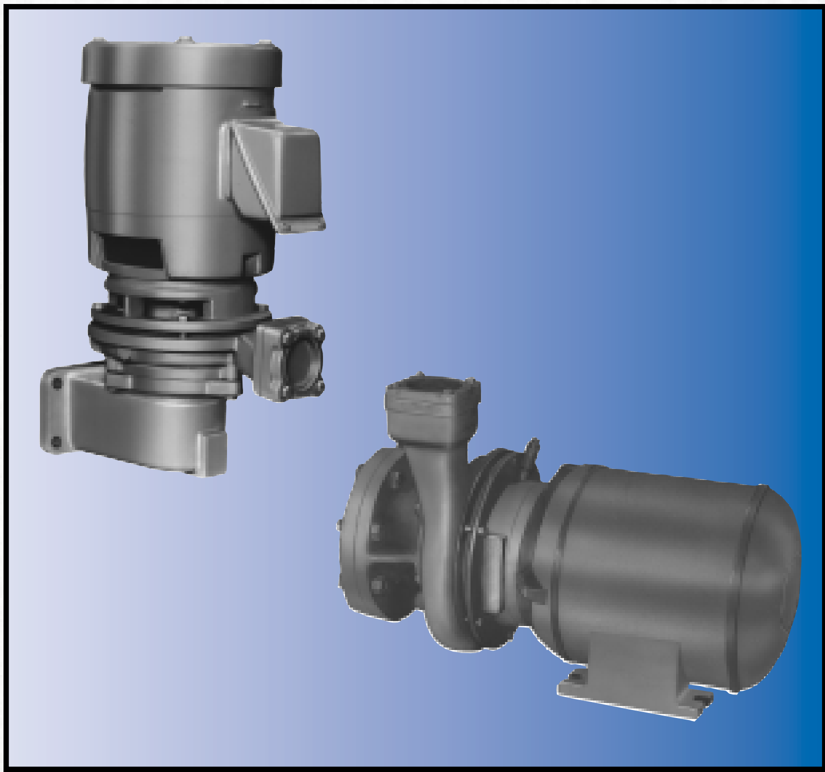
Domestic Pump



Type B Series B35, HB35 and HB17 2 Ft. NPSH Centrifugal Pumps

- **3500 RPM Capacities to 160 gpm Discharge Pressures to 100 psig**
- **1750 RPM Capacities to 340 gpm Discharge Pressures to 50 psig**

Domestic Pump

ITT Industries
Engineered for life

A brief discussion of NPSH

as it affects pump selection

The term NPSH (**N**et **P**ositive **S**uction **H**ead) has often been confusing for many people. In the following paragraphs we would like to clarify this term and its relevance to pump application.

NPSH is often defined as the net positive pressure which causes liquid to flow through the suction piping to a pump and enter the eye of the pump impeller. Net positive suction head is simply a statement of the minimum suction conditions required to prevent flashing of a fluid in a pump.

There are two values of NPSH. First is the required NPSH of the pump (NPSHR). Required NPSH as a function of the pump design is measured and supplied by the pump manufacturer. The second value of NPSH is that net positive suction head which is available to the pump suction (NPSHA). Both NPSHA and NPSHR are normally expressed in feet.

Net positive suction head available must be equal to or greater than the net positive suction head required by the pump for proper operation. Insufficient available NPSH will permit steam bubbles to form in the pump suction causing pump cavitation. Cavitation sets up violent conditions as steam pockets occur and implode in the pump impeller. This condition if permitted to persist will erode the impeller and reduce capacity.

Available NPSH can be easily determined using the following guideline:

Positive

- System Pressure
- Static Head
- Vapor Pressure of Liquid

Negative

- Friction Loss thru Piping
- Suction Lift

In a closed system, available suction head is equal to the system pressure. In open systems where the receivers are vented as in most condensate or boiler feed applications the system pressure is zero. Static head or water column into the pump also develops available positive suction head. This value can be simply determined by measurement of the distance from the water line above the pump to the impeller.

The last area to evaluate positive suction head is the vapor pressure of the fluid. Typically the vapor pressure of condensate decreases as its temperature increases. This value is the difference between barometric pressure in feet and vapor pressure at a given temperature. The following chart exhibits these values for condensate (water) at sea level.

On the negative side, friction loss through the suction piping into the pump collated against the required flow of the pump must be evaluated. In addition the static lift must be considered if the condensate source into the pump is lower than the pump suction.

