

7500 A DFLX 36



0. Cover Sheet for Check Out Form

Power leads being tested: 7500 A DFLX 35 7500 A DFLX 36

Task #	Responsible	Task	Received Date,time		Performed Date,time	
1	Inspection	Unpack the leads				
2	Inspection	IB4 mech. & Tolerances				
3	Mechanical	Move the leads to MTF	102103	09:13	102103	09:13
4	Electrical	Initial electrical check out				
4a	Mechanical	Preliminary leak check	102103	10:30	102103	15:30
5	Mechanical	Installation of the current leads	102203	09:00	102203	15:00
6	Mechanical	Pressure test	102203	15:00	102203	16:00
7	Mechanical	Leak check	102203	16:00	102303	10:00
7a	Mechanical	Top plate insertion into the dewar	102403	09:30	102403	10:00
8	M. Tartaglia	Configuration of the DAQ system				
9	Electrical	Room temp. electrical test	102703	09:30	102703	16:00
10	Mechanical	Installation of the top plate				
10.1	Electrical	Room temp. GHe hipot	102703	16:30	102703	17:00
12	Mechanical	Cool down				
13	Electrical	Electrical & instrumentation test	102803	09:35	102803	09:15
14	Mechanical	Connect the leads to the Power Supply & configure			10/28/03	10:00
15	Electrical	Electrical & instrumentation test				
16	M. Thompson	Cold test of the power lead			102803	08:30
17	Mechanical	Perform a Thermal cycle			102803	14:30
18	M. Thompson	Cold test of the power lead			102903	11:50
19	Mechanical	Warm up			103003	09:30
20	Electrical	Electrical & instrumentation test			102003	13:30
21	Mechanical	Remove the top plate			103003	18:30
22	Mechanical	Remove the leads from the top plate			103003	16:00
23	Mechanical	Pack and move the leads				

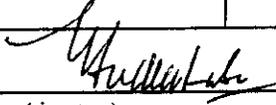


FERMILAB
Technical
Division

7500A HTS Power leads for the LHC DFBX

Doc. No.
Rev. No.
Date: January 6, 2003
Page 1 of 1
Author: Sandor Feher

1. Unpacking Check Out Form

Performed by SUDHIR GHANTA  (name typed) (signature)

Date & time 6/30/03 8:30 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 35 7500 A DFLX 36
 (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: 7500A DFLX 35
 Not tripped Tripped (Black) Remark: 7500A DFLX 36

1.4 Container content:
 a. Power leads: 7500 A DFLX 35 ; 7500 A DFLX 36

- 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

MISSING

(4) 4 UNIDENTIFIED PARTS.

Review of Pirelli Traveller DFLX 35 & DFLX 36

HTS Lead #	Pr Test	Leak Test	Volt Test	Small Hole Pos O/T	Small Hole Size O/T	Large Hole Pos O/T	Distance Between Holes
DFLX 35	OK	OK	OK	0.0044	OK	OK	OK
DFLX 36	OK	OK	OK	0.0028	OK	OK	OK

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

7500A OFLX35

MM	DIM CYL -A-DIA= LOCATION OF CYLINDER CYL -A-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	99.000	0.200	0.200	99.071	0.071	0.000

MM	DIM -A-= ROUNDNESS OF CYLINDER CYL -A-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.095	0.095	0.000

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

MM	DIM PERP1= PERPEND OF PLANE PLN -B- TO CYLINDER CYL -A- EXTEND=0.000					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.400	0.000	0.275	0.275	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	1.313	1.313	0.913

MM	DIM -C- DIA= LOCATION OF CYLINDER -C-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	80.000	0.200	0.200	80.035	0.035	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	1.108	1.108	0.108

MM	DIM RND2= ROUNDNESS OF CYLINDER -C-					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.091	0.091	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	562.434	1.434	0.434

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				123.958	0.387	
DF	18.000	0.200	0.200		17.980	-0.020	0.000
TP	RFS	0.130		0.000		0.774	0.644

MM	DIM LOC10= TRUE POSITION OF CIRCLE CIR3						
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
X	-78.890				-79.002	-0.113	
Z	95.047				95.561	0.514	
DF	18.000	0.200	0.200		17.980	-0.020	0.000
TP	RFS	0.130		0.000		1.051	0.921

MM	DIM LOC11= TRUE POSITION OF CIRCLE CIR4						
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
X	78.890				78.899	0.009	
Z	95.047				95.349	0.302	
DF	18.000	0.200	0.200		17.975	-0.025	0.000
TP	RFS	0.130		0.000		0.603	0.473

MM DIM LOC12= TRUE POSITION OF CIRCLE CIR5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
X	78.890				78.612	-0.278	
Z	-95.047				-94.733	0.314	
DF	18.000	0.200	0.200		17.980	-0.020	0.000
TP	RFS	0.130		0.000		0.839	0.709

MM DIM 16.00 DIA HOLE #5= TRUE POSITION OF CIRCLE CIR6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
X	-78.918				-79.294	-0.376	
Z	-95.047				-94.505	0.542	
DF	18.000	0.200	0.200		17.899	-0.101	0.000
TP	RFS	0.130		0.000		1.318	1.188

MM DIM 8.433 DIA HOLE #1= TRUE POSITION OF CIRCLE SH1							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.532	-0.018	
PA	-153.004				-153.401	-0.398	
DF	8.433	0.200	0.000	0.117	8.549	0.117	0.000
TP	MMC	0.080		0.117		1.257	1.061

MM DIM 8.407 DIA HOLE #2= TRUE POSITION OF CIRCLE SH2							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.740	0.190	
PA	-171.000				-171.354	-0.354	
DF	8.433	0.200	0.000	0.107	8.540	0.107	0.000
TP	MMC	0.080		0.107		1.182	0.995

MM DIM 8.433 DIA HOLE #3= TRUE POSITION OF CIRCLE SH3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.394	-0.156	
PA	-135.000				-135.378	-0.378	
DF	8.433	0.200	0.000	0.117	8.550	0.117	0.000
TP	MMC	0.080		0.117		1.235	1.038

MM DIM 8.433 DIA HOLE #4= TRUE POSITION OF CIRCLE SH4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.819	0.269	
PA	171.000				170.721	-0.279	
DF	8.433	0.200	0.000	0.115	8.548	0.115	0.000
TP	MMC	0.080		0.115		1.035	0.840

MM DIM 8.433 DIA HOLE #5= TRUE POSITION OF CIRCLE SH5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.880	0.330	
PA	153.000				152.765	-0.235	
DF	8.433	0.200	0.000	0.111	8.544	0.111	0.000
TP	MMC	0.080		0.111		0.994	0.803

MM DIM 8.433 DIA HOLE #6= TRUE POSITION OF CIRCLE SH6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.984	0.434	
PA	135.000				134.852	-0.148	
DF	8.433	0.200	0.000	0.119	8.552	0.119	0.000
TP	MMC	0.080		0.119		0.986	0.787

MM DIM 8.433 DIA HOLE #7= TRUE POSITION OF CIRCLE SH7							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.972	0.422	
PA	117.000				116.923	-0.077	
DF	8.433	0.200	0.000	0.122	8.555	0.122	0.000
TP	MMC	0.080		0.122		0.879	0.677

MM DIM 8.433 DIA HOLE #8= TRUE POSITION OF CIRCLE SH8							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.978	0.428	
PA	99.000				99.009	0.009	
DF	8.433	0.200	0.000	0.095	8.528	0.095	0.000
TP	MMC	0.080		0.095		0.856	0.681

MM DIM 8.433 DIA HOLE #9= TRUE POSITION OF CIRCLE SH9							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.889	0.339	
PA	81.000				81.085	0.085	
DF	8.433	0.200	0.000	0.132	8.565	0.132	0.000
TP	MMC	0.080		0.132		0.730	0.518

MM DIM 8.433 DIA HOLE #10= TRUE POSITION OF CIRCLE SH10							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.782	0.232	
PA	63.000				63.228	0.228	
DF	8.433	0.200	0.000	0.124	8.557	0.124	0.000
TP	MMC	0.080		0.124		0.858	0.654

MM DIM 8.433 DIA HOLE #11= TRUE POSITION OF CIRCLE SH11							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.613	0.063	
PA	45.000				45.277	0.277	
DF	8.433	0.200	0.000	0.112	8.545	0.112	0.000
TP	MMC	0.080		0.112		0.886	0.694

MM DIM 8.433 DIA HOLE #12= TRUE POSITION OF CIRCLE SH12							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.464	-0.086	
PA	27.000				27.226	0.226	
DF	8.433	0.200	0.000	0.116	8.549	0.116	0.000
TP	MMC	0.080		0.116		0.735	0.539

MM DIM 8.433 DIA HOLE #13= TRUE POSITION OF CIRCLE SH13							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.345	-0.205	
PA	9.000				9.200	0.200	
DF	8.433	0.200	0.000	0.113	8.546	0.113	0.000
TP	MMC	0.080		0.113		0.754	0.560

MM DIM 8.433 DIA HOLE #14= TRUE POSITION OF CIRCLE SH14							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.202	-0.348	
PA	-9.000				-8.816	0.184	
DF	8.433	0.008	0.000	0.008	8.557	0.125	0.117
TP	MMC	0.080		0.008		0.906	0.818

MM DIM 8.433 DIA HOLE #15= TRUE POSITION OF CIRCLE SH15							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.057	-0.493	
PA	-27.000				-26.888	0.112	
DF	8.433	0.200	0.000	0.156	8.589	0.156	0.000
TP	MMC	0.080		0.156		1.048	0.812

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	1452.602	2.602	2.202

MM DIM 130.0DIA= LOCATION OF CIRCLE OD1						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	130.000	0.200	0.200	129.904	-0.096	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	502.449	0.449	0.049

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	-1.309	-1.309	0.000

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	-0.677	-0.677	0.577

MM	DIM X LOC OF WARM TERM= LOCATION OF PLANE MID PLN					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
X	0.000	0.130	0.130	-0.826	-0.826	0.696

IN	DIM POLAR ANGLE OF COOLING HOLE= LOCATION OF CIRCLE ID15					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
PA	90.000	2.000	2.000	91.494	1.494	0.000

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	444.921	0.421	0.000

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

7500A DFLX 36

MM DIM CYL -A-DIA= LOCATION OF CYLINDER CYL -A-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	99.000	0.200	0.200	99.104	0.104	0.000

MM DIM -A= ROUNDNESS OF CYLINDER CYL -A-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.058	0.058	0.000

MM DIM -B= FLATNESS OF PLANE PLN -B-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.050	0.000	0.004	0.004	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	0.151	0.151	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	1.060	1.060	0.660

MM DIM -C- DIA= LOCATION OF CYLINDER -C-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	80.000	0.200	0.200	79.955	-0.044	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	1.599	1.599	0.599

MM DIM RND2= ROUNDNESS OF CYLINDER -C-						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	0.000	0.200	0.000	0.050	0.050	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	563.029	2.029	1.029

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				123.935	0.364	
DF	18.000	0.200	0.200		17.980	-0.020	0.000
TP	RFS	0.130		0.000		0.729	0.599

MM DIM LOC10= TRUE POSITION OF CIRCLE CIR3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
X	-78.890				-78.950	-0.061	
Z	95.047				95.413	0.366	
DF	18.000	0.200	0.200		17.978	-0.022	0.000
TP	RFS	0.130		0.000		0.741	0.611

