DFLX - 17

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] (signature)

Date & time 1/4/2005 10.07 AM

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 17 7500 A DFLX 20
(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: 17/20
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: 17
Not tripped ☐ Tripped (Black) ☑ Remark: 20

1.4 Container content:
a. Power leads: 7500 A DFLX 17 ; 7500 A DFLX 20
b. Travel document for each lead in an envelope ☒ ~~MISSING~~ OK.
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

OTHER UNIDENTIFIED PARTS

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

DFLx 17

MM	DIM CYL -A-DIA= LOCATION OF CYLINDER CYL -A-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
D	99.000	0.200	0.200	98.789	-0.211	0.011	

MM	DIM -A-= ROUNDNESS OF CYLINDER CYL -A-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	0.000	0.200	0.000	0.051	0.051	0.000	

MM	DIM -B-= FLATNESS OF PLANE PLN -B-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	0.000	0.050	0.000	0.008	0.008	0.000	

MM	DIM PERP1= PERPEND OF PLANE PLN -B- TO CYLINDER CYL -A- EXTEND=0.000						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	0.000	0.400	0.000	0.109	0.109	0.000	

MM	DIM PERP2= PERPEND OF PLANE LRG FLANGE TO CYLINDER CYL -A- EXTEND=560.000						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	0.000	0.400	0.000	1.687	1.687	1.287	

MM	DIM -C- DIA= LOCATION OF CYLINDER -C-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
D	80.000	0.200	0.200	80.060	0.060	0.000	

MM	DIM CONCEN2=CONCENTRICITY FROM CYLINDER -C- TO CYLINDER CYL -A-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	0.000	1.000	0.000	0.694	0.694	0.000	

MM	DIM RND2= ROUNDNESS OF CYLINDER -C-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	0.000	0.200	0.000	0.054	0.054	0.000	

MM	DIM DIST1= 2D DISTANCE FROM PLANE PLN -B- TO PLANE LRG FLANGE PAR TO YAXIS						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
M	561.000	1.000	1.000	562.172	1.172	0.172	

5 HOLES IN LARGE FLANGE

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				124.263	0.692		
DF	18.000	0.200	0.200		17.982	-0.018	0.000	
TP	RFS	0.130		0.000		1.384	1.254	

MM	DIM LOC10= TRUE POSITION OF CIRCLE CIR3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	-78.890				-79.035	-0.145		
Z	95.047				95.979	0.932		
DF	18.000	0.200	0.200		17.994	-0.006	0.000	
TP	RFS	0.130		0.000		1.887	1.757	

MM	DIM LOC11= TRUE POSITION OF CIRCLE CIR4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	78.890				78.864	-0.026		
Z	95.047				95.520	0.473		
DF	18.000	0.200	0.200		17.985	-0.015	0.000	
TP	RFS	0.130		0.000		0.946	0.816	

MM	DIM LOC12= TRUE POSITION OF CIRCLE CIR5							
	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	78.890				78.282	-0.608		
Z	-95.047				-94.530	0.517		
DF	18.000	0.200	0.200		17.980	-0.020	0.000	
TP	RFS	0.130		0.000		1.596	1.466	

MM | DIM 18.00 DIA HOLE= TRUE POSITION OF CIRCLE CIR6

AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
X	-78.890				-79.631	-0.741	
Z	-95.047				-94.075	0.972	
DF	18.000	0.200	0.200		17.909	-0.091	0.000
TP	RFS	0.130		0.000		2.445	2.315

POSITION OF 16X 8.41 DIA HOLES IN LARGE FLANGE

MM | DIM 8.433 DIA HOLE #1= TRUE POSITION OF CIRCLE SH1

AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.404	-0.146	
PA	-153.000				-153.724	-0.724	
DF	8.433	0.200	0.000	0.131	8.564	0.131	0.000
TP	MMC	0.080		0.131		2.307	2.096

MM | DIM 8.433 DIA HOLE #2= TRUE POSITION OF CIRCLE SH2

AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.622	0.072	
PA	-171.000				-171.706	-0.706	
DF	8.443	0.200	0.000	0.200	8.658	0.215	0.015
TP	MMC	0.080		0.200		2.237	1.957

MM | DIM 8.433 DIA HOLE #3= TRUE POSITION OF CIRCLE SH3

AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.171	-0.379	
PA	-135.000				-135.667	-0.667	
DF	8.433	0.200	0.000	0.126	8.559	0.126	0.000
TP	MMC	0.080		0.126		2.236	2.030

MM | DIM 8.433 DIA HOLE #4= TRUE POSITION OF CIRCLE SH4

AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.948	0.398	
PA	171.000				170.384	-0.616	
DF	8.433	0.200	0.000	0.137	8.570	0.137	0.000
TP	MMC	0.080		0.137		2.108	1.891

MM | DIM 8.433 DIA HOLE #5= TRUE POSITION OF CIRCLE SH5

AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				91.129	0.579	
PA	153.000				152.485	-0.515	
DF	8.433	0.200	0.000	0.133	8.566	0.133	0.000
TP	MMC	0.080		0.133		2.001	1.787

MM | DIM 8.433 DIA HOLE #6= TRUE POSITION OF CIRCLE SH6

AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				91.270	0.720	
PA	135.000				134.602	-0.398	
DF	8.433	0.200	0.000	0.139	8.572	0.139	0.000
TP	MMC	0.080		0.139		1.916	1.697

MM | DIM 8.433 DIA HOLE #7= TRUE POSITION OF CIRCLE SH7

AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				91.376	0.826	
PA	117.000				116.770	-0.230	
DF	8.433	0.200	0.000	0.138	8.571	0.138	0.000
TP	MMC	0.080		0.138		1.807	1.589

MM | DIM 8.433 DIA HOLE #8= TRUE POSITION OF CIRCLE SH8

AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				91.330	0.780	
PA	99.000				98.931	-0.069	
DF	8.433	0.200	0.000	0.120	8.553	0.120	0.000
TP	MMC	0.080		0.120		1.576	1.376

MM | DIM 8.433 DIA HOLE #9= TRUE POSITION OF CIRCLE SH9

	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				91.210	0.660	
PA	81.000				81.092	0.092	
DF	8.433	0.200	0.000	0.108	8.541	0.108	0.000
TP	MMC	0.080		0.108		1.351	1.163

MM	DIM 8.433 DIA HOLE #10= TRUE POSITION OF CIRCLE SH10						
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				91.096	0.546	
PA	63.000				63.232	0.232	
DF	8.433	0.200	0.000	0.106	8.539	0.106	0.000
TP	MMC	0.080		0.106		1.316	1.130

MM	DIM 8.433 DIA HOLE #11= TRUE POSITION OF CIRCLE SH11						
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.876	0.326	
PA	45.000				45.299	0.299	
DF	8.433	0.200	0.000	0.104	8.537	0.104	0.000
TP	MMC	0.080		0.104		1.151	0.966

MM	DIM 8.433 DIA HOLE #12= TRUE POSITION OF CIRCLE SH12						
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.620	0.070	
PA	27.000				27.355	0.355	
DF	8.433	0.200	0.000	0.111	8.544	0.111	0.000
TP	MMC	0.080		0.111		1.132	0.940

MM	DIM 8.433 DIA HOLE #13= TRUE POSITION OF CIRCLE SH13						
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.389	-0.161	
PA	9.000				9.356	0.356	
DF	8.433	0.200	0.000		8.527	0.094	0.000
TP	RFS	0.080		0.000		1.169	1.089

MM	DIM 8.433 DIA HOLE #14= TRUE POSITION OF CIRCLE SH14						
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.089	-0.461	
PA	-9.000				-8.694	0.306	
DF	8.433	0.200	0.000	0.099	8.532	0.099	0.000
TP	MMC	0.080		0.099		1.335	1.155

MM	DIM 8.433 DIA HOLE #15= TRUE POSITION OF CIRCLE SH15						
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				89.851	-0.699	
PA	-27.000				-26.788	0.212	
DF	8.433	0.200	0.000	0.104	8.537	0.104	0.000
TP	MMC	0.080		0.104		1.548	1.364

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	1452.842	2.842	2.442

MM	DIM 130.0DIA= LOCATION OF CIRCLE OD1					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	130.000	0.200	0.200	129.914	-0.086	0.000

MM	DIM 502 COOLING HOLE= 2D DISTANCE FROM CIRCLE ID15 TO PLANE LRG FLANGE PAR TO YAXIS					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	502.000	0.400	0.400	502.636	0.636	0.236

MM	DIM X LOC OF COOLING HOLE= LOCATION OF CIRCLE ID15					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
X	0.000	1.800	1.800	-7.994	-7.994	6.194

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	-0.483	-0.483	0.383

MM	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	-0.683	-0.683	0.583

MM | DIM POLAR ANGLE OF COOLING HOLE= LOCATION OF CIRCLE ID15

AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
PA	90.000	2.000	2.000	99.208	9.208	7.208

MM | DIM 444.5= 2D DISTANCE FROM LINE FRT END TO PLANE PLN -B- PAR TO YAXIS

AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	444.500	1.500	1.500	445.142	0.642	0.000

FERMILAB Technical Division	7500A HTS Power leads for the LHC DFBX	Doc. No. Rev. No. 1 Date: August 18, 2003 Page 1 of 1 Author: Sandor Feher
	0. Cover Sheet for Check Out Form	

Power leads being tested: 7500 A DFLX 17 7500 A DFLX 18

Task #	Responsible	Task	Received Date,time		Performed Date,time	
1	Inspection	Unpack the leads			022803	
2	Inspection	IB4 mech. & Tolerances			022803	
3	Mechanical	Move the leads to MTF			022004	
4	Electrical	Initial electrical check out			032103	
4a	Mechanical	Preliminary leak check				
5	Mechanical	Installation of the current leads			040204	
6	Mechanical	Pressure test			040204	
7	Mechanical	Leak check			040504	
7a	Mechanical	Top plate insertion into the dewar			040504	
8	M. Tartaglia	Configuration of the DAQ system				
9	Electrical	Room temp. electrical test			040604	
10	Mechanical	Installation of the top plate			040604	
10.1	Electrical	Room temp. GHe hipot			040604	
12	Mechanical	Cool down			040704	
13	Electrical	Electrical & instrumentation test			040704	
14	Mechanical	Connect the leads to the Power Supply & configure			090704	
15	Electrical	Electrical & instrumentation test			040704	
16	M. Thompson	Cold test of the power lead			0945	4/7/04
17	Mechanical	Perform a Thermal cycle			1600	4/7/04
18	M. Thompson	Cold test of the power lead			N/A	
19	Mechanical	Warm up			N/A	
20	Electrical	Electrical & instrumentation test			040904	
21	Mechanical	Remove the top plate			040904	
22	Mechanical	Remove the leads from the top plate			040904	
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] (signature)

