ATLAS EndCap Signal Feedthrough Project

QA/QC Document: Version 4 (30 Mar 2001)

Table of Contents

Overview

To ensure the quality of the finished EndCap Signal Feedthrough, a database and detailed form sheets will document all essential quality characteristics of the component and assembly testing procedures throughout the entire project. The sections of the signal feedthroughs that will be integrated with the EndCap cryostat to form part of the cryostat liquid argon space will be manufactured to conform to the ASME Pressure Vessel Codes. For overall quality assurance the Victoria ATLAS team has determined that the following five points are key to producing a quality product.

Material Traceability & Certification

The steel manufacturer for each batch of steel produced will supply a material certification sheet to ATLAS. A distribution sheet will then be generated which will contain the certification sheet number of the low inclusion steel and the type of component being manufactured with that steel. Upon arrival of each component in the EndCap Signal Feedthrough a material certification sheet number will be entered on each component's form sheet. These material certification sheets will be filed in the Victoria ATLAS laboratory for easy reference if a problem arises with the steel properties. Victoria ATLAS will further require that the bellows (316SS) manufacturer and the bellows cuff (304LSS) manufacturer provide material certification sheets.

Physical Characteristics

Upon arrival at the Victoria ATLAS laboratory, dimensions of each component will be measured using precision measuring devices to check that they comply with the tolerances set. Other physical characteristic tests will also be performed specific for each component. For a more detailed description refer to the form sheet for that component.

Assembly Procedures

The assembly procedure for the EndCap Signal Feedthrough is highly detailed, with most assemblies requiring a specific orientation to be assembled properly. A detailed description as well as a graphic depiction of how the components are to be assembled is described on the reverse of the form sheet created for each assembly procedure. Before any assembly that requires a specific orientation is completed, a second person not involved in the assembly must approve the orientation.

Testing Procedures

All leak testing of components and assemblies requires that no leak be detected. A helium leak detector described in Appendix B1 will be used to detect any leaks. Leak testing of all components will be done in ambient conditions as well as cryogenic operating conditions. All leak tests performed on the components and assemblies will be documented on form sheets. These tests are specific and highly detailed; for a detailed description see the form sheet and procedure sheets. Electrical test will also be performed. Detailed tests will be performed on each Vacuum Cable and Pigtail Cable upon delivery to Victoria. Further electrical tests will be carried out during and after assembly of each feedthrough. These tests are detailed in the corresponding form sheets and procedure sheets.

Non-Conformity Procedure

A component or assembly which fails any of the materiel requirements, physical characteristics, or testing procedures will be tagged with a coloured sticker and placed on a shelf specific to non-conforming components. This will ensure that a non-conforming component will not be used in an EndCap Signal Feedthrough.

Chapter 1
Pin Carriers

Chapter 1
Pin Carriers

1. *Detail Drawings*

GBL 20011-600147-4 Rev D (7 Row Pin Carrier)
GBL 20011-600148-4 Rev D (8 Row Pin Carrier)
The drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. *Material Traceability*

All Pin Carriers are fabricated from AISI 304L stainless steel. Atlas Victoria will require the material vendor to supply certification of origin, physical and chemical specification and an Inclusion report, for each batch of material supplied. We will also require the Pin Carrier vendor to verify the supplied steel was used to construct all Pin Carriers and account for remaining material. The specification will be stored in files at ATLAS Victoria. Each Pin Carrier inspected will have an accompanying form sheet, upon which, the relevant material specification sheet number will be entered. All form sheet data will subsequently be transferred to a database.

3. *Arrival Information*

a. Record the serial number from the Pin Carrier on a new Pin Carrier form sheet.
b. Record the date the Pin Carrier was received on the form sheet.
c. Record the number of rows of the Pin Carrier on the form sheet.
d. Record the name of the person who recorded the above information, on the form sheet.

4. *Inspection*

a. Visual inspect the condition of the weld lip, checking for any dents or other obvious defects. If the weld lip looks good then write Pass on the form sheet, if the weld lip looks bad then write Fail on the form sheet.
b. Using Vernier Calipers measure the length of the Pin Carrier in millimeters and record the number on the form sheet.
c. Using Vernier Calipers measure the width of the Pin Carrier in millimeters and record the number on the form sheet.
d. Using Vernier Calipers measure the height of the Pin Carrier in millimeters and record the number on the form sheet.
e. Using a UNC 4-40 screw, thread the screw into each hole of the Pin Carrier to ensure that the it was tapped properly. If the screw will not thread in smoothly then enter Fail on the form sheet. If the screw does thread in smoothly then enter Pass on the form sheet.
f. Inspect each row of the Pin Carrier for bent pins. Enter the number of bent pins found, on the form sheet.
g. Using the pin straightener carefully slide it over the row with the bent pin. If the pin is still not straightened then carefully straighten the pin using the alignment hand tool. If all the pins were successfully straightened, check Yes on the form sheet. If they were not successfully straightened check No on the form sheet.
h. Each Pin Carrier must be leak tested after the above tests have been performed. To leak test the Pin Carriers follow the procedures laid out in the Leak Testing section of this document.

Note: After the initial leak test each Pin Carrier will have to be cooled down to 77K, following the Cold Cycling procedure in this document. After the first cold cycle of the Pin Carrier it will have to be leak tested again. After this leak tests each Pin Carrier will then be cold cycle 2 more times. After the last cold cycle each Pin Carrier will be leak tested for a final time. If at any time during the testing a Pin Carrier should fail a leak test refer to the flow chart at the end of this document to determine what test should then be performed on the Pin Carrier.

5. *Leak Testing*

a. Mount the Pin Carrier into its leak-testing jig, and place it on the leak test platter for leak testing.
b. For this test the DVP500 Pump will be used for a roughing vacuum.
c. Close valves:
   E 3-Position Valve
   D Leak Checker Valve

A Roughing Vent Valve
N Bellows Roughing Valve

d. Open valves:
P Roughing Pump Valve
C Roughing Valve
e. Also, turn on the Vacuum Process Controller to monitor the roughing vacuum.
f. Turn on the DVP500 pump and pump down the test apparatus to a vacuum of $3.0x10^{-1}$ or better. When the vacuum reaches $3.0x10^{-1}$ close valve:
C Roughing Valve
g. Start pumping with the leak checker. When the leak checker reaches $5.0x10^{-1}$ open valve:
D Leak Checker Valve
h. When the base rate of the leak checker bottoms out, testing can start.
i. Attach the helium line that exits the flow gauge to the Pin Carrier cover and attach a vent line from the other side of the Pin Carrier cover and run the line out of the lab.
j. Enter the base rate of the leak checker on the form sheet.
k. Place the Pin Carrier cover over the Pin Carrier and turn the helium on. Adjust the flow of the helium with the flow gauge 0.5LPM and allow the helium to flow for 1 minute.
l. Record the highest level of helium detected by the leak checker, on the form sheet.
m. Subtract the base rate from the leak rate and enter this number as the actual leak rate.
n. Close valve:
D Leak Checker Valve
o. Turn on the DVP500 pump and pump until –1 vacuum is achieved, open valve:
C Roughing Valve
p. Shut off the DVP500 pump and open valve
A Roughing Vent Valve
q. Vent the leak checker.
r. Enter the name of the person who performed the tests and the date the tests were performed on the form sheet.
s. Using Acetone then Ethanol remove any vacuum grease that may have been used during testing.

6. Cold Cycling

a. Select 12 Pin Carriers (P/C) for cooling and insert the P/C's into the P/C basket. Enter the serial numbers of the 12 P/C's being tested into the P/C logbook.
b. Insert Diode 1 into the steel plate on P/C basket and insert diode A into a P/C.
c. Lower the P/C Basket into the cooler and secure the basket in place with two screws.
d. Turn on the Delta Air products controller and ensure that diode 1 is reading properly. Turn on the temperature controller and ensure that diode A is reading properly.
e. Insert the inner aluminum lid.
f. Clean the o-ring for the lid to the cooler using ethanol. Apply a very small amount of vacuum grease to the o-ring. Stretch the o-ring and place it in the o-ring groove at the top of the P/C cooler.
g. Place the lid on the P/C cooler and check to make sure the o-ring is still in the groove.
h. Log onto WINO and open the Labview program in the following directory:
Network Neighborhood/ hepserv/ Labview/ Cold Test Station/ SI 9620-1 Monitor.vi
i. In the comment box of the VI program record the following information:
- Date
- Which cold cycle it is for which Pin Carriers 1, 2, or 3.
- Diode locations
- Any other relevant test information

j. Click on the run button, which is the white arrow, located at the upper left portion of the Labview window. A dialogue box will appear asking for the destination where the data is to be saved. Save the Labview data in the following destination: (Use ddmmyy format for saving the data)
Network Neighborhood/ Hepcad/ users/ aaron/ Atlas Documents/ Labview Data/ Data Files/ Pin Carriers
k. After the program has been saved in the above directory Labview will be taking data. Set the time on the Labview screen for taking data to 2 minutes.
l. Turn on the cooling water that is located about 4-feet up on the wall beside the entrance to the lab.
m. Turn on the compressor by flicking the green switch on the front of the compressor. Also, turn on the expander by flicking the yellow switch located in the rack, below the Delta Air Products temperature controller.
n. Change the set point on the Delta Air Products temperature controller to 60K. To do this perform the following steps:

- Press the [MAN] button
- Press the red * button
- Press the number 3 button (this button also has set point written on it)
- Enter 060.0 (The decimal place is placed automatically)
- Press Enter

o. At the end of the day the cooler needs to be evacuated. Evacuate the cooler to a pressure of 8 x 10^{-2} mbar. To Do this follow the steps listed below:
- Open the nupro valve in the vacuum line
- Close the nupro valve for helium gas
- Close the vent valve
- Turn on the vacuum process controller to monitor the pressure
- Turn on the Edwards pump until the pressure reaches 8 x 10^{-2} mbar
- Close the nupro valve in the vacuum line
- Shut off the Edwards pump
- Open the vent valve

p. The next morning the vacuum should be in the 10^{-4} to 10^{-2} range and there may be a separation in the temperature of the steel plate and the Pin Carriers. To lower the temperature of the Pin Carriers to the temperature of the steel plate follow the steps listed below.
- Purge the line from the helium bottle
- Attach the helium line to the connection above nupro valve for helium gas
- Slowly open the nupro valve for helium gas until the pressure in the P/C cooler reaches 1 or 2 x 10^{-2} mbar
- Close the nupro valve for helium gas

q. When the temperature of the Pin Carriers reaches 77°K turn off the expander, compressor, and the water.

r. Change the set point on the Delta Air Products temperature controller to 285°K. To do this perform the following steps:
- Press the [MAN] button
- Press the red * button
- Press the number 3 button (this button also has set point written on it)
- Enter 285.0 (The decimal place is placed automatically)
- Press Enter

s. When the temperature of the cooler is at room temperature, print the Labview screen and file the plot in the blue binder.

t. Press the stop button in Labview located in the upper left corner of the window and then close the program.

u. Vent the P/C cooler following the steps listed below:
- Open the nupro valve in the vacuum line
- Open the Helium line valve

v. Remove the lid of the P/C cooler and remove the inner aluminum lid.

w. Remove the screws holding the P/C basket in place and remove the basket from the P/C Cooler.

x. Remove the diodes from the steel plates and remove the Pin Carriers from the basket.

y. Perform leak test.

7. Remove residual gold from weld lips

a. The weld lips should be cleaned with Scotch Bright to remove any remaining gold residue.

8. 1000 Volt HiPot Tests

a. Each pincarrier should be HiPot tested using the Cirris tester with wirelist PCHIPOT.WIR Use the custom built Jig for this test, and ensure that the jig is grounded to the Cirris tester. Use the special Cirris connect marked *shorted* for this test. The pincarrier should be vacuumed before the test, and any failed channels should be examined under a microscope or video camera and retested after debris is removed. **The pincarrier must be protected from any further debris contamination after completion of this test!**

Note: If any of the above tests failed then the Pin Carrier has failed and this should be circled at the bottom of the form sheet. Also, if the Pin Carrier has failed then a rejection sticker needs to be placed on the Pin Carrier and it needs to be stored on the reject shelf. If the Pin Carrier has passed all tests then Pass must be circled on the bottom of the form sheet.

9. Database Entry

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Pin Carrier

Arrival Information

Serial Number# _____ Date Received _____

Material Traceability Form # _____ Number of Rows _____

Recorded By: _____

Weld Date: _____ Flange #: _____

Testing

Weld Lip Condition _____ Quality of Threads _____

Length (mm) _____ Number of Bent Pins _____

Width (mm) _____ Bent Pins Repaired ☐ Y ☐ N

Height (mm) _____

Leak Test #1

Base Rate (No He) _____

Leak Rate (He) _____

Actual Leak Rate _____

Date Tested _____

Tested By: _____

Leak Test #2

Base Rate (No He) _____

Leak Rate (He) _____

Actual Leak Rate _____

Date Tested _____

Tested By: _____

Leak Test #3

Base Rate (No He) _____

Leak Rate (He) _____

Actual Leak Rate _____

Date Tested _____

Tested By: _____

Leak Test #4

Base Rate (No He) _____

Leak Rate (He) _____

Actual Leak Rate _____

Date Tested _____

Tested By: _____

Leak Test #5

Base Rate (No He) _____

Leak Rate (He) _____

Actual Leak Rate _____

Date Tested _____

Tested By: _____

HiPot Test: ☐

Gold Removed from Weld Lip: ☐

Pin Carrier Continued

Pin Carrier Serial #

Cold Cycle Information

Cold Cycle #1
Lowest Temperature _____
Time to Cool _____
Date Tested _____
Tested By _____

Cold Cycle #2
Lowest Temperature _____
Time to Cool _____
Date Tested _____
Tested By _____

Cold Cycle #3
Lowest Temperature _____
Time to Cool _____
Date Tested _____
Tested By _____

1000 V HiPot Test (init ial) _____

Recorded in Database By: _____
Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 2
Cold Signal Flange

1. Detail Drawing

PDE-0202D Rev C
Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. Material Traceability

All Cold Signal Flanges are fabricated from Low Inclusion AISI 304L stainless steel. Atlas Victoria will require the material vendor to supply certification of origin, physical and chemical specification and an Inclusion report, for each batch of material supplied. We will also require the Cold Signal Flange vendor to verify the supplied low inclusion steel was used to construct all Cold Signal Flanges and account for remaining material. The specification will be stored in files at ATLAS Victoria. Each Cold Signal Flange inspected will have an accompanying form sheet, upon which, the relevant material specification sheet number will be entered. All form sheet data will subsequently be transferred to a database.

3. Arrival Information

a. Using the electronic scribe, scribe a new serial number on the side of the flange that the Pin Carriers are welded to. Check the database to find the last serial number inscribed on a flange. The serial number on each flange is to increase by one.
b. Clean each flange using dish soap and water. Clean all drilled holes with q-tips to remove as much oil as possible.
c. Place the flange on the counter to air dry.
d. Enter information requested on the form sheet.

4. Testing

a. Using Vernier Calipers measure the outside diameter on both sides and enter these numbers on the form sheet. Inspect the weld lip for any defects, enter pass or fail on the form sheet.
b. Using Vernier Calipers measure the width and lengths of slot A7, B7, A8, and B8. The positions of these slots can be found below. Enter these numbers on the form sheet.

Note: Pin carrier weld lip is up for proper slot arrangement.

c. Inspect the weld lips for each pin carrier, checking for any defects, enter pass or fail on the form sheet.

Note: If any of the inspections failed then the Cold Signal Flange has failed and this should be circled at the bottom of the form sheet. Also, if the Cold Signal Flange has failed then a rejection sticker needs to be placed on the Cold Signal Flange and it needs to be stored on the reject shelf. If the Cold Signal Flange has passed all tests then Pass must be circled on the bottom of the form sheet.

d. Carefully package the flange for ultrasonic cleaning at Triumf.
e. At Triumf lower the flange into the ultrasonic bath for 5 minutes. Raise the flange and clean all holes with cleaning tips attached to drills. Lower the flange into the ultrasonic bath for another 5 minutes and then remove it from the bath.
f. Rinse the flange with water and then dry with purified air.
g. Seal the flange in polyethylene bags.
h. Enter the date the ultrasonic cleaning was tested on the form sheet

5. Database Entry

a. Record the information from the form sheet into the database.

b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Cold Signal Flange

Arrival Information

Serial Number# _____ Date Received _____

Material Traceability Form # _____

Recorded By: _____

Testing

Outside Diameter (mm) Bellows (278.92 - 279.17) _____

Outside Diameter (mm) Funnel (278.75 - 279.00) _____

Outside Weld Lip Condition ☐ P ☐ F

Pin Carrier Slot A7

Width 64.97-65.12 mm _____

Length 105.15-105.30 mm _____

Weld Lip Condition ☐ P ☐ F

Pin Carrier Slot B7

Width 64.97-65.12 mm _____

Length 105.15-105.30 mm _____

Weld Lip Condition ☐ P ☐ F

Pin Carrier Slot A8

Width 73.66-73.81 mm _____

Length 105.15-105.30 mm _____

Weld Lip Condition ☐ P ☐ F

Pin Carrier Slot B8

Width 73.66-73.81 mm _____

Length 105.15-105.30 mm _____

Weld Lip Condition ☐ P ☐ F

Date Tested _____ Tested By: _____

Date Ultrasonic Cleaned _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 3
Ambient Signal Flange

1. ***Detail Drawing***

   PDE-0203D Rev D
   Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. ***Material Traceability***

All Ambient Signal Flanges are fabricated from Low Inclusion AISI 304L stainless steel. Atlas Victoria will require the material vendor to supply certification of origin, physical and chemical specification and an Inclusion report, for each batch of material supplied. We will also require the Ambient Signal Flange vendor to verify the supplied low inclusion steel was used to construct all Ambient Signal Flanges and account for remaining material. The specification will be stored in files at ATLAS Victoria. Each Ambient Signal Flange inspected will have an accompanying form sheet, upon which, the relevant material specification sheet number will be entered. All form sheet data will subsequently be transferred to a database.

3. ***Arrival Information***

   a. Using the electronic scribe, scribe a new serial number on the side of the flange that the heater plate is mounted too. Check the database to find the last serial number inscribed on a flange. The serial number on each flange is to increase by one.
   b. Clean each flange using dish soap and water. Clean all drilled holes with q-tips to remove as much oil as possible.
   c. Place the flange on the counter to air dry.
   d. Enter information requested on the form sheet.

4. ***Testing***

   a. Using Vernier Calipers measure the outside diameter and enter this number on the form sheet. Inspect the weld lip that mates with the Bellows Seal Ring for any defects, enter pass or fail on the form sheet.
   b. Using Vernier Calipers measure the width and lengths of slot A7, B7, A8, and B8. The positions of these slots can be found below. Enter these numbers on the form sheet.

Note: Pin carrier weld lip is up for proper slot arrangement.

   c. Inspect the weld lips for each pin carrier, checking for any defects.

