1.0  **Scope**

The purpose of the Standard is to provide a uniform graphic representation of the performance characteristics of CPB rated pumps under stated conditions. The complete graphical representation of the data herein shall be called the “Pump Performance Curve”.

2.0  **Definitions**

2.1  **Capacity**

The capacity of a pump is the total volume throughput per unit of time and is typically expressed in units of US gallons per minute, liters per second or cubic meters per hour.

2.2  **Total Head**

Total Head is the measure of the total energy imparted to the liquid by the pump per unit weight of liquid and is typically expressed in units of feet or meters.

2.3  **Speed**

Speed is the number of revolutions of the shaft in a given unit of time and is typically expressed in units of revolutions per minute.

2.4  **Suction Lift**

Suction lift is the hydraulic pressure below atmospheric at the intake port of the pump and is typically expressed in feet or meters.

2.5  **Net Positive Suction Head Required (NPSHR)**

NPSHR is the amount of suction head over vapor pressure required to prevent more than a 3% loss in total head at a specific capacity and is usually expressed in units of feet or meters.
2.6 Water Horsepower (HP)

Water horsepower is the power required to be imparted to the liquid by the pump to achieve the desired head at the given capacity and is typically expressed in units of horsepower or kilowatts.

2.7 Efficiency

Efficiency is the ratio of the energy imparted to the liquid by the pump to the energy delivered to the pump shaft and is typically expressed in percent (%).

2.8 Best Efficiency Point (BEP)

The Best Efficiency Point is the capacity and head at which the pump efficiency is at maximum.

2.9 Recommended Operating Range

The recommended operating range is the range of permissible off-peak flows before the onset of excessive noise, vibration or cavitation.

2.10 Minimum Stable Flow

The Minimum Stable Flow is the lowest flow rate at which a pump can operate before the onset of excessive noise, vibration or cavitation. These issues occur when operating left of the minimum stable flow line on the Performance Curve. (See Performance Curve Graph Example #2).

3.0 Format

3.1 Size

The performance curve shall be provided on full size 8½” x 11” paper or larger.

3.2 Graph

A graph shall be constructed using the Cartesian two-dimensional (rectangular) coordinate system with the horizontal or abscissa axis being denoted as the capacity and the vertical or ordinate axis being denoted as Total Head. The horizontal and vertical axis shall start from zero and terminate at the maximum values for the capacity and head of the pump.
3.3 Product Data

Any pertinent product data such as the impeller diameter, impeller type, solids handling size capability, etc. shall be provided on the Pump Curve.

4.0 Graphical Representation of Data  [See corresponding examples, Pgs 6 & 7]

4.1 Head-Capacity (H-Q) Curves

A series of curves shall be plotted on the graph to show the head-capacity relationship at the various recommended operating speeds. Each curve shall be labeled with the appropriate speed expressed in units of RPM. The head-capacity curves shall start from zero capacity and terminate at the maximum recommended flows of the pump.

4.2 Efficiency/Horsepower Curves

Either the efficiency of the pump expressed as a %, or the horsepower required by the pump expressed in units of HP or kW shall be plotted on the graph to show the power performance of the pump. For the efficiency curves, the best efficiency point shall be readily distinguishable.

\[
\text{BHP} = \frac{\text{GPM} \times \text{Head}}{3960 \times \text{Efficiency}}
\]

\[
\text{Efficiency} = \left( \frac{\text{GPM} \times \text{Head}}{3960} \right) \div \text{BPH}
\]

4.3 Suction Lift or NPSHR Curves

Either the suction lift required by the pump expressed in feet or meters or the net positive suction head required by the pump expressed in feet or
meters shall be plotted on the graph to show suction performance of the pump.

<table>
<thead>
<tr>
<th>Maximum Suction</th>
<th>Atmospheric Pressure (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lift Calculation:</td>
<td>minus NPSHR (ft)</td>
</tr>
<tr>
<td></td>
<td>minus Vapor Pressure (ft)</td>
</tr>
<tr>
<td></td>
<td>minus 2 (ft) safety margin</td>
</tr>
</tbody>
</table>

4.4 **Recommended Operating Range**

The recommended operating range is the range of permissible off-peak flows before the onset of excessive noise, vibration or cavitation.

The recommended operating range shall be clearly indicated on the graph. If represented graphically as a reference to minimum stable flow, be sure to operate pump to the right of minimum stable flow capacity.

Ref Example #2, “4.4 Minimum Stable Flow”

5.0 **Test Conditions**

5.1 **Type of Test Fluid**

The type of fluid used for the test shall be indicated on the Pump Curve.

5.2 **Temperature of Test Fluid**

The temperature of the test fluid shall be indicated on the Pump Curve in either degrees F or C.

5.3 **Viscosity of Test Fluid**

The viscosity of the test fluid shall be indicated on the Pump Curve in SSU’s or centistokes.

5.4 **Specific Gravity of Test Fluid**

The specific gravity of the test fluid shall be indicated on the Pump Curve.
5.5 Altitude

The altitude for the test location shall be indicated on the Pump Curve.

6.0 Standards

6.1 Test Data Standard

The CPB Performance Curve Standard shall be indicated on the Pump Curve.

6.2 Testing Standards

The applicable Hydraulic Institute Test Standard used for testing the pump shall be indicated on the Pump Curve.

6.3 CPB Rating

The specific CPB rating for the pump shall be indicated on the Pump Curve.

7.0 Document Information

7.1 Pump Model Number

The manufacturer’s pump model number or designation shall be provided on the Pump Curve.

7.2 Document Reference Number

A document reference number shall be provided on the Pump Curve.

7.3 Effective Date or Revision Level

The effective date or revision level shall be provided on the Pump Curve.
Example #1

PUMP MODEL: ______

<table>
<thead>
<tr>
<th>Impeller Dia.</th>
<th>Impeller Type</th>
<th>No. Vanes</th>
<th>Solids Dia.</th>
</tr>
</thead>
</table>

![Graph showing pump characteristics with labeled lines](image)

**TOTAL DYNAMIC HEAD (FEET)**

**H-Q (max speed)**

**H-Q (intermediate speed)**

**H-Q (intermediate speed)**

**H-Q (min speed)**

**Recommended Operating Range**

**EFF**

**Etp**

**BEP**

**EFF**

**EFF**

**EFF**

**EFF**

**TEST CONDITIONS:**

- **Fluid:** ______
- **S.G.:** ______
- **Temperature:** ______
- **Altitude:** ______
- **Viscosity:** ______

Test Data Standard: CPB Performance Curve Standard

Testing Standard: ANSI/HI 1.6 – 1994

CPB Rating: ___________________________
Example #2

PUMP MODEL: _______

TEST CONDITIONS
Fluid: _______
S.G.: _______
Temperature: _______
Altitude: _______
Viscosity: _______

PUMP DATA
Impeller Dia.: _______
Impeller Type: _______
No. Vanes: _______
Solids Dia.: _______

Total Dynamic Head (Feet)

4.1
H-Q (max speed)

4.2
Int. Speed
Min. Speed

4.3
Speed

4.4

NPSH Feet

Capacity (USGPM)

Minimum Stable Flow

Test Data Standard: CPB Performance Curve Standard
Testing Standard: ANSI/HI 1.6 – 1994
CPB Rating: _____________________