



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-16-022

May 27, 2016

10 CFR 50.55a

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 1 and 2
Facility Operating License Nos. NFP-90 and NFP-96
NRC Docket Nos. 50-390 and 50-391

Browns Ferry Nuclear Plant, Units 1, 2, and 3
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, and 50-296

Sequoyah Nuclear Plant, Units 1 and 2
Renewed Facility Operating License Nos. DPR-77 and DPR-79
NRC Docket Nos. 50-327 and 50-328

Subject: **Browns Ferry Nuclear Plant Units 1, 2, and 3, Sequoyah Nuclear Plant Units 1 and 2, and Watts Bar Nuclear Plant Units 1 and 2 - Request for Approval for Use of Alternate Calibration Block Reflector Requirements 16-PDI-5**

Reference: 1. TVA letter , L.M. Mills to A. Schwencer, "Request for Relief ISI-1," dated August 13, 1980, (ML073520649)

2. NUREG-0847 Supplement 10, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant Units 1 and 2," dated October 1992 (ML072060473)

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a, "Codes and Standards," paragraph (z)(1), Tennessee Valley Authority (TVA) is requesting the Nuclear Regulatory Commission (NRC) approval of the enclosed request for an alternative (16-PDI-5) to the requirements of the 2001 Edition through 2003 Addenda and the 2007 Edition through 2008 Addenda of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section XI, Mandatory Appendix III, Subsubarticle III-3430, "Calibration Reflectors," including Mandatory Appendix III, Supplement 1, Paragraph (b)(3), for the Watts Bar Nuclear Plant (WBN) Units 1 and 2 , Sequoyah Nuclear Plant (SQN) Units 1 and 2, and Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3 basic calibration blocks. Refer to Section 2 of the Enclosure for the applicable code of records.

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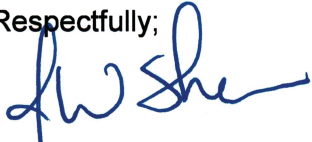
ASME B&PV Code Section XI, Mandatory Appendix III, Subsubarticle III-3430 states that basic calibration blocks shall have a notch depth as specified in Table III-3430-1. Table III-3430-1 specifies that for a nominal pipe wall thickness (t) of 0.312 to 6.0 inches, the calibration block shall have a notch depth of $0.104t - 0.009t^2$ (10% of t for austenitic and dissimilar metals welds) with a tolerance of +10% to -20%. This equates to a nominal notch depth from $5\%t$ to approximately $10\%t$ for ferritic materials. TVA requests NRC approval to continue to utilize calibration blocks that were fabricated with alternative notch depths of $5\%t$ with +10% to -20% tolerance. The $5\%t$ calibration blocks were fabricated for TVA and result in more conservative and sensitive ultrasound examinations.

The enclosure provides a description and assessment of the proposed request for alternative, and the basis as to why the proposed alternative provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1).

TVA requests approval of this request by October 1, 2016, which is the scheduled start date for the BFN Unit 1 refueling outage because the potential exists that these calibration blocks will be used during that outage. TVA also requests that approval be granted for the remainder of plant life for BFN Units 1, 2, and 3, SQN Units 1 and 2, and WBN Units 1 and 2.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Mr. Ed Schroll at 423-751-3850.

Respectfully;



J. W. Shea
Vice President, Nuclear Licensing

Enclosure: Request for Alternative Number 16-PDI-5

cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
NRC Senior Resident Inspector - Sequoyah Nuclear Plant
NRR Project Manager - Watts Bar Nuclear Plant
NRR Project Manager - Browns Ferry Nuclear Plant
NRR Project Manager - Sequoyah Nuclear Plant

Enclosure

Tennessee Valley Authority Browns Ferry Nuclear Plant Units 1, 2, and 3 Sequoyah Nuclear Plant Units 1 and 2 Watts Bar Nuclear Plant Units 1 and 2

Request for Alternative Number 16-PDI-5

I. Systems/Components Affected

Basic calibration blocks, used for ultrasonic testing (UT), are standards that provide a means to correlate an ultrasonic system with reference reflectors of known dimensions. Reference reflectors are dimensioned surfaces, used to establish accurately reproducible reference levels of ultrasonic sensitivity, resolution and sound path distance.

The basic calibration blocks are used to provide a calibration standard for ultrasonic systems used for testing thin-walled vessel (less than or equal to 2" thickness) and piping welds. This request for alternate approval is for basic calibration blocks with a nominal pipe wall thickness (t) five percent (5%) t notch depth. Attachment A provides a list of 5% t notch depth calibration blocks currently in use at TVA nuclear plants.

II. Applicable Code Edition and Addenda

The current in-service inspection (ISI) and pre-service inspection (PSI) code of record for Browns Ferry Nuclear Plant (BFN) Unit 1 (third interval), Unit 2 (fifth interval), and Unit 3 (fourth interval) is the American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel (B&PV) Code Section XI, 2007 Edition through 2008 Addenda.

The current ISI and PSI code of record for Sequoyah Nuclear Plant Units 1 and 2 (SQN) Unit 1 (third interval), Unit 2 (third interval), and for Watts Bar Nuclear Plan (WBN) Unit 1 (second interval) is the ASME B&PV Code Section XI, 2001 Edition through 2003 Addenda.

WBN Unit 2 is currently in the PSI period. The PSI code of record for WBN Unit 2 is the ASME B&PV Code Section XI, 2001 Edition through 2003 Addenda.

SQN Units 1 and 2 and WBN Units 1 and 2 are in the process of transitioning to the ASME B&PV Code Section XI, 2007 Edition through 2008 Addenda for their next upcoming ISI intervals.

