# FLUID POWER Design Data Sheet

**Revised Sheet 44 - Womack Design Data File**

## APPLICATIONS FOR CAM-ACTUATED VALVES

A cam valve (or more properly, a cam-actuated valve) is a directional control valve, and is available for both air and hydraulic operation. For air service, 2-way, 3-way, and 4-way cam valves in sizes up to 1-inch are available. For hydraulics, most cam valves are 2-way, either normally open (N.O.) or normally closed (N.C.), but are not generally available larger than 1/4 or 3/8-inch size. However, as shown in these circuits, they can be used to pilot larger valves.

For applications like those described here, in which the action takes place at an exact position of the cylinder piston rod, a cam valve may be used in preference to a limit switch because, being mechanically actuated, it is more reliable and will repeat every cycle to a greater accuracy. Also, it is not dependent on the presence of an electrical power supply.

### Cylinder Deceleration

**Figure 1. Small Cylinder.** The cam valve is located near the end of the cylinder stroke to reduce the speed of travel before impact of the piston against the cylinder end cap.

During the forward stroke a free-flow path is provided through the cam valve for oil leaving the cylinder, and travel speed is a maximum. When the cam valve is actuated, the discharge oil is forced to go through the variable restrictor (needle valve) and speed is reduced.

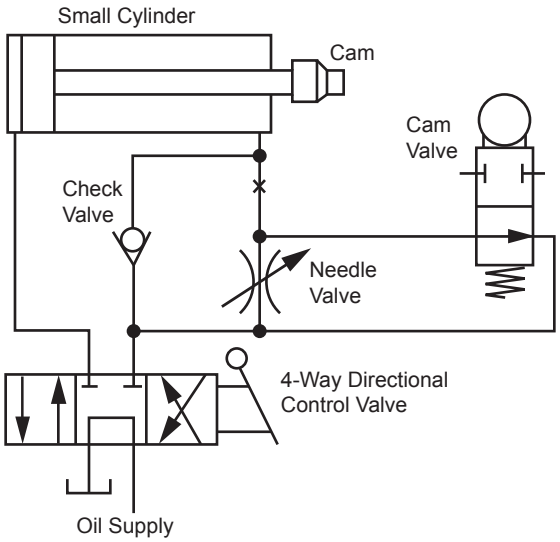


***Figure 1.*** *Deceleration at end of cylinder stroke - low-flow circuits and small cylinders.*

A check valve allows free flow of oil into the cylinder on its return stroke. To add deceleration at the end of the return stroke, a second cam valve and needle valve can be added. Point x indicates the location for installing a flow control valve for setting the maximum speed throughout the stroke up to the deceleration point.

**Figure 2. Large Cylinder.** Where oil flow is too great for a 1/4 or 3/8″ cam valve, a small cam valve can control a pilot-operated check valve. Pilot pressure source is the 4-way valve inlet. During the forward stroke, pilot pressure holds the check valve open. But when the cam valve is actuated, pilot pressure is blocked. The check valve closes, forcing discharge oil to pass through the flow control valve.

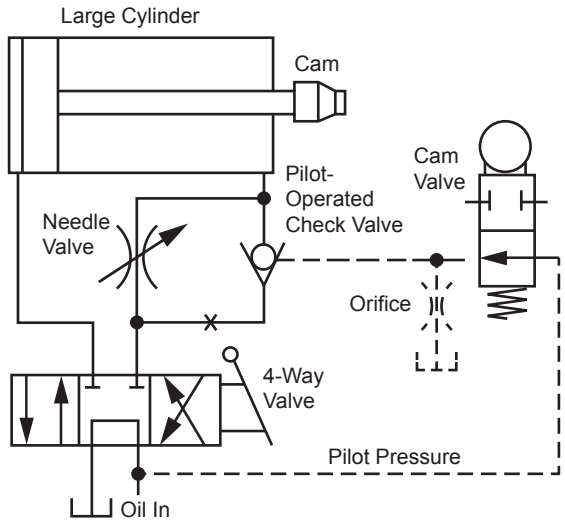


***Figure 2.*** *Deceleration circuit for high flow circuits using large cylinders.*

### Skip Feeding

**Figure 3.** This circuit can be used on machine tools to reduce speed as the tool approaches cutting position, then to restore full speed at the end of the cut. The length of the cam determines the distance through which the cylinder will remain in slow feed. Several cams may be used where several cuts are to be made with “rapid traverse” between them.

