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	DFLX - 02

Performed by SUDHIR GHANTA (name typed) [signature] (signature)

Date & time 1/8/03 5pm

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 ____ 7500 A DFLX ____ ID MISSING ON BOX
(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: INSTALLED ON FLAG OF LEADS
- Not tripped ☑ Tripped (red) ☐ Remark: INSTALLED ON FLAG OF LEADS

c. Each leads have another "10G DROP" devices installed on the flag of the leads
- Not tripped ☐ Tripped (Black) ☐ Remark: MISSING
- Not tripped ☐ Tripped (Black) ☐ Remark: MISSING.

1.4 Container content:

a. Power leads: 7500 A DFLX 01 ; 7500 A DFLX 02
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 ☑

2-1

PART NAME : 7.5 KA CURRENT LEAD ASSY (LBNL01)   7500A OFLX02
REV NUMBER :
SER NUMBER :   WITH INSULATOR
STATS COUNT : 1

MM	DIM CYL -A-DIA= LOCATION OF CYLINDER CYL -A-				
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	99.000	0.200	0.200	98.714	-0.286	0.086

MM	DIM -A-= ROUNDNESS OF CYLINDER CYL -A-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.083	0.083	0.000

MM	DIM -B-= FLATNESS OF PLANE PLN -B-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.050	0.000	0.010	0.010	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	0.040	0.040	0.000

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	0.515	0.515	0.385

MM	DIM -C- DIA= LOCATION OF CYLINDER -C-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	80.000	0.200	0.200	80.073	0.073	0.000

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	0.950	0.950	0.700

MM	DIM RND2= ROUNDNESS OF CYLINDER -C-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.046	0.046	0.000

MM	DIM DIST1= 2D DISTANCE FROM PLANE PLN -B- TO PLANE LRG FLANGE PAR T(					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	561.000	1.000	1.000	561.421	0.421	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				123.740	0.169	
DF	16.000	0.200	0.200		17.953	1.953	1.753
TP	RFS	0.400		0.000		0.338	0.000

2-2

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=1/9/2003 TIME=9:44:04 AM

MM	DIM LOC10= TRUE POSITION OF CIRCLE CIR3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	-78.890				-78.906	-0.016		
Z	95.047				95.096	0.049		
DF	16.000	0.200	0.200		17.954	1.954	1.754	
TP	RFS	0.400		0.000		0.104	0.000	

MM	DIM LOC11= TRUE POSITION OF CIRCLE CIR4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	78.890				78.993	0.103		
Z	95.047				95.370	0.323		
DF	16.000	0.200	0.200		17.954	1.954	1.754	
TP	RFS	0.400		0.000		0.677	0.277	

MM	DIM LOC12= TRUE POSITION OF CIRCLE CIR5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	78.890				79.321	0.431		
Z	-95.047				-94.689	0.358		
DF	16.000	0.200	0.200		17.919	1.919	1.719	
TP	RFS	0.400		0.000		1.120	0.720	

MM	DIM LOC13= TRUE POSITION OF CIRCLE CIR6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	-78.890				-78.574	0.316		
Z	-95.047				-94.944	0.103		
DF	16.000	0.200	0.200		17.946	1.946	1.746	
TP	RFS	0.400		0.000		0.665	0.265	

MM	DIM LOC09= TRUE POSITION OF CIRCLE ID1							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.189	-0.361		
PA	-153.000				-152.994	0.006		
DF	8.407	0.200	0.200		8.514	0.106	0.000	
TP	RFS	0.080		0.000		0.722	0.642	

MM	DIM LOC20= TRUE POSITION OF CIRCLE ID2							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.275	-0.275		
PA	-171.000				-171.042	-0.042		
DF	8.407	0.200	0.200		8.513	0.106	0.000	
TP	RFS	0.080		0.000		0.565	0.485	

MM	DIM LOC31= TRUE POSITION OF CIRCLE ID3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.138	-0.412		
PA	-135.000				-134.921	0.079		
DF	8.407	0.200	0.200		8.526	0.119	0.000	
TP	RFS	0.080		0.000		0.860	0.780	

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01)   DATE=1/9/2003   TIME=9:44:05 AM

MM	DIM LOC1= TRUE POSITION OF CIRCLE ID4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.343	-0.206		
PA	171.000				170.919	-0.081		
DF	8.407	0.200	0.200		8.515	0.108	0.000	
TP	RFS	0.080		0.000		0.486	0.406	

MM	DIM LOC2= TRUE POSITION OF CIRCLE ID5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.425	-0.125		
PA	153.000				152.909	-0.091		
DF	8.407	0.200	0.200		8.511	0.104	0.000	
TP	RFS	0.080		0.000		0.380	0.300	

MM	DIM LOC3= TRUE POSITION OF CIRCLE ID6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.515	-0.035		
PA	135.000				134.923	-0.077		
DF	8.407	0.200	0.200		8.505	0.098	0.000	
TP	RFS	0.080		0.000		0.253	0.173	

MM	DIM LOC4= TRUE POSITION OF CIRCLE ID7							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.606	0.056		
PA	117.000				116.945	-0.055		
DF	8.407	0.200	0.200		8.501	0.094	0.000	
TP	RFS	0.080		0.000		0.207	0.127	

MM	DIM LOC6= TRUE POSITION OF CIRCLE ID8							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.675	0.125		
PA	99.000				98.965	-0.035		
DF	8.407	0.200	0.200		8.508	0.101	0.000	
TP	RFS	0.080		0.000		0.274	0.194	

MM	DIM LOC7= TRUE POSITION OF CIRCLE ID9							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.645	0.096		
PA	81.000				81.028	0.028		
DF	8.407	0.200	0.200		8.530	0.123	0.000	
TP	RFS	0.080		0.000		0.211	0.131	

MM	DIM LOC8= TRUE POSITION OF CIRCLE ID10							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.804	0.254		
PA	63.000				63.002	0.002		
DF	8.407	0.200	0.200		8.519	0.112	0.000	
TP	RFS	0.080		0.000		0.509	0.429	

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=1/9/2003 TIME=9:44:06 AM

MM	DIM LOC14= TRUE POSITION OF CIRCLE ID11							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.854	0.304		
PA	45.000				45.058	0.058		
DF	8.407	0.200	0.200		8.514	0.106	0.000	
TP	RFS	0.080		0.000		0.635	0.555	

MM	DIM LOC15= TRUE POSITION OF CIRCLE ID12							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.855	0.305		
PA	27.000				27.143	0.143		
DF	8.407	0.200	0.200		8.511	0.104	0.000	
TP	RFS	0.080		0.000		0.759	0.679	

MM	DIM LOC16= TRUE POSITION OF CIRCLE ID13							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.814	0.265		
PA	9.000				9.283	0.283		
DF	8.407	0.200	0.200		10.803	2.396	2.196	
TP	RFS	0.080		0.000		1.040	0.960	

MM	DIM LOC17= TRUE POSITION OF CIRCLE ID14							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.748	0.199		
PA	-9.000				-8.702	0.298		
DF	8.407	0.200	0.200		8.496	0.088	0.000	
TP	RFS	0.080		0.000		1.023	0.943	

MM	DIM LOC18= TRUE POSITION OF CIRCLE ID16							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.654	0.104		
PA	-27.000				-26.663	0.337		
DF	8.407	0.200	0.200		8.501	0.094	0.000	
TP	RFS	0.080		0.000		1.087	1.007	

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	1452.819	2.819	2.419	

MM	DIM 130.0DIA= LOCATION OF CIRCLE OD1						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
D	130.000	0.200	0.200	129.968	-0.032	0.000	

