BRITISH STANDARD

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+A1:2010
Incorporating Corrigenda May & June 2009

Continuous handling equipment and systems — Safety and EMC requirements for equipment for mechanical handling of bulk materials except fixed belt conveyors

ICS 53.040.10

National foreword

This British Standard is the UK implementation of EN 618:2002+A1:2010. It supersedes BS EN 618:2002 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1⟩ ⟨A1].

The UK participation in its preparation was entrusted to Technical Committee MHE/9, Continuous mechanical handling equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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31 May 2009	Reprinting of corrected text as provided by CEN
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31 March 2011	Implementation of CEN Amendment A1:2010

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 618:2002+A1

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ICS 53.040.10

Supersedes EN 618:2002

English Version

Continuous handling equipment and systems - Safety and EMC requirements for equipment for mechanical handling of bulk materials except fixed belt conveyors

Equipements et systèmes de manutention continue - Prescriptions de sécurité et de CEM pour les équipements de manutention mécanique des produits en vrac à l'exception des transporteurs fixes à courroie

Stetigförderer und Systeme - Sicherheits- und EMV-Anforderungen an mechanische Fördereinrichtungen für Schüttgut ausgenommen ortsfeste Gurtförder

This European Standard was approved by CEN on 8 March 2001 and includes Amendment 1 approved by CEN on 9 November 2010.

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Contents

Foreword

This document (EN 618:2002+A1:2010) has been prepared by Technical Committee CEN /TC 148, "Continuous handling equipment and systems - Safety", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2011, and conflicting national standards shall be withdrawn at the latest by June 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1, approved by CEN on 2010-11-09.

This document supersedes EN 618:2002.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟨A1⟩ ⟨A1⟩.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document.

⟨A1⟩ *deleted text* ⟨A1⟩

This standard forms part of a series of five standards the titles of which are given below:

EN 617, *Continuous handling equipment and systems — Safety and EMC requirements for the equipment for the storage of bulk materials in silos, bunkers, bins and hoppers*

EN 618, *Continuous handling equipment and systems — Safety and EMC requirements for equipment for mechanical handling of bulk materials except fixed belt conveyors*

⟨A1⟩ EN 619 ⟨A1⟩, *Continuous handling equipment and systems — Safety and EMC requirements for equipment for mechanical handling of unit loads*

EN 620, *Continuous handling equipment and systems — Safety and EMC requirements for fixed belt conveyors for bulk material*

EN 741, *Continuous handling equipment and systems — Safety requirements for systems and their components for pneumatic handling of bulk materials.*

⟨A1⟩ *deleted text* ⟨A1⟩

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This European standard is a "Type C" standard as defined in EN 1070.

The equipment concerned and the extent to which hazards are covered are indicated in the scope of this standard.

EN 617, EN 620 and EN 741 need to be considered for a complete continuous handling system (machine).

While producing this standard, it was assumed that:

— only suitably trained persons will operate the equipment;

— all parts of the equipment without specific requirements in this standard are:

  — designed in accordance with the usual engineering practice and calculation codes (e.g. for mobile equipment FEM 2 131/2 132 or ISO 5049-1, ...) including all failure modes;

  — made of materials of adequate strength and of quality for their intended purpose taking into account all failure modes using recognised design methods and appropriate safety factors;

— harmful materials, such as asbestos, are not used as part of the machine;

— components will be kept in good repair and working order in accordance with the manufacturer's instructions, to retain specified health and safety characteristics throughout its working life;

— by design of the load bearing elements, a safe operation of the equipment is assured for loading ranging from zero to 100 % of the rated capacity;

— negotiations occur between the manufacturer [1)] and the user concerning materials characteristics (see Note 1) and particular conditions for the use and places of use for the machinery related to health and safety;

— the place of installation is adequately lit.

NOTE 1 For the description of bulk materials, reference can be made to documents FEM 2 581/2 582 and ISO 3435.

When provisions of this type C standard are different from those which are stated in type A or B standards the provisions of this type C standard take precedence over the provisions of other standards, for equipment that have been designed and built according to the provisions of this type C standard.

1) "Manufacturer" within the European Union is to be understood as intended in the Machinery Directive.

1 Scope

1.1 This standard deals with the technical requirements to minimise the risks due to the hazards listed in clause 4, which can arise during operation and maintenance of mechanical handling equipment defined in clauses 3.1 to 3.3 and which are designed for continuously conveying bulk materials from the loading point(s) to the unloading point(s).In general, it also applies to equipment which are built into machines or attached to machines. This standard deals with the technical requirements for EMC.

1.2 The standard does not apply to:

— continuous handling equipment and systems for open-cast lignite mining;

— continuous handling equipment and systems for underground mining;

— tunnel digging and excavating machines;

— bulk material processing or classification machines such as grinders, crushers, screens;

— fixed belt conveyors for bulk materials. These are covered by the standard [A1] EN 620:2002+A1:2010 [A1];

— fixed pneumatic handling equipment. These equipment and systems are covered by the standard EN 741;

— the interface between the machinery dealt with in this standard and the fixed belt or pneumatic conveyor.

1.3 This standard does not give the additional requirements for:

a) use in public areas or for the transportation of people;

b) floating, dredging and ship mounted equipment;

c) conveyors requiring a high level of cleanliness for hygiene reasons, e.g. in direct contact with foodstuffs or pharmaceuticals;

d) transportation of the equipment;

e) hazards caused by vibration;

f) use in ambient air temperature below – 20 °C and above + 40 °C;

g) the effects of wind on strength and stability;

h) hazards resulting from handling specific hazardous materials, (e.g. Explosives, radiating material);

i) hazards resulting from contact with or inhalation of harmful fluids, gas, mists, fumes and dusts;

j) biological and micro-biological (viral or bacterial) hazards;

k) hazards due to heat radiation from the materials handled;

l) hazards caused by operation in electromagnetic fields outside the range of EN 61000-6-2;

m) hazards caused by operation subject to special regulations (e.g. explosive atmospheres);

n) hazards caused by noise;

o) hazards caused by the use of ionising radiation sources (e.g. measurement equipment);

p) hazards caused by hydraulic equipment;

q) hazards caused by inadequate controls cabins lighting;

r) the risk related to elevating of the control stations;

s) hazards related to contact with or inhalation of harmful fluids, gases, mists, fums and dusts.

1.4 The safety requirements apply to equipment and systems placed on the market after the date of publication of this standard.

NOTE 1 The requirements of this standard can be used for comparable machines outside the scope of this standard with the same risks.

NOTE 2 Directive 94/9/EC concerning equipment and protective systems intended for use in potentially explosive atmospheres can be applicable to the type of machine or equipment covered by this European Standard. The present standard is not intended to provide means of complying with the essential health and safety requirements of Directive 94/9/EC.

2 Normative references

[A1] 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. [A1]

[A1] *deleted text* [A1]

EN 294:1992, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*

EN 349:1993, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 418:1992, *Safety of machinery — Emergency stop equipment functional aspects - Principles for design*

[A1] *deleted text* [A1]

EN 617, *Continuous handling equipment and systems — Safety and EMC requirements for storage of bulk materials in silos, bunkers, bins and hoppers*

[A1] EN 620:2002+A1:2010 [A1], *Continuous handling equipment and systems — Safety and EMC requirements for fixed belt conveyors for bulk material*

[A1] EN 741 [A1], *Continuous handling equipment and systems — Safety requirements for systems and their components for pneumatic handling of bulk materials*

EN 811:1996, *Safety of machinery — Safety distances to prevent danger zone being reached by the lower limbs*

EN 953:1997, *Safety of machinery — General requirements for the design and construction of guards (fixed, movable)*

EN 954-1:1997, *Safety of machinery — Safety related parts of control systems — Part 1: General principles for design*

EN 1037:1995, *Safety of machinery — Prevention of unexpected start-up*

EN 1070:1998, *Safety of machinery — Terminology*

EN 1088:1995, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 1127-1:1997, *Safety of machinery — Fire and explosion — Part 1: Explosion prevention and protection*

EN 12150-1:2000, *Glass in building — Thermally toughened soda lime silicate safety glass — Part 1: Definition and description*

[A1] *deleted text* [A1]

EN 13586:1999, *Cranes — Access*

EN 26184-1:1991, *Explosion protection systems — Part 1: Determination of explosion indices of combustibles dusts in air (ISO 6184-1:1985)*

[A1] *deleted text* [A1]

EN 60204-1:1997, *Safety of machinery — Electrical equipment of machines — Part 1: Specification for requirements*

[A1] EN 60204-11:2000, *Safety of machinery — Electrical equipment of machines — Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 d.c. and not exceeding 36 kV (IEC 60204-11:2000)* [A1]

EN 60947-5-1:1991, *Low voltage switch gear and control gear — Part 5: Control circuit devices and switching elements — Section 1: Electromechanical control circuit devices*

EN 60529:1991, *Degrees of protection provided by enclosures (IP code)*

EN 61000-6-2:1999, *Electromagnetic compatibilty (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (CEI 61000-6-2:1999)*

[A1] EN 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3:2006)* [A1]

[A1] EN ISO 12100-1, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)* [A1]

[A1] EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)* [A1]

[A1] EN ISO 13732-1:2008, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732-1:2006)* [A1]

ISO 2148:1974, *Continuous handling equipment — Nomenclature — Bilingual edition*

ISO 3435:1977, *Continuous mechanical handling equipment — Classification and symbolisation of bulk materials*

ISO 3864:1984, *Safety colours and safety signs*

ISO 5049-1:1994, *Mobile equipment for continuous handling of bulk materials — Part 1: Rules for the design of steel structures*

IEC 61241-1-2:1999, *Electrical apparatus for use in the presence of combustible dust — Part 1-2: Electrical apparatus protected by enclosures — Selection, installation and maintenance*

3 Terms and definitions

For the purposes of this standard, the terms and definitions stated in EN 1070 and ISO 2148 apply. Additional terms used in this standard are defined below. For other definitions on components of fixed belt conveyors, see [A1] EN 620:2002+A1:2010 [A1].

3.1
fixed equipment

3.1.1
scraper conveyor / drag bar feeder :
conveyor for loose bulk materials with as driving medium one or more endless chains equipped with scraper bars pushing the material in an open trough shaped casing (see Figure 1)

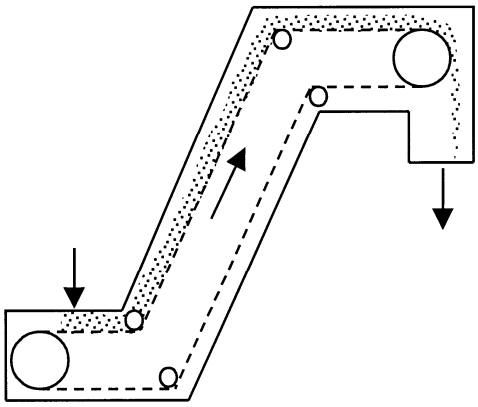


Figure 1

3.1.2
"en-masse" conveyor
conveyor for loose bulk materials with a chain as the driving medium having attached flights or scraper flights moving the material "en masse" in an enclosing trough (see Figure 2)

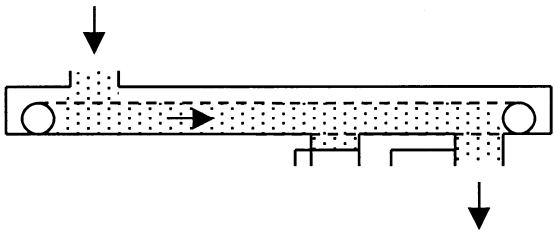


Figure 2

3.1.3
bucket elevator :
elevator for loose bulk materials with buckets as the carrying medium attached to a belt or chains as the driving medium (see Figure 3)

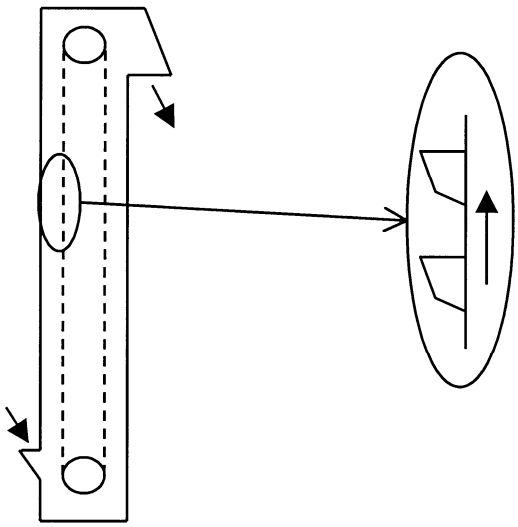


Figure 3

3.1.4
screw feeders / conveyors
conveyor for loose bulk materials with a trough or tube as the carrying medium, the material being moved by the action of a rotating screw. This screw can be rigid or flexible to take curves (see Figure 4)

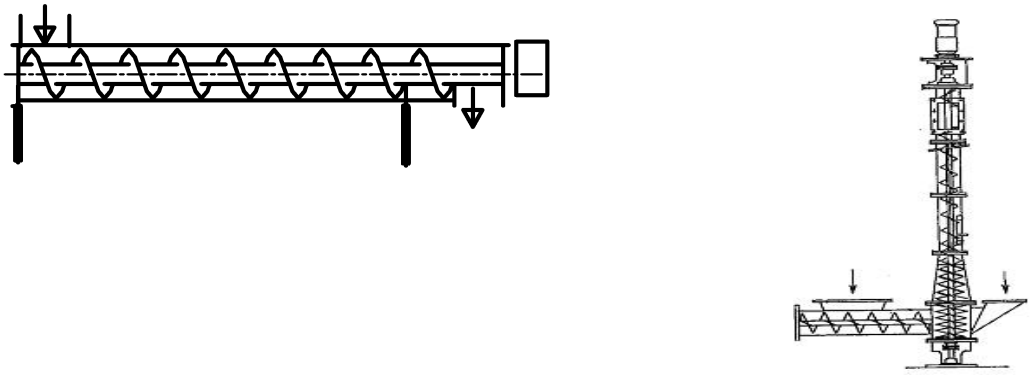


Figure 4

3.1.5
vibratory conveyor
conveyor for loose bulk materials which consists of a flexibly mounted trough or tube, in which the material moves under the effect of vibrations (see Figure 5)

Figure 5

3.1.6
rotarydrum, table or vane feeder
continuous volumetric dosing element within a housing consisting of a rotating shaft with several blades which transport the material from the inlet to the outlet (see Figure 6)

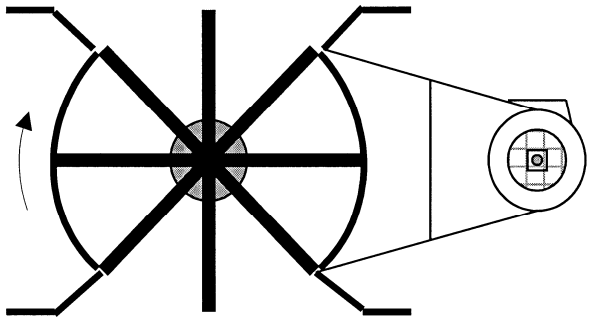


Figure 6

3.2
movable equipment
equipment generally intended to be moved only when out of operation (see Figure 7)

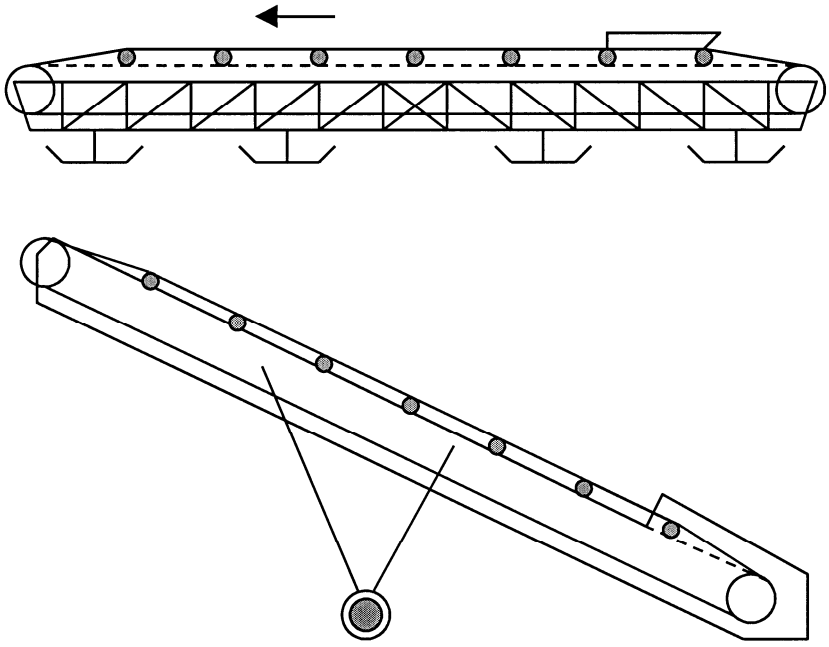


Figure 7

3.3
mobile equipment
equipment whose structure is self propelled during normal operation

