

Code of practice for

Stationary air compressors —

[ISO title: Stationary air compressors —
Safety rules and code of practice]

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The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

Contractors Plant Association	Institution of Mining Engineers
Imperial College of Science and Technology	South Wales Institute of Engineers
Institute of Marine Engineers	Coopted member
Institution of Mining and Metallurgy	

This British Standard, having been prepared under the direction of the Mechanical Engineering Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 March 1982

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National foreword

This British Standard, which has been prepared under the direction of the Mechanical Engineering Standards Committee, is identical with ISO 5388-1981 “*Stationary air compressors — Safety rules and code of practice*” prepared by Technical Committee ISO/TC 118, Compressors, pneumatic tools and pneumatic machines, published by the International Organization for Standardization (ISO).

Terminology and conventions. The text of the international standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following.

Wherever the words “International Standard” appear, referring to this standard, they should be read as “British Standard”.

The comma has been used throughout as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

For the purposes of this code of practice, wherever the word “shall” has been used, it should be read as “should”.

Cross-references

International standard	Corresponding British Standard
ISO 1000-1973	BS 5555:1976 SI units and recommendations for the use of their multiples and of certain other units (Identical)
ISO 2314-1973	BS 3135:1975 Gas turbines: acceptance tests (Identical)
ISO 3046	BS 5514 Specification for reciprocating internal combustion engines: Performance (Identical)
ISO 3977-1978	BS 3863:1979 Guide for gas turbines procurement (Identical)

The technical committee has reviewed the provisions of the following International Standards, to which reference is made in clause 2, and has decided that they are acceptable for use in conjunction with this standard. Related British Standards are as follows.

International standard	Corresponding British Standard
ISO 508	BS 1710:1975 Identification of pipelines
ISO 1996-1	BS 4142:1967 Method of rating industrial noise affecting mixed residential and industrial areas
ISO 1999-1975	BS 5330:1976 Method of test for estimating the risk of hearing handicap due to noise exposure
ISO 3448-1975	BS 4231:1975 Viscosity classification for industrial liquid lubricants
ISO 3864 ^a	BS 5378 Safety signs and colours
IEC 34	BS 4296:1968 Methods of test for determining synchronous machine quantities and BS 4999 General requirements for rotating electrical machines
IEC 45:1970	BS 132:1965 Steam turbines

^a In course of preparation.

The technical committee has also reviewed the provisions of ISO 2151 to which reference is made in clause 2, and has decided that they are acceptable for use in conjunction with this standard.

It is understood that ISO 2151 will be withdrawn on publication of ISO 3989 (also referred to in clause 2). Consideration will then be given to publishing a corresponding British Standard to ISO 3989.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope and field of application

1.1 This International Standard establishes standards for the safe design, construction, installation and operation of stationary and skid-mounted air compressors for general use. It specifies requirements to help minimize compressor accidents and defines general safety practices for the field. Potential hazards associated with compressors are listed and detailed under the following headings in clause 6:

- a) improper lubrication;
- b) inadequate cooling;
- c) mechanical failures;
- d) personal injury;
- e) exposure to noise;
- f) fires and explosions in the pressure system;
- g) crankcase explosions;
- h) incorrect installation, operation or maintenance.

This International Standard does not cover the prime movers, which are dealt with in other International Standards.

1.2 This International Standard is based on the requirement that the compressor components be designed in accordance with recognized good practice and applicable national standards.

1.3 This International Standard is intended to apply to stationary and skid-mounted air compressors for general use. However, the following types of compressor are specifically excluded:

- a) compressors with a shaft input less than 2 kW;
- b) compressors with an effective discharge pressure less than 0,5 bar (50 kPa);
- c) compressors with an effective discharge pressure exceeding 50 bar (5 MPa);
- d) compressors specifically supplying air for breathing, diving or surgery;
- e) compressors used for air brake systems
- f) ejectors.

2 References

ISO 508, *Identification colours for pipes conveying fluids in liquid or gaseous condition in land installations and on board ships*¹⁾.

ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units*.

ISO 1996, *Acoustics — Description and measurement of environmental noise — Part 1: Basic quantities and procedures*²⁾.

ISO 1999, *Acoustics — Assessment of occupational noise exposure for hearing conservation purposes*.

ISO 2151, *Measurement of airborne noise emitted by compressor/primemover-units intended for outdoor use*.

ISO 2314, *Gas turbines — Acceptance tests*.

ISO 3046, *Reciprocating internal combustion engines: Performance*.

ISO 3448, *Industrial liquid lubricants — ISO viscosity classification*.

ISO 3864, *Safety colours and safety signs*³⁾.

