BRITISH STANDARD

BS EN
617:2001

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

The European Standard EN 617:2001 has the status of a British Standard

ICS 53.040.01

National foreword

This British Standard is the official English language version of EN 617:2001.

The UK participation in its preparation was entrusted to Technical Committee MHE/9, Mechanical handling, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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EUROPEAN STANDARD

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English version

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

Equipements et systèmes de manutention continue - Prescriptions de sécurité et de CEM pour les équipements de stockage des produits en vrac en silos, soutes, réservoirs et trémies

Stetigförderer und Systeme - Sicherheits- und EMV-Anforderungen an Einrichtungen für die Lagerung von Schüttgütern in Silos, Bunkern, Vorratsbehältern und Trichtern

This European Standard was approved by CEN on 4 June 2001.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 617:2001 E

Contents

Foreword

This European Standard 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 January 2002, and conflicting national standards shall be withdrawn at the latest by January 2002.

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).

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

Within the framework of its programme of work, CEN/TC 148 requested the working group 4 ”Safety requirements for the storage of bulk materials in silos, bunkers, bins and hoppers " to prepare the following standard :

— 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.*

This draft standard forms part of a series of five draft 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.*

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

— prEN 619, *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.*

Annex A is normative, the annexes B, C, D, ZA and ZB are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard is a type C standard as stated in EN 1070.

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

While producing this standard it was assumed that :

— only competent persons operate the system ;

— components without specific requirements are :

a) designed in accordance with the usual engineering practice and calculation codes, including all failure modes (see also Bibliography and annex B) ;

b) of sound mechanical and electrical construction ;

c) made of materials with adequate strength and of suitable quality ;

d) made of materials free of defects.

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

— components are kept in good repair and working order, so that required characteristics remain despite wear ;

— by design of the load bearing elements, a safe operation of the system is assured for loading ranging from zero to 100 % of the rated possibilities and during the tests ;

— to ensure the correct function of the equipment the ambient temperature is maintained between -5 °C to + 50 °C;

— negotiation occurred between the manufacturer[1)] and the user concerning particular conditions for the use and places of use for the machinery related to health and safety ;

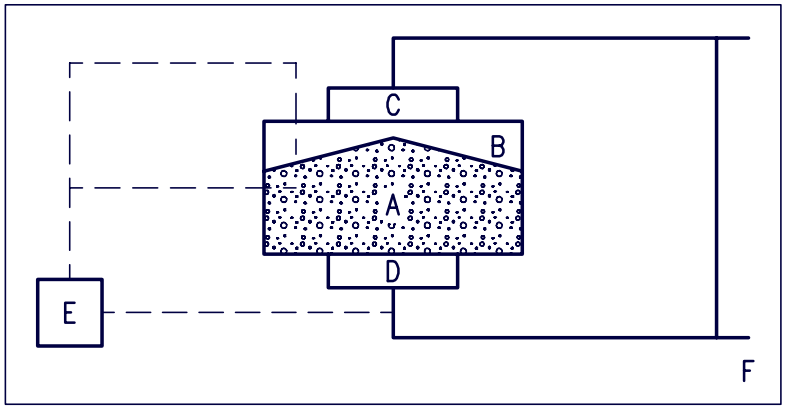
— the place of installation allows a safe use of the machine.

1) “manufacturer” within the European Union is to be understood as intended in the Machinery Directive.

1 Scope

This European Standard deals with the technical requirements to minimise the hazards listed in clause 4 and annex A. These hazards can arise during the operation and maintenance of equipment to store bulk materials in silos, bunkers, bins and hoppers and their built-in inlet and outlet devices when carried out in accordance with the specifications given by the manufacturer or his authorised representative. This standard deals with safety related technical verification during commissioning.

The following parts are dealt with in this standard (see Figure 1) :



Key

A Bulk material to be stored
B Storage space limited by the silo structure
C Charging
D Discharging
E Associated and additional equipment (e.g. flow aid devices, instrumentation, local control systems)
F Working and traffic area

Figure 1 – Parts of a storage equipment

NOTE Silos are made of different materials e.g. concrete, steel, aluminium, spun rayon, wood.

Safety requirements and/or measures in this standard apply to equipment used in all environments. However, additional risk assessment and safety measures need to be considered in severe conditions, e.g. low or high temperatures out of the range covered by EN 60204-1, corrosive environments, strong magnetic fields, radioactive conditions and bulk materials to be stored included their flow the nature of which could lead to a dangerous situation.

This standard does not cover requirements for :

— movable, non permanent storage equipment such as road vehicles, rail wagons, containers for bulk materials, ships and barges ;

— blow tanks and pressure vessels as used in pneumatic conveying systems ;

— stockpiles and flat storage ;

— storage equipment for non bulk materials (liquid, gas, slurries, sludge, silage) ;

— dismantling and transport of storage equipments;

— procedure for entering the silo and behaviour of persons inside the silo;

— storage equipments for underground mining.

This European Standard deals with the technical requirements for electromagnetic compatibility (EMC).

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 131, *Ladders - Terms, types, functional sizes*.

EN 292-1, *Safety of machinery - Basic concepts, general principles for design – Part 1: Basic terminology, methodology.*

EN 292-2:1991, *Safety of machinery - Basic concepts, general principles for design – Part 2: Technical principles and specifications.*

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 the parts of the human body*.

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

EN 547-1:1996, *Safety of machinery - Human body measurements – Part 1: Principles for determining the dimensions required for openings for whole body access into machinery*.

EN 547-3, *Safety of machinery - Human body measurements – Part 3: Anthropometric data*.

EN 563, *Safety of machinery - Temperatures of touchable surfaces – Ergonomics data to establish temperature limit values for hot surfaces*.

EN 574, *Safety of machinery - Two- hand control devices - Functional aspects - Principles for design.*

prEN 618, *Continuous handling equipment and systems - Safety and EMC requirements for equipment for mechanical handling of bulk material except fixed belt conveyors*.

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

EN 626-1, *Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery – Part 1: Principles and specifications for machinery manufacturers*.

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

EN 795, *Protection against falls from a height - Anchor devices – Requirements and testing*.

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

EN 842, *Safety of machinery - Visual danger signals - General requirements, design and testing*.

EN 953:1997, *Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards.*

EN 954-1:1996, *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 1088:1995, *Safety of machinery - Interlocking devices associated with guards - Principles for design and selection*.

EN 1127-1, *Explosive atmospheres – Explosion prevention and protection – Part 1: Basic concepts and methodology.*

prEN ISO 14122-1, *Safety of machinery - Permanent means of access to machines and industrial plants – Part 1: Choice of a fixed means of access between two levels (ISO/FDIS 14122-1:1999)*.

prEN ISO 14122-2, *Safety of machinery - Permanent means of access to machines and industrial plants – Part 2: Working platforms and walkways (ISO/FDIS 14122-2:1999)*.

prEN ISO 14122-3, *Safety of machinery - Permanent means of access to machines and industrial plants – Part 3: Stairways, stepladders and guard- rails (ISO/FDIS 14122-3:1999)*.

prEN 12464, *Lighting applications – Lighting of work places*.

prEN 13202:1998, *Ergonomics of thermal environment - Temperatures of touchable hot surfaces - Guidance for establishing surface temperature limit values in production standards with the aid of EN 563*.

EN 26184-1, *Explosion protection systems - Part 1: Determination of explosion indices of combustible dust in air (ISO 6184-1: 1985).*

EN 50081-1, *Electromagnetic compatibility - Generic emission standard - Part 1: Residential, commercial and light industry.*

EN 60204-1:1997, *Safety of machinery - Electrical equipment of machines – Part 1: General requirements (IEC 60204-1:1997)*.

prEN 60204-11:1998, *Safety of machinery - Electrical equipment of machines - Part 11: General requirements for voltage above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV*.

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989).*

EN 60825-1, *Safety of laser products – Part 1: Equipment classification, requirements and user's guide (IEC 60825-1:1993)*.

EN 60947-5-1:1997, *Low voltage switchgear and controlgear - Part 5: Control circuit devices and switching elements - Section 1: Electromechanical control circuit devices (IEC 60947-5-1:1997)*.

IEC 60364-7-706, *Electrical installations of buildings- Part 7: Requirements for special installations or locations. Section 706 – Restrictive conducting locations.*

EN 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments (IEC 61000-6-2:1999).*

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

ISO 3435, *Continuous mechanical handling equipment - Classification and symbolisation of bulk materials*.

