Surface Facilities for Oil and Gas Handling

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Basics Of Surface Facilities

Good morning everybody, I will continue the lecture on the Basic Part of Surface Production so, this lecture contains fluid properties and some surface production operation-related introductions.

So, surface facility when we are talking about so that means, we have one choke from choke it will go to separators separators. So, why are separators required? So, from the weld bore you are getting fluid so, before that, we will have the weld head and the weld head is getting fluid from the weld bore. So, during the completion stage, you will fix all this weld head choke everything and you fix the separator also in the separator, you are getting 3 phase, 4 phase separation. What are the different phases? Oil, water, gas, sand from weld bore you are getting these 3 fluids oil, water, gas and you are getting solid sand also.

So, the separator will have 2 phase separator, 3 phase separator, 2-phase, 3-phase from 2-phase, and a 3-phase separator on separation is done gas will go to your customer, or maybe compression after compression you will be sent to the customer.

For example, CNG you are using in your vehicles or Indian or other gas cylinders are there coming to your home. So, the gas is also coming from your oil and gas upstream industry. And if you have water you dispose of it properly because the water you cannot use that water and if you have oil you send it to refineries. How to send it? Maybe a tanker will be there, maybe a pipeline will be there.

So, crude oil you are sending to the refinery. So, the refinery will be producing diesel, petrol, kerosene, and many other components. Now how to separate? So in our course, we will be focusing on this part. So separator, separator let us say oil gas choke, the choke is giving this then you have 2 phase separator. So, 2 2-phase separators will separate liquid gas, gas-liquid and that can be sand also will be there.

So, gas if you get, the gas you cannot use it directly because it will have a certain amount of water content and moisture and it may contain corrosive gas or acidic gas. So, you have to separate that one also. So, you will have a contactor column. From the contactor column, the purified gas you send to the customer is. And liquid whatever you are getting liquid will have oil and water, oil plus water.

So, there also let us say initial pressure P. So, after 2 phases pressure will be P minus

delta P certain amount of pressure will be lost. So, in every stage of separation you are getting reduced pressure, reduced pressure, reduced pressure, and pressure will be going down.

So, at high pressure amount of gas or low volatility low volatile component will be dissolved more, but when you are reducing pressure your volatility will be volatile gas ah volatile gas will be removed from the oil or liquid. So, first phase 2 phase your pressure is higher you have a certain amount of gas coming out.

Then you are going to separate oil and water there again you are reducing pressure. So, some amount of gas will be coming out from a liquid. So, again you are getting gas ok? Again you are sending to the contactor column then you are sending to the customer. So, here you are getting an oil-water separator. So, you cannot send this to your refineries directly because the oil will have a certain amount of water particles it can have a certain amount of sand. So, you have to remove all those impurities. So, again every stage of separation pressure will be going down.

So, some gas will go out and you will get oil and water. This oil small amount of oil is there ah gas water whatever things are there you have to remove everything and then send it to your stock tank.

Stock tank is stored once storage is done from their tanker or pipeline maybe tanker or whatever transportation mechanism will be there to send to your refineries. Now, water at every stage you are getting and gas also at every stage you are getting. So, gas will go to your contactor column again because there is gas maybe low pressure, but you cannot release it into the atmosphere which will be polluting you cannot use it directly which

may have corrosive gases or it will have water content also water means moisture content. You cannot send any gas to customers with moisture content or corrosive gas. So, you have to remove those then you have to send them to the customer.

If a very low-pressure gas in that case you compress it and put it in your contactor column you remove all the water and unnecessary particles then you send it to the customer. Regarding water whatever water you have, you cannot dispose of the water everywhere wherever you like why?

Because water will have sand maybe basic sand maybe some amount of oil and this water if oil content is there traces of hydrocarbon. So, that hydrocarbon you cannot dispose of because it will be destroying your aquifer zone. So, you have to remove all the hydrocarbon content and you can dispose of it maybe you can re-inject it in a fuel bore so that way you can dispose. So, disposal one is.

So, if you are producing more water it will take more money because disposal one another problem. And if you are getting sand anytime that also will be a challenging job because sand may counter hydrocarbon particles. So, hydrocarbon particles are there you cannot use that one randomly everywhere. You have to remove hydrocarbon and you can dispose. The task is huge you have to choke initially two phases gas and liquid separate then gas whatever gas you are getting you put some gas separation unit.

