



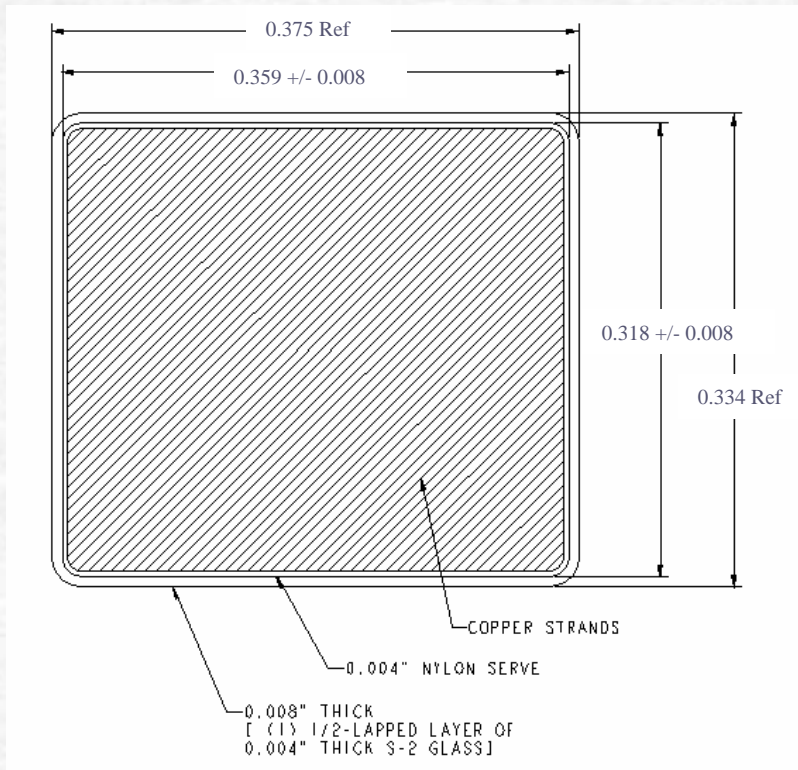
NCSX- Cable Property Testing

February 25, 2005
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Scope

- ☞ Materials used in Specimens
 - Conductor
 - Insulation
 - Epoxy system
- ☞ Tests Being Performed
- ☞ Test Equipment
- ☞ Description of specimens

Conductor Description



- Flexible spooled compacted copper cable [12x5/44/34]
- Nylon serve on outside surface [0.004 in. thick]
- 2640 strands
- 34 gauge [nom. 0.0063 in.]
- Conductor A: Normal cable mfg. Process
- Conductor B: Clean cable mfg. process

Insulation

- Conductor is pre-insulated (turn to turn) with (1) half-lapped layer of glass tape
- Insulation description
 - S-2 glass (Four harness satin weave) with reactive amino silane finish
 - Nominal thickness 0.004 in. thick
 - Glass tape identifier: ECG150-2/2
 - Temperature class 180 degrees C

Epoxy System

Resin system selected: **CTD-101K**

- Product of Composite Technology Dev. Inc.
- 3- Part component epoxy system
- Excellent performance at cryogenic temperatures with a long pot life and low viscosity
- Cure Cycle:
 - 5 hours @ 100 degrees C (*Cure*)
 - 16 hours @ 125 degrees C (*Post cure*)
- Pot Life:
 - 145 hours @ 25 degrees C1300 Cp
 - 60 hours @ 40 degrees C400 Cp
 - 20 hours @ 60 degrees C100 Cp

Performance Tests

☞ Type of Tests

- Flexural tests.. [8 inch long single conductor specimens]
- Compression tests.. [0.75 inch long single conductor specimens]
- Tensile tests.. [Racetrack coils- 4-turn specimens]
- Cure shrinkage [Racetrack coils 2 lengths 4-turn specimens]
- Fatigue (cyclic) testing [TBD] [single conductor and/or 40 turn bundle]

☞ Test Parameters

- 2- different processed conductors (clean vs. standard)
- 3- different temperature ranges (77 deg.K, 194 deg.K and room temperature)

