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## 1 OBJECTIVE

To establish the complementary requirements of the "Rule of Certification of Product" – 700-RC-1-E - for electrical wires, cables and flexible cords, focusing safety, through the mechanism of certification, in compliance with the Technical Rule of Quality (TRQ) for electrical wires, cables and flexible cords, focusing the purpose of reducing the risk of the use of the product. The requirements for every type of electrical wire, cable and flexible cords are established in the Specific Annexes of this document.
For the simplification the electrical wires, cables, conductors and flexible cords are called in this document as "cables".

### 1.1 Scope of Application

The scope of this complement is limited by the Specific Annexes, as to the following table.

| SPECIFIC ANNEX | SCOPE |
|---|---|
| **I** | Extruded polyvinyl chloride (PVC) or polyethylene (PE) insulated power cables for rated voltages of 1 kV, including, covered by ABNT NBR 7288 |
| **II** | Flexible cord with extruded chlorossulfonated polyethylene (CSP) insulation for rated voltages up to and including 300 V - covered by ABNT NBR 14633 |
| **III** | PVC insulated flexible cables (cords) for special applications in connector cords for household appliances, for rated voltages up to and including 500 V, including, covered by ABNT NBR 14897 |
| **IV** | Ethylene-propylene rubber (EPR) insulated flexible cables for special applications in connector cords for household appliances, for rated voltages up to and including 500 V, including, covered by ABNT NBR 14898 |
| **V** | Power and control cables and insulated wires with low smoke emission extruded insulation for rated voltages up to 1 kV, including, covered by ABNT NBR 13248 |
| **VI** | Assembled flexible cords for rated voltages up to and including 300 V, including, covered by ABNT NBR 15717 |
| **VII** | Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V, including, covered by ABNT NBR NM 247-3 (insulated conductors - without sheath - for fixed installations) |
| **VIII** | Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V, including, covered by ABNT NBR NM 247-5 (flexible cables) |
| **IX** | Non-sheathed single-core and sheathed multicore flexible cables insulated with heat resistant silicone of rated voltages up to and including 450/750 V, including, covered by ABNT NBR NM 274 |
| **X** | Rubber insulated cables of rated voltages up to and including 450/750 V, including, covered by ABNT NBR NM 287-3 (insulated cables in silicone rubber resistant to the heat) |
| **XI** | Rubber insulated cables of rated voltages up to and including 450/750 V, including, covered by ABNT NBR NM 287-4 (flexible cables and cords) |

### 1.2 Grouping for the certification purpose and Register of Object

**1.2.1** For the certification and Register of Object of this 702-CRC-4-E, applies the concept of family.

**1.2.2** The certification and Register of electrical wires, cables and flexible cords must be carried out for each family according to the specified by each Specific Annex of this 702-CRC-4-E.

## 2 ACRONYMS

For this 702-CRC-4-E are valid the acronym established in the 700-RC-1-E, complemented as follow:

NM - "Norma Mercosul" which in English means Mercosul Standard
RC - "Regra de Certificação" which in English means Rule of Certification
RAC - "Regulamento de Avaliação da Conformidade" which in English means Rule of Conformity Evaluation
PAC - "Programa de Avaliação da Conformidade" which in English means Program of Conformity Evaluation
CRC - "Complemento da Regra de Certificação" which in English means Complement of the Rule of Certification
RTQ - "Regulamento Técnico da Qualidade" which in English means Technical Rule of Quality (TRQ)
RGCP - "Requisitos Gerais de Certificação de Produtos" which in English means General Requirements of Certification of Products (GRCP)

## 3 COMPLEMENTARY DOCUMENTS

For the purposes of this 702-CRC-4-E, the complementary documents are adopted as mentioned below and the others cited in the Specific Annex of each type of cable.

| | |
|---|---|
| Inmetro rule nº 640/2012 | General Requirements of Certification of Products (GRCP) |
| Inmetro rule nº 589/2012 | Technical Rule of Quality (TRQ) for electrical wires, flexible cables and cords |
| Inmetro Rule nº 335/2011 | It makes available the obligatory information for the electrical devices of low voltage |
| Standard ABNT NBR 5426 | Sampling Plan and procedures on an inspection by attributes |

## 4 DEFINITIONS

The definitions of item 4 of the 700-RC-1-E are applicable to this 702-CRC-4-E, complemented by those below and by those cited in the Specific Annexes for each type of cable.

### 4.1 Critical components

Are those whose characteristics impact directly on the safety and the performance of the final product. For this 702-CRC-4-E are considered critical all the raw materials used for the manufacturing of electrical wires, cables and cords up to 1 kV.

## 5 MECHANISM OF CONFORMITY EVALUATION

The mechanism of Conformity Evaluation for electrical wires, cables and flexible cords is the certification.

## 6 STEPS OF CONFORMITY EVALUATION

### 6.1 Definition of the Model of Certification used

This 702-CRC-4-E establishes the adoption of the ISO CASCO Model 5 of certification that is consisted of type test, evaluation and approval of the Quality Management System of the manufacturer, monitoring through audits in the manufacturer and test on the samples taken in the commerce, according to the defined in the current 700-RC-1-E.

## 6.2 Initial Evaluation

### 6.2.1 Application of Certification

The applicant must send one formal application to TÜV Rheinland do Brasil Ltda., together with the following documents:

a) Identification of the families to be certified and their respective products, according to the Specific Annexes of this 702-CRC-4-E;

b) List of raw materials and the respective suppliers;

c) Product technical specification;

d) Documentation of the Quality Management System made in compliance with the established in the 700-RC-1-E related to the items of verification of the standard ABNT NBR ISO 9001.

### 6.2.2 Analysis of the Application and of the Documentation Conformity

The criteria of the analysis of the application and the conformity of the documentation must follow the requirements established in the 700-RC-1-E.

### 6.2.3 Initial audit of the Management System(s)

The criteria for the initial audit of the Quality Management System must follow the requirements established in the 700-RC-1-E, beyond those described in the following items.

6.2.3.1 The minimum requirements of verification of the QMS for the manufacturers with valid certification for the Standard ISO 9001 or Standard ABNT NBR ISO 9001 during the initial audit

| Requirements of QMS | ABNT NBR ISO 9001 |
|---|---|
| Control of records | 4.2.4 |
| Planning of product realization | 7.1 |
| Customer Communication | 7.2.3 |
| Purchasing process | 7.4.1 |
| Verification of purchased product | 7.4.3 |
| Control of production and service provision | 7.5.1 |
| Identification and traceability | 7.5.3 |
| Customer property | 7.5.4 |
| Preservation of product | 7.5.5 |
| Control of monitoring and measuring equipment | 7.6 |
| Monitoring and measurement of processes | 8.2.3 |
| Monitoring and measurement of product | 8.2.4 |
| Control of nonconforming product | 8.3 |
| Corrective action | 8.5.2 |

6.2.3.2 Minimum requirements of verification of the QMS for manufacturers without certification for the Standard ISO 9001 or Standard ABNT NBR ISO 9001 during the initial audit

| Requirements of QMS | ABNT NBR ISO 9001 |
|---|---|
| Control of documents | 4.2.3 |
| Control of records | 4.2.4 |
| Top management review | 5.6.1 / 5.6.2 / 5.6.3 |
| Competence, training and awareness | 6.2.2 |
| Infrastructure | 6.3 |
| Planning of product realization | 7.1 |
| Customer Communication | 7.2.3 |
| Purchasing process | 7.4.1 |
| Verification of purchased product | 7.4.3 |
| Control of production and service provision | 7.5.1 |
| Validation of processes for production and service provision | 7.5.2 |
| Identification and traceability | 7.5.3 |
| Customer property | 7.5.4 |

| | |
|---|---|
| Preservation of product | 7.5.5 |
| Control of monitoring and measuring equipment | 7.6 |
| Customer satisfaction | 8.2.1 |
| Internal audit | 8.2.2 |
| Monitoring and measurement of processes | 8.2.3 |
| Monitoring and measurement of product | 8.2.4 |
| Control of nonconforming product | 8.3 |
| Analysis of data | 8.4 (b), (c), (d) |
| Corrective action | 8.5.2 |

6.2.3.3 Even with a presentation of a valid certificate, according to the current edition of Standard ISO 9001 or ISO 9001 standard issued by an OCS accredited by INMETRO or IAF MLA member, for the scope of its accreditation, TÜV Rheinland do Brasil Ltda must conduct the initial audit of the QMS on the factory during the initial evaluation stage, in accordance with the paragraph 6.2.3.1 or 6.2.3.2 of this document, in order to check the conformity of the production process.

Certificates issued by a foreign OCS must be accompanied by a sworn translation in Portuguese, when they are issued in language other than English or Spanish. The other documents related to the Management System, which are in a different language other than English or Spanish, must be translated into Portuguese.

During the audit, the Supplier as applicant of the certification must make available to TÜV Rheinland do Brasil Ltda, all documents related to the Quality Management System certification based on current edition of the Standard ISO 9001 or Standard ABNT NBR ISO 9001 and to present the records the production process where there is clearly the identification of the object of certification. TÜV Rheinland do Brasil Ltda must analyze the relevant documentation to be sure that the requirements described in the item 6.2.3.1 or 6.3.2.2 are met.

- The tests of quality control of the production established in each Specific Annex of the TRQ of this object;
- The equipments of measurement for the tests of quality control of the production that must have specifications compatible with the normative requirements and must be duly calibrated;
- The existing of procedure for the treatment of the non-conform products identified in production;
- The traceability of the process of manufacturing, that must be able to identify the lots of all raw materials used and tests carried out, from the finished product on.

**6.2.3.2** In the audit of the quality management system, must be checked the correct functioning of the spark tester, considering the method established by ABNT NBR NM 244. The spark tester must be evaluated as to its effectiveness and its calibration in the electrical voltage range applied by the supplier, in the conditions specified by the standards, listed in the Specific Annexes of this 702-CRC-4-E.

### 6.2.4 Plan of Initial Tests

The criteria for the plan of initial tests must follow the requirements established in the 700-RC-1-E, complemented by the Specific Annexes of each type of cable.
The test reports sent by the laboratories must include the uncertainties of practiced measurements.
Test reports issued before the beginning of the process of certification will not be accepted.

**6.2.4.1 Definition of the tests to be carried out**
The criteria for the definition of the tests to be carried out must follow the requirements established in the 700-RC-1-E, complemented by the Specific Annexes of each type of cable.

**6.2.4.2 Definition of Sampling**
The criteria for the definition of the sampling must follow the requirements established in the 700-RC-1-E, complemented by the Specific Annexes of each type of cable.

**6.2.4.2.1** If the sample of proof of the cable has been considered conform to all the tests established in its Specific Annex, it is not necessary to test and inspect the samples of counterproof and witness.

**6.2.4.2.2** If the sample of proof has been failed in one of the tests, all the tests must be repeated on the samples of counterproof and witness, must both fulfill the requirements established in the Specific Annex.

