

## ENGINEERING SCIENCES

### REDUCING RISKS OF WELDING POROSITY

**Volodymyr Haievskiy<sup>1</sup>**

DOI: <https://doi.org/10.30525/978-9934-588-13-6-16>

The modern quality management system in production is based on the control of risks of non-compliance with quality requirements [1, p. 41]. Pores are a common defect in welds. The appearance of pores can disrupt the functionality of products, lead to man-made disasters, human casualties. To reduce the risks of porosity of welds, coordinated actions of managers, designers, technologists, quality inspectors are required. The reduction of porosity risks can be achieved by optimizing the applied welding methods, the parameters of the welding modes, the welding materials used and their preparation for welding, methods for controlling the porosity and sample control volumes. Unreasonably large volumes of control lead to additional costs, and too small volumes of selective control increase the risk of transferring into operation products with unacceptable porosity of welds. Thus, by optimizing sampling volumes, the risks of weld porosity can be reduced with minimal technical control costs.

Hydrogen is the main cause of porosity of welds. The moisture of welding materials is the main source of hydrogen in the weld metal. We have developed a method for determining the resistance of welds to pore formation [2, p. 38]. This technique allows you to experimentally determine the probability of exceeding the permissible porosity of the welds.

Risks for exceeding the permissible porosity of welds can be assessed using the Potential Failure Mode and Effect Analysis technique (FMEA) [3, p. 24]. The risk of non-compliance with a quality requirement is determined by three factors: the probability of non-compliance, the consequences of such non-compliance and the possibility of timely detection of non-compliance or its cause. Quantitative data on the probability of exceeding the permissible porosity of the welds, combined with an understanding of the consequences of exceeding the permissible porosity and an acceptable level of risk, allow us to calculate the minimum required volumes of selective control of the porosity of the welds [4, p. 5].

---

<sup>1</sup> National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Ukraine

The method for determining the minimum sample volume necessary for controlling porosity has been successfully implemented in the production of air tanks R7-78 in combination with statistical control of the production process.

A method for reducing technological risks, based on determining the minimum required sample size, seems to be quite universal and can be recommended for controlling defects with known (predicted) occurrence probabilities.

### References:

1. Fomichov, S., Banin, A., Skachkov, I., Lysak, V., Gaievskiy, O., & Yudina, N. (2019). *Standard Management Systems. Quality Management*. Kyiv: KIM.
2. Prokhorenko, V. M., & Haievskiy, V. O. (2014). Jmovirnistj nevykonannja vymogh do porystosti shva pry zvarjuvanni pid flju-som [The probability of failure to meet the requirements for the porosity of the seam when welding under flux]. *Technological systems*, vol. 3, no. 68, pp. 33-41. (in Ukrainian)
3. Rybakov, I. N. (2009) *Analiz vidov i posledstviy potentsialnykh otkazov. FMEA. Ssylochnoe rukovodstvo* [Analysis of the types and consequences of potential failures. FMEA. Reference guide]. Nizhniy Novgorod: «Prioritet» Publ. (in Russian)
4. Gaievskiy, V., Prokhorenko, V., & Ziberov, M. (2014). Limitation of risks of non-compliance of weld metal porosity. *Graduação em Engenharia Mecânica*, vol. 1. pp. 4-7.

## PROBLEMATIC ASPECTS AND WAYS TO INCREASE THE LEVEL OF METALLURGICAL SLAGS DISPOSAL

**Mykhailo Petlovanyi<sup>1</sup>**  
**Oleksandr Filonenko<sup>2</sup>**

DOI: <https://doi.org/10.30525/978-9934-588-13-6-17>

Functioning of the industrial complex of Ukraine is characterized by a high level of waste formation, resulting in more than 30 billion tons of solid waste, accumulated on the daylight surface of Ukraine [1, p. 24; 2, p. 46]. The metallurgical industry is one of the leading sectors of the Ukrainian economy, hence, it plays an important role in the functioning of the economy, providing inflow of foreign currency to the nation's budget at the level of 40%. Instead,

---

<sup>1</sup> Dnipro University of Technology, Ukraine

<sup>2</sup> Dnipro University of Technology, Ukraine