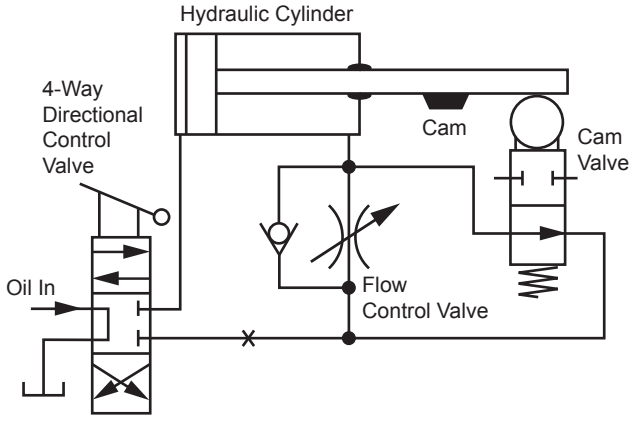


***Figure 3.*** *Skip feeding circuit.*

## Cam to Reduced Pressure

**Figure 4.** One or more cams may be placed where they will actuate the cam valve at pre-determined points in the cylinder stroke where system pressure is to be reduced.

Highest pressure must be set on the pump relief valve. The vent relief valve, 1/4" in size, is set to a lower pressure. The cam valve, when actuated, connects the vent port of the pump relief valve to the vent relief valve which reduces the setting of the pump relief to the value set on the vent relief.

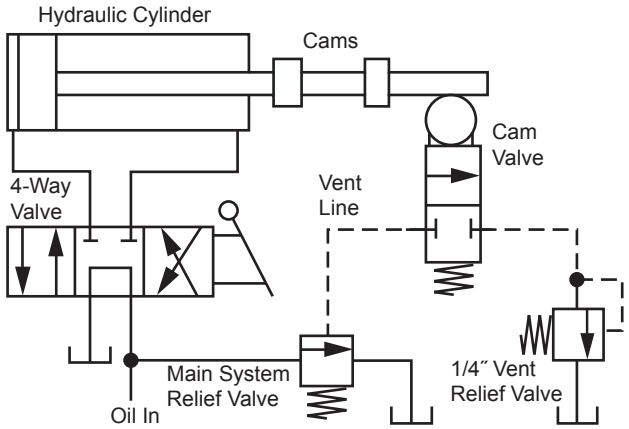


***Figure 4.*** *Actuation of the cam valve reduces system pressure.*

## Pump Unloading

Two circuits are shown in which a cam valve is used to unload the oil supply as the cylinder piston reaches home position. The advantage of these methods over a tandem center 4-way valve for unloading is the resultant simplicity of the electrical control circuit, with one or more holding relays and complicated wiring eliminated. A simple pushbutton or toggle switch will control the solenoid 4-way valve.

**Figure 5. Low-Flow Circuits.** If the cam valve is rated to pass the full oil flow this circuit may be used. When the cam valve is actuated at home position, the oil unloads through the cam valve, through the 4-way valve to tank. When the solenoid valve is energized to start a forward stroke, the unloading passage through the 4way valve becomes blocked, and the cylinder starts forward under full pressure.

