ASSEMBLY PROCEDURE OF SUPERCONDUCTOR READOUT CABLE

*** Safety Precautions (Personnel): Special emphasis shall be placed on safety during all etching operations to prevent injury to personnel and/ or damage to hardware.**

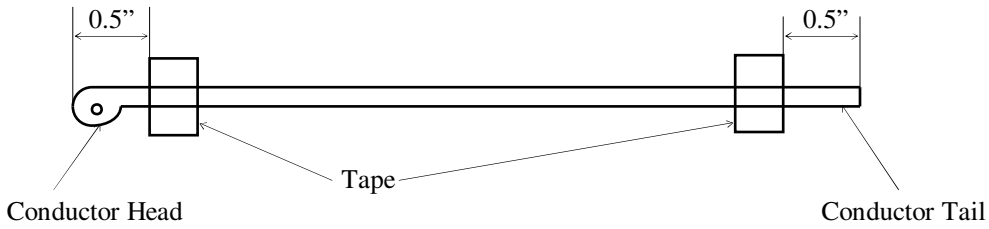
** **Gloves are required to keep the parts clean through all the assembly processing except step 4.1 and 4.2.**

***** The cable assembly needs to meet the requirement of magnetic zone 1. Only non-magnetic tools are allowed for all the assembly processing except step 4.1 and 4.2.**

1. Conductor Deburring

1.1 Visually inspect the conductors. Check for kinks, notches or any other defects. Measure the conductors with a micrometer and confirm a thickness of .0025" - .0030".

1.2 Tape an aluminum sheet on the workbench with kapton tape. Lay down the conductor on the aluminum sheet. Put kapton tape on both ends of conductor and attach to the aluminum. Tape should cover about 1/2" at each end of the strip. Make sure the conductor is straight and flat. Up to 4 conductors can be used in each batch. The conductors should be parallel to each other and kept apart by about 1.5".



1.3 Cut a piece of #320 grit emery paper into 2"x 2" square pieces. Carefully scrub conductors with emery paper until the shiny surface becomes dull.

1.4 Remove the tape. Turn the conductor over and tape it down as in step 1.2. Carefully scrub conductors with emery paper until the shiny surface becomes dull. Move tape as required to clean the entire length of each conductor.

1.5 Remove the tape. Place the conductor with the head toward the operator. Tape the conductor down at about 1" from the head and leave the other end hanging freely. Carefully scrub the head area with emery paper until the shiny surface becomes dull. Be careful not to bend the conductor.

1.6 After taking off the shiny surface of the conductors, carefully clean the edges with a 1/2"x 1/2" piece of emery paper all the way to the head of the conductor.

1.7 Carefully examine the conductors by using a magnifying visor or microscope to confirm the edges are clean. Measure the conductor and confirm a thickness of .0020" to .0025".

1.8 Clean conductors with Alcohol (Ethanol). Put conductors in a clean storage tube. Label and date the tube.

2. Put Heat Shrink Tubing over Conductors

2.1 Visually inspect all conductors. Examine both sides of the conductors and confirm that there are no kinks, notches or other defects.

2.2 Verify continuity from end to end of the conductor using BK.-2706 meter. Write down the resistance readings in table P0102-Tab1.

2.3 Cut Polyester heat shrink tubing # 050050CST to about 30" long. Slide the shrink tubing down the conductor until it reaches the head. Hold the shrink tubing at the end near the conductor head with tweezers. Set the power of the ProHeat heat gun at the #10 position. Shrink the tubing down to size, first at the head end then along the conductor. Cut off the extra shrink tubing.

3. Shield Cleaning, Slot Cutting, and Welding to Capacitor Flange

3.0 Clean inside and outside of each shield with acetone.

3.1 Put the shield conductors in a 24" long glass tube. Fill the tube with Nb Surface Etch Hydrochloric Acid 20%/80% DI water solution just above the shield. Let sit in the tube for 1 hour. Turn the up side down every 10 minutes.

3.1.1 Remove the shield from the glass tube and rinse for 10 minutes with water. Dry the shield and use the nitrogen blow gun to dry the inside of the shield. Make sure the inside is completely dry.

3.1.2 Perform magnetic screening (at room temperature).

3.2 Use the rolling crushing fixture tool to pre-crush the shield to .031" - .032 ".

3.3 Send tubing to Moldcraft for EDM machining to cut slot per drawing # 25004. Pay special attention to packing and shipping.

