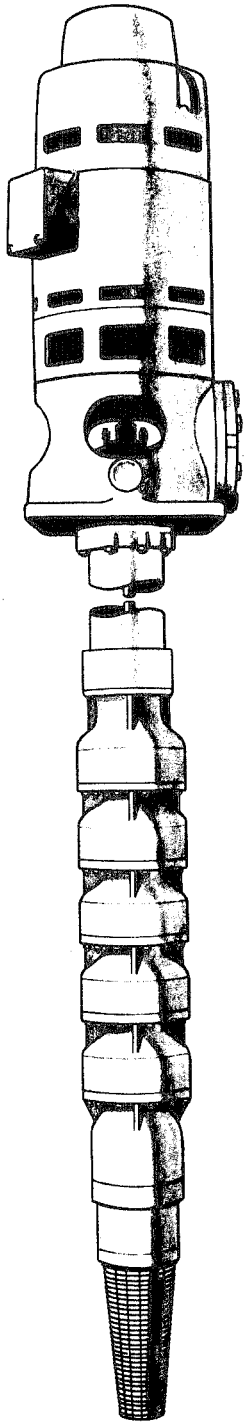
Peerless Pump

VERTICAL TURBINE PUMP DATA



The performance curves contained herein represent expected performance with standard materials of construction and premium efficiency impellers. Refer to Sterling for guaranteed performance.

Motor Data

REQUIRED	DIRECT CURRENT	ALTERNATING CURRENT	
		Single-phase	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

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.

MOTOR LOADING

The maximum allowable continuous horsepower load on an electric motor is determined by multiplying the nameplate horsepower by the service factor. The maximum allowable continuous horsepower must provide, without motor overload, for the following:

a. Pump performance tolerance (+3%, +5% or +10%) per Section 100, page 5.

b. Any customer-specified limitation on usable horsepower.

c. NEMA temperature and electrical tolerances; see Section 105, page 2.

A motor with a 1.0 service factor may be loaded up to only 1.0 x nameplate horsepower. For special requirements for explosion-proof motors, see Section 105, page 41.

A motor with a 1.15 service factor may be loaded up to 1.0 x nameplate horsepower if temperature and electrical conditions are within NEMA tolerances; see Section 105, page 2. A 1.15 S.F. motor may be loaded to 1.15 x nameplate hp if all temperature and electrical conditions are exactly on the nominal nameplate ratings with no allowable deviation. Loading between 1.0 and 1.15 x nameplate hp depends on the extent to which operating temperature and electrical conditions deviate from nominal. In marginal cases, consult the motor supplier or the factory.

SYNCHRONOUS AND FULL LOAD SPEED OF INDUCTION MOTORS—220-440 VOLTS

Number of Poles	50 Cycle		60 Cycle	
	Synch. Speed	Full Load Speed	Synch. Speed	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
16	375	365	450	440
18	333	320	400	390
20	300	290	360	350

NOTE: Induction motors have full load speeds from two to six percent less than synchronous motors. Synchronous Speed = $\frac{120 \times \text{FREQUENCY}}{\text{No. of Poles}}$

	Characteristic	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.

Subject to change without notice

NEMA TOLERANCES FOR MOTORS WITH 1.15 S.F.

Characteristic	Allowable Variation
Horsepower (Ref. NEMA Standards para. MG 1-14. 34.a):	
1.0 x nameplate HP	With maximal temperature, voltage or frequency variations, as allowed.
1.15 x nameplate HP	With no temperature, voltage and/or frequency variation from nameplate rating.
Temperature (Ref. NEMA Standards para. MG 1-12, 42):	
Ambient temperature	40°C (104°F) Maximum

Above 3300 ft. altitude, reduce the maximum allowable ambient temperature 1°C (approx. 2°F) for each additional 330 ft. of altitude.

Temperature rise: Insulation	Max. Temperature Rise	Max. Operating Temp.
Class B	90°C (194°F)	130°C (266°F)
Class F	115°C (239°F)	155°C (311°F)
Class H	140°C (284°F)	180°C (356°F)

Voltage* (Ref. NEMA Standards para. MG 1-12.43 & MG 1-12.45.a):	
Rated voltage	±10% *
Voltage unbalance	1% max. between motor terminals.
Frequency* (Ref. NEMA Standards para. MG 1-12.44):	
Rated frequency	±5%*
*Combined Variation of Voltage and Frequency (NEMA para. 1 - 12.45):	
Simultaneous voltage & frequency variations	"Motors shall operate successfully at rated load with a combined variation in the voltage and frequency up to 10% above or below the rated voltage and the rated frequency, provided that the frequency variation does not exceed 5%."

THRUST LOAD LOSSES

NOTE: Efficiency values are for standard thrust motors with no thrust load applied. The additional thrust load of the pump will cause additional loss in the thrust bearing. This loss is approximately 0.0075H.P. per 100 R.P.M. per 1000 lbs. thrust load. This additional loss should be taken into consideration by the pump manufacturer in calculating the pump unit efficiency.

EXAMPLE: Wanted 100H.P. 1800R.P.M. motor with 6000 lbs. additional thrust load.

Full load speed = 1170 R.P.M.

0.0075 x 17.70 x 6 = 0.790 H.P. additional loss

No thrust efficiency = 91.5%

$$\frac{100\ \text{H.P.}}{0.915} = 109.29\ \text{H.P. input}$$

$$\frac{100\ \text{H.P.}}{109.29\ \text{H.P.} + 0.790\ \text{H.P.}} = 90.84\%\ \text{efficiency with 6000 lbs. external load applied.}$$

REQUIREMENTS FOR EXPLOSION-PROOF MOTORS

The customer (the user-customer or the specifying engineering) who specifies that an explosion - proof motor is required must also furnish the following data for quotation or purchasing purposes:

- Atmosphere Group
- T - Code
- Hazard Class
- Hazard Class Division

For your information, these items are described by the "National Electrical Code - 1971, "Articles 500, 501 and 502, summarized below.

ATMOSPHERE GROUPS

Group A
Acetylene

Group B
Butadiene[1]
Ethylene oxide[2]
Hydrogen
Mfgd gases w/more than 12% hydrogen by volume
Propylene oxide[3]

Group C
Acetaldehyde
Cyclopropane
Diethyl ether
Ethylene
Unsymmetrical dimethyl hydrazine

Group D
Acetone
Acrylonitrile
Ammonia[3]
Benzene
Butane
1 - Butanol (butyl alcohol)
2 - Butanol (secondary butyl alcohol)
N - Butyl acetate
Ethane
Ethanol (ethyl alcohol)
Ethyl acetate

Group D (continued)
Ethylene dichloride
Gasoline
Heptanes
Hexanes
Isoprene
Methane (natural gas)
Methanol (methyl alcohol)
3 - Methyl - 1 - butanol (isoamyl alcohol)
Methyl ethyl keytone
Methyl isobutyl keytone
2 - Methyl - 1 - propanol (isobutyl alcohol)
2 - Methyl - 2 - propanol (tertiary butyl alcohol)
Petroleum naptha[4]
Octanes
Pentanes
1 - Pentanol (amyl alcohol)
Propane
1 - Propanol (propyl alcohol)
2 - Propanol (ispropyl alcohol)
Propylene
Styrene
Toluene
Vinyl acetate
Vinyl chloride
Xylenes

[1] May be Group D if all 1/2" or larger conduits are sealed.

[2] May be Group C if all 1/2" or larger conduits are sealed.

[3] For safe storage requirements, see ANSI B9.1-1971 and ANSI K61.1-1972.

[4] Saturated hydrocarbon also known as benzine, ligroin, petroleum ether, or naptha.

HAZARD CLASSES

Class	Description
1.	Hazardous gases or vapors
2.	Hazardous dust-air mixtures
3.	Hazardous flying fibers or linters

HAZARD CLASS DIVISIONS

Division	Description
I.	Hazard (Class 1, 2 or 3) exists under normal operating circumstances.
II.	Hazard (Class 1, 2 or 3) does not exist under normal operating circumstances.

T-NUMBER CODES

T-Code	Maximum Allowable Motor Temperature Deg. F	Deg. C
T1	842	450
T2	572	300
T2A	536	280
T2B	500	260
T2C	446	230
T2D	419	215
T3	392	200
T3A	356	180
T3B	329	165
T3C	320	160
T4	275	135
T4A	248	120
T5	212	100
T6	185	85

Type S and SHP
Cast Iron Surface Discharge Heads

APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	Discharge Data (1)		Stuffing Box Register	Column Data								Motor Flange
				Top Shaft				Oil Tube		Column Pipe		
	Size	Maximum Operating Pressure		Min.	Maximum			Min.	Max.	Min.	Max.	Base Sizes
					ELS	OLS	OLS W/ Sleeve					
2½x2½x10S	2½NPT	175#	Cast in Head	3/4	—	1	—	—	—	2½	2½	10 - 12
2½x3x10S										3	3	
6x6x12S	6-125#	200	3.88	3/4	1-3/16	1-1/2	1	1¼	2	3	6	
6x8x16½S			4.69	1	1-1/2	1-15/16	1-1/2	1½	2½	4	8	16 - 20
6x8x16½SHP	6-250	400										
8x8x12S	8-125	200										10 - 12
8x8x16½S												16½-20
8x8x16½SHP	8-250	400										
10x10x16½S	10-125	200	5.56	1-3/16	2-3/16	2-7/16	1-15/16	2	3½	4	10	16½-20 24½
10x10x16½SHP	10-250	400										
10x10x20S	10-125	200										
10x10x20S	10-250	400										
12x12x20S	12-125	200								5	12	
12x12x20SHP	12-250	400										
14x14x24½S	14-125	150								10	14	
14x14x24½SHP	14-250	300										
16x16x30½S	16-125	150	6.38	1-11/16	2-7/16			3	4	10	16	30½
16x16x30½SHP	16-250	300										

MAXIMUM SETTING FOR STANDARD HEADS

Head Size	Column Size			
	6" & Smaller	8"	10"	12" & Larger
2½x2½x10S thru 6x6x12S	1000'	—	—	——
6x8x16½S and 8x8x16½S	1000'	800'	—	——
10x10x16½S and 10x10x20S	1000'	800'	600'	——
12x12x20S	1000'	800'	600'	500'
14x14x24½S and 16x16x30½S	——	—	600'	500'

LIFTING LUG LOADING

Head Size	Load Applied	
	Gradually	Suddenly
2½x2½x10S 2½x3x10S	12000#	3000#
6x6x12S	24000	6000
6x8x16½S thru 12x12x20SHP	37500	9400
14x14x24½S thru 16x16x30½SHP	53000	13250

(1) Flange rating is limited to 150°F maximum water temperature.

Type C & CHP
Cast Round Base Surface Discharge Heads

APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	Discharge Data (1)		Stuffing Box Register	Column Data								Motor Flange
				Top Shaft				Oil Tube		Column Pipe		
	Size	Maximum Operating Pressure (2)		Min.	Maximum			Min.	Max.	Min.	Max.	Base Sizes
					ELS	OLS	OLS W/ Sleeve					
4x4x10C	4-125#	200#	3.88	3/4	1-3/16	1-1/2	1	1¼	2	4" Threaded Only		10 - 12
4x4x10CHP	4-250	400										
6x6x12C	6-125	200	4.69	1	1-1/2	1-15/16	1-1/2	1½	2½	5	6	16½-20
6x8x16½C										6	8	
6x8x16½CHP	6-250	400										
8x8x12C	8-125	200										16½-20 24½
8x8x16½C												
8x8x16½CHP	8-250	400	5.56	1-3/16	1-15/16	2-7/16	1-15/16	2	3	8	10	
10x10x20C	10-125	200								10	12	
12x12x20C	12-125											

MAXIMUM SETTING FOR ROUND BASE HEADS

Head Size	Column Size			
	6" & Smaller	8"	10"	12" & Larger
4x4x10C and 4x4x10CHP	1000'	—	—	—
6x6x12C thru 12x12x20C	200'	200'	200'	200'

LIFTING LUG LOADING

Head Size	Load Applied	
	Gradually	Suddenly
4x4x10C	13500#	3400#
6x6x12C 6x8x16½C	24000	6000
6x8x16½CHP thru 12x12x20C	37500	9400

(1) Flange rating is limited to 150°F maximum water temperature.

(2) Maximum suction pressure for can mounted heads - 100PSI

Type FA, FR & FRA
Fabricated Surface Discharge Heads

Type FA Head has square base
Type FR Head has round 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
				Top Shaft			Column Pipe		
	Size	Maximum Operating Pressure		Min.	Maximum				Base Sizes
				OLS	OLS	OLS w/ Sleeve	Min.	Max.	
6x6x12F	6" - 150#	275#	4.69	1.00	1.94	1.50	4	6	10 - 12
6x6x16½F	6 - 150	275	4.69	1.00	1.94	1.50	4	6	16.5 - 20
8x8x12F	8 - 150	275	4.69	1.00	1.94	1.50	6	8	10 - 12
8x8x16½F	8 - 150	275	5.56	1.19	2.44	1.94	6	8	16.5 - 20
10x10x16½F	10 - 150	275	5.56	1.19	2.44	1.94	8	10	16.5 - 20
10x10x20F	10 - 150	275	5.56	1.19	2.44	1.94	8	10	16.5 - 20
12x12x16½F	12 - 150	275	5.56	1.19	2.44	1.94	10	12	16.5 - 20
12x12x20F	12 - 150	275	5.56	1.19	2.44	1.94	10	12	16.5 - 20
14x14x20F	14 - 150	275	5.56	1.19	2.44	1.94	12	14	16.5 - 20
14x14x24½F	14 - 150	275	5.56	1.19	2.44	1.94	12	14	16.5 - 20 24.5
16x16x20F	16 - 150	275	5.56	1.19	2.44	1.94	14	16	16.5 - 20
16x16x24½F	16 - 150	275	5.56	1.19	2.44	1.94	14	16	16.5 - 20 24.5
16x16x30½F	16 - 150	275	6.38	1.69	2.44	1.94	14	16	30.5
18x18x24½F	18 - 150	275	6.38	1.69	2.44	1.94	16	18	16.5 - 20 24.5
18x18x30½F	18 - 150	275	6.38	1.69	2.44	1.94	16	18	30.5
20x20x30½F	20 - 150	275	6.38	1.69	2.44	1.94	18	20	30.5 (1)

(1) For smaller base motors use motor adapter plate.

Subject to change without notice

Type UG
Cast Iron Underground Discharge Heads

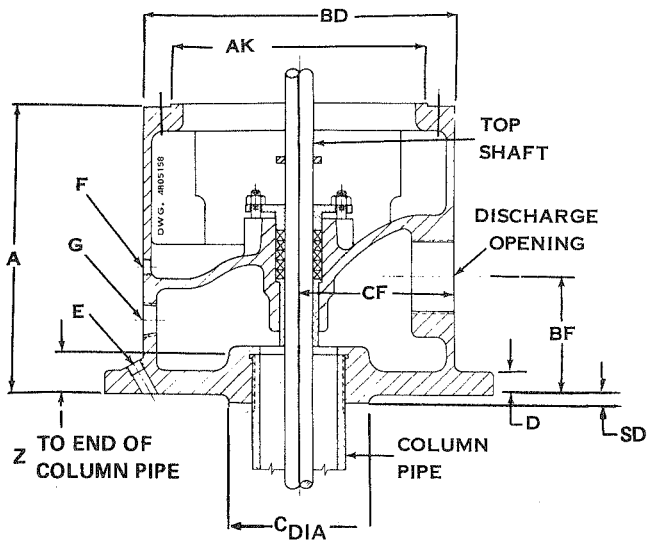
APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

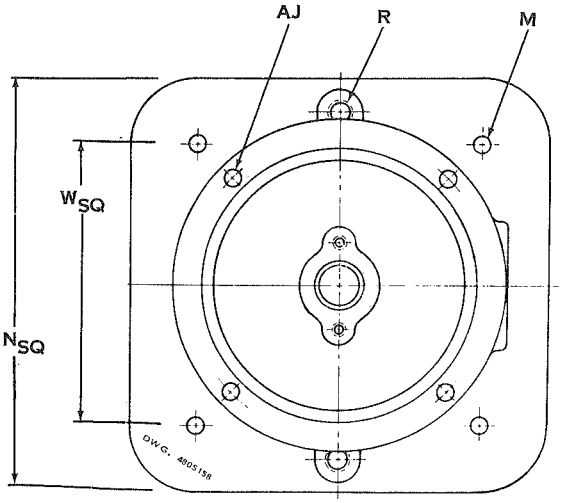
Head Size	Size ①		Stuffing Box Register	Column Data								Motor Flange
				Top Shaft				Oil Tube		Column Pipe		Base Sizes
				Min.	Maximum							
	Min.	Max.			ELS	OLS	OLS W/ Sleeve	Min.	Max.	Min.	Max.	
6x10UG	4-150#	6-150#	3.88	3/4	1-3/16	1-1/2	1	1¼	2	4	6	10-12
12x16½UG	4-150	10-150	4.69	3/4	1-1/2	1-15/16	1-1/2	1½	2½	4	12	16½-20
12x24½UG	6-150	16-150	5.66	1-3/16	2-3/16	2-7/16	1-15/16	2	3½	6	12	20-24½
16x30½UG	10-150	16-150	6.38	1-11/16	2-7/16			3	4	10	16	30½

Maximum setting for UG heads; 50 foot, all sizes.

① Maximum operating pressure; 175 PSI limited to 150°F maximum water temperature.

Type S
Threaded Cast Iron Surface Discharge Heads
2-1/2 x 2-1/2 x 10 and 2-1/2 x 3 x 10
Open Lineshaft Construction Only





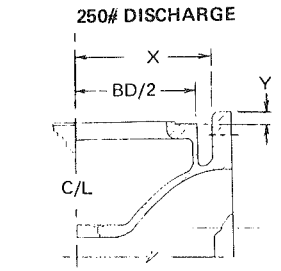
GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	Discharge Size	BF	CF	A	Z	Base Mounting 4 Holes D	M	$N_{Sq.}$	$W_{Sq.}$	NEMA Driver Mounting BD	AK	AJ Drilling (4 HOLES) STRADDLE C/L	Below Base Clearance Req'd $C_{Dia.}$	SD	Auxiliary Connections E NPS	F NPT	G NPT	H NPS	R NC
2½x2½x10S	2½NPT	3-13/16	5	9¼	1-9/16	3/4	9/16	12½	9¼	10	8¼	7/16, 9-1/8BC	5"	1"	1/4	1/4	3/4	—	3/4-10 2Holes
2½x3x10S																			

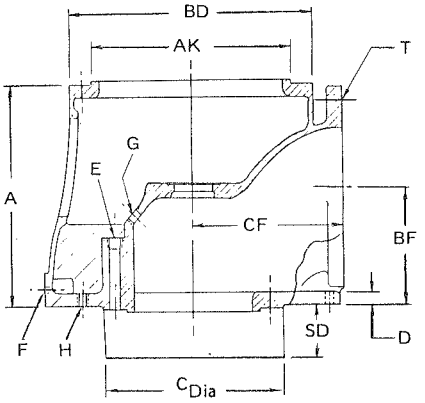
E = AIRLINE F = STUFFING BOX DRAIN G = PRELUBE R = HOLES FOR LIFTING EYE BOLTS

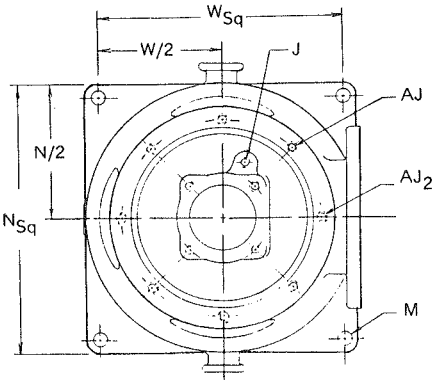
Subject to change without notice

Type S & SHP
Cast Iron Surface Discharge Heads
Type S - 125# Discharge Flange
Type SHP-250# Discharge Flange



8x8x16½HP: x = 10-7/8, Y = 1/4
14x14x24½HP: x = 13½, Y = 1/2
THE FLANGE IS LOWER THAN THE DRIVER BASE ON ALL OTHER HEADS.





DISCHARGE FLANGES ARE ANSI DRILLED FLAT FACE FLANGES

GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

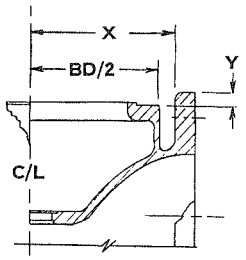
Head Size	BF	CF	A	D	Discharge Flange			Base Mounting 4 Holes			NEMA Driver Mounting			Below Base Clearance Req'd		Auxiliary Connections				
					Size/ Rating	T Drilling STRADDLE C/L No.	T Drilling STRADDLE C/L Thrd/BC	M	NSq.	WSq.	BD	AK	AJ Drilling (4 HOLES) STRADDLE C/L	CDia.	SD	E NPS	F NPT	G NPT	H NPS	J NPT
6x6x12S	6½	8	13-11/16	3/4	6, 125#	8	3/4-10NC 9-1/2BC	3/4	15	13¼	12	8¼	See Note 1	9-15/16	3-3/8	3/4	1/2	3/4	N/A	1/4
6x8x16½S	7¾	10-1/4	14-3/4	1¼	6, 125	8	3/4-10NC 9-1/2BC	1	20	18	16½	13½	5/8-11NC 14-3/4BC	12-1/4	3-3/8	3/4	3/8		1/2	
6x8x16½SHP		10-7/8			6, 250	12	3/4-10NC 10-5/8BC													
8x8x12S	7	9	14-3/4	7/8	8, 125	8	3/4-10NC 11-3/4BC	7/8	17	15	12	8¼	See Note 1	12-1/4	3-3/4	3/4	1/2	3/4	1/2	1/4
8x8x16½S	7¾	10-1/4	14-3/4	1¼	8, 125	8	3/4-10NC 11-3/4BC	1	20	18	16½	13½	5/8-11NC 14-3/4BC	14-1/4	4-1/2		3/8			
8x8x16½SHP		10-7/8			8, 250	12	7/8-9NC 13BC													
10x10x16½S	9	10-1/4	18	1½	10, 125	12	7/8-9NC 14-1/4BC	1	20	18	16½	13½								
10x10x16½SHP		11-1/8			10, 250	16	1-8NC 15-1/4BC													
10x10x20S	9	10-1/4	18	1½	10, 125	12	7/8-9NC 14-1/4BC	1	20	18	20	13½	5/8-11NC 14-3/4BC and 5/8-11NC 18-1/4BC							
10x10x20SHP		11-1/8			10, 250	16	1-8NC 15-1/4BC													
12x12x20S	10½	12-1/4	21	1¾	12, 125	12	7/8-9NC 17BC	1	23	21	20	13½	5/8-11NC 14-3/4BC	16-1/2	4-7/16			1		
12x12x20SHP		13-1/8			12, 250	16	1-1/8-7NC 17-3/4BC													
14x14x24½S	11½	14-3/4	22-1/4	1¾	14, 125	12	1-8NC 18-3/4BC	1	28	25	24½	13½		18-1/4	5-7/8					
14x14x24½SHP		15-5/8			14, 250	20	1-1/8-7NC 20-1/4BC													

NOTES:

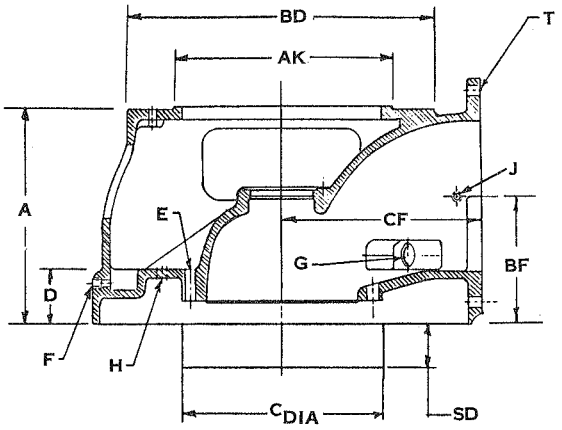
1. **Driver Mounting Drilling (AJ2) for the 6x6x12 and 8x8x12 Heads** is 4 Holes, 3/8-16NC, 9-1/8BC on centerline and 4 clearance holes 7/16Dia., 9-1/3BC straddle centerline.
2. **Maximum Operating Pressure** ratings are:
   6, 8, 10 and 12 Inch Heads - 125# Discharge - 200PSI
   6, 8, 10 and 12 Inch Heads Type HP - 250# Discharge - 400PSI
   14 Inch Head - 125# Discharge - 150PSI
   14 Inch Head Type HP - 250# Discharge - 300PSI
   Ratings are for 150°F maximum water temperature.
3. **Auxiliary Connections:**
   E - Air Line
   F - Stuffing Box Drain
   G - Prelube or Pressure Tap
   H - Drain
   J - Pressure Tap
4. **Below Base Clearance Required** shown is for clearing the Top Column Flange, other factors may dictate the minimum floor opening size required.

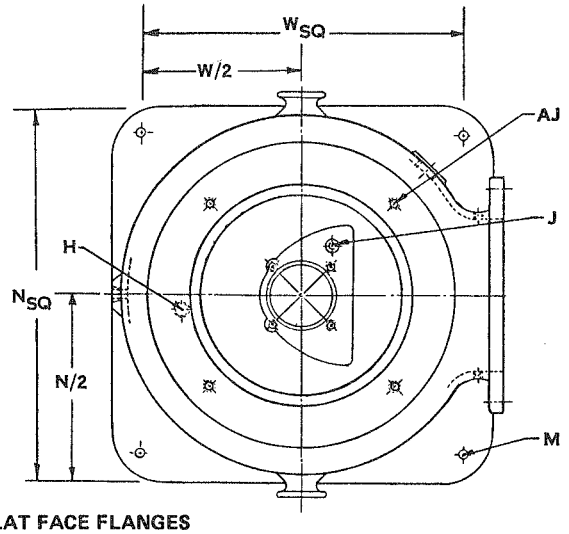
Subject to change without notice

Type S & SHP
Cast Iron Surface Discharge Heads
16 x 16 x 30-1/2
Type S - 125# Discharge Flange
Type SHP-250# Discharge Flange



MOTOR FLANGE TO DISCHARGE FLANGE DETAILS SEE DIMENSIONS BELOW





DISCHARGE FLANGES ARE ANSI DRILLED FLAT FACE FLANGES

GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	BF	CF	A	D	Discharge Flange			Base Mounting 4 Holes			NEMA Driver Mounting			Below Base Clearance Req'd.		Auxiliary Connections				
					Size/ Rating	T Drilling STRADDLE C/L No.	T Drilling STRADDLE C/L Thrd/BC	M	$N_{Sq.}$	$W_{Sq.}$	BD	AK	AJ Drilling (4 HOLES) STRADDLE C/L	$C_{Dia.}$	SD	E NPS	F NPT	G NPT	H NPS	J NPT
16x16x30½S	12¾	20	21½	3½	16, 125#	16	1-8-NC 21¼BC	1	38	32	30½	22	3/4-10NC 26BC	20-1/8	2-7/8	59/64	1/2	2	1	1/4
16x16x30½SHP					16, 250	20	1-1/4-7NC 22½BC													

AVAILABLE CLEARANCE FOR MOTOR BASE TO DISCHARGE FLANGE.

Head Size	BD/2	X	Y
16x16x30½S	15¼	18-5/8	3
16x16x30½SHP	15¼	18-5/8	4

NOTES:

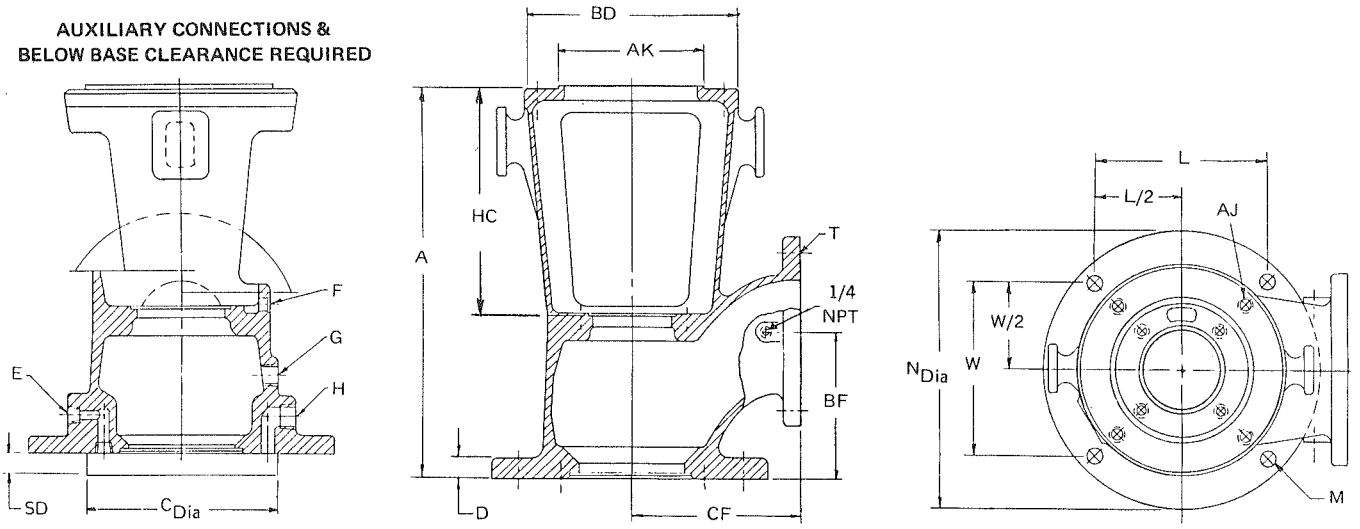
1. **Maximum Operating Pressure** ratings are:
   16" Head - 125# Discharge - 150PSI
   16" Head - Type HP-250# Discharge - 300PSI
   Ratings are for 150°F maximum water.
2. **Below Base Clearance Required** shown is for clearing the Top Columm Flange, other factors may dictate the minimum floor opening size required.
3. **Auxiliary Conncections:**
   E - Air Line
   F - Stuffing Box Drain
   G - Prelube Tap
   H - Drain
   J - Pressure Tap

Subject to change without notice

Type C & CHP
Cast Iron Round Base Discharge Heads

Discharge Flange: Type C-125#, Type CHP-250#

AUXILIARY CONNECTIONS & BELOW BASE CLEARANCE REQUIRED



BASE FLANGE AND DISCHARGE FLANGE ARE ANSI DRILLED FLAT FACE FLANGES

GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	BF	CF	A	N_{Dia}	D	Discharge Flange		Flange or Four Bolt Base Mounting				NEMA Driver Mounting		
						Size/ Rating	T Drilling STRADDLE C/L	Flange MTG (125# ANSI)		Four Bolt MTG		BD	AK	AJ Drilling (4 HOLES) STRADDLE C/L
								Size	M Drilling STRADDLE C/L	L *	W			
4x4x10C	5¾	8½	16-3/8	13½	1-1/8	4, 125#	3/4, 8 Holes 7-1/2BC	8	7/8, 8 Holes 11-3/4BC	10-7/8	5	10	8¼	3/8-16NC 9-1/8BC
4x4x10CHP						4, 250	7/8, 8 Holes 7-7/8BC							
6x6x12C	8-5/8	12	22-7/8	21	1-5/16	6, 125	7/8, 8 Holes 9-1/2BC	14	1-1/8, 12 Holes 18-3/4BC	13-1/4	13-1/4	12		
6x8x16½C	9	14	25-3/4	23½	1-3/8	6, 125		16	1-1/8, 16 Holes 21-1/4BC	17-3/4	11-13/16	16½	13½	5/8-11NC 14-3/4BC
6x8x16½CHP						6, 250	7/8, 12 Holes 10-5/8BC							
8x8x12C	10	14½	24-1/2	25	1-1/4	8, 125	7/8, 8 Holes 11-3/4BC	18	1-1/4, 16 Holes 22-3/4BC	19	12-5/8	12	8¼	3/8-11NC 9-1/8BC
8x8x16½C	10	14¾	26-3/4	25	1-3/8	8, 125						16½	13½	5/8-11NC 14-3/4BC
8x8x16½CHP						8, 250	1, 12 Holes 13BC							
10x10x20C	12	14½	30-1/8	25	1-3/8	10, 125	1, 12 Holes 14-1/4BC					20		
12x12x20C	13	15½	32-1/8	27½	1-7/16	12, 125	1, 12 Holes 17BC	20	1-1/4, 20 Holes 25BC	17-11/16	17-11/16			

Head Size	Below Base Clearance Req'd.		Auxiliary Connections NPT Size				Available Space HC
	C_{Dia}	SD	E	F	G	H	
4x4x10C 4x4x10CHP	7-15/16	1-1/8	1/4	1/4	3/4	3/4	9-5/8
6x6x12C	9-15/16	3-3/8					13-3/16
6x8x16½C 6x8x16½CHP 8x8x12C 8x8x16½C 8x8x16½CHP	12-1/4	3-3/4		3/8	1	1	15-1/2 13-3/16 15-1/2
10x10x20C	14-1/4	4-1/2					17-5/16
12x12x20C	16-1/2	4-7/16					

NOTES:

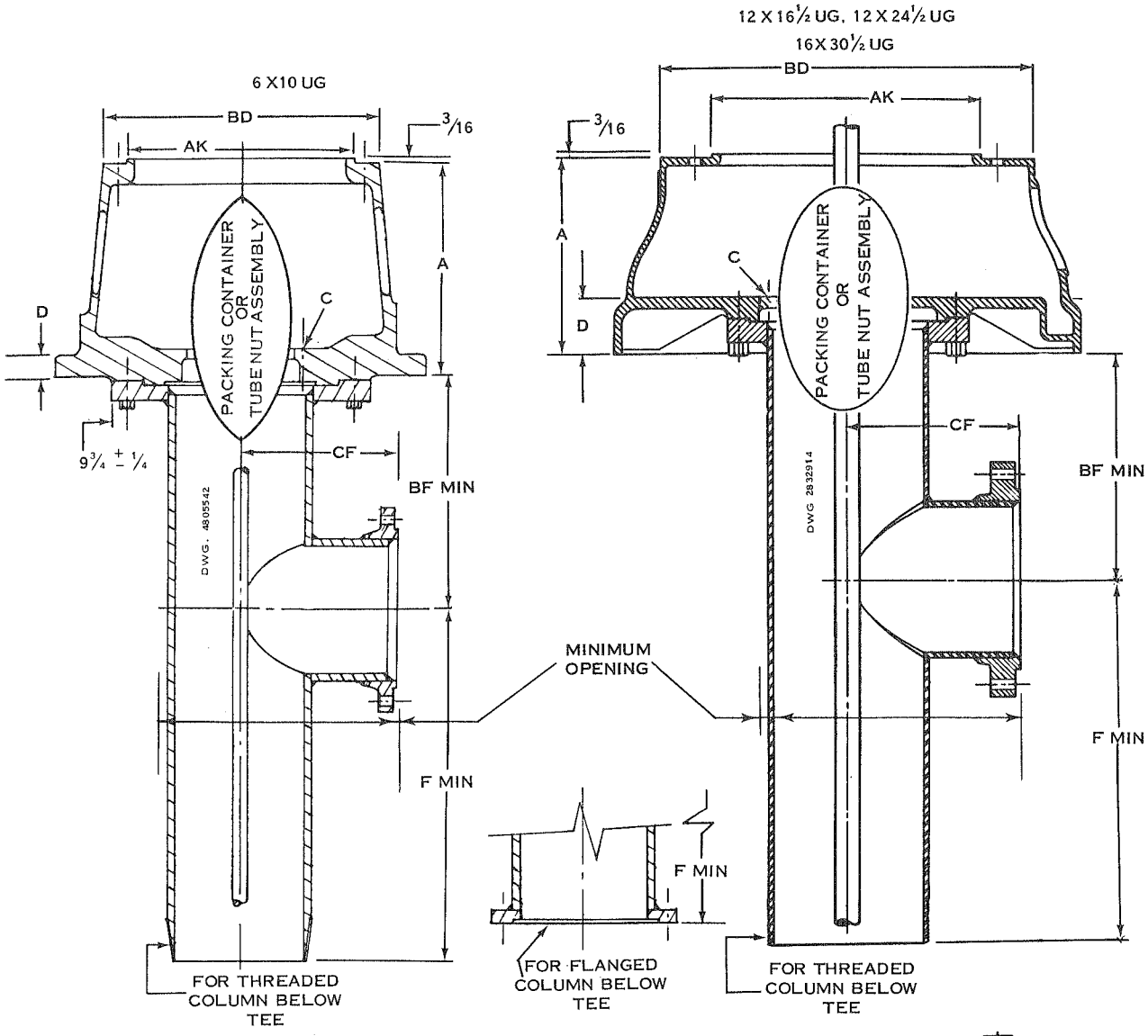
1. 4x4x10C and CHP are threaded for 4 inch Column. All other sizes are machined for Top Column Flanges.
2. * **Four Bolt Base Mounting** - Base Flange is 125# ANSI drilled. Four of the existing holes are used for the Four Bolt Mounting.
3. **Maximum Operating Pressure** ratings are:
   Type C-125# Discharge Flange - 200 PSI
   Type CHP-250# Discharge Flange - 400 PSI
   Ratings are per ANSI B16.1 for 150°F max. water temperature.
4. **Maximum Suction Pressure** for ANSI Flange Mounted pump is 100 PSI.
5. **Auxiliary Connections:**
   E - Air Line or Drain
   F - Stuffing Box Drain
   G - Prelube or Pressure Tap
   H - Vent or Drain (use as suction vent for Can Pumps)

VERTICAL TURBINE PUMPS

Type UG

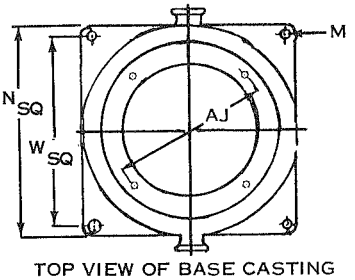
Cast Iron Underground Discharge Heads

STANDARD – 150# RF DISCHARGE FLANGE



GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

COLUMN PIPE SIZE		4"	5"	6"	8"	10"	12"	14"	16"
BF – MINIMUM		8½	9½	10	11	13	14	16	17
CF – DIMENSION		5½	5½	6	9	10	10½	14	15
F MIN	FLANGED	8	9	10	11	14	14	15	16
	THREADED	12	15	18	24	30	30	31	31
MINIMUM OPENING		12½	12½	14	19	21	25	27½	31



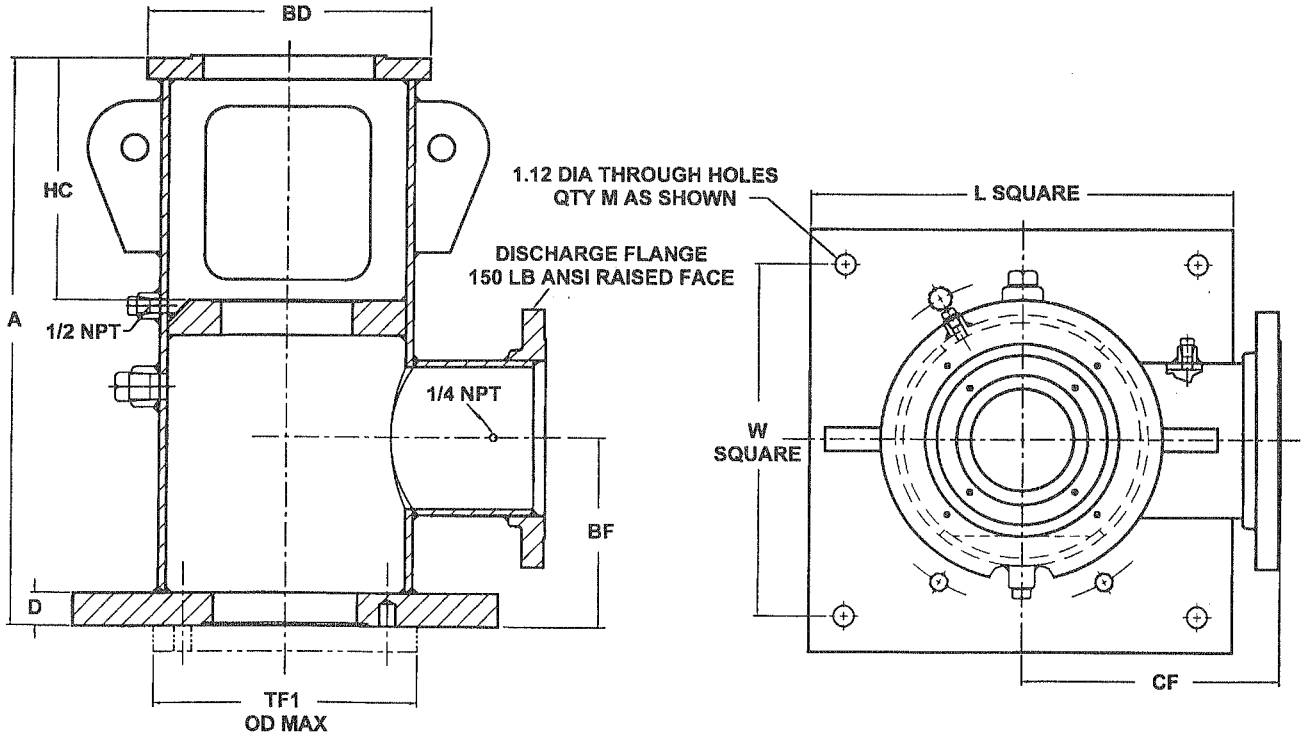
TOP VIEW OF BASE CASTING

BASE SIZE	A	D	(1) C N.P.T	N	W	M	AK	AJ	BD	TOP SHAFT MIN.	TOP SHAFT MAX.	COLUMN (2) MIN.	COLUMN (2) MAX.
6X10UG	7 15/16	¾	½	13½	10½	11/16	8¼	9⅛	10	¾	1 3/16	4	6
12X16½UG	13 5/16	¾	1"	23	19	⅞	13½	14¾	18	1	1½	4	12
12X24½UG	15 5/16	¾	1"	31	26	1"	13½	14¾	25	1 3/16	2 3/16	6	12
16X30½UG	17 1/16	4½	1"	38	32	1"	22	26	30¼	1 15/16	2 7/16	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
Discharge Heads
Type FA Square Base



All dimensions are in inches

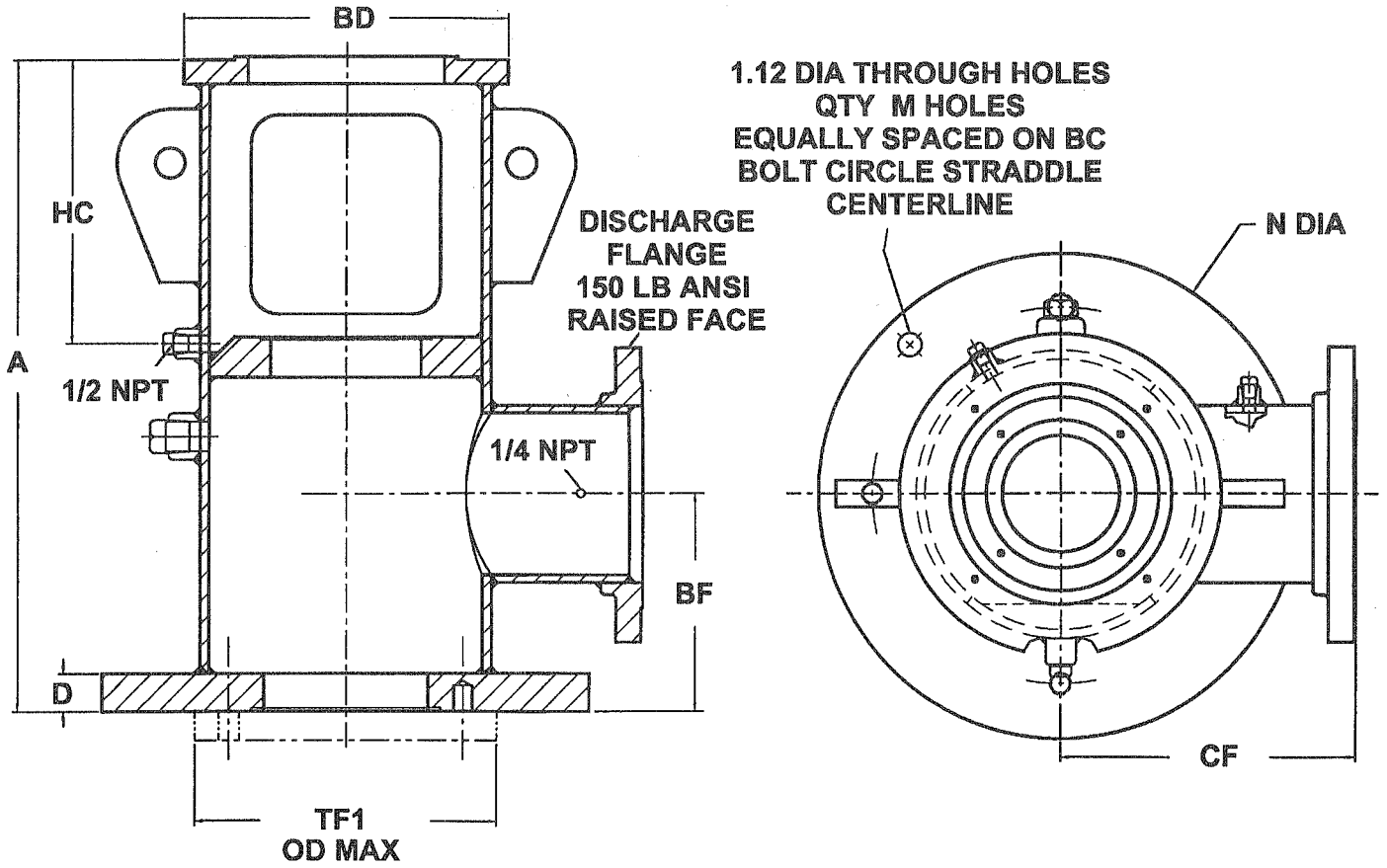
Type FA Fabricated Head Dimensional Data

Discharge Head Size	VHS Discharge Head				VSS Discharge Head				VHS And VSS Discharge Heads			VHS And VSS Base Plates				Nominal Column	Top Flange OD Max
	VHS Head Part No.	Overall Height A	Stand Height HC	VHS Wt Lb.	VSS Head Part Number	Overall Height A	Stand Height HC	VHS Wt Lb.	Motor BD	Nozzle Height BF	Head Width CF	Base Square L	Bolt Hole Square W	Hole Qty M	Thick D	Size	TF1
6X6X12 FA	4604130H	27.12	14.19	281	4604130S	34.81	22.00	298	12.00	7.50	11.75	18.00	15.00	4	1.38	6.00	9.69
6X6X16.5 FA	4604131H	27.06	14.19	398	4604131S	36.25	23.50	430	16.50	7.50	11.75	20.00	17.00	4	1.38	6.00	9.69
8X8X12 FA	4604132H	30.12	14.25	397	4604132S	37.56	22.00	413	12.00	9.50	13.00	22.00	19.00	4	1.62	8.00	12.31
8X8X16.5 FA	4604133H	30.50	14.25	486	4604133S	39.00	23.50	516	16.50	9.50	13.00	22.00	19.00	4	1.62	8.00	12.31
10X10X16.5 FA	4604134H	35.44	17.00	758	4604134S	43.12	24.50	783	16.50	11.00	15.00	24.00	21.00	4	1.62	10.00	14.50
10X10X20 FA	4604135H	35.44	17.00	808	4604135S	44.94	26.50	833	20.00	11.00	15.00	24.00	21.00	4	1.62	10.00	14.50
12X12X16.5 FA	4604136H	37.94	17.00	613	4604136S	45.62	24.50	638	16.50	12.50	16.00	24.00	21.00	4	1.62	12.00	17.06
12X12X20 FA	4604137H	37.94	17.00	783	4604137S	47.44	26.50	809	20.00	12.50	16.00	28.00	25.00	4	1.62	12.00	17.06
14X14X20 FA	4604138H	39.19	17.00	891	4604138S	48.69	26.50	917	20.00	13.00	18.50	30.00	27.00	4	1.62	14.00	18.31
14X14X24.5 FA	4604139H	39.19	17.00	1111	4604139S	53.81	31.00	1147	24.50	13.00	18.50	30.00	27.00	4	1.62	14.00	18.31
16X16X20 FA	4604140H	42.56	17.00	936	4604140S	52.06	26.50	962	20.00	15.00	18.50	30.00	27.00	4	1.62	16.00	20.31
16X16X24.5 FA	4604141H	42.81	17.00	1156	4604141S	56.81	31.00	1192	24.50	15.00	18.50	30.00	27.00	4	1.62	16.00	20.31
16X16X30.5 FA	4604142H	43.19	17.50	1654	4604142S	57.69	32.00	1700	30.50	15.00	21.00	36.00	33.00	4	1.62	16.00	20.31
18X18X24.5 FA	4604143H	44.31	17.50	1416	4604143S	58.81	32.00	1449	24.50	15.00	22.00	36.00	33.00	8	1.62	18.00	23.31
18X18X30.5 FA	4604144H	45.19	17.50	1722	4604144S	58.69	32.00	1768	30.50	15.00	22.00	36.00	33.00	8	1.62	18.00	23.31
20X20X24.5 FA	4604145H	47.31	17.50	1653	4604145S	61.81	32.00	1687	24.50	17.00	23.00	36.00	33.00	8	2.25	20.00	25.31
20X20X30.5 FA	4604146H	47.19	17.50	1960	4604146S	61.69	32.00	2006	30.50	17.00	23.00	36.00	33.00	8	2.25	20.00	25.31
24X24X24.5 FA	4604147H	51.19	17.50	2058	4604147S	65.89	32.00	2092	24.50	19.00	25.00	42.00	39.00	8	2.25	24.00	29.69

Subject to change without notice

Drawing No. 4853842

VERTICAL TURBINE PUMPS
VHS Discharge Heads
Type FR Round Base



All dimensions are in inches

FR Fabricated Discharge Head Dimensional Data ①

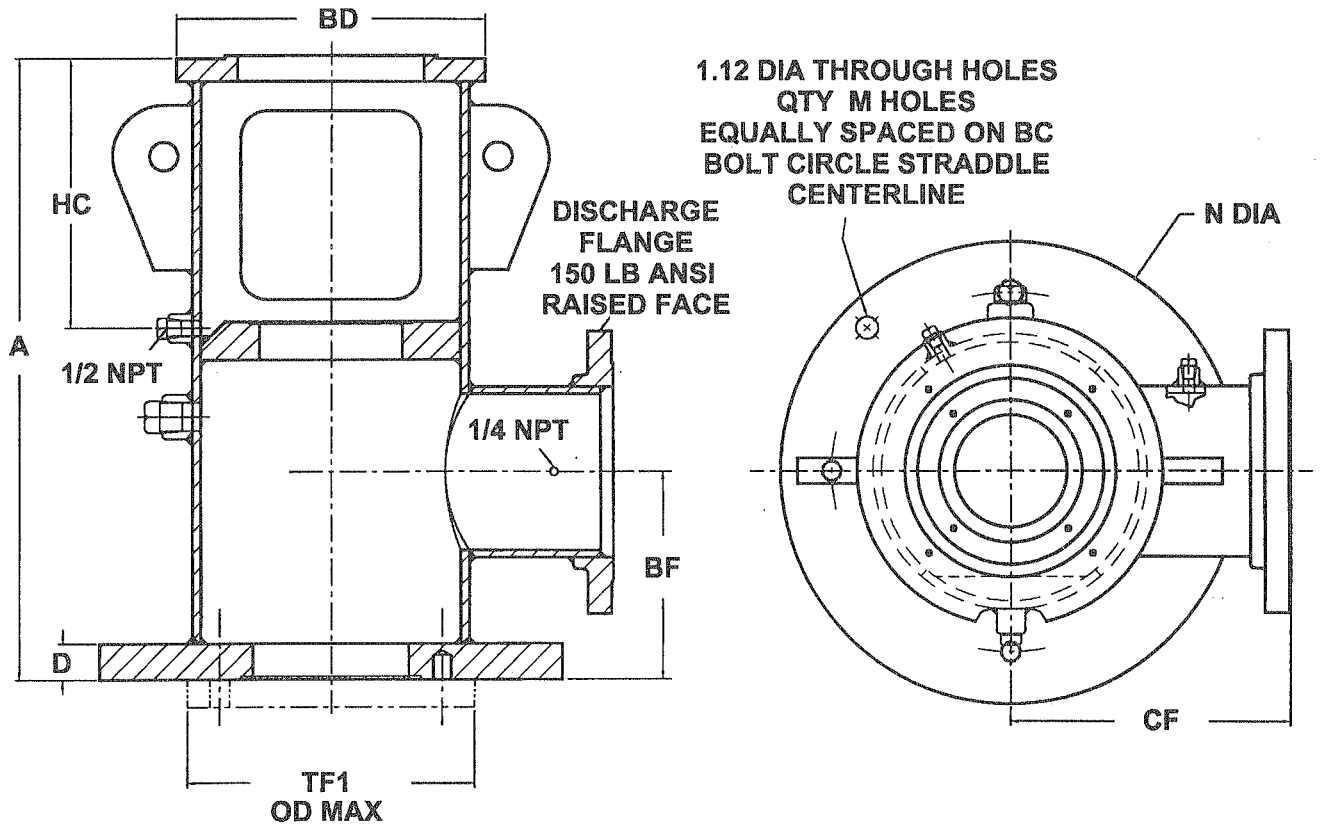
Discharge Head Size	VHS Discharge Head												
	Head Part No.	Nominal Column Size	VHS Weight Lb.	Overall Height A	Stand Height HC	Motor BD	Nozzle Height BF ②	Head Width CF②	Base Dia. N	Hole Qty M	Thick D	Bolt Hole BC	Top Flange Max OD TF1
16X16X20 FR	4604170H	16	912	42.56	17.00	20.00	15.00	18.50	32.00	4	1.62	29.50	20.31
16X16X24.5 FR	4604171H	16	1151	42.81	17.00	24.50	15.00	18.50	32.00	4	1.62	29.50	20.31
16X16X30.5 FR	4604172H	16	1610	43.19	17.50	30.50	15.00	21.00	36.50	4	1.62	34.00	20.31
18X18X24.5 FR	4604173H	18	1321	44.31	17.50	24.50	15.00	22.00	36.50	8	1.62	34.00	23.31
18X18X30.5 FR	4604174H	18	1626	44.19	17.50	30.50	15.00	22.00	36.50	8	1.62	34.00	23.31
20X20X24.5 FR	4604175H	20	1531	47.31	17.50	24.50	17.00	23.00	36.50	8	2.25	34.00	25.31
20X20X30.5 FR	4604176H	20	1838	47.19	17.50	30.50	17.00	23.00	36.50	8	2.25	34.00	25.31
24X24X24.5 FR	4604177H	24	1562	50.31	17.50	24.50	19.00	25.00	36.50	8	2.25	34.00	29.69
24X24X30.5 FR	4604178H	24	1878	50.19	17.50	30.50	19.00	25.00	36.50	8	2.25	34.00	29.69

① FR heads do not have ANSI drilled base plates, for this option refer to factory for price addition.
② For 3 Piece segmented elbows refer to the factory for these dimensions

Subject to change without notice

Drawing No. 4853844

VERTICAL TURBINE PUMPS
VSS Discharge Heads
Type FR Round Base



All dimensions are in inches

FR Fabricated Discharge Head Dimensional Data ①

Discharge Head Size	VSS Discharge Head												
	Head Part No.	Nominal Column Size	VSS Weight Lb.	Overall Height A	Stand Height HC	Motor BD	Nozzle Height BF ②	Head Width CF②	Base Dia. N	Hole Qty M	Thick D	Bolt Hole BC	Top Flange Max OD TF1
16X16X20 FR	4604170S	16	967	52.06	26.50	20.00	15.00	18.50	32.00	4	1.62	29.50	20.31
16X16X24.5 FR	4604171S	16	1260	56.81	31.00	24.50	15.00	18.50	32.00	4	1.62	29.50	20.31
16X16X30.5 FR	4604172S	16	1752	57.69	32.00	30.50	15.00	21.00	36.50	4	1.62	34.00	20.31
18X18X24.5 FR	4604173S	18	1434	58.81	32.00	24.50	15.00	22.00	36.50	8	1.62	34.00	23.31
18X18X30.5 FR	4604174S	18	1768	58.69	32.00	30.50	15.00	22.00	36.50	8	1.62	34.00	23.31
20X20X24.5 FR	4604175S	20	1644	61.81	32.00	24.50	17.00	23.00	36.50	8	2.25	34.00	25.31
20X20X30.5 FR	4604176S	20	1980	61.69	32.00	30.50	17.00	23.00	36.50	8	2.25	34.00	25.31
24X24X24.5 FR	4604177S	24	1683	65.81	32.00	24.50	19.00	25.00	36.50	8	2.25	34.00	29.69
24X24X30.5 FR	4604178S	24	2029	65.69	32.00	30.50	19.00	25.00	36.50	8	2.25	34.00	29.69

① FR heads do not have ANSI drilled base plates, for this option refer to factory for price addition.
② For 3 Piece segmented elbows refer to the factory for these dimensions

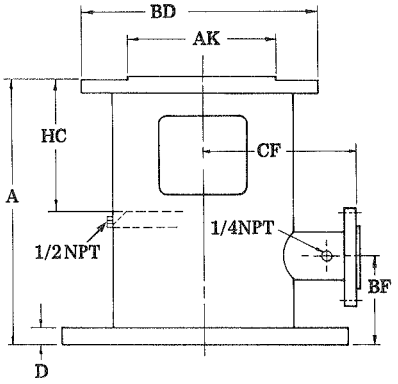
Subject to change without notice

Drawing No. 4853845

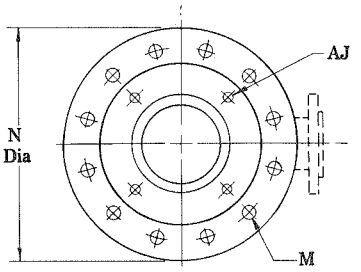
VERTICAL TURBINE PUMPS

Type FRA – Round Base
Fabricated Surface Discharge Heads
ANSI Drilled
matches 150# flat face flange
VHS & VSS Construction

6" through 14" Discharge 150 PSI Working Pressure



FRA Series Fabricated Head



Type FRA matches
150# flat face flange

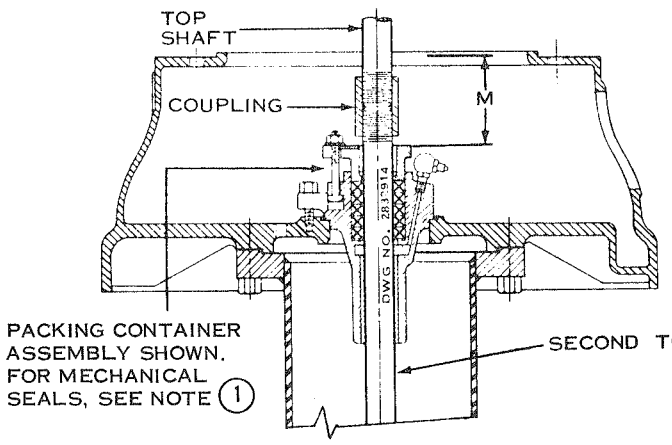
GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	BF	CF	A		HC		N_{Dia}	D	Discharge Flange		Flange Mounting		NEMA Driver Mounting		
									Size/ Rating	T Drilling STRADDLE C/L	Flange MTG (150# ANSI) Size	Flange MTG (150# ANSI) M Drilling STRADDLE C/L	BD	AK	AJ Drilling (4 HOLES) STRADDLE C/L
			VHS	VSS	VHS	VSS									
6x6x12FRA12	9.00	13.00	28.50	37.50	13.50	22.50	19.00	1.38	6" - 150#	.875 8holes 9.50BC	12"	1.00 12holes 17.00BC	12.00	8.25	.375 - 16NC 9.13
6x6x12FRA14	9.00	13.00	28.50	37.50	13.50	22.50	21.00	1.38	6 - 150	.875 8holes 9.50BC	14	1.00 12holes 18.75BC	12.00	8.25	.375 - 16NC 9.13BC
6x6x16½FRA14	9.00	13.00	28.50	37.50	13.50	22.50	21.00	1.38	6 - 150	.875 8holes 9.50BC	14	1.00 12holes 18.75BC	16.50	13.50	.625 - 11NC 14.75BC
6x6x16½FRA16	9.00	13.00	28.50	37.50	13.50	22.50	23.50	1.62	6 - 150	.875 8holes 9.50BC	16	1.13 16holes 21.25BC	16.50	13.50	.625 - 11NC 14.75BC
8x8x12FRA16	10.00	15.00	30.50	40.00	13.50	22.75	23.50	1.62	8 - 150	.875 8holes 11.75BC	16	1.13 16holes 21.25BC	12.00	8.25	.375 - 16NC 9.13BC
8x8x12FRA18	10.00	15.00	30.50	40.00	13.50	22.75	25.00	1.62	8 - 150	.875 8holes 11.75BC	18	1.25 16holes 22.75BC	12.00	8.25	.375 - 16NC 9.13BC
8x8x16½FRA16	10.00	15.00	30.50	41.75	13.50	24.50	23.50	1.62	8 - 150	.875 8holes 11.75BC	16	1.13 16holes 21.25BC	16.50	13.50	.625 - 11NC 14.75BC
8x8x16½FRA18	10.00	15.00	30.50	41.75	13.50	24.50	25.00	1.62	8 - 150	.875 8holes 11.75BC	18	1.25 16holes 22.75BC	16.50	13.50	.625 - 11NC 14.75BC
8x8x16½FRA20	10.00	15.00	30.50	41.75	13.50	24.50	27.50	1.62	8 - 150	.875 8holes 11.75BC	20	1.25 20holes 25.00BC	16.50	13.50	.625 - 11NC 14.75BC
10x10x16½FRA18	11.50	16.00	36.75	45.75	16.50	25.50	25.00	1.62	10 - 150	1.00 12holes 14.25BC	18	1.25 16holes 22.75BC	16.50	13.50	.625 - 11NC 14.75BC
10x10x16½FRA20	11.50	16.00	36.75	45.75	16.50	25.50	27.50	1.62	10 - 150	1.00 12holes 14.25BC	20	1.25 20holes 25.00BC	16.50	13.50	.625 - 11NC 14.75BC
10x10x20FRA18	11.50	16.00	36.75	45.75	16.50	25.50	25.00	1.62	10 - 150	1.00 12holes 14.25BC	18	1.25 16holes 22.75BC	20.00	13.50	.625 - 11NC 14.75BC
10x10x20FRA20	11.50	16.00	36.75	45.75	16.50	25.50	27.50	1.62	10 - 150	1.00 12holes 14.25BC	20	1.25 20holes 25.00BC	20.00	13.50	.625 - 11NC 14.75BC
12x12x16½FRA18	12.50	16.50	38.38	47.38	16.50	25.50	25.00	1.62	12 - 150	1.00 12holes 17.00BC	18	1.25 16holes 22.75BC	16.50	13.50	.625 - 11NC 14.75BC
12x12x16½FRA20	12.50	16.50	38.38	47.38	16.50	25.50	27.50	1.62	12 - 150	1.00 12holes 17.00BC	20	1.25 20holes 25.00BC	16.50	13.50	.625 - 11NC 14.75BC
12x12x20FRA20	12.50	16.50	38.38	47.38	16.50	25.50	27.50	1.62	12 - 150	1.00 12holes 17.00BC	20	1.25 20holes 25.00BC	20.00	13.50	.625 - 11NC 14.75BC
12x12x20FRA24	12.50	16.50	38.38	47.38	16.50	25.50	32.00	1.62	12 - 150	1.00 12holes 17.00BC	24	1.38 20holes 29.50BC	20.00	13.50	.625 - 11NC 14.75BC
14x14x20FRA20	13.50	19.00	42.50	52.00	19.00	28.50	27.50	1.62	14 - 150	1.13 12holes 18.75BC	20	1.25 20holes 25.00BC	20.00	13.50	.625 - 11NC 14.75BC
14x14x20FRA24	13.50	19.00	42.50	52.00	19.00	28.50	32.00	1.62	14 - 150	1.13 12holes 18.75BC	24	1.38 20holes 29.50BC	20.00	13.50	.625 - 11NC 14.75BC
14x14x24½FRA20	13.50	19.00	42.75	52.25	19.00	28.50	27.50	1.62	14 - 150	1.13 12holes 18.75BC	20	1.25 20holes 25.00BC	24.50	13.50	.625 - 11NC 14.75BC
14x14x24½FRA24	13.50	19.00	42.75	52.25	19.00	28.50	32.00	1.62	14 - 150	1.13 12holes 18.75BC	24	1.38 20holes 29.50BC	24.50	13.50	.625 - 11NC 14.75BC

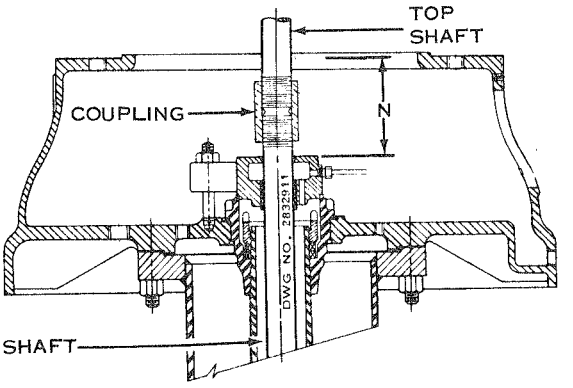
Two-Piece Top Shaft

FOR TYPE UG DISCHARGE ASSEMBLIES
WITH THREADED COUPLINGS & VHS DRIVERS

OLS



ELS



LIMITATIONS

Maximum setting is 50 feet for 6x10UG without custom machining lineshaft 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 stickdown below flange face.

