TEST REPORT

Accepted for Use

REPORT NUMBER: 101266224SAT-014
ORIGINAL ISSUE DATE: September 4, 2014
REVISED DATE: N/A

EVALUATION CENTER
16015 Shady Falls Road
Elmendorf, TX 78112
(voice) 210-635-8100
(fax) 210-635-8101
www.intertek.com

RENDERED TO

AREVA NP Inc.
4100 International Plaza
Fort Worth, TX 76109

AREVA	AREVA NP Inc.
	58-9224204-000

PRODUCTS EVALUATED: Quantum Silicones QSil Primer #3, Quantum Silicones QSil 5558MC Silicone Elastomer, Arlon Silicone Impregnated Fiberglass Fabric, IDEAL Clamp 9/16" All Stainless Steel 64 Series, Unifrax Fiberfrax® Durablanket® S, and Dow Corning® 732 Multi-Purpose Sealant

EVALUATION PROPERTY: Fire and Pressure Resistance (Fire-Pressure Test 2)

Report of Testing various fire stop systems when exposed to the fire and positive pressure conditions of ASTM E814-94b Standard Test Method for Fire Tests of Penetration Firestop Systems, and in accordance with AREVA NP Inc. Document No. 51-9217966-000, *Detailed Test Plan for Conducting MOX Fire-Pressure Test 2.*

1 Table of Contents

2 Introduction

Intertek Testing Services NA (Intertek) has conducted testing for AREVA NP Inc., on the fire and pressure resistance capabilities of Quantum Silicones QSil Primer #3 (QSil Primer #3), Quantum Silicones QSil 5558MC Silicone Elastomer (QSil 5558MC), Arlon Silicone Impregnated Fiberglass Fabric (Boot Fabric), IDEAL Clamp 9/16" All Stainless Steel 64 Series, Unifrax Fiberfrax® Durablanket® S (Durablanket), and Dow Corning® 732 Multi-Purpose Sealant and through a 12" thick concrete deck for compliance with the applicable requirements of and in accordance with AREVA NP Inc. Document No. 51-9217966-000, *Detailed Test Plan for Conducting MOX Fire-Pressure Test 2.* This test took place on March 5 and March 6, 2014.

This project was undertaken to evaluate the ability of select penetration seal designs to withstand various pressure levels after being subjected to a fire exposure (fire test).

NOTE: The test assembly used in this fire-pressure test was the same test assembly that was constructed and tested in Pressure Test 4C with select changes made to certain portions of the Pressure 4C test assembly. Refer to AREVA Doc. 58-9224196-000 or Intertek Test Report No. 101276459SAT-025 for details on Pressure Test 4C. Changes made to the Pressure Test 4C assembly in support of this fire-pressure test are described within this test report.

3 Test Samples

3.1. SAMPLE SELECTION

The sealant and primer materials were not independently selected for testing; they were supplied by AREVA NP Inc., and were received in several shipments from June 13 through December 27, 2013. All samples, except the QSil Primer #3, were received with Certificates of Conformance and are considered traceable. The QSil Primer #3 was received from the manufacturer (Quantum Silicones) as a "sample" and was not supplied with a Certificate of Conformance. Basic information on sealant and primer materials is presented in the table below.

Sealant Material	Lot /Batch#	Expiration Date
QSil 5558 MC	131014	11/4/2014
QSil Primer #3	131235	12/23/2014
Arlon 56493F031 Boot Material	100512Z9F	N/A
Ideal Hose Clamps	64880, 64104 (Series Numbers)	N/A
Durablanket® S	33274	N/A
DC-732 Sealant	0007251823	5/29/2015

Information regarding receiving dates and origin of the QSil 5558MC and QSil Primer #3 materials in the assembly can be found in Appendix F: Quality Documents of Pressure Test 4C (Intertek Test Report 101276459SAT-025; AREVA Doc. 58-9224196-000). Information

regarding receiving dates and origin for all remaining materials can be found in Appendix G of this report. All samples were received in good condition at the Evaluation Center.

3.2. SAMPLE AND ASSEMBLY DESCRIPTION

The assembly used in this test was the initial assembly tested as Pressure Test 4C with select modifications (as planned) for Fire-Pressure Test 2.

A detailed description and drawings of the concrete deck and penetrations can be found in AREVA NP Inc. Document No. 51-9217966-000, *Detailed Test Plan for Conducting MOX Fire-Pressure Test 2* which is contained in Appendix E. The installation and documentation of penetration seal assemblies contained within the test slab was performed by AREVA under AREVA's Quality Assurance Program (Reference 12.3 in the Test Plan found in Appendix E).

Note: The test assembly used for MOX Fire-Pressure Test 2 was the same test assembly that was constructed and used for MOX Pressure Test 4C [Test Plan Reference 12.7], modified to include addition of cables and internal conduit seals (ICS) in the two existing conduits, and converting the 12" diameter HVAC ducts to sleeves, installing pipes, and adding boot seals.

An opening size of 34" x 48" was selected because it represents the largest opening size that can be tested with the current pressure chamber design, when considering that the most challenging geometric shape for a flat plate with respect to flexural response occurs when the Length is ≈1.4 times the Width (34" x 1.4 = 47.6"). All sides of the opening will be unlined, with the previously installed enamel surface coating removed.

The penetrating items for this blockout will include the following:

- (1) 18"x4" stainless steel, solid-bottom (SSSB) cable tray without cover, with cables
- (1) 18"x4" galvanized steel, ladder-back (GLB) cable tray without cover, with cables
- (1) 4"x4" powder-coated carbon steel (PCCS) wire way without cover, with cables
- (1) 3" diameter stainless steel (SS) conduit with CPSE, XLPE, Modified XLPO, and LSZH-XLPO jacketed cable installed
- (1) 3" diameter rigid galvanized steel (RGS) conduit with CPSE, XLPE, Modified XLPO, and LSZH-XLPO jacketed cable installed
- (1) 2" diameter schedule 40 carbon steel pipe
- (1) 2" diameter S-40S stainless steel pipe
- (1) 2" diameter S-40S zirconium pipe
- (1) 1 ¼" diameter S-40S titanium pipe
- (1) 16 ga. 12" diameter galvanized steel sleeve with a 4" diameter carbon steel pipe
- (1) 16 ga. 12" diameter stainless steel sleeve with a 4" diameter stainless steel pipe

The cables penetrated through the opening, made a "u" shaped bend on one side of the seal and penetrate through the opening again. In effect the cables were looped with both ends of each cable terminating on the same side of the opening and forming a "u" shape through the seal. Using this configuration prevented any pressure leakage due to air travel through the cables.

The opening was sealed with an eight (8) inch thick Quantum Silicones QSil 5558MC Silicone Elastomer (QSil 5558MC) penetration seal with no permanent damming installed around the various penetrating commodities. Prior to placing the elastomer seal, the opening and all penetrating commodities were primed with QSil Primer #3 to promote elastomer adhesion. The placement of primer and elastomer was done under Pressure Test 4C. The installation of internal conduit seals (caulk and fiber) in the two 3" conduits, as well as, the installation of boot assemblies around the two 4" diameter pipes, comprises the scope of modifications made as part of the conduct of Fire-Pressure Test 2.

4 Testing and Evaluation Methods

Fire-pressure tests are unique in that a fire-pressure test consists of two separate tests; a modified fire test, followed by a pressure test.

The Test Plan in Appendix E defines the test methods, acceptance criteria and test report documentation requirements for conducting MOX Fire-Pressure Test 2. Additionally, this detailed test plan defines the roles and responsibilities of MOX Services, AREVA, the selected testing laboratory, and any other subcontracted entity engaged in support of fire-pressure testing efforts.

The detailed test plan also describes the procurement plan for materials associated with Fire-Pressure Test 2 and identifies the entities responsible for procuring the various components of the test assemblies based on the quality level assigned to each component.

The Test Plan also establishes minimum quality requirements for the penetration seal materials used in the test assemblies and links quality requirements in the AREVA QA program to customer/project quality requirements.

4.1. INSTRUMENTATION FOR FIRE TESTING

There were no thermocouples installed on the unexposed surface of the assembly because that information was already collected in previous tests of similar seal configurations, and previous fire-pressure tests had demonstrated that very little useful data was collected during a 30-minute fire test of 3-hour fire rated penetration seal designs. The output of the furnace thermocouples was monitored by a 300-channel Yokogawa, Inc., Darwin Data Acquisition Unit. The computer was programmed to save data every 30 seconds. Following the test, those files were imported into MS Excel for tabular and graphical display (presented in Appendix C1).

4.2. TEST STANDARD FOR FIRE TESTING

ASTM E814-94b, Standard Test Method for Fire Tests of Through-Penetration Fire Stops

The test was conducted in accordance with an older version of the standard, per the client's request. The acceptance criteria identified in ASTM E814-94b, Standard Test Method for Fire Tests of Through-Penetration Fire Stops are identified below.

A fire stop (penetration seal) shall be considered as meeting the requirements for an F-rating when it remains in the opening during the fire test and hose stream test within the following limitations:

a) The fire stops (penetration seals) shall have withstood the fire test for the rating period without permitting the passage of flame through openings, or the occurrence of flaming on any element of the unexposed side of the fire stops (penetration seals)

b) During the hose stream test, the fire stops (penetration seals) shall not develop any opening that would permit a projection of water from the stream beyond the unexposed side.

4.2.1 Deviation from Standard Method

Engineering thermocouples were not installed on each fire stop system in accordance with the test standard. Therefore, no attempt was made to determine compliance with T-rating requirements for this test.

The test plan did not require a hose stream test, so none was conducted. As such, F-ratings were not applicable for this test.

4.3. TEST APPARATUS FOR PRESSURE TESTING

In the absence of any consensus codes or standards related to the pressure testing of penetration seal assemblies, the MOX Penetration Seal Program has developed a standardized method for conducting pressure testing of MOX penetration seal designs. In support of this effort, Intertek assisted in the design and construction of a pressure test apparatus to be use in the conduct of MOX penetration seal pressure tests.

The pressure chamber apparatus consists of two hemispherical 72” diameter steel pressure vessels, calibrated equipment and a data acquisition system. The apparatus accurately maintains the desired air pressure, using one of two sensitive, manually adjustable pressure regulators; a high (0-15 psi) and a low (0-2 psi) range. The sealed collection chamber feeds any leakage air back to the test device, where it is channeled through one of two calibrated flow meters, once again, a high (0-200 L/min) and a low (0-20 L/min) range. A calibrated electronic pressure transducer (0-5 psi) measures the differential pressure between the two chambers and the data acquisition software determines the net pressure drop across the test seal and the leakage through the seal. The chambers are interchangeable and the direction can be reversed very quickly so both can serve as the pressure or the collection chamber.

The primary components described above include the following devices:

Pressure Chamber 2-piece hemispherical 72” diameter steel vessel
3 connection ports per piece
16 flange attachment points per piece
Flange attachment via 3/8” diameter holes @ 22-1/2° spacing

Pressure Cart Stainless steel rolling cart with control equipment and associated Data Acquisition System

Regulator (low)	Control Air, Inc., Amherst, NH Type 700 0-2 psi
Regulator (high)	Control Air, Inc., Amherst, NH Type 700 0-15 psi

Mass Flow Meter

Omega Engineering, Inc., Stamford, CT
Model No. FMA-872A-V-NIST
Serial No. 4270050001001
0-20 lpm

Mass Flow Meter

Omega Engineering, Inc., Stamford, CT
Model No. FMA-875A-V-NIST
Serial No. 4270050003001
0-200 lpm

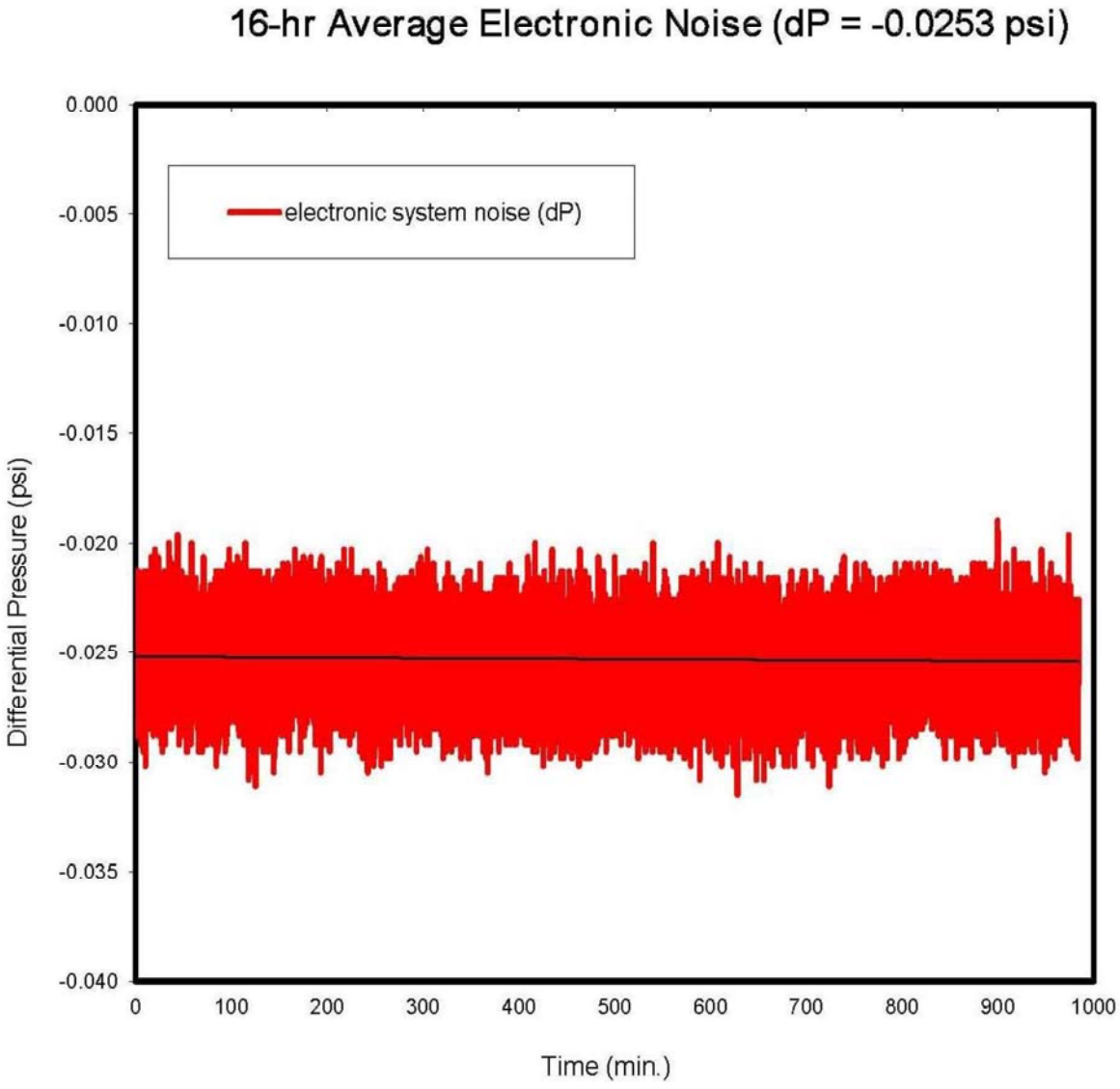
Pressure Transducer	Omegadyne Inc., Sunbury, OH Model No. PX409-005 DWUV Serial No. 406707 Pressure Range: 0-5 psi Input 0-100mVdc

Power Supply	Omega Engineering, Inc., Stamford, CT Model No. PSS-10 +10V @ 400 mA Input 115 VAC 50/60 Hz
Multifunction DAQ	National Instruments, Model No. NI USB-6210 16 Input, 16-bit, 250 kS/s, Multifunction I/O

Dedicated CPU

HP Compaq Pro-6300 Microtower
Serial No. MXL3090LN6
OS Windows 7 Pro

During initial system start-up testing and verification, it was discovered that the data acquisition system (DAQ) was so sensitive that "signal noise" resulted in data fluctuations for reported differential pressure even when the system was at equilibrium (i.e., both high side and low side pressure chambers were at atmospheric conditions). After collecting data for 16 hours overnight, the average fluctuation was -0.025 psi.



For this test, the Test Plan required pressure was applied and maintained using the DAQ reported differential pressure without consideration for any "signal noise". Since the "signal noise" always reported some level of negative pressure at the beginning of the test, this method assured that the tests were conducted with additional margin, as the actual differential pressure that the test specimen was subjected to was equal to the DAQ reported differential pressure plus the additional pressure needed to overcome the negative "signal noise" reported at the beginning of the test when both pressure chambers were at atmospheric conditions.

4.4. TEST STANDARD FOR PRESSURE TESTING

AREVA NP Inc. Document No. 51-**9217966-000**, *Detailed Test Plan for Conducting MOX Fire-Pressure Test 2*.

The requirements for fire rated penetration seals are discussed in DCS01-BRA-DS-TRD-B-01365-0, *Technical Requirements Document for MFFF Penetration Seals* [Test Plan Reference 12.5]. These requirements include the need for fire barrier penetration seals to be F-rated, commensurate with the hourly rating of the fire barrier in which they are installed. Additionally, these requirements also discuss the need for fire barrier penetration seals to withstand different forms of pressure concurrent with a fire (i.e., fire induced pressures and pressures from clean agent system discharge).

The MOX qualification strategy for concurrent fire and pressure conditions was to fire test penetration seals following consensus codes and standards committed to by the MOX project (ASTM E 814-94b [Test Plan Reference 12.8]), while invoking the "standard pressure condition" from standard test method ASTM E 814-94b for maintaining furnace pressure (i.e., furnace pressure at 0.01 in. wg greater than the pressure on the unexposed side of the test assembly).

Separate penetration seal assemblies will be pressure tested using detailed test plans for conducting pressure tests.

Finally, some additional test assemblies, such as the assembly to be tested under this Test Plan, underwent a limited duration fire test (30 minute duration) with the fire tested specimens then subjected to subsequent pressure tests.

The results of fire testing, pressure testing and combination limited duration fire tests followed by pressure testing of the same assembly served as the overall qualification for penetration seals required for concurrent fire and pressure conditions.

Based on the above, the specific acceptance criteria to be used for combination fire-pressure testing were as follows:

1. During the limited duration fire endurance portion of the test, the fire stops (penetration seals) shall have withstood the fire test for the limited 30 minute duration without permitting the passage of flame through openings, or the occurrence of flaming on any element of the unexposed side of the fire stops (penetration seals).

2. After the limited duration fire test, any residual flaming on the exposed side of the test assembly shall be extinguished with water. Following flame extinguishment, the fire stops (penetration seals) shall remain in place such that the unexposed side of the penetration remains completely sealed.

3. During the pressure test, the fire stops (penetration seals) are allowed to leak. However, the fire stops (penetration seals) shall remain in place (i.e., shall not become dislodged from the opening or otherwise catastrophically fail).

The anticipated fire-induced differential pressures, as they apply to MFFF penetration seal designs, are discussed in DCS01-BRA-DS-TRD-B-01365-0 [Test Plan Reference 12.5] and in calculation DCS01-ASI-DS-CAL-R-10552 [Test Plan Reference 12.6]. Most areas of the facility are bounded by a fire induced differential pressure of +/- 7.0 inches w.g. Plant areas with higher fire induced differential pressures are identified in calculation DCS01-ASI-DS-CAL-R-10552 [Test Plan Reference 12.6]. The maximum fire-induced differential pressure in any plant area is -14.7 inches w.g.

The pressure levels specified in the table below are to be used in the pressure test portion of this fire-pressure test. The 10 inch w.g. pressure is intended to bound the +/- 7.0 inches w.g. with margin. The 20 inches w.g. pressure is intended to bound the maximum fire-induced compartment pressure of -14.7 inches w.g. with margin.

A hold time of 5 minutes has been established for each pressure level to ensure that sufficient time at pressure is maintained to; 1) confirm that no leakage occurs at that pressure, or 2) stabilize make up air to maintain the pressure and identify the apparent location of the leak.

Differential Pressure Test Levels

Test Stage	Differential Pressure (inch w.g.)	Required Hold Time (minutes)	Acceptance Criteria	Basis for the Selected Differential Pressure
1	10.0	5	Seal Remains In Place	Testing at this differential pressure bounds the +/- 7.0 inches w.g. pressure used as the screening pressure cutoff for fire induced pressures [Test Plan Reference 12.6].
2	20.0	5	Seal Remains In Place	Testing at this differential pressure bounds the –maximum compartment fire-induced pressure of -14.7 inches w.g. pressure per the fire-induced pressure calculation [Test Plan Reference 12.6].

The test assembly was attached to the pressure test apparatus and subjected to the pressures identified in the above table as described below.

For Test Stages 1 and 2 the side of the test deck applied to the pressure was the same side that was exposed to fire. The pressure was applied as described below.

The test assembly was attached to the pressure test apparatus and subjected to air pressure at the select pressure levels identified in table, beginning with the Stage 1 pressure of 10.0 inches w.g. Once this pressure was obtained, the pressure was maintained for the hold time specified. Any leakage observed during the hold time was noted.

Once the designated hold time had been achieved, the pressure was increased to the next pressure level identified in the table (Stage 2, 20.0 inches w.g.) and held for the designated hold time. Any leakage observed during this hold time was noted.

If at any pressure level (or test stage) the penetration seal became dislodged from the opening or otherwise catastrophically failed, the pressure test was terminated and the time to failure and pressure at which the failure occurred was recorded.

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

5.1.1. Fire Test

The test assembly was placed on the laboratory's small-scale (7' x 7') horizontal furnace on March 5, 2014. Scott Groesbeck from AREVA was present to witness the test. The ambient temperature at the start of the test was 61°F, with a relative humidity of 51%.

The furnace was fired at 2:28 p.m. and the standard time/temperature curve in ASTM E814-94b was followed for a period of 30 minutes. After the first 5 minutes, the pressure differential between the inside of the furnace (measured at a point 12" below the concrete slab) and the laboratory ambient air was maintained at a nominal 0.00 inches of water column, which resulted in a positive pressure of 0.01" WC at the bottom of the test slab. Throughout the test, no visible changes occurred on the unexposed side of the assembly. There was no hose stream test required for this fire-pressure test. However, water was applied with a standard garden hose to extinguish residual flaming as allowed by the test plan. The assembly was allowed to cool overnight prior to conducting the subsequent pressure test.

Following the fire test, it was observed that the exposed side boot assemblies were white in color, but still intact. Most of the cable insulation on the exposed side was consumed, leaving the conductors exposed, with some cables still covered with charred cable insulation. The exposed surface of the elastomer seal material showed minor signs of charring.

Listings of the furnace control temperatures and specimen unexposed surface temperatures may be found in Appendix C1. Photographic documentation of the test has been included in Appendix D1.

