FERMILAB Technical Division	**7500A HTS Power leads for the LHC DFBX**	Doc. No. Rev. No. Date:January 6, 2003 Page 1 of 1 Author: Sandor Feher
	0. Cover Sheet for Check Out Form	DFLX 06

Power leads being tested: 7500 A DFLX 6 7500 A DFLX 16

Task #	Responsible	Task	Received Date,time		Performed Date,time	
1	Inspection	Unpack the leads			2/25/03	16:00
2	Inspection	IB4 mech. & Tolerances	2/25/03	16:00	2/25/03	16:00
3	Mechanical	Move the leads to MTF	5/12/03	10:50	5/12/03	14:00
4	Electrical	Initial electrical check out			3/2/03	11:00
5	Mechanical	Installation of the current leads into the chimney			5-14-03	11:00
6	Mechanical	Pressure test			5-13-03	14:00
7	Mechanical	Leak check			5-13-03	15:00
8	Electrical	Room temp. electrical test	5/19/03	11:50	5/21/03	11:50
9	Mechanical	Installation of the top plate into the dewar			5-19-03	13:00
10	M. Tartaglia	Configuration of the DAQ system				
11	Electrical	Pre-cool down electrical check out	5/21/03	12:00	5/21/03	13:14
12	Mechanical	Cool down			5/21/03	0606
13	Electrical	Electrical & instrumentation test	5/22/03	10:00	5/22/03	12:03
14	Mechanical	Connect the leads to the Power Supply & configure			5/22/03	13:30
15	Electrical	Electrical & instrumentation test	5/22/03	13:30	5/22/03	16:22
16	M. Thompson	Cold test of the power lead	5/22/03	16:30	5/22/03	21:50
17	Mechanical	Perform a Thermal cycle	5/23/03	0:00	4/18/03	10:30
18	Electrical	Electrical & instrumentation test	6/10/03	11:50	6/10/03	11:50
19	M. Thompson	Cold test of the power lead	5/28/03	10:30	5/29/03	16:36
20	Mechanical	Warm up			06/09/03	09:30
21	Mechanical	Remove the top plate			6/12/03	08:30
22	Mechanical	Remove the leads from the top plate				
23	Mechanical	Pack and move the leads				

FERMILAB Technical Division	7500A HTS Power leads for the LHC DFBX	Doc. No. Rev. No. Date:January 6, 2003 Page 1 of 1 Author: Sandor Feher
	1. Unpacking Check Out Form	

Performed by SUDHIR GHANTA (name typed) (signature)

Date & time 2/28/03 4:00PM

Note: Save the shipping container for storing and moving the leads around TD and after the test is complete to ship them to the DFBX manufacturer.

1.1 Container Identification: 7500 A DFLX 06 7500 A DFLX 16
(Leads serial numbers are on one side of the container)

1.2 Note condition of shipping container
No damage ☑ Slight damage ☐ Massive damage ☐

1.3 Examine condition of g-load indicators
a. Each side of the box are Shock Watch-s are installed
Not tripped ☑ Tripped (red) ☐ Remark: _____
Not tripped ☑ Tripped (red) ☐ Remark: _____

b. Each leads have a Shock Watch installed onto their body
Not tripped ☑ Tripped (red) ☐ Remark: _____
Not tripped ☑ Tripped (red) ☐ Remark: _____

c. Each leads have another "10G DROP" devices installed on the flag of the leads
Not tripped ☐ Tripped (Black) ☑ Remark: TWO BLUE ARROWS #16
Not tripped ☐ Tripped (Black) ☑ Remark: 1 BLUE ARROW (COVER) #06

1.4 Container content:
a. Power leads: 7500 A DFLX 06 ; 7500 A DFLX 16
b. Travel document for each lead in an envelope ☑
c. In a plastic box:
1. One clamp: Item No. C105-12-401; Description NW16/10 Clamping ring ST/STEEL PK1 ☑
2. One valve made by "precision Cryogenic System" ☑
3. One O-ring seal with brass insert ☑

BOX CONTAINS TWO ADDITIONAL UNIDENTIFIED PARTS.

2. IB4 Mech. & Tolerances

PART NAME : 7.5 KA CURRENT LEAD ASSY (LBNL01)
REV NUMBER :
SER NUMBER :
STATS COUNT : 1

7500 DFLX 06

MM	DIM CYL -A-DIA= LOCATION OF CYLINDER CYL -A-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	99.000	0.200	0.200	99.085	0.085	0.000

MM	DIM -A-= ROUNDNESS OF CYLINDER CYL -A-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.072	0.072	0.000

MM	DIM -B-= FLATNESS OF PLANE PLN -B-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.050	0.000	0.006	0.006	0.000

MM	DIM PERP1= PERPEND OF PLANE PLN -B- TO CYLINDER CYL -A- EXTEND=0.00(					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.130	0.000	0.133	0.133	0.003

MM	DIM PERP2= PERPEND OF PLANE LRG FLANGE TO CYLINDER CYL -A- EXTEND=5(					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.130	0.000	0.576	0.576	0.446

MM	DIM -C- DIA= LOCATION OF CYLINDER -C-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	80.000	0.008	0.008	79.950	-0.050	0.042

MM	DIM CONCEN2=CONCENTRICITY FROM CYLINDER -C- TO CYLINDER CYL -A-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.250	0.000	1.836	1.836	1.586

MM	DIM RND2= ROUNDNESS OF CYLINDER -C-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.099	0.099	0.000

MM	DIM DIST1= 2D DISTANCE FROM PLANE PLN -B- TO PLANE LRG FLANGE PAR TC					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	561.000	1.000	1.000	561.380	0.380	0.000

MM	DIM LOC5= TRUE POSITION OF CIRCLE CIR2							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	0.000				0.000	0.000		
Z	123.571				123.493	-0.078		
DF	16.000	0.200	0.200		17.979	1.979	1.779	
TP	RFS	0.400		0.000		0.156	0.000	

7500 DFLX OG

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=3/3/2003 TIME=10:53:19 AM

MM	DIM LOC10= TRUE POSITION OF CIRCLE CIR3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	-78.890				-78.987	-0.097		
Z	95.047				95.055	0.008		
DF	16.000	0.200	0.200		17.978	1.978	1.778	
TP	RFS	0.400		0.000		0.194	0.000	

MM	DIM LOC11= TRUE POSITION OF CIRCLE CIR4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	78.890				78.913	0.023		
Z	95.047				94.899	-0.148		
DF	16.000	0.200	0.200		17.980	1.980	1.780	
TP	RFS	0.400		0.000		0.299	0.000	

MM	DIM LOC12= TRUE POSITION OF CIRCLE CIR5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	78.890				78.728	-0.162		
Z	-95.047				-95.190	-0.143		
DF	16.000	0.200	0.200		17.966	1.966	1.766	
TP	RFS	0.400		0.000		0.432	0.032	

MM	DIM LOC13= TRUE POSITION OF CIRCLE CIR6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	-78.890				-79.168	-0.278		
Z	-95.047				-95.030	0.017		
DF	16.000	0.200	0.200		17.965	1.965	1.765	
TP	RFS	0.400		0.000		0.557	0.157	

MM	DIM LOC09= TRUE POSITION OF CIRCLE ID1							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.684	0.134		
PA	-153.000				-153.033	-0.033		
DF	8.407	0.200	0.200		8.573	0.166	0.000	
TP	RFS	0.080		0.000		0.288	0.208	

MM	DIM LOC20= TRUE POSITION OF CIRCLE ID2							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.638	0.089		
PA	-171.000				-171.009	-0.009		
DF	8.407	0.200	0.200		8.575	0.168	0.000	
TP	RFS	0.080		0.000		0.179	0.099	

MM	DIM LOC31= TRUE POSITION OF CIRCLE ID3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.645	0.095		
PA	-135.000				-135.038	-0.038		
DF	8.407	0.200	0.200		8.579	0.171	0.000	
TP	RFS	0.080		0.000		0.224	0.144	

7500 DFLX 06

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=3/3/2003 TIME=10:53:20 AM

MM	DIM LOC1= TRUE POSITION OF CIRCLE ID4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.627	0.077		
PA	171.000				171.019	0.019		
DF	8.407	0.200	0.200		8.577	0.170	0.000	
TP	RFS	0.080		0.000		0.166	0.086	

MM	DIM LOC2= TRUE POSITION OF CIRCLE ID5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.577	0.027		
PA	153.000				153.030	0.030		
DF	8.407	0.200	0.200		8.563	0.156	0.000	
TP	RFS	0.080		0.000		0.109	0.029	

MM	DIM LOC3= TRUE POSITION OF CIRCLE ID6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.559	0.009		
PA	135.000				135.038	0.038		
DF	8.407	0.200	0.200		8.553	0.146	0.000	
TP	RFS	0.080		0.000		0.122	0.042	

MM	DIM LOC4= TRUE POSITION OF CIRCLE ID7							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.480	-0.070		
PA	117.000				117.049	0.049		
DF	8.407	0.200	0.200		8.547	0.140	0.000	
TP	RFS	0.080		0.000		0.209	0.129	

