Oil Hydraulics and Pneumatics
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Directional Control Valves
Lecture - 34
Part 3: Construction and Application of 3/2 idle return valve, 4/2 DCV, 5/2 DCV and signal conflict

My name is Somashekhar, course faculty for this course.

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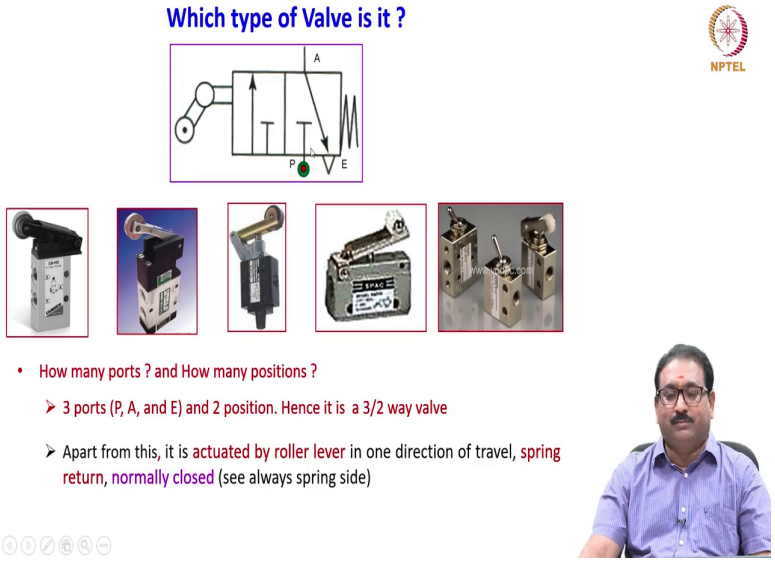

Can you please tell me what is this friends? See some of the features of this. Quickly you will see how many ports are there quickly and how many positions, yes. P port is there, A port is there, E port is there and 2 position; this is a null position, this is actuated position. How it is actuation? Using idle return roller valve you will see roller valve, it is 3 ports, 2 position.

Hence it is a 3 by 2 DCV; immediately we will tell Then it is actuation how it is, apart from this it is actuated by the roller lever in one direction of travel and a spring return normally closed. See always it is a spring side normally closed type.

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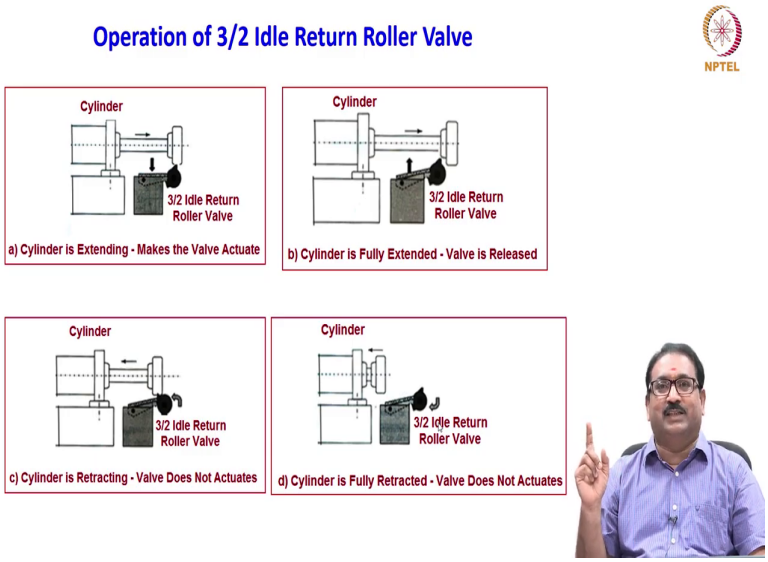

Quickly you will see the operation of 3 by 2 idle return roller valve. I am showing you here idle return valve is placed in the direction of the actuator motion, linear motion. When it will hits it will actuate when it will fully extent, it will released. While coming back it is slide over it; it is not actuated. How it is, we will see with the sketch.