5.1.2. Pressure Test

The exposed side of the test deck was fixed to the pressure chamber using (16) 5/16" x 2-1/2" long sleeve anchors (Red Head) through 16 pre-drilled holes. Silicone II caulk (GE) was used to create a pressure tight seal between the pressure chamber and the test deck.

The test was initiated at 1:50 p.m. on March 6, 2014. Scott Groesbeck representing AREVA NP Inc. was present to witness the test. The ambient temperature at the start of the test was 68°F, with a relative humidity of 42%.

The test procedure followed that presented in Section 9.0 of the Test Plan. During both stages of the pressure test, a soapy-water solution was applied to the non-pressurized side of the seal assembly. Leakage was detected and noted as follows:

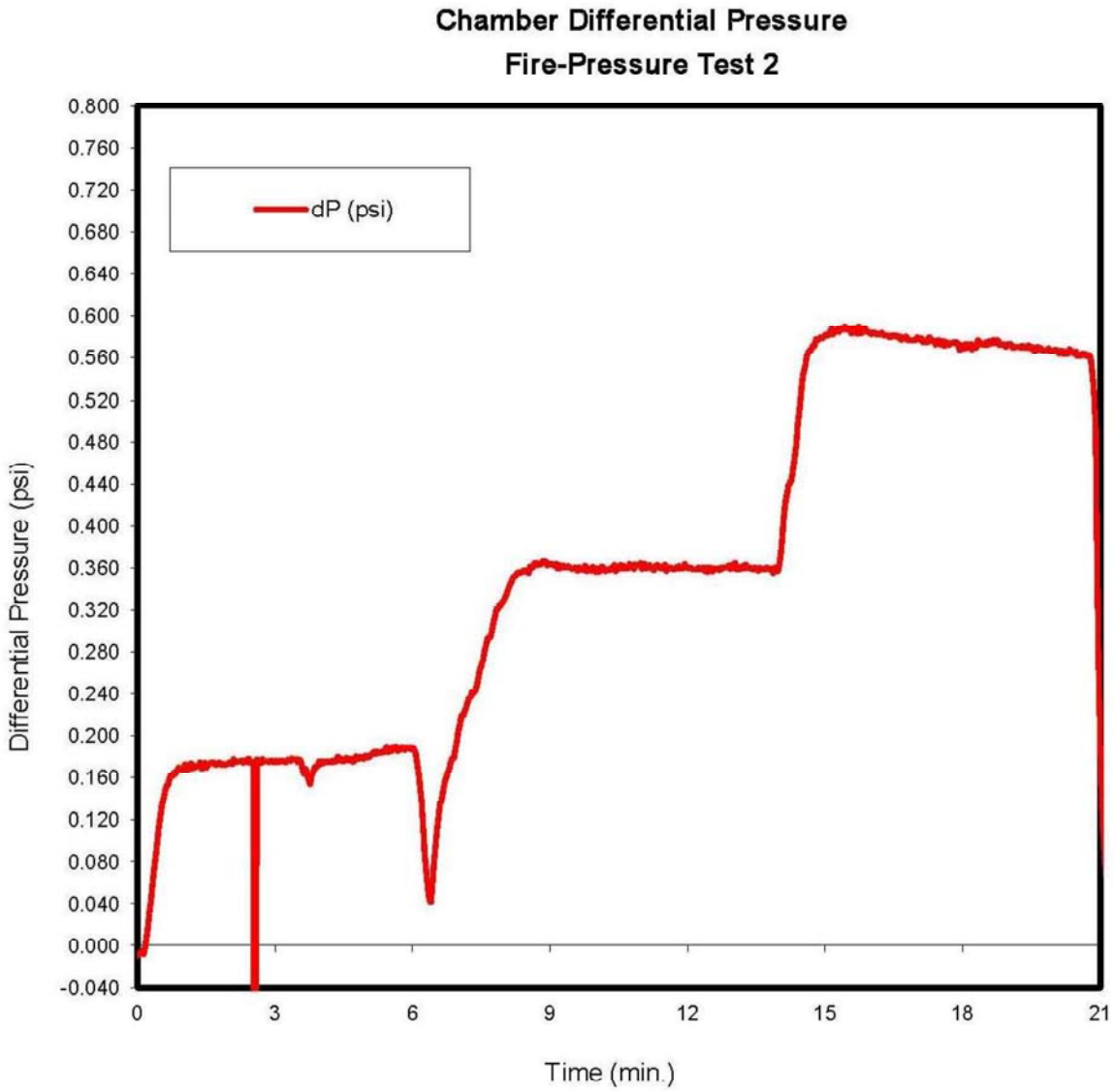
Stage 1 (10" WC): Large leaks detected at numerous cables in both cable trays and at the 2" carbon steel pipe. Seal held at required pressure for 5 minutes despite leaks.

Stage 2 (20" WC): Required pressure of 20" WC (0.723 psi) could not be achieved due to large amount of leakage and make up air limitations. Leakage points were similar to Stage 1 leak point, with an additional leakage point around the galvanized sleeve (P11).

Maximum pressure attained was 0.588 psi (plus noise). Pressure held for 5 minutes in the range of 0.566-0.588 psi (plus noise). Seal remained in place at these pressures.

The graph and table on the following page(s) provide a summary of results and observations for the two pressure stages.

Listings of the pressure data may be found in Appendix C2. Photographic documentation of the test has been included in Appendix D2.



Stage 2 Pressure could not be reached because the total leakage exceeded the available input air. With the 0-15 psi air regulator fully open, the differential pressure reached 0.588 psi which was lower than the required 0.722 psi. The seal did remain in place throughout the test.

Test Results and Observations

Test Stage	Differential Pressure inch w.g. (psi)	Required Hold Time (minutes)	Acceptance Criteria	PASS/FAIL
1	10 (0.361)	5	Seal Remains In Place	PASS
2	20 (0.723)	5	Seal Remains In Place	Undetermined

5.1.3. POST TEST EXAMINATION

Following completion of the pressure test, visual post-test examinations were performed. These examinations included, but were not limited to, the following:

- Integrity of seal and conditions on the exposed side of the penetration
  - The seal is uniformly charred to ~½" depth. The seal is tight against the barrier. 1/16" gap around commodities (except cables). 1/16" gap at pipes and conduits. 1/16" gap at cable tray and wire way. ¼" gap at stainless sleeve and 1/8" gap at galvanized sleeve. The majority of the cable jacket is gone, the remaining is charred but in place. For ICS, the ceramic fiber remains in place but the DC 732 is all gone. Bottom side of boots is whitish-gray and brittle but remains in place. All exposed side pipes, conduits, cable trays and wire ways are discolored.
- Integrity of seal and conditions on the unexposed side of the penetration
  - No visible changes were observed.
- Location of any penetration seal degradation
  - As noted on exposed side. No change on unexposed side.
- Condition of seal to barrier interface
  - Remains tight all around the opening on both exposed and unexposed sides.
- Condition of seal to penetrating item interfaces
  - Exposed side conditions as noted above. Unexposed side, the seal is visibly tight against the commodities, even at the 2" carbon steel pipe that leaked. ICS caulk is tight against cables and conduit. The boots are tight at the seal and at the pipes. The boot seals and conduit seals are pristine.

6 Conclusion

Intertek Testing Services NA (Intertek) has conducted testing for AREVA NP Inc., on the fire and pressure resistance capabilities of Quantum Silicones QSil Primer #3 and Quantum Silicones QSil 5558MC Silicone Elastomer through a 12" thick concrete deck for compliance with the applicable requirements of and in accordance with AREVA NP Inc. Document No. 51-9217966-000, *Detailed Test Plan for Conducting MOX Fire-Pressure Test 2.* This evaluation took place on March 5 and March 6, 2014.

This project was undertaken to evaluate the ability of select penetration seal designs to withstand various pressure levels after being subjected to a fire exposure (fire test).

The tested configurations did not burn through when exposed to the fire and positive pressure conditions as outlined in ASTM E814-94b, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.. In addition, the seals met the acceptance criteria (remained in place) for the first pressure stage (10" w.g.). The total leakage through the seal exceeded the available input air so the second stage pressure (20" w.g.) could not be reached. Therefore, the ability of the seal to remain in place at the second pressure stage is undetermined. These results apply only to the configurations and materials tested.

The conclusions of this test report may not be used as part of the requirements for Intertek product certification. Authority to Mark must be issued for a product to become certified.

INTERTEK TESTING SERVICES NA

[redacted]

Reported by: _____
Mike Dey
Staff Engineer

Reviewed by: _[redacted]_____
J
Project Engineer, Fire Resistance

[redacted]

Reviewed by: _
Michael A. Brown
Quality Supervisor

APPENDIX A
Assembly Drawings

APPENDIX A: TEST DECK/TEST SLAB DRAWINGS

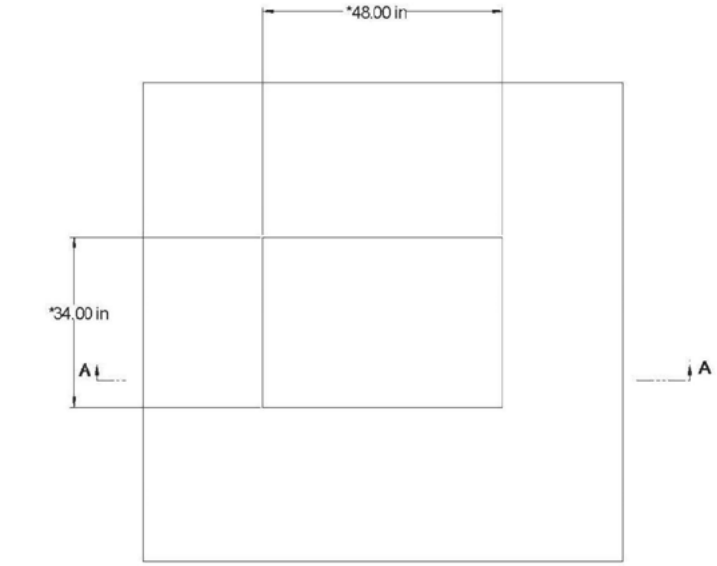
The test deck (test slab) for Fire-Pressure Test 2 is depicted on page A-2.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2



Section A-A

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

Intertek

APPENDIX B: TEST PENETRATION DRAWING

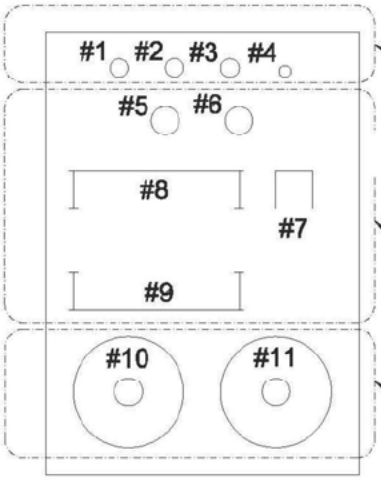
This appendix contains drawings for Fire-Pressure Test 2. These drawings identify penetrating item locations within the test penetration, as well as, the penetration seal design. Table B1 of this appendix provides the cable types to be used in each location.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Penetrating Item Locations



See page B-4 for piping commodity location dimensions.

See page B-6 for electrical commodity location dimensions.

See page B-10 for pipe and sleeve commodity location dimensions.

Penetrant descriptions are provided on page B-3.

Cable Fill Per Table B-1

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

Penetrant Description:

Penetrating Item #1 = 2" diameter schedule 40 carbon steel pipe capped on top side

Penetrating Item #2 = 2" diameter S-40S stainless steel pipe capped on top side

Penetrating Item #3 = 2" diameter S-40S zirconium pipe capped on top side

Penetrating Item #4 = 1 ¼" diameter S-40S titanium pipe capped on top side

Penetrating Item #5 = 3" diameter empty stainless steel (SS) conduit with cables

Penetrating Item #6 = 3" diameter empty rigid galvanized steel (RGS) conduit with cables

Penetrating Item #7 = 4"x4" powder-coated carbon steel (PCCS) wireway with cables

Penetrating Item #8 = 18"x4" stainless steel, solid-bottom (SSSB) cable tray with cables

Penetrating Item #9 = 18"x4" galvanized steel, ladder-back (GLB) cable tray with cables

Penetrating Item #10 = 12" diameter 16 gauge stainless steel sleeve with 4" diameter stainless steel pipe

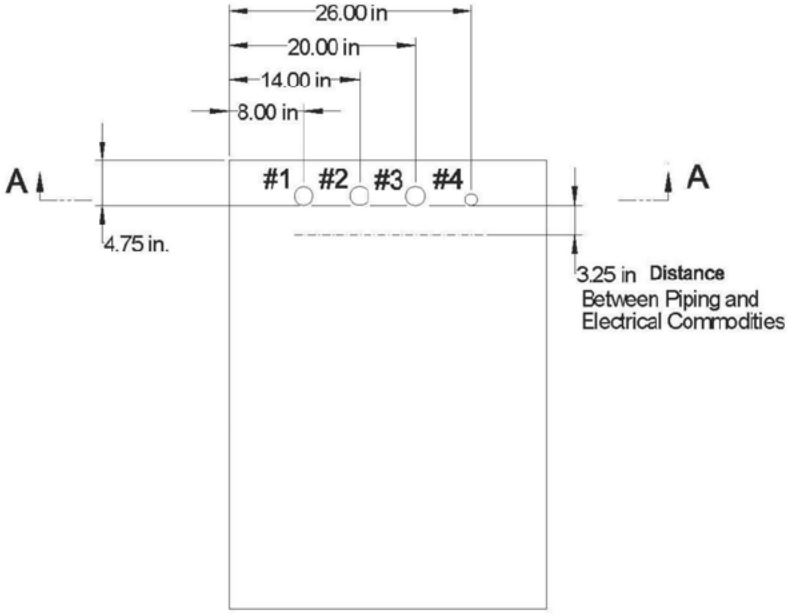
Penetrating Item #11 = 12" diameter 16 gauge galvanized steel sleeve with 4" diameter carbon steel pipe

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Piping Commodity Locations



See Page B-5 for Section A - A

Penetrant descriptions are provided on page B-3.

NOTES:

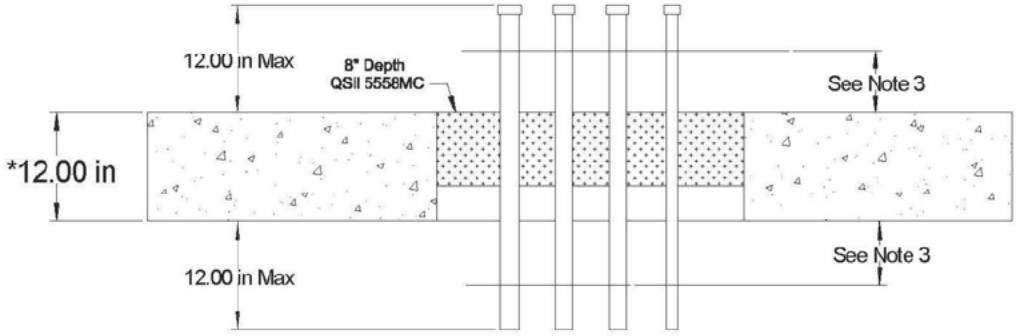
1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Penetrating Item Locations



Section A-A

NOTES:

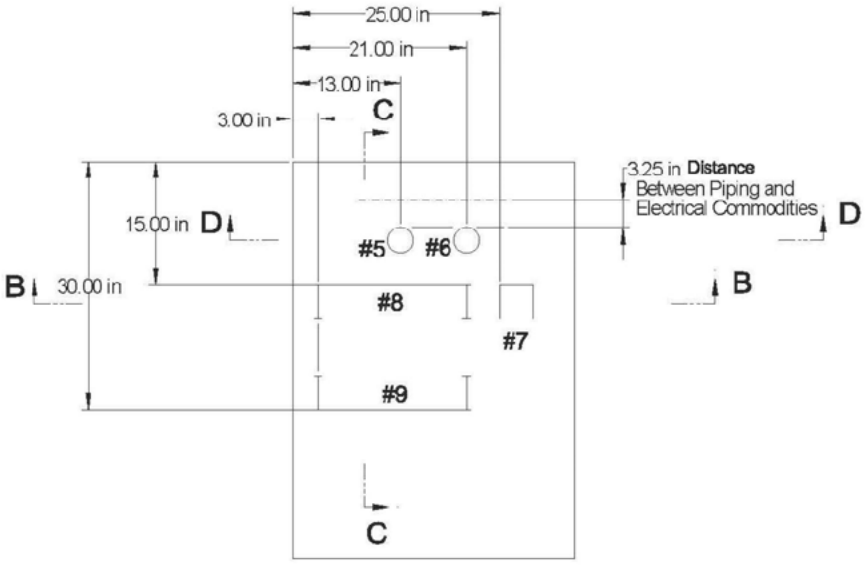
1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 6" TO 8" ABOVE AND BELOW SLAB. PIPE CLAMPS REQUIRED FOR TITANIUM AND ZIRCONIUM PIPES.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Electrical Commodity Locations



See Page B-7 for Section B - B,
Page B-8 for Section C - C
and Page B-9 for Section D - D

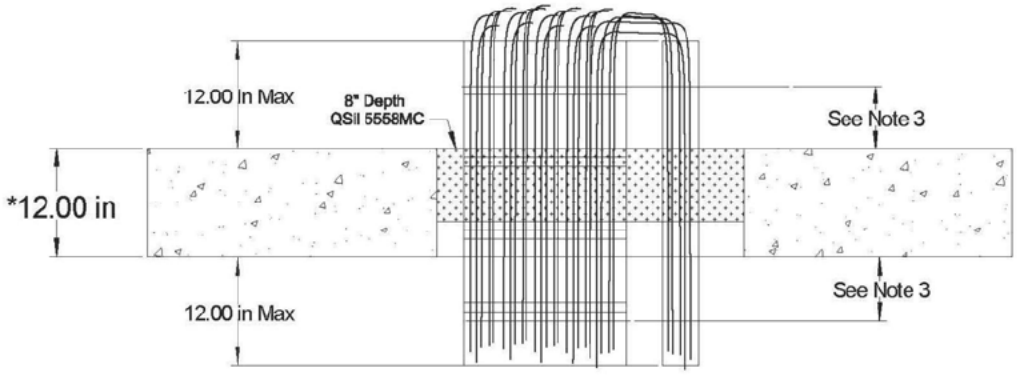
Penetrant descriptions are provided on page B-3.

Cable Fill Per Table B-1

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

Fire Pressure Test 2
Penetrating Item Locations



Section B-B

NOTES:

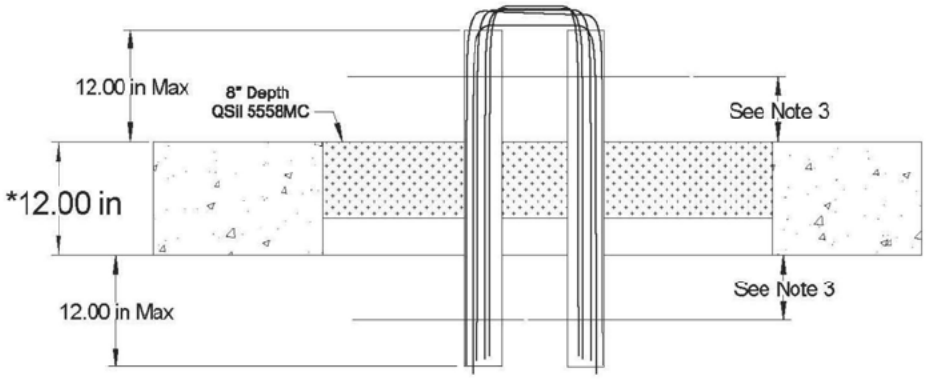
1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 6" TO 8" ABOVE AND BELOW SLAB.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Penetrating Item Locations



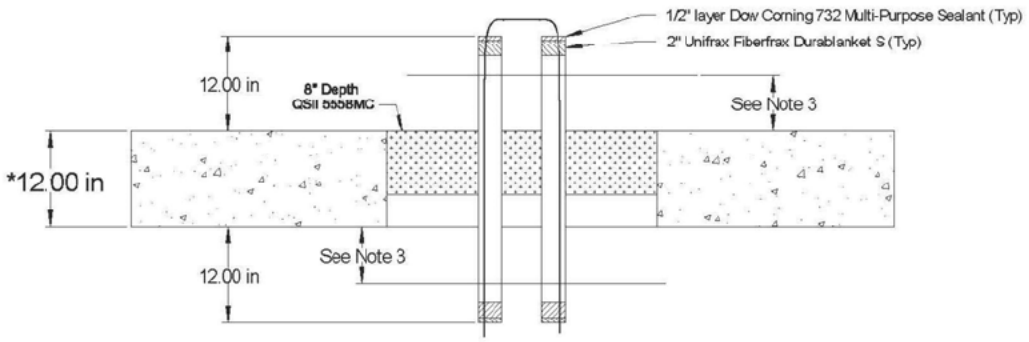
Section C-C

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 6" TO 8" ABOVE AND BELOW SLAB.

Intertek

Fire Pressure Test 2
Penetrating Item Locations



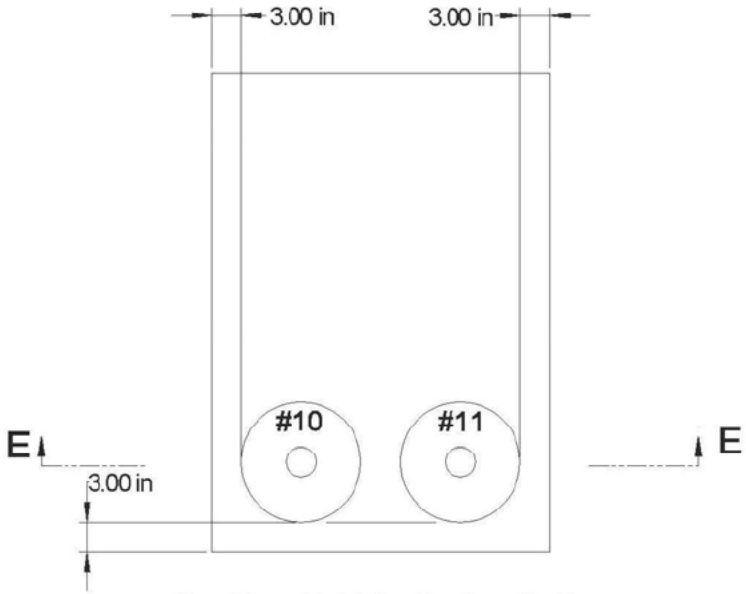
Section D-D

Cable Fill Per Table B-1

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 6" TO 8" ABOVE AND BELOW SLAB.