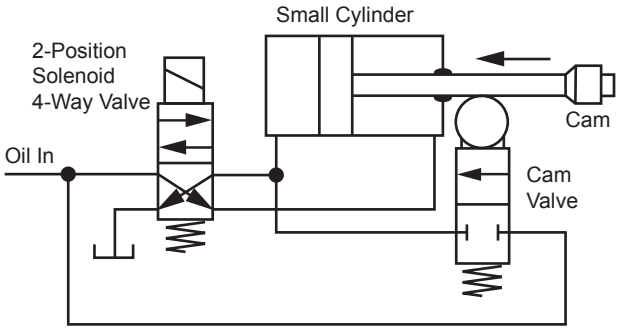


***Figure 5.*** *Pump oil unloads directly through the cam valve.*

**Figure 6. High-Flow Circuits.** If the oil flow is too high to be handled directly through the cam valve, the cam valve may be used as a venting device for the main system relief valve which must be a pilot-operated type relief valve. The full pump flow can unload through the vented relief valve when the cylinder has retracted to home position and has actuated the cam valve.

When the solenoid valve is shifted to extend the cylinder, the vent line becomes blocked, causing high pressure to build up behind the piston. The check valve prevents high pressure oil from back flowing into and saturating the pilot section of the relief, causing improper action of the valve.

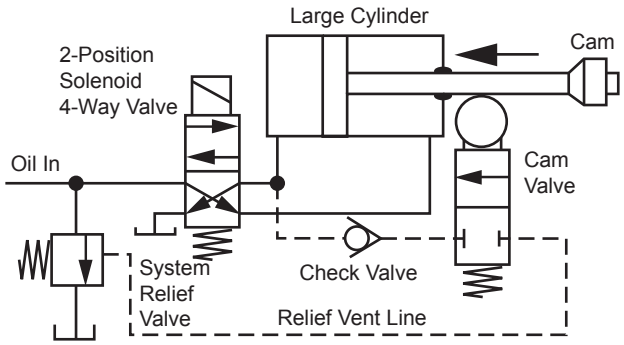


***Figure 6.*** *Cam valve vents pump relief for oil unloading.*

## Master/Slave Cylinders

**Figure 7.** The slave cylinder automatically responds to certain stroke positions of the master cylinder. For example, with the master cylinder extended, the cam valve is unactuated. Pilot flow to the 4-way valve is being vented off to tank without building up pressure. When the cam valve is actuated by the retracting master cylinder, the pilot vent becomes blocked. Pilot pressure builds up on the 4-way valve, causing it to shift and to extend the slave cylinder.

During the forward stroke of the master cylinder, when the cam valve is allowed to return to its normal position, pilot pressure on the 4-way valve is lost and it returns to its normal position, retracting the slave cylinder.

The orifice should be as small as practical to minimize oil bleed-off to tank when the cam valve is unactuated.

The hydraulic circuit for operation of the master cylinder is not shown in the diagram.

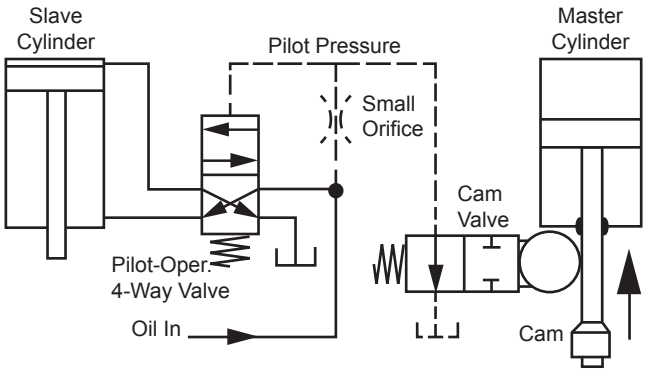


***Figure 7.*** *Master/slave cylinder system.*

Published by:
**WOMACK EDUCATIONAL PUBLICATIONS**
**Womack Machine Supply Co.**
13835 Senlac Dr.
Farmers Branch, TX 75234
Tel: 800-859-9801
Fax: 214-630-5314
www.womack-educational.com