

1.4 Qualification of 525 kV DC extruded cables

Technologies for Global Energy Grid

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Dr. Roland D. Zhang

Topics

- Introduction
- GTSO PQ tests for HVDC underground cable systems
- Qualification of DC submarine cable systems for offshore wind
- Discussion

Introduction (1)



Europe's first cross-border TSO

- Headquartered in Arnhem (the Netherlands) and Bayreuth (Germany)
- Fully owned by the State of the Netherlands
- The 4th largest TSO in the EU after RTE (France), Terna (Italy), REE (Spain)
- Grid availability 99,9988% in 2018
- Worldwide the largest TSO for HVDC extruded cables

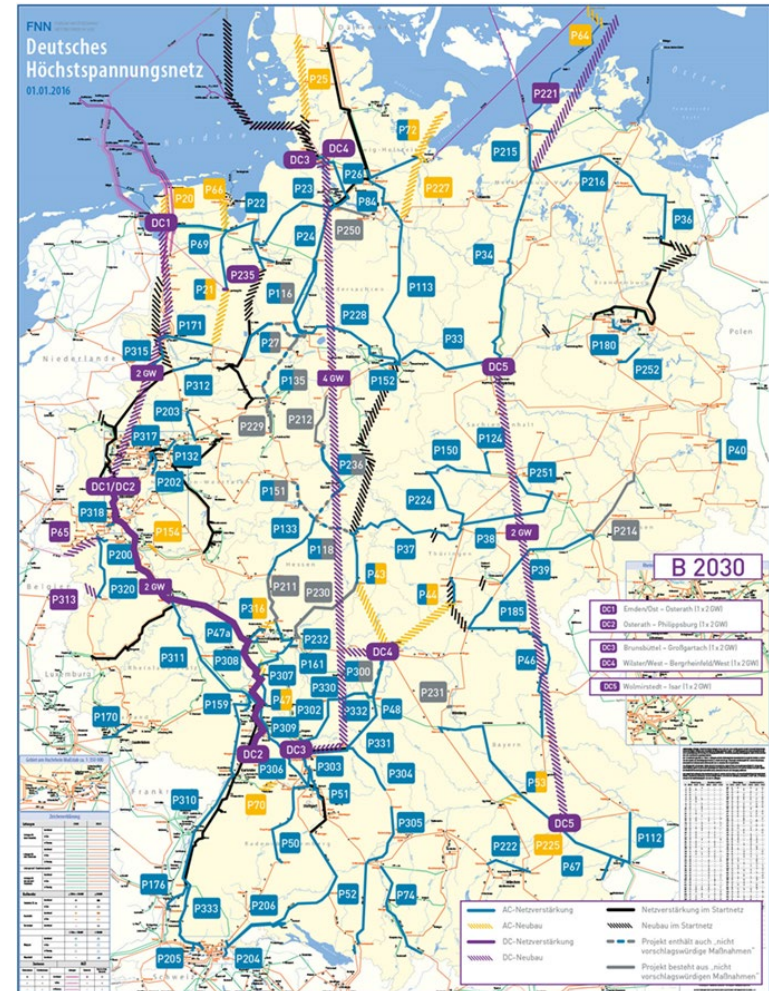




Introduction (2)

Why needs TenneT the qualification of DC 525kV cable

- German Energy transition: new DC corridor transmission projects
- Dutch offshore project: Ijmuiden Ver



