



Bulletin B-207G

# Bell & Gossett



## Series 1510 Centrifugal Pumps – Technical Bulletin

- For hydronic heating and cooling systems, industrial, pressure boosting and general pumping applications
- High efficiency, low operating costs
- Easy maintenance
- Seal options

motralec

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Bell & Gossett



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Equipment Selection Program

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## Useful Pump Formulas

$$\begin{aligned} \text{Pressure (PSI)} &= \frac{\text{Head (Feet)} \times \text{Specific Gravity}}{2.31} \\ \text{Head (Feet)} &= \frac{\text{Pressure (PSI)} \times 2.31}{\text{Specific Gravity}} \\ \text{Vacuum (Inches of Mercury)} &= \frac{\text{Dynamic Suction Lift (Feet)} \times .883}{\text{Specific Gravity}} \\ \text{Horsepower (Brake)} &= \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960 \times \text{Pump Efficiency}} \\ \text{Horsepower (Water)} &= \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960} \\ \text{Efficiency (Pump)} &= \frac{\text{Horsepower (Water)}}{\text{Horsepower (Brake)}} \times 100 \text{ Per Cent} \\ \text{NPSH (Available)} &= \text{Positive Factors} - \text{Negative Factors} \end{aligned}$$

### Affinity Laws: Effect of change of speed or impeller diameter on centrifugal pumps.

	GPM Capacity	Ft. Head	BHP
Impeller Diameter Change	$Q_2 = \frac{D_2}{D_1} Q_1$	$H_2 = \left(\frac{D_2}{D_1}\right)^2 H_1$	$P_2 = \left(\frac{D_2}{D_1}\right)^3 P_1$
Speed Change	$Q_2 = \frac{\text{RPM}_2}{\text{RPM}_1} Q_1$	$H_2 = \left(\frac{\text{RPM}_2}{\text{RPM}_1}\right)^2 H_1$	$P_2 = \left(\frac{\text{RPM}_2}{\text{RPM}_1}\right)^3 P_1$

Where Q = GPM, H = Head, P = BHP, D = Impeller Dia., RPM = Pump Speed

# Take away these seven standard features and you'll have a pump like everyone else's.



## TRUE BACK PULLOUT

A B&G standard in design and construction. Ease in service is assured, while piping and motor remain undisturbed. Extended delays for repairs are virtually eliminated.

## INTERNALLY SELF-FLUSHING MECHANICAL SEAL

This design is way ahead of its time. This unique seal design is proven in many years of service. It requires no special external flushing provisions, since the design provides for constant efficient flushing action internally.

This standard feature ensures maximum seal face lubrication, heat dissipation and debris removal without vulnerable, external flush tubing. The internal flushing action passes two and a half to three times the flow over the seal faces — compared to a few GPM for conventional, stuffing-box designed pumps.



## COMPUTER CONTROLLED IMPELLER BALANCING

1510 impellers are balanced to HI/ANSI 1.1-1.5-1994 section 1.4.6.1.3.1, balance grade G6.3 standards. This method of computer balancing Impellers provides for quiet, efficient, vibration free performance. Diameters are computer selected at the factory to furnish assurance that your capacity requirements will be met.



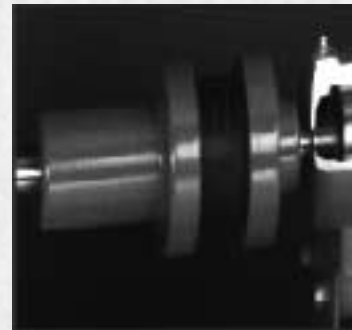
## HEAVY DUTY, RUGGED BASEPLATE

The Bell & Gossett fabricated heavy duty baseplate is supplied as standard on every Series 1510 pump. Unlike rolled steel and "C" channel baseplates, the Series 1510 baseplate provides a heavy duty saddle assembly, full seam welds, closed baseplate ends and an open top to provide ease of access for proper equipment grouting.



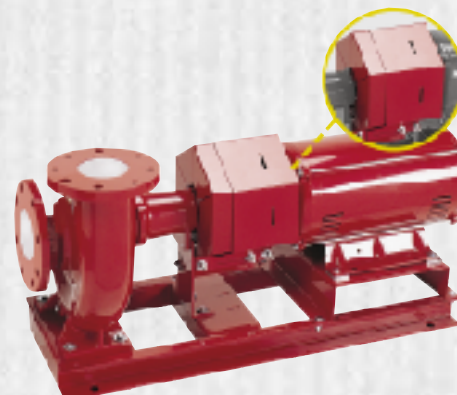
## SOLID-FOOT MOUNTED VOLUTE

All Series 1510 pumps are provided as standard with an integrally cast volute foot located directly beneath the pump volute. This integrally cast foot ensures that the alignment between the volute and motor assembly is maintained. Without solid support beneath the volute, the piping weight alone will cause distortion which can lead to premature failure of the bearings, shaft and mechanical seal. This feature is equally important on hot water applications. The Series 1510 volute foot provides a solid foundation and eliminates the deflections which would otherwise exist within an unsupported overhung volute during the normal thermal expansion of the system piping against the volute.



## CENTER DROP-OUT SPACER COUPLING

Unlike conventional jaw type or rigid style couplings, a center drop-out spacer coupling allows removal of the bearing frame and rotating element without disturbing the pump end pipe alignment or motor electrical connections.



## ANSI/OSHA-COMPLIANT COUPLING GUARD

The coupler guard complies with ANSI B15.1, Section 8 and OSHA 1910.219. The guard offers increased protection against potential injuries and is standard on all 1510 pumps. The guards include slotted viewing windows for easy inspection.