**6.2.4.2.3** If it occurs disapproval on the sample of counterproof or witness, the sample must be considered non-conform and the family of the cable must have its process of certification cancelled.

**6.2.4.3 Definition of the Laboratory**
TÜV Rheinland do Brasil Ltda adopts accredited laboratories by Cgcre in the scope of the specified tests in the RAC.
In case of non-accredited laboratories, TÜV Rheinland do Brasil Ltda must register, through evidences, the reasons that made them to choose the laboratory, registering still the results of the made evaluations in order to take it to its qualification.

For the definition of the laboratories must consider the following items:
a) the chosen laboratories must be of 3rd party accredited by Cgcre;
b) exceptionally and precariously, since under condition of an evaluation and approved by TÜV Rheinland do Brasil Ltda, it can be used non-accredited laboratory for the specified scope, when configured one of the hypothesis below described:
I – when there is no accredited laboratory for the specific scope related to PAC;
II – when there is only one laboratory accredited and TÜV Rheinland do Brasil Ltda evidences that the price of the analysis of the non-accredited laboratory, increased the costs resulted of the evaluation by TÜV Rheinland do Brasil Ltda, in comparative with the other accredited, is at minimum, under 50%;
III – when the accredited laboratory cannot fulfil in, at maximum, two months to the initial term for the beginning of the analysis or of the established tests in the Requirements of Evaluation of the Conformity – RAC;
c) when there are no laboratories of 3rd party accredited in the due scope, TÜV Rheinland do Brasil Ltda must take the following order of priority in the selection of the laboratory:

- laboratory de 1st party accredited;
- laboratory de 3rd party accredited for other(s) scope(s) of test (s);
- laboratory de 1st party accredited for other(s) scope(s) of test(s);
- laboratory de 3 rd party non-accredited;
- laboratory de 1 st party non-accredited;

d) when the designation by Inmetro of non-accredited laboratory, that has the term of 18 months to obtain its accreditation, without, it will not participate more of the program of evaluation of the conformity as mentioned;
e) the evauation made by TÜV Rheinland do Brasil Ltda in the non-accredited laboratory must be done by professional of TÜV Rheinland do Brasil Ltda who has record of training of at least 16 hours/class, in the current Standard ABNT NBR ISO IEC 17025, beyond the formal evidence of experience and technical knowledge specific to the tests to be evaluated;
f) in the case of hiring of laboratory of 1st party, TÜV Rheinland do Brasil Ltda must follow the execution of all the tests, every time that the laboratory execute such service;
g) in the case of hiring of non-accredited laboratory or of 1st or 3rd party accredited by other(s) scope(s) of test(s), TÜV Rheinland do Brasil Ltda must evaluate the requirements listed in the Annex A of this document;

h) in the tests carried out by foreign laboratories, since agreed by the ruler, must be observed and documented, the equivalence of the method of test and the methodology of established sampling. Beyond that, those laboratories must be accredited by Inmetro or by TÜV Rheinland do Brasil Ltda that is signatory of one agreement of multilateral recognition of where Inmetro also is part of. They are:
- Interamerican Accreditation Cooperation – IAAC;
- International Laboratory Accreditation Cooperation – ILAC.

**6.2.5 Treatment of non-conformities in the stage of Initial Audit**
The criteria for the treatment of non-conformities in the stage of initial audit must follow the requirements established in the 700-RC-1-E.

**6.2.6 Issue of the Certificate of Conformity**
The criteria for the issue of the Certificate of Conformity must follow the requirements established in the 700-RC-1-E.

**6.2.6.1 Commission of Certification**
TÜV Rheinland do Brasil Ltda constitute and keep working a Commission of Certification ***according to the procedure 700-PI-002***, under consulting character, that must meet themselves, at least every three months, in order to analyses critically the issued certificates, renewed, suspended, cancelled or cancelled in this period.
The Commission of Certification has the character permanent and consulting. Their function is to analyse the processes of certification.
Their composition includes people representant of classes, consumers and of neutral organizations, among others, recognized by their representativity and/or capacity in their area of actuation.
The opinion of the Commission of Certification has consulting character and, in anyway, exempt TÜV Rheinland do Brasil Ltda of the responsibility of the issued certificates, kept or renewed.

**6.2.6.2 Certificate of Conformity**
The Certificate of Conformity must have validity of 2 (two) years. Beyond those established in the 700-RC-1-E, the Certificate of Conformity must contain, at minimum, the following information:
a) Identification of the standard(s) of the product(s) with its/their respective publishing year(s) and the reference to the Inmetro Rule nº 640/2012;
b) Corporate's name, CNPJ (Corporate's ID Card Number), complete address and trade name of the supplier, when applicable;
c) Description of the critical components;
d) Number and date of the test reports.

**6.3 Maintenance Audit**
The maintenance audit process occurs among the initial certification of the object and the renewal of it. The frequency of these audits is of half-year.

**6.3.1 Maintenance Audit**
The criteria for the maintenance audit must follow the requirements established in the 700-RC-1-E, complemented by the following requirements and by those contained in the Specific Annexes of type of product.

**6.3.1.1** During the audit must be checked the following requirements:
- The tests of quality control of the production that are being carried out on the production line of the certified product;
- The equipments of measurement for the tests of quality control of the production, that must have specifications compatible with the normative requirements and must be duly calibrated;
- The existence of procedure for the treatment of non-conform products identified in production;
- The traceability of the process of manufacturing, that must be able to identify the lots of all raw materials used and tests carried out, from the finished product on.

**6.3.1.2** During the periodic audit of the quality management system of the manufacturing must be checked the correct functioning of the spark tester, in relation to the method established by ABNT NBR NM 244. The

spark tester must be evaluated as to its effectiveness and its calibration in the electrical voltage range applied by the supplier, within the conditions specified by the standards of the products, listed in the Specific Annexes of this 702-CRC-4-E.

**6.3.2 Plan of Maintenance Tests**
The criteria for the plan of maintenance tests must follow the requirements established in the 700-RC-1-E, complemented by the Specific Annexes of each type of cable.

**6.3.2.1 Definition of the tests to be carried out**

**6.3.2.1.1** The criteria for the definition of tests to be carried out must follow the conditions described in the 700-RC-1-E, complemented by the Specific Annexes of each type of cable and by the following requirements.

**6.3.2.1.2** The maintenance tests are classified as basic tests and complementary tests. Both are carried out half-yearly (every 6 months), but the basic tests for the product are always the same, while the complementary tests vary in each semester.

**6.3.2.1.3** If a non-conformity is identified during the tests of a semester, in the next periodic evaluation must be carried out the tests established for the semester and also all tests of the semester when the non-conformity was identified.

**6.3.2.2 Definition of the maintenance sampling**
The dispositions of the 700-RC-1-E are applicable to this 702-CRC-4-E, complemented by those cited in the Specific Annexes of each type of cable.

**6.3.2.2.1** If the sample of cable has been considered in compliance with all the tests established in their Specific Annex, it is not necessary to test and inspect the samples of counterproof and witness.

**6.3.2.2.2** If the sample of proof has been failed in one of the tests, all the tests must be repeated on the samples of counterproof and witness, must both fulfill the requirements established in the Specific Annex.
**6.3.2.2.3** If it occurs a failure on the sample of counterproof or witness, the sample must be considered as non-conform and the family of the cable must have its Register suspended.

**6.3.2.3 Definition of the Laboratory**
The criteria for the definition of the laboratory must follow the requirements established in the 700-RC-1-E.

**6.3.3 Treatment of non-conformities on the stage of Maintenance Audit**
The criteria for the treatment of non-conformities on the stage of maintenance audit must follow the requirements established in the 700-RC-1-E.

**6.3.4 Confirmation of the Maintenance**
The criteria for the confirmation of the maintenance must follow the requirements established in the 700-RC-1-E.

**6.4 Renewal Audit**
The criteria for the renewal audit must follow the requirements established in the 700-RC-1-E and in this 702-CRC-4-E. This audit must be carried out for each 24 (twenty four) months and must include the results of the conformity in the documentation, audit of renewal of the Quality Management System and the test plan of renewal.

**6.4.1 Treatment of non-conformities during the stage of Renewal**
The criteria for the treatment of non-conformities during the stage of renewal audit must follow the requirements established in the 700-RC-1-E.

**6.4.2 Confirmation of the Renewal**

The criteria for the confirmation of the renewal must follow the requirements established in the 700-RC-1-E.

**7 TREATMENT OF COMPLAINTS**
The criteria for the treatment of complaints must follow the requirements established in the 700-RC-1-E.

**8 ACTIVITIES CARRIED OUT BY FOREIGN CERTIFICATION BODIES**
The criteria for the activities carried out by foreign certification bodies must follow the requirements established in the 700-RC-1-E.

**9 CLOSURE OF THE CERTIFICATION**
The criteria for the closure of the certification must follow the requirements established in the 700-RC-1-E.

**10 SEAL OF CONFORMITY IDENTIFICATION**
The criteria for the Seal of Conformity Identification are included in the 700-RC-1-E and in the Annex A of this 702-CRC-4-E.

**11 AUTHORIZATION FOR THE USE OF THE SEAL OF CONFORMITY IDENTIFICATION**
The criteria for the authorization of the use of the Seal of Conformity Identification must follow the requirements established in the 700-RC-1-E.

**12 RESPONSIBILITIES AND OBLIGATIONS**
The criteria for the responsibilities and obligations must follow the requirements established in the 700-RC-1-E.

**13 MONITORING OF MARKET**
The criteria for the monitoring of market must follow the requirements established in the 700-RC-1-E.

**14 PENALITIES**
The criteria for the application of penalties must follow the requirements established in the 700-RC-1-E.

**15 CHANGES MADE**
- Revision of the items below for the adjustment to the GRPC as to the annex to the INMETRO rule nº 118/2015:
A1 of Annex A
6.2.3 Initial audit of the Management System(s)
6.2.4 Plan of Initial Tests
6.2.6.1 - inserted references to document
6.5.1 - Complementary Tests of chapter XI

## ANNEX A – MARKINGS AND SEAL OF CONFORMITY IDENTIFICATION

### A.1 Markings on the cable, coils, wheels and reels

Models of the Seals of the Conformity Identification to be applied on the product body and on the package must be submitted for the previous approbation by TÜV Rheinland do Brasil Ltda., and before the issuance of certificates. In case of products submitted to the INMETRO Registration of Object, the Seals and marks to be applied on the products and packages must be confirmed, already with the Registration Numbers.

The cables, coils, wheels and reels must be, obligatorily, marked in Portuguese language with the following information:

- Obligatory information for each type of cable described in the respective Specific Annex of TRQ;
- Seal of Conformity Identification (on the product body, coils, wheels and reels), according to the items A.1.1 and A.1.2.

### A.1.1 Use of the Seal of Conformity Identification on the cable

**A.1.1.1** On the cable body must be present, in the indicated sequence, the following information: "N" + "Number of Register of the Object" + "TÜV RHEINLAND" or "△" + "OCP-0004".

