

Hydrostatic Operation

- Hydrostatic transmissions are a pump and motor connected in a circuit together
- Most are constructed using piston pumps and piston motors
- Four basic configurations:
 - In-line
 - U-shaped
 - S-shaped
 - Split

In-Line Configuration

- The pump is directly connected to the motor
- All fluid is contained within the pump/motor combination
- Usually uses a variable pump and a constant displacement motor

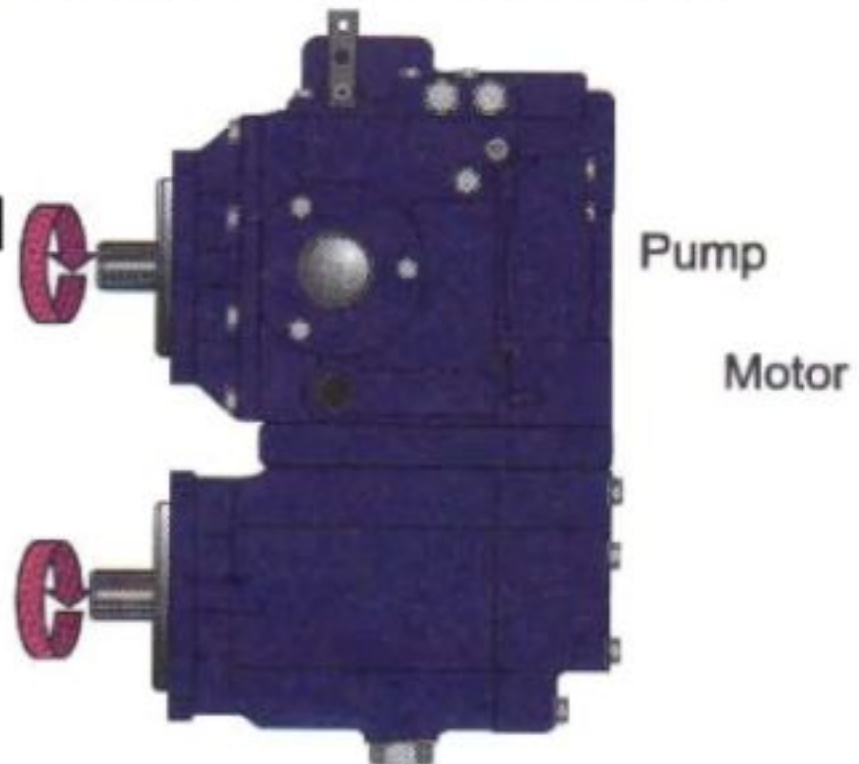


Pump

Motor

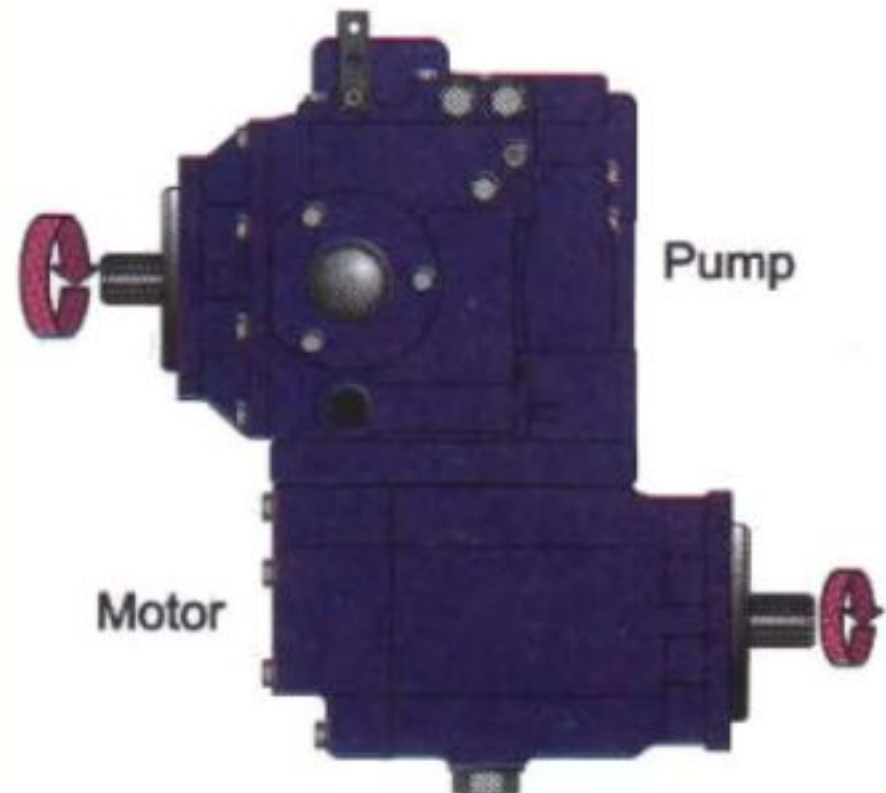
U-Shaped Configuration

- Similar to the in-line except that the motor is connected under the pump
