Fermilab

SDC SOLENOID DESIGN NOTE #187

TITLE: Progress of Cryostat Component Design (Cooling Pipes, R/S, Supports, Chimney, etc.)

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DATE: Dec. 9, 1992

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

SDC Solenoid Subgroup Meeting in Japan

Progress of Cryostat Component Design

(Cooling Pipes, R/S, Support, Chimney etc.)

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RESULTS OF THE GFRP SUPPORT MECHANICAL TEST

1. RADIAL SUPPORT

For radial support, [redacted] and [redacted] were carried out using same dimensional GFRP support(φ30mm) except length.

Results are as follows.

RESULTS OF TENSILE TEST

Test No	Temp.	MAX Tensile Load (KN)	MAX Tensile Stress (kgf/mm2)
1	R.T.	452	65.2
2		462	66.7
3	LN_2	551	79.5
4		543.5	78.5

RESULTS OF FATIGUE TEST

Test No	Temp.	MAX Load (ton)	MAX Stress (kgf/mm2)	Fatigue Life (cycle)
1	R.T.	20	28.3	9613
2		25	35.4	4875
3		30	42.4	544

Design Value

- $\sigma = \frac{60 \times 10^3}{4} \times \frac{1}{\frac{\pi}{4} \times 30^2} = 21.2\ kgf/mm^2$
- n (Life cycle) : 1×10^3

2. AXIAL SUPPORT (Z-SUPPORT)

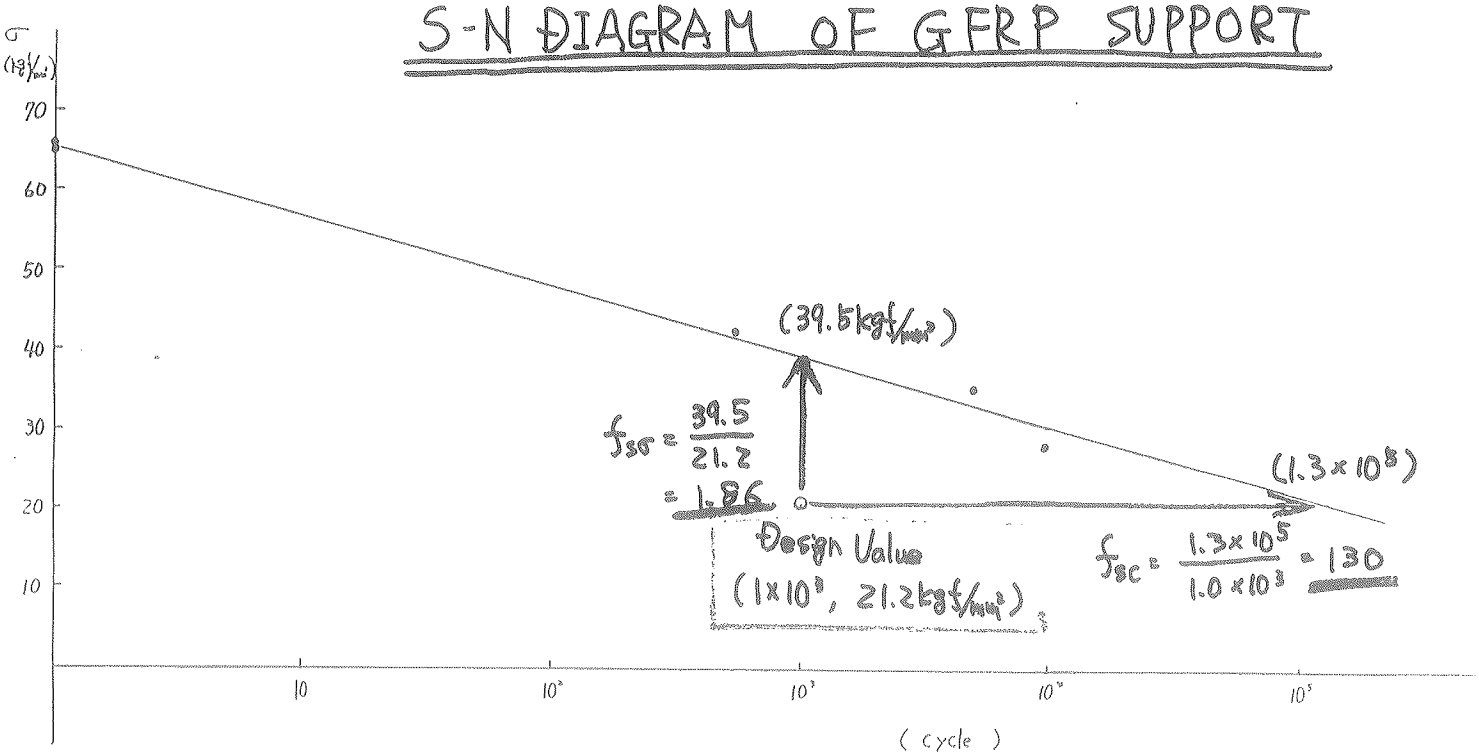
For axial support, three mechanical tests are planned, i.e., 1) tensile test at R.T. and LN2, 2) fatigue test under completely reversed tension and compression at R.T., 3) compression (anti-buckling) test at R.T., using full size GFRP support (φ20mm). These test are continued.

