Refrigeration Rig Experiment

Aim: Demonstrate the thermodynamic basic principal of a vapour compression refrigeration cycle.

What you need to do:

1. View the "Refrigeration Rig Overview" Video. This video describes the operation of the whole rig and all its parts. The icing up of the thermal expansion valve is discussed and the flow of the refrigerant.
2. View the "Refrigeration Rig Experiment" Video. This video goes through the calculations needed for this experiment using a sample set of results.
3. Your submission:
    a) Beside your name is your assigned Experiment Data #1, #2 or #3. You must use your assigned data. All the work must be your own.
    b) Complete the calculations for all three tests in your Experiment Data #. Clearly show your work, calculations, steps and graphs used.
    c) Plainly state if the coefficient of performance that is calculated is as you would expect! Explain using your results the relationship between the shape of the pressure – enthalpy diagram and its correlation to the resultant value of the coefficient of performance.
    d) Answer the following questions:
        a. Why is the term of coefficient of performance used rather than efficiency?
        b. What would happen if the heat absorbed by the evaporator is more than the heat dissipated by the condenser?
        c. The refrigerant oil rotameter (flow meter for refrigerant) just before the Thermal Expansion Valve shows a clear liquid flowing, but the compressor is compressing a gas. Explain what is happening here.

Refrigeration Rig Experiment

Heat Pump Refrigeration Cycle Data #1

	Test 1		Test 2		Test 3	
Condenser Pressure (Gauge)	-40	KN/m^2	0	KN/m2	10	KN/m2
Evaporator Pressure (Gauge)	600	KN/m2	610	KN/m2	710	KN/m2
T1-Superheated Gas Temperature	-18.1	DegC	-17.6	DegC	-6.1	DegC
T2-Compressor Delivery	36.9	DegC	53.9	DegC	59.7	DegC
T3-Sub cooled Temperature Liquid in Condenser	25.7	DegC	26.8	DegC	27.4	DegC
T4- Evaporator Temperature	-35.8	DegC	-25.4	DegC	-16.5	DegC
T5- Water Inlet Temperature	27	DegC	27	DegC	26.7	DegC
T6-Water Outlet Temperature	27.5	DegC	28.4	DegC	31	DegC
Mass flow rate:	20	g/s	20	g/s	20	g/s
Refrigeration (R134a) flow rate:	1	g/s	1	g/s	1	g/s
Energy at Evaporator						
Evaporator Volts	40	Volts	80	Volts	110	Volts
Amps	1	A	2	A	3	A

Heat Pump Refrigeration Cycle Data #2

	Test 1		Test 2		Test 3	
Condenser Pressure (Gauge)	-50	KN/m^2	0	KN/m2	10	KN/m2
Evaporator Pressure (Gauge)	590	KN/m2	610	KN/m2	690	KN/m2
T1-Superheated Gas Temperature	-18.6	DegC	-25	DegC	-14	DegC
T2-Compressor Delivery	40.6	DegC	51	DegC	52.6	DegC
T3-Sub cooled Temperature Liquid in Condenser	24.2	DegC	25	DegC	25.3	DegC
T4- Evaporator Temperature	-35.8	DegC	-25.5	DegC	-18.3	DegC
T5- Water Inlet Temperature	25.6	DegC	25.3	DegC	24.5	DegC
T6-Water Outlet Temperature	26.8	DegC	27.6	DegC	28.7	DegC
Mass flow rate:	20	g/s	20	g/s	20	g/s
Refrigeration (R134a) flow rate:	1	g/s	1	g/s	1	g/s
Energy at Evaporator						
Evaporator Volts	40	Volts	70	Volts	100	Volts
Amps	1	A	2	A	3	A

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Heat Pump Refrigeration Cycle Data #3						
	Test 1		Test 2		Test 3	
Condenser Pressure (Gauge)	-42	KN/m^2	-10	KN/m2	10	KN/m2
Evaporator Pressure (Gauge)	500	KN/m2	510	KN/m2	640	KN/m2
T1-Superheated Gas Temperature	-18.7	DegC	-22	DegC	-5.8	DegC
T2-Compressor Delivery	33.3	DegC	48.7	DegC	58.7	DegC
T3-Sub cooled Temperature Liquid in Condenser	22.8	DegC	22.1	DegC	23.8	DegC
T4- Evaporator Temperature	-36.2	DegC	-27	DegC	-18.3	DegC
T5- Water Inlet Temperature	20.4	DegC	20.6	DegC	21.8	DegC
T6-Water Outlet Temperature	22.3	DegC	24	DegC	27.2	DegC
Mass flow rate:	20	g/s	20	g/s	20	g/s
Refrigeration (R134a) flow rate:	1	g/s	1	g/s	1	g/s
Energy at Evaporator						
Evaporator Volts	40	Volts	75	Volts	105	Volts
Amps	1	A	2	A	3	A