- The motor shaft goes out the same direction and the input shaft
- Used when the drive axle is under or behind the prime mover



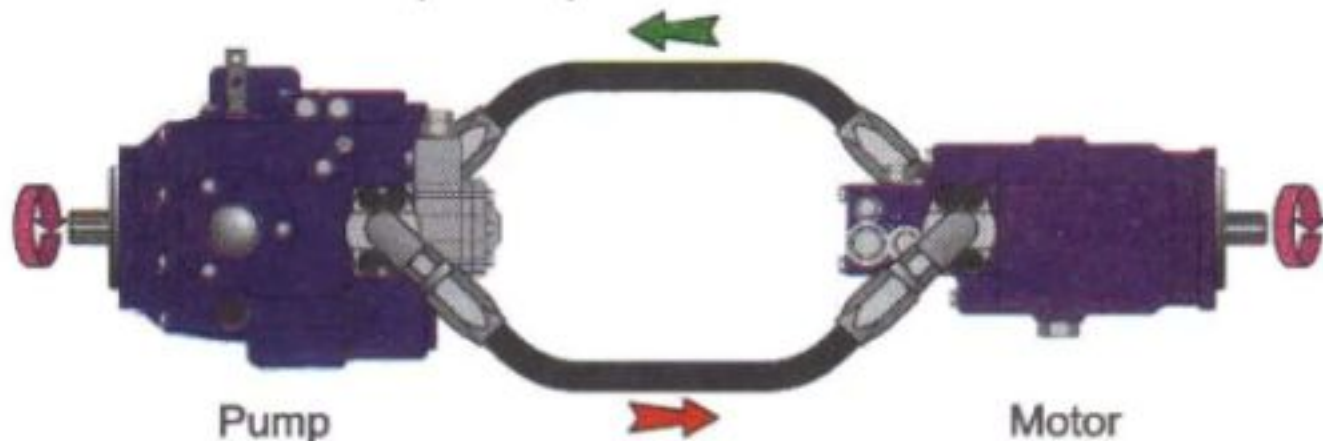
S-Shaped Configuration

- Similar to the U-shaped configuration
- The motor shaft goes out behind the prime mover, but under it
- Used when the drive axle is under the level of the prime mover



Split Configuration

- The motor and pump and motor are not physically connected together
- The motor can be located some distance from the pump and across a barrier
- Contains very high pressure hose that connects the pump to the motor