Here we will see friends cylinder is extending now makes the valve actuate, you will see here valve actuated; only once it is. Cylinder is fully extended, you will see valve released air

released. Here you will see cylinder is retracting valve does not activates here after retracting completely also valve does not actuate.

Meaning at only in one instant it is actuated, then it is released. This is a plenty of application in pneumatic circuit when you are handling the multiple cylinders to overcome the signal conflicts. We will see these things when we are discussing the circuits.

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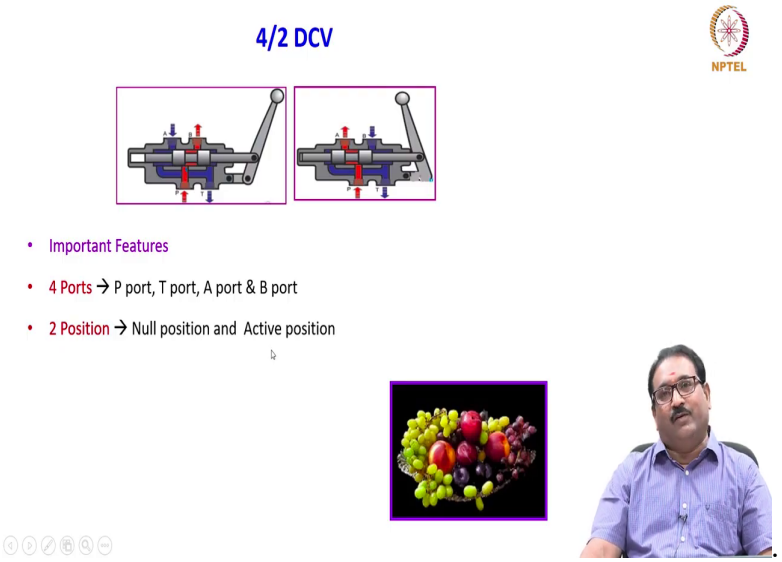

Now, we will move on to very quickly the 4 by 2 DCV meaning very quickly we tell 4 ports are there, 2 positions. What are 4 ports? See the figure here, 4 port immediately you will tell pressure port should be there, tank port should be there; A and B port should be there. A and B are the working ports, then meaning it is double acting cylinder having two ports.

Quickly important features, 4 ports, P port, T port, A port and B port. 2 position null position and active position. Null position is always achieved through the stiff spring active position any one of the actuation method.

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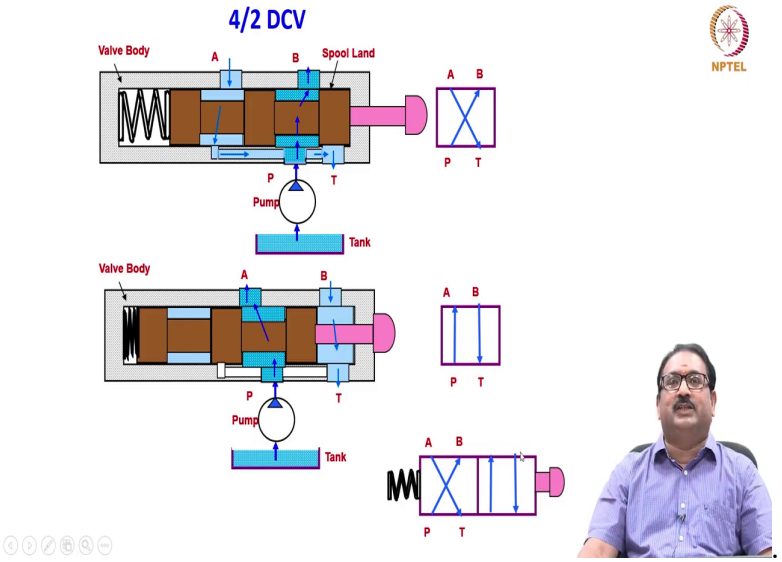

Quickly we will see the constructional feature here friends. This is the valve body. How many ports are there? A port, B port, P port and a T port, T is a tank port. You will see in this configuration. Using the stiff spring, they made an arrangement such a way that P is connecting to B and A is connecting to T. How A is connecting look here, small groove is cut and it is connecting to tank.