When a 2-piece top 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.

STD. CONSTRUCTION

—OLS—

Top Shaft - 1045 Steel

Second Top Shaft - Stainless Steel

Coupling - Carbon Steel

—ELS—

Top Shaft - 1045 Steel

Second Top Shaft - 1045 Steel

Coupling - Carbon Steel

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

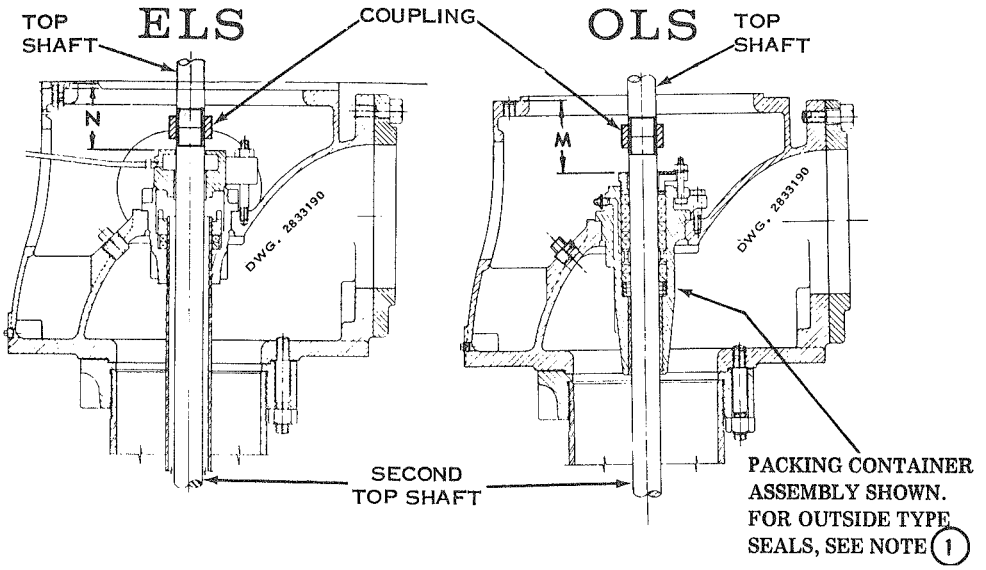
Base Size	Shaft Size	Space Available (2)		Coupling To Be Used		
		ELS "N"	OLS "M"	Short Length	Coupling Part No	Standard Length
6x10UG	.75	3.32	3.94	1.75	2622695	—
	1.00	3.32	3.94	1.88	2622696	—
	1.19	3.32	3.69	2.25	2622697	—
12x16½UG	1.00	5.32	6.06	—	T90170	2.50
	1.19	5.32	6.00	2.25	2622697	—
	1.50	5.32	5.88	2.38	2622698	—
12x24½UG	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	—
16x30½UG	1.69	8.69	8.88	—	T92093	4.25
	1.94	8.69	8.88	—	T92094	5.00
	2.19	8.69	8.75	—	T92095	5.50
	2.44	8.69	8.50	—	T92096	6.00

(1) 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.

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

VERTICAL TURBINE PUMPS
Two-Piece Top Shaft

FOR TYPE S & SHP DISCHARGE ASSEMBLIES
WITH THREADED COUPLING AND VHS DRIVERS



LIMITATIONS

Maximum setting before customer machining of second top 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 stickdown of driver below flange face.

For a 2-piece topshaft with threaded coupling below a VHS motor, a steady bushing is required in the motor for:

1) all pumps with mechanical seal;
2) pumps operating at 2900 rpm and faster.

Refer to motor mfr for price.

CONSTRUCTION

— OLS —

Top Shaft - AISI 1045 Steel

Second Top Shaft - Stainless Steel

Coupling - Carbon Steel

— ELS —

Top Shaft - AISI 1045 Steel

Second Top Shaft - AISI 1045 Steel

Coupling - Carbon Steel

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	Shaft Size	Space Available (2) ELS "N"	Space Available (2) OLS "M"	Coupling to Be Used: Short Length	Coupling to Be Used: Coupling Part No.	Coupling to Be Used: Standard Length
2½x2½x10S and 2½x3x10S	Coupling cannot be used due to space limitation					
6x6x12S	.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	—
6x8x16½S	1.19	3.44	3.82	1.88	2622696	—
8x8x12S	1.38	3.44	3.82	2.25	2622697	—
8x8x16½S	1.50	3.44	3.63	2.38	2622698	—
10x10x16½S 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	—
14x14x24½S	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	5.00
16x16x30½S	Coupling cannot be used					

(1) RA and 8B2 outside type mechanical seals can be used with two-piece top shaft with the following exceptions:

A - 6x6x12 Head with 1.19 Shaft.

B - 10x10x16½ and 10x10x20 Heads with 1.69 and 1.94 Shafts.

C - Seal container is required.

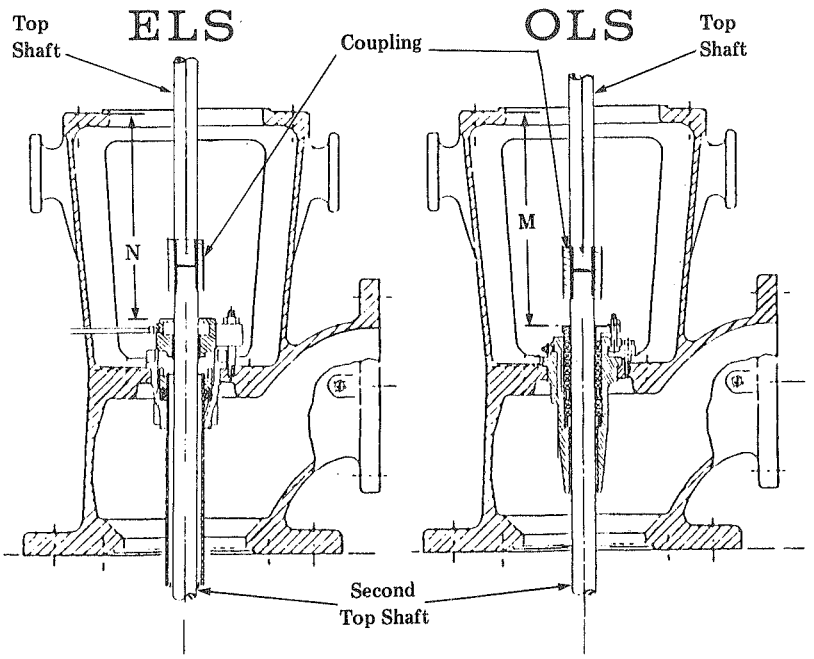
D - Short length coupling may be required when using outside type seals.

For inside type mechanical seals refer to factory.

(2) Use 1/2 of N or M dimensions for break between top and second top shaft.

Two-Piece Top Shaft

FOR TYPE C & CHP DISCHARGE ASSEMBLIES
WITH THREADED COUPLING AND VHS DRIVERS



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Head Size	Shaft Size	Space Available		Coupling to Be Used	
		ELS "N" (1)	OLS "M"	Coupling Part No.	Standard Length
4x4x10C	.75	6.25	6.88	T-99111	2.25
	1.00	6.25	6.88	T-90170	2.50
	1.19	6.25	6.88	T-92091	3.50
	1.50	5.87	——	T-92092	3.50
6x6x12C	.75	9.94	——	T-99111	2.25
	.88	9.94	——	T-90169	2.25
	1.00	9.44	9.63	T-90170	2.50
	1.19	9.44	9.63	T-92091	3.50
	1.50	9.44	9.63	T-92092	3.50
	1.69	9.56	——	T-92093	4.25
	1.94	9.56	——	T-92094	5.00
6x8x16½C	1.00	11.75	11.94	T-90170	2.50
	1.19	11.75	11.94	T-92091	3.50
	1.50	11.75	11.94	T-92092	3.50
	1.69	11.97	——	T-92093	4.25
	1.94	11.97	——	T-92094	5.00
8x8x12C	1.00	9.44	9.63	T-90170	2.50
	1.19	9.44	9.63	T-92091	3.50
	1.50	9.44	9.63	T-92092	3.50
	1.69	9.56	——	T-92093	4.25
	1.94	9.56	——	T-92094	5.00
8x8x16½C	1.19	11.75	11.94	T-92091	3.50
	1.50	11.75	11.94	T92092	3.50
	1.69	11.87	11.94	T-92093	4.25
	1.94	11.87	11.94	T-92094	5.00
	2.19	11.87	11.94	T-92095	5.50
10x10x20C 12x12x20C	1.19	13.56	13.75	T-92091	3.50
	1.50	13.56	13.75	T-92092	3.50
	1.69	13.68	13.75	T-92093	4.25
	1.94	13.68	13.75	T-92094	5.00
	2.19	13.68	13.75	T-92095	5.50
	2.44	13.18	13.75	T-92096	6.00

(1) Use 1/2 of N or M dimensions for break between top and second top shaft.

LIMITATIONS

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

For a 2-piece topshaft, with threaded coupling below a VHS motor, a steady bushing is required in the motor for:

1) all pumps with mechanical seal;
2) pumps operating at 2900rpm and faster.

Refer to motor mfr for price.

CONSTRUCTION

— OLS —

Top Shaft - AISI 1045 Steel

Second Top Shaft - Stainless Steel

Coupling - Carbon Steel

— ELS —

Top Shaft - AISI 1045 Steel

Second Top Shaft - AISI 1045 Steel

Coupling - Carbon Steel

MECHANCIAL SEALS

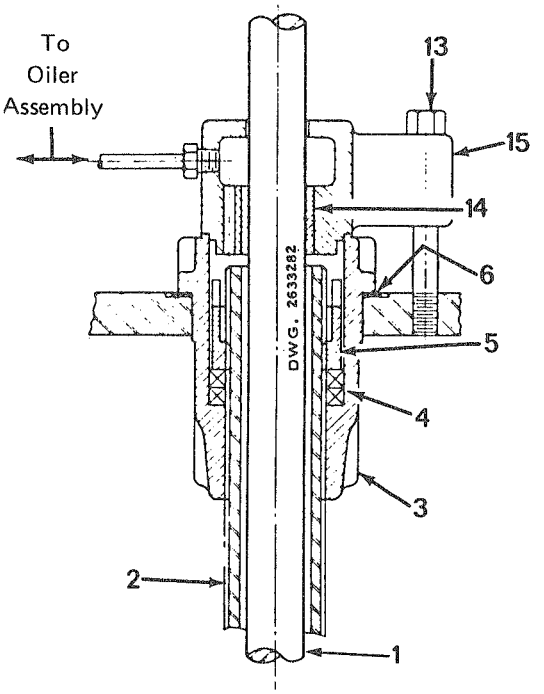
Inside and outside type seals fit these heads with two-piece top shaft construction and VHS motors.

Subject to change without notice

Tube Tension Nuts

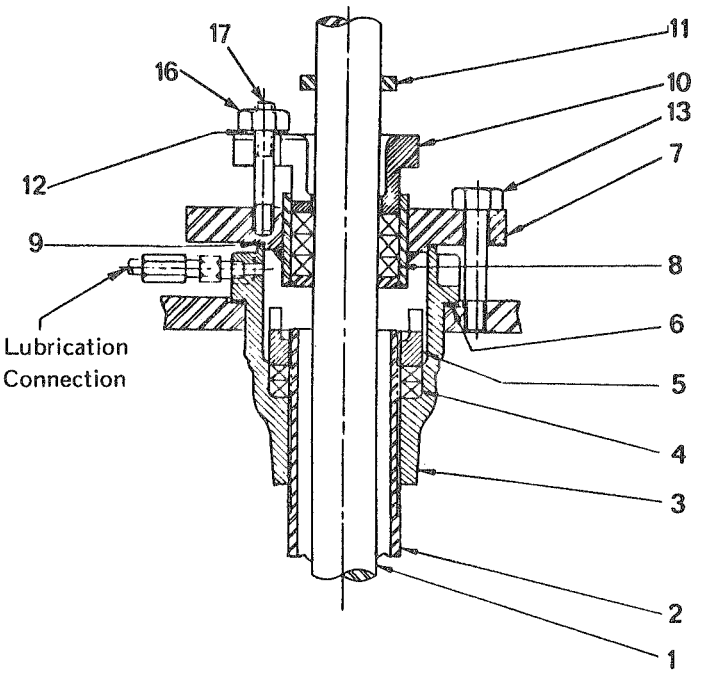
STANDARD TUBE NUT ASSEMBLY

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



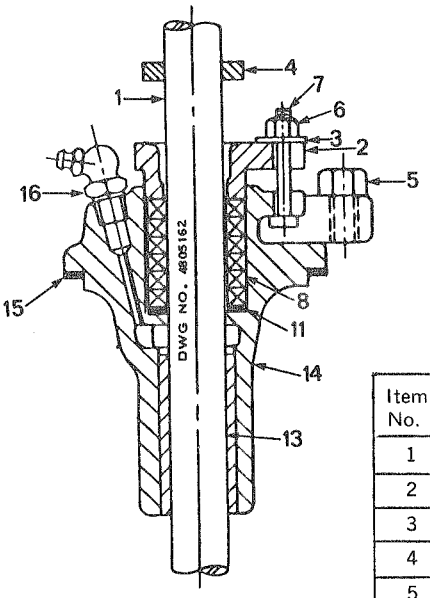
PACKED TUBE NUT ASSEMBLY

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



Item No.	Part	Material
1	Top Shaft	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	Packing container	Carbon Steel
8	Packing for packing container	Graphited Fiber
9	Gasket for packing container	Vellumoid
10	Packing gland (pair of halves)	Cast Iron - Cad Plate
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

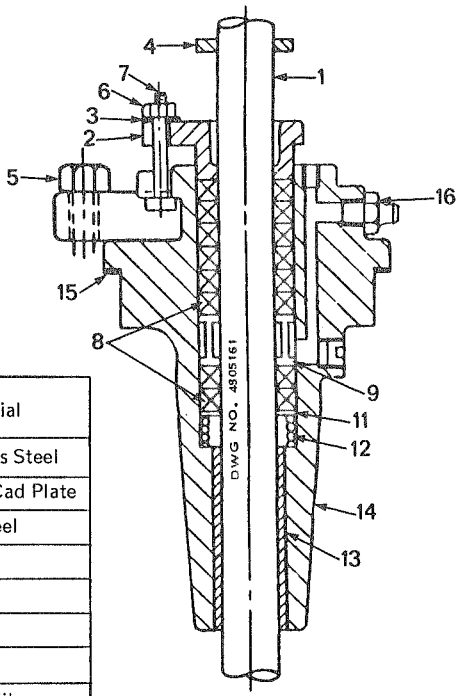
Stuffing Boxes



TYPE II
0 to 175 psi
Uses graphited synthetic fiber packing.

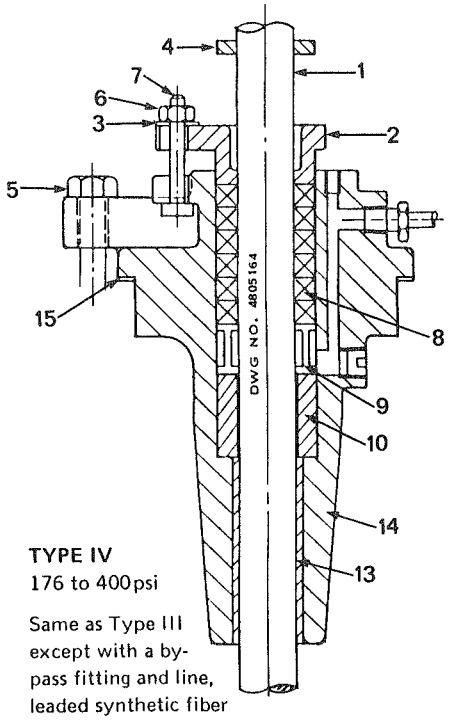
For 176 to 400 psi the grease fitting and ell are replaced by a by-pass fitting and line, as shown in Type IV (lower left) and leaded synthetic fiber packing is used.

Item No.	Part	Material
1	Top Shaft	416 Stainless Steel
2	Packing Gland - Split Type	Cast Iron - Cad Plate
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 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	Vellumoid
16	Fitting, Grease	Steel



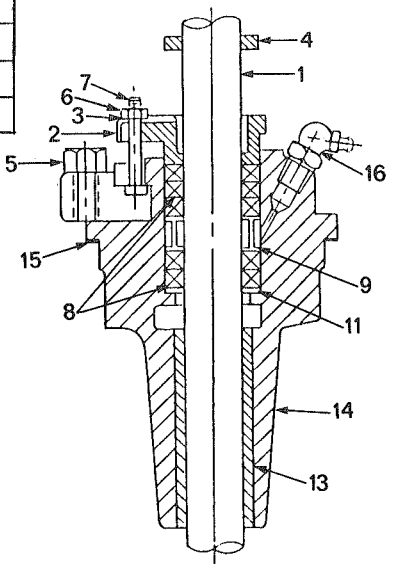
TYPE III
0 to 175 psi

Graphited synthetic fiber packing used.



TYPE IV
176 to 400 psi

Same as Type III except with a by-pass fitting and line, leaded synthetic fiber packing and bottom ring below seal lantern.



TYPE VI
0 to 175 psi
Uses graphited synthetic fiber packing.

For 176 to 400 psi the grease fitting and ell are replaced by a by-pass fitting and line and leaded synthetic fiber packing is used.

VERTICAL TURBINE PUMPS

Stuffing Box Data

Head Size	Stuffing Box Register	Type	Shaft or Sleeve Size	Quantity Rings	Size Square
2½x2½x10S	Integrally	——	.75	5	.38
2½x3x10S	Cast	——	1.00	5	.25
4x4x10C	3.88	II	.75	6	.38
6x6x12S		II	.88	6	.38
6x10UG		II	1.00	6	.38
		II	1.19	6	.38
		VI	1.50	5	.50
6x6x12C	4.69	VI	.75	5	.38
6x6x12F		VI	.88	5	.38
6x6x16½F		II	1.00	6	.38
6x8x16½C		II	1.19	6	.38
6x8x16½S		II	1.50	6	.50
8x8x12C		VI	1.69	6	.50
8x8x12F		VI	1.94	6	.50
8x8x12S					
8x8x16½S					
12x16½UG					
8x8x16½C	5.56	II	1.19	6	.38
8x8x16½F		II	1.50	6	.50
10x10x16½C		II	1.69	6	.50
10x10x16½F		II	1.94	6	.50
10x10x16½S		II	2.19	6	.63
10x10x20C		VI	2.44	6	.63
10x10x20F					
10x10x20S					
12x12x20C					
12x12x20F					
12x12x20S					
12x24½UG					
14x14x20F					
14x14x24½F					
14x14x24½S					
16x16x20F					
16x16x24½F					
16x16x30½F	6.38	III or IV	1.69	8	.50
16x16x30½S		III or IV	1.94	8	.50
16x30½UG		III or IV	2.19	8	.63
18x18x24½F		III or IV	2.44	8	.63
18x18x30½F					
20x20x30½F					

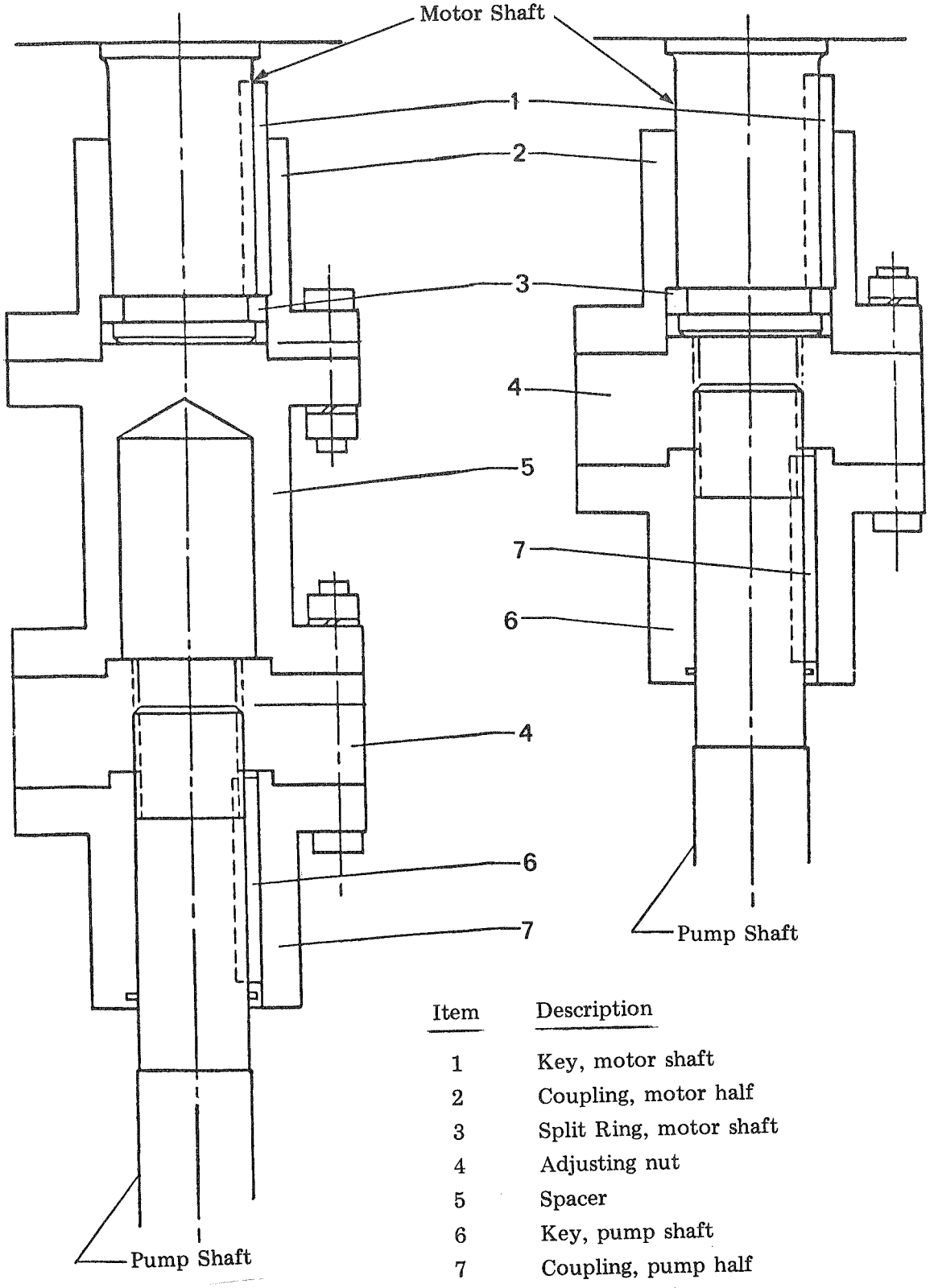
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Subject to change without notice

Flange Top Shaft Couplings

Spacer Type

Standard Type



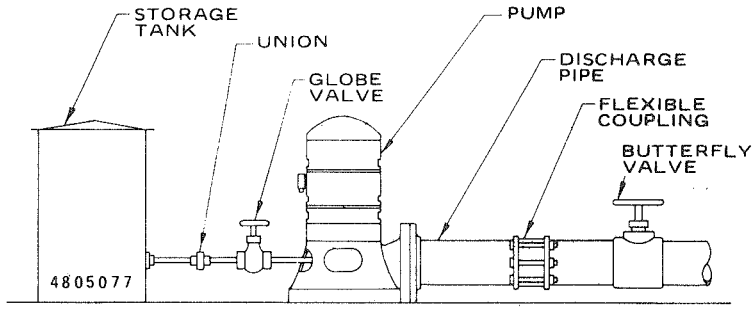
Item	Description
1	Key, motor shaft
2	Coupling, motor half
3	Split Ring, motor shaft
4	Adjusting nut
5	Spacer
6	Key, pump shaft
7	Coupling, pump half

Prelubrication Methods

for Open Lineshaft Column

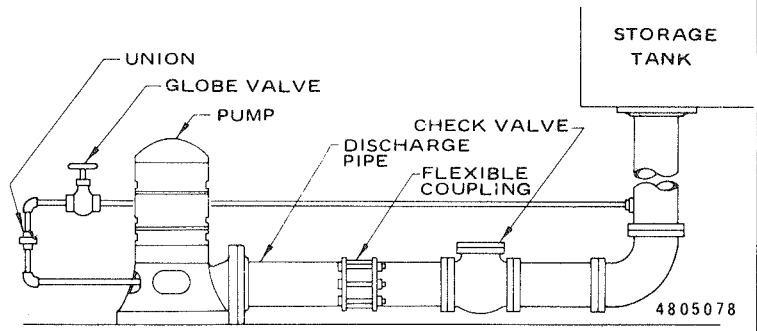
Peerless Pump offers components for on site assembly of the configuration described in Figure (a) only.

These drawings represent suggested configurations only. Actual configurations can be different as long as functional requirements are met.



(a) Manual Control

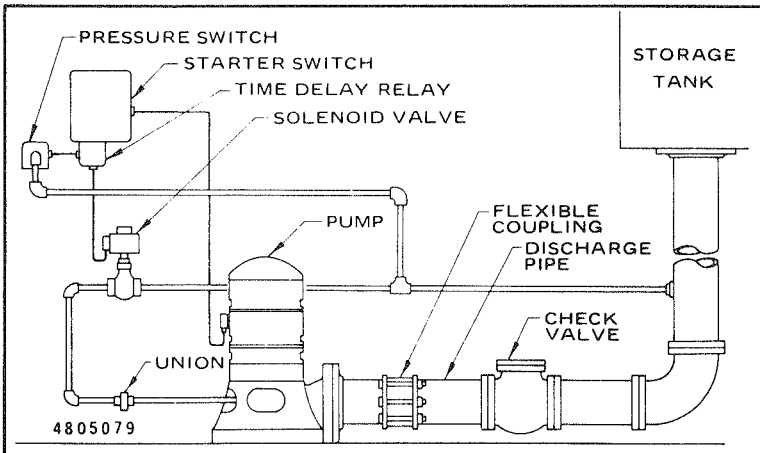
SHAFT DIAMETER	DEPTH TO STANDING WATER LEVEL	TANK CAPACITY GALLONS	PRELUBRICATING PIPE SIZE	PRELUBRICATING VALVE SIZE
3/4-1 1 3/16-1 1/2	100 Ft or less	30	3/4	3/4
	101 to 200 Ft	50	1	1
	201 to 500 Ft	100	1 1/2	1 1/2
1 11/16- 1 15/16	100 Ft or less	50	1	1
	101 to 200 Ft	100	1 1/2	1 1/2
	201 to 500 Ft	200	2	2



(b) Manual Control

SHAFT DIAMETER	DEPTH TO STANDING WATER LEVEL	PRELUBRICATING PIPE SIZE	PRELUBRICATING VALVE SIZE
3/4-1 1 3/16-1 1/2	100 Ft or less	3/4	3/4
	101 to 200 Ft	1	1
	201 to 500 Ft	1	1
1 11/16 1 15/16	100 Ft or less	1	1
	101 to 200 Ft	1 1/2	1 1/2
	201 to 500 Ft	1 1/2	1 1/2

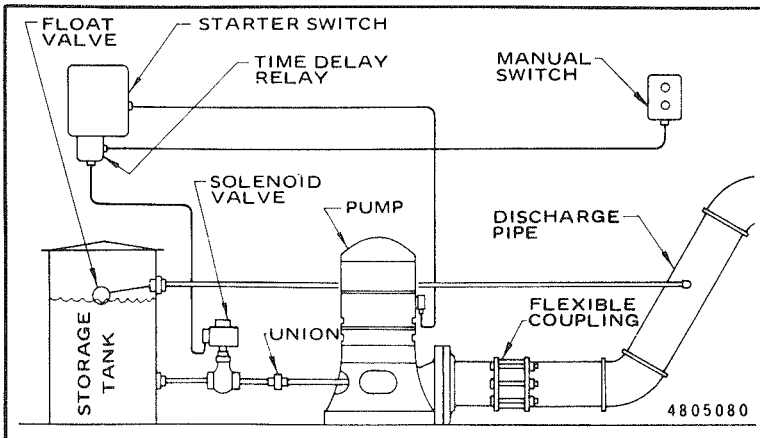
STORAGE TANK CAPACITY SAME AS IN (a) & (d)



(c) Automatic Control

SHAFT DIAMETER	DEPTH TO STANDING WATER LEVEL	ADJUSTABLE TIME DELAY RELAY	PRELUBRICATING PIPE SIZE	SOLENOID VALVE SIZE
3/4-1 1 3/16-1 1/2	100 Ft or less	15 sec to 5 min	3/4	3/4
	101 to 200 Ft		3/4	3/4
	201 to 500 Ft		1	1
1 11/16 1 15/16	100 Ft or less		3/4	3/4
	101 to 200 Ft		3/4	3/4
	201 to 500 Ft		1 1/4	1 1/4

STORAGE TANK CAPACITY SAME AS IN (a) & (d)



(d) Remote Control

SHAFT DIAMETER	DEPTH TO STANDING WATER LEVEL	TANK CAPACITY GALLONS	FLOAT VALVE SIZE	FLOAT VALVE PIPE SIZE	SOLENOID VALVE SIZE	PRELUBRICATING PIPE SIZE	ADJUSTABLE TIME DELAY RELAY
3/4-1 1 3/16- 1 1/2	100 Ft. or less	30	1/2	1/2	3/4	3/4	15 sec to 5 min
	101 to 200 Ft.	50	1/2	1/2	1	1	
	201 to 500 Ft	100	1/2	1/2	1 1/2	1 1/2	
1 11/16 1 15/16	100 Ft. or less	50	1/2	1/2	1	1	
	101 to 200 Ft.	100	1/2	1/2	1 1/2	1 1/2	
	201 to 500 Ft.	200	3/4	3/4	2	2	

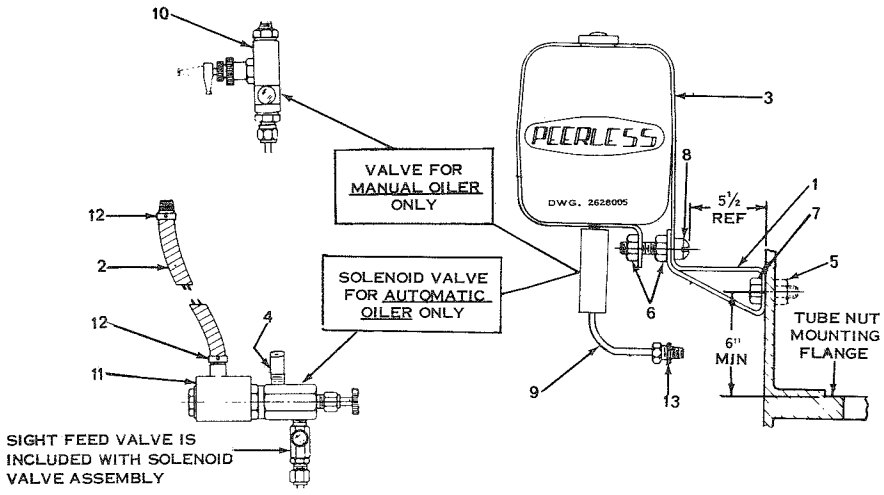
Oiler Assemblies

(with container)

Enclosed Lineshaft Construction

Standard Type

(Manual or Automatic)



PARTS LIST (STANDARD CONSTRUCTION)

ITEM NO.	NAME	MATERIAL
1	BRACKET, OIL CONTAINER	STEEL
2	CONDUIT, FLEXIBLE	STEEL
(2) 3	CONTAINER, OIL–WITH CAP	STEEL
4	NIPPLE, PIPE	GALVANIZED STEEL
5	NUT, HEX (QTY 2)	STEEL
6	NUT, HEX	STEEL
7	SCREW, HEX HEAD CAP (QTY 2)	STEEL
8	SCREW, ROUND HEAD	STEEL
9	TUBE, OILER	COPPER
10	VALVE, SIGHT FEED OIL	ASSEMBLY (BRASS)
11	VALVE, SOLENOID	ASSEMBLY (BRASS AND STEEL)
12	CONNECTOR CONDUIT	MALLEABLE IRON
13	FITTING, TUBE CONNECTOR	BRASS

RECOMMENDED DRIP RATE PER MINUTE

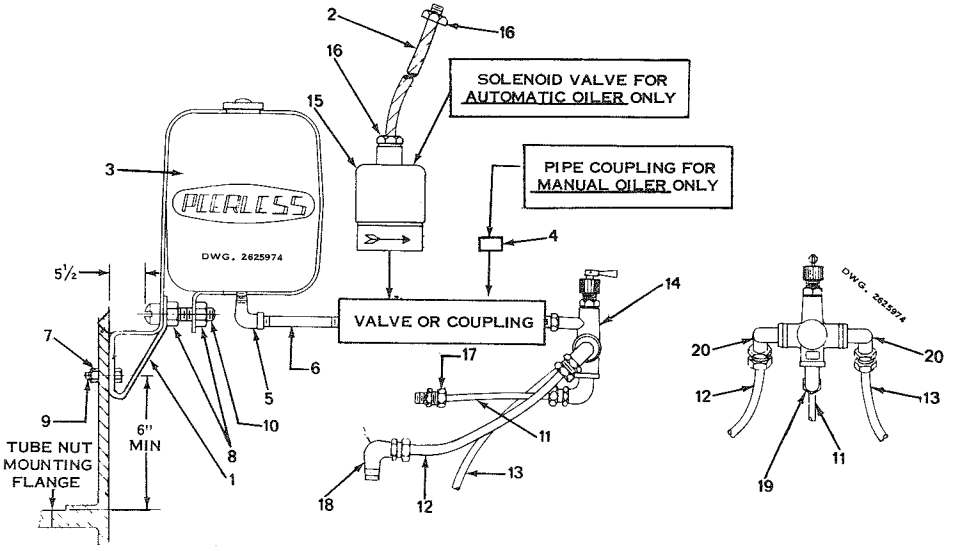
SHAFT SIZE	PER 100FT OF COLUMN		TOTAL COLUMN LENGTH
	FIRST 2 WEEKS	AFTER 2 WEEKS	
¾ TO 2 3/16	5 TO 6 DROPS	3 DROPS	ALL
(1) ABOVE 2 3/16	10 TO 12 DROPS	6 DROPS	20FT

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

(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.

Ambient Temperature Compensated Type

(Manual or Automatic)



PARTS LIST (STANDARD CONSTRUCTION)

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

(1) Oil container capacity is 2 gallons which will last approximately 60 days (24 hours per day) based on 3 drops per minute.

Note A: For drip rate see chart at left.

Note B: To connect water supply, install Item 18 in ¼ NPT pressure tap in cast discharge head next to tube nut, use Item 13 to conduct water back to well.

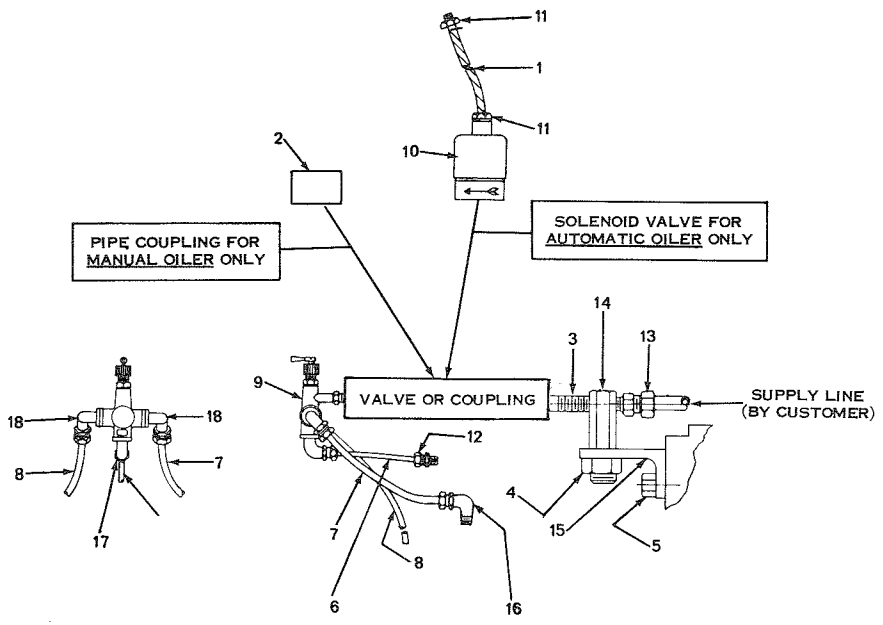
Oiler Assemblies

(less container)

Enclosed Lineshaft Construction

Ambient Temperature Compensated Type

(Manual or Automatic)



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

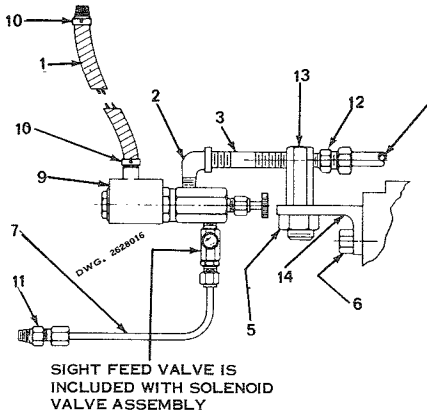
To connect water supply, install item 16 in ¼ NPT pressure tap in cast discharge head next to tube nut, use item 8 to conduct water back to well.

NOTE: For drip rate see page 28.

Standard Type

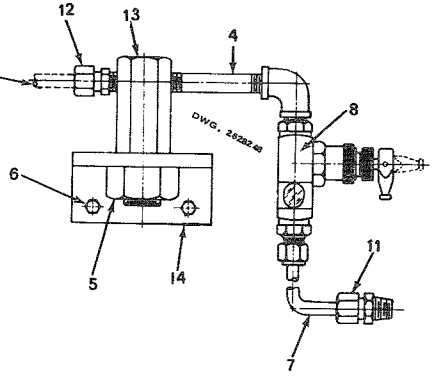
(Manual or Automatic)

AUTOMATIC TYPE



SIGHT FEED VALVE IS INCLUDED WITH SOLENOID VALVE ASSEMBLY

MANUAL TYPE



PARTS LIST (STANDARD CONSTRUCTION)		
ITEM NO.	NAME	MATERIAL
1	CONDUIT, FLEXIBLE	STEEL
2	ELBOW, STREET	GALVANIZED IRON
3	NIPPLE, PIPE	GALVANIZED STEEL
4	NIPPLE, PIPE	GALVANIZED STEEL
5	NUT, HEX	STEEL
6	SCREW, HEX HEAD CAP (QTY 2)	STEEL
7	TUBE, OILER	COPPER
8	VALVE, SIGHT FEED OIL	ASSEMBLY (BRASS)
9	VALVE, SOLENOID	ASSEMBLY (BRASS AND STEEL)
10	CONNECTOR, CONDUIT	MALLEABLE IRON
11	FITTING, TUBE CONNECTOR	BRASS
12	FITTING, TUBE CONNECTOR	BRASS
13	STUD, OILER MOUNTING	ALUMINUM
14	BRACKET, OILER STUD	STEEL

NOTE: **For drip rate of oil see page 28.**

Technical Data for Dura Seals

Type PTO and RO (1)

Part Name	Standard Material for	
	Water - Salt Water	Hydrocarbons
Seal Flange	316 S.S.	Steel (plated)
Seal Ring Face	Chromeoxide Coated 316 S.S.	Stellite
Insert	Carbon →	
O rings	Buna - N	Viton
Seal Sleeve	316 S.S. →	
Springs/parts	20 S.S./316 S.S. →	
(3) Throttle Bushing	Bronze →	

(4) Dura Seal Code # EP5EFOO ES5NFVV

Type RA

Part Name	Standard Material for	
	Water - Salt Water	Hydrocarbons
Seal Flange	316 S.S.	Steel (plated)
Seal Ring Face	Chromeoxide Coated 316 S.S.	Stellite
Insert	Carbon →	
O ring	Buna - N	Viton
Springs/ parts	20 S.S./316 S.S. →	

(4) Dura Seal Code # EP5EFO ES5NFV

Type PT and ROTT (1)

Part Name	Standard Material for	
	Water - Salt Water	Hydrocarbons
Seal Flange	316 S.S.	Steel (plated)
Seal Ring Face	Chromeoxide Coated 316 S.S.	Stellite
Insert	Carbon →	
V rings and Spreader ring	Teflon →	
Seal Sleeve	316 S.S. →	
Springs/parts	20 S.S./316 S.S. →	
(3) Throttle Bushing	Bronze →	

(4) Dura Seal Code # EP5EFTT ES5NFTT

Temperature and Pressure Ratings

Type Seal	Type Liquid	Temperature Rating (2)		Pressure Rating	
		Max	Min	Max	Min
PTO, PT	Water Salt Water	160°F	-40°F	600 PSIG	50 PSIG
PTO	Hydrocarbons	300°F	-20°F		
PT	Hydrocarbons	350°F	-20°F		
RO, ROTT	Water Salt Water	160°F	-40°F	Use Dura Seal PV curves on page 88 to determine	
RO	Hydrocarbons	300°F	-20°F		
ROTT	Hydrocarbons	350°F	-20°F		
RA	Water Salt Water	160°F	-40°F	350 PSIG	0 PSIG
	Hydrocarbons	300°F	-20°F		

THE FOLLOWING MUST BE VERIFIED BEFORE USING ABOVE SEALS WITH MATERIALS SHOWN

A. Water should have no more than 200 PPM of chromates maximum.
B. Salt water should not have a salt concentration above 50% at any temperature.
C. Hydrocarbon specific gravity must be .63 minimum.
D. Hydrocarbons must not "coke" (solidify or thicken) to the point where the operation of the seal is affected.

NOTE: If any of the above conditions can not be met, or if the liquid is corrosive or has abrasives present, contact the seal vendor for a proper selection.

GENERAL INFORMATION

(1) TYPE RO and ROTT seals are unbalanced all others are balanced.

(2) Special cooling is not required for the maximum temperatures shown.

(3) A throttle bushing is optional for these seals (not available for the RA seal).

(4) The material code # does not include the seal sleeve or throttle bushing material. These must be listed separately for a complete material description.

NOTE: A steady bushing is required in VHS drivers when a mechanical seal is used. A bypass line is required from seal flange to low pressure area for proper circulation of liquid.

Technical Data for John Crane Seals

Type 1①, 1B⑤ and 8B1

Part Name	Standard Material for	
	Water - Salt Water	Hydrocarbons
Seal Flange	18 - 8 S.S.	Steel
Washer	Carbon →	→
Seat	Ceramic	Tungsten Carbide
O ring/Bellows	Buna - N	Viton
Seal Sleeve	18 - 8 S.S. →	→
Springs etc.	18 - 8 S.S. →	→
③ Throttle Bushing	Bronze →	→
④ Crane code #	BF 1C1	XF 1D1

Type 9① and 9B

Part Name	Standard Material for	
	Water - Salt Water	Hydrocarbons
Seal Flange	18 - 8 S.S.	Steel
Washer	Carbon →	→
Seat	Ceramic	Tungsten Carbide
O rings	Buna - N	Viton
Seal Sleeve	18 - 8 S.S. →	→
Springs/retainer	18 - 8 S.S.	
Wedge	Teflon →	→
③ Throttle Bushing	Bronze →	→
④ Crane code #	Q/BF1C1	Q/XF 1D1

Type 8B2

Part Name	Standard Material for	
	Water - Salt Water	Hydrocarbons
Seal Flange	18 - 8 S.S.	Steel
Washer	Carbon →	→
Seat	Ceramic	Tungsten Carbide
Spring/retainer	18 - 8 S.S. →	→
O ring	Buna - N	Viton
④ Crane code #	BF 1C1	XF 1D1

Temperature and Pressure Ratings

Type Seals	Type Liquid	② Temperature Rating Max	Temperature Rating Min	Pressure Rating
I, IB 8BI 9, 9B	Water Salt Water	160° F	- 40° F	Use J. Crane PV curves on page 89 to determine
	Hydrocarbons	400° F	- 20° F	
8B2	Water Salt Water	160° F	- 40° F	150 psig Max
	Hydrocarbons	400° F	- 20° F	

THE FOLLOWING MUST BE VERIFIED BEFORE USING ABOVE SEALS WITH MATERIALS SHOWN

A. Water should have no more than 200 PPM of chromates maximum.
B. Salt water should not have a salt concentration above 50% at any temperature.
C. Hydrocarbon specific gravity must be .63 minimum for all unbalanced seals and also for balanced seals operating below 75 PSIG.
D. Hydrocarbons must not "coke" (solidify or thicken) to the point where the operation of the seal is affected.

NOTE: If any of the above conditions can not be met, or if the liquid is corrosive or has abrasives present, contact the seal vendor for a proper selection.

GENERAL INFORMATION

① TYPE I and 9 seals are unbalanced, all others are balanced.

② Special cooling is not required for the maximum temperatures shown.

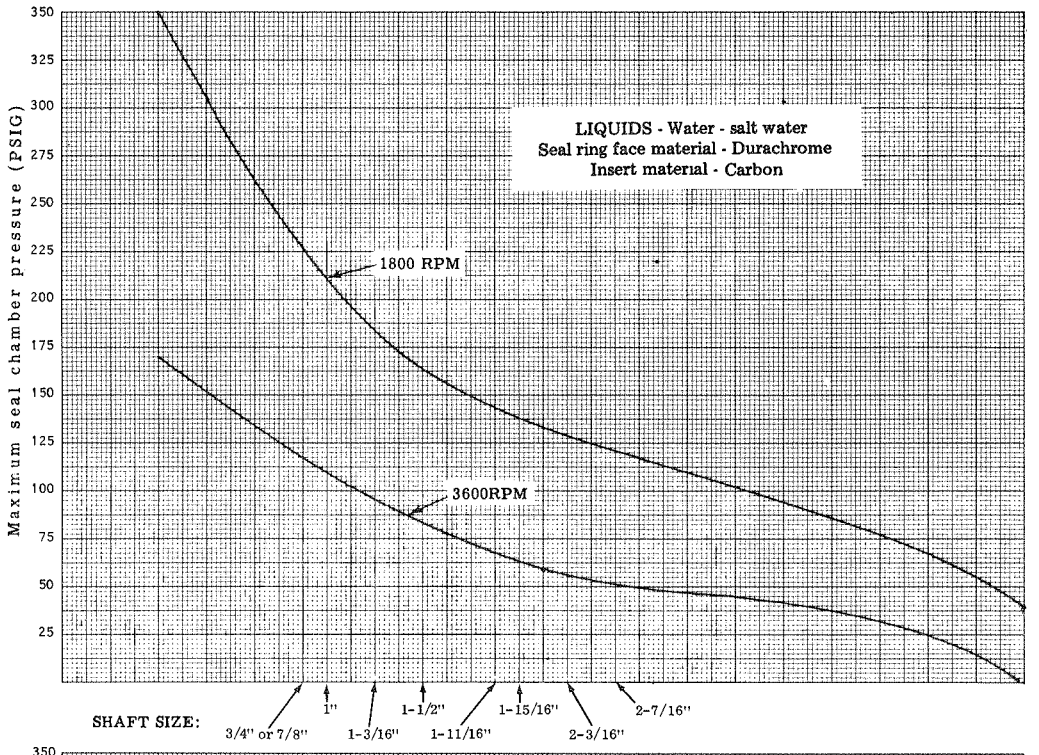
③ A throttle bushing is optional for these seals (not available for the 8B2 seal).

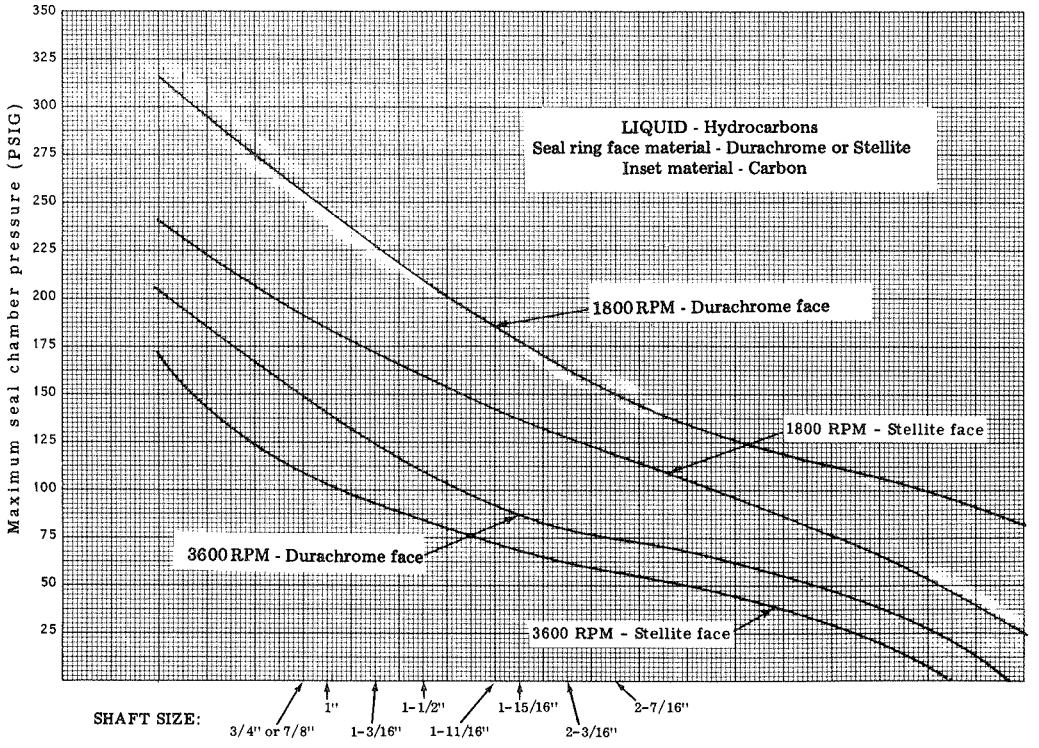
④ The material code # does not include the seal flange, seal sleeve or throttle bushing material. These must be listed separately for a complete material description.

⑤ IB seals for 2-3/16 and 2-7/16 shafts are to long to be removed through the 5" space in a standard spacer coupling. Refer to the factory for a special coupling, when required

NOTE: A steady bushing is required in VHS drivers when a mechanical seal is used. A bypass line is required from seal flange to low pressure area for proper circulation of liquid.

