## Specification for

# Pressure and vacuum switches

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Industrial-process Measurement and Control Standards Policy Committee (PCL/-) to Technical Committee PLC/1, upon which the following bodies were represented:

British Coal Corporation
British Gas plc
Department of Energy (Gas and Oil Measurement Branch)
Department of Trade and Industry (National Weights and Measures Laboratory)
Electricity Industry in United Kingdom
Energy Industries Council
Engineering Equipment and Materials Users' Association
GAMBICA (BEAMA Ltd.)
Health and Safety Executive
Institution of Gas Engineers

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

British Compressed Air Society
British Compressed Gases Association
British Fluid Power Association
British Pressure Gauge Manufacturers Association
Department of Trade and Industry (National Engineering Laboratory)
Institute of Measurement and Control
Society of British Water Industries

This British Standard, having been prepared under the direction of the Industrial-process Measurement and Control Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 31 January 1992



First published October 1981
Second edition January 1992

The following BSI references relate to the work on this standard:
Committee reference PCL/1
Draft for comment 91/25630 DC

**ISBN 0 580 20285 2**

**Amendments issued since publication**

| Amd. No. | Date | Comments |
|---|---|---|
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# Contents

# Foreword

This British Standard has been prepared under the direction of the Industrial-process Measurement and Control Standards Policy Committee. It supersedes BS 6134:1981 which is withdrawn.

This edition introduces technical changes but it does not reflect a full review or revision of the standard, which will be undertaken in due course. In addition, this edition includes revisions implemented by Amendment No. 1, published in 1982, to BS 6134:1981.

All changes incorporated in this edition of BS 6134 are indicated by a side line in the margin.

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**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, 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.

## 1 Scope

This British Standard specifies general requirements for pressure and vacuum switches for industrial use and gives performance characteristics that are to be stated by the manufacturer. It is applicable to switches suitable for use up to 1 000 bar and with fluids and in atmospheres that are non-flammable, non-corrosive and non-toxic. It is also applicable to switches suitable for higher pressures, other fluids or atmospheres if in other respects the switches meet the requirements of their special application.

The tests to check compliance with the performance requirements of this standard are type tests (see clause **9**) and routine tests (see clause **10**).

This standard is not applicable to pressure difference switches, pressure indicating devices or switches with non-electrical outputs.

For switches for use in explosive atmospheres, additional requirements are specified in BS 4683 and BS 5501.

## 2 References

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

## 3 Definitions

For the purposes of this British Standard the following definitions apply.

NOTE Where the word "pressure" is used in this standard, it means "pressure", "vacuum" or "absolute pressure" as applicable, unless otherwise stated.

**3.1**
**gauge pressure switch**

a switch with a single pressure connection and responsive to the difference between the pressure applied to that connection and the surrounding atmospheric pressure. The switch is responsive only to pressures greater than the surrounding atmospheric pressure

**3.2**
**vacuum switch**

a switch generally similar to a gauge pressure switch but responsive to pressures less than the surrounding atmospheric pressure

**3.3**
**combined pressure and vacuum switch**

a switch generally similar to a gauge pressure switch but responsive to pressures both less than and greater than surrounding atmospheric pressure

**3.4**
**absolute pressure switch**

a switch with a single pressure connection and responsive to the difference between the pressure applied to that connection and a reference high vacuum

NOTE Such a device is said to be "barometrically compensated" and is insensitive to changes in the surrounding atmospheric pressure.

**3.5**
**pressure difference switch**

a switch with two pressure connections and responsive to the difference between the two applied pressures

NOTE Such switches are insensitive to variations in surrounding atmospheric pressure.

**3.6**
**bourdon tube**

a curved tube that tends to straighten under internal pressure

**3.7**
**diaphragm**

a membrane that tends to deflect under pressure

**3.8**
**capsule**

a chamber consisting of two membranes joined at their edges

**3.9**
**capsule stack**

a number of capsules assembled in series

**3.10**
**bellows**

a cylinder, with thin convoluted walls, that tends to deflect longitudinally under pressure

**3.11**
**piston**

a piston, enclosed in a cylinder, that tends to move under pressure

NOTE A seal may be provided to prevent leakage of the pressure medium past the piston.

