February 3, 1994

Docket No. 50-390

APPLICANT: Tennessee Valley Authority (TVA)

FACILITY: Watts Bar Nuclear Plant, Unit 1

SUBJECT: MEETING SUMMARY - JANUARY 18, 1994, MEETING TO DISCUSS TECHNICAL ISSUES REGARDING USE OF U-BOLTS AS PIPE CLAMPS (TAC M79718)

REFERENCE: Meeting notices by P. S. Tam, January 3, 1994

The referenced meeting notice announced a management meeting between NRC and TVA representatives to discuss issues regarding TVA's use of U-bolt supports on safety-related systems at Watts Bar Unit 1. However, due to a snowstorm in Tennessee, TVA participants were prevented from participating in person so a technical discussion was held by telephone in place of the management meeting. Enclosure 1 is the list of meeting participants.

Enclosures 2 through 4 are handouts provided by TVA for the meeting. Enclosure 2 is the collection of slides used. Enclosure 3 is a "talking paper" that TVA used, outlining a proposal to resolve the staff's concerns about the U-bolt supports. Enclosure 4 is a table delineating information on size, type, deflection, preload, etc., for all the U-bolt supports. The staff asked questions to obtain clarification on the handouts.

No conclusion was rendered by the staff. Participants agreed to hold a management meeting on January 28, 1994 to follow up (the meeting was announced by a notice dated January 19, 1994, and was cancelled on January 28, 1994).

Original signed by
Peter S. Tam, Senior Project Manager
Project Directorate II-4
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Participants and Observer List
2. Slides
3. Draft Letter
4. Information on U-bolt supports

cc w/Enclosure 1:
See next page

NRC FILE CENTER COPY

Memo of

| OFFICE | PDII-4/LA | PDII-4/PM | PDII-4/D |
|---|---|---|---|
| NAME | BClayton BAC | PTam PST | FHebdon |
| DATE | 2/3/94 | 2/3/94 | 2/3/94 |

DOCUMENT NAME: UBOLTMTG

9402090152 940203
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P PDP

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J. Crlenjak, RII

Distribution w/Enclosures 1, 2, 3, and 4
Docket File
PDR & LPDR
WBN Reading
P. Tam/C. Jackson

cc: Licensee & Service List

ENCLOSURE 1

# LIST OF PARTICIPANTS

## WATTS BAR MEETING TO DISCUSS U-BOLTS

## January 18, 1993

| Name | Affiliation |
|---|---|
| James Adair* | TVA Civil Engineering |
| Terence Chan | NRC/NRR/Mechanical Engineering Branch |
| R. L. Cloud* | R. L. Cloud & Associates (TVA contractor) |
| W. L. Elliott* | TVA Watts Bar Engineering |
| John Fair | TVA Watts Bar Site Licensing |
| Fred Hebdon | NRC/NRR/Project Directorate II-4 |
| Roger Huston* | TVA Rockville Office |
| W. A. Massie* | TVA Watts Bar Site Licensing |
| R. Milhiser* | TVA |
| W. J. Museler* | TVA Watts Bar Site VP |
| James Norberg | NRC/NRR/Mechanical Engineering Branch |
| Dwight E. Nunn* | TVA |
| George Pannell* | TVA Watts Bar Site Licensing |
| Per Svennson* | R. L. Cloud & Associates (TVA contractor) |
| Peter Stanish* | TVA |
| Peter Tam | NRC/NRR/Project Directorate II-4 |
| Glenn Walton* | NRC Senior Resident Inspector at Watts Bar |
| H. Lee Williams* | TVA Civil Engineering |

* denotes participation by telephone

Enclosure 2

# WATTS BAR NUCLEAR PLANT

## NRC/TVA MEETING

## U-BOLTS

## ROCKVILLE, MD

## JANUARY 18, 1994

# AGENDA

| | |
|---|---|
| • OPENING REMARKS | W.MUSELER |
| • TECHNICAL BACKGROUND/ WBN U-BOLT PROGRAM | L. WILLIAMS |
| • REMAINING QUESTIONS/ PROPOSED RESOLUTIONS | L. WILLIAMS |
| • CONCLUDING REMARKS | D. NUNN |

# OPENING REMARKS

# TECHNICAL BACKGROUND

## PIPING SYSTEM ANALYSIS

- Tpipe Computer Program
- Lumped/Distributed Mass Model (Centerline Representation)
- Pipe Supports Modeled as "Rigid"
- Tpipe Post Processor Used to Address Load Combinations for Loads at Supports, Stresses in Pipe and Code Compliance

## PIPE SUPPORTS ANALYSIS

- FAPPS Computer Program and/or Manual Calculations
- Compliance with Criteria, Including Support Deflection

Max of MDL, Seismic and DYN $\leq$ 1/16"

Max from Tot. Des LOAD $\leq$ 1/8"

(Includes Strut or snubber and structural steel, but does not include local pipe deflection, baseplates and anchor bolts)

# WBN U-BOLT PROGRAM

## Complete Engineering Program

- Testing - Dynamic and Static
- Analysis
- Acceptance Criteria
- Installation Procedures

## U-Bolt Support Methodology and Design Criteria - R. L. Cloud and Associates

- Stability Assurance

## Design Improvements

- Belleville Washers
- Preload

# TECHNICAL QUESTIONS REMAINING

- U-BOLTS ON CLASS 1 PIPING
- APPLICATION TO FITTINGS
- PIPE WALL VS SUPPORT DEFLECTION

# CLASS 1 PIPING APPLICATIONS

## STAFF QUESTION

Use of U-Bolts on Class 1 Piping

## TVA TECHNICAL POSITION

- PIPE STRESS ASME III, Sub. NB-3228.3
  - Plastic Analysis - Loadings do not exceed 2/3's of Plastic Analysis Collapse Load (Pc).
- U-BOLT/CROSS MEMBER - AISC
  - U-Bolt stress limited to 60% Yield Stress or 50% of Ultimate Strength of U-Bolt material.
  - Maximum U-Bolt stress from applied loadings limited to 90% of U-Bolt material Yield Stress.
  - Above limits are substantially more conservative than ASME Section III, Subsection NF for component supports.

## RESOLUTION

In order to achieve prompt resolution and provide added safety assurance:

- All U-Bolt support designs on Class 1 piping, regardless of pipe size, to be eliminated (19 supports).

# FITTINGS APPLICATIONS

## STAFF QUESTION

**Use of U-Bolts on Fittings**

## TVA TECHNICAL POSITION

- **Elbows most limiting fittings.**
- **Elbow responds by ovalizing.**
- **U-Bolt reduces ovalization (U-Bolt increased stiffness).**
- **U-Bolt restrains radial deflection.**
- **Ovalization - Second order effect relative to seismic, thermal and dead weight loading.**
  - **Considered in conservatism and design factor of 1.5 in methodology.**
  - **Table 1 of 10/25/93 submittal to NRC.**
    - **32% margin for worst U-Bolt case located on an elbow.**

## RESOLUTION

**In order to achieve project resolution and provide added safety assurance:**

- **All U-Bolts to be eliminated on all fittings (elbows, reducers, valves and tees) in safety related pipe, regardless of pipe size (49 supports).**

# LOCAL DEFLECTIONS

## STAFF QUESTIONS

Effect of potential pipe wall deflection from maximum strut design load on FSAR support deflection limits.

Effect of pipe wall deflection on U-Bolt preload.

## TVA TECHNICAL POSITION

- Pipe supports are designed in accordance with FSAR deflection criteria:

  ≤ 1/16 inch for maximum of seismic, dynamic and MDL

  ≤ 1/8 inch for total load

- This ensures the rigid support assumption in the piping analyses is not violated.

- ASME Code, industry practice, does not require a check of local pipe wall deflections in support design.

# LOCAL DEFLECTIONS
(Cont'd)

## RESOLUTION

- Additional criteria beyond WBN U-Bolt support design methodology.
- For U-Bolt supports used in conjunction with pinned struts or snubbers:
  - Support deflection ($\Delta_s$) (previously calculated) plus local pipe deflection ($\Delta_{pl}$)
  - Effect of Belleville washer stiffness for collars designed with gaps is included in $\Delta_{pl}$
  - Combined or composite deflection ($\Delta_e$) ($\Delta_e = \Delta_s + \Delta_{pl}$) used to conservatively demonstrate compliance with FSAR support deflection criteria.
  - In addition, a hypothetical approach used to assess the impact of local pipe wall deflection on U-Bolt preload.
    - Local pipe wall deflection assumed to totally translate to pipe centerline.
    - Belleville washer spring load must remain equal to or greater than the initial U-Bolt preload.
- Applying above approach, composite support deflections ($\Delta_e$) that exceed the FSAR deflection criteria, or pipe wall deflections that result hypothetically in reduction of U-Bolt preload below initial preload, will be modified or removed.
- Present tabulation indicates a total of 52 supports to be modified or removed.

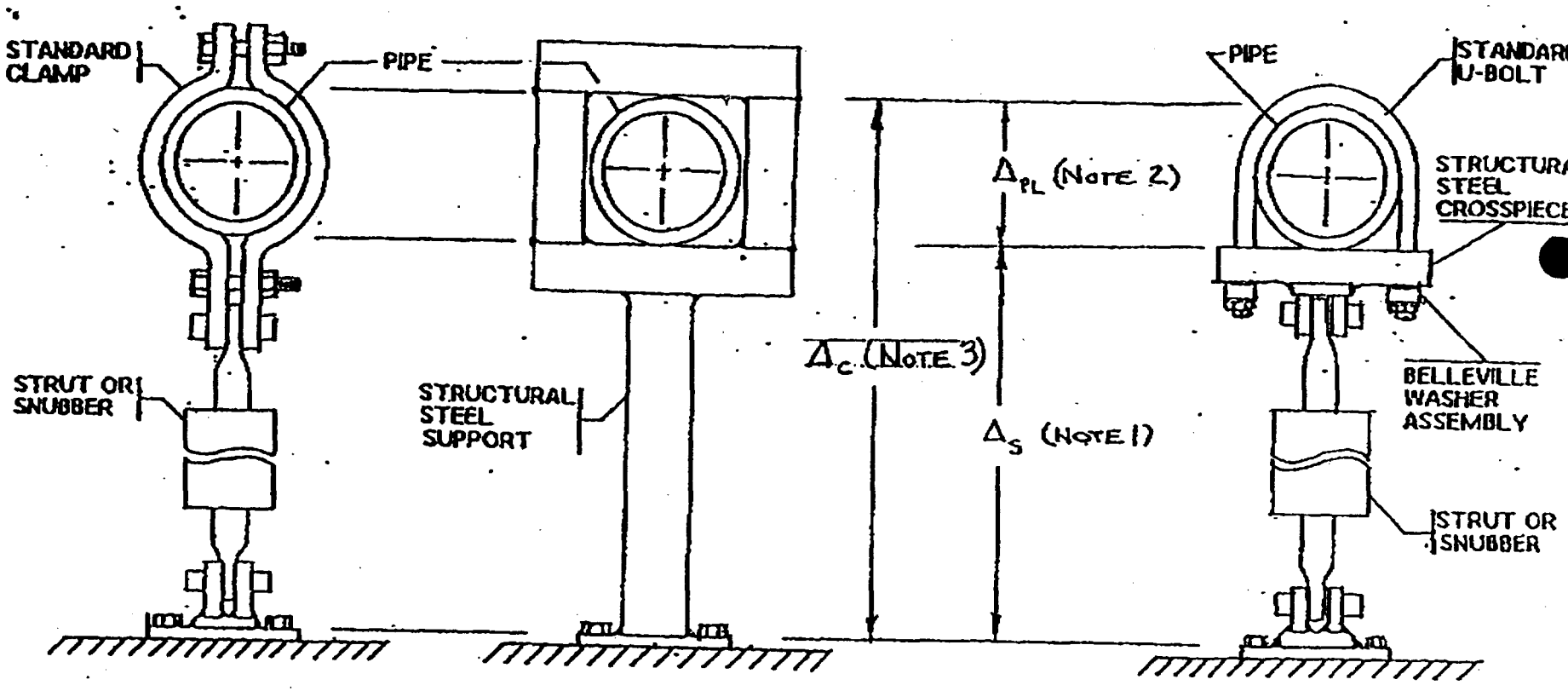



FIGURE 1 - WIDELY USED SUPPORT CONFIGURATIONS AT WBN

FIGURE 2 - TYPICAL WBN U-BOLT SUPPORT CONFIGURATION

NOTES:

1. PORTION OF THE PIPE SUPPORT USED IN THE WBN DEFLECTION CRITERIA COMPLIANCE CHECK

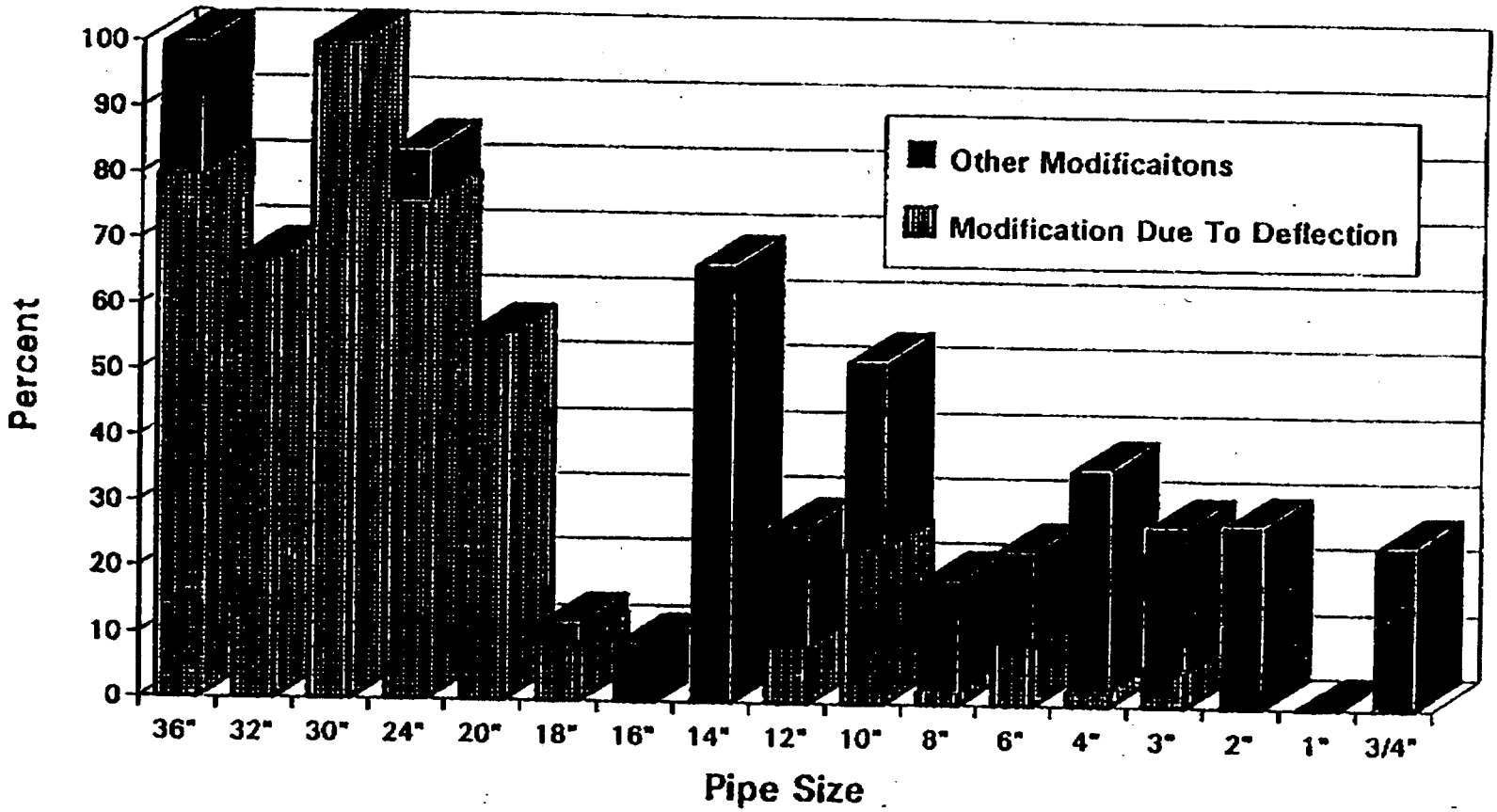
2. LOCAL DEFLECTION OF PIPE NOT INCLUDED IN THE WBN DEFLECTION CRITERIA COMPLIANCE CHECK.

