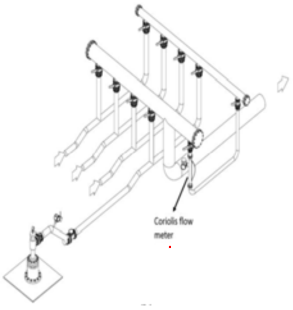
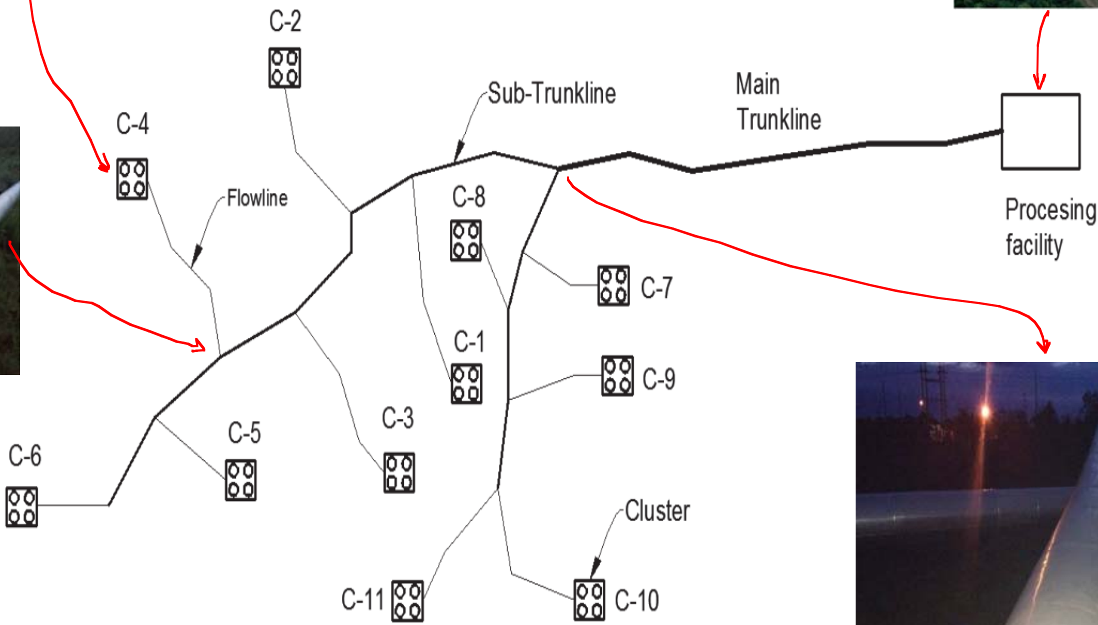
Production Networks





insulation material

Comment on ICD - ICV

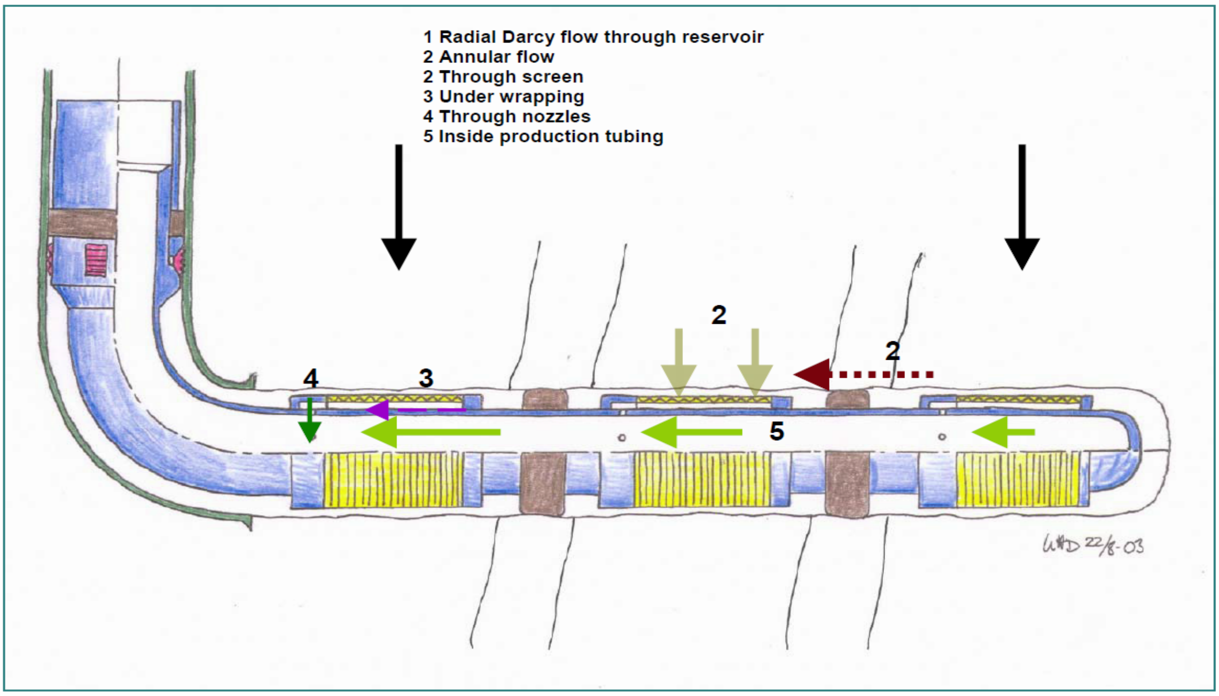
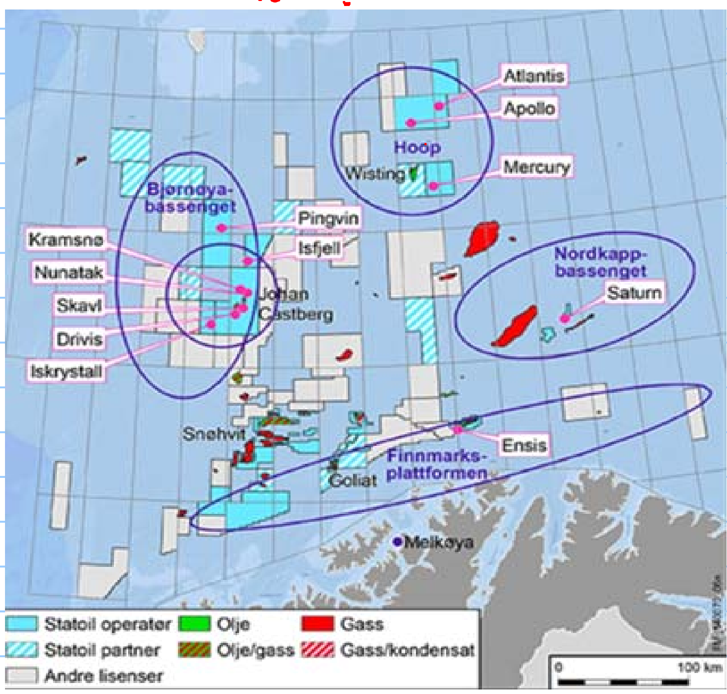