ISO 3864, *Safety colours and safety signs*.

3 Terms and definitions

For the purposes of this standard the terms and definitions in EN 292-1 and the following terms and definitions apply :

3.1
silo
that part of a continuous handling system used to contain intended kind(s) of bulk material(s) during a certain period of time. The silo is usually charged from the top and discharged from one or more outlets at the bottom or side

With regard to this document ”silo” is a generic term for bunker, bin, and hopper.

3.2
bulk material
a bulk material is a mixture consisting of a minimum of two phases, solid and gas. Normally liquid is also present in a bulk material and is referred to as moisture content. The solid in a bulk material consists of fine or coarse particles or of larger pieces or mixtures of these. In practice bulk materials are known as dusts, powders, meals, grains, granules, lumps, and pellets

NOTE For further information relating to description and classification of bulk materials see FEM 2.381 and FEM 2.581/2.582 (see Bibliography) and ISO 3435 (clause 2).

3.3
charging
devices to facilitate silo filling

3.4
discharging
devices to facilitate silo emptying. The minimum function of this equipment is :

— withdrawal of bulk material through the designed outlet ;

— converging of bulk material from the silo to downstream equipment (e.g. airlocks, gates) ;

— provision of the intended discharge rate(s).

3.5
working area
an area as intended by the manufacturer where persons operate equipment under normal conditions (inspection, maintenance and cleaning are excluded)

NOTE For manufacturers information relating to intended use see Introduction, negotiation.

3.6
traffic area
an 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

NOTE For manufacturers information relating to intended use see Introduction, negotiation.

3.7
flow aid devices
additional equipment to assist the flow of bulk materials from silos. These can be static or dynamic. Static aids include all types of wall linings and non-moving inserts. Dynamic aids include all moving inserts and also fixed or moving equipment that may incorporate all forms of energy input into the bulk material e.g. via air, vibration (including sound), mechanical agitation etc.

3.8
flow channel
a route through a bulk material stored in a silo through which flow can occur

Flow channels are usually wider at the top than at the silo outlets and have quite steep walls. When flow channels are present the full capacity of the silo may not be realisable.

3.9
flow behaviour
the characteristic or pattern of bulk materials flow during the discharge period in a silo, known as mass flow, core flow (funnel flow), rat-holing, etc.

3.9.1
mass flow
flow behaviour of bulk material in a silo during the discharge period. All particles of bulk material are in motion towards the outlet during this period of time. No dead or stagnant zones occur

NOTE Mass flow silos empty completely.

3.9.2
core flow
flow behaviour of bulk material in a silo during the discharge period. At the beginning of the discharge period only a core zone of bulk material is in motion towards the outlet. Bulk material adjacent to this core zone remains stationary. The movement of bulk material starts above the outlet, forming a flow channel or funnel (funnel flow) which either extends up vertically to the top surface of bulk material or inclined to the silo walls. The geometry of this flow channel can be variable. As discharge operation proceeds, bulk material surrounding the flow channel either gradually slides down into the channel on certain slip lines or remains stationary forming a stable hole which is referred to as rat-holing or piping

NOTE Core flow is also referred to as funnel flow.

3.9.3 rat-holing
flow behaviour of bulk material in core flow (see core flow) forming a stable hole shaped like a pipe or a rat-hole

NOTE Rat-holing is also referred to as piping.

3.9.4
flooding
flow behaviour of aerated or fluidised bulk material, caused by increase of the contained air or voidage. These bulk materials show properties similar to a liquid, resulting in flooding dischargers, feeders or flushing through small gaps between flanges, gates etc.

NOTE Flooding is also referred to as flushing.

3.9.5
arching
the formation of a blockage of bulk material in a silo which obstructs flow. It can occur at any position in the silo but is usually to be found in any converging section. The arch can be caused by particles held in position by mechanical friction or by all forms of cohesion e.g. surface tension, van der Waals forces, electrostatic charges, icing up, crystallisation

NOTE Arching is also referred to as bridging, or doming.

4 Hazards

This clause contains the 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.

Risks in systems for the storage of bulk materials in silos are very different from those risks resulting from the hazards for typical machines listed in EN 292-1 and EN 292-2. Therefore in annex A, the types of hazards are marked with respect to systems for the storage of bulk materials.

The following hazards in equipment for the storage of bulk materials in silos are of major importance :

— **hazards arising from bulk materials**, which can cause risk of fire, explosion, noxious vapours, burns, uncontrolled increasing or lowering of the temperature ;

— **hazards arising from the problems associated with the flow of bulk materials** and/or initiated by associated equipment (mass flow, core flow, arching, flooding, overfilling, overloading, etc.) ;

— **hazards in connection with entry of persons into silos.**

5 Safety and EMC requirements and/ or measures

Machinery shall comply with the safety requirements and/or measures of this clause and in addition with EN 292-1 and EN 292-2 for hazards relevant but not significant which are not dealt with in this standard.

Charging and discharging equipment covered by prEN 618, EN 620 and/or EN 741 shall comply with the requirements of these standards.

For the application of EN 547-1, EN 547-3, EN 842, EN 953:1997, 5.3 of EN 954-1:1996, 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.

5.1 Mechanical hazards

Mechanical hazards shall be safeguarded by guards.

Appropriate safety distances in accordance with EN 349:1993, Table 1 or EN 294:1992, Table 1 or Tables 2, 3, 6 and EN 811:1996 and/or hinged or slidable guards, fixed enclosing guards, fixed distance guards or interlocking guards shall be provided to protect operators from crushing and shearing hazards.

5.1.1 Guard construction

Guards shall be in accordance with EN 953 and may be perforated or imperforate sheet construction. If of perforated construction, the safety distances to prevent danger areas being reached shall comply with EN 294:1992 (see 5.1 above).

Where it is intended to step on covers or guards, they shall be able to withstand a force of 1 500 N evenly distributed over an area of 0,2 m × 0,2 m, with a deformation less 1 % of any reference dimension and no contact with moving parts. After 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 a area of 0,2 m × 0,2 m with a deformation less 1 % of any reference dimension and with no contact with moving parts. After loading it shall be possible to reuse the guard.

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

5.1.1.1 Fixed enclosing guards

Fixed enclosing guards shall be in accordance with 3.2.1 of EN 953:1997. 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 EN 294:1992, Tables 3, 4 or 6 and EN 811:1996, Table 1.

5.1.1.2 Fixed distance guards

Fixed distance guards shall be in accordance with 3.2.2 of EN 953:1997. 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: 1992, Table 2.

5.1.1.3 Hinged or slidable guards

For hinged guards (e.g. doors) 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 opening and compartment are large enough for any person to enter, the panel shall be capable of being opened from inside without a key or tool. Openings shall conform with EN 294:1992, Tables 3, 4 or 6 and EN 811:1996, Table 1.

5.1.1.4 Interlocking guards

Interlocking guards shall be in accordance with 3.5 of EN 953:1997, shall be securely fixed in position and shall use interlocking devices in accordance with EN 1088: 1995, 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:

1) safety distance of EN 294:1992, Tables 2, 3, 4, 6 and EN 811:1996, Table 1 shall be met ; or

2) 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 294:1992, Table 4 and EN 811:1996, Table 1.

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

5.1.2.2 Access guards for maintenance or repair out of operation

If access guards for maintenance or repair out of operation are intended to be opened more frequently than once every eight hours they shall be interlocked with guards.

If access guards for maintenance or repair out of operation are intended to be opened less frequently than once every eight hours they shall be opened with a tool or a key.

If there are hinged or slidable guards they shall be retained open by a positive engagement device.

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 5.10.1.2 shall be fixed, hinged or slidable guards. They shall be retained open or shut by a positive engagement device. They shall be able to be opened from inside without a tool or a key.

5.1.3 Crushing

The lowering and raising system of chutes and telescoping pipes shall be fitted with a safety device to prevent the accidental lowering, or lifting, of the articulated part, and to prevent kickback of any manually operated crank.

The device for lowering and raising the movable part shall be so located that there is no necessity for the operator to be under the equipment. The range of movement in any direction shall be limited by safety devices, so as to ensure a minimum gap according to EN 349:1993, Table 1 (body and head).

The devices for operating the equipment shall be so located or designed that :

— bulk material cannot fall down on the operator ;

— the operator cannot be crushed by vehicles (e.g. not in a traffic zone).

