

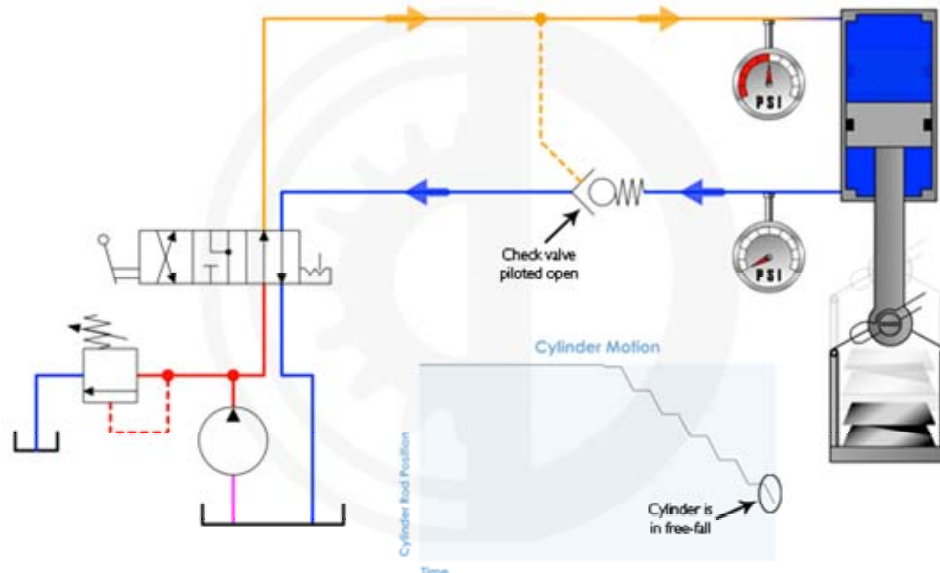
Newsletters That Teach.

Counterbalance Valves, Part II

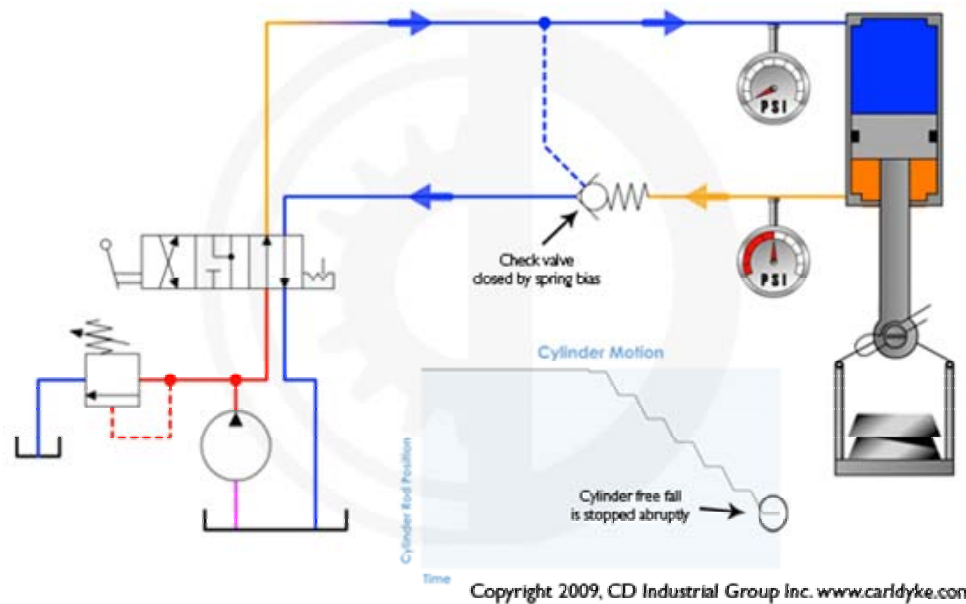
Jul 6, 2009
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Last time we looked at the basic function and purpose of a counterbalance valve. What we did not do is compare the motion control function of a counterbalance valve to that of a pilot operated check valve when used as a load lock.

What you will see is that a check valve based load lock is only useful for low flow applications. High flow cylinders with a pilot operated check valve will feature very uneven motions while in the lowering mode. The force of gravity will cause the rod of a heavily loaded cylinder to run ahead of the fluid supply. This will cause a drop in pressure on the inlet port of the cylinder to the point where the check valve can no longer be piloted open. At this point, fluid leaving the cylinder will force the check valve closed.

