

2002

NTD

Development of NTD Driving Mechanism in HANARO

150

(Neutron Transmutation Doping, NTD)

NTD (NTD1, NTD2)

NTD-Si 2003

가 NTD-Si 가 Si-ingot

NTD , NTD2 Si-ingot

가

NTD2 ,

NTD1

Abstract

NTD(Neutron Transmutation Doping) is one of the effective utilization of the research reactor. We have a plan to begin the commercial production, from 2003, of the NTD-Si which is widely used for high-power semiconductors or sensors, using two NTD sites (NTD1, NTD2) provided in HANARO reactor. For the uniform irradiation, the most important factor for the production of NTD-Si, it is necessary to rotate the Si-ingot with a uniform speed at a certain position in the NTD irradiation sites. Therefore, HANARO have developed a mechanical driving mechanism for NTD, and successfully performed the irradiation test to confirm the excellent uniformity of irradiation for a few samples of Si-ingot in the NTD2 site.

This report summarizes the design concept and design requirements, the detail design including the selection of proper mechanism using a chain and the preventive design against the inverse motion during lifting, the results of performance tests, and the history of trial and error for the development NTD2 driving mechanism. Also the items of design improvement are summarized for the NTD1 driving mechanism designed subsequently.

1.

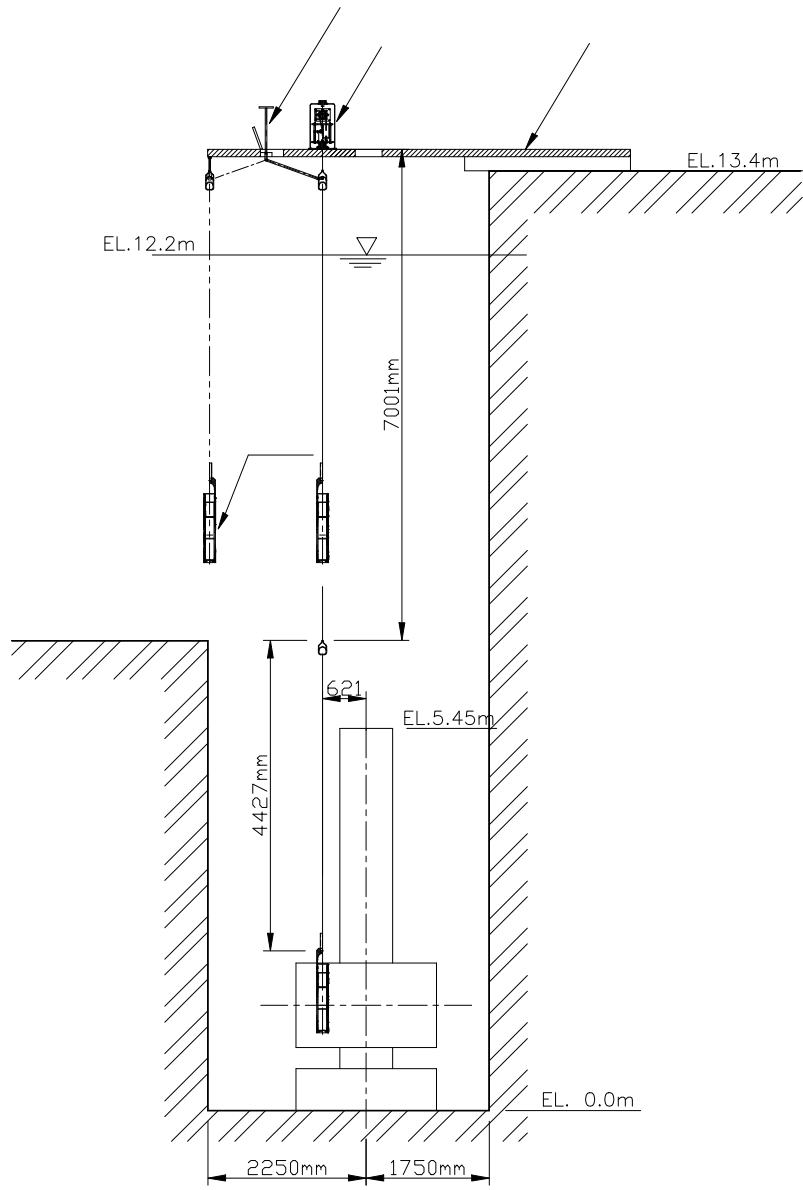
(Neutron Transmutation Doping, NTD)
 (Si-30) Si-31 (P-31) NTD
 100 , 1
 NTD-Si 가 15
 NTD 가
 [1]. NTD (NTD1, NTD2)
 2003 NTD-Si NTD2
 Si-ingot