**A.1.1.2** In case of wires, cables and cords, composed of just one conductor, with section 2,5 mm² or smaller than, by its dimensions, it makes impossible the clear marking of the seals of Conformity Identification, it is allowed the use of INMETRO name in full instead of the logo "N".

### A.1.2 Use of the Seal of Conformity Identification for coils, wheels and reels

Independently of the kind of packing (transparent, opaque etc), that must always exist, and of the cable section that it accommodates, it is obligatory the use of the complete Seal of Conformity Identification, can be even impressed or fixed through an adhesive label.

### A.1.2.1 Model of the Seal of Conformity Identification

The following Seals of Conformity Identification to be applied to the coil packings, wheels and reels are:

Fonte
Univers
Univers Black


Pantone 1235
100%
80%

CMYK
C2 M34 Y94 K0
C2 M27 Y90 K0


Tons de Cinza
100%
90%
70%

## ANNEX B - HIGHLIGHTS OF THE INMETRO RULE Nº 640 FROM 30/11/2012

Art. 4º To determine that from 18 (eighteen) months on, considering the publication date of the Inmetro rule nº640/2012, the electrical wires, cables and flexible cords must be made and imported only in compliance with the Requirements herein approved and duly registered directly with Inmetro.

Paragraph unique – From 6 (six) months on, considering the end of the term established in the caput, the electrical wires, flexible cables and cords must be commercialized, in the Brazilian market, by manufacturers and importers, only in compliance with the Requirements herein approved and duly registered directly with Inmetro.

Art. 5º To determine that from 36 (thirty six) months on, considering the date of this Inmetro rule publication, the electrical wires, flexible cables and cords must be commercialized, in the Brazilian market, only in compliance with the Requirements herein approved and duly registered directly with Inmetro.

Paragraph unique – The determination contained in the caput of this article is not applicable to the manufacturers and importers that must observe the terms established in the previous article.

Art. 6º It is prohibited the manufacturing, importation and commercialization of the insulated cables in polyvinyl chloride (PVC) for nominal rated voltages up to 450/750 V, including (flexible cables) and of the insulated cables in thermoset elastomeric compounds, for nominal rated voltages up to 450/750 V, including (flexible cables and cords), belonging to the scope of the Specific Annexes VIII and XI, of the Inmetro Rule herein approved and that have conductor class 4.

Art. 7º It is prohibited the manufacturing, importation and commercialization of the insulated cables and conductors in polyvinyl chloride (PVC) for nominal rated voltages up to 450/750 V, including (insulated conductors - with no sheath - for fixed installations), belonging to the scope of the Specific Annex VII of the Inmetro rule herein approved, that have conductor class 4 and that are intended to be used for home appliances and electronic equipments.

Art. 9º To revoke the Inmetro decree nº 85, from May 26th, 2003, published in the Official Gazette of the Federation in May 27th, 2003, section 01, page 226, in the term of 36 (thirty six) months after this Rule publication.

Art. 10º To revoke the Inmetro decree nº 86, from May 26th, 2003, published in the Official Gazette of the Federation in May 27th, 2003, section 01, page 226, in the term of 36 (thirty six) months after the publication of this Rule.

Art. 11º To revoke the Inmetro decree nº 87, from May 20th, 2003, published in the Official Gazette of the Federation in May 27th, 2003, section 01, page 226 to 227, in the term of 36 (thirty six) months after the publication of this Rule.

Art. 12 To revoke the Inmetro decree nº 281, from July 19th, 2007, published in the Official Gazette of the Federation in July 23rd, 2007, section 01, page 82, in the term of 36 (thirty six) months after the publication of this Rule.

Art. 13 To revoke the Inmetro decree nº 282, from July 19th, 2007, published in the Official Gazette of the Federation in May 23rd, 2007, section 01, page 82, in the term of 36 (thirty six) months after the publication of this Rule.

Art. 14 To revoke the Inmetro decree nº 286, from July 19th, 2007, published in the Official Gazette of the Federation in May 23rd, 2007, section 01, page 86, in the term of 36 (thirty six) months after the publication of this Rule.

## ANNEX C – TESTS AND SAMPLINGS

### C.1 Routine tests

The routine tests for the products established in this Complement are, at least, the tests of markings checking, construction checking, dimensional, electrical resistance of the conductor at 20ºC, voltage test, insulation resistance at 20ºC or, when not established, the maximum temperature of operation, and spark test.
These tests are carried out by the manufacturer and must include all the lots of materials made and released for the stock/commerce.
The samplings are in compliance with the relevant standards of product.

### C.2 Periodic Tests for the manufacturer

The Periodic Tests are not established. Therefore, we recommend that the tests of mechanical characteristics of the insulation and/or sheath (tensile strength and elongation at break, before and after aged), at least for every development of new suppliers / raw material be carried out.

## SPECIFIC ANNEX I

### 1 OBJECTIVE

This specific annex is applicable to the Extruded polyvinyl chloride (PVC) or polyethylene (PE) insulated power cables for rated voltages of 1 kV, including, covered by ABNT NBR 7288.

### 2 COMPLEMENTARY DOCUMENTS

Beyond the documents of this 702-CRC-4-E, the following documents are applicable:

| | |
|---|---|
| ABNT NBR 7288 | Extruded polyvinyl chloride or polyethylene insulated power cables for rated voltages from 1 kV up to 6 kV - Specification |
| NBR NM IEC 60332-3-23 | Tests on electric cables under fire condition Part 3-23: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category B |

### 3 ACRONYMS

NM "Norma Mercosul" that in English means Mercosul Standard
PE "Polietileno" that in English means Polyethylene
PVC "Cloreto de Polivinila" that in English means Polyvinyl Chloride

### 4 DEFINITIONS

#### 4.1 Family

The products covered by this Specific Annex are divided in the following families:

**Group 1**

a. Power cable insulated in PVC/A and with sheath in PVC/ST1, with rigid conductor in class 1;
b. Power cable insulated in PVC/A and with sheath in PVC/ST1, with rigid conductor in class 2;
c. Power cable insulated in PVC/A and with sheath in PVC/ST1, with flexible conductor in classes 4 or 5;

**Group 2**

d. Power cable insulated in PVC/A and with sheath in PE/ST3, with rigid conductor class 1;
e. Power cable insulated in PVC/A and with sheath in PE/ST3, with rigid conductor class 2;
f. Power cable insulated in PVC/A and with sheath in PE/ST3, with flexible conductor classes 4 or 5.

**Group 3**

g. Power cable insulated in PE and with sheath in PVC/ST1, with rigid conductor class 1;
h. Power cable insulated in PE and with sheath in PVC/ST1, with rigid conductor class 2;
i. Power cable insulated in PE and with sheath in PVC/ST1, with flexible conductor classes 4 or 5;

**Group 4**

j. Power cable insulated in PE and with sheath in PE/ST3, with rigid conductor class 1;
k. Power cable insulated in PE and with sheath in PE/ST3, with rigid conductor class 2;
l. Power cable insulated in PE and sheath in PE/ST3, with flexible conductor classes 4 or 5.

### 5 INITIAL AUDIT

#### 5.1 Application for the Certification

In the application for the certification, the applicant must declare if the cable is projected in order to have special characteristics as to the non-propagation of flame. From this declaration on, the certificate must contain if the product is projected "with special characteristics of non-propagation of fire" or if it is projected "without special characteristics of non-propagation of fire".

#### 5.2 Definition of the Initial Tests, Sampling and Criteria of Acceptance

**5.2.1** The initial tests are those of type, established in the Specific Annex I of the TRQ for this object.

**5.2.2** The sample to be taken for the tests to be carried out, must be composed by an unit of logistics in coil, with a nominal length of 100 m or, in case of cables conditioned in reels, of a sample of minimum length of 30 m, enough for all the tests to be done. For the test of vertical flame spread of vertically-

mounted bunched wires or cables - category B, the quantity of sample must be calculated considering the section to be tested, as to NBR NM IEC 60332-3-23.

**5.2.3** The necessary quantity of samples, by group of families, for the tests to be done is that indicated in the following table

| Cable type | Conductor class | Initial tests |
|---|---|---|
| | | Type |
| Unipolar or multiplexed | 1, 2, 4, 5 | On the smallest section of the highest conductor class and on the highest section of the smallest conductor class made. |
| Multipolar | 2, 4, 5 | On the highest and smallest sections of the smallest conductor class made. |

**Nota 1**: the maximum section of the cable is of 120 mm² for the initial tests to be done, except for the test of vertical flame spread - category B, item 6.1.3(a) of the standard ABNT NBR 7288, where the maximum section is of 35 mm².

**Nota 2:** the test of vertical flame spread - category B must be applied when the supplier identifies the product as a project with special characteristics as to the non-propagation of fire. Otherwise, flame resistance test must be carried out.

**5.2.4** A sample must be collected as proof, counterproof and witness, according to the item 6.2.4.2, of the main part of this document.

**5.2.5** If any family has not been tested according to the criteria of sampling as established in the item 5.2.3, this family must be submitted to the following tests: Electrical resistance of the conductor, voltage test and insulation resistance at 20ºC.

## 6 MAINTENANCE TESTS

### 6.1 Maintenance test plan

**6.1.1** The maintenance tests are classified in basic tests and complementary tests. Both are carried out half-yearly (every 6 months), however the basic tests for the product are always the same while the complementary varies every semester. The description of the tests and their requirements are established in the Specific Annex I of the TRQ for this object.

**6.1.1.1** If a non-conformity is identified during the tests of a semester, in the next periodic evaluation, the tests established for the semester more the half-yearly tests where the non-conformity was identified must be carried out.

**6.1.2** The maintenance tests must be carried out, on samples collected in the market, after the certification, on a nominal section of each family of product. For each maintenance, the cables to be tested must be, according to their nominal sections, collected randomly in the tested family.

**6.1.2.1** A sample of proof, counterproof and witness must be collected, according to the item 6.2.4.2, of the main part of this document.

**6.1.3** The sample to be tested must be taken must be constituted by one unit of logistics in coil, with a nominal length of 100 m or, in case of cables conditioned in wheels, of a minimum length of the sample of 30 m, enough for the tests to be done. Furthermore, a sample of 30 m of a copper wire must be collected, before the processes of stranding, for the test to be done in order to determine the copper elongation and copper electrical resistivity.

**6.1.4 Basic Tests**

For every six months the following tests must be carried out:
- Checking of the marking;
- Checking of the cable construction;
- Checking of the electrical resistance;
- Voltage test; and
- Insulation resistance test at 20ºC.