Mechanical Test Equipment

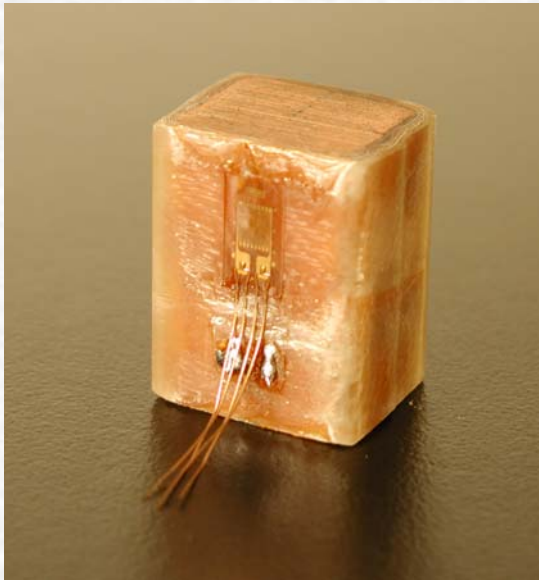


**MTS Servo-Hydraulic Tester
Capacity 100 KIPS**



**MTS Servo-Hydraulic Tester
Capacity 10 KIPS**

Flexural and Compression Specimens



Compression Tests

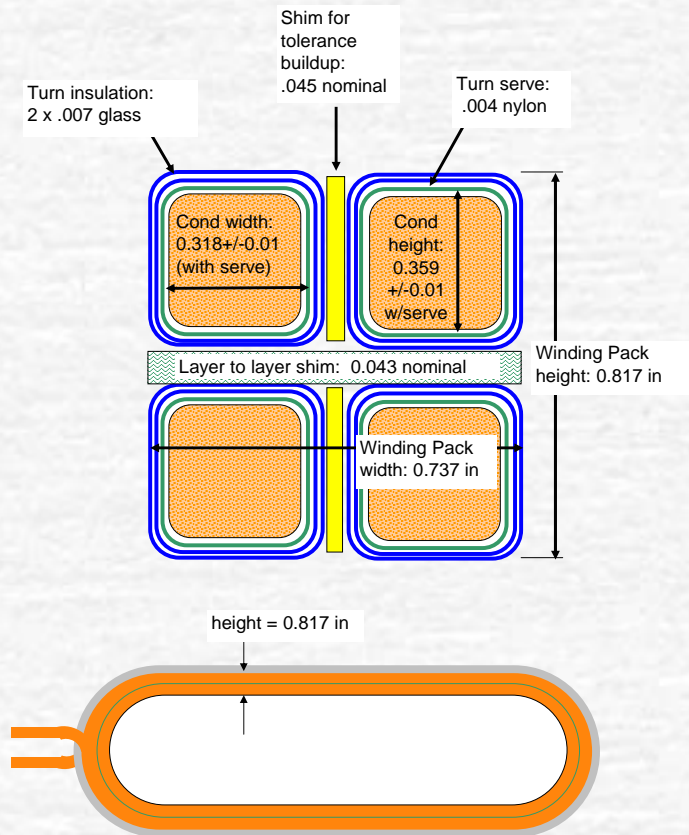


Flexural Tests



Cold Bath

Winding Pack Dimensions for 4-turn Racetrack Coils



- 4-turn racetrack coils will be wound without ground wrap and will be used for the tensile tests
- Coil leads will allow the coil to be electrically tested during or following the tensile tests

40-Turn Bundle

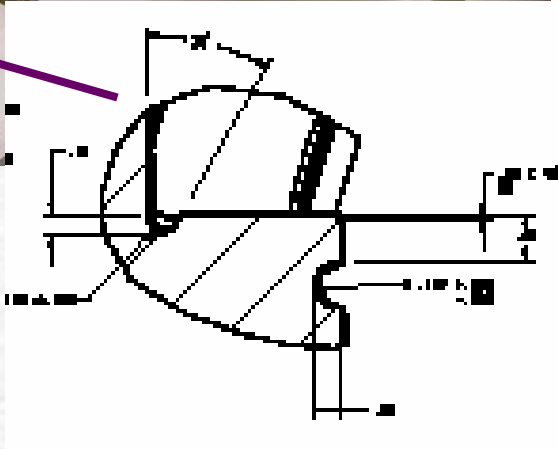
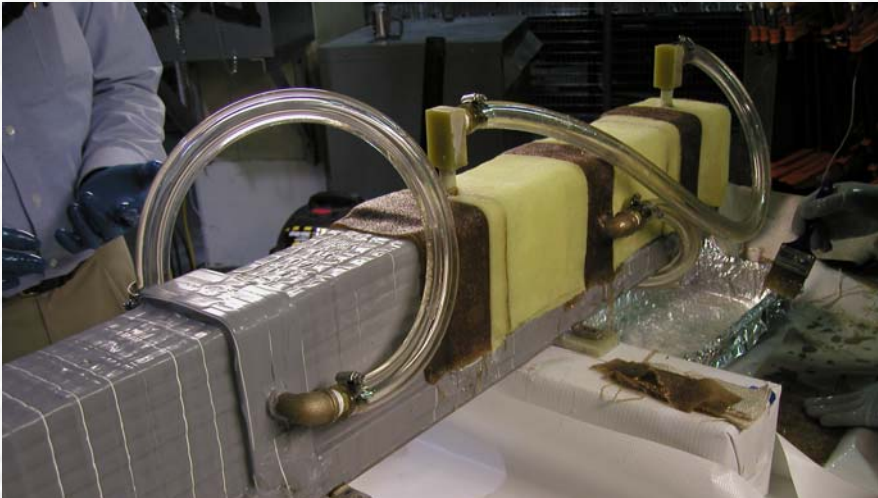


40-turn bundle with ground wrap will be fabricated and can be used for flexural and fatigue tests

40 turn Bundle Preparation

- Mold release tee surfaces
- Copper cladding [0.040 "] with Kapton insulation on inner surface
- Apply Groundwrap
 - 3 layers- 0.010 in. thick S-2 dry glass
 - 2 layers - 0.003 in. thick Type H Kapton
- Lay insulated conductor turns in place [4 wide x 10 high]
- Apply Bag mold
- Vacuum-Pressure-Impregnate [VPI]

Bag Mold



- Install final ground wrap
- Install (2) Layers silicone rubber tape mold [secure edge in place with casting groove and copper tubing]
- Paint mold with 2-part RTV 11 (several layers)
- Install final coil clamps
- Install epoxy impregnated felt between the clamps
- Install strong backs between clamps

Summary

- ✎ Fabrication of test specimens and testing of mechanical properties is underway
- ✎ Both clean and regular processed conductor will be tested
- ✎ Specimens will be tested at 77deg.K, 194 deg.K and RT
- ✎ **Further discussions are needed:**
 - Type of tests being performed
 - Types of specimens being proposed
 - How the test should be performed