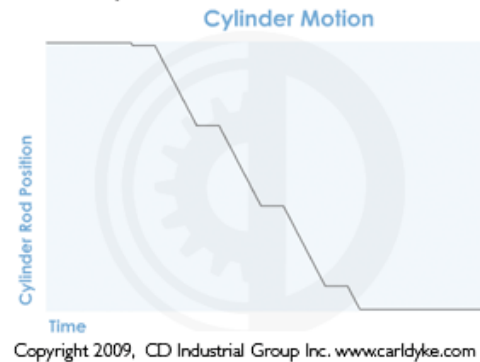


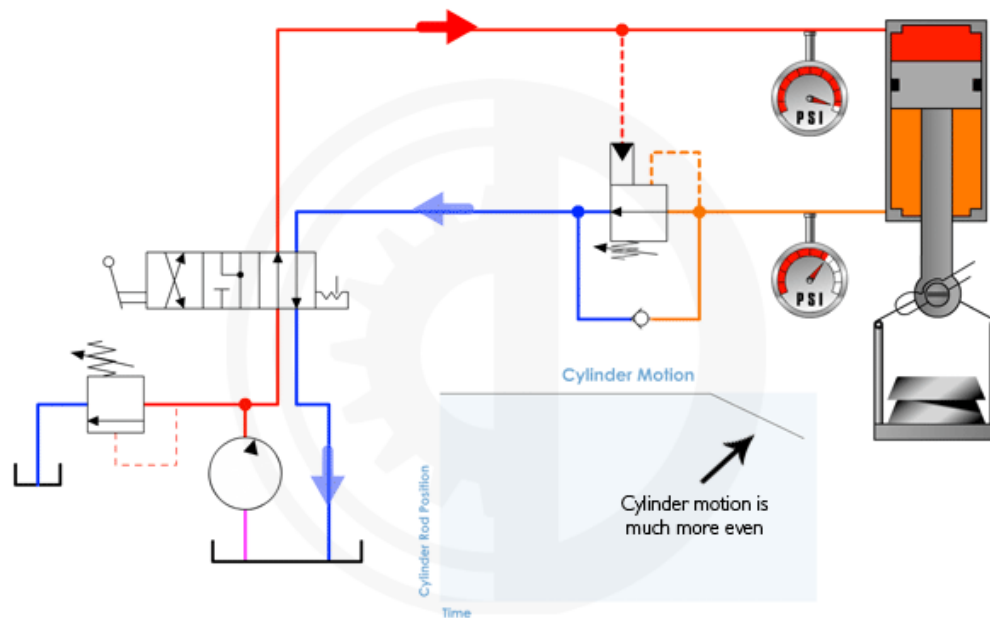
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What happens then? You guessed it. Motion stops and pressure builds quickly again on the cylinder's inlet port. This pressure also pilots the check valve to the fully open position and high flow occurs again along with a sudden lowering motion at the cylinder. A graph of the cylinder's position over time show that the motion was anything but even.

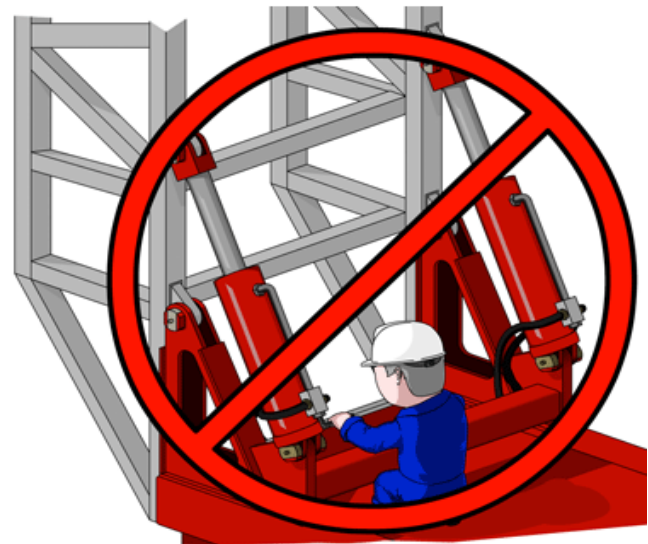
Compare the above flow behaviors with that of a counterbalance valve. The same low pressure starts to develop on the upper cylinder port as the rod is lowered. But with a spring loaded poppet that quickly becomes more resistant to flow as the pilot pressure drops, the flow from the lower cylinder port never fluctuates that much. The counterbalance makes much faster changes to the poppet opening as the pressure differential across the two cylinder ports fluctuates. The result is a much smoother motion, hence the valve's alternate name; the motion control valve.





