

PROBLEM SOLVING SERIES

HPS Troubleshooting Tactics: **Common Hydraulic Valve Issues**

Diagnosing and fixing valve issues may take a little bit of troubleshooting, and we're here to help.

Once a problem arises, it's always better to systematically solve it by looking at the most common problems first and avoid simply changing random parts, which can cost downtime, be disorganized, and result in a misdiagnosis.

What Are the Most Common Causes of Valve Failure?

The Fail-Safe Condition of an improperly functioning valve is important. Knowing what happens on the machine when a valve failure occurs may make the difference between somebody getting hurt or not. ISO standards such as 4413:2010 provide general rules and safety requirements for this.

Hydraulic Valve Failure Modes typically result in the actuator or pump not performing correctly.

A hydraulic valve typically has either a mechanical or electrical failure mode, and outlined below are examples of each.

Mechanical Failure Modes

- **Extended contamination:** The most common source of mechanical hydraulic valve failure is due to extended hydraulic fluid contamination, resulting in the hydraulic fluid and filters being replaced. Often times the pressure reducing valve will not reach the appropriate pressure or the directional control valve will not operate the actuator or motor properly.
- **Spool stiction:** The spool does not completely shift, and the actuator or motor does not fully actuate to the open or closed position. In the case of a directional control valve, the downstream motor or actuator does not operate properly.
- **Inadequate flow to the valve:** Often caused by issues with pump cavitation, plumbing restrictions, or the hydraulic tank fluid level not being full enough for the suction side of the pump.
- **Incorrect sizing:** Typically caused when the flow requirements are greater than the valve flow rating. An undersized valve will not operate an actuator or motor at the proper speed. An oversized valve will likely operate fine but could result in a larger pressure drop out of the A&B ports to the actuator or motor.
- **Sometimes a valve seal wears and causes a leak, reducing or stopping the performance of the valve.**

Electrical Failure Modes

- The most common electrical failure mode is caused by not meeting the minimum voltage requirement at the valve solenoid to always shift the valve. Check the voltage at your power supply and at the solenoid valve when shifting to fully know your voltage drop.
- The next most likely issue resides with intermittent performance due to poor electrical connector or wiring. Loose connections or worn terminations at electrical connectors may cause the valve solenoid to not always actuate.
- Improper voltage going to the solenoid. Solenoids are rated as either Alternating Current (AC) or Direct Current (DC). If the incorrect voltage type or rating is applied the solenoid will likely fail.

Root Cause Methodologies

In this article series, we move through the below steps to help diagnose low pressure, pump, valve, and motor problems, as well as how to troubleshoot common issues that can lead to a system failure.

1. Identify the specific problem
2. Gather information from schematics
3. Adjust and verify the diagnosis
4. Plan and schedule maintenance

There are many different types of hydraulic valves, and many ways in which each can malfunction.

Complexities for each valve do not make troubleshooting easy, so let's start by considering how each type of valve should be evaluated for common problems.

Identifying the Problem

Valves are complex and delicate. It's common for them to malfunction and even fail due to:

- Debris and worn parts
- High temperatures
- Improper installation and maintenance

Although there are dozens of varieties that all serve different purposes, we will focus on issues that may arise among hydraulic valves that fall within three major categories:

1. Pressure Control Valves: Pressure relief valves, pressure-reducing valves, and sequence valves
2. Directional Control Valves: Spool, rotary, and check valves
3. Flow Control Valves

Troubleshooting can continue here by information gathering and examining common causes of each valve's issues. Below, we have listed some causes that could have led to problems individual to Pressure Control, Directional Control, and Flow Control valves.

Valves	
Relief valve issues	Possible causes
Low or erratic pressure	Adjustment off, contamination, wear and tear, sticking, spring damage
Low or no pressure	Valve is loose, poppet is off, orifice or balance hole is plugged, spring is broken, debris holding valve open
Excessive noise or chatter	High oil viscosity, worn poppets, excessive line pressure return, pressure settings off
Excessive system pressure when adjusting	Broken or worn spring, improper spring, drain line restricted
System overheating	Relief setting is off, high viscosity, leaking valve seat
Pressure reducing valve issues	Possible causes
Erratic pressure	Oil contaminants, restricted orifices, valve spool binding, improper spring, worn poppet or seat

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Valves (Cont.)	
Sequence valve issues	Possible causes
Not functioning	Broken spring, contaminants in plunger seat or orifices, leaky or blown gasket, plugged drain line, worn plunger, oil impurities, overheating
Premature movement to secondary operation	Excessive or high inertia load on a primary cylinder, valve setting is low
Slow or no movement to secondary operation	Relief valve setting is too close to sequence valve setting, spool binding, valve setting is high

Directional Control Valves	
Common issues	Possible causes
Incomplete shifting	Centering spring defective, spool adjustment, worn or binding linkage, low pilot pressure
Actuating cylinder shifting	Spool is worn, shifted, or not centering; cylinder or valve seat leakage
Cylinder load dropped	Loose lines in valve housing, broken spring, leaking relief valves or O-rings, spool valve position is off

Flow Control Valves	
Common issues	Possible causes
Variations in flow	Spool binding, leaks in cylinder, oil is dirty or has a high viscosity, low pressure
Erratic pressure	Worn poppet or seat, oil is dirty
Slow flow	Piston travel or orifices restricted, leaky relief valves, oil too hot, valve piston is cocked

Adjusting and Verifying

After figuring out any valve issues and causes of those issues, it's time for action. Depending on what problem was identified, you may need to:

- Set the relief valve
- Install pressure gauges and adjust to the correct pressure
- Repair or replace damaged or worn parts
- Fix any functional issues
- Clean and replace hydraulic fluids

After making any adjustments, complete any essential checks and run the system. Monitor for pressure, temperature, and sound changes. If all seems to be running smoothly, do a final verification by checking the pressure sensor for potential failure.

Planning Ahead

With all systems a go, you may want to include the problem in a scheduled preventative maintenance program.

A preventive program may include:

- Investigation of fluid health and appropriate lubrication
- A strategy for adding critical filter locations to trap more particles
- A schedule for fluid and filter changes
- Filter change-out according to pressure differential, adding a pressure gauge or indicator
- Installation of electrical monitoring devices of filter differential pressure or analog transducers to log trends
- Automatic supply re-orders

Any preventive maintenance program should be clearly defined with well-documented maintenance activities, and the plan should be regularly reviewed and adjusted if necessary.



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