Date & time 3/18/03 9.30Am

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 17 7500 A DFLX 20
(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: 17
Not tripped ☐ Tripped (Black) ☑ Remark: 20

1.4 Container content:
a. Power leads: 7500 A DFLX 17 ; 7500 A DFLX 20
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 Clamps
2. One valve made by "precision Cryogenic System" ☑
3. One O-ring seal with brass insert ☑ 2 RINGS

(4) 2 UNIDENTIFIED PARTS IN BOX

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

75C04 OFLX 17

MM — DIM CYL -A-DIA= LOCATION OF CYLINDER CYL -A-

AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	99.000	0.200	0.200	98.771	-0.229	0.029

MM — DIM -A-= ROUNDNESS OF CYLINDER CYL -A-

AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.065	0.065	0.000

MM — DIM -B-= FLATNESS OF PLANE PLN -B-

AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.050	0.000	0.008	0.008	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	0.074	0.074	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	1.978	1.978	1.848

MM — DIM -C- DIA= LOCATION OF CYLINDER -C-

AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	80.000	0.008	0.008	79.914	-0.085	0.077

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	0.675	0.675	0.425

MM — DIM RND2= ROUNDNESS OF CYLINDER -C-

AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.115	0.115	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	561.956	0.956	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				124.309	0.738	
DF	16.000	0.200	0.200		17.989	1.989	1.789
TP	RFS	0.400		0.000		1.476	1.076

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=3/18/2003 TIME=2:51:54 PM

MM	DIM LOC10= TRUE POSITION OF CIRCLE CIR3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	-78.890				-79.042	-0.152		
Z	95.047				96.008	0.961		
DF	16.000	0.200	0.200		17.988	1.988	1.788	
TP	RFS	0.400		0.000		1.946	1.546	

MM	DIM LOC11= TRUE POSITION OF CIRCLE CIR4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	78.890				78.861	-0.029		
Z	95.047				95.572	0.525		
DF	16.000	0.200	0.200		17.987	1.987	1.787	
TP	RFS	0.400		0.000		1.052	0.652	

MM	DIM LOC12= TRUE POSITION OF CIRCLE CIR5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	78.890				78.314	-0.576		
Z	-95.047				-94.484	0.563		
DF	16.000	0.200	0.200		17.982	1.982	1.782	
TP	RFS	0.400		0.000		1.610	1.210	

MM	DIM LOC13= TRUE POSITION OF CIRCLE CIR6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
X	-78.890				-79.588	-0.698		
Z	-95.047				-94.065	0.982		
DF	16.000	0.200	0.200		17.958	1.958	1.758	
TP	RFS	0.400		0.000		2.409	2.009	

MM	DIM LOC09= TRUE POSITION OF CIRCLE ID1							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.382	-0.168		
PA	-153.000				-153.726	-0.726		
DF	8.407	0.200	0.200		8.518	0.111	0.000	
TP	RFS	0.080		0.000		2.318	2.238	

MM	DIM LOC20= TRUE POSITION OF CIRCLE ID2							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.694	0.145		
PA	-171.000				-171.708	-0.708		
DF	8.407	0.200	0.200		8.563	0.155	0.000	
TP	RFS	0.080		0.000		2.258	2.178	

MM	DIM LOC31= TRUE POSITION OF CIRCLE ID3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.146	-0.404		
PA	-135.000				-135.661	-0.661		
DF	8.407	0.200	0.200		8.524	0.116	0.000	
TP	RFS	0.080		0.000		2.235	2.155	

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01)   DATE=3/18/2003   TIME=2:51:55 PM

MM	DIM LOC1= TRUE POSITION OF CIRCLE ID4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.942	0.392		
PA	171.000				170.371	-0.629		
DF	8.407	0.200	0.200		8.569	0.162	0.000	
TP	RFS	0.080		0.000		2.142	2.062	

MM	DIM LOC2= TRUE POSITION OF CIRCLE ID5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				91.119	0.569		
PA	153.000				152.470	-0.530		
DF	8.407	0.200	0.200		8.574	0.167	0.000	
TP	RFS	0.080		0.000		2.030	1.950	

MM	DIM LOC3= TRUE POSITION OF CIRCLE ID6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				91.284	0.734		
PA	135.000				134.592	-0.408		
DF	8.407	0.200	0.200		8.554	0.146	0.000	
TP	RFS	0.080		0.000		1.958	1.878	

MM	DIM LOC4= TRUE POSITION OF CIRCLE ID7							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				91.400	0.850		
PA	117.000				116.764	-0.236		
DF	8.407	0.200	0.200		8.553	0.146	0.000	
TP	RFS	0.080		0.000		1.858	1.778	

MM	DIM LOC6= TRUE POSITION OF CIRCLE ID8							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				91.366	0.817		
PA	99.000				98.918	-0.082		
DF	8.407	0.200	0.200		8.534	0.127	0.000	
TP	RFS	0.080		0.000		1.654	1.574	

MM	DIM LOC7= TRUE POSITION OF CIRCLE ID9							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				91.253	0.704		
PA	81.000				81.091	0.091		
DF	8.407	0.200	0.200		8.539	0.131	0.000	
TP	RFS	0.080		0.000		1.437	1.357	

MM	DIM LOC8= TRUE POSITION OF CIRCLE ID10							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				91.144	0.594		
PA	63.000				63.245	0.245		
DF	8.407	0.200	0.200		8.550	0.143	0.000	
TP	RFS	0.080		0.000		1.420	1.340	

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=3/18/2003 TIME=2:51:55 PM

MM	DIM LOC14= TRUE POSITION OF CIRCLE ID11							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.919	0.369		
PA	45.000				45.319	0.319		
DF	8.407	0.200	0.200		8.561	0.153	0.000	
TP	RFS	0.080		0.000		1.251	1.171	

MM	DIM LOC15= TRUE POSITION OF CIRCLE ID12							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.660	0.110		
PA	27.000				27.371	0.371		
DF	8.407	0.200	0.200		8.565	0.158	0.000	
TP	RFS	0.080		0.000		1.194	1.114	

MM	DIM LOC16= TRUE POSITION OF CIRCLE ID13							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.407	-0.143		
PA	9.000				9.358	0.358		
DF	8.407	0.200	0.200		10.299	1.892	1.692	
TP	RFS	0.080		0.000		1.165	1.085	

MM	DIM LOC17= TRUE POSITION OF CIRCLE ID14							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				90.111	-0.438		
PA	-9.000				-8.662	0.338		
DF	8.407	0.200	0.200		8.551	0.144	0.000	
TP	RFS	0.080		0.000		1.379	1.299	

MM	DIM LOC18= TRUE POSITION OF CIRCLE ID16							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL	
PR	90.550				89.861	-0.689		
PA	-27.000				-26.753	0.247		
DF	8.407	0.200	0.200		8.552	0.145	0.000	
TP	RFS	0.080		0.000		1.582	1.502	

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	1452.718	2.718	2.318	

MM	DIM 130.0DIA= LOCATION OF CIRCLE OD1						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL	
D	130.000	0.200	0.200	129.922	-0.078	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	501.894	-0.106	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	-8.783	-8.783	8.583	

PART NUMBER=7.5 KA CURRENT LEAD ASSY (LBNL01) DATE=3/18/2003 TIME=2:51:56 PM

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	-0.593	-0.593	0.493

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	-0.026	-0.026	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	99.207	9.207	8.707

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	445.409	2.909	2.509

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 PW8 to MTF are:
7500 DFLX 17 & 7500 DFLX 20
Approved by __________ SandorFeher __________
(name typed) (signature)
Date & time __________

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

Requested by ROGER RABEHL Roger Rabehl
(name typed) (signature)
Date & time MARCH 12, 2004 ~~1130~~ 1200

Delivered by G VEZAN [signature]
(name typed) (signature)
Date & time 3/15/04 15:15

Received by __________
(name typed) (signature)
Date & time __________

The next person __________ responsible to perform Checkout form #5 (5. Installation of the current leads into the top plate) has been

Notified by __________
(name typed) (signature)
Date & time __________

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

FERMILAB Technical Division	7500A HTS Power leads for the LHC DFBX	Doc. No. Rev. No. Date:January 15, 2003 Page 1 of 2 Author: Sandor Feher
	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 3/21/03 15:00

Power Lead 7500 A DFLX 17

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)** 82 V	Pin 2 - pin 3	**(225uv)** 233 V
Pin 1 - pin 3	**(300uv)** 318 V	Pin 3 - pin 4	**(240uv)** 283 V
Pin 1 - pin 4	**(530uv)** 602 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)** 83 V		

Voltage tap Connector 2 (Redundant) (Fisher DEE104A06)

Pin 1 - pin 2	**(80uv)** 82 V	Pin 2 - pin 3	**(225uv)** 234 V
Pin 1 - pin 3	**(300uv)** 317 V	Pin 3 - pin 4	**(240`uv)** 269 V
Pin 1 - pin 4	**(530uv)** 587 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 .807 Ω
Resistance between Pin 5 and pin 7 108.6 Ω
Resistance between Pin 5 and pin 8 108.6 Ω
Resistance between Pin 6 and pin 7 108.6 Ω
Resistance between Pin 6 and pin 8 108.6 Ω
Resistance between Pin 7 and pin 8 .799 Ω
Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

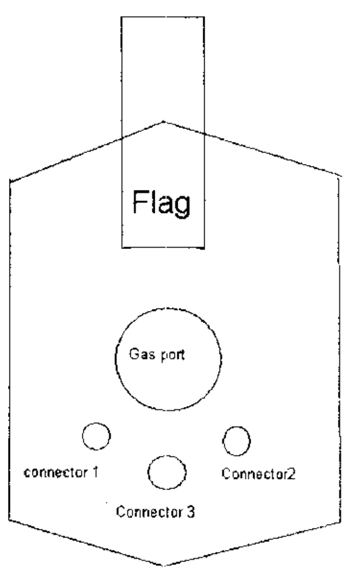
Resistance between Pin 9 and pin 10 .724 Ω
Resistance between Pin 9 and pin 11 108.6 Ω
Resistance between Pin 9 and pin 12 108.6 Ω
Resistance between Pin 10 and pin 11 108.6 Ω
Resistance between Pin 10 and pin 12 108.6 Ω
Resistance between Pin 11 and pin 12 .698 Ω
Pins 9-12 resistance to lead ______ Ω Pins 9-12 resistance to flange ______ Ω

PIN	RESISTANCE LEAD
9	2.7
10	2.5
11	110.5
12	110.4

SHORTED TO LEAD?

