Oil Hydraulics and Pneumatics
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Fluid Power Symbols
Lecture – 10
Part 1 : Introduction to Fluid Power Symbols, Hydraulic lines and Color Coding

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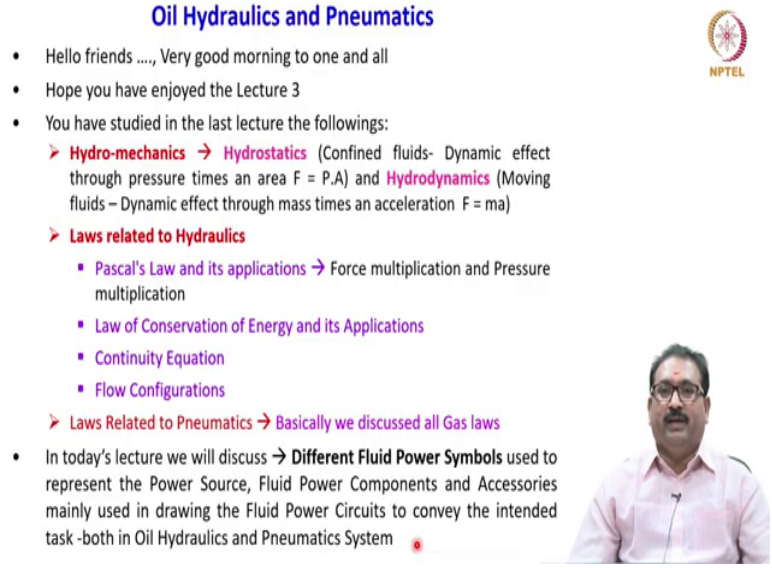

My name is Somashekhar course faculty for this course. Hello friends, very good morning to one and all. Hope you have enjoyed the lecture 3. You have studied in the last lecture the followings.

Hydro mechanics in which we studied hydrostatics and hydrodynamics, hydrostatics for the confined fluids, here we are getting the dynamic effect through pressure times an area. In hydrodynamics for the moving fluids, dynamic effect through the mass times an acceleration.

Next we studied laws of hydraulics in which we studied the Pascal's law and its applications for force multiplication and pressure multiplication. And also we have seen some of the commercial devices like a hydraulic jack, hydraulic lift, air to oil boosters, etcetera.

Laws of conservation of energy and its applications, continuity equations, flow configurations, laws related to pneumatics – basically we discussed all gas laws; Boyle's law, Charles law, Gay-Lussac's, and ideal gas laws. Hope you understood all these things in the lecture 3.

We will discuss different fluid power symbols used to represent the power source, fluid power components, and accessories mainly used in drawing the fluid power circuits to convey the intended task both in oil hydraulic and pneumatic system. Please understand friends, wherever in industry, you will find hydraulic systems in machine tools, transfer lines, robotics you will never see anything physically.

Only thing we required to understand the hydraulics involved in it we required or maintenance people also will ask hydraulics circuit for the system which will portrayed using the fluid power symbols that is why it is a prime importance for the students to understand the different fluid power symbols or a graphic symbols used to represent the various components and accessories. The well-begun is half finished. So, understand these symbols very carefully in the today's class.

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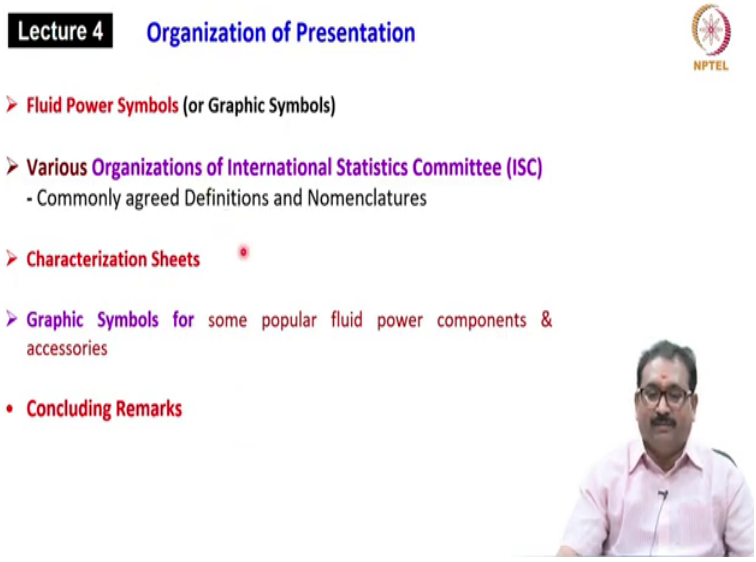