Fire Pressure Test 2
Pipe and Sleeve Commodity Locations



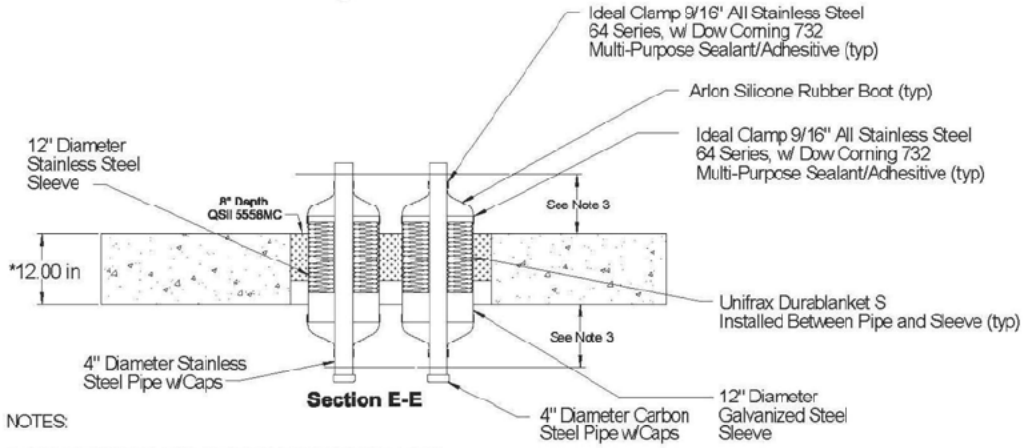
See Page B-11 for Section D - D

Penetrant descriptions are provided on page B-3.

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

Fire Pressure Test 2
Penetrating Item Locations



Section E-E

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 8" TO 10" ABOVE AND BELOW SLAB.
4. CAP ALL PIPES ON TOP OR BOTTOM (AIR TIGHT).

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Table B-1: Cable Fill By Raceway

Penetrating Item	Raceway Description	Cable Fill	Cable Description	Quantity (Lengths)
#1	2" Carbon Steel Pipe	NA		
#2	2" Stainless Steel Pipe	NA		
#3	2" Zirconium Pipe	NA		
#4	1 ¼" Titanium Pipe	NA		
#5	3" Stainless Steel Conduit	Single CSPE Jacket	Item no. 2 (Control) 1/C 8 AWG 7/S TC 45 MILS XLPE, 15 MILS CSPE FIREWALL III® 600V	1 wfb-7
		Single XLPE Jacket	Item no. 283 (SIS) 1/C 6 AWG 7/S TC Class B Strand 60 MILS XLPE FIREWALL® SIS 600V Type SIS/XHHW-2 (UL) Listed Colored Grey	1 wbe-1
		Single XLPE Jacket	Item no. 25 (Control) 4/C 20 AWG 7/S TC 20 MILS XLPE, 15 MIL XLPE JKT 600V	1 whd-3
		Single Modified XLPO Jacket	Item no. 77 (COAX) COAX CABLE WITH RG TYPE 59/U, or equal / 22 AWG FOR 62 OHMS (RSS-6-104/LE) Except Not UL Listed & Meets ICEA S-19-81 Paragraph 6.19.6 (IEEE-383 Paragraph 2.56)	1 whe-8
		Single LSZH-XLPO Jacket	Item no. 85HF (VFD Power) 3/C 10 AWG 7/S TC, 20 MILS XLPE, 1-#10 AWG CU GW, O/A TINNED COPPER BRAID SHIELD, 35 MIL ZH-XLPO JKT X-LINK® 600V	1 wfa-26
#6	3" Carbon Steel Conduit	Single CSPE Jacket	Item no. 2 (Control) 1/C 8 AWG 7/S TC 45 MILS XLPE, 15 MILS CSPE FIREWALL III® 600V	1 wfb-7

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

		Single	Item no. 283 (SIS) 1/C 6 AWG 7/S TC Class B Strand 60 MILS XLPE FIREWALL® SIS 600V Type SIS/XHHW-2 (UL) Listed Colored Grey	1 wbe-1
		Single XLPE Jacket	Item no. 25 (Control) 4/C 20 AWG 7/S TC 20 MILS XLPE, 15 MIL XLPE JKT 600V	1 whd-3
		Single Modified XLPO Jacket	Item no. 77 (COAX) COAX CABLE WITH RG TYPE 59/U, or equal / 22 AWG FOR 62 OHMS (RSS-6-104/LE) Except Not UL Listed & Meets ICEA S-19-81 Paragraph 6.19.6 (IEEE-383 Paragraph 2.56)	1 whe-8
		Single LSZH-XLPO Jacket	Item no. 85HF (VFD Power) 3/C 10 AWG 7/S TC, 20 MILS XLPE, 1-#10 AWG CU GW, O/A TINNED COPPER BRAID SHIELD, 35 MIL ZH-XLPO JKT X-LINK® 600V	1 wfa-26
#7	4" x 4" PCCS Wire Way	40% Power / Control Cable - Moderate OD, Copper Cross Section and HOC	Item no. 261 (Power) 2/C 12 AWG 7/S TC, 30 MILS XLPE, 1-#12 AWG GW, 34 AWG TC BRAID SHLD, 45 MIL CSPE JKT FIREWALL® III 600V	17 wga-14
			Item no. 30 (Control) 5/C 14 AWG 7/S TC 30 MILS XLPE, 45 MIL CSPE JKT FIREWALL® III 600V	17 wha-4
#8	18"x4" SSSB Cable Tray	50% Control / Instrument Cable - High OD, Copper Cross Section and HOC	Item no. 70 (Control) 37/C 16 AWG 7/S TC 25 MILS XLPE, 80 MIL CSPE JKT FIREWALL® III 600V	13 whb-19
			Item no. 178 (Instrumentation) 9 STP 16 AWG 7/S TC, 25 MILS XLPE 18 AWG TC DW, 2 MIL ALUM-MYLAR SHLD OVER PR, 18 AWG TC DW, O/A 2 MIL ALUM-MYLAR SHLD, 60 MIL CSPE JKT FIREWALL® III 600V	13 whb-69
			Item no. 261 (Power) 2/C 12 AWG 7/S TC, 30 MILS XLPE, 1-#12 AWG GW, 34 AWG TC BRAID SHLD, 45 MIL CSPE JKT FIREWALL® III 600V	13 wga-14
			Item no. 30 (Control) 5/C 14 AWG 7/S TC 30 MILS XLPE, 45 MIL CSPE JKT FIREWALL® III 600V	13 wha-4

AREVA

Document No.: 51-9217966-000

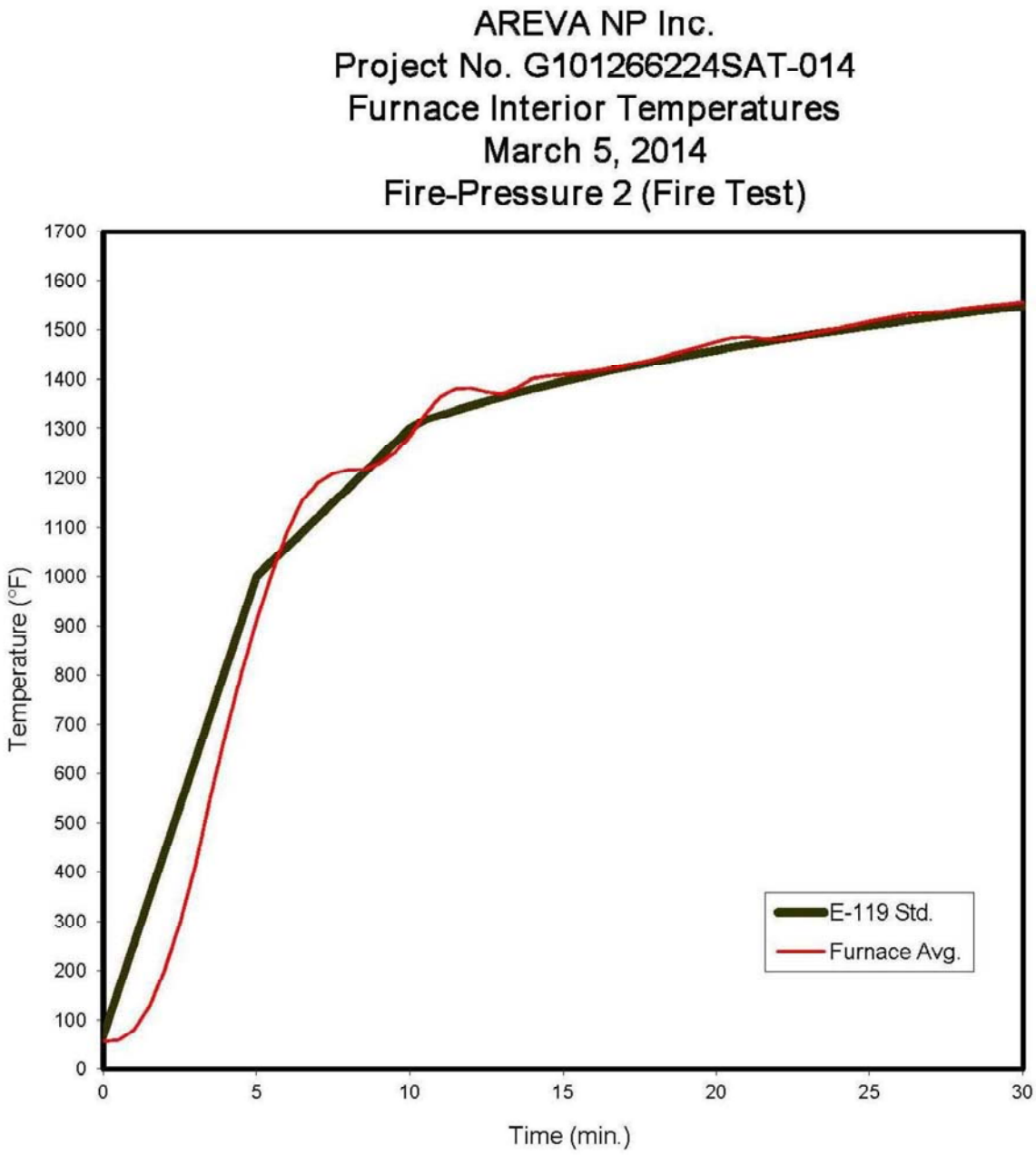
Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Penetrating Item	Raceway Description	Cable Fill	Cable Description	Quantity (Lengths)
#9	18"x4" Galv. Ladder Back Cable Tray	40% Control / Instrument Cable - High OD, Copper Cross Section and HOC	Item no. 70 (Control) 37/C 16 AWG 7/S TC 25 MILS XLPE, 80 MIL CSPE JKT FIREWALL® III 600V	13 whb-19
			Item no. 178 (Instrumentation) 9 STP 16 AWG 7/S TC, 25 MILS XLPE 18 AWG TC DW, 2 MIL ALUM-MYLAR SHLD OVER PR, 18 AWG TC DW, O/A 2 MIL ALUM-MYLAR SHLD, 60 MIL CSPE JKT FIREWALL® III 600V	13 whb-69
			1/C 6 AWG 7/S TC Class B Strand 60 MILS XLPE FIREWALL® SIS 600V Type SIS/XHHW-2 (UL) Listed Colored Grey	2 wbe-1
			4/C 20 AWG 7/S TC 20 MILS XLPE, 15 MIL XLPE JKT 600V	2 whd-3
			COAX CABLE WITH RG TYPE 59/U, or equal / 22 AWG FOR 62 OHMS (RSS 6 104/LE) Except Not UL Listed & Meets ICEA S-19-81 Paragraph 6.19.6 (IEEE-383 Paragraph 2.56)	2 whe-8
			3/C 10 AWG 7/S TC, 20 MILS XLPE, 1-#10 AWG CU GW, O/A TINNED COPPER BRAID SHIELD, 35 MIL ZH-XLPO JKT X-LINK® 600V	2 wfa-26
#10	12" Diameter Stainless Steel Sleeve and Stainless Steel Pipe	NA		
#11	12" Diameter Galv. Sleeve and Carbon Steel Pipe	NA		

APPENDIX B
Thermocouple Layout

No unexposed side engineering thermocouples were installed for this test. Previous fire-pressure tests had shown that very little temperature change typically occurs during a 30-minute fire test of a 3-hour fire rated penetration seal design. Since Fire-Pressure 2 was the last test conducted, the decision was made not to install unexposed side thermocouples.

APPENDIX C1
Temperature Data


AREVA NP Inc.
Project No. G101266224SAT-014
Furnace Interior Temperatures
March 5, 2014
Fire-Pressure 2 (Fire Test)
Temperature (°F)
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Time (min.)
E-119 Std.
Furnace Avg.

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	E119 Std Average (°F)	Furnace Average (°F)	Furnace Probe #1 (°F)	Furnace Probe #2 (°F)	Furnace Probe #3 (°F)	Furnace Probe #4 (°F)
0	68	56	56	56	56	56
0.5	161	59	58	58	58	60
1	254	79	87	73	73	84
1.5	348	127	161	103	109	133
2	441	200	284	147	165	203
2.5	534	296	444	203	239	296
3	627	411	621	270	329	425
3.5	720	553	811	353	440	607
4	814	683	959	440	544	787
4.5	907	803	1077	533	650	950
5	1000	909	1172	626	753	1086
5.5	1030	1006	1254	720	849	1200
6	1060	1090	1321	814	935	1289
6.5	1090	1155	1367	897	1005	1351
7	1120	1190	1373	956	1049	1381
7.5	1150	1210	1369	998	1075	1396
8	1180	1217	1355	1030	1087	1396
8.5	1210	1218	1345	1051	1090	1386
9	1240	1229	1362	1073	1095	1387
9.5	1270	1250	1391	1100	1111	1399
10	1300	1284	1439	1132	1142	1422
10.5	1317	1330	1499	1173	1185	1461
11	1328	1365	1534	1211	1223	1493
11.5	1337	1381	1531	1234	1245	1513
12	1347	1383	1518	1245	1257	1512
12.5	1356	1375	1500	1247	1255	1496
13	1364	1371	1492	1250	1252	1488
13.5	1373	1383	1509	1261	1265	1498
14	1381	1402	1532	1277	1279	1518
14.5	1388	1407	1531	1287	1283	1525
15	1396	1409	1530	1294	1286	1526
15.5	1403	1413	1532	1300	1290	1529
16	1410	1417	1535	1308	1292	1532
16.5	1417	1422	1537	1316	1299	1535
17	1424	1427	1540	1323	1306	1539
17.5	1430	1435	1547	1332	1315	1545
18	1436	1442	1554	1341	1322	1551
18.5	1442	1451	1562	1350	1330	1560
19	1448	1459	1569	1359	1337	1570
19.5	1454	1467	1578	1368	1344	1579
20	1459	1476	1587	1377	1351	1588
20.5	1465	1484	1593	1385	1361	1598

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	E119 Std Average (°F)	Furnace Average (°F)	Furnace Probe #1 (°F)	Furnace Probe #2 (°F)	Furnace Probe #3 (°F)	Furnace Probe #4 (°F)
21	1470	1486	1591	1391	1365	1597
21.5	1475	1483	1585	1394	1366	1587
22	1480	1482	1582	1395	1368	1581
22.5	1485	1486	1586	1400	1372	1584
23	1490	1492	1593	1406	1376	1591
23.5	1495	1498	1600	1413	1382	1598
24	1499	1504	1604	1421	1389	1602
24.5	1504	1510	1610	1429	1394	1608
25	1508	1517	1616	1438	1400	1614
25.5	1513	1523	1621	1445	1408	1618
26	1517	1529	1625	1453	1415	1624
26.5	1521	1534	1627	1460	1421	1626
27	1525	1536	1627	1465	1426	1626
27.5	1529	1539	1628	1469	1431	1627
28	1533	1544	1632	1475	1437	1630
28.5	1537	1548	1633	1480	1443	1634
29	1541	1551	1634	1485	1449	1635
29.5	1545	1554	1637	1489	1454	1636
30	1549	1558	1640	1493	1459	1640

APPENDIX C2
Pressure Data

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
0	-0.0095	0.0077	0.0022	0.0099
0.0333	-0.0072	0	0	0
0.0667	-0.0069	0.0077	0.0022	0.0099
0.1	-0.0052	0	0.0009	0.0009
0.1333	-0.0078	0.0208	0	0.0208
0.1667	-0.0009	0.0077	0.0009	0.0085
0.2	0.0096	0	0	0
0.2333	0.0178	0	0	0
0.2667	0.032	0	0	0
0.3	0.0435	0.0077	0.0009	0.0085
0.3333	0.0596	0.0077	0.0009	0.0085
0.3667	0.0728	0.0077	0	0.0077
0.4	0.0847	0	0.0009	0.0009
0.4333	0.0988	0.0077	0	0.0077
0.4667	0.1133	0.0077	0.0009	0.0085
0.5	0.1238	0.0077	0	0.0077
0.5333	0.1334	0	0	0
0.5667	0.14	0	0	0
0.6	0.1469	0.0077	0.0009	0.0085
0.6333	0.1518	0	0	0
0.6667	0.1528	0	0	0
0.7	0.1587	0	0	0
0.7333	0.1617	0.0077	0	0.0077
0.7667	0.1613	0.0077	0.0009	0.0085
0.8	0.1653	0.0077	0.0009	0.0085
0.8333	0.1637	0.0077	0.0022	0.0099
0.8667	0.166	0.0208	0.0009	0.0217
0.9	0.1699	0.0077	0.0009	0.0085
0.9333	0.1683	0.0077	0	0.0077
0.9667	0.1676	0	0.0009	0.0009
1	0.1669	0	0.0009	0.0009
1.0333	0.1725	0.0077	0	0.0077
1.0667	0.1706	0.0077	0.0009	0.0085
1.1	0.1673	0	0.0009	0.0009
1.1333	0.1706	0.0077	0.0009	0.0085
1.1667	0.1739	0.0077	0.0009	0.0085
1.2	0.1689	0.0077	0	0.0077
1.2333	0.1716	0	0	0
1.2667	0.1699	0.0208	0.0009	0.0217
1.3	0.1712	0	0.0022	0.0022
1.3333	0.1722	0	0.0009	0.0009
1.3667	0.1748	0	0.0022	0.0022
1.4	0.1686	0	0.0022	0.0022
1.4333	0.1719	0.0077	0	0.0077

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
1.4667	0.1742	0.0077	0	0.0077
1.5	0.1692	0.0208	0.0009	0.0217
1.5333	0.1716	0.0208	0.0009	0.0217
1.5667	0.1739	0.0077	0.0009	0.0085
1.6	0.1742	0	0	0
1.6333	0.1755	0.0077	0.0009	0.0085
1.6667	0.1742	0.0077	0.0009	0.0085
1.7	0.1725	0.0077	0	0.0077
1.7333	0.1725	0.0208	0.0022	0.023
1.7667	0.1742	0	0	0
1.8	0.1742	0.0077	0	0.0077
1.8333	0.1725	0	0.0022	0.0022
1.8667	0.1722	0.0208	0.0009	0.0217
1.9	0.1719	0.0077	0.0009	0.0085
1.9333	0.1729	0.0077	0.0009	0.0085
1.9667	0.1732	0.0077	0.0009	0.0085
2	0.1748	0.0077	0.0009	0.0085
2.0333	0.1748	0	0	0
2.0667	0.1729	0.0077	0.0009	0.0085
2.1	0.1778	0.0077	0.0009	0.0085
2.1333	0.1755	0	0	0
2.1667	0.1748	0.0077	0	0.0077
2.2	0.1758	0	0.0009	0.0009
2.2333	0.1755	0.0208	0.0009	0.0217
2.2667	0.1768	0	0.0009	0.0009
2.3	0.1742	0.0077	0.0009	0.0085
2.3333	0.1762	0.0077	0.0009	0.0085
2.3667	0.1771	0	0	0
2.4	0.1748	0.0077	0.0009	0.0085
2.4333	0.1785	0.0077	0.0022	0.0099
2.4667	0.1739	0	0.0009	0.0009
2.5	0.1742	0	0	0
2.5333	0.1742	0.0077	0	0.0077
2.5667	-0.9595	0	0.0009	0.0009
2.6	0.1775	0	0.0022	0.0022
2.6333	0.1768	0.0077	0.0009	0.0085
2.6667	0.1752	0.0208	0	0.0208
2.7	0.1739	0.0077	0.0009	0.0085
2.7333	0.1778	0.0077	0.0009	0.0085
2.7667	0.1758	0.0077	0.0009	0.0085
2.8	0.1758	0.0077	0.0022	0.0099
2.8333	0.1762	0.0077	0.0009	0.0085
2.8667	0.1752	0.0208	0	0.0208
2.9	0.1755	0.0077	0.0009	0.0085

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
2.9333	0.1768	0	0	0
2.9667	0.1748	0	0.0009	0.0009
3	0.1758	0	0.0009	0.0009
3.0333	0.1765	0	0.0022	0.0022
3.0667	0.1748	0.0077	0.0022	0.0099
3.1	0.1758	0.0077	0	0.0077
3.1333	0.1771	0.0077	0.0022	0.0099
3.1667	0.1765	0.0077	0	0.0077
3.2	0.1758	0.0077	0.0009	0.0085
3.2333	0.1745	0.0208	0.0009	0.0217
3.2667	0.1771	0	0	0
3.3	0.1771	0	0	0
3.3333	0.1762	0.0077	0.0009	0.0085
3.3667	0.1788	0.0208	0.0009	0.0217
3.4	0.1778	0.0077	0.0009	0.0085
3.4333	0.1768	0	0.0022	0.0022
3.4667	0.1778	0.0077	0	0.0077
3.5	0.1745	0.0077	0.0009	0.0085
3.5333	0.1775	0	0	0
3.5667	0.1752	0	0	0
3.6	0.1686	0.0077	0.0009	0.0085
3.6333	0.1637	0.0077	0	0.0077
3.6667	0.1686	0.0208	0	0.0208
3.7	0.1646	0	0	0
3.7333	0.1577	0.0077	0.0009	0.0085
3.7667	0.1538	0	0.0009	0.0009
3.8	0.1623	0.0077	0	0.0077
3.8333	0.1653	0.0077	0.0022	0.0099
3.8667	0.1706	0.0077	0	0.0077
3.9	0.1699	0	0.0022	0.0022
3.9333	0.1722	0.0208	0	0.0208
3.9667	0.1758	0.0077	0.0009	0.0085
4	0.1732	0.0077	0.0009	0.0085
4.0333	0.1762	0.0077	0.0009	0.0085
4.0667	0.1742	0.0077	0.0009	0.0085
4.1	0.1752	0	0	0
4.1333	0.1755	0.0208	0.0022	0.023
4.1667	0.1755	0.0077	0	0.0077
4.2	0.1745	0	0.0022	0.0022
4.2333	0.1762	0	0	0
4.2667	0.1748	0.0077	0	0.0077
4.3	0.1768	0.0077	0.0009	0.0085
4.3333	0.1755	0.0077	0.0009	0.0085
4.3667	0.1804	0	0.0009	0.0009

