BRITISH STANDARD

BS EN 741:2000

Continuous handling equipment and systems — Safety requirements for systems and their components for pneumatic handling of bulk materials

The European Standard EN 741:2000 has the status of a British Standard

ICS 53.040.30

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National foreword

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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.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 35 and a back cover.

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 May 2000

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ISBN 0 580 35041 X

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 741

January 2000

ICS 53.040.30

English version

Continuous handling equipment and systems – Safety requirements for systems and their components for pneumatic handling of bulk materials

Equipements et systèmes de manutention continue – Prescriptions de sécurité pour les systèmes et leurs composants pour la manutention pneumatique des produits en vrac

Stetigförderer und Systeme – Sicherheitanforderungen an Systeme und ihre Komponenten zur pneumatischen Förderung von Schüttgut

This European Standard was approved by CEN on 1 July 1999.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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Ref. No. EN 741:2000 E

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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 July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

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 Annex ZA, which is an integral part of this standard.

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.

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 requirements for equipment for the storage of bulk materials in silos, bunkers, bins and hoppers*.

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

EN 619, *Continuous handling equipment and systems - Safety requirements for equipment for mechanical handling of units loads.*

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

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

In this standard Annex A is normative, Annexes B, C and Z are informative.

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Introduction

This European Standard is a type C standard as defined in EN 292-1.

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 the other standards, for systems and components that have been designed and built according to the provisions of this type C standard.

While producing this standard it was assumed that:

- only trained persons operate the machine;
- parts without specific requirements are:

  a) designed in accordance with the usual engineering practice and calculation codes, including all failures modes;

  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 system and components;
- components and system are kept in good repair and working order, so that the required characteristics remain despite wear;
- by design of the load bearing elements, a safe operation of the system and components is assured for loading ranging from zero to 100 % of the rated possibilities and during the tests;
- the ambient air temperature is maintained between - 15 °C and + 40 °C;
- the relative humidity is kept between limits which do not impede the safe working of the system and components;
- the components (see clause 3.4) are not exposed to external vibration;
- the noise threshold does not exceed 85 dB (A) at an horizontal distance of 1 m from the nozzle and at height of 1,6 m from the floor of the working area;
- a negotiation takes place between the user / installer and the manufacturer concerning the particular conditions for the use and places of use of the machinery;
- the working area is adequately lit;
- the places of installation allow a safe use of the system;
- safety data sheets on the bulk materials to be conveyed are provided by the user / installer and are part of the design criteria.

EN 617, EN 618 and EN 620 may need to be considered for a complete continuous handling system (machine).

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1 Scope

1.1 This standard specifies the special safety requirements for those types of fixed pneumatic handling systems and components as defined in clause 3, which are designed for conveying bulk materials on a continuous or an intermittent basis (batch conveying system) from the loading point(s) to the unloading point(s).

1.2 This European Standard deals with the technical requirements to minimize the hazards listed in clause 4 which can arise during the operation and the maintenance of the pneumatic conveying system, when carried out in accordance with the specifications given by the manufacturer or his authorized representative.

Annex A gives a list of hazards according to EN 292-1 and the safety requirements and/or measures are specified in the same order as they are given in Annex A.

1.3 This standard applies to design, on site assembly, and commissioning stages.

1.4 This standard applies also to the built-in actuators and parts of the systems, which control the components.

1.5 Exclusions

This standard does not specify the requirements for any elements used as a link between a fixed part(s) of the system and any other part mounted on mobile/movable supports (e.g.: ship, unloaders, ...).

This standard does not take into account the risks of burns and scalds by the radiation of heat sources or by contact with hot gases.

This standard does not take into account the risk generated by ionizing materials used in measuring equipment (e.g. level indicators).

This standard does not specify the requirements for handling specific hazardous materials, such as radiating material, explosives, explosive gases, ...

This standard does not specify the requirements for hazards due to electrostatic charges of pipes and equipment made of non-metallic materials.

The safety requirements for the transportation including loading and unloading of the components are not covered by this standard.

This standard does not apply to pneumatic conveying systems used underground, for mining and in public areas.

This European Standard does not establish the additional requirements for: freezer applications, high temperatures, corrosive environments, strong magnetic fields, potentially explosive atmospheres, radioactive environment, operation on ships and earthquake effects, hazards during decommissioning.

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.

EN 292-1:1991, *Safety of machinery - Basic concepts, general principles for design - Part 1 : Basic terminology, methodology*.

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EN 292-2/A1:1995, *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 parts of the human body*.

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

EN 563:1994, *Safety of machinery - Temperature of touchable surfaces - Ergonomics data to establish temperature limit values for hot surfaces*.

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

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

EN 1050:1996, *Safety of machinery - Risk assessment*.

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 explosions - Part 1 : Explosion prevention and protection*.

prEN 12437-1:1996, *Safety of machinery - Permanent means of access to machines and industrial plants - Part 1 : Choice of a fixed means of access between two levels*.

prEN 12437-2:1996, *Safety of machinery - Permanent means of access to machines and industrial plants - Part 2 : Working platforms and gangways*.

prEN 12437-3:1996, *Safety of machinery - Permanent means of access to machines and industrial plants - Part 3 : Stairways, stepladders and guard-rails*.

prEN 12437-4:1996, *Safety of machinery - Permanent means of access to machines and industrial plants - Part 4 : Fixed ladders*.

EN 50014:1992, *Electrical apparatus for potentially explosive atmospheres - General requirements*.

EN 50082-2:1995, *Electromagnetic compatibility - Generic immunity standard - Part 2 : Industrial environment*.

prEN 60204-1:1997, *Safety of machinery - Electrical equipment of machines - Part 1 : Specification for general requirements*.

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

EN 61310-2:1995, *Safety of machinery - Indication, marking and actuation - Part 2 : Requirements for marking*.

EN 1672-2:1997, *Food processing machinery - Basic concepts - Part 2 : Hygiene requirements*.

CENELEC R044-001:1999, *Guidance and recommendations for the avoidance of hazards due to static electricity*

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

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3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply in addition to those stated in EN 1070:

3.1
pneumatic conveying system
a system (see 3.2 and 3.3) for the pneumatic conveying of loose bulk materials in pipes (ducts) by means of gas, usually air, including the piping and components (see 3.4) and limited to them

3.2 systems related terms

3.2.1
open and closed systems
open systems operate on a once-through basis with regard to the conveying gas. In closed systems the conveying gas is recirculated and all or part of this gas is reused

3.2.2
continuous and batch conveying systems
continuous conveying systems are those in which flow of gas and material is not interrupted during operation. In batch conveying systems individual batches of material are conveyed on an intermittent basis

3.2.3
fixed systems
fixed systems are those where the relative position of all components is fixed. This includes:

- parts of the system mounted on mobile/movable supports (structure);

- flexible connecting piping between rigid piping

3.3
systems and limits of systems
on the schematic drawings below, the limit of the system is defined by the black part of the flag

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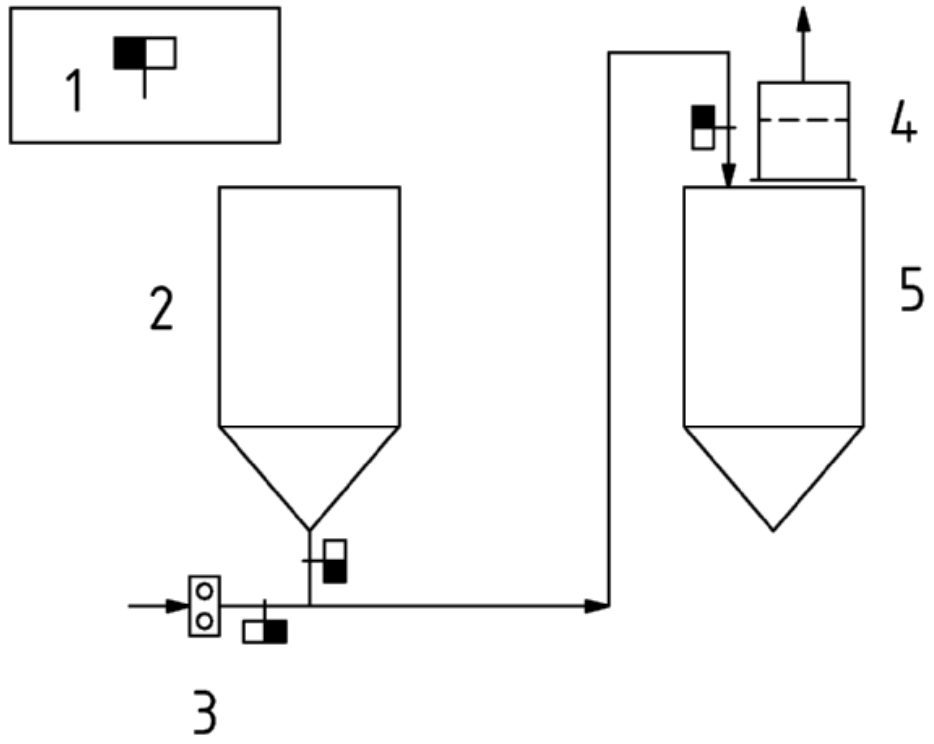
3.3.1
simple pressure conveying system
pneumatic conveying under pressure by blowing, with discharge into a single separator of gas and material, which is also a material-receiving vessel (see Figure 1)