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 107.9 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 PPR	7500A HTS Power leads for the LHC DFBX	Doc. No. Rev. 1 (SF) Date:January 15, 2003 Page 1 of 2 Author: Fred Lewis
	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)

Date & time 2/23/2005

Power Lead 7500 A DFLX 17

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)** 90 u V Pin 2 - pin 3 **(225uv)** 262 u V
Pin 1 - pin 3 **(300uv)** 354 u V Pin 3 - pin 4 **(240uv)** 307 u V
Pin 1 - pin 4 **(530uv)** 663 u 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)** 93 u V Pin 2 - pin 3 **(225uv)** 262 u V
Pin 1 - pin 3 **(300uv)** 354 u V Pin 3 - pin 4 **(240`uv)** 301 u V
Pin 1 - pin 4 **(530uv)** 661 u 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 1.09 Ω
Resistance between Pin 1 and pin 3 108.97 Ω
Resistance between Pin 1 and pin 4 109.02 Ω
Resistance between Pin 2 and pin 3 108.91 Ω

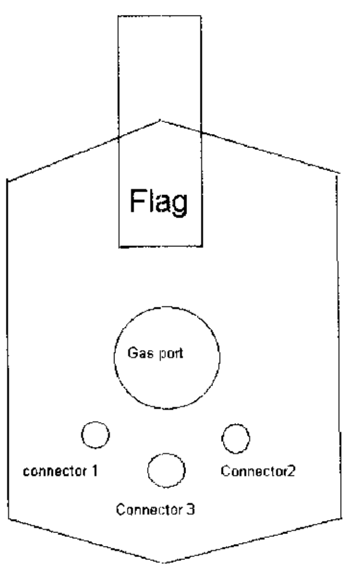
Resistance between Pin 2 and pin 4 108.95 Ω
Resistance between Pin 3 and pin 4 1.11 Ω
Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 1.02 Ω
Resistance between Pin 5 and pin 7 108.83 Ω
Resistance between Pin 5 and pin 8 108.86 Ω
Resistance between Pin 6 and pin 7 108.84 Ω
Resistance between Pin 6 and pin 8 108.87 Ω
Resistance between Pin 7 and pin 8 1.10 Ω
Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 .91 Ω
Resistance between Pin 9 and pin 11 108.80 Ω
Resistance between Pin 9 and pin 12 108.84 Ω
Resistance between Pin 10 and pin 11 108.81 Ω
Resistance between Pin 10 and pin 12 108.85 Ω
Resistance between Pin 11 and pin 12 1.01 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 107.87 Ω (I+ at pin 1, I- at pin 3, U+ at pin 2, U- at pin 4)
Resistance of T2 107.80 Ω (I+ at pin 5, I- at pin 7, U+ at pin 6, U- at pin 8)
Resistance of T3 107.86 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.
Connector 2= Redundant and Connector 1= Primary

DFLX 17

FERMILAB
Technical Division

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

Lead Pair

Negative Lead: 18

Positive Lead: 17

Signed [signature] Date 04.02.04

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.

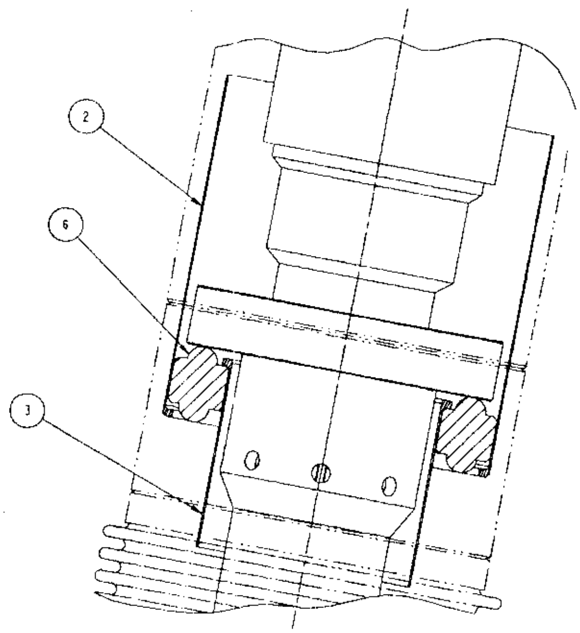


__Figure 1.3__ 2 – Upper Insulator, 3 – Lower Insulator, 6 – PEEK Seal

1.6 Attach the lifting/insertion tool to the lead flag as shown in Figure 1.6 and lift the lead from the steel table where the preliminary leak check was performed.

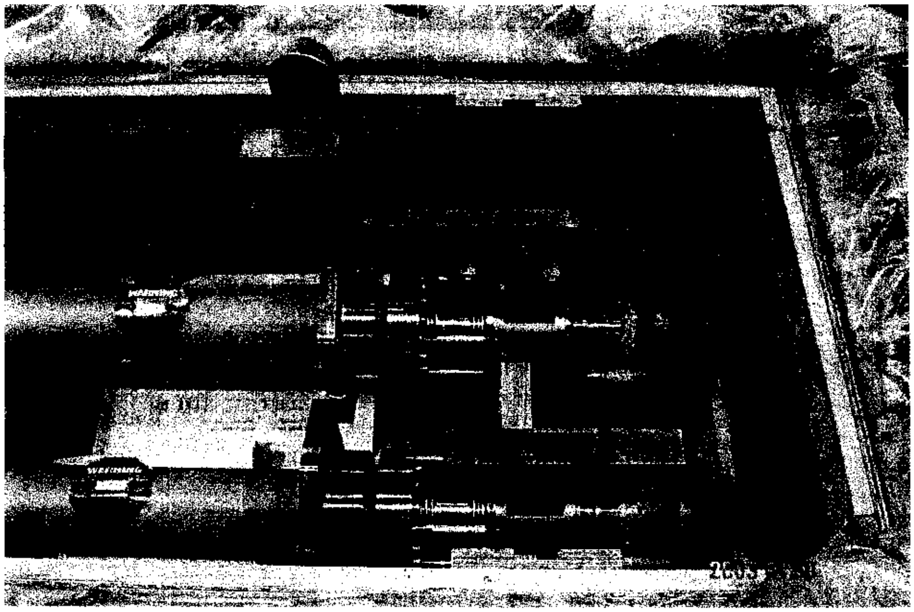


Figure 1.6 The lifting/insertion tool bolted to a power lead.

1.7 Remove the rubber gasket and PVC clamshells 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 Prepare to install the power lead baffle by removing the short threaded rods to open the baffle.
1.11 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 1.11.

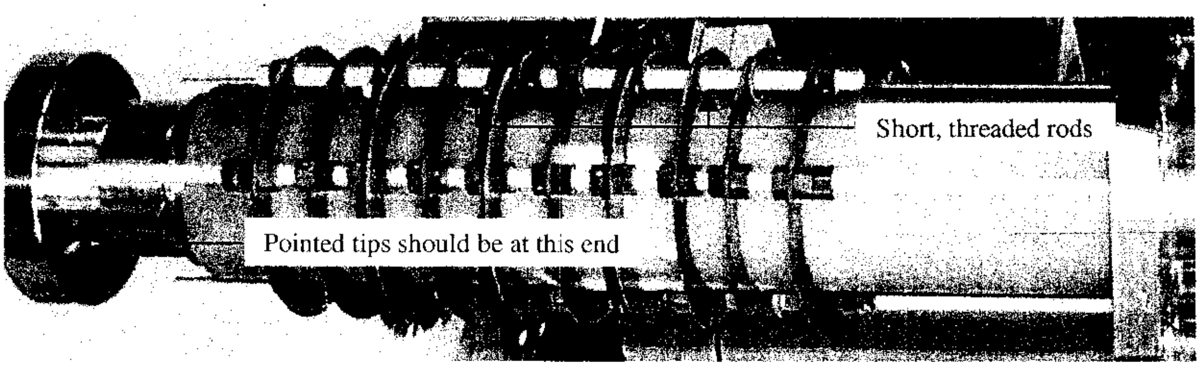


Figure 1.11 A baffle installed on a power lead.

1.12 Clamp the end support around the lower flange so that the handles will rest on the backs of the C-channels clamped to the steel table.
1.13 Set the lead between the C-channels on the steel table.
1.14 Clean the top plate Conflat flange knife edge and copper gasket. Install the gasket on the top plate Conflat flange.

Negative Lead DFLX 18 Positive Lead DFLX 17

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.

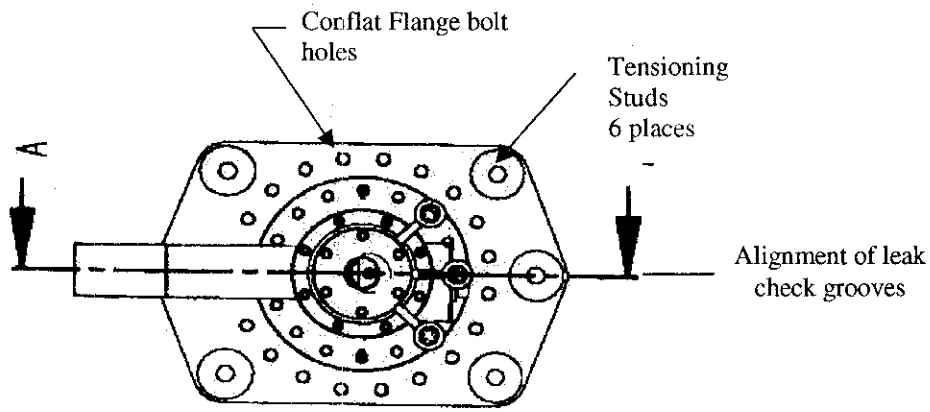


Figure 1.15 The 20-hole Conflat bolt pattern is bisected by center tensioning studs.

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.

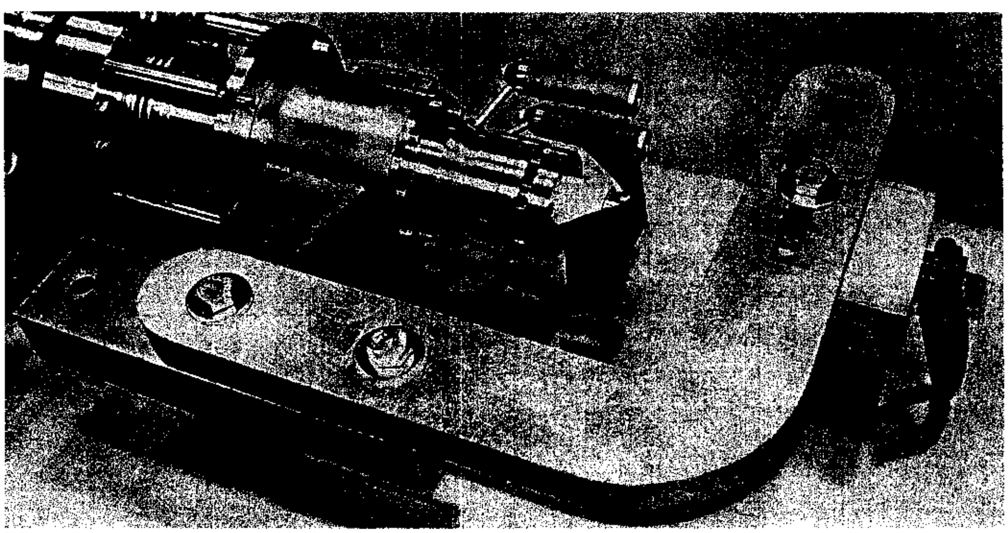


Figure 1.17 The lifting/insertion tool in position to lift the power lead into a vertical position.

