



April 12, 2017

10 CFR 50.4

Serial: BSEP 17-0036

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

Subject: Brunswick Steam Electric Plant, Unit No. 2  
Renewed Facility Operating License No. DPR-62  
Docket No. 50-324  
Application of Dissimilar Metal Weld Full Structural Overlay on Reactor Pressure  
Vessel Nozzle N9 (CAC No. MF9561)

Reference: 1. Letter from William R. Gideon (Duke Energy) to the U.S. Nuclear Regulatory  
Commission Document Control Desk, *Proposed In-service Inspection  
Alternative for Application of Dissimilar Metal Weld Full Structural Overlay*,  
dated April 6, 2017, ADAMS Accession Number ML17096A619

Ladies and Gentlemen:

By letter dated April 6, 2017 (i.e., Reference 1), Duke Energy Progress, LLC (Duke Energy),  
proposed a 10 CFR 50.55a(z)(1) alternative to apply a dissimilar metal weld full structural weld  
overlay (FSWOL) to the reactor pressure vessel N9 nozzle-to-end cap weld for the Brunswick  
Steam Electric Plant (BSEP), Unit No. 2.

Prior to BSEP Unit 2 entering Mode 2 following completion of the FSWOL, Duke Energy  
committed to provide a summary for the FSWOL applied to the N9 nozzle-to-end cap weld, to  
demonstrate the as-built dimension equals or exceeds the minimum design dimensions of the  
overlay design. Duke Energy also committed to provide the overall component shrinkage after  
the weld overlay application. Enclosed is the summary comparing the as-built measurements to  
the minimum design dimensions and the overall component shrinkage measurements following  
application of the weld overlay.

Please refer any questions regarding this submittal to Mr. Lee Grzeck, Manager – Regulatory  
Affairs, at (910) 457-2487.

Sincerely,

Mark McPherson  
Director – Organizational Effectiveness (Acting)  
Brunswick Steam Electric Plant

WRM/wrm

Enclosure: Brunswick Steam Electric Plant, Unit No. 2 Summary, Comparing the Nozzle N9 Full Structural Weld Overlay Design to the As-Built Dimensions and the Overall Weld Overlay Shrinkage Measurements

cc (with enclosure):

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Brunswick Steam Electric Plant, Unit No. 2 Summary,  
 Comparing the Nozzle N9 Full Structural Weld Overlay Design to the As-Built Dimensions  
 and the Overall Weld Overlay Shrinkage Measurements

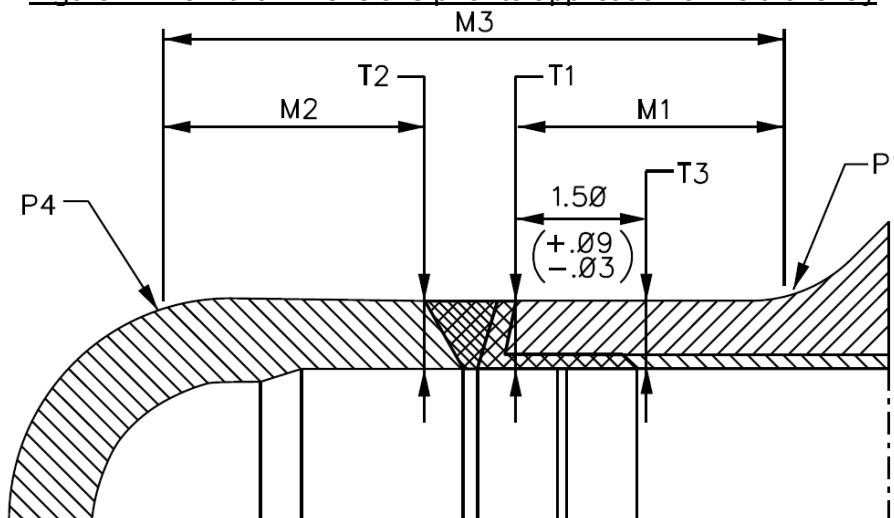
The purpose of this enclosure is to document the evaluation of the final weld overlay as-built dimensions and compare these to the design requirements contained in Calculation 1700487.310, Revision 1, and Design Drawing 1700487.510, Revision 1.

Additionally, this enclosure documents the measured axial shrinkage due to the application of the full structural weld overlay (FSWOL).

**Documentation of Raw Measurements Obtained During the Weld Overlay Process**

The applicable dimensions are shown in Figures 1 and 2 below.