3.4 Visually inspect the shield conductor with slot. Check for any kinks or other damage on shield conductor. Check the slot under a microscope to make sure the size and position are correct.

3.5 Send out the shield to APPLIED FUSION for resistance welding of the Nb tubing and capacitor flange per drawing # 25004-101.

3.6 Visually inspect the shield conductor and capacitor flange. Check for any kinks or other damages on shield conductor. Check the spot weld under a microscope to make sure the weld is flat and strong.

3.7 Use a diamond pen to mark a serial number at the Nb flange for the cable assembly

4. Cut the Shield to Length and Clean up

4.1 Cut the shield tubing to 19" using a jeweler saw and a 5 mil jeweler blade. Deburr the end of the shield tubing with the sharp-tip file. Use a fine jeweler file and the fine grit #600 sand paper to smooth the end of the shield.

4.2 Make sure the shield is not blocked with residue. Use an air jet to free any obstacles. Clean the shield with alcohol.

4.3 Put the shield conductors in a 24" long glass tube. Fill the tube with Nb Surface Etch Hydrochloric Acid 20% solution just above the shield. Let sit in the tube for 1 hour. Note: Skip this step if shield passed the original room temperature screening.

4.4 Remove the shield from the glass tube and rinse for 10 minutes with water. Dry the shield and use the nitrogen blow gun to dry the inside of the shield. Make sure the inside is completely dry.

5. Put Heat Shrink Tubing over Nb Shield

5.1 Cut Polyester shrink tubing # 085250CST to about 20" long. Slide the shrink tubing over shield conductor all the way down to the capacitor flange per drawing #25002. Hold the shrink tubing close to the flange with a pair of tweezers. Set the power level of Proheat heat gun at # 10 position and shrink the tubing down to size. Cut off the extra shrink tubing.

5.2 Cut two 0.170". pieces of shrink tubing # 085250CST and slide them down the shield to the capacitor flange. Do not shrink these two pieces. (They will be shrunk at a later step.)

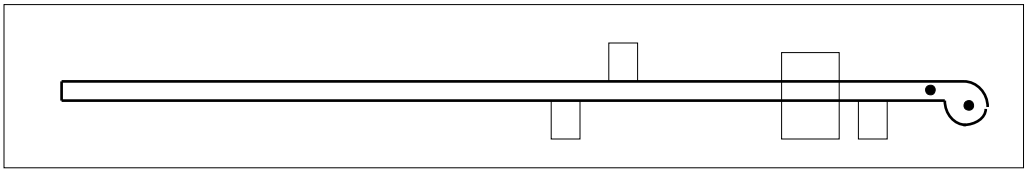
6. Insert Conductors into Nb Shield

6.1 Insert the conductors into the shield per drawing #25002-102. Using conductors #3 -25393-103 and #4 - 25393-104.

6.2 Strip the end of conductors about 1/4". Verify continuity of each conductor after insertion. Make sure the two conductors don't short to the shield or to each other. Fill out table P0102-Tab1 with resistance readings.

7. Locate the Cable Relative to Gyro Housing

7.1 Place the assembly on the proper end of the cable assembly fixture as shown below:



7.2 Align the conductors and the shield with the locating pins on the assembly fixture. Crush the end of shield to 0.025" by tightening the screws on the aluminum block.

7.3 Deleted

7.4 Remove the assembly from the fixture. Insert the assembly into the roll /crush fixture. (Same as note 3.2). Adjust the roller spacing gradually and feed the assembly through the crushing fixture. Measure the thickness after

each run. Repeat this step until the crushed shield reaches a dimension of 0.022 / 0.024" all along the cable except the area near capacitor flange. Typically it will take 5-6 runs to crush the tube down to the final size.

7.5 Check the continuity of conductors, also check for electrical shorts between conductors and the shield. Fill out table P0102-Tab1 with resistance readings.

8. Form Cones at Pin Holes

8.1 Form a cone at the end of each conductor using the pin hole forming tool per drawing #25001-102. Be careful with the direction of inserting conductors into the fixture.