MM	DIM 502 COOLING HOLE= 2D DISTANCE FROM CIRCLE ID15 TO PLANE LRG FLAN						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	502.000	0.400	0.400	502.156	0.156	0.000	

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	-1.814	-1.814	1.614	

2-1

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=1/9/2003 TIME=9:44:07 AM

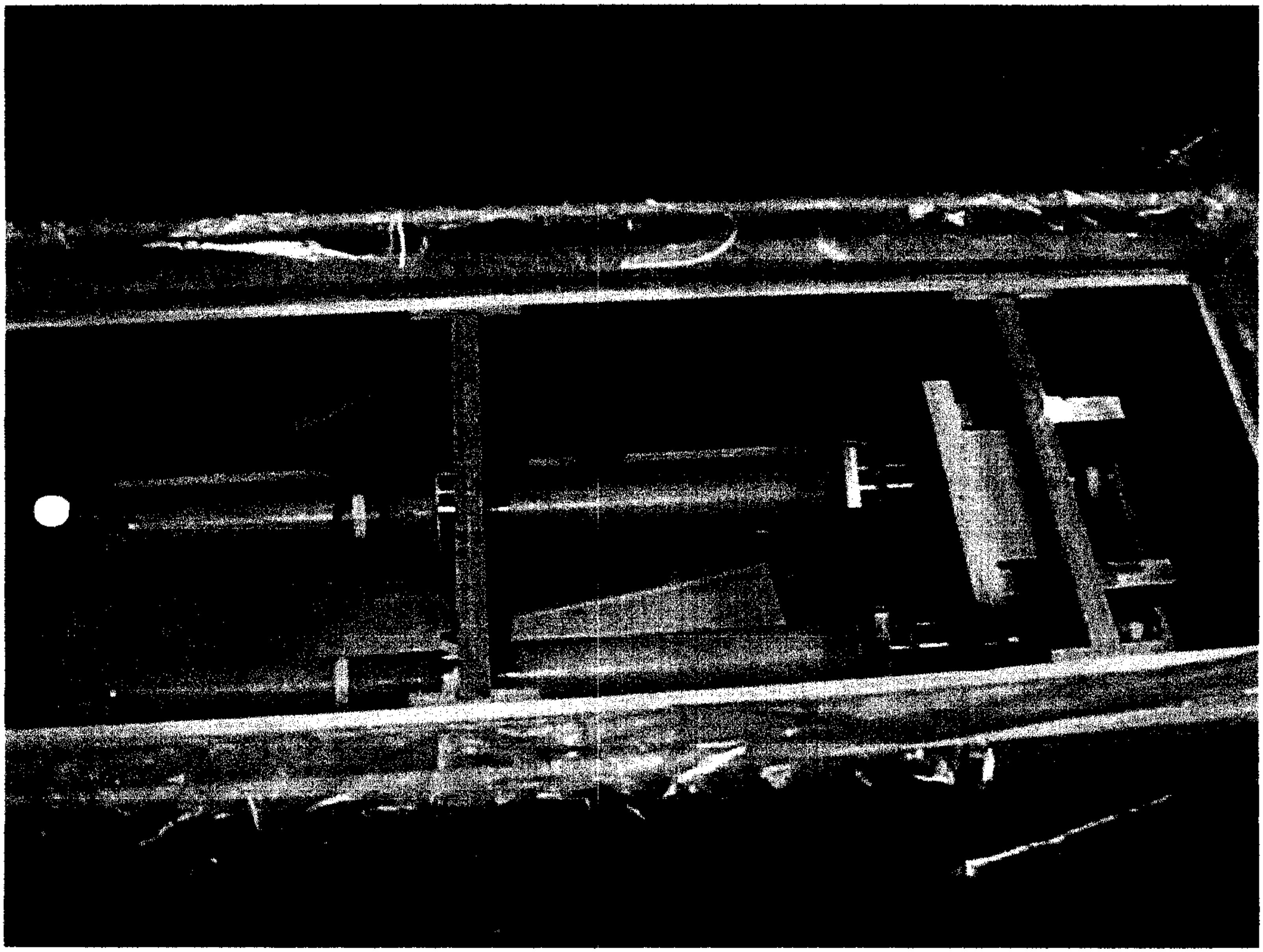
DEG	DIM WARM TERMINAL= 3D ANGLE (TRUE) FROM PLANE PLN2 TO ZAXIS						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
A	0.000	0.100	0.100	-0.159	-0.159	0.059	

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	-0.031	-0.031	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	91.946	1.946	1.446	

MM	DIM 442.5= 2D DISTANCE FROM LINE FRT END TO PLANE PLN -B- PAR TO YA>						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	442.500	0.400	0.400	444.898	2.398	1.998	

7500A DFLX 01, 02
WITH INSULATORS



FERMILAB Technical Division	7500A HTS Power leads for the LHC DFBX	Doc. No. Rev. No. Date: January 31, 2003 Page 1 of 4 Author: Fred Lewis
	4. 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 DAN EDDY (Name typed) Dan Eddy (Signature)

Date & time 3/20/03 10:00 A.M.

Pos. Power Lead 7500 A DFLX 02 and Neg. Power Lead 7500 A DFLX 01

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

3.1 Voltage segment and drop measurement.

Apply 10 Amps between the copper flag on Positive Lead and the copper flag on Negative Lead.

Record the applied current 10 A

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

Measure the voltages between the following pins:

Positive Lead

Voltage tap Connector 1 (Primary) (Fisher DEE104A06)

Pin 1 - pin 2 **(160uv)** 165 V Pin 2 - pin 3 **(450uv)** 465 V
Pin 1 - pin 3 **(610uv)** 630 V Pin 3 - pin 4 **(480uv)** 451 V
Pin 1 - pin 4 **(1.1mv)** 1.08 V Pin 4 - pin 5 **(3.5mv)** 3.89 V
Pin 1 - pin 5 **(4.7mv)** 4.98 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)** 463 V
Pin 1 - pin 3 **(610uv)** 630 V Pin 3 - pin 4 **(480uv)** 556 V
Pin 1 - pin 4 **(1.1mv)** 1.19 V Pin 4 - pin 5 **(3.5mv)** 3.79 V
Pin 1 - pin 5 **(4.7mv)** 4.98 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)** -473 V
Pin 1 - pin 3 **(-600uv)** -638 V Pin 3 - pin 4 **(-480uv)** -498 V
Pin 1 - pin 4 **(-1.1mv)** -1.13 V Pin 4 - pin 5 **(-3.5mv)** -3.71 V
Pin 1 - pin 5 **(-4.7mv)** -4.85 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)** -166 V Pin 2 - pin 3 **(-450uv)** -469 V

Pin 1 - pin 3 (-600uv) -633 V Pin 3 - pin 4 (-480uv) -496 V
Pin 1 - pin 4 (-1.1mv) -1.12 V Pin 4 - pin 5 (-3.5mv) -3.72 V
Pin 1 - pin 5 (-1.5mv) -4.85 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 to the primary of each lead
Connection 2- one vtap cable to the redundant of each lead

Connection1 (Primary)

Positive Lead Pin 1 - Negative Lead pin 5 (3.7mv) 3.89 V
Positive Lead Pin 1 - Negative Lead pin 4 (7.3mv) 7.61 V
Positive Lead Pin 1 - Negative Lead pin 3 (7.7mv) 8.10 V
Positive Lead Pin 1 - Negative Lead pin 2 (8.2mv) 8.57 V
Positive Lead Pin 1 - Negative Lead pin 1 (8.3mv) 8.74 V

Connection 2 (Redundant)

