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Jawaharlal Nehru
“Step Out From the Old to the New”

Indian Standard

METHODS FOR STABILITY TESTING OF FORK LIFT TRUCKS

(Second Revision)

ICS 53.060
FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Industrial Trucks Sectional Committee had been approved by the Transport Engineering Division Council.

This standard was first published in 1967 and revised in 1974. This revision was undertaken to bring it in line with the ISO 1074:1991 'Counterbalanced fork lift trucks — Stability tests' issued by International Organization for Standardization.

In this revision the following technical changes have been incorporated:

a) Rated capacity of fork lift trucks enhanced from 10 000 kg to 50 000 kg.

b) Table of tests for longitudinal stability and lateral stability had been modified for rated capacity up to 50 000 kg (see Table 3).

  c) Table for test load dimensions had been made up to \( Q > 10 000 \) kg (see Table 1).

  d) New table for height of blocks has been included (see Table 2).

e) Three new diagrams are included for stability tests for trucks with attachments.

This revision compiles the latest information and includes additional clause covering the current day practice in stability testing of fork lift trucks.

With the trend towards assistance to man-power in the handling of materials, the use of mechanical handling aids has greatly increased. Among the mechanical handling aids, the fork lift trucks in their various forms play an important role. The safe use of such trucks under all conditions of operations depends to a large extent on the margins of stability that are designed into the trucks in order to meet various operational requirements.

The composition of the Committee responsible for formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard.
Indian Standard
METHODS FOR STABILITY TESTING OF FORK LIFT TRUCKS
(Second Revision)

1 SCOPE
1.1 This standard specifies basic tests to verify the stability of counterbalanced fork lift trucks. It applies to counterbalanced fork lift trucks with tiltable or non-tiltable masts, whether rider-controlled or with a separate operator, of rated capacity up to and including 50,000 kg. It also applies to trucks operating under the same conditions when equipped with load-handling attachments.

1.2 This standard does not apply to trucks with retractable devices such as a mast or fork, or when handling suspended loads which may swing freely.

2 REFERENCES
The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4660 : 1993</td>
<td>Powered industrial truck — Terminology (third revision)</td>
</tr>
<tr>
<td>7552 : 2003</td>
<td>Industrial trucks operating in special conditions of stacking with mast tilted forward — Additional stability test (first revision)</td>
</tr>
<tr>
<td>11113 : 1999</td>
<td>Earth-moving machinery and tractors and machinery for agriculture and forestry — Seat index point (second revision)</td>
</tr>
</tbody>
</table>

3 TERMINOLOGY
For the purpose of this standard the terms and definitions given in IS 4660 shall apply.

4 CONDITIONS OF VALIDITY
4.1 Normal Operating Conditions
The basic tests specified in this standard ensure that such a lift truck demonstrates satisfactory stability when reasonably and appropriately used, under normal operating conditions:

a) Stacking with the mast approximately vertical and the fork arms reasonably horizontal on substantially firm, smooth, level and prepared surfaces;

b) Travelling with the mast or fork arms tilted rearwards and the load in the lowered (travelling) position on substantially firm, smooth and prepared surfaces; and

c) Operating with the load centre of gravity on the longitudinal centre-plane of the truck.

4.2 Operating Conditions Other than Normal
When the operating conditions differ from those stated in 4.1, it is necessary to use either:

a) A truck complying with other Standard(s) covering the different specific conditions in accordance with IS 7552; or

b) A truck, the stability of which is agreed upon between the purchaser and manufacturer. This agreed stability shall not be less than that required by the tests specified for normal operating conditions in 4.1.

5 STABILITY TESTS FOR FORK LIFT TRUCKS
5.1 Test Requirements
The stability of these trucks shall be verified by means of one of the procedures described below. For trucks with a rated capacity up to and including 10,000 kg, the tilting platform test shall be used to verify stability in the event of a dispute.

