1.0 OBJECTIVE

Structural evaluation of the 3-60B Cask trunnion assembly under various load conditions.

2.0 INTRODUCTION

The 3-60B cask is equipped with four identical trunnions to help the lifting, handling and transportation of the cask. The details of the trunnions are shown in Reference 1 drawing. Analyses of the trunnion assemblies and the cask body are provided in this document to show that the trunnion design meets the applicable requirements of 10 CFR Part 71 (Reference 2).

The following load cases have been addressed.

Load Case 1: Lifting

The loaded cask is lifted using the two upper trunnions as shown in Figure 1.

Load Case 2: Handling

The cask is designed to be supported on the two pairs of the trunnions during the transportation. The trunnions also help the cask down-ended and lowered unto the supporting structure. See Figure 1 for the trunnion loading during the handling process.

Load Case 3: Transportation/Regulatory Requirement

Trunnions are used for the tie-down of the 3-60B Cask package during transportation. The transportation of the packages in the United States is controlled under the provisions of 49 CFR 393 (Reference 3). Loadings are specified by 49 CFR 393.102 for minimum performance criteria for cargo securement devices and systems. However, 10 CFR 71.45(b) requires that:

> "If there is a system of tie-down devices that is a structural part of the package, the system must be capable of withstanding, without generating stress in any material of the package in excess of its yield strength, a static force applied to the center of gravity of the package having a vertical component 2 times the weight of the package with its contents, a horizontal component along the direction in which the vehicle travels of 10 times weight of the package with contents, and a horizontal component in the transverse direction of 5 times the weight of the package with its contents."

Since the 10CFR71 loading on the tie-down system is much more severe than the 49CFR393 loading, it is used for the evaluation of the 3-60 Cask package for the transportation conditions.

Enveloping loading conditions on the trunnions are developed from the above load cases and for these load cases analyses of the trunnion assembly and the cask body has been performed using ANSYS finite element models (Reference 4).

3.0 REFERENCES

1. Energy*Solutions* Drawing C-002-165024-001, Rev. 0, "3-60B Cask General Arrangement and Details."
2. Code of Federal Regulations 10 CFR PART 71- Packaging and Transportation of Radioactive Material.
3. Code of Federal Regulations 49 CFR PART 393 - Transportation.
4. ANSYS, Rev. 11.0, Computer Software, ANSYS Inc., Canonsburg, PA, 2007.

4.0 MATERIAL PROPERTIES

Cask Shell

Specification: ASTM A-240 Type 304L

Minimum Yield Strength, S_y = 25,000 psi

Minimum Ultimate Strength, S_u = 70,000 psi

Trunnions

Specification: ASTM A-240 Type 304 (or Equivalent)

Minimum Yield Strength, S_y = 30,000 psi

Minimum Ultimate Strength, S_u = 75,000 psi

5.0 ALLOWABLE STRESSES

The load cases described in Section 2.0 of this document require that the materials of the cask package do not yield under specified factored loads. Thus the following stress criteria are set for the factored loads:

Normal stress allowable = yield strength of the material (S_y)

Shear stress allowable = 0.6×Normal stress allowable = $0.6S_y$

Material Type	Normal Stress Allowable, psi	Shear Stress Allowable, psi
ASTM A-240 Type 304L	25,000	15,000
ASTM A-240 Type 304	30,000	18,000

The allowable stresses in the weld are conservatively taken to be the same as the base metal.

6.0 DESIGN LOADING

Weight of the package with its content, W = 80,000 lb

Load Case 1:

As shown in Figure 1, under the lifting conditions, each trunnion is subjected to the following loading:

Longitudinal = 1.5×W = 1.5×80,000 = 120,000 lb

Lateral = 0

Radial = 0

Load Case 2:

As shown in Figure 1, under the handling conditions, each trunnion is subjected to the following loading:

Longitudinal = 0.25×W = 0.25×80,000 = 20,000 lb

Lateral = 0.25×W = 0.25×80,000 = 20,000 lb

Radial = 0

Load Case 3:

As shown in Figure 1, subject to the transportation loading enveloped by the 10CFR71 loading, the maximum load a trunnion is subjected to is the following:

Longitudinal = 2.5×W = 2.5×80,000 = 200,000 lb

Lateral = 0.5×W = 0.5×80,000 = 40,000 lb

Radial = 2.5×W = 2.5×80,000 = 200,000 lb

Enveloping Loading

From the above loading cases the following enveloping loading is developed. If the materials meet the allowable for this loading, they will automatically meet the allowable stresses for other load cases as well.

Longitudinal = 2.5×W = 2.5×80,000 = 200,000 lb

Lateral = 0.5×W = 0.5×80,000 = 40,000 lb

Radial = 2.5×W = 2.5×80,000 = 200,000 lb

7.0 MODEL DESCRIPTION

The trunnion assembly is modeled and evaluated for the enveloping loads using ANSYS finite element program (Reference 4).This model is a half-symmetry solid model representing the trunnion assembly, including the 3 ½" thick back-up plate, a portion of the cask inner and outer shells, and the lead material in between the cask inner and outer shells. It comprises of 3-D, 8-Node structural solid elements (SOLID 185) for the trunnion, backing plate and the lead and 3-D, 8-Node solid shell elements (SOLSH 190) for the cask inner and outer shells. Various components of the model are tied together with the contact and target surface combinations. The model is shown in Figures 2 and 3, and it is analyzed for the enveloping loading conditions shown in Section 6.0. Loading condition 1 a longitudinal load of 200,000 lbs., loading condition 2, a radial load of 200,000 lbs, and loading condition 3, a vertical load of 40,000 lbs.

Figure 4 shows the applied loading for Condition 1, Figure 8 shows the applied loading for Condition 2, and Figure 12 shows the applied loading for Condition 3.

8.0 RESULTS & CONCLUSIONS

Figures 5 to 7 show the stress intensity distribution in the model for loading Condition 1. Maximum stress intensity in the trunnion is 27,953 psi that is less than the 30,000 psi maximum allowable stress. Maximum stress intensity in the attaching shell is 14,652 psi that is less than the 25,000 psi maximum allowable stress. Figures 9 to 11 show the stress intensity distribution in the model for loading Condition 2. Maximum stress intensity in the trunnion is 14,026 psi that is less than the 30,000 psi maximum allowable stress. Maximum stress intensity in the attaching shell is 9,445 psi that is less than the 25,000 psi maximum allowable stress. Figures 13 to 15 show the stress intensity distribution in the model for loading Condition 3. Maximum stress intensity in the trunnion is 5,403 psi that is less than the 30,000 psi maximum allowable stress. Maximum stress intensity in the attaching shell is 3,695 psi that is less than the 25,000 psi maximum allowable stress.

It should be noted that the welds in the trunnion assemblies have been exclusively included in the finite element model. Therefore, the stresses in the welds have been implicitly analyzed. They are also subjected to stresses below their allowable values.

It has been demonstrated by the analyses presented in this document that the 3-60B cask trunnion assemblies have a sufficient margin of safety in its design to be safely lifted, it could safely be downended to a horizontal orientation with the help of a pair of trunnions provided in the lower part of the cask and also meets the regulatory requirements of 10CFR71.45 (b).

9.0 ANSYS PRINTOUT AND DATA FILES

The printout of the important data from the program is included with this document in electronic form as Appendix 1. The following is the directory of the data on the CDR.

```
Volume in drive F is My Disc
 Volume Serial Number is ABAF-A995
```

```
 Directory of F:\

12/07/2007  11:33 AM            15,761 Model.txt
12/10/2007  03:25 PM         2,924,234 file.cdb
09/24/2007  10:06 AM        51,118,080 file.rst
09/24/2007  07:53 AM            65,949 file.s01
09/24/2007  07:56 AM           112,121 file.s02
09/24/2007  09:59 AM            65,949 file.s03
09/24/2007  10:11 AM           135,899 file000.png
09/24/2007  10:12 AM           160,936 file001.png
09/24/2007  10:16 AM           121,466 file002.png
09/24/2007  10:21 AM           186,871 file003.png
09/24/2007  10:21 AM           186,281 file004.png
09/24/2007  10:22 AM           117,210 file005.png
09/24/2007  10:23 AM           158,600 file006.png
09/24/2007  10:24 AM           158,788 file007.png
09/24/2007  10:25 AM           119,253 file008.png
11/08/2007  02:27 PM           199,319 file009.png
11/08/2007  02:34 PM           213,759 file010.png
11/08/2007  02:35 PM           211,548 file011.png
11/08/2007  02:40 PM           140,407 file012.png
11/08/2007  03:51 PM           100,030 file013.png
11/08/2007  03:55 PM           144,967 file014.png
              21 File(s)     56,657,428 bytes
               0 Dir(s)               0 bytes free
```

10.0 APPENDICES

Appendix 1 Print-out of the ANSYS model data input

Appendix 2 Electronic data on CDROM

Figures

(15 Pages)

