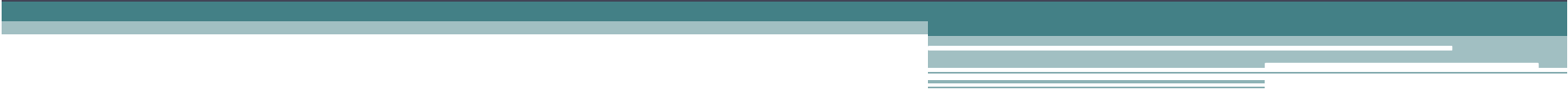


**Pump selection  
Installation and trouble  
shooting**



# **Criteria and Procedure for selecting a pump**

**The pump selection depends on:**

- 1.The requirement of irrigation water by the crops to be irrigated.**
- 2.Yield of the source of water (open well, stream, river, ponds etc)**
- 3.The availability and cost of the type of pump and kind of energy.**

## How to calculate the discharge of the pump?

$$q = 27.78 \frac{A y}{R T}$$

Where,

**Q=Rate of discharge of pump, lit/sec**

**A=Area of the land under the crop, hectare**

**y=Depth of irrigation, cm**

**R=Rotation periods, days**

**T=Duration of pumping, hours/day**

# Water Horse Power

It is the theoretical horse power required for pumping. It is the head and capacity of the pump expressed in terms of horse power

$$\begin{aligned} \text{WHP} &= \frac{\text{Discharge in lit/sec} \times \text{Total head, meter}}{75} \\ &= \frac{\text{Discharge /sec} \times \text{Total head, meter}}{273} \end{aligned}$$

**Shaft Horse Power is the power required at pump shaft**

- **SHP=** 
$$\frac{\text{WHP}}{\text{Pump efficiency}}$$

**Break Horse Power is the power required at break**

$$\text{BHP} = \frac{\text{WHP}}{\text{Pump efficiency} \times \text{Drive efficiency}}$$

# INSTALLATION OF PUMPS

## ❖ 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.




# UNIT LOCATION

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

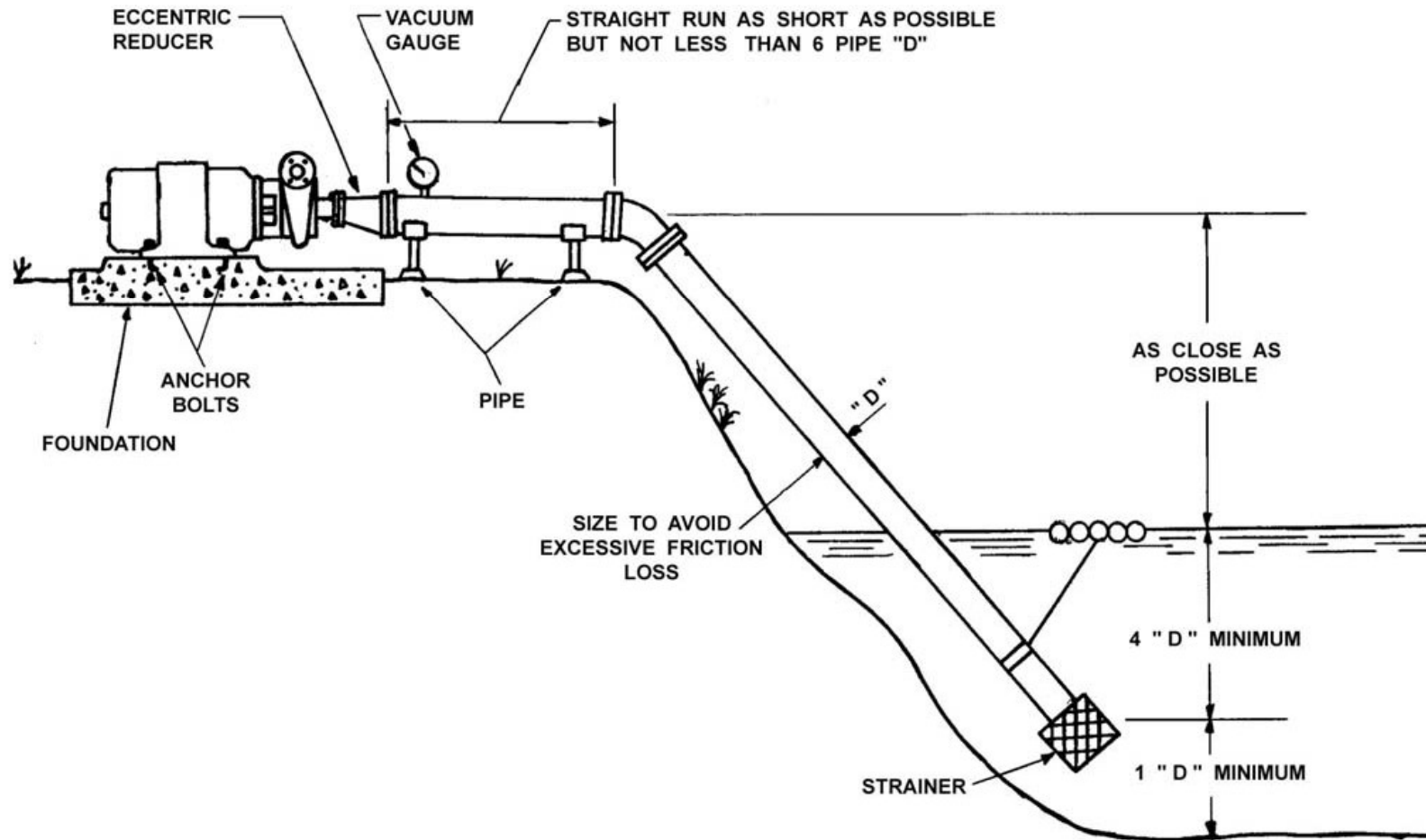
- ❖ The function of suction piping is to supply an evenly distributed flow of liquid to the pump suction, with sufficient pressure to the pump to avoid cavitation and related damage in the impeller.
- ❖ An uneven flow distribution leads to excessive entrained air.
- ❖ **Cavitation** is the formation of bubbles or cavities in liquid, developed in areas of relatively low pressure around an impeller, and it leads to significant damage to impeller and the pump housing.