3.3.1
stacker
mobile equipment on tracks (rails), crawlers or tyres for continuously piling or stacking bulk materials using unidirectional moving belts mounted on a boom as the final carrying and conveying medium (see Figure 8)

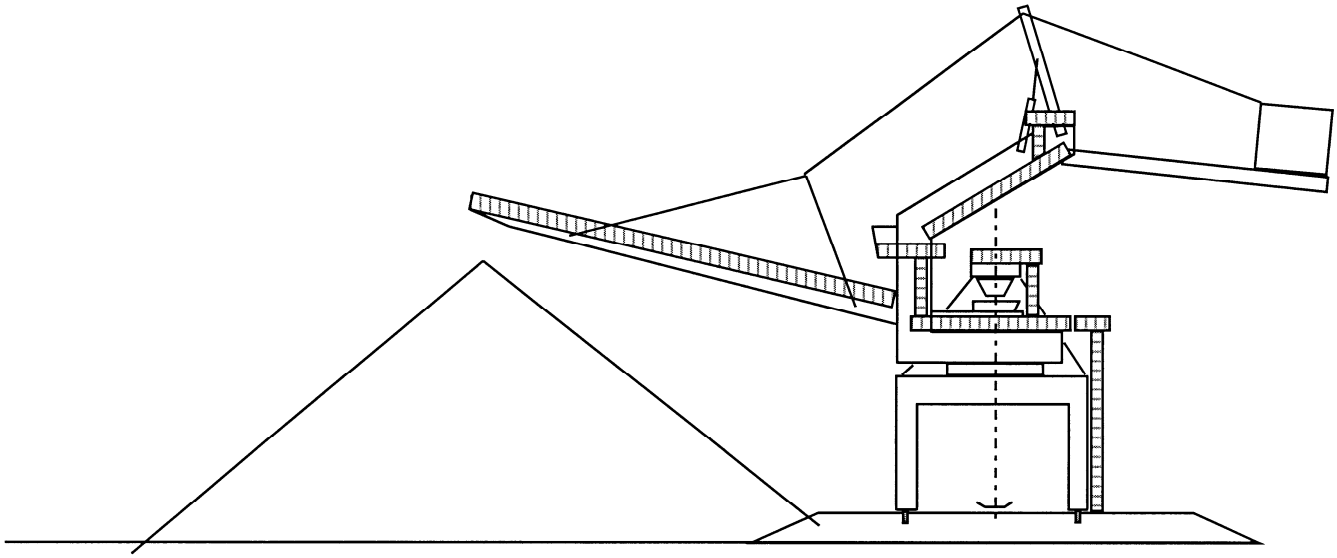


Figure 8

3.3.2
gantry stacker
mobile equipment mounted on a gantry travelling over the bulk material stack and along rail tracks, for continuously pileling or stacking bulk materials using endless moving belts as the carrying and conveying medium (see Figure 9)

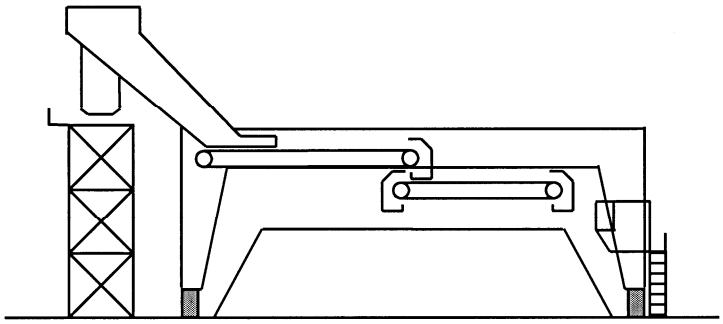


Figure 9

3.3.3
ship loader
mobile equipment travelling on rails or tyres for continuously loading a ship with bulk materials or bags of bulk materials (see Figure 10)

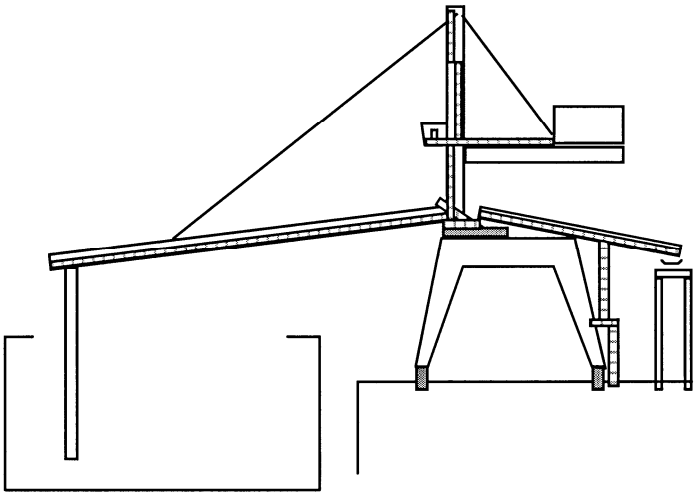


Figure 10

3.3.4
bucket-wheel reclaimer
mobile equipment on rails, crawlers or tyres used to reclaim continuously bulk materials, using a bucket wheel at the end of a boom and endless moving belts as the carrying and conveying medium (see Figure 11)

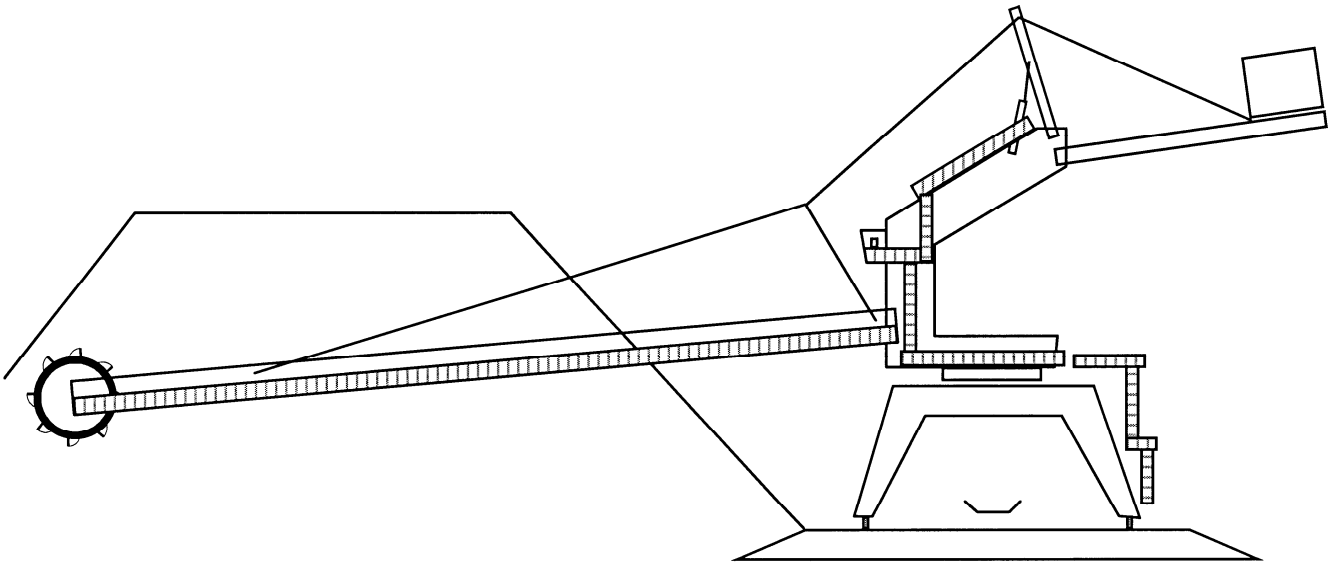


Figure 11

3.3.5
ship unloader
mobile equipment travelling on rails or tyres for continuously unloading bulk materials or bags of bulk materials from ship holds (see Figure 12)

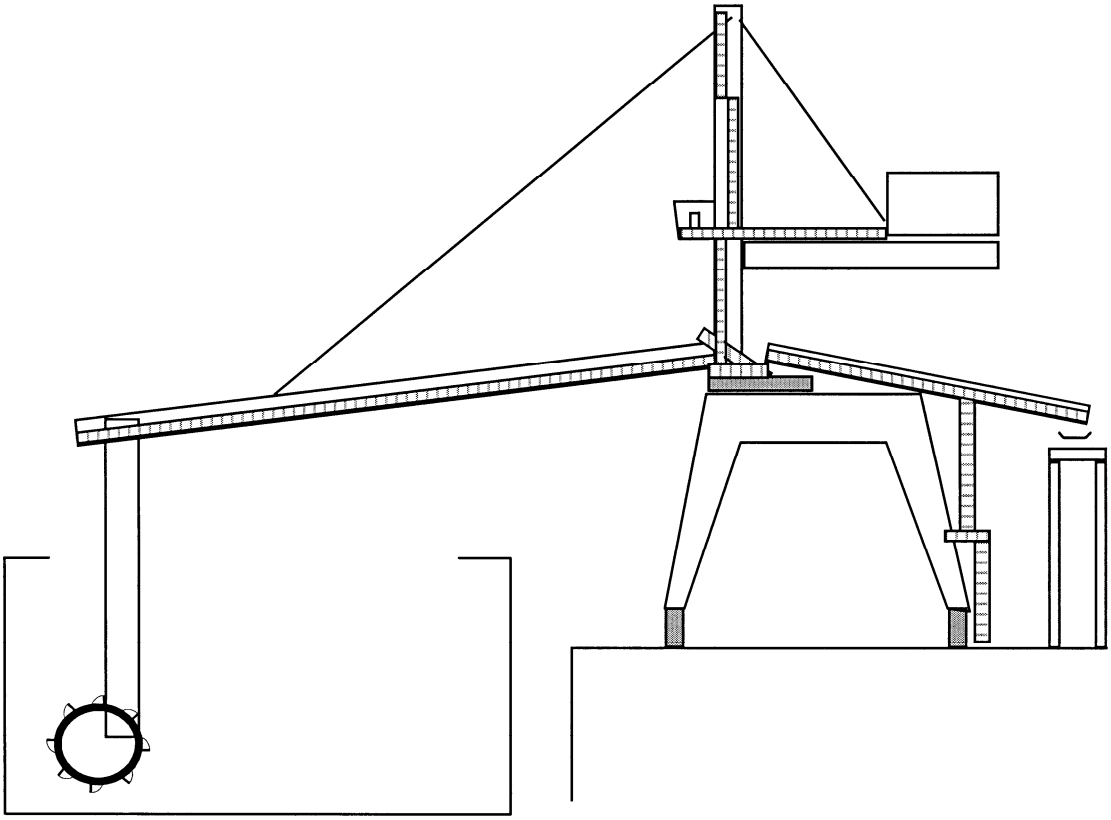


Figure 12

3.3.6
scraper/reclaimer
mobile equipment travelling on rails for continuously reclaiming bulk materials from a stockpile using an endless scraper chain (see Figure 13)

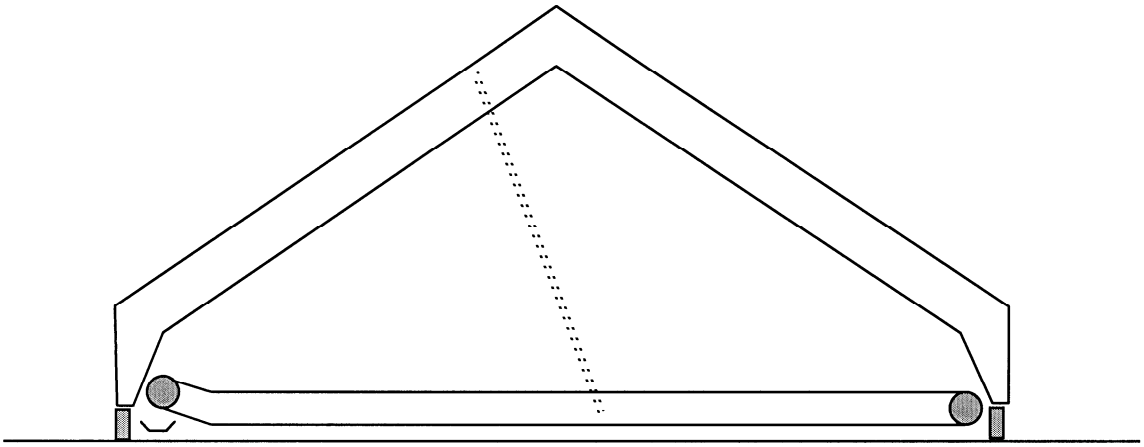


Figure 13

3.3.7
bridge reclaimer
mobile equipment mounted on rails for continuously blending/reclaiming bulk materials from a stockpile using a bucket wheel running along a girder and a belt as the carrying and conveying medium (see Figure 14)

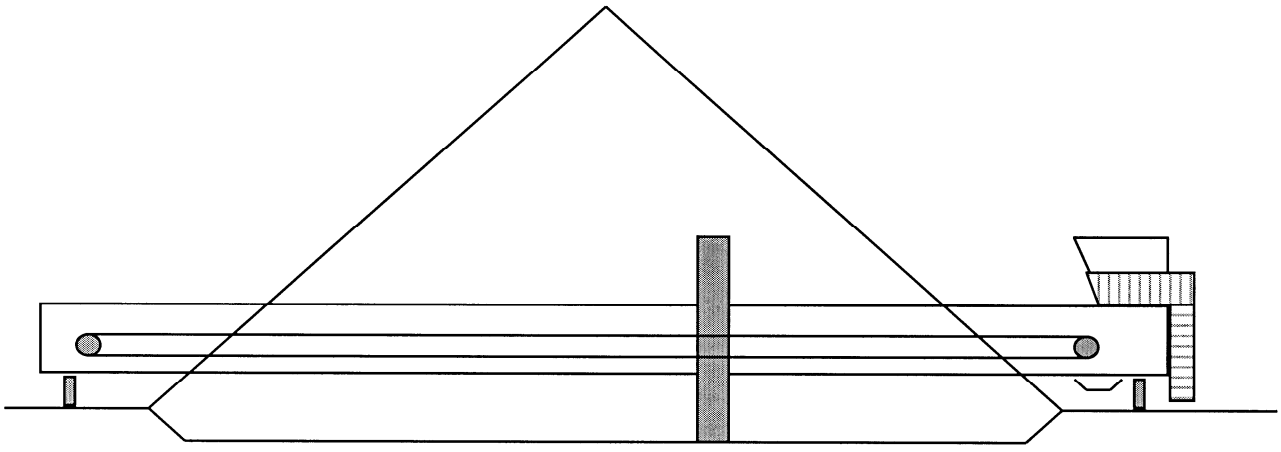


Figure 14

3.3.8
screw reclaimers
mobile equipment located bellow a stockpile for continuously reclaiming bulk materials using a screw as the carrying or conveying medium (see Figure 15)

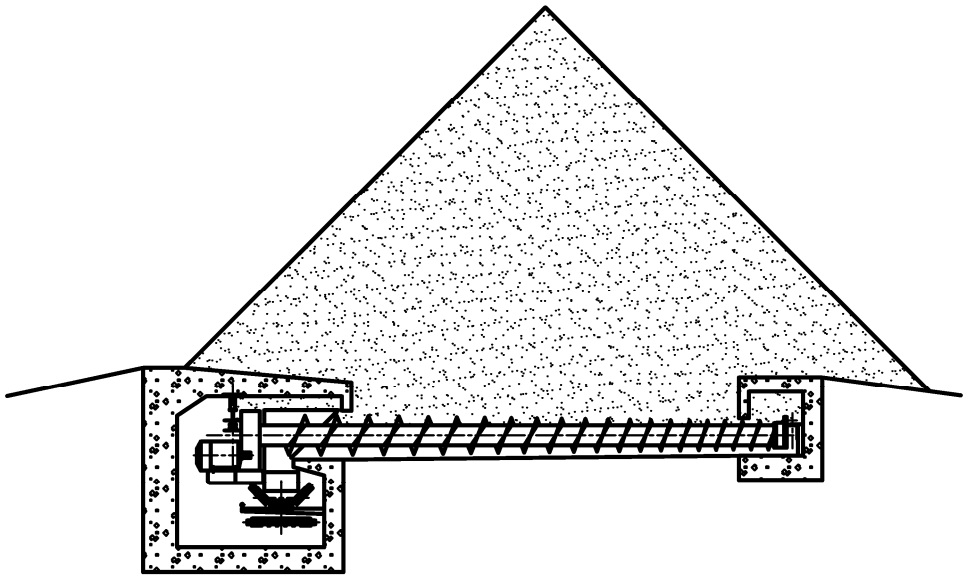


Figure 15

3.3.9
buckets loader
mobile equipment for continuously reclaiming bulk materials from a stockpile and loading it into trucks or trailers, using scraping or digging buckets and a feeding screw to feed a belt conveyor which elevates the bulk materials to the level of the trucks or trailers (see Figure 16)

