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A study of parameters affecting the dirtiness on the performance signals of a room air conditioning unit

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Abstract

To maintain a good performance, a room air conditioning unit is generally recommended to be cleaned twice a year, regardless of operating hours or concentration of airborne particles. With less operating hours or under clean ambience, the maintenance cost could be postponed under common energy efficiency. If a cleaning signal could be sent from the unit, itself, to the owner, a proper cleaning schedule could be provided. A dirtiness monitoring factors are aimed to be investigated from this study. Under varied degree of dirtiness simulated on the fan coil unit, system operation behaviors and thermodynamic properties were investigated. An experimental apparatus was installed under the actual indoor and outdoor conditions, in order to follow up related factors on real-time vapor compression cycle.

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Keywords: Air condition; dirtiness; performance; energy; control system

1. Introduction

Airborne particle collected on fan-coil surface of a room air conditioner is especially problematic in the air conditioner's system. In normal operation, flowing of dirt, dust and other solid particles are easily collected with assistance of condensed water vapor. The blower's weighted and the fan speed could also be reduced with the dirt mass. They cause a reduction in flow of supply air, and as a result on lower convection heat transfer. The dirt coated fins and tube reduce in the system's cooling capacity and performance. The dirt inherent with moisture condensed on

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the cooling coil could also facilitate the microbial growth, which is risky to human health [1].

Air filter in a room air conditioning unit is generally recommended to be cleaned at least monthly to maintain a good energy performance [2]. However, less operating hours or under clean ambience, the maintenance cost could be postponed under common energy efficiency. Higher level of dirtiness causes reduction in air flow velocity. It yields a larger drop in capacity and coefficient of performance [3].

This study is aimed to find out the effects of dirtiness on a split-type air conditioner's operation. Selection of parameters found from this study would be an input to a design of control system that could be informed by the unit to the owner in the future. The experimental apparatus provides 7 different degrees of dirtiness simulated by individual cover layer on the fan coil unit, system operation behaviors and thermodynamic properties were investigated.

2. Experimental Apparatus and Procedure

An experimental apparatus (Fig.1) was installed under the actual indoor and outdoor conditions of existing split-type air conditioner (A/C), installed at an ongoing office, in order to follow up related factors on real-time vapor compression cycle. Pressure and temperature sensors were installed in the refrigerant pipe line to located enthalpies of the fluid inside the cycle. Supply and return air flows and temperatures were measured. Outdoor air condition and indoor air condition were measured during the operating period.

The studied A/C was cleaned before the experiment. The dirtiness was simulated by covering the fan coil unit (FCU) with 1, 2, 3, 4, 5, 6 and 7 screen layer, respectively, of cotton100% Ne 16 X Ne16,Wrap X weft 30 X 30 per inch cloth (as seen in Fig.2),

Specification of the A/C is 32,476 btu/h, 11.52 btu/Wh in EER. Serviced time is currently 9-years-old.

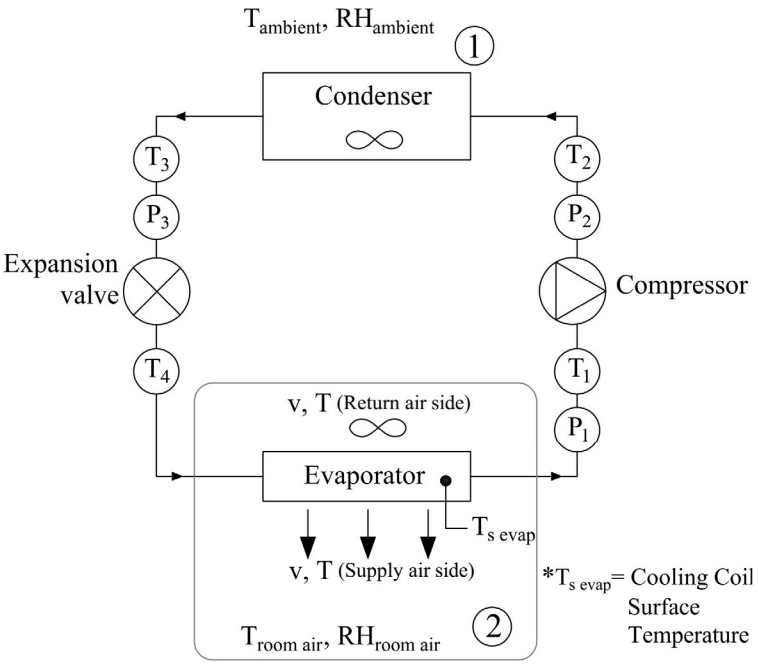

Fig. 1. Experimental apparatus schematic diagram.