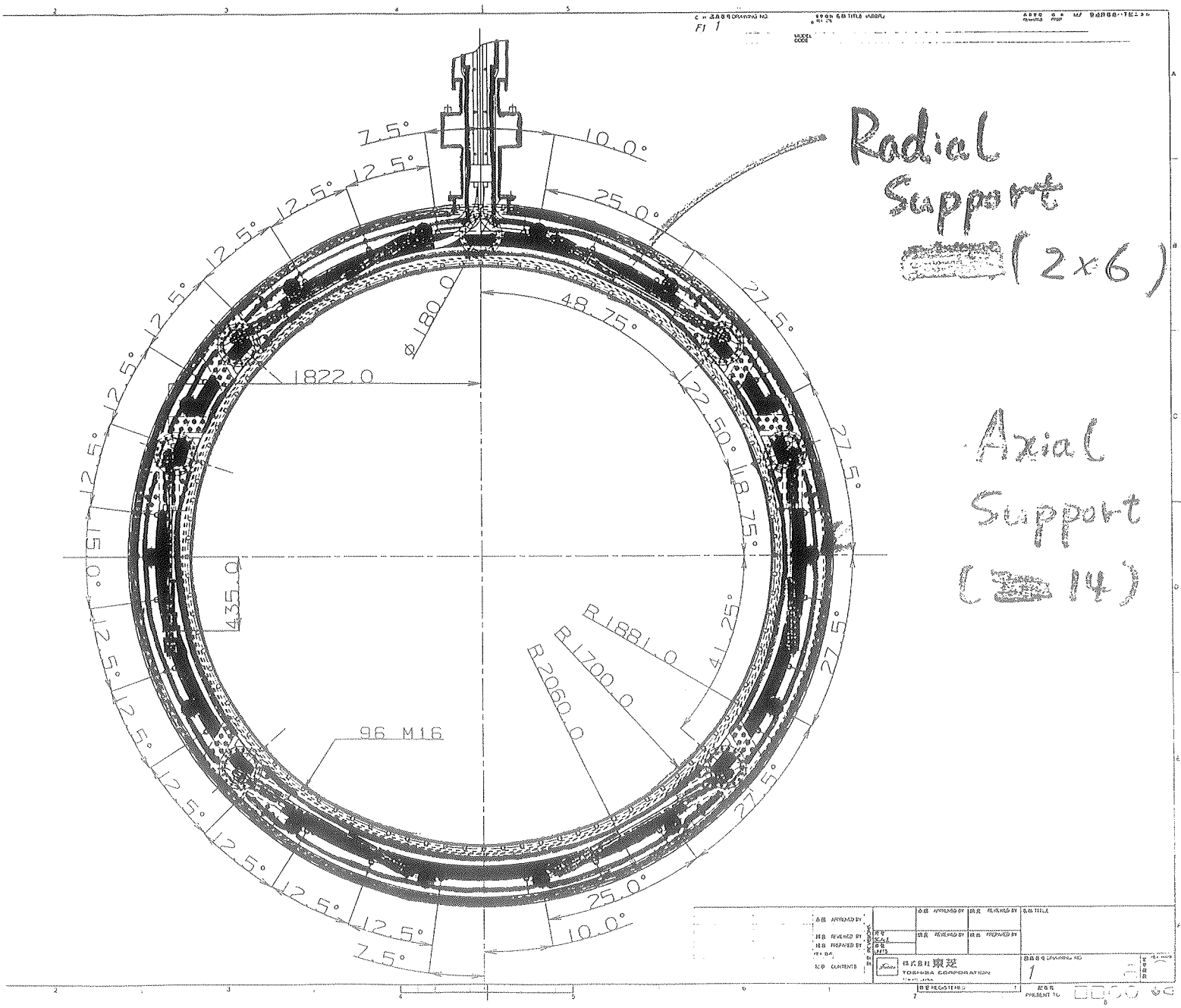
Some results are as follows,

RESULTS OF TENSILE TEST

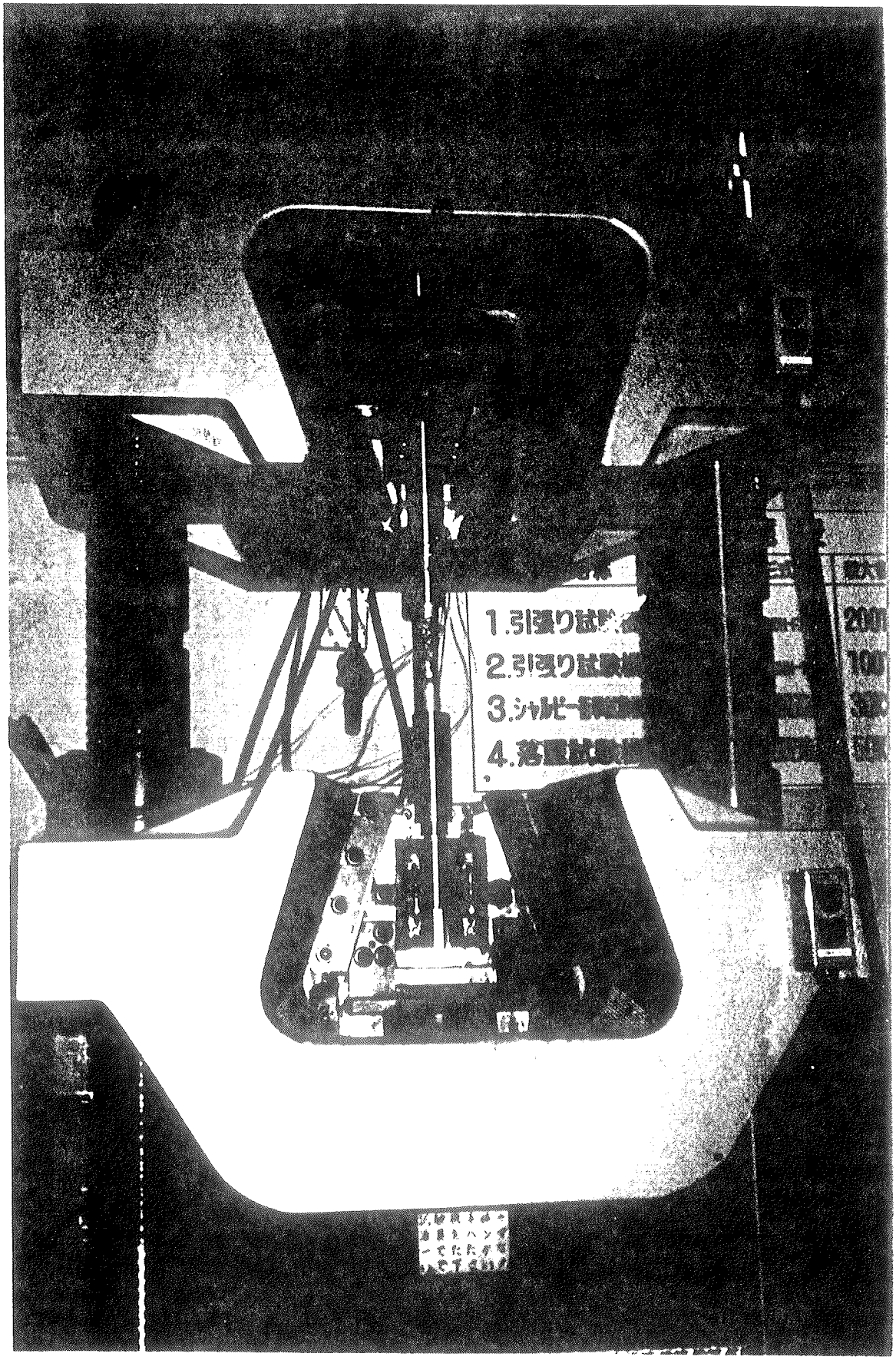
Test No	Temp.	MAX Tensile Load (ton)	MAX Tensile Stress (kgf/mm2)
1	R.T.	15.77	50.2
2		16.53	52.6

