INTERNATIONAL STANDARD

ISO 10972-1

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Cranes — Requirements for mechanisms —

Part 1: General

Appareils de levage à charge suspendue — Prescriptions pour les mécanismes —

Partie 1: Généralités

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10972-1 was prepared by Technical Committee ISO/TC 96, *Cranes*, Subcommittee SC 9, *Bridge and gantry cranes.*

ISO 10972 consists of the following parts, under the general title *Cranes — Requirements for mechanisms*:

— *Part 1: General*

— *Part 2: Mobile cranes*

— *Part 3: Tower cranes*

— *Part 4: Jib cranes*

— *Part 5: Overhead travelling and portal bridge cranes*

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Introduction

This part of ISO 10972 establishes requirements and gives guidance and design rules that reflect the present state of the art in the field of crane machine design. The rules given represent good design practice that provides guidance for the fulfilment of essential safety requirements and adequate service of components. Deviation from these rules normally may lead to increased risks or reduction of service life, but it is acknowledged that new technical innovations, materials, etc., may enable new solutions that result in equal or improved safety and durability.

Cranes — Requirements for mechanisms —

Part 1:
General

1 Scope

This part of ISO 10972 establishes requirements which apply generally to mechanisms and related components of cranes and lifting appliances as described in ISO 4306-1, ISO 4306-2 and ISO 4306-3.

Requirements concern:

a) general layout and design of mechanisms;

b) selection and/or design requirements of components;

c) instructions for manufacture, mounting, installation and testing.

Rules for proof of competence calculation regarding different limit states (yield strength, fatigue, wear) are excluded from this part of ISO 10972.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10972. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10972 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1328-1:1995, *Cylindrical gears — ISO system of accuracy — Part 1: Definitions and allowable values of deviations relevant to corresponding flanks of gear teeth.*

ISO 2408:1985, *Steel wire ropes for general purposes — Characteristics.*

ISO 3077:—[1)], *Short link chain for lifting purposes — Grade T (8), calibrated, for chain hoists and other lifting appliances.*

ISO 4301-1:1986, *Cranes and lifting appliances — Classification — Part 1: General.*

1) To be published. (Revision of ISO 3077:1984)

ISO 4306-1;1990, *Cranes — Vocabulary — Part 1: General.*

ISO 4306-2:1994, *Cranes — Vocabulary — Part 2: Mobile cranes.*

ISO 4306-3; 1991, *Cranes — Vocabulary — Part 3: Tower cranes.*

ISO 4308-1;1986, *Cranes and lifting appliances — Selection of wire ropes — Part 1: General.*

ISO 4309:1990, *Cranes — Wire ropes — Code of practice for examination and discard.*

ISO 4310:1981, *Cranes — Test code and procedures.*

ISO 4347:1992, *Leaf chains, clevises and sheaves.*

ISO 4413:—[2], *Hydraulic fluid power — General rules for the application of equipment to transmission and control systems.*

ISO 4414:—[3], *Hydraulic fluid power — Recommendations for the application of equipment to transmission and control systems.*

ISO 4779:1986, *Forged steel lifting hooks with point and eye for use with steel chains of grade M(4).*

ISO 6336-1:1996, *Calculation of load capacity of spur and helical gears — Part 1: Basic principles, introduction and general influence factors.*

ISO 6336-2:1996, *Calculation of load capacity of spur and helical gears — Part 2: Calculation of surface durability (pitting).*

ISO 6336-3:1996, *Calculation of load capacity of spur and helical gears — Part 3: Calculation of tooth bending strength.*

ISO 6336-5:1996, *Calculation of load capacity of spur and helical gears — Part 5: Strength and quality of materials.*

ISO 7752-1:1983, *Lifting appliances — Controls — Layout and characteristics — Part 1: General principles.*

ISO 7597:1987, *Forged steel lifting hooks with point and eye for use with steel chains of grade T(8).*

ISO 10300-1:—[4], *Calculation of load capacity of bevel gears — Part 1: Introduction and general influencing factors.*

ISO 11660-1:—[4], *Cranes— Access, guards and restraints — Part 1: General.*

3 Definitions

For the purposes of this part of ISO 10972, the definitions given in ISO 4306-1, ISO 4306-2 and ISO 4306-3 and the following definitions apply.

3.1 in-service braking: Stopping or slowing the crane motion with the motor disconnected, through an immediate and easy control by the operator from the normal working position.

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2) To be published. (Revision of ISO 4413:1979)

3) To be published. (Revision of ISO 4414:1982)

4) To be published.

3.2 out-of-service braking: Avoiding unwanted starts for indefinite periods of time.

NOTE — Actuation may be automatic or manual.

3.3 emergency braking: Stopping the crane motion or motions in the case of loss of power or pressure supply through engagement with a limiting device or the activation of an emergency stop switch.

3.4 control braking: Maintaining a desired speed, automatically or by the operator, with the motor engaged.

3.5 chain drive: Device for supporting and moving loads via chain and roller arrangement.

3.6 rope drive: Device for supporting and moving loads via rope, sheave and drum arrangement.

