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Unit-3

Subject : Hydraulics and pneumatics

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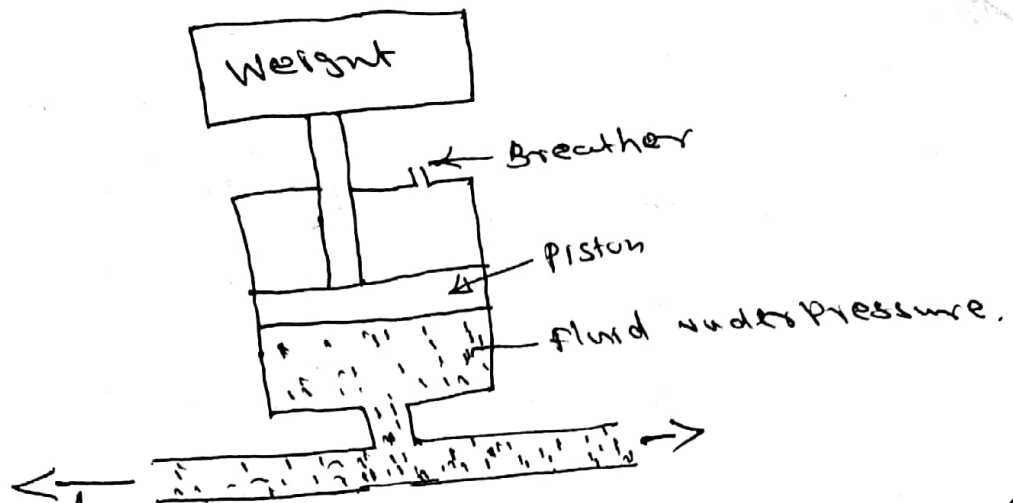
NAME OF THE : S. DINESH / MECHANICAL
FACULTY

Draw Neat sketch and briefly explain weight loaded Accumulator?

WEIGHT LOADED ACCUMULATORS

- * Weight loaded accumulator : An accumulator in which a dead weight is used for the pressure load is called as weight loaded accumulator.
- * Weight - loaded accumulator is historically the oldest type of accumulator. They are heavy weight and are bulky size.
- * A weight loaded accumulator maintains constant discharge pressure ~~varies~~ through its operation, while in all other type of accumulators the discharge pressure varies with the volume of fluid stored. This is the major advantage of a weight loaded accumulator.
- * As the weight loaded accumulators are in bulky size and heavy weight they are not suitable for mobile equipments. This is the major disadvantage of a weight loaded accumulator.
- * Weight loaded accumulators are most often used in central hydraulic system to serve several hydraulic systems at a time.

Construction of Weight loaded Accumulator ^{low rod.}



- * A weight loaded accumulator consists of a cylinder, a piston, and heavy weight.
- * The cylinder used in weight loaded accumulator is a vertical heavy wall steel cylinder.
- * The cylinder incorporates a piston inside it. The piston is provided with packing to prevent leakage.
- * The piston and cylinder inner wall are fine finished to reduce frictions.
- * The top of the piston is loaded with a heavy weight. The weight may be of some heavy materials such as iron block, steel block or concrete block.
- * The block weight decides the pressure of fluid stored inside the accumulator.

Operation of weight loaded Accumulators:-

In the beginning of hydraulic system operation the piston in the accumulator used to be at the lower

position in the cylinder.

* During operation, the pump continuously supplies pressurized oil to the hydraulic machine. Whenever the oil pressure rises above the required pressure, the pumped oil will enter into the accumulator raising the piston and weight.

* As the piston and weight raises, the dead weight applies a force on the piston that generates a pressure on the fluid side of piston. When the piston rose to its upper most position, it indicates that the accumulator has stored the maximum amount of pressure energy.

* Whenever the oil pressure in the system drops the dead weight in the accumulator forces the stored energy to the machine. During discharge, the fluid output pressure will not decrease with the decrease of volume in the accumulator. Accumulator creates a constant pressure throughout the operation, because the fluid pressure depends on the weight. The weight remains unchanged.