2. NTD

NTD-Si 가 , NTD
 1 NTD 가 12m
 , 2

2.1

Si-ingot 가 NTD 가
 Si-ingot 가
 가



1. NTD

6.7m

6.7m

1.5m

4

가

가

가

가

1

, 15

가

가

가

,

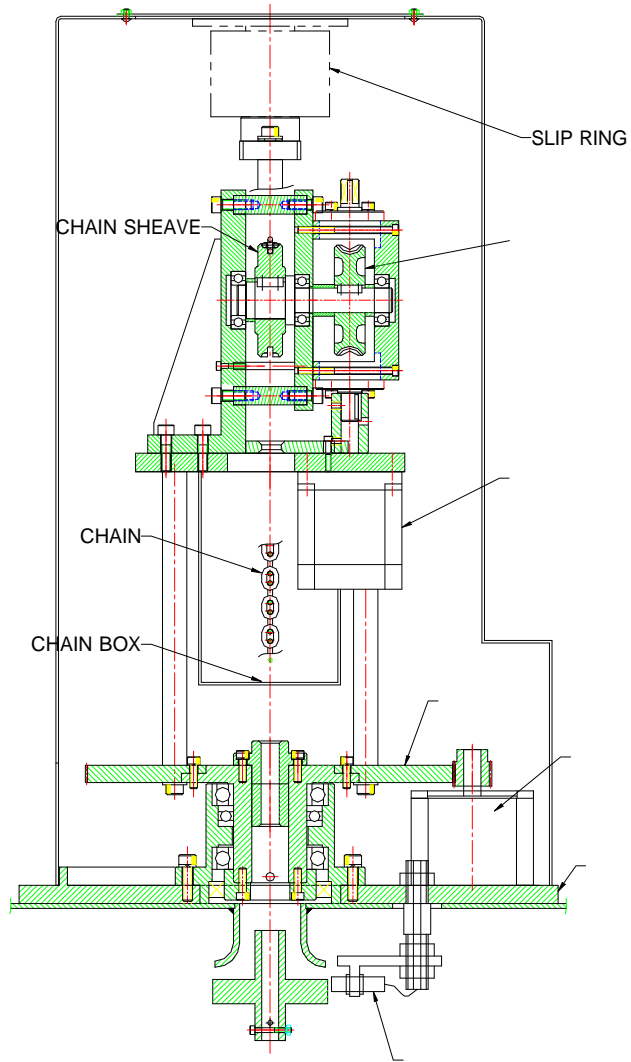
가

15

가 가

± 2mm

NTD



2. NTD

2.2

NTD

[1] 100kg 가 .
가 30kg .
가
(torquemeter)

2.3

(worm) (worm gear) (sheave)

3.

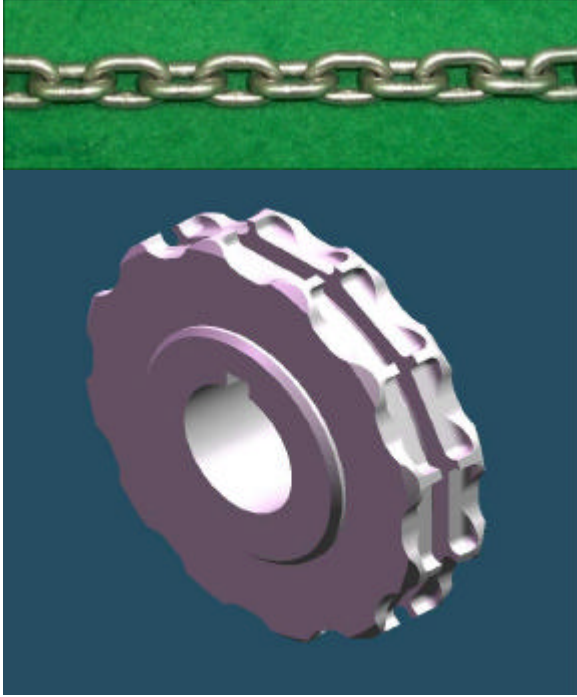
3.1

가 .
3 가
4 가
4 가 (JIS H4040)
187-208 kgf (sheave) 30 kgf
가 .
가 가
가
(4)

가

가 .

가 가 가
가 .