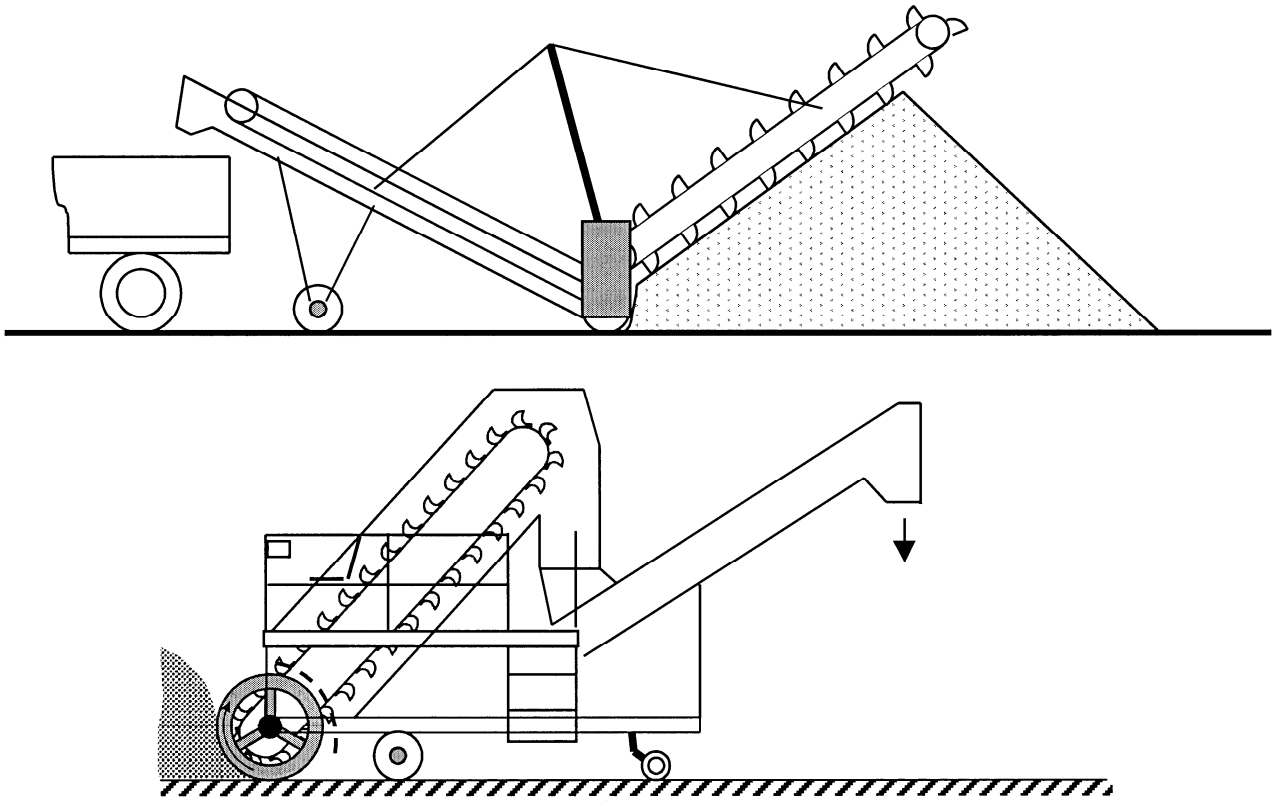


Figure 16

3.4
working area
area as intended by the manufacturer, where persons work at, or operate equipment under normal conditions (inspection, maintenance and cleaning are excluded)

3.5
traffic area
area as intended by the manufacturer, which is accessible or reachable by all persons without opening a guard, activating a trip device or using additional means. This area includes permanent means of access

3.6
mechanical brake
brake applied mechanically by stored energy (e.g. spring force) until released by an external sustained power supply under the control of the operator or automatically

3.7
automatically acting mechanical brake
mechanical brake that is automatically applied in the event of:

— failure of energy supply in the brake system;

— failure in the brake electrical control circuit(s);

— failure of energy supply to the drive(= motor).

4 Hazards

This clause contains hazards and hazardous situations, as far as they are dealt with in this European standard, identified by risk assessment significant for this type of machinery and which require action to eliminate or reduce risk. Clause 5 deals with these hazards in the same order.

NOTE The hazards listed in Annex A usually occur in combination e.g. crushing, shearing and drawing-in.

5 Safety and EMC requirements and/or measures

Equipment and systems shall comply with the safety requirements and/or measures of this clause.

For the application of EN 953, EN 294, EN 811, EN 349, EN 1037, EN 60204-1 and ⟦A1⟩ EN 60204-11 ⟨A1⟧ the manufacturer shall carry out an adequate risk assessment for the requirements thereof where choice is necessary.

NOTE This specific risk assessment is part of the general risk assessment relating to the hazards not covered by this “C” standard.

Belt conveyor mounted on the equipment shall be in accordance with ⟦A1⟩ EN 620:2002+A1:2010 ⟨A1⟧ with the exception of double safe way of escape.

Safety devices shall also be provided to prevent kickback of any manually operated crank.

In addition, the equipment shall be designed according to the principles to ⟦A1⟩ EN ISO 12100 ⟨A1⟧ for hazards relevant but not significant which are not dealt with by this standard.

NOTE The general safety requirements given in Clauses 5.1 to 5.12 are common to all types of mechanical handling equipment dealt with by this standard. Clause 5.13 gives the specific safety requirements of some types of mechanical handling equipment.

5.1 Mechanical hazards

Mechanical hazards shall be safeguarded preferably by guards.

Appropriate safety distances in accordance with Table 1 of EN 349 or Table 2, 3, 4 or 6 of EN 294 and EN 811 and/or hinged or sliding guards, fixed enclosing guards, fixed distance guards or interlocking guards shall be provided to protect operators from crushing and shearing hazards.

For mobile equipment, visual warning devices such as flashing lamps and/or auditory warning devices shall be fitted. If the driver cannot see the danger zone, the auditory warning devices shall provide a sound pressure level 15 dB(A) over the threshold of ambient sound pressure level at a height of 1,6 m from the floor at an horizontal distance of 1m and shall be started 10 s before the start of the movement and provided during 3 s; the visual warning devices shall operate throughout the equipment operation.

5.1.1 Guard construction

Guards shall be in accordance with EN 953 and may be perforated or imperforated sheet construction. If of perforated construction, the safety distances to prevent danger areas being reached shall comply with EN 294.

Where it is intended to step on covers or guards, they shall be able to withstand a force of 1500 N evenly distributed over an area of 0,2 x 0,2 m, with a deformation less 1 % of any reference dimension and no contact with moving part. After the loading it shall be possible to replace the guard.

The other guards shall be able to withstand a force of 150 N evenly distributed on an area of 0,2 × 0,2 m with a deformation less 1 % of any reference dimension and with no contact with moving parts. After the loading it shall be possible to reused the guard.

NOTE The design of guards should enable spillage to be cleared without removal of guards.

〈A1〉 Fixed guards shall be fixed by systems that can be opened or removed only with tools.

Their fixing systems shall remain attached to the guards or to the machinery when the guards are removed. 〈A1〉

5.1.1.1 Fixed sliding guards

Fixed enclosing guards shall be in accordance with clause 3.2.1 of EN 953. They shall be securely fixed in position using captive type fastenings and shall only be capable of being fixed and fastened with the aid of a tool. If they are removable, they shall be capable of being removed and replaced without dismantling any other part. Guards shall be designed so that they cannot remain in the closed position unless they are fastened.

Openings in fixed enclosing guards shall conform with Table 3, 4 or 6 of EN 294 and EN 811 Table 1.

5.1.1.2 Fixed distance guards

Fixed distance guards shall be in accordance with clause 3.2.2 of EN 953. They shall be securely fixed in position using captive type fastenings and shall only be capable of being fixed and fastened with the aid of a tool. The safety distance provided by fixed distance guards shall conform to EN 294 Table 2.

5.1.1.3 Hinged or sliding guards

For hinged guards on totally enclosed parts, the type of attachment and the type and direction of opening shall be in accordance with the requirements of EN 953.

Where the hinged or sliding guards opening and compartment are large enough for any person to enter, the panel shall be capable of being opened from the inside without a key or a tool.

Openings shall conform with Table 3, 4 or 6 of EN 294 and EN 811 Table 1.

Hinged or sliding guards shall be self closing and self locking.

5.1.1.4 Interlocking guards

Interlocking guards shall be in accordance with clause 3.5 of EN 953, shall be securely fixed in position and shall use interlocking devices in accordance with EN 1088 clause 4.2.1.

5.1.2 Choice of guards

5.1.2.1 Inspection guards during operation

If a guard is intended to be opened during operation to allow viewing of a danger zone

a) safety distance of EN 294 Table 2, 4, 3, 6 and EN 811 Table 1 shall be met or;

b) an additional fixed guard shall be provided which prevents danger points from being reached, e.g. made from perforated plate or wire mesh and complying with the safety distances of EN 294 Table 4 and EN 811 Table 1.

5.1.2.2 Access guards for maintenance or repair when machinery is out of operation

If access guards for maintenance or repair out of operation are intended to be opened more frequently than once every 8 h they shall be interlocking guards.

If access guards for maintenance or repair out of operation are intended to be opened less frequently than once every 8 h they shall only be opened using a tool or a key.

If there are hinged or sliding guards they shall only be retained open by a positive engagement devices.

5.1.2.3 Access guards for maintenance or repair in special operating modes

Access guards for maintenance and repair in special operating modes as defined in clause 5.12 shall be fixed, hinged or sliding guards. They shall be retained open or shut by a positive engagement devices. They be able to be open from inside without a tool or a key.

5.1.3 Crushing and shearing hazards

5.1.3.1 Luffing, slewing and travelling mechanisms

The range of movement shall be limited by safety devices, e.g. ultimate limit switches with positive opening operation as defined by chapter 3 of EN 60947-5-1, mechanical end stops.

5.1.3.2 Movable/ mobile equipment on fixed tracks

Movable/ mobile equipment on fixed tracks, such as the loading chute, feeders, etc., whether self-propelled or hand-operated, shall be provided with a device enabling it to be held in positions. Safety devices shall be provided to limit the travel of such equipment, e.g. buffers, latches or ultimate limit switches with positive opening operation as defined by chapter 3 of EN 60947-5-1.

5.1.3.3 Take up devices

Where take-up devices without counterweights can operate automatically, then fixed distance guarding shall be provided to prevent danger points being reached over the full length of travel.

Take-up devices that are manually adjusted shall be adjustable from outside the guards.

5.1.3.4 Inlets and outlets

Inlets and outlets which are reachable from traffic and working areas shall have fixed guards in accordance with EN 294 or EN 811 to prevent access to moving parts and the materials discharges.If this is not possible (e.g. lorries or carriages loading), then a warning signal 3 s long with a sound pressure level 15 dB(A) over the intended threshold of ambient sound pressure level at a height of 1,6 m from the floor at an horizontal distance of 1m shall be given 10 s prior to the activation of the machinery.

5.1.4 Cutting and severing hazards

In working and traffic areas between the floor and a height of 2,100 m there shall be rounded, chamfered or protected sharp edges and corners

Where wheels are reachable to personnel in working and traffic area, rail sweepers shall be fitted on each side to all equipment on rails. The clearance between the rail and the rail sweeper shall be less than 5 mm. The rail sweeper shall be fitted as close as possible to the wheels.

The glazing of the operators cabin shall be made of tempered glass or any equivalent material (see EN 12150-1). The windows shall be mounted so as not to fall towards the outside and can be easily replaced from the inside.

5.1.5 Entanglement, drawing-in or trapping hazards

These hazards occur on, scraper conveyors, drag bar feeder, en masse conveyors, bucket elevators, screw feeders/conveyors, rotary drum, Table or vane feeder, bucket-wheel reclaimers, ship unloaders, scrapers, blending reclaimers, screw reclaimers, buckets loaders.

Gears, rotating shafts, couplings, roller chains and roller chain wheels, and all other transmission parts, shall be protected by fixed enclosing guards, or by fixed distance guards

5.1.6 Impact hazards

Parts of the equipment moving towards other parts of the equipment (e.g. counterweights.) shall, where practicable, not be within the distance in EN 294 of working and traffic area.

Where this is not practicable, access to such dangerous areas within the working and traffic areas shall be restricted by self closing and self locking doors which shall be painted with paint strips in accordance with ISO 3864 showing the hazard.

In working and traffic areas obstacles between 1,4 and 2 m above the floor shall be indicated by a warning sign or protected by a shock absorbing material.

5.1.7 Falling of parts (of machinery or handled materials)

5.1.7.1 Parts of machinery

Gratings and floorings shall be installed in such a way that they cannot fall even in the event of fixing systems loosening.

The support rollers of the belt situated above working and traffic area shall be fitted with a retaining device (e.g. grating) to prevent rollers falling on persons.

5.1.7.2 Handled materials

Where equipment is situated above working and traffic areas, protection (e.g. metal plate or net) depending on the type of handled material shall be provided against falling of handled materials.

The control station shall be located or designed so that the driver is not endangered by falling materials.

Conveying equipment shall be designed in such a way that bulk material cannot slip back.

5.1.8 Loss of stability (of machinery itself and machine parts)

If the mobile equipment is fitted with stabilizers cylinders shall be equipped with pilot operated non return valves to stop the movement of the cylinder in case of line rupture. Flow sensitive valves shall not be used for this function. The pilot operated valves shall be close coupled to the cylinders or placed close to the cylinders and connected to it by means of rigid pipes having welded or flange connections.

When it is necessary to ensure the stability of mobile equipment with slings, locking pins or anchors the maximum time to reach the nearest anchorage point shall be less than 5 min.

If the equipment needs to be anchored it shall be fitted with a wind speed indicator.

Travelling and slewing devices of mobile equipment shall be designed so that in the event of a wheel breaking the equipment shall remain within safe limits in terms of stability (e.g. stop). Wheels sweepers may be designed for this purposes.

Equipment may have elements likely to come into contact with external obstacles, such as ships, stored materials, etc. and due to this fact be subject to dangerous overloading and underloading, particularly when equipment stability is concerned Such equipment shall be provided with load detecting devices and, if practicable, automatic load limiting devices. These devices shall be preferably adjustable and positive acting (pressure, torque, load limiters, etc.). Bucket-wheel drives shall be fitted with a torque limiter to keep the maximum torque compatible withthe design, the luffing drive system shall be equipped with devices detecting underloading and warning the operator if underloading has not been taken into account in the stability calculation.

NOTE 1 Safety requirements are covered in the documents FEM 2 131/2 132.

NOTE 2 The designer shall take into account the case when new mobile equipment is used in existing site conditions (terrain, rails, new loads, ...).

5.1.9 Slip, trip and fall hazards

Mobile and movable equipment shall have permanent means of access in accordance with prEN 13586 with the following deviation from the Table 6: v_1 the gap between the top of the toe board and the bottom of the intermediate guard rail equal or less than 0,5 m instead of 0,4 m. Inclined walkways shall be fitted with cross bars. Fixed equipment shall have permanent means of access in accordance with ⟩A1⟨ EN 620:2002+A1:2010 ⟩A1⟨.

NOTE 1 Width of permanent means of access along belt conveyors shall be in accordance with ⟩A1⟨ EN 620:2002+A1:2010 ⟩A1⟨.

Equipment with luffing, slewing and travelling intended to be used in conditions where lowering to an accessible surface is not possible shall have permanent means of access for all operational or maintenance work.

NOTE 2 If negotiations shows that access is possible with temporary means this requirements needs to be reconsidered.

Machinery or equipment which cannot be lowered to the ground or reached by elevating working platforms or other temporary means of access (e.g. over stockpiles or water) shall have permanent means of access for all operational and maintenance work.

To pass from a fixed equipment to a mobile equipment, or from the fixed parts to the mobile part of an equipment, the mobile equipment or the mobile part of the equipment shall be stopped, if speed is greater than 0,150 m/s.

Cleaning cab glazing, lighting and visual warning devices shall be possible from a safely accessible place (e .g . from inside the cabin).

The driving position of mobile equipment shall be maintained horizontal ± 5 % by means of an adequate device without specific action from the operator.

The driving position, if enclosed, shall have an emergency exit located opposite the entrance door. A window can be used as an emergency exit if the dimensions of the clear opening are at least 0,6 m × 0,6 m, if a means of access is present at that window and if the window can be opened in wards or if the glass can be broken by an always available safety hammer

5.2 Electrical hazards

5.2.1 Electrical equipment

Operators and other persons shall be protected from the hazards associated with electrical equipment as listed in clause 4 above and clauses 6.1 of EN 60204-1 and/or ⟩A1⟨ EN 60204-11 ⟩A1⟨.

