Oil Hydraulics and Pneumatics
Prof. Somashekhar S
Department of Mechanical Engineering
Indian Institute of Technology, Madras

Part 2: Break down of a control chain, Hardware arrangement for signal flow, Building-up the circuit diagram, Pneumatic circuits-single-acting cylinder, Pneumatic motors, Double-acting cylinders, Quick exhaust valve
Lecture - 75
Pneumatic Circuits: Design and Analysis

My name is Someshekhar, course faculty for this course.

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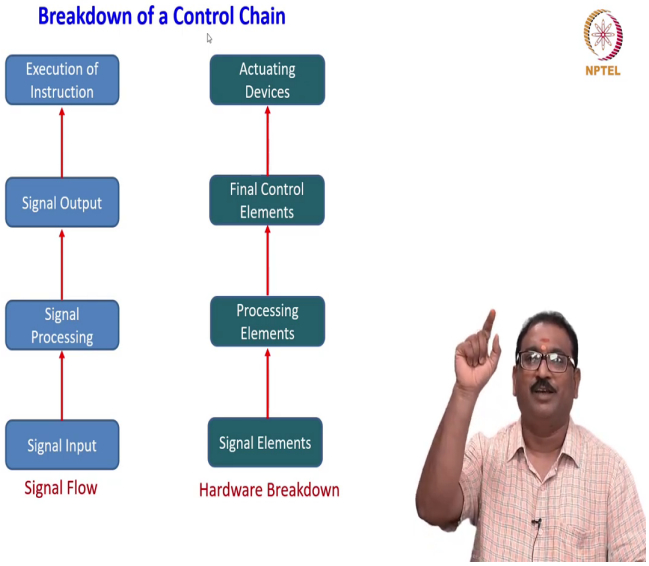

After knowing some of the unique valves in the pneumatics let us we will see the Breakdown of the Control Chain. Here you will see the signal flow from the signal input, signal

processing, signal output and execution of instructions like this they are divided let us we will see what are these.

In the signal input the hardware breakdown is like this. Signal elements here processing elements, final control elements, actuating elements. You will see the control chain to do the work all the elements are divide signal will flow from the bottom to the up. Similarly we have to choose the hardware breakdown is from here we are going up to the actuating devices this is known as breakdown of the control chain.

How the signal will flow from the bottom to the up starting with signal input, signal processing, signal output, execution of instruction. Similarly, hardware, signal elements, processing elements, final control elements, actuating.

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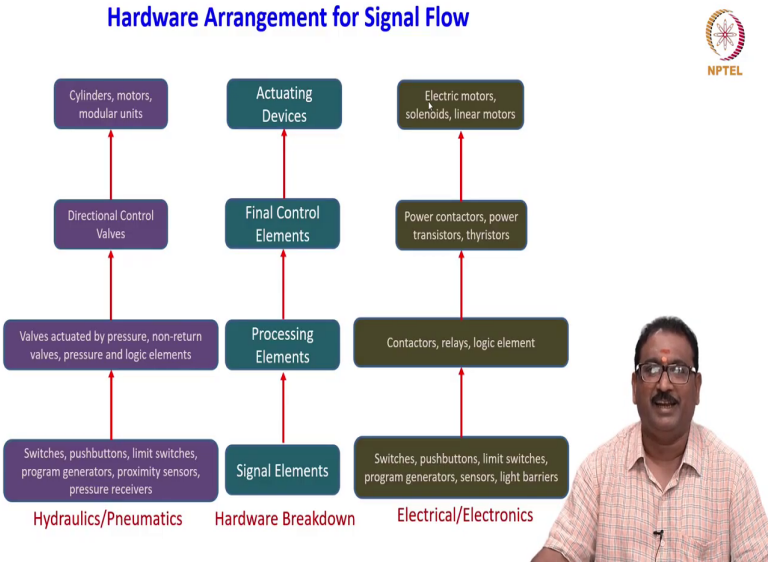

Now, I will show you the hardware arrangement for the signal flow both for hydraulics and pneumatics and I am comparing to the electrical how it is. Hardware breakdown you are seeing already signal elements, processing elements, final control elements, actuating devices. How they are there in the hydraulic and pneumatics?

Here signal elements are switches, push buttons, limits switches, program generator, proximity sensors and a pressure receivers. Processing elements are valve actuated by the pressure, non return valves pressure and logic elements. Final control elements here directional control valves and actuating devices what we will call drive elements are cylinders, motors and modular units.

