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Material Handling Equipment Subject to Technical Supervision – types, Requirements and Importance In Ensuring Safety

KEYWORDS

Transportation, material handling equipment, overhead crane, stacker crane

ABSTRACT

Material handling equipment plays a key role in industry and logistics, enabling the efficient movement of cargo over short distances. In Poland, their operation is subject to technical supervision regulations, which are designed to ensure occupational safety and protect the health of users. The article discusses the basic types of material handling equipment, such as overhead cranes, forklifts and cranes, and outlines the legal and technical requirements associated with their use. Regular inspections help prevent failures, minimize the risk of accidents and ensure the safety of equipment use. The purpose of the article is to introduce the basic concepts of material handling equipment and legal issues related to their use and approval. In addition, the article aims to raise awareness of the importance of the administrative unit, which is the Office of Technical Inspection (UDT), and the consequences of not complying with the regulations in this regard.

Introduction

Transport is a set of activities related to the movement of loads using appropriate technical means. Material handling equipment is used in halls, warehouses and production plants [1]. The first crane designs appeared in ancient times – simple cranes were used, among other things, during the construction of the pyramids [2]. Technological developments in Greece and Rome brought improvements in the form of pulley and gear systems, enabling the movement of heavier loads [3]. In the Middle Ages, wheel cranes became widespread, used, among other things, in the construction of Gothic cathedrals, and manual drive was supported by treadwheels or crank mechanisms [4]. The breakthrough came with the industrial revolution of the 19th century, which, thanks to the development of metallurgy and hydraulic drives, enabled the creation of modern overhead travelling cranes and port cranes, which form the basis of modern material handling equipment.

The hydraulic solutions used facilitated the handling of cargo and improved loading and unloading work. However, these types of structures could initially be used only in areas where there was a water supply. Nowadays, we can't imagine the construction, storage or transportation industry without the use of tower cranes, mobile cranes, forklifts or overhead cranes, which bear little resemblance to the old structures. All crane

structures, which had their beginning in ancient times, can be called as material handling equipment (UTB). This is a very broad term, which can be generally defined as “mechanisms that are used to move people and loads over short distances” [5]. Material handling equipment is currently used in virtually every industrial plant.

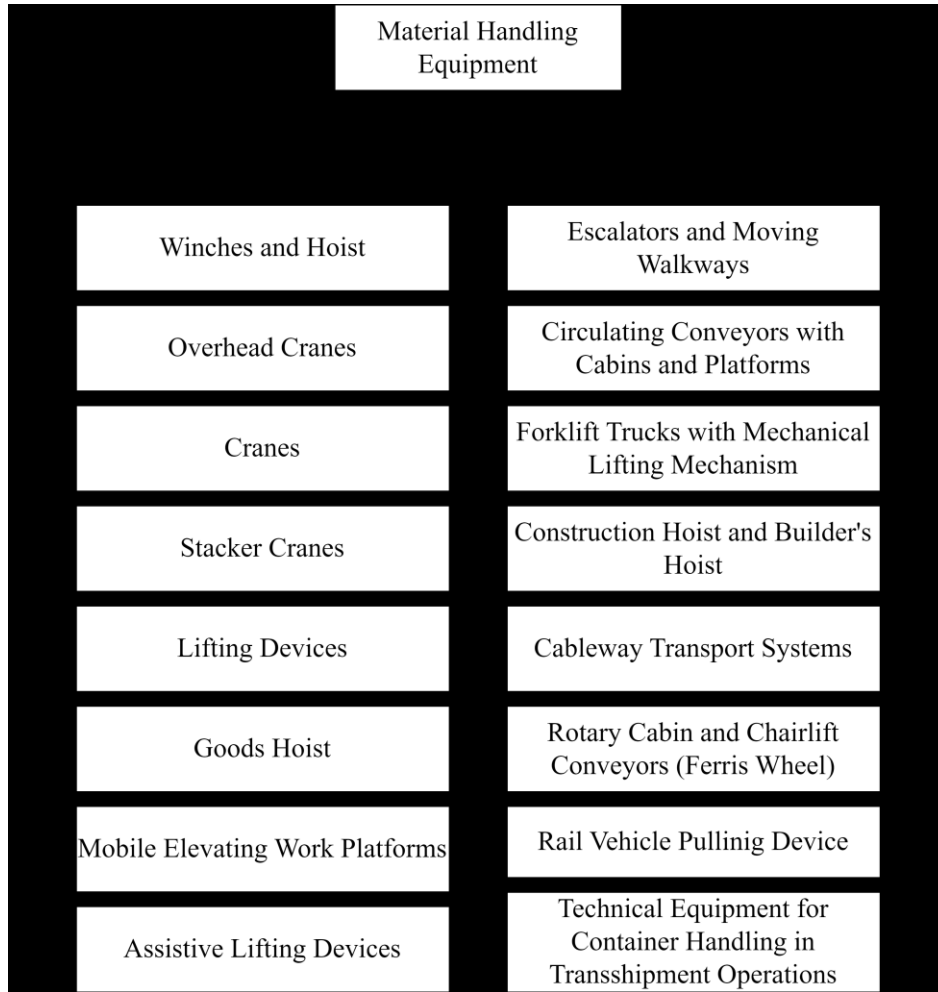
The use of this type of equipment has become necessary by the need for easy and fast movement of materials and products between specific parts of a building or during construction. Such transport processes have a number of risk factors during implementation, hence ensuring the safety of the personnel performing the activity and those in the aforementioned environment is crucial [6, 20]. Among the institutions with the help of which safety – improving measures are taken and implemented are the Office of Technical Inspection (UDT), Transport Technical Inspection (TDT) and Military Technical Inspection (WDT). The administrative unit of the UDT takes care of the correct operation of material handling equipment. It is worth noting that the aforementioned technical devices, over which supervision is exercised, “may pose a threat to human life or health, as well as property and the environment due to, among other things, the release of potential or kinetic energy when moving people or loads within a limited range” [7, 21]. Legal principles related to technical supervision equipment are regulated by the following legal acts, which form the basis for technical supervision of technical equipment [8]:

- Act of December 21, 2000 on technical supervision (Journal of Laws 2000 No. 122 item 1321);
- Regulation of the Council of Ministers of December 7, 2012 on types of technical devices subject to technical supervision (Journal of Laws 2012 item 1468);
- Regulation of the Minister of Entrepreneurship and Technology of May 21, 2019 on the manner and procedure for verifying qualifications required for operation and maintenance of technical devices, and the manner and procedure for extending the validity period of qualification certificates (Journal of Laws 2019 item 1008);
- Regulation of the Minister of Economy of November 26, 2010 on the amount of fees for activities of technical supervision units (Journal of Laws 2016 item 696).

Material handling equipment subject to technical supervision

On ecology.co.uk we can find a definition of technical equipment, which is as follows: “objects that make it possible to perform a given process” [9]. Material handling equipment performs basic transport processes that are used to move people and cargo over short distances, ensuring the safety

of the personnel performing the process as well as other employees and/or users of the equipment in question. The technical supervision is responsible for this type of equipment when it is released for the use as new, in cyclic periodic examinations specified by law and in the event that such an examination is necessary, e.g. after an accident. In the Ordinance of the Minister of Entrepreneurship and Technology of October 30, 2018 on the technical conditions of technical supervision in the operation, repair and modernization of material handling equipment, you can find a breakdown of material handling equipment subject to UDT [10]. Figure 1 shows a diagram of all equipment subject to technical supervision, among which the most common and well-known are cranes, cranes, overhead cranes or forklifts. As can be seen from the diagram below, the scope of supervision is huge, and in addition to materials handling equipment (UTB). the Office of Technical Inspection inspects and supervises Fuel Vapor Recovery Equipment and Pressure Equipment, including transmission and process pipelines. Most people do not realize the magnitude of the scope of equipment under the UDT, such as a staircase in a shopping mall or a chairlift on a ski slope.



Source: own development based on [10].

Figure 1. Diagram of the division of material handling equipment over which supervision is exercised by the UDT

The equipment in question is a key piece of equipment for any industrial plant, manufacturing plant, warehouses and logistics centers, as well as being used during the performance of many construction works. Machines of this type enable the safe and efficient movement of people or cargo, characterized by a limited working range and requiring specialized supervision.

Overhead crane

An overhead crane is a crane operating in intermittent motion, capable of moving on rails or raceways, having at least one horizontal girder and equipped with at least one lifting mechanism, designed to move loads in a space limited by the lifting height, the span of the girder or girders and the length of the track of the entire machine [11]. Figure 2 shows an example of an overhead crane.