Positive Lead Pin 1 - Negative Lead pin 5 (3.7mv) 3.89 V
Positive Lead Pin 1 - Negative Lead pin 4 (7.3mv) 7.61 V
Positive Lead Pin 1 - Negative Lead pin 3 (7.7mv) 8.10 V
Positive Lead Pin 1 - Negative Lead pin 2 (8.2mv) 8.57 V
Positive Lead Pin 1 - Negative Lead pin 1 (8.3mv) 8.74 V

3.3 Temperature sensor resistance measurements.

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

Resistance between Pin 1 and pin 2 (.800) .830 Ω
Resistance between Pin 1 and pin 3 (109) 109.07 Ω
Resistance between Pin 1 and pin 4 (109) 109.07 Ω
Resistance between Pin 2 and pin 3 (109) 109.04 Ω
Resistance between Pin 2 and pin 4 (109) 109.04 Ω
Resistance between Pin 3 and pin 4 (.800) .900 Ω
Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 (.800) .809 Ω
Resistance between Pin 5 and pin 7 (109) 109.02 Ω
Resistance between Pin 5 and pin 8 (109) 109.02 Ω
Resistance between Pin 6 and pin 7 (109) 109.03 Ω
Resistance between Pin 6 and pin 8 (109) 109.03 Ω
Resistance between Pin 7 and pin 8 (.800) .806 Ω
Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 (.800) .727 Ω
Resistance between Pin 9 and pin 11 (109) 109.06 Ω
Resistance between Pin 9 and pin 12 (109) 109.06 Ω
Resistance between Pin 10 and pin 11 (109) 109.05 Ω
Resistance between Pin 10 and pin 12 (109) 109.05 Ω
Resistance between Pin 11 and pin 12 (.800) .704 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 108.24 Ω(108.5)(I+ at pin 1,U+ at pin 2,I- at pin 3,U- at pin 4)
Resistance of T2 108.22 Ω(108.5) (I+ at pin 5, U+ at pin 6, I- at pin 7, U- at pin 8)
Resistance of T3 108.34 Ω(108.5)(I+ at pin 9,U+ at pin 10,I- at pin 11,U- at pin 12)

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

Resistance between Pin 1 and pin 2 (.800) .835 Ω
Resistance between Pin 1 and pin 3 (109) 109.09 Ω
Resistance between Pin 1 and pin 4 (109) 109.09 Ω
Resistance between Pin 2 and pin 3 (109) 109.07 Ω
Resistance between Pin 2 and pin 4 (109) 109.06 Ω
Resistance between Pin 3 and pin 4 (.800) .809 Ω
Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 (.800) .822 Ω
Resistance between Pin 5 and pin 7 (109) 109.05 Ω
Resistance between Pin 5 and pin 8 (109) 109.05 Ω
Resistance between Pin 6 and pin 7 (109) 109.06 Ω
Resistance between Pin 6 and pin 8 (109) 109.06 Ω
Resistance between Pin 7 and pin 8 (.800) .815 Ω
Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 (.800) .744 Ω
Resistance between Pin 9 and pin 11 (109) 109.11 Ω
Resistance between Pin 9 and pin 12 (109) 109.11 Ω
Resistance between Pin 10 and pin 11 (109) 109.09 Ω
Resistance between Pin 10 and pin 12 (109) 109.09 Ω
Resistance between Pin 11 and pin 12 (.800) .715 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:

4. Room Temperature Electrical Checkout

Resistance of T1 _108.26_ Ω(108.5)(I+ at pin 1,U+ at pin 2,I- at pin 3,U- at pin 4)
Resistance of T2 _109.23_ Ω (108.5)(I+ at pin 5, U+ at pin 6, I- at pin 7, U- at pin 8)
Resistance of T3 _109.37_ Ω(108.5)(I+ at pin 9,U+ at pin 10,I- at pin 11,U- at pin 12)

3.4 Connect all dewar rtd's and liquid level. Connect three 19-pin top plate cables labeled "dewar 0, dewar 1, and dewar inlet HE te/ll". Also connect N2 shield rtd and outlet HE rtd's(one for each lead). All of these should be read out on cryo computer. All should read room temperature that is approximately 295 K. Any problems list in space provided below:

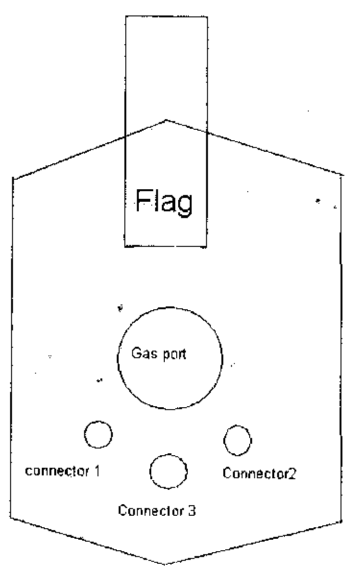
T1 507-3A READS 280(K) → 4 WIRE MEASUREMENT (66.313 OHMS)

ALL OTHERS AROUND 295(K)

3.5 Check the liquid level by connecting the test box into J1 of liquid level meter. As you adjust meter from 0 to 12 inches, the cryo computer liquid level should read the same. Do a resistance measurement on liquid level probe. The resistance should read about 160 Ω. The liquid level is connected to pins 9,10,11,12 of "dewar inlet HE te/ll" connector. _✓_OK ___NOT OK

BOTH 12" & 30"

4.0 Using a Droege HV power supply, hi-pot the flag of the positive lead to 1000v.



Looking from the top of the lead down where the LTS cable is located.
Connector 2= Redundant, Connector 1= Primary and Connector 3= RTD.

CHECKOUT OF LIQUID LEVEL PROBE

1. RED → BLUE = 5 OHMS (APPROX.)
2. BLUE → YELLOW = 13.75 x ACTIVE LENGTH
3. YELLOW → BLACK = .7 OHMS
4. RED → BLACK = (RED → BLUE + BLUE → YELLOW)

12" PROBE @ J1 CONN.

4 WIRE @ J1 = 163.72

1. 6.055
2. 165.550 (13.75 x 12) = 165
3. 2.239
4. 170.292 (6.055 + 165.550 = 171.605)

30" PROBE @ J1 CONN.

4 WIRE @ J1 = 403.C

1. 6.348
2. 404.42 (13.75 x 30 = 412.50
3. 1.361
4. 409.31 (404.42 + 6.34 = 410.76)

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) [signature] (signature)

Date & time 1/22/03 1:35 P.M.

Power Lead 7500 A DFLX 02

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 (Fisher DEE104A06)(PRIMARY)

Pin 1 - pin 2	80 u V	Pin 2 - pin 3	230 u V
Pin 1 - pin 3	311 u V	Pin 3 - pin 4	125 u V
Pin 1 - pin 4	437 u V	Pin 4 - pin 5	FLOAT V
Pin 1 - pin 5	FLOAT V	Pin 5 - pin 6	FLOAT V
Pin 1 - pin 6	FLOAT V		

Voltage tap Connector 2 (Fisher DEE104A06)(REDUNDANT)

Pin 1 - pin 2	81 u V	Pin 2 - pin 3	229 u V
Pin 1 - pin 3	311 u V	Pin 3 - pin 4	290 u V
Pin 1 - pin 4	602 u V	Pin 4 - pin 5	FLOAT V
Pin 1 - pin 5	FLOAT V	Pin 5 - pin 6	FLOAT V
Pin 1 - pin 6	FLOAT V		

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

Connector 1: between pin 5 and the end of the wire continuity is OK ☑ not OK ☐

Connector 2: between pin 5 and the end of the wire continuity is OK ☑ not OK ☐

3.3 Temperature sensor resistance measurements.

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

Resistance between Pin 1 and pin 2	.814	Ω
Resistance between Pin 1 and pin 3	108.22	Ω
Resistance between Pin 1 and pin 4	108.21	Ω
Resistance between Pin 2 and pin 3	108.19	Ω
Resistance between Pin 2 and pin 4	108.18	Ω
Resistance between Pin 3 and pin 4	.777	Ω
Pin 1,2,3,4 resistance to lead	∞	Ω
Pin 1,2,3,4 resistance to flange	∞	Ω

