

ATTACHMENT 3

TO ENTERGY LETTER 2.14.032

PILGRIM RELIEF REQUEST PRR-25, Rev 1

Calculation Cover Page EC # 49514

**Pilgrim Salt Service Water Discharge Piping Elbow (JF29-8-4) Wall Thinning Stress
Analysis**

Structural Integrity Associates Calculation No. 1400287.301, Rev. 0

(22 Pages)

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| <input type="checkbox"/> ANO-1 | <input type="checkbox"/> ANO-2 | <input type="checkbox"/> GGNS | <input type="checkbox"/> IP-2 | <input type="checkbox"/> IP-3 | <input type="checkbox"/> PLP |
| <input type="checkbox"/> JAF | <input checked="" type="checkbox"/> PNPS | <input type="checkbox"/> RBS | <input type="checkbox"/> VY | <input type="checkbox"/> W3 | |
| <input type="checkbox"/> NP-GGNS-3 | <input type="checkbox"/> NP-RBS-3 | | | | |

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| CALCULATION COVER PAGE | (1) EC # <u>49514</u> | (2) Page 1 of <u>22</u> |
| (3) Design Basis Calc. <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO | | (4) <input checked="" type="checkbox"/> CALCULATION <input type="checkbox"/> EC Markup |
| (5) Calculation No: <u>M1397</u> | | (6) Revision: <u>0</u> |
| (7) Title: <u>Pilgrim Salt Service Water Discharge Piping Elbow (JF29-8-4) Wall Thinning Stress Analysis</u> | | (8) Editorial <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO |
| (9) System(s): <u>29</u> | | (10) Review Org (Department): |
| (11) Safety Class: <input checked="" type="checkbox"/> Safety / Quality Related <input type="checkbox"/> Augmented Quality Program <input type="checkbox"/> Non-Safety Related | (12) Component/Equipment/Structure Type/Number: | |
| | <u>PIPE / JF29-8-4</u> | |
| | | |
| | | |
| (13) Document Type: <u>CALC</u> | | |
| (14) Keywords (Description/Topical Codes): <u>JF29-8-4, spool, SIA, Structural Integrity Associates, flaw, leak, rubber lining, 1400287.301, 1400287</u> | | |
| | | |
| | | |
| REVIEWS | | |
| (15) Name/Signature/Date <u>Structural Integrity Assoc.</u> Responsible Engineer | (16) Name/Signature/Date <u>John A. Tucker <i>AM</i> 3-3-14</u> <input type="checkbox"/> Design Verifier <input checked="" type="checkbox"/> Reviewer <input type="checkbox"/> Comments Attached | (17) Name/Signature/Date <u>See IAS</u> Supervisor/Approval <input type="checkbox"/> Comments Attached |

**CALCULATION
REFERENCE SHEET**

 CALCULATION NO: M1397
 REVISION: 0
I. EC Markups Incorporated (N/A to NP calculations)

1. N/A
- 2.
- 3.
- 4.
- 5.

| II. Relationships: | Sht | Rev | Input Doc | Output Doc | Impact Y/N | Tracking No. |
|-----------------------|------|-----|--------------------------|--------------------------|---------------|-----------------|
| 1. Specification M300 | 2-12 | 109 | x | <input type="checkbox"/> | N | |
| 2. M100-7250 | - | 5 | x | <input type="checkbox"/> | N | |
| 3. | | | <input type="checkbox"/> | <input type="checkbox"/> | | |
| 4. | | | <input type="checkbox"/> | <input type="checkbox"/> | | |
| 5. | | | <input type="checkbox"/> | <input type="checkbox"/> | | |

III. CROSS REFERENCES:

1. PNPS Dwg M100-7250
2. ASME Code Case N-513-3
3. Flow of Fluids Through valves, Fittings and Pipe, Crane Co., Technical Paper No. 410
- 4.
- 5.

IV. SOFTWARE USED:

 Title: ANSYS Mechanical APDL and PrepPost Version/Release: 12.1x64, Nov 2009
 Disk/CD No. --
V. DISK/CDS INCLUDED:

 Title: N/A Version/Release Disk/CD No.
VI. OTHER CHANGES:



Structural Integrity Associates, Inc.®

CALCULATION PACKAGE

File No.: 1400287.301

Project No.: 1400287

Quality Program: ☒ Nuclear ☐ Commercial

PROJECT NAME:

Pilgrim Leaking Elbow Evaluation Support

CONTRACT NO.:

10404807, Change Order No. 001

CLIENT:

Entergy Nuclear

PLANT:

Pilgrim Nuclear Power Station

CALCULATION TITLE:

Pilgrim Salt Service Water Discharge Piping Elbow (JF29-8-4 Spool) Wall Thinning Stress Analysis

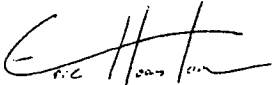
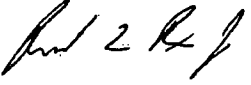

| Document Revision | Affected Pages | Revision Description | Project Manager Approval Signature & Date | Preparer(s) & Checker(s) Signatures & Date |
|----------------------|----------------------------------|----------------------|--|--|
| 0 | 1 - 16 A-1 - A-2 B-1 - B-2 | Initial Issue |  Eric Houston EJH 3/3/14 |  Richard Bax RLB 3/3/14  Jim Wu JW 3/3/14 |



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1.0 OBJECTIVE

A weeping flaw was identified in a 90° elbow at Pilgrim Nuclear Power Station. The leakage was identified in the Salt Service Water system, JF29-8-4 Spool [1]. Structural Integrity Associates (SI) was contracted to demonstrate the suitability for continued operation of the leaking elbow using methods consistent with an upcoming revision of Code Case N-513-3 [2]. The objective of this calculation is to develop a finite element model of the thinned elbow and determine the local stresses due to applied bending loads.

2.0 TECHNICAL APPROACH

A finite element model (FEM) of the leaking elbow will be developed using the ANSYS finite element software program [3]. Unit moment loads will then be applied to the model and stresses in the local region of the leak will be extracted for use in an evaluation of allowable through-wall flaw lengths, which will be documented in a later calculation.

3.0 ASSUMPTIONS / DESIGN INPUTS

The evaluated local thinning is from Reference [4] and is shown in Appendix B. The grid spacing is 0.75 inch [4]. The thinning data point locations for the Reference [4] values are shown in Figure 1.

Design input for the 90° elbow is taken from Reference [1] unless noted otherwise.

- Elbow Type: long radius (R) = $1.5 \cdot (\text{Nominal Pipe Size}) = 27$ inches
- Outside diameter (OD): 18 inches
- Nominal wall thickness (t): Schedule 20 pipe = 0.312 inches [5]
- Elbow material: ASTM A-234, Grade WPB.

4.0 90° ELBOW FINITE ELEMENT MODEL DEVELOPMENT

A three-dimensional (3-D) FEM of the 90° elbow is developed with the ANSYS finite element analysis software package [3].

4.1 Geometry and Element Selection

The three-dimensional finite element model is constructed using ANSYS 8-node SOLID45 structural solid elements. The region of ultrasonic (UT) measurement consists of eight (8) axial grid blocks by sixty-one (61) circumferential grid blocks [4]. Reference [4b] indicates that the axial grid is centered across the axial position of the leak (see Figure 1). The axial position of the hole, relative to the elbow is provided in Reference [6] and shown in Figure 2. The remaining elbow region, which was not UT examined is assumed to have a wall thickness equal to the nominal wall thickness of the pipe, 0.312 inch.

An additional length of straight pipe is added to either end of the elbow in order to remove boundary condition end effects from the areas of interest. The wall thicknesses of the additional lengths of pipe are modeled using nominal wall thickness, 0.312 inch.

The leak location that is shown in Figure 2 is modeled as a square hole that is approximately 0.674 inches long axially by 0.464 inches long circumferentially. The elements originally modeled in the hole region are deactivated via the ANSYS EKILL command. The deactivated elements have near-zero stiffness contribution to the structure. The hole center axially between the Row 4, Column AO and Row 5 Column AO UT data points [4b] (see Appendix B).

Figure 3 shows a global view of the FEM solid model geometry. Figure 4 shows a view of the thinning in the solid model geometry with a detailed view of the leak region. Figure 5 shows a global view of the final finite element model mesh. The ANSYS input files that generate the FEM are listed in Appendix A.

4.2 Boundary Conditions

Two separate moment loads are applied to the FEM; an arbitrary unit 10,000 in-lb moment in the plane (moment about the global-z) of the elbow and an arbitrary unit 10,000 in-lb moment out of the plane (moment about the global-y) of the elbow (torsion loading is not evaluated). For the evaluations, one end of the attached piping is fixed in the axial and circumferential directions, and the CONTA175 and TARGE170 ANSYS elements are used in the application of a pilot node to apply the moment loading to the other free end of the attached piping. An example of the applied boundary conditions is shown in Figure 6.

