Technical Data – 1900 Series Multi-Stage Split Case Pumps Engineering Data

Maximum case working pressure is the sum of the differential pressure and the suction pressure. Table 2 indicates the maximum case working pressure for the 1900 Series Split Case Pumps in various materials and at various operating temperatures. These maximum allowable pressures are based on wall thickness for the particular series of pumps, ratings for American Standard Flange Specifications, see Table 1, and take into account the material at various allowable application temperatures.

External inertia or flywheel effect is the kinetic energy stored in the rotating assembly that must be overcome when the pump impeller is caused to rotate within the casing. This energy frequently must be calculated to determine the torque required to start, accelerate or decelerate the pump. If the acceleration is rapid, the torque may be several times greater than the torque required to run the pump at normal or constant speed. WR^2 values in lbs-ft^2 are provided for these calculations. See tables 3 through 6.

Bearing life is based on the radial and thrust loads imposed on the bearings at the specific operating head and suction pressure. The Split Case Pump is designed for two year minimum B^{10} life at the maximum recommended loads. Bearing life at any other point of greater capacity on the curves will greatly exceed the minimum life shown. Average bearing life is equal to five times the mimimum bearing life (note*).

Shaft deflection is the consequence of the unbalanced hydraulic force acting inside the pump on the impeller and shaft in a radial direction. This unbalance occurs when the pump is operating away from its best efficiency point. At shut-off condition (zero flow) the unbalance is greatest and therefore the resultant radial load is maximum. Radial load and shaft deflection approach zero at the best efficiency point of the pump. 1900 Series pumps are designed for a maximum deflection of .002" at the mechanical seal faces when operating at the maximum recommended differential pressure.

WR^2 values given in tables are for bronze impeller .... lb-ft^2

EXAMPLE 1: Find WR^2 value for a 15" impeller diameter 5" 1922 bronze fitted pump handling cold water. From chart the "WET" value for a 15" diameter impeller .... 16.60 lb-ft^2

Add power series 4 rotating element less impeller ....09 lb-ft^2

.... Total 16.69 lb-ft^2

EXAMPLE 2: Find WR^2 value for a 15" impeller diameter 5" 1922 all iron pump handling 0.67 specific gravity gasoline. From chart select "DRY" value and correct for difference in materials.

$\frac{\text{Sp. Gr. cast iron}}{\text{Sp. Gr. bronze}}$ x 14.9 lb-ft^2 .... 12.09 lb-ft^2

Take difference ("WET"–"DRY") values and correct for difference in specific gravities.

1.70 x 0.67 ....1.14 lb-ft^2

Add power series 4 rotating element less impeller .... .09 lb-ft^2

.... Total 13.32 lb-ft^2

PROCEDURE FOR DETERMINING MAXIMUM SHAFT DEFLECTION AND MINIMUM BEARING LIFE.

1. Determine the proper pump size, approximate shut-off head in feet power series number, and speed from the range charts.

2. From table 11 determine the pump size factor based on pump size and RPM.

3. On table 13, page 35, locate the correct shut-off head in feet and read across to the proper pump size factor and down to the applicable power series. Note the load factor in the process. Read to the scale on the left for the maximum shaft deflection value.

4. From table 14, page 35, using the load factor from step 3 above read across to the correct power series number and down for the min. bearing life in hours.

NOTE: 1. One year life is based on 8740 hours (continuous operation)
2. Additional bearing information can be found on page 35. 3. Specific information on bearing life and shaft deflection can be obtained from the factory.