III. Applicable Code

ASME Code Components Affected:

ASME Code Classes:	1 & 2
References:	IWA-2232 Appendix III, Subsubarticle III-3430 Appendix III, Supplement 1(b)(3)
Examination Categories: Item Numbers:	B-F, B-J, B-O, C-F-1, C-F-2 - B-B, C-A B5.10, B5.130, B9.11, B9.12, B9.31, B14.20, C5.11, C5.12, C5.52
Description:	Alternative to Appendix III Calibration Reflector Requirements
Component Numbers:	ASME Class 1 and 2 components subject to examination in accordance with Appendix III of Section XI.

IV. Reason for Request

ASME B&PV Code Section XI (see the code of record previously specified for each unit in Section II of this enclosure), Mandatory Appendix III, Subsubarticle III-3430 states that basic calibration blocks shall have a notch depth as specified in Table III-3430-1. Table III-3430-1 specifies that for a nominal pipe wall thickness (t) of 0.312 to 6.0 inches, the calibration block shall have a notch depth of $0.104t - 0.009t^2$ with a tolerance of +10% to -20%. This equates to a nominal notch depth from 5% t to approximately 10% t for ferritic materials. Appendix III, Supplement I paragraph (b)(3) requires calibration blocks for austenitic and dissimilar metals welds to have a notch depth of 10% t .

The nondestructive examination (NDE) requirements were revised to comply with the 1989 Edition of the ASME Section XI Code for all nuclear sites (WBN, SQN, and BFN). This upgrade was a result of the second interval update for SQN (December 16, 1995 through May 31, 2006). The NDE upgrade provided a consistency in procedure implementation at all TVA nuclear sites. When TVA NDE requirements were revised to comply with the 1989 Edition of the ASME Section XI Code, the code requirements included use of basic calibration blocks with notch depths in the range of 5% t to approximately 10% t , depending on wall thickness. In this edition of the ASME B&PV Code, up to the 1999 Edition of the ASME B&PV Code, provisions were made in Section XI, Division 1, Appendix III, Subarticle III-1100 that allowed alternative designs for basic calibration blocks in accordance with Subsubarticle IWA-2240. Thus, some basic calibration blocks were fabricated by the Tennessee Valley Authority (TVA) with 5% t (+10% to -20% tolerance) notches for piping and vessels 2" or less in thickness versus the 5% t to approximately 10% t range of depths defined in Table III-3430-1 for ferritic material and the 10% t notch depth defined in Appendix III, Supplement 1(b)(3) for austenitic or dissimilar metal welds.

In the 1999 Addenda of Section XI, Subsubarticle III-1100 was revised to add the following phrase after the reference to IWA-2240: "except when the requirements of Subsubarticle III-3430 apply." The inclusion of this phrase removed provisions for using alternative notch depths for ISI examinations performed to the 1999, or later, code year of Section XI.

Alternative calibration notch depths are required to ensure that TVA can comply with the requirements of IWB 2200(b)(2) with regards to comparing ISI results with previous ISI or PSI results. In addition, these alternative notch depth requirements will allow TVA to continue use of basic calibration blocks that were fabricated with alternative notch depths without the necessity of fabricating new blocks.

V. Proposed Alternative and Basis for Use

Proposed Alternative:

For ASME Class 1 and ASME Class 2 components subject to ultrasonic examination in accordance with ASME Section XI, Appendix III, TVA requests the Nuclear Regulatory Commission (NRC) approval to use calibration blocks with 5%*t* notches in lieu of the 5%*t* to approximately 10%*t* range specified in Table III-3430-I and the 10%*t* specified in Supplement 1 paragraph (b)(3). This does not eliminate the option for TVA to use calibration blocks with notches as specified by Appendix III.

Basis For Use:

When TVA nondestructive examination (NDE) requirements were revised to comply with the 1989 Edition of the ASME Section XI Code, the code requirements included use of basic calibration blocks with notch depths in the range of 5%*t* to approximately 10%*t*, depending on wall thickness. A technical justification and demonstrations (Attachments B and C to the enclosure) were performed in accordance with IWA-2240, which provided documented alternatives to the Supplement III notch depth requirements, by allowing the use of 5%*t* notches for all pipe thicknesses up to six inches.

To demonstrate that calibration blocks with 5%*t* notch depths provide an equivalent or better quality of examination, two demonstrations were conducted on a sampling of blocks that had both 5%*t* and 10%*t* nominal notches.

The first demonstration, conducted in 1996 before a TVA site Authorized Nuclear Inspection Inspector (ANII) Supervisor using conventional UT methods, concluded that the 5%*t* notches increased examination sensitivity by +2 to +6 dB. This demonstration is provided in Attachment B.

The second demonstration was performed in 2014, for the SQN site ANII, using linear phased array (LPA) techniques. This demonstration is provided in Attachment C. Similar to the demonstration in Attachment B, this demonstration concluded that the nominal 5%*t* notches result in a similar increase (+2 to +6 dB) in calibration sensitivity when compared to the nominal 10%*t* notches.

These demonstrations provide an acceptable level of quality and safety because the information and data obtained provides sufficient information to determine that applicable UT calibrations will conservatively establish a marginally more sensitive gain setting. Therefore, pursuant to 10 CFR 50.55a(z)(1), TVA requests NRC approval for the alternate design of the calibration blocks.

Additionally, in Reference 1, TVA submitted a relief request (ISI-1) for WBN Units 1 and 2 to request the use of "circumferential notches located on the I.D. and O.D. surface at a nominal depth of 5%*t* as reference reflectors." Relief was requested to use 5%*t* or optionally 10%*t* notches in lieu of the requirements of ASME Code Section XI, 1974 Edition, Summer 1975

Addenda. The NRC in Appendix Z, Section 3.1 of Reference 2, authorized the use of this relief request and stated, "that the use of the notched calibration reflectors, and the recording and reporting level for indications for the pre-service examinations of relatively thin-walled vessel welds are acceptable alternatives to the code requirements."