3. $\Delta_C$ (COMBINE OR COMPOSITE) $= \Delta_S + \Delta_{PL}$

# SUMMARY PROPOSED MODIFICATIONS

| | |
|---|---|
| • CLASS 1 PIPING | 19 |
| • FITTINGS | 49 |
| • DEFLECTION | 52 |
| TOTAL | 120 |

# U-Bolt




| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Deflection Mod | | 4 | 6 | 1 | 19 | 5 | 3 | 0 | 0 | 2 | 4 | 1 | 4 | 1 | 2 | 0 | 0 | 0 |
| Class 1 Mod | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 5 | 3 | 1 | 4 | 0 | 2 |
| Fitting Mod | | 1 | 0 | 0 | 2 | 0 | 1 | 1 | 7 | 4 | 4 | 8 | 1 | 12 | 7 | 1 | 0 | 0 |
| Total Mod | (120) | 5 | 6 | 1 | 21 | 5 | 4 | 1 | 10 | 6 | 9 | 9 | 10 | 16 | 10 | 5 | 0 | 2 |
| Total Pop | (344) | 5 | 9 | 1 | 25 | 9 | 33 | 11 | 15 | 22 | 17 | 47 | 42 | 44 | 36 | 18 | 2 | 8 |

Date: January 11, 1994

# CONCLUDING REMARKS

Enclosure 3

**DRAFT**

Gentlemen:

## Introduction

The Tennessee Valley Authority ("TVA") has undertaken substantial efforts to address and resolve NRC staff questions regarding U-bolt pipe support designs at the Watts Bar Nuclear Plant ("WBN"). These efforts have included the development of a comprehensive U-bolt design methodology and associated criteria, detailed analyses of U-bolt supports used in conjunction with pinned struts or snubbers, and the conduct of additional (and the confirmation of prior) U-bolt support testing, as well as numerous meetings with the Staff. TVA believes that its efforts have provided substantial evidence, consistent with accepted industry pipe support design practices, of the adequacy of these designs to perform their intended safety functions.

However, TVA recognizes that there remain some Staff questions related to U-bolt support designs. TVA believes that these questions can be resolved on a technical basis. Nevertheless, in view of the current schedule for WBN start-up, and the additional effort involved in addressing those remaining questions, TVA has elected to eliminate or modify approximately 120 U-bolt supports at WBN. These changes provide added assurance that the WBN U-bolt support designs will perform their intended safety functions, and satisfy applicable design standards. TVA believes that these changes address the remaining Staff questions.

The proposed disposition of the remaining questions is described below.

## Discussion

### Overview

The proposed modifications, described below, provide for the elimination of U-bolt support designs on Class 1 piping (19 supports) and on fittings on safety-related piping (49 supports), regardless of pipe size. In addition, applying several conservative assumptions related to consideration of local pipe wall deflections, TVA proposes to remove or modify an additional 52 U-bolt supports. In total, TVA proposes to remove or modify 120

supports.[1]

**Proposed Modifications**

Class 1 Pipe Supports: To resolve Staff questions regarding U-bolt applications on Class 1 piping, TVA proposes to eliminate U-bolt support designs on Class 1 piping, regardless of pipe size.

TVA has tabulated a total of 19 U-bolt support designs on Class 1 piping.

Fittings : In order to resolve Staff questions related to U-bolt pipe support designs on fittings, TVA proposes to eliminate U-bolt support designs located on fittings in safety-related pipe (elbows, reducers, valves and tee's), regardless of pipe size.

TVA has tabulated a total of 49 U-bolt supports located on fittings in safety-related piping.

Local Deflections: TVA will eliminate or modify U-bolt support designs based on a conservative application of the current TVA support deflection criteria. Specifically, TVA will include local pipe wall deflections in its calculation of U-bolt support deflections. The local deflection of the pipe wall considering the stiffness of the pipe, U-bolt and cross member under design loadings, will be calculated. This local pipe wall deflection will be added to the standard U-bolt pipe support structural deflection previously calculated as part of the normal Code of Record support calculations. (Consideration of gaps between the Belleville washer collars and the support will be accounted for by including the Belleville washer stiffness as part of the above composite stiffness.) This combined deflection will be used to assure satisfaction of the WBN FSAR-defined deflection criteria:

- Deflection less than 1/16th inch for the greater of seismic/dynamic load condition from pipe stress

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[1] Modifications anticipated with respect to the U-bolt support designs for which the composite deflection does not satisfy the deflection criteria may involve one of several design changes, including (1) addition of formed saddles to existing U-bolt configurations, (2) elimination of the support, (3) elimination of the U-bolt design and substitution of a pipe clamp, or (4) modification to a box frame support. As noted, U-bolt designs on Class 1 pipe and on safety-related pipe fittings will be eliminated.

calculation or minimum design load.

- Deflection less than 1/8th inch for maximum strut load condition (deadweight, thermal, seismic/dynamic).

Further, TVA proposes to apply a hypothetical approach to the evaluation of pipe wall deflections on U-bolt preload, in addition to the existing U-bolt support methodology related to preload considerations.[2] This hypothetical approach will include the assumption that local pipe wall deflections translate completely to the pipe centerline deflections. If, from this hypothetical standpoint, the Belleville washer spring load drops below the initial U-bolt preload value already established, the support will be modified[3] or removed.

In summary, applying these conservative parameters, TVA proposes to remove or modify U-bolt supports for which the composite deflection does not meet the design deflection criteria, or for which a hypothetical application of local pipe wall deflection could analytically indicate a reduction in Belleville washer spring load below initial U-bolt preload values. TVA's present tabulation indicates that there is a total of 52 supports which will require modification as a result of these local deflection considerations.

**Figure 1**

TVA presents, in Figure 1 (attached), a tabulation of the modifications proposed to be performed on WBN U-bolt support designs. Figure 1 lists the modifications by pipe size for the Class 1 and Fittings applications. In addition, Figure 1 illustrates the distribution of the percentage of supports, by pipe size, requiring removal or modification based on the considerations

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[2] The current WBN U-bolt support methodology accounts for the effects of seismic strut loads in combination with other design loads which result in variations in U-bolt tension. These variations are already accounted for in the establishment of initial minimum preloads to assure the U-bolt clamping force does not fall below that which ensures stability of the pipe.

[3] Modification options for U-bolt supports to be modified as a result of this consideration will include the replacement of the Belleville spring packs, in addition to the options already described above.

described above related to local pipe wall deflections.[4]

**Additional Documentation**

TVA will provide, separately, a tabulation of the results of calculations for each support identifying (1) support loads, (2) the local and composite deflections, as described above, (3) initial minimum required U-bolt preload, and (4) results of additional assumptions concerning local pipe wall deflections related to U-bolt preload. TVA is presently tabulating and verifying this information. TVA anticipates providing this information by no later than Thursday, January 13, 1994.

**Conclusion**

TVA believes that the above proposed modifications, and supplemental documentation, address the remaining Staff questions. We would welcome the opportunity to clarify or discuss further the details of this proposal.

Attachment (Figure)

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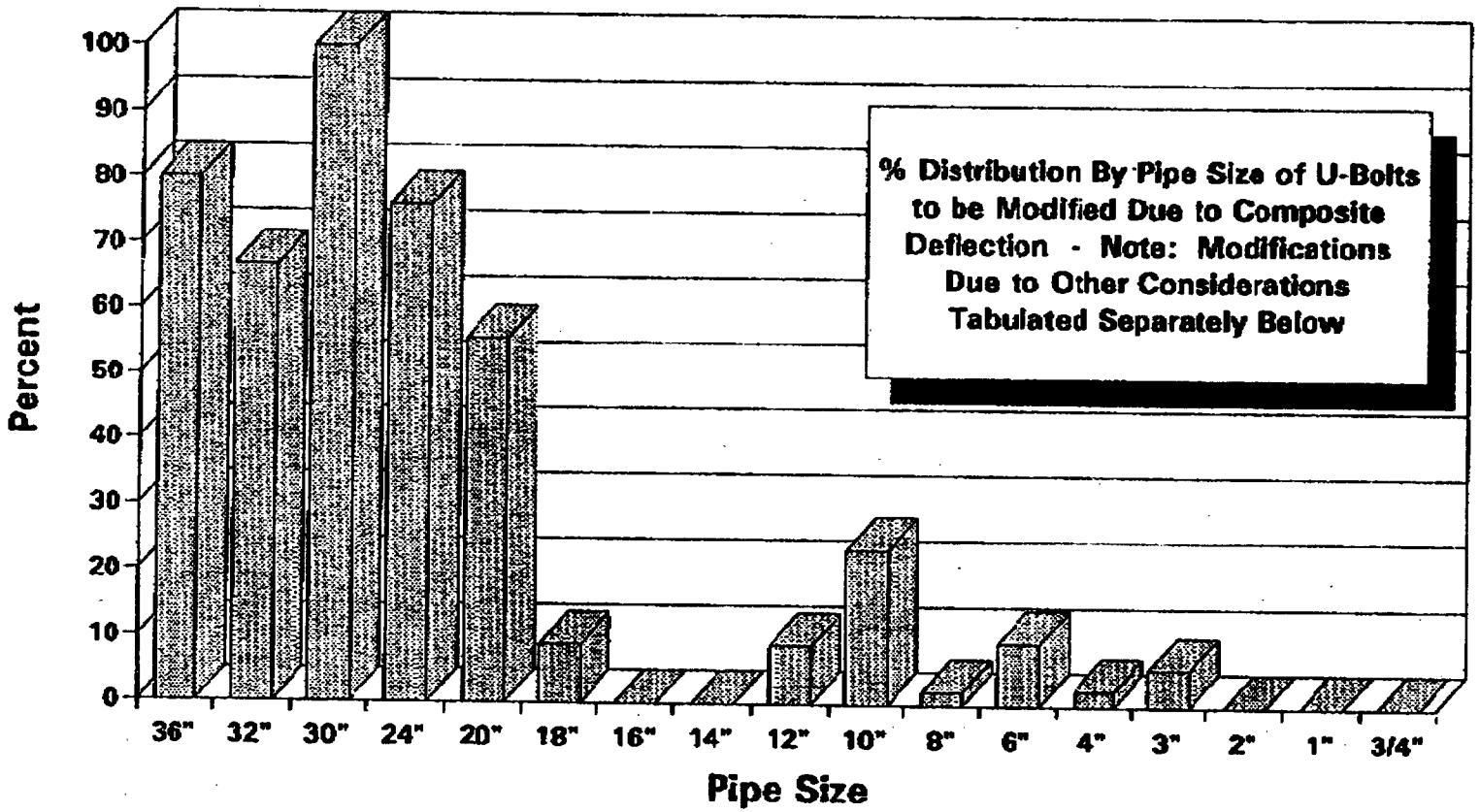
[4] TVA is presently verifying the calculations on which this figure is premised. This verification could result in slight variations in the final numbers. This verification is to be completed with the tabulation of the additional material to be provided, as described below.

# U-Bolts




| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Deflection Mod** | 4 | 6 | 1 | 19 | 5 | 3 | 0 | 0 | 2 | 4 | 1 | 8 | 1 | 2 | 0 | 0 | 0 |
| **Class 1 Mod** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 5 | 3 | 1 | 4 | 0 | 2 |
| **Fitting Mod** | 1 | 0 | 0 | 2 | 0 | 1 | 1 | 7 | 4 | 4 | 8 | 1 | 12 | 7 | 1 | 0 | 0 |
| **Total Mod (120)** | 5 | 6 | 1 | 21 | 5 | 4 | 1 | 10 | 6 | 9 | 9 | 10 | 16 | 10 | 5 | 0 | 2 |
| **Total Pop (344)** | 5 | 9 | 1 | 25 | 9 | 33 | 11 | 15 | 22 | 17 | 47 | 42 | 44 | 36 | 18 | 2 | 8 |

**Date:** January 11, 1994

Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 671ERCWR436 | 36 | HTR | | | | | X | | 0.1420 | 4000 | 1500 | 291 | | 0.177/10 | 21500 | 11344 |
| 2 | 671ERCWR440 | 36 | HTR | | | | | X | | 0.1760 | 6000 | 2500 | -3600 | | 0.122/9 | 21500 | 22638 |
| 3 | 671ERCWR349 | 36 | HTR | | | | | X | | 0.1740 | 6000 | 2400 | -3491 | | 0.154/9 | 21500 | 22349 |
| 4 | 671ERCWR348 | 36 | HTR | | | | | X | | 0.1427 | 7000 | 3100 | 1073 | | 0.184/10 | 21500 | 12939 |
| 5 | 671ERCWR445 | 36 | VSR | | X | | | | | 0.1040 | 7000 | 3400 | 1129 | | 0.126/9 | 21500 | 13717 |
| 6 | 101A313 | 32 | HSS | | | YES | X | | 0.0866 | 0.0676 | 13750 | 13700 | 9727 | | 0.309/9 | 21500 | 67461 |
| 7 | 101A308 | 32 | HTR | | | YES | X | | 0.1696 | 0.0846 | 30000 | 28500 | 22189 | | 0.289/9 | 21500 | 149561 |
| 8 | 101A348 | 32 | VTS | | | YES | | | 0.0456 | 0.0356 | 10000 | 3000 | 6955 | | 0.247/9 | 21500 | 26563 |
| 9 | 101A350 | 32 | HSS | | | | X | | 0.0726 | 0.0726 | 13750 | 3600 | 9581 | | 0.265/9 | 21500 | 68772 |
| 10 | 101A429 | 32 | VTS | | | | | | | 0.0416 | 11000 | 7100 | 9068 | | 0.316/9 | 21500 | 37165 |
| 11 | 101A435 | 32 | HSS | | | | X | | 0.0650 | 0.0650 | 24000 | 21000 | 14366 | | 0.268/9 | 21500 | 70030 |
| 12 | 101A424 | 32 | HSS | | | YES | X | | 0.1235 | 0.0735 | 17500 | 12000 | 11533 | | 0.277/9 | 21500 | 93809 |
| 13 | 101A389 | 32 | VTS | | | | | | | 0.0365 | 13750 | 6900 | 12434 | | 0.306/9 | 21500 | 22239 |
| 14 | 101A392 | 32 | HTS | | | | X | | 0.0696 | 0.0696 | 13750 | 4000 | 9801 | | 0.277/9 | 21500 | 65585 |
| 15 | 47A45003154 | 30 | HSR | | | | | X | | 0.1580 | 4000 | 3600 | -1745 | | 0.140/9 | 13537 | 23129 |
| 16 | 671ERCWR030 | 24 | VSR | | | | | | 0.0584 | 0.0996 | 6000 | 3000 | 1418 | X | 0.148/9 | 8909 | 19386 |
| 17 | 631SISR121 | 24 | VTR | | | | | | 0.0548 | 0.0907 | 4000 | 3100 | 1382 | X | 0.294/9 | 8909 | 15384 |
| 18 | 631SISR115 | 24 | VTR | | | | | | 0.0394 | 0.0767 | 2700 | 2600 | 1447 | X | 0.269/9 | 8909 | 16745 |
| 19 | 671ERCWR207 | 24 | VTR | | | | | | 0.0584 | 0.0996 | 6000 | 3600 | 1418 | X | 0.222/10 | 8909 | 18124 |
| 20 | 671ERCWR145 | 24 | HTR | | | | X | | 0.0653 | 0.1010 | 4000 | 3000 | 982 | | 0.233/9 | 8909 | 19919 |
| 21 | 671ERCWR092 | 24 | HTR | | | | X | | 0.0680 | 0.1070 | 6000 | 2800 | 2455 | | 0.095/9 | 8909 | 13919 |
| 22 | 47A46409001 | 24 | VSR | | | | X | | 0.0727 | 0.1199 | 6000 | 3200 | 3164 | | 0.173/9 | 8909 | 28211 |
| 23 | 47A45004036 | 24 | HSR | | X | | | | | 0.0910 | 6000 | 3700 | 1036 | | 0.132/9 | 8909 | 18452 |
| 24 | 47A43503005 | 24 | VTR | | | | | X | | 0.1410 | 4000 | 1300 | 2764 | | 0.248/9 | 8909 | 6373 |
| 25 | 631SISR114 | 24 | HTS | | | | | | | 0.0552 | 7500 | 7430 | 4840 | X | 0.277/9 | 8909 | 10161 |
| 26 | 631SISR112 | 24 | HTS | | | | X | | 0.0660 | 0.0660 | 6000 | 3600 | 2836 | | 0.334/9 | 8909 | 12575 |
| 27 | 631SISR109 | 24 | HTS | | | | X | | 0.1100 | 0.1100 | 6000 | 3900 | 1309 | | 0.467.9 | 8909 | 18676 |
| 28 | 671ERCWR283 | 24 | HTR | | | | X | | 0.0932 | 0.0980 | 6000 | 3600 | 1364 | | 0.374/9 | 8909 | 20098 |