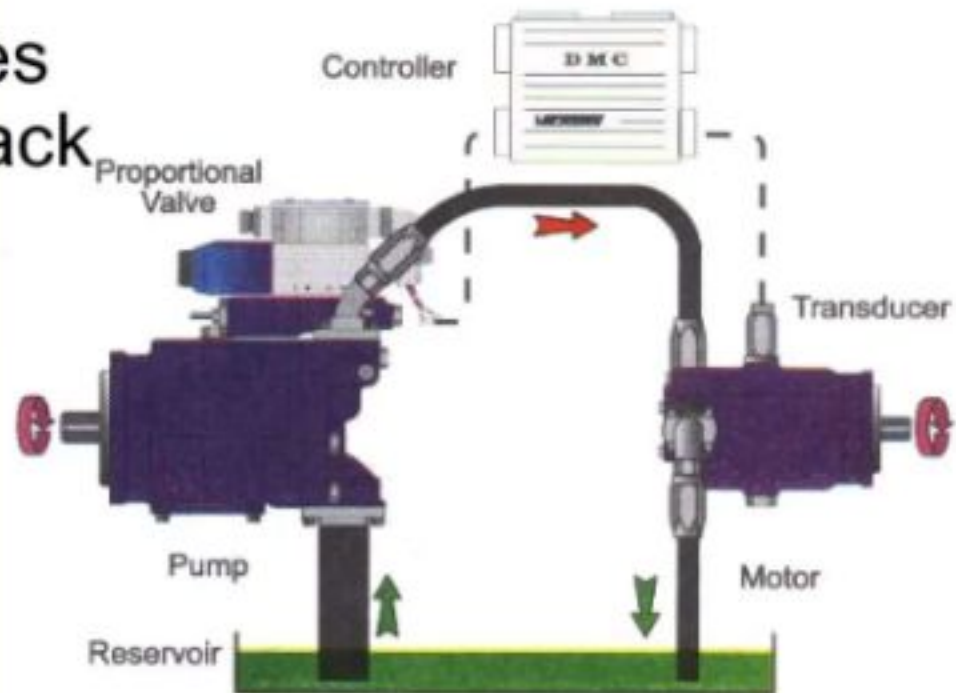


Advantages of Hydrostatic Transmissions

- It offers the ability to operate over a wide range of speeds without changing the prime mover speed
- It can change speeds rapidly because there are no large parts which add inertia
- It provide dynamic braking
- There is no interruption of power to the wheels when shifting

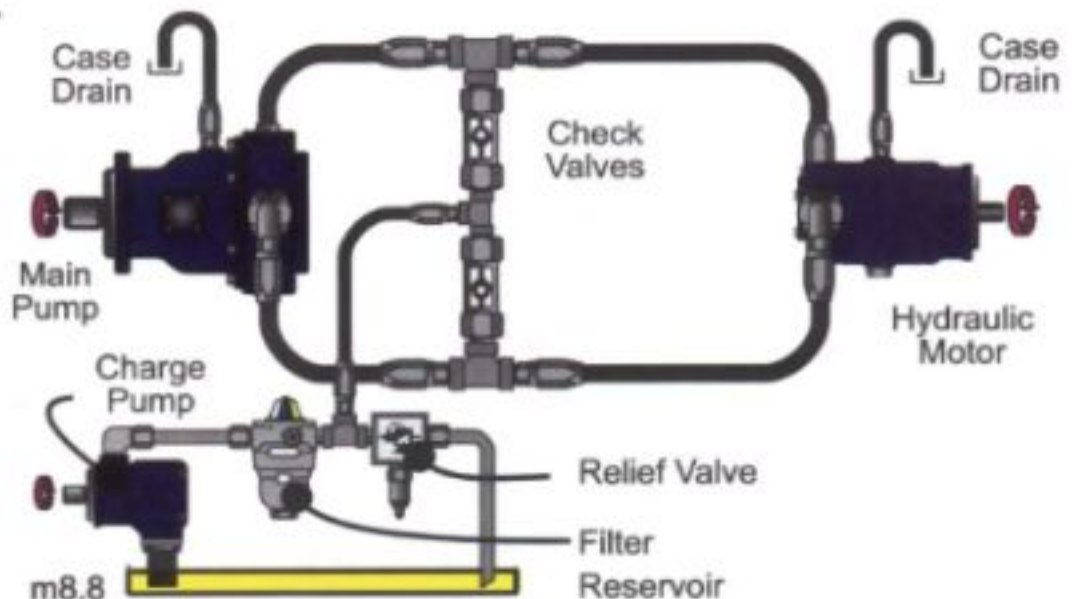
Hydrostatic Circuits

- **Open circuit**
- All fluid comes from the tank and is pumped to the motor
- When the fluid leaves the motor, it goes back to the tank
- Does not require a charge pump



Hydrostatic Circuits

- **Closed circuit**
- The fluid is pumped to the motor
- As the fluid leaves the motor, it is returned to the pump inlet
- Requires a charge pump