This is P is connecting to B, A is connecting to T, this is a valve position when the valve is in null position. This is called a crossed configuration. When you will [FL] this button, what happen? It will reverse. What happen? P is connecting to A and B is connecting to T. How it

is? By pushing this, the spring will compress making the connection P to A, B to T; this is parallel configuration.

Then one more pressing friends automatically spring will push back to achieve the crossed configuration alone. How to represent these two completely? Completely represented by the symbol like this. What is this? You will see crossed P is connecting to B, A is connecting to T with the spring stiff spring at the spool land.

When you will press this button, how to how to read this? P is connecting to A, B is connecting to T, but do not write here any symbol here. Always the numbers are engraved on the valve body at a null positions, please understand friends then quickly we will see the.

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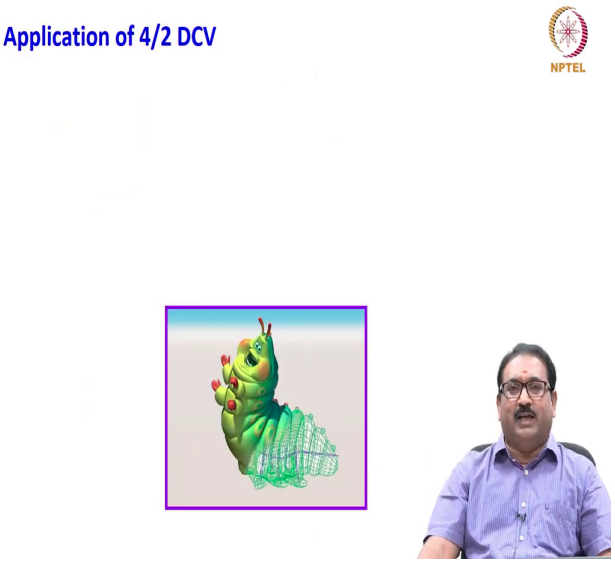

As I have told you 2 ports are there, working ports then application is very simple.

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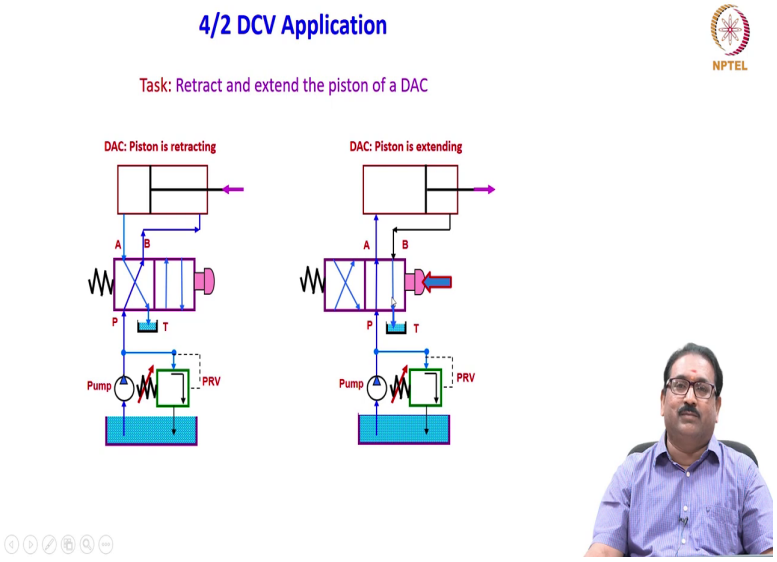

Retract and extend the piston of a double acting cylinder DAC see here. Always shall I connect here or here, you will as I have told you always the initial figure is piston is in the retracting position. You will see crossed configuration P is flow is sending to the tail side or a rod side, the head side flow is going to the tank.