Figure 1 - As-Built Dimensions prior to application of weld overlay



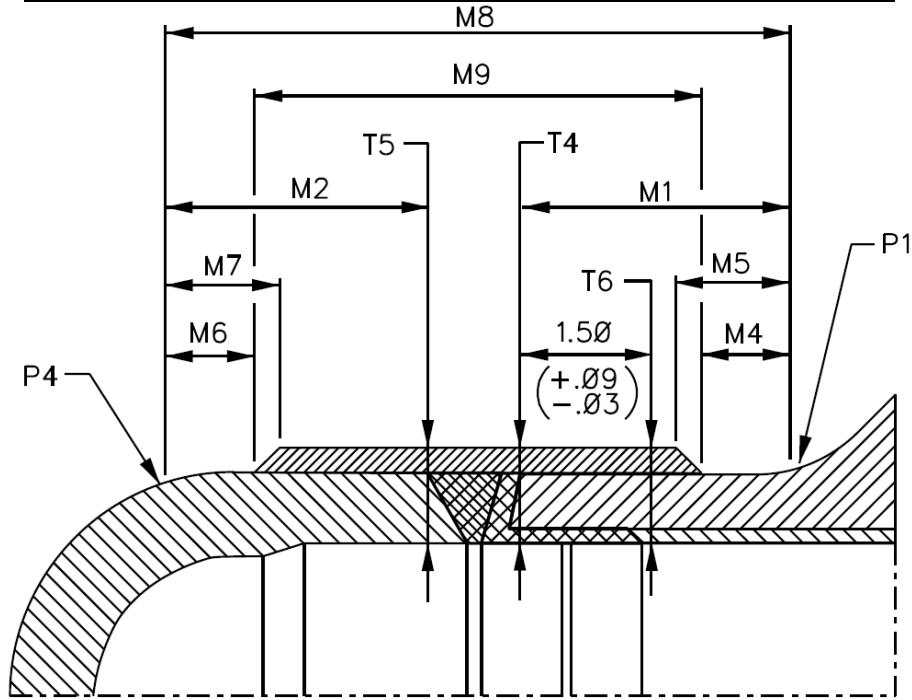
Linear Measurements

Location	M1 (in)	M2 (in)	M3 (in)
0°	3.280	3.300	7.970
90°	3.350	3.350	8.070
180°	3.360	3.310	8.200
270°	3.260	3.270	7.960

Thickness Measurements

Location	T1 (in)	T2 (in)	T3 (in)
0°	0.908	0.817	0.910
90°	0.896	0.833	0.920
180°	0.913	0.831	0.910
270°	0.896	0.847	0.896

Figure 2 - As-Built Dimensions following application of weld overlay



Linear Measurements

Location	M4 (in)	M5 (in)	M6 (in)	M7 (in)	M8 (in)	M9 (in)
0°	0.910	1.430	0.860	1.280	7.930	6.160
90°	1.100	1.430	0.900	1.480	8.010	6.010
180°	0.810	1.370	0.800	1.440	8.130	6.520
270°	0.880	1.410	0.880	1.420	7.950	6.190

Thickness Measurements

Location	T4 (in)	T5 (in)	T6 (in)
0°	1.387	1.337	1.348
90°	1.335	1.326	1.310
180°	1.408	1.314	1.396
270°	1.385	1.312	1.371

Dilution Layer Thickness

Location	TD (in)
0°	0.025
90°	0.035
180°	0.047
270°	0.036

**Comparison of As-Built Data to Design Requirements**

The tables below document the developed critical length and thickness dimensions from the process traveler raw data. These developed dimensions are compared to the Acceptance Criteria from the Design Drawing.

**Critical Length Dimensions**

Location	M1-M4 (in)	Acceptance Criteria (in)	Comment
0°	2.370	2.10-2.60	Criteria Met
90°	2.250	2.10-2.60	Criteria Met
180°	2.550	2.10-2.60	Criteria Met
270°	2.380	2.10-2.60	Criteria Met

Location	M1-M5 (in)	Acceptance Criteria (in)	Comment
0°	1.850	1.79-2.04	Criteria Met
90°	1.920	1.79-2.04	Criteria Met
180°	1.990	1.79-2.04	Criteria Met
270°	1.850	1.79-2.04	Criteria Met

Location	M2-M6 (in)	Acceptance Criteria (in)	Comment
0°	2.440	2.10-2.54	Criteria Met
90°	2.450	2.10-2.54	Criteria Met
180°	2.510	2.10-2.54	Criteria Met
270°	2.390	2.10-2.54	Criteria Met

Location	M2-M7 (in)	Acceptance Criteria (in)	Comment
0°	2.020	1.79-2.04	Criteria Met
90°	1.870	1.79-2.04	Criteria Met
180°	1.870	1.79-2.04	Criteria Met
270°	1.850	1.79-2.04	Criteria Met

**Critical Thickness Dimensions**

Location	T4-T1-TD (in)	T5-T2-TD (in)	T6-T3-TD (in)	Acceptance Criteria (in)	Comment
0°	0.454	0.495	0.413	0.31-0.56	Criteria Met
90°	0.404	0.458	0.355	0.31-0.56	Criteria Met
180°	0.448	0.436	0.439	0.31-0.56	Criteria Met
270°	0.453	0.429	0.439	0.31-0.56	Criteria Met

**Included Transition Angle**

The transition angle was verified by gauge measurement to ensure that the included angle at the transition to the overlay met or exceeded the acceptance criteria of 135 degrees or greater.

**Weld Shrinkage Information**

The follow table documents the amount of weld shrinkage which occurred during the welding process.

Location	M3-M8 (in)
0°	0.040
90°	0.060
180°	0.070
270°	0.010