bsi.

...making excellence a habit.™

Please be aware that this PDF has been created from the original hardcopy document, which might not be in good condition and so the PDF might reflect this.

BSI Group
389 Chiswick High Road
London, W4 4AL
United Kingdom

T: +44 20 845 086 9001
F: +44 20 8996 7400
cservices@bsigroup.com
bsigroup.com

British Standards Limited
Registered in England no: 07864997
Registered address: 389 Chiswick High Road
London, W4 4AL, United Kingdom

AVA Documents
INVESTORS IN PEOPLE
Document Sharing Hub

Full document details: BS 2631:1955

Full document details: BS 2631:1955

WID 11 Aug 1977 2 AMD
S/S by 5463 (1977)

BRITISH STANDARD 2631 : 1955

OIL SWITCHES

For Alternating Current Systems

BRITISH STANDARDS INSTITUTION

AVA Documents
Document Sharing Hub

BRITISH STANDARD SPECIFICATION

OIL SWITCHES

For Alternating Current Systems

B.S. 2631 : 1955

Price 6/- net

BRITISH STANDARDS INSTITUTION

INCORPORATED BY ROYAL CHARTER

BRITISH STANDARDS HOUSE, 2 PARK ST., LONDON, W.1

TELEGRAMS: STANDARDS, AUDLEY, LONDON TELEPHONE: MAYFAIR 9000

AVA Documents
Document Sharing Hub

THIS BRITISH STANDARD, having been approved by the Electrical Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 26th August, 1955.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 2500, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook, price 12s. 6d.

This standard makes reference to the following British Standards:—

B.S. 116. Oil circuit breakers for alternating current systems.
B.S. 148.
B.S. 162. Electric power switchgear.
B.S. 223.
B.S. 229. Flameproof enclosure of electrical apparatus.
~~B.S. 480 : Part I. Impregnated paper-insulated cables.~~
B.S. 923. Impulse voltage testing.
B.S. 1086. Maintenance of electrical switchgear.

British Standards are revised, whenever necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following B.S.I. references relate to the work on this Standard:
Committee reference ELE/10/1 Draft for comment CR(ELE) 2032

CO-OPERATING ORGANIZATIONS

The Electrical Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations :—

*Admiralty
*Air Ministry
*Association of Consulting Engineers (Incorporated)
Association of Supervising Electrical Engineers
*British Electrical and Allied Industries Research Association
British Electrical and Allied Manufacturers' Association
British Electrical Development Association
*British Railways, The British Transport Commission
*Cable Makers' Association
*Central Electricity Authority and Area Boards
*Crown Agents for Oversea Governments and Administrations
Electric Lamp Manufacturers' Association
Electric Light Fittings Association
Electrical Contractors' Association (Incorporated)
Electrical Contractors' Association of Scotland
*Engineering Equipment Users' Association
*General Post Office
Independent Cable Workers' Association
Institution of Electrical Engineers
*Ministry of Fuel and Power
*Ministry of Labour and National Service (Factory Department)
*Ministry of Supply
*Ministry of Works
*National Physical Laboratory
*North of Scotland Hydro Electric Board
*Oil Companies Materials Committee
Public Transport Association (Incorporated)
Radio Industry Council
War Office

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of the standard :—

Association of Mining, Electrical and Mechanical Engineers
Engineer Surveyors' Association
High Commission of India
Lloyd's Register of Shipping
London Transport Executive
National Coal Board

AVA Documents
Document Sharing Hub

CONTENTS

Foreword 7

SECTION ONE : GENERAL

1. Scope 7
2. Definitions 7
3. Symbols 10

SECTION TWO : RATING

4. Rating of switch 11
5. Rated voltage 11
6. Rated normal-current 11
7. Rated making-capacity 11
8. Rated breaking-current 11
9. Rated short-time current 11
10. Rating of integral earthing device 12

SECTION THREE : MARKING

11. Marking the nameplate 12

SECTION FOUR : SERVICE CONDITIONS

12. System earthing 13
13. Ambient temperature 13
14. Altitude 13
15. Atmospheric conditions 13
16. Operation 14

SECTION FIVE : OPERATION IN SERVICE

17. Operation in service of switch 14
18. Operation in service of integral earthing device 15
19. Maintenance after operating duty 15
20. Oil 16

SECTION SIX : LIMITS OF TEMPERATURE-RISE

21. Reference ambient temperature 16
22. Temperature-rise 16
23. Temperature-rise correction for altitude 16

SECTION SEVEN : CONSTRUCTION

24. Bushing insulators 17
25. Outdoor construction 17
26. Operating mechanisms 17
27. Ventilating outlets 17

SECTION EIGHT : TYPE TESTS

28. General 17
29. Mechanical endurance test 18
30. Tests of temperature-rise 18
31. Impulse-voltage tests for outdoor-type switches 18