VI. Duration of Proposed Alternative and Implementation Schedule:

TVA requests that approval be granted for the remainder of plant life for BFN Units 1, 2, and 3, SQN Units 1 and 2, and WBN Units 1 and 2.

TVA requests approval of this request by October 1, 2016, which is the scheduled start date for the BFN Unit 1 refueling outage because the potential exists that these calibration blocks will be used during that outage.

VII. Precedents:

This request for alternative is similar to alternative request NDE-R014 that was approved by the NRC for the Duane Arnold Energy Center (DAEC) in Reference 3. Specifically, the NRC approved an alternative to Section XI, Appendix III, Subsubarticle Appendix III-3430 that allowed DAEC to use calibration blocks that were procured when the plant was built. These calibration blocks had notches of various depth that deviated from the requirements of Section XI, Appendix III, Table III-3430-1.

VIII. References

1. TVA letter , L.M. Mills to A. Schwencer, "Request for Relief ISI-1," dated August 13, 1980, (ML073520649)
2. NUREG-0847 Supplement 10, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant Units 1 and 2," dated October 1992 (ML072060473)
3. NRC Letter, "Evaluation of the Third 10-year Inservice Inspection Interval Program Plan Requests for Relief for the Duane Arnold Energy Center (TAC No. M95412)," dated March 23, 1998 (ML 9804010216)

IX. List of Attachments

Attachment A- Current List of TVA Calibration Blocks with Nominal 5%*t* Notch Depth

Attachment B- Ultrasonic Calibration Standards (L18 960329 800)

Attachment C- Ultrasonic Basic Calibration Block Demonstration (N-GP-18)
(W47140528001)

Attachment A

Current List of TVA Calibration Blocks with Nominal 5%*t* Notch Depth

DocLink	General Description	Actual Wall Thickness	Material Type
BF-001	4" SCH 80	0.326	A-106 GR. B CS
BF-002	4" SCH 80	0.332	A-358 TP-304 SS
BF-003	10" SCH 40	0.375	A-106 GR. B CS
BF-004	6" SCH 140	0.752	A-358 TP-304 SS
BF-005	10" SCH 100	0.730	A-106 GR. B CS
BF-006	8" SCH 100	0.767	A-358 TP-304 SS
BF-007	14" pipe Sch. 80	0.698"	A-106 GR. B CS
BF-010	48" x 12 5/16" x 4"	4"	A-533 Gr. B
BF-011	6 1/2" x 4" x 4"	4"	A515 Gr. 70
BF-012	12"x3"x2" Flat Plate	3"	A515 Gr. 55
BF-014	3/4" SCH 160	0.226"	SA-106 GR B CS
BF-015	10" SCH 160	1.53"	A-519 GR. MT-1020 CS
BF-016	20" X II" X 10" Nozzle Block Clad	10"	SA-533 GR. B. CS
BF-018	24" X 6" X 6" Flat Block	6.125"	A-533 GR. B CS
BF-019	24" X 6" X 4" Flat Block	4 1/64"	SA-533 GR B. CS
BF-026	12" X 4" .75" Flat Block	0.75"	ASME SA 106 CS
BF-029	4" SCH 160	0.506"	A-106 GR B. CS
BF-030	6" SCH 160	0.754"	A-106 CS
BF-032	20" X 9" X 1" Flat Block	1.140"	ASTM 516 GR 70
BF-034	6" sch 80	0.399	A-53 Gr. B
BF-035	8" sch 100	0.520	A-106 GR. B CS
BF-036	5" sch 40 pipe	0.344	A-106 GR. B CS
BF-037	14" sch 30 pipe	0.364	A-106 GR. B CS
BF-040	Flat Plate 20" x 9 7/8" x 1"	0.944	A-106 GR. B CS
BF-041	4" sch 160 SS Pipe	0.452	SA-376 TP-316
BF-042	10" Sch 80 CS Pipe	0.597	A-106 GR. B CS
BF-043	Flat Plate 20" x 9 27/32" x 1	1.036	316L
BF-044	Flat Plate 20" x 10" x 1.5"	1.552	TP-304
BF-045	6" sch 40 CS Pipe	0.275	SA-106 GA
BF-046	10" Sch 80 SS Pipe	0.588	A-312 TP-304 SS
BF-048	20" Sch 80 SS Pipe w/Overlay	1.6875	TP-304
BF-049	22" Sch 80 Pipe w/Overlay	1.342	SA-240 TP-304
BF-050	12" Sch 100 Pipe w/Overlay	1.139	TP-304