The electrical equipment of the machinery shall be provided in accordance with all applicable clauses of EN 60204-1 and ⟩A1⟨ EN 60204-11 ⟩A1⟨, together with the particular requirements below. If the equipment is intended for use in electrical supply conditions outside the range of EN 60204-1, clause 4.3, or ⟩A1⟨ EN 60204-11:2000 ⟩A1⟨, clause 4.3, the manufacturer shall make any necessary design modifications, take any necessary safety precautions and/or state any operational restrictions in the operating manual.

NOTE Electrical equipment includes materials, fittings, devices, machines, fixtures, apparatus and the like, used as part of, or in connection with, the electrical installation of the equipment, including the means of isolation from the supply. This includes electronic equipment, the means of disconnection from the supply and all wiring on and from the conveyor to the means of disconnection from the supply.

5.2.1.1 Means of disconnection

Provision shall be made to prevent unexpected start-up and electric shock when work is being carried out on the

mechanical handling equipment (see EN 1037, EN 60204-1, clauses 5.4 and 5.5, and/or [A1] EN 60204-11:2000 [A1], clauses 5.4 and 5.5).

If the mechanical handling equipment is part of a system which is sub-divided into individual sections, each section having a discrete supply, each individual section shall be capable of isolation from the supply to allow work to be carried out.

Where parts of the electrical equipment remain live after switching off the disconnecting device (e.g. due to interconnections between sections of a mechanical handling system) such parts shall be marked/identified/protected against direct contacts as appropriate (see EN 60204-1, clauses 5.3.5 and 6.2).

5.2.1.2 Environment

The supplier shall select and install electrical equipment which is suitable for the intended working environment. Enclosures (cabinets, boxes, compartments) for the electrical equipment (including control devices) and motors shall be positioned outside the range of falling materials and provide suitable protection against ingress of objects and liquids, e.g. where enclosures for electrical equipment are indoors, they shall have a minimum degree of protection of IP 22, for motors IP 23 and when outdoors and subject to liquid penetration they shall generally have a degree of protection of IP 54 (see EN 60529).

5.2.1.3 Wiring practices

Wiring practices used on mechanical handling equipment and from mechanical handling equipment to the point of supply, including any work carried out on site, shall meet the requirements of EN 60204-1, clauses 13 and 14 and of [A1] EN 60204-11:2000 [A1], clauses 13 and 14. This includes identification techniques and wiring methods used both inside and outside enclosures. In particular, where practicable, wiring external to enclosures shall not be located in proximity to combustible materials, or located where it may be subject to mechanical damage. Where this in unavoidable, wiring shall be suitable protected, e.g. in rigid conduit, flexible tubing, raceways, or other suitable means. Electrical equipment shall be designed, marked and arranged, as far as is practicable, to prevent or deter the making of incorrect connections which could result in a risk of injury (e.g. reversal of the direction of movement or influencing the function of a safety device).

5.2.2 Electrostatic charges

Hazards including shock and fire may be caused by electrostatic charges. If it has been identified that persons may be directly or indirectly endangered by such charges, suitable protective measures shall be taken (e.g. earth bonding, brush contact or discharge element for moving items, provision of suitably conductive conveyors belting).

NOTE Provisions for electrostatic hazards are under consideration by CENELEC/TC 44 X.

5.3 Safety related to EMC phenomena

The continuous handling equipment shall also have sufficient immunity to electromagnetic disturbances to enable it to operate safely as intended. It shall not fail dangerously, when exposed to the levels and types of disturbance as specified in EN 61000-6-2.

The manufacturer of the continuous handling equipment shall design, install and wire the equipment and sub-assemblies, taking into account the recommendations of the supplier(s) of the sub-assemblies, to ensure that the effects of electromagnetic disturbances thereon shall not lead to unsafe operation and/or dangerous failure.

The following performance criteria shall be used to determine the result (pass/fail) of EMC immunity testing:

a) for those tests specified in EN 61000-6-2, the performance criteria as specified in EN 61000-6-2 shall apply.

b) with regard to all of the performance criteria specified in EN 61000-6-2 (A, B etc.), there shall be no loss of performance or degradation of performance which could lead to danger. In particular, the following losses of performance or degradations of performance, shall not occur:

— unexpected start-up (see EN 1037);

— blocking of an emergency stop command, or resetting of the emergency stop function (see EN 418 and EN 60204-1);

— inhibition of the operation of safety related circuit as in clause 5.11.2.1(see EN 1088);

— any reduction in fault detection capability.

NOTE Information on measures to reduce the effects of electromagnetic disturbances on the continuous handling equipment is given in EN 60204-1, clause 4.4.2.

5.4 Hazards due to lightning

Protective measures against lightning effects shall be taken where appropriate, e.g. on very high equipment installed outdoors.

These measures shall comply with the requirements of IEC/TC 81 "Protection of structures against lightning". Consideration should be given in particular to the effects of lightning on vulnerable structural parts (e.g. cables supporting the luffing part) and on ball and roller bearings linking important structural parts (e.g. slewing ring, rail wheels). The following measures shall be taken in particular:

— total interconnection of all structural metallic elements to the general earthing circuit of the electrical installations;

— mobile equipment supplied by an earth network, corresponding earth interconnection to be made (e.g. earth wire in the trailing cable);

— track-mounted mobile equipment, interconnection with the rails through collector shoes fitted in the lower part;

— installation of lightning arresters or overvoltage limiters wherever necessary, in particular on electronic equipment;

— where impossible, control circuits shall be supplied through isolating transformers (with earthed control screen. For sensitive installations, if necessary, supply through inverters or chargers - accumulator batteries).

5.5 Thermal hazards

5.5.1 Burns and scalds by a possible contact of persons with parts or materials at high temperature

Where materials conveyed or any part of the equipment itself which, on contact with persons, can lead to burns or scalds, suitable measures shall be taken:

— to prevent contact with the conveyed materials or with hot or very cold surfaces (e.g. screen, fixed distance guards);

— or to limit the temperature of hot surfaces to the value defined by ▌A1⟩ EN ISO 13732-1 ⟨A1▐ based on one second contact time. For non intentional touching the temperature defined in Annex B of ▌A1⟩ EN ISO 13732-1:2008 ⟨A1▐ based on 0,5 s contact time shall apply.

5.5.2 Health damaging effect by hot or cold work environment

Where an operator's cabin is installed, provision shall be made for heating/air conditioning facilities.

NOTE Due to the fact that this equipment is used in a wide range of temperatures and environmental conditions, it is not possible to give precise technical requirements in this standard (see Introduction, negotiations).

5.6 Measures for protection against fire and explosion hazards due to materials conveyed

If the equipment may be required to convey finely divided materials (dusts), with a possible risk of fire and explosion, see Annex B (informative).

5.7 Jamming and blocking of materials conveyed

The possibility of jamming or blocking of handled materials shall be considered when designing the equipment and eliminated as far as possible. A safe system of work to free blocked and jammed materials shall be established.

5.8 Local lighting

Safety lighting and/or beaconing shall be provided to assist emergency safe egress of persons from the control cabins of mobile equipment in case of failure of power supply. The internal lighting system of the control cabin shall be adjustable relative to the outside lighting in order to facilitate vision on the outside (e.g. reduction of the inside lighting intensity).

5.9 Mental overload or underload stress etc.

For control cabins a mean of communication e.g. telephone with e.g. the control room, shall be provided.

5.10 Visibility

Control cabins of mobile equipment shall enable the driver to monitor the loading and/or unloading work and travel pass. The cabin shall include provision for reducing the effects of glare and reflections (e.g. antireflection coated/tinted glazing).

Windscreen wipers and windscreen washers shall be provided.

5.11 Hazards arising from control systems or caused by failure of energy supply, breaking down of machinery parts and other functional disorders

5.11.1 Failure of power supply

The braking devices or similar devices specified in 5.11.2.6 (Stopping) shall automatically operate, in case of failure of the power supply with the exception of the foot brakes. If a foot brake is fitted, it shall be possible for it to perform its function even in the case of a failure of the power supply.

5.11.2 Measures for protection against hazards arising from unsuitability, failure or malfunction of safety related parts of control

5.11.2.1 Controls and controls systems systems

— Controls and circuits used for safety purposes includes :trip device related circuits, ultimate-position switch related circuits, slack-rope switch related circuits, "interlocking" switches related circuits, emergency stop device related circuits, safety gear related circuits, brake related circuits, start and stop related circuits.

5.11.2.2 Safety related devices

Safety related devices shall be designed, selected, located, and/or protected to meet intended site conditions, and the various applications of the equipment. e.g. ice build-up.

The switching arrangements of mechanically actuated electrical safety devices listed in 5.11.2.1, shall be of positive opening operation in accordance with chapter 3 of EN 60947-5-1 (i.e. "safety switches").

If a safety device is actuated, a stop command shall be automatically given out, which shall initiate a category "0" or category "1" stop as appropriate to be compatible with the design (see EN 60204-1, clause 9.2.2). The stop function shall comply with EN 954 -1, clause 5.2.

5.11.2.3 Transmission elements used for safety purposes

Transmission elements which are used for safety purposes listed in 5.11.2.1, e.g. wiring, shall be designed so that in the event of failure or rupture, the equipment shall not fail to danger, i.e. a stop command shall be automatically given out. For safety related parts of control systems see clause 5.11.2.1.

5.11.2.4 Control systems

The control system and control equipment shall be designed using proven techniques and shall use proven components.(see EN 60204-1, clause 9.4) The safety related parts of the control system shall be designed in accordance with the requirements of at least EN 954-1 Category 1 (see Clause 6.2.2 in EN 954-1). Where programmable electronic equipment, or electronic devices including electronic sub-assemblies are used for safety related purposes listed in 5.11.2.1, they shall be in accordance with the requirements of at least EN 954-1 Category 2 (see Clause 6.2.3 in EN 954-1). Where programmable electronic equipment or electronic devices (including electronic sub-assemblies) are the only means used to transmit emergency stop commands, the emergency stop system shall be in accordance with the requirements of EN 954-1 Category 4 (see Clause 6.2.5 in EN 954-1).

When the supply is switched-on there shall be no movement of the machinery.

Electronic control circuitry, software and adjustable safety devices/safety equipment shall not be accessible to unauthorised persons, e.g. by use of access codes, special tools.).

5.11.2.5 Start function

Start devices shall be constructed and mounted so as to minimise the risk of inadvertent operation; they shall be positioned within reach of the operator and shall be clearly identifiable and visible

If starting mechanical handling equipment may result in a hazardous condition, then an unambiguous 3 s long auditory warning signal shall be given out, 10 s before the start and/or a visual warning signal such as flashinglamp. Such signals shall be provided for example in situations where mechanical handling equipment is out of sight of the operator, or when it is necessary to warn persons who may be in the area, that a particular equipment or mechanism is about to start. The auditory warning devices shall provide a sound pressure level 15 dB(A) over the threshold of ambient sound pressure level at a height of 1,6 m from the floor at an horizontal distance of 1m.

5.11.2.6 Stop function and stop control devices

Stop control devices shall be positioned within reach of the operator at all control stations and shall be clearly identifiable and visible. The stop function shall be a category “0” or category “1” stop as appropriate to be compatible with the design (see EN 60204-1, clause 9.2.2).

Stop devices shall be of the impulse type and after actuation of a stop device the appropriate part of the equipment, or the complete equipment, shall come to a halt and then remain in a stationary condition.

The stop function shall be arranged to avoid creating hazardous conditions, (e.g. dangerous discharge of conveyed material). If the stopping of particular conveyors could cause risks at other related parts of the installation, stopping shall be suitably controlled (e.g. by time delay or sequencing).

When internal friction cannot prevent the loaded equipment from free running under the effect of inertia and gravity, equipment shall be fitted with a braking device or any similar device actuated by the stopping control and intended to absorb inertia when stopping occurs.

5.11.2.7 Emergency stop systems

The emergency stop system shall be in accordance with EN 418 and shall be a category “0” stop or category “1” stop as appropriate to be compatible with the design (see EN 418, clause 4.1.5).

Emergency stop control devices shall have positive operation and be self-latching.

Where the equipment’s supply disconnecting device is at a distance less than 10 m from any accessible point of the equipment it can be used for emergency stopping.

Emergency stop devices shall be at all control stations and at the location specified for each type of equipment in clause 5.13.

The height of the emergency stop device shall be from 0,6 m and 1,7 m.

NOTE The provision of an emergency stop device is not an alternative to the installation of suitable guarding, see EN 418, clause 4.1.3.

5.12 Hazards arising during inspection, maintenance and cleaning

Provisions shall be made to allow removal of parts safety during repair operations.

The equipment shall be designed so that, as far as possible, adjustment, lubrication and maintenance points are located outside danger areas (see clause 5 of ⟨A1⟩ EN 1037:1995 ⟨A1⟩). For special maintenance or repair operations it can be necessary to provide other measures which can be one or a combination of the following:

— each unit of the equipment such as the conveyor needs to be isolated and the energy dissipated (see 5 of EN 1037)

— special operating modes:

  — remote hold-to-run devices with a cable long enough to be out of the danger area and enable viewing of the danger zone;

  — devices to limit the speed;

  — limited movement control devices;

  — cableless control shall not be used for maintenance operation.

If specific safety measures are needed then all the necessary equipment shall be supplied with the machinery.

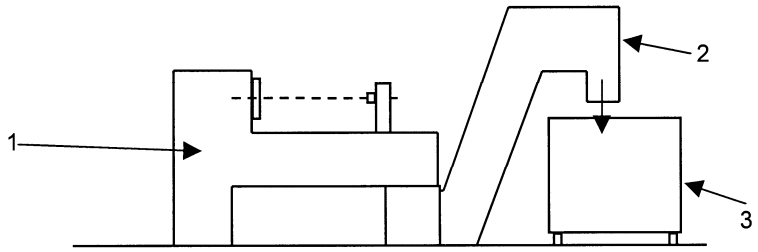
Mode selection means shall preclude any possibility of normal operation control.

5.13 Specific safety requirements and locations of the risks

Clauses 5.13.1 to 5.13.13 give specific requirements for the equipment and show the location of some of the risks but not of all the significant risks for the equipment.

NOTE Clauses 5.1 to 5.12 apply for each type of equipment in addition to the following clauses.

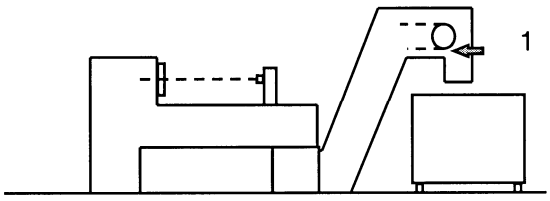
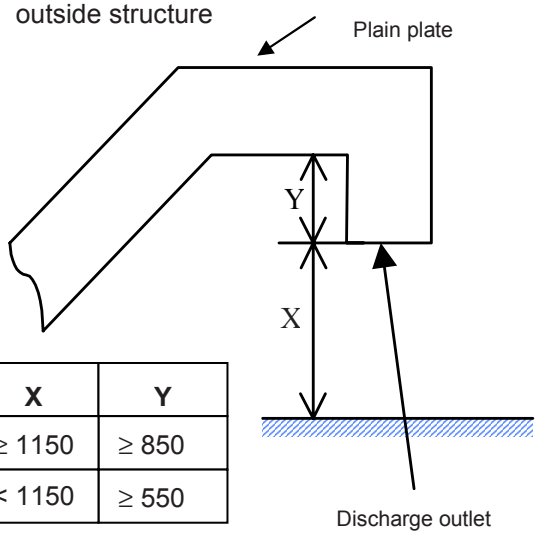
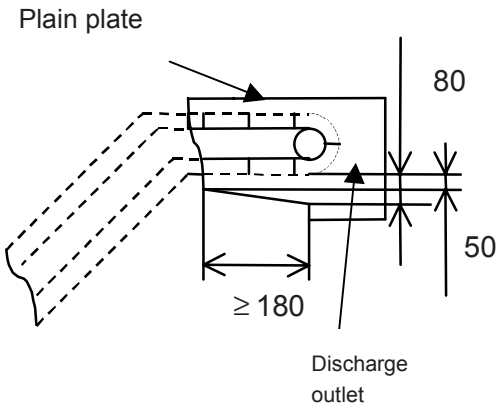
5.13.1 Scraper conveyors (used in combination with machines, e.g. lathes)



Key

1 machine
2 fixed arm
3 container

Figure 17
Table 1

Location of the risks	Requirements
 ① between structure and scraper chains (shearing)	a) outside structure  X ≥ 1150, Y ≥ 850 X < 1150, Y ≥ 550 b)protection zone for scraper conveyor used in combination with a machine for machining metal parts and a container to collect the metal cuttings. 