Note: If any of the inspections failed then the Ambient Signal Flange has failed and this should be circ led at the bottom of the form sheet. Also, if the Ambient Signal Flange has failed then a rejection sticker needs to be placed on the Ambient Signal Flange and it needs to be stored on the reject shelf. If the Ambient Signal Flange has passed all tests then Pass must be circled on the bottom of the form sheet.

   d. Carefully package the flange for ultrasonic cleaning at Triumf.
   e. At Triumf lower the flange into the ultrasonic bath for 5 minutes. Raise the flange and clean all holes with cleaning tips attached to drills. Lower the flange into the ultrasonic bath for another 5 minutes and then remove it from the bath.
   f. Rinse the flange with water and then dry with purified air.
   g. Seal the flange in polyethylene bags.
   h. Enter the date the ultrasonic cleaning was tested on the form sheet

5. ***Database Entry***

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Ambient Signal Flange

Arrival Information

Serial Number# _____ Date Received _____
Material Traceability Form # _____
Recorded By: _____

Testing

Outside Diameter 271.04-271.17 mm _____
Outside Weld Lip Condition ☐ P ☐ F

Pin Carrier Slot A7
Width 64.97-65.12 mm _____
Length 105.15-105.30 mm _____
Weld Lip Condition ☐ P ☐ F

Pin Carrier Slot B7
Width 64.97-65.12 mm _____
Length 105.15-105.30 mm _____
Weld Lip Condition ☐ P ☐ F

Pin Carrier Slot A8
Width 73.66-73.81 mm _____
Length 105.15-105.30 mm _____
Weld Lip Condition ☐ P ☐ F

Pin Carrier Slot B8
Width 73.66-73.81 mm _____
Length 105.15-105.30 mm _____
Weld Lip Condition ☐ P ☐ F

Date Tested _____ Tested By: _____
Date Ultrasonic Cleaned _____

Recorded in Database By: _____
Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 4
Funnel Base

1. ***Detail Drawing***
   PDE-0206D Rev C
   Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. ***Material Traceability***
   All Funnel Bases are fabricated from Low Inclusion AISI 304L stainless steel. Atlas Victoria will require the material vendor to supply certification of origin, physical and chemical specification and an Inclusion report, for each batch of material supplied. We will also require the Funnel Base vendor to verify the supplied low inclusion steel was used to construct all Funnel Bases and account for remaining material. The specification will be stored in files at ATLAS Victoria. Each Funnel Base inspected will have an accompanying form sheet, upon which, the relevant material specification sheet number will be entered. All form sheet data will subsequently be transferred to a database.

3. ***Arrival Information***
   a. Using the electronic scribe, scribe a new serial number on the outside face of Funnel Base. Check the database to find the last serial number inscribed on a flange. The serial number on each flange is to increase by one. Enter this serial number on the form sheet.
   b. Record the date received on the form sheet
   c. A material traceability form for the Funnel Bases can be found filed under M in the top drawer of the filing cabinet in Paul Birneys office. There is a unique number to this form, record this number on the form sheet.
   d. Enter the name of the person who recorded the above information, on the form sheet.

4. ***Testing***
   a. Using Vernier Calipers measure the inside diameter of the offset hole and enter the number on the form sheet.
   b. Using Vernier Calipers measure the outside diameter of the weld lip and enter the number on the form sheet.
   c. Using the template made for the placement of the offset hole check to see that the offset is correctly machined and enter Pass on the form sheet if it is correctly machined, and Fail if it is incorrectly machined.
   d. Enter the name of the person who tested the flange and the date the flange was tested on the form sheet.

5. ***Shipping***
   a. Carefully wrap the Funnel Base in bubble wrap and place it in the crate to be shipped to Specific Mechanical.
   b. Enter the name of the person who packaged the Funnel Base in the crate, on the form sheet.
   c. Enter the date that the crates of Funnel Bases were shipped to Specific Mechanical.

6. ***Database Entry***
   a. Record the information from the form sheet into the database.
   b. Record the name of the person and the date the date the information was recorded into the database, on the form sheet.

Note: If any of the tests failed then the Funnel Base has failed and this should be circled at the bottom of the form sheet. Also, if the Funnel Base has failed then a rejection sticker needs to be placed on the Funnel Base and it needs to be stored on the reject shelf. If the Funnel Base has passed all tests the Pass must be circled on the bottom of the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Funnel Base

Arrival Information

Serial Number# _____ Date Received _____

Material Traceability Form # _____

Recorded By: _____

Testing

Inside Diameter of Offset Hole (137.00 - 137.20mm) _____

Outside Diameter of Weld Lip (278.92 - 279.17mm) _____

Offset Distance ☐ P ☐ F

Tested By: _____ Date Tested: _____

Shipping (To Specific Mechanical)

Packed By: _____ Shipping Date: _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 5
Lower Funnel Tube

1. Detail Drawings

PDE-0212D Rev A
Drawings can be found at http://www.lhc01.cern.ch/cdd/

2. Material Traceability

All Lower Funnel Tubes are fabricated from AISI 304L stainless steel. Atlas Victoria will require Lower Funnel Tube vendor to supply certification of the suitability of the material to be used in a pressure vessel. The specification will be stored in files at ATLAS Victoria. Each Lower Funnel Tube inspected will have an accompanying form sheet, upon which, the relevant material specification sheet number will be entered. All form sheet data will subsequently be transferred to a database.

3. Arrival Information

a. Using the electronic scribe, scribe a new serial number on the outside face of the Lower Funnel Tube. Check the database to find the last serial number inscribed on a Lower Funnel Tube. The serial number on each Lower Funnel Tube is to increase by one. Enter this serial number on the form sheet.
b. Record the date received on the form sheet
c. A material traceability form for the Lower Funnel Tube can be found filed under M in the top drawer of the filing cabinet in Paul Birney's office. There is a unique number to this form, record this number on the form sheet.
d. Enter the name of the person who recorded the above information, on the form sheet.

4. Testing

a. Each Lower Funnel Tube will undergo an initial inspection upon arrival at ATLAS Victoria. Itemized below are a number of tests that each Lower Funnel Tube will be subject to upon arrival at Victoria.
b. If a Lower Funnel Tube does not pass all the tests it will be tagged with a blue sticker and placed in an area designated for defective components.
c. Each of the dimensions labeled A, B, C, D, E and F on the drawing below of the Lower Funnel Tube will be measured using Vernier Calipers to ensure they fall within the allowable tolerances laid out on the form sheet.
d. After testing, record who did the testing and the date the Lower Funnel Tube was tested.

If the outer tube passed all the above required tests then circle "PASS" in the lower right corner of the form sheet. If it failed any of the above tests and the defect was not repaired then circle "FAIL" on the form sheet. If it failed any of the above tests and the defect was repaired then circle "PASS" in the lower right corner of the form sheet.

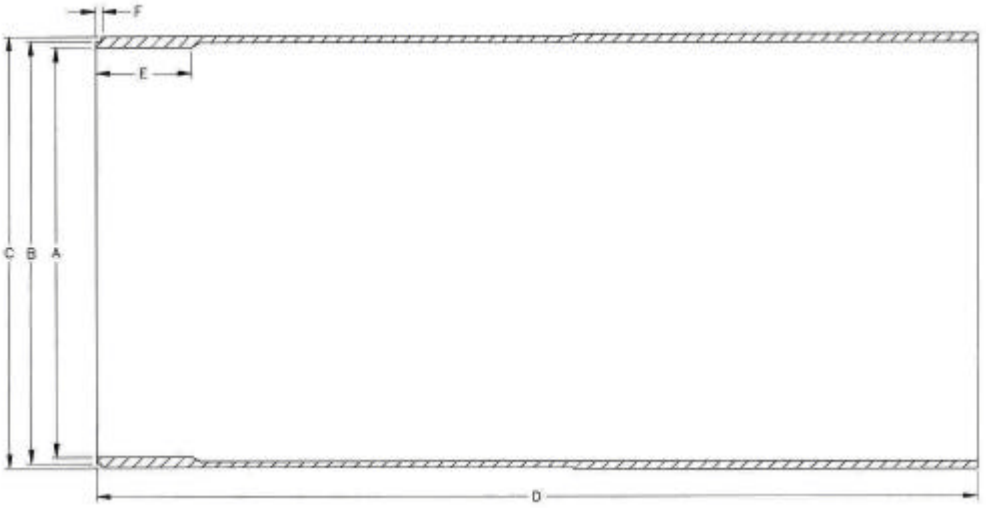
Note: If the Lower Funnel Tube failed any of the above tests, then the Funnel Assembly has failed and this should be circled at the bottom of the form sheet. Also, if the Lower Funnel Tube has failed then a rejection sticker needs to be placed on the Lower Funnel Tube and it needs to be stored on the reject shelf. If the Lower Funnel Tube has passed all tests then Pass must be circled on the bottom of the form sheet.

5. Database Entry

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Lower Funnel Tube

6. Dimension Diagram



Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Lower Funnel Tube

Arrival Information

Serial Number# _____ Date Received _____

Material Traceability Form # _____

Recorded By: _____

Testing

Dimension A 133.15-133.00 mm _____ Dimension D 285.25-284.75 mm _____

Dimension B 136.90-136.65 mm _____ Dimension E 31.25-29.75 mm _____

Dimension C 140.20-139.8 mm _____ Dimension F 1.85-1.35 mm _____

Tested By: _____ Date Tested: _____

Shipping

Packed By: _____ Shipping Date: _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 6
Funnel Assembly

1. *Detail Drawing*

PDE-0204D Rev C (Funnel Assembly)
Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. *Welding*

All welds for the Funnel Assembly will be performed at Specific Mechanical, Saanichton, BC. All welds will conform to the requirements of the A.S.M.E. Pressure Vessel Code, and must be suitable for Vacuum service. The welds will require a WPS Sheet (Welding Procedure Specifications, QW-482), PQR Sheet (Procedure Qualification Records, QW-483), and a WPQ Sheet (Welding Operator Performance Qualifications, QW-484). These sheets are included in the University Of Victoria TRIUMF Hadronic End Cap Signal Feedthrough Welding Plan located in Appendix A.

3. *Arrival Information*

a. Record the serial number for the Funnel Base on the form sheet. This serial number can be found on the outside face of the Funnel Base.
b. Record the serial number for the Lower Funnel Tube on the form sheet. This serial number can be found on the outside of the Lower Funnel Tube.
c. Record the date the Funnel Assembly arrived from Specific Mechanical on the form sheet.
d. Enter the name of the person who recorded the above information, on the form sheet.

4. *Testing*

a. Remove the funnel assembly from its sealed bag.
b. Slide the Upper Funnel Tube over the Go/No-Go Gauge. If the Upper Funnel Tube slides over the Go/No-Go gauge enter Pass on the form sheet, if it does not slide over enter Fail on the form sheet.
c. Bolt a Blank CF Flange to the CF Flange that is welded to the Lower Funnel Tube; use a copper gasket.
d. Mount the Funnel Assembly into its leak-testing jig, and place it on the leak test platter for leak testing.
e. For this test the DVP500 Pump will be used for a roughing vacuum. So, close valves E, D, A, and N. Open valves P and C. Also, turn on the Vacuum Process Controller to monitor the roughing vacuum.
f. Turn on the DVP500 pump and pump down the test apparatus to a vacuum of $3.0x10^{-1}$ or better. When the vacuum reaches $3.0x10^{-1}$ close valve C.
g. Start pumping with the leak checker. When the leak checker reaches $5.0x10^{-1}$ open valve D. When the base rate of the leak checker bottoms out, testing can start.
h. To leak test the Lower Tube Weld to the Funnel Base, first enter the base rate of the leak checker on the form sheet. Slowly run the helium wand around the join between the Lower Funnel Tube and the Funnel Base, and enter the maximum leak rate registered by the leak checker during this test.
i. Subtract the base rate from the leak rate and enter this number as the actual leak rate.
j. Repeat steps 7 & 8 for The Upper Tube weld to the Funnel Base, and the Lower Tube Weld to the CFF.
k. Shut Valve D, turn on the DVP500 pump and pump until –1 vacuum is achieved, open valve C, shut off the DVP500 pump and open valve A to vent the system. Vent the leak checker.
l. Enter the name of the person who performed the tests and the date the tests were performed on the form sheet.
m. Using Acetone then Ethanol remove any vacuum grease that may have been used on the muff ring.
n. Place the Funnel Assembly back in its back and seal the bag.

Note: If any of the tests failed then the Funnel Assembly has failed and this should be circled at the bottom of the form sheet. Also, if the Funnel Assembly has failed then a rejection sticker needs to be placed on the Funnel Assembly and it needs to be stored on the reject shelf. If the Funnel Assembly has passed all tests then Pass must be circled on the bottom of the form sheet.

5. *Database Entry*

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Funnel Assembly

Arrival Information

Funnel Base Serial # _____ Date Received _____
Lower Funnel Tube Serial # _____
Recorded By: _____

Testing

Inside Diameter Gauge Test _____

Leak Test Lower Tube Weld
Base Rate (No He) _____
Leak Rate (He) _____
Actual Leak Rate _____

Leak Test Upper Tube Weld
Base Rate (No He) _____
Leak Rate (He) _____
Actual Leak Rate _____

Leak Test Lower Tube Weld to CFF
Base Rate (No He) _____
Leak Rate (He) _____
Actual Leak Rate _____

Tested By: _____ Date Tested _____
Cleaned By: _____ Date Cleaned _____

Recorded in Database By: _____
Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 7
Bellows Seal Ring

1. ***Detail Drawing***
   PDE-0208D
   Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. ***Material Traceability***
   All Bellows Seal Rings are fabricated from Low Inclusion AISI 304L stainless steel. Atlas Victoria will require the material vendor to supply certification of origin, physical and chemical specification and an Inclusion report, for each batch of material supplied. We will also require the Funnel Base vendor to verify the supplied low inclusion steel was used to construct all Funnel Bases and account for remaining material. The specification will be stored in files at ATLAS Victoria. Each Bellows Seal Ring inspected will have an accompanying form sheet, upon which, the relevant material specification sheet number will be entered. All form sheet data will subsequently be transferred to a database.

3. ***Arrival Information***
   a. Using the electronic scribe, scribe a new serial number on the outside of the Seal Ring. Check the database to find the last serial number inscribed on a Seal Ring. The serial number on each Seal Ring is to increase by one. Enter this serial number on the form sheet.
   b. Record the date received on the form sheet
   c. A material traceability form for the Seal Rings can be found filed under M in the top drawer of the filing cabinet in Paul Birney's office. There is a unique number to this form, record this number on the form sheet.
   d. Enter the name of the person who recorded the above information, on the form sheet.

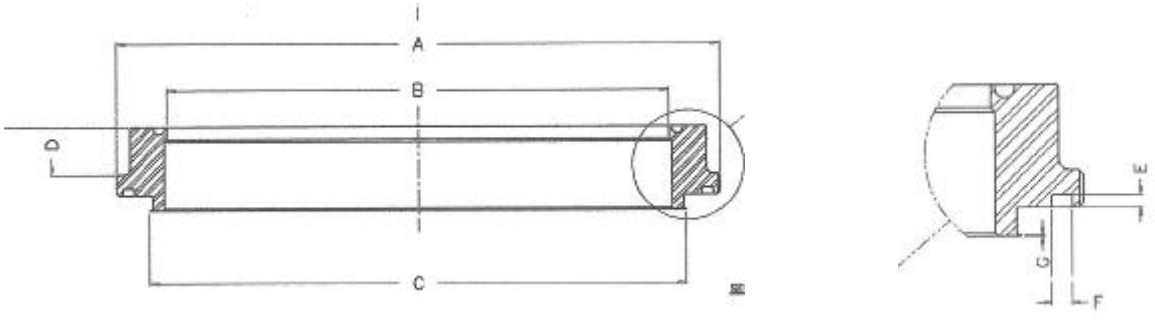
4. ***Testing***
   a. Using Vernier Calipers measure dimension A, B, C, D, E, and F. Record the dimensions on the form sheet. All numbers obtained should fall within the tolerances provided on the front of the form sheet. If the dimensions do not fall within the tolerances, follow the instructions in the note below. A Diagram of the dimensions is shown below.
   b. Enter the name of the person who performed the tests and the date the tests were performed on the form sheet.

Note: If any of the tests have failed then the Seal Ring is non conforming and "fail" should be circled at the bottom of the form sheet. Also, if the Seal Ring has failed then a rejection sticker needs to be placed on the Seal Ring and it needs to be stored on the reject shelf. If the Seal Ring has passed all tests then Pass must be circled on the bottom of the form sheet.

5. ***Shipping***
   a. Carefully wrap the Seal Ring in bubble wrap and place it in the crate to be shipped to American BOA.
   b. Enter the name of the person who packaged the Seal Ring in the crate, on the form sheet.
   c. Enter the date that the crates of Seal Rings were shipped to American Boa.

6. ***Database Entry***
   a. Record the information from the form sheet into the database.
   b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

7. Dimension Diagrams



Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Bellows Seal Ring

Arrival Information

Serial Number# _____ Date Received _____

Material Traceability # _____

Recorded By: _____

Testing

Dimension A _____
271.22 - 271.35mm (Inside Diameter)

Dimension D _____
3.86 - 3.99mm (O-ring Depth)

Dimension B _____
289.43 - 289.69mm (Bellows Weld Lip)

Dimension E _____
6.07 - 6.20mm (O-ring Width)

Dimension C _____
11.39 - 11.52mm (Protrusion Thickness)

Dimension F _____
0.38 - 0.43 (Bellows Weld Lip Thickness)

Tested By: _____ Date Tested _____

Shipping (To American BOA)

Packed By: _____ Shipping Date: _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 8
Bellows Cuff Ring

1. *Detail Drawing*

PDE-0209D Rev B
Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. *Material Traceability*

All Bellows Cuff Rings are fabricated from AISI 304L stainless steel. Atlas Victoria will require the material vendor to supply certification of origin, physical and chemical specification for each batch of material supplied. The specification will be stored in files at ATLAS Victoria. Each Bellows Cuff Ring inspected will have an accompanying form sheet, upon which, the relevant material specification sheet number will be entered. All form sheet data will subsequently be transferred to a database.

3. *Arrival Information*

a. Using an electronic scribe, scribe a serial number on the inside of the Cuff Ring. Check the form sheets and the database to check the last serial number used. The serial numbers are incremented by one and start with CR. Record this serial number on the form sheet.
b. Record the date that the Cuff Rings were received.
c. Record the name of the person who recorded the above information, on the form sheet.

4. *Testing*

a. Using Vernier Calipers measure dimension A, B, C, D, and E. Record the dimensions on the form sheet. All numbers obtained should fall within the tolerances provided on the front of the form sheet. If the dimensions do not fall within the tolerances, follow the instructions in the note below. A Diagram of the dimensions is shown below.
b. Enter the name of the person who performed the tests and the date the tests were performed on the form sheet.

Note: If any of the tests have failed then the Cuff Ring is non conforming and "fail" should be circled at the bottom of the form sheet. Also, if the Cuff Ring is non conforming then a rejection sticker needs to be placed on the Cuff Ring and it needs to be stored on the reject shelf. If The Cuff Ring has passed all tests then Pass must be circled on the bottom of the form sheet.

