



GS 112-12

Guidance for Specification GS 112-12

**REQUIREMENTS FOR FLAME
RETARDANT AND FIRE
RESISTANT CABLES**

July 1993

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Document Title REQUIREMENTS FOR FLAME RETARDANT AND FIRE RESISTANT CABLES											
APPLICABILITY Does not preclude adaptation for other applications Regional Applicability: International (Based upon Europe)											
SCOPE AND PURPOSE This Specification is for flame retardant and fire resistant cables and is primarily aimed at cables for offshore installations, but can be used for onshore installations where fire protection/oil resistance is required. Its purpose is for the specification of 'fit-for-purpose' cables at minimum cost.											
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FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering

The Introductory volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Guidance for Specification

This Guidance for Specification identifies general requirements for flame retardant and fire resistant cables and provides for the specification of performance and testing requirements.

Application

This Guidance for Specification is intended to guide the purchaser in the use or creation of a fit-for-purpose specification for enquiry or purchasing activity.

Text in *italics* is Commentary. Commentary provides background information which supports the requirements of the Specification, and may discuss alternative options. It also gives guidance on the implementation of any 'Specification' or 'Approval' actions; specific actions are indicated by an asterisk (*) preceding a paragraph number.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Specification Ready for Application

A Specification (BP Spec 112-12) is available which may be suitable for enquiry or purchasing without modification. It is derived from this BP Group Guidance for Specification by retaining the technical body unaltered but omitting all commentary, omitting the data page and inserting a modified Foreword.

Principal Changes from Previous Edition

This Specification groups together three superseded BP Engineering Standards (235 - Fire Resistant Power Cables; 236 - Fire Resistant Instrument Cables; and 242 - Flame Retardant Cables).



Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSEs, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP International or the Custodian. See Quarterly Status List for contacts.



1. INTRODUCTION

1.1 Scope

This Specification details general requirements for power, control and instrumentation cables for applications where flame retardant or fire resistant cables are required. It will be supplemented with a separate specification to detail the general requirements for the cables where these are not included within this specification. The supplementary specification may adapt this document for each specific application.

This Specification gives only limited requirements for the materials to be used. It principally defines the performance requirements of the cables and the tests to be performed to demonstrate these.

Specific requirements will be defined on appropriate data sheets attached to each enquiry or order. These data sheets will also indicate any permissible variations from this Specification.

This Specification is primarily aimed at cables for offshore installations, however, it can be used directly for onshore installations where fire protection /oil resistance is required. It is considered that, with suitable adaptation, this specification can be used for any cable purchase.

This document is applicable to all Power and Control cabling which requires flame retardancy or fire resistance and can be used for those telecommunication cables which employ constructions similar to Instrumentation/Control applications e.g. Public Address system cables. Some Telecommunications and specialist types of Control cables e.g. Co-Axial and Antennae feed cables, may comprise a small order for any particular application and may not warrant the rigid adherence to the flame retardant aspects of this specification.

It is expected that as a minimum there would be a supplementary schedule attached to this document to detail the following:-

- (a) Cable type designation for the specific Project
- (b) Cable service. e.g. Instrument/Digital/Analogue d.c. etc.
- (c) Length required.
- (d) Cable drumming information.

1.2 Layout of this Specification

This Specification is divided into two parts. Part 1 specifies the general requirements for flame retardant cables which also apply to fire resistant cables. Part 2 specifies the requirements for fire resistant cables which are in addition to those detailed in Part 1.

1.3 Quality Assurance

The vendor shall ensure that each drum of cable is identified in such a way that the purchaser will be able to trace the batch, materials, mix, components and build of the cable on that drum. This shall be readily cross referenced to any type testing information which is offered by the manufacturer in respect of cable performance.



Verification of the vendor's quality system is normally part of the pre-qualification procedure, and is therefore not specified in the core text of this specification. If this is not the case, clauses should be inserted to require the vendor to operate and be prepared to demonstrate the quality system to the purchaser. The quality system should ensure that the technical and QA requirements specified in the enquiry and purchase documents are applied to all materials, equipment and services provided by sub-contractors and to any free issue materials.

