

Enclosure 6 to ET 07-0022

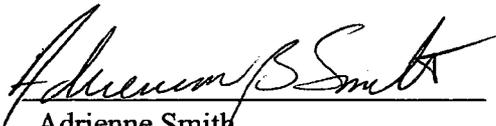
**Nutherm International Quality Assurance Plan (WCN-9175QAP), Revision 0**

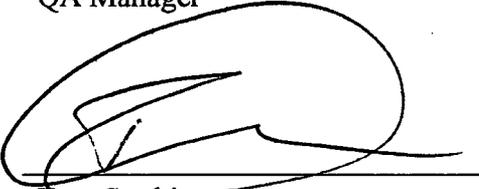
**NUTHERM**  
**QUALITY ASSURANCE**  
**PLAN**

**FOR**  
**CS INNOVATIONS**  
**REPLACEMENT MSFIS SYSTEM**

**WOLF CREEK NUCLEAR OPERATING CORPORATION**  
**PURCHASE ORDER NO. 734527**

**NUTHERM DOCUMENT NUMBER WCN-9715QAP, REV. 0**

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**REVISIONS**

The revision number is indicated at the top of each page, for all revisions. To delineate the exact location of a given revision, a vertical line is used on the right margin. However, for a complete report rewrite, no vertical lines are used.

**REVISION LOG**

<b><u>REVISION</u></b>	<b><u>DATE</u></b>	<b><u>PAGE</u></b>	<b><u>SECTION</u></b>	<b><u>REFERENCE</u></b>
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### PURPOSE

The purpose of this Quality Assurance Plan (QAP) is to establish and define the Quality Assurance controls Nutherm International, Inc. shall apply to the goods and services used to qualify and dedicate the commercial grade items described in the "Device Descriptions" section of this document. All activities shall be conducted in accordance with the Nutherm International, Inc. Quality Assurance Program.

The Nutherm International, Inc. QA program, as outlined in the Nutherm International, Inc. Quality Assurance Manual (QAM) referenced below, satisfies the requirements of 10 CFR 50, Appendix B, 10 CFR 21, ANSI/ASME N45.2, and ANSI/ASME NQA-1.

This plan addresses the methodology to verify the critical characteristics, testing, and verification of the units described in the "Device Descriptions" section of this document. The plan outlines the processes through which conformance with the applicable sections of the customer's specifications shall be achieved.

Qualification of the units is addressed in Nutherm International, Inc. Qualification Plan WCN-9715P. Qualification shall be accomplished through a combination of type testing.

Dedication of the production units is addressed in Nutherm International, Inc. Dedication Plan WCN-9715DP. Dedication shall be accomplished through a combination of inspection, testing, survey, and source inspection of the manufacturer, and analysis. Dedication shall be performed in accordance with EPRI NP-5652.

Documentation shall be in accordance with the Nutherm International, Inc. QA Program requirements and augmented by any other requirements in the customer's Purchase Order.

### APPLICABLE STANDARDS AND DOCUMENTS

- IEEE 344-1975 – "Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations."
- IEEE 323-1974 – "Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations"
- 10CFR50, Appendix B. – "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"
- Nutherm International, Inc. Quality Assurance Manual No.: QA-N-10179-5.
- EPRI NP-5652- "Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications"



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- EPRI TR-102260-“Supplemental Guidance for the Application of EPRI NP-5652 on the Utilization of Commercial Grade Items”
- EPRI TR-102323-R2-1997 – “Guidelines for Electromagnetic Interference Testing in Power Plants”
- Regulatory Guide 1.180-R1-“Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems”
- IEEE 649-1991 – “Standard for Qualifying Class 1E Motor Control Centers for Nuclear Power Generating Stations”
- Wolf Creek Generating Station Specification J-105A(Q), Rev. 2
- EPRI TR-106439 – “Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment of Nuclear Safety Applications”
- WCN-9715DP, Rev. 1 – “Nutherm Dedication Plan for Replacement MSFIS System”
- WCN-9715P, Rev. 1 – “Nutherm Qualification Plan for Replacement MSFIS System”

### EQUIPMENT DESCRIPTION

The MSFIS System is a logic-controller-based system which performs the control functions to operate the Main Steam Isolation Valves (MSIVs) and Main Feedwater Isolation Valves (MFIVs). The Wolf Creek Nuclear Operating Corporation (WC) MSFIS System replacement will be designed and manufactured by CS Innovations, LLC. (CSI).