I have made organization of presentation in lecture 4 as follows. The fluid power symbols in some textbooks, you will get the graphical symbols. We will discuss here the various organizations of International Statistics Committee briefly known as ISC. Here the various countries are involved. Their commonly agreed definitions and nomenclatures are seen.

Later we will move on to characterization sheets. Graphic symbols for some popular fluid power components and accessories. But during the course you learn many other symbols also for the various systems in the course. Finally, I will conclude that today's lecture 4 at the end.

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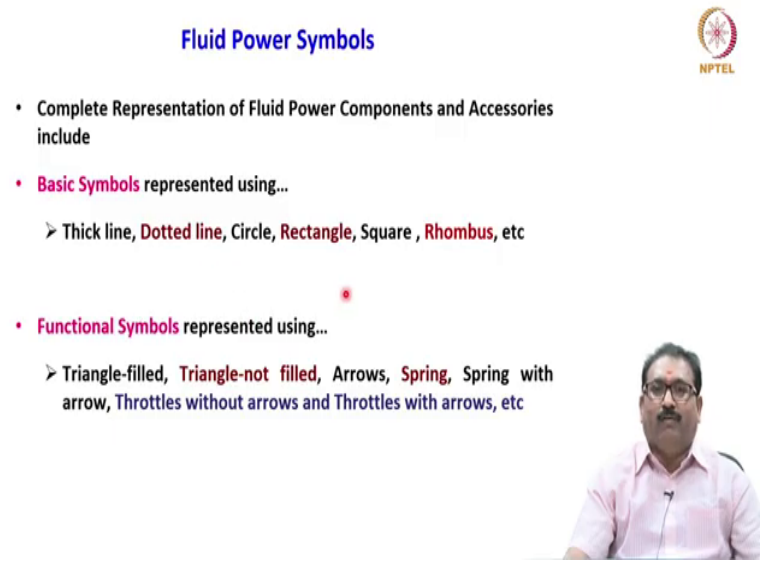

Now, we will see complete representation of fluid power components and accessories include basic symbols represented using thick line, dotted line, circle, rectangle, square, rhombus, these are the basic symbols. Along with this, we are using the functional symbols represented using triangle-filled, triangle-not filled, arrows, spring, spring with arrows, throttles without arrows and throttles with arrows.

Meaning any fluid power symbol consists of basic symbols and a functional symbols, then only it is a complete symbol for the component and accessories.

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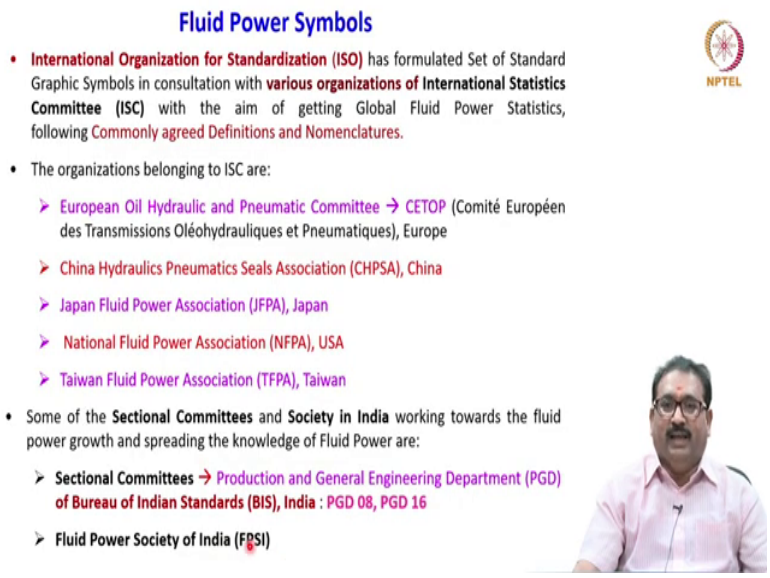

Move onto International Organization for Standardization – ISO has formulated a set of standard graphic symbols in consultation with various organizations of International Statistics Committee with the aim of getting global fluid power statistics following commonly agreed definitions and nomenclatures.