Further suggestions may be found in the BP Group RPSEs Introductory Volume

PART 1: REQUIREMENTS FOR FLAME RETARDANT AND FLAME RESISTANT CABLES

2. GENERAL

2.1 Voltage Designation

Instrument cables for general purpose use shall be suitable for ac or dc voltages up to that stated on the data sheet and for Instrumentation System duty peak voltages up to and including 300 V r.m.s. core to earth and 500 V r.m.s. core to core.

Power cables shall be designated for rated voltages (U₀/U) of 0.6/1, 1.8/3, 6/10, or 8.7/15 kV rms.

Manufacturers may not guarantee cables above 600V (or perhaps 3.3 kV) as fire resistant owing to the build of such cables. However, they will construct cables which are manufactured as fire resistant for which guarantee waivers have been issued in the past. As material and cable manufacturing technologies are improving quite rapidly there is good possibility of guarantees for high voltage cables in the near future.

2.2 Conductors

The conductors shall comply with [IEC 228](#). For power cables the conductors may be circular stranded or shaped stranded. Plain annealed copper conductors may be used where elastomeric insulation of conductors is not employed providing that the manufacturer confirms that the core insulation material will not corrode the conductors.

For instrument cables, conductor sizes shall be in accordance with an appropriate National Standard, except that compensating cable conductors for thermocouples shall be as specified in the data sheet.

[BS 5308](#) defines cable core sizes meeting UK specifications (there is no direct IEC equivalent) however [IEC 92-375](#) offers specification detail associated with General Instrumentation and Control cables for Ships which may be acceptable as an alternative to [BS 5308](#).



2.3 Insulation

Insulation of the cores shall be suitable for the specified voltage designation and duty. The insulation shall be applied by an extrusion process to form a compact homogeneous body.

It is considered acceptable to buy standard products unless these are of a lesser quality or performance than required. PVC insulation is not essential but can be accepted if other performance criteria are met. It is also acceptable to procure cables with elastomeric (EPR/CSP/EVA) or XLPE insulation.

Further information regarding the particular properties of the various insulation materials may be obtained from the manufacturer.

2.4 Filling and Bedding

The cable shall be circular and shall be substantially compact to meet the requirements for direct entry into Ex(d) equipment.

Fillers shall be used in the interstices between each core or pair, and any central voids, where it is not possible to achieve a substantially compact and circular cross section with the extruded bedding.

Bedding shall be suitable for the specified duty and configuration and shall be applied by an extrusion process.

The meaning of substantially compact to meet the requirements for Ex(d) is taken as being tightly filled enough to prevent any escape of material or hot gas likely to cause an explosion outside the Ex(d) enclosure. The concept of 'substantially compact' is derived from IEC 79-14 (BS 5345 Part 3) and is a consideration which allows suitable cables to be terminated directly into an Ex(d) enclosure without the need for a barrier gland.

It is most efficient to buy standard products unless these are of a lesser quality or performance than required, PVC filling and bedding are not essential. It is now within standard to order cables with elastomeric (EPR/CSP) filling and bedding. XLPE is also possible.

Further information regarding the particular properties of the various filling and bedding materials may be obtained from the manufacturer.

2.5 Marking and Identification of Cores and Sheath

A means of identifying the manufacturer shall be provided throughout the interior length of all cables by printed tapes or other suitable method. Coloured tapes are not acceptable.

Outer sheath shall be embossed throughout the cable length on two sides with the following information:-

Manufacturers Name
National/International Standard Identification
Cable Designation (Cores Size etc.)



The cores of all cables shall be identified by colours or numbers in accordance with an appropriate National Standard. The manufacturer shall specify the standard to be used for identification.

All multipair cores shall be uniquely and effectively identified.

IEC 92-375, BS 5308, BS 6746, BS 6883, BS 6899, or local regulations and practices would offer acceptable arrangements for cable core identification.

Numbered polyester film over black and blue core pairs are acceptable for unique identification but any method employing specific pair colour coding is also acceptable. The objective is to be able to uniquely identify the pair and between the individual cores of the pair.

