IEC 62067

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REDLINE VERSION

# INTERNATIONAL STANDARD

colour inside

## Power cables with extruded insulation and their accessories for rated voltages above 150 kV ($U_m$ = 170 kV) up to 500 kV ($U_m$ = 550 kV) – Test methods and requirements

## Câbles d'énergie à isolation extrudée et leurs accessoires pour des tensions assignées supérieures à 150 kV ($U_m$ = 170 kV) et jusqu'à 500 kV ($U_m$ = 550 kV) – Méthodes et exigences d'essai

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# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

## Power cables with extruded insulation and their accessories for rated voltages above 150 kV ($U_m$ = 170 kV) up to 500 kV ($U_m$ = 550 kV) – Test methods and requirements

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IEC 62067:2011

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

# POWER CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR RATED VOLTAGES ABOVE 150 kV ($U_m$ = 170 kV) UP TO 500 kV ($U_m$ = 550 kV) – TEST METHODS AND REQUIREMENTS

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International Standard IEC 62067 has been prepared by IEC technical committee 20: Electric cables.

This second edition of IEC 62067 cancels and replaces the first edition, published in 2001, and its Amendment 1 (2006), and constitutes a technical revision.

The significant technical changes with respect to the previous edition are as follows:

– addition of the extension of prequalification test, requiring significant less time to be completed compared with the full prequalification test;
– during the routine tests on the main insulation of prefabricated accessories the required sensitivity level for the partial discharge test is reduced from 10 pC to 5 pC.

NOTE For a more detailed history of events leading up to this second edition, see the Introduction.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|---|---|
| 20/1268/FDIS | 20/1278A/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

# INTRODUCTION

As a result of major developments in cable systems with extruded insulation for voltages above 150 kV, CIGRE Study Committee (SC) 21 set up Working Group (WG) 21.03 in 1990. The terms of reference of WG 21.03 were "*to prepare recommendations for electrical type tests, sample and routine tests, based on extending IEC 60840:1988 up to 400 kV and to make proposals for prequalification/development tests which, as a minimum, should be performed*".

WG 21.03 reported that the extension of IEC 60840 to voltages above 150 kV needed extra consideration because of the following factors:

– such cables form part of the backbone of the transmission system and, therefore, reliability considerations are of the highest priority;

– these cables and their accessories operate with higher electrical stresses than cables up to 150 kV and, as a result, have a smaller safety margin with respect to the intrinsic performance boundaries of the cable system;

– such cables and accessories have a thicker insulation wall than those up to 150 kV and, as a result, are subjected to greater thermomechanical effects;

– the design and coordination of the cables and accessories becomes more difficult with increasing system voltage levels.

The recommendations of the WG 21.03 were published in Electra No. 151 in December 1993 and taken into account by IEC in 1995 in the preparation of this standard for cable systems with extruded insulation for voltages above 150 kV. IEC considered that the new standard should also cover the 500 kV level. Thus, at its meeting in September 1996, CIGRE SC 21 set up task force 21.18 to study the extension of the initial recommendations to the 500 kV level. The updated recommendations were cited in Electra No. 193 in December 2000 and thus were also taken into account by IEC Technical Committee (TC) 20 in the preparation of the first edition of this standard.

On the advice of CIGRE, a long term accelerated ageing test was introduced in the first edition, in order to gain some indication of the long term reliability of a cable system. This test, known as the "prequalification test", was to be performed on the complete system comprising the cable, joints and terminations in order to demonstrate the performance of the system.

In addition, CIGRE WG 21.09, published recommendations for “tests after installation on high-voltage extruded insulation cable systems” in Electra No 173 in August 1997. These recommendations (which state, amongst other things, that d.c. tests should be avoided on the main insulation, as they are both ineffective and potentially damaging) were also taken into account in the first edition of this standard.