MM	DIM LOC6= TRUE POSITION OF CIRCLE ID8							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.446	-0.104		
PA	99.000				99.027	0.027		
DF	8.407	0.200	0.200		8.559	0.151	0.000	
TP	RFS	0.080		0.000		0.224	0.144	

MM	DIM LOC7= TRUE POSITION OF CIRCLE ID9							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.359	-0.191		
PA	81.000				81.012	0.012		
DF	8.407	0.200	0.200		8.517	0.110	0.000	
TP	RFS	0.080		0.000		0.384	0.304	

MM	DIM LOC8= TRUE POSITION OF CIRCLE ID10							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.374	-0.176		
PA	63.000				62.952	-0.048		
DF	8.407	0.200	0.200		8.538	0.130	0.000	
TP	RFS	0.080		0.000		0.383	0.303	

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=3/3/2003 TIME=10:53:21 AM

MM	DIM LOC14= TRUE POSITION OF CIRCLE ID11							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.341	-0.209		
PA	45.000				44.937	-0.063		
DF	8.407	0.200	0.200		8.544	0.137	0.000	
TP	RFS	0.080		0.000		0.462	0.382	

MM	DIM LOC15= TRUE POSITION OF CIRCLE ID12							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.351	-0.199		
PA	27.000				26.886	-0.114		
DF	8.407	0.200	0.200		8.542	0.135	0.000	
TP	RFS	0.080		0.000		0.536	0.456	

MM	DIM LOC16= TRUE POSITION OF CIRCLE ID13							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.422	-0.127		
PA	9.000				8.857	-0.143		
DF	8.407	0.200	0.200		9.867	1.459	1.259	
TP	RFS	0.080		0.000		0.517	0.437	

MM	DIM LOC17= TRUE POSITION OF CIRCLE ID14							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.432	-0.117		
PA	-9.000				-9.137	-0.137		
DF	8.407	0.200	0.200		8.564	0.156	0.000	
TP	RFS	0.080		0.000		0.491	0.411	

MM	DIM LOC18= TRUE POSITION OF CIRCLE ID16							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.485	-0.065		
PA	-27.000				-27.153	-0.153		
DF	8.407	0.200	0.200		8.561	0.154	0.000	
TP	RFS	0.080		0.000		0.501	0.421	

MM	DIM 1450= 2D DISTANCE FROM LINE FRT END TO LINE LIN2 PAR TO YAXIS						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	1450.000	0.400	0.400	1453.310	3.310	2.910	

MM	DIM 130.0DIA= LOCATION OF CIRCLE OD1						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
D	130.000	0.200	0.200	130.006	0.006	0.000	

MM	DIM 502 COOLING HOLE= 2D DISTANCE FROM CIRCLE ID15 TO PLANE LRG FLAI						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	502.000	0.400	0.400	501.500	-0.500	0.100	

MM	DIM X LOC OF COOLING HOLE= LOCATION OF CIRCLE ID15						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
X	0.000	0.200	0.200	-6.737	-6.737	6.537	

7500 DFLX 6

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=3/3/2003 TIME=10:53:22 AM

DEG	DIM WARM TERMINAL= 3D ANGLE (TRUE) FROM PLANE PLN2 TO ZAXIS					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
A	0.000	0.100	0.100	-0.224	-0.224	0.124

IN	DIM X LOC OF WARM TERM= LOCATION OF PLANE MID PLN					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
X	0.000	0.100	0.100	-0.001	-0.001	0.000

IN	DIM POLAR ANGLE OF COOLING HOLE= LOCATION OF CIRCLE ID15					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
PA	90.000	0.500	0.500	97.161	7.161	6.661

MM	DIM 442.5= 2D DISTANCE FROM LINE FRT END TO PLANE PLN -B- PAR TO YAX					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	442.500	0.400	0.400	445.336	2.836	2.436

FERMILAB Technical Division	7500A HTS Power leads for the LHC DFBX	Doc. No. Rev. No. Date:January 6, 2003 Page 1 of 1 Author: Sandor Feher
	3. Form for moving power leads	

Power leads need to be moved from NW8 to MTF are:
7500 DFLX 6 & 7500 DFLX 16
Approved by SandorFeher (name typed) (signature)
Date & time 5/12/03 10:50

The request should go through Marsha Schmidt who is responsible keeping track of whereabouts of the power leads.

Requested by Charles Hess (name typed) (signature) 2767
Date & time 11:00 05.12.03

Delivered by CLIFF DESCH (12698) (name typed) (signature)
Date & time 5-12-03 14:13

Received by DAN MASSENGILL (name typed) (signature)
Date & time 5-12-03 14:15

The next person C Hess responsible to perform Checkout form #4 has been

Notified by DAN MASSENGILL (name typed) (signature)
Date & time 5-12-03 14:20

This form should be copied and each copy should be placed into the folders of both of the power leads

4. Initial Electrical Checkout

Note: Save the shipping container for storing and moving the leads around TD and after the test is complete to ship them to the DFBX manufacturer.

Performed by DAN EDDY (name typed) Dan Eddy (signature)

Date & time 11:00 3/21/03

Power Lead 7500 A DFLX 06

When checkout is complete, make sure you place this document in the Traveler Binder

3.1 Voltage segment and drop measurement.

Apply 5 Amps between the copper flag and the LTS cable.

Record the applied current 5 A

Use HP3458 DVM, set it to 40 line cycle integration time.

Measure the voltages between the following pins:

Voltage tap Connector 1 (Primary) (Fisher DEE104A06)

Pin 1 - pin 2 **(80uv)** 83 V Pin 2 - pin 3 **(225uv)** 231 V
Pin 1 - pin 3 **(300uv)** 315 V Pin 3 - pin 4 **(240uv)** 264 V
Pin 1 - pin 4 **(530uv)** 580 V Pin 4 - pin 5 **(float)** FLOAT V
Pin 1 - pin 5 **(float)** FLOAT V Pin 5 - pin 6 **(float)** FLOAT V
Pin 1 - pin 6 **(float)** FLOAT V

Voltage tap Connector 2 (Redundant) (Fisher DEE104A06)

Pin 1 - pin 2 **(80uv)** 83 V Pin 2 - pin 3 **(225uv)** 231 V
Pin 1 - pin 3 **(300uv)** 314 V Pin 3 - pin 4 **(240`uv)** 268 V
Pin 1 - pin 4 **(530uv)** 582 V Pin 4 - pin 5 **(float)** FLOAT V
Pin 1 - pin 5 **(float)** FLOAT V Pin 5 - pin 6 **(float)** FLOAT V
Pin 1 - pin 6 **(float)** FLOAT V

3.2 Verify that between pin 5 and the coiled wire at the bottom of the lead has continuity:

Connector 1 (Primary) Pin 5 and end of the wire continuity is OK ☑ not OK ☐

Comments

Connector 2 (Redundant) Pin 5 and end of the wire continuity is OK ☑ not OK ☐

Comments

3.2.1 Using a small piece of fiberglass tape, mark the Primary and Redundant wires

3.3 Temperature sensor resistance measurements.

3.3.1 Two wire measurement on connector 3 (Fisher DEE104Z086):

Resistance between Pin 1 and pin 2 .820 Ω
Resistance between Pin 1 and pin 3 108.7 Ω
Resistance between Pin 1 and pin 4 108.7 Ω
Resistance between Pin 2 and pin 3 108.7 Ω

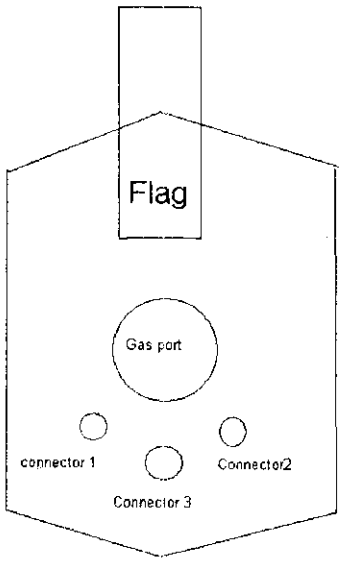
Resistance between Pin 2 and pin 4 108.7 Ω
Resistance between Pin 3 and pin 4 .796 Ω
Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 .810 Ω
Resistance between Pin 5 and pin 7 108.7 Ω
Resistance between Pin 5 and pin 8 108.7 Ω
Resistance between Pin 6 and pin 7 108.7 Ω
Resistance between Pin 6 and pin 8 108.7 Ω
Resistance between Pin 7 and pin 8 .801 Ω
Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 .727 Ω
Resistance between Pin 9 and pin 11 108.6 Ω
Resistance between Pin 9 and pin 12 108.6 Ω
Resistance between Pin 10 and pin 11 108.6 Ω
Resistance between Pin 10 and pin 12 108.6 Ω
Resistance between Pin 11 and pin 12 .703 Ω
Pins 9-12 resistance to lead ∞ Ω Pins 9-12 resistance to flange ∞ Ω