**3.12**
**set point**

the nominal pressure at which the switch is set to operate

**3.13**
**range of adjustment**

the upper and lower limits of pressure stated by the manufacturer, within which the set-point is adjusted

**3.14**
**maximum working pressure**

the maximum pressure (positive or negative) to which the switch can be continuously subjected while its performance remains within the requirements of its accuracy class

**3.15**
**span**

the difference between the values of the upper and lower limits of pressure within which the set-point is adjusted

**3.16**
**operating value**

the value (increasing or decreasing) of the pressure that is sufficient to cause the switch to be actuated

**3.17**
**switching error**

the difference between the operating value and the set-point, the switch having been set using an external reference pressure, expressed as a percentage of span at a specified set-point

**3.18**
**average switching error**

the arithmetic mean of five values of switching error obtained from test measurements of the operating value, expressed as a percentage of span at a specified set-point

**3.19**
**re-setting value**

the value of the pressure which has to be re-established in order to cause the switch to revert to its pre-operating condition

**3.20**
**switching differential value**

the difference in pressure between the operating value and the resetting value

**3.21**
**switching differential value adjustment**

means by which the resetting value is adjusted relative to the operating value, or vice versa

**3.22**
**operating value repeatability**

the root mean square deviation of five values obtained from test measurements of the operating value, expressed as a percentage of span at a specified set-point

**3.23**
**combined switching error**

the sum of the average switching error and the operating value repeatability expressed as a percentage of span at a specified set-point

**3.24**
**scale accuracy**

the specified maximum value of the difference, for any point on the scale, between the scale setting and the corresponding operating value, expressed as a percentage of span

NOTE This term is applicable only to certain switches having a setting scale [see clause **5** f)].

**3.25**
**accuracy class**

the specified maximum value of the combined switching error under reference conditions

NOTE The reference conditions are specified in **9.2**.

**3.26**
**temperature coefficient**

the change in operating value, expressed as a percentage of span, caused by a 10 °C change in ambient temperature

## 4 Classification

**4.1 General.** Pressure switches are classified in terms of details of their construction and use, as specified in **4.2** to **4.7**.

**4.2 Actuating means.** Pressure switches are classified according to their actuating means, as follows.

a) gauge pressure;

b) vacuum;

c) combined pressure and vacuum;

d) absolute pressure;

e) pressure difference.

NOTE Requirements for pressure difference switches are not specified in this standard.

**4.3 Type of switch contacts.** Pressure switches are classified according to their type of switch contacts, as follows.

a) air-break switch;

b) mercury tilt-switch;

c) magnetically operated switch;

d) contactless switch (for example, solid state switching element).

Any of these types of switch contacts are further classified in terms of number of poles and configuration (make, break or change-over) as specified in BS 4794-1 and BS 5424-1.

**4.4 Type of circuit duty.** Pressure switches are classified according to their type of circuit duty, as follows.

a) *Main circuit switching duty*. An example is the switching of tungsten filament lamps and small motors. For this type of circuit the conditions of BS 5424-1 and BS 4941-1 apply.

b) *Pilot switching duty*. An example is the switching of an electromagnet in a control circuit. For this type of circuit the conditions of BS 4794-1 apply.

**4.5 Type of pressure element.** Pressure switches are classified according to their type of pressure element, as follows:

a) bourdon tube;

b) diaphragm;

c) capsule;

d) capsule stack;

e) bellows;

f) piston.

**4.6 Accuracy class.** Pressure switches are classified according to their accuracy class. Accuracy classes are 1 %, 2 %, and 5 %.

**4.7 Type of enclosure.** Pressure switches are classified in accordance with BS 5420.

## 5 Performance characteristics to be specified

The performance of a pressure switch shall be stated by the manufacturer in the following terms.

a) *Range of adjustment*. It shall be stated whether the set-points indicated apply to rising or falling pressure. Preferred upper limits of ranges of adjustment are given in Appendix A.