Resistance between Pin 5 and pin 6	.785	Ω
Resistance between Pin 5 and pin 7	108.17	Ω

4. Initial Electrical Checkout

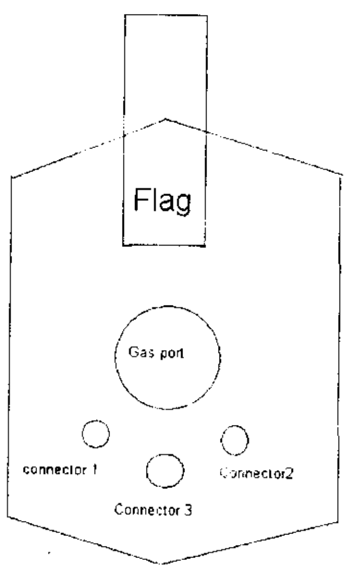
Resistance between Pin 5 and pin 8 108.17 Ω
Resistance between Pin 6 and pin 7 108.18 Ω
Resistance between Pin 6 and pin 8 108.18 Ω
Resistance between Pin 7 and pin 8 .781 Ω
Pin 5,6,7,8 resistance to lead ∞ Ω
Pin 5,6,7,8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 .710 Ω
Resistance between Pin 9 and pin 11 108.05 Ω
Resistance between Pin 9 and pin 12 108.05 Ω
Resistance between Pin 10 and pin 11 108.04 Ω
Resistance between Pin 10 and pin 12 108.03 Ω
Resistance between Pin 11 and pin 12 .690 Ω
Pin 9,10,11,12 resistance to lead ∞ Ω
Pin 9,10,11,12 resistance to flange ∞ Ω

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

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

Resistance of T1 107.40 Ω (I+ at pin 1, I- at pin 3, U+ at pin 2, U- at pin 4)
Resistance of T2 107.38 Ω (I+ at pin 5, I- at pin 7, U+ at pin 6, U- at pin 8)
Resistance of T3 107.34 Ω (I+ at pin 9, I- at pin 11, U+ at pin 10, U- at pin 12)



Looking from the top of the lead down where the LTS cable is located

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
	4. Room Temperature Hi-pot In HE Gas 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 DAN EDDY (Name typed) Dan Eddy (Signature)

Date & time 3/5/03 11:30 A.M.

Pos. Power Lead 7500 A DFLX 02 and Neg. Power Lead 7500 A DFLX 01

This hi-pot should be performed after room temp electrical checkout is complete. When both checkouts are complete, make sure you place the original and a copy of these documents in the Traveler Binder.

3.1 Hi-pot the leads at room temperature in a HE gas environment to 1500V (1.3 Bar) using a droege. Connect the positive to one lead and the negative to ground. **Be sure to disconnect the redundant voltage taps on both leads and the power connections (one on each lead) from kepco power supply.**

Record breakdown voltage (if any) —— V.
Record current >.1ua A.
Record approximate temp 295 K.

FERMILAB
Technical Division

Stand 3 LHC-HTS Lead Testing: Mechanical Installation Procedure

Lead Pair

Negative Lead: DFLX01

Positive Lead: DFLX02

Signed CHARLIE HESS / ROGER RABEHL Date FEB 21, 2003

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.

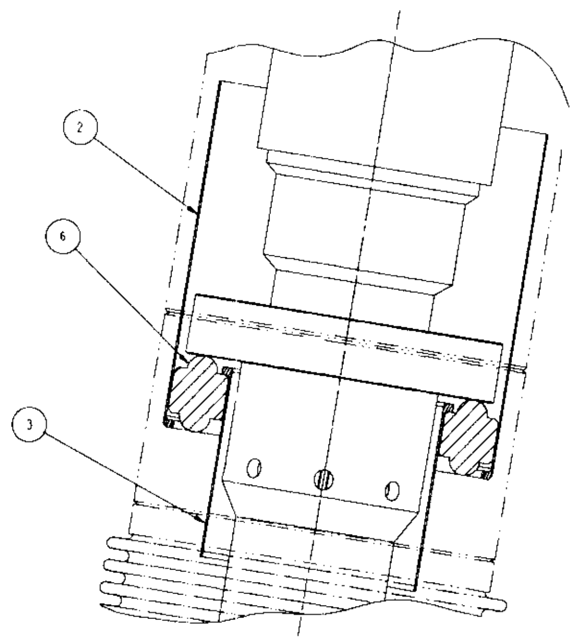


Figure 1.3 2 – Upper Insulator, 3 – Lower Insulator, 6 – PEEK Seal

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.

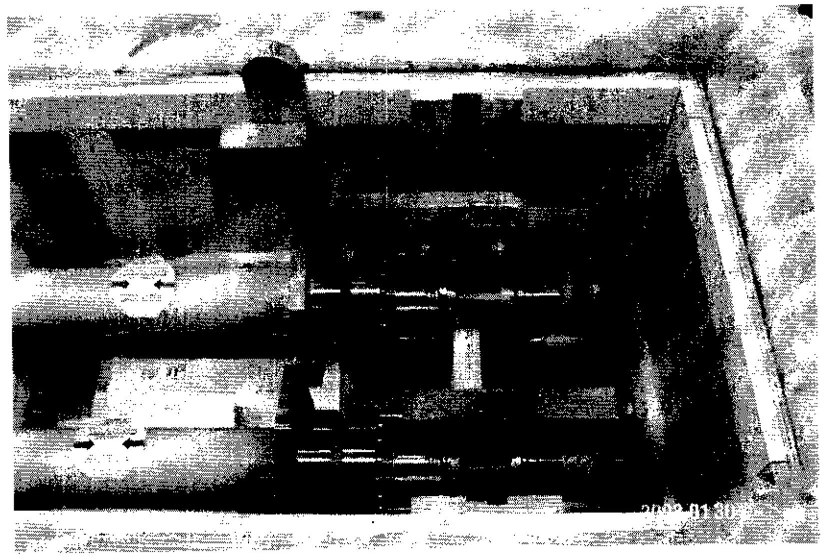


Figure 1.6 The lifting/insertion tool bolted to a power lead in preparation for removing it from the shipping container.

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.

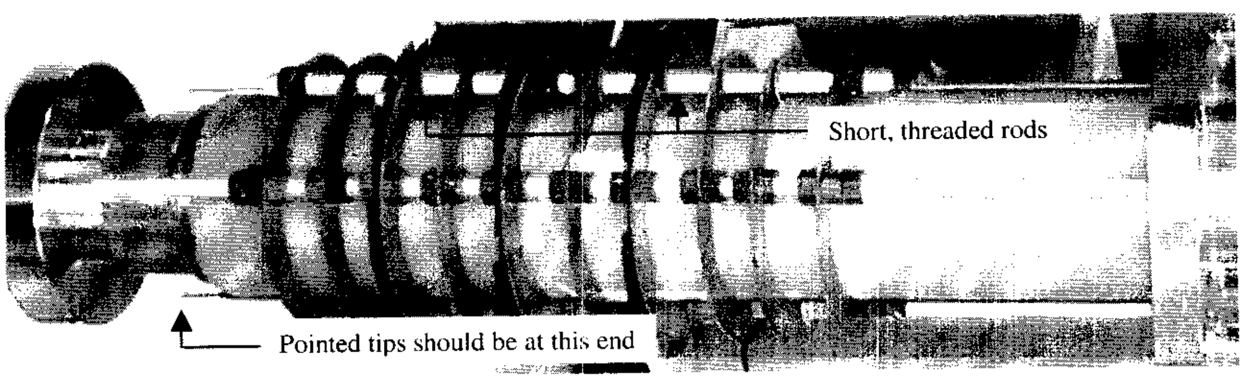


Figure 1.13 A baffle installed on a power lead.