5.2 Verification Procedure
5.2.1 Tilting Platform
A test platform which can be tilted about one side shall be used. A truck being tested for stability is placed on the initially horizontal test platform, in the conditions specified in 5.3 and successively, in each of the positions described in Table 3. In each of these tests, the test platform shall be tilted slowly to the slope indicated in Table 3. The truck is considered stable if
it passes all tests without overturning. For the purpose of these tests, overturning is defined as the test platform slope value which, if increased, would cause overturning of the truck. It is permissible in lateral tests for one of the load wheels to lose contact with the test platform and it is acceptable for parts of the structure or other designed features to make contact with the test platform.

5.2.2 Fixed Slope

Fixed slopes, with inclinations equivalent to the prescribed test slope, shall be used. The slope surface shall be smooth and capable of supporting the truck mass with no deformation likely to affect the test results. The truck under test shall be driven onto the fixed slopes with mast lowered and positioned according to Table 3. For each of the laden truck positions, the load shall be elevated slowly and smoothly to the height indicated in Table 3.

5.2.3 Calculation

Compliance with the specified values may be determined by calculation. Such calculated capacities shall take into account manufacturing variations and deflections of mast, tyres, etc.

5.3 Test Conditions

5.3.1 Condition of Truck

The tests shall be carried out on an operational truck. The operator on rider-controlled trucks shall be simulated by an object having a mass of 90 kg, if the stability during a test is thereby decreased. For a truck designed for operation with a standing operator, an object having a mass of 90 kg shall be secured with its centre of gravity 1000 mm above the floor of the operator's platform at the centre of the position normally occupied by the operator. For a truck designed for operation with a seated operator, the centre of gravity of the object shall be secured 150 mm above the seat index point (SIP) as determined in accordance with IS 11113, with the seat at the midpoint of the adjustments provided. Fuel tanks of internal combustion engine trucks shall be full, if stability is thereby decreased. All other tanks shall be filled to their correct operating levels, as applicable. Tyres shall be inflated to the pressure specified by the truck manufacturer.

5.3.2 Position of Truck on Platform

a) For tests No. 1 and 2 (see Table 3), the truck shall be placed on the test platform so that the load axle is parallel to the tilt axis, XY, of the test platform (see Fig. 7).

b) For tests No. 3 and 4, the truck shall be placed on the test platform in a turning position with line MN parallel to the tilt axis, XY of the test platform. In Fig. 8, 9 and 10, the steer wheel nearest to the tilt axis shall be parallel with it.

c) Lateral stability tests shall be conducted to the side of the truck which is less stable.

d) Point N is the centre point of the area of contact between the test platform surface and the front wheel nearest the tilting axis (see Fig. 8, 9 and 10).

e) Point M is defined as follows:

1) For trucks having an articulated steering axle: The projection on the test platform of the intersection of the longitudinal centre-plane AB of the truck with the axis of this axle (see Fig. 8);

2) For trucks steered by a single swiveling wheel: The centre point of the tread contact area between the steer wheel and the test platform surface (see Fig. 9);

3) For trucks steered by twin swiveling wheels: The centre point of the tread contact area between the steer wheel nearer to the axis of tilt XY, and the test platform surface (see Fig. 10); and

4) For trucks having steer wheels not connected by a common axle, but which are arranged to articulate about the longitudinal center-plane of the truck, the projection on the test platform of the intersection of the longitudinal center-plane of the truck, AB, with a line CD (see Fig. 8) connecting the vertical turning axes of the steer wheels.