Thus the accumulator stores energy when the fluid pressure in the circuit is higher than the required pressure and it delivers the stored energy when pressure is lower in hydraulic circuit.

Advantages of weight loaded Accumulators

- * produce constant discharge pressure.

- * Can serve several hydraulic systems at a time.
 - * Can hold large volume of fluid under high pressure.
- Disadvantages of weight loaded Accumulators.

- * Bulky size
 - * Heavy weight
 - * Not suitable for mobile equipment.
 - * Slow response to system demand.
- (2) Draw neat sketch and Briefly explain Intensifier?

INTENSIFIER :-

* Intensifier is a pressure booster which generates a higher pressure from a low-pressure hydraulic power source.

* Intensifiers are always powered by a pump which is operating at a set pressure and from this the intensifier simply generates a higher output pressure.

Constructions of intensifier :-

A hydraulic intensifier consists of two cylinders of different diameters. Each cylinder has piston, and they connected by a common piston rod.

These pistons have very fine clearances to move within their respective cylinders.

of the intensifier assembly.

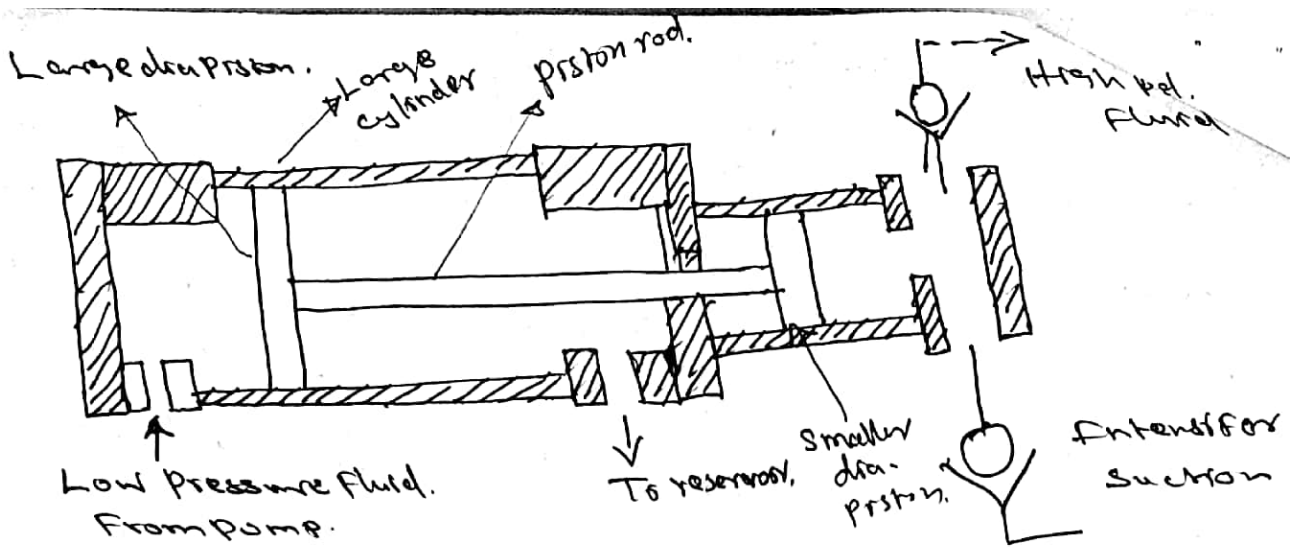
The pressurized [low pressure] oil entering the larger diameter piston to push the smaller diameter piston in the smaller cylinder. Because of this the same force acting on the larger diameter piston also acts on the oil in the smaller cylinder.

Now the oil pressure in the small cylinder gets multiplied due to area difference and high pressure oil forced out of the intensifier to the actuator.

This cycle is repeated continuously and low pressure oil comes out with high pressure intensity.

