



## SDC SOLENOID DESIGN NOTE #184

TITLE: Report of Test Coil Winding (Result of the Test)  
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This design note is one of a series which represents the proceedings of the SDC solenoid subgroup meeting held in Japan on December 8-11, 1992. The plan and purpose of the meeting was to:

- Look at the prototype coil winding and honeycomb vessel R&D in Japan
- Reports of technical progress from each group
- Plan and schedule for the prototype magnet assembly and test
- Discussions on design of the SDC solenoid power supply
- Discussions on cryogenic design for the SDC solenoid
- Discussions on responsibilities for the cryogenics fabrication
- Response to the report of the DOE review sub-committee
- Publications and presentations of the technical progress

**Report of Test Coil Winding  
(Result of the Test)**

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Dec. 8, 1992

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# RESULTS OF THE BREAKDOWN VOLTAGE MEASUREMENT FOR THE TEST WINDING COIL

## 1. GROUND INSULATION

CHARGED VOLTAGE	INSULATION RESISTANCE	REMARKS
1.0 KV	2200 M $\Omega$	
2.0	2000	
3.0	1750	
4.5	----	B. D.

B. D. Between Coil and Inner Al Plate

## 2. TURN INSULATION

TURN NO	B. D. VOLTAGE (v)
5-6	1000
10-11	1000
15-16	1300
25-26	1000
44-45	800

# RESULTS OF THE VOLTAGE DISTRIBUTION MEASUREMENT FOR THE TEST WINDING COIL

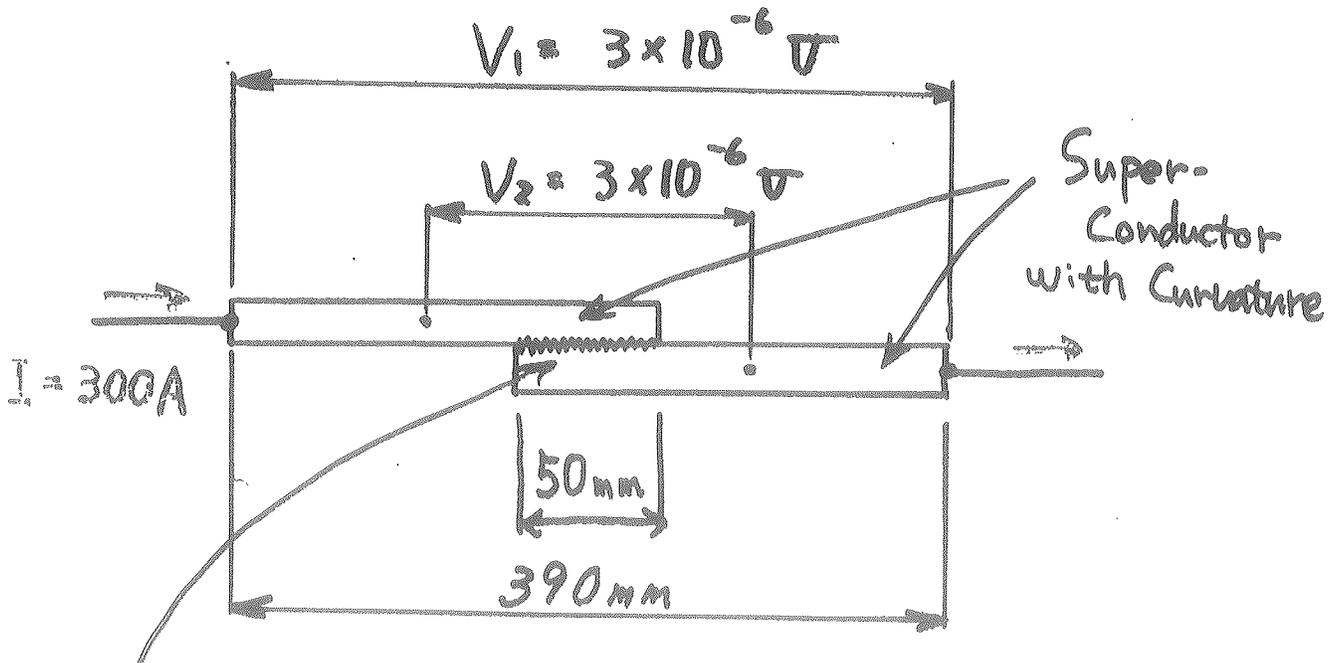
## VOLTAGE DISTRIBUTION

TURN No	VOLTAGE (mV)	TURN No	VOLTAGE (mV)	TURN No	VOLTAGE (mV)
0-1,2	0.09	- 17	0.17	- 33	0.18
- 3	0.18	- 18	0.18	- 34	0.17
- 4	0.17	- 19	0.18	- 35	0.17
- 5	0.18	- 20	0.17	- 36	0.18
- 6	0.17	- 21	0.18	- 37	0.18
- 7	0.18	- 22	0.17	- 38	0.17
- 8	0.17	- 23	0.18	- 39	0.18
- 9	0.18	- 24	0.17	- 40	0.17
- 10	0.17	- 25	0.18	- 41	0.18
- 11	0.18	- 26	0.17	- 42	0.17
- 12	0.17	- 27	0.18	- 43	0.17
- 13	0.17	- 28	0.17	- 44	0.18
- 14	0.18	- 29	0.18	- 45	0.17
- 15	0.18	-30, 31	0.09	- 46	0.18
- 16	0.17	- 32	0.17	- 47	0.17
				-48, 49	0.09

@ I = 0.1A , TOTAL VOLTAGE = 7.85mV

# RESULT OF THE CONDUCTOR JOINT RESISTANCE MEASUREMENT

## TEST SAMPLE



TIG WELD (JOINT)

$$R_{\text{TEST}} = \frac{V}{I} = \frac{3 \times 10^{-6}}{300} = 0.01 \mu\Omega$$

$$\therefore R_{\text{PROTO}} = 0.01 \mu\Omega \times \frac{50 \text{ mm}}{\sim 3700 \text{ mm} \times \pi} = 4.5 \times 10^{-11} \Omega$$

