
**Industrial trucks — Verification of
stability —**

Part 21:
**Order-picking trucks with operator
position elevating above 1 200 mm**

Chariots de manutention — Vérification de la stabilité —

*Partie 21: Chariots préparateurs de commandes avec un poste de
conduite élevable au-dessus de 1 200 mm*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document 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 22915-21:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

- the wording of [4.2.3](#) is revised editorially for better comprehensibility;
- an additional stability test for creep speed is added to [Table 1](#), tests 3 and 4;
- the explanatory note to the maximum travel speed is adapted to the state of the art;
- several drawings in [Table 1](#) are redrawn for better comprehensibility.

A list of all parts in the ISO 22915- series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Industrial trucks — Verification of stability —

Part 21:

Order-picking trucks with operator position elevating above 1 200 mm

1 Scope

This document specifies the tests for verifying the stability of order picking trucks with an elevating operator position, as defined in ISO 5053-1, where the operator's position can be raised to an elevation above 1 200 mm.

It is applicable to industrial trucks fitted with fork arms, platforms and/or integrated attachments under normal operating conditions.

It is not applicable to trucks fitted with a load carrier that can be shifted laterally or pivoted out of the truck's longitudinal centre plane.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 5053-1, *Industrial trucks — Terminology and classification — Part 1: Types of industrial trucks*

ISO 22915-1, *Industrial trucks — Verification of stability — Part 1: General*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5053-1 and ISO 22915-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

normal operating conditions

operating conditions corresponding to the truck travelling indoors on smooth, level floors of sufficient strength such as those of concrete

Note 1 to entry: This definition is different from the one given for normal operating conditions in ISO 22915-1.

3.2

guided steering

steering mode, either mechanical (e.g. guidance rails) or non-mechanical (e.g. inductive guidance, laser sensor or infrared) not controlled directly by the operator, used to steer the truck on a predetermined straight path while travelling

3.3 restricted steering

operation under which the truck's steering is controlled by the operator and the steering angle is limited to not more than 10° from the forward or reverse travel direction

3.4 unrestricted steering

steering mode controlled by the operator with no limitation of the steering angle

4 Test conditions

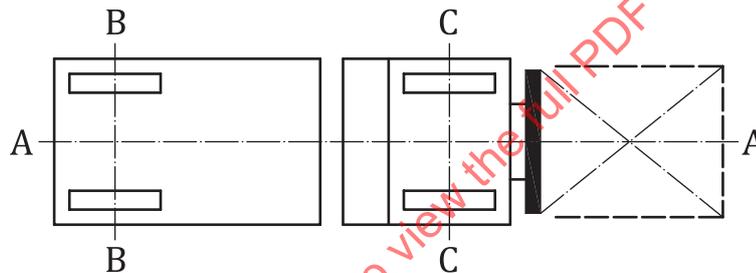
4.1 General

See ISO 22915-1.

4.2 Position of the truck on the tilt table

4.2.1 Load and drive/steer axles

The load axle and the drive/steer axle are defined by [Figure 1](#).



Key

- A-A longitudinal centre plane of truck
- B-B drive/steer axle
- C-C load axle

Figure 1 — Load and drive/steer axles

4.2.2 Tests 1

The truck shall be positioned on the tilt table so that its drive/steer axle, B-B, and load axle, C-C, are parallel to the tilt axis, X-Y, of the tilt table. See [Table 1](#).

4.2.3 Tests 2, 3, 4 and 5

The truck shall be positioned on the tilt table with the line, M-N, parallel to the tilt axis, X-Y, of the tilt table. See [Table 1](#).

In all positions, the castor wheel(s) shall be turned away from X-Y to the orientation that produces minimum stability.

Point M is the point located on the drive/steer axle end of the truck and defined as follows.

- a) For trucks with a single drive (steer) wheel: point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the drive/steer axle and the centreline of the drive wheel width.

- b) For trucks with a drive/steer axle in an articulating frame articulated in the centre plane of the truck: point M shall be the vertical projection onto the tilt table of the point of intersection between the lateral axis of the articulating frame and the centre plane, A–A, of the truck.
- c) For trucks with dual drive (steer) wheels: point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the drive/steer axle and the centre plane, A–A, of the truck.
- d) For trucks with a single or dual non-sprung castor wheel: point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the castor wheel axle and the centreline of the castor wheel width.
- e) For trucks with non-articulated, non-sprung castors or wheels and a non-articulated drive wheel:
 - 1) for the non-sprung castor or wheel, point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the castor or wheel axle and the centreline of the castor or drive wheel width, with the non-sprung castor or wheel being positioned with the centreline of the castor wheel axle nearer to the centre plane of the truck;
 - 2) for the non-articulated drive wheel, point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the drive wheel axle and the centre line of the drive wheel width.
- f) For trucks with a sprung castor or wheel: point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the drive wheel axle and the centreline of the drive wheel width.

As shown in [Table 1](#), point N is defined as the centre point of the area of contact between the tilt table surface and the front load wheel closest to the tilt axis, X–Y, of the tilt table.

4.3 Lift height

Lift heights for tests shall be measured from the tilt table to the upper-most point of the load carrying surface.

5 Verification of stability

The stability shall be verified in accordance with [Table 1](#).

Table 1 — Verification of stability

Test criteria	Test 1	Test 2	Test 3	Test 4	Test 5
Steering	Guided	x			
	Restricted	x			
	Unrestricted	x	x	x	x
Direction of test	Longitudinal	x			
	Lateral		x	x	x
Load	With	x	x		x
	Without	x	x	x	x
Lift height	b	b	c	c	d
	(4 + 1,24v) % ^e (8 + 1,24v) % ^f	6 %	6 % ^g (6 + 1,24v) %	6 % ^g (6 + 2,48v) %	(15 + 1,1v) %
Tilt-table angle					

v is the maximum travel speed of the truck as defined for the specific test, in km/h.

(a See next pages.)

b Any attainable combination of lift height, load and corresponding maximum travel speed v (in km/h) that produces the least tilt table angle value for a given tilt table angle requirement of tests 1 and 2. Travel speed v can be zero.

c Any attainable combination of lift height above 1 200 mm and corresponding maximum travel speed v (in km/h) that produces the least tilt table angle value for a given tilt table angle requirement of tests 3 and 4. Travel speed v can be zero.

d Lift height up to and including 1 200 mm.

e Required tilt table angle for test 1 when travelling load leading.

f Required tilt table angle for test 1 when travelling load trailing.

g Requirement for creep speed up to and including 2,5 km/h.