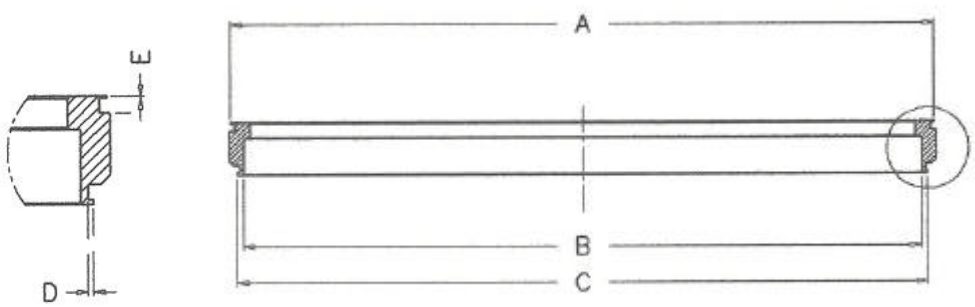
5. *Shipping*

a. Carefully wrap the Cuff Ring in bubble wrap and place it in the crate to be shipped to American BOA.
b. Enter the name of the person who packaged the Cuff Ring in the crate, on the form sheet.
c. Enter the date that the crates of Cuff Rings were shipped to American Boa.

6. *Database Entry*

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

7. *Dimension Diagrams*



Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Bellows Cuff Ring

Arrival Information

Serial Number# _____ Date Received _____

Recorded By: _____

Testing

Dimension A[289.43-289.69 mm] _____ Dimension D[1.00-1.25 mm] _____

Dimension B[279.20-279.40 mm] _____ Dimension E[.33-.43 mm] _____

Dimension C[284.07-284.33 mm] _____

Tested By: _____ Date Tested _____

Shipping (To American Boa)

Packed By: _____ Shipping Date: _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 9
Bellows Assembly

1. *Detail Drawings*

PDE-0207D (Bellows Assembly)
Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. *Arrival Information*

a. Record the Bellows serial number on the form sheet. The Bellows serial number is the same as the Seal Ring serial number.
b. Record the Cuff Ring serial number on the form sheet.
c. Record the name of the person who recorded the above information, on the form sheet.

3. *Inspection*

a. Record the date the ultrasonic cleaning was done on the Bellows Assembly and also enter the name of the person or persons who cleaned the Bellows Assembly, on the form sheet.
b. Inspect the Cuff Ring weld lip for any dents or defects. If any dents or defects are found check the Fail box on the form sheet. If no dents or defects are found check the Pass box on the form sheet.
c. Inspect the Seal Ring weld lip for any dents or defects. If any dents or defects are found check the Fail box on the form sheet. If no dents or defects are found check the Pass box on the form sheet.
d. Count the number of convolutions on the Bellows and enter the number on the form sheet.
e. Using a measuring tape measure the overall length of the Bellows Assembly in four places and add the four measurement together and divide the sum by 4 to obtain a mean length, enter the mean length on the form sheet.
f. Record the date the above inspection was completed.

4. *Cleaning*

The Bellows assemblies are taken to Triumf in Vancouver to be cleaned in the Ultrasonic cleaning bath.

5. *Leak Testing*

a. Mount the Bellows Assembly into its leak-testing jig, and place it on the leak test platter for leak testing.
b. For this test the DVP500 Pump will be used for a roughing vacuum.
c. Close valves:
   - E 3-Position Valve
   - D Leak Checker Valve
   - A Roughing Vent Valve
   - N Bellows Roughing Valve
d. Open valves:
   - P Roughing Pump Valve
   - C Roughing Valve
e. Turn on the Vacuum Process Controller to monitor the roughing vacuum.
f. Turn on the DVP500 pump and pump down the test apparatus to a vacuum of 3.0×10^{-1} or better. When the vacuum reaches 3.0×10^{-1} close valve:
   - C Roughing Valve
g. Start pumping with the leak checker. When the leak checker reaches 5.0×10^{-1} open valve:
   - D Leak Checker Valve
h. When the base rate of the leak checker bottoms out the testing can start.
i. To leak test the Bellows weld to the Seal Ring, first enter the base rate of the leak checker on the form sheet. Slowly run the helium wand around the join between the Bellows and the Seal Ring, and enter the maximum leak rate registered by the leak checker during this test.
j. Subtract the base rate from the leak rate and enter this number as the actual leak rate.
k. Repeat steps 7 & 8 for the Bellows to Cuff Ring weld and the Bellows seam weld.
l. Close valve:
   - D Leak Checker Valve
m. Turn on the DVP500 pump and pump until –1 vacuum is achieved, open valve:
   - C Roughing Valve
n. Shut off the DVP500 pump and open valve:
   - A Roughing Vent Valve

o. Vent the leak checker.
p. Enter the name of the person who performed the tests and the date the tests were performed on the form sheet.
q. Using Acetone then Ethanol remove any vacuum grease that may have been used during testing.
r. Place the Bellows Assembly back in its back and seal the bag.

Note: If any of the tests failed then the Bellows Assembly has failed and this should be circled at the bottom of the form sheet. Also, if the Bellows Assembly has failed then a rejection sticker needs to be placed on it and it needs to be stored on the reject shelf. If The Bellows Assembly has passed all tests then Pass must be circled on the bottom of the form sheet.

6. Database Entry

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Bellows Assembly

Arrival Information

Bellows Serial Number#:(Seal Ring#) _____

Cuff Ring Serial Number# _____

Date Received _____ Recorded By: _____

Testing

Cuff Ring Weld Lip ☐ P ☐ F

Seal Ring Weld Lip ☐ P ☐ F

Convolutions _____

Tested By: _____

Mean Length: _____

Leak Test Bellows To Cuff Ring

Base Rate (No He) _____

Leak Rate (He) _____

Actual Leak Rate _____

Date Tested: _____

Date Ultrasonic Cleaned _____

Leak Test Bellows Test #2

Base Rate (No He) _____

Leak Rate (He) _____

Actual Leak Rate _____

Leak Test Bellows Test #3

Base Rate (No He) _____

Leak Rate (He) _____

Actual Leak Rate _____

Tested By: _____

Cleaned By: _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 10
Modified VCR Gland

1. Detail Drawing

- PDE-0213B (Modified VCR Gland)
  Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. Arrival Information

a. Record the serial number of the Modified VCR Gland on the form sheet.
b. Record the date the Gland arrived on the form sheet.
c. Record the name of the person who recorded the above information on the form sheet

3. Testing (optional)

a. Visually inspect the gland for any obvious defects, specifically large dings in the sealing face. If there is nothing noticeable enter Pass on the form sheet if there is noticeable defects on the gland enter Fail.
b. Mount the Modified VCR Gland on the vacuum station next to the Valve B. On the end of the VCR gland closest to the valve use a copper gasket, on the end furthest from the valve use a solid rubber gasket.
c. For this test the DVP500 Pump will be used for a roughing vacuum.
d. Close valves:
   - E 3-Position Valve
   - D Leak Checker Valve
   - A Roughing Vent Valve
   - N Bellows Roughing Valve
e. Open valves
   - P Roughing Pump Valve
   - B VCR Test Valve
   - C Roughing Valve
f. Turn on the Vacuum Process Controller to monitor the roughing vacuum.
g. Turn on the DVP500 pump and pump down the test apparatus to a vacuum of $3.0x10^{-1}$ or better. When the vacuum reaches $3.0x10^{-1}$ close valve:
   - C Roughing Valve
h. Start pumping with the leak checker. When the leak checker reaches $5.0x10^{-1}$ open valve:
   - D Leak Checker Valve
i. When the base rate of the leak checker bottoms out testing can start.
j. To leak check the Modified VCR Gland first enter the base rate of the leak checker on the form sheet. Then using the helium wand slowly run it around the VCR connection closest to Valve B. Enter the largest leak rate registered by the leak checker on the form sheet.
k. Subtract the base rate from the leak rate, this will give the actual leak rate of that end of the Modified VCR Gland, record this number on the form sheet.
l. Close valve:
   - D Leak Checker Valve
m. Turn on the DVP500 pump and pump until –1 vacuum is achieved.
n. Open valve:
   - C Roughing Valve
o. Shut off the DVP500 pump and open valve:
   - A Roughing Vent Valve
p. Vent the leak checker.
q. Repeat steps 2 through 8 for the opposite side of the Gland.

Note: If any of the tests failed then the Modified VCR Gland has failed and this should be circled at the bottom of the form sheet. Also, if the Gland has failed then a rejection sticker needs to be placed on it and it needs to be stored on the reject shelf. ANY LEAK IS CONSIDERED A FAILURE. If The Gland has passed all tests then Pass must be circled on the bottom of the form sheet.

4. Database Entry

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Modified VCR Gland

Arrival Information

Serial Number# **GL** _____ Date Received _____

Recorded By: _____

Testing

Visual Inspection _____

Leak Test 1st End		**Leak Test 2nd End**	
Base Rate (No He)	_____	Base Rate (No He)	_____
Leak Rate (He)	_____	Leak Rate (He)	_____
Actual Leak Rate	_____	Actual Leak Rate	_____
Date Tested	_____	Date Tested	_____
Tested By:	_____	Tested By:	_____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 11
Bolt Ring

1. Detail Drawing

PDE-0205D Rev A
Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. Arrival Information

a. Using an electronic scribe, scribe a serial number on the inside of the Bolt Ring. Check the form sheets and the database to check the last serial number used. The serial numbers are incremented by one and start with CR. Record this serial number on the form sheet.
b. Record the date that the Bolt Rings were received.
c. Record the name of the person who recorded the above information, on the form sheet.

3. Testing

a. Using the template check to see if the Bolt Ring was properly machined. Check either the "Y" or "N" depending on whether or not the Bolt Ring holes matches the template on the form sheet.
b. Visually check to make sure all of the holes have been taped. Check either the "Y" or "N" depending on whether or not the Bolt Ring holes have been properly tapped.
c. Enter the name of the person who performed the tests and the date the tests were performed on the form sheet.

Note: If any of the tests failed then the Bolt Ring has failed and this should be circled at the bottom of the form sheet. Also, if the Bolt Ring has failed then a rejection sticker needs to be placed on the Bolt Ring and it needs to be stored on the reject shelf. If The Bolt Ring has passed all tests then Pass must be circled on the bottom of the form sheet.

4. Database Entry

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #:010330

Bolt Ring

Arrival Information

Serial Number# _____ Date Received _____

Recorded By: _____

Testing

Bolt Hole Pattern Alignment ☐ **Y** ☐ **N**

Tapped Holes ☐ **Y** ☐ **N**

Tested By: _____ Date Tested: _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 12
Vacuum Cables

1. Arrival Information

a. Record the serial number for the Vacuum Cable on the form sheet. The serial number should be written as VC followed by a 4-digit number. The serial number can be found on one of the plastic cases.
b. Record the date the Vacuum cable was received, on the form sheet.
c. Record the FCI serial number on the form sheet. This serial number can be found stamped on the kapton coating. The serial number is usually a series of two 4-digit numbers. Occasionally there is only one 4-digit number.
d. The slot designation will be determined after testing and analysis is performed on the cables and will have to be entered on the form sheet in a later step.
e. Record the name of the person, on the form sheet, who recorded the arrival information.
f. The box # refers to the box that the set of cables is stored in. This number will be obtained after all electrical tests have been performed on the cable, and will be asked for in a later step.
g. The feedthrough # will not be determined until the cable is installed in a feedthrough, this number will be asked for in a later step.
h. Using a green felt tip marker mark the orientation of pin 1 on the Vacuum Cable. The placement of pin 1 can be found in the diagram below.

Note: If any of the tests failed then the Vacuum Cable has failed and this should be circled at the bottom of the form sheet. Also, if the Vacuum Cable has failed then it needs to be placed in the Vacuum Cable rejection box on the cable shelf. If The Vacuum Cable has passed all tests then Pass must be circled on the bottom of the form sheet.

2. Testing

a. Check that there are no bent spring clip segments, and, to ensure a reasonable degree of 'spring clip bow', check that daylight can be seen between the spring clips (ground shields) and the plastic housing when viewed end on.
b. Check that the cable length is in the 340mm to 350mm range.
c. Check that there are no tears or any other obvious defects on the kapton stripline coating. Also ensure that there is no glue residue transferred to the kapton from the packaging.
d. Check that the plastic case has been welded correctly (i.e., no significant gap between the halves) and that there is no significant bowing of the plastic housing when viewed end on. The nominal pincarrier slot spacing spacing is 8.7 mm; the maximum tolerable case width is 8.85 mm, however those cables with case widths greater than 8.7 mm should be flagged on the form sheets.
e. Ensure that the plastic spacer is not up side down.
f. Each Vacuum Cable is to be put through a series of electrical tests. These test are to be performed on each cable in the following order: Cirris Continuity Test, Cross Talk Tests, Impedance, Resistance, and Contact Resistance Measurements.

3. Cirris Continuity Tests

This test checks for intermittent signal trace faults using the Cirris tester.

a. Load the wirelist **VAC.WIR**.
b. Ensure that the Cirris tester is in **continuous** mode.

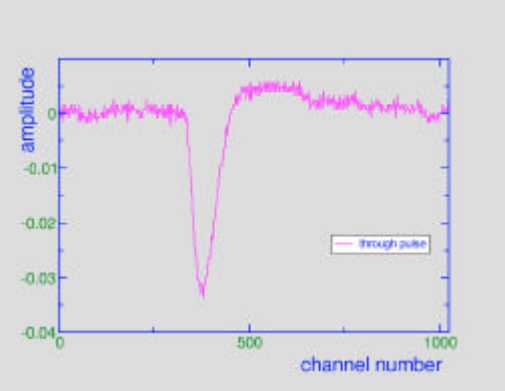
For each cable to be tested:

c. Connect a vacuum cable to the Cirris tester, with the pin 1 mark of the vacuum cable placed adjacent to the pin 1 mark of the **J1**/**J2** Cirris port.
d. Gently move (wiggle...) the stripline back and forth to observe any potential faults.
e. In event of failure, document which line(s) failed in the **comment** section of the Vacuum Cable form sheet.
f. No Cirris data, aside from a simple pass/fail, is saved for this test.

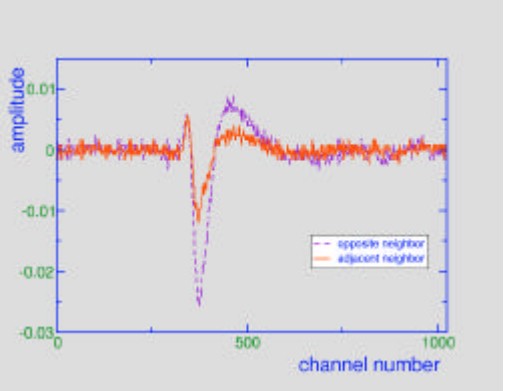
4. Cross Talk Tests

The Cross Talk tests can be carried out on either the mobile cross talk station, using the Tek2440 scope, or the fixed cross talk station, using the Lecroy 8818 Transient Recorder. Instructions are given for the mobile cross talk station. Instructions for the fixed cross talk station are analogous.

a. Log onto the cold test station computer (WINO) and start the program shown below from Windows Explorer: **Network Neighborhood/ Strange/ Electrical Tests/ Pro/ Exe/ Vacuum Cables/ Crosstalk/ ScopeF01.bat** (This assumes that the UBC fanout F01 is mounted on the mobile cross talk station, rather than F02, which is normally at the fixed cross talk station.)
b. In the VI window that should now appear, start the VI by pressing the RUN button (right arrow).
c. Follow the instructions on the pup-up window to set the properties of the BNC pulser. Note that **the pulser should be turned on at least 30 minutes before data collection** to allow it to warm up.
d. Attach the Vacuum Cable to test to the two Pin Carriers at the cross talk station. The Vacuum Cable should be attached to the two slots marked with red dots, and pin 1 of the Vacuum Cable should be adjacent to pin 1 of the Pin Carrier marked with a green dot.
e. Run your finger along the bottom of the Vacuum Cable to move any `loops' between the two striplines to one end or the other.
f. Press **Scan** to start the scanning procedure.
g. In the popup window that now appears, enter the directory name for the data to be stored. The directory name should be the serial number of the Vacuum Cable, e.g., **vc0123**. If a cable is being re-measured for any reason, use **vc0123.1** (or **vc0123.2**... etc). Enter **Save** to proceed.
h. Another popup window now appears instructing you to set the attenuator box (white box with toggle) to **Through Pulses**. Do so, and press **OK** to continue. Be sure to watch the first few pulses on the scope screen to ensure that they appear reasonable, i.e., clean negative pulses (see figure below).
i. Once the **Through Pulses** are completed (~ 1 minute) another popup window appears instructing you to set the attenuator box to **Cross Talk** Pulses. Do so, and press **OK** again to proceed. As before, watch the first few pulses on the scope screen to ensure that they appear reasonable, i.e. bipolar pulses (see figure below).
j. After all 64 lines are scanned (~ 3 minutes), remove the Vacuum Cable and proceed with measuring the next.
k. Note that the jackscrew sockets on the scanner and the pincarrier should be lubricated every 5 - 10 plugins to prevent gauling.



Typical Through Pulse



Typical Cross Talk Pulses

5. Impedance, Resistance, and Contact Resistance Measurements

Impedance, resistance, and contact resistance measurement are performed at the **Impedistance** test station.

a. Log onto the computer at the Impedistance test station (**STRANGE**) and start the Impedistance **Vi** at

Strange\Data\ElectricalTests\pro\exe\VacuumCables\Impedistance\Impedistance.VI.

b. In the **VI** window that should now appear, start the **VI** by pressing the **RUN** button (right arrow).
c. Turn the power on for the Keithley micro Ohmmeter, the network analyzer, **armadillo**, **Phred**, and **Phreda**.

6. Impedance Measurements

a. Attach the vacuum cable to the Impedance measuring device (Armadillo). The green dot on the surface of Armadillo marks the connector corner corresponding to pin 1. Connect the terminator block (looks like a kite handle...) to the Vacuum Cable first. This must be done very carefully to avoid bending the pins. Note that to get the pin 1 orientation correct, the green dot marking the pin 1 position on the Vacuum Cable will be on the connector attached to the terminator block. Now hang the terminator block handle over the vertical support structure, and carefully plug the other end of the Vacuum Cable into Armadillo.
b. Start scanning the cable by pressing the **Scan** button on the **Armadillo** area of the **Impedistance VI** screen.
c. Watch the first couple of measured traces on the network analyzer to ensure that they are changing. If not, **Armadillo**'s power is probably off!
d. After the six traces have been scanned, a popup window will prompt you for the filename to be used for the saved data. This should be the serial number of the Vacuum Cable, e.g., **vc01234.dat**. If a cable is re-measured, use **vc01234.1.dat** (or **vc01234.2.dat**...).
e. The ambient temperature and humidity during this measurement should be recorded on the form sheet.

7. Resistance Measurements

a. Attach the vacuum cable to the Resistance measuring device (**Phred**). This must be done very carefully, with feeling... The green dot, marking pin 1 on the vacuum cable should be placed adjacent to the green dot, marking pin 1 on the surface of **Phred**. Note that ***during measurements with Phred, there must be no vacuum cable connected to the Contact Resistance measuring device*** (**Phreda**).
b. Start scanning the cable by pressing the **Scan** button on the **Phred** area of the **Impedistance VI** screen.
c. Watch the first few measured values to ensure that they are reasonable, i.e., ~ 0.8 - 1.0 Ohms.
d. After the 64 traces have been scanned, a popup window will prompt you for the filename to be used for the saved data. This should be the serial number of the Vacuum Cable, e.g., **vc01234.dat**. If a cable is re-measured, use **vc01234.1.dat** (or **vc01234.2.dat**...).