# Technical Data

## BALANCE STANDARDS

Impellers are balanced to Hydraulic Institute Standards (ANSI/HI 1.1-1.5-1994), section 1.4.6.1.3.1 Refer to Figure 1.106.

The allowable residual unbalance in the impeller rotating assembly conforms to ANSI grade G6.3.

ANSI Balance Quality Grades of G2.5 and G1 for the rotating assembly are also available. Consult your local Bell & Gossett Representative for additional details.

## VIBRATION LIMITS

Series 1510 pumps conform to Hydraulic Institute ANSI/HI 1.1-1.5-1994, section 1.4.6.1.1 for recommended acceptable unfiltered field vibration limits (as measured at the pump bearings per H.I. 1.4.6.5.2, Figure 1.108.) for pumps with rolling contact bearings.

<b>PUMP SPEED RPM</b>	<b>OVERALL DISPLACEMENT (Unfiltered) Peak to Peak-Mils (.001")</b>
3600	2.2
1800	3.8
1200	5.8

## SEISMIC CAPABILITIES

Series 1510 pumps are capable of withstanding a horizontal load of 0.5g\* without adversely affecting pump operation.

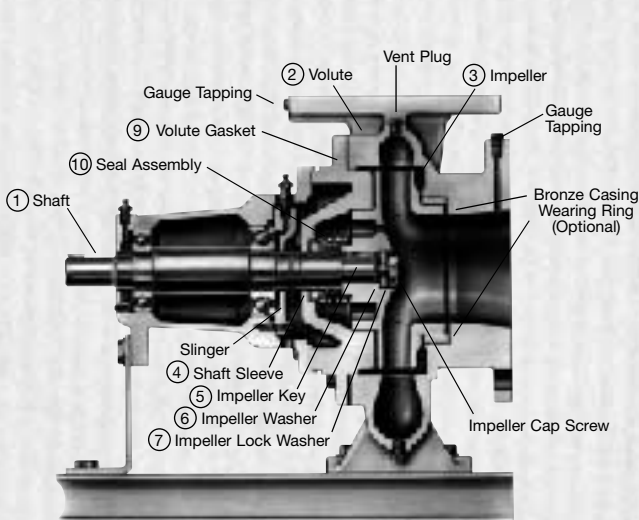
\*Piping and/or fasteners used to anchor the pump to the mounting pads on the floor are excluded.

## MECHANICAL SEAL

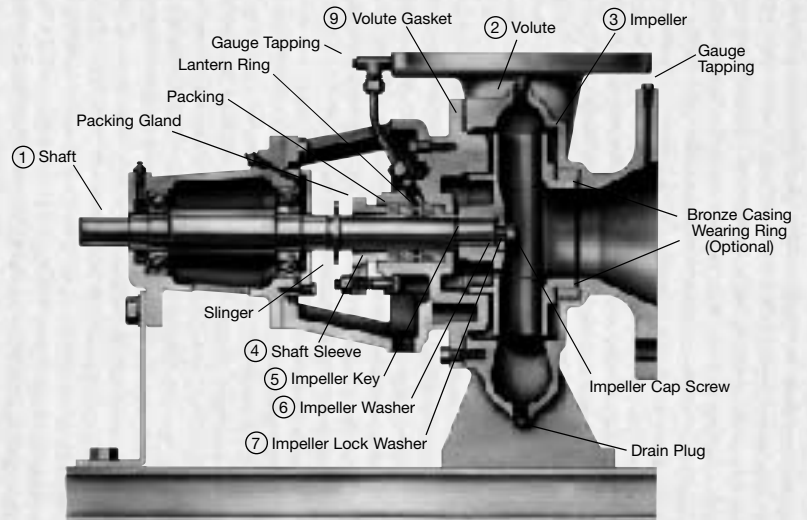
<b>Seal Features</b>	
Standard Seal Type	B&G
Internally Flushed Seal	Yes
Enlarged Seal Chamber	Yes
Standard Seal Construction	Buna-Carbon-Ceramic
Standard Working Pressure	175 psig (12 Bar)
Maximum Working Pressure	250 psig (17 Bar)
Standard Seal Temperature Rating	225 deg F (107°C)
Optional Temperature Rating	250 deg F (121°C)

The ceramic material is 99.5% pure alumina oxide, ceramic seat hardness of 68 Rockwell C, or a tensile strength of 300,000 psi.

# Materials of Construction



Standard Configuration



Optional -S Configuration

DESCRIPTION	BRONZE FITTED PUMP (STANDARD CONFIGURATION)	ALL IRON PUMP (OPTIONAL)	ALL BRONZE PUMP* (OPTIONAL)
1 Shaft	Steel SAE 1144	Steel SAE 1144	Steel SAE 1144
2 Volute	Cast Iron ASTM #A159	Cast Iron ASTM #A159	Cast Bronze ASTM #B584
3 Impeller	Cast Bronze ASTM #B584	Cast Iron ASTM #A159	Cast Bronze ASTM #B584
4 Shaft Sleeve	Aluminum Bronze ASTM #B111	#304 Stainless Steel ASTM #A312	Aluminum Bronze ASTM #B111
5 Impeller Key	#304 Stainless Steel	#304 Stainless Steel	#304 Stainless Steel
6 Impeller Washer	1510 – Steel	Stainless Steel	Brass
7 Impeller Lock Washer	#304 Stainless Steel	#304 Stainless Steel	#304 Stainless Steel
8 Impeller Cap Screw	#304 Stainless Steel	#304 Stainless Steel	#304 Stainless Steel
9 Volute Gasket	Cellulose Fiber	Cellulose Fiber	Cellulose Fiber
10 Seal Assemblies			
<b>Standard Seal</b>			
Bellows	Buna N	Buna N	Buna N
Faces	Carbon-Ceramic	Carbon-Ceramic	Carbon-Ceramic
Metal Parts	Brass	Stainless Steel	Brass
Spring	Stainless Steel	Stainless Steel	Stainless Steel
<b>For Stuffing Box</b>			
10A Flushed Single			
O-Rings	EPR	EPR	
Faces	Carbon-Tungsten Carbide	Carbon-Tungsten Carbide	
Metal Parts	Stainless Steel	Stainless Steel	
Spring	Stainless Steel	Stainless Steel	
Packed			
Packing	Graphited Impregnated Teflon	Graphited Impregnated Teflon	
Gland	Bronze	Cast Iron	
Lantern Ring	Filled TFE	Filled TFE	