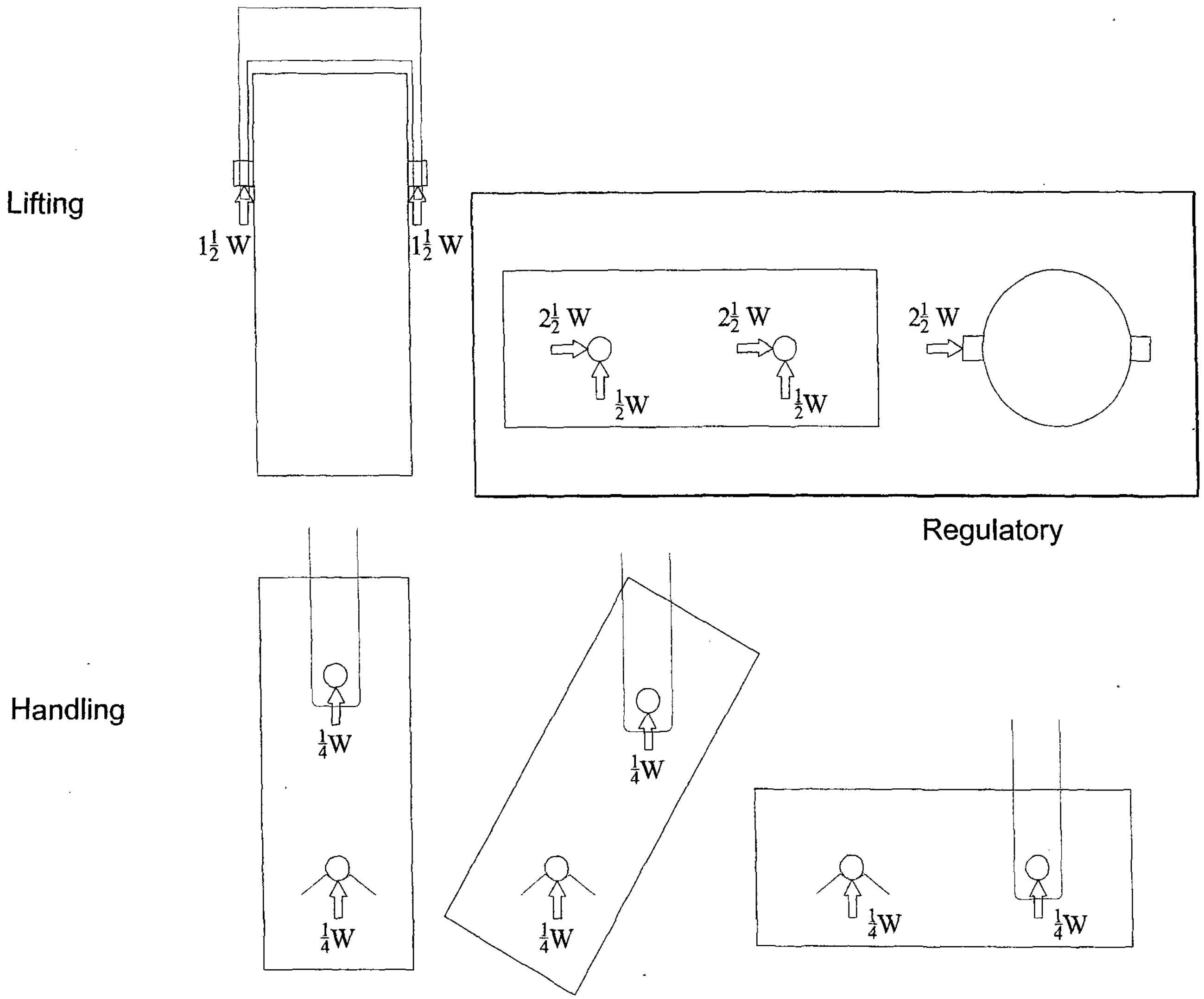


Figure 1

Loads on the Trunnions during Lifting and Handling Operation and per the Regulatory Requirement

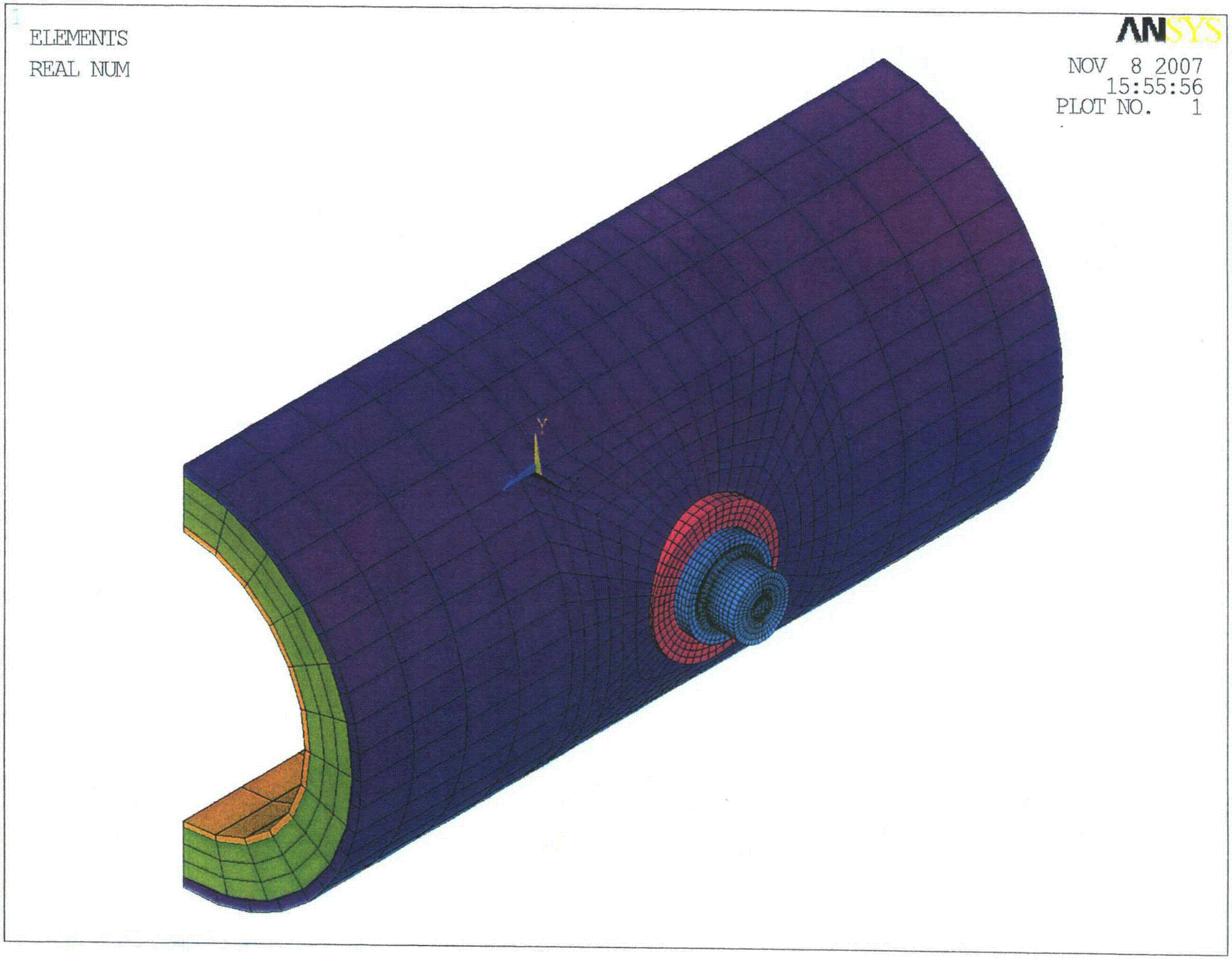
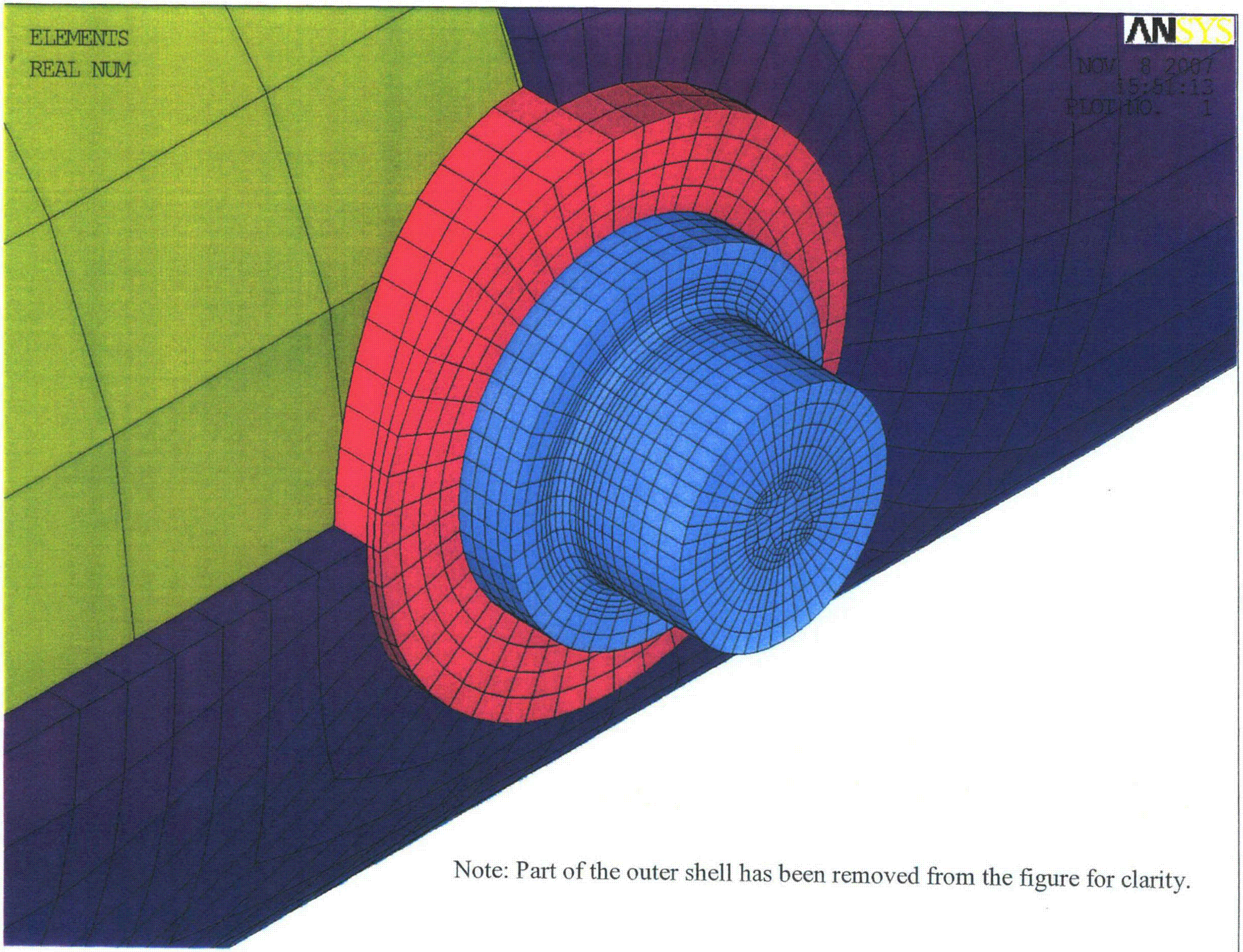


Figure 2

Finite Element Model of the 3-60B Cask Trunnion & its Vicinity



Note: Part of the outer shell has been removed from the figure for clarity.