**6.1.5 Complementary Tests**

Beyond those mentioned in the previous item, the following tests must be carried out, according to the frequency of the maintenance tests:

a) For the insulation in PVC/A and sheath in PVC/ST1:
- 1º Semester: copper electrical resistivity and pressure test at the high temperature;
- 2º Semester: mechanical characteristics of the insulation and sheath, elongation/bending at low temperature, cold impact test and copper elongation;
- 3º Semester: long term voltage test, flame resistance test (in case of PVC compound with no special characteristics of non-propagation of fire) or vertical flame spread of vertically-mounted bunched wires or cables - category B and heat shock test;
- 4º Semester: water absorption, insulation resistance at 70ºC and non-contamination test on the complete cable.

b) For the insulation in PVC/A and sheath in PE/ST3:
- 1º Semester: copper electrical resistivity, carbon black content and pressure at the high temperature test;
- 2º Semester: mechanical characteristics of the insulation and of the sheath, elongation/bending test at low temperature and copper elongation;
- 3º Semester: long term voltage test and flame resistance test and heat shock test;
- 4º Semester: water absorption test, insulation resistance at 70ºC and test of non-contamination on the complete cable.

c) For insulation in PE and sheath in PVC/ST1:
- 1º Semester: copper electrical resistivity, water absorption, shrink test and pressure test at the high temperature;
- 2º Semester: mechanical characteristics of the insulation and sheath, copper elongation, elongation/bending test at low temperature and cold impact test;
- 3º Semester: long term voltage test, flame resistance test and heat shock;
- 4º Semester: insulation resistance at 70ºC and test of non-contamination on the complete cable.

d) For the insulation in PE and sheath in PE/ST3:
- 1º Semester: copper electrical resistivity, water absorption of the insulation, shrink of the insulation and black carbon content;
- 2º Semester: mechanical characteristics of the insulation and sheath and copper elongation;
- 3º Semester: long term voltage test and flame resistance test;
- 4º Semester: insulation resistance at 70ºC and test of non-contamination on the complete cable.

**Note:** the reference for these tests is the Certificate of Conformity grant.

**6.1.6** In the checking of the marking of the packing of the product, the requirements of special characteristics as to its non-propagation and self-extinguishing of fire must be considered;

## SPECIFIC ANNEX II

### 1 OBJECTIVE

This specific annex applies for the flexible cords with insulation extruded in chlorosulfonated polyethylene (CSP) for rated voltage up to and including 300 V, including, covered by the standard ABNT NBR 14633.

### 2 COMPLEMENTARY DOCUMENTS

Beyond the documents of this 702-CRC-4-E, applies the following complementary document:

| | |
|---|---|
| ABNT NBR 14633 | Flexible cord with extruded chlorossulfonated polyethylene (CSP) insulation for rated voltages up to and including 300 V - Performance requirements |

### 3 ACRONYM

CSP - "Polietileno Clorossulfonado" that in English means Chlorossulfonated Polyethylene.

### 4 DEFINITIONS

#### 4.1 Family

The products covered by this Specific Annex constitute just one family, where the thermal class, nominal section and color can vary.

### 5 INITIAL AUDIT

#### 5.1 Definition of the Initial Tests, Sampling and Criteria of Acceptance

**5.1.1** The initial tests are those of type, established in the Specific Annex II of the TRQ for this object.

**5.1.2** The sample to be taken for the tests to be done carried out must be constituted of the highest and the smallest nominal section of the conductors. It must correspond to one unit of the logistics in coil, with a minimum length of 100 m or, in case of cables conditioned in wheels, of a minimum length of a sample of 30 m, enough for all the tests to be carried out.

**5.1.2.1** A sample for the proof, counterproof and witness must be collected, as to the item 6.2.4.2, of the main part of this document.

### 6 MAINTENANCE TESTS

#### 6.1 Maintenance test plan

**6.1.1** The maintenance tests are classified in basic tests and complementary tests. Both are carried out half-yearly (every 6 months), but the basic tests for the product are always the same while the complementary vary in each semester. The description of the tests and their requirements are established in the Specific Annex II of the TRQ for this object.

**6.1.1.1** If a non-conformity is identified during the tests a semester, in the next periodic evaluation must be carried out the tests established for the semester, added of all tests of the semester when the non-conformity was identified.

**6.1.2** The maintenance tests must be carried out on samples collected in the market. For each maintenance, the cables to be tested must be, according to their nominal sections, collected randomly in the family to be tested.

**6.1.3** The sample to be taken, for the tests to be carried out, must be constituted of one unit of logistics in coil, with a minimum length of 100 m or, in case of cables conditioned in wheels, of a sample with minimum length of 30 m, enough for all the tests to be carried out. Furthermore, sample of 30 m must be collected of

a copper wire, before the processes of stranding, for the copper elongation test and copper electrical resistivity.

**6.1.3.1** A sample of proof, counterproof and witness must be collected, as to the item 6.2.4.2, of the main part of this document.

**6.1.4 Basic Tests**

For every six months, the following tests must be carried out:
- Checking of the marking;
- Checking of the construction of the conductor;
- Checking of the dimension of the insulation;
- Voltage test;
- Electrical resistance;
- Separation of the insulated cores;
- Insulation resistance at 20ºC.

**6.1.5 Complementary Tests**

Beyond those mentioned in the previous item, the following tests must be carried out, according to the frequency of the maintenance tests:
- 1º Semester: Electrical resistivity and resistance to high temperature;
- 2º Semester: Mechanical characteristics of the insulation before and after ageing and adherence of the insulation on the conductor;
- 3º Semester: Flame resistance test and long term voltage test;
- 4º Semester: Insulation resistance at the operation temperature (90°C or 105°C) and mechanical characteristics of the insulation before and after ageing.

**Note:** the reference for those tests is the Certificate of Conformity grant.

## SPECIFIC ANNEX III

### 1 OBJECTIVE

This Specific Annex applies to the insulated flexible cables (cords) in polyvinyl chloride (PVC), for special applications in connector cords for household appliances, for rated voltages up to and including 500 V, covered by ABNT NBR 14897.

### 2 COMPLEMENTARY DOCUMENTS

Beyond the documents of this 702-CRC-4-E, the following complementary document is applied:

| | |
|---|---|
| ABNT NBR 14897 | PVC insulated flexible cables (cords) for special applications in connector cords for household appliances, for rated voltages up to and including 500 V |

### 3 ACRONYM

PVC "Policloreto de vinila" that in English means polyvinyl chloride.

### 4 DEFINITIONS

#### 4.1 Family

The products covered by this Specific Annex are divided in three classes:

a. Parallel Cord;
b. Circular flexible cable;
c. Flat flexible cable.

### 5 INITIAL AUDIT

#### 5.1 Definition of the Initial Tests, Sampling and Criteria of Acceptance

**5.1.1** The initial tests are of type tests and of flexing, established in the Specific Annex III of the TRQ for this object.

**5.1.2** The following requirements to be fulfilled for the cords and cables, according to their families are:

| Family of products | Nº of cores | Conductor class | Rated voltage (V) | Type tests (nº x mm²) | Flexing test (nº x mm²) |
|---|---|---|---|---|---|
| Parallel cord | 2 | 4, 5 or 6 | 300 | 2 x 2,5 | 2 x 0,5 |
| Circular flexible cable | 2 to 5 | 4, 5 or 6 | 500 | 3 x 1,5 | 2 x 0,5 |
| Flat flexible cable | 2 and 3 | 4, 5 or 6 | 500 | 3 x 1,5 | 2 x 0,5 |

**Note 1:** If none of the cables with the indicated nominal sections are submitted to the process of certification, the closest nominal section possible must be used.

**Note 2:** The table above is applicable for the smallest conductor class among those requested for the certification. For the cables of the remaining conductor class of each family, the quality control of production tests are carried out, as flexing test and electrical voltage test, on the sections and constructions established in the table above, as established in the Specific Annex III of the TRQ.

**Note 3:** The insulation is in polyvinyl chloride of type PVC/EB and the sheath of the type PVC/ST10.

**5.1.3** The sample to be taken for the tests to be carried out must be constituted by one unit of logistics in coil, with a minimum strength of 100 m or, in case of cables conditioned in wheels, of a minimum length of the sample of 30 m, enough for all the tests to be carried out.

**5.1.3.1** For the proof, counterproof and witness must be collected one sample, as to the item 6.2.4.2, of the main part of this document.

## 6 MAINTENANCE TESTS

### 6.1 Maintenance test plan

**6.1.1** The maintenance tests are classified in basic tests and complementary tests. Both are carried out half-yearly (every 6 months), but the basic tests for the product are always the same while the complementary varies every semester. The description of the tests and their requirements are established in the Specific Annex III of the TRQ for this object.
**6.1.1.1** If a non-conformity is identified during the tests of a semester, in the next periodic evaluation must be carried out the tests established for the semester and also all tests of the semester when the non-conformity was identified.

**6.1.2** The maintenance tests must be carried out, on the samples collected in the market, on one section of each family of product. For each maintenance, the cables to be tested must be, according to their nominal sections, collected randomly in the family tested.

**6.1.3** The sample to be taken for the tests to be carried out must be constituted by one unit of logistics in coil, with a minimum length of 100 m or, in case of cable conditioned in wheels, of a minimum length of the sample of 30 m, enough for all the tests to be carried out.

**6.1.3.1** A sample for the proof, counterproof and witness must be collected, as to the item 6.2.4.2, of the main part of this document.

**6.1.4 Basic Tests**
For every six months must be carried out the following tests:
- Checking of the marking;
- Checking of the construction (dimensional);
- Voltage test;
- Electrical resistance of the conductor;
- Insulation resistance at 20ºC;
- Separation of cores, only for the parallel cords.

**6.1.5 Complementary Tests**
Beyond those mentioned in the previous item, must be carried out, according to the frequency of the maintenance tests, the following tests:
- 1º Semester: pressure test at the high temperature of the insulation/sheath and voltage test on the cores;
- 2º Semester: mechanical characteristics of the insulation/sheath before and after ageing and thermal stability of the sheath;
- 3º Semester: heat shock test, flame resistance test and flexing test followed by voltage test; and
- 4º Semester: test of non-contamination and insulation resistance at 105ºC.

**Note:** the reference for those tests is the Certificate of Conformity grant.

## SPECIFIC ANNEX IV

### 1 OBJECTIVE

This Specific Annex applies to the flexible cables insulated in ethylene-propylene rubber (EPR) for special applications in connector cords for household appliances, for rated voltages up to and including 500 V, covered by ABNT NBR 14898.

### 2 COMPLEMENTARY DOCUMENTS

Besides the documents of this 702-CRC-4-E, the following documents are applicable:

| | |
|---|---|
| ABNT NBR 14898 | flexible cables insulated in Ethylene-Propylene Rubber (EPR) for special application in connector cords for household appliances, for rated voltages up to and including 500 V |

### 3 ACRONYMS

EPR Ethylene-Propylene Rubber (EPR)

### 4 FAMILY

The products covered by this Specific Annex constitute in just one family, of Circular Flexible Cable.

