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Hydraulics: The Reservoir

This critical piece of the hydraulic system functions in many ways to prevent equipment failures.

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KEY CONCEPTS

- The reservoir can perform many important jobs in several ways depending on the hydraulic system.
- Most reservoirs have an internal baffle to help isolate the return line from the suction line.
- Hydraulic fluids may begin to oxidize and could fail due to excessive heat.

In previous articles, we have taken a look at a number of the components in a hydraulic system. Now we will take a look at the reservoir. According to the dictionary, a reservoir is "a natural or artificial pond or lake used for the storage and regulation of water." I don't think that will work, but the second meaning is a little better: "A receptacle or chamber for storing a fluid." But that doesn't begin to describe the many critical functions of the reservoir in a hydraulic system, as shown in Figure 1.

The little box on the left in the system diagram is the reservoir. It has a number of important jobs to perform: reduce or eliminate contamination, cool the fluid, manage foam, eliminate the possibility for pump cavitation and maintain fluid level. *(Note: Cavitation is the sudden formation and collapse of low-pressure bubbles in liquids by means of mechanical forces such as those resulting from rotation of the hydraulic pump. Aside from inefficient pumping, this can also result in pitting of the pump surfaces).*

Generally, the No. 1 source of hydraulic system failure is due to some kind of contamination.

These important jobs are performed in a number of ways depending on the system. Whether in a large industrial system, a log splitter or a jet fighter, all hydraulic systems have to deal with these issues.

If you look a little closer, you can see that the reservoir (in this case a basic industrial reservoir as shown in Figure 2) has a number of key component parts that contribute to its effectiveness.

As you look over this basic design, let's review some of the things the reservoir must do for our system.

Proper reservoir design also helps to control system temperature. Hydraulic systems, when working hard, generate a lot of heat.

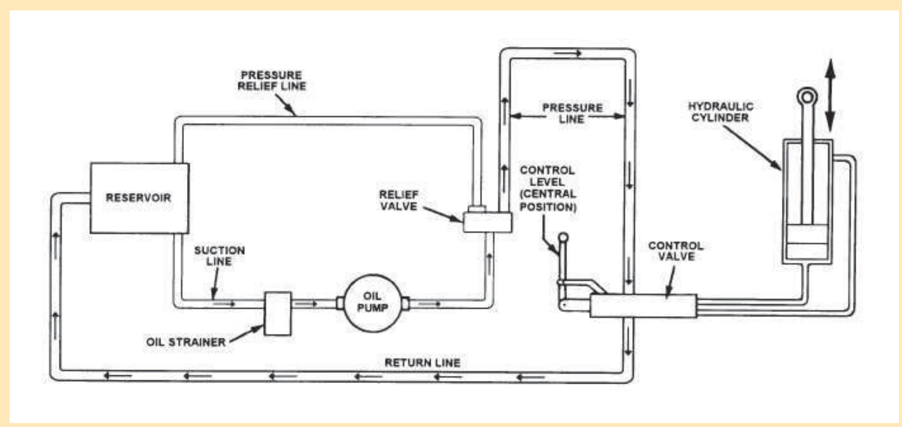

Figure 1 | **Diagram of the industrial hydraulic system.**

First, assuming that our new, incoming hydraulic fluid is clean of particulate contamination (not always a foregone conclusion), the reservoir should also have a filter on the fill line to insure that no contamination is introduced when filling the tank. Likewise, there is an air breather cap that allows for pressure relief as the fluid level rises or falls. This cap should be designed to eliminate introduction of particulate contamination and water ingestion (including condensation) from the air.

In other words, from a contamination perspective, we should have a sealed system. In fact, some systems are designed to be truly sealed with a pressurized reservoir. Regardless of the specific design, the goal is to eliminate all sources of outside contaminants.

Next, we should have means of reducing internally generated contaminants, usually wear debris. This is often a filter in the line from the reservoir on the suction side of the pump to insure that we protect the pump and any other downstream components. The suction line should be located and sized to eliminate the possibility for pump cavitation. Further, it should also be located in the reservoir where it is least likely to see contaminants, turbulence or hot fluid with entrained air (foam), all introduced by fluid from the return line. This usually means locating the suction line far from the return line, a few inches above the bottom and often with an inlet filter.

Most reservoirs have an internal baffle of some sort to help isolate the return line from the suction line. This baffle reduces turbulence from the return line, provides time for any particulates to settle and provides time for any entrained air (foam) to separate from the fluid.

Additionally, the baffle helps provide time for the fluid to cool. Proper reservoir design also helps to control system temperature. Hydraulic systems, when working hard, generate a lot of heat. If we don't control that heat, our hydraulic fluid may begin to oxidize, and other components, such as seals, may fail due to the excessive heat. In some cases, the reservoir is sized to give the fluid time to cool before being pumped back into the system. Other systems are fitted with heat exchangers to cool the fluid.

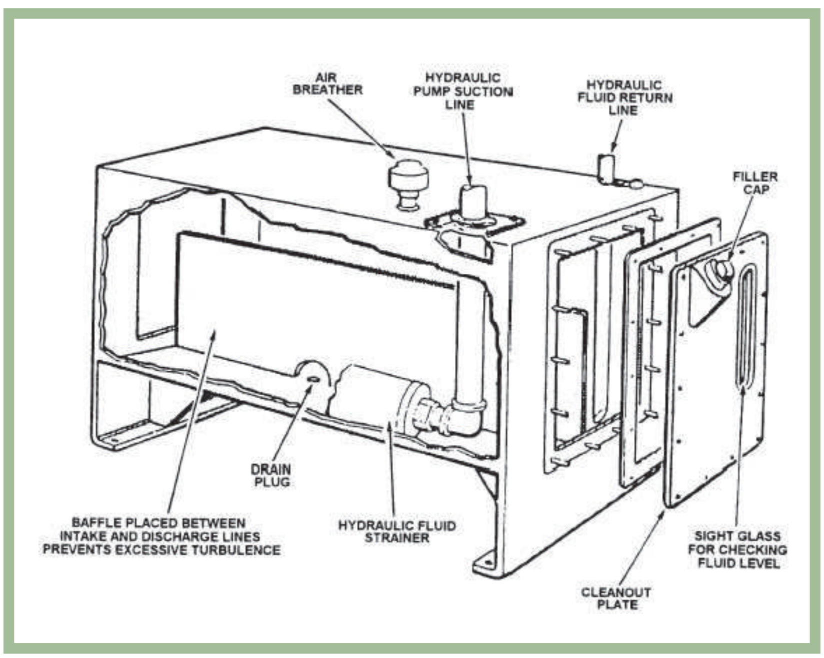

Figure 2 | **Diagram of a basic industrial reservoir.**

Like the dictionary definition, the reservoir stores fluid, so it must also be fitted with a level gauge. This can be as simple as a sight glass or, better, a float switch that can control the fluid level between specific levels. Further, it should have an alarm system should those limits be exceeded either by a system leak or overfilling.

Finally, the reservoir should be fitted with a drain and access port for cleaning and maintenance.

Generally, the No. 1 source of hydraulic system failure is some kind of contamination. Clearly, a properly designed, operated and maintained reservoir is a key component in control of contamination to the system. TLT

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