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.

Negative Lead DFLX 18 Positive Lead DFLX 17

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.

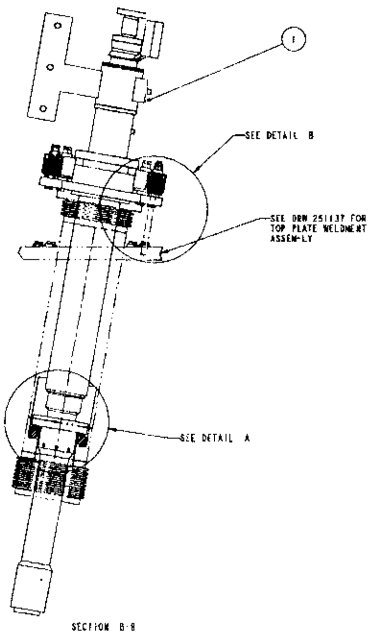


Figure 1.21a HTS Lead in Test Chimney. Note: CERN chimneys do not have bellows.

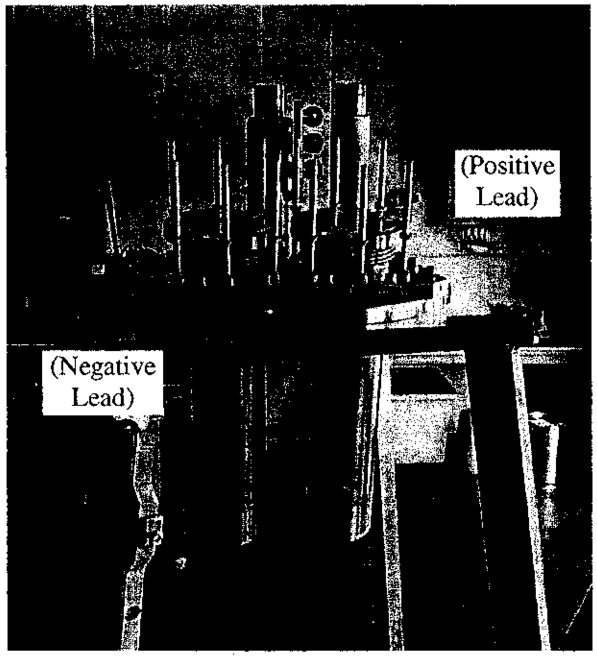


Figure 1.21b Locations of the negative and positive leads.

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

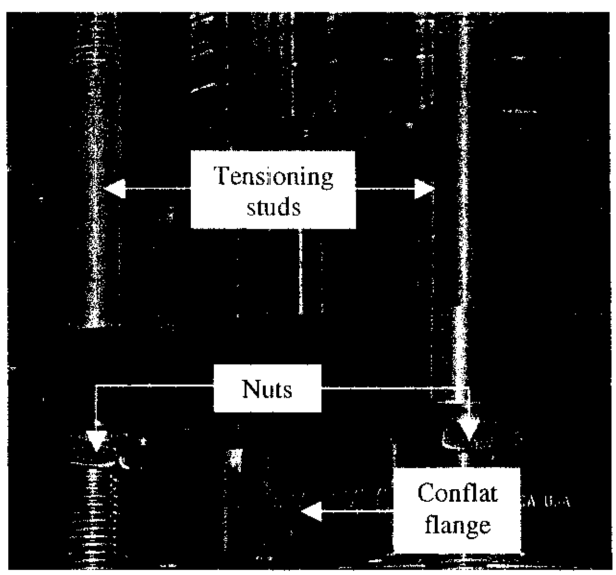


Figure 1.22 The positions of the tensioning studs, nuts, and top plate Conflat flange as the 20 Conflat bolts are tightened.

Negative Lead DFLX 18 Positive Lead DFLX 17

1.23 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 1.23.

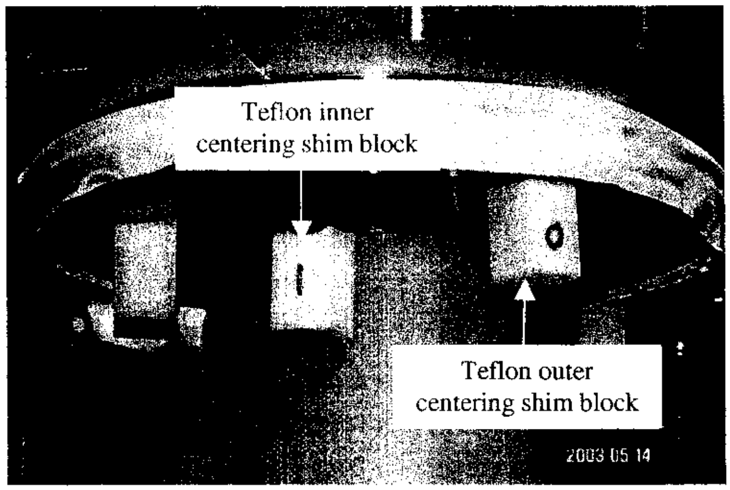


Figure 1.23 The installed Teflon centering shim blocks.

1.24 On the power lead flange, number the Conflat bolt holes 1 through 20 as indicated by Figure 1.24.

1.25 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.

1.26 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. 1.24.

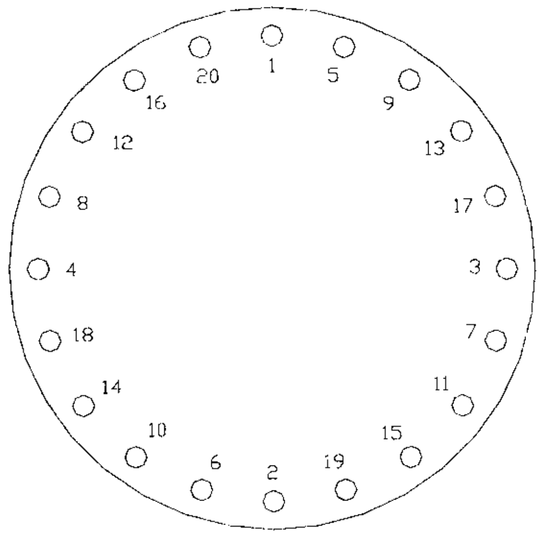


Figure 1.24 Tightening sequence for the 20 Conflat bolts.

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

1.28 Install Belleville Washer Assemblies on each tensioning stud per Figures 1.28a and 1.28b. 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.

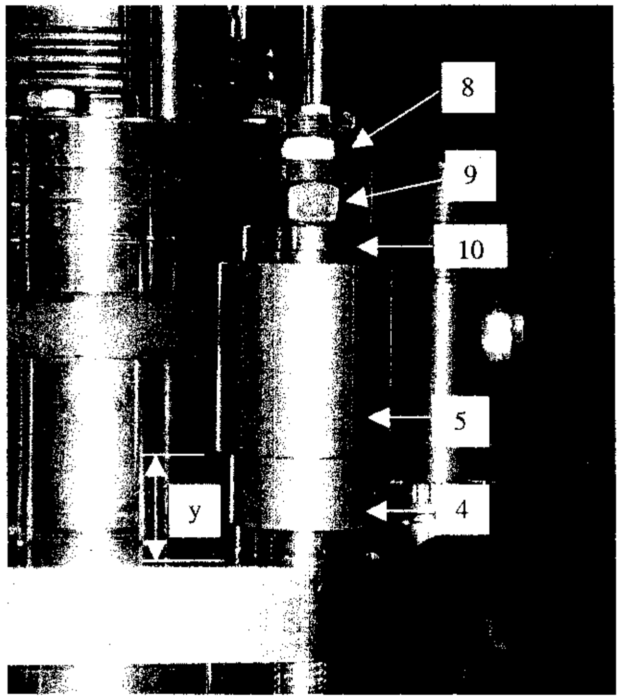


Figure 1.28a An installed Belleville Washer Assembly.

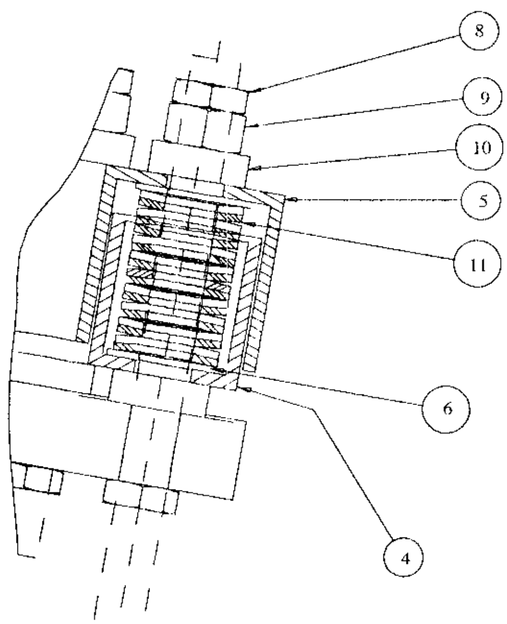


Figure 1.28b An installed Belleville Washer Assembly.

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

1.29.1 Washers for Lead **DFLX** 17

Negative Lead DFLX 15 Positive Lead DFLX 17

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

1.29.1.2 Tighten the 6 loading nuts finger-tight. With adjustable parallels, measure and record the gap "y" indicated in Figure 1.28a between Item 5 and the current lead top flange at the 6 locations specified in Figure 1.29.1.5. Units are mm.

