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Heat Recovery System for Dairy Plants

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ABSTRACT

In refrigeration plants the heat extracted from the refrigerated medium, plus the energy in form of mechanical work from the compressor, is discharged to the atmosphere through the condenser. In this project a study is made on the alternatives for recovering this amount of energy to produce hot water, or warm air. A basic thermodynamic analysis is carried out, showing the most appropriate conditions for heat recovery. A simulation model is also employed for the performance prediction of cases where temperature requirements are present. Data from an experimental unit are also presented and compared with predicted results. Tests were performed over a range of condenser and evaporator temperatures. In refrigeration plants the heat extracted from the refrigerated medium, plus the energy in form of mechanical work from the compressor, is discharged to the atmosphere through the condenser. In the present paper a study is made on the alternatives for recovering this amount of energy to produce hot water, or warm air. A basic thermodynamic analysis is carried out, showing the most appropriate conditions for heat recovery. A simulation model is also employed for the performance prediction of cases where temperature requirements are present. Data from an experimental unit are also presented and compared with predicted results. Tests were performed over a range of condenser and evaporator temperatures.

Keywords—analysis of heat recovery system, compressor, refrigeration system, refrigerant, condenser,shell and tube type heat exchanger

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I. INTRODUCTION

[Energy utilization system in dairy industry with the help of refrigeration system.Energy is the most major part in the any system. In diary industry there are various process on the milk to make the by productlikekhava, paneer, ghee.to make this by products need to proper temperature. Many at so there is cooling of milk below the atmospheric temperature and heating of milk as well as other process.So there is need of refrigeration and heating to the system are required. We are research on the how we will consume or utilize the energy in this heating and cooling process.Every operator of a refrigeration system gets the chance of saving energy very effectively. A refrigeration system extracts heat from the goods it cools. It has been developed to optimally extract this heat to avoid wasting it to the environment together with the machine heat.Heat is energy, so energy saving is one of the key matters from view point of fuel consumption and for the protection of global environment. So it is necessary that a significant and concrete effort should be made for conserving energy through waste heat recovery too. The main objective of this paper is to study "Waste Heat recovery system for domestic refrigerator". An attempt has been made to utilize waste heat from condenser of refrigerator. This heat can be used for number of domestic and industrial purposes. In minimum constructional, maintenance and running cost, this system is much useful for domestic purpose. It is valuable alternative approach to improve overall efficiency and reuse the waste heat. The study has shown that such a system is technically feasible and economically viable.The heat exchanger is fitted vertically in the storage tank, designed to match the specific condenser performance. This creates a system separate from the refrigeration plant for transferring its waste heat to the storage tank. An additional corrugated stain - less steel pipe is used for hygienic heating of fresh

water.You will always have warm water, even under less than full load.

II. LITERATURE REVIEW

IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684, PP: 28-32 www.iosrjournals.org. Design and Development of Waste Heat Recovery System for Domestic Refrigerator

Waste heat is generally the energy associated with the waste streams of air, gases and liquids that leaves the boundary of the system and enter into environment. Waste heat which is rejected from a process at a temperature enough high above the ambient temperature permits the recovery of energy for some useful purposes in an economic manner. The essential quality of heat is not the amount but its value. Waste heat recovery and utilization is the process of capturing and reusing waste heat for useful purposes. Not all waste heat is practically recoverable. The strategy of how to recover this heat depends on the temperature of the waste heat sources and on the economics involves behind the technology incorporated. By experimentation with waste heat recovery system (WHRS) in refrigeration unit, Kaushik andSingh .wehave found that 40% of condenser heat can be recovered through the Canopus heat exchanger for typical set of operating conditions. P. Sathiamurthi and PSS. Shrinivasan, discussed in studies on WHR from an air conditioning unit that the energy can be recovered and utilized without sacrificing comfort level. They have also shown that such a system is economically viable. Energy consumption by the system and environmental pollution can still further be reduced by designing and employing energy saving equipments.

In this paper, the authors have investigated a WHRS and experimented to recover condensation heat from domestic refrigerator of 165 liter. The refrigerating unit rejects considerable amount of heat to the atmosphere through its condensing coil unit. So, by suitably retrofitting the WHRS in the unit, waste heat is recovered. This heat is used to keep snacks and food warm, to heat the water which can be further used in health care centers, schools and industrial processes, to wash the cans in dairy by hot condensate, to dry clothes, grains etc. thereby saving significant amount of energy.