3.3.2 Using HP3458 DVM measure temperature sensor resistance with the four wire measurement technique:

Resistance of T1 107.9 Ω (I+ at pin 1, I- at pin 2, U+ at pin 3, U- at pin 4)
Resistance of T2 107.9 Ω (I+ at pin 5, I- at pin 6, U+ at pin 7, U- at pin 8)
Resistance of T3 107.8 Ω (I+ at pin 9, I- at pin 10, U+ at pin 11, U- at pin 12)



Looking from the top of the lead down where the LTS cable is located.
Connector 2= Redundant and Connector 1= Primary

FERMILAB
Technical Division

Stand 3 LHC-HTS Lead Testing:
5. Installation of the Current Leads

Lead Pair
Negative Lead: #6
Positive Lead: #16

Signed _____ Date _____

1. Mechanical Integration of Current Leads in Test Facility

1.1 Using wedges, tilt the insert by 10° so that the power leads will be vertical when installed.

1.2 Clean sealing surfaces inside the chimneys with acetone and/or alcohol wipe.

1.3 Position the upper insulator in each chimney according to Figure 1.3.

1.4 Position the PEEK seal in each chimney according to Figure 1.3.

1.5 Position the lower insulator in each chimney according to Figure 1.3.

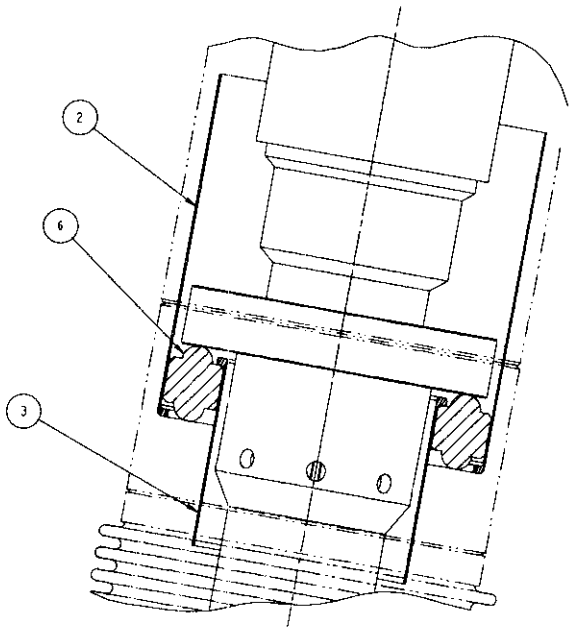


Figure 1.3 2 – Upper Insulator, 3 – Lower Insulator, 6 – PEEK Seal

1.6 Attach the lifting/insertion tool to the lead flag as shown in Figure 1.6 and remove the lead from the shipping container.

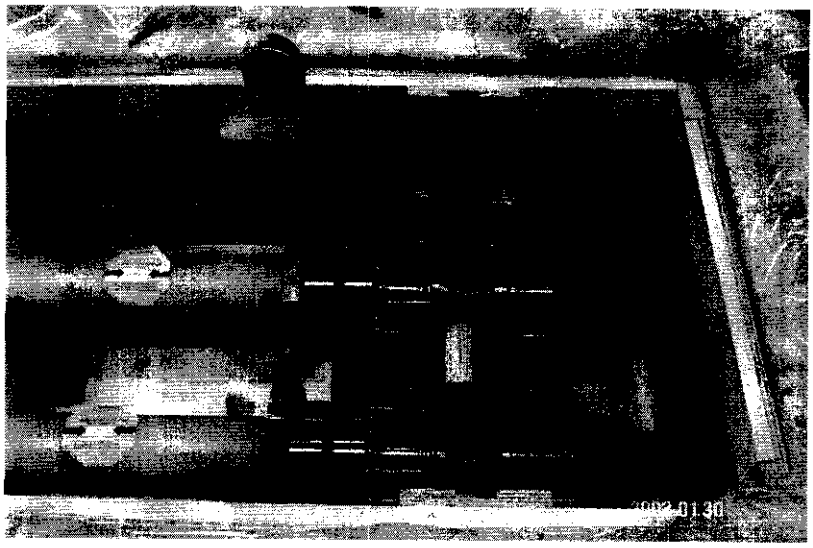


Figure 1.6 The lifting/insertion tool bolted to a power lead in preparation for removing it from the shipping container.

1.7 Remove the plastic plug from the 4-20 K gas inlet on the lead body.
1.8 Remove the protective covers from the lower and upper flanges.
1.9 With alcohol, clean the lower flange and the upper flange knife edge and sealing surface.
1.10 Clamp the end support around the lower flange with the rounded portion on the bottom so that it will sit in a V-block.
1.11 Set the lead in V-blocks on the steel table.
1.12 Prepare to install the power lead baffle by removing the short threaded rods to open the baffle.
1.13 Install the baffle on the lead with the pointed tips of the threaded rods pointing toward the bottom of the lead. An installed baffle is shown in Figure 1.13.

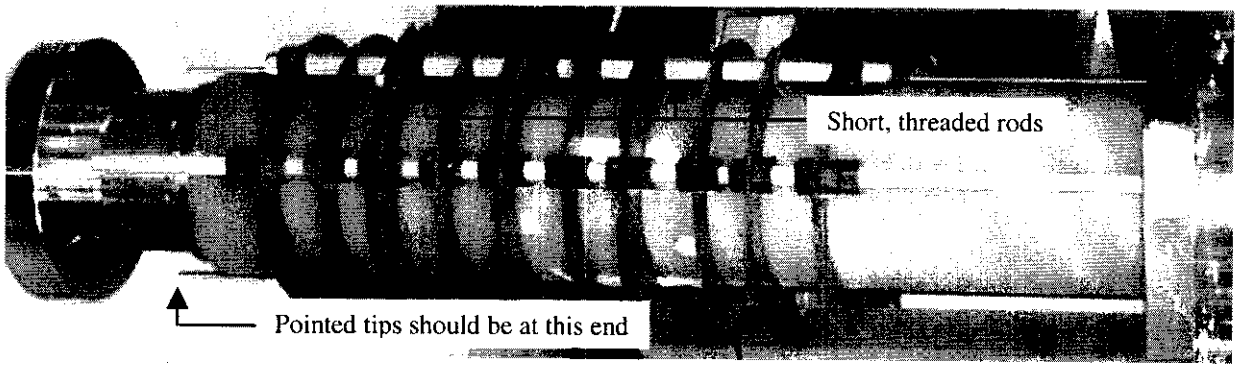


Figure 1.13 A baffle installed on a power lead.

1.14 Clean the top plate Conflat flange knife edge and copper gasket. Install the gasket on the top plate Conflat flange.

1.15 Align the top plate rotatable Conflat flange to the orientation shown on Figure 1.15, where the leak check grooves on the flange align with the middle tensioning studs.

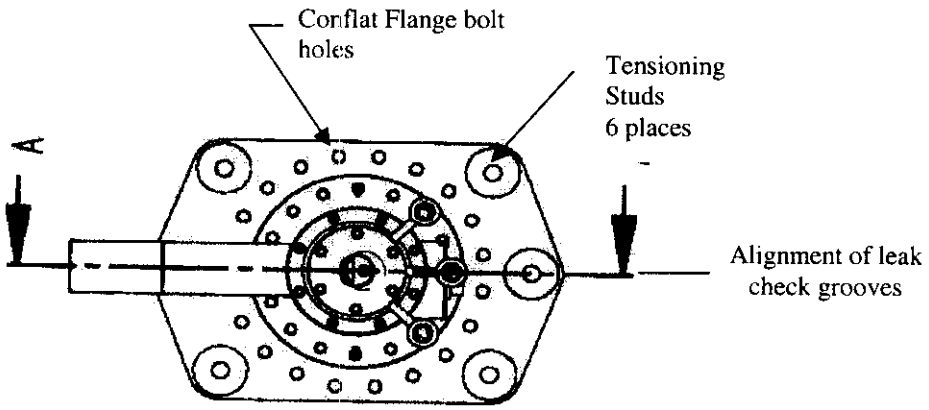


Figure 1.15 The 20-hole Conflat bolt pattern is bisected by center tensioning studs.

1.16 Back down the nuts on the tensioning studs.

1.17 Swing the lifting/insertion tool 180 degrees as shown in Figure 1.17 in preparation for lifting the power lead into the vertical position.

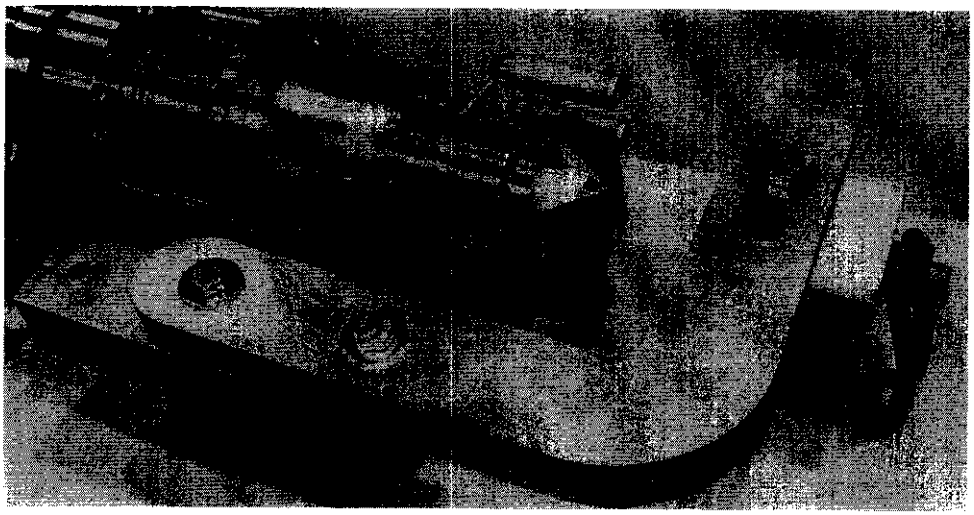


Figure 1.17 The lifting/insertion tool in position to lift the power lead into a vertical position.