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.

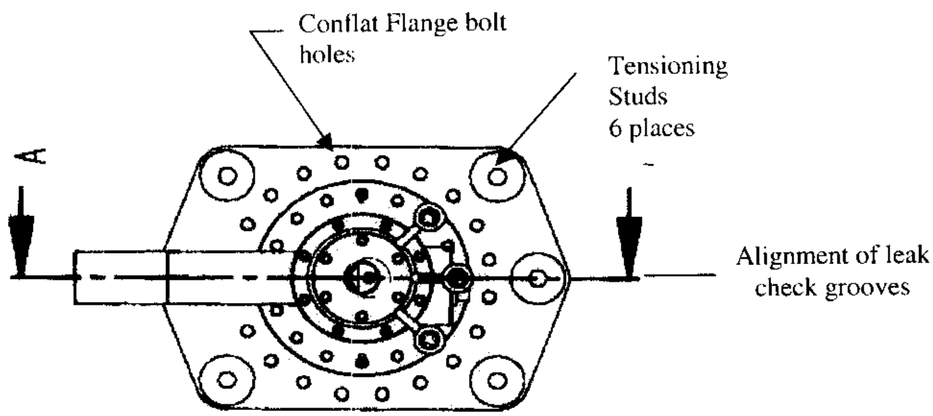


Figure 1.15 The 20-hole Conflat bolt pattern is bisected by center tensioning studs.

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.

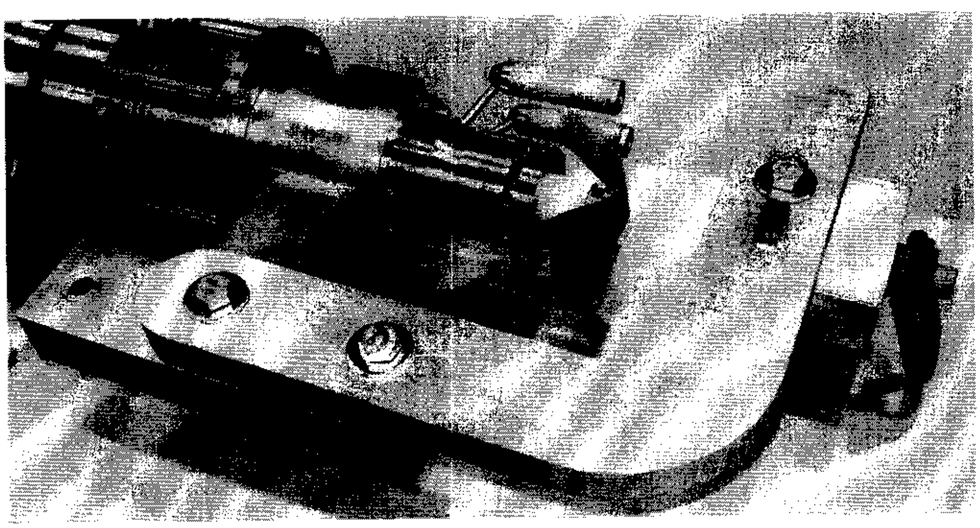


Figure 1.17 The lifting/insertion tool in position to lift the power lead into a vertical position.

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.

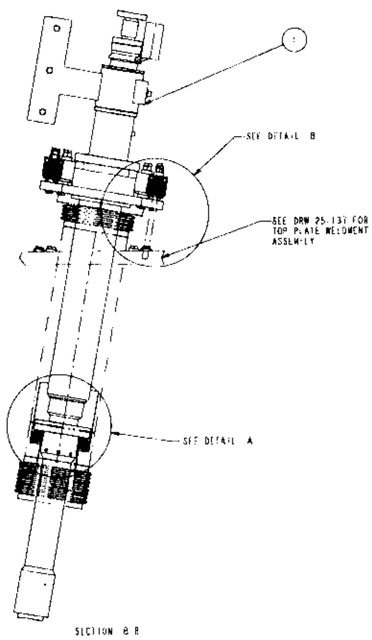


Figure 1.21a HTS Lead in Test Chimney. Note: CERN chimneys do not have bellows.

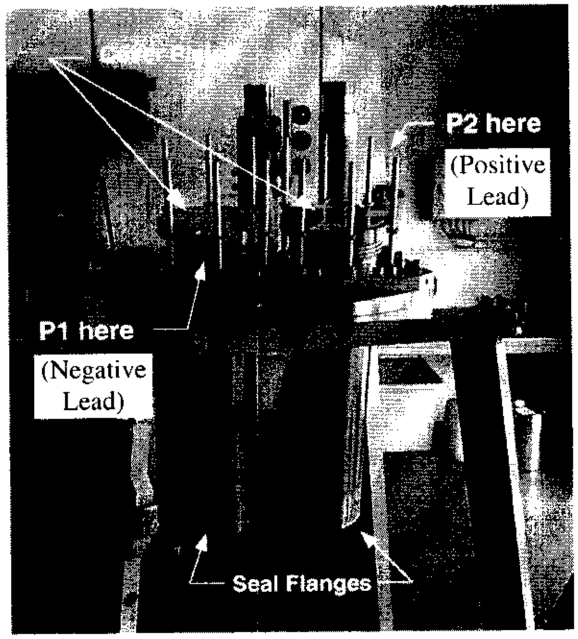


Figure 1.21b Locations of the negative and positive leads.

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

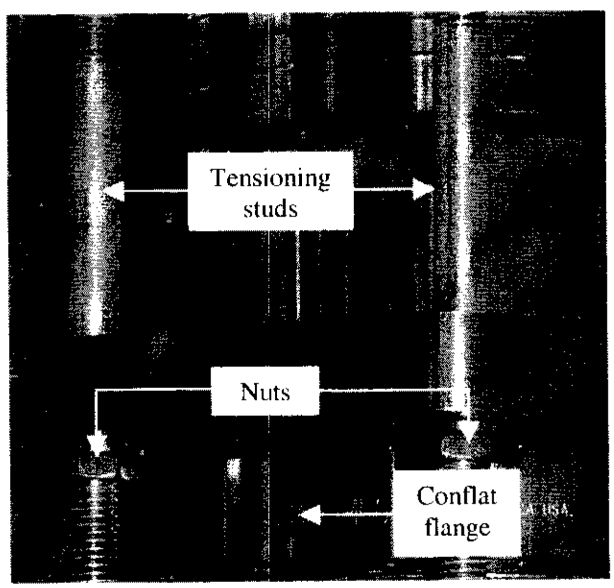


Figure 1.22 The positions of the tensioning studs, nuts, and top plate Conflat flange as the 20 Conflat bolts are tightened.

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 sequench is given by Fig. 1.25.

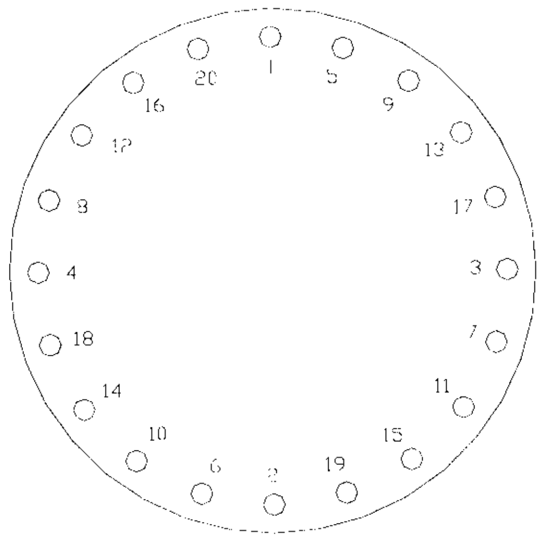


Figure 1.25 Tightening sequence for the 20 Conflat bolts.

