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## Earth-moving machinery — Lifting and tying-down attachment points — Performance requirements

*Engins de terrassement — Dispositifs de levage et d'arrimage —  
Exigences de performance*

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## Foreword

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ISO 15818 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 3, *Operation and maintenance*.

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## Introduction

This International Standard has been developed to define the performance requirements of lifting and tying-down devices fitted on, or incorporated into, earth-moving machinery for the purposes of its effective and safe transportation.

Although manufacturers of machines do not have direct responsibility for such transportation, the method and precautions necessary for lifting, tying-down and disassembling for transportation are described in informative annexes which can be used by the manufacturer as guidance when preparing the operator's manual.

The tying-down requirements and recommendations given in this International Standard are intended to match widely applied practices such as those described in IMO/ILO/UN ECE guidelines (CTU). However, where this is not the case, another or other supplemental methods to secure the machine will need to be provided in the operator's manual.

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# Earth-moving machinery — Lifting and tying-down attachment points — Performance requirements

## 1 Scope

This International Standard specifies the performance requirements for the lifting and tying-down attachment points of earth moving machinery as defined in ISO 6165.

It can also be applied to heavy components of earth-moving machinery in cases where the components themselves need to be lifted and/or tied-down. If, however, the attachment points of the components cannot be used for the parent machine, this must be made evident for sling workers and others by a label or other warning.

This International Standard can be applied except where national or local regulations are more stringent than its requirements. It does not include requirements for airlift or transport by air; nor is it applicable to the tying-down attachment points used to secure working machines in maritime, river or similar work vessels.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6016, *Earth-moving machinery — Methods of measuring the masses of whole machines, their equipment and components*

ISO 6165, *Earth-moving machinery — Basic types — Identification and terms and definitions*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **lifting attachment point**

device fitted on, or incorporated into, an earth-moving machine, used for lifting the machine

NOTE The point can be a hole, a lifting eye or any specific part of the machine as specified by the manufacturer.

### 3.2

#### **lifting accessories**

combination of tools and materials (shackles, wire ropes, slings, etc.) used for lifting the machine

### 3.3

#### **tying-down attachment point**

device fitted on, or incorporated into, earth-moving machinery, used for tying-down when transporting the machine

NOTE The device can be a hole, a tying-down eye or any specific part of the machine as specified by the manufacturer.

**3.4**  
**tying-down accessories**  
combination of tools and materials (square timbers/skids, chains, chain blocks, wire ropes, shackles etc.) used for tying down and fastening when transporting machines

**3.5**  
**sling**  
assembly of slinging components, such as chains, wire ropes or textile material joints to upper or lower terminals, suitable for attaching to a lifting attachment point

NOTE A sling can also be used as special equipment to allow balanced lifting of the machine.

**3.6**  
**lifting position**  
manufacturer's recommended position of the machine for lifting

**3.7**  
**machine tying-down configuration**  
manufacturer's recommended position of the machine for transport

**3.8**  
**machine mass for calculation**  
<machines disassembled during transport> mass of each disassembled unit of a machine, used for calculating forces exerted on lifting or tying down attachment points

**3.9**  
**machine mass for calculation**  
<all other machines> mass of the machine, used for calculating forces exerted on lifting or tying down attachment points, including the heaviest combination of cab, canopy, operator-protective structures, if any, with all their components and mountings, and any combination of equipment and attachment approved by the manufacturer of the machine, including operator and full-liquid systems according to ISO 6016

**3.10**  
**distributed lifting force**  
force applied onto each lifting attachment point during lifting

NOTE 1 Based on machine manufacturer's lifting instructions, if necessary, because of machine configuration or orientation of lifting accessories, the distributed lifting force magnitude and direction for a given lifting attachment point will need to be adjusted to account for unequal distribution of loads and non-vertical lifting accessories.

NOTE 2 See Table 1.

