

# Innovation in Electric Arc Furnaces: Scientific Basis for Selection



## An effect of heat insulation parameters on thermal losses of water-cooled roofs for secondary steelmaking electric arc furnaces

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**ABSTRACT.** The aim of this work is research in the insulation parameters effect on the thermal losses of water-cooled roofs for secondary steelmaking electric arc furnaces. An analytical method has been used for the investigation in heat transfer conditions in the working area. The results of the research can be used to choose optimal cooling parameters and select a suitable kind of insulation for water-cooled surfaces.

**KEYWORDS.** Electric arc furnaces; Heat transfer; Mathematical modeling; Water-cooled roofs.

### INTRODUCTION

In order to extend the run time between repairs of electric arc-heated furnaces and to reduce consumption of refractories, in recent years modular water-cooled components are used more frequently in their design. Application of such components, however, involves increased thermal losses, and their faultless operation imposes additional design and operation requirements. It is well-known that, in the presence of water-cooled components, one of the possible ways to reduce thermal losses is application of low-emissivity coatings. Another option is creation of additional heat resistance using refractory insulation. The effect of applying such insulations and coatings depends on the thermophysical characteristics of the materials. Besides, one should expect that, depending on the particular construction, the influence of the thermophysical and radiation insulation characteristics on thermal losses is not simple. That provoked a more detailed study of the water-cooled elements thermal performance under various options of additional measures (application of additional insulation) which would help to establish the influence of various parameters.

### MATHEMATICAL MODEL OF HEAT EXCHANGE

The normal work and efficient usage of water cooling elements requires restrictions to be made and a number of special features to be taken in consideration when defining the constructive parameters:

- heat load under the influence of the arcs and metal;
- cooling water movement regime;
- outlet cooling water temperature;
- possibilities for heat losses decrease through protective cooling covering with a definite emissivity and thickness.

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