A 24.44 B 24.30 C 24.08 D 24.05 E 24.31 F 23.85

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

A 22.64 B 22.50 C 22.28 D 22.25 E 22.51 F 22.05

1.29.1.4 Using the sequence A through F in Figure 1.29.1.5, 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 ____

Negative Lead DFLX 18 Positive Lead DFLX 17

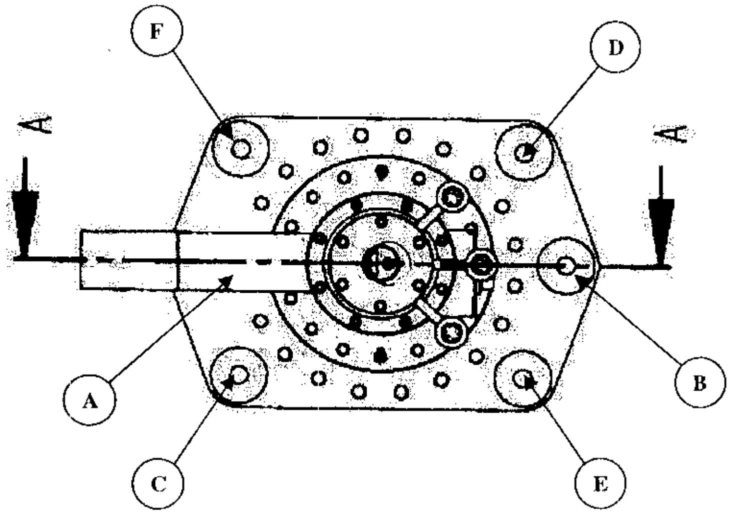


Figure 1.29.1.5 The specified sequence for tightening the Belleville Washer Assemblies.

1.29.1.5 Remove the adjustable parallels from under each Belleville washer assembly, then replace them and measure the final gaps 'y' in Figure 1.28a. Units are mm.

A 22.67 B 22.49 C 22.24 D 22.23 E 22.41 F 22.05

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

1.29.2 Washers for Lead **DFLX** 18

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

1.29.2.2 Tighten the 6 loading nuts finger-tight. With adjustable parallels, measure and record the gap "y" indicated in Figure 1.28a between Item 5 and the current lead top flange at the 6 locations specified in Figure 1.29.1.5. Units are mm.

A 24.21 B 24.30 C 23.86 D 23.87 E 24.17 F 23.96

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

A 24 41 B 22.56 C 22.00 D 22.07 E 32.37 F 22.16

1.29.2.4 Using the sequence A through F in Figure 1.29.1.5, 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 ✓

Negative Lead DFLX 18 Positive Lead DFLX 17

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 ______

1.29.2.5 Record the final measured gaps 'y' in Figure 1.28a. Units are mm.

A 22.36 B 22.48 C 22.02 D 21.99 E 22.27 F 22.05

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

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

1.31 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, "7500 A HTS Power Leads for the LHC DFBX: 6. Pressure Test Procedure."

3. Leak Check

3.1 Follow the procedure specified in the document entitled, "7500 A HTS Power Leads for the LHC DFBX: 7. Leak Check Procedure."

4. Electrical Integration of Current Leads in Test Facility

4.1 Attach the G-10 clamshell clamp at the bottoms of the power leads, and install the clamp support.

4.2 Clean the LTS pigtails with alcohol.

4.3 Make connection to LTS pigtails. The joint is a mechanical connection with a stainless steel clamp block (supplied by LBNL) and indium foil between the cables to ensure good electrical contact. Torque each of the clamp block fasteners to **10 ft-lbf**. Figure 4.3a shows a rendition of the installed power leads. Figure 4.3b shows the G-10 clamshell clamp, the clamp support, and the mechanical clamp.

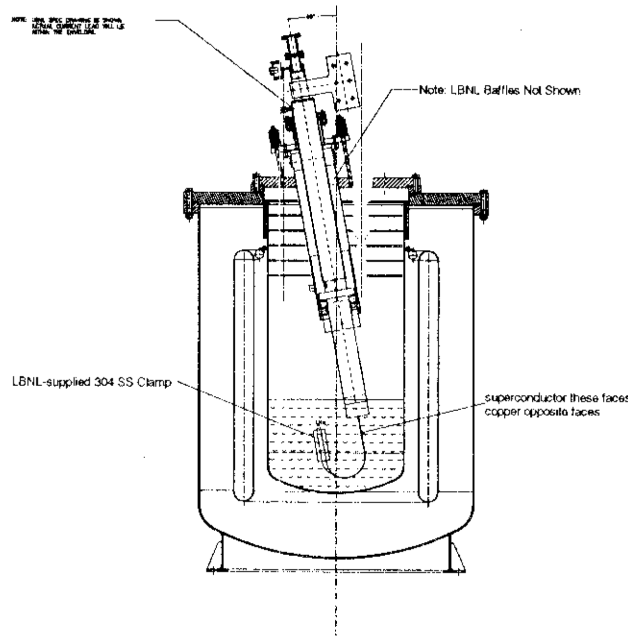


Figure 4.3a Side View of Lead in Cryostat with the LTS cables connected.

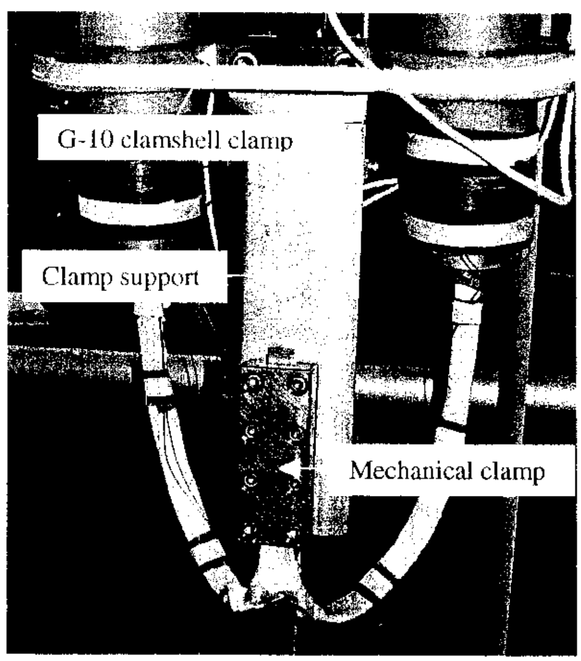


Figure 4.3b Electrical integration of the LTS sections.

Negative Lead DFLX 18 ________ Positive Lead DFLX 17 ________

4.4 Clamp a piece of bus wire and a small amount of indium to the LTS cable. Solder the two V5 voltage tap wires to the bus wire. Wind excess voltage tap wire around the bottom of the lead, securing it with Kapton and glass tape.

4.5 Insulate the superconducting cable with Kapton and glass tape.

4.6 Install He space temperature sensors and LHe liquid level probes.

4.7 Install the bottom fill tube.

4.8 Bolt the heaters to each power lead. Use grease at the interface to improve the thermal contact between the heater and power lead.

4.9 Measure and record dimensions required for the insert map.

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

Lead Pair

Negative Lead: 18

Positive Lead: 17

Signed C.P. Hess Jr. Date 04.05.04

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.

62.3D X50

Baseline: 7.83e-7 atm cc sec⁻¹

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: 7.81e-7 atm cc sec⁻¹ 62.0D X50

Negative Lead DFLX 18 Positive Lead DFLX 17

FERMILAB
Technical Division

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

Lead Pair

Negative Lead: __________

Positive Lead: __________

Signed ____ Date ________________

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: 65.6 psig

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

     Final pressure: 65.5

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.

10:39

10:48

Negative Lead DFLX 18 Positive Lead DFLX 17

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Technical Division

7500 A HTS Power Leads for the LHC DFBX: 7a. Top Plate Insertion into the Dewar

Lead Pair

Negative Lead: 18

Positive Lead: 17

Signed C.E. Haas Jr Date 04.05.04

✓ 1. Grease and install an o-ring on the top flange of the dewar extension.

✓ 2. Remove the 10 degree blocks from under the top plate.

✓ 3. Lift the top plate and insert from the roll-around cart and set them onto the dewar extension. The leads must be on the south side of the test dewar.

✓ 4. Install a power lead vent stack on each power lead, keeping in mind the orientation of the vent line.

✓ 5. Verify that the heaters are bolted to the power leads.

Negative Lead DFLX 18 Positive Lead DFLX 17

9. 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 W
(Name typed) (Signature)

Date & time 4-6-04

Pos. Power Lead 7500 A DFLX 17 and Neg. Power Lead 7500 A DFLX 18

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

1.0 Before beginning checkout, be sure that the following is done:

Make sure all of the 4-pin circular Hypertronic connectors inside dewar have been connected and taped up with fiberglass tape.
Cool down and check pos and neg lead heaters. ~1ohm
Install positive and negative lead heaters.
Be sure to apply thermal compound on the back of heaters before attaching to leads.
Attach primary and redundant labels to the fisher connector assembly on each lead

Primary = Left Redundant=Right

2.0 Voltage drop measurement for Vtap & flag cables.

2.1 Connect Kepco power supply cable to the LHC power leads. This is the gray two-conductor cable (black to negative lead and clear to positive lead).
2.2 Connect before and After Flags ring terminals to both leads.
2.3 Configure the Kepco distribution box on the Stand 4 platform to power the LHC power leads (jumper should be in the Checkout power/Stand-3 Power leads position).
2.4 Turn on Kepco power supply and set the output for 10 amps. (5v on HP meter=10 amps)
2.5 Connect stand 3 trim current cable to shunt current monitor above the Kepco power supply.
2.6 Log into cryo computer (left computer at Stand 3). Password is: ScMagsRU
NOTE: Be sure that Mike T has rebooted the system and scans are active or values will not show

2.7 Bring up a terminal and type the following to bring up the numerical display
ssh mdtf34
The password is: ScMagsRU (can also rlogin mdtf24)
You should be in the directory mdtf34: home/mdtf34/cryo
Type the command: numdisp –n mtfvx27&
(numeric display on mtfuz27 shows up)
Click on chooser
Click the File button on numeric display.
Then choose Load setup
Enlarge window
In **directories**, double click: home/mdtf34/cryo/Setups and then home/mdtf34/cryo/Setups/Stand3
After you are in the Stand3 directory, under **Files**: double click LHC02_Dvm_CheckoutVariables.numdisp_setup
This will bring up a preset display with the trim current and all Stand 3 RTD's
You won't need to check the RTD's until later in checkout.
Record the applied current(trim)___10___A (Should be approx. 10A)
2.8 Connect both primary and redundant Vtap cables to positive and negative leads.
2.9 Remove the four primary and redundant Vtap cables from the back of the Vtap distribution box (these cables are located on the right side).
2.10 Using the dual 8-pin breakout box, connect the cables as per the following instructions:
2.11 Use HP3457 DVM, set it to 40-line cycle integration time.