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
4.4	0.1768	0.0077	0.0009	0.0085
4.4333	0.1785	0.0077	0	0.0077
4.4667	0.1765	0.0077	0	0.0077
4.5	0.1755	0.0077	0	0.0077
4.5333	0.1775	0.0077	0.0022	0.0099
4.5667	0.1795	0.0077	0	0.0077
4.6	0.1765	0	0	0
4.6333	0.1781	0.0077	0.0022	0.0099
4.6667	0.1785	0.0208	0.0009	0.0217
4.7	0.1752	0.0208	0.0022	0.023
4.7333	0.1768	0.0077	0	0.0077
4.7667	0.1808	0.0208	0.0009	0.0217
4.8	0.1791	0	0	0
4.8333	0.1778	0.0077	0.0009	0.0085
4.8667	0.1804	0.0077	0	0.0077
4.9	0.1798	0.0077	0.0009	0.0085
4.9333	0.1778	0.0077	0	0.0077
4.9667	0.1814	0.0077	0	0.0077
5	0.1801	0.0077	0.0009	0.0085
5.0333	0.1798	0	0.0009	0.0009
5.0667	0.1804	0.0077	0.0009	0.0085
5.1	0.1827	0	0	0
5.1333	0.1831	0.0077	0	0.0077
5.1667	0.185	0.0077	0	0.0077
5.2	0.1827	0.0077	0	0.0077
5.2333	0.185	0.0208	0.0009	0.0217
5.2667	0.1847	0	0.0022	0.0022
5.3	0.1834	0.0077	0	0.0077
5.3333	0.1844	0.0077	0.0009	0.0085
5.3667	0.1857	0.0077	0.0022	0.0099
5.4	0.1847	0	0	0
5.4333	0.1893	0.0208	0.0022	0.023
5.4667	0.1847	0.0077	0.0009	0.0085
5.5	0.186	0	0	0
5.5333	0.1854	0.0208	0.0009	0.0217
5.5667	0.1893	0.0208	0	0.0208
5.6	0.1874	0.0077	0.0009	0.0085
5.6333	0.1897	0.0077	0.0009	0.0085
5.6667	0.1857	0.0077	0	0.0077
5.7	0.1864	0	0	0
5.7333	0.1877	0.0077	0.0009	0.0085
5.7667	0.1893	0.0077	0.0022	0.0099
5.8	0.187	0.0077	0	0.0077
5.8333	0.1867	0.0077	0.0009	0.0085

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
5.8667	0.189	0.0077	0.0009	0.0085
5.9	0.189	0.0077	0.0009	0.0085
5.9333	0.1887	0	0	0
5.9667	0.1874	0	0	0
6	0.189	0	0.0022	0.0022
6.0333	0.1864	0.0077	0.0009	0.0085
6.0667	0.1837	0.0077	0.0022	0.0099
6.1	0.1748	0	0	0
6.1333	0.1653	0.0077	0.0009	0.0085
6.1667	0.1515	0	0	0
6.2	0.1373	0.0077	0.0009	0.0085
6.2333	0.1133	0.0208	0.0009	0.0217
6.2667	0.0866	0	0.0009	0.0009
6.3	0.0705	0.0208	0.0022	0.023
6.3333	0.055	0.0208	0.0009	0.0217
6.3667	0.0442	0.0077	0.0009	0.0085
6.4	0.0415	0	0.0009	0.0009
6.4333	0.06	0.0077	0	0.0077
6.4667	0.0794	0.0077	0	0.0077
6.5	0.0955	0.0077	0.0009	0.0085
6.5333	0.109	0.0077	0	0.0077
6.5667	0.1218	0.0077	0.0009	0.0085
6.6	0.1344	0.0077	0	0.0077
6.6333	0.1386	0.0077	0	0.0077
6.6667	0.1469	0.0077	0.0009	0.0085
6.7	0.1551	0	0	0
6.7333	0.1597	0	0.0009	0.0009
6.7667	0.1646	0.0208	0.0009	0.0217
6.8	0.1683	0.0077	0.0022	0.0099
6.8333	0.1752	0.0208	0.0009	0.0217
6.8667	0.1791	0	0.0009	0.0009
6.9	0.1791	0.0077	0.0009	0.0085
6.9333	0.186	0.0077	0.0022	0.0099
6.9667	0.1939	0	0.0009	0.0009
7	0.2041	0.0077	0	0.0077
7.0333	0.2097	0.0077	0.0009	0.0085
7.0667	0.219	0.0077	0.0009	0.0085
7.1	0.2186	0.0077	0.0009	0.0085
7.1333	0.2226	0	0	0
7.1667	0.2265	0.0208	0.0009	0.0217
7.2	0.2318	0.0077	0.0009	0.0085
7.2333	0.2361	0.0077	0.0009	0.0085
7.2667	0.2367	0	0.0022	0.0022
7.3	0.242	0	0.0022	0.0022

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
7.3333	0.241	0.0077	0	0.0077
7.3667	0.242	0.0077	0	0.0077
7.4	0.2479	0.0077	0	0.0077
7.4333	0.2538	0.0077	0	0.0077
7.4667	0.2624	0.0077	0	0.0077
7.5	0.2664	0.0077	0.0009	0.0085
7.5333	0.271	0.0077	0.0009	0.0085
7.5667	0.2798	0.0077	0.0009	0.0085
7.6	0.2854	0.0077	0.0009	0.0085
7.6333	0.2924	0.0077	0.0009	0.0085
7.6667	0.2927	0	0	0
7.7	0.294	0.0208	0	0.0208
7.7333	0.3012	0.0077	0.0022	0.0099
7.7667	0.3088	0	0.0009	0.0009
7.8	0.3138	0.0077	0	0.0077
7.8333	0.3207	0.0077	0.0022	0.0099
7.8667	0.321	0	0	0
7.9	0.3246	0.0077	0.0009	0.0085
7.9333	0.3246	0.0077	0	0.0077
7.9667	0.3279	0.0077	0.0009	0.0085
8	0.3296	0.0077	0.0022	0.0099
8.0333	0.3332	0.0208	0.0009	0.0217
8.0667	0.3371	0.0077	0.0009	0.0085
8.1	0.3411	0	0.0009	0.0009
8.1333	0.3447	0	0.0009	0.0009
8.1667	0.348	0	0.0022	0.0022
8.2	0.3516	0	0	0
8.2333	0.3516	0	0	0
8.2667	0.3533	0	0.0009	0.0009
8.3	0.3556	0	0.0009	0.0009
8.3333	0.3556	0.0077	0	0.0077
8.3667	0.3552	0	0	0
8.4	0.3565	0.0077	0.0009	0.0085
8.4333	0.3579	0	0.0022	0.0022
8.4667	0.3562	0.0077	0.0009	0.0085
8.5	0.3575	0	0.0009	0.0009
8.5333	0.3552	0	0.0009	0.0009
8.5667	0.3612	0.0077	0.0022	0.0099
8.6	0.3595	0.0077	0	0.0077
8.6333	0.3612	0.0077	0.0022	0.0099
8.6667	0.3644	0	0.0009	0.0009
8.7	0.3648	0.0077	0.0009	0.0085
8.7333	0.3625	0	0	0
8.7667	0.3641	0	0.0009	0.0009

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
8.8	0.3635	0.0077	0	0.0077
8.8333	0.3661	0.0208	0	0.0208
8.8667	0.3664	0.034	0.0022	0.0362
8.9	0.3661	0.0077	0	0.0077
8.9333	0.3621	0.0077	0.0022	0.0099
8.9667	0.3644	0	0	0
9	0.3628	0.0077	0.0022	0.0099
9.0333	0.3635	0	0.0009	0.0009
9.0667	0.3628	0.0077	0.0009	0.0085
9.1	0.3621	0.0077	0.0022	0.0099
9.1333	0.3638	0.0077	0	0.0077
9.1667	0.3592	0	0.0022	0.0022
9.2	0.3625	0	0.0022	0.0022
9.2333	0.3595	0.0077	0.0009	0.0085
9.2667	0.3621	0.0077	0	0.0077
9.3	0.3618	0.0077	0	0.0077
9.3333	0.3602	0.0208	0.0009	0.0217
9.3667	0.3602	0	0.0009	0.0009
9.4	0.3615	0.0208	0.0009	0.0217
9.4333	0.3602	0.0077	0.0009	0.0085
9.4667	0.3588	0.0208	0.0009	0.0217
9.5	0.3592	0.0077	0.0009	0.0085
9.5333	0.3598	0.0208	0.0009	0.0217
9.5667	0.3602	0	0.0022	0.0022
9.6	0.3572	0.0077	0	0.0077
9.6333	0.3608	0.0208	0.0009	0.0217
9.6667	0.3585	0.0077	0.0009	0.0085
9.7	0.3592	0.0077	0.0009	0.0085
9.7333	0.3575	0.0077	0.0009	0.0085
9.7667	0.3618	0	0.0009	0.0009
9.8	0.3565	0	0	0
9.8333	0.3588	0	0.0009	0.0009
9.8667	0.3585	0.0077	0.0009	0.0085
9.9	0.3569	0	0.0009	0.0009
9.9333	0.3608	0.0077	0	0.0077
9.9667	0.3575	0.0077	0	0.0077
10	0.3559	0.0077	0.0009	0.0085
10.0333	0.3592	0.0077	0.0009	0.0085
10.0667	0.3562	0.0077	0.0009	0.0085
10.1	0.3569	0.0077	0.0009	0.0085
10.1333	0.3612	0	0	0
10.1667	0.3588	0	0.0009	0.0009
10.2	0.3565	0	0.0009	0.0009
10.2333	0.3579	0.0208	0	0.0208

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
10.2667	0.3582	0.0077	0.0009	0.0085
10.3	0.3579	0.0077	0	0.0077
10.3333	0.3598	0	0.0022	0.0022
10.3667	0.3585	0.0208	0.0009	0.0217
10.4	0.3625	0	0.0009	0.0009
10.4333	0.3565	0	0.0009	0.0009
10.4667	0.3585	0.0077	0.0009	0.0085
10.5	0.3608	0.034	0.0022	0.0362
10.5333	0.3628	0	0	0
10.5667	0.3592	0	0.0022	0.0022
10.6	0.3618	0.0077	0.0009	0.0085
10.6333	0.3608	0	0	0
10.6667	0.3592	0.0077	0	0.0077
10.7	0.3598	0.0077	0.0009	0.0085
10.7333	0.3635	0.0208	0	0.0208
10.7667	0.3608	0	0.0009	0.0009
10.8	0.3628	0.0208	0.0009	0.0217
10.8333	0.3588	0.0077	0.0022	0.0099
10.8667	0.3635	0.0077	0.0009	0.0085
10.9	0.3625	0	0.0022	0.0022
10.9333	0.3618	0	0.0009	0.0009
10.9667	0.3644	0.0077	0.0009	0.0085
11	0.3585	0.0208	0.0022	0.023
11.0333	0.3605	0.0077	0	0.0077
11.0667	0.3638	0.0077	0	0.0077
11.1	0.3595	0.0077	0.0009	0.0085
11.1333	0.3605	0.0077	0.0009	0.0085
11.1667	0.3628	0.0077	0.0009	0.0085
11.2	0.3595	0.0077	0.0009	0.0085
11.2333	0.3595	0	0.0009	0.0009
11.2667	0.3575	0	0.0009	0.0009
11.3	0.3621	0.0077	0.0009	0.0085
11.3333	0.3625	0	0	0
11.3667	0.3618	0.0077	0	0.0077
11.4	0.3598	0	0.0009	0.0009
11.4333	0.3598	0	0.0009	0.0009
11.4667	0.3592	0.0077	0.0009	0.0085
11.5	0.3628	0	0.0009	0.0009
11.5333	0.3572	0.0077	0.0009	0.0085
11.5667	0.3595	0.0077	0.0009	0.0085
11.6	0.3602	0.0077	0.0009	0.0085
11.6333	0.3598	0.0077	0.0009	0.0085
11.6667	0.3595	0.0208	0.0009	0.0217
11.7	0.3582	0.0077	0.0022	0.0099

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
11.7333	0.3588	0.0208	0.0022	0.023
11.7667	0.3608	0.0077	0.0009	0.0085
11.8	0.3615	0	0.0009	0.0009
11.8333	0.3588	0.0077	0	0.0077
11.8667	0.3598	0.0077	0.0009	0.0085
11.9	0.3595	0	0.0009	0.0009
11.9333	0.3635	0	0.0022	0.0022
11.9667	0.3608	0.0077	0.0009	0.0085
12	0.3598	0	0	0
12.0333	0.3595	0.0077	0	0.0077
12.0667	0.3602	0.0077	0.0022	0.0099
12.1	0.3588	0.0208	0.0009	0.0217
12.1333	0.3585	0.0077	0	0.0077
12.1667	0.3582	0	0.0009	0.0009
12.2	0.3582	0	0.0009	0.0009
12.2333	0.3605	0.0077	0.0022	0.0099
12.2667	0.3582	0.0077	0.0022	0.0099
12.3	0.3585	0.0208	0	0.0208
12.3333	0.3602	0.0077	0.0022	0.0099
12.3667	0.3569	0.0077	0	0.0077
12.4	0.3598	0.0077	0.0022	0.0099
12.4333	0.3559	0.0208	0	0.0208
12.4667	0.3605	0.0077	0.0009	0.0085
12.5	0.3572	0.0208	0.0009	0.0217
12.5333	0.3562	0.0208	0.0009	0.0217
12.5667	0.3598	0.0208	0.0009	0.0217
12.6	0.3585	0.0077	0	0.0077
12.6333	0.3592	0.0077	0.0009	0.0085
12.6667	0.3585	0.0077	0	0.0077
12.7	0.3579	0	0	0
12.7333	0.3605	0.0208	0.0009	0.0217
12.7667	0.3602	0.0208	0.0009	0.0217
12.8	0.3598	0.0077	0.0009	0.0085
12.8333	0.3605	0	0	0
12.8667	0.3602	0	0.0009	0.0009
12.9	0.3625	0.0208	0.0009	0.0217
12.9333	0.3588	0.0208	0.0022	0.023
12.9667	0.3628	0.0077	0.0009	0.0085
13	0.3598	0	0.0009	0.0009
13.0333	0.3648	0	0.0009	0.0009
13.0667	0.3585	0.0077	0.0009	0.0085
13.1	0.3602	0.0077	0.0009	0.0085
13.1333	0.3585	0.0077	0	0.0077
13.1667	0.3598	0.0077	0.0009	0.0085

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
13.2	0.3618	0	0	0
13.2333	0.3595	0.0208	0.0009	0.0217
13.2667	0.3631	0	0.0009	0.0009
13.3	0.3605	0.0077	0	0.0077
13.3333	0.3598	0	0.0009	0.0009
13.3667	0.3602	0.0077	0	0.0077
13.4	0.3585	0.0077	0	0.0077
13.4333	0.3588	0.0077	0	0.0077
13.4667	0.3605	0.0077	0	0.0077
13.5	0.3585	0	0.0009	0.0009
13.5333	0.3569	0	0.0022	0.0022
13.5667	0.3602	0.0077	0.0009	0.0085
13.6	0.3585	0.0077	0.0009	0.0085
13.6333	0.3595	0.0077	0.0009	0.0085
13.6667	0.3592	0.0077	0.0022	0.0099
13.7	0.3582	0.0208	0.0035	0.0243
13.7333	0.3602	0.0077	0.0009	0.0085
13.7667	0.3592	0	0.0009	0.0009
13.8	0.3588	0.0077	0.0022	0.0099
13.8333	0.3585	0	0.0009	0.0009
13.8667	0.3552	0.0077	0.0009	0.0085
13.9	0.3598	0	0.0009	0.0009
13.9333	0.3595	0.0077	0.0009	0.0085
13.9667	0.3569	0.0077	0.0022	0.0099
14	0.3641	0.0077	0.0009	0.0085
14.0333	0.3743	0	0.0009	0.0009
14.0667	0.3924	0	0	0
14.1	0.4086	0.0077	0.0009	0.0085
14.1333	0.4217	0	0.0022	0.0022
14.1667	0.429	0.0077	0.0035	0.0112
14.2	0.4385	0	0.0022	0.0022
14.2333	0.4408	0.0077	0.0022	0.0099
14.2667	0.4431	0.0208	0.0009	0.0217
14.3	0.454	0.0077	0.0009	0.0085
14.3333	0.4652	0.0077	0.0035	0.0112
14.3667	0.4764	0.0208	0.0009	0.0217
14.4	0.4964	0.0208	0.0022	0.023
14.4333	0.5093	0.0208	0.0009	0.0217
14.4667	0.5241	0	0.0009	0.0009
14.5	0.5376	0	0.0009	0.0009
14.5333	0.5471	0.0077	0.0009	0.0085
14.5667	0.5521	0.0077	0	0.0077
14.6	0.5616	0.0077	0.0009	0.0085
14.6333	0.5656	0	0	0

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
14.6667	0.5669	0.0208	0.0009	0.0217
14.7	0.5682	0.0077	0.0009	0.0085
14.7333	0.5715	0.0077	0.0022	0.0099
14.7667	0.5715	0.0077	0	0.0077
14.8	0.5774	0	0	0
14.8333	0.5768	0.0077	0	0.0077
14.8667	0.5781	0.0077	0.0009	0.0085
14.9	0.5794	0.0077	0.0009	0.0085
14.9333	0.5784	0	0.0009	0.0009
14.9667	0.5794	0	0	0
15	0.5814	0.0077	0.0022	0.0099
15.0333	0.5817	0.0208	0	0.0208
15.0667	0.581	0.0077	0	0.0077
15.1	0.5837	0.0077	0	0.0077
15.1333	0.5873	0	0.0009	0.0009
15.1667	0.5824	0	0.0022	0.0022
15.2	0.5853	0.0208	0.0009	0.0217
15.2333	0.587	0.0077	0.0022	0.0099
15.2667	0.5866	0.0208	0.0009	0.0217
15.3	0.5843	0	0.0022	0.0022
15.3333	0.5879	0.0077	0	0.0077
15.3667	0.5866	0.0208	0.0009	0.0217
15.4	0.5886	0.0077	0	0.0077
15.4333	0.5899	0.0077	0	0.0077
15.4667	0.5866	0	0.0009	0.0009
15.5	0.5873	0.0208	0.0009	0.0217
15.5333	0.5863	0	0	0
15.5667	0.5833	0	0.0009	0.0009
15.6	0.5883	0.0077	0.0009	0.0085
15.6333	0.585	0.0208	0.0009	0.0217
15.6667	0.5879	0	0.0009	0.0009
15.7	0.5827	0.0077	0.0009	0.0085
15.7333	0.5896	0.0077	0	0.0077
15.7667	0.5827	0.0077	0.0009	0.0085
15.8	0.5837	0.0077	0.0009	0.0085
15.8333	0.5847	0.0077	0.0022	0.0099
15.8667	0.5883	0.0077	0.0022	0.0099
15.9	0.5847	0.0077	0	0.0077
15.9333	0.5847	0	0.0009	0.0009
15.9667	0.5837	0.0077	0.0009	0.0085
16	0.5824	0.0077	0.0009	0.0085
16.0333	0.584	0.0077	0	0.0077
16.0667	0.5837	0.0208	0.0009	0.0217
16.1	0.5824	0	0.0009	0.0009

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
16.1333	0.5827	0.0208	0.0009	0.0217
16.1667	0.582	0.0077	0.0009	0.0085
16.2	0.5824	0.0208	0	0.0208
16.2333	0.5837	0.0077	0	0.0077
16.2667	0.582	0.0208	0.0009	0.0217
16.3	0.5807	0.0077	0.0022	0.0099
16.3333	0.5817	0	0	0
16.3667	0.5807	0.0077	0.0035	0.0112
16.4	0.5794	0	0.0009	0.0009
16.4333	0.58	0	0.0009	0.0009
16.4667	0.581	0.0077	0.0022	0.0099
16.5	0.5807	0	0.0009	0.0009
16.5333	0.5807	0	0	0
16.5667	0.5807	0.0208	0.0009	0.0217
16.6	0.5791	0.0077	0.0009	0.0085
16.6333	0.58	0.0077	0.0009	0.0085
16.6667	0.5771	0.0077	0.0009	0.0085
16.7	0.5797	0.0208	0.0009	0.0217
16.7333	0.5794	0.0077	0.0022	0.0099
16.7667	0.58	0.0077	0.0009	0.0085
16.8	0.5771	0	0.0009	0.0009
16.8333	0.5771	0	0.0022	0.0022
16.8667	0.5768	0	0	0
16.9	0.5768	0.0077	0.0009	0.0085
16.9333	0.5764	0.0208	0.0009	0.0217
16.9667	0.5771	0	0	0
17	0.5794	0.0208	0.0009	0.0217
17.0333	0.5781	0.0077	0.0009	0.0085
17.0667	0.5777	0.0077	0.0022	0.0099
17.1	0.5781	0	0	0
17.1333	0.5748	0	0.0009	0.0009
17.1667	0.5771	0.0077	0.0009	0.0085
17.2	0.5754	0.0077	0.0009	0.0085
17.2333	0.5751	0.0077	0.0009	0.0085
17.2667	0.5794	0.0077	0.0009	0.0085
17.3	0.5758	0.0208	0.0009	0.0217
17.3333	0.5771	0.0077	0.0009	0.0085
17.3667	0.5768	0.0077	0.0009	0.0085
17.4	0.5725	0	0.0009	0.0009
17.4333	0.5741	0.0208	0.0009	0.0217
17.4667	0.5771	0.0208	0	0.0208
17.5	0.5735	0.0208	0.0009	0.0217
17.5333	0.5725	0.0077	0.0009	0.0085
17.5667	0.5761	0	0.0009	0.0009

