



GE Oil & Gas

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U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001  
ATTN: Document Control Desk  
Subject: Reply to a Notice of Nonconformance - NON 99901468/2016-201-01

Document Control Desk:

This notification is to provide response to the subject NON 99901468/2016-201-01 related to Inspection Report 99901468/2016-201. GE Oil & Gas has completed the investigation of this issue and has identified and implemented the appropriate improvement actions required for resolution. The specific Nonconformance is provided as attachment A to this letter.

**Finding Response:**

**1. Cause- Reasons for nonconformance**

The commercial grade dedication (CGD) process for safety related components requires verification of mechanical strength of valve components. The program at GE Oil & Gas Dresser, Inc. Alexandria utilizes material tensile strength and hardness as critical characteristics to achieve this. Alexandria has documented the acceptance criteria for these characteristics within an internal procedure, Engineering Guideline EG504, "Hardness Calculations for Safety Related Materials". This procedure, EG504 Revision 4, was reviewed during the NRC Inspection.

***Material strength for non-steel materials***

The EG504 procedure incorporated a commonly used industry formula which correlates ultimate tensile strength to hardness values for steel materials. This procedure also listed the required hardness values for some non-steel materials. In revision 4, the procedure described the method for calculating acceptable hardness values using the correlated formula for steel; but did not describe the method or source for acceptance values for the non-steel materials. This layout seemed to indicate that the steel formula was being applied incorrectly for non-steel materials, and prompted the concern about the validity of this formula for non-steel materials. During the Inspection, the site did not provide another method used to determine the non-steel values.

During later investigation of this issue for root cause and for 10CFR Part 21 evaluation, it was determined that this correlation formula was never used for the non-steel materials. The non-steel values were determined from an alternate source based on ASME Section II.

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The procedure EG504 Revision 4 was found to be inadequate in that it listed hardness values for steel and non-steel materials; but only described the method used for steel materials.

The document also did not denote the limitation of usage of the formula for steel only materials. The document also did not describe the Source for the hardness values for non-steel materials.

Further investigation into prior revisions of this procedure indicate that when the original document was issued; it had only included the steel materials. In the past 2-3 years, as the 4 non-steel materials were added to this procedure, the correct hardness values and tensile strength were added to the table; but the table did not indicate that those values were obtained from a different source. The entire procedure is being corrected.

### ***Hardness margin***

In a prior revision of the same procedure EG504 Revision 3 from December, 2013; a note was added to the table of tensile and hardness values. The note reads:

“Note 2: A 10% margin is given for final hardness acceptance.”

The table included the minimum hardness values accepted and had included tightened values for steels to allow the design margin. The intent was to provide Engineering with added design margin which they could apply judiciously case by case with Engineering approval if needed. There was no justification provided for addition of this note or for the potential 10% margin. There was also no tightening of the non-steel limits to allow for later margin.

## **2. Correction & Containment**

GE Oil & Gas Alexandria has completed an extensive evaluation for 10CFR Part 21 applicability and concluded that no safety concern exists for any of the components impacted by these issues. New applications of CGD for non-steel components were halted until resolution of these analyses. Since the inception of EG504 for Alexandria’s CGD program, a total of 29 components have been dedicated via this method. All have been analyzed for the conditions identified herein; and none have a potential safety concern. It is concluded that the identified conditions do not constitute a reportable safety condition under 10 CFR Part 21. These items were also reviewed for potential nonconformance to the internal Quality program.

### ***Material strength for non-steel materials***

For the 4 spindles of ASTM B637 Type 2 Inconel identified in this issue, the CGD have been reanalyzed. As stated above, none of the tensile strength or hardness values used were based on the stainless steel correlation formula in EG504. The required tensile and hardness limits were obtained from ASTM Code Ref. 8.2 & Ref. 8.3 and ASME Section II Part D Ref 8.1. No other non-steel components utilized values based on the steel correlation formula. So, all of the components are conforming to the internal Quality program regarding this issue.



### ***Hardness margin***

A review was done to identify potential nonconformances on the pressure containing and retaining parts made with Inconel X-750 (2015 ASME Boiler & Pressure Vessel Code IIB, SB-637) relative to the appropriate hardness limits. Of the 29 components commercially dedicated via CGD process per EG504; there are 8 with possible quality deviations given the hardness values used with the 10% margin allowance.