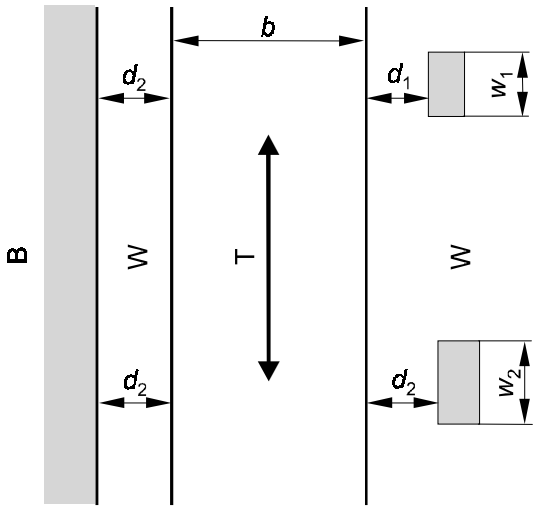
NOTE The operator can also be the driver of the lorry.

If it is intended by the manufacturer that the bulk materials are transported away by vehicles, the minimum horizontal distances for traffic and working areas between the structure of the silo and the vehicles intended by the manufacturer shall be designed as follows :

Vertical : Minimum vertical height shall be 2,1 m.

NOTE This should take into account the vehicle to be loaded.

Horizontal (see Figure 2) :



v	**w_1**	**w_2**	**d_1**	**d_2**
≤ 30 km/ h	< 300 mm	≥ 300 mm	500 mm	700 mm
> 30 km/ h	< 300 mm	≥ 300 mm	700 mm	700 mm

with :

T Direction of travel
B Building, warehouse, wall
W Working area
w_1, w_2 Length of obstacles in direction T
d_1, d_2 Minimal horizontal distances
v Maximal intended velocity (see 7.2.3)
b Maximum intended width of the vehicles

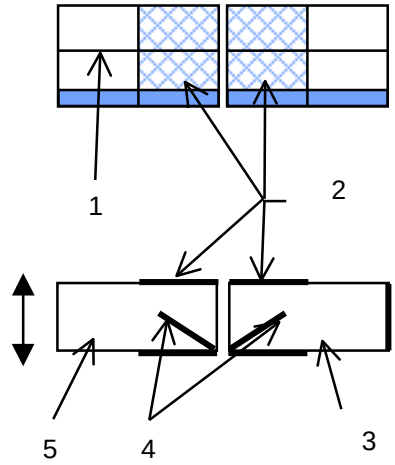
In case of non rail vehicles these minimum horizontal distances shall be safeguarded by wheel guides e.g. steps, curbs or guard rails. This equipment shall be of an adequate height (more than 0,2 m) and stability.

Figure 2 – Minimal horizontal safety distances d_1, d_2

5.1.4 Shearing, cutting or severing

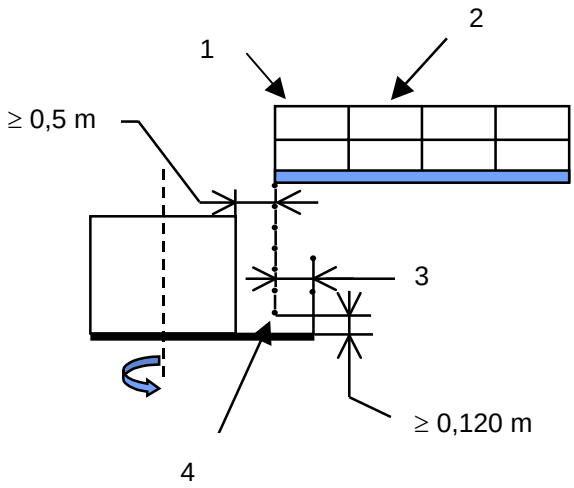
In the working and traffic area moving parts of silo charging and discharging equipment shall be safe guarded either by distance guarding as required in EN 294:1992, Table 2 (e.g. for clamshells, knifegates, valves, chutes) or with enclosing guards (e.g. for pneumatic cylinders).

If access between fixed and moving platforms or gangways is intended by the manufaturer the solutions given in Figure 3 shall be taken.



Key
1 Guardrail
2 Fixed guard
3 Fixed platform
4 Doors
5 Mobile platform

3.1 – Access on the same level



Key
1 Self closing and self locking door
2 Fixed platform
3 0,22 m to 0,2 m or if not ≥ 0,5 m
4 Relative speed v ≤ 0,15 m/s

3.2 – Access by means of a ladder

Figure 3 – Access between fixed and mobile parts

5.1.5 Entanglement

Where access to silo space B may be necessary whilst the equipment is working as a minimum one of the following shall be provided :

1) for complete emptying :

— inlets of discharge equipment shall comply with EN 294:1992, Table 1 and EN 811:1996, Table 1 by design, or

— inlets of discharge equipment shall be equipped with fixed guards according to EN 953:1997, 5.3.2, EN 811:1996, Table 1 and EN 294:1992, Table 1 or

— discharge equipment shall be equipped with a fixed two- hand control device according to EN 574 (category 1). This device shall be located outside silo space B. When operating the discharge equipment working inside silo space B shall be visible completely, or

— the discharge equipment shall be equipped with a temporary cable connected remote control. The plug of this device shall be located outside silo space B. Plugging in shall give automatically priority of this device to all other controls. The control cable between plug and operating console shall be sufficient in length and flexibility to allow the operator safe distance to moving parts. Minimum distance shall be at least 1,1 m. The distance from the underside of the console to the floor shall be within 0,9 m and 1,5 m. On the console the controls with exception of any emergency stop shall be safe guarded against inadvertent operation. If the discharging equipment is able to move to more than one dimension (e.g. screw feeder which is turning around a longitudinal and a vertical axis) the speed of movement towards the operator shall be limited to 0,3 m/s maximum.

2) for means of maintenance :

— the requirements given above shall be fulfilled, or

— temporary guarding of the discharge equipment shall be foreseen. These guards shall comply with EN 811:1996, Table 1 and EN 294:1992, Table 1 after installing. Installing shall be possible without any additional hazard.

5.1.6 Drawing-in or trapping

5.1.6.1 General

Sinking into and being drawn in the bulk material, being buried under the bulk material shall be prevented by the following requirements:

In traffic areas any opening in a silo shall be guarded with one of the following where the dimensions of the opening(s) are over 0,2 m by 0,2 m or a diameter over 0,3 m.

At the top of the silo :

a) fixed guards around free openings ;

NOTE 1 These fixed guards are normally situated in a vertical position and can be guard-rails.

NOTE 2 External actions on these guards can be caused by shocks induced e.g. by vehicles, grabs. This should be taken into account.

b) fixed bars, grids or nets of an adequate strength (see 5.1.1) and width of meshes (taking EN 294:1992, Table 1 into account) ;

NOTE Loading can be due to persons, materials, lorries etc.

c) lids, hinged or not complying with 5.1.1 and taking into account adequate strength (see b) above). These shall be designed so that they can easily be moved without any danger of personnel falling into the silo ;

NOTE This equipment is normally situated as shown in Figure 4.1 and maintained closed by locks or screws.

d) openings between the charging devices and the silo smaller than 0,2 m need not be guarded.

In the sidewalls of the silo :

a) inspection panels complying with 5.1. 2 and equipped with hinges with a vertical axis ;

b) access door(s) to storage space B shall be self-locking and self-closing by design. Opening from outside shall only be possible with means not permanently attached to the door. Opening from inside shall always be possible without any special means. There shall be an additional equipment to prevent persons from falling into storage space B after opening the door. As a minimum a handrail complying with prEN ISO 14122-3 shall be installed.

NOTE These doors are normally situated as shown in Figure 4.2.

Guards (lids, grids or other covering appliances) shall be designed to avoid them falling into or off the silo, e.g. by the use of hinges, chains etc.

5.1.6.2 Access into storage space B

Where it is intended to go into storage space B, the following measures apply:

NOTE Where the cross section of the silo increases, several inspection doors or entrances may be necessary.

1) Access into the silo shall only be obtained from a traffic area.

2) The access openings shall have a minimum size of 600 mm.

3) Adequate space shall be provided to ensure safe entry and rescue and possible use of person lifting means, e.g. silo lift (see introduction " negotiation ").

4) The structure of the silo shall provide free space on the whole height for the passage of a person using lifting means, e.g. silo lift.