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
17.6	0.5715	0.0208	0	0.0208
17.6333	0.5748	0.0208	0	0.0208
17.6667	0.5721	0.0077	0	0.0077
17.7	0.5718	0	0.0009	0.0009
17.7333	0.5741	0.0077	0.0022	0.0099
17.7667	0.5741	0.0077	0	0.0077
17.8	0.5748	0	0.0009	0.0009
17.8333	0.5738	0	0	0
17.8667	0.5748	0	0.0009	0.0009
17.9	0.5725	0.0077	0	0.0077
17.9333	0.5679	0	0.0009	0.0009
17.9667	0.5718	0.0208	0.0009	0.0217
18	0.5712	0.034	0.0022	0.0362
18.0333	0.5689	0.0077	0	0.0077
18.0667	0.5728	0.0077	0	0.0077
18.1	0.5702	0.0077	0.0009	0.0085
18.1333	0.5702	0.0077	0.0009	0.0085
18.1667	0.5728	0.0077	0.0009	0.0085
18.2	0.5682	0	0.0022	0.0022
18.2333	0.5718	0	0	0
18.2667	0.5728	0	0.0009	0.0009
18.3	0.5698	0.0077	0	0.0077
18.3333	0.5768	0.0077	0.0009	0.0085
18.3667	0.5748	0.0208	0	0.0208
18.4	0.5731	0.0208	0.0009	0.0217
18.4333	0.5731	0	0.0009	0.0009
18.4667	0.5718	0.0077	0.0022	0.0099
18.5	0.5745	0.0077	0	0.0077
18.5333	0.5721	0.0077	0.0009	0.0085
18.5667	0.5754	0	0.0009	0.0009
18.6	0.5731	0	0.0009	0.0009
18.6333	0.5748	0	0.0022	0.0022
18.6667	0.5771	0.0077	0	0.0077
18.7	0.5741	0.0077	0.0009	0.0085
18.7333	0.5758	0.0208	0	0.0208
18.7667	0.5764	0.0077	0.0009	0.0085
18.8	0.5725	0	0.0009	0.0009
18.8333	0.5728	0.0077	0.0009	0.0085
18.8667	0.5735	0.0077	0	0.0077
18.9	0.5725	0.0077	0	0.0077
18.9333	0.5705	0	0.0022	0.0022
18.9667	0.5721	0.0077	0.0009	0.0085
19	0.5735	0.0077	0.0022	0.0099
19.0333	0.5731	0	0.0009	0.0009

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
19.0667	0.5712	0.0077	0.0009	0.0085
19.1	0.5692	0	0.0009	0.0009
19.1333	0.5702	0.0208	0.0035	0.0243
19.1667	0.5705	0.0077	0.0035	0.0112
19.2	0.5708	0.0077	0	0.0077
19.2333	0.5708	0.0077	0	0.0077
19.2667	0.5695	0.0208	0.0022	0.023
19.3	0.5715	0.0208	0	0.0208
19.3333	0.5702	0.0077	0.0009	0.0085
19.3667	0.5689	0.0077	0.0022	0.0099
19.4	0.5698	0	0.0009	0.0009
19.4333	0.5718	0.0208	0.0009	0.0217
19.4667	0.5689	0	0.0009	0.0009
19.5	0.5708	0.0077	0.0022	0.0099
19.5333	0.5689	0.0077	0.0009	0.0085
19.5667	0.5659	0.034	0.0022	0.0362
19.6	0.5679	0.0077	0.0022	0.0099
19.6333	0.5705	0.0208	0.0009	0.0217
19.6667	0.5682	0	0	0
19.7	0.5692	0	0.0022	0.0022
19.7333	0.5669	0.0077	0	0.0077
19.7667	0.5672	0.0077	0.0009	0.0085
19.8	0.5666	0.0077	0.0022	0.0099
19.8333	0.5672	0.0077	0.0009	0.0085
19.8667	0.5692	0.0077	0	0.0077
19.9	0.5666	0.0208	0.0009	0.0217
19.9333	0.5659	0.0077	0.0022	0.0099
19.9667	0.5666	0	0.0009	0.0009
20	0.5672	0.0208	0	0.0208
20.0333	0.5682	0	0.0009	0.0009
20.0667	0.5669	0	0.0022	0.0022
20.1	0.5636	0.0077	0.0009	0.0085
20.1333	0.5659	0.0208	0.0009	0.0217
20.1667	0.5669	0.0077	0.0009	0.0085
20.2	0.5633	0.0208	0	0.0208
20.2333	0.5662	0.0208	0.0009	0.0217
20.2667	0.5636	0	0.0009	0.0009
20.3	0.5639	0.0208	0.0009	0.0217
20.3333	0.5685	0.0208	0	0.0208
20.3667	0.5662	0.0208	0.0009	0.0217
20.4	0.5659	0.0077	0	0.0077
20.4333	0.5636	0	0.0009	0.0009
20.4667	0.5662	0.034	0.0009	0.0348
20.5	0.5613	0.0077	0	0.0077

AREVA NP, Inc. Project No. G101266224SAT-014 March 5, 2014

Time (min)	Ch 1 dP (psi)	Ch 2 High Flow (LPM)	Ch 3 Low Flow (LPM)	Total Flow (LPM)
20.5333	0.5633	0	0.0009	0.0009
20.5667	0.5616	0.0077	0	0.0077
20.6	0.5639	0	0	0
20.6333	0.5642	0.0077	0	0.0077
20.6667	0.5619	0.0077	0	0.0077
20.7	0.5636	0	0.0009	0.0009
20.7333	0.561	0.0208	0	0.0208
20.7667	0.5626	0	0.0022	0.0022
20.8	0.557	0.0077	0.0009	0.0085
20.8333	0.5432	0.0077	0.0009	0.0085
20.8667	0.5251	0.0077	0.0022	0.0099
20.9	0.4928	0.0077	0.0009	0.0085
20.9333	0.3585	0.0208	0.0009	0.0217
20.9667	0.2627	0.0077	0.0009	0.0085
21	0.19	0.0208	0.0009	0.0217
21.0333	0.1429	0.0077	0.0009	0.0085
21.0667	0.1064	0.0077	0	0.0077
21.1	0.0804	0.0077	0.0009	0.0085
21.1333	0.0629	0.0077	0.0022	0.0099
21.1667	0.0494	0.0077	0	0.0077
21.2	0.0392	0.0077	0	0.0077
21.2333	0.033	0	0.0009	0.0009
21.2667	0.0267	0.0077	0	0.0077
21.3	0.0205	0	0	0
21.3333	0.0228	0.0208	0.0022	0.023
21.3667	0.0215	0.0077	0.0009	0.0085
21.4	0.0165	0.0208	0.0009	0.0217
21.4333	0.0132	0.0077	0.0009	0.0085
21.4667	0.0129	0.0077	0	0.0077
21.5	0.0145	0.0077	0.0022	0.0099
21.5333	0.0083	0.0208	0.0009	0.0217
21.5667	0.0119	0	0.0009	0.0009
21.6	0.0086	0.0077	0.0009	0.0085
21.6333	0.008	0	0	0
21.6667	0.007	0	0	0
21.7	0.0116	0	0.0009	0.0009
21.7333	0.0083	0.0208	0.0009	0.0217
21.7667	0.008	0.0077	0.0009	0.0085
21.8	0.0053	0.0077	0.0022	0.0099
21.8333	0.0086	0.0208	0.0009	0.0217
21.8667	0.0037	0.0208	0	0.0208

APPENDIX D1
Photographs: Fire Test

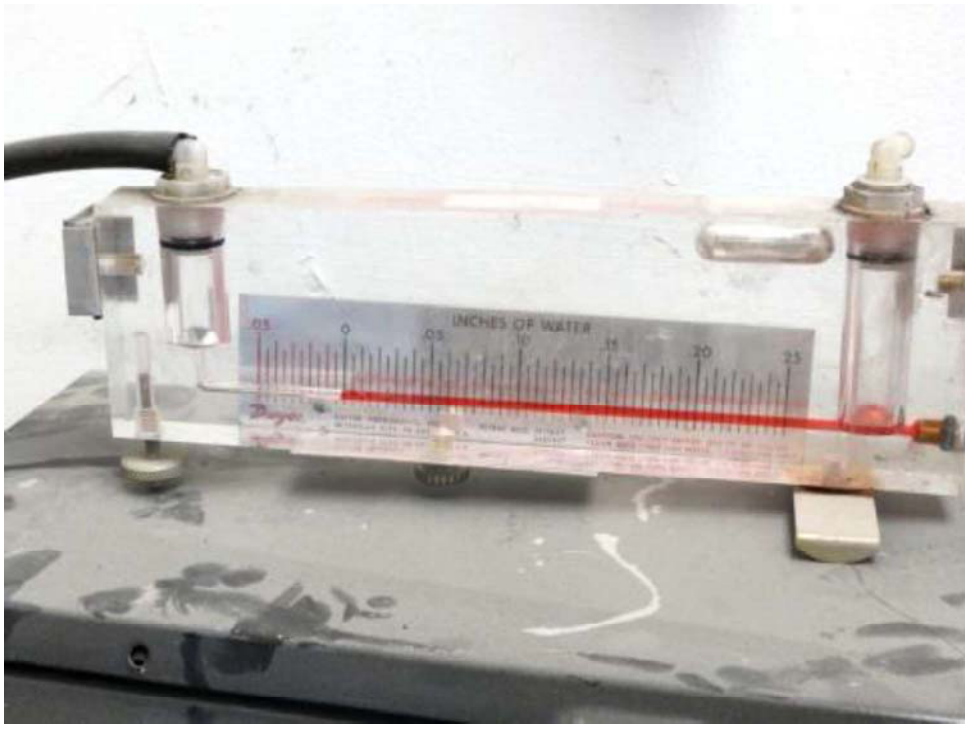

2014/03/04


2014/03/04

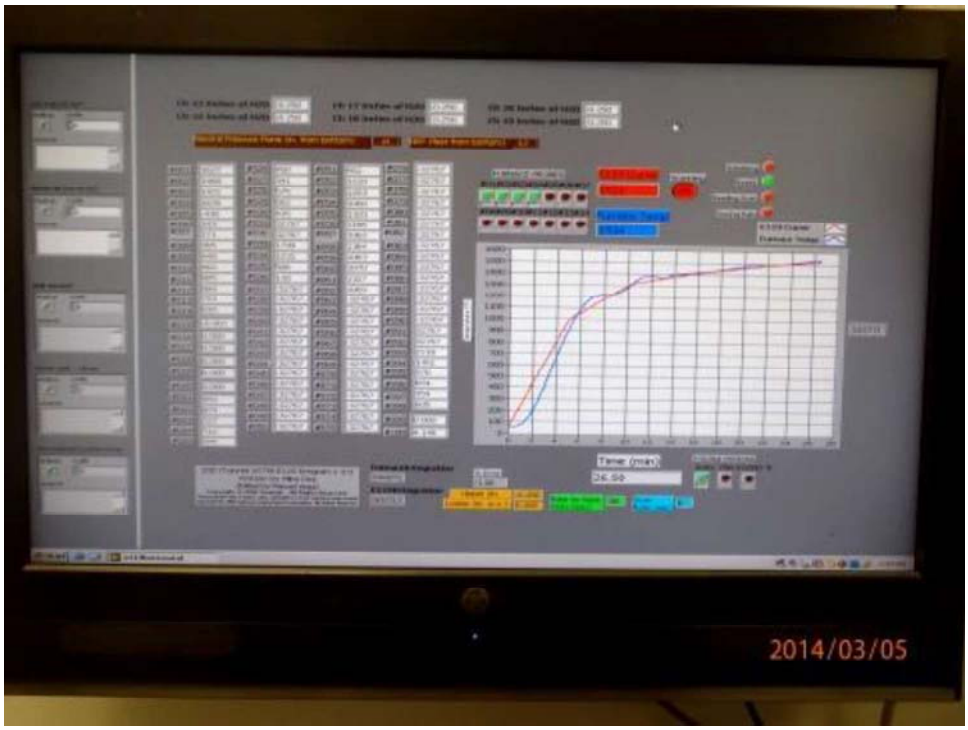

2014/03/04


2014/03/05


2014/03/05


INCHES OF WATER


2014/03/05


2014/03/05


2014/08/05


EXIT


2014/03/05

APPENDIX D2
Photographs: Pressure Test


2014/03/06


2014/03/06


2014/03/06


2014/03/06

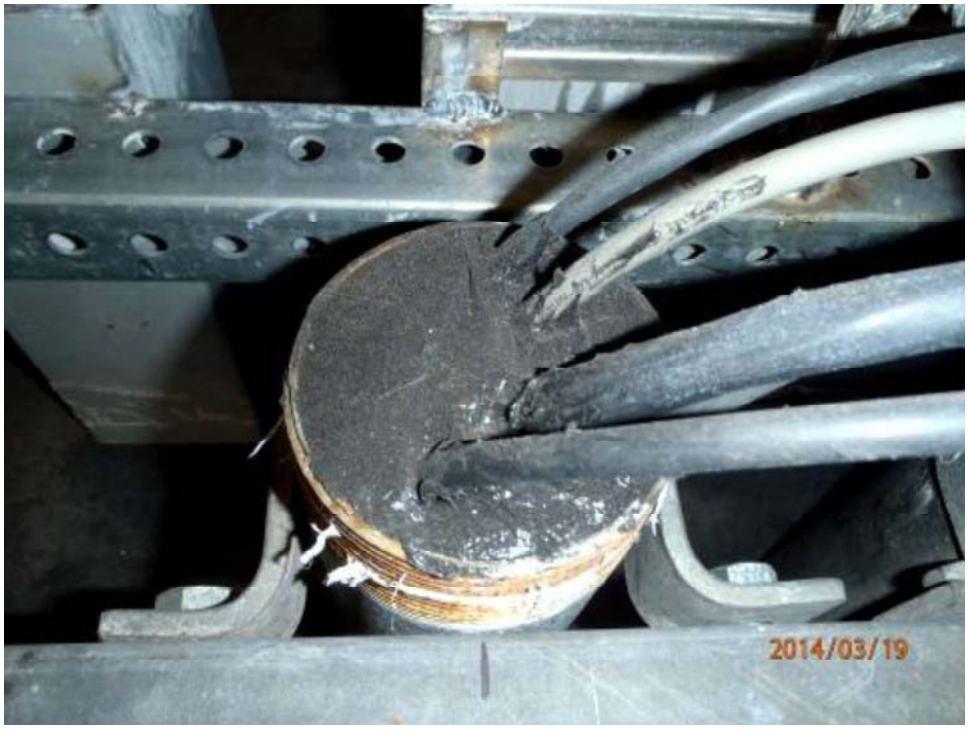

2014/03/06


2014/03/06


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19


2014/03/19

APPENDIX E
Test Plan

Controlled Document

20004-020 (10/21/2013)

AREVA

[redacted]

AREVA NP Inc.

[redacted]

Engineering Information Record

[redacted]

Document No.: 51 - 9217966 - 000

[redacted]

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

[redacted]

[redacted]

[redacted]

Mike Dey
Staff Engineer

[redacted]

Michael A. Brown
Quality Supervisor

[redacted]

Page 1 of 45

AREVA

20004-020 (10/21/2013)
Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Safety Related? ☒ YES ☐ NO

Does this document establish design or technical requirements? ☐ YES ☒ NO

Does this document contain assumptions requiring verification? ☐ YES ☒ NO

Does this document contain Customer Required Format? ☐ YES ☒ NO

Signature Block

Name and Title/Discipline	Signature	P/LP, R/LR, A-CRF, A	Date	Pages/Sections Prepared/Reviewed/ Approved or Comments
Aaron Adrian Prime Des Eng Spec II / PEYF1-A	[redacted]	P	2-4-14	All
Derrick Risner Eng I / PEYF1-A	[redacted]	R	2-4-14	All
Scott Groesbeck Manager Tech Ops / PEYF1-A	[redacted]	A	2/4/14	All

Note: P/LP designates Preparer (P), Lead Preparer (LP)
R/LR designates Reviewer (R), Lead Reviewer (LR)
A-CRF designates Project Manager Approver of Customer Required Format (A-CRF)
A designates Approver/RTM – Verification of Reviewer Independence

Project Manager Approval of Customer References (N/A if not applicable)

Name (printed or typed)	Title (printed or typed)	Signature	Date
Perry Calos	Project Manager / IBL-A	[redacted]	2/4/14

MOX Services concurrence: [redacted] Engineer 05Feb14
Name / Title Date

AREVA

20004-020 (10/21/2013)
Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Record of Revision

Revision No.	Pages/Sections/ Paragraphs Changed	Brief Description / Change Authorization
000	All	Initial Issue. This document contains the main body of the report (pages 1-21), Appendix A (2 pages), Appendix B (14 pages), Appendix C (6 pages), and Appendix D (2 pages) for a total of 45 pages.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Table of Contents

Table of Contents
(continued)

Page

List of Tables

Page

ACRONYMS

CGD	Commercial Grade Dedication
CGI	Commercial Grade Item
CS	Carbon Steel
GLB	Galvanized Ladder Back
ICS	Internal Conduit Seal
IROFS	Items Relied On For Safety
MOX	Mixed Oxide
MFFF	Mixed Oxide Fuel Fabrication Facility
PCCS	Powder Coated Carbon Steel
QA	Quality Assurance
QC	Quality Control
QL	Quality Level
RCS	Rigid Galvanized Steel
SS	Stainless Steel
SSC	Structures, Systems and Components
SSSB	Stainless Steel Solid Bottom
w.g.	Water Gauge

Penetration Seal Materials

DC 732	Dow Corning 732 Multi-Purpose Sealant
QSil 5558MC	Quantum Silicones QSil 5558MC Silicone Elastomer
QSil Primer #3	Quantum Silicones QSil Primer #3

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

BACKGROUND

AREVA Inc. (AREVA) is assisting Shaw AREVA MOX Services (MOX Services) in the development and implementation of a penetration seal program for the Mixed Oxide Fuel Fabrication Facility (MFFF). One aspect of the MOX penetration seal program includes conducting various types of qualification tests of penetration seal assemblies to substantiate the performance capabilities of specific penetration seal designs. Fire-Pressure testing is one type of qualification testing that needs to be performed in order to demonstrate that MOX penetration seal designs can withstand anticipated fire-induced pressures without catastrophic failure resulting in open penetrations. Other types of qualification testing, such as fire testing, pressure testing, and testing for seismic qualification of penetration seal assemblies, are addressed by other test plans.

1.0 PURPOSE

The purpose of this test plan is to define the test assembly, test methods and acceptance criteria for conducting a fire-pressure test in support of the MOX penetration seal program. Fire-pressure tests are unique in that a fire-pressure test is comprised of two separate tests; a modified fire test, followed by a pressure test.

This test plan defines the test methods, acceptance criteria and test report documentation requirements for conducting MOX Fire-Pressure Test 2. Additionally, this detailed test plan defines the roles and responsibilities of MOX Services, AREVA, the selected testing laboratory, and any other subcontracted entity engaged in support of fire-pressure testing efforts.

This detailed test plan also describes the procurement plan for materials associated with Fire-Pressure Test 2 and identifies the entities responsible for procuring the various components of the test assemblies based on the quality level assigned to each component.

This test plan also establishes minimum quality requirements for the penetration seal materials used in the test assemblies and links quality requirements in the AREVA QA program to customer/project quality requirements.

2.0 OBJECTIVE

The primary objective of this test plan is to evaluate the ability of a select penetration seal design to withstand various pressure levels after being subjected to a fire exposure (fire test). To accomplish this, the test assembly will be subjected to a fire exposure as described in Sections 9.1 and 9.2, and then the same test assembly will be subjected to a pressure test as described in Sections 9.3 and 9.4.

The specific configuration to be tested is described below. Critical characteristics and the associated limiting parameters that will be substantiated by a successful test are also provided.

2.1 Test Deck Description

The test deck will consist of a 12" thick concrete slab measuring approximately 96" x 96" (8' x 8') [Note: Final test slab size to be determined by Intertek and documented in the final test report]. Within this slab will be one (1) precast 48" x 34" opening without any liner material (bare concrete). The test deck will be horizontally oriented during both the fire endurance test and the subsequent pressure test.

Note: The test assembly to be used for MOX Fire Pressure Test 2 is to be the same test assembly that was constructed and used for MOX Pressure Test 4C [Reference 12.7] with modifications. It is anticipated that the slab used for Pressure Test 2, 4, 4A, 4B, and Seismic Pressure Test 3 will not be damaged during previous testing and will be available for reuse in Pressure Test 4C. It is anticipated that the slab with the silicone elastomer seal material used for Pressure Test 4C will

not be damaged during testing and will be available for use in this fire-pressure test. Anticipating successful completion of Pressure Test 4C, the only changes or modifications that need to be made to the test assembly include the addition of cables and internal conduit seals (ICS) in the two existing conduits, and converting the 12" diameter HVAC ducts to sleeves, installing pipes, and adding boot seals.

Additionally, most of the openings (penetrations) in the MOX facility have been cast with a ¾" bevel on both sides of the opening. For testing and qualification purposes, this feature is considered aesthetic, and it has no adverse effect on the functional performance of the penetration seal installation. In fact for some applications, such as in the case of pressure resistant penetrations seals, the bevel provides a benefit over non-beveled openings. Therefore, for the purposes of the penetration seal test program, the bevel feature will not be included in this test plan.

Drawings showing the general layout of the test deck (test slab) for this fire-pressure test can be found in Appendix A.

Note: If the slab from Pressure Test 4C was damaged during testing or is otherwise not available, this test plan will require revision.

2.2 Test Description

The opening to be sealed and tested in Pressure Test 4C was a 48" x 34" blockout containing electrical raceways (e.g., cable trays, conduits, wireways), mechanical pipes and HVAC ducts. Fire-Pressure Test 2 will utilize this sealed test slab with modifications made to the conduits and HVAC ducts, without modifications made to the surrounding elastomer seal.

Three sides of the opening in the original slab were unrepaired concrete while the remaining side had three small repairs with a maximum area of less than one (1) square inch and a maximum depth of 3/16". The repairs were made using Panel Patch by Nox-crete. All sides of the opening were then coated with Keeler & Long KL 3500 *Kolor-Poxy Self Priming Surfacing Enamel*. The Keeler & Long KL 3500 *Kolor-Poxy Self Priming Surfacing Enamel* was then mechanically removed on two adjacent sides with a needle gun scaler and on the other two sides with a masonry grinding wheel until all coating material was visually eliminated.

Note: The Nox-crete and Keeler & Long KL 3500 Kolor-Poxy Self Priming Surfacing Enamel were installed on the slab during construction of Pressure Test 2 and removed during preparation of Pressure Test 4. Removal of the Keeler & Long KL 3500 Kolor-Poxy Self Priming Surfacing Enamel using the masonry grinding wheel left a very smooth finish. For Pressure Test 4B, the concrete was further prepared for re-use by roughening the sides previously addressed by the masonry grinding wheel using a grinder equipped with a Hilti® DG-CW AP-SP Diamond Cup Wheel (Hilti® Item No. 2066711). This is the same method that MOX Services will be using to remove the epoxy coating from the inside of the penetrations in the plant. This will ensure that the seal material to concrete interface of the test penetration is representative of anticipated plant installations. For Pressure Test 4C the surface was again prepared for re-use by roughening the sides using a grinder equipped with a Hilti® DG-CW AP-SP Diamond Cup Wheel (Hilti® Item No. 2066711). Upon inspection it was discovered that one of the Panel Patch repairs had been dislodged. A repair was made using Panel Patch by Nox-crete. For Fire-Pressure Test 2, the elastomer seal will remain in place from Pressure Test 4C, therefore, it is anticipated that the penetration surface will be suitable without additional preparation.

An opening size of 34" x 48" was selected because it represents the largest opening size that can be tested with the current pressure chamber design, when considering that the most challenging geometric

shape for a flat plate with respect to flexural response occurs when the Length is ≈1.4 times the Width (34" x 1.4 = 47.6").

