Surface Facilities for Oil and Gas Handling

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Heater Treater and Gunbarrel-02

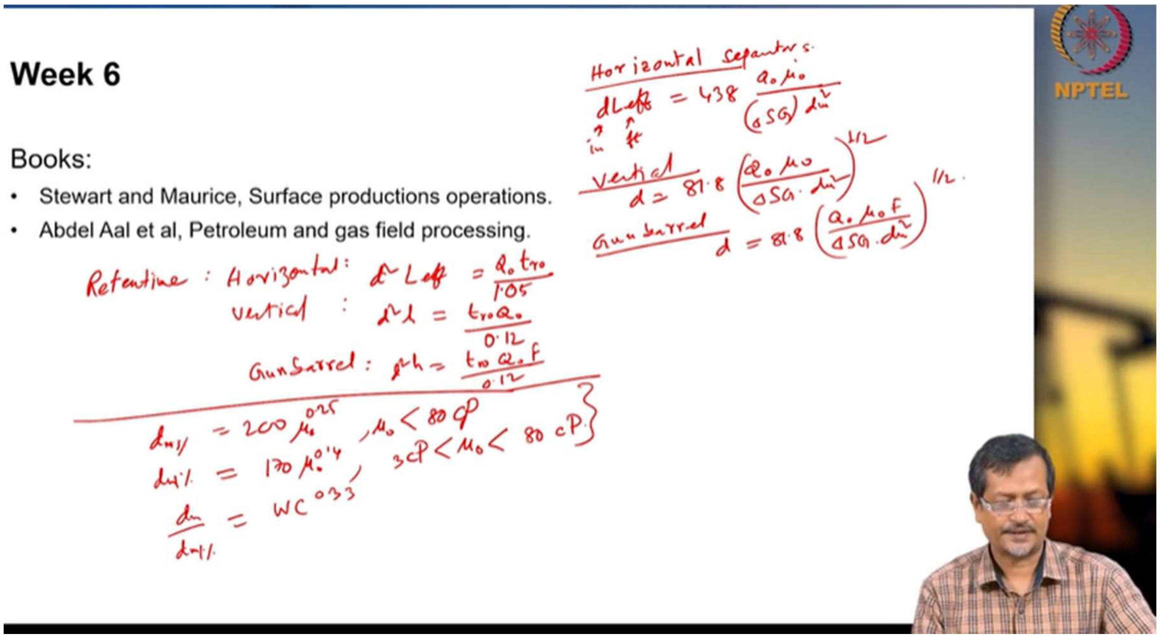
Now, we will go for retention time calculation and retention time equation. So, in the previous cases in the 2 phase, 3 phases, if you have seen high-pressure cases. So, in that case, gas phase, gas phase calculation liquid base calculation you have done like a gas capacity based liquid capacity. In this case, we are not considering the gas part, we are considering the liquid part of how the oil-water particle is getting separated because you are treating oil-water emulsion and you are trying to get 0.5 percent BSW around liquid oil, not with solid or gas ok. So, that is why we are not including the gas capacity equation here, only the liquid part you are calculating liquid separated from liquid water particles from oil, not vice versa also ok?

Now for the horizontal vessel, for horizontal vessel d square L EFF equals QO TRO 1.05 ok, this formula we try to derive. So, T again, T equals volume divided by Q ok, assumes 75 percent effective length is useful ok. They are assuming that 75 percent effective length is useful for separation separation.

So, in that case, volume equals 0.75 we are multiplying and what is the area pi by 4 d square into L effective length ok. So, this area is pi by 4 this area into this effective length. So, the total volume of fluid you are calculating. So, this is an area this into L effective length ok, d again I am writing capital that means, the unit is feet ok.

So, if I want to convert it into an inch, it will be like 0.75 pi d square L effective length divided by 4 into 144 ok. And the Q formula already you know 6.49 into 10 power minus 5 Q oil, this is BPD, BPD this is cubic feet per second ok. So, if we equate so, volume divided by flow rate if you make then it will come like this d square L effective length equals 0.

0159 Q o t and T r in minute T ro in a minute this is second this T second ok. So, T r in a minute, the equation will be like this T equals 60 T ro therefore, d square L eff equals Q o T ro 1.05 ok. So, this is your retention time calculation formula d square into L eff Q o not only Q otherwise the unit will be a problem I am using Q unit is cubic feet per second Q o barrel per day BPD ok. This is for the horizontal separator ok.



