

## Research and Development of $\pm 320\text{kV}$ Flexible HVDC Power Cable

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### ABSTRACT

HVDC power cable is one of the most important equipments in the flexible DC transmission project. ZTT developed the  $\pm 320\text{kV}$  XLPE insulated HVDC power cable according to the actual demand of the  $\pm 320\text{kV}$  flexible DC transmission project in Xiamen city, China and the cable had already passed the type tests by TICW and EETC. This paper introduces the development of  $\pm 320\text{kV}$  HVDC power cable focusing on the test of space charge and electrical conductivity characteristic of insulation and screen material of DC power cable for the insulation design. Also the way of achieving longitudinal water tightness for stranded circular conductor with cross section of  $1800\text{mm}^2$  is analyzed as well as subsequent cross-linking and degasification process of insulation. Besides, the type test of the  $\pm 320\text{kV}$  XLPE insulated power cable is introduced by describing the test method and procedure of electrical performance of cable system.  $\pm 320\text{kV}$  HVDC power cable is independently researched and developed in China and its industrialization has just started and will serve domestic and overseas flexible DC transmission projects.

### KEYWORDS

Xiamen flexible DC Project; DC Cable;  $\pm 320\text{kV}$ ; Type test;

### 0 PREFACE

ZTT starts the  $320\text{kV}$  DC cable's study combined the requirements of Xiamen flexible HVDC cable demonstration project, the cable has passed the overall type test of TICW and Inspection and Test Center of Electrical Industry and Electrical Equipment Quality. ZTT provided the  $320\text{kV}$  DC cable products. The project rated voltage is  $\pm 320\text{kV}$ , transmission power is  $1000\text{MW}$ . The bipolar long length DC cable which uses the sunsea tunnel laying consists of Xiangnan convert station, Pengcun convert station, lake convert station, lakeside convert station, and  $10.2\text{km}$  DC ne, the system can operate in single pole. Cable system is provided by ZTT, which includes  $23\text{km}$  anode and cathode DC cable,  $11.5\text{km}$   $10\text{kV}$  back ground wire and matched accessory terminations etc. The project is expected to begin at the end of 2015, After the completion of the project, it will greatly improve the ability of Xiamen island's power supply and power supply reliability, Meet the needs of the local economy and load fast growth, with the development of China new energy, the exploitation of ocean resources, the expansion of urban power grid and other needs, and the improvement of commutation technology and the cable manufacturing level, flexible DC shall become the important power transmission mode in the future DC power grid.

### 1 320KV DC CBALE MAIN PERFORMANCES

The  $\pm 320\text{kV}$  Dc cable structure of Xiamen project is copper cores, XLPE insulation, grain aluminum flame retardant, anti-termite PE sheath structure, the product model is ZC-DC-Z-YJLW03  $320\text{kV}$   $1 \times 1800$ , structure is shown in Fig.1, product structure parameter is shown in Tab.1.

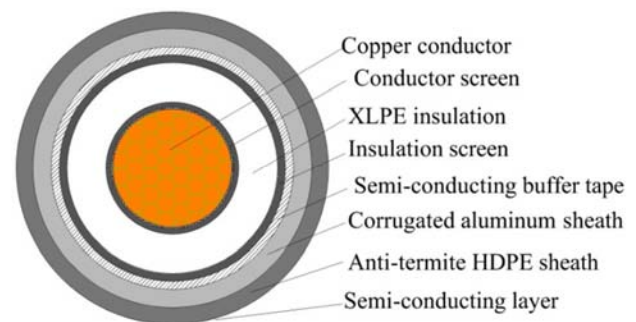


Fig.1. Structure of  $\pm 320\text{kV}$  DC land cable

Product main dimension parameters are shown in Tab.1.

Tab.1 Cable dimension sheet

Structure	Description	Value	Unit
Conductor	Cross section	1800	$\text{mm}^2$
	Conductor O.D.	50.2	mm
Conductor binder	2 layers overlap wrapping 0.27mm	51.2	mm
Conductor screen	Nominal thickness	2.0	mm
	semi-conducting screen O.D.	55.2	mm
XLPE insulation	Nominal thickness	26.0	mm
	XLPE insulation O.D.	107.2	mm
Insulation screen	Nominal thickness	1.2	mm
	semi-conducting screen O.D	109.6	mm
Longitudinal water blocking layer	Nominal thickness	$4 \times 2.0$	mm
	Semi-conducting tape O.D	121.5	mm
Corrugate aluminum sheath	Nominal thickness	2.8	mm
	aluminum sheath O.D.	138.0	mm
PE sheath	Nominal thickness	5.0	mm
	Nominal O.D.	148.0	mm

### 2 DESIGN OF DC CABLE INSULATION STRUCTURE