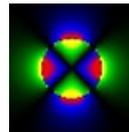


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Magnet Division Procurement Specification

Specification Number: SMD-ELENS-2001

Revision: B



Superconducting
Magnet Division

Conductor for the Electron-Lens Solenoid

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Revision History

Rev. A: Initial Release 5-2-10
Rev. B Changes per ECN MG1329 5-13-10

1 Scope:

This specification establishes the requirements for the manufacture, inspection, test, identification and delivery of conductor use in the ELENS Solenoid.

2 Applicable Documents:

The following documents in effect on the date of invitation to quote form a part of this specification to the extent specified herein:

None

3 Requirements:

3.1 The conductor chosen for this magnet is a rectangular monolith insulated with a half-overlap wrap of Kapton film, 25 micron thick.

Table I
Bare conductor parameters

Dimension	1.78 mm x 1.14 mm	± 0.02 mm
Copper/Non-Cu ratio	3.0	± 0.3
Number of filaments	150	± 20
Ic at 7 T (4.22 K)	> 700 A	
RRR	>100	
Twist Pitch	20 mm	± 2 mm
Unit length (UL)	as specified in the purchase order	
Number of UL required	as specified in the purchase order	

- 3.2 Wire Dimension: The tolerance on the wire size is an absolute maximum limit and does not include averaging or statistical weighing. The tolerance must be held for the wire measured across any location. Verification of this size shall be determined by the vendor using an appropriately calibrated laser micrometer used to check all of the wire produced. The laser micrometer should be capable of detecting local variations in the wire size over a length of 12 mm. Statistical analysis of laser micrometer measurements shall be provided by the vendor to BNL.
- 3.3 Nominal Copper-to-Non-Copper Ratio: The nominal value of the ratio of copper volume to non-copper volume is 3.0:1. This is determined by chemical etch-and-weigh technique.
- 3.4 Number of Filaments: The vendor shall choose the number of filaments for the production to be within the range specified in Table I. This chosen number shall remain fixed throughout the production.
- 3.5 Wire Twist Direction and Pitch: All wire shall be right-twist so the filaments follow the same rotation as a right-hand screw thread. The wire is to be twisted before the final sizing die. Requirements on twisting shall apply over the full length of the delivered wire. No leaders with variable twist are allowed. The vendor shall submit to BNL for approval a method to assure Quality Control of the parameters for wire twist direction and pitch.
- 3.6 Wire Surface Condition: The wire surface shall be free of all surface defects, slivers, folds, laminations, dirt, or inclusions. No filaments shall be visible. These conditions must be met for any sample of the wire inspected using a magnification of 10x.
- 3.7 Wire Critical Current Determination: The critical current, I_c , value refer to a test temperature of (4.22 ± 0.01) K and a critical current criterion of $\rho = 1 \times 10^{-14}$ ohm-m, based on the wire cross section area and with the applied magnetic field (given in Table I) perpendicular to the wire axis. The tolerance on the magnetic field is ± 0.01 T. No correction is made for self-field effects. For reference, the minimum I_c requirement at 7T translates to a minimum critical current density in the non-Cu area of the wire to be greater than 2300 A/mm² at 5 T, 4.22 K. The critical current has to be measured for each billet of wire delivered.
- 3.8 Wire Minimum RRR: The resistance of the wire at (295.0 ± 0.2) K is referred to as the room temperature normal state resistance. It is an important parameter for magnet construction and depends primarily on the content and purity of the copper. The value of R(295) is to be reported. The resistance of the wire just above the Nb-Ti superconductor transition temperature and at zero field is termed R(10). The wire residual resistance ratio or RRR is given by the ratio R(295)/R(10) and is required to be greater than 100. The RRR is to be reported for each billet of wire delivered.

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3.9 Unit Length: Length of continuous wire required for one double layer winding of the solenoid magnet. Conductor may be delivered in multiples of unit length, not to exceed 4 on a 24-inch spool. Each spool delivered can only have a continuous length of wire. Maximum amount of conductor must not exceed 200 lbs.

3.10 Packaging & Shipping:

3.10.1 Wire shall be supplied on a standard 24" spool with 1.5" diameter shaft hole and 1.5" wide drive slots. Maximum width of spool assembly shall not exceed 14"

3.10.2 Wire shall be secured against unraveling during shipping.

3.10.3 Spools shall be protected from the elements with plastic wrap and desiccant or equivalent.

3.10.4 All wire spools must be shipped with the spool axis horizontal.

4 Quality Assurance Provisions:

4.1 The vendor shall maintain a quality assurance program to ensure that each item offered for acceptance or approval conforms to the requirements herein.