The sum of both the positive and negative sources of suction head determines the Net Positive Suction Head Available to the Pump (NPSHA).

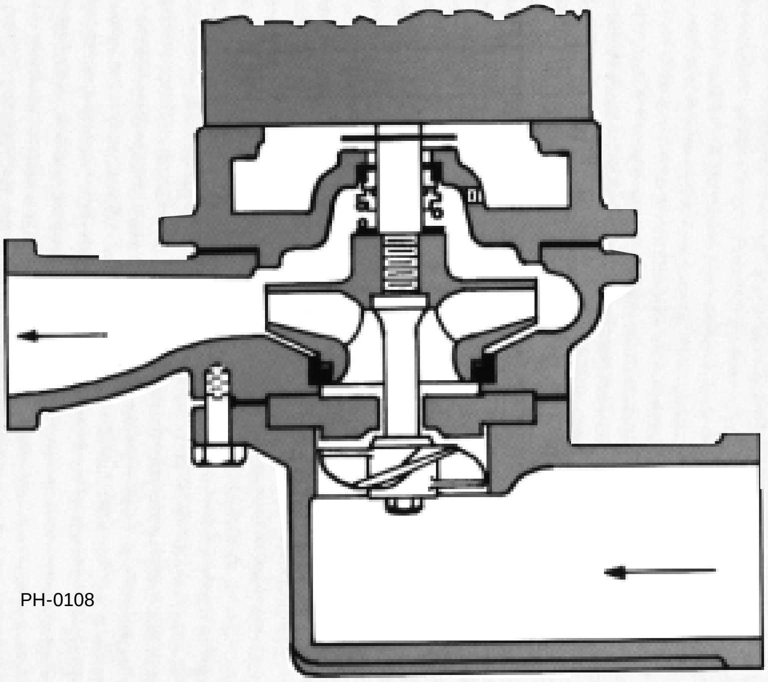
The pumps in the Type B group are designed with an axial flow impeller that builds up a positive pressure of about 5 psig (34.4 kPa) (eleven feet of head) directly into the centrifugal impeller thus guaranteeing low NPSH pump requirements. These pumps are well suited for high temperature and less than 2 ft. (0.6M) NPSHA application. Although we do furnish pumps to operate at less than two feet NPSHA, we have on the following pages tabulated the pumps at 2 feet NPSHR. The Type B pumps were originally designed as components to low profile Boiler Feed and Condensate Units. Type B pumps are also available in packaged assemblies with the receiver elevated no more than twenty four inches. Please refer to the individual pump curves for applications which require pump NPSH other than two feet (0.6M).

NPSH TABLE FOR WATER AT SEA LEVEL*
AND ATMOSPHERICALLY VENTED SUPPLY TANK

		STATIC SUCTION HEAD IN FEET (M)										
Temp.	Temp.	0	1(0.3)	2(0.6)	3(0.9)	4(1.2)	5(1.5)	6(1.8)	7(2.1)	8(2.4)	9(2.7)	10(3.0)
°F	°C	NPSH										
212°	100°	0 (0)	1(0.3)	2(0.6)	3(0.9)	4(1.2)	5(1.5)	6(1.8)	7(2.1)	8(2.4)	9(2.7)	10(3.0)
210°	98.9°	1.4(0.4)	2.4(0.7)	3.4(1.0)	4.4(1.3)	5.4(1.6)	6.4(2.0)	7.4(2.3)	8.4(2.6)	9.4(2.9)	10.4(3.2)	11.4(3.5)
208°	97.8°	2.6(0.8)	3.6(1.1)	4.6(1.4)	5.6(1.7)	6.6(2.0)	7.6(2.3)	8.6(2.6)	9.6(2.9)	10.6(3.2)	11.6(3.5)	12.6(3.8)
206°	96.7°	4.0(1.2)	5.0(1.5)	6.0(1.8)	7.0(2.1)	8.0(2.4)	9.0(2.7)	10.0(3.0)	11.0(3.4)	12.0(3.7)	13.0(4.0)	14.0(4.3)
204°	95.6°	5.1(1.6)	6.1(1.9)	7.1(2.2)	8.1(2.5)	9.1(2.8)	10.1(3.1)	11.1(3.4)	12.1(3.7)	13.1(4.0)	14.1(4.3)	15.1(4.6)
200°	93.3°	7.5(2.3)	8.5(2.6)	9.5(2.9)	10.5(3.2)	11.5(3.5)	12.5(3.8)	13.5(4.1)	14.5(4.4)	15.5(4.7)	16.5(5.0)	17.5(5.3)
190°	87.8°	12.5(3.8)	13.5(4.1)	14.5(4.4)	15.5(4.7)	16.5(5.0)	17.5(5.3)	18.5(5.6)	19.5(5.9)	20.5(6.2)	21.5(6.6)	22.5(6.9)

