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DOI: 10.15199/40.2023.11.3

Quality control of material supplies used in the operation of underground mining plants

Kontrola jakości dostaw materiałów stosowanych w ruchu podziemnych zakładów górniczych

This article presents issues relating to the quality control of materials supplied and used in the operation of underground mines. The analysis considers the legal aspects resulting from national and EU regulations. The above-mentioned legal requirements are reviewed and the characteristics of organisational and technical solutions in the quality control of materials, machinery and equipment are presented. Finally, the fundamental practical problems related to the most common quality control procedures in purchasing processes are characterised.

Keywords: quality control, mining company, legal and practical aspects

W artykule przedstawiono zagadnienia związane z kontrolą jakości dostaw materiałów stosowanych w ruchu podziemnych zakładów górniczych. W analizie uwzględniono aspekty prawne, zarówno z zakresu prawa krajowego, jak i unijnego. Dokonano przeglądu wymagań prawnych oraz przedstawiono rozwiązania organizacyjne i techniczne stosowane w procesach kontroli jakości materiałów, maszyn i urządzeń. Omówiono najczęściej występujące w procesach zakupowych podstawowe problemy praktyczne związane z procedurami kontroli jakości.

Słowa kluczowe: kontrola jakości, przedsiębiorstwo górnicze, aspekty prawne i praktyczne

1. Introduction

Mining companies today are faced not only with issues relating to geological and mining conditions, the changing coal sales climate, unclear EU energy policy and problems arising from the COVID-19 pandemic, but also with widely differing interpretations by manufacturers and their authorised representatives of the requirements and approvals to be met by products, including machinery and equipment, used in underground mines. The regulations, which originate in European Union legislation and have been transposed into the domestic market through delegated acts and regulations, are often selectively interpreted by manufacturers or their authorised representatives, as well as by importers and distributors, according to their own needs [1–3].

Although these regulations clearly define the rules for the introduction of products for use in underground mines, they are often interpreted inappropriately, often against the interests of the client. These practices are evident in the daily reality of the majority of mining companies, which are constantly trying to find their way around them. The problem of properly defining the requirements, including the current state of the law, for products, including machinery and equipment, already arises at the stage of drawing up a contract's terms of reference, the fulfilment of which is a key condition for the bidder and later the contractor in a given contract. The subsequent enforcement of potential claims by the client in such a situation becomes virtually impossible, exposing the company to financial loss and its employees to often real dangers when using such equipment during operation.

Previous work in this area has identified a number of issues, the complexity of which poses formal and managerial challenges that need to be clarified. An additional problem is the ambiguous interpretation of regulations, even by state authorities, which further motivates the need to clarify the formal principles of quality control of supplied materials, products, machinery and equipment.

Otrzymano / Received: 20.07.2023. Przyjęto / Accepted: 11.10.2023

2. Analysis of the legal requirements for the quality control of materials, machinery and equipment used in underground mine sites

The current regulations defining the requirements for products used in underground mines include, among others [5–8]:
- Act of 9 June 2011 – geological and mining law (Journal of Laws 2011 No. 163, item 981),
- Act of 13 April 2013 – conformity assessment and market surveillance systems (Journal of Laws 2016, item 542),

and the following regulations, which include:
- Regulation of the Minister of Economy of 21 October 2008 on Essential Requirements for Machines (Journal of Laws No. 199, item 1228),
- Regulation of the Minister of Development of 6 June 2016 on the Requirements for Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres (Journal of Laws 2016, item 817),
- Regulation of the Council of Ministers of 30 April 2004 on the Approval of Products for Use in Mining Plants (Journal of Laws No. 99, item 1003).

Therefore, there are two approaches to allowing the use of products in underground mines that take into account ensuring the safety of users in the face of the hazardous conditions present there. The first approach involves a "decision permitting the use of a product in mines" issued by the President of the Higher Mining Authority in accordance with the provisions contained in the regulation of the Council of Ministers. The second approach, resulting from the incorporation of the European Parliament's directives through the Act on Conformity Assessment and Market Surveillance Systems, along with the resulting regulations of the competent Minister, specifies, among other things, the rules for conducting conformity assessments of products, the obligations of businesses, the conditions and procedures for granting accreditations, the rules and procedures for authorising conformity assessment bodies, as well as the manner in which authorised conformity assessment bodies are notified.