Advantages of Intensifier :-

- * Intensifier is a compact device
- * It eliminates the need of high pressure pump, in places where high pressure is needed for a short period of time.
- * It can be directly attached with the hydraulic machinery, where-ever it is needed.
- * Easy to operate and control
- * Energy saving.
- * Heat generated is minimum.
- * It provides constant force and pressure in whole working process.



- * The larger cylinder is connected to the pump which supplies fluid at low pressure.
- * The smaller cylinder is connected to the system that needs fluid at high pressure.
- * The smaller cylinder is also called as intensifier chamber.
- * Low pressure oil from the hydraulic pump enters into the larger cylinder and high pressure oil discharged from the smaller cylinder or intensifier chamber.

Operation of Intensifier :-

* A hydraulic intensifier operates on a differential piston principle, where a larger diameter piston pushes a smaller diameter piston, thus increasing the pressure to a factor equal to the ratio, larger diameter area divided by smaller diameter area.

When the hydraulic system is operated, a large quantity of low pressure oil from the hydraulic pump enters into the larger cylinder.

Disadvantages of Intensifier :-

- * Even small leakage of the fluid will affect the actuator performance.
- * Requires high maintenance.

Application :-

- * Hydraulic work holding on machine tools.
- * Hydraulic press operation
- * Drilling machine operation
- * pressure die casting machine operation
- * Hydraulic power packs.
- * Electro and air hydraulic bolting machine operations
- * Hydraulic constructions and demolition tools operation
- * Stone crushing machine operation
- * Fork lift operation.
- * Conducting rupture tests on hydraulic hoses etc.,

③ Briefly explain construction of Regenerative Circuit?

Regenerative Circuit :-

A hydraulic circuit that is used to speed up the extension stroke of a double acting single rod hydraulic cylinder is known as regenerative circuit.

A single rod cylinder normally moves slower

when extending compared to retracting because of the different piston area. So to speed up the extension stroke. Regenerative circuit can be used.

In the regenerative circuit, oil from the rod end of cylinder is directed into the blank end along with the main pressure line. So the regenerative circuit increases the speed of the piston.

The applications of this circuit can be seen in drilling machine operation.

Operation :-

* The hydraulic pump draws fluid from the reservoir through filter. and then sends it to the directional control valve (DCV)

* The directional control valve directs flow to the hydraulic cylinder according to the valve position selected.

The figure shows a simple regenerative circuit to speed up the extension stroke of the double acting single rod hydraulic cylinder.