The organizations belonging to ISC are European Oil Hydraulic and Pneumatic Committee briefly known as CETOP; China Hydraulics Pneumatics Seals Association; Japan Fluid Power Association; National Fluid Power Association, USA; Taiwan Fluid Power Association.

Apart from these some of the Sectional Committees and Society in India working towards the fluid power growth and spreading the knowledge of fluid power in the country are Sectional

Committees, Production and General Engineering Committee; this is generally known as PGD of Bureau of Indian Standards – BIS.

Here these are the two sectional committees PGD 08 and PGD 16 for the fluid power growths and fluid power society of India also working towards the fluid power growth in India. Let us I will give you some of the features of fluid power society of India in the next slide.

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This Fluid Power Society of India was established in 1973 is a non-profit professional body committed in promoting fluid power knowledge and technology in the country. It has made remarkable progress over the last 4 decades in Education, Research, and Technological service by facilitating and effective connection between professionals in the field of Fluid Power.

Today, its services are available to a massive network of more than 1500 members including industrial and institutional members spread across the Indian subcontinent. Besides the registered office in Bangalore, the Regional Chapters at Chennai, Hyderabad, Mumbai and Pune are equally active in spreading the knowledge of Fluid Power by conducting the expert lectures, seminars, conferences.

As a part of the Industry-Academia Initiative, student chapters have been opened in various engineering colleges to enable student to do apprenticeship programs in fluid power companies, facilitate industrial visits to FPSI member companies, award engineering projects to the students and to develop their leadership qualities in the fluid power system. Focused sessions are also allotted in technical seminars for student project presentation on oil hydraulics and pneumatics.

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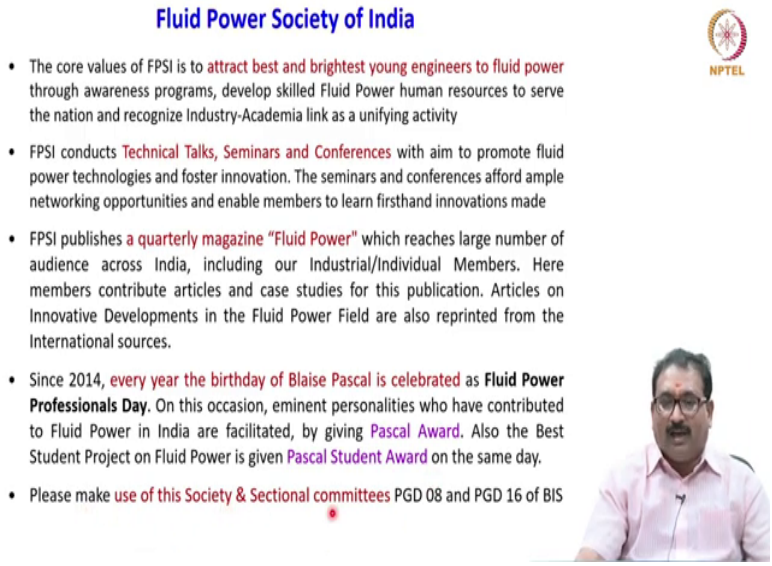

The core values of FPSI is to attract best and brightest young engineers to fluid power through awareness programs develop a skilled fluid power human resources to serve the nation and recognize Industry-Academia link as a unifying activity. FPSI conducts technical talks, seminars and conferences with aim to promote fluid power technologies and foster innovation. The seminars and conferences offered ample networking opportunities and enable a members to learn firsthand innovations made.

Also FPSI publishes a quarterly magazine known as Fluid Power which reaches a large number of audiences across the India including our industrial, individual members. Here members contribute articles and case studies for this publication. Articles on innovative developments in the fluid power field are also reprinted from the International resources for the benefit to the students and industry people.

Since 2014, every year the birthday of Blaise Pascal is celebrated as a Fluid Power Professional Day. On this occasion, eminent personalities who have contributed to Fluid Power in India are facilitated, by giving Pascal Award.

