

NOISE CONTROL IN ELECTRIC STEELWORKS

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One of the most important sources in the steelworks is the electric arc furnaces.

Noise measurements in the main works of the steel industry in the country pointed out a high level of noise, presenting a harmful character in most of the analyzed cases. The daily personal noise exposure of the employees exceeds 87 dBA (the highest value accepted by the general Regulations for Work Protection) with values between 6 and 11 dBA, depending on the type of the furnace and its loading.

Data from the specialized papers show the existence of a package of solutions for noise control, which include the electric furnace and its technology as well as the manner to build the hall. A synthesis of these solutions is presented. Starting from the mentioned data, there were structured two categories of solutions: They are:

- Solutions for the existing steelworks;
- Solutions for the new steelworks.

The first category solves only partially the problem of employees' exposure to noise in the electric steelworks. The people working on the furnace platform, in the cast house, in the vault repairing and manufacturing section are still under the action of the noise produced by furnaces.

Therefore, only a change in the manner of designing the steelworks can solve the problem.

The proposed system implies a sound insulating partition of the steelworks, the proposed structure allowing the loading of the furnace with buckets, the motion of mobile bridge through the trap-door in the ceiling, and the access to the furnace hole. The casting is made in the ladle moved by a carriage in the cast house, the space between the furnace and the cast house being closed with sound insulating doors.

The most important noise sources in the steelworks are the electric arc furnaces.

The noise radiated by the electric arc in the furnace is extremely intense during the melting, especially at the first stack, and becomes moderate at the refining.

There are two parameters that are decisive in the level of the electric arc noise:

- space stability of the arc
- electric power.

An electric arc furnace has the noisiest level at the beginning of the melting, when the electric arcs are very unstable, taking into consideration the arc ignitions and blow-outs on the solid iron scrap.

Regarding the influence of the electric power it was proved the directly proportional relation between the noise level of the electric arc furnace and its power.

Moreover, former researches pointed out that an electric arc gets noisier whenever:

- its perturbations of its functional characteristics are higher;
- its temperature is lower; the atmosphere of arc operation is unsuitable.

Noise measurements in the main steelworks of the processing industry in Romania (not steelworks in the metallurgy of iron) pointed out a high level of noise, with harmful effect in most of the analyzed cases. The daily exposure of the workers is higher than 87 dBA (the highest value accepted by the General Regulations for Work Protection) with 6 to 11 dBA depending on the type of the furnace and its loading.

Data from the specialized papers show the existence of a package of solutions for noise control, which refers to the electric arc furnace and its technology as well as the building design of the hall. A synthesis of these solutions leads to the following:

- a) use, of the basic rare earths and titanium in the process of preparing the electrodes;
- b) improvement of the ionization condition of the electric arc atmosphere by blowing an inert gas (argon);
- c) replacement of the electric furnace supply with alternating current by the supply of direct current; the solution presents further advantage in the consumption of the electrodes as well, by contributing to its reducing;
- d) constant loading of the furnace with pre-reduced ores or hacked iron scrap resulted in the reduction of the noise level from 100 ...105 dB to 95 dB;
- e) proper setting of the iron scrap in the furnace. The loading of the high iron scrap above the heavy iron scrap led to a reduction of the noise level of 5 to 10 dBA;
- f) building of sound insulated cabins for the furnace command and control;
- g) sound insulating isolation of the furnace area from the rest of the halls;
- h) a sound insulating compartment for station of demolition and rebuilding of the heat resisting walls and vault;
- i) use of the induction furnace for obtaining the steel. Its role is to melt the iron, scrap, whereas refining takes place in the melted steel tank – the solution provides other effects (economical ones) apart from the important reducing of the noise level.

Starting from the mentioned data, two categories of solutions were structured. They are:

- solutions for the existing steelworks;
- solutions for the new steelworks.

In the existing steelworks, where the products circulation is set rigidly, depending on the furnace location, the implementation of the noise reduction solutions must take into consideration the existing operating process and must allow its flow. Therefore, in order to reduce the noise level, the following solutions were settled:

- a) building of sound insulated cabins for furnace command and control, wherever they haven't already been built;

- b) improvement of the sound insulating characteristics of the existing cabins;
- c) provision of the steelworks with iron scrap hacking machines and proper setting of the iron in the furnaces;
- d) use, for the small furnaces, of an equipment of automatic adjusting of electrodes, proposed by an institute for electro technical design.