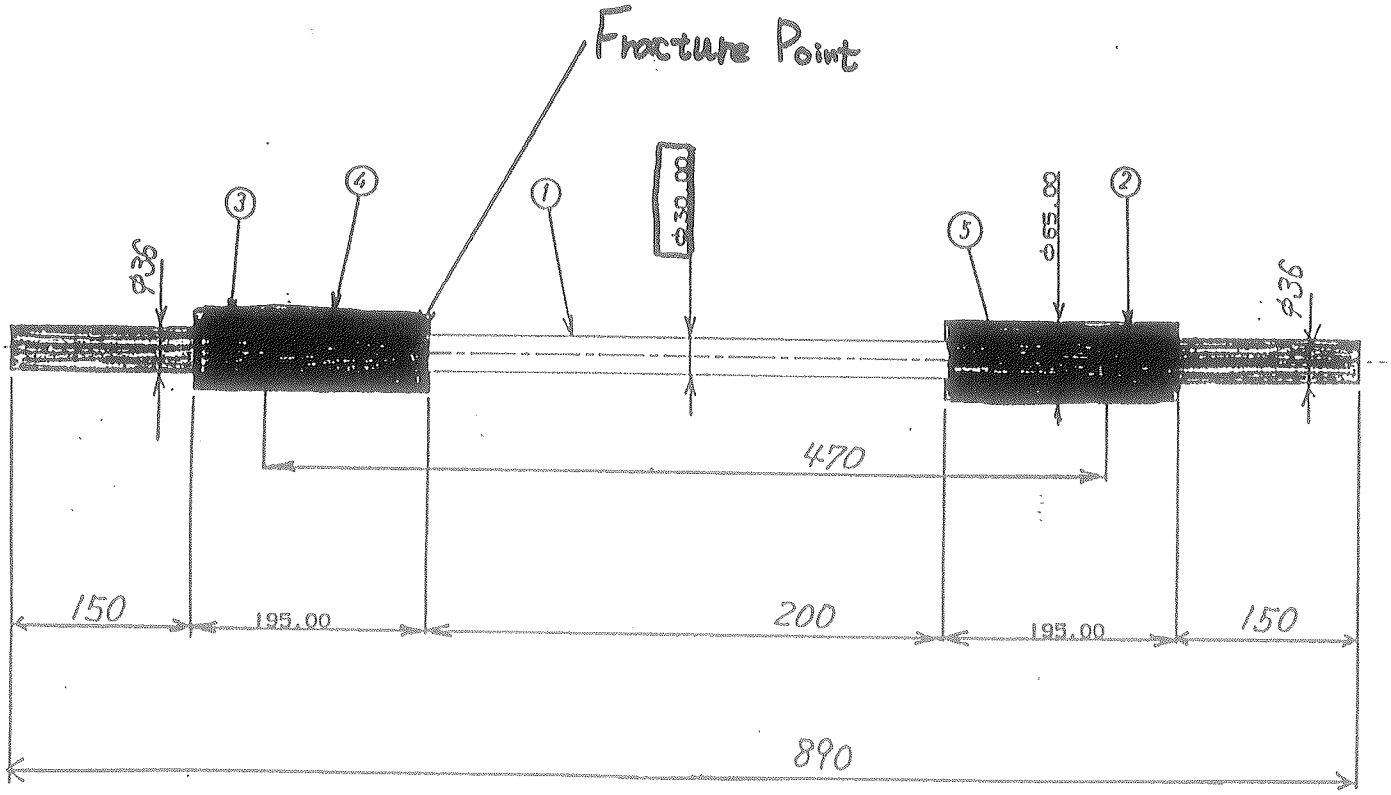
S-N DIAGRAM OF GFRP SUPPORT



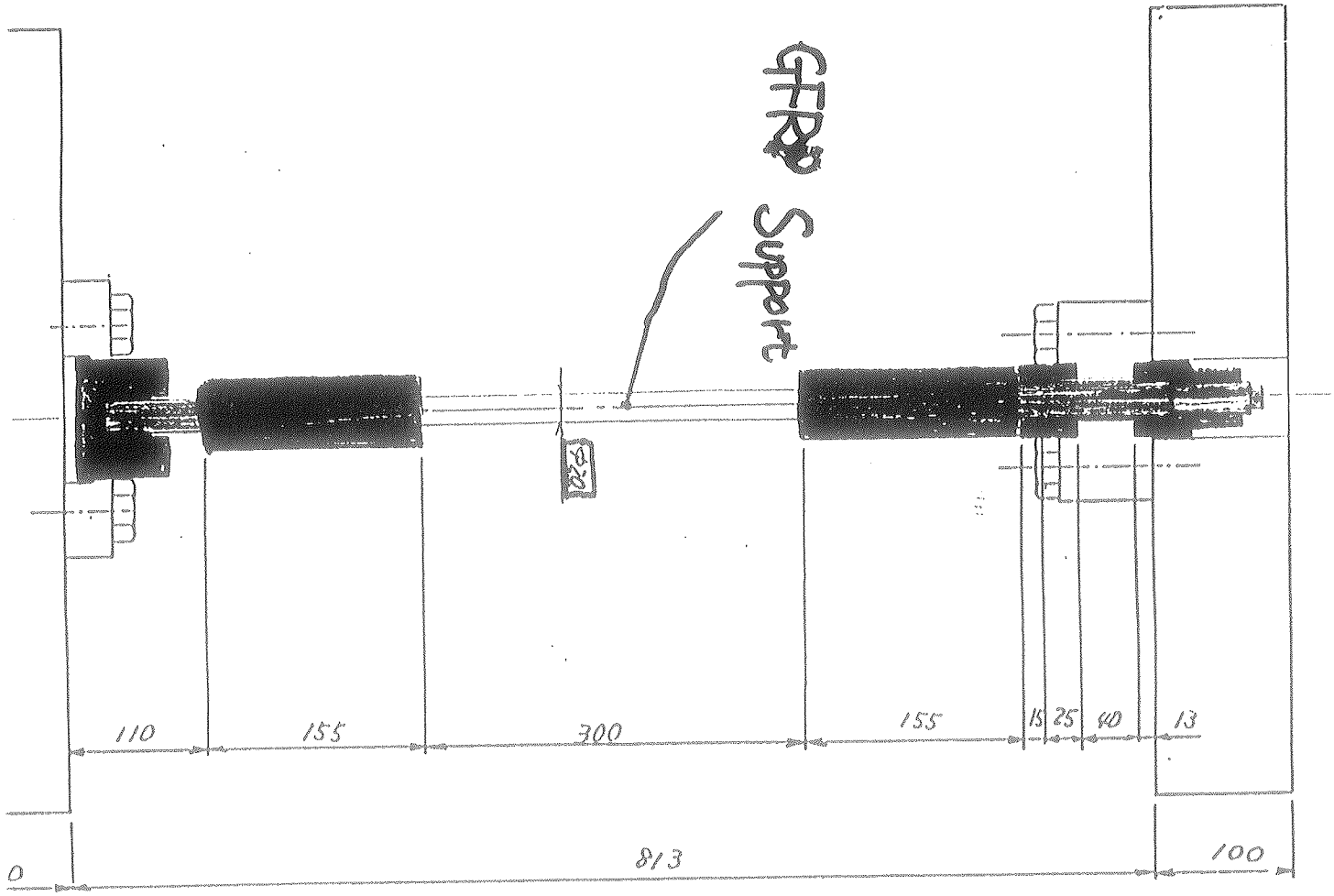


Radial Support (2×6)
Axial Support (14)
7.5°
10.0°
12.5°
25.0°
27.5°
48.75°
22.50°
18.75°
41.25°
15.0°
φ180.0
1822.0
435.0
R1881.0
R1700.0
R2060.0
96 M16
TOSHIBA CORPORATION