Similarly, we will see in the electrical and electronics, the signal elements are switches, push buttons, limit switches, program generator, sensors and a light barriers. Here processing elements are the contactors, relays, logic elements. The final control elements are power contactors, power transistors and thyristors. Actuating devices or electric motors, solenoids and a linear motors.

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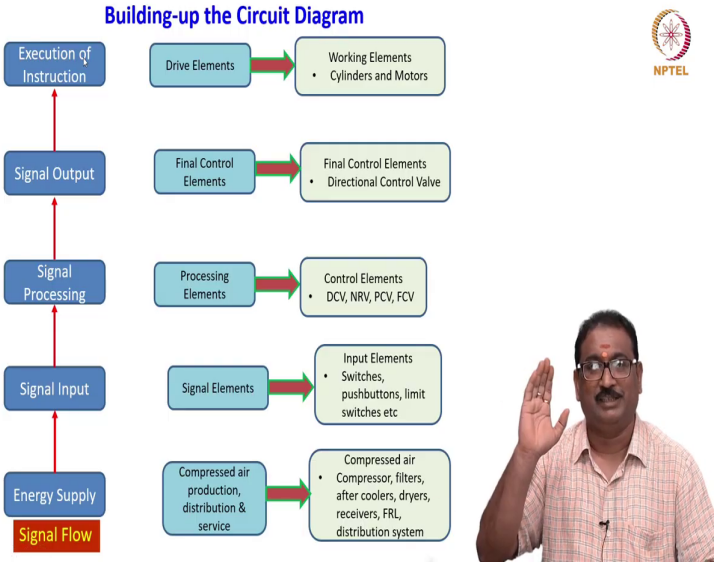

Now, I will show you the building-up the circuit diagram how it will go. Seen here I am starting with the signal flow always from the energy supply to the execution of instruction from the actuators. How it will go I will show you now. You will see here energy supply always, here in the pneumatics a compressed air production distribution and a service.

How it is? Using the compressors, filters, air coolers, dryers, receivers, FRL unit and later through the distribution system you are seen the looping system many things air will pass on to the control valves. Now, signal input here, signal elements or the input elements how it is? Switches, push buttons, limit switches and many more.

Now, signal processing- processing elements are all control elements like a directionally control valves, non return valve, pressure control valves and flow control valves then here signal inputs are final control elements as I have told you direction control valves are very

very important generally it is a as I have told you 5 by 2 a valve, which is receiving the signal form pilot operated to operate the main valve this is a final control element is a direction control valve.

Next execution of instruction through the drive elements like a cylinders and a motors. This is how we will build the circuit. How energy will signal will flow from the input energy supply to the execution of instructions understand these friends very neatly, same way we are building the circuits.

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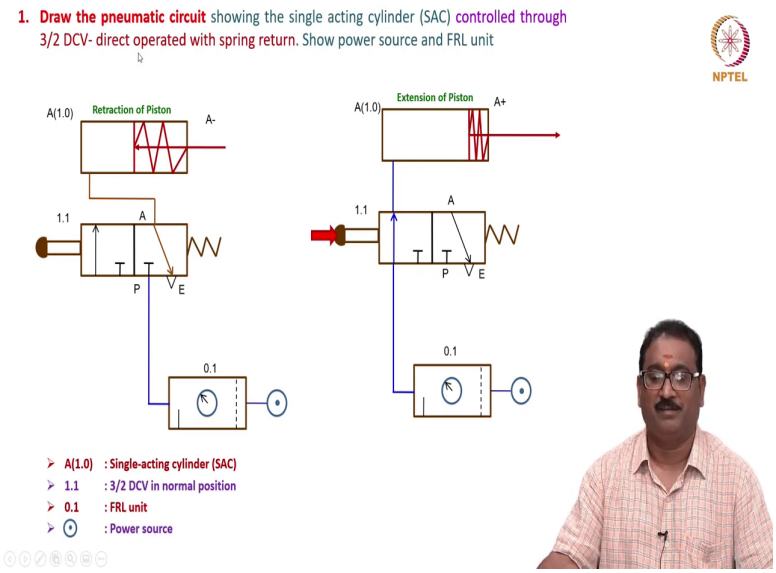

Now, let us we will move on to the a task based circuit selection and element selection and circuit drawing. Draw the pneumatic circuit 1st problem, showing the single acting cylinder SAC, controlled through 3 by 2 DCV-a direct operated with a spring returns. Here very important thing in pneumatic circuit you have to show the power source and FRL unit.

Even though they will not ask you to show the power source meaning what how to show the power source you no need to draw the what I will call compressors, electric motor all the things. You have to draw the circle with dots as I have told you here. Here you will see the circuit how it is?

