

Study on the marginal length for the pantograph arm of In-Vessel Transfer Machine in KALIMER-600

150

가
150 MWe 600MWe 가
가 가 가
5.5 m
ANSYS

Abstract

In case the power of the KALIMER is increased as the large size, the marginal length for the pantograph arm of In-Vessel Transfer Machine(IVTM) was studied. The core size is expanded due to the increasing of the electric power 150 MWe to 600 MWe. Thus, the size of rotating plug and IVTM in KALIMER-600 are changed. The modeling configuration of IVTM is the condition of fully extended with the pantograph arm and the deflection and deformation are occurred by the weight of the core assembly, self weight and reaction force for the withdrawal of the core assembly. The outer diameter of the core in KALIMER-600 was selected in 5.5 m and the marginal length for the pantograph arm of IVTM was analyzed. The structural analysis of IVTM was carried out by the finite element analysis using ANSYS. The stress and deformation were calculated to the design load including the refueling and seismic load.

1.

가

1

3

OBE

SSE

가

150 MWe

600MWe

가

가 가

가 가

5.5m

가

ANSYS

2.

2.1.

18

(In-Vessel Transfer Machine)

6

가

main tube

11.8 m main tube
KALIMER-150 0.915m
180°

[1].

2.2

- , ,
- 6

- . IVTM tube –
- . Telescopic tube –
- . Pantograph arm –
- . Grapple –
- . Grapple finger –
- . Grapple head –

- receptacle ,
- thermal striping

. telescopic tube
. telescopic tube

- , ,
- , ,

-
[2].

3.

OBE SSE

ground ZPA 1.0 1.5
[3].

inertial load 가

ANSYS

KALIMER-150

0.72 cm 0.53 cm z 0.054 cm가 x y [4].

3.1

가

main tube

가

KALIMER-150

가

5.5m 가
2.74 m

2
1.82 m

main tube

ANSYS

가 APDL

beam 4

15

3.2

interassembly contact friction (227 Kgf), 2270 Kgf 가
 가 600 Kgf, backup holddown(136 Kgf), (1043 Kgf)
 113% margin
 OBE event SSE event 0.25g ZPA 0.5g ZPA [5].
 가 1 1 가 2.5
 $78.57 \times 10^{-7} \text{ Kg/mm}^3$, 가 0.3, 가 $2.04 \times 10^4 \text{ Kg/mm}^2$

3.3

ANSYS
 가 1.82m 2.74m 3 ~
 6 가 1.82m
 3 4 OBE link 90MPa 17mm
 가
 133 MPa SSE 119 MPa 5 6
 mm SSE 20
 가 2.74m 7 ~ 10
 link 7 8 가 1.82m 가
 40 mm 186 MPa
 가 가 2.74 m
 가
 main tube, link, grapple
 ANSYS APDL grapple 0.2m x 0.2m
 0.3m x 0.3m main tube link 가
 2 3 [6]. 2
 Grapple 0.2 m x 0.2 m link 0.2m x 0.1m
 0.2m x 0.2m 가 103~106 MPa 29~19mm

가 9 10 link 0.2m
x 0.2m 가 3 가 0.3m
x 0.3m link 0.3 m x 0.2 m 가
가 11 12 link 0.3m x 0.3m
가
가 가
가 link
가
가

4.

가 ANSYS
main tube
가
가
가 1.82m 가
가 2.74m 가 link
가 0.2m x 0.2m

1. KALIMER preliminary conceptual design report, KAERI/TR-1636/2000.
2. , “Design Requirements for KALIMER Reactor Refueling System, KALIMER/MS 440-DR-01 rev. 0/2000, ,2000.
3. 1 , “KALIMER ”,
, ,2002.
4. 1 , “ KALIMER ”,
, ,2000.
5. PRISM Preliminary Safety Information Document, GE, 1987.

