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The Murraylink project – the first commercial 150 kV extruded HVDC cable system

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Abstract: The Murraylink dc transmission system pushes forward the possibilities of HVDC transmission with extruded cables over long distances. The link enables a reversible power flow of more then 200 MW over a 177 km distance. The ±150 kV cable pair was installed with unprecedented speed in compliance with strict environmental regulation. This paper outlines the properties of the extruded dc cable system and highlights the ease of installation. Also, testing schemes and parameters are described.

Keywords: Murraylink, extruded dc cable, dc transmission

Résumé: Le système de transmission courant continu MurrayLink accroît les possibilités de transmission d'énergie avec des câbles à isolation extrudée. Cette connexion permet une transmission réversible de 200MW sur une distance de 177 km. L'installation de deux câbles de ±150kV a été effectuée avec une vitesse sans précédent conformément à des règlements environnementaux très stricts. Cet article décrit les propriétés du système de câbles extrudées et met en évidence la facilité d'installation. En outre, les dispositions et les paramètres d'essai sont décrits.

Mots clés: Murraylink, câbles courant continu à isolation extrudée, transmission courant continu.

1. Introduction

Long haul power transmission with direct current has a history almost a century long. The earliest dc cable link known to the authors is the 1906 4 km 110 kV dc cable system at Lyon, France. Other early dc cable connections were the 1925 Novelaise-Chambery, France, 150 kV connection and the 1944 Elbe-Berlin 200 kV cable connection [1]. The latter was, however, never commissioned due to war turmoil.

Decades later HVDC transmission schemes were chosen for long distance power lines. HVDC lines have great advantages over ac connections in terms of losses and network stability. Where overhead lines were impossible to construct dc cables were used. An impressive number of submarine HVDC links have been established.

HVDC cables have superior availability and reliability records. They are well protected against atmospheric and climate impacts and vandalism.

Until the late 90's HVDC cables were designed using the classical paper/oil insulation. This cable design is environmentally sound [2] and very well-proven. However, manufacturers and utilities wanted to use extruded cables also for dc links as they have some intrinsic advantages compared to paper-insulated cables. The extruded DC cables offer a robust design, straightforward manufacturing, top-of-the-scale environmental performance, and completely oil-free joints and terminations. Many extruded dc cable development efforts were made to harness the space charges that were made responsible for the failure of many extruded dc cables in the test labs. Two major technical breakthroughs in the late 90's paved the road for the introduction of extruded dc cables:

a) The development of Voltage (-controlled) Source (dc) Converter (VSC) stations using IGBT transistors in lieu of thyristors used in the "classical" HVDC converter stations. The VSC (IGBT converter) stations were smaller and suitable for moderate transmission capability (50-300 MW) so that more and smaller projected transmission schemes became viable [3]. The concept of "HVDC Light" enabled the connection of remote load centers, islands, or remote generation plants. With deregulation processes taking up speed the solution also became an option for electricity trading.