~~**Positive Lead** (single cable test)~~
Voltage tap Connector 1 (**Primary**)

Pin 1 - pin 2	**(160uv)**	160.5u V	Pin 2 - pin 3	**(450uv)**	457u V
Pin 1 - pin 3	**(610uv)**	619u V	Pin 3 - pin 4	**(480uv)**	537u V
Pin 1 - pin 4	**(1.1mv)**	1.158m V	Pin 4 - pin 5	**(3.5mv)**	3.481m V
Pin 1 - pin 5	**(4.7mv)**	4.637m V	Pin 5 - pin 6	**(float)**	-4.467m V
Pin 1 - pin 6	**(float)**	167u V	Pin 6 – pin 7	**(float)**	-570.1u V
Pin 1 - pin 7	**(-20uv)**	-405u V	Pin 7 – pin 8	**(0v)**	-509u V
Pin 1 - pin 8	**(-20uv)**	-458u V			

Voltage tap Connector 2 (**Redundant**)

Pin 1 - pin 2	**(160uv)**	160.3u V	Pin 2 - pin 3	**(450uv)**	452u V
Pin 1 - pin 3	**(610uv)**	614.2u V	Pin 3 - pin 4	**(480uv)**	522u V
Pin 1 - pin 4	**(1.1mv)**	1.140m V	Pin 4 - pin 5	**(3.5mv)**	3.491m V
Pin 1 - pin 5	**(4.7mv)**	4.633m V	Pin 5 - pin 6	**(float)**	— V
Pin 1 - pin 6	**(float)**	— V			

DFLX ______ DFLX ______

Negative Lead (single cable test)

Voltage tap Connector 1 (**Primary**)

Pin 1 - pin 2 **(-160uv)** -159.7u V Pin 2 - pin 3 **(-450uv)** -443u V
Pin 1 - pin 3 **(-600uv)** -601.5u V Pin 3 - pin 4 **(-480uv)** -541u V
Pin 1 - pin 4 **(-1.1mv)** -1.141m V Pin 4 - pin 5 **(-3.5mv)** -3.302m V
Pin 1 - pin 5 **(-4.7mv)** -4.442m V Pin 5 - pin 6 **(float)** — V
Pin 1 - pin 6 **(float)** — V Pin 6 – pin 7 **(float)** — V
Pin 1 - pin 7 **(+20uv)** 269u V Pin 7 – pin 8 **(0v)** 41u V
Pin 1 - pin 8 **(+20uv)** 312u V

Voltage tap Connector 2 (**Redundant**)

Pin 1 - pin 2 **(-160uv)** -160.3u V Pin 2 - pin 3 **(-450uv)** -449u V
Pin 1 - pin 3 **(-600uv)** -608u V Pin 3 - pin 4 **(-480uv)** -553u V
Pin 1 - pin 4 **(-1.1mv)** -1.139m V Pin 4 - pin 5 **(-3.5mv)** -3.304m V
Pin 1 - pin 5 **(-4.7mv)** -4.442m V Pin 5 - pin 6 **(float)** — V
Pin 1 - pin 6 **(float)** — V

Connection 1 (**Primary**) (dual cable test)

Positive Lead Pin 1 - Negative Lead pin 5 **(3.7mv)** 3.449m V
Positive Lead Pin 1 - Negative Lead pin 4 **(7.3mv)** 6.749m V
Positive Lead Pin 1 - Negative Lead pin 3 **(7.7mv)** 7.287m V
Positive Lead Pin 1 - Negative Lead pin 2 **(8.2mv)** 7.729m V
Positive Lead Pin 1 - Negative Lead pin 1 **(8.3mv)** 7.887m V

Connection 2 (**Redundant**) (dual cable test)

Positive Lead Pin 1 - Negative Lead pin 5 **(3.7mv)** 3.446m V
Positive Lead Pin 1 - Negative Lead pin 4 **(7.3mv)** 6.748m V
Positive Lead Pin 1 - Negative Lead pin 3 **(7.7mv)** 7.278m V
Positive Lead Pin 1 - Negative Lead pin 2 **(8.2mv)** 7.727m V
Positive Lead Pin 1 - Negative Lead pin 1 **(8.3mv)** 7.885m V

2.12 When finished taking voltage measurements reconnect the Vtap cables on back of the Vtap Distribution box.

3.1 Check QC Signals through the Cryo Computer.

3.2 Setup Kepco for +/- 10Amps. Set function generator for square wave. You should see current go from +10A to –10A. Frequency should be set at .01 (approx. 100 seconds).

DFLX ______ DFLX ______

9. Room Temperature Electrical Checkout

3.3 Bring up a new terminal and type the command: numdisp –n mtfvx1a
(numeric display on mtfuz1a shows up)
Click on chooser
Click the File button on numeric display.
Then choose Load setup
Enlarge window
In **directories**, double click: home/mdtf34/cryo/Setups and then home/mdtf34/cryo/Setups/Stand3
Then double click: LHC02_FVT_VOLTAGES.numdisp_setup
Select the Print Button on the numeric display on mtfuz1a window and staple the

3.4 Printout to the back of this checkout form.

Check QC POS and NEG Vtaps to the below

FVT NEGVOLTAGES	+10A	-10A
H3_VoTapNegCu_V1V2M_1 (-160uv) -----	61uV	374uV
H3_VoTapNegHtsBotV3V4M_1 (-480uv) -----	-440uV	621uV
H3_VoTapNegHtsLtsV2V5M_1 (-4.45mv) -----	-4.11mV	4.4mV
H3_VoTapNegHts_V2V4M_1 (-950uv) -----	-910uV	1.02mV
H3_VoTapNegLts_V4V5M_1 (-3.5mV) -----	-3.23mV	3.36mV

FVT POSVOLTAGES	+10A	-10A
H3_VoTapPosCu_V1V2M_1 (160uv) -----	396uV	76uV
H3_VoTapPosHtsBotV3V4M_1 (480uv) -----	644uV	-431uV
H3_VoTapPosHtsLtsV2V5M_1 (4.45mv) -----	4.65mV	-4.28mV
H3_VoTapPosHts_V2V4M_1 (950uv) -----	1.02uV	-974uV
H3_VoTapPosLts_V4V5M_1 (3.5mV) -----	3.62mV	-3.31mV

3.5 Return Kepco to +10Amps.

4.0 Voltage Drop measurements for QC & QD Cables

4.1 Connect QC POS LEAD & QC NEG LEAD Connectors on Stand 4 platform Quench Management Vtap Box to the breakout box.
4.2 Use a 3457 DVM to check the voltages on specified pins.

QC POS LEAD (+VTAP QC RR STN3 DBOX +VTAP QC STN4 QMBOX)

Pin 1 - pin 2 **(160uv)** 158u V (V1-V2)
Pin 3 - pin 4 **(950uv)** 947u V (V2-V4)
Pin 5 - pin 6 **(480uv)** 538u V (V3-V4)
Pin 7 - pin 8 **(3.5mv)** 3.48m V (V4-V5)

DFLX ______ DFLX ______

QC NEG LEAD

Pin 1 - pin 2 **(-160uv)** -159u V (V1-V2)
Pin 3 - pin 4 **(-950uv)** -980u V (V2-V4)
Pin 5 - pin 6 **(-480uv)** -548u V (V3-V4)
Pin 7 - pin 8 **(-3.5mv)** -3.30 m V (V4-V5)

Restore QC cables

4.3 Connect QD POS LEAD & QD NEG LEAD Connectors on Stand 4 platform Quench Management Vtap Box to the breakout box.
4.4 Use a 3457 DVM to check the voltages on specified pins.

QD POS LEAD (+VTAP QD RR STN3 DBOX +VTAP QD STN4 QMBOX)

Pin 1 - pin 2 **(4.61mv)** 5.03 m V (flag-V5)
Pin 3 - pin 4 **(4.45mv)** 4.47m V (V2-V5)
Pin 5 - pin 6 **(float)** -.4u V (shorted)
Pin 7 - pin 8 **(3.5mv)** 3.48m V (V4-V5)

QD NEG LEAD

Pin 1 - pin 2 **(-4.61mv)** -4.71m V (flag-V5)
~~Pin 3 - pin 4 **(-4.45mv)** -4.28mV (V2-V5)~~
Pin 5 - pin 6 **(float)** -.4u V (shorted)
Pin 7 - pin 8 **(-3.5mv)** -3.30mV (V4-V5)

Restore QD cables

4.5 When voltage measurements are complete, turn off kepco power supply and disconnect kepco power cable on positive and negative LHC power leads. Disconnect the before and After Flags.

5.0 RTD resistance measurements.

5.1 Using the special RTD test cable (cable should be located in the bottom of the rack for Stand 3), use the standard blue breakout box (box should be in the breakout box cabinet), connect it to each LEADS RTD connectors. This is the connector between the primary and redundant Vtap connectors. Each RTD connector connect to 3 sets of RTDs. The LHC lead RTD's are
5.2 511-3, 512-3, 509-3A, 509-3B, 510-3A, and 510-3B.
5.3 Using a hand-held meter, perform a two-wire measurement on connector #3 of Positive Lead

Resistance between Pin 1 and pin 2 (.800) .644 Ω
Resistance between Pin 1 and pin 3 (109) 109.3 Ω
Resistance between Pin 1 and pin 4 (109) 109.3 Ω
Resistance between Pin 2 and pin 3 (109) 109.3 Ω
Resistance between Pin 2 and pin 4 (109) 109.3 Ω
Resistance between Pin 3 and pin 4 (.800) .621 Ω

510-3P Pins 1-4 resistance to lead **(infinite)** ∞ Ω
Pins 1-4 resistance to ground **(infinite)** ∞ Ω

Resistance between Pin 5 and pin 6 (.800) .630 Ω
Resistance between Pin 5 and pin 7 (109) 109.2 Ω
Resistance between Pin 5 and pin 8 (109) 109.2 Ω
Resistance between Pin 6 and pin 7 (109) 109.2 Ω
Resistance between Pin 6 and pin 8 (109) 109.2 Ω
Resistance between Pin 7 and pin 8 (.800) .622 Ω

510-3B Pins 5-8 resistance to lead **(infinite)** 7,8 109.5 Ω 5,6 .652 Ω
+ LEAD Pins 5-8 resistance to ground **(infinite)** ∞ Ω

Resistance between Pin 9 and pin 10 (.800) .560 Ω
Resistance between Pin 9 and pin 11 (109) 109.3 Ω
Resistance between Pin 9 and pin 12 (109) 109.3 Ω
Resistance between Pin 10 and pin 11 (109) 109.3 Ω
Resistance between Pin 10 and pin 12 (109) 109.3 Ω
Resistance between Pin 11 and pin 12 (.800) .531 Ω

512-3 Pins 9-12 resistance to lead **(infinite)** ∞ Ω
Pins 9-12 resistance to ground **(infinite)** ∞ Ω

5.4 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) ok
Resistance of T2 108.6 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)