It is intended that the cable should be readily identifiable from the external sheath information. Manufacturers Standard provisions would normally prove acceptable. It is not intended that provisions beyond those required by National Standards should be necessary.

2.6 Laying Up

The cores of all cables having two or more cores shall be laid with a right hand direction of lay. Alternate directions shall be used for successive layers of multicore cables.

Cores of instrument cables shall be laid in accordance with [IEC 92-375](#).

BS 5308 offers alternative specification reference for core lay-up.

For multipair instrument cables, two appropriately coloured insulated conductors shall be uniformly twisted together to form a pair. The lengths of lay used shall be such that the two wires forming each pair are not disassociated by normal handling. The lay lengths of adjacent pairs shall not be equal, in order to reduce cross talk. In achieving this, the length of lay of any pair shall not exceed 100 mm. (This represents a minimum of 10 twists per metre.)

Dummy or filler elements and bedding may be used where necessary.

2.7 Screens (Instrument Cables Only)

When individual pairs and/or collective screening is specified, screening tape and drain wires shall comply with an appropriate National Standard. For individual pair screening, each screen shall be insulated from the remaining cable components by the application of suitable tapes numbered in accordance with the pair numbering system. When two tapes are used they shall have 25% overlap; one tape shall have 50% overlap.

An acceptable standard detailing screening tape construction is [BS 5308](#). The requirement for screen and drain wire construction ensures that each individual screen is insulated from its neighbour.



2.8 Armour (Metallic Covering)

The armour specified in the Data Sheets shall comply with the appropriate requirements for that type which is detailed in [IEC 92-3](#).

Although it was previously thought necessary to use braided armour cables this could involve buying non-standard cables, which, although not necessarily more expensive when buying amounts for a complete project, are not available in lengths less than a 'manufactured minimum'. This can cause considerable expense in replacement of small lengths of cable and generally increases the maintenance costs. In many cases other types of armour (e.g. galvanised steel wire) can be acceptable. Notwithstanding this, it should be borne in mind that cable glands appropriate to the cables to be used and the classification of the installation are required and in the interests of simplicity (and therefore cost and safety) a standardised cable type may prove more sensible as an initial installation.

2.9 Oversheath

The oversheath material shall be appropriate to the application of the cable. Any cable for Intrinsically Safe application shall be coloured Blue, otherwise the sheath may be coloured Black.

Cables with PVC, elastomeric (CSP) or LSF sheathing are within this performance standard. It should also be noted that the availability of zero halogen sheaths is increasing, however it has been noted that CSP sheathing, having fluropolymers reacted with EVA beddings and insulations and such combinations should be avoided. Zero halogen cables with CSP sheath, EPR bedding and/or XLPE insulation is acceptable as are cables with EVA sheath and bedding with XLPE insulation. Further information regarding the particular properties of the various sheathing materials may be obtained from the manufacturer.

The manner of installation needs to be considered carefully in the selection of the materials to be employed for insulation and for oversheath. e.g. PVC proves brittle when worked at low temperatures.

Other than the case of IS cables, no specific colour is required for cables. However on any specific installation a balance between cost and confusion should be considered. There may be a cost advantage in accepting a manufacturers standard colour for cable sheath but too many differing colours for cables can lead to the assumption by maintenance staff that there is a defined colour code for the installation.

3. PERFORMANCE REQUIREMENTS

3.1 Flame Propagation

The complete cable shall be deemed flame retardant. (See 4.2)

3.2 Halogen Acid Evolution

No constituent component of the insulation, bedding or sheathing of the cable shall release total acidic degradation products during



combustion at any temperature up to and including 1000°C which by weight when expressed as HCl are greater than that percentage required in the data sheet. (See 4.3)

Previously, BP standards required that the maximum HCl release for all flame retardant and fire resistant cables was 15%. However, where the installation may not be in an area which is sensitive to this issue (e.g. on unmanned installations) this may not be a requirement.