6. ANSYS Computer Program, Version 6.1, 2001.

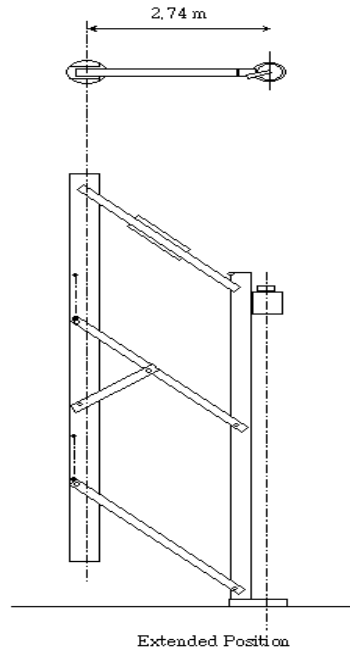
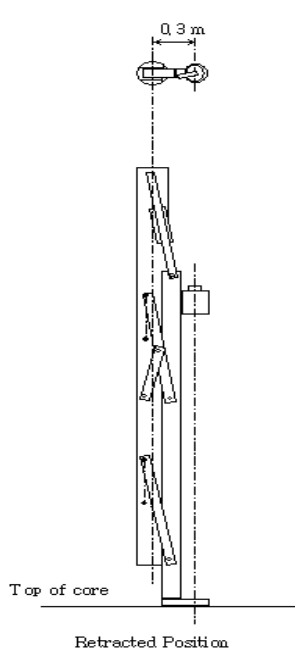
1.

Event \ Load	Ground ZPA(g)	Equivalent Static Inertial Load(g)	
		Horizontal	Vertical
OBE	0.25	0.25	0.625
SSE	0.50	0.5	1.25

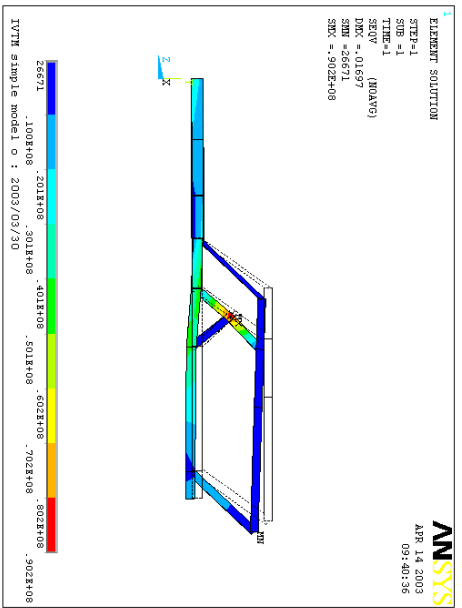
2.

(Grapple 0.2 m x 0.2 m)

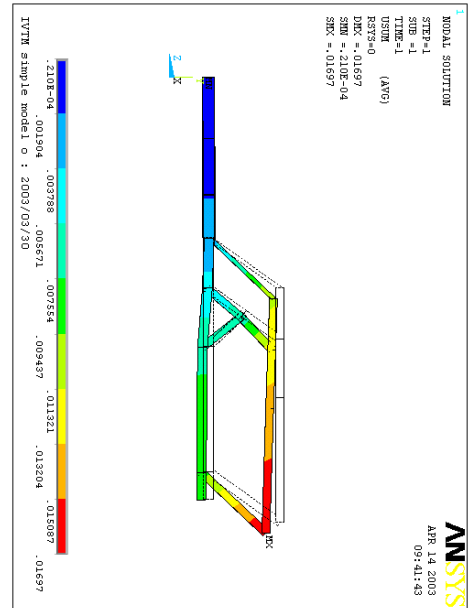
Link \ Main Tube		0.3 m	0.4 m	0.5 m	0.6 m	
		0.2 m x 0.1 m	(mm)	40	33	
	(MPa)	186	187	188	188	
0.2 m x 0.2 m	(mm)	29	22	20	19	
	(MPa)	103	105	105	106	



