

TECHNICAL NOTE

IN SUPPORT OF THE SALE OF SURPLUS Nb_3Sn CONDUCTOR STRAND

Abstract

Information is presented regarding the sale of excess Nb_3Sn conductor strand following the completion of magnets for the ITER project. Two variants are available – one manufactured using a “Bronze Route” process and the other an “Internal Tin” process.

The principal geometric, electrical and material properties are described.

Approximately 300 kg (66 km) of “Bronze Route” Nb_3Sn strand is to be made available.

Approximately 4,700 kg (980 km) of “Internal Tin” Nb_3Sn strand is to be made available.

In addition, a quantity of copper strand, produced to the same dimensions as the Nb_3Sn strand, is also to be made available.

Its principal characteristics are provided.

Approximately 84 kg (17 km) of copper strand is to be made available.

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1. Nb₃Sn Strand - General Description

Two strand variants are available, manufactured via “Bronze Route” and “Internal Tin” processes respectively. Both variants have been produced to the same specification for size (i.e. diameter) and electrical characteristics as shown in Table 1 below.

Table 1: Technical requirements for un-reacted Cr-plated Nb₃Sn strand

| Item | Requirement |
|--|---|
| Superconductor type | Nb ₃ Sn |
| Layout | Identical as used for CPQS (see section 3.4) |
| Twist pitch | 15 ± 2 mm |
| Twist pitch direction | Right hand twist (clockwise) |
| Diameter | 0.82 ± 0.005 mm |
| Cu:non Cu volume ratio | 1 ± 0.1 |
| Cr plating thickness | 2 +0/-1 μm |
| Minimum length | 1000 m (+ multiples of 900 m) |
| Residual Resistivity Ratio (RRR) | > 100 (after heat treatment as specified in section 3.3) |
| Hysteresis loss per strand volume (at 4.22 K over a ± 3 T cycle) | < 500 kJ/m ³ |
| Resistive transition index n (at 4.22 K and 12 T measured on ITER type barrel in the 10 to 100 μV/m range) | > 20 |
| Minimum critical current (at 4.22 K and 12 T measured on ITER type barrel) | I _{c,min} as defined in section 3.2 |

2. Copper Strand – General Description

The available copper strand has been produced to the same dimensions, and features the same Cr plating, as the superconducting strand. General characteristics are as below:

Table 1: Technical requirements for Cr plated Cu strand

| Item | Requirement |
|----------------------------------|---|
| Base material | Cu-OFE (CEN CW009A, UNS C10100) |
| Commercial specification | ASTM B2 or equivalent |
| Diameter | 0.82 ± 0.005 mm |
| Cr plating thickness | 2 +0/-1 µm |
| Minimum length | 9000 m (+ multiples of 900 m) |
| Residual Resistivity Ratio (RRR) | > 100 (after heat treatment as specified in 3.2) |