PV CURVES
for
Unbalanced Dura Seals



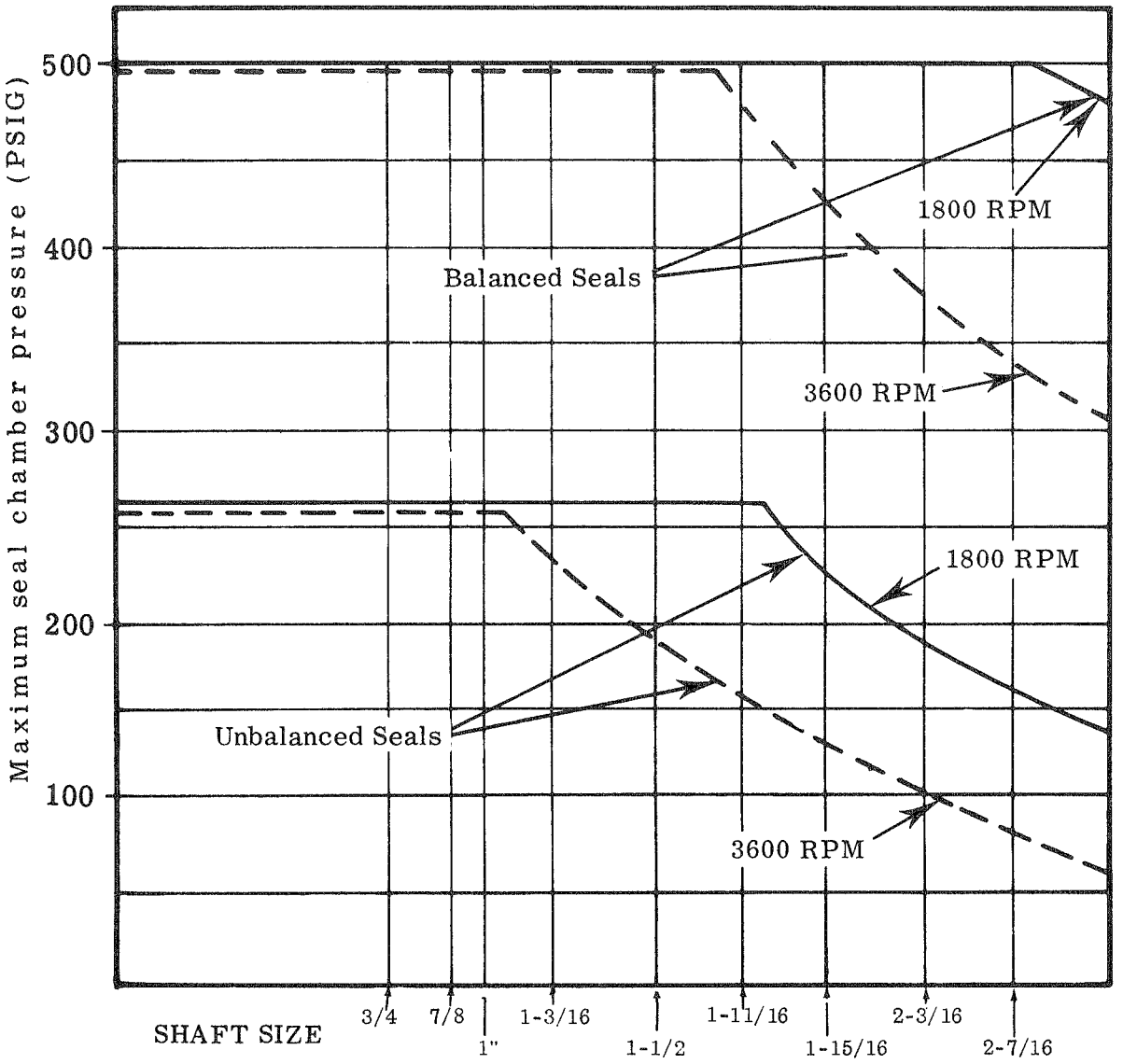


NOTE:

1 - For 50 Hertz speeds use the next higher 60 Hertz speed (example - for 1500 RPM, use 1800 RPM curve).

2 - For 1200 RPM, use the 1800 RPM curves. If the seal chamber pressure exceeds those shown for 1800 RPM, consult the Dura seal vendor for a possible change in limitations.

PV CURVES
for
Balanced and Unbalanced Crane Seals
EXCEPT 8B2



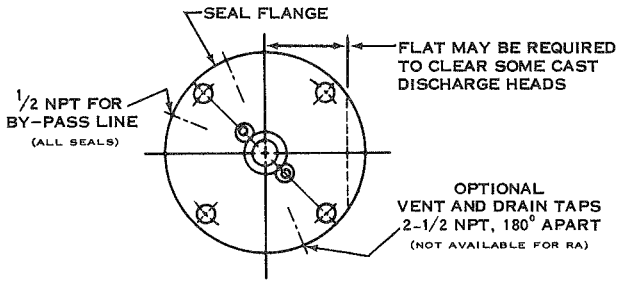
NOTE:

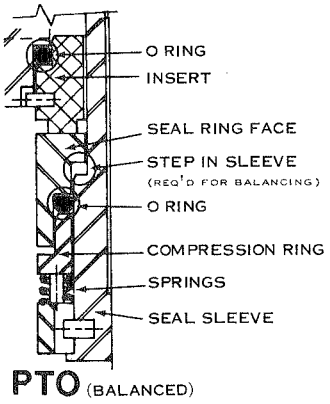
1 - Curves are based on faces (washers and seats) of carbon versus ceramic, stellite or tungsten carbide.

2 - For 50 Hertz speeds use next higher 60 Hertz speed (example - for 1500 RPM, use 1800 RPM curve).

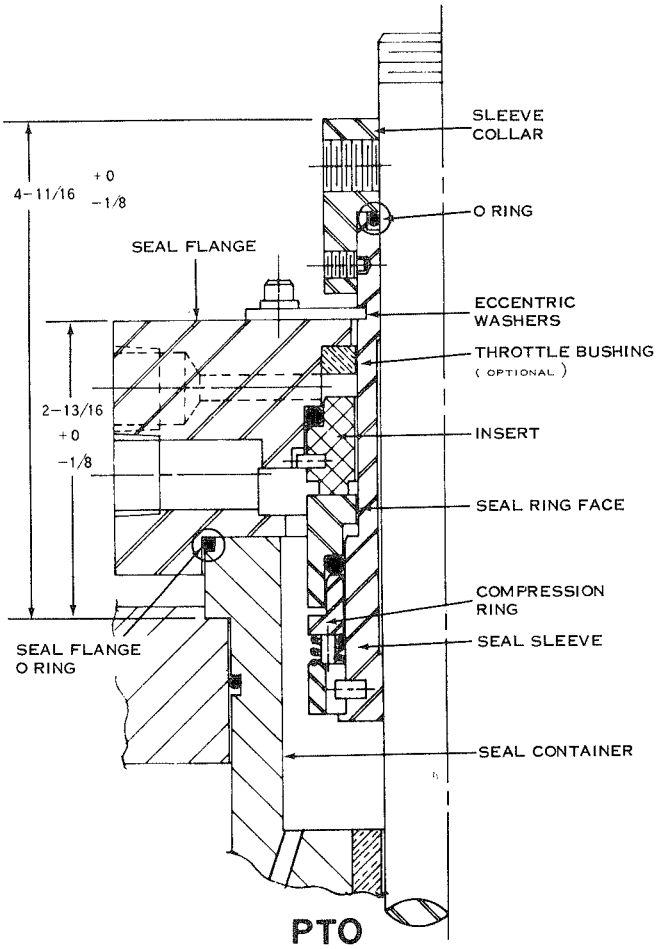
3 - For 1200 RPM, use the 1800 RPM curves. If the seal chamber pressure exceeds those shown for 1800 RPM, consult the crane seal vendor for a possible change in limitations.

DURA SEALS
Types PTO, PT, RO, ROTT and RA



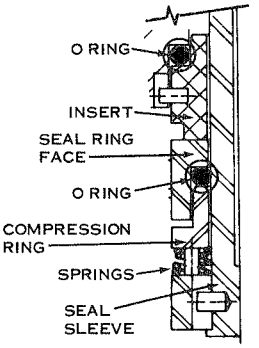


PTO (BALANCED)



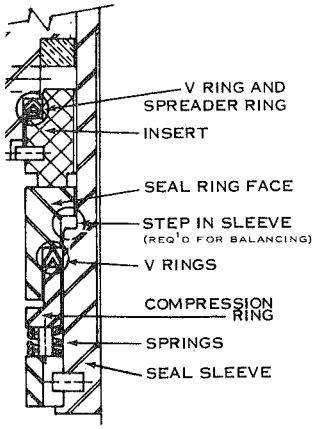
PTO

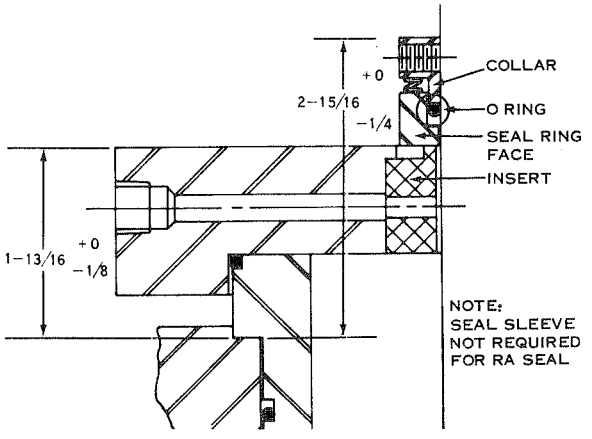
SHOWN HERE FOR GENERAL ARRANGEMENT PURPOSES. FLANGE AND SLEEVE COLLAR INFORMATION SAME FOR ALL SEALS EXCEPT RA SHOWN BELOW.



RO (UNBALANCED)

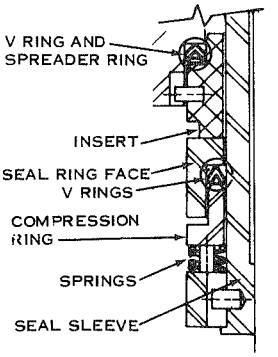
PT (BALANCED)



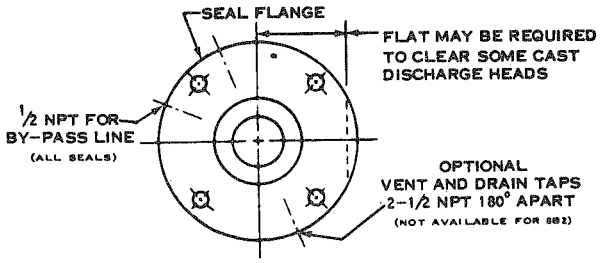


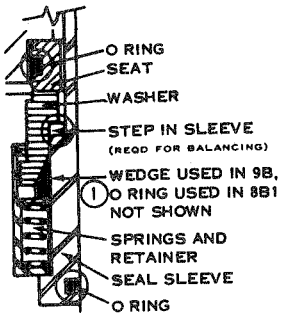
RA (BALANCED)
OUTSIDE TYPE

ROTT (UNBALANCED)

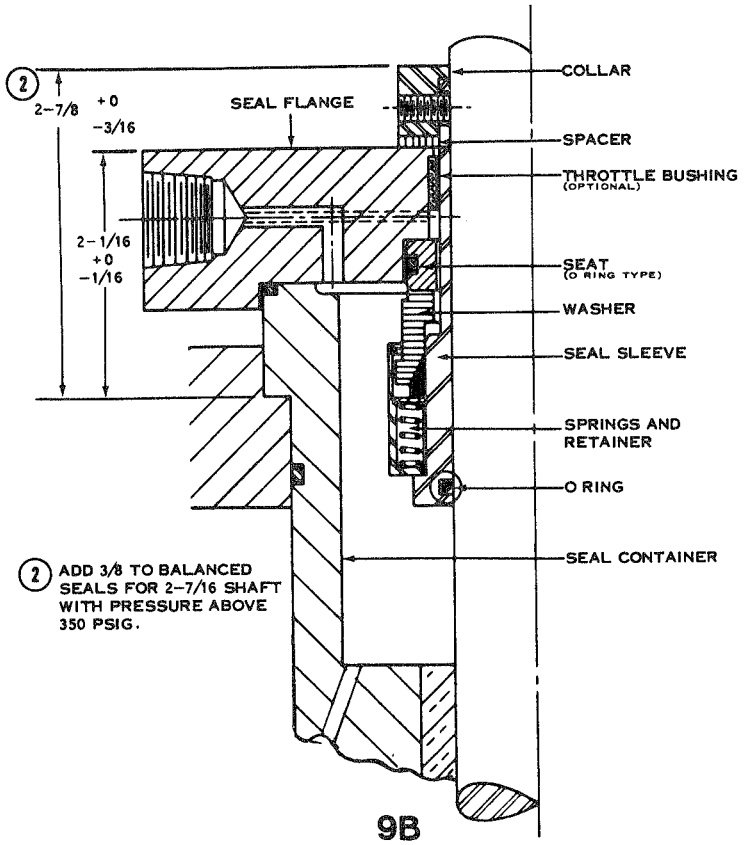


JOHN CRANE SEALS
Types 9B,9,1B,1,8B1 and 8B2



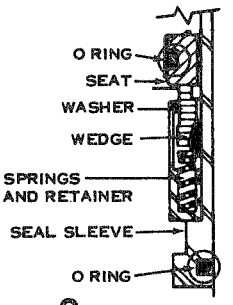


9B or 8B1 (BALANCED) ①



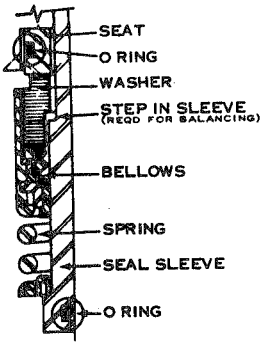
9B

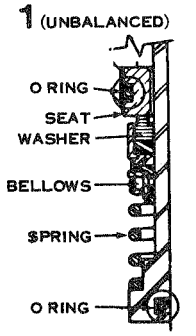
SHOWN HERE FOR GENERAL ARRANGEMENT PURPOSES. FLANGE AND SLEEVE COLLAR INFORMATION SAME FOR ALL SEALS EXCEPT 8B2 SHOWN BELOW.



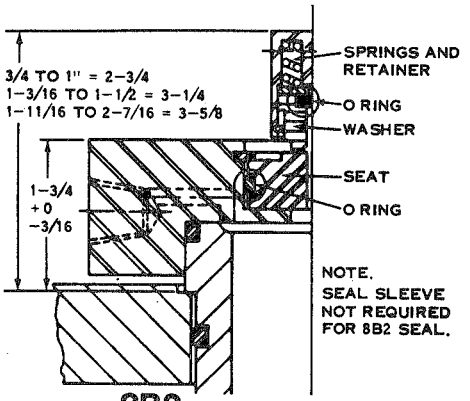
9 (UNBALANCED)

1B (BALANCED)





1 (UNBALANCED)

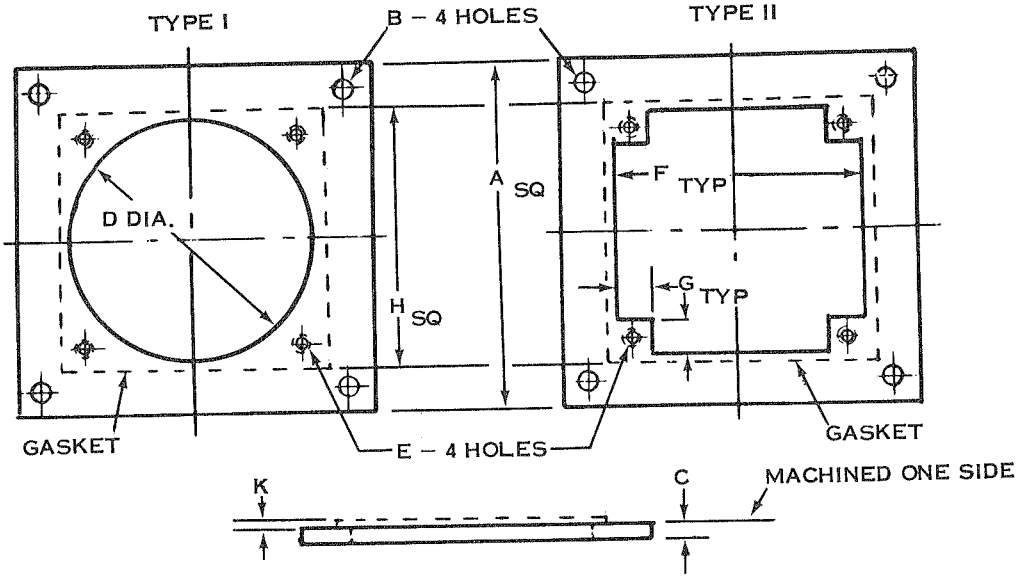


8B2 (BALANCED) OUTSIDE TYPE

Steel Sole Plates

for Type UG

Underground Discharge Head

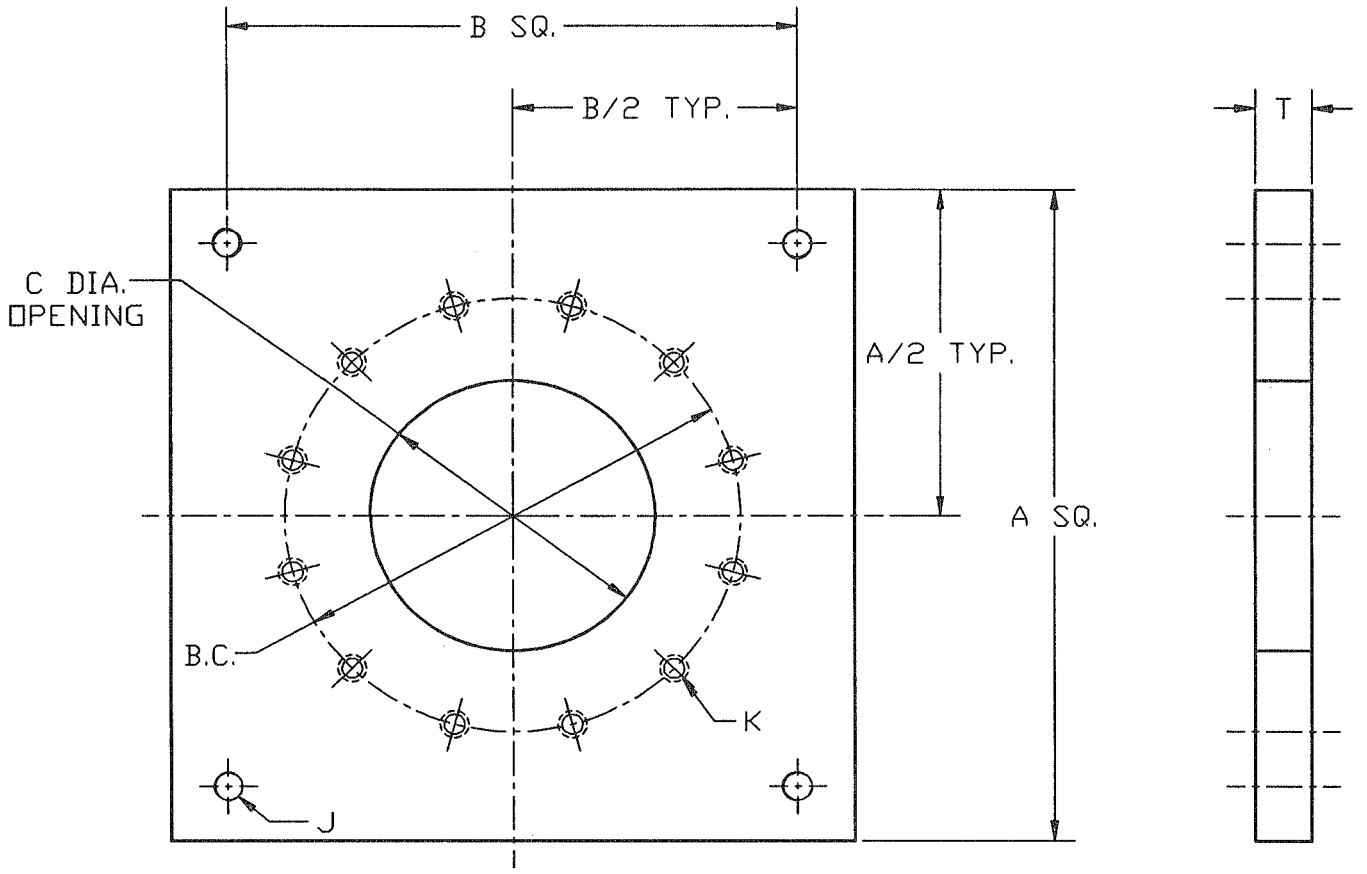


GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

UG BASE SIZE	TEE SIZE	TYPE	A	B		C	D	E		F	G	H	K	FOUNDATION DIA OPENING (1)		
				DIA	SQ			SIZE	SQ					MIN	NOM	MAX
6x10UG	4"	I	16½	3/4	14½	1/2	12½	5/8-11 NC	10½	—	—	14	1/16	12½	13	13
	5"															
	6	II	16½	3/4	14½	1/2	—	5/8-11 NC	10½	12¼	1¾	14	1/16	14	14	14
12x16½UG	4"	I	29	1-1/8	25½	7/8	21	3/4-10 NC	19	—	—	23¾	1/16	12½	21	23
	5"													12½	21	23
	6"													14	21	23
	8"													19	21	23
	10"													21	21	23
	12"	II	29	1-1/8	25½	7/8	—	3/4-10 NC	19	20½	2¼	23¾	1/16	25	25	25
12x24½UG	6"	I	37	1-1/4	33½	1"	25	7/8-9 NC	26	—	—	31¾	1/8	14	25	31
	8"													19	25	31
	10"													21	25	31
	12"													25	25	31
16x30½UG	10"	I	46	1-1/4	41½	1"	31	7/8-9 NC	32	—	—	38¾	1/8	21	31	38
	12"													25	31	38
	14"													27½	31	38
	16"													31	31	38

(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.

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



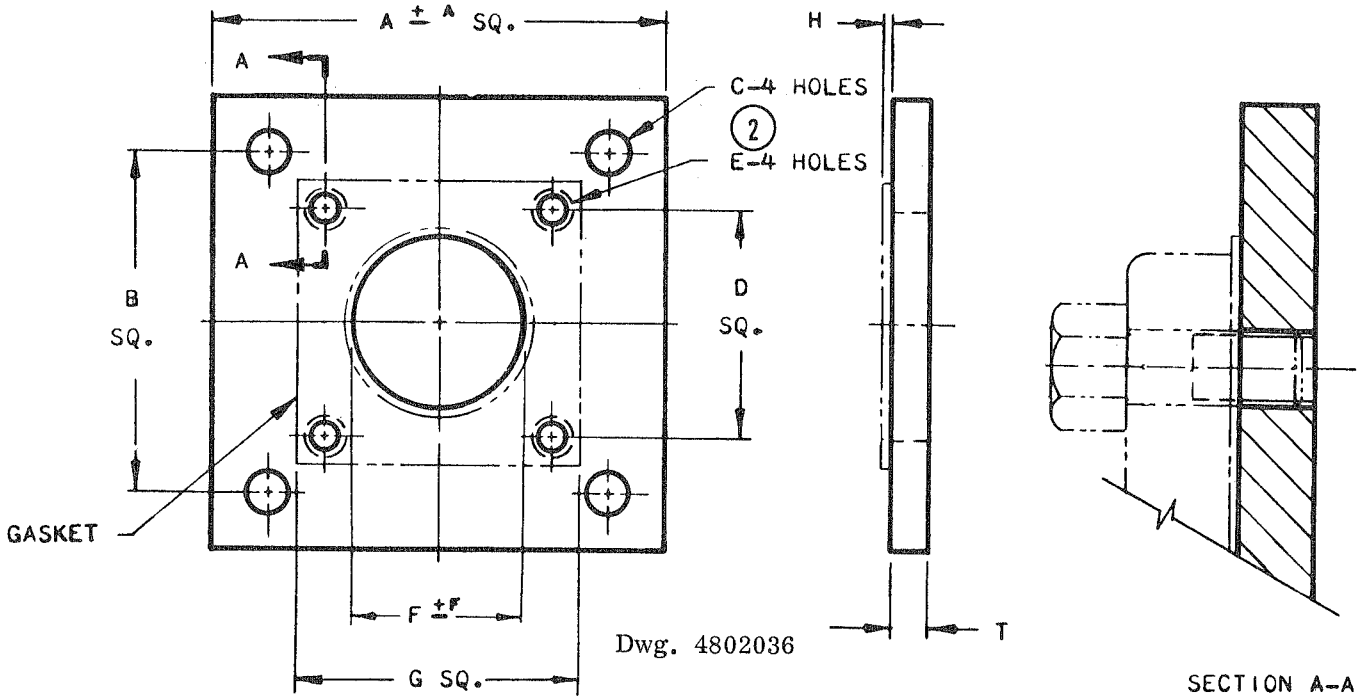
GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

✓	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

Subject to change without notice

DWG. NO. **4853647**

Steel Sole Plates
for Type S
Cast Iron Heads



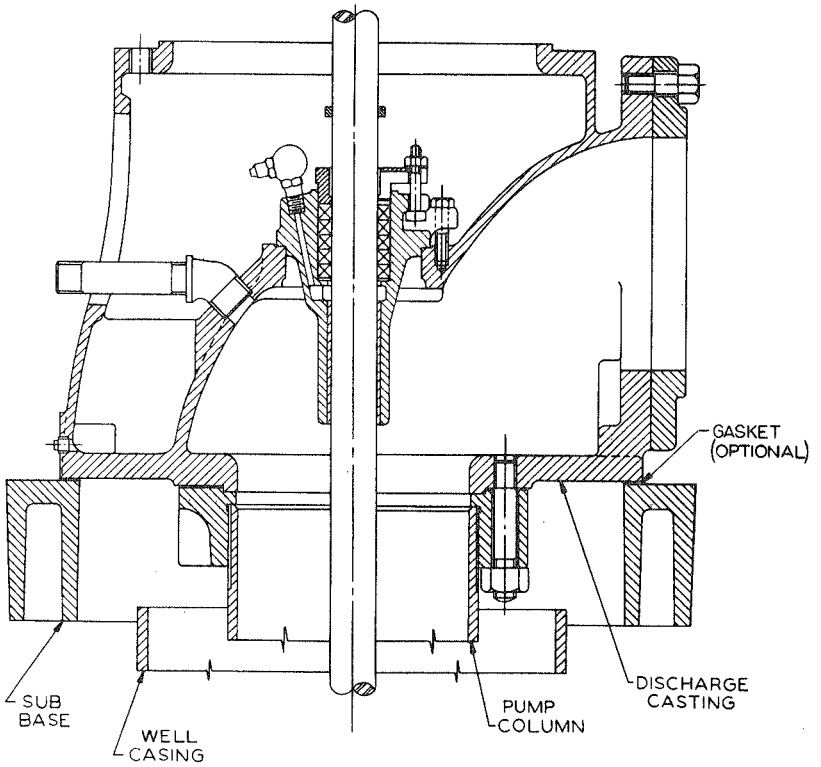
Dwg. 4802036

GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

HEAD SIZE	A	B	C	D	E	F	G	H	T
2½ x 2½ x 10S	14½	13	3/4	9-1/4	3/8-16 UNC	9	13	1/16	1/2
2½ x 3 x 10S	14½	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	21¼	7/8	15	5/8-11 UNC	14½	17-1/2	1/16	3/4
6 x 8 x 16½S	26	23	1-1/8	18	3/4-10 UNC	16½	20-1/2	1/16	7/8
8 x 8 x 16½S	26	23	1-1/8	18	3/4-10 UNC	16½	20-1/2	1/16	7/8
10 x 10 x 16½S	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	20½	23-1/2	1/16	7/8
14 x 14 x 24½S	36	32	1-1/4	25	3/4-10 UNC	24½	28-3/4	1/8	1
16 x 16 x 30½S	42	39	1-1/4	32	3/4-10 UNC	28	38-3/4	1/8	1

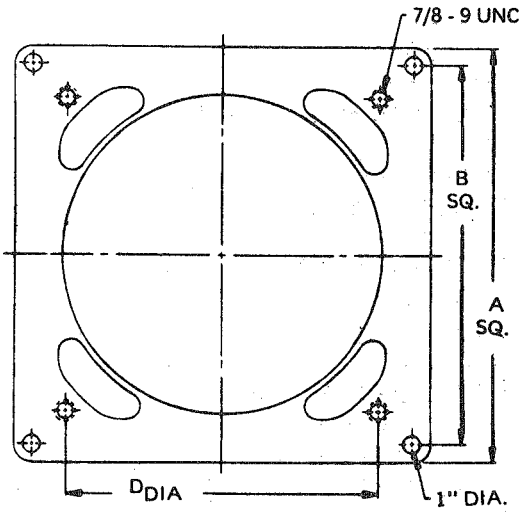
NOTE: Standard soleplate is machined on one side.

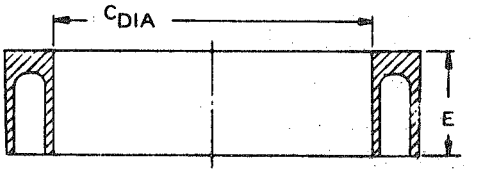
Cast Iron Sub-Base for Type S Cast Iron Heads



GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

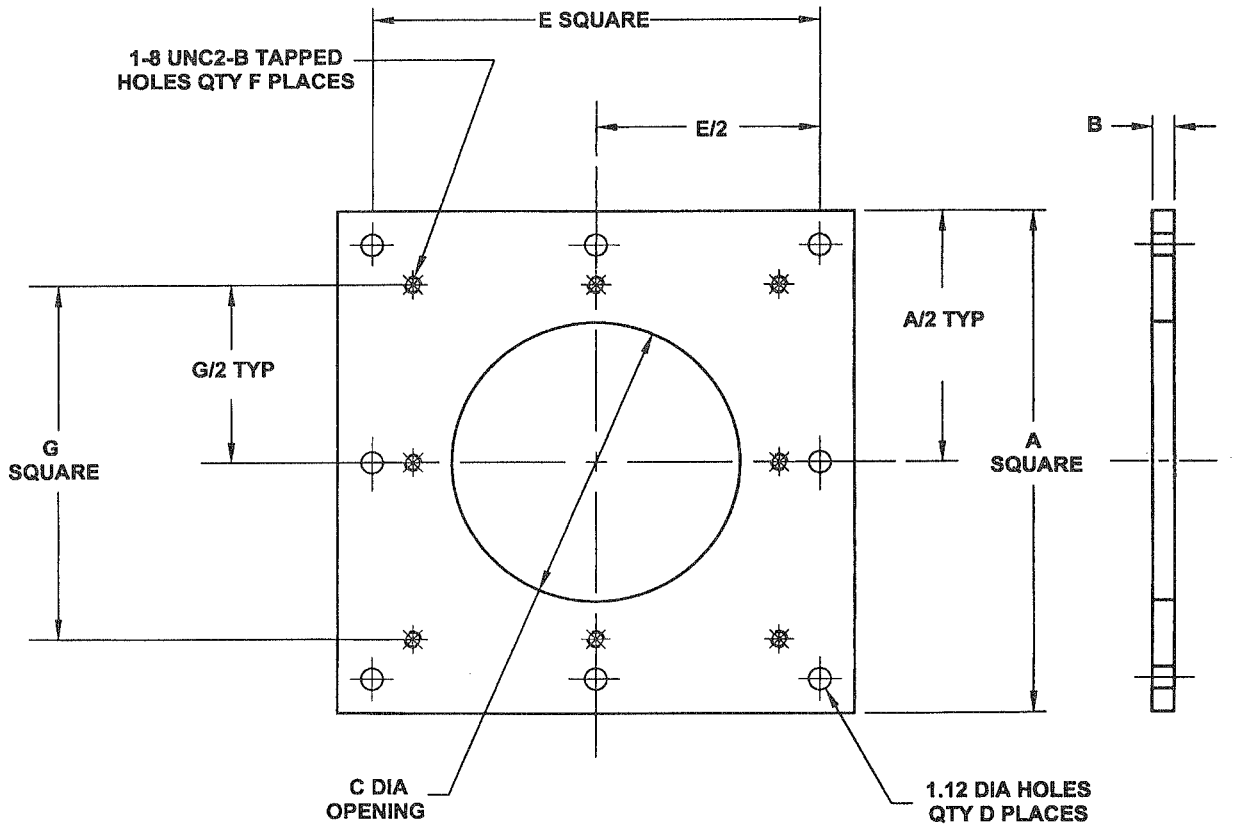
For Head Size	A	B	C	D	E	Sub Base Part No.
6x8x16½S	24	21¼	18½	18	3¾	2622459
8x8x16½S	24	21¼	18½	18	3¾	2622459
10x10x16½S	24	21¼	18½	18	3¾	2622459
10x10x20S	24	21¼	18½	18	3¾	2622459
12x12x20S	27	24	22	2	3¾	2622456
14x14x24½S	32	29	26½	25	3¾	2622452





Dwg. No. 2832533

VERTICAL TURBINE PUMPS
Discharge Heads Type FA
Sole Plates



All Dimensions are in Inches

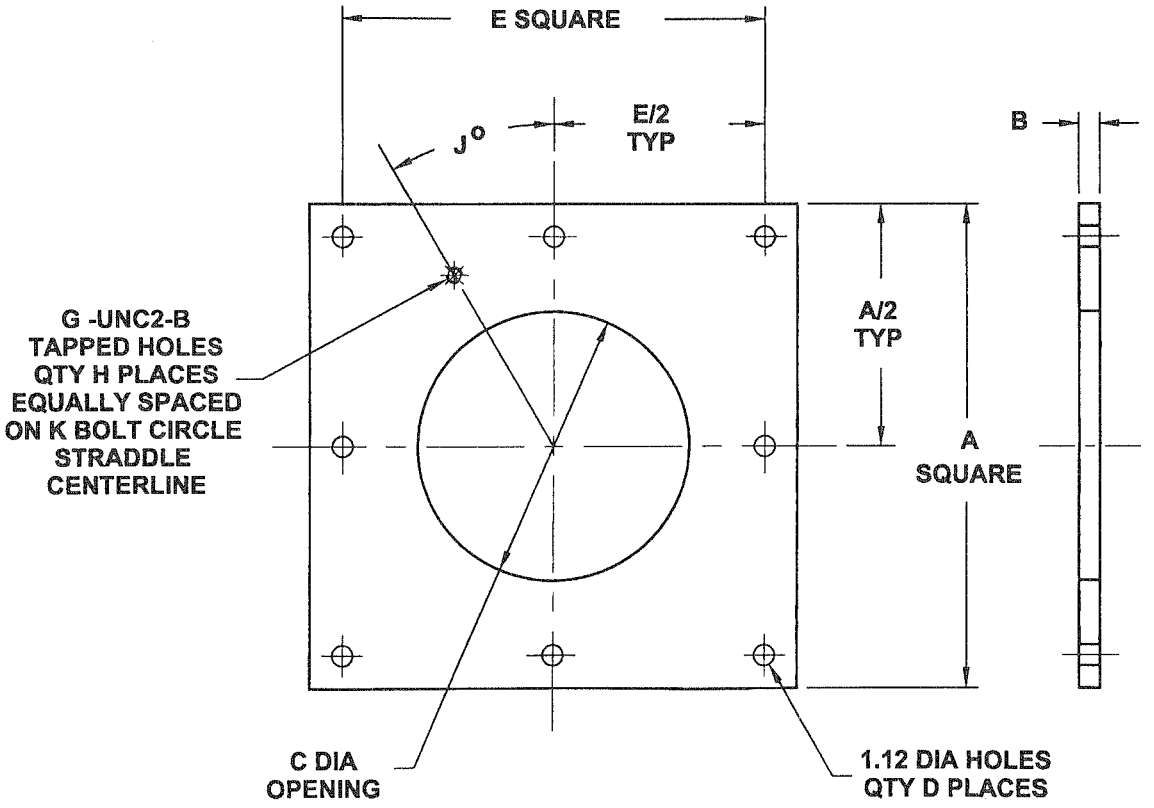
FA Sole Plates Dimensional Data

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	141
8x8x12 FA	4601778	28.00	1.12	19.00	4	24.50	4	19.00	157
8x8x16.5 FA	4601778	28.00	1.12	19.00	4	24.50	4	19.00	157
10x10x16.5 FA	4601780	30.00	1.12	21.50	4	26.50	4	21.00	168
10x10x20 FA	4601780	30.00	1.12	21.50	4	26.50	4	21.00	168
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	4601784	36.00	1.12	27.00	8	32.50	4	27.00	238
14x14x24.5 FA	4601784	36.00	1.12	27.00	8	32.50	4	27.00	238
16x16x20 FA	4601784	36.00	1.12	27.00	8	32.50	4	27.00	238
16x16x24.5 FA	4601784	36.00	1.12	27.00	8	32.50	4	27.00	238
16x16x30.5 FA	4604414	42.50	1.25	29.00	8	39.00	8	33.00	368
18x18x24.5 FA	4604414	42.50	1.25	29.00	8	39.00	8	33.00	368
18x18x30.5 FA	4604414	42.50	1.25	29.00	8	39.00	8	33.00	368
20x20x24.5 FA	4604414	42.50	1.25	29.00	8	39.00	8	33.00	368
20x20x30.5 FA	4604414	42.50	1.25	29.00	8	39.00	8	33.00	368
24x24x24.5 FA	4604415	48.50	1.25	35.00	8	45.00	8	39.00	487
24x24x30.5 FA	4604415	48.50	1.25	35.00	8	45.00	8	39.00	487

Subject to change without notice

Drawing No. 4853841

VERTICAL TURBINE PUMPS
Discharge Heads
Type FR Sole Plates



All dimensions are in inches

FR Sole Plates Dimensional Data

Discharge Head Size	Sole Plate Part No.	Sole Plate			Anchor Bolt		Base Plate Hole				Sole Plate Approx Wt Lb
		L x W	Thick	Id	Qty	Dim	Bolt Thd	Qty	Angle	BC	
		A	B	C	D	E	G	H	J	K	
16X16X20 FR	4604411	38.50	1.12	22.50	8	35.00	1.00	4	45.0	29.50	340
16X16X24.5 FR	4604411	38.50	1.12	22.50	8	35.00	1.00	4	45.0	29.50	340
16X16X30.5 FR	4604412	43.00	1.25	22.50	8	39.50	1.00	8	22.5	34.00	508
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

Subject to change without notice

Drawing No. 4853840

Standard Column Construction Data

PIPE, SHAFT AND OIL TUBE

	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

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.

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'

Column Length (1)	Quantities of Pipes and Bearing Retainers (Bearing Spacing)											
	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'	10'	5'	10'
5'	1	0	5'	—	Not Available (5)						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.

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
2½" Std.	40	.203	5.79	2#	8	3/16	3-1/4	—	—
3" Std.	40	.216	7.57	3	8	3/16	3-15/16	6-1/4	—
4" Std.	40	.237	10.79	4	8	3/16	5-3/32	7-1/4	—
5" Std.	40	.258	14.61	8½	8	3/16	6-5/16	8-3/8	—
6" - ¼" 6" Std.	— 40	.250 .280	17.02 18.97	9	8	3/16	7-3/8	9-5/8	9-3/4
8" - ¼" 8" Std.	20 30	.250 .277	22.36 24.69	13½	8	3/16	9-7/16	11-5/8	12
10" - ¼" 10" Std.	20 —	.250 .279	28.04 31.20	28	8	3/16	11-3/4	14	14 (4)
12" Std.	30	.330	43.77	42½	8	3/16	13-15/16	16-1/4	16-1/4 (5)
14" O. D.	30	.375	54.57	40	8	3/16	15-7/16	18	—
16" O. D.	30	.375	62.58	56	8	3/16	17-7/16	20	—
18" O. D.	—	.375	70.59	—	—	—	—	23-1/4	—
20" O. D.	20	.375	78.60	—	—	—	—	25-1/4	—
24" O. D.	20	.375	94.62	—	—	—	—	29-3/4	—

(1) Weight does not include couplings or flanges.

(2) T. P. I. = threads per inch.

(3) Pipe couplings have straight thread.

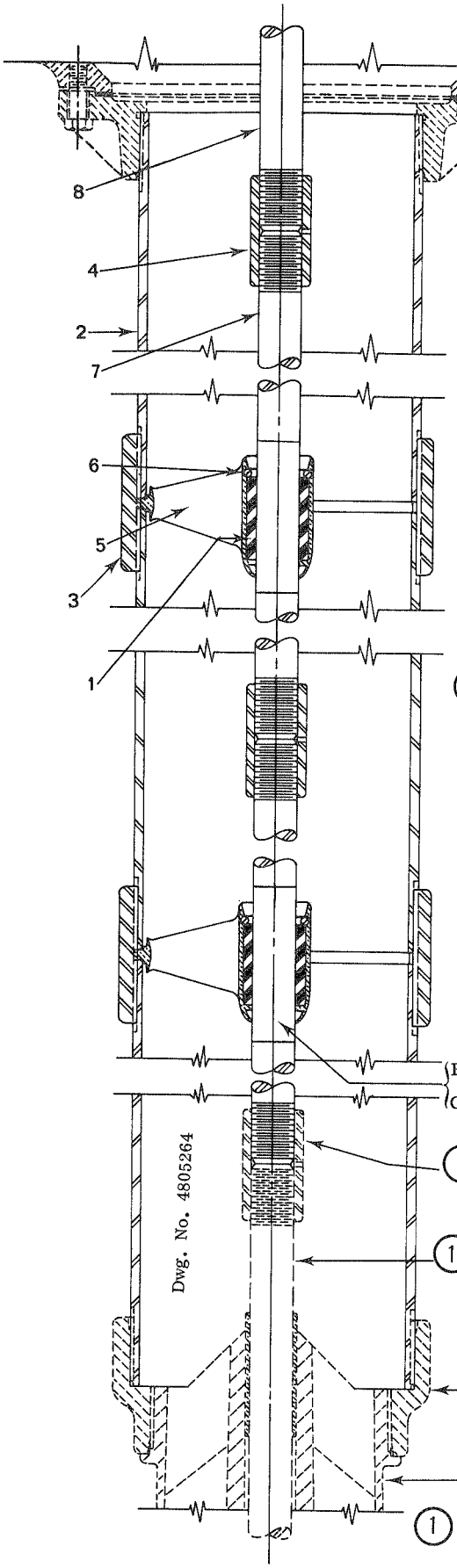
(4) Bottom Flange O.D. for 15LC, 15-1/8".

(5) Bottom Flange O.D. for 18HXB, 18".

SHAFT AND TUBE WEIGHTS PER FOOT

Shaft Diameter	3/4"	1"	1-3/16"	1-1/2"	1-11/16"	1-15/16"	2-3/16"	2-7/16"	2-11/16"	2-15/16"	3-3/16"	3-7/16"	3-11/16"	3-15/16"
Wt. of Shaft, ft.	1.50	2.67	3.77	6.01	7.60	10.02	12.78	15.86	19.29	23.04	27.13	31.56	36.31	41.40
Size of Tube	1¼"	1½"	2"	2½"	3"	3"	3½"	4"	5"	5"	5"	5"	6"	6"
Wt. of Tube, ft.	2.99	3.63	5.02	7.66	10.25	10.25	12.50	14.98	20.78	20.78	20.78	20.78	28.57	28.57

Open Line Shaft Column Assembly
Threaded and Coupled



PARTS LIST (standard construction)

Item No.	Part Name	Standard Material
1	Bearing, shaft	Neoprene
2	Column, OLS Threaded	Steel, low carbon
3	Coupling, Pipe	Steel, low carbon
4	Coupling, Shaft	Steel, AISI 1215
5	Retainer, Bearing	Brz., ASTM B-145 Modified
6	Ring, Brg. Retainer lock	302 Stainless Steel
(2)	or	
	Nut, Brg. Retainer lock	Bronze, SAE 63
7	Shaft, OLS Column	Steel, SAE C-1045 (3)
8	Shaft, OLS Top	416 Stainless Steel
	or	
	Shaft, Second Top	416 Stainless Steel

(2) Lock nut (not shown) is used on retainers for 2-7/16 and larger shafts only.

(3) 3/4 shaft and 2-7/16 and larger shafts are standard in 416 S.S.

Flame sprayed stn. stl. journal is std. on 1" thru 1-15/16 C-1045 stl. shafts.
Chrome plated section is std. on 2-3/16 C-1045 stl. shaft.

(1) Coupling, Impeller Shaft

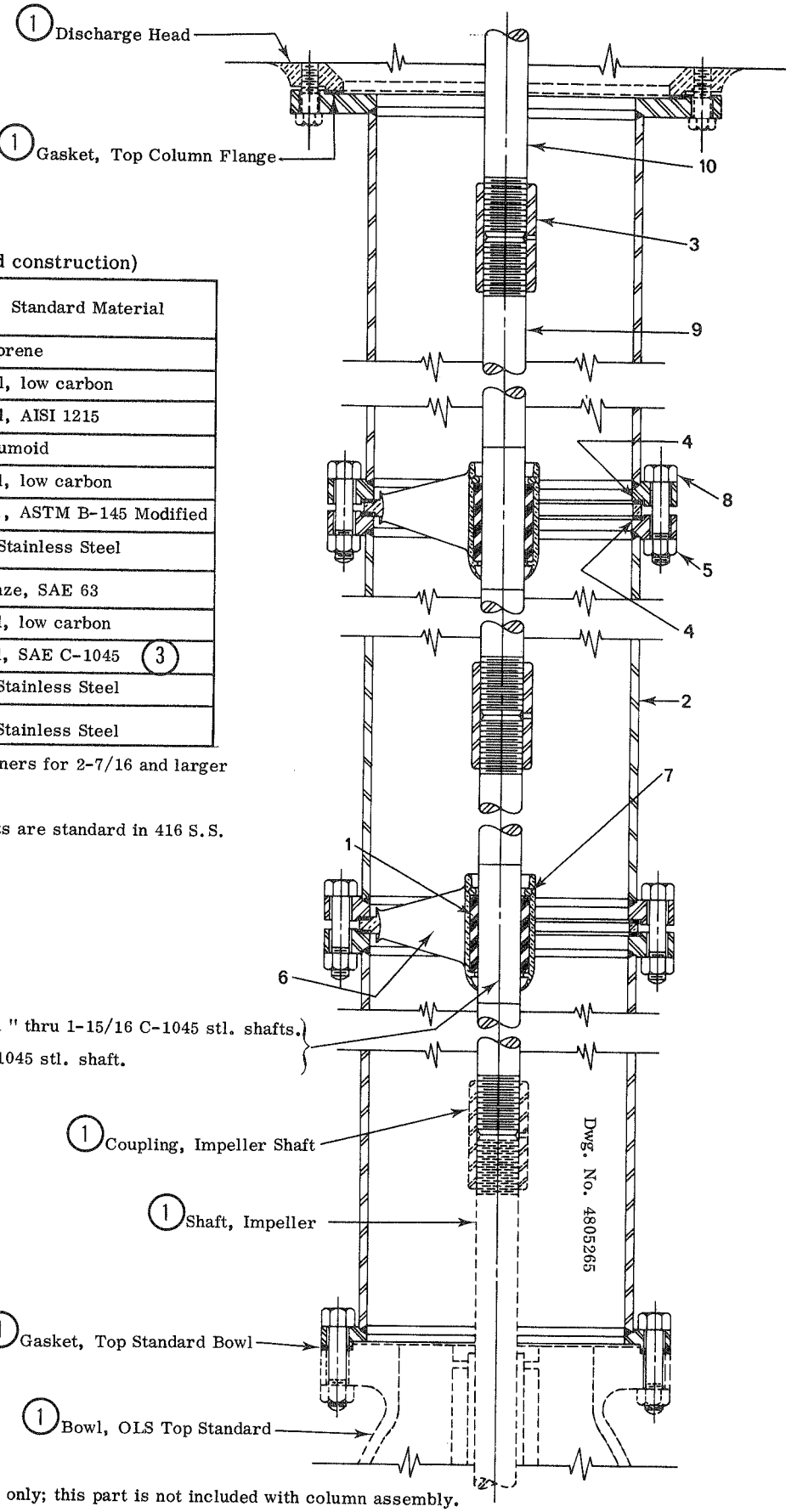
(1) Shaft, Impeller

(1) Adapter, Column

(1) Bowl, OLS Top

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

Open Line Shaft Column Assembly
Flanged Type F



PARTS LIST (standard construction)

Item No.	Part Name	Standard Material
1	Bearing, shaft	Neoprene
2	Column, OLS Flanged	Steel, low carbon
3	Coupling, Shaft	Steel, AISI 1215
4	Gasket, Column Flange	Vellumoid
5	Nut, Hex	Steel, low carbon
6	Retainer, Bearing	Brz., ASTM B-145 Modified
(2) 7	Ring, Brg. Retainer lock	302 Stainless Steel
	or	
	Nut, Brg. Retainer lock	Bronze, SAE 63
8	Screw, Hex Head Cap	Steel, low carbon
9	Shaft, OLS Column	Steel, SAE C-1045 (3)
10	Shaft, OLS Top	416 Stainless Steel
	or	
	Shaft, Second Top	416 Stainless Steel

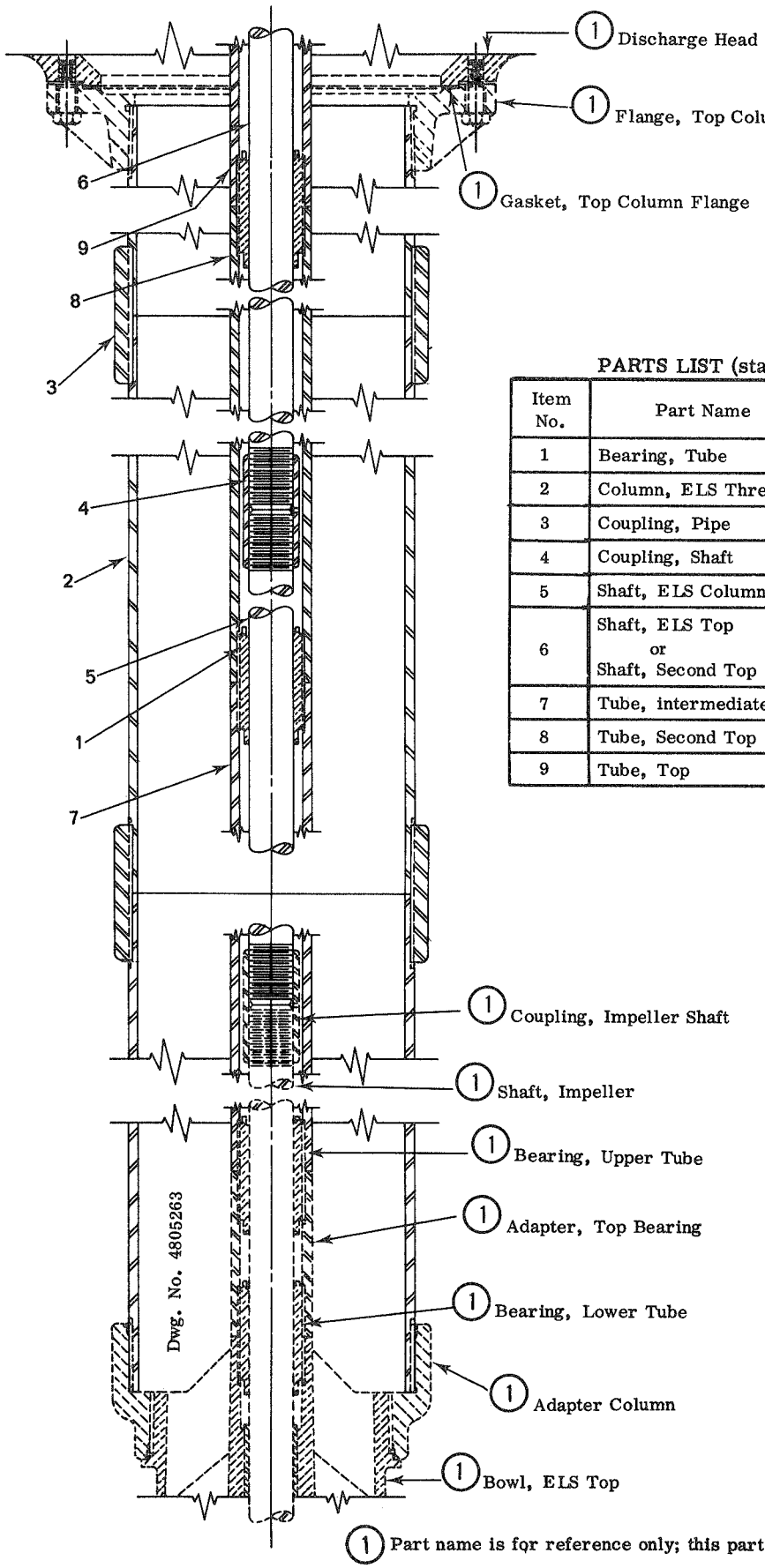
(2) Lock nut (not shown) is used on retainers for 2-7/16 and larger shafts only.

(3) 3/4 shaft and 2-7/16 and larger shafts are standard in 416 S.S.

Flame sprayed stn. stl. journal is std. on 1 " thru 1-15/16 C-1045 stl. shafts.
Chrome plated section is std. on 2-3/16 C-1045 stl. shaft.

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

Enclosed Line Shaft Column Assembly
Threaded and Coupled



PARTS LIST (standard construction)

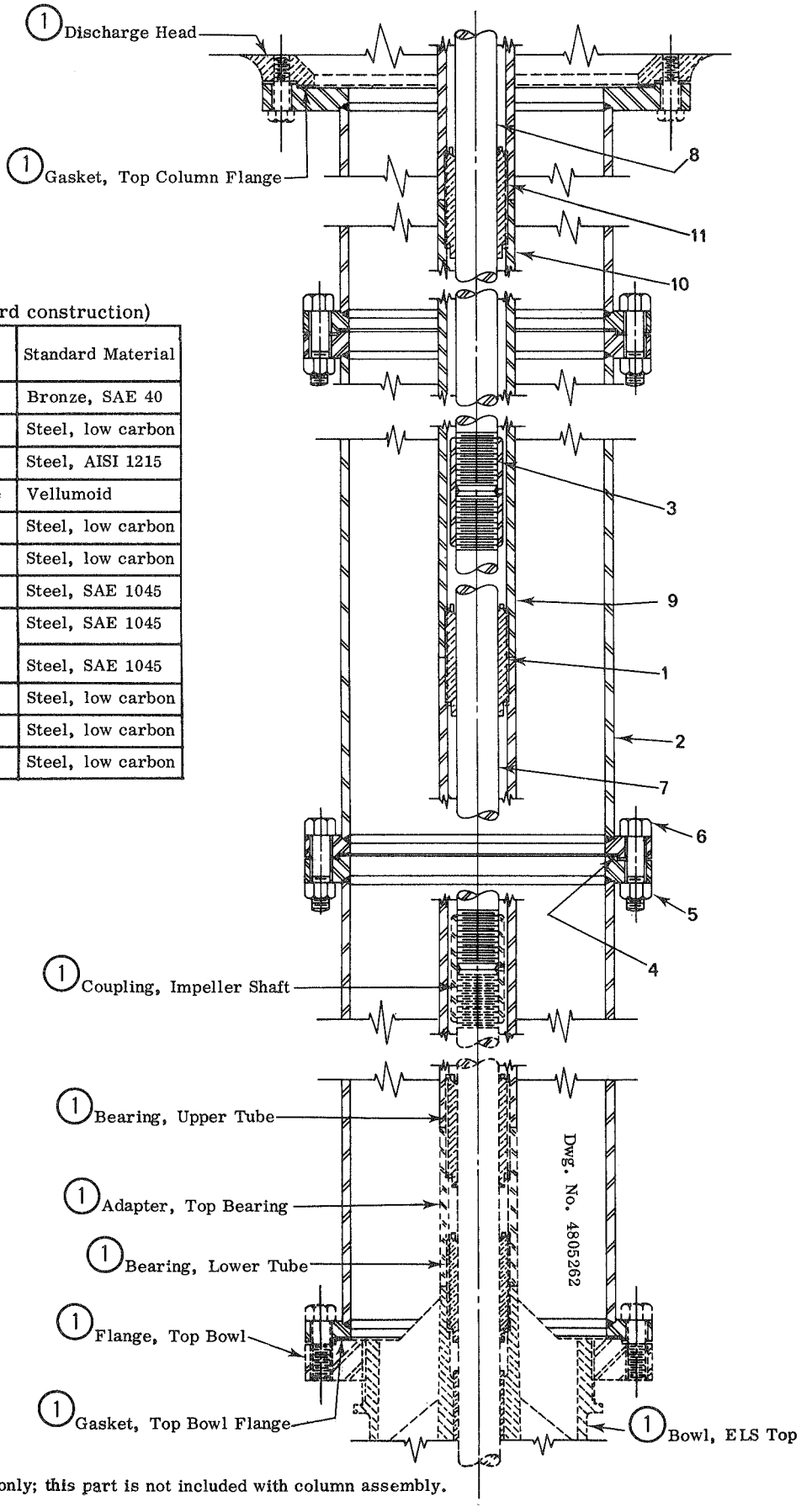
Item No.	Part Name	Standard Material
1	Bearing, Tube	Bronze, SAE 40
2	Column, ELS Threaded	Steel, low carbon
3	Coupling, Pipe	Steel, low carbon
4	Coupling, Shaft	Steel, AISI 1215
5	Shaft, ELS Column	Steel, SAE 1045
6	Shaft, ELS Top	Steel, SAE 1045
	or	
	Shaft, Second Top	Steel SAE 1045
7	Tube, intermediate	Steel, low carbon
8	Tube, Second Top	Steel, low carbon
9	Tube, Top	Steel, low carbon

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

Enclosed Line Shaft Column Assembly
Flanged Type F

PARTS LIST (standard construction)

Item No.	Part Name	Standard Material
1	Bearing, Tube	Bronze, SAE 40
2	Column, ELS Flanged	Steel, low carbon
3	Coupling, Shaft	Steel, AISI 1215
4	Gasket, Column Flange	Vellumoid
5	Nut, Hex	Steel, low carbon
6	Screw, Hex Head Cap	Steel, low carbon
7	Shaft, ELS Column	Steel, SAE 1045
8	Shaft, ELS Top or Shaft, Second Top	Steel, SAE 1045 Steel, SAE 1045
9	Tube, intermediate	Steel, low carbon
10	Tube, Second Top	Steel, low carbon
11	Tube, Top	Steel, low carbon

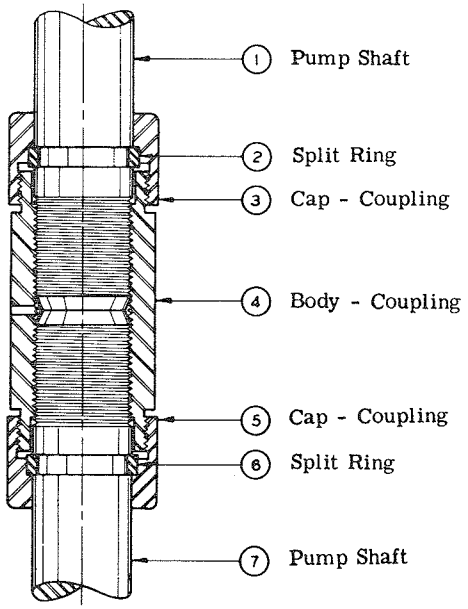


(1) Part name is for reference only; this part is not included with column assembly.