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Table 1 (continued)

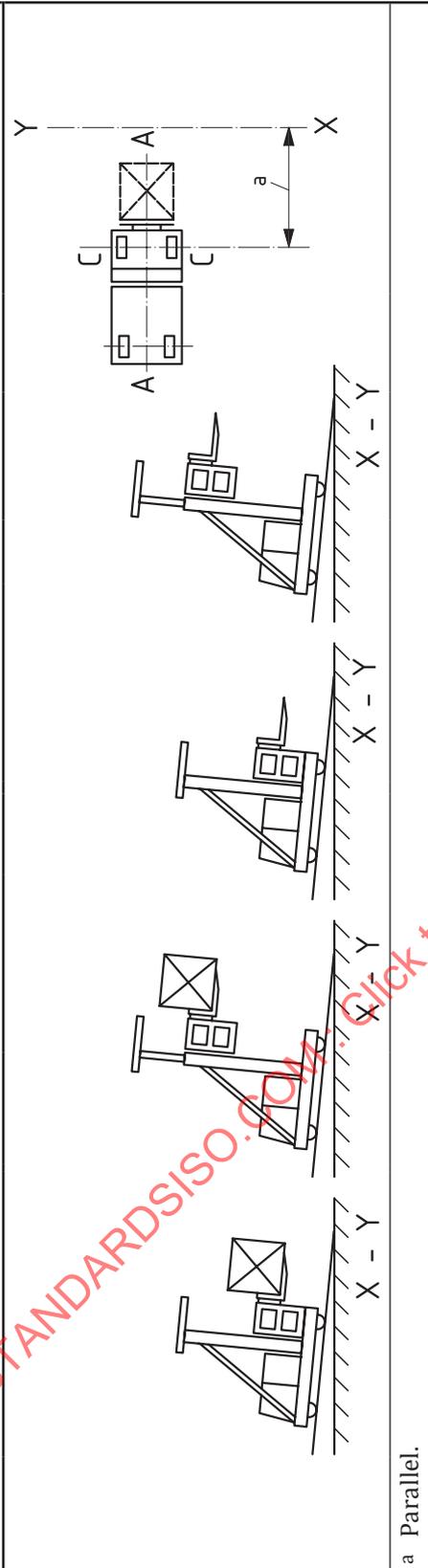
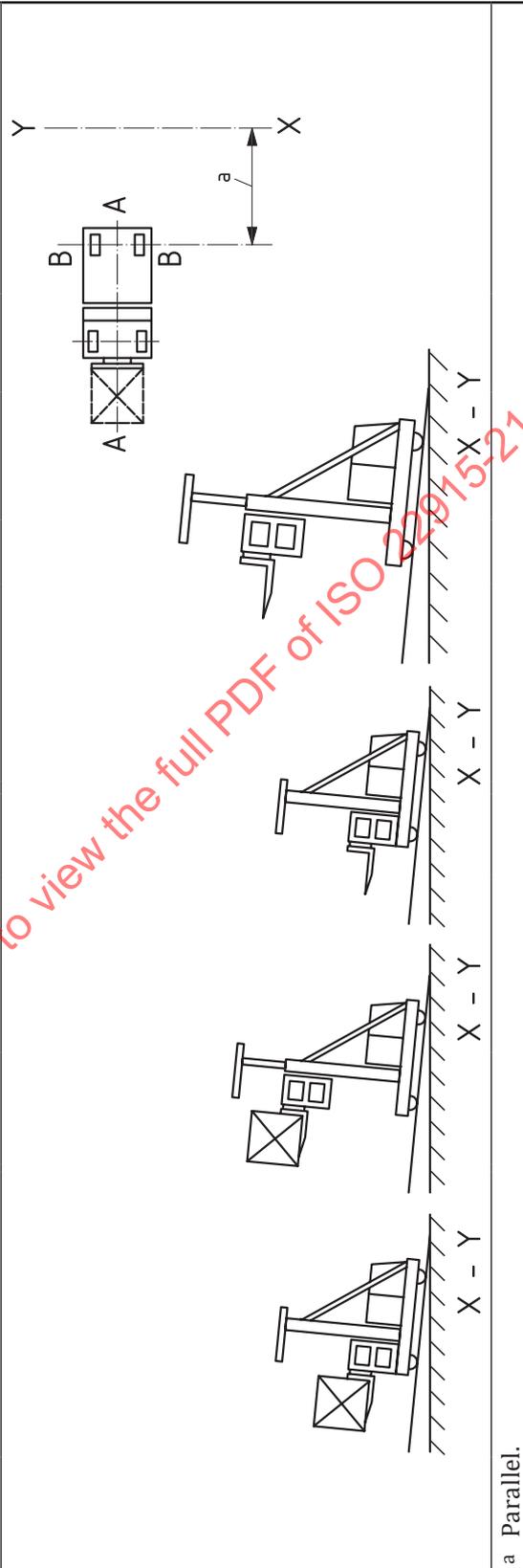
Test criteria	Test 1 — As per 4.2.2
<p>Truck position on tilt table — Load leading</p>	 <p>a Parallel.</p>
<p>Truck position on tilt table — Load trailing</p>	 <p>a Parallel.</p>

Table 1 (continued)