MM DIM LOC11= TRUE POSITION OF CIRCLE CIR4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
X	78.890				78.946	0.055	
Z	95.047				95.447	0.400	
DF	18.000	0.200	0.200		17.979	-0.021	0.000
TP	RFS	0.130		0.000		0.808	0.678

MM DIM LOC12= TRUE POSITION OF CIRCLE CIR5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
X	78.890				78.969	0.079	
Z	-95.047				-94.620	0.427	
DF	18.000	0.200	0.200		17.978	-0.022	0.000
TP	RFS	0.130		0.000		0.868	0.738

MM DIM 16.00 DIA HOLE #5= TRUE POSITION OF CIRCLE CIR6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
X	-78.918				-78.914	0.004	
Z	-95.047				-94.609	0.438	
DF	18.000	0.200	0.200		17.920	-0.080	0.000
TP	RFS	0.130		0.000		0.877	0.747

MM DIM 8.433 DIA HOLE #1= TRUE POSITION OF CIRCLE SH1							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.368	-0.182	
PA	-153.004				-153.280	-0.256	
DF	8.433	0.200	0.000	0.119	8.551	0.119	0.000
TP	MMC	0.080		0.119		0.887	0.688

MM DIM 8.407 DIA HOLE #2= TRUE POSITION OF CIRCLE SH2							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.495	-0.055	
PA	-171.000				-171.270	-0.270	
DF	8.433	0.200	0.000	0.121	8.554	0.121	0.000
TP	MMC	0.080		0.121		0.861	0.660

MM DIM 8.433 DIA HOLE #3= TRUE POSITION OF CIRCLE SH3							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.191	-0.359	
PA	-135.000				-135.206	-0.206	
DF	8.433	0.200	0.000	0.102	8.535	0.102	0.000
TP	MMC	0.080		0.102		0.968	0.786

MM DIM 8.433 DIA HOLE #4= TRUE POSITION OF CIRCLE SH4							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.633	0.083	
PA	171.000				170.728	-0.272	
DF	8.433	0.200	0.000	0.129	8.561	0.129	0.000
TP	MMC	0.080		0.129		0.875	0.666

MM DIM 8.433 DIA HOLE #5= TRUE POSITION OF CIRCLE SH5							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.760	0.210	
PA	153.000				152.787	-0.213	
DF	8.433	0.200	0.000	0.119	8.552	0.119	0.000
TP	MMC	0.080		0.119		0.794	0.595

MM DIM 8.433 DIA HOLE #6= TRUE POSITION OF CIRCLE SH6							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.867	0.317	
PA	135.000				134.829	-0.171	
DF	8.433	0.200	0.000	0.136	8.569	0.136	0.000
TP	MMC	0.080		0.136		0.834	0.618

MM DIM 8.433 DIA HOLE #7= TRUE POSITION OF CIRCLE SH7							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.908	0.358	
PA	117.000				116.888	-0.112	
DF	8.433	0.200	0.000	0.124	8.557	0.124	0.000
TP	MMC	0.080		0.124		0.798	0.594

MM DIM 8.433 DIA HOLE #8= TRUE POSITION OF CIRCLE SH8							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.970	0.420	
PA	99.000				98.984	-0.016	
DF	8.433	0.200	0.000	0.123	8.556	0.123	0.000
TP	MMC	0.080		0.123		0.841	0.638

MM DIM 8.433 DIA HOLE #9= TRUE POSITION OF CIRCLE SH9							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.967	0.417	
PA	81.000				81.070	0.070	
DF	8.433	0.200	0.000	0.124	8.556	0.124	0.000
TP	MMC	0.080		0.124		0.863	0.660

MM DIM 8.433 DIA HOLE #10= TRUE POSITION OF CIRCLE SH10							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.925	0.375	
PA	63.000				63.134	0.134	
DF	8.433	0.200	0.000	0.130	8.563	0.130	0.000
TP	MMC	0.080		0.130		0.862	0.652

MM DIM 8.433 DIA HOLE #11= TRUE POSITION OF CIRCLE SH11							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.832	0.282	
PA	45.000				45.227	0.227	
DF	8.433	0.200	0.000	0.131	8.563	0.131	0.000
TP	MMC	0.080		0.131		0.913	0.702

MM DIM 8.433 DIA HOLE #12= TRUE POSITION OF CIRCLE SH12							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.733	0.183	
PA	27.000				27.241	0.241	
DF	8.433	0.200	0.000	0.131	8.564	0.131	0.000
TP	MMC	0.080		0.131		0.846	0.636

MM DIM 8.433 DIA HOLE #13= TRUE POSITION OF CIRCLE SH13							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.569	0.019	
PA	9.000				9.291	0.291	
DF	8.433	0.200	0.000	0.120	8.553	0.120	0.000
TP	MMC	0.080		0.120		0.922	0.722

MM DIM 8.433 DIA HOLE #14= TRUE POSITION OF CIRCLE SH14							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.446	-0.104	
PA	-9.000				-8.705	0.295	
DF	8.433	0.008	0.000	0.008	8.565	0.133	0.125
TP	MMC	0.080		0.008		0.955	0.867

MM DIM 8.433 DIA HOLE #15= TRUE POSITION OF CIRCLE SH15							
AX	NOMINAL	+TOL	-TOL	BONUS	MEAS	DEV	OUTTOL
PR	90.550				90.304	-0.246	
PA	-27.000				-26.738	0.262	
DF	8.433	0.200	0.000	0.122	8.555	0.122	0.000
TP	MMC	0.080		0.122		0.962	0.760

MM DIM 1450= 2D DISTANCE FROM LINE FRT END TO LINE LIN2 PAR TO Y AXIS						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
M	1450.000	0.400	0.400	1452.572	2.572	2.172

MM DIM 130.0DIA= LOCATION OF CIRCLE OD1						
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
D	130.000	0.200	0.200	129.915	-0.085	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	502.760	0.760	0.360

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	-4.076	-4.076	2.276

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	1.189	1.189	1.089

MM	DIM X LOC OF WARM TERM= LOCATION OF PLANE MID PLN					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
X	0.000	0.130	0.130	2.543	2.543	2.413

IN	DIM POLAR ANGLE OF COOLING HOLE= LOCATION OF CIRCLE ID15					
AX	NOMINAL	+TOL	-TOL	MEAS	DEV	OUTTOL
PA	90.000	2.000	2.000	94.360	4.360	2.360

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	443.801	-0.699	0.000



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7500A HTS Power leads for the LHC DFBX

Doc. No.
Rev. No.
Date: January 6, 2003
Page 1 of 1
Author: Sandor Feher

3. Form for moving power leads

Power leads need to be moved from NW8 to MTF are:

7500 DFLX 35 & 7500 DFLX 36

Approved by Sandor Feher
(name typed) (signature)

Date & time OCTOBER 20, 2003 0900

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 OCTOBER 20, 2003 0900

Delivered by WYFF BRON WYFF BRON
(name typed) (signature)

Date & time 10/21/03 9:13

Received by Charles Hass C.F. Hass
(name typed) (signature)

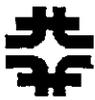
Date & time 10-21-03 09:13

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



4. Initial Electrical Checkout

36

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 7/31/03 PAIR 35336

Power Lead 7500 A DFLX 36

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) <u>88</u> V	Pin 2 - pin 3 (225uv) <u>255</u> V
Pin 1 - pin 3 (300uv) <u>343</u> V	Pin 3 - pin 4 (240uv) <u>247</u> V
Pin 1 - pin 4 (530uv) <u>590</u> V	Pin 4 - pin 5 (float) <u>FL0AT</u> V
Pin 1 - pin 5 (float) <u>FL0AT</u> V	Pin 5 - pin 6 (float) <u>FL0AT</u> V
Pin 1 - pin 6 (float) <u>FL0AT</u> V	

Voltage tap Connector 2 (Redundant) (Fisher DEE104A06)

Pin 1 - pin 2 (80uv) <u>84</u> V	Pin 2 - pin 3 (225uv) <u>254</u> V
Pin 1 - pin 3 (300uv) <u>338</u> V	Pin 3 - pin 4 (240uv) <u>242</u> V
Pin 1 - pin 4 (530uv) <u>581</u> V	Pin 4 - pin 5 (float) <u>FL0AT</u> V
Pin 1 - pin 5 (float) <u>FL0AT</u> V	Pin 5 - pin 6 (float) <u>FL0AT</u> V
Pin 1 - pin 6 (float) <u>FL0AT</u> 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	<u>1.39</u>	Ω
Resistance between Pin 1 and pin 3	<u>109.86</u>	Ω
Resistance between Pin 1 and pin 4	<u>109.87</u>	Ω
Resistance between Pin 2 and pin 3	<u>109.77</u>	Ω



4. Initial Electrical Checkout

36

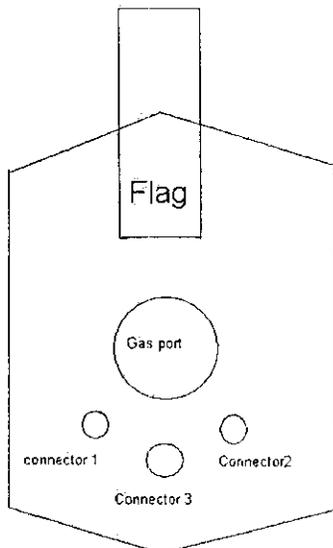
Resistance between Pin 2 and pin 4 109.78 Ω
 Resistance between Pin 3 and pin 4 1.11 Ω
 Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 1.09 Ω
 Resistance between Pin 5 and pin 7 109.70 Ω
 Resistance between Pin 5 and pin 8 109.71 Ω
 Resistance between Pin 6 and pin 7 109.72 Ω
 Resistance between Pin 6 and pin 8 109.71 Ω
 Resistance between Pin 7 and pin 8 1.12 Ω
 Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 1.58 Ω
 Resistance between Pin 9 and pin 11 109.63 Ω
 Resistance between Pin 9 and pin 12 109.60 Ω
 Resistance between Pin 10 and pin 11 110.27 Ω
 Resistance between Pin 10 and pin 12 110.21 Ω
 Resistance between Pin 11 and pin 12 1.04 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 108.61 Ω (I+ at pin 1, I- at pin 2, U+ at pin 3, U- at pin 4)
 Resistance of T2 108.61 Ω (I+ at pin 5, I- at pin 6, U+ at pin 7, U- at pin 8)
 Resistance of T3 108.61 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



35

4. Initial Electrical Checkout

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

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

Date & time 7/31/03

Power Lead 7500 A DFLX 35

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) <u>83</u> V	Pin 2 - pin 3 (225uv) <u>255</u> V
Pin 1 - pin 3 (300uv) <u>343</u> V	Pin 3 - pin 4 (240uv) <u>260</u> V
Pin 1 - pin 4 (530uv) <u>609</u> V	Pin 4 - pin 5 (float) <u>FLOAT</u> V
Pin 1 - pin 5 (float) <u>FLOAT</u> V	Pin 5 - pin 6 (float) <u>FLOAT</u> V
Pin 1 - pin 6 (float) <u>FLOAT</u> V	

Voltage tap Connector 2 (Redundant) (Fisher DEE104A06)

