

Hydraulics

Hydraulics are used for providing high torques and high forces with a high level of control of the motion. Hydraulic fluid is virtually incompressible so controlling the flow of fluid provides accurate control of the motion of the relevant actuator..

Typical uses of Hydraulic drives include..

Vehicle drives in agricultural and civil applications

High power low weight motors (high speed and low speed)

Elevators

Aircraft motion control- wings - undercarriage etc

Hydraulic Hoists

Automation actuators

Machine tool drives

Flight Simulators- For training pilots

Motion Simulators- For vibration seismic testing

The primary advantage of hydraulic systems compared to pneumatic and electric systems is that high forces and torques can be developed with comparatively compact motors without the need for gearboxes.

Very accurate motion controls are possible using sophisticated servo valves.

The disadvantages of hydraulic systems include the relatively high cost of components and the need to condition and contain the hydraulic fluid.

Hydraulic system Components

Hydraulic systems are generally confined to local areas e.g. a vehicle, a machine tool. They are not designed as distributed systems as are pneumatic systems.

However large distributed systems have been employed. In times past, in cities, very extensive systems have been engineered to serve diverse hydraulic units elevators - bridges etc.

Hydraulic systems ...

Operating Conditions.

Hydraulic power systems systems use hydraulic fluids at pressures between 35 barg and 350 barg.

The hydraulic fluid must be maintained within safe temperature regime by use of coolers.

The hydraulic components have close clearances so the fluid must be filtered.

Power Pack

The hydraulic power pack impart the essential potential energy to the hydraulic fluid using appropriate pumps e.g. Gear, Vane, Piston pumps are used. The power pack normally includes the following features

Reservoir for hydraulic fluid - with instrumentation, air filter and strainer over outlet

Protection for pump including filter

Pump located below reservoir to minimise suction feed requirement

Accumulator to maintain steady pressure against flow variations

Cooler for removing waste heat from the system (Air cooler /Water cooler)

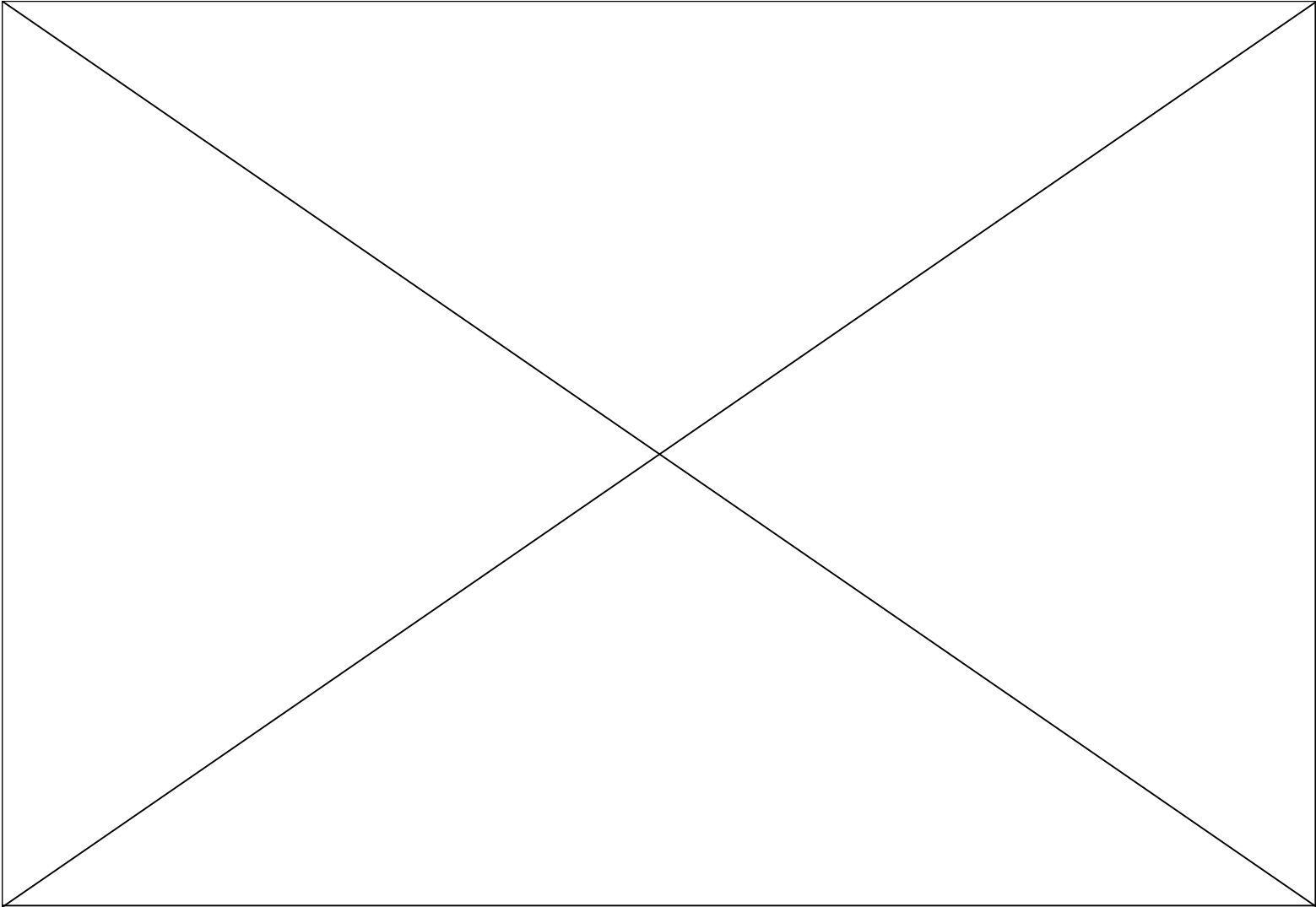
Control valves, relief valve, unloading valve, isolation valves