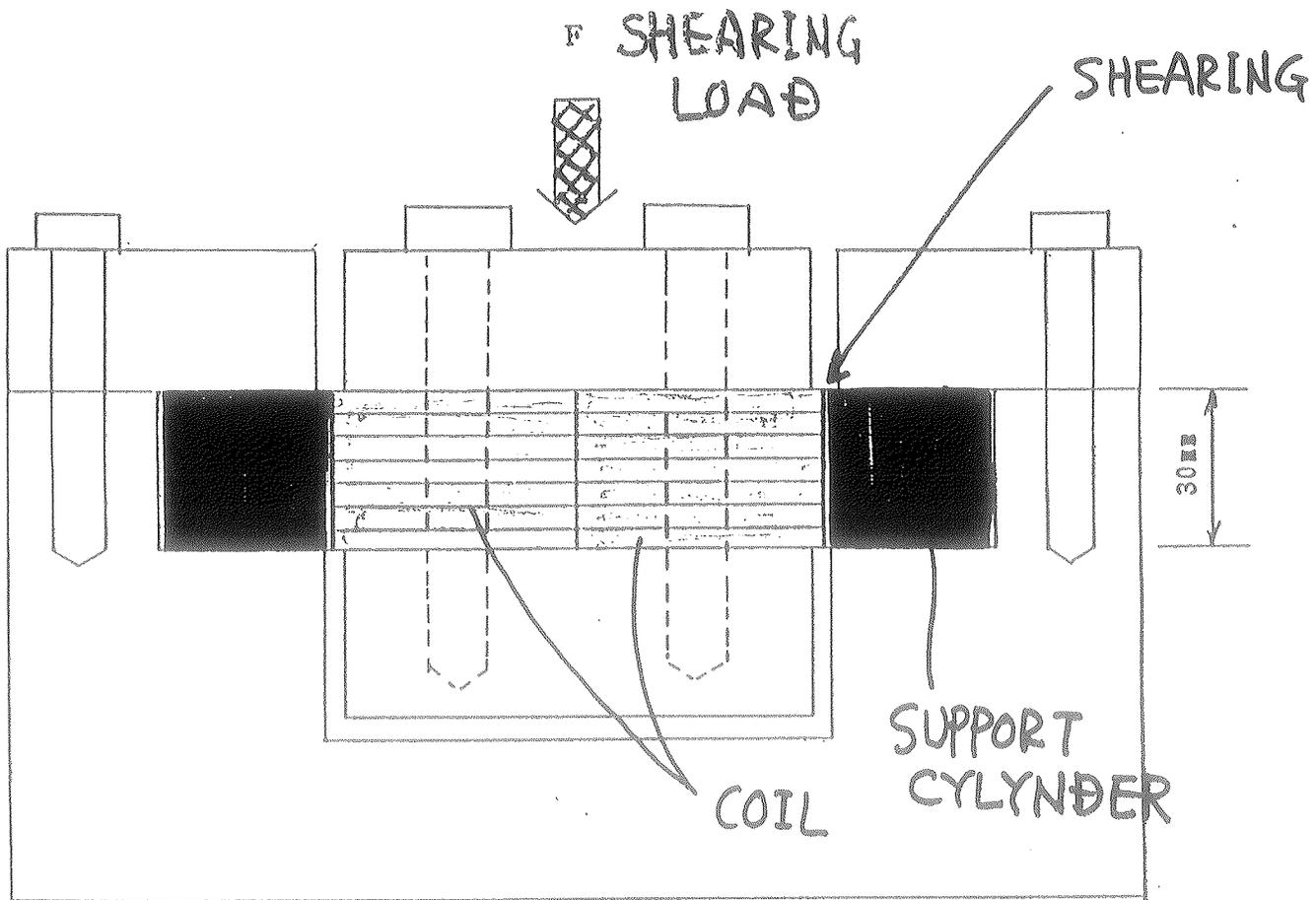
Equivalent to 1 turn of SDC Solenoid

## WEIGHT COMPOSITION OF COIL BLOCK

Measured total weight	192.8 g
Support cylinder & inner Al sheet	78.8 g
Conductor	109.8 g
Insulator (Remainder)	4.2 g

CONSIDERING THE RESULTS MENTIONED ABOVE,  
WEIGHT COMPOSITION OF PROTOTYPE COIL IS THE  
FOLLOWING,

Support cylinder & inner Al sheet	40.9 %
Conductor (Al, Cu, NbTi)	56.9 %
Insulator	2.2 %



TEST DEVICE OF EPOXY BONDING  
SHEAR - STRENGTH

# RESULTS OF EPOXY BONDING SHEAR-STRENGTH TEST

(SAMPLES WERE TAKEN  
FROM TEST WINDING COIL)

No	Temperature	Shear-Strength (kgf/mm <sup>2</sup> )
1	R. I.	<u>2.47</u>
2		2.32
3		1.64
4		1.94
5		1.92
6		2.26 <del>2.26</del>
7		<u>3.11</u>
8		2.41
9		2.60
10		2.36
11		2.58
12		2.53 <del>2.53</del>

( ): AVERAGE OF 6 DATA

## CONCLUSION

1. BREAKDOWN VOLTAGE OF THE TEST WINDING COIL WAS MESURED AND CONFIRMED  $>2KV$ .  
(B. D. VOLTAGE WAS 4.5KV)
2. BREAKDOWN VOLTAGE OF THE TURN INSULATION USING CUTTING SAMPLE FROM TEST WINDING COIL WAS MESURED AS  $>800V$ .
3. VOLTAGE DISTRIBUTION OF EACH TURN WAS MESURED AND IT'S DATA WAS VALID.
4. RESISTANCE OF THE CONDUCTOR JOINT WAS MESURED USING TEST SAMPLE.  
IT IS EQUIVALENT TO  $4.3 \times 10^{-11} \Omega$  IN SDC SOLENOID OF ONE TURN JOINT.
5. EPOXY BONDING SHEAR-STRENGTH WAS MESURED USING SAMPLES TAKEN FROM TEST WINDING COIL AT R. T. AND LN<sub>2</sub>.  
IT IS ENOUGH TO WITHSTAND AXIAL COMPRESSION.