

How to perform a prequalification test – interpretation of the standard

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ABSTRACT

With the first edition of IEC 62067 in 2001 the prequalification test (PQ Test) was introduced. The test subjects highly stressed cable designs and their accessories to heating cycles under voltage. The cable is usually installed under various laying conditions, resulting in different conductor temperatures. The prequalification test requires the voltage to be applied during one year and at least 180 heating cycles, each with a minimum of 24 hours. This leaves room for interpretations and consequently different ways to execute this test, resulting in different outcome depending on the choices made at the start.

KEMA Laboratories has performed this test since the first edition of IEC 62067 at their test facility in Arnhem, the Netherlands, and has witnessed this test at various manufacturers and test facilities world-wide. Based on our experience, a guideline is given to execute this prequalification test in accordance with the requirements in the standard and in line with the background for this test.

KEYWORDS

prequalification, experience, recommendation, PQ, HV, EHV.

INTRODUCTION

Extruded cable systems up to 150 kV, which are covered by IEC 60840, are tested based on type tests, sample tests and routine tests. This series of tests is considered adequate to verify design and production of extruded cable and their accessories. With the introduction of extruded cable systems at voltages above 150 kV, it was felt that this series of tests is not sufficient to proof the long term reliability of these cable systems. Investigations by CIGRE WG 21.03 and later on by TF 21.18, resulted in a recommendation [1] to include a long term test, called prequalification test, to cover the long term reliability of these cable systems. The main part of this prequalification

test is a long term ac voltage test with heating cycles. The CIGRE recommendations address the test arrangements and which tests are to be performed, or test schedule. It recommends to install approximately 100 m cable and accessories in arrangements representing (various) practical conditions. During one year a voltage of $1,7 U_0$ is to be applied while at the same time the test loop is to be subjected to thermal cycles. No number of heating cycles is given in the CIGRE recommendations, but it states that the cycles should take place during the whole of the test period, i.e. one year. To prove the ac voltage has not caused any damage, a lightning impulse voltage test on cable samples is proposed.

Only minor changes were made when this prequalification test was introduced in the first edition of IEC 62067. The present, second edition of this standard [2] is practically identical to the first edition. According to the standard, the prequalification test is to be performed on a cable system consisting of approximately 100 m of complete cable and at least one of each type of accessory. This cable system is to be installed under various laying conditions such as direct buried, rigidly installed in a tunnel, installed in a duct, etc. An impression of the construction of one of the test sites in Arnhem is shown in figure 1. The test set-up is to be submitted to a heating cycle voltage test, which takes one year (8760 hours), followed by a lightning impulse voltage test on one or more cable samples taken from the test set-up or on the whole test set-up. Finally an examination of the cable system after completion of these two tests must be performed.

During the heating cycle voltage test the cable is to be heated to a temperature slightly above the maximum operating conductor temperature. The minimum duration of a heating cycle is 24 hours: a minimum of 8 hours for heating and a minimum of 16 hours for natural cooling. The total number of heating cycles is not fixed but at least 180 heating cycles are to be carried out.



Fig. 1: Construction of the test site; in the middle tunnel elements and at right hand side termination supports