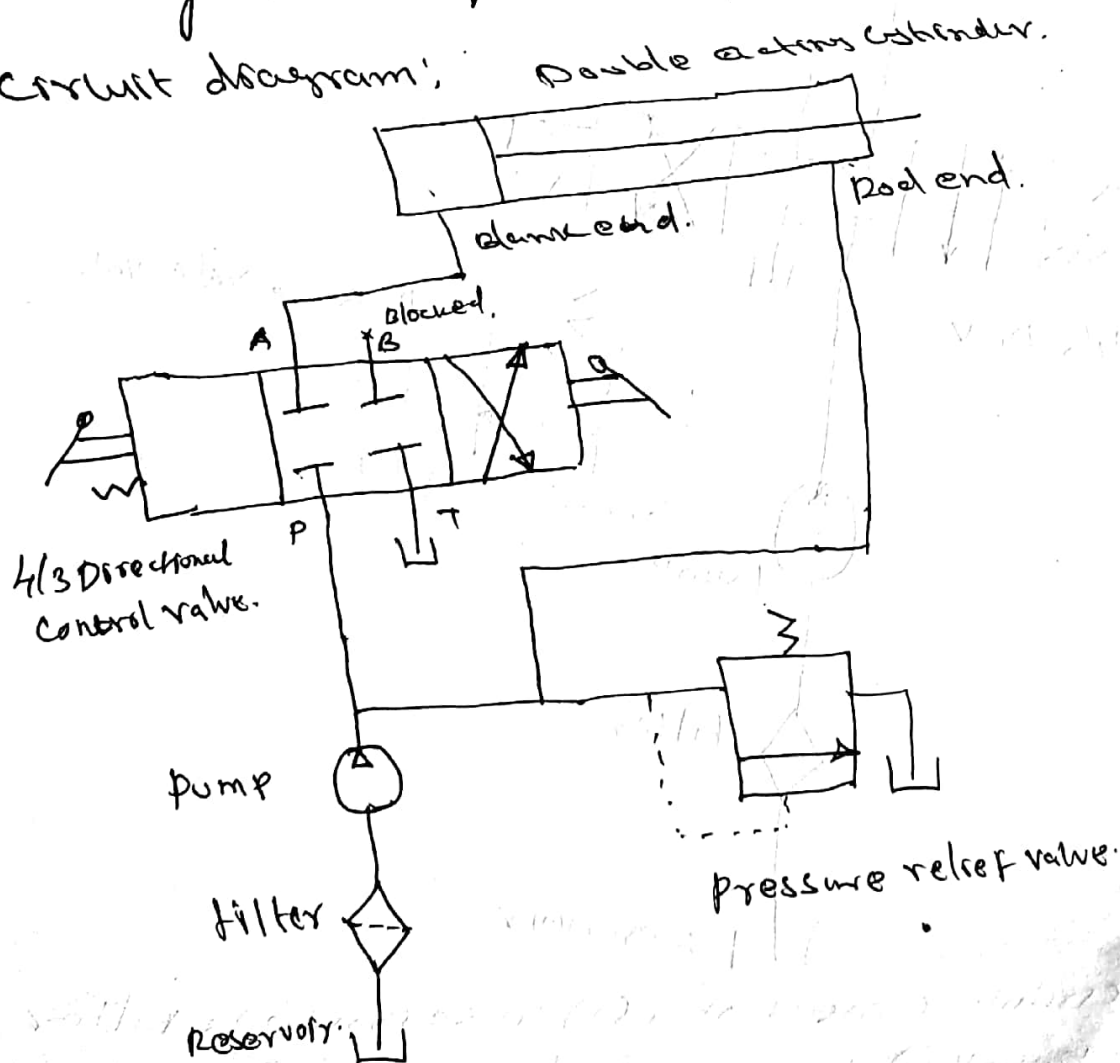
The circuit consists (1) reservoir (2) a filter (3) pressure relief valve (4) a 4/3 DCV and (5) a double acting single rod cylinder.

The pump used in this circuit is a fixed displacement unidirectional pump.

The direction Control Valve DCV used in this circuit is a three position four way manually (lever) Operated spring Centred Valve. Its center Value Configuration is a closed center.

