TAIYO NIPPON SANSO
The Gas Professionals

February 13, 2019

**Notice Regarding Delivery of Large Cooling Capacity Turbo Refrigerator for World's First Commercial Superconducting Cable (Product name: NeoKelvin®-Turbo 10 kW)**

Taiyo Nippon Sanso Corporation (TNSC) announced today that it has completed delivery and onsite test operation of the large cooling capacity turbo-Brayton refrigerator [Note1)], NeoKelvin®-Turbo 10 kW at the world's first commercial superconducting electricity transmission cable installation project being undertaken by Korea Electric Power Corporation and LS Cable & System Ltd.

## 1. Delivery Background and Concept

TNSC installed a NeoKelvin®-Turbo 10 kW prototype and contributed to successful trials in a proof of concept for a long distance superconducting power cable conducted by Korea Electric Power Corporation and LS Cable & System Ltd. at Jeju island (South Korea). These results were highly regarded, and the decision was made to adopt a NeoKelvin®-Turbo 10 kW for a commercial superconducting electricity transmission project. The unit has been installed at a transformer substation in Suwon, South Korea, and onsite test operation of the refrigerator section has now been completed.

The super conducting cable to be cooled by the unit (voltage 23 kV, electricity transmission capacity 50 MVA, length 1 km) will be installed between transformer substations within Suwon, and test operation and power transmission using the system is scheduled to begin in 2019.

## 2. Specification of machine

| | |
|---|---|
| Refrigeration temperature: | 70K (-203ºC) (Temperature of liquid nitrogen at the outlet of the refrigerator) |
| Refrigeration capability: | 10kW (Cooling water temperature 20ºC, Substance to cool: Liquid nitrogen with the circulation volume of 0.6kg/s) |
| Power source voltage: | 3-phase alternating current, 400V, 380V |
| Electricity consumption: | 170kW |
| Cooing water: | 750L/min |

## 3. Development Going Forward

Trial testing of superconducting electricity transmission cables and consideration for introduction are expected to proceed in South Korea and other countries around the world. TNSC will use its experience in this project to advance initiatives for capturing further orders going forward.

Note 1) Turbo-Brayton refrigerator

This is a refrigerator to generate cold by 4 processes ((1) Adiabatic compression, (2) Isobaric cooling, (3) Adiabatic expansion, (4) Isobaric heating). The neon gas that is compressed by the turbo compressor ejects the compression heat to the atmosphere, then it is expanded under adiabatic condition by a turbo expander to lower the temperature of the neon gas. After that, it absorbs the surrounding heat, and it is returned to the inlet of the turbo compressor. In case of an actual refrigerator, a heat exchanger is inserted between the turbo compressor and the turbo expander to collect the cold generated at the expander.