Now, we will go for vertical separators, finish this one for vertical separator retention time retention time ok. So, the vertical separator formula is there d square H T ro Q o 0.12. So, this is the formula final formula, but how to derive this one derivation you have to remember again T equals V volume divided by flow rate. So, volume equals I have to draw one vertical separator this is the height for coil height for the actual oil pad height.

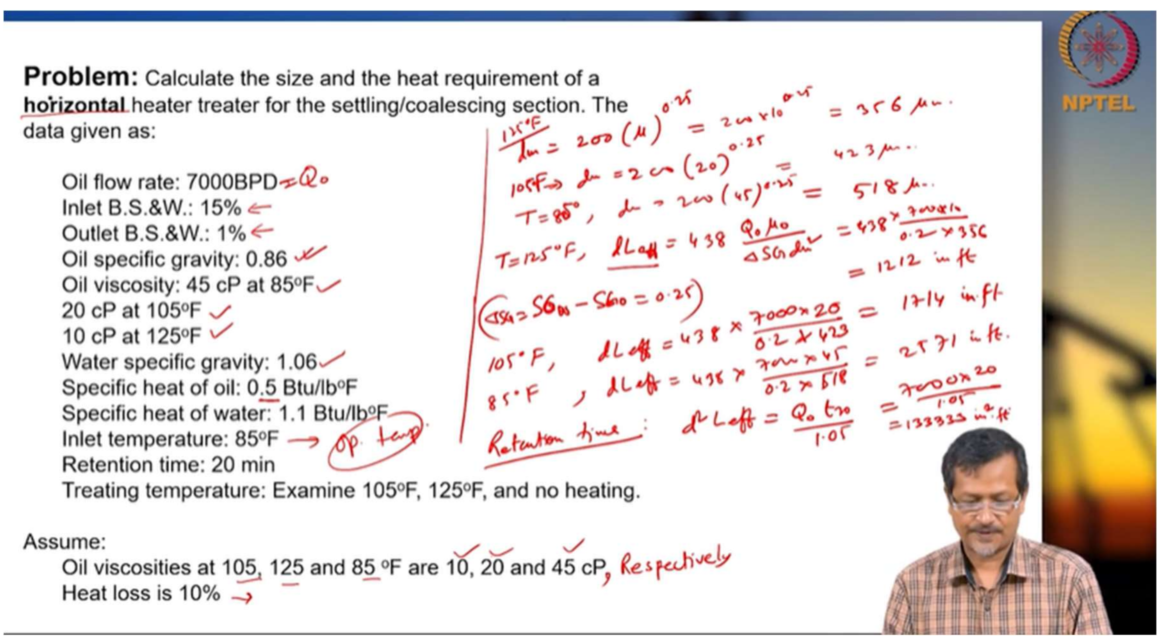
So, their coalescence is happening ok, coalescence ok. Now, volume equals pi d square by 4 into h by 12 ok. So, this area and this height. So, the total volume is becoming now 4.55 into 10 power minus 4 d square h.

So, capital D I converted into feet. So, this year, that way we got this formula volume values. Now Q in B Q o in BPD Q feet Q per second. So, Q equals 6.49 into 10 power 10 power minus 5 Q o ok.

So, this formula we already know. Now, therefore, T equals T means the volume per-flow rate you can see here. So, volume I have got 4.55 10 power minus 4 d square h divided by flow rate flow rate we have got 6.49 into 10 power minus 5 Q o.

So, if we equate this one. So, T, we got we get 7 d square h Q o ok. Now, T r in minute T r in minute T r o you can say. So, this will be giving d square h equals T r o Q o 0.

12 ok. So, you got the formula for retention time for the vertical separator. So, you should not mix up horizontally and vertically. So, you should remember ok. So, if you know the derivation procedure remembering will be easier if you want to remember the final equation then sometimes you can get confused, about whether it will be vertical or horizontal ok. And for gun barrel ok, for gun barrel this is vertical.