Many manufacturers now produce reduced and zero halogen cables which are acceptable for use in any situation and may be particularly considered useful for use in closed manned areas and accommodation blocks. However the selection of such cable is dependent upon either cost advantage or upon a project specific enhanced safety requirement to specify such cable. Where such cables are to be employed, the performance for smoke emission needs to be specified in accordance with a National/International standard. [BS 6724](#) or [BS 7211](#) provide details for a Smoke Test as well as other additional type tests which are appropriate for this type of material.

[IEC 754-1](#) details the test for acid evolution. Note that this standard requires a temperature of up to 1000°C.

The percentage halogen evolution of cables should be carefully matched to their application.

3.3 Bending

Cables shall be suitable for installation with a minimum bending radius, appropriate for the type of cable to be supplied, which shall be as specified in a declared National or otherwise Nationally recognised standard. The manufacturer shall declare the national standard or other nationally acceptable standard specification giving minimum bending radii.

Table IIX of the IEE Recommendations for Fixed and Mobile Platforms provides an example of a nationally recognised standard for bending radii for cables.

The manufacturer shall indicate with his tender the minimum handling temperature for the cable.

3.4 Electrical Characteristics

The electrical characteristics of the complete cable shall comply with the appropriate requirements of [IEC 92-3](#). (See 4.5)

3.5 Physical Characteristics

*

The physical characteristics of the insulation, bedding and sheathing materials shall comply with the relevant parts of [IEC 227](#), [IEC 92](#) or [IEC 502](#) as appropriate for the type of material employed.

[BS 6746](#), [BS 6883](#), or [BS 6899](#) are British Standards which are acceptable if declared.



Where required, the manufacturer shall provide cable sheath oil resistance performance characteristics. These tests shall be based on tests called for in section 4.8 and shall be presented as comparisons to PVC and CSP sheathing with defined (standard) properties.

3.6 Oxygen Index

Bedding and sheathing materials shall have an oxygen index of 28 or greater.

4. TESTS

4.1 Routine/Type Tests

All cables shall be subject to routine factory tests in accordance with clauses 4.5 to 4.8.

Type test certificates/ test data shall be provided to show that cables have been subjected to type tests in accordance with clauses 4.2 to 4.4.

At the time of tender, the manufacturer shall schedule each of the tests called for in this specification.

Routine tests are required on all cables purchased.

Type tests need be carried out only on cables that have not been type tested previously.

When type tests are to be carried out on a range of cable sizes of the same type, it is necessary only to carry out tests on the smallest size, a mid-range size and the largest size. If the results of these tests are successful, further type testing is not required. If tests on a cable in part of the range are not successful, it will be necessary to carry out tests on all sizes of cable in that part of the range to determine the point in the range at which failure does not occur.

4.2 Flame Propagation

The cable shall be tested in accordance with the method detailed in [IEC 332-3](#). Test category A shall be taken for the test arrangement.

Although this test is fairly precise as to set up of the cables to be tested it should be noted that the performance of cables in the flame propagation test may be dependent upon the quite specific arrangements of:-

- (a) The volume of combustible material.*
- (b) The geometric configuration of the cables.*
- (c) The arrangements for the ventilation air.*

It would therefore be theoretically possible to determine a "worst possible" arrangement for each installation. However, this test is not intended to exactly duplicate the planned installation nor is it intended that the "theoretical worst"



arrangement for a particular type of cable be sought. It is considered that the general test arrangement will be sufficient to indicate an acceptable level of performance.

4.3 Halogen Acid Evolution

The test for halogen acid evolution shall conform to the following:-

- 4.3.1 A sample of each constituent component of the insulation, bedding and sheathing of the cable shall be tested in accordance with [IEC 754](#) part 1.
- 4.3.2 The test shall be arranged to ensure that the total mass of each sample is consumed in combustion providing that this is achieved within one hour. Where total combustion is not achieved in one hour, the mass which has been consumed shall be determined.
- 4.3.3 For each sample the total mass of acidic product released, expressed as HCl released shall not exceed the percentage stated in the data sheet. This percentage is a percentage of the total mass of the sample consumed in combustion.