Table 5	MODEL 1900						Table 6	MODEL 1900															
	2" 1913A, 2" 1923A, 2" 1943A		2" 1913B, 2" 1923B, 2" 1943B		2-1/2" 1913A, 2-1/2" 1923A, 2-1/2" 1943A			3" 1913A, 3" 1923A, 3" 1943A		3" 1913B, 3" 1923B, 3" 1943B		4" 1922		5" 1924		5" 1922		6" 1924		6" 1922A		6" 1922B	
DIA	DRY	WET	DRY	WET	DRY	WET	DIA	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET
12.0	4.96	5.19	4.69	4.99	4.53	4.88	17.0	-	-	-	-	-	-	RTF	RTF	-	-	RTF	RTF	26.6	30.3	25.0	28.5
11.5	4.29	4.45	3.95	4.18	3.65	3.92	16.5	-	-	-	-	-	-	RTF	RTF	-	-	RTF	RTF	22.6	25.5	21.6	24.5
11.0	3.67	3.75	3.43	3.65	2.98	3.20	16.0	-	-	-	-	-	-	RTF	RTF	-	-	RTF	RTF	20.0	22.6	19.9	22.6
10.5	2.97	3.04	2.91	3.10	2.42	2.61	15.5	-	-	-	-	-	-	RTF	RTF	-	-	RTF	RTF	17.8	20.1	18.4	20.9
10.0	2.52	2.61	2.44	2.58	2.02	2.19	15.0	-	-	-	-	14.7	16.4	RTF	RTF	14.9	16.6	RTF	RTF	15.8	17.9	17.0	19.3
9.5	2.08	2.16	1.94	2.06	1.66	1.78	14.5	-	-	11.3	12.3	12.5	13.8	RTF	RTF	13.5	15.1	-	-	14.5	16.2	15.7	17.8
9.0	1.75	1.80	-	-	1.41	1.52	14.0	10.2	11.1	10.2	11.2	10.8	11.9	RTF	RTF	12.2	13.6	-	-	13.1	14.7	14.5	16.4
8.0	1.18	1.22	-	-	0.99	1.06	12.0	5.65	6.10	5.80	6.30	5.80	6.25	-	-	7.24	8.05	-	-	-	-	9.85	11.0
7.0	0.79	0.81	-	-	0.71	0.76	11.0	4.00	4.34	4.05	4.40	-	-	-	-	5.55	6.15	-	-	-	-	7.30	8.20
6.0	0.52	0.54	-	-	0.48	0.51	10.0	2.72	2.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	9.0	1.67	1.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WGT.	35#		34#		33#		WGT.	56#		56#		67#		40#		72#		42#		100#		98#	

Technical Data – 1900 Series Multi-Stage Split Case Pumps Engineering Data

TABLE 1 PUMP CASING MATERIAL	MINIMUM REQUIREMENT FOR STANDARD SUCTION AND DISCHARGE FLANGES			
	ANSI SPEC.	CLASSIFICATION	PIPE SIZE	CODE
Cast Iron ASTM A48	B16.1	125 psi flat face	1-12	A
			14-24	B
		250 psi flat face	1-12 14-24	C
Bronze ASTM B62	B16.24	150 psi flat face	All	D
		300 psi flat face		C
Stainless Steel ASTM A743 Grade CF8M	B16.5	150 psi flat face	All	E
		300 psi flat face		C

Maximum hydrostatic pressure 1-1/2 times maximum case working pressure at 100°F.

