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# International Standard



# 4310

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## Cranes — Test code and procedures

*Appareils de levage — Code et méthodes d'essai*

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**Descriptors** : hoists, cranes (hoists), gantry cranes, tests, performance tests, visual inspection, hoisting tests, mechanical tests, static tests, stability tests, testing conditions.

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4310 was developed by Technical Committee ISO/TC 96, *Cranes, lifting appliances and related equipment*, and was circulated to the member bodies in June 1978.

It has been approved by the member bodies of the following countries:

Australia	Israel	South Africa, Rep. of
Austria	Korea, Rep. of	Spain
Bulgaria	Mexico	Switzerland
Czechoslovakia	Netherlands	Turkey
Finland	Norway	United Kingdom
France	Philippines	USSR
Germany, F. R.	Poland	Yugoslavia
Ireland	Romania	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Belgium  
India  
Japan  
USA

# Cranes — Test code and procedures

## 1 Scope and field of application

This International Standard 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 rated loads. Where rated loads are governed by stability, a test procedure and test load are specified that permit stability margins to be easily verified.

The following crane types are governed by this International Standard :

- a) overhead travelling cranes;
- b) travelling bridge cranes;
- c) portal cranes;
- d) mobile cranes and crane-excavators;
- e) tower cranes;
- f) railway cranes;
- g) cable cranes;
- h) others to be determined.

## 2 Types of test procedure and number of samples

2.1 Three types of test procedure are to be used to accomplish the aims of this International Standard :

- a) testing of cranes for conformity to specifications as set forth in 3.1;
- b) visual inspection as set forth in 3.2;
- c) load lifting competence testing as set forth in 3.4, 3.5 and 3.6.

2.2 All cranes shall be required to satisfy the test procedures stipulated above; however, in the case of serially manufactured cranes, the sample number of cranes to be tested under a) and

c) should be established by mutual agreement between the "vendor" and the "purchaser".<sup>1)</sup>

2.3 Cranes which leave the manufacturing factories ready for service shall be tested in these factories prior to delivery; cranes which are mounted or finally assembled at their places of use shall be tested at these places unless other agreements between the vendor and the purchaser are made.

## 3 Test procedures

### 3.1 Conformity tests

When cranes are tested for conformity to specifications, tests shall be performed according to the crane load characteristics, and the following parameters shall be verified :

- mass of crane (where practical);
- distance from axis of rotation to the balance edge;
- load lifting height;
- hook approaches;
- load lifting speed;
- precision load lowering speed;
- crane travelling speed;
- crab traversing speed;
- slewing speed;
- derricking time;
- telescoping time;
- cycle time (where necessary);
- functioning of limiting devices;
- performance of driving medium, for example, motor currents under test load conditions.

1) In legal terms, the "vendor" and the "purchaser" are understood to be the parties who have signed the contract. The "vendor" is the party supplying the crane. The "purchaser" is the party who receives the crane according to the contract.

### 3.2 Visual inspection

Visual inspection should include checking for compliance with specifications and/or condition of all vital components such as :

- mechanisms, electrical equipment, safety devices, brakes, controls, and lighting and signalling systems;
- crane metal structures and their connections, ladders, means of access, cabins, platforms;
- all guardings;
- hook or other load-handling attachments and their connections;
- ropes and their fastenings;
- sheave blocks, their pivots and fastening details, and jib linkage elements.

It shall not be inferred that dismantling of any parts is necessary during this inspection but opening of covers which would be required for normal service and inspection purposes shall be included, for example, limit switch covers.

The inspection procedure shall include verification that all certificates required have been submitted and checked.

### 3.3 Load lifting tests

Load lifting competence testing shall include the following :

- static tests;
- dynamic tests;
- stability tests (where applicable).

#### 3.3.1 Static tests

**3.3.1.1** Static tests are conducted for the purpose of demonstrating the structural competence of the crane and its components.

The test shall be considered to be successful if no crack, permanent deformation, paint flaking or damage which affects the function and safety of the crane is visible and no connection has loosened or been damaged.

**3.3.1.2** Static tests shall be performed separately for each hoisting mechanism and for concurrent operation of hoisting mechanism, if permitted by the crane specification, in such positions and configurations as will impose maximum rope loads, maximum bending moments and/or maximum axial forces, as applicable, in the major crane components.

The test load, built up progressively, shall be lifted 100 to 200 mm from the ground and suspended for a period necessary for the test but not less than 10 min unless a higher value is required.

**3.3.1.3** The test load shall be  $1,25 P$  for all cranes unless a higher value is required by national regulations or specified in the purchase contract, where  $P$  is defined as follows :

- a) for mobile cranes : the load on the hoisting mechanism, including the weight of the payload and the weight of the hook assembly and rigging attachments;
- b) for other cranes : the rated capacity for the equipment as specified by the manufacturer. Rated capacity does not include any lifting attachment which is a permanent part of the crane in its working condition.