Pin 1 - pin 2 (80uv) <u>85</u> V	Pin 2 - pin 3 (225uv) <u>266</u> V
Pin 1 - pin 3 (300uv) <u>352</u> V	Pin 3 - pin 4 (240uv) <u>269</u> V
Pin 1 - pin 4 (530uv) <u>622</u> V	Pin 4 - pin 5 (float) <u>FLOAT</u> V
Pin 1 - pin 5 (float) <u>FLOAT</u> V	Pin 5 - pin 6 (float) <u>FLOAT</u> V
Pin 1 - pin 6 (float) <u>FLOAT</u> 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

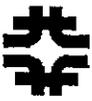
Comments _____

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	<u>1.24</u>	Ω
Resistance between Pin 1 and pin 3	<u>109.54</u>	Ω
Resistance between Pin 1 and pin 4	<u>109.53</u>	Ω
Resistance between Pin 2 and pin 3	<u>109.47</u>	Ω



35

4. Initial Electrical Checkout

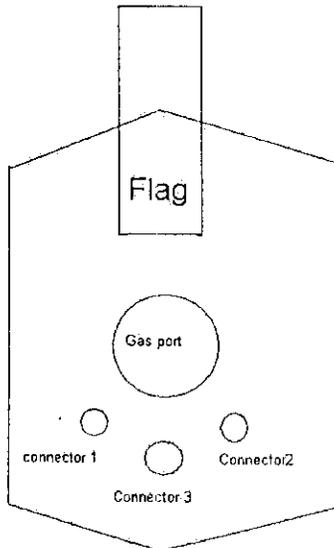
Resistance between Pin 2 and pin 4 109.84 Ω
 Resistance between Pin 3 and pin 4 1.14 Ω
 Pins 1-4 resistance to lead ∞ Ω Pins 1-4 resistance to flange ∞ Ω

Resistance between Pin 5 and pin 6 1.22 Ω
 Resistance between Pin 5 and pin 7 109.94 Ω
 Resistance between Pin 5 and pin 8 109.87 Ω
 Resistance between Pin 6 and pin 7 109.86 Ω
 Resistance between Pin 6 and pin 8 109.83 Ω
 Resistance between Pin 7 and pin 8 1.22 Ω
 Pins 5-8 resistance to lead ∞ Ω Pins 5-8 resistance to flange ∞ Ω

Resistance between Pin 9 and pin 10 1.15 Ω
 Resistance between Pin 9 and pin 11 109.77 Ω
 Resistance between Pin 9 and pin 12 109.74 Ω
 Resistance between Pin 10 and pin 11 109.80 Ω
 Resistance between Pin 10 and pin 12 109.78 Ω
 Resistance between Pin 11 and pin 12 1.09 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 108.66 Ω (I+ at pin 1, I- at pin 2, U+ at pin 3, U- at pin 4)
 Resistance of T2 108.63 Ω (I+ at pin 5, I- at pin 6, U+ at pin 7, U- at pin 8)
 Resistance of T3 108.65 Ω (I+ at pin 9, I- at pin 10, U+ at pin 11, U- at pin 12)



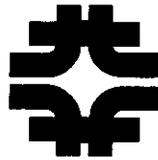
Looking from the top of the lead down where the LTS cable is located.
Connector 2= Redundant and Connector 1= Primary



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**7500 A HTS Power Leads for the
LHC DFBX:
4a. Preliminary Leak Check
Procedure**

Doc. No.
Rev. 1 (RJR)
Rev. Date: August 18, 2003
Page 1 of 2



FERMILAB
Technical Division

**7500 A HTS Power Leads for the LHC DFBX:
4a. Preliminary Leak Check Procedure**

Lead Number: 36

Signed

P. E. [Signature]

Date

10.21.03



**7500 A HTS Power Leads for the
LHC DFBX:
4a. Preliminary Leak Check
Procedure**

1. Preparation for Leak Checking

- 1.1 Attach the lifting/insertion tool to the lead flag as shown in Figure 1.1 and remove the lead from the shipping container.

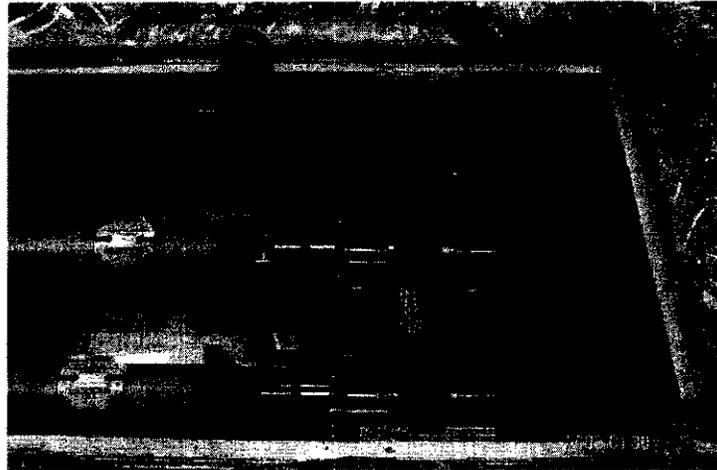


Figure 1.1 The lifting/insertion tool bolted to a power lead in preparation for removing it from the shipping container.

- 1.2 Remove the plastic plug from the 4-20 K gas inlet on the lead body.
1.3 Put the power lead on the steel table, with the power lead lower flange resting in a V-block.
1.4 Hose clamp a rubber gasket and PVC clamshells around the lead to cover and seal the 4-20 K inlet.
1.5 Attach an adapter to the top of the power lead so that a leak detector can be connected.
1.6 Wrap the voltage tap wires around the bottom of the lead and secure them with tape.

2. Leak Check-Lead Number 36

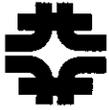
- 2.1 Pump out the power lead with the leak detector.
2.2 Record the baseline reading from the leak detector.

Baseline: 3.56 e-8

- 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: 3.56 e-8

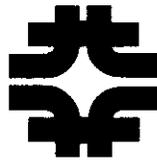
Lead DFLX 36



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**7500 A HTS Power Leads for the
LHC DFBX:
4a. Preliminary Leak Check
Procedure**

Doc. No.
Rev. 1 (RJR)
Rev. Date: August 18, 2003
Page 1 of 2



**FERMILAB
Technical Division**

**7500 A HTS Power Leads for the LHC DFBX:
4a. Preliminary Leak Check Procedure**

Lead Number: 35

Signed

C.E. Hays

Date

10. 21. 03



**7500 A HTS Power Leads for the
LHC DFBX:
4a. Preliminary Leak Check
Procedure**

1. Preparation for Leak Checking

- 1.1 Attach the lifting/insertion tool to the lead flag as shown in Figure 1.1 and remove the lead from the shipping container.



Figure 1.1 The lifting/insertion tool bolted to a power lead in preparation for removing it from the shipping container.

- 1.2 Remove the plastic plug from the 4-20 K gas inlet on the lead body.
1.3 Put the power lead on the steel table, with the power lead lower flange resting in a V-block.
1.4 Hose clamp a rubber gasket and PVC clamshells around the lead to cover and seal the 4-20 K inlet.
1.5 Attach an adapter to the top of the power lead so that a leak detector can be connected.
1.6 Wrap the voltage tap wires around the bottom of the lead and secure them with tape.

2. Leak Check-Lead Number 35

- 2.1 Pump out the power lead with the leak detector.
2.2 Record the baseline reading from the leak detector.

Baseline: 3.56 e-8

- 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: 3.56 e-8

Lead DFLX 35



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

Doc. No.
Rev. 7 (RJR)
Rev. Date: October 17, 2003
Page 1 of 14



FERMILAB
Technical Division

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

Lead Pair

Negative Lead: 35

Positive Lead: 36

Signed _____ Date _____



1. Mechanical Integration of Current Leads in Test Facility

- 1.1 Using wedges, tilt the insert by 10° so that the power leads will be vertical when installed.
- 1.2 Clean sealing surfaces inside the chimneys with acetone and/or alcohol wipe.
- 1.3 Position the upper insulator in each chimney according to Figure 1.3.
- 1.4 Position the PEEK seal in each chimney according to Figure 1.3.
- 1.5 Position the lower insulator in each chimney according to Figure 1.3.

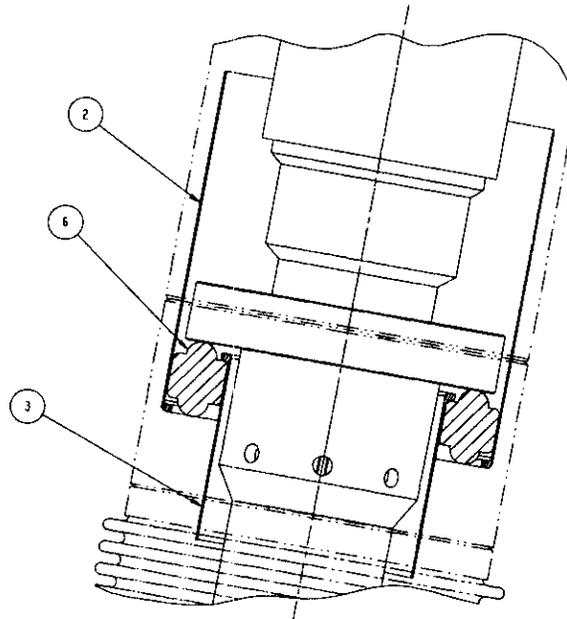


Figure 1.3 2 – Upper Insulator, 3 – Lower Insulator, 6 – PEEK Seal

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

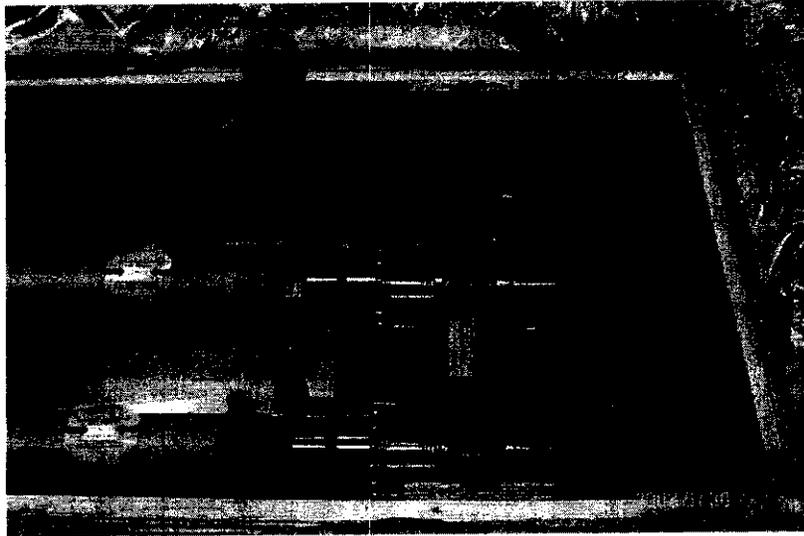


Figure 1.6 The lifting/insertion tool bolted to a power lead.

- 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.

