

All Iron Pump (Symbol A. I.).—All parts of the pump coming in direct contact with the liquid pumped are to be made of iron or ferrous metal.

Standard Fitted Centrifugal Pumps (Symbol S. F.).—Casing of cast-iron, shaft of steel, impeller of bronze or cast-iron, wearing rings and shaft sleeves when used of bronze or cast-iron.

Bronze Fitted Centrifugal Pumps (Symbol B. F.).—Casing of cast-iron, shaft of steel, impeller of bronze, wearing rings and shaft sleeves when used, of bronze.

STANDARD EQUIPMENT OF PUMPS

The following lists of standard equipment, which are in accordance with the *Hydraulic Societies' Standards*, should be used:

Trade Steam Pumps (Single or Duplex).—The following is considered standard equipment for trade pumps and is to be furnished by the manufacturer:

Drip cocks for steam cylinders, Drain plugs for liquid cylinders, Special wrenches, Piston packing for water only, Oil or grease cups for rocker shafts, companion flanges for all openings up to 6 in. inclusive.

Plunger packing will be furnished for inside packed plunger pumps. Packing will not be furnished for outside packed plunger pumps.

Power Pumps.—The following is considered standard equipment for duplex and triplex power pumps:

Liquid Valve Service, Oil or Grease Cupers, Tight pulley only, Discharge air chamber up to 400 lb. pressure. Companion flanges up to and including 6 in. Special wrenches where required.

Gear Guard covering the teeth of the pinion and the adjacent teeth of the gear will be furnished as a part of the Standard Equipment. *Gear Guards conforming to the laws of the various states will be furnished as extras, when such laws are quoted in the purchaser's inquiry or order.*

Centrifugal Pumps.—The following is considered standard equipment for horizontal centrifugal pumps:

Coupling or pulley, Bed plates up to 24 in. pumps inclusive, Oil gages for bearings. Air cock at top of pump casing. Drain plug at bottom of pump casing. Packing for shaft stuffing boxes. Water seal gland—piping for same optional. Special wrenches when required.

DEFINITION OF TERMS USED

The following definitions of terms, which are in accordance with the *Hydraulic Societies' Standards*, should be used:

Static Head is the vertical distance between the free level of the source of supply and to the point of free discharge, or to the level of the free surface of the discharge water.

Total dynamic head is the vertical distance between the source of supply and point of discharge when pumping required capacity, plus velocity head, plus friction, velocity, entrance and exit losses.

Total dynamic head as determined on test, where suction lift exists, is the reading of a mercury column connected to the suction nozzle of pump plus the reading of a pressure gage connected to discharge nozzle of pump, plus vertical distance between point of attachment of mercury column and center of gage, plus excess, if any, of velocity head of discharge over velocity head of suction as measured at points where the instruments are attached, plus head of water resting on mercury column, if any.

Total dynamic head as determined on test, where suction head exists, is the reading of a gage attached to the discharge nozzle of pump minus the reading of gage connected to the suction nozzle of pump, plus or minus vertical distance between centers of gages (depending on whether suction gage is below or above discharge gage), plus excess, if any, of velocity head of discharge over velocity head of suction as measured at points where instruments are attached.

Total dynamic discharge head is the total dynamic head minus dynamic suction lift, or plus dynamic suction head.

Suction Lift.—Suction lift exists when the suction measured at the pump nozzle and corrected to the center line of the pump is below atmospheric pressure.

Static suction lift exists when the source of supply is below the center of pump and is the vertical distance from the free level of source of supply to center of pump.

Dynamic suction lift, where static suction lift exists, is the vertical distance from the source of supply, when pumping required capacity, to center of pump, plus velocity head, plus entrance friction and velocity losses, but not including internal pump losses; where static suction head exists but where the losses exceed the static suction head, the dynamic suction lift is the sum of the velocity head, entrance, friction and velocity losses, minus the static suction head, but not including internal pump losses.

Dynamic suction lift as determined on test, is the reading of a mercury column connected to suction nozzle of pump, plus vertical distance between point of attachment of mercury column to center of pump, plus head of water resting on mercury column if any.

Suction Head (sometimes called head on suction) exists when the pressure measured at the suction nozzle and corrected to the center line of the pump is above atmospheric pressure.

Static suction head exists when the source of supply is above the center of pump and is the vertical distance from the free level of the source of supply to center of pump.

Dynamic suction head, where static suction head exists, is the vertical distance from the source of supply, when pumping at required capacity to center of pump, minus velocity head, minus entrance friction and velocity losses, but not minus internal pump losses.

Dynamic suction head as determined on test is the reading of a gage connected to suction nozzle of pump, minus vertical distance from center of gage to center line of pump. Suction head, after deducting the various losses, may be a negative quantity, in which case a condition equivalent to suction lift will prevail.

Guarantee on Suction Lift.—All guarantees unless otherwise specified should be based on handling clear fresh water at a temperature of not over 85 deg. Fahr. and a total dynamic suction lift of not over 15 ft. at sea level.

HORSE POWER OF MOTORS

For motors of less than 100 hp. capacity when rated on a 50 deg. basis and when used to drive centrifugal pumps should be of a capacity at least 20 per cent above the actual horsepower required by the pump. When rated on a 40 deg. basis the extra margin of capacity should be made 5 per cent in excess of the actual power required by the pump at the normal rated capacity conditions for which the pump is guaranteed. For motors over 100 hp. capacity the rated motor capacity may be less than that given previously.

INSTALLATION DATA

All pumps, in general, should be set on substantial foundations and be provided with heavy cast iron sub-bases, securely anchored to foundation and provided with drip rim with drain connected to sump or sewer.

Especially in the case of centrifugal or turbine pumps every reasonable precaution should be taken to prevent distortion of base plates of pumps due to handling in shipment or bolting down without suitable grouting.

Flexible couplings should not be used to compensate for misalignment but only to compensate for temperature variations.

Pipe connections should, in general, be supported to prevent undue stresses in pumps due either to weight or expansion.

The exhaust from steam driven pumps supplying steam for heating purposes should be taken through an effective oil separator before entering any part of the heating system or other apparatus.

A full set of the manufacturers working drawings should be used in connection with each installation.