Figure-8 Functioning and interplay of an ICD completion architecture. Fluids enter the screen and flow between the axial wires and the un-perforated base pipe into the ICD housing, before passing through the nozzles and entering into the base pipe. All these flow issues are properly analyzed and put in the right perspective to achieve an optimal well completion design and solution.

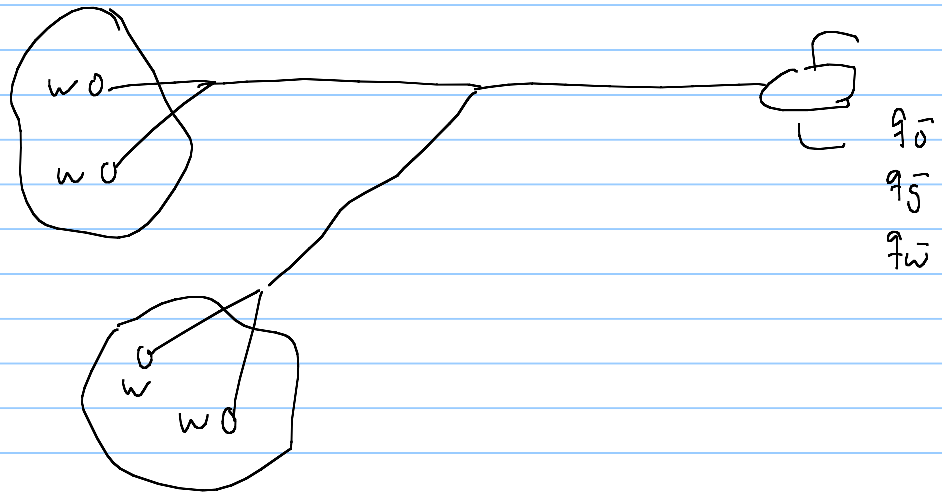
https://www.youtube.com/watch?v=E2g4hxGZP94

Comment on exercise 2:

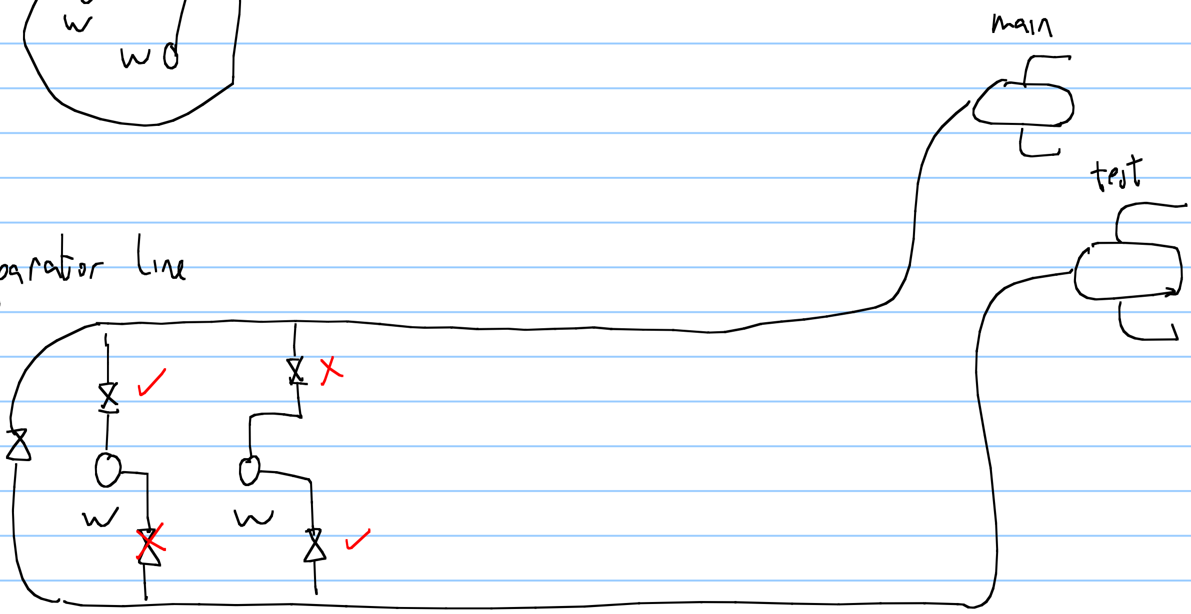


Allocation: determine or partition where the rates are coming from?

- ↳ reservoir
- ↳ well
- ↳ formation



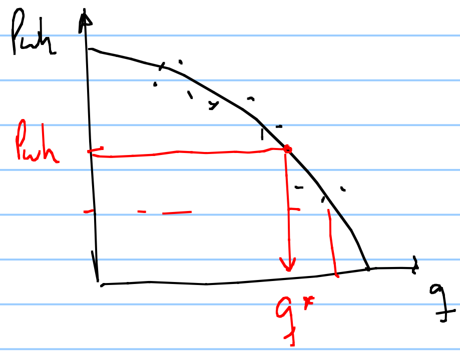
test separator line



- portable separators

• multiphase flow meter

• wellhead performance relationship



Allocation (oil and gas)

From Wikipedia, the free encyclopedia

In the petroleum industry, **allocation** refers to practices of breaking down measures of quantities of extracted hydrocarbons across various contributing sources.[1] Allocation aids the attribution of ownerships of hydrocarbons as each contributing element to a commingled flow or to a storage of petroleum may have a unique ownership. Contributing sources in this context are typically producing petroleum wells delivering flows of petroleum or flows of natural gas to a commingled flow or storage.

The terms **hydrocarbon accounting** and allocation are sometimes used interchangeably.[2][3] Hydrocarbon accounting has a wider scope, taking advantages of allocation results, it is the petroleum management process by which ownership of extracted hydrocarbons is determined and tracked from a point of sale or discharge back to the point of extraction. In this way, hydrocarbon accounting also covers inventory control, material balance, and practices to trace ownership of hydrocarbons being transported in a transportation system, e.g. through pipelines to customers distant from the production plant.

In an allocation problem, contributing sources are more widely natural gas streams, fluid flows or multiphase flows derived from formations or zones in a well, from wells, and from fields, unitised production entities or production facilities. In hydrocarbon accounting, quantities of extracted hydrocarbon can be further split by ownership, by "cost oil" or "profit oil" categories, and broken down to individual composition fraction types. Such components may be alkane hydrocarbons, boiling point fractions,[4] and mole weight fractions.[5][6]

Principles of Allocation:

Proportion based allocation: An allocation principal commonly used in the oil and gas industry is called proportional allocation. Proportional allocation assigns the quantity measured by reference meter (total system entitlement) back to incoming streams (sources) in proportional to the quantity measured by allocation meter in each stream. In other words, proportional allocation assign the difference between reference meter and sum of quantity by all allocation meters, either positive or negative, to each stream according to the relative quantity measured by allocation meters. The proportional allocation is irrespective of the measurement uncertainty in the allocation meters.

Allocation Procedure:

The example of fundamental application of allocation is show in Fig1, where allocation meters Meter#1, Meter#2 and Meter#3 measure quantity Q_1, Q_2, Q_3 respectively in the incoming or source streams. Fluid from these three sources are comingled in the form of processing, pipeline or storage etc and output quantity Q_R is measured by reference meter, Meter#R.

In the ideal situation, the summation of quantity measured by incoming source (allocation) flow meters, Q_1, Q_2, and Q_3 should be equal to the quantity measured by reference meter, Q_R, after accounting fuel consumption and flaring etc. However, in the practical world, they would not match and so rules are required to account for the differences.

Normally the quantity measured by reference meter is assumed to be true or accepted value, so the imbalance is allocated back to the allocation streams according to a defined allocation principle.

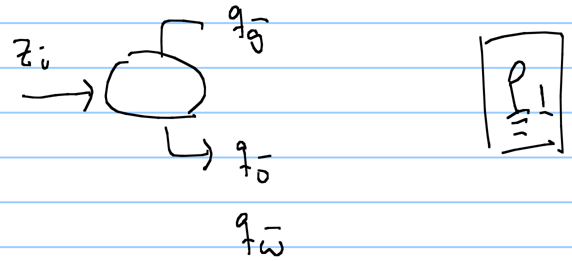
Reconcile the measurements of the meters with measurements at the { tanker / storage.

why do we want to do allocation?