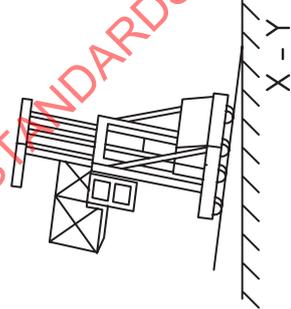
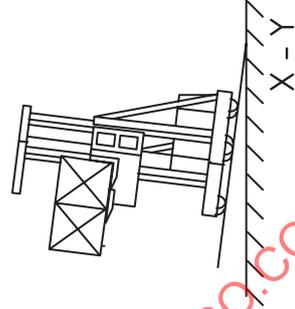
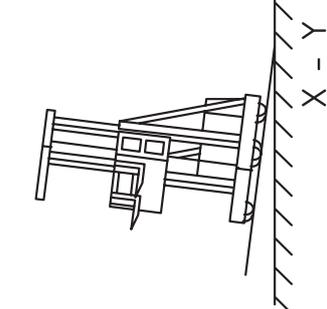
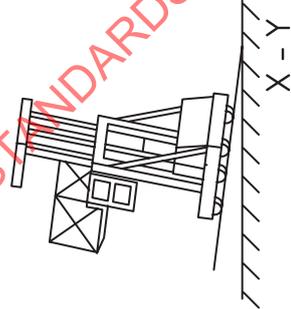
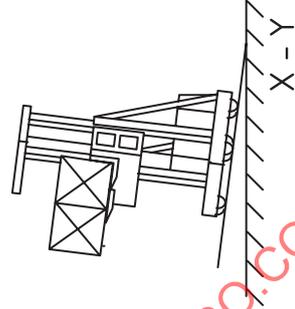
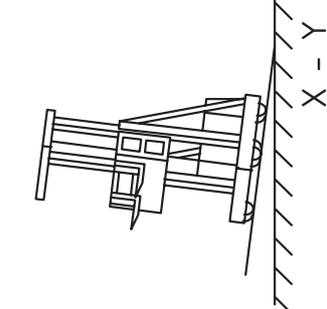
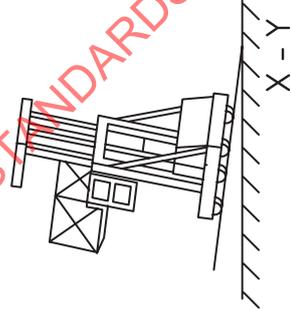
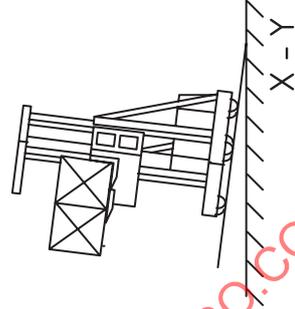
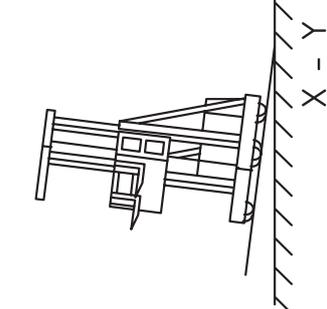
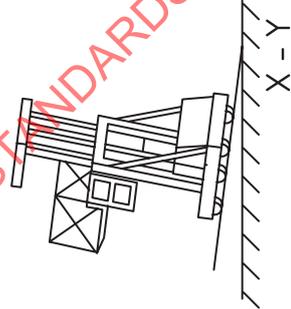
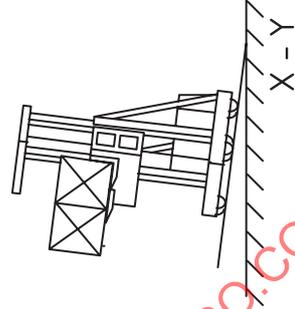
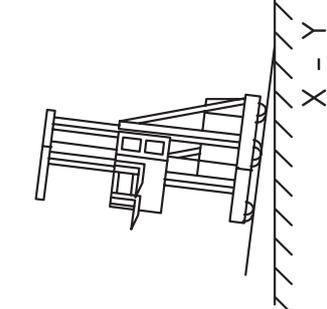
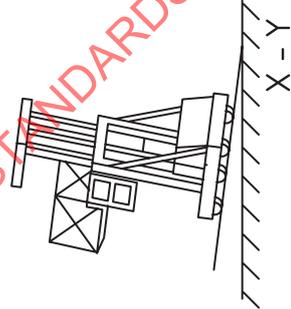
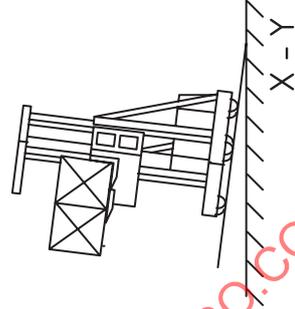
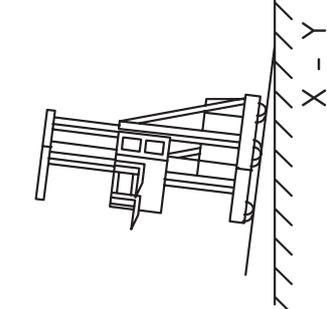
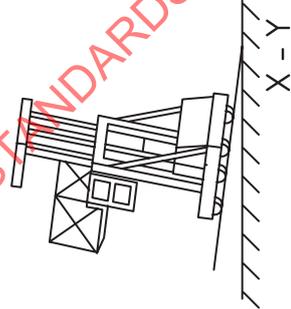
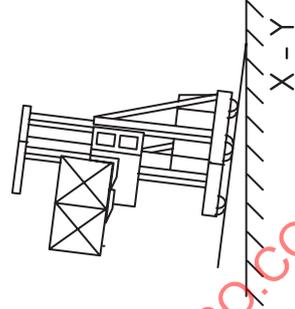
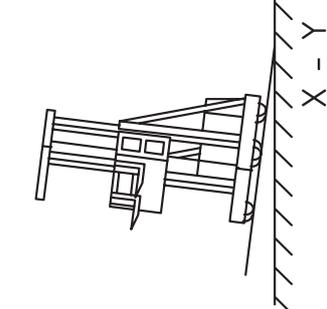
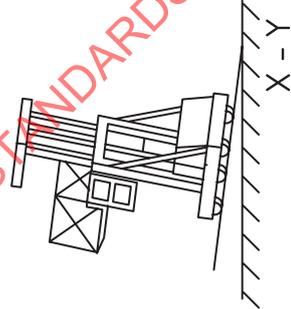
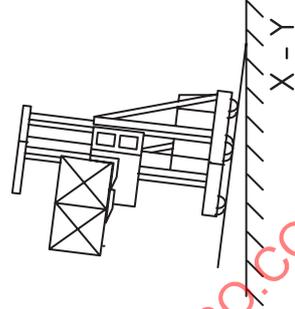
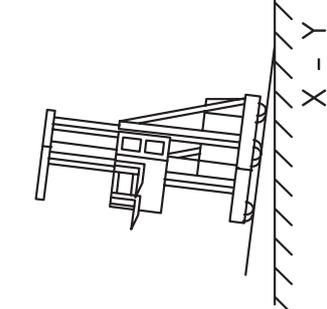
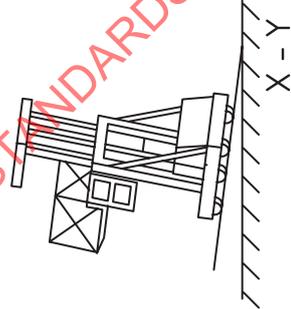