It is already we know that it is a single acting cylinder and 3 by 2 DCV always you have to connect to the exhaust port meaning it is in the retracted position from the head side you have to take the air here correct. Then you list it the components as I have told you cylinders are represented A 1.0, if it is two are there B 2.0 like this correct.

Here A 1.0 is a single acting cylinder, 1.1 valves should be named here 1.1 is 3 by 2 DCV normal position meaning in the null position exhaust position using the spring. FRL unit 0.1 is a FRL unit and then here this is a power source these are the component I have used. Now you will see very simple it is if I will press this button what happen?

The head side will receives the energy pneumatic energy and it will extends what happen? A plus will takes place when more pressing of this automatically shift to the this position. Then cylinders will retract that is A minus how I am doing here by pressing the 3 by 2 DCV direct operated.

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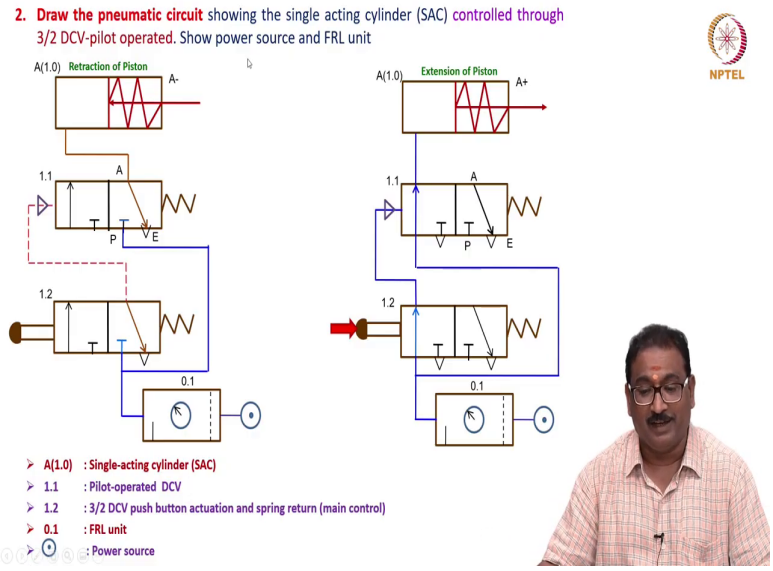

Now, let us we will move onto the one more problem, draw the pneumatic circuit showing a single acting cylinder again controlled through 3 by 2 DCV-pilot operated show the power source and a FRL unit. 3 by 2 is there know previously push button. Now, I want to put a dotted line, this is controlled in turned through the other valves like a 3 by 2 or 2 by 2 whatever it is.

The circuit looks like this see here it is a pilot operated valve it is, the pilot signal. This is controlled again I am doing one more 3 by 2-way valve or you will use 2 by 2-way valve on or off valve you will use. Now, I am showing you here always the actuators are in the retracted position where you will connect to this 3 by 2 pilot operated valves always it will be in the exhaust position.

Here also you will see in the exhaust position here one again you will list it out the component friends the A 1.0 is a single-acting cylinder, 1.1 is a 3 by 2, 1.1 is a pilot operated DCV, here 1.2 is a 3 by 2 DCV push button actuation spring return correct. 0.1 is a FRL unit it is a power source when you will press this, what happen?

The energy will come here then actuation will go here then what happens the energy will go to here and to the head side then it will extend otherwise it is a interacted position A minus always you have to show A minus. You will see here when I will push this button the energy will come here it will actuate this position a pneumatic energy will come here, pass here to the head side, it will effect in the A plus positions.

Here it is controlled through the 3 by 2 pilot operated valve not directly through the 3 by 2 push button actuations. How to select, how to draw based on the task you will remember.

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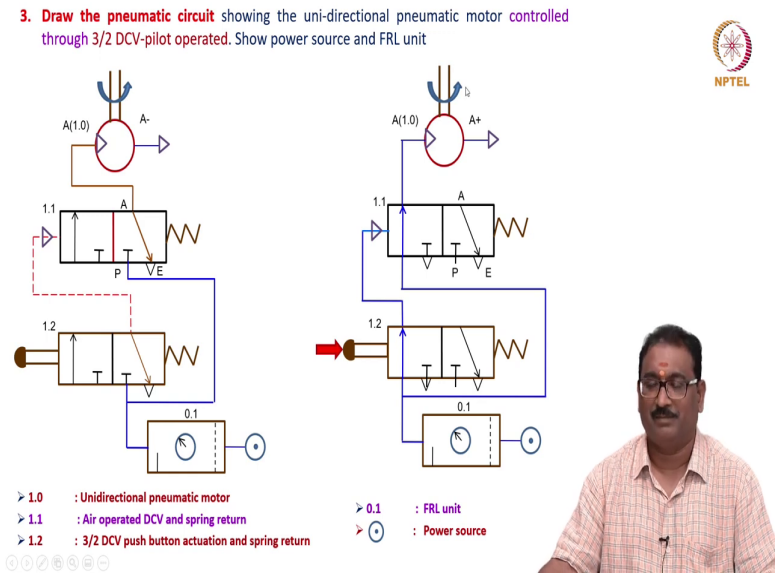