Attachment A

Current List of TVA Calibration Blocks with Nominal 5%*t* Notch Depth

DocLink	General Description	Actual Wall Thickness	Material Type
BF-051	12" Sch 100 Pipe w/Overlay	0.947	TP-304
BF-052	22"x12" Sweeplet (Recirc Loops)	0.948	SA-240 TP-304
BF-053	6" sch 160 SS Pipe	1.122	TP-304
BF-054	6" sch 160 SS Pipe	1.328	TP-304
BF-056	14" Sch. 100 CS Pipe	0.938	A-106 GR. B CS
BF-057	Flat Plate 20" x 4 7/8" x 1.25"	1.269	SS-304L
BF-058	1" Sch 160 CS Pipe	0.222	A-106 GR. B CS
BF-059	Jet Pump	.9229	SA-182 F316
BF-060	5" sch xxHvy SS Pipe	0.758	SA312 T316L
BF-061	6" SCH 120		TP-304 Gr. 316
BF-062	4" XXS SS Pipe / Weld Buildup	1.89	SS
BF-063	6" XXS SS Pipe	0.840	SA312/SA376 TP304
BF-064	2 sch 160 SS Pipe	0.375	SA312 TP304
BF-065	12" Sch 160 SS Pipe	1.345	SA-376 TP-304 SS
BF-066	4" Sch XX Hvy	0.685	SA-312
BF-067	14" Sch 160 SS	1.339	SA-376 TP-316
BF-068	0.863" Dia x 12.5"	0.046	Admiralty Brass
BF-069	10" x 2" x 1" Flat Block	0.950	Carbon/SS
BF-069A	10" x 2" x 1" Flat Block	0.900	Carbon/SS
BF-070	12" Carbon Steel Pipe Segment With Stainless Butter	1.32"	ASME SA-376 TP 316
BF-071	12" SCH 80 Clad Block	Varies	SA-358 GR 304 SS
BF-072	Clad Block for Nozzles	1.32	ASTM A508 CL 2 CS
BF-074	20" SCH 20	0.187	SA-106 GrB CS
BF-075	12" SCH 80	0.688	SA-106 GrB CS
BF-076	5.38" 00x12"	0.846	SA 508 CL2
BF-077	16" SCH 30	0.375	SA-106 GrB CS
BF-079	12" SCH 80	0.691	SA-358 GR 304 SS
BF-080	6" SCH 80	0.860"	SA-376 TP-304 SS
BF-082	28" Dia Pipe Seg.	1.250"	A358 GR 304 SS
BF-083	28" Dia Pipe Seg.	1.750"	A358 GR 304 SS/308L
BF-084	N1 N2 N3 Nozzle IR	Varies	SA 508 CL2
BF-085	N2 N5 N9 Nozzle Inner Radius	Varies	ASTM A508 CL2
BF-086	N8 Nozzle Inner Radius		ASTM A508 CL2

Attachment A

Current List of TVA Calibration Blocks with Nominal 5%*t* Notch Depth

DocLink	General Description	Actual Wall Thickness	Material Type
BF-087	20" SS Pipe	1.031	SA-376 TP-316
BF-088	22" SS Pipe	1.031	SA-376 TP-316
BF-089	24" SS Pipe	1.285	SA-376 TP-316
BF-090	28" SS Pipe	1.44	SA-376 TP-316
BF-091	6" CS Pipe	0.562	ASTM A106 Grade B
BF-092	8" CS Pipe	0.322	ASTM A106 Grade B
BF-093	12" CS Pipe	0.843	ASTM A106 Grade B
BF-094	16" CS Pipe	1.031	ASTM A106 Grade B
BF-095	18" CS Pipe	0.312	ASTM A106 Grade B
BF-096	18" CS Pipe	0.500	ASTM A106 Grade B
BF-097	18" CS Pipe	0.938	ASTM A106 Grade B
BF-098	20" CS Pipe	0.500	ASTM A106 Grade B
BF-099	20" CS Pipe	1.281	ASTM A106 Grade B
BF-100	24" CS Pipe	0.375	ASTM A106 Grade B
BF-101	24" CS Pipe	0.500	ASTM A106 Grade B
BF-102	24" CS Pipe	1.531	ASTM A106 Grade B
BF-103	24" CS Pipe	2.5	ASTM A106 Grade B
BF-104	26" Pipe	0.950	ASTM A155 KC-70
BF-105	30" CS Pipe	0.375	ASTM A106 Grade B
BF-106	Core Spray Nozzle	1.358	SA508 CL 2
BF-107	Recirc Outlet Nozzle	1.737	SA508 CL 2
BF-108	24" Sch. 80 CS Pipe	1.218	A-106 GR. B CS
BF-109	147" Radius RV Wall	6.60	SA533 Gr. B class 1
BF-111	3/4" Pipe	0.154	SA-376 TP-316
BF-112	1" Pipe	0.179	SA-376 TP-316
BF-113	1.25" pipe	0.191	SA-376 TP-316
BF-114	1.5" Pipe	0.200	SA-376 TP-316
BF-115	2" Pipe	0.154	SA-376 TP-316
BF-116	3" pipe	0.300	SA-376 TP-316
BF-117	4" pipe	0.337	SA-376 TP-316
BF-118	6" pipe	0.432	SA-376 TP-316
BF-127	12" Pipe UT Cal Block	0.375"	ASTM A106 Grade B
BF-128	20" pipe UT Cal Block	0.375"	ASTM A106 Grade B
BF-129	RPV Instrument Nozzle to Flange UT Cal Block	1.0"	ASTM A105 Grade 2
BF-130	RPV Instrument Nozzle to Flange UT Cal Block	1.0"	A105 Grade 2
BF-131	4" Axial Scan UT	2"	304 SS
BF-132	4" Circumferential Scan	Varies	304 SS