#### 3.3.2 Dynamic tests

**3.3.2.1** Dynamic tests are conducted primarily for the purpose of verifying the functioning of crane mechanisms and brakes.

The test shall be considered to be successful if the components concerned have been found to perform their functions and if visual inspection subsequent to the test reveals no damage to the mechanisms or structural components, and no connection has loosened or been damaged.

During performance of the test, the crane shall be controlled according to the rules specified in the operating manual, and care must be taken to limit accelerations, decelerations, and speeds to those appropriate to normal crane operation.

**3.3.2.2** Dynamic tests shall be performed separately for each crane motion or, if stated in the specifications of the crane, for concurrent crane motions in such positions and configurations as will impose maximum loading on the mechanism(s). Tests shall include repeated starting and stopping for each motion throughout the range of the motion and shall continue for 1 h minimum under consideration of the duty cycle. The tests shall include a mid-air start with the test load suspended. No back running should occur with the test load under these circumstances.

**3.3.2.3** The test load shall be  $1,1 P$  unless a higher value is required.

#### 3.3.3 Stability tests

**3.3.3.1** The purpose of the stability test is to check crane stability. The test shall be considered to be successful if no crane tipping occurs when the crane's hook is statically loaded.

**3.3.3.2** Stability test loads for mobile cranes shall be determined according to the formula :

$$1,25 P + 0,1 F_i \quad \dots (1)$$

where  $F_i$  ( $F_1$  or  $F_2$ ) is the jib weight  $G$  or fly jib weight  $g$  reduced to the head of the jib or that of the fly jib.

Where jib weight  $G$  is very high and the fly-jib is designed for relatively light loads, the stability test shall not be performed with the test load, according to formula (1), lifted on the head

of the fly-jib. Such stability requirements shall be verified by calculation.

NOTE — 1,25  $P$  may alter where a higher value is required.

The figure shows the side elevation for a typical crane giving the designations of the parameters to be considered.

$L$  and  $l$  — lengths of jib and fly jib (for telescopic jibs,  $L$  will relate to the jib length under consideration);

$(X, Y)$  and  $(x, y)$  — co-ordinates of centres of gravity for jib and fly jib;

$j$  and  $k$  — radii for jib and fly jib;

$m$  and  $n$  — radii of centres of gravity for jib and fly jib.

$F_i$  is calculated as follows :

