



**International
Standard**

ISO 18623-1

**Air compressors and compressed
air systems — Safety —**

**Part 1:
Air compressors**

Compresseurs à air et systèmes à air comprimé — Sécurité —

Partie 1: Compresseurs à air

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Sample Document

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Foreword

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

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

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

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

This document was prepared by Technical Committee ISO/TC 118, *Compressors and pneumatic tools, machines and equipment*, Subcommittee SC 6, *Air compressors and compressed air systems*.

A list of all parts in the ISO 18623 series can be found on the ISO website.

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

Introduction

This document is a type-C standard as stated in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organisations, market surveillance, etc.)

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (e.g. small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

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

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Air compressors and compressed air systems — Safety —

Part 1: Air compressors

1 Scope

This document is applicable to compressors, partially completed compressor units and compressor units having an operating pressure greater than 50 kPa and designed to compress air, nitrogen or inert gases. This document deals with all significant hazards, hazardous situations and events relevant to the design, installation, operation, maintenance, dismantling and disposal of compressors and compressor units when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see [Clause 4](#)).

This document includes under the general term compressor units those machines which comprise

- the compressor,
- a drive system, and
- any component or device which is necessary for operation.

This document covers compressors driven by any power media, including battery powered and which are fitted in or used with motor vehicles.

The significant hazards dealt with in this document are identified in [Annex A](#).

This document does not cover requirements for compressors and compressor units used in potentially explosive atmospheres.

This document is not applicable to compressors and compressor units which are manufactured before the date of publication of this document.

This document does not cover compressors and compressor units for processing petroleum, petrochemicals, or chemicals within the scope of ISO/TC 67.

This document does not give performance levels or safety integrity levels for safety related parts of control systems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2151, *Acoustics — Noise test code for compressors and vacuum pumps — Engineering method (Grade 2)*

ISO 3857-1, *Compressors, pneumatic tools and machines — Vocabulary — Part 1: General*

ISO 3857-2, *Compressors, pneumatic tools and machines — Vocabulary — Part 2: Compressors*

ISO 4126-1, *Safety devices for protection against excessive pressure — Part 1: Safety valves*

ISO 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

- ISO 4414, *Pneumatic fluid power — General rules and safety requirements for systems and their components*
- ISO 8573-1, *Compressed air — Part 1: Contaminants and purity classes*
- ISO 8573-2, *Compressed air — Contaminant measurement — Part 2: Oil aerosol content*
- ISO 8573-3, *Compressed air — Part 3: Test methods for measurement of humidity*
- ISO 8573-4, *Compressed air — Contaminant measurement — Part 4: Particle content*
- ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*
- ISO 13766-1, *Earth-moving and building construction machinery — Electromagnetic compatibility (EMC) of machines with internal electrical power supply — Part 1: General EMC requirements under typical electromagnetic environmental conditions*
- ISO 13766-2, *Earth-moving and building construction machinery — Electromagnetic compatibility (EMC) of machines with internal electrical power supply — Part 2: Additional EMC requirements for functional safety*
- ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*
- ISO 13850, *Safety of machinery — Emergency stop function — Principles for design*
- ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*
- ISO 14120, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*
- ISO 14122-1, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means and general requirements of access*
- ISO 14122-2, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*
- ISO 14122-3, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*
- ISO 14122-4, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders*
- ISO 14123-1, *Safety of machinery — Reduction of risks to health resulting from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers*
- ISO 15534-1, *Ergonomic design for the safety of machinery — Part 1: Principles for determining the dimensions required for openings for whole-body access into machinery*
- IEC 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*
- IEC 60204-11, *Safety of machinery — Electrical equipment of machines — Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV*
- IEC 60417-DB-12M, *Graphical Symbols For Use On Equipment — 12-Month Subscription To Online Database Comprising All Graphical Symbols Published In IEC 60417*
- IEC 61000-6-1, *Electromagnetic compatibility (EMC) — Part 6-1: Generic standards — Immunity standard for equipment in residential environments*
- IEC 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity standard for industrial environments*
- IEC 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for equipment in residential environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments*

IEC 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking*

IEC 61310-3, *Safety of machinery — Indication, marking and actuation — Part 3: Requirements for the location and operation of actuators*

IEC 62061, *Safety of machinery — Functional safety of safety-related control systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100, ISO 3857-1, ISO 3857-2 and the following apply.