At its meeting in November 2004, TC 20 concluded that the next revision of IEC 62067 should include the recommendation for testing of HV and EHV extruded cables that was under preparation by the CIGRE SC B1 (previously SC 21) WG B1.06. This was made available as a CIGRE Technical Brochure 303 before the meeting of TC 20 in October 2006, which confirmed this view. Therefore Technical Brochure 303 has been considered by TC 20 and major parts implemented in this standard. This has resulted in some modifications to the prequalification test requirements, a major change being the addition of the extension of prequalification test. The latter test requires approximately one quarter of the time to complete when compared with the full prequalification test.

A list of relevant CIGRE references is given in the bibliography.

# POWER CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR RATED VOLTAGES ABOVE 150 kV ($U_m$ = 170 kV) UP TO 500 kV ($U_m$ = 550 kV) – TEST METHODS AND REQUIREMENTS

## 1 Scope

This International Standard specifies test methods and requirements for power cable systems, cables with extruded insulation and their accessories for fixed installations, for rated voltages above 150 kV ($U_m$ = 170 kV) up to and including 500 kV ($U_m$ = 550 kV).

The requirements apply to single-core cables and to their accessories for usual conditions of installation and operation, but not to special cables and their accessories, such as submarine cables, for which modifications to the standard tests may be necessary or special test conditions may need to be devised.

This standard does not cover transition joints between cables with extruded insulation and paper insulated cables.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE The IEC 60811 series is currently undergoing a revision, which will lead to a restructuring of its parts. A description of this, as well as a cross-reference table between the current and planned parts will be given in IEC 60811-100.

IEC 60060-1 *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60183, *Guide to the selection of high-voltage cables*

IEC 60228, *Conductors of insulated cables*

IEC 60229:2007, *Electric cables – Tests on extruded oversheaths with a special protective function*

IEC 60230, *Impulse tests on cables and their accessories*

IEC 60287-1-1:2006, *Electric cables – Calculation of the current rating – Part 1-1: Current rating equations (100 % load factor) and calculation of losses – General*

IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

IEC 60811-1-1:1993, *Common test methods for insulating and sheathing materials of electric cables and optical cables – Section 1-1: Methods for general application – Measurement of thickness and overall dimensions – Tests for determining the mechanical properties*
Amendment 1 (2001)

IEC 60811-1-2:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Two: Thermal ageing methods*
Amendment 1 (1989)
Amendment 2 (2000)

IEC 60811-1-3:1993, *Common test methods for insulating and sheathing materials of electric cables – Part 1-3: General application – Methods for determining the density – Water absorption tests – Shrinkage test*
Amendment 1 (2001)

IEC 60811-1-4:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Four: Tests at low temperature*
Amendment 1 (1993)
Amendment 2 (2001)

IEC 60811-2-1:1998, *Common test methods for insulating and sheathing materials of electric and optical cables – Part 2-1: Methods specific to elastomeric compounds – Ozone resistance, hot set and mineral oil immersion tests*
Amendment 1 (2001)

IEC 60811-3-1:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 3: Methods specific to PVC compounds – Section 1: Pressure test at high temperature – Tests for resistance to cracking*
Amendment 1 (1994)
Amendment 2 (2001)

IEC 60811-3-2:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 3: Methods specific to PVC compounds – Section two: Loss of mass test – Thermal stability test*
Amendment 1 (1993)
Amendment 2 (2003)

IEC 60811-4-1:2004, *Insulating and sheathing materials of electric and optical cables – Common test methods – Part 4-1: Methods specific to polyethylene and polypropylene compounds – Resistance to environmental stress cracking –Measurement of the melt flow index – Carbon black and/or mineral filler content measurement in polyethylene by direct combustion – Measurement of carbon black content by thermogravimetric analysis (TGA) – Assessment of carbon black dispersion in polyethylene using a microscope*