Attachment A

Current List of TVA Calibration Blocks with Nominal 5%t Notch Depth

DocLink	General Description	Actual Wall Thickness	Material Type
BF-133	Flat Probe UT	3.00	304 SS
BF-136	3" Contour Block	1.00	316/316L
BF-137	3" Circumferential Scan	1.00	316L SS
BF-138	28"/29" OD/ID Axial Scan	3.9	304 SS
BF-139	28" OD Circ Scan	2.4	304 SS
BFN-134	12" Axial Scan	2.92	304 SS
BFN-135	12" SS Circumferential Scan	1.27	304 SS
IR-CSCL-38-PEB	O.D Inner Radius UT Cal Block N1 N2 N3 N4 N5	Varies	SA508 CLII
SQ-001	6" SCH 160	0.707"	TP-304 SS
SQ-002	6" SCH 160	0.707"	TP-304 SS
SQ-003	12" SCH 140	1.209"	TP-316 SS
SQ-005	32" Dia. Pipe Seg.	1.429"	A-516 GR. 70
SQ-006	2" SCH 160	0.340"	TP-304 SS
SQ-007	8" SCH 120	0.760"	TP-304 SS
SQ-008	12" SCH 80	0.764"	TP-316 SS
SQ-009	8" SCH 80	0.311"	A-312 TP-316 SS
SQ-010	14" SCH 160	1.358"	A-312 TP-304 SS
SQ-012	2.5" SCH 160	0.430"	A-312 TP-304 SS
SQ-013	4" SCH 120	0.436"	A-312 TP-304 SS
SQ-014	12" X 4" X 1.5" Flat Block	1.5"	A-516 GR. 70 CS
SQ-015	12" X 4" X 1" Flat Block	1.022"	TP-304 SS
SQ-016	12" SCH 160	1.310"	A-403-WP-316 SS
SQ-017	6" SCH 120	0.580"	A276 TP-304 SS
SQ-018	18" SCH 80	0.977"	A-333 GR. 1 CS
SQ-019	6" Dble. E.H.	0.875"	A-106 GR. B CS
SQ-020	1.5" SCH 160	0.324"	A-376 TP-304 SS
SQ-021	10" Pipe 1.5" Thick	1.50"	SA-106 GrB CS
SQ-029	6" Dia. Pipe Seg.	1.2"	304 SS
SQ-030	5" Dia. E.H.	0.897"	304 SS
SQ-037	Transferred to BFNP	0.502	A-36 A283
SQ-039	18" SCH 40	0.640"	304 SS
SQ-040	12" X 6" X 3" Vessel Block	3.0"	SA-533 GR.A CL-2 CS
SQ-041	12" X 6" X 4" (3/16 Clad) Vessel	3 7/8"	SA-533 GR.A CL-2 CS
SQ-043	22" X 6" X 6" (7/32 Clad) Vessel	5 13/16"	A-508 CL-2 CS

Attachment A

Current List of TVA Calibration Blocks with Nominal 5%*t* Notch Depth

DocLink	General Description	Actual Wall Thickness	Material Type
SQ-044	33" X 6" X 8-11/16" (1/4 Clad) Vessel	8 11/16"	A-508 CL-2 CS
SQ-045	43" X 6" X 11" (5/16 Clad) Vessel	11 1/8"	A-508 CL-2 CS
SQ-046	27" X 6" X 7" (7/32 Clad) Vessel	7 1/16"	A-508 CL-2 CS
SQ-049	15" X 6" X 5" (1/4 Clad)	5"	SA-216 GR. WCC CS
SQ-050	10-1/2" O.D. X 7" I.D. Nut Block	1.75"	SA-540 GR.B24
SQ-051	12" X 6" X 6" (3/16" Clad)	5 29/32"	A-508 CL-2 CS
SQ-053	26" X 23" X 6" (3/16 Clad) Nozzle	Varies	A-508 CL-2 CS
SQ-054	16" Rad. (1/4 Clad)	Varies	A-508 CL-2 CS
SQ-055	2-1/2" Dia. x 9-3/4" Stud	Stud	A-193 GR. B7 CS
SQ-056	Letdown Heat Exchanger Block	0.428"	AISI TP-304 SS
SQ-057	24" X 6" X 4" Vessel Block	4"	SA-533 GR. A CL-1 CS
SQ-058	3/4" Dia. X 13 5/8"	.049"	Admiralty Brass
SQ-059	SG Primary Nozzle I.R. W/Clad	16.0"	A216 GR. WCC CS
SQ-061	S.G. Feedwater Nozzle	.837"	A333 GR. 1 CS
SQ-062	S.G. Nozzle to Transition Spool	0.6	SA508 CL.2 CS
SQ-065	3" Dia. Branch Connection	1.313"	A182, F-316 SS
SQ-066	6" Dia. Branch Connection	1.85	A182, F-316 SS
SQ-067	10" Dia. Branch Connection	2.490"	A182, F-316 SS
SQ-068	16 X 16" X 4" RCP Flywheel Block	3.75"	SA533, GR. B CS
SQ-069	4" Dia. Branch Connection	1.530"	A182, F-316 SS
SQ-070	8" Dia. Branch Connection	2.090"	A182, F-316 SS
SQ-071	12" Dia. Branch Connection	2.99"	A182, F-316 SS
SQ-072	4" Dia. Lifting Rig	4.00"	A322, GR4340
SQ-073	4" Dia. Lifting Rig	4.00"	A322, GR4340
SQ-074	4" Dia. Lifting Rig	4.00"	A322, GR4340
SQ-075	3.5" Dia. Lifting Rig	3.50"	A564, GR630
SQ-076	Mainsteam/Feedwater Nozzle I.R.	14"	A508 CL.2
SQ-077	Pressurizer Nozzle I.R.	13.624"	A508 CL.2
SQ-078	Flywheel Cal. Block	4.5"	SA 533 Gr B
SQ-079	4" CS Sch 80 Cal. Block	.337"	A-106 GR. B CS
SQ-080	UHI Inconel Cal Block	.531"	ASME SB-166