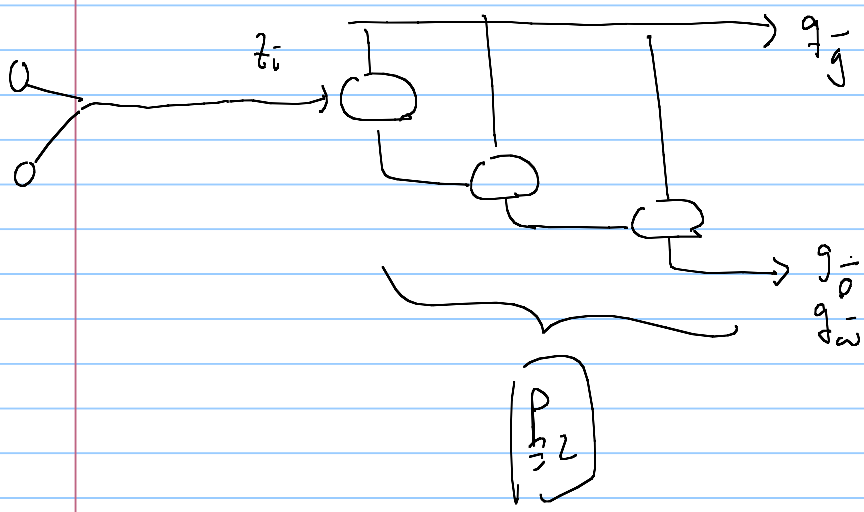
- Calculate partner share

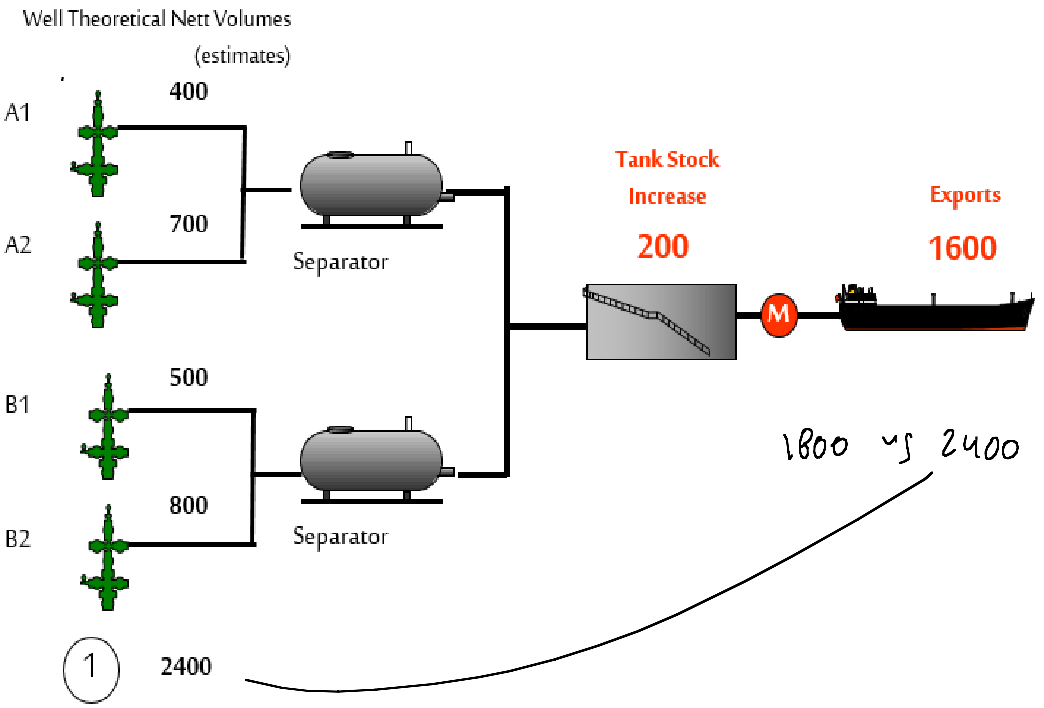
- Company revenue
- Tax payments, Royalty payments
- Governmental regulatory requirements.
- Verify and tune reservoir models, verify field management strategy
- production optimization and planning

• meter accuracy.

