



MEASUREMENTS OF THRUST LOAD IN CABLE SYSTEMS SEMI-RIGIDLY INSTALLED IN DUCT / MANHOLE STRUCTURES



Riccardo BODEGA, Prysmian Cables and Systems, The Netherlands, riccardo.bodega@prysmian.com
 Henk GEENE, Prysmian Cables and Systems, The Netherlands, henk.geene@prysmian.com
 Frank FRENTZAS, ComEd Chicago, USA, frank.frentzas@exeloncorp.com
 Angelo DE ANGELIS, ComEd Chicago, USA, angelo.deangelis@exeloncorp.com
 Jos VAN ROSSUM, Prysmian Cables and Systems, The Netherlands, jos.rossum@prysmian.com
 Nathan KELLEY, Prysmian Power Cables and Systems, USA, nathan.kelley@prysmian.com

ABSTRACT

This paper describes an experimental approach for testing the suitability of racking systems to be used for the fixation of cables and joints in duct/manhole structures. To this purpose, thermo-mechanical forces that will occur in operation can be reproduced on a cable system of reduced length, which is fixed on a test installation composed of a full-size duct/manhole structure. Forces can be applied and measured at the cable while the racking system is monitored. This can be done for several test conditions, including asymmetric load.

Preliminary results indicate that this testing method can provide an effective picture of the suitability of the racking system, including the tracking of eventual weak spots.

KEYWORDS

Duct, manhole, cable joint, installation, semi-rigid installation, thrust forces, racking system.

INTRODUCTION

Duct/manhole structures are often used for the installation of cable systems, especially in North America. In such structures the cable system is considered semi-rigidly installed. In a manhole, the cable system is generally fixed on a racking system, to avoid uncontrolled cable bending, see figure 1. Inside the manhole the cable is then restrained from any movement due to thermal expansion. On the other hand, in a duct, the small clearance between outer surface of the cable and inner surface of the duct only allows the so-called snaking of the cable, see figure 2. Consequently, the cable may develop a thrust load when heated and its components may be subjected to compressive strain.

Thrust forces on HV cables can be as high as several tons, depending on the cable type, on the duct characteristics and on the temperature rise. Therefore, appropriate racking systems are required for a proper fixation of the cable and of the cable joints. A racking system can be considered appropriate if the reactions of the cable and joints are limited when thermo-mechanical forces that will occur in operation are applied to the cable. However, an estimation of the cable system reactions is rather difficult for cables installed in duct/manholes.

Firstly, the calculation of thrust forces for a ducted system requires a quite sophisticated modelling [1] and a number of input data that are not always known during the design

phase.

Secondly, practical situations such as the presence of bends in the cable route and/or the positioning of the cable cleats have a strong effect the behaviour of the semi-rigid installation.

For these reasons, an experimental approach has been chosen for the characterization of racking systems. After estimating the maximal cable thrust assuming the installation fully rigid, a mechanical load can be applied on a sample of the semi-rigidly installed cable system. To that purpose, the test facility described in this paper has been constructed.



Figure 1: Rigid installation of Click-fit joints a manhole.



Figure 2: Snaking of a loaded HV cable inside a duct.