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.



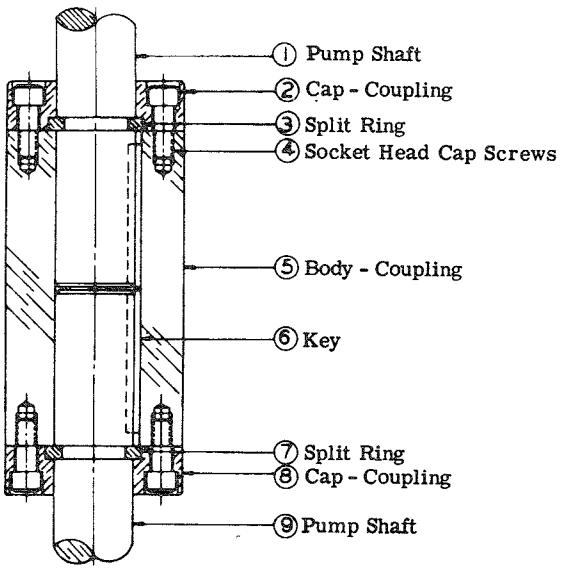
Drawing No 2805075

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.



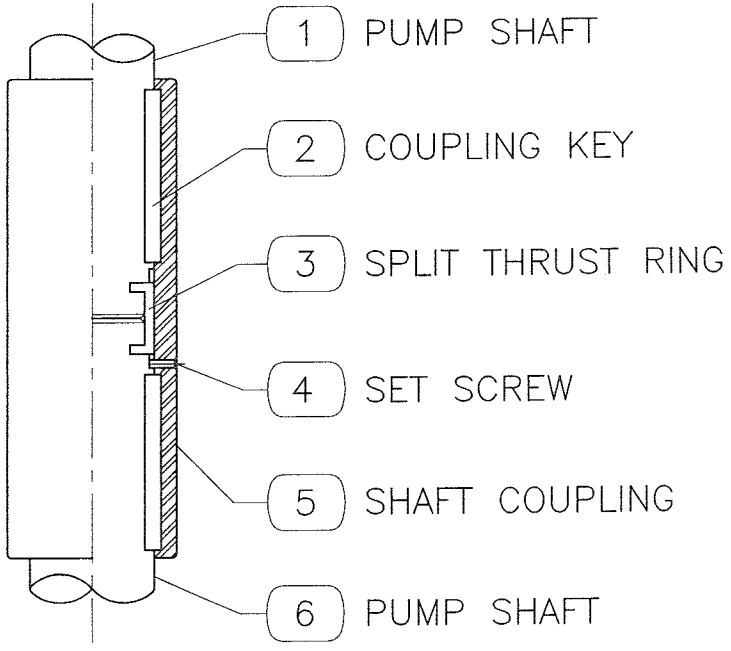
Drawing No 2625061

M 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.



General Bowl Assembly Information and Data

Standard First Stage Price Includes:

Cast iron-enameled top bowl, with bronze bearings, bronze or polished cast iron impeller, steel taperlock bushing, cast iron suction manifold with extra long bronze bearings and lateral bowl wear ring (Group A), 416SS impeller shaft, adapted for Peerless standard column.

Standard Additional Stage Includes:

Cast iron-enameled standard bowl with dual bearings (bronze and rubber-Group A) or all bronze (Group B), bronze or polished cast iron impeller, steel taperlock bushing, lateral bowl wear ring (Group A) and additional 416SS shaft.

Data Required With Order:

Maximum total head.

Maximum capacity in gpm.

Speed (rpm).

Well diameter.

Where special adaption is required to column other than Peerless, the following data should also be included with the order.

Column size.

Column threading

Column tube stick-up.

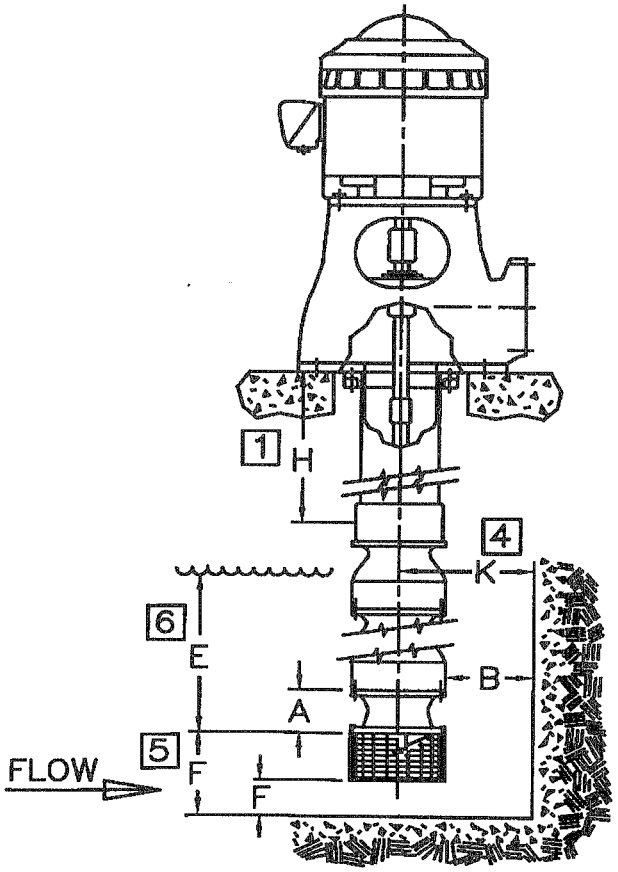
Shaft stick-up.

The hydraulic guarantee is limited to clear water, 80°F or less.

Standard construction with neoprene bearings is mechanically limited to 115°F.

Vertical Turbine Pumps
Bowls

Bell Suction
With Clip on Strainer



Threaded Suction
With Basket on Strainer

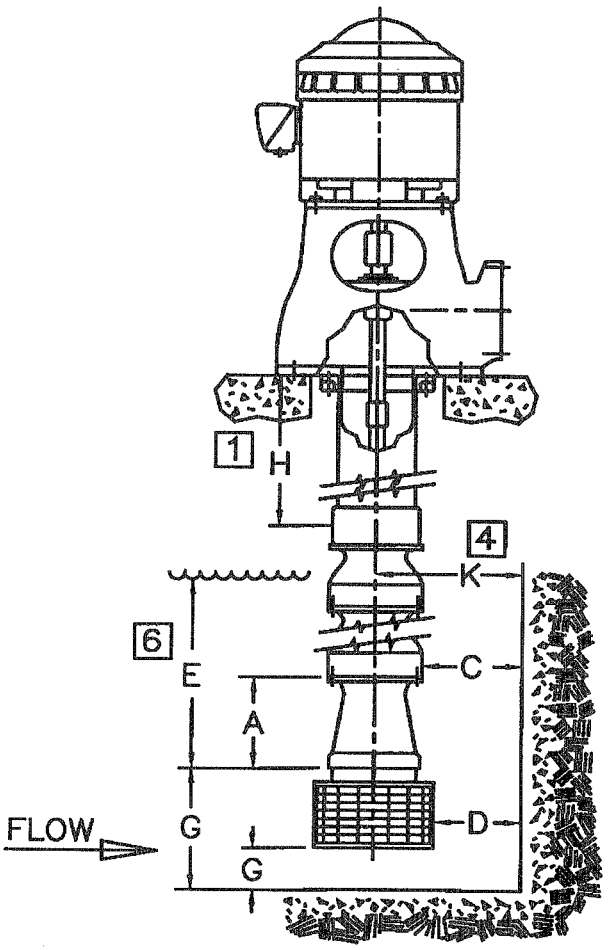


Figure 1.1

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

Material Specifications for Turbine Pump Bowl Unit Assemblies

IN GROUP "A" CONSTRUCTION

a) Enamel bowls furnished thru 20" size. Over 20" bowls are plastic coated.

b) Dual rubber and bronze bowl bearings furnished thru 14" size. (Except 11MB) Over 14" bowl bearings will be bronze.

(1) 4LE, 4LO, 6HXB, 7HXB, 8HXB, 8MFH and 10MFH in 40 brz only. 6LB, 7LB and 8LB in 40 brz or CI only; CIE not available. 6MA and 8MA in 40 brz or CI; CIE available on special order.

(2) At factory option, 660 brz bearings may be substituted for G1800 ci bearings on hydrocarbons & salt water applications.

(3) Where nf is indicated for top bowl, a top std bowl is furnished. (ELS applications must be referred to factory).

(4) Castings will be A743 Grades CA15 or CA6NM at factory option.

GROUP	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	U	V
Part	standard	standard industrial	all iron pump with iron bushings	ci bowls & 316 ss impellers	ci bowls & ni-resist impellers	SAE 40 brz bowls SAE 40 brz impellers	all zincless SAE 63 brz bowls & impellers	SAE 63 bowls & 316 ss impellers	cast steel bowls & bronze impellers	cast steel bowls & 410 ss impellers (4)	12% Cr. Stl. bowls & 12% Cr. Stl. impellers (4)	304 ss bowls & 304 ss impellers	ni-resist bowls & ni-resist impellers	ni-resist bowls & 304 ss impellers	28-9 ss bowls & 28-9 ss impellers	316 ss bowls & 316 ss impellers	20 ss bowls & 20 ss impellers	monel bowls & monel impellers	Ni Al. Brz Bowl Impeller
Coupling Shaft	steel	steel	steel	316 ss	410 ss	410 ss	303 ss	316 ss	steel	steel	303 ss	303 ss	303 ss	303 ss	316 ss	316 ss	20 ss	k monel	NIT-60
Impeller Shaft	416 ss	416 ss	416 ss	316 ss	416 ss	416 ss	316 ss	316 ss	416 ss	416 ss	416 ss	303 ss	303 ss	303 ss	316 ss	316 ss	20 ss	k monel	NIT-50
Top Bowl	ci, enam	ci, enam	ci, enam	ci, enam	ci, enam	SAE 40 brz	SAE 63 brz	SAE 63 brz	nf (3)	nf (3)	nf (3)	nf (3)	nf (3)	nf (3)	nf (3)	nf (3)	nf (3)	nf (3)	Ni Al.
Top Std Bowl	ci, enam	ci, enam	ci, enam	ci, enam	ci, enam	SAE 40 brz	SAE 63 brz	SAE 63 brz	cast steel	cast steel	12% Cr. Stl.	304 ss	type II ni-resist	type II ni-resist	28-9 ss	316 ss	20 ss	cast monel	Ni Al.
Standard Bowl	ci, enam	ci, enam	ci, enam	ci, enam	ci, enam	SAE 40 brz	SAE 63 brz	SAE 63 brz	cast steel	cast steel	12% Cr. Stl.	304 ss	type II ni-resist	type II ni-resist	28-9 ss	316 ss	20 ss	cast monel	Ni Al.
Suction Manifold: threaded	ci	ci	ci	ci	ci	SAE 40 brz	SAE 63 brz	SAE 63 brz	cast steel	cast steel	12% Cr. Stl.	304 ss	type II ni-resist	type II ni-resist	28-9 ss	316 ss	20 ss	cast monel	Ni Al.
Suction Bell	ci	ci	ci	ci	ci	SAE 40 brz	SAE 63 brz	SAE 63 brz	cast steel	cast steel	12% Cr. Stl.	304 ss	type II ni-resist	type II ni-resist	28-9 ss	316 ss	20 ss	cast monel	Ni Al.
Suction Manifold Plug	ci	ci	ci	ci	ci	316 ss	316 ss	316 ss	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	316 ss
Impeller	SAE 40 brz, ci (1)	SAE 40 brz, ci (1)	ci (1)	316 ss	type II ni-resist	SAE 40 brz	SAE 63 brz	316 ss	SAE 40 brz	410 ss	12% Cr. Stl.	304 ss	type II ni-resist	304 ss	28-9 ss	316 ss	20 ss	cast monel	Ni Al.
Impeller Taper Lock	steel	steel	steel	316 ss	303 ss	303 ss	303 ss	316 ss	steel	303 ss	303 ss	303 ss	303 ss	303 ss	316 ss	316 ss	20 ss	k monel	316 ss
Top Bowl Bearing	SAE 660 brz	SAE 660 brz	G1800 ci (2)	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 67 brz	SAE 660 brz	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	SAE 67
Top Std Bowl Bearing	SAE 660 brz & neoprene	SAE 660 brz	G1800 ci (2)	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 67 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	graphitar #80	SAE 660 brz	SAE 67
Standard Bowl Bearing	SAE 660 brz & neoprene	SAE 660 brz	G1800 ci (2)	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 67 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	graphitar #80	SAE 660 brz	SAE 67
Suction Manifold Bearing	SAE 660 brz	SAE 660 brz	G1800 ci (2)	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 67 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	SAE 660 brz	graphitar #80	SAE 660 brz	SAE 67
Caps Screws or Studs and Nuts For Bowl Flanges	steel	steel	steel	steel	steel	416 ss	18-8 ss	18-8 ss	steel	steel	416 ss	18-8 ss	18-8 ss	18-8 ss	316 ss	316 ss	20 ss	monel	316 ss
Lateral Bowl Wear Ring	neoprene with steel core	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
Sand Collar	steel	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
Sand Collar Set Screw	303 ss	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
Upper Tube Bearing	SAE 40 brz	SAE 40 brz	nf	SAE 40 brz	SAE 40 brz	SAE 40 brz	SAE 63 brz	SAE 63 brz	Open Line Shaft Construction Recommended										
Lower Tube Bearing	SAE 40 brz	SAE 40 brz	nf	SAE 40 brz	SAE 40 brz	SAE 40 brz	SAE 63 brz	SAE 63 brz											
Top Bearing Adapter Straight Type	steel	steel	nf	steel	steel	steel	303 ss	303 ss	Refer To Factory For Enclosed Line Shaft Pricing										
Reducing or Increasing	ci	ci	nf	ci	ci	SAE 40 brz	SAE 63 brz	SAE 63 brz											
Column Adapter Straight Type	steel	steel	steel	steel	steel	steel	SAE 63 brz	SAE 63 brz	steel	steel	12% Cr. Stl.	304 ss	type II ni-resist	type II ni-resist	28-9 ss	316 ss	20 ss	cast monel	Ni Al.
Reducing or Increasing	ci	ci	ci	ci	ci	ci	SAE 63 brz	SAE 63 brz	cast steel	cast steel	12% Cr. Stl.	304 ss	type II ni-resist	type II ni-resist	28-9 ss	316 ss	20 ss	cast monel	Ni Al.
Suction Adapter Straight Type	steel	steel	steel	steel	steel	steel	SAE 63 brz	SAE 63 brz	Suction Bell Is Standard										
Reducing or Increasing	ci	ci	ci	ci	ci	ci	SAE 63 brz	SAE 63 brz	Threaded Type Suction Manifold Is Optional At Extra Cost										

nf = not furnished

Dwg. No. 2833366

OPEN LINE SHAFT STANDARD CONSTRUCTION

Refer to 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 Std.	H Disch. Head to Top Bowl Min. (1)	Col. Size (2)	RECOMMENDED SUMP CLEARANCE (3) Threaded Suction Without Strainer C	K	G	Threaded Suction With Strainer D	K	G	Bell Type Suction Without Strainer B	K	F	Bell Type Suction With Strainer B	K	F	E (6) Minimum Submergence for Priming Thd. Suct.	Bell Suct.	A Eye of Impeller to Bottom of Suction Manifold Thd. Suct.	Bell Suct.
6	LB	18	18	4	1	4	4½	1	5	2	1	4	4½	1½	4½	2	9	6½	6½	4½
	MA	18	18	4	1	4	3	1	5	2	1	4	3	1½	4½	2	12	8½	8 15/16	4⅛
	HXB	18	18	4	1	4	4	1	5	2							11		7 11/16	
7	LB	18	8	5	1	4½	4½	1	6	2	1	4½	4½	1½	5	2	12	8	11½	7
	HXB	18	8	5	1	4½	4	1	6	2½							12		9	
8	LB	18	8	5	1	5	5	1	6	2½	1	5	5	1½	5½	2	10½	8	8¼	5⅜
	MA	18	8	6	1	5	5	1	6	2½	1	5	5	1½	5½	2	13	10¾	12⅛	5⅜
	HXB	18	8	6	1	5	5	1	6	2½							11⅜		9 5/16	
	MFH	18	8	6	1	5	5	1	6	2½							9 1/16		7⅝	
9	LA	18	8	6	1	5½	5	1	6	2½	1½	6	5	2	6½	2½	15	10½	12 5/16	6½
10	LB	18	8	6	1	6	5½	1	6	2½	1	6	5¾	1½	6½	2½	14⅜	8 5/16	11½	7
	MA	18	9	6	1	6	5	1	7	2½	1½	6½	5	1½	6½	2½	14	10	12 5/16	6
	HXB	18	9	8	1	5¾	4½	1	10	3½	1	5¾	4½	1½	6¼	2½	14	12½	11⅜	6⅝
	HH	18	9	8	1	6	7½	1	7	3	1½	6½	7½	2	7	3	16½	9¾	13⅛	6 7/16
	HHA	18	9	8	1	6	7½	1	7	3	1½	6½	7½	2	7	3	16 7/16	9 11/16	13 3/16	6⅞
	MFH	18	9	8	1	6	6	1	7	3	1½	6	5¼	2	6½	3	10½	6⅞	8½	4⅞
11	MB	18	10	8	1	6¾	6	1	7	3							17		13¼	
12	LD	18	9	8	1	7	6	1	7	3	1	7	6	1½	7½	3	13¼	10⅞	9	6½
	MB	18	9	8	1	7	6	1	10	3½	1	7	6	1½	7½	3	16	9¾	14	5¾
	HXB	18	10	10	1	7	6½	1	10	4½	1	7	5½	1½	7½	3	16	13¼	13⅛	6 1/16
	HXH	18	10	10	1	6¾	8	1	10	4½	2½	8¼	8	2½	8¼	3½	17	10	13 15/16	6 3/16
	HD	18	18	10	1	7¼	6½	1	10	4½							17		12¾	
14	LD	18	10	10	1	8	6½	1	10	4½	1	8	6½	2	8¾	3½	14⅞	11⅞	10	7
	MC	18	10	10	1	8	6½	1	10	4½	1	8	6½	1½	8½	3½	16⅝	11⅞	12⅝	7⅞
	HXB	18	10	10	1	8	6½	1	10	4½	1	8	6½	1½	8½	3½	18	9 3/16	13 7/16	4¾
	HH	18	10	12	1	8	7½	1	10	4½	1½	8½	7½	2	9	4	18	11	11¼	6¾
15	LC	18	10	10	1	8¾	7½	1	10	4½							17		12⅜	
	MA	18	10	10	1	8¾	8	1	10	4½	1	8¾	8	1½	9¼	4	18	11	13 1/16	6⅜
16	MC	18	11	12	1	8¾	7	1	11	5	1	8¾	7¼	1	8¾	3½	17⅝	12¾	12 7/16	11¼
	HXB	18	11	14	1	8¾	7½	1	11	5	1	8¾	7¾	1½	9¼	4	19	11	14¼	6⅜
	HH	18	11	14	1	8¾	9	1	11	5	2½	10¼	9	3	10¾	4½	21	11		5 5/16

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

(2) Sump clearance dimensions (distance to wall) are base on the column sizes shown and qualified below:

A - Threaded column through 16HH.

B - Column to bowl combinations not included in "A" above must be referred to factory to maintain minimum wall clearance without possible interference.

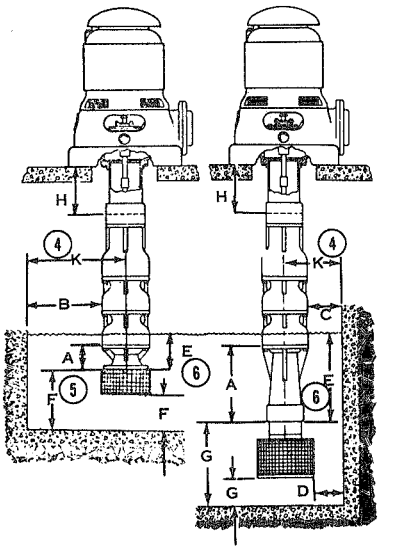
(3) Sump wall clearance dimensions shown are minimum - for maximum, based on flow rates above 3000gpm, see Section 133, pages 31 through 34.

(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".

BELL TYPE SUCTION MANIFOLD (WITH CLIP ON STRAINER) THREADED TYPE SUCTION MANIFOLD (WITH BASKET STRAINER)



OPEN LINE SHAFT STANDARD CONSTRUCTION

Refer to 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) Minimum Submergence for Priming		A Eye of Impeller to Bottom of Suction Manifold	
					Threaded Suction						Bell Type 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.
18	MA	18	10	12	1½	10¼	7	1½	10½	4½	1½	10¼	7	1½	10½	3½	20	9	15¼	5
	HXB	18	11	14	1	9½	8	1	10	5	1	9½	8	1½	10	4½	13¾	14½	11⅜	7
	HH	18	11	14							1½	10½	10	2	11	5		13⅞		8½
20	MA	18	11	14	1½	11¼	9	1½	11½	5	1½	11¼	9	1½	11¼	5	18¼	19¾	15	10⅞
	HXB	18	11	16	1½	11¼	9	1½	14	6	1½	11¼	9	1½	11¼	5	22	14	16	8½
	HH	18	11	16							2	12	10	2½	13	5		15		6½
24	MA	18	12	18							1½	13½	9½	1½	13½	5		16		7
	HXB	18	12	18							1½	12½	10½	1½	12½	5		19		10 1/16
	HH	18	12	18							2½	13¾	12	3	14¼	6		15½		7¼
	HH-OH	18	12	18							2½	13¾	12	3	14¼	6		15½		7¼
26	HXB	18	12	20							1½	14¼	12	1½	14¼	6		18½		8¾
	HH	18	12	20							2½	15¾	14	3	16¼	7		17⅞		7 15/16
	HH-OH	18	12	20							2½	15¾	14	3	16¼	7		17⅞		7 15/16
27	MA	18	12	20							2	15¼	13½	2½	15¾	7		16¼		9½
28	HXB	18	12	20							2	15½	13	2	15½	7		15¾		8
30	LA	18	12	20							2	17	14½	2	17	7		23		15¼
	HH	18	12	24							3½	19½	17½	4	20	9		14¾		11¼
	HH-OH	18	12	24							3½	19½	17½	4	20	9		14¾		11¼
32	HXB	18	12	24							2	17½	15	2	17½	8		20⅝		8⅝
36	MA	18	12	24							2	20	16	2	20	8		20½		13⅝
	HXB	18	12	30							2	20	17½	2	20	9		24		10 3/16
	HH	18	12	30							2½	21	19	3	21½	10		18⅛		12
	HH-OH	24	18	30							2½	21	19	3	21½	10		18⅛		12
42	HXB	18	12	30							2½	23½	20	2½	23½	10		26		10 11/16
	HH	REFER TO FACTORY																		
48	HXB	18	12	42							3	27	24	3	27	12		31		14 9/16
	HH	18	12	42							4½	28	25	5	28½	13		31		13¼
	HH-OH	24		42							4½	28	25	5	28½	13		31		13¼
56	HH	48	36	48							4½	34½	30	4	20	9		43¼		20¼
	HH-OH	48	36	48							4½	34½	30	4	20	9		43¼		20¼
66	HH	REFER TO FACTORY																		

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

(2) Sump clearance dimensions (distance to wall) are base on the column sizes shown and qualified below:

A - Threaded column through 20MA.

B - Flanged column for 20HXB through 66HH.

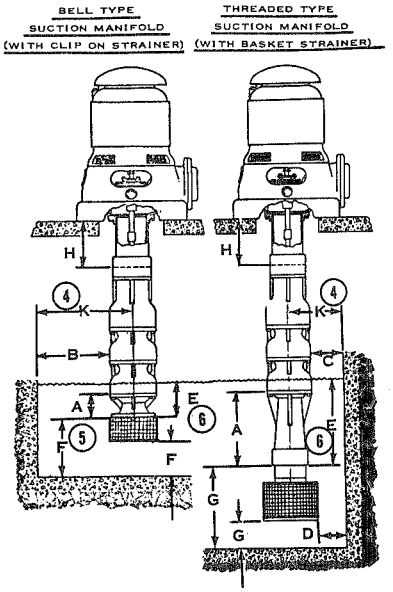
C - Column to bowl combinations not included in "A" and "B" above must be referred to factory to maintain minimum wall clearance without possible interference.

(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".



Vertical Turbine Pumps
Bowl Assemblies

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]		Nom. as Cast	Turned O.D. [2]	Bell O.D.	Hub Stick [3] Down
4LE/4LO [4]	12.62	FOR 2.50 OLS COLUMN ONLY							3.50		3.75		
4LE/4LO [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			8.25	9.75	9.50	9.25	3.69
10MA	23.12		19.81	16.81		13.50			7.50	9.75	9.50	10.00	0.38
10HXB	23.50		18.88	16.94		12.31			7.50	9.44		9.25	1.56
10HH	27.50		23.12	20.75		16.38			9.88	9.75	9.50	10.62	5.31
10HHA	27.50		23.12	20.75		16.38			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			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]	[9]	14.00	5.62
12HD	29.75								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		30.25	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			22.38			15.50	15.75		17.88	6.69
16HH-ELS		43.12	[10]		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.

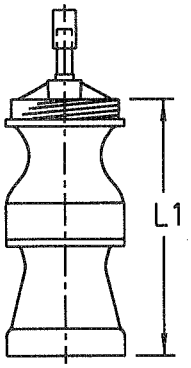
[12] Maximum length of first column shaft and maximum spacing of first line shaft bearings above the pump must be 5 feet when flanged discharge bowl or intermediate bowl to flanged column and intermediate bowl with column adapter to threaded column constructions are used.

Subject to change without notice

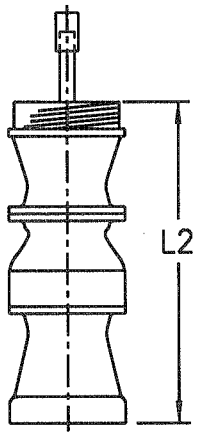
VERTICAL TURBINE PUMPS
BOWL ASSEMBLIES

SUCTION CASE

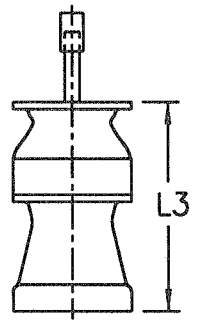
THREADED DISCHARGE BOWL



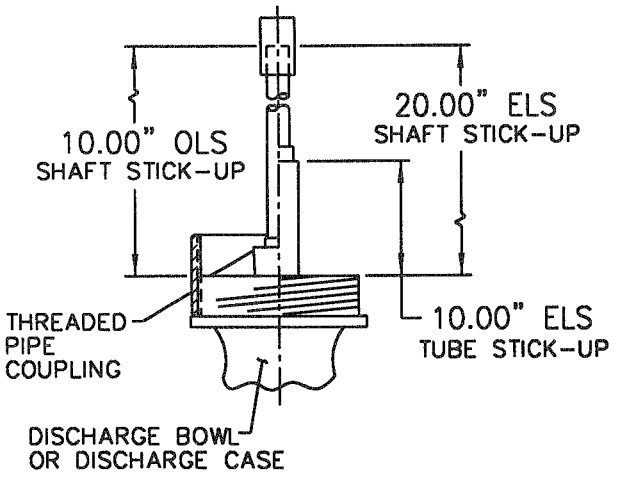
DISCHARGE CASE



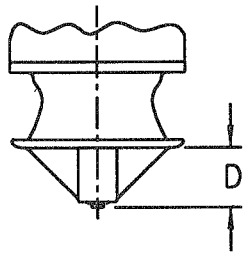
FLANGED DISCHARGE BOWL



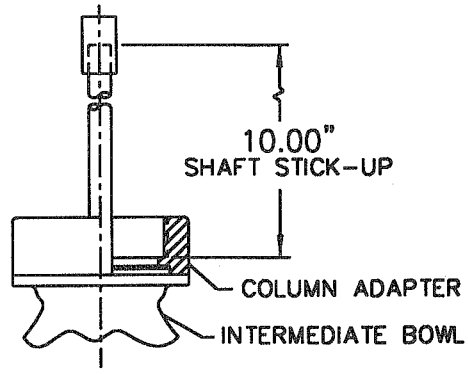
STANDARD SHAFT & TUBE STICK-UP



SUCTION BELL HUB STICK-DOWN

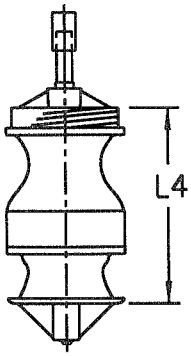


INTERMEDIATE BOWL WITH COLUMN ADAPTER STICK-UP (OLS ONLY)

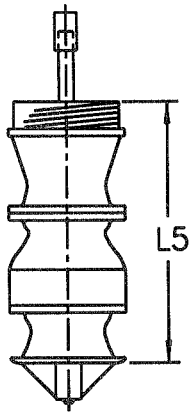


SUCTION BELL

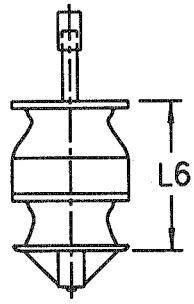
THREADED DISCHARGE BOWL



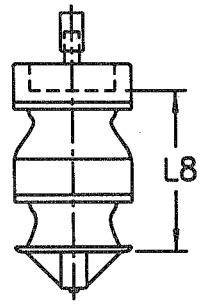
DISCHARGE CASE



FLANGED DISCHARGE BOWL



COLUMN ADAPTER



Subject to change without notice

DWG. NO. 4853667

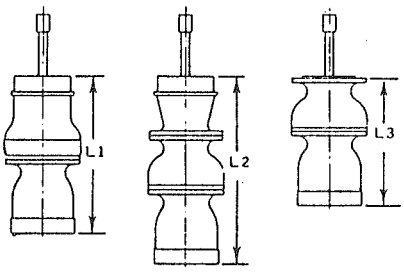
Bowl Assemblies

GENERAL DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

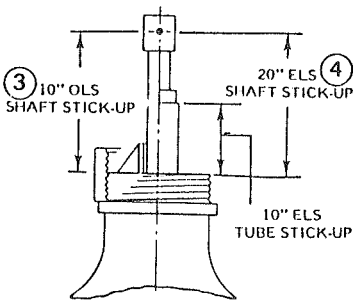
Bowl Model	Length of One Stage Bowl Unit						Lgth. Each Add'l Stage	Bowl OD (5) (6)		Bell Suction	
	L1	L2	L3	L4	L5	L6		Nom. as Cast	(1) Turned OD	Bell O.D.	(2) Hub Stick Down
18 MA	35 5/8		28 3/4	25 3/8		18 1/2	13 1/2	17 1/2	—	13 3/4	4 1/16
18 HXB		36 1/2	24 5/8		33 9/16	21 11/16	13 1/4	16 7/8	—	16 1/2	4
18 HH						27 1/8	18 5/8	18 1/8	—	18 3/4	7 13/16
20 MA-OLS			30			23 1/2	15	19 1/2	—	18	6 15/16
20 MA-ELS		40 1/8			33 5/8		15	19 1/2	—	18	6 15/16
20 HXB			31			23 3/4	15	19 1/2	—	17 1/2	4 5/8

Bowl Model	Lgth. L6	Lgth. Each Add'l Stage	Nom. As Cast O.D.	Bell Suction	
				Bell O.D.	Hub Stick Down
20 HH	28 11/16	20	20 1/8	20 1/4	5 9/16
24 MA	25 3/4	18 3/4	24	18 3/4	6 9/16
24 HXB	25 11/16	16 3/4	22	21	8 1/4
24HXC	25 11/16	16 3/4	22	21	8 1/4
24 HH	31 5/16	22	22 5/8	24 1/4	6 1/16
24 HH-OH	32 1/16	22 3/4	22 5/8	24 1/4	6 1/16
26 HXB	29 1/4	19 3/4	25 1/2	24 5/8	7 9/16
26 HH	36 1/4	25 1/2	26 3/8	28	3 3/16
26 HH-OH	37 1/4	26 1/2	26 3/8	28	3 3/16
27 MA	32 3/8	21 3/8	26 3/8	27	4 7/16
28 HXB	32	22	27 1/4	26	6 13/16
(7) 30 LA-OLS	39	23 3/4	29 3/4	29	7/16
30 HH	45 7/8	31 1/8	31 5/8	34 5/8	1 7/16
30 HH-OH	46 7/8	32 1/8	31 5/8	34 5/8	1 7/16
32 HXB	38 5/8	26 5/8	31 1/4	30	0
36 MA	40 5/8	27	36	32	0
36 HXB	43 5/16	29 5/16	36	34 5/8	0
36 HH	48 1/16	37	36 3/16	38	0
36 HH-OH	49 5/16	38 1/4	36 3/16	38	0
42 HXB	48 5/8	33 5/8	41 1/2	40	0
42 HH	REFER TO FACTORY				
48 HXB	53 7/16	36	48 1/8	48 1/8	0
48 HH	59	46 1/2	47	50	1 1/16
48 HH-OH	59	46 1/2	47	50	1 1/16
56 HH	75	58	57 7/8	60	0
56 HH-OH	75	58	57 7/8	60	0
66 HH	REFER TO FACTORY				

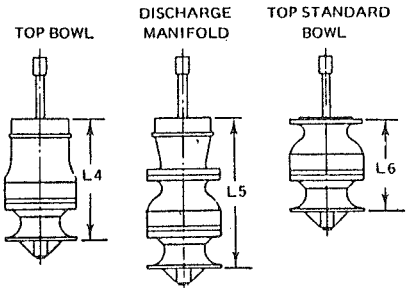
THREADED SUCTION MANIFOLD



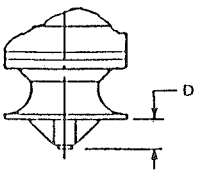
STANDARD SHAFT & TUBE STICK-UP



BELL SUCTION



BELL SUCTION HUB STICK-DOWN



(1) All bowl models with a dimension in this column will be factory machined to diameters shown when material is cast iron. Bowls in other materials will be furnished to "as cast" dimensions.

(2) Hub stick-down includes pipe plug.

(3) 10" stick-up is standard for all OLS pumps with threaded couplings except 36HH-OH which is standard with 15".

(4) 20" stick-up is standard for all ELS pumps with threaded couplings except 36HH-OH which is standard with 25".

(5) These bowl O.D. dimensions do not include bell diameter of bell type suction manifold which in some cases are larger.

(6) Except for 18MA column increaser coupling may exceed bowl unit diameter (O.D.).

(7) With ELS construction a flanged top bowl is used. The L4=53".

Bowl Assemblies

APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Bowl Unit Size/Type		Max. Size of column less than bowl dia.	Column Pipe (6)			Suction Pipe		Dia. of impeller Shaft (2)	Column Shaft Size		Nom. Size of Oil Tubing		Max. Head (psi) (3) Class	
			Min.	Nominal	Max.	Min.	Max.		Min.	Max.	Min.	Max.	30 C.I.	(A)
4	LO/LE	3 STD. (4)	2½ STD.	2½ - 3" STD. (1)	3 STD.	2½ STD.	2½ STD.	¾	¾	1	—	—	368	—
6	LB	4 STD.	3 STD.	4 STD.	5 STD.	4 STD.	4 STD.	⅞	¾	1	1¼	1½	627	714
	MA	4 STD.	4 STD.	4 STD.	5 STD.	4 STD.	4 STD.	⅞	¾	1	1¼	1½	606	708
	HXB	4 STD.	4 STD.	4 STD.	5 STD.	4 STD.	4 STD.	⅞	¾	1	1¼	1½	346	399
7	LB	5 STD.	4 STD.	5 STD.	6 STD.	5 STD.	5 STD.	1	¾	1 3/16	1¼	2	410	478
	HXB	5 STD.	4 STD.	5 STD.	6 STD.	5 STD.	5 STD.	1	¾	1 3/16	1¼	2	410	477
8	LB	6 STD.	4 STD.	5 STD.	6 STD.	5 STD.	5 STD.	1 3/16	¾	1½	1¼	2½	390	622
	MA	6 STD.	5 STD.	6 STD.	8 STD.	6 STD.	6 STD.	1 3/16	¾	1½	1¼	2½	627	766
	HXB	6 STD.	5 STD.	6 STD.	8 STD.	6 STD.	6 STD.	1 3/16	¾	1½	1¼	2½	550	671
	HDX	6 STD.	5 STD.	6 STD.	8 STD.	6 STD.	6 STD.	1½	1 3/16	1 11/16	2	2½		750 (8)
	MFH	6 STD.	5 STD.	6 STD.	8 STD.	6 STD.	6 STD.	1 3/16	¾	1½	1¼	2½	321	—
9	LA	6 STD.	5 STD.	6 STD.	8 STD.	6 STD.	6 STD.	1 3/16	¾	1½	1¼	2½	390	471
10	LB	8 STD.	5 STD.	6 STD.	8 STD.	6 STD.	6 STD.	1 3/16	¾	1½	1¼	2½	325	400
	MA	8 STD.	5 STD.	6 STD.	8 STD.	6 STD.	8 STD.	1 3/16	¾	1½	1¼	2½	497	765
	HXB	8 STD.	8 STD.	8 STD.	10 STD.	8 STD.	10 STD.	1½	1	1 15/16	1½	3	368	452
	HH	8 STD	8 STD.	8 STD.	10 STD.	8 STD.	8 STD.	1½	1	1 15/16	1½	3	346	446
	HHA	8 STD.	8 STD.	8 STD.	10 STD.	8 STD.	8 STD.	1½	1	1 15/16	1½	2½	300	—
	MFH	8 STD.	8 STD.	8 STD.	10 STD.	8 STD.	8 STD.	1½	1	1 15/16	1½	3	241	—
11	MB	8 STD.	8 STD.	8 STD.	10 STD.	8 STD.	8 STD.	1 15/16	1½	2 3/16	2½	3½	497	612
12	LD	10 STD.	6 STD.	8 STD.	10 STD.	8 STD.	8 STD.	1½	1 3/16	1 11/16	2	3	385	498
	MB	8 STD.	8 STD.	8 STD.	10 STD.	8 STD.	10 STD.	1½	1	1 15/16	1½	3	357	439
	HXB	10 STD. (4)	8 STD.	10 STD.	12 STD.	10 STD.	12 STD.	1½	1	1 15/16	1½	3	433	548
	HXH	10 STD.	8 STD.	10 STD.	12 STD.	10 STD.	10 STD.	1 15/16	1½	2 3/16	2½	3½	355	433
	HD	10 STD.	8 STD.	10 STD.	12 STD.	10 STD.	10 STD.	1 15/16	1½	2 3/16	2½	3½	540	650
14	LD	10 STD.	8 STD.	10 STD.	12 STD.	10 STD.	10 STD.	1 15/16	1½	2 3/16	2½	3½	325	498
	MC	10 STD.	8 STD.	10 STD.	12 STD.	10 STD.	12 STD.	1 15/16	1½	2 3/16	2½	3½	303	366
	MD	12 STD.	10 STD.	10 STD.	12 STD.	12 STD.	12 STD.	1 15/16	1½	2 3/16	2½	3½	365	RTF
	HXB	10 STD.	10 STD.	10 STD.	12 STD.	10 STD.	12 STD.	1 15/16	1½	2 3/16	2½	3½	295	378
	HH	12 STD.	10 STD.	12 STD.	14 O.D.	12 STD.	12 STD.	1 11/16	1 3/16	1 15/16	2	3	200	236
15	LC	12 STD.	8 STD.	10 STD.	12 STD.	10 STD. (5)	12 STD.	2 3/16	1 11/16	2 7/16	2½	4	475	575
	MA	12 STD.	8 STD.	10 STD.	12 STD.	10 STD.	12 STD.	2 3/16	1 11/16	2 7/16	2½	4	330	422
16	MC	12 STD.	10 STD.	12 STD.	14 O.D.	12 STD.	14 O.D.	1 15/16	1½	2 3/16	2½	3½	325	389
	HXB	14 O.D.	12 STD.	14 O.D.	16 O.D.	14 O.D.	14 O.D.	1 15/16	1½	2 3/16	2½	3½	303	366
	HH (7)	14 O.D.	12 STD.	14 O.D.	16 O.D.	14 O.D.	14 O.D.	1 15/16	1½	2 3/16	2½	3½	271	319

NOTE: (A) HIGH STRENGTH IRON, CL50 OR DUCTILE AT FACTORY OPTION.

(1) Maximum column length for 4LO is 150 feet, for 4LE 400 feet.

(2) Standard impeller shaft sizes are shown in this column. Refer to the factory for availability of other sizes.

(3) 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 construction consult the factory for limitations.

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

c. To change these ratings to HEAD IN FEET 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 well applications at the deeper settings check bowl lateral requirements.

(4) 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 cost.

(5) All suction threads are for butt pipe threads EXCEPT 15MA, 15LC, 14OD and 16OD which have 3/4 taper threads.

(6) All top bowls and discharge manifolds have butt threads.

(7) 16HH available for threaded column: OLS 12" and 14"; ELS 12", 14" and 16".

(8) Standard bowl material is ductile iron.

Bowl Assemblies

APPLICATION DATA ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Bowl Unit Size/Type		Max. Size of column less than bowl dia.	Column Pipe (4)			Suction Pipe		Dia. of impeller Shaft (1)	Column Shaft Size		Nom. Size of Oil Tubing		Max. Head (psi) (2) Class	
			Min.	Nominal	Max.	Min.	Max.		Min.	Max.	Min.	Max.	30 C.I.	(A)
18	MA	14 O.D.	10 STD.	12 STD.	14 O.D.	10 STD.	12 STD.	$1\frac{15}{16}$	$1\frac{1}{2}$	$2\frac{3}{16}$	$2\frac{1}{2}$	$3\frac{1}{2}$	295	354
	HXB	14 O.D.	12 STD.	14 O.D.	16 O.D.	14 O.D.	14 O.D.	$1\frac{15}{16}$	$1\frac{1}{2}$	$2\frac{3}{16}$	$2\frac{1}{2}$	$3\frac{1}{2}$	334	
	HH	14 O.D.	14 O.D.	16 O.D.	18 O.D.			$2\frac{3}{16}$	$1\frac{11}{16}$	$2\frac{7}{16}$	$2\frac{1}{2}$	4	314	
20	MA	14 O.D.	12 STD.	14 O.D.	16 O.D.	12 STD.	14 O.D.	$2\frac{3}{16}$	$1\frac{1}{2}$	$2\frac{3}{16}$	$2\frac{1}{2}$	$3\frac{1}{2}$	195	
	HXB	14 O.D.	14 O.D.	16 O.D.	16 O.D.	16 O.D.	16 O.D.	$2\frac{3}{16}$	$1\frac{1}{2}$	$2\frac{3}{16}$	$2\frac{1}{2}$	$3\frac{1}{2}$	217	
	HH	18 O.D.	14 O.D.	16 O.D.	18 O.D.			$2\frac{3}{16}$	$1\frac{11}{16}$	$2\frac{7}{16}$	$2\frac{1}{2}$	4	200	
24	MA	18 O.D.	16 O.D.	18 O.D.	18 O.D.			$2\frac{7}{16}$	$1\frac{15}{16}$	$2\frac{7}{16}$	3	4	250	
	HXB	16 O.D.	14 O.D.	18 O.D.	18 O.D.			$2\frac{3}{16}$	$1\frac{1}{2}$	$2\frac{3}{16}$	$2\frac{1}{2}$	$3\frac{1}{2}$	195	
	HXC	16 O.D.	14 O.D.	18 O.D.	18 O.D.			$2\frac{3}{16}$	$1\frac{1}{2}$	$2\frac{3}{16}$	$2\frac{1}{2}$	$3\frac{1}{2}$	195	
	HH/HH-OH	16 O.D.	16 O.D.	18 O.D.	20 O.D.			$2\frac{7}{16}$	$1\frac{15}{16}$	$2\frac{7}{16}$	3	4	195	
26	HXB	20 O.D.	16 O.D.	20 O.D.	24 O.D.			$2\frac{15}{16}$	$2\frac{3}{16}$	$2\frac{15}{16}$	$3\frac{1}{2}$	5	152	
	HH/HH-OH	20 O.D.	18 O.D.	20 O.D.	20 O.D.			$2\frac{15}{16}$	$2\frac{11}{16}$	$2\frac{15}{16}$	5	5	152	
27	MA	20 O.D.	16 O.D.	20 O.D.	24 O.D.			$2\frac{15}{16}$	$2\frac{3}{16}$	$2\frac{15}{16}$	$3\frac{1}{2}$	5	303	
28	HXB	20 O.D.	16 O.D.	20 O.D.	24 O.D.			$2\frac{15}{16}$	$2\frac{11}{16}$	$2\frac{15}{16}$	5	5	130	
30	LA	24 O.D.	18 O.D.	20 O.D.	20 O.D.			$2\frac{1}{16}$	$2\frac{3}{16}$	$2\frac{15}{16}$	$3\frac{1}{2}$	5	195	
	HH/HH-OH	24 O.D.	20 O.D.	24 O.D.	30 O.D.			$2\frac{15}{16}$	$2\frac{3}{16}$	$2\frac{15}{16}$	$3\frac{1}{2}$	5	130	
32	HXB	24 O.D.	20 O.D.	24 O.D.	24 O.D.			$3\frac{11}{16}$	$2\frac{17}{16}$	$3\frac{11}{16}$	5	6	195	
36	MA	30 O.D.	20 O.D.	24 O.D.	24 O.D.			$3\frac{11}{16}$	$2\frac{11}{16}$	$3\frac{11}{16}$	5	6	173	
	HXB	30 O.D.	24 O.D.	30 O.D.	30 O.D.			$3\frac{15}{16}$	$2\frac{11}{16}$	$3\frac{15}{16}$	5	6	173	
	HH/HH-OH	30 O.D.	24 O.D.	30 O.D.	30 O.D.			$3\frac{11}{16}$	$3\frac{3}{16}$	$3\frac{11}{16}$	5	6	140	
42	HXB	36 O.D.	24 O.D.	30 O.D.	30 O.D.			$3\frac{15}{16}$	$2\frac{15}{16}$	$3\frac{15}{16}$	5	6	130	
	HH	REFER TO FACTORY												
48	HXB	42 O.D.	36 O.D.	42 O.D.	42 O.D.			$3\frac{15}{16}$	$3\frac{15}{16}$	$3\frac{15}{16}$	6	6	130	
	HH/HH-OH	42 O.D.	36 O.D.	42 O.D.	48 O.D.			$3\frac{15}{16}$	$3\frac{7}{16}$	$3\frac{15}{16}$	5	6	173	
56	HH/HH-OH	(3)		54 O.D.	(3)			$4\frac{1}{4}$	(3)		8	(3)	173	
66	HH	REFER TO FACTORY												

(3)

NOTE: (A) HIGH STRENGTH IRON, CL 50 OR DUCTILE AT FACTORY OPTION.

(1) Standard impeller shaft sizes are shown in this column. Refer to factory for availability of other sizes.

(2) a. Pressure ratings are for bowls in CL 30 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 construction consult the factory for limitations.

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

c. To change these ratings to HEAD IN FEET 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 well applications at the deeper settings check bowl lateral requirements.

(3) Refer to factory.

(4) 20 inch and larger bowls are available with Flanged Column connection only.

Bowls – 6 Thru 10 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 ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Pump Size	Impeller Number	Net Eye Area In^2	Sphere Size	WR^2 in Lbs-In^2	Best Lat	Lateral	
						Standard	Max. (1)
6LB	2616324	3.375	1/4	5.85	1/8	.281	.656
	2618292	3.375	1/8	5.85	1/8	.281	.656
	2616318	3.375	1/8	5.8	1/8	.281	.656
6MA	V850B	5.072	5/16	5.09	1/16	.25	.625
6HXB	2607800	6.891	3/8	7.0	1/8	.281	.656
7LB	2626207	4.89	9/32	12.1	1/8	.500	.875
	2626208	4.89	1/4	12.8	1/8	.375	.750
7HXB	2607926	8.496	7/16	16.7	1/8	.313	.688
	2607921	8.496	1/2	16.7	1/8	.313	.688
8LB	2616464	6.920	1/4	22.3	1/4	.281	.656
	2616465	6.920	3/16	25.8	1/8	.281	.656
8MA	T84229	8.513	1/2	19.3	3/16	.406	.781
	T84234	8.513	7/16	19.3	1/8	.406	.781
8HXB	2616348	10.592	9/16	29.2	1/16	.281	.656
8HDX	4602048	19.38	15/16	55.4	1/16	.875	1.00 (2)
8MFH	2606032	REFER TO FACTORY					
9LA	T84391	9.032	7/16	47.6	1/8	.594	.968
	T84323	9.032	7/16	47.6	1/8	.406	.781
10LB	2625032	9.572	3/8	76.8	1/8	.313	.688
	2625033	9.572	3/8	76.8	1/8	.313	.688
10MA	T84363	12.256	5/8	64.2	1/8	.406	.781
	2624288	12.256	11/16	64.2	1/8	.344	.718
10HXB	T82337	15.954	1/2	82.5	3/16	.313	.688
	T82366	15.954	5/8	82.5	3/16	.313	.688
10HH	2622864	26.121	1/2	60.9	1/16	.469	.843
	2626818	26.121	15/16	63.2	1/16	.500	.875
10HHA	4601873	28.224		100.1		.468	
10MFH	2602101	REFER TO FACTORY					

(1) Maximum lateral with extra lateral machining.

(2) 1.25 without lateral seal ring.

Bowls – 11 Thru 16 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 ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Pump Size	Impeller Number	Net Eye Area In^2	Sphere Size	WR^2 in Lbs-In^2	Best Lat	Lateral	
						Standard	Max. (1)
11MB	2622504	16.687	13/16	118	3/16	.844	.844
12LD	2634820	18.025	7/8	166	1/16	.687 (2)	1.25
	2649365	18.025	7/8	187	1/16	.687 (2)	1.25
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	(3) 1.750
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
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	.906	1.406
	2617215	52.140	3/4	958	1/8	.656	1.156
	4601399	52.140	1-1/8	641	1/8	.656	1.156
16HH	2621593	74.9	3/4	900	1/32	.438	.937
	2620735	74.9	3/4	1250	1/16	.438	.937

(1) Maximum lateral with extra lateral machining.

(2) 1" if lateral seal ring removed.

(3) 1.75" if lateral seal ring removed. No machining required.

Bowls – 18 Thru 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 ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Pump Size	Impeller Number	Net Eye Area In^2	Sphere Size	WR^2 in Lbs - In^2	Best Lat	Standard Lateral
18MA	T84489 2606879	41.231 41.231	1-1/4	925 925	1/8 1/8	.406 .406
18HXB	2617433 2618937	64.708 66.437	3/4 1-3/8	1430	1/16 1/16	.625 .315
18HH	2621974 2621975	84.906 97.862	7/8 7/8	1900 1900	1/16 1/16	.594 .469
20MA	2605012	49.698	1-1/8	2350	1/16	.281
20HXB	2607495 2607491 2607492	73.148 83.642 73.148	1-1/4 7/8 1-1/8	2720 2720 2720	1/16 1/16 1/16	.406 .906 .406
20HH	4600652 4600653	124.000 111.000	1 1	2700 2224	1/16 1/16	.625 .625
24MA	2617890 2603427 2605615	79.100 79.100 79.100	1-1/8 1-1/8	5460 5460 5460	1/16 1/8 1/16	.281 .281 .281
24HXB	2615491 2616866	103.532 104.912		3060 3060	1/16 1/8	.812 .750
24HXC	4602026	107.31	1-7/8	3650	1/8	.750
24HH	2621597 2620986	152.04 152.04	1-1/8 1-1/8	5220 6750	1/8 1/32	.475 .714
24HH-OH	2633415	152.04	1-1/8		1/32	
26HXB	2607148	143.82	1.88	9050	1/16	.344
26HH	2621599 2620629	202.22 203.83	1-5/16 1-11/32	13200	1/8 1/8	.813 .563
26HH-OH	2629638	203.8	1-11/32		1/32	
27MA	2621402 2621565	179.28 147.17	1-7/16 1-3/16	12305 12305	1/16 1/16	.563 .563

Bowls – 28 Thru 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 ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Pump Size	Impeller Number	Net Eye Area In^2	Sphere Size	WR^2 in Lbs-In^2	Best Lat	Standard Lateral
28HXB	2617403 2617422	168.22 168.22		14850 14850	1/8 1/32	.719 .531
30LA	T84305 V655C	105.12 106.323		10400	1/16	.531 .531
30HH	2621977 2621978	295.71 299.57	1-5/8 1-5/8	21000 30000	1/8 1/8	.969 .656
30HH-OH	2633416	299.6	1-5/8		1/32	
32HXB	2622117 2618419	222.34 222.34	 2-3/4	21700 24700	1/32 1/8	1.156 .594
36MA	2606023 2604215	182.32 182.32	3-1/4	48000 48000	1/8 1/8	.656 .656
36HXB	2620664 2618436	296.06 296.06	 3-1/8	50000 51500	1/8 1/4	1.563 .688
36HH	2621980 2621981	348.16 404.80	1-27/32 1-27/32	45000 64000	1/8 1/8	.906 .656
36HH-OH	2633417	404.8	1-27/32		1/32	
42HXB	2618460 2621920	399.84 399.84		95000 101000	1/4 1/8	.969 .651
42HH	REFER TO FACTORY					
48HXB	2608562	553.44	4-9/16	129000	1/8	.531
48HH	2621983 2621984	587.19 682.94	 2-1/4	203052 289000		.781 .781
48HH-OH	2633418	682.9	2-1/4		3/64	
56HH	2621987	989.61	2-27/32	444000		.406
56HH-OH	2633419	989.6			3/64	
66HH	REFER TO FACTORY					

BOWL UNIT EFFICIENCY ADJUSTMENTS

The curves in Bulletin B-180 show the performance of (a) polished bronze impellers (b) with cast iron bowls with coated flow passages. Because the highest efficiencies attainable are produced by this combination, their efficiencies are the basic values used in the performance section. The efficiencies of other impeller/bowl material/surface finish combinations are "bench mark" referenced to this combination.

Impellers in sizes from 6" through 18" are available with either of two different surface finishes in their flow passages: (1) Non-polished (cleaned and deburred) or (2) polished. Impellers for 20" and larger bowls always have polished flow passages.

Non-polished impellers have their vane exit tips filed, for streamlining, and casting irregularities (if any) "cleaned up". Polished impellers have their flow passage surfaces smoothed to a high degree for maximum performance.

To determine the efficiency of a pump with other than polished bronze impellers and coated iron bowls, subtract the applicable deduction on the following page from the efficiency shown on the performance curve. THESE EFFICIENCY DEDUCTIONS MUST BE MADE IN ADDITION TO ANY STAGING CORRECTIONS SHOWN ON THE PERFORMANCE CURVE.

Assuming a constant capacity, the new head, (after an efficiency reduction) is calculated as follows:

New Head = (Book Head) (1.0-Percent Deduction)

Example:

Given: 2% efficiency reduction from book performance at 50 ft./stage head.

Then: New Head = (50) (1.0-.02) = 49 ft./stage.

If head becomes marginal under these circumstances, consult the factory for performance verification.