5.3.3 Test Load

The test load shall have a mass equivalent to the maximum load, Q, which the truck can elevate to its maximum lift height acting through the centre of gravity, G, nominally positioned at the standard load centre distance, D, as indicated on the information plate of the truck both horizontally from the front face of the fork arm shank and vertically from the upper face of the fork arm blade. When additional lift heights, loads and load centre distances are to be indicated on the information plate, the truck shall meet the requirements established by the tests specified in this standard for these additional ratings. The centre of gravity, G, of the test load (see Fig. 1) shall be located in the longitudinal centre-plane, AB, of the truck (see Fig. 7, 8, 9, 10 and Table 1).
Table 1 Standard Load Centre Distance
(Foreword and Clause 5.3.3)

<table>
<thead>
<tr>
<th>SL No.</th>
<th>Load Q kg</th>
<th>Load Centre Distance D mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>i) Q &lt; 1000</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>ii) 1000 ≤ Q ≤ 4999</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>iii) 5000 ≤ Q ≤ 10000</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>iv) Q &gt; 10000</td>
<td>600 or 900 or 1200 or 1500</td>
</tr>
</tbody>
</table>

5.3.4 Location of Truck on Test Platform

The initial position of the truck on the test platform shall be maintained during each test. This may be achieved by application of parking or service brakes, which can be secured in the ‘on’ position, or by wedging the wheels against the truck frame, ensuring however that articulation is not affected. Blocks (chocks) having a maximum height not exceeding the value indicated in Table 2 may be used, if necessary, to maintain the initial position of the truck on the test platform. Blocks (chocks), if used, shall not artificially improve stability (see Table 2).

Table 2 Height of Blocks
(Foreword and Clause 5.3.4)

<table>
<thead>
<tr>
<th>SL No.</th>
<th>Tyre Outside Diameter, d</th>
<th>Height of Blocks (Chocks) Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>i)</td>
<td>d ≤ 250</td>
<td>25</td>
</tr>
<tr>
<td>ii)</td>
<td>d ≤ 250</td>
<td>0.1d</td>
</tr>
</tbody>
</table>

The coefficient of friction of the platform surface may be increased, if necessary by an appropriate friction-increasing material.

5.3.5 Position of Front Face of Fork Arm Shank

Test No. 1 shall be conducted with the horizontal position of load datum point (for example, point E) unchanged when elevated from its lowered position [see Fig. 2(c)]. By means of a plumb-line or other suitable equipment, set the mast vertical. Elevate the fork and the prescribed test load to 300 mm above the test platform. With the front face of the fork arm Shank vertical, establish a point, E [see Fig. 2(a)] on the fork or fork carrier having a fixed relationship to the centre of gravity of the test load, G (see Fig. 1). This point, E, shall be used to provide a reference datum, F, on the test platform [see Fig. 2(a)]. When the mast is elevated, a new point, $F_1$, on the test platform may occur [see Fig. 2(b)], by the following adjustments this new point, $F_1$, can be returned to the original location of F [see Fig. 2(c)].

5.3.5.1 For trucks with tiltable masts, changes in the location of $F_1$ shall be corrected by varying the tilt of the mast within the limits provided by the design of the truck.

5.3.5.2 For trucks with fixed masts, adjustments in the fork arms or fork carrier tilt (where provided) may be used to correct for changes in location of point $F_1$, within the limits of tilt provided by the design of the truck.

5.3.5.3 For trucks having non-tiltable masts, fork arms, or fork carrier, adjustments cannot be made.

5.3.6 Lift Height for Tests Simulating Travel

For tests simulating travel, that is, tests No. 2 and 4, the upper face of the fork arms, measured at the heel of the fork arm, shall be positioned 300 mm from the test platform.

5.3.7 Safety Precautions

Precautions shall be taken to prevent the overturning of the truck or displacement of the test load during the course of the test. If the means for preventing the total overturning of the truck consist of rope lashing or chain, this shall be sufficiently slack to impose no appreciable restriction on the truck until the overturning point is reached.

Displacement of the test load shall be prevented by means such as:

a) Firmly securing the test load to the load carrier or equivalent structure; and

b) Suspending the test load near the ground from an appropriate support placed on the fork so that the suspension point is at the point where the centre of gravity, G, of the test load would
be, if the test load were to be placed on the fork.

