Irrigation
FACTSHEET

BRITISH COLUMBIA
Ministry of Agriculture, Food and Fisheries

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CENTRIFUGAL PUMP SELECTION AND INSTALLATION

Efficient operation of a pump can only be obtained by selecting the correct pump, as well as the proper selection and installation of suction and discharge fittings. The pump should be evaluated on a regular basis to ensure the pump is operating properly and is still sized correctly for the system, especially after any major system modifications. The most commonly used pumps in irrigation are centrifugal pumps, turbine and submersible pumps.

Centrifugal pumps are a good choice to pump water from lakes, rivers, creeks or shallow wells. Horizontal centrifugal pumps commonly used for irrigation systems have total dynamic heads of less than 400 ft and suction lifts of less than 20 ft. This factsheet focuses on centrifugal pumps.

Turbine and submersible pumps are used when pumping from wells with a static water level below 15 ft. Turbines are often used for total dynamic heads exceeding 450 ft. Submersibles are available up to 10 inch in diameter and motor sizes up to 100 hp.

PUMP SELECTION

STEP 1

The first step in selecting a pump is to determine the flow rate and pressure requirements of the irrigation system. The pump selected should provide the operating requirements of the irrigation system at or close to its best efficiency point (BEP). The BEP of a centrifugal pump can vary from 45 – 80%, but consideration should be given to selecting pumps that have BEPs of 65% or better.

A centrifugal pump should not be operated at less than 80% of its BEP; therefore, a pump with a BEP of 80% should not be operated at an efficiency of less than 65%.

STEP 2

The second step is to check the suction capabilities of the pump. For efficient pump operation, the calculated Total Dynamic Suction Lift (TDSL) must be less than the allowable TDSL shown on the pump performance curves ***Note:*** *Manufacturers' pump curves usually provide data for pumps operating at sea level with a water temperature of 70°F. The* B.C Sprinkler Irrigation Manual *has a table that can be used to correct the TDSL ability of a pump operating at higher elevations or water temperatures.*

$$TDSL = H_e + H_l + H_v$$

where

H_e = vertical suction lift [ft]
H_l = friction loss in suction system [ft]
H_v = velocity head [ft]

Pump capacity and efficiency are reduced by excessively high suction lifts, or long but small diameter suction lines which increase friction loss in the suction system.

EXAMPLE

An example of a pump curve is shown in Figure 1. The B.E.P. of the pump occurs at 480 US gpm and 150 ft of head. If we wish the pump to operate at this condition, the following information can be extracted from the pump curves:

Maximum Efficiency = 79.3%
Impellor Size = 6.5" full diameter
Motor = 25 hp
Total Dynamic Suction Lift is approximately 21 ft.
Net Positive Suction Head is approximately 12 ft.

In this case, the total dynamic suction lift (TDSL) should not exceed 21 ft if the pump is to operate effectively. ***Note:*** *The TDSL will drop to approximately 17 ft if the pump is to produce 660 US gpm, even though the efficiency is 70%.*

Refer to the B.C Sprinkler Irrigation Manual for additional information on calculating the suction requirements and total dynamic head.