Also the Best Student Project on the Fluid Power is given Pascal Student Award on the same day. Dear friends, please make use of this society and a Sectional Committees PGD 08 and PGD 16 of BIS India to understand the growth, development, innovations on fluid power technology.

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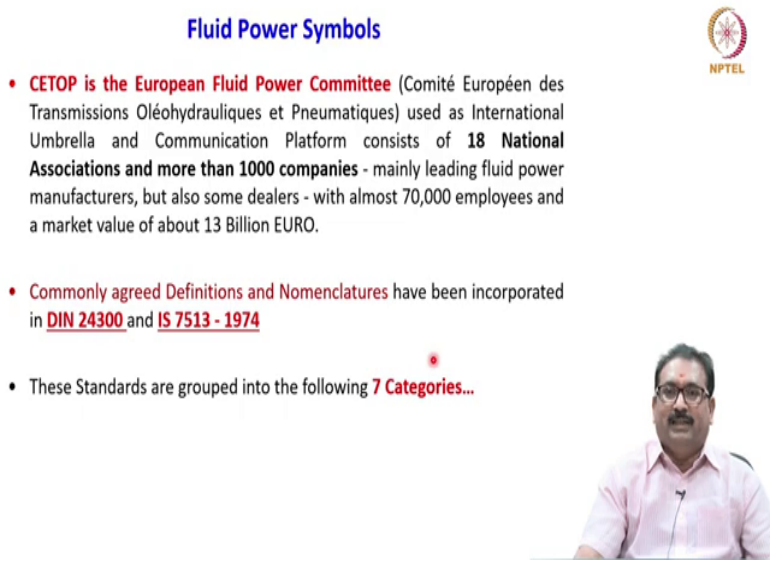

Now, we will move on to CETOP is the European Fluid Power Committee used as International Umbrella and Communication Platform consists of 18 national associations and more than 1000 companies - mainly leading fluid power manufacturers, but also some dealers with almost 70,000 employees and a market value of about 13 Billion EURO.

Commonly agreed definitions and nomenclatures have been incorporated in DIN 24300 and IS 7513-1974. These standards are grouped into 7 categories. I will explain to you what are these categories to represent the fluid power component accessories and a systems.

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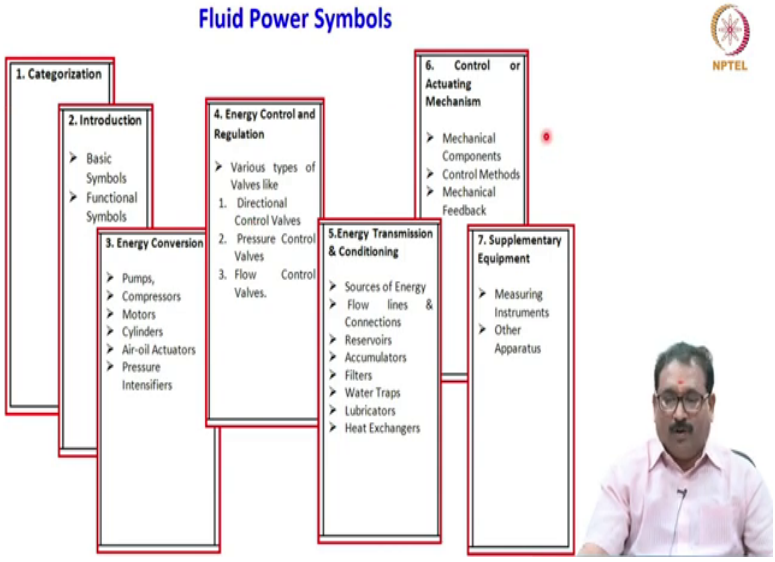

These 7 categories includes the categorization, introduction which includes the basic symbols and a functional symbols used to represent the fluid power components. Energy conversion, which includes the pumps, compressors, motors, cylinders, air-oil actuators, pressure intensifiers. The fourth categorization includes energy control and regulation which includes the various types of valves, direction control valves, pressure control valves, flow control valves.

The fifth category includes energy transmission and conditioning elements, sources of energy, flow lines and connections, reservoirs, accumulators, filters, water traps, lubricator, heat exchangers.

