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Safety at work of the Maintenance Services in enterprises in the wood industry

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Abstract: *Safety at work of the Maintenance Services in enterprises in the wood industry*. The paper presents the issues related to work safety of employees of the Maintenance Department. The paper presents a description of the implementation of the LOTO system, as well as new trends in the protection of employees against mechanical risks at the workplace in a wood industry enterprise.

Keywords: Maintenance, LOTO system, work safety, wood industry

INTRODUCTION

Occupational health and safety is the basic rules collection regarding safe and hygienic work. It has its own policy and goals to be achieved. Safe working conditions provide employees with the comfort of performing their duties and health protection, which results in lower accidents in the company and absenteeism caused by the impact of risk factors.
One of the key elements of the zero-accident strategy, namely the OHS (Occupational health and safety) program, whose goal is to minimize the number of accidents at work is the implementation of modern solutions that use, among others, radio systems to identify and detect people and objects in hazardous areas.

The purpose of the paper is to present the equipment of selected work stations of the employees of the Maintenance Department (MD) of the enterprise from the wood industry, in safeguards aimed at increasing the level of work safety and implementation of the LOTO security system to the enterprise.

THE ROLE OF MAINTENANCE IN THE ENTERPRISE

A fundamental element of an effective system of supervision and repair of technical infrastructure, besides a well-chosen exploitation strategy, is the efficient management of maintenance services (Antosz and Prucnal 2011).

At the turn of the years, the hypothesis was assumed that the main goal of the maintenance staff is to optimize the availability of devices at a minimum cost. Nowadays, the work of maintenance services is defined much more broadly, and includes in its scope, also the safety of people and the environment, production efficiency, the level of risk taken, effective energy consumption, as well as the quality of products and services (Mikler 2008).

Along with the evaluation of production systems, the technical department itself is gaining importance, experts agree that it is the maintenance of traffic that generates huge costs associated with protection of production liquidity. An efficiently managed board of experts dealing with current and preventive activities related to the elimination of any anomalies of the machine park is a road to rationalization and improvement and securing the entire production process.

In order to ensure an efficient maintenance department, strategic MD should be defined and basic functions assigned to them. You can use different methods of action for this purpose, but it is worth reaching for the literature on the subject, and describe the goals and functions of MD with the three basic rights of maintenance services (Legutko 2009):

- the correct technical service of the means of production allows to produce a large quantity of high-quality products,
- incorrect technical service of the means of production allows to produce a small amount of poor quality products,
- lack of technical service of the means of production does not allow for the production of any products.

The process of work organization and management aspects, maintenance should contain framework actions in the field of economic tracking system and technical system, taking into account spare parts management (Mikler 2008, Pomietlorz–Loska and Plinta 2017).

LEGAL REQUIREMENTS RELATED TO THE SAFETY OF EMPLOYEES OF THE MAINTENANCE DEPARTMENT

The legal requirements related to ensuring safe working conditions for non-productive employees are strictly related to certain terminology issues. Due to the wide range of the problem, the authors chose the one related only to technical means of protection (TMP).

Mechanical hazards arising at the workplace can be eliminated or reduced by means of two groups of preventive measures, namely: technical means and organizational measures.

Technical protection measures are defined as devices designed to prevent hazards caused by mechanical factors, used only due to directly or indirectly performed protection against operator's or other persons' threats (eg, here refers to employees of the Maintenance Department) (Myrcha et al. 2000). TMP is divided into two main groups, which is presented in Figure 1.

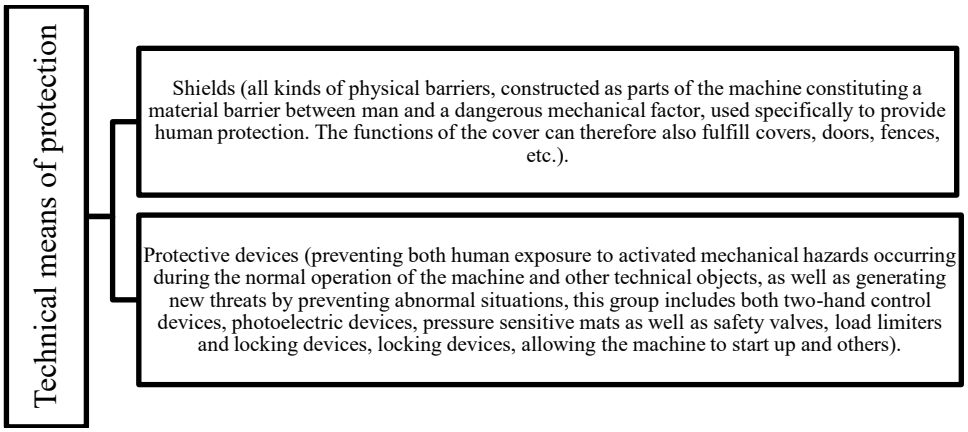

Figure 1. Technical means of protection types (own elaboration based on Myrcha et al. 2000).