### 5 INITIAL TESTS

**5.1** Definition of Initial Tests, Sampling and Criteria of Acceptance.

**5.1.1** The initial tests are type tests and flexing, established in the Annex IV of the specific TRQ of this object.

**5.1.2** The requirements to be fulfilled for the tests of cables and cords, according to their families are:

| Family of products | N° of cores | Class of strand | Rated voltage (V) | Type tests (n° x mm²) | Flexing tests (n° x mm²) |
|---|---|---|---|---|---|
| Circular Flexible Cable | 2 to 5 | 4, 5 or 6 | 500 | 3 x 1,5 | 2 x 0,5 |

**Note 1**: the table above is applicable for the smallest conductor class requested for the certification. The remaining class of strand are carried out the tests of the quality control of production, of flexing test and voltage test, on the nominal sections and constructions established in the table above, as established in the Specific Annex IV of the TRQ.

**Note 2**: the insulation must be EPR and the sheath in compound thermoset ES130.

**5.1.3** If the sections established in the table above in the item 5.1.2 of this 702-CRC-4-E are not submitted to the certification process, it must be used the closest nominal section possible.

**5.1.4** The sample to be collected for the tests must constituted by one unit of logistics in coil, with a minimum length of 100 m or, in case of cable wheels, a minimum sample length of 30 m, enough for all the tests to be carried out.

**5.1.4.1** For the proof, counterproof and witness must be collected one sample, as to the item 6.2.4.2, of the main part of this document.

### 6 MAINTENANCE TESTS

### 6.1 Maintenance test plan

**6.1.1** The maintenance tests are classified by basic tests and complementary tests. Both are carried out half-yearly (every 6 months), however the basic tests for the product are always the same while the

complementary tests vary every semester. The description of the tests and their requirements are established in the Specific Annex IV of the RTQ for this object.

**6.1.1.1** If a non-conformity is identified during the tests a semester, in the next periodic evaluation must be carried out the tests established for the semester and also all tests of the semester when the non-conformity was identified.

**6.1.2** The maintenance tests must be carried out on the samples collected in the market, on one section of each family of product. For each maintenance, the cables to be tested must be, according to their nominal sections, collected randomly in the family tested

**6.1.2.1** It must be collected one sample for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

**6.1.3** The sample to be collected for the maintenance tests must be consisted of one cable roll from the manufacturer stock, with a minimum length of 100 m or, in case of cable reels, a sample length at least 30 m, enough for the tests to be carried out. Besides that, it must be collected one sample length of 30 m of elementary copper wire, before the stranding process, for the tests of elongation at break and electric resistivity of the copper.

**6.1.4 Basic tests**

Every six months it must be carried out the following tests:
- Marking verification;
- Construction verification (Dimensional);
- Voltage test;
- Electrical resistance;
- Insulation resistance at the room temperature.

**6.1.5 Complementary tests**

Besides those items mentioned above, it must be carried out, according to the frequency of maintenance tests, the following tests:
- 1° semester: Ozone resistance and Insulation resistance at a temperature of 130° C;
- 2° semester: Insulation/sheath tensile strength before and after ageing and ageing in the complete cable;
- 3° semester: Non flame propagation test, hot set test of insulation/sheath and flexing followed by voltage test;
- 4° semester: Mechanical tests in air bomb of insulation/sheath, voltage test on cores and oil immersion test.

**Note:** the reference for these tests is the granting of the Conformity Certificate.

## SPECIFIC ANNEX V

### 1 OBJECTIVE

This Specific Annex applies to power cables and insulated conductors without sheath, with extruded insulation and low smoke emission for voltage up to and including 1kV, covered by ABNT NBR 13248.

### 2 COMPLEMENTARY DOCUMENTS

Besides the documents of this 702-CRC-4-E, the following additional documents are applicable:

| | |
|---|---|
| **ABNT NBR 13248** | Power and control cables and insulated conductors without cover, with extruded insulation and low smoke emission for voltages up to 1kV – Performance Requirements. |
| **NBR NM IEC 60332-3-24** | Tests on electric cables under fire conditions - Part 3-23: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category C. |

### 3 ACRONYMS

XLPE Cross-linked Polyethylene
EPR Ethylene Propylene

### 4 DEFINITIONS

#### 4.1 Family

The products covered by this Specific Annex are divided by the following families:
a. Solid conductor, insulated in thermoplastic polyolefin compound, 70° C, up to 450/750 V, without sheath;
b. Rigid conductor, insulated in thermoplastic polyolefin compound, 70° C, up to 450/750 V, without sheath;
c. Flexible conductor, insulated in thermoplastic polyolefin compound, 70° C, up to 450/750 V, without sheath;
d. Solid conductor, insulated in thermoset polyolefin compound EPR/B, 90° C, up to 450/750 V, without sheath;
e. Rigid conductor, insulated in thermoset polyolefin compound EPR/B, 90° C, up to 450/750 V, without sheath;
f. Flexible conductor, insulated in thermoset polyolefin compound EPR/B, 90° C, up to 450/750 V, without sheath;
g. Solid conductor, insulated in thermoset polyolefin compound XLPE, 90° C, up to 450/750 V, without sheath;
h. Rigid conductor, insulated in thermoset polyolefin compound XLPE, 90° C, up to 450/750 V, without sheath;
i. Flexible conductor, insulated in thermoset polyolefin compound XLPE, 90° C, up to 450/750 V, without sheath;
j. Power cable, insulated in thermoset compound EPR, sheath in thermoplastic polyolefin compound, 90° C, up to 0,6/1 kV;
k. Power cable, insulated in thermoset compound EPR, sheath in thermoset polyolefin compound, 90° C, up to 0,6/1 kV;
l. Power cable, insulated in thermoset compound XLPE, sheath in thermoplastic polyolefin compound, 90° C, up to 0,6/1 kV;
m. Power cable, insulated in thermoset compound XLPE, sheath in thermoset polyolefin compound, 90° C, up to 0,6/1 kV;
n. Flexible power cable, insulated in thermoset compound EPR, sheath in thermoplastic polyolefin compound, 90° C, up to 0,6/1 kV;
o. Flexible power cable, insulated in thermoset compound EPR, sheath in thermoset polyolefin compound, 90° C, up to 0,6/1 kV;
p. Flexible power cable, insulated in thermoset compound XLPE, sheath in thermoplastic polyolefin compound, 90° C, up to 0,6/1 kV;
q. Flexible power cable, insulated in thermoset compound XLPE, sheath in thermoset polyolefin compound, 90° C, up to 0,6/1 kV;

### 5 INITIAL TESTS

#### 5.1 Initial tests definition, sampling and acceptance criteria.

**5.1.1** The initial tests are those of type, established in the Specific Annex V of the TRQ of this object.

**5.1.2** The requirements to be fulfilled for the tests of cable, according to their families, are the following:

| Product families | Insulation material | Sheath material | N° of cores | Conductor class | Voltage (V) | Type test |
|---|---|---|---|---|---|---|
| Insulated solid conductor 70° C | thermoplastic polyolefin compound | --- | 1 | 1 | 750 | smallest and highest section |
| Rigid insulated conductor 70° C | thermoplastic polyolefin compound | --- | 1 | 2 | 750 | smallest and highest section |
| Flexible insulated conductor 70° C | thermoplastic polyolefin compound | --- | 1 | 4 or 5 | 750 | smallest and highest section |
| Solid insulated conductor 90° C | EPR/B | --- | 1 | 1 | 750 | smallest and highest section |
| Rigid insulated conductor 90° C | EPR/B | --- | 1 | 2 | 750 | smallest and highest section |
| Flexible insulated conductor 90° C | EPR/B | --- | 1 | 4 or 5 | 750 | smallest and highest section |
| Solid insulated conductor 90° C | XLPE | --- | 1 | 1 | 750 | smallest and highest section |
| Rigid insulated conductor 90° C | XLPE | --- | 1 | 2 | 750 | smallest and highest section |
| Flexible insulated conductor 90° C | XLPE | --- | 1 | 4 or 5 | 750 | smallest and highest section |
| Power cable | EPR | thermoplastic polyolefin compound | 1 to 5 | 2 | 0,6/1 k | 1 x 35mm² and 3 x 4mm² |
| Power cable | EPR | thermoset polyolefin compound | 1 to 5 | 2 | 0,6/1 k | 1 x 35mm² and 3 x 4mm² |
| Power cable | XLPE | thermoplastic polyolefin compound | 1 to 5 | 2 | 0,6/1 k | 1 x 35mm² and 3 x 4mm² |
| Power cable | XLPE | thermoset polyolefin compound | 1 to 5 | 2 | 0,6/1 k | 1 x 35mm² and 3 x 4mm² |
| Flexible power cable | EPR | thermoplastic polyolefin compound | 1 to 5 | 4 or 5 | 0,6/1 k | 1 x 35mm² and 3 x 4mm² |
| Flexible power cable | EPR | thermoset polyolefin compound | 1 to 5 | 4 or 5 | 0,6/1 k | 1 x 35mm² and 3 x 4mm² |
| Flexible power cable | XLPE | thermoplastic polyolefin compound | 1 to 5 | 4 or 5 | 0,6/1 k | 1 x 35mm² and 3 x 4mm² |
| Flexible power cable | XLPE | thermoset polyolefin compound | 1 to 5 | 4 or 5 | 0,6/1 k | 1 x 35mm² and 3 x 4mm² |

**Note 1:** If the power cables are not submitted to the certification process on the sections established in the table 5.1.2, it must be used the closest nominal section.

**Note 2:** For conductor class 4 or 5, the table above is applicable for the most flexible conductor class among those requested. The lowest flexible conductor class must be submitted to production quality control tests, in the nominal section and constructions established in the table above, as to the Specific Annex V of the TRQ of this object.

**5.1.4** The sample to be collected for the tests must be consisted of one cable roll from the manufacturer stock, with a rated minimum length of 100 m or, in case of cable reels, a sample length at least 30 m, enough for the tests to be carried out, except the vertical burn test. For vertical burn test, the quantity of sample must be calculated considering the section to be tested, according to ABNT NBR NM IEC 60332-3-24.

**5.1.4.1** It must be collected one sample for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

## 6 MAINTENANCE TESTS

### 6.1 Maintenance test plan

**6.1** The maintenance tests are classified in basic tests and complementary tests. Both are carried out half-yearly (every 6 months), however the basic tests are always the same while the complementary tests vary every semester. The description of the tests and their requirements are established in the Specific Annex V of the TRQ for this object.

**6.1.1** If a non-conformity is identified during the tests a semester, in the next periodic evaluation must be carried out the tests established for the semester and also all tests of the semester when the non-conformity was identified.

**6.1.2** The maintenance tests must be carried out on the samples collected from the market. For every maintenance, the cables to be tested must be, according to their nominal sections, collected randomly from the family to be tested.

**6.1.3** The sample to be collected for the maintenance tests must be consisted of one cable roll from the manufacturer stock, with a minimum length of 100 m or, in case of cable reels, a sample length at least 30 m, enough for the tests to be carried out.

**6.1.3.1** It must be collected one sample for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

**6.1.4 Basic Tests**
Every six months it must be carried out the following tests:
- Marking checkings of the label and product;
- Dimension checking;
- Conformity checking according to the constructive requirements;
- Voltage test;
- Electric resistance of the conductor;
- Insulation resistance at room temperature.