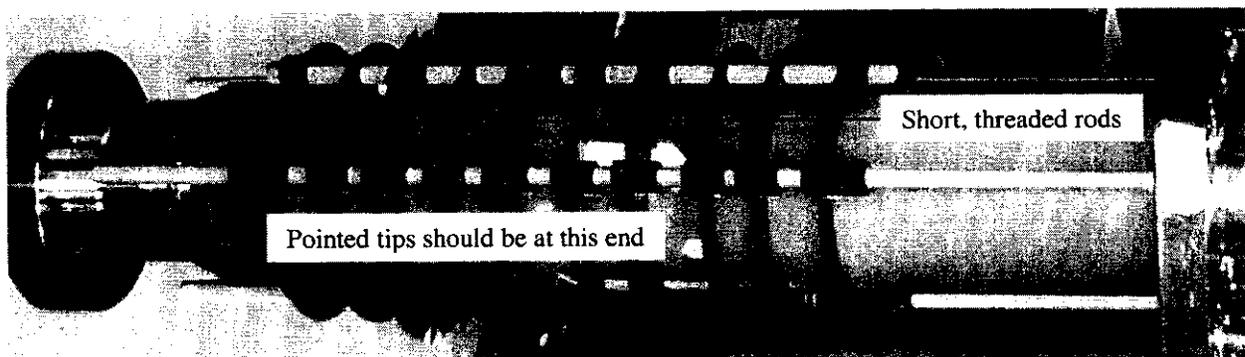


Figure 1.11 A baffle installed on a power lead.

- 1.12 Clamp the end support around the lower flange so that the handles will rest on the backs on the C-channels clamped to the steel table.
- 1.13 Set the lead in 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.



- 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.

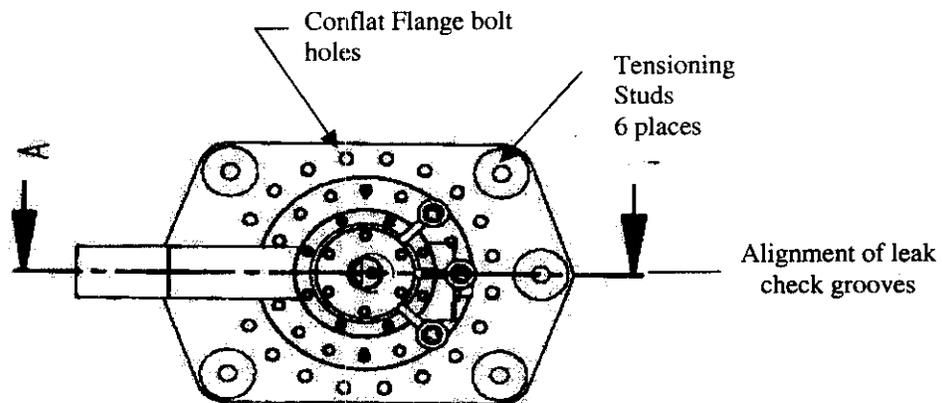


Figure 1.15 The 20-hole Conflat bolt pattern is bisected by center tensioning studs.

- 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.

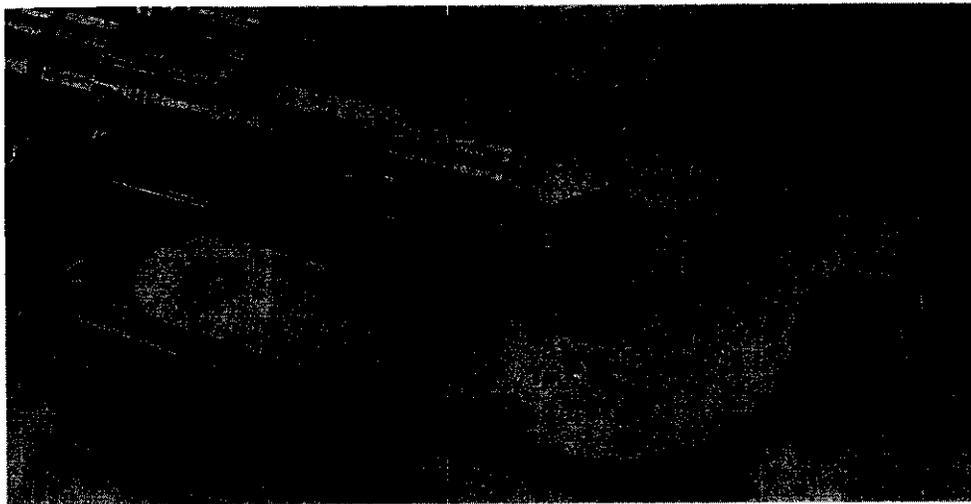


Figure 1.17 The lifting/insertion tool in position to lift the power lead into a vertical position.

- 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.



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7500 A HTS Power Leads for the LHC DFBX: 5. Installation of the Current Leads

Doc. No.
Rev. 7 (RJR)
Rev. Date: October 17, 2003
Page 5 of 14

- 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.

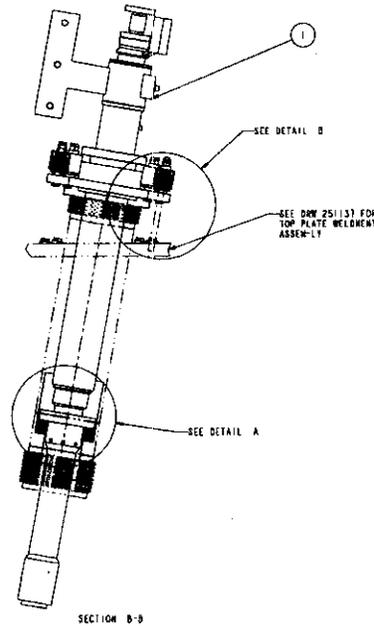


Figure 1.21a HTS Lead in Test Chimney. Note: CERN chimneys do not have bellows.

Negative Lead DFLX 35 Positive Lead DFLX 36



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7500 A HTS Power Leads for the LHC DFBX:

5. Installation of the Current Leads

Doc. No.
Rev. 7 (RJR)
Rev. Date: October 17, 2003
Page 6 of 14

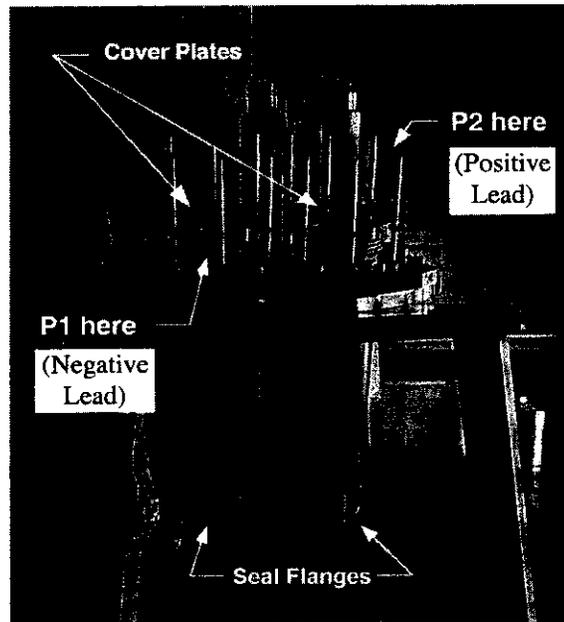


Figure 1.21b Locations of the negative and positive leads.

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

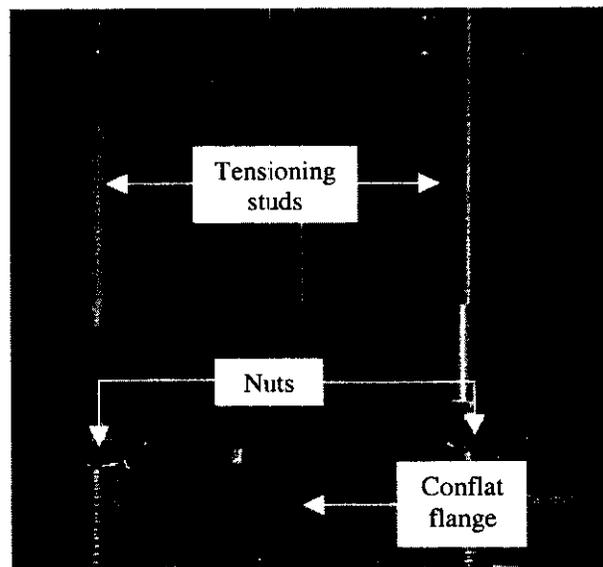


Figure 1.22 The positions of the tensioning studs, nuts, and top plate Conflat flange as the 20 Conflat bolts are tightened.

Negative Lead DFLX _____ Positive Lead DFLX _____



- 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.

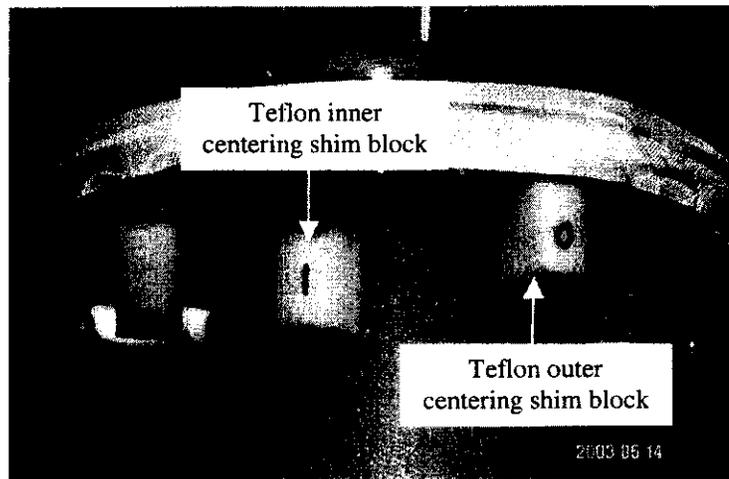


Figure 1.23 The installed Teflon centering shim blocks.

- 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 $\frac{1}{4}$ turn increments to a final torque of 15 ft-lbf (180 in-lbf). The tightening sequence is given by Fig. 1.26.



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Technical
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7500 A HTS Power Leads for the LHC DFBX:

5. Installation of the Current Leads

Doc. No.
Rev. 7 (RJR)
Rev. Date: October 17, 2003
Page 8 of 14

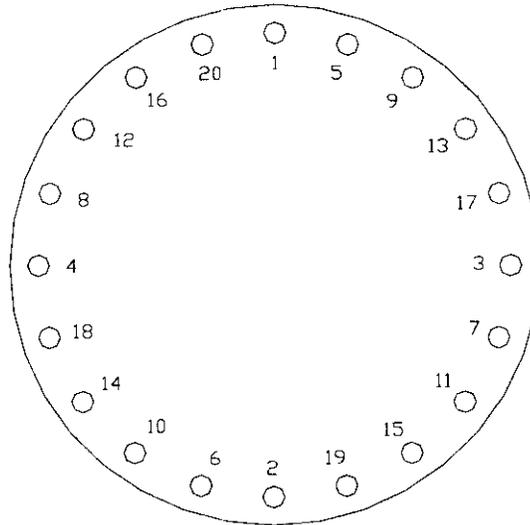


Figure 1.24 Tightening sequence for the 20 Conflat bolts.

- 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.



7500 A HTS Power Leads for the LHC DFBX: 5. Installation of the Current Leads

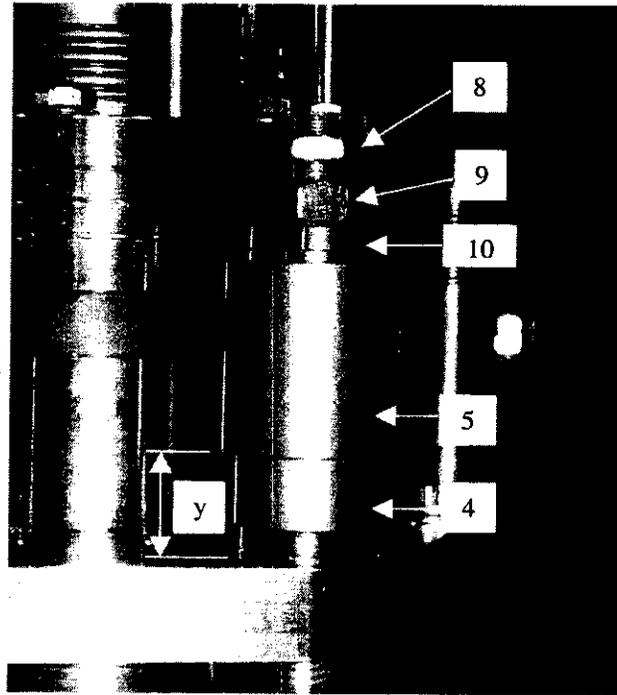


Figure 1.28a An installed Belleville Washer Assembly.