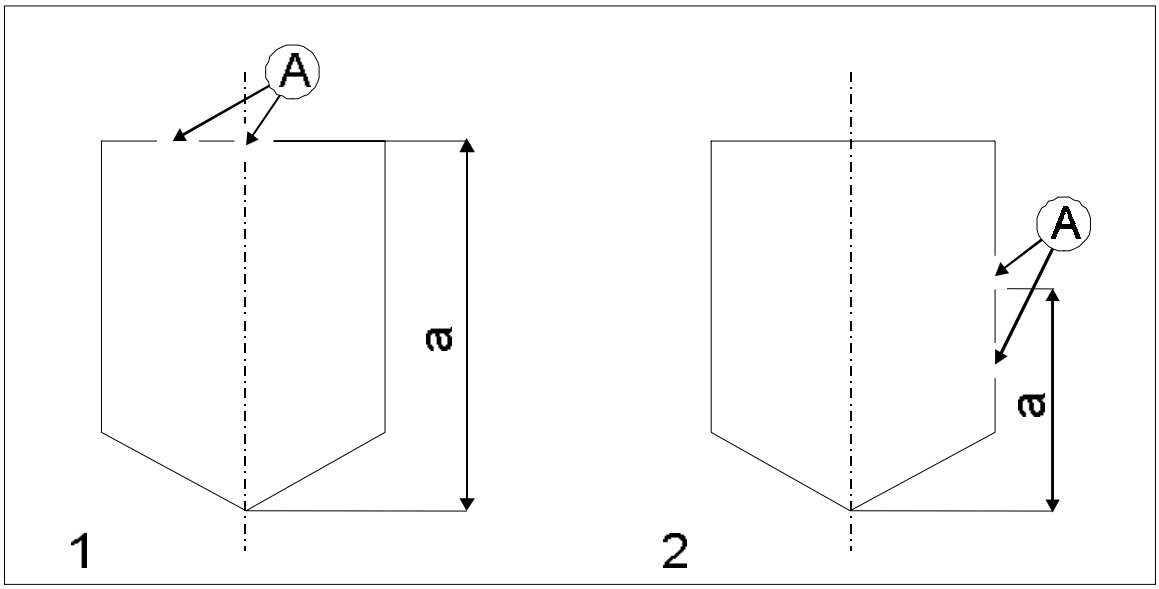
5) Where a ladder is provided inside the silo it shall be positioned directly under the opening and a free space complying with 4.3 of EN 547-1:1996 and with EN 547-3 shall be provided. An anchorage point for the use of a personal protective equipment shall be provided (see EN 795).

6) mdd up to 4 m (see Figure 4). If the dimension of the lower part of the silo are not compatible with the use of a portable ladder complying with EN 131 a fixed ladder shall be installed.

7) mdd 4 m up to 10 m (see Figure 4) : Fixed ladder(s) shall be provided.

8) mdd more than 10 m (see Figure 4) : Access by fixed ladders shall not be considered. The use of an suspended access equipment (silo lift) shall be foreseen.

9) Lockable guards to prevent persons from having direct access into silo space B and an additional advice e.g. warning sign shall be foreseen (see 7.2.3).



Key

A Access opening
a mdd

4.1 Access from the top 4.2 Access from the side

Figure 4 – Definition of maximum descent depth (mdd)

5.1.7 High pressure fluid

It shall be possible to disconnect each air cannon or other high pressure gas material flow aid device working on the principle of fluid injection from the power supply by a control valve which shall be lockable. It shall be also be possible to depressurise them. The status of the equipment (pressure on/pressure off) shall be shown by instruments or signal lamps which are situated :

— directly at the silo access opening for a single air cannon or flow aid device, or

— inside the operator's cabin, or

— concentrated at one place for multiple air cannons or flow aid devices.

5.1.8 Ejection of parts (of machinery and/or bulk material)

Where overpressure or underpressure can be expected safety devices (valves, vents, bursting discs, etc.) shall be provided on silos so as to release any unintended excessive pressure in the silo and to prevent the ejection of silo parts (e.g. access door, filter or complete silo roof). Access doors, panels, lids etc. shall be designed taking this into account.

Pressure relief devices e.g. bursting discs shall be positioned so as to avoid damage when they disintegrate.

Safety measures to avoid flooding of bulk material are given in 5.9.2.

To prevent the silo from overflowing when full or creating spillage when an empty silo is filled unintentionally with an open gate, it shall be equipped at least with level indicators. If the bulk material creates any additional risks in case of overflowing and spillage (such as risk of burns, explosions, etc.) level indicators shall be interlocked with

the possibility of charging and discharging. Where the vehicle is charged by gravity this interlocking shall prevent access to the charging area.

Silo charging and discharging equipment shall also be designed to prevent bulk material spillage by using e.g. correct troughing, covers, gap, housing, suction cleaning.

Pressure relief valves or other appropriate devices (vents, bursting discs, etc.) shall be designed in such a way that they can be positioned so that ejection into working and traffic areas is avoided when activated.

If chutes can be moved to vary the inclination of the slope, it shall be ensured that bulk material lying on the chute cannot fall down in working and traffic areas.

5.1.9 Loss of stability (of machinery and machine parts)

Where silos operate under intended or forseeable overpressure and/or underpressure conditions, they shall be equipped with relevant pressure equilisation devices to avoid excessive stresses, which also may cause a loss of stability (see also annex B).

On silos equipped with explosion discs or diaphragms, these shall be placed in the upper part of the silo or on the upper sides of the silo symmetrically in relation to the longitudinal axis of the silo. The silo and its fixing devices shall be designed to withstand the reaction resulting from the explosion discharge which may cause the silo to overturn.

5.1.10 Slip, trip and fall in relationship with machinery (because of their mechanical nature)

At the top of silos guard(s) shall prevent persons falling down from or into the silo. The guard-rails shall be in accordance with prEN ISO 14122-3.

NOTE For hazards associated with falling into silo see 5.1.6.1.

If the walkway is sloped more than 5 degrees, at least two kneerails shall be installed.

Where access is intended once a week or more often, permanent access shall be provided (as required by prEN ISO 14122-1 and prEN ISO 14122-3). The surface of walkways, platforms, etc. shall be slip resistant (e.g. checker plates, grids). The nature of the product intended to be stored and water evacuation shall be taken into consideration for the choice of the flooring to avoid material falling (see prEN ISO 14122-2).

Accessible roofs shall be designed so that they can be cleaned. (e.g. with suction systems, vacuum cleaning systems, wash down systems).

If it is possible that charging or discharging equipment can be walked on, the structure shall be able to support a load of 1,5 kN/m^2 minimum.

5.2 Electrical hazards

5.2.1 Electrical equipment

The electrical equipment shall be provided in accordance with all applicable clauses of EN 60204-1:1997, together with the particular requirements below.

If the equipment is for use in electrical supply conditions outside the range of EN 60204-1:1997, 4.3, or prEN 60204-11:1997, clause 4, 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, appliances, fixtures, apparatus and the like, used as part of, or in connection with, the electrical installation, 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 silo 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 a silo or its electrical equipment (see EN 1037 and 5.4 and 5.5 of EN 60204-1:1997). A disconnecting device shall be provided which satisfies the requirements of 5.3.2a), b), c) or d) and 5.3.3 of EN 60204-1:1997.

If the silo 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 storage equipment) such parts shall be marked, and/or identified and/or protected against direct contact as appropriate (see 5.3.5 and 6.2 of EN 60204-1:1997).

5.2.1.2 Environment

The supplier shall select and install equipment which is suitable for the intended working environment. Enclosures (cabinets, boxes, compartments) for the electrical equipment shall provide suitable protection 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 have a minimum degree of protection of IP 54 (see EN 60529).

Equipment shall be designed to withstand the vibration normally occurring on silos, without failing to danger.

If the silo is intended for use in conditions outside the range of 4.4 of EN 60204-1:1997, e.g. ambient temperature, humidity, altitude, corrosive atmosphere, the manufacturer shall take account of this in the design.

5.2.1.3 Wiring practices

Wiring practices used in silos and from silos to the means of disconnection from the supply, including any work carried out on site, shall meet the requirements of 13 and 14 of EN 60204-1:1997. 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 is unavoidable, wiring shall be suitably protected, e.g. in armoured cable, rigid metal conduit, flexible conduit, electrical metallic tubing, metal raceway or other suitable means.

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).

NOTE Provisions for electrostatic hazards are under consideration by CENELEC/TC44X.

Where equipotential connection between the equipment (e.g. vehicles, container) is provided, charging and discharging shall only be possible after this equipotential connection is efficient.