IEC 60885-3, *Electrical test methods for electric cables – Part 3: Test methods for partial discharge measurements on lengths of extruded power cables*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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# CÂBLES D'ÉNERGIE À ISOLATION EXTRUDÉE ET LEURS ACCESSOIRES POUR DES TENSIONS ASSIGNÉES SUPÉRIEURES À 150 kV ($U_m$ = 170 kV) ET JUSQU'À 500 kV ($U_m$ = 550 kV) – MÉTHODES ET EXIGENCES D'ESSAI

## AVANT-PROPOS

1) La Commission Electrotechnique Internationale (CEI) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de la CEI). La CEI a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. A cet effet, la CEI – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de la CEI"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec la CEI, participent également aux travaux. La CEI collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
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3) Les Publications de la CEI se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de la CEI. Tous les efforts raisonnables sont entrepris afin que la CEI s'assure de l'exactitude du contenu technique de ses publications; la CEI ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
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La Norme internationale CEI 62067 a été établie par le Comité d'études 20 de la CEI: Câbles électriques.

Cette seconde édition de la CEI 62067 annule et remplace la première édition, parue en 2001, et son Amendement 1 (2006), et constitue une révision technique.

Les modifications principales par rapport à l'édition précédente sont les suivantes:

– ajout d'une extension d'essai de préqualification, exige significativement moins de temps pour être achevé comparé à l'essai de prequalification complet;
– lors des essais courant concernant l'isolation principale des accessoires préfabriqués, le niveau de sensibilité exigé pour l'essai de décharge partiel est réduit de 10 pC à 5 pC.

NOTE Voir l'Introduction pour un historique plus complet sur les evenements qui conduissaient à la publication de cette deuxième édition.

Le texte de cette norme est issu des documents suivants:

| FDIS | Rapport de vote |
|---|---|
| 20/1268/FDIS | 20/1278A/RVD |

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/CEI, Partie 2.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de la CEI sous "http://webstore.iec.ch" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

# INTRODUCTION

En raison des développements importants des réseaux de câbles à isolation extrudée pour les tensions supérieures à 150 kV, le Comité d'études (CE) 21 de la CIGRE a constitué un Groupe de Travail (GT) 21.03 en 1990, dont les termes de référence étaient « *de préparer des recommandations pour les essais de type électriques, les essais sur prélèvements et les essais individuels, en étendant la norme CEI 60840:1988 jusqu'à 400 kV, et de faire des propositions pour les essais de préqualification/développement qui doivent être effectués a minima* ».

Le GT 21.03 a indiqué que l'extension de la CEI 60840 aux tensions supérieures à 150 kV méritait une considération particulière en raison des facteurs suivants:

– ces câbles constituent l'un des éléments essentiels des réseaux de transport et, par conséquent, les considérations de fiabilité sont de la plus haute importance;
– ces câbles et leurs accessoires fonctionnent sous des contraintes électriques supérieures à celles des câbles de tensions jusqu'à 150 kV et, de ce fait, ont une marge de sécurité plus restreinte par rapport à la performance intrinsèque des liaisons par câbles;
– ces câbles et leurs accessoires ont une épaisseur d'isolation plus forte que celle des matériels jusqu'à 150 kV et sont donc soumis à des contraintes thermomécaniques plus fortes;
– la conception et la compatibilité des câbles et de leurs accessoires deviennent plus difficiles avec l'accroissement des niveaux de tension des réseaux.

Les recommandations du GT 21.03 ont été publiées dans Electra n°151 en décembre 1993 et prises en compte par la CEI en 1995 dans la préparation de la présente norme pour les réseaux de câbles à isolation extrudée de tensions supérieures à 150 kV. La CEI a cependant considéré que cette norme devrait aussi couvrir le niveau 500 kV. Ainsi, lors de sa réunion de septembre 1996, le SC 21 de la CIGRE a créé un groupe ad hoc 21.18 pour étudier l'extension des recommandations initiales au niveau 500 kV. Les recommandations mises à jour ont été exposées dans Electra n° 193 en décembre 2000 et ont alors, été également prises en compte par le Comité d'études de la CEI 20 dans la préparation de la première édition de cette norme.