Key

1 EN 741/other
2 Storage hopper
3 Gas supply
4 Filter
5 Discharge hopper

Figure 1 - Example of a typical simple pressure conveying system

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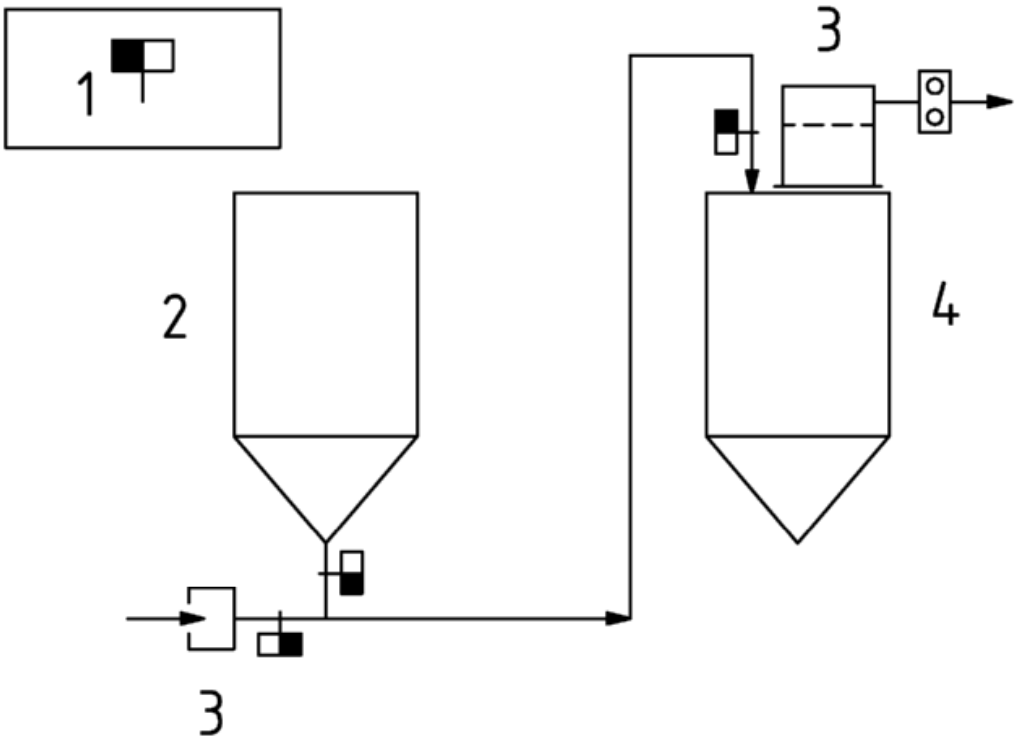
3.3.2
simple suction conveying system
pneumatic conveying under suction, with discharge into a single separator of gas and material, which is also a material receiving vessel (see Figure 2)



Key

1 EN 741/other
2 Storage hopper
3 Filter
4 Discharge hopper

Figure 2 - Example of a typical simple suction conveying system

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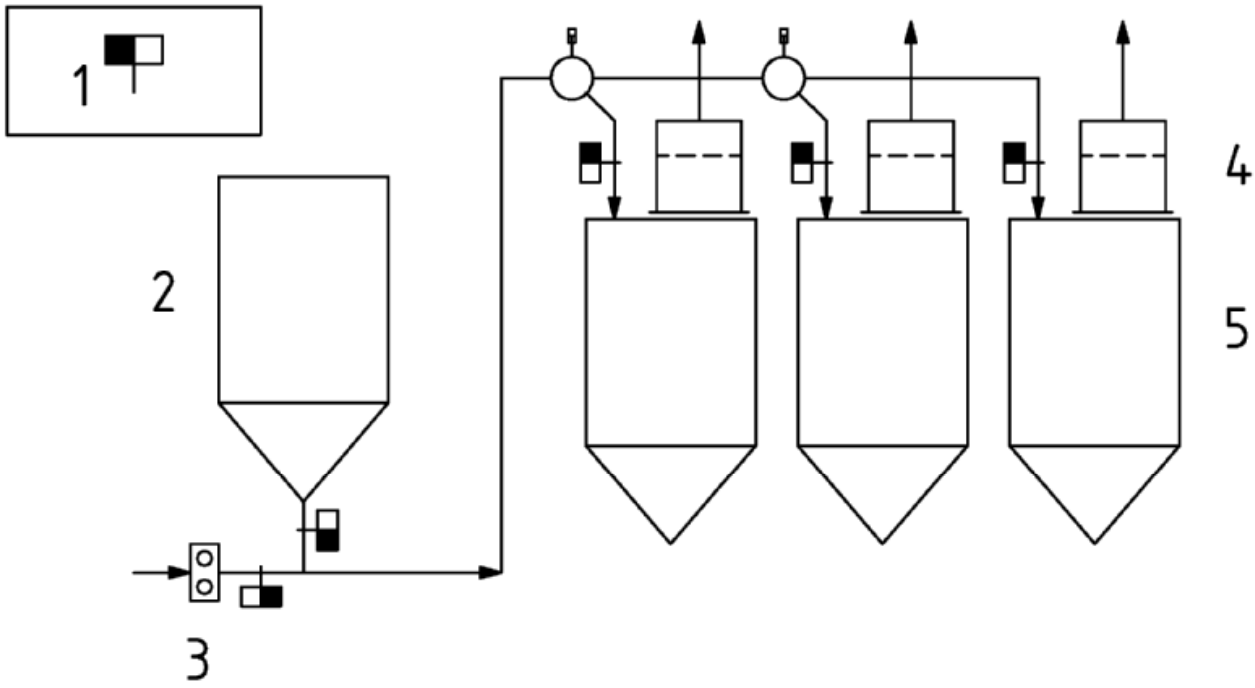
3.3.3
multi-discharge conveying system
pneumatic conveying by blowing or suction with discharge into several separators of gas and material, which are also material receiving vessels (see Figure 3)



Key

1 EN 741/other
2 Storage hopper
3 Gas supply
4 Filter
5 Discharge hopper

Figure 3 - Example of a typical multi-discharge conveying system (pressure conveying system)

