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CE COMPLIANCE FOR CRANES: LIFTING ACCESSORIES AND PROTECTIVE DEVICES AND EQUIPMENT

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Abstract: This research aims to describe the CE marking, including the analysis and description of key segments of the directives and standards that are used in the process of crane conformity. In this way, there will be an easier and more concise overview of the essential requirements that lifting accessories and protective devices and equipment of cranes must fulfill, that will help engineers in the process of aligning cranes with the most important requirements, simplifying their inspection, and ensuring a high level of crane safety during use.
Key words: cranes, CE marking, essential requirements

INTRODUCTION

Through legal and other regulations, each country defines safety management goals and alignment with safety standards. Before 1985, standards were very detailed at the product level, written by lawmakers, and the decision-making process and systematization of product requirements, and the development and implementation of technical ideas took a long time. Introducing the "New Approach", European legislators decided only on the essential safety requirements through legislative and recommended EU guidelines, while the creation of technical specifications was left to economic operators [1].

EU legislation is divided into: regulations (REG), directives (DIR), resolutions (RES), commissions (COM), and recommendations (REC), where directives represent the most important legal instruments, along with regulations, strengthening the EU internal market. Within the framework of standards and directives, the mandatory marking of products with the Conformité Européene - CE mark is introduced, which indicates that the product meets the requirements set out in EU directives and will not endanger the health or safety of users. The New Approach aims to protect public objectives related to the safety and health of product users, as well as to draw attention to potential hazards [2]. This increases consumer confidence in new products bearing the CE mark, which will lead to a higher volume of product purchases, as well as more cost-effective development of new products and increased innovation by manufacturers [3].

The subject and objective of the research are reflected in describing the CE marking, but it will also include a regulatory analysis of lifting accessories and protective devices and equipment of cranes.

CE MARKING

In July of 1993 general rules for a single method of CE marking for the directives were established. In the directives adopted before the said decision, the term "CE mark" is replaced by the term "CE marking" (Fig. 1) [4-6].

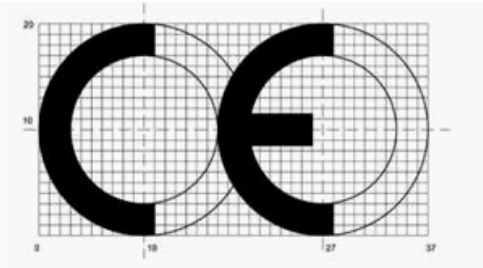

Fig. 1. *"CE marking" defined by 93/465/EEC (source: https://www.paragraf.rs/propisi/t03_0168_s001.gif)*

"CE marking" symbolizes compliance with all obligations of the manufacturer, relating to the product, and the mark is not intended to be used for commercial purposes. Compliance is not limited only to the essential requirements that are related to safety, but also to general health and consumer protection. "CE marking" is the only marking that confirms that products comply with the directives based on a global approach. The CE mark is placed on every product that meets the safety standards that are valid in all EU countries, and it is designed with the intention to facilitate the free movement of goods within the EU [4-6].
Products that don't have a CE mark and that are not in compliance with directives can be restricted for sale or excluded from the European market. If non-conformities are found, or damages or injuries caused by the product occur, the company-manufacturer, or anyone else responsible for selling the product on the European market may bear personal responsibility, that is, they may be prosecuted. The CE mark indicates that the manufacturer has adapted to the requirements of EU legislation and, accordingly, can sell their products freely within the EU, without further modifications or testing. The CE mark is not a quality mark and does not indicate compliance with the standard, but compliance with the legal essential requirements of the EU directives [4-6].
Before placing the product on the market and putting it into operation, the manufacturer must place the CE mark on the product, unless other directives require otherwise. The obligation to place the CE mark applies to all products covered by the directives, which are intended for the EU, including the following products:

- to all new products, manufactured in EU member states or third countries,
- on all used products imported from third countries,
- substantially modified products, which are subject to the directives as new products.

Until the conformity assessment procedure is completed, the CE mark cannot be affixed. This is done to ensure that the product is in compliance with all provisions of the relevant directives. CE marking is usually done at the end of the production phase [4].
The CE mark is placed by the manufacturer or an authorized EU representative, directly on the product or on the data plate, although it can also be placed on the packaging or accompanying documentation. When installing, it is necessary to fulfill the requirement for visibility, that is, that it is easily accessible, legible, and indelible, so that it cannot be removed under normal circumstances without leaving visible traces. The minimum height of the sign should be 5 mm [4-6].
The CE mark can be placed at any other stage of production if it is an inseparable part of the product or its component and if this is justified due to technical or other reasons (for example, the impossibility of meeting the minimum dimensions of the CE mark). In such cases and if the mark is placed on the packaging or accompanying documents, the manufacturer or the authorized body must equally verify the conformity of the product in the production control phase. It is forbidden to omit the CE mark from the product, or to move it to the packaging and

accompanying documentation for aesthetic reasons. Depending on the applied conformity assessment procedures, the authorized body may be involved in the design phase, the production phase or in both phases, and the identification number of the authorized body will follow after the CE mark, if the authorized body is involved in the production phase [4].

