

April 27, 2017  
QA-2017-012

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

Ladies and Gentlemen:

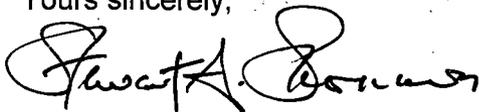
Subject: Reply to a Notice of Nonconformance Cited in Nuclear Regulatory Commission Vendor  
Inspection Report No. 99901383/2016-201

References: 1. Notices of Nonconformance 99901383/2016-201-01 and 9901383/2016-201-02  
2. Curtiss-Wright Electromechanical Corporation Letter QA-2017-005, dated  
January 31, 2017

Curtiss Wright Electromechanical Corporation (CW-EMD) acknowledges receipt of NRC  
Inspection Report 99901383/2016-201 and NRC letter, dated March 29, 2017, regarding CW-  
EMD's dispute of the Notices of Nonconformance 99901383/2016-201-01 and  
9901383/2016-201-02.

CW-EMD is committed to complying with the provisions of Appendix B, "Quality Assurance  
Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"; to Title 10 Code of Federal  
Regulations; and to Title 10 Code of Federal Regulations Part 21, "Reporting of Defects and  
Noncompliance". CW-EMD has taken the results of this inspection seriously and is taking  
action to resolve Notices of Nonconformance. CW-EMD respectfully submits Attachments  
1 and 2 as our revised responses to the Notices.

Yours sincerely,



Stewart A. Shannon, PE  
Senior Director, Product Assurance  
Curtiss-Wright Electro-Mechanical Division

Attachments: 1) Response to NON 99901383/2016-201-01, Revision 1  
2) Response to NON 99901383/2016-201-02, Revision 1

cc: J. Burke, Chief, Quality Assurance Vendor Inspection Branch – 2, Division of Construction  
Inspection and Operational Programs, Office of New Records  
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IED9  
NRD

## Attachment 1, Revision 1

### Notice of Nonconformance 99901383/2016-201-01

- A. Criterion III, "Design Control," of Appendix B "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the Code of Federal Regulations (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," states, in part, that, "Measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in 10 CFR 50.2, and as specified in the license application, for those structures, systems, and components to which the appendix applies are correctly translated into specifications, drawings, procedures, and instructions."

Westinghouse Electric Company (WEC) design specification document APP-MP01-M2-001, "AP1000 Reactor Coolant Pump," Revision 4, dated March 1, 2013, Section 5.1.3, "Flywheel Materials," states in part, that, "The flywheel assembly shall be encased within a welded Alloy 625 enclosure to protect the heavy alloy from contact with the reactor coolant."

WEC design specification document, APP-MP01-M2-001 references WEC design specification document, APP-GW-VLR-010, "AP1000 Supplemental Fabrication and Inspection Requirements," Revision 1, dated May 11, 2010, Section 4.2.5, which states in part, that, "Any uses of Alloy 600 filler metals in contact with reactor coolant at temperatures less than 400°F (204°C) require engineering evaluation and justification."

Contrary to the above, as of November 18, 2016, CW-EMD failed to transfer all pertinent design requirements into applicable instructions and failed to use the material specified in the design specification. Specifically, Alloy 600 weld filler material was used for weld numbers 37, 38, 39 and 61 of the flywheel enclosure without performing a documented engineering evaluation as required by WEC design specification APP-GW-VLR-010, Section 4.2.5.

The safety function of the Reactor Coolant Pump when power is removed is to provide coastdown flow to maintain adequate core cooling. The flywheel enclosure is part of the flywheel assembly which is critical to this function.

#### Response

- (1) The reason for the noncompliance:

Westinghouse Electric Company (Westinghouse) document APP-GW-VLR-010, "AP1000 Supplemental Fabrication and Inspection Requirements," Revision 1, was issued on May 11, 2010, after the discussions described below had been completed.