8. Contact Resistance Measurements

a. Use the spring clip tool to carefully unclip any spring clip segments that might be caught over the top edge of the plastic housing on the vacuum cable connector. If the spring clip tool won't fit under the top edge of the spring clip segment, then that segment does not require un-springing. in other words, ***don't try too hard, or else you risk damaging the spring clip***... Note that the Contact Resistance should be the last measurement done in order to avoid further sticking of the spring clips.
b. Attach the vacuum cable to the Contact Resistance measuring device (**Phreda**). The green dot, marking pin 1 on the vacuum cable should be placed adjacent to the green dot, marking pin 1 on the surface of **Phreda**.
c. Start scanning the cable by pressing the **Scan** button on the **Phreda** area of the **Impedistance VI** screen.
d. Watch the first few measured values to ensure that they are reasonable, i.e., ~ 15 - 20 milli Ohms.
e. If an open is encountered, a popup window will give you the option to **retest** or **skip**. You may opt to reseat the connectors and retest. If the segment fails again, just press the **skip** button to continue. It is not unexpected to have up to ~ 3 opens on a single cable.
f. After the 26 segments have been scanned, a popup window will prompt you for the filename to be used for the saved data. This should be the serial number of the Vacuum Cable, e.g., **vc01234.dat**. If a cable is re-measured, use **vc01234.1.dat** (or **vc01234.2.dat**...).

9. Offline Analysis

Offline analysis of the cross talk data, impedance data, resistance data, and contact resistance data is performed on a UNIX workstation. Cross talk for adjacent lines should be < 1%, and the average impedance for each stripline should nominally lie in the range $Z = 33 \pm 4\ \Omega$. Cables whose impedance is measured to be within 1 Ω outside this nominal range will still be considered for use, but will be flagged for use only matched with a 25 Ω pigtail (T48 or T52) if $28\ \Omega < Z < 29\ \Omega$, or with a 50 Ω pigtail (T47, T49, T50, or T51) if $37\ \Omega < Z < 38\ \Omega$. Vacuum cable pairs whose resistances all lie within a 50 mΩ band will be flagged for use in Pin Carrier slots designated for calibration signals.

10. Database Entry

a. Record the information from the form sheet into the database.

b. Record the name of the person and the date the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Vacuum Cable

Arrival Information

Serial Number# _____ Date Received _____
FCI Serial Number: _____ Slot Designation _____
Recorded By: Initials: _____ Box # _____
Feedthrough#: _____ Pin 1 Mark _____

Testing

Spring Clips: ☐ P ☐ F
Length 340mm-350mm ☐ P ☐ F
Center Spacer ☐ P ☐ F

Kapton Coating: ☐ P ☐ F
Plastic Case ☐ P ☐ F
Room Temp: _____
Humidity: _____

Trace Resistance Initials: _____
Ground Contact Resistance Initials: _____
Impedance Initials: _____
Crosstalk Initials: _____
Cirris Wiggle Test Initials: _____

Calibration Cable ☐ Y ☐ N

Recorded in Database By: Initials: _____
Date Recorded (ddmmyy) _____

Comments: _____

PASS / FAIL

Chapter 13
Pigtails

1. Arrival Information

a. Record the serial number of the Pigtail on the form sheet.
b. Record the date that the Pigtail arrived on the form sheet.
c. Record the Impedance of the cable on the form sheet. This information is found on the label, in the same place the serial number is found. The impedance for each type is as follows:

T47	**50** W
T48	**25** W
T49	**50** W
T50	**50** W
T51	**50** W
T52	**25** W
LV	**----**

d. Record the type of pigtail on the form sheet.
e. Record the *original* slot position of the cable on the form sheet. This can also be found in the same location the serial number is found. Due to a labeling error at Axon, there are no pigtails arriving with labels designated for slots A1, B1, A14, B14, A15, and B15. Consequently, all pigtails are relabeled once they arrive at UVIC, with an effort to duplicate the original position label whenever possible.
f. The actual slot designation will be determined at a later date. The original slot designation may not necessarily be where the cable is being positioned. The slot designation will be determined at a later date, a sticker will be placed on each cable showing its proper slot designation, and this number is what will be entered in the Actual Slot Designation space on the form sheet.
g. Visually Inspect the spring clips for any defects such as dents or creases. If no defects are found check Good on the form sheet. If defects are found check No Good on the form sheet.
h. Measure the overall length of the pigtail. If the pigtail is the correct length then check Good on the form sheet. If the pigtail is not the correct length then check No Good on the form sheet. The nominal lengths for each type of pigtail is as follows:

T47	**90 cm**
T48	**90 cm**
T49	**265 cm**
T50	**265 cm**
T51	**265 cm**
T52	**430 cm**
LV	**265 cm**

2. Cirris Pigtail Continuity Tests

a. Mount a 2x32 pin connector to the **J1/J2** Cirris port and a µD female connector to the **J3/J4** Cirris port.
b. Note that the HEC signal pigtails must be tested as jumpered pairs, using 2x32 pin connectors on both Cirris ports. The HEC signal cables must be jumpered with each block of one cable jumpered to the corresponding block of the other cable. The HEC LV cables are tested singly, but with each block self jumpered.
c. Load the wirelist. Use, for example, **T47.WIR** for **type 47** cables, and **T48.WIR for type 48** cables.
d. Ensure that the Cirris tester is in **single test** mode (Test Control / single test).
e. The pigtails should be tested in sequence of serial number in order to associate test results with specific pigtail cables.
f. Insert a blank floppy disk into the floppy drive of the Cirris tester.
g. Press **Test Cable** on the Cirris tester.

h. For each cable to be tested:
i. Connect a pigtail cable to the Cirris tester, with the pin 1 mark on the ATI connector placed adjacent to the pin 1 mark of the **J1/J2** Cirris port.
j. Press **START TEST** to test the cable.
k. Remove the pigtail cable and proceed with the next cable.
l. In the event a cable must be retested, make a note in the PigTails logbook the sequence number of the repeated test.
m. When all pigtail cables of the test session have been tested, press **CANCEL** and observe the green light on the floppy disk drive to ensure that the data is being written to the floppy disk.
n. Enter into the PigTails logbook the time and date of the test session, and the range of pigtail serial numbers tested.

3. Cirris Pigtail Data Instructions

a. Open explorer and navigate to:
Network Neighborhood\Strange\Data\ElectricalTests\pro\dat\PigTailCables\Cirris
In this directory create a new folder using the following format:
YYMMDD.X Where: **YY** (Year) of delivery to ATLAS Victoria
MM (Month) of delivery to ATLAS Victoria
DD (Day) of delivery to ATLAS Victoria
.X is the testing run done for that delivery
Example: 000329.3 The delivery of the cables to ATLAS Victoria was 29-March-2000, and this is the third run of tests.
b. Copy the file created on the floppy disk from the Cirris tester to the following directories:
Neighborhood\Strange\Data\ElectricalTests\pro\dat\PigTailCables\Cirris\yymmdd.x created in step "a" and the Cirris directory in your own home directory.
c. Remove the floppy disk from the disk drive.

d. Using explorer, **double-click** on the file that you copied to your home directory.
e. After double clicking on the file a new window will appear, and one of the choices in that window is **Read from Data Collection Files**. Select this button.
- A window will appear saying it cannot find the files on Drive A; this will only happen if you removed the disk from the drive.
- Use the **browse** option and select the file that is saved in the Cirris directory in your home directory.

f. After you have selected the file and opened it, select the **Read** button in the window. It will read the file and a new window will appear telling you it read the data successfully. Note that once read, the data file in your home directory will be deleted automatically.
g. A new window will appear after the file has been read; select the **OK** button.
h. In the window that is now on the screen select the **Choose Data to Write to a Text File** button.
In the **DATA RANGE** pull down menu select **Today** if the tests were done today; if not select the appropriate choice.
i. Select (click on) the desired line in the **Cable List** window. Then select the desired line in the **Test Group** window.
j. After the desired line has been selected in the test group window, there is a directory at the bottom of the window for saving the information. You want this file to be the Cirris directory in your home directory, so click **browse** and select the Cirris directory in your home directory. Change the name of the file to the type of cables that were tested (eg, t47, t48,…). Press the **write** button and then press **OK**. Copy the three newly created **.MVF**, **.SUM**, and **.ERR** files to the folder created in step "a".
k. Map the **network drive** for **Strange\Data** if not already mapped: in **explorer**, right click on **NetworkNeighborhood\Strange\Data**, select **Map Network Drive**, and choose the drive letter. For the sake of further discussion, we will assume that the drive letter **Z:** has been chosen. ***Be sure to unmap (disconnect) the network drive when finished; LabVIEW has problems saving data to drives that have been mapped.***
l. Start an ftp session by selecting **Start/Programs/Ws_ftp/Ws_FTP95LE.** Once the program starts, a window will appear. The following information is necessary in that window:
- Profile Name: **silly**
- User ID: **cable**
- Password: **af2ct!**

Now hit **OK** in the **session properties** window. In the left window, navigate to the files created in the Cirris folder of your home directory. They should be in the directory
Z:\ElectricalTests\pro\dat\PigTailCables\Cirris\yymmdd.xx. In the right window, navigate to **/tmp_mnt/net/ polly/banana/home/cable/work**. If the **work** directory in the right window is not already empty,

remove any files that might have been left from a previous session. Transfer the **.MVF** and the **.ERR** files from the left window to the right window. Both of these files should be copied using **ASCII** mode. This is an option near the bottom of the **WS_FTP** screen.

m. Without closing the ftp window, start a telnet session with: **start/programs/accessories/telnet.** Pulldown the **connect** menu and select **polly**. The login is **cable** and the password is **af2ct!**.

n. At the prompt **{cable}:/home/cable>** type **cd work.** The new prompt should now say **{cable}:/home/cable/work>**.
   - Type **ls** to view the files. There should be a **.ERR** and a **.MVF** file.
   - Type **mvf2dat Txx** (where Txx the name used to save the data) to process the data (note that unix is case sensitive!). A brief summary of the processed data should now be displayed.
   - Type **ls** to check that a **.dat** file was created.
   - Type **cirris Txx.dat**.
   - Type **ls** to check that a **.hbk** file was created.

   Type **exit**. A window will say **connection to host lost**. Just click **OK** and close the telnet window.

o. In the right hand side **WS_FTP** window click **refresh**.
   Select **cirris.hbk** and transfer it to the left window in **binary** mode.
   - Select **Txx.dat** and transfer it to the left window in **ascii** mode.
   - Delete the **.MVF**, **.ERR**, **.hbk** and **.dat** files from the right window.
   - Click **close** at the bottom left of the **WS_FTP** window, then click **exit** at the bottom right.

p. Use **notepad** to create a **readme.txt** file describing the tests done, including any problems, type of cable, serial numbers (the *range* of serial number is sufficient) and the date tested in the directory created in step "a".

q. Copy the **.MVF**, **.SUM**, **.ERR**, **.hbk**, **.dat and .txt** files from the Cirris folder in your home directory to the directory created in step "a".

r. Clear your home **cirris** directory of all files.

s. Open the **PAW** program.
   - Press enter
   - Type **check yymmdd.x**, where **yymmdd.x** is the folder name created in step "a". This should produce a histogram of the data collected for the cables you tested. Check to see that there are no entries in the histogram that are significantly separated from the bell shaped distribution, and that the expected number of entries are present (use **opt sta** in the paw window).

t. Replace the floppy disk into the floppy drive and delete the **cirris** data file. ***This should be done only after the data has been safely stored and processed in the primary data storage in \Strange\Data\ElectricalTests\pro\dat\PigTailCables\Cirris.***

u. Enter the name of the data file for the pigtail on the pigtail form sheet

4. Cross Talk Tests

Cross Talk tests for pigtail cables are carried out only for those pigtails to be connected to pincarrier slots designated to carry calibration signals. The Cross Talk tests can be carried out on either the mobile cross talk station, using the Tek2440 scope, or the fixed cross talk station, using the Lecroy 8818 Transient Recorder. Instructions are given here for the mobile cross talk station. Instructions for the fixed cross talk station are analogous.

a. Log onto the ColdTest station computer (**WINO**) and start the program *Strange\Data\ElectricalTests\pro\exe\PigTailCables\CrossTalk\ScopeFO1.bat* (This assumes that the UBC fanout **FO1** is mounted on the mobile cross talk station, rather than **F02** which is nominally at the fixed cross talk station.)

b. In the **VI** window that should now appear, start the **VI** by pressing the **RUN** button (right arrow).

c. Follow the instructions on the popup window to set the properties of the BNC pulser. Note that ***the pulser should be turned on at least 30 minutes before data collection*** to allow it to warm up.

d. Press the **test type** button to set the test mode to **64x64**.

e. Connect the **PigTail Cable Under Test** between the **scanner** and the Pin Carrier at the cross talk station. The **PigTail Cable Under Test** should be attached with pin 1 of the ATI connector matched to ***pin 2*** of the pigtail (MD2884/001) connected between the **fanout** and the Pin Carrier.

f. Press **Scan** to start the scanning procedure.

g. In the popup window that now appears, enter the directory name for the data to be stored. The directory name should be the serial number of the Vacuum Cable, eg, **pt0123**. If a cable is being remeasured for any reason, use **pt0123.1** (or **pt0123.2**... etc). Enter **Save** to proceed.

h. Another popup window now appears instructing you to set the attenuator box (white box with toggle) to **Through Pulses**. Do so, and press **OK** to continue. Be sure to watch the first few pulses on the scope screen to ensure that they appear reasonable (see the **Through Pulse** figure in the Vacuum Cables chapter).

i. Once the **Through Pulses** are completed (~ 1 minute) another popup window appears instructing you to set the

attenuator box to **CrossTalk** Pulses. Do so, and press **OK** again to proceed. As before, watch the first few pulses on the scope screen to ensure that they appear reasonable (see the **Cross Talk Pulses** figure in the Vacuum Cables chapter). Note that the 64x64 cross talk measurement takes several hours to acquire all data.

j. After all 64 lines are scanned, remove the PigTail Cable and proceed with measuring the next. Note that the jackscrew sockets on the scanner and the Pin Carrier should be lubricated every 5 - 10 plugins to prevent gauling.

5. Offline Analysis

Offline analysis of the cross talk data is performed on a UNIX workstation. Cross talk for adjacent lines should be < 1%.

Note: If any of the above tests and inspections failed, then the Pigtail has failed and this should be circled at the bottom of the form sheet. Also, if the Pigtail has failed, then it needs to be placed in the Pigtail rejection box on the cable shelves. If The Pigtail has passed all tests then Pass must be circled on the bottom of the form sheet.

6. Database Entry

a. Record the information from the form sheet into the database.

b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Pigtails

Arrival Information

Serial Number# _____ Date Received _____

Recorded By: _____ Impedance: _____

Pigtail Type: _____ Original Slot Label: _____

Actual Slot Designation _____

Testing

Spring Clips ☐ **G** ☐ **NG**

Overall Length ☐ **G** ☐ **NG**

Cirris Tested: ☐ P ☐ F Initials: ☐ Cross Talk: (Calibration Cables only) Initials ☐

Date Tested: (ddmmyy)_____ Data File #: _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

PASS / FAIL

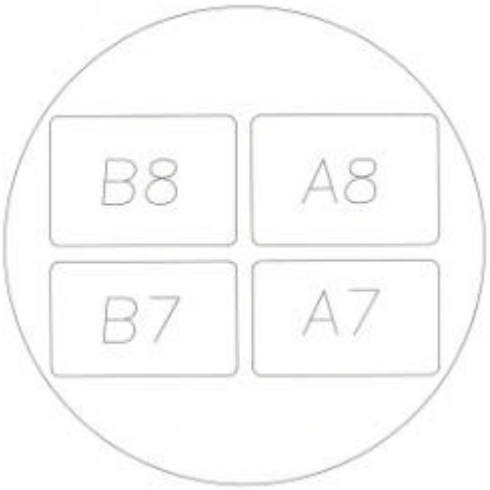
Chapter 14
Cold Flange Assembly

1. *Detail Drawing*

- PDE-0210D (Cold Flange Assembly)
  Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. *Preparation*

a. Select a Cold Signal Flange that has passed all testing and inspection. To ensure that it has passed all testing and inspection refer to the form sheet & Database for that flange.
b. Select four Pin Carriers that have passed all testing and inspection. To ensure that each pin carrier has passed testing and inspection refer to the form sheet & Database for each Pin Carrier.
c. Remove the Cold Signal Flange from its bagging and carefully inspect it for cleanliness. The flange should be very clean. If any residue from the ultrasonic cleaning is found on the flange use acetone then alcohol to remove the residue.
d. Using acetone then alcohol carefully clean the outside of each Pin Carrier, as well as the weld lip on each Pin Carrier.
e. Place the Pin Carriers in slots A7, A8, B7, and B8. Refer to the diagram pinned on the wall by the welding station for the orientation of each slot on the Cold Signal Flange.
f. Enter all the information requested on the Cold Flange Assembly form sheet in the Preparation box.



Note: For proper orientation of the Cold Signal Flange when inserting the Pin Carriers the weld lip on the Cold Signal Flange must be facing up. The picture above is looking from the cold funnel side.

3. *Welding*

The welding plan can be found in Appendix A

a. Specific Mechanical will be doing all the welding for each feedthrough. Before the welder starts welding make sure that a plate is covering the pins on each Pin Carrier and that the welder is wearing cotton gloves.
b. On the Cold Flange Assembly form sheet, in the Welding box, enter the name of the welder and the date the weld was performed. After the welder has completed the welding, vacuum the pincarrier and then use alcohol to clean all the welds, then initial the form sheet.

4. *Testing*

a. Place the Cold Signal Flange in its leak testing apparatus and place the leak testing apparatus on the leak test platform.
b. For this test the DVP500 Pump will be used for a roughing vacuum. So, close valves E, D, A, and N. Open valves P and C. Also, turn on the Vacuum Process Controller to monitor the roughing vacuum.
c. Turn on the DVP500 pump and pump down the test apparatus to a vacuum of 3.0×10^{-1} or better. When the vacuum reaches 3.0×10^{-1} close valve C.

d. Start pumping with the leak checker. When the leak checker reaches $5.0x10^{-1}$ open valve D. When the base rate of the leak checker bottoms out, testing can start.
e. Before testing each Pin Carrier weld enter the base rate in column 1 next to the Pin Carrier being tested. Run the helium wand around the weld for that Pin Carrier and through the pin slots for that Pin Carrier. Enter the leak rate in Column 1. Subtract the base rate from the leak rate and enter the actual leak rate in column 1.
f. Shut Valve D, turn on the DVP500 pump and pump until –1 vacuum is achieved, open valve C, shut off the DVP500 pump and open valve A to vent the system. Vent the leak checker.
g. Enter the date the testing was performed and the person who performed the tests on the form sheet. Clean the vacuum grease used on the assembly with acetone then alcohol. Enter the cleaning information on the form sheet.