**6.1.5 Complementary tests**
Besides those mentioned in the item above, it must be carried out, according to the frequency of maintenance tests, the following tests:

a) Insulated conductor in thermoplastic compound 70° C (rigid, solid or flexible)
- 1° semester: Determination of acidity level, determination of halogen, nitrogen and sulfur presence, mechanical characteristics and long term voltage test;
- 2° semester: Determination of the quantity of acid gas, determination of toxicity index, water absorption (electric method) and cold bend/elongation test;
- 3° semester: Smoke density, loss of mass and vertical burn test;
- 4° semester: Pressure test at high temperature, shock thermal and insulation resistance at the maximum temperature of operation.

b) Insulated conductor in thermoset compound 90° C in EPR/B (rigid, solid or flexible)
- 1° semester: Mechanical characteristics, hot set test, insulation resistance at maximum temperature of operation and long term voltage test;
- 2° semester: Vertical burn test and water absorption (gravimetric);
- 3° semester: Determination of halogen, nitrogen and sulfur presence, determination of acidity level, determination of the quantity of acid gas and determination of toxicity index.
- 4° semester: Smoke density, ozone resistance and tensile test after ageing in air bomb.

c) Insulated conductor in thermoset compound 90° C in XLPE (rigid, solid or flexible)
- 1° semester: Mechanical characteristics, hot set test, insulation resistance at maximum temperature of operation and long term voltage test;
- 2° semester: Vertical burn test and water absorption (gravimetric);
- 3° semester: Determination of halogen, nitrogen and sulfur presence, determination of acidity level, determination of the quantity of acid gas and determination of toxicity index.
- 4° semester: Smoke density and shrink test.

d) Power cables insulated in EPR or XLPE with sheath in thermoplastic polyolefin compound 90° C.
- 1° semester: Mechanical characteristics, determination of halogen, nitrogen and sulfur presence, determination of acidity level and long term voltage test;
- 2° semester: Water absorption (gravimetric), cold bend/elongation, determination of the quantity of acid gas and determination of toxicity index;
- 3° semester: Loss of mass, smoke density, ageing in air bomb (applicable only for EPR), ozone resistance (applicable only for EPR), vertical burn test and ageing on the complete cable;
- 4° semester: Pressure test at high temperature, cold impact resistance, hot set test and insulation resistance at maximum temperature of operation.

e) Power cables insulated in EPR or XLPE with sheath in thermoset polyolefin compound 90° C.
- 1° semester: Mechanical characteristics, determination of halogen, nitrogen and sulfur presence, determination of acidity level and long term voltage test;
- 2° semester: Water absorption (gravimetric), determination of the quantity of acid gas and determination of toxicity index;
- 3° semester: Smoke density, ageing in air bomb (applicable only for EPR), ozone resistance (applicable only for EPR) and vertical burn test;
- 4° semester: Hot set test, ageing on the complete cable, insulation resistance at maximum operation temperature and oil immersion.

**Note:** the reference for these tests is the granting of the Conformity Certificate.

## SPECIFIC ANNEX VI

### 1 OBJECTIVE

This Specific Annex is applied to flexible twisted cords for voltages up to and including 300 V, covered by the ABNT NBR 15717.

### 2 COMPLEMENTATY DOCUMENTS

Besides the documents of this 702-CRC-4-E, the following complementary documents are applicable:

| | |
|---|---|
| **ABNT NBR 15717** | Flexible twisted cords for voltage up to and including 300 V. |

### 3 DEFINITIONS

#### 3.1 Family

The products covered by this Specific Annex are constituted by just one family, and may vary the section, conductor class and color.

### 4 INITIAL TESTS

#### 4.1 Definition of Initial Tests, Sampling and Acceptance Criteria.

**4.1.1** The initial tests are those of type, established in the Specific Annex VI of the TRQ of this object.

**4.1.2** The type tests are applicable for the most flexible conductor class among those submitted to the certification process. The section to be tested is of 2 x 2,5 mm². On the other conductor classes are carried out the construction checking and electrical resistance. In case when the section mentioned above are not submitted to the certification process, it must be used the closest nominal section possible.

**4.1.3** The sample to be collected for the initial tests must be consisted of one cable roll from the manufacturer stock, with a rated minimum length of 100 m or, in case of cable reels, one sample length at least 30 m, enough for the tests to be carried out.

**4.1.3.1** It must be collected one sample for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

### 5 MAINTENANCE TESTS

#### 5.1 Maintenance tests plan

**5.1.1** The maintenance tests are classified in basic tests and complementary tests. Both are carried out half-yearly (every 6 months), however the basic tests are always the same while the complementary tests vary every semester. The description of tests and their requirements are provided in the Specific Annex VI of the RTQ for this object.

**5.1.1.1** If a non-conformity identified during the tests of a semester, in the next periodic evaluation, it must be carried out the tests established for the specific semester and also all the tests from the semester that was identified the non-conformity.

**5.1.2** The maintenance tests must be carried out on the samples collected from the market. For every maintenance, the cables to be tested must be, according to their nominal sections, collected randomly from the family to be tested.

**5.1.3** The samples to be taken for the tests must be consisted of a cable roll from the manufacturer stock, with a minimum length of 100 m or, in case of cable reels, a sample length at least 30 m, enough to be carried out.

**5.1.3.1** It must be collected one sample for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

**5.1.4 Basic Tests**

Every six months it must be carried out the following tests:

- Marking verification;
- Cable construction verification;
- Insulation voltage test;
- Conductor electric resistance;
- Insulation resistance at room temperature.

**5.1.5 Complementary tests**

Besides those mentioned in the item above, it must be carried out, according to the frequency of maintenance tests, the following tests:

- 1° semester: electrical resistivity and pressure at high temperature;
- 2° semester: mechanical insulation, cold bend test and copper elongation for the individual wire;
- 3° semester: thermal shock, loss of mass test and flame resistance test;
- 4° semester: long term voltage test, insulation resistance at maximum temperature of operation and mechanical characteristics of the insulation.

**Note:** the reference for these tests is the granting of the Conformity Certificate.

## SPECIFIC ANNEX VII

### 1 OBJECTIVE

This Specific Annex is applied to the conductors insulated with polyvinyl chloride (PVC) for voltages up to and including 450/750 V, covered by the ABNT NBR NM 247-3 (insulated conductors – without sheath – for fixed installations)

### 2 COMPLEMENTARY DOCUMENTS

Besides the documents of this 702-CRC-4-E, the following complementary documents are applicable:

| | |
|---|---|
| ABNT NBR NM 247-3 | Insulated cables with polyvinyl chloride for nominal voltages up to and including 450/750 V – Part 3: insulated conductors ( no cover), for fixed wiring (IEC 60227-3, MOD) |
| ABNT NBR NM 247-1 | Insulated cables with polyvinyl chloride for nominal voltages up to and including 450/750 V – Part 1: General requirements (IEC 60227-1. MOD) |
| ABNT NBR NM 247-2 | Insulated cables with polyvinyl chloride for nominal voltages up to and including 450/750 V – Part 2: test methodology (IEC 60227-2, MOD) |
| NBR NM IEC 60332-3-23 | Tests on electric cables under fire conditions - Part 3-23: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category B. |

### 3 ACRONYMS

MOD Modified
NM Mercosul standard
PVC Polyvinyl chloride

### 4 DEFINITIONS

#### 4.1 Families

The products covered by this Specific Annex are divided by the following families:
a. Solid wire (insulated conductor (without sheath), with rigid conductor, for general application, 450/750 V). Designation 247 NM 01 C1 – BWF-B;
b. Rigid cable (insulated conductor (without sheath), with rigid conductor, for general application, 450/750 V). Designation 247 NM 01 C2 – BWF-B;
c. Flexible cable (insulated conductor (without sheath), with flexible conductor, for general application, 450/750 V). Designation 247 NM 02 C4 – BWF-B, for class 4, or 247 NM 02 C5 – BWF-B, for class 5;
d. Insulated conductor (without sheath), with solid conductor, for internal wiring and maximum conductor temperature of 70° C, 300/500 V – designation 247 NM 05 C1;
e. Insulated conductor (without sheath), with flexible conductor, for internal wiring and maximum conductor temperature of 70° C, 300/500 V – designation 247 NM 06 C5;
f. Insulated conductor (without sheath), with solid conductor, for internal wiring and maximum conductor temperature of 90° C, 300/500 V – designation 247 NM 07 C1 - 90° C ;
g. Insulated conductor (without sheath), with flexible conductor, for internal wiring and maximum conductor temperature of 90° C, 300/500 V – designation 247 NM 08 C5 - 90° C.

**NOTE:** The families intended for internal wiring, defined above, must not be used as an alternative for the types 247 NM 01 C1 and C2 – BWF-B or 247 NM 02 C4 and C5 – BWF-B because they do not have compatible characteristics of flame resistance. These products may only be used for installations of command and control panels.

## 5 INITIAL TESTS

### 5.1 Definition of Initial Tests, Sampling and Acceptance Criteria.

**5.1.1** The initial tests are those of type, established in the Specific Annex VII of the TRQ for this object.

**5.1.2** The quantity of samples needed for the tests is established in the ABNT NBR NM 247-2 and corresponding to the lowest and highest conductor section for each family. For the specific case of the vertical burn test, the maximum nominal section to be tested is limited to 50 mm².

**5.1.3** In the specific case of the family constituted by the cables with designation 247 NM 02 C4 BWF-B and 247 NM 02 C5 BWF-B, and have been sent to the certification process conductor classes 4 and 5, it must be selected for the type test the cable with the highest section and the cable with the lowest section, and both must be of different conductor class.
Additionally, analyzing the critical among the sections presented, it must be selected for routine test, two other cables with distinct sections from the ones selected for type test, being necessarily of different conductor classes.

**NOTE:** the tests referred in the ABNT NBR NM 247-3 as routine and incoming, must be here understood as routine test.

**5.1.4** The sample to be collected for the initial tests must be consisted of a cable roll from the manufacturer stock, with a minimum length of 100 m or, in case of cable reels, a sample length at least 30 m, enough to be carried out, except the vertical burn test. For vertical burn test, the quantity of samples must be calculated according to the section to be tested, according to ABNT NBR NM IEC 60332-3-23. Furthermore, it must be collected a sample length of 30 m of elementary copper wire, before the stranding process, for the test of determination of the elongation and electrical resistivity of the copper.

**5.1.4.1** It must be collected a sample for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

**5.1.5** The oxygen index test must be carried out on test pieces representing the sample of the vertical burn test. With satisfactory results, the obtained lowest value in this test will be considered as a value of reference.

## 6 MAINTENANCE TESTS

### 6.1 Maintenance tests plan

**6.1.1** The maintenance tests are classified in basic tests and complementary tests. Both are carried out half-yearly (every 6 months), however the basic tests are always the same while the complementary tests vary every semester. The description of the tests and their requirements are established in the Specific Annex VII of the TTQ for this object.