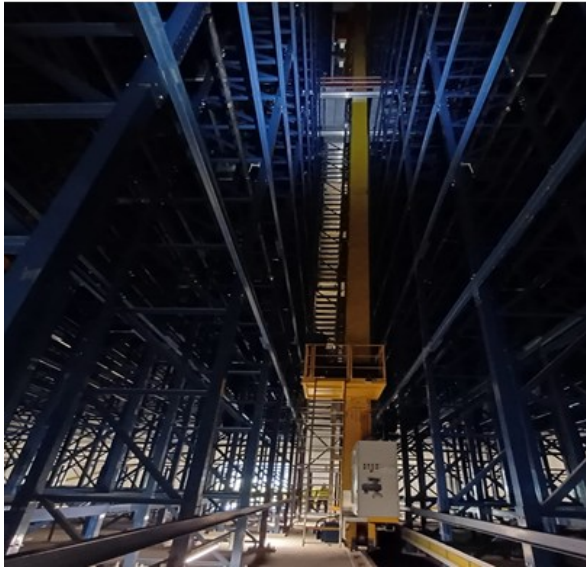
Source: own development.

Figure 2. Crane

Summarizing, an overhead crane is a lifting device used to lift and move loads horizontally. It is one of the most well-known pieces of equipment subject to technical supervision and supporting warehouse processes in many enterprises, where the need is to move bulky things over short distances.

Stackers

A warehouse stacker crane is a crane that is part of a warehouse system, used to transport and store goods on specially adapted racks. The load-bearing structure of a stacker crane most often consists of a column, a set of columns or a frame riding between the racks, on which a chief or a set of chiefs equipped with load handling devices, such as pallet forks, move [11]. Figure 3 shows a stacker crane in a high-bay warehouse.



Source: own development.

Figure 3. Stacker crane in a high-bay warehouse

Warehouse stacker cranes are crane equipment used in warehouses to transport and store goods. They move along racking aisles, allowing easy automation of the process of storing loads. Stacker cranes can be equipped with different types of grippers, so they can be adapted to different types of loads. Warehouse stacker cranes are highly efficient devices that allow for quick and efficient transport of goods in the warehouse.

Mobile platform

A mobile pass-through platform is a pass-through machine designed to move people to workstations where they perform work from a work platform, assuming that the people enter and exit the platform in its one specific access position. At a minimum, it consists of a work platform with controls, a boom, a chassis and can come in articulated or scissor versions [12]. Figure 4 shows an example of a mobile platform.



Source: own development.

Figure 4. Mobile platform

This is another lifting device subject to UDT supervision, used for lifting people and materials during construction or installation work at heights. It consists of a platform or gondola suspended from a linkage or lifted by a lever. It can be mobile or self-propelled. Mobile platforms are used in construction, industry, energy, emergency services, as well as in agriculture and horticulture.

Lift trucks

Lift truck with mechanical lifting mechanism: it is a truck with an attached platform, forks or other load handling devices, adapted to lift a palletized load or not, to a height that makes it possible to store and retrieve the load, as well as to stack in nests and take up from nests. Accordingly, forklifts that do not have a lifting mechanism (lift, push, tractor forklifts) are not subject to the regulations on technical supervision. By mechanical drive, we mean any type of drive (internal combustion, electric, hydraulic) that does not require direct action of human muscle power during load lifting operations [13]. Figure 5 shows an example of a lift truck.



Source: own development.

Figure 5. Lift truck

A forklift truck, customarily referred to as a forklift, is a power-driven wheeled motor vehicle designed to carry materials of significant weight and used in material handling and storage. It is mainly used to move pallets of goods.

Mobile crane (crane)

A mobile crane (crane) is a crane on a truck chassis or a specially constructed self-propelled chassis, used mainly for loading and assembly work. It consists of winches and a pivoting boom, which allows lifting and lowering of loads and their movement [14]. Figure 6 shows an example of a mobile crane.



Source: own development.

Figure 6. Mobile crane (crane)

It is a lifting device on a truck chassis or a specially constructed self-propelled chassis, mainly used for handling work. Primarily, it is used for lifting and moving heavy loads in various industries and construction. Figure 6 shows the moment of loading a stacker crane component in a high-bay warehouse onto a truck.

Scope of technical supervision

The purchase or ownership of a piece of handling equipment does not entitle us to use it. According to the applicable regulations for materials handling equipment (UTB), the owner of such a machine is obliged to meet the relevant requirements. According to the legislation in force, before being put into operation, technical devices should be notified to the UDT in order to obtain a decision authorising their use. Therefore, companies that use handling equipment under full and limited supervision are obliged to carry out technical inspections of this type of machinery. Three types of tests can be distinguished [15]:

- receivers,
- periodic,
- interim.