Enclosure 4

Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 671ERCWR292 | 24 | VSR | | | | X | | 0.0764 | 0.1226 | 6000 | 3600 | 164 | | 0.168/9 | 8909 | 25014 |
| 30 | 671ERCWR310 | 24 | HTR | | | | | X | | 0.1290 | 6000 | 4500 | -1036 | | 0.291/9 | 8909 | 30037 |
| 31 | 671ERCWR282 | 24 | VSR | | | | X | | 0.0639 | 0.1106 | 4000 | 3400 | 545 | | 0.363/9 | 8909 | 22542 |
| 32 | 671ERCWR231 | 24 | VTR | | | | | | 0.0385 | 0.0786 | 6000 | 3200 | 2182 | X | 0.165/9 | 8909 | 15773 |
| 33 | 671ERCWR220 | 24 | VSR | | | | X | | Deleted | 0.1050 | 6000 | 1600 | 273 | | 0.206/9 | 8909 | 13611 |
| 34 | 671ERCWR312 | 24 | HTR | | | | | X | | 0.1310 | 6000 | 4700 | -1145 | | 0.187/9 | 8909 | 30925 |
| 35 | 701CCR243 | 24 | HSR | | | | | X | | 0.1430 | 10000 | 7500 | 2270 | | 0.164/9 | 8909 | 22682 |
| 36 | 701CCR249 | 24 | VSR | | X | | | | | 0.0810 | 10000 | 4700 | 5622 | | 0.476/10 | 8909 | 17546 |
| 37 | 671ERCWR214 | 24 | VSR | | | | | | | 0.0580 | 4000 | 2300 | 1964 | X | 0.138/9 | 8909 | 11338 |
| 38 | 671ERCWR388 | 24 | VTR | | | | | | | 0.0487 | 4000 | 1700 | 2364 | | 0.130/9 | 8909 | 8486 |
| 39 | 671ERCWR389 | 24 | HTR | | | | | | | 0.0476 | 6000 | 1800 | 4255 | | 0.107/9 | 8909 | 7193 |
| 40 | 701CCR239 | 24 | HTR | | | | | | | 0.0588 | 6000 | 2500 | 4036 | | 0.127/9 | 8909 | 12373 |
| 41 | 671ERCWR371 | 20 | VTR | | | | | | | 0.0463 | 6000 | 2200 | 4200 | | 0.108/9 | 6138 | 9369 |
| 42 | 671ERCWR368 | 20 | VTR | | | | | | | 0.0567 | 6000 | 2500 | 3982 | | 0.114/9 | 6138 | 10499 |
| 43 | 671ERCWR373 | 20 | VTR | | | | | | | 0.0300 | 6000 | 1900 | 4364 | | 0.086/9 | 6138 | 8039 |
| 44 | 701CCR079 | 20 | VTS | | | | | X | | 0.1365 | 10000 | 7700 | 7973 | | 0.344/10 | 6138 | 18229 |
| 45 | 701CCR062 | 20 | VTS | | | | X | | 0.0708 | 0.0708 | 8000 | 2600 | 5775 | | 0.167/9 | 6138 | 11745 |
| 46 | 671ERCWR046 | 20 | VTR | | | | | | | 0.0440 | 6000 | 1700 | 4527 | | 0.067/9 | 6138 | 7304 |
| 47 | 631SISR219 | 20 | HSR | | | | X | | 0.0739 | 0.1015 | 6000 | 5700 | 1418 | | 0.218/9 | 6138 | 23445 |
| 48 | 631SISR218 | 20 | HSR | | | YES | X | | 0.1277 | 0.1106 | 3250 | 2900 | 2075 | | 0.218/9 | 6138 | 11900 |
| 49 | 47A45003084 | 20 | HSR | | | | | | 0.0451 | 0.0626 | 4000 | 2800 | 2291 | X | 0.202/10 | 6138 | 14023 |
| 50 | 701CCR391 | 18 | HTR | | | | | | | 0.0330 | 8000 | 1400 | 6993 | | 0.180/9 | 4810 | 5740 |
| 51 | 701CCR393 | 18 | HTR | | | | | | | 0.0231 | 8000 | 1100 | 7311 | | 0.180/9 | 4810 | 3816 |
| 52 | 701CCR404 | 18 | HTR | | | | | | | 0.0430 | 6000 | 1400 | 5345 | | 0.198/10 | 4810 | 5326 |
| 53 | 701CCR418 | 18 | HTR | | | | | | | 0.0336 | 8000 | 2200 | 6570 | | 0.224/9 | 4810 | 8814 |
| 54 | 701CCR421 | 18 | HTR | | | | | | | 0.0432 | 8000 | 1600 | 7046 | | 0.138/9 | 4810 | 5904 |
| 55 | 701CCR411 | 18 | HTR | | | | | | | 0.0330 | 8000 | 1500 | 6940 | | 0.147/9 | 4810 | 5823 |
| 56 | 701CCR428 | 18 | VTR | | | | | X | | 0.1490 | 8000 | 5500 | 4556 | | 0.142/9 | 4810 | 21539 |