Sur avis de CIGRE, un essai de vieillissement accéléré de longue durée avait été introduit dans la première édition, afin d'obtenir des indications sur la fiabilité à long terme d'un réseau de câbles. Cet essai dénommé «essai de préqualification», devait être effectué sur le système complet comprenant câble, jonctions et extrémités afin de démontrer la performance du système.

En outre, le GT 21.09 de la CIGRE, dont la tâche était d'étudier les essais après la pose des réseaux de câbles haute tension à isolation extrudée, a publié ses recommandations dans Electra n° 173 en août 1997. Celles-ci avaient également été prises en compte dans la première édition de la présente norme. Ces recommandations indiquent, entre autres, qu'il convient que les essais sous tension continue soient évités sur l'isolation principale car ils sont à la fois inefficaces et dangereux.

Lors de sa réunion de novembre 2004, le TC 20 a décidé que la prochaine révision de la CEI 62067 devrait incorporer les recommandations d'essais des câbles extrudés HT et THT que préparait le GT B1.06 du Comité Technique B1 (antérieurement appelé SC 21). Ces recommandations parurent sous forme d'une Brochure Thématique 303 avant la réunion d'octobre 2006 du TC 20 qui confirma cette position. Pour cette raison, la Brochure Thématique 303 a été prise en compte par le TC 20 qui en a introduit d 'importantes parties dans cette norme. Il en a résulté quelques modifications aux exigences d'essai de préqualification. Un changement majeur a été l'ajout de l'essai d'extension de préqualification. Pour être réalisé complètement cet essai requiert approximativement le quart du temps de l'essai de préqualification dans son entièreté.

Une liste des références CIGRE appropriées est donnée dans la bibliographie.

# CÂBLES D'ÉNERGIE À ISOLATION EXTRUDÉE ET LEURS ACCESSOIRES POUR DES TENSIONS ASSIGNÉES SUPÉRIEURES À 150 kV ($U_m$ = 170 kV) ET JUSQU'À 500 kV ($U_m$ = 550 kV) – MÉTHODES ET EXIGENCES D'ESSAI

## 1 Domaine d'application

La présente Norme internationale spécifie les méthodes et les exigences d'essai applicables aux systèmes de câbles d'énergie, comprenant les câbles à isolation extrudée et leurs accessoires pour installations fixes, pour des tensions assignées supérieures à 150 kV ($U_m$ = 170 kV) et jusqu'à 500 kV ($U_m$ = 550 kV) compris.

Les exigences sont applicables aux câbles unipolaires et à leurs accessoires, pour des conditions habituelles d'installation et de fonctionnement, mais ne le sont pas à des câbles spéciaux et à leurs accessoires comme les câbles sous-marins, pour lesquels il peut être nécessaire d'apporter des modifications aux essais normaux ou d'élaborer des conditions d'essai particulières.

Cette norme ne concerne pas les jonctions de transition entre câbles à isolation extrudée et câbles isolés au papier.

## 2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le présent document et sont indispensables pour son application. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

NOTE La série CEI 60811 subit actuellement une révision, qui mènera à une restructuration de ses parties. On en donnera une description, aussi bien qu'une table de correspondance entre les parties actuelles et planifiées dans IEC 60811-100.