5.13.2 "En-masse" conveyors (requirements for free discharge)

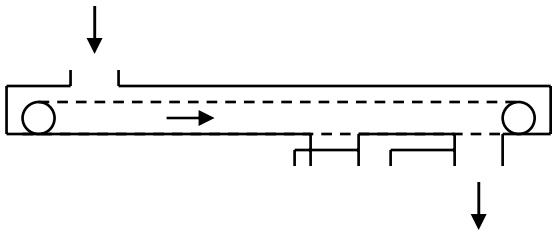
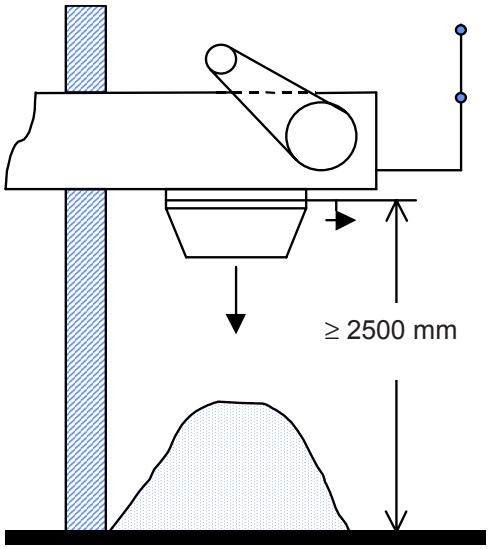


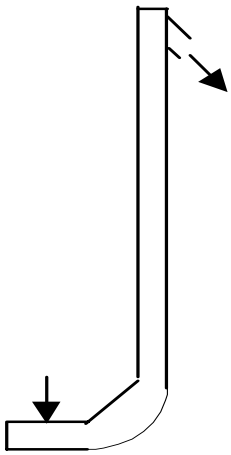
Figure 18

Table 2

Location of the risks	Requirements
1 – Discharge area 	In case of intermittent and/or irregular discharge in traffic areas, a visual warning signal indicating the equipment operation shall be provided (see 5.11.2.5)

"to be continued"

Table 2 *(concluded)*

Location of the risks	Requirements
2 – Discharge at the inlet area 	If the configuration is such that a run back is possible then a mechanical brake shall be fitted on the driving mechanisms

5.13.3 Bucket elevators

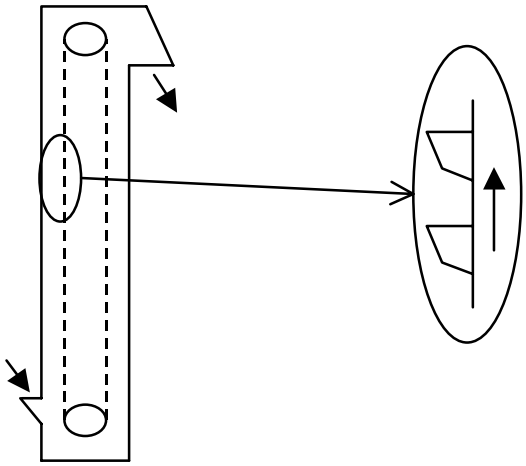
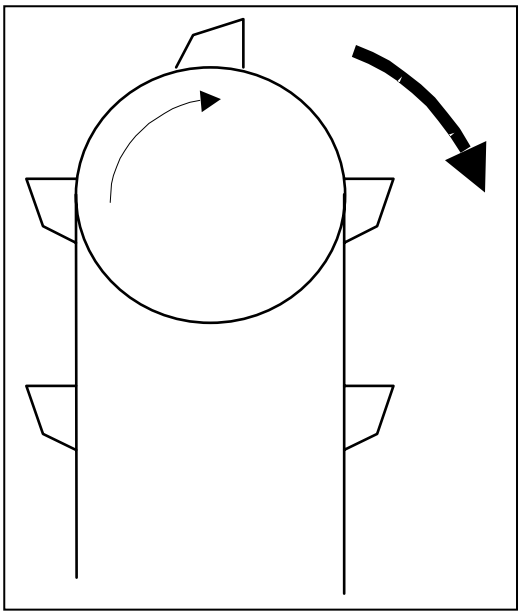


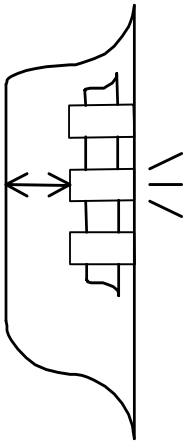
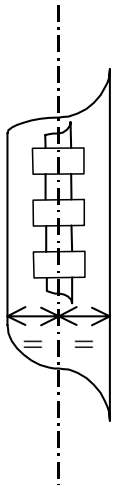
Figure 19

Table 3

Location of the risks	Requirements
1 - Ejection of parts (of machinery or handled products : non cased bucket elevator) 	In working and traffic areas where falling materials or ejection of machine parts (in particular belt running downwards in elevators) may occur, guards shall prevent access to the danger zone. Where provided, these shall be fixed distance guards or protection against falling objects (see also clause 7.1.3). These guards are different from those designed to ensure that the mobile element is not accessible.
2 - Discharge at the inlet or run back at the tail pulley	A mechanical brake shall be fitted

" to be continued"

Table 3 *(concluded)*

Location of the risks	Requirements
3 - Friction of buckets on the casing (Fire)	Belt centering to be automatically controlled e.g. by electric device
	

5.13.4 Movable belt conveyors

(for fixed belt conveyors compliance shall be ensured with ⟦A1⟩ EN 620:2002+A1:2010 ⟨A1⟧).

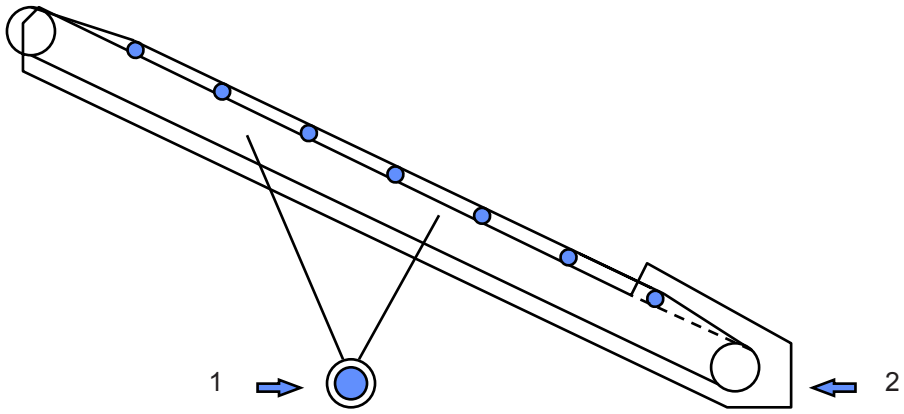


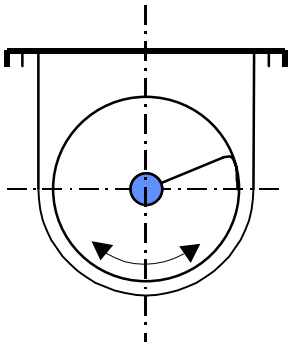
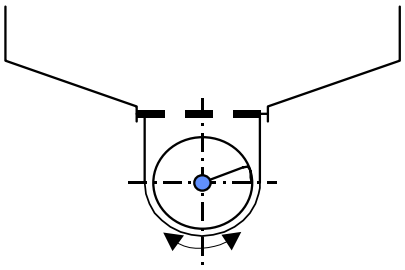
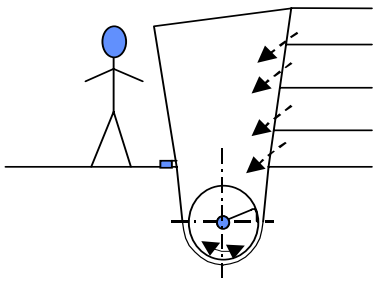
Figure 20

Table 4

Location of the risks	Requirements
1 - Bad wedging supports	It shall be possible to lock the equipment supports during operation
2 – Anchoring (Loss of stability)	If necessary, to ensure the stability with adequate means

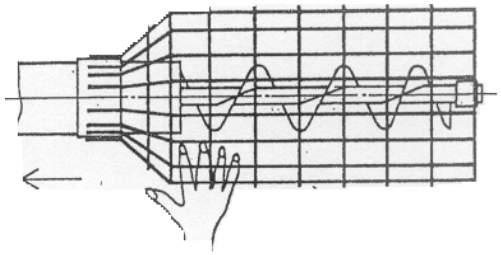
5.13.5 Screw feeders and conveyors

Table 5

Location of the risks	Requirements
1 - ScrewEntanglement, drawing-in or trapping hazards	Fixed guard on trough: plain plate No brakes 
2 - Screw feeding through open casing Entanglement, drawing-in or trapping hazards	Fixed guard : wire mesh or perforated plate No brakes  — Movable guard with interlocking device as defined by clause 3.2 of EN 1088 or — removable hopper with interlocking device as defined by clause 3.1 of EN 1088 or — Fixed guard : plain plate, perforated plate or wire mesh 

" to be continued"

Table 5 *(concluded)*

Location of the risks	Requirements
3 – Self- feeding screw (screw end going into the material stockpile) Entanglement, drawing-in or trapping hazards	Fixed guard : wire mesh or perforated plate No brakes 

5.13.6 Loaders with scraping buckets

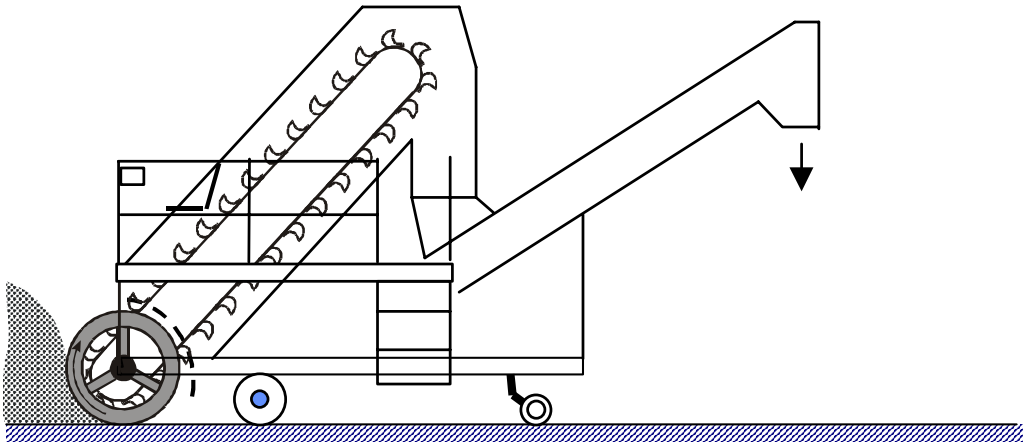
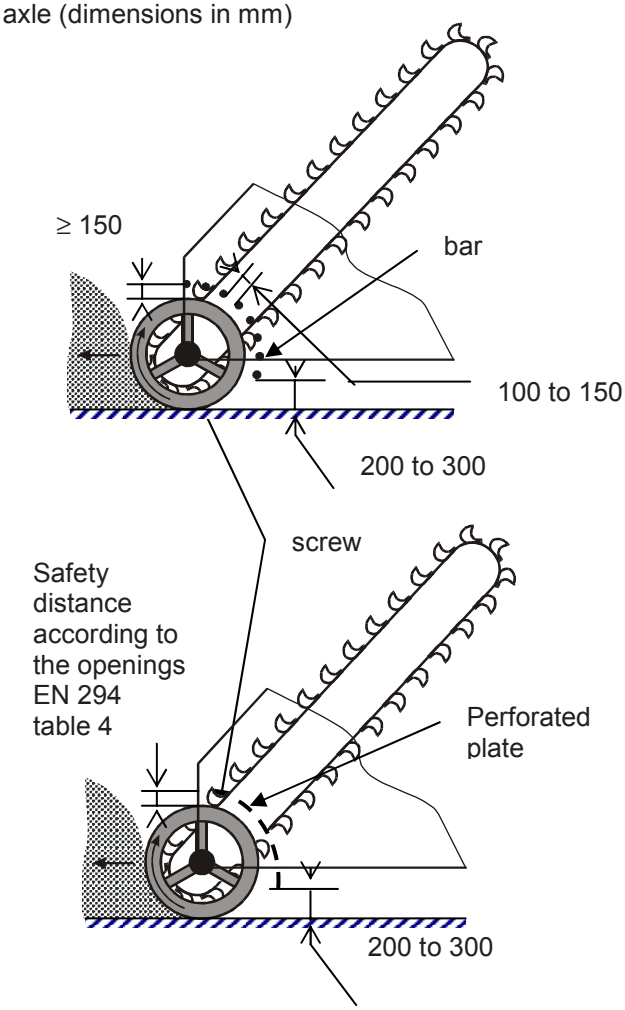


Figure 21

Table 6

Location of the risks	Requirements
1 – Screw (no brake)	A fixed guard shall be fitted above the screw and on the sides without impairing the operator's visibility at the operating station Bars or perforated plates parallel to the screw axle (dimensions in mm) 

" to be continued"

Table 6 *(concluded)*

Location of the risks	Requirements
2 – Wheels	Lorry mounted : braking systems of the vehicle, seated driver : foot brakes/hydrostatic drive with parking brake, other : mechanical brakes
3 - Bucket elevator	see 5.1 a fixed guard shall be fitted to prevent reaching buckets from the operation platform or from the floor
4 - Access	see 5.1.9 see [A1] EN 620:2002+A1:2010 [A1]

5.13.7 Stackers (for fixed belt conveyors compliance shall be ensured with EN 620:2002+A1:2010)

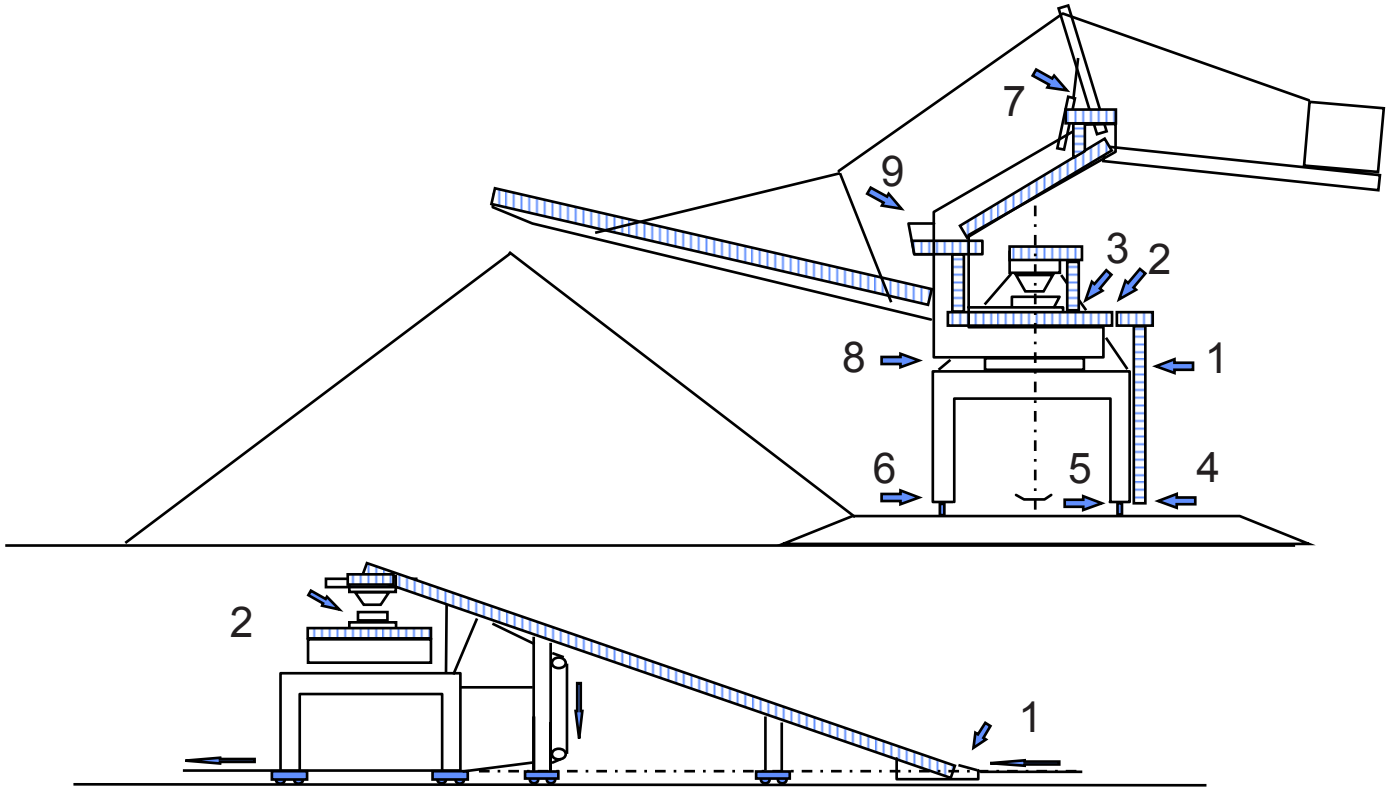
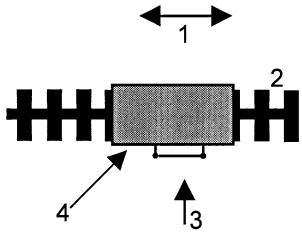