Figure 3
Finite Element Model Close-Up of the Trunnion

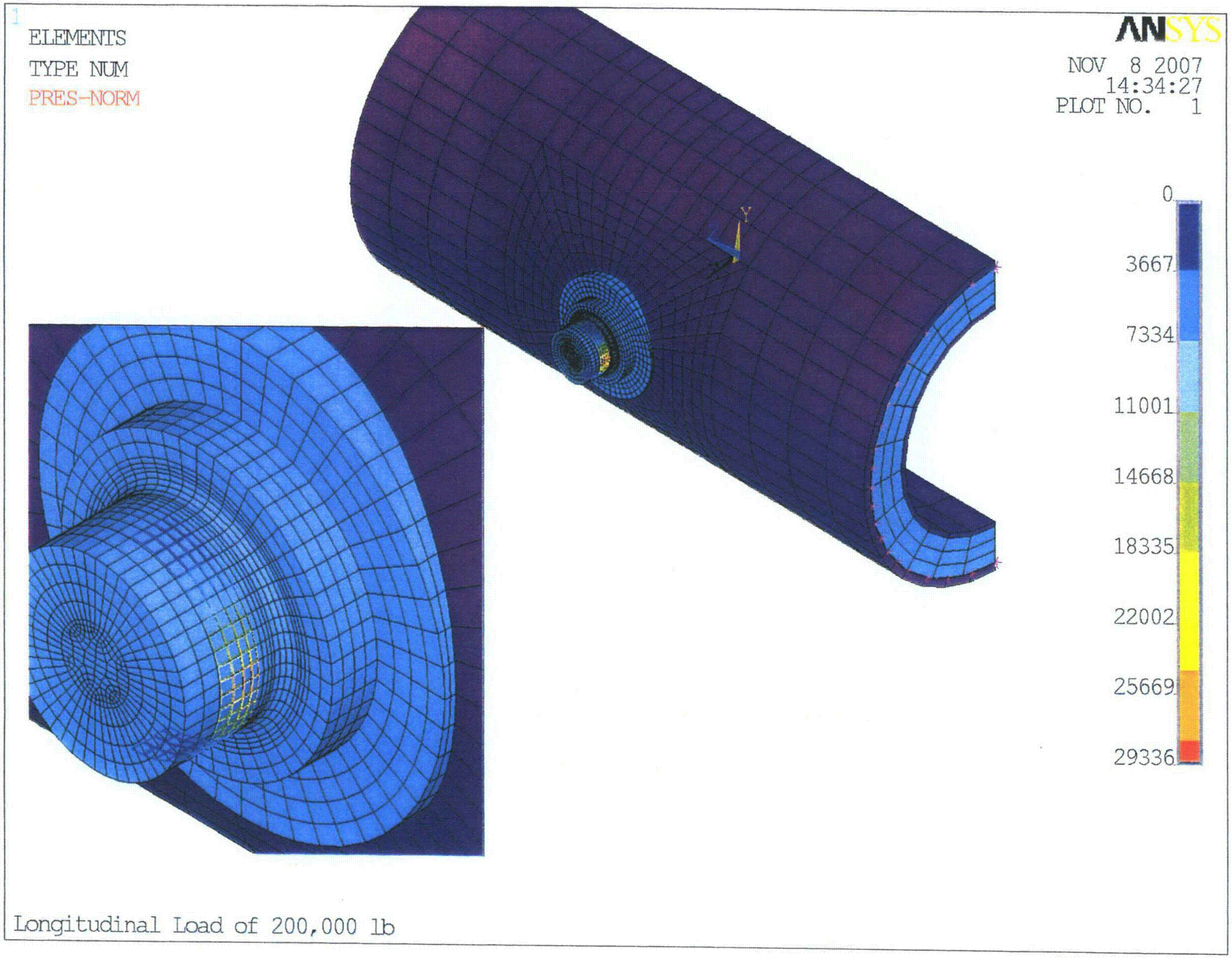


Figure 4
Finite Element Model Analysis Load Step 1 – Applied Loading

Title Trunnion Analyses of the 3-60B Cask under Various Loading Conditions
Calc. No. ST-503 (Figures) Rev. 0 Sheet 4 of 15