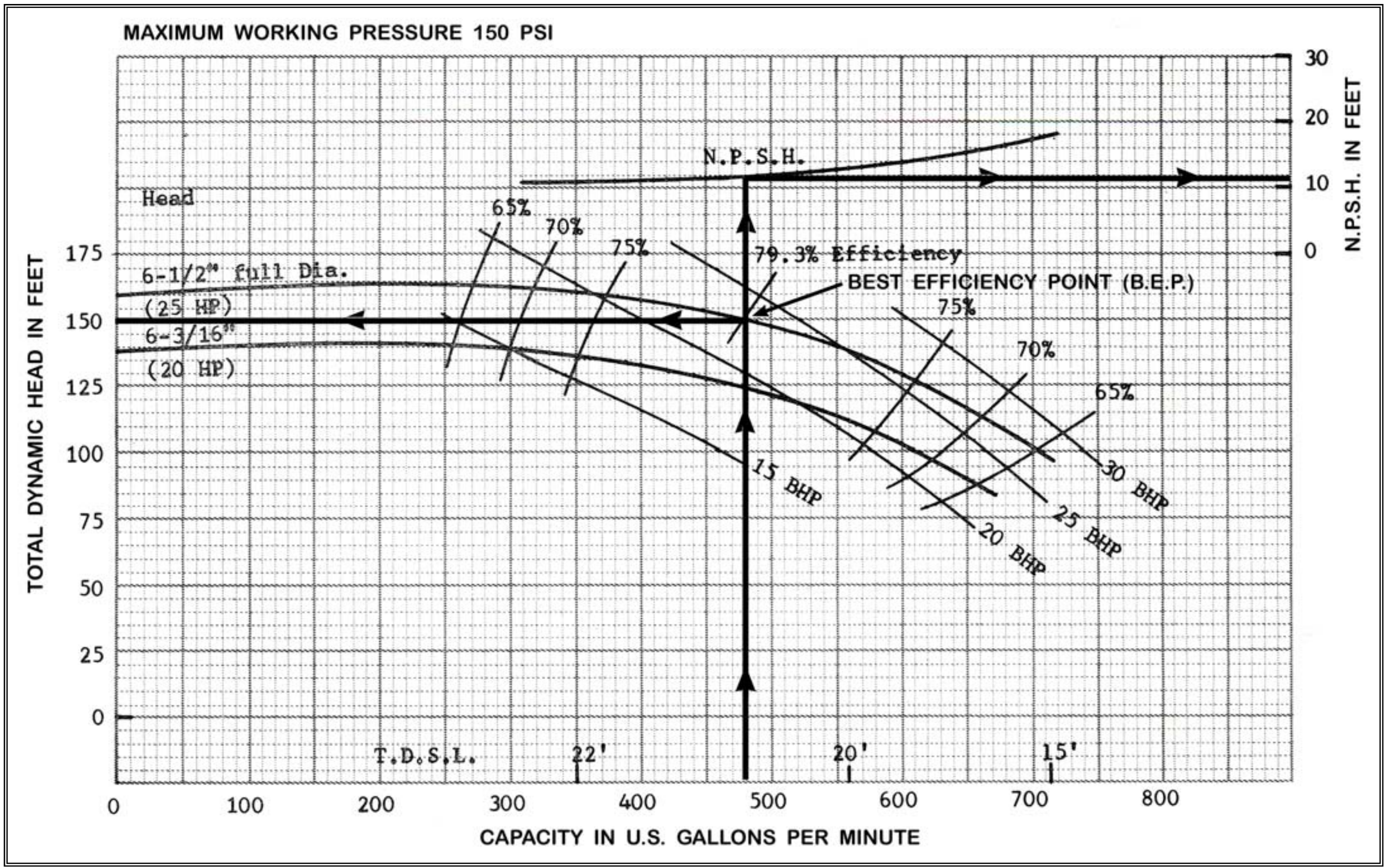

Figure 1 Pump Performance Curve

PUMP INSTALLATION

UNIT LOCATION

The pump unit should be located as close to the water surface as possible to minimize vertical suction lifts and to allow for the use of a short, direct suction pipe with a minimum number of fittings. Suction lifts exceeding 15 ft should be avoided whenever possible.

1. The suction and discharge pipes should be naturally aligned with the pump and independently supported to prevent strain on the pump case.
2. A totally enclosed fan cooled motor should be used in severe weather situations where other shelters are not practical.
3. The pump unit must be properly anchored to prevent movement during operation.
4. The motor feet should be elevated 3 to 4 inches and adequate drainage should be provided to prevent water from accumulating under the motor air intake openings.

SUCTION PIPING

See Figure 2.

1. The friction loss in the suction system must be controlled within acceptable limits. The minimum suction pipe size to be used can be determined by comparing the allowable TDSL by the pump (from the pump curves) with the calculated TDSL of the suction system.

Two other criteria that can be used to determine an acceptable suction pipe size are:

2. The flow velocity in the suction system should be less than 10 ft/sec.
3. The pipe size should be at least one or two sizes larger than the suction nozzle on the pump.

The following points should be considered to prevent air from entering or becoming entrapped in the suction system:

4. The entire suction piping system should incline slightly upward towards the pump. A suggested minimum slope is ¼” per foot.
5. All flanged joints should be fitted with a gasket and be air-tight.
6. The suction pipe inlet should be submerged at least four pipe diameters and be at least one pipe diameter off the bottom. In situations where there is not enough submergence, an anti-vortex plate should be used to prevent air from being drawn into the suction system.
7. An eccentric reducer must be used as a transition between the suction line and the pump inlet nozzle. The eccentric reducer should be attached directly to the pump nozzle whenever possible.
8. A control valve should never be installed on the suction piping if the pump is operating with a suction lift. (A valve on the discharge piping should be used for throttling the pump).
9. A straight piece of pipe at least 6 pipe diameters long should be used between the pump suction nozzle and the elbow. An elbow attached directly at the pump suction causes unequal thrust due to the liquid filling one side of the suction chamber and impellor eye more than the other.
10. A strainer should always be installed on the suction system of a centrifugal pump. The strainer must be capable of extracting objects that are too large to pass through the pump or irrigation system. The strainer must have an open area at least three times the area of the suction pipe.
11. When drawing water from a fish bearing stream or lake, the maximum flow velocity through the screen must be restricted to 0.1 ft/sec.