Circuit Schematics

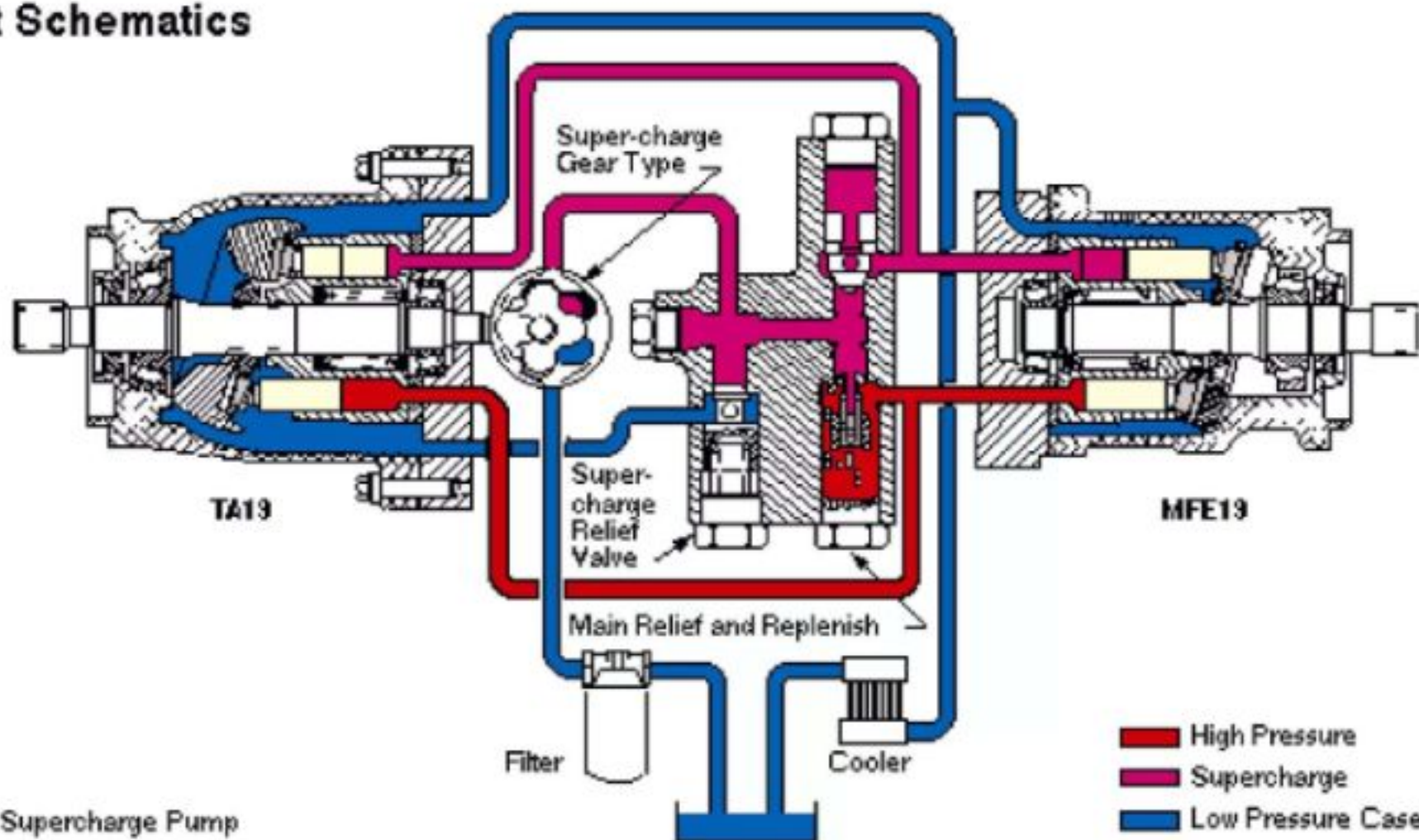