NOTE It is normal for the lower limit of set pressure to be above zero, as indicated in the manufacturer's information.

b) *Maximum working pressure*. In addition, for vacuum and combined pressure and vacuum switches, both positive and negative maximum working pressure shall be stated.

c) *Switching differential value*

1) *Non-adjustable differential switches*. The maximum value shall be stated with reference to the set-point.

2) *Adjustable differential switches*. The limits of adjustment shall be stated.

In addition, if the switching differential value or the limits of adjustment vary with the set-point, this fact shall also be stated.

d) *Accuracy class*.

e) *Accuracy under influence conditions*. The temperature coefficient within the range specified in **8.1** shall be stated.

f) *Scale accuracy*. Where the switch is fitted with a setting scale, either it shall be stated that the scale is for guidance only or the scale accuracy shall be given.

g) *Accuracy endurance*. The number of cycles for which the accuracy class is maintained, without adjustment, shall be stated in accordance with **4.3** and Table III of BS 4794-1:1979, and the test specified in **9.3.14** of this standard.

h) *Mechanical endurance*. The number of cycles for which the accuracy class is maintained, with adjustment, shall be stated in accordance with **4.3** and Table III of BS 4794-1:1979, and the test specified in **9.3.14** of this standard.

NOTE For switches, such as those incorporating a bellows, in which the mechanical endurance of the pressure element depends upon the actual pressure excursions relative to the set-point and differential value, the manufacturer may provide more specific information.

j) *Electrical rated quantities*. These shall be stated in accordance with **4.2** of BS 4794-1:1979, or **4.3** of BS 5424-1:1977, or **4.4.1** to **4.4.6**, as appropriate, of BS 4941-1:1973.

## 6 Construction

**6.1 Dimensions.** No requirements are specified for overall or fixing dimensions.

**6.2 Pressure entry.** The designation of the pipe thread used in the pressure entry shall be identified thereon.

NOTE Appropriate British Standards are BS 21 and BS 2779.

**6.3 Electrical entry.** No requirements are specified for the electrical entry.

NOTE An appropriate British Standard is BS 4568-2.

**6.4 Contact elements and terminals.** The contact elements and terminals shall be in accordance with BS 5424-1 or BS 4794-1 as appropriate.

An earthing terminal shall be provided unless the construction of the pressure switch or limitation of its use makes this unnecessary.

**6.5 Materials of construction.** The material of parts in contact with the process fluid shall be stated by the manufacturer.

NOTE Attention should be given to compatibility of materials with the process fluid.

**6.6 Pressure relief.** When the maximum working pressure ($P_{max}$) is in excess of 1.6 bar[1)], failure of pressurized components of the switch shall not result in a build-up of pressure within the enclosure.

NOTE This requirement may be met by venting or by other provisions.

[1)] 1 bar = $10^5$ N/m$^2$ = 100 kPa.

## 7 Marking

**7.1** Markings shall be visible and permanent and they shall be on fixed nameplates or essential parts of the pressure switch. Where, however, the type of construction makes it necessary for markings to be on a detachable part such as the cover, means shall be provided to identify the detachable part with the pressure switch.

**7.2** The following items shall be marked.

a) the name of the manufacturer, or a mark by which he can be readily identified;

b) a type designation or a serial number that completely identifies the pressure switch within the manufacturer's range, including the materials of the wetted parts unless these are marked on the switch;

c) the range of adjustment;

d) the maximum working pressure ($P_{max}$);

e) the accuracy class;

f) the electrical ratings of the switching elements or reference to the pressure switch manufacturer's data;

g) the terminal configuration.

## 8 Service conditions

**8.1 Ambient air temperature.** The pressure switch shall be capable of operating within a range of ambient air temperature from – 25 °C or – 5 °C to + 55 °C provided that the process fluid does not freeze over the temperature range and the ambient air is dry below 0 °C. The manufacturer shall state which of the lower temperature limits applies.