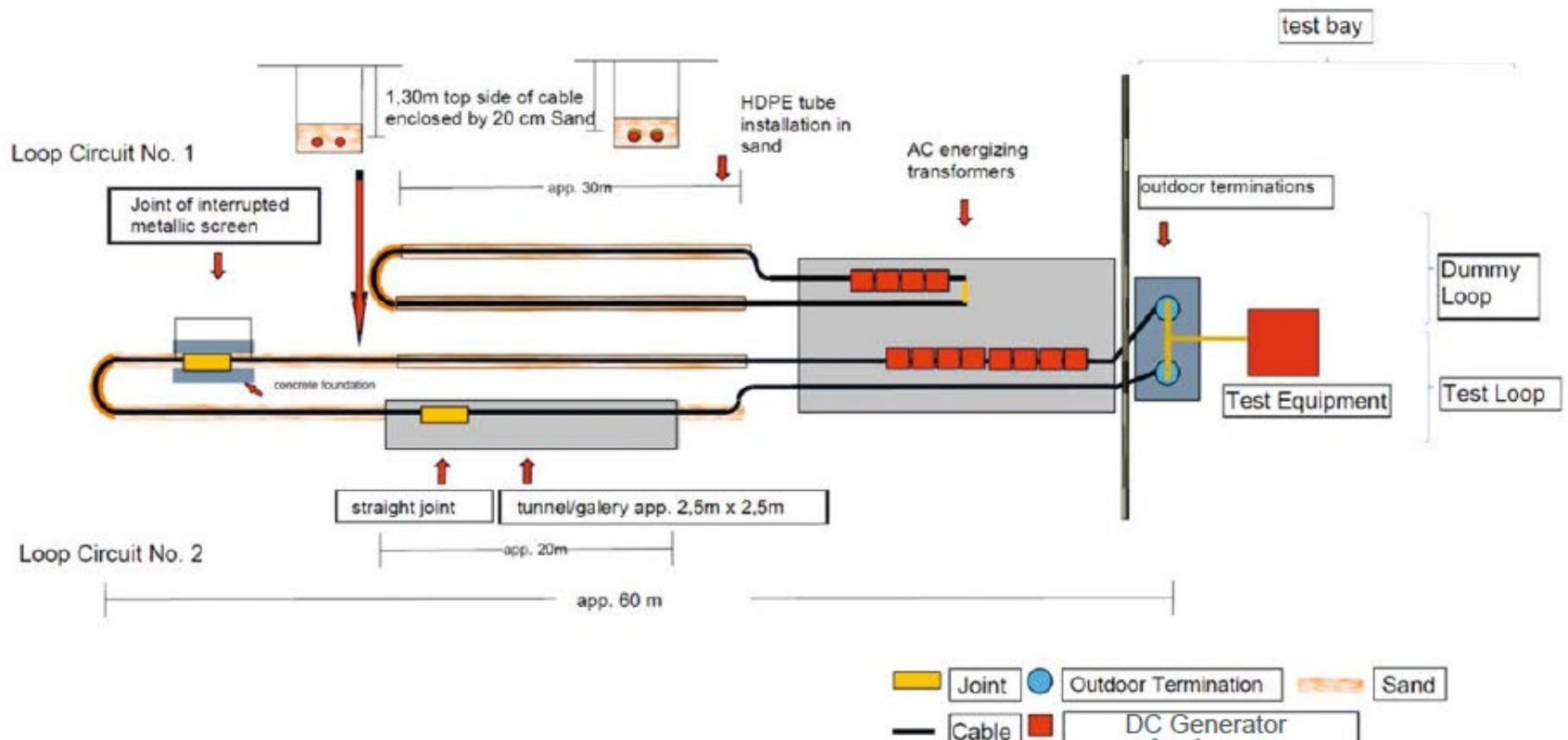
GTSO PQ Tests (1)



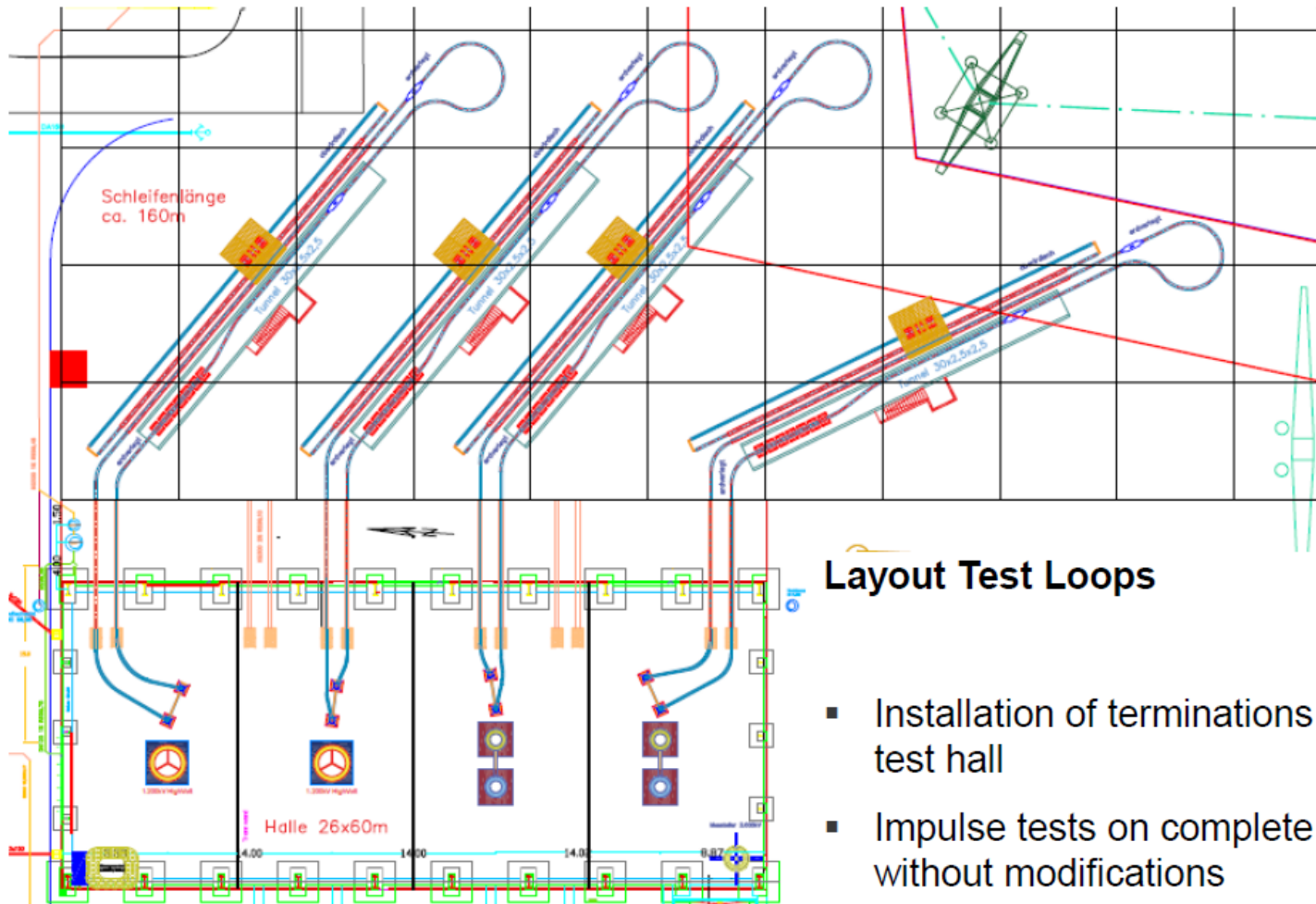
General Information:

- Financing for the test labs by 4 GTSOs
- 4 manufacturers, 5 test loops and 2 test labs
- HVDC cable systems with different insulation materials and different design of accessories
- Starting in the summer of 2017, ongoing till today
- New technical specification for cable systems and Technical specification for PQ tests from GTSOs
- Real burial condition with the dummy loop for the temperature control

GTSO PQ Tests (2)



GTSO PQ Tests (3)



Layout Test Loops

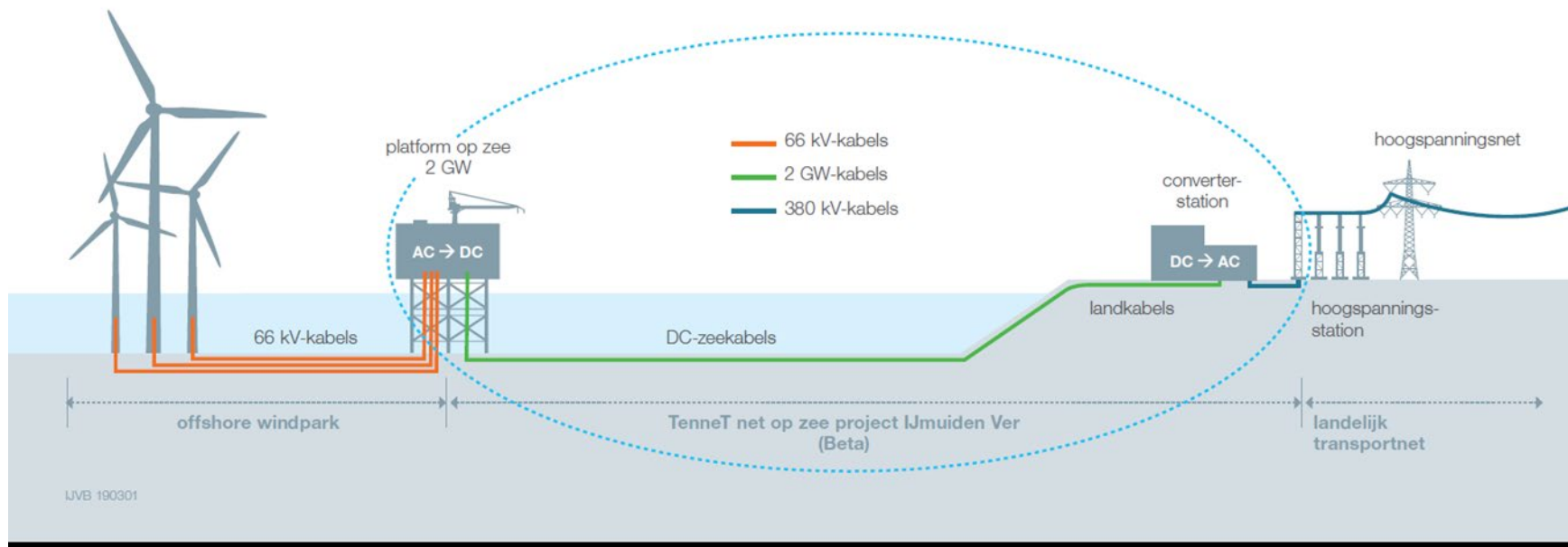
- Installation of terminations in test hall
- Impulse tests on complete loop without modifications

PQ DC Submarine cables (1)



Grid Concept IJmuiden Ver:

525kV HVDC for 2GW



PQ DC Submarine cables (2)



“substantial” changes submarine vs. underground, i.e.:

- Water tightness conductors/metal sheath
- Armour
- Mechanical treatment during production/installation
- Water tightness of rigid repair joints
- Delivery lengths and weights
- Routine tests (AC and PD) of cable and joints

The definition of significant/substantial changes is difficult, can be subjective and can be unexpected, e.g.

- different type of lubricant
- new or different CV line
- new or improved insulation materials etc.

Discussion



- Lesson-Learned from GTSO PQ Tests:
 - Enough planning time
 - Temperature distribution
 - Temperature drop
 - Test equipment
- Mechanical pre-conditioning for submarine cable
- Need one repeated PQ on the submarine cable system? How to check the long-term performance of HVDC cables?



**Thank you very much
for your attention!**