

Tests of Locking Devices for the Conceptual Design of ARR Fuel Assembly

, , ,

150

, bottom guide, receptacle cup
 , ,
 bottom guide
 가 가
 bottom guide receptacle cup 가
 가 가
 bottom guide receptacle cup 1
 가 1
 가 ,

Abstract

The objective of this work is to investigate the locking performance of the preliminary designed locking device for the fuel assembly of the ARR(A new Research Reactor). For this purpose, the elements of the locking devices such as bottom guide, receptacle cup and spring were fabricated. Then loading and unloading, rotating resistance, fixing status and vibration characteristics of the locking device were tested. The test results show that using the locking device with fins on the bottom guide can prevent the rotating motion of the fuel assembly. It is observed that the fixing status of the locking device in the lateral direction is incomplete and the lateral motion of the fuel assembly can be occurred due to the manufacturing tolerance of the contact surface between the bottom guide and the receptacle cup. This observation demonstrates that additional spring or guide on the top of the fuel assembly is needed to suppress the lateral motion of the fuel assembly. The vibration test results show that the effect of the contact angle between the bottom guide and receptacle cup on the 1st natural frequency of the fuel assembly is negligible. It is observed that the 1st natural frequency of the fuel assembly with locking device of surface contact type is higher than that of the fuel assembly with fin contact type locking device. In the near future, based on the experimental results, the fuel assembly of the ARR will be newly designed and tested.

1.

stiffener,

가

가

bottom guide receptacle cup

[1].

bottom guide receptacle cup

6

guide receptacle cup

[2]

bottom

2.

1

bottom guide, receptacle cup

2 3

receptacle cup

receptacle cup

가

, 30 , 36)

bottom guide

2 bottom guide receptacle cup bottom guide

. Bottom guide receptacle cup

가

3가

(26

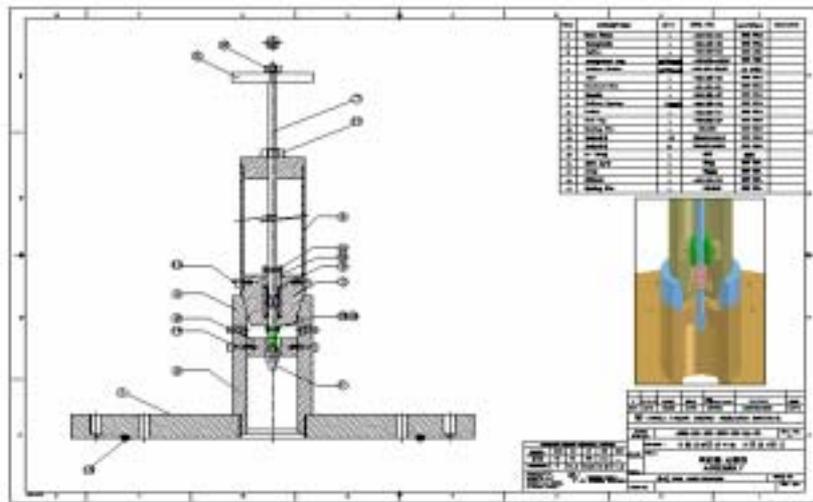
. 3 bottom guide 3

6 (fin)