3.



4.

, 3

NTD

가

1610 kgf

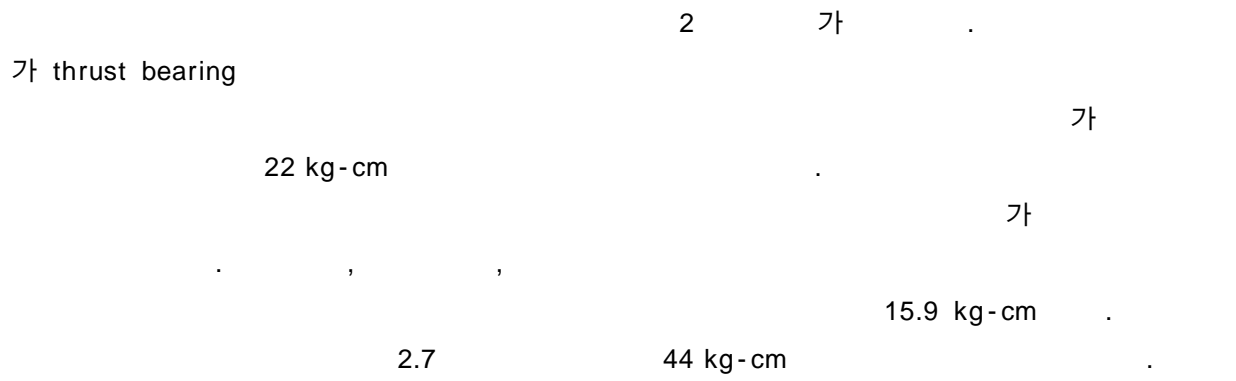
가

가 , NTD

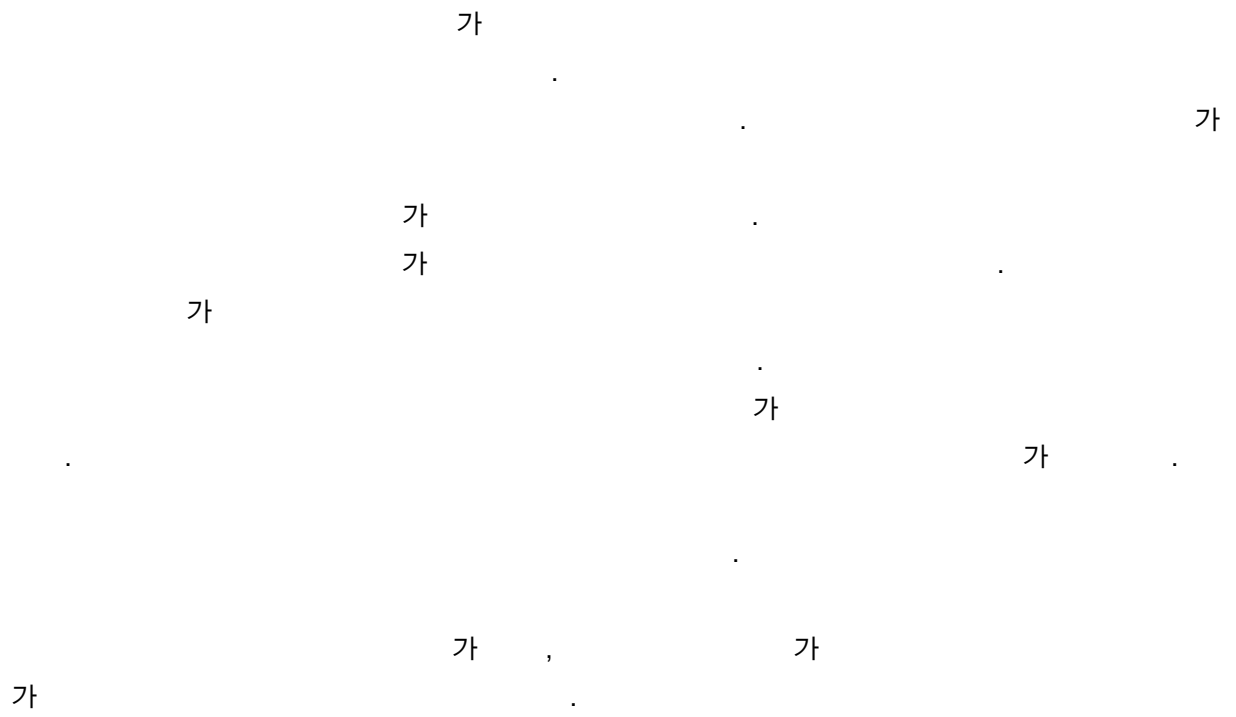
가

()

