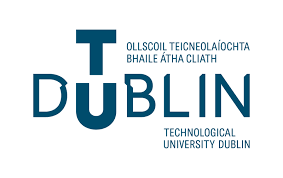
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**TU Dublin – Grangegorman**

**Refrigeration Rig Experiment**

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# Experiment Aim

Demonstrating the thermodynamic basic principle of a vapour compression refrigeration cycle.

## Introduction

This experiment rig is designed for the study of thermodynamics of vapour compression refrigeration cycle by way of experimentation and testing during laboratory. It has a facility to measure various parameters for experimentation.

There are four Main Refrigeration cycle components

* The compressor.
* The condenser.
* The expansion device.
* The evaporator.

# Laboratory Tasks

## 2.1. Tasklist

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.

# Procedure

Table 1 - Experiment data #3 assigned

Table

Description automatically generated

## 3.1. The test with 0.5kw

Diagram

Description automatically generated

Figure 2 - Psychrometric graph of the colling tower experiment 3.1

3.1.1. Mass flow of Air

Using Bernoulli’s equation in this experiment to calculate the mass flow of air.

3.1.2. Energy transferred to the water

The amount of energy transfer calculated from the first principle is 1.05kw even though the switch is 0.5kw. Therefore, calculating furthermore to get more evidence.

3.1.3. Energy transferred to Air

**0.914 kw**

So, the energy transferred to Air is about equal to the energy transferred to the water.

3.1.4. Evaporation Rate

**=**

=

**=**

3.1.5. Summary

Table 2 - Summary of 0.5kw label switch

|  |  |  |
| --- | --- | --- |
| **Energy to water** | **Energy to Air** | **Measured Evaporating rate** |
|  | 0.914 kw | 0.000415 |
|  |  | **Calculated Evaporating rate** |
|  |  |  |

## 3.2. The test with 1kw

Diagram

Description automatically generated

Figure 3 - Psychrometric graph of the colling tower experiment 3.2

3.2.1. Mass flow of Air

Using Bernoulli’s equation in this experiment to calculate the mass flow of air.

3.2.2. Energy transferred to the water

The amount of energy transfer calculated from the first principle is 0.6187kw even though the switch is 1kw. Therefore, calculating furthermore to get more evidence.

3.2.3. Energy transferred to Air

**0.562 kw**

So, the energy transferred to Air is about equal to the energy transferred to the water.

3.2.4. Evaporation Rate

**=**

=

**=**

3.2.5. Summary

Table 3 - Summary of 1kw label switch

|  |  |  |
| --- | --- | --- |
| **Energy to water** | **Energy to Air** | **Measured Evaporating rate** |
|  | 0.562 kw | 0.00025 |
|  |  | **Calculated Evaporating rate** |
|  |  |  |

## 3.3. The test with 1.5kw

Chart

Description automatically generated with medium confidence

Figure 4 - Psychrometric graph of the colling tower experiment 3.3

3.3.1. Mass flow of Air

Using Bernoulli’s equation in this experiment to calculate the mass flow of air.

3.3.2. Energy transferred to the water

The amount of energy transfer calculated from the first principle is 1.5884kw even though the switch is 1.5kw. Therefore, calculating furthermore to get more evidence.

3.3.3. Energy transferred to Air

**1.344 kw**

So, the energy transferred to Air is about equal to the energy transferred to the water.

3.3.4. Evaporation Rate

**=**

=

**=**

3.3.5. Summary

Table 4 - Summary of 1kw label switch

|  |  |  |
| --- | --- | --- |
| **Energy to water** | **Energy to Air** | **Measured Evaporating rate** |
|  | 1.344 kw | 0.0005 |
|  |  | **Calculated Evaporating rate** |
|  |  |  |

## 3.4. Experiment Question

Dry bulb temperature (T1) of air entering base of the column and Wet bulb temperature (T2) of air entering the base of a column.

Dry bulb temperature (T3) of air at the exit from a column and Wet bulb temperature (T4) of air at the exit from the column.

T1 is hotter than T3, since we are dissipating energy the outlet air temperature T3 should be hotter than the inlet air temperature T1! it may seem unusual, however, the idea of evaporating cooling is where an object that is damped evaporates moisture and its colder than the environment that is its in.

# 4. References

**[1]** "cooling tower", *Me.iitb.ac.in*, 2021. [Online]. Available: https://www.me.iitb.ac.in/~matrey/PDF's/cooling%20tower.pdf. [Accessed: 20- Nov- 2021]