$$F_i = \frac{m G + g (j + n)}{j + k} \quad \dots (2)$$

For cranes equipped only with a jib,  $k = n = g = 0$  and

$$F_1 = \frac{m}{j} G$$

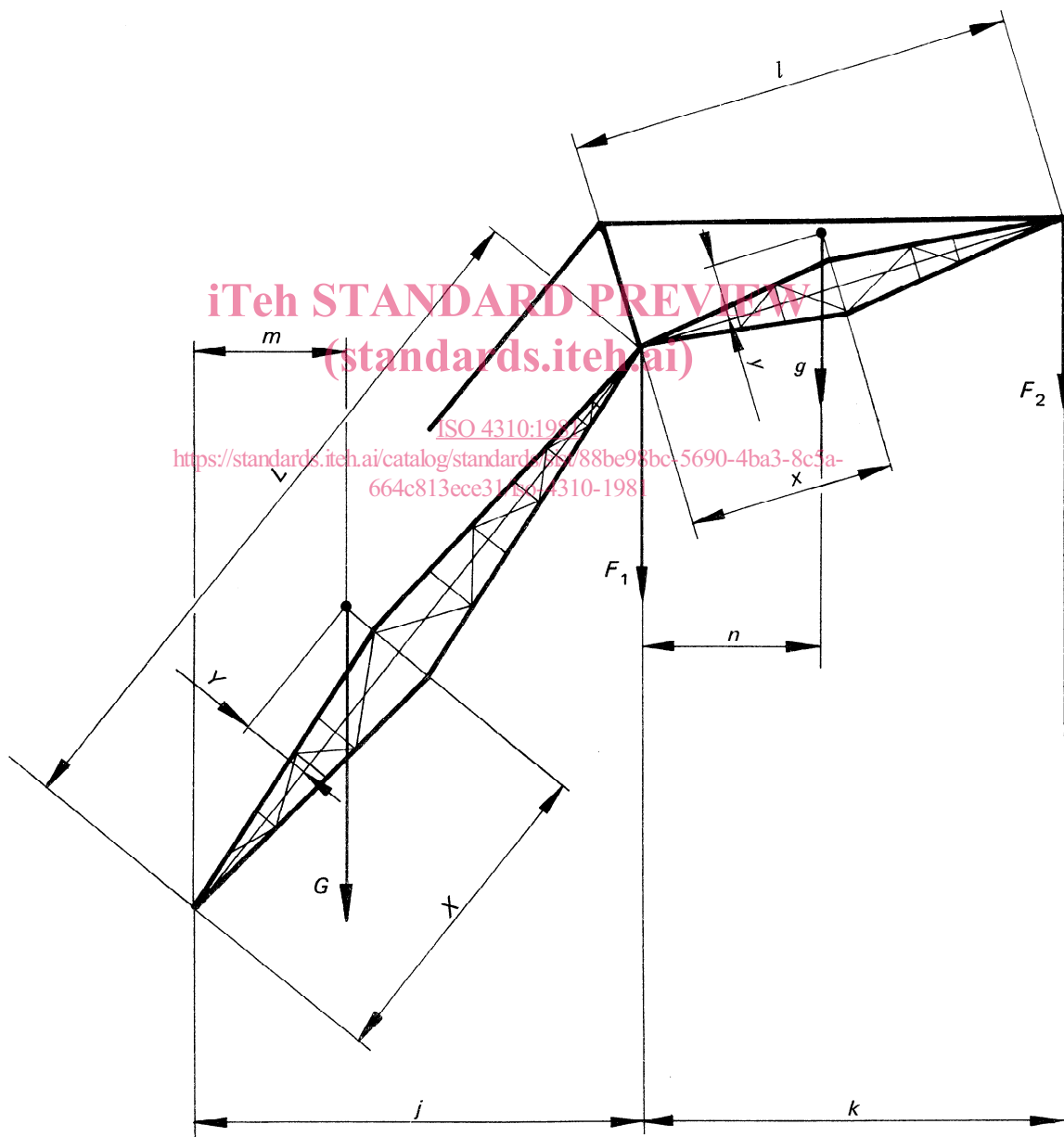


Figure — Designation of parameters for determination of stability test loads

For cranes equipped with a jib and a fly jib, if the load is lifted on jib head,  $k = 0$  and

$$F_1 = \frac{m G + g (j + n)}{j}$$

If the load is lifted on fly jib head,

$$F_2 = \frac{m G + g (j + n)}{j + k}$$

NOTE — Values of  $P$ ,  $G$ ,  $g$  and co-ordinates of centres of gravity ( $X$ ,  $Y$ ) and ( $x$ ,  $y$ ) shall be specified in the crane documentation for each of the lengths  $L$  and  $l$ .

**3.3.3.3** For cranes other than mobile cranes, special stability tests may not be required.

**3.3.3.4** The tests shall be carried out in those positions or configurations within the specified working area for which stability is at a minimum. If different loads are specified for different positions or working areas, tests shall be carried out to check the stability for a selection of those conditions.

### 3.4 Test report

On completion of the tests outlined in 2.1, a report shall be prepared listing the conclusions and findings of the tests. The report shall identify the crane tested, and shall give the date and location of the tests and the name of the test supervisor. It shall be specific as to the loads, positions, configurations, procedures and findings in each case.

For cranes that are subject to the requirements of 2.1b) only, an abbreviated form of report may be used. The identity of the crane, date and location of inspection, name of inspector and the findings for each item inspected shall be included in an abbreviated report.

## 4 Test conditions

**4.1** For the purpose of testing, the crane shall be equipped with working equipment suitable for operation with the rated load in accordance with specifications.

**4.2** Cranes travelling on rail tracks shall be tested on rails manufactured and laid in conformity with the crane specifications.

**4.3** When testing cranes on pneumatic tyres or crawler equipment, the appliance shall be placed on a firm level surface (within  $\pm 0,5\%$ ).

**4.4** At the time of test, wind speed shall not exceed 8,3 m/s (30 km/h), but this should not be construed as requiring that the crane be oriented so as to receive the most unfavourable effect of wind unless otherwise specified in the purchase contract.

**4.5** When testing pneumatic tyred equipment while operating on tyres, the tyres shall be inflated to within  $\pm 3\%$  of the pressure stipulated by the manufacturer, and all wheels shall be in the ahead position.

NOTE — Supporting conditions for the tyres are to align with manufacturers requirements.

**4.6** For conducting tests of cranes with outriggers in the "on outriggers" condition, the crane shall be level within  $\pm 0,5\%$ .

**4.6.1** When outriggers are used in the course of testing pneumatic tyred cranes, the crane shall be raised by the outriggers so as to provide clearance between the ground and all the wheels or to relieve all wheels of the weight of the crane unless the vendor specifies otherwise.

**4.6.2** When outriggers are used in the course of testing crawler cranes, the crane shall be installed so as to provide firm bearing of the outriggers on the supporting surface.

**4.6.3** Other cranes shall be set up as specified by national regulations or contract.

**4.7** The fuel tank shall be between 1/3 and 2/3 full. Coolant, lubricating oil and hydraulic fluids shall be at operating levels specified by the vendor.

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