

Study Committee A3

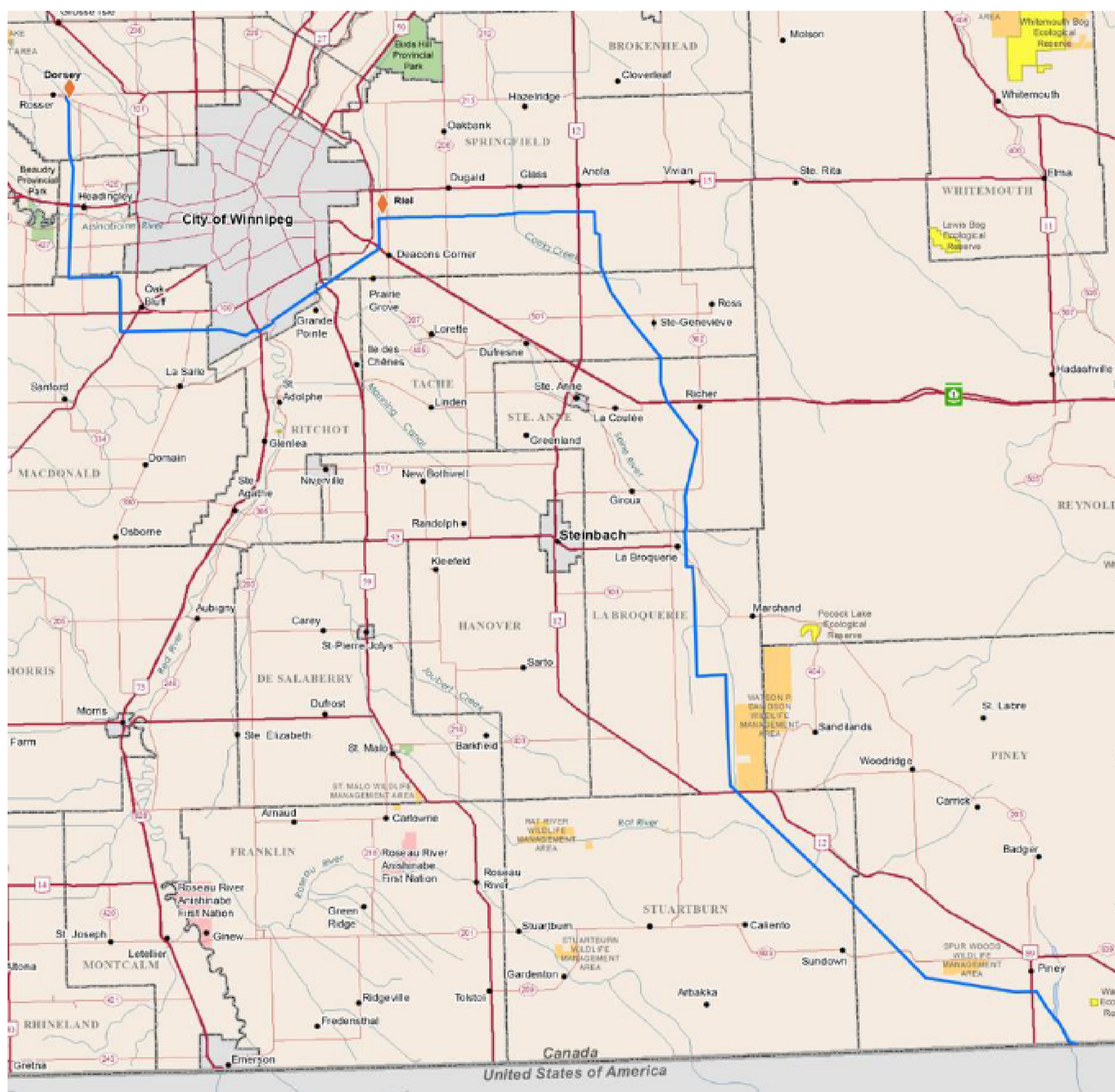
Transmission and Distribution Equipment

Paper 10209_2022

A New 500 kV AC Overhead Transmission Line Delivering Clean Hydroelectric Power from Canada to The State of Minnesota USA Utilizing 500 kV Dry Type EHV Current Transformers

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THE MANITOBA, CANADA TO MINNESOTA, USA TRANSMISSION LINE PROJECT (MMTP)



Canadian Portion of the Line



USA Portion of the Line

Project Facts

A power sales agreement between Manitoba Hydro and Minnesota Power required the construction of 575 km of new 500 kV AC transmission line from the Winnipeg, Manitoba Canada area to the State of Minnesota's Iron Range area.