Curtiss-Wright Electro-Mechanical Corporation (CW-EMD) held numerous discussions with Westinghouse during the evolution of the AP1000 RCP regarding the flywheel design due to the critical function of the AP1000 RCP flywheel. These exchanges spanned the years 2005 through 2010, and consisted of various forms of formal and informal communication that included emails, telephone calls, meetings, and document submittals such as weld procedures. These exchanges culminated in June, 2009, with an agreement by both parties

**Attachment 1**  
**Notice of Nonconformance 99901383/2016-201-01**

regarding the use of the materials selected for construction. CW-EMD submitted weld procedures that specifically identified alloy 600 weld filler material 82/182 for welds 37, 38, 39 and 61 on the flywheel assembly which Westinghouse approved in June, 2009. CW-EMD did not produce a formal document as a result of these various communications to summarize the engineering evaluation and technical basis that led to this design decision.

Westinghouse subsequently approved the CW-EMD weld procedures associated with the alloy 600 type weld material 82/182 on the flywheel weld joints in question. Westinghouse issued Revision 2 of the design specification that included language specific to the flywheel materials, which has remained unchanged. CW-EMD considered the issuance of Revision 2 of the design specification as acknowledgement by Westinghouse that the use of the alloy 600 type weld filler material was technically justified and that no additional action by CW-EMD was required.

CW-EMD did not interpret the requirement in APP-GW-VLR-010, "AP1000 Supplemental Fabrication and Inspection Requirements," Revision 1, dated May 11, 2010, as requiring a new formal engineering evaluation and justification. This was due in part to the fact that the flywheel design and the use of the alloy 600 type weld filler material 82/182 for welds 37, 38, 39 and 61 on the flywheel assembly was concluded in 2009, prior to the issuance of APP-GW-VLR-010, Revision 1, in 2010. Additionally, CW-EMD considered that the requirements of this supplemental specification had effectively been met by: (1) the aforementioned interaction with Westinghouse on the flywheel assembly, and (2) Westinghouse's approval of the weld procedures for the particular welds in question. CW-EMD considered approval of the weld procedures as acceptance of the engineering evaluation and technical justification for the use of alloy 600 type weld filler material 82/182 on the flywheel assembly that had been previously communicated.

(2) The corrective steps that have been taken and the results achieved:

CW-EMD initiated Corrective Action Request (CAR)-2016-00272 following the NRC inspection.

A team comprised of Design Engineers, Metallurgist, Quality Assurance Engineers, Engineering Managers and Quality Assurance Managers evaluated the processes, procedures, engineering decisions and communications between CW-EMD and Westinghouse on the use of alloy 600 type weld filler material 82/182.

As recommended in the March 29, 2017, NRC letter, CW-EMD has informed Westinghouse of the revision of the NRC nonconformance associated with the alloy 600 type weld filler material 82/182 as it pertains to the AP1000 flywheel assembly and that additional actions may be necessary on the part of Westinghouse to rectify the conflict between the manufactured component and the AP1000 Design Control Document (DCD). Westinghouse was notified by formal letter on March 31, 2017.

**Attachment 1**  
**Notice of Nonconformance 99901383/2016-201-01**

(3) The corrective steps that will be taken to avoid further noncompliance:

CW-EMD is in the process of formally documenting the engineering evaluation and justification for the use of alloy 600 type weld filler material 82/182 on the AP1000 flywheel assembly that is in contact with reactor coolant at temperatures less than 400°F (204°C) to meet the requirements of APP-GW-VLR-010, Revision 1, dated May 11, 2010, Section 4.2.5. The completed engineering evaluation and justification will be submitted to Westinghouse.

In the interest of continuous improvement, CW-EMD will share the learnings from this nonconformance to reinforce the importance of documenting and communicating design bases to ensure compliance with equipment design specification requirements and that they are correctly translated into specifications, drawings, procedures and instructions.

(4) The date when the corrective action will be completed:

The above corrective actions will be completed by June 30, 2017.

## Attachment 2

### Notice of Nonconformance 99901383/2016-201-02

- B. Criterion III, of Appendix B to 10 CFR Part 50, states, in part, that, "Measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems and components."

Criterion VII, "Control of Purchased, Material, Equipment, and Services," of Appendix B to 10 CFR Part 50 states, in part, that, "Measures shall be established to assure that purchased material, equipment, and services, whether purchased directly or through contractors or subcontractors, conform to the procurement documents. These measures shall include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products upon delivery." EMD Product Assurance Instruction No. 224, "Commercial Grade Surveys," Revision 2, dated November 5, 2015, states, in part, that, "The Commercial Grade Survey Checklist shall be used to guide the evaluation process, document the observed control of critical characteristics, and provide adequate objective evidence to support the conclusions regarding the adequacy of the supplier's controls."

