



FERMILAB
Technical
Division

**7500 A HTS Power Leads for the
LHC DFBX:
Installation of the Current Leads**

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Rev. -
Rev. Date: Feb. 17, 2004
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FERMILAB
Technical Division

Installation of the LHC HTS Current Leads

Lead: DFLX _____

Signed _____ Date _____



1. Mechanical Integration of Current Leads in Feed Box

- 1.1 Clean sealing surfaces inside the chimney with acetone and alcohol.
- 1.2 Position the upper insulator in the chimney according to Figure 1.2.
- 1.3 Position the PEEK seal in the chimney according to Figure 1.2.
- 1.4 Position the lower insulator in the chimney according to Figure 1.2.

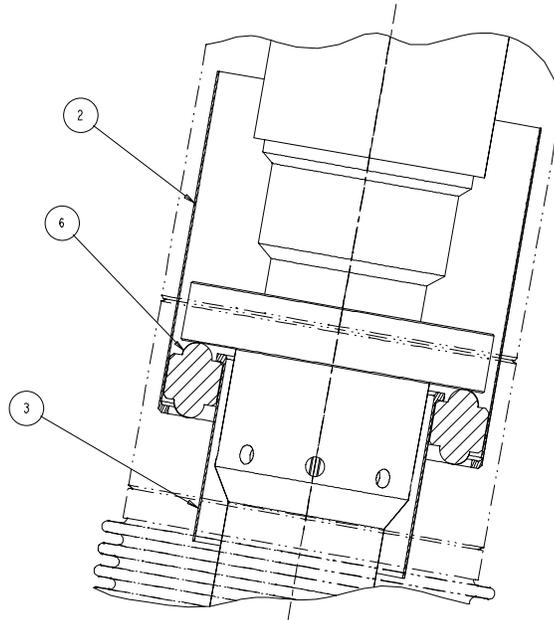


Figure 1.2 2 – Upper Insulator, 3 – Lower Insulator, 6 – PEEK Seal

- 1.5 Attach the lifting/insertion tool to the power lead flag, and lift the power lead from the shipping crate. The lead should be tilted at 10° . **Note:** Do not lift or support the lead by the large rectangular flange.
- 1.6 Remove g-force trip indicators from the power lead.
- 1.7 Untape the LTS cable from the power lead body. Carefully reposition cable strands, if necessary.
- 1.8 Remove the protective covers from the lower and upper flanges.
- 1.9 Remove the plastic plug from the 20 K port.
- 1.10 With alcohol, clean the lower flange and the upper flange knife edge and sealing surface.
- 1.11 Prepare to install the power lead baffle by removing the short threaded rods to open the baffle.
- 1.12 Install a baffle on the upper end of the lead.
- 1.13 Pre-tin the cable section that will be in the solder box with Stay-Bright solder and SP44 flux. Use a large soldering iron with a Variac set at 70%.
- 1.14 Insulate 6 in of soldered cable with 0.002 in Kapton wrapped with 50% overlap.
- 1.15 Untape the voltage tap wire secured around the base of the power lead. Secure the wire to the edges of the insulated cable with Kevlar tape.



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- 1.16 Clean the top plate Conflat flange knife edge and copper gasket. Install the gasket on the top plate Conflat flange.
- 1.17 Back down the nuts and washers on the tensioning studs.
- 1.18 Strapping the overhead crane to the lifting/insertion tool and manually guiding the lower end support, lift the power lead and position it 10° from vertical while not allowing any loading on the bottom end of the lead.
- 1.19 Remove the lower end support when the power lead is suspended freely from the crane.
- 1.20 Tie a weighted string to the LTS cable to help guide it through the chimney during installation. Do not tie the string around the voltage tap wire.
- 1.21 Install the lead in the chimney per Figure 1.21 until the lower sealing flange bottoms out. The flag should be pointed up the 10° slope of the feed box.

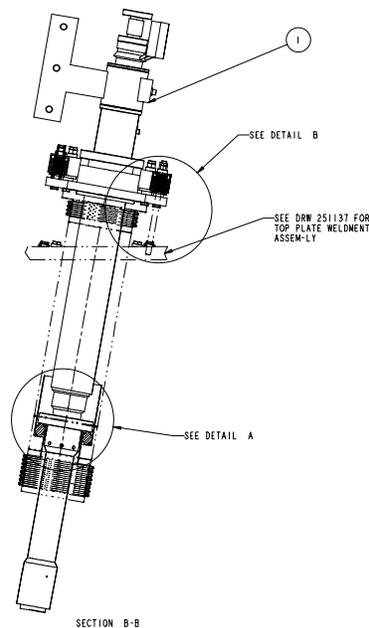


Figure 1.21 HTS Lead in chimney.

- 1.22 Raise the nuts on the tensioning studs to hold the lead in place, as shown in Figure 1.22.