**6.1.1.1** If a non-conformity was identified during the tests of a semester, in the next periodic evaluation, it must be carried out the tests established for the specific semester and also all the tests from the semester that was identified the non-conformity.

**6.1.2** The maintenance tests must be carried out on the samples collected from the market on a section of each family. For every maintenance, the cables to be tested must be, according to their nominal sections, collected randomly from the family to be tested.

**6.1.3** The sample to be collected for the maintenance tests must be consisted of a cable roll from the manufacturer stock, with a minimum length of 100 m or, in case of cable reels, a sample length at least 30 m, enough to be carried out all the tests. Besides that, it must be collected a sample length of 30 m of elementary copper wire, before the stranding process, for the test of the determination of the elongation and the electrical resistivity of the copper.

**6.1.3.1** It must be collected a sample for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

**6.1.4 Basic tests**

Every six months it must be always carried out the following tests on each sampling:
- Marking verification;
- Conformity verification according to the constructive requirements;
- Conductor and insulation dimensional measurements;
- Voltage test;
- Conductor resistance;
- Insulation resistance at 20° C;
- Oxygen index, for the families BWF-B;
- Non flame propagation, others than BWF-B families.

**NOTE:** On the oxygen index test, the values obtained for the samples may not present results under 0,2 percent from the reference value obtained from initial tests. For inferior results specified above, it must be carried out the vertical burn test. If the vertical burn test shows satisfactory results, the new oxygen index value obtained becomes the value of reference.

**6.1.5 Complementary tests**

Besides those mentioned in the previous item, it must be carried out, according to the frequency of maintenance tests, the following tests:
- 1° semester: electrical resistivity, pressure test at high temperature and loss of mass test;
- 2° semester: mechanical characteristics of the insulation, cold bend/elongation test for the insulation and elongation of the copper.
- 3° semester: thermal shock and insulation resistance at maximum temperature of operation (70° C or 90° C);
- 4° semester: water absorption and mechanical characteristics of the insulation.

**Note:** the reference for these tests is the granting of the Conformity Certificate.

## SPECIFIC ANNEX VIII

### 1 PURPOSE

This Specific Annex is applicable to the polyvinyl chloride (PVC) insulated cables for rated voltages up to and including 450/750V covered by ABNT NBR NM 247-5 (flexible cables).

### 2 COMPLEMENTARY DOCUMENTS

Beyond the documents of this 702-CRC-4-E, the following additional documents are applicable:

| | |
|---|---|
| ABNT NBR NM 247-5 | Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V Part 5: Flexible cables (cords) (IEC 60227-5, MOD) |
| ABNT NBR NM 247-1 | Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V Part 1: General Requirements (IEC 60227-1, MOD) |
| ABNT NBR NM 247-2 | Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V Part 2: Test Methods (IEC 60227-2, MOD) |

### 3 ACRONYMS

MOD Modified
NM "Norma Mercosul" that in English means Mercosul Standard
PVC "Cloreto de Polivinila" that in English means Polyvinyl chloride

### 4 DEFINITIONS

#### 4.1 Family

The products covered by this Specific Annex are divided into the following families:
a. Non-sheathed flat cord (parallel cord) Designation 247 NM 42-C5 and 247 NM 42-C6;
b. Cord for indoor decorative lighting chains. Designation 247 NM 43-C5;
c. Light polyvinyl chloride sheathed cord (flat flexible cable 300/300V) Designation 247 NM 52-C5;
d. Light polyvinyl chloride sheathed cord (circular flexible cable 300/300V) Designation 247 NM 52-C5;
e. Ordinary polyvinyl chloride sheathed cord (flat flexible cable 300/500V) Designation 247 NM 53-C5;
f. Ordinary polyvinyl chloride sheathed cord (circular flexible cable 300/500V) Designation 247 NM 53-C5.

### 5 INITIAL TESTS

#### 5.1 Definition of Initial Tests, Sampling and Criteria of Acceptance

**5.1.1** The initial tests are those of type and flexing, established in the Specific Annex VIII of the TRQ for this object.

**5.1.2** The quantity of samples required for the tests is established in the standard ABNT NBR NM 247-5. The testing requirements to be met by the cables and cords, according to their families are:

| Product | Nº of cores | Strand class | Voltage (V) | Profile | Type tests (nº x mm²) | Flexing tests (nº x mm²) |
|---|---|---|---|---|---|---|
| 247 NM 42 | 2 | 5 or 6 | 300 | Flat | 2 x 2,5 | 2 x 0,5 |
| 247 NM 43 | 1 | 5 | 300 | -- | 1 x 0,75 | --- |
| 247 NM 52 | 2 | 5 | 300 | Flat | 2 x 0,5 | --- |
| | 2 and 3 | | | Circular | 3 x 0,75 | --- |
| 247 NM 53 | 2 and 3 | 5 | 500 | Flat | 2 x 0,75 | 3 x 1,5 |
| | 2 to 5 | | | Circular | 3 x 2,5 | 2 x 0,5 |

**Note:** If the cable section mentioned is not submitted to the certification process, the closest section possible must be tested.

**5.1.2.1** For cables of designation 247 NM 42, the smallest conductor class must be tested from those requested by the supplier.

**5.1.2.2** In case of cables of designation 247 NM 52 and 247 NM 53 flat and circular, the previous mentioned tests in the table must be carried out on the flat profile of designation 52 and on the circular profile of designation 53. The routine tests and flexing tests must be additionally carried out on the flat profile of designation 53 and on the circular profile of designation 52.

**Note:** the tests referred in the standard ABNT NBR NM 247-5 as routine and receiving, must also be understood here as routine tests.

**5.1.3** The sample to be taken for the tests must consist of a cable coil from the manufacturer logistics with a minimum length of 100 m or, in case of cable conditioned in wheel, a sample length must be at least 30 m, sufficient to perform all tests. For the specific case of sample for the flexing test, when the sample is taken as the section indicated in the table of item 5.1.2 having different section from the samples for the other tests, the minimum length of cable only for the flexing test must be 10 m.

**5.1.3.1** A sample must be collected for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

## 6 MAINTENANCE TESTS

### 6.1 Maintenance test plan

**6.1.1** The maintenance tests are classified into basic tests and complementary tests. Both are carried out half-yearly (every 6 months), therefore the basic tests for the product are always the same while the complementary tests vary every semester. The description of the tests and requirements are established in the Specific Annex VIII of the TRQ for this object.

**6.1.1.1** If a non-conformity is identified during the tests of a semester, in the next periodic evaluation must be carried out the tests for that semester and also all the tests of the previous semester for when was identified the non-conformity.

**6.1.2** The maintenance tests must be carried out on the samples collected in the market. For every maintenance, the cables to be tested must be in accordance with their nominal sections collected randomly in the family tested.

**6.1.3** The sample to be taken for the tests must consist of a cable coil from the manufacturer logistics with a minimum length of 100 m or, in case of cables conditioned on the wheels, a sample length must be at least 30 m, sufficient to perform all tests. Furthermore, it must be collected sample of 30 m of copper wire before the process of strand, for the tests of elongation and electrical resistivity.

**6.1.3.1** A sample must be collected for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

#### 6.1.4 Basic Tests

Every six months must always be performed the following tests on each of the selected samples:
- Marking verification of the label and product;
- Dimension verification;
- Construction requirements checking;
- Voltage tests on cores and on the complete cable;
- Electrical resistance of the conductor;
- Core separation;
- Insulation resistance at 20 º C.

#### 6.1.5 Complementary Tests

Besides those mentioned in the previous item, it must be carried out according to the frequency of the maintenance test, the following tests:

- 1º Semester: Electrical resistivity of the conductor, pressure test at high temperature and flexing;
- 2º Semester: Mechanicals for the insulation/sheath, cold bending/elongation test, cold impact on the complete cable and elongation at break of the conductor;
- 3º Semester: Heat shock, non-propagation of the flame test and loss of mass test;
- 4º Semester: Insulation resistance at 70 °C, mechanicals for the insulation/sheath and non-contamination test.

**Note:** the reference for these tests is the granting of the Conformity Certificate.

## SPECIFIC ANNEX IX

### 1 PURPOSE

This Specific Annex applies to non-sheathed single-core and sheathed multicore flexible cables insulated with heat resistant silicone of rated voltages up to and including 450/750V, covered by the standard ABNT NBR NM 274.

### 2 COMPLEMENTARY DOCUMENTS

Beyond the documents of this RAC the following additional documents are applicable:

| | |
|---|---|
| ABNT NBR NM 274 | Non-sheathed single-core and sheathed multicore flexible cables insulated with heat resistant silicone of rated voltages up to and including 450/750V |

### 3 ACRONYMS

NM Mercosul Standard

### 4 DEFINITIONS

#### 4.1 Family

The products covered by this Specific Annex are divided into the following families:

a. Non-sheathed single-core flexible cables insulated with heat resistant silicone, for maximum temperature of 180°C on the conductor, designation 274 NM SIL 01-CX (flexible cable 300/500 V) or designation 274 NM SIL 02-CX (flexible cable 450/750 V);

b. Sheathed multicore flexible cables insulated with heat resistant silicone, for maximum temperature of 180°C on the conductor, designation 274 NM SIL 03 - CX (flexible cable 300/500 V) or designation 274 NM SIL 04-CX (flexible cable 450/750 V).

**Note**: X is equal to 4 or 5, according to the used conductor class.

### 5 INITIAL TESTS

#### 5.1 Definition of Initial Tests, Sampling and Criteria of Acceptance.

**5.1.1** The initial tests must occur according to the Specific Annex IX of the TRQ for this object and according to the following table:

| Product | N.º of cores | Conductor class | Voltage (V) | Type tests |
|---|---|---|---|---|
| Single core | 1 or 2, 3, 4, 5, 7, 12 | 4 or 5 | 300/500 | On the smallest section of the highest conductor class and on the highest section of the smallest conductor class produced. |
| | | | 450/750 | |
| Multicore | 1 or 2, 3, 4, 5, 7, 12 | 4 or 5 | 300/500 | On the smallest section of the highest conductor class and on the highest section of the smallest conductor class produced. |
| | | | 450/750 | |

**5.1.2** The maximum section to perform the initial tests must be 1x120mm² or 4x10mm².

**5.1.3** Type tests are applicable for both single core and for multicore cables, on the smallest section of the highest conductor class and highest section of the smallest conductor class produced cable and for the highest voltage level, among those submitted to certification process. In this case, the cables with lower voltage level will be subjected to routine and flexibility tests.

**Note:** the tests referenced in ABNT NBR NM 274 as routine and incoming, must also be understood here as routine tests.

**5.1.5** The sample to be taken for the initial tests to be carried out must consist of a unit roll from the manufacturer stock with a nominal 100m length or, in the case of wires on reels, a sample length of at least 30 m, enough to perform all tests.