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Typically counterbalance valves are set with a holding pressure that is approximately thirty percent higher than the static pressure of the heaviest normal load. This helps keep the raised load in place with a fully closed off counterbalance poppet. If there is a shock load to the rod in the direction of extension, or if pressure builds due to heat expansion of the fluid, the poppet in the counterbalance may crack for a brief moment.



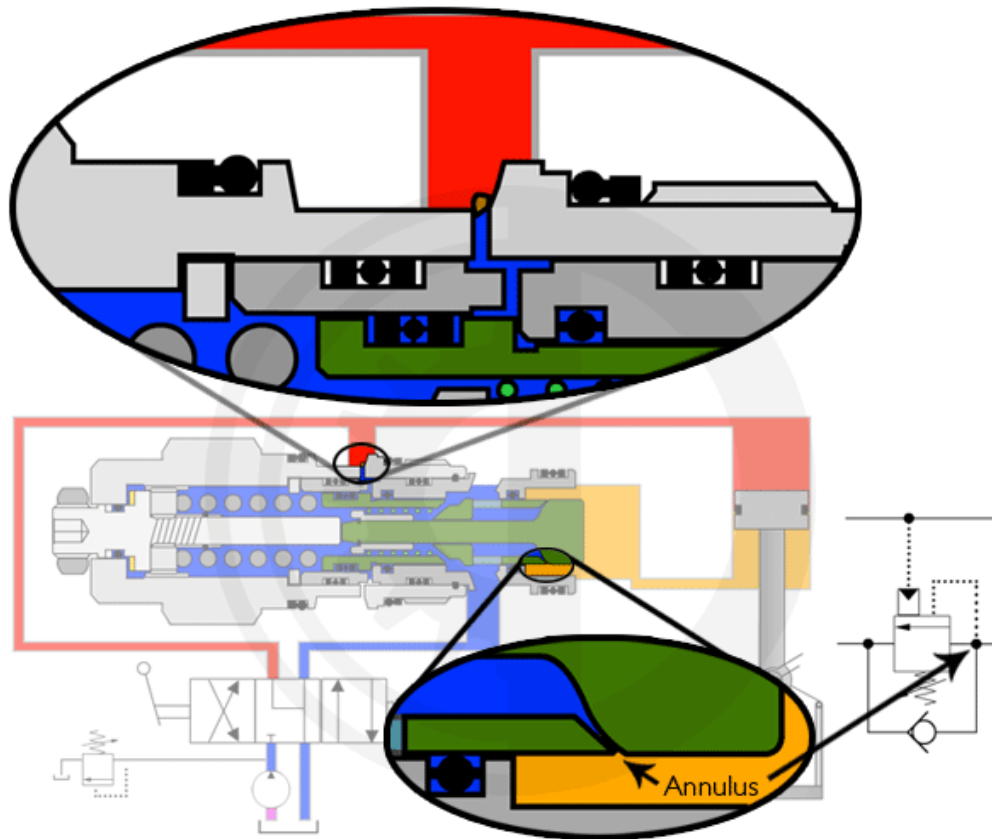
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Safety:

Do not attempt to adjust a counterbalance valve on a machine that is supporting a vertical load. If the load is creeping downward while you adjust the valve, you may cause a faster and potentially fatal drop. Some counterbalance valves are set to a lower holding pressure with a clockwise turn of the adjustment screw. To be safe, you must not adjust a counterbalance valve until the load has been lowered to a rest. It is best to have the counterbalance valve preset at a hydraulics shop.

Troubleshooting:

Can you imagine what happens when the tiny pilot port in the counterbalance valve becomes plugged with contaminants? In this condition the poppet is not cracked open by pilot pressure, but rather from a much higher pressure on the cylinder's lower port. The counterbalance will crack open with a relief function using a small annular surface at the poppet. But the valve's ability to modulate the poppet opening using the pressure differential across the cylinder ports is now gone. The resulting motion may not be smooth and system pressure may be higher along with unnecessary heat. The solution to many potential hydraulic problems of course is to apply rigorous contamination control.



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That's it for this time. A new interactive simulation has been loaded into the online training tools page.