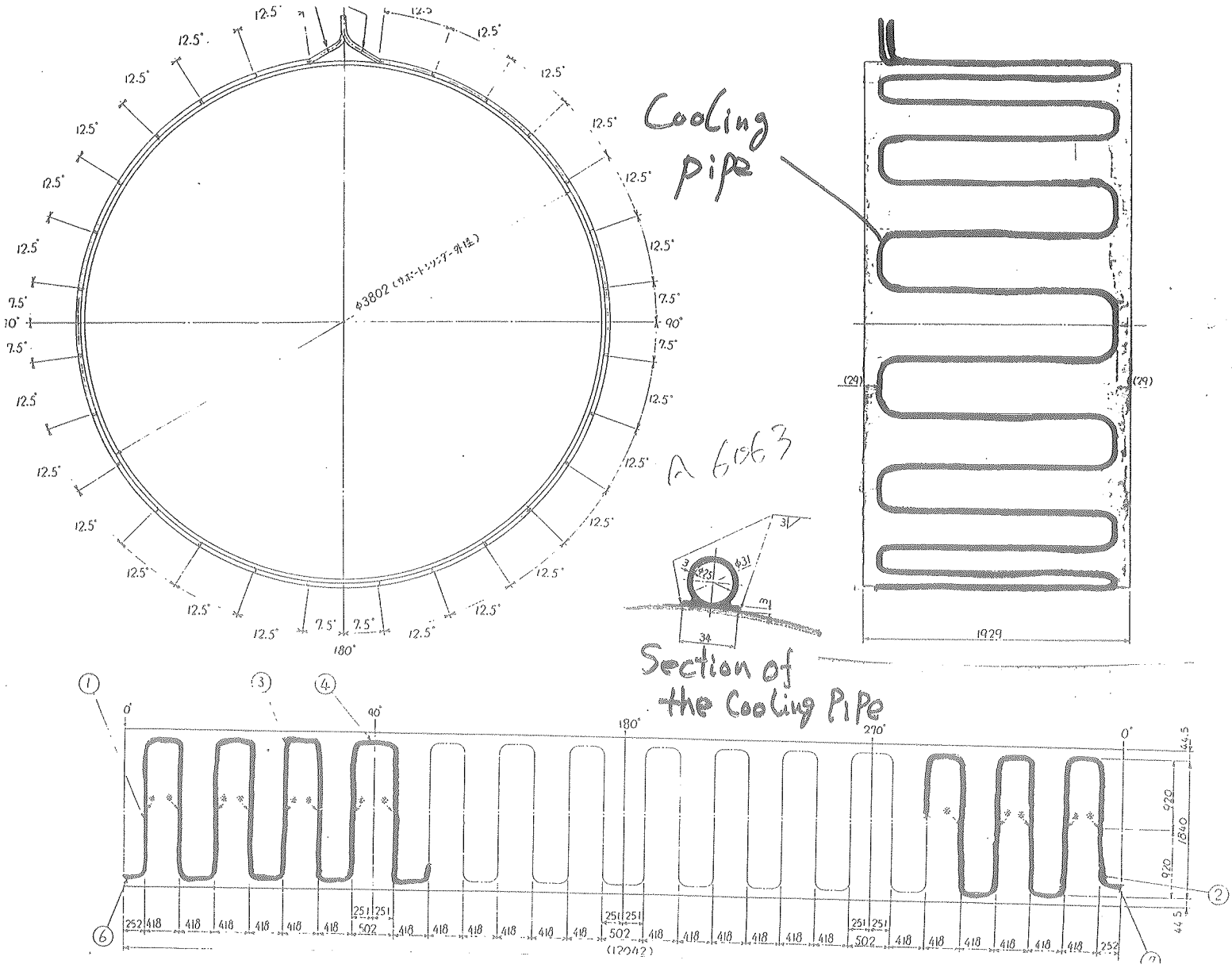

1.引張り試験
2.引張り試験
3.シャルピー
4.