5. Database Entry

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Cold Flange Assembly

Preparation

Flange Serial #

Pin Carrier A7 Serial # _____ Pin Carrier B7 Serial # _____

Pin Carrier A8 Serial # _____ Pin Carrier B8 Serial # _____

Flange Cleaned By: _____ Pin Carriers Cleaned By: _____

Prepared By: _____ Date Prepared: _____

Welding

Welded By: _____ Date Welded: _____

Cleaned By: _____

Testing

Leaktest Slot A7	**1**	**2**	**Leaktest Slot B7**	**1**	**2**
Base Rate (No He)			Base Rate (No He)		
Leak Rate (He)			Leak Rate (He)		
Actual Leak Rate			Actual Leak Rate		

Leaktest Slot A8	**1**	**2**	**Leaktest Slot B8**	**1**	**2**
Base Rate (No He)			Base Rate (No He)		
Leak Rate (He)			Leak Rate (He)		
Actual Leak Rate			Actual Leak Rate		

Tested By: _____ _____ Date Tested: _____ _____

Cleaned By: _____ _____ Date Cleaned: _____ _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 15
Ambient Flange Assembly

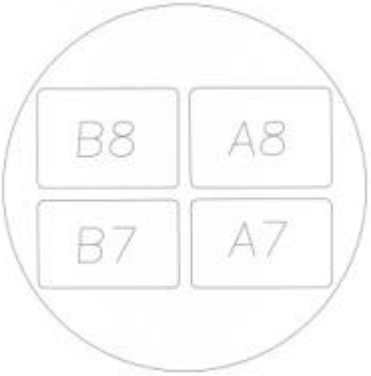
1. *Detail Drawing*

- PDE-0211D (Ambient Flange Assembly)

Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. *Preparation*

a. Select an Ambient Signal Flange that has passed all testing and inspection. To ensure that it has passed all testing and inspection refer to the form sheet & Database for that flange.
b. Select four Pin Carriers that have passed all testing and inspection. To ensure that each pin carrier has passed testing and inspection refer to the form sheet & Database for each Pin Carrier.
c. Select two Modified VCR Glands that have passed all testing and inspection. To ensure that they have passed all testing and inspection refer to the form sheet & Database for each gland.
d. Remove the Ambient Signal Flange from its bagging and carefully inspect it for cleanliness. The flange should be very clean. If any residue from the ultrasonic cleaning is found on the flange use acetone then alcohol to remove the residue.
e. Using acetone then alcohol carefully clean the outside of each Pin Carrier, as well as the weld lip on each Pin Carrier.
f. Place the Pin Carriers in slots A7, A8, B7, and B8. Refer to the diagram below for the orientation of each slot on the Ambient Signal Flange.



For proper orientation of the Ambient Signal Flange when inserting the Pin Carriers the weld lip on the Ambient Signal Flange must be facing up. The picture above is looking from the bellows side.

g. Place the Modified VCR Glands in the Ambient Signal Flange. The 8-Row Gland is the one next to the 8-Row Pin Carriers, and the 7-Row Gland is next to the 7-Row Pin Carriers.
h. Enter all the information requested on the Ambient Flange Assembly form sheet in the Preparation box.

3. *Welding*

The welding plan can be found in Appendix A

a. Specific Mechanical will be doing all the welding for each feedthrough. Before the welder starts welding make sure that a plate is covering the pins on each Pin Carrier and that the welder is wearing cotton gloves.
b. On the Ambient Flange Assembly form sheet, in the Welding box, enter the name of the welder and the date the weld was performed. After the welder has completed the welding, vacuum the pin carriers, use alcohol to clean all welds, and then initial the form sheet.

4. Testing

a. Remove all the covers that were placed over the pins on the Pin Carriers and place rubber bungs in each Modified VCR Gland.
b. Place the Ambient Signal Flange in its leak testing apparatus and place the leak testing apparatus on the leak test platform.
c. For this test the DVP500 Pump will be used for a roughing vacuum. So, close valves E, D, A, and N. Open valves P and C. Also, turn on the Vacuum Process Controller to monitor the roughing vacuum.
d. Turn on the DVP500 pump and pump down the test apparatus to a vacuum of $3.0x10^{-1}$ or better. When the vacuum reaches $3.0x10^{-1}$ close valve C.
e. Start pumping with the leak checker. When the leak checker reaches $5.0x10^{-1}$ open valve D. When the base rate of the leak checker bottoms out, testing can start.
f. Before testing each Pin Carrier weld enter the base rate in column 1 next to the Pin Carrier being tested. Run the helium wand around the weld for that Pin Carrier and through the pin slots for that Pin Carrier. Enter the leak rate in Column 1. Subtract the base rate from the leak rate and enter the actual leak rate in column 1.
g. Repeat step 6 for all four Pin Carriers and the Modified VCR Glands. If all the actual leak rates are zero then circle pass at the bottom of the Ambient Flange Assembly form sheet.
h. Shut Valve D, turn on the DVP500 pump and pump until –1 vacuum is achieved, open valve C, shut off the DVP500 pump and open valve A to vent the system. Vent the leak checker.
i. Enter the date the testing was performed and the person who performed the tests on the form sheet. Clean the vacuum grease used on the assembly with acetone then alcohol. Enter the cleaning information on the form sheet.

5. Database Entry

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Ambient Flange Assembly

Preparation

Flange Serial # _____

Pin Carrier A7 Serial # _____ Pin Carrier B7 Serial # _____

Pin Carrier A8 Serial # _____ Pin Carrier B8 Serial # _____

8-row Gland# _____ 7-Row Gland# _____

Flange Cleaned By: _____ Pin Carriers Cleaned By: _____

Prepared By: _____ Date Prepared: _____

Welding

Welded By: _____ Date Welded: _____

Cleaned By: _____

Testing

Leaktest Slot A7	**1**	**2**	**Leaktest Slot B7**	**1**	**2**
Base Rate (No He)			Base Rate (No He)		
Leak Rate (He)			Leak Rate (He)		
Actual Leak Rate			Actual Leak Rate		

Leaktest Slot A8	**1**	**2**	**Leaktest Slot B8**	**1**	**2**
Base Rate (No He)			Base Rate (No He)		
Leak Rate (He)			Leak Rate (He)		
Actual Leak Rate			Actual Leak Rate		

VCR Glands Leak Checked: ☐

Tested By: _____ _____ Date Tested: _____ _____

Cleaned By: _____ _____ Date Cleaned: _____ _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 16
Pigtail Assembly

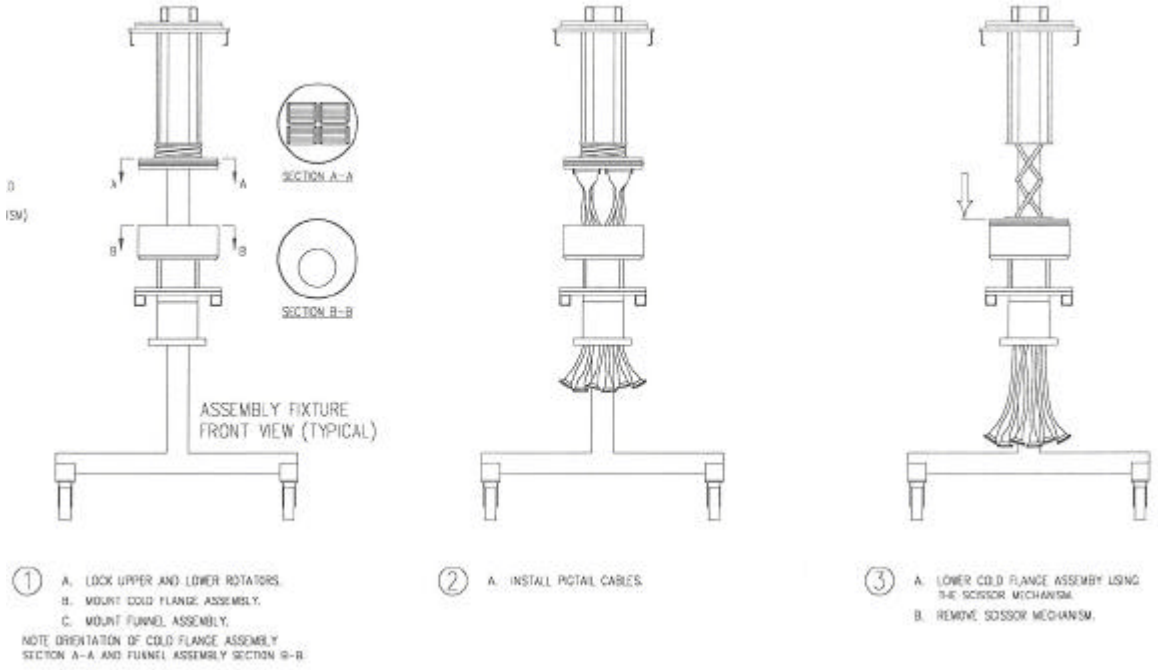
1. Detail Drawing

- PDE-0216D (Pigtail Installation)

Drawings can be found at http://wwwlhc01.cern.ch/cdd/

2. Assembly Procedures

Before Assembly 30 Pigtails, 1 Cold Flange Assembly, and 1Funnel Assembly will be selected. Make sure that they have passed all tests performed on them. Before a component is used in the assembly the form sheet for each component in the assembly must be compiled and each form sheet must have PASS circled in its lower right corner and check the database to ensure each component has passed. Below is a list of assembly procedure and drawings of the installation. Also note on the **Pigtail Assembly** form sheet the serial number of the Cold Flange, and also the name of the person who mapped the slot number designation for each pigtail.

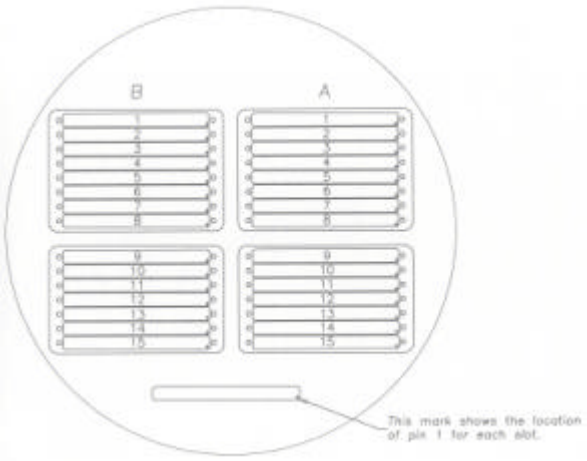


a. Thread the 4 M8 bolts into the Funnel Base of the Funnel Assembly making sure that the bellows alignment jig is in place, then lower the Funnel Assembly into the assembly jig. The funnel assembly should be offset towards the front.
b. Install the scissor jack using 4-M12 ready rod. Make sure the scissor jack is in the fully retracted position, as shown in drawing 1.
c. Inspect all of the pins in the cold flange for straightness.
d. Put four plastic cover plates onto the cold flange pin carriers – bellows side.
e. Vacuum the pincarriers on the funnel side.
f. Mount the Cold Flange Assembly to the scissor jack using the 4-M5 holes in the Cold Signal Flange. If assembled properly the weld lip for the Pin Carriers should be facing the Funnel Assembly. The 7-row pincarriers should at the front.
g. Make sure that the locking pin is located on the left-hand side.
h. There is slot designated for each Pigtail. These slots are labeled A1 to A15 and B1 to B15. A form sheet for this assembly will have the map of where each Pigtail cable is to be positioned. When a Pigtail Cable is placed in one of these slots initial the box next to the serial number on the Pigtail Assembly form sheet. A drawing of the orientation of the flange and slots is shown below.
i. Rotate the assembly jig to the horizontal position.

Pigtail Assembly

j. Place bubble wrap on the con-flat flange edge to protect the pigtails.
k. The outer edges of the ATI connectors to be placed in the outside pincarrier slots (1, 7 or 8, and 15) must be filed in order that they fit properly.

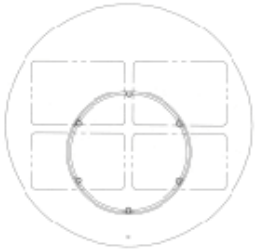
Back of assembly jig here



Cold Flange viewed from LAR (funnel) side

Note: For proper orientation of the Cold Signal Flange when inserting the Pigtails the weld lip on the Cold Signal Flange must be facing down towards the floor.

l. After each pigtail has been installed, a second person must check the installation to ensure that the serial number of the pigtail is in the slot designated on the form sheet..
m. After all pigtails have been checked by a second person, carefully lower the Cold Flange with Pigtails into the Funnel Assembly. The final position of the assembly should look like the drawing below.



Cold Flange viewed from LAR (funnel) side; 7-row pincarriers are at the bottom (front), 8-row pincarriers are at the top (back).

n. Rotate the assembly jig back to the vertical position.
o. Remove the scissor jack from the assembly jig.
p. Check for ground shorts with the multimeter once the pincarriers on the bellows side of the cold flange have been uncovered. Use the probe with the custom blunt probe for these checks.

3. Database Entry

a. Record the information from the form sheet into the database.
Hepserv/home/atlas/ feedthrough database/ Secure atlas feedthrough DB.mdb
- click on feedthroughs
- click add
- create new feedthrough
- enter all the available data for the feedthrough such as pigtails, cold flange and the funnel assembly.

b. Record the name of the person and the date the date the information was recorded into the database, on the form sheet.
c. Check to make sure that the gap between the funnel and cold flange is 1.7mm. Check this off on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Pigtail Assembly

Cold Flange Serial # _____ Funnel Assembly Serial #: _____

Date Installed (ddmmyy) _____

Slot #	Pigtail Serial Number	Type Of Pigtail	Installer Initails	Checked By Initails	Pin 1 checked
Slot A1					
Slot A2					
Slot A3					
Slot A4					
Slot A5					
Slot A6					
Slot A7					
Slot A8					
Slot A9					
Slot A10					
Slot A11					
Slot A12					
Slot A13					
Slot A14					
Slot A15					
Slot B1					
Slot B2					
Slot B3					
Slot B4					
Slot B5					
Slot B6					
Slot B7					
Slot B8					
Slot B9					
Slot B10					
Slot B11					
Slot B12					
Slot B13					
Slot B14					
Slot B15					

Mapped By: _____

Has the Flange correctly seated? (approx. 1.7mm) ☐

Recorded In Database By: _____ Date Recorded (ddmmyy) _____

Pass / Fail

Chapter 17
Vacuum Cable Assembly

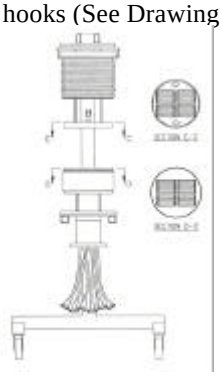
1. *Detail Drawing*

PDE-0216D (Vacuum Cable Installation)
Drawings can be found at http://wwwlhc01.cern.ch/cdd/

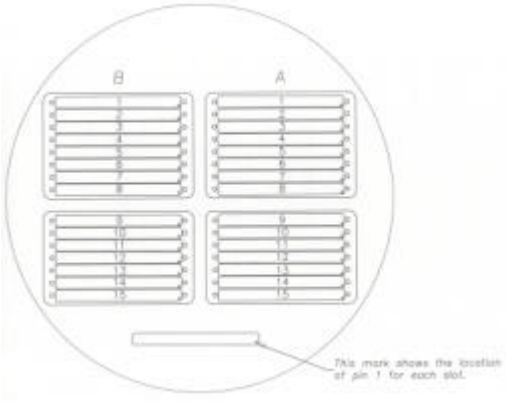
2. *Assembly Procedures*

Before assembly, 30 Vacuum Cables, one Pigtail Assembly, Ambient Flange Assembly, and one Bellows Assembly will be selected, making sure that they have passed all tests performed on them. Before a component is used in the assembly the form sheet for each component in the assembly must be completed and each form sheet must have PASS circled at the bottom, and also check the database to see that the cable has passed. Below is a list of assembly procedures and drawings of the installation.

a. Record the Cold Flange, Ambient Flange, and Bellows serial numbers on the vacuum cable assembly form sheet, as well as the date of installation.
b. Install the four M12 ready Rods.
c. Clean the weld lips of the bellows and flanges with ethanol.
d. Using the four hooks at the top of the assembly jig raise the Bellows Assembly over the Ambient Flange Assembly securing it in place with the four hooks (See Drawing Below).

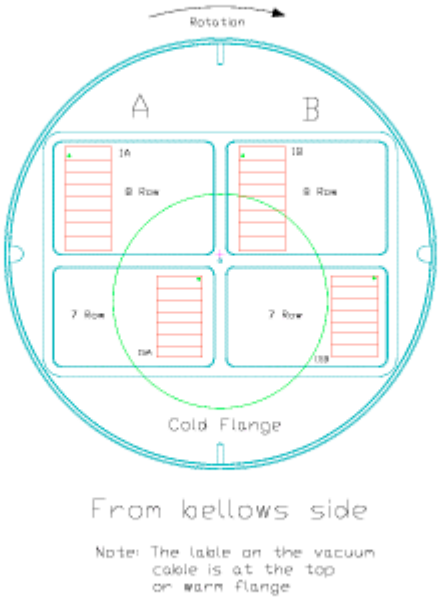


e. Using the 4-12mm ready rods secure the Ambient Flange Assembly. If the Ambient Flange assembly is oriented properly the weld lip for the Pin Carriers will be facing the Funnel Assembly. Also, the 7 & 8-row Pin Carriers will be directly above the 7 & 8-row Pin Carriers in the Cold Flange Assembly, (See Drawing Below).
f. The pincarriers should be vacuumed before installation of the vacuum cables.
g. Plastic washers must be placed on each jackscrew of the vacuum cables to prevent the vacuum cable ground shield from bottoming out.
h. During installation, the vacuum cables should not be bottomed out until an entire pincarrier is filled
i. There is slot designated for each Vacuum Cable. These slots are labeled A1 to A15 and B1 to B15. A form sheet for this assembly will have the map of where each vacuum cable is to be positioned. When a Vacuum Cable is placed in one of these slots initial the box next to the serial number on the Vacuum Cable Assembly form sheet. A drawing of the orientation of the ambient flange and slots, viewed from the bellows side, is shown below.



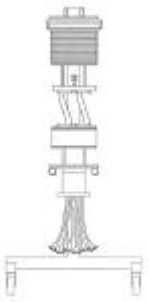
Ambient Flange viewed from the bellows side

j. Note that the orientation of the vacuum cables is reversed when inserting into the 7-row pincarriers (slots 9 – 15). See the figure below for the proper orientation, where the stripline is represented in red.



k. After each vacuum cable is installed, a second person must check the installation to ensure that the serial number of the Vacuum Cable is in the slot designated on the form sheet and that the pin one of the vacuum cable is in the proper location. The person doing the check should then initial the form sheet.