VERTICAL TURBINE PUMPS

Bowl Unit Efficiency Adjustments

For bowl units with other than (a) polished bronze impellers and (b) enameled or plastic coated iron bowls, reduce the heads and efficiencies shown on the performance curves by the following values (4) (5) (6) (7):

ENTER TABLE HERE

CIE (1)		CIE	CI		Bronze (2)		Stn. Stl.		← BOWL →	
Bronze		CI ★	CI		Bronze		Stn. Stl.		← IMPELLER →	
(3) Yes	No	Yes	Yes	No	Yes	No	Yes	No	← Impel. Polish? (3) →	
	%	%	%	%	%	%	%	%	Size	Size
	2	N/A	3	5	4½	6½	N/A	10	6LB	14LD
	2	1	4	6	5	7	7	9	6MA	14MC
	2	N/A	N/A		5½	7½	N/A		6HXB	14HXB
	2	1	3½	5½	4½	6½	6½	8½	7LB	14HH
	2	N/A	N/A		5½	7½	N/A		7HXB	15LC
	2	1	3	5	4½	6½	6½	8½	8LB	15MA
	2	1	4	6	5	7	7	9	8MA	16MC
	2	N/A	N/A		5½	7½	N/A		8HXB	16HXB
	2	N/A	N/A		5½	7½	N/A		8MFH	16HH
	2	1	3	5	4	6	6	8	9LA	18MA
	2	1	3	5	4	6	6	8	10LB	18HXB
	2	1	3	5	5	7	7	9	10MA	18HH
	2	N/A	N/A		5½	7½	7½	9½	10HXB	20MA
	2	N/A	N/A		5½	7½	7½	9½	10HH	20HXB
	2	N/A	N/A		5½	7½	7½	9½	10HHA	20HH
	2	N/A	N/A		5½	7½	N/A		10MFH	24MA
	2	1	3	5	4½	6½	6½	8½	11MB	24HXB
	2	1	2½	4½	3½	5½	5½	7½	12LD	24HH
	2	1	3	5	4½	6½	6½	8½	12MB	24HH-OH
	2	1	3½	5½	5½	7½	7½	9½	12HXB	26HXB
	2	1	3½	5½	5½	7½	7½	9½	12HXH	26HH
	2	N/A			5	7	N/A		12HD	26HH-OH

Basic values shown on performance curves

CIE (1)		CIE	CI		Bronze (2)		Stn. Stl.		(3)
Bronze		CI ★	CI		Bronze		Stn. Stl.		
Yes	No	Yes	Yes	No	Yes	No	Yes	No	
	%	%	%	%	%	%	%	%	
	2	1	3	5	4	6	6	8	
	2	1	3½	5½	4½	6½	6½	8½	
	2	1	4½	6½	5½	7½	7	9	
	2	1	4½	6½	5½	7½	7	9	
	2	1	2	4	3	5	5	7	
	2	1	3½	5½	4½	6½	6	8	
	2	1	3½	5½	4½	6½	4½	6½	
	2	1	4	6	5	7	5	7	
	2	1	4	6	5	7	5	7	
	2	1	2	4	3	5	3	5	
	2	1	4	6	4	6	4	6	
	2	1	4	6	4	6	4	6	
		Refer to Factory	2		3		3		
			3½		4		4		
			2		4		4		
			2		3		4		
			2		4		4		
			2		4		4		
			2		4		4		
			2		3		3		
			2		3		3		
			2		3		3		

N/A = not available in this material combination.

(1) Cast iron enameled through 20"; cast iron plastic coated 24" and up.

(2) Standard bronze bowls have uncoated flow passages. Coatings can be furnished to provide increased efficiencies. Refer to factory for price addition and efficiency.

(3) "No" indicates that impellers are unpolished. "Yes" indicates that impellers will be polished; see Section 125, page 19 for "Premium Efficiency" price addition.

(4) For efficiencies with materials, material combinations, models or sizes not shown, refer to factory.

(5) Any applicable staging correction shown on the performance curves must be calculated in addition to the above efficiency deductions.

(6) Stainless steel wear rings further reduce both efficiency and head per stage. Consult the factory for efficiency deductions.

(7) For bowls machined for extra lateral (not deep setting construction) deduct two (2) points from efficiency.

★NOTE: ENAMELED CAST IRON IMPELLERS ARE NO LONGER AVAILABLE.

Bowl Assemblies

Open Lineshaft Construction

WITH TOP BOWL

Sizes 6LB, 6MA, 6HXB, 7LB, 7HXB, 8LB, 8MA, 8HXB, 9LA, 10LB, 10MA, 10HXB, 10HH, 12LD, 12MB, 12HXB, 12HXH, 14LD, 14MC, 14HXB, 14HH, 16MC, 16HXB, 18MA

1 shaft coupling

2 impeller shaft

4 top bowl bronze bearing

5 top bowl

7 impeller taper lock bushing

8 impeller

9 lateral bowl wear ring

10 standard bowl

11 standard bowl bronze bearing

12 standard bowl rubber bearing*

13 sand collar

14 bell type suction manifold

15 suction manifold bearing

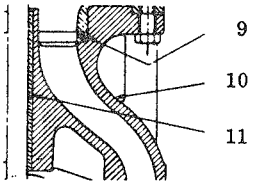
16 suction manifold plug

21 suction manifold

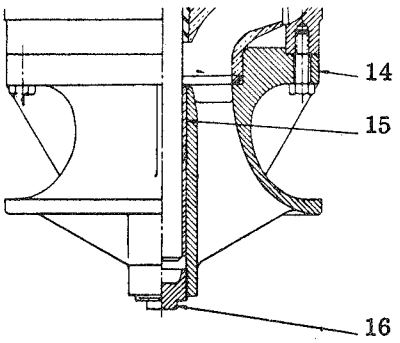
28 sand collar

Sand collars (13 & 28) are used when abrasive conditions require

All of above are connected by cap screws except 6LB, 6MA, 6HXB, 7LB, 7HXB, and 8HXB, which are threaded, and 8MA, 10MA, 10HXB and 12HXB which have studs and nuts.

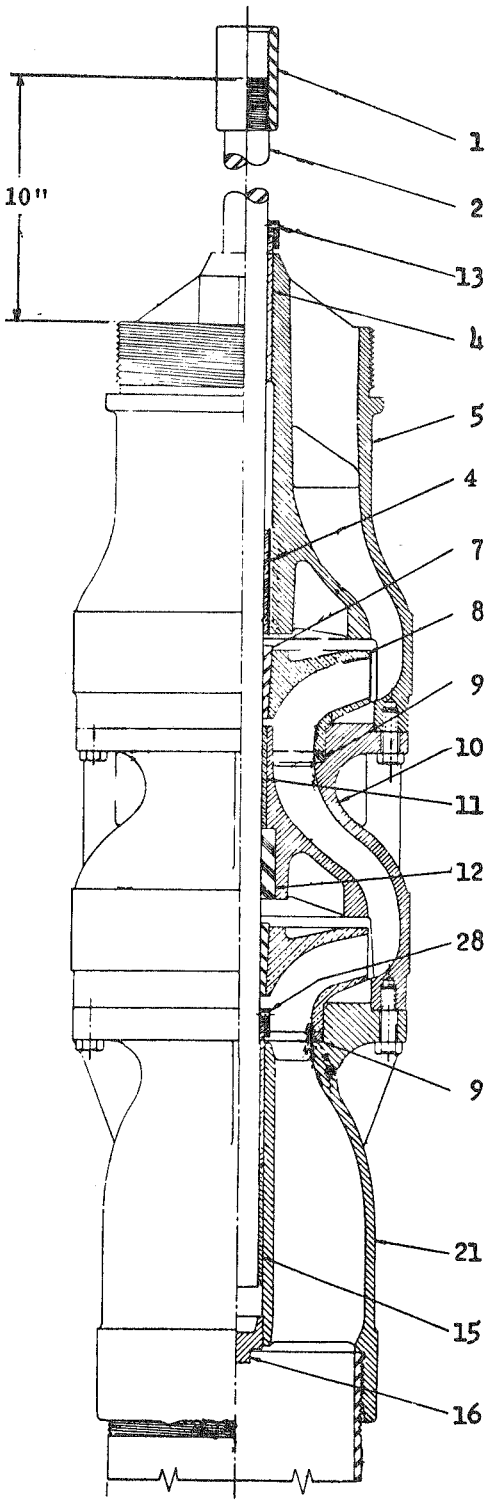


* Bronze bearing construction 15" and larger



OPTIONAL BELL TYPE SUCTION MANIFOLD

Not available on 6HXB, 7HXB or 8HXB



Bowl Assemblies

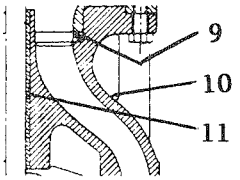
Enclosed Lineshaft Construction
with
Top Bowl

Sizes 6LB, 6MA, 6HXB, 7LB, 7HXB, 8LB, 8MA, 8HXB, 9LA, 10LB, 10MA, 10HXB, 10HH, 12LD, 12MB, 12HXB, 12HXH, 12HD, 14LD, 14MC, 14HXB, 14HH, 16MC, 16HXB, 18MA

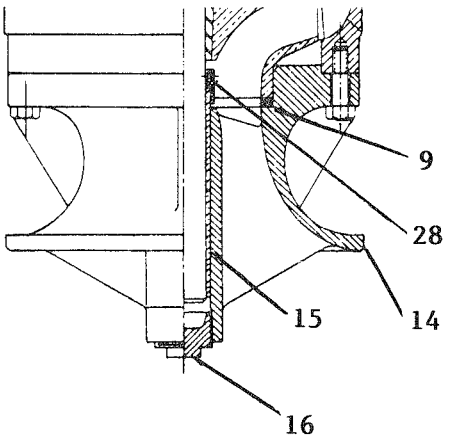
All of above are connected by cap screws except 6LB, 6MA, 6HXB, 7LB, 7HXB and 8HXB, which are theraded, and 8MA, 10MA, 10HXB and 12HXB which have studs and nuts.

1 shaft coupling
2 impeller shaft
3 upper tube bearing
7 impeller taper lock bushing
8 impeller
9 lateral bowl wear ring
10 standard bowl
11 standard bowl bronze bearing
12 standard bowl rubber* bearing
14 bell type suction manifold
15 suction manifold bearing
16 suction manifold plug
18 lower tube bearing
21 suction manifold
22 top bearing adapter
26 top bowl bearing
27 top bowl
28 sand collar

Sand collar (28) is used when abrasive conditions require

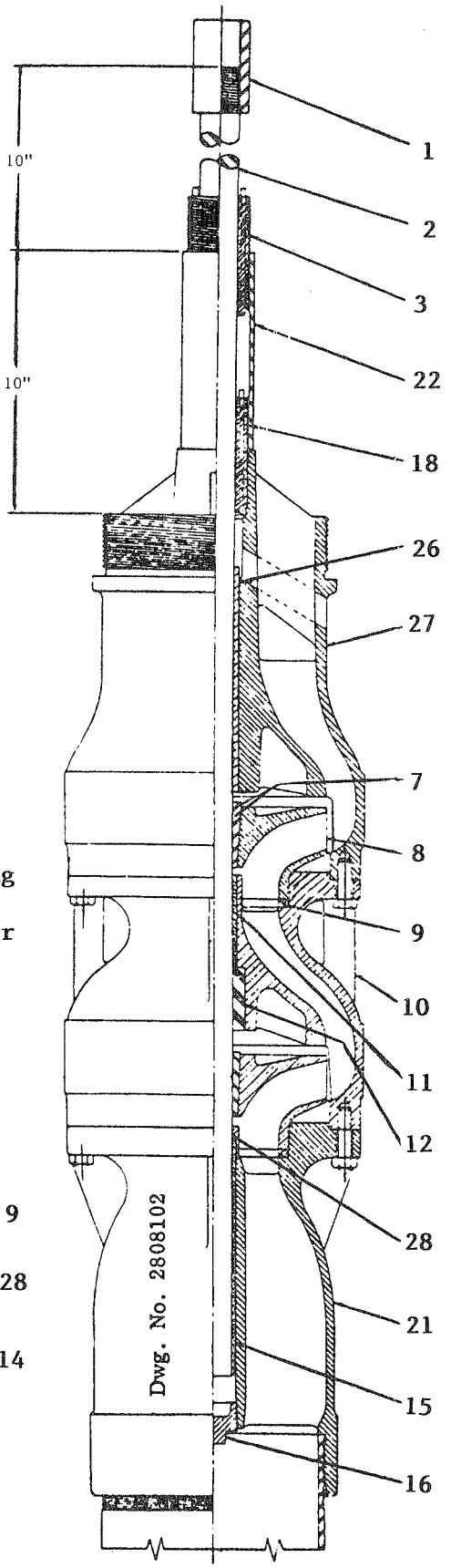


*Bronze bearing construction 15" and larger



OPTIONAL BELL TYPE SUCTION MANIFOLD

Not available on 6HXB, 7HXB, 8HXB or 12HD



Bowl Assemblies

Open Lineshaft Construction

WITH DISCHARGE CASE FOR THREADED COLUMN

Sizes 8MFH, 10MFH, 11MB, 14MD, 15LC, 15MA, 18HXB, 20MA

1 shaft coupling

2 impeller shaft

3 sand collar

4 discharge case bearing

5 discharge case

6 standard bowl

7 bowl bearing bronze

8 bowl bearing rubber

9 impeller lock collet

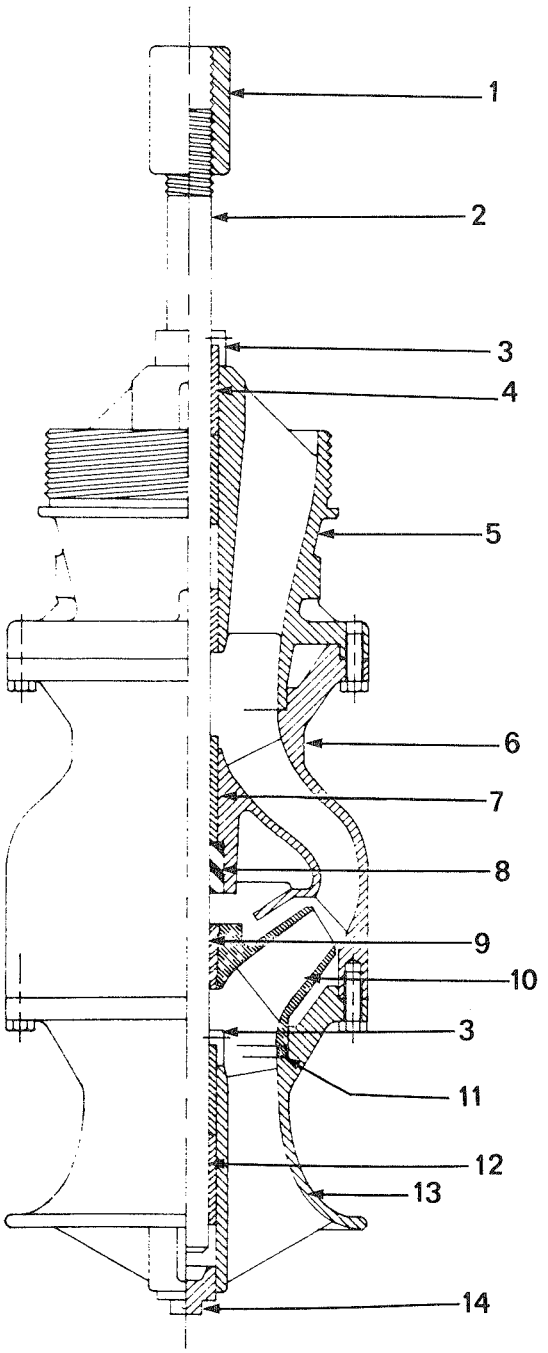
10 impeller - 8MFH and 10MFH have semi-open impellers

11 lateral bowl wear ring

12 suction case bearing

13 bell mouth suction case
threaded suction case
also available (1)

14 suction case plug



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

Optional bowl and impeller wear rings not shown.

Bowl Assemblies

Enclosed Lineshaft Construction

with

Discharge Manifold

Sizes 8HXD, 8MFH, 10MFH, 11MB, 14MD, 15LC, 15MA, 16HH, 18HXB, 20MA

1 shaft coupling

2 impeller shaft

3 upper tube bearing

4 impeller taper lock bushing

5 impeller

6 lateral bowl wear ring

7 standard bowl

8 standard bowl bronze bearing

9 bell type suction manifold (1) (2)

10 suction manifold bearing

11 suction manifold plug

12 lower tube bearing

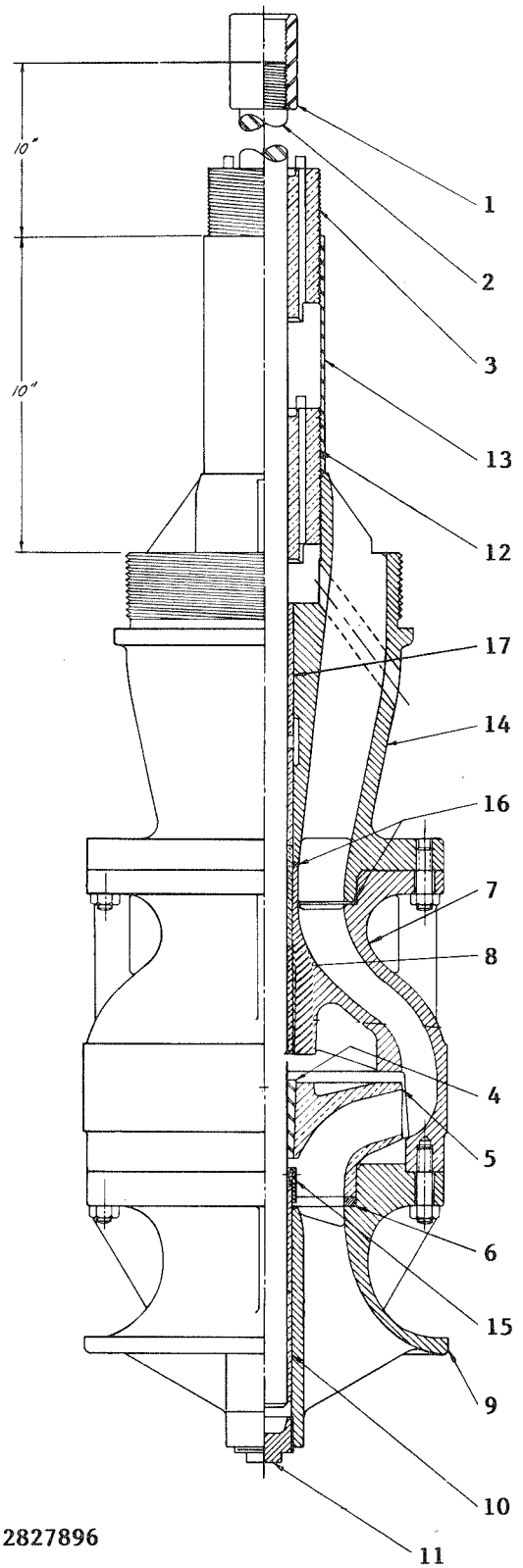
13 top bearing adapter

14 E.L.S. discharge manifold

15 sand collar

16 o-ring (3)

17 discharge manifold bearing



(1) 8HDX, 8MFH, 11MB and 15LC are available with threaded suction manifolds only.

(2) Bell suction is shown, threaded suction manifold is available.

(3) 8MFH, 10MFH, 16HH and 18HXB do not require any o-rings. 20MA uses an o-ring at the center hub only.

Dwg. No. 2827896

Bowl Assemblies

Open Lineshaft 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

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

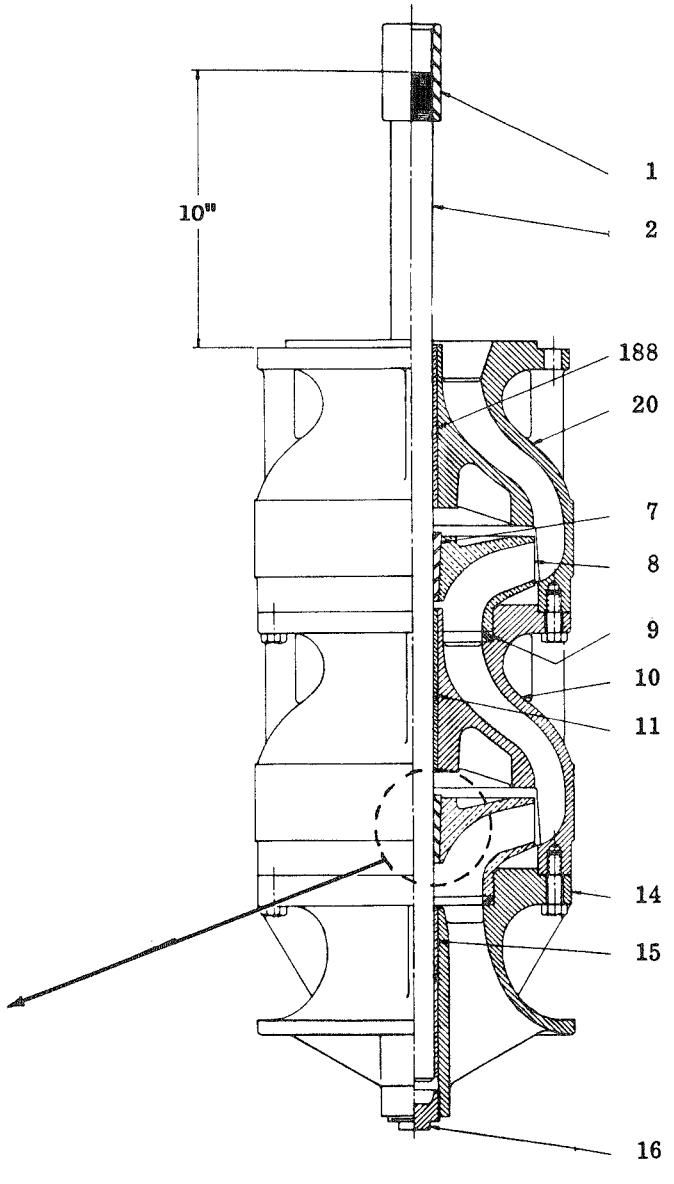
16 suction manifold plug

20 top standard bowl

188 top standard bowl bearing

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

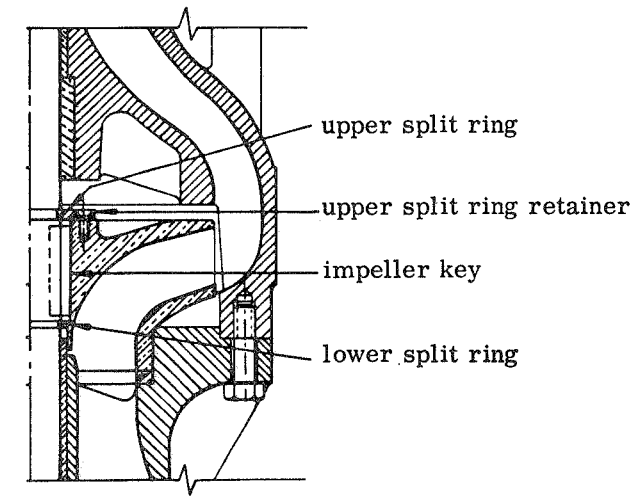
* Discharge manifold and impeller taper lock bushing construction on 11MB, 15MA, 15LC and 18HXB.



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



Bowl Assemblies

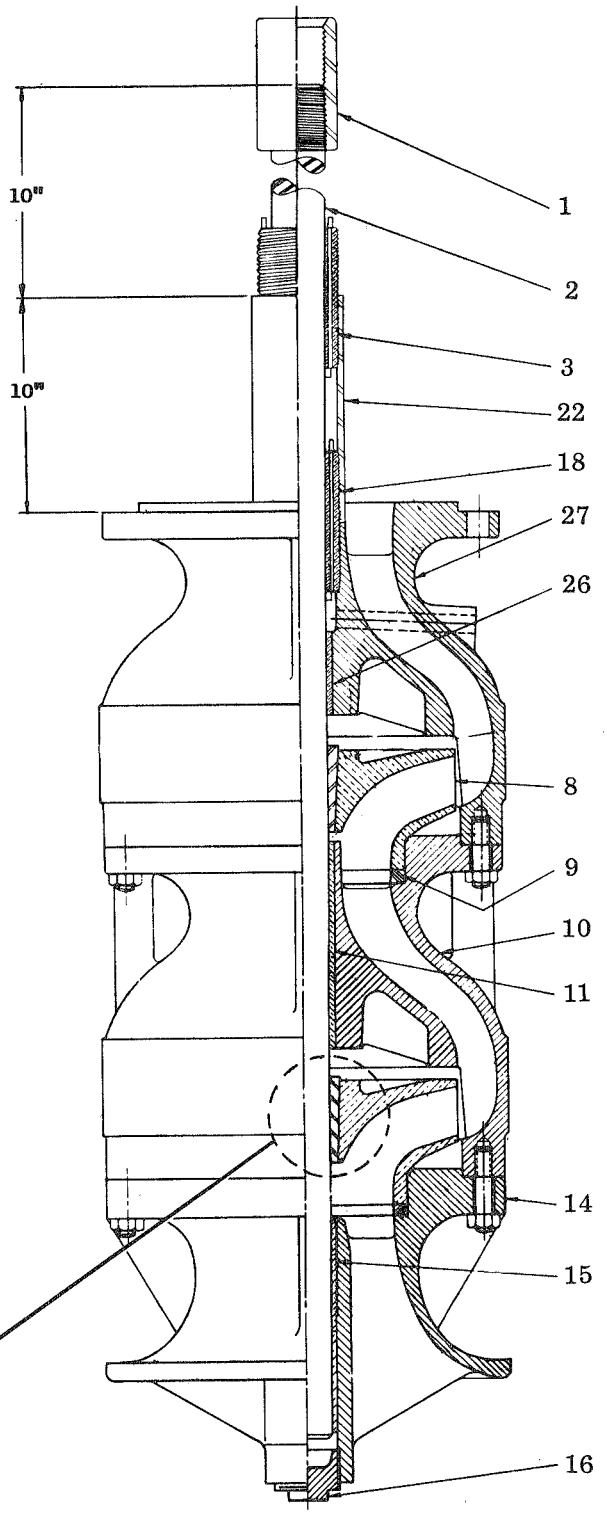
Enclosed Lineshaft Construction

with

Top Standard Bowl

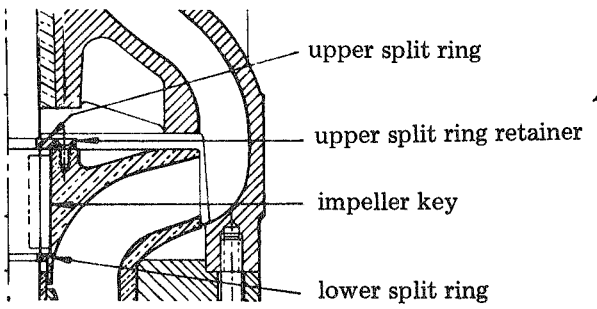
Sizes 18HH*, 20HXB*, 20HH*, 24MA*, 24HXB*, 24HXC*, 24HH*, 26HXB*, 26HH*, 27MA*, 28HXB*, 30LA*, 30HH*, 32HXB*, 36MA*, 36HXB*, 36HH*, 42HXB, 42HH, 48HXB*, 48HH*, 56HH*, 66HH*

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

Bowl Assemblies

Open Lineshaft Construction

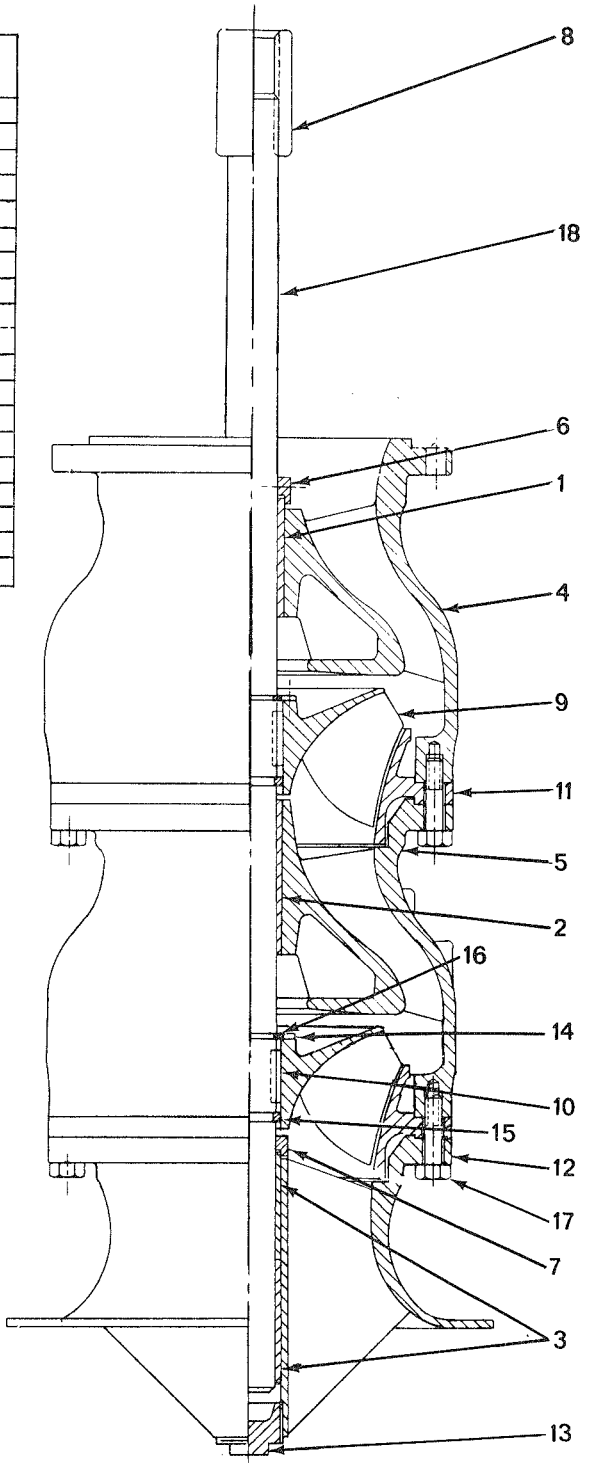
with

Semi-Open Impeller and Top Standard Bowl

24HH-OH, 26HH-OH, 30HH-OH and 36HH-OH

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.



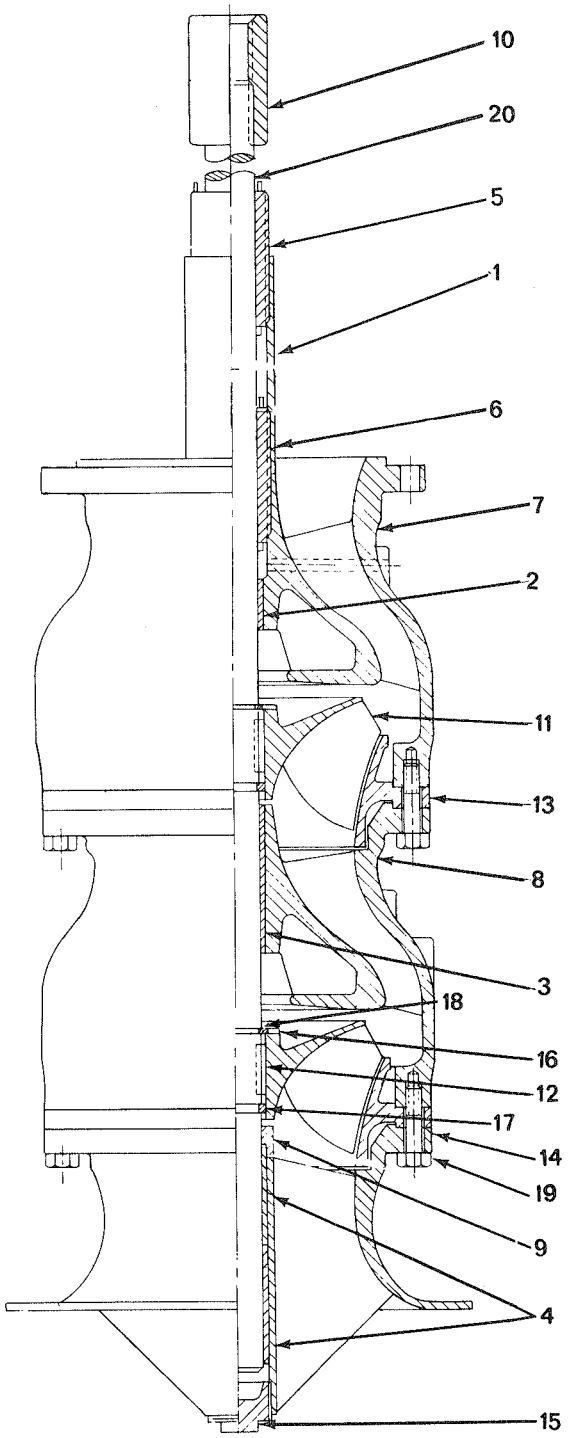
Dwg. No. 4805471

Bowl Assemblies

Enclosed Lineshaft Construction
with
Semi-Open Impeller and Top Standard Bowl
24HH-OH, 26HH-OH, 30HH-OH and 36HH-OH

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.

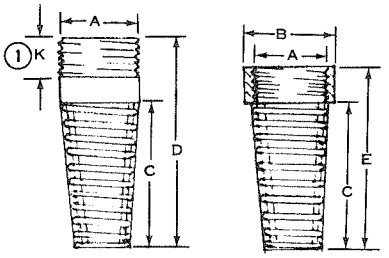


Dwg. No. 4805472

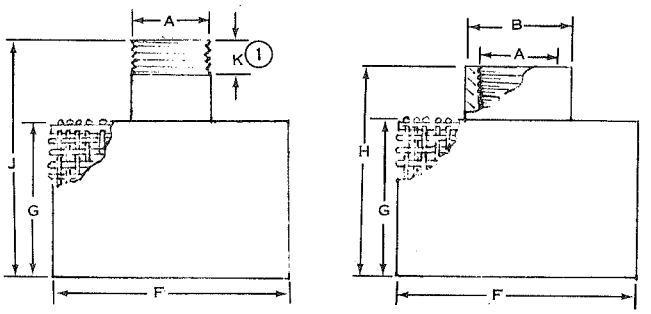
STRAINERS

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 (1)
	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	
2½"	2½" – 8 THD, BUTT	3¼	9¾	12¾	11¼	6	6	3	5	4½	6½	6	8	1"
3"	3" – 8 THD, BUTT	4	9¾	12¾	11¼	6	6	3	5	4½	6½	6	8	1⅝
4"	4" – 8 THD, BUTT	5	9¾	12¾	11¾	8	8	4	5	6	7	7	8	1 13/16
5"	5" – 8 THD, BUTT	6¼	10¾	13¾	12¾	10	9	5	5	7	7	8	8	2 1/16
6"	6" – 8 THD, BUTT	7¼	13¾	16¾	15¾	10	9	6	7½	8	9½	9	10½	2 1/16
8"	8" – 8 THD, BUTT	9¼	20	23	22	12	12	8	10	10	12	11	13	2 5/16
10"	10" – 8 THD, BUTT	11½	27½	31½	30	18	18	10	10	12½	12½	14	14	3 1/16
12"	12" – 8 THD, BUTT	13½	29½	33½	32	18	18	12	12½	14½	15	16	16½	3 1/16
14"	14" – 8 THD, ¾ TAPER	14⅝	38½	42½	41½	20	20	12	12½	15	15½	16	16½	1 13/16
16"	16" – 8 THD, ¾ TAPER	16⅝	42½	46½	45½	24	25	12	12½	15	15½	16	16½	2 1/16

MESH SIZE FOR BASKET STRAINERS	
2½" THRU 5" = ¼	10" THRU 14 = ½
6" THRU 8" = ⅜	16" = ¾

SLOT WIDTH FOR CONE STRAINERS
STEEL – ALL SIZES = 5/16
BRONZE – ALL SIZES = ¼

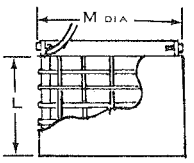
NOTE: ALL STRAINERS HAVE A NET WATER PASSAGE AREA OF AT LEAST FOUR TIMES PIPE SIZE.

STRAINERS

CLIP ON TYPE FOR BELL TYPE SUCTION MANIFOLDS

Bowls 6 thru 16 Inch

DIMENSIONS (ALL MATERIALS)							
BOWL SIZE	L	M (2)	MESH SIZE	BOWL SIZE	L	M (2)	MESH SIZE
6 LB	4¾	6¾	¼	12LD	9¼	12 15/16	½
6 MA	4¾	6¾	¼				
7 LB	5½	7¾	¼	12MB	9¾	12⅞	⅜
8 LB	6	8½	¼	12HXB	9¼	12⅜	½
8 MA	6	8½	¼	12HXH	11⅝	15⅜	½
				14LD	11	14¾	½
9 LA	8	10⅞	⅜	14MC	11	14⅜	½
				14MD	15⅛	15¼	½
10 LB	8	10⅝	¼	14HXB	11	14⅜	½
10 MA	8½	11⅜	½	14HH	12⅝	16⅜	½
10 HXB	8	10⅝	¼	15MA	12⅝	16⅞	½
10 HH	9	12	⅜	16MC	11⅝	15⅛	½
10 MFH	8	10⅝	¼	16HXB	12¾	16½	½
				16HH	15	19⅞	½



(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.

STRAINERS

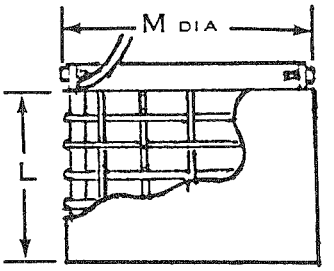
CLIP ON TYPE FOR BELL TYPE SUCTION MANIFOLDS

Bowls 18 inch and larger

DIMENSIONS (ALL MATERIALS)											
BOWL SIZE	L	M (1)	MESH SIZE	BOWL SIZE	L	M (1)	MESH SIZE	BOWL SIZE	L	M (1)	MESH SIZE
18 MA	11 5/8	15 1/8	1/2	24 HH-OH	20 1/4	26 1/2	1"	32 HXB	25 1/2	32	1 1/2
18 HXB	14	18	1/2	26 HXB	21	27	1"	36 MA	27	34 3/8	1 1/2
18 HH	16	20 7/8	3/4					36 HXB	29 1/2	37	1 1/2
20 MA	15 1/4	19 1/2	1"	26 HH	23 5/8	30 3/8	1"	36 HH	32 1/4	40 3/8	1 1/2
20 HXB (2)	14 3/4	19	3/4	26 HH-OH	23 5/8	30 3/8	1"	36 HH-OH	32 1/4	40 3/8	1 1/2
20 HH	16	22 1/4	1"	27 MA	23	29 3/8	1"	42 HXB	34	42 3/4	1 1/2
24 MA	16	21	1"	28 HXB	22	28 3/8	1"	48 HXB	40 3/4	50 7/8	1 1/2
24 HXB	17 3/4	23 1/4	1"	30 LA	REFER TO FACTORY			48 HH	42 1/4	52 3/4	1 1/2
24 HXC	17 3/4	23 1/4	1"	30 HH	29 1/4	37 1/4	1 1/2	48 HH-OH	42 1/4	52 3/4	1 1/2
24 HH	20 1/4	26 1/2	1"	30 HH-OH	29 1/4	37 1/4	1 1/2	56 HH	REFER TO FACTORY		

(1) 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.

(2) 20HXB LOW NPSH FIRST STAGE IS 16 X 21 WITH 1" MESH (SAME AS 24MA.)



GENERAL SPECIFICATION FORM

WATER 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 (total of 4 plus 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.

MOTOR:

The motor thrust bearings 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 standards of the National Electrical Manufacturers Association.

The motor shall be a ___volt, ___phase, ___Hertz, 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 maximum operating temperature of 90°C. (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. The centerline of the discharge tee shall be ___inches below the bottom of the base plate.

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 weigh 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, 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. 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 O.D. (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 dimensional tolerances.

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.

Impeller(s) shall be of (bronze) (cast iron) (enameled 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 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 or copper 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 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.

PUMP BOWL ASSEMBLY: Peerless Pump bowls conform to the specifications as written but they also include the following 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 efficiences 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 a neoprene bearing to support the impeller shaft which gives the longest possible life based on the widest range of pumping conditions.

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 (total of 4 plus 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.

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 standards of the National Electrical Manufacturers Association.

The motor shall be a ___volt, ___phase, ___Hertz, 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 maximum operating temperature of 90°C. (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. The centerline of the discharge tee shall be ___inches below the bottom of the base plate.

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 weigh 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. Pipe joints shall be butt fit to assure correct 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 dimensional tolerances.

The impeller shaft shall be of stainless steel of not less than 12% chrome. The impeller shaft shall be supported by water lubricated bronze bearings.

The impellers shall be of (bronze) (cast iron) (enameled 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 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 or copper 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.

A Peerless oil lubricated pump will meet all the requirements of the foregoing specifications and, in addition, will 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.

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 per cent 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 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 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 limitations of the site.

Complete analysis of intake structures is best accomplished by scale model tests (See Model Tests of Intakes page 83).

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).

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.

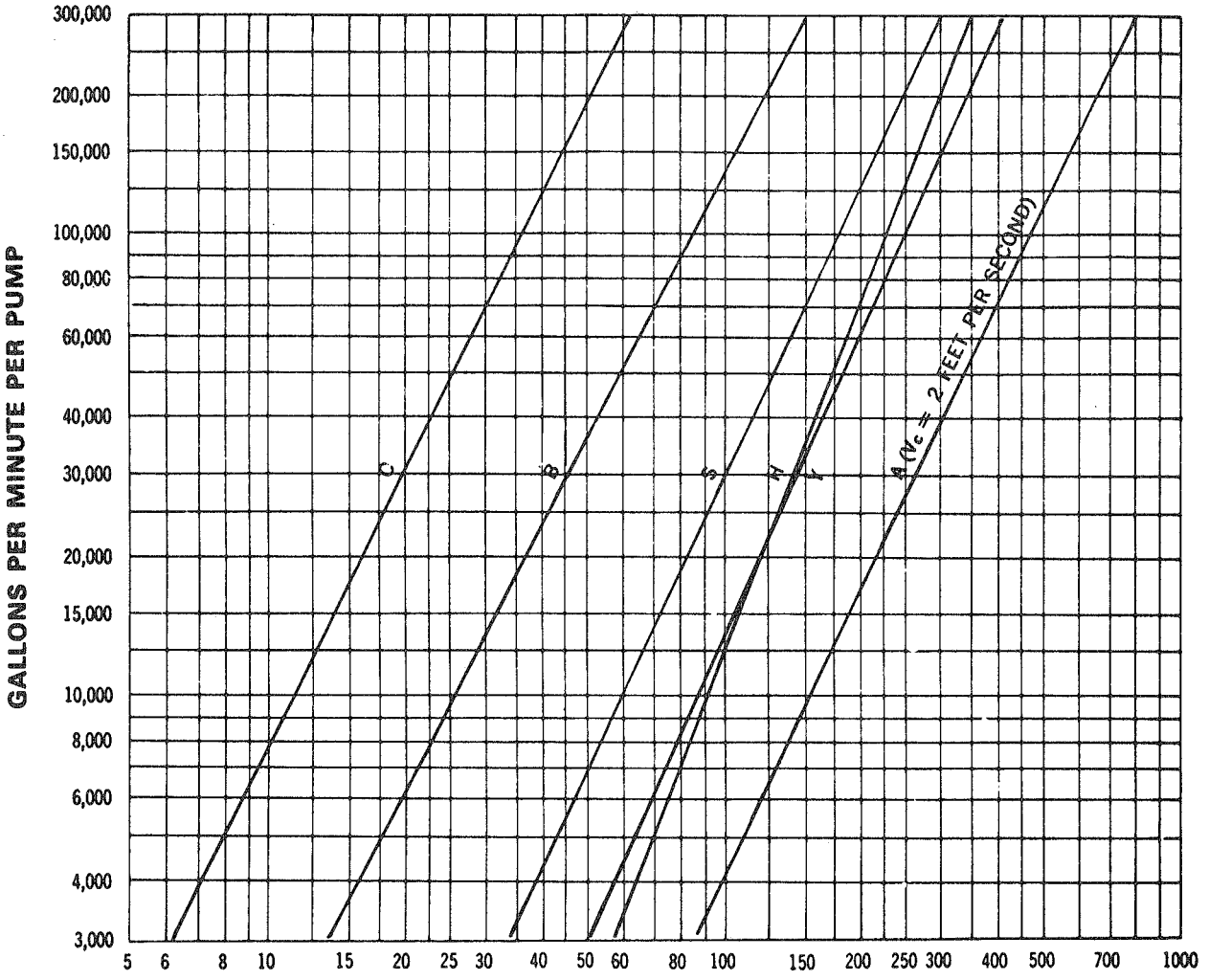
Fig. 67c. Abrupt changes in size from inlet pipe or channel to pump bay are not desirable. A relatively small pipe emptying into a large pump pit should connect to the pit with a gradually increasing taper section. The angle should be as large as possible, preferably not less than 45 degrees. With this 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 68 and 69. Figures apply to sumps for clear liquid. For fluid-solids mixtures refer to the pump manufacture .

Fig. 64

SUMP DIMENSIONS VERSUS FLOW

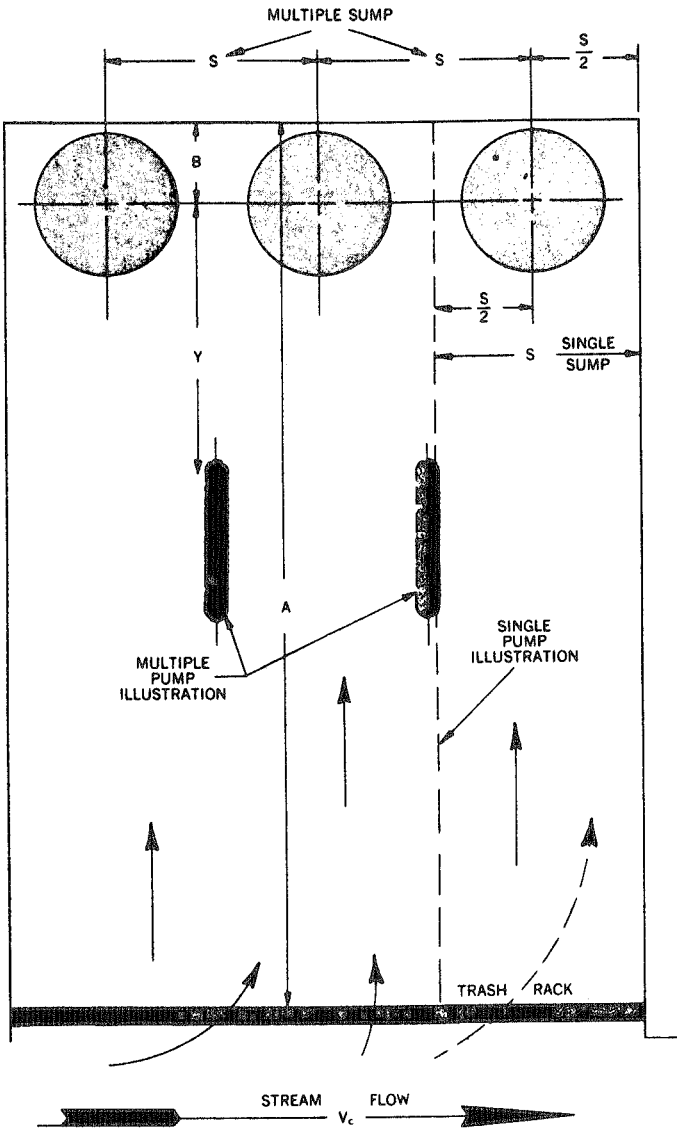


Fig. 65

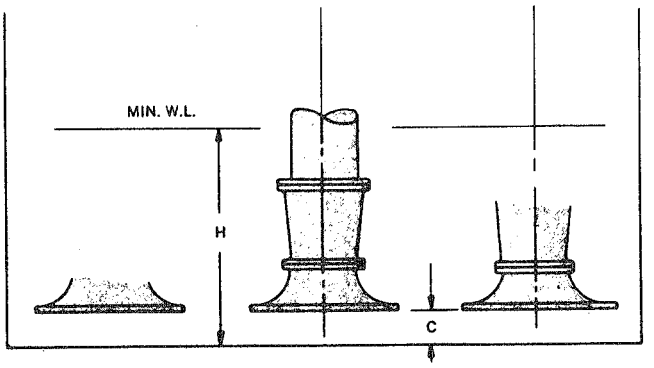
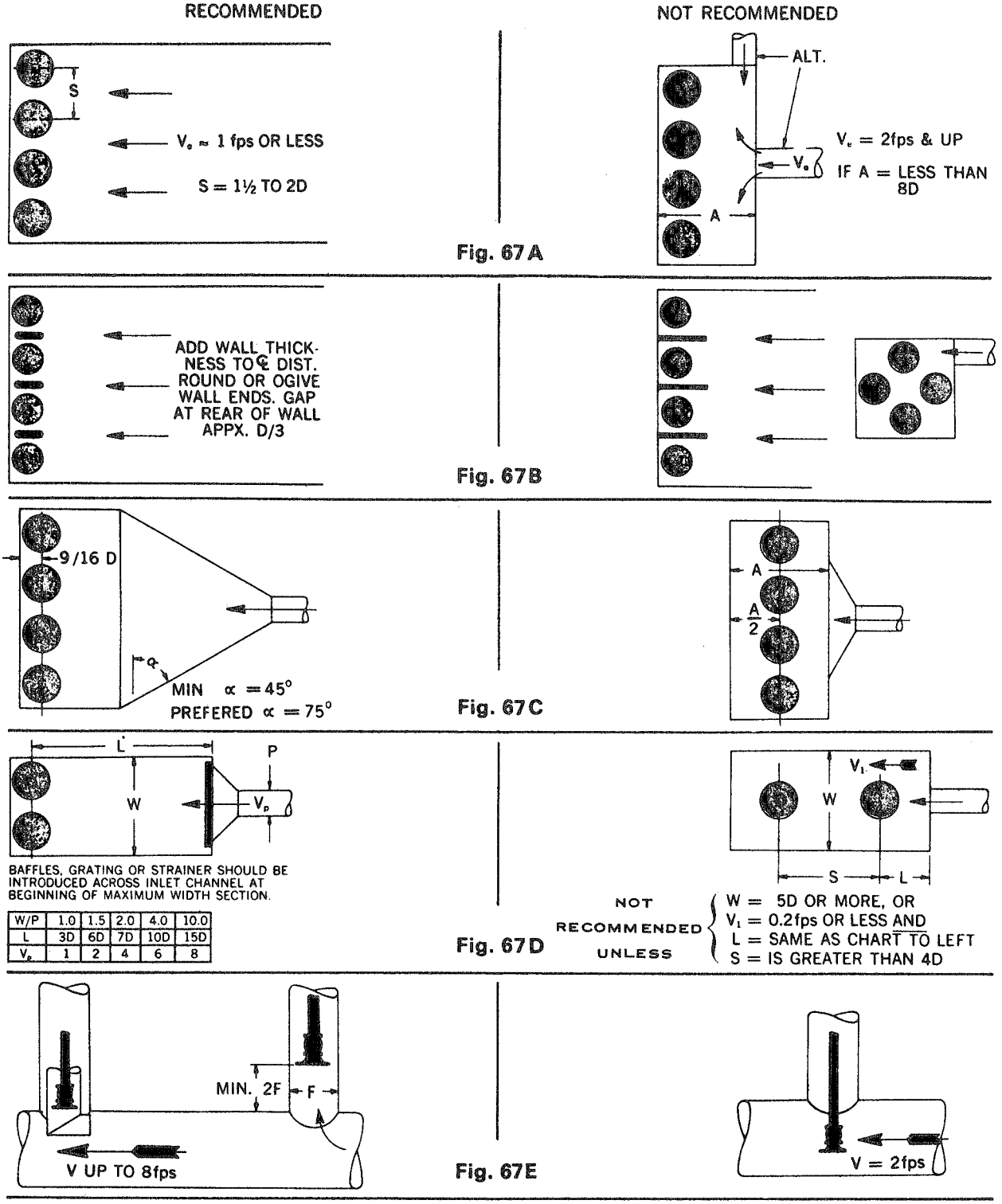


Fig. 66

MULTIPLE PUMP PITS



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 made by 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 manufacturer. The sump model test may show 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 this basis,

$$V_M = V_P \times \sqrt{R}$$

where

V_M = velocity of water in the model
V_P = velocity of water in the prototype
R = linear scale ratio of model to prototype

or $\frac{L_M}{L_P}$

where

L_M = any linear dimension of the model
L_P = the dimension on the prototype corresponding to any dimension L_M on the model.

Several investigators have found better agreement between model and prototype 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 previous pages.

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 recommendations should be requested.

In addition to the general design principles outlined, 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 distibution nozzle can be used to prevent 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 assue 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

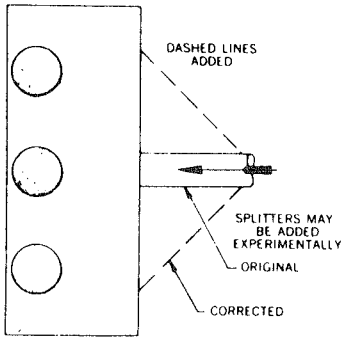


Fig. 68A

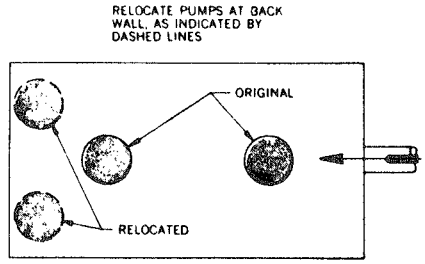


Fig. 68B

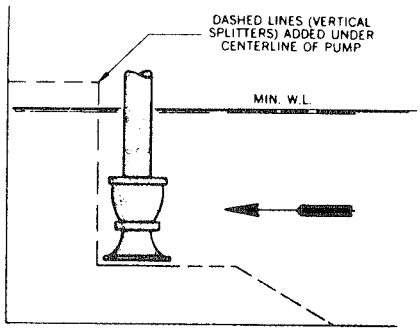


Fig. 68C

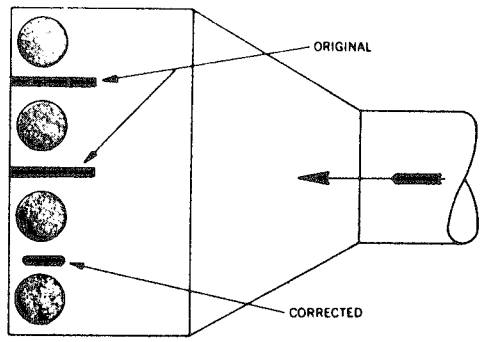


Fig. 68D

Fig. 68

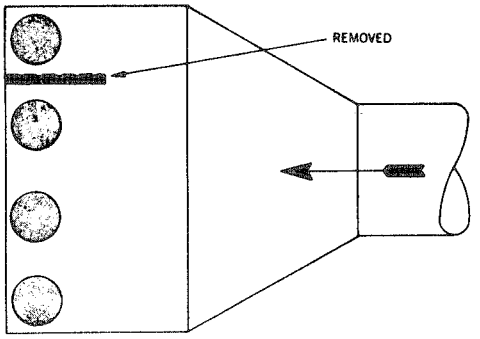
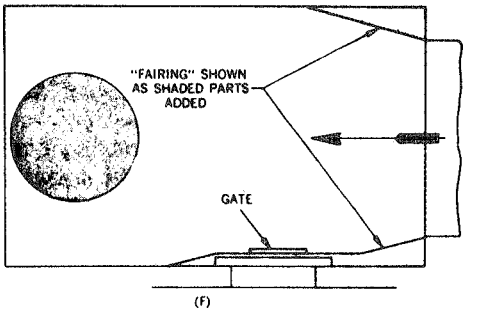
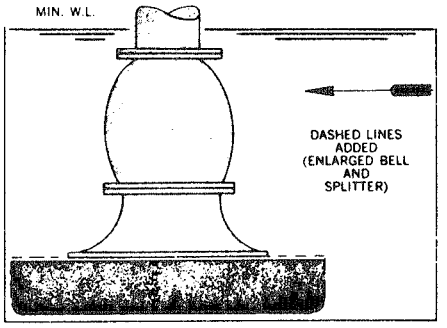


Fig. 68 E



(F)

Fig. 68 F



(G)

Fig. 68 G

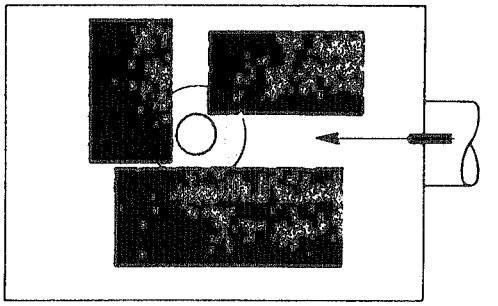


Fig. 68 H

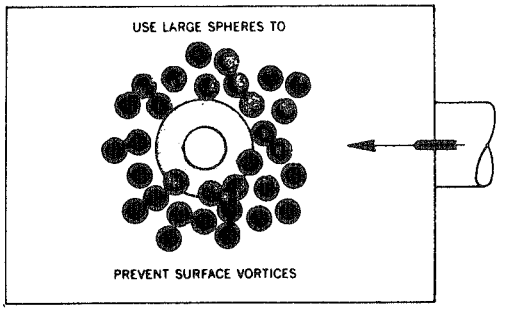


Fig. 68 I

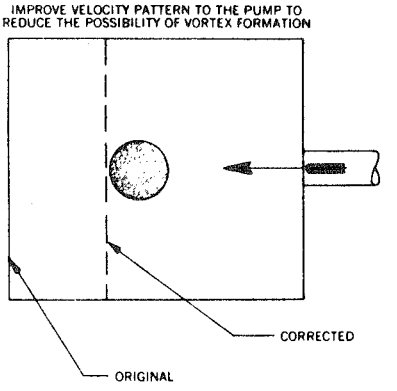


Fig. 68 J

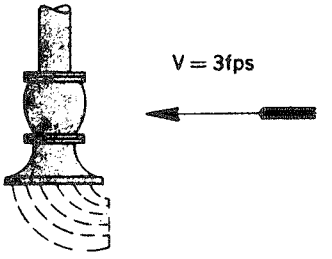
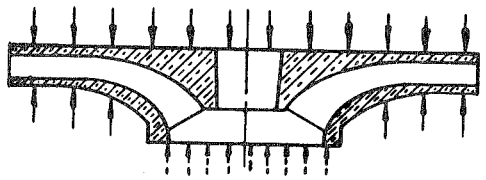


Fig. 68 K

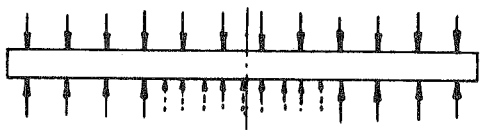
Note: Figures apply to sumps for clear liquid.
For fluid-solids mixtures refer to the pump manufacturer.