When you will press this parallel configuration, what happen? Pump flow is coming to the head side, then it will push whatever the flow is here, it is going to the tank. It is a crossed configuration. After pushing, it is going to the parallel configuration.

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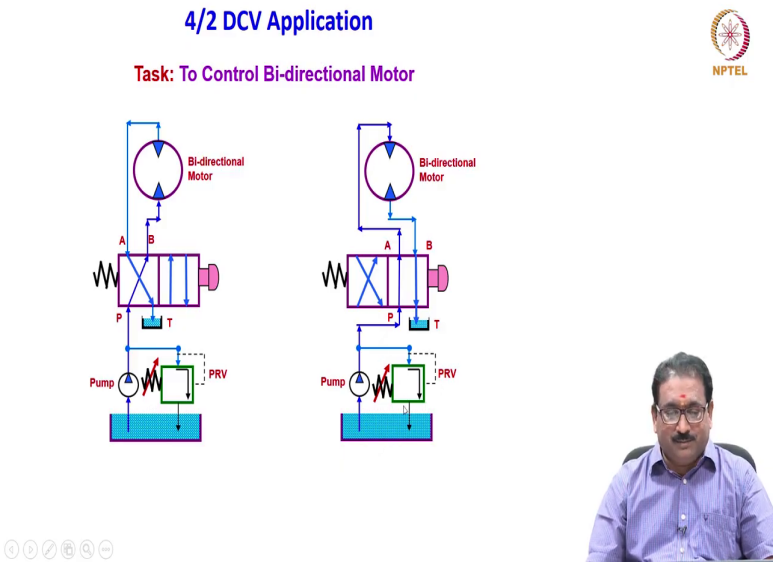

The same way the 4 by 2 DCV is also used to control the bi directional motor whether it is a air motor or a hydraulic motor. Meaning what for it is, once one position this is rotating in the clockwise direction. When you will move to another position, it will move in the anti clockwise direction.

Based on which direction you want torque and a motor speed, you will do it by using the 4 by 2 DCV along with the your motor. You will see here, this is the bidirectional motor; you already seen the symbols here, triangle is inverted here connected to the four by 2 DCV the pump flow you will see here. It is rotating in one direction whatever the flow is going to the other side. When you will press this, the flow is reversed. Correct friends, very simple it is.

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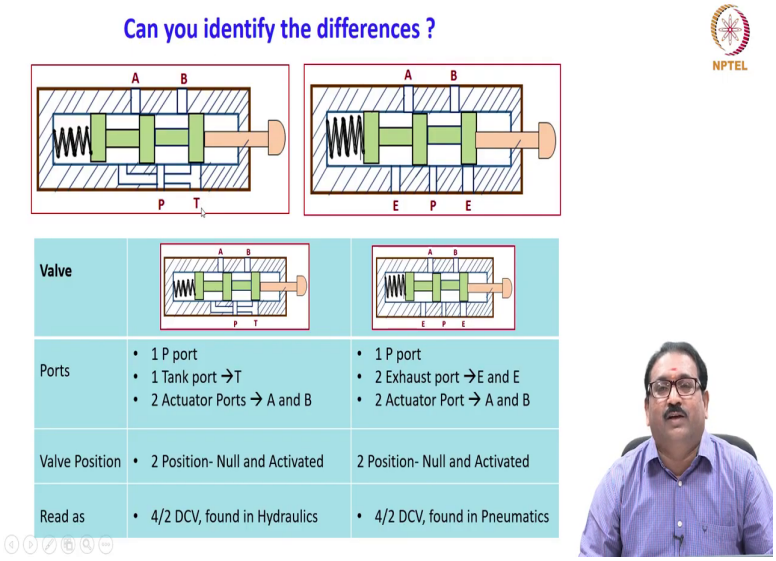

Then can you please tell me what is a difference between these 2 valves? Slowly you will see, I have shown the cut section model also just send this, think it. Please 1 minute. Think how many ports are there without actuation and how ports are connected after pushing the button, how ports are connected. You will see friends very carefully how many ports are there here? By seeing this very quickly you have to tell P port, T port, A port, B port.

