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ABOUT CHANGE OF TIGHTNESS EMISSION-HAZARDOUS ASSEMBLIES OF THERMAL UNITS

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To estimate reliability of thermal units it is offered complex criteria in which parameters of the technical state of assemblies and also the functions reflecting a degree of effect operational, mechanical and temperature factors on process of a depressurization and loss of functional properties of the unit elements are integrated.

The main requirements to technical objects are reliability, profitability and minimum possible of environmental contamination. Thermal units of a traditional design (coke oven, blast furnace, glass furnace etc.) for the present in an insufficient measure correspond to modern norms under these characteristics, and increase of their individual capacity, along with positive results, is connected with increase in material losses and an ecological damage at refusals, idle times and repairs.

In coke-ovens such dangerous assemblies the most difficult constructive elements are: covers, hatches, assemblies of loading and an unloading of raw materials and a product, supply of gases, control, clearing, repair etc.

Dangerous assemblies of the coke-ovens to constructive signs are transformed to two generalized schemes (fig. 1): type "cover" – for one-piece connections and «pipe in brickwork» – for split connections [1].

The further accumulation and chips increase leads to formation of pits. The given kind of defects is the main reason critical damages of formation – troughs, especially in the upper zones of division walls. Criteria of a technical condition of thermal units [2] are offered for the analysis of technical condition emissions dangerous assemblies for the prevention occurrence critical situations purpose, timely elimination of defects and the undesirable phenomena.

Their quantity is defined by the process parameters quantity of the functional properties loss – tensile strength σ^{*} (for refractory elements) or a yield stress $\sigma_{\text{т}}$ (for metal elements) and specific leak Q per unit of the perimeter for a time unit.

In a general view these criteria are the following:

$$\sigma^{M}_{i=1...n} \le \sigma^{*} \cdot K_{\sigma}; \tag{1}$$

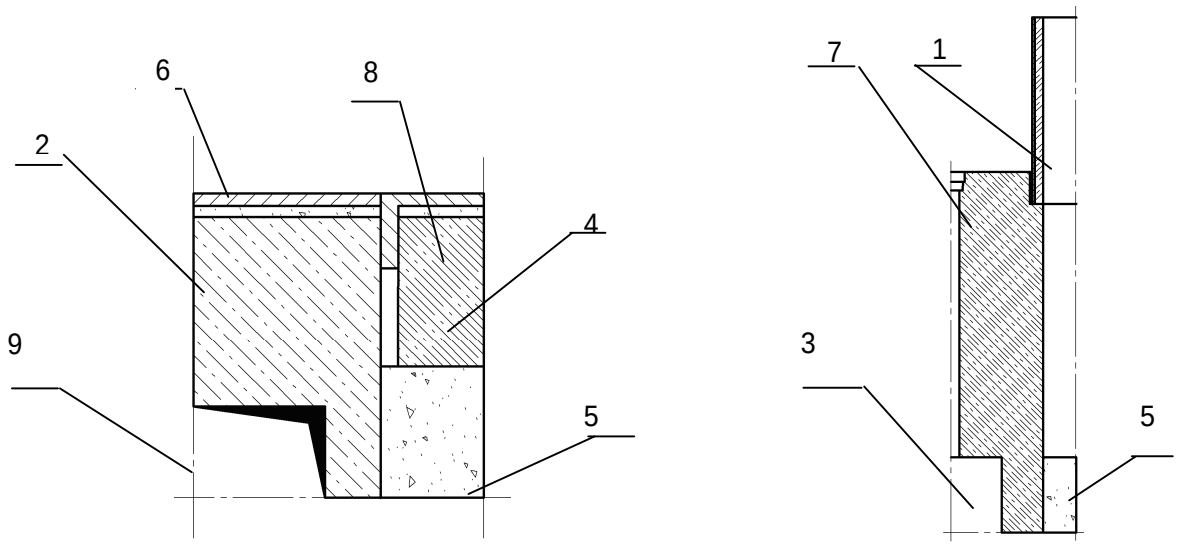
$$Q_{ПДВ} \ge \left(\frac{\Delta pB}{\mu}\right) K_{Q} \ , \tag{2}$$

Where $\sigma^{\mathbf{m}}$ – stress in elements, Δp - pressure difference between internal and an environment; μ - dynamic viscosity of gas emissions, B – the area of the gap arising in connection of elements, $K_{\sigma^{*}}$, K_{Q} - the functions considering influence on assembly durability and their hermiticity of the destruction factors (temperature, mechanical, operational).

In a general view criterions functions represent the regressions equations. Factors of the regressions equations are obtained by properly of the experimental researches of a elements material strength change and connections hermiticity in coke-ovens operation. Data about the temperature and stress strain state of coke-ovens elements are obtained as a result of the distribution temperatures mathematical model realization and stress in the section of considered assemblies [3].