Provision for containing any leaks with suitable instrumentation

The Basic Idea

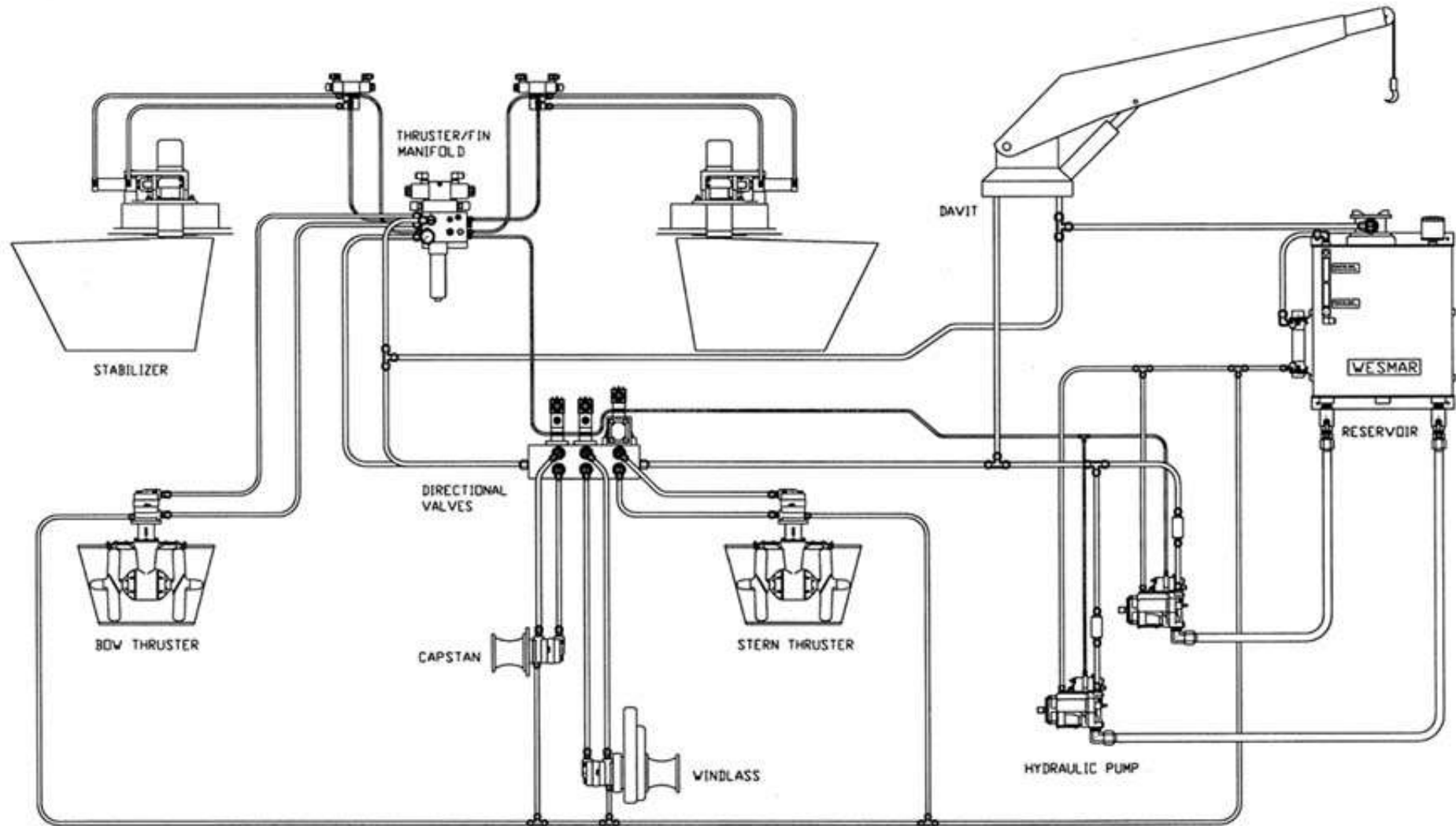
The basic idea behind any hydraulic system is very simple: **Force that is applied at one point is transmitted to another point using an incompressible fluid.** The fluid is almost always an oil of some sort. The force is almost always multiplied in the process. The picture below shows the simplest possible hydraulic system:

Hydraulic multiplication. The piston on the right has a surface area nine times greater than the piston on the left. When force is applied to the left piston, it will move nine units for every one unit that the right piston moves, and the force is multiplied by nine on the right-hand piston.



High-pressure oil from the pump is shown in light blue, and low-pressure oil returning to the tank is shown in yellow.

Hydraulic System



Typical Hydraulic System Reservoir

This aluminum tank is equipped with a 2" suction 100 mesh stainless steel screen, sight glass and breather, and one return line inlet. The reservoir should be mounted to provide flooded suction to the pump.

Gate Valve used so the pump can be isolated out of circuit for repairs.

Load Sensing Pump "senses" the amount of pressure necessary to move the load and adjust output flow to match the valve opening selected on the flow control.

Check Valve used to keep from back pressuring the pump.

Pressure compensated Flow Control maintains accurate constant flow at pressures up to 3000 PSI.

Bow Thruster Directional Control Valve handles flows up to 93 GPM and pressure up to 3000 PSI, including 3 position directional control and manifold.

Cushion Valve designed to minimize or eliminate shock surge and overload conditions on hydraulic equipment

Return Filter with a 3 micron filter element.

Gate Valve allows easy filter element replacement.

Small Cooler used to cool oil.

Pressure Gauge 0 to 3000 PSI.