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

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

3.1 General terms

3.1.1

compressor

part of a *compressor unit* (3.1.3) that compresses a gas or vapour media to a pressure higher than that at the inlet

3.1.2

partially completed compressor unit

unit that comprises the *compressor* (3.1.1), components and sub-assemblies that is almost a compressor unit but cannot perform function on its own

3.1.3

compressor unit

unit that comprises the *compressor* (3.1.1), a *drive system* (3.1.4) and any component or device which is necessary for operation

3.1.4

drive system

system that consists of a prime mover and coupling mechanism

Note 1 to entry: Prime mover may be an electric motor, steam engine (turbine), etc.

Note 2 to entry: Coupling mechanism may be a drive belt, shaft, gears, etc.

3.1.5

inert gas

chemically inactive gas which retains this characteristic even at elevated pressures

3.1.6

pressure

pressure relative to atmospheric pressure, i.e. gauge pressure

Note 1 to entry: In many cases, this is referred to as effective pressure.

Note 2 to entry: The unit kPa for pressure is used 100 kPa = 1 bar.

3.1.7

liquid shock

excessive force resulting from an attempt to compress incompressible medium

3.1.8

maximum allowable pressure

maximum pressure for which the *compressor* (3.1.1) or *compressor unit* (3.1.3) is designed, as specified by the manufacturer

Note 1 to entry: This is also identified as maximum allowable working pressure.

3.1.9

normal operating conditions

conditions considered to be when the *compressor* (3.1.1) is properly maintained and operated within admissible limits, in particular; ambient temperature, as specified by the manufacturer when compressing the specified media

3.2 Specific terms

3.2.1

air compressor

compressor (3.1.1) intended for compression of air, nitrogen or *inert gases* (3.1.5)

3.2.2

portable compressor unit

compressor unit (3.1.3) which is wheel-mounted and can be towed on- and off-site

3.2.3

skid-mounted compressor unit

compressor unit (3.1.3) which is mounted on skids and which can be towed short distances on-site or transported

3.2.4

gross mass

maximum specified mass of a *skid-mounted* (3.2.3) or *portable compressor unit* (3.2.2) (including tools, equipment and fuel)

Note 1 to entry: Tools and equipment include for example concrete breakers, picks and hoses likely to be carried for a typical working application.

3.2.5

water-injected compressor

compressor (3.1.1) design in which the compressed media and the water are mixed

4 Safety requirements and/or protective measures

4.1 General

The machine shall comply with the following safety requirements and/or protective measures and be verified in accordance with [Clause 5](#). In addition, the machine shall be designed according to the principles of ISO 12100 for relevant, but not necessarily significant hazards, which are not dealt with by this document.

When choices are necessary for the application of type B standards referred to in this document, i.e. listed in [Clause 2](#), the manufacturer shall carry out an appropriate risk assessment for making these choices.

The measures adopted to conform with the requirements of this clause shall take account of the state-of-the-art when more effective technical means become available.

4.2 Mechanical safety

4.2.1 Guards

4.2.1.1 General

When fixed guards have to be removed for periodic maintenance or repair, their fixing systems shall remain attached to the guard or machinery when the guards are removed.

4.2.1.2 Cutting and severing, friction and abrasion

All moving parts shall be enclosed within the permanent compressor casing or compressor unit cover, enclosure or canopy. When this is not possible, separate guards shall be provided to prevent contact with all rotating and reciprocating parts to minimize the risk of cutting and severing, friction and abrasion to personnel in accordance with ISO 14120 and ISO 13857 for safety distances.

4.2.1.3 Bodily contact

Deflections shall not result in contact with moving parts or permanent deformation of the guard. The provisions for rigidity of guards shall be in accordance with ISO 14120.

4.2.1.4 Ejection of parts

Moving parts shall be designed and mounted in such a way that in all foreseeable modes of operation the risk of ejection of parts is minimised. Where the risk assessment identifies a remaining risk of ejection, e.g. a drive belt from a belt driven compressor, then the impact resistance for guarding shall be in accordance with ISO 14120.