(CONT.)
Fig. 68

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 the vast majority of applications there is only downthrust. To understand why there is thrust, it is only necessary to know the pressure forces acting on each impeller.

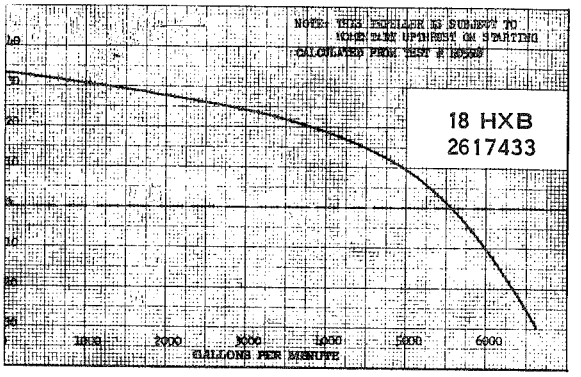


The solid lines represent the force exerted by the discharge pressure. The dotted lines show the comparatively lesser force (suction pressure) acting across the eye of the impeller. In essence, there exists a situation as follows:



It can be seen that the load down is greater than the load up, thus resulting in downthrust. 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 downthrust, is actually pushed up or put in compression from upthrust.

A typical thrust curve illustrates graphically how the thrust value changes and how upthrust results at high capacities. Each impeller design has its own thrust curve characteristic just as it has its own head capacity characteristic. Note that if this impeller is operated at capacities over 5500 gpm, the pump will start to upthrust.



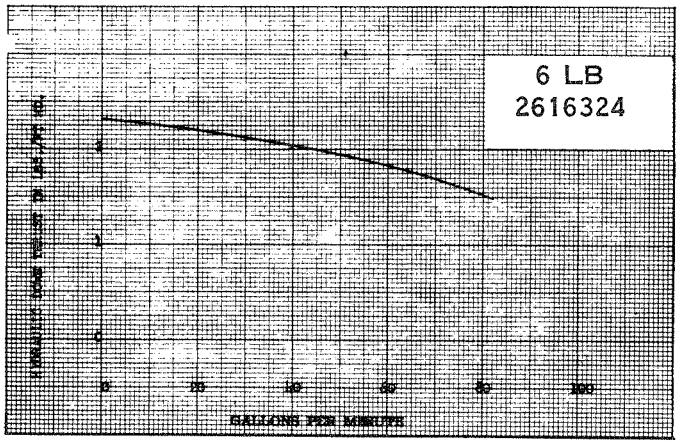
To determine the total thrust load in the driver, the weight of rotating parts (column shaft and impellers) should be considered. These weights are added to the hydraulic thrust if the thrust is down and are subtracted if the hydraulic thrust is acting up. When a pump is first started, it usually comes 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 upthrust" which is momentary only because the unit (in most cases) very quickly starts operating in a more normal part of the curve.

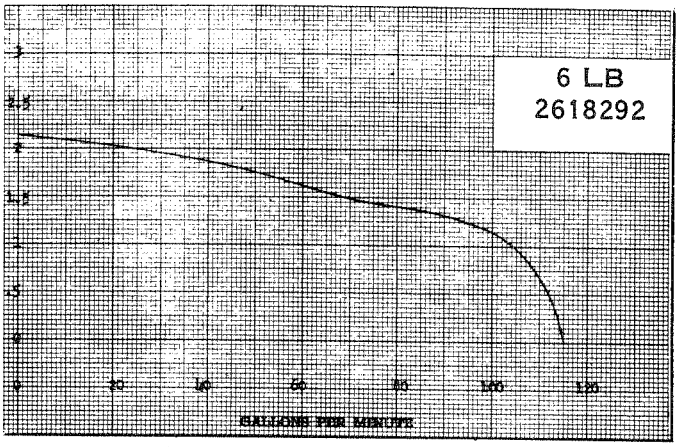
Bearings in the driver must be designed to take the thrust loads imposed by the pump. These loads are usually downward, but can be upward either momentarily or continuously, depending both on the specific impeller and the operation of the pump. Driver manufacturers usually publish only downthrust values. However, momentary upthrust 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 upthrust capacity equal to 30% of the downthrust rating and must have the top drive coupling bolted down. Drivers which must take continuous upthrust must be referred to the factory, since both motor and pump require special design.

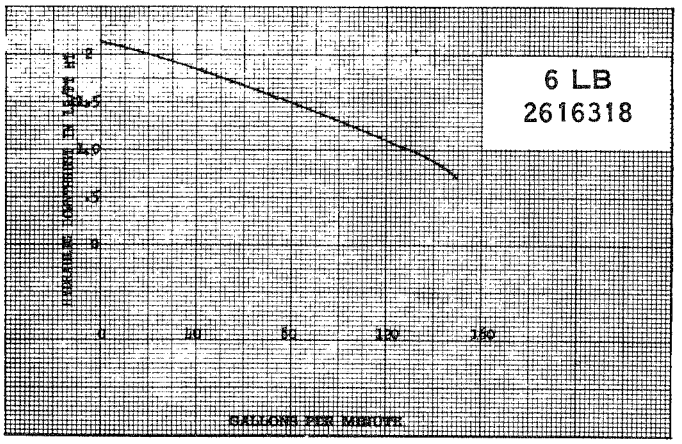
In general, spherical roller bearings are used on motors of 300 hp at 1800 rpm (or equivalent size) and larger, for thrusts in excess of 100% of the normal high thrust rating. Where spherical roller bearings are furnished, a minimum downthrust is required. Also, water cooling may be required in the larger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

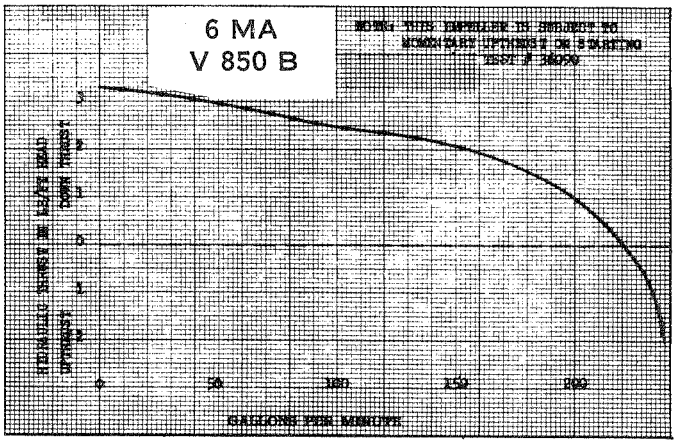
1760 RPM

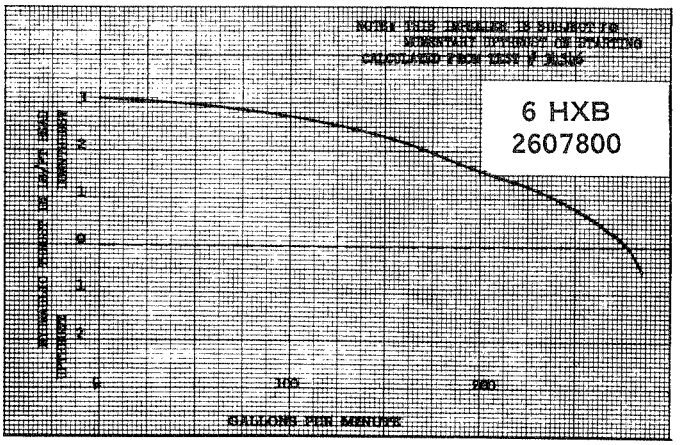
THRUST DATA BY SIZE AND IMPELLER NUMBER

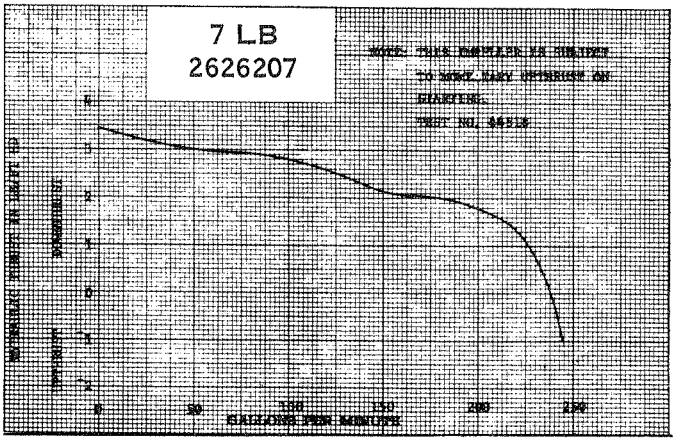


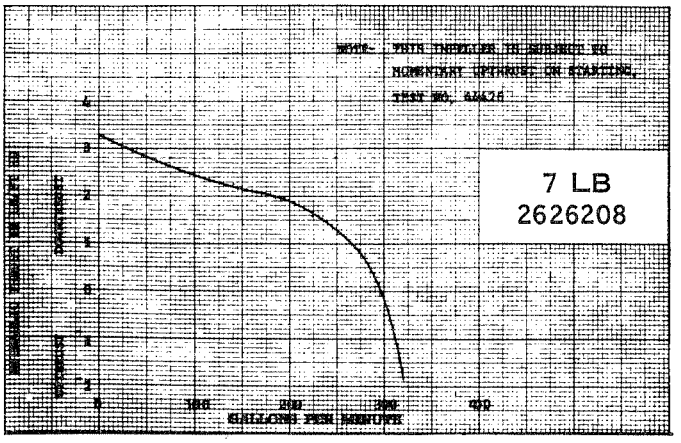


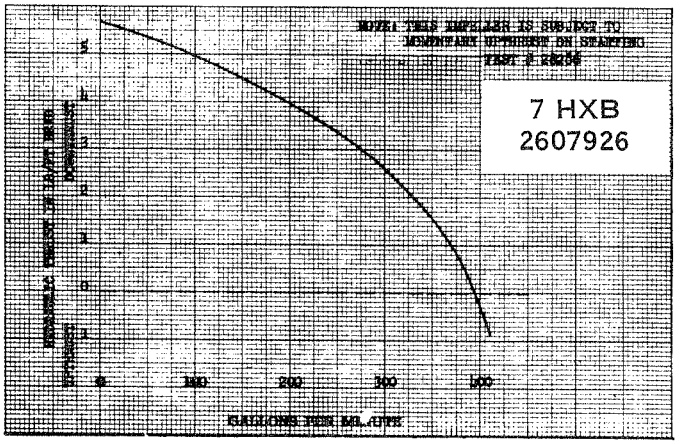






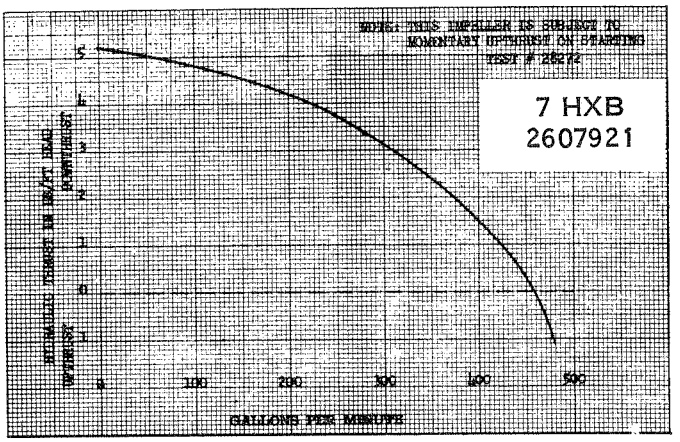


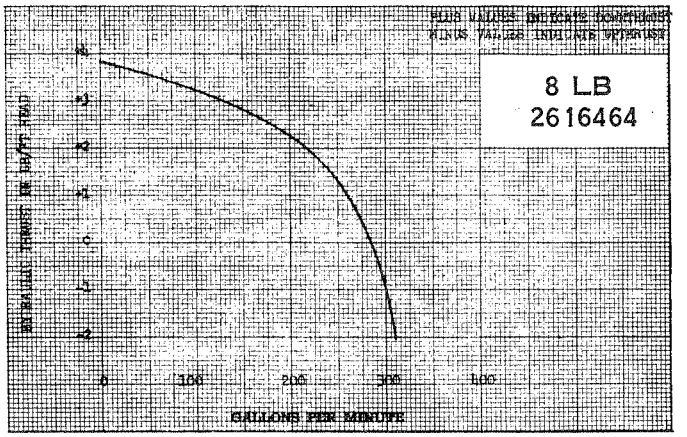


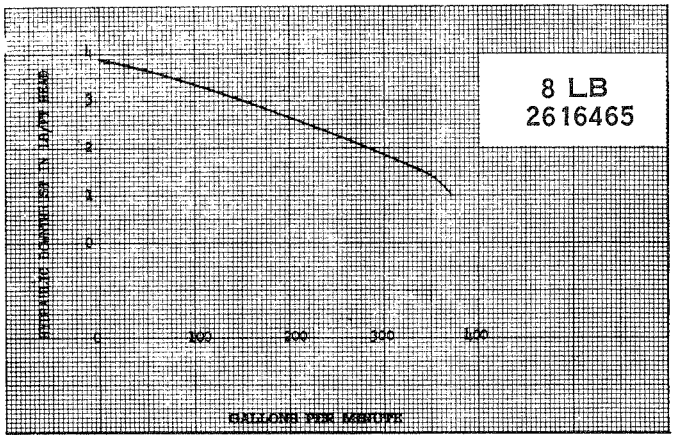


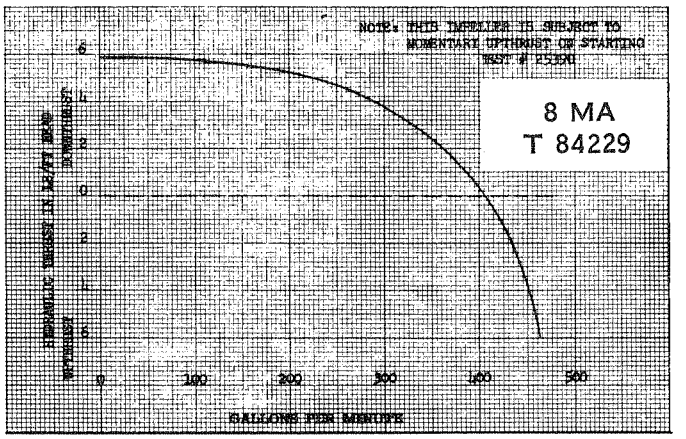
1760 RPM

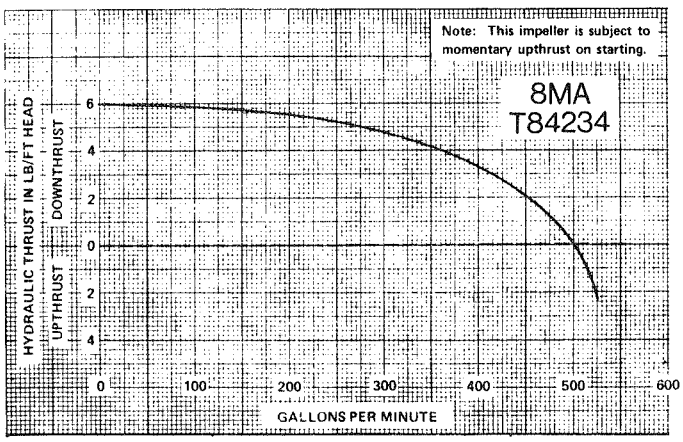
THRUST DATA BY SIZE AND IMPELLER NUMBER

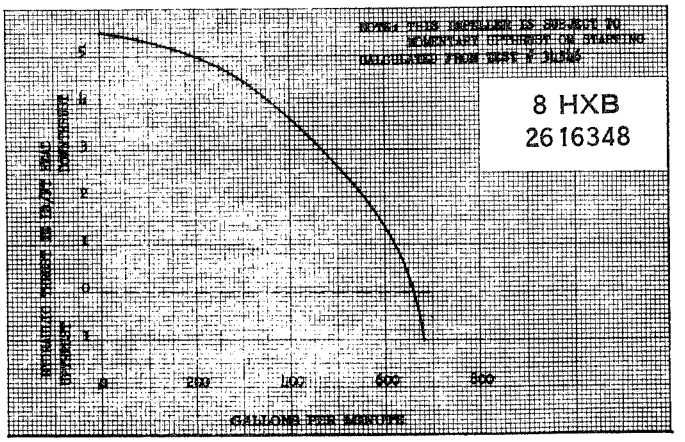


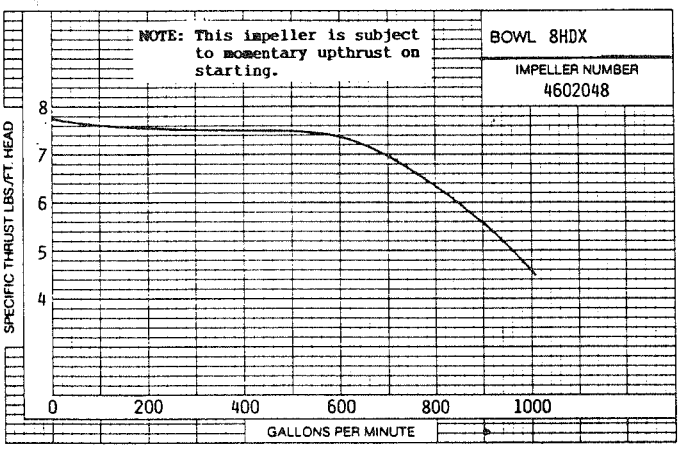


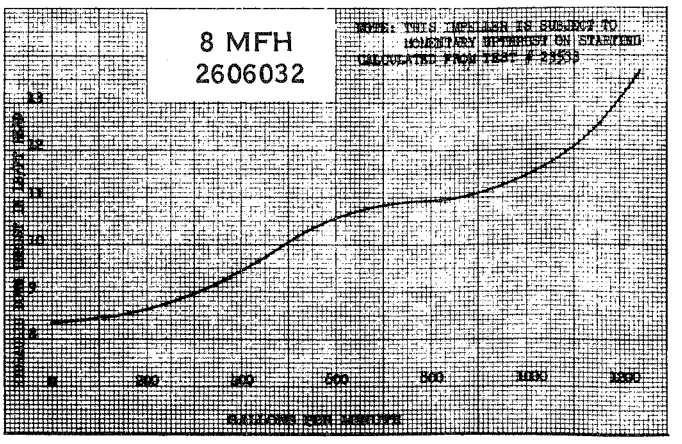






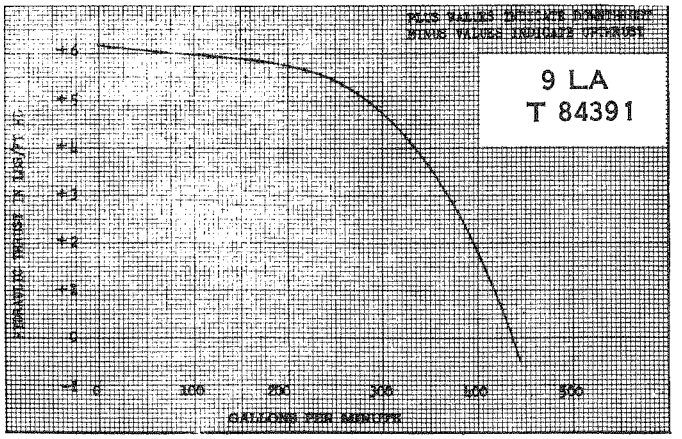


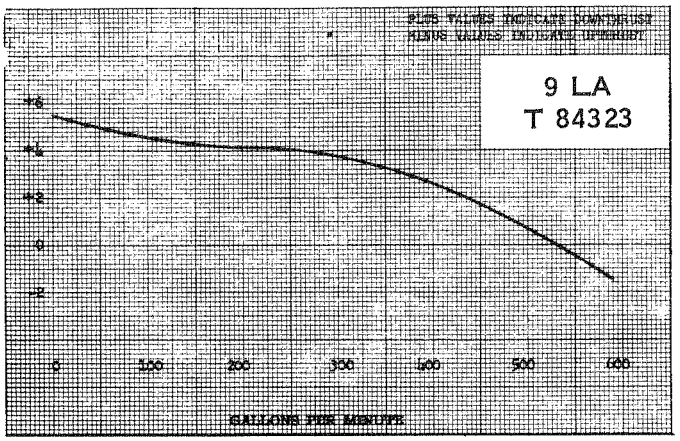




1760 RPM

THRUST DATA BY SIZE AND IMPELLER NUMBER





1760 RPM

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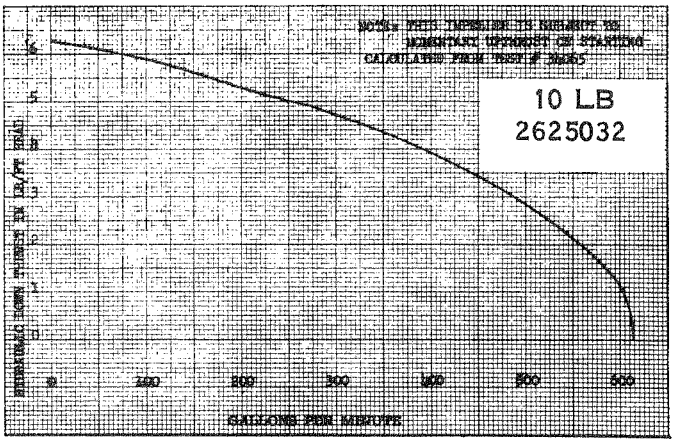
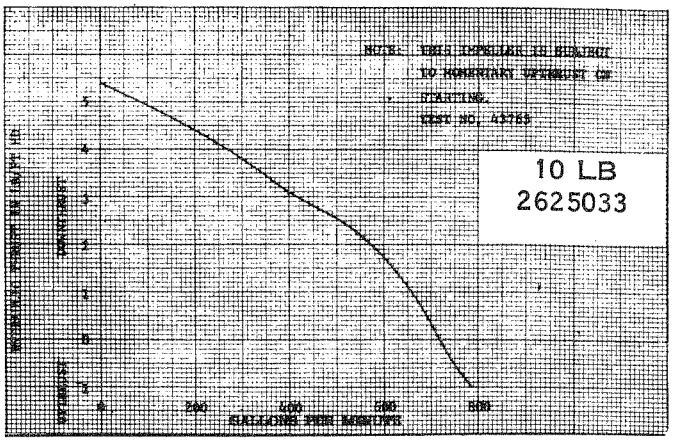
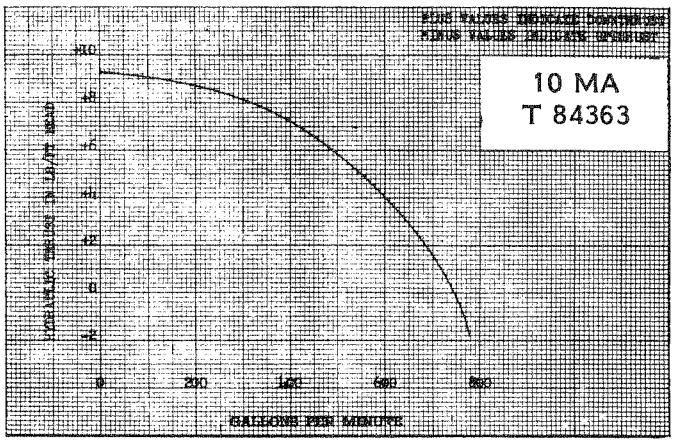
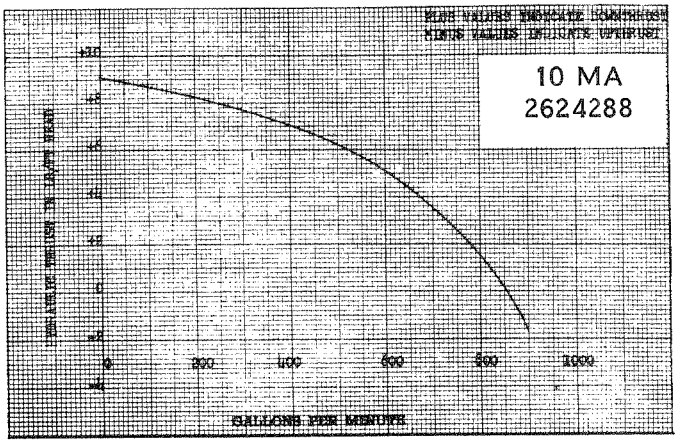
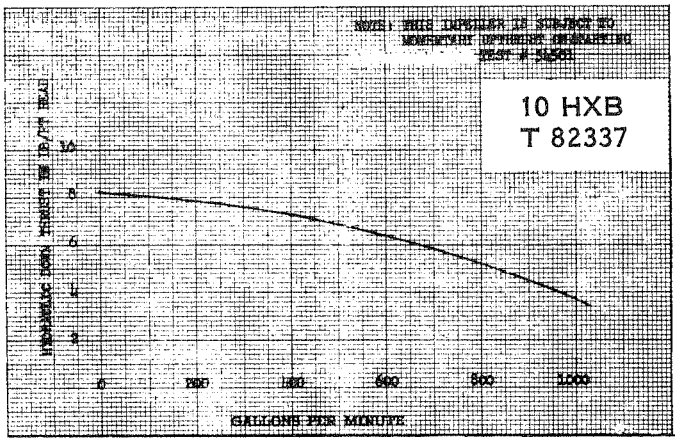
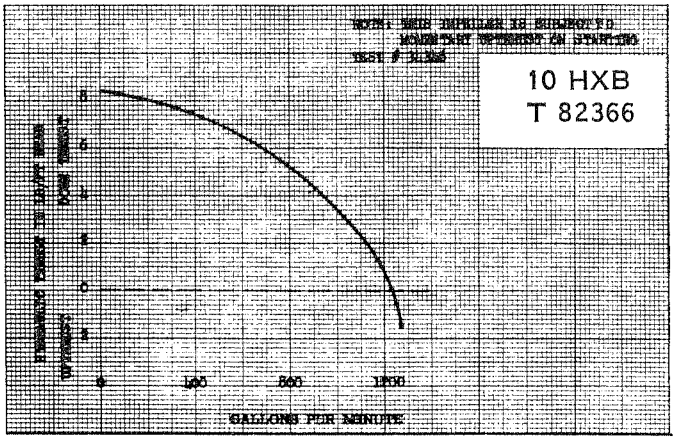