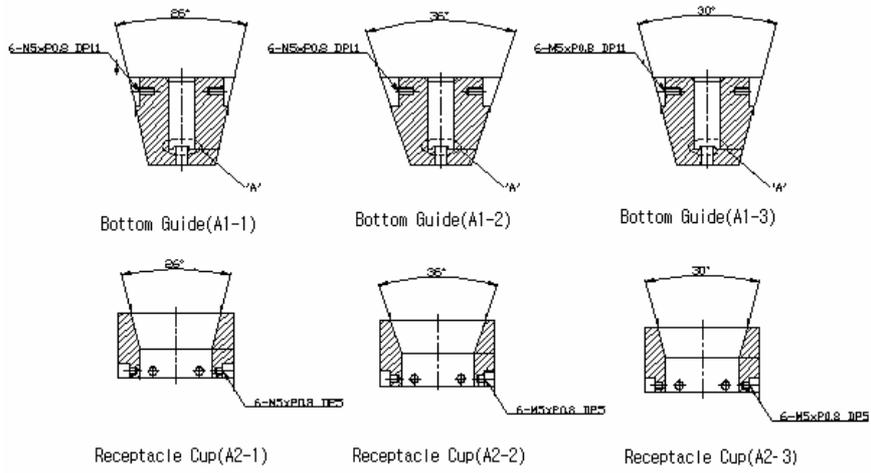
bottom guide receptacle cup

3가

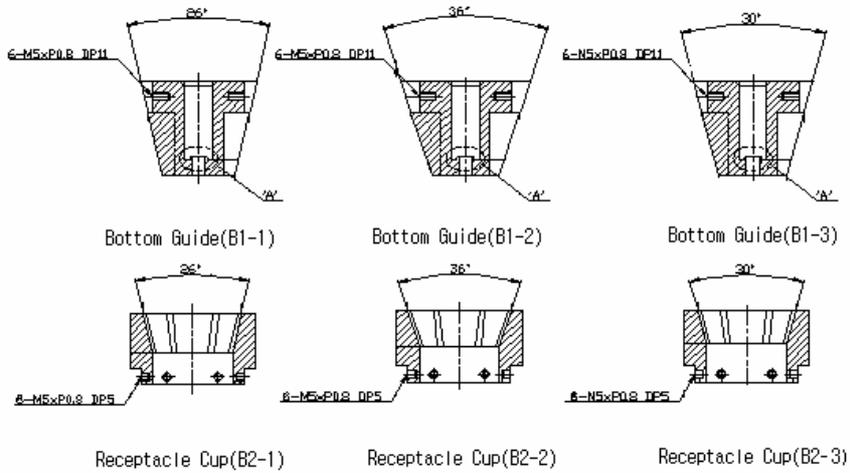
(26 , 30 , 36)



1



2 bottom guide receptacle cup(fin)



3 bottom guide receptacle cup(fin)

(1)

- 1)
- 2)
- 3)
- 4)
- 5)
- 6) 가
- 7)
- 8)
- 9)
- 10)

가

3)~8)

1

	1	2	3	4	5	6
bottom guide	A1-1	A1-2	A1-3	B1-1	B1-2	B1-3
receptacle cup	A2-1	A2-2	A2-3	B2-1	B2-2	B2-3

3.

3.1~3.3

3.1

6 bottom guide 4 receptacle cup 3 가 receptacle cup 6 가 bottom guide receptacle cup

가

가

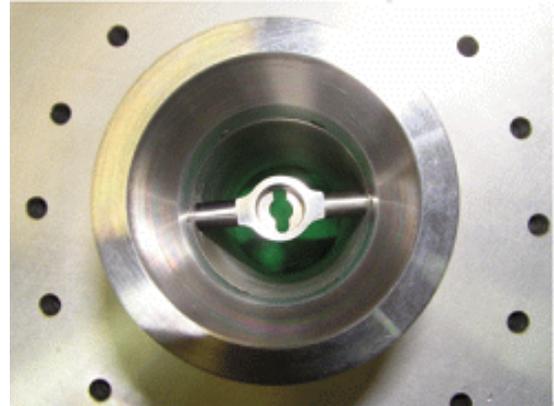
가

가



(a) bottom guide

4



(b) receptacle cup

bottom guide receptacle cup

3.2

가

5

receptacle cup

bottom guide가

가

bottom guide

2 bottom guide (fin)