All sides of the opening will be unlined, with the previously installed enamel surface coating removed. The penetrating items for this blockout will include the following:

- (1) 18"x4" stainless steel, solid-bottom (SSSB) cable tray without cover, with cables
- (1) 18"x4" galvanized steel, ladder-back (GLB) cable tray without cover, with cables
- (1) 4"x4" powder-coated carbon steel (PCCS) wire way without cover, with cables
- (1) 3" diameter stainless steel (SS) conduit with CPSE, XLPE, Modified XLPO, and LSZH-XLPO jacketed cable installed
- (1) 3" diameter rigid galvanized steel (RGS) conduit with CPSE, XLPE, Modified XLPO, and LSZH-XLPO jacketed cable installed
- (1) 2" diameter schedule 40 carbon steel pipe
- (1) 2" diameter S-40S stainless steel pipe
- (1) 2" diameter S-40S zirconium pipe
- (1) 1 ¼" diameter S-40S titanium pipe
- (1) 16 ga. 12" diameter galvanized steel sleeve with a 4" diameter carbon steel pipe
- (1) 16 ga. 12" diameter stainless steel sleeve with a 4" diameter stainless steel pipe

2.3 Critical Characteristics and Limiting Parameters Being Tested

Fire-Pressure Test 2 will not only subject the same commodity interfaces evaluated in Pressure Test 4C to the effects of a fire pressure test, but with minor modifications will also introduce internal conduit seals and boot seals to the effects of fire-pressure testing.

The opening will be sealed with an eight (8) inch thick Quantum Silicones QSil 5558MC Silicone Elastomer (QSil 5558MC) penetration seal with no permanent damming installed in and around the various penetrating commodities. In an attempt to improve elastomer adherence to the penetrating commodities, Quantum Silicones, QSil Primer #3 will be applied as stipulated in Pressure Test 4C.

For internal conduit seals (Penetrations P5 and P6) cables will be routed such that no cut cable ends will exist on the top side (unexposed side) of the penetration. This configuration will prevent the possibility of air leakage through the inside of a cable from influencing the results of the test. See Appendix A and B drawings for additional details. The ends of the conduits (both top and bottom) will be sealed with an approximate 2 inch thick layer of Unifrax Fiberfrax® Durablanket® S topped with an approximate ½ inch thick layer of Dow Corning® 732 Multi-Purpose Sealant.

For the boot seal penetrations (P10 and P11) 16 gauge 12" diameter (stainless– P10, and galvanized – P11) sheet metal ducts will be sealed in place using an eight (8) inch thick seal of Quantum Silicones QSil 5558MC Silicone Elastomer (QSil 5558MC) with no permanent damming installed in the penetration during construction of Pressure Test 4C. These ducts will be modified

(cut to length 3" above and below the slab surface to create a pair of 18" long sleeves. The sheet metal sleeves will be installed in accordance with AREVA NP Inc. Document 01-9198306, Installation Instruction Manual for MOX Penetration Seal Test Program [Reference 12.4]. A 4" diameter pipe will pass through each of the sleeves, a schedule 40 carbon steel pipe in the galvanized steel sleeve, and a schedule S10 stainless steel pipe in the stainless steel sleeve. The pipes will be capped on at least one side or fitted with a welded cover plate (Note: caps and/or cover plates are construction aids only and are not being qualified by this fire-pressure test). The cap/welded cover plate shall be made air tight, so that any leakage during the test must pass through the seal assembly and not internally through the pipe. The gaps between the sleeves and the pipes will be sealed using a silicone rubber boot assembly as described in AREVA NP Inc. Document 01-9198306, Installation Instruction Manual for MOX Penetration Seal Test Program [Reference 12.4].

Successful completion of Fire-Pressure Test 2 will demonstrate that an eight (8) inch thick Quantum Silicones QSil 5558MC Silicone Elastomer (QSil 5558MC) penetration seal using QSil Primer #3 to improve adhesion with electrical, mechanical and HVAC penetrants, as well as internal conduit seals and boot seals, can withstand anticipated fire-induced pressures, regardless of configuration and size. Specifically, the following material interfaces with QSil 5558MC and QSil Primer #3 will be qualified:

- Stainless steel raceways
- Galvanized steel raceways
- Powder coated steel raceways
- RGS conduits
- SS conduits
- ICS in RGS conduits*
- ICS in SS conduits*
- CS piping
- SS piping
- Titanium piping
- Zirconium piping
- Stainless steel HVAC ducts
- Galvanized steel HVAC ducts
- Stainless steel sleeves with boot seals*
- Galvanized steel sleeves with boot seals*
- CS pipes with boot seals*
- SS pipes ith boot seals*

*QSil Primer #3 will not be used in ICS installations nor at boot to sleeve and boot to pipe interfaces. These interfaces use DC 732 sealant without primer application.

A successful test will also substantiate material compatibility during fire-pressure testing between QSil 5558MC elastomer seals (w/ QSil Primer #3) and DC 732 caulk and fiber seals (without primer) and the following cable jacket materials:

- CSPE
- XLPE
- Modified XLPO
- LSZH – XLPO

3.0 ASSUMPTIONS AND ACCEPTANCE CRITERIA

3.1 Assumptions

No assumptions were used.

3.2 Acceptance Criteria

The requirements for fire rated penetration seals are discussed in DCS01-BRA-DS-TRD-B-01365-0, *Technical Requirements Document for MFFF Penetration Seals* [Reference 12.5]. These requirements include the need for fire barrier penetration seals to be F-rated, commensurate with the hourly rating of the fire barrier in which they are installed. Additionally, these requirements also discuss the need for fire barrier penetration seals to withstand different forms of pressure concurrent with a fire (i.e., fire induced pressures and pressures from clean agent system discharge).

The MOX qualification strategy for concurrent fire and pressure conditions is to fire test penetration seals following consensus codes and standards committed to by the MOX project (ASTM E 814-94b [Reference 12.8]), while invoking the "standard pressure condition" from standard test method ASTM E 814-94b for maintaining furnace pressure (i.e., furnace pressure at 0.01 in. wg greater than the pressure on the unexposed side of the test assembly).

Separate penetration seal assemblies will be pressure tested using detailed test plans for conducting pressure tests.

Finally, some additional test assemblies, such as the assembly to be tested under this test plan, will undergo a limited duration fire test (30 minute duration) with the fire tested specimens then subjected to a subsequent pressure test.

The results of fire testing, pressure testing and combination limited duration fire tests followed by pressure testing of the same assembly will serve as the overall qualification for penetration seals required for concurrent fire and pressure conditions.

Based on the above, the specific acceptance criteria to be used for combination fire-pressure testing shall be as follows:

1. During the limited duration fire endurance portion of the test, the fire stops (penetration seals) shall have withstood the fire test for the limited 30 minute duration without permitting the passage of flame through openings, or the occurrence of flaming on any element of the unexposed side of the fire stops (penetration seals).

2. After the limited duration fire test, any residual flaming on the exposed side of the test assembly shall be extinguished with water. Following flame extinguishment, the fire stops (penetration

seals) shall remain in place such that the unexposed side of the penetration remains completely sealed.

3. During the pressure test, the fire stops (penetration seals) are allowed to leak. However, the fire stops (penetration seals) shall remain in place (i.e., shall not become dislodged from the opening or otherwise catastrophically fail).

4.0 RESPONSIBILITIES

The following roles and responsibilities apply to this test plan.

4.1 MOX Services

4.1.1 Provide review and concurrence of this detailed fire-pressure test plan.

4.1.2 Provide concurrence for any revisions made to this test plan during test specimen construction activities.

4.1.3 Provide some of the materials for test assembly construction from MOX Services surplus or scrap (if available).

4.1.4 Witness the fire-pressure test if desired.

4.2 AREVA

4.2.1 Develop and revise (if necessary) this detailed fire-pressure test plan.

4.2.2 Provide management and oversight of all aspects of the MOX penetration seal test program.

4.2.3 Select the testing facility and establish sub-contract agreements. The testing laboratory selected for performance of this test is Intertek Testing Services NA, Inc., Elmendorf, TX.

4.2.4 Provide engineering instructions to the testing laboratory for performance of the test including test parameters, acceptance criteria, requirements for documenting the test results in a final test report, etc.

4.2.5 Procure all primary penetration seal materials, devices and components (i.e., any materials, devices and components intended to replicate future Safety Related (QL-1) designs to be installed in the MOX facility) as designated in the procurement plan section (Section 5.0) of this test plan.

4.2.6 Notify MOX Services at least 10 days prior to test date to facilitate MOX Services decision to witness the test.

4.2.7 Witness test.

4.2.8 Perform post-test examinations.

4.2.9 Review, approve and issue final test reports.

4.3 Testing Laboratory (Intertek Testing Services NA, Inc.)

4.3.1 Notify AREVA at least 5 days prior to the start of test assembly construction activities.

4.3.2 Construct test decks in accordance with this test plan and AREVA direction.

4.3.3 Procure test deck materials and any other test assembly components identified under the Testing Laboratory scope in the procurement plan section (Section 5.0) of this test plan.

4.3.4 Procure testing equipment necessary for pressure testing services in accordance with this test plan and verify that the testing equipment is properly calibrated.

4.3.5 Provide fire and pressure testing services in accordance with this test plan.

4.3.6 Assist AREVA, as necessary, in conducting detailed post-test destructive examinations of the test assemblies.

4.3.7 Dispose of test assemblies upon completion of the tests.

4.3.8 Generate final test reports in accordance with test plan requirements (Section 11.0).

4.4 Other Subcontracted Entities

There are no other Subcontractors for this fire pressure test plan.

5.0 PROCUREMENT PLAN

This penetration seal fire-pressure test plan involves many elements beyond the penetration seal material being qualified. Some of these elements include the test deck or test slab, various fasteners for securing laboratory instrumentation to the test assembly, etc. Not all elements of the test assembly are required to be procured to the same quality level as the penetration seal material, which must be capable of satisfying the quality requirements of the end product (i.e., QL-1 qualified penetration seal assemblies for plant applications). The following procurement plan takes into consideration the required quality level of the various materials required for this penetration seal fire pressure test and prescribes an approach for material procurement which considers cost, schedule and quality requirements.

5.1 Penetration Seal Materials

The vast majority of penetration seals that will be installed throughout the MFFF are designated QL-1. MOX Services defines QL-1 in PP9-1, *SSC Quality Levels & Marking Design Documents* [Reference 12.1] as follows:

> *QL-1 SSCs are typically IROFS (all IROFS are QL-1 and may be either SSCs or Administrative Controls) credited in the Integrated Safety Analysis with a required function to prevent or mitigate design basis events such that high-consequence events are made highly unlikely; intermediate-consequence events are made unlikely; or to prevent criticality. For example, the failure of an IROFS item could cause:*
>
> 1. *Loss of a primary confinement feature leading to release of material resulting in exceeding 10CFR70.61 performance requirements;*

2. *Failure to satisfy the double contingency principle for the prevention of a criticality accident; or*

3. *Loss of other safety function required to meet 10CFR70.61 performance requirements.*

This definition correlates with the following definition of "Nuclear Safety Related" in AREVA Administrative Procedure (AP) 1702-25, *Assignment of Nuclear Safety Classification to Products and Services* [Reference 12.2]:

Definition of "Nuclear Safety Related"

Company products and services are considered to be nuclear safety related if they involve the evaluation, specification, design or change in design, operation, or performance of structures, systems, and components which must function directly, or must support other systems which function, to ensure any of the following:

- *The integrity of the reactor coolant pressure boundary*
- *The capability to shut down the reactor and maintain it in a safe shutdown condition*
- *The capability to prevent or mitigate the consequences of accidents which could result in potential offsite radiation exposures greater than accepted limits.*

On this basis, permanent penetration seal materials used in this test program shall be procured by AREVA or supplied by MOX Services and suitably base-lined so that future procurements of the same commercial materials can undergo the commercial grade dedication process in support of Nuclear Safety Related (i.e., MOX QL-1) plant installations. Only the primary seal material specified as a part of the final seal design and which are left in place during testing become an integral part of the seal assembly and need to be base-lined for future dedication of similarly procured materials.

The quality level of the penetration seal materials procured for this test plan is **Non-Safety**.

Note: Commercial Grade Dedication (CGD) must be performed for Commercial Grade Items (CGIs) used in Safety Related applications when procured from suppliers where specific quality controls for nuclear applications cannot be imposed in a practical manner in accordance with 56-9141754-001, *AREVA NP Inc. Quality Assurance Program* [Reference 12.3]. However, none of the seal materials to be procured and used in the test program are intended or approved for installation in the MOX facility. Therefore, CGD of penetration seal materials used for test purposes is not required.

For this fire-pressure test, the following materials shall be procured by AREVA and base-lined for future dedication activities.

1. Quantum Silicones QSil 5558MC Silicone Elastomer (QSil 5558MC)
2. Unifrax Fiberfrax® Durablanket® S (6 pcf density)
3. Dow Corning® 732 Multi-Purpose Sealant
4. Silicone Rubber Boot Material – Arlon Silicone Impregnated Fiberglass Fabric (56493F031)
5. Ideal Clamp 9/16" All Stainless Steel 64 Series
6. Quantum Silicones QSil Primer #3

5.2 Test Deck/Test Slab

The test deck will be used to simulate a fire barrier in which the penetration seal assemblies may be installed. The test deck is not considered an integral part of the penetration seal assembly being tested and therefore is not intended to replicate MOX-specific plant conditions and not considered integral in bounding the performance of the penetration seal assemblies (e.g., concrete blend, compressive strength, rebar size and spacing). The test deck will be comprised of normal weight reinforced concrete.

The opening cast into the test deck will simulate certain features consistent with MOX penetrations (e.g., painted or coated interior finishes, beveled edges, etc.) as defined by the test plan drawings contained in Appendix A.

The testing laboratory shall be responsible for procuring all materials and components associated with the construction of the test deck, unless otherwise specified below. The test deck shall comply with the requirements of the approved test plan drawings contained in Appendix A, and in accordance with the testing facility's Quality Assurance Program.

The quality level of the test deck is **Non-safety**.

5.3 Penetrating Items

Penetrating items (e.g., electrical raceways, pipes, etc.) will be used in this fire pressure test to simulate MOX-specific plant commodities during the fire pressure test but are not considered an integral part of the penetration seal assembly being tested. Therefore, the quality level of the penetrating items is **Non-safety**.

Penetrating items for this fire pressure test will come from one of two sources: MOX Services or the testing laboratory. MOX Services supplied items are identified on the MOX Services Bill of Materials in Section C.2 of Appendix C. Items provided by the testing laboratory are identified on the Testing Laboratory Bill of Materials in Section C.3 of Appendix C.

6.0 SPECIAL PRECAUTIONS

6.1 Precautions for Construction of Test Assemblies

Observe testing facilities safe work practices for construction, lifting, and moving of test assemblies.

6.2 Precautions for Installation of Seal Assemblies

Observe specific precautions recommended by seal material manufacturers as noted on product literature and material safety data sheets contained in AREVA NP Inc. Document 01-9198306, *Installation Instruction Manual for MOX Penetration Seal Test Program* [Reference 12.4].

6.3 Precautions for Conducting Pressure Test

Proper safety precautions shall be exercised to preclude personnel from direct exposure to loss of pressure events, unexpected disengaging of testing equipment from the test deck, and all other related hazards.

7.0 PREREQUISITES

7.1 General Test Configuration Requirements

The test assembly, including slab layout and penetration seal configurations shall be as specified by AREVA and in accordance with the drawings and information contained in **Error! Reference source not found.** and Appendix B of this test plan, and AREVA NP Inc. Document 01-9198306, *Installation Instruction Manual for MOX Penetration Seal Test Program* [Reference 12.4].

7.2 Safety Related Materials

Penetration seal materials that are purchased **Non-Safety** for this test program but are to be base-lined for future Nuclear Safety Related via the Commercial Grade Dedication process are indicated on the AREVA Bill of Materials (Appendix C.1).

7.3 Dimensioned Drawings

All test articles shall conform to the dimensioned drawings supplied by AREVA and contained in **Error! Reference source not found.** and Appendix B of this test plan. Any differences between designed and constructed/tested assemblies shall be noted in final drawings contained within the test report.

7.4 Test Configuration

All test articles shall be securely fastened to the test apparatus by the laboratory. All openings shall be sealed in accordance with test plan instructions, drawings (**Error! Reference source not found.** and Appendix B) and AREVA Document 01-9198306 [Reference 12.4].

8.0 TEST ASSEMBLY CONSTRUCTION

8.1 Test Slab Construction

The Testing Laboratory shall construct the test slab, including location and size of openings, in accordance with the drawings contained in Appendix A of this Test Plan.

AREVA quality control representative (or approved designee) shall conduct an inspection of the test slab for compliance with the approved Test Plan drawings prior to installation of individual penetration seal test assemblies. Any differences between the approved Test Plan drawings and the as-built test slab configuration shall be corrected (if deemed necessary by the AREVA Test Engineer) or noted by the QC Inspector (if correction is not required). Completion of this verification shall be documented as required by AREVA NP Inc. Document 01-9198306, *Installation Instruction Manual for MOX Penetration Seal Test Program* [Reference 12.4].

8.2 Penetration Seal Installation

AREVA (or approved designee) shall install the penetration seal test assemblies in accordance with the drawings contained in Appendix A and B of this Test Plan and in accordance with AREVA NP Inc. Document 01-9198306, *Installation Instruction Manual for MOX Penetration Seal Test Program* [Reference 12.4].

QA/QC verification of penetration seal installations shall be documented as required by AREVA NP Inc. Document 01-9198306, *Installation Instruction Manual for MOX Penetration Seal Test Program* [Reference 12.4].

8.3 Pre-Test Verifications

Prior to conducting the fire-pressure test for each test assembly, the AREVA Test Engineer shall sign-off indicating that the test article (test penetration) is complete and ready for testing as required by AREVA NP Inc. Document 01-9198306, *Installation Instruction Manual for MOX Penetration Seal Test Program* [Reference 12.4].

9.0 PROCEDURE

9.1 Fire Endurance Test

The fire endurance test portion of the fire-pressure test shall comply with the pertinent requirements of *ASTM E 814-94b* [Reference 12.8]. Specifically:

- The fire environment within the furnace shall be in accordance with the standard time temperature curve shown in Fig. 1 of *ASTM E 814-94b* for 30 minutes.
- The furnace temperature shall be the average temperature from readings taken from thermocouples symmetrically distributed within the test furnace to show the temperature near all parts of the test assembly. Placement of furnace thermocouples shall comply with *ASTM E 814-94b* requirements.
- Furnace temperature shall be recorded at intervals not exceeding 5 minutes during the test.
- The accuracy of the furnace control shall comply with the requirements of *ASTM E-814-94b*.
- Temperatures monitored by engineering thermocouples shall be read and recorded at intervals of 5 minutes or less.
- The furnace pressure shall comply with the Standard Pressure Condition provisions of *ASTM E 814-94b* (i.e., furnace pressure at least +0.01 inches wg with respect to the unexposed side of the test assembly).

Engineering thermocouples shall be installed as determined during test assembly construction and their locations shall be documented in the final test report. Since the penetrations being tested only require an F rating, engineering thermocouple data is not tied to any test acceptance criteria. Engineering thermocouple data will be used for analysis purposes, such as designing test assemblies for subsequent fire tests or evaluating penetration seal installations that fall outside the parameters of fire tested configurations.

9.2 Hose Stream Test

There is no formal hose stream required for this fire-pressure test.

Following the 30 minute fire endurance portion of the test, the test assembly shall be promptly removed from the furnace chamber and any residual flaming on the exposed side of the test assembly shall be extinguished with water. Depending upon the amount of flaming, a garden hose may be sufficient to extinguish the flames. In the event a larger diameter hose is needed, a hose equipped with an adjustable spray nozzle should be used. Care shall be taken not to impart an excessive amount of force on the test assembly during extinguishment of any residual flaming.

9.3 Pressure Test Apparatus

The pressure test apparatus to be used for the pressure portion of this fire-pressure test shall be one of the two pressure bonnets constructed and used for MOX pressure and seismic pressure tests. One of the hemispherical 72" diameter steel pressure vessels shall be attached to the exposed side of the test assembly. The pressure bonnet shall be used to induce the testing pressures above atmospheric pressure based on Table 9-1. A spray bottle with a soapy-water solution shall be used to detect leakage on the exposed side of the test assembly. Hold times and acceptance criteria shall be as defined in Table 9-1.

Note: In the event the concrete on the exposed surface of the slab is damaged to the point where the pressure bonnet cannot be attached , the pressure bonnet may be installed on the top (unexposed side) of the fire-tested assembly. If this occurs, it shall be noted in the final test report and the condition of the concrete on the exposed side of the test assembly shall be clearly described in the final test report.

9.4 Pressure Test Process

The anticipated fire-induced differential pressures, as they apply to MFFF penetration seal designs, are discussed in DCS01-BRA-DS-TRD-B-01365-0 [Reference 12.5] and in calculation DCS01-ASI-DS-CAL-R-10552 [Reference 12.6]. Most areas of the facility are bounded by a fire induced differential pressure of +/- 7.0 inches w.g. Plant areas with higher fire induced differential pressures are identified in calculation DCS01-ASI-DS-CAL-R-10552 [Reference 12.6]. The maximum fire-induced differential pressure in any plant area is -14.7 inches w.g.

The pressure levels specified in Table 9-1 are to be used in the pressure test portion of this fire-pressure test. The 10 inch w.g. pressure is intended to bound the +/- 7.0 inches w.g. with margin. The 20 inches w.g. pressure is intended to bound the maximum fire-induced compartment pressure of -14.7 inches w.g. with margin.

A hold time of 5 minutes has been established for each pressure level to ensure that sufficient time at pressure is maintained to; 1) confirm that no leakage occurs at that pressure, or 2) stabilize make up air to maintain the pressure and identify the apparent location of the leak.

Table 9-1: Differential Pressure Test Levels

Test Stage	Differential Pressure (inch w.g.)	Required Hold Time (minutes)	Acceptance Criteria	Basis for the Selected Differential Pressure
1	10.0	5	Seal Remains In Place	Testing at this differential pressure bounds the +/- 7.0 inches w.g. pressure used as the screening pressure cutoff for fire induced pressures [Reference 12.6].
2	20.0	5	Seal Remains In Place	Testing at this differential pressure bounds the – maximum compartment fire-induced pressure of -14.7 inches w.g. pressure per the fire-induced pressure calculation [Reference 12.6].

The test assembly shall be attached to the pressure test apparatus and subjected to the pressures identified in Table 9-1 as described below. For Test Stages 1 and 2 the side of the test deck which was

exposed to the furnace during the fire test be pressurized in accordance with Sections 9.4.1 through 9.4.4 below.