• 

when using portable-test separators the surface process is different

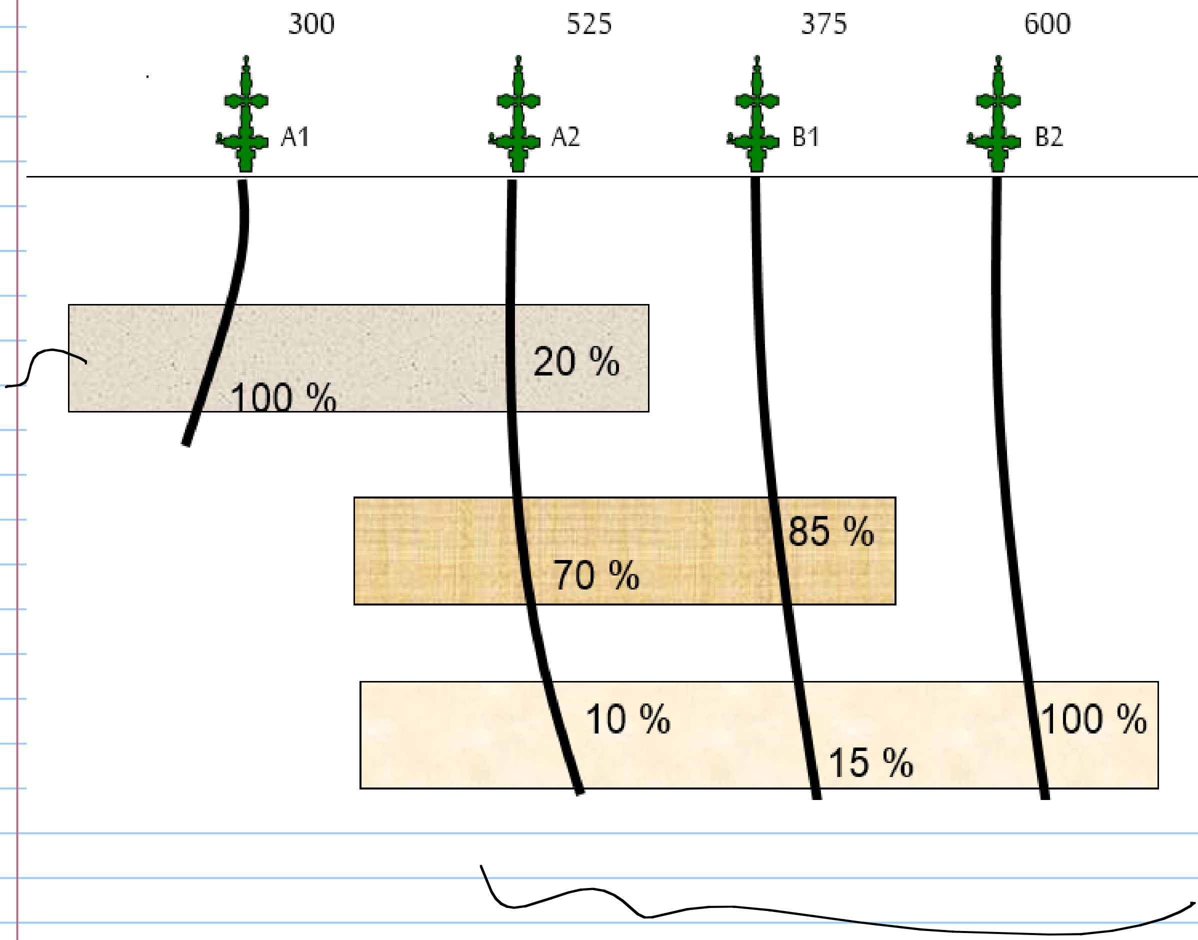




Calculate a reconciliation factor: $f = \frac{1800}{2400} = 0.75$

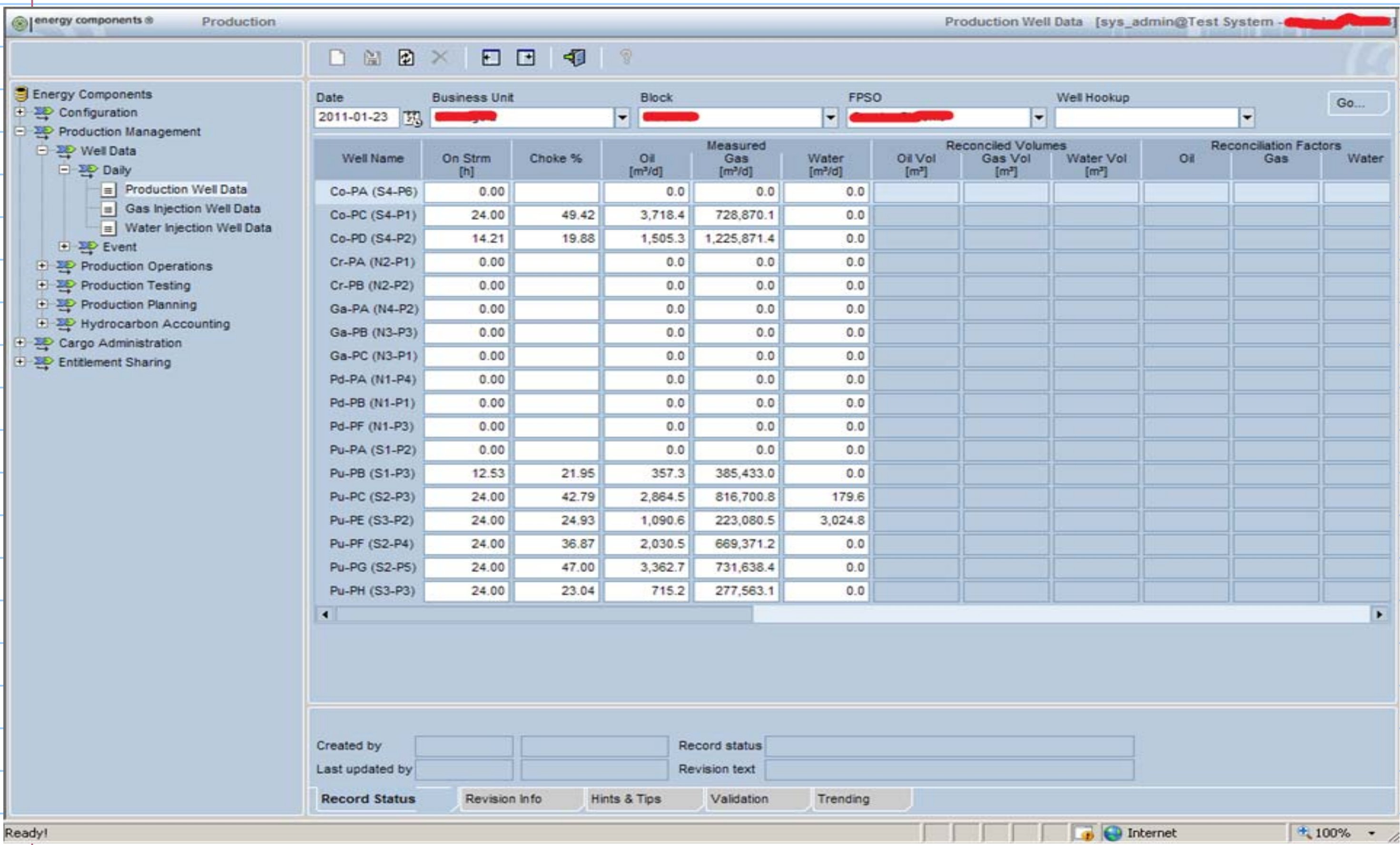
with this factor, it is possible to scale the well rates