6 STABILITY TESTS FOR TRUCKS WITH ATTACHMENTS

6.1 Trucks fitted with attachments other than fork arms shall be subjected to the same stability tests, except in cases where the attachment can bring the centre of gravity of the load out of the longitudinal centre-plane, \( AB \), of the truck [see 4.1(c)].

6.2 For verification of the vertical position of the mast, a reference point having a fixed relationship to the centre of gravity of the test load, \( G \) (see Fig. 1) shall be chosen.

6.3 The test load shall be the specified load, at the specified load centre distance indicated for the attachment when used on the truck being tested.

6.4 The fork lift height specified for the tests shall be measured between the test platform surface and the underside of the load or the attachment, whichever is the lower.

\[ \text{FIG. 2 \ POSITION OF LOAD DATUM POINT IN RELATION TO TEST LOAD} \]
Table 3 Summary of Tests
(Foreword and Clauses 5.2.1, 5.2.2 and 5.3.2)

<table>
<thead>
<tr>
<th>Test No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability</td>
<td>Longitudinal</td>
<td>Travelling</td>
<td>Stacking</td>
<td>Travelling</td>
</tr>
<tr>
<td>Operation</td>
<td>Stacking</td>
<td>Test load</td>
<td>Test load</td>
<td>Test load</td>
</tr>
<tr>
<td>Load</td>
<td>Test load</td>
<td>Test load</td>
<td>Test load</td>
<td>Test load</td>
</tr>
<tr>
<td>Lift height</td>
<td>Maximum</td>
<td>Lowered (see 5.3.6)</td>
<td>Maximum</td>
<td>Lowered (see 5.3.6)</td>
</tr>
<tr>
<td>Position of mast</td>
<td>Vertical</td>
<td></td>
<td></td>
<td>Full rearward tilt (for trucks with tiltable mast)</td>
</tr>
<tr>
<td>Position on test platform</td>
<td>Fig. 5 and Fig. 9</td>
<td>Fig. 6 and Fig. 9</td>
<td>Fig. 7 and Fig. 10, Fig. 11 or Fig. 12</td>
<td>Fig. 8 and Fig. 10, Fig. 11 or Fig. 12</td>
</tr>
<tr>
<td>Test Platform Slope</td>
<td>Rated capacity &lt; 4 999 kg</td>
<td>4%</td>
<td>18%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>5 000 kg ≤ rated capacity ≤ 50 000 kg</td>
<td>3.5%</td>
<td>18%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Position of Truck on Test Platform

Position of Test Platform

AB: Longitudinal centre-plane of truck
CD: Axis of steer axle
MN: Truck axis of original tilt
XY: Axis of tilt of test platform