3. Characteristics of organisational and technical solutions in the quality control of materials, machinery and equipment

At present, the internal documents of the mining company under review which define the rules for the receipt and acceptance of materials and products into warehouses include:

1. Rules for the receipt and acceptance of materials and products purchased under purchasing procedures, complaint procedures and the performance of control tests – these rules cover all matters relating to the receipt and acceptance of materials and products in warehouses, as well as complaint procedures and control tests. They do not apply to materials and products to the extent that they are covered by separately applicable regulations on the manner of their receipt and acceptance into warehouses.
2. Rules for the receipt and acceptance into warehouses, the keeping and maintenance of warehouse records, complaint procedures and the conduct of complaint investigations of fixed assets purchased under purchasing procedures – they cover all matters relating to the receipt, acceptance, storage and keeping of records of all fixed assets purchased under purchasing procedures, as well as the handling of non-conforming deliveries, the complaint procedure and the conduct of complaint investigations.
3. Order on the registration of complaints about deliveries of materials, products and spare parts to material supply warehouses – among other things, it stipulates that:
   - Purchasing managers are obliged to continuously monitor the information contained in the register of complaints about deliveries and to use it in the process of issuing documents to contractors confirming the execution of deliveries of materials, products and spare parts.
   - Directors of the subordinate units are required to draw up and implement in these units a procedure for the communication of information by the competent services on complaints concerning materials, products and spare parts to the employees designated in the annex to the aforementioned order and to the other units mentioned.
   - The director of material logistics has been assigned the task of supervising the monitoring of information contained in the delivery claims register and its use in the process of issuing documents to contractors confirming the delivery of materials, products and spare parts, as well as the power to grant authorisation to enter claims information.
   - The directors of the subordinate units were made responsible for overseeing the complaint registers and implementing an appropriate procedure to that extent.
4. Rules regulating the processes taking place in the area of management of assets purchased as part of purchasing procedures – these principles standardize the basic processes taking place in this area and cover the following topics:
   - needs planning,
   - preparation of demand requests and demand satisfaction,
   - preparation and performance of requests,
   - consumption and storage statuses,
   - monitoring of assets issued from the warehouse and delivered to the user with mining means of transport (horizontal and vertical).
5. A manual for the qualification and management of fixed assets establishing uniform rules for the qualification of assets and the management of fixed assets – it also applies to fixed assets under finance leases, including fixed assets used under contracts that qualify as finance leases in accordance with the provisions of the Accounting Act.
6. Procedure on stock management in material supply warehouses – it describs the rules for receiving, storing and issuing materials, products, machinery and equipment parts to ensure efficient warehouse management.
7. Procedure for dealing with non-conforming supplies defining the handling of materials that do not meet the established requirements supplied by a supplier – the aim of the procedure is to identify the non-conformity and to define the procedure depending on the type of non-conformity.
8. Decisions implementing the provisions of the various regulations.

These documents do not clearly define how to assess the quality of materials and products entering the warehouse. An exception is, for example, the manual for the reception, acceptance and storage of timber, which specifies in detail the procedures and control methods to be used during acceptance. It has been developed taking into account a number of Polish standards, which, due to their volume and complexity, make them difficult to interpret and complicated for most warehouse employees.

4. Characterisation of the current state of quality control processes for materials, machinery and equipment

Based on an overview of the control and measurement instruments and their current state of technology, we can observe that the majority of control and measurement instruments consist of different types of weight scales. They account for about 87% of all control and measurement instruments in the company's possession. Another group consists of thermodensimeters and their accessories, which are used in the reception of diesel deliveries. Most of the warehouses are also equipped with callipers, hardness gauges, line gauges, micrometres and thickness gauges.

Due to the vagueness of the regulations governing the receipt and acceptance of goods and materials, the information contained in the terms of reference or the general terms of purchase and delivery is often used for identification. In many cases they describe

in more detail what quality characteristics are required to meet the terms of the contract. On the other hand, these documents do not normally define how the quality characteristics are to be verified under stock conditions, but simply state the requirements of the relevant standards or other reference documents in a given area. Therefore, in many cases, the "procedure" for quality control of selected product characteristics is of an informal nature, developed on the basis of the relevant standards, from which a measurement methodology or a type of control and measurement instrument is partly taken. In most cases, no records or archiving of this measurement data is made during delivery acceptance.