CEI 60060-1, *Techniques des essais à haute tension – Première partie: Définitions et exigences générales relatives aux essais*

CEI 60183, *Guide pour le choix des câbles à haute tension*

CEI 60228, *Ames des câbles isolés*

CEI 60229:2007, *Câbles électriques – Essais sur les gaines extérieures extrudée avec fonction spéciale de protection*

CEI 60230, *Essais de choc des câbles et de leurs accessoires*

CEI 60287-1-1:2006, *Câbles électriques – Calcul du courant admissible – Partie 1-1: Equations de l'intensité du courant admissible (facteur de charge 100 %) et calcul des pertes – Généralités*

CEI 60332-1-2, *Essais des câbles électriques et à fibres optiques soumis au feu – Partie 1-2: Essai de propagation verticale de la flamme sur conducteur ou câble isolé – Procédure pour flamme à prémélange de 1 kW*

CEI 60811-1-1:1993, *Méthodes d'essais communes pour les matériaux d'isolation et de gainage des câbles électriques et des câbles optiques – Section 1-1: Méthodes d'application générale – Mesure des épaisseurs et des dimensions extérieures – Détermination des propriétés mécaniques*
Amendement1 ( 2001)

CEI 60811-1-2, *Méthodes d'essais communes pour les matériaux d'isolation et de gainage des câbles électriques – Première partie: Méthodes d'application générale – Section Deux: Méthodes de vieillissement thermique*
Amendement 1 (1989)
Amendement 2 (2000)

CEI 60811-1-3:1993, *Méthodes d'essais communes pour matériaux d'isolation et de gainage des câbles électriques et optiques – Partie 1-3: Application générale – Méthodes de détermination de la masse volumique – Essais d'absorption d'eau – Essai de rétraction*
Amendement 1 (2001)

CEI 60811-1-4:1985, *Méthodes d'essais communes pour les matériaux d'isolation et de gainage des câbles électriques – Première partie: Méthodes d'application générale – Section quatre: Essais à basse température*
Amendement 1 (1993)
Amendement 2 (2001)

CEI 60811-2-1:1998, *Méthodes d'essais communes pour matériaux d'isolation et de gainage des câbles électriques et optiques – Partie 2-1: Méthodes spécifiques pour les mélanges élastomères – Essais relatifs à la résistance à l'ozone, à l'allongement à chaud et à la résistance à l'huile*
Amendement 1 (2001)

CEI 60811-3-1:1985, *Méthodes d'essais communes pour les matériaux d'isolation et de gainage des câbles électriques – Troisième partie: Méthodes spécifiques pour les mélanges PVC – Section une: Essai de pression à température élevée – Essais de résistance à la fissuration*
Amendement 1 (1994)
Amendement 2 (2001)

CEI 60811-3-2:1985, *Méthodes d'essais communes pour les matériaux d'isolation et de gainage des câbles électriques – Troisième 3: Méthodes spécifiques pour les mélanges PVC – Section deux: Essai de perte de masse – Essai de stabilité thermique*
Amendement 1 (1993)
Amendement 2 (2003)

CEI 60811-4-1, *Matériaux d'isolation et de gainage des câbles électriques et optiques – Méthodes d'essais communes – Partie 4-1: Méthodes spécifiques pour les mélanges polyéthylène et polypropylène – Résistance aux craquelures sous contraintes dues à l'environnement – Mesure de l'indice de fluidité à chaud – Mesure dans le polyéthylène du taux de noir de carbone et/ou des charges minérales par méthode de combustion directe – Mesure du taux de noir de carbone par analyse thermogravimétrique – Evaluation de la dispersion du noir de carbone dans le polyéthylène au moyen d'un microscope*

CEI 60885-3, *Méthodes d'essais électriques pour les câbles électriques – Troisième partie: Méthodes d'essais pour mesures de décharges partielles sur longueurs de câbles de puissance extrudés*

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**Power cables with extruded insulation and their accessories for rated voltages above 150 kV ($U_m$ = 170 kV) up to 500 kV ($U_m$ = 550 kV) – Test methods and requirements**

**Câbles d'énergie à isolation extrudée et leurs accessoires pour des tensions assignées supérieures à 150 kV ($U_m$ = 170 kV) et jusqu'à 500 kV ($U_m$ = 550 kV) – Méthodes et exigences d'essai**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

# POWER CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR RATED VOLTAGES ABOVE 150 kV ($U_m$ = 170 kV) UP TO 500 kV ($U_m$ = 550 kV) – TEST METHODS AND REQUIREMENTS

## FOREWORD

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International Standard IEC 62067 has been prepared by IEC technical committee 20: Electric cables.