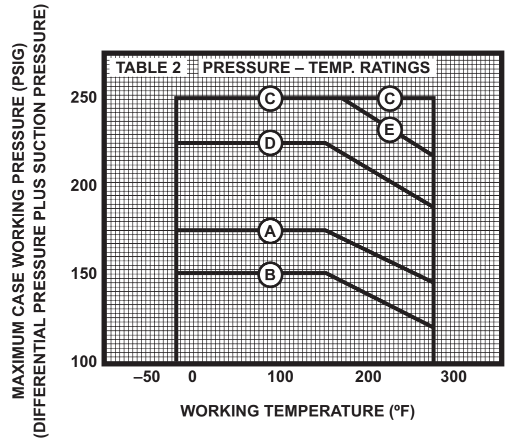


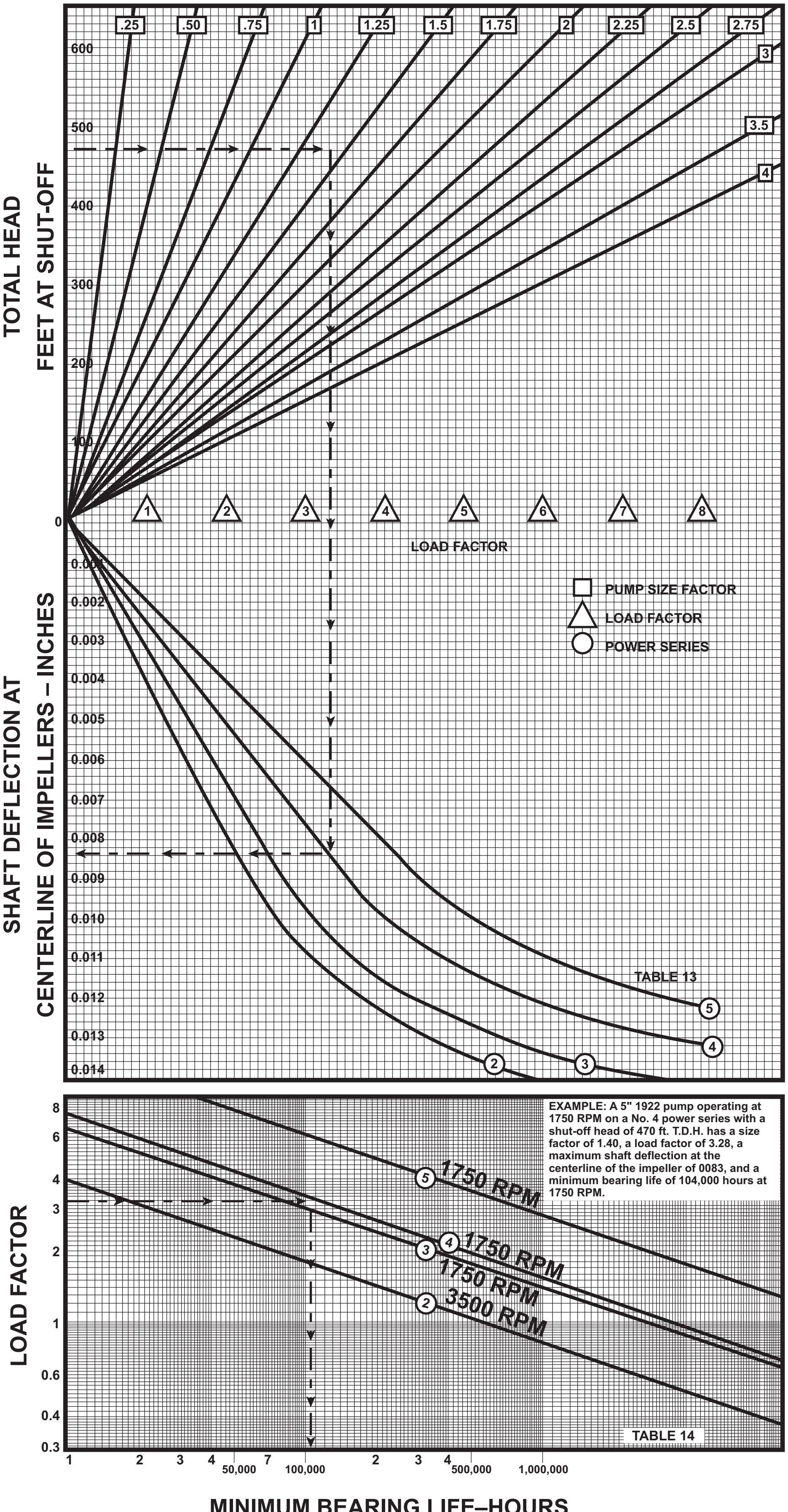
TABLE 3 – SPECIFIC GRAVITY OF COMMON METALS				
TYPE METAL	CAST BRONZE	CAST IRON	CARBON STEEL	STAINLESS STEEL
SP. GR.	8.86	7.20	7.84	7.90

EXAMPLE: A model 1900 pump with a bronze casing has been selected for operating at a case working pressure of 240 psig at 150°F. Enter Table 2 at 150°F and read upward to 240 psig. It is determined that the selection is within the recommended maximum case working pressure area for 300 psi flanges and is therefore acceptable. Note that the example exceeds the maximum case working pressure unit if the material selected would have been 125 psi flanged cast iron or 150 psi flanged bronze.

TABLE 4 (LESS IMPELLER)			TABLE 9 – QUIET PUMP DATA				TABLE 11 – PUMP SIZE FACTOR		
PUMP SIZE	POWER SERIES	WR^2 ROT ELEMENT	MAX. IMP. DATA	CUT WATER DIA.	QUIET IMP. DIA.	SPHERE DIA.	3500 RPM	1750 RPM	1150 RPM
2" 1913A, 2" 1923A, 2" 1943A	2	.025	12.00	13.25	11.25	.25	.50	.65	-
2" 1913B, 2" 1923B, 2" 1943B			12.00	13.25	11.25	.31	-	.70	-
2-1/2" 1913B, 2-1/2" 1923B, 2-1/2" 1943B			12.00	13.25	11.25	.25	.60	.65	.70
3" 1913A, 3" 1923A, 3" 1943A	3	.060	14.00	15.50	13.25	.50	-	1.15	1.25
3" 1913B, 3" 1923B, 3" 1943B			14.50	15.50	13.25	.43	-	1.10	-
4" 1922			15.00	16.53	14.00	.68	-	1.40	1.50
5" 1924	4A	RTF	12.00	13.13	12.00	.70	RTF	-	-
5" 1922	4	.099	15.00	16.56	14.00	.68	-	1.40	-
6" 1924	5A	RTF	12.00	13.13	12.00	.70	RTF	-	-
6" 1922A	5	.210	17.00	18.75	16.00	.68	-	1.80	-
6" 1922B			17.00	18.75	16.00	.81	-	1.65	1.7