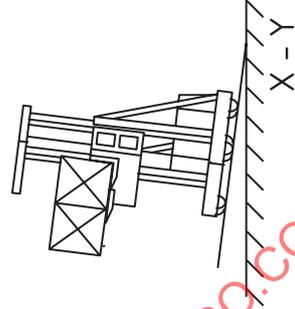
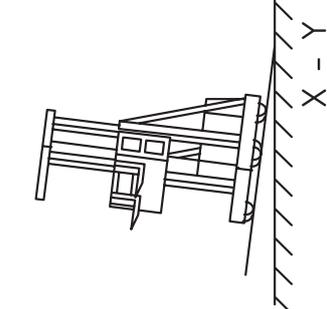
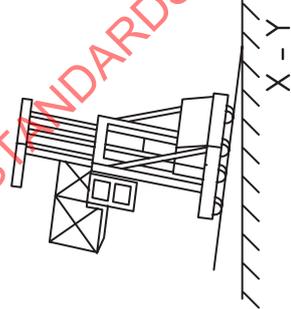
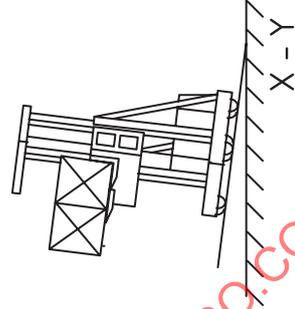
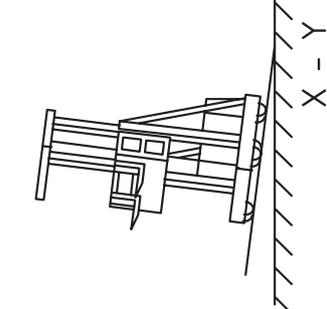
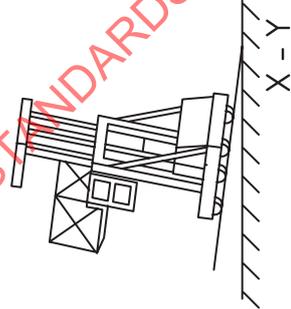
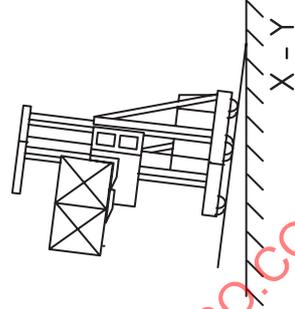
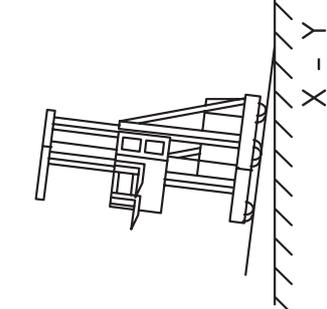
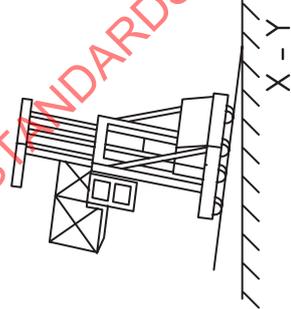
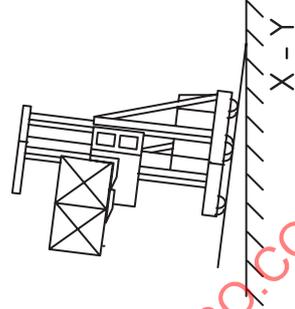
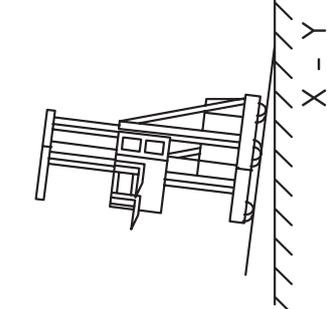
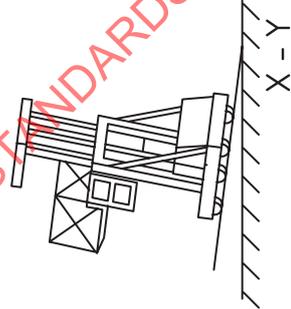
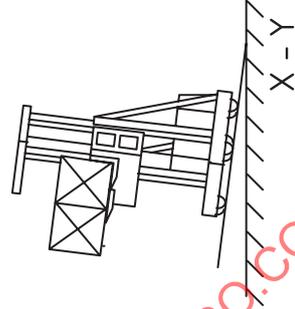
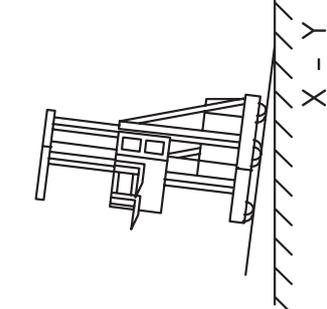
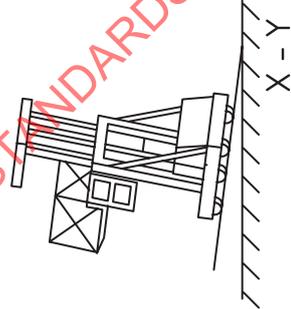
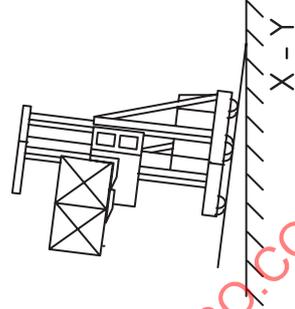
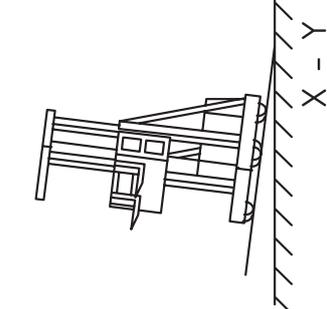
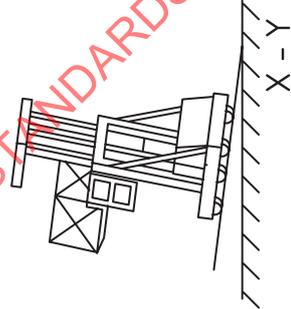
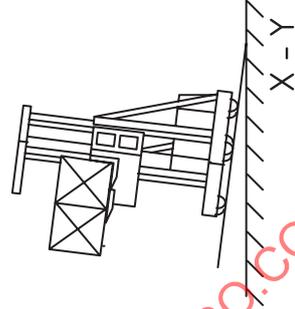
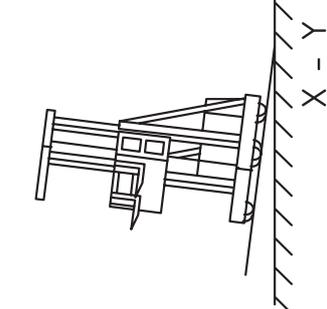
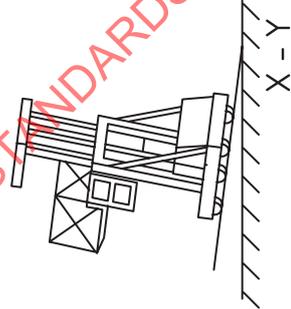
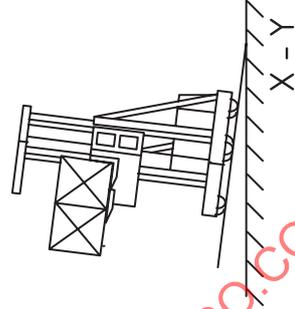
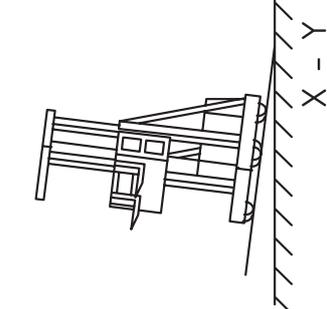