For example, the following shortcomings were found during an inspection of the procedure for accepting a delivery: The employees responsible for acceptance did not have full knowledge of the appendix to the order regarding the details of the procedure for dealing with nonconforming deliveries in terms of appointing members to the commission for the acceptance of materials and products, which follows from the above-mentioned rules for the acceptance and receipt of materials and products and for the handling of complaints and conducting control tests. As a result, the acceptance of an inspected consignment was not carried out correctly, which is confirmed by the relevant acceptance protocol, according to which the consignment was accepted by one person, whereas the rules and order state that this type of consignment should be accepted by a committee consisting of at least two persons.

The employee accepting the delivery did not carry out any quality control of the geometric dimensions, although these were confirmed in the measurement sheet. According to the relevant orders and instructions, the quality control of the delivered elements by the warehouse staff should consist in comparing the delivered items with the standard specimen for marking conformance, and in taking certain geometric measurements and measuring the shape of an item. However, it is clear from the terms of the contract with the supplier that the shape of the part was incorrectly defined. In such a situation, acting in accordance with the contractual provisions would have prevented the acceptance of any delivery of such an item. However, due to the design of the delivered product, it was technically impossible for the acceptance staff to verify this parameter. In addition, the lack of staff and equipment, and the large number of deliveries make it impossible to carry out a detailed check of each delivery against the contractual provisions, and the number of complicated and often unclear provisions in the internal rules and regulations leads to difficulties in their interpretation and practical application. Another significant problem is that no training has been provided on how to verify the quality parameters of incoming deliveries, and staff are only equipped with a calliper gauge – which does not have a calibration certificate. This makes it impossible to check many of the required quality characteristics contained in the general terms and conditions of purchase and delivery under warehouse conditions. In order to verify the quality characteristics that cannot be checked on delivery by the warehouse staff, it is standard practice to send samples from each batch for testing to another unit of the company that has the equipment to determine these characteristics. The shipment is held in the warehouse and withheld from production until the results are received from the unit. This normally takes around two working days. Once the delivered items have been verified, they can be released from the warehouse. If quality defects are found, a complaint procedure is initiated.

5. Conclusion

The above example, based on the practice of warehouse staff and internal control bodies, clearly shows that the multiplicity of rules, instructions, orders and guidance memos, as well as the provisions and regulations to which they refer, make the procedures pertaining to the quality control of deliveries unclear and many times incomprehensible. The procedures used are very elaborate and complicated and fail to address the essence of the problem, which is to ensure that proper verification of the quality of materials at the time of receipt and acceptance of a delivery. At the same time, research shows that in the last two years, warehouse staff have not received any training not only on the need for and methods of material quality testing, but also on the use of basic control and measurement instruments, which is essential in the case of such equipment as ultrasonic hardness testers or thickness gauges. Although these employees often have access to IT modules for materials management in the broadest sense, they are often unable to use them properly. A problem was also identified with regard to checking the current technical condition of control and measurement instruments. The only exception is the timely validation testing of most scales.

If, for example, the hardness of a wear-resistant plate or the wall thickness of a high-pressure steel pipe is measured with an instrument that is not validated, the data obtained as the result of the measurements cannot be relied upon in any complaint or appeal. This problem is important and far-reaching, as it applies not only to sophisticated control and measurement instruments, but also to measuring tapes, line gauges or callipers. Checking quality parameters with control and measurement instruments that has a legal defect in the form of a missing validation or calibration certificate will ultimately not allow any decision to be made on the disposition of the accepted delivery.

Taking into account the lack of staff and training, the complexity of the types of material groups, the difficulties of interpretation resulting from overly general provisions on the one hand and from complicated and complex regulations on the other, the difficulties related to the technical condition of the control and measurement instruments and its frequent absence, the enormous volume of accepted deliveries and the basic knowledge of the warehouse staff, as well as the practical lack of information flow between the warehouses of all the subordinate units of the same company, it must be stated that the development of an unambiguous, i.e. simple and clear, regulation for the quality control of incoming goods is essential.

Acknowledgements
This research was financed by the Ministry of Education and Science of Poland under grant No. DWD/3/7/2019.

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