And what is how many ports are there here friends? P port, E port, E port, A port, B port. Then question arises, sir this is a 4 port, this is a 5 port. The position also as usual 2 position, then shall I call it as a 4 by 2 way DCV or shall I call it as a 5 by 2 DCV according to number of ports. Let us we will see now it is.

Ports are 1 P port is there, 1 tank port is there, 2 actuator port. Here you will see in this sketch 1 P port is there, 2 exhaust ports are there, E and B, E and E are 2 exhaust ports 2 actuator

port A and B, valve position. As I have told you, null position and activated position null position activated 2 position.

It is read as a 4 by 2 DCV found in hydraulics. This is 4 by 2 DCV found in pneumatics. What is a meaning friends here? See here the exhaust ports are kept open to the atmosphere after doing the work, but here you should not leave the oil either in the crossed configuration or a parallel configuration.

The oil should you have to sent to the tank because they are petroleum based fluids, easy to catch the fire in the hydraulics. That is why the 4 by 2 DCV of the hydraulic valves are expensive as because they will cut internally at here, they will not do like this.

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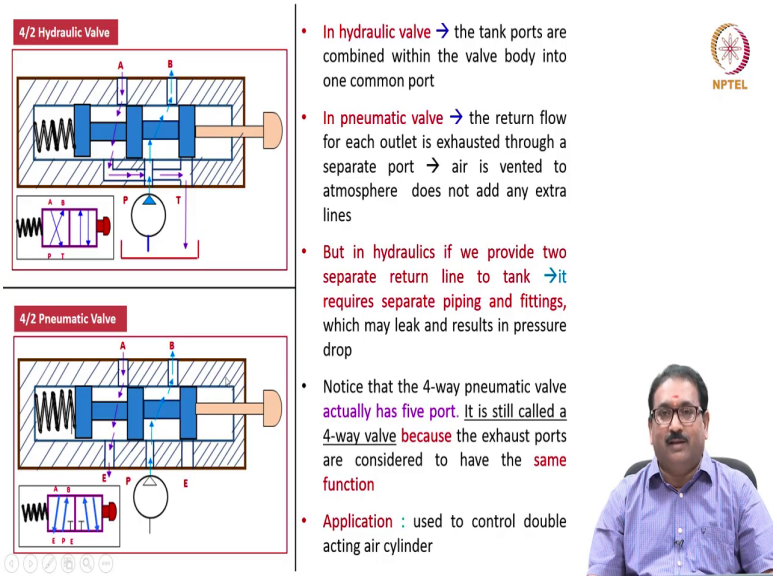

Quickly we will see this futures very quickly 4 by 2 same valve, 4 by 2 hydraulic valve it is what I have shown, here 4 by 2 pneumatic valve 4 by 2. How to represent? You will see friends. Two exhaust ports are there. Here how it is P is connecting to B meaning it is retracting the flow in the head side it is A is going to E. When we will push this, what happened friends? P is connect P is connecting to A and B is connecting to exhaust with actuation.

Quickly we will see this. In hydraulic valve, the tank ports are combined. See here tank ports are combined within the valve body into one common port. In pneumatics the return flow for each outlet is exhausted through the separate port air is vented to atmosphere does not add any extra lines.

But in the hydraulics if you provide a 2 separate lines not cutting this cavity, what happen? Again the piping systems all are required, it adds to the cost. Notice that the 4 way pneumatic valve actually has a 5 ports, it is still called a 4 way valve because the exhaust ports are considered to have the same function. Application here is used to control double acting air cylinder.