	old rate [stm³/d]	new rate [Sm³/d]
	400	300
0.75	700	525
	500	375
	800	600



- production logging
- downhole meters
- Downhole network simulation

Energy Components – Tieto



energy components® | Production | Production Well Data [sys_admin@Test System - [redacted]]

- Energy Components
  - Configuration
  - Production Management
    - Well Data
      - Daily
        - Production Well Data
        - Gas Injection Well Data
        - Water Injection Well Data
      - Event
    - Production Operations
    - Production Testing
    - Production Planning
    - Hydrocarbon Accounting
  - Cargo Administration
  - Entitlement Sharing

Date: 2011-01-23 | Business Unit: [redacted] | Block: [redacted] | FPSO: [redacted] | Well Hookup: | Go...

Well Name	On Strm [h]	Choke %	Measured Oil [m³/d]	Measured Gas [m³/d]	Measured Water [m³/d]	Reconciled Volumes Oil Vol [m³]	Reconciled Volumes Gas Vol [m³]	Reconciled Volumes Water Vol [m³]	Reconciliation Factors Oil	Reconciliation Factors Gas	Reconciliation Factors Water
Co-PA (S4-P6)	0.00		0.0	0.0	0.0						
Co-PC (S4-P1)	24.00	49.42	3,718.4	728,870.1	0.0						
Co-PD (S4-P2)	14.21	19.88	1,505.3	1,225,871.4	0.0						
Cr-PA (N2-P1)	0.00		0.0	0.0	0.0						
Cr-PB (N2-P2)	0.00		0.0	0.0	0.0						
Ga-PA (N4-P2)	0.00		0.0	0.0	0.0						
Ga-PB (N3-P3)	0.00		0.0	0.0	0.0						
Ga-PC (N3-P1)	0.00		0.0	0.0	0.0						
Pd-PA (N1-P4)	0.00		0.0	0.0	0.0						
Pd-PB (N1-P1)	0.00		0.0	0.0	0.0						
Pd-PF (N1-P3)	0.00		0.0	0.0	0.0						
Pu-PA (S1-P2)	0.00		0.0	0.0	0.0						
Pu-PB (S1-P3)	12.53	21.95	357.3	385,433.0	0.0						
Pu-PC (S2-P3)	24.00	42.79	2,864.5	816,700.8	179.6						
Pu-PE (S3-P2)	24.00	24.93	1,090.6	223,080.5	3,024.8						
Pu-PF (S2-P4)	24.00	36.87	2,030.5	669,371.2	0.0						
Pu-PG (S2-P5)	24.00	47.00	3,362.7	731,638.4	0.0						
Pu-PH (S3-P3)	24.00	23.04	715.2	277,563.1	0.0						

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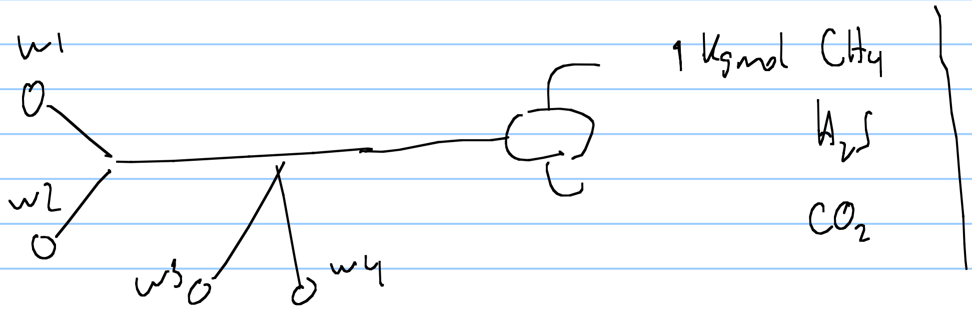
Last updated by | Revision text

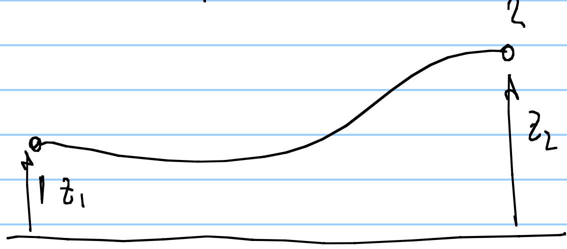
Record Status | Revision Info | Hints & Tips | Validation | Trending

