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Pneumatic fluid power — General rules and safety requirements for systems and their components

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee MCE/18/-/9, Systems.

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

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English Version

**Pneumatic fluid power - General rules and safety requirements
for systems and their components (ISO 4414:2010)**

Transmissions pneumatiques - Règles générales et
exigences de sécurité pour les systèmes et leurs
composants (ISO 4414:2010)

Fluidtechnik - Allgemeine Regeln und sicherheitstechnische
Anforderungen an Pneumatikanlagen und deren Bauteile
(ISO 4414:2010)

This European Standard was approved by CEN on 6 November 2010.

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Foreword

This document (EN ISO 4414:2010) has been prepared by Technical Committee ISO/TC 131 “Fluid power systems” in collaboration with Technical Committee CEN/TC 114 “Safety of machinery” the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by May 2011, and conflicting national standards shall be withdrawn at the latest by November 2011.

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

This document supersedes EN 983:1996+A1:2008.

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

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

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

Endorsement notice

The text of ISO 4414:2010 has been approved by CEN as a EN ISO 4414:2010 without any modification.

Annex ZA (informative)

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

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

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements, except Essential Requirements 1.5.8 and 1.7.4.2 u), of that Directive and associated EFTA regulations.

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

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*Transmissions pneumatiques — Règles générales et exigences de
sécurité pour les systèmes et leurs composants*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 4414 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 9, *Installations and systems*.

This third edition cancels and replaces the second edition (ISO 4414:1998), which has been technically revised, specifically with regards to the following:

- a) integration of ISO 4414:1998 and EN 983:1996;
- b) integration of safety requirements to comply with the European Machinery Directive 2006/42/EC;
- c) updating of safety requirements, taking into account International Standards on machine safety.

Introduction

This International Standard is a type B standard as defined in ISO 12100. The stipulations of this International Standard can be supplemented or modified by a type C standard. For machines that are covered by the scope of a type C standard and that have been designed and built in accordance with the provisions of that standard, the provisions of that type C standard take precedence over the provisions of this type B standard.

In pneumatic fluid power systems, power is transmitted and controlled through air or a neutral gas under pressure within a circuit.

The application of pneumatic fluid power systems requires a thorough understanding and precise communication between the supplier and purchaser. This International Standard was prepared to assist that understanding and communication and to document many of the good practices learned from experience with pneumatic systems.

Use of this International Standard assists in

- a) identifying and specifying the requirements for pneumatic systems and components;
- b) identifying respective areas of responsibility;
- c) designing systems and their components to comply with specific requirements;
- d) understanding the safety requirements of a pneumatic system.

Equivalent requirements for hydraulic systems are defined in ISO 4413.

Pneumatic fluid power — General rules and safety requirements for systems and their components

1 Scope

This International Standard specifies general rules and safety requirements for pneumatic fluid power systems and components used on machinery as defined by ISO 12100:2010, 3.1. It deals with all significant hazards associated with pneumatic fluid power systems and specifies principles to apply in order to avoid those hazards when the systems are put to their intended use.

NOTE 1 See Clause 4 and Annex A.

The significant hazard noise is incompletely dealt with in this International Standard.

NOTE 2 Noise emission depends especially on the installation of pneumatic components or systems into machinery.

This International Standard applies to the design, construction and modification of systems and their components, also taking into account the following aspects:

- a) assembly;
- b) installation;
- c) adjustment;
- d) uninterrupted system operation;
- e) ease and economy of maintenance and cleaning;
- f) reliable operation in all intended uses;
- g) energy efficiency; and
- h) environment.

This International Standard does not apply to air compressors and the systems associated with air distribution as typically installed in a factory, including gas bottles and receivers.

2 Normative references

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

ISO 1219-1, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols for conventional use and data-processing applications*

ISO 1219-2, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 2: Circuit diagrams*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 11727, *Pneumatic fluid power — Identification of ports and control mechanisms of control valves and other components*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13850, *Safety of machinery — Emergency stop — Principles for design*

ISO 13851, *Safety of machinery — Two-hand control devices — Functional aspects and design principles*

ISO 14118, *Safety of machinery — Prevention of unexpected start-up*

IEC 60529, *Degrees of protection provided by enclosures (IP code)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and ISO 12100 and the following apply.

