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Cranes — Safety code on mobile cranes

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TECHNICAL REPORT

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Cranes — Safety code on mobile cranes

Appareils de levage à charge suspendue — Code de sécurité sur les grues mobiles

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In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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ISO/TR 19961 was prepared by Technical Committee ISO/TC 96, *Cranes*, Subcommittee SC 6, *Mobile cranes*.

This second edition cancels and replaces the first edition (ISO/TR 19961:2005). Subclauses 4.2, 4.3 and 4.4 have been removed and these sections are now covered under ISO 10972-2. The Bibliography has been updated.

Cranes — Safety code on mobile cranes

1 Scope

This Technical Report provides a guide to International Standards applicable to mobile cranes (crawler cranes, railway cranes, wheel-mounted cranes and any variations thereof that retain the same fundamental characteristics) and a summary of related provisions. Special adaptations of the general types of machine covered, where applicable, also fall within its scope.

NOTE According to the ISO Directives, Part 2, the verbal forms used to identify provisions in an International Standard are

— "shall" or "shall not", used to indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted,

— "should" or "should not" for recommendations, indicating that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited, and

— "may" or "need not", used to indicate a course of action permissible within the limits of the document.

2 Purpose

The purpose of this Technical Report is to

a) identify the many International Standards relevant to mobile cranes and their safety (see Bibliography for a complete listing),

b) summarize the content of those documents,

c) promote mobile crane safety by the delineation of these standards, so that the incorporation of their provisions into the design and use of mobile cranes will guard against, and minimize, injury to workers and damage to equipment,

d) facilitate the work of all those working in the field of mobile cranes (designers, supervisors and others either directly or indirectly responsible for the safe use and maintenance of the machines) with a need to consult the current standards relating to mobile cranes, and

e) contribute to further international harmonization of mobile crane standards.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4306-1 and ISO 4306-2 apply.

4 Construction and characteristics

4.1 Load rating

4.1.1 Crane stability (backward/forward)

ISO 4305 specifies the conditions to be taken into consideration when verifying the stability of a mobile crane by calculation, assuming that the crane is operating on a firm and level surface (up to 1 % gradient). It applies to mobile cranes defined in ISO 4306-2 mounted on wheels or crawlers with or without outriggers.

4.1.2 Crane structural competence

ISO 8686-1 establishes general methods for calculating loads and principles to be used to select load combinations for proofs of competence for the structural and mechanical components of cranes. Based on rigid-body kinetic analysis and elasto-static analysis, it expressly permits the use of more advanced methods (calculations or tests) to evaluate the effects of loads and load combinations, and the value of dynamic load factors, where it can be demonstrated that these provide at least equivalent levels of competence.

It provides the general form, content and ranges of parameter values for more specific standards to be developed for individual lifting appliance types.

It provides a framework for agreement on loads and load combinations between a designer or manufacturer and an appliance purchaser for those types of lifting appliances where specific standards do not exist.

ISO 8686-2 applies the principles set forth in ISO 8686-1 to mobile cranes, as defined in ISO 4306-2, and presents loads and load combinations appropriate for use in proof of competence calculations for the steel structures of mobile cranes. It applies to mobile cranes used for normal service and for duty cycle service.

ISO 11662 specifies a test method that provides a systematic, non-destructive procedure for determining the stresses induced in crane structures under specified conditions of static loading through the use of resistance type electronic strain gages and to specify appropriate acceptable criteria for specified loading conditions.

4.1.3 Wind load

ISO 4302 relates to wind loads on cranes. It gives a simplified method of calculation and assumes that the wind can blow horizontally from any direction, that the wind blows at a constant velocity and that there is a static reaction to the loading it applies to the crane structure. It includes built-in allowances for the effects of gusting and for dynamic response.

4.1.4 Crane rating manuals

ISO 11661 specifies a standard presentation or format for mobile crane rated capacities on rated capacity charts. It applies to mobile cranes fitted with booms as defined in ISO 4306-2, when used in lifting mode.

4.2 Mechanisms

ISO 10972-2 establishes requirements specific to the mechanisms of mobile cranes, in addition to the general requirements for cranes given in ISO 10972-1.

These additional requirements concern:

a) the arrangement, features and characteristics of the crane mechanisms, and

b) the minimum requirements for certain mechanism components.

4.3 Controls

ISO 7752-1 establishes principles and requirements for the controls of lifting appliances. It deals with the arrangement of those controls which are used in positioning loads and serves as a general basis for the elaboration of detailed standards covering controls for particular types of lifting appliances.

ISO 7752-2 establishes the arrangement, requirements and direction of movement of the basic controls for slewing, load hoisting and lowering and jib luffing and telescoping. Section 1 deals with bi-directional controls, while Section 2 (see Addendum 1 to ISO 7752-2:1985) covers the basic arrangement and requirements for cross-shift levers (joysticks).

4.4 Wire rope and reeving accessories

4.4.1 Wire rope

ISO 4308-1 specifies two methods for the selection of wire rope to be used on the types of lifting appliances designated in ISO 4306-1. This part establishes the minimum requirements for these wire ropes to have acceptable strength and performance levels with respect to design, application and maintenance of the appliance.

ISO 4308-2 establishes values for the minimum practical utilization, Z_p, as defined in ISO 4308-1, for ropes and rotation-resistant ropes used on mobile cranes.

ISO 4309 details the care, maintenance (including fitting) and examination of wire rope in service on a crane, and enumerates the discard criteria which need to be applied to ensure the efficient and safe use of the crane.

4.4.2 Reeving

ISO 8087 establishes values for the minimum ratio of the pitch diameters of the drum and sheaves to the nominal diameter of the rope for hoisting and luffing operations.