DFLX ______ DFLX ______

9. Room Temperature Electrical Checkout

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

Resistance between Pin 1 ok and pin 2 (.800) .667 Ω
Resistance between Pin 1 ok and pin 3 (109) 109.3 Ω
Resistance between Pin 1 ok and pin 4 (109) 109.3 Ω
Resistance between Pin 2 and pin 3 (109) 109.2 Ω
Resistance between Pin 2 and pin 4 (109) 109.2 Ω
Resistance between Pin 3 and pin 4 (.800) .618 Ω

509-3A Pins 1-4 resistance to lead **(infinite)** ∞ Ω
Pins 1-4 resistance to ground **(infinite)** ∞ Ω

Resistance between Pin 5 and pin 6 (.800) .639 Ω
Resistance between Pin 5 and pin 7 (109) 109.3 Ω
Resistance between Pin 5 and pin 8 (109) 109.3 Ω
Resistance between Pin 6 and pin 7 (109) 109.3 Ω
Resistance between Pin 6 and pin 8 (109) 109.3 Ω
Resistance between Pin 7 and pin 8 (.800) .625 Ω

509-3B Pins 5-8 resistance to lead **(infinite)** ∞ Ω
Pins 5-8 resistance to ground **(infinite)** ∞ Ω

Resistance between Pin 9 and pin 10 (.800) .552 Ω
Resistance between Pin 9 and pin 11 (109) 109.3 Ω
Resistance between Pin 9 and pin 12 (109) 109.3 Ω
Resistance between Pin 10 and pin 11 (109) 109.3 Ω
Resistance between Pin 10 and pin 12 (109) 109.3 Ω
Resistance between Pin 11 and pin 12 (.800) .523 Ω

511-3 Pins 9-12 resistance to lead **(infinite)** ∞ Ω
Pins 9-12 resistance to ground **(infinite)** ∞ Ω

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

Resistance of T1 108.6 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)

DFLX ______ DFLX ______

5.7 **Check remaining RTDs**
Connect the following cables

Connect four-pin N2 shield
594-3
Connect four-pin outlet HE for each lead
513-3, 514-3
Connect cables for three 19-pin top plate connectors
dewar 0, dewar 1, dewar inlet HE te/ll

All Stand 3 RTD's can be read out on the numeric display that was opened earlier in the checkout. Be sure that Mike T has rebooted the system and scans are active. Check that all Temps for the RTDs read approximately 295K on all channels below.

507-3A ✓, 507-3B X ✓, 509-3A ✓, 509-3B ✓, 510-3A ✓, 510-3B ✓, 511-3 ✓,
512-3 ✓, 513-3 ✓, 514-3 ✓, 515-3 ✓, 516-3 ✓, 526-3 ✓, 530-3 X, 531-3 X,
532-3 X, 533-3 X, 534-3 X, 535-3 X, 594-3 ✓

5.8 TE 507-3B doesn't always read the correct temp; the display will have 507-3B's resistance. It should read approx. 60 Ω.
To exit click Exit.

5.9 Check all three liquid levels probes (12", 30", and 36").
The 12" liquid level is connected to pins 9-12 of "dewar inlet HE te/ll" cable.
~~Connect 4-pin cable on 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.

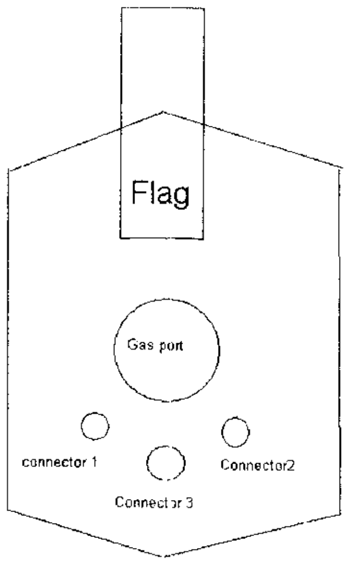
Using a breakout box measure the resistance of each probe on J1:

1. pin1(red) to pin 8(blue) — should be approx. 5 Ω
2. pin 8(blue) to pin 6(yellow) — should be approx. (13.75 X active length of probe) 165 Ω for 12" and 412.5 Ω for 30"
3. pin 6(yellow) to pin 7(black) — should be something less than 5 Ω
4. pin 1(red) to pin 7(black) — should approximately equal resistance from #2 + #1

5.10 Do a 4-Wire resistance measurement:
12" Dewar 168.6 30" Dewar 403.5 30" Phase sep. 404.1

	12" Dewar	30"Dewar	30" Phase sep
1.1(red) to 8(blue)	6.5	6.4	7.0
2. 8(blue) to 6(yellow)	166.0	404.6	406.1
3. 6(yellow) to 7(black)	2.5	1.2	2.0
4. 1(red) to 7(black)	170.6	409.7	411.0

DFLX ______ DFLX ______



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: After checkout is complete, be sure to set up kepco with function generator for +/- 10 amps and then turn off. Cryo techs will turn on when they begin cool down.

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).

DFLX ______ DFLX ______

FERMILAB
Technical Division

7500 A HTS Power Leads for the LHC DFBX:
10. Installation of the Top Plate

Lead Pair
Negative Lead: 18
Positive Lead: 17

Signed C.E. Hess Jr. **Date** 04.06.04

✓ **1.** Install all bolts to fasten the top plate to the dewar extension.

✓ **2.** Loosen the tensioning rod nuts on the undersides of the lead plates at least 0.5 mm below the lead plate.

✓ **3.** Install the transfer lines for maintaining the test dewar liquid level.

✓ **4.** Install the transfer lines supplying the 4-20 K circuit.

✓ **5.** Install the test dewar flexible vent line.

✓ **6.** Connect the vent lines (thermally insulated, non-conductive hoses) to the power lead vent stacks.

✓ **7.** Connect the lines labeled "+ LD PDT L" and "- LD PDT L" to the positive and negative lead vent stacks, respectively. These lines connect to the low side of the differential pressure transducers.

✓ **8.** Connect the lines labeled "+ LD PDT H" and "- LD PDT H" at the 4-20 K female bayonet vacuum jacket. These lines connect to the high side of the differential pressure transducers.

✓ **9.** Connect the power leads' warm gas supply line to the 4-20 K transfer line.

✓ **10.** Connect one end of the bypass line at the phase separator and the other end at the vent piping.

Negative Lead DFLX 18 Positive Lead DFLX 17

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	10.1 Warm Temp Hi-pot In Gasous 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 Dan W
(Name typed) (Signature)

Date & time 4/6/04 4/7/04

Pos. Power Lead 7500 A DFLX 17 and Neg. Power Lead 7500 A DFLX 18

This hi-pot should be performed after dewar has been filled with gaseous helium. 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.

1.0 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. — V 5103B Shorted
Record current .01 u A -LEAD .01 A +LEAD

1.2 Hi-pot the leads in a gaseous 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 all voltage tap cables on both leads and the power connections from Kepco power supply.**

Record breakdown voltage (if any) — V.
Record current .04 u A.
Record approximate temp. 295 K. (Record Temp of TI532-3)
Record approximate test dewar pressure 16.8 PSIA.

NOTE: After checkout is complete, be sure to set up kepco with function generator for +/- 10 amps and then turn off. Cryo techs will turn on when they begin cool down. Also reconnect Vtaps and RTDs when finished.

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).

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

Lead Pair

Negative Lead: DFLX 18

Positive Lead: DFLX 17

Signed ______________________ Date 04/07/04

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

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

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

Negative Lead DFLX 18 Positive Lead DFLX 17

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 Dan W
(Name typed) (Signature)

Date & time 4/7/04

Pos. Power Lead 7500 A DFLX 17 and Neg. Power Lead 7500 A DFLX 18

This hi-pot should be performed after dewar has been filled with liquid helium. 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.

1.1 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. 510-3B was removed for this
Record current .01 n A

1.2 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) — V.
Record current 10 u A.
Record approximate temp. 4.2 K. (Record Temp of TI532-3)
Record approximate test dewar pressure 14.5 PSIA.

NOTE: Reconnect Vtaps and RTDs when finished.

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7500 A HTS Power Leads for the LHC DFBX: 14. Connect the Leads to the Power Supply & Configure

Lead Pair

Negative Lead: DFLX 18

Positive Lead: DFLX 17

Signed Roger Rabehl Date 4/7/04

1. Bus Connection Changes – VMTF End

✓ 1.1 Visually verify completion of electrical connection of the green flex leads to the Stand 4 hard bus in the trench.

✓ 1.2 Visually verify completion of LCW connections between the green flex leads and the Stand 4 hard bus in the trench.

N/A 1.3 Visually verify completion of electrical connection of the 1000 MCM flexible leads and Main Injector dipoles.

✓ 1.4 Visually verify all exposed bus has been wrapped with rubber insulation for personnel safety.

2. Bus Connection Changes – Stand 4 Platform

✓ 2.1 Visually verify that the Stand 3 hard bus has been mated with the Stand 4 flexible bus on the Stand 4 platform and that the polarity is correct.

3. Bus Connection Changes – Stand 3 Test Dewar

✓ 3.1 Visually verify the flex leads and chill blocks have been bolted to the power lead flags. ~~with Penetrox E conductive grease applied to the cooling block-lead flag joint.~~

✓ 3.3 Visually verify that voltage taps VFF-A and VFF-B have been connected at the negative and positive flex lead flags, respectively, and voltage taps VLF-A and VLF-B have been connected at the negative and positive power lead flags, respectively. These taps will allow the combined voltage drop across the flex lead/chill block joint and chill block/power lead joint to be measured.

✓ 3.4 Visually verify Kapton-wrapped platinum temperature sensors TE515-3 and TE516-3 have been attached to the positive and negative lead flags, respectively, using glass tape.

✓ 3.5 Visually verify the power lead flags have been wrapped with rubber insulation for personnel safety.

✓ 3.6 Visually verify the plexiglass enclosure has been installed around the power leads for personnel safety.

3. Power Supply System Configuration

✓ 3.1 On the FIX32 HMTF Power Interlock screen, switch the selector switch to the Stand 3 position.

✓ 3.2 Switch warning lights at the VMTF pit and at the Stand 4 platform to the "Stand 3" position.

✓ 3.3 Adjust the power supply time constant by setting the resistance to 500 μΩ.

✓ 3.4 Adjust the power supply time constant by setting the inductance to 0.05 mH.

✓ 3.5 Adjust the dump resistance to 30 mΩ.

✓ 3.6 Place the VMTF ground switch in the "off" position.

✓ 3.7 Place the Stand 4 ground switch in the "on" position.

_______ 3.8 Place the Stand 3/VMTF ground switch on the ETS panel in the Stand 3 (up) position and press the Master Reset.

✓ 3.9 Remove the power control cable, which contains QLM, PLC, etc. signals, from the VMTF "j" plug and insert into the Stand 4 "j" plug.