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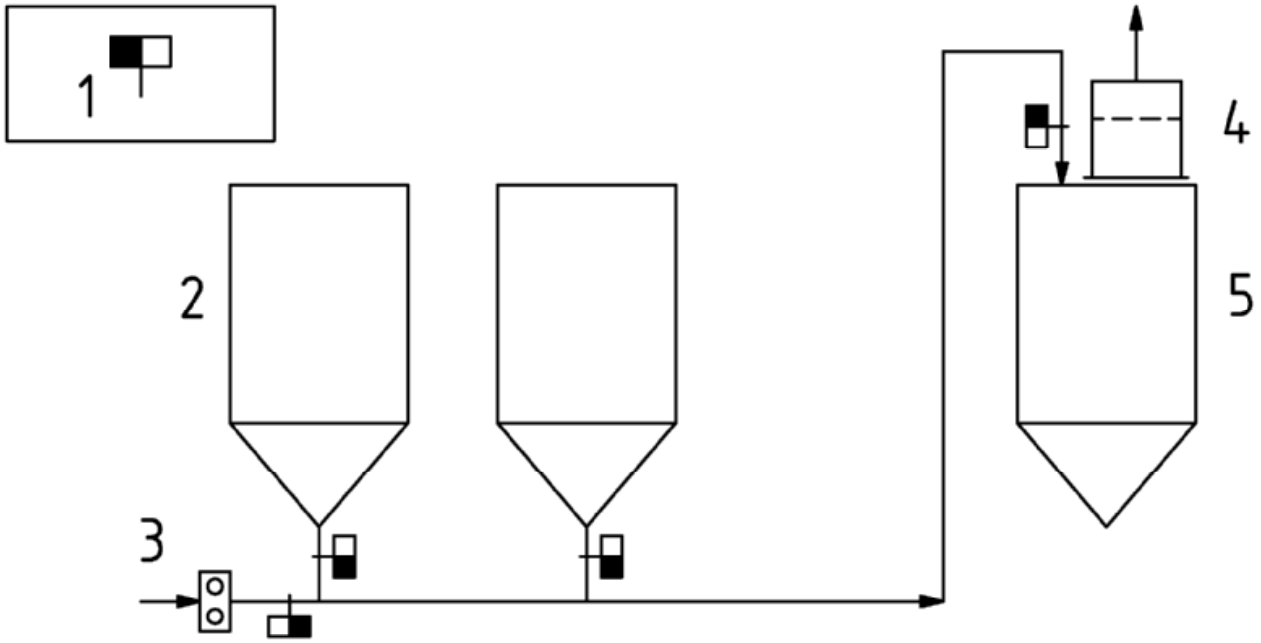
3.3.4
multi-pick up conveying system
pneumatic conveying under suction or blowing, with multiple feeder units and with one or more separators of gas and material which are also material receiving vessels (see Figure 4)



Key

1 EN 741/other
2 Storage hopper
3 Gas supply
4 Filter
5 Discharge hopper

Figure 4 - Example of a typical multi pick up conveying system (pressure conveying system)

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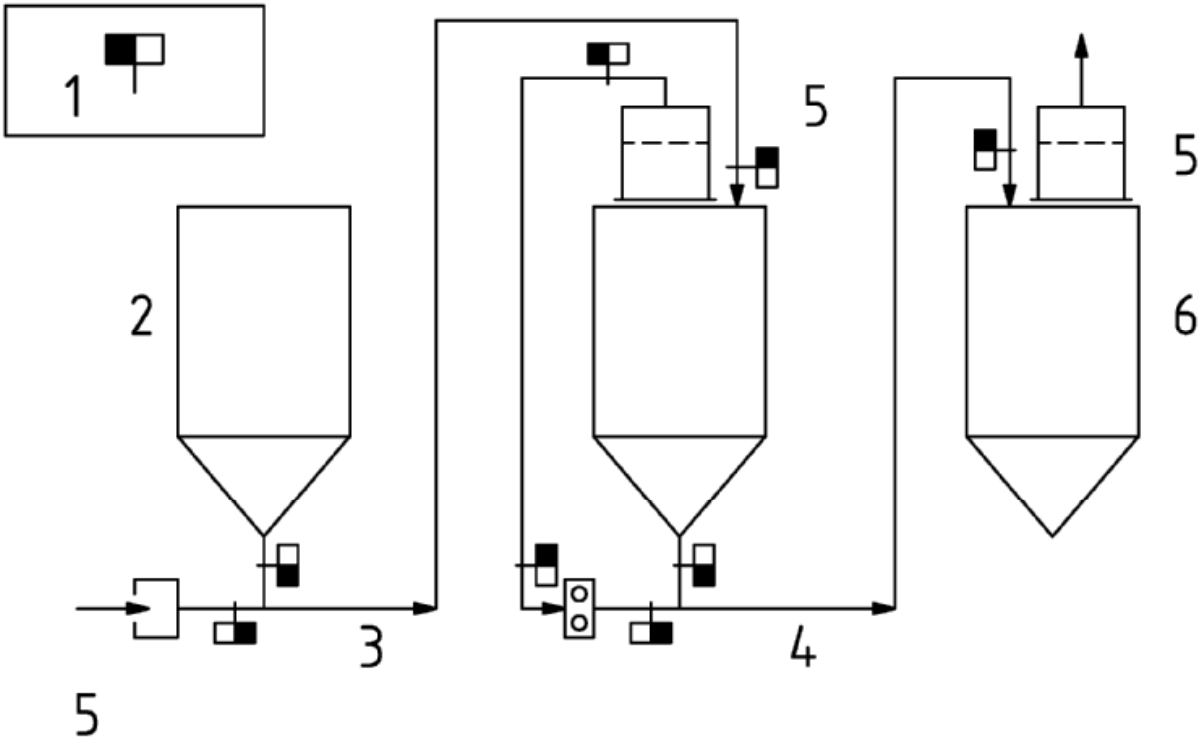
3.3.5
combined suction / pressure conveying system
pneumatic conveying under suction to a single separator of gas and material which is also a material-receiving vessel. The same unit provides a pressure system to one or more separators of gas and material which are also material receiving vessels (see Figure 5)



Key

1 EN 741/other
2 Storage hopper
3 Suction line
4 Pressure line
5 Filter
6 Discharge hopper

Figure 5 - Example of a typical combined suction pressure conveying system

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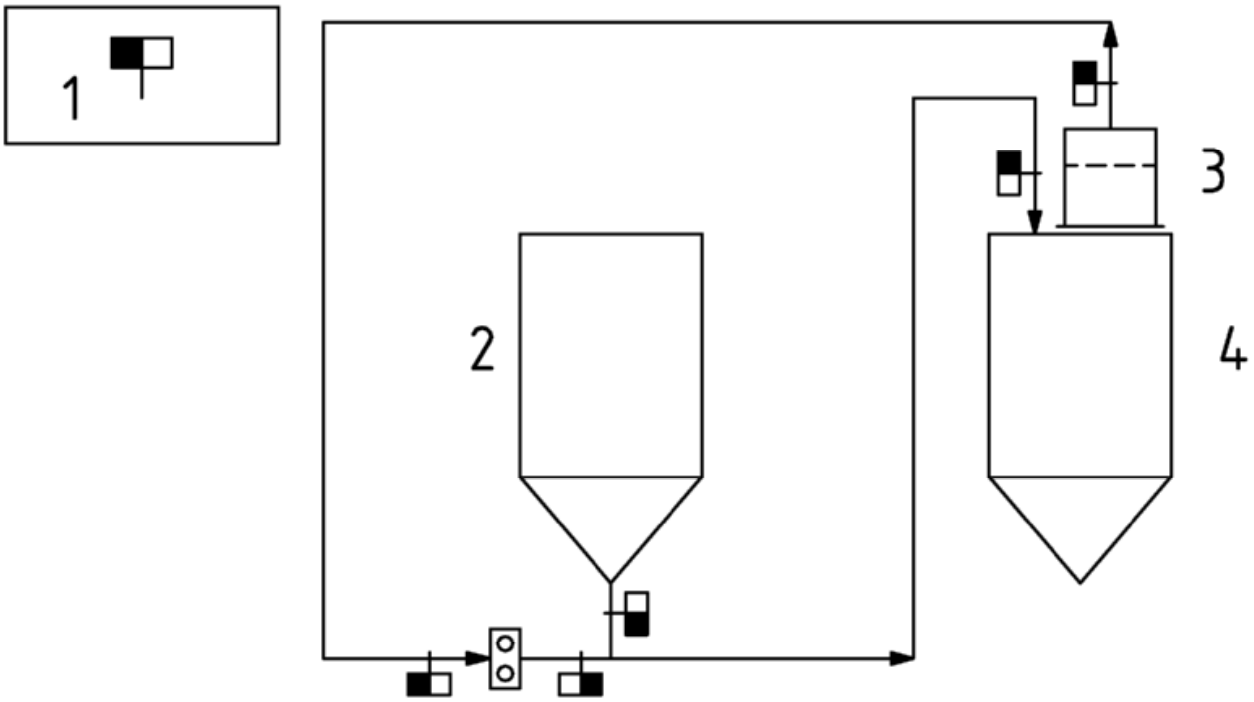
3.3.6
closed loop conveying system
pneumatic conveying under blowing or suction with discharge into a separator of gas and material which also serves as a material-receiving vessel. The gas is drawn back into the system (see Figure 6)



