

SUPERCONDUCTING
SUPER
COLLIDER

MATERIAL SPECIFICATION

NO. SSC-MAG-M-403

TITLE: PRE-IMPREGNATED FIBERGLASS CLOTH -
SSC CABLE INSULATION

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REV. DATE _____

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REVISION RECORD

REVISION NO.	DATE	PAGE	SUBJECT	APPROVAL

1. Scope:

This specification establishes the requirements for semi-cured (B-stage) resin pre-impregnated (prepreg) fiberglass cloth used to bond and insulate adjacent layers of superconducting magnet cable.

2. Applicable Documents

The following documents of the issue in effect on the date of invitation to bid form a part of this specification to the extent specified herein.

MIL-Y-1140H	Yarn, cord, sleeving, cloth and tape- glass.
MIL-C-9084 Type III	Cloth, glass, finished, for resin laminates.
ASTM D-790-81	Flexural properties of plastics and insulating materials.

3. Requirements

3.1 General - The material shall consist of a woven fiberglass cloth substrate, treated with an appropriate compatible finish, impregnated with epoxy resin which has been advanced to the "B" stage. The resin shall be of such a nature, that it will cure to a thermoset state upon the application of heat and pressure. The material shall not cause corrosion or otherwise deteriorate metallic or non-metallic members with which it comes in contact, and shall meet the requirements specified herein.

3.2 Reinforcement - The fiberglass cloth shall be of a continuous filament type woven into fabric conforming to MIL-C-9084 Type III.

3.3 Fabric Finish - The fiberglass cloth shall be uniformly treated with silane enhancement Z6040, Hexcel F69 or qualified equivalent. No different finish may be used without prior written approval from the buyer. If a different finish is used, with buyer approval, the material must be requalified.

3.4 Resin System - The finished fiberglass substrate shall be impregnated with a qualified epoxy resin formulation similar to Hexcel formulation F185 and advanced to a "B" stage.

3.5 Physical Properties

3.5.1 Glass Fabric

Material	120-E
Width of Cloth	38 inches \pm 0.250 inches
Splice or seam free	125 yards min. length

3.5.2 Prepreg

Flexural Strength	70,000 psi minimum
Volatiles	0.4 to 1.2%
Epoxy Resin Content	24 ± 3%
Thickness	0.0045/ply (inches) ± .00025 inches
Tack	Low

3.6 Surface Condition/Cleanliness - The finished material shall be of uniform quality and visibly free from surface defects such as wrinkles, tears, nabs, discolorations, oil, grease, etc.

3.7 Storage Life (Shelf Life)- The pre-impregnated fiberglass material shall be capable of meeting the requirements specified herein, when stored in its original unopened container at a temperature not exceeding 10°F and 75°F and a 50% maximum relative humidity in the absence of ultra-violet light or other catalytic environment.

3.8 Acceptance Tests - The seller is responsible for the performance of the tests specified in Table I for each lot of prepreg ordered. The tests shall be conducted at the specified frequencies and by the referenced test methods.

Table I - Prepreg Test Requirements

Characteristics	Requirement	Test Specimen		Test
	Value	Sample ²	Frequency	Method ¹
Flexural Strength	70,000 psi Min.	Full width 18" long samples	Beginning and end of each roll	TM144-1
Epoxy Content	24% ± 3%	Included in sample or #1 above	Beginning and end of each roll	TM144-2

¹Tests shall be conducted at 75°F ± 5°F with a relative humidity of 65% maximum

²See buyer sample requirements in #5 below.

3.8.1 Nonconforming Material - Material found to depart from the requirements shall not be offered to the buyer for acceptance.

4. Quality Assurance Provisions

4.1 Buyer Source Inspection - The buyer or his representative retains the right to perform source inspections at the seller's facility to verify compliance with the requirements of this specification and the purchase order.

4.2 Certification of Conformance - The seller shall provide a written statement certifying compliance with the requirements of the applicable P.O. and this specification with each product shipment. The certification statement shall include actual shipment lot, flexural strength, and epoxy content test pressure.

5. Preparation for Delivery

5.1 Spooling - The pre-impregnated material shall be supplied to the length ordered without splices on non-metallic 3 inch diameter rolls or spools. Each roll or spool shall be enclosed in a flexible plastic container and sealed in a manner that will prevent contamination. Rolls shall be end-supported to prevent damage to the prepreg material. The pre-impregnated fiberglass material shall be interleaved, when rolled, with a polyethylene or equivalent liner in a manner to provide an outer wrapping which is guaranteed to completely separate from the prepreg. The liner shall overlap each edge a minimum of one inch.

5.2 Packaging - The packaged rolls and spools shall be packed for refrigerated shipment in a manner which will assure carrier acceptance and safe delivery at their destination. Shipping containers shall meet the rules and regulations applicable to the mode of transportation.

5.3 Marking for Shipment - The carton containing each roll or spool shall be permanently marked with the following data:

Pre-impregnated fiberglass cloth (prepreg) No. _____
SSC-MAG-M-403
Manufacturer's name, trademark or symbol
Roll or spool number
Date of manufacture
Material must remain below 32°F

5.4 Shipping Notification/Conditions - The seller shall notify the buyer of shipping times and conditions prior to shipment. Shipments shall be scheduled to arrive at their destination between 9 A.M. and 4 P.M. Monday through Friday. During transportation, the material shall not be subjected to a temperature above 32°F for more than one (1) day.

APPENDIX A

Prepreg Test Methods

<u>Test Methods</u>	<u>Title</u>
No. 404-1	Flexural Strength
No. 404-2	Epoxy Content Test

Test Method No. 404-1 - Determination of pre-impregnated fiberglass flexural strength

1. Purpose

The purpose of this test is to determine the flexural strength of a molded stack of twenty (20) layers of the pre-impregnated fiberglass cloth. For further details reference ATP-005, CBA Acceptance Test Procedure for Pre-impregnated Fiberglass Cloth.

2. Specimen Preparation

The specimen is prepared by molding twenty (20) layers of 0.325 inch wide by 3 inch long pre-impregnated fiberglass cloth strips at 5000 psi for the following times and temperatures:

45 minutes at 90°C (Gel)
90 minutes at 155°C (Cure)

3. Number of Specimens

A minimum of three specimens are to be made.

4. Test

The flexural strength of the sample is evaluated using a standard center point loading test in the spirit of and similar to the procedure described in ASTM D-790-71, Method I, Procedure A with a cross-head speed of 0.05 inches per minute. The loading nose and simple supports have cylindrical surfaces 1/4 inch in diameter. The supports are spaced one (1) inch apart and the load is applied at the center of this span - 1/2 inch from either support.

Test Method No. 404-2 - Determination of pre-impregnated fiberglass cloth epoxy content.

1. Purpose

The purpose of this test is to determine the epoxy resin content in the pre-impregnated fiberglass cloth.

2. General Test Outline

- a. Three representative samples, one taken from each side and the center, of the impregnated cloth shall be weighed on a precision balance. The typical sample weight is 500 milligrams.
- b. The weighed sample shall be placed in a cubicle and washed with MEK to dissolve and remove the epoxy resin. The residual solvent is allowed to evaporate and the dried sample is weighed. The calculated weight difference is used to determine the percent epoxy resin dissolved.
- c. Ideally, the weighed sample would be placed in a cubicle and subjected to a temperature sufficient to burn off all the epoxy and binder in the cloth.
- d. In actual practice, the weighed sample is held with forceps and the binder and remaining epoxy are burned off with a propane torch.
- e. The burned residue shall be weighed and the difference calculated to determine the percent epoxy resin burned from the cloth.