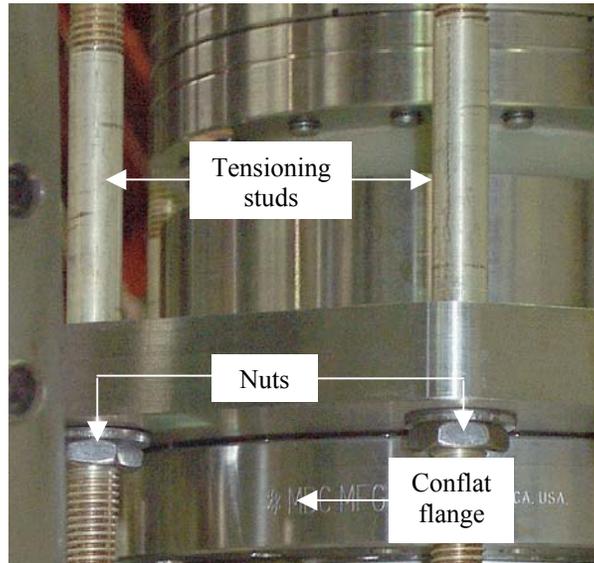


Figure 1.22 Holding the power lead in place using the tensioning studs.

- 1.23 Center the lower end of the lead in the chimney using the centering ring.
- 1.24 At Fermilab, the Conflat bolt holes on the power lead flange have been numbered 1 through 20 as indicated by Figure 1.24.
- 1.25 If there is a gap between the top plate Conflat flange and the power lead flange, pull the bellows up to close the gap using bolts 1 through 4.
- 1.26 Use a 5/16 12-point socket to tighten the 20 Conflat bolts. The tightening must be made gradually in 1/4 turn increments to a final torque of 15 ft-lbf (180 in-lbf). The tightening sequence is given by Fig. 1.27.

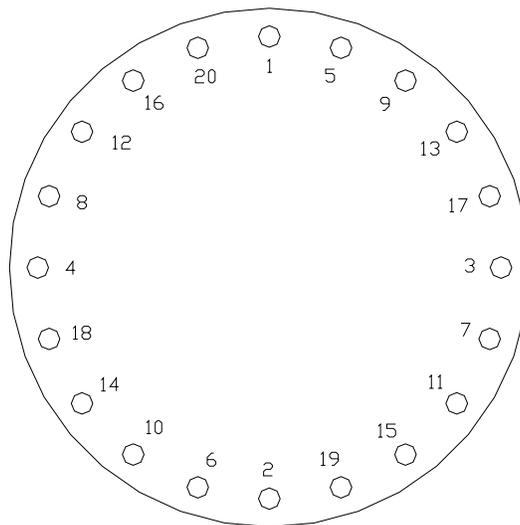


Figure 1.24 Tightening sequence for the 20 Conflat bolts.



- 1.27** Unbolt the lifting/insertion tool from the installed power lead.
- 1.28** Install Belleville washer assemblies on each tensioning stud per Figures 1.31a and 1.31b. A spherical washer must be placed below the Belleville washer holder on each stud. In the figures: Items 11 (10 per assembly) are Belleville washers, arranged as shown; Items 6 (2 per assembly) are flat washers; Items 4 and 5 are the Belleville washer holder lower and upper halves, respectively; Items 10 (2 per assembly) are spherical washers for above and below the washer holder; Item 9 is a loading nut; and Item 8 is a jam nut.

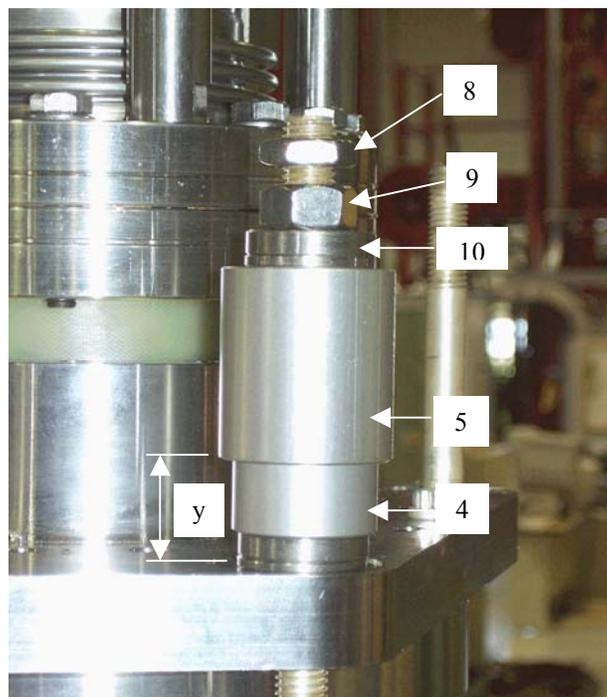


Figure 1.31a An installed Belleville washer assembly.