## OPTIONAL FEATURES

- All Iron Construction
- All Bronze Construction\*
- Bronze Casing Wear Ring
- Stainless Steel Shaft Sleeve
- Stainless Steel Shaft
- Drip Pan
- EPT/Tungsten Carbide Seal (Standard Configuration only)
- Stuffing Box Construction with several seal and packing options

## SEAL SELECTION GUIDE FOR:

### A. STANDARD SEALS

- BUNA-PH Limitations 7-9; Temperature Range -20°F to +225°F
  - EPT-PH Limitations 7-11; Temperature Range -20°F to +250°F
- For use on open or closed clear water systems. Maximum working pressure 175 psi.

### B. FLUSHED SINGLE SEALS

- (Stuffing Box Design)
- PH Limitations 7-11; Temperature Range -20°F to +300°F\*\*
- For use on closed or open systems where the temperature or pressure requirements exceed the limitations of the standard seal. Available in 175 psi, or 250 psi working pressures.

### C. FLUSHED DOUBLE SEALS

- (Stuffing Box Design)
- PH Limitations 7-9; Temperature Range 0°F to +250°F
- For use on closed or open low pressure systems which may contain a high concentration of abrasives. An external flush is required. Maximum working pressure 175 psi.

### D. PACKING (Stuffing Box Design)

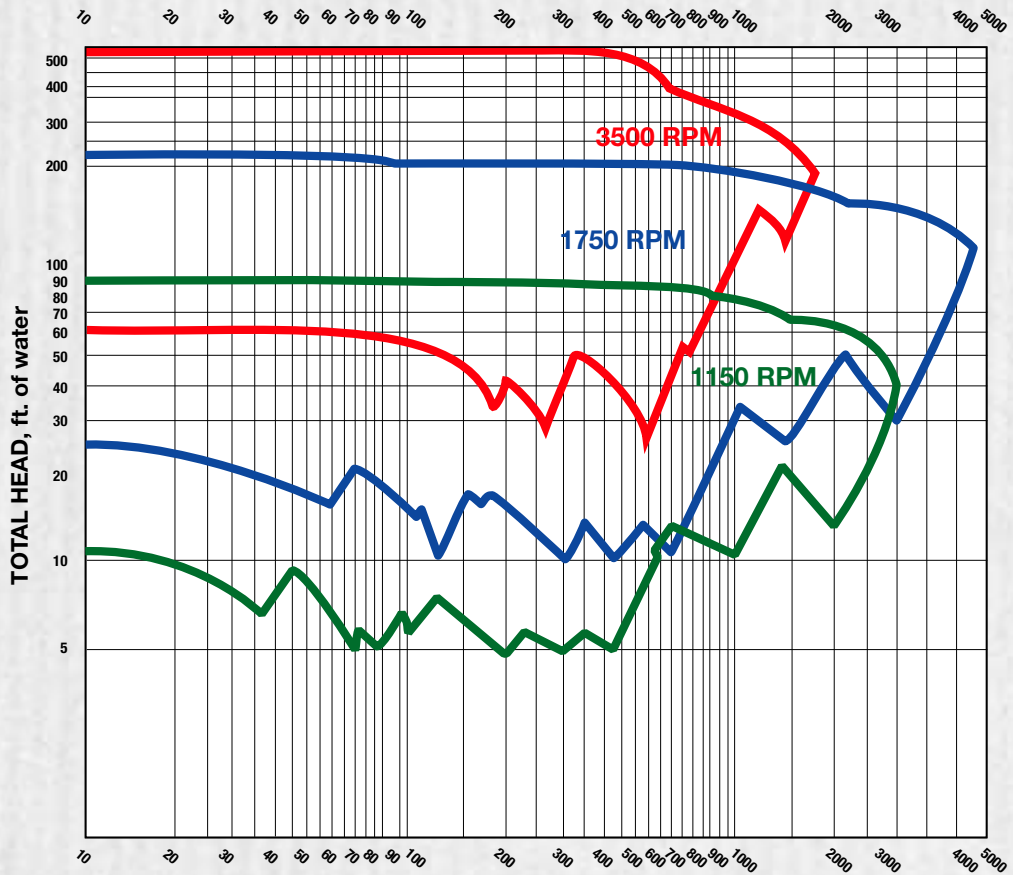
- PH Limitations 7-9; Temperature Range 0°F to +190°F
- For use on open or closed systems which require a large amount of make-up water, as well as systems which are subjected to widely varying chemical conditions and solids buildup.

\* All Bronze Construction NOT available in following sizes: 1 1/2"AC, 3AC, 3BC, 4AC, 5A, 4BC, 5BC, 6BC, all E, and all G sizes, or stuffing box configuration.

