Surface Facilities for Oil and Gas Handling

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Introduction to IC/CI Engine-02

So, two stroke cycle what happens? Two stroke cycle PV diagram will be like this. And before previous diagrams what I have done that is ideal cycle practically there will be certain differences, but we are not going for the details, but those are ideal order cycle or diesel cycle four stroke cycle ok. And for two stroke cycle what happens when 1, 2, 3, 4 when process is happening let us say compression stroke happening. So, in compression stroke when piston is reaching towards TDC. So, in between there will be a spark ok, spark will be happening and combustion will be taking place when piston is going for power stroke. So, nearby end of the power stroke or nearby BDC exhaust port will be open.

So, some air fuel mixture will be entering there and gas will be entering. So, some mix up will be possible. There is no extra ideal stroke, ideal stroke means that horizontal line I had drawn for four stroke ok. This is called ideal stroke, ideal ok the horizontal like one for exhaust, one for entry compression power compression combustion power again exhaust those strokes are not there in two stroke engine.

So, what happens because of extra ideal stroke not there. So, entry of air fuel and burned gas those mixing are possible because we do not have any extra stroke. So, what happens because of that some fuel and air mixture will go through the tail pipe ok if you see autos are making lots of noise and lots of smoke coming that means that may be two stroke engine because incomplete combustion happening because of that some fuel and air mixture going out from the tail pipe. So, their fuel efficiency will low that is they are giving lots of pollution also. So, that is harmful to the environment ok, but two stroke engine can be smaller engine ok.

But four stroke engine will be very heavy like for example, diesel truck or car or train that locomotive engines those are also four stroke engine four stroke engine will be heavier, but it will have more fuel economy and good for pollution. So, fuel air mixture. So, whenever you are having any chemical reaction. So, chemical reaction it will take certain amount of air anything ok. When you are taking certain amount of air and fuel mixture it will be burning completely.

So, burning completely means exact amount of air you have to give air means oxygen. So, that there will be no extra fuel or extra air. So, if you are giving less amount of air. So, extra fuel will be there that means, some fuel particle will not burn and you will not get that much of energy, but if you are having higher amount of air. So, in that case fuel will be burnt, but some air will get heated up that unburnt air and that will take certain amount of heat.

So, that heat you can reduce. So, very high amount or very low amount of air is not good for your system. So, you have to give proper amount of air and fuel mixture that is stoichiometric ratio ok. So, for the trihebron diagram power and air fuel ratio ok. So, you get higher power here ok.

This is a rich mixture rich mixture means higher amount of fuel is there. So, higher fuel lean lean mixture means less fuel ok. So, less amount of fuel this side and vertical line is a proper air fuel mixture. So, little bit mixture will give higher power because all fuel will be burnt ok. This is power curve ok and for normal operation 15 is to 1 for normal hydrocarbon burning in a IC engine 15 is to 1 will be normal ratio it may be more or less also based on your hydrocarbon property ok.

Whenever you are talking about IC engines. So, we should know some definitions also. So, definitions are like this first I have to draw the figure 1, 2, 3, 4 does not matter which sequence I am writing whenever whatever numbering method you use you should use uniformly ok. So, compression ratio compression ratio equals R equals V 3 by V 4 cut off ratio R c equals V 1 by V 4 expansion ratio expansion ratio equals R e equals V 2 by V 1 ok. So, this formula maybe you can use later, but you should remember ok.

So, there is one problem an auto cycle has maximum temperature 1200 degree 1200 Kelvin and exhaust temperature. So, auto cycle I have to draw first ok, auto cycle if I have to draw it will be like this ok 1, 2, 3, 4 if I have to draw diesel cycle it will be like this ok. So, present problem is for auto cycle ok, but for diesel cycle also you should practice 1, 2, 3, 4 this point is 4 and if I have to draw the same thing in T S diagram it will be like 1, 2, 3, 4 1, 2, 3, 4 ok. Now at the beginning of the compression stroke the pressure and temperature given 1 bar and temperature is given 27 degree centigrade means 300 K. So, all unit must be checked ok the compression ratio you have to calculate V 1 by V 2 you have to calculate and specific heat ratio is given 1.