It was determined that the 8 components which include 5 spindles and 3 disc holders would be non-conforming to the revised hardness limits in the proposed EG504 revision. This revision specifies a min/max range of acceptable values vs the audited revision which had only a minimum hardness with a 10% tolerance added.

The revised limits for this material are:

Minimum Hardness per SB-637	302 (HBN) Equivalent Hardness: 32.5 HRC
Maximum Hardness per SB-637	363 (HBN) Equivalent Hardness: 40 HRC

For the spindles which exceed limits by < 1.5 HRC points, a failure mode and effects analysis was performed at fire sizing load conditions on the parts to determine potential safety risks. Each was evaluated for the potential failure modes of compressive fracture, Brinelling of the spindle, brittle fracture and stress corrosion cracking. All have no risk to very minimal risk of failure

For the disc holders, the hardness values exceed the lower limit by 1 HBN point.

The peak stress on this part would be the Hertzian contact stress at the load bearing surface. With no lapping at assembly, the maximum contact stress calculated was 73,007 psi. The equivalent tensile strength for 85 HRB is approximated to be 79,000 psi. There is a minimal risk of failure of these parts.

Overall, no safety risks exist in the components which do not meet the proposed revision of Engineering Guideline EG504. The Quality program risks will be dispositioned within the internal Quality program.

### **3. Corrective Actions**

1. Complete an investigation for 10CFR Part21 applicability - Complete. No safety concerns
2. Reanalyze all items commercially dedicated per EG504 - Complete per internal Design File
3. Revise and correct Procedure EG504, "Hardness Calculations for Safety Related Materials". Complete - The procedure has been updated to clearly describe the method and source used by GE Oil & Gas Alexandria for obtaining acceptable tensile strength and hardness values for dedication of various materials including stainless steel, and non-steels. The updated Revision "A" of EG504 also clarifies the applicability and limits for each value.



#### 4. Action Closure

All committed actions are completed.

Please provide your comments and/or closure of this NON.

Thank you for your attention and consideration in this matter.

A handwritten signature in cursive script that reads "Anne Sullivan".

Sincerely,  
Anne Sullivan  
Global Quality Manager

CC: Chief, Mechanical Vendor Inspection Branch  
Division of Construction and Operational Programs  
Office of New Reactors



**Attachment A      Notice of Nonconformance 99901468/2016-201-01**

**Finding**

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted at the GE Oil & Gas facilities located in Pineville, LA, on May 2, 2016, through May 6, 2016, certain activities were not conducted in accordance with NRC requirements which were contractually imposed on GE Oil & Gas by its customers or NRC licensees.

A. Criterion III, "Design Control," of Appendix B, "Quality Assurance 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 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."

Contrary to the above, as of May 6, 2016, GE Oil & Gas failed to adequately review certain parts that are essential to the safety-related functions of components for suitability of application, as evidenced by the following examples. Specifically GE Oil & Gas:

1. Failed to adequately verify the material property critical characteristic of tensile strength during the commercial-grade dedication of valve spindles. For safety-related valve spindles supplied on purchase order (PO) SNG10078319 with Georgia Power for Edwin I. Hatch Nuclear Plant, PO 00713094 with Duke Energy Corporation for H.B. Robinson Steam Electric Plant, and one spare spindle on GE/Dresser production order 20040774, the value of tensile strength, a critical characteristic, was calculated rather than tested. This calculation was performed using a formula that correlates the measured Brinell hardness test value to tensile strength. This methodology is commonly used for steel materials, but the formula is not applicable for the ASTM B637 Type 2 (Inconel) material specified in the above examples. GE Oil & Gas did not perform a technical evaluation to justify the use of the calculation formula for stainless steel in an Inconel alloy application. This resulted in inadequate verification of the material's tensile strength property to provide reasonable assurance that the spindles have sufficient mechanical strength to perform the intended safety function. GE Oil & Gas has fabricated and shipped four spindles as part of safety-related valves and has one spindle fabricated and in stock that is available for a future customer order.

2. Failed to provide a technical evaluation to justify the hardness margin tolerance, used to accept a hardness value, a critical characteristic used during



commercial-grade dedication for a valve spindle. GE Oil & Gas applied a 10 percent margin tolerance, with no technical justification. This resulted in inadequate verification of the material's hardness property to provide reasonable assurance that the spindle has sufficient hardness to perform its intended safety function. The spindle is in stock that is available for a future customer order.

These issues have been identified as Nonconformance 99901468/2016-201-01.