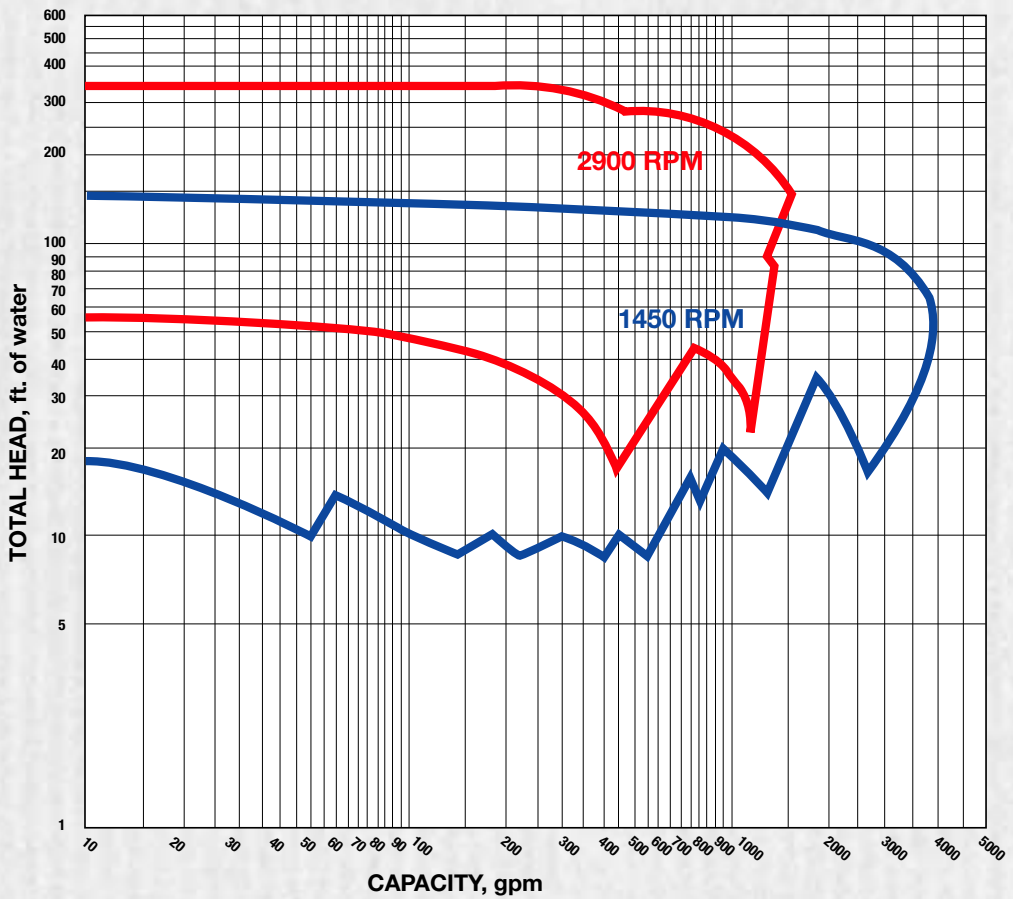
\*\* For operating temperatures above 250°F, a cooled flush is required – and is recommended for temperatures above 225°F for optimum seal life. On closed systems, cooling is accomplished by inserting a small heat exchanger in the flush line to cool the fluid. Flush-line Filters and Sediment Separators are available on special request.