Once the manufacturing process of the handling equipment has been completed, the first technical examination is carried out in working order. For this purpose, the authority of the relevant UDT unit performs a number of actions. It checks the completeness of the documents, the technical condition and marking, the conformity of the equipment with the operation documentation, and then an operational test at the owner of the equipment at the target workplace. Periodic inspections are carried out during the operation of equipment under full supervision. This type of test checks for damage or changes in condition that may have a significant impact on safety during operation [16]. During the periodic inspection, the competent authority of the technical supervision unit checks: the inspection book, the equipment maintenance log, the electrical measurement reports, the qualification certificates of the maintenance and operating staff. On the other hand, ad hoc inspections are also carried out in the course of equipment operation, but they are valid only for equipment under limited supervision or as a result of justified circumstances, such as installation in a new location, modernisation, repair, replacement of an element influencing the level of safety. Such inspections are also performed in post-accident or post-failure situations [15]. Therefore, the safe operation of the handling equipment, in addition to meeting the formal requirements for obtaining a decision authorising its use, requires appropriate tests to be carried out, depending on the type of equipment and its place of use. Safety during the use of the LST re-

quires that the persons authorised to operate them have the appropriate qualifications, confirmed by the UDT.

Issues related to the technical supervision of material handling equipment are also present in other countries and are based on similar assumptions regarding the safety of operation. In Germany, these functions are performed by certification bodies such as TÜV, which carry out mandatory technical inspections in accordance with DIN standards and European Union regulations. In the United Kingdom, the legal framework is set out in the Lifting Operations and Lifting Equipment Regulations (LOLER), which require operators to carry out regular inspections by authorised institutions. In the United States, these issues are regulated by the Occupational Safety and Health Administration (OSHA) guidelines and the American Society of Mechanical Engineers (ASME) standards, which specify both technical requirements and operator qualification rules. An analysis of solutions used internationally shows that, regardless of the legal system, the overriding objective of the regulations remains to minimise the risk of accidents and maintain a high level of occupational safety and environmental protection.

Obligations to use the equipment and the consequences of failing to do so

However, the operator's licence alone is not enough, as the operator is required above all to comply with the applicable operating instructions dictated by the equipment manufacturer's recommendations, as well as to comply with current health and safety regulations. That is why the Office of Technical Inspection attaches great importance to popularising issues related to the safe operation of technical equipment [7]. An ideal example to illustrate how many responsibilities arise from the use of handling equipment is the mechanical lift truck, which is commonly referred to as a forklift. More precisely, it is a forklift truck with an attached platform, forks or other load handling device, which is designed to lift and transport palletised loads for the purpose of transporting, loading or stacking them in designated areas. Only equipment with a lifting mechanism using mechanical drive is subject to technical inspection. This means any type of drive, such as hydraulic or electric, which does not require direct action by human muscles to manipulate the load [13]. All materials handling equipment (UTB) have a legal

basis, which in a general sense is 'a legal rule or set of rules demonstrating the legality of subordinate acts, as well as the taking of certain actions – whether legal or factual' [17]. In the case of forklift trucks, the following legislation and regulations apply [18]:

- Act of 21 December 2000 on technical supervision (Dz.U. No. 122, item 1321, as amended), as amended.
- Regulation of the Council of Ministers of 7 December 2012 on types of technical devices subject to technical supervision (Journal of Laws 2012 No. 0 item 1468), issued on the basis of Article 5(2) of the Act on Technical Supervision.
- Regulation of the Minister of Entrepreneurship and Technology of 21 May 2019 on the manner and procedure for verifying qualifications required for the operation and maintenance of technical equipment and the manner and procedure for extending the period of validity of qualification certificates, issued pursuant to Article 23(5) of the Technical Supervision Act.
- Ordinance of the Minister of Entrepreneurship and Technology of 30 October 2018 on the technical conditions of technical supervision in the operation, repair and modernisation of materials handling equipment (Journal of Laws 2018 item 2176).
- Regulation of the Minister of Economy of 23 December 2011 amending the regulation on the amount of fees for activities of technical supervision units (Dz.U. No. 294, item 1736), issued on the basis of Article 34(3) of the Act on Technical Supervision.

Persons who operate or maintain power-operated lift trucks (hereinafter referred to as forklift trucks) are required to have the relevant qualifications to perform these activities. Notifying the technical supervision unit of the intention to operate the forklift truck and submitting it to regular technical inspections performed by a technical supervision inspector;

- the establishment and retention, separately for each materials handling equipment (UTB), of a maintenance logbook (which may be in electronic form) maintained by the maintainer, and the recording of the materials handling equipment (UTB) operation based on the requirements of the operating manual;
- ensuring that the trolley is in proper working order on a daily basis;

- determining the resurrection of the materials handling equipment (UTB), where this is not known, based on the current state of technical knowledge and good engineering practice;
- if the service life of the materials handling equipment (UTB) is exceeded, carry out a technical condition assessment of the materials handling equipment (UTB) or have it carried out.