The sixth category includes control of actuating mechanisms; includes mechanical components, control methods, mechanical feedback. Last but one very important is

supplementary equipments for measuring instrument and other apparatus. These are the 7 categories are used in the field power symbols.

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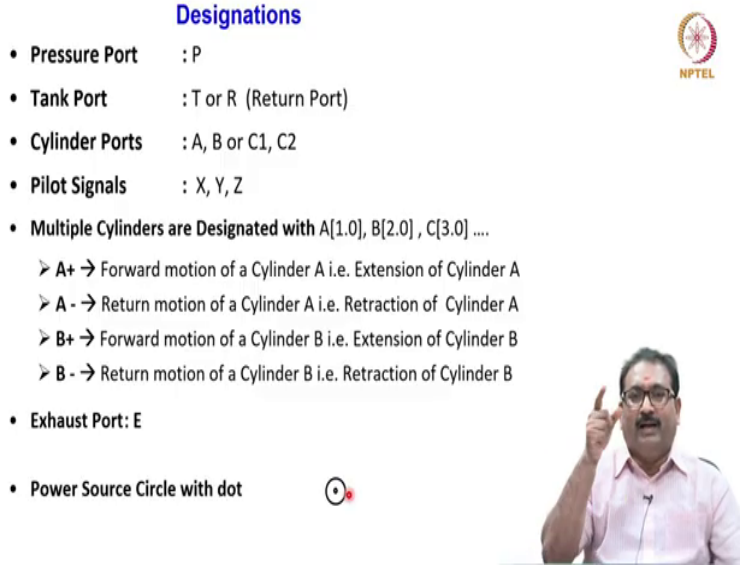

Now, I will quickly I will give you the designations which are popularly used in the circuit design. The pressure port always represented using the symbol P. Tank port, you use T or R, R is also known as return ports. These are reserved word friends remember. Cylinder ports, if it is double acting cylinder that time A and B; similarly use C 1 or C 2 anything. Pilot signals or a control signals, they are represented using X, Y, Z.

If you are using the multi cylinders that time, they are represented in the circuit as A square bracket 1.0, B square bracket 2.0, C 3.0 like this based on how many multi cylinders are used in the circuits.

Also you will remember friends when I will use a plus in the circuit it designates the forward motion of the cylinder A, and A minus return motion of the cylinder A; similarly, B plus for the forward motion of the cylinder B, B minus – return motion of the cylinder B.

Exhaust port, this is generally in the pneumatics they are using E for the exhaust port. Then power source represented circle with dot. You no need to draw the pump, pressure relief valve, tank or many things. Only we will write the circle with dot, then you will start drawing the circuits connecting to the directional control valves and flow control valves and actuator. This is a very quick way how to represent the power source; it is a circle with a dot.

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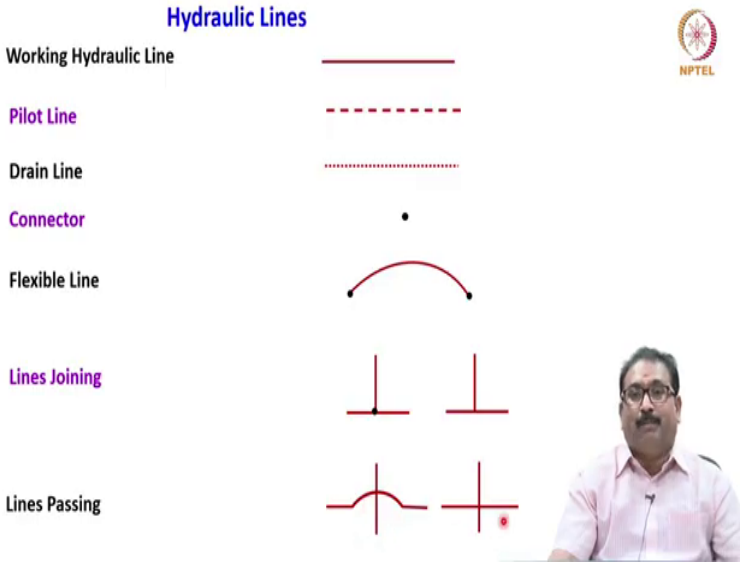

Then hydraulic lines, the working hydraulic lines are shown with thick lines; pilot lines are represented using the dotted lines; drain lines are also dotted lines, please understand the length of the lines in the pilot lines and a drain lines. Connectors are represented circle –

filled circle. Flexible hoses or flexible lines represented like this. Line joining with dot or without dot both are using. Line passing a connections, they are represented like this.