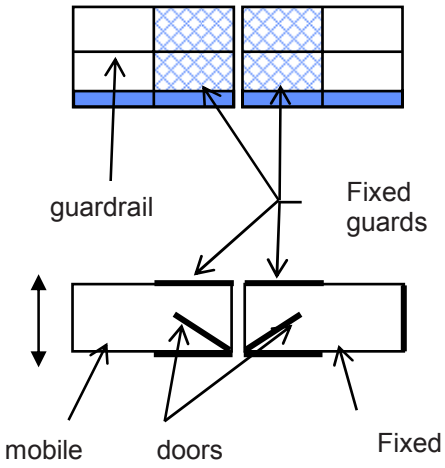
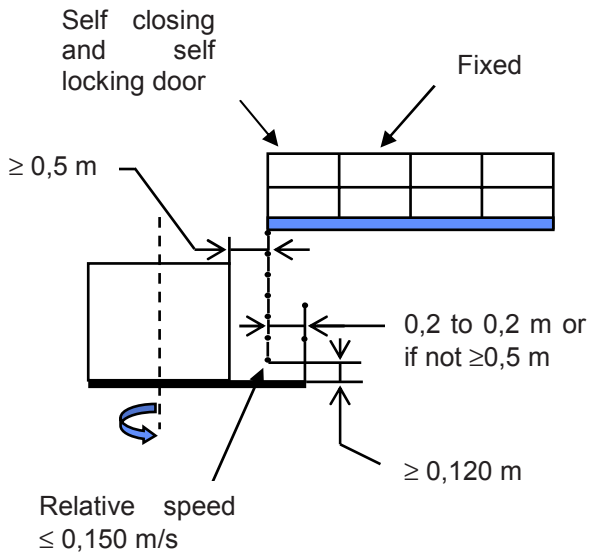
Figure 22

Table 7

Location of the risks	Requirements
1 - Main access to the equipment from the ground (shearing)	 **Key** 1 direction of travel of the machine 2 rails 3::access without stepping over the rails 4 carriage

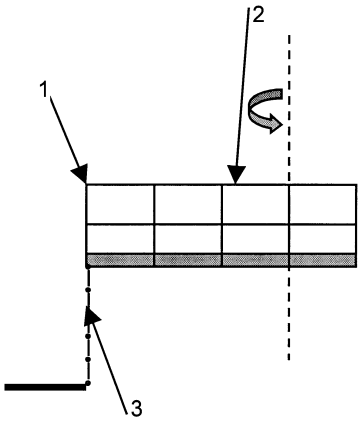
" to be continued"

Table 7 *(continued)*

Location of the risks	Requirements
2 - Access between fixed and mobile parts (shearing)	1st solution : access on the same level (passage when the rotation movement is stopped)  2 self-closing and self locking doors + communication devices with the driver
2 - Access between fixed and mobile parts (shearing)	2nd solution : access by means of a ladder (passage without stopping the rotation), fitted with an emergency stop device 

" to be continued"

Table 7 *(concluded)*

Location of the risks	Requirements
3 - Between fixed parts (crushing, impact) and slewing parts	Areas strictly restricted to maintenance personnel  maintenance area to be kept away from dangerous parts as far a possible (safety distance barrier, wire mesh...) **Key** 1 information on a sign "Check that you are in front of the ladder" + door opening/closing with a key (without interlocking) + door opening towards the inside of the slewing part 2 slewing art 3 fixed ladder
4 - Area where the equipment moves (impact)	Devices shall be fitted to detect obstacles and avoid collision
5 - Wheels	Shearing (see 5.1.4)
6 - Travelling mechanisms	Automatically acting mechanical brakes and a braking devices for the out of service (parking) positions
7 - Luffing mechanisms	Automatically acting mechanical brakes on the winch
8 – Slewing mechanisms	Automatically acting mechanical brakes and a braking device for the out of service (parking) positions
9 - Control cabin : — emergency exit (loss of stability) — safety glazing (cutting or shearing)	See 5.1.9 See 5.1.4

5.13.8 Gantry stackers

(for fixed belt conveyors, shuttle conveyors and trippers compliance shall be ensured with [A1] EN 620:2002+A1:2010 [A1])

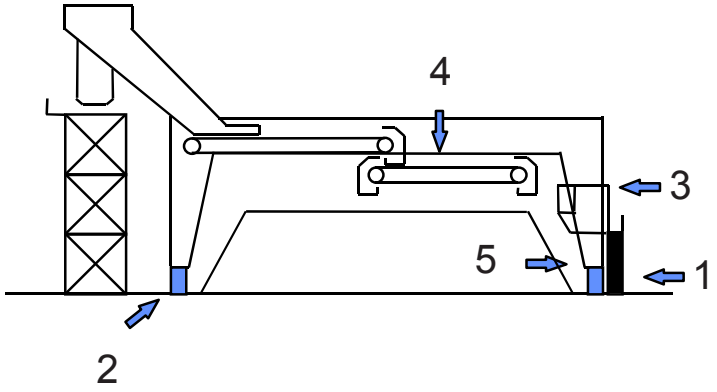


Figure 23

Table 8

Location of the risks	Requirements
1 - Main access to the equipment from the ground (shearing)	See 5.13.7, item 1
2 - Rail wheel	See 5.1.4
3 - Control cabin :	
. emergency exit (loss of stability)	See 5.1.9
. safety glazing (cutting or shearing)	See 5.1.4
4 - Fixed belt conveyors - shuttle conveyors	(see [A1] EN 620:2002+A1:2010 [A1])
(shearing or drawing-in)	
Access between fixed and mobile parts	
(shearing or drawing-in)	See 5.1
5 – Travelling mechanisms	Automatically acting mechanical brakes and a braking devices for the out of service (parking) positions

5.13.9 Ship loaders

(for fixed belt conveyors, shuttle conveyors and trippers compliance shall be ensured with [A1] EN 620:2002+A1:2010 [A1])

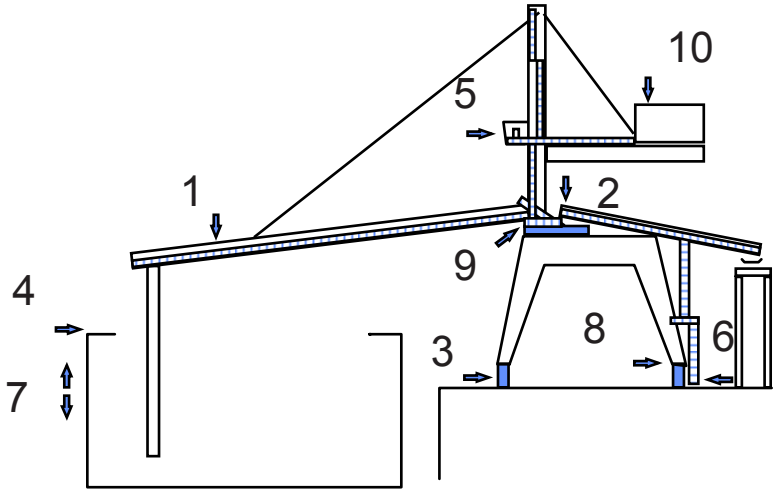


Figure 24

Table 9

Location of the risks	Requirements
— 1 -Mobile and slewing gangway (slip, trip and fall of persons)	See 5.1.9
2 - Luffing and slewing gangway (shearing, drawing-in, impact)	See 5.13.7, item 2, 2nd solution
3 - Rail wheels	See 5.1.4
4 - Ship coamings	See 5.1.8
5 - Control cabin :	
— emergency exit (loss of stability)	See 5.1.9
— safety glazing (cutting or shearing)	See 5.1.4
6 - Area where the equipment moves (impact)	See 5.13.7., point 4
7 - Ship movement	A device detecting underloading and warning the operator
8 – Travelling mechanisms	Automatically acting mechanical brakes and a braking devices for the out of service positions
9 – Slewing mechanisms	Automatically acting mechanical brakes and a braking devices for the out of service positions
10 – Luffing mechanisms	Automatically acting mechanical brakes

5.13.10 Bucket-wheel reclaimers

(for fixed belt conveyors compliance shall be ensured with A1 EN 620:2002+A1:2010 A1)

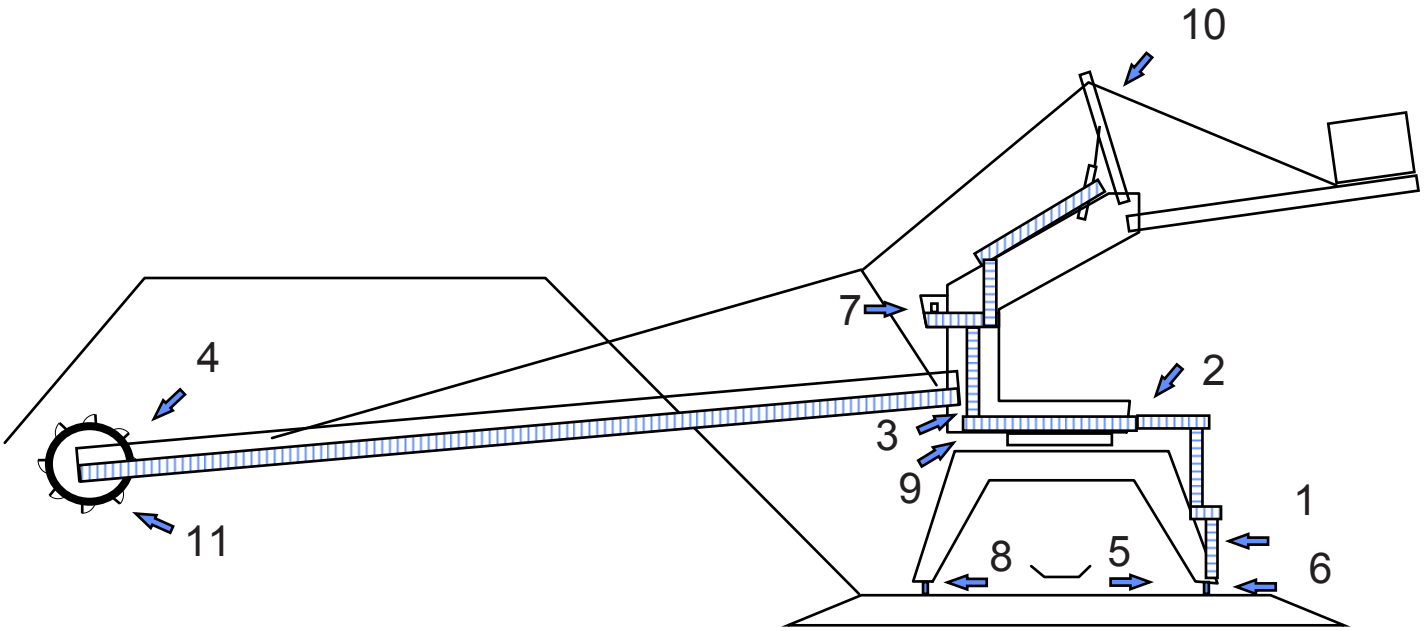


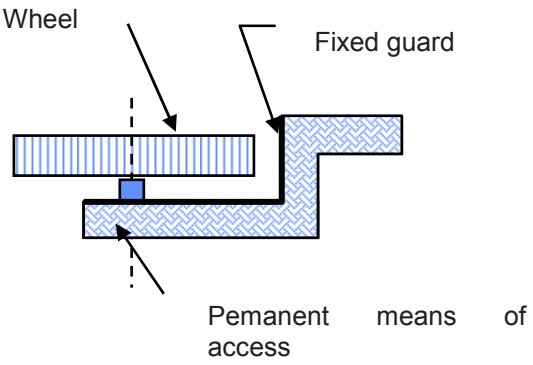
Figure 25

Table 10

Location of the risks	Requirements
1 - Main access to the equipment from the ground (shearing)	See 5.13.7, item 1
2 - Access between fixed and mobile parts (shearing)	1st solution : access on the same level (passage when the slewing movement is stopped)
	See 5.13.7, item 2, 1st solution
	2nd solution : access by means of a ladder (passage without stopping the slewing)
	See 5.13.7, item 2, 2nd solution
3 - Between fixed parts and articulated lifting parts (crushing, impact)	See 5.13.7, item 3

" to be continued"

Table 10 *(concluded)*

Location of the risks	Requirements
4 - Bucket-wheel :	Fixed guard complying with the safety distances (see EN 294)
— access around the bucket-wheel (entanglement, drawing-in, trapping)	
5 - Area where the equipment moves (impact)	See 5.13.7, point 4
6 - Rail wheels (	See 5.1.4
7 - Control cabin :	
— emergency exit (loss of stability)	See 5.1.9
— safety glazing (cutting or shearing)	See 5.1.4
8 – Travelling mechanisms	Automatically acting mechanical brakes and a braking device(s) for the out of service (parking) positions
9 – Slewing mechanisms	Automatically acting mechanical brakes and a braking device(s) for the out of service (parking) positions
10 – Luffing mechanisms	Automatically acting mechanical brakes
11 – Bucket-wheel drives	A torque limiter to keep the maximum torque compatible with the design

5.13.11 Ship unloaders

(for fixed belt conveyors, shuttle conveyors and trippers compliance shall be ensured with [A1] *EN 620:2002+A1:2010* [A1]*)*

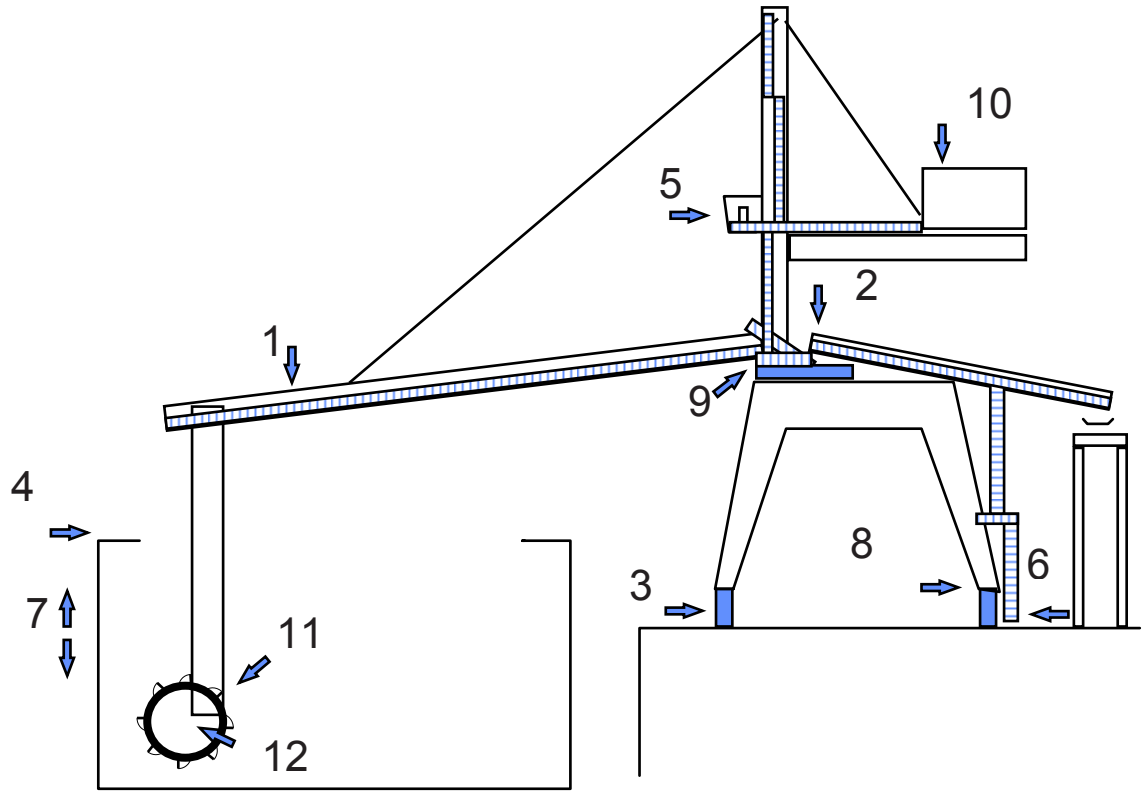


Figure 26

Table 11

Location of the risks	Requirements
1 - Mobile and slewing gangway (slip, trip and fall of persons)	See 5.1.9
2 - Luffing and slewing gangway (shearing, drawing-in, impact)	See 5.13.7, item 2, 2nd solution
3 - Rail wheels	See 5.1.4
4 - Ship coamings	See 5.1.8
5 - Control cabin :	
— emergency exit (loss of stability)	See 5.1.9
— safety glazing (cutting or shearing)	See 5.1.4
6 - Area where the equipment moves (impact)	See 5.13.7, point 4