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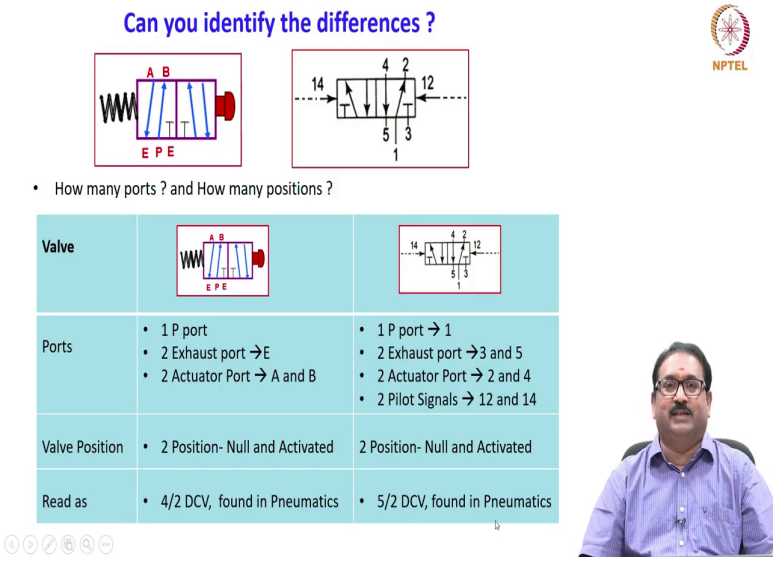

Another category, can you please identify the difference between the valve what I have shown here? How many ports are there here? You will see already you know this, this is a 4 by 2 way valve.

Here also same here. I am not written the E P A B instead of that one in sometimes in pneumatic valves are represented 1, 2, 3, 4, 5. Here 1 is a please understand, it is a pressure port 3 and 4 are the exhaust port, 2 and 4 are the A and B. This will come by practice, then 14 and 12. How it is? You will see.

What is this? Yes pilot operated symbol it is, then you will see the some features of these 2 valve. 1 pressure port is there, 2 exhaust port, 2 actuator port A and B here, 1 P port is there

that is the one in the symbol; 2 exhaust port 3 and 5 in pneumatics mostly, they will represent like this 2 actuator port 2 and 4 and 2 pilot signal 12 and 14.

Positions how many position? This position, this position, this position, this position meaning only 2 positions are there in the each valve. The null position, activated position. Then how to read this friends? As we know already, we have read this even though exhaust ports are 2 function is same meaning vent the air that is why it is a 4 by 2 DCV found in pneumatics.

Here also you will see friends, same similar to this apart from that one exhaust port meaning the 12 and 14 treated as a one function meaning opening either the let position or a right position; pilot signal operation is to switch over this or a this. Hence it is a only one function, hence it can be read as a 5 by 2 DCV. It is also found in the pneumatics.

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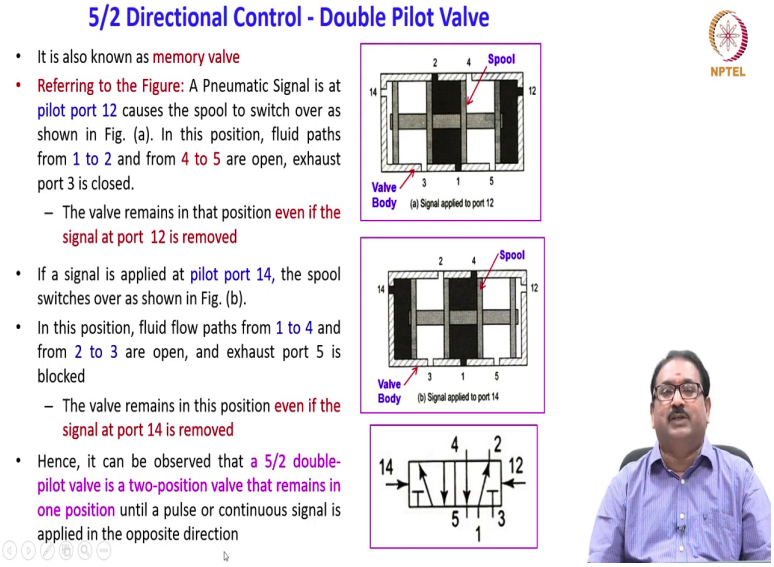

Then operations, I will tell you very quickly. This 5 by 2 operations, you will see this is a spool valve. The ports are there. Here as I have told you, one is a pressure port 3 and 4, 3 and 5 are the exhaust port and 2 and 4 are the your actuator ports, 12 and 14 are the pilot signals X and Y whatever it is capital letter or here it is 12 and 14.