MAKING-CAPACITY, BREAKING-CURRENT AND SHORT-TIME CURRENT TESTS

32. General 20
33. Condition of switch for test 20
34. Earthing the test circuit 21
35. Making-capacity and breaking-current tests 21
36. Behaviour of switch during test 21
37. Condition of switch after test 22
38. Frequency 22
39. Making-current 22
40. Making-capacity 23
41. Recovery voltage 23
42. Short-time current test 23

SECTION NINE : ROUTINE TESTS

43. General 24
44. Millivolt drop test 24
45. Power-frequency voltage tests at manufacturer's premises 24
46. Voltage tests ~~(power-frequency and d.c.)~~ after erection on site 25

see Amdt 2.

Full document details: BS 2631:1955
AVA Documents
Document Sharing Hub

TABLES

1. Standard three-phase oil switches. Standard ratings 12

2. Impulse-voltage test values for outdoor-type oil switches 19

3. Power-frequency test-voltages on apparatus at manufacturer's premises 24

4. Power-frequency test-voltages on apparatus after erection on site 25

5. Power-frequency voltage tests for durations exceeding one minute (after erection on site) 26

6. D.C. Test voltages.

APPENDICES

A. Information to be given with enquiry and order 27

B. Standard information for tenders 28

C. Selection of standard oil switches 29

D. Care and maintenance of oil switches 34

E. Information to be included in reports of type-tests for making-capacity and breaking-current ratings, and for short-time-current ratings 36

F. Measurement of power-factor 37

G. Measurement of recovery-voltage 38

H. Determination of short-time current 38

J. Measurement of temperature 39

BRITISH STANDARD SPECIFICATION FOR

OIL SWITCHES

FOR ALTERNATING CURRENT SYSTEMS

FOREWORD

This British Standard supersedes B.S. 116: Part 1 : 1937 in relation to the requirements for oil switches. B.S. 116: 1937 covered oil circuit-breakers, oil switches and oil isolating-switches. B.S. 116 : 1952 covers oil circuit-breakers only and oil switches are the subject of this new British Standard. The scope of this standard, and the rating and performance of the oil switches covered by it have been carefully considered in relation to the trend of service requirements.

Oil isolating-switches will continue to be covered by the relevant portions of B.S. 116: Part 1 : 1937 until these are superseded.

SECTION ONE: GENERAL

SCOPE

1. This British Standard applies to manually operated 3-pole oil switches (as defined in Definition 1 of Clause 2) for three-phase a.c. systems. The standard ratings are set out in Table 1. It does not apply to switches that can be opened or closed by power, to oil isolators (oil isolating-switches as defined in B.S. 116: 1937), to oil selectors, to combinations of switches and fuses in series, or to switches intended for making and breaking circuits frequently at short intervals (e.g. starting switches). Neither does it include the additional requirements necessary in connection with flameproof enclosures as given in B.S. 229: 'Flameproof enclosure of electrical apparatus'.

DEFINITIONS

2. For the purposes of this British Standard, the following definitions shall apply:

1. Oil switch. (Generally referred to in the text as a switch). A device suitable for making a circuit in oil under normal and abnormal conditions, such as those of short-circuit, and capable of breaking a circuit in oil under normal conditions.

NOTE. For the operating duty of an oil switch see Clause 17.

2. Auxiliary switch. A switching device, working in conjunction with a switch, to control a circuit for operating auxiliary devices such as indicators or alarms.

AVA Documents
Document Sharing Hub

3. Main contacts. The fixed and moving contacts in the normal load current-carrying circuit.

4. Arcing-contacts (or auxiliary break contacts). Contacts that open after, and close before, the main contacts and which are intended to protect main contacts from injury.

5. Integral earthing device. A device, integral with the switch, used for earthing the circuit.

6. Earth-contacts. The fixed and moving contacts in the earthing circuit.

7. The break. The sum of the gaps introduced in one pole between main contacts, or arcing-contacts (if any), when the switch is fully open.

8. The travel. The distance through which the moving contacts pass between the closed and fully opened positions.

9. Loop. That part of an alternating wave which extends from any one zero to the next.

10. Arc-duration (or Arcing-time). The time between the instant of separation of the switch contacts and the instant of arc extinction of the breaking-current. For the purpose of indicating the number of current zeros after the instant of separation of the contacts up to the instant of arc-extinction, arc-duration (or arcing-time) may be referred to as including a stated number of loops.

11. Rating of a switch. The set of values assigned by the manufacturer to define the working conditions for which it is built.

12. Performance of a switch. The general term used to denote its behaviour on and the values obtained from tests made on it under prescribed conditions.