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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 85 | 701CCR758 | 16 | HTR | | | | | | | 0.0556 | 5500 | 2400 | 4354 | | 0.296/9 | 3825 | 16103 |
| 86 | 701CCR528 | 16 | HTR | | | | | | | 0.0306 | 5500 | 900 | 5271 | | 0.115/9 | 3825 | 2805 |
| 87 | 701CCR761 | 16 | HTR | | | | | | 0.0524 | 0.0640 | 5500 | 2300 | 4526 | | 0.109/10 | 3825 | 11847 |
| 88 | 631SISR131 | 16 | VSR | | X | YES | | | | 0.0440 | 3250 | 3216 | 2150 | | 0.249/9 | 3825 | 16608 |
| 89 | 47A46402237 | 16 | HTR | | | | | | | 0.0495 | 7000 | 600 | 6734 | | 0.089/9 | 3825 | 2173 |
| 90 | 103A240 | 16 | HTS | | | | | | | 0.0190 | 7500 | 1300 | 7074 | | 0.331/10 | 3825 | 12698 |
| 91 | 103A260 | 16 | HTS | | | YES | | | 0.0570 | 0.0360 | 10000 | 6700 | 7297 | | 0.400/9 | 3825 | 54915 |
| 92 | 103A200 | 16 | HTS | | | | | | | 0.0540 | 4000 | 1200 | 3731 | | 0.310/10 | 3825 | 12738 |
| 93 | 701CCR156 | 16 | HTR | | | | | | | 0.0364 | 5500 | 2000 | 4898 | | 0.101/10 | 3825 | 8628 |
| 94 | 47A43201031 | 14 | HTS | | | | | | | 0.0307 | 2900 | 1100 | 2660 | | 0.181/9 | 2857 | 4516 |
| 95 | 631SISR221 | 14 | HSS | | | | | | | 0.0240 | 2000 | 1000 | 1925 | | 0.175/9 | 2857 | 2231 |
| 96 | 47A43201005 | 14 | HTS | | | | | | | 0.0259 | 2900 | 1700 | 2529 | | 0.305/10 | 2857 | 7072 |
| 97 | 631SISR182 | 14 | HTR | | | | | | | 0.0329 | 4000 | 1700 | 3433 | | 0.226/9 | 2857 | 7729 |
| 98 | 631SISR230 | 14 | HTS | | X | | | | | 0.0060 | 4000 | 2000 | 3821 | | 0.211/0 | 2857 | 2451 |
| 99 | 174020 | 14 | HTS | X | | YES | | | | 0.0020 | 7500 | 900 | 7394 | | 0.171/9 | 2857 | 8096 |
| 100 | 174006 | 14 | HTS | X | | YES | | | | 0.0060 | 16000 | 12000 | 15518 | | 0.256/10 | 2857 | 23808 |
| 101 | 631SISR140 | 14 | HSR | | X | | | | | 0.0120 | 4000 | 1900 | 3642 | | 0.224/9 | 2857 | 4356 |
| 102 | 631SISR137 | 14 | HSR | | X | YES | | | | 0.0360 | 2250 | 2250 | 1721 | | 0.781/9 | 2857 | 11221 |
| 103 | 631SISR138 | 14 | HSR | | X | YES | | | | 0.0390 | 4000 | 3800 | 2836 | | 0.550/9 | 2857 | 16432 |
| 104 | 631SISR161 | 14 | HSR | | X | YES | | | | 0.0510 | 1700 | 1600 | 1012 | | 0.584/10 | 2857 | 13623 |
| 105 | 631SISR162 | 14 | HSR | | X | | | | | 0.0180 | 4000 | 4000 | 3463 | | 0.333/9 | 2857 | 6447 |
| 106 | 631SISR164 | 14 | HSR | | X | | | | | 0.0030 | 4000 | 1000 | 3910 | | 0.203/10 | 2857 | 1254 |
| 107 | 174007 | 14 | HTS | X | | YES | | | | 0.0060 | 15000 | 8300 | 14250 | | 0.356/10 | 2857 | 32776 |
| 108 | 631SISR142 | 14 | VTS | | | | | | | 0.0208 | 2000 | 900 | 1925 | | 0.204/9 | 2857 | 2325 |
| 109 | 631SISR212 | 12 | VTR | | | | | | | 0.0102 | 4000 | 1000 | 3821 | | 0.171/9 | 2267 | 2949 |
| 110 | 47A46409149 | 12 | VTR | | | | | | | 0.0160 | 7000 | 1400 | 6468 | | 0.079/9 | 2267 | 5719 |
| 111 | 631SISR206 | 12 | HSR | | | YES | | | 0.0215 | 0.0248 | 2000 | 1100 | 1746 | | 0.177/9 | 2267 | 3144 |
| 112 | 701CCR335 | 12 | VTR | | | | | | | 0.0256 | 7000 | 1200 | 6557 | | 0.110/9 | 2267 | 4702 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod PL | Max. Str In#./Eq. | MDL | Max. Str Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 113 | 701CCR319 | 12 | HTR | | | | | | | 0.0080 | 7000 | 800 | 6778 | | 0.058/10 | 2267 | 2293 |
| 114 | 701CCR725 | 12 | HTR | | | | | | | 0.0094 | 7000 | 1500 | 6823 | | 0.086/9 | 2267 | 2159 |
| 115 | 701CCR357 | 12 | HTR | | | | | | | 0.0150 | 7000 | 800 | 6734 | | 0.104/10 | 2267 | 2768 |
| 116 | 701CCR369 | 12 | HTR | | | | | | 0.0294 | 0.0740 | 7000 | 1500 | 6424 | | 0.156/10 | 2267 | 6283 |
| 117 | 701CCR362 | 12 | HTR | | | | | | | 0.0480 | 7000 | 900 | 6646 | | 0.098/9 | 2267 | 3707 |
| 118 | 701CCR359 | 12 | HTR | | | | | | | 0.0110 | 7000 | 900 | 6690 | | 0.143/9 | 2267 | 3355 |
| 119 | 631SISR227 | 12 | VSR | | X | | | | | 0.0170 | 2900 | 2300 | 2529 | | 0.177/9 | 2267 | 7370 |
| 120 | 631SISR226 | 12 | HTS | | X | | | | | 0.0080 | 2900 | 1200 | 2726 | | 0.208/9 | 2267 | 3626 |
| 121 | 631SISR214 | 12 | HSS | | | | | | | 0.0140 | 2900 | 1200 | 2660 | | 0.149/9 | 2267 | 4976 |
| 122 | 631SISR238 | 12 | VTR | | X | | | | | 0.0050 | 4000 | 1600 | 3851 | | 0.199/9 | 2267 | 2603 |
| 123 | 701CCR731 | 12 | HTR | | | | | | | 0.0443 | 8000 | 7600 | 6167 | X | 0.171/9 | 2267 | 17822 |
| 124 | 701CCR732 | 12 | HTR | | | | | | | 0.0256 | 7000 | 1900 | 6557 | | 0.150/9 | 2267 | 4874 |
| 125 | 701CCR734 | 12 | HTR | | | | | | | 0.0266 | 7000 | 2100 | 6513 | | 0.199/9 | 2267 | 5382 |
| 126 | 47A45003085 | 12 | HSR | | | | | | | 0.0249 | 4000 | 600 | 3851 | | 0.060/9 | 2267 | 2353 |
| 127 | 47A45003163 | 12 | HTS | | | | | | | 0.0150 | 7000 | 1000 | 6472 | | 0.263/10 | 2267 | 4014 |
| 128 | 47A45003099 | 12 | HSS | | X | | | | | 0.0050 | 7000 | 1600 | 6670 | | 0.200/10 | 2267 | 2257 |
| 129 | 47A45003100 | 12 | HSS | | | | X | | 0.0934 | 0.0934 | 8500 | 8200 | 6408 | | 0.097/9 | 2267 | 16434 |
| 130 | 47A46403135 | 12 | VTR | | | | | | 0.0449 | 0.0833 | 7000 | 3800 | 6646 | | 0.106/9 | 2267 | 4202 |
| 131 | 47A42708028 | 10 | HSS | | | | | | | 0.0166 | 3000 | 300 | 2972 | | 0.030/10 | 1641 | 348 |
| 132 | 721CSR031 | 10 | HTR | | X | | | | | 0.0040 | 4000 | 1400 | 3892 | | 0.137/9 | 1641 | 2285 |
| 133 | 721CSR117 | 10 | HTR | | | YES | X | | 0.0706 | 0.0559 | 5500 | 5200 | 3631 | | 0.224/10 | 1641 | 11013 |
| 134 | 721CSR115 | 10 | HTR | | | YES | X | | 0.0673 | 0.0455 | 8000 | 7700 | 5056 | | 0.215/10 | 1641 | 16467 |
| 135 | 47A43706008 | 10 | HSR | | | | | | | 0.0450 | 4000 | 3700 | 3541 | X | 0.368/9 | 1641 | 8870 |
| 136 | 701CCR282 | 10 | VTR | | | | | | | 0.0075 | 5000 | 700 | 4803 | | 0.103/9 | 1641 | 3428 |
| 137 | 721CSR013 | 10 | HSR | | X | | | | | 0.0010 | 3000 | 2800 | 2972 | | 0.205/10 | 1641 | 2968 |
| 138 | 721CSR003 | 10 | HSS | | X | YES | | | | 0.0030 | 3000 | 600 | 2917 | | 0.069/9 | 1641 | 1305 |
| 139 | 721CSR124 | 10 | HTR | | | YES | | | 0.0486 | 0.0306 | 5500 | 4900 | 3738 | X | 0.191/10 | 1641 | 10274 |
| 140 | 701CCR133 | 10 | HTR | | | | | | | 0.0512 | 5000 | 1200 | 4326 | | 0.554/9 | 1641 | 14029 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 141 | 781FPCR021 | 10 | HTS | | | | | | | 0.0092 | 4000 | 600 | 3865 | | 0.061/10 | 1641 | 2547 |
| 142 | 701CCR469 | 10 | HTR | | | | | | | 0.0096 | 7000 | 1200 | 6823 | | 0.243/9 | 1641 | 2294 |
| 143 | 701CCR471 | 10 | HTR | | | | | | | 0.0100 | 8000 | 1200 | 7841 | | 0.169/9 | 1640 | 1937 |
| 144 | 701CCR473 | 10 | HTR | | | | | | | 0.0080 | 5000 | 2200 | 4888 | | 0.170/10 | 1641 | 2175 |
| 145 | 701CCR614 | 10 | VTR | | | | | | | 0.0080 | 5000 | 700 | 4831 | | 0.513/10 | 1641 | 3425 |
| 146 | 163454 | 10 | HTS | X | | YES | | | | 0.0050 | 2200 | 1500 | 2099 | | 0.256/9 | 1641 | 19657 |
| 147 | 781FPCR049 | 10 | HSR | | X | | | | | 0.0190 | 2000 | 1300 | 1743 | | 0.126/9 | 1641 | 9528 |
| 148 | 163591 | 8 | HSS | | | YES | | | 0.0166 | 0.0156 | 900 | 800 | 893 | | 0.296/10 | 955 | 1603 |
| 149 | 261FPR122 | 8 | VSR | | | | | | | 0.0324 | 3000 | 700 | 2822 | | 0.124/10 | 955 | 4621 |
| 150 | 261FPR154 | 8 | VTR | | | | | | | 0.0043 | 4000 | 2000 | 3933 | | 0.065/9 | 955 | 1209 |
| 151 | 37A20601020 | 8 | HSR | | | | | | | 0.0216 | 4000 | 1400 | 3798 | | 0.077/9 | 955 | 3148 |
| 152 | 37A20601019 | 8 | HSR | | | | | | | 0.0216 | 4000 | 1400 | 3798 | | 0.077/9 | 955 | 3148 |
| 153 | 671ERCWR496 | 8 | VTR | | | | | | | 0.0155 | 2000 | 1100 | 1828 | | 0.645/10 | 955 | 5815 |
| 154 | 701CCR145 | 8 | VTR | | | | | | | 0.0115 | 2900 | 300 | 2833 | | 0.078/9 | 955 | 1958 |
| 155 | 701CCR147 | 8 | VTR | | | | | | | 0.0046 | 2900 | 300 | 2867 | | 0.066/10 | 955 | 1089 |
| 156 | 701CCR176 | 8 | VTR | | | | | | | 0.0157 | 2900 | 1100 | 2717 | | 0.180/9 | 955 | 5725 |
| 157 | 671ERCWR239 | 8 | HSR | | | | | | | 0.0172 | 2000 | 1000 | 1862 | | 0.177/9 | 955 | 3894 |
| 158 | 672ERCWR036 | 8 | HTR | | | | | | | 0.0256 | 3000 | 1100 | 2778 | | 0.234/10 | 955 | 5827 |
| 159 | 701CCR142 | 8 | VTR | | | | | | | 0.0196 | 2900 | 500 | 2833 | | 0.083/9 | 955 | 2467 |
| 160 | 701CCR177 | 8 | HTR | | | | | | | 0.0023 | 2900 | 600 | 2867 | | 0.145/9 | 955 | 1176 |
| 161 | 701CCR180 | 8 | VTR | | | | | | | 0.0109 | 2900 | 400 | 2833 | | 0.163/9 | 955 | 2077 |
| 162 | 701CCR181 | 8 | VTR | | | | | | | 0.0081 | 2900 | 500 | 2817 | | 0.069/9 | 955 | 2421 |
| 163 | 47A45002110 | 8 | VSR | | | | | | | 0.0316 | 3500 | 3300 | 2956 | X | 0.166/10 | 955 | 10006 |
| 164 | 631SISR237 | 8 | VTR | | | | | | | 0.0113 | 2000 | 500 | 1966 | | 0.124/9 | 955 | 1255 |
| 165 | 701CCR178 | 8 | VTR | | | | | | | 0.0072 | 2900 | 400 | 2833 | | 0.155/9 | 955 | 2117 |
| 166 | 47A43203003 | 8 | VTS | | | YES | | | 0.0052 | 0.0052 | 3000 | 400 | 2978 | | 0.183/10 | 955 | 1998 |
| 167 | 621CVCR021 | 8 | VSR | | X | | | | | 0.0050 | 3000 | 500 | 2889 | | 0.124/10 | 955 | 2380 |
| 168 | 621CVCR001 | 8 | VTR | | X | | | | | 0.0080 | 3000 | 1300 | 2822 | | 0.214/10 | 955 | 4113 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 169 | 671ERCWR325 | 8 | VTR | | | | | | | 0.0156 | 2000 | 1000 | 1828 | | 0.132/9 | 955 | 5403 |
| 170 | 702CCR031 | 8 | HTR | | | | | | | 0.0153 | 2900 | 1000 | 2733 | | 0.201/10 | 955 | 5509 |
| 171 | 701CCR757 | 8 | VSR | | | | | | | 0.0216 | 2900 | 1000 | 2800 | | 0.135/9 | 955 | 2491 |
| 172 | 781FPCR047 | 8 | HSR | | X | | | | | 0.0090 | 3000 | 1000 | 2800 | | 0.117/9 | 955 | 4333 |
| 173 | 701CCR765 | 6 | HTR | | | | | | | 0.0120 | 5000 | 1400 | 4775 | | 0.123/10 | 955 | 5115 |
| 174 | 741RHRR003 | 8 | VTR | | | YES | | | 0.0558 | 0.0456 | 2000 | 1100 | 1534 | | 0.195/10 | 955 | 7078 |
| 175 | 741RHRR130 | 8 | HTR | | | | | | | 0.0206 | 3000 | 700 | 2889 | | 0.133/10 | 955 | 2900 |
| 176 | 741RHRR133 | 8 | HTR | | | | | | | 0.0060 | 3000 | 900 | 2956 | | 0.142/9 | 955 | 1051 |
| 177 | 741RHRR231 | 8 | VTR | | | YES | | | 0.0170 | 0.0110 | 3000 | 700 | 2733 | | 0.203/9 | 955 | 3314 |
| 178 | 741RHRR101 | 8 | VSR | | X | YES | | | | 0.0030 | 4000 | 1200 | 3910 | | 0.380/10 | 955 | 10882 |
| 179 | 741RHRR004 | 8 | VTR | | X | YES | | | | 0.0100 | 2900 | 2200 | 2682 | | 0.181/10 | 955 | 5837 |
| 180 | 741RHRR017 | 8 | VTS | | X | | | | | 0.0080 | 2000 | 1000 | 1862 | | 0.179/9 | 955 | 3845 |
| 181 | 741RHRR058 | 8 | HTS | | | | | | | 0.0597 | 2000 | 1600 | 1897 | | 0.333/9 | 955 | 3372 |
| 182 | 701CCR754 | 8 | VSR | | | | | | | 0.0236 | 2900 | 900 | 2767 | | 0.213/9 | 955 | 4119 |
| 183 | 701CCR585 | 6 | HTR | | | | | | | 0.0032 | 2900 | 500 | 2867 | | 0.067/9 | 955 | 934 |
| 184 | 163055 | 8 | HSS | | | YES | | | 0.0010 | 0.0010 | 5500 | 600 | 5500 | | 0.163/9 | 955 | 1454 |
| 185 | 163032 | 8 | HSS | | | YES | | | 0.0155 | 0.0145 | 3000 | 1100 | 2917 | | 0.285/10 | 955 | 8086 |
| 186 | 622CVCR001 | 8 | VTR | | X | | | | | 0.0070 | 3000 | 800 | 2844 | | 0.163/9 | 955 | 3775 |
| 187 | 671ERCWR471 | 8 | HTR | | | | | | | 0.0023 | 3000 | 200 | 2956 | | 0.100/10 | 955 | 1061 |
| 188 | 671ERCWR365 | 8 | HTS | | | | | | | 0.0186 | 3000 | 700 | 2917 | | 0.656/11 | 955 | 1812 |
| 189 | 781FPCR074 | 8 | HSR | | X | | | | | 0.0100 | 1500 | 800 | 1389 | | 0.086/10 | 955 | 4141 |
| 190 | 701CCR649 | 8 | HTR | | | | | | | 0.0203 | 4000 | 2400 | 3725 | | 0.183/10 | 955 | 8456 |
| 191 | 701CCR648 | 6 | VTR | | | | | | | 0.0103 | 7000 | 3300 | 6697 | | 0.267/10 | 955 | 5995 |
| 192 | 163030 | 8 | HSS | | | YES | | | 0.0593 | 0.0593 | 3000 | 400 | 2978 | | 0.277/10 | 955 | 2575 |
| 193 | 701CCR637 | 8 | VSR | | | | | | | 0.0216 | 2900 | 600 | 2800 | | 0.080/9 | 955 | 2559 |
| 194 | 701CCR753 | 8 | VSR | | | | | | | 0.0216 | 2900 | 800 | 2800 | | 0.207/9 | 955 | 3054 |
| 195 | 671ERCWR542 | 6 | HTR | | | | | | | 0.0084 | 4400 | 4300 | 4333 | | 0.178/10 | 535 | 843 |
| 196 | 671ERCWR546 | 6 | VSR | | | | | | | 0.0435 | 3000 | 1000 | 2889 | | 0.096/10 | 535 | 3324 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 197 | 671ERCWR552 | 6 | HTR | | | | | | | 0.0033 | 3000 | 1400 | 2978 | | 0.178/10 | 535 | 835 |
| 198 | 671ERCWR529 | 6 | HTR | | | | | | | 0.0119 | 3000 | 700 | 2978 | | 0.309/10 | 535 | 564 |
| 199 | 671ERCWR525 | 6 | HTR | | | | | | | 0.0129 | 3000 | 800 | 2956 | | 0.176/10 | 535 | 969 |
| 200 | 671ERCWR532 | 6 | HTR | | | | | | | 0.0119 | 3000 | 700 | 2978 | | 0.093/10 | 535 | 603 |
| 201 | 671ERCWR534 | 6 | HTR | | | | | | | 0.0119 | 3000 | 700 | 2978 | | 0.121/10 | 535 | 424 |
| 202 | 671ERCWR360 | 6 | VTR | | | | | | | 0.0014 | 3000 | 1000 | 2978 | | 0.058/9 | 535 | 670 |
| 203 | 671ERCWR555 | 6 | HTR | | | | | | | 0.0310 | 3000 | 700 | 2978 | | 0.075/9 | 535 | 844 |
| 204 | 163080 | 6 | VSS | X | | YES | | | | 0.0000 | 4000 | 1300 | 4000 | | 0.168/9 | 535 | 1505 |
| 205 | 163462 | 6 | VTS | X | | YES | | | | 0.0010 | 4000 | 500 | 3970 | | 0.468/10 | 535 | 1890 |
| 206 | 168018 | 6 | HTS | X | | YES | | | | 0.0020 | 4000 | 600 | 3946 | | 0.379/10 | 535 | 5298 |
| 207 | 721CSR093 | 6 | HSR | | | | | | | 0.0138 | 1300 | 900 | 1199 | | 0.064/9 | 535 | 5016 |
| 208 | 163021 | 6 | VSS | | | YES | | | 0.0033 | 0.0033 | 4000 | 800 | 4000 | | 0.363/10 | 535 | 883 |
| 209 | 163064 | 6 | VSS | | | YES | | | 0.0099 | 0.0099 | 3000 | 3000 | 3000 | | 0.170/9 | 535 | 1239 |
| 210 | 168120 | 6 | HSS | | | YES | | | 0.0091 | 0.0051 | 2000 | 1400 | 1879 | | 0.189/9 | 535 | 1834 |
| 211 | 671ERCWR563 | 6 | HTR | | | | | | | 0.0100 | 3000 | 600 | 2978 | | 0.089/9 | 535 | 409 |
| 212 | 671ERCWR561 | 6 | HTR | | | | | | | 0.0110 | 3000 | 700 | 2956 | | 0.214/10 | 535 | 1318 |
| 213 | 671ERCWR556 | 6 | HTR | | | | | | | 0.0210 | 3000 | 700 | 2978 | | 0.482/10 | 535 | 53 |
| 214 | 168427 | 6 | HSS | X | | YES | | | | 0.0010 | 3000 | 2000 | 2978 | | 0.327/9 | 535 | 5374 |
| 215 | 03B1AFWR043 | 6 | HSR | | | | | | | 0.0166 | 2000 | 900 | 1983 | | 0.040/10 | 535 | 2259 |
| 216 | 671ERCWR600 | 6 | VSR | | X | | | | | 0.0040 | 2000 | 1600 | 1931 | | 0.439/10 | 535 | 2066 |
| 217 | 47A45021084 | 6 | HTR | | | | | | | 0.0012 | 3000 | 400 | 2978 | | 0.042/9 | 535 | 571 |
| 218 | 47A45002078 | 6 | HTR | | | | | | 0.0070 | 0.0635 | 3000 | 800 | 2978 | | 0.297/10 | 535 | 558 |
| 219 | 47A45021112 | 6 | HTR | | | | | | | 0.0018 | 3000 | 600 | 2978 | | 0.042/9 | 535 | 571 |
| 220 | 47A45021098 | 6 | HTR | | | | | | | 0.0012 | 3000 | 400 | 2978 | | 0.042/9 | 535 | 571 |
| 221 | 47A42705023 | 6 | VSR | | | | | | | 0.0090 | 2000 | 1700 | 1897 | | 0.650/9 | 535 | 8186 |
| 222 | 671ERCWR128 | 6 | HSS | | | | | | | 0.0176 | 2000 | 800 | 1966 | | 0.039/9 | 535 | 1001 |
| 223 | 47A40108001 | 6 | HTS | | | YES | | | 0.0193 | 0.0143 | 3000 | 1600 | 2711 | | 0.644/9 | 535 | 9982 |
| 224 | 671ERCWR019 | 6 | HTR | | | | | | | 0.0423 | 2000 | 500 | 1966 | | 0.127/9 | 535 | 1358 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 225 | 103A374 | 6 | HTS | | | | | | | 0.0176 | 3000 | 400 | 2956 | | 0.241/9 | 535 | 1969 |
| 226 | 621LCVR244 | 6 | HTS | | | | | | | 0.0086 | 2000 | 200 | 1983 | | 0.054/9 | 535 | 322 |
| 227 | 631SISR043 | 6 | HSR | | | | | | | 0.0140 | 2000 | 400 | 1966 | | 0.198/10 | 535 | 731 |
| 228 | 47A46502037 | 6 | HSS | | | | | | | 0.0166 | 3000 | 500 | 2978 | | 0.229/9 | 535 | 661 |
| 229 | 47A46502040 | 6 | HSS | X | | | | | | 0.0030 | 3000 | 500 | 2933 | | 0.174/9 | 535 | 1336 |
| 230 | 103A487 | 6 | HTS | | | YES | | | 0.0214 | 0.0124 | 1800 | 1500 | 1534 | | 0.413/9 | 535 | 13457 |
| 231 | 103A450 | 6 | VSS | | | YES | | | 0.0600 | 0.0600 | 2000 | 1900 | 2000 | X | 0.322/9 | 535 | 8849 |
| 232 | 47A45021126 | 6 | HTR | | | | | | | 0.0012 | 3000 | 300 | 2978 | | 0.042/9 | 535 | 571 |
| 233 | 103A482 | 6 | HTS | | | | | | | 0.0186 | 2300 | 2250 | 2165 | | 0.363/9 | 535 | 8465 |
| 234 | 103A453 | 6 | HTS | | | YES | | | 0.0316 | 0.0246 | 2000 | 1800 | 1724 | X | 0.597/9 | 535 | 12220 |
| 235 | 47A40007012 | 6 | HSS | | | | | | | 0.0057 | 2800 | 2100 | 2733 | | 0.319/10 | 535 | 3688 |
| 236 | 47A40007011 | 6 | VTR | | | | | | | 0.0200 | 2800 | 2800 | 2467 | X | 0.236/9 | 535 | 24752 |
| 237 | 47A92031117 | 5 | HSS | | X | | | | 0.1649 | 0.1649 | 500 | 100 | 500 | | .000/9 | 228 | 136 |
| 238 | 47A40006200 | 4 | HSS | | | | | | | 0.0197 | 1500 | 1000 | 1500 | | 0.151/9 | 228 | 334 |
| 239 | 03B1AFWR146 | 4 | HTR | | | YES | | | 0.0012 | 0.0002 | 2000 | 1200 | 1962 | | 0.209/10 | 228 | 555 |
| 240 | 47A40006199 | 4 | HSS | | | | | | | 0.0156 | 800 | 600 | 800 | | 0.155/9 | 228 | 250 |
| 241 | 03B1AFWR147 | 4 | VSR | | X | | | | | 0.0020 | 3000 | 2300 | 2944 | | 0.604/10 | 228 | 2912 |
| 242 | 47A40006114 | 4 | VSS | | | YES | | | 0.0021 | 0.0021 | 1800 | 1100 | 1785 | | 0.230/10 | 228 | 599 |
| 243 | 03B1AFWR121 | 4 | HTR | | | YES | | | 0.0003 | 0.0003 | 2000 | 1300 | 2000 | | 0.165/9 | 228 | 601 |
| 244 | 03B1AFWR048 | 4 | VSR | | X | | | | | 0.0020 | 4000 | 2000 | 3946 | | 0.293/9 | 228 | 4054 |
| 245 | 47A40006087 | 4 | HSS | | | | | | | 0.0240 | 1500 | 1000 | 1489 | | 0.198/9 | 228 | 910 |
| 246 | 03B1AFWR137 | 4 | VTR | | | YES | | | 0.0004 | 0.0004 | 2000 | 1100 | 2000 | | 0.271/10 | 228 | 671 |
| 247 | 47A56004088 | 4 | VSR | | | | | | | 0.0002 | 2000 | 300 | 2000 | | 0.045/9 | 228 | 161 |
| 248 | 47A40006085 | 4 | HSS | | | | | | | 0.0118 | 1500 | 1200 | 1489 | | 0.201/9 | 228 | 956 |
| 249 | 163411 | 4 | HTS | | | YES | | | 0.0209 | 0.0209 | 1700 | 800 | 1687 | | 0.200/9 | 228 | 2129 |
| 250 | 621CVCR072 | 4 | VTR | | X | | | | | 0.0020 | 2000 | 1900 | 1965 | | 0.060/9 | 228 | 1409 |
| 251 | 701CCR456 | 4 | HTR | | | | | | | 0.0019 | 2300 | 700 | 2286 | | 0.200/10 | 228 | 597 |
| 252 | 621CVCR073 | 4 | HSR | | X | | | | | 0.0010 | 2000 | 500 | 1982 | | 0.139/10 | 228 | 686 |