5.3 Electromagnetic compatibility (EMC)

5.3.1 is related to the EMC Directive, 5.3.2 to the Machinery Directive.

5.3.1 Electromagnetic compatibility requirements

The electromagnetic disturbances generated by the equipment shall not exceed the levels specified in generic emission standard EN 50081-1. 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 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 error ;

— speed variation in excess of +/- 20 % of the discharge equipment ;

— inhibition of the operation of interlocking devices ;

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

— reduction in non safety-related fault detection capability.

Information on measures to reduce generated disturbances and measures to reduce the effects of disturbances on the equipment is given in 4.4.2 of EN 60204-1:1997. For those tests specified in EN 61000-6-2, any degradation of performances or loss of function allowed with regard to performance criteria ”A” and ”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.

5.3.2 Safety requirements related to EMC

The equipment shall also have sufficient immunity to electromagnetic disturbances to enable it to operate safely as intended and shall not fail to danger when exposed to the levels and types of disturbances as specified in EN 61000-6-2. The manufacturer 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 failure to danger.

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 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 loss of performance or degradation 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 following safety/interlocking devices ultimate-position switch related circuits, "interlocking" switches related circuits, emergency stop device related circuits, level control system related circuits, discharge control systems related circuits, and start and stop related circuits ;

   — any reduction in fault detection capability of safety related control systems with electronic components according to 5.9.3.4, as far as such systems have been chosen for devices according to the before mentioned clauses.

Information on measures to reduce the effects of electromagnetic disturbances is given in 4.4.2 of EN 60204-1:1997.

5.4 Thermal hazards

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

— When maximum temperature hereunder can be maintained:

   — for non intentional touching the temperature defined in annex B of prEN 13202:1998 based on a contact time of 0,5 s shall apply ;

   — for reachable parts of the system the temperature defined by EN 563 based on a contact time of 1 s shall apply ;

- for components actuated by hand, the temperature defined by EN 563 based on a contact time of 1 min shall apply.

- When maximum temperature above mentioned cannot be maintained the following provisions shall be considered :

  - cooling :

  - insulation ;

  - safety distances (see EN 294:1992, Table 1 excluded).

5.5 Hazards generated by radiation

5.5.1 Lasers

Lasers which may be used e.g. as level indicators in silos or for special measurements, shall comply with EN 60825-1.

Laser of class 3B and 4 shall only be used where lower classes are not sufficient due to local conditions.

5.5.2 Solar radiation

If risks can occur by the heating of bulk material inside the silo, the temperature of the bulk material shall be permanently controlled. Measures shall be taken to prevent heating by e.g. use of :

- reflecting surfaces outside ;

- insulation ;

- cooling equipment.

5.6 Hazards generated by bulk materials handled and stored in the storage equipment

The manufacturer shall take into consideration the characteristics of the bulk materials (see introduction “negotiation”).

NOTE For the description of bulk materials see FEM 2.581/2.582 (see Bibliography).

5.6.1 Hazards resulting from contact with or inhalation of harmful gases, and dusts

Equipment shall be so designed and constructed as to be suitable for operation in the intended environmental conditions.

The housing shall be properly sealed and, where necessary, provided with a correctly designed gas or dust extraction device (see EN 626-1).

Where harmful dusts could be exhausted to the atmosphere (e.g. pneumatic charging) filter(s) shall be provided.

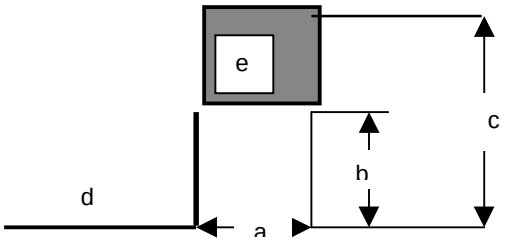
5.6.2 Fire or explosion hazard

If the equipment may be required to store finely divided materials (dusts), with a possible hazard of fire and explosion, see annex D (informative).

5.7 Hazards generated by neglected ergonomic principles in machine design (mismatch of machinery with human characteristics and abilities)

5.7.1 Inadequacy with human hand-arm or foot-leg anatomy

Control actuators shall be situated in such positions where they easily can be reached (see Figure 5 for an operator which is intended to stay).



Key

a Less or up to 0,5 m
b More than 0,9 m
c Less than 1,5 m
d Working area
e Area for manual control actuators

Figure 5 – Positions for manual control actuators (operator is intended to stay)

They shall be designed in order to be operated with acceptable forces (less than 150 N).

5.7.2 Neglected use of personal protection equipment

If safety gloves are intended to be worn, the control actuators shall be designed so that they can be operated under this conditions.

The free space between each control device and its surroundings shall not be less than :

a) 50 mm for operating handles that require a force of greater than 50 N ;

b) 25 mm for operating handles that require a force up to and including 50 N ;

c) 10 mm between rows of push buttons or switches ;

d) 15 mm between separate push buttons ;

e) 100 mm for pedals.

5.7.3 Inadequate local lighting

Lighting of workplaces shall comply with prEN 12464.

5.8 Hazard combinations

Covering each individual hazard is sufficient for covering combinations of hazards.

5.9 Hazards caused by failure of energy supply, braking down of machinery parts and others functional disorders

5.9.1 Failure of energy supply (of energy and/or control circuits)

Discharge systems included their drives shall be designed so as to prevent unintended movement and unintended modification of the flow rate setting.

The accuracy of the flow rate setting shall be designed to avoid overflow. The gate system shall ensure interruption of the flow within the shortest time and avoid flooding (e.g. additional gate).

Manual interruption of the flow shall be possible in case of failure of the power supply or of the control system.

5.9.2 Unexpected ejection/retention of bulk materials

The occurrence of :

— flooding ;

— irregular or unstable flow behaviour (core flow, rat-holing) in non mass-flow silos ;

— arching,

shall be minimised by the design of the silo. This depends on the type of material and its flow properties, the shape, slope and friction characteristics of the walls, the positions and dimensions of discharge openings, the discharge rate and flow aid devices.

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

5.9.3.1 Controls and control systems

Controls and circuits used for safety purposes include :

ultimate-position switch related circuits, "interlocking" switches related circuits, emergency stop device related circuits, level control system related circuits, discharge control systems related circuits, start and stop related circuits.

5.9.3.2 Safety related parts

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

The switching arrangements of mechanically actuated switches shall be of positive opening operation in accordance with clause 3 of EN 60947-5-1:1997 (i.e. "safety switches").

If a safety device is actuated, a stop command shall be automatically given, which shall initiate a category "0" or category "1" stop as appropriate to be compatible with the design (see 9.2.2 of EN 60204-1:1997). The stop function shall comply with 5.2 of EN 954-1:1996.

5.9.3.3 Transmission elements used for safety purposes

Transmission elements which are used for safety purposes listed in 5.9.3.1, 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.

5.9.3.4 Control systems

The control system and control equipment shall be designed using proven techniques and shall use proven components (see 9.4 of EN 60204-1:1997). The safety related parts of the control system shall be designed in

accordance with the requirements of at least category 1 (see 6.2.2 of EN 954-1:1996). Where programmable electronic equipment, or electronic devices including electronic sub-assemblies are used for safety related purposes listed in 5.9.3.1, they shall be accordance with the requirements of at least category 2 (see 6.2.3 of EN 954-1:1996). 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 accordance with the requirements of category 4 (see 6.2.5 of EN 954-1:1996).

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

In the event of a supply interruption, excessive supply fluctuation and restoration of supply (see 7.5 of EN 60204-1:1997) or a fault or a failure of the control system, no dangerous situation shall occur (e.g. failure to stop, unexpected start-up; see 4.2 of EN 954-1:1996).

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.

5.9.3.5 Start function

For prevention of unexpected start-up see EN 1037.

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.

5.9.3.6 Stop function and stop control devices

Stop devices shall be positioned within reach of the operator at all control stations and shall be clearly identifiable and visible (for positioning see 5.7.1 above). The stop function shall be a category ”0” or category ”1” stop as appropriate to be compatible with the design (see EN 60204-1:1997, 9.2.2).

NOTE Interlocking with possible other equipment should be considered.

Stop devices shall be of the impulse type. After their actuation the appropriate part of the equipment, shall come to a stop and then remain in a stationary condition.

The stop function shall, be arranged to avoid creating hazardous conditions, (e.g. dangerous discharge of material). If gates are used for discharging they shall close immediately after actuating the stopping device.