9. Put Ti Clamp on

9.1 Slide the two pieces of shrink tubing (from step 5.2) up to the top of the shield. Insert the shield with the shrink tubing into the clamp per drawing #25001-102. Set the power level of the Proheat heat gun at # 10 position and shrink the two pieces of tubing down to size. Shrink the tubing all the way along the cable. Make sure that no air pockets or wrinkles exist.

9.2 Insert the Ti clamp into the testing housing per drawing #25000-102 (2 conductors). Align the conductors to their respective holes in the test housing and insert the contact pins per drawing #25000-102. Use kapton tape to hold the pins on the housing, pull the cable all the way away from the housing. Use kapton tape to keep the conductors flat and tight against the housing.

9.3 Use a 2cc syringe to apply epoxy (Stycast 1266) into the slot of the clamp. Be careful not to overfill the space between the shield and the clamp. Let the epoxy cure over night or 24 hours at room temp.

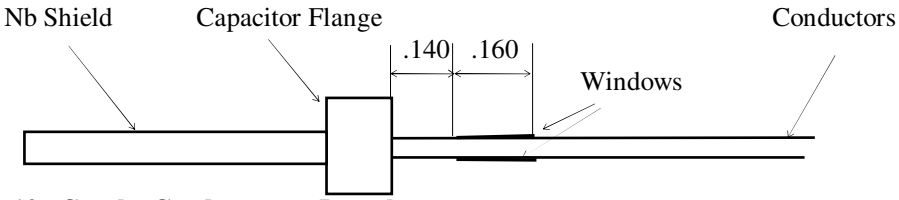
9.4 Remove the kapton tape and the contact pins carefully. Loosen and remove the cable assembly from the test housing.

10. Epoxy the Capacitor Flange

10.1 Use a fixture to hold the cable assembly vertically with the Ti clamp up and the flange down. Place a drop of Stycast 1266 epoxy on the top of the capacitor flange Let the epoxy thicken a little before applying to keep it from running down onto the conductors. Let cure over night or 24 hours at room temperature.

11. Cut Windows for Capacitor Assembly

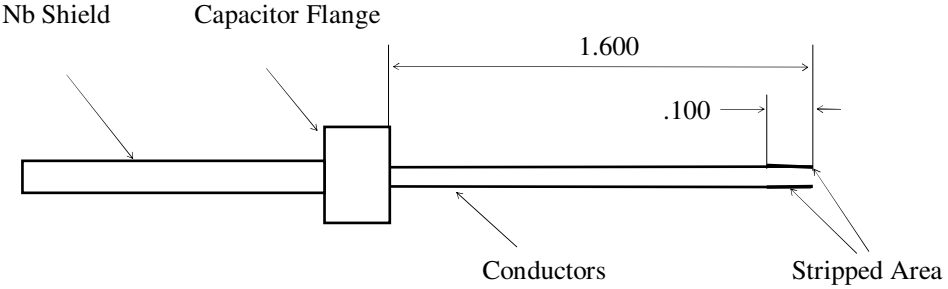
11.1 Use a sharp #2 ceramic blade to cut a window on the outer surface of the heat shrink tubing of one conductor. Turn the assembly over and cut a window on the outer surface of the other conductor. The position and size of the windows are sketched below:



12. Cut the Conductors to Length

12.1 Cut conductors to length so that the tip of the conductor is 1.6 inch from the edge of the flange.

12.2 Strip .100" at the end of each conductor to make a square bare area for connecting to SQUID input pads.



13. Final Assembly

13.1 Verify continuity and insulation. Fill out table P0102-Tab1 with resistance readings.

13.2 Slide the flat washer (#25007-101) and curved washer (#25007-102) onto the cable. Slide the hex nut (#25006-101) onto the cable assembly per drawing #25000-102. Thread nut onto clamp.

14. Assembly Completed

Note: Final cleaning of this assembly is required prior to integration with gyroscope to comply with the zone 1 cleanliness standard. Magnetic screening of assembly is required to verify compliance with the magnetic's standard. Finally, a cable-to-housing fit check must be performed to verify compliance with the out-of-plane stray area requirement.

15. Bag and label the cable assembly

P0102-Tab1

Date: _____

Operator:_____

Cable Serial Number: _____

Table. Continuity and Insulation Check of SC Readout Cable

Step	Continuity		Insulation		
	Conductor -103	Conductor -104	-103 to Shield	-104 to Shield	-103 to -104
2.2			N/A	N/A	N/A
6.2					
7.4					
13.1					