1.18 Strapping the overhead crane to the lifting/insertion tool and manually guiding the lower end support, lift the lead and position it vertically while not allowing any loading on the bottom end of the lead.

1.19 Remove the lower end support.

1.20 Tie a weighted string to the LTS bus to help guide it through the chimney during installation.

1.21 Install the lead in the chimney per Figure 1.21a until the lower sealing flange bottoms out. The flag should be toward the bayonet connections on the insert. The negative lead is installed on the left hand side, and the positive lead is installed on the right hand side as shown in Figure 1.21b.

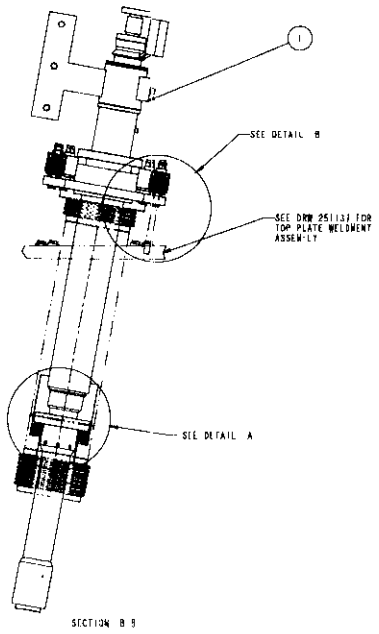


Figure 1.21a HTS Lead in Test Chimney. Note: CERN chimneys do not have bellows.

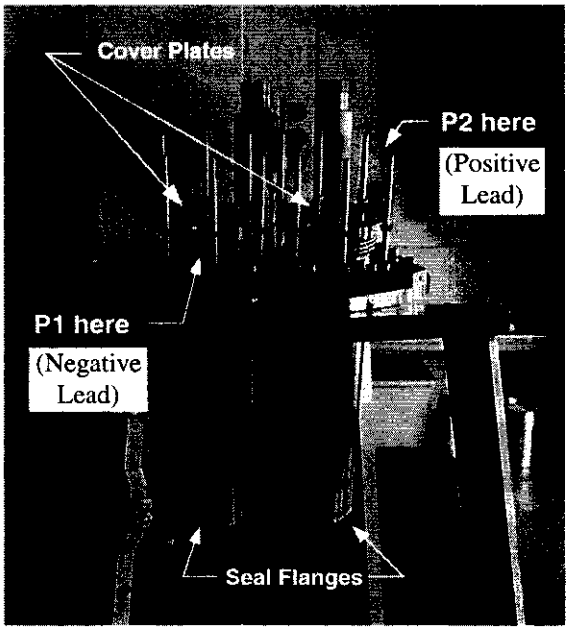


Figure 1.21b Locations of the negative and positive leads.

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

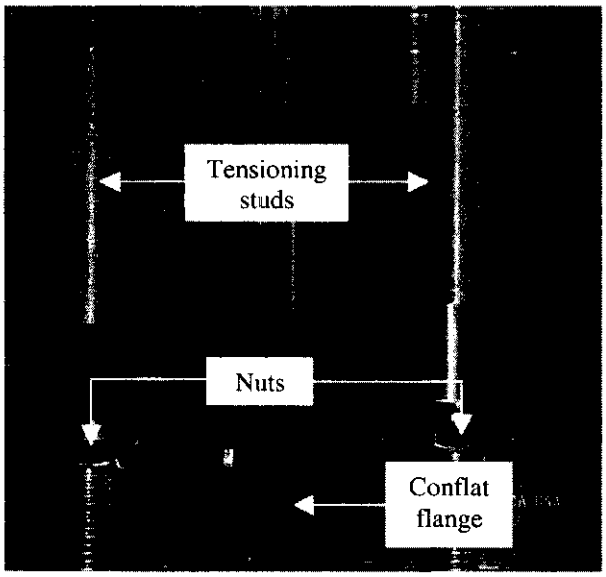


Figure 1.22 The positions of the tensioning studs, nuts, and top plate Conflat flange as the 20 Conflat bolts are tightened.

1.23 On the power lead flange, number the Conflat bolt holes 1 through 20 as indicated by Figure 1.25.

1.24 If there is a gap between the top plate Conflat flange and the Pirelli flange, pull the bellows up to close the gap using bolts 1 through 4.

1.25 Use a 5/16 12-point socket to tighten the 20 Conflat bolts. The tightening must be made gradually in ¼ turn increments to a final torque of 15 ft-lbf (180 in-lbf). The tightening sequence is given by Fig. 1.25.

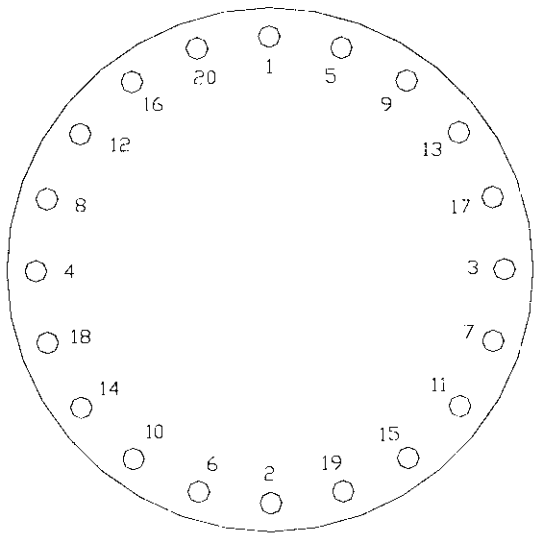


Figure 1.25 Tightening sequence for the 20 Conflat bolts.

1.26 Unbolt the lifting/insertion tool from the installed power lead.

1.27 Install Belleville Washer Assemblies on each tensioning stud per Figures 1.27a and 1.27b. A spherical washer must be placed below the Belleville washer holder on each stud. In the figures: Items 11 (10 each) are Belleville Washers, arranged as shown; Items 6 (2 each) are flat washers; Items 4 and 5 are the Belleville Washer Holder; Item 10 are Spherical Washers for above and below the washer holder; Item 9 is a loading nut; and Item 8 is a jam nut.

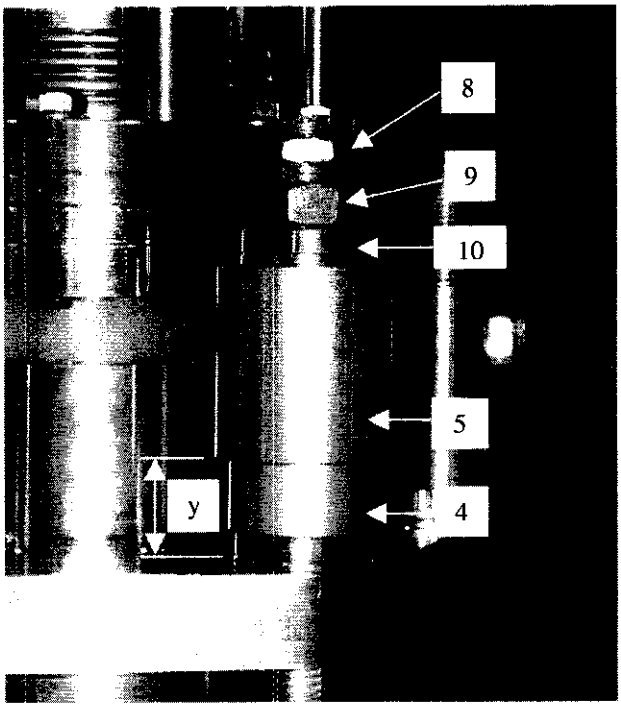


Figure 1.27a An installed Belleville Washer Assembly.

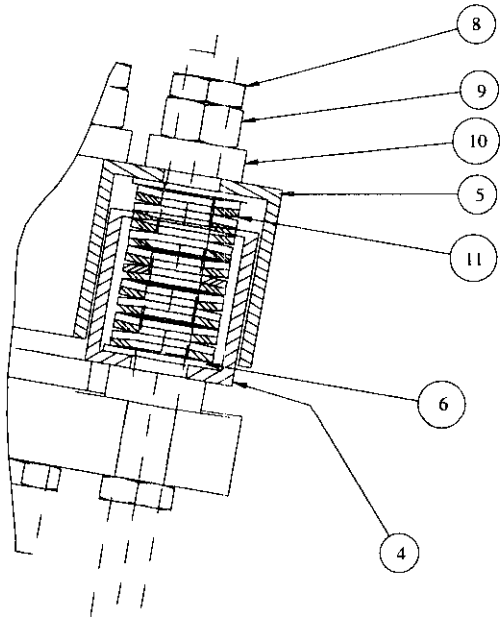


Figure 1.27b An installed Belleville Washer Assembly.

