CAMOSUN COLLEGE

MECH 275 THERMODYNAMICS II

VAPOUR COMPRESSION REFRIGERATION LAB

OBJECTIVE:

- Use the Hilton Refrigeration Unit R712 to examine the operation of a vapour compression refrigeration cycle.

PROCEDURE:

Examine the operation of the test equipment. Identify the route of the refrigerant and that of the water. Touch the various components to see if the temperature readings make sense.

Set up the system to take the required measurements.

CALCULATIONS & REPORT:

Select one test and conduct a complete analysis (energy balance) on the unit.

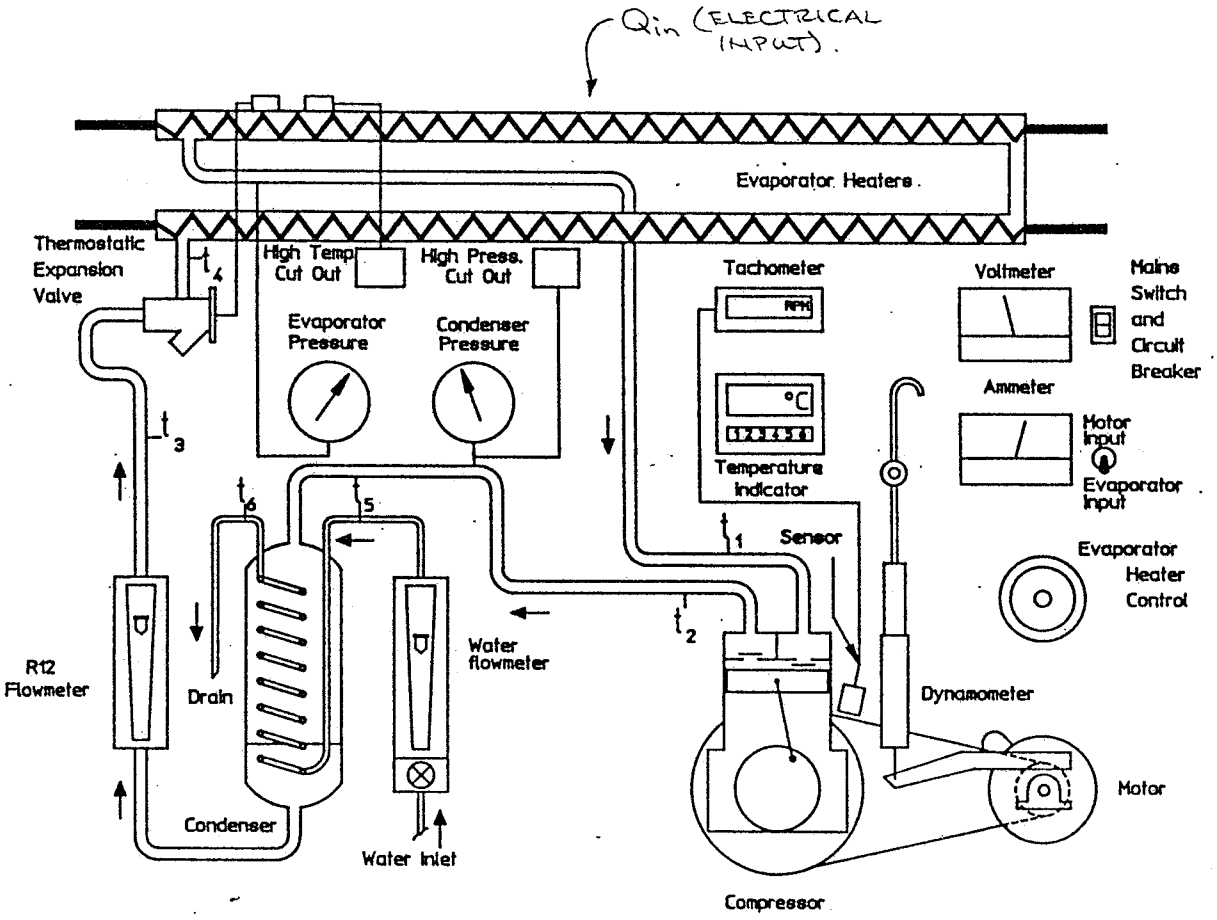
- energy input to the evaporator.
- energy output from the condenser.
- energy loss across the valve.
- energy input from the electric motor to the compressor.
- energy input to the motor.
- energy lost from the motor.
- and so on…
- Determine the COP.

