Methane liquefaction cycle

Ms.Preethi Para
NIT Rourkela

Unit system: C5

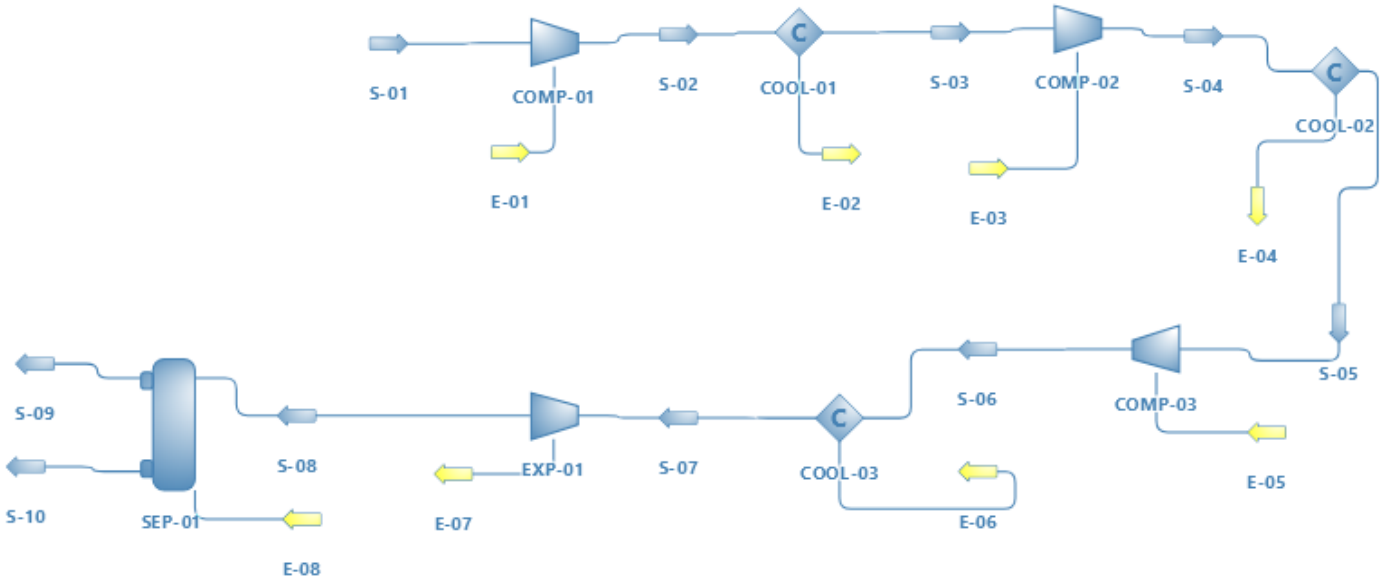
Thermodynamic Package: NRTL is chosen to describe vapor-liquid equilibrium

Background:

Methane is the simplest hydrocarbon found in small quantities in Earth's atmosphere. It is a potent greenhouse gas. Methane is flammable and is used as fuel worldwide. It is a principal component of natural gas. Natural gas consists almost entirely of methane (CH4). Typically, LNG is 85 to 95-plus per cent methane, along with a few per cent ethane, even less propane and butane, and trace amounts of nitrogen. Liquefied natural gas (LNG) is 600 times smaller than natural gas when the latter is in its gaseous form, and it can be quickly shipped overseas. LNG is converted back to a gaseous state for use as an energy source upon reaching its destination. LNG is also used directly as a transportation fuel for ships and cars. Commercial uses for natural gas include heating, generating electricity, manufacturing products like fertilizers, paints and medicines, and occasionally fueling commercial vehicles. Liquefied natural gas (LNG) is predominantly methane (CH4) converted into liquid form for storage or transport.

Description:

Here, in the below flowsheet, Methane is used as the working fluid. 1 Kg/hr of Methane enters the compressor in S-01 at 6.8°C and 1 bar. It is then compressed to a pressure of 5 bar, and the temperature rises to 127.43°C. Then, this stream S-02 passed through a cooler to reduce its temperature to 6.8°C. Where it is again passed through a compressor to be compressed to a pressure of 25 bar and cooled again to 6.8°C, where it is again passed through a compressor to 100 bar. And cooled to -63.15°C, then it is passed through expander, to reduce pressure to 1 bar, and next passed through gas-liquid separator from which 0.606kg/hr of vapour and 0.394 kg/hr of liquid methane is separated.



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Results:

Master Property Table											
Object	S-10	S-09	S-08	S-07	S-06	S-05	S-04	S-03	S-02	S-01	
Temperature	-161.698	-161.698	-161.698	-63.15	116.082	6.85	129.159	6.85	127.43	6.85	C
Pressure	1	1	1	100	100	25	25	5	5	1	bar
Mass Flow	0.393659	0.606341	1	1	1	1	1	1	1	1	kg/h
Molar Flow	0.0245385	0.037796	0.0623346	0.0623346	0.0623346	0.0623346	0.0623346	0.0623346	0.0623346	0.0623346	kmol/h
Molar Fraction (Vapor)	0	1	0.606341	0	1	1	1	1	1	1	
Molar Fraction (Mixture) / Methane	1	1	1	1	1	1	1	1	1	1	
Mass Fraction (Mixture) / Methane	1	1	1	1	1	1	1	1	1	1	

Conclusion:

Ultimately, 0.606kg/hr of vapour and 0.394kg/hr of liquid methane is separated from 1kg of methane.