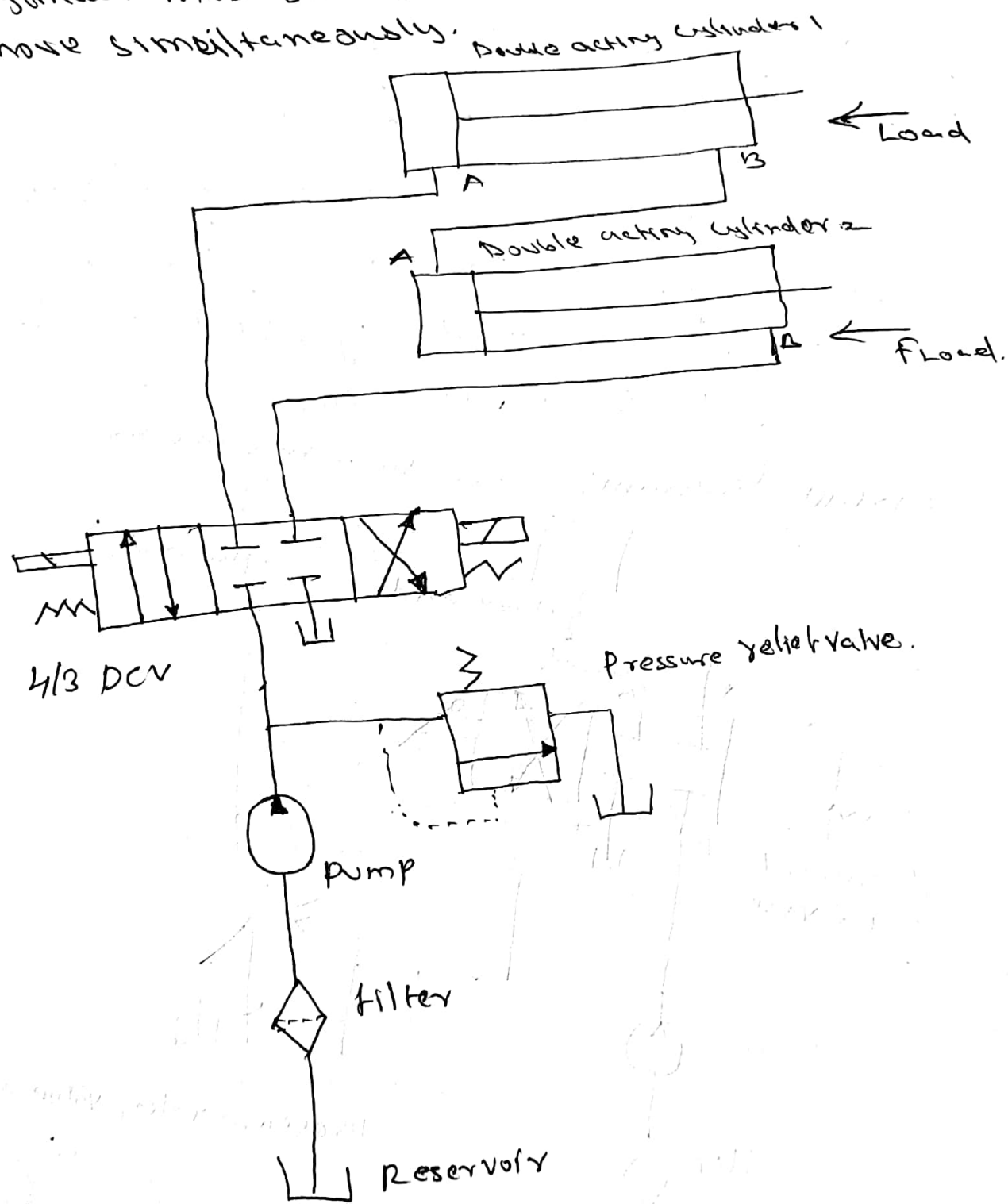
In this circuit the port "B" of the DCV which conventionally connects to the cylinder is blocked and the rod end of the cylinder is connected directly to the pressure line.

Circuit diagram:



check valve

② Briefly explain construction of synchronization
some hydraulic machine Applications needs more than
one cylinder to move heavy loads, which are not possible
to be done by a single cylinder, in such cases the
cylinder must be synchronized, so that all cylinder
move simultaneously.



