
British Standard

Fluid power transmission and control systems

Part 2. Code of practice for pneumatic equipment and systems

Systèmes de transmission et de régulation hydrauliques et pneumatiques
Partie 2. Appareils et systèmes pneumatiques — Code de bonne pratique

Fluidtechnik; Kraftübertragungs- und Steuerungssysteme
Teil 2. Leitfaden für Pneumatikanlagen und -systeme

Foreword

This Part of BS 4575 has been prepared under the direction of the Machinery and Components Standards Committee. BS 4575 gives guidance and recommendations to designers, manufacturers and users for what are considered to be minimum basic essential features of the design and construction of fluid power systems and components. The aim of this Part of BS 4575 is to promote the safety of personnel, productivity and long life of pneumatic equipment and to facilitate maintenance.

Hazards arising from the use of machinery are identified in BS 5304* in which methods for the elimination or reduction of these hazards and for the safeguarding of machinery, and the use of safe working practices are described. It particularly makes reference to main items (such as interlocking devices and methods, signal-operated valves and overall system design) that should be considered in the design of pneumatically operated and controlled machinery.

A Guidance Note on pneumatic safety is also in preparation by the Health and Safety Executive (see item (j) of appendix A). It is anticipated that this Guidance Note will give advice on the safe supply and distribution of clean dry compressed air, the safe design, use and maintenance of pneumatic equipment and machinery powered by compressed air and precautions to be taken to avoid the risk of injury from hazards arising from the use of compressed air. The Guidance Note will also include specific advice on the design of safety interlocking circuits.

This Part of BS 4575 closely follows the guidance and recommendations given in ISO 4414, published by the International Organization for Standardization (ISO) (but not approved by the UK), and includes additional and amended textual matter.

This Part of BS 4575 is presented in such a manner that recommendations relating to particular subjects are grouped in their own respective clauses and can readily be understood by all grades of personnel.

Clauses of this Part of BS 4575 may also be used as a guide in the preparation of detailed specifications and designs of industrial equipment utilizing pneumatic components or equipment.

Compliance with a British Standard does not of itself confer immunity from legal obligations. In particular attention is drawn to the statutory regulations listed in appendix A.

* Under revision.

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Code of practice

1 Scope

This Part of BS 4575 makes recommendations to suppliers and users for the design, supply and use of industrial pneumatically operated or controlled equipment used in, or necessary for, manufacturing processes and/or assembly. The recommendations include features which are intended to safeguard personnel and which provide conditions for ease of assembly and economy of maintenance.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definition

For the purposes of this Part of BS 4575 the following definition applies.

supplier. The contractual supplier for warranty and services purposes.

NOTE. Additional definitions are given in ISO 5598.

3 Design considerations

3.1 Safety

3.1.1 Pressurized components. Many components within a pneumatic circuit, e.g. compressors, coolers, dryers, receivers, surge tanks, air bottles, filters, lubricators, cylinders and actuators, contain large volumes of compressed air, and they should therefore be designed and manufactured so as to comply with the appropriate legislation listed in appendix A.

3.1.2 Failure-to-safety concept. When designing pneumatic circuits, all aspects of possible modes of failure (including control supply failure) should be considered. In each case, components should be selected, applied, mounted and adjusted so that in the event of a failure, maximum safety to personnel is the prime consideration and damage to equipment is minimized.

3.1.3 Application concept. The intent of every application concept should be to ensure that:

- (a) all system components operate within their manufacturer's specifications;
- (b) all parts of the system are protected against over-pressure;
- (c) the system is designed and constructed so that components are located where they are accessible and can be safely adjusted and serviced;
- (d) loss of pressure will not create a hazard;
- (e) exhausting air will not create a hazard.

3.2 Site conditions

The supplier and purchaser should discuss relevant site conditions; the subsequent design of the system should take account of these site conditions, e.g.:

- (a) vibration;
- (b) degree of contamination;
- (c) humidity level;
- (d) the possible existence of a fire hazard;
- (e) the required level of maintenance;
- (f) electrical network details, i.e. voltage and its tolerance, frequency, available power (if limited), etc.;
- (g) protection for electrical devices;
- (h) ambient temperature range;
- (i) acceptable noise levels emanating from the system or component.

Where full details of final site conditions are not available, the supplier should provide, with the equipment, data giving details of the environment and other parameters within which satisfactory performance can be achieved.

4 Documentation

4.1 Language

The purchaser and supplier should agree on the language to be used in all documentation, the supplier being responsible for ensuring that the translation has the same meaning as the original text.

NOTE. Where appropriate, use may be made of ISO 5598.

4.2 Layout drawings

4.2.1 Floor and foundations. Where relevant, the supplier should provide the purchaser with details of the floor plan and foundation requirements. If there are two or more assemblies, details of the dimensional relationships should also be supplied.