**3.11**  
**distributed tying-down force**  
force potentially applied onto each tying-down attachment point during transport

NOTE See Table 2.

**3.12**  
**working load limit**  
**WLL**  
maximum mass, expressed in tonnes, that the lifting accessories or tying-down accessories are used to sustain

NOTE In EN 13155 it is defined as the "maximum load (mass), expressed in tonnes, that the non-fixed load lifting attachment is designed to lift under the conditions specified by the manufacturer".

**3.13**  
**transport vehicle**  
vehicle to which the earth-moving machine is tied down for transportation purposes



**3.14****proof force**

maximum force at which the lifting or tying-down device sustains the load without visible deformation

**3.15****breaking force**

maximum force at which the lifting or tying-down device retains the load

**4 Lifting attachment points****4.1 Location and number**

Whenever possible, the lifting attachment points should be located such as to provide access from the ground or a platform.

There shall be enough space around the attachment points for easy fixing of the lifting accessories.

Sufficient numbers of attachment points shall be placed so that distributed and balanced lifting with a sling or lifting accessories is possible.

See the example shown in Figure B.1.

The attachment points shall be so located that damage of the lifting accessories is avoided. The lifting accessories in particular shall be protected against damage caused by sharp edges.

Where there are no appropriate central lifting attachment points [see Figures B.2 and B.3 b)], points shall be spaced the maximum practicable distance for optimum stability and balance.

If so required, a device or devices shall be fitted to hold the terminal fittings of the lifting accessories in the foreseen position to avoid slipping.

If the lifting devices used are eye openings, their dimensions shall be appropriate to the typical lifting accessories.

If a machine structural member is used as a lifting device, the method for fixing the lifting accessories at the structural member shall be described in the operation manual.

**4.2 Strength and safety**

Each lifting attachment point shall fulfil the strength requirements according to Table 1 and shall be verified according to Clause 8.

Open-end attachment points such as hooks shall have a safety latch or other device to prevent unintended disengagement of the mating wire rope, etc. or lifting accessory.

Table 1 — Strength requirements of lifting attachment points

Distributed lifting force	Strength requirement <sup>a</sup>	
	Proof force	Breaking force
$\frac{m \times g}{n \times \cos \alpha}$	$\frac{m \times g \times 2,5}{n \times \cos \alpha}$	$\frac{m \times g \times 4,0}{n \times \cos \alpha}$
<p><i>m</i> machine mass for calculation  <i>g</i> acceleration due to the force of gravity (<math>g = 9,8 \text{ m/s}^2</math>)  <i>n</i> number of effective lifting attachment points used simultaneously  <math>\alpha</math> angle between the vertical line and the sling leg at the lifting attachment point</p> <p>While, in general, the machine manufacturer cannot decide angle <math>\alpha</math> in each case, it is recommended for design and verification that the attachment point specify a certain angle, e.g. 30° or 45°, and that this be indicated with a warning in the operator's manual as the maximum.</p>		
<p><sup>a</sup> For both design and verification purposes.</p>		

## 5 Tying-down attachment points

### 5.1 Location and number

The tying-down attachment points shall be so located that access is possible.

There shall be enough space around the tying-down attachment points for the fixing of mating tying-down accessories.

The points shall be so positioned that damage of the mating apparatus is avoided.

If holes are used as tying-down attachment points, their opening size shall be appropriate for typical mating tying-down accessories.

If a machine structural member is used as a tying down attachment point, the method for fixing the tying-down accessories at the structural member shall be described in the operator's manual.

A sufficient number of tying-down attachment points shall be provided in order to allow for tying-down accessories sufficient for the calculated distributed tying down force. A minimum of four points is recommended; alternatively, a lesser number of another appropriate and integrated system may be provided by the manufacturer, and described in the operator's manual.

### 5.2 Strength

The tying-down attachment points shall fulfil the strength requirements according to Table 2 and shall be verified in accordance with Clause 8.