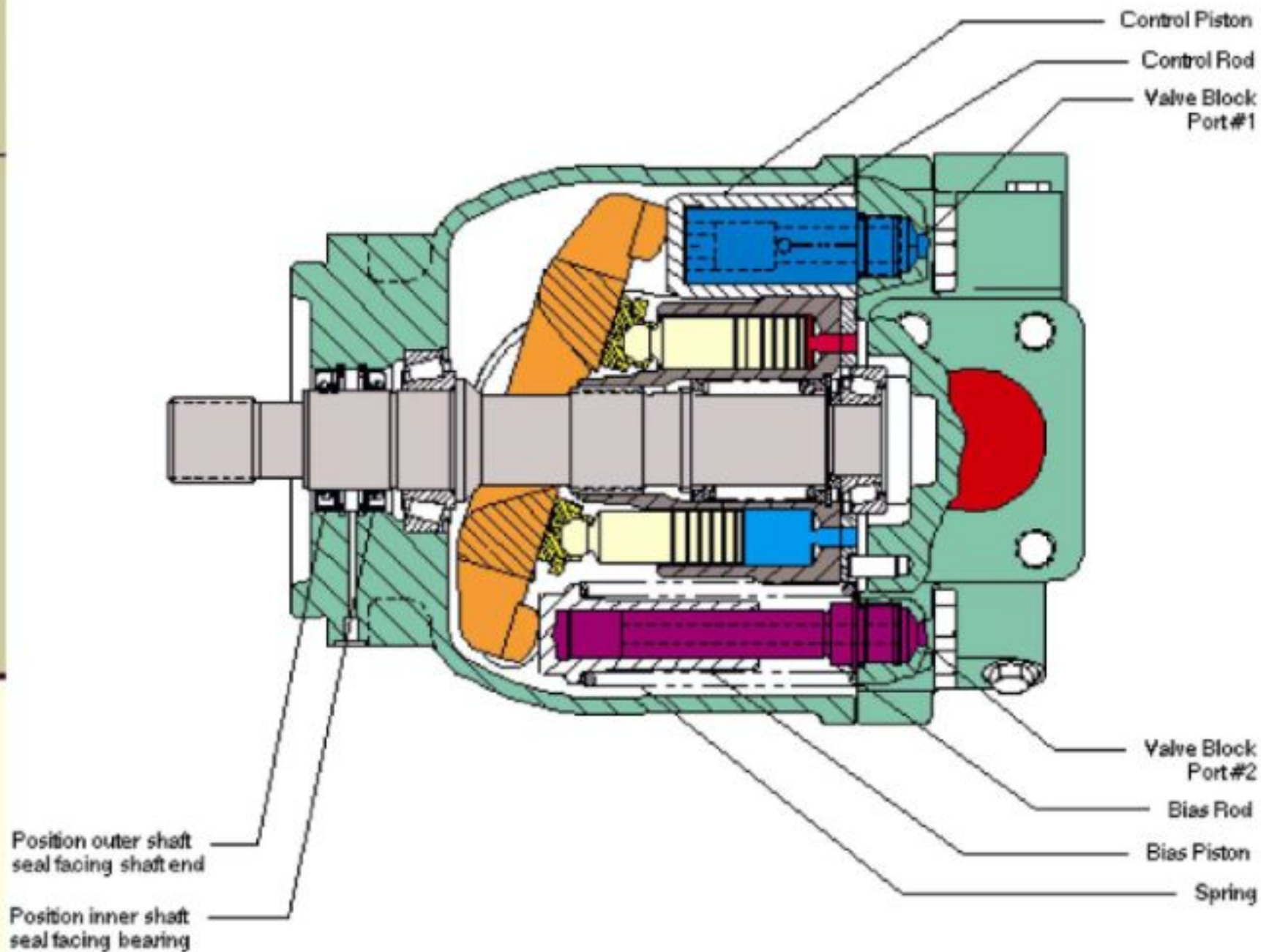