**5.1.5.1** A sample must be collected for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

## 6 MAINTENANCE TESTS

### 6.1 Maintenance test plan

**6.1.1** The maintenance tests are classified into basic tests and complementary tests. Both are carried out half-yearly (every 6 months), however the basic tests for the product are always the same while the complementary tests vary each semester. A description of the tests and requirements are set out in Annex IX of the TRQ specific to this object.

**6.1.1.1** If a non-conformity is identified during the tests of a semester, in the next periodic evaluation must be carried out the tests for that semester and also all the tests of the semester when was identified non-conformity.

**6.1.2** The maintenance test must be carried out on the samples collected in the market on one section of each product family. Each maintenance, the cables to be tested must be according to their nominal sections, collected randomly in the family tested.

**6.1.3** The sample to be taken, for maintenance tests, must consist of a cable roll from the manufacturer stock with a minimum length of 100 m or, in case of cable reels, a sample length must be at least 30 m, enough for all tests to be carried out.

**6.1.3.1** A sample must be collected for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

### 6.1.4 Basic Tests

Every six months must always be performed the following tests:
- Marking verification;
- Construction requirements;
- Dimension verification of the conductor, insulation and sheath;
- High voltage test;
- Conductor resistance.

### 6.1.5 Complementary Tests

Besides those mentioned in the previous item, it must be carried out according to the frequency of the maintenance test, the following tests:
- 1º Semester: Voltage test on cores, when applicable;
- 2º Semester: Mechanical characteristics, before and after ageing (insulation and sheath);
- 3º Semester: Hot set test (insulation and sheath);
- 4º Semester: No specific tests for this semester.

**Note:** the reference for these tests is the granting of the Conformity Certificate.

## SPECIFIC ANNEX X

### 1 PURPOSE

This Annex applies to Rubber insulated cables of rated voltages up to and including 450/750 V, covered by ABNT NBR NM 287-3 (Heat resistant silicone insulated cables).

### 2 COMPLEMENTARY DOCUMENTS

Besides the documents of this RAC the following complementary documents are applicable:

| | |
|---|---|
| ABNT NBR NM 287-3 | Rubber insulated cables of rated voltages up to and including 450/750 V<br>Part 3: Heat resistant silicone insulated cables (IEC 60245-3 MOD) |

### 3 ACRONYMS

MOD Modified
NM Mercosul Standard
IE2 Silicone rubber compound

### 4 DEFINITIONS

#### 4.1 Family

For this specific annex, it is considered only one family of cables, according to designation 287 NM 03.

### 5 INITIAL EVALUATION

#### 5.1 Definition of Initial Tests, Sampling and Acceptance Criteria

**5.1.1** The initial tests are those of type and flexing, established in the Specific Annex X of the TRQ specific for this object, and must be carried out on the smallest and on the highest sections of the family.

**5.1.2** The sample to be taken for the initial tests to be carried out must consist of a unit roll from the manufacturer stock with a nominal 100m length or, in the case of wires on reels, a sample length of at least 30 m, enough for all tests to be carried out.

**5.1.2.1** A sample must be collected for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

### 6 MAINTENANCE TESTS

#### 6.1 Maintenance test plan

**6.1.1** The maintenance tests are classified into basic tests and complementary tests. Both are carried out half-yearly (every 6 months), however the basic tests for the product are always the same while the complementary tests vary every semester. The description of the tests and requirements are established in the Specific Annex X of the TRQ for this object.

**6.1.1.1** If a non-conformity is identified during the tests of a semester, in the next periodic evaluation must be carried out the tests for that semester and also all the tests of the semester of when a non-conformity was identified.

**6.1.2** The maintenance test must be carried out on the samples collected in the market on one section of each product family. For every maintenance, the cables to be tested must be according to their nominal sections collected randomly in the family tested.

**6.1.3** The sample to be selected for the tests must consist of a cable roll from the manufacturer stock with a minimum length of 100 m or, in case of cable reels, a sample length must be at least 30 m, enough for all the tests to be carried out.

**6.1.3.1** A sample must be collected for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

**6.1.4 Basic Tests**

Every six months must always be performed the following tests:
- Marking checking;
- Construction requirements;
- Dimension checking of the conductor, insulation and braid;
- Voltage test;
- Conductor resistance;

**6.1.5 Complementary Tests**

Besides those mentioned in the previous item, it must be carried out according to the frequency of the maintenance test, the following tests:
- 1º Semester: Mechanical characteristics before and after ageing in an air oven;
- 2º Semester: No specific tests for this semester;
- 3º Semester: Hot set test;
- 4º Semester: No specific tests for this semester.

**Note:** the reference for these tests is the granting of the Conformity Certificate.

## SPECIFIC ANNEX XI

### 1 PURPOSE

This Specific Annex applies to Rubber insulated cables of rated voltages up to and including 450/750V, covered by ABNT NBR NM 287-4 (Cords and flexible cables).

### 2 COMPLEMENTARY DOCUMENTS

Besides the documents of this RAC the following complementary documents are applicable:

| | |
|---|---|
| ABNT NBR NM-287-4 | Rubber insulated cables of rated voltages up to and including 450/750 V Part 4: Cords and flexible cables (IEC 60245-3 MOD) |
| ABNT NBR NM-287-1 | Rubber insulated cables of rated voltages up to and including 450/750 V Part 1: General requirements (IEC 60245-1, MOD) |
| ABNT NBR NM-287-2 | Rubber insulated cables of rated voltages up to and including 450/750 V Part 2: Test methods (IEC 60245-2 MOD) |

### 3 ACRONYMS

EPR Ethylene Propylene
IE4 Ethylene Propylene rubber compound (EPR)
HEPR Ethylene Propylene rubber compound "Hard grade"
MOD Modified
SE3 Rubber compound
SE4 Polychloroprene compound

### 4 DEFINITIONS

#### 4.1 Family

The products covered by this Specific Annex are divided into the following families:
a. Circular flexible cable IE4 SE3 300/500V Class 5 - Code: 287 NM 53-C5-60;
b. Circular flexible cable EPR or HEPR SE3 300/500V Class 5 - Code: 287 NM 53-C5-90;
c. Circular flexible cable IE4 SE4 300/500V Class 5 - Code: 287 NM 57-C5-60;
d. Circular flexible cable EPR or HEPR SE4 300/500V Class 5 - Code: 287 NM 57-C5-90;
e. Circular flexible cable IE4 SE4 450/750V Class 5 - Code: 287 NM 66-C5-60;
f. Circular flexible cable EPR or HEPR SE4 450/750V Class 5 - Code: 287 NM 66-C5-90

### 5 INITIAL TESTS

#### 5.1 Definition of Initial Tests, Sampling and Acceptance Criteria

**5.1.1** The initial tests are those of type established in the Specific Annex XI of the TRQ specific for this object.

**5.1.2** The requirements to be met for the tests of cables and cords, according to their families are:

| Product | Nº of cores | Conductor class | Voltage (V) | Profile | Type tests (nº x mm²) |
|---|---|---|---|---|---|
| 287 NM 53 | 2 to 5 | 5 | 500 | Circular | One sample of the smallest section and the smallest number of cores |
| 287 NM 57 | 2 to 5 | 5 | 500 | | |
| 287 NM 66 | 1 to 5 | 5 | 750 | | |

**5.1.3** The sample to be selected for the tests must consist of a cable roll from the manufacturer stock with a minimum length of 100m or, in case of cable reels, a sample length must be at least 30 m, enough for all tests to be carried out.

**5.1.3.1** A sample must be collected for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

**5.1.4** Changes in cable insulation make necessary further tests to be carried out, according to the table above and the family division.

## 6 MAINTENANCE TESTS

### 6.1 Maintenance test plan

**6.1.1** The maintenance tests are classified into basic tests and complementary tests. Both are carried out half-yearly (every 6 months), however the basic tests for the product are always the same while the complementary tests vary each semester. The description of the tests and requirements are established in the Specific Annex XI of the TRQ specific for this object.

**6.1.1.1** If a non-conformity is identified during the tests of a semester, in the next periodic evaluation must be carried out the tests for that semester and also all the tests of the semester when a non-conformity was identified.

**6.1.2** The maintenance test must be conducted on samples collected in the market on one section of each product family. For each maintenance, the cables to be tested must be according to their nominal sections collected randomly in the family tested.

**6.1.3** The sample to be selected for the tests must consist of a cable roll from the manufacturer stock with a minimum length of 100 m or, in case of cable reels, a sample length must be at least 30 m, enough for all tests to be carried out. Furthermore, it must be collected sample of 30m elemental copper wire, before the stranding process, for the determination of elongation and electrical resistivity of the copper.

**6.1.3.1** A sample must be collected for proof, counterproof and witness, according to item 6.2.4.2, of the main part of this document.

**6.1.4 Basic Tests**
Every six months must always be performed the following tests:
- Marking verification;
- Construction requirements (including ovality, when applicable);
- Voltage test;
- Conductor resistance; and
- Insulation resistance at 20°C

**6.1.5 Complementary Tests**
Besides those mentioned in the previous item, it must be carried out, per family and according to the frequency of the maintenance tests, the following tests:

a) Circular flexible cable IE4 SE3 300/500V Class 5 or Circular flexible cable EPR or HEPR SE3 300/500V Class 5
- 1º Semester: Flexing test followed by voltage test, Hardness (HEPR) and electrical resistivity;
- 2º Semester: Mechanical characteristics (insulation/sheath), cooper elongation and module of elasticity HEPR;
- 3º Semester: Voltage test on cores, hot set and insulation resistance at the maximum temperature of operation (60ºC or 90°C);
- 4º Semester: Ozone resistance, tensile strength after ageing in an air bomb and water absorption (EPR or HEPR).

b) Circular flexible cable IE4 SE4 300/500V Class 5 or Circular flexible cable EPR or HEPR SE4 300/500V Class 5
- 1º Semester: Flexing test followed by voltage test, Hardness (HEPR), electrical resistivity and cold bending for the sheath (applicable only for compound SE 4);
- 2º Semester: Mechanical characteristics (insulation/sheath), tensile strength after oil immersion and cooper

elongation and module of elasticity for HEPR;
- 3º Semester: Voltage test on cores, hot set and insulation resistance at the maximum temperature of operation (60ºC or 90°C);
- 4º Semester: Ozone resistance, Tensile strength after ageing in an air bomb and water absorption (EPR or HEPR).

***c) Circular flexible cable IE4 SE4 450/750V Class 5 or Circular flexible cable EPR or HEPR SE4 450/750V Class 5***
***- 1º Semester: Flexing test followed by voltage test, hardness (HEPR), electrical resistivity and cold bending/elongation;***
***- 2º Semester: Mechanical characteristics (insulation/sheath), cooper elongation and module of elasticity for HEPR; Traction after oil immersion *.***
***- 3º Semester: Voltage test on cores, hot set and insulation resistance at the maximum temperature of operation (60ºC or 90°C);***
***- 4º Semester: Ozone resistance, tensile strength after ageing in an air bomb and water absorption (EPR or HEPR).***
**** TUV requirement.***

**Note:** the reference for these tests is the granting of the Conformity Certificate.