Contrary to the above, as of November 18, 2016, the NRC inspection team identified two examples where EMD failed to establish adequate measures for the selection and review for suitability of application of materials and processes that are essential to the safety-related functions of structures, systems, and components. Also, EMD failed to provide objective evidence of quality furnished by the contractor or subcontractor. Specifically, EMD failed to verify through the conduct of a commercial-grade survey or another acceptance method that certain critical characteristics identified in the technical evaluation of the impeller casting, impeller weld repair, and calibration services were adequately controlled. EMD's commercial-grade survey of Precision Castparts Corporation did not verify that they had imposed and verified the necessary controls on their commercial sub-suppliers for performing hot isostatic pressing activities and control and testing of weld filler material. In addition, EMD's commercial-grade survey of R. L. Holliday (RLH) did not verify that they had imposed and verified the necessary controls on their commercial sub-suppliers for the calibration of RLH's equipment. For both of these suppliers, EMD did not perform any additional verification or acceptance activities to ensure that the identified critical characteristics were adequately controlled and the components would perform their intended safety function.

The safety function of the Reactor Coolant Pump when power is removed is to provide coastdown flow to maintain adequate core cooling. The impeller is part of the safety-related rotor assembly which performs this function.

**Attachment 2**  
**Notice of Nonconformance 99901383/2016-201-02**

**Response:**

(1) The reason for the noncompliance:

Curtiss-Wright Electro-Mechanical Corporation (CW-EMD) identified "approval and control of suppliers" and "subcontractor calibration controls" as critical characteristics, for the commercial grade surveys of Precision Castparts Corporation (PCC) and R. L. Holliday (RLH), respectively. While conducting the commercial grade surveys of these suppliers, CW-EMD's ASME NQA-1 Qualified Lead Auditors concluded that the objective evidence provided by PCC and RLH included controls and measures with appropriate provisions to verify that the critical characteristics were met with reasonable assurance.

CW-EMD, as the purchaser and dedicating entity, identified the critical characteristics and verified with reasonable assurance that the safety function of the item would be met by means of the commercial grade survey as well as the other acceptance methods employed as part of the commercial grade dedication process.

The following causes contributed to the referenced notice of nonconformance:

- 10CFR Appendix B is not specific as to the extent of the objective evidence required during a commercial grade survey. As a result:
  - During the commercial grade surveys of PCC and RLH, objective evidence of the sub-supplier controls was reviewed and deemed sufficient by the CW-EMD ASME NQA-1 Lead Auditor.
  - The manner in which CW-EMD ASME NQA-1 Lead Auditors document objective evidence is not standardized.

(2) The corrective steps that have been taken and the results achieved:

CW-EMD initiated Corrective Action Request (CAR)-2016-00268 following the NRC inspection.

On February 14, 2017, CW-EMD implemented recurring training for ASME NQA-1 Lead Auditors. The first training session reviewed good practice for documenting audits and surveys.

On March 2, 2017, CW-EMD implemented a monthly peer review process for supplier audits and surveys. In the review, supplier audits and commercial grade surveys completed in the previous month are critiqued for completeness, accuracy, and sufficient objective evidence. The first session was conducted on March 2, 2017.

In April, 2017, CW-EMD conducted an assessment of PCC weld filler material controls to assure PCC has adequately controlled their commercial sub-suppliers. CW-EMD obtained samples of weld filler material from PCC for three PCC sub-suppliers of weld filler material. Those samples were tested at an independent laboratory. The results of the independent tests are consistent with the information reported on the weld filler material certified material test reports obtained with the weld filler material.

**Attachment 2**  
**Notice of Nonconformance 99901383/2016-201-02**

On March 15, 2017, CW-EMD conducted a commercial grade survey of RLH's quality system. This survey of RLH's quality manual, procedures, and quality records included review of supplier qualification and assessment activities. The survey showed sufficient controls are in place to assure that sub-suppliers of calibration services are capable of providing the required services to assure the quality of the services provided by RLH to CW-EMD.

(3) The corrective steps that will be taken to avoid further noncompliance:

CW-EMD will conduct a commercial grade survey of PCC in May, 2017.

(4) The date when the corrective action will be completed:

The above corrective action will be completed by May 31, 2017.