4.2.1.5 Entry to inlet ducts and enclosures

Atmospheric inlets and inspection openings in inlets shall be provided with protective devices, so that persons cannot be drawn in or danger zones be reached when the compressor is running. For this purpose, any openings shall comply with ISO 13857 for upper and lower limbs, when applicable.

Openings giving access to moving parts creating a risk of trapping or shearing shall be prevented by either

- total enclosure with an interlocked means of access, e.g. door, cover, etc. such that the compressor is shut down when the access is opened and cannot be started until the access is closed, or
- total enclosure without interlock when access to moving parts, e.g. fan belts, barring gear, timing marks, shall be prevented by local guarding, or
- without total enclosure when access to moving parts, e.g. fan belts, barring gear, timing marks, etc., shall be prevented by local guarding.

Where service, maintenance or inspection activities require access within the enclosure doors whilst the compressor is still operational, consideration shall be given to the additional hazards created and the measures taken shall be in accordance with ISO 12100. The provisions of [6.3.3](#) shall also be applied.

Where whole body access is required to inlet ducts and enclosures for service, maintenance or inspection the provisions of ISO 15534-1 shall be followed when determining the minimum dimensions of openings for such whole-body access.

Where whole body access is required to inlet ducts for service, maintenance or inspection, a guard shall be fitted to prevent unauthorised access. The guard shall be

- interlocked such that when the guard is opened the compressor is shut-down and cannot be restarted until the guard is closed, and

- unintentional closure of the guard is prevented by the use of a trapped key interlock or a padlock where the only key for the trapped key or the padlock can be retained by the person entering the inlet duct.

Where it is foreseeable that the compressor remains operational during whole body access to the inlet duct for service, maintenance or inspection, the design of the inlet duct shall be such that the air flow at the entrance to the inlet duct shall be $\leq 2,5$ m/s and in addition a protective grid shall be installed inside the duct to prevent personnel being drawn into the compressor.

A safe system of work shall also be identified in accordance with [6.4.1](#).

4.2.2 Fluid injection

The risk of fluid (gas or liquid) injection into the human body shall be minimized by

- designing and supporting integral pipework, hoses and auxiliaries to withstand vibration, thermal expansion and their own mass, foreseeable external forces, influence of contaminants and external chemical substances,
- ensuring that all piping which is in a position likely to be damaged is protected, robust and sufficiently supported, but shall be free to move with changing temperature,
- ensuring that the design of oil/coolant filler plugs does not allow the dangerous release of fluid, e.g. by means of preventing the removal of the filler plug under pressure or an effective warning system, and
- the design and location of pressure vents and drains, shall take account of the velocity of air, gas, vapour or liquid likely to be discharged.

4.2.3 Loss of stability

4.2.3.1 Generally applicable

Compressor units shall be in accordance with ISO 12100.

4.2.3.2 Portable and skid-mounted compressor units

The centre of gravity, mainly associated with the engine/compressor combination shall be low enough to ensure that the compressor unit remains stable, without tipping or slipping, when used within intended limits.

The provisions of [6.3.2](#) shall be applied to indicate the intended limits.

Tyres of a portable compressor unit shall be rated to carry the maximum gross mass of the portable compressor unit at the highest towing speed the compressor unit is intended for. All tyres shall be of the same construction.

The support leg or jockey wheel shall be capable of supporting the gross nose mass of the portable compressor unit as defined in the instruction handbook. It shall be possible to securely lock it in the support and towing positions by, for example, a clamping system or removable pin in locating holes.

The jockey wheel device shall be positively retained in the draw bar in the event of the operator leaving it unlocked.

NOTE Portable compressor units used on-road are also subject to regulations related to motor vehicles and their trailers.

4.2.4 Slip, trip and fall

If access to elevated areas around a compressor unit is necessary and is an integral part of a compressor unit then these access areas shall be in accordance with ISO 12100. Where such access is provided, permanent means of access to working platforms, walkways, fixed ladders and stairways shall be in accordance with ISO 14122-1, ISO 14122-2, ISO 14122-3 and ISO 14122-4.