Lesson Objective

Become familiar with the most common types of pumps, how the different types of pumps operate, and how the different types of pumps are used

Learn the different types of pump drivers used

Learn how to determine where pumps are located within a process unit
Pumps are a device which moves a liquid by means of suction or pressure from one location to another.
There are three basic types of pumps

Centrifugal
Rotary
Reciprocating
A centrifugal pump uses centrifugal force to develop pressure to move a commodity. The commodity is first drawn into the suction nozzle of the pump and into a high speed impeller located in the pump’s casing. The impeller slings the commodity outwards against the casing and the commodity exits the pump under greater pressure through the discharge nozzle.

Centrifugal pumps are the most commonly used type of pump. This type of pump is normally more economical and has a low initial cost.

The centrifugal pump is characterized by its smooth flow.
Centrifugal Pumps

Typical Horizontal Centrifugal Pump

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project execution services
Centrifugal Pumps

Typical In-line Vertical Pump

FLUOR®
Centrifugal Pumps

Vertical Sump Pump
A rotary pump uses gears and screws to develop positive pressure to move a commodity viscous in nature such as grease, asphalt, and heavy fuel oils. The commodity is first drawn into the suction nozzle of the pump using a set of gears or screws located in the pump’s casing. As the set of gears or screws rotate the commodity fills the space between the gear teeth or screws on the suction side. As the gears or screws rotate the commodity is pushed out the pump’s discharge nozzle much like a nut on a bolt.

The rotary pump is characterized by its smooth flow and is considered to be a positive displacement pump. Positive displacement means that a set volume of liquid is discharged for each complete rotation of the shaft.
Rotary Pumps
Screw Pumps

SUCTION

DISCHARGE

FLUOR.
The reciprocating pump is characterized by its pulsating flow and is considered to be a positive displacement pump. Positive displacement means that a set volume of liquid is discharged for each complete rotation of the shaft. Reciprocating pumps are normally used to inject small amounts of additives in high pressure systems.

A reciprocating pump uses a plunger or piston within a chamber to develop positive pressure to move a commodity from one location to another. The commodity is first drawn into the suction nozzle of the pump when the plunger or piston is drawn back within the suction chamber. As the commodity fills the suction chamber a baffle opens in the discharge chamber and. As the plunger or piston is pushed forward in the suction chamber the commodity fills the discharge chamber through the baffle. As the suction chamber is re-filled by the suction cycle being repeated the commodity is pushed out the pump’s discharge nozzle by the plunger or piston in the discharge chamber.
Reciprocating Piston Type Pump
Reciprocating Pumps

Plunger Type Pump
There are two different types of pump drivers:

- Electric motor
- Steam Turbine
Electric Motors are commonly used.
Steam turbines are normally used for spare or back-up pumps in case of electrical failure.

Steam turbines can be used in an area which has the potential of becoming explosive in nature due to gas leaks.

Steam turbines are normally ran by surplus steam source which makes operation less costly.

Steam turbines have steam governors which can throttle or vary the speed of the driver.
Pumps & Nozzles Locations

To be our customer’s benchmark for dependability, expertise & safety

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This is a typical top suction – top discharge pump arrangement.
For the aboveground piping symbol all we show is a simple outline of the pump foundation along with the suction and discharge nozzles

Plan view:
Do not show any detail of the pump and/or driver on the piping plans
This is a typical end suction – top discharge pump arrangement
For the aboveground piping symbol all we show is a simple outline of the pump foundation along with the suction and discharge nozzles.

**Plan view:**
Do not show any detail of the pump and/or driver on the piping plans.
This is a typical side suction – side discharge pump arrangement
For the aboveground piping symbol all we show is a simple outline of the pump foundation along with the suction and discharge nozzles.

**Plan view:**
Do not show any detail of the pump and/or driver on the piping plans.
The pump should be located as close as possible to the source of suction to minimize pressure drop. This keeps line sizes and equipment elevations to a minimum.

Due to support availability, most pumps in process areas are located under the pipe way.

Vertical or horizontal vessels must be elevated high enough to allow pump suction lines to drop from the equipment to the pump without pockets or blocking passageways.
To identify pumps on plan drawings call out:
Centerline coordinate of pump
Centerline coordinate of discharge nozzle
Pump tag number
Nozzle Charts
Tabulates all the required piping and utility connections
Give sizes and rating of the connection.
Locate the connections by centerline or face elevation and coordinates