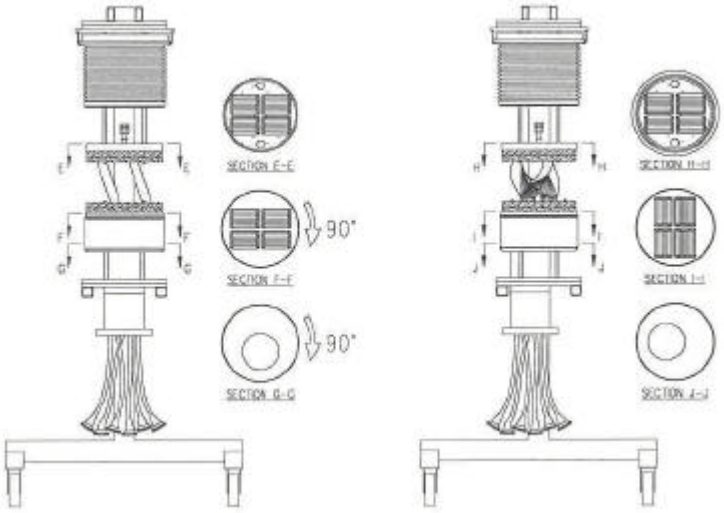
l. Also after each vacuum cable is installed, the continuity should be checked with the Cirris tester (**ASS.WIR** with 100 Volt HiPot test) using the procedures outlined in the *Cirris Pre Weld Electrical Tests* below, except that no data is to be saved for this particular test. Checks for ground shorts should also be done with the multimeter as each vacuum cable is plugged in. Use the probe with the custom blunt probe for these checks.



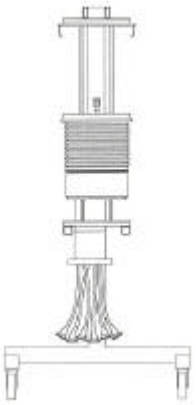
m. Install rohacell

1. Collect and clean or vacuum all of the items required for the rohacell installation.
   (2) 19mm spacer plates – (one with 19mm holes, one without)
   (2) 25mm comb plates – (one with 19mm holes, one without)
   (4) Pieces 11.5mm x 104mm x 19mm thick
   (2) Aluminized mylar sheets. (one with 19mm holes, one without)
   (8) M5 x 70 studs, (16) M5 nuts, (8) type LL M5 washers
2. Cut the 25mm plates in half with the band saw and vacuum any rohacell dust
3. For the cold flange, get a 19 mm spacer plate and a 25mm comb plate (without the 19mm holes). Place the spacer plate (both halves) on the flange.
   Place the two 11.5mm x 104mm x 19mm pieces between the pin carriers.
   With the help of the comb guide, insert the comb plate one half at a time. Place the side with the dimples toward the flange. Thread in the four M5 x 70 studs.
   With scissors cut one of the aluminized mylar sheets (without 19mm holes) in four places and install it on top of the rohacell comb. Note that two of the rectangular pockets are for the 7-row cables and the other two are for the 8-row cables.
   Install four type LL M5 washers.
   Use a locked double nut to tighten the studs into the cold flange.
   Unlock the nuts and snug them finger tight against the rohacell and mylar sheet, if required use a wrench to snug the nuts. Re-lock the M5 Nuts.
4. This procedure is repeated for the warm flange except the rohacell and aluminized mylar must have 19mm holes at the pumping ports. For this flange it is easier to put the 25mm comb plates on first and then install the spacer plates.
5. Check to make sure the pumping ports are clear and mark this on the form sheets. Note this on the Vacuum Cable Assembly Form Sheet. Vacuum all rohacell dust from inside the bellows.

n. After all the Vacuum Cables have been checked by a second person the lower half of the assembly (cold flange,pigtails & funnel) is rotated clockwise by 90°.



o. After the Assembly has been rotated the Bellows Assembly can be lowered into to position to prepare for the electrical testing & welding.



3. Cirris Pre Weld Electrical Tests

a. Mount a 2x32 pin connector to the **J1/J2** Cirris port and a µD female connector to the **J3/J4** Cirris port.
b. Load the wire list **ASS.WIR**, with 100 Volt HiPot test, on the Cirris Cable Tester**.**
c. Ensure that the Cirris tester is in **single test** mode (Test Control / single test).
d. Ensure that the assembly jig is grounded!
e. Insert a blank floppy disk into the floppy drive of the Cirris tester.
f. Press **Test Cable** on the Cirris tester.
g. The warm flange slots should be tested in order **A1** ⇒ **A15** and **B1** ⇒ **B15**.
h. For each slot to be tested:
i. Use the 1.2-meter test harness **MD3209/01** to connect between the **J1/J2** Cirris port the slot to be tested of the Feedthrough warm flange. The test harness is marked with a **C** on the ATI connector to be attached to the Cirris tester, and with a **WF** on the ATI connector to be attached to the warm flange. These marks also designate the pin 1 positions of the Cirris tester and warm flange.
j. Connect the corresponding pigtail cable to the **J3/J4** Cirris port.
k. Press **START TEST** to test the cable.
l. Detach the test harness from the warm flange and the pigtail cable from the Cirris tester and proceed with the next slot.
m. Note that the jackscrews on the test harness and the jackscrew sockets on the Cirris µD connector should be lubricated every 5 - 10 plugins to prevent gauling.
n. In the event a cable must be re-tested, make a note in the **Feedthroughs** logbook of the sequence number of the repeated test.
o. When all 30 slots have been tested, press **CANCEL** and observe the green light on the floppy disk drive to ensure that the data is being written to the floppy disk.
p. Enter into the **Feedthroughs** logbook the time and date of the test session, and the range of pigtail serial numbers tested.
q. Following the instructions analogous to those given in the Cirris Pigtail Data Instructions process the collected data saved on the floppy disk. The data will be saved in the directory \Strange\Data\ElectricalTests\pro\dat\assembly\Cirris\ftxx, where ftxx is the serial number of the feedthrough being tested.

4. Database Entry

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Vacuum Cable Assembly

FT #: _____

Cold Flange Serial # _____ Warm Flange Serial # _____

Bellows Serial# _____ Date Cables Installed (ddmmyy) _____

Slot #	CableDesigantion						Serial Number	Installer Initails	Checked By Initails
Slot A1	Signal		Power		Calibration				
Slot A2	Signal		Power		Calibration				
Slot A3	Signal		Power		Calibration				
Slot A4	Signal		Power		Calibration				
Slot A5	Signal		Power		Calibration				
Slot A6	Signal		Power		Calibration				
Slot A7	Signal		Power		Calibration				
Slot A8	Signal		Power		Calibration				
Slot A9	Signal		Power		Calibration				
Slot A10	Signal		Power		Calibration				
Slot A11	Signal		Power		Calibration				
Slot A12	Signal		Power		Calibration				
Slot A13	Signal		Power		Calibration				
Slot A14	Signal		Power		Calibration				
Slot A15	Signal		Power		Calibration				
Slot B1	Signal		Power		Calibration				
Slot B2	Signal		Power		Calibration				
Slot B3	Signal		Power		Calibration				
Slot B4	Signal		Power		Calibration				
Slot B5	Signal		Power		Calibration				
Slot B6	Signal		Power		Calibration				
Slot B7	Signal		Power		Calibration				
Slot B8	Signal		Power		Calibration				
Slot B9	Signal		Power		Calibration				
Slot B10	Signal		Power		Calibration				
Slot B11	Signal		Power		Calibration				
Slot B12	Signal		Power		Calibration				
Slot B13	Signal		Power		Calibration				
Slot B14	Signal		Power		Calibration				
Slot B15	Signal		Power		Calibration				

Mapped By: _____ Pumping Ports Clear: ☐

Pre-Weld Warm Continuity Test

Tested By: _____ Date Tested: dd/mm/yr _____ grounded: ☐ Data Dir : _____

Recorded In Database By: _____ Date Recorded (ddmmyy) _____

Comments: _____

Pass / Fail

Chapter 18
Final Assembly - Welding

Note: This procedure is a continuation of the "Feedthrough Assembly" procedure. All of the Feedthrough components should already be assembled in the Assembly jig and ready for welding. Gloves must be worn at all times when handling the Feedthrough.

1. Welding

a. Specific Mechanical will be doing all of the welds on the Feedthrough.
b. There are three different welds to done to complete the Final Assembly of the Feedthrough.
    i. Upper Tube to Cold Signal Flange
    ii. Cuff Ring to Cold Signal Flange
    iii. Seal Ring to Ambient Signal Flange
c. For specific information on the welds being done refer to the "University of Victoria TRIUMF Hadronic End Cap Signal Feedthroughs Welding Plan". The welding plan has all the information in great detail about each type of weld that will be done on the Feedthrough.

2. Form and Database Entry

a. Record on the "Final Assembly – Welding" form sheet the Feedthrough serial number, the Cold Flange serial number, the Bellows serial number, the Ambient Flange serial number and the Funnel Assembly serial Number. The serial number for each Feedthrough is to be increased by one.
b. Enter the name of the person who recorded the above information, on the form sheet.
c. Enter the name of the welder that did the Upper Tube to Cold Signal Flange weld and the date it was welded on, on the form sheet.
d. Enter the name of the welder that did the Cuff Ring to Cold Signal Flange weld and the date it was welded on, on the form sheet.
e. Enter the name of the welder that did the Seal Ring to Ambient Signal Flange weld and the date it was welded on, on the form sheet.
f. Repeat steps "a" through "e" to record the above information in the Atlas Secure Database
g. Record the name of the person and the date the information was recorded in the database, on the form sheet.
h. The Feedthrough is now ready for the Ambient Leak tests, refer to the procedure labeled "Final Assembly – Ambient Leak Test".

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Final Assembly (Welding)

Component Serial Numbers

Feedthrough Serial # _____

Cold Flange _____ Bellows (Seal Ring #) _____

Ambient Flange _____ Funnel Assembly (Funnel Base #) _____

Recorded By _____

Welding

Upper Tube to Cold Signal Flange

Welded By: _____ Date Welded _____

Cuff Ring to Cold Signal Flange

Welded By: _____ Date Welded _____

Seal Ring to Ambient Signal Flange

Welded By: _____ Date Welded _____

Cleaned By: _____

Recorded By: _____

Dye Penetrant Tests completed ☐ Pass ☐ Fail Date: _____

Ferite Measurements Completed (approx 6.5) ☐ Pass ☐ Fail Date: _____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments _____

PASS / FAIL

Chapter 19
Final Assembly – Ambient Leak Test Outside the Leak Test Station

Note: Gloves must be worn at all times when handling the Feedthrough and Pigtails.

1. Turn on the Leak Checker

a. The Leak checker must be on for a minimum of 30 minutes for it to be properly warmed up

2. Remove the Feedthrough from the Assembly Jig

a. Place the old cradle on the table under the collapsible crane
b. Wheel the assembly jig over so that it is under the collapsible crane
c. Rotate the assembly jig to the horizontal position
d. Maneuver the assembly jig so that the Feedthrough is over the cradle
e. Lower Feedthrough onto cradle 1
f. Remove the M12 ready rods from the warm flange
g. Remove the M8 bolts from the funnel base
h. Remove the pigtail bag and protector bucket from the Feedthrough
i. Carefully pass the lower funnel tube & pigtails through the assembly jig
j. Move the assembly jig clear of the Feedthrough
k. Install the four bellows support bars
l. Install The hoist Brackets To The Bellows Supports

3. Place Feedthrough on one of the modern cradles

a. Place a modern cradle (Type 2) onto one of the Triumf Carts
b. Using the Collapsible crane, hook onto the rotating sling
c. Use the crane to pick up and lower feedthrough onto the cradle
d. Remove the hoist brackets from the bellows support brackets on the Feedthrough
e. Wheel the Feedthrough over to the left-hand side of the Cold Test Station next to the electronics rack.

4. Connect up Feedthrough to the Leak Test Station

a. Connect up the 420mm long conflat to VCR adapter to the test port at valve B.
b. Slowly move the Feedthrough so that the VCR gland on the Feedthrough is in line with the VCR adapter. Be careful not to bang the VCR gland against the VCR adapter.
c. Connect the VCR gland on the Feedthrough up to the VCR adapter. Use the black Neoprene with a hole in the centre for sealing.
d. Use the rubber plugs to seal the remaining three open VCR gland openings on the Feedthrough.

5. Rough out the Bellows on the Feedthrough and prepare the Leak Checker

a. Make sure the following valves are closed:
    - N Bellows Roughing Valve
    - Q Insulating Vacuum Valve
    - R Funnel Roughing Valve
    - A Roughing Vent Valve
    - X Calibrated Leak Valve
    - D Leak Checker Valve
    - E 3-Position Valve

b. Open the following valves:
    - B VCR Test Valve
    - P Roughing Pump Valve
    - C Roughing Valve

c. Turn on the 303 Vacuum Process Controller
d. Turn on the DVP 500 Roughing Pump
e. It may take over night to rough out the Bellows.
f. When the vacuum inside the bellows reaches approximately $2.0E^{-1}$, close valve;
    - C Roughing Valve

g. Push the "START/STOP" Button on the Leak Checker
h. When the Leak Checker reaches $5.0E^{-1}$ open valve:
   D Leak Checker Valve
i. When the base rate of the Leak Checker bottoms out, hold down the zero button on the Leak Checker for about 4 seconds until the zero has been turned off.

6. Leak test the Ambient Signal Flange to Bellows

a. Before testing, enter the base rate of the Leak Checker on to the form sheet under the Ambient Signal Flange to Bellows column.
b. Turn on the helium and run the wand around the weld connecting the Ambient Signal Flange to the bellows. Record the leak rate on the form sheet under the Ambient Signal Flange to bellows column. Subtract the base rate from the leak rate and enter the actual leak rate on the form sheet.
c. Enter the date the testing was preformed and the person who preformed the tests on the form sheet.

7. Leak test the Cold Signal Flange to Bellows

a. Before testing, enter the base rate on the Leak Checker on to the form sheet under the Cold Signal Flange to Bellows column.
b. Turn on the helium and run the wand around the weld connecting the Cold Signal Flange to the bellows. Record the leak rate on the form sheet under the Cold Signal Flange to bellows column. Subtract the base rate from the leak rate and enter the actual leak rate on the form sheet.
c. Enter the date the testing was preformed and the person who preformed the tests on the form sheet.
d. There is an option to spray He into the cold funnel to test the cold flange pin carriers at this point.

8. Shut off equipment and update the database

a. Close valve:
   D Leak Checker Valve
b. Turn on the DVP500 Roughing Pump and pump until vacuum reaches approximately E^{1}
c. Open valve:
   C Roughing Valve
d. Turn off the DVP500 Roughing Pump
e. Open valve:
   A Roughing Vent Valve
f. Push the "START/STOP" button on the Leak Checker to vent.
g. Turn off the Leak Checker
h. Turn off the 303 Vacuum Process Controller

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Final Assembly - Ambient Leak Tests Outside CTS

Feedthrough Serial # _____

Ambient Signal Flange to Bellows		**Cold Signal Flange to Bellows**	
Base Rate (No He)	_____	Base Rate (No He)	_____
Leak Rate (He)	_____	Leak Rate (He)	_____
Actual Leak Rate	_____	Actual Leak Rate	_____
Date Tested	_____	Date Tested	_____
Tested By:	_____	Tested By:	_____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments _____

PASS / FAIL

Chapter 20

Insertion of A Feedthrough into the Cold Test Station

Note: Gloves must be worn at all times when handling the Feedthrough and Pigtails.

1. ***Prepare the Feedthrough for the insertion into the vacuum station***
   a. Bundle the pigtails as required.
   b. Wrap each bundle with saran wrap
   c. Attach A 1 meter long string to each of the four groups of pigtails
   d. Place the pigtail protector bucket back onto the feedthrough
   e. Install The Rotating Sling Brackets To The Bellows Supports
   f. Using the Collapsible crane hook onto the rotating sling
   g. Use the crane to pick up and lower feedthrough onto the trolley
   h. Disconnect the rotating sling from the feedthrough
   i. Remove the rotating sling brackets from the bellows support brackets on the Feedthrough
   j. Wheel the Feedthrough over to the cold test station

2. ***Insert the Feedthrough into the vacuum station***
   a. Turn on the Scientific Instruments Temperature Indicator Model 9300 located in the electronics rack beside the cold test station.
   b. Check to make sure all diodes are connected and working properly
   c. Fix or replace any diodes that are not working
   d. Remove the pigtail protector bucket from the feedthrough
   e. Install the lifting connector in the groove of the CF flange - long side towards back
   f. Clean the CF flange on the feedthrough with ethanol
   g. Place a cooper gasket on the CF flange
   h. Lower the winch through the cold test station and attach to lifting connector
   i. Feed the pigtail cables up through the vacuum station
   j. Tighten winch to take the slack out of the hoist rope
   k. Cover the two Ln2 tubes at the top of the cold test station to protect pigtails
   l. Clean the o-ring surface on the bottom of the cold test station
   m. Remove the four bellows support bars, ensuring the winch is supporting the Feedthrough
   n. Clean the o-ring groove on the seal ring using ethanol
   o. Clean the o-ring for the seal ring, using ethanol, and place it in the groove
   p. Install copper belt onto the lower funnel tube, using the alignment guide, vacuum grease and large hose clamp to tighten
   q. Slowly begin raising the Feedthrough
   r. Use the 1 m long strings to help pass the pigtails through the main chamber of the vacuum station
   s. Watch the pigtails closely at this stage because the pigtails can easily get snagged or hung up on something
   t. Just before the cold flange goes through the bottom of the Cold Test Station insert diode B at the back and Diode D at the front of the cold flange
   u. Secure the diodes in place by tying them down with fishing line
   v. Check to make sure that the diodes are reading correctly
   w. If the diodes are not reading correctly:
      i. lower the feedthrough and fix the diode(s)
      ii. return to step 3 line n
   x. Pull the pigtails one group at a time through the CF Flange on the vacuum station
   y. Guide the Feedthrough into the cold test station – watch that the diodes don't get pinched or damaged going through the bottom of the vacuum station
   z. When the Feedthrough reaches the top check its rotation and insert 20 M8 Bolts into the special CF Flange, the proper rotation is when the funnel is offset to the back of the feedthrough.

3. The final touches

a. Insert The Bolt Ring and 16 M8x50 Bolts
b. Remove the lifting connector from the special CF Flange
c. Install the M10 Bolt into the copper belt
d. Close the Copper Band Access Port with the CF Blank
e. Remove the LN2 covers
f. Install the LN2 fill tube into the funnel ensuring diode "C" is securely attached
g. Install the LN2 vent tube (points up)
h. Install the LN2 level
i. Install the Pin Carrier diode (Diode A)
j. Vacuum out any Rohacell dust from upper chamber
k. Remove saran wrap
l. Remove the four 1m long strings
m. Install the inner part of the pigtail bucket and insulation
n. Coil the pigtails into the inner bucket
o. Clean the groove and o-ring that seal the pigtail bucket and then install the o-ring
p. Install the outer pigtail bucket with the 10 M8 bolts
q. Connect the VCR Tee to the Cold Test Station. Make sure the rubber seals have **HOLES** in them!
r. Install rubber bungs into the remaining open VCR Tee's (3)
s. The Installation is complete: Make sure to record the date and feedthrough number in the Feedthroughs logbook.
t. Proceed to the procedure, “Ambient Leak Test of A Feedthrough in the Cold Test Station”.

