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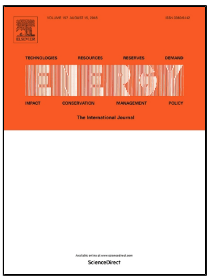

Experimental analysis of an improved regulation concept for multi-panel heating radiators: Proof-of-concept

Matjaž Prek, Gorazd Krese

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Experimental analysis of an improved regulation concept for multi-panel heating radiators: Proof-of-concept

Matjaž Prek[a]*, Gorazd Krese[b]

[a] - University of Ljubljana, Faculty of Mechanical Engineering, Aškerčeva 6, SI-1000 Ljubljana, Slovenia
[b]- Korona d.d., Cesta v Mestni log 88 a, SI-1000 Ljubljana, Slovenia

* Corresponding author. *Tel.:* +386 1 4771 101; *Fax:* +386 1 2518 567; *E-mail address:* matjaz.prek@fs.uni-lj.si

Abstract

Lower heating demands for space heating impose new requirements for the operation of radiators. Contemporary type of new building construction, retrofitted buildings with smaller heat losses and higher requirements for energy efficiency and thermal comfort, demand an improved radiator design and regulation of heat output. As heating systems mostly operate at part loads, it is important to adopt the heat output as quickly as possible to the variable conditions.
This paper presents an experimental validation of an improved heat output regulation concept for multi-panel radiators. A novel concept of water flow arrangement for double panel radiators was investigated. The proposed design enables different sequential water flows through each parallel connected panel. The experimental analysis was carried out in two steps: first, the heat output was studied in a nominal steady state at standard testing conditions; second, the radiator was tested at transient conditions.
The results show that the implementation of the modified water flow arrangement significantly improves the transient response of heating radiators in terms of reduced time delay and balancing time. An improvement of the regulation ability, expressed as controllability, was also identified.

Keywords: Heating radiator, Heat output, Transient response, Infrared thermography.

Highlights:

- Parallel connected panel radiator with sequential water flow arrangement was tested.
- Analysis of step heating up process by transient infrared thermography.
- Transient response improvement in terms of reduced time delay and balancing time.
- Novel regulation concept significantly improves the controllability of heating radiators.

Nomenclature

C	total heat capacity (J/K)
c	sensitivity coefficient (-)
c	specific heat capacity (J/kgK)
k	coverage factor (-)
m	mass (kg)
$\dot{m}$	mass flow rate (kg/s)