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ANALYSIS OF EFFICIENCY IMPROVEMENT OF AIR CONDITIONING SYSTEMS: A CASE STUDY

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of Science

University of Moratuwa



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Prof. Lanka Udawatta 

ABSTRACT

This research intends to study the principles and the concept of air conditioning set out by Willis Carrier and to look into the manner in which its discovery has changed the world we live in. It involves the study of various equipment used in air conditioning systems currently and the way they have evolved over time. The research primarily strives to recognize problems that can arise when using these machines, understand the reasons for various inefficiencies in their performance and the calculation of the energy losses that arise as a result. It then sets out the framework by which a solution to lessen such energy loss can be successfully arrived at. All activities of this research inclusive of the collection of data, the calculations made using these data and the identification of problems that surfaced, were carried out based on the air conditioning systems at the Lady Ridgeway Children's Hospital, Colombo. A successful effort has then been made in this dissertation to summarize the problems identified in the operation of these machines at the above mentioned site and to provide a comprehensive and viable solution. In doing so, the efficiencies of the A/C machines at the hospital have been calculated separately according to the ASHARE guidelines while calculations have also been made with some assumptions to ascertain the loss of energy on a daily basis due to deficiencies existing in these air conditioning systems. However, this research extends far beyond a mere effort to find the loss of energy from these systems at the Lady Ridgeway Children's Hospital and reduce such loss; the collective of information gathered and the solutions provided to the problems revealed through this collective extend the scope of this research to one with a wider authority. Further, this dissertation presents its facts and findings so that a correct understanding about the changes in the efficiencies of an air conditioning system and about the economic benefits accruing from the exertion of effective control over such changes is delivered to anyone who wishes to study it in depth.



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DEDICATION

The effort being made to successful end of this assignment will be dedicated to my loving parents, who left me this world few years ago.



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LIST OF ABBREVIATIONS

| Abbreviation | Description |
|--------------|--|
| A/C | Air Conditioning |
| ACCA | Air Conditioning Construction of America |
| ASHARE | American Society of Heating Air Conditioning and Refrigeration Engineers |
| q | Amount of Heat |
| A | Area |
| AC | Alternative Current |
| BUR | Build Up Roof |
| BTU | British Thermal Units |
| COP | Coefficients of Performance |
| CEIFS | Construction of Exterior Insulation and Finish Systems |
| CMU | Concrete Masonry Unit |
| DC | Direct Current |
| dp | Dew Point |
| EER | Energy Efficiency Ratio |
| E | Energy |
| η | Efficiency |
| h | Enthalpy |
| Q | Heat |
| HVAC&R | Heating Ventilation Air Conditioning and Refrigeration |
| HCFC | Hydro Cloro Floro Carbon |
| U | Internal Energy, Overall Heat Transfer Coefficient |
| Ql | Latent Heat |
| L | Length |
| LRH | Lady Ridgway Hospital |



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| | |
|------|----------------------------------|
| M | Mass |
| G | Moisture Content of Air |
| OFN | Oxygen Free Nitrogen |
| RH | Relative Humidity |
| C | Specific Heat Capacity |
| SEER | Seasonal Energy Efficiency Ratio |
| SHR | Sensible Heat Ratio |
| Qs | Sensible Heat |
| T | Temperature |
| k | Thickness Thermal Conductivity |
| R | Thermal Resistant |
| U | Thermal Transmittance |
| USA | United State of America |



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