Chapter 21

Final Assembly -Ambient Leak Test of A Feedthrough in the Cold Test Station

1. Test Preparation

a. Open the Leak checker log book and record the date, Feedthrough Number
b. Turn on the leak checker (Required warm up time is approximately 30 minutes)
c. Record in logbook the time the leak checker was turned on and the base rate
d. Turn on the Balzers pressure gauge
e. Turn on the 303 Vacuum Process Controller pressure gauge

2. Rough out the main chamber and inside the bellows

a. Ensure that the following valves are closed:

C	Roughing Valve
D	Leak Checker Valve
F	Calibrated Leak Valve
G	RGA Valve
K	Ion Pump
N	Bellows Roughing Valve
Q	Insulating Roughing Valve
W	Nitrogen Purge Valve
Z	Calibrated Leak Valve

b. Open the following Valves

Note: Before opening any valves ensure chambers have equal pressure on both sides

E	3 position Valve
H	Turbo Valve
I	Turbo Backing Valve
J	Middle Valve
L	Metal Seal Valve
M	Bellows Valve
O	Insulating Vacuum Valve

c. Turn on the Balzers Pressure Gauge
d. Turn on the Varian Tri-Scroll Pump
e. It may take awhile to pump out the insulating chamber and the inside bellows chamber. If the vacuum doesn't decrease after two minutes – there is a leak.
   i. If there is a leak, turn off the pump.
   ii. There are several possibilities on why there is a leak. Each possibility must be checked for leaks. The possibilities are:
      - ❑ The CF flange on the Feedthrough and the Cold Test Station may not be properly aligned or tightened
      - ❑ The o-ring on the seal ring my not be sitting correctly in the o-ring groove.
      - ❑ The CF Flange that goes to the insulating chamber next to the copper band may not be properly aligned or tightened.
      - ❑ Etc…
   iii. Once the leak has been fixed return to step d
f. Once the vacuum pressure bottoms out at approximately 2.0E-1 mbar on the Balzers pressure gauge, turn on the Turbo Pump
   i. Push the Power button on the Seiko-Seiko STP Control Unit to turn on the turbo.
   ii. Push the Start Button.
   iii. An accelerating light will light up on the control unit. The vacuum pressure should continue to decrease from this point to approximately $5.0E^{-4}$
   iv. The control panel will display a light next to normal operation when it reaches that state, approximately 12 minutes.

3. ***Rough out the Roughing lines in Cold Test Station including the Pigtail Bucket***
   a. Ensure that the following valves are closed:
      T LN2 Input Valve
      U N2 Vent Valve
      S Helium/Nitrogen Gas Admittance Valve
      V Helium/Nitrogen Purge Valve
   b. Open the following Valves
      R Funnel Roughing Valve
      P Roughing Pump Valve
   c. Turn on the DP-500 roughing pump
   d. This will take a few minutes to pump out the upper chamber
   e. Once the upper chamber has been pumped out to approximately 3.0E-1 on the 303 Vacuum Process Controller pressure gauge, close the following valve:
      R Funnel Roughing Valve
      P Roughing Pump Valve

4. Connect up Helium
   a. Connect up the dry helium tank to the helium admittance port using 3/8" Polly flow tubing
   b. Open valve:
      V Helium Purge valve

5. Leak test of Feedthrough
   a. Push the "START/STOP" Button on the Leak checker
   b. Close Valve:
      H Turbo Valve
   c. Let the Leak Check pump for approximately 2 minutes against the valve:
      D Leak Checker Valve
   d. Open Valve
      D Leak Checker Valve
      The Leak Checker is now open to the insulating chamber and inside the Bellows chamber
   e. Record in the log book the base rate before zero
   f. Hold down the "Zero" button on the Leak Checker for 4 seconds
   g. Record in the log book the base rate after zero is turned off. This number should be in the low E^{-9}
   h. Have one person constantly monitoring the leak checker for any signs of leaks
   i. Open the valve on the helium tank
   j. Wait 30 seconds and then close the valve:
      V Helium Purge Valve
   k. Open valve:
      S Helium Gas Admittance Valve
   l. Once the pressure in the upper chamber reaches 0.5 bar close valve
      S Helium Gas Admittance Valve
   m. Record the leak rate in Feedthroughs log book and in the form sheet
   n. If there are no leaks then continue to step 7

6. Feedthrough Leaks
   a. Close the following valves:
      M Bellows Valve
      O Insulating Vacuum Valve
   b. Wait for the base rate on the leak checker to re-stabilize
   c. Open valve
      M Bellows Valve
   d. Record the leak rate in logbook.
   e. If there is a leak, this means that there is a leak in the welds from the funnel assembly to the cold flange. Make sure to record this information in the logbook
   f. Close valve
      M Bellows Valve
   g. Wait for the base rate on the leak checker to re-stabilize

h. Open Valve
   - O Insulating Vacuum

i. Record the leak rate in Feedthroughs logbook and in the form sheet
j. If there is a leak, this means that there is a leak through the pin carriers. Make sure to record this information in the logbook
k. If you noticed a leak in both steps, “f” and “k” then chances are there is a problem with the test setup. Make sure that the following valve is closed:
   - H Turbo Valve

7. *Completion of Leak Test*

a. Close the following valves
   - D Leak Checker Valve

b. Open the following valves
   - H Turbo Valve
   - M Bellows Valve
   - O Insulating Vacuum

c. Push the vent button on the leak checker
d. Turn off the leak checker
e. Turn off the 303 Vacuum Process Controller pressure gauge
f. Proceed to the procedure, “Cool Down of A Feedthrough in Cold Test Station”.

Atlas Endcap Signal Feedthrough Project

Revised: 010330

Final Assembly: Ambient Tests In CTS

Feedthrough Serial # _____

Cold Signal Flange to Funnel Assembly
Base Rate (No He) _____
Leak Rate (He) _____
Actual Leak Rate _____
Date Tested _____
Tested By: _____

Leak Test of Pin Carriers in Cold Flange
Base Rate (No He) _____
Leak Rate (He) _____
Actual Leak Rate _____
Date Tested _____
Tested By: _____

Recorded in Database By: _____
Date Recorded (ddmmyy) _____

Comments _____

Pass / Fail

Chapter 22

Cool Down of A Feedthrough in Cold Test Station

Note: This procedure is a continuation of the Ambient Leak Test of a Feedthrough in the Cold Test Station. The cool down procedure should not be done before the ambient leak test. This procedure assumes that the ambient tests have been completed, the turbo pump is still running, the temperature indicators are still on and all valves have not been touched since the Ambient Leak Test. The vacuum inside the insulating chamber and the inner bellows chamber should be at approximately $5.0E^{-5}$.

1. Order Liquid Nitrogen

a. The Liquid nitrogen needs to be ordered three days prior to the desired cool down test.
b. To Order the Liquid nitrogen:
   i. Call the Liquid Nitrogen supplier. The supplier is:
      Airgas Canada Inc.
      1-931 Ellery St
      Victoria BC
      Ph#: 383-2442
   ii. The standing Purchase Order number is: ***S0000965***
   iii. This standing purchase Order Expires: 31 March 2001

Day 1 (Afternoon)

2. Open Temp monitor Vi

a. Log on to the computer named "WINO"
b. Start the LabVIEW program by double clicking on the LabVIEW shortcut on the desktop.
c. A LabVIEW msgbox will appear on the screen. Click on the button labeled "Open VI"
d. Locate and open the VI program located in the following directory:
   Network Neighborhood \ Hepserv \ LabVIEW \ Cold Test Station \ Temp monitor.vi
e. The LabVIEW vi will now load. In the comment box of the LabVIEW window, enter the all the appropriate information pertaining to this test such as: current date, the Feedthrough number, the diodes being used to run this test (A-D) and their positions. The diode positions should be:
   Diode A = Center of Cold Flange
   Diode B = Back of Cold Flange
   Diode C = Bottom of Nitrogen Flow tube
   Diode D = Front of Cold Flange
f. In the box labeled "Number of Plots" enter the number 4
g. In the box labeled "Delay" enter 1 minute
h. Press the white arrow on the menu bar to run the Vi
i. A msgbox window will appear asking you where to save the data. Save the data in the following directory:
   D:\ users \ Cold Tests \ Data Files Cold Test Station
   Enter the filename as dd/mm/yy – corresponding to the date of the test. Hit the save button. This will start lab view.

3. Turn on the cold head

a. Turn on the cold head by flipping the green switch on the front of the compressor. This switch turns on both the compressor and expander.
b. Make sure that there is water flowing out of the compressor into the drain
c. If no water is flowing, turn off compressor and refer to the compressor manual to determine problem.
d. The cold head should run through the night.

4. Purge out the Helium from the upper chamber

Cool Down of Feedthrough

a. Wheel the dewar next to the Cold Test Vacuum Station
b. Install the ¼" polyflow vent line to the vent line on the Cold Test Station
c. Connect up the dry Nitrogen tank to the helium/nitrogen admittance line using 3/8" polyflow tubing
d. Open the nitrogen valve on the Nitrogen tank
e. Open the following valve:
    V Helium/Nitrogen Purge Valve
f. After 30 seconds close valve:
    V Helium/Nitrogen Purge Valve
g. Open valve:
    S Helium/Nitrogen Admittance valve
    U N2 Vent Valve
h. After 2 minutes close valves:
    U N2 Vent Valve
    S Helium/ Nitrogen Admittance valve

5. Connect up flow gauges to the Cold Test Vacuum Station

a. Connect a 1/4" polyflow tube from the back of the flow gauges to the upper chamber vent.

Day 2 (Morning)

6. Preparations for cool down

a. In LabVIEW change box labeled "Delay" enter 0.5 seconds
b. Turn on the leak checker at lunch time.

7. Add Liquid Nitrogen

a. Connect a hose from the dewar liquid line to the Cold Test Vacuum Station via the LN_2 input line
b. Open the main liquid line valve on the Nitrogen Dewar to full.
c. Open the following valve:
    W Nitrogen Purge Valve
d. Let the line purge out for approximately 30 seconds
e. Close the following valves:
    W Nitrogen Purge Valve
    Y Boil Off Relief Valve
f. Open the following valves:
    T LN2 Admittance valve
    U N2 Vent Valve
g. Watch the temperature sensors to make sure that there is no liquid nitrogen hitting the cold flange.
h. Diode C can be approximately 100 degrees cooler than diodes A, B, and D.
i. Diodes A, B, and D should not have a temperature difference greater than 30.

8. Cooling down the Feedthrough

a. It will take approximately 5 to 6 hours to cool down the feedthrough to 77 degrees Kelvin.
b. To control the rate of cool down, simply adjust the flow rate by turning the knob on the left flow gauge to increase or decrease the amount of liquid nitrogen boil off.
c. When the left flow gauge reaches its maximum flow rate:
    i. Turn the left flow gauge knob down to approximately 40.
    ii. Open the boil off relief valve a small amount to decrease the pressure inside the feedthrough.
        Y Boil Off Relief Valve
    iii. Readjust the flow gauge to achieve the desired cool down rate.
d. Step "c" will have to be repeated several times throughout the cool down.
e. When Diodes A, B and D are at or below 200 Degrees Kevin, turn on the power to the resistors on the warm flange. Set the power to 10 watts.
f. When diodes B and D are at or below 110 degrees Kelvin the boil off relief valve can be fully opened.
    Y Boil Off Relief Valve
g. When the diodes A, B, and D all reach 85 degrees Kelvin close the following valve:
    T LN_2 Admittance Valve

h. Turn the Boil Off Relief Valve so that the handle points toward the 3psi pressure relief valve.
i. The Feedthrough is now ready for the cold leak and pressure tests.
j. Proceed to the next section, “Cold Leak and Pressure tests in the Cold Test Station”.

Chapter 23

Cold Leak and Pressure Tests in the Cold Test Station

Note: This test is done after the feedthrough has been cooled down to 77 degrees Kelvin. This procedure is a continuation of the cool down procedure and assumes that all valves and equipment are in the same state as from the cool down procedure.

Pressure Test

a. Start the lab view program that monitors the cold funnel pressure.
   Network Neigborhood / strange / mechanical tests / pro / src / labview / funnel pressure / robinsonhalpern.vi
b. To start the pressure test, close the LN2 inlet and vent valves.
   T LN2 Vale
   U LN2 Vent Valve
c. As the liquid Nitrogen boils off, the pressure will increase until it reaches the set point of the first pressure relief valve at 2.8 bar absolute or 1.8 bar gauge. After ten minutes close the valve to this relief valve. The pressure will now continue to increase until the set point of 3.5 bar absolute on the second relief valve is reached. The pressure is left at 3.5 bar for 30 minutes.
d. Slowly open a vent valve to vent the N2 gas until the pressure is down to one Atmosphere. The pressure should decrease at the rate of .35 bars per min.
e. Print the plot from labview showing the pressure test cycle.

Cold Leak Test of Funnel Welds and Cold Flange Pin Carriers.

1. Open Leak Checker up to the main line

a. Push the "START/STOP" button on the Leak Checker
b. Close valve:
   H Turbo Valve
c. Let the leak checker pump for approximately 3 minutes against the valve:
   D Leak Checker Valve
d. Open valve:
   D Leak Checker Valve
e. Watch the Pressure gauge and make sure the pressure doesn't increase greater than approximately $5.0E^{-4}$
f. If the pressure increases to greater than $5.0E^{-4}$ then:
   i. Close the valve:
      D Leak Checker Valve
   ii. Open valve:
      H Turbo Valve
   iii. Repeat steps "b" through "e" several times. If the problem persists, end this procedure and assess the problem.
g. The leak Checker is now open to the insulating chamber and inside the bellows.
h. Hold down the "ZERO" button on the leak checker for approximately 4 seconds until the zero has been turned off.
i. Record in the Feedthrough log book and the form sheet labeled "Final Assembly (Leak & Pressure Test") the base rate. This number should be in the low E^{9} mbar l/s

2. Wait for the LN_2 to boil off

a. This procedure cannot continue until all of the Liquid Nitrogen in the Feedthrough has boiled off.
b. Watch both the flow gauge and LabVIEW for indications of warm up.
   i. One indication of complete boil off is when the ball on the flow gauge drops to zero
   ii. Another indication is when LabVIEW shows diodes A, B and D all beginning to rise
c. While still watching for signs of warm up:

i. Connect up the dry Helium bottle to the Cold Test Station via the helium/Nitrogen admittance port, bypassing the flow gauges.
ii. Turn on the 303 Vacuum Process Controller pressure gauge
iii. Connect the vent 3/8" poly vent line to the vent port on the Cold Test station

d. When both the flow gauge and LabVIEW shows that the Liquid Nitrogen has boiled off, continue to step 3.

3. Pull a vacuum in the upper chamber

a. Turn on the DVP-500 roughing Pump
b. Close the following valves:
   U Vent Valve
   T LN_2 Valve
c. Open the following valves:
   P Roughing Pump Valve
   R Funnel Roughing Valve
d. It will take a few minutes to pump out the upper chamber
e. When the 303 Vacuum Process controller Pressure gauge reads approximately 1 mbar, the upper chamber has been pumped out, close the following valves:
   R Funnel Roughing Valve
   P Roughing Pump Valve

4. Leak test the Feedthrough

a. The rest of this test will require 2 people
b. One person should be constantly watching the Leak Checker for any signs of leaks.
c. The second person will do the purging of lines, opening and closing of valves and any other miscellaneous tasks.
d. Open the valve on the dry helium tank.
e. Open the valve:
   V Helium/Nitrogen Purge Valve
f. Wait for approximately 10 seconds then close the valve:
   V Helium/Nitrogen Purge Valve
g. Open valve:
   S Helium/Nitrogen Admittance valve
h. Once the pressure in the upper chamber reaches 1 bar close valve
   S Helium Gas Admittance Valve
i. Close the valve on the helium tank
j. Hold the pressure in the upper chamber for 2 to 3 minutes
k. Record the leak rate in logbook and on the form sheet labeled "Final Assembly (Leak & Pressure Tests)".
l. Subtract the base rate from the leak rate and enter the actual leak rate on the form sheet.
m. If there are no leaks then continue to step 6

5. Feedthrough Leaks

a. Close the following valves:
b. M Bellows Valve
c. Insulating Vacuum Valve
d. Wait for the base rate on the leak checker to re-stabilize
e. Open valve
f. M Bellows Valve
g. Record the leak rate in logbook.
h. If there is a leak, this means that there is a leak in the welds from the funnel assembly to the cold flange. Make sure to record this information in the logbook
i. Close valve
j. M Bellows Valve
k. Wait for the base rate on the leak checker to re-stabilize
l. Open Valve
m. Insulating Vacuum
n. Record the leak rate in logbook.
o. If there is a leak, this means that there is a leak through the pin carriers. Make sure to record this information in the logbook

6. Purge out the helium from the upper chamber

a. Turn the Helium/Nitrogen admittance port on the Cold test Station from helium to dry Nitrogen

b. Open the valve on the dry Nitrogen tank.
c. Open the valve:
   V Helium/Nitrogen Purge Valve
d. Wait for approximately 10 seconds then close the valve:
   V Helium/Nitrogen Purge Valve
e. Open the following valves:
   U Vent Valve
   S Helium/Nitrogen Admittance valve
f. While the nitrogen gas is purging out the upper chamber (approximately 2 minutes)
   i. Close the following valves
      D Leak Checker Valve
   ii. Open the following valves
      H Turbo Valve
      M Bellows Valve
      O Insulating Vacuum Valve
   iv. Push the vent button on the leak checker
   v. Turn off the leak checker
   vi. Turn off the 303 Vacuum Process Controller pressure gauge

g. When the nitrogen gas has purged the upper chamber for approximately 2 minutes then close valve
   S Helium Gas Admittance Valve

6. Preparation to re-fill the Feedthrough in the Cold Test Station – If Required.

a. Connect a 3/8" polyflow line from the back of the flow gauges to the upper chamber vent.
b. Turn on the Fluke 77 Multimeter - set it to DC Amperage
c. Turn on the PE 1542 DC Power Supply.
d. Close valve:
   Y Boil Off Relief Valve
e. Look at the temperatures of the diodes on the Temperature gauge
   i. If the temperature of diodes A, B and D are 110 Degrees Kelvin or less then go to step 7.
   ii. If the temperature of diodes A, B and D are greater than 110 degrees Kelvin then go to Step 8.

7. If the temperature of diodes A, B and D are 110 Degrees Kelvin or less

a. Open the main liquid line valve on the Nitrogen Dewar to full.
b. Open the valve:
   W Nitrogen Purge Valve
c. Remove the 3/8" polyflow line from the vent port on the Cold Test Station
d. Let the line purge out until liquid nitrogen starts to spit out the purge line
e. Close the valve:
   W Nitrogen Purge Valve
f. Open the following valves:
   T LN2 Admittance valve
   Y Boil Off Relief Valve
g. When the current on the multimeter reaches 6.94mA, close the main liquid line valve on the Nitrogen Dewar
h. Reattach the ¼" Polyflow line from the flow gauges to the vent port on the Cold Test Station
i. Continue to step 9.

