QUALIFICATION AND EXPERIENCES WITH LARGE 400 kV XLPE CABLE SYSTEMS INSTALLED ON THE ARABIAN PENINSULA

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ABSTRACT

Huge infrastructure projects have been executed on the Arabian Peninsula within the last 15 years. Many of those projects show a very high demand of electrical power, which is delivered by underground XLPE cables at highest voltage levels of 400 kV and typical system length of about 15-20 km for transmission of about 1000 MVA *per system. The environmental conditions with extreme ambient temperatures ask for more severe ampacity conditions and stronger qualification parameter than required in common international standards.*
Südkabel has qualified its 400 kV/2500 mm² XLPE cable system in accordance with customer requirements for conductor temperatures up to 105°C by a specially modified qualification test consisting of 80 load cycles @105°C (without applied voltage) and final lightning impulse test with 1425 kV which was applied to the complete testing loop including all accessories.
Additionally short circuit tests with 160kA/63kA has been executed to demonstrate the short circuit current capability. This paper gives a summary of delivered 400kV XLPE cable projects projects with a total cable length of more than 700km, qualification procedures and the experiences.

KEYWORDS

EHV AC XLPE cable systems, 400 kV 2500 mm²

INTRODUCTION

In the years 2012 – 2019 Südkabel has delivered more than 700 km of 400 kV/2500 mm² XLPE isolated cables to the Arabian Peninsula.
The individual projects needed cable supplies up to 137 km cable core length. For these projects SÜDKABEL was applying their worldwide experiences based on 345-525kV XLPE projects executed since 1996 [1].
Different sheath designs (lead sheath, copper wire/Al-laminated screen, longitudinally welded Al-sheath) were chosen to fulfil the differing requirements at the individual projects on the Arabian Peninsula.
Double cable/phase and direct buried conditions are most chosen installations, but open trough installations have been executed as alternative.

OVERVIEW OF PROJECTS

The following table gives an overview of the large EHV 400kV/2500mm² cable system projects delivered by SÜDKABEL to the Arabian Peninsula:

Table 1: Overview of 400 kV projects
* installation ongoing

project name	year of comm.	cable km	sheath type	no. joints	no. GIS term.	no. outd. term.
Jeddah North to North West	2014	26	Lead	45	6	
Al Fardous	2015	137	Lead	258	21	
Princess Noura	2016	73	Al-foil Cu wire	140	18	
Sultanah	2016	101	Al-foil Cu wire	186	21	
Wha-Jam	2018	48	Lead	108	15	
Madinah	2019*	124	Lead	207	18	
Al Adel	2019*	99	Lead	192	15	12
Sohar Free Zone, Oman	2018	93	smooth welded Al	198	24	12
Total		**701**		**1334**	**138**	**24**

In total more than 700 km 400 kV XLPE cable with copper conductor and a cross section of 2500 mm² and more than 1300 joints have been delivered. Most of them have been commissioned and are under operation. Two projects are planned to be commissend during the year 2019.

TYPICAL PROJECT PARAMETERS

Typically, individual cable lengths of about 500-600 m (see Fig. 1) have been installed because of system requirements (max. induced sheath voltages) or logistic limitations (drum weight and/or drum size).
The oversea shipment has been done by ship (starting with river vessels from Mannheim harbour close to the factory, see Fig. 2). Up to 30 drums has been shipped per shipment lot.

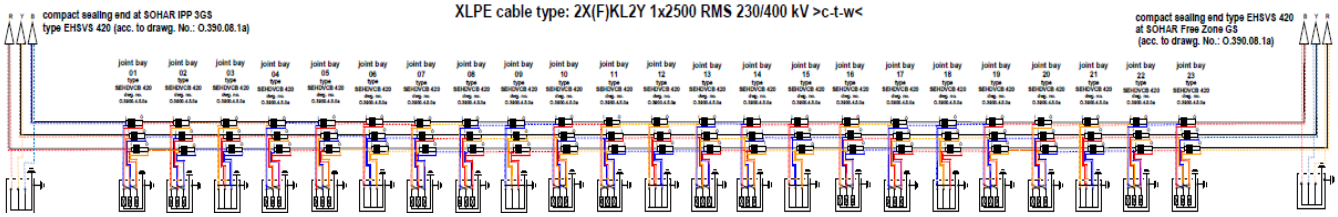

Fig 1: Typical cross bonding scheme of a large 400kV cable system