# Selection Charts

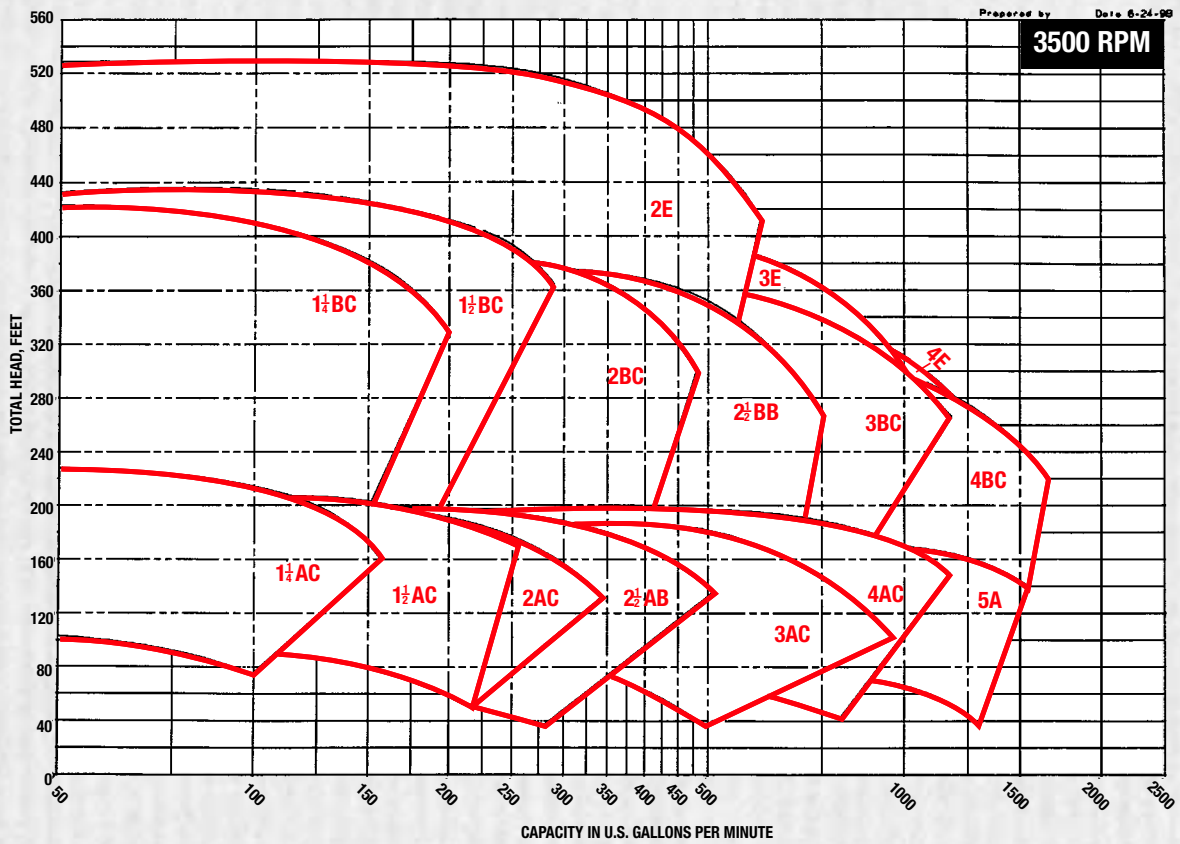
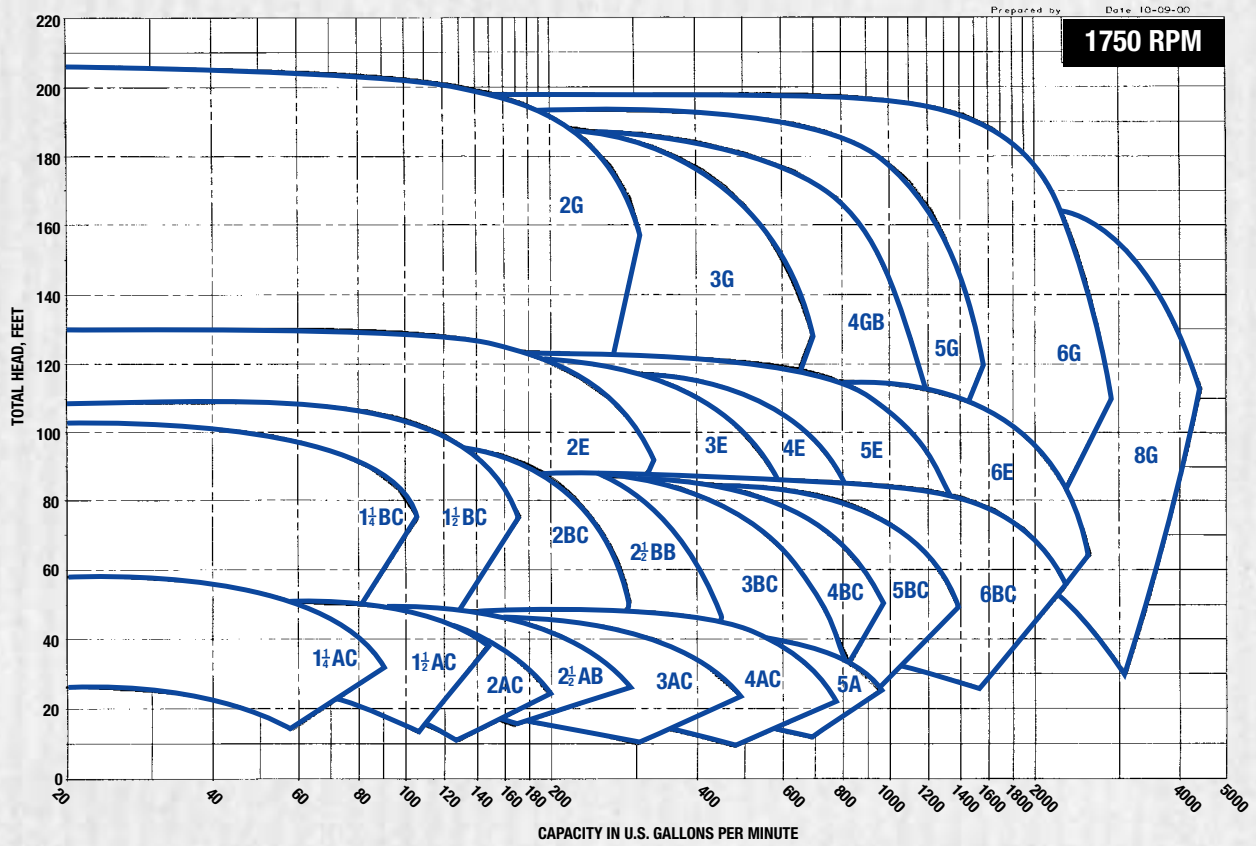
60 Hz