The MSFIS System will consist of two redundant and separate channels, with the control systems physically located in different cabinets. Each channel control system consists of a panel mounted Feed Rack, a panel mounted Steam Rack, and an Assembly Panel consisting of fuse blocks, a power block, and a terminal block with MOV's and TVS's mounted to an aluminum mounting plate. The Feed Rack and Steam Rack contain the same number and type of control boards, with identical electronic components used on the respective boards.

The Main Steam and Feedwater Isolation System (MSFIS) has two distinct functions:

- Steam Line Isolation System (SLIS) – Main Steam Line Isolation minimizes the uncontrolled cool down of the Reactor Coolant System (RCS) that would result from a main steam line rupture. Input signals pass from the detectors through the Solid State Protection System (SSPS) to the MSFIS cabinet where the output signal is generated.

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- Feedwater Isolation System (FWIS) – Feedwater isolation minimizes the potential for excessive post-trip cool down of the RCS due to overfilling the steam generators. It also prevents moisture carryover caused by high steam generator levels, and isolates normal Feedwater in the event of a high Energy Line Break inside containment.

The MSFIS provides 125 VDC output to energize or de-energize control solenoids to operate the plant Main Steam Isolation Valves (MSIVs) and Main Feedwater Isolation Valves (MFIVs). The MSFIS System has two redundant subsystems located in separate cabinets. Each MSFIS cabinet is capable of supplying the control logic outputs required for operating each of the 4 Main Steam Isolation Valves and 4 Main Feedwater Isolation Valves.

## **MANAGEMENT PLAN**

Nutherm International, Inc. implements a Quality Assurance Program meeting the requirements of 10CFR50, Appendix B. The Nutherm International, Inc. Quality Assurance Manual defines the management characteristics. This document displays the purpose, organization, oversight, and responsibilities for this project.

## **DEDICATION PROCESS**

Nutherm International, Inc. (NI) shall perform the dedication process in accordance with the controls outlined in the NI Quality Assurance Program and implementing procedures. In accordance with these procedures, a Dedication Plan was developed to define the critical characteristics and the applicable processes and standards which will be used to dedicate the MSFIS system. Dedication activities are performed in accordance with the methodology described in EPRI Report 5652.

In accordance with the EPRI guideline, determination of the item's safety function, confirmation of item's designation as commercial grade, and identification of the item's critical characteristics was performed in the Nutherm Dedication Plan for Replacement MSFIS System during the technical review process of the project. In accordance with NI procedures, a Component Dedication Planner (CDP) was generated for each item to be dedicated. The CDP identifies the safety classification, safety function/application requirements, critical characteristics to be verified, and verification method(s) to be used. The CDP requires independent engineering review prior to issuance.

The MSFIS System replacement will be designed and manufactured by CS Innovations (CSI). CSI does not maintain a Quality Assurance program meeting the requirement of 10 CFR 50, Appendix B. Nutherm International, Inc. (NI) will perform qualification and dedication activities for Wolf Creek Nuclear Operating Corporation (WC).

Nutherm shall conduct surveys and surveillances of CSI during manufacture of the MSFIS System replacement. Survey activities shall be used to determine the process



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controls in place at CSI to meet the requirements in the customer's purchase documents. Surveillance activities will be used to confirm the implementation of the controls observed during the initial survey.

NI personnel shall verify by direct observation any critical manufacturing steps or manufacturer testing necessary as part of the dedication plan. The surveillance activities shall be coordinated to coincide with these activities. The results of surveillance activities shall be recorded in accordance with NI procedural requirements.

Qualification will be based on testing performed on a test specimen in accordance with the NI Qualification Plan. Qualification testing shall be in accordance with the requirements of the WC purchase order and applicable codes and standards. The results of the testing performed for the qualification shall be recorded in a Qualification Report.

Production units will be manufactured using the same procedures, practices, and controls as the prototype unit. Changes to design or configuration will be documented in the CSI drawings. Testing and dedication of the production units will be performed in accordance with the NI Quality Assurance Program and the customer's requirements as outlined in the purchase document. Testing activities performed by the manufacturer shall be witnessed during surveillance activities at manufacturer's facility.

Any deviation from design, material, and performance characteristics relevant to the safety function of this system shall be documented by means of the NI nonconformance system. Nonconformance dispositions shall be documented in accordance with the NI quality assurance program.

NI shall generate and maintain documentation showing objective evidence of successful completion of the dedication and qualification activities performed for this project. Records shall be maintained in accordance with the NI quality assurance program.