5.9.3.7 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 4.1.5 of EN 418:1992).

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

Emergency stop devices shall be at least installed at discharging and charging points where permanent means of access are provided. For the height of the emergency stop device see 5.7.1 above.

The emergency stop arrangements shall be so designed that they do not create other hazards (e.g. a complete emptying of a silo, because at the emergency stop the operator cannot close the gate).

5.10 Hazards caused by (temporary) missing and/or incorrectly positioned safety related measures/means

5.10.1 Energy supply disconnecting devices

There shall be separate disconnecting devices for each type of energy (hydraulic, pneumatic, and electric), see EN 1037 and EN 60204-1.

5.10.1.1 Safe access to silo space B

The disconnecting devices in relation with safe access to silo space B shall be concentrated at one place as close as possible to the access openings. These devices shall be lockable. This applies also to power driven charging means.

For air cannon and other flow aid devices see 5.1.7.

If there is a risk to persons entering silo space B from material falling down from charging equipment even when the equipment is disconnected, there shall be special covers or guards.

5.10.1.2 Essential equipment and accessories for safe adjusting and/or maintaining

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 EN 1037:1995).

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 needs to be isolated and the energy dissipated (see 5 of EN 1037:1995),

— special operating modes :

a) hold to run device on local control ;

b) remote control (see 5.1.5) ;

c) devices to limit the speed ;

d) temporary movement limiting control devices.

Cableless controls shall not be used.

If specific compensating measures have to be taken, the required material means shall be supplied with the equipment. Mode selection means shall preclude any possibility of normal operation control.

For access see also 5.1.6.2.

6 Verification of safety and EMC requirements and /or measures

6.1 General

Safety requirements and/or measures of clauses 5 and 7 of this standard shall be verified according to the Table below, which covers :

1) Type verification, the intention of which being to ensure that the type complies with the requirements of this standard (the first section of the Table).

2) Individual verification, the intention of which being to prove that before despatch, each unit satisfies all the safety requirements of this standard. In the case of assembly 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 the Table).

The following methods of verification are included in the Table :

a) **visual check**: the intention of which only being to establish, whether something is present (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)

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

2) **loaded test(s**): tests outside the range of functional tests, the intention of which being to establish 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);

3) **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).

	Type verification			Individual verification		
clause	visual checks	measurement	tests	visual checks	measurement	tests
5	V			V		
5.1	V	M		V	M	
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	V	M	FT	V	M	FT
5.1.4	V	M		V		
5.1.5	V	M	FT	V		FT
5.1.6.1	V	M		V		
5.1.6.2	V	M		V	M	
5.1.7	V		FT	V		FT
5.1.8	V	calculation check	FT	V		FT
5.1.9	V	M		V		
5.1.10	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		FT	V		FT
5.3.1			SV (see 6.2.1)			SV (see 6.2.1)
5.3.2			SV (see 6.2.2)			SV (see 6.2.2)
5.4	V		LT	V		LT
5.5.1	V			V		
5.5.2	V			V		
5.6	V			V		
5.6.1	V			V		
5.6.2			SV			SV
5.7.1	V	M		V		
5.7.2	V	M		V		
5.7.3	V	M		V		
5.9.1	V		LT	V		LT
5.9.2	V			V		
5.9.3.1	V			V		
5.9.3.2	V		FT	V		FT
5.9.3.3	V			V		
5.9.3.4	V		FT	V		FT
5.9.3.5	V		FT	V		FT
5.9.3.6	V		FT	V		FT
5.9.3.7	V	M	FT	V		FT
5.10.1	V			V		
5.10.1.1	V			V		
5.10.1.2	V		FT	V		FT
7	Verification of the content			V		

6.2 Special verification

6.2.1 Verification of electromagnetic compatibility

Compliance with the EMC requirements of 5.3.1 above, shall be checked in accordance with the standards mentioned. If testing of the completed 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 5.3.1 above. 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 Verification of safety requirements related to EMC

Compliance with the EMC requirements of 5.3.2 above, shall be checked by carrying out preliminary testing and function testing. If testing of the completed 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 5.3.2 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

7.1 Operating instruction- Instruction handbook

7.1.1 General

The operating instruction handbook shall be in accordance with 5.5 of EN 292-2:1991 and shall include information mentioned in 1.7.4 of annex A to EN 292-2:1991. The instruction handbook shall include information about the conditions under which the storage equipment is intended to be used, in particular with regard to :

— the bulk material to be handled;

NOTE See also Bibliography: FEM 2581 and 2582.

— indication of relevant flow properties such as bulk densities, friction angles;

— geometric design data (e.g. outlet diameter, wall slope of converging section);

— description of surface finish of the inside walls;

— working and traffic areas;

— operating conditions (e.g. indication of the operating mode, in particular the charging and discharging of the storage equipment);

— dust explosion characteristics (e.g. according to VDI 3673, see annex B);

— maximum permissible environmental conditions (e.g. snow, wind, moisture, temperature).

— the fact that this handbook does not cover the procedure for entering the silo and behaviour of persons inside the silo.

The instruction handbook shall draw the attention to non intended utilisation such as:

— changing of critical parts of the storage equipment from those specified in the contract without permission by the manufacturer (this applies particularly to the stored materials) ;

— use of the system in conditions classed as other than normal (e.g. excess moisture in bulk material).

Where a programmable logic system is provided, the instruction handbook shall contain all the instructions necessary for modifications of programmes considered allowable by the manufacturer.

EN 60825-1 shall apply for the information for use.

7.1.2 Information about the installation of the storage equipment

When the storage equipment is supplied unassembled, the manufacturer shall provide assembly specifications and drawings showing :

— instructions for assembly and installation ;

— the various assembly phases ;

— the loads imposed by the storage equipment ;

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

— the necessary lifting means (capacity - span) and operating procedure ;

— the precautions to be taken (e.g. anchoring, support with detail) ;

— electric, hydraulic and pneumatic connections ;

— the checks to be carried out during and on completion of the assembly ;

— earth bonding requirements where electrostatic charging is a hazard ;

— any special equipment for assembly and settings ;

— the information in relation to the interfaces where the equipment is intended to be associated with other components of a continuous handling system(s) ;

— the remaining verifications after assembling.

7.1.3 Information for the use of the storage equipment

The instruction handbook shall include :

— the information relating to the training of operators ;

— the function of the controls ;

— instructions for restarting ;

— instructions for settings, adjustments and modifying computer software ;

— stopping modes and means (in particular a list and location of emergency stops) ;

— instructions for charging and discharging ;

— clear instructions concerning hazards caused by missing and / or incorrectly positioned safety related measures / means ;

— information on the temporary access means provided by the user where charging openings are greater than 0,05 m × 0,05 m ;

The instruction handbook shall draw the attention of the user to :

— 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 clause 6;

— all working/ traffic areas shall be kept clear;

— if there are risks generated by noise, resulting in interference with speech communication, special equipment is necessary to enable personnel to speak with each other undisturbed. These can be phone boxes, special rooms, etc.;

— if there are restrictive conducting locations in storage equipments, e.g. inside silo space B, special lamps and electrical tools shall be provided for work to be done inside (see IEC 60364-7-706) by the user.

7.1.4 Information for inspection and maintenance

7.1.4.1 General information

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

— the equipment shall be kept in proper working condition and maintained in accordance with the manufacturer's instructions ;

— inspection, adjustment, maintenance and cleaning shall be carried out regularly in a safe manner according to the manufacturer's instructions ;

— inspection and adjustment of the equipment, in motion or in use, shall only be carried out with guards in position ;

— displacing or removal of a guard and/or neutralisation of a safety device shall be carried out according to the manufacturer's instructions (see 4.2.2 of EN 292-2:1991) ;

— repairs and removal of protective enclosures or panels shall only be carried out after stopping the equipment and starting devices have been rendered inoperative by persons authorised to do so in accordance with a safe system of work.

The instruction handbook shall specify in particular :

— the information relating to training ;

— the information about the necessity of switching off laser beams ;

— the position for anchorage point for personal protective equipment ;

— information about restricted use of the means for opening the access doors ;

— the measures to be taken to authorise operations without any risk of unintentional starting ;

— a list of wearing parts as well as the approximate frequency and conditions for their replacement (e.g. thickness of wall lining) ;

— the measures to be taken if it is necessary to create maintenance or repair islands by protective devices (e. g. providing temporary fencing or barriers).