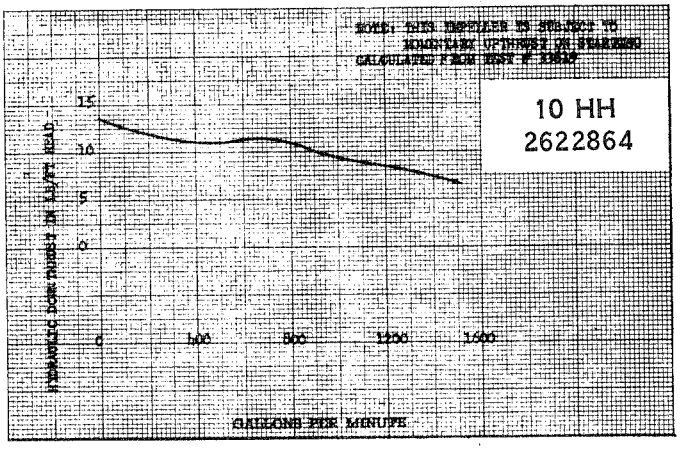


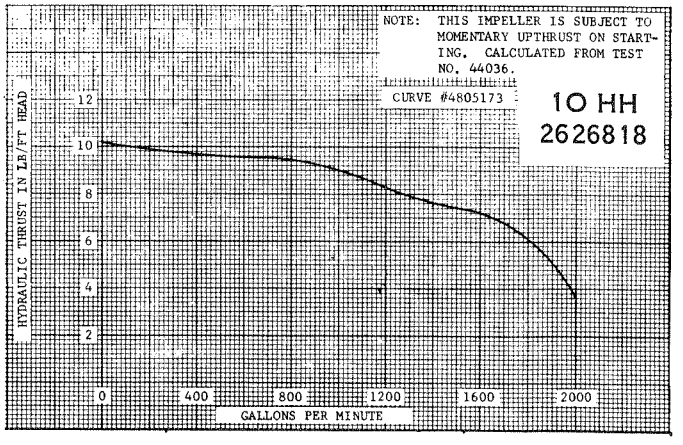






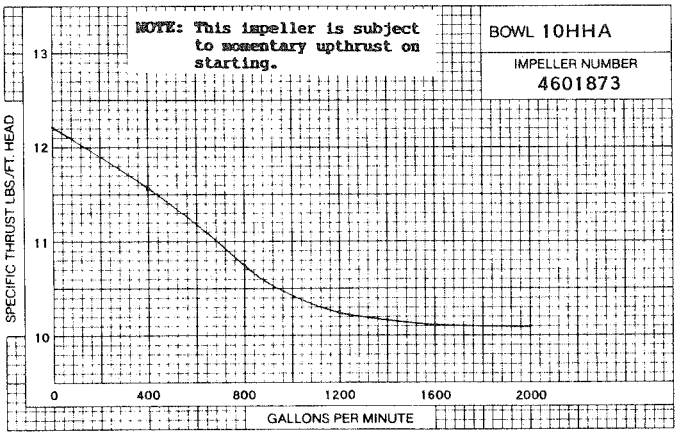


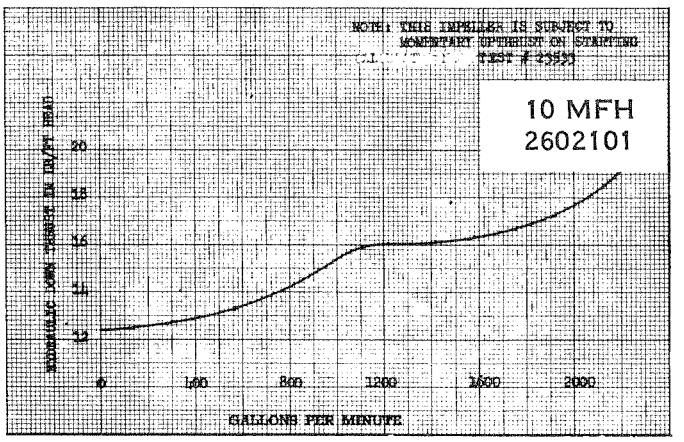


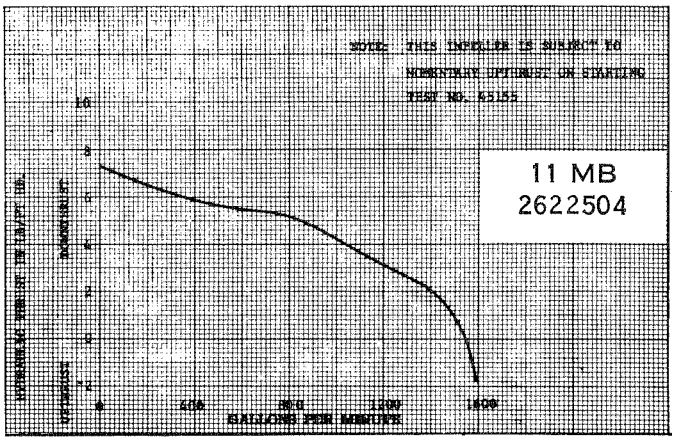


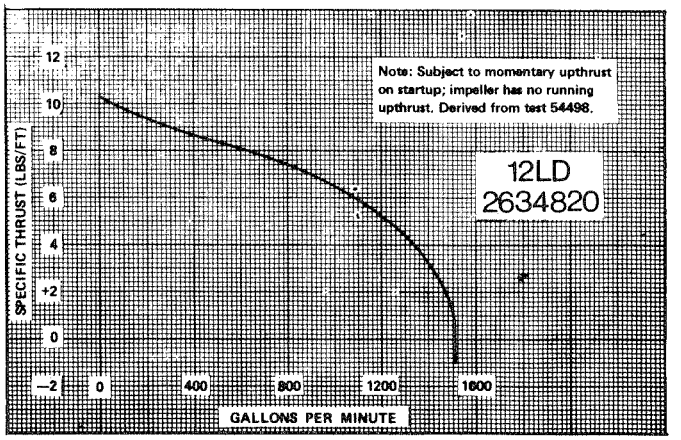
1760 RPM

THRUST DATA BY SIZE AND IMPELLER NUMBER



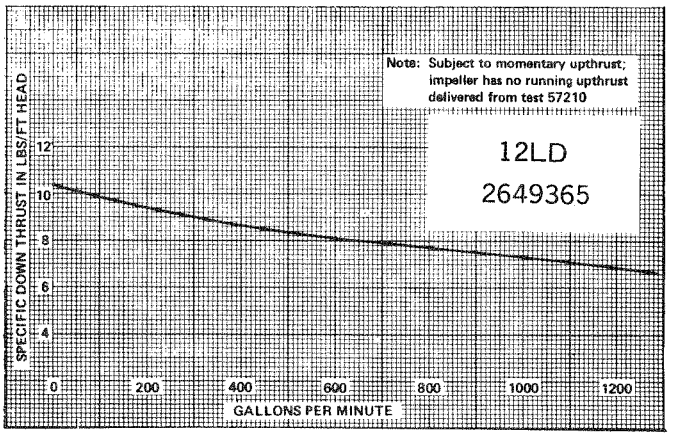


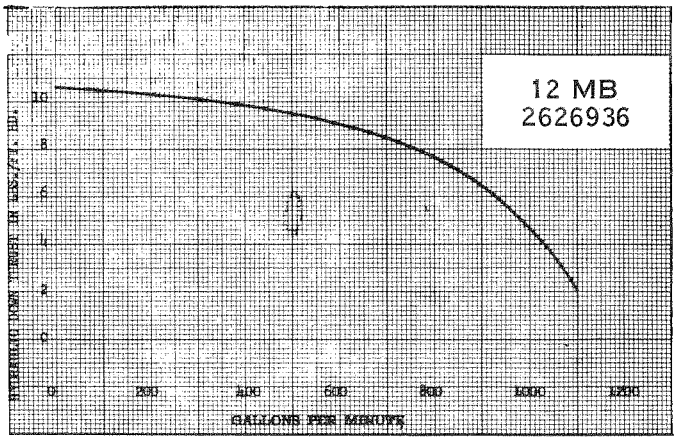


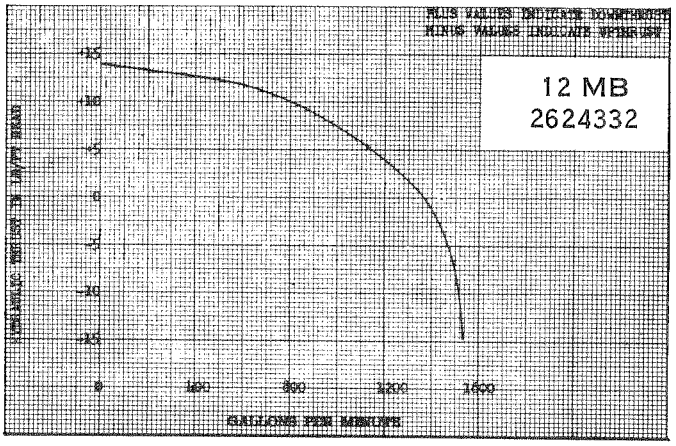


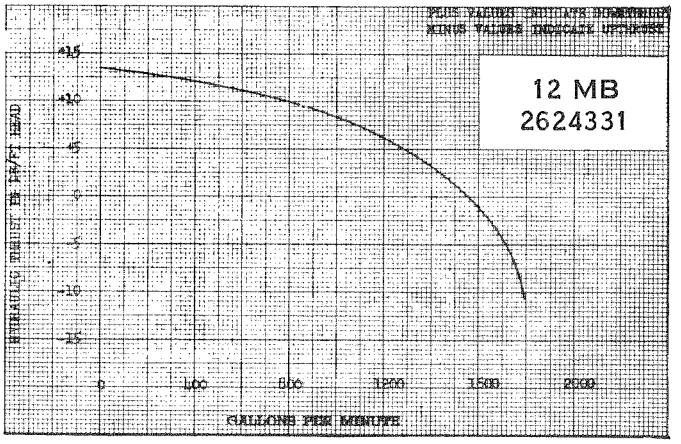
1760 RPM

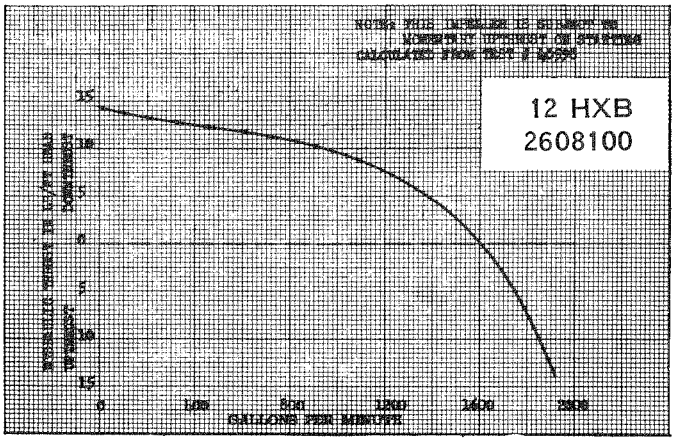
THRUST DATA BY SIZE AND IMPELLER NUMBER

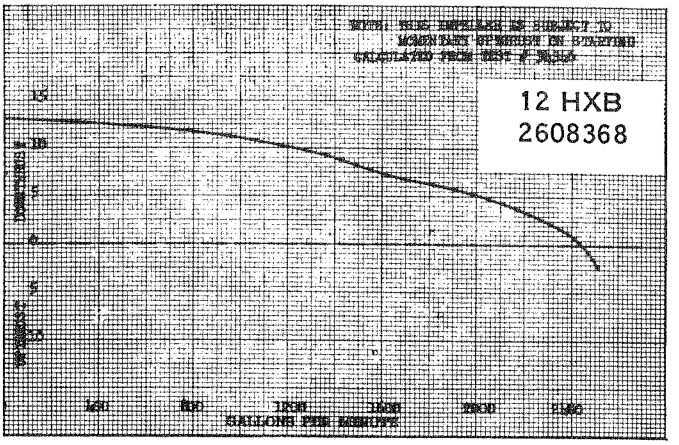


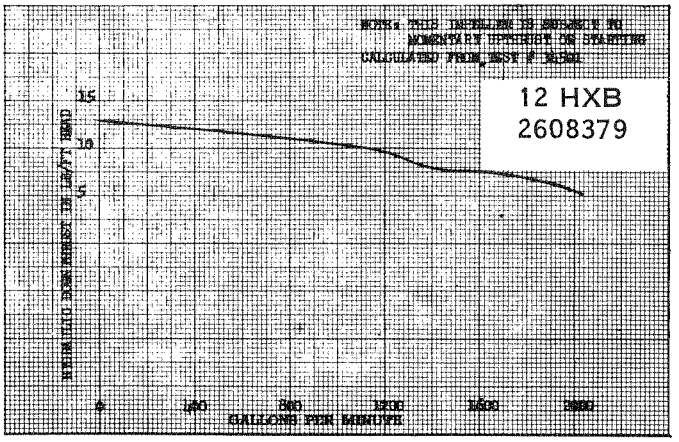


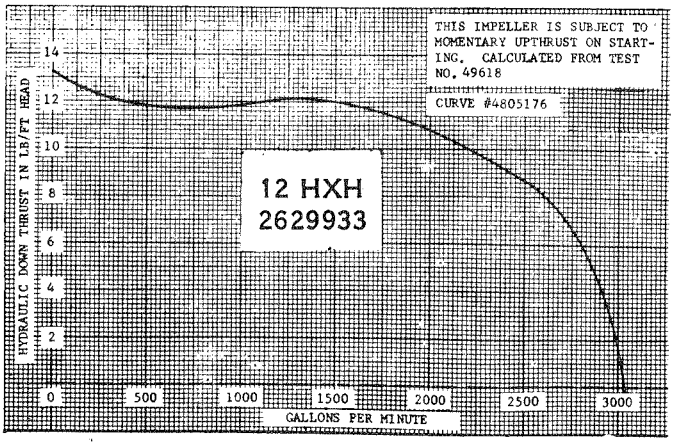






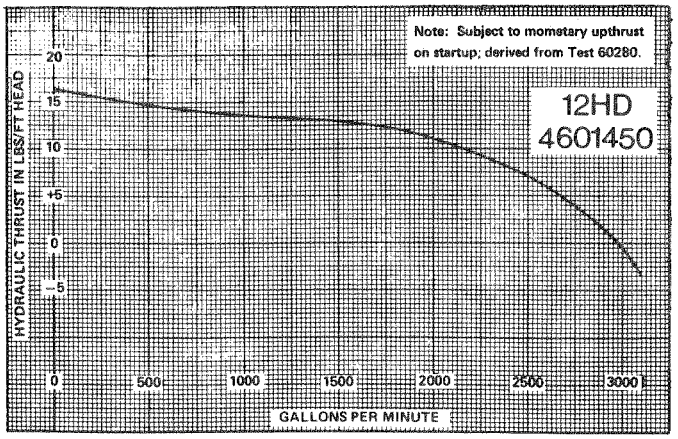


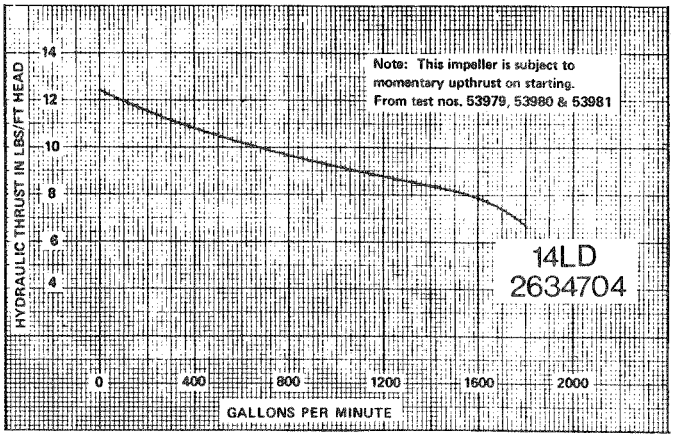


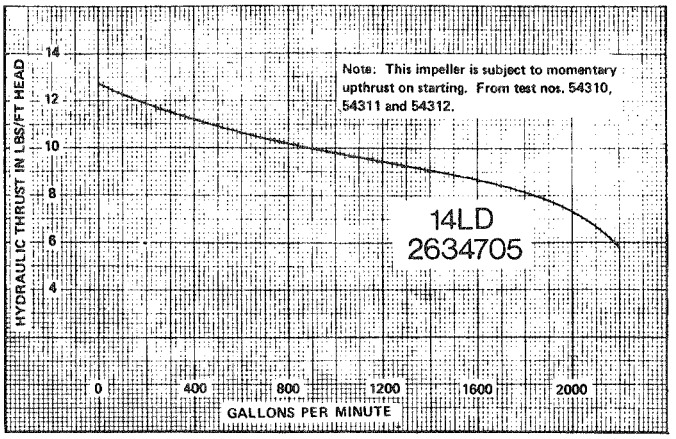


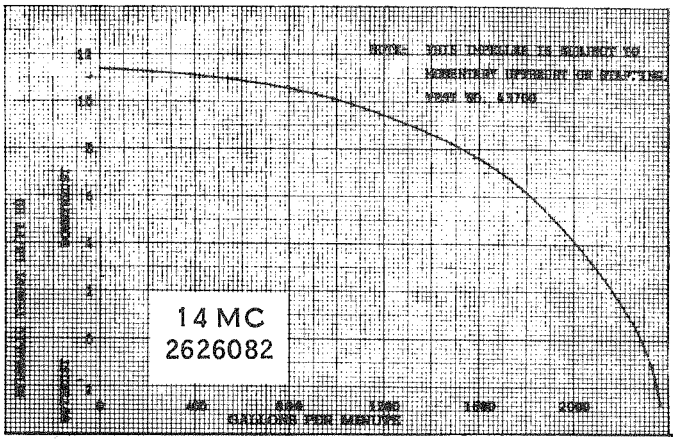
1760 RPM

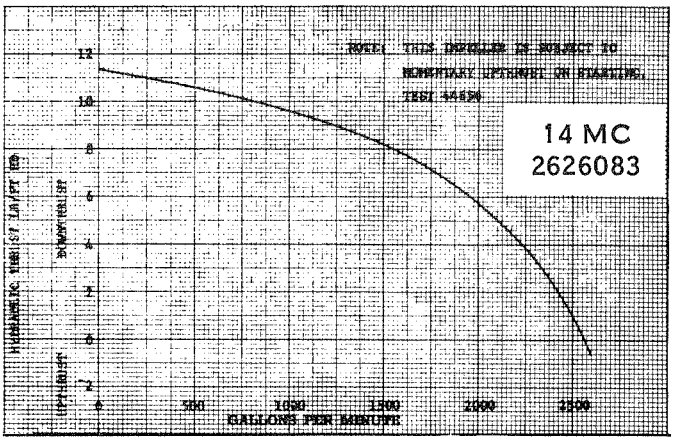
THRUST DATA BY SIZE AND IMPELLER NUMBER

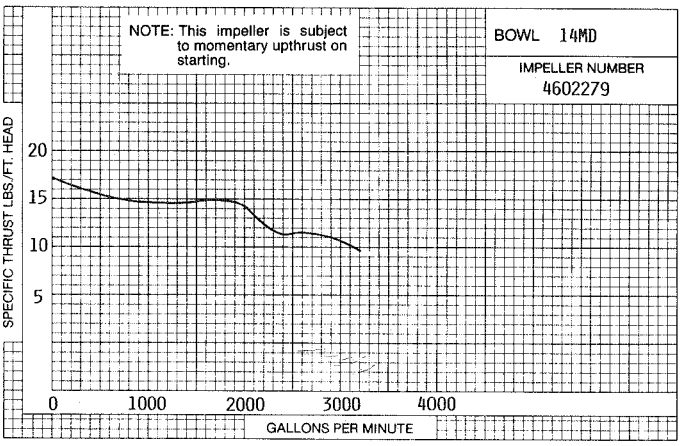






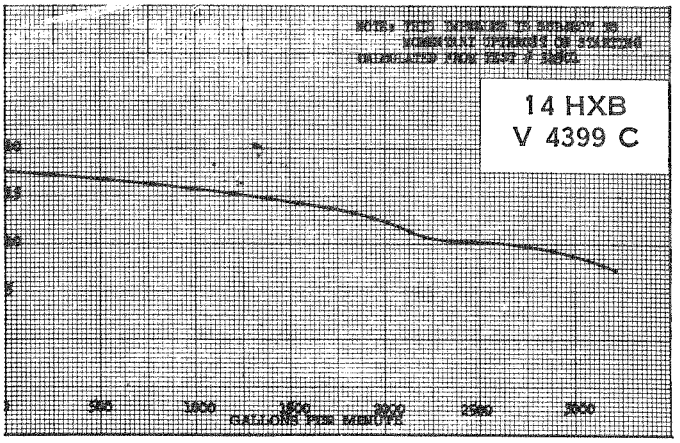


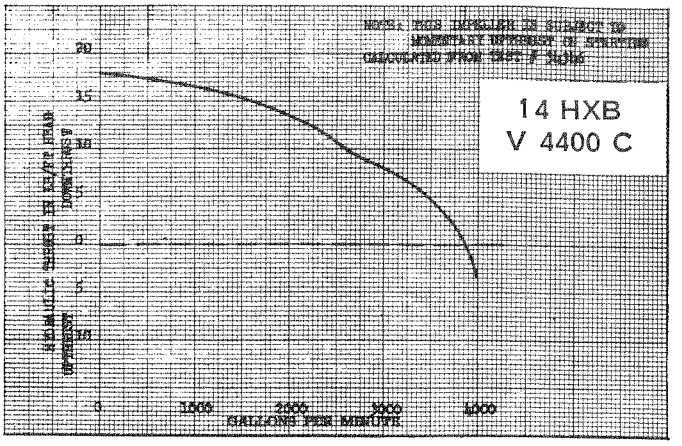


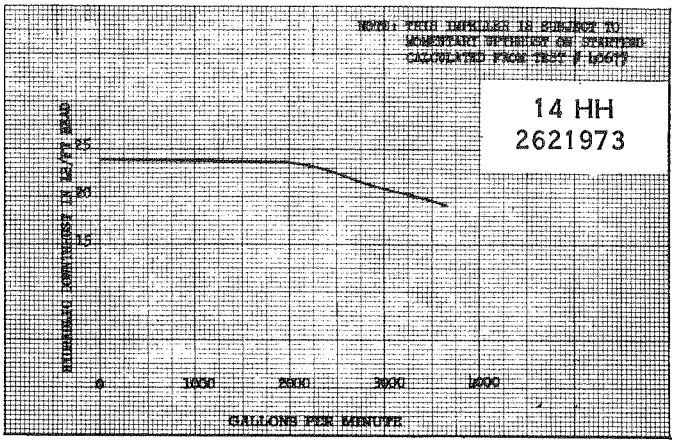


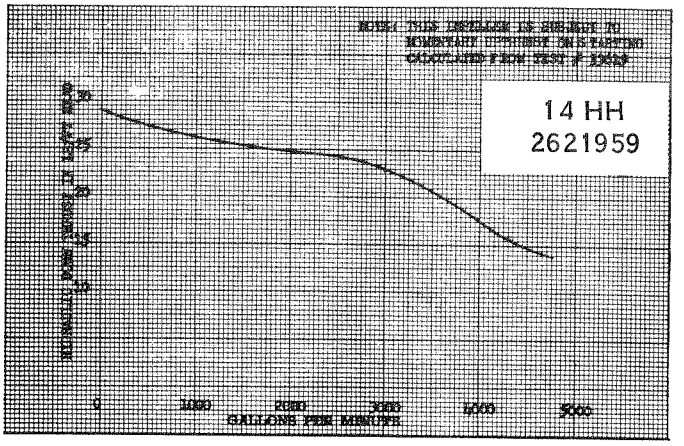
1760 RPM

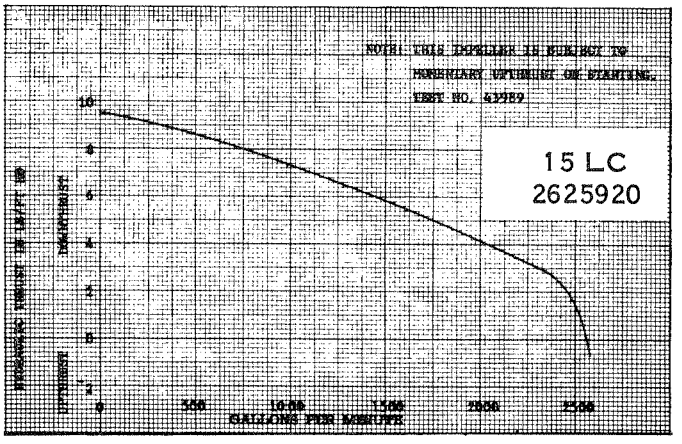
THRUST DATA BY SIZE AND IMPELLER NUMBER

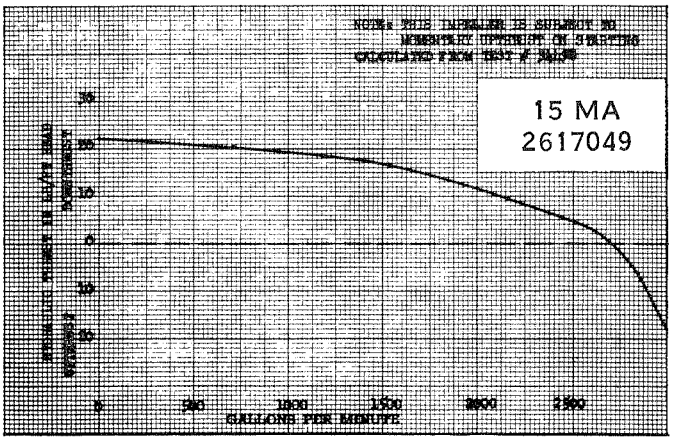


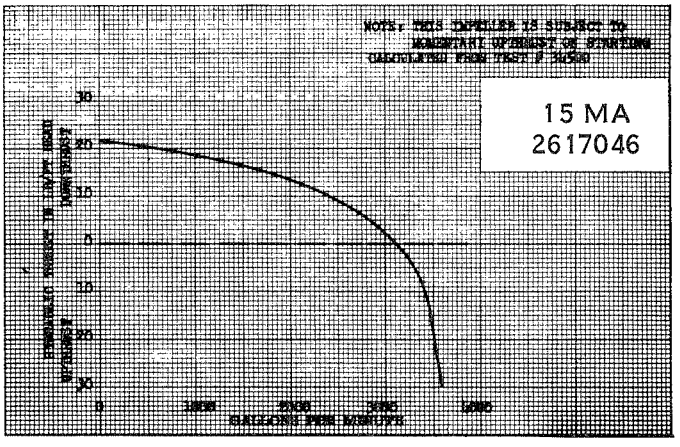


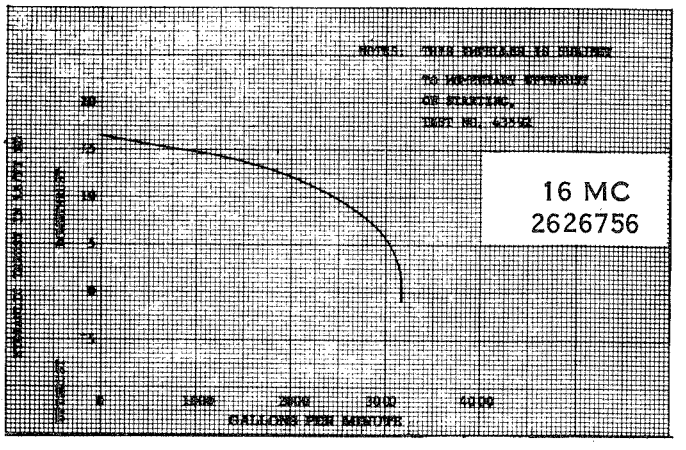






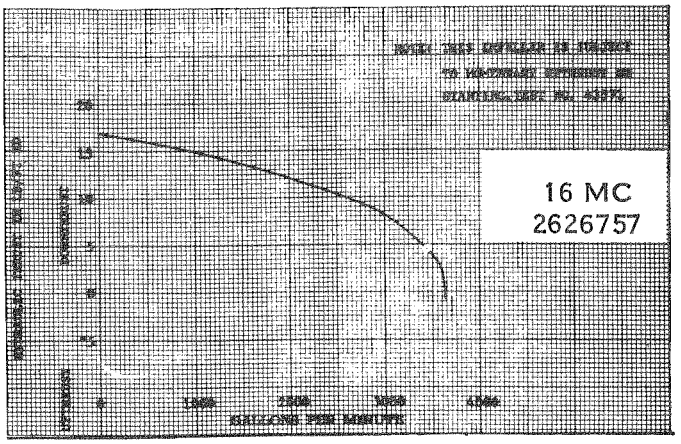


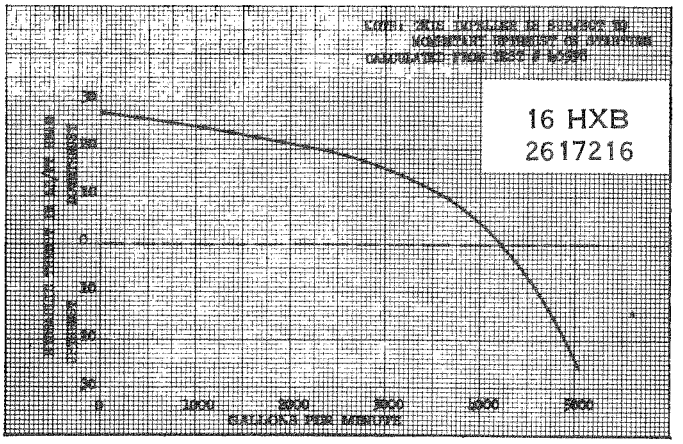


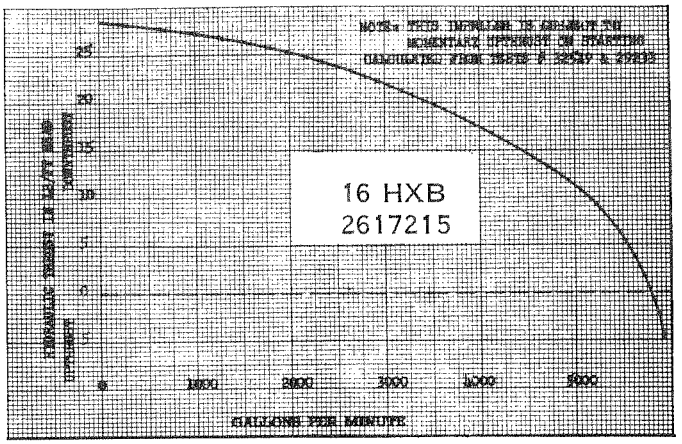


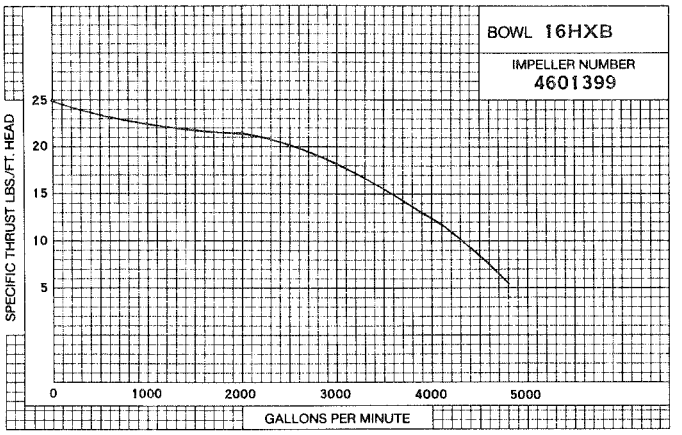
1760 RPM

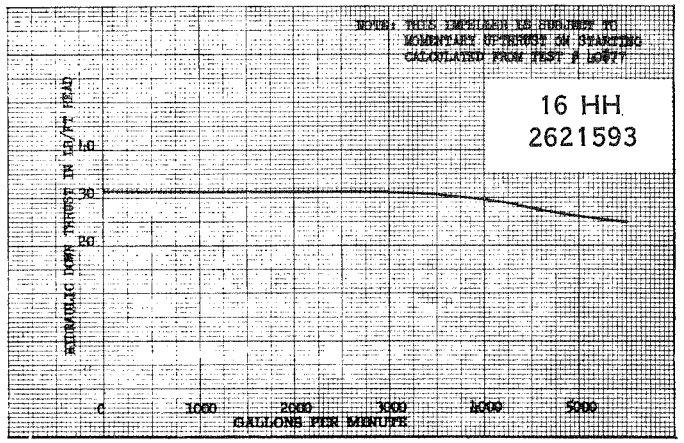
THRUST DATA BY SIZE AND IMPELLER NUMBER

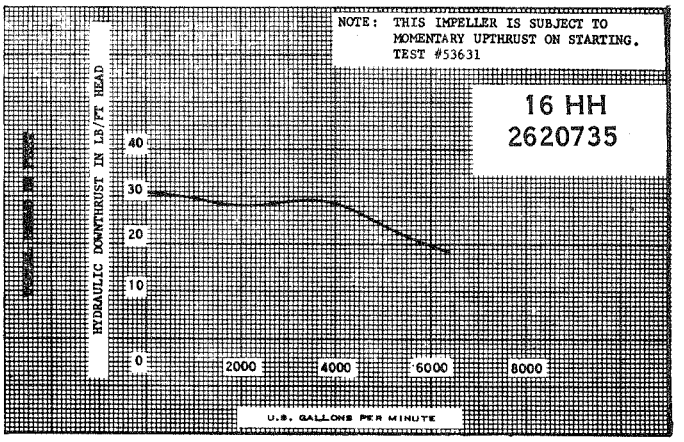


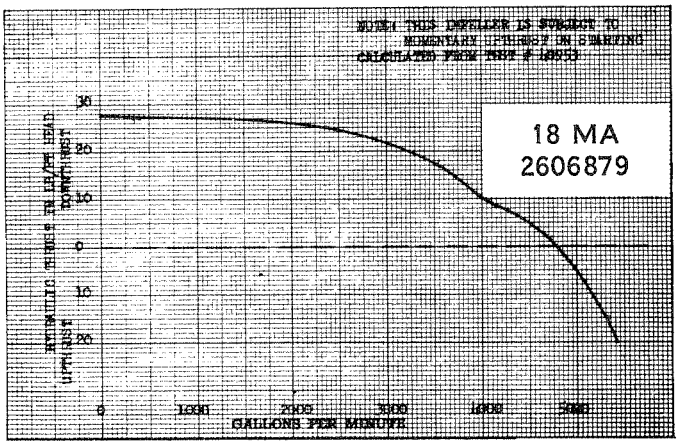






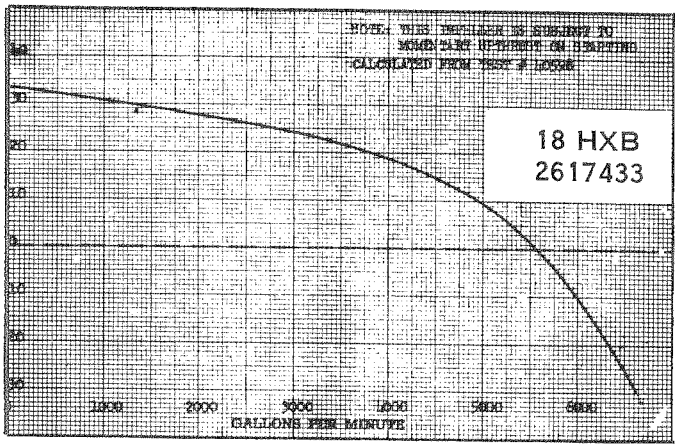


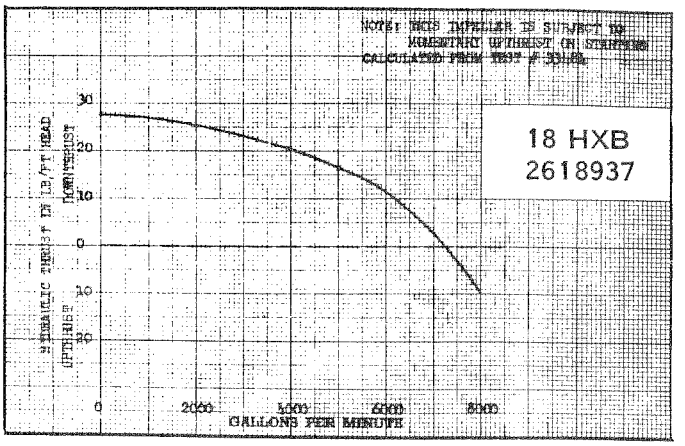


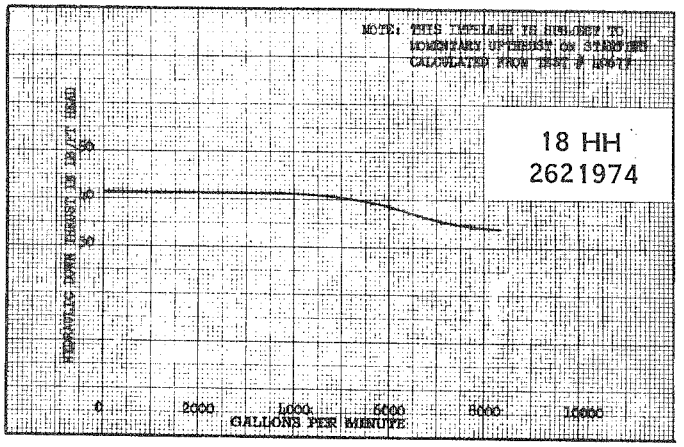


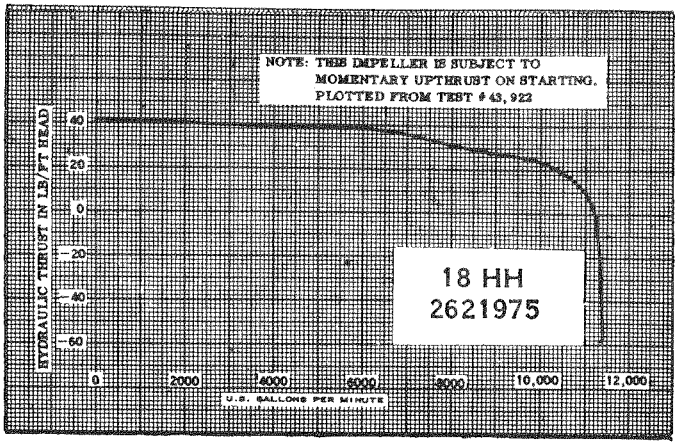
1760 RPM

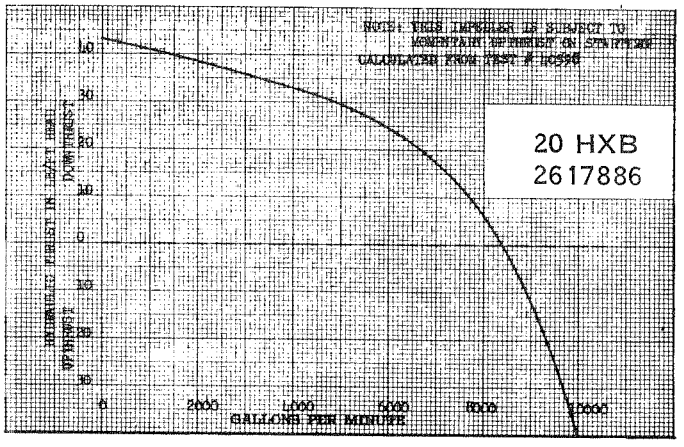
THRUST DATA BY SIZE AND IMPELLER NUMBER

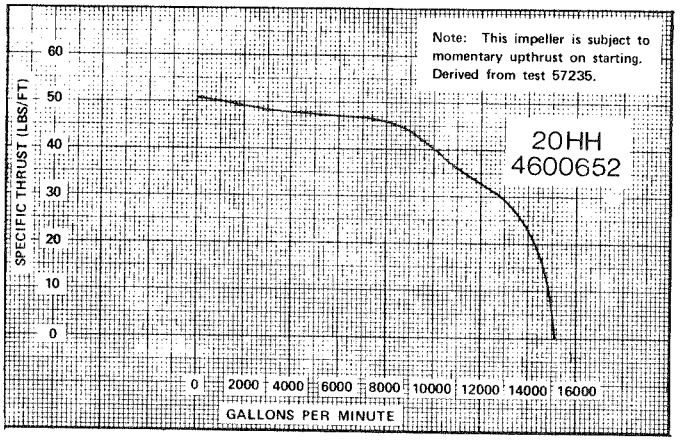


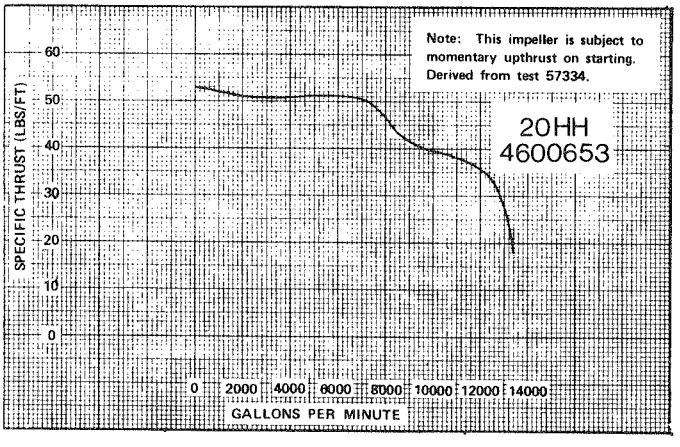






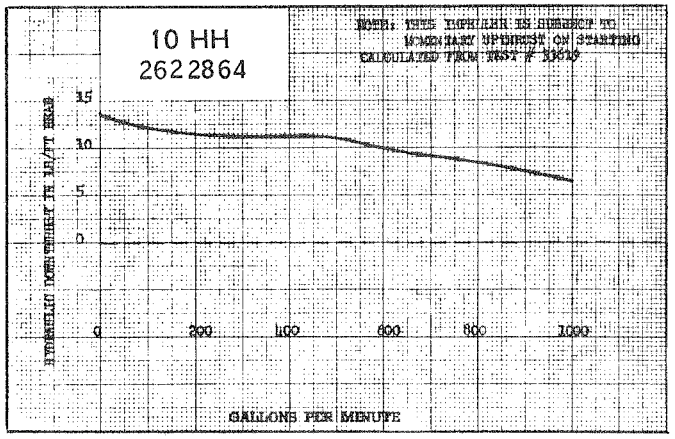


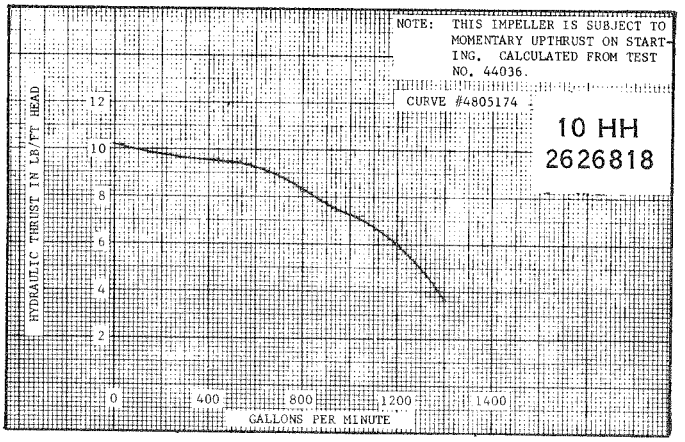


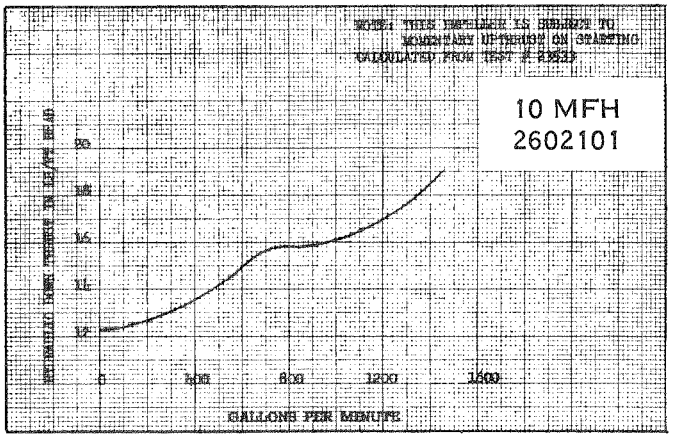


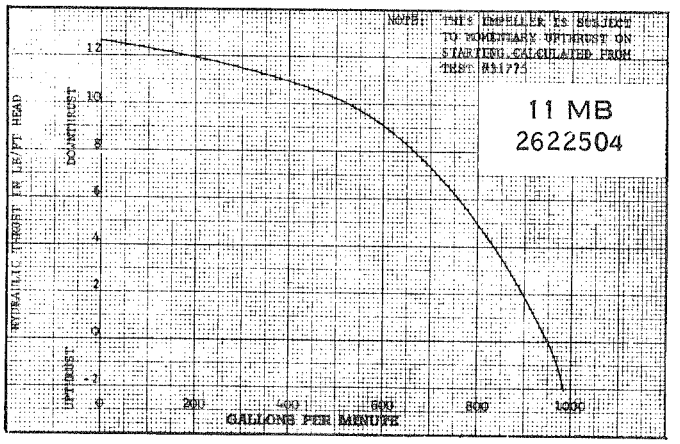
1160 RPM

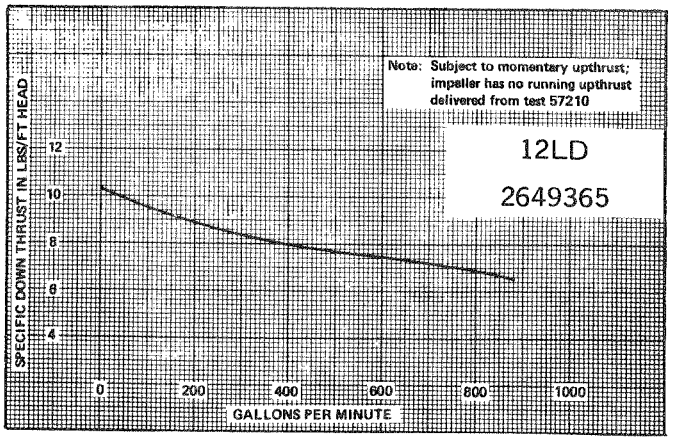
THRUST DATA BY SIZE AND IMPELLER NUMBER

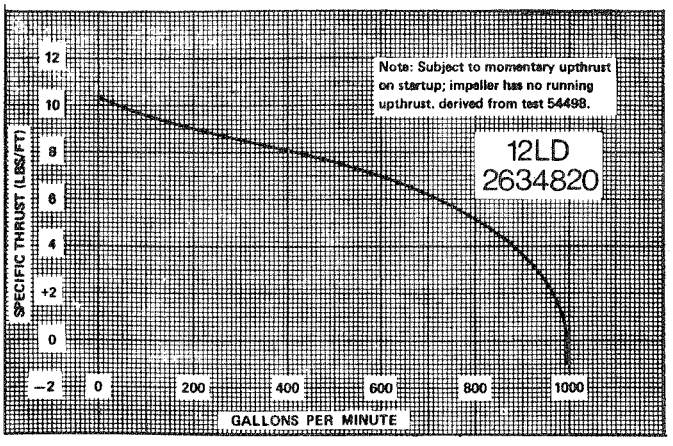


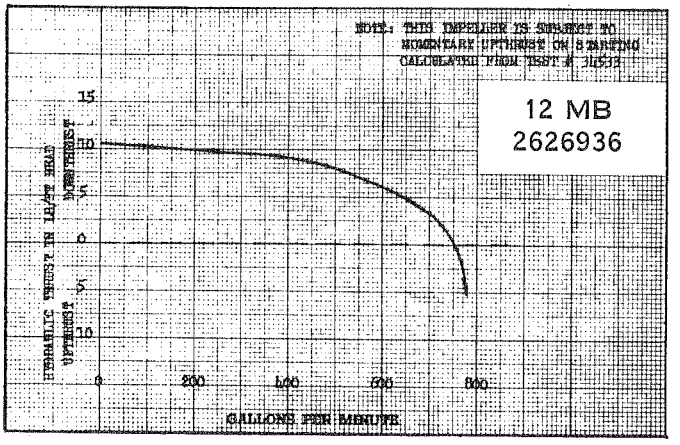






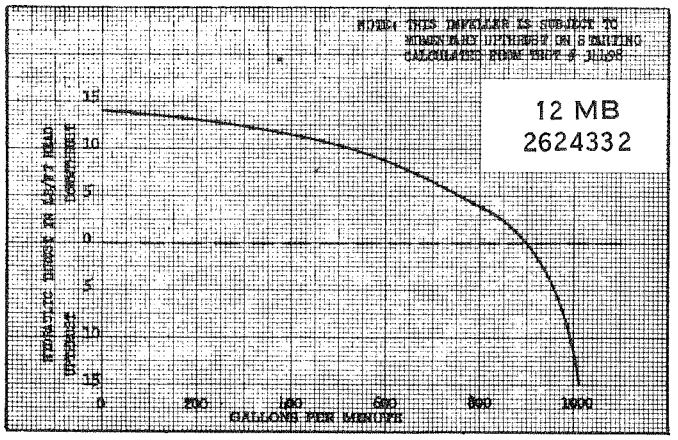


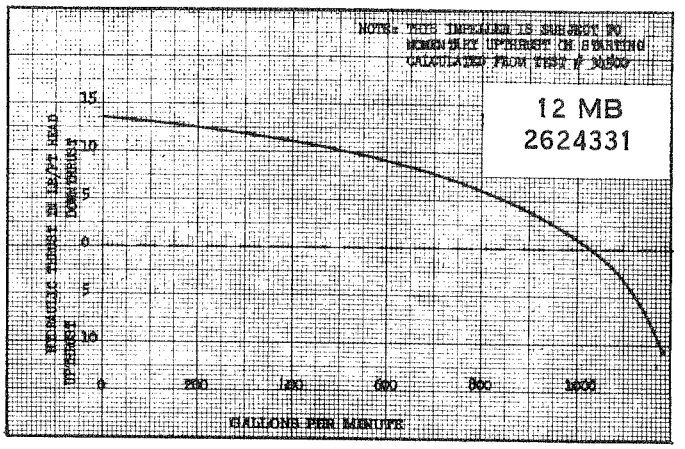


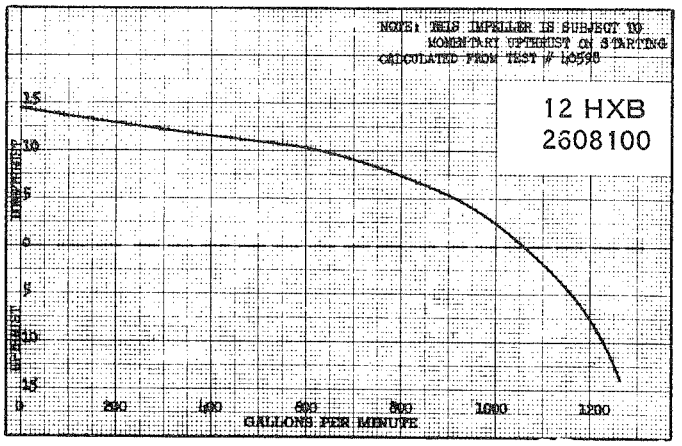


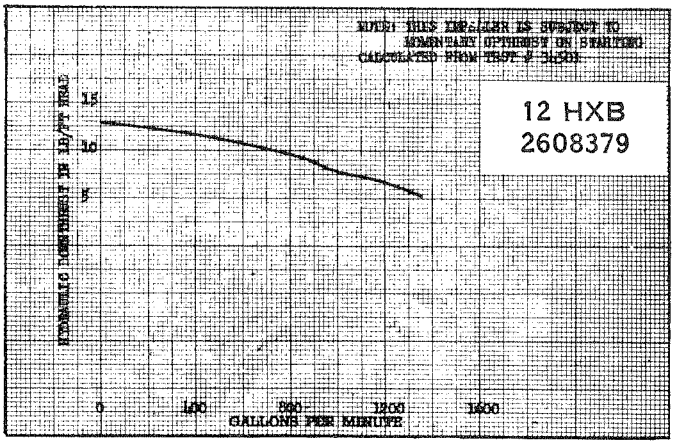
1160 RPM

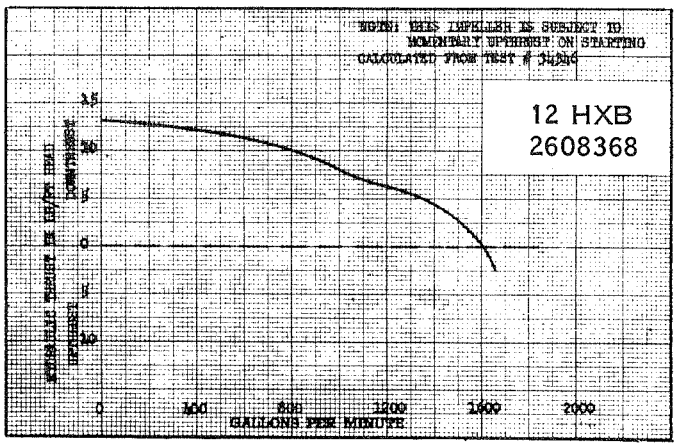
THRUST DATA BY SIZE AND IMPELLER NUMBER

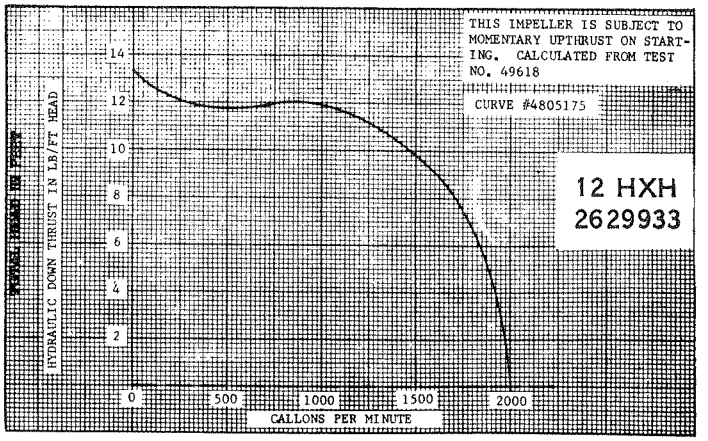


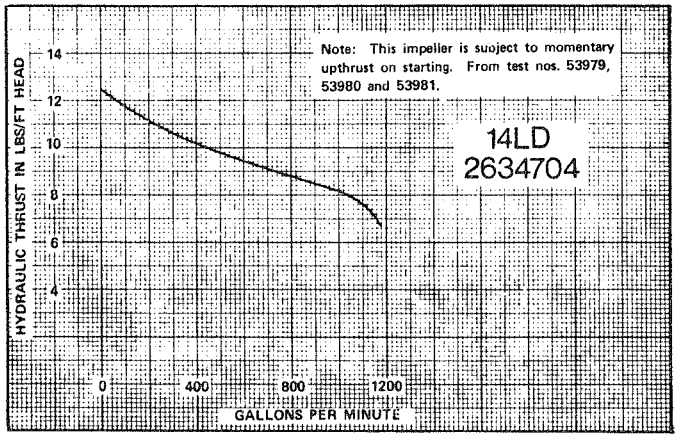


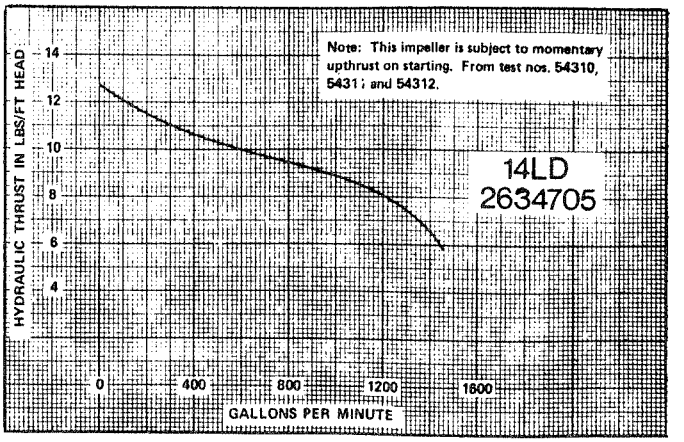






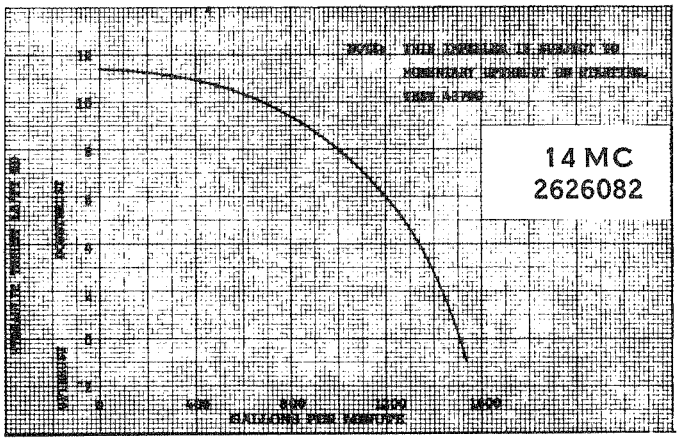


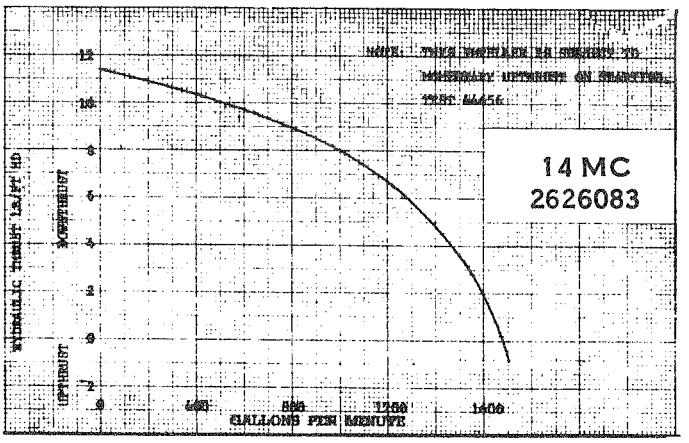


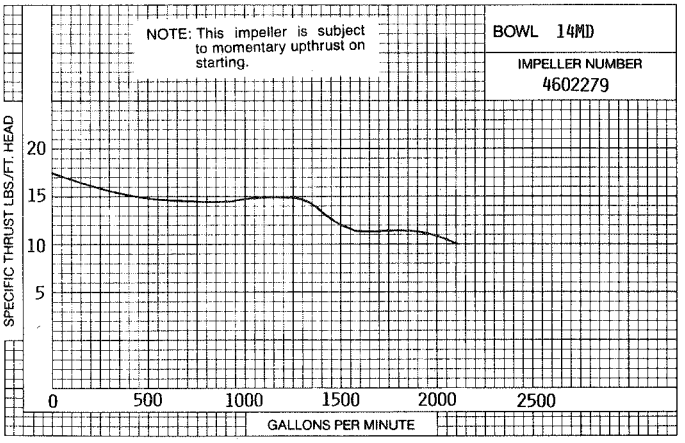


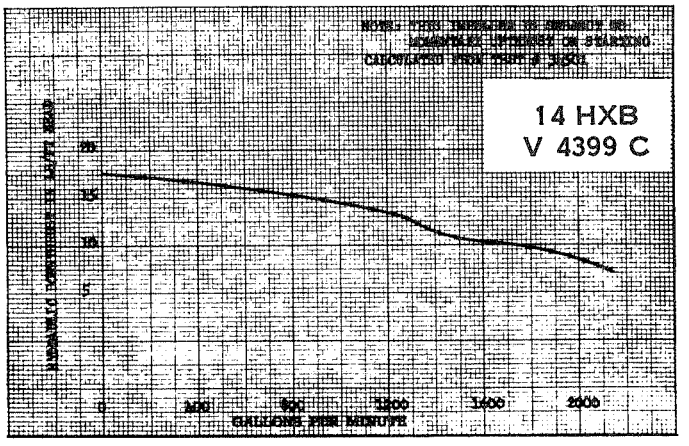
1160 RPM

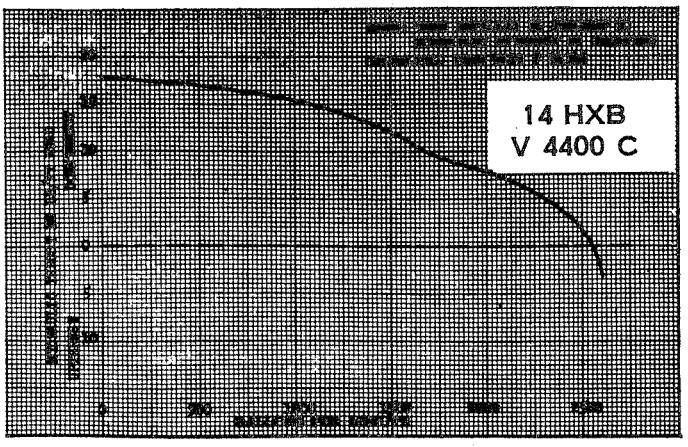
THRUST DATA BY SIZE AND IMPELLER NUMBER

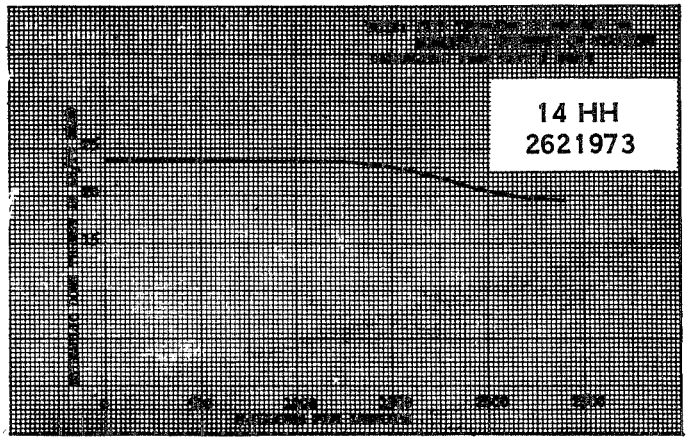












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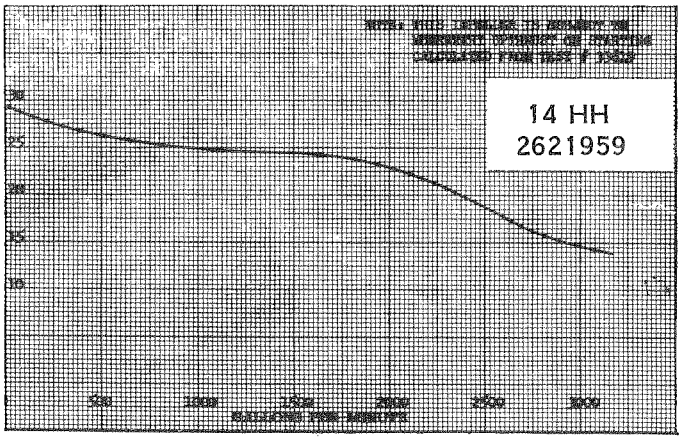
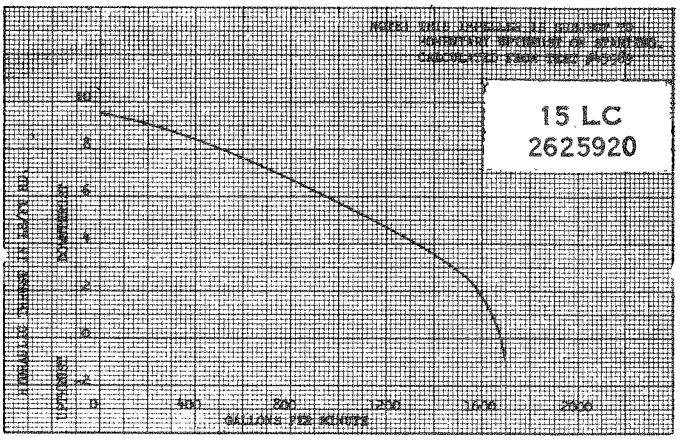
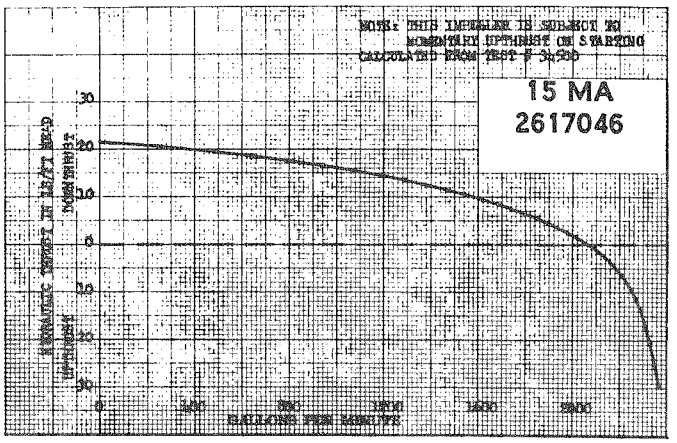
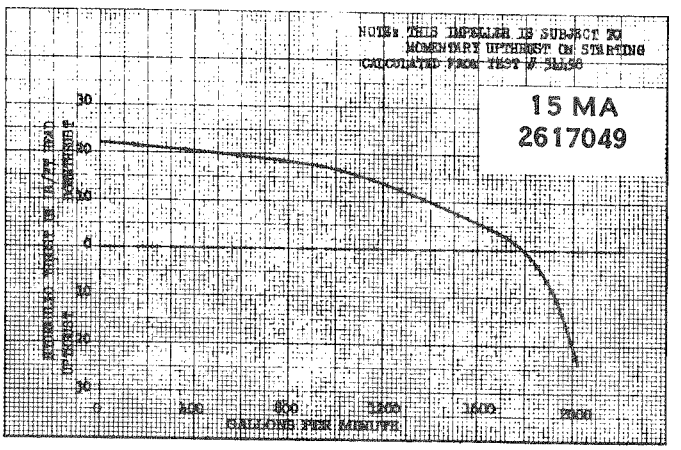
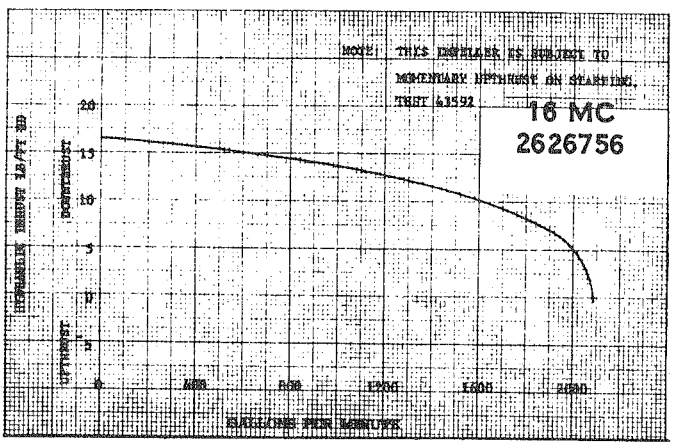
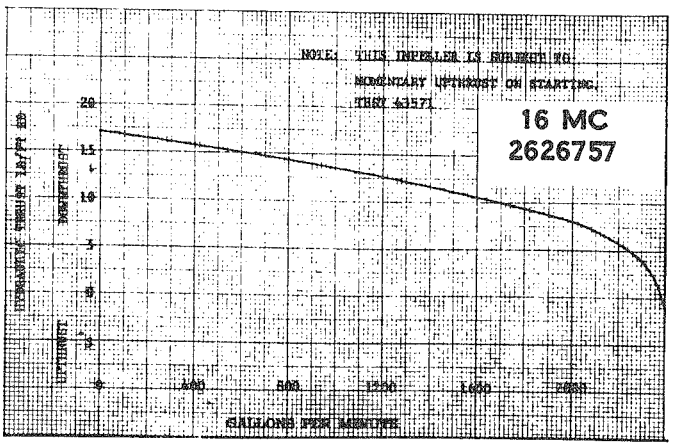


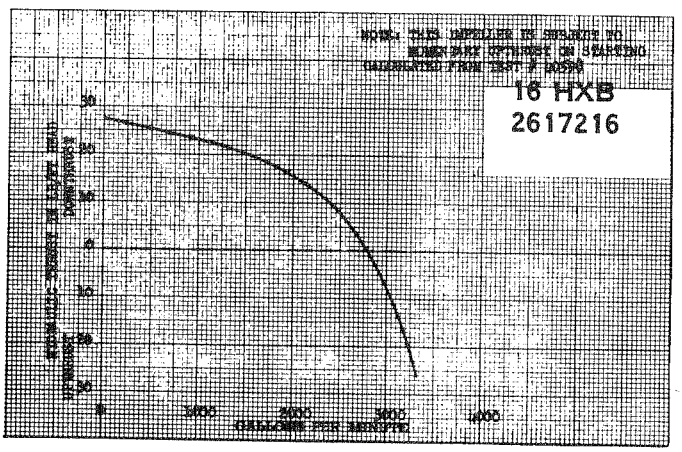


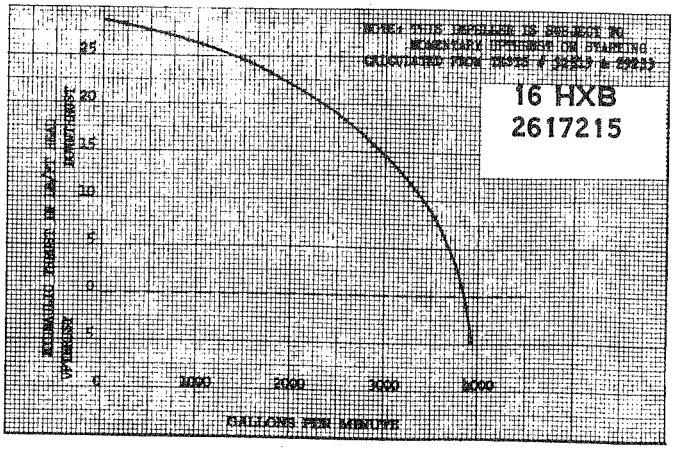






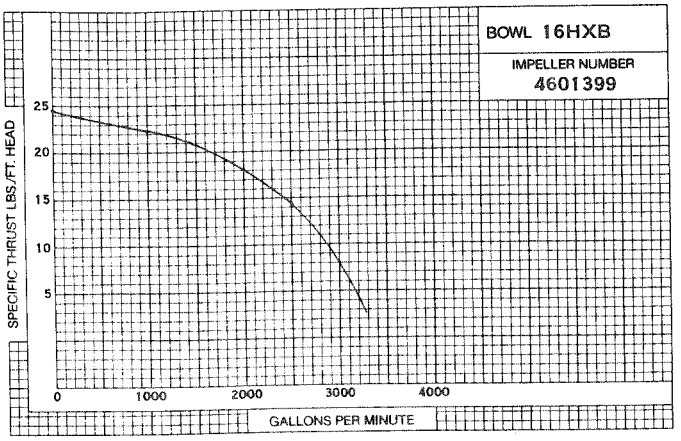


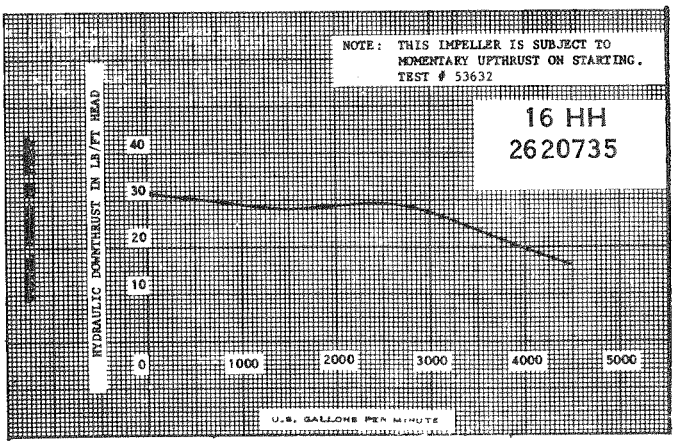


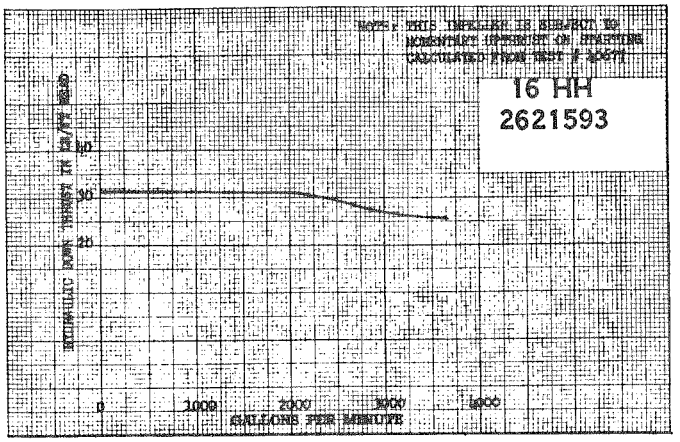


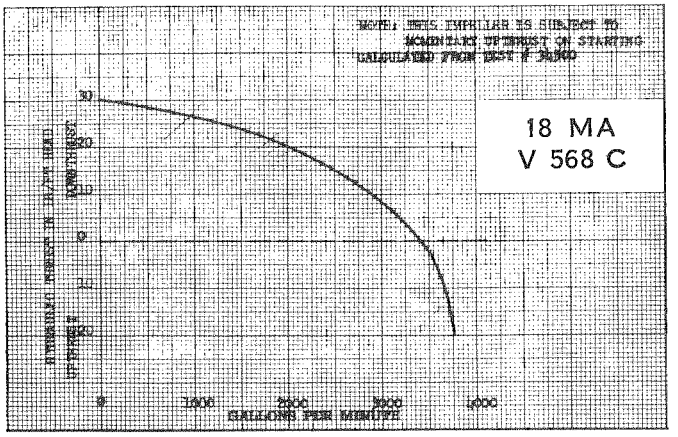
1160 RPM

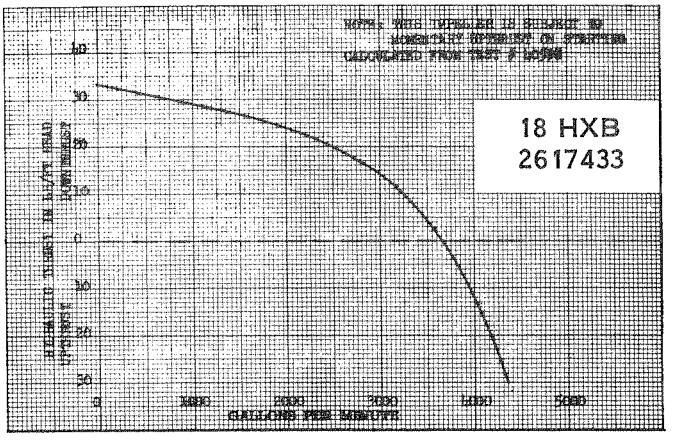
THRUST DATA BY SIZE AND IMPELLER NUMBER

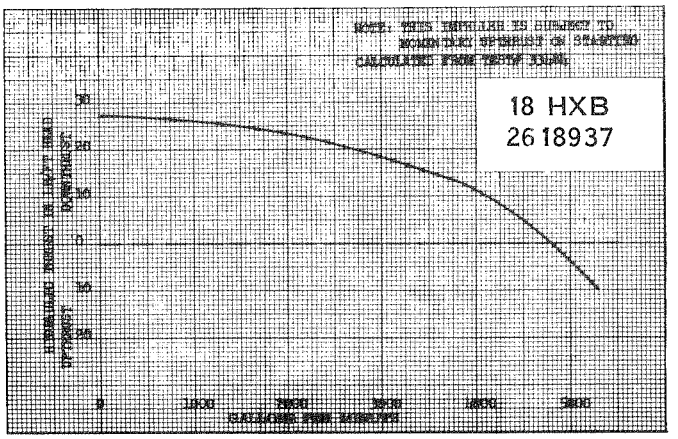


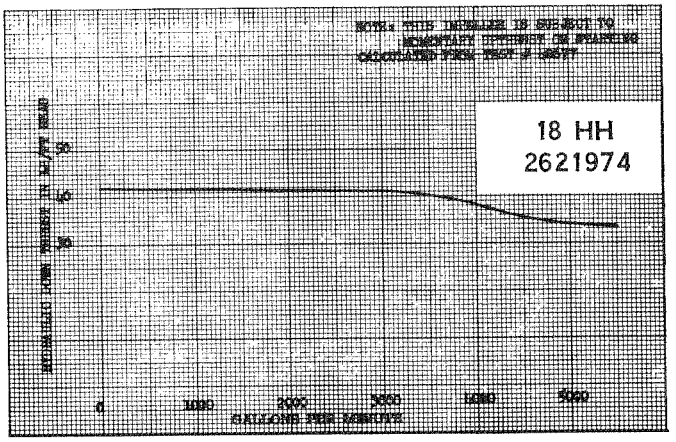


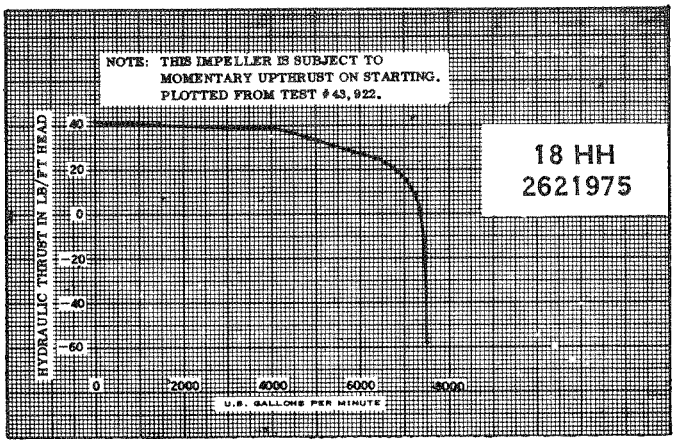






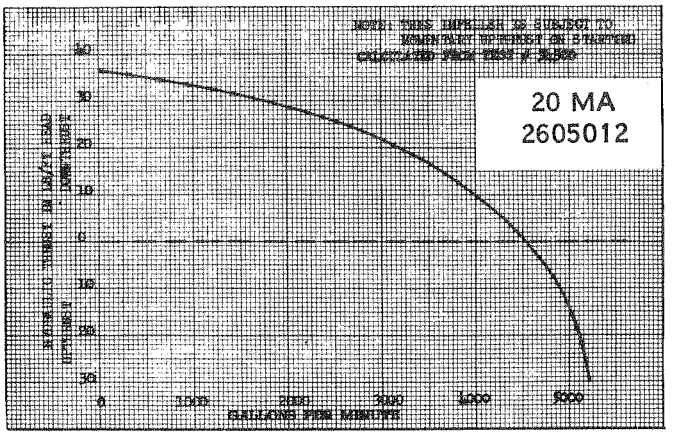


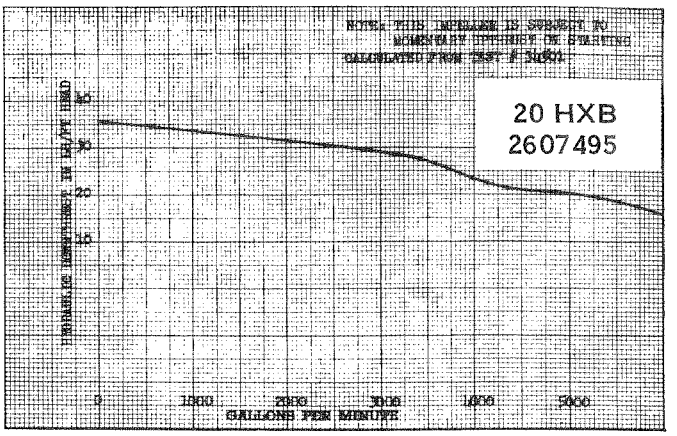


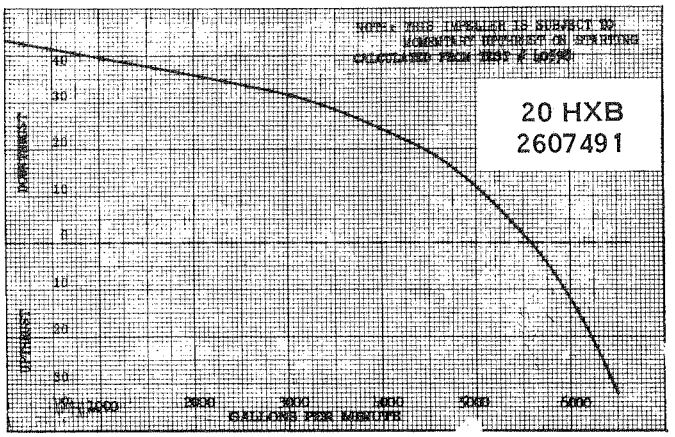


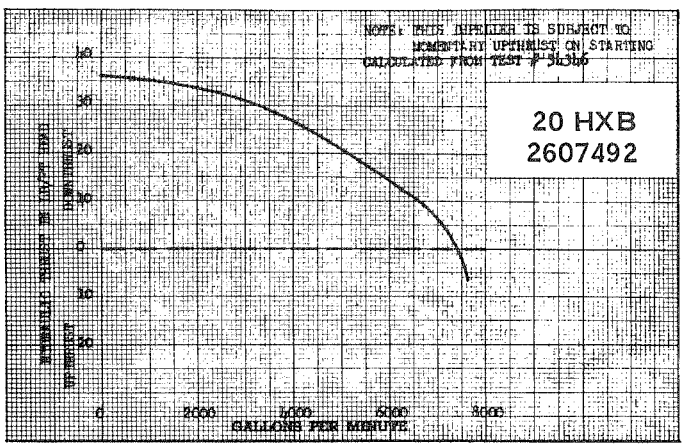
1160 RPM

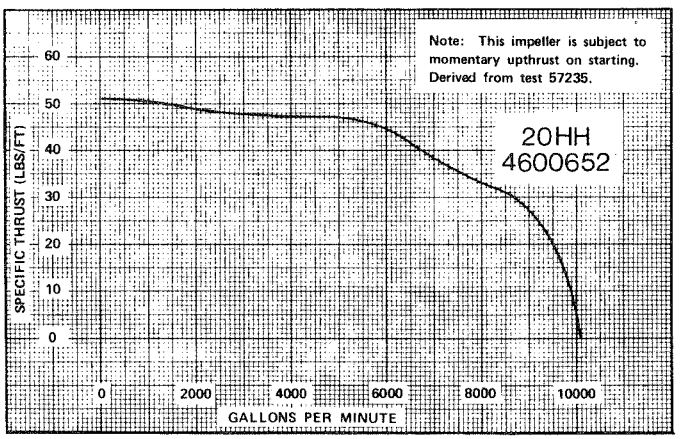
THRUST DATA BY SIZE AND IMPELLER NUMBER

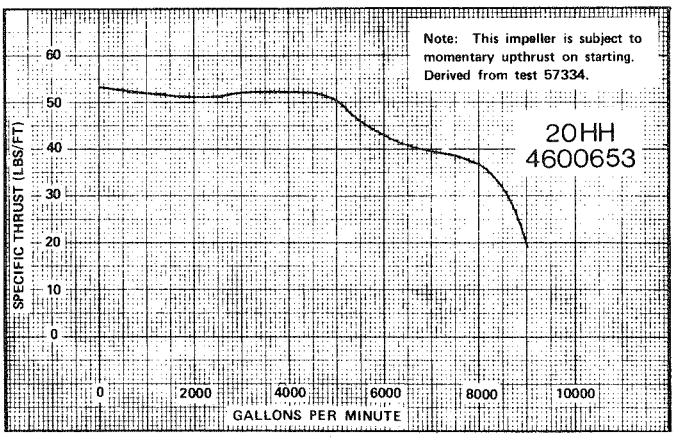


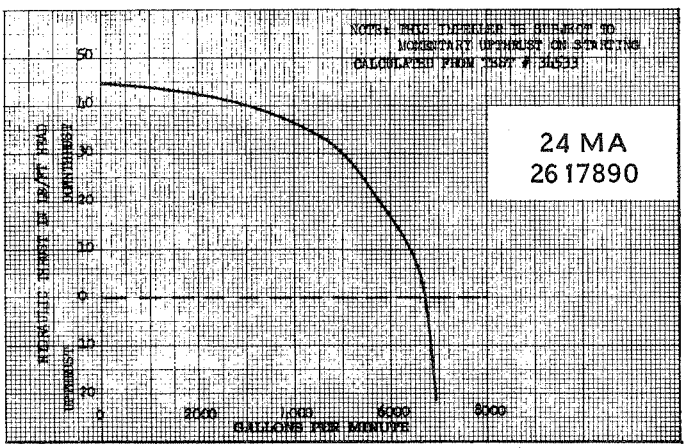


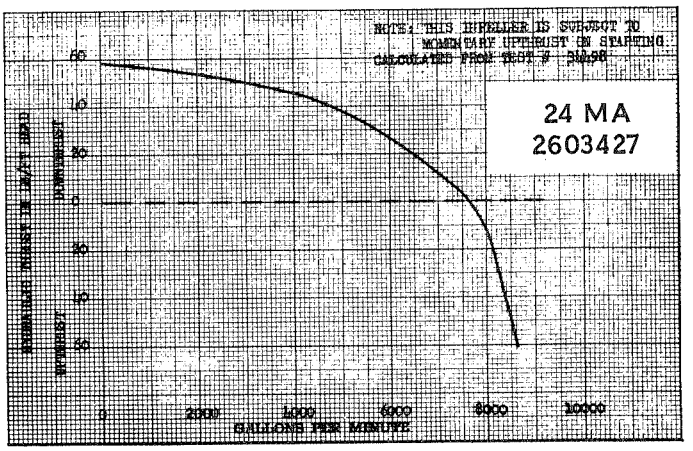






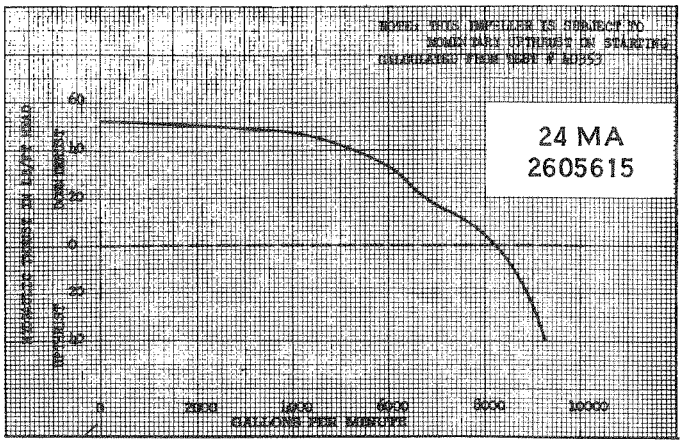


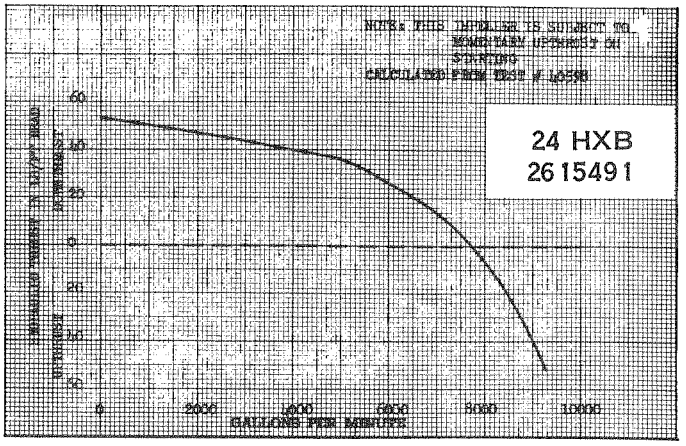


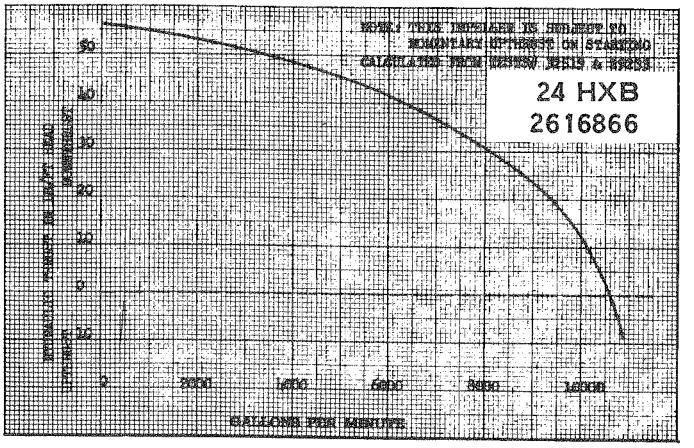


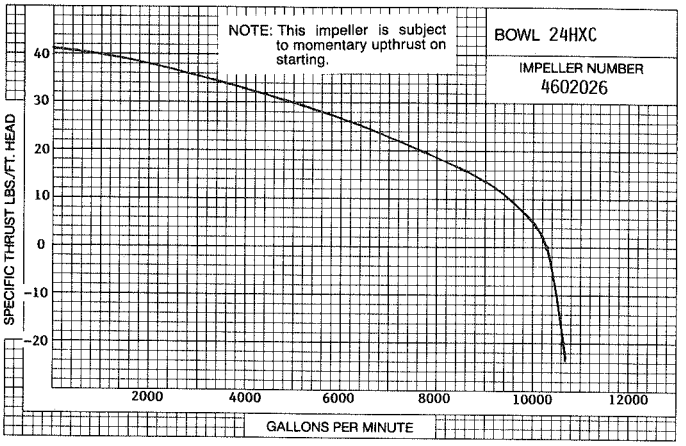
1160 RPM

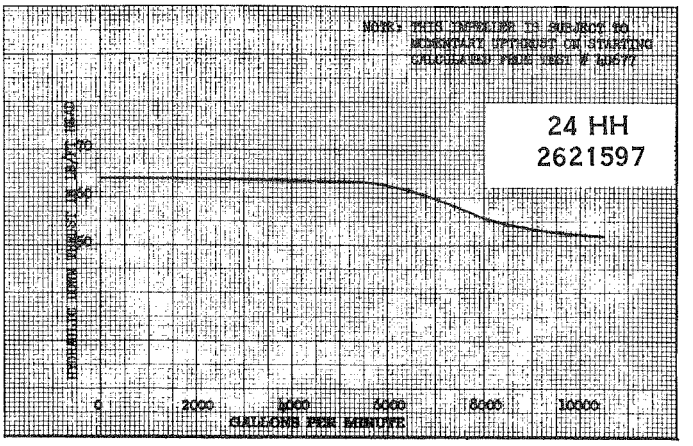
THRUST DATA BY SIZE AND IMPELLER NUMBER

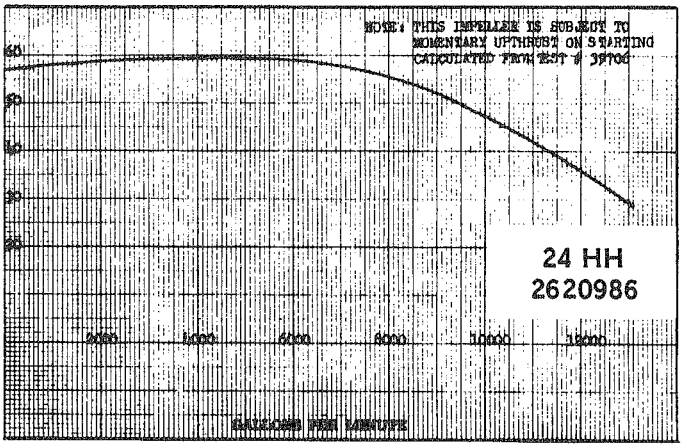


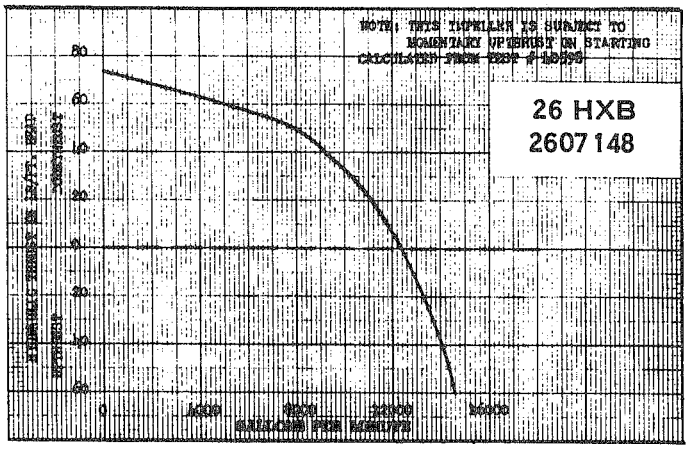












1160 RPM

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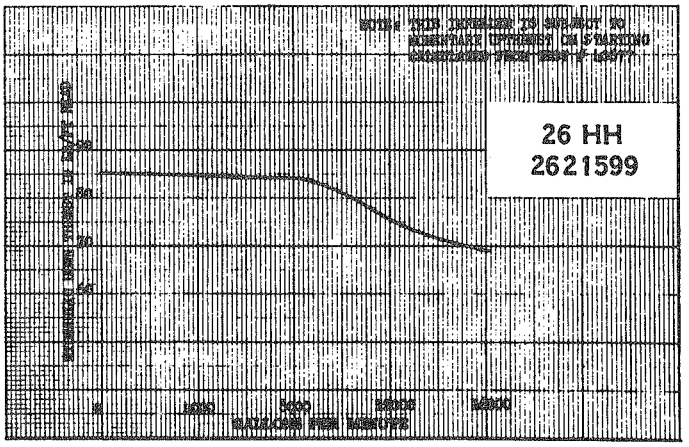

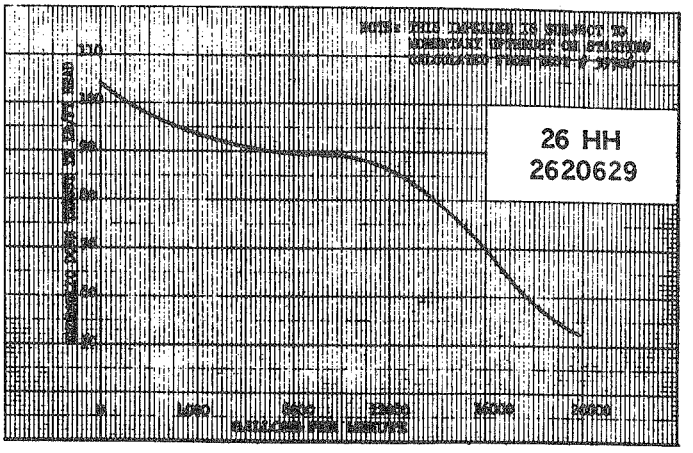

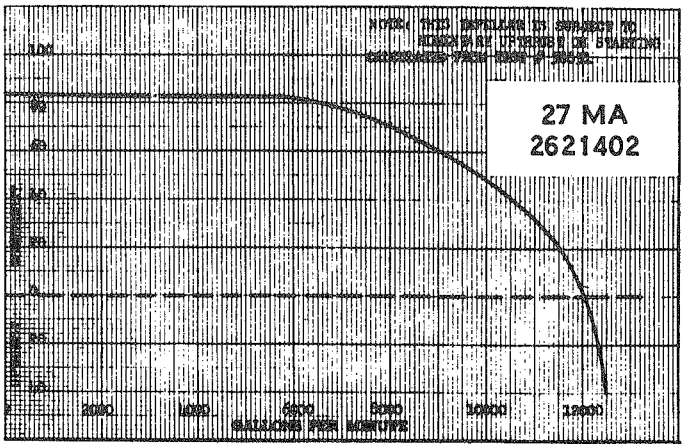

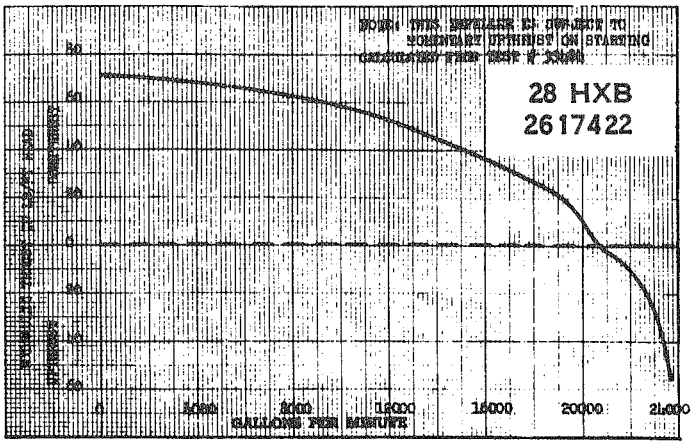

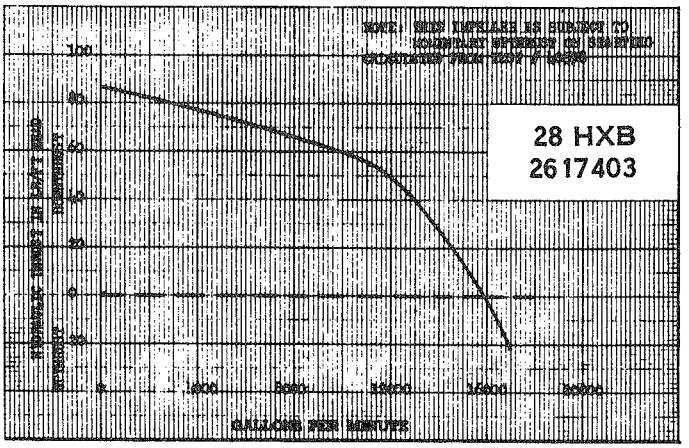

The Application and Selection of Vertical Turbine Pumps for Deep Wells

THE WORK to be done by a vertical turbine deep well pump is to raise water from the free pool in the well to the discharge point (either sub-surface, called "underground discharge", or at ground level, called "surface discharge"). At the discharge point, the pump may also be required to provide additional lift (called head) to deliver the water into a raised tank or reservoir, or into a piping system under pressure.