13. Operating-duty. A defined sequence of making and/or breaking operations without any deliberate alteration of the main circuit in which the switch is placed.

14. Applied voltage. The r.m.s. value of the voltage applied to a test-circuit immediately before the initiation of the current.

15. Recovery-voltage. The normal frequency r.m.s. voltage that re-appears between the poles of a switch after final arc-extinction.

16. Normal-current. The r.m.s. value of the current that a switch is capable of carrying continuously under prescribed conditions.

17. Short-time current. The r.m.s. value of current that a switch is capable of carrying for the stated time under prescribed conditions.

18. Breaking-current. The current that exists at the instant of contact separation expressed as an r.m.s. value.

19. Making-current. The peak value of the maximum current loop (including the d.c. component) in any pole during the first cycle of current when the circuit is closed by a switch.

20. Making-capacity. The making-current that a switch is capable of making and carrying instantaneously at the rated voltage (see Clause 5) under prescribed conditions.

21. Closed switch. A switch is closed when its closing operation has been completed.

22. Dependent manual closing operation. A closing operation by hand without using any other supply or storage of energy and which is therefore entirely dependent on the operator.

23. Independent manual closing operation. A closing by hand in a single operation in which energy stored during the initial part of the operation is later used to complete the closing operation independently of the operator.

24. Co-ordination of insulation. The process of correlating the insulation strengths of electrical equipment, with anticipated over-voltages and with the characteristics of protective devices (see Appendix C, Section 2 *e*). It consists of the steps taken to prevent damage to electrical equipment due to over-voltages and to localize flashovers (when they cannot economically be prevented) to points where they will not cause damage.

25. Insulation level of apparatus. The level that determines the principal dielectric qualities of apparatus, and which is expressed for impulse-tested apparatus by a peak impulse voltage value (impulse withstand voltage with a full 1/50 microsecond wave, see B.S. 923, ' Impulse voltage testing ') and for non-impulse-tested apparatus by a power-frequency r.m.s. voltage (power-frequency withstand voltage) value which the apparatus must withstand under specified test conditions.

26. Electrically exposed installation. An installation in which the apparatus is subject to over-voltages of atmospheric origin. (See Appendix C, Section 2 *e*.)

NOTE 1. Such installations are usually connected to overhead transmission lines, either directly or through a short length of cable.

NOTE 2. Apparatus may be required for installations which are semi-exposed to over-voltages of atmospheric origin, that is of magnitude less than for an exposed installation. Such installations are usually connected to overhead transmission lines through two-winding transformers, or a longer length of cable, which reduce the amplitude of incoming over-voltages. These cases require special consideration. The apparatus will be chosen from the appropriate exposed or non-exposed insulation class, as a special class of insulation is not proposed for this case.

AVA Documents
Document Sharing Hub

27. Electrically non-exposed installation. An installation in which the apparatus is not subject to over-voltages of atmospheric origin. (Appendix C, Section 2 *e*.)

NOTE. Such installations are usually connected to cable networks.

28. Surge-protected installation. An installation whose external and internal over-voltages are effectively limited by protective devices to values less than the insulation level of the apparatus, with a reasonable safety margin.

29. Insulated neutral system. A system that has no intentional connection of the neutral point to earth except through indicating, measuring or protective devices of very high impedance (see Clause 12).

30. Earthed neutral system. A system, the neutral point of which is connected to earth, either solidly, or through a resistor or reactor (see Clause 12).

31. Over-voltage. An abnormal voltage in excess of the peak voltage to earth of the system (see Appendix C, Section 2 *e*).

32. Arc-suppression coil earthed system. A system in which the neutral is earthed through a device having a reactance selected to produce resonance with the capacitance to earth of the system during phase-to-earth faults, thus neutralizing the capacitive component of the current passing through the fault.

NOTE. An arc-suppression coil is generally adjusted slightly out of resonance to prevent resonance from causing over-voltages in cases of phase unbalance.

33. Type test. A test of one article intended to show that all articles having the same essential details and made to the same specifications would pass an identical test.

34. Routine test. A test of every article made to the same specification.

SYMBOLS

3. The following symbols are used in this specification to define the steps of any operating-duty or test-duty.

B denoting a breaking operation.
M denoting a making operation.
t (or a numeral) denoting a time in minutes between successive operations of an operating-duty or test-duty.

SECTION TWO: RATING

RATING OF SWITCH

4. A switch shall be rated in terms of the following:

a. Number of poles (3 poles).
b. Voltage.
c. Normal current (400 amperes).
d. Frequency.
e. Making-capacity.
f. Breaking-current.
g. Short-time current (3 seconds).

RATED VOLTAGE

5. The rated voltage of a switch shall be one of the standard values given in column 1 of Table 1 and shall be the nearest voltage to, but not less than, the r.m.s. voltage of the circuit or system in which it is intended to operate.