Although testing was previously required at various temperatures it was decided that the worst case would occur at 1000°C thus testing at this temperature alone would suffice.

A particular test to determine acid evolution is specified in this standard. It is not intended to apply this rigidly where an acceptable alternative is offered. Any alternative shall be considered on the basis of 'industry acceptability' by referring to a chemist.

4.4 Oxygen Index

Bedding and oversheath materials shall be tested for Oxygen Index according to the requirements of a National Standard declared by the manufacturer.

[BS 2782](#) Part 1, Method 141D specifies an acceptable manner of testing for Oxygen Index. A value above 28 is expected (see clause 3.6).

4.5 Electrical Characteristics

The cables shall be tested in accordance with the relevant clauses of [IEC 92-3](#) or [IEC 502](#) depending on the type of cable and materials used in the manufacture of the cable.

[BS 5308](#) or [BS 6346](#) may be acceptable if cables are offered to British Standards.



4.6 Electrical Characteristics (Power Cables)

The cable shall be tested in accordance with [IEC 92-3](#), clauses 10.41 to 10.44 inclusive with the amendments detailed in 4.6.1 through 4.6.2 below:-

4.6.1 For PVC insulated cables, insulation resistance tests may be performed in accordance with clause 10.45 instead of clause 10.44.

4.6.2 Partial Discharge Test

A partial discharge test shall be performed on cables of rated voltages U_0/U of 6/10 and 8.7/15 kV in accordance with [IEC 540](#), clause 3. The magnitude of the discharge at $1.25 U_0$ shall not exceed 20%.

4.7 Electrical Characteristics (Instrument Cables)

The cable shall be tested in accordance with the applicable requirements of [IEC 92-3](#) and the following:-

4.7.1 Conductor Resistance

The maximum dc resistance of each copper conductor in a completed cable at 20°C shall not exceed the following:-

Conductor Nominal Area mm ²	Conductor Details mm	Nominal Diameter mm	Resistance at 20°C /km
0.5	16/0.2	0.93	39.0
0.75	24/0.2	1.14	26.0
1.5	7/0.5	1.50	13.9

4.7.2 Spark Testing Cores

All cores shall be spark tested in accordance with the requirements of an appropriate National Standard without failure of the insulation.

[BS 5099](#) details arrangements for Spark Testing which is suitable for use in UK.



4.7.3 Spark Testing Sheath

The outer sheath shall be spark tested in accordance with a National Standard which covers cable sheath testing. The National standard appropriate for the test arrangement shall be nominated by the manufacturer.

BS 5099 provides guidance for UK based cables. An a.c. power frequency voltage of 6 kV per millimetre of radial thickness of sheath up to a maximum of 25 kV is expected, however a d.c. source or a high frequency (1k Hz to 1 MHz sine wave) with appropriately differing values of voltage will be acceptable..

4.7.4 Pressure Testing Complete Cable

The completed cable shall be subject to a voltage test applied between conductors and remaining conductors, screens, and armour, which shall be earthed. The test shall be made at room temperature with an alternating voltage approximately of sine-wave form having a frequency in the range 40 Hz to 62 Hz. The value of the applied voltage shall be 1000 V (unless a higher voltage is declared by the manufacturer to accord with an appropriate National Standard). The voltage shall be increased gradually and maintained at the full value for 1 minute without breakdown of the insulation.

This test specification assumes that the cables will not be used for service above 600V. (Actually some National Standards would require a 3,500V r.m.s. test for 600V/1000V cable, as in the case of [BS 6724](#)). If HV cables are specified the pressure test should be appropriate for that voltage standard for the cable.

4.7.5 Individual Core Insulation Resistance

The insulation resistance of each conductor measured against the remaining bunched conductors/screens/armour when tested at 500V d.c. after steady electrification for 1 minute shall be not less than 5 G ohm/km at 20°C.

Alternatively, for cables with individually screened pairs, the insulation resistance measured between screens when tested at 500V d.c. after steady electrification for 1 minute shall be not less than 1 M ohm/km at 20°C.