This second edition of IEC 62067 cancels and replaces the first edition, published in 2001, and its Amendment 1 (2006), and constitutes a technical revision.

The significant technical changes with respect to the previous edition are as follows:

– addition of the extension of prequalification test, requiring significant less time to be completed compared with the full prequalification test;
– during the routine tests on the main insulation of prefabricated accessories the required sensitivity level for the partial discharge test is reduced from 10 pC to 5 pC.

NOTE For a more detailed history of events leading up to this second edition, see the Introduction.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|---|---|
| 20/1268/FDIS | 20/1278A/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

# INTRODUCTION

As a result of major developments in cable systems with extruded insulation for voltages above 150 kV, CIGRE Study Committee (SC) 21 set up Working Group (WG) 21.03 in 1990. The terms of reference of WG 21.03 were "*to prepare recommendations for electrical type tests, sample and routine tests, based on extending IEC 60840:1988 up to 400 kV and to make proposals for prequalification/development tests which, as a minimum, should be performed*".

WG 21.03 reported that the extension of IEC 60840 to voltages above 150 kV needed extra consideration because of the following factors:

– such cables form part of the backbone of the transmission system and, therefore, reliability considerations are of the highest priority;

– these cables and their accessories operate with higher electrical stresses than cables up to 150 kV and, as a result, have a smaller safety margin with respect to the intrinsic performance boundaries of the cable system;

– such cables and accessories have a thicker insulation wall than those up to 150 kV and, as a result, are subjected to greater thermomechanical effects;

– the design and coordination of the cables and accessories becomes more difficult with increasing system voltage levels.

The recommendations of the WG 21.03 were published in Electra No. 151 in December 1993 and taken into account by IEC in 1995 in the preparation of this standard for cable systems with extruded insulation for voltages above 150 kV. IEC considered that the new standard should also cover the 500 kV level. Thus, at its meeting in September 1996, CIGRE SC 21 set up task force 21.18 to study the extension of the initial recommendations to the 500 kV level. The updated recommendations were cited in Electra No. 193 in December 2000 and ~~again~~ thus were also taken into account by IEC Technical Committee (TC) 20 in the preparation of the first edition of this standard.

~~Compared with IEC 60840 (1988), revised and published in 1999 as IEC 60840 edition 2, there is a major difference~~ On the advice of CIGRE, a long term accelerated ageing test was introduced in the first edition, in order to gain some indication of the long term reliability of a cable system. This test, known as the "prequalification test", was to be performed on the complete system comprising the cable, joints and terminations in order to demonstrate the performance of the system.

In addition, CIGRE WG 21.09, published recommendations for “tests after installation on high-voltage extruded insulation cable systems” in Electra No 173 in August 1997. These recommendations (which state, amongst other things, that d.c. tests should be avoided on the main insulation, as they are both ineffective and ~~dangerous~~ potentially damaging) were also taken into account in the first edition of this standard. ~~On the other hand, d.c. tests are recommended on the oversheath.~~

At its meeting in November 2004, TC 20 concluded that the next revision of IEC 62067 should include the recommendation for testing of HV and EHV extruded cables that was under preparation by the CIGRE SC B1 (previously SC 21) WG B1.06. This was made available as a CIGRE Technical Brochure 303 before the meeting of TC 20 in October 2006, which confirmed this view. Therefore Technical Brochure 303 has been considered by TC 20 and major parts implemented in this standard. This has resulted in some modifications to the prequalification test requirements, a major change being the addition of the extension of prequalification test. The latter test requires approximately one quarter of the time to complete when compared with the full prequalification test.