The resulting peak hoop stresses in the elbow are shown in Figures 7 and 8 for the in-plane and out-of-plane moment loads, respectively. The resulting stresses from these moment evaluations will be scaled to the appropriate load combination piping resultant moments in a later calculation. The input files for the moment evaluation are listed in Appendix A.

5.0 RESULTS OF ANALYSIS

Linearized stresses are extracted at each of the grid locations provided in Reference [4] along the axial path of the elbow and through the leak location as shown in Figure 9. The extracted hoop membrane stress due to two moment loads are stored in the Excel spreadsheet, *Pilgrim-Results.xlsx*, and the results are shown in Table 1.

The input files for the post-processing as well as the output files are listed in Appendix A.



6.0 REFERENCES

1. Entergy Drawing No. M100-7250, Rev. E5, "Service Water System, E209N SSW Backwash Drain Piping," SI File No. 1400287.201.
2. ASME Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1," Cases of ASME Boiler and Pressure Vessel Code, January 26, 2006.
3. ANSYS Mechanical APDL and PrepPost, Release 12.1 x64, ANSYS, Inc., November 2009.
4. Email from John Tucker (Entergy) to Eric Houston (SI), "Subject: FW: JF29-4-8," dated 2/25/14, with attached files, SI File No. 1400287.201.
 - a) JF29-4-8 spool.JPG
 - b) Spool JF29 4 8 012.xls
5. Flow of Fluids Through Valves, Fittings and Pipe, Crane Co., Technical Paper No. 410, 1976.
6. Email from Roger Metthe (Entergy) to Eric Houston (SI), "Subject: Pilgrim Hole Location Sketch," dated 2/25/14, with attached file, SI File No. 1400287.201.
 - a) Pilgrim Hole Location Sketch.pdf

Table 1: Membrane Stresses along the Elbow through the Leak Location

| UT Data Point ⁽¹⁾ | Thickness Inches ⁽²⁾ | Membrane Hoop Stress, psi ⁽³⁾ | |
|------------------------------|---------------------------------|--|-------------------------|
| | | In-Plane (Global-Z) | Out-of-Plane (Global-Y) |
| Nominal | 0.312 | 16 | 2 |
| 1, AO | 0.352 | 17 | 25 |
| 2, AO | 0.353 | 25 | 21 |
| 3, AO | 0.361 | 21 | 61 |
| 4, AO ⁽⁴⁾ | 0.051 | 352 | 165 |
| 5, AO ⁽⁴⁾ | 0.064 | 281 | 52 |
| 6, AO | 0.362 | 21 | 39 |
| 7, AO | 0.343 | 36 | 23 |
| 8, AO | 0.366 | 41 | 42 |
| Nominal | 0.312 | 16 | 3 |

Notes:

- 1) See Figure 9 for layout of UT Data Points and Figure 4 for relative location on the elbow.
- 2) UT data per Reference 4b and nominal thickness for 18 inch, Schedule 20 pipe.
- 3) The unit moment loadings were applied in arbitrary directions and thus the stress reported here are in terms of absolute values.
- 4) The modeled hole is centered between these two data points.

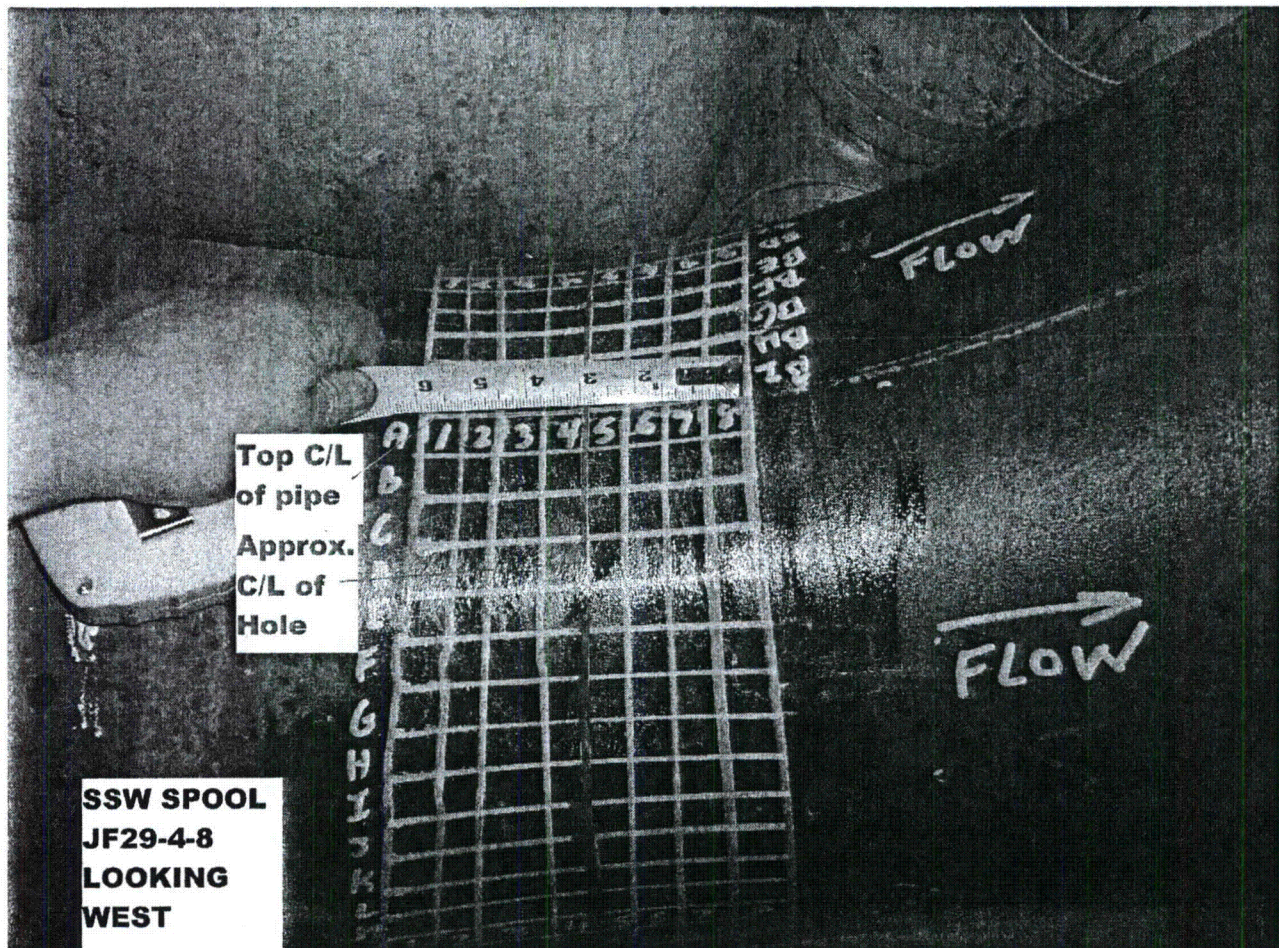


Figure 1: Photo of UT Grid

(From Reference 4a)