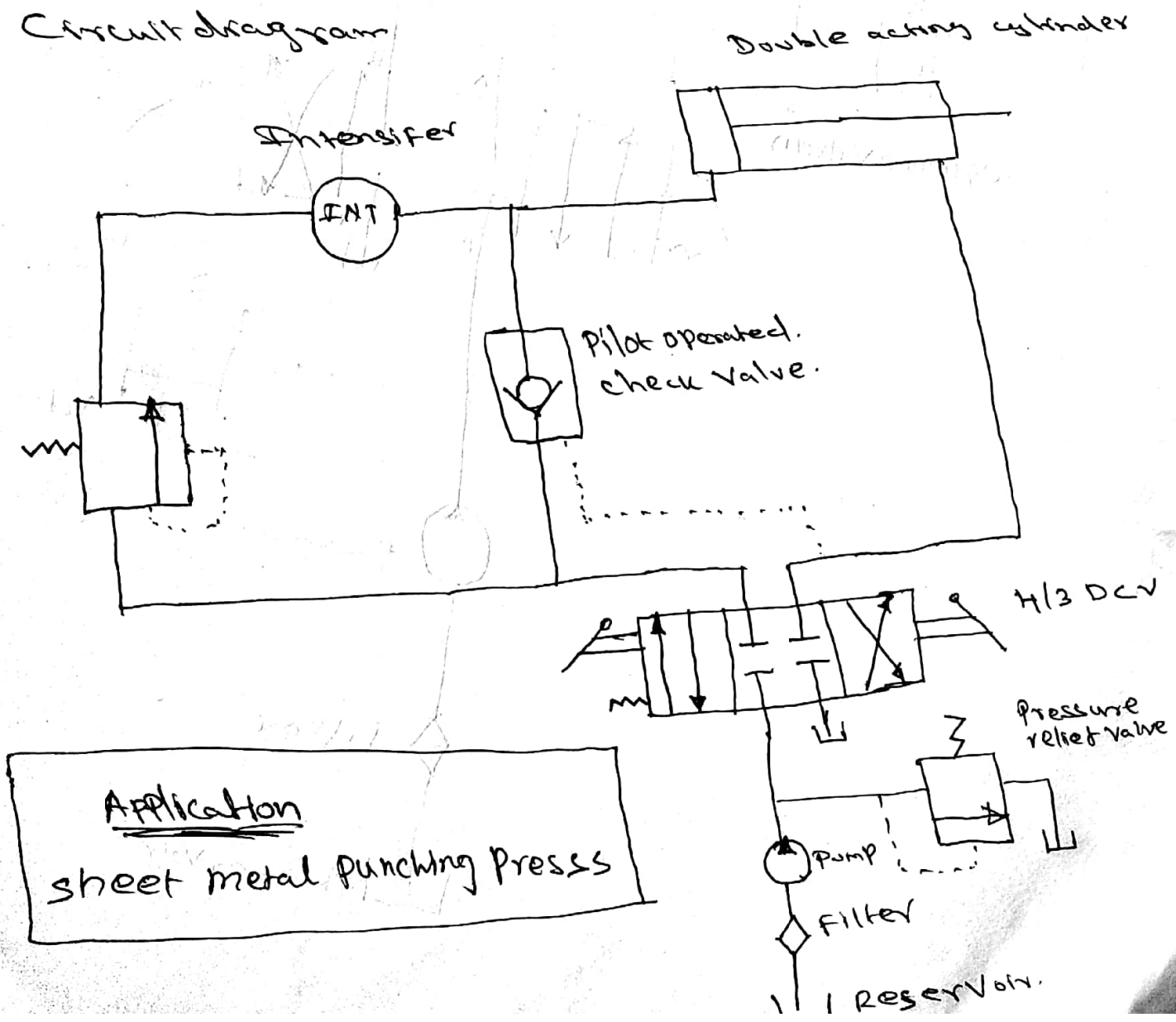
The circuit consist of a (1) reservoir (2) a filter
③ a pump. ④ pressure relief valve ⑤ 4/3 DCV
⑥ two double acting cylinder.

Design following Hydraulic Circuits
 (i) Pressure Intensifier Circuit
 (ii) Sequence Circuit.

(i) Pressure Intensifier Circuit:

In high-low pumping circuit, two pumps are needed to accomplish the different task such as moving the tool at high speed with low pressure pump and performing the punching operation with high pressure pump. But for such case, if pressure intensifier is used in the hydraulic cylinder, then the need for high pressure pump can be eliminated.

Circuit diagram



(ii) Sequence circuit:

Sequence circuits are needed in applications, where it is necessary to perform more than one operation in a definite order.