50 Hz



# Series 1510 Performance Curves







# Series 1510 Centrifugal Pumps cont.'d

DIMENSIONS - INCHES (MM)			STANDARD MECHANICAL SEAL PUMP MODEL 1510, 1510-F								STUFFING BOX CONSTRUCTION PUMP MODEL 1510-PF, 1510-S																							
PUMP SIZE DISCHARGE	SUCTION SIZE	MOTOR FRAME SIZE	HA	HB	HD	HL	HO	HP	Y	Z	HA	HB	HD	HL	HO	HP	Y	Z																
3 BC		182T-184T	14 3/8 (371)	31(787)	10 1/8 (273)	3 1/8 (94)	18 1/8 (464)	3 (76)	4 1/8 (121)	6 1/8 (156)	14 3/8 (371)	34 1/8 (879)	10 1/8 (273)	3 1/8 (94)	18 1/8 (464)	3 (76)	4 1/8 (121)	6 1/8 (156)																
		213T-215T		34 3/8 (870)							46 1/2 (1181)	12(305)	4 1/8 (122)	20 1/2 (521)	19 1/8 (495)																			
		254T		39 3/8 (1000)							46 1/2 (1181)	12(305)	4 1/8 (122)	20 1/2 (521)	19 1/8 (495)																			
		284TS-286TS		46 1/2 (1181)							13(330)	4 1/8 (122)	20 1/2 (521)	19 1/8 (495)																				
3 Et	4	184T	16 (406)	42 1/8 (1073)	14 (356)	6 1/8 (170)	23 1/2 (597)	5 (127)	5 1/2 (140)	7 1/8 (187)	16 (406)	42 1/8 (1073)	14 (356)	6 1/8 (170)	23 1/2 (597)	5 (127)	5 1/2 (140)	7 1/8 (187)																
		213T-215T		46 1/2 (1181)							4 1/8 (110)	20 1/2 (521)	19 1/8 (495)																					
		254T		51 1/4 (1314)							4 1/8 (110)	20 1/2 (521)	19 1/8 (495)																					
		256T		51 1/4 (1314)							4 1/8 (110)	20 1/2 (521)	19 1/8 (495)																					
3 Gt		324TS-326TS	24 (610)	56 (1422)	16 1/2 (419)	4 1/8 (125)	26 (660)	6 (152)	5 1/2 (143)	8 (203)	24 (610)	56 (1422)	16 1/2 (419)	4 1/8 (125)	26 (660)	6 (152)	5 1/2 (143)	8 (203)																
		213T-215T		46 1/2 (1181)							4 1/8 (105)	23 1/2 (597)	19 1/8 (495)																					
		254T-256T		51 1/4 (1314)							4 1/8 (105)	23 1/2 (597)	19 1/8 (495)																					
		284T-286T		51 1/4 (1314)							4 1/8 (105)	23 1/2 (597)	19 1/8 (495)																					
4 AC†		145T	14 3/8 (371)	31 (787)	10 1/8 (273)	4 1/8 (110)	18 1/8 (464)	3 (76)	4 1/8 (125)	5 1/4 (146)	14 3/8 (371)	34 1/8 (879)	10 1/8 (273)	4 1/8 (110)	18 1/8 (464)	3 (76)	4 1/8 (125)	5 1/4 (146)																
		182T-184T		34 3/8 (870)							46 1/2 (1181)	12(305)	5 1/8 (138)	20 1/2 (521)	19 1/8 (495)																			
		213T		39 3/8 (1000)							46 1/2 (1181)	12(305)	5 1/8 (138)	20 1/2 (521)	19 1/8 (495)																			
		215T		39 3/8 (1000)							46 1/2 (1181)	12(305)	5 1/8 (138)	20 1/2 (521)	19 1/8 (495)																			
4 BC	5	254T-256T	16 (406)	46 1/2 (1181)	12(305)	4 (102)	19 1/2 (495)	5 (127)	5 (127)	7 (178)	16 (406)	46 1/2 (1181)	12 (305)	5 1/8 (138)	20 1/2 (521)	19 1/8 (495)	5 (127)	7 (178)																
		284TS-286TS		51 1/4 (1314)							4 1/8 (130)	22 (559)	5 (127)																					
		324TS-326TS		51 1/4 (1314)							4 1/8 (130)	22 (559)	5 (127)																					
		364TS-365TS		56 (1422)							16 1/2 (419)	5 1/4 (146)	24 1/2 (622)	6 (152)																				
4 Et		213T-215T	16 (406)	42 1/8 (1073)	14 (356)	6 1/8 (170)	23 3/4 (603)	5 (127)	5 1/8 (141)	7 1/8 (184)	16 (406)	42 1/8 (1073)	14 (356)	6 1/8 (170)	23 3/4 (603)	5 (127)	5 1/8 (141)	7 1/8 (184)																
		254T		46 1/2 (1181)							4 1/8 (110)	20 1/2 (521)	19 1/8 (495)																					
		284T-286T		51 1/4 (1314)							4 1/8 (110)	20 1/2 (521)	19 1/8 (495)																					
		324TS-326TS		51 1/4 (1314)							4 1/8 (110)	20 1/2 (521)	19 1/8 (495)																					
4 GB		364TS-365TS	24 (610)	56 (1422)	16 1/2 (419)	4 1/8 (125)	26 1/4 (667)	6 (152)	6 (152)	8 1/8 (217)	24 (610)	56 (1422)	16 1/2 (419)	4 1/8 (125)	26 1/4 (667)	6 (152)	6 (152)	8 1/8 (217)																
		213T-215T		46 1/2 (1181)							15 (381)	5 1/8 (137)	25 (635)	5 (127)																				
		254T-256T		51 1/4 (1314)							15 (381)	5 1/8 (137)	25 (635)	5 (127)																				
		284T-286T		51 1/4 (1314)							15 (381)	5 1/8 (137)	25 (635)	5 (127)																				