Figure 1. Supercharge Pump

Hydrostatic Transmission Operation - Pump

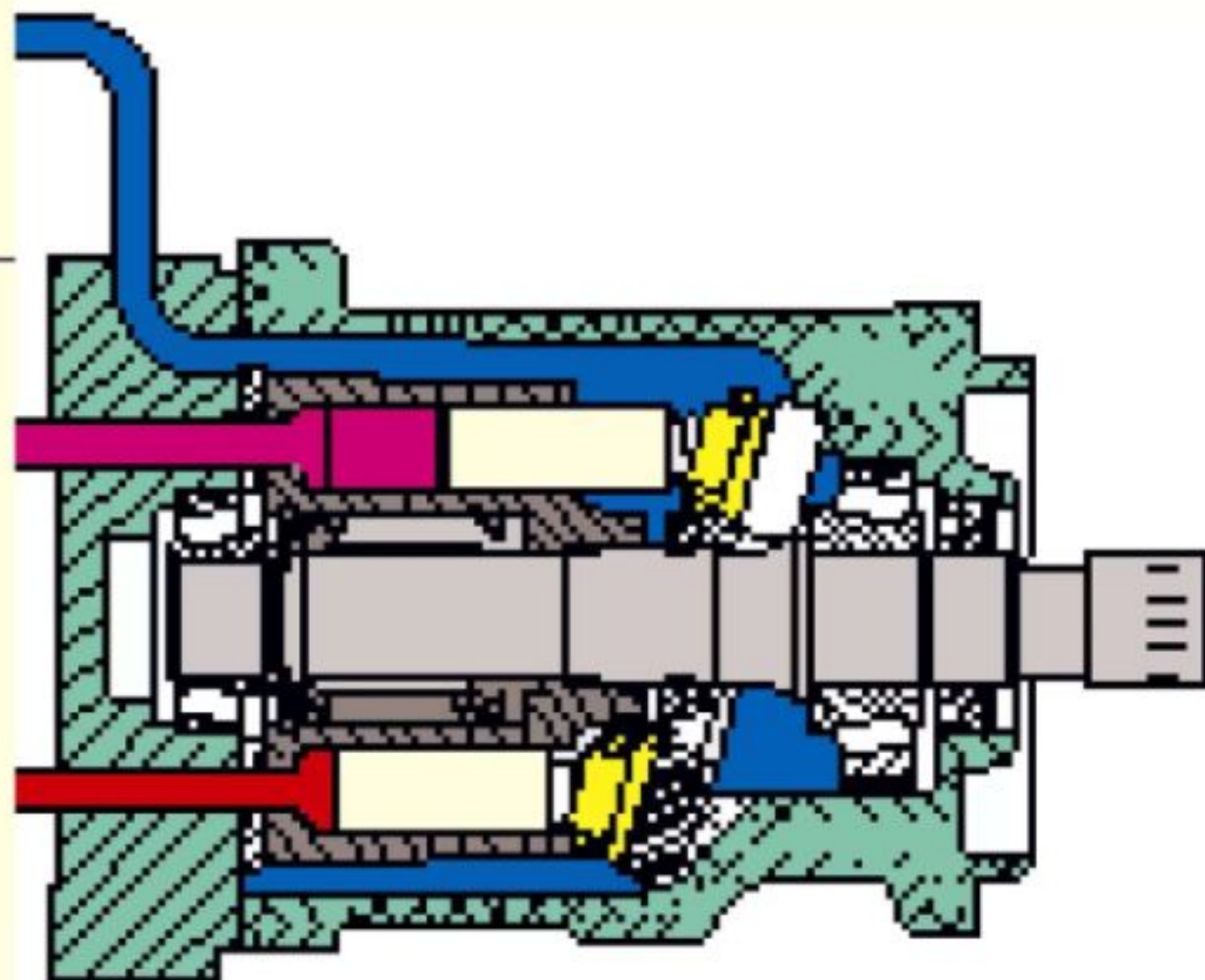
- The cylinder is turned by the input shaft
- The pistons are connected to a swash plate, which varies how much the pistons travel
- The greater the angle of the swash plate, the more fluid is pumped
- Reversing the angle of the swash plate causes it to pump backwards
- The more fluid is pumped per revolution, the more horsepower is needed