7.1.4.2 Regular inspections

The instruction handbook shall specify all regular inspections depending on the bulk material to be recorded and their maximum intervals. This may be :

— all explosion safety devices, bursting disks, vents, etc.- at least once a year ;

— all vacuum prevention installations- at least once a month ;

— all electronic, electrical, hydraulic, and pneumatic equipment- at least once a year ;

— all safety devices as guards, grids, interlocking devices- at least once a month ;

— spillage- at least once a day ;

— bulk materials being stored- at least once a month ;

— filters- at least once a month.

7.1.5 Information about emergency situation

The instruction handbook shall give special advice if bulk materials to be stored are likely to create fire and/or explosion hazards (in accordance with 5.6.2).

7.2 Minimum marking

7.2.1 General

The storage equipment shall be marked with the following :

1) the name and address of the manufacturer ;

2) the year of manufacturing ;

3) legal marking;

4) designation of series or type ;

5) serial number ;

6) names of bulk materials for which the storage equipment was designed ;

7) special notice if stored bulk materials are likely to create fire and / or explosion hazards (see 7.2.3) or dangerous or if noxious bulk materials are to be stored ;

8) capacity (volume) of silo space B ;

9) bulk densities for each bulk material handled ;

10) max. allowed operating pressure, if necessary ;

11) max. allowed vacuum pressure, if necessary ;

12) max. and min. allowed operation temperatures, if necessary ;

13) max. and min. allowed storage time (if relevant) for each bulk material handled ;

14) max. and min. allowed charging and/ or discharging rate (if relevant) for each bulk material handled ;

15) ″Further information is given in the Instruction Handbook.″

7.2.2 Reduced marking

Where relevant storage equipment with a nominal capacity up to 1 m^3 shall be marked at least with points 1 to 7 and 15. The points 10 to 14 shall only be mentioned if necessary.

7.2.3 Safety signs and tags

All safety signs shall be in accordance with ISO 3864.

If applicable the following safety signs shall be provided (the plates are shown in annex C) :

— the maximum intended velocity for vehicles driving in the hazard zone F shall be marked by a sign (see 5.1.3);

— if there is an additional equipment using a laser system a plate : W10;

— if the bulk material creates an explosive atmosphere or may burn a plate : P02 and / or W02;

— if the charging opening cannot permanently be guarded a plate : W15 and an additional plate stating:

”Cover the opening immediately after charging”;

— if there is an opening for access to silo space B a plate : P06 and an additional plate stating :

”Unauthorised access is forbidden” ;

— if mdd exceeds 4,0 m a plate (see 5.1.6.2): M09;

— if wearing of hearing protection is required: M03.

Annex A
(normative)

List of hazards according to EN 292-1

Risks in systems for the storage of bulk materials in silos are very different from those risks resulting from the hazards for typical machines listed in EN 292-1 and EN 929-2. Therefore in Table A.1 the types of hazards are marked with respect to systems for the storage of bulk materials. Additional hazard locations A - F, which are listed in 1, the relating requirements/ measures are given in 5 and information given in clause 7 are listed.

Table A.1 - List of hazards according to EN 292-1 in comparison with annex 1 of the Machinery Directive

Hazards		Significant	Locations	Typical hazard items or situations	Requirements (clauses/subclauses)
1	**Mechanical hazards**				
1.1	Crushing	yes	C,D,E,F	telescoping pipes, chutes, vehicles	5.1.3
1.2	Shearing	yes	B,C,D,E,F	charging and discharging equipment, valves, gates	5.1.4
1.3	Cutting and severing				
1.4	Entanglement	yes	C,D,E,F	charging and discharging equipment	5.1.5
1.5	Drawing-in or trapping	yes	A,B,C,D	silo inlets, inspection opening, sinking into or under bulk material, access into silo	5.1.6
1.6	Impact	yes	A,B,D,F	vehicle under silo	5.1.3
1.7	Stabbing or puncture	no			
1.8	Friction or/ abrasion	no			
1.9	High pressure fluid injection	yes	B	air cannon	5.1.7
1.10	Ejection of parts (of machinery and processed materials / workpieces	yes	A,B,C,D,F	safety devices (valves, vents, bursting discs, etc.), stored or conveyed bulk material	5.1.8
1.11	Loss of stability (of machinery and machine parts)	yes	A,B,C,D,E,F	all the storage equipment parts, structure	5.1.9
1.12	Slip, trip and fall in relationship with machinery	yes	F	platforms, floors, ladders, gangways, stairs, step	5.1.10
2	**Electrical hazards caused e.g. by :**				
2.1	electrical contact direct or indirect	yes	B,C,D,E,F	electrical equipment, means of disconnection, environment, wiring practices	5.2.1
2.2	electrostatic phenomena	yes	B,C,D,E,F	between particles of bulk material, wall material etc. (explosive atmosphere)	5.2.2
2.3	thermal radiation or other phenomena such as projection of molten particles and chemical effects from short- circuits, overload etc.	no			

"to be continued"

Table A.1 *(continued)*

Hazards		Significant	Locations	Typical hazard items or situations	Requirements (clauses/subclauses)
2.4	external influence on electrical equipment	yes	C,D,E	electromagnetic compatibility, charging, discharging, unexpected start-up, blocking of emergency stop	5.3
3	**Thermal hazards resulting in :**				
3.1	burns and scalds by possible contact of persons by flames or explosions and also by the radiation of heat sources	yes	A,B,C,D,E,F	bulk material	5.4
3.2	health-damaging effects by hot or cold work environment	yes	B,F		not dealt with
4	**Hazards generated by noise, resulting in**				
4.1	hearing losses (deafness); other physiological disorders	yes	F	working and traffic area	Not dealt with
4.2	interference with speech communication, acoustic signals etc.	yes	C,D,E,F	working and traffic area, charging and discharging equipment, vibrators	Not dealt with
5	**Hazards generated by vibration (resulting in a variety of neurological and vascular disorders)**	**no**			
6	**Hazards generated by radiation, especially by**				
6.1	electrical arcs	no			
6.2	lasers	yes	B	control system for special measurements	5.5.1 7.2.3
6.3	ionising radiation sources	yes	B,F	level indicators	Not dealt with
6.4	use of high frequency electromagnetic fields	no			
6.5	solar radiation	yes	A,B,F	heating up of structure, bulk material and operator's working area	5.5.2
7	**Hazards generated by materials and substances processed, used or exhausted by machinery e.g.**				
7.1	contact or inhalation of harmful fluids, gases, mists, fumes and dusts	yes	A,B,C,D,E,F	charging, discharging and additional equipment	5.6.1,
7.2	fire and explosion	yes	A,B,C,D,E,F	silo space B, during charging and discharging	5.6.2, 7.1.1, 7.1.5, 7.2.3
7.3	biological and micro-biological (viral or bacterial)	yes	A,B,C,D,E,F	operator's working area	Not dealt with
8	**Hazards generated by neglecting ergonomic principles in machine design caused e.g. by**				
8.1	unhealthy postures or excessive efforts	yes	B,F		not dealt with
8.2	inadequacy with human hand-arm or foot- leg anatomy	yes	F	working area, control actuators	5.7.1

"to be continued"

Table A.1 *(continued)*

Hazards		Significant	Locations	Typical hazard items or situations	Requirements (clauses/subclauses)
8.3	neglected use of personal protection equipment	yes	B,F	use of gloves	5.7.2
8.4	inadequate area lightning	yes	F	inside silo space B, operator's working area, traffic area	5.7.3
8.5	mental overload or underload, stress	no			
8.6	human errors	yes	B,F	entering silo space B with inadequate personnel, manual and equipment support	7.1.4.1, 7.2.3
9	**Hazard combinations**				**5.8**
10	**Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders, e.g.**				
10.1	failure of energy supply	yes	C,D,E	unintended movement of gates, overfilling, uncontrolled emptying	5.9.1
10.2	unexpected ejection of machine parts or fluids	yes	A,B,C,F	flooding of bulk material, overfilling	5.9.2
10.3	failure, malfunction of control system	yes	A,B,C,D,E,F	emergency stoppage, changing software	5.9.3, 7.1.1
10.4	errors of fitting	yes	C,D,E	system and equipment, design errors	7.1.2
10.5	overturn, unexpected loss of machine stability	no			
11	**Hazards caused by (temporary) missing and/ or incorrectly positioned safety related measures/ means, e.g.**	**yes**	**A,B,C,D,E,F**	**maintenance**	**5.10.1.2, 7.1.4**
11.1	all kind of guards	yes	A,B,C,D,E,F	replaceable lids and grids, falling into or from silo	7.1.3, 5.1.1, 5.1.2.3, 5.1.6.1, 5.1.10, 7.2.3
11.2	all kinds of safety related (protection) devices	yes	A,B,C,D,E,F	flooding of bulk material	7.1.3, 5.9.1
11.3	starting and stopping devices	yes	C,D,E,F	starting and stopping equipment	5.9.3.6, 5.9.3.7
11.4	safety signs and signals	yes	B,C,D,E,F	noise, laser, velocity, unauthorised access, explosive atmosphere	7.2.3
11.5	all kinds of information and warning devices	yes	B,C,D,E,F	silo plate, persons entering silo space B	7.1.3, 7.2
11.6	energy supply disconnecting devices	yes	B,C,D,E	entering silo space B, incorrect starting procedure for all conditions	5.10.1
11.7	emergency devices	yes	B,C,D,E	equipment starting and material flowing before silo space is evacuated of personnel and also before any maintenance is completed in other locations	5.9.3.7

