



CASE STUDY

OISD/CS/2025-26/P&E/09

Dt.: 04/09/25

INTRODUCTION

Title: 220 KV cable fire incident in a RCC cable trench.
Location: Refinery
Loss/ Outcome: Complete damage of 4 nos. of 220 KV feeders (total 12 nos cables) in a span of 175 m

BRIEF OF INCIDENT

Total 4 feeders comprising of 12 nos. of 220 KV Extra High Voltage (EHV) cables were laid inside a RCC trench. Cable fault in one of the feeders triggered series of adjacent cable failures within the cable trench corridor for nearly 175 m. The heavy smoke caused by the incident drew attention of the local public, local panchayat bodies & media.

Cable failure and the extent of damage was observed to be similar in nature in all the four feeders.

OBSERVATIONS / LAPSES

1. All the cables were laid inside a RCC trench (approximately 1.5 m deep & 2 m wide) covered with heavy duty slabs. This trench was passing through the industry premises. Two feeders were providing supply to the industry while other two feeders were interconnecting two sub-stations of the State Electricity Board.
2. A fault was recorded for one of the feeder at State Electricity Board sub-station when it was charged after a maintenance job.
3. Extensive damage to the cable joint of R-phase of one of the cable, adjacent supports and chipping of concrete were observed near to the said joint. Apparently, during the charging, the failure of cable joint occurred accompanied with explosion.
4. Only the metal parts of the cables viz. copper conductor, copper armour & aluminium sheath/armour parts remained after the incident. The soft parts (XLPE insulation) of all the cables in a stretch of 175m had burned. The OFC cables for cable differential protection, which were also laid in the same trench, were also destroyed.
5. Confirmation of tripping of all feeders was received from the State Electricity Board at 1830 hrs. However, firefighting using foam was initiated at 2020 hrs. only after confirmation of positive isolation from State Electricity Board. The delay in proper firefighting led to exacerbated damage to the cables and extensive smoke in nearby areas. Fire could be controlled only after use of foam.
6. The Distributed Temperature Measuring System (DTMS) was provided in all 4 feeders. However, same was not monitored at a manned location. In absence of proper monitoring, no pre-incident alarm was triggered to contain the damage.

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7. General practice of laying of 220 KV cable in trenches in oil installations is not very prevalent and has started in the past few years. Accordingly, the guidelines like, fire/smoke detection system, advanced monitoring techniques such as Partial Discharge (PD) are not yet established. Hence, such facilities were not installed in trench/any of the cables. In absence of such advanced techniques, fault (arcing) at incipient stage could not be detected.

Configuration of cables in the trench – healthy portion



Extensive damage to all 12 power cables in a stretch of 175 m

Bare copper conductor with all outer covering viz XLPE insulation etc. melted away

Cable joint after explosion

Initiation point of the damage with extensive damage to cable trays, supports, adjacent concrete structure & melting away of copper conductor



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REASONS OF FAILURE / ROOT CAUSE

The cable joint might have deteriorated due to poor workmanship during cable jointing or manufacturing issues and the charging of the cable resulted in the cable joint failure triggered by the switching surge. The cable joint explosion heat-initiated smouldering of insulations of other three feeders and resulted in failure of the other cables also.

In absence of any systemic monitoring process, like Partial discharge (PD) detection, the cable joint deterioration remained undetected. Furthermore, inspite of availability of Distributed Temperature Measuring System (DTMS) system, early detection and preemptive action could not be taken as the same was not being utilized/ monitored.

RECOMMENDATIONS

1. Ensure continuous monitoring of distributed temperature measuring system (DTMS) at a manned location with configuration of alarm to alert operator in case of hot spot generation and/or abnormal rise/rate of rise in cable temperature.
2. Online Partial discharge (PD) monitoring system for all EHV systems shall be provided for detecting faults at an incipient stage before it converts into a major fault.
3. EHV Cable joints inside a cable trench should be protected against fire/explosions by suitable means like fire- and explosion-proof partitions, joint protection boxes, fire- and explosion-proof blankets, covering with sand etc.
4. Fire-fighting shall be ensured immediately on de-energisation of the power supply. Same shall be sensitised to the fire-fighting crew and first responders. Training and mock exercises should be ensured.
5. Ensuring close coordination/interaction with State Electricity Board on regular basis for status updates and emergency coordination for feeders passing through the industry premises.
6. Industry to carry out the root cause analysis for cable joint failure along with the cable OEM's. Any recommendations thereof shall be implemented in a time bound manner.