NOTE The range – 5 °C to + 55 °C is generally appropriate to normal indoor use. The range – 25 °C to + 55 °C is generally appropriate to normal outdoor use. The manufacturer may state other temperature limits outside the range – 25 °C to + 55 °C.

**8.2 Altitude.** The pressure switch shall be capable of operating at an altitude of the site of installation not exceeding 2 000 m above sea level.

**8.3 Atmospheric conditions.** The pressure switch shall be capable of operating with a relative humidity not exceeding 50 % at a temperature of 40 °C and not exceeding 90 % at 20 °C.

NOTE 1 Moderate condensation may occasionally occur owing to variations in temperature.

The pressure switch shall be capable of operating in conditions of dust and water corresponding to the classification of its enclosure as specified in **4.7**.

NOTE 2 The user should seek guidance on the suitability of a pressure switch required for operation in corrosive or other atmospheres outside the scope of this specification.

**8.4 Conditions of installation**. The pressure switch shall be capable of operating in accordance with the manufacturer's instructions for installation.

NOTE 1 Where the process fluid is not compatible with the available materials of construction of the pressure switch, means should be provided to ensure separation.

NOTE 2 Attention is drawn to the possible need to provide for safe venting (see **6.6**).

## 9 Type tests on pressure switches

**9.1 General.** Type tests are essentially tests to determine performance characteristics of types of pressure switch with respect to the requirements specified in this standard.

They are usually performed by the manufacturer, or at a suitable laboratory of his choice, on representative samples.

The tests are carried out on the complete pressure switch, with the cover on or off as appropriate.

NOTE Before the tests are carried out, it is necessary for the performance requirements to be stated (see clause **5**).

The tests given in **9.3.3** to **9.3.12** shall be carried out on the same sample.

**9.2 Test conditions.** Except where otherwise specified in this standard, the tests shall be performed at an ambient temperature of 20 ± 20 °C.

Except where otherwise specified in this standard, the voltage and current applied shall be sufficient only for indication purposes.

A.C. and d.c. tests shall be performed on separate switches.

The error of any measuring instrument used in a test shall be not greater than one third of the specified maximum error of the quantity being measured.

**9.3 Test procedure**

**9.3.1** *General.* Mount and connect up the switch in accordance with the manufacturer's instructions.

Carry out the accuracy test at the beginning, and repeat after completion of the set of tests given in **9.3.4** to **9.3.12**.

**9.3.2** *Pre-conditioning*. Apply a pressure to the switch equal to its upper limit of range and then slowly release to atmosphere.

**9.3.3** ***Accuracy tests***

**9.3.3.1** *Method*. Set the switch to operate at the values specified in this subclause using an external pressure reference. A calibrated set-point scale, if fitted to the switch, should not be used for fine adjustments of the set-point. For adjustable differential switches, the switching differential value adjustment should be set to the nominal minimal specified by the manufacturer. Smoothly raise and lower the input pressure five times for each set point, at 10 %, 50 % and 90 % span and take measurements of the operating and resetting values. The limits for the input pressure during the raising and lowering operation are approximately 10 % of the span beyond the operating and resetting values.

Calculate five values of switching error at the operating value for each set-point.

From the results obtained, calculate the following characteristics for rising and falling pressure:

a) average switching error;

b) operating value repeatability.

From these calculate the corresponding combined switching error.

**9.3.3.2** *Requirement*. The combined switching error shall not exceed the accuracy class of the switch.

**9.3.4** ***Switching differential value calculation (non-adjustable switching differential)***

**9.3.4.1** *Method*. From the results obtained from the tests given in **9.3.3**, calculate the switching differential values for each set-point.

**9.3.4.2** *Requirement*. The calculated switching differential values shall not exceed the maximum values stated by the manufacturer.

**9.3.5** ***Minimum switching differential value calculation (adjustable switching differential)***

**9.3.5.1** *Method*. From the results obtained from the tests given in **9.3.3**, calculate the switching differential values for each set-point.