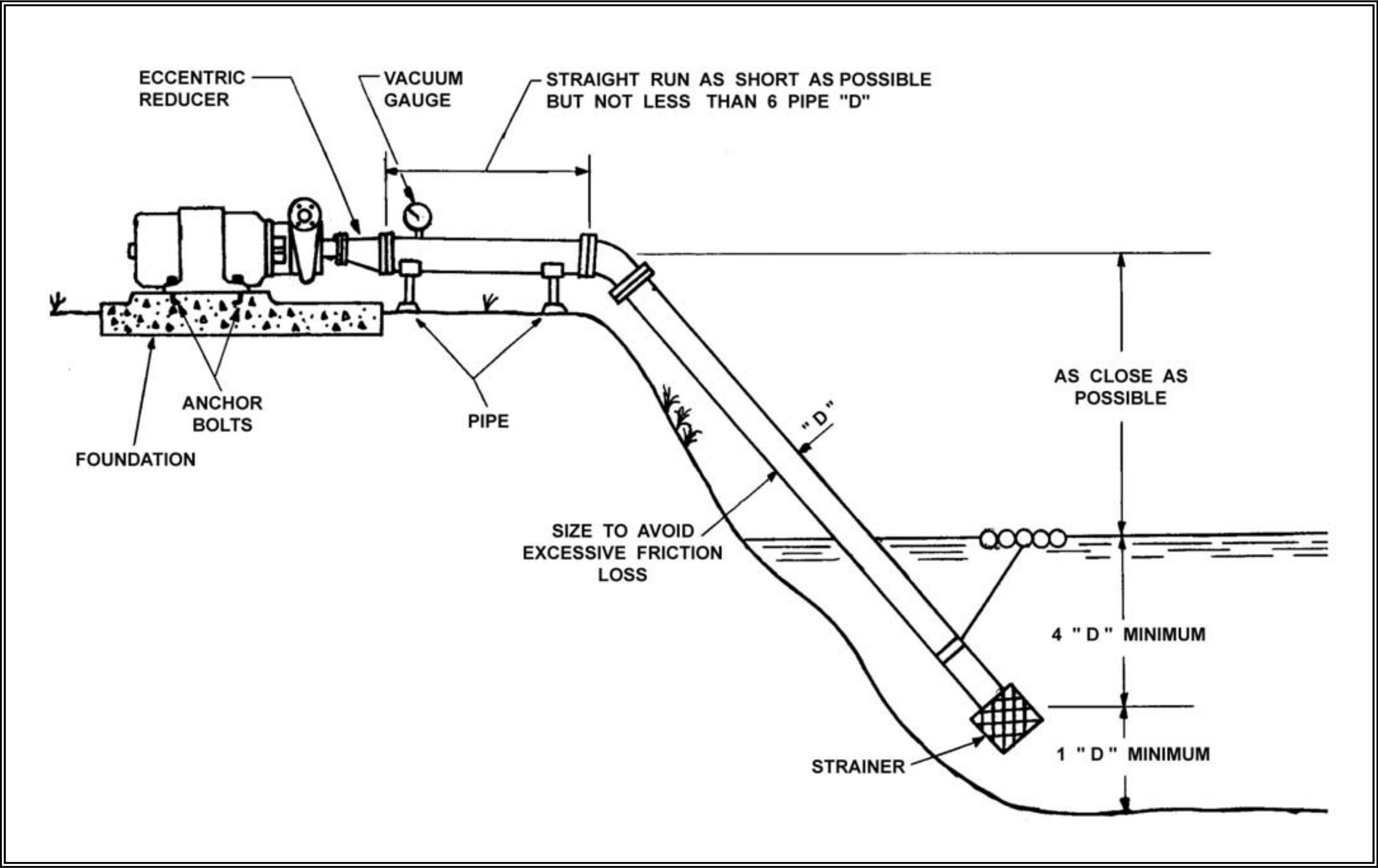

Figure 2 Suction Pipe Installation

DISCHARGE PIPING

See Figure 3.

1. The maximum flow velocity in the discharge line should not exceed 5 ft/sec. This will help limit any pressure surges that may occur due to sudden flow stoppages, i.e., pump shut down, valve closure, etc.
2. The discharge valve should either be a ball, globe or butterfly valve if it is to be used as a flow or pressure throttling device. A gate valve can only be used as a shut-off valve, i.e., either fully open or closed. ***Note:*** caution should be used in operating a globe, ball or butterfly valve to prevent serious pressure surges from occurring.
3. A non-slam or spring-loaded check valve should be used to prevent backflow through the pump during shut down. A spring loaded check valve is desired, as it will close before the build-up of a reverse velocity.
4. Tapered reducers or increasers should be used when changing from one pipe size to another. A concentric increaser is sufficient for the discharge piping system.

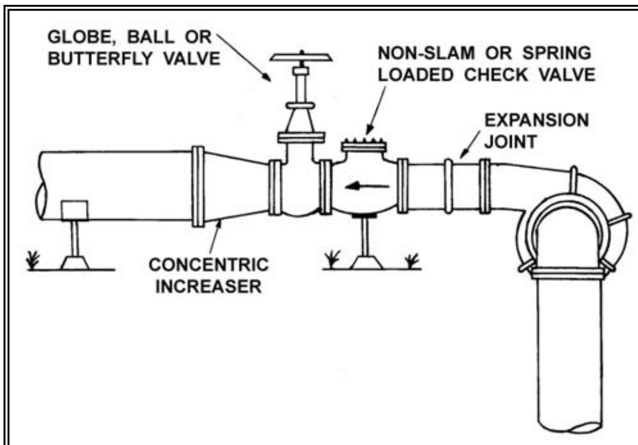

Figure 3 Discharge Pipe Installation

FOR FURTHER INFORMATION CONTACT
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