

**BASIC
TROUBLESHOOTING
FOR AC
3-PHASE MOTORS,
PUMPS, AND
CONTROLS**



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INTRODUCTION

AC motors and pumps are some of the most used pieces of equipment in the industrial, utility, and commercial industries. They are used to power small and large equipment alike. Ranging in sizes from fractional HP to well over 100,000 HP, these rotating machines drive some of the most critical equipment in their respective processes. When these machines fail, production stops.

Understanding how to troubleshoot and test these machines and their accessories is an important process in keeping the equipment up and running. Our goal with this training session is to try get an understanding how to properly trouble shoot and test the motor, pump, and control circuit.

Class Goals

Motors

- 1) Participants will be able to identify the components of an AC Motor. (Single Phase & Three Phase)
- 2) Participants will be able identify causes of motor failure.
- 3) Participants will be able to determine whether a motor failure is mechanical or electrical.
- 4) Participants will be able to test for mechanical failure.
- 5) Participants will be able to test for electrical failure.
- 6) Participants will be able to connect a motor correctly for a variety of connection types.

Pumps

- 1) Participants will be able to identify the components of a pump. (Submersible & Centrifugal)
- 2) Participants will be able to identify the causes of a pump failure.
- 3) Participants will be able to troubleshoot pump hydraulics.
- 4) Participants will be able to test for mechanical failure in pumps.
- 5) Participants will be able to test for electrical failure in pumps.
- 6) Participants will be able to correctly connect a pump.

Control Panels

- 1) Participants will be able to identify the components of a control panel.
- 2) Participants will be able to troubleshoot a control panel.
- 3) Participants will be able to test the components of a control panel.
- 4) Participants will be able to replace the components of a control panel.
- 5) Participants will be able to test circuits in a control panel.