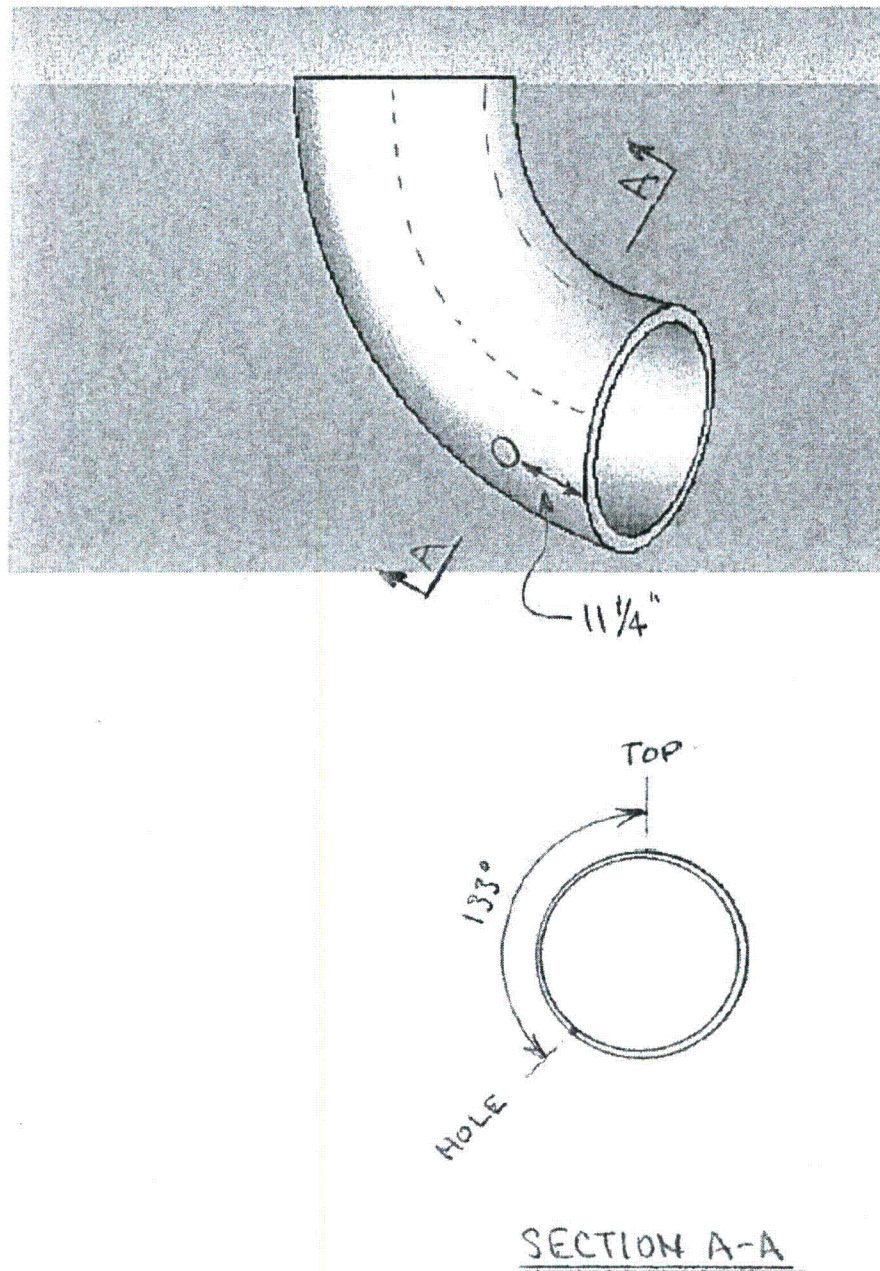


Figure 2: Leak Location

(From Reference 6a)