9.4.1 The test assembly shall be attached to the pressure test apparatus and subjected to air pressure test stages at the select pressure levels identified in Table 9-1, beginning with the Stage 1 pressure of 10.0 inches w.g. Once this pressure has been obtained, the pressure shall be maintained for the hold time specified in Table 9-1. Any leakage observed during the hold time shall be noted.

9.4.2 Once the designated hold time has been achieved, the pressure shall be increased to the next pressure level identified in Table 9-1 (Stage 2, 20.0 inches w.g.) and held for the designated hold time. Any leakage observed during this hold time shall be noted.

9.4.3 Following completion of Stage 2 pressure testing, the test may continue at the discretion of the AREVA test engineer and the testing laboratory manager in charge. Subsequent pressures and hold times shall be recorded as directed by the AREVA test engineer.

9.4.4 If at any pressure level (or test stage) the penetration seal becomes dislodged from the opening or otherwise catastrophically fails, the pressure test shall be terminated and the time to failure and pressure at which the failure occurred shall be recorded.

9.5 Post Test Examination

Following completion of the fire-pressure test, visual and destructive (if deemed necessary) post-test examinations shall be performed. These examinations shall include, but not necessarily be limited to, the following:

Visual observations of penetration seal condition including:

- Integrity of seal and conditions on both sides of the penetration
- Location of any penetration seal degradation
- Condition of seal to barrier interface
- Condition of seal to penetrating item(s) interface (if applicable)

Once visual observations are complete, destructive examinations may be used to obtain additional information or gain extra insights into seal performance during the fire-pressure test.

10.0 DATA SYSTEMS

During the fire exposure period, all thermocouples (including engineering thermocouples) shall be scanned at time intervals of 15 minutes or less. Data storage for reporting purposes shall comply with ASTM E 814-94b intervals, although furnace thermocouples may be scanned at more frequent intervals, to allow close control of the furnace. Data recorded shall be compiled and contained in the final test report. Additionally, the final test report shall include a description of the data acquisition system used during the test, including identification of software programs used.

During the pressure test, the various data systems connected to the test apparatus (blowers, anemometers, manometers, etc.) shall be controlled and monitored by the testing laboratory. Data recorded for these components shall be compiled and contained in the final test report.

11.0 TEST REPORT

The testing laboratory shall submit a report on the results of both the fire and pressure test portions of this fire-pressure test. The test report shall contain the collected data and required quality control documentation. The final test report shall be prepared in sufficient detail to summarize the total testing activity. The final report shall include as a minimum:

- Date of tests (fire and pressure)
- Location of tests
- Description of test apparatus and test articles
- Calibration documentation for all data systems connected to the test apparatus
- Test procedures used
- Acceptance criteria
- Provide quality control records
- Results of the fire and pressure tests
- Color digital photographs of the test project

12.0 REFERENCES

References identified with an (*) are maintained within the MOX Records System and are not retrievable from AREVA Records Management. These are acceptable references per AREVA Administrative Procedure 0402-01, Attachment 8. See page 2 for Project Manager Approval of customer references.

12.1 *Shaw AREVA MOX Services Procedure PP9-1, Revision 14, *SSC Quality Levels & Marking Design Documents*

12.2 AREVA NP Inc. Procedure 1702-25, Revision 018, *Assignment of Nuclear Safety Classification to Products and Services*

12.3 AREVA NP Inc. Document 56-9141754-001, *AREVA NP Inc. Quality Assurance Program*

12.4 AREVA NP Inc. Document 01-9196306 (latest revision), *Installation Instruction Manual for MOX Penetration Seal Test Program*

12.5 *Shaw AREVA MOX Services Document DCS01-BRA-DS-TRD-B-01365-0, *Technical Requirements Document for MFFF Penetration Seals*

12.6 *Shaw AREVA MOX Services Calculation DCS01-ASI-DS-CAL-R-10552-0, *Fire Induced Room Pressure Analysis*

12.7 AREVA NP Inc. Document 51-9216954 (latest revision), *Detailed Test Plan for Conducting MOX Pressure Test 4C*

12.8 ASTM E 814-94b, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops*, American Society for Testing and Materials

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

APPENDIX A: TEST DECK/TEST SLAB DRAWINGS

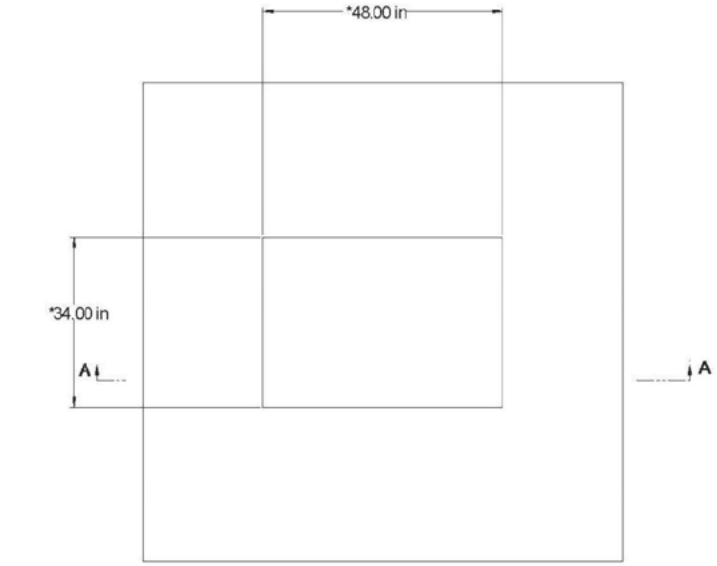
The test deck (test slab) for Fire-Pressure Test 2 is depicted on page A-2.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2



Section A-A

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

Intertek

APPENDIX B: TEST PENETRATION DRAWING

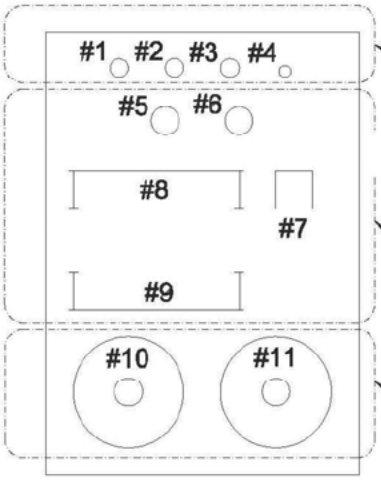
This appendix contains drawings for Fire-Pressure Test 2. These drawings identify penetrating item locations within the test penetration, as well as, the penetration seal design. Table B1 of this appendix provides the cable types to be used in each location.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Penetrating Item Locations



See page B-4 for piping commodity location dimensions.

See page B-6 for electrical commodity location dimensions.

See page B-10 for pipe and sleeve commodity location dimensions.

Penetrant descriptions are provided on page B-3.

Cable Fill Per Table B-1

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

Penetrant Description:

Penetrating Item #1 = 2" diameter schedule 40 carbon steel pipe capped on top side

Penetrating Item #2 = 2" diameter S-40S stainless steel pipe capped on top side

Penetrating Item #3 = 2" diameter S-40S zirconium pipe capped on top side

Penetrating Item #4 = 1 ¼" diameter S-40S titanium pipe capped on top side

Penetrating Item #5 = 3" diameter empty stainless steel (SS) conduit with cables

Penetrating Item #6 = 3" diameter empty rigid galvanized steel (RGS) conduit with cables

Penetrating Item #7 = 4"x4" powder-coated carbon steel (PCCS) wireway with cables

Penetrating Item #8 = 18"x4" stainless steel, solid-bottom (SSSB) cable tray with cables

Penetrating Item #9 = 18"x4" galvanized steel, ladder-back (GLB) cable tray with cables

Penetrating Item #10 = 12" diameter 16 gauge stainless steel sleeve with 4" diameter stainless steel pipe

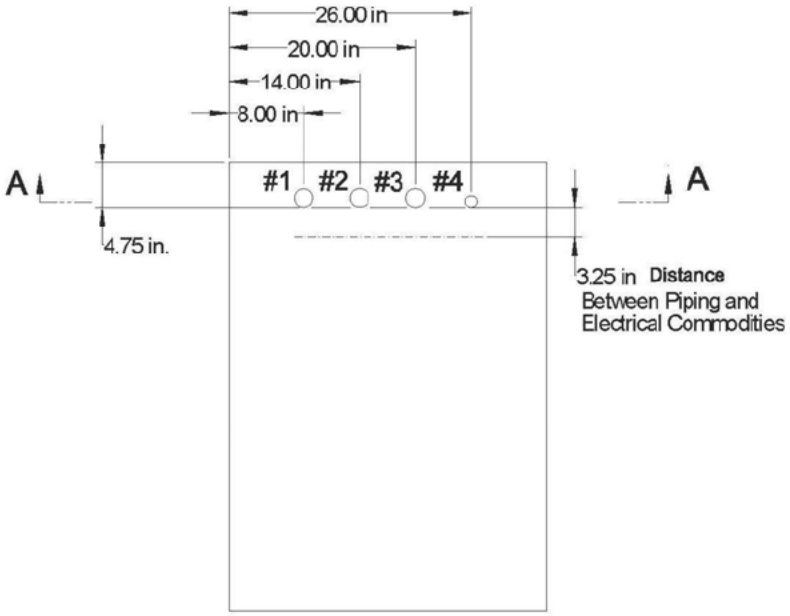
Penetrating Item #11 = 12" diameter 16 gauge galvanized steel sleeve with 4" diameter carbon steel pipe

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Piping Commodity Locations



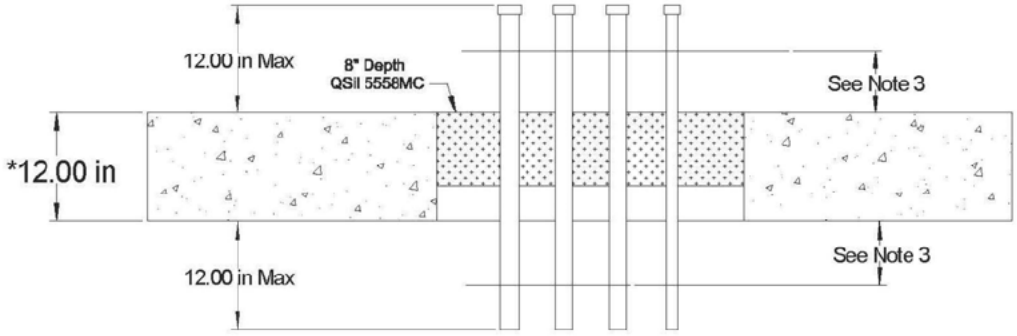
See Page B-5 for Section A - A

Penetrant descriptions are provided on page B-3.

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

Fire Pressure Test 2
Penetrating Item Locations



Section A-A

NOTES:

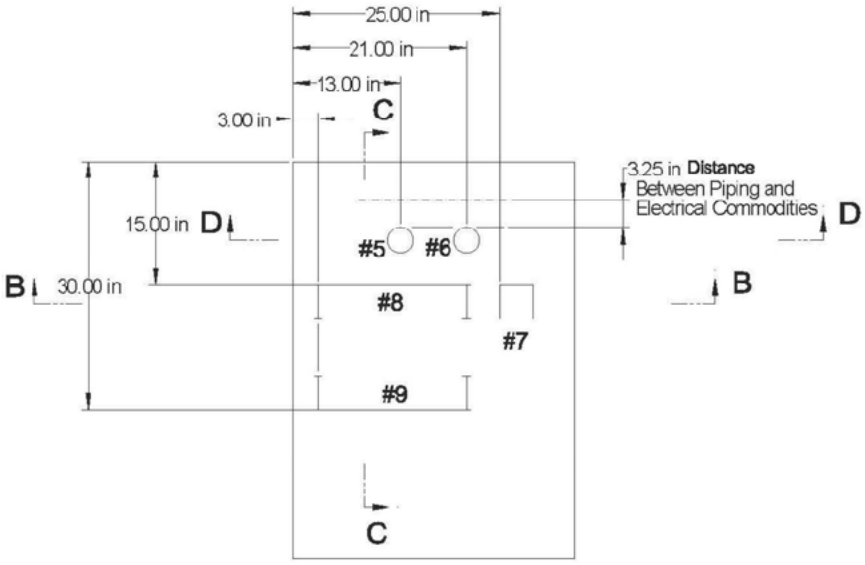
1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 6" TO 8" ABOVE AND BELOW SLAB. PIPE CLAMPS REQUIRED FOR TITANIUM AND ZIRCONIUM PIPES.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Electrical Commodity Locations



See Page B-7 for Section B - B,
Page B-8 for Section C - C
and Page B-9 for Section D - D

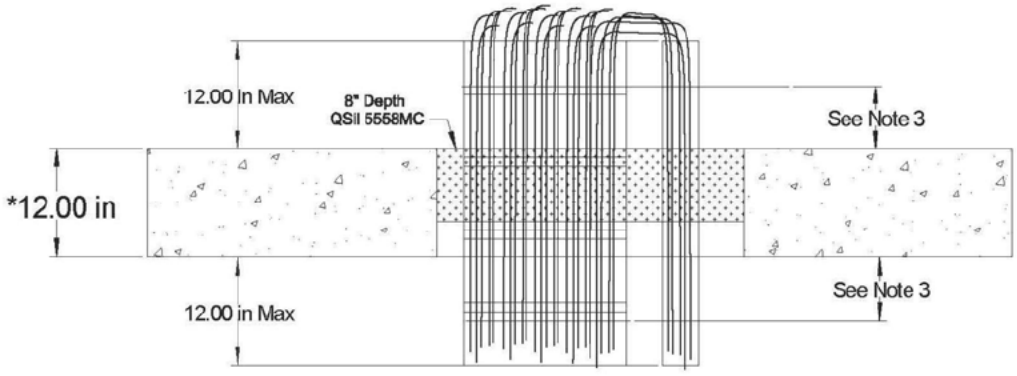
Penetrant descriptions are provided on page B-3.

Cable Fill Per Table B-1

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

Fire Pressure Test 2
Penetrating Item Locations



Section B-B

NOTES:

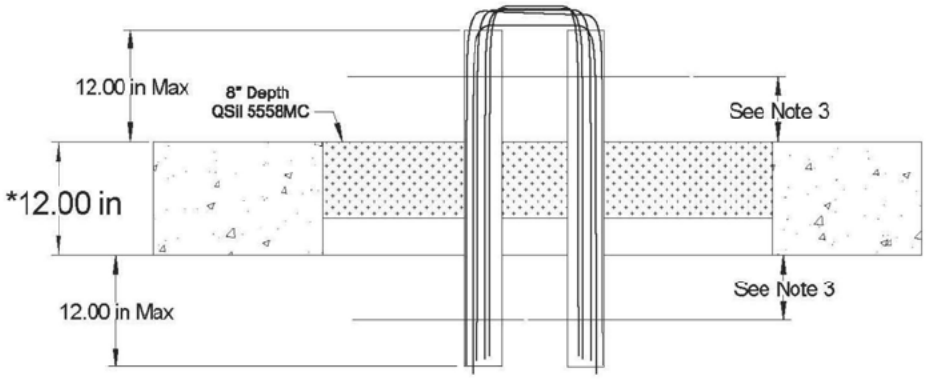
1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 6" TO 8" ABOVE AND BELOW SLAB.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Penetrating Item Locations



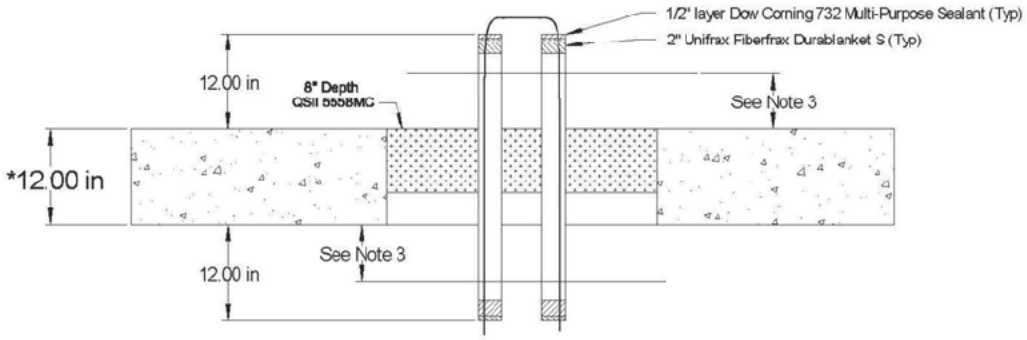
Section C-C

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 6" TO 8" ABOVE AND BELOW SLAB.

Intertek

Fire Pressure Test 2
Penetrating Item Locations



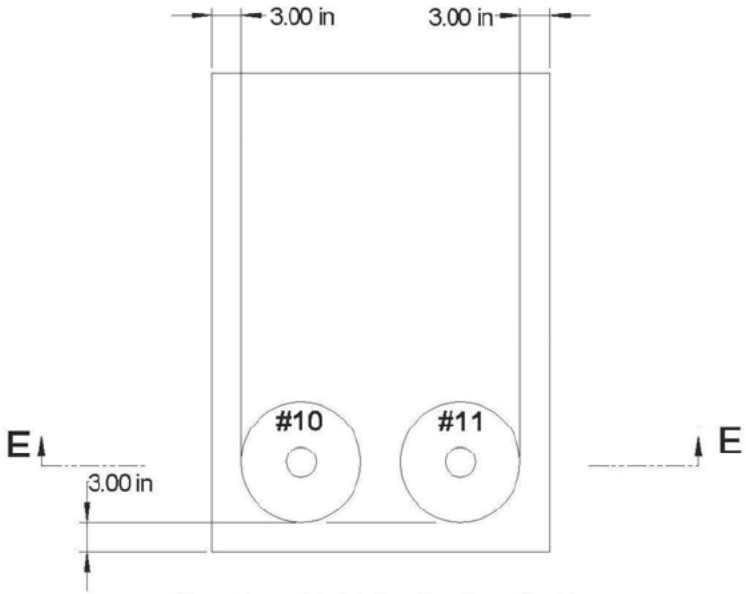
Section D-D

Cable Fill Per Table B-1

NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 6" TO 8" ABOVE AND BELOW SLAB.

Fire Pressure Test 2
Pipe and Sleeve Commodity Locations



See Page B-11 for Section D - D

Penetrant descriptions are provided on page B-3.

NOTES:

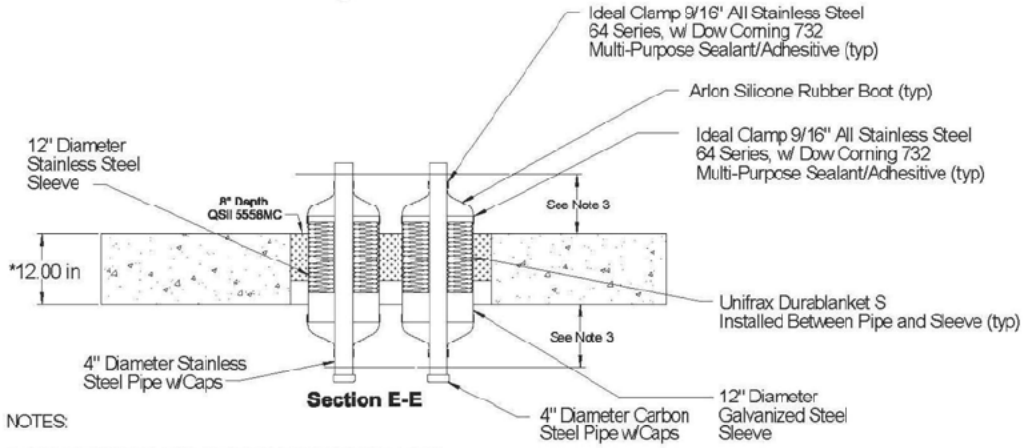
1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Fire Pressure Test 2
Penetrating Item Locations



NOTES:

1. TOLERANCE ON ALL SLAB DIMENSIONS IS +/- 1/4"
2. * INDICATES DIMENSIONS TO BE VERIFIED BY AREVA QC.
3. INSTALL SUPPORT APPROXIMATELY 8" TO 10" ABOVE AND BELOW SLAB.
4. CAP ALL PIPES ON TOP OR BOTTOM (AIR TIGHT).