<table>
<thead>
<tr>
<th>NUMBER OR DESCRIPTION</th>
<th>SIZE AND RATING</th>
<th>FACE ELEVATION (OR AS NOTED)</th>
<th>CENTERLINE (OR AS NOTED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUC&quot; 5 1/2&quot;</td>
<td>104'-10&quot;</td>
<td>1556'-5&quot;</td>
<td>FACE 3412'-10&quot;</td>
</tr>
<tr>
<td>DISCH &quot;6&quot;</td>
<td>104'-10&quot;</td>
<td>1556'-9&quot;</td>
<td>3402'-0&quot;</td>
</tr>
<tr>
<td>STM INLET 3&quot;</td>
<td>104'-10&quot;</td>
<td>1556'-10&quot;</td>
<td>3412'-10&quot;</td>
</tr>
<tr>
<td>STM Exhaust 4&quot;</td>
<td>103'-10&quot;</td>
<td>1556'-10&quot;</td>
<td>3328'-6&quot;</td>
</tr>
</tbody>
</table>
The Nozzle Chart is found on the Aboveground Piping Plan
Components of a Typical Pump Suction And Discharge Piping System
Typical Piping Arrangement For Centrifugal Pumps

Top Suction - Top Discharge

Reference: Practice # 000.250.2350
Typical Piping Arrangement For Centrifugal Pumps

Side Suction - Side Discharge

Reference: Practice # 000.250.2350
Typical Piping Arrangement For Centrifugal Pumps

Vertical In-line

Reference: Practice # 000.250.2350

NOTE: PROVIDE FLEXIBILITY IN PIPING FOR PUMP REMOVAL.
Handwheel Orientation

Preferred Installation

Note: Alternate installation may be required, depending upon job criteria
Handwheel Orientation

Alternate Installation

Note: Alternate installation may be required depending upon job criteria
# Reduction At Pump Suction

<table>
<thead>
<tr>
<th>Situation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>One suction pump pipe</td>
<td>Reduction before the pump for one suction pipe.</td>
</tr>
<tr>
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</tr>
</tbody>
</table>

**Reference:** Practice # 000.250.2351
Strainers:

Typical Basket Strainer

Typical Temporary Tee-Type Strainer

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Perforated Basket Temporary Strainers

FOR 150 LB. - 300 LB. - 600 LB. FLAT FACE, RAISED FACE AND RING JOINT FLANGES
900 LB. - 1500 LB. - 2500 LB. AVAILABLE UPON SPECIAL REQUEST.

14 GA. PERFORATED SHEET BASKET
1/8" HOLES—33 HOLES PER SQ. INCH.

FOR STRainers 8" AND OVER
4-1/8" X 3/4"
STIFFENERS 8" TO 10"
6-3/10" X 3/4"
STIFFENERS 12" TO 19"
5-1/2" X 3/4"
STIFFENERS 18" TO 24"

R/F/F (Raised and/or
that Face Flanges)
for use with 150W,
300W, and 500W flanges.
Perforated Conical Temporary Strainers

FOR 150 LB. - 300 LB. FLAT FACE, RAISED FACE, AND RING JOINT FLANGES
900 LB. - 1500 LB. AVAILABLE UPON SPECIAL REQUEST.

IMPORTANT
Wire conical strainers available in mesh size and material to your specifications.

Series PC R/FF (Raised and/or Flange Flanges)
for use with 150#, 300#, and 600# flanges.

14 GA. PLATE
PERFORATED WITH 0.03" Holes
PER SQ. INCH
Flat Perforated Strainers

FOR 150 LB.-300 LB.-600 LB. FLAT FACE, RAISED FACE AND RING JOINT FLANGES
900 LB.-1500 LB.-2500 LB. AVAILABLE UPON SPECIAL REQUEST.

RAISED FACE
Series FP, F-RJ, and F-FF
for use with 150#, 300#, and 600# flanges.

REVOLUTIONARY
CONSTRUCTION
Flange deeply rebated into ring joint
gasket under pressure for tremendous
strength and prevention of deformation.
Smooth, accurate contours . . . no weld
"blush" around ring edge.

RAISED FACE FLANGES

RING JOINT FLGS.

SERIES FP
REBATED NOT LESS THAN 1/4" NOT WELDED

SERIES F-RJ

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SIDE Suction - SIDE Discharge Pumps
Front View
SIDE Suction - SIDE Discharge Pumps
Aerial View
END Suction - TOP Discharge Pumps
Piping Arrangement - Front View
Vertical And Side-top Pumps
Piping Arrangement - Side View
Horizontal Pump
End Suction - Top Discharge

REFERENCE: Shell Goal Venture – Geismar Plant
REFERENCE: Shell Goal Venture - Geismar Plant
References:
Practices #

000.250.2040  - Typical Unit Plot Arrangement
000.250.2350  - Typical arrangement for Centrifugal Pumps
000.250.2351  - Reduction at Pump Suction
000.250.2352  - Pump Piping (Steam) Turbines and Reciprocating Pumps
000.250.2353  - Miscellaneous Pump Piping
000.250.2360  - Strainers, Pump Suction, Conical
Questions??
Exercise PI-E11A