**9.3.5.2** *Requirement*. The calculated switching differential values shall not exceed the minimum values stated by the manufacturer.

**9.3.6** ***Additional accuracy test (adjustable switching differential)***

**9.3.6.1** *Method*. Set the differential value adjustment at the maximum obtainable in practice, and select a suitable set-point so that operation and resetting are possible during the test, within the defined range of adjustment of the switch.

Then smoothly raise and lower the input pressure five times and take measurements of the operating and resetting values. The limits for the input pressure during the raising and lowering operations are approximately 10 % of the span beyond the operating and resetting values, or the limits of range of adjustment if less.

From the results obtained, calculate the following characteristics for rising and falling pressure:

a) average switching error;

b) operating value repeatability.

From these, calculate the corresponding combined switching error.

**9.3.6.2** *Requirement*. The combined switching error shall not exceed the accuracy class of the switch.

**9.3.7** ***Maximum switching differential value calculation (adjustable switching differential)***

**9.3.7.1** *Method*. From the results obtained from the test given in **9.3.6**, calculate switching differential value.

**9.3.7.2** *Requirement*. The calculated switching differential value shall be not less than the maximum value stated by the manufacturer.

**9.3.8** ***Scale accuracy test***

**9.3.8.1** *Method*. This test is performed only where the scale accuracy is stated by the manufacturer.

For this test, position the set-point using only the calibrated scale incorporated within the instrument.

For each of the set-point adjustments specified in this clause, carry out the final setting operation in an up-scale direction only.

With the set-point positioned at a major mark corresponding to approximately 10 % of span, smoothly raise the input pressure and measure the operating value. Then move the scale pointer away from the set position, reset to the same position and measure the operating value again. Repeat this procedure to obtain a total of five measurements.

Repeat this sequence but with the set-point positioned in turn at major marks corresponding to approximately 50 % and 90 % of span.

**9.3.8.2** *Requirement*. The maximum difference between the operating value and the scale setting expressed as a percent of input span shall not exceed the scale accuracy of the switch.

**9.3.9** ***Maximum working pressure test***

**9.3.9.1** *Method*. With a set-point of 50 % of span, raise the input pressure steadily to the maximum working pressure stated by the manufacturer, hold for 1 min and then release steadily to atmospheric pressure.

Measure the operating value before and after the test and calculate the switching errors.

**9.3.9.2** *Requirement*. The change in switching error shall not exceed the value of one half of the accuracy class.

**9.3.10** ***Mounting position test***

**9.3.10.1** *Method*. This test is omitted where requirements for accurate levelling of the switch are stated by the manufacturer.

The influence of the switch mounting position is tested by measurement of the changes in the switching error caused by the switch being tilted.

Mount the switch in the manufacturer's recommended normal mounting position, with a set-point of 50 % span. Measure the operating value and calculate the switching error.

Tilt the switch to each of four positions in turn at an angle of 10° in each direction from the manufacturer's recommended normal mounting position in each of two mutually perpendicular vertical planes. In each of these positions, measure the operating value again and calculate the switching error.

**9.3.10.2** *Requirement*. The change in switching error shall not exceed the value of one half of the accuracy class.

**9.3.11** ***Temperature variation test***

**9.3.11.1** *Method*. With a set-point of 50 % of span, subject the switch to the following temperature conditions in turn:

20 °C
55 °C
20 °C
– 5 °C
20 °C
– 25 °C
20 °C
} only for outdoor switches; see **8.1**

Perform the 55 °C test in accordance with test Bb of BS 2011-2.1B and perform the – 5 °C and – 25 °C tests in accordance with test Ab of BS 2011-2.1A.

Calculate the switching errors for each of the 20 °C conditions.

**9.3.11.2** *Requirement*. The changes in switching error shall not exceed the value of one half of the accuracy class.

**9.3.12** ***Drop test***

**9.3.12.1** *Method*. Drop the switch from a height of 25 mm on to a steel plate not less than 8 mm thick which has been wet-floated on and bolted down to a block of concrete at least 0.5 m thick, or its equivalent as specified by the manufacturer.