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Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res Preload | Mod PL | Max. Str Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 253 | 03B1AFWR149 | 4 | VSR | | | | | | | 0.0021 | 2000 | 1800 | 1982 | | 0.242/9 | 228 | 1943 |
| 254 | 163398 | 4 | VSS | | | YES | | | 0.0049 | 0.0073 | 2000 | 800 | 2000 | | 0.171/10 | 228 | 1509 |
| 255 | 03B1AFWR187 | 4 | VSR | | X | | | | | 0.0030 | 1500 | 900 | 1467 | | 0.255/9 | 228 | 3028 |
| 256 | 168022 | 4 | HTR | X | | YES | | | | 0.0466 | 2000 | 1000 | 1982 | | 0.344/10 | 228 | 2312 |
| 257 | 168031 | 4 | HTS | X | | YES | | | | 0.0009 | 2000 | 600 | 2000 | | 0.428/10 | 228 | 721 |
| 258 | 168036 | 4 | VTS | X | | YES | | | | 0.0073 | 2000 | 200 | 2000 | | 0.366/10 | 228 | 782 |
| 259 | 621CVCR057 | 4 | VTR | | | YES | | | 0.0114 | 0.0074 | 1500 | 700 | 1422 | | 0.098/9 | 228 | 2254 |
| 260 | 701CCR440 | 4 | HTR | | | | | | | 0.0012 | 2300 | 700 | 2286 | | 0.038/9 | 228 | 400 |
| 261 | 621CVCR046 | 4 | VTR | | | | | | | 0.0026 | 2000 | 300 | 1982 | [redacted] | 0.276/9 | 228 | 723 |
| 262 | 03B1AFWR049 | 4 | VSR | | X | | | | | 0.0010 | 4000 | 1900 | 3973 | | 0.261/9 | 228 | 2558 |
| 263 | 47A40006197 | 4 | HSS | | | | | | | 0.0312 | 1500 | 1300 | 1500 | | 0.180/9 | 228 | 432 |
| 264 | 03B1AFWR191 | 4 | HTR | | X | YES | | | | 0.0010 | 2000 | 600 | 1982 | | 0.229/9 | 228 | 1238 |
| 265 | 03B1AFWR161 | 4 | HTR | | | YES | | | 0.0592 | 0.0582 | 1500 | 1100 | 1467 | | 0.221/9 | 228 | 3824 |
| 266 | 47A40006191 | 4 | VTS | | | | | | | 0.0296 | 1500 | 300 | 1500 | | 0.244/9 | 228 | 238 |
| 267 | 47A40006196 | 4 | HSS | | | | | | | 0.0123 | 1800 | 1800 | 1785 | X | 0.274/9 | 228 | 1162 |
| 268 | 47A42705005 | 4 | VSS | | | | | | | 0.0279 | 2000 | 600 | 1965 | | 0.349/9 | 228 | 3593 |
| 269 | 03B1AFWR175 | 4 | HTR | | X | YES | | | | 0.0020 | 1500 | 700 | 1476 | | 0.772/10 | 228 | 2347 |
| 270 | 03B1AFWR202 | 4 | HSR | | | YES | | | 0.0460 | 0.0440 | 1500 | 600 | 1433 | | 0.112/10 | 228 | 3986 |
| 271 | 47A40007046 | 4 | HSS | | | | | | | 0.0166 | 1500 | 300 | 1489 | | 0.239/10 | 228 | 964 |
| 272 | 03B1AFWR197 | 4 | VSR | | | | | | | 0.0020 | 2000 | 500 | 1982 | | 0.261/9 | 228 | 1070 |
| 273 | 47A46501066 | 4 | HSS | | X | YES | | | | 0.0050 | 1500 | 1300 | 1444 | | 0.649/10 | 228 | 2996 |
| 274 | 03B1AFWR192 | 4 | VSR | | X | | | | | 0.0030 | 1500 | 700 | 1467 | | 0.292/9 | 228 | 3460 |
| 275 | 03B1AFWR209 | 4 | HTS | | | YES | | | 0.0429 | 0.0429 | 2000 | 800 | 1982 | | 0.907/10 | 228 | 1032 |
| 276 | 03B1AFWR113 | 4 | VSR | | X | | | | | 0.0020 | 1000 | 800 | 982 | | 0.466/10 | 228 | 1700 |
| 277 | 47A40006118 | 4 | HTS | | | | | | | 0.0037 | 1500 | 1200 | 1500 | | 0.909/10 | 228 | 306 |
| 278 | 47A49606009 | 4 | HSS | | | | | | | 0.0370 | 1000 | 700 | 973 | | 0.765/10 | 228 | 2079 |
| 279 | 47A40006198 | 4 | HSS | | | | | | | 0.0156 | 1500 | 900 | 1500 | | 0.181/9 | 228 | 198 |
| 280 | 47A49605012 | 4 | HTS | | | | | | | 0.0210 | 2000 | 300 | 2000 | | 0.211/10 | 228 | 316 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 281 | 162A364 | 3 | VSS | | | YES | | | 0.0084 | 0.0084 | 1500 | 300 | 1500 | | 0.195/9 | 150 | 738 |
| 282 | 781FPCR063 | 3 | HSR | | X | YES | | | | 0.0030 | 1800 | 1600 | 1756 | | 0.053/9 | 150 | 2145 |
| 283 | 162A357 | 3 | HTS | | | YES | | | 0.0100 | 0.0100 | 1500 | 100 | 1500 | | 0.332/9 | 150 | 556 |
| 284 | 47A55503015 | 3 | HTR | | | YES | | | 0.0000 | 0.0000 | 2400 | 2300 | 2400 | | 0.243/9 | 150 | 140 |
| 285 | 621LCVR042 | 3 | HTS | | | YES | | | 0.0036 | 0.0036 | 1200 | 300 | 1176 | | 0.164/9 | 150 | 615 |
| 286 | 621LCVR050 | 3 | HTR | | | | | | | 0.0033 | 1000 | 100 | 1000 | | 0.057/9 | 150 | 141 |
| 287 | 162A366 | 3 | HTS | X | | YES | | | | 0.0000 | 2000 | 300 | 2000 | | 0.349/9 | 150 | 1231 |
| 288 | 621CVCR102 | 3 | HSR | | X | | | | | 0.0020 | 1400 | 1100 | 1377 | | 0.181/9 | 150 | 2030 |
| 289 | 621LCVR036 | 3 | HTR | | | YES | | | 0.0040 | 0.0030 | 1200 | 100 | 1188 | | 0.104/9 | 150 | 205 |
| 290 | 47A55503017 | 3 | HTR | | | | | | | 0.0250 | 1000 | 500 | 1000 | | 0.077/9 | 150 | 199 |
| 291 | 47A55503012 | 3 | HTR | | | YES | | | 0.0599 | 0.0589 | 1600 | 1300 | 1585 | | 0.097/9 | 150 | 203 |
| 292 | 47A55511005 | 3 | HSR | | | | | | | 0.0187 | 1500 | 200 | 1500 | | 0.016/9 | 150 | 92 |
| 293 | 47A55503010 | 3 | HTR | | | YES | | | 0.0280 | 0.0270 | 1600 | 1200 | 1585 | | 0.158/9 | 150 | 263 |
| 294 | 47A55503006 | 3 | HSR | | | | | | 0.0402 | 0.0741 | 1000 | 800 | 1000 | | 0.142/10 | 150 | 335 |
| 295 | 47A46503048 | 3 | HTS | | | YES | | | 0.0349 | 0.0319 | 1200 | 600 | 1141 | | 0.691/10 | 150 | 1626 |
| 296 | 162A345 | 3 | VTS | | | YES | X | | 0.0630 | 0.0630 | 2000 | 100 | 2000 | | 0.376/10 | 150 | 667 |
| 297 | 47A55503014 | 3 | HSR | | | YES | | | 0.0156 | 0.0156 | 1600 | 900 | 1600 | | 0.128/9 | 150 | 169 |
| 298 | 162A325 | 3 | HSS | | | YES | | | | 0.0000 | 2000 | 500 | 2000 | | 0.175/9 | 150 | 386 |
| 299 | 47A55503013 | 3 | HTR | | | YES | | | 0.0166 | 0.0156 | 1600 | 1500 | 1585 | | 0.115/9 | 150 | 198 |
| 300 | 702CCR022 | 3 | VTR | | | | | | | 0.0001 | 2300 | 1000 | 2300 | | 0.293/9 | 150 | 245 |
| 301 | 621LCVR074 | 3 | HTR | | X | YES | | | | 0.0010 | 1000 | 500 | 991 | | 0.112/10 | 150 | 787 |
| 302 | 622LCVR002 | 3 | HTR | | | YES | | | 0.0001 | 0.0001 | 1500 | 1200 | 1500 | | 0.072/9 | 150 | 143 |
| 303 | 622LCVR005 | 3 | HTR | | | YES | X | | 0.0630 | 0.0637 | 1600 | 1000 | 1585 | | 0.073/9 | 150 | 205 |
| 304 | 621LCVV101 | 3 | VSR | | X | YES | | | | 0.0000 | 2000 | 500 | 2000 | | 0.128/10 | 150 | 266 |
| 305 | 621LCVR099 | 3 | HTR | | X | | | | | 0.0010 | 1200 | 300 | 1188 | | 0.063/10 | 150 | 465 |
| 306 | 621LCVR220 | 3 | HTR | | | | | | | 0.0028 | 1000 | 900 | 991 | | 0.110/9 | 150 | 472 |
| 307 | 170329 | 3 | VSS | | | | | | | 0.0122 | 2300 | 1900 | 2266 | | 0.209/10 | 150 | 874 |
| 308 | 631SISR248 | 3 | HTS | | | YES | | | 0.0011 | 0.0001 | 1700 | 900 | 1687 | | 0.228/10 | 150 | 248 |