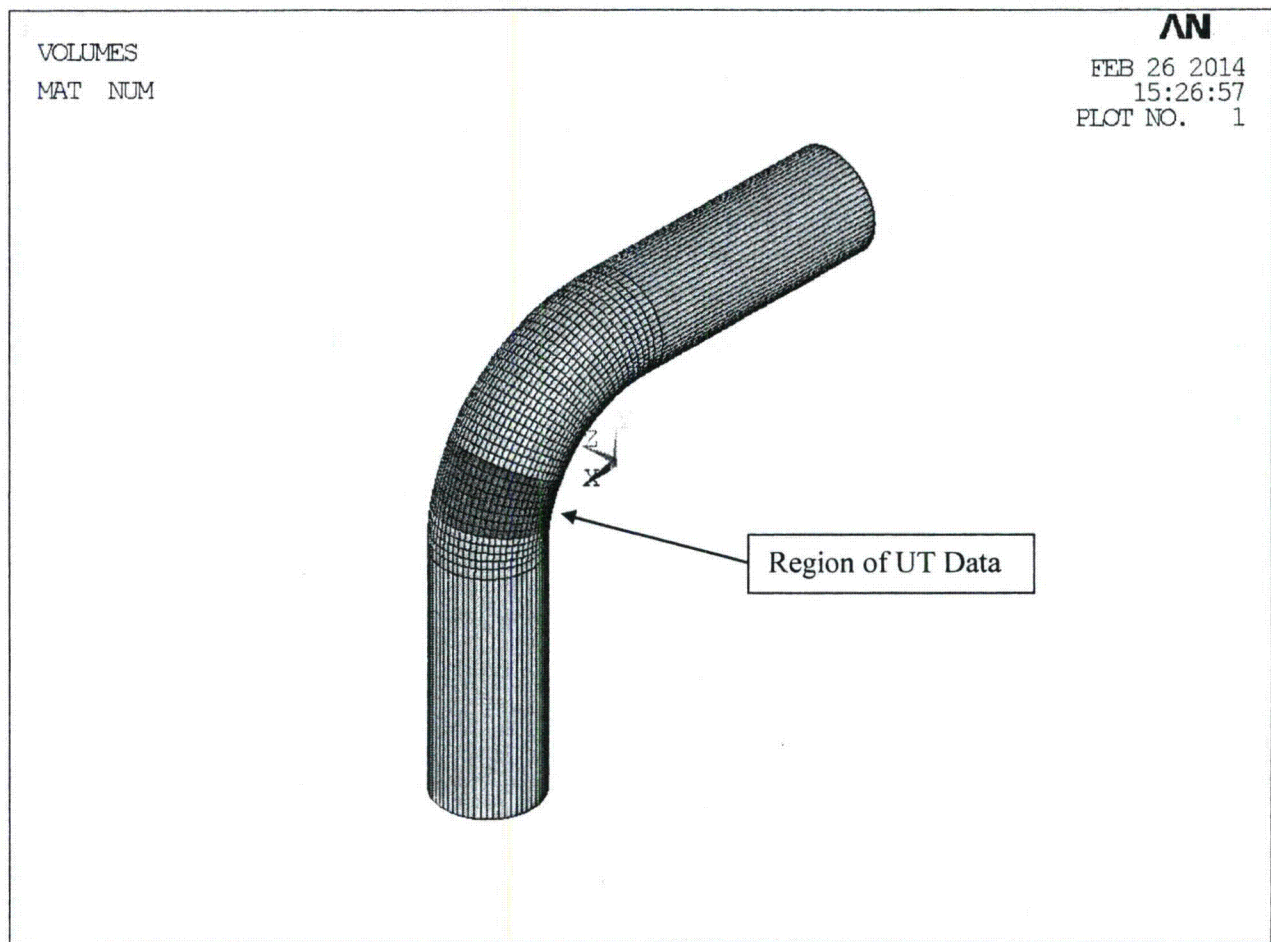


Figure 3: Model Geometry, Global View

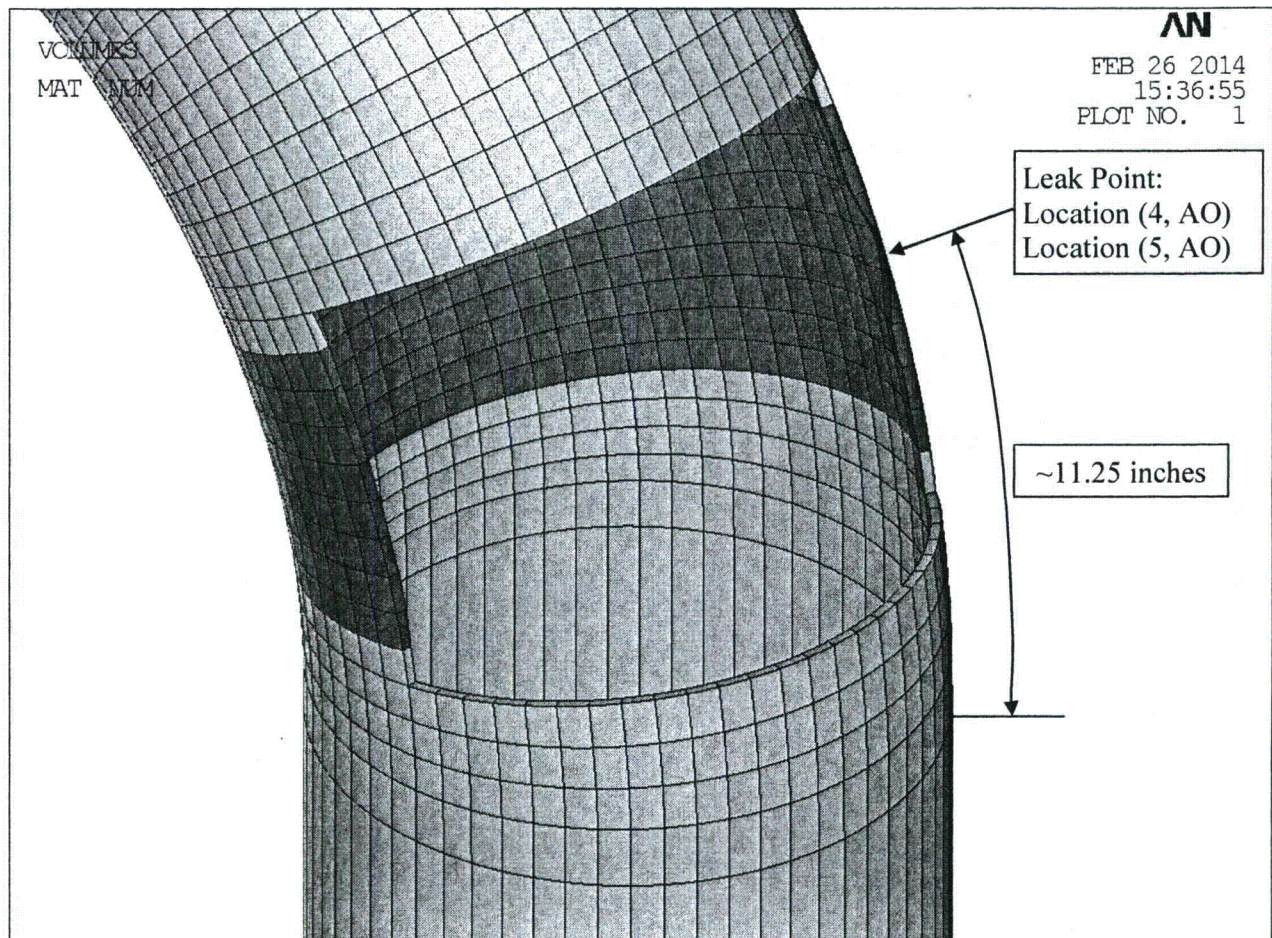


Figure 4: Model Geometry, Thinning View

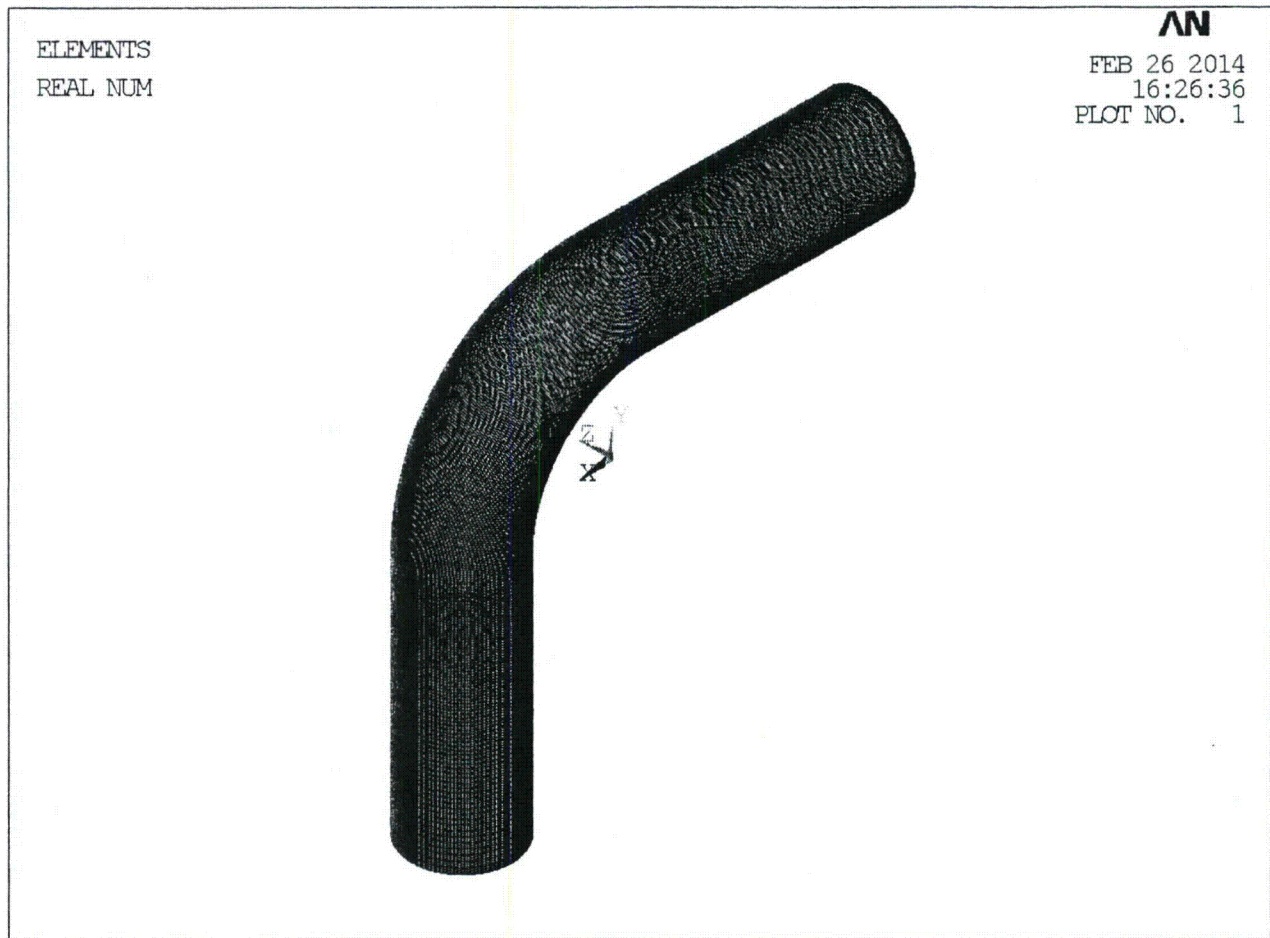


Figure 5: Finite Element Model

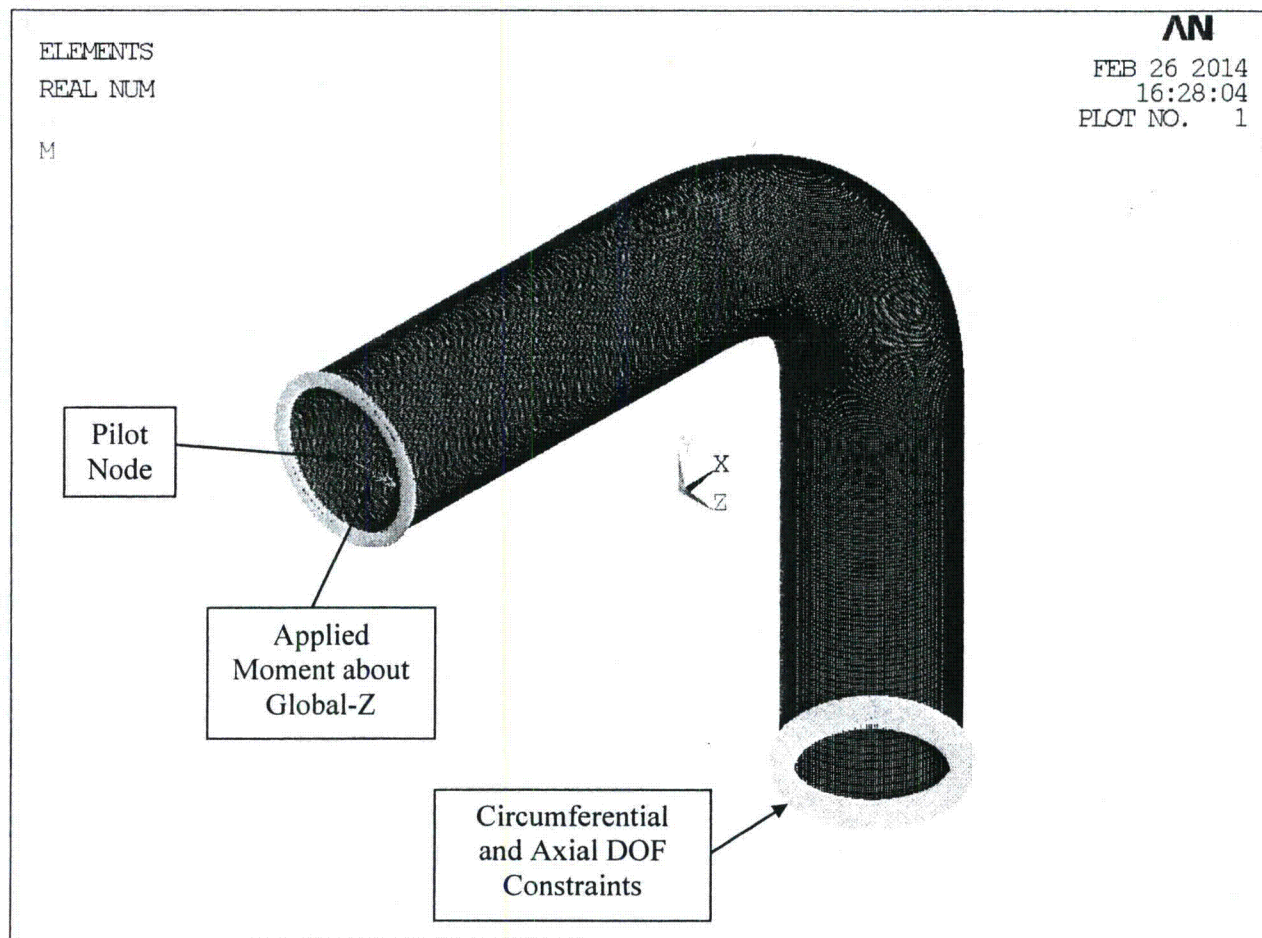


Figure 6: Loads and Boundary Condition Application for Global-Z Moment