" to be continued"

Table 11 *(concluded)*

Location of the risks	Requirements
7 - Ship movement	a device detecting underloading and warning the operator
8 – Travelling mechanisms	Automatically acting mechanical brakes and a braking device(s) for the out of service (parking) positions
9 – Slewing mechanisms	Automatically acting mechanical brakes and a braking device(s) for the out of service (parking) positions
10 – Luffing mechanisms	Automatically acting mechanical brakes
11 – Lifting and slewing mechanisms of the tool	Automatically acting mechanical brakes
12 – Buckett-wheel drives	A torque limiter to keep the maximum torque compatible with the design

5.13.12 Scrapers

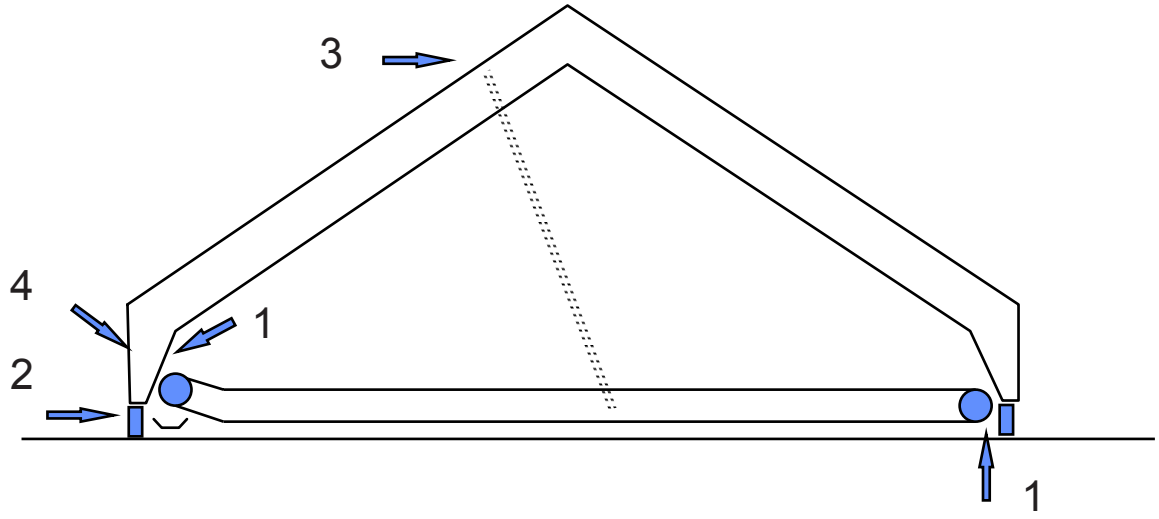


Figure 27

Table 12

Location of the risks	Requirements
1 - Conveyor scrapers (drawing-in)	— conveyor ends (discharge points) shall be fitted with guards — an acoustic warning signal shall be emitted before starting the equipment
2 – Travelling mechanisms	Automatically acting mechanical brakes and a braking devices for the out of service (parking) positions
3– Luffing mechanisms	Automatically acting mechanical brakes
4- rail wheels	See 5.1.4

5.13.13 Screw reclaimers working under an open stockpile

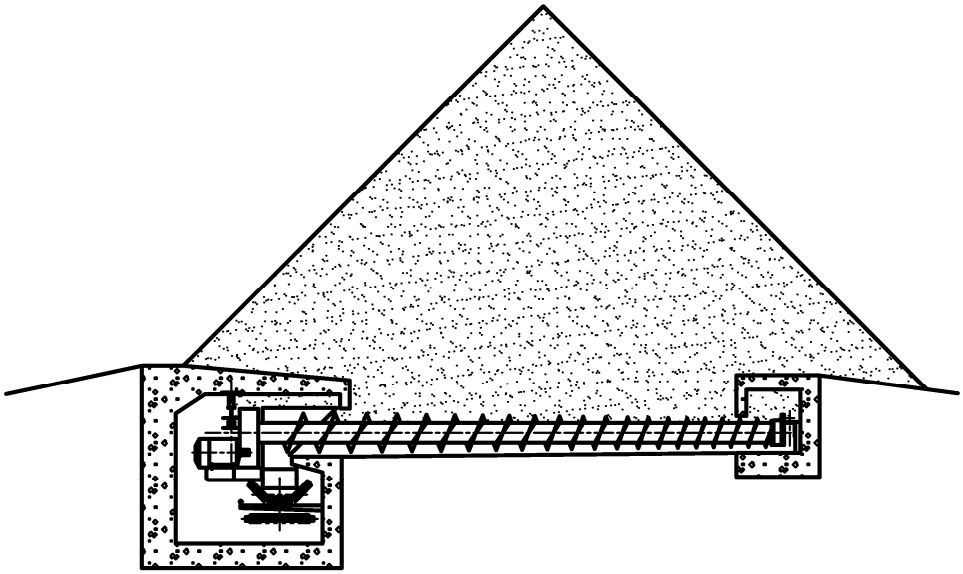


Figure 28

Table 13

(see 7.1.3 and 7.1.4 for instructions).

Location of the risks	Requirements
1 - Stockpile base (in the screw plane) (cutting, severing, drawing-in)	— warning light(s) indicating the running of the reclaimer visible anywhere on and around the stockpile, — warning signs ("Danger ! Access permitted to authorized personnel only") at every passageway to the stockpile, — acoustic signal before starting of the reclaimer (see 5.11.2.5).

For special instructions for use and for maintenance, see 7.1.3 and 7.1.4.

6 Verification of safety requirements and/or measures

6.1 General

Safety requirements and/or measures of clauses 5 and 7 and also requirements of clause 8 of this standard shall be verified according to the table 14 below, which covers:

a) Type verification of the machine type, the intention of which being to ensure that the type of machine complies with the requirements of this standard. (The first section of table 14).

b) Individual verification of each machine put on the market, the intention of which being to prove that before despatch, each machine satisfies all the safety requirements of this standard. Where the machine is assembled on site, the part of the verification that cannot be made before despatch shall be carried out at the place of use. (The second section of table 14).

The following methods of verification are included in table 14:

a) visual check : the intention of which only being to establish, whether something is present on the machine, system or component (e.g. guarding, visual warning device, marking, ...), or that documents, drawings are provided and are adequate to meet the requirements of the standard (symbol “V” in the table);

b) measurement : the intention of which being to establish whether the stated measurable parameters have been met (e.g. geometric dimensions, safety distances, isolation resistance of electric circuits, noise, vibration) (symbol “M” in the table);

c) Test(s):

   i) functional test: the intention of which being to establish whether, in an unloaded working operation, normal cycle or part of cycle, the machine, including all safety devices, works as intended and all functions comply with the requirements of this standard and with the technical documentation. (symbol “FT” in the table);

   ii) loaded test(s): tests outside the range of functional tests, the intention of which being to establish when the equipment is loaded with the bulk materials whether, e.g. strength and/or stability and all safety devices and their adjustments are adequate and the result of their actuation is in accordance with the requirements of this standard. (symbol “LT” in the table);

   iii) specific verification/ measurements (e.g. Electrical, EMC, Fire/Explosion risk, the intention of which being to establish whether stated parameters have been met (e.g. compliance with electrical standards) (symbol “SV” in the table).

Table 14

	Type verifications			Individual verifications		
Clauses N°	**Visual checks**	**Measurement**	**Tests**	**Visual checks**	**Measurement**	**Tests**
5	V			V		
5.1	V	M	FT	V		FT
5.1.1	V	M or calculation check		V		
5.1.1.1	V	M		V		
5.1.1.2	V	M		V		
5.1.1.3	V	M		V		
5.1.1.4	V		FT	V		FT
5.1.2.1	V	M		V		
5.1.2.2	V		FT	V		FT
5.1.2.3	V		FT	V		FT
5.1.3.1	V			V		
5.1.3.2	V		FT	V		FT
5.1.3.3	V			V		
5.1.3.4	V	M	FT	V		FT
5.1.4	V of the manu-facturers documents	M		V		
5.1.5	V			V		
5.1.6	V	M		V		
5.1.7.1	V			V		
5.1.7.2	V			V		
5.1.8	V			V		
5.1.9	V	M		V		
5.2.1			SV			SV
5.2.1.1	V			V		
5.2.1.2	V			V		
5.2.1.3	V			V		
5.2.2	V			V		
5.3			SV (see 6.2.2)			SV (see 6.2.1)
5.4			SV			SV
5.5.1	V	M		V		
5.5.2	V			V		
5.6			SV			SV
5.7	V		LT	V		LT
5.8	V		FT	V		FT
5.9	V			V		
5.10	V			V		
5.11.1			FT and LT			FT and LT
5.11.2.1	V			V		
5.11.2.2	V		FT	V		FT
5.11.2.3	V			V		
5.11.2.4	V		FT	V		FT
5.11.2.5	V		FT	V		FT
5.11.2.6	V		FT	V		FT
5.11.2.7	V	M	FT	V		FT
5.12	V		FT	V		FT
5.13.1	V	M		V		
5.13.2			FT			FT
5.13.3	V			V		
5.13.4	V			V		

" to be continued"

Table 14 *(concluded)*

	Type verifications			Individual verifications		
Clauses N°	**Visual checks**	**Measurement**	**Tests**	**Visual checks**	**Measurement**	**Tests**
5.13 .5	V	M		V		
5.13.6	V	M		V		
5.13.7	V	M	FT	V		FT
5.13.8	V	M	FT	V		FT
5.13.9	V	M	FT	V		FT
5.13.10	V	M	FT	V		FT
5.13.11	V	M	FT	V		FT
5.13.12	V	M	FT	V		FT
5.13.13	V		FT	V		FT
7	Verification of the content			V		
8			SV (see 6.2.1)			SV (see 6.2.1)

M Measurement
V Visual check
FT Functional test
LT Loaded test
SV Specific verification/measurements

6.2 Special verification

6.2.1 EMC compliance criteria (general aspects)

Compliance with the EMC requirements of clause 8, shall be checked in accordance with the standards mentioned. If testing of the completed continuous handling equipment is not reasonably practicable due to the size of the machinery, the manufacturer shall verify that all appropriate equipment sub-assemblies comply with requirements of clause 8. The manufacturer shall also verify, that these sub-assemblies are suitably installed and wired, to minimise the effects of disturbances on the equipment, to minimise generated disturbances and in accordance with any recommendations of the supplier(s) of the sub-assemblies.

6.2.2 Compliance with safety criteria related to EMC phenomena

Compliance with the EMC requirements of 5.3 above, shall be checked by carrying out preliminary testing and function testing. If testing of the completed continuous handling equipment is not reasonably practicable due to the size of the machinery, the manufacturer shall verify that all appropriate equipment sub-assemblies comply with requirements of 5.3 above. The manufacturer shall also verify, that these sub-assemblies are suitably installed and wired to minimise the effects of disturbances on the equipment and in accordance with any recommendations of the supplier(s) of the sub-assemblies.

7 Information for use - Instruction handbook

7.1 Instruction handbook

7.1.1 General

〚A1〛 The instruction handbook shall be in accordance with 6.5 of EN ISO 12100-2:2003 〈A1〉. and clause 7 of 〚A1〛 EN 620:2002+A1:2010 〈A1〉 for fixed belt conveyor mounted on the equipment. This information shall include the duties and conditions under which the equipment is intended to be used, in particular with regard to:

— the materials to be handled: indication of the maximum permissible characteristics (e.g. moisture, grains size, bulk density) and maximum permissible capacities (e.g. mass flow and volume flow for each material):

— description of operating modes (types, automatic/manual operation, hours/day);

— range of authorised environmental conditions (e.g. wind, temperature, relative humidity...);

— the maximum threshold of ambient sound pressure level for which the equipment is intended (see 5.1);

— the limit of working and traffic areas;

— the obligation for the user to read the instruction handbook;

— the guards designed to carry the weight of people.

[A1] The instruction handbook shall provide the following information on noise emission:

— The A-weighted emission sound pressure level at workstations, where this exceeds 70 dB(A); where this level does not exceed 70 dB(A), this fact shall be indicated;

— The peak C-weighted instantaneous value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 µPa);

— The A-weighted sound power level emitted by the machinery, where the A-weighted emission sound pressure level at workstations exceeds 80dB(A). [A1]

Details of safety functions and list and location of safety devices shall also be provided.

When supplied with a programmable logic system, the handbook shall contain all the instructions necessary for the modification of programs approved by the manufacturer.

The instruction handbook shall also contain information on prohibited applications such as:

— handling of materials or loads different from those specified and hazardous materials;

— use of equipment as a transportation method for people.

The instruction handbook shall mention that:

— it is necessary to draw attention to the fact that people shall not travel on or in material carrying elements of continuous handling equipment;

— when necessary, equipment of large height shall be equipped with aircraft warning lights in accordance with local regulations;

— when the equipment is operated in cold and damp conditions, the user shall check that the equipment does not conveyed any large lumps of the bulk material formed due to the ambient conditions which can cause a hazard;

— measures have to be taken to avoid discharge into traffic areas.

7.1.2 Instructions for the installation and commissioning of the equipment

The instructions for installation shall specify that:

a) a minimum clearance of 0,500 m shall be ensured between a fixed obstacle and:

   1) either mobile parts of a fixed machine;

   2) or mobile machines on a fixed path (rails);

   3) otherwise access shall be safeguarded in accordance with [A1] EN ISO 12100-2 [A1], e.g. fixed interlocking guard, trip device, ...).

b) When guardrails are fitted on the fixed structures of mobile rail-mounted machines, it is possible to depart from the above provisions and to reduce the clearance to 0,100 m, provided guardrails include two rails instead of one (see also, ▌A1⟩ EN 620:2002+A1:2010 ⟨A1▐).

When the equipment is supplied unassembled, then the manufacturer shall provide assembly specifications with the equipment, preferably including drawings showing:

— any special requirements for storage of the separate components supplied;

— electric connections, etc;

— the maximum weights and dimensions and lifting points of the separate components supplied;

— the methods for handling the components and equipment;

— the assembly phases;

— the fixing and anchoring positions to ensure stability during assembly and operation.

The instructions handbook shall also contain and describe the verifications and tests necessary before or during commissioning. These shall necessarily include the verification of speed and range of movements specified when designing the equipment.

For bucket elevators information shall be provided for the installation of fixed distance guards or protection from falling objects to be added that are not provided with the machines (see 5.13.3).

7.1.3 Instructions for the use of the equipment

▌A1⟩ The instruction handbook shall include, in addition to 6.5.1 d) of EN ISO 12100-2:2003: ⟨A1▐

— a statement that only authorised personnel shall start, operate or stop the normal working of the equipment;

— if necessary, description of the procedures to stop the equipment;

— instruction and procedures to make the equipment safe when not in use;

— a description of stopping modes and means, with a statement that normal and emergency stopping devices shall be made known to all appropriate personnel ; that areas giving access to them shall be kept clear of obstacles, and their proper working shall be periodically checked;

— cleaning requirements to avoid any dangerous accumulation of handled materials;

— a description of a safe system of work to free possible blockages;

— the information that where separate stop control and emergency-stop control are fitted, the emergency-stop control shall not be used for normal stopping;

— a statement that the closing movement of self closing doors shall not be blocked and that access guards for maintenance or repair in special operating modes (clause 5.1.2.3) shall be closed by the maintenance operator when inspection, maintenance or cleaning work is complete.

The instruction handbook shall also state that:

— it should not be assumed that stopped equipment is safe equipment, as stored energy may be released unintentionally or by incorrect maintenance procedures;

— some operations on a working machine, e.g. to free a blockage, can be dangerous;

— all restarting operations on an equipment which has been inoperative because of an emergency or accidental stoppage shall be preceded by an inspection aiming at:

  — determining the cause of the emergency or accidental stoppage;

  — verifying that the cause of stoppage is eliminated.

The instruction handbook shall draw the user's attention to the fact that:

— the user shall be careful to ensure regular feed, avoiding overloading;

— the user shall not modify the design or configuration of the equipment without consulting the manufacturer or his authorised representative;

— after modification of the design or configuration of the equipment, recommissioning shall be carried out in accordance with 6.3;

— all loading and working stations and passageways shall be kept clear and free of obstacles.

For loaders with scraping buckets the instruction handbook shall indicate that the screw shall only be started near the pile.