This chapter presents the most important regulations and standards specifying, among others, recommendations related to machinery safety, which should be implemented through the use of technical protective measures (TMP) in the field of occupational health and safety, also non-productive workers. And general provisions related to health and safety requirements.

The most important of them include (Kusiak and Kowalewski 2018):

- PN-EN ISO 12100: 2012, "Safety of machines. General design principles. Risk assessment and risk reduction"
- PN-EN ISO 14120: 2016-03, "Safety of machinery. Covers. General requirements for the design and construction of fixed and movable guards”
- PN-EN ISO 14119: 2014-03, "Safety of machines. Locking devices coupled to shields. Principles of design and selection"
- PN-EN ISO 13857: 2010, "Safety of machinery. Safety distances that prevent reaching with upper and lower limbs to dangerous zones"

- PN-EN 61496-1: 2014-02, "Safety of machinery. Electrochromic protective equipment. Part 1: General requirements and tests”
- PN-EN 61496-2: 2014-02, "Safety of machines. Electrochromic protective equipment. Part 2: Particular requirements for equipment using active optoelectronic protective devices (AOPD)”
- PN-EN ISO 13855: 2010, "Safety of machinery. Location of protective equipment due to the speed of approaching parts of the human body"
- PN-EN 954-1: 2001. „Machinery. Safety - Elements of control systems related to safety. Part 1: General principles of design"
- ISO TR 14121-2: 2007 “Safety of machinery-Risk assessment-Part 2. Practical guidance and examples of methods”
- Directive 2006/42 / EC of the European Parliament and of the Council of 17 May 2006 on machinery (UE L 157, 09.06.2006, pp. 24-86)
- Directive 2009/104 / EC of the European Parliament and of the Council of 16 September 2009 concerning minimum safety and health requirements for the use of work equipment by workers at work (second individual directive within the meaning of Article 16 (1) of Directive 89/391 / EWG) (260 from 03.10.2009, pp. 5-19)
- Directive 2006/95 / EC of the European Parliament and of the Council of 12 December 2006 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits. OJ L 374, 27/12/2006 (replaced Directive 73/23 / EEC), implemented by the ordinance of the Minister of Economy of August 21, 2007 on the essential requirements for electrical equipment (Polish DzU No. 155, item 1089)
- Regulation of the Minister of Economy of October 21, 2008 on essential machine requirements (Journal of Laws of 2008 No. 199, item 1228, as amended)
- Regulation of the Minister of Economy of October 30, 2002 on minimum requirements regarding health and safety at work in the use of machines by employees at work (Journal of Laws of 2002 No. 191, item 1596, as amended)
- Regulation of the Minister of Labor and Social Policy of September 26, 1997 on general health and safety at work regulations (Journal of Laws of 1997 No. 129, item 844, as amended)

The above-mentioned documents contain a number of information, recommendations that are to reduce or even eliminate the risk of accidents at work, machine operators and non-productive workers. However, as indicated by a number of studies, the human factor plays the largest role in accidents and potentially accidental events. Protection against unauthorized interference by third parties in the danger zone becomes crucial in terms of security. To this end, a number of systems are created on the market that focus on problems related to the necessity of access to hazardous areas and the presence of operating personnel in them. These systems include systems such as LOTO (Lockout / Tagout).

LOTO (Lockout / Tagout) is a system consisting of security and closures and markings, which increases the level of employee safety, especially of maintenance services. Thanks to LOTO systems, a number of threats are eliminated, which result, among others, from human errors arising, for example, during repairs or maintenance of the machine park (Humienna - Berta 2015).

LOTO oversees the destructive energy that can reach maintenance workers or bystanders who are staying in the zones affected by this energy. LOTO consists of technical means enabling disconnection of machines from various sources of destructive energy: mechanical, electrical, thermal, radiation, chemical processes (locks, covers, barriers, plugs, valves, latches, locks, padlocks, tags, etc.), and procedures, and whatsoever related to it, and training of the personnel of a given company (Kusiak and Kowalewski 2018).

LOTO consists of three basic principles:

- Lock (secure).
- Tag (flag).
- Try (check / test) - expanding the system with the need to check energy zeroing, then such a system is called LOTOTO: Lockout / Tagout / Tryout.

The classic LOTO system is designed to disable and dissipate harmful residual energy and block the possibility of switching on and starting the machine before servicing, repairing or maintaining maintenance workers. Requirements related to securing the SUR work with regard to, among other things, residual energy, are formulated in the Tooling Directive and machine. They sound as follows:

- Adjustment and maintenance points should be located outside hazardous areas. It must be possible to carry out adjustment, maintenance, repair, cleaning and other servicing operations while the machine is at a standstill.
- If, for technical reasons, at least one of the conditions referred to paragraph above, cannot be fulfilled, it should be possible to perform adjustment, maintenance, repair, cleaning and other activities without the risk associated with their performance.
- It should be possible to carry out maintenance work while the machine is standing still. If this is not possible, appropriate protective measures are taken to perform these works or these works are carried out outside hazardous areas.
- If, for some works, the machine must be operated with shifted or removed guards or a fixed safety device, the selector of the operating mode selection must:
  1) immobilize all other control or work modes,
  2) allow hazardous functions to be triggered only by control elements that require constant support,
  3) allow to run dangerous functions only in conditions of reduced risk, while preventing threats resulting from conjugate sequences,
  4) prevent any hazardous functions from being triggered by intentional or unintentional operation on the machine's sensors.
- If the above four conditions cannot be met simultaneously, the control or operating mode selector switch must activate the remaining protective measures designed and constructed to ensure a safe intervention zone.