Typical Cross Section



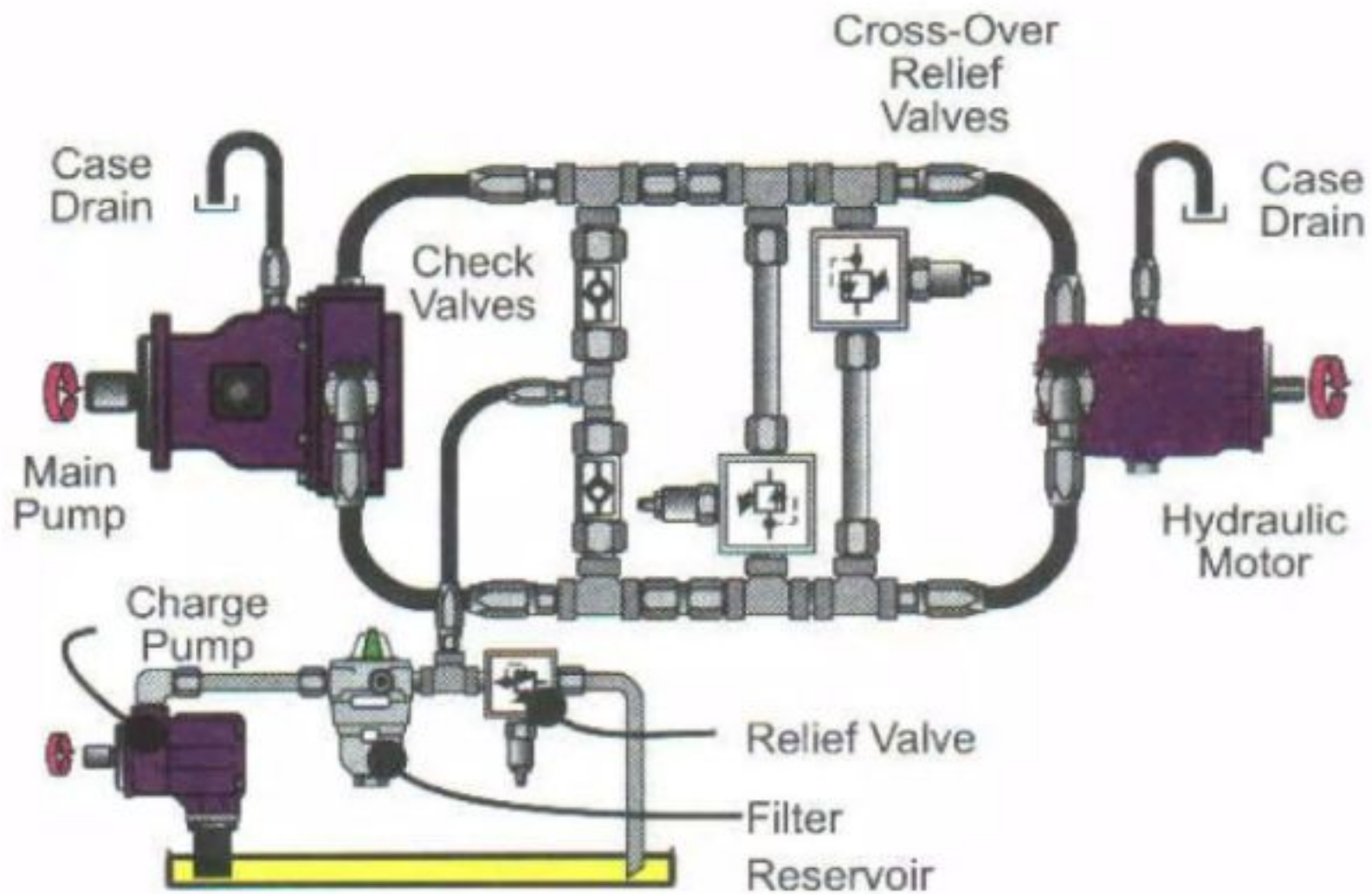
Hydrostatic Transmission Operation - Motor

- The motor accepts the fluid from the pump and turns a differential or wheel, depending on the configuration
- When the pump reverses direction, the motor turns backwards, giving you reverse
- Not all hydrostats are designed to pump backwards
- Many motors use a shuttle valve to reverse the flow of hydraulic fluid