Next, one more we will see friends now. Draw the pneumatics circuit showing the uni-directional pneumatic motor controlled through 3 by 2 pilot operated DCV. Show the power source and FRL. It is similar to previous one, but only thing you have to remember how to represent the unidirectional air motors that is all. Otherwise, it is same you will see here this is a circle with triangle inside no do not fill it is a exhaust.

Always you have to show in the A minus positions meaning it is in the exhaust port you will see same it is exhaust port. Then same you will represent all the parts here A 1.0 is now a unidirectional pneumatics motor or air motor all the components are same 1.1 is a again it is a 3 by 2 pilot operated valves.

1.2 is a push button actuation and spring return, 0.1 is the FRL unit power source correct friends. When you will press this what happen when you will press this signal will come and

actuate the left position of the pilot operated valves, then pneumatic air will come here, enters here and it will rotates.

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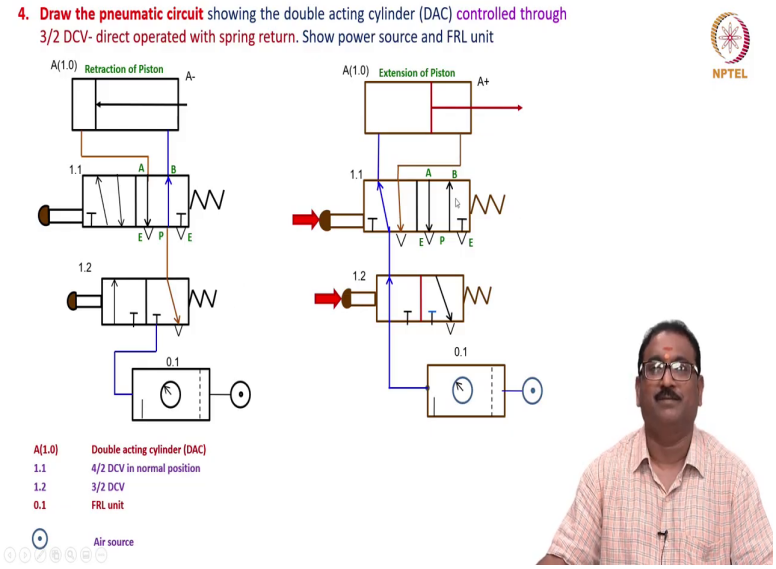

Remember move on to the 4th problem draw the pneumatic circuit showing the double acting cylinder controlled through the 3 by 2 DCV direct operated with a spring return. Show the power source and a FRL unit. Now, we have to control the double acting cylinder. Double acting cylinder has the two ports which is controlled through the 4 by 2 DCV.

Again this 4 by 2 DCV we have to controlled through the 3 by 2 DCV like this it is how it will, you will see now circuit. Now, we will see friends here this is a double acting cylinder two ports are there which is connected to the 4 by 2 DCV you will see how to connect you auto practice correct?

Always you will connect first P port to the tail side head port is connected to the retracted then only you will get the A minus, this is connected to the again exhaust correct. When you will press this and this the energy will come here go to the head, then only it will extends when again pressing of this automatically shift here again automatically it will go to here remember this very very simple.