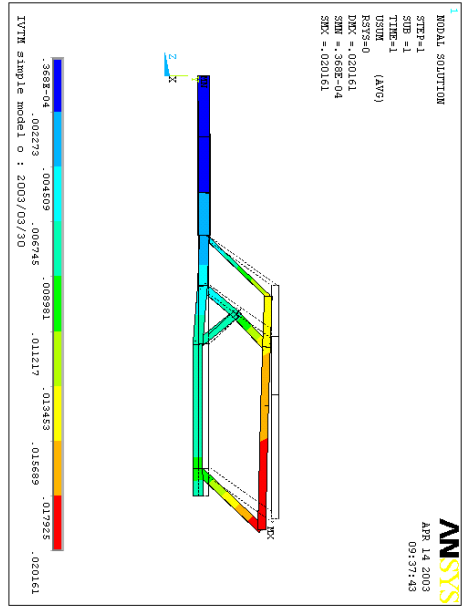
2



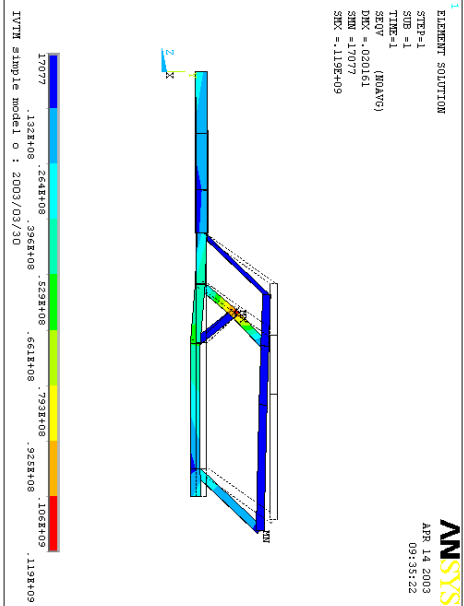
3 OBE
 (grapple/0.2x0.2 , link/ 0.2x0.1)



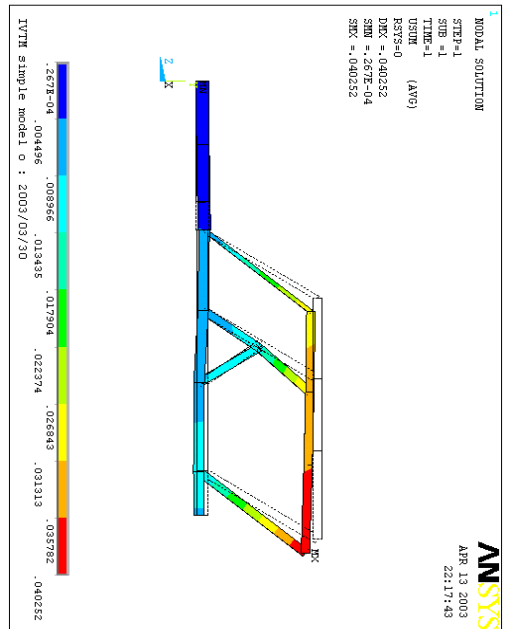
4 OBE
 (grapple/0.2x0.2 , link/ 0.2x0.1)



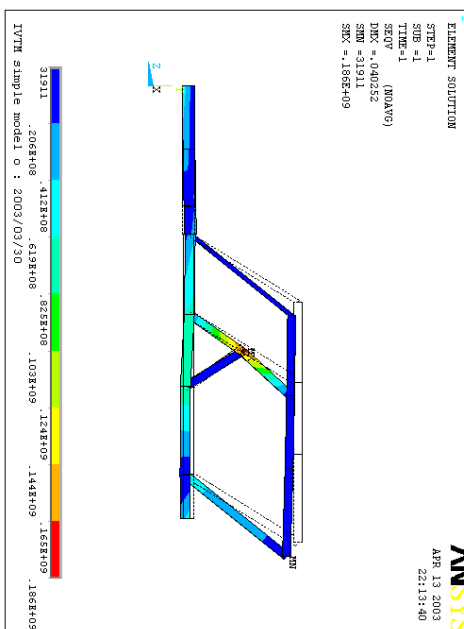
6 SSE
(grapple/0.2x0.2 , link/ 0.2x0.1)