The conclusion of legislative considerations is that LOTO should be understood not only as a classic technical protection measure used to block energy, but as a comprehensive system of supervising and destroying destructive energy, at the same time guaranteeing the performance of the tasks of the Maintenance Service (MS), with the risk tolerated in accordance with deliberately accepted acceptance criteria, behind which there is a number of legal powers (Kusiak and Kowalewski 2018).

Lockout / Tagout system performs its basic function, described above with the help of technical means, which can include (Kusiak and Kowalewski 2018):

- simple construction of the pneumatic or hydraulic valve block
- locking of control elements
- lockouts
- tagout
- access and stay supervision systems in hazardous areas connected with machine control systems, by means of blocking devices (eg limiters), with or without a bolt lock, mounted on covers, entrance gates to fenced machine areas, etc.

The implementation of the LOTO system starts with the so-called initial inspection, i.e. specify the size of the machine park, the types and age of the machines to be covered by the system. A very important issue during the implementation of the LOTO system is to

conduct a risk analysis of each machine that has been selected for system implementation. Such analysis should include:

- specifying the tasks for which the LOTO system should apply
- identification, type of destructive energy supplying the machine
- determination of the impact of energy cutoff on the surroundings, e.g. neighboring machines
- determine whether technical safety measures limiting and monitoring these energies are available for work with dangerous (destructive) energies and appropriate operational reliability levels are selected (Lis et al. 2016).

The next step in the implementation of LOTO procedures is to check whether the machines and installations have the right devices that will be able to dissipate potential energies. If there are none, it is recommended to select and install them properly (Lis et al. 2016).

Then, the appropriate blocking system and marking of all LOTO energy blocking points is selected, along with the development of the instructions. Next, the blocking and labeling system for the whole enterprise is unified.

The final stage of the implementation of the LOTO system is the training of employees and the selection of the coordinator of the system, which will supervise and verified processes related to LOTO procedures (Lis et al. 2016).

NEW TRENDS IN SUR SECURITY

Modern technological solutions used in extremely different industries have their application also in the practice related to ensuring safe working conditions for employees, among others, the MS of enterprises of the wood industry.

At the turn of recent years, more and more emerging solutions using radio systems can be observed in order to oversee hazardous areas and people working in them. These solutions use the new technology RTLS (real time location system) and active transponders, ie tags worn by employees who communicate with a set of antennas working in 3-6 GHz frequencies.

An important element of this innovative solution is the accuracy of detection, which reaches several or a dozen centimeters, while identifying very large areas of supervision of these zones up to hundreds of square meters.

An example of this solution is the Ubisense RTLS system, which uses active labels for the location, which emit ultra-broadband (UWB) location impulses. The use of these impulses allows to achieve high accuracy of location in 3D space, as well as reliability and resistance to interference with low energy consumption. Supervision of any large spaces is done by dividing the supervised area into cells, while the signal from active labels is received by location sensors. The company Ubisense has prepared in its offer, also dedicated software, which uses advanced algorithms to analyze received signals, determining the position of 3D labels. In addition, labels and sensors exchange information with each other using a communication channel operating in the standard 2.4 GHz band. This channel is also used to identify labels, program them and provide feedback.

CONCLUSIONS

To sum up, regarding the safety of non-production workers, in particular, the Maintenance Service, consideration should be given to the need to implement, minimize systems to an acceptable level, the risk of potentially fatal accidents. After a deep analysis of specialist literature and legal requirements in the area of work safety of the Maintenance Services, it is possible to identify the area of introducing improvements and innovative solutions related to eg technical protection measures.

Persons responsible for creating, implementing and supervising solutions potentially eliminating hazards at the MS workplace, should more willingly reach for solutions related to, for example, RFID and RTLS radio systems, which bring a number of benefits primarily in the form of the security of their employees.

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Streszczenie: *Bezpieczeństwo pracy Służb Utrzymania Ruchu w przedsiębiorstwach branży drzewnej*. Artykuł przedstawia zagadnienia związane z bezpieczeństwem pracy pracowników Działu Utrzymania Ruchu. W artykule przedstawiono opis wdrożenia systemu LOTO, oraz nowe trendy w zabezpieczeniach pracowników przed zagrożeniami mechanicznymi na stanowisku pracy w przedsiębiorstwie branży drzewnej.

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