4.2.2 Piping. Where requested on the purchaser's enquiry and confirmed on the supplier's quotation, a piping layout should be furnished by the supplier. Photographs which clearly show the piping arrangement and assembly, are an acceptable alternative.

4.3 Circuit diagrams

All circuit diagrams should include the data listed in 4.4 and use the appropriate graphical symbols given in BS 2917 and BS 3939. The presentation of the circuit diagrams should be in accordance with the practice recommended in BS 5070*.

A copy of each diagram should be supplied with the equipment and a further copy should be retained by the supplier.

* Under revision.

4.4 Technical data

Where appropriate, the following data should be included on, or in association with, the circuit diagrams.

- (a) Identification of all pneumatic equipment by part number, and item number or letter.
 - (b) Diameter and length of stroke of each cylinder, or similar data for rotary actuator.
 - (c) Identity of filters and lubricators.
 - (d) Clear indication of any circuitry contained within circuit manifolds.
- Where boundary lines or boundary envelopes are used for this purpose, the boundary indicated should not include any symbol of a component not mounted on or within the circuit manifold.
- (e) Clear indication of the function of each actuator in each direction.
 - (f) The identification size, type and location of test and drain points in the circuit.
 - (g) Identification of all component or manifold ports (as marked on the component).
 - (h) Nominal volume of the air reservoirs.
 - (i) The quantity, type and viscosity range of the fluid required to fill each lubricator.
 - (j) Identification of valve-actuating devices.

4.5 Operational and maintenance data

The supplier should provide the purchaser with operational and maintenance data for the pneumatic equipment supplied that clearly:

- (a) describes normal operating procedures, e.g. start-up, running and shut-down, emergency stop, and complete exhaustion of the system when components are to be dismantled for maintenance;
- (b) describes adjustment procedures;
- (c) indicates external lubrication points and the type of lubricant required;
- (d) states maintenance procedures;
- (e) locates drains, filters, test points, strainers, etc. that require regular scheduled maintenance;

(f) gives further identification of parts in the pneumatic components which are commercially available or manufactured in accordance with a British Standard or international standard that provides for uniform coding, the identification being the manufacturer's part number or the code specified in the standard;

(g) lists recommended spare parts.

4.6 Final data

All final diagrams, drawings, technical data, maintenance data and other texts should comply with the equipment delivered and should be received by the purchaser by not later than the time of equipment delivery.

When specifically required by the purchaser, all final diagrams and drawings should be on unfolded reproducible material.

4.7 Maintenance manual

The supplier should advise the purchaser regarding the availability of maintenance manuals for standard equipment, particularly relating to 4.5(f) and (g).

5 Component labelling

The following particulars should be shown on all components in a permanent and readily visible form:

- (a) supplier's name and/or trademark;
- (b) supplier's type or model number;
- (c) its graphical symbol, in accordance with BS 2917, and all ports correctly identified;
- (d) the safe continuously rated pressure and temperature range;
- (e) identification of year of manufacture;
- (f) the relevant additional information given in table 1 where space permits. If sufficient space is not available, this information should be included in the maintenance manual.

Table 1. Additional information to be shown on components		
Component	Information	Notes
(a) Receivers, surge tanks and air bottles	(1) hydraulic test pressure (2) date of pressure test (3) design pressure (4) standard or code of practice in accordance with which the vessel is manufactured (5) volumetric capacity (6) serial number	Information should be stamped either: (i) on to a metal plate which is subsequently welded to the vessel; or (ii) on to a portion of the vessel which is not highly stressed, e.g. formed end cap. It is essential that no stamping occurs on highly stressed regions such as the cylindrical shell
(b) Heat exchangers	(1) directions of flow (2) type of cooling medium (3) working pressure (4) working pressure of cooling medium, if relevant	Directions of flow should preferably be marked adjacent to inlet and outlet ports
(c) Dryers	(1) maximum usable air flow (at stated conditions), exclusive of purge air (2) maximum and minimum working ambient temperatures (3) maximum compressed air temperature of inlet (4) direction of air flow (5) reference number of relevant servicing document (6) electrical supply voltage, frequency and current rating (7) rating of fuse required in supply connection	Also state purge air requirements, when applicable
(d) Filters	(1) rating of filter element (2) direction of flow (3) element identification	Rating of filter element in accordance with BS 5600 : Part 3 : Section 3.5, or BS 1752 where applicable
(e) Lubricators	(1) direction of flow	
(f) Air motors and rotary actuators	(1) free air consumption (at standard conditions) (2) direction of rotation, relative to ports (3) torque, at stated conditions (4) maximum rotational frequency range (5) limits of movement	Item (4) applies to air motors only Item (5) applies to rotary actuators only
(g) Pressure control valves	(1) range of pressure adjustment (in bar*) (2) maximum inlet pressure (3) working temperature range (in °C) (4) direction of flow	Non-relieving pressure regulators should be appropriately identified
* 1 bar = 100 kN/m ² = 100 kPa.		