EXPERIMENT STUDY ON CONTINUOUS COMMISSIONING A REAL VAV SYSTEM

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ABSTRACT: In order to study the automated continuous commissioning characteristics of VAV systems, a set of experiments were conducted on a real VAV system in the office building of Yamatake Building System Company. Four types faults, which are top problems amenable to automated continuous commissioning, were introduced into the VAV system. The performance data of the VAV system were measured and automatically recorded once a minute using a data logger. From the experiment results, three conclusions can be drawn: 1) Automated continuous commissioning is feasible if simulation analysis and operation records are used for commissioning, and new simulation models suitable for continuous commissioning are need; 2) Operation records are useful for continuous commissioning sensors; 3) If the status of a component changes, the relevant variables, such as supply air volume, air temperature, pressure etc., do not change simultaneously. Some variables change several minutes late. This change delay should be taken into consideration during automated on-line commissioning.
Keywords: Automated continuous commissioning, Variable air volume (VAV) systems, Fault detection and diagnosis (FDD), Experiment study

NOMENCLATURE

E	Energy consumption (W)	*Subscripts*	
ΔP	Pressure loss (Pa)	o	Outdoor air
S	Air flow resistance coefficient (Pa/(m^3/s)^2)	r	Return air
V	Volume flow rate (m^3/s)	t	Total
Greek symbols			
α	Flow rate ratio of outdoor air to return air		
η	Efficiency		

1. INTRODUCTION

Building commissioning is the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent [1]. Building commissioning is increasingly recognized as a viable method to help ensure the high performance of buildings and their energy management systems (EMS). This idea is gradually conceived since some analyses on the data from the buildings participating in the energy conservation program revealed that many of the installed energy efficiency measures were not performing as expected [2]. Energy efficiency measures and technologies began to be studied since the Middle East War crisis of 1973-1974, when the oil embargo by a number of Arab producers made the main industrial countries became painfully aware of their vulnerability to the new economic power of the oil producer countries [3]. The urgent need for oil security management and energy policy co-operation led to the establishment of International Energy Agency (IEA) and comprehensive study on energy efficiency. For the awareness of the importance of commissioning, IEA started a new research program Annex 40 in 2001, which is named Commissioning of Building HVAC Systems for Improved Energy Performance. The main objective of Annex 40 is to develop, validate and document tools for commissioning buildings and building services that will help facilitate the achievement of this goal [4]. Building commissioning begins with the program phase and continues across design phase, construction phase, acceptance phase and post-acceptance phase [1]. Post-acceptance phase commissioning includes ongoing commissioning, which is named continuous commissioning, and the commissioning of HVAC systems that are changed or modified during operation phase, which is named retro-commissioning. This paper studied the characteristics of continuous commissioning through conducting a set of experiments on a real variable air volume (VAV) system in the office building of the Yamatake Building System Company. The following four types of faults were selected to introduce into the VAV system, which are problems amenable to automated continuous commissioning [5][6].