The new 500 kV line was energized in 2020 and will be used to deliver 250 MW of power each year over a 15 - year period.

The new transmission line will provide clean, reliable hydroelectric electricity for the increasing load growth in the State of Minnesota's Iron Range area.

The new transmission line will improve the reliability of the Manitoba Hydro system in emergency conditions by providing another source of electricity from the USA.

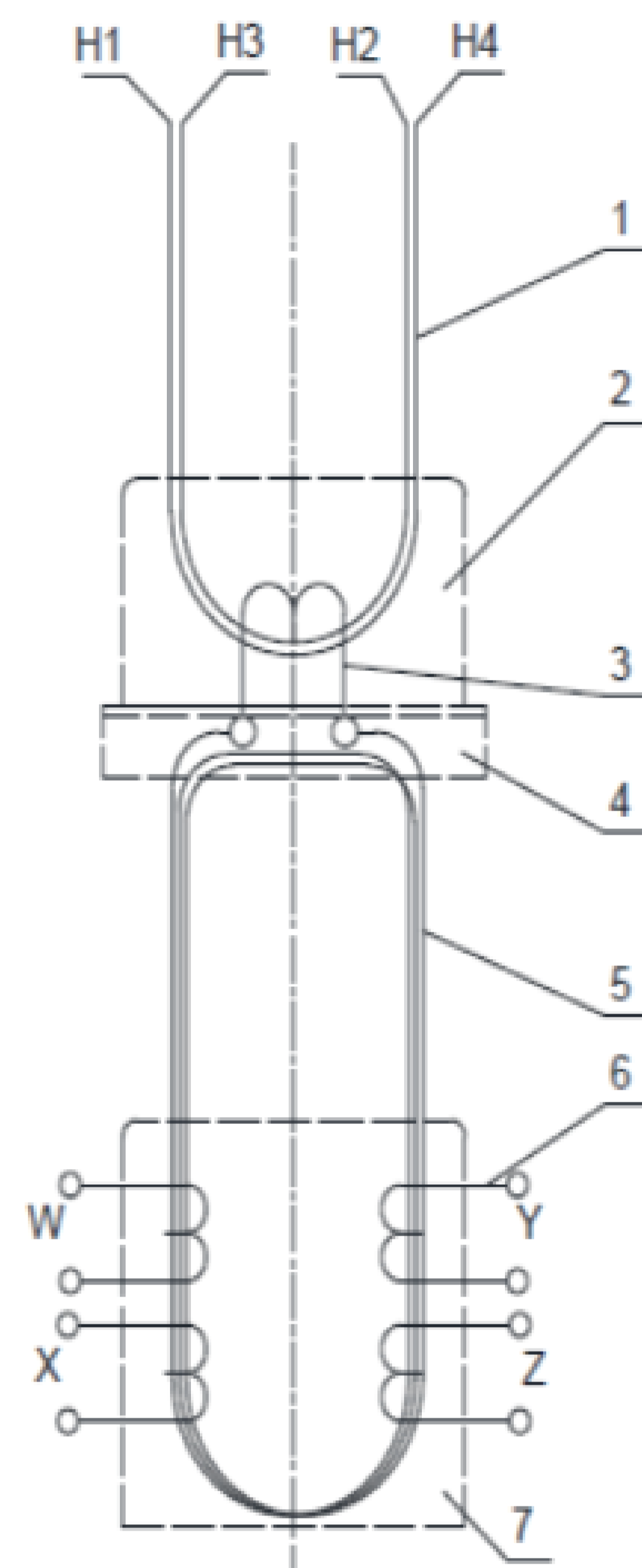
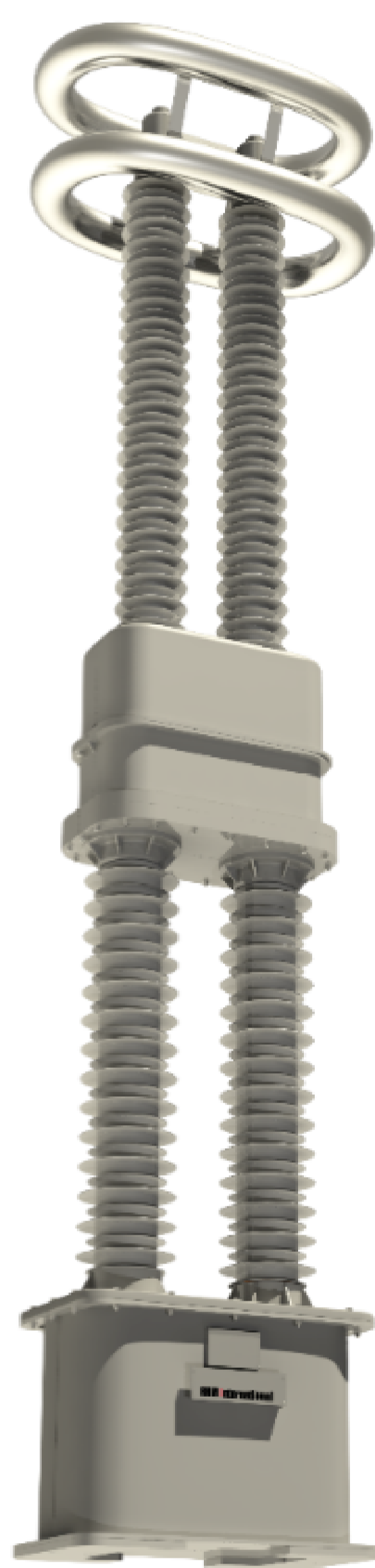
In addition to the construction of the new transmission line extensive modifications were required at several substations on both sides of the border. In accordance with Manitoba Hydro's stated commitment of using new technologies that support the environment and promote safety and reliability, Manitoba Hydro chose to use a new dry type EHV CT technology for the line's protection and metering requirements.