A list of relevant CIGRE references is given in the bibliography.

# POWER CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR RATED VOLTAGES ABOVE 150 kV ($U_m$ = 170 kV) UP TO 500 kV ($U_m$ = 550 kV) – TEST METHODS AND REQUIREMENTS

## 1 Scope

This International Standard specifies test methods and requirements for power cable systems, cables with extruded insulation and their accessories for fixed installations, for rated voltages above 150 kV ($U_m$ = 170 kV) up to and including 500 kV ($U_m$ = 550 kV).

The requirements apply to single-core cables and to their accessories for usual conditions of installation and operation, but not to special cables and their accessories, such as submarine cables, for which modifications to the standard tests may be necessary or special test conditions may need to be devised.

This standard does not cover transition joints between cables with extruded insulation and paper insulated cables.

## 2 Normative references

~~The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revision of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.~~

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE The IEC 60811 series is currently undergoing a revision, which will lead to a restructuring of its parts. A description of this, as well as a cross-reference table between the current and planned parts will be given in IEC 60811-100.

IEC 60060-1~~:1989~~, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60183~~:1984~~, *Guide to the selection of high-voltage cables*

IEC 60228~~:1978~~, *Conductors of insulated cables*

IEC 60229:~~1982~~ 2007, *Electric cables – Tests on ~~cable~~ extruded oversheaths ~~which have~~ with a special protective function ~~and are applied by extrusion~~*

IEC 60230~~:1966~~, *Impulse tests on cables and their accessories*

IEC 60287-1-1:2006, *Electric cables – Calculation of the current rating – Part 1-1: Current rating equations (100 % load factor) and calculation of losses – General*

~~IEC 60332-1:1993, *Tests on electric cables under fire conditions – Part 1: Test on a single vertical insulated wire or cable*~~

IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

IEC 60811-1-1:1993, *Common test methods for insulating and sheathing materials of electric cables and optical cables – Part 1-1: Methods for general application – Measurement of thickness and overall dimensions – Tests for determining the mechanical properties*
Amendment 1 (2001)

IEC 60811-1-2:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Two: Thermal ageing methods*
Amendment 1 (1989)
Amendment 2 (2000)

IEC 60811-1-3:1993, *Common test methods for insulating and sheathing materials of electric cables – Part 1-3: General application – Methods for determining the density – Water absorption tests – Shrinkage test*
Amendment 1 (2001)

IEC 60811-1-4:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Four: Tests at low temperature*
Amendment 1 (1993)
Amendment 2 (2001)

IEC 60811-2-1:1998, *Common test methods for insulating and sheathing materials of electric and optical cables – Part 2-1: Methods specific to elastomeric compounds – Ozone resistance, hot set and mineral oil immersion tests*
Amendment 1 (2001)

IEC 60811-3-1:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 3: Methods specific to PVC compounds – Section 1: Pressure test at high temperature – Tests for resistance to cracking*
Amendment 1 (1994)
Amendment 2 (2001)

IEC 60811-3-2:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 3: Methods specific to PVC compounds – Section two: Loss of mass test – Thermal stability test*
Amendment 1 (1993)
Amendment 2 (2003)

IEC 60811-4-1:~~1985~~ 2004, *Insulating and sheathing materials of electric and optical cables – Common test methods – Part 4-1: Methods specific to polyethylene and polypropylene compounds – Resistance to environmental stress cracking – ~~Wrapping test after thermal ageing in air –~~ Measurement of the melt flow index – Carbon black and/or mineral filler content measurement in ~~PE~~ polyethylene by direct combustion – Measurement of carbon black content by thermogravimetric analysis (TGA) – Assessment of carbon black dispersion in polyethylene using a microscope*

IEC 60885-3~~:1988~~, *Electrical test methods for electric cables – Part 3: Test methods for partial discharge measurements on lengths of extruded power cables*