Key

1 EN 741/other
2 Storage hopper
3 Filter
4 Discharge hopper

Figure 6 - Example of a typical closed loop conveying system

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3.4 components

3.4.1
rotary valve feeder
continuous volumetric dosing element within a housing consisting of a rotating shaft with several blades which transports the material from the inlet to the outlet. Many types are available including blow through and drop through type valve feeder (see Figure 7)

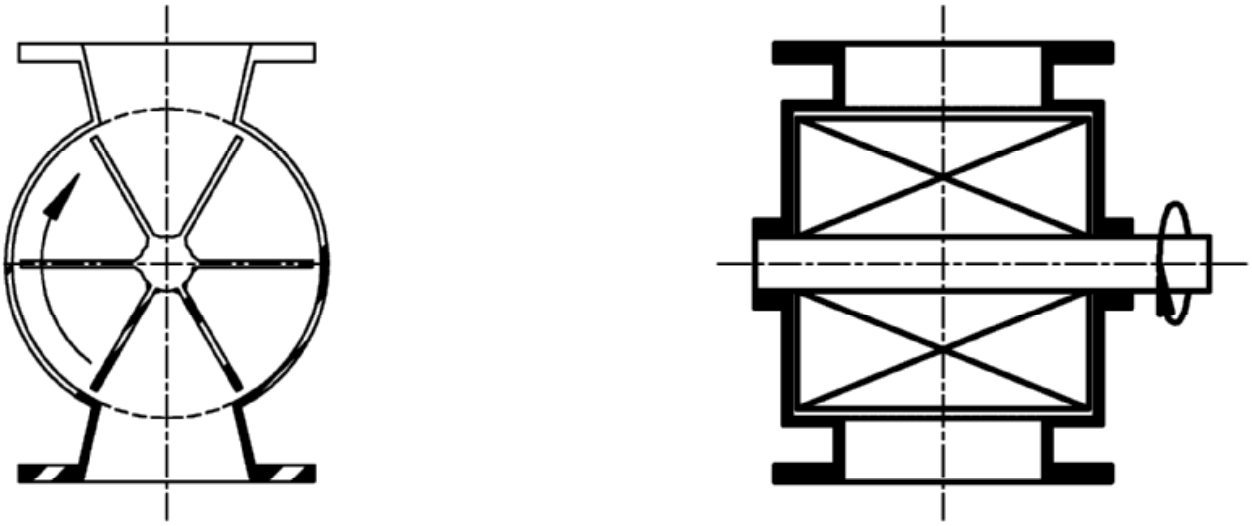

Figure 7 - Example of a typical drop through rotary valve feeder

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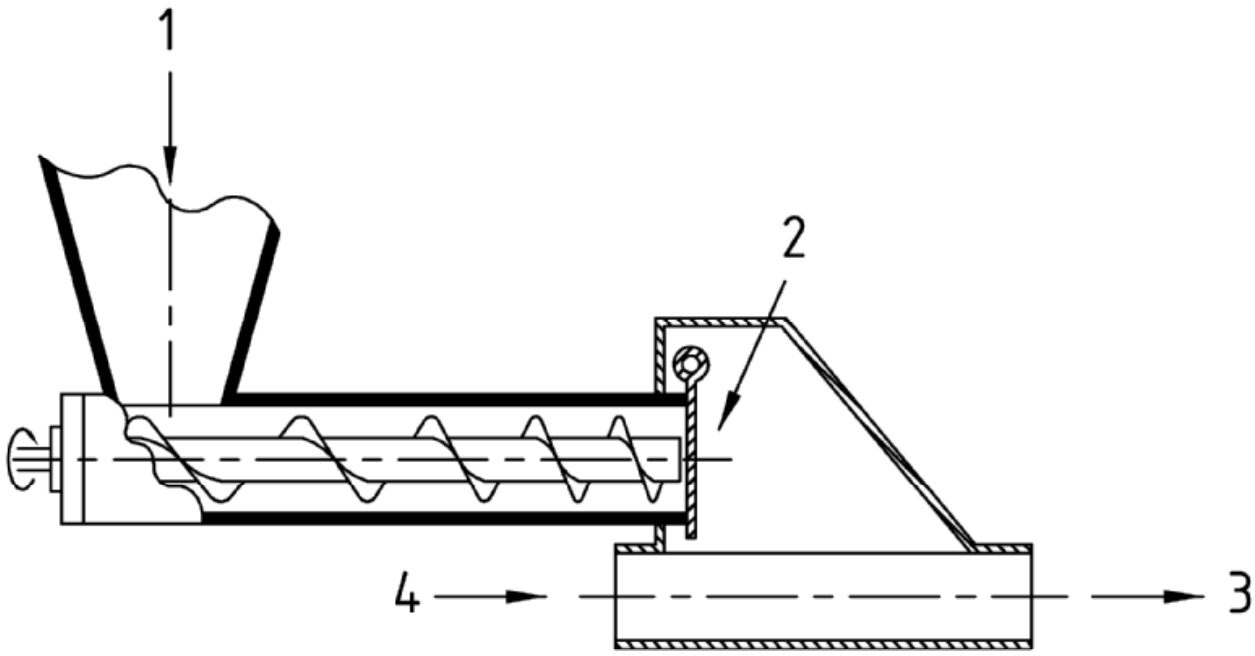
3.4.2
pressure screw feeder
a feeder used for introducing material into systems working above atmospheric pressure. The material is compacted, forming a seal against line pressure (see Figure 8)



Key

1 Material
2 Non return valve
3 Gas + material
4 Gas

Figure 8 - Example of a typical pressure screw feeder

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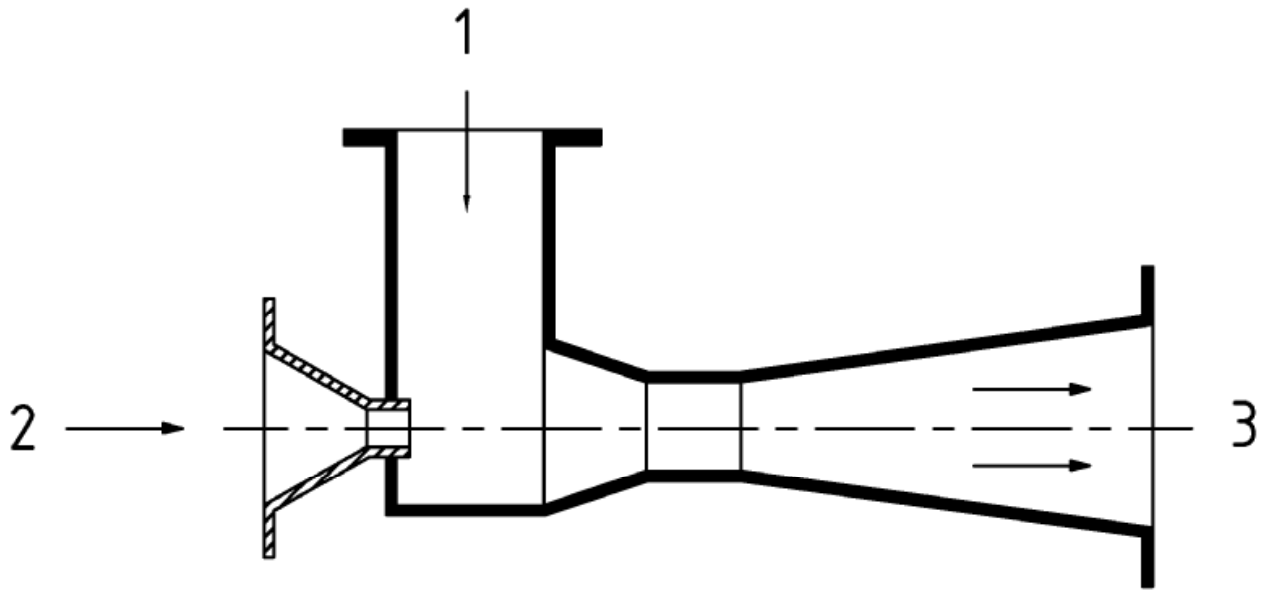
3.4.3
venturi feeder
a feeder used for introducing material into systems working above atmospheric pressure. High gas velocity decreases the pressure in the throat in order to encourage material to flow more readily under gravity into the pipeline (see Figure 9)