4.7.6 Mutual Capacitance

The maximum capacitance for pairs and adjacent cores when measured at a frequency of 1 KHz shall be below the figure stated on the data sheet.

4.7.7 Capacitance between Core and Screen

The maximum capacitance between any core and screen when measured at a frequency of 1 KHz shall be below the figure stated on the data sheet.

4.7.8 L/R Ratio

The maximum L/R ratio for adjacent cores shall be below the value stated on the data sheet.

4.8 Physical Characteristics

The insulating and sheathing materials shall be tested in accordance with the relevant clauses of [IEC 227](#), [IEC 92-3](#) or [IEC 540](#),

[BS 6746](#), [BS 6883](#) or [BS 6899](#) represent alternative British Standards for cables with PVC, Elastomeric or Rubber insulation and Sheaths.

Where cable sheath resistance to oil absorption is required the cable sheaths shall be tested in accordance with [IEC 92-3](#) Clause 10.58. (Although the [IEC 92-3](#) specification referenced represents a test for PCP and PVC, the same test shall be applied whatever the sheath material in order to determine the relative suitability of the proposed sheath material for the service envisaged.) Where specific contaminants are given in the Data Sheets these shall form part of the test contaminants used for the oil resistance tests.

The results of the oil resistance tests should be given in the form of a comparison with commonly used cable sheath materials. The type of sheath used should be chosen on a 'best for job' basis and the choice should be job specific. [IEC 92-3](#) Table VII indicates typically acceptable values for Tensile Strength and Elongation at break.

The oil absorption tests called for are concerned with the sheath only. This test does not deal with continuous exposure to a contaminant. Where there is a possibility that the cable will be continuously exposed to a contaminant a lead sheath is generally required because no polymeric sheath has been developed which can be satisfactory for long term (20 years plus) exposure to hydrocarbon containment.

The oil absorption tests do not give characteristics for swell and abrasion resistance. Where a cable is open to possible damage due to these factors other protection may be required to prevent damage and contaminant ingress into insulation, alternatively the manufacturer may be able to demonstrate by test that a cable sheath has sufficient resistance to such damage following exposure to the contaminant..

4.9 Witnessing of Tests

BP may require to witness all or some of the routine and type tests. The manufacturer shall give the purchaser two working weeks notice of testing to allow time to arrange attendance.



PART 2: FIRE RESISTANT CABLE

5. GENERAL

5.1 Flame Barrier Tapes/Collective Screen

For instrument cables, if an overall collective screen is specified, tapes or braids of heat resistant and/or heat reflecting material may be provided over the bedding, providing they are suitable for the duty specified. Only one flame barrier tape may be metallic and in this case an electrically conductive drain wire shall be provided under and in contact with this tape. The tape/drain wire need not be fault current rated but shall be arranged so that the drain wire may be terminated with the armour specified.

6. PERFORMANCE REQUIREMENTS

6.1 Fire and Impact Resistance

The cable shall be capable of operating when exposed to a source of heat as detailed in [IEC 331](#) and simultaneously sustaining a degree of mechanical impact for the full time of the test detailed in [IEC 331](#). The mechanical impact shall be substantially similar to that detailed in [Norme Francaise C32-070](#), Section 2.3 or [Norme Belge NBN C30-004](#) Section 3.3.3.2., or [BS 6387](#) Section D.4.1.4.

The fire performance requirements specified here (effectively 750°C for 3 hours) are meant as a compromise. One could specify a need for almost any temperature withstand and time (1000°C and a period of 20 min have been employed in the past) but there would inevitably be manufacturers offering a differing set of values. The adopted approach is to specify an Internationally recognised standard (albeit with the additional impact test specified) with the expectation that there would be a greater number of manufacturers either having carried out tests to that standard or having the test arrangements for doing so. Clearly there will still be manufacturers who will offer alternatives to those specified. e.g. 800°C for 1 hour. No specific guidance is available on equivalents and it is left to the specific application engineer to determine whether acceptance of alternative fire resistant proofs would be reasonable.