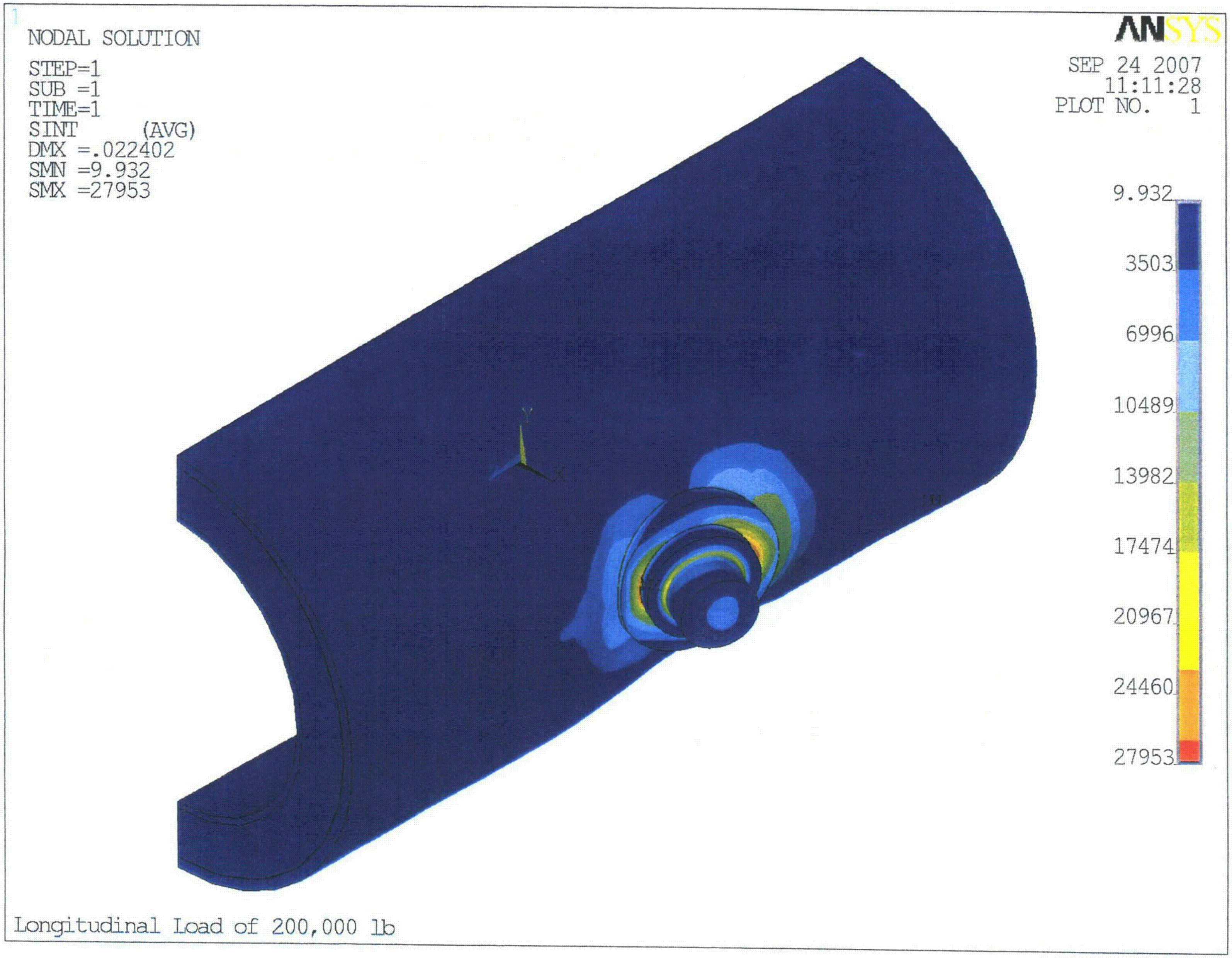


Figure 5

Load Step 1 – Stress Intensity Plot

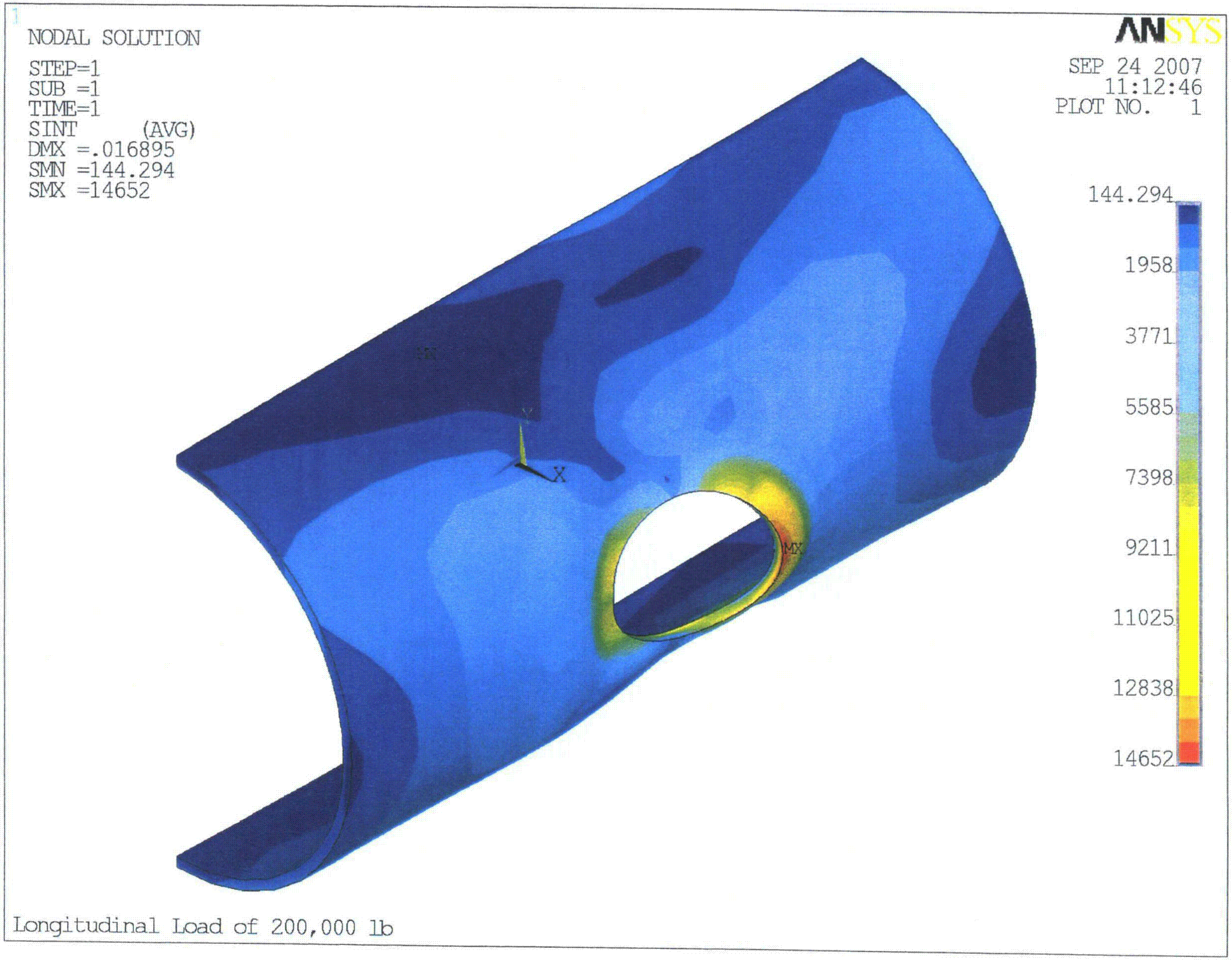


Figure 6

Load Step 1 – Stress Intensity in the Shell

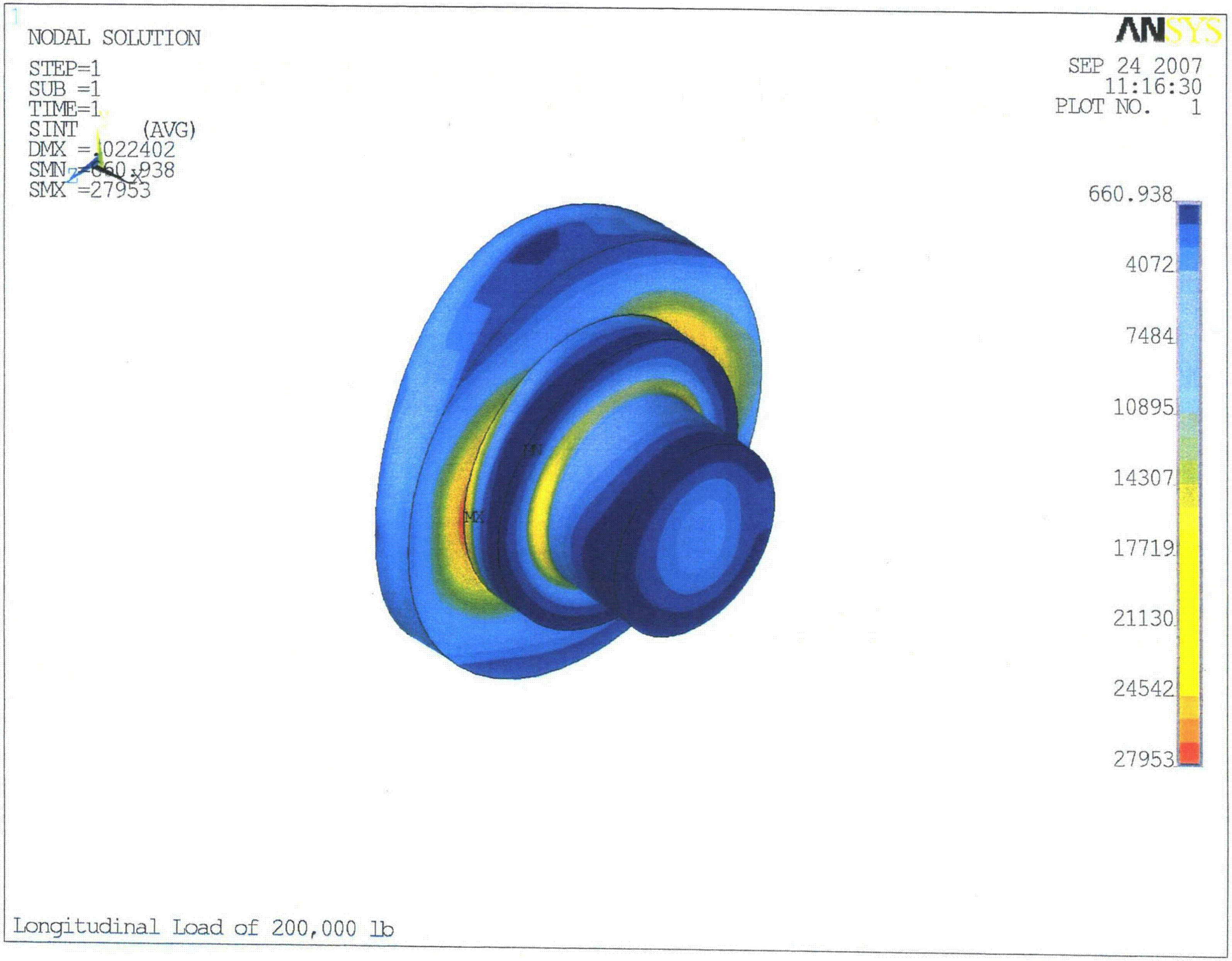


Figure 7

Load Step 1 – Stress Intensity in the Trunnion

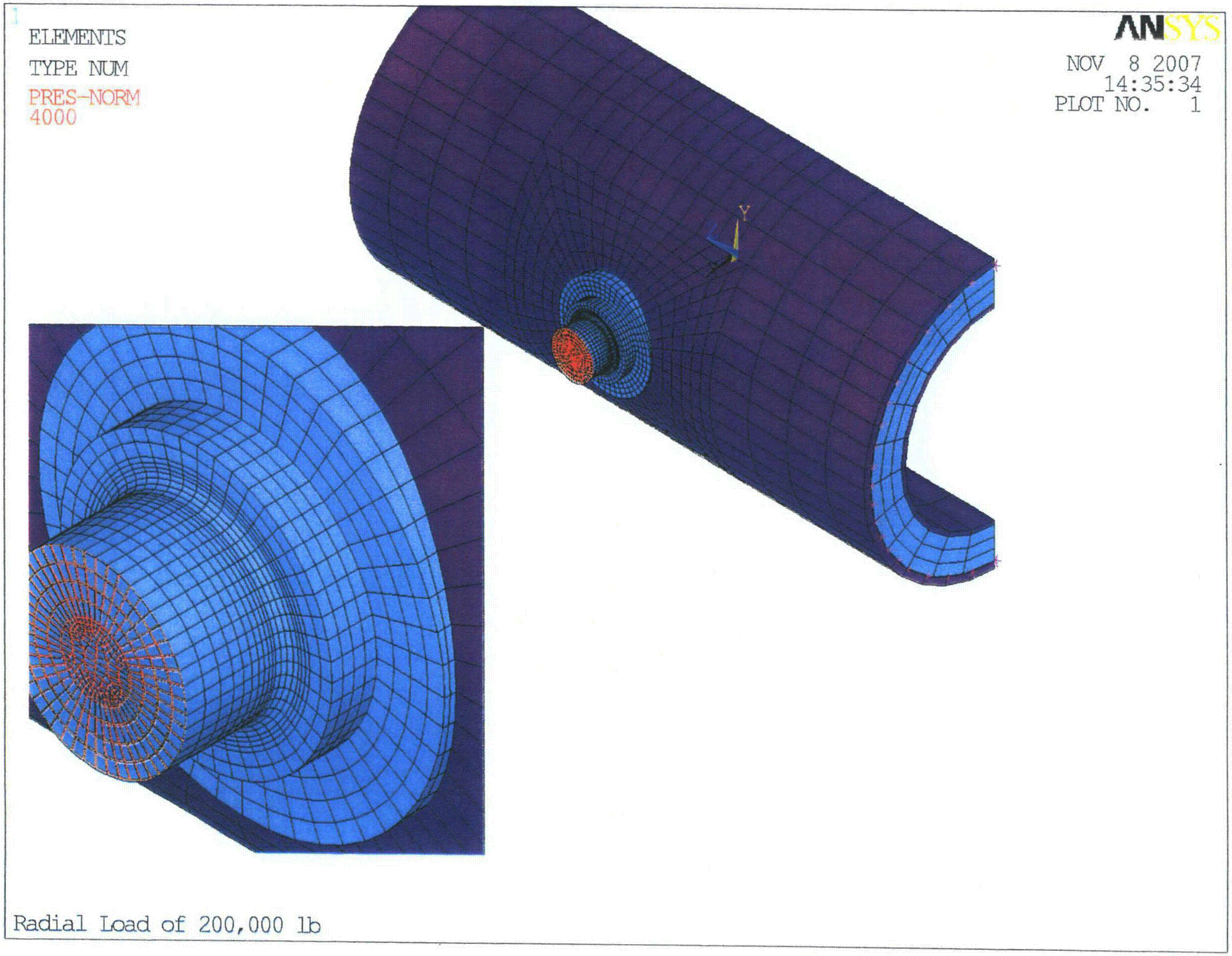


Figure 8

Finite Element Model Analysis Load Step 2 – Applied Loading

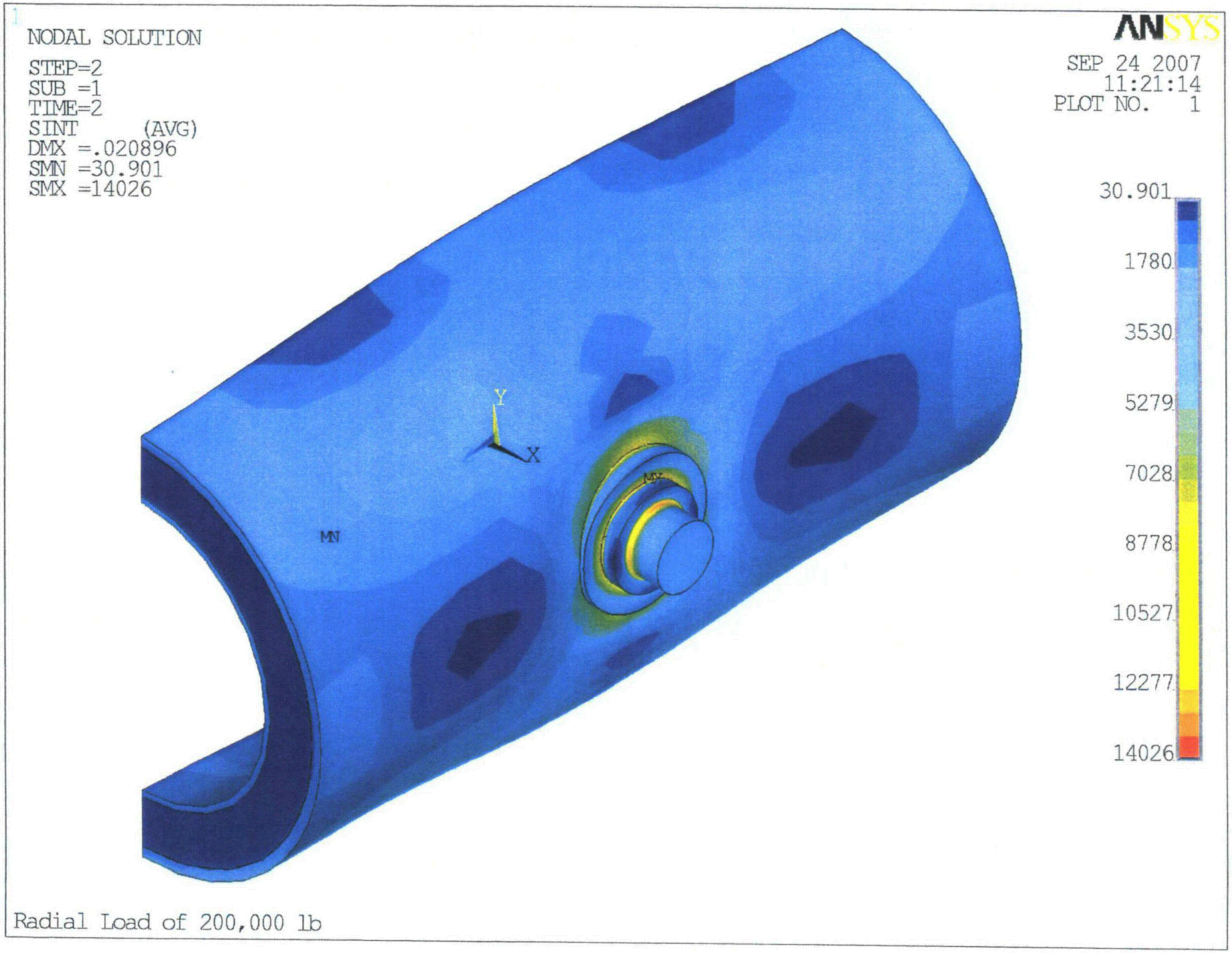


Figure 9
Load Step 2 – Stress Intensity Plot

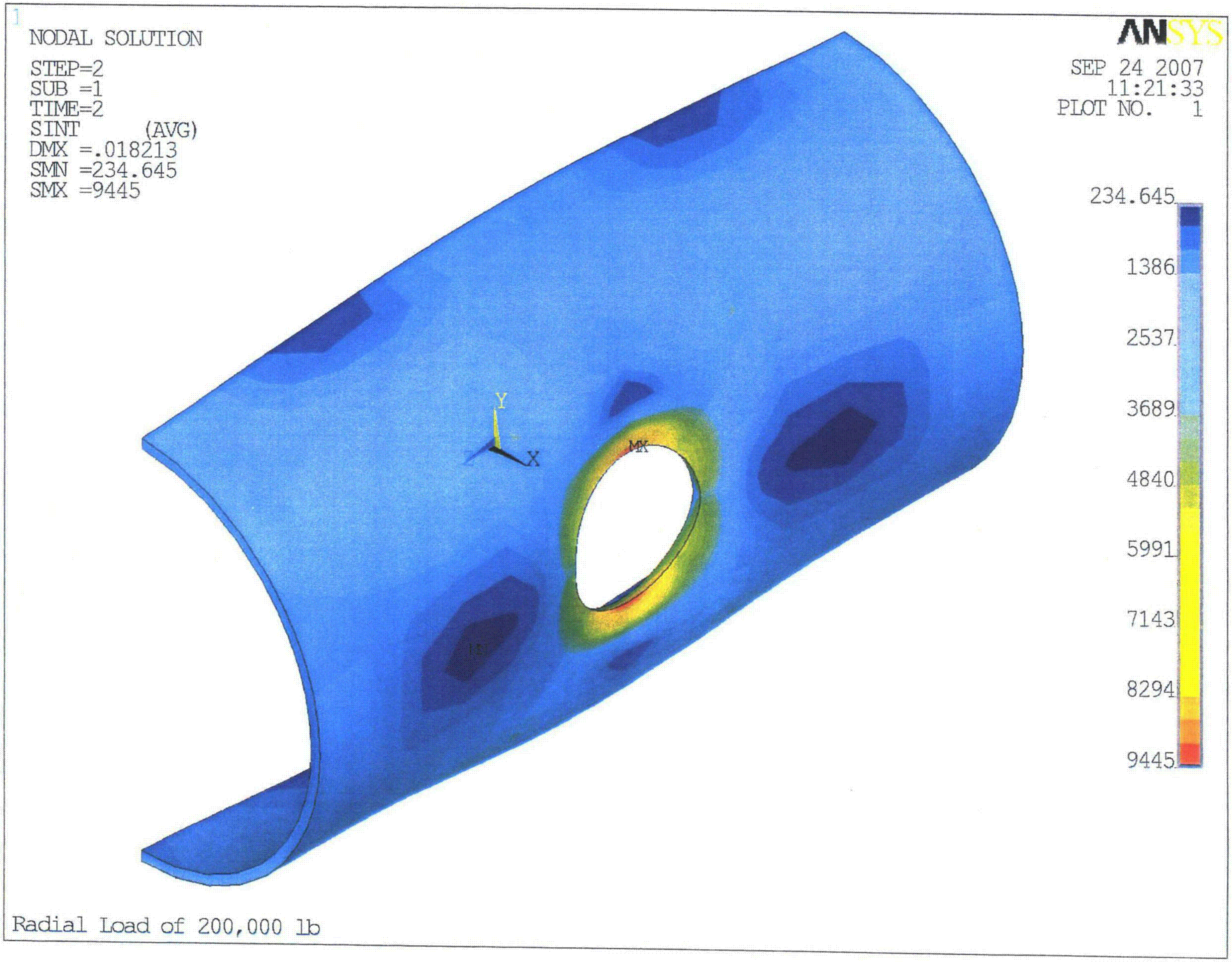


Figure 10

Load Step 2 – Stress Intensity in the Shell

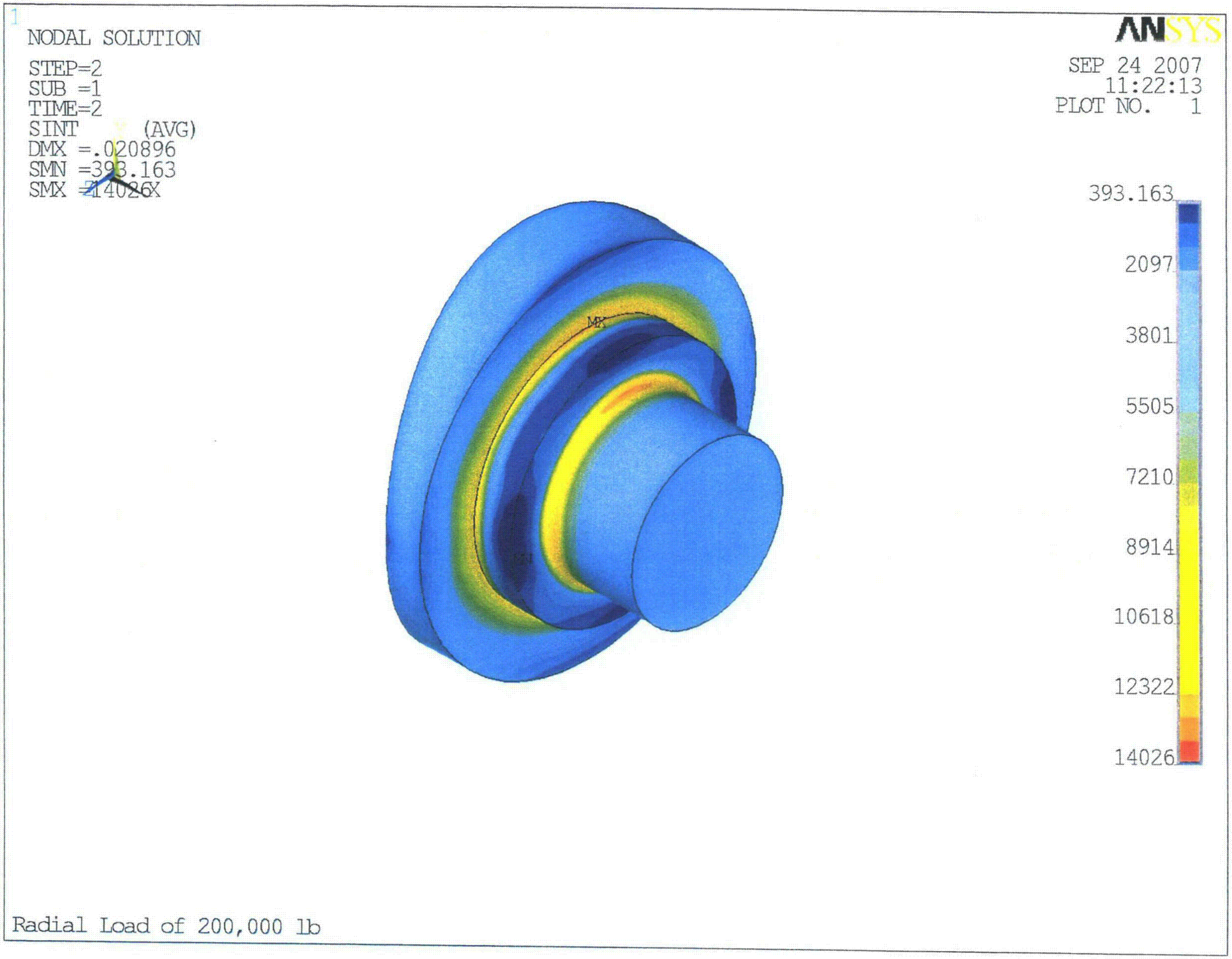


Figure 11

Load Step 2 – Stress Intensity in the Trunnion

Title Trunnion Analyses of the 3-60B Cask under Various Loading Conditions

Calc. No. ST-503 (Figures) Rev. 0 Sheet 11 of 15

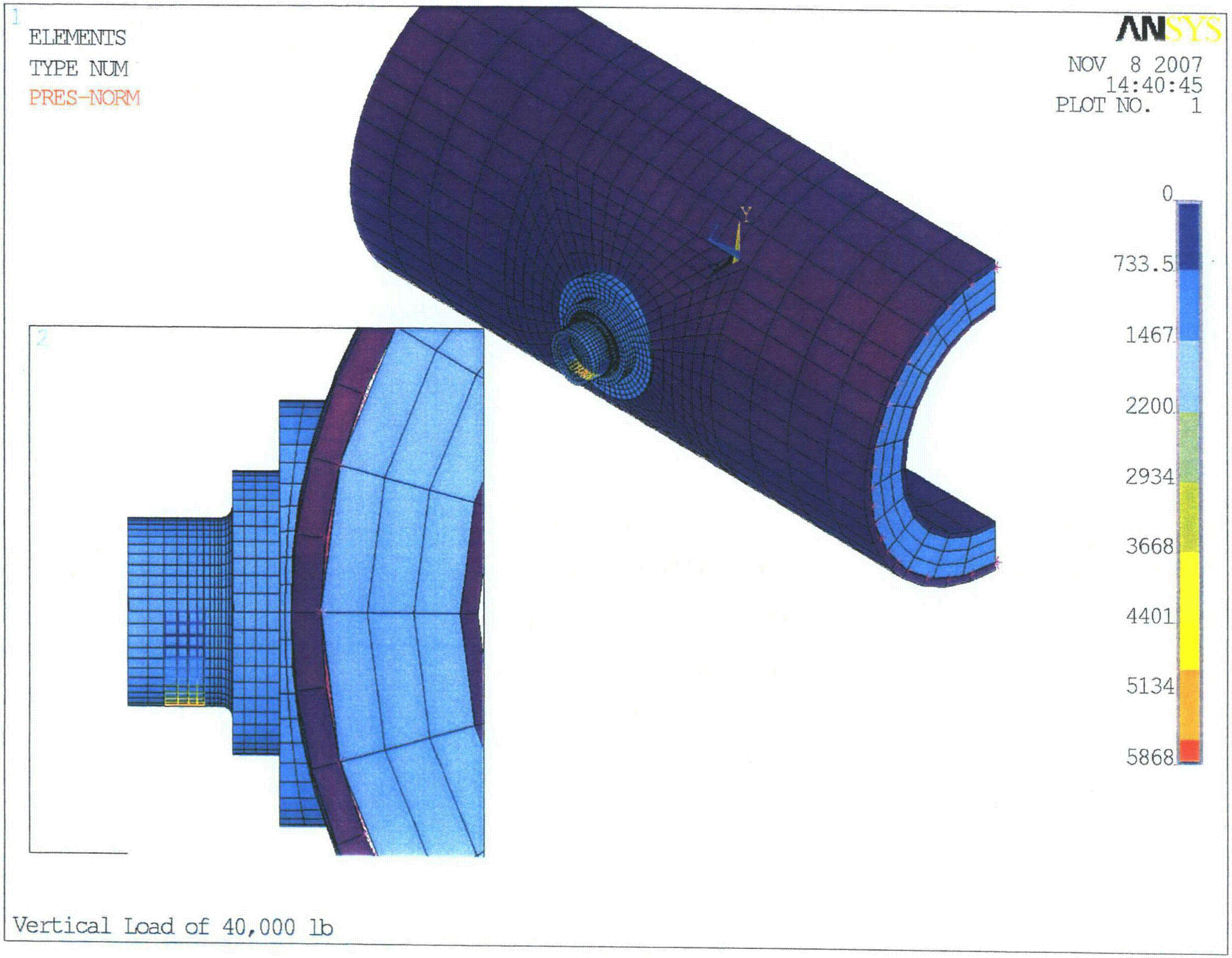


Figure 12

Finite Element Model Analysis Load Step 3 – Applied Loading

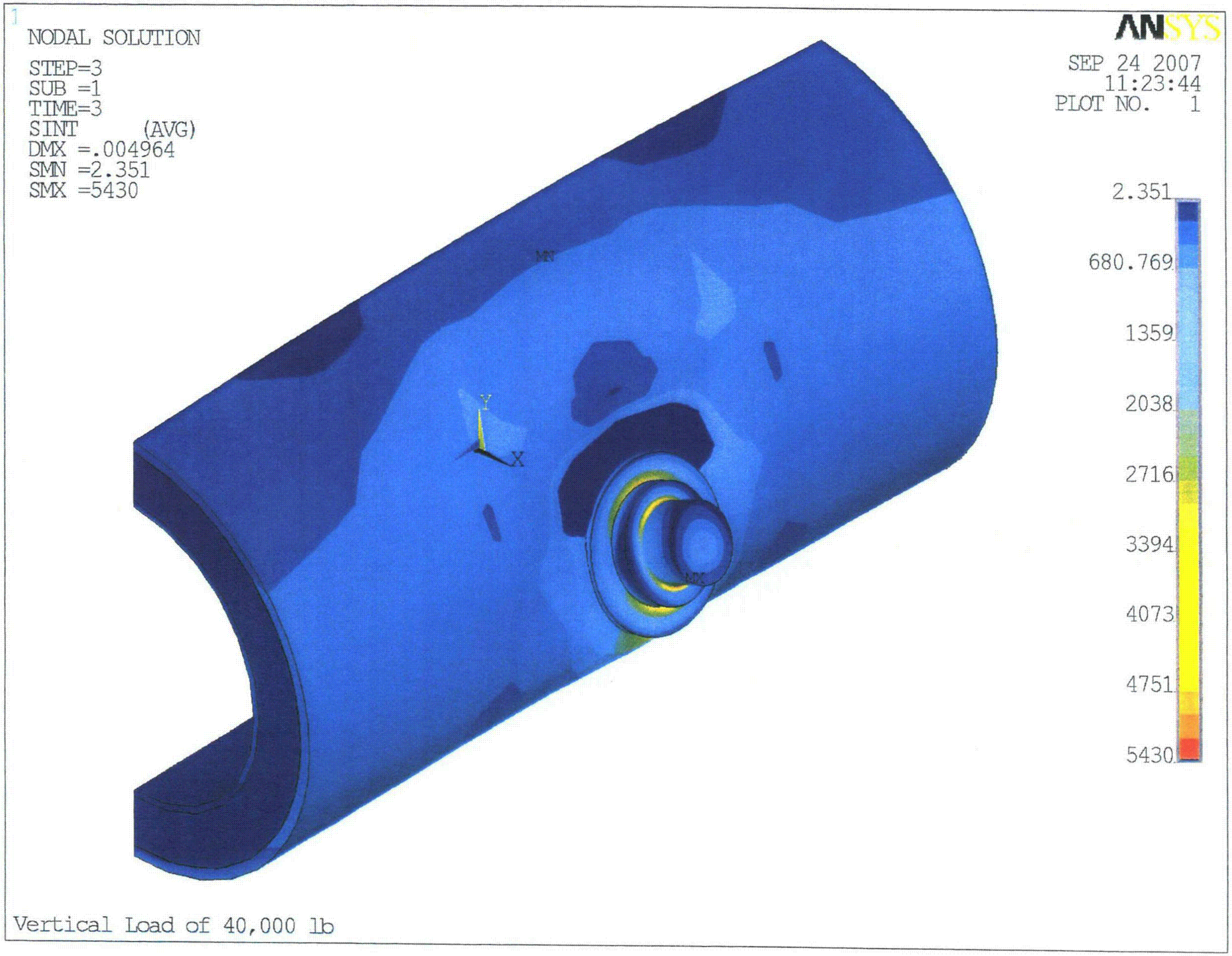


Figure 13

Load Step 3 – Stress Intensity Plot

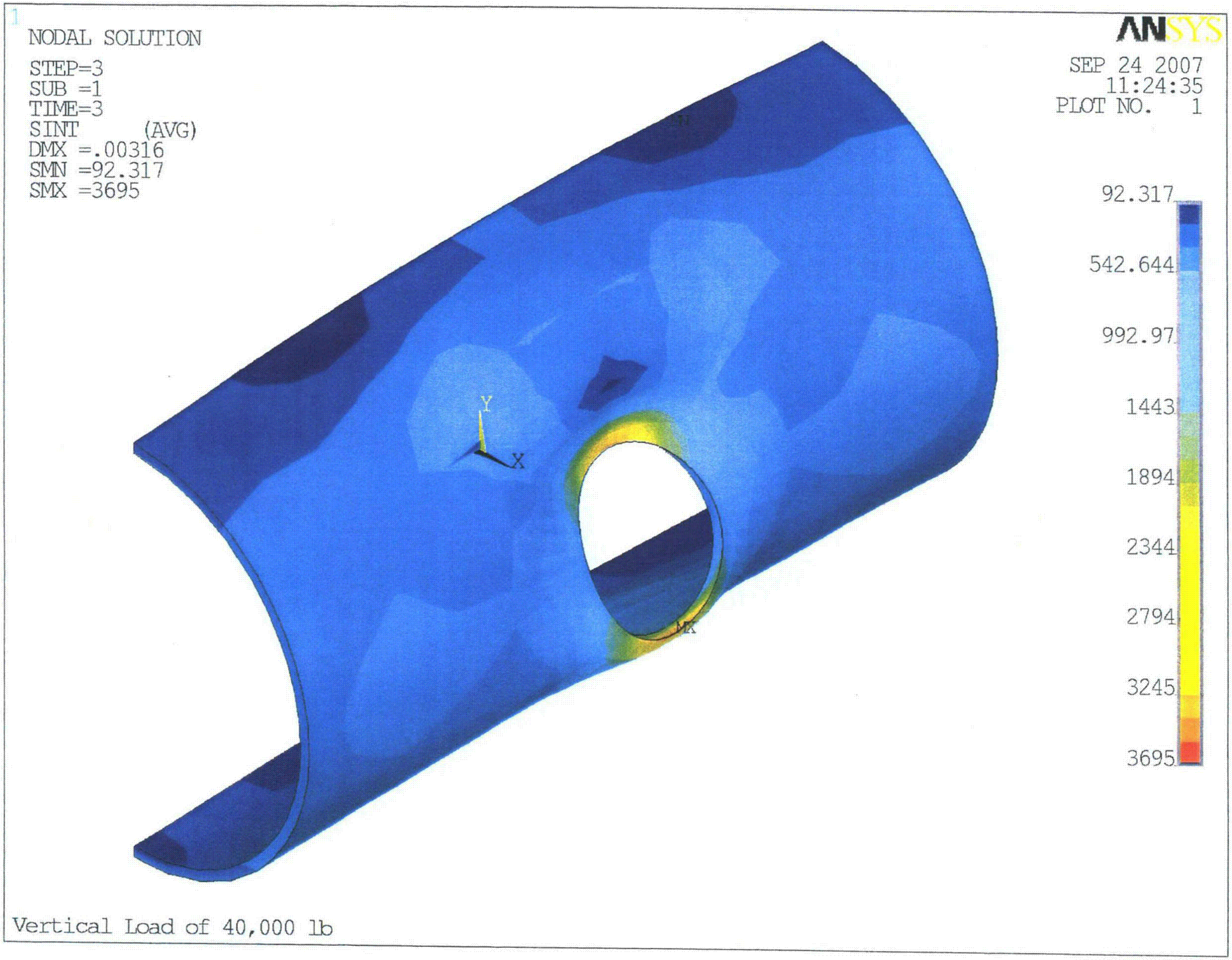


Figure 14

Load Step 3 – Stress Intensity in the Shell

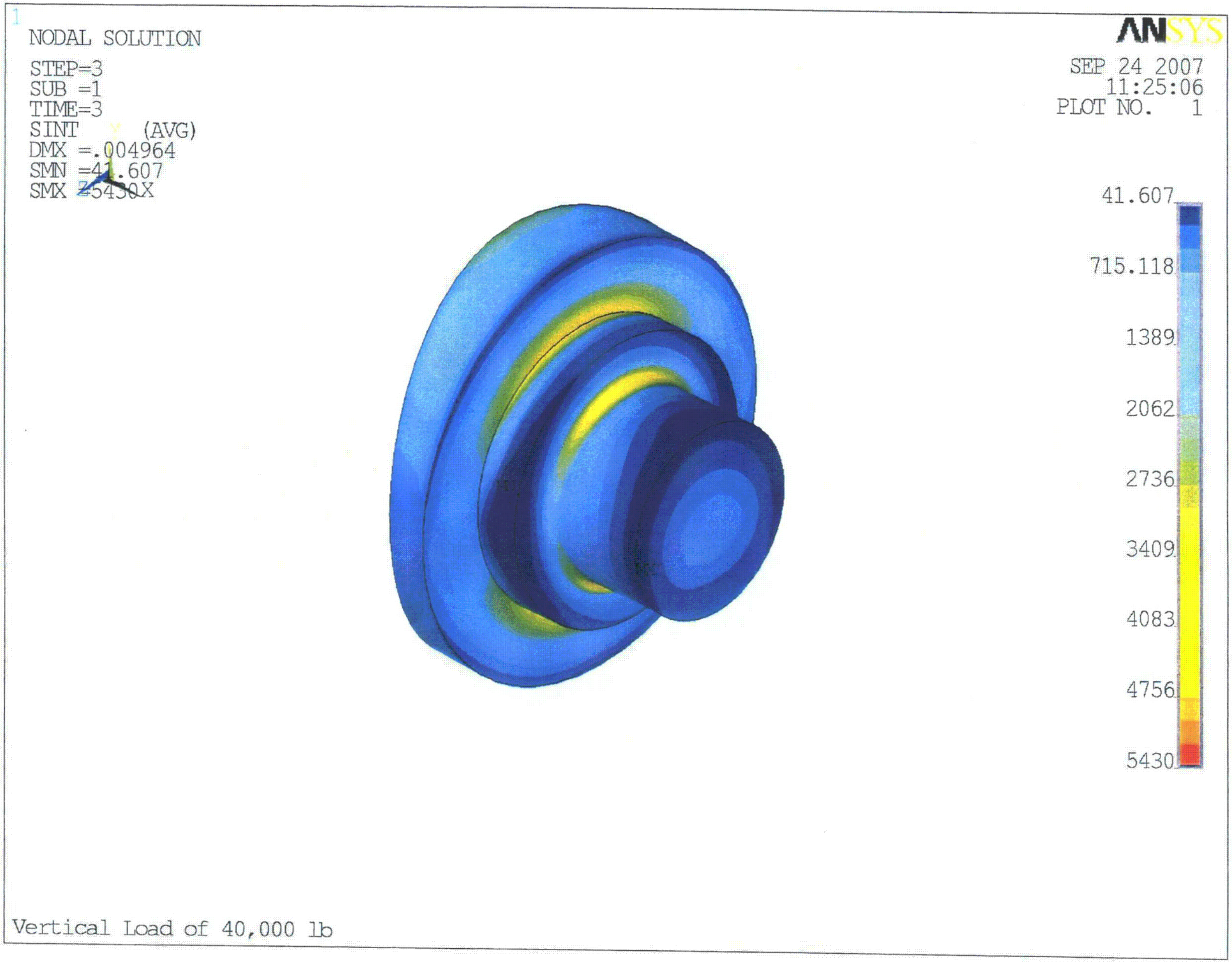


Figure 15

Load Step 3 – Stress Intensity in the Trunnion

Title Trunnion Analyses of the 3-60B Cask under Various Loading Conditions

Calc. No. ST-503 (Figures) Rev. 0 Sheet 15 of 15

Appendix 1

Printout of the ANSYS Model Data

(7 Pages)

3-60B Cask Trunnion Analyses

By Dr. Mirza I. Baig

Report Generated by ANSYS

Title Listing

```
     ***** TITLES *****

