

Quality Checks on LV and MV cables as an act of Supplier Quality Management

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ABSTRACT

Dutch DSO Enexis decided to perform quality checks on low and medium voltage cables on a yearly basis. This in addition to routine tests and sample tests carried out by cable manufacturers on prescription in the cable standards. The tests conducted at the laboratories of ENGIE-Laborelec have proven to be useful. Deviations found, during the investigation, were discussed with the concerned parties and led to improvements in the production and/or testing processes.

INTRODUCTION

Suppliers play an important role in the success of an organization. They can be of added value where confidence levels are high and work is performed in good partnership. In these situations, delivery of products and services from suppliers may exceed expectations. On the other hand, suppliers can become a major concern, delivering problems and swallowing up resources and money. Mostly Enexis finds itself in a comfortable situation somewhere between these extremes. The quality of purchased network components is among others secured by requiring quality management certifications from suppliers as well as type tests, sample tests and routine tests according to relevant component standards.

As, according to Enexis, cable manufacturers increasingly seem to manufacture around the lower limits of the standards, possibly due to the competition in the market, Enexis decided to perform random quality checks on low and medium voltage cables on a yearly basis. This in addition to routine tests and sample tests already carried out by cable manufacturers on prescription of the cable standards. Together with ENGIE-Laborelec, several checks were determined regarding the conductor, insulation, semiconducting layers, earth screen and the outer sheath. Cable samples were randomly chosen by Enexis. The quality checks were conducted at the laboratories of ENGIE-Laborelec.

Figure 1 shows an overview of the performed checks and their outcomes. It can be concluded that 9 of the 117 quality checks did not achieve the specified requirements (red colour). This outcome shows the importance of performing such “after sales quality checks”.

QUALITY CHECKS ON MV CABLES

The following quality checks were determined for and performed on four selected MV-cable samples:

- Aluminum conductor: Verification of the diameter and the conductor resistance.
- XLPE insulation: Verification of thickness, material composition, melting temperature, elongation under load and resistance to water treeing (test at 3 kHz).
- Insulation screen: Verification of thickness, material composition, melting temperature and resistivity.
- Copper wire screen: Verification of the cross-sectional area and the screen resistance.
- Water barrier: water penetration test.
- PE outer sheath: Verification of thickness, material composition, melting temperature, shrinkage test.

Almost all checks performed, concerned a repetition of routine tests or sample tests, described in the applicable cable standard [1]. The performed 3kHz test however, is not in accordance with the cable standard but concerns an in-house development of ENGIE-Laborelec [2] [3].

Test outcome for MV cables

Thickness of the outer sheath

The tests carried out on the cable samples showed, among others, that the thickness of the outer sheath of one specific cable of one supplier (sample R1053) did not meet the requirements. In this case the manufacturer incorrectly referred to an old agreement between Enexis and the manufacturer that had expired by the last tender and was overruled by new specifications. After discussion with Enexis this manufacturer has promised to produce this cable in accordance with the specifications in the cable standard [1].

Shrinkage test

Too much shrinkage of the outer sheath was observed on two cable samples (R1054 and R1056) of one other manufacturer. This manufacturer indicated that they had op-ted for production settings leading to a better workability of the outer sheath by installers. After discussion with Enexis it was decided that the production settings will be adjusted to reduce the shrinkage within the limits.

		NEN-HD 620				HD 603 (NEN 3616)		NEN 3617		
		R1053	R1054	R1055	R1056	B113	B116	B112	B114	B115
Conductor	Dimensions	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Resistance	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mech. properties	✓	✓	✓	✓	✓	✓	✓	✓	✓
Insulation	Materiaal analysis	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Dimensions	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Hot Set Test	✓	✓	✓	✓	✓	✓	✓	✓	✓
	3 kHz test	✓	✓	✓	✓	✓	✓	✓	✓	✓
Semiconductor	Mech. properties	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Conductivity	✓	✓	✓	✓	✓	✓	✓	✓	✓
Screen	Dimensions	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Resistance	✓	✓	✓	✓	✓	✓	✓	✓	✓
Water barrier	Water penetration test	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Materiaal analysis	✓	✓	✓	✓	✓	✓	✓	✓	✓
Outer sheath	Dimensions	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Shrinkage test	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mech. properties	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(before and after aging)	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Loss of mass test	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 1: Global overview of test results.