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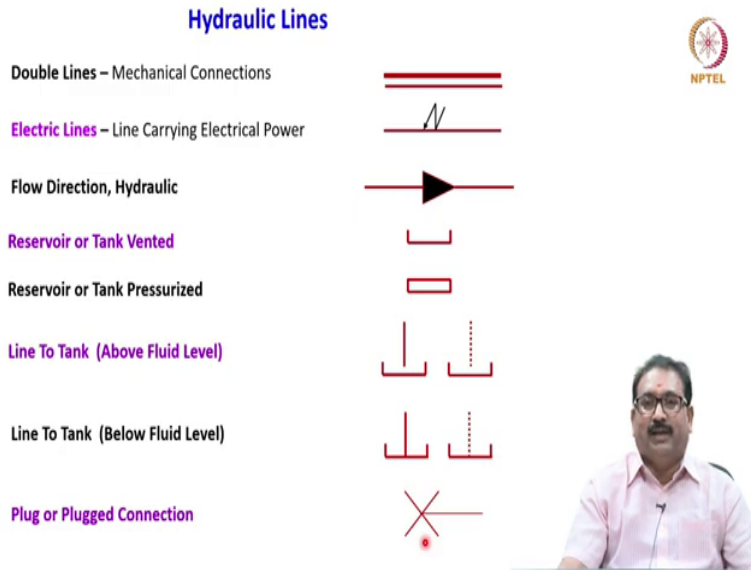

Double lines used for mechanical connection, when I will use the thick and thin line, they will for the mechanical connections. Similarly, electric lines, line carrying electric power is represented like this. Flow direction, hydraulics – triangle filled. Reservoir or a tank vented simple like this. Vented means atmospheric pressure is acting over the tank, they will represent like this.

Reservoir or a tank pressurized closed; you will see here how it is. Line to tank above the fluid level, they are represented like this you will see the line where it is. Line to tank below the fluid level they represent like this. Plug or a plugged connections are represented using this graphic symbol.

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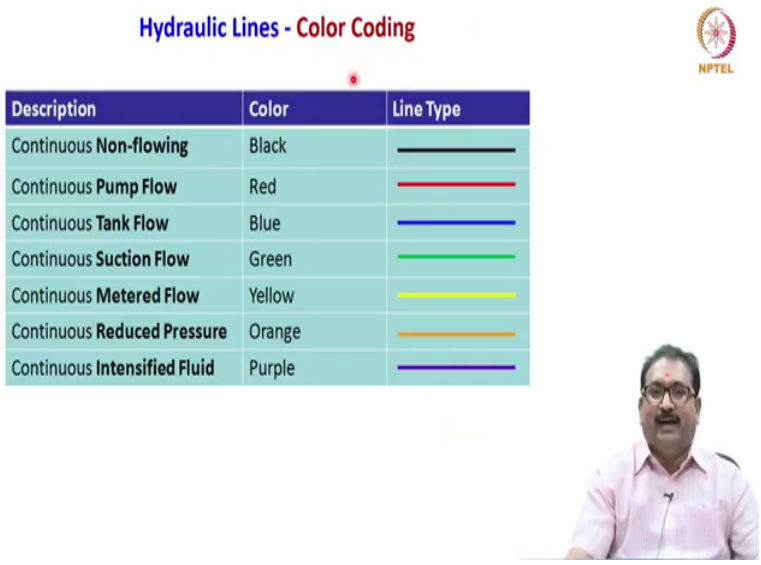

Now, also whenever there are the so many hydraulic lines are there, to overcome the difficulties for the maintenance people and also in the aircraft, they are using the color coding for the lines. How it is?

You will see here continuous non-flowing lines are represented black color; continuous pump flow – red color; continuous tank flow – blue color; continuous suction flow – green color; continuous metered flow – yellow color; continuous reduced pressure – orange; continuous intensified fluid – purple color.

Some of the color codings are also used whenever there are various lines are there for easy identification for the maintenance people as well as for that user as I have told you in the aircraft.