This first pack of solutions solves only partially the problem of the employee exposure to noise of the electric steelworks. The ones working on the furnace platform, in cast house, or workshop for the vault recondition and building are still under the action of the furnace noise.

Therefore, only a change in the way to design a steelwork can solve the problem. The main solution is to isolate the furnace from the rest of the halls. There are already some projects which use either the sound insulating of the furnace hall (e.g. BREDA SIDERURGICA, ASEA, DEMAG/DDS), or the electric arc furnace location in an enclosed area (KRUPP). Apart from the conditions of a better capture of the emissions (gas, dust) this later solution allows the diminution of the isolated area, and, due to a better surface/volume ratio, the possibility of a better sound insulation.

Since exploiting the furnace includes a series of manipulations, one must make sure that the sound insulation should not be diminished by the sealing failure that may occur.

Such a system of individual sound insulating enclosing of each electric arc furnace was proposed by the Sound and Vibrations Laboratory within I.N.C.D.P.M. The schematic design is presented in the figure.

The proposed system implies a sound insulating partition of the steelworks, the proposed structure allowing the loading of the furnace with buckets, the motion of mobile bridge through the trap-door in the ceiling, and the access to the furnace opening. The casting is made in the ladle moved by a carriage in the cast house, the space between the furnace and the cast house being closed with sound insulating doors.

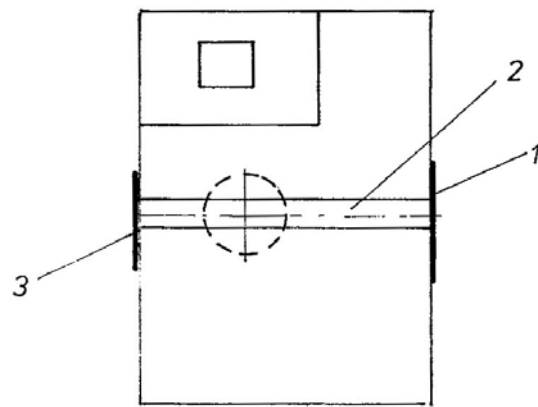
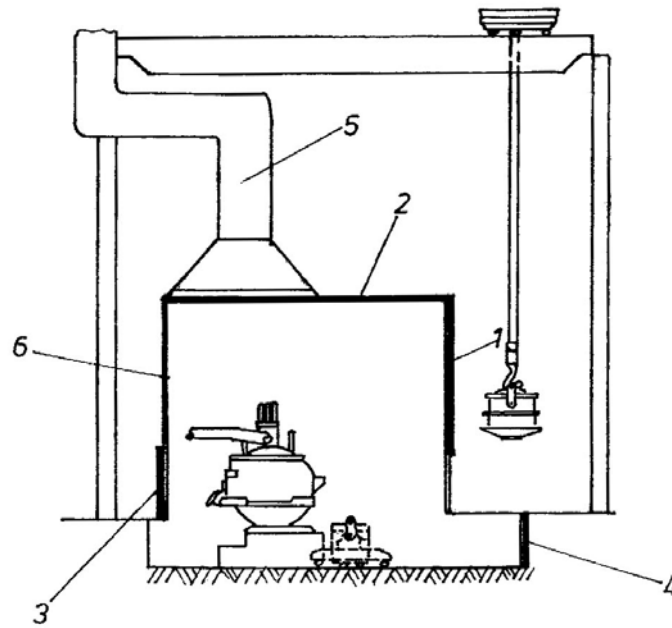


Fig.1. system of sound insulation of an electric arc furnace

- 1 – access door for the loading buckets
- 2 – mobile hood for the bridge cables
- 3 – furnace access door
- 4 – casting ladle access door
- 5 – gas capture system
- 6 – sound insulating structure

The individual sound insulating enclosing of the furnace, in the proposed system, brings about the advantage of protecting the workers on the furnace platform as well as the ones in the cast house and in the workshop for vault recondition and building without any additional measures. Furtheron, a system of gas and dust capture can be branched in, possibly a gas capture and evacuation equipment made by our colleagues in the Industrial Ventilation Laboratory within I.N.C.D.P.M. The size of the enclosure shall allow the swinging of the vault and the circulation of the buckets containing iron scrap for loading.

Applying such a system in steelworks with small and medium electric arc furnaces allows a daily exposure to noise of the workers within the limits of General Regulations for Work Protection (2002 issue in Romania).