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.

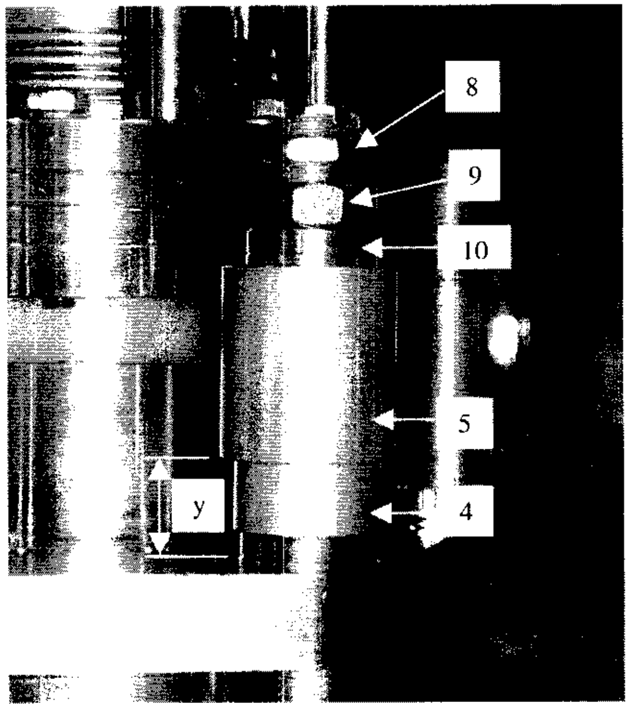


Figure 1.27a An installed Belleville Washer Assembly.

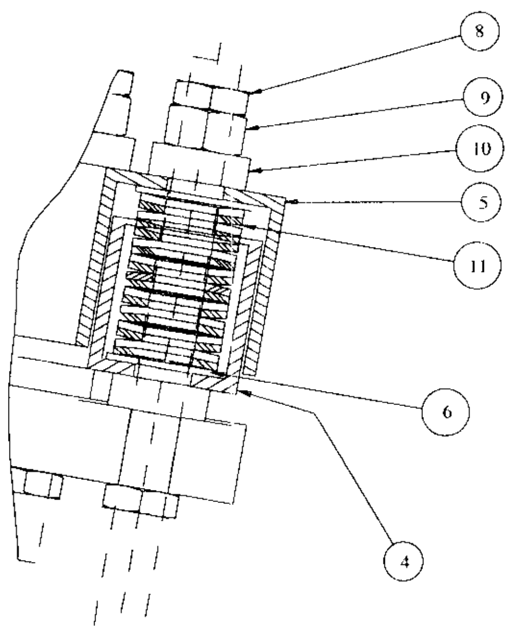


Figure 1.27b An installed Belleville Washer Assembly.

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 two Teflon centering rings. The inner Teflon centering ring goes between the power lead and the lower insulator. The outer Teflon centering ring goes between the lower insulator and the chimney. A small rubber mallet may be used to help install the Teflon centering rings. The installed Teflon centering rings are shown in Figure 1.28.1.2.

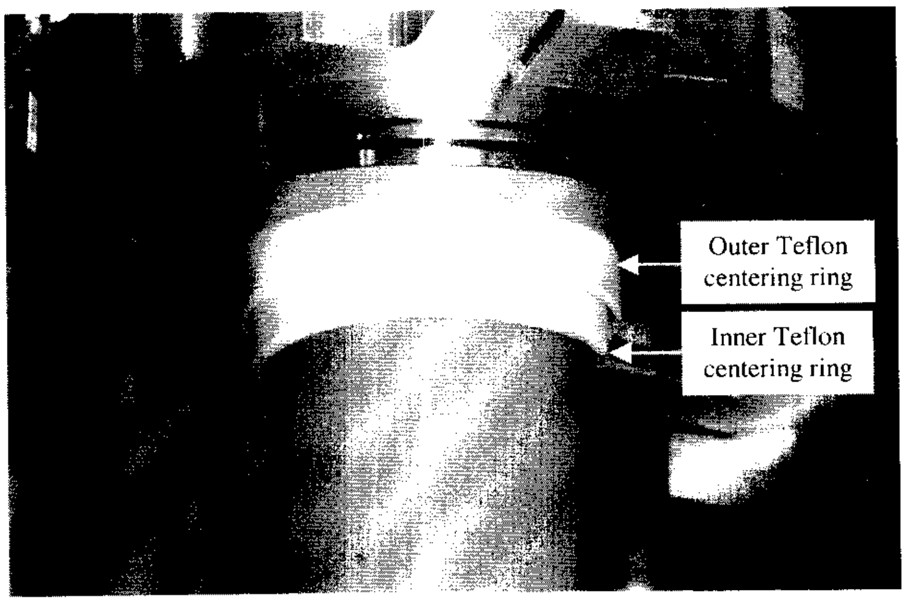


Figure 1.28.1.2 The installed Teflon centering rings.

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 _______ B ______ C ______ D ______ E ______ F ______

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 _______ B ______ C ______ D ______ E ______ F ______

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 ______

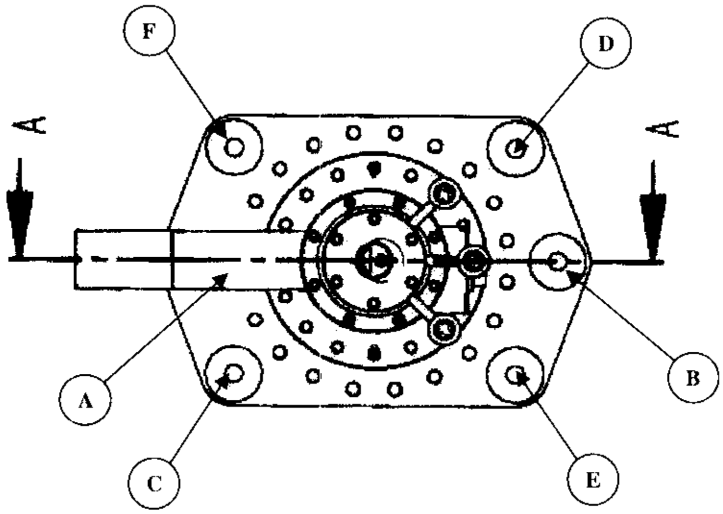


Figure 1.28.1.5 The specified sequence for tightening the Belleville Washer Assemblies.

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

A _______ B ______ C ______ D ______ E ______ F ______

1.28.1.7 Remove the Teflon centering rings 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 two Teflon centering rings. One Teflon centering ring goes between the power lead and the lower insulator. The second Teflon centering ring goes between the lower insulator and the chimney. A small rubber mallet may be used to help install the Teflon centering rings.

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 23.92 B 23.90 C 23.80 D 23.63 E 23.89 F 23.98

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 22.12 B 22.10 C 22.00 D 21.83 E 22.09 F 22.18

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 22.27 B 22.06 C 21.88 D 21.84 E 22.05 F 22.16

1.28.2.7 Remove the Teflon centering rings 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.

1.30 Tighten the nuts on the underside of the current lead top plate against the plate to provide stability during transportation.