Let us we will see it is also known as a memory valve, 5 by 2 way valve is a memory valve it is also known as referring to figure. A pneumatic signal is at 12 now, you will see here causes the spool to switch over as shown in the figure here 12 is applied here. In this position, what happened? Friends here 4 to 5 meaning 4 is venting the fluid here then 1 is connecting to 2.

Meaning 1 to 2 means, it is extending cylinder is extending correct 3 is closed the valve remains in that position. Even if the signal 12 is removed because it will always in this positions. If the signal is applied at the 14, the spool switches over as shown in the figure here meaning what happened friends here, you will see.

One pressure port is connecting to 4 and 2 is connecting to 3 meaning cylinder will retract. But you will remember even 14 is removed, it remains in this position until 12 will come. In this position, the fluid flow from as I have told you 1 to 4, 2 to 3 and exhaust port 5 is blocked. The signal remains in this position even if the signal at the 14 is removed that is why it is called memory valve.

Hence it can be observed that a 5 by 2 double pilot valve is a 2 position valve that remains in the 1 position until a pulse or a continuous signal is applied in the opposite direction.

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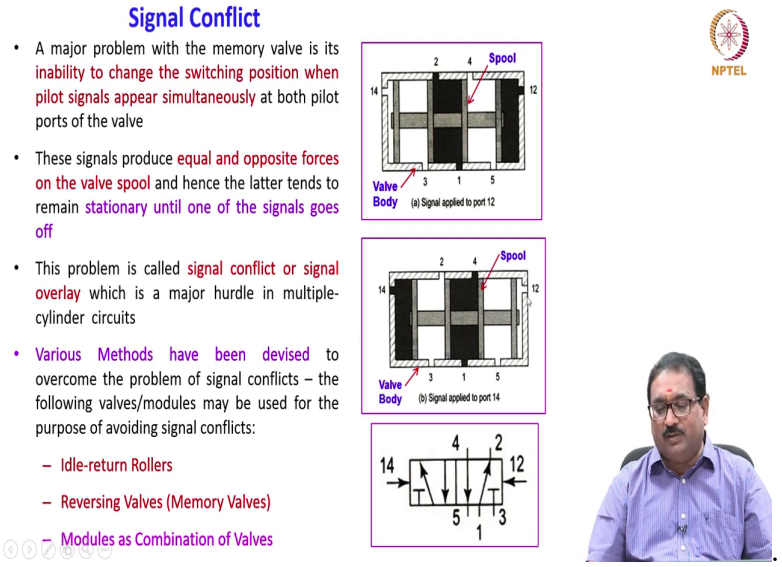

This what you can call it as a signal conflict. A major problem with a memory valve is its inability to change the switching position, when the pilots signals appears simultaneously at both pilot ports.

For example signal is coming from the 14 and 12, it cannot switch over. It is get confused to hang valve will hang. These signals produced equal and opposite forces on the valve body and hence the latter tends to remain stationary until one of the signal goes off. This problem is called a signal conflict or a signal over lay which is a major hurdle in the multiple cylinder circuits.

Various methods have been developed to overcome the signal conflicts. The following valves or a modules may be used for the purpose of avoiding the signal conflicts. Idle return roller

valves, reversing valves are also known as memory valves and a modulus as a combination of valves. These things we will discuss when we are designing the circuits.

Now, you will remember this 5 by 2 a valve is a memory valve, it will operates only when 12 is coming. It will connects 1 to 2 and 4 to 5. When 13 pilot signal is coming, it is connecting 1 to 4 and 2 to 3. If 2 signals will come, it will not switch over. It is known as signal conflicts.