REGULATORY ANALYSIS: LIFTING ACCESSORIES AND PROTECTIVE DEVICES AND EQUIPMENT OF CRANES

Šostakov et al. [7] state that safety when working with cranes is achieved through the implementation of constructive and exploitation measures that obligate both crane designers and manufacturers (constructive measures), as well as crane users (exploitation measures). Crane elements which are subjected to different requirements include: (1) load – bearing structure, (2) lifting accessories (hooks, ropes and rope slings, chains and chain slings, lifting straps, sheaves, drums, sprockets), (3) drive mechanism, (4) travel mechanism – wheels, (5) braking mechanism, (6) safety devices, (7) cabin, operator station, and control devices, (8) electrical components, (9) hydraulic components, (10) crane runway and standing area, (11) access – climbing the crane and (12) protective devices and equipment.
The requirements that lifting accessories, protective devices and equipment for cranes must fulfill are based on compliance with various laws, rulebooks, standards, and regulations [8-30]. Reviewing the literature [8-30], a regulatory analysis of lifting accessories and protective devices and equipment of cranes was conducted. The result of a regulatory analysis is shown in Table 1, where the essential requirements that lifting accessories and protective devices and equipment of cranes must fulfill, are explained.

Table 1. *An overview of the essential requirements that lifting accessories and protective devices and equipment of cranes must fulfill*

CRANE ELEMENT	ESSENTIAL REQUIREMENTS
LIFTING ACCESSORIES	
• **HOOKS**	▪ inspected, bearing load capacity mark and attest present, ▪ use exclusively forged or laminated hooks, ▪ manufacturer's marks, serial number, hook number, load capacity, material, and order number must be permanent, ▪ cleaned and maintained, ▪ secure positioning of the load suspension device, ▪ tested with 25% overload, ▪ hook safety latch
• **ROPES AND ROPE SLINGS**	▪ possession of attest, ▪ the rope's construction must correspond to its intended use, ▪ replacement of the rope in cases of wear, abrasion, corrosion, wire breaks, fractures, etc., ▪ fastening means (ferrules, eyes) must have certification and the manufacturer's mark, ▪ regular maintenance, replacement, and inspection, ▪ regular cleaning and lubrication of the rope, ▪ proper storage and handling, ▪ impregnation as protection against rotting, ▪ mandatory inspections and checks
• **CHAINS AND CHAIN SLINGS**	▪ possession of attest, ▪ regular maintenance, inspection, and testing,

	▪ use exclusively of improved chains – LP (heat-treated chains), ▪ possession of the appropriate breaking strength of the chain, ▪ mandatory tag with permanent marking of the chain class, manufacturer, and permitted load, ▪ mandatory use of corner protectors to prevent damage to the load, ▪ chain replacement is necessary in case of length change, wear, damage, or reduction in diameter, ▪ during testing, the chain is loaded with 1.25× the permitted load
• **LIFTING STRAPS**	▪ must have a label with markings of load capacity, length, manufacturer, type, serial number, standard, material, year, and month of production, ▪ the label color must correspond to the type of sling material, ▪ regular inspection, check, and maintenance, ▪ testing is performed once a year, ▪ store on appropriate shelves in a dry area, protected from sunlight, mechanical damage, and chemically aggressive substances
• **SHEAVES, DRUMS, SPROCKETS**	▪ possession of attest, ▪ manufactured in accordance with standards, ▪ sheave rims must be designed to prevent the rope from falling out; drum rims must be high or enclosed in a housing to prevent rope slippage, ▪ grooves must be clean and undamaged, ▪ the rope must be properly wound onto the drum, ▪ a bumper made of elastic material must be installed on the lower sheave assembly to prevent impact when reaching the highest position, ▪ must be withdrawn from use in cases of diameter reduction by a defined percentage or in cases of reduction in groove rim thickness by a defined percentage
PROTECTIVE DEVICES AND EQUIPMENT	
• **PROTECTIVE GUARDS AND PROTECTIVE DEVICES**	▪ robust, securely fastened, must not cause additional hazards, prevent easy dismantling, and bypassing, ▪ installed at an appropriate distance from the danger zone, ▪ designed so that the movement of moving parts and hazardous functions is prevented while within the operator's reach, and the absence of any component should prevent the movement of moving parts or stop them
• **EMERGENCY STOP DEVICE**	▪ clearly recognizable and visible, ▪ quick and unobstructed access, ▪ stops the hazardous operation process as quickly as possible without creating additional risks, ▪ initiates or allows the initiation of certain safety movements,

	▪ once activated, must hold the command until it is explicitly canceled, ▪ shape: red mushroom button on a yellow background
• **SAFETY AND HEALTH SIGNS AT WORK**	▪ installed at the crane's access points, around the crane, and on the crane itself, ▪ all information and warnings must be unambiguous and not overly detailed, ▪ regular maintenance and cleaning, ▪ replacement of worn-out, poorly visible, and unusable signs, ▪ shapes and colors must correspond to their purpose, ▪ pictograms should be as simple and clear as possible, ▪ sign materials must be resistant to impact, water, and other harmful environmental effects, ▪ must be placed in well-lit, accessible, and visible locations

CONCLUSION

The process of harmonizing lifting machines with harmonized standards and all other valid regulations in the given area is a key factor in ensuring the safety of lifting machines. The research showed the essential requirements that lifting accessories and protective devices and equipment of cranes must meet in order to be marked with the CE mark and which is a key indicator of whether the lifting accessories and protective devices and equipment of cranes complies with the relevant technical regulations and directives.
When examining the fundamental requirements, engineers can more effectively match lifting accessories and protective equipment of cranes with CE marking processes, emphasize the crucial safety standards during inspection and testing, and thus enhance the safety of operating cranes.

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