2. Pressure Test

2.1 Follow the procedure specified in the document entitled, "Stand 3 LHC-HTS Lead Testing: Pressure Test Procedure.

3. Leak Check

3.1 Follow the procedure specified in the document entitled, "Stand 3 LHC-HTS Lead Testing: Leak Check Procedure.

4. Electrical Integration of Current Leads in Test Facility

4.1 Make connection to LTS pigtails. Use a "Praying Hands" type joint 120 mm-long as shown in Figures 4.1a and 4.1b. The ends of the LTS pigtails are individually pretinned for about 120 mm by Pirelli, and the joint is a mechanical connection with indium foil (supplied by LBNL) between the cables to ensure good electrical connection. The conductors are arranged in a spiral path so the NbTi cables in the joint are facing each other, with the copper cables against the stainless steel mechanical clamp.

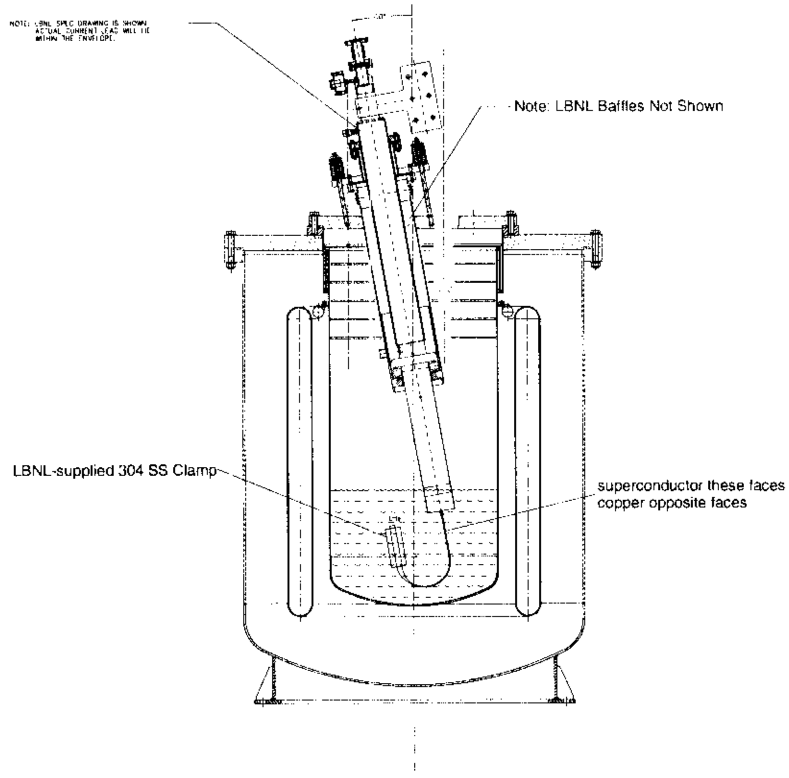


Figure 4.1a Side View of Lead in Cryostat with the LTS cables connected in a "Praying Hands" Type Joint.

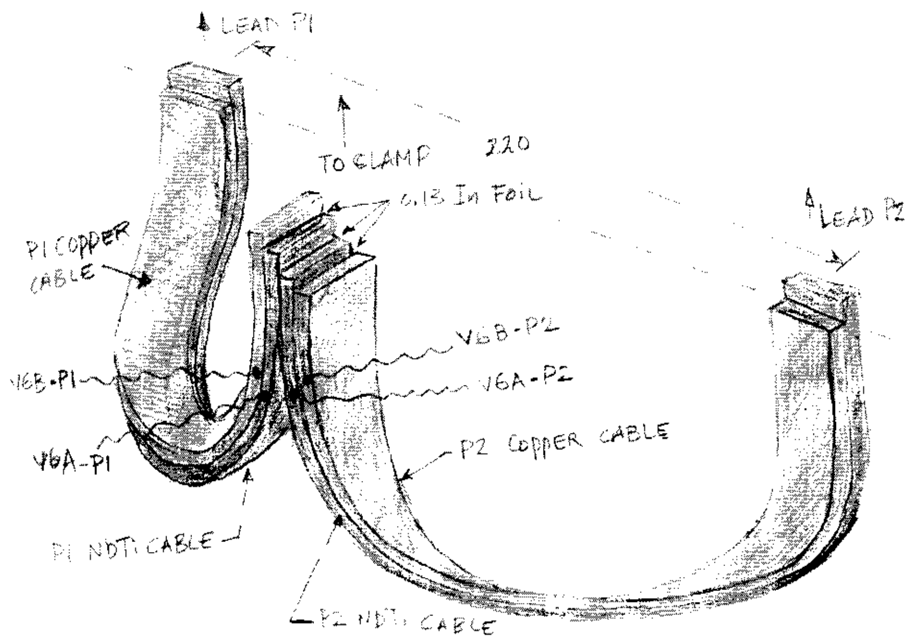


Figure 4.1b Illustration of LTS Pigtail Routing to Praying Hands Joint.

- **4.2** Attach the G-10 clamshell clamp at the bottoms of the power leads, and install the splice block support.
- **4.3** Attach the voltage tap wires labeled "V6" to the LTS cables as indicated on Figure 4.1b.
- **4.4** Insulate the conductor as needed with Kapton tape, and secure it with Kevlar string and/or G-10 support plates.
- **4.5** Install He space temperature sensors and LHe liquid level probes.
- **4.6** Adjust position of the LHe level sensor so the level can be controlled with respect to the maximum and minimum LHe levels marked on the current leads
- **4.7** Install assembly into test dewar.

5. Cooldown

- **5.1** Before cooldown, loosen the nuts on the underside of the lead plate that were tightened in 1.29 at least 0.5 mm below the top plate.
- **5.2** Complete the Stand 3 LHC-HTS Lead Testing: Pre-Cooldown Checklist.
- **5.3** Cool down the test system using the Stand 3 LHC-HTS Lead Testing: Cooldown Procedure.

FERMILAB
Technical Division

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

Lead Pair
Negative Lead: DFLX-01
Positive Lead: DFLX-02

Signed [signature] Date 02/24/03

FERMILAB Technical Division	7500A HTS Power leads for the LHC DFBX	Doc. No. Rev. No. Date:January 31, 2003 Page 1 of 4 Author: Fred Lewis
	4. 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 DAN EDDY (Name typed) Dan Eddy (Signature)

Date & time 2/26/03 11:00 A.M.

Power Lead 7500 A DFLX 02 and Power Lead 7500 A DFLX 01

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

3.1 Voltage segment and drop measurement.

Apply 10 Amps between the copper flag on Positive Lead and the copper flag on Negative Lead.

Record the applied current 10 A

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

Measure the voltages between the following pins:

Positive Lead

Voltage tap Connector 1 (Primary) (Fisher DEE104A06) ← SWITCHED POLARITY

Pin 1 - pin 2 **(160uv)** 160 uv V Pin 2 - pin 3 **(450uv)** 448uv V -461 uV

Pin 1 - pin 3 **(600uv)** 610 uv V Pin 3 - pin 4 **(480uv)** 240 uv V -250 uV

Pin 1 - pin 4 **(1.1mv)** 852 uv V Pin 4 - pin 5 **(400uv)** 3.92mv V -4.032 mV

Pin 1 - pin 5 **(1.5mv)** 4.78 mv 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)** 160uv V Pin 2 - pin 3 **(250uv)** 449uv V -460 uV

Pin 1 - pin 3 **(600uv)** 609 uv V Pin 3 - pin 4 **(480uv)** 536 uv V -551 uV

Pin 1 - pin 4 **(1.1mv)** 1.14mv V Pin 4 - pin 5 **(400uv)** 3.63mv V -3.73 mV

Pin 1 - pin 5 **(1.5mv)** 4.79 mV 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)** -160uv V Pin 2 - pin 3 **(-450uv)** -455uv V