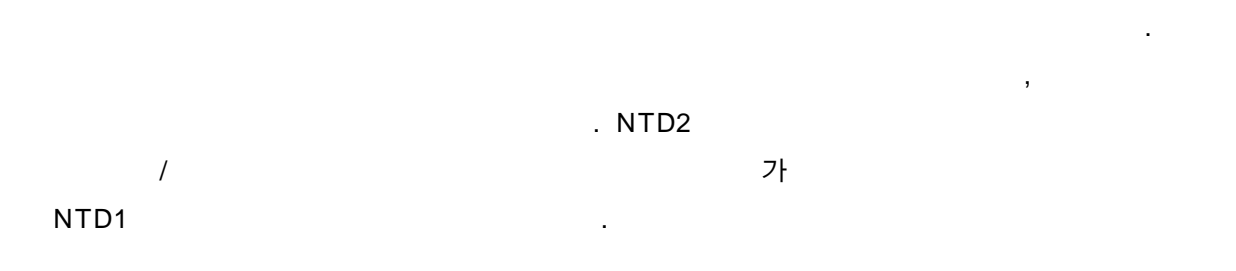
3.2 Stepping Motor



3.3

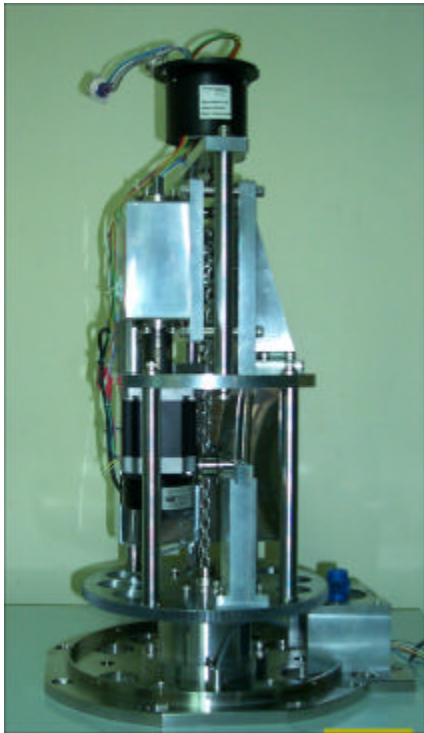


3.4



3.5 NTD2

NTD
 NTD2 5 가 , 6
 400mm, 727mm, 68 kgf (54kgf, : 14kgf)



5. NTD



6. NTD2

4.

NTD
 가 NTD NTD
 . NTD1 NTD2 NTD
 NTD (CT)
 CT NTD
 가 10mm NTD2
 가 NTD2 12m
 NTD 2mm

5.

5.1 NTD

NTD
가

NTD1 NTD2

NTD1(220mm) NTD2(180mm)

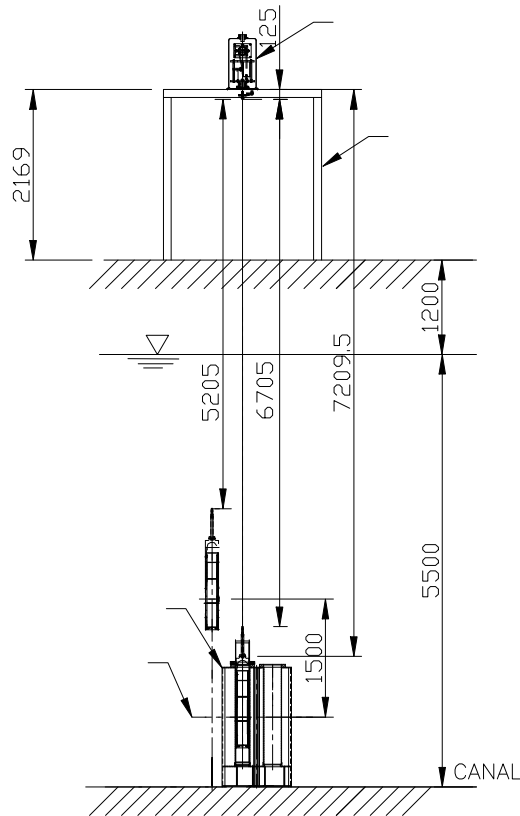
NTD

NTD

(6.7m)가

7

NTD



7. NTD

5.2

(22.6kg, 27kg, 31.4kg) NTD 1.5m

(1)