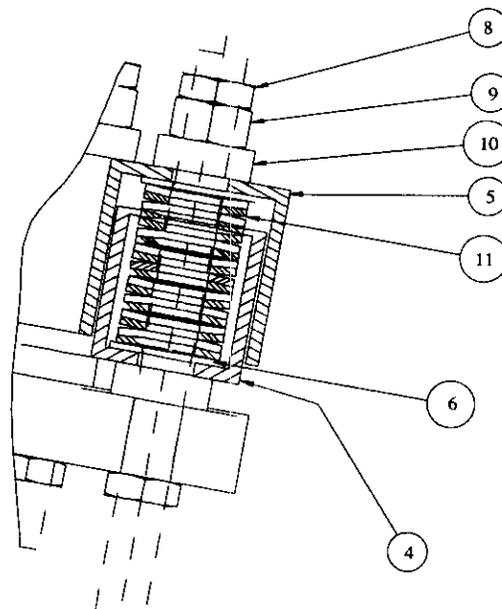


Figure 1.28b An installed Belleville Washer Assembly.

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

1.29.1 Washers for Lead DFLX _____

Negative Lead DFLX _____ Positive Lead DFLX _____



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

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 23.96 B 24.47 C 23.75 D 23.71 E 24.03 F 23.80

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 22.16 B 22.67 C 21.95 D 21.91 E 22.33 F 22.00

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 _____

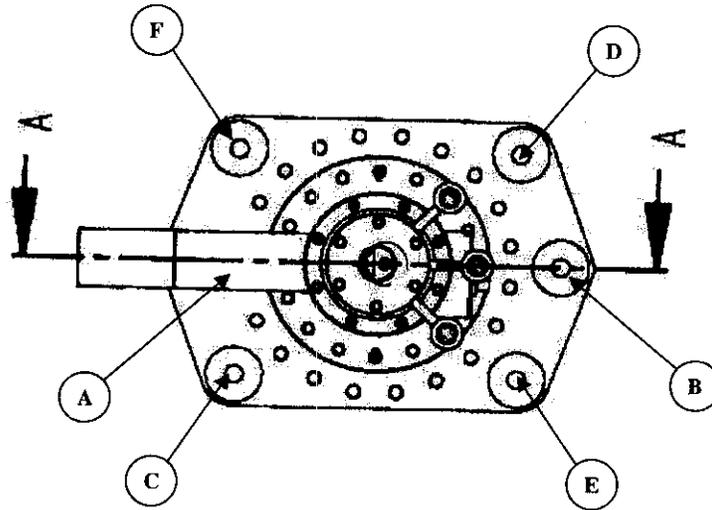
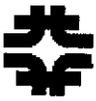


Figure 1.29.1.5 The specified sequence for tightening the Belleville Washer Assemblies.

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

A 22.16 B 22.62 C 21.87 D 21.91 E 22.22 F 21.84

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

1.29.2 Washers for Lead DFLX

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.

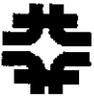
A 24.19 B 24.05 C 24.10 D 24.38 E 24.22 F 23.67

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 22.39 B 22.25 C 22.30 D 22.58 E 22.42 F 21.87

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



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

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 22.46 B 22.25 C 22.30 D 22.58 E 22.93 F 21.86

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 pigtailed with alcohol.

4.3 Make connection to LTS pigtailed. 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



7500 A HTS Power Leads for the LHC DFBX: 5. Installation of the Current Leads

the installed power leads. Figure 4.3b shows the G-10 clamshell clamp, the clamp support, and the mechanical clamp.

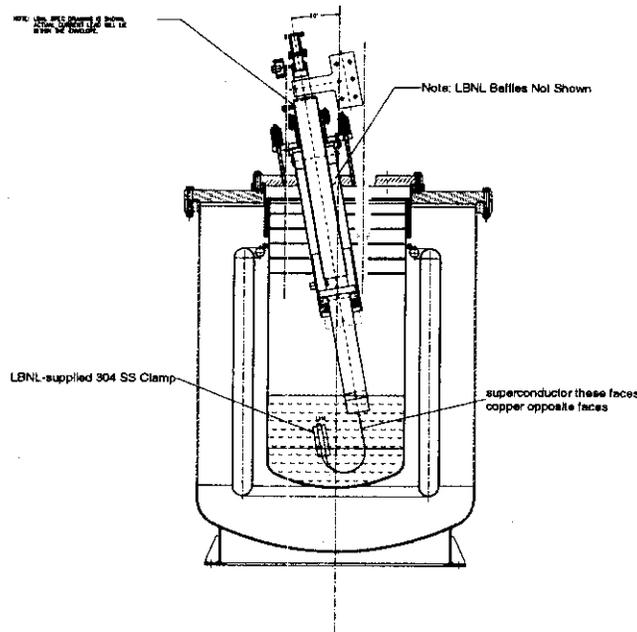


Figure 4.3a Side View of Lead in Cryostat with the LTS cables connected.

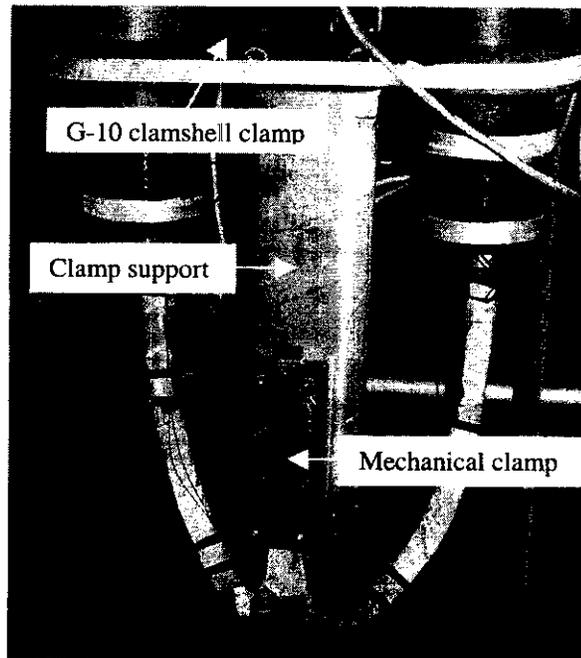


Figure 4.3b Electrical integration of the LTS sections.



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

Doc. No.
Rev. 7 (RJR)
Rev. Date: October 17, 2003
Page 14 of 14

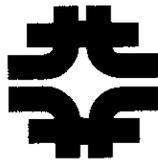
- 4.4 Clamp a piece of bus wire and a small amount of indium to the LTS cable. Solder the two V5 voltage tap wires to the bus wire. Wind excess voltage tap wire around the bottom of the lead, securing it with Kapton and glass tape.
- 4.5 Insulate the superconducting cable with Kapton and glass tape.
- 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:
6. Pressure Test Procedure**

Doc. No.
Rev. 1 (RJR)
Rev. Date: Feb. 13, 2003
Page 1 of 2



**FERMILAB
Technical Division**

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

Lead Pair

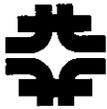
Negative Lead: 35

Positive Lead: 36

Signed

Date

10.21.03



1. Preparation for Pressurization

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

2. Pressurization

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

Initial pressure: 65.0 psia 14:28:00

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

Final pressure: 64.9 psia 14:35:18

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.



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

Doc. No.
Rev. – (RJR)
Rev. Date: February 7, 2003
Page 1 of 2



**FERMILAB
Technical Division**

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

Lead Pair

Negative Lead: 35

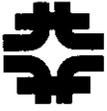
Positive Lead: 36

Signed

C.F. How

Date

10.23.03



1. Preparation for Leak Checking

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

2. Leak Check

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

Baseline: 1.20 e⁻⁶

- 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: 1.20 e⁻⁶

There were GHe leaks to saturation at both
PEEK seals. No response elsewhere c. Hous



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

Doc. No.
Rev. 1 (RJR)
Rev. Date: Sept. 3, 2003
Page 1 of 2



**FERMILAB
Technical Division**

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

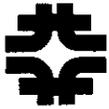
Lead Pair

Negative Lead: 35

Positive Lead: 36

Signed P. E. Hershey

Date 10/24/03



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

Doc. No.
Rev. 1 (RJR)
Rev. Date: Sept. 3, 2003
Page 2 of 2

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 _____ Positive Lead DFLX _____



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7500A HTS Power leads for the LHC DFBX

Doc. No.
Rev. 1 (SF)
Date: January 31, 2003
Page 1 of 8
Author: Fred Lewis

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 Steve Helis (Name typed) Steve Helis (Signature)

Date & time 10/27/05 09:45

Pos. Power Lead 7500 A DFLX 36 and Neg. Power Lead 7500 A DFLX 35

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. 2/2

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 mdtf34
You should be in the directory mdtf34: home/mdtf34/cryo
Type the command: numdisp -n mtfvx27&

DFLX _____ DFLX _____



9. Room Temperature Electrical
Checkout

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

357

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

A	B				
Pin 1 - pin 2	(160uv)	<u>1574</u>	V	Pin 2 - pin 3	(450uv) <u>4604</u> V 473
Pin ^A 1 - pin ^C 3	(610uv)	<u>6294</u>	V	Pin 3 - pin 4	(480uv) <u>4564</u> V 459
Pin ^A 1 - pin ^P 4	(1.1mv)	<u>1.08 m</u>	V	Pin 4 - pin 5	(3.5mv) <u>3.3 m</u> V
Pin ^A 1 - pin ^F 5	(4.7mv)	<u>4.4 m</u>	V	Pin 5 - pin 6	(float) <u>-----</u> V
Pin ^A 1 - pin ^F 6	(float)	<u>-----</u>	V	Pin 6 - pin 7	(float) <u>-----</u> V
^{-140u} Pin ^A 1 - pin ^F 7	(-20uv)	<u>+7.6 m</u>	V	Pin 7 - pin 8	(0v) <u>-8.2 m</u> V
^{-90u} Pin ^A 1 - pin ^F 8	(-20uv)	<u>-5704</u>	V		<u>+51uV</u>

Voltage tap Connector 2 (**Redundant**)

Pin 1 - pin 2	(160uv)	<u>1574</u>	V	Pin 2 - pin 3	(450uv) <u>4744</u> V
Pin 1 - pin 3	(610uv)	<u>6334</u>	V	Pin 3 - pin 4	(480uv) <u>4484</u> V
Pin 1 - pin 4	(1.1mv)	<u>1.08 m</u>	V	Pin 4 - pin 5	(3.5mv) <u>3.3 m</u> V
Pin 1 - pin 5	(4.7mv)	<u>4.4 m</u>	V	Pin 5 - pin 6	(float) <u>-----</u> V
Pin 1 - pin 6	(float)	<u>-----</u>	V		