3.1 commissioning

procedure by which a system is formally accepted by the purchaser

3.2 emergency control

control function that brings a system to a safe condition

3.3 function plate

surface that contains information describing either the performance of a manually operated device (e.g. ON/OFF, forward/reverse, left/right, up/down) or the status of a function performed by the system (e.g. clamp, lift, advance)

3.4 neutral gas

non-combustible gas that has properties similar to air and does not react to the effects of pressure and/or temperature in a manner different from air

3.5 purchaser

party that stipulates the requirements of a machine, equipment, system or component and judges whether the product satisfies those requirements

3.6 supplier

party that contracts to provide the product(s) to satisfy the purchaser's requirements

4 List of significant hazards

Table A.1 lists significant hazards associated with the use of pneumatic fluid power in a machine.

5 General rules and safety requirements

5.1 General

5.1.1 When designing pneumatic systems for machinery, all intended operations and use of systems shall be considered. Risk assessment, e.g. in accordance with ISO 14121-1, shall be carried out to determine the foreseeable risks associated with systems when they are used as intended. Reasonably foreseeable misuse shall not cause hazards. The risks identified shall be eliminated by design and, where this is not practicable, safeguards (first preference) or warnings (second preference) against such risks shall be incorporated, in accordance with the hierarchy established in ISO 12100.

NOTE This International Standard provides requirements for components of fluid power systems; some of these requirements are dependent on the hazards associated with the machine in which the system is installed. Therefore, the final specification and construction of the pneumatic system could need to be based on risk assessment and agreement between purchaser and supplier.

5.1.2 The control systems shall be designed in accordance with the risk assessment. This requirement is met when ISO 13849-1 is used.

5.1.3 The prevention of damage to the machine, systems and the environment shall be considered.

5.1.4 Deviations from this International Standard shall be agreed to in writing between the purchaser and supplier. Attention should be drawn by the purchaser and/or the supplier to applicable national and local codes or laws.

5.2 Basic requirements for the design and specification of pneumatic systems

5.2.1 Component selection

5.2.1.1 All components and piping in the system shall be selected or specified to provide for safety in use, and they shall operate within their rated limits when the system is put to its intended use. Components and piping shall be selected or specified so as to ensure that they can operate reliably under all intended uses of the system. Particular attention shall be paid to the reliability of components and piping that can create a hazard in the event of their failure or malfunction.

5.2.1.2 Components and piping shall be selected, applied and installed in accordance with the manufacturer's recommendations.

5.2.1.3 It is recommended that wherever practicable, components and piping made in accordance with recognized International Standards should be used.

5.2.2 Unintended pressures

5.2.2.1 All related parts of the system shall be designed or otherwise protected against foreseeable pressures exceeding the maximum working pressure of the system or the rated pressure of any part of the system if the excessive pressure can cause a hazard.

5.2.2.2 The preferred means of protection against excessive pressure is one or more pressure-relief valves located to limit the pressure in all related parts of the system. Other means, such as pressure regulators, may be used, provided these means satisfy the application requirements.

5.2.2.3 Systems shall be designed, constructed and adjusted to minimize pressure surges and fluctuations. Pressure surges and fluctuations shall not cause hazards.

5.2.2.4 Loss of pressure or pressure drop shall not expose persons to a hazard and should not damage the machinery.

5.2.2.5 All pneumatic components shall vent into a non-hazardous area with a connection to the atmosphere.

5.2.2.6 Means shall be provided to prevent unacceptable pressure build-up where high external loads are reflected on actuators.

5.2.3 Mechanical movements

Mechanical movements, whether intended or unintended (e.g. effects from acceleration, deceleration or lifting/holding of masses), shall not result in a situation hazardous to persons.

5.2.4 Noise

In the design of pneumatic systems, the expected noise shall be taken into account. Depending on the application, measures shall be taken to minimize the risks caused by noise. Airborne noise and structure-borne noise shall be considered.

NOTE For the design of low-noise machinery and systems, see ISO/TR 11688-1.

5.2.5 Leakage

Leakage (internal or external) shall not cause hazards.

5.2.6 Operational and functional requirements for pneumatic systems

The following specifications for operation and function shall be defined:

- a) working pressure range;
- b) working temperature range;
- c) type of gas to be used (e.g., air, nitrogen or other neutral gas);
- d) cycle rates;
- e) duty cycle;
- f) service life of components;
- g) sequence of events;
- h) filtration and lubrication, including identification of components not to be lubricated;
- i) lifting provisions;
- j) emergency, safety and energy isolation requirements;
- k) painting or protective coating;
- l) lubricant compatibility with components.

Annex B provides forms and checklists to facilitate the gathering and recording of this information. These forms and checklists can also be useful to record those specifications that apply to pneumatic systems used in mobile machinery. The individual forms in Annex B are also available in a separate revisable electronic format.