VAPOR COMPRESSION REFRIGERATION CYCLE

Background: Vapor Compression Refrigeration system is one in which the refrigerant undergoes phase changes, is one of the many refrigeration cycles and it is widely used method for air conditioning and in automobiles. It is also used in domestic and commercial refrigerators, large-scale warehouses for chilled or frozen storage of foods and meats, refrigerated trucks and railroad cars, and host of other commercial and industrial services. Oil refineries, petrochemical and chemical processing plants and natural gas processing plants are among the many industrial plants that often utilize large vapor-compression refrigeration systems. In very basic terms, refrigeration systems are used to remove heat from one area and transfer it into another area.

Description of the flow-sheet: The vapor compression system simulated here uses propane as the liquid refrigerant medium because of its favorable properties. Circulating refrigerant enters the **adiabatic compressor** in the thermodynamic state known as saturated vapor, the compressor increases it pressure and temperature and propane leaves the compressor in the super-heated vapor state. This super-heated vapor now enters the **condenser** which converts it to a saturated liquid at the same pressure. Now this saturated liquid is at a high pressure hence it is throttled with the help of a **valve** and a vapor-liquid mixture at atmospheric pressure is sent to an evaporator which converts the mixture to saturated vapor and the outlet stream from the **evaporator** is recycled and sent as the input to the adiabatic compressor.

RESULTS:

1) Saturated propane vapor enters the compressor at a temperature of 230K which is desired temperature for the refrigeration of certain products and 1 atm.
2) Propane leaves the compressor at 298K which is around the ambient temperature.
3) Energy spent on various operations is as follows

i) Evaporator energy: 232.749 KW
ii) Condenser energy: 348.2409 KW
iii) Compressor energy: 115.491 KW

Reference:

https://www.ohio.edu/mechanical/thermo/Intro/Chapt.1_6/Chapter4c.html

- A basic R134a Vapor-Compression Refrigeration System