8. If the temperature of diodes A, B and D are greater than 110 degrees Kelvin

a. Watch the temperature sensors to make sure that there is no liquid nitrogen hitting the cold flange.
b. Diodes A, B, and D should not have a temperature difference greater than 30.
c. To control the rate of cool down, simply adjust the flow rate by turning the knob on the left flow gauge to increase or decrease the amount of liquid nitrogen boil off.
d. When the left flow gauge reaches its maximum flow rate:
   j. Turn the left flow gauge knob down to approximately 40.
   iv. Open the boil off relief valve a small amount to decrease the pressure inside the feedthrough.
      Y Boil Off Relief Valve
   v. Readjust the flow gauge to achieve the desired cool down rate.
e. When diodes A, B and D are at or below 110 degrees Kelvin the boil off relief valve can be opened full.
   Y Boil Off Relief Valve

f. When the current on the multimeter reaches 6.94mA, close the main liquid line valve on the Nitrogen Dewar

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Final Assembly: Cold Leak & Pressure Tests

Feedthrough Serial # _____

Cold Signal Flange to Funnel Assembly

Base Rate (No He) _____
Leak Rate (He) _____
Actual Leak Rate _____
Date Tested _____
Tested By: _____

Leak Test of Pin Carriers in Cold Flange

Base Rate (No He) _____
Leak Rate (He) _____
Actual Leak Rate _____
Date Tested _____
Tested By: _____

Pressure Test

Pressure _____

Date Tested _____
Tested By _____

Recorded in Database By: _____
Date Recorded (ddmmyy) _____

Comments _____

PASS / FAIL

Chapter 24

Final Assembly - Cold Electrical Tests

Note: The Cold Electrical Tests should be done immediately after the Feedthrough in the Cold Test Station has been topped up with Liquid Nitrogen. It takes approximately 5 hours for the Liquid Nitrogen to completely boil off. This should be enough time to complete all of the Cold Electrical Tests.

Extra care should be taken when inserting the connectors into the Pin Carriers to ensure that no pins get damaged.

1. Cold Continuity Tests with Cirris Tester

a. Two people should be used for this job, one for attaching the cables, and the other for driving the Cirris tester. Approximately one hour should be sufficient to complete the Cirris tests.
b. Wheel the Cirris tester on its low cart next to the test area, on the side facing the weld station.
c. Place the foamy mattress under the feedthrough.
d. Make sure that the Cirris tester is clear of old unsaved data.
e. Load Wirelist COLD.WIR (Test Setup / Retrieve Wirelist), and ensure that the Cirris tester is set to `single' mode, *not* `continuous' mode. A 100 Volt HiPot test is included here.
f. Use the multi-pin straightener to ensure that all pins are straight before connecting the test harnesses. Use the single-pin straightener to straighten any bent pins.
g. Spray the ATI jackscrews on MD3209/01 and MD3209/02 with Teflon. This should be repeated after each Pin Carrier is tested (ie, after 7 or 8 plugins).
h. Attach two 1.2 meter test harnesses between the Cirris tester and slots A1 and B1 of the feedthrough, routing the test harnesses over the horizontal bar of the cold test station for support
i. Connect test harness MD3209/01 between J1/J2 of the Cirris tester and slot A1 of the Warm Flange:
    - The end of the test harness to be attached to the Cirris tester is marked with a `C' on the ATI connector, which also indicates the `pin 1' location. The `pin 1' location on the Cirris tester is marked with a `1'. The end of the test harness to be attached to the Warm Flange is marked with `WF', and the `pin 1'location on the ATI connector is marked with a green dot. The slot A1 and pin 1 locations on the Warm Flange are indicated on the frame of the Cold Test Station, visible while lying under the feedthrough.
    - Use test harness MD3209/02 to connect J3/J4 of the Cirris tester with slot B1 of the Warm Flange, following the same instructions listed above.
j. Test the A1/B1 continuity.
k. Repeat steps “h” -> “j” for slots A2/B2 -> A15/B15.
l. Make sure that a blank disk is in the Cirris tester.
m. Press either HOME or CANCEL and watch that the data gets written to the floppy disk.
n. Save and Process the Cirris data on both NT and UNIX as for the pigtails, but under the ColdTests directory. The directory on NT for ftxx will be Strange\Data\ElectricalTests\pro\dat\ColdTests\Cirris\ftxx.

2. Cold Cross Talk Tests

a. Two people should be used for this job, one for attaching the cables, and the other for driving the VI. Approximately two hours should be sufficient to complete the cross talk tests.
b. The Pulser and other electronics should be turned on at least 30 minutes before tests start.
c. Wheel the mobile cross talk station to a point between the computer and the feedthrough, and offset toward the weld station to allow access under the feedthrough.
d. Place the foamy mattress under the feedthrough.
e. Detach the ATI ends of the pigtails from the bottom side of the Pin Carriers of the mobile cross talk station. Pigtail MD2884/001 should still be attached to the Fanout, and pigtail MD2884/003 should be attached to the scanner.
f. Start up the VI by running scopeFO1.bat located in *STRANGE\Data\ElectricalTests\pro\exe\ColdTests\CrossTalk*.
g. Follow the instructions on the pop-up message (after starting the VI) for the correct pulser settings.
h. Use the multi-pin straightener to ensure that all pins are straight before connecting the test harnesses. Use the single-pin straightener to straighten any bent pins.
i. Spray the ATI jackscrews with Teflon. This should be repeated after each Pin Carrier is tested (ie, after 7 or 8

plugins).

j. Attach the cable from the Fanout to slot A1, and the cable from the scanner to slot B1. The `pin 1' marks on the ATI connectors go to pins 2 on the Pin Carriers.
k. Ensure that the correct cable type (T47, T48, T49…) is selected in the CrossTalk VI.
l. Click on `SCAN' to start recording data. For ftxx (where ftxx is the Feedthrough serial number) and slots 1, data will be saved in folder *STRANGE\Data\ElectricalTests\pro\dat\ColdTests\CrossTalk\ftxx\slot01*. The directory ftxx will have to be created first by hand. A pop-up message will remind you to switch to the appropriate attenuation on the attenuator box. This will happen again after about one minute.
m. Watch the scope for at least the first few `through' pulses, and also the first few `crosstalk' pulses to ensure the pulses look reasonable.
n. Repeat steps “h” to “k” for slots 2 -> 15.

Note: If any of the tests failed then the nature of the failure and the channels involved should be indicated in the comments section of the *Final Assembly (Cold Electrical Tests)* form sheet. If the Feedthrough has passed all the electrical tests then the Pass must be circled on the bottom of the form sheet.

3. Form and Database Entry

a. Record on the Final Assembly (Cold Electrical Tests) form sheet the person who completed the Cold Continuity Tests and the date the test was done.
b. Record on the from sheet the person who completed the Cold Cross Talk Tests and the date the test was completed
c. Enter in the database all the information that has been recorded on the form sheet.
d. Record on the form sheet the date the information was recorded into the database and the name of the person who recorded it.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Final Assembly (Cold Electrical Tests)

Feedthrough Serial # _____

Cold Electrical Tests

Cold Continuity	Tested By:	_____	Date Tested:	_____
Cold Cross Talk	Tested By:	_____	Date Tested:	_____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments _____

PASS / FAIL

Chapter 25

Warm up of A Feedthrough in the Cold Test Station

Note: This procedure is a continuation of the "Cold Leak and Pressure Tests" procedure. All valves, pumps and gauges should be in the same state they were left in from the "Cold Leak and Pressure Tests". It is very important that no air be introduced to the upper chamber anytime during the warm up.

1. ***Ensure that No pressure can build up in the upper chamber and that No air can be introduced to the upper chamber.***
   a. It is important that the following valves are checked to ensure that they are open so that there is no pressure build up in the Feedthrough.
      U Vent valve
      Y Boil Off Relief Valve
   b. The arrow on the handle of the boil off relief valve should be pointing towards the 1 psi Vent Valve
   c. Check to make sure that the following valve is closed:
      T Ln2 Admittance Valve
   d. Remove the 3/8" Polyflow line from the vent port on the Cold Test Station
   e. Plug the vent port on the Cold Test Station with the 3/8" Polyflow plug.

2. ***Turn off the Turbo Pump***
   a. Close Valve:
   b. H Turbo Valve
   c. I Turbo Backing Valve
   d. Push the "STOP" button on the Seiko-Seiko STP Control Unit
   e. It will take approximately 20 minutes for the Turbo Pump to wind down.
   f. Turn off the Tri-Scroll Pump

3. ***Purge out the Insulating Vacuum and inside the Bellows with dry Nitrogen***
   a. Close Valve:
      J Middle Valve
   b. Turn on the DVP-500 Roughing Pump
   c. Open valve:
      P Roughing Pump Valve
   d. Turn on the 303 Vacuum Process Controller Pressure Gauge
   e. When the 303 Vacuum Process controller Pressure gauge reads approximately $3.0E^{-1}$, close the following valve:
      P Roughing Pump Valve
   f. SLOWLY open the following valve:
      N Bellows Roughing Valve
   g. The pressure on the Balzers Pressure Gauge should increase from approximately E^{-8} to E^{-1} mbar.
   h. Open the valve on the dry Nitrogen Tank
   i. Purge N_2 gas for 10 seconds.
   j. SLOWLY open valve:
      A Roughing Vent Valve
   k. After the pressure on the Balzers Pressure Gauge reads 200 mbar close valves:
      A Roughing Vent Valve
      N Bellows Roughing Valve

4. ***Completion of Warm Up***
   a. Decrease the power to resistors on the warm flange to approximately 5 watts to prevent condensation from forming on the pin carriers
   b. In LabVIEW change the box labeled "Delay" to read 5 minutes.
   c. It will take approximately 13 hours for the Feedthrough to completely warm up to 294 degrees Kelvin (room temperature).

d. It is safe to let the Feedthrough warm up overnight as long as step 1 (one) was followed exactly.
e. Once all the diodes reach a temperature of 294 degrees Kelvin or higher print the screen on lab view showing the graph of the entire cool down and warm up.
f. Print out another detailed page of just the cool down
g. Print out another detailed page of just the warm up
h. Once all the pages have been printed out, staple them together and put them into the blue binder labeled “Pin Carrier and Vacuum Station LabVIEW Printouts”

Chapter 26

Removal of A Feedthrough from the Cold Test Station

Note: Gloves must be worn at all times when handling the feedthrough and pigtails. The Feedthrough cannot be removed from the cold test station until the temperatures of all 4 diodes read 294 degrees Kelvin or higher. This procedure requires 3 people.

1. *Remove the main components from the Cold Test Station and Feedthrough*

a. Disconnect the VCR Tee from the Cold Test Station
b. Place the rubber gaskets in one of the blue storage baskets for future use.
c. Disconnect the power supply from the resistor plate
d. Remove the 10 M8 bolts that hold the outer pigtail bucket and place them into the blue container bucket labeled " Pigtail Bucket Bolts".
e. Remove the outer pigtail bucket
f. Take the o-ring that is in the pigtail bucket o-ring groove and place it in a Ziplock bag labeled "Pigtail Bucket O-Ring"
g. Uncoil the pigtails and support them up with the overhead I-Beam with rope
h. Remove the insulation from the inner part of the pigtail bucket
i. Remove the inner part of the pigtail bucket
j. Remove the pigtail jumpers from the pigtail cables.
k. Place the pigtail jumpers in their green plastic static free bags
l. Place the 3" plastic bags onto every pigtail connector. Secure each bag with a rubber band
m. Remove the Pin Carrier diode (Diode A)
n. Remove the LN_2 level
o. Remove the LN_2 vent tube
p. Remove the LN_2 Fill tubes. Be careful not to damage the diode "C", which is attached to the bottom of the left fill tube
q. Install the LN_2 protective covers
r. Bundle the pigtails into four separate groups with Saran wrap
s. Attach a 1m long string to each bundle
t. Remove the 6" (100mm) CF blank from the Copper Band Access Port that allows access to the copper belt. Place these bolts into the blue container labeled "Copper Band Access Port".
u. Remove the M10 bolt from the copper belt and store it in a Ziplock bag container labeled "Copper Belt" and place this bag in the blue plastic container labeled "Copper Band Access Port".
v. Remove the Bolt Ring, store the bolts in the blue storage container labeled "Bolt Ring Bolts".

2. *Remove the Feedthrough from the Cold Test Station*

a. Install the lifting connector in the groove of the Special CF flange - long side towards back
b. Connect the lifting connector up to the overhead crane
c. Tighten the winch on the overhead crane to take out the slack in the rope
d. Remove the 20 M8 bolts from the special CF Flange. The Winch may have to be continuously tightened to take the weight off the remaining bolts. Store the bolts in the blue plastic container labeled " Special CF Flange".
e. Using the winch lower the Feedthrough down through the cold test station – watch that the diodes don't get pinched or damaged going through the bottom of the vacuum station
f. Watch the pigtails closely at this stage because the pigtails can easily get snagged or hung up on something
g. Just after the cold flange goes through the bottom of the Cold Test Station remove diode E at the back and Diode D at the front of the cold flange by cutting the fishing line.
h. Place the diodes out of the way so that they won't get in the way or get damaged
i. Use the 1m long string to help pass the pigtails through the main chamber in vacuum station
j. Position the trolley with the big hole in it for the VCR glands underneath the Feedthrough
k. Slowly lower the feedthrough onto the trolley
l. Once the Feedthrough is properly positioned on the trolley keep the tension in the hoist rope tight to prevent the bellows from collapsing.

m. Remove the copper band from the lower funnel tube
n. Clean the lower funnel tube with acetone and ethanol
o. Install the four bellows support bars on the Feedthrough
p. Once the bellows support bars are securely attached to the Feedthrough remove the slack in the hoist rope.
q. Disconnect the lifting connector from the overhead crane
r. Wheel the feedthrough out from underneath the Cold Test Station. Guiding the pigtails out from the Cold Test Station. Take special care with the pigtails, ensuring that they don't get caught or snagged on anything.

3. Clean Up

a. Remove the lifting connector
b. Place the Pigtail protector bucket onto the Feedthrough
c. Install the Rotating Sling brackets to the bellows support bars
d. Take the o-ring out of the out of the seal ring groove and place it in a Ziplock bag labeled "Seal Ring"
e. Remove the copper CF gasket from the special CF flange on the Feedthrough and place it in the cupboard for possible future use
f. Turn off the Scientific Instruments Temperature Indicator

4. Place Feedthrough on one of the modern cradles

a. Wheel the Feedthrough underneath the collapsible crane
b. Place a modern cradle (Type 2) onto one of the Triumf Carts
c. Using the Collapsible crane hook onto the rotating sling
d. Use the crane to pick up and lower feedthrough onto the cradle
e. Disconnect the rotating sling from the feedthrough
f. Remove the rotating sling brackets from the bellows support bars
g. Remove the three black rubber plugs from the VCR glands on the Feedthrough. Store the rubber plugs in the Blue box labeled "VCR Plugs"

Chapter 27

Final Assembly (Final Warm Electrical Tests)

The Cross Talk tests can be carried out on either the mobile cross talk station, using the Tek2440 scope, or the fixed cross talk station, using the Lecroy 8818 Transient Recorder. Instructions are given here for the mobile cross talk station. Instructions for the fixed cross talk station are analogous.

1. Cross Talk Tests

a. Log onto the ColdTest station computer (**WINO**) and start the program *Strange\Data\ElectricalTests\pro\exe\FinalTests\CrossTalk\ScopeFO1.bat* (This assumes that the UBC fanout **FO1** is mounted on the mobile cross talk station, rather than **F02** which is nominally at the fixed cross talk station.)
b. In the **VI** window that should now appear, start the **VI** by pressing the **RUN** button (right arrow).
c. Follow the instructions on the popup window to set the properties of the BNC pulser. Note that ***the pulser should be turned on at least 30 minutes before data collection*** to allow it to warm up.
d. Connect the warm flange slot to be tested to the scanner using the test harness pigtail **MD2884/009.** The pin 1 mark on the ATI connector of the test harness pigtail is marked with a yellow dot.
e. Connect the corresponding pigtail to the fanout.
f. Note that the **T49**, **T50**, and **T51** pigtails of the **HEC** feedthroughs must be tested while jumpered. Do so using the same VI used in the Cold Cross Talk tests. No cross talk tests are performed for the **HEC LV** cables, since they have no ground shield and a continuity (**Phred** resistance) measurement is sufficient.
g. Press **Scan** to start the scanning procedure.
h. In the popup window that now appears, enter the directory name for the data to be stored. A new directory must first be made by hand, using the serial number of the feedthrough as the name of the directory, eg, **ft12**. The subdirectories for the cross talk data collected for this feedthrough will hang from this directory. The subdirectory name for the saved cross talk data for each slot should be the slot number being tested, eg, **slot01a**. If a cable is being remeasured for any reason, use **slot01a.1** (or **slot01a.2**... etc). Enter **Save** to proceed.
i. Another popup window now appears instructing you to set the attenuator box (white box with toggle) to **Through Pulses**. Do so, and press **OK** to continue. Be sure to watch the first few pulses on the scope screen to ensure that they appear reasonable.
j. Once the **Through Pulses** are completed (~ 1 minute) another popup window appears instructing you to set the attenuator box to **CrossTalk** Pulses. Do so, and press **OK** again to proceed. As before, watch the first few pulses on the scope screen to ensure that they appear reasonable.
k. After all 64 lines are scanned, proceed with measuring the next slot.
l. Note that the jackscrews of the test harness and the jackscrew sockets of the µ-D connector on the fanout should be lubricated every 5 – 10 plugins to prevent gauling.

2. Resistance Measurements

Resistance measurements are performed at the **Impedistance** test station.

a. Log onto the computer at the Impedistance test station (**STRANGE**) and start the Impedistance **Vi** at Strange\Data\ElectricalTests\pro\exe\VacuumCables\Impedistance\Impedistance.VI.
b. In the **VI** window that should now appear, start the **VI** by pressing the **RUN** button (right arrow).
c. Turn the power on for the Keithley micro Ohmmeter and **Phred**.
d. Connect the warm flange slot to be tested to **Phred** using the 1.2 meter test harness **MD3209/02**. The ATI connector to be attached to the warm flange slot of the feedthrough is marked with a **WF**, which also designates the pin 1 position. The ATI connector to be attached to **Phred** is marked with a **P**, and that mark should be placed adjacent to the yellow dot on **Phred**. Connect the corresponding pigtail for that slot to the µ-D socket on **Phred**.
e. A new directory to hold the collected data must be made by hand, using the serial number of the feedthrough as the name of the directory, eg, **ft12**. The files for the resistance data collected for this feedthrough will hang from this directory, eg, *\Strange\Data\ElectricalTests\pro\dat\FinalTests\Phred\ft01\slot01a.dat*.
f. Start scanning the cable by pressing the **Scan** button on the **Phred** area of the **Impedistance VI** screen.
g. After the 64 traces have been scanned, a popup window will prompt you for the filename to be used for the saved data. This should be the slot number being tested, eg, **slot01a.dat**. If a cable is remeasured, use **slot01a.1.dat** (or **slot01a.2.dat**...).
h. Note that the jackscrews of the test harness and the jackscrew sockets of the µ-D connector on **Phred** should be lubricated every 5 – 10 plugins to prevent gauling.
i. After the resistance measurements with **Phred**, manually check all pins for ground shorts using a multimeter and the custom made blunt ended probe. Make a note in the *Comments* section of the *Final Assembly (Final Warm*

Electrical Tests) form sheet of any failed channels encountered.

3. Database Entry

a. Record the information from the form sheet into the database.
b. Record the name of the person and the date the information was recorded into the database, on the form sheet.

Atlas Endcap Signal Feedthrough Project

Revision #: 010330

Final Assembly (Final Warm Electrical Tests)

Feedthrough Serial # _____

Final Warm Electrical Tests

Precision Resistance	Tested By:	_____	Date Tested:	_____
Cross Talk	Tested By:	_____	Date Tested:	_____

Recorded in Database By: _____

Date Recorded (ddmmyy) _____

Comments _____

PASS / FAIL