

Test Regimes for HV and EHV Cable Connectors

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ABSTRACT

This paper introduces the final report TB 758 of the CIGRE WG B1.46 proposing test regimes for connectors for high voltage (HV) and extra high voltage (EHV) cables. The standard, IEC 61238-1-3 applies to cable connectors up to 30 kV. There is no IEC standard for testing HV/EHV connectors. The task of the WG was to review existing cable connector designs, collect available experimental data, service conditions and performance of connectors in the field, including highly loaded systems, and propose thermal and mechanical tests with special attention to connectors for large cable conductors.

KEYWORDS

Cable connectors, ferrules, type tests, development tests

INTRODUCTION

When WG16 of IEC TC20 commenced work on revision of the IEC 61238-1, the standard on testing low voltage (LV) and medium voltage (MV) compression and mechanical cable connectors, it was decided to split the standard into 3 parts: Part 1 for low voltage (LV) connectors; Part 2 for LV piercing connectors and Part 3 for MV connectors. A part 4 (IEC 61238-1-4) was planned to cover HV and EHV cable connectors. For this a technical evaluation by experts in HV and EHV cable systems / accessories was necessary and TC20 agreed to pass the work to CIGRE. Study Committee B1 of CIGRE set up WG B1.46 to review this subject and to issue a report proposing the tests for HV and EHV cable connectors.

IEC 61238-1 was originally developed for LV and MV connectors as commodity products. As such, MV connectors may be, and in many cases are, used and installed in MV cable accessories without consent from the cable accessory manufacturer. Inappropriate use and improper installation of MV connectors have been the cause of numerous failures in MV networks, especially in systems with high and intermittent loads such as wind farms.

In HV/EHV applications, where the system approach is dominant, connectors are often developed for a specific projects and specific cable design. The test requirements specified in IEC 61238-1 do not fully reflect thermal and mechanical stresses existing in HV and EHV applications. Some tests are neither practical nor relevant for large size connectors. Consequently, manufacturers of HV / EHV cable systems and accessories came up with their own test regimes to verify suitability of new connectors to be used first in the test circuits for cable accessories and systems and subsequently in the field. For HV / EHV the

development, design, testing and installation of connectors is under strict control of the cable system/accessory manufacturer who takes full responsibility for their performance. Upon successful development tests, the connector / conductor combinations are used in type testing cable systems and accessories according to the relevant IEC standard, IEC 60840 or IEC 62067.

The feedback on performance of HV/EHV cable connectors in the field is very positive. The results of the worldwide survey conducted by the WG and contributions presented by major users at the WG meetings, are provided in the Technical Brochure (TB).

Based on current experience, the WG proposes a test sequence to provide guidance in development tests for new HV/EHV conductor-connector combinations. The proposed tests may be used for evaluation of other connectors, such as terminal lugs for outdoor terminations, sliding connections in GIS terminations and so on. The sequence and test methods are presented by the WG for evaluation purposes. Type tests for HV/EHV connectors are not recommended at this point of time.

CONTENT OF TB 758

The TB describes the use, function, design and testing of connectors for HV / EHV power cables in concise form avoiding lengthy discussions readily available in the literature. A comprehensive reference is provided for those interested in a particular topic.

There are ten chapters in the TB:

- background information
- cable conductor designs
- connection theory
- cable connectors in accessories
- connector installation
- field experience
- existing test methods for connectors
- proposal for connector development tests
- conclusions
- bibliography/references

Differences between MV and HV cable connectors

One can argue that due to the identical function of connectors in MV and HV / EHV networks, the evaluation criteria should be the same. Not so. The following are some of the reasons.

- The cable size in MV ranges from 95 to 1200 mm², in HV from 185 to 3000 mm² or larger.
- The thermal impact of cable accessories, for pre-