❖ Three criteria that can be used to determine an acceptable suction pipe size are as follows:

1. The **flow velocity** in the suction system should be **less than 2.1m/sec**.
2. The pipe size should be at least one or two sizes larger than the suction nozzle on the pump.
3. In practice, the suction pipe should be large enough to minimize friction losses.


# Suction Pipe Installation





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

1. **The entire suction piping system should incline slightly upward towards the pump. A suggested minimum slope is 2%.**
  2. **All flanged joints should be fitted with a gasket and be airtight.**
  3. **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.**

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4. An **eccentric reducer** must be used as a **transition between the suction line and the pump inlet nozzle**.
  5. 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).
  6. 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.
  7. When **drawing water from a fish bearing stream or lake**, the maximum flow velocity through the screen must be restricted to 3cm/sec.


# DISCHARGE PIPING


1. The **maximum flow velocity in the discharge line should not exceed 1.5m/sec**. This will help to limit any pressure surges (change in fluid velocity) 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.



# **Pump troubleshooting— centrifugal pumps**

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- An efficient farming operation depends upon trouble-free pumping.
  - By keeping pumping equipment in good working order, savings in time and energy costs can be made.
  - Centrifugal type **irrigation pumps are very common and generally give reliable service.**
  - Investigations show that **most troubles with centrifugal pumps result from faulty conditions on the suction side.**


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- Except for mechanical trouble, nine times out of ten this is where to look for the cause.
  - Most pump troubles can be rectified on the farm by the farmer or manager.
  - However, at times, there will be problems or failures which you may not be able to fix.
  - If you cannot identify the problem within this fact sheet, you should consult your supplier or the pump manufacturer.

# 1. No water delivered

1. **Priming-casing and suction pipe not completely filled with liquid**
2. Speed too slow
3. Discharge head too high – **check lift and friction loss**
4. Suction lift too high or suction pipe too small or too long, causing excessive friction loss – **check with gauge**
5. Impeller or suction pipe or suction entry completely plugged
6. Wrong direction of rotation
7. Air pocket in suction line
8. Air leak in suction line.

# Not enough water delivered

- Priming-casing and suction pipe not completely filled with water
- Speed too low
- Discharge head higher than estimated – **check, particularly friction loss**
- Suction lift too high or suction pipe too small or too long, causing excessive friction loss – **check with gauge.**
- Impeller or suction pipe or opening partially plugged
- Wrong direction of rotation
- Air pocket in suction line, perhaps because of sharp vertical bend or concentric reducer in suction line

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- Stuffing box packing worn or water seal plugged, allowing leakage of air into pump casing
  - Air leak in suction line
  - Foot valve too small
  - Foot valve not immersed deep enough
  - Mechanical defects – wear rings worn, impeller damaged, casing packing defective.

# Not enough pressure

- Speed too low
- Air in water
- Impeller diameter too small
- Mechanical defects – wear rings worn, impeller damaged, casing packing defective
- Wrong direction of rotation
- Pressure measured at incorrect point – measure pressure at top of pump case.



# **Pump works for a while then quits**

1. Leakage in suction line
2. Stuffing box packing worn or water seal plugged, allowing leakage of air into pump casing
3. Air pocket in suction line
4. Not enough suction head for hot water or volatile liquids – check carefully as this is a frequent cause of trouble with hot water, etc
5. Air or gases in liquid
6. Suction lift too high.



# Pump takes too much power

1. Speed too high
- 2 .Head lower than rating, pumps too much water
- 3 .Mechanical defects – shaft bent, rotating element binds, pump and driving unit misaligned
- 4 .Wrong direction of rotation.



## **Pump leaks excessively at the stuffing box**

- 1 Packing worn or not properly lubricated
- 2 Packing incorrectly installed or not properly run in
- 3 Packing type incorrect for liquid handled
- 4 Shaft scoured.



# **Pump is too noisy**

- 1 Hydraulic noise (cavitation) – suction lift too high –check with gauge
- 2 Mechanical defects – shaft bent; rotating parts bind, are loose or broken; bearings worn out; pump and driving unit misaligned



**Thank  
you**