4 General

4.1 Design criteria

4.1.1 General design and layout

General design and layout of a crane mechanism shall take into consideration:

— requirements of the user;

— specific function of the mechanism and its use;

— reliability of the mechanism, considering the consequences of failure;

— displacement of the structure supporting the mechanism;

— avoidance of uncontrolled motions considering the limits of transmission of force or moments, when provided for example by motors, clutches, brakes;

— avoidance of undesirable or excessive vibrations;

— avoidance of excessive noise emissions;

— ease of use and controls of the mechanism with adequate space and motion limiters and indicators;

— recommendations of the component supplier for the selection and installations of component parts;

— serviceability, i.e. easy accessibility for maintenance of components (see ISO 11660-1);

— interchangeability of components;

— availability of lifting lugs or lifting points for handling;

— access for operator or maintenance personnel, see ISO 11660-1;

— environmental conditions and hazards.

4.1.2 Criteria for strength of components

When selecting the components of the mechanisms, it shall be verified that the applicable loading conditions in terms of maximum loading, load spectrum and number of load cycles comply with the corresponding rated characteristics of the components.

4.2 Power

The power mechanism shall be an electrical, hydraulic or pneumatic motor or an internal combustion engine.

The crane mechanism shall have sufficient power and torque to control the motions under the specified design conditions. Gravitational, inertial, in-service wind, friction forces and mechanism efficiency shall be taken into account.

4.3 Couplings

4.3.1 General

Selection of the type of coupling shall be made on the basis of the general design of the mechanism, its use and performance required in order to avoid vibrations and unwanted reactions. Alignment shall comply with the supplier's instructions.

When necessary, rotating parts shall be statically or dynamically balanced.

4.3.2 Clutches

When sprag-type clutches are used in hoist and derricking systems, they shall incorporate a positive mechanical lock against failure or be designed to transmit twice the maximum torque imposed by the maximum line pull.

Dry friction clutches shall be protected against rain and other liquids such as oil and lubricants.

Clutches shall be arranged to permit adjustments where necessary to compensate for wear.

The maximum permissible torque of the clutch shall be at least as high at any operating temperature as the torque impulses occurring during operations, taking into account the impulse frequency and the permissible wear.

4.4 Brakes

Means shall be provided for arresting each powered motion of the crane.

Emergency braking shall be performed using brakes which are automatically applied in case of power failure. The emergency brakes shall provide a deceleration rate consistent with the design parameters for a fully loaded mechanism.

The force to apply a manual in-service brake by hand or foot shall comply with the requirements of ISO 7752.

The same brake may be used for different types of braking, as appropriate.

4.4.1 Hoist brake

The frictional hoist brakes shall be capable of automatically arresting and sustaining any rated load and dynamic test load at any position within the range of hoisting.

When emergency load-lowering is required, the hoist brake shall be capable of manual release so that control of the load will be maintained during lowering. The emergency load-lowering shall be carried out according to readily available instructions which take into account the heat-dissipating capability of the brake.

The hoist brake shall be selected to have a nominal torque that is at least 1,5 times the load torque.

Cranes intended for transportation of molten metals or similar hazardous materials shall be equipped so that dropping of the load is prevented if a component in the force flow fails. This requirement is met by

— having redundant systems, or

— an emergency stopping brake on the rope drum in conjunction with a redundant rope drive, or

— up to a gross load capacity of 16 t, designing the hoist at least two classification groups higher than required for actual operating conditions, and taking M5 as the minimum group.

4.4.2 Travel and slewing brake

Travel and slewing braking shall be capable of arresting the motion of a crane in the most unfavourable loading condition.

4.5 Out-of-service devices

When the mechanism is not in use, its position shall be retained by means of a brake or locking device. The locking device shall be arranged to avoid inadvertent engagement and disengagement. Engagement of the locking device shall prevent inadvertent operation of the motion.

When a crane is required to "weather-vane" in the out-of-service mode, the means of controlling this feature shall be operable from the control station. The device should operate automatically when

— the power supply to the crane is removed;

— the crane is taken out of service.

4.6 Hydraulic and pneumatic systems

The general requirements presented in ISO 4413 and ISO 4414 for hydraulic and pneumatic systems shall be applied for cranes.

The hydraulic system and the control arrangement shall be such that no combination of control selections can initiate any movement not intended by the operator, unless this is essential for the operation of a safety device or interlock.

The circuits shall incorporate the following safety features:

— relief valves shall be provided in pressurized hydraulic and pneumatic circuits in order to limit the maximum pressure in the circuit;

— safety devices to protect against the effects of failure of a hose, pipe or fittings in any load-carrying circuit on the crane.

All components and controls shall be capable of handling the design loads and shall provide safe function of the crane under regular, occasional and exceptional conditions, considering the failure of power source and the testing of the system.

All components and fluids (in a hydraulic system) shall be compatible with the application and the operational environment.

For diagnostic trouble-shooting, pressure test points shall be provided at the appropriate places in the system and be indicated on the circuit diagrams.

Where appropriate, means shall be provided to purge entrapped gas from the hydraulic system.

Back-pressure which may damage or inadvertently control brake components within the system shall be prevented.

Selection or design of hydraulic cylinders shall be made on the basis of maximum compressive and tensile loads at effective length during the characteristic working cycles. Consideration shall be made for the available hydraulic pressure and flow, type of fluid, type and material of seals and wipers and bearing size.