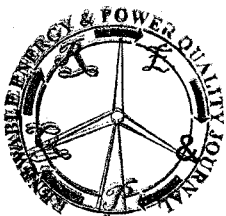
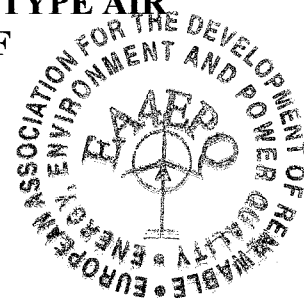


IDENTIFICATION OF THE REFRIGERANT PRESSURE IN SPLIT-TYPE AIR CONDITIONERS BASED ON HARMONIC ANALYSES OF ELECTRICITY SUPPLY CURRENT



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ABSTRACT

An analysis is presented of the interdependence between power supply characteristics of single phase split-type air conditioners and pressure of the operating fluid (refrigerant) within the air conditioner system. On the basis of the tests performed by a real air conditioner the corresponding correlations have been established. Of special interest is the influence of refrigerant pressure on the level of the second harmonic of the supply current and active input power of air conditioner. The established correlations allow that by processing the input current and voltage of an air conditioner one can make a diagnosis of the state of refrigerant pressure within the system which is a fast, comfortable, and ecologically better approach compared to the classic direct measurement on the operating fluid by a pressure gauge.

KEY WORDS

Identification, air conditioners; refrigerant pressure; power supply; harmonic analyses.

1. Introduction

An ever increasing number of air conditioners, particularly in urban residential and office objects, in Serbia is being installed over the past decade, Fig. 1. Typically, the units of rated power 12000 BTU/h of the split-type system are being in use. HFC refrigerants such as R410A, R407C and HCFC22 (in older types) predominantly use in residential and office air-conditioners.



Fig. 1: An office building in Belgrade having many single phase split-type air conditioners installed

The outdoor units of air conditioners are often mounted on building walls at places which are difficult to access [1], and their maintenance is sometimes a difficult and hazardous job. The most frequent problem is to make a diagnosis of the refrigerant pressure in the system. Measurement of refrigerant pressure is usually performed by a classic pressure gauge connected to the corresponding valve on the outdoor unit of air conditioner. Owing to the difficulties in accessing these outdoor units the maintenance job could cause serious and hazardous problems to maintenance personnel. In addition, during each measurement certain amount of refrigerant [2] leaks in the atmosphere contributing to the negative global effects on the atmosphere [3,4].

In this article a new possibility of detecting the state of refrigerant pressure on the basis of an analysis of electrical parameters of the corresponding power supply is presented. In this way the diagnosis of the state of refrigerant pressure would be made by performing measurements at the electrical inlet of air conditioner which is a fast, comfortable, less hazardous, and ecologically superior approach compared to the classical measurement of refrigerant pressure by a pressure gauge. In addition to the mentioned good points, the proposed method belongs to the group of non-invasive measurement methods since the measurement does not involve contact with the refrigerant whose pressure is being measured.

2. The Measurement Method

For the purpose of establishing how the state of refrigerant pressure affects the current and power of the supply, a test has been performed with a typical air conditioner of rated power 12000 BTU/h. The principle wiring diagram of the measurement is shown in Fig. 2.

The measurement of electrical characteristics of air conditioner power supply and harmonic analyses of current has been carried out by a PC based measurement system [5].