NTD
7m 27kgf 1699mm
1.15mm

(2)

gear ratio 가 , gear ratio [3]

(3)

(24 rpm) 22.6kgf, 27kgf, 31.4kgf 1.9m,
1.7m, 1.5m 가 , 1.5m 가

(4)

rpm 가 18-24

5.3

7

NTD

4.7kgf 13.7kgf, 19kgf
1500mm

5205mm,

가 19 kgf

가 가

가

가

18-24 rpm

가

4.7kgf

37mm , 13.7kgf
가

14mm

가

5.4

4.4m

가

(19kgf)

21.2kgf가

2-3mm

21 rpm,

1486mm

NTD2

가

가

5.5

NTD

가 . 가

가

가 가

가

6.

NTD2

가

NTD2

NTD

가

. NTD1

,

가

, 2

NTD

6.1

가

NTD2

30kgf

NTD2

22.6kgf, 27kgf, 31.4kgf

가

8

. NTD1

40kgf

가 50%

가

8

6.2

NTD2

/

가

NTD1

slip ring

가

가

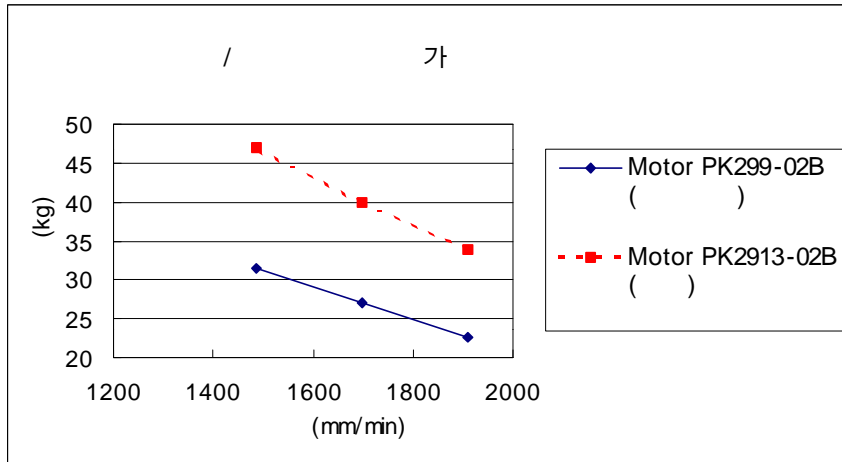
NTD1

9

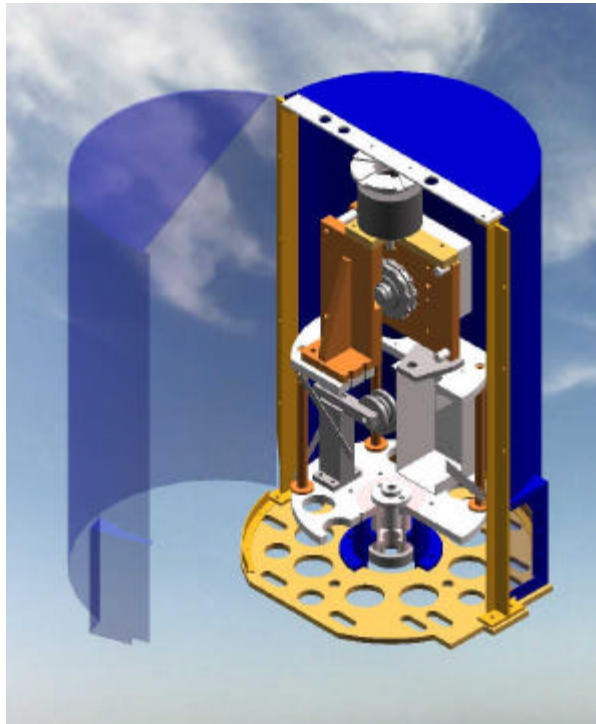
가

가

NTD



8.



9. NTD

6.3

NTD2

가

가

7.

(NTD1, NTD2)
2003 NTD-Si NTD NTD2
/
NTD2 31kgf
1.5m 18-24 rpm 가
NTD2 NTD1
NTD 가

- (1) , “ ”, , KAERI/AR-604/2001, 2001. 9,
- (2) , “ ”, HAN-RS-DD-SP-402-01-001, Rev.0,
2001. 3,
- (3) , NTD , 2002. 7,