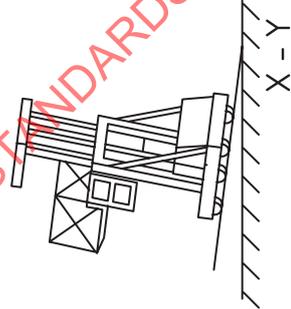
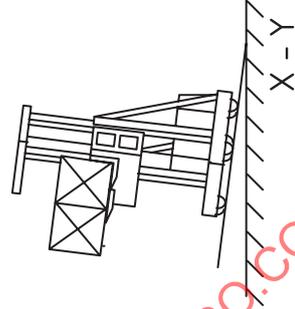
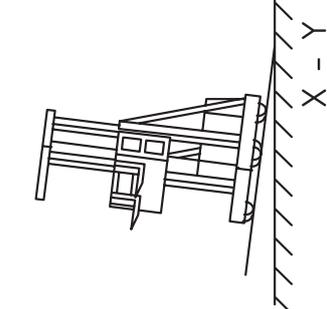
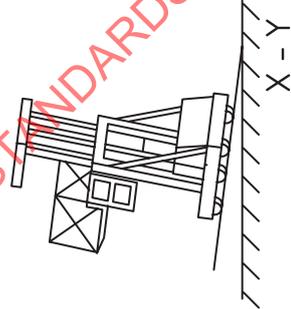
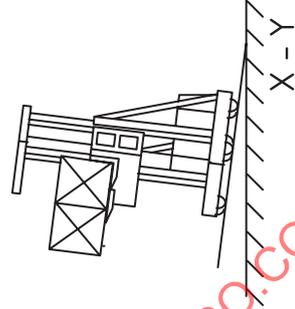
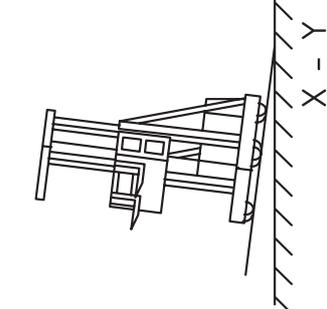
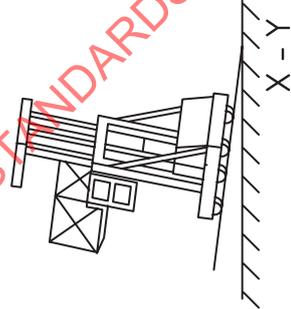
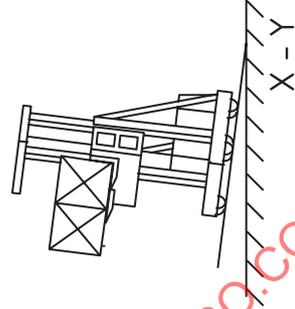
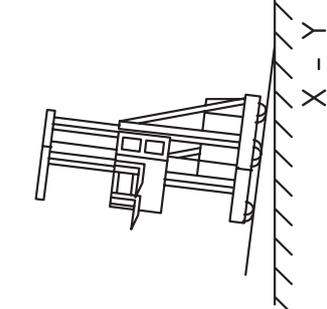
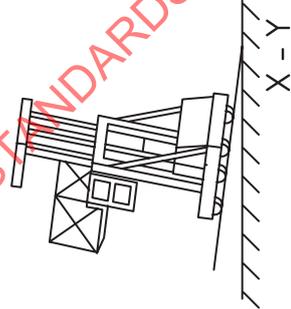
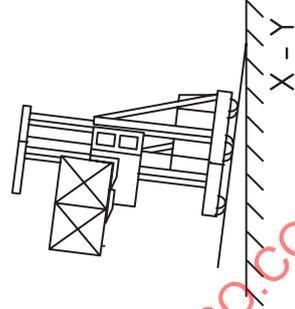
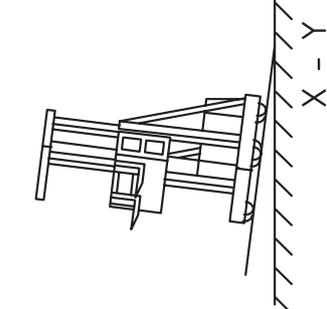
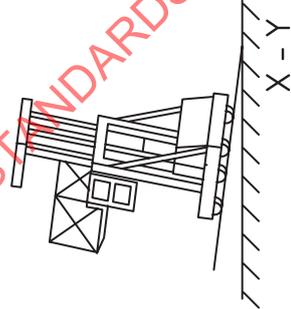
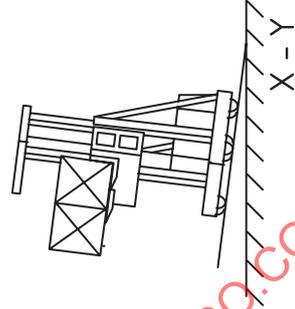
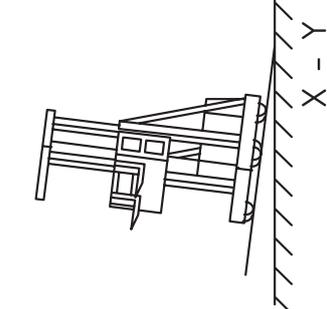
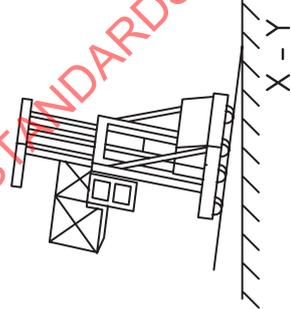
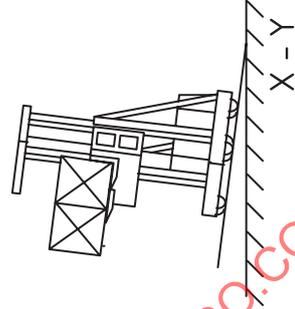
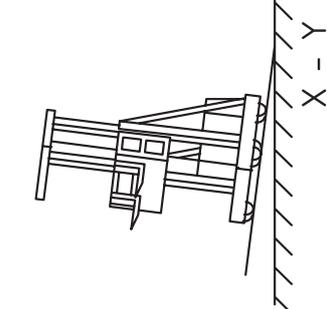
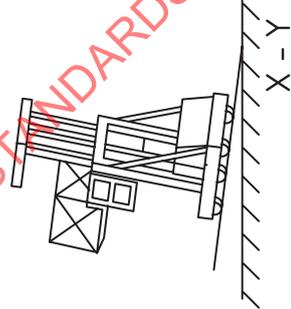
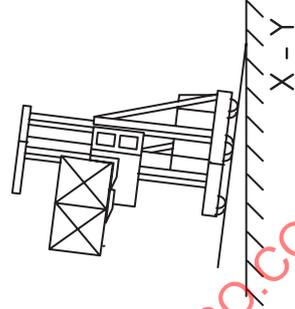
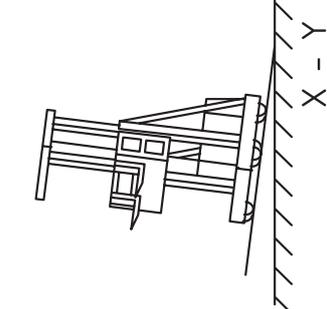
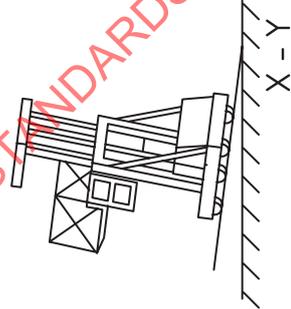