5 At		182T-184T	14 3/8 (371)	31(787)	12 1/8 (324)	5 1/8 (146)	21 1/8 (540)	3 (76)	5 1/8 (148)	6 1/8 (159)	14 3/8 (371)	34 1/8 (879)	12 1/8 (324)	5 1/8 (146)	21 1/8 (540)	3 (76)	5 1/8 (148)	6 1/8 (159)																
		213T-215T		34 3/8 (870)							46 1/2 (1181)	14 (356)	6 1/8 (175)	22 1/2 (572)	19 1/8 (495)																			
		254T-256T		46 1/2 (1181)							14 (356)	6 1/8 (175)	22 1/2 (572)	19 1/8 (495)																				
		284TS-286TS		51 1/4 (1314)							14 (356)	6 1/8 (175)	22 1/2 (572)	19 1/8 (495)																				
5 BC†	6	324TS-326TS	16 (406)	46 1/2 (1181)	15 (381)	6 1/8 (164)	25 (635)	5 (127)	6 (152)	7 1/2 (191)	16 (406)	46 1/2 (1181)	15 (381)	6 1/8 (164)	25 (635)	5 (127)	6 (152)	7 1/2 (191)																
		213T-215T		51 1/4 (1314)							4 1/8 (113)	25 1/2 (648)	19 1/8 (495)																					
		254T		46 1/2 (1181)							4 1/8 (113)	25 1/2 (648)	19 1/8 (495)																					
		256T		46 1/2 (1181)							4 1/8 (113)	25 1/2 (648)	19 1/8 (495)																					
5 Et		284T-286T	24 (610)	56 (1422)	16 1/2 (419)	5 1/8 (138)	29 1/2 (749)	6 (152)	6 (152)	9 (229)	24 (610)	56 (1422)	16 1/2 (419)	5 1/8 (138)	29 1/2 (749)	6 (152)	6 (152)	9 (229)																
		254T-256T		46 1/2 (1181)							15 (381)	8 1/8 (213)	25 1/2 (648)	5 (127)																				
		284T-286T		51 1/4 (1314)							15 (381)	8 1/8 (213)	25 1/2 (648)	5 (127)																				
		324T-326T		51 1/4 (1314)							15 (381)	8 1/8 (213)	25 1/2 (648)	5 (127)																				
6 BC†		254T-256T	16 (406)	46 1/2 (1181)	15 (381)	8 1/8 (213)	25 1/2 (648)	5 (127)	7 (178)	8 1/8 (210)	16 (406)	51 1/4 (1314)	15 (381)	8 1/8 (213)	25 1/2 (648)	5 (127)	7 (178)	8 1/8 (210)																
		284T-286T		51 1/4 (1314)							15 (381)	8 1/8 (213)	25 1/2 (648)	5 (127)																				
		324T-326T		51 1/4 (1314)							15 (381)	8 1/8 (213)	25 1/2 (648)	5 (127)																				
		364T-365T		56 (1422)							16 1/2 (419)	6 (152)	27 1/2 (699)	6 (152)																				
6 Et	8	284T-286T	24 (610)	56 (1422)	16 1/2 (419)	6 (152)	27 1/2 (699)	6 (152)	6 1/8 (156)	8 1/8 (216)	24 (610)	56 (1422)	16 1/2 (419)	6 (152)	27 1/2 (699)	6 (152)	6 1/8 (156)	8 1/8 (216)																
		324T-326T		56 (1422)							16 1/2 (419)	6 (152)	27 1/2 (699)	6 (152)																				
		364T		56 (1422)							16 1/2 (419)	6 (152)	27 1/2 (699)	6 (152)																				
		404TS		56 (1422)							16 1/2 (419)	6 (152)	27 1/2 (699)	6 (152)																				
6 G†*		"L" FRAME - TO AND INCLUDING 12 1/2" IMPELLER																																
		256T	24 (610)	56 (1422)	16 1/2 (419)	6 1/8 (159)	30 1/2 (775)	6 (152)	6 1/2 (165)	9 1/8 (237)	24 (610)	56 (1422)	16 1/2 (419)	6 1/8 (159)	30 1/2 (775)	6 (152)	6 1/2 (165)	9 1/8 (237)																
		284T-286T																	26 (660)	59 1/4 (1505)	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)	26 (660)	59 1/4 (1505)	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)
		324T-326T																	26 (660)	59 1/4 (1505)	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)	26 (660)	59 1/4 (1505)	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)
364T-365T	26 (660)	59 1/4 (1505)																	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)	26 (660)	59 1/4 (1505)	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)		
"XL" FRAME - 12 1/2" IMPELLER AND LARGER																																		
365TS	26 (660)	59 1/4 (1505)	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)	26 (660)	59 1/4 (1505)	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)																		
404TS-405TS	26 (660)	59 1/4 (1505)	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)	26 (660)	59 1/4 (1505)	17 (432)	6 1/2 (165)	31 (787)	6 (152)	6 1/2 (165)	9 1/8 (237)																		