\[ v = \text{maximum speed of unladen truck, in km/h.} \]
## ANNEX A

*Foreword*

### COMMITTEE COMPOSITION

**Industrial Trucks Sectional Committee, TED 23**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Representative(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macneill Engineering Ltd, Kolkata</td>
<td>SHRI S. RAYCHOUDHARY <em>(Chairman)</em></td>
</tr>
<tr>
<td>Chennai Port Trust, Chennai</td>
<td>SHRI N. A. KAMATH</td>
</tr>
<tr>
<td>Department of Heavy Industries and Public Enterprises, New Delhi</td>
<td>SHRI V. RAM DOSS <em>(Alternate)</em></td>
</tr>
<tr>
<td>Directorate General of Aeronautical Quality Assurance, New Delhi</td>
<td>SHRI SUSIL KUMAR</td>
</tr>
<tr>
<td>Directorate General of Quality Assurance, Kolkata</td>
<td>SHRI B. N. DAS <em>(Alternate)</em></td>
</tr>
<tr>
<td>Directorate General of Factory Advice, Chennai</td>
<td>SHRI D. GANGAPADDAY <em>(Alternate)</em></td>
</tr>
<tr>
<td>Directorate General of Supplies &amp; Disposals, New Delhi</td>
<td>SHRI N. K. MAHAWAR <em>(Alternate)</em></td>
</tr>
<tr>
<td>Escorts Construction Equipment Ltd, Faridabad</td>
<td>SHRI D. PAL</td>
</tr>
<tr>
<td>Godrej Boyce Mfg Co Pvt Ltd, Mumbai</td>
<td>SHRI S. K. DEB <em>(Alternate)</em></td>
</tr>
<tr>
<td>Indital Construction Machinery Ltd, Bangalore</td>
<td>SHRI G. M. E. K. RAJ <em>(Alternate)</em></td>
</tr>
<tr>
<td>Jost’s Engg Co Ltd, Thane</td>
<td>SHRI S. K. GAUTAM <em>(Alternate)</em></td>
</tr>
<tr>
<td>Kolkata Port Trust, Kolkata</td>
<td>SHRI S. M. MUNJAAL <em>(Alternate)</em></td>
</tr>
<tr>
<td>Macneill Engineering Ltd, Kolkata</td>
<td>SHRI RAVINDRA LUTHRA <em>(Alternate)</em></td>
</tr>
<tr>
<td>Ministry of Railways, New Delhi</td>
<td>SHRI S. K. AGGARWAL <em>(Alternate)</em></td>
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<tr>
<td>Mumbai Port Trust, Mumbai</td>
<td>SHRI H. F. RAGNA <em>(Alternate)</em></td>
</tr>
<tr>
<td>Punjab Tractors Ltd, Dist Ropar (Punjab)</td>
<td>SHRI D. B. VIJAYAKAR <em>(Alternate)</em></td>
</tr>
<tr>
<td>Research, Design &amp; Standards Organization, Lucknow</td>
<td>SHRI RAVI KUMAR</td>
</tr>
<tr>
<td>Texmaco Ltd, Kolkata</td>
<td>SHRI GRISH MALVIYA <em>(Alternate)</em></td>
</tr>
<tr>
<td>Vehicle, Research &amp; Development Establishment, Ahmednagar</td>
<td>SHRI S. CHAKRABORTY <em>(Alternate)</em></td>
</tr>
<tr>
<td>Voltas Ltd, Mumbai</td>
<td>SHRI K. K. MITRA <em>(Alternate)</em></td>
</tr>
<tr>
<td>BIS Directorate General</td>
<td>SHRI R. C. SHARMA <em>(Alternate)</em></td>
</tr>
<tr>
<td></td>
<td>SHRI N. G. KAMAT SATOSKAR <em>(Alternate)</em></td>
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<td>SHRI R. NAGARAJAN <em>(Alternate)</em></td>
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<tr>
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<td>SHRI N. S. NINDI <em>(Alternate)</em></td>
</tr>
<tr>
<td></td>
<td>SHRI A. C. BHATTACHARYA <em>(Alternate)</em></td>
</tr>
<tr>
<td></td>
<td>SHRI ALOK K. HALDAR <em>(Alternate)</em></td>
</tr>
<tr>
<td></td>
<td>SHRI V. P. SULAKSHI <em>(Alternate)</em></td>
</tr>
<tr>
<td></td>
<td>SHRI M. N. SHEVASTAVA <em>(Alternate)</em></td>
</tr>
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<td></td>
<td>SHRI D. B. SARDARAI <em>(Alternate)</em></td>
</tr>
<tr>
<td></td>
<td>SHRI K. V. VASHISTHA, Director and Head (TED) <em>(Ex-officio)</em></td>
</tr>
</tbody>
</table>

*Member-Secretary*

SHRI P. K. SHARMA  
Director (TED), BIS
Bureau of Indian Standards

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Amendments Issued Since Publication

<table>
<thead>
<tr>
<th>Amend No.</th>
<th>Date of Issue</th>
<th>Text Affected</th>
</tr>
</thead>
</table>

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