

Removal of submarine oil filled cables in the Tsugaru Strait 2021/2022

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ABSTRACT

The Hokkaido-Honshu HVDC Link (600 MW / DC±250 kV) connects the islands of Hokkaido and Honshu. It has contributed to the stable supply of electricity to both islands since it went into operation in 1979. In February 2018, the spare submarine cable (OF cable) was damaged by an anchor. The insulating oil in the cable leaked into the ocean, and seawater leaked into the cable, preventing the cable from carrying an electric charge. Therefore, the decision was made to decommission and remove the cable.

The removal required the safe collection of the aged cable while preventing the insulating oil from leaking into the ocean in very deep water and under volatile hydrographic conditions. Additionally, the removal area is on an international shipping route through one of Japan’s leading fishing grounds; discussions with stakeholders took a long time. From the construction planning to the completion of the cable removing work, many technical issues were resolved, and the removal was completed according to the original plan: without incident and without marine pollution. This paper is a summary of the cable removing work from the preliminary study to the completion of the removal.

KEYWORDS

Submarine cable, aged OF cable, insulating oil, removal, very deep water.

1. INTRODUCTION

The Hokkaido-Honshu Link is a 600 MW / DC±250 kV direct-current interconnection transmission facility of J-POWER Transmission Network Co., Ltd. that links the islands of Hokkaido and Honshu. The link has contributed to the stable supply of electricity over a wide area since it went into operation in 1979. (Fig.1)

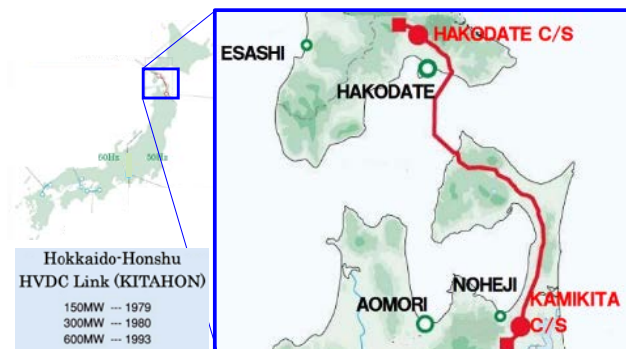


Fig.1 : Schematic location map of Kitahon DC main line

The link comprises four cables (two main lines, one spare line, one neutral line) that run roughly 43 km along a relatively gently sloped sandy route through the Tsugaru

Strait with a maximum depth of roughly 280 m. (Fig.2)

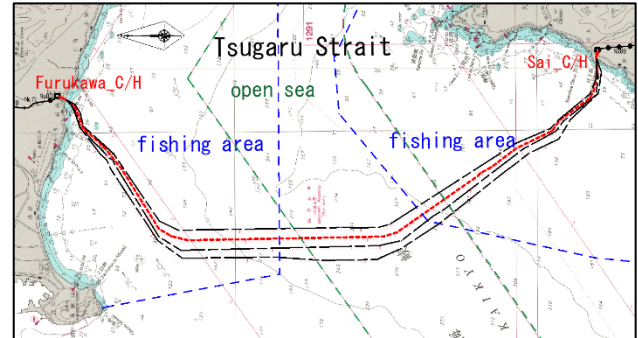


Fig.2 : Cable route

One of the main lines and the spare line are OF cables (the core of each comprises a 25-mm oil passage, a 600-mm² copper conductor, insulating paper, and lead coating) armored with 38 strands of 8-mm steel wire to ensure cable tension during installation and protect the cable from damage by reefs, fishing gear, and the like. The submarine cable is 125 mm in diameter and weigh roughly 46 kg/m. (Fig.3).

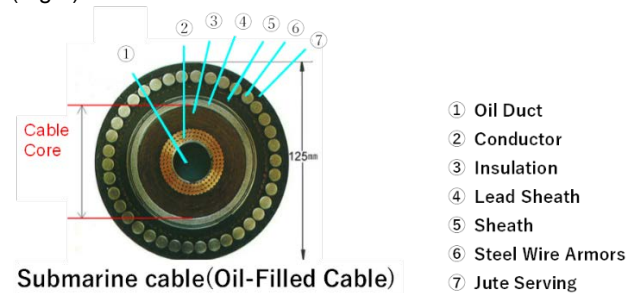


Fig.3 : Cable structure (cross-section)

In February 2018, the spare cable was damaged by an anchor at a depth of roughly 170 m and leaked oil, resulting in the shutdown of the pumping plants at both ends of the submarine cable section and the suspension of the supply of insulating oil (soft synthetic alkylbenzene oil) to the cable.

This allowed seawater to leak into the cable and prevented it from carrying an electric charge. Legally, unusable cables are considered waste; therefore, removal of the entire cable was required, except for some sections where collection was technically impossible.

2. OVERVIEW OF WORK

To safely collect the damaged cable, it was necessary to consider measures to prevent insulating oil leakage and cable breakage due to the age-related deterioration of the steel wires. In addition, the cable removal work required the agreements of many interested parties, including government agencies, fishing cooperatives, and other