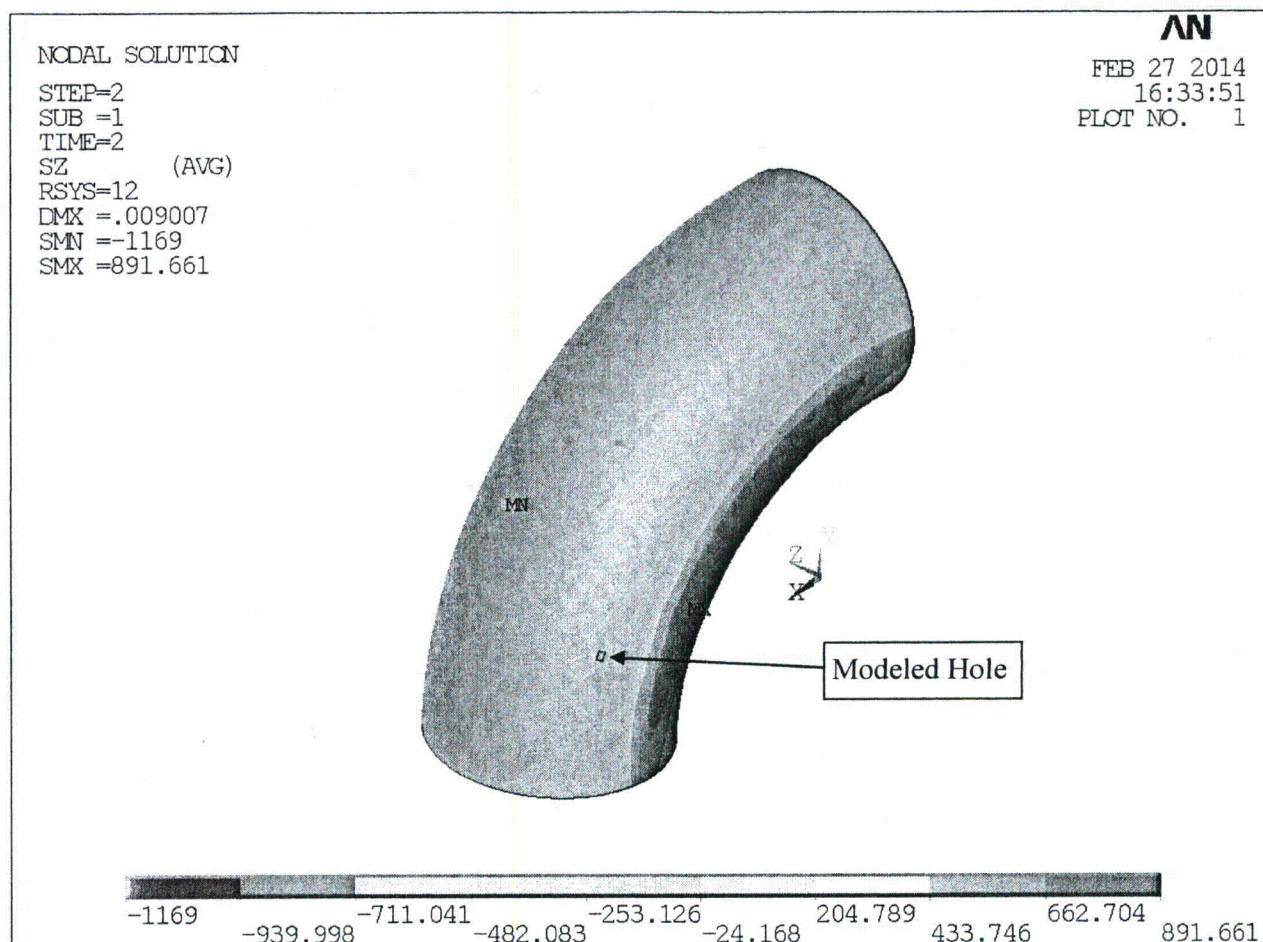


Figure 7: Total Hoop Stress Results due to In-Plane (Global-Z) Unit Moment

(Units are in terms of psi)

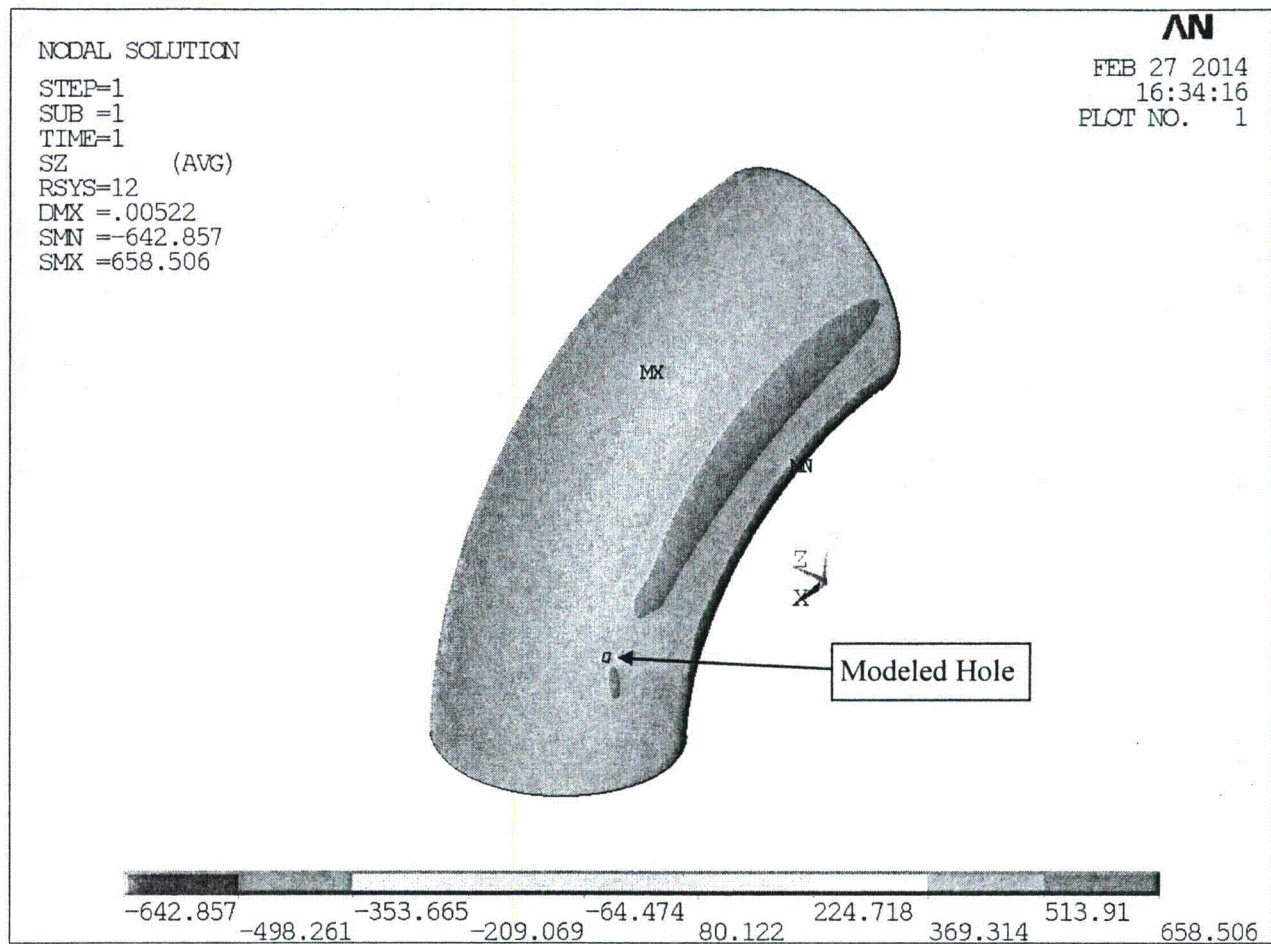


Figure 8: Total Hoop Stress Results due to Out-of-Plane (Global-Y) Unit Moment

(Units are in terms of psi)