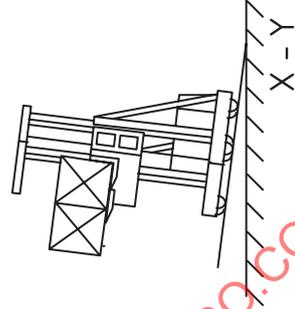
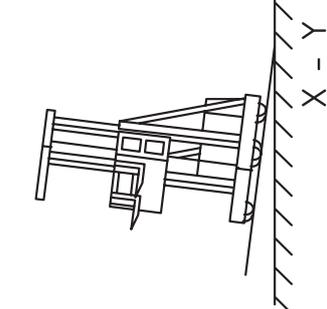
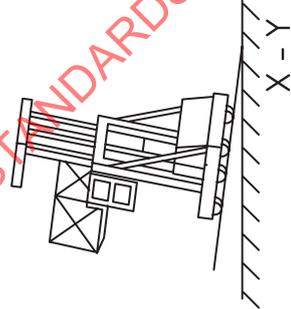
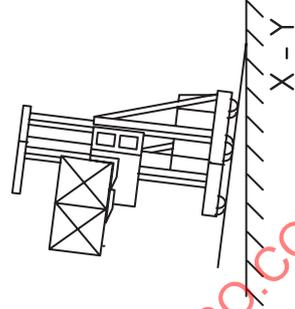
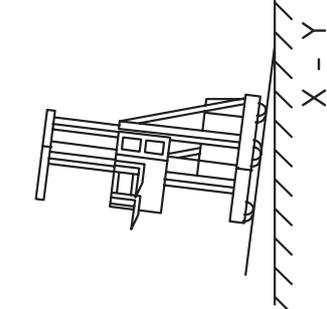
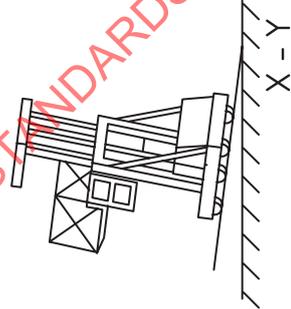
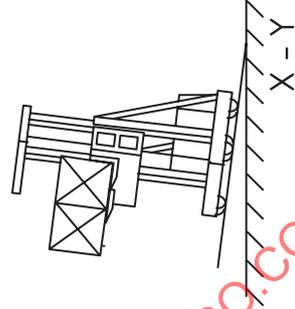
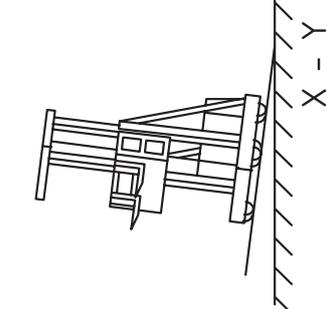
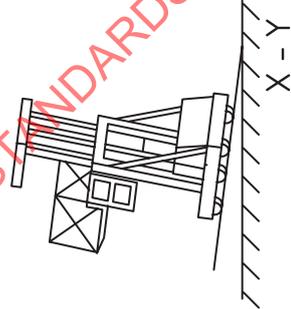
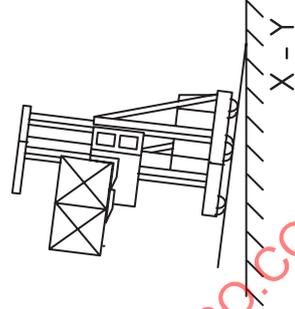
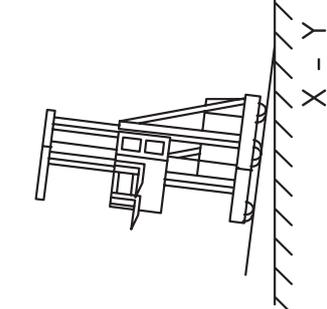
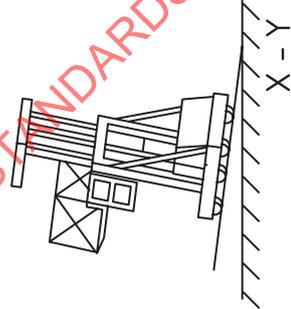
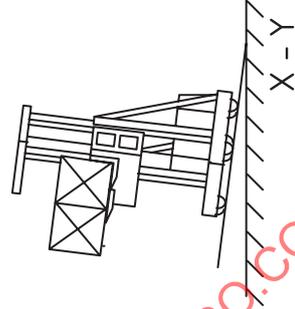
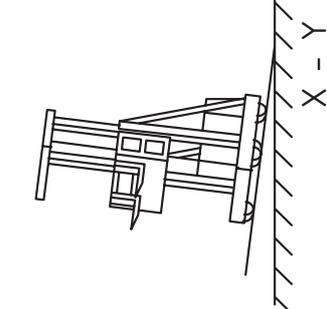
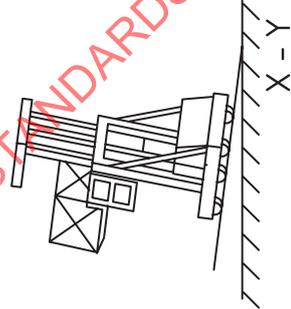
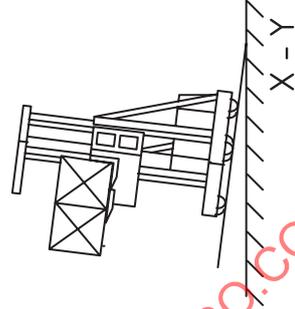
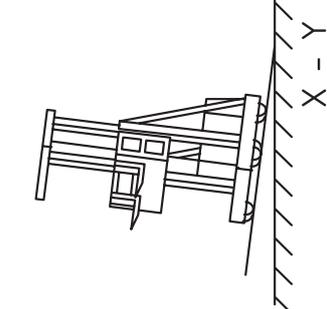
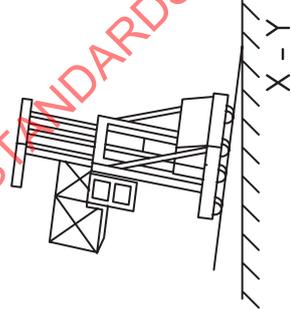
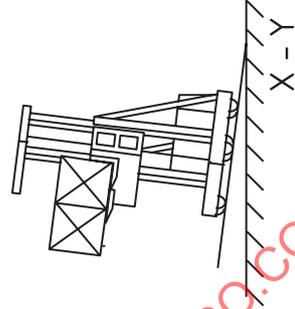
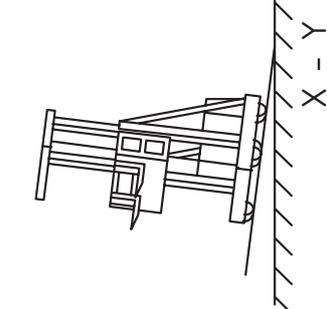
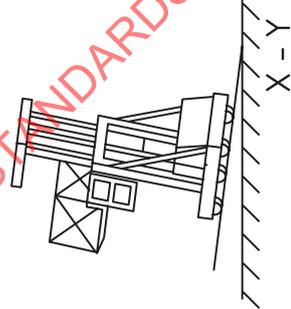
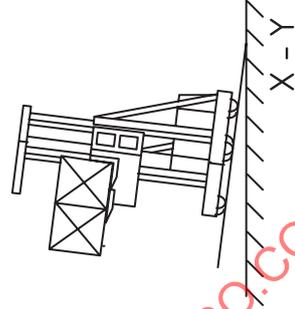