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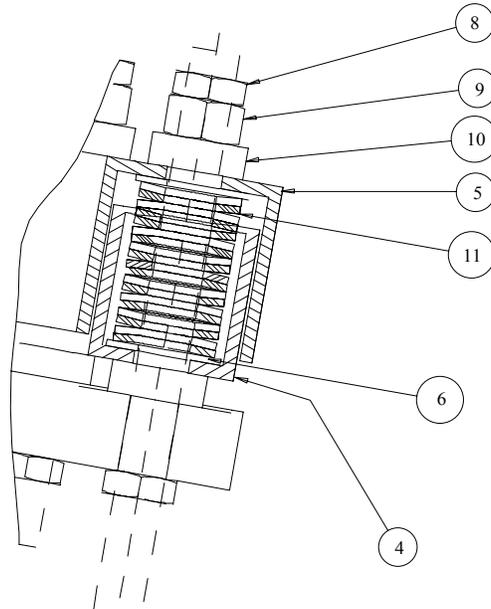


Figure 1.31b An installed Belleville washer assembly.

1.29 Tighten the 6 Belleville washer assemblies to apply load to the PEEK seal.

1.29.1 Back down the tensioning rod nuts used in Step 1.25 so they are about 5 mm below the power lead flange.

1.29.2 Tighten the 6 loading nuts finger-tight. With adjustable parallels, measure and record the gap 'y' indicated in Figure 1.31a between Item 5 (Belleville washer holder upper half) and the power lead top flange at the 6 locations specified in Figure 1.32.2. Units are mm.

A _____ B _____ C _____ D _____ E _____ F _____

1.29.3 For each of the six studs: remove the adjustable parallel, adjust it for 1.8 mm of compression, and return the adjustable parallel into position under the Belleville washer holder. Record the adjusted heights of the adjustable parallels. Units are mm.

A _____ B _____ C _____ D _____ E _____ F _____

1.29.4 Using the sequence A through F in Figure 1.32.2, sequentially tighten the loading nuts ¼ turn until the total compression is 1.8 mm at each of the six locations. As each loading nut is tightened ¼ turn, check off the appropriate line.

A _____ B _____ C _____ D _____ E _____ F _____

A _____ B _____ C _____ D _____ E _____ F _____

Lead DFLX _____



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A _____ B _____ C _____ D _____ E _____ F _____

A _____ B _____ C _____ D _____ E _____ F _____

A _____ B _____ C _____ D _____ E _____ F _____

A _____ B _____ C _____ D _____ E _____ F _____

A _____ B _____ C _____ D _____ E _____ F _____

A _____ B _____ C _____ D _____ E _____ F _____

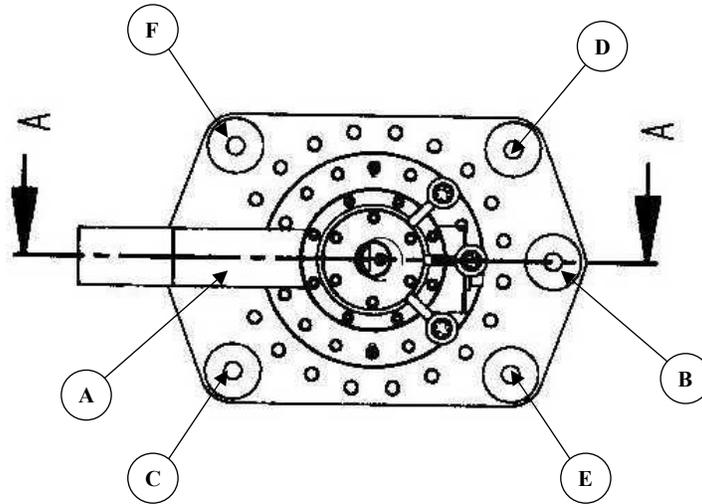


Figure 1.32.2 The specified sequence for tightening the Belleville washer assemblies.

1.29.5 Remove the adjustable parallels from under each Belleville washer assembly, then replace them and measure the final gaps 'y' in Figure 1.31a. Units are mm.

A _____ B _____ C _____ D _____ E _____ F _____

1.29.6 Attach a Conflat flange with a pressure gauge and a fill valve to the gas outlet port. Pressurize to 10 psig. The seal is acceptable if the pressure loss is less than 1 psi after 2 minutes.

1.30 Reduce compression of Belleville washer assemblies.

1.30.1 Remove the Teflon centering ring from the installed power lead.

1.30.2 Back off the loading nuts sequentially to reduce the Belleville compression to 0.75 mm (0.030 in).

1.31 Tighten down the jam nuts to secure the loading nuts on the installed Belleville washer assemblies.



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- 1.32 Tighten the tensioning stud nuts against the underside of the power lead flange to provide stability during transportation.
- 1.33 Bolt a heater onto the power lead. Use thermally conductive grease at the interface between the heater and the power lead.