The calculation of elements and connections by criteria of a technical condition (1, 2) [4] defines the criterions functions limiting values, at which non-failure operation of elements and observance of sanitary specifications on emissions is guaranteed, are defined.

It is established that at a deviation from the normal operation mode and absence of resets of thermal units dangerous assemblies after 500 cycles of operation there are unserviceability sites in elements and after 2000 cycles there will be a loss of functional properties for all elements - covers, hatches, loading and unloading assemblies.



a *b*

Fig. 1. Calculated schemes of the emissions dangerous assemblies:

Assembly of type "cover", type assembly “pipe in brickwork”: 1 - pipe, 2 - oven brickwork, 3 - aperture of recirculation, 4 - plug, 5 – material to be processed, 6 - brickwork reinforcing, 7 – oven roof brickwork, 8 - cover, 9 - heating funnel

To increase the duration of the period of failure-free elements operation it is necessary to raise values of the criterion function K_{σ^*} and to reduce values K_Q.

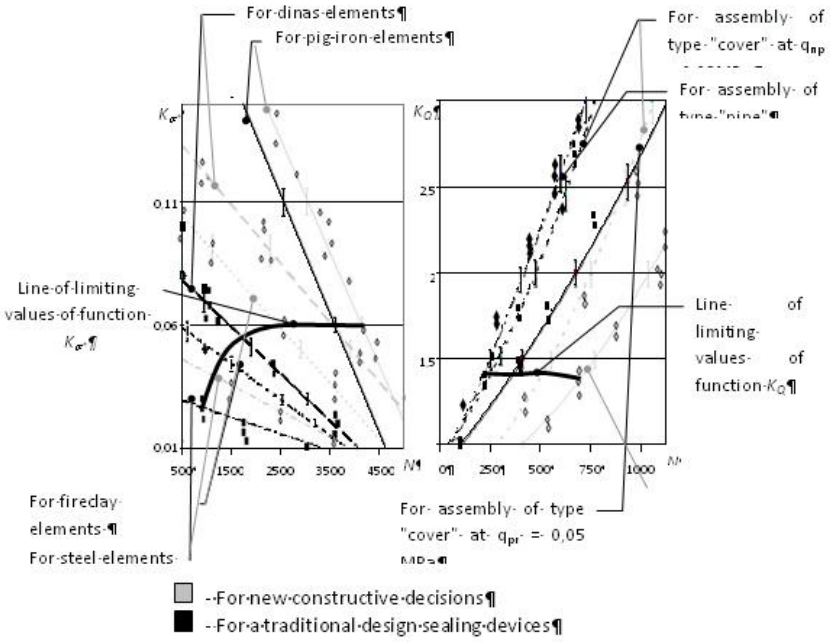


Fig.·2.·Change·of·values·criterions·functions·K_σ·,·K_Q·depending·on·quantity·deliveries·of·the·coke oven· pushing· N· and· efforts· of· pressing· pressurizes· elements· q_{pr}· in· various· conditions· of operation¶

For this purpose it is necessary to pass to new conditions of operation of thermal units, so to prevent occurrence of the events breaking functioning of assembly (fig. 2).

The dangerous emissions assemblies elements calculation results analysis by criteria (1), (2) has shown, that prevention, first of all, of such events as

pollution of surfaces by resinous products of coking, burning of gases on unit surfaces, constructive changes of elements (increase in length of a head of a division wall at 50-100 mm, use of the large-block plug for metal elements), maintenance of a self-centering of thermal unit hatches and doors, will lead to reduction values of temperature and mechanical loadings, speed reduction of superficial elements destruction, will reduce to a minimum dimensions of the gap between a cover and a frame of assembly [3].

Assemblies elements calculation by technical condition criteria (1), (2) with criterion functions K_{σ^*} and K_Q in new conditions has shown that the quantity and the dimensions of the reliability low level zones in assemblies was sharply reduced. Unserviceability sites will appear in the assembly only after 4000 cycles. It is brickwork of the first heating funnel and a plug surface (50-70 mm). Duration of the period of failure-free operation of such elements as a door case, brickwork of refractory elements at the door zones, reinforcing elements will increase over 5000 cycles. During operation of the coke battery with a deviation from a normal mode infringement of sanitary specifications on emissions will occur after 400 cycles of the coke oven pushing.

Criterions functions change laws research of the each assembly element has allowed defining failure-free operation periods of the least secure elements, and also limiting values of the criterions functions for each element and assembly type at which failure-free operation and also observance of sanitary specifications on emissions.

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