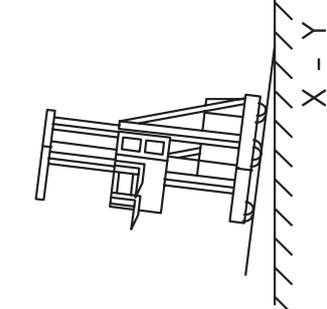
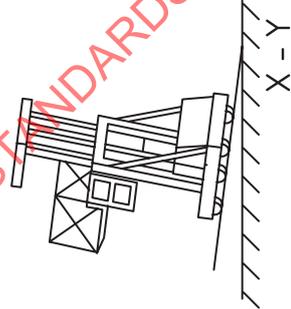
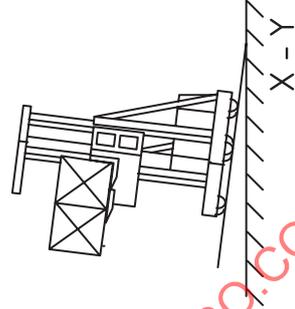
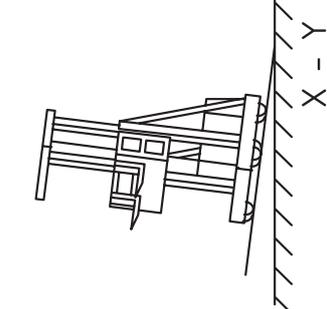
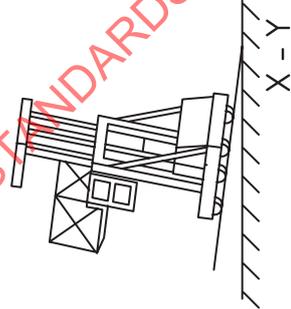
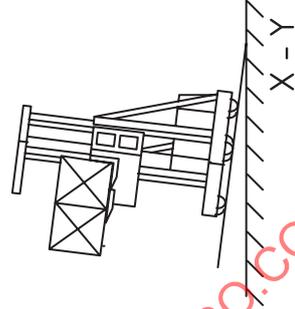
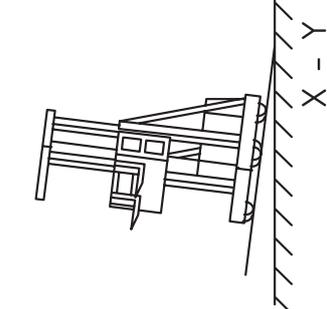
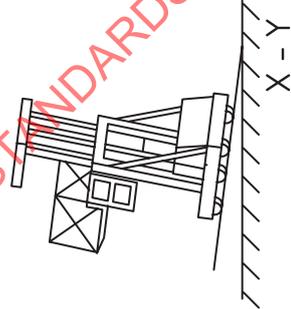
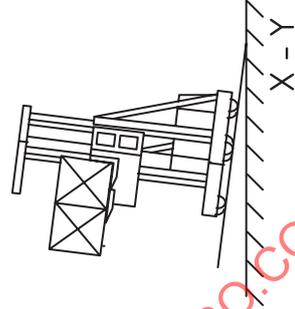
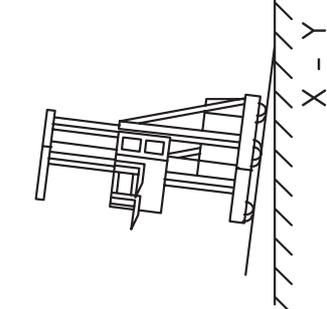
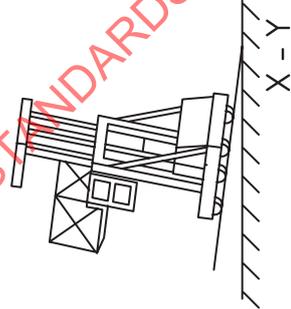
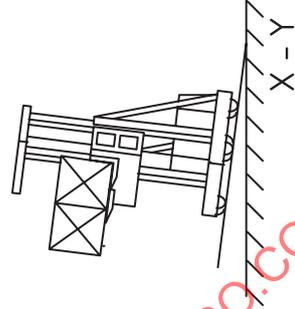
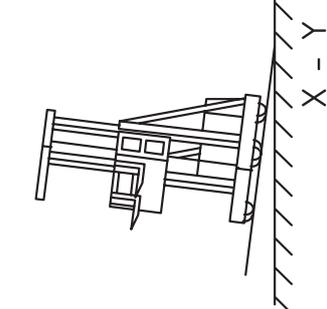
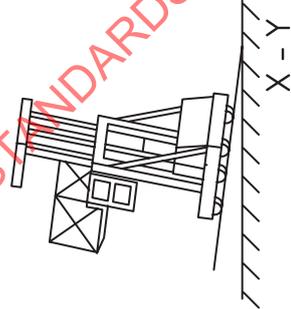
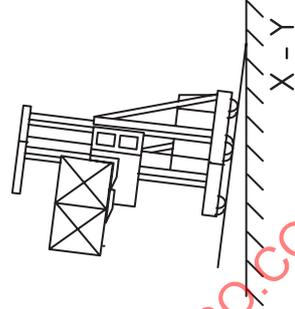
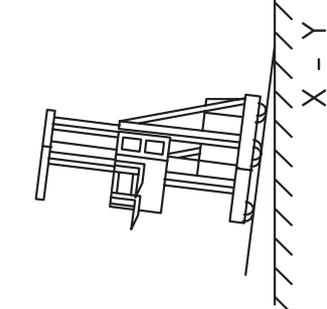
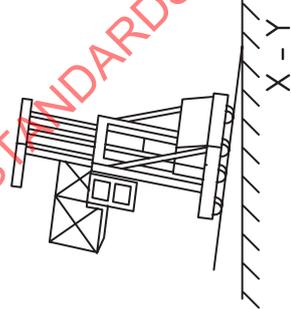
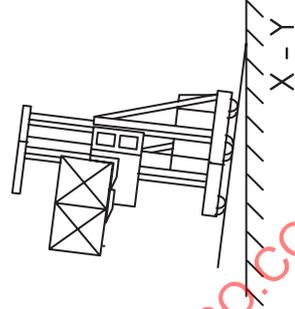
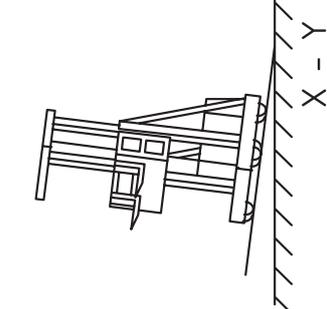
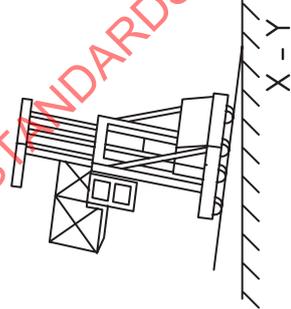
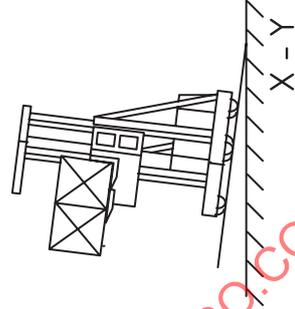
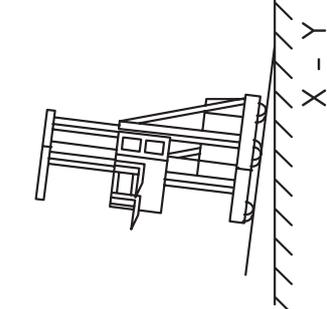