Pin 1 - pin 3 **(-600uv)** -615uv V Pin 3 - pin 4 **(-480uv)** -479uV V

Pin 1 - pin 4 **(-1.1mv)** -1.09mv V Pin 4 - pin 5 **(-400uv)** -3.55mV V

Pin 1 - pin 5 **(-1.5mv)** -4.64mV 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)** -160uV V Pin 2 - pin 3 **(-250uv)** -450uv V

Pin 1 - pin 3 **(-600uv)** -610uV V Pin 3 - pin 4 **(-480uv)** -478uV V
Pin 1 - pin 4 **(-1.1mv)** -1.08mV V Pin 4 - pin 5 **(-400uv)** -3.55mV V
Pin 1 - pin 5 **(-1.5mv)** -4.64mV 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 to the primary of each lead
Connection 2- one vtap cable to the redundant of each lead

Connection1 (Primary)

Positive Lead Pin 1 - Negative Lead pin 5 **(800uv)** 3.74mV V
Positive Lead Pin 1 - Negative Lead pin 4 **(1.2mv)** 7.29mV V
Positive Lead Pin 1 - Negative Lead pin 3 **(1.6mv)** 7.77mV V
Positive Lead Pin 1 - Negative Lead pin 2 **(1.8mv)** 8.22mV V
Positive Lead Pin 1 - Negative Lead pin 1 **(2mv)** 8.38mV V

Connection 2 (Redundant)

Positive Lead Pin 1 - Negative Lead pin 5 **(800uv)** 3.74mV V
Positive Lead Pin 1 - Negative Lead pin 4 **(1.2mv)** 7.30mV V
Positive Lead Pin 1 - Negative Lead pin 3 **(1.6mv)** 7.77mV V
Positive Lead Pin 1 - Negative Lead pin 2 **(1.8mv)** 8.22mV V
Positive Lead Pin 1 - Negative Lead pin 1 **(2mv)** 8.38mV V

3.3 Temperature sensor resistance measurements.
3.3.1 Two wire measurement on connector 3 of Positive Lead (Fisher DEE104Z086):

Resistance between Pin 1 and pin 2 .825 Ω
Resistance between Pin 1 and pin 3 109.30 Ω
Resistance between Pin 1 and pin 4 109.29 Ω
Resistance between Pin 2 and pin 3 109.28 Ω
Resistance between Pin 2 and pin 4 109.27 Ω
Resistance between Pin 3 and pin 4 .802 Ω
Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 .808 Ω
Resistance between Pin 5 and pin 7 109.26 Ω
Resistance between Pin 5 and pin 8 109.26 Ω
Resistance between Pin 6 and pin 7 109.26 Ω
Resistance between Pin 6 and pin 8 109.27 Ω
Resistance between Pin 7 and pin 8 .804 Ω
Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 .927 Ω
Resistance between Pin 9 and pin 11 109.19 Ω
Resistance between Pin 9 and pin 12 109.20 Ω
Resistance between Pin 10 and pin 11 109.19 Ω
Resistance between Pin 10 and pin 12 109.18 Ω
Resistance between Pin 11 and pin 12 .704 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 108.47 Ω (I+ at pin 1, U+ at pin 2, I- at pin 3, U- at pin 4)
Resistance of T2 108.46 Ω (I+ at pin 5, U+ at pin 6, I- at pin 7, U- at pin 8)
Resistance of T3 108.47 Ω (I+ at pin 9, U+ at pin 10, I- at pin 11, U- at pin 12)

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

Resistance between Pin 1 and pin 2 .831 Ω
Resistance between Pin 1 and pin 3 109.29 Ω
Resistance between Pin 1 and pin 4 109.28 Ω
Resistance between Pin 2 and pin 3 109.26 Ω
Resistance between Pin 2 and pin 4 109.26 Ω
Resistance between Pin 3 and pin 4 .812 Ω
Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 .824 Ω
Resistance between Pin 5 and pin 7 109.24 Ω
Resistance between Pin 5 and pin 8 109.25 Ω
Resistance between Pin 6 and pin 7 109.25 Ω
Resistance between Pin 6 and pin 8 109.25 Ω
Resistance between Pin 7 and pin 8 .814 Ω
Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 .744 Ω
Resistance between Pin 9 and pin 11 109.23 Ω
Resistance between Pin 9 and pin 12 109.22 Ω
Resistance between Pin 10 and pin 11 109.22 Ω
Resistance between Pin 10 and pin 12 109.21 Ω
Resistance between Pin 11 and pin 12 .716 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:

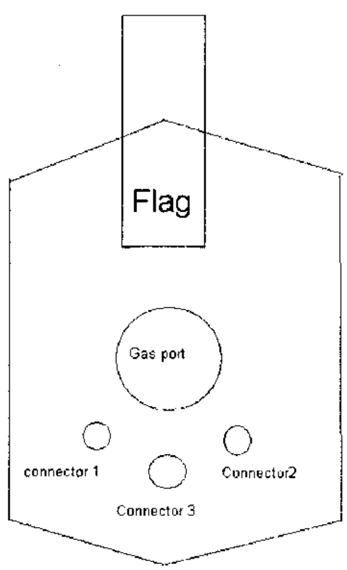
4. Room Temperature Electrical Checkout

Resistance of T1 __108.49__ Ω (I+ at pin 1, U+ at pin 2, I- at pin 3, U- at pin 4)
Resistance of T2 __108.43__ Ω (I+ at pin 5, U+ at pin 6, I- at pin 7, U- at pin 8)
Resistance of T3 __108.45__ Ω (I+ at pin 9, U+ at pin 10, I- at pin 11, U- at pin 12)

3.4 Connect all dewar rtd's and liquid level. Connect three 19-pin top plate cables labeled "dewar 0, dewar 1, and dewar inlet HE te/ll". Also connect N2 shield rtd and outlet HE rtd's(one for each lead). All of these should be read out on cryo computer. All should read room temperature that is approximately 295 K. Any problems list in space provided below:

3.5 Check the liquid level by connecting the test box into J1 of liquid level meter. As you adjust meter from 0 to 12 inches, the cryo computer liquid level should read the same. _✓_OK ___NOT OK

4.0 Using a Droege HV power supply, hi-pot the flag of the positive lead to 1000v.



Looking from the top of the lead down where the LTS cable is located.
Connector 2= Redundant, Connector 1= Primary and Connector 3= RTD.

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 3/5/2003 11:30 A.M.

Pos. Power Lead 7500 A DFLX 02 and Neg. Power Lead 7500 A DFLX 01

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 Binder.

3.1 Hi-pot the leads in a cold (4.5K-300K) He environment to 1500V (1.3 Bar) using a droege. Connect the positive to one lead and the negative to ground. **Be sure to disconnect the redundant voltage taps on both leads and the power connections (one on each lead) from kepco power supply.**

Record breakdown voltage (if any) —— V.
Record current >.1ua A.
Record approximate temp. 295 K

FERMILAB
Technical Division

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

Lead Pair

Negative Lead: DFLX01

Positive Lead: DFLX02

Signed [signature] Date APRIL 29, 2003

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: 65.2 psia

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

Final pressure: 65.2 psia

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: DFLX01

Positive Lead: DFLX02

Signed (SEE PAGE 2) Date ____________

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.

DFLX-02

Baseline: 92d X 50 scale

05.02.03

   - **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: 92d X 50 scale ≈ 3.3e-7 atm cc sec

DFLX-01

2.2 Baseline 21d X 50 scale 05.02.03

2.4 Maximum Reading 21d X 50 scale ≈ 7.7e-8 atm cc sec

C.E. Hess Jr.