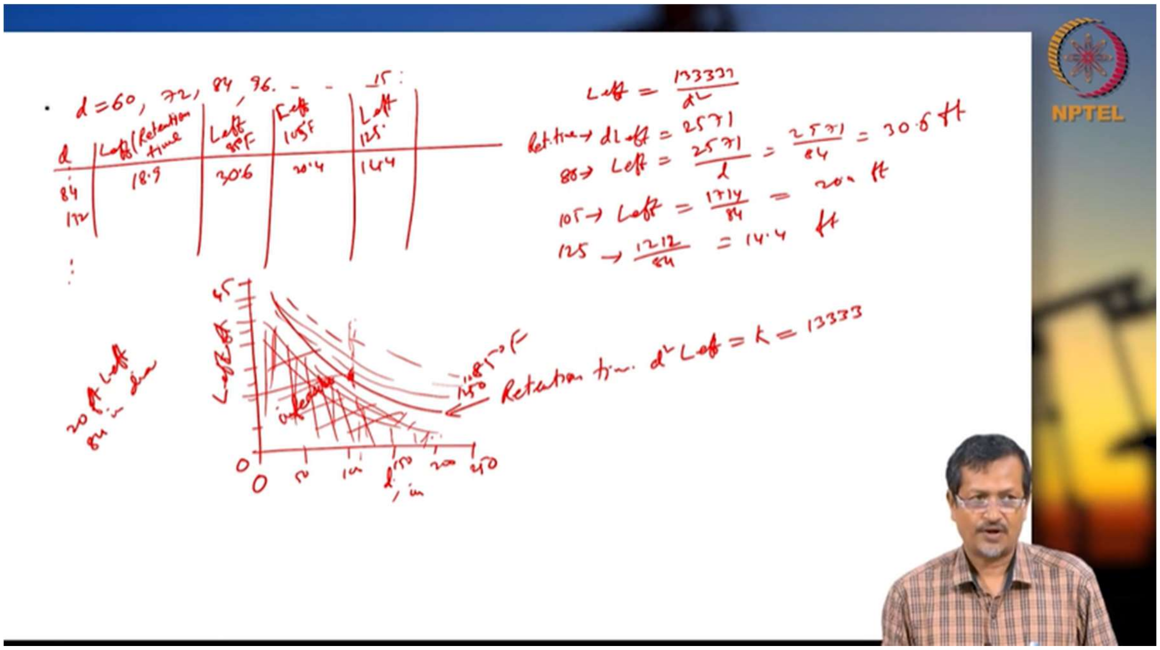


So, if we go for gun barrel the formula will be modified as d square h equals f, f came up now T r o Q o 0.12 same formula only f came up ok. Soft circuit factor, but soft circuit factor can be applicable for your vertical heater heater also already we have seen. So, droplet size ok. So, normally 500 micrometers or microns size you can take there are some formulas for 10 to 30 minutes retention time they are assuming 10 to 30 minutes for initial assumption retention time, and retention time ok.

So, for initial assumption previously we said that the 500-micron water droplet size we consider ok. There are some formulas that Thoreau and Morris Morris R i C Morris 1994 developed using 1 percent water cut ok. So, for 1 percent water cut the formula they derived like this d m 1 percent equals 200 mu power 0.25 for mu less than 8 C p 8 0 C p C p ok. For d the diameter of the water droplet is the diameter of the water droplet to be settled from oil to achieve 1 percent water cut micron mu o already you know oil viscosity ok.

Using the same procedure the following correlation for droplet size was developed for electrostatic theta for electrostatic theta criteria d m 1 percent equals 170 mu 0.4 and range is 0.03 C p 280 ok. Within this range, this equation should be valid. And how to implement this formula we will see when we will be solving a problem we will see ok.

So, one more formula we have d m by d m 1 percent equals water cut power 0.33. So, what is this formula ok? So, we can make a box for this formula this formula this formula. So, d m d m is the diameter of water droplet dia of a water droplet to be settled from oil to achieve given water cut or W c ok. And W c is percentage water percent 1 percent 2 percent something ok.



So, you want to achieve. So, your diameter size will be like this the formula or 0.33 power 0.33 ok.