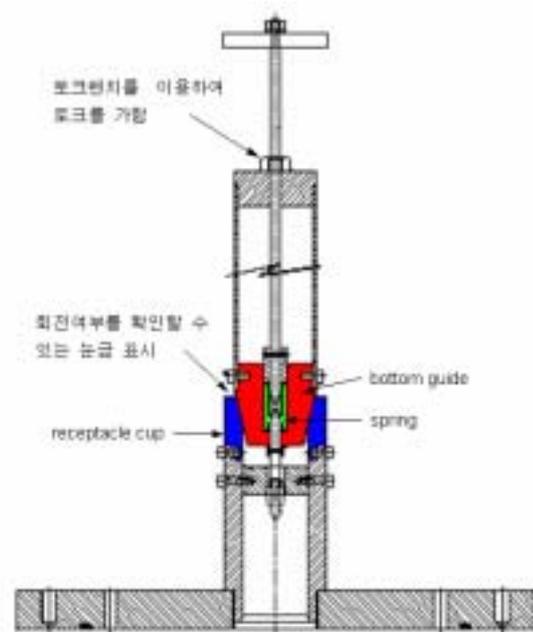
, 3

가

, 6

bottom guide receptacle

cup



5

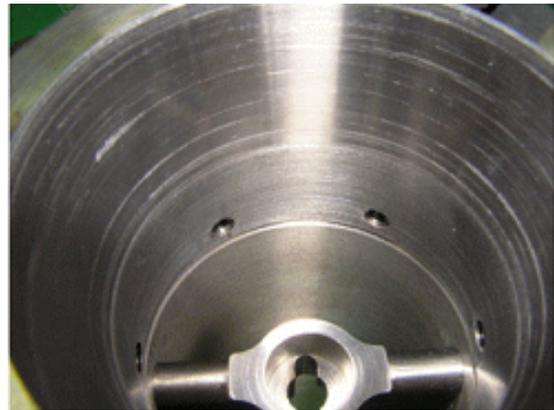
가 (7)
 , 가
 가

2

	(Nm)		
A1-1(26)	90	bottom guide	receptacle cup
A1-2(36)	20	bottom guide	receptacle cup
A1-3(30)	50	bottom guide	receptacle cup



(a) Bottom guide



(b) Receptacle cup

6 bottom guide receptacle cup ()



(a) Receptacle cup bottom guide

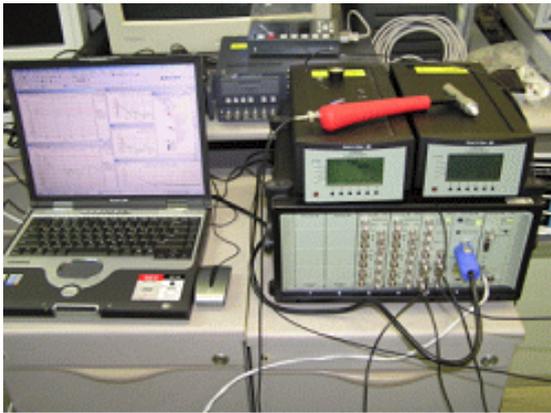


(b)

7 Receptacle cup bottom guide ()

3.3

가 (fluid induced vibration) 가 .
 가 BPF(blade passing frequency) , [3,4]
 가 () .
 가 (resonance)
 ,
 가 .
 (impact hammer) 가 가
 가 , 가 [5] . 8 (a)
 , 8 (b)
 가 . 8 (c)

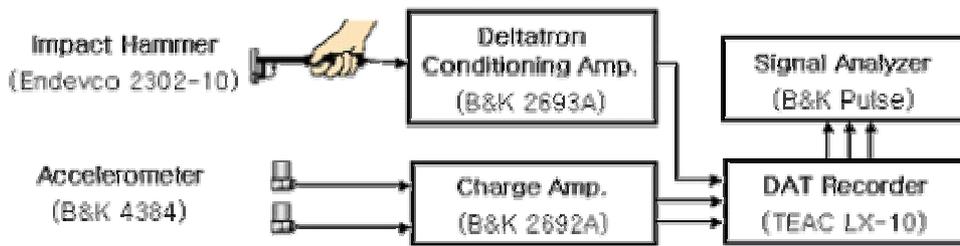


(a)