Additional responsibilities for operators of handling equipment materials handling equipment (UTB), such as stacker trucks and mobile cranes, which are indispensable in many industries and logistics, include adherence to several key principles:

- operation in accordance with the instructions,
- timely inspection and testing,
- ensuring safe operation of equipment.

Carefully read the operating instructions before working with the materials handling equipment (UTB). Operators should be trained and qualified. Permissible load capacities and lifting heights should be observed. Equipment should only be used for the purpose for which it is intended. Any damage or malfunction should be reported immediately. Materials handling equipment (UTB) should be regularly inspected and tested in accordance with legislation and the manufacturer's recommendations. Inspections should include checking the technical condition of the equipment, including the drive, brake and control systems. Periodic examinations shall be carried out by authorised certification bodies and confirm that the equipment complies with the applicable safety standards. The working area of the materials handling equipment (UTB) should be properly marked and secured. Operators should wear appropriate personal protective equipment. Internal traffic rules should be observed and collisions with other equipment or workers should be avoided. Equipment should be equipped with appropriate safety features such as load limiters, tilt sensors and emergency stop switches. Following these rules helps to ensure safe and efficient operation of handling equipment, minimising the risk of accidents and downtime.

Failure to comply with obligations relating to the operation, inspection and testing of material handling equipment (UTB) can have serious consequences, both financial and legal. It can distin-

guish the most important consequences of failing to comply with the obligations:

- financial penalties,
- criminal liability,
- suspension or withdrawal of authorisations to operate the materials handling equipment (UTB),
- loss of liability insurance,
- negative impact on companies' reputationy.

Inspectors of the Office of Technical Inspection (UDT) can impose financial penalties on materials handling equipment (UTB) users who fail to comply with the regulations on operation, inspection and testing. The amount of the penalty depends on the type of failure and the degree of risk it poses to the safety of workers and the environment. In the event of an accident caused by a failure to comply with materials handling equipment (UTB) related obligations, those responsible may be held criminally liable. The Criminal Code provides for penalties of up to five years' imprisonment for causing an accident with fatal or serious injury. Criminal liability can be incurred by those directly responsible for the operation of the materials handling equipment (UTB), as well as by company managers who have failed to fulfil their obligations to ensure occupational safety. To avoid these consequences, materials handling equipment (UTB) users should comply with the legislation, the manufacturer's recommendations and the rules for the safe operation of the equipment [19].

Conclusion

In conclusion, technical supervision is a system of overseeing the operation of technical equipment, the purpose of which is to ensure its safe and trouble-free operation. In the case of material handling equipment (UTB), such as lift trucks and mobile cranes, technical supervision is particularly important, as these devices can pose a serious threat to the safety of workers and the environment. Among the most significant benefits of complying with technical supervision are:

- Increased occupational safety: Regular inspection and testing of materials handling equipment (UTB) allows detection and correction of defects that could lead to accidents;
- Reduced risk of downtime: Properly serviced and maintained materials handling equipment (UTB) suffer fewer breakdowns, resulting in increased productivity;

- Reducing operating costs: Regular maintenance helps extend the life of the materials handling equipment (UTB) and avoid costly repairs;
- Compliance with legal requirements: materials handling equipment (UTB) users are required to comply with technical supervision regulations, and failure to do so can lead to financial penalties or even criminal liability;
- Improving company reputation: Companies that take care of occupational safety and comply with technical supervision regulations build a positive image and trust among customers and business partners.

An important addition to the analysis of material handling equipment is its relation to sustainable development issues. The energy efficiency of the solutions used is becoming increasingly important, including the use of electric drives, energy recovery systems and automation of processes that reduce energy losses. Equally important is reducing the negative impact on the environment, including reducing exhaust emissions, noise and leaks of operating fluids. A life cycle assessment (LCA) of this equipment shows that a significant environmental impact occurs not only during operation, but also during production and disposal. Taking environmental aspects into account in the design, use and modernisation of material handling equipment helps to reduce the overall carbon footprint and increases the competitiveness of companies implementing modern, energy-efficient solutions. As a result, material handling equipment is seen not only as an element ensuring work safety, but also as an important factor shaping the efficiency of logistics processes and their compliance with the principles of sustainable development.

Compliance with technical supervision is therefore the key to ensuring safe and efficient operation of material handling equipment, as well as avoiding negative legal and financial consequences.

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