ISO 3977, *Gas turbines — Procurement*.

ISO 3989, *Acoustics — Measurement of airborne noise emitted by compressor units including primemovers — Engineering method for determination of sound power levels*⁴⁾.

IEC Publication 34, *Rotating electrical machines*.

IEC Publication 45, *Specification for steam turbines*.

3 Unit system

Throughout this International Standard, SI units are used. (See ISO 1000.) However, in accordance with accepted practice in the compressed air industry, the bar is used as the unit of pressure (1 bar = 10⁵ Pa).

NOTE Unless otherwise stated, the term pressure means effective (gauge) pressure.

4 Definitions

4.1

maximum allowable working pressure

the maximum operating air pressure which the manufacturer specifies for any service condition specified for the compressor or any part to which the term is referred, such as an individual stage or casing

4.2

relief valve or safety valve set pressure

the pressure on the inlet side of a relief valve or safety valve when opening commences

4.3

maximum allowable working temperature

the maximum compressed air temperature which the manufacturer specifies at any service condition specified for the compressor or any part to which the term is referred

¹⁾ At present at the stage of draft. (Revision of ISO/R 508-1966.)

²⁾ At present at the stage of draft. (Revision of ISO/R 1996-1971.)

³⁾ At present at the stage of draft. (Revision of ISO/R 408-1964 and ISO/R 557-1967.)

⁴⁾ At present at the stage of draft.

4.4**maximum expected outlet temperature**

the highest predicted outlet air temperature resulting from any specified service condition including part-load operation

4.5**maximum allowable compressor speed**

the highest rotational frequency at which the manufacturer's design will permit operation, assuming overspeed and governor mechanisms are installed and operating

4.6**trip speed**

the rotational frequency at which the primemover is automatically tripped out

4.7**surge limit**

the limiting flow below which stable operation of a turbocompressor is not possible

5 Compressor categories

Air compressors can be grouped into the following three categories from a lubrication viewpoint:

a) "Oil-free" compressors in which the air does not come into contact with the oil used to lubricate the machine, for example dynamic compressors, labyrinth compressors, diaphragm compressors or compressors with unlubricated piston rings.

b) Oil-lubricated compressors in which the moving parts in the compression chamber are lubricated with oil which is either specially injected for that purpose by a mechanical lubricator or is carried over from other parts of the machine, as in a single-acting trunk type of reciprocating compressor without a crosshead.

Oil-lubricated compressors can be grouped into any of the four main classes below:

1) Air-cooled reciprocating types with a power input up to 20 kW, usually built as single- or two-stage machines up to about 25 bar (2,5 MPa) and often for intermittent service.

2) Air-cooled reciprocating types with a power input above 20 kW, usually built as single-stage machines up to about 3 bar (0,3 MPa), two-stage up to about 25 bar (2,5 MPa) and more stages for higher pressures.

3) Water-cooled reciprocating types, usually built as single-stage machines up to about 5 bar (0,5 MPa), two-stage up to about 25 bar (2,5 MPa) and more stages for higher pressures.

4) Water- or air-cooled rotary vane types, usually built as single-stage machines up to about 4 bar (0,4 MPa) to 7 bar (0,7 MPa) and two-stage up to about 12 bar (1,2 MPa).

c) Oil-flooded rotary compressors in which relatively large quantities of oil are injected into the compression chamber not only to lubricate the working parts but also to assist in sealing and to absorb the heat of compression.

6 Potential hazards

The following sub-clauses do not attempt to identify all the possible hazards associated with running machinery but only those which are specific or particularly applicable to stationary air compressors. (See Annex A to Annex E.)

6.1 Improper lubrication

6.1.1 The more common causes of improper lubrication are:

- a) use of improper lubricant;
- b) lack of oil;
- c) poor maintenance leading to bearing wear with increased clearances and too low oil pressure;
- d) insufficient or excessive cooling;
- e) overlubrication.

6.1.2 Malfunction of the lubrication system may lead to a temperature increase which, with continued operation, may introduce the risk of an oil fire.

6.2 Improper cooling

The risks stemming from poor cooling are obvious. However, overcooling is also to be avoided because it gives rise to internal cylinder corrosion as the condensate modifies the lubricant.

6.3 Mechanical failures

These usually emanate from one or more of the following causes:

- a) excessive pressure;
- b) overspeed;
- c) secondary phenomena caused by improper lubrication;
- d) secondary phenomena caused by improper cooling;
- e) poor maintenance;
- f) excessive vibrations or external forces.

6.4 Personal injury

The more common potential causes of injury are:

- a) contact with moving parts;
- b) contact with hot parts;
- c) falling from elevated positions;