9. Room Temperature Electrical Checkout

Negative Lead (single cable test)

Voltage tap Connector 1 (Primary)

Pin 1 - pin 2	(-160uv)	<u>-161₄</u> V	Pin 2 - pin 3	(-450uv)	<u>-494₄</u> V
Pin 1 - pin 3	(-600uv)	<u>-654₄</u> V	Pin 3 - pin 4	(-480uv)	<u>-502₄</u> V
Pin 1 - pin 4	(-1.1mv)	<u>-1.1_m</u> V	Pin 4 - pin 5	(-3.5mv)	<u>-3.16_m</u> V
Pin 1 - pin 5	(-4.7mv)	<u>-4.3_m</u> V	Pin 5 - pin 6	(float)	<u>_____</u> V
Pin 1 - pin 6	(float)	<u>_____</u> V	Pin 6 - pin 7	(float)	<u>_____</u> V
112u Pin 1 - pin 7	(+20uv)	<u>float</u> V	Pin 7 - pin 8	(0v)	<u>float</u> V 10u
125u Pin 1 - pin 8	(+20uv)	<u>611₄</u> V			

Voltage tap Connector 2 (Redundant)

Pin 1 - pin 2	(-160uv)	<u>-160₄</u> V	Pin 2 - pin 3	(-450uv)	<u>-499₄</u> V
Pin 1 - pin 3	(-600uv)	<u>-658₄</u> V	Pin 3 - pin 4	(-480uv)	<u>-501₄</u> V
Pin 1 - pin 4	(-1.1mv)	<u>-1.1_m</u> V	Pin 4 - pin 5	(-3.5mv)	<u>-3.1_m</u> V
Pin 1 - pin 5	(-4.7mv)	<u>-4.3_m</u> V	Pin 5 - pin 6	(float)	<u>_____</u> V
Pin 1 - pin 6	(float)	<u>_____</u> V			

Connection 1 (Primary) (dual cable test)

Positive Lead Pin 1 - Negative Lead pin 5	(3.7mv)	<u>3.3_m</u> V
Positive Lead Pin 1 - Negative Lead pin 4	(7.3mv)	<u>6.5_m</u> V
Positive Lead Pin 1 - Negative Lead pin 3	(7.7mv)	<u>7.0_m</u> V
Positive Lead Pin 1 - Negative Lead pin 2	(8.2mv)	<u>7.5_m</u> V
Positive Lead Pin 1 - Negative Lead pin 1	(8.3mv)	<u>7.6_m</u> V

Connection 2 (Redundant) (dual cable test)

Positive Lead Pin 1 - Negative Lead pin 5	(3.7mv)	<u>3.3_m</u> V
Positive Lead Pin 1 - Negative Lead pin 4	(7.3mv)	<u>6.5_m</u> V
Positive Lead Pin 1 - Negative Lead pin 3	(7.7mv)	<u>7.0_m</u> V
Positive Lead Pin 1 - Negative Lead pin 2	(8.2mv)	<u>7.5_m</u> V
Positive Lead Pin 1 - Negative Lead pin 1	(8.3mv)	<u>7.6_m</u> V

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

3.0 Voltage Drop measurements for Quench Character Cables

3.1 Connect QC POS LEAD & QC NEG LEAD Connectors on Stand 4 platform Quench Management Vtap Box to the breakout box.

3.2 Use a ~~handheld~~ DVM to check the voltages on specified pins.

3457



**9. Room Temperature Electrical
Checkout**

QC POS LEAD (+VTAP QC RR STN3 DBox +VTAP QC STN4 QM Box)

Pin 1 - pin 2 (160uv) 1554 V
 Pin 3 - pin 4 (950uv) 9254 V
 Pin 5 - pin 6 (480uv) 4544 V
 Pin 7 - pin 8 (3.5mv) 3.3m V

QC NEG LEAD

Pin 1 - pin 2 (-160uv) -1644 V
 Pin 3 - pin 4 (-950uv) -9924 V
 Pin 5 - pin 6 (-480uv) -5024 V
 Pin 7 - pin 8 (-3.5mv) -3.1m V

Restore QC Cables

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

4.0 RTD resistance measurements.

4.1 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

4.2 511-3, 512-3, 509-3A, 509-3B, 510-3A, and 510-3B.

4.3 Using a hand-held meter, perform a two-wire measurement on connector #3 of Positive Lead

Resistance between Pin 1 and pin 2 (.800) 0.8 Ω
 Resistance between Pin 1 and pin 3 (109) 109 Ω
 Resistance between Pin 1 and pin 4 (109) 108.9 Ω
 Resistance between Pin 2 and pin 3 (109) 108.7 Ω
 Resistance between Pin 2 and pin 4 (109) 108.7 Ω
 Resistance between Pin 3 and pin 4 (.800) 0.6 Ω

Pins 1-4 resistance to lead (infinite) ∞ Ω
 Pins 1-4 resistance to ground (infinite) ∞ Ω



**9. Room Temperature Electrical
Checkout**

Resistance between Pin 5 and pin 6 (.800) 0.6 Ω
 Resistance between Pin 5 and pin 7 (109) 108.8 Ω
 Resistance between Pin 5 and pin 8 (109) 108.7 Ω
 Resistance between Pin 6 and pin 7 (109) 108.8 Ω
 Resistance between Pin 6 and pin 8 (109) 108.8 Ω
 Resistance between Pin 7 and pin 8 (.800) 0.6 Ω

Pins 5-8 resistance to lead (infinite) ∞ Ω
 Pins 5-8 resistance to ground (infinite) ∞ Ω

Resistance between Pin 9 and pin 10 (.800) 0.6 Ω
 Resistance between Pin 9 and pin 11 (109) 108.7 Ω
 Resistance between Pin 9 and pin 12 (109) 108.7 Ω
 Resistance between Pin 10 and pin 11 (109) 108.7 Ω
 Resistance between Pin 10 and pin 12 (109) 108.7 Ω
 Resistance between Pin 11 and pin 12 (.800) 0.6 Ω

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

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

Resistance of T1 108.0 Ω (108.5) (I+ at pin 1, U+ at pin 2, I- at pin 3, U- at pin 4)
 Resistance of T2 108.0 Ω (108.5) (I+ at pin 5, U+ at pin 6, I- at pin 7, U- at pin 8)
 Resistance of T3 108.1 Ω (108.5) (I+ at pin 9, U+ at pin 10, I- at pin 11, U- at pin 12)

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

Resistance between Pin 1 and pin 2 (.800) 0.6 Ω
 Resistance between Pin 1 and pin 3 (109) 108.8 Ω
 Resistance between Pin 1 and pin 4 (109) 108.8 Ω
 Resistance between Pin 2 and pin 3 (109) 108.7 Ω
 Resistance between Pin 2 and pin 4 (109) 108.7 Ω
 Resistance between Pin 3 and pin 4 (.800) 0.6 Ω

Pins 1-4 resistance to lead (infinite) ∞ Ω
 Pins 1-4 resistance to ground (infinite) ∞ Ω



9. Room Temperature Electrical
Checkout

Resistance between Pin 5 and pin 6 (.800) 0.7 Ω
 Resistance between Pin 5 and pin 7 (109) 109 Ω
 Resistance between Pin 5 and pin 8 (109) 108.8 Ω
 Resistance between Pin 6 and pin 7 (109) 108.7 Ω
 Resistance between Pin 6 and pin 8 (109) 108.7 Ω
 Resistance between Pin 7 and pin 8 (.800) 0.7 Ω

Pins 5-8 resistance to lead (infinite) ∞ Ω
 Pins 5-8 resistance to ground (infinite) ∞ Ω

Resistance between Pin 9 and pin 10 (.800) 0.6 Ω
 Resistance between Pin 9 and pin 11 (109) 108.8 Ω
 Resistance between Pin 9 and pin 12 (109) 108.8 Ω
 Resistance between Pin 10 and pin 11 (109) 108.8 Ω
 Resistance between Pin 10 and pin 12 (109) 108.8 Ω
 Resistance between Pin 11 and pin 12 (.800) 0.5 Ω
 Pins 9-12 resistance to lead (infinite) ∞ Ω
 Pins 9-12 resistance to ground (infinite) ∞ Ω

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

Resistance of T1 108.1 Ω (108.5) (I- at pin 1, U+ at pin 2, I- at pin 3, U- at pin 4)
 Resistance of T2 108.1 Ω (108.5) (I+ at pin 5, U+ at pin 6, I- at pin 7, U- at pin 8)
 Resistance of T3 108.1 Ω (108.5) (I+ at pin 9, U+ at pin 10, I- at pin 11, U- at pin 12)

4.7 Check remaining RTDs

connect the following cables

RTDs in the Dewar

~~530-3, 531-3, 532-3, 533-3, 534-3, 535-3~~

Top of leads

~~507-3A, 507-3B~~

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.



9. Room Temperature Electrical
Checkout

ADD 4/2/03

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

4.8 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.

4.9 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/II" 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. pin 1 (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

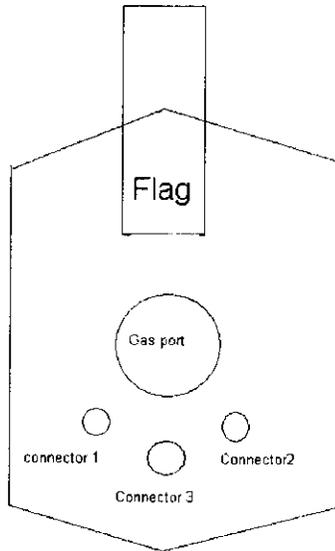
4.10 Do a 4-Wire resistance measurement:

12" Dewar 163.7 30" Dewar 402 30" Phase sep. 403

	12" Dewar	30" Dewar	30" Phase sep
1. 1 (red) to 8 (blue)	<u>7.4</u>	<u>6.8</u>	<u>7.7</u>
2. 8 (blue) to 6 (yellow)	<u>166.3</u>	<u>404</u>	<u>406</u>
3. 6 (yellow) to 7 (black)	<u>2.8</u>	<u>1.5</u>	<u>2.3</u>
4. 1 (red) to 7 (black)	<u>171.1</u>	<u>409</u>	<u>411</u>



9. Room Temperature Electrical Checkout



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 kepc0 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).



FERMILAB
Technical Division
Development & Test

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

Doc. No.
Rev. 4 (RJR)
Rev. Date: Sept. 3, 2003
Page 1 of 2



FERMILAB
Technical Division

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

Lead Pair

Negative Lead: 35

Positive Lead: 36

Signed

C. E. [Signature]

Date

10/27/03



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

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.



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7500A HTS Power leads for the LHC DFBX

Doc. No.
Rev. No.
Date: March 5, 2003
Page 1 of 1
Author: Dan Eddy

10.1 Warm Temp Hi-pot In Gaseous 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 Steve Helis, Dan Watson [Signature]
(Name typed) (Signature)

Date & time 10/27/03 16:50

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

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.

Record current 4.0124 A

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 0.0164 A.

Record approximate temp. 295 K.