Measure the height of drop from the surface of the plate to the lowest point of the switch when it is suspended before being dropped. With a set-point of 50 % of span, drop the switch six times on each of three mutually perpendicular faces. Measure the operating values before and after the test and calculate the switching errors.

**9.3.12.2** *Requirement*. The change in switching error shall not exceed the value of the accuracy class.

**9.3.13** ***Long-term drift test***

**9.3.13.1** *Method*. With a set-point of 90 % of span, apply a steady input pressure of 75 % of span for a period of not less than 30 days. During this period measure the operating value once in every 48 h period.

**9.3.13.2** *Requirement*. The change per 1 000 h in switching error at the operating value shall not exceed the value of one half of the accuracy class.

**9.3.14** ***Accuracy and mechanical endurance test***

**9.3.14.1** *Method*. With a set-point of 50 % span, alternately raise the input pressure to 75 % span and reduce to 10 % span at a frequency not greater than that to which the switch mechanism can fully respond and not less than that given in Table III of BS 4794-1:1979, or BS 5424-1, or **8.2.7.3** of BS 4941-1:1973, as appropriate for the required class of accuracy and mechanical endurance. The waveform of the applied pressure should avoid pressure shocks developing within the test system. Operate the contacts without load or with a minimum load as necessary to indicate contact operation.

**9.3.14.2** *Requirements*. After the number of operating cycles without adjustment specified for the accuracy endurance, the combined switching error shall not exceed the value of the accuracy class.

After the number of operating cycles with adjustment specified for the mechanical endurance, the combined switching error shall not exceed the value of the accuracy class.

**9.3.15** *Electrical rated making and breaking capacity and electrical endurance test*. Test the contact elements in accordance with the relevant clauses of BS 4794, BS 5424-1 or BS 4941-1 as appropriate. Omit this test if the contact elements have previously been tested to the appropriate specification.

**9.3.16** ***Vibration test***

**9.3.16.1** *Method*. The test consists of a single sweep over the range 10 Hz to 150 Hz. The test conditions shall be in accordance with clause **3** of BS 2011-2.1Fc:1977. The severity of the vibration is $1g_n$ with the maximum amplitude limited to 1 mm.

With a set-point of 50 % of span, apply a pressure equal to 5 % of span beyond the operating value. Apply the vibration along each of three mutually perpendicular axes in turn.

Repeat the test with an applied pressure equal to 5 % of span beyond the resetting value.

During the test note any components which visually show a marked resonance together with the corresponding frequency.

**9.3.16.2** *Requirement*. During the test, there shall be no operation of the electrical contacts.

**9.3.17** *Electric strength test*. The switch shall withstand the test made in accordance with **8.1.2** of BS 4794-1:1979, or **8.2.3** of BS 5424-1:1977, or **8.2.3** of BS 4941-1:1973, as appropriate. The test is not performed on the open contact gaps of microswitches.

**9.3.18** ***Proof pressure test***

**9.3.18.1** *Method*. Subject the switch to a pressure of 1.5 times the maximum working pressure. Raise the pressure steadily to its maximum value, hold for 1 min, then steadily release.

**9.3.18.2** *Requirement*. The pressurized components shall not leak.

NOTE After the test, the sample may not be suitable for normal use.

## 10 Routine tests on pressure switches

**10.1 General.** Routine tests are tests on each switch, mounted in its normal working attitude, to ensure that pressure switches produced to a design which has been satisfactorily type tested conform to the performance requirements stated by the manufacturer.

The tests are carried out on the complete pressure switch, with the cover on or off as appropriate.

NOTE Before the tests are carried out, it is necessary for the performance requirements to be stated (see clause **5**).

**10.2 Test conditions.** The error in any measuring instrument used in a test shall be not greater than one third of the specified maximum error of the quantity being measured, at the temperature at which the tests are being carried out.

**10.3 Electrical continuity test.** Check the operation of every contact by applying a voltage and current sufficient only for indication purposes.

