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**ISO**  
**2330**

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**Fork-lift trucks — Fork arms — Technical  
characteristics and testing**

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*Chariots élévateurs à fourches — Bras de fourche — Caractéristiques  
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INTERNATIONAL

**ISO**



Reference number  
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## 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 2330 was prepared by Technical Committee ISO/TC 110, *Industrial trucks*, Subcommittee SC 2, *Safety of powered industrial trucks*.

This second edition cancels and replaces the first edition (ISO 2330:1974), of which it constitutes a technical revision.

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# Fork-lift trucks — Fork arms — Technical characteristics and testing

## 1 Scope

This International Standard specifies manufacturing, testing and marking requirements for solid section fork arms, for quantity production and with all types of mounting.

By agreement between the fork arm manufacturer and the purchaser, these requirements may also be applied to fork arms not intended for quantity manufacture.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 148:1983, *Steel — Charpy impact test (V-notch)*.

ISO 683-1:1987, *Heat-treatable steels, alloy steels and free-cutting steels — Part 1: Direct-hardening unalloyed and low-alloyed wrought steel in form of different black products*.

ISO 2328:1993, *Fork-lift trucks — Hook-on type fork arms and fork arm carriages — Mounting dimensions*.

ISO 2331:1974, *Fork lift trucks — Hook-on type fork arms — Vocabulary*.

## 3 Definitions

For the purposes of this International Standard, the definitions given in ISO 2331 and the following definition apply.

**3.1 prototype fork arm:** Fork arm intended for quantity production where any combination of the blade, shank cross-section, material specification, hook or fork heel design is new to production.

## 4 Manufacture

The fork arms shall be manufactured from material of solid cross-section.

## 5 Testing

**5.1** A prototype fork arm shall be subjected to, and meet the requirements of, the yield test in clause 6 and the impact test in clause 7.

Prototype fork arms each having a specified capacity not greater than 4 000 kg shall be subjected to, and meet the requirements of, the fatigue test in clause 8.

**5.2** The tests in clauses 6 and 7 may, by agreement between the fork arm manufacturer and the purchaser, be repeated periodically for quantity production fork arms.

## 6 Yield test

### 6.1 Test load

#### 6.1.1 Fork arms each of specified capacity up to and including 5 000 kg

The test load  $F_T$  shall correspond to three times the specified capacity  $C$  of the fork arm.

#### 6.1.2 Fork arms each of specified capacity greater than 5 000 kg

The test load  $F_T$  shall correspond to the specified capacity  $C$  of the fork arm multiplied by the factor  $R$ , where  $R$  is given as follows:

$$R = 3 - 0,08(Q - 10)$$

where

$$R \geq 2,5$$

$$Q = \frac{2C}{1000}$$

### 6.2 Procedure

Restrain the fork arm in a manner identical to that used on the fork-lift truck. Fit the fork arm with a means of measuring any permanent deformation.

Apply the appropriate yield test load twice at the distance  $D$  from the front face of the fork arm shank (see figure 1), gradually and without shock; maintain it for 30 s each time. For fork arms each of specified capacity below 5 500 kg,  $D$  shall be taken as the appropriate rated load centre distance as specified in table 1 of ISO 2328:1993. For fork arms each of

specified capacity of 5 500 kg and above,  $D$  shall be specified by the truck manufacturer.

### 6.3 Requirement

Datum readings shall be taken on the top surface of the fork blade tip after the first test and again after the second test. Comparison between these two readings shall indicate no permanent deflection.

## 7 Impact test

### 7.1 Sampling

Specimens longitudinal to the grain shall be taken in relation to the fork arm section in accordance with the location of test pieces in bars and wire rods specified in ISO 683-1. These shall preferably be taken from an area between the top and bottom hooks, but it is also permissible to take specimens from a specially provided extension of the fork shank above the top hook or from a separate piece of semi-finished material of adequate size (i.e. length at least twice the width), which has the same cross-section, has been taken from the same material batch and has received the same heat treatment as the fork arm itself.

### 7.2 Procedure

Carry out the impact tests in accordance with ISO 148 using standardized V-notched samples, at a temperature of  $-20\text{ }^{\circ}\text{C}$ .

### 7.3 Requirement

The samples shall achieve an impact value of at least 27 J at  $-20\text{ }^{\circ}\text{C}$ .

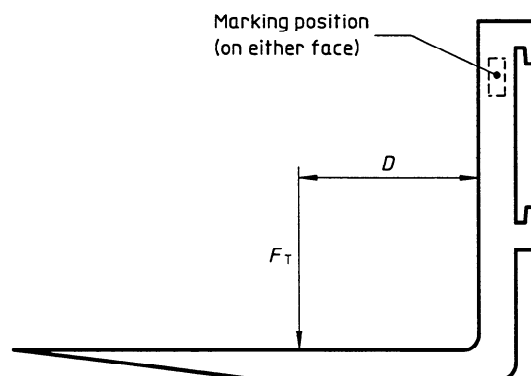


Figure 1 — Marking position and test loads application position

## 8 Fatigue test

### 8.1 Test load magnitude, frequency and duration

**8.1.1** The dynamic test load shall be of constant amplitude and have a peak magnitude of 1,25 times the specified capacity  $C$ . The minimum value for the dynamic test load shall not exceed 0,1 times the specified capacity  $C$ .

**8.1.2** The test load frequency shall be 10 Hz maximum. The frequency shall be reduced if the temperature of the fork arm exceeds 50 °C or resonance symptoms occur.

**8.1.3** The duration of the test shall be not less than  $10^6$  test load cycles.

### 8.2 Procedure

Restrain the fork arm in a manner identical to that used on the fork-lift truck. Apply the dynamic test load at the distance from the front face of the fork arm shank where  $D$  is as specified in 6.2 (see figure 1).

### 8.3 Requirement

There shall be no cracks or permanent deformation in the fork arm on completion of the test. The crack detection procedure shall be as specified in clause 9.

## 9 Surface-crack detection

The fork arm manufacturer shall thoroughly visually examine every fork arm in quantity production (or following a fatigue test) for cracks, and subject them to a non-destructive crack detection process with special attention being given to the heel and any welds and heat-affected zones at the top and bottom hooks, including their attachment to the shank. The fork arm shall be withdrawn if indications of cracking are detected.

NOTE 1 It is recommended that the non-destructive crack detection process is by the magnetic particle inspection method.

## 10 Marking

**10.1** At the position indicated in figure 1 (on either face), each fork arm shall be marked permanently with the following:

- a) the specified fork arm capacity  $C$ , in kilograms;
- b) the specified load centre distance  $D$ , in millimetres;
- c) the fork arm manufacturer's identification;
- d) the week or month and year of manufacture or agreed serial number.

**10.2** The truck manufacturer's identification and part number may be shown if requested.

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