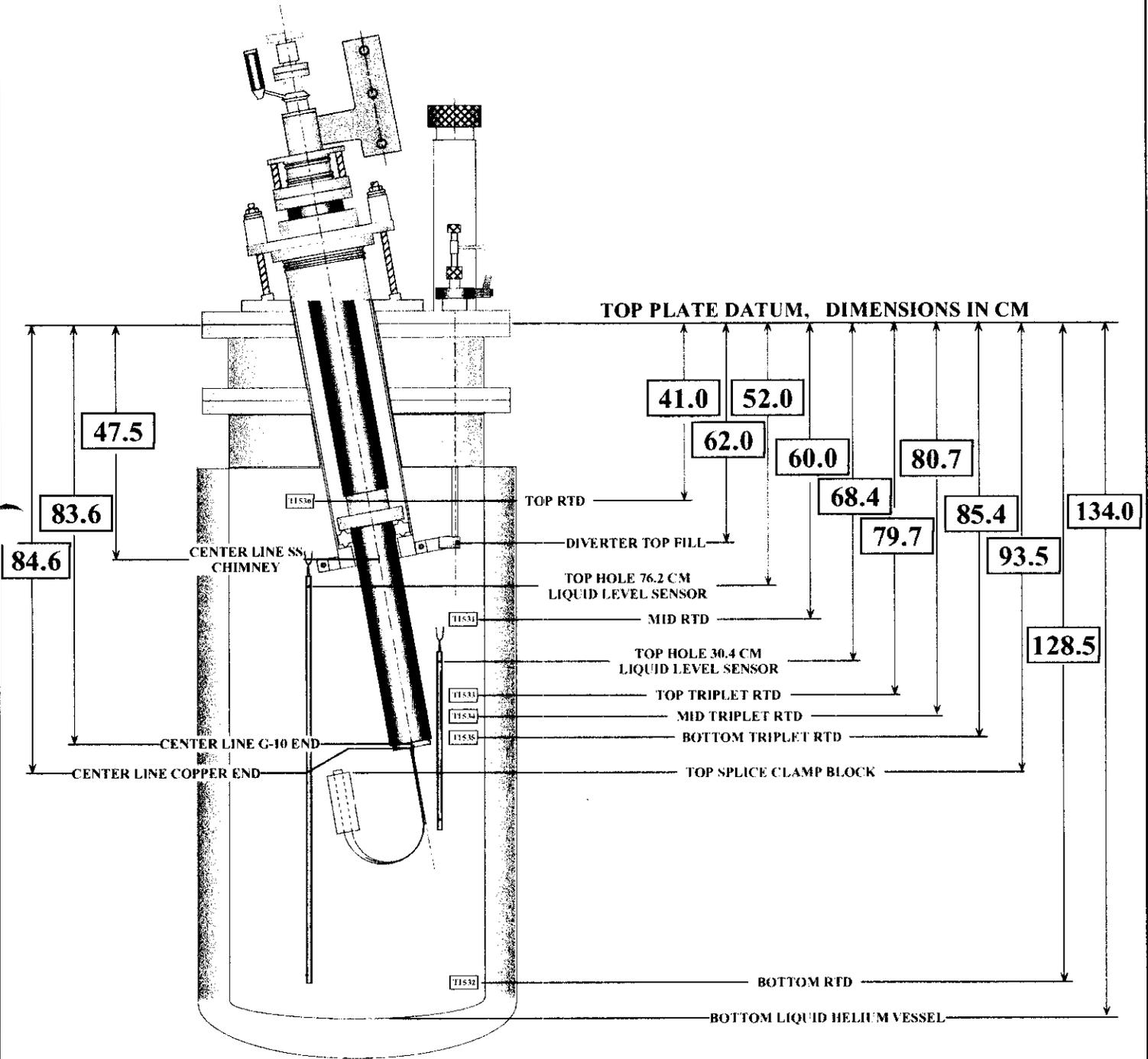
Record approximate test dewar pressure 16.9 PSIA.

NOTE: After checkout is complete, be sure to set up kepcos 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).

LHC HTS POWER LEAD TESTING @ TEST STAND 3

PAIR - DFLX- 35 (-) & DFLX- 36 (+)





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Technical Division
Development & Test

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

Doc. No.
Rev. 1 (RJR)
Rev. Date: May 12, 2003
Page 1 of 2



FERMILAB
Technical Division

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

Lead Pair

Negative Lead: DFLX 35

Positive Lead: DFLX 36

Signed

George Kinschler

Date

10-28-03



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

- SK
- SK
- SK
1. ± 5 A applied to the current leads during cooldown.
 2. DAQ system is operational (temperature sensor readouts in the test dewar helium space are updating).
 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".



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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 Steve Helis (Name typed) [Signature] (Signature)

Date & time 10/28/03 8:37

Pos. Power Lead 7500 A DFLX 26 and Neg. Power Lead 7500 A DFLX 35

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.

Record current 0.0144 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 0.144 A.

Record approximate temp. 4.2 K. Record Temp of TI 532-3

Record approximate test dewar pressure 14.5 PSIA.

NOTE: Reconnect Vtaps and RTDs when finished.



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Technical Division
Development & Test

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

Doc. No.
Rev. 3 (RJR)
Rev. Date: July 25, 2003
Page 1 of 3



FERMILAB
Technical Division

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

Lead Pair

Negative Lead: DFLX.35

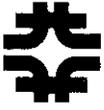
Positive Lead: DFLX.36

Signed

Roger J. Rubell

Date

10/28/03



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

1. Power Supply Changes

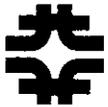
- 2.1 On the FIX32 HMTF Power Interlock screen, switch the selector switch to the Stand 3 position.
- 2.2 Switch warning lights to the "Stand 3" position.
- 2.3 Adjust the power supply time constant by setting the resistance to 500 $\mu\Omega$.
- 2.4 Adjust the power supply time constant by setting the inductance to 0.5 mH.
- 2.5 Adjust the dump resistance to 30 m Ω .

2. Bus Connection Changes – Stand 3 Side

- 2.1 Perform MTF-ELEC-07 (VMTF/ST4/ST3) LOTO procedure for all handling of flexible bus work.
- 2.2 Mate the Stand 3 hard bus with the Stand 4 flexible bus on the Stand 4 platform. Verify the polarity is correct.
- 2.3 Disconnect trim current supply leads.
- 2.4 Connect the flex leads and chill blocks to the power lead flags. Apply Penetrox E conductive grease to the cooling block-lead flag joint.
- 2.5 Attach voltage taps VFF-A and VFF-B at the negative and positive flex lead flags, respectively, and voltage VLF-A and VLF-B at the negative and positive power lead flags, respectively. These taps will allow the voltage drop across the flex lead/chill block joint and chill block/power lead joint to be measured.
- 2.6 Using glass tape, attach the Kapton-wrapped platinum temperature sensors TE515-3 and TE516-3 to the positive and negative lead flags, respectively.
- 2.7 Wrap the power lead flags with rubber insulation for personnel safety.
- 2.8 Install the plexiglass enclosure around the power leads for personnel safety.

3. Bus Connection Changes – VMTF End

- 3.1 Remove the short VMTF flex leads from the 30 kA bus work.



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

- 3.2 Install flex leads from the Stand 4 bus to the 30 kA bus work.
- 3.3 Wrap all exposed bus with rubber insulation for personnel safety.
- 3.4 Place the VMTF ground switch in the "off" position.
- 3.5 Place the Stand 4 ground switch in the "on" position.
- 3.6 Place the Stand 3/VMTF ground switch on the ETS panel in the Stand 3 (up) position and press the Master Reset.
- 3.7 Remove the power control cable, which contains QLM, PLC, etc. signals, from the VMTF "j" plug and insert into the Stand 4 "j" plug.



15. OD circuit checkout

Performed by Steve Helis (name typed)  (signature)

Date & time 10/27/03 15:30

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 dual 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.

Checked settings, Nothing Changed



16. Cold test of the power leads

Performed by ROGER RABEHL (name typed) Roger Rabehl (signature)
Date & time OCTOBER 28, 2003 0835

Power Lead 7500 A DFLX 35 & 7500 A DFLX 36

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 1/2 hour

Neg. lead flow rate 0.141 g/s Pos. lead flow rate 0.110 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 1/2 hour

Neg. lead flow rate 0.131 g/s Pos. lead flow rate 0.101 g/s

Neg. lead diff. pressure 0 mbar Pos. lead diff. pressure 0 mbar

Frost observed on leads? (Y/N) N

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 35 $R(\text{joint between V2 \& V3}) = \frac{0.000188 - 0.000109 \text{ V}}{7500 \text{ A}} = 39.6 \text{ n}\Omega$

$R(\text{joint between V3 \& V4}) = \frac{0.000158 - 0.000131 \text{ V}}{7500 \text{ A}} = 3.3 \text{ n}\Omega$

7500 A DFLX 36 $R(\text{joint between V2 \& V3}) = \frac{0.000391 - 0.000091 \text{ V}}{7500 \text{ A}} = 40.0 \text{ n}\Omega$

$R(\text{joint between V3 \& V4}) = \frac{0.000308 - 0.000282 \text{ V}}{7500 \text{ A}} = 3.5 \text{ n}\Omega$

16.3 Coolant loss test.

Apply 7500 A and

a) Close the coolant flow for 7500 A DFLX 35

Wait until QD detects the quench and record

$T1 = 8.2 \text{ K}$; $T2 = 295 \text{ K}$; $V12 = -95.1 \text{ mV}$; $V23 = -0.91 \text{ mV}$; $V34 = 0.14 \text{ mV}$;

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).



16. Cold test of the power leads

- b) Re-establish operating conditions
- c) Close the coolant flow for 7500 A DFLX 26.
Wait until QD detects the quench and record
 $T1 = 79\text{ K}$; $T2 = 313\text{ K}$; $V12 = 101,5\text{ mV}$; $V23 = 1,08\text{ mV}$; $V34 = 0,30\text{ mV}$;

✓ 16.4a Set the upper HTS terminal temperature to 45 K and apply current profile 2.

Neg. lead flow rate $0,482\text{ g/s}$ Pos. lead flow rate $0,433\text{ g/s}$
Neg. lead diff. pressure $3,8\text{ mbar}$ Pos. lead diff. pressure $7,2\text{ mbar}$

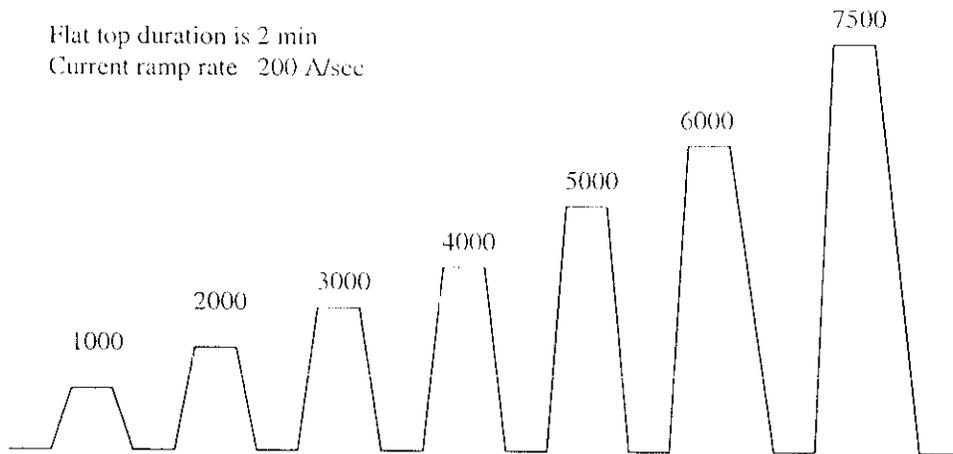
✓ 16.4b Set HTS terminal temp to 50 K and apply current profile 2.