 *** YOU ARE IN   ANSYS - ENGINEERING ANALYSIS SYSTEM ***
 ANSYS Mechanical/Emag
 RELEASE  11.0SP1   UPDATE 20070830   CUSTOMER  00222442

 INITIAL JOBNAME = file
 CURRENT JOBNAME = file

 Current Working Directory: Y:\Trunnion

 MENULIST File: C:\Program Files\ANSYS Inc\v110\ANSYS\gui\en-us\UIDL\menulist110.ans
```

Global Status

```
G L O B A L   S T A T U S

 ANSYS - Engineering Analysis System              Dec 07, 2007          11:33
 Release 11.0SP1                00222442                   INTEL NT     Version

 Current working directory: Y:\Trunnion


 MENULIST File: C:\Program Files\ANSYS Inc\v110\ANSYS\gui\en-us\UIDL\menulist110.ans

 Product(s) enabled: ANSYS Mechanical/Emag


 Total connect time. . . . .   0 hours  0 minutes
 Total CP usage. . . . . . .   0 hours  0 minutes  2.6 seconds

 J O B   I N F O R M A T I O N ----------------------------------------------

 Current jobname . . . . . .file
 Initial jobname . . . . . .file

 Units . . . . . . . . . . .unknown

                                Available              Used
 Scratch Memory Space. . . .    256.000 mb             3.871 mb (  1.5%)
```

```
Database space . . . . . .  65535.750 mb         37.573 mb (  0.1%)

 User menu file in use . . .C:\Program Files\ANSYS Inc\v110\ANSYS\gui\en-
us\uidl\UIMENU.GRN
 User menu file in use . . .C:\Program Files\ANSYS Inc\v110\ANSYS\gui\en-
us\uidl\UIFUNC1.GRN
 User menu file in use . . .C:\Program Files\ANSYS Inc\v110\ANSYS\gui\en-
us\uidl\UIFUNC2.GRN
 User menu file in use . . .C:\Program Files\ANSYS Inc\v110\ANSYS\gui\en-
us\uidl\MECHTOOL.AUI