THE WELL is bored into the sub-surface ground structure by a drilling rig. As the bit penetrates the various strata, it is followed closely by the downward insertion of a string of casing pipe to prevent cave-in. Samples of water-bearing strata are taken as the well deepens to determine both the quality and quantity of the water yield at each level. When sufficient such strata have been penetrated to provide the required capacity of good water, the well is continued to an additional depth for submergence of the pumping element, plus a safety factor of depth for the settling of loose composite.

WELL DEVELOPMENT & TESTING. When drilling is finished, the casing is perforated at the good-water producing levels, and a test pump is installed to develop the well. This consists of pumping out loose sand and the establishing of a good composite filter for future flow. The water must be under 85° temperature, free of gases.

After the well is thus developed, its flow characteristics are determined. Upon this data, the required pump can be selected.

THE VERTICAL TURBINE PUMP to be installed in this well will raise the water to the point at which it will discharge into either a sub-surface piping system (underground discharge); or into a surface piping system; or into a reservoir or other open waterway.

The pump consists of four component assemblies:

(1) the pumping element, or BOWL UNIT;
(2) the eduction system, or COLUMN assembly;
(3) the DISCHARGE ASSEMBLY at the surface; and
(4) The DRIVE

To take these components in reverse order:
(4) The DRIVE is either a right-angle-geared drive which has a gasoline or diesel engine as its prime mover, or is an electric motor. The drive is mounted on the (3) DISCHARGE ASSEMBLY, and rotates a vertical lineshaft which extends downward thru (2) the COLUMN assembly to (1) the BOWL UNIT. In the bowl unit are one or more pumping stages (each consisting of a bowl case, and an impeller which rotates at the speed of the drive). Each stage gives to a definite quantity of water a definite height of vertical lift.

When the rotating energy of the drive is transmitted thru the lineshaft, there is a known mechanical friction (horsepower) loss in the lineshaft bearings. Also, as the pumped water is raised vertically thru the eduction (column) pipe there is a known hydraulic friction (vertical lift) loss. These two basic factors must be provided for in selecting the proper components of the pump.

An example for selection:
For this example, the test pump has established that the standing (static) level of the free pool in the well is 85 feet (max.) below ground surface. When 900 gpm is being pumped, the level drops to a distance of 95 feet (max.) below ground surface. The WELL DATA for this example is thus:

Inside diameter of the well --- 10 inches
Drilled depth of the well --- 130 feet
Capacity of the well --- 1000 gpm
Capacity required to be pumped --- 900 gpm
Static level --- 85 feet (max.)
Vertical lift (from pumping level to discharge) --- 95 feet (max.)
(The 10 foot difference is called drawdown)
Power available for drive --- 220 V, 60 cyc.

This selection example is based on a well application in which an electric motor will be the drive, and the pump will discharge at the surface into an open system (such as a ditch or reservoir).

BOWL UNIT selection is the first step, and we turn to the PERFORMANCE CURVES in Bulletin B-180.

The curves are grouped in sub-sections according to rpm. The speeds are those of 60 cycle electric motors. To obtain the lowest initial cost and the most economical operation of the pump, the speed of operation should be as high as possible without sacrifice of efficiency. Except for capacities which are unusually low or high for the well's internal diameter, this would mean 1760 rpm for 60 cycle current.

On each curve sheet there is a bowl size designation; such as 6LB, 10MA, etc. The number portion is the nominal diameter of the bowl unit, and indicates the smallest I.D. of well casing into which the unit can be installed. The well in our example is 10 inches inside diameter; therefore we can select from only 10 inch or smaller (nominal size) bowl units.

For each nominal size there are curves for low, medium and high capacity bowl units. The letters LA, LB, LC, LD, indicate the low; the MA, MB, MC for medium; and HXB, HH for high capacity.

For some bowl units there are two or more choices of impeller, the numbers of which are shown in the lower left portion of the curve sheets.

For each impeller, 10" and larger, performance is shown for bronze and/or enameled impellers. An enameled impeller has the letter E after the impeller number.

Impellers for 4" thru 8" are cast in bronze only in standard construction.

The first (lowest) stage of a bowl unit determines the quantity (capacity) of fluid which the unit will handle, and imparts lift (head) as shown by the performance curve. Additional stages (impeller and the intermediate bowl) are added as required to increase the head, but they do not increase the capacity.

The per-stage performance of some bowl units is affected by the number of stages that are required, so on their curves the effect of multi-staging is shown in the upper right corner of the curve sheet.

When the curve sheet shows the performance of more than one impeller diameter, the curves are marked (1), (2), etc., and in the lower left of the sheet these impellers are described by number and diameter in inches.

STEP ONE - (Tentative selection of the bowl unit)
Our example calls for a bowl unit which can be installed in a 10-inch well, and can pump 900 gpm a total of 95 feet of lift. To secure the greatest efficiency we start our selection with the last curve of the largest size unit at 1760 rpm, which is 10MFH curve number 2805175.

We look first for a curve which shows a capacity of 900 gpm a little to the right of the peak of the efficiency curve. We quickly see that the capacity range of the 10MFH unit is far beyond the needs of our example.

The 10HXB unit with T82366 impeller (curve sheet #2811598) may be a possible selection. Curve #2 (for CI or bronze impeller) shows about 25.5 feet of head per stage. This indicates that a 4-stage pump would be required for the 95 foot lift of our example. (4 stage x 25.5 feet per stage = 102 feet lift less hydraulic friction)

We will use this as our preliminary selection of the bowl unit.

At 900 gpm, the corresponding #2 bhp curve shows that about 7.4 hp is required to drive each stage's impeller. Thus a 4-stage pump would need about 30 hp.

STEP TWO - (Tentative determination of lineshaft dia and hp loss)
Vertical turbine curves show the performance of the bowl unit connected directly to a discharge head in our test laboratory. The water friction (hydraulic) loss in the elbow of the discharge head is negligible. For our deep-well application we determine the proper size shaft to transmit the hp developed by the bowl unit and the hp lost in the shaft bearings within the column assembly. There are two methods for determining shaft size and hp loss.

Alternate A (Utilizing consolidated shaft size selection chart -- page 114).
To determine the proper size shaft to transmit the hp developed by the bowl and to overcome the friction in the column shaft bearings, we refer to the consolidated shaft selection chart. You will note that a 1" diameter shaft is good for a maximum of 50 hp at 1760 rpm, and that .53 hp is consumed in turning 100' of shaft in the bearings. The consolidated shaft size selection chart is limited to settings under 500' and developed heads to 500'. This chart, while it is very convenient, does not always indicate the most economical shaft selection.

Alternate B (Thrust versus shaft size method)
First we must determine the total hydraulic downthrust of the pump unit. Page 91 shows the hydraulic downthrust in lb per foot of head developed by a 10HXB bowl unit is 4.4 lb per foot x 95 ft (the pumping head) = 418 lb. To the bowl hydraulic downthrust, add the weight of the line shaft. 1" line shaft weighs 2.67 lb per ft x 90 ft (the setting of the pump) = 240 lb. Rotating element for 4 stages is 60 lb. Thus the total downthrust at design conditions of the pump unit that we have selected is 418 + 60 lb = 718 lb.

Referring to page 112 (max H.P. rating charts) shows that at 100 lb downthrust, 1" C1045 lineshaft is good for 68.8 bhp and top shaft is adequate for 57.1 bhp. Therefore, 1" shafting is ample to transmit the 30 hp load developed by the pump. Note that the consolidated shaft size selection chart limited 1" shaft to a maximum of 50 hp at 1760 rpm.

STEP THREE A - (Determination of column assembly losses)
To determine the additional head (lift) which must be provided to compensate for the loss caused by the skin friction as the water rises in the column pipe we refer to the fricition loss chart (page 109). The losses shown are in ft per 100 ft of column. For exonomical operation the loss should be less than 5 ft per 100. For our example of 900 gpm, the loss with 8" Std. pipe is 6 ft per 100 ft of column assembly. The loss applies to either oil or water lubricated column assembly.

STEP THREE B - (Final selection of COLUMN ASSEMBLY) The horsepower requirements have established that the column's lineshaft will be 1" diameter. The capacity requires 8" Std. pipe. Now we determine the length of the column assembly (which is called the "setting").

A vertical turbine bowl unit must be submerged for at least the first stage's depth at starting time, so the column length (setting) in this case will be 90 feet.

A 10-ft suction pipe is attached to the suction manifold to maintain the flow of water into the pumping unit during seasonal lows. A strainer could be added to prevent harmful solids from entering the pump.

STEP FOUR - (Final selection of BOWL UNIT)
The total head to be met is:

pumping level - - - - - - - - -	95 ft.
plus column friction (hydraulic) loss (.95 x 1.6) - - - - -	1.52 ft.
Total head to be developed - - -	96.52 ft.

Therefore it is determined that the 10HXB bowl unit with T82366 impeller #2 at 1760 rpm on curve number 2811598 will deliver the required capacity and lift for this application.

Since a NEMA motor of 30 hp rating can safely deliver 115% output of the rated hp, and no unusual factors of altitude or ambient temperatures are being considered at this point, a 30 hp VHS motor, 1760 rpm, 60 cycle is selected. From motor manufacturers' data it is determined that this motor is furnished in two frames. One has a BD dimension of 10", 9⅛" AJ and 8¼" AK. The other has a BD dimension of 16½", with 14¾" AJ and 13½" AK.

Generally speaking, motors thru 50 hp at 1760 rpm have 10" BD; thru 200 hp at 1760 rpm have 16½" BD; and thru 450 hp at 1760 rpm have 20" BD. The 30 hp, 1760 rpm required in this example could be furnished with the 10" BD to fit the 6 x 6 x 12 or the 16½" BD to fit the 8 x 8 x 16½". The pump example requires 8" std. column pipe — consequently the 8 x 8 16½" discharge assembly is used with the driver having a 16½" BD.

STEP FIVE - (Final selection of DRIVE and DISCHARGE ASSEMBLY)
The hp required for the four stages is:

laboratory head: 4 stages x 7.4 hp	= 29.6 hp
mechanical friction loss for 90 ft of lineshaft is .53 x .9	= .477
Total hp required of the drive	= 30.08

SUMMARY OF APPLICATION EXAMPLE

Taken in order of determination, selection consists of the following:

BOWL UNIT: 4 stage 10HXB with impeller T82366 (curve sheet 2811598 with #2 impeller)

COLUMN: 90 feet of 8" Std. x 1" (plus 1½" shaft enclosing tube if pump will be oil lubricated)

SUCTION PIPE: 10 feet of 8" Std. (Page 48)

STRAINER: 8", cone type

MOTOR: 30 hp VHS, 220 V, 3 phase, 60 cycle with 16½" BD.

DISCHARGE HEAD: Size 8 x 8 x 16½
(With solenoid oil valve and oil container if pump will be oil lubricated)
or
(With pre-lubrication tank and fittings if water lubricated)

Hydraulic Friction Loss Chart

LOSS PER 100 FT OF OPEN OR ENCLOSED LINE SHAFT STANDARD PIPE COLUMN

FOR ENCLOSED LINESHAFT, use the friction loss under the appropriate tube size.

FOR OPEN LINESHAFT, use the friction loss under the appropiate shaft size.

(1) 3" tube takes 1-11/16" and 1-15/16" shaft.

(2) 5" tube takes 2-11/16", 2-15/16", 3-3/16" and 3-7/16" shaft.

(3) 6" tube takes 3-11/16" and 3-15/16" shaft.

For capacities of 10 GPM to 1000 GPM inclusive use figures to the left of division line.

For capacities of 1050 GPM to 5000 GPM inclusive use figures to the right of division line.

Column Size	2½"ID	3" STD		4" STD			5" STD				6" STD				8" STD				10" STD						12" STD							Column Size
Tube Size	N/A	N/A	N/A	1¼"	1½"	2"	1¼"	1½"	2"	2½"	1½"	2"	2½"	3"	1½"	2"	2½"	3"	2"	2½"	3"	3½"	4"	5"	2"	2½"	3"	3½"	4"	5"	6"	Tube Size
Shaft Size	3/4"	3/4"	1"	3/4"	1"	1 3/16"	3/4"	1"	1 3/16"	1½"	1"	1 3/16"	1½"	(1)	1"	1 3/16"	1½"	(1)	1 3/16"	1½"	(1)	2 3/16"	2 7/16"	(2)	1 3/16"	1½"	(1)	2 3/16"	2 7/16"	(2)	(3)	Shaft Size
10	1.0	.31	.38			.11									2.1	3.5	4.2	5.9	.93	1.1	1.3	1.6	2.1	3.5	.37	.42	.48	.55	.66	.93	1.3	1050
20	3.2	.98	1.2	.13	.18	.35									2.2	3.8	4.6	6.5	1.0	1.2	1.4	1.7	2.2	3.8	.40	.45	.53	.60	.71	1.0	1.4	1100
30	6.2	1.9	2.3	.26	.36	.70			.11	.15					2.4	4.2	5.0	7.0	1.1	1.3	1.5	1.9	2.4	4.2	.44	.50	.57	.65	.78	1.1	1.5	1150
40	9.9	3.1	3.7	.44	.59	1.1	.11	.13	.19	.24				.13	2.6	4.5	5.4		1.2	1.4	1.6	2.0	2.6	4.5	.47	.54	.62	.71	.84	1.2	1.6	1200
50		4.5	5.4	.65	.86	1.6	.16	.19	.28	.36			.12	.19	2.8	4.9	5.8		1.3	1.5	1.8	2.2	2.8	4.9	.50	.58	.67	.76	.91	1.3	1.8	1250
60		6.1	7.3	.89	1.2	2.2	.22	.26	.38	.50		.11	.16	.26	3.0	5.2	6.2		1.4	1.6	1.9	2.3	3.0	5.2	.54	.62	.71	.82	.98	1.4	1.9	1300
70		7.8		1.2	1.5	2.9	.29	.34	.50	.65	.11	.15	.21	.34	3.2	5.6	6.7		1.5	1.7	2.0	2.5	3.2	5.6	.58	.67	.77	.88	1.0	1.5	2.0	1350
80				1.5	1.9	3.6	.36	.43	.63	.81	.14	.18	.27	.43	3.5	6.0			1.6	1.8	2.2	2.7	3.5	6.0	.62	.71	.82	.94	1.1	1.6	2.2	1400
90				1.8	2.4	4.4	.45	.53	.78	1.0	.17	.23	.34	.53	3.7	6.4			1.7	1.9	2.3	2.9	3.6	6.4	.67	.76	.87	1.0	1.2	1.7	2.3	1450
100				2.2	2.8	5.3	.54	.65	.94	1.2	.21	.28	.40	.65	3.9	6.7			1.8	2.0	2.5	3.0	3.9	6.7	.71	.80	.93	1.1	1.3	1.8	2.5	1500
120				3.0	3.9	7.2	.74	.89	1.3	1.7	.29	.38	.55	.89	4.5				2.0	2.3	2.8	3.4	4.5		.80	.90	1.1	1.2	1.4	2.0	2.8	1600
140				3.9	5.1		.98	1.2	1.7	2.2	.38	.51	.73	1.2	5.0				2.3	2.6	3.1	3.8	5.0		.89	1.0	1.2	1.3	1.6	2.3	3.1	1700
160				4.9	6.4		1.3	1.5	2.1	2.8	.49	.64	.92	1.5	5.5				2.5	2.8	3.4	4.3	5.5		.99	1.1	1.3	1.5	1.8	2.5	3.4	1800
180				6.1	7.8		1.5	1.8	2.6	3.4	.60	.79	1.1	1.8	6.1				2.8	3.2	3.8	4.7	6.1		1.1	1.2	1.4	1.6	2.0	2.8	3.8	1900
200				7.3			1.8	2.2	3.1	4.0	.73	.96	1.4	2.2	6.7				3.0	3.5	4.2	5.2	6.7		1.2	1.4	1.6	1.8	2.1	3.0	4.2	2000
220							2.2	2.6	3.7	4.8	.86	1.1	1.6	2.6	.12	.21	.25	.34	3.6	4.1	5.0	6.1			1.4	1.6	1.9	2.1	2.6	3.6	5.0	2200
240							2.6	3.0	4.3	5.6	1.0	1.3	1.9	3.0	.14	.24	.29	.40	4.2	4.9	5.8	7.2			1.7	1.9	2.2	2.5	3.0	4.2	5.8	2400
260							2.9	3.5	5.0	6.4	1.2	1.5	2.2	3.5	.16	.28	.34	.46	4.9	5.6	6.8				1.9	2.2	2.5	2.9	3.5	4.9	6.8	2600
280							3.3	4.0	5.7	7.3	1.3	1.7	2.4	4.0	.18	.32	.38	.53	5.6	6.4					2.2	2.5	2.8	3.3	4.0	5.6		2800
300							3.8	4.5	6.4		1.5	2.0	2.8	4.5	.21	.37	.44	.60							2.5	2.9	3.3	3.8	4.5	6.4		3000
325							4.4	5.2	7.4		1.7	2.3	3.2	5.2	.24	.42	.50	.70	.11	.12	.15	.18	.24	.42	2.8	3.2	3.7	4.3	5.1			3200
350							5.0	6.0			2.0	2.6	3.6	6.0	.28	.48	.58	.80	.12	.14	.17	.21	.28	.48	3.2	3.6	4.2	4.8	5.7			3400
375							5.6	6.7			2.2	2.9	4.1	6.7	.31	.55	.65	.90	.14	.16	.19	.24	.31	.55	3.5	4.0	4.7	5.3	6.4			3600
400							6.3	7.5			2.5	3.3	4.6	7.5	.35	.61	.74	1.0	.16	.18	.22	.27	.35	.61	3.9	4.4	5.1	5.9				3800
425							7.8				2.8	3.7	5.1		.39	.69	.82	1.1	.18	.20	.24	.30	.39	.69	4.3	4.9	5.6	6.4				4000
450											3.1	4.1	5.7		.43	.77	.91	1.3	.20	.22	.27	.33	.43	.77	4.7	5.3	6.1					4200
475											3.4	4.5	6.2		.48	.85	1.0	1.4	.22	.25	.30	.37	.48	.85	5.1	5.8	6.7					4400
500											3.7	5.0	6.9		.53	.93	1.1	1.5	.24	.27	.33	.40	.53	.93	5.6	6.3						4600
550											4.4	5.8			.63	1.1	1.3	1.8	.29	.32	.39	.48	.63	1.1	6.0	6.8						4800
600											5.2	6.8			.74	1.3	1.5	2.1	.33	.38	.45	.56	.74	1.3	6.5							5000
650											6.0				.86	1.5	1.8	2.5	.39	.44	.53	.65	.86	1.5	.15	.18	.20	.23	.27	.39	.53	
700											6.8				.98	1.7	2.0	2.8	.44	.50	.60	.75	.98	1.7	.17	.20	.23	.26	.31	.44	.60	
750															1.1	1.9	2.3	3.2	.50	.57	.69	.85	1.1	1.9	.20	.23	.26	.30	.35	.50	.69	
800															1.3	2.2	2.6	3.6	.57	.65	.77	.95	1.3	2.2	.22	.25	.29	.33	.40	.57	.77	
850															1.4	2.4	2.9	4.0	.63	.72	.86	1.1	1.4	2.4	.25	.29	.33	.37	.45	.63	.86	
900															1.6	2.7	3.2	4.5	.70	.80	.96	1.2	1.6	2.7	.28	.32	.36	.42	.50	.70	.96	
950															1.7	2.9	3.5	4.9	.77	.88	1.1	1.3	1.7	2.9	.31	.35	.40	.46	.55	.77	1.1	
1000															1.9	3.2	3.9	5.4	.85	.97	1.2	1.4	1.9	3.2	.34	.38	.44	.50	.60	.85	1.1	

GALLONS PER MINUTE

GALLONS PER MINUTE

Hydraulic Friction Loss Charts

LOSS PER 100 FT OF OPEN OR ENCLOSED LINESHAFT LARGE O. D. PIPE COLUMN (1)

(1) FOR ENCLOSED LINESHAFT, use the friction loss under the appropriate tube size.

(1) FOR OPEN LINESHAFT, use the friction loss under the appropriate shaft size.

Pipe	14" O.D.						16" O.D.					
Tube	2½"	3"	3½"	4"	5"	6"	2½"	3"	3½"	4"	5"	6"
Shaft	1½"	(2)	2 3/16"	2 7/16"	(3)	(4)	1½"	(2)	2 3/16"	2 7/16"	(3)	(4)
GPM												
850	.15	.16	.18	.21	.29	.37					.11	.14
900	.16	.18	.20	.24	.32	.42				.11	.12	.15
950	.18	.20	.23	.26	.35	.46		.10	.11	.12	.14	.17
1000	.20	.22	.25	.29	.38	.50	.10	.11	.12	.13	.15	.18
1050	.22	.24	.27	.31	.42	.55	.11	.12	.13	.14	.16	.20
1100	.23	.26	.30	.34	.45	.60	.12	.13	.14	.15	.18	.22
1150	.25	.29	.32	.37	.50	.65	.13	.14	.15	.16	.19	.24
1200	.28	.31	.35	.40	.54	.71	.14	.15	.16	.18	.21	.26
1250	.30	.33	.38	.43	.58	.76	.15	.16	.18	.19	.23	.28
1300	.32	.36	.40	.46	.62	.82	.16	.18	.19	.21	.24	.30
1350	.34	.39	.43	.50	.67	.88	.17	.19	.21	.22	.26	.32
1400	.37	.41	.46	.53	.71	.94	.18	.20	.22	.24	.28	.34
1450	.39	.44	.49	.56	.76	1.0	.20	.21	.23	.25	.30	.36
1500	.42	.47	.52	.60	.80	1.1	.21	.23	.25	.27	.32	.38
1600	.47	.53	.59	.67	.90	1.2	.23	.26	.28	.30	.36	.43
1700	.52	.59	.66	.75	1.0	1.3	.26	.29	.31	.34	.40	.48
1800	.58	.65	.73	.84	1.1	1.5	.29	.32	.35	.38	.44	.54
1900	.65	.72	.81	.92	1.2	1.6	.32	.35	.38	.42	.49	.60
2000	.71	.80	.89	1.0	1.4	1.8	.35	.39	.42	.45	.54	.65
2200	.85	.95	1.1	1.2	1.6	2.1	.42	.46	.50	.54	.65	.78
2400	.99	1.1	1.2	1.4	1.9	2.5	.50	.54	.59	.64	.75	.91
2600	1.1	1.3	1.4	1.6	2.2	2.9	.58	.63	.69	.74	.87	1.1
2800	1.3	1.5	1.6	1.9	2.5	3.3	.66	.72	.79	.85	1.0	1.2
3000	1.5	1.7	1.9	2.1	2.9	3.8	.75	.81	.89	.97	1.1	1.4
3200	1.7	1.9	2.1	2.4	3.2	4.3	.85	.92	1.0	1.1	1.3	1.6
3400	1.9	2.1	2.4	2.7	3.6	4.8	.95	1.0	1.1	1.2	1.4	1.7
3600	2.1	2.4	2.6	2.9	4.0	5.3	1.1	1.1	1.3	1.4	1.6	1.9
3800	2.3	2.6	2.9	3.3	4.4	5.9	1.2	1.3	1.4	1.5	1.8	2.1
4000	2.5	2.9	3.2	3.6	4.9	6.4	1.3	1.4	1.5	1.6	1.9	2.3
4200	2.8	3.1	3.5	3.9	5.3		1.4	1.5	1.7	1.8	2.1	2.6
4400	3.0	3.4	3.8	4.3	5.8		1.5	1.6	1.8	2.0	2.3	2.8
4600	3.3	3.7	4.1	4.6	6.3		1.6	1.8	2.0	2.1	2.5	3.0
4800	3.5	4.0	4.4	5.0	6.8		1.8	1.9	2.1	2.3	2.7	3.3
5000	3.8	4.3	4.8	5.4			1.9	2.1	2.3	2.5	2.9	3.5
5250	4.2	4.7	5.2	5.9			2.1	2.3	2.5	2.7	3.2	3.8
5500	4.6	5.1	5.7	6.4			2.3	2.5	2.7	2.9	3.5	4.2
5750	5.0	5.5	6.2	6.9			2.5	2.7	3.0	3.2	3.8	4.5
6000	5.4	6.0	6.7				2.7	2.9	3.2	3.5	4.1	4.9

(2) 3" tube takes 1-11/16" and 1-15/16" shaft.

(3) 5" tube takes 2-11/16", 2-15/16", 3-3/16" and 3-7/16".

(4) 6" tube takes 3-11/16" and 3-15/16" shaft.

Pipe	18" O.D.				20" O.D.				24" O.D.				Pipe
Tube	3½"	4"	5"	6"	3½"	4"	5"	6"	3½"	4"	5"	6"	Tube
Shaft	2 3/16"	2 7/16"	(3)	(4)	2 3/16"	2 7/16"	(3)	(4)	2 3/16"	2 7/16"	(3)	(4)	Shaft
GPM													GPM
1100			.10	.13					6.2	6.4	7.4	10.0	28000
1200			.12	.16					6.6	6.9	7.9		29000
1300	.10	.11	.14	.19				.10	7.0	7.3	8.4		30000
1400	.12	.13	.16	.21				.12	7.4	7.8	9.0		31000
1500	.13	.14	.18	.24			.10	.13	7.9	8.2	9.4		32000
1600	.15	.16	.20	.27			.11	.15	8.4	8.7	10.0		33000
1700	.17	.18	.23	.30		.10	.12	.17	8.8	9.2			34000
1800	.19	.20	.25	.34	.11	.11	.14	.19	9.3	9.6			35000
1900	.21	.22	.27	.37	.12	.12	.15	.21					
2000	.23	.24	.30	.41	.13	.13	.17	.23					
2500	.34	.36	.45	.61	.20	.21	.25	.34				.12	
3000	.47	.50	.63	.86	.28	.29	.35	.47	.11	.11	.13	.17	
3500	.62	.67	.83	1.1	.38	.39	.46	.62	.14	.15	.17	.23	
4000	.80	.85	1.1	1.4	.47	.49	.59	.80	.18	.19	.22	.29	
4500	.99	1.2	1.3	1.8	.58	.60	.73	.99	.22	.23	.27	.36	
5000	1.2	1.3	1.6	2.2	.71	.74	.88	1.2	.27	.28	.33	.44	
5500	1.4	1.5	1.9	2.6	.84	.88	1.1	1.4	.32	.34	.39	.52	
6000	1.7	1.8	2.2	3.0	.99	1.0	1.3	1.7	.38	.39	.45	.60	
6500	1.9	2.1	2.5	3.5	1.2	1.2	1.4	1.9	.44	.45	.53	.70	
7000	2.2	2.4	2.9	4.0	1.3	1.4	1.6	2.2	.50	.52	.60	.80	
7500	2.5	2.7	3.3	4.6	1.5	1.6	1.9	2.5	.57	.59	.69	.91	
8000	2.8	3.0	3.7	5.1	1.7	1.8	2.1	2.8	.64	.63	.77	1.0	
8500	3.1	3.3	4.1	5.8	1.9	2.0	2.4	3.1	.71	.74	.86	1.2	
9000	3.5	3.7	4.6	6.4	2.1	2.2	2.6	3.5	.79	.82	.95	1.3	
9500	3.8	4.1	5.0	7.0	2.3	2.4	2.9	3.8	.87	.90	1.1	1.4	
10000	4.2	4.5	5.6	7.7	2.5	2.6	3.1	4.2	.96	.99	1.2	1.5	
11000	5.0	5.3	6.6	9.1	3.0	3.1	3.7	5.0	1.1	1.2	1.4	1.8	
12000	5.9	6.2	7.7		3.5	3.7	4.4	5.9	1.3	1.4	1.6	2.1	
13000	6.8	7.2	8.9		4.1	4.2	5.1	6.8	1.5	1.6	1.9	2.4	
14000	7.7	8.2	10.0		4.7	4.9	5.8	7.7	1.7	1.8	2.1	2.8	
15000	8.8	9.3			5.3	5.5	6.6	8.8	2.0	2.1	2.4	3.2	
16000	9.8				6.0	6.2	7.4	9.8	2.2	2.3	2.7	3.6	
17000					6.7	7.0	8.3		2.5	2.6	3.0	4.0	
18000					7.4	7.8			2.8	2.9	3.3	4.5	
19000					8.2				3.1	3.2	3.7	4.9	
20000					9.0				3.4	3.5	4.0	5.4	
21000					9.8				3.7	3.8	4.4	5.9	
22000									4.0	4.2	4.8	6.4	
23000									4.3	4.5	5.2	7.0	
24000									4.7	4.9	5.6	7.5	
25000									5.0	5.2	6.0	8.1	
26000									5.4	5.6	6.5	8.7	
27000									5.8	6.0	7.0	9.3	

Friction Losses in Discharge Heads (1)

CAST IRON HEADS

GPM \ SIZE	2½x2½x10	2½x3x10	4x4x10C	6x6x12	6x8x16½	8x8x12 8x8x16½	10x10x16½ 10x10x20	12x12x20	14x14x24½	16x16x30½
50	.25	.23								
100	1.05	1.0	.15							
150	2.4	2.2	.33							
200	4.2	4.	.60	.12						
250	6.6	6.2	.93	.19	.17					
300			1.34	.25	.23					
400			2.4	.46	.43	.15				
500			3.7	.72	.67	.24				
600			5.2	1.04	.99	.35	.15			
700			7.2	1.41	1.3	.46	.20			
800				1.84	1.73	.61	.24			
900				2.4	2.2	.78	.31	.15		
1000				2.8	2.7	.96	.39	.19		
1200				4.0	3.7	1.38	.57	.27	.18	
1400				5.7	5.3	1.87	.75	.37	.27	.15
1600					6.9	2.5	.99	.48	.33	.18
1800						3.1	1.25	.61	.42	.24
2000						3.7	1.54	.75	.51	.29
2500						6.0	2.4	1.17	.78	.45
3000						8.6	3.5	1.7	1.14	.64
3500							4.8	2.3	1.55	.90
4000							6.1	3.	2.03	1.17
4500							7.8	3.7	2.55	1.47
5000								4.6	3.14	1.8
6000								6.7	4.5	2.5
7000										3.6

2712876

STANDARD FABRICATED STEEL HEADS

GPM	4x4F	6x6F	8x8F	10x10F	12x12F	14x14F	16x16F	18x18F	20x20F	24x24F	GPM
100	.15							5.47	3.45	1.43	11,000
200	.60	.12						6.35	4.05	1.71	12,000
300	1.33	.25						7.57	4.80	2.03	13,000
400	2.4	.46	.15						5.55	2.31	14,000
500	3.7	.72	.24						6.45	2.66	15,000
600	5.2	1.04	.35	.14						3.03	16,000
700	7.2	1.41	.47	.20						3.86	18,000
800	9.4	1.84	.62	.24						4.74	20,000
900		2.4	.78	.32	.15						
1000		2.8	.96	.39	.20						
1200		4.0	1.38	.56	.27	.18					
1400		5.7	1.88	.75	.38	.27					
1600			2.55	.99	.48	.33	.18				
1800			3.15	1.25	.62	.42	.24				
2000			3.75	1.55	.75	.51	.29				
2200			4.65	1.86	.92	.63	.35	.22			
2500			6.00	2.4	1.2	.78	.45	.29			
3000			8.55	3.45	1.7	1.14	.65	.41	.26		
3500				4.65	2.31	1.55	.89	.56	.36		
4000				6.15	3.0	2.03	1.16	.72	.47		
4500				7.8	3.75	2.55	1.46	.90	.60	.24	
5000					4.65	3.14	1.8	1.11	.72	.30	
6000					6.75	4.5	2.55	1.65	1.05	.44	
7000						6.15	3.6	2.25	1.47	.59	
8000						8.1	4.65	2.9	1.8	.78	
9000							5.85	3.6	2.32	.96	
10000							7.2	4.5	2.9	1.19	

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(1) Friction losses are in feet of head at specified GPMs.

HORSEPOWER RATINGS FOR STANDARD KEYED LINESHAFTS OR TOPSHAFTS

CARBON STEEL (1) AT 1760 RPM

These charts are based on minimum effective shaft diameters.
Selection must be made from the proper chart for either threaded or keyed lineshaft.

Thrust	3/4"	1"	1-3/16"	1-1/2"	1-11/16"	1-15/16"	2-3/16"	2-7/16"	2-11/16"	2-15/16"	3-3/16"	3-7/16"	3-11/16"	3-15/16"
1000	23.7	57.1	104.8	196	297	417	641	586	829	1032	1379	1658	2128	2500
1200	23.6	57.1	104.8	196	297	417	641	586	829	1032	1379	1658	2128	2500
1400	23.6	57.0	104.7	196	297	417	641	586	829	1032	1379	1658	2128	2500
1600	23.5	57.0	104.7	196	297	417	641	586	829	1032	1379	1658	2128	2500
1800	23.4	56.9	104.7	196	297	417	641	586	829	1032	1379	1658	2128	2500
2000	23.4	56.9	104.6	196	296	416	641	586	829	1032	1379	1658	2128	2500
2400	23.2	56.7	104.5	195	296	416	641	586	829	1032	1379	1658	2128	2500
2800	23.0	56.6	104.4	195	296	416	641	586	829	1032	1379	1658	2128	2500
3200	22.7	56.4	104.2	195	296	416	641	586	829	1032	1379	1658	2128	2500
3600	22.4	56.2	104.0	195	296	416	641	586	829	1032	1379	1658	2128	2500
4000	22.1	55.9	103.9	195	296	416	641	585	828	1031	1378	1658	2127	2500
4400	21.7	55.7	103.6	195	296	416	640	585	828	1031	1378	1658	2127	2500
4800	21.3	55.4	103.4	195	296	416	640	585	828	1031	1378	1658	2127	2500
5200	20.8	55.1	103.2	194	295	416	640	585	828	1031	1378	1658	2127	2500
5600	20.3	54.7	102.9	194	295	416	640	585	828	1031	1378	1658	2127	2500
6000	19.7	54.3	102.6	194	295	415	640	585	828	1030	1378	1657	2127	2499
6500	19.0	53.8	102.2	194	295	415	640	585	828	1030	1378	1657	2127	2499
7000	18.1	53.3	101.7	193	294	415	639	585	828	1030	1378	1657	2127	2499
7500	17.1	52.7	101.3	193	294	414	639	585	828	1030	1378	1657	2127	2499
8000	15.9	52.0	100.8	192	294	414	639	583	827	1029	1377	1656	2126	2499
9000	13.0	50.6	99.7	192	293	413	638	583	826	1029	1376	1656	2125	2498
10000	8.8	48.9	98.4	191	292	413	638	582	825	1028	1375	1655	2125	2498
12000		44.8	95.4	188	290	411	636	580	823	1026	1374	1654	2124	2496
14000		39.4	91.8	186	288	409	634	577	821	1025	1372	1652	2122	2495
16000		32.0	87.4	182	285	406	632	575	819	1022	1370	1650	2120	2493
18000		20.7	82.1	179	282	404	630	572	816	1020	1370	1648	2118	2491
20000			75.8	174	278	401	627	568	813	1017	1365	1646	2116	2489
22000			68.1	169	274	397	624	564	810	1014	1362	1643	2114	2487
24000			58.6	164	270	393	621	560	806	1010	1359	1640	2111	2484
26000			46.1	158	265	389	618	555	802	1006	1356	1637	2108	2482
28000			26.5	151	260	384	614	550	797	1002	1352	1633	2105	2479
30000				143	254	379	610	544	792	998	1348	1630	2102	2475
32000				134	247	374	605	538	787	993	1344	1626	2098	2472
34000				124	240	368	600	532	782	988	1339	1622	2094	2468
36000				112	232	362	595	525	776	983	1335	1617	2090	2464
38000				98	224	355	590	518	769	977	1329	1612	2085	2460
40000				80	214	348	584	510	763	971	1324	1607	2081	2456
42000				57	204	340	578	501	756	964	1318	1602	2076	2451
44000					193	331	571	492	748	958	1312	1596	2071	2446
46000					180	322	564	482	740	950	1306	1590	2065	2441
48000					166	313	557	472	732	943	1299	1584	2060	2436
50000					150	302	549	461	723	935	1292	1577	2054	2430
55000					93	272	527	430	698	913	1273	1560	2038	2416
60000						235	503	394	671	889	1252	1541	2021	2399
65000						186	475	350	639	861	1229	1519	2001	2381
70000						110	443	295	603	831	1203	1496	1980	2361
75000							405	221	562	797	1175	1470	1958	2340

MATERIAL FACTORS: For other than C-1045, multiply by the following factor:

Size	XX-45	T, G & P	304 SS	316 SS	416 SS	17-4 PH
3/4 thru 2-3/16	1.000	—	0.614	0.526	1.053	1.421
2-7/16 & larger	—	1.000	0.875	0.750	1.500	2.025

(1)

SPEED FACTORS: For other than 1760 rpm, multiply by the following factor:

RPM	3460	2900	1460	1160	970	870	730	690	575	490	430	390
Factor	1.96	1.64	0.83	0.66	0.551	0.494	0.415	0.392	0.326	0.278	0.244	0.221

(1) Standard material is AISI C-1045. Sizes 3/4" thru 2-3/16" are XX-45; 2-7/16" thru 3-15/16" are turned, ground and polished. Their mechanical differences account for the HP rating anomaly between 2-3/16" and 2-7/16".

The formulas and allowable stresses for the above tables are based upon those outlined in AWWA E 101-71 and ANSI B58 1-1971.

HORSEPOWER RATINGS FOR STANDARD THREADED LINESHAFTS

CARBON STEEL (1) AT 1760RPM

These charts are based on minimum effective shaft diameters.
Selection must be made from the proper chart for either threaded or keyed lineshaft.

Thrust	3/4"	1"	1-3/16"	1-1/2"	1-11/16"	1-15/16"	2-3/16"	2-7/16"	2-11/16"	2-15/16"	3-3/16"	3-7/16"	3-11/16"	3-15/16"
1000	27.4	68.8	107.8	236	348	545	804	764	1040	1383	1794	2279	2845	3497
1200	27.3	68.8	107.8	236	348	545	804	764	1040	1383	1794	2279	2845	3497
1400	27.3	68.7	107.7	236	347	545	804	764	1040	1383	1794	2279	2845	3497
1600	27.2	68.7	107.7	236	347	545	804	764	1040	1383	1794	2279	2845	3497
1800	27.2	68.6	107.7	236	347	545	804	764	1040	1383	1794	2279	2845	3497
2000	27.1	68.6	107.6	236	347	545	804	764	1040	1383	1794	2279	2845	3497
2400	26.9	68.5	107.5	236	347	544	804	764	1040	1383	1794	2279	2845	3497
2800	26.7	68.3	107.4	236	347	544	804	764	1040	1383	1794	2279	2845	3497
3200	26.5	68.1	107.2	236	347	544	804	764	1040	1383	1794	2279	2845	3497
3600	26.2	67.9	107.0	235	347	544	804	764	1040	1383	1794	2279	2845	3497
4000	25.9	67.7	106.9	235	347	544	803	763	1040	1383	1794	2279	2845	3497
4400	25.5	67.5	106.6	235	347	544	803	763	1040	1383	1794	2279	2845	3497
4800	25.1	67.2	106.4	235	347	544	803	763	1040	1383	1794	2279	2845	3497
5200	24.7	66.9	106.2	235	346	544	803	763	1040	1383	1794	2279	2845	3497
5600	24.2	66.6	105.9	235	346	544	803	763	1040	1383	1794	2279	2845	3497
6000	23.7	66.2	105.6	234	346	543	803	762	1039	1382	1793	2278	2844	3496
6500	23.0	65.8	105.2	234	346	543	803	762	1039	1382	1793	2278	2844	3496
7000	22.2	65.3	104.8	234	346	543	802	762	1039	1382	1793	2278	2844	3496
7500	21.3	64.7	104.3	233	345	543	802	762	1039	1382	1793	2278	2844	3496
8000	20.3	64.1	103.8	233	345	542	802	761	1038	1381	1792	2278	2843	3496
9000	17.9	62.8	102.7	232	344	542	801	760	1037	1380	1792	2277	2843	3495
10000	14.8	61.3	101.5	231	343	541	801	760	1037	1380	1791	2277	2842	3495
12000		57.6	98.5	229	341	539	799	758	1035	1378	1790	2275	2841	3494
14000		52.9	94.9	226	339	538	798	756	1033	1377	1788	2274	2840	3492
16000		47.0	90.6	223	337	535	796	753	1031	1375	1786	2272	2838	3491
18000		39.1	85.4	220	334	533	794	750	1028	1372	1784	2270	2836	3489
20000		27.9	79.3	216	330	530	791	747	1025	1370	1782	2268	2834	3487
22000			71.8	212	327	527	788	744	1022	1367	1779	2266	2832	3485
24000			62.7	207	322	523	786	740	1019	1364	1776	2263	2830	3483
26000			50.9	201	318	520	782	736	1015	1360	1773	2260	2827	3481
28000			33.8	195	313	516	779	731	1011	1357	1770	2257	2824	3478
30000				188	307	511	775	726	1007	1353	1766	2254	2821	3475
32000				181	302	506	771	721	1002	1348	1762	2250	2818	3472
34000				172	295	501	766	715	997	1344	1758	2246	2814	3469
36000				163	288	496	762	709	991	1339	1754	2242	2811	3465
38000				152	280	490	757	702	986	1334	1749	2238	2807	3461
40000				140	272	483	751	695	980	1328	1744	2233	2802	3458
42000				126	263	477	746	688	973	1323	1739	2229	2798	3454
44000				110	254	469	740	680	966	1317	1734	2224	2793	3449
46000				89	243	462	734	672	959	1310	1728	2218	2789	3445
48000				61	231	454	727	663	952	1304	1722	2213	2784	3440
50000					219	445	720	653	944	1297	1716	2207	2778	3435
55000					180	421	701	628	922	1278	1699	2192	2764	3422
60000					125	394	680	599	898	1257	1680	2175	2748	3407
65000						361	656	565	871	1233	1659	2156	2731	3392
70000						322	630	526	840	1208	1636	2136	2713	3374
75000						274	599	482	807	1179	1612	2114	2693	3356

MATERIAL FACTORS: For other than C-1045, multiply by the following factor:

Size	XX-45	T, G & P	304 SS	316 SS	416 SS	17-4 PH
3/4 thru 2-3/16	1.000 (1)	—	0.614	0.526	1.053	1.421
2-7/16 & larger	—	1.000	0.875	0.750	1.500	2.025

SPEED FACTORS: For other than 1760rpm, multiply by the following factor:

RPM	3460	2900	1460	1160	970	870	730	690	575	490	430	390
Factor	1.96	1.64	0.83	0.66	0.551	0.494	0.415	0.392	0.326	0.278	0.244	0.221

(1) Standard material is AISI C-1045. Sizes 3/4" thru 2-3/16" are XX-45; 2-7/16" thru 3-15/16" are turned, ground and polished. Their mechanical differences account for the HP rating anomaly between 2-3/16" and 2-7/16".

The formulas and allowable stresses for the above tables are based upon those outlined in AWWA E 101-71 and ANSI B58 1-1971.

CONSOLIDATED SHAFT SIZE SELECTION CHART
(For settings to 500 ft and heads to 500 ft)

This chart does not always indicate the most economical shaft selection. See pages 4 and 5, Section 135.
Max setting for ¾" shaft is 400 ft. at greater than 2200 rpm.

C-1045 Material						
Maximum Shaft Diameter				Shaft HP Loss Per 100 Ft.		
Max. Shaft Dia.	RPM			RPM		
	1760	3550	1180	1760	3550	1180
3/4"	10	20	7	.32	.62	.21
1"	50	100	33	.53	1.1	.35
1-3/16"	75	150	50	.72	1.45	.48
1-1/2"	150	300	100	1.25	2.2	.75
1-11/16"	250	-	165	1.4	-	.94
1-15/16"	400	-	270	1.9	-	1.2
2-3/16"	600	-	400	2.3	-	1.5
2-7/16"	700	-	460	2.9	-	1.9

NOTE: 2-7/16" rating is based on using 416SS top shaft.

SHAFT HORSEPOWER LOSSES PER 100 FT OF LINESHAFT
Based on Turned, Ground and Polished Carbon Steel Shaft (AISI C-1045)

RPM OF PUMP	DIAMETER OF SHAFT IN INCHES													
	3/4	1	1-3/16	1-1/2	1-11/16	1-15/16	2-3/16	2-7/16	2-11/16	2-15/16	3-3/16	3-7/16	3-11/16	3-15/16
3500	.62	1.1	1.45	2.2	2.8									
2900	.52	.88	1.3	1.8	2.3									
1760	.32	.53	.72	1.25	1.4	1.9	2.3	2.9	3.4	4.2	4.8			
1460	.26	.44	.61	.96	1.2	1.6	2.0	2.4	2.9	3.5	4.0			
1160	.21	.35	.48	.75	.94	1.2	1.5	1.9	2.3	2.7	3.1	3.6	4.0	4.7
970		.29	.40	.61	.77	1.0	1.3	1.6	1.9	2.3	2.6	3.1	3.5	4.0
870		.26	.36	.56	.69	.92	1.2	1.4	1.7	2.1	2.35	2.7	3.1	3.5
730		.22	.31	.48	.58	.77	1.0	1.2	1.4	1.7	2.0	2.4	2.6	3.0
690		.21	.29	.45	.55	.74	.92	1.13	1.32	1.61	1.89	2.18	2.46	2.84
575		.17	.24	.38	.46	.61	.77	.95	1.10	1.34	1.58	1.81	2.04	2.36
490		.15	.21	.32	.39	.52	.65	.81	.94	1.14	1.34	1.54	1.74	2.01
430		.13	.18	.28	.34	.46	.57	.71	.82	1.00	1.18	1.36	1.53	1.71
390		.12	.17	.26	.31	.42	.52	.64	.75	.91	1.07	1.23	1.39	1.6

STAGING FACTOR FOR HXB PUMPS

Staging factors are of two types. All vertical turbine curves show as efficiency correction for various number of stages. A second type of staging factor reduces the head developed in the additional stages of some multistage HXB pump series, the MD series and some HH series pumps.

With a 20HXB or larger HXB pump each stage after the first produces only 90% of the first stage head. Thus, the full head shown on the curve is produced by the first stage; for 2 stages, multiply the head by 1.9; for 3 stages, multiply the head by 2.8 etc. The applicable staging factors are included on each of the HXB curves. ***The head staging factor must be applied in addition to the efficiency factor shown in the box at the upper right of each HXB curve.***

There are also staging limitations for the PL and the MF, MFAL, MFAH and MFH curves in the Hydro-Foil section. See Section 340, page 5 for these restrictions.

THRUST CALCULATIONS

Hydraulic downthrust in pounds per foot of head

Weight per stage of rotating element (including per stage wt of bowl shaft) ②

Data is for liquid with a Specific Gravity of 1.0. Multiply total hydraulic down thrust by Specific Gravity of liquid pumped. Add the weight of the column shaft, weight of rotating element to the hydraulic down thrust to determine the total thrust.

Use thrust curves, Section 133, pages 51 - 76 (rather than this table) whenever possible.

Bowl Size	Down Thrust	②	Bowl Size	Down Thrust	②	Bowl Size	Down Thrust	②
4LO	1.60	1.5	14MD	12.0	42	30HH-OH	104.0	370
4LE	1.00	1.5	14HXB	12.4	32	32HXB	87.0	470
6LB	1.50	3.5	14HH	20.0	44	36MA	83.0	636
6MA	2.80	3.0	15LC	6.4	46	36HXB	112.0	680
6HXB	2.20	3.0	15MA	15.0	56	36HH	140.0	784
7LB	2.40	5.0	16MC	12.7	50	36HH-OH	140.0	679
7HXB	3.40	6.0	16HXB	20.3	35	42HXB	152.0	870
8LB	2.60	7.0	16HH	30.0	75	48HXB	208.0	1075
8MA	5.60	7.0	18MA	22.5	54	48HH	235.0	1600
8HXB	3.62	7.0	18HXB	24.4	72	48HH-OH	235.0	1425
8HDX	6.60	12.0	18HH	35.0	151	56HH	338.0	2675
9LA	3.90	11.0	20MA	30.0	100	56HH-OH	338.0	2467
10LB	4.10	25.0	20HXB	25.3	120			
10MA	5.50	12.0	20HH	48.0	137			
10HH	9.50	35.0	24MA	46.1	200			
10HHA	10.20	17.0	24HXB	38.5	135			
10HXB	5.80	15.0	24HXC	18.0	111			
11MB	6.20	58.0	24HH	57.0	190			
12LD	7.80	22.0	24HH-OH	57.0	154			
12LDT	5.30	16.0	26HXB	54.3	166			
12MB	7.50	21.0	26HH	69.0	275			
12HXB	8.50	17.0	26HH-OH	69.0	225			
12HXH	11.00	27.0	27MA	74.5	270			
12HD	9.50	28.3	28HXB	64.2	205			
14LD	10.40	38.0	30LA	64.0	210			
14MC	10.00	33.0	30HH	104.0	450			

Subject to change without notice

NOTICE

WAIVER

Materials of construction, specifications, dimensions, design features, and application information, where shown in this bulletin, are subject to change and/or modification without notice by Peerless Pump.

HYDRAULICS

Operating speeds shown are nominal, and will vary with different makes and types of motors. Pump performance will vary accordingly. For certified performance curves consult factory.

DIMENSIONS

All dimensions in inches. Dimensions not certified for construction. Consult factory for certified dimension prints.

COUPLING GUARDS

Illustrations are shown without coupling guards. Guards are to be used on installed equipment.

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