The nominal diameter of the rope is considered the base factor when applying the ratio. The use of this nominal diameter allows flexibility of application, as it is not limited to crane mechanisms (mobile cranes are frequently constructed for multi-purpose duty, such as hook lifting, grabbing or magnet operation).

4.5 Cabin (operator's station)

ISO 8566-1 establishes specifications for the general requirements of cabins from which cranes are operated. Considerations include the conditions of use of the cabin.

ISO 8566-2 establishes criteria for cabins for mobile cranes. These are intended to cover cabins only for crane operators and not for road travel.

4.6 Machine access, guards and restraints

ISO 11660-1 and ISO 11660-2 specify requirements for steps, stairways, ladders, walkways, platforms, handrails, handholds, guardrails, and entrance openings which permit access to and from operator, inspection or maintenance platforms on mobile cranes. It also presents requirements for guards and restraints as related to moving parts.

4.7 General requirements

ISO 2374 sets forth the recommended range of maximum capacities of cranes from 0,1 to 1 000 t and applies to all types of cranes.

4.8 Classification

ISO 4301-1 establishes a general classification for cranes based on the number of operating cycles to be carried out during the expected life of the crane with a load spectrum factor which represents a nominal state of loading.

NOTE This is not to imply that the same method of stress calculation or testing will apply to all types of lifting appliances which come under the scope of ISO/TC 96.

ISO 4301-2 establishes a classification of mobile cranes and related crane mechanisms based on the number of operating cycles to be carried out during the expected life of the crane or mechanism and on a load spectrum factor which represents a nominal state of loading.

4.9 Graphic symbols, colours and signs

ISO 7296-1 establishes general graphic symbols for use on the controls of cranes and colours for control buttons and signal lamps. It divides the symbols into those for basic directions of motion and on/off positions; those for operator controls; and information symbols.

ISO 7296-2 establishes graphical symbols for use on operator control and other displays for mobile cranes.

ISO 3864 prescribes safety colours and safety signs for the purposes of preventing accidents and health hazards and meeting emergencies. The use of safety colours and safety signs does not replace proper working instructions or precautionary measures.

ISO 13200 outlines safety sign objectives, describes the basic safety sign formats, specifies colours for safety signs, and provides guidance on developing the various panels that together constitute a safety sign.

4.10 Information to be provided

ISO 7363 presents the form of presentation and content for the documents which a manufacturer should provide with cranes and lifting appliances. Such documents give technical information and include acceptance documents for the equipment to facilitate its installation, testing and use.

ISO 9374-1 specifies information to be provided by the purchaser and the manufacturer so that the most suitable crane can be provided for the duty requirements and service conditions.

ISO 9942-1 specifies the minimum requirements for labels for the identification (marking) and the operation of cranes.

ISO 9928-1 gives requirements and recommendations on the contents of crane driving manuals.

ISO 9928-2 gives requirements and recommendations on the contents of crane driving manuals for mobile cranes, including erection, use, dismantling, inspection and maintenance.

ISO 10973 gives general requirements for the preparation of spare part manuals for cranes.

4.11 Limiting and indicating devices

ISO 10245-1 specifies general requirements for limiting and indicating devices for lifting appliances that are applicable to loads and motions, performance and environment. These devices restrict operation and/or provide the driver or other persons with operational information. Safe and reliable operation of limiters and indicators depends upon regular inspection and maintenance.

ISO 10245-2 establishes specific requirements for limiting and indicating devices fitted to mobile cranes. Some basic machine types within its scope are convertible for use in excavating work and other applications not considered to be lifting service, with the requirements in such cases applicable only when the machines are used as lifting cranes.

4.12 Safety of machinery — Basic concepts

ISO 12480-1 establishes required practice for the safe use of cranes, including safe systems of work, management, planning, selection, erection and dismantling, operation and maintenance of cranes and the selection of drivers, slingers and signalers.

5 Inspection/maintenance

5.1 Inspection — General

ISO 9927-1 specifies the regular inspections to be carried out on cranes as defined in ISO 4306-1, ISO 4306-2 and ISO 4306-3.

ISO 12482-1 aims at ensuring that the design constraints of the intended use of a crane are clearly identified and to define actions to be taken when the crane has been used over a period of time and has approached these constraints to ensure a new safe working period.

ISO 23814 specifies competency requirements for crane inspectors.

5.2 Maintenance

ISO 12478-1 establishes guidelines on the general requirements necessary for the preparation and presentation of maintenance manuals for cranes

5.3 Rope inspection, replacement and maintenance

ISO 4309 specifies the examination and discard criteria for wire rope.

6 Testing

ISO 4310 specifies the tests and procedures to be followed in order to verify that a crane conforms to its operational specifications and is capable of lifting its rated loads.

ISO 9373 specifies the principle requirements for instruments and measurement systems of test loads, distances, time and other relevant parameters when testing cranes and related equipment. It also gives recommended limit values of relative errors in measurement during testing.

ISO 14518 establishes standard methods for composition and measurement of test loads. It also provides standard methods and procedures for application of test loads during tests of cranes.

ISO 11662-1 specifies a test method for determining the maximum capacity of a mobile crane to counterbalance loads applied on its hook block. The test is applicable for cranes whose capacity to support loads is based on its static resistance to overturning. The test shall not be used on cranes whose capacity is based on structural strength or on limitations due to available load hoist, jib hoist or jib telescope capacity.

7 Operation — Qualifications/practices for job-site personnel

ISO 9926-1 specifies the minimum training to be given to trainee drivers of cranes, to develop basic operational skills and to impart the requisite knowledge for the proper use of those skills.

ISO 15513 specifies competency requirements for crane operators, slingers, signalers and assessors.

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