*Boiling point decreases 1°F (.55°C) for every 500 feet (150M) of elevation above sea level. [@ 500' (150M) above seal level, boiling point is 211°F (99.44°C)].

B35



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This is the original Type B pump, proven in over thirty years of high temperature pumping.

When we designed this pump, we wanted a reasonable and intelligent way to pump boiling water. Previous solutions were unwieldy: elevate the tank so high that the required NPSH of the pump was attained. Oversizing the pump to allow for cavitation losses was another poor solution. What was required was to develop actual pressure on the eye of the centrifugal impeller, and we accomplished this with an axial flow impeller, ahead of the centrifugal impeller. The rest is history: the Type B35 pump has been flattered by imitation by many manufacturers. No wonder this pump is imitated – one-piece bronze impellers, hand-finished and balanced, bronze-fitted construction, space-saving close-coupled design, easy field servicing, stainless steel motor shaft, and heavy duty motors.

NOTE: Available for Vertical Flange Mounted or Vertical Foot Mounted. For Horizontal Design 5 HP and above see page 4.

SELECTION DATA FOR B35

Pumps are designed for up to 35 PSI (241kPa) suction pressure and up to 250°F (121°C). CONSULT FACTORY for other suction pressure applications.

PUMP DELIVERY IN GMP AT MOTOR HP, 3500 RPM, 2 FT (0.6M) NPSH AND APPLICABLE DISCHARGE PRESSURE

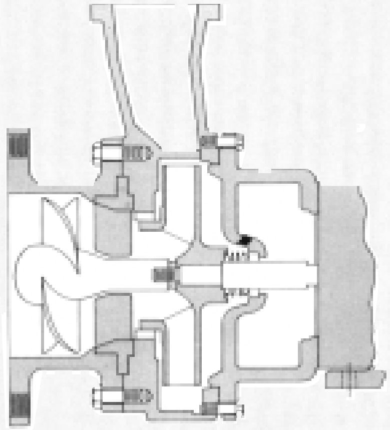
HP	FT. TDH(M) PSIG (kPa)	34.6(10.5) 15(103)	46.2(14.1) 20(138)	57.7(17.6) 25(172)	69.3(21.1) 30(207)	92.4(28.2) 40(276)	115.5(35.2) 50(345)	139(42.4) 60(414)	173(52.7) 75(517)	196(59.7) 85(586)	231(70.4) 100(690)
1/2	gpm (l/S) Model	30(1.9) 616	15(0.9) 616								
3/4	gpm(l/S) Model	45(2.8) 616	45(2.8) 616	30(1.9) 616	22(1.4) 616						
1	gpm(l/S) Model	45(2.8) 616	45(2.8) 616	45(2.8) 616	37(2.3) 616						
1 1/2	gpm(l/S) Model	90(5.7) 626	60(3.8) 626	45(2.8) 616	45(2.8) 616	22(1.4) 617	9(0.6) 617				
2	gpm(l/S) Model		80(5.0) 626	75(4.7) 626	60(3.8) 626	35(2.2) 617	22(1.4) 617				
3	gpm(l/S) Model	125(7.9) 625	125(7.9) 625	90(5.7) 625	90(5.7) 626	65(4.1) 627	50(3.2) 627	25(1.6) 620	9(0.6) 620		
5	gpm(l/S) Model			150(9.5) 614	150(9.5) 614	110(6.9) 614	80(5.0) 613	75(4.7) 620	45(2.8) 620	37(2.3) 620	22(1.4) 620
7 1/2	gpm(l/S) Model					145(9.1) 614	136(8.6) 614	90(5.7) 618	75(4.7) 620	75(4.7) 620	37(2.3) 618
10	gpm(l/S) Model							140(8.8) 618	130(8.2) 618	110(6.9) 618	80(5.0) 618
15	gpm(l/S) Model								140(8.8) 618	140(8.8) 618	90(5.7) 618

Selection tables capacities are based on performance at 2 ft. (0.6M) NPSH. For other NPSH requirements refer to pump curves.
Impellers trimmed to nearest 1/16" (1.6mm) to meet capacity specified.