TABLE 12	CHART RPM	DESIRED RPM	MULTIPLY LIFE BY
SPEED (RPM) FACTORS	3500	1750	2
	3500	1150	3
	1750	1150	1.5

TABLE 15 – DIMENSION & DESCRIPTION	POWER SERIES			
	2	3	4	5
A – STUFFING BOX I.D.	2.43	2.81	3.06	3.43
B – STUFFING BOX DEPTH	3-1/8	3	3-1/2	3-3/4
C – O.D. OF SLEEVE	1-1/2	1-3/4	2	2-3/8
PACKAGE RINGS WITHOUT LANTERN RING	12	10	12	12
PACKAGE RINGS WITH LANTERN RING	10	8	10	10
RING IN FRONT OF LANTERN	2	2	2	2
PACKAGING SIZE (SQ.)	7/16	1/2	1/2	1/2
D – WIDTH OF LANTERN RING	5/8	5/8	3/4	3/4
E – NEAREST OBSTRUCTION	1-5/8	1-3/4	1-3/4	2
F – DIAMETER OF MECHANICAL SEAL SEAT	2-1/8	2-1/2	2-3/4	3-1/4
G – LENGTH OF MECHANICAL SEAL	1-9/16	1-7/8	2	2-3/8
J – SHAFT DIAMETER AT IMPELLER	1-3/8	1-5/8	1-7/8	2-1/8
K – SHAFT DIAMETER AT SLEEVE	1-1/4	1-1/2	1-3/4	2
L – SHAFT DIAMETER AT COUPLING END	1-1/8	1-3/8	1-1/2	1-3/4
MAXIMUM DEFLECTION AT SEAL FACE	.002	.002	.002	.002
INBOARD BEARING NUMBER	206	207	208	309
OUTBOARD BEARING NUMBER	5305	5306	5307	5309
M – BEARING CENTERS	20-3/4	24-1/2	27-3/8	30
MINIMUM BEARING LIFE	6 YEARS	6 YEARS	6 YEARS	6 YEARS



SHAFT DEFLECTION AND BEARING LIFE

QUIET PUMP operation is always desirable and sometimes essential. One of the most important factors for noise control in a pumping installation is the correct selection of a pumping unit for the system. To ensure that the pump will run quietly, it should be selected so that it will operate as close as possible to the best efficiency point. At this point the hydraulic shock within the pump is at a minimum since the flow angle of the fluid from the tip of the impeller is correct for the casing design. Every pump is designed for the best efficiency point, and operations at any other point on the characteristic curves is a compromise. The amount of turbulence on either side of the best efficiency point increases as the point of operation is moved along the curve from the maximum efficiency. Therefore, the greater the turbulence, the greater the noise generated.

Hydraulic shock is also a factor if the periphery of the impeller passes too close to the cutwater. If the ratio of the impeller diameter to the cutwater diameter in centrifugal pumps is greater than 0.92, the pump is likely to be hydraulically noisy. In such instances the hydraulic pulses are actually differential pressures that occur when the impeller vanes pass the cutwater. Cutwater ratios of 0.9 to 9.5 are typical; however, significantly lower noise levels are achieved in pumps designed with a ratio of 0.7 to 0.75. Although there is an optimum gap for pump efficiency, increases of only 3%–5% may be realized by using the optimum. A cutwater ratio of 0.85 is commonly specified by practicing engineers, thereby realizing a minimum reduction in pump efficiency with a mean reduction in noise level. Table 9 offers recommended quiet impeller diameter at 85% cutwater ratio.

The charts reflect the worst possible conditions at pump shut-off. The effect from the impeller, shaft sleeves, wearing rings and packing will reduce the amount of deflection.