Key

1 Material
2 Gas
3 Material + Gas

Figure 9 - Example of a typical Venturi feeder

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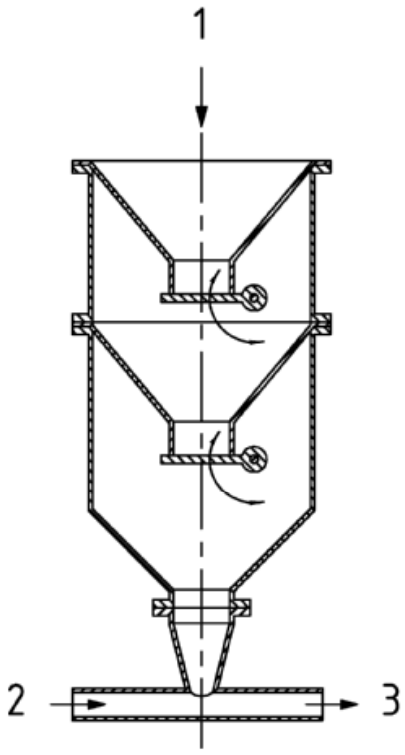
3.4.4
gate valve feeder
discontinuous volumetric dosing element with one or more chambers filled and discharged sequentially (see Figure 10). Used for pressure and suction conveying duties



Key

1 Material
2 Gas
3 Material + Gas

Figure 10 - Example of a typical gate valve feeder

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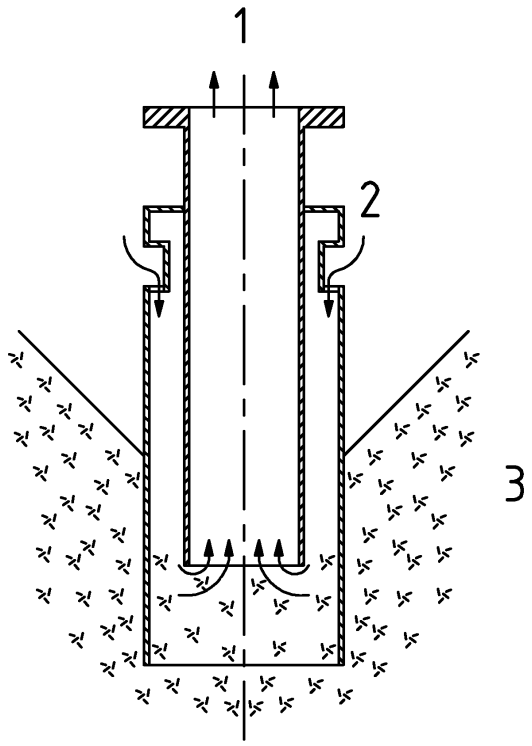
3.4.5
suction nozzle
a feeder used for introducing material into systems working below atmospheric pressure (see Figure 11). Suction nozzles are generally moved during operation. This facility is provided by means of flexible joints, telescopic sections or flexible hose sections of pipeline



Key

1 Gas + material
2 Gas inlet
3 Material

Figure 11 - Example of a typical suction nozzle

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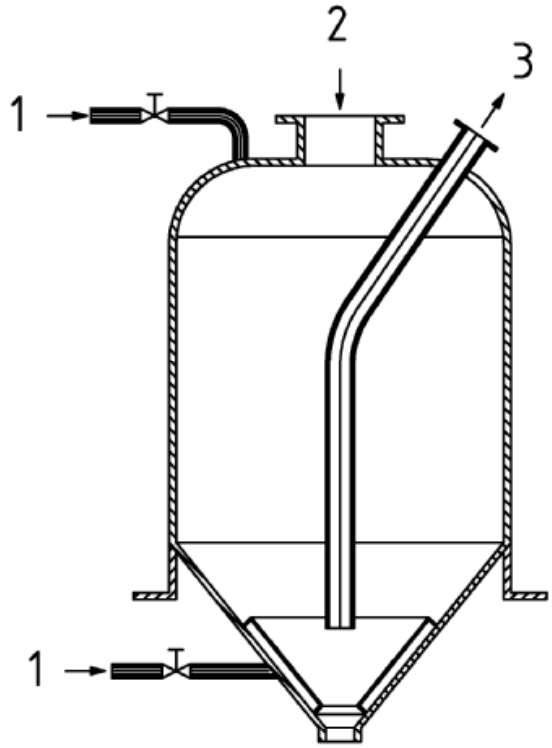
3.4.6
blow tank (pressure vessel)
Discontinuous or batch type pressure feeders. Two or more blow tanks may be combined to give continuous operation. A large number of types are available, for example: bottom or top discharge, with or without fluidization device (see Figure 12)



Key

1 Gas
2 Material
3 Material + Gas

Figure 12 - Example of a typical top discharge blow tank

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3.4.7
diverters
a device to direct the flow of material in a pipeline to alternative destinations (see Figure 13, 14 and 15)

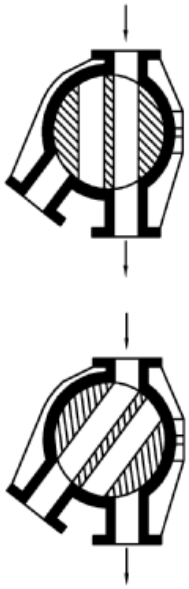

Figure 13 - plug diverter
(Typical example)

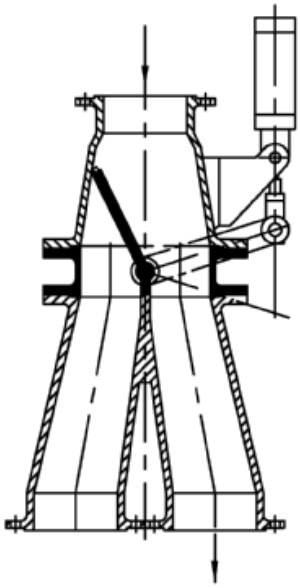

Figure 14 - flap diverter
(Typical example)

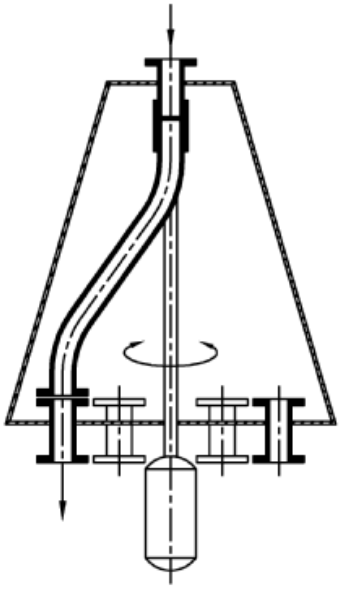

Figure 15 - multiway diverter
(Typical example)

3.5
piping
any combination of fittings with flexible or rigid pipes which allow the gas and the conveyed bulk materials to flow between components

3.6 area

3.6.1
working area
an area where persons work at or operate conveyors under normal conditions (inspection, maintenance and cleaning are excluded)

3.6.2
traffic area
an area which is accessible or reachable to all persons without opening a guard, activating a trip device or using additional means

3.7
installer
Assembler of the system and components covered by this standard

4 List of hazards

This clause (see Annex A) contains all the hazards, as far as they are dealt with in this standard, identified by risk assessment significant for this type of equipment and systems and which require action to eliminate or reduce the risk.

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5 Safety requirements and/or safety measures

Systems and their components shall comply with the safety requirements and/or measures of this clause. In addition, the systems and their components shall be designed according to the principles of EN 292 for hazards relevant but not significant which are not dealt with by this standard.

5.1 Mechanical hazards

5.1.1 Crushing hazard

Minimum gaps according EN 349 Table 1 and/or fixed guards or interlocking guards shall be provided to protect operators from crushing hazards caused by moving parts of the components.

In the event of a risk arising from crushing hazards due to suction nozzles being moved, visual warning signals, such as flashing lamps shall be provided in the area next to the nozzles. The signal shall be automatically turned on when the remote operated nozzle is being moved.

5.1.2 Shearing hazard

Minimum gaps according EN 349 Table 1 and/or fixed guard or interlocking guards shall be provided to protect operators from shearing hazards caused by moving parts of the components.

All components with automatic control (e.g. multiway diverters or rotary valves) shall be protected by means of a guard or crankcase, in accordance with EN 294, 4.5 and, Table 4 in order to prevent access to the moving parts of the machine.

When the inlet or the outlet of a rotary feeder is open, a pipe length, which complies with the safety distances, specified in the EN 294 standard or a fixed distance guard shall be provided to prevent access to the rotor. When this is not possible, a guard (e.g. a grating), in accordance with EN 294, shall be fitted.

