

Optimal Refrigerant by Integrated Operational and Environmental Criteria in Air Conditioner

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The study provides a developed methodology by aiding Analytical Hierarchy Process (AHP) to select a robust decision process for integration of environment, operation and maintenance. The developed methodology is a new process of selecting refrigerant with high efficiency performance and lowest impact on environment in AC system under high condensing temperatures (up to 55°C) for R22, R290, R404A and R410A. This will improve its operational performance through increasing the level of application of the international standards for performance and environment together. The methodological model provides three phases; decision of design phase, decision of management phase and decision phase. The goal of the study is to integrate of those decisions to reach for robust design by optimal design of products by focusing on three main sets of tools: simulation, optimization and multi-objective analysis. The model is based on two main criteria of air-condition system, quantitative criteria (operation) and qualitative (environment and maintenance) criteria. The results obtained from the AHP are that the best rank of the refrigerants was R404A (0.3763) followed by R22 (0.3657) for the other refrigerants and so on. Therefore, the developed model can help the decision maker selecting the best refrigerants for both criteria (qualitative and quantitative) in complex selecting process.

CONCLUSION AND RECOMMENDATIONS

Choosing the optimal performance offer is multiple - criterion decision making problem, where could be made conflict between alternatives of decisions making. Therefore, the manager who does the select and the evaluation has to reach a compromise between these alternatives and to reach the weights for each of alternatives. So, one of the best solution which are offered in these conflict situations, is the AHP method. The developed model based on AHP provides redundancy for preference assignment of alternatives to validate performance criteria (operation and environment) consistency. As with all complex systems problems, selecting the most suitable process was AHP process for designing conditioner systems. Figure.4 shows the variation of difference in the effect of each sub-criteria on the performance of the system. The study proposed model for helping managers and designers to facing this effect. The methodology prefers a specific refrigerant which carries the best effecting to make the decision making at optimal. the results obtained from the developed model are that the best rank of the suitable refrigerants was R404A (0.3763) followed by R22 (0.3657) and so on for the other refrigerants under study. The preferring process based on integrated between criteria of operation, environment and maintenance. Therefore, the developed model can be used to

select the best alternative for both criteria (qualitative and quantitative), when facing a complex selecting process in AC system.