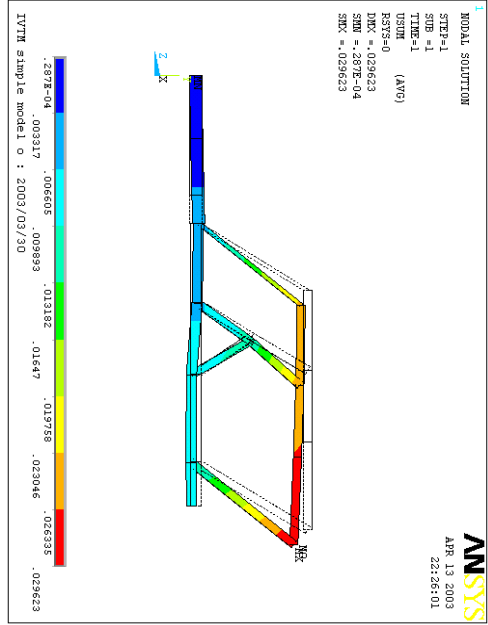
5 SSE
(grapple/0.2x0.2 , link/ 0.2x0.1)



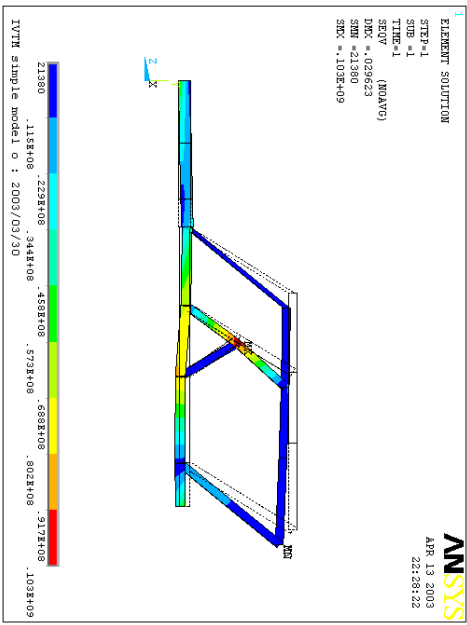
8 SSE
(grapple/0.2x0.2 , link/ 0.2x0.1)



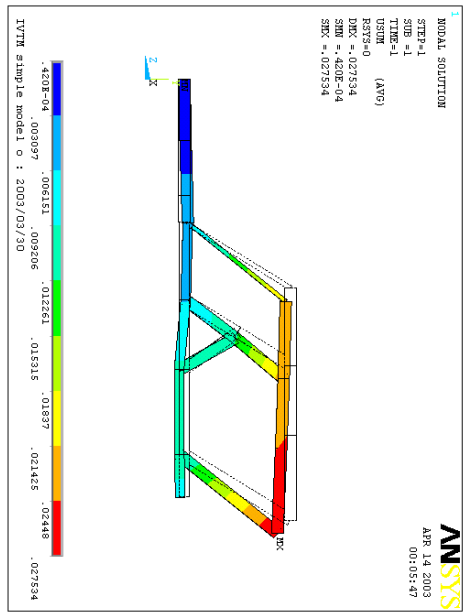
7 SSE
(grapple/0.2x0.2 , link/ 0.2x0.1)



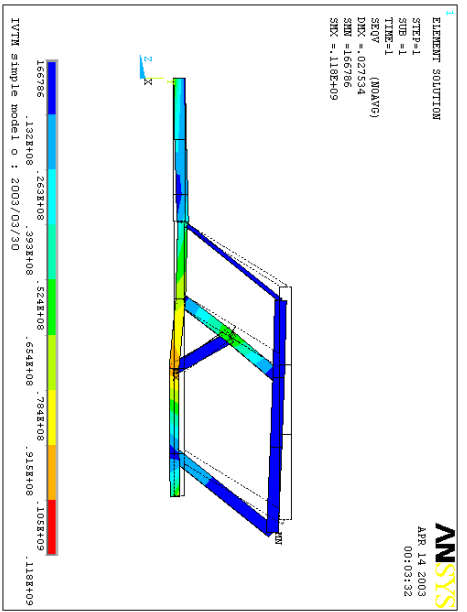
10 SSE
(grapple/0.2x0.2 , link/ 0.2x0.2)



9 SSE
(grapple/0.2x0.2 , link/ 0.2x0.2)



12 SSE
(grapple/0.3x0.3 , link/ 0.3x0.2)



11 SSE
(grapple/0.3x0.3 , link/ 0.3x0.2)