

Study Committee B3
Substations & Electrical Installations
10893_2022

Innovative “3D” architecture for an air-insulated substation of nuclear power plant

Damien JOUAN

EDF CNEPE

Christophe ELLEAU

EDF CIST-INGEUM

Motivation

- Historically, French NPP substations use GIS technology for the compactness of the solution, **for the new model, the GIS solution is challenged.**
- Reduce the impact of the evolution of the F-gas regulation on the project,
- Increase the availability of the switchyard during outage,
- Avoid constraints of GIS regarding the SLD of NPP switchyard,

Method/Approach

- Use AIS instead GIS
- Use the vertical component to erect the switchyard
- Use DCB to reduce the footprint of the switchyard
- Use the lower part of the floor for apparatus and handling system

Objects of investigation

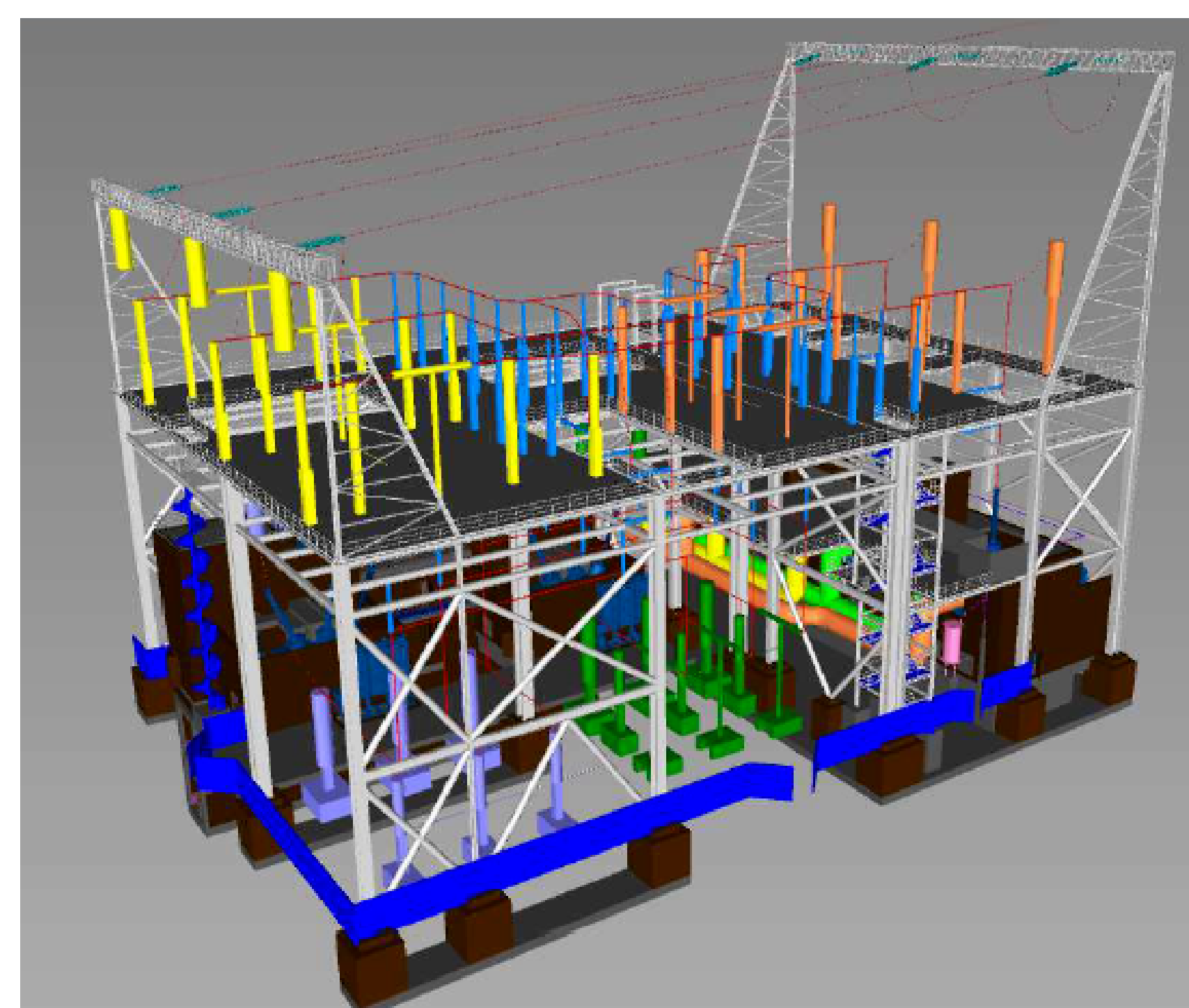
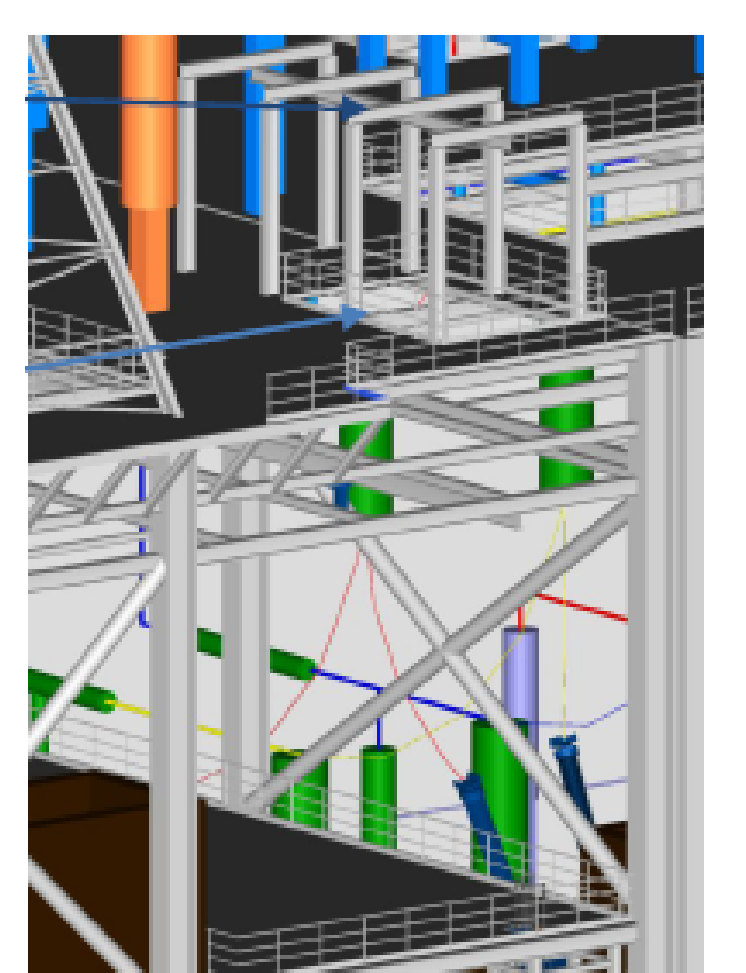
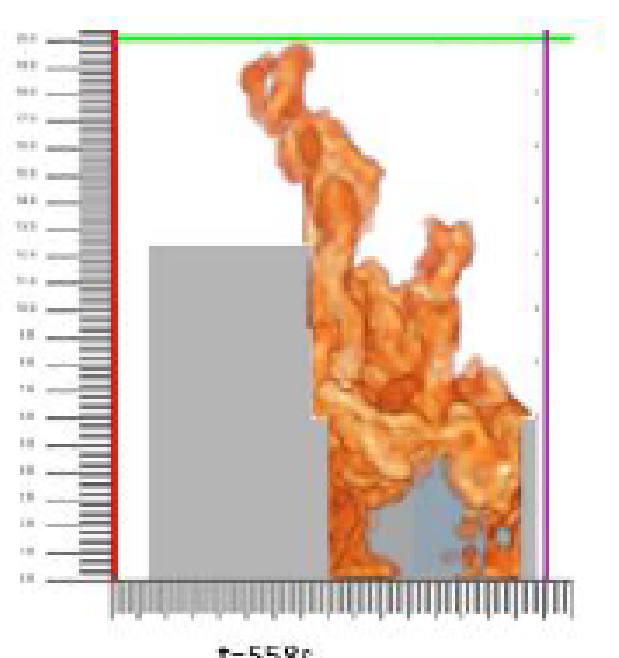
- Study the arrangement of the switchyard to install the necessary apparatus requested in a NPP substation
- Take into consideration the limited area on the plot plant for the sea-side NPP
- Optimize volumes and access for maintenance and handling system



Experimental setup & test results

Many calculations have been performed to design the concept. Demonstration of compliance with respect to :