5.1.3 Entanglement hazard

Safeguards for hazards arising at rotating shafts and couplings, chains and chain wheels, gears and power transmissions, belts and pulleys shall be made by means of fixed guards or interlocking guards and in accordance with the requirements of EN 294, Table 4 and as defined in EN 1088, 3.2 or in EN 953, 3.2 or 3.5.

5.1.4 Drawing-in or trapping hazard

Where a gas inlet of a suction nozzle shall allow a sphere with a diameter of 120 mm to pass through the guard, it shall be equipped with a guard, e.g. suitable grill, perforated sheet. The dimension of this guard shall be selected according the material size and shall not allow a sphere with a diameter of 120 mm to pass through it.

Where there is a danger of a drawing-in or a trapping hazard, the gas inlet of a suction nozzle shall be equipped with a device for cutting off the vacuum, e.g. emergency stop device or release valve.

In the event of risks arising from entanglement, drawing in or trapping hazards due to suction nozzles, visual warning devices shall be provided. Visual warning signal such as flashing lamps shall indicate that the machine is operating and shall be provided in the area next to the nozzles.

NOTE See 7.1.2 below for the requirements on the auditory warning device which indicates an impending start of the system for 5 sec minimum in the working area next to the nozzle.

5.1.5 Impact hazard

Conveying pipes, which can move during operating conditions (e.g. flexible pipe) shall be routed and made secure so that hazards to operators are avoided, (see 5.1.6.2).

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Piping movement or shocks can occur in plug or slug flow mode due to dynamic forces. Limiting the piping displacement (e.g. with additional supports) shall reduce impact hazard.

5.1.6 Ejection of parts of machinery, handled materials and conveying gazes

5.1.6.1 Ejection of part of machinery

Any pressure change in the system beyond the design limits of the system shall be prevented by appropriate measures e.g. relief valves or bursting discs.

Relief valves or other appropriate devices shall be designed in such a way that they can be positioned so that ejection to traffic or working areas is avoided when activated.

5.1.6.2 Ejection of handled materials

Relief valves or other appropriate devices shall be designed in such a way that they can be positioned so that ejection to traffic or working areas is avoided when activated.

Special attention shall be paid at the design stage when abrasive material is conveyed.

5.1.6.3 Hazards due to gases (other than air) used for conveying

Any discharge points (e.g. relief valves) shall allow the gas to be discharged safely.

NOTE Safe discharge may be obtained with e.g. a gas-tight duct to guide the gas to a safe area in order to prevent gas accumulation in confined spaces around the system.

5.2 Electrical hazards

5.2.1 Electrical equipment

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

5.2.1.1 Environment

The installer shall select and install electrical equipment, which is suitable for the intended-working environment. Enclosures (cabinets, boxes, compartments, motor casings) for the electrical equipment shall provide suitable protection (see EN 60529 and prEN 60204-1, 12.3 and 15.2).

If the conveyor is for use in special conditions outside the scope of prEN 60204-1, e.g. ambient temperature, component temperature, humidity, altitude, corrosive atmosphere, the manufacturer shall take account of this in the design.

5.2.1.2 Wiring practices

Electrical wiring of components shall be located where it is not subject to mechanical damage.

Where this is not possible, wiring shall be suitably protected, e.g. in rigid conduit, flexible tubing, trunking systems 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 endangered by such charges, suitable protective measures shall be taken (e.g. earth bonding, brush contact or discharge element for moving items). If the conveyed material or the conveying system material can create a hazard due to the generation of static electricity, safe discharge of static build up to earth shall be provided.

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Fixed filling and emptying devices which can create a hazard due to the generation of static electricity shall include equipotential linkage **and** an earthing point which shall be connected up to transportable devices, e.g. ship or truck, before filling or emptying.

NOTE For provisions for electrostatic hazards see CENELEC R044-001.

5.3 Thermal hazards - Burns by possible contact of persons

In the working area where materials conveyed or any part of the conveying system itself which, on contact with persons, can lead to burns, (e.g. the temperature of hot surfaces exceeds the values defined by EN 563 based on a one second contact time) suitable measures shall be taken to prevent contact with the conveyed materials or with hot surfaces (e.g. screen, fixed distance guards).

5.4 Hazards generated by electromagnetic radiation

Inductive and capacitive detectors shall also have sufficient immunity to electromagnetic disturbances to enable them to operate as intended, and not fail to danger, when exposed to the levels and types of disturbance as specified in EN 50082-2 and when subject to the power supply disturbances as specified in prEN 60204-1, clause 4.3. See prEN 60204-1, clause 4.4.2 for information on measures to reduce generated disturbances, and measures to reduce the effects of disturbances on the continuous handling equipment. They shall be installed and wired according to their instructions.

5.5 Biological and micro biological (bacterial) / hazards generated by materials and substances handled

Where the material conveyed is organic in nature, e.g. foodstuffs or other organic substances for human or animal consumption, care shall be taken to facilitate all cleaning operations of the system.

During the design phase, great care shall be taken to avoid crevices and pockets (e.g. conveying pipe couplings, diverters, bends, ...) in the system where food or organic particles might easily be deposited and remain. Requirements of EN 1672-2 apply.

5.6 Hazards caused by failure of energy supply, and other functional disorders

5.6.1 Failure of energy supply

In case of failure of the energy supply, the pneumatic conveying system shall stop in a safe condition in such a way that no uncontrolled gas and/or material discharge is possible.

5.6.2 Unexpected or unintended start-up

The requirements of EN 1037 apply.

5.6.3 Control equipment

The safe working of the systems and their components shall be ensured by appropriate devices, e.g. pressure sensors or limit switches, or procedures.

Systems with blowtanks, the pressure of which is released to atmospheric pressure before filling with material shall be designed in such a manner that is not possible without overriding control signals to open the filling valve (manually or automatically), when the blowtank is pressurized.

5.7 Measures for protection against hazards arising during inspection, maintenance and cleaning

In areas other than working and traffic areas where the risk of injury is foreseeable, suitable safety measures shall be provided in accordance with the risk.

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When there are several hose pipe couplings at the same place for the conveying of materials of different natures, they shall have clear identification to ensure correct connections, e.g. colour, type, diameter, limit switches, ...

The components shall be designed so that they retain their integrity in use. Guards shall be designed so that they remain in place and cannot be incorrectly installed.

Equipment shall be designed so that safe access for inspection, cleaning and lubrication purposes is facilitated, using correct procedures defined in instruction handbook.

5.8 Safety signs - General safety requirements

When access, passageways with obstacles and emergency exits are provided, they shall be indicated by written signs (or pictograms).

Points where a hazard may remain or appear (e.g. thermal hazard) shall be fitted with warning signs (see EN 61310-2).

Warning signs shall be design according to ISO 3864.

6 Verification of safety requirements and/or measures

Safety requirements and/or measures of the chapters 5 and 7 of this standard shall be verified according to the table below. It includes the following types of verifications:

1) visual check: the result of which only being to establish the adequacy of the drawings with the requirements of the standard and/or that something is present on the system or component (e.g. guarding, visual warning device, marking, document, …);

2) measurement: the result of which being that the stated measurable parameters have been met (e.g. geometric dimensions);

3) functional test: the result of which shows that the adequate signals intented to be forwarded to the main control system of the complete machine are available and comply with the requirements and with the technical documentations.

The table below shows the verifications, which have to be done on the type and on each individual components if they are produced in series.