1.28 Tighten the 6 Belleville Washer Assemblies to apply load to the PEEK seal.

1.28.1 Washers for Negative Lead

1.28.1.1 Ensure that the tensioning rod nuts used in 1.22 have a gap of about 5 mm below the lead flange.

1.28.1.2 Center the lower end of the lead in the chimney using the centering shim blocks. The Teflon inner centering shim blocks are labeled with an 'I' and go between the power lead and the lower insulator. The Teflon outer centering shim blocks are labeled with an 'O' and go between the lower insulator and the chimney. The installed Teflon centering shim blocks are shown in Figure 1.28.1.2.

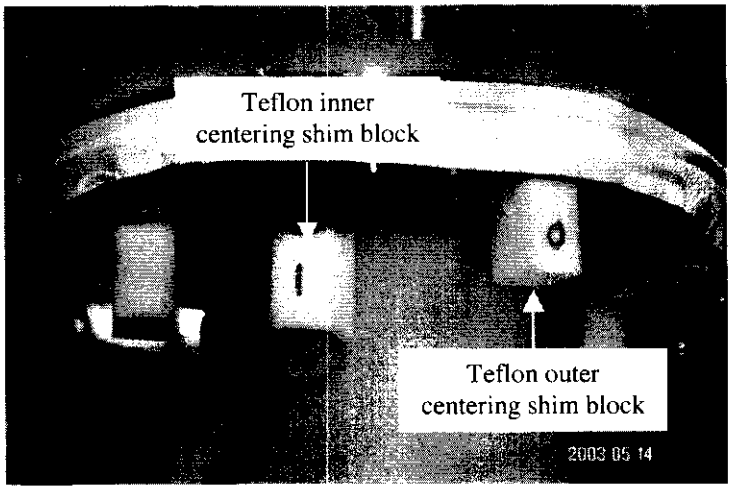


Figure 1.28.1.2 The installed Teflon centering shim blocks.

1.28.1.3 Tighten the 6 loading nuts finger-tight. With adjustable parallels, measure and record the gap "y" indicated in Figure 1.27a between Item 5 and the current lead top flange at the 6 locations specified in Figure 1.28.1.5. Units are mm.

A 23.58 B 23.85 C 23.95 D 23.70 E 23.78 F 24.11

1.28.1.4 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 21.78 B 22.05 C 22.15 D 21.90 E 21.98 F 22.31

1.28.1.5 Using the sequence A through F in Figure 1.28.1.5, 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 ✓

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 ✓

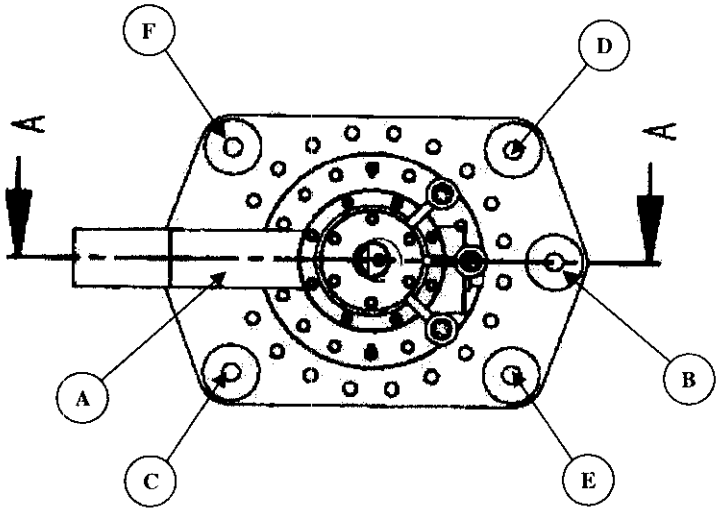


Figure 1.28.1.5 The specified sequence for tightening the Belleville Washer Assemblies.

1.28.1.6 Record the final measured gaps 'y' in Figure 1.27a. Units are mm.

A 21.82 B 22.07 C 22.14 D 21.91 E 21.95 F 22.33

1.28.1.7 Remove the Teflon centering shim blocks from the installed power lead.

1.28.2 Washers for Positive Lead

1.28.2.1 Ensure that the nuts used in 1.22 have a gap of about 5 mm below the lead flange.

1.28.2.2 Center the lower end of the lead in the chimney using the centering shim blocks. The Teflon inner centering shim blocks are labeled with an 'I' and go between the power lead and the lower insulator. The Teflon outer centering shim blocks are labeled with an 'O' and go between the lower insulator and the chimney. The installed Teflon centering shim blocks are shown in Figure 1.28.1.2.

1.28.2.3 Tighten the 6 loading nuts finger-tight. With adjustable parallels, measure and record the gap "y" indicated in Figure 1.27a between Item 5 and the current lead top flange at the 6 locations specified in Figure 1.28.1.5. Units are mm.

A 23.93 B 23.35 C 23.71 D 23.66 E 23.79 F 23.49

1.28.2.4 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 22.13 B 21.55 C 21.91 D 21.86 E 21.99 F 21.69

1.28.2.5 Using the sequence A through F in Figure 1.28.1.5, tighten the loading nuts ¼ turn until the total compression is 1.8 mm at each of the six locations. As each of the loading nuts is turned ¼ turns, check off the appropriate line.

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 –

A ✓ B – C – D – E ✓ F –

A ✓ B – C – D ✓ E ✓ F –

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

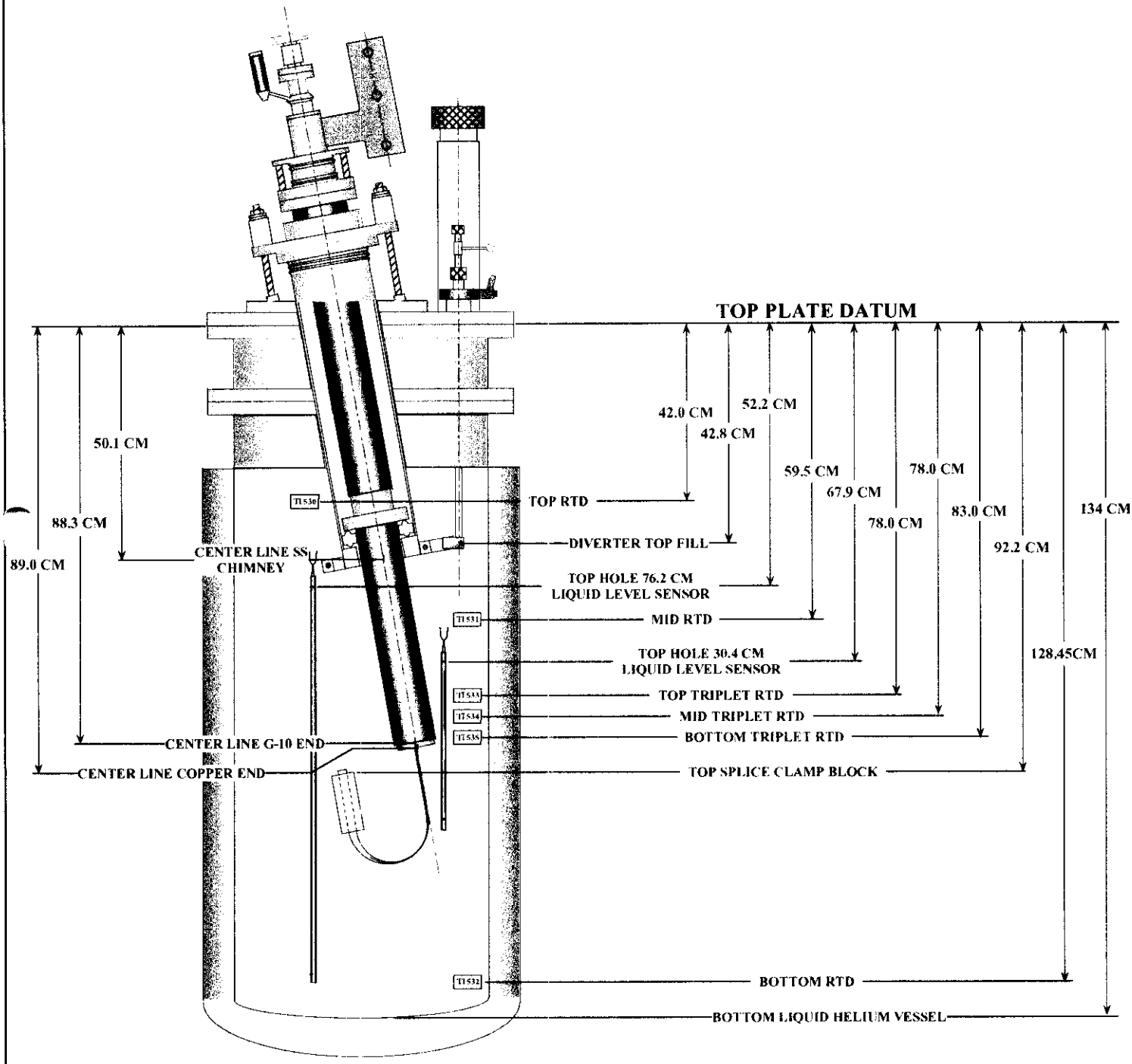
1.28.2.6 Record the final measured gaps 'y' in Figure 1.27a. Units are mm.