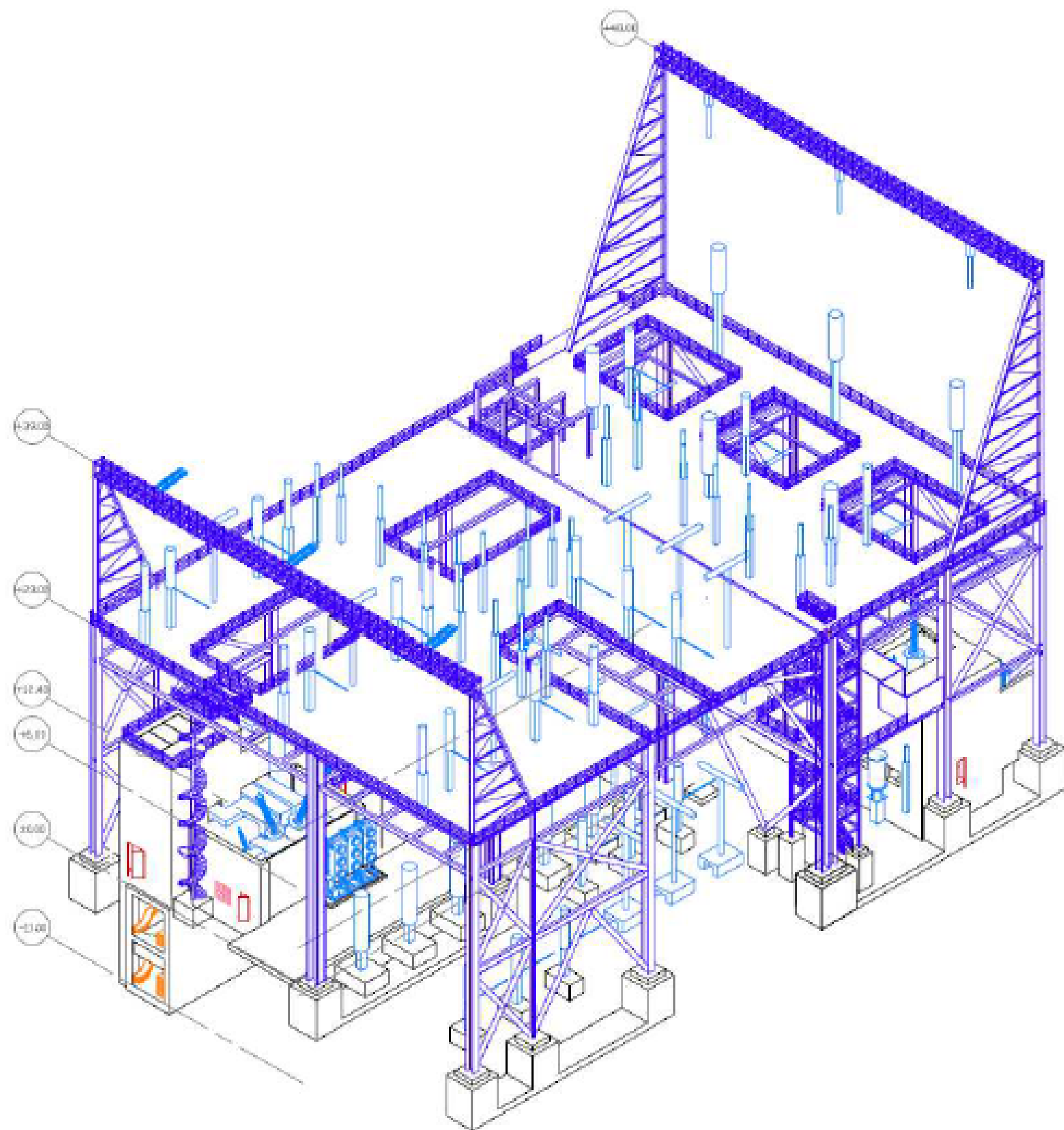
- Reduce drastically SF₆ mass used
- Use DCB (Dual functions)
- Optimize the footprint
- Limit the impact of fire transformer in the switchyard
- Affordable and easy maintenance
- Transformers cooling unchanged



Innovative “3D” architecture for an air-insulated substation of nuclear power plant

Discussion

- SF₆ seems to be unavoidable in particular for HV C.breakers
- Compactness comes up against dielectric clearance distances
- Many skills are involved during design study



Conclusion

The concept is validated for the new EPR model substation.

This 3D innovative air-insulated substation for NPP fulfills the requirements with the following pros :

- Reduced footprint
- Structure assembly pattern has been optimized
- Better NPP availability thanks to maintenance time reduction
- Reduction of maintenance cost (Easy access)
- GWP regulation anticipated by limiting of SF₆ used
- Limitation of the fire impact
- No concessions on dielectric aspects
- Service Conditions :
1800 MW / 420 kV / 3400 A /BIL 1425 kV