The impact test references above were, at the time of drafting this document, the only ones considered applicable and substantially contained within standards published within Europe. Alternative arrangements which offer similar shock treatment to the Cable should be considered if the particular arrangements of the specified test arrangements are not appropriate. The intention of this requirement is to be assured that a fire resistant cable can be robust enough to withstand at least some degree of mechanical shock during the time it is exposed to fire.

6.2 Water Resistance During a Fire

The cable shall be capable of operating when exposed to a water spray during a fire. This shall be demonstrated by compliance with the test



specified in 7.1. Fire and impact resistance tests and water resistance tests are to be carried out on the same piece of cable.

7. TESTS

7.1 Fire, Impact and Water Resistance

These tests shall be carried out on the same sample of cable.

Fire resistance and impact resistance tests shall be carried out simultaneously.

The cable shall be tested in respect of fire resistance in accordance with [IEC 331](#) and in respect of impact resistance in accordance with [Norme Francaise C32-070](#), Section 2.3 or [Norme Belge NBN C30-004](#) Section 3.3.2.2. or [BS 6387](#) Section D.4. After fire resistance with simultaneous impact resistance has been proven, the cable shall be tested for water resistance by subjecting it for a period of 5 minutes to a water spray applied at such angles as to ensure that the complete circumference is tested. Water shall be sprayed at a rate of not less than 15 litres per minute from a nozzle inside diameter 8.0 - 12.5 mm, at a distance of 1.5 m from the test sample.

The apparatus shall be arranged to demonstrate that the insulation resistance of the cable is not less than 1 megohm.

The 1 megohm insulation resistance called for in this test can be difficult to achieve with certain apparatus arrangements. In order to achieve such an insulation resistance, the cable ends at which the measurement is taken must be maintained in a dry environment for the duration of the test. Where this is not done the insulation resistance measurements will be inaccurate. Therefore it is expected that particular test arrangements will differ from the standard test arrangements to achieve meaningful results.

It is suggested that if the cable has been previously type tested in accordance with the French, Belgian or the British standard as referenced above, then this may be considered acceptable but it is likely that the time for impact test could be substantially shorter than the 3 hours called for in this document. Therefore the acceptability should be considered as project specific. The performance for impact testing covering 3 hours of testing is aimed at achieving a particularly secure cable.

Should some of the cables comprising an order require to be type tested then any one of the National Test arrangements above could be used as a basis to conform with the type testing already accepted for other cables in the order. If all cables comprising the order require to be tested then the agreed test arrangement should be worked out according to this standard and the National standards above used as a guide as to the salient features of the test arrangement.

Appendix C - Data Sheets

The information detailed on the data sheets shall be provided for each cable. Where applicable, a cable data sheet may be compiled and presented to cover all of



this information over a range of cable types and sizes. It is expected that the purchaser will part complete the Data Sheets and the manufacturer will complete the entries. The emboldened item numbers represent those parts which are expected to be completed by the purchaser.



DEFINITIONS AND ABBREVIATIONS**Definitions**

Standardised definitions may be found in the BP Group RPSEs Introductory Volume.

fire resistant cable: cable constructed to allow continued normal operation for a specified time when exposed to combustion.

flame retardant cable: cable constructed of materials which will not assist the spread of flame when the cable is exposed to combustion. Fire resistant cables built to this standard will also be flame retardant.

routine test: test carried out on each full length of cable or part thereof

type test: test carried for a particular make, design or build of cable

U: for power cables, the power-frequency voltage between conductors for which the cable is designed.

U₀: for power cables, the power-frequency voltage to earth for which the cable is designed.

