

UNIT 3

Hydraulic Fundamentals - Hydraulic System Components

Objectives

Upon completion of this unit, the students will be able to:

1. State how basic hydraulic principles are used in the operation of hydraulic system components.
2. State the function of hydraulic tanks, fluids, pumps and motors, various valves and cylinders.
3. Identify the different hydraulic tanks, pumps and motors, fluids, valves and cylinders.
4. Identify the ISO symbol for the hydraulic tank, the pump and/or motor, the various valves and the cylinders.

Introduction

Mobile construction machines are designed using various hydraulic components (tanks, fluids, pumps and motors, valves and cylinders). Some components when used in different parts of the circuit perform different functions. Although these components may look alike, they may be given different names. The ability to identify the component, state the component's function and describe the component's operation will allow the serviceman to reduce complex circuits to several simple circuits that may be more easily understood.

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Lesson 1: Hydraulic Tank

Basic Hydraulic Systems

- **Hydraulic Tank**
- Hydraulic Fluids
- Hydraulic Pumps and Motors
- Pressure Control Valves
- Directional Control Valves
- Flow Control Valves
- Cylinders

Introduction

When construction machines and equipment are in the design stage, considerable thought is given to the type, size and location of the hydraulic oil tank. Once the machine or equipment is in operation, the hydraulic tank functions as a storage place for the hydraulic oil, a device to remove heat from the oil and a separator to remove air from the oil. This unit will discuss some of the characteristics of the hydraulic tank.

Objectives

Upon completion of this lesson, the student will be able to:

1. Identify the common components of the hydraulic tank and state the component function.
2. State the characteristics of the vented and the pressurized hydraulic tank.

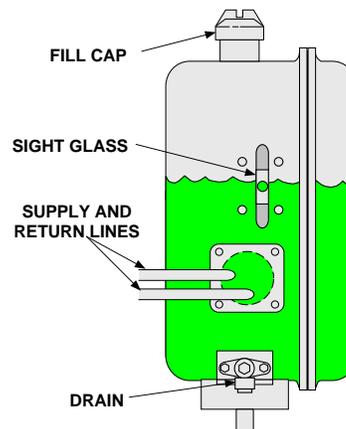


Fig. 3.1.1 Hydraulic Tank

Hydraulic Tank

The main function of the hydraulic oil tank is to store oil. The tank also removes heat and air from the oil.

Tanks must have sufficient strength, adequate capacity and keep dirt out. Hydraulic tanks are usually but not always sealed.

Tank components seen in Figure 3.1.1 are:

Fill Cap - Keeps contaminants out of the opening that's used to fill and add oil to the tank and seals pressurized tanks.

Sight Glass - Used to check the oil level. The oil level should be checked when the oil is cold. The oil level is usually correct when the oil is in the middle of the sight glass.

Supply and Return Lines - The supply line allows oil to flow from the tank to the system. The return line allows oil to flow from the system to the tank.

Drain - Located at the lowest point in the tank, the drain is used to remove old oil from the tank. The drain also allows for the removal of water and sediment from the oil.

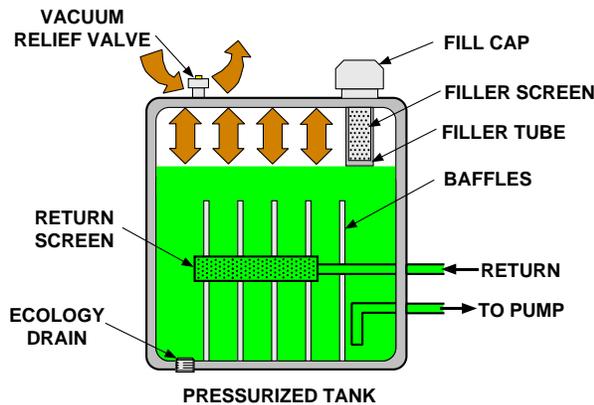


Fig. 3.1.2 Pressurized Tank

Pressurized Tank

The two main types of hydraulic tanks are pressurized and vented (unpressurized).

The pressurized tank is completely sealed. Atmospheric pressure does not effect the pressure in the tank. However, when the oil is sent through the system, it absorbs heat and expands. The expanding oil compresses the air in the tank. The compressed air forces the oil out of the tank and into the system.

The vacuum relief valve serves two purposes. It prevents a vacuum and limits the maximum pressure in the tank.

The vacuum relief valve prevents a vacuum by opening and allowing air to enter the tank when the tank pressure drops to 3.45 kPa (.5 psi).

When pressure in the tank reaches the vacuum relief valve pressure setting, the valve opens and vents compressed air to the atmosphere. The vacuum relief valve pressure setting may vary from 70 kPa (10 psi) to 207 kPa (30 psi).

Other tank components are:

Filler screen - keeps large contaminants from entering the tank when the fill cap is removed.

Filler tube - allows the tank to be filled to the correct level, but not over filled.

Baffles - prevents the return oil from flowing directly to the tank outlet, allowing time for bubbles in the return oil to rise to the top. Also, prevents the oil from sloshing which helps reduce forming of the oil.

Ecology Drain - used to prevent accidental spills when removing water and sediment from the tank.

Return screen - prevents larger particles from entering the tank, but does not provide fine filtering,

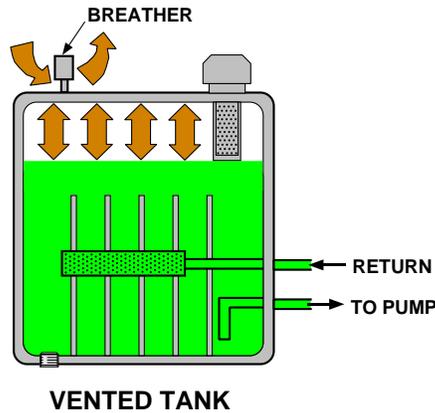


Fig. 3.1.3 Vented Tank

Vented Tank

The vented or un-pressurized tank differs from the pressurized tank in that the vented tank has a breather. The breather allows air to enter and exit freely. Atmospheric pressure on the top of the oil forces the oil out of the tank and into the system. The breather has a screen that prevents dirt from entering the tank.

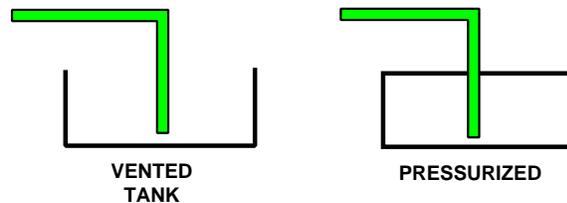


Fig. 3.1.4 Hydraulic Tank ISO Symbols

ISO Symbol

Figure 3.1.4 shows the ISO symbol for the vented and the pressurized hydraulic tanks.

The vented hydraulic tank symbol is merely an open-topped box or rectangle. The pressurized tank symbol is drawn as a completely closed box or rectangle. Tanks are shown with hydraulic lines to enhance understanding.

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