 Beta features . . . . . . .are not shown in the user interface
```

M O D E L   I N F O R M A T I O N --

Solid model summary:

	Largest Number	Number Defined	Number Selected
Keypoints	32	24	24
Lines	56	36	36
Areas	28	16	16
Volumes	3	2	2

Finite element model summary:

	Largest Number	Number Defined	Number Selected
Nodes	22230	12268	10261
Elements.	32839	9870	7632
Element types	30	14	n.a.
Real constant sets.	8	6	n.a.
Material property sets. . .	2	2	n.a.
Coupling.	0	0	n.a.
Constraint equations. . . .	0	0	n.a.
Master DOFs	0	0	n.a.
Dynamic gap conditions. . .	0	0	n.a.

B O U N D A R Y   C O N D I T I O N   I N F O R M A T I O N ----------------

	Number Defined
Constraints on nodes.	928
Constraints on keypoints.	0
Constraints on lines.	0
Constraints on areas.	0
Forces on nodes	0
Forces on keypoints	0
Surface loads on elements	96
Number of element flagged surfaces . . .	0
Surface loads on lines.	0
Surface loads on areas.	0
Body loads on elements.	0

```
Body loads on nodes . . . . . . . . . . .        0
Body loads on keypoints . . . . . . . . .        0

Temperatures
   Uniform temperature. . . . . . . . . .      0.000
   Reference temperature. . . . . . . . .      0.000
   Offset from absolute scale . . . . . .      0.000

                                              X           Y           Z
Linear acceleration . . . . . . . . . . . 0.0000      0.0000      0.0000
Angular velocity (about global CS). . . . 0.0000      0.0000      0.0000
Angular acceleration (about global CS). . 0.0000      0.0000      0.0000
Location of reference CS. . . . . . . . . 0.0000      0.0000      0.0000