Abbreviations

BS	British Standard
IEC	International Electrotechnical Commission



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

BS 2782 Part 1	Methods of testing plastics
BS 5099	Specification for spark testing of electric cables
BS 5308	Instrument Cables
BS 5345	Code of practice for selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres.
BS 6346	Specification for PVC insulated cables for electricity supply
BS 6387	Performance Requirement for Cables Required to Maintain Circuit Integrity Under Fire Conditions.
BS 6724	Armoured Cables for Electricity Supply Having Thermosetting Insulation With Low Emissions of Smoke and Corrosive Gases When Affected by Fire.
BS 6746	Specification for PVC insulation and sheath of electric cables
BS 6883	Specification for elastomer insulated cables for fixed wiring in ships
BS 6899	Specification for rubber insulation and sheath of electric cables
BS 7211	Thermosetting Insulated Cables (non armoured) for Electric Power and Lighting With Low Emission of Smoke and Corrosive Gases When Affected by Fire.
IEC 79-14	Electrical Installations in Explosive Gas Atmospheres (Other than Mines)
IEC 92-3	Cables (construction, testing and installation)
IEC 92-375 Part of IEC 92-3	
IEC 227	PVC Insulated Cables of Voltages up to 450/750
IEC 228	Conductors of insulated cables
IEC 331	Fire-resisting characteristics of electric cables
IEC 332-3	Tests on electric cables under fire conditions
IEC 502	Extruded solid dielectric insulated power cables for voltages from 1 kV up to 30 kV



IEC 540	Test methods for insulations and sheaths of electric cables and cords (elastomeric and thermoplastic compounds)
IEC 754 Part 1	Test on gases evolved during combustion of electric cables
NORME FRANCAISE C32-070	Insulated Conductors of Cables and Flexible Cords for Installations, Classification Tests on Cables and Cords with Respect to their Behaviour in Fire.
NORME BELGE NBN C30-004	Fire Resistance of Electrical Cables - Classification and Test Methods.



DATA SHEETS

Data sheets for indent and purchase of cable
To be completed in block capitals by purchaser/vendor

1. **Nominal Voltage** (kV): Power 0.6/1 1.8/3 6/10 8.7/15
(kV): Instrument 0.6/1
2. **Type** DC Single Phase a.c. 3 Phase a.c.
Other
3. **Frequency (Hz)** 50 / 60 / Not Applicable
4. **Number of cores and Construction**)
)
)
5. **Nominal cross sectional area of cores**) See attached
) schedule.
)
6. **Lengths**)
7. **Conductors** Copper Other
8. **Insulation** To vendor's standard Other
9. **Bedding** To vendor's standard Other
10. **Sheath** To vendor's standard Other
11. **Armour** SWBA GSWA Other
12. **Halogen Acid Evolution** No specific requirement
Less than 15%
Less than 5%
Less than 0.5% (Zero halogen)
13. **Installation** Tray Buried Unfilled Trenches



14. Special Requirements

(e.g. Excessive sunlight; Abnormal ambient temperature; Unusual mode of installation; Resistance to chemicals)

1. Current Ratings (Vendor standard ratings for standard conditions in:-)
Air
Duct
Ground
Please supply details of standard conditions for temperatures, thermal resistivities, proximity other cables, etc.
2. Resistance (ohm/km)
Max d.c. at 20°C
Max a.c. at 20°C
3. Impedance (ohm/km at 90°C and 60Hz)
4. Inductance (milliH/km)
5. Capacitance (microF/km)

Core-Core

Core-Earth
6. Volt drop (per amp per km) for each cable type.
7. Fault current (KA) for each cable type

duration	250°C	
	conductor	armour
1.0 sec		
0.5 sec		
0.2 sec		
	160°C	
1.0 sec		
0.5 sec		
0.2 sec		

8. Diameter (mm) under armour For each cable type
over armour
overall
9. Weight (kg/km) for each cable type
10. Bending radius (mm) for each cable type



11. Oxygen index for each cable type
12. Materials Used for each cable type
 - Insulation
 - Bedding
 - Sheath
 - Armour
13. Instrument cables for each cable type:-
 - (a) Resistance (ohm/km) Max ac at 90°C
 - (b) Inductance (milliH/km) Max at up to 1 KHz
 - (c) Impedance (ohm/km) Max at 90°C
 - (d) Conductor loop resistance per km at 20°C
(2 x 1 km of core)
 - (e) Max loop self inductance per km at up to 1 KHz
2 x 1 km of core)
 - (f) Max L/R ratio
 - (g) Max mutual capacitance (microF/km)