For screw reclaimers (5.13.13) under an open stockpile (not inclosed in a silo), the instruction handbook shall indicate that all operations on the stockpile shall be made using a safe system of work which includes:

— access to the pile with vehicles only;

— need for audio-communication to the control station;

— visual control of the stockpile from the control station;

— training of the operator on hazards due to material bridging;

— a minimum height of material to be kept during operation of the equipment above the screw ;

— stopping and disconnecting the equipment to remove the lowest part of the pile when it is necessary to get access to the screw for maintenance operation;

— hazards due to the equipment.

7.1.4 Instructions for maintenance

〚A1〛 In addition to the requirements of 6.5.1 of EN ISO 12100-2:2003 〈A1〉, the instruction handbook shall in particular specify :

a) the technical knowledge and skills of the maintenance staff especially for particular operations which need specific competence and shall specify that all adjustments, whether mechanical or electrical, must be carried out by persons authorised to do so in accordance with a safe system or work;

b) the conditions under which maintenance works, rectification of fault the inspection, adjustment, maintenance and cleaning of moving parts and of cleaning devices on continuous handling equipment can be performed e.g. the equipment is disconnected, protected against unexpected start-up and measures taken against unexpected movement;

c) a list of wearing parts, as well as the approximate frequency and conditions for their replacement;

d) a list of parts to be checked periodically including emergency stop devices;

e) in the case of utilisation of bolts with controlled tightening, the frequency of the checks as well as values of torque or tensions to be used for these bolts;

f) conditions for examination and discard of wire ropes and chains;

g) that access to maintenance and inspection points shall be kept clear of obstacles;

h) a statement that the closing movement of self closing doors shall not be blocked and that access guards for maintenance or repair in special operating modes (clause 5.1.2.3) shall be closed by the maintenance operator when inspection, maintenance or cleaning work is complete.

Attention shall be specifically drawn to the obligation of stopping and locking (e.g. padlocking) the power supply disconnecting means in the open position or the disconnected state of all or part of the equipment to replace certain components, (e.g. rollers, buckets).

The instruction handbook for maintenance will require (at least) that:

a) continuous handling equipment shall be kept in proper working condition and maintained in accordance with the manufacturer's instructions;

b) the inspection, adjustment, maintenance and cleaning of moving parts and of cleaning devices shall be carried out regularly in a safe manner according to the manufacturer's instructions;

c) the tension and centering of the carrying element shall be adjusted preferably when the equipment is stopped, the power supplied is disconnected and the disconnecting means is locked in the open position (e.g. padlocks);

d) inspection and adjustment of continuous mechanical handling equipment, in motion or in use, shall only be carried out with guards in position;

e) the frequency of the operations in b) and d) will depend on the nature of the materials conveyed. With the exception of automatic cleaning, or in the case of special devices designed to allow cleaning while the equipment is in operation, these operations shall only be undertaken when the equipment is at rest and after rendering the starting devices inoperative;

f) where a guard has to be displaced or removed and/or a safety device neutralised the work shall be carried out in accordance with ▌A1⟩ EN ISO 12100-2:2003, 5.5.4 ⟨A1▌;

g) repairs, and removal of protective enclosures or panels, shall only be carried out after stopping the equipment, and after starting devices have been rendered inoperative, by persons authorised to do so according to a safe system of work;

h) requirements for creation of maintenance or repair islands by protective devices, e.g. providing temporary fencing or barriers.

For screw reclaimers working under an open stockpile (5.13.13), the requirements of 7.1.3 apply using a permit-to-work system taking into account the presence of a second person.

7.1.5 Training

Where the training of user's operators has been deemed necessary, the training programme shall be included in the instruction handbook.

7.2 Marking

7.2.1 Machine plate

The equipment shall be marked legibly and indelibly with at least the following particulars:▌A1⟩

a) The business name and address of the machine manufacturer and where applicable, his authorised representative;

b) Year of construction, that is the year in which the manufacturing process is completed;

c) Designation of the machinery and the designation of series or type;

d) Machine identification or serial number, if any; 〈A1〉

e) rating information (supply) : voltage, frequency, power, pressure;

f) rating information (capacity) : e.g. working load limit, maximum capacity.

7.2.2 Warning signs

Signs related to electrical hazards shall comply with EN 60204-1 and 〈A1〉 EN 60204-11 〈A1〉.

A written sign (or pictogram) shall be installed to indicate, the accesses, passageways with reduced dimensions, emergency exits.

Points where a hazard may remain or appear (e.g. thermal hazard) shall be fitted with warning signs.

A written sign (or pictogram) shall be installed near the equipment when it can be cable-less or automatically controlled.

Written sign(s) or pictogram(s) shall be installed to indicate mobile machines, mobile parts of equipment.

Where a part of the equipment must be handled with lifting equipment, it’s mass shall be indicated legibly and unambiguously.

On mobile equipment at access point a warning signs ("Danger! Access permitted to authorised personnel only") shall be fitted.

Moreover, at control stations(s), the following shall be marked: "For information on the safe of the machine, see the instruction handbook".

8 Electromagnetic compatibility (EMC)

The electromagnetic disturbances generated by the continuous handling equipment shall not exceed the levels specified in generic emission standard 〈A1〉 EN 61000-6-3 〈A1〉. The continuous handling equipment shall also have sufficient immunity to electromagnetic disturbances to enable it to operate as intended when exposed to the levels and types of disturbance as specified in EN 61000-6-2. The manufacturer of the continuous handling equipment shall design, install and wire the equipment and sub-assemblies, taking into account the recommendations of the supplier(s) of the sub-assemblies, to ensure that the effects of electromagnetic disturbances thereon shall not lead to unintended operation.

In particular, the following loss of performance or degradation of performance shall not occur:

— any sequencing, timing or counting errors;

— speed variation in excess of ± 20 % of the setting value;

— increase/decrease of starting operation duration by more than 10 %;

— reduction in non-safety related fault detection capability.

For those tests specified in EN 61000-6-2, any degradations of performance or loss of function allowed with regard to performance criteria “A” & “B” shall be declared by the manufacturer. Any temporary loss of function allowed with regard to performance criteria “C” shall be declared by the manufacturer.

NOTE Information on measures to reduce generated disturbances and measures to reduce the effects of disturbances on the continuous handling equipment is given in EN 60204-1, clause 4.4.2.

Annex A
(normative)

List of significant hazards

Table A.1

N°	Hazards	Requirements/ measures clause 5 and 7
1	mechanical hazards	//////////////////
1.1	generated by machine parts or workpieces caused, for example by :	////////////////// //////////////////
1.1.1	shape	5
1.1.2	relative location	5.1 5.1.6 7.1.2 5.13
1.1.3	mass and stability (potential energy of elements which may move under the effect of gravity)	5.1.8 5.13 5.11.1
1.1.4	mass and velocity (kinetic energy of elements in controlled or uncontrolled motion)	5.1.1.2 5.11.2.6 5.11.1 5.13
1.1.5	inadequacy of mechanical strength of guards	5.1.1
1.2	accumulation or energy inside the machinery caused, for example by	//////////////////
1.2.1	elastic elements (springs)	5.1.3.3
1.2.2	liquids and gases under pressure	Not dealt with
1.3	elementary forms of mechanical hazards	////////////////// //////////////////
1.3.1 1.3.2	crushing hazard shearing hazard	5.1 5.1.3 5.13 7.1.4
		" to be continued "

Table A.1 *(continued)*

N°	Hazards	Requirements/ measures clause 5 and 7
1.3.3	cutting or severing hazard	5.1.4 5.13
1.3.4 1.3.5	entanglement hazard drawing-in or trapping hazard	5.1.5 5.13 7.1.4
1.3.6	impact hazard	5.1.6 5.13 7.1.4 7.2.2
1.3.7	friction or abrasion hazard	5.1 7.1.4
1.3.8	high pressure fluid injection or ejection hazard	Not dealt with
2	electrical hazards due to	////////////////////////// //////////
2.1 2.2	contact of persons with live parts (direct contact) contact of persons withpart which have become live under faulty conditions (indirect contact)	5.2.1 5.2.1.1 to 5.2.1.3 7.1.4
2.3	approach to live parts under high voltage	5.2.1
2.4	electrostatic phenomena	5.2.2
2.5	thermal radiation or other phenomena such as the projection of molten particles and chemical effects form short circuits, overloads, etc...	Not dealt with
3	thermal hazards, resulting in :	////////////////////////// //////////
3.1	burns and scalds, by a possible contact of persons with object or materials with an extreme temperature	5.5.1
3.2	health-damaging effects by hot or cold work environment	5.5.2
4	hazards generated by noise, resulting in :	////////////////////////// //////////
4.1	hearing losses (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	Not dealt with

" to be continued"

Table A.1 *(continued)*

N°	Hazards	Requirements/ measures clause 5 and 7
4.2	interference with speech communication,acoustic signals, etc.	Not dealt with
5	Hazards generated by vibration :	Not dealt with
6	hazards generated by radiation	//////////////////
6.1	low frequency, radio frequency radiation, micro waves	5.3
6.2	infrared, visible and ultraviolet light	Not dealt with
6.3	χ and gamma rays	Not dealt with
6.4	α and β rays, electron or ion beams, neutrons	Not dealt with
6.5	Lasers	Not dealt with
7	hazards generated by materials and substances processed, used by the machinery and by its constituent materials	////////////////////////// //////////////////
7.1	hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	Not dealt with
7.2	fire or explosion hazards	5.6 5.13.3 7.1.1
7.3	biological and micro-biological (viral or bacterial hazards)	Not dealt with
8	hazards generated by neglecting ergonomic principles in machine design as, e.g. hazards from :	////////////////////////// //////////////////
8.1	unhealthy postures or excessive efforts	Not dealt with
8.2 8.3	inadequacy with human hand-arm or foot-leg anatomy neglected use of personal protection equipment	Not dealt with
8.4	inadequate local lighting	Not dealt with
8.5	mental overload or undersold, stress	5.9
8.6	human error, human behaviour	5.2 5.11 5.13 7.1.3 7.1.4 7.2.2
8.7	inadequate design, location or identification of manual controls	5.2 5.11.2.7
8.8	inadequate design, location or visual display units	5.2

"to be continued "

Table A.1 *(continued)*

N°	Hazards	Requirements/ measures clause 5 and 7
9	combinations of hazards	Not dealt with
10	unexpected start-up, unexpected overrun-overspeed (or any similar malfunction) from :	////////////////////////// //////////////////
10.1	failure-disorder of the control system	5.11.2.4
10.2	restoration of energy supply after an interruption	5.2.1 7.1.3 7.1.4
10.3	external influences on electrical equipment	5.2.1.2 5.3,8
10.4	other external influences (gravity, wind, etc)	5.1 5.1.7 5.1.8 5.11.2.2 5.13
10.5	errors in software	Not dealt with
10.6	errors made by the operator (due to mismatch of machinery with human characteristics and abilities) (see 8.6)	Not dealt with
11	impossibility of stopping the machine in the best possible conditions	5.11.2 7.1.1 7.1.4
12	variations in the rotational speed of tools	Not dealt with
13	failure of the power supply	5.11.1 7.1.3
14	failure of the control circuit	5.3 5.11.2 7.1.1
15	errors of fitting	5.2.1.3 7.1.2
16	break-up during operation	Not dealt with
17	falling or ejected objects	5.1.3.4 5.1.7 5.7 5.11.1 5.13 7.1.3

"to be continued"

Table A.1 *(continued)*

N°	Hazards	Requirements/ measures clause 5 and 7
18	lost of stability - overturning of machinery	5.1.8 7.1.2
19	slip and fall of persons (related to machinery)	5.1.9 7.1.2
	additional hazards, hazardous situations and hazardous events due to mobility	
20	relating to the travelling function	////////////////
20.5	excessive oscillations when moving	Not dealt with
20.6	failure of power supply	5.11.1 5.11.2.6 5.13
21	linked to the work position (including (driving station) on the machine	////////////////////////// ////
21.1	fall or persons during access to (or at/from) the work position	5.1.9
21.4	mechanical hazards at the work position	5.1 5.13 7.1.3 7.1.4
21.5	Insufficient visibility from the work position	5.10
21. 10	insufficient means for evacuation/emergency exit	5.1.9 5.8
23	lack of stability	5.1.8 7.1.1
24	due to the power source and to the transmission of power	////////////////////////// ////
24.3	hazards from coupling and towing	Not dealt with
25	from/to third persons	////////////////
25.2	drift of a part away from its stopping position	5.1.8 5.11.2.6
	additional hazards, hazardous situations and hazardous events due to lifting	
27	mechanical hazards and hazardous events	
27.1	from load falls, collisions, machines tipping caused by :	////////////////////////// ////

"to be continued"

Table A.1 *(concluded)*

N°	Hazards	Requirements/ measures clause 5 and 7
27.1.2 27.1.3 27.1.4	uncontrolled loading - overloading - overturning moments exceeded uncontrolled amplitude of movements unexpected-unintended movement of load	 5.1.8 5.7 7.1.1
27.8	From abnormal conditions of assembly/ testing/use/maintenance	5.12
28	electrical hazards	///////////////
28.1	from lightning	5.4

Annex B
(informative)

Fire or explosion hazard

Many finely divided organic materials, both natural and synthetic are capable of causing dust explosions. Some metal and inorganic materials are also explosible. A powdered material is unlikely to cause a serious explosion risk unless it contains a significant proportion of combustible dust of particle size less than 200 microns.

NOTE 1 Requirements for equipment intended for use in explosive atmospheres are under consideration by CEN/TC 305.

NOTE 2 It is essential when carrying out the hazard analysis and risk assessment for fire and explosion hazards in the conveying system, that account is taken of upstream and downstream processes, as fires which start in conveying equipment may cause explosions in upstream or downstream processes and vice-versa.

NOTE 3 Reference should be made to specific standards e.g. FEM/VDI 3673.

NOTE 4 A method of test for possibly explosible materials is given in EN 26184-1.

Where a concentration of these dusts represents a risk of explosion, precautions shall be taken to remove these dusts at their source, especially at transfer points and in hoppers. If necessary, explosion venting or suppression equipment shall be fitted, in particular in totally enclosed equipment.

If equipment is intended to convey finely divided materials(dusts), with a possible risk of fire and explosion, the equipment shall be suitably designed to minimise the risk, in accordance with EN 1127-1.

If explosive materials is handled, risk of fire or explosion shall be minimised, by e.g.

— positioning sources of ignition outside the dusty area, e.g. bearings, items with mechanical friction or impact ;

— by using electrical equipment suitable for hazardous areas zone 20, 21 or 22 (see IEC 61241-1-2:1999 and EN 1127-1) ;

— anti-static measures (see 5.2.2) ;

— using speed, rotation detectors, belt deviation detectors, where there is risk of sparks from failed mechanical components ;

— using indicators, detection means and/or overload detectors where there is risk of jamming or blocking.

If explosive materials is handled, the consequences of fire and explosion shall be minimised by e.g.

— using explosion vents, explosion suppression systems, pressure resistant or pressure shock resistant design in particular in totally enclosed equipment.

If explosion vents are fitted they shall be sited at the ends or other locations where the material flow is restricted. Conveyors more than 10m long may need additional vents. Advice on the spacing needed between vents, and related matters is contained in FEM/VDI 3673.

Explosion vents shall be interlocking in accordance with 4.1.1 of EN 1088 and if opened, the conveying system and other connected equipment shall stop automatically.

Relief valves, bursting panels, doors, or other appropriate devices, shall be positioned and designed so that in the event of an explosion, materials or devices are not ejected into traffic or working areas.

The system shall be designed to withstand, without failing, the maximum pressure which can arise in practice including the pressure to initiate the explosion relief equipment).

NOTE 5 this requires a knowledge of the pressure strength of the equipment.

NOTE 6 special attention shall be paid if abrasive material is conveyed.

NOTE 7 for pressure relief calculation see VDI 2263.

There shall always be at least two exits from any workstation or permanent means of access. These shall be arranged so that it is not possible to get trapped in case of fire, explosion, etc.

For emergency exit from control cabins see 5.1.9.

Annex ZA
(informative)

A1 Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. A1

Annex ZB
(informative)

Clauses of this European Standard which address Principal Protection Requirements of the EU Electro-magnetic compatibility Directive [A1] 2004/108/EC [A1]

This European standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive(s).

— [A1] Electromagnetic Directive 2004/108/EC [A1]

Compliance with clause 8 of this standard provides one means of conforming with the specific essential requirements of the Electromagnetic Compatibility Directive concerned and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

FEM 2 581 : 11.1991, *Properties of bulk materials*

FEM 2 582 : 11.1991, *General properties of bulk materials and their symbolisation*

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ECE Règle N° 43, (United Nations) *Uniform requirements related to the approval of safety glass and materials for glazing*

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BSI Group
Headquarters 389
Chiswick High Road,
London, W4 4AL, UK
Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
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