A 22.15 B 21.57 C 21.97 D 21.86 E 21.99 F 21.71

1.28.2.7 Remove the Teflon centering shim blocks from the installed power lead.

1.29 On both power leads, tighten down the jam nuts to secure the loading nuts on the installed Belleville Washer Assemblies.

LHC HTS POWER LEAD TESTING @ TEST STAND 3
PAIR - DFLX-06 (-) & DFLX-16 (+)



SUBJECT	TITLE	DATE	SKETCH/DWG NO.
LHC HTS POWER LEADS (-) DFLX-06 & (+) DFLX-16	POWER LEAD TEST DIMENSION MAP	05.21.03	CEH-030521-1

FERMILAB
Technical Division

7500 A HTS Power Leads for the LHC DFBX: 5a. Preliminary Leak Check Procedure

Lead Number: DFLX-06

Signed C.E. Hess Jr. Date 05.13.03

1. **Preparation for Leak Checking**
   - **1.1** Put the power lead on the steel table, with the power lead lower flange resting in the end support clamp.
   - **1.2** Plug the 4-20 K inlet.
   - **1.3** Attach an adapter to the top of the power lead so that a leak detector can be connected.

2. **Leak Check-Lead Number** DFLX06
   - **2.1** Pump out the power lead with the leak detector.
   - **2.2** Record the baseline reading from the leak detector.

     Baseline: 6.2 e-9

   - **2.3** Spray all joints with He and watch for a signal from the leak detector
   - **2.4** Record the maximum leak detector reading.

     Maximum reading: 5.9 e-9

FERMILAB
Technical Division

7500 A HTS Power Leads for the LHC DFBX: 6. Pressure Test Procedure

Lead Pair

Negative Lead: #6

Positive Lead: #16

Signed _____ Date 5-15-03

1. **Preparation for Pressurization**
   - **1.1** Install the bayonet plug into the 4-20 K supply bayonet on the top plate. Tie it down.
   - **1.2** On the 4-20 K female bayonet vacuum jacket, cap off one of the 1/4 inch compression fittings. Connect the test gauge and associated tubing to the second 1/4 inch compression fitting.
   - **1.3** Install Conflat blankoffs on the vents of the installed power leads.
   - **1.4** Put the cover cans over each lead vent and tie them down.
   - **1.5** Connect a nitrogen bottle to the pressure test tubing.

2. **Pressurization**
   - **2.1** Pressurize the 4-20 K circuit to 65 psia (50 psig) and record the initial pressure from the test gauge.

     Initial pressure: 65.4 PSIA 10:56

   - **2.2** Wait five minutes and record the final pressure from the test gauge.

     Final pressure: 65.3 PSIA 10:02

3. **Release of Pressure**
   - **3.1** Isolate the nitrogen bottle.
   - **3.2** Release the pressure by opening the hand valve on the pressure test tubing.
   - **3.3** Disconnect the pressure test tubing from the top plate/insert.

FERMILAB
Technical Division

7500 A HTS Power Leads for the LHC DFBX: 7. Leak Check Procedure

Lead Pair

Negative Lead: #6

Positive Lead: #6

Signed _____ Date 5-16-03

1. **Preparation for Leak Checking**
   - **1.1** Cap/plug the two 1/4 inch compression fittings on the 4-20 K female bayonet vacuum jacket.
   - **1.2** Remove the Conflat blankoff from one of the lead vents and install the modified Conflat with a vacuum pumpout.
   - **1.3** Attach a leak detector to the vacuum pumpout installed on the top of one of the power leads.

2. **Leak Check**
   - **2.1** Pump out the 4-20 K circuit with the leak detector.
   - **2.2** Record the baseline reading from the leak detector.

RR 6/17/03

Baseline: 54 x 50 (3.4×10^{-7} atm·cc/s)

   - **2.3** Spray all joints with He and watch for a signal from the leak detector
   - **2.4** Record the maximum leak detector reading.

RR 6/17/03

Maximum reading: 54 x 50 (3.4×10^{-7} atm·cc/s)

8. Room Temperature Electrical Checkout

Note: Save the shipping container for storing and moving the leads around TD and after the test is complete to ship them to the DFBX manufacturer.

Performed by _____ (Name typed) _____ (Signature)

Date & time _____

Pos. Power Lead 7500 A DFLX _____ and Neg. Power Lead 7500 A DFLX _____

When checkout is complete, make sure you place the original and a copy of this document in the Traveler Binder.

Before beginning checkout, be sure that all 4-pin hypertronic connectors in dewar have been connected and taped up with fiberglass tape. Also install positive and negative lead heaters. Be sure to put thermal compound on back of heaters before attaching.

3.1 Voltage segment and drop measurement. Connect Kepco power supply cable to the leads. On stand 4, be sure that power supply box is switched to stand 3 and HFU kepco. Under stand 4 platform, connect stand 3 trim cable to shunt current monitor. Turn on kepco and set for 10 amps. Set up function generator for square wave. You should see current go from +10A to –10A. Frequency should be set at .01 (approx. 100 seconds). Check the cryo computer numerical display for trim to verify approx. 10A on leads. Record the applied current _____ A

Connect both primary and redundant vtap cables to positive and negative lead. Go to the back of vtap distribution box and disconnect both primary and redundant vtap cables for the positive and negative lead. Using a breakout box and these cables measure the voltages between the following pins:
Use HP3458 DVM, set it to 40-line cycle integration time.

Positive Lead

Voltage tap Connector 1 (Primary) (Fisher DEE104A06)

Pin 1 - pin 2 **(160uv)** _____ V Pin 2 - pin 3 **(450uv)** _____ V
Pin 1 - pin 3 **(610uv)** _____ V Pin 3 - pin 4 **(480uv)** _____ V
Pin 1 - pin 4 **(1.1mv)** _____ V Pin 4 - pin 5 **(3.5mv)** _____ V
Pin 1 - pin 5 **(4.7mv)** _____ V Pin 5 - pin 6 **(float)** _____ V
Pin 1 - pin 6 **(float)** _____ V

8. Room Temperature Electrical Checkout

Performed by DAN EDDY (Name typed) Dan Eddy (Signature)

Date & time 5/19/03

Pos. Power Lead 7500 A DFLX 16 and Neg. Power Lead 7500 A DFLX 06

Voltage tap Connector 2 (Redundant) (Fisher DEE104A06)

Pin 1 - pin 2 **(160uv)** .163 V Pin 2 - pin 3 **(450uv)** .483 V
Pin 1 - pin 3 **(610uv)** .677 V Pin 3 - pin 4 **(480uv)** .494 V
Pin 1 - pin 4 **(1.1mv)** 1.19 V Pin 4 - pin 5 **(3.5mv)** 4.42 V
Pin 1 - pin 5 **(4.7mv)** 5.96 V Pin 5 - pin 6 **(float)** FLOAT V
Pin 1 - pin 6 **(float)** FLOAT V

Negative Lead

Voltage tap Connector 2 (Primary) (Fisher DEE104A06)

Pin 1 - pin 2 **(-160uv)** -.165 V Pin 2 - pin 3 **(-450uv)** -.457 V
Pin 1 - pin 3 **(-600uv)** -.624 V Pin 3 - pin 4 **(-480uv)** -.527 V
Pin 1 - pin 4 **(-1.1mv)** -1.19 V Pin 4 - pin 5 **(-3.5mv)** -4.32 V
Pin 1 - pin 5 **(-4.7mv)** -5.96 V Pin 5 - pin 6 **(float)** FLOAT V
Pin 1 - pin 6 **(float)** FLOAT V

Voltage tap Connector 2 (Redundant) (Fisher DEE104A06)

Pin 1 - pin 2 **(-160uv)** -.165 V Pin 2 - pin 3 **(-450uv)** -.484 V
Pin 1 - pin 3 **(-600uv)** -.621 V Pin 3 - pin 4 **(-480uv)** -.528 V
Pin 1 - pin 4 **(-1.1mv)** -1.19 V Pin 4 - pin 5 **(-3.5mv)** -4.32 V
Pin 1 - pin 5 **(-1.5mv)** -5.96 V Pin 5 - pin 6 **(float)** FLOAT V
Pin 1 - pin 6 **(float)** FLOAT V

3.2 Using 2 Vtap cables: Connection 1-one vtap cable from the primary of each lead
Connection 2- one vtap cable from the redundant of each lead

Connection1 (Primary)

Positive Lead Pin 1 - Negative Lead pin 5 **(3.7mv)** 2.9 V
Positive Lead Pin 1 - Negative Lead pin 4 **(7.3mv)** 7.1 V
Positive Lead Pin 1 - Negative Lead pin 3 **(7.7mv)** 7.6 V
Positive Lead Pin 1 - Negative Lead pin 2 **(8.2mv)** 8.1 V
Positive Lead Pin 1 - Negative Lead pin 1 **(8.3mv)** 8.2 V

Connection 2 (Redundant)

Positive Lead Pin 1 - Negative Lead pin 5 **(3.7mv)** 2.8 V
Positive Lead Pin 1 - Negative Lead pin 4 **(7.3mv)** 7.1 V
Positive Lead Pin 1 - Negative Lead pin 3 **(7.7mv)** 7.6 V
Positive Lead Pin 1 - Negative Lead pin 2 **(8.2mv)** 8.1 V
Positive Lead Pin 1 - Negative Lead pin 1 **(8.3mv)** 8.2 V

When voltage measurements are complete, turn off kepco power supply and disconnect kepco power cable on positive and negative lead.