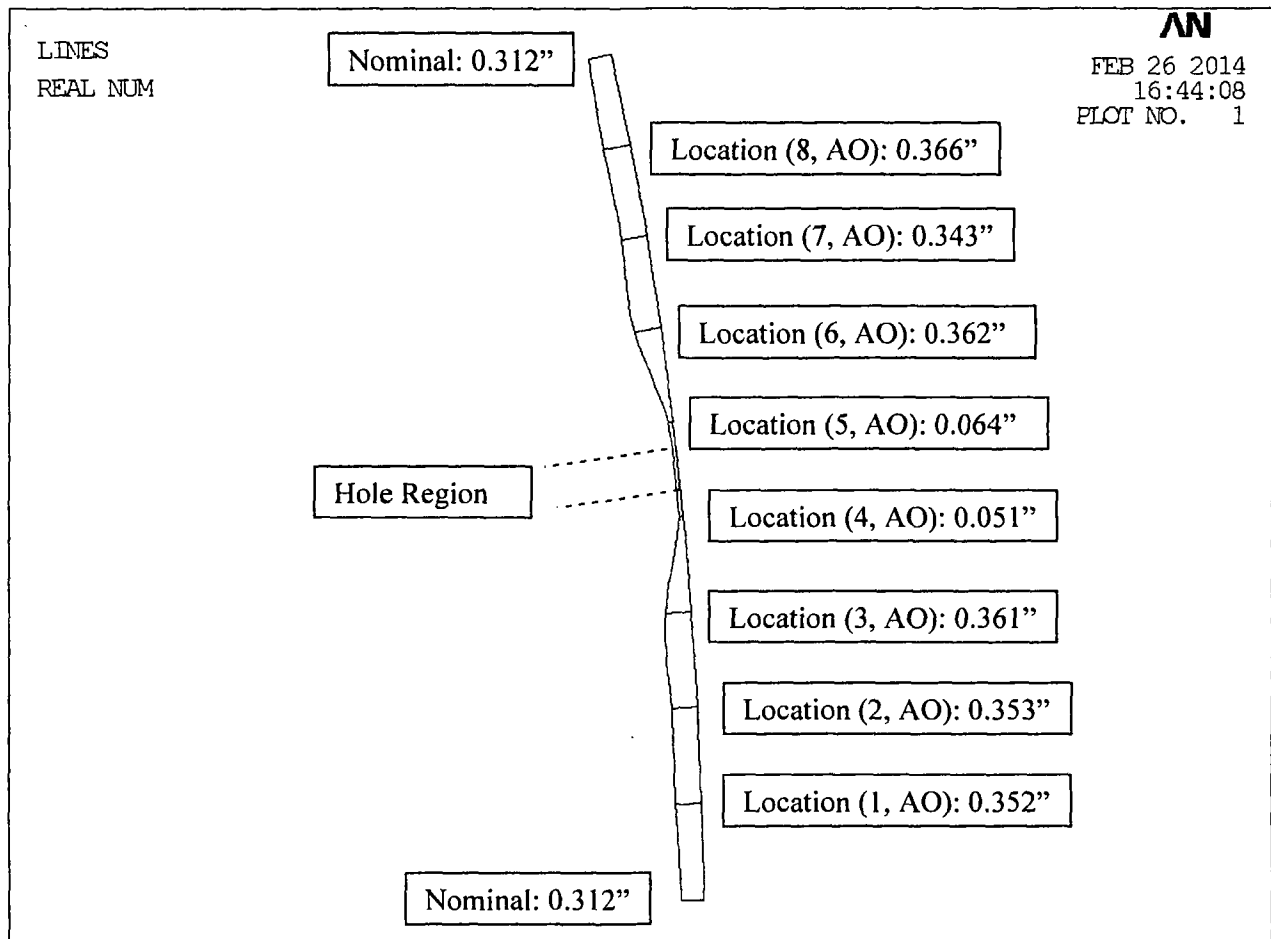


Figure 9: Linearized Path Locations


APPENDIX A
COMPUTER FILES



| FILENAME | DESCRIPTION |
|----------------------|--|
| geom-pil.inp | ANSYS input file to generate finite element model. |
| pilgrim.prn | ASCII file called by geom-pil.inp containing UT data. Generated in Excel spreadsheet <i>Thickness Data.xls</i> . |
| load-pil-M.inp | ANSYS input file to run two 10,000 in-lb moment evaluations. |
| post-pil-M.inp | ANSYS input file to extract linearized stress results for two 10,000 in-lb moment evaluations. |
| Pilgrim-Unit-In.out | Output file containing linearized stress results for 10,000 in-lb in-plane moment (about Global-Z) evaluation. |
| Pilgrim-Unit-Out.out | Output file containing linearized stress results for 10,000 in-lb out-of-plane moment (about Global-Y) evaluation. |
| Thickness Data.xls | Excel file with final UT data. |
| Pilgrim-Results.xlsx | Compilation of the linearized stress results. |