Ready! | Internet | 100%

Compositional allocation



Calculation of pressure drop in conduits with liquid: (oil, water)

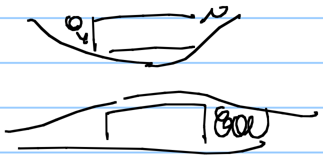


$$h_1 = h_2$$

$$\frac{P_1}{\rho g} + z_1 + \frac{v_1^2}{2g} = \frac{P_2}{\rho g} + z_2 + \frac{v_2^2}{2g}$$

frictional losses $\Delta h_f = f \frac{L}{\phi} \frac{V^2}{2g}$

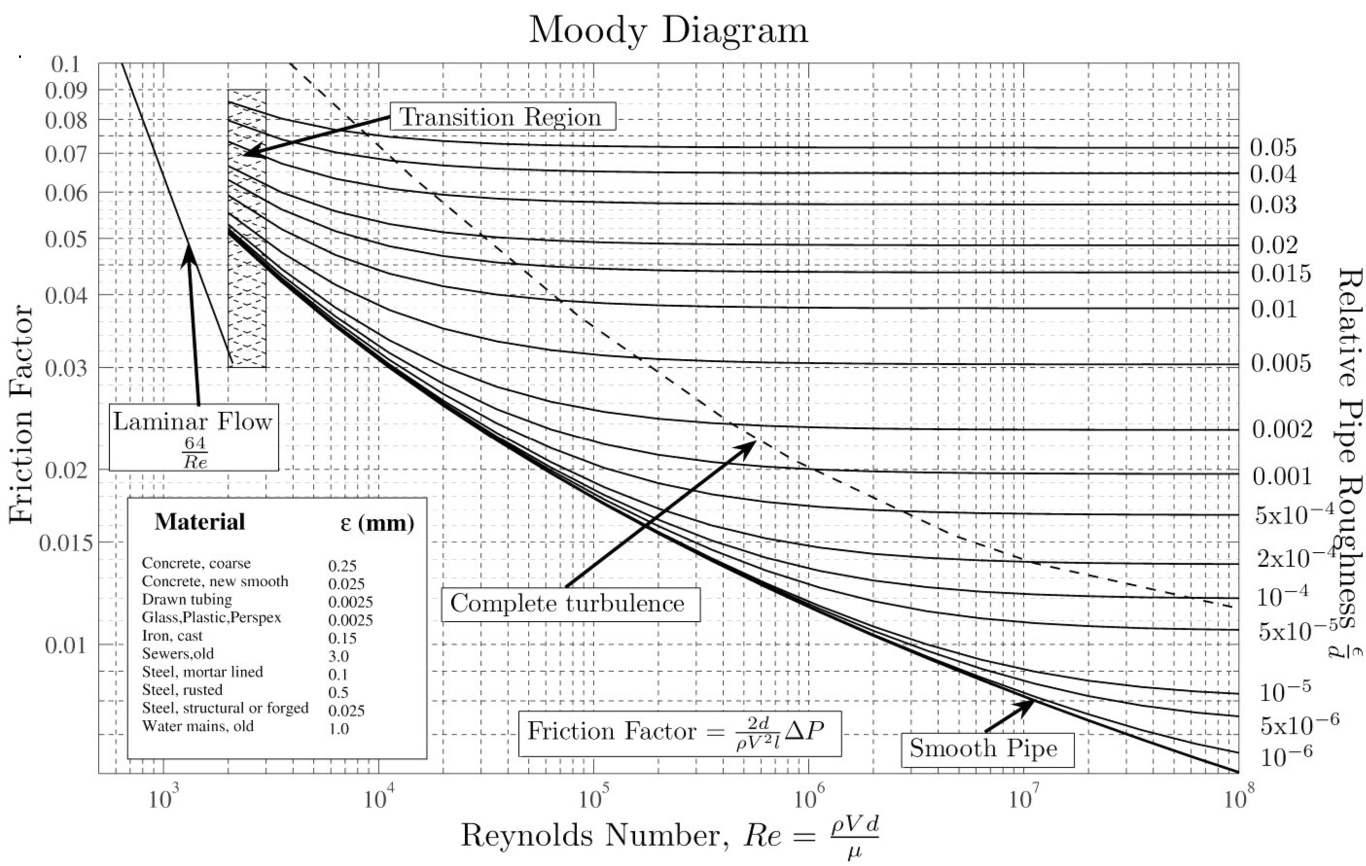
pipe length (L), flow velocity (V), inner diameter (ϕ)



~> localized pressure drop ~> $\Delta h_{acc} = K \cdot \frac{V^2}{2g}$

loss coefficient (K)

$$\Delta h_{acc} = f \frac{L_{eq}}{\phi} \frac{V^2}{2g}$$



$$\frac{1}{\sqrt{f}} = -1.8 \log_{10}\left[\left(\frac{\varepsilon/D}{3.7}\right)^{1.11} + \frac{6.9}{\text{Re}}\right]$$ [7]