"to be continued"

Table A.1 *(concluded)*

11.8	feeding / removal of workpieces	no			
11.9	essential equipment and accessories for safe adjusting and / or maintaining	yes	B,C,D,E	opening of access or inspection doors during working process	5.1.5, 7.1.4
11.10	equipment evacuating gases, etc.	yes	B,F	gas, dust	5.6.1

Annex B
(informative)

Further Documents and Remarks

VDI 2263:1992, Dust fires and dust explosions; hazards, assessment, protective measures.

VDI 3673-1:1995, Pressure venting of dust explosions.

Load and load combination assessment

The manufacturer shall design the silo system structure taking into account the internal and external loads resulting from the limits of the intended use (forseeable overloading due to the characteristics of the system included).

Loads and load combinations due to the material flow in relation with the silo characteristics can be assessed on the basis e.g. of :

— the measured bulk material flow properties ;

NOTE See also FEM 2.381 (see [7] in Bibliography).

— the detailed geometry of the silo structure ;

— the frictional properties of the silo internal wall surfaces ;

— the flow behaviour of the bulk material in the silo ;

— the potential impact of mobile charging or discharging equipment, e.g. grabs, ships or wagons.

With this knowledge it is possible to design for the worst conditions. The safety of the design requires great care with regard to changes in the above mentioned measures or in discharge methods.

Mass flow minimises the hazard of loss of stability. Non mass flow (core flow, arching, rat-holing, flooding) increases this risk.

Annex C
(informative)

Safety signs mentioned in 7.2.3

Ear protection must be worn (M03)

Safety hareness must be worn (M09)

No smoking and naked flames prohibited (P02)

No access for unauthorized persons (P06)

Explosive material (W02)

Drop (W15)

Laser beam (W10)

Annex D
(informative)

Fire or explosion hazard

If equipment is intended to store 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.

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 dust of particle size less than 200 µm.

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 storage equipment, that account is taken of upstream and downstream processes. Fires which start in storage equipment may cause explosions in upstream or downstream processes and vice-versa.

NOTE 3 Reference should be made to specific standards e.g. VDI 2263 (see annex B).

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 silos. If necessary, explosion venting or suppression equipment shall be fitted, in particular in totally enclosed equipment.

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 and EN 1127-1) ;

— anti-static measures (see 5.2.2) ;

— using indicators to inform about critical conditions (e.g. temperature, CO, oxygen, methane) in silo space B ;

— using speed, rotation detectors, where there is risk of sparks from failed mechanical components of the charging or discharging equipment.

The consequences of fire and explosion shall be minimised by e.g.:

— planning cooling systems, manufacture from fire resistant material, fire fighting device ;

— using explosion vents, explosion suppression systems, pressure resistant or pressure shock resistant design, (nitrogen) inert gas blanket (in particular in totally enclosed equipment).

If explosion vents are fitted they shall be situated in the upper part of silo space B. Advice on the spacing needed between vents, and related matters is contained in VDI 3673 (see annex B).

Explosion vents shall be interlocking in accordance with 4.1.1 of EN 1088:1995. If they are opened, the charging / discharging equipment 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 should be paid if abrasive material is stored.

NOTE 7 For pressure relief calculation see VDI 3673.

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

Annex ZA
(informative)

Relationship of this document with EC Directives

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 following EC Directives :

Machinery Directive 98/37/EC, amended by Directive 98/79/EC.

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

WARNING Other requirements and other EC Directives <u>may</u> be applicable to the products falling within the scope of this standard.

Table ZA.1 – Clauses/subclauses of this European Standard addressing essential requirements of Machinery Directive

Requirements of Machinery Directive (in order of annex A)	Number (as given in annex A)	appropriate clauses/subclauses of EN 617
General remarks		
Definitions	1.1.1	3.1 - 3.9.5
Principles of safety integration	1.1.2	-
Materials and products	1.1.3	5.1.8, 5.6, 5.6.1, 5.6.2
Lighting	1.1.4	5. 7.3
Design of machinery to facilitate its handling	1.1.5	-
Controls		
Safety and reliability	1.2.1	5.9.3.2
Control devices	1.2.2	5.7.1, 5.7.2
Starting	1.2.3	5.9.3.5
Stopping	1.2.4	5.9.3.6
Mode selection	1.2.5	-
Failure of the power supply	1.2.6	5.9.1
Failure of control unit	1.2.7	5.9.3.4
Software	1.2.8	5.9.3.4
Protection against mechanical hazards		
Stability	1.3.1	5.1.9
Risk of break-up during operation	1.3.2	5.1.9
Risks due to falling or ejected objects	1.3.3	5.1.8, 5.1.6.1, 5.1.10
Risks due to surface, edges or angles	1.3.4	-
Risks related to combined machinery	1.3.5	-
Risks related to variations in the rotational speed of tools	1.3.6	-

"to be continued"

Table Z.A.1 *(concluded)*

Requirements of Machinery Directive (in order of annex A)	**Number (as given in annex A)**	**appropriate clauses/subclauses of EN 617**
Prevention of risks related to moving parts	1.3.7	5.1.3, 5.1.5, 5.1.6.1
Choice of protection against risks related to moving parts	1.3.8	5.1.2.1, 5.1.2.2, 5.1.2.3,
Required characteristics of guards and protection devices		
General requirement	1.4.1	5.1.1
Special requirements for guards	1.4.2	5.1.1.1, 5.1.1.2, 5.1.1.3, 5.1.1.4
Fixed guards	1.4.2.1	5.1.1.1
Movable guards	1.4.2.2	5.1.1.3, 5.1.1.4
Adjustable guards restricting access	1.4.2.3	-
Special requirements for protection devices	1.4.3	5.1.2.3
Protection against other hazards		
Electricity supply	1.5.1	5.2.1
Static electricity	1.5.2	5.2.2
Energy supply other than electricity	1.5.3	5.10.1.2
Errors of fitting	1.5.4	7.1.4.1, 7.1.2
Extreme temperatures	1.5.5	5.4
Fire	1.5.6	5.6.2
Explosion	1.5.7	5.6.2
Vibration	1.5.9	-
Radiation	1.5.10	
External radiation	1.5.11	5.5.2
Laser equipment	1.5.12	5.5.1
Emissions of dust, gases, etc.	1.5.13	5.6.1
Risk of being trapped in a machine	1.5.14	5.1.6, 5.1.6.1, 5.1.6.2, 7.1.4.1
Risk of slipping, tripping or falling	1.5.15	5.1.10
Maintenance		
Machinery maintenance	1.6.1	5.10.1.2, 5.1.5
Access to operating position and servicing points	1.6.2	5.1.10
Isolation of energy sources	1.6.3	5.10.1
Operator intervention	1.6.4	-
Cleaning of internal parts	1.6.5	5.1.6.2,5.1.5
Indicators		
Information devices	1.7.0	7.1.3
Warning devices	1.7.1	7.2.3
Warning of residual risks	1.7.2	5.1.7, 7.1.4.1
Marking	1.7.3	7.2
Instruction handbook	1.7.4	7.1

Annex ZB
(informative)

Clauses of this European Standard which address Principal Protection Requirements of the EU Electro-magnetic compatibility Directive 89/336/EEC

The following clauses of this standard are likely to support requirements of the EMC Directive 89/336/EC:

5.3.1 Electromagnetic compatibility requirements;

6.2.1 EMC-tests.

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

WARNING Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

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