Angular velocity (about reference CS) . . 0.0000      0.0000      0.0000
Angular acceleration (about reference CS) 0.0000      0.0000      0.0000

R O U T I N E   I N F O R M A T I O N ------------------------------------

Current routine. . . . . . . . . . . . .Preprocessing (PREP7)

Active coordinate system . . . . . . .    1 (Cylindrical)

Display coordinate system. . . . . . .    0 (Cartesian)

Current element attributes:
   Type number . . . . . . . . . . . .     30  (CONTA175)
   Real number . . . . . . . . . . . .      8
   Material number . . . . . . . . . .      1
   Element coordinate system number. .      0

Current mesher type. . . . . . . . . .free mesher

Current element meshing shape 2D . . .use default element shape.

Current element meshing shape 3D . . .use hexahedra.

SmrtSize Level  . . . . . . . . . . . . OFF

Global element size. . . . . . . . . .      0 divisions per line

Active coordinate system . . . . . . .    1 (Cylindrical)

Display coordinate system. . . . . . .    0 (Cartesian)

Analysis type. . . . . . . . . . . . .Static (steady-state)

Active options for this analysis type:
   Large deformation effects . . . . .Not included
   Plasticity. . . . . . . . . . . . .Not included
   Creep . . . . . . . . . . . . . . .Not included
   Equation solver to use. . . . . . .Program Chosen

Results file . . . . . . . . . . . . .file.rst

Load step number . . . . . . . . . .        1

Number of substeps . . . . . . . . .        1
```

```
Step change boundary conditions . .No
```