8. Room Temperature Electrical Checkout

Performed by Dan Eddy (Name typed) Dan Eddy (Signature)

Date & time 5/19/03

Pos. Power Lead 7500 A DFLX 16 and Neg. Power Lead 7500 A DFLX 05

3.3 Temperature sensor resistance measurements. Using test cable, connect to connector 3 (lead rtd's) of leads. Lead rtd's are (511-3, 512-3, 509-3A, 509-3B, 510-3A, 510-3B).

3.3.1 Two wire measurement on connector 3 of Positive Lead (Fisher DEE104Z086):

Resistance between Pin 1 and pin 2 **(.800)** .849 Ω
Resistance between Pin 1 and pin 3 **(109)** 109.5 Ω
Resistance between Pin 1 and pin 4 **(109)** 109.5 Ω
Resistance between Pin 2 and pin 3 **(109)** 109.5 Ω
Resistance between Pin 2 and pin 4 **(109)** 109.5 Ω
Resistance between Pin 3 and pin 4 **(.800)** .846 Ω
Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 **(.800)** .846 Ω
Resistance between Pin 5 and pin 7 **(109)** 109.5 Ω
Resistance between Pin 5 and pin 8 **(109)** 109.5 Ω
Resistance between Pin 6 and pin 7 **(109)** 109.5 Ω
Resistance between Pin 6 and pin 8 **(109)** 109.5 Ω
Resistance between Pin 7 and pin 8 **(.800)** .814 Ω
Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 **(.800)** .747 Ω
Resistance between Pin 9 and pin 11 **(109)** 109.5 Ω
Resistance between Pin 9 and pin 12 **(109)** 109.5 Ω
Resistance between Pin 10 and pin 11 **(109)** 109.5 Ω
Resistance between Pin 10 and pin 12 **(109)** 109.5 Ω
Resistance between Pin 11 and pin 12 **(.800)** .717 Ω
Pins 9-12 resistance to lead ∞ Ω Pins 9-12 resistance to flange ∞ Ω

3.3.2 Using HP3458 DVM measure temperature sensor resistance with the four wire measurement technique:

Resistance of T1 108.7 Ω**(108.5)**(I+ at pin 1,U+ at pin 2,I- at pin 3,U- at pin 4)
Resistance of T2 108.7 Ω**(108.5)** (I+ at pin 5, U+ at pin 6, I- at pin 7, U- at pin 8)
Resistance of T3 108.7 Ω**(108.5)**(I+ at pin 9,U+ at pin 10,I- at pin 11,U- at pin 12)

8. Room Temperature Electrical Checkout

Performed by Dan Eddy (Name typed) Dan Eddy (Signature)

Date & time 5/19/03

Pos. Power Lead 7500 A DFLX 16 and Neg. Power Lead 7500 A DFLX 05

3.3.3 Two wire measurement on connector 3 of Negative Lead (Fisher DEE104Z086):

Resistance between Pin 1 and pin 2 **(.800)** .930 Ω
Resistance between Pin 1 and pin 3 **(109)** 109.5 Ω
Resistance between Pin 1 and pin 4 **(109)** 109.5 Ω
Resistance between Pin 2 and pin 3 **(109)** 109.5 Ω
Resistance between Pin 2 and pin 4 **(109)** 109.5 Ω
Resistance between Pin 3 and pin 4 **(.800)** .932 Ω
Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 **(.800)** .818 Ω
Resistance between Pin 5 and pin 7 **(109)** 109.5 Ω
Resistance between Pin 5 and pin 8 **(109)** 109.5 Ω
Resistance between Pin 6 and pin 7 **(109)** 109.5 Ω
Resistance between Pin 6 and pin 8 **(109)** 109.5 Ω
Resistance between Pin 7 and pin 8 **(.800)** .808 Ω
Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 **(.800)** .792 Ω
Resistance between Pin 9 and pin 11 **(109)** 109.7 Ω
Resistance between Pin 9 and pin 12 **(109)** 109.4 Ω
Resistance between Pin 10 and pin 11 **(109)** 109.7 Ω
Resistance between Pin 10 and pin 12 **(109)** 109.4 Ω
Resistance between Pin 11 and pin 12 **(.800)** .712 Ω
Pins 9-12 resistance to lead ∞ Ω Pins 9-12 resistance to flange ∞ Ω

3.3.4 Using HP3458 DVM measure temperature sensor resistance with the four wire measurement technique:

Resistance of T1 108.7 Ω**(108.5)**(I+ at pin 1,U+ at pin 2,I- at pin 3,U- at pin 4)
Resistance of T2 108.4 Ω **(108.5)**(I+ at pin 5, U+ at pin 6, I- at pin 7, U- at pin 8)
Resistance of T3 108.4 Ω**(108.5)**(I+ at pin 9,U+ at pin 10,I- at pin 11,U- at pin 12)

8. Room Temperature Electrical Checkout

Performed by DAN EDDY (Name typed) Dan Eddy (Signature)

Date & time 5/19/03

Pos. Power Lead 7500 A DFLX ____ and Neg. Power Lead 7500 A DFLX ____

3.4 Check remaining rtd's. This includes rtd's in the dewar (530-3,531-3,532-3,534-3, 535-3), in the leads (507-3A, 507-3B), for the N2 shield (594-3), and the outlet HE for each lead (513-3,514-3). Connect cables for three 19-pin top plate connectors labeled "dewar 0, dewar 1, and dewar inlet HE te/ll". Also connect 4-pin cables for N2 shield and outlet HE (one for each lead). All of these can be read out on the cryo computer. All should read room temperature that is approximately 295 K. The cables for rtd's in the leads can be connected (511-3,512-3,509-3A, 509-3B, 510-3A, 510-3B) and can be read out on the mtfops computer and should also read approximately 295K. Any problems list in space provided below:

TE 509-3B NOT READ [illegible] CALIBRATION FAILURE
TE 509-3 CALIBRATION FAILURE

3.5 Check both liquid levels (12" and 30"). The 12" liquid level is connected to pins 9-12 of "dewar inlet HE te/ll" cable. Connect 4-pin cable to top plate for 30" probe. Disconnect J1 at the back of each liquid level meter and do a 4-wire resistance measurement on each probe. The resistance should read about 160 Ω. Wires come out to pins 1(red), 7(black), 8(blue), and 6(yellow) on J1 connector. Do following measurements for each probe:

1.1(red) to 8(blue)	should be approx. 5 Ω
2. 8(blue) to 6(yellow)	should be approx. (13.75 X active length of probe) 165 Ω for 12" and 412.5 Ω for 30"
3. 6(yellow) to 7(black)	should be something less than 5 Ω
4. 1(red) to 7(black)	should approximately equal resistance from #2 + #1

✓ OK ___ NOT OK

12" PROBE
1. 4.66
2. 164.70
3. 2.83
4. 176.86

30" PROBE
1. 4.67
2. 404.70
3. 1.57
4. 406.70

FERMILAB
Technical Division

7500 A HTS Power Leads for the LHC DFBX: 12. Cooldown Checklist

Lead Pair

Negative Lead: DFLX06

Positive Lead: DFLX96

Signed George Ramsburn Date 05.21.03

Initials

SK 1. ±5 A applied to the current leads during cooldown.

SK 2. DAQ system is operational (temperature sensor readouts in the test dewar helium space are updating).

SK 3. Test dewar and power leads cooled down as per the cooldown procedure "7500 A HTS Power Leads for the LHC DFBX: 12b. Cryogenic Operating Procedure".

FERMILAB Technical Division	7500A HTS Power leads for the LHC DFBX	Doc. No. Rev. No. Date: March 5,2003 Page 1 of 1 Author: Dan Eddy
	13. Cold Temp Hi-pot In HE Environment	

Note: Save the shipping container for storing and moving the leads around TD and after the test is complete to ship them to the DFBX manufacturer.

Performed by Fred Lewis Dan Eddy (Name typed) (Signature)

Date & time 3/22/03 11:50

Pos. Power Lead 7500 A DFLX 16 and Neg. Power Lead 7500 A DFLX 6

This hi-pot should be performed after dewar has been filled with HE. When checkout is complete, make sure you place the original and a copy of this document in the Traveler Binders.