N/A ~~3.10 Switch LCW control box switch to Main Injector Magnets In position to enable flow~~ switches in PLC interlock logic.

4. LCW System Verification

N/A 4.1 Record the flow indicator readings for LCW flow to the 1000 MCM flexible leads and the Main Injector dipoles.

1000 MCM Flexible lead flow FI2239 (IB1 south wall): _______ gpm (12 gpm nominal)
Main Injector dipole 1 flow FI2278: _______ gpm (5 gpm nominal)
Main Injector dipole 2 flow FI2279: _______ gpm (5 gpm nominal)
Main Injector dipole combined flow FI2236: _______ gpm (10 gpm nominal)

✓ 4.2 Record the flow indicator readings for LCW flow to the 750 MCM green flexible leads.

Positive flex lead flow FI2230: 11.2 gpm (12 gpm nominal, 11 gpm actual)
Negative flex lead flow FI2231: 9.2 gpm (12 gpm nominal, 9 gpm actual)

Negative lead DFLX 18 Positive lead DFLX 17

___✓___ **4.3** Record the flow indicator readings for LCW flow to Stand 3.

10 ft negative flex lead on the Stand 4 platform FI553-3: ___4.1___ gpm (4 gpm nominal)
10 ft positive flex lead on the Stand 4 platform FI554-3: ___3.9___ gpm (4 gpm nominal)
Copper bus flow FI556-3: ___13___ gpm (12 gpm nominal)
6 ft flex leads at the Stand 3 test dewar FI558-3: ___3.7___ gpm (4 gpm nominal)

Performed by Dan W
(name typed) (signature)

Date & time 4/7/04

Power Lead 7500 A DFLX ____

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

Print-out Threshold setup spreadsheet.

1.1 Connect the HTS LEAD V-TAP Breakout Box to 6 pin Primary V-TAP cable for Lead #1 and Lead #2.

1.2 Connect the HTS LEAD V-TAP Breakout Box to 8 pin Lead test cable for Lead #1 and Lead #2. These red cables are located in the back of Stand 3 Relay-Rack.

1.3 Connect the HTS LEAD V-TAP Breakout Box to special flag cable. Use the Before Flag for Lead #1 and Lead #2.

1.4 Connect the duel breakout box to both of the 8 pin Lead test cables on the Stand-4

1.5 Use a voltage source to inject a signal into the appropriate pins as per Threshold Setup spreadsheet and set the threshold. Repeat for other lead test cable.

1.6 Make a copy of the Threshold setup spreadsheet and place it in Traveler for both leads along with a copy of this form.

1.7 The quench management cables for stand 3 will always remain connected to the QM box. These cables include quench characterization for the positive and negative lead and quench detection for the positive and negative lead. There are six cables that need to be connected from stand 4. These include FVTLD1, FVTLD2, FVT+LEAD, FVT-LEAD, FVT WC 1/2C M1, and FVT WC 1/2C M2. These cables should be plugged into the corresponding connectors on QM box.

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	16. Cold test of the power leads	

Performed by ROGER RABEHL (name typed) Roger Rabehl (signature)

Date & time APRIL 7, 2004 0945

Power Lead 7500 A DFLX 17 (+) & 7500 A DFLX 18 (-)

✓16.0 Set the DAQ system ScribeLeads and ScribeFix32 Data Logging Intervals to capture data every 5 seconds.

✓16.1. Establish cryogenic parameters for normal high current operating conditions.
Set the liquid level at 6in location using the 1 foot LL probe ✓
Set the copper section inlet cooling gas temperature to 15-20K range ✓
Set the LHe vapor cooling control loop in automatic mode to keep the upper HTS terminal temperature at 45 K for ½ hour ✓
Neg. lead flow rate 0.142 g/s Pos. lead flow rate 0.136 g/s
Neg. lead diff. pressure 0 mbar Pos. lead diff. pressure 0 mbar
Set the upper HTS temperature to 50 K and keep it there for ½ hour ✓
Neg. lead flow rate 0.123 g/s Pos. lead flow rate 0.119 g/s
Neg. lead diff. pressure 0 mbar Pos. lead diff. pressure 0 mbar
Frost observed on leads? (Y/N) Y, A LITTLE ON LEAD 18

✓16.1.1 Set software quench detection thresholds by executing:
/usr/vmtf/sh/lhchts_setquenchthreshold_run.sh

✓16.2 Stair step profile test.
Turn on the Power Supply. Set HTS terminal temperature to 50K and apply current profile 1 (/usr/vmtf/sh/hmtf3_run_prf.sh) ✓
Monitor voltages and make sure that the data is recorded.
Run data analysis tool on the obtained data file to determine joint resistances.

7500 A DFLX 17 (+) R(joint between V2 & V3) = $\frac{0.000401-0.000108\ V}{7500\ A}$ = 39.1 nΩ
R(joint between V3 & V4) = $\frac{0.000293-0.000274\ V}{7500\ A}$ = 2.5 nΩ

7500 A DFLX 18 (-) R(joint between V2 & V3) = $\frac{0.000126-(-0.000166)\ V}{7500\ A}$ = 38.9 nΩ
R(joint between V3 & V4) = $\frac{0.000137-0.000102\ V}{7500\ A}$ = 4.7 nΩ

16.3 Coolant loss test.
Apply 7500 A and
a) Close the coolant flow for 7500 A DFLX 17 (+)
Wait until QD detects the quench and record
T1 = 82 K ; T2 = 294 K; V12 = 98.8 mV; V23 = 1.08 mV; V34 = 0.289 mV;

T1 is the HTS warm terminal temp., TI509-3 (neg. lead) or TI510-3 (pos. lead).
T2 is the upper copper temp., TI511-3 (neg. lead) or TI512-3 (pos. lead).

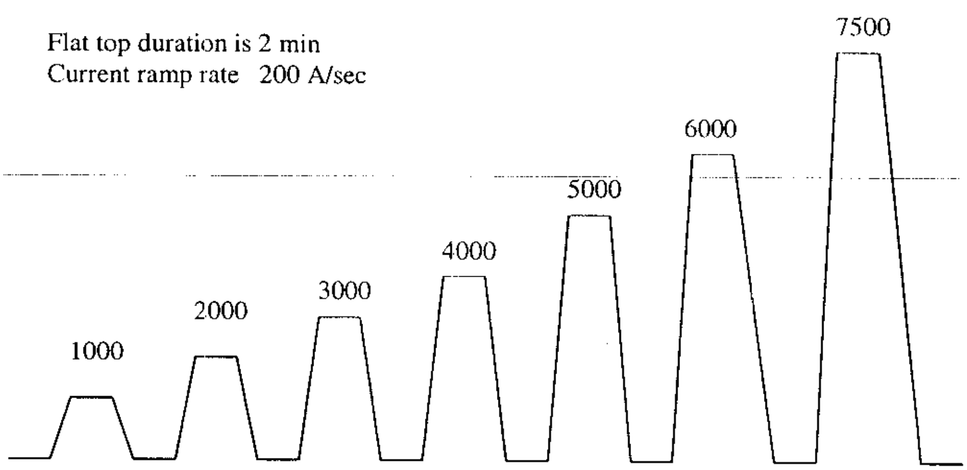
b) Re-establish operating conditions
c) Close the coolant flow for 7500 A DFLX 18 (-)
Wait until QD detects the quench and record
T1 = 85 K ; T2 = 300 K ; V12 = -97.0 mV ; V23 = -0.878 mV ; V34 = 0.109 mV ;

16.4a Set the upper HTS terminal temperature to 45 K and apply current profile 2.
Neg. lead flow rate 0.476 g/s Pos. lead flow rate 0.494 g/s
Neg. lead diff. pressure 2.7 mbar Pos. lead diff. pressure 4.8 mbar

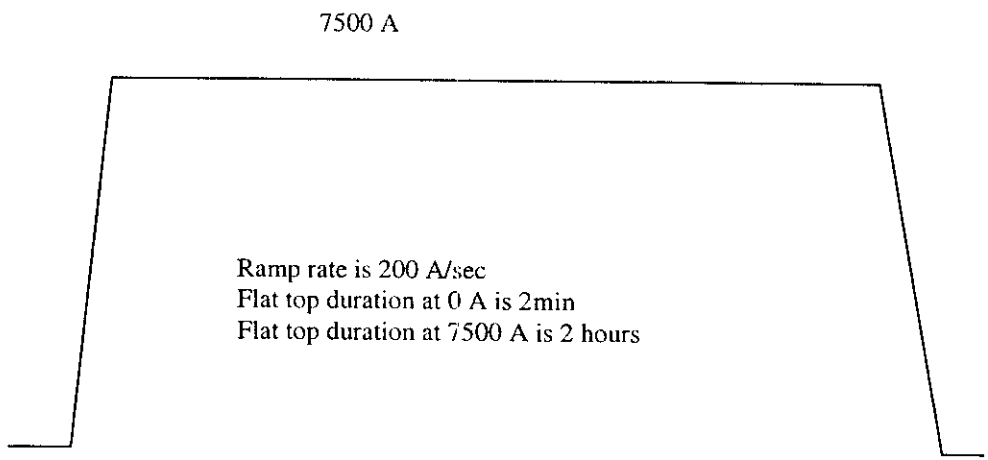
16.4b Set HTS terminal temp to 50 K and apply current profile 2.
Neg. lead flow rate 0.452 g/s Pos. lead flow rate 0.468 g/s
Neg. lead diff. pressure 2.5 mbar Pos. lead diff. pressure 4.7 mbar

16.5 When test is completed, set the ScribeLeads and ScribeFix32 Data Logging Intervals to 300 seconds.
Note: If any irregularity occur call Sandor.

Profile 1:



Profile 2:


7500 A
Ramp rate is 200 A/sec
Flat top duration at 0 A is 2min
Flat top duration at 7500 A is 2 hours

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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) [signature] (Signature)

Date & time 4/9/04 9:30

Pos. Power Lead 7500 A DFLX 17 and Neg. Power Lead 7500 A DFLX 18

This hi-pot should be performed after dewar has been filled with gaseous helium after the second test cycle has been completed and the dewar is at room temperature. When checkout is complete, make sure you place the original and a copy of this document in the Traveler Binders.

1.1 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 .024 A

1.2 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)__________V.
Record current .024 A.
Record approximate temp. 295 K. (Record Temp of TI532-3)
Record approximate test dewar pressure — PSIA.

NOTE: Reconnect Vtaps and RTDs when finished.
Turn OFF Main Power Switch to Hoffman Enclosure on Side of END RACK!!!!

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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 the 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 handles can rest on the backs of C-channels when the lead is put on a steel table.

2.9 Place the lead on the C-channels, 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.