(b)

가



(c)

9
(peak)가
9

180

가

9 (a)

가

25.5~29.9 Hz

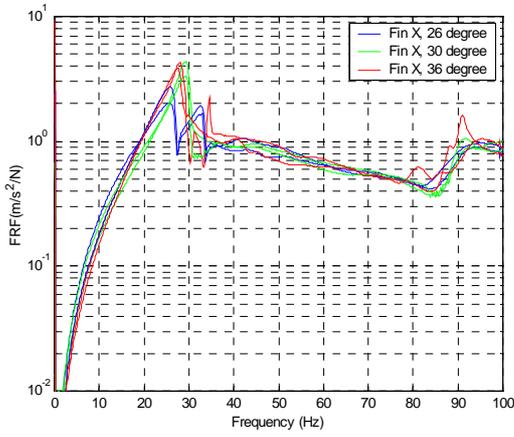
bottom guide receptacle cup

1

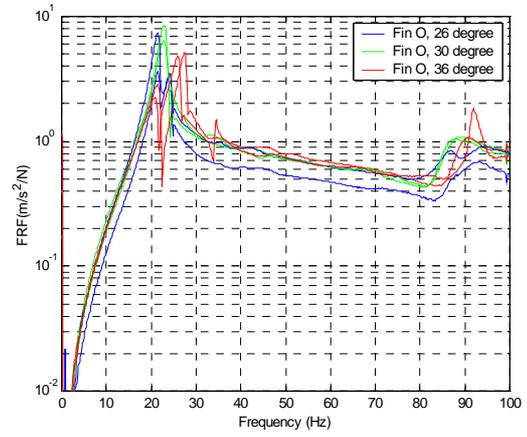
9 (b)

가 21.4~25.9 Hz

가 bottom guide receptacle cup



(a)



(b)

9 가

10

10 bottom guide

가

1

가

1

가

가

가

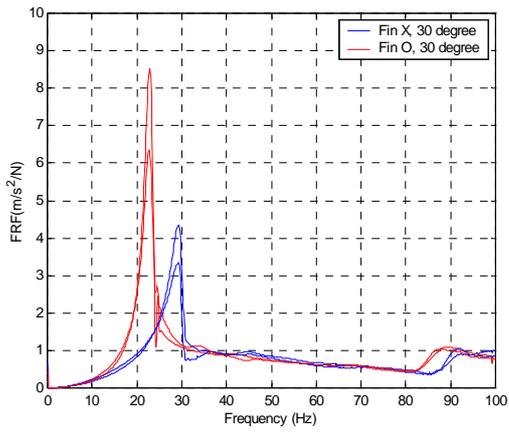
bottom guide

receptacle cup

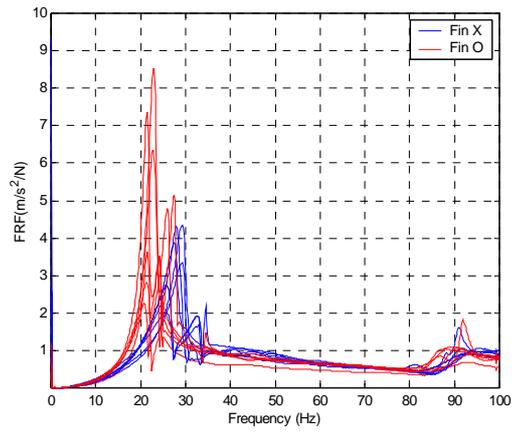
가

, bottom guide

bottom guide receptacle cup



(a) 가 30



(b)

10

4.

1)

2)

guide receptacle cup

bottom

가

3)

가

가

4)

가

bottom guide receptacle cup

가

5)

6

3

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- [2] , “ ,” , ARR-ME-RD-TR-038-03-001, Rev. 0, 2003. 9. 17.
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- [5] D. J. Ewins, *Modal Testing: Theory and Practice*, John Wiley & Sons, 1984.