3.1 Short all of the temperature sensors together using the special RTD high pot cable. High pot each set of temperature sensor to 300v with respect to the Lead (ground).

Record breakdown voltage (if any)_____V.
Record current .03 A

3.2 Hi-pot the leads in a cold (4.5K-300K) He environment to 1500V (1.3 Bar) using a Droege HV power supply. Connect the positive clip to one lead and the negative clip to ground. Also, short all of the temperature sensors together using the special RTD high pot cable. Connect the ring terminal from each connector to the flag of each lead. **Be sure to disconnect the redundant voltage taps on both leads and the power connections from Kepco power supply.**

Record breakdown voltage (if any) 1400 V. With RTDs Connected
Record current 14 A. ← Disconnected RTDs (No trip)
Record approximate temp. 4.2 K

FERMILAB Technical Division	7500A HTS Power leads for the LHC DFBX 2) Warm ~~1.~~ ~~Cold~~ Temp Hi-pot In HE Environment	Doc. No. Rev. No. Date: March 5,2003 Page 1 of 1 Author: Dan Eddy

Note: Save the shipping container for storing and moving the leads around TD and after the test is complete to ship them to the DFBX manufacturer.

Performed by Fred Lewis (Name typed) Fred Lewis. (Signature)

Date & time 6/10/03

Pos. Power Lead 7500 A DFLX 16 and Neg. Power Lead 7500 A DFLX 6

Make Sure Power (Flex) Leads are disconnected

~~This hi-pot should be performed after dewar has been filled with HE. Notify the Cryo Operator before you disconnect cables.~~ **When checkout is complete, make sure you place the original and a copy of this document in the Traveler Binders.**

3.1 Short all of the temperature sensors together using the special RTD high pot cable. High pot each set of temperature sensor to 300v with respect to the Lead (ground).

Record breakdown voltage (if any) N/A V.
Record current .015 mA A

Warm

3.2 Hi-pot the leads in a ~~cold (4.5K)~~ He environment to 1500V (1.3 Bar) using a Droege HV power supply. Connect the positive clip to one lead and the negative clip to ground. Also, short all of the temperature sensors together using the special RTD high pot cable. Connect the ring terminal from each connector to the flag of each lead. **Be sure to disconnect the redundant voltage taps on both leads and the power connections from Kepco power supply.**

Record breakdown voltage (if any) N/A V.
Record current .025 m A.
Record approximate temp. Room K

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7500 A HTS Power Leads for the LHC DFBX: 21. Removal of the Top Plate from the Dewar

1. **Electrical Disconnections**
   - **1.1** Put the power system into LOTO.
   - **1.2** Remove the plexiglass shield around the power leads.
   - **1.3** Remove the Kapton-wrapped platinum temperature sensors TE515-3 and TE516-3 from the positive and negative lead flags, respectively.
   - **1.4** Remove voltage taps VF-A and VF-B from the negative and positive flex lead flags, respectively.
   - **1.5** Disconnect the flex leads and chill blocks from the power lead flags.

2. **Piping Disconnections**
   - **2.1** Disconnect the GN2 warmup supply line from the 4-20 K supply line.
   - **2.2** Disconnect the GN2 warmup supply line from the top plate.
   - **2.3** Remove the Hot Watt if it was used to during the warmup.
   - **2.4** Disconnect the lines labeled "+ LD PDT +" and "- LD PDT +" from the 4-20 K female bayonet vacuum jacket. The lines connect to the high side of the differential pressure transducers.
   - **2.5** Disconnect the lines labeled "+ LD PDT – " and "- LD PDT –" from the positive and negative lead vent stacks, respectively. These lines connect to the low side of the differential pressure transducers.
   - **2.6** Disconnect the vent lines (thermally insulated, non-conductive hoses) to the power lead vent stacks.
   - **2.7** Remove the power lead vent stack from each power lead.
   - **2.8** Remove the test dewar flexible vent line.
   - **2.9** Remove the transfer lines supplying the 4-20 K circuit.

3. **Top Plate and Insert Removal**
   - **3.1** Remove all bolts fastening the top plate to the dewar extension.
   - **3.2** Lift the top plate and insert from the test dewar and set them onto the roll-around cart.
   - **3.3** Tighten the nuts on the underside of the current lead top plate against the plate to provide stability during transportation.

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Stand 3 LHC-HTS Lead Testing:
22. Removal of the Current Leads

1. **Electrical Disconnection of Current Leads from Test Facility**
   - **1.1** Unbolt the heater from each power lead flag.
   - **1.2** Remove the bottom fill tube.
   - **1.3** Remove the He space temperature sensors and the liquid level probes.
   - **1.4** Remove the Kapton and glass tape insulating the low temperature superconducting cable.
   - **1.5** Unclamp the V5 voltage tap wires from the LTS cable.
   - **1.6** Unwind the excess voltage tap wire from around the bottom of each power lead and gather it into a coil. Secure it with tape and let it hang from the end of the power lead.
   - **1.7** Separate the joined LTS cables by opening the mechanical clamp. Recover as much indium as possible.
   - **1.8** Remove the mechanical clamp, the clamp support, and the G-10 clamshell clamp.

2. **Mechanical Removal of Current Leads from Test Facility**
   - **2.1** Using wedges, tilt the insert by 10° so that the power leads are vertical.
   - **2.2** Remove the jam nuts from the tensioning studs.
   - **2.3** Remove the loading nuts and Belleville washer assemblies from the tensioning studs. Put each Belleville washer assembly/loading nut/jam nut group on a threaded rod for storage.
   - **2.4** Use a 5/16 12-point socket to loosen and remove the 20 Conflat bolts connecting lead plate to the insert top plate.
   - **2.5** Attach the lifting/insertion tool to the lead flag and carefully lift the lead from the top plate.
   - **2.6** With the lead supported by the crane at a reasonable working height, remove the power lead baffle.
   - **2.7** Remove the Conflat copper gasket from the knife edge on the underside of the lead plate.
   - **2.8** Clamp the end support around the lead lower flange so that the rounded portion can rest in V-blocks when the lead is put on a steel table.
   - **2.9** Place the lead in V-blocks, using the end support to prevent any loading on the lower part of the lead.
   - **2.10** Recover as much indium as possible from the power lead LTS cables.
   - **2.11** Remove the upper insulator, PEEK seal, and lower insulator from each chimney.
   - **2.12** Put each upper insulator, PEEK seal, and lower insulator in LN2. This will drive off the absorbed helium and will greatly improve the system background during the leak check of the next pair of leads to be tested.

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Stand 3 LHC-HTS Lead Testing:
23. Pack and Ship the Leads

Lead Pair
Negative Lead: _____
Positive Lead: _____

Signed _____ Date _____

1. **Pack the Leads**
   - **1.1** With the lead on the steel table, swing the insertion/lifting tool 180° so that the lead can be picked up and remain horizontal as shown in Figure 1.1.

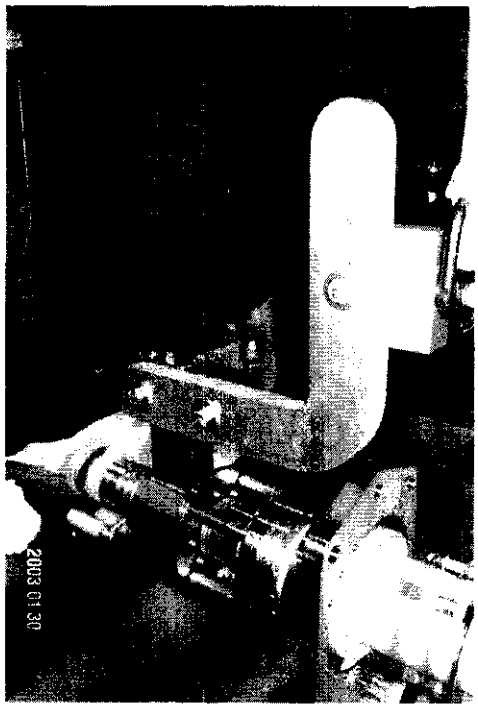

Figure 1.1 Orientation of the insertion/lifting tool to allow the power lead to be held horizontally.

   - **1.2** Lift the power lead out of the V-blocks.
   - **1.3** While supporting the lead from the crane, remove the end support clamped around the lower flange of the power lead.
   - **1.4** Install the protective covers for the lead plate knife edge sealing surface and for the lower flange sealing surface. Secure them with tape.
   - **1.5** Insert a protective plastic cap into the 4-20 K gas port.
   - **1.6** Reattach the g-force indicators that were attached to the lead when it arrived.
   - **1.7** Set the lead in the shipping crate and remove the insertion/lifting tool.
   - **1.8** Make two photocopies of all documents in the lead travelers, and place the power lead travelers with the original documents in the shipping crate.
   - **1.9** Close the shipping crate

2. **Ship the Leads**
   - **2.1** Call Marsha Schmidt (X-4377) to request that the power leads be shipped to the NW8 storage site.