RATED NORMAL-CURRENT

6. *a.* The rated normal-current of a switch shall be the r.m.s. current it can carry continuously with a temperature-rise in accordance with the conditions of Section Six.

b. The standard rated normal-current shall be 400 amperes.

c. If a switch is used at a frequency other than 50 c/s, its standard rated normal-current may be increased or decreased if necessary, in order that it shall comply in all other respects with the requirements of this specification. The larger or smaller current so determined shall then be the rated normal-current at the frequency marked on the nameplate.

RATED MAKING-CAPACITY

7. The rated making-capacity of a switch shall be one of the standard values given in column 2 of Table 1.

RATED BREAKING-CURRENT

8. The standard rated breaking-current of a switch shall be 400 amperes.

RATED SHORT-TIME CURRENT

9. The rated short-time current of a switch shall be not less than its rated making-current divided by the product of the factors 1·8 and 1·414, i.e. by 2·55 (see Fig. 1). The duration of the rated short-time current shall be 3 seconds.

AVA Documents
Document Sharing Hub

TABLE 1. STANDARD THREE-PHASE OIL SWITCHES STANDARD RATINGS

(Preferred ratings are indicated by heavy type)

1	2	3	4	5	6
Voltage	Making-capacity	Equivalent† MVA corresponding to columns 2 and 6	Normal current	Breaking-current	Short-time current
kV	Peak kA	MVA	Amperes	Amperes	kA
3·3	33·4	75	400	400	13·1
6·6	33·4 55·8	150 250	400 400‡	400 400	13·1 21·9
11	20·1 33·4	150 250	400 400	400 400	7·88 13·1
22	16·8 33·4	250 500	400 400	400 400	6·57 13·1
33	22·3 33·4	500 750	400 400	400 400	8·76 13·1

RATING OF INTEGRAL EARTHING DEVICE

see Amdt 2

10. Where integral earthing facilities are provided the integral earthing device(s) shall have the same rated making-capacity and rated short-time current as the main contacts of the switch. The device(s) need not have a rated breaking-current or a rated normal-current.

SECTION THREE: MARKING

MARKING THE NAMEPLATE

11. All switches shall be provided with nameplates which shall be indelibly marked with the following rating data:

a. The number of this British Standard, i.e. B.S. 2631: 1955.
b. Voltage.
c. Normal current (400 A).
d. Frequency.
e. Making-capacity .... Peak kA equivalent to .... MVA.
f. Breaking-current (400 A).
g. Short-time current, 3 seconds .... kA.

† The equivalent MVA is derived from

$$\frac{\text{making-capacity (peak kA)}}{2{\cdot}55} \times \sqrt{3} \times \text{rated voltage (kV)}.$$

‡ Owing to the high ratio of short-time current to normal-current, the design of the current carrying parts is likely to be governed by the three-second short-time rating.

SECTION FOUR: SERVICE CONDITIONS

SYSTEM EARTHING

12. Standard switches complying with this specification shall be suitable for use on systems earthed as given in conditions *a*, *b* (i) and *b* (ii) below.

Switches for use on systems having other earthing conditions (e.g. *b* (iii) and *c*) require special consideration. (See Appendix C, Section 2 *a* Selection of rated voltage.)

The following system earthing conditions are recognized:

a. At least one of the neutral points of a three-phase system permanently earthed, either solidly or through a resistor or reactor of low impedance.

b. At least one of the neutral points of a three-phase system earthed normally through an arc-suppression coil.

On such a system it is the intention that the majority of phase-earth faults will be self-clearing without interruption of the supply. When phase-earth faults occur which are not self-clearing three methods of system operation are recognized:

(i) The fault is automatically disconnected from the system after a short delay.

(ii) When non-automatic disconnection is used the faults are generally cleared quickly although they may be allowed to persist for several hours provided that the total duration does not exceed 125 hours per annum, with a maximum of 8 hours in any 24.

(iii) Faults are allowed to remain for a longer duration than in (ii) but not approaching continuous operation with one phase earthed.

c. All the neutral points of a three-phase system insulated from earth.

AMBIENT TEMPERATURE

13. The performance of standard switches shall be based on the following limits of ambient temperature:

A peak value not exceeding 40°C and an average value not exceeding 35°C when measured over a 24 hour period. (See Clause 21.)

ALTITUDE

14. Standard switches in accordance with this specification shall be suitable for use at an altitude not exceeding 3300 ft above sea level. (See Clause 23.)

ATMOSPHERIC CONDITIONS

15. Standard switches in accordance with this specification shall be suitable for use in an atmosphere not subject to excessive pollution by

AVA Documents
Document Sharing Hub