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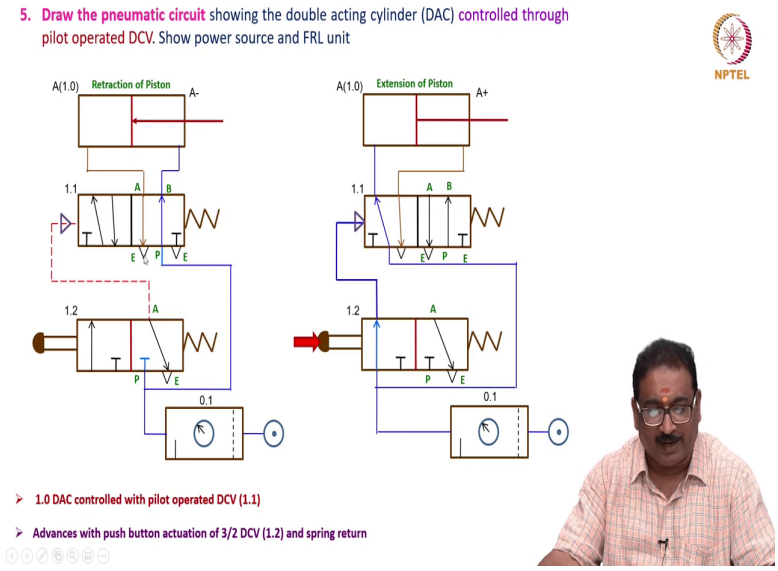

Now, we will move on to the 5th problem draw the pneumatic circuit showing the double acting cylinder controlled through pilot operated DCV. Show the power source and FRL units. Same here you will see here I am using the pilot operated valves correct? Previously, I used a push button now no need to worry now here friends you will see here it is a pilot operated DCV 4 by 2 DCV whatever you will call.

Here it is a 3 by 2 DCV controlling the whole operations all are connected in the you will see always in the retracted position cylinder is in A minus position correct when you will press here 1.0 is a DAC correct? Double acting cylinder with a pilot operator DCV 1.1, advances with the push button actuation of 3 by 2 DCV 1.2, which is a spring centered.

You will press this, what happen? Energy will come here the pilot signal will go here actuate this, then the pneumatic air will come here enters to the head side it will extend. One more pressing you will do automatically it will jump to this then retracts whatever the air is there it will go to the atmosphere.

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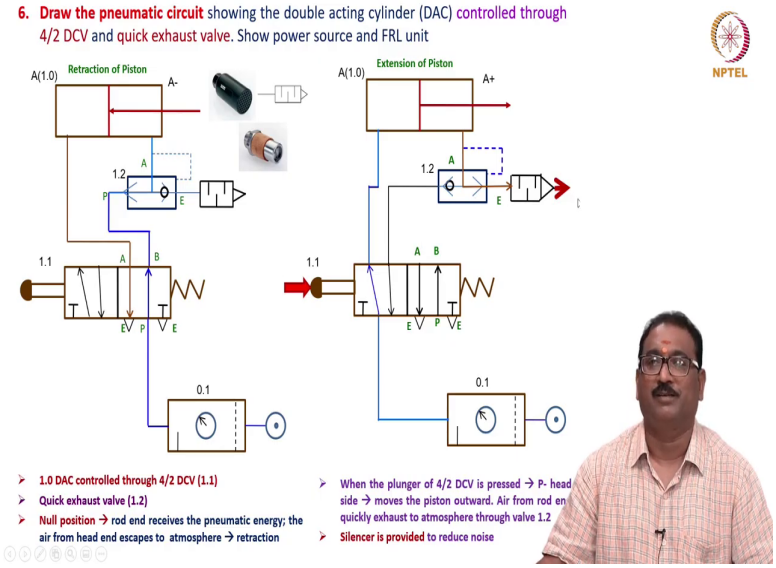

Draw the pneumatic circuit showing the double acting cylinder controlled through 4 by 2 DCV quick exhaust valve. Show the power source and a FRL unit. Now our objective is where to place this quick exhaust valve. As I have told you in one direction it will pass

through the quick exhaust valve and it will do the operation when the air is returning it will directly exhaust to the atmosphere through this opening quick exhaust valve.

Because it is having the bigger port air will pass how to place it you will see in the circuit. You will see here friends, it is a double acting cylinder connected to the quick exhaust valve here correct and this is a silencer otherwise it will make the big sound. Then you will see the in the null position this is the 4 by 2 DCV, push button actuation spring is center.

How I am connecting here? You will see it will go here, it will go here tail end, then it will push here air will come here and always in the retracted positions please understand this. The null position itself it is going. Now, I am listing the component here friends what are those? 1.0 is a double acting cylinder controlled through 4 by 2 DCV 1.1.

It is a quick exhaust valve 1.2 the null position the rod and receives the pneumatic energy the air from the head and it will escape to the atmosphere retraction. When the plunger of 4 by 2 DCV is pressed then what happen? The P side is connected to the head and moves the piston outward, air from the rod and quickly exhaust to the this, how it is?

That is why silencer is provided to reduce a noise the circuit looks like this. When you will press this air will come to the head side it will push whatever the air is there going to the atmosphere it will not coming to the DCV, through the quick exhaust it is going to the atmosphere.