System Description and Design In the proposed system, the basic requirement is to utilize more and more exergy (waste heat). For that purpose some calculations are made regarding size and length of condenser and then WHRS is designed. But after different discussions and calculations for heat transfer rates we approached to the final design of insulated cabin with compact construction and with reasonable cost. So as to extract more and more heat, we have mounted two sections of air cooled condenser one at bottom and one at top side of the insulated cabin. This whole assembly is placed on the top of the refrigerator. The main advantage of this design is that we can get maximum heat with minimum losses. 3. Fabrication and Assembly Work

III.EXPERIMENTAL SETUP

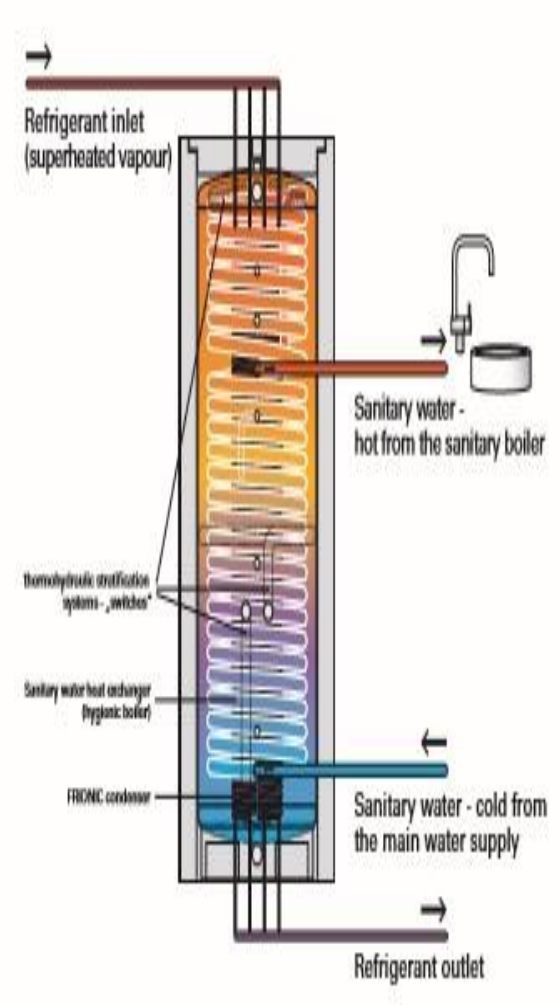

FIG-1 –EXPERIMENTAL SETUP OF SHELL AND TUBE TYPE HEAT EXCHANGER

IV.PROJECT OVERVIEW

The present paper gives an insight on the thermodynamics of refrigeration plant heat recovery systems. The concept of an energy conversion ratio, ECR, the heating load divided by the total energy consumption, is introduced to measure the efficiency of the conversion of electrical energy into heat. In the first part of the paper a simple energy analysis of both recovery schemes is carried out, showing that ECR is strongly dependent on the proportion between the existing cooling and heating load requirements. In section 3 experimental results from an existing refrigeration unit, with direct heat recovery, are shown. Finally, in section 4, a study is made taking into account temperature requirements at both evaporator and condenser /heater outlets. For this study a numerical simulation model was employed.

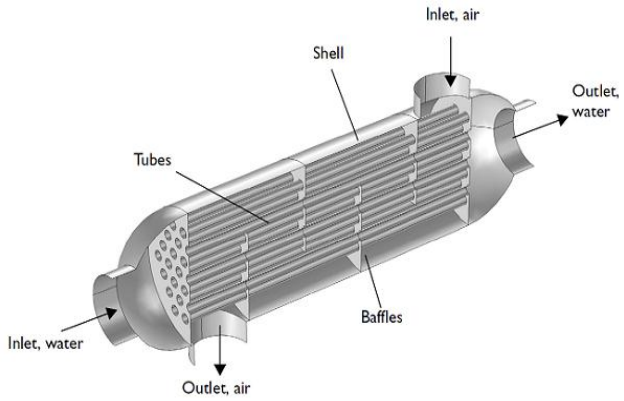

FIG-2 TUBE AND SHELL HEAT EXCHANGER

On the ideal cycle study only energy (heat and work) quantities were involved whilst on the experimental analysis, in the previous section, the only concern with temperature regarded that of condensing and evaporating temperature levels. In practice, however, there is a definite requirement regarding the temperatures of water (or air, in smaller units) achieved at both evaporator and condenser /heater outlets. To evaluate the effects of these temperatures on the performance of the plant as a total energy system., two simulation models were employed

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V. EXPECTED CONCLUSION

By this system we can utilize upto several percentage of waste energy. This system will helps to heat the feed water for boiler so that the efficiency of boiler will be increase by some percentage also we can use this pre heated water in many processes in industry.

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