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Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 309 | 47A40006259 | 3 | HSS | | | | | | | 0.0376 | 1500 | 1000 | 1500 | | 0.270/10 | 150 | 507 |
| 310 | 47A40006260 | 3 | HSS | | | | | | | 0.0500 | 1000 | 400 | 991 | | 0.252/10 | 150 | 865 |
| 311 | 631SISR274 | 3 | VSR | | | YES | | | 0.0404 | 0.0590 | 1700 | 800 | 1687 | | 0.090/9 | 150 | 505 |
| 312 | 671ERCWR258 | 3 | VTR | | | | | | | 0.0166 | 2000 | 1400 | 1982 | | 0.235/9 | 150 | 610 |
| 313 | 671ERCWR205 | 3 | HSR | | | | | | | 0.0177 | 2000 | 1000 | 1982 | | 0.156/10 | 150 | 442 |
| 314 | 621LCVR078 | 3 | HSR | | | YES | | | 0.0072 | 0.0062 | 800 | 600 | 785 | | 0.191/10 | 150 | 629 |
| 315 | 621LCVR079 | 3 | HSR | | X | YES | | | | 0.0000 | 2000 | 700 | 2000 | | 0.066/10 | 150 | 279 |
| 316 | 621LCVR098 | 3 | HSR | | X | YES | | | | 0.0000 | 1200 | 300 | 1200 | | 0.042/10 | 150 | 163 |
| 317 | 47A40006123 | 2 | HSS | | | | | | | 0.0109 | 1000 | 400 | 1000 | | 0.205/9 | 150 | 631 |
| 318 | 741RHRR190 | 2 | HTS | | | YES | | | 0.0166 | 0.0156 | 1000 | 300 | 990 | | 0.164/9 | 150 | 99 |
| 319 | 162A034 | 2 | HTS | X | | | | | | 0.0000 | 2000 | 700 | 2000 | | 0.395/10 | 150 | 166 |
| 320 | 47A42708024 | 2 | HSR | | | YES | | | 0.0604 | 0.0895 | 1000 | 300 | 1000 | | 0.075/10 | 150 | 160 |
| 321 | 103A569 | 2 | VSR | | X | | | | | 0.0000 | 1000 | 500 | 1000 | | 0.123/9 | 150 | 178 |
| 322 | 47A42703041 | 2 | VSS | | | | | | | 0.0120 | 1000 | 500 | 1000 | | 0.363/9 | 150 | 980 |
| 323 | 741RHRR196 | 2 | HTS | | | YES | | | 0.0016 | 0.0210 | 1000 | 700 | 990 | | 0.159/9 | 150 | 396 |
| 324 | 741RHRR194 | 2 | HTS | | | YES | | | 0.0030 | 0.0020 | 1500 | 1200 | 1489 | | 0.117/9 | 150 | 114 |
| 325 | 47A40006126 | 2 | HSS | | | | | | | 0.0262 | 1000 | 1000 | 1000 | | 0.204/9 | 150 | 314 |
| 326 | 741RHRR192 | 2 | HTS | | | YES | | | 0.0166 | 0.0156 | 1000 | 300 | 990 | | 0.171/9 | 150 | 193 |
| 327 | 163038 | 2 | HTS | X | | YES | | | | 0.0000 | 1700 | 1100 | 1700 | | 0.267/10 | 150 | 220 |
| 328 | 103A582 | 2 | HSS | | | | | | | 0.0250 | 1000 | 904 | 990 | | 0.452/9 | 150 | 1009 |
| 329 | 162A536 | 2 | HSR | | | YES | | | 0.0388 | 0.0434 | 500 | 300 | 497 | | 0.242/9 | 150 | 261 |
| 330 | 621LCVR097 | 2 | HSR | | | YES | | | 0.0090 | 0.0090 | 1000 | 750 | 990 | | 0.115/10 | 150 | 330 |
| 331 | 163572 | 2 | HSS | | | | | | | 0.0198 | 3000 | 2900 | 3000 | | 0.226/9 | 150 | 916 |
| 332 | 47A40006083 | 2 | HSS | | | | | | | 0.0350 | 1000 | 300 | 1000 | | 0.081/9 | 150 | 241 |
| 333 | 162A006 | 2 | HSS | X | | | | | | 0.0000 | 1000 | 900 | 1000 | | 0.146/9 | 150 | 294 |
| 334 | 162A002 | 2 | HTS | X | | YES | | | | 0.0000 | 1000 | 400 | 1000 | | 0.187/9 | 150 | 693 |
| 335 | 631SISR266 | 1 | VTR | | | | | | | 0.0166 | 2000 | 300 | 1982 | | 0.130/9 | 150 | 1161 |
| 336 | 47A46508092 | 1 | HTR | | | YES | | | 0.0406 | 0.0406 | 400 | 300 | 400 | | 0.480/10 | 150 | 292 |

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Total U-Bolt Support Population

| | Support Number | Pipe Diam | Sup. Type | Cl. 1 | Fitting | Gapped BW | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Comp. Dyn. Deflect. | Comp. Max. Deflect. | Actual Preload | Min. Reqd. Preload | Hypt. Res. Preload | Mod. PL | Max. Str. Int./Eq. | MDL | Max. Str. Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 337 | 47A40608068 | 0.75 | HSS | X | | YES | | | | 0.0000 | 400 | 150 | 400 | | 0.077/9 | 150 | 78 |
| 338 | 162A468 | 0.75 | HTS | | | YES | | | 0.0012 | 0.0012 | 1200 | 1200 | 1200 | | 0.537/10 | 150 | 109 |
| 339 | 162A680 | 0.75 | HSS | | | | | | | 0.0001 | 500 | 200 | 500 | | 0.208/10 | 150 | 121 |
| 340 | 47A43508023 | 0.75 | HSS | | | YES | | | 0.0110 | 0.0110 | 500 | 400 | 500 | | 0.089/9 | 150 | 47 |
| 341 | 162A407 | 0.75 | HSS | | | YES | | | 0.0000 | 0.0000 | 350 | 0 | 350 | | 0.351/10 | 150 | 15 |
| 342 | 162A406 | 0.75 | HSS | | | YES | | | 0.0138 | 0.0138 | 400 | 250 | 400 | | 0.866/10 | 150 | 65 |
| 343 | 47A40610018 | 0.75 | HSS | | | YES | | | 0.0185 | 0.0185 | 2000 | 1800 | 2000 | | 0.559/10 | 150 | 232 |
| 344 | 162A431 | 0.75 | HTS | X | | YES | | | | 0.0000 | 1000 | 800 | 1000 | | 0.417/9 | 150 | 123 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 1 | 671ERCWR436 | 36 | | | | | 0.102 | 0.040 |
| 2 | 671ERCWR440 | 36 | | | | | 0.176 | |
| 3 | 671ERCWR349 | 36 | | | | | 0.174 | |
| 4 | 671ERCWR348 | 36 | | | | | 0.105 | 0.038 |
| 5 | 671ERCWR445 | 36 | | X | | | 0.104 | |
| 6 | 101A313 | 32 | | | 0.074 | 0.013 | 0.055 | 0.013 |
| 7 | 101A308 | 32 | | | 0.154 | 0.016 | 0.069 | 0.016 |
| 8 | 101A348 | 32 | | | 0.030 | 0.016 | 0.020 | 0.016 |
| 9 | 101A350 | 32 | | | | | 0.057 | 0.016 |
| 10 | 101A429 | 32 | | | | | 0.026 | 0.016 |
| 11 | 101A435 | 32 | | | | | 0.057 | 0.008 |
| 12 | 101A424 | 32 | | | 0.104 | 0.020 | 0.054 | 0.020 |
| 13 | 101A389 | 32 | | | | | 0.018 | 0.018 |
| 14 | 101A392 | 32 | | | | | 0.054 | 0.016 |
| 15 | 47A45003154 | 30 | | | | | 0.158 | |
| 16 | 671ERCWR030 | 24 | | | 0.049 | 0.009 | 0.084 | 0.016 |
| 17 | 631SISR121 | 24 | | | 0.044 | 0.011 | 0.072 | 0.019 |
| 18 | 631SISR115 | 24 | | | 0.036 | 0.003 | 0.071 | 0.006 |
| 19 | 671ERCWR207 | 24 | | | 0.049 | 0.009 | 0.084 | 0.016 |
| 20 | 671ERCWR145 | 24 | | | 0.054 | 0.012 | 0.083 | 0.018 |
| 21 | 671ERCWR092 | 24 | | | 0.041 | 0.027 | 0.065 | 0.042 |
| 22 | 47A46409001 | 24 | | | 0.047 | 0.025 | 0.078 | 0.042 |
| 23 | 47A45004036 | 24 | | X | | | 0.091 | |
| 24 | 47A43503005 | 24 | | | | | 0.034 | 0.107 |
| 25 | 631SISR114 | 24 | | | | | 0.050 | 0.005 |
| 26 | 631SISR112 | 24 | | | | | 0.058 | 0.008 |
| 27 | 631SISR109 | 24 | | | | | 0.086 | 0.024 |
| 28 | 671ERCWR283 | 24 | | | 0.081 | 0.012 | 0.085 | 0.013 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 29 | 671ERCWR292 | 24 | | | 0.067 | 0.010 | 0.107 | 0.016 |
| 30 | 671ERCWR310 | 24 | | | | | 0.129 | |
| 31 | 671ERCWR282 | 24 | | | 0.055 | 0.009 | 0.095 | 0.016 |
| 32 | 671ERCWR231 | 24 | | | 0.034 | 0.004 | 0.070 | 0.009 |
| 33 | 671ERCWR220 | 24 | | | | | 0.105 | |
| 34 | 671ERCWR312 | 24 | | | | | 0.131 | |
| 35 | 701CCR243 | 24 | | | | | 0.143 | |
| 36 | 701CCR249 | 24 | | X | | | 0.081 | |
| 37 | 671ERCWR214 | 24 | | | | | 0.056 | 0.002 |
| 38 | 671ERCWR388 | 24 | | | | | 0.045 | 0.004 |
| 39 | 671ERCWR389 | 24 | | | | | 0.032 | 0.016 |
| 40 | 701CCR239 | 24 | | | | | 0.054 | 0.005 |
| 41 | 671ERCWR371 | 20 | | | | | 0.033 | 0.013 |
| 42 | 671ERCWR368 | 20 | | | | | 0.037 | 0.022 |
| 43 | 671ERCWR373 | 20 | | | | | 0.030 | 0.000 |
| 44 | 701CCR079 | 20 | | | | | 0.060 | 0.078 |
| 45 | 701CCR062 | 20 | | | 0.010 | 0.042 | 0.042 | 0.029 |
| 46 | 671ERCWR046 | 20 | | | | | 0.027 | 0.017 |
| 47 | 631SISR219 | 20 | | | 0.061 | 0.013 | 0.084 | 0.017 |
| 48 | 631SISR218 | 20 | | | 0.093 | 0.035 | 0.047 | 0.064 |
| 49 | 47A45003084 | 20 | | | 0.037 | 0.008 | 0.047 | 0.016 |
| 50 | 701CCR391 | 18 | | | | | 0.019 | 0.014 |
| 51 | 701CCR393 | 18 | | | | | 0.013 | 0.010 |
| 52 | 701CCR404 | 18 | | | | | 0.018 | 0.025 |
| 53 | 701CCR418 | 18 | | | | | 0.027 | 0.007 |
| 54 | 701CCR421 | 18 | | | | | 0.018 | 0.025 |
| 55 | 701CCR411 | 18 | | | | | 0.020 | 0.013 |
| 56 | 701CCR428 | 18 | | | | | 0.065 | 0.084 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 57 | 701CCR389 | 18 | | | 0.014 | 0.040 | 0.024 | 0.068 |
| 58 | 671ERCWR301 | 18 | | | | | 0.012 | 0.003 |
| 59 | 671ERCWR295 | 18 | | | | | 0.022 | 0.004 |
| 60 | 671ERCWR269 | 18 | | | | | 0.015 | 0.016 |
| 61 | 671ERCWR463 | 18 | | | | | 0.020 | 0.010 |
| 62 | 701CCR228 | 18 | | | | | 0.016 | 0.005 |
| 63 | 701CCR155 | 18 | | | 0.040 | 0.021 | 0.050 | 0.026 |
| 64 | 672ERCWR023 | 18 | | | 0.015 | 0.063 | 0.015 | 0.073 |
| 65 | 701CCR429 | 18 | | | | | 0.033 | 0.006 |
| 66 | 701CCR621 | 18 | | | 0.020 | 0.016 | 0.042 | 0.034 |
| 67 | 701CCR672 | 18 | | | | | 0.025 | 0.006 |
| 68 | 701CCR605 | 18 | | | | | 0.033 | 0.018 |
| 69 | 701CCR594 | 18 | | | | | 0.035 | 0.008 |
| 70 | 701CCR601 | 18 | | | 0.023 | 0.022 | 0.042 | 0.039 |
| 71 | 701CCR779 | 18 | | | | | 0.035 | 0.000 |
| 72 | 701CCR776 | 18 | | | | | 0.035 | 0.025 |
| 73 | 701CCR694 | 18 | | | | | 0.022 | 0.011 |
| 74 | 701CCR675 | 18 | | X | | | 0.035 | |
| 75 | 701CCR692 | 18 | | | | | 0.039 | 0.016 |
| 76 | 701CCR562 | 18 | | | | | 0.025 | 0.033 |
| 77 | 701CCR551 | 18 | | | | | 0.023 | 0.006 |
| 78 | 701CCR450 | 18 | | | | | 0.039 | 0.006 |
| 79 | 701CCR556 | 18 | | | | | 0.017 | 0.007 |
| 80 | 701CCR452 | 18 | | | 0.027 | 0.006 | 0.059 | 0.014 |
| 81 | 701CCR443 | 18 | | | | | 0.029 | 0.015 |
| 82 | 701CCR553 | 18 | | | | | 0.021 | 0.005 |
| 83 | 103A320 | 16 | | | | | 0.014 | 0.022 |
| 84 | 671ERCWR352 | 16 | | | | | 0.024 | 0.011 |

Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 85 | 701CCR758 | 16 | | | | | 0.040 | 0.016 |
| 86 | 701CCR528 | 16 | | | | | 0.008 | 0.023 |
| 87 | 701CCR761 | 16 | | | 0.028 | 0.025 | 0.034 | 0.030 |
| 88 | 631SISR131 | 16 | | X | | | 0.044 | |
| 89 | 47A46402237 | 16 | | | | | 0.006 | 0.044 |
| 90 | 103A240 | 16 | | | | | 0.008 | 0.011 |
| 91 | 103A280 | 16 | | | 0.050 | 0.007 | 0.029 | 0.007 |
| 92 | 103A200 | 16 | | | | | 0.009 | 0.045 |
| 93 | 701CCR156 | 16 | | | | | 0.021 | 0.015 |
| 94 | 47A43201031 | 14 | | | | | 0.011 | 0.020 |
| 95 | 631SISR221 | 14 | | | | | 0.005 | 0.019 |
| 96 | 47A43201005 | 14 | | | | | 0.017 | 0.009 |
| 97 | 631SISR182 | 14 | | | | | 0.019 | 0.014 |
| 98 | 631SISR230 | 14 | | X | | | 0.006 | |
| 99 | 174020 | 14 | X | | | | 0.002 | |
| 100 | 174008 | 14 | X | | | | 0.006 | |
| 101 | 631SISR140 | 14 | | X | | | 0.012 | |
| 102 | 631SISR137 | 14 | | X | | | 0.036 | |
| 103 | 631SISR138 | 14 | | X | | | 0.039 | |
| 104 | 631SISR161 | 14 | | X | | | 0.051 | |
| 105 | 631SISR162 | 14 | | X | | | 0.018 | |
| 106 | 631SISR164 | 14 | | X | | | 0.003 | |
| 107 | 174007 | 14 | X | | | | 0.006 | |
| 108 | 631SISR142 | 14 | | | | | 0.005 | 0.016 |
| 109 | 631SISR212 | 12 | | | | | 0.006 | 0.004 |
| 110 | 47A46409149 | 12 | | | | | 0.012 | 0.004 |
| 111 | 631SISR206 | 12 | | | 0.017 | 0.005 | 0.012 | 0.013 |
| 112 | 701CCR335 | 12 | | | | | 0.010 | 0.016 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 113 | 701CCR319 | 12 | | | | | 0.005 | 0.003 |
| 114 | 701CCR725 | 12 | | | | | 0.004 | 0.005 |
| 115 | 701CCR357 | 12 | | | | | 0.006 | 0.009 |
| 116 | 701CCR369 | 12 | | | 0.005 | 0.024 | 0.013 | 0.061 |
| 117 | 701CCR362 | 12 | | | | | 0.008 | 0.040 |
| 118 | 701CCR359 | 12 | | | | | 0.007 | 0.004 |
| 119 | 631SISR227 | 12 | | X | | | 0.017 | |
| 120 | 631SISR226 | 12 | | X | | | 0.008 | |
| 121 | 631SISR214 | 12 | | | | | 0.011 | 0.003 |
| 122 | 631SISR238 | 12 | | X | | | 0.005 | |
| 123 | 701CCR731 | 12 | | | | | 0.033 | 0.011 |
| 124 | 701CCR732 | 12 | | | | | 0.010 | 0.016 |
| 125 | 701CCR734 | 12 | | | | | 0.011 | 0.016 |
| 126 | 47A45003085 | 12 | | | | | 0.005 | 0.020 |
| 127 | 47A45003163 | 12 | | | | | 0.008 | 0.007 |
| 128 | 47A45003099 | 12 | | X | | | 0.005 | |
| 129 | 47A45003100 | 12 | | | | | 0.032 | 0.061 |
| 130 | 47A46403135 | 12 | | | 0.008 | 0.037 | 0.008 | 0.075 |
| 131 | 47A42708028 | 10 | | | | | 0.001 | 0.016 |
| 132 | 721CSR031 | 10 | | X | | | 0.004 | |
| 133 | 721CSR117 | 10 | | | 0.035 | 0.036 | 0.016 | 0.040 |
| 134 | 721CSR115 | 10 | | | 0.053 | 0.014 | 0.024 | 0.022 |
| 135 | 47A43705008 | 10 | | | | | 0.017 | 0.028 |
| 136 | 701CCR282 | 10 | | | | | 0.007 | 0.001 |
| 137 | 721CSR013 | 10 | | X | | | 0.001 | |
| 138 | 721CSR003 | 10 | | X | | | 0.003 | |
| 139 | 721CSR124 | 10 | | | 0.033 | 0.016 | 0.015 | 0.016 |
| 140 | 701CCR133 | 10 | | | | | 0.024 | 0.027 |

Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 141 | 781FPCR021 | 10 | | | | | 0.005 | 0.004 |
| 142 | 701CCR469 | 10 | | | | | 0.004 | 0.006 |
| 143 | 701CCR471 | 10 | | | | | 0.003 | 0.007 |
| 144 | 701CCR473 | 10 | | | | | 0.004 | 0.004 |
| 145 | 701CCR614 | 10 | | | | | 0.006 | 0.002 |
| 146 | 163454 | 10 | X | | | | 0.005 | |
| 147 | 781FPCR049 | 10 | | X | | | 0.019 | |
| 148 | 163591 | 8 | | | 0.001 | 0.016 | 0.000 | 0.016 |
| 149 | 261FPR122 | 8 | | | | | 0.008 | 0.024 |
| 150 | 261FPR154 | 8 | | | | | 0.002 | 0.002 |
| 151 | 37A20601020 | 8 | | | | | 0.006 | 0.016 |
| 152 | 37A20601019 | 8 | | | | | 0.006 | 0.016 |
| 153 | 671ERCWR496 | 8 | | | | | 0.010 | 0.006 |
| 154 | 701CCR145 | 8 | | | | | 0.004 | 0.008 |
| 155 | 701CCR147 | 8 | | | | | 0.002 | 0.003 |
| 156 | 701CCR176 | 8 | | | | | 0.011 | 0.005 |
| 157 | 671ERCWR239 | 8 | | | | | 0.008 | 0.009 |
| 158 | 672ERCWR038 | 8 | | | | | 0.010 | 0.016 |
| 159 | 701CCR142 | 8 | | | | | 0.004 | 0.016 |
| 160 | 701CCR177 | 8 | | | | | 0.002 | 0.000 |
| 161 | 701CCR180 | 8 | | | | | 0.004 | 0.007 |
| 162 | 701CCR181 | 8 | | | | | 0.005 | 0.003 |
| 163 | 47A45002110 | 8 | | | | | 0.016 | 0.016 |
| 164 | 631SISR237 | 8 | | | | | 0.002 | 0.009 |
| 165 | 701CCR178 | 8 | | | | | 0.004 | 0.003 |
| 166 | 47A43203003 | 8 | | | 0.001 | 0.004 | 0.001 | 0.004 |
| 167 | 621CVCR021 | 8 | | X | | | 0.005 | |
| 168 | 621CVCR001 | 8 | | X | | | 0.008 | |

Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 169 | 671ERCWR325 | 8 | | | | | 0.010 | 0.006 |
| 170 | 702CCR031 | 8 | | | | | 0.010 | 0.005 |
| 171 | 701CCR757 | 8 | | | | | 0.006 | 0.016 |
| 172 | 781FPCR047 | 8 | | X | | | 0.009 | |
| 173 | 701CCR765 | 8 | | | | | 0.008 | 0.004 |
| 174 | 741RHRR003 | 8 | | | 0.027 | 0.029 | 0.011 | 0.035 |
| 175 | 741RHRR130 | 8 | | | | | 0.005 | 0.016 |
| 176 | 741RHRR133 | 8 | | | | | 0.002 | 0.004 |
| 177 | 741RHRR231 | 8 | | | 0.012 | 0.005 | 0.006 | 0.005 |
| 178 | 741RHRR101 | 8 | | X | | | 0.003 | |
| 179 | 741RHRR004 | 8 | | X | | | 0.010 | |
| 180 | 741RHRR017 | 8 | | X | | | 0.008 | |
| 181 | 741RHRR058 | 8 | | | | | 0.006 | 0.054 |
| 182 | 701CCR754 | 8 | | | | | 0.008 | 0.016 |
| 183 | 701CCR585 | 8 | | | | | 0.002 | 0.001 |
| 184 | 163055 | 8 | | | 0.000 | 0.001 | 0.000 | 0.001 |
| 185 | 163032 | 8 | | | 0.003 | 0.013 | 0.002 | 0.012 |
| 186 | 622CVCR001 | 8 | | X | | | 0.007 | |
| 187 | 671ERCWR471 | 8 | | | | | 0.002 | 0.000 |
| 188 | 671ERCWR365 | 8 | | | | | 0.003 | 0.016 |
| 189 | 781FPCR074 | 8 | | X | | | 0.010 | |
| 190 | 701CCR649 | 8 | | | | | 0.014 | 0.006 |
| 191 | 701CCR648 | 8 | | | | | 0.008 | 0.002 |
| 192 | 163030 | 8 | | | 0.001 | 0.058 | 0.001 | 0.058 |
| 193 | 701CCR637 | 8 | | | | | 0.006 | 0.016 |
| 194 | 701CCR753 | 8 | | | | | 0.006 | 0.016 |
| 195 | 671ERCWR542 | 6 | | | | | 0.002 | 0.006 |
| 196 | 671ERCWR546 | 6 | | | | | 0.005 | 0.039 |

Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 197 | 671ERCWR552 | 6 | | | | | 0.001 | 0.002 |
| 198 | 671ERCWR529 | 6 | | | | | 0.001 | 0.011 |
| 199 | 671ERCWR525 | 6 | | | | | 0.002 | 0.011 |
| 200 | 671ERCWR532 | 6 | | | | | 0.001 | 0.011 |
| 201 | 671ERCWR534 | 6 | | | | | 0.001 | 0.011 |
| 202 | 671ERCWR360 | 6 | | | | | 0.001 | 0.000 |
| 203 | 671ERCWR555 | 6 | | | | | 0.001 | 0.030 |
| 204 | 163060 | 6 | X | | | | 0.000 | |
| 205 | 163462 | 6 | X | | | | 0.001 | |
| 206 | 168018 | 6 | X | | | | 0.002 | |
| 207 | 721CSR093 | 6 | | | | | 0.009 | 0.005 |
| 208 | 163021 | 6 | | | 0.000 | 0.003 | 0.000 | 0.003 |
| 209 | 163064 | 6 | | | 0.000 | 0.010 | 0.000 | 0.010 |
| 210 | 168120 | 6 | | | 0.007 | 0.002 | 0.003 | 0.002 |
| 211 | 671ERCWR563 | 6 | | | | | 0.001 | 0.009 |
| 212 | 671ERCWR561 | 6 | | | | | 0.002 | 0.009 |
| 213 | 671ERCWR558 | 6 | | | | | 0.001 | 0.020 |
| 214 | 168427 | 6 | X | | | | 0.001 | |
| 215 | 03B1AFWR043 | 6 | | | | | 0.001 | 0.016 |
| 216 | 671ERCWR600 | 6 | | X | | | 0.004 | |
| 217 | 47A45021084 | 6 | | | | | 0.001 | 0.000 |
| 218 | 47A45002078 | 6 | | | 0.001 | 0.006 | 0.001 | 0.063 |
| 219 | 47A45021112 | 6 | | | | | 0.001 | 0.001 |
| 220 | 47A45021098 | 6 | | | | | 0.001 | 0.000 |
| 221 | 47A42705023 | 6 | | | | | 0.006 | 0.003 |
| 222 | 671ERCWR128 | 6 | | | | | 0.002 | 0.016 |
| 223 | 47A40108001 | 6 | | | 0.013 | 0.006 | 0.008 | 0.006 |
| 224 | 671ERCWR019 | 6 | | | | | 0.002 | 0.040 |

Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 225 | 103A374 | 6 | | | | | 0.002 | 0.016 |
| 226 | 621LCVR244 | 6 | | | | | 0.001 | 0.008 |
| 227 | 631SISR043 | 6 | | | | | 0.002 | 0.012 |
| 228 | 47A46502037 | 6 | | | | | 0.001 | 0.016 |
| 229 | 47A46502040 | 6 | X | | | | 0.003 | |
| 230 | 103A487 | 6 | | | 0.018 | 0.003 | 0.009 | 0.003 |
| 231 | 103A450 | 6 | | | 0.000 | 0.000 | 0.006 | 0.054 |
| 232 | 47A45021126 | 6 | | | | | 0.001 | 0.000 |
| 233 | 103A482 | 6 | | | | | 0.006 | 0.013 |
| 234 | 103A453 | 6 | | | 0.016 | 0.016 | 0.009 | 0.016 |
| 235 | 47A40007012 | 6 | | | | | 0.003 | 0.003 |
| 236 | 47A40007011 | 6 | | | | | 0.015 | 0.005 |
| 237 | 47A92031117 | 5 | | X | | | 0.000 | 0.165 |
| 238 | 47A40006200 | 4 | | | | | 0.000 | 0.020 |
| 239 | 03B1AFWR146 | 4 | | | 0.001 | 0.000 | 0.000 | 0.000 |
| 240 | 47A40006199 | 4 | | | | | 0.000 | 0.016 |
| 241 | 03B1AFWR147 | 4 | | X | | | 0.002 | |
| 242 | 47A40006114 | 4 | | | 0.001 | 0.001 | 0.001 | 0.001 |
| 243 | 03B1AFWR121 | 4 | | | 0.000 | 0.000 | 0.000 | 0.000 |
| 244 | 03B1AFWR048 | 4 | | X | | | 0.002 | |
| 245 | 47A40006087 | 4 | | | | | 0.001 | 0.023 |
| 246 | 03B1AFWR137 | 4 | | | 0.000 | 0.000 | 0.000 | 0.000 |
| 247 | 47A56004088 | 4 | | | | | 0.000 | 0.000 |
| 248 | 47A40006085 | 4 | | | | | 0.001 | 0.011 |
| 249 | 163411 | 4 | | | 0.001 | 0.020 | 0.001 | 0.020 |
| 250 | 621CVCR072 | 4 | | X | | | 0.002 | |
| 251 | 701CCR456 | 4 | | | | | 0.001 | 0.001 |
| 252 | 621CVCR073 | 4 | | X | | | 0.001 | |

Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 253 | 03B1AFWR149 | 4 | | | | | 0.001 | 0.001 |
| 254 | 163398 | 4 | | | 0.001 | 0.004 | 0.000 | 0.007 |
| 255 | 03B1AFWR187 | 4 | | X | | | 0.003 | |
| 256 | 168022 | 4 | X | | | | 0.001 | 0.046 |
| 257 | 168031 | 4 | X | | | | 0.000 | 0.001 |
| 258 | 168036 | 4 | X | | | | 0.000 | 0.007 |
| 259 | 621CVCR057 | 4 | | | 0.007 | 0.004 | 0.003 | 0.004 |
| 260 | 701CCR440 | 4 | | | | | 0.001 | 0.000 |
| 261 | 621CVCR046 | 4 | | | | | 0.001 | 0.002 |
| 262 | 03B1AFWR049 | 4 | | X | | | 0.001 | |
| 263 | 47A40006197 | 4 | | | | | 0.000 | 0.031 |
| 264 | 03B1AFWR191 | 4 | | X | | | 0.001 | |
| 265 | 03B1AFWR161 | 4 | | | 0.003 | 0.056 | 0.002 | 0.056 |
| 266 | 47A40006191 | 4 | | | | | 0.000 | 0.030 |
| 267 | 47A40006196 | 4 | | | | | 0.001 | 0.011 |
| 268 | 47A42705005 | 4 | | | | | 0.002 | 0.026 |
| 269 | 03B1AFWR175 | 4 | | X | | | 0.002 | |
| 270 | 03B1AFWR202 | 4 | | | 0.006 | 0.042 | 0.002 | 0.042 |
| 271 | 47A40007046 | 4 | | | | | 0.001 | 0.016 |
| 272 | 03B1AFWR197 | 4 | | | | | 0.001 | 0.001 |
| 273 | 47A46501066 | 4 | | X | | | 0.005 | |
| 274 | 03B1AFWR192 | 4 | | X | | | 0.003 | |
| 275 | 03B1AFWR209 | 4 | | | 0.001 | 0.042 | 0.001 | 0.042 |
| 276 | 03B1AFWR113 | 4 | | X | | | 0.002 | |
| 277 | 47A40006118 | 4 | | | | | 0.000 | 0.004 |
| 278 | 47A49606009 | 4 | | | | | 0.003 | 0.034 |
| 279 | 47A40006198 | 4 | | | | | 0.000 | 0.016 |
| 280 | 47A49605012 | 4 | | | | | 0.000 | 0.021 |

Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 281 | 162A364 | 3 | | | 0.000 | 0.008 | 0.000 | 0.008 |
| 282 | 781FPCR063 | 3 | | X | | | 0.003 | |
| 283 | 162A357 | 3 | | | 0.000 | 0.010 | 0.000 | 0.010 |
| 284 | 47A55503015 | 3 | | | 0.000 | 0.000 | 0.000 | 0.000 |
| 285 | 621LCVR042 | 3 | | | 0.002 | 0.002 | 0.001 | 0.003 |
| 286 | 621LCVR050 | 3 | | | | | 0.000 | 0.003 |
| 287 | 162A366 | 3 | X | | | | 0.000 | |
| 288 | 621CVCR102 | 3 | | X | | | 0.002 | |
| 289 | 621LCVR036 | 3 | | | 0.001 | 0.003 | 0.000 | 0.003 |
| 290 | 47A55503017 | 3 | | | | | 0.000 | 0.025 |
| 291 | 47A55503012 | 3 | | | 0.001 | 0.059 | 0.000 | 0.059 |
| 292 | 47A55511005 | 3 | | | | | 0.000 | 0.019 |
| 293 | 47A55503010 | 3 | | | 0.001 | 0.027 | 0.000 | 0.027 |
| 294 | 47A55503006 | 3 | | | 0.000 | 0.040 | 0.000 | 0.074 |
| 295 | 47A46503048 | 3 | | | 0.005 | 0.030 | 0.002 | 0.030 |
| 296 | 162A345 | 3 | | | 0.000 | 0.063 | 0.000 | 0.063 |
| 297 | 47A55503014 | 3 | | | 0.000 | 0.016 | 0.000 | 0.016 |
| 298 | 162A325 | 3 | | | 0.000 | 0.000 | 0.000 | 0.000 |
| 299 | 47A55503013 | 3 | | | 0.001 | 0.016 | 0.000 | 0.016 |
| 300 | 702CCR022 | 3 | | | | | 0.000 | 0.000 |
| 301 | 621LCVR074 | 3 | | X | | | 0.001 | |
| 302 | 622LCVR002 | 3 | | | 0.000 | 0.000 | 0.000 | 0.000 |
| 303 | 622LCVR005 | 3 | | | 0.001 | 0.062 | 0.000 | 0.064 |
| 304 | 621LCVV101 | 3 | | X | | | 0.000 | |
| 305 | 621LCVR099 | 3 | | X | | | 0.001 | |
| 306 | 621LCVR220 | 3 | | | | | 0.001 | 0.002 |
| 307 | 170329 | 3 | | | | | 0.001 | 0.011 |
| 308 | 631SISR248 | 3 | | | 0.001 | 0.000 | 0.000 | 0.000 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 309 | 47A40006259 | 3 | | | | | 0.000 | 0.038 |
| 310 | 47A40006260 | 3 | | | | | 0.001 | 0.049 |
| 311 | 631SISR274 | 3 | | | 0.001 | 0.039 | 0.001 | 0.058 |
| 312 | 671ERCWR258 | 3 | | | | | 0.001 | 0.016 |
| 313 | 671ERCWR205 | 3 | | | | | 0.001 | 0.017 |
| 314 | 621LCVR078 | 3 | | | 0.002 | 0.005 | 0.001 | 0.005 |
| 315 | 621LCVR079 | 3 | | X | | | 0.000 | |
| 316 | 621LCVR098 | 3 | | X | | | 0.000 | |
| 317 | 47A40006123 | 2 | | | | | 0.000 | 0.011 |
| 318 | 741RHRR190 | 2 | | | 0.001 | 0.016 | 0.000 | 0.016 |
| 319 | 162A034 | 2 | X | | | | 0.000 | |
| 320 | 47A42708024 | 2 | | | 0.000 | 0.060 | 0.000 | 0.090 |
| 321 | 103A589 | 2 | | X | | | 0.000 | |
| 322 | 47A42703041 | 2 | | | | | 0.000 | 0.012 |
| 323 | 741RHRR196 | 2 | | | 0.001 | 0.001 | 0.001 | 0.020 |
| 324 | 741RHRR194 | 2 | | | 0.001 | 0.002 | 0.000 | 0.002 |
| 325 | 47A40006126 | 2 | | | | | 0.000 | 0.026 |
| 326 | 741RHRR192 | 2 | | | 0.001 | 0.016 | 0.000 | 0.016 |
| 327 | 163038 | 2 | X | | | | 0.000 | |
| 328 | 103A582 | 2 | | | | | 0.001 | 0.024 |
| 329 | 162A536 | 2 | | | 0.001 | 0.038 | 0.000 | 0.043 |
| 330 | 621LCVR097 | 2 | | | 0.001 | 0.008 | 0.001 | 0.008 |
| 331 | 163572 | 2 | | | | | 0.000 | 0.020 |
| 332 | 47A40006083 | 2 | | | | | 0.000 | 0.035 |
| 333 | 162A006 | 2 | X | | | | 0.000 | |
| 334 | 162A002 | 2 | X | | | | 0.000 | |
| 335 | 631SISR266 | 1 | | | | | 0.001 | 0.016 |
| 336 | 47A46508092 | 1 | | | 0.000 | 0.041 | 0.000 | 0.041 |

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Watts Bar Nuclear Plant

Total U-Bolt Support Population

| | Support Number | Pipe Diam | Cl. 1 | Fitting | PW Dyn. Defl. | PS Dyn. Defl. | PW Max. Defl. | PS Max. Defl. |
|---|---|---|---|---|---|---|---|---|
| 337 | 47A40608068 | 0.75 | X | | | | 0.000 | |
| 338 | 162A466 | 0.75 | | | 0.000 | 0.001 | 0.000 | 0.001 |
| 339 | 162A680 | 0.75 | | | | | 0.000 | 0.000 |
| 340 | 47A43508023 | 0.75 | | | 0.000 | 0.011 | 0.000 | 0.011 |
| 341 | 162A407 | 0.75 | | | 0.000 | 0.000 | 0.000 | 0.000 |
| 342 | 162A406 | 0.75 | | | 0.000 | 0.014 | 0.000 | 0.014 |
| 343 | 47A40610018 | 0.75 | | | 0.000 | 0.019 | 0.000 | 0.019 |
| 344 | 162A431 | 0.75 | X | | 0.000 | 0.000 | 0.000 | |

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hot functional test

Total U-Bolt Supports in HFT Boundary and RCB

| | Support Number | Pipe Diam | Cl. 1 | Fitting | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Mod. PL | CONT | HFT |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 101A313 | 32 | | | X | | | | X |
| 7 | 101A308 | 32 | | | X | | | | X |
| 8 | 101A348 | 32 | | | | | | | X |
| 9 | 101A350 | 32 | | | X | | | | X |
| 10 | 101A429 | 32 | | | | | | | X |
| 11 | 101A435 | 32 | | | X | | | | X |
| 12 | 101A424 | 32 | | | X | | | X | X |
| 13 | 101A389 | 32 | | | | | | | X |
| 14 | 101A392 | 32 | | | X | | | | X |
| 83 | 103A320 | 16 | | | | | | X | |
| 88 | 631SISR131 | 16 | | X | | | | | X |
| 90 | 103A240 | 16 | | | | | | X | |
| 91 | 103A280 | 16 | | | | | | X | |
| 92 | 103A200 | 16 | | | | | | X | |
| 94 | 47A43201031 | 14 | | | | | | | X |
| 96 | 47A43201005 | 14 | | | | | | | X |
| 97 | 631SISR182 | 14 | | | | | | | X |
| 99 | 174020 | 14 | X | | | | | X | X |
| 100 | 174006 | 14 | X | | | | | X | X |
| 101 | 631SISR140 | 14 | | X | | | | | X |
| 102 | 631SISR137 | 14 | | X | | | | | X |
| 103 | 631SISR138 | 14 | | X | | | | | X |
| 104 | 631SISR161 | 14 | | X | | | | | X |
| 105 | 631SISR162 | 14 | | X | | | | | X |
| 106 | 631SISR164 | 14 | | X | | | | | X |
| 107 | 174007 | 14 | X | | | | | X | X |
| 108 | 631SISR142 | 14 | | | | | | | X |
| 131 | 47A42708028 | 10 | | | | | | | X |
| 146 | 163454 | 10 | X | | | | | X | X |
| 148 | 163591 | 8 | | | | | | X | |
| 166 | 47A43203003 | 8 | | | | | | X | X |
| 178 | 741RHRR101 | 8 | | X | | | | | X |
| 181 | 741RHRR058 | 8 | | | | | | | X |
| 184 | 163055 | 8 | | | | | | X | |
| 185 | 163032 | 8 | | | | | | X | |
| 192 | 163030 | 8 | | | | | | X | |
| 204 | 163080 | 6 | X | | | | | X | X |
| 205 | 163462 | 6 | X | | | | | X | X |
| 206 | 168018 | 6 | X | | | | | X | X |
| 208 | 163021 | 6 | | | | | | X | |

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Total U-Bolt Supports in HFT Boundary and RCB

| | Support Number | Pipe Diam | Cl. 1 | Fitting | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Mod. PL | CONT | HFT |
|---|---|---|---|---|---|---|---|---|---|
| 209 | 163064 | 6 | | | | | | X | X |
| 210 | 168120 | 6 | | | | | | X | X |
| 214 | 168427 | 6 | X | | | | | X | X |
| 217 | 47A45021084 | 6 | | | | | | X | |
| 219 | 47A45021112 | 6 | | | | | | X | |
| 220 | 47A45021096 | 6 | | | | | | X | |
| 221 | 47A42705023 | 6 | | | | | | X | X |
| 223 | 47A40108001 | 6 | | | | | | X | X |
| 225 | 103A374 | 6 | | | | | | X | X |
| 228 | 47A46502037 | 6 | | | | | | X | X |
| 229 | 47A46502040 | 6 | X | | | | | X | X |
| 230 | 103A487 | 6 | | | | | | X | X |
| 231 | 103A450 | 6 | | | | | X | X | X |
| 232 | 47A45021126 | 6 | | | | | | X | |
| 233 | 103A482 | 6 | | | | | X | X | X |
| 234 | 103A453 | 6 | | | | | X | X | X |
| 235 | 47A40007012 | 6 | | | | | | X | X |
| 236 | 47A40007011 | 6 | | | | | X | X | X |
| 238 | 47A40006200 | 4 | | | | | | X | X |
| 240 | 47A40006199 | 4 | | | | | | X | X |
| 242 | 47A40006114 | 4 | | | | | | X | X |
| 244 | 03B1AFWR048 | 4 | | X | | | | | X |
| 245 | 47A40006087 | 4 | | | | | | X | X |
| 246 | 03B1AFWR137 | 4 | | | | | | | X |
| 248 | 47A40006085 | 4 | | | | | | X | X |
| 249 | 163411 | 4 | | | | | | X | |
| 254 | 163398 | 4 | | | | | | X | |
| 256 | 168022 | 4 | X | | | | | X | X |
| 257 | 168031 | 4 | X | | | | | X | X |
| 258 | 168036 | 4 | X | | | | | X | X |
| 262 | 03B1AFWR049 | 4 | | X | | | | | X |
| 263 | 47A40006197 | 4 | | | | | | X | X |
| 266 | 47A40006191 | 4 | | | | | | X | X |
| 267 | 47A40006196 | 4 | | | | | X | X | X |
| 268 | 47A42705005 | 4 | | | | | | X | X |
| 269 | 03B1AFWR175 | 4 | | X | | | | | X |
| 270 | 03B1AFWR202 | 4 | | | | | | | X |
| 271 | 47A40007046 | 4 | | | | | | X | X |
| 273 | 47A46501066 | 4 | | X | | | | X | |
| 275 | 03B1AFWR209 | 4 | | | | | | | X |

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Total U-Bolt Supports in HFT Boundary and RCB

| | Support Number | Pipe Diam | Cl. 1 | Fitting | Dyn. Comp. Defl.>1/16" | Max. Comp. Defl.>1/8" | Mod. PL | CONT | HFT |
|---|---|---|---|---|---|---|---|---|---|
| 277 | 47A40006118 | 4 | | | | | | X | X |
| 278 | 47A49600009 | 4 | | | | | | X | X |
| 279 | 47A40006198 | 4 | | | | | | X | X |
| 281 | 162A364 | 3 | | | | | | X | X |
| 283 | 162A357 | 3 | | | | | | X | X |
| 287 | 162A366 | 3 | X | | | | | X | X |
| 295 | 47A46503048 | 3 | | | | | | X | X |
| 296 | 162A345 | 3 | | | X | | | X | X |
| 298 | 162A325 | 3 | | | | | | X | X |
| 307 | 170329 | 3 | | | | | | X | |
| 309 | 47A40006259 | 3 | | | | | | X | X |
| 310 | 47A40006260 | 3 | | | | | | X | X |
| 317 | 47A40006123 | 2 | | | | | | X | |
| 318 | 741RHRR190 | 2 | | | | | | | X |
| 319 | 162A034 | 2 | X | | | | | X | |
| 320 | 47A42708024 | 2 | | | | | | | X |
| 321 | 103A589 | 2 | | X | | | | X | |
| 322 | 47A42703041 | 2 | | | | | | X | X |
| 323 | 741RHRR196 | 2 | | | | | | | X |
| 324 | 741RHRR194 | 2 | | | | | | | X |
| 325 | 47A40006126 | 2 | | | | | | X | X |
| 326 | 741RHRR192 | 2 | | | | | | | X |
| 327 | 163038 | 2 | X | | | | | X | X |
| 328 | 103A582 | 2 | | | | | | X | |
| 329 | 162A536 | 2 | | | | | | X | X |
| 331 | 163572 | 2 | | | | | | X | |
| 332 | 47A40006083 | 2 | | | | | | X | X |
| 333 | 162A006 | 2 | X | | | | | X | |
| 334 | 162A002 | 2 | X | | | | | X | |
| 336 | 47A46508092 | 1 | | | | | | X | X |
| 337 | 47A40608068 | 0.75 | X | | | | | X | |
| 338 | 162A466 | 0.75 | | | | | | X | |
| 339 | 162A680 | 0.75 | | | | | | X | |
| 340 | 47A43508023 | 0.75 | | | | | | X | X |
| 341 | 162A407 | 0.75 | | | | | | X | |
| 342 | 162A406 | 0.75 | | | | | | X | |
| 343 | 47A40610018 | 0.75 | | | | | | X | |
| 344 | 162A431 | 0.75 | X | | | | | X | |

Total = 118

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| | |
|---|---|
| Total U-Bolt Supports in HFT Boundary | 87 |
| Total U-Bolt Supports in HFT Boundary proposed to be modified | 37 |
| Total U-Bolt Supports in Containment (non-HFT) | 31 |
| Total U-Bolt Supports in Containment (non-HFT) proposed to be modified | 7 |
| Total U-Bolt Supports in HFT Boundary & Containment | 118 |
| Total U-Bolt Supports in HFT Boundary & Containment proposed to be modified | 44 |

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# Legend For Support Table

The supports with the support number shaded indicate the supports TVA proposes to modify to resolve the remaining NRC staff questions. The specific reason for the modification is annotated in the table with an X in one of the following columns: Class 1, fittings, Dynamic deflection > 1/16", Maximum deflection > 1/8", or the column label "Mod. PL". This latter column indicates that the hypothetical resultant preload is below the minimum preload established by the WBN U-bolt support methodology.

| | | |
|---|---|---|
| Sup. Type | First Character | H = Horizontal<br>V = Vertical |
| | Second Character | T = Trapeze<br>S = Single |
| | Third Character | S = Snubber<br>R = Strut |
| Cl. 1 | Support on Class 1 Piping | |
| Fitting | Support on a Fitting | |
| Gapped BW | Support has a Belleville Washer with a gap between the collar and the compression plate. | |
| Dyn. Comp Defl. > 1/16" | Indicates supports where the composite dynamic deflection (dynamic pipe wall deflection plus dynamic pipe support defection) exceeds 1/16". | |
| Max. Comp. Defl. > 1/8" | Indicates supports where the composite maximum deflection (maximum pipe wall deflection plus the maximum pipe support deflection) exceeds 1/8". | |

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# Legend For Support Table

| | |
|---|---|
| Composite Dyn. Deflect. | Magnitude of the composite dynamic deflection (PW Dyn. Defl. plus PS Dyn. Defl.). |
| Composite Max. Deflect. | Magnitude of the composite maximum deflection (PW Max. Defl. plus PS Max. Defl.). |
| Actual Preload | Load applied by Belleville washers to each leg of the U-Bolt. |
| Min. Reqd. Preload | Minimum initial preload value reported in the stability calculation. |
| Hypt. Res. Preload | Hypothetical resultant value of the preload assuming pipe wall deflections translate completely to pipe centerline deflections causing relaxation of the Belleville washers. |
| Mod. PL | Modifications required due to hypothetical loss of preload. |
| Max. Str. Int./Eq. | Highest intensified stress interaction for the piping analysis of record at the U-Bolt location and the applicable Code equation. |
| MDL | The minimum design load for the support. |
| Max. Str. Load | The maximum strut load at the support location. |
| PW Dyn. Defl. | Pipe wall deflection at the support location due to the greater of the dynamic component of the maximum load or the minimum design load. |
| PS Dyn. Defl. | Pipe support deflection at the support location as described for PW Dyn. Defl. |

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# Legend For Support Table

| | |
|---|---|
| PW Max. Defl. | Maximum pipe wall deflection at the support location due to the greater of the maximum load or the minimum design load. |
| PS Max. Defl. | Maximum pipe support deflection at the support location as described for PW Max. Defl. |