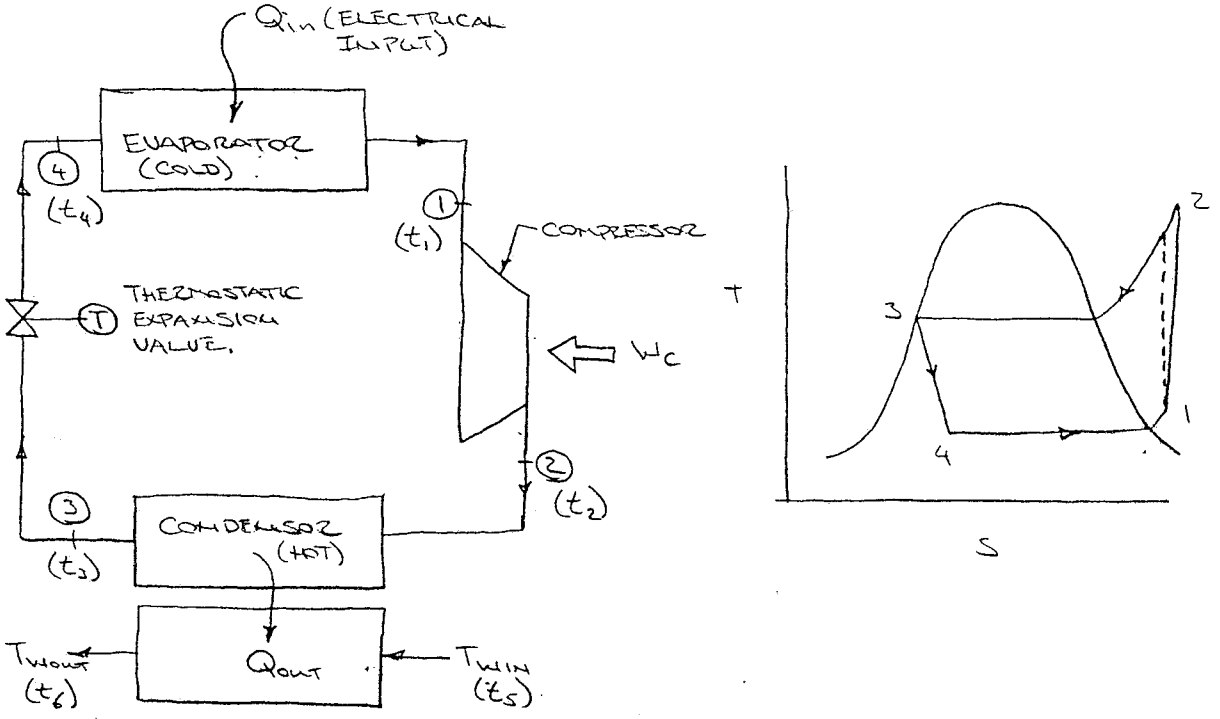
In most cases you will be able to validate your information in two ways. And be aware of the energy transfers within the room itself.

THE REPORT

Draw a schematic of the process. Report your findings in tabular form and plot the process on the P-h diagram.

January 12, 2004


Qin (ELECTRICAL INPUT).
Evaporator Heaters.
Thermostatic Expansion Valve
t4
High Temp Cut Out
High Press. Cut Out
Evaporator Pressure
Condenser Pressure
Tachometer
RPM
Voltmeter
Mains Switch and Circuit Breaker
Ammeter
Motor Input
Evaporator Input
°C
Temperature Indicator
t3
t6
t5
t1
Sensor
Evaporator Heater Control
t2
Water flowmeter
R12 Flowmeter
Drain
Dynamometer
Motor
Condenser
Water Inlet
Compressor


Qin (ELECTRICAL INPUT)
EVAPORATOR (COLD)
4
(t4)
1
(t1)
COMPRESSOR
THERMOSTATIC EXPANSION VALVE.
T
Wc
2
(t2)
3
(t3)
CONDENSOR (HOT)
TWOUT
(t6)
QOUT
TWIN
(t5)
T
2
3
1
4
S

Measurement	Test 1	Test 2	Test 3
Evaporator Heater Voltage, V_E	30	60	100
Water flow rate, m_W, grams/second	30	30	30
Atmospheric pressure, P_A, kPa			
Condenser pressure (gage), P_C, kPa			
Evaporator pressure (gage), P_E, kPa			
Compressor inlet temperature, t1, °C			
Compressor outlet temperature, t2, °C			
Condenser outlet temperature, t3, °C			
Evaporator inlet temperature, t4, °C			
Water inlet temperature, t5, °C			
Water outlet temperature, t6, °C			
R12 Flowrate, m_R, grams/second			
Evaporator Amps, I_E			
Motor Volts, V_M			
Motor Amps, I_M			
Spring Balance, F, Newtons			
Compressor Speed, n_C, rpm			
Motor Speed, n_M, rpm			