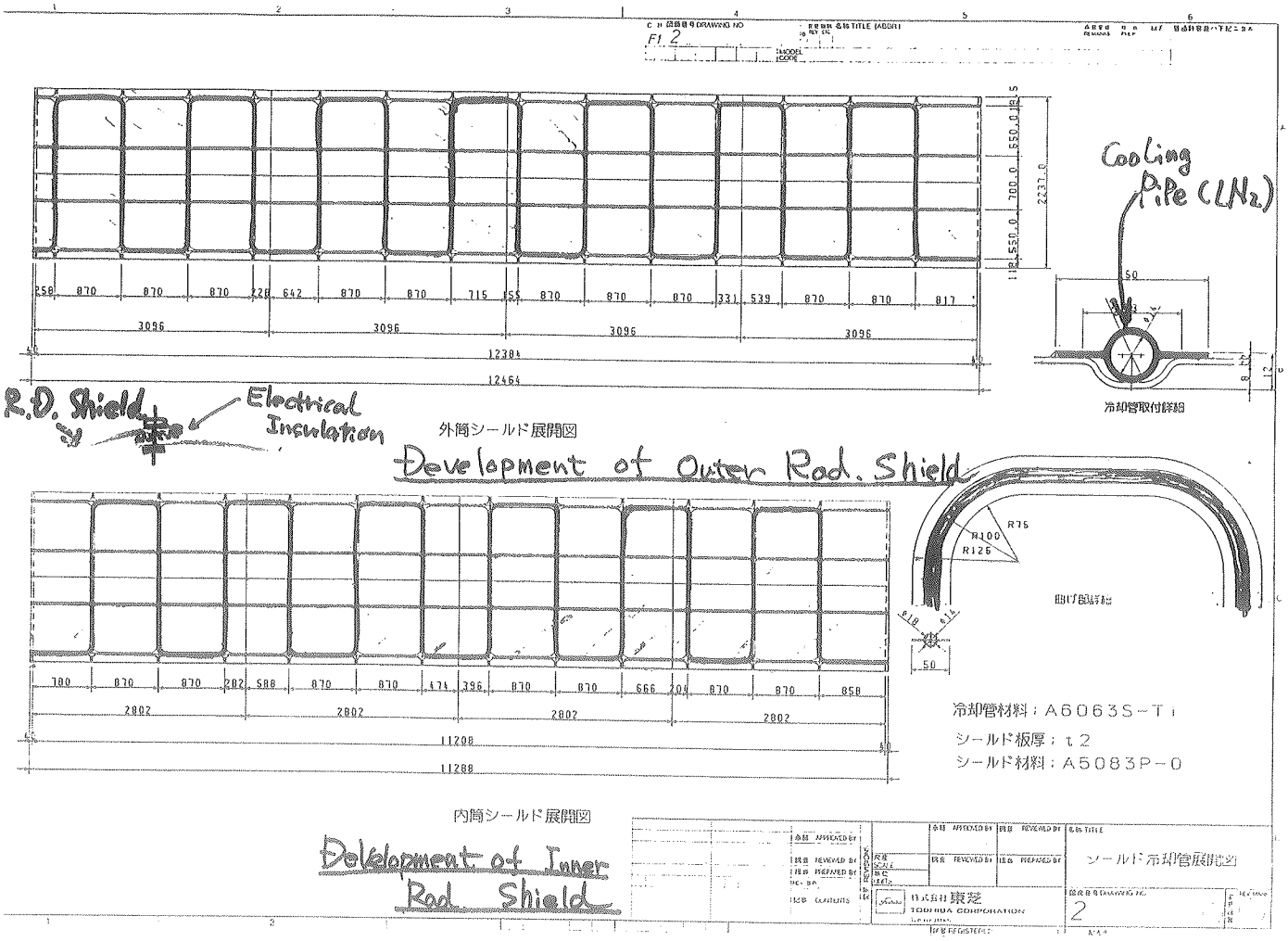
RADIAL SUPPORT



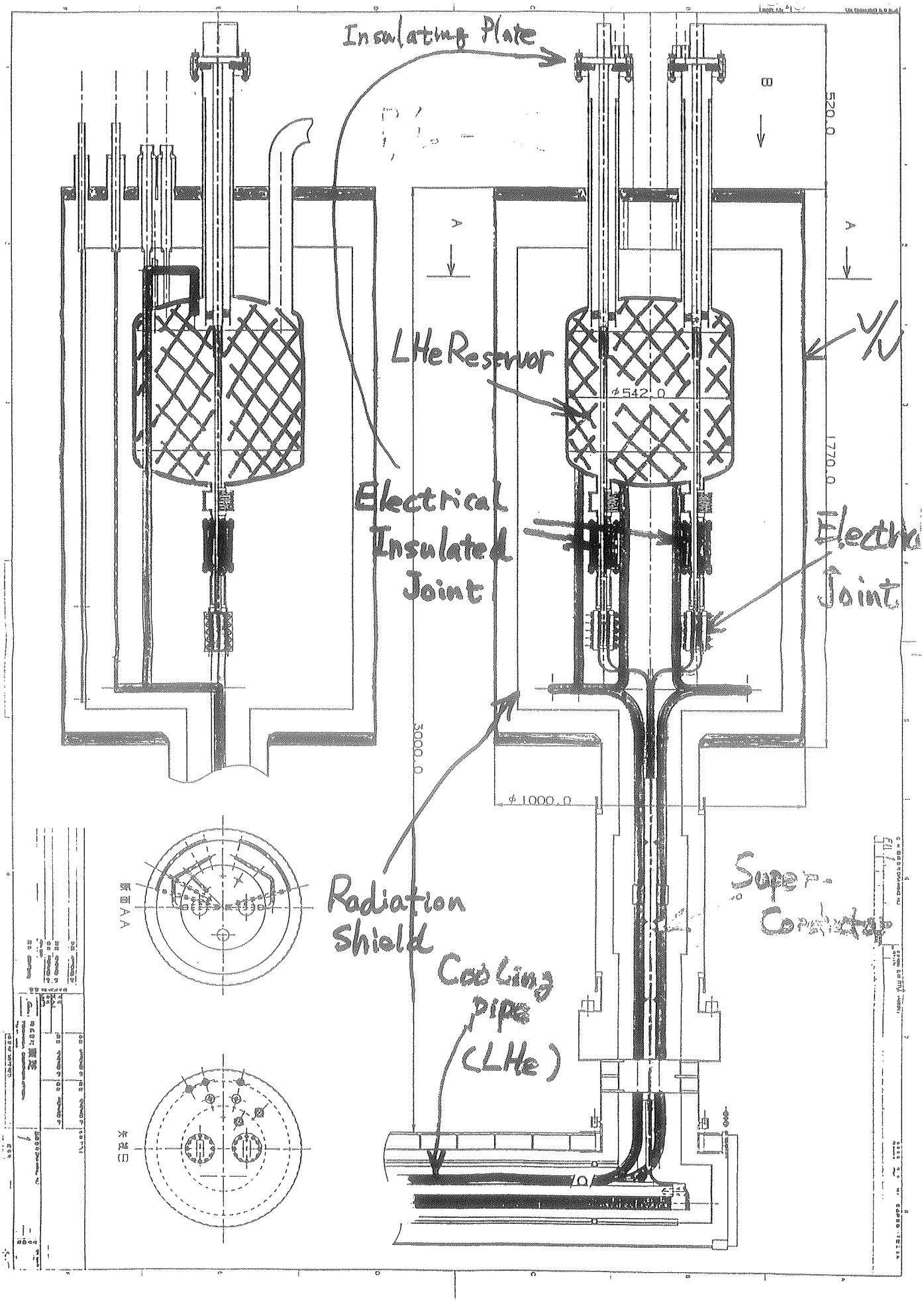
AXIAL SUPPORT



Development of Outer Support Cylinder



Cooling Pipe (LN2)
R.D. Shield
Electrical Insulation
冷却管取付詳細
外筒シールド展開図
Development of Outer Rod. Shield
曲げ部詳細
冷却管材料：A6063S-Ti
シールド板厚：t2
シールド材料：A5083P-0
内筒シールド展開図
Development of Inner Rod Shield
シールド冷却管展開図
株式会社東芝
TOSHIBA CORPORATION



Chimney and Test Port