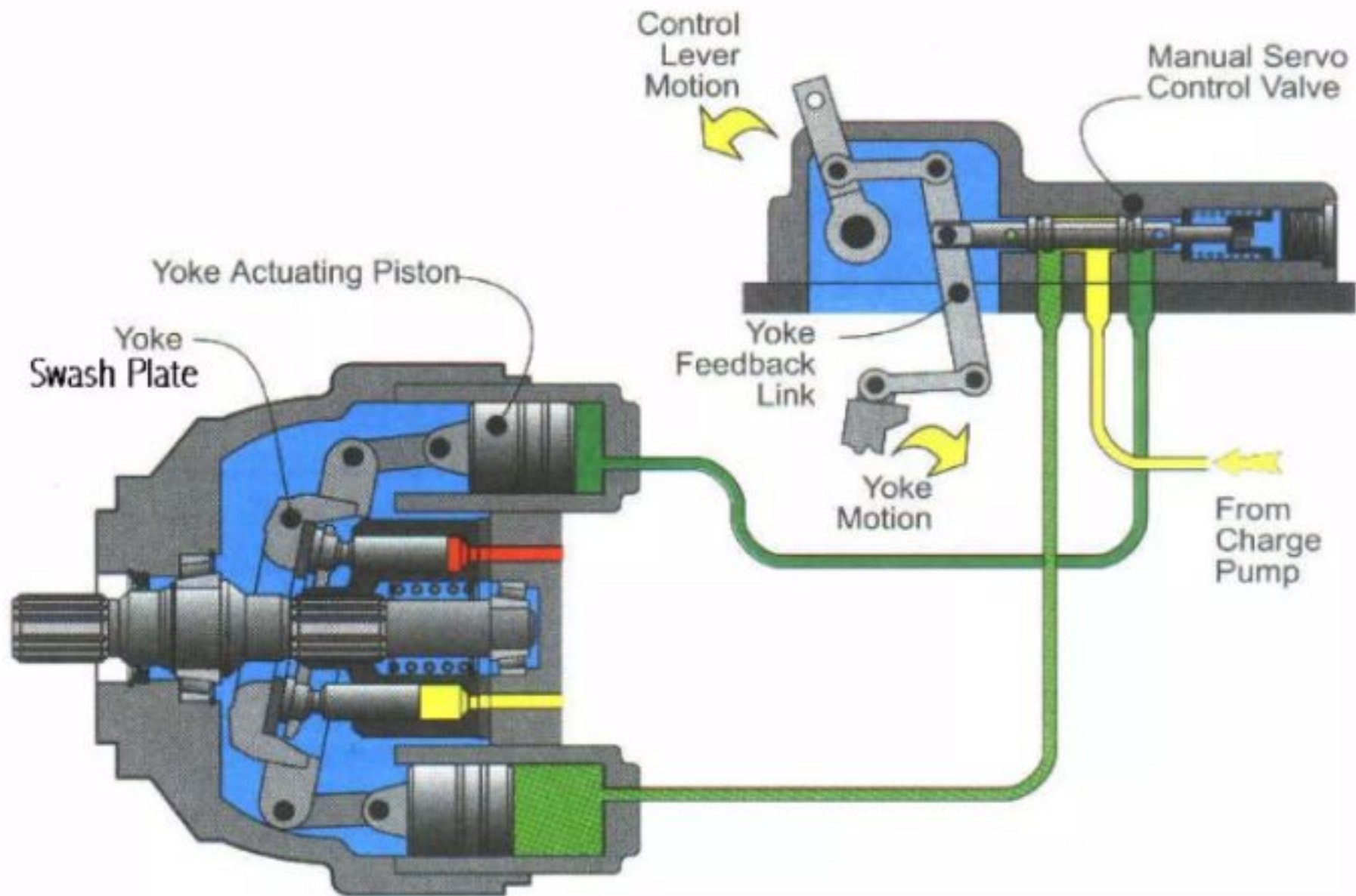
Hydrostatic Transmission Components

- All circuit types require a relief valve to prevent overpressurizing during dynamic braking
- The pump and motor have case drain lines to keep fluid that leaks internally from building pressure behind the piston
- Case drains are connected to the tank
- Charge pumps must provide enough fluid to replace leakage and cool the pump/motor assembly



Servo Activated Hydrostatic Transmissions

- In larger hydrostats, the swash plate can be hard to move
- In these systems, a small piston assembly is attached to the swash plate and activated by low pressure (300 PSI)
- These servos are controlled by a small shuttle, making it easier to move the swash plate



Hydrostatic Transmission Testing

- Use a flow meter hooked to the case drain line to measure to output. It should be below the charge pump volume
- All hydrostatic transmissions have tight tolerances. The filters should be change at regular intervals
- Many systems have a pressure sensor that shuts down the prime mover if the charge pressure falls below a certain level

Hydrostatic Transmission Testing

- If the prime mover has a problem, it could fail to supply the needed power to the hydrostat
- Always rule out the prime mover first when checking for insufficient power problems
- Charge pressure varies, but should be between 160 to 300 PSI