Some useful information:

$P_{absolute} = P_{gage} + P_{atmosphere}$

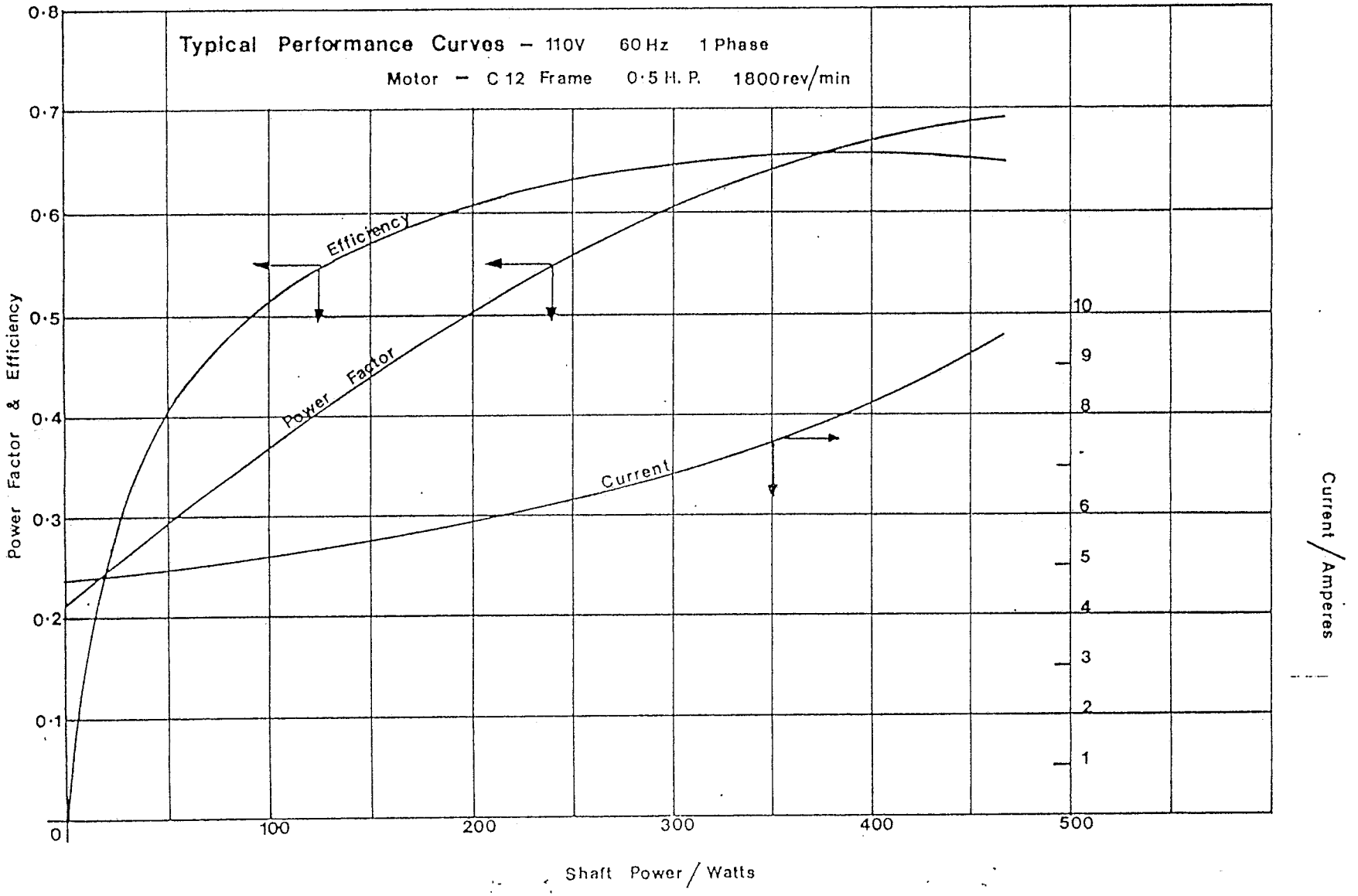
$n_M = n_C$ x pulley ratio

pulley ratio = 3.17 3 1/8

Motor torque arm radius = 165 mm 171.46 (6 3/4")

Electrical Power input = V x I x power factor

(Power Factor: for motor see graph
for evaporator, Power factor = 1)


Typical Performance Curves – 110V 60 Hz 1 Phase
Motor – C 12 Frame 0·5 H. P. 1800 rev/min
Efficiency
Power Factor
Current
Power Factor & Efficiency
Current / Amperes
Shaft Power / Watts
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
100
200
300
400
500
10
9
8
6
5
4
3
2
1