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Table 1

Type verifications				Individual verifications		
Clauses of EN 741	**Visual check**	**Measurement**	**Functional tests**	**Visual check**	**Measurement**	**Functional tests**
5.1.1	x	x	Interlocking guards, visual warnings	x		
5.1.2	x	x	Interlocking guards	x		
5.1.3	x	x	Interlocking guards	x		
5.1.4	x	x	visual warnings, device for cutting off the vacuum	x		
5.1.5	x			x		
5.1.6.1	x (relief valves and bursting discs see their manufacturer's documents)			x		
5.1.6.2	x			x		
5.1.6.3	x			x		
5.2.1	x			x		
5.2.2	x			x		
5.2.1.1	x					
5.2.1.2	x			x		
5.3	x	x				
5.4	x		x	x		
5.5	x			x		
5.6.1	x		x	x		
5.6.2	x		x	x		
5.6.3	x		x	x		
5.7	x			x		
5.8	x			x		
7.1	verification of the content			x		
7.2	verification of the content			x		

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7 Information for use

7.1 Instruction handbook

7.1.1 General

The instruction handbook shall be in accordance with EN 292-2, 5.5 and shall include the information mentioned in EN 292-2, 1.7.5 of Annex A. It shall be provided to the installer. It includes the conditions under which the system or components are intended to be used, in particular with regard to:

a) the personal protective equipment needed for operation of the system or components and the hazards which it is designed to protect against;

b) type and physical characteristics of conveyed bulk material which the system is designed to handle (e.g. bulk density, particle size, temperature, humidity, ...);

c) type and physical characteristics of the conveying gas;

d) operating conditions: indication of the operating mode(s) e.g. automatic/manual operation;

e) range of intended environmental conditions considering also the restrictions in the scope (e.g. wind, temperature, relative humidity, …);

f) the load bearing capacity of loading points.

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

The instruction handbook shall indicate to the installer that the general information listed above shall be provided to the user.

The instruction handbook shall indicate that modification of the intended functioning should not be done without the agreement of the manufacturer.

7.1.2 Instructions for the installation of the system and components

The instructions for the installation of the system and components shall indicate that the installer shall carry out a full hazard analysis and risk assessment, in accordance with EN 1050 to identify all hazards and potentials risks to ensure that the complete machine is suitable and safe for its intended uses.

NOTE The hazard analysis and risk assessment require the collaboration of the user.

The following information shall be included in the instructions for installation of the systems and components:

Information on the storage of the components;

Information on assembly, preferably with drawings showing:

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

b) the assembly phases and technical requirements;

c) the handling method required;

d) requirements for anchoring and fixing points.

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Information:

a) for the design of the auditory warning device which is not provided by the manufacturer of the system, which shall provide a signal with a sound pressure level 15 dB(A) over the threshold of ambient sound pressure level in the working area next to the nozzle at an horizontal distance of 1m from the nozzle and at a height of 1,6 m from the floor of the working area and which indicates an impending start of the system for 5 sec minimum;

b) that the orientation of the relief valves, bursting discs, ... shall be determined to avoid hazards in the working and traffic area;

c) for the safe method for connecting hoses;

d) for the safe access for inspection, cleaning and lubrication operations defined in instruction handbook including location for installation of fixed access by the installer (see prEN 12437-1 to 4);

e) for the design of means of electrical isolation. If the conveyor 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 conveyor system) such parts shall be marked, identified and protected against direct contact as appropriate (see prEN 60204-1, 5.4.5 and 6.2);

f) for provisions to prevent unexpected start-up and electric shock when work is being carried out on the system, its components or their electrical equipment (see EN 1037 and prEN 60204-1, 5.4);

g) for the design of emergency-stop function in accordance with EN 418 and either a category "0" or "1". The category shall be chosen to bring the machine which includes the system or components to a stop condition within the shortest time compatible with the machine;

h) for the suitable measures to be taken to prevent contact with the conveyed materials or with hot surfaces when the temperature of hot surfaces exceeds the values defined by EN 563 based on a one second contact time (e.g. : screen, fixed distance guards);

i) for the location at a vertical distance above the floor between 0 m and 1.5 m of actuators of manually operated valves and couplings which need to be operated during routine or emergency procedures;

j) for suitable assembling methods for systems intended to convey foodstuff or organic substances for human consumption;

k) for the actuators of hand-operated control devices in order to have them selected and installed so that:

- they are not less than 0,6 m above the servicing level and are within easy reach of the normal working position of the operator;
- hazardous situations for the operator when he operates them are avoided;
- the possibility of inadvertent operation is minimized;

l) for the free minimum height in working area: 2.1 m is necessary for work standing (see prEN 12437-2, 4.2.2) and 1 m above the seat level for work sitting with minimum access of 0.6 m width and 2.1 m height;

m) for the installer (see clause 3.7) in charge of verifying that sub - assemblies are suitably installed and wired to minimize the effects of electromagnetic disturbances on the system and their components and in accordance with any recommendations of the supplier(s) of the sub - assemblies;

n) for the installation of written signs (or pictograms) to indicate obstacles in access, passageways and emergency exits;

o) for the protective measures related to the generation of electrostatic electricity (e.g. earth bonding);

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p) for the design of safe discharge points (e.g. relief valves) which may be obtained with e.g. a gas-tight duct to guide the gas to a safe area in order to prevent gas accumulation in confined spaces around the equipment.

7.1.3 Instructions for the functional check (before first put into service) of the pneumatic conveyingsystem

When the pneumatic conveying systems and/or components are a part of a complete conveying system, the instruction handbook shall specify the verification methods to check:

a) that power disconnection/connection and normal stopping and starting functions operate;

b) that audible and visual warning devices, and phonic connections operate as intended;

c) that all limit switches and emergency-stop devices are operating correctly by actuation;

d) that safety distances for people are as prescribed and that interlocking operate as intended;

e) that all safety signs and markings are attached;

f) that the system or components under normal operating conditions work safely;

g) that all sensing and metering equipment and the related control systems operate as intended.

7.1.4 Instructions for the use of the pneumatic conveying system or components

The instruction handbook shall indicate to the installer that the instructions for use shall be provided to the user.

7.1.4.1 The instruction handbook shall include, in addition to EN 292-2, 5.5.1 the following information:

a) the material safety data sheet of the conveyed material shall be made available by the user and incorporated by the systems or components manufacturer;

b) the minimum and/or maximum operating pressure;

c) the instructions for starting-up the system or components;

d) that it is prohibited to change of the setting of safety devices (e.g. setting of relief valves);

e) the safe methods for releasing pipeline blockages formed from the conveyed material;

f) the method and frequency of cleaning the system depending on material conveyed;

g) the safe method of working in the area of hazards (e.g. relief valves vent, explosion vent, bursting disk and pipe moving in plug or slug flow mode);

h) the instructions to train the personnel in charge of starting, operating the system or components;

i) the safe method for connecting hoses;

j) restarting operations of the system or components (which has been inoperative because of an emergency or accidental stoppage) shall be preceded by an inspection aimed at:

- determining the cause of the emergency or accidental stoppage;
- repairing the fault.

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It shall not be assumed that a stopped system or components is a safe system or components. Stored energy may be released unintentionally or by incorrect maintenance procedures. This is also true for operations, which would be hazardous if they were carried out when the machine is operating, e.g. freeing a blockage.

7.1.4.2 The instruction for use shall draw the attention of the user:

a) to be careful to ensure a regular feed, avoiding over-loading;

b) not to modify the design or configuration of the system or components without obtaining competent advice;

c) that after modification of the design or configuration of the systems or components, recommissioning shall be carried out in accordance with the instructions for commissioning (see 7.1.3);

d) that all loading and working stations and passageways shall be kept clear.

7.1.5 Instructions for maintenance

The instruction handbook shall indicate to the installer that the instructions for maintenance shall be provided to the user.

7.1.5.1 The instruction handbook shall specify in particular (see EN 292-2, 5.5.1 e):

a) the requirements on safety devices (e.g. safety valves, vacuum breakers, bursting disc and diaphragm,...) shall be kept in fully operating condition;

b) the continuity of earthing;

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

d) the conditions under which maintenance works and rectification of faults on continuous handling systems or components can be performed e.g. by requiring that the system or part of the system is isolated, protected against unexpected start-up and measures are taken against unexpected movements;

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

f) a list of parts to be checked periodically;

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

7.1.5.2 Consideration shall also be given to hazards arising when entry to the system is required for maintenance purposes, e.g. poison/asphyxiation, suffocation from toxic and/or inert gases. An appropriate written safe system of work and safety measures shall be provided by the manufacturer of the conveying system and/or components.

7.1.5.3 The instruction handbook shall specifically be drawn attention to the obligation of stopping and de-pressuring all or part of the system to replace certain parts of components.

7.1.5.4 Instruction handbook for maintenance will require (at least) that:

a) continuous handling system or components shall be kept in proper working condition (including evacuating of snow and ice) and maintained in accordance with the manufacturer's instructions;

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

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c) inspection and adjustment of continuous mechanical handling system or components, in motion or in use, should be carried out with guards in position;

d) displacing or removal of a guard and/or neutralization of a safety device shall be carried out in accordance with EN 292-2, 4.2.2;

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

7.1.6 Training

In the instruction handbook the supplier shall indicate whether operator training is required and give details of this training.