NOTE: TEFC and explosion proof motors available. The motor horsepower requirements is often greater using explosion proof as they have unity service factor.

HORIZONTAL HB35 & HORIZONTAL HB17

Illustration shows Horizontal HB17
Horizontal HB35 is similar in construction.



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SELECTION DATA FOR HB35

Pumps are designed for up to 35 PSI (241kPa) suction pressure and up to 250°F (121°C). CONSULT FACTORY for other suction pressure applications.

PUMP DELIVERY IN GMP AT MOTOR HP, 2 FT. (0.6M) NPSH AND APPLICABLE DISCHARGE PRESSURE

HP	FT. TDH(M) PSIG (kPa)	57.7(17.6) 25(172)	69.3(21.1) 30(207)	92.4(28.2) 40(276)	115.5(35.2) 50(345)	139(42.4) 60(414)	173(52.7) 75(517)	196(59.7) 85(586)	231(70.4) 100(690)
TYPE HB35				3500 RPM					
5	gpm(I/S) Model	150(9.5) 614	150(9.5) 614	110(6.9) 614	80(5.0) 613	75(4.7) 620	45(2.8) 620	37(2.3) 620	22(1.4) 620
7½	gpm(I/S) Model			150(9.5) 614	150(9.5) 614	120(7.6) 618	75(4.7) 620	75(4.7) 620	37(2.3) 618
10	gpm(I/S) Model					140(8.8) 618	130(8.2) 618	110(6.9) 618	80(5.0) 618
15	gpm(I/S) Model						140(8.8) 618	140(8.8) 618	95(6.0) 618

Selection tables capacities are based on performance at 2 ft. (0.6M) NPSH. For other NPSH requirements refer to pump curves.
Impellers trimmed to nearest 1/16" (1.6mm) to meet capacity specified.

NOTE: TEFC and explosion proof motors available. The motor horsepower requirements is often greater using explosion proof as they have unity service factor.

The high capacity HB17, the only 2 ft. (0.6M) NPSH pump to operate at 1750 rpm.

The HB17 fills the demand for a 2 ft. (0.6M) NPSH pump for moderate pressure and large volume of water. It has the same quality features as the rest of the group, such as hand-finished and balanced one-piece bronze impellers, easy field servicing, rugged and uncomplicated design and construction. The greater capacity of this pump not only provides a long-awaited selection for the designer who needs the capacity, but it also is extremely useful for those jobs where moderate capacity is needed in a situation providing less than 2 ft. (0.6M) NPSH.

SELECTION DATA FOR HB17

Pumps are designed for up to 35 PSI (241kPa) suction pressure and up to 250°F (121°C). CONSULT FACTORY for other suction pressure applications.

PUMP DELIVERY IN GMP AT MOTOR HP, 2 FT. (0.6M) NPSH AND APPLICABLE DISCHARGE PRESSURE

HP	FT. TDH(M) PSIG (kPa)	34.6(10.5) 15(103)	46.2(14.1) 20(138)	57.7(17.6) 25(172)	69.3(21.1) 30(207)	92.4(28.2) 40(276)	115.5(35.2) 50(345)	139(42.4) 60(414)	173(52.7) 75(517)	196(59.7) 85(586)
TYPE HB17					1700 RPM					
5	gpm(I/S) Model	275(17.3) 654	235(14.8) 654	175(11.0) 654						
7½	gpm(I/S) Model		275(17.3) 654	275(17.3) 654	260(16.4) 659	200(12.6) 659				
10	gpm(I/S) Model			310(19.6) 659	310(19.6) 659	275(17.3) 659	180(11.4) 659			
15	gpm(I/S) Model				340(21.4) 658	340(21.4) 658	340(21.4) 658			

Selection tables capacities are based on performance at 2 ft. (0.6M) NPSH. For other NPSH requirements refer to pump curves.
Impellers trimmed to nearest 1/16" (1.6mm) to meet capacity specified.

NOTE: TEFC and explosion proof motors available. The motor horsepower requirements is often greater using explosion proof as they have unity service factor.