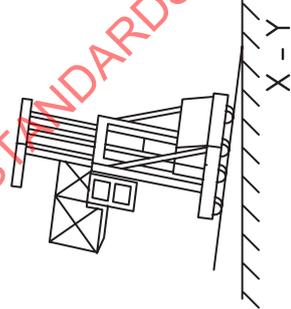
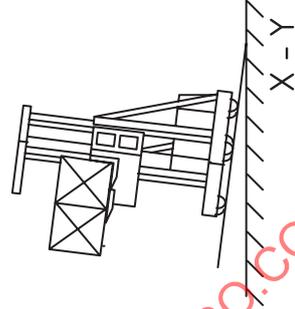
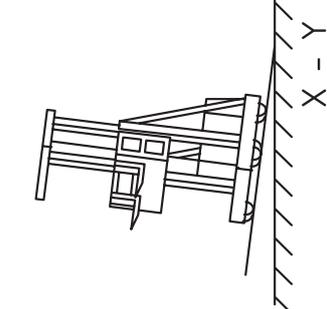
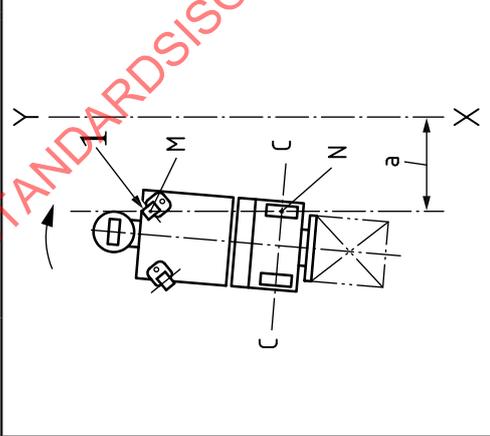
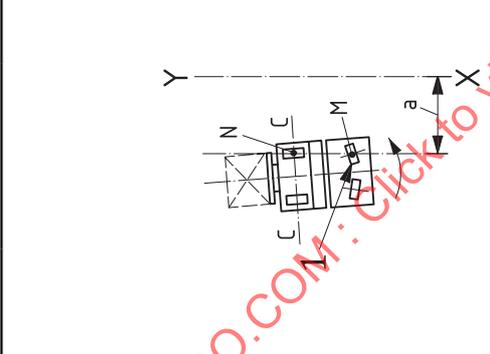
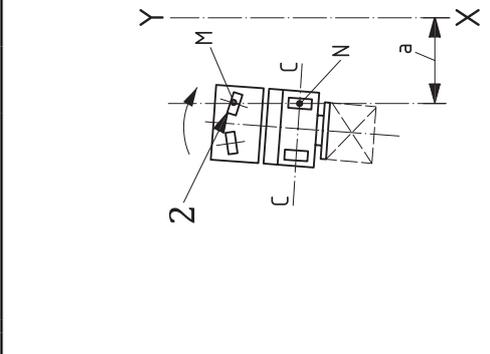
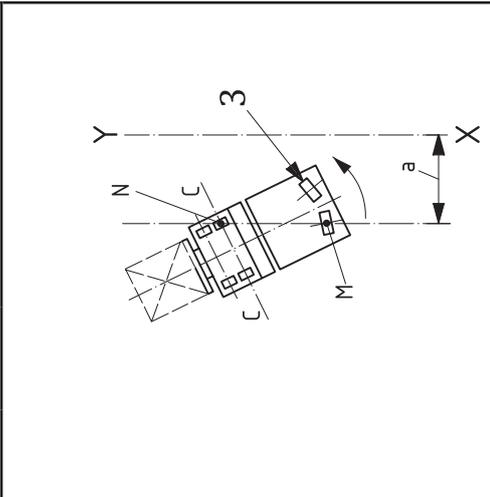
Test criteria	Tests 2, 3 and 5	Tests 2 to 5	Tests 2, 4 and 5
<p>Truck position on tilt table</p>			
<p>Truck position on tilt table</p>			
<p>Truck position on tilt table</p>			
<p>Truck position on tilt table</p>			
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<p>Truck position on tilt table</p>			
<p>Truck position on tilt table</p>			

Table 1 (continued)

Test criteria	Tests 2 to 5 (points M and N)			
Truck position on tilt table				
	As per 4.2.3 d)	As per 4.2.3 e) 1)	As per 4.2.3 e) 2)	As per 4.2.3 f)
	Key 1 non-articulated non-sprung castor or wheel 2 non-articulated drive wheel 3 sprung castor or wheel a Parallel.			