4 ok if it is not given you should assume this value. So, T 1, T 3, T 3 is given 1200 K, T 4 is given 600 K, P 1 is given. So, V 1 by V 2 adiabatic so, T 2 by T 1 1 by gamma minus 1 ok. So, and V 3 by V 4 equals V 1 by V 2 actually equals T 3 by T 4 gamma by gamma minus 1. So, this will be giving V 1 by V 2 equals 1200 divided by 600 1 by gamma minus 1 equals 5.

65. Now, if I have to find T 2 so, it will be like T 2 divided by T 1 equals T 3 by T 4 plus T 2 equals T 1 into T 3 by T 4 equals 600 K ok. Gas turbine so, gas turbine means it is also internal combustion engine, but it does not have any piston like reciprocating piston crank or connecting rod and there are different very sizes of gas turbines available. On micro turbine micro does not mean this it will be like millimeter or micrometer it is a micro turbine less than 50 horsepower power if it is producing then it is called micro turbine. And it can be like 50 less than 50 to large turbine very for industrial applications and it is open cycle like gas compression will be happening burning and exhaust will be there, but there will be no complete cycle. In IC engine your system were complete cyclic ok.

In gas turbine engine this is used in aircraft engine you can remember the aircraft wings will have engines ok air entering and it is going out. So, the same air is not being used ok that is why it is open cycle this is called Brayton cycle Brayton cycle how it is working I will explain. And air body compression so, it will have one compressor you see this and one turbine ok. So, air will be entering here air entering then air after compression it will go to one combustor or combustion chamber. Once combustion happening the hot gas burned gas will be entering to turbine from turbine it will go to exhaust ok.

Aircraft engine like if you see top diagram air entering and hot gas exiting ok. Now, what is compressor? Compressor is like it is not like reciprocating compressor it will be like centrifugal or axial type compressor ah that compressor will be compressing air because the compression chamber is higher amount of air. So, to get higher amount of air actually you compress and you give condensed or compressed air into compression chamber or combustor. So, from there hot gas high volume gas you pass through one turbine. So, normally it will be like axial turbines and compressor also normally axial compressor and the centrifugal compressor also possible.

So, axial turbine axial compressor they will be using ok and compressor will be run by a turbine ok ah. There is no piston cylinder arrangement there is no crank arrangement . So, it will have turbine compressor this is main component and other component also possible, but these are the mains ok. Now, if I draw a diagram for this one how things are working P V. So, initially 1 to 2 compression will be happening 1 to 2 compression will be happening ok you see the diagram from here and 2 to 3 combustion happening 2 to 3 combustion happening and 3 to 4 3 to 4 actually expansion happening.

So, hot gas whatever you are getting high pressure and high temperature gas again high pressure and high temperature ok high temperature high pressure gas you take and expansion will be happening ok. So, not this direction this will be right direction ah 3 to 4 ok and after 4 to 1 actually normally we do not show any line because the same air is not entering or same exhausting ok. So, cycle is that 1 to 2 will be compression you take air you compress it put in combustion chamber separately then same air or high high temperature and high pressure gas you pass through turbine. So, this is turbine ok this is compressor ok and if I draw a T S diagram T S diagram it will be like this 1 to 2 compression. So, adiabatic compression P V gamma equals constant 2 to 3 heat addition heat addition lots of heat will be given temperature will be high very high at 3 ok then expansion also P V per gamma equals constant or entropy constant ok.

So, 3 to 4 ok. So, normally do not connect this one and whenever you are drawing to compressor and turbine you have some you have to follow some rule compressor means you are compressing ok. So, that is why you drawlike like cone shaped compressor ok if you draw opposite way let us say you are drawing compressor like this like this ok and shaft and turbine like this. So, what is happening? So, if gas is you are taking and

exiting like this. So, like gas is expanding, but in compressor you are compressing. So, this figure is wrong it will be like this ok.

So, gas entering compressing and turbine gas expanding. So, expanding means in size in in increasing. So, that way we draw if you draw opposite way this will be wrong this will be wrong ok. So, 2 to 3 actually isobaric process at same isobaric process ok and 1 to 2 isentropic process 3 to 4 also isentropic process and is very fast process continuous process. So, it it must not be isentropic ok.

So, we are assuming these are adiabatic process 1 to 2 and 3 to 4. Thank you very much today I am finishing this 12th field lecture I hope you have learnt well in this course. Thank you very much. .