A matrix of the critical characteristics was developed as part of the Nutherm dedication plan. This matrix classified the critical characteristics into three broad categories. These categories were physical characteristics, performance, and product dependability.

#### **PHYSICAL CHARACTERISTICS**

The physical characteristics include manufacturer's product information and the physical attributes of the manufactured item. These attributes are reviewed to assure that the item received is the item that was ordered. These critical characteristics shall be verified during receipt inspection and the Factory Acceptance Test (FAT).

Results of tests and inspections shall be documented in accordance with NI procedures. Nutherm Engineering Department is responsible for review and approval of all test and inspection results. The NI Quality Assurance Department is responsible for assuring the implementation of test and inspection procedures.

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As part of the receipt inspection, a comparison of the item used for qualification testing and the item received for dedication is performed. Differences between the item used in the qualification testing and the item received for dedication are reviewed and evaluated by the Nutherm Engineering Department. The results of this evaluation are maintained by NI as a quality record.

Surveillance activities at CSI shall confirm that design controls at this supplier maintain adequate control over the physical design of the item. CSI shall provide NI with drawings and documentation to allow receipt inspection of the items.

### PERFORMANCE

Performance testing shall be performed at Nutherm as part of the dedication. The FAT performed at NI will confirm the performance capability of the units. Testing shall be performed in accordance with a Nutherm test procedure. Acceptance criteria shall be in accordance with the WC specification. This test procedure shall be reviewed and approved by WC prior to performance. Test results shall be incorporated into the dedication report.

All production units shall be function tested and the results documented in accordance with the test procedure. Testing shall be performed by qualified technicians in accordance with the test procedures using calibrated measuring & test equipment. The test results shall be reviewed by an independent technician prior to acceptance.

Nutherm Engineering Department is responsible for review and approval of all test and inspection results. Quality Assurance Department is responsible for assuring the implementation of test and inspection procedures.

### DEPENDABILITY

The "Dependability" category of critical characteristics is described in EPRI TR-106439. Dependability includes the quality of design and manufacture, hardware design process, configuration control, failure modes/management, reliability, and problem reporting.

CSI shall perform hardware design in accordance with the recommendations of DO-254, "Design Assurance Guidance for Airborne Electronic Hardware". This document describes the hardware design life cycle and the data to be developed as evidence of compliance. NI Quality Assurance shall be perform surveys and surveillances to confirm CSI adherence to these requirements.

The design performed by CSI shall be reviewed by a WC representative as part of the V & V of the system. The final design shall be documented in drawings issued by CSI. Confirmation of configuration control shall consist of comparison of the system provided by CSI to the drawings issued (receipt inspection) and performance of the FAT. Surveillance activities conducted by NI shall provide confirmation that the manufacturer appropriately applied the quality program to design, design change, and manufacturing activities.

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Quality of manufacture is established by confirming the adequacy of the sub-components, assembly of the sub-components, and programming the FPGA. Sub-components used to produce the assembly consist of Commercial Off The Shelf (COTS) items. Adequacy of these items shall be confirmed by successful completion of the FAT. Sub-component assembly consists of populating the board in accordance with the design documents and the soldering of components to the board. Adequacy of these items shall be determined by receipt inspection activity and confirmed by successful completion of the FAT. The FPGA shall be programmed in accordance with the approved design. Adequacy of this shall be determined by successful completion of the FAT.

The quality of design and manufacture of the FPGA based MISFIS actuation system shall be confirmed by successful completion of the Nutherm Dedication Plan WCN-9715DP. Successful completion of validation activities listed in the Critical Characteristic Matrix listed in the dedication plan shall provide reasonable assurance of the adequacy of the quality of design and manufacture process of the system.

Failure modes and failure management shall be determined as part of design review process conducted by the WC representative. The results of this review shall be incorporated into the NI dedication report. It shall be the responsibility of WC to verify this critical characteristic and provide NI with documentation and attestation of the verification.

A system reliability analysis (SRA) shall be performed by a WC representative as part of the V & V of the system. The results of this analysis shall be incorporated into the NI dedication report. It shall be the responsibility of WC to verify this critical characteristic and provide NI with documentation and attestation of the verification.

Problem reporting shall be in accordance with the NI Quality Assurance Manual. The problem reporting procedures established by CSI shall be reviewed for adequacy by NI as part of the scope of a survey. Implementation of these procedures shall be reviewed during subsequent surveillance at CSI.