**10.4 Pre-conditioning and leak tests**

**10.4.1** *Method*. Apply the maximum working pressure to the switch and then close off the pressure source. After the leak test in **10.4.2** slowly release the pressure to atmosphere.

**10.4.2** *Requirement*. There shall be no discernible leak or pressure drop during the 5 s after the pressure source is closed off. This requirement does not apply, however, to bellows and capsule type switches where the complete pressure element has been satisfactorily tested for leaks prior to final assembly, and to piston type switches without seals.

**10.5 Range of adjustment and switching differential test**

**10.5.1** *Method*. Set the switch and check its operation at both its upper and lower limits of range.

**10.5.2** *Requirement*. The requirements for the range of adjustment and switching differential value stated by the manufacturer shall be met.

**10.6 Scale accuracy test.** This test is performed only where the scale accuracy is stated by the manufacturer. The test is as described in **9.3.8** except that only one measurement is taken at each set-point.

**10.7 Electric strength test.** This test is performed in accordance with **8.1.2** of BS 4794-1:1979, except that the minimum duration of voltage application is reduced to about 1 s and the metal foil and external terminal connections are dispensed with. This test is omitted where an equivalent test is carried out at a sub-assembly stage of manufacture and subsequent assembly cannot result in a failure of insulation. This test is not performed on the open contact gaps of microswitches.

## Appendix A Ranges of adjustment

Values of preferred upper limits of ranges of adjustment are given in Table 1.

**Table 1 — Preferred upper limits of ranges of adjustment**

| Upper limit of range | | | |
|---|---|---|---|
| **Vacuum switch** | **Combined pressure and vacuum switch** | **Gauge pressure switch** | **Absolute pressure switch** |
| bar<br>– 1 | bar<br>– 1 to 1.5 | mbar<br>4<br>10<br>25<br>60<br>160<br>400 | bar<br>1 |
| mbar<br>– 400<br>– 160<br>– 60<br>– 25<br>– 10<br>– 4 | | bar<br>1<br>1.6<br>2.5<br>4<br>6<br>10<br>16<br>25<br>40<br>60<br>100<br>160<br>250<br>400<br>600<br>1 000 | |

NOTE 1 It should not be assumed that all the ranges in this table are available from a given manufacturer.

NOTE 2 Pressure switches with an upper limit of range below 2.5 bar may be damaged by vacuum.

NOTE 3 1 bar = $10^5$ N/$m^2$ = 100 kPa.

NOTE 4 The term "upper limit" refers in all cases to the limit with the larger numerical value.

# Publication(s) referred to

BS 21, *Pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).*

BS 2011, *Environmental testing.*

BS 2011-2.1, *Tests.*

BS 2011-2.1A, *Tests A. Cold.*

BS 2011-2.1B, *Tests B. Dry heat.*

BS 2011-2.Fc, *Test Fc. Vibration (sinusoidal).*

BS 2779, *Specification for pipe threads for tubes and fittings where pressure-tight joints are not made on the threads (metric dimensions).*

BS 4568, *Specification for steel conduit and fittings with metric threads of ISO form for electrical installations.*

BS 4568-2, *Fittings and components.*

BS 4683, *Specification for electrical apparatus for explosive atmospheres.*

BS 4794, *Specification for control switches (switching devices, including contactor relays, for control and auxiliary circuits, for voltages up to and including 1 000 V a.c and 1 200 V d.c.).*

BS 4941, *Specification for motor starters for voltages up to and including 1 000 V a.c. and 1 200 V d.c.*

BS 4941-1, *Direct-on-line (full voltage) a.c. starters.*

BS 5420, *Specification for degrees of protection of enclosures of switchgear and controlgear for voltages up to and including 1 000 V a.c. and 1 200 V d.c.*

BS 5424, *Specification for controlgear for voltages up to and including 1 000 V a.c. and 1 200 V d.c.*

BS 5424-1, *Contactors.*

BS 5501, *Electrical apparatus for potentially explosive atmospheres.*

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