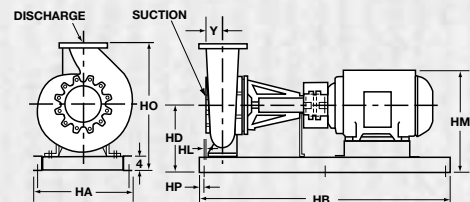
These dimensions are not to be used for installation purposes unless certified.  
 \*13 1/2" impeller for 1450 RPM service with "L" frame.

†250 psi (17 bar) available Maximum Working Pressure 175 psi (12 bar)

## 8G ONLY

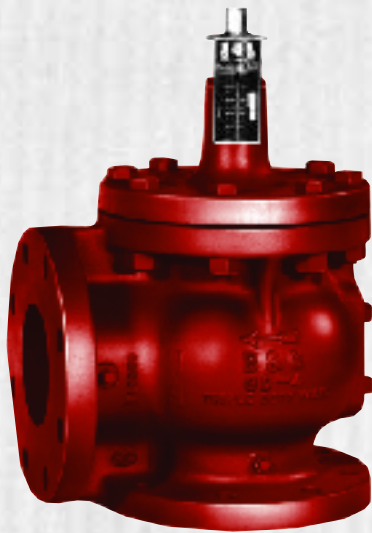
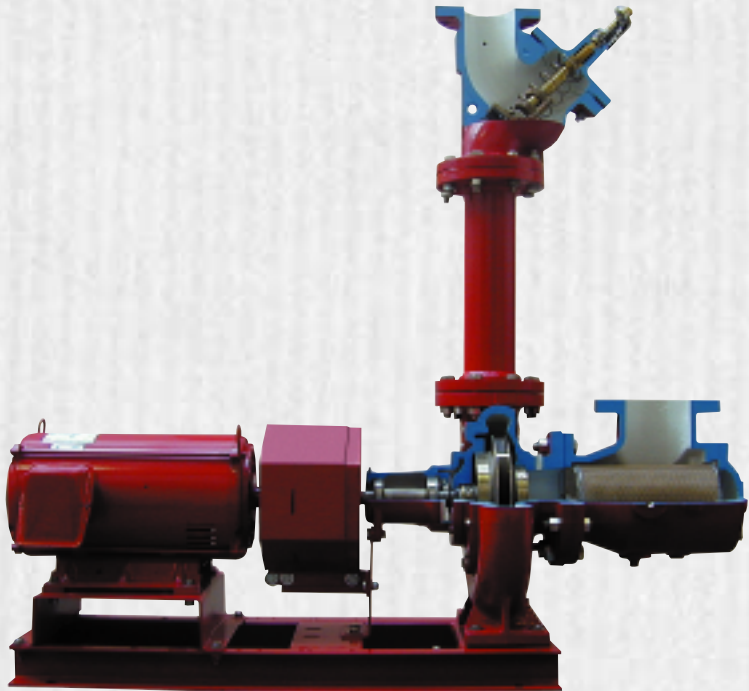
DIMENSIONS - INCHES (MM)			STUFFING BOX CONSTRUCTION PUMP MODEL 1510-S							
PUMP SIZE DISCHARGE	SUCTION SIZE	MOTOR FRAME SIZE	HA	HB	HD	HL	HO	HP	Y	
8G (203)	10 (254)	284T-445TS	28 (711)	70 (1778)	18 1/8 (464)	.44 (11)	35.7 (907)	1 1/4 (32)	4 1/8 (121)	

Flanges are: 125# ANSI - Standard



# THE B&G End Suction Pump System

*Consists of:*  
**B&G Series 1510 Pump**  
**B&G Triple Duty Valve**  
**B&G Suction Diffuser**



## Triple Duty Valve

- Lowest Pressure Drop
- ASHRAE 90.1 Energy Efficient Design
- Three Valves in one!
  - Nonslam drip-tight check valve
  - Positive shutoff valve
  - Calibrated system balance valve
- EPDM Disc Soft Seat Design
- Repack Under Pressure
- Brass Seat & Bronze Disc
- Stainless Steel Stem
- Multi-turn Valve (8-9 turns) vs 1/4 turn range of control
- Available connections
  - Threaded – Flanged – Grooved
- ESP-Plus System Selection



## Suction Diffuser

- Full length stainless steel straightening vanes
- Oversize cylinder assures minimum strainer pressure drop
- Pressure gauge tap
- Magnetic drain plug to protect pump seals
- Adjustable support foot
- Space saving design reduces the “footprint” size of the unit
- Available connections
  - Threaded – Flanged – Grooved
- Reducer and elbow provide multiple combinations of inlet and pump suction configurations which eliminate the need for reducer fittings
- ESP-Plus System Selection

# Typical Specification for Series 1510 Base Mounted, Flexible Coupled, End-Suction Pumps

Furnish and install pumps with performance characteristics as shown on plans. Pumps shall be base mounted, single stage, end suction design with a foot mounted volute to allow removal and service of the entire rotating assembly without disturbing the pump piping, electrical motor connections or pump to motor alignment.

Pump volute shall be Class 30 cast iron with integrally-cast pedestal support feet. The impeller shall be cast bronze enclosed type, balanced to ANSI/HI 1.1-1.5-1994, section 1.4.6.1.3.1, figure 1.106, balance grade G6.3 and keyed to the shaft and secured by a locking capscrew.

The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225°F (107°C). A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.

Pump shall be rated for minimum of 175 psi (12 bar) working pressure. Volute shall have gauge tapings at the suction and discharge nozzles and vent and drain tapings at the top and bottom.

The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 1.1-1.5-1994, section 1.4.6.1.1 for recommend acceptable unfiltered field vibration limits (as measured per HI 1.4.6.5.2, Figures 1.108) for pumps with rolling contact bearings.

Baseplate shall be of structural steel or fabricated steel channel with fully enclosed sides and ends, and securely welded cross members. Grouting area shall be fully open. The combined pump and motor baseplate shall be sufficiently stiff as to limit the susceptibility of vibration. The minimum baseplate stiffness shall conform to ANSI/HI 1.3.4-1997 for *Horizontal Baseplate Design* standards.

The seismic capability of the pump shall allow it to withstand a horizontal load of 0.5g, excluding piping and/or fasteners used to anchor the pump to mounting pads or to the floor, without adversely affecting pump operation.

A flexible type, center drop-out design coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor. Pumps for variable speed application shall be provided with a suitable coupler sleeve. The coupling shall be shielded by a dual rated ANSI B15.1, Section 8 & OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling.

Motor shall meet NEMA and EPACT '92 (where applicable) specifications and shall be of the size, voltage and enclosure called for on the plans. Pump and motor shall be factory aligned, and shall be realigned by the contractor per factory recommendations after installation.

The pump(s) selected shall conform to ANSI/HI 9.6.3.1 standards for Preferred Operating Region (POR) unless otherwise approved by the engineer. The pump NPSH shall conform to the ANSI/HI 9.6.1-1997 standards for *Centrifugal and Vertical Pumps for NPSH Margin*.

Each pump shall be factory hydrostatically tested per Hydraulic Institute standards. It shall then be thoroughly cleaned and painted with at least one coat of high grade paint prior to shipment.

The pump(s) shall be manufactured, assembled and tested in an ISO 9001 approved facility.

Pumps shall be Series 1510 as manufactured by ITT Bell & Gossett or equal.

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