APPENDIX B
JF29-8-4 SPOOL UT DATA



Direction of Flow 

| N° | P ₁ | P ₂ | P ₃ | P ₄ | P ₅ | P ₆ | P ₇ | P ₈ | P ₉ | P ₁₀ | P ₁₁ | P ₁₂ | P ₁₃ | P ₁₄ | P ₁₅ | P ₁₆ | P ₁₇ | P ₁₈ | P ₁₉ | P ₂₀ | P ₂₁ | P ₂₂ | P ₂₃ | P ₂₄ | P ₂₅ | P ₂₆ | P ₂₇ | P ₂₈ | P ₂₉ | P ₃₀ | P ₃₁ | P ₃₂ | P ₃₃ | P ₃₄ | P ₃₅ | P ₃₆ | P ₃₇ | P ₃₈ | P ₃₉ | P ₄₀ | P ₄₁ | P ₄₂ | P ₄₃ | P ₄₄ | P ₄₅ | P ₄₆ | P ₄₇ | P ₄₈ | P ₄₉ | P ₅₀ | P ₅₁ | P ₅₂ | P ₅₃ | P ₅₄ | P ₅₅ | P ₅₆ | P ₅₇ | P ₅₈ | P ₅₉ | P ₆₀ | P ₆₁ | P ₆₂ | P ₆₃ | P ₆₄ | P ₆₅ | P ₆₆ | P ₆₇ | P ₆₈ | P ₆₉ | P ₇₀ | P ₇₁ | P ₇₂ | P ₇₃ | P ₇₄ | P ₇₅ | P ₇₆ | P ₇₇ | P ₇₈ | P ₇₉ | P ₈₀ | P ₈₁ | P ₈₂ | P ₈₃ | P ₈₄ | P ₈₅ | P ₈₆ | P ₈₇ | P ₈₈ | P ₈₉ | P ₉₀ | P ₉₁ | P ₉₂ | P ₉₃ | P ₉₄ | P ₉₅ | P ₉₆ | P ₉₇ | P ₉₈ | P ₉₉ | P ₁₀₀ | P ₁₀₁ | P ₁₀₂ | P ₁₀₃ | P ₁₀₄ | P ₁₀₅ | P ₁₀₆ | P ₁₀₇ | P ₁₀₈ | P ₁₀₉ | P ₁₁₀ | P ₁₁₁ | P ₁₁₂ | P ₁₁₃ | P ₁₁₄ | P ₁₁₅ | P ₁₁₆ | P ₁₁₇ | P ₁₁₈ | P ₁₁₉ | P ₁₂₀ | P ₁₂₁ | P ₁₂₂ | P ₁₂₃ | P ₁₂₄ | P ₁₂₅ | P ₁₂₆ | P ₁₂₇ | P ₁₂₈ | P ₁₂₉ | P ₁₃₀ | P ₁₃₁ | P ₁₃₂ | P ₁₃₃ | P ₁₃₄ | P ₁₃₅ | P ₁₃₆ | P ₁₃₇ | P ₁₃₈ | P ₁₃₉ | P ₁₄₀ | P ₁₄₁ | P ₁₄₂ | P ₁₄₃ | P ₁₄₄ | P ₁₄₅ | P ₁₄₆ | P ₁₄₇ | P ₁₄₈ | P ₁₄₉ | P ₁₅₀ | P ₁₅₁ | P ₁₅₂ | P ₁₅₃ | P ₁₅₄ | P ₁₅₅ | P ₁₅₆ | P ₁₅₇ | P ₁₅₈ | P ₁₅₉ | P ₁₆₀ | P ₁₆₁ | P ₁₆₂ | P ₁₆₃ | P ₁₆₄ | P ₁₆₅ | P ₁₆₆ | P ₁₆₇ | P ₁₆₈ | P ₁₆₉ | P ₁₇₀ | P ₁₇₁ | P ₁₇₂ | P ₁₇₃ | P ₁₇₄ | P ₁₇₅ | P ₁₇₆ | P ₁₇₇ | P ₁₇₈ | P ₁₇₉ | P ₁₈₀ | P ₁₈₁ | P ₁₈₂ | P ₁₈₃ | P ₁₈₄ | P ₁₈₅ | P ₁₈₆ | P ₁₈₇ | P ₁₈₈ | P ₁₈₉ | P ₁₉₀ | P ₁₉₁ | P ₁₉₂ | P ₁₉₃ | P ₁₉₄ | P ₁₉₅ | P ₁₉₆ | P ₁₉₇ | P ₁₉₈ | P ₁₉₉ | P ₂₀₀ | P ₂₀₁ | P ₂₀₂ | P ₂₀₃ | P ₂₀₄ | P ₂₀₅ | P ₂₀₆ | P ₂₀₇ | P ₂₀₈ | P ₂₀₉ | P ₂₁₀ | P ₂₁₁ | P ₂₁₂ | P ₂₁₃ | P ₂₁₄ | P ₂₁₅ | P ₂₁₆ | P ₂₁₇ | P ₂₁₈ | P ₂₁₉ | P ₂₂₀ | P ₂₂₁ | P ₂₂₂ | P ₂₂₃ | P ₂₂₄ | P ₂₂₅ | P ₂₂₆ | P ₂₂₇ | P ₂₂₈ | P ₂₂₉ | P ₂₃₀ | P ₂₃₁ | P ₂₃₂ | P ₂₃₃ | P ₂₃₄ | P ₂₃₅ | P ₂₃₆ | P ₂₃₇ | P ₂₃₈ | P ₂₃₉ | P ₂₄₀ | P ₂₄₁ | P ₂₄₂ | P ₂₄₃ | P ₂₄₄ | P ₂₄₅ | P ₂₄₆ | P ₂₄₇ | P ₂₄₈ | P ₂₄₉ | P ₂₅₀ | P ₂₅₁ | P ₂₅₂ | P ₂₅₃ | P ₂₅₄ | P ₂₅₅ | P ₂₅₆ | P ₂₅₇ | P ₂₅₈ | P ₂₅₉ | P ₂₆₀ | P ₂₆₁ | P ₂₆₂ | P ₂₆₃ | P ₂₆₄ | P ₂₆₅ | P ₂₆₆ | P ₂₆₇ | P ₂₆₈ | P ₂₆₉ | P ₂₇₀ | P ₂₇₁ | P ₂₇₂ | P ₂₇₃ | P ₂₇₄ | P ₂₇₅ | P ₂₇₆ | P ₂₇₇ | P ₂₇₈ | P ₂₇₉ | P ₂₈₀ | P ₂₈₁ | P ₂₈₂ | P ₂₈₃ | P ₂₈₄ | P ₂₈₅ | P ₂₈₆ | P ₂₈₇ | P ₂₈₈ | P ₂₈₉ | P ₂₉₀ | P ₂₉₁ | P ₂₉₂ | P ₂₉₃ | P ₂₉₄ | P ₂₉₅ | P ₂₉₆ | P ₂₉₇ | P ₂₉₈ | P ₂₉₉ | P ₃₀₀ | P ₃₀₁ | P ₃₀₂ | P ₃₀₃ | P ₃₀₄ | P ₃₀₅ | P ₃₀₆ | P ₃₀₇ | P ₃₀₈ | P ₃₀₉ | P ₃₁₀ | P ₃₁₁ | P ₃₁₂ | P ₃₁₃ | P ₃₁₄ | P ₃₁₅ | P ₃₁₆ | P ₃₁₇ | P ₃₁₈ | P ₃₁₉ | P ₃₂₀ | P ₃₂₁ | P ₃₂₂ | P ₃₂₃ | P ₃₂₄ | P ₃₂₅ | P ₃₂₆ | P ₃₂₇ | P ₃₂₈ | P ₃₂₉ | P ₃₃₀ | P ₃₃₁ | P ₃₃₂ | P ₃₃₃ | P ₃₃₄ | P ₃₃₅ | P ₃₃₆ | P ₃₃₇ | P ₃₃₈ | P ₃₃₉ | P ₃₄₀ | P ₃₄₁ | P ₃₄₂ | P ₃₄₃ | P ₃₄₄ | P ₃₄₅ | P ₃₄₆ | P ₃₄₇ | P ₃₄₈ | P ₃₄₉ | P ₃₅₀ | P ₃₅₁ | P ₃₅₂ | P ₃₅₃ | P ₃₅₄ | P ₃₅₅ | P ₃₅₆ | P ₃₅₇ | P ₃₅₈ | P ₃₅₉ | P ₃₆₀ | P ₃₆₁ | P ₃₆₂ | P ₃₆₃ | P ₃₆₄ | P ₃₆₅ | P ₃₆₆ | P ₃₆₇ | P ₃₆₈ | P ₃₆₉ | P ₃₇₀ | P ₃₇₁ | P ₃₇₂ | P ₃₇₃ | P ₃₇₄ | P ₃₇₅ | P ₃₇₆ | P ₃₇₇ | P ₃₇₈ | P ₃₇₉ | P ₃₈₀ | P ₃₈₁ | P ₃₈₂ | P ₃₈₃ | P ₃₈₄ | P ₃₈₅ | P ₃₈₆ | P ₃₈₇ | P ₃₈₈ | P ₃₈₉ | P ₃₉₀ | P ₃₉₁ | P ₃₉₂ | P ₃₉₃ | P ₃₉₄ | P ₃₉₅ | P ₃₉₆ | P ₃₉₇ | P ₃₉₈ | P ₃₉₉ | P ₄₀₀ | P ₄₀₁ | P ₄₀₂ | P ₄₀₃ | P ₄₀₄ | P ₄₀₅ | P ₄₀₆ | P ₄₀₇ | P ₄₀₈ | P ₄₀₉ | P ₄₁₀ | P ₄₁₁ | P ₄₁₂ | P ₄₁₃ | P ₄₁₄ | P ₄₁₅ | P ₄₁₆ | P ₄₁₇ | P ₄₁₈ | P ₄₁₉ | P ₄₂₀ | P ₄₂₁ | P ₄₂₂ | P ₄₂₃ | P ₄₂₄ | P ₄₂₅ | P ₄₂₆ | P ₄₂₇ | P ₄₂₈ | P ₄₂₉ | P ₄₃₀ | P ₄₃₁ | P ₄₃₂ | P ₄₃₃ | P ₄₃₄ | P ₄₃₅ | P ₄₃₆ | P ₄₃₇ | P ₄₃₈ | P ₄₃₉ | P ₄₄₀ | P ₄₄₁ | P ₄₄₂ | P ₄₄₃ | P ₄₄₄ | P ₄₄₅ | P ₄₄₆ | P ₄₄₇ | P ₄₄₈ | P ₄₄₉ | P ₄₅₀ | P ₄₅₁ | P ₄₅₂ | P ₄₅₃ | P ₄₅₄ | P ₄₅₅ | P ₄₅₆ | P ₄₅₇ | P ₄₅₈ | P ₄₅₉ | P ₄₆₀ | P ₄₆₁ | P ₄₆₂ | P ₄₆₃ | P ₄₆₄ | P ₄₆₅ | P ₄₆₆ | P ₄₆₇ | P ₄₆₈ | P ₄₆₉ | P ₄₇₀ | P ₄₇₁ | P ₄₇₂ | P ₄₇₃ | P ₄₇₄ | P ₄₇₅ | P ₄₇₆ | P ₄₇₇ | P ₄₇₈ | P ₄₇₉ | P ₄₈₀ | P ₄₈₁ | P ₄₈₂ | P ₄₈₃ | P ₄₈₄ | P ₄₈₅ | P ₄₈₆ | P ₄₈₇ | P ₄₈₈ | P ₄₈₉ | P ₄₉₀ | P ₄₉₁ | P ₄₉₂ | P ₄₉₃ | P ₄₉₄ | P ₄₉₅ | P ₄₉₆ | P ₄₉₇ | P ₄₉₈ | P ₄₉₉ | P ₅₀₀ | P ₅₀₁ | P ₅₀₂ | P ₅₀₃ | P ₅₀₄ | P ₅₀₅ | P ₅₀₆ | P ₅₀₇ | P ₅₀₈ | P ₅₀₉ | P ₅₁₀ | P ₅₁₁ | P ₅₁₂ | P ₅₁₃ | P ₅₁₄ | P ₅₁₅ | P ₅₁₆ | P ₅₁₇ | P ₅₁₈ | P ₅₁₉ | P ₅₂₀ | P ₅₂₁ | P ₅₂₂ | P ₅₂₃ | P ₅₂₄ | P ₅₂₅ | P ₅₂₆ | P ₅₂₇ | P ₅₂₈ | P ₅₂₉ | P ₅₃₀ | P ₅₃₁ | P ₅₃₂ | P ₅₃₃ | P ₅₃₄ | P ₅₃₅ | P ₅₃₆ | P ₅₃₇ | P ₅₃₈ | P ₅₃₉ | P ₅₄₀ | P ₅₄₁ | P ₅₄₂ | P ₅₄₃ | P ₅₄₄ | P ₅₄₅ | P ₅₄₆ | P ₅₄₇ | P ₅₄₈ | P ₅₄₉ | P ₅₅₀ | P ₅₅₁ | P ₅₅₂ | P ₅₅₃ | P ₅₅₄ | P ₅₅₅ | P ₅₅₆ | P ₅₅₇ | P ₅₅₈ | P ₅₅₉ | P ₅₆₀ | P ₅₆₁ | P ₅₆₂ | P ₅₆₃ | P ₅₆₄ | P ₅₆₅ | P ₅₆₆ | P ₅₆₇ | P ₅₆₈ | P ₅₆₉ | P ₅₇₀ | P ₅₇₁ | P ₅₇₂ | P ₅₇₃ | P ₅₇₄ | P ₅₇₅ | P ₅₇₆ | P ₅₇₇ | P ₅₇₈ | P ₅₇₉ | P ₅₈₀ | P ₅₈₁ | P ₅₈₂ | P ₅₈₃ | P ₅₈₄ | P ₅₈₅ | P ₅₈₆ | P ₅₈₇ | P ₅₈₈ | P ₅₈₉ | P ₅₉₀ | P ₅₉₁ | P ₅₉₂ | P ₅₉₃ | P ₅₉₄ | P ₅₉₅ | P ₅₉₆ | P ₅₉₇ | P ₅₉₈ | P ₅₉₉ | P ₆₀₀ | P ₆₀₁ | P ₆₀₂ | P ₆₀₃ | P ₆₀₄ | P ₆₀₅ | P ₆₀₆ | P ₆₀₇ | P ₆₀₈ | P ₆₀₉ | P ₆₁₀ | P ₆₁₁ | P ₆₁₂ | P ₆₁₃ | P ₆₁₄ | P ₆₁₅ | P ₆₁₆ | P ₆₁₇ | P ₆₁₈ | P ₆₁₉ | P ₆₂₀ | P ₆₂₁ | P ₆₂₂ | P ₆₂₃ | P ₆₂₄ | P ₆₂₅ | P ₆₂₆ | P ₆₂₇ | P ₆₂₈ | P ₆₂₉ | P ₆₃₀ | P ₆₃₁ | P ₆₃₂ | P ₆₃₃ | P ₆₃₄ | P ₆₃₅ | P ₆₃₆ | P ₆₃₇ | P ₆₃₈ | P ₆₃₉ | P ₆₄₀ | P ₆₄₁ | P ₆₄₂ | P ₆₄₃ | P ₆₄₄ | P ₆₄₅ | P ₆₄₆ | P ₆₄₇ | P ₆₄₈ | P ₆₄₉ | P ₆₅₀ | P ₆₅₁ | P ₆₅₂ | P ₆₅₃ | P ₆₅₄ | P ₆₅₅ | P ₆₅₆ | P ₆₅₇ | P ₆₅₈ | P ₆₅₉ | P ₆₆₀ | P ₆₆₁ | P ₆₆₂ | P ₆₆₃ | P ₆₆₄ | P ₆₆₅ | P ₆₆₆ | P ₆₆₇ | P ₆₆₈ | P ₆₆₉ | P ₆₇₀ | P ₆₇₁ | P ₆₇₂ | P ₆₇₃ | P ₆₇₄ | P ₆₇₅ | P ₆₇₆ | P ₆₇₇ | P ₆₇₈ | P ₆₇₉ | P ₆₈₀ | P ₆₈₁ | P ₆₈₂ | P ₆₈₃ | P ₆₈₄ | P ₆₈₅ | P ₆₈₆ | P ₆₈₇ | P ₆₈₈ | P ₆₈₉ | P ₆₉₀ | P ₆₉₁ | P ₆₉₂ | P ₆₉₃ | P ₆₉₄ | P ₆₉₅ | P ₆₉₆ | P ₆₉₇ | P ₆₉₈ | P ₆₉₉ | P ₇₀₀ | P ₇₀₁ | P ₇₀₂ | P ₇₀₃ | P ₇₀₄ | P ₇₀₅ | P ₇₀₆ | P ₇₀₇ | P ₇₀₈ | P ₇₀₉ | P ₇₁₀ | P ₇₁₁ | P ₇₁₂ | P ₇₁₃ | P ₇₁₄ | P ₇₁₅ | P ₇₁₆ | P ₇₁₇ | P ₇₁₈ | P ₇₁₉ | P ₇₂₀ | P ₇₂₁ | P ₇₂₂ | P ₇₂₃ | P ₇₂₄ | P ₇₂₅ | P ₇₂₆ | P ₇₂₇ | P ₇₂₈ | P ₇₂₉ | P ₇₃₀ | P ₇₃₁ | P ₇₃₂ | P ₇₃₃ | P ₇₃₄ | P ₇₃₅ | P ₇₃₆ | P ₇₃₇ | P ₇₃₈ | P ₇₃₉ | P ₇₄₀ | P ₇₄₁ | P ₇₄₂ | P ₇₄₃ | P ₇₄₄ | P ₇₄₅ | P ₇₄₆ | P ₇₄₇ | P ₇₄₈ | P ₇₄₉ | P ₇₅₀ | P ₇₅₁ | P ₇₅₂ | P ₇₅₃ | P ₇₅₄ | P ₇₅₅ | P ₇₅₆ | P ₇₅₇ | P ₇₅₈ | P ₇₅₉ | P ₇₆₀ | P ₇₆₁ | P ₇₆₂ | P ₇₆₃ | P ₇₆₄ | P ₇₆₅ | P ₇₆₆ | P ₇₆₇ | P ₇₆₈ | P ₇₆₉ | P ₇₇₀ | P ₇₇₁ | P ₇₇₂ | P ₇₇₃ | P ₇₇₄ | P ₇₇₅ | P ₇₇₆ | P ₇₇₇ | P ₇₇₈ | P ₇₇₉ | P ₇₈₀ | P ₇₈₁ | P ₇₈₂ | P ₇₈₃ | P ₇₈₄ | P ₇₈₅ | P ₇₈₆ | P ₇₈₇ | P ₇₈₈ | P ₇₈₉ | P ₇₉₀ | P ₇₉₁ | P ₇₉₂ | P ₇₉₃ | P ₇₉₄ | P ₇₉₅ | P ₇₉₆ | P ₇₉₇ | P ₇₉₈ | P ₇₉₉ | P ₈₀₀ | P ₈₀₁ | P ₈₀₂ | P ₈₀₃ | P ₈₀₄ | P ₈₀₅ | P ₈₀₆ | P ₈₀₇ | P ₈₀₈ | P ₈₀₉ | P ₈₁₀ | P ₈₁₁ | P ₈₁₂ | P ₈₁₃ | P ₈₁₄ | P ₈₁₅ | P ₈₁₆ | P ₈₁₇ | P ₈₁₈ | P ₈₁₉ | P ₈₂₀ | P ₈₂₁ | P ₈₂₂ | P ₈₂₃ | P ₈₂₄ | P ₈₂₅ | P ₈₂₆ | P ₈₂₇ | P ₈₂₈ | P ₈₂₉ | P ₈₃₀ | P ₈₃₁ | P ₈₃₂ | P ₈₃₃ | P ₈₃₄ | P ₈₃₅ | P ₈₃₆ | P ₈₃₇ | P ₈₃₈ | P ₈₃₉ | P ₈₄₀ | P ₈₄₁ | P ₈₄₂ | P ₈₄₃ | P ₈₄₄ | P ₈₄₅ | P ₈₄₆ | P ₈₄₇ | P ₈₄₈ | P ₈₄₉ | P ₈₅₀ | P ₈₅₁ | P ₈₅₂ | P ₈₅₃ | P ₈₅₄ | P ₈₅₅ | P ₈₅₆ | P ₈₅₇ | P ₈₅₈ | P ₈₅₉ | P ₈₆₀ | P ₈₆₁ | P ₈₆₂ | P ₈₆₃ | P ₈₆₄ | P ₈₆₅ | P ₈₆₆ | P ₈₆₇ | P ₈₆₈ | P ₈₆₉ | P ₈₇₀ | P ₈₇₁ | P ₈₇₂ | P ₈₇₃ | P ₈₇₄ | P ₈₇₅ | P ₈₇₆ | P ₈₇₇ | P ₈₇₈ | P ₈₇₉ | P ₈₈₀ | P ₈₈₁ | P ₈₈₂ | P ₈₈₃ | P ₈₈₄ | P ₈₈₅ | P ₈₈₆ | P ₈₈₇ | P ₈₈₈ | P ₈₈₉ | P ₈₉₀ | P ₈₉₁ | P ₈₉₂ | P ₈₉₃ | P ₈₉₄ | P ₈₉₅ | P ₈₉₆ | P ₈₉₇ | P ₈₉₈ | P ₈₉₉ | P ₉₀₀ | P ₉₀₁ | P ₉₀₂ | P ₉₀₃ | P ₉₀₄ | P ₉₀₅ | P ₉₀₆ | P ₉₀₇ | P ₉₀₈ | P ₉₀₉ | P ₉₁₀ | P ₉₁₁ | P ₉₁₂ | P ₉₁₃ | P ₉₁₄ | P ₉₁₅ | P ₉₁₆ | P ₉₁₇ | P ₉₁₈ | P ₉₁₉ | P ₉₂₀ | P ₉₂₁ | P ₉₂₂ | P ₉₂₃ | P ₉₂₄ | P ₉₂₅ | P ₉₂₆ | P ₉₂₇ | P ₉₂₈ | P ₉₂₉ | P ₉₃₀ | P ₉₃₁ | P ₉₃₂ | P ₉₃₃ | P ₉₃₄ | P ₉₃₅ | P ₉₃₆ | P ₉₃₇ | P ₉₃₈ | P ₉₃₉ | P ₉₄₀ | P ₉₄₁ | P ₉₄₂ | P ₉₄₃ | P ₉₄₄ | P ₉₄₅ | P ₉₄₆ | P ₉₄₇ | P ₉₄₈ | P ₉₄₉ | P ₉₅₀ | P ₉₅₁ | P ₉₅₂ | P ₉₅₃ | P ₉₅₄ | P ₉₅₅ | P ₉₅₆ | P ₉₅₇ | P ₉₅₈ | P ₉₅₉ | P ₉₆₀ | P |
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