Neg. lead flow rate $0,467\text{ g/s}$ Pos. lead flow rate $0,420\text{ g/s}$
Neg. lead diff. pressure $3,7\text{ mbar}$ Pos. lead diff. pressure $7,0\text{ mbar}$

✓ 16.5 When test is completed, set the ScribeLeads and ScribeFix32 Data Logging Intervals to 300 seconds.

Note: If any irregularity occur call Sandor.

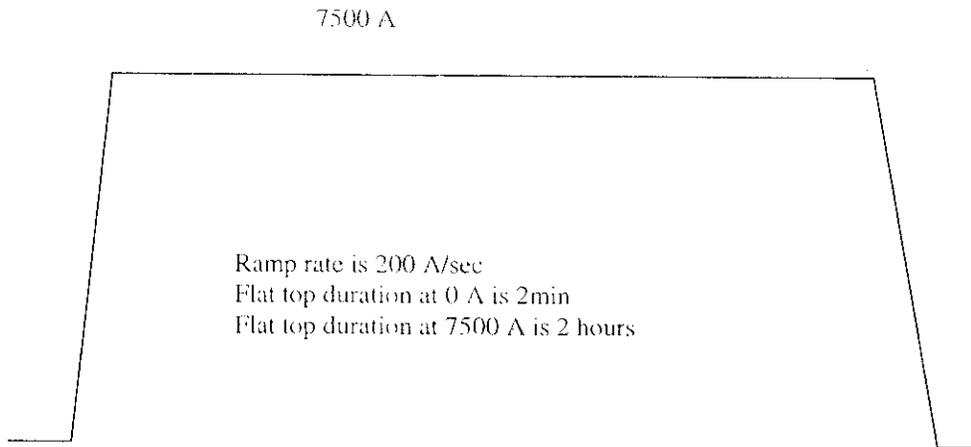
Profile 1:





16. Cold test of the power leads

Profile 2:





16. Cold test of the power leads

Performed by ROGER RABEHL
(name typed)

Roger Rabehl
(signature)

Date & time OCTOBER 29, 2003

1150

Power Lead 7500 A DFLX 35 & 7500 A DFLX 36

✓ 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 1/2 hour ✓

Neg. lead flow rate 0.140 g/s Pos. lead flow rate 0.101 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 1/2 hour ✓

Neg. lead flow rate 0.122 g/s Pos. lead flow rate 0.080 g/s

Neg. lead diff. pressure 0 mbar Pos. lead diff. pressure 0 mbar

Frost observed on leads? (Y/N) N

✓ 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 35 $R(\text{joint between V2 \& V3}) = \frac{0.00124 - 0.00173 \text{ V}}{7500 \text{ A}} = 39.6 \text{ n}\Omega$

$R(\text{joint between V3 \& V4}) = \frac{0.00131 - 0.00166 \text{ V}}{7500 \text{ A}} = 3.3 \text{ n}\Omega$

7500 A DFLX 36 $R(\text{joint between V2 \& V3}) = \frac{0.00114 - 0.00166 \text{ V}}{7500 \text{ A}} = 41.1 \text{ n}\Omega$

$R(\text{joint between V3 \& V4}) = \frac{0.00299 - 0.00275 \text{ V}}{7500 \text{ A}} = 3.2 \text{ n}\Omega$

16.3 Coolant loss test.

Apply 7500 A and

a) Close the coolant flow for 7500 A DFLX 35

Wait until QD detects the quench and record

$T1 = 80 \text{ K}$; $T2 = 296 \text{ K}$; $V12 = 95.4 \text{ mV}$; $V23 = 0.91 \text{ mV}$; $V34 = 0.11 \text{ mV}$;

T1 is the HTS warm terminal temp., T1509-3 (neg. lead) or T1510-3 (pos. lead).

T2 is the upper copper temp., T1511-3 (neg. lead) or T1512-3 (pos. lead).



16. Cold test of the power leads

- b) Re-establish operating conditions
- c) Close the coolant flow for 7500 A DFLX 36

Wait until QD detects the quench and record

$T1 = 83 K$; $T2 = 318 K$; $V12 = 10.4 mV$; $V23 = 1.10 mV$; $V34 = 0.29 mV$;

16.4a Set the upper HTS terminal temperature to 45 K and apply current profile 2.

Neg. lead flow rate _____ Pos. lead flow rate _____
Neg. lead diff. pressure _____ Pos. lead diff. pressure _____

16.4b Set HTS terminal temp to 50 K and apply current profile 2.

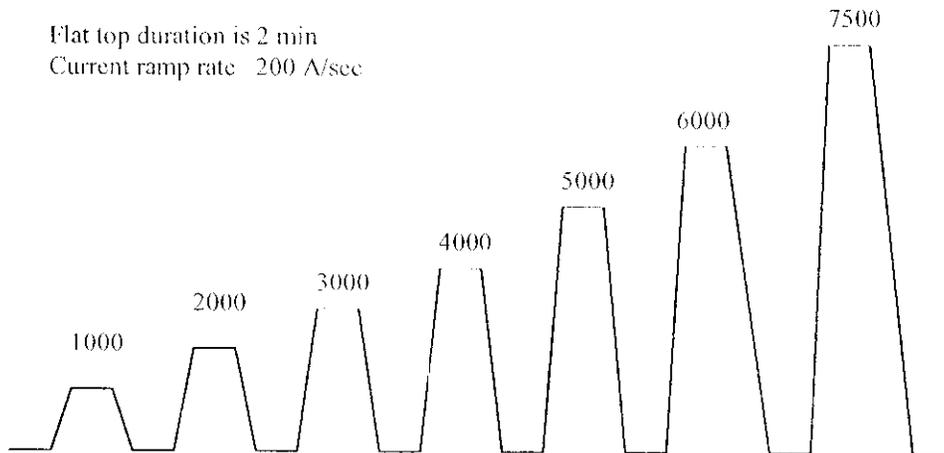
Neg. lead flow rate _____ Pos. lead flow rate _____
Neg. lead diff. pressure _____ Pos. lead diff. pressure _____

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:

Flat top duration is 2 min
Current ramp rate 200 A/sec

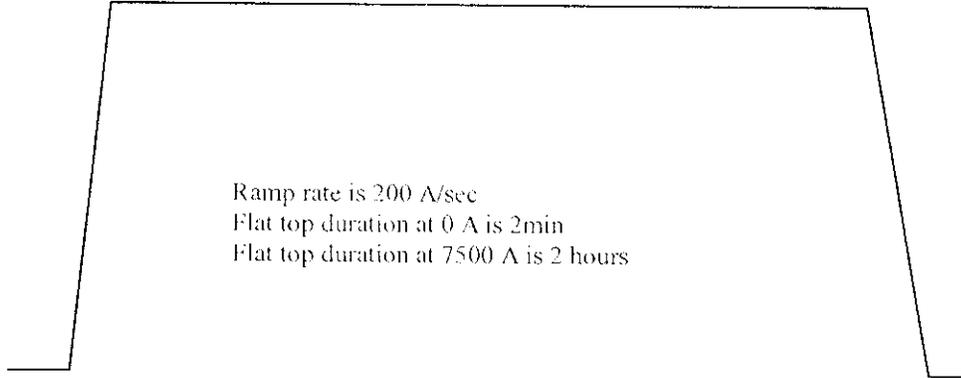




16. Cold test of the power leads

Profile 2:

7500 A





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7500A HTS Power leads for the LHC DFBX

Doc. No.
Rev. No.
Date: March 5, 2003
Page 1 of 1
Author: Dan Eddy

20. Warm Temp Hi-pot In Gaseous 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 Steve Helis (Name typed) Steve Helis (Signature)

Date & time 10/30/03

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

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.

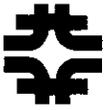
1.1 Short all of the temperature sensors together using the special RTD high pot cable. High pot each set of temperature sensor to 300v with respect to the Lead (ground).

Record breakdown voltage (if any) _____ V.
Record current 0.0124 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 0.084 A.
Record approximate temp. 290 K.
Record approximate test dewar pressure 16.5 PSIA.

NOTE: Reconnect Vtaps and RTDs when finished.



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**7500 A HTS Power Leads for the
LHC DFBX:
23. Pack and Ship the Leads**

Doc. No.
Rev. - (RJR)
Rev. Date: June 17, 2003
Page 1 of 3



FERMILAB
Technical Division

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

Lead Pair

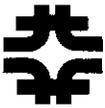
Negative Lead: 35

Positive Lead: 36

Signed

Date

11.07.03



1. Pack the Leads

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

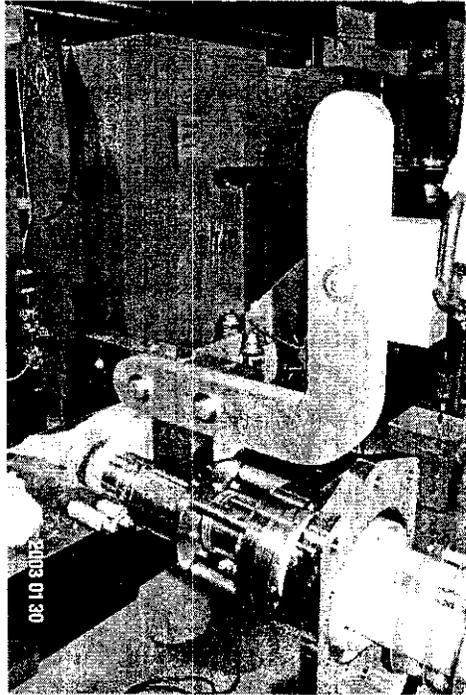
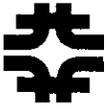


Figure 1.1 Orientation of the insertion/lifting tool to allow the power lead to be held horizontally.

- 1.2 Lift the power lead off of the steel table.
- 1.3 While supporting the lead from the crane, remove the end support clamped around the lower flange of the power lead.
- 1.4 Complete the lead preparation checklist:
- a) Install the protective covers for the lead top plate knife edge sealing surface and for the lower flange sealing surface on each lead. Secure them with tape.
 - b) Insert a protective plastic cap into the 4-20 K gas port for each lead.
 - c) Reattach the g-force indicators that were attached to the leads when they arrived.
 - d) Wrap the ceramic insulator at the top of each lead in bubble wrap.
 - e) Place a cap on the Conflat flange at the top of each lead.



**7500 A HTS Power Leads for the
LHC DFBX:
23. Pack and Ship the Leads**

- f) Wrap the power lead vacuum pumpout in aluminum foil.
- g) Secure the power lead bus and voltage tap wires to the power lead lower G-10 section with tape.
- h) Set each lead in the shipping crate and remove the insertion/lifting tool.

1.5 Complete the packing checklist:

- a) Reinstall the wooden supports in the crate to hold the lead in place during shipping.
- b) Make two photocopies of all documents in the lead travelers, and place the power lead travelers in the shipping crate. One copy of the documents is for Sandor, the second copy is for Marsha Schmidt.
- c) Verify the following items are in the shipping crate:
 - i) Two flag heaters
 - ii) Two flag heater connectors
 - iii) Vacuum pumpout actuator
 - iv) NW16 clamp
 - v) NW16 o-ring

1.6 Close the shipping crate

2. Ship the Leads

2.1 Complete the shipping checklist:

- a) Call Marsha Schmidt (X-4377) to request that the power leads be shipped to storage.