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THE NEW DRY TYPE EHV CURRENT TRANSFORMER TECHNOLOGY INSTALLED BY MANITOBA HYDRO



1 – Upper CT; 2 – Upper primary winding; 3 – Upper secondary winding; 4 – Duct board; 5 – Lower CT; 6 – Lower primary winding; 7 – Lower secondary winding

The CT Specifications:

Nominal system voltage: 500 kV r.m.s

Maximum continuous operating voltage: 600 kV r.m.s

Rated primary current of top C.T. part: up to 2000×4000 Amp

Rated primary current of bottom C.T. part: 16 Amp

Primary current rating factor: 1.0

Rated Secondary current of top C.T. part: 16 Amp

Rated Secondary current of bottom C.T. part: 5-5-5-5 Amp

Secondary current rating factor: 1.0

Current ratio of top C.T. part: up to 2000×4000:16

Current ratio of bottom C.T. part including taps: 16 to 1.6 :5:5:5:5

Accuracy class and burden: 10L800 and 0.3B1.8 at 0.9P.F (on maximum taps)

Number of primary sections: 2

Number of cores: 4

Standard: CAN/CSA-C61869-1 &-2:14

The new dry type EHV CT uses a cascade style configuration (an upper and lower CT connected in series). The cascade style provides a more economical EHV CT design that has a reduced manufacturing lead time and is easier to ship and install.

The HV DryShield® CT design described in our paper uses a composite insulation technology that consists of PTFE (PolyTetraFluoroEthylene) film layers with interstitial silicone gel for its primary conductor insulation. The overall design provides key environmental, safety and maintenance benefits – no oil or gas is used, explosion-resistant design and maintenance-free installation.



Dorsey Converter Station



Riel Converter Station

Six EHV dry type cascade style current transformers were installed in new circuit breaker positions at Manitoba Hydro's Dorsey and Riel converter stations for the new transmission line's relaying and metering requirements