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Energy Efficient Refrigeration System with Evaporative Cooling

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Abstract

Refrigerator is mainly a composition of four devices Compressor, Condenser, Expansion device and evaporator which has some limitations. Temperature range of working is also a limitation for Refrigerator which affects their performance.

Here we provides more effort to reduce the limitations related to working temperature range and tries to modify the size of refrigerator with the effect of evaporative cooling.

Since condenser rejects latent heat of refrigerant to atmosphere due to higher temperature of refrigerant at condenser. So due to this rejection of heat it provides the cooling in evaporator. Co-efficient of performance of refrigeration system mainly depends on temperature difference between the condenser and that medium where heat is to be rejected. More temperature difference, more heat rejection so more cooling on account of same work to refrigeration system. But if the temperature difference is less, less heat rejection will be there so less cooling by giving same amount of work which decreases the Co-efficient of performance of the system.

Keywords- Co-efficient of performance (C.O.P), Evaporative cooling, Percentage increment in C.O.P

Introduction

Refrigeration system is used to provide cooling by the use of mainly four components Compressor, Condenser, expansion device and evaporator. These four components are operated with a refrigerant which works as heat carrier in this system. It extracts the heat from evaporator in the form of latent heat and rejects that heat to atmosphere through the condenser. Therefore heat rejection capacity depends on difference between refrigerant temperature at condenser and atmospheric temperature. Quantity of heat rejection also affects the quantity of heat absorption through evaporator. It is clear that more heat rejection will result more heat absorption. Atmospheric temperature varies according to environmental condition i.e. during the summer atmospheric temperature becomes higher which decreases the temperature difference between refrigerant and atmosphere, results less heat rejection which decreases the overall performance of refrigeration system.

Fig 1 Vapour compression system

Methodology

1) Fill the tank of ice plant with 7 kg of water and note down the initial temperature of water and Wattmeter reading .Then start the compressor for 50 minutes.
2) Note down the reading temperatures after compressor, after condenser, after expansion, after

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evaporator, water temperature, suction pressure and exhaust pressure when test rig utilized the 0.1Kwh power.
3) Now calculate the C.O.P of refrigeration test rig.
4) After that spray the water on condenser and again read the temperatures at previous locations when test rig utilized the 0.1Kwh power.
5)Now calculate the C.O.P of refrigeration test rig.

Result

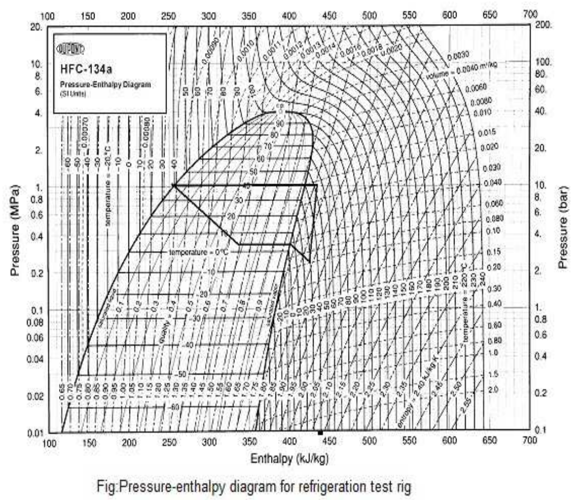

Fig:2 Pressure-enthalpy diagram

Here actual coefficient of performance forrefrigeration system with evaporative cooling = 2.035
And actual coefficient of performance for refrigeration system = 1.465

Conclusion

So percentage increment in C.O.P by the use of evaporative cooling is 39.04%.

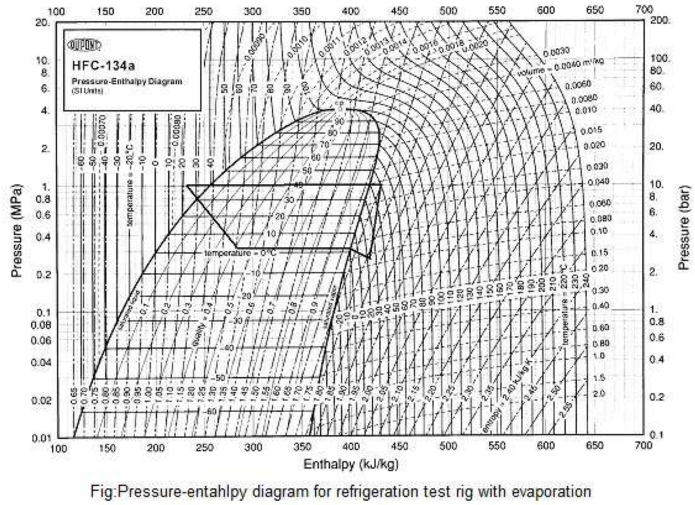

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Fig:3 Pressure-enthalpy diagram with evaporative cooling

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