Course Outline

Motor Components

Pump Components

Motor and Pump Troubleshooting

Break

Control Panel Components

Control Panel Overview

Q&A

Lunch

Motor Activity

Pump Activity

Break

Control Panels Activity

Dismiss

Plan for lesson covering Basic Troubleshooting of AC Motors & Controls

0-30 Min – Introductions/Backgrounds

30-35 Min – Overview and Goals

35-45 Min – Components of an AC Motor

45-55 Min – Safety

55-120 Min – Theory of Motor Troubleshooting

120-140 Min – Break

140-150 Min – Components of Pumps

150-175 Min – Theory of Pump Troubleshooting

175-185 Min – Components of Control Panels

185-205 Min – Theory of Control Troubleshooting

205-210 Min – Review Q&A

210-240 Min – Lunch

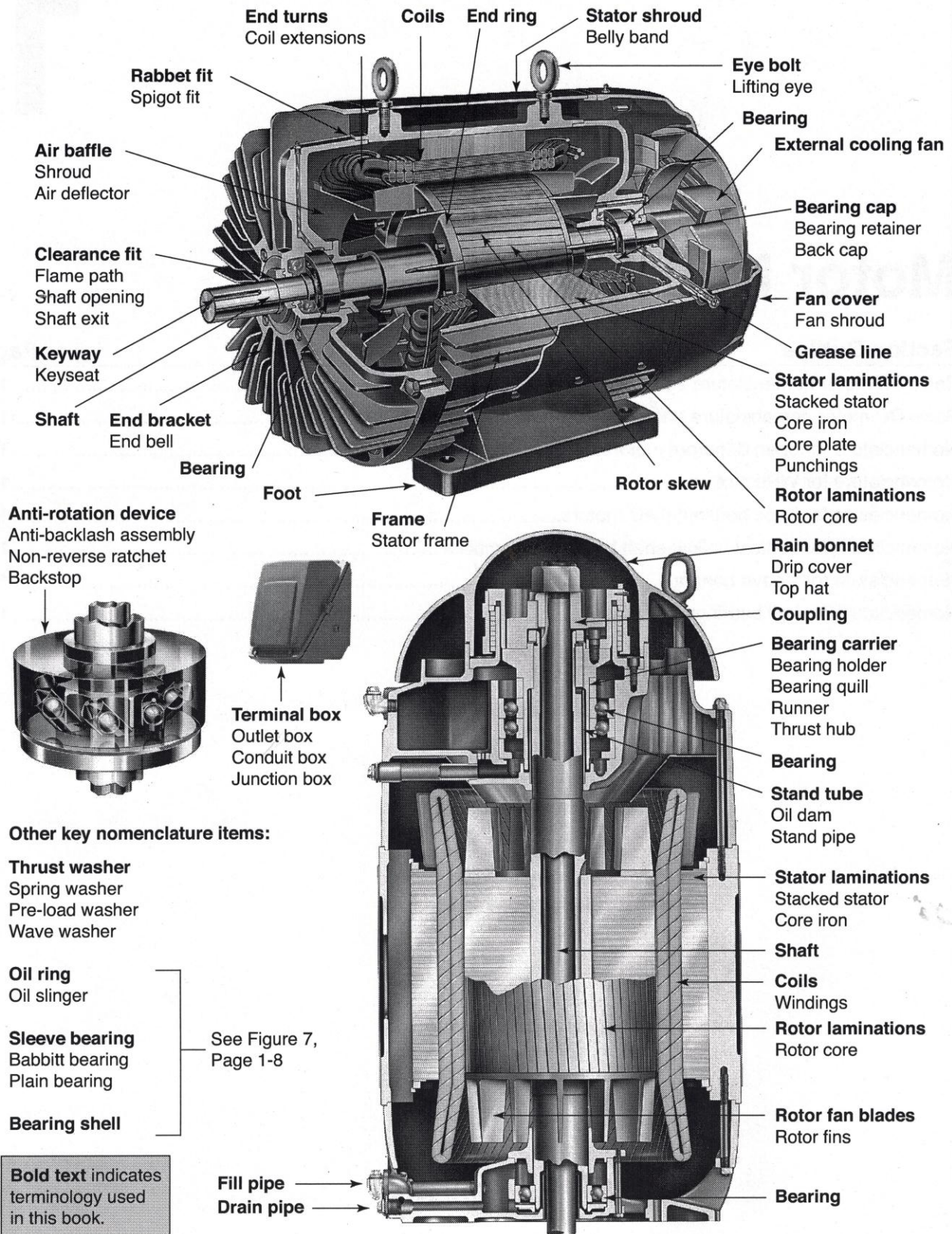
240-310 Min – Pump and Motor Activities

310-330 Min – Break

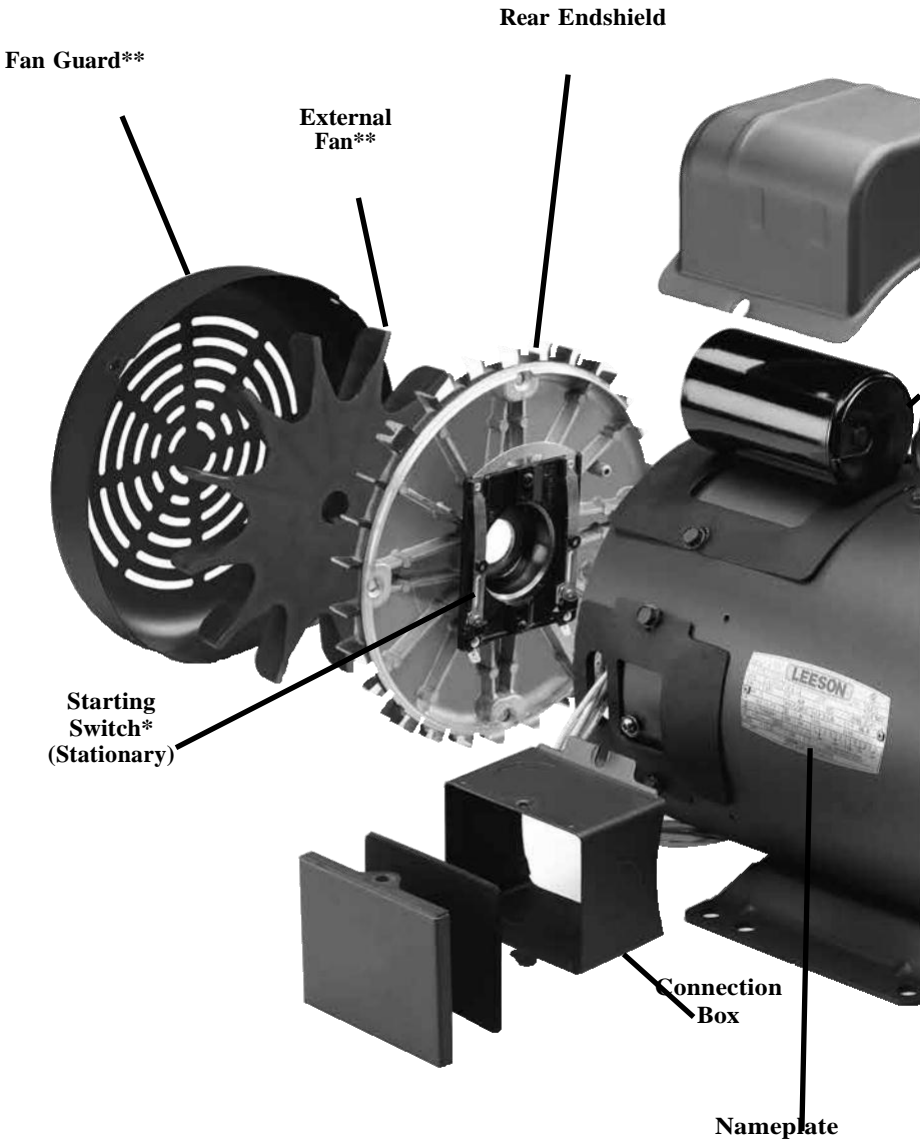
330-390 Min – Control Panel Troubleshooting Activity