Fitting Type		K
Pipe Entry Losses		
Square Inlet		0.50
Re-entrant Inlet		0.80
Slightly Rounded Inlet		0.25
Bellmouth Inlet		0.05
Pipe Intermediate Losses		
Elbows R/D < 0.6	45°	0.35
	90°	1.10
Long Radius Bends (R/D > 2)	11¼°	0.05
	22½°	0.10
	45°	0.20
	90°	0.50
Tees		
(a) Flow in line		0.35
(b) Line to branch flow		1.00
Sudden Enlargements		
Ratio	d/D	
	0.9	0.04
	0.8	0.13
	0.7	0.26
	0.6	0.41
	0.5	0.56
	0.4	0.71
	0.3	0.83
	0.2	0.92
	<0.2	1.00
Sudden Contractions		
Ratio	d/D	
	0.9	0.10
	0.8	0.18
	0.7	0.26
	0.6	0.32
	0.5	0.38
	0.4	0.42
	0.3	0.46
	0.2	0.48
	<0.2	0.50

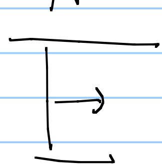
Fitting Type		K
Gradual Enlargements		
Ratio d/D q = 10° typical		
	0.9	0.02
	0.7	0.13
	0.5	0.29
	0.3	0.42
Gradual Contractions		
Ratio d/D q = 10° typical		
	0.9	0.03
	0.7	0.08
	0.5	0.12
	0.3	0.14
Valves		
Gate Valve (fully open)		0.20
Reflux Valve		2.50
Globe Valve		10.00
Butterfly Valve (fully open)		0.20
Angle Valve		5.00
Foot Valve with strainer		15.00
Air Valves		zero
Ball Valve		0.10
Pipe Exit Losses		
Square Outlet		1.00
Rounded Outlet		1.00

$$z_1 + \frac{P_1}{\rho g} + \frac{V_1^2}{2g} = z_2 + \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + f\,\frac{L}{\phi}\,\frac{V^2}{2g}$$

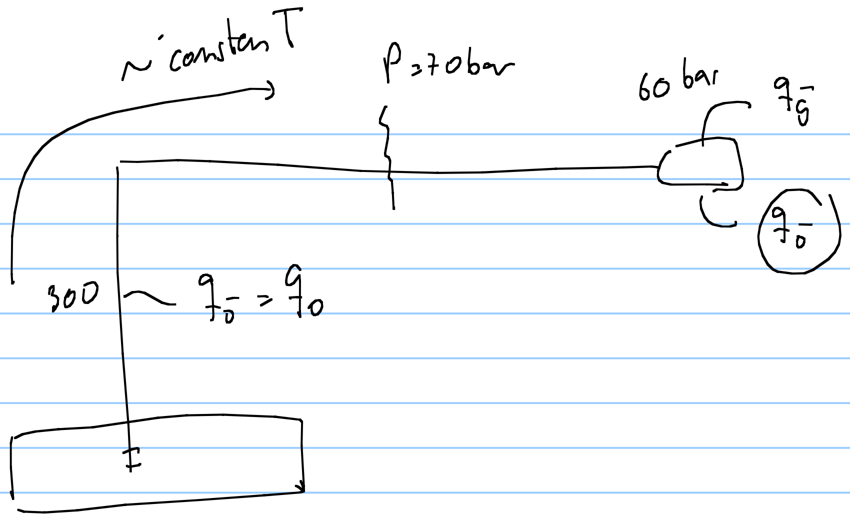
$$\rho g\left((z_1 - z_2) + \frac{P_1}{\rho g} - f\,\frac{L}{\phi}\,\frac{V^2}{2g}\right) = P_2$$

$$\rho g\left[(z_1 - z_2) + \frac{P_1}{\rho g} - \frac{f L 8 q^2}{\pi^2 \phi^5 g}\right] = P_2$$

? $[m^3/s]$



we need a way to convert from Standard conditions rate to local rates



$P_b(T) \approx 70$ bar

- undersaturated oil system low bubble point pressure ⇝ Heavy oils

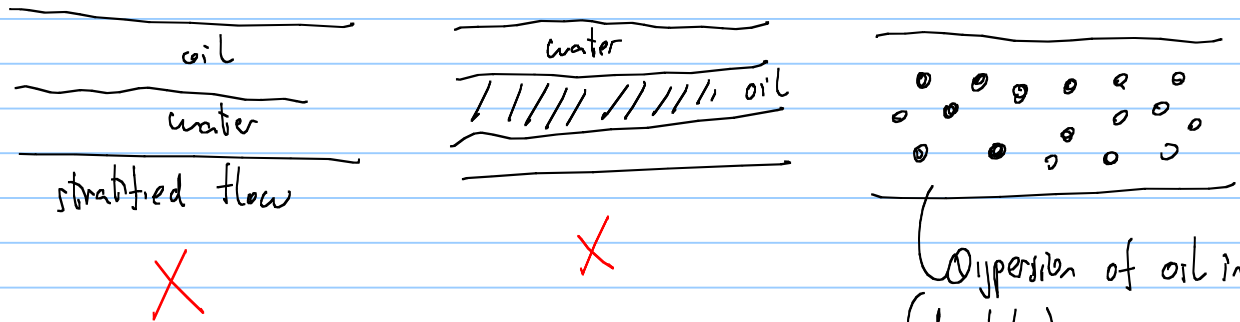
  properties change along the production system ρ, μ due to P and T

  a stepwise calculation is required !

  q_o depends P, T.

- undersaturated oil + water

  phases arrange themselves in different configurations in the pipe



Dispersion of oil in water (droplets)

of water in oil