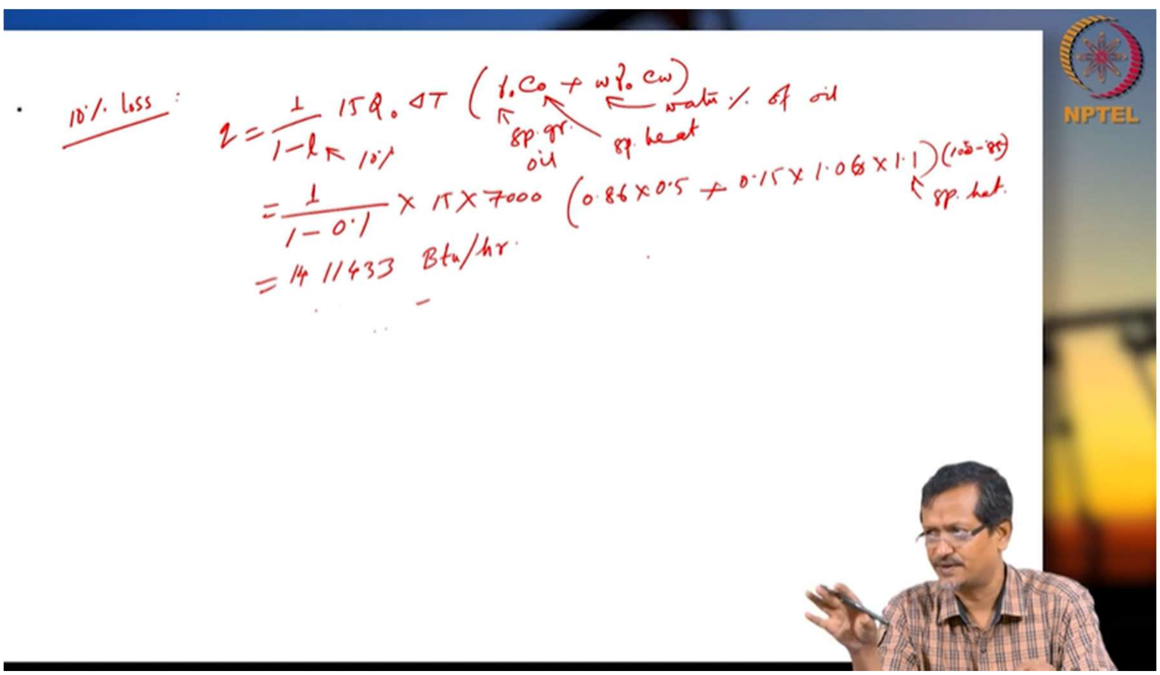
So, it should be 0.33 ok. Done ok. So, conventional treaters, have given on chart or figure. So, treating temperature temperature for treating and flow rate BPD or BOPD ok. So, the like 20-degree API 25. So, this way increasing 25 degree API is 35 degree API ok.

So, treating temperature and temperature like 0 50 100 250 after 250 they have given and flow rate range also they have given 160 equally divided not logarithm by any other scale to be equally 160 equally divided this is for conventional N A-ok. Another they have given for electrostatic treater same thing temperature and flow rate the range is becoming lower ok 20 25 ok 35 API. So, in this case flow rate is higher for this is electrostatic electrostatic treater. So, in this case flow rate is higher. For the same temperature, you are getting a higher flow rate.

So, your productivity or separation rate is higher. So, before we solve one problem done ok. Before we solved one problem we had the heat transfer calculation several times we did it again one more time just recapping the purpose of heat transfer because we had to size the whole separator. So, the heat transfer formula was again recapped. So, Q equals M C T you already have gone through this formula and mass flow rate if you have flow rate you know then mass flow rate you can calculate like this Q this is B pd or small b pd mass flow rate pound per hour ok.

Then B pd you can convert like this B pd divided by day into day a hour 5.61 cubic feet divided by barrel into 62.4 gamma cubic feet by pound L B per hour ok. So, this will be giving M equals 15 gamma Q L B per hour ok. So, if you are given Q in B pd then you can convert pound ok, pound per hour.

So, normally amount of water is given as a percentage of oil volume. So, Q water will be a percentage of oil volume. So, this is the oil volume percentage ok? How much water is there? So, Q o Q o equals 15 gamma o C o Q o because this unit conversion is why this 15 term is coming del T Q water if I say the 15 gamma water C water Q oil then W will come and del T same del T ok. Then how much total heat they are taking and how much heat is getting lost?



So, as it is previously the same different way they have derived ok. Let us say L percent energy lost and how this energy getting lost because of radiation convection conduction because of this way some energy will get lost you cannot recover that one. So, that heat will not go to your go-to heat oil or water ok? So, that heat you cannot recover the energy you are giving from your burner, but that is not reducing to heat your fluid ok. So, Q oil plus Q water plus Q loss equals total ok.

This is the basic formula I am saying something is lost energy lost ok? Previously also this formula is given actually. So, finally, this formula becomes like this Q equals 1 by 1 minus L percentage of energy lost ok. 15 Q o delta T gamma o C o plus W gamma W C w this is B T u per hour ok. This is the formula for heat transfer calculation.

So, anyway whatever formula you can use basic formula is Q equals MST you have to remember then you have to convert units then done ok. So, mass-specific heat and temperature difference the heat. So, you are getting the heat transfer rate right. Now, you convert units if I am not giving directly your barrel cubic feet or degree Fahrenheit yes instead of degree Fahrenheit I will give Rankine temperature or centigrade temperature I can mix up in your exam. So, if I am giving centigrade you have to convert it into Fahrenheit ok?

If you do not convert then it will not match ok. So, that unit conversion you must remember ok, because field unit SI unit and so many units are there you are playing with unit. If you make one mistake anywhere in the converting unit then you are done you will not get marks.