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Table B-1: Cable Fill By Raceway

Penetrating Item	Raceway Description	Cable Fill	Cable Description	Quantity (Lengths)
#1	2" Carbon Steel Pipe	NA		
#2	2" Stainless Steel Pipe	NA		
#3	2" Zirconium Pipe	NA		
#4	1 ¼" Titanium Pipe	NA		
#5	3" Stainless Steel Conduit	Single CSPE Jacket	Item no. 2 (Control) 1/C 8 AWG 7/S TC 45 MILS XLPE, 15 MILS CSPE FIREWALL III® 600V	1 wfb-7
		Single XLPE Jacket	Item no. 283 (SIS) 1/C 6 AWG 7/S TC Class B Strand 60 MILS XLPE FIREWALL® SIS 600V Type SIS/XHHW-2 (UL) Listed Colored Grey	1 wbe-1
		Single XLPE Jacket	Item no. 25 (Control) 4/C 20 AWG 7/S TC 20 MILS XLPE, 15 MIL XLPE JKT 600V	1 whd-3
		Single Modified XLPO Jacket	Item no. 77 (COAX) COAX CABLE WITH RG TYPE 59/U, or equal / 22 AWG FOR 62 OHMS (RSS-6-104/LE) Except Not UL Listed & Meets ICEA S-19-81 Paragraph 6.19.6 (IEEE-383 Paragraph 2.56)	1 whe-8
		Single LSZH-XLPO Jacket	Item no. 85HF (VFD Power) 3/C 10 AWG 7/S TC, 20 MILS XLPE, 1-#10 AWG CU GW, O/A TINNED COPPER BRAID SHIELD, 35 MIL ZH-XLPO JKT X-LINK® 600V	1 wfa-26
#6	3" Carbon Steel Conduit	Single CSPE Jacket	Item no. 2 (Control) 1/C 8 AWG 7/S TC 45 MILS XLPE, 15 MILS CSPE FIREWALL III® 600V	1 wfb-7

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

		Single	Item no. 283 (SIS) 1/C 6 AWG 7/S TC Class B Strand 60 MILS XLPE FIREWALL® SIS 600V Type SIS/XHHW-2 (UL) Listed Colored Grey	1 wbe-1
		Single XLPE Jacket	Item no. 25 (Control) 4/C 20 AWG 7/S TC 20 MILS XLPE, 15 MIL XLPE JKT 600V	1 whd-3
		Single Modified XLPO Jacket	Item no. 77 (COAX) COAX CABLE WITH RG TYPE 59/U, or equal / 22 AWG FOR 62 OHMS (RSS-6-104/LE) Except Not UL Listed & Meets ICEA S-19-81 Paragraph 6.19.6 (IEEE-383 Paragraph 2.56)	1 whe-8
		Single LSZH-XLPO Jacket	Item no. 85HF (VFD Power) 3/C 10 AWG 7/S TC, 20 MILS XLPE, 1-#10 AWG CU GW, O/A TINNED COPPER BRAID SHIELD, 35 MIL ZH-XLPO JKT X-LINK® 600V	1 wfa-26
#7	4" x 4" PCCS Wire Way	40% Power / Control Cable - Moderate OD, Copper Cross Section and HOC	Item no. 261 (Power) 2/C 12 AWG 7/S TC, 30 MILS XLPE, 1-#12 AWG GW, 34 AWG TC BRAID SHLD, 45 MIL CSPE JKT FIREWALL® III 600V	17 wga-14
			Item no. 30 (Control) 5/C 14 AWG 7/S TC 30 MILS XLPE, 45 MIL CSPE JKT FIREWALL® III 600V	17 wha-4
#8	18"x4" SSSB Cable Tray	50% Control / Instrument Cable - High OD, Copper Cross Section and HOC	Item no. 70 (Control) 37/C 16 AWG 7/S TC 25 MILS XLPE, 80 MIL CSPE JKT FIREWALL® III 600V	13 whb-19
			Item no. 178 (Instrumentation) 9 STP 16 AWG 7/S TC, 25 MILS XLPE 18 AWG TC DW, 2 MIL ALUM-MYLAR SHLD OVER PR, 18 AWG TC DW, O/A 2 MIL ALUM-MYLAR SHLD, 60 MIL CSPE JKT FIREWALL® III 600V	13 whb-69
			Item no. 261 (Power) 2/C 12 AWG 7/S TC, 30 MILS XLPE, 1-#12 AWG GW, 34 AWG TC BRAID SHLD, 45 MIL CSPE JKT FIREWALL® III 600V	13 wga-14
			Item no. 30 (Control) 5/C 14 AWG 7/S TC 30 MILS XLPE, 45 MIL CSPE JKT FIREWALL® III 600V	13 wha-4

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Penetrating Item	Raceway Description	Cable Fill	Cable Description	Quantity (Lengths)
#9	18"x4" Galv. Ladder Back Cable Tray	40% Control / Instrument Cable - High OD, Copper Cross Section and HOC	Item no. 70 (Control) 37/C 16 AWG 7/S TC 25 MILS XLPE, 80 MIL CSPE JKT FIREWALL® III 600V	13 whb-19
			Item no. 178 (Instrumentation) 9 STP 16 AWG 7/S TC, 25 MILS XLPE 18 AWG TC DW, 2 MIL ALUM-MYLAR SHLD OVER PR, 18 AWG TC DW, O/A 2 MIL ALUM-MYLAR SHLD, 60 MIL CSPE JKT FIREWALL® III 600V	13 whb-69
			1/C 6 AWG 7/S TC Class B Strand 60 MILS XLPE FIREWALL® SIS 600V Type SIS/XHHW-2 (UL) Listed Colored Grey	2 wbe-1
			4/C 20 AWG 7/S TC 20 MILS XLPE, 15 MIL XLPE JKT 600V	2 whd-3
			COAX CABLE WITH RG TYPE 59/U, or equal / 22 AWG FOR 62 OHMS (RSS 6 104/LE) Except Not UL Listed & Meets ICEA S-19-81 Paragraph 6.19.6 (IEEE-383 Paragraph 2.56)	2 whe-8
			3/C 10 AWG 7/S TC, 20 MILS XLPE, 1-#10 AWG CU GW, O/A TINNED COPPER BRAID SHIELD, 35 MIL ZH-XLPO JKT X-LINK® 600V	2 wfa-26
#10	12" Diameter Stainless Steel Sleeve and Stainless Steel Pipe	NA		
#11	12" Diameter Galv. Sleeve and Carbon Steel Pipe	NA		

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

APPENDIX C: BILL OF MATERIALS

This appendix contains the Bill of Materials for this fire pressure test. The Bill of Materials in Section C.1 identifies materials to be provided by AREVA. The Bill of Materials in Section C.2 identifies materials to be provided by MOX Services. The Bill of Materials in Section C.3 identifies materials to be provided by Intertek.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

C.1 Table Bill of Materials for AREVA Supplied Items

Bill of Material for AREVA Supplied Items					
Item	**Description**	**Part Number**	**Quantity**	**Units**	**Total**
1*	Quantum Silicones QSil 5556MC (50lb part A, 50lb part B, 100lb set)	N/A	9	Set	9 Sets
2*	Quantum Silicones QSil Primer #3	N/A	1	Gallon	1 Gallon
3	Dow Corning® 732 Multi-Purpose Sealant	N/A	N/A	N/A	N/A**
4	Unifrax Fiberfrax® Durablanket® S – 6 lbs/cu. ft., 1" thick, 48" wide, 25 linear feet	N/A	N/A	N/A	N/A**
5	Arlon Silicone Impregnated Fiberglass Fabric	56493F031	1	Roll (38 Inch x 25 Yard)	N/A**
6	Ideal – All Stainless Steel Clamp 64 Series (5.00 – 7.00 inches)	64104	1	Box	N/A**
7	Ideal – All Stainless Steel Clamp 64 Series (4.00 – 6.00 inches)	6488	1	Box	N/A**

* Installed under Pressure Test 4C test plan.

** Previously purchased for prior test plans.

Page C-2

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

C.2 Bill of Materials for MOX Services Supplied Items

Bill of Material for MOX Services Supplied Items					
Item	**Description**	**Part Number**	**Quantity**	**Units**	**Total**
1	2/C 12 AWG 7/S TC, 30 MILS XLPE, 1-#12 AWG GW, 34 AWG TC BRAID SHLD, 45 MIL CSPE JKT FIREWALL® III 600V	wga-14	120	Ft.	120 Ft.**
2	5/C 14 AWG 7/S TC 30 MILS XLPE, 45 MIL CSPE JKT FIREWALL® III 600V	wha-4	120	Ft.	120 Ft.**
3	37/C 16 AWG 7/S TC 25 MILS XLPE, 80 MIL CSPE JKT FIREWALL® III 600V	whb-19	110	Ft.	110 Ft.**
4	9 STP 16 AWG 7/S TC, 25 MILS XLPE 18 AWG TC DW, 2 MIL ALUM-MYLAR SHLD OVER PR, 18 AWG TC DW, O/A 2 MIL ALUM-MYLAR SHLD, 60 MIL CSPE JKT FIREWALL® III 600V	whb-69	110	Ft.	110 Ft.**
5	1/C 6 AWG 7/S TC Class B Strand 60 MILS XLPE FIREWALL® SIS 600V Type SIS/XHHW-2 (UL) Listed Colored Grey	wbe-1	10	Ft.	10 Ft.**
6	4/C 20 AWG 7/S TC 20 MILS XLPE, 15 MIL XLPE JKT 600V	whd-3	10	Ft.	10 Ft.**
7	COAX CABLE WITH RG TYPE 59/U, or equal / 22 AWG FOR 62 OHMS (RSS-6-104/LE) Except Not UL Listed & Meets ICEA S-19-81 Paragraph 6.19.6 (IEEE-383 Paragraph 2.56)	whe-8	10	Ft.	10 Ft.**
8	3/C 10 AWG 7/S TC, 20 MILS XLPE, 1-#10 AWG CU GW, O/A TINNED COPPER BRAID SHIELD, 35 MIL ZH-XLPO JKT X-LINK® 600V	wfa-26	10	Ft.	10 Ft.**

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Bill of Material for MOX Services Supplied Items					
Item	**Description**	**Part Number**	**Quantity**	**Units**	**Total**
9	1/C 8 AWG 7/S TC 45 MILS XLPE, 15 MILS CSPE FIREWALL III® 600V	wfb-7	10	Ft.	10 Ft.**
10*	2" Diameter Zirconium Pipe S-40S, Zirconium, SMLS, ASME SB658-R60702 (1@ 3 ft.)	N/A	3	Ft.	3 Ft.
11*	1 ¼" Diameter Titanium Pipe, S-40S, Titanium, SMLS, ASME SB861GR2 (1@ 3 ft.)	N/A	3	Ft.	3 Ft.

* Pipes previously supplied by MOX for other tests.

** Cables previously procured for prior test plans (mostly for Pressure Tets 4C).

Page C-4

C.3 Bill of Materials for Intertek Supplied Items

Bill of Material for Intertek Supplied Items*					
Item	**Description**	**Part Number**	**Quantity**	**Units**	**Total**
1*	2" Diameter Schedule 40 Carbon Steel Pipe (1@ 3 ft.)	N/A	3	Ft.	3 Ft.
2*	2" Diameter Stainless Steel Pipe S 10S, 304L SS, SMLS, ASTM A312TP304L (1@ 3ft.)	N/A	3	Ft.	3 Ft.
3*	3" Diameter Stainless Steel Conduit– Calbrite Stainless Steel Conduit Systems, Type 304, or Equal with Cap (Need 1 @ 3 LF w/1 Cap)	S43010CT00	3	Ft.	3 Ft.
4*	3" Diameter Galvanized Conduit– Calconduit or Equal with Cap (Need 1 @ 3 LF w/1 Cap)	ST3010CT00	3	Ft.	3 Ft.
5	4"x4" Painted Wire Way – Cooper B-Line or Equal (Need 1 @ 3 LF)	4460 G NK	5	Ft.	5 Ft.
6*	18"x4" Stainless Steel Solid Bottom Cable Tray – Cooper B-Line or Equal (Need 1 @ 3 LF)	348 SS4 SB 18 120	3	Ft.	3 Ft.
7*	18"x4" Galvanized Ladder Back Cable Tray – Cooper B-Line or Equal (Need 1 @ 3 LF)	444 G 09 18 120	3	Ft.	3 Ft.
8*	12" Diameter 16 ga. Stainless Steel Sleeve (Need 1 @ 1.5 LF)	N/A	1.5	Ft.	1.5 Ft.

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

Bill of Material for Intertek Supplied Items*					
Item	**Description**	**Part Number**	**Quantity**	**Units**	**Total**
9*	12" Diameter 16 ga. Galvanized Steel Sleeve (Need 1 @ 1.5 LF)	N/A	1.5	Ft.	1.5 Ft.
10	4" Diameter Schedule S10 Stainless Steel Pipe (Need 1 @ 3 LF)	N/A	3	Ft.	3 Ft.
11	4" Diameter Schedule 40 Carbon Steel Pipe (Need 1 @ 3 LF)	N/A	3	Ft.	3 Ft.

* Items marked with an asterisk (*) will be reclaimed from previous pressure tests or from MOX surplus at the Intertek site.

** *This BOM applies to Intertek Supplied Items other than materials required to construct the test slab. Construction of the test slab, including procurement of any materials required for the test slab and commodity supports, is the responsibility of Intertek.*

Page C-6

AREVA

Document No.: 51-9217966-000

Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

APPENDIX D: DESIGN VERIFICATION CHECKLIST

22410-8 (02/25/2013) *Page 1 of 2*

AREVA

DESIGN VERIFICATION CHECKLIST

Document Identifier 51 - 9217966 - 000

Title Detailed Test Plan for Conducting MOX Fire-Pressure Test 2

1.	Were the inputs correctly selected and incorporated into design or analysis?	☒ Y	☐ N	☐ N/A
2.	Are assumptions necessary to perform the design or analysis activity adequately described and reasonable? Where necessary, are the assumptions identified for subsequent re-verifications when the detailed design activities are completed? Note: If there are no assumptions (of any type), then N/A shall be checked.	☐ Y	☐ N	☒ N/A
3.	Are the appropriate quality and quality assurance requirements specified? Or, for documents prepared per AREVA NP Inc. procedures, have the procedural requirements been met?	☒ Y	☐ N	☐ N/A
4.	If the design or analysis cites or is required to cite requirements or criteria based upon applicable codes, standards, specific regulatory requirements, including issue and addenda, are these properly identified, and are the requirements/criteria for design or analysis met?	☒ Y	☐ N	☐ N/A
5.	Have applicable construction and operating experience been considered?	☒ Y	☐ N	☐ N/A
6.	Have the design interface requirements been satisfied?	☒ Y	☐ N	☐ N/A
7.	Was an appropriate design or analytical method used?	☒ Y	☐ N	☐ N/A
8.	Is the output reasonable compared to inputs?	☒ Y	☐ N	☐ N/A
9.	Are the specified parts, equipment and processes suitable for the required application?	☒ Y	☐ N	☐ N/A
10.	Are the specified materials compatible with each other and the design environmental conditions to which the material will be exposed?	☒ Y	☐ N	☐ N/A
11.	Have adequate maintenance features and requirements been specified?	☐ Y	☐ N	☒ N/A
12.	Are accessibility and other design provisions adequate for performance of needed maintenance and repair?	☐ Y	☐ N	☒ N/A
13.	Has adequate accessibility been provided to perform the in-service inspection expected to be required during the plant life?	☐ Y	☐ N	☒ N/A
14.	Has the design properly considered radiation exposure to the public and plant personnel?	☐ Y	☐ N	☒ N/A
15.	Are the acceptance criteria incorporated in the design documents sufficient to allow verification that design requirements have been satisfactorily accomplished?	☒ Y	☐ N	☐ N/A
16.	Have adequate preoperational and subsequent periodic test requirements been appropriately specified?	☐ Y	☐ N	☒ N/A
17.	Are adequate handling, storage, cleaning and shipping requirements specified?	☒ Y	☐ N	☐ N/A
18.	Are adequate identification requirements specified?	☒ Y	☐ N	☐ N/A
19.	Is the document prepared and being released under the AREVA NP Inc. Quality Assurance Program? If not, are requirements for record preparation review, approval, retention, etc., adequately specified?	☒ Y	☐ N	☐ N/A

AREVA

DESIGN VERIFICATION CHECKLIST

Document Identifier 51 - 9217966 - 000

Comments on the preceding responses:

Verified By: Derrick V Risner [redacted] 2/4/2014

(First, MI, Last) Printed / Typed Name Date

APPENDIX F

Commercial Grade Dedication-Related Documents

The vast majority of penetration seals that will be installed throughout the MFFF will be designated as quality level QL-1. For this reason, permanent penetration seal materials used in this test program were procured by AREVA or supplied by MOX Services and suitably base-lined so that future procurements of the same commercial materials can undergo the Commercial Grade Dedication process in support Nuclear Safety Related (i.e., MOX QL-1) plant installations.

Only the primary seal material(s) that were specified as a part of the final penetration seal design and left in place during the test needed to be base-lined for future dedication of similarly procured materials. For this test, the following AREVA documents contain information associated with materials that underwent the base-lining process. These documents establish material critical characteristics as a baseline for future Commercial Grade Dedication.

- AREVA Document 51-9212663-000, "Quantum Silicones QSil 5558MC Silicone Elastomer Critical Characteristics"
- AREVA Document 51-9212666-000, "Dow Corning 732 Multi-Purpose Sealant Critical Characteristics"
- AREVA Document 51-9212669-000, "Arlon 56493F031 Critical Characteristics"
- AREVA Document 51-9212670-000, "Unifrax Durablanket S Critical Characteristics"
- AREVA Document 51-9212671-000, "Ideal Tridon Series 64 Hose Clamp Critical Characteristics"
- AREVA Document 51-9218221-000, "Quantum Silicones QSil Primer #3 Critical Characteristics"

These documents are available from the AREVA Records Management System or the MOX Records Management System.

APPENDIX G
Quality Documents

The test assembly for Fire-Pressure Test 2 was the same assembly constructed and tested as Pressure Test 4C with select modifications to add internal conduit seals and boot seals.

For QC Records of the seal installation, Certificates of Conformance of the sealant materials, and QA Receiving documentation for the unmodified portion of the test assembly re-purposed from Pressure Test 4C, please see the Appendices in Pressure Test 4C (Intertek Report No. 101276459SAT-025; AREVA Doc. 58-9224196-000).

QC Records for the modifications made to the Pressure Test 4C test assembly as part of Fire-Pressure Test 2 (i.e., installation of internal conduit seals and boot seals), as well as, associated Certificates of Conformance, and QA Receiving documentation are contained on the following pages of this Appendix.

AREVA

Document No.: 01-9198306-004

Installation Instruction Manual for MOX Penetration Seal Test Program

A.5 Quality Verification for Sleeve Inserts and Sleeve Extensions

Page 1 of 5

01-9198306-F05 (QC-F05)

Attribute	Requirement	Initial / Date
11.1.1	Record the test penetration's unique identification number Test Penetration Number ~~9216954 P1~~ 9217966-P1*	[redacted] -14 [redacted] 2-20-14
QC	Verify the penetration opening is clean and free of dirt, oil, and any other foreign materials. Ensure the exterior of the sleeve insert or sleeve extension is also clean and free of dirt, oil, and any other foreign materials.	[redacted] 2-25-14
11.2.4, 11.2.10, 11.2.12 (11.3.5) [11.4.4, 11.4.10, 11.4.12]	Record the material type, lot number and expiration date for the sealants to be used in the sleeve insert (or sleeve extension) installation. Use Comments section to indicate where each type of sealant was used. Material Type: N/A SLEEVE SEAMS ARE WELDED Lot Number: _____ Expiration Date: _____	[redacted] 3-4-14
	Material Type: N/A Lot Number: _____ Expiration Date: _____	N/A [redacted] 3-4-14
11.2.8 (11.3.6) [11.4.8]	Record the fastener type and size used to connect the sleeve insert seam. Fastener Type & Size: N/A SLEEVE SEEMS ARE WELDED	[redacted] 3-4-14
QC	Verify that the completed sleeve insert (or sleeve extension) has been installed in accordance with the test plan design and this instruction manual. **Any approved deviations from the test plan shall be clearly noted below.**	[redacted] 3-4-14

Comments (can be continued on back): PT4C [redacted] -26-14

* THIS FORM COVERS BOTH SLEEVE INSERTS. SLEEVE INSERTS ARE INSTALLED AS 12" DIA DUCTS FOR EPT (9216954-P1) TO BE MODIFIED AS SLEEVES FOR FPT2 (9217966-P1). LUGS INSTALLED PER INSTALLATION INSTRUCTION MANUAL PRIOR TO ELASTOMER INSTALLATION. DC-732 CAULK NOT INSTALLED PER SECTION 11.3.3.1 OF THE INSTALLATION INSTRUCTION MANUAL BECAUSE OF ADVERSE RESULTS OF PT4B

SEE ALSO PAGE 2.

Penetration Seal Assembly Complete: [redacted] 3-4-14 Date

Penetration Ready for Testing: [redacted] AREVA Test Engineer 3/4/14 Date

Page 2 of 5

9217966-P1

The following minor changes were made to penetrating items P10 and P11 from that depicted on the test plan:

1. Sleeves were cut approximately 2" from the bottom of the slab (approximately 6" below the bottom of the seal).
2. The stainless steel sleeve (P10) was cut approximately 3" above the top of the slab (approximately 3" above the top of the seal) and the galvanized steel sleeve (P11) was cut approximately 2 ½" above the top of the slab (approximately 2 ½" above the top of the seal)
3. The tops of the stainless steel and carbon steel pipes (P10 and P11 respectfully) were installed approximately 16" above the top of the slab, rather than 12" above.

NOTE: THE ~~EBS~~ LSC 3/4/14 QSIL 5558 MC SEAL, ALONG WITH THE QSIL #3 PRIMER, WERE INSTALLED UNDER PT4C. SEE PT4C TEST REPORT FOR THESE QC RECORDS.

[redacted] 3/4/14
4/14

AREVA

Document No.: 01-9198306-004

Installation Instruction Manual for MOX Penetration Seal Test Program

A.3 Quality Verification for Installation of Flexible Boot Seals

Page 3 of 5

01-9198306-F03 (QC-F03)

Attribute	Requirement	Initial / Date
10.1.3	Record the test penetration's unique identification number Test Penetration Number 921796-P1 *	[redacted] 2-23-14
QC	Verify critical attributes of the test slab and the applicable penetration are correct. Critical attributes are identified in the test plan (i.e., dimensions marked with an asterisk).	[redacted] 3-4-14
10.2.4	Record the lot number for the boot material Lot Number: 1005/229F	3-4-14
QC	Verify the penetration is clean and free of dirt, oil, and any other foreign materials. Ensure the bonding surfaces of the sleeve and penetrating pipe are free of any burrs and sharp edges.	3-4-14
10.3.6	Record the lot number for the Durablanket® S Lot Number: 33274 76452/000	3-4-14
QC	Verify the Durablanket S material has been installed in accordance with the test plan.	3-4-14
10.3.8	Record the material type, lot number and expiration date for the sealant Material Type: DC-732 Lot Number: 0007251823 Expiration Date: 29 MAY 15	[redacted] 3-4-14
10.3.11.6	Record clamp model numbers and quantities used at pipe Clamps at Pipe: 6480 x2 BOTH PIPES	3-4-14
10.3.13.6	Record clamp model numbers and quantities used at pipe Clamps at Sleeve: 64104 x2 BOTH SLEEVES	3-4-14
QC	Verify that the completed seal assembly is in accordance with Section 10.0 of this document and the test plan design. **Any approved deviations from the test plan shall be clearly noted below.**	[redacted] 3-4-14

Comments (can be continued on back):
* THIS COVERS BOTH PIPE/SLEEVES, PENETRATING ITEMS #10 & #11, TOP & BOTTOM.

Penetration Seal Assembly Complete: [redacted] 3-4-14 Date

Penetration Ready for Testing: [redacted] 3/4/14 Date
AREVA Test Engineer

Page A-5

Controlled Document

AREVA

Document No.: 01-9198306-004

Installation Instruction Manual for MOX Penetration Seal Test Program

A.4 Quality Verification of Calculation for Flexible Boot Seal Material Template

Sleeve OD: 12 1/8"

Page 4 of 5

Pipe OD: 4 1/2"

01-9198306-F04 (QC-F04)

Attribute	Requirement	Initial / Date
10.1.3	Record the test penetration's unique identification number Test Penetration Number 92179606-P1 *	[redacted] 2/23/14
10.2.1.2	Record input information for h, R, and r: h: 14 5/8" R: 60 5/16" r: 2 1/2"	
10.2.1.4	1) Calculate sin(t): $\sin(t) = (R-r)/\sqrt{(h^2 + [R-r]^2)}$ sin(t) = 0.252	
10.2.1.6	2) Find the major radius (S): S = R/sin(t) + 1-9/16" S = 26.59	
10.2.1.8	3) Find the minor radius (s): s = r/sin(t) s = 9.91	
10.2.1.10	4) Find the central angle (T in radians): T = 2*Pi*sin(t) T = 1.59 radians	
10.2.1.11	5) Find the central angle in degrees (Θ): Θ = T*180°/Pi Θ = 90.8 degrees	

Calculation Complete:

[redacted] Preparer — 3-3-14 Date

* THIS COVERS P10 & P11 TOP AND BOTTOM BOOTS.

[redacted] AREVA Test Engineer — 3/3/14 Date