Solution Status

```
                    S O L U T I O N   O P T I O N S

  PROBLEM DIMENSIONALITY. . . . . . . . . . . . . .3-D
  DEGREES OF FREEDOM. . . . . . UX   UY   UZ   ROTX ROTY ROTZ
  ANALYSIS TYPE . . . . . . . . . . . . . . . . .STATIC (STEADY-STATE)
  NEWTON-RAPHSON OPTION . . . . . . . . . . . . .PROGRAM CHOSEN
  GLOBALLY ASSEMBLED MATRIX . . . . . . . . . . .SYMMETRIC

                       L O A D   S T E P   O P T I O N S

  LOAD STEP NUMBER. . . . . . . . . . . . . . . .     1
  TIME AT END OF THE LOAD STEP. . . . . . . . . .  1.0000
  NUMBER OF SUBSTEPS. . . . . . . . . . . . . . .     1
  MAXIMUM NUMBER OF EQUILIBRIUM ITERATIONS. . . .    15
  STEP CHANGE BOUNDARY CONDITIONS . . . . . . . .    NO
  TERMINATE ANALYSIS IF NOT CONVERGED . . . . . .YES (EXIT)
  CONVERGENCE CONTROLS. . . . . . . . . . . . . .USE DEFAULTS
  COPY INTEGRATION POINT VALUES TO NODE . . . . .   YES
  PRINT OUTPUT CONTROLS
     ITEM     FREQUENCY   COMPONENT
     RSOL       NONE
  DATABASE OUTPUT CONTROLS
     ITEM     FREQUENCY   COMPONENT
      ALL        ALL
```

Element Type Listing

```
 LIST ELEMENT TYPES FROM      1 TO     30 BY      1

 ELEMENT TYPE      1 IS SOLID185     3-D 8-NODE STRUCTURAL SOLID    INOPR
  KEYOPT(1-12)=    0  0  0    0  0  0    0  0  0    0  0  0        0

 ELEMENT TYPE      2 IS SOLSH190     3-D 8-NODE SOLID SHELL         INOPR
  KEYOPT(1-12)=    0  0  0    0  0  0    0  0  0    0  0  0        0

 ELEMENT TYPE     19 IS TARGE170     3-D TARGET SEGMENT             INOPR
  KEYOPT(1-12)=    0  0  0    0  0  0    0  0  0    0  0  0        0

 ELEMENT TYPE     20 IS CONTA174     3D 8-NODE SURF-SURF CONTACT    INOPR
  KEYOPT(1-12)=    0  0  0    0  3  0    0  0  0    2  0  0        0

 ELEMENT TYPE     21 IS TARGE170     3-D TARGET SEGMENT             INOPR
  KEYOPT(1-12)=    0  0  0    0  0  0    0  0  0    0  0  0        0

 ELEMENT TYPE     22 IS CONTA174     3D 8-NODE SURF-SURF CONTACT    INOPR
  KEYOPT(1-12)=    0  0  0    0  3  0    0  0  1    2  0  0        0
```

```
ELEMENT TYPE     23 IS TARGE170     3-D TARGET SEGMENT              INOPR
 KEYOPT(1-12)=    0  0  0    0  0  0    0  0  0    0  0  0        0

ELEMENT TYPE     24 IS CONTA174     3D 8-NODE SURF-SURF CONTACT     INOPR
 KEYOPT(1-12)=    0  0  0    0  3  0    0  0  1    2  0  0        0

ELEMENT TYPE     25 IS TARGE170     3-D TARGET SEGMENT              INOPR
 KEYOPT(1-12)=    0  0  0    0  0  0    0  0  0    0  0  0        0

ELEMENT TYPE     26 IS CONTA174     3D 8-NODE SURF-SURF CONTACT     INOPR
 KEYOPT(1-12)=    0  0  0    0  3  0    0  0  1    2  0  0        0

ELEMENT TYPE     27 IS TARGE170     3-D TARGET SEGMENT              INOPR
 KEYOPT(1-12)=    0  0  0    0  0  0    0  0  0    0  0  0        0

ELEMENT TYPE     28 IS CONTA175     NODE-TO-SURFACE CONTACT         INOPR
 KEYOPT(1-12)=    0  0  0    0  3  0    0  0  1    2  0  0        0

ELEMENT TYPE     29 IS TARGE170     3-D TARGET SEGMENT              INOPR
 KEYOPT(1-12)=    0  0  0    0  0  0    0  0  0    0  0  0        0

ELEMENT TYPE     30 IS CONTA175     NODE-TO-SURFACE CONTACT         INOPR
 KEYOPT(1-12)=    0  0  0    0  0  0    0  0  1    2  0  0        0

CURRENT NODAL DOF SET IS  UX    UY    UZ    ROTX  ROTY  ROTZ
 THREE-DIMENSIONAL MODEL
```

Real Constant Listing

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LIST REAL SETS        1 TO        8 BY        1

 REAL CONSTANT SET        3  ITEMS    1 TO    6
   0.0000       0.0000       1.0000      0.10000       0.0000       0.0000

 REAL CONSTANT SET        3  ITEMS    7 TO   12
   0.0000       0.0000     0.10000E+21    0.0000       1.0000       0.0000

 REAL CONSTANT SET        3  ITEMS   13 TO   18
   0.0000       0.0000       1.0000       0.0000       1.0000      0.50000

 REAL CONSTANT SET        3  ITEMS   19 TO   24
   0.0000       1.0000       1.0000       0.0000       0.0000       1.0000

 REAL CONSTANT SET        4  ITEMS    1 TO    6
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 REAL CONSTANT SET        4  ITEMS    7 TO   12
   0.0000       0.0000     0.10000E+21    0.0000       1.0000       0.0000

 REAL CONSTANT SET        4  ITEMS   13 TO   18
   0.0000       0.0000       1.0000       0.0000       1.0000      0.50000

 REAL CONSTANT SET        4  ITEMS   19 TO   24
   0.0000       1.0000       1.0000       0.0000       0.0000       1.0000
```

```
REAL CONSTANT SET        5  ITEMS   1 TO   6
   0.0000       0.0000       1.0000      0.10000       0.0000       0.0000

REAL CONSTANT SET        5  ITEMS   7 TO  12
   0.0000       0.0000      0.10000E+21   0.0000       1.0000       0.0000

REAL CONSTANT SET        5  ITEMS  13 TO  18
   0.0000       0.0000       1.0000       0.0000       1.0000      0.50000

REAL CONSTANT SET        5  ITEMS  19 TO  24
   0.0000       1.0000       1.0000       0.0000       0.0000       1.0000

REAL CONSTANT SET        6  ITEMS   1 TO   6
   0.0000       0.0000       1.0000      0.10000       0.0000       0.0000

REAL CONSTANT SET        6  ITEMS   7 TO  12
   0.0000       0.0000      0.10000E+21   0.0000       1.0000       0.0000

REAL CONSTANT SET        6  ITEMS  13 TO  18
   0.0000       0.0000       1.0000       0.0000       1.0000      0.50000

REAL CONSTANT SET        6  ITEMS  19 TO  24
   0.0000       1.0000       1.0000       0.0000       0.0000       1.0000

REAL CONSTANT SET        7  ITEMS   1 TO   6
   0.0000       0.0000       1.0000      0.10000       0.0000       0.0000

REAL CONSTANT SET        7  ITEMS   7 TO  12
   0.0000       0.0000      0.10000E+21   0.0000       1.0000       0.0000

REAL CONSTANT SET        7  ITEMS  13 TO  18
   0.0000       0.0000       1.0000       0.0000       1.0000      0.50000

REAL CONSTANT SET        7  ITEMS  19 TO  24
   0.0000       1.0000       1.0000       0.0000       0.0000       1.0000

REAL CONSTANT SET        7  ITEMS  25 TO  30
   10.000       0.0000       0.0000       0.0000       0.0000       0.0000

REAL CONSTANT SET        8  ITEMS   1 TO   6
   0.0000       0.0000       1.0000      0.10000       0.0000       0.0000

REAL CONSTANT SET        8  ITEMS   7 TO  12
   0.0000       0.0000      0.10000E+21   0.0000       1.0000       0.0000

REAL CONSTANT SET        8  ITEMS  13 TO  18
   0.0000       0.0000       1.0000       0.0000       1.0000      0.50000

REAL CONSTANT SET        8  ITEMS  19 TO  24
   0.0000       1.0000       1.0000       0.0000       0.0000       1.0000

REAL CONSTANT SET        8  ITEMS  25 TO  30
   10.000       0.0000       0.0000       0.0000       0.0000       0.0000
```

Material Properties Listing

```
LIST MATERIALS        1 TO        2 BY        1
  PROPERTY= ALL

 PROPERTY TABLE EX     MAT=         1  NUM. POINTS=  1
   TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
     0.0000      0.30000E+08

 PROPERTY TABLE NUXY  MAT=         1  NUM. POINTS=  1
   TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
     0.0000      0.30000

 PROPERTY TABLE DENS  MAT=         1  NUM. POINTS=  1
   TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
     0.0000      0.28300

 PROPERTY TABLE MU    MAT=         1  NUM. POINTS=  1
   TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
     0.0000       0.0000

 PROPERTY TABLE EMIS  MAT=         1  NUM. POINTS=  1
   TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
     0.0000      0.78886E-30

 PROPERTY TABLE EX     MAT=         2  NUM. POINTS=  1
   TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
     0.0000      0.22700E+07

 PROPERTY TABLE NUXY  MAT=         2  NUM. POINTS=  1
   TEMPERATURE     DATA    TEMPERATURE     DATA    TEMPERATURE     DATA
     0.0000      0.45000
```

Appendix 2

Electronic Data on CDROM

(1 CDROM)