Hydraulic Motor Speed Control

Successful speed control of a hydraulic motor is more difficult than for hydraulic cylinders, because of the internal slippage present in all hydraulic motors. Slippage causes bad speed regulation resulting in a loss of speed as torque load is applied to the motor shaft. Slippage increases in direct proportion to system PSI (and motor torque) but remains about constant for all motor speeds. Slippage may affect motor performance only slightly at the high end of the range, but may cause it to stall on a slight increase of load when operating on the low end of the range.

How well the motor will perform depends on several factors: the type, quality, and brand of the motor itself; the kind of speed control circuit which is selected; and on the type and accuracy of the flow control valve. Pressure compensated flow control valves are required in all of the circuits below except the final circuit in which a needle valve is used.

Motor Type

The type of motor should be selected on the basis of the adjustable speed range which must be covered:

Mobile-type gear and vane motors may not be able to cover more than a 2:1 speed range with good performance. Industrial type gear and vane motors, being of higher quality, may be able to cover a 3:1 or 4:1 range. Piston motors should be used where more than a 4:1 range must be covered. They should be able to cover a 6:1 range with meter-in speed control, but can cover a wider range when the speed control valve is placed in the outlet where it will not be affected by internal slippage oil.

Bypass Speed Control

Although this method usually produces a minimum amount of oil heating, it is the poorest system to use with a hydraulic motor, and should only be used when the required range of adjustable speed is very limited.

Series Meter-in Speed Control

This is an improved method when a wider speed range is required. It should give good motor performance over about twice the adjustable range of the bypass method. Several branch circuits can be operated from one pump, but this method tends to generate more heat in the oil.

Three Port Speed Control

A three port flow control valve meters the oil in series to the motor, giving good speed regulation, but it has a 3rd port through which the unused oil is diverted to tank at a pressure only slightly above load pressure rather than at relief valve pressure. It combines the best features of both the series and the bypass methods, but has one limitation: Only one branch circuit can be operated from a pump.

Meter-Out Bypass Speed Control

When used with piston motors, this is the best method of controlling motors which must operate over a wide range of adjustable speed. A needle valve is placed in the motor outlet for meter-out control. Pressure drop across this needle valve must always be 75 PSI.

If motor speed should tend to increase due to drop off of load, pressure drop across the needle valve would tend to increase to more than 75 PSI. This increased pressure should tend to shift the bypass valve slightly more open to bypass the excess oil before it reaches the motor. Internal leakage must be routed directly to tank from the motor case drain. Only one branch circuit can be operated from a pump when using this method.