7.1.7 Errors of fitting - Incorrect assembly

The instructions for maintenance shall indicate those various types of risks, which can arise from incorrect assembly of the different components of the handling equipment or the system.

7.2 Marking

7.2.1 Rating plate

The components shall be marked at least with the following:

a) name and address of the manufacturer;

b) year of manufacturing;

c) maximum pressure for system under pressure or minimum pressure for system operating under vacuum;

d) designation of series or type;

e) serial number.

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Annex A
(normative)

List of hazards according to EN 292-1 in comparison with Annex I of the Machinery Directive.

NOTE Y = significant hazard, N = Not significant hazard.

Table A.1

	Hazards	Y or N	Hazard location / occurrence	Requirements Chap 5, 7
4.1	**Mechanical hazards**			
4.1.1	Crushing	Y	suction nozzles	5.1.1,
4.1.2	Shearing	Y	valves, diverters, feeders	5.1.2,
4.1.3	Cutting or severing	N		
4.1.4	Entanglement	Y	transmission parts	5.1.3
4.1.5	Drawing-in or trapping	Y	suction nozzles, gas inlets	5.1.4
4.1.6	Impact	Y	flexible pipes and couplings	5.1.5
4.1.7	Stabbing or puncture	N		
4.1.8	Friction or abrasion	N		
4.1.9	High pressure fluid ejection	Y	relief valves, bursting discs, explosion vents all parts and materials under pressure	5.1.6
4.1.10	Ejection of parts of: - machinery; - handled materials or loads.	Y	relief valves, bursting discs, explosion vents all parts and materials under pressure	5.1.6
4.1.11	Loss of stability	N		
4.1.12	Slip, trip, fall hazards	Y	Fixed access	7.1.2
4.2	**Electrical hazards**			
4.2.1	Electrical contact direct or indirect	Y	all electrical equipment	5.2.1
4.2.2.	Electrostatic phenomena	Y	material, equipment	5.2.2
4.2.3	Thermal radiation	N		
4.2.4	External influence on electrical equipment	Y	electrical equipment Inductive and capacitive detectors	5.2.1 5.4
4.3	**Thermal hazards**			
4.3.1	Burns and scalds by contact	Y	hot material and system parts	5.3
4.3.2	Hot or cold work environment	N		
4.4	**Hazards generated by noise**			not dealt with
4.4.1	Physiological disorders			see 1.5
4.4.2	Interference with communication			
4.5	**Hazards generated by vibration**	N	gas compressor, blowers, fans, pipes	

continued

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Table A.1 (*concluded*)

	Hazards	Y or N	Hazard location / occurrence	Requirements Chap 5, 7
4.6	Hazards generated by radiation			
4.6.1	Electrical arcs	N		
4.6.2	Lasers	N		
4.6.3	Ionizing radiation sources	Y	Instruments	Not dealt with see 1.5
4.6.4	High frequency electromagnetic fields	N		
4.7	Hazards generated by materials or loads conveyed			
4.7.1	Inhalation of harmful materials	Y	nature of material	5.1.6, 7.1.2
4.7.2	Fire or explosion	N	nature of material and gas	Annex C (informative)
4.7.3	Biological	Y	nature of material	5.5, 7.1.2
4.8	Hazards generated by neglecting ergonomic principles			
4.8.1	Unhealthy postures	N		
4.8.2	Inadequacy with human anatomy	N		
4.8.3	Neglecting of personal protection	N		
4.8.4	Inadequate local lighting	N		
4.8.5	Mental overload, stress	N		
4.8.6	Human errors	N		
4.9	Hazards combinations	N		
4.10	Hazard caused by failures of energy supply and others			
4.10.1	Failure of energy supply	Y	pressurized vessel and parts of the system under pressure	5.6.1
4.10.2	Unexpected ejection of machine part	N		
4.10.3	Failure of control system	N		
4.10.4	Errors of fitting or programmation	Y	Hose pipe couplings	5.7
4.10.5	Breaking down of machinery parts -	N		
4.11	Hazards caused by non correct positioned of safety related measures or means			
4.11.1	All kinds of guard	Y	whole system	5.1
4.11.2	All kinds of safety devices	Y	whole system	5.1
4.11.3	Starting and stopping devices	Y	whole system	7.1.2
4.11.4	Safety signs and tags	Y	whole system	5.8
4.11.5	All kind of warning devices	Y	whole system	5.1, 7.1.2
4.11.6	Energy supply disconnecting devices	Y	whole system	7.1.2
4.11.7	Emergency devices	Y	whole system	7.1.2
4.11.8	Feeding take-off means of handled materials or loads	N		
4.11.9	Essential equipment and accessories for safe adjusting and/or maintenance	Y	whole system	7.1.5
4.11.10	Equipment for evacuating gas	Y	whole system	5.1.6.3, 7.1.2

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Annex B
(informative)

Bibliography

ISO 7149, *Continuous handling equipment - Safety code - Specific rules*.

VDI 3673*, Pressure venting of dust explosions*.

VDI 2263, *Dusts fires and dusts explosions, hazards assessment, protective measures*.

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Annex C
(informative)

Fire or explosion hazard

If materials to be conveyed are combustible, consideration shall be given to the prevention and limitation of fire and explosion hazards by protection inside and outside of the equipment.

NOTE 1 Requirements for equipment are under consideration by CEN/TC 305.

NOTE 2 It is essential that during the hazard analysis and risk assessment not only hazards in the pneumatic conveying system itself but also upstream and downstream processes, such as hoppers and filters, shall be considered (see also prEN 617).

Fires or explosions can be avoided, by:

- avoiding the build-up of an explosive atmosphere by using an inert gas, for example CO_2 or nitrogen:
- avoiding sources of ignition by using electrical equipment conforming to the appropriate standards, e.g. EN 50014 by using electrical equipment suitable for hazardous areas zone 20, 21 or 22 (see EN 1127-1);
- by applying anti-static measures (see 5.2.3);
- by measures preventing metal in the conveyed material;
- by excluding overheating of the material.

Hazards due to explosion can be limited by e.g. one or more of the following:

- using explosion vents;
- using explosion suppression systems;
- pressure resistant and/or pressure shock resistant design.

Explosion vents or other appropriate devices should be designed in such away that they can be positioned so that ejection to traffic or working areas is avoided when activated. When explosion vents or other appropriate devices are opened, the conveying system should stop automatically.

If an inert gas or air with added inert gas is used for explosion prevention, an oxygen measuring instrument and control system shall be provided to ensure that the concentration of oxygen is always below to the appropriate critical value.

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Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU 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 EU Directives.

Machinery Directive 98/37/EC(*).

Low voltage Directive 73/23/EEC.

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

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

The clauses of this standard are likely to support requirements of Directives listed above in this annex (*).

Table ZA.1 - Correspondence between EN 741 clauses and essential requirements of the Machinery Directive 98/37 EC

Clauses/sub-clauses of this European Standard	Essential requirements of the Machinery Directive
5.1.1	1.3.7, 1.3.8, 1.4.1, 1.4.2, 1.7.1
5.1.2	1.3.7, 1.3.8, 1.4.1, 1.4.2
5.1.3	1.3.7, 1.3.8, 1.4.1, 1.4.2
5.1.4	1.3.7, 1.3.8, 1.4.1, 1.4.2, 1.7.1
5.1.5	1.3.2
5.1.6.1	1.3.2, 1.3.3
5.1.6.2	1.3.3
5.1.6.3	1.5.13
5.2.1	1.5.1
5.2.1.1	1.5.1
5.2.1.2	1.5.1
5.2.2	1.5.2
5.3	1.5.5
5.4	1.5.11
5.5	2.1
5.6.1	1.2.6
5.6.2	1.6.3
5.6.3	1.3.3
5.7	1.5.4, 1.6.2
5.8	1.7.2
7.1	1.2.2, 1.2.6, 1.3.5, 1.5.11, 1.5.13, 1.5.15, 1.6.2, 1.6.3, 1.7.4
7.2	1.7.0, 1.7.3

(*) The Machinery Directive 98/37/EC is a consolidation of 89/392/EEC and its amendments 91/368/EEC, 93/44/EEC and 93/68/EEC.

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