Attachment A

Current List of TVA Calibration Blocks with Nominal 5%*t* Notch Depth

DocLink	General Description	Actual Wall Thickness	Material Type
SQ-081	UHI Stainless Cal Block	.527"	ASME SA-479
SQ-082	CRDM Inconel Cal Block	.625"	ASME SB-166
SQ-083	CRDM Stainless Cal Block	.622"	ASME SA-479
SQ-085	2" Sch 80 Cal. Block	.210"	SA-376-304
SQ-086	3" Sch 80 Cal. Block	.308"	SA-376-304
SQ-087	3" Sch 40 Cal. Block	.214"	SA-376-304
SQ-088	4" Sch 80 Cal. Block	.370"	SA-376-304
SQ-089	16" Cal. Block	.400"	SA-358-304
SQ-090	20" Cal. Block	.420"	SA-358-304
SQ-091	24" Cal. Block	.407"	SA-358-304
SQ-092	3.38" Main Steam Cal Block	3.38"	ASTM A-105
SQ-093	14" Sch 40 Cal Block	.438"	SA-376 GR-304
SQ-103	2.35" f X 13.5"	Stud	ASTM 193, GR B-6
SQ-104	12" x 6" x .75" Flat Block	.75"	TP-304 SS
SQ-105	12" x 6" x .5" Flat Block	.5"	TP-304 SS
SQ-106	12"x4"X.75"SS CLAD FLAT BLOCK	.775"	SA-515,GR 70
SQ-108	18"x6"x3" Flat Block	3.00"	SA-508, CL.3.
SQ-110	27"x7" CLAD BLOCK (0.2")	7.00"	SA-508, CL. 3
SQ-111	CLAD SG NOZZLE BLOCK I.R.	9.00"	SA-508, CL.3
SQ-112	25"x7.5" NOZZLE BLOCK	7.54"	SA-336 F316LN
SQ-113	12"X10" FW Nozzle IR	Varies	SA-508, CL3
SQ-124	9.75"X6"X0.750"		ASTM A36
SQ-131	8" Ax. Overlay Cal Block	2.000"	304 SS
SQ-132	16" Ax. Overlay Block	2.000"	304 SS
SQ-133	Flat Overlay Block	3.000"	304 SS
SQ-134	8" Circ Scan Overlay Block	2.248"	304 SS
SQ-135	16" Circ Scan Overlay Block	2.500"	302 SS
SQ-136	6" Circ. Scan Overlay Block	1.617"	304 SS
SQ-137	6" Axial Scan Overlay Block	2.502	305 SS
WB-001	6" SCH 160 Pipe segment	0.715	SA-376 TP-304 SS
WB-002	8" SCH 160 Pipe Segment	0.942	SA-376 TP-304 SS
WB-003	12" SCH 140 Pipe Segment	1.158	SA-376 TP-316
WB-004	16" SCH 80 Pipe Segment	0.754	SA-333 GR.6
WB-005	16" SCH 140 Pipe Segment	1.410	SA-515,GR 70
WB-006	2" SCH 160	0.346	TP-304
WB-007	8" SCH 120 Pipe Segment	0.758	TP-304
WB-008	12" SCH 80 Pipe Segment	0.767	SA-376 TP-316
WB-009	8" SCH 40 Pipe Segment	0.307	A-312 TP-316 SS

Attachment A

Current List of TVA Calibration Blocks with Nominal 5%*t* Notch Depth

DocLink	General Description	Actual Wall Thickness	Material Type
WB-010	14" SCH 160	1.352	A-312 TP-304 SS
WB-011	3" SCH 160 Pipe Segment	0.450	304H
WB-012	2" SCH 160 Pipe Segment	0.395	SA-376 TP-304 SS
WB-014	1.5" Flat Block	1.482	SA-516 SR70
WB-015	1" Flat Block	1.028	SA-376 TP-304 SS
WB-016	12" Sch 160 SS Pipe	1.322	SA-376 TP-304 SS
WB-017	5" Sch 160 Pipe	0.585	SA-403 WP-315
WB-018	18" SCH 80 Pipe	0.938	SA-333 GR.6
WB-019	5" sch xxHvy Pipe	0.782	A-106 GR. B CS
WB-020	1-1/2" SCH 160 Pipe	0.312	SA-376 TP-304 SS
WB-021	10" Pipe 1.5" Thick	1.493	SA-106 GrB CS
WB-027	2" Round Bar	2.00	SA-193 GR B7
WB-029	4" Pipe Segment	1.206	SA-376 TP-304 SS
WB-030	3" Pipe Segment	0.918	SA-376 TP-304 SS
WB-033	10" x 1" thick pipe segment	1.005	TP 304
WB-034	12" pipe segment	1.247	TP 304
WB-037	6" SCH 80	0.433	SA 53 Gr-B
WB-038	8" Sch. 80	0.484	SA-106 Gr. B
WB-039	Vessel	4.015	SA-533 GR A CL2 CS
WB-041	12" Sch 40S Pipe Segment	0.363	SA-312 TP 304
WB-042	18" Sch 30 Pipe Segment	0.431	SA-403 TP 304
WB-043	18" SCH 40 Pipe Segment	0.641	SA-240 TP-304
WB-044	2.15" Thick Bar	2.15	SA-240 TP-304
WB-045	2.5" dia x 10" long Stud	2.5	SA-193 GR B7
WB-046	14" Sch 40 Pipe Segment	0.470	SA-358 GR 304 SS
WB-052	CRDM Stainless/Inconel Block	0.626	SA-182 TP 304/ASME SB-167
WB-053	3" thick Safe End	3.00	SA-182 TP 304/SA-508 CL. 2
WB-061	2" Sch 80 Pipe Segment	.225	SA-376 TP-304 SS
WB-062	3" Sch 40 Pipe Segment	0.265	SA-376
WB-063	3" SCH 80 Pipe Segment	0.287	SA-376 TP-304 SS
WB-064	4" SCH 40 Pipe Segment	0.268	SA-376 TP-304 SS
WB-065	4" SCH 80 Pipe Segment	0.343	SA-376 TP-304 SS
WB-066	14" Pipe Segment	0.370	SA-358 TP-304 SS
WB-067	16" Pipe Segment	0.395	SA-358 TP-304 SS
WB-068	20" Pipe Segment	0.414	SA-358 TP-304 SS
WB-069	24" Pipe Segment	0.400	SA-358 TP-304 SS
WB-071	Upper Injection Nozzle	0.785	SB-168 TP600
WB-072	Upper Injection Nozzle	0.785	SA-479 304L/SA-182