So, you purify the gas you send to the customer whatever liquid you have water oil separate water dispose after removing all the hydrocarbon oil remove water particles remove other unnecessary impurities send them to the stock tank or tanker then you transport them to your refineries. So, this is the pressure. Now it is looking so simple, but there will be some issues.

For example, if you have an emulsion. So, emulsion will not allow oil and water to separate quickly.

So, we have to do some mechanism for example, heating, or maybe you have to use some electrostatic precipitator you have to use or some other mechanism where emulsion can be broken and

you can get oil and water separator quickly. The next is what will be the size of the separator how big it should be what will be the flow rate what will be the pressure rating?

They say in wellbore some after certain time what water is coming more. So, either the same separator will be working or you have to change the separator or your gas rate will change because of a gas rate change in your contactor column mechanism whatever there.

So, that will be there or not or do you have to change some certain mechanism or some separator system?

So, you can accommodate multiple wellbores will be there, but one gas gathering system or separator system will be there on the ocean surface like a platform in a semi-submersible

or on your land wells. So, there are different levels of difficulty. So, this course will discuss all these things like how to separate gas, how to separate water, oil and what are the different mechanisms, and how to calculate the dimensions this will be continuing. Why talk about separators in surface production operations separators? So, there will be two types of separators vertical and horizontal there will be one spherical type separator.

So, separators can be vertical, horizontal, and spherical. Later we will discuss details of different mechanisms of how they are separating. So, normally spherical will be used for the offshore application, normal application horizontal and vertical separators are very common. And horizontal also there will be a single tube, single tube later we will discuss in

detail a double tube. So, there will be a skimmer heater teeter, there will be a flow control mechanism flow control mechanism pressure gauges pressure.

So, many other equipment will be there on the surface production operation. So, we will discuss later. So, whenever talking about separator two phase three phase.

So, just I will discuss one or two separators simply briefly you see I have one horizontal type separator that will look like this, and fluid from choke is coming after choke let us say fluid is coming like this ok? So, this fluid when at a very high velocity is coming it will fall like this.

It creates a phase flow there will be one gas extraction unit which is called a mist extractor this term is called a mist extractor gas going out like this.

And this is a two-phase flow initially I am assuming. So, there will be water plus oil. If sand is there then sand can be deposited bottom also, but you can go through water and oil channels also. But how to control the level? Let us say this is water and oil here ok?

Now continuously you are getting gas continuous choke fluid from the choke is coming.

Now if you are not melting that level of water and oil this layer ok, what will happen is the level will go up after a certain time very high or the level will go below the outlet of oil and gas. That means you must control the level. So, there will be a certain mechanism called a level controller.

Level controller level controller ok. So, this is called a gravity separator. Two-phase mean gas and liquid are separated in this two-phase flow.

Now if I go for three phases, three three-phase mechanisms will be almost similar, but it will create three layers of oil, and water will enter oil water gas.

Again, the mist extractor is where the gas will go.

Oil you take gas you take. Again every time you must have one level controller ok. So, the level controller will be here. So, this level controller will be controlling the water level be the oil level will be there.

If we have a higher water level.

So, the oil outlet will get water or the water outlet will get oil or gas will be coming out through the oil outlet.

So, you have to control this level controller properly. So, that system will be working without any problem. If you do not maintain this level properly then the system will not work after some time and there will be multiple problems. Now you have three phases you have water let us say you got water. So, water you have to separate certain way so that water hydrocarbon particles will be almost removed then you can dispose.

Oil you again pass through another level of separator ok? There you remove small very small tiny tiny water particles you have to then after that you can send them to your stomach

and gas we will discuss later. Gas separation, so gas separation actually when you have gas, gas can have moisture it can have your H2S, CO2 ok basically H2S and CO2 those are acidic gas or sour gas ok. If these components are not there normally it will be for sweet gas.

So, if how to remove them ok. So, for that, they will create a contactor column amine or glycol separation unit.

So, you inject your gas and you separate you remove this H2O or H2S this will contactor column. Later we will discuss in detail how the function of this contactor column works. So, the contactor column will have a glycol glycol-separated unit.

So, glycol will remove H2O and amine solution, amine solution removes acidity gas.

So, if you have an amine solution you can you can remove H2S or CO2 if you have water content then you can remove you can use glycol. So, this way this contactor column works.