390 Min – Dismissal

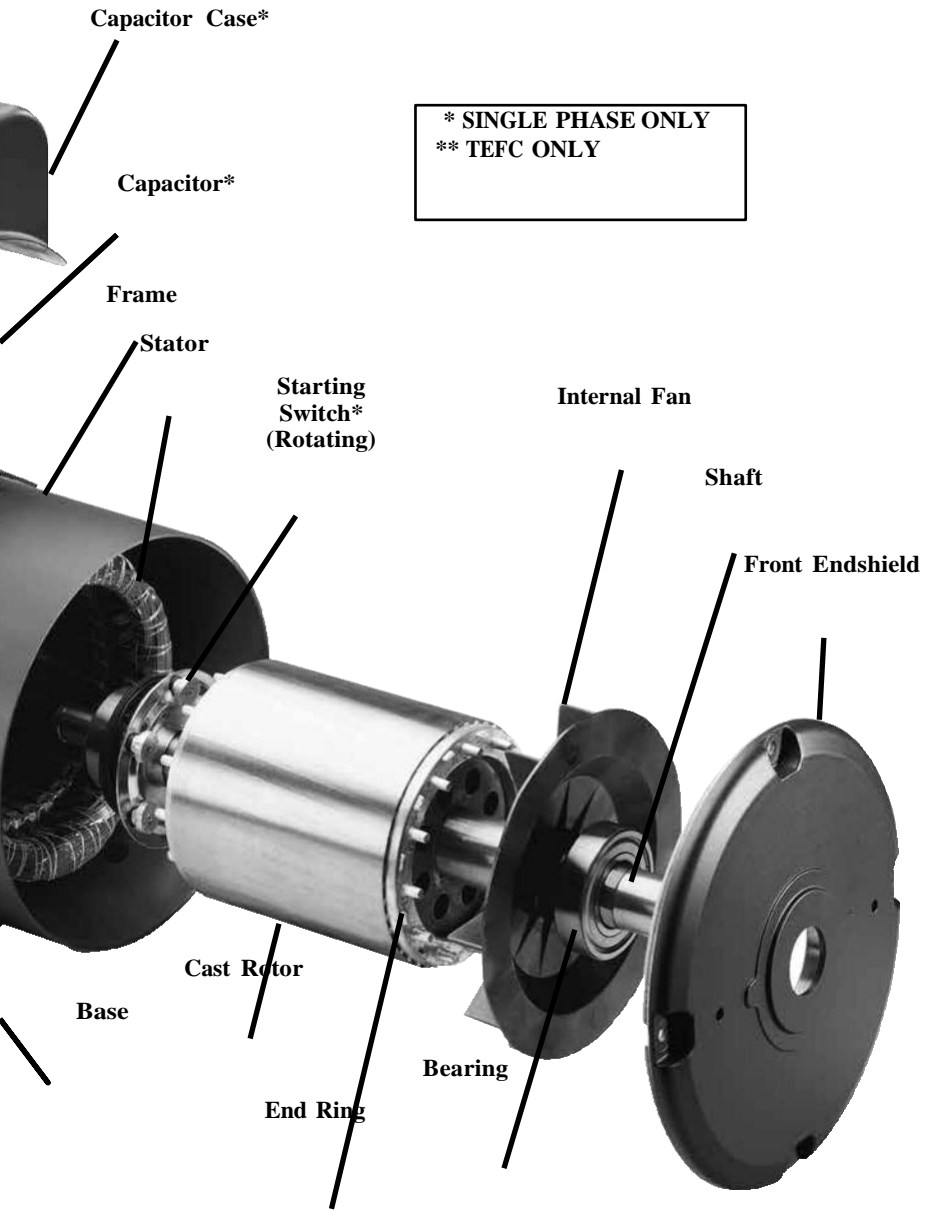
FIGURE 1: BASIC AC MOTOR NOMENCLATURE AND COMMON ALTERNATIVES



Major Components of

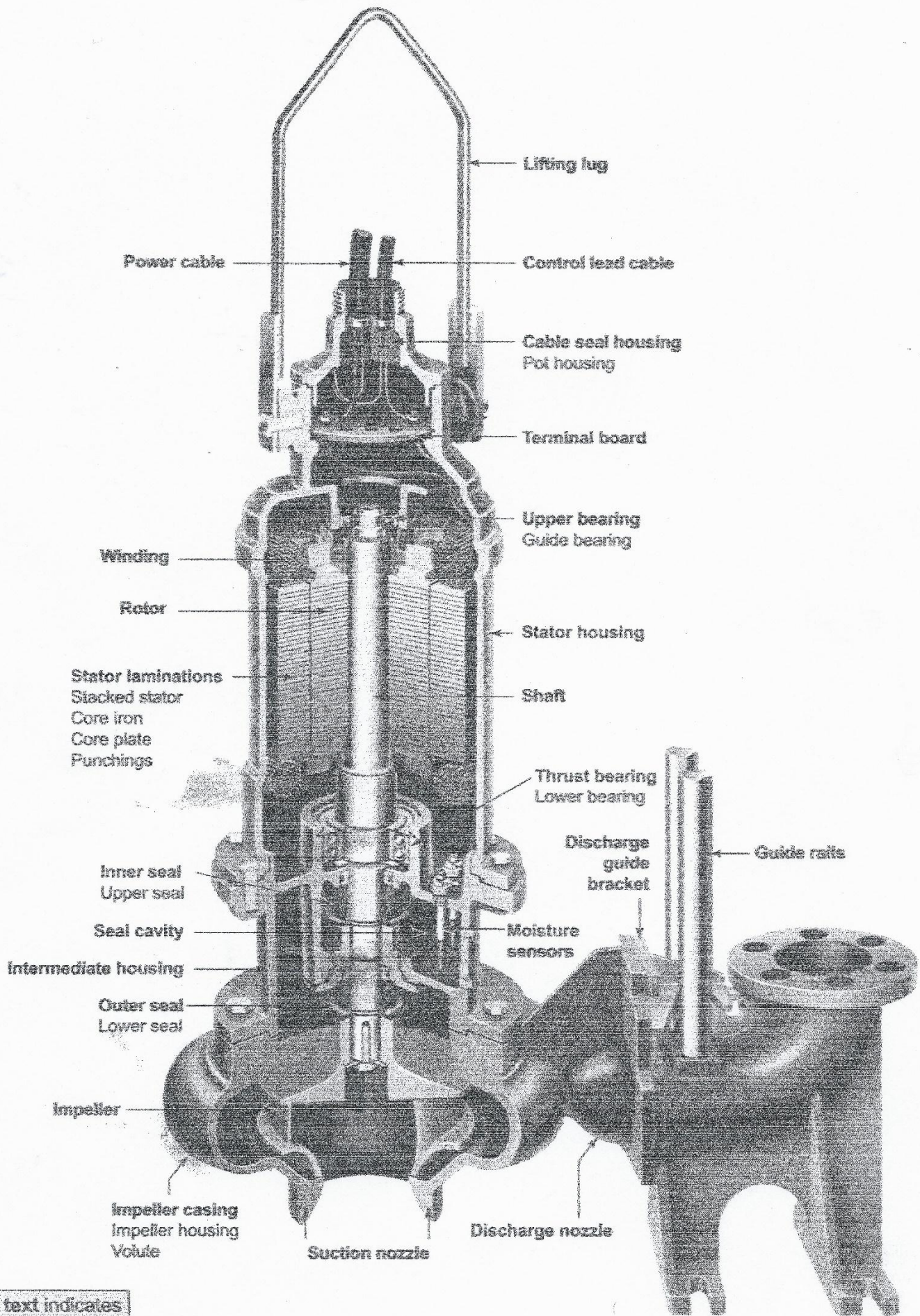


an Electric Motor



* SINGLE PHASE ONLY
** TEFC ONLY

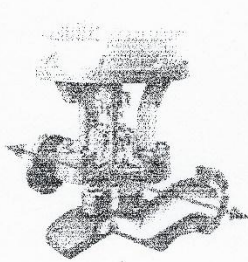
SUBMERSIBLE PUMP NOMENCLATURE



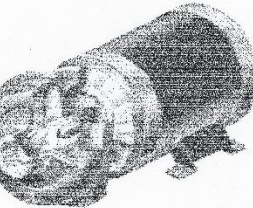
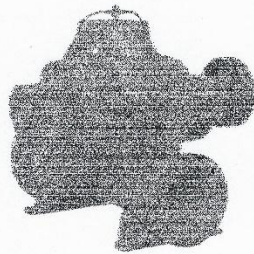
Solid text indicates terminology used in this book.

TYPES OF CENTRIFUGAL PUMPS

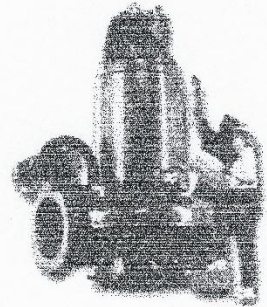
Centrifugal pumps create flow by induction, much like using a fan to move air. Centrifugal pumps belong to the larger family of pumps known as dynamic pumps. Dynamic pumps may be centrifugal flow, axial flow, or regenerative turbine type, with numerous variations of each.



Inline pumps



Close-coupled pump



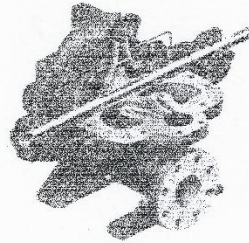
Submersible pump



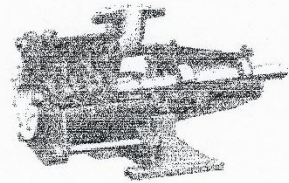
Vertical immersion sump pump



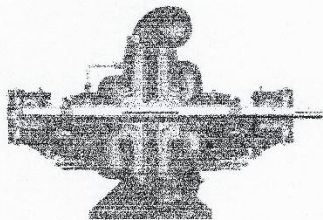
Vertical turbine double-casing pump



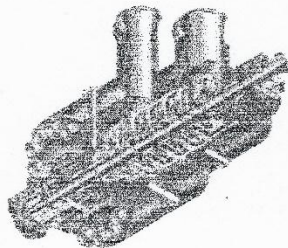
Center-hung, double-suction, split-case pump



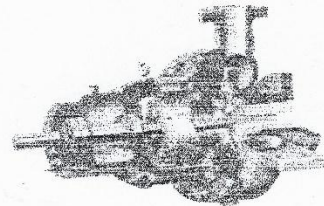
Multistage pump



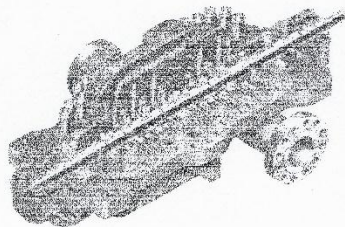
Axially split, two-stage pump



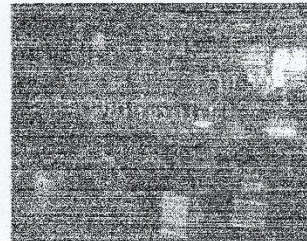
Radial split, multistage barrel pump



Centerline-mounted pump



Multistage, axial split-case pump



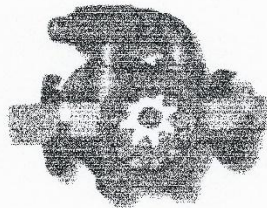
Split-suction pump

TYPES OF POSITIVE DISPLACEMENT PUMPS

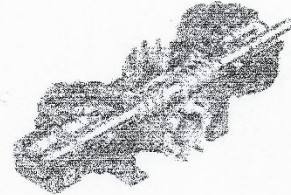
Positive displacement (PD) pumps create flow by force. A good example is a piston moving in a cylinder that forces the fluid out. PD pumps may be linear action, rotary action or variations of each.



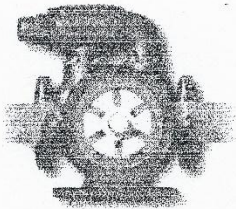
Peristaltic pump



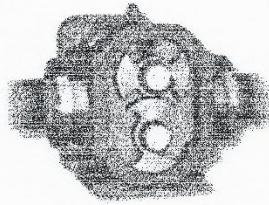
Gear pump



Screw pump



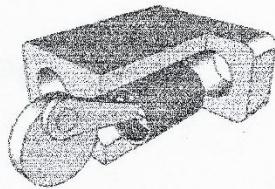
Vane pump



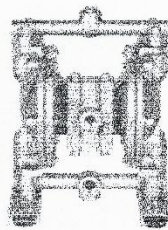
Rotary lobe pump



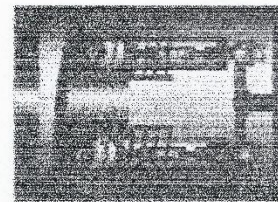
Progressive cavity (Moineau) pump



Piston pump



Diaphragm pump



Hydrostatic pump



Duplex Alternating Controller

Questions to be answered

Motor components

What components make up a motor?

What makes a motor work?

Motor terms

Pump Components

What components make up a pump?

What makes a pump work?

Pump Terms

Troubleshooting

Motors

Mechanical

Physical Condition

Bearings

Environment

Electrical (Applies to Pumps and Motors)

Physical condition of electrical components

Types of tests

Resistance (Ohms)

Voltage

Current (Amps)

Capacitors

Repair Shop Testing Overview

Typical Wiring Diagram

Accessory Component Tests (Thermals, Space Heaters, etc.)

Pumps

Mechanical

Physical condition

Clogged, Can you turn the impeller, etc.

Seals

Does the oil have water in it?

Impeller Condition

Worn?

Vent Holes

Discharge flange and gasket condition

Electrical

Physical condition of electrical components

Types of tests

Resistance (Ohms)

Voltage

Current (Amps)

Repair Shop Testing Overview

Typical Wiring Diagram

Accessory Component Tests (Thermals, Space Heaters, etc.)

Cords

Power Cords

Control Cords

Control Panel Components

Cabinet

Breaker

Starters/Contactors

Relays

Switches

Control Transformer

Fuses

Alarms

Wiring

Troubleshooting

Testing Components

Breaker

Starters/Contactors

Relays

Switches

Control Transformer

Fuses

Alarms

Wiring

LUNCH

Activity #1

Motors

Testing

Troubleshooting

Activity #2

Pumps

Testing

Troubleshooting

Activity #3

Control Panels

Testing

Troubleshooting