Attachment A

Current List of TVA Calibration Blocks with Nominal 5%*t* Notch Depth

DocLink	General Description	Actual Wall Thickness	Material Type
WB-073	CRDM Pipe Segment	0.625	SB-168 TP600
WB-074	CRDM Pipe Segment	0.625	SA-479 304L/SA-182
WB-075	Recirc Coolant Pump Bolt	4.5	SA-540 E4340H
WB-077	Nozzle to Shell UT	2.5/1.0	

Attachment B

Ultrasonic Calibration Standards (L18 960329 800)



Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379-2000

L18 960329 800

March 29, 1996

Mr. Ernest Farrow
Hartford Steam Boiler Inspection & Insurance Co.
200 Ashford Center North, Suite 300
Atlanta, GA 30338-4860

Dear Mr. Farrow:

ULTRASONIC CALIBRATION STANDARDS

Purpose:

The purpose of this memorandum is to state TVA's position regarding calibration block design and provide justification why existing calibration standards surpass current requirements established by the ASME Section XI Code, 1989 Edition.

Background:

Ultrasonic piping calibration blocks for Browns Ferry baseline examinations were fabricated to the 1971 Edition of the ASME Section XI code. These blocks contain 5% sawtooth notches. In addition, baseline calibration blocks for Sequoyah and Watts Bar were fabricated to the 1974 Edition with Summer 1975 Addenda of Section XI with similar calibration notch design (i.e., 5% notches) for a majority of piping applications.

Ultrasonic calibration blocks for TVA nuclear sites (Browns Ferry, Sequoyah, Watts Bar) continue to be fabricated to the requirements of ASME Section XI with 5% circumferential and axial notches for a majority of austenitic and ferritic applications. Bellefonte calibration blocks used at other TVA sites are reviewed by the inspection agency when used in a specific application. In some cases, the calibration standards for austenitic piping may contain 10% notches (e.g., centrifugal cast piping).

The nondestructive examination (NDE) requirements were recently revised to comply with the 1989 Edition of the ASME Section XI Code for all nuclear sites (WBN, SQN and BFN). This upgrade was a result of the second interval update for Sequoyah. The NDE upgrade provides a generic consistency in procedure implementation at all TVA nuclear sites.

c:mlt/letters

Applicable Code Requirement

Section XI Subsection IWA-2232 requires that ultrasonic examinations be conducted in accordance with Appendix I. The requirements for vessel welds less than or equal to 2 inches in thickness and all piping welds are contained in Appendix III, as supplemented by Appendix I. The requirements for calibration reflectors are contained in Article III-3430 with reference to Table III-3430-1 and Appendix III Supplement 4 for austenitic and dissimilar metal welds.

Applicable Components

Full penetration butt welds and adjacent base metal in piping systems having a nominal wall thickness of 0.2 to 6 inches. Vessel welds less than or equal to 2 inches in thickness.

Description of Condition

The 1989 edition of the ASME Section XI code currently requires that calibration blocks contain notches within tolerances described in Appendix I and Appendix III. A majority of piping calibration blocks contain 5% notches which are determined to be conservatively outside the limits of Table III-3430-1 and Appendix III Supplement 4, as applicable.

Technical Justification

Currently TVA has continued with this conservative measure of using notches less than code requirements due to the following reasons:

- Current examination results are compared with previous examination data in order to determine if significant change has occurred (i.e., greater than +6dB). If calibration blocks are remachined to comply with 1989 Section XI tolerances then current results are not comparable.
- The cost to machine deeper notches is not justified and provides no value add to the current Inservice Inspection Program examinations.
- Appendix III, Article III-3430 of the ASME Section XI code 1989 Edition makes provision for an acceptable alternative block design. In addition, IWA-2240 Alternative Examination methods may be substituted for the methods specified in the applicable Division, provided the results are demonstrated to be equivalent or superior to those of the specified method. Where alternative methods (i.e., the use of 5% notches) have been demonstrated, the Inspection Agency review has been documented and found to be equivalent or superior.
- Examination sensitivity is increased by +2 to +6 dB when using 5% notches as compared to 10% notches.
- TVA procedures require any flaw regardless of amplitude to be recorded.
- Sizing of a flaw is not based on reference sensitivity of the notch but actual satellite pulse signals which accurately locate the flaw tip.

Conclusion:

TVA's position concludes that the ASME Section XI code contains the requirements essential for the examination of piping and components. More conservative measures (notches that are below the maximum code allowable) are deemed to comply with ASME Section XI. The proposed alternatives do not compensate a decrease in the level of quality and safety. We request that you review the subject position and concur with the technical basis stipulated. Any questions may be directed to myself at (423)843-4355.



Frank C. Leonard
Manager, Ultrasonic Group
Inspection Services Organization
STC 1I-SQN

Concurrence: Ernest R. Farwell 4/6/96
Authorized Nuclear Inservice Inspector Supervisor (ANIIS)

cc: George Deaton, CFC 1A-BFN
Bruce Earnigh, WBN
Albert Ladd, CFC 1A-BFN
Tom McGovern, SQN
Neal Jackson
Charles Metcalf
Bill Rice

Attachment C

Ultrasonic Basic Calibration Block Demonstration (N-GP-18) (W47 140528 001)

ULTRASONIC BASIC CALIBRATION BLOCK DEMONSTRATION (N-GP-18)

Purpose:

The purpose of this demonstration is to document equivalency (or better) of the typical TVA Basic Piping Calibration Block designs compared to the ASME design defined in ASME Section XI, Appendix III, Paragraph III-3430 (2001 Edition through 2007 Edition with 2008 Addenda). This demonstration is applicable to examinations performed to meet the requirements of Section XI, Appendix VIII.

Background:

Ultrasonic piping calibration blocks for Browns Ferry baseline examinations were fabricated to the 1971 Edition of the ASME Section XI code. These blocks contain 5% saw-tooth notches. In addition, baseline calibration blocks for Sequoyah and Watts Bar were fabricated to the 1974 Edition with Summer 1975 Addenda of Section XI with similar calibration notch design (i.e., 5% notches) for a majority of piping applications.

Ultrasonic calibration blocks for TVA nuclear sites (Browns Ferry, Sequoyah & Watts Bar) continue to be fabricated to the requirements of ASME Section XI with 5% circumferential and axial notches for a majority of austenitic and ferritic applications. Bellefonte calibration blocks used at other TVA sites are reviewed by the inspection agency when used in a specific application.

In some cases, the calibration standards for austenitic piping may contain 10% notches (e.g., centrifugal cast piping).

When the nondestructive examination (NDE) requirements were revised to comply with the 1989 Edition of the ASME Section XI Code for all nuclear sites (WBN, SQN and BFN), the requirements included use of Basic Calibration Blocks with 10% notches. A technical justification and demonstration were performed in accordance with IWA-2240 (Ref: L18 960329 800), which provided documented alternatives to the 10% notch requirement, by allowing the use of 5% notches.

Applicable Code Requirements:

Section XI Subsection IWA-2232 requires that ultrasonic examinations be conducted in accordance with Appendix I. For all piping welds, Appendix I requires compliance with Appendix VIII, with no additional Appendix I Supplements.

Most Generic PDI and vendor piping procedures that are qualified in accordance with Section XI, Appendix VIII allow for the use of the Basic Calibration Block, designed in accordance with Section XI,

W47 140528 001

Appendix III. However, Appendix VIII also offers provisions for alternative calibration methods, provided equivalency (or better) is demonstrated for each applicable angle and sound mode.

Applicable Components:

This demonstration is applicable to full penetration butt welds and adjacent base metal in piping systems, with UT requirements defined by Section XI, Appendix VIII.

Problem Statement:

In the 1998 Edition with 1999 Addenda of Section XI, Appendix III, Paragraph III-1100(c) [III-1100(d) in later Editions and Addenda], an additional statement was added which restricts the use of IWA-2240 for notch dimensions. However, Section XI, Appendix VIII, VIII-4300 provide a means of demonstrating equivalency (or better) of alternative calibration methods for exams performed in accordance with Section XI, Appendix VIII. Thus, PER 833069 was written to address these additional demonstration requirements.

Technical Justification:

Currently TVA has continued with this conservative measure of using notches shallower than code requirements due to the following reasons:

- Current examination results are required to be compared with previous examination data in order to determine if significant change has occurred (Appendix VIII, VIII-2100). If calibration blocks are re-machined to comply with Section XI tolerances then the results will not be comparable.
- The cost to machine deeper notches is not justified and provides no value added to the current In-service Inspection Program examinations.
- Re-machining basic calibration blocks runs the risk of compromising the specimen (i.e. cutting too deep).
- Appendix VIII, Article VIII-4300 of the ASME Section XI code makes provision for acceptable alternative calibration methods. This may be done without requalification of the procedure.
- TVA procedures require any flaw regardless of amplitude to be recorded.
- Sizing of a flaw is not based on reference sensitivity of the notch but actual satellite pulse signals which accurately locate the flaw tip.

Demonstration Process:

- This demonstration was conducted on 5/28/2014.
- Equipment was selected and calibrated in accordance with N-UT-84, Revision 0002, which incorporates EPRI-PIPE-MPA-1, Rev 0 (EPRI TR 1016650).
- Calibration was performed using a longitudinal and a shear wave transducer on basic calibration block number BF-31.
- Signal response was observed from the 5%T circumferentially oriented ID notch for the following angles:
 - Longitudinal Mode: 40-70 degrees in 1 degree increments
 - Shear Mode: 30-70 degrees in 1 degree increments
- The process was repeated for each angle and sound mode on the 10%T circumferential ID notch and the sensitivity was compared to that of the 5%T notch.
- For each angle and sound mode observed, the sensitivity level was higher for the 5%T notch compared to that of the 10%T notch.

Conclusion:

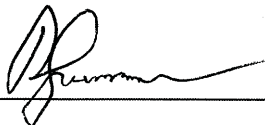
Based on the results of this demonstration, TVA concludes that the use of 5%T notches in the Basic Calibration Blocks used for Section XI, Appendix VIII purposes are acceptable and comparable – or better – in sensitivity to those described in Section XI, Appendix III, Paragraph III-3430. Thus, these calibration blocks are deemed to comply with ASME Section XI, Appendix VIII, paragraph VIII- 4300. Should future Appendix VIII examinations include requirements for angles or sound modes outside of those documented in this demonstration, then additional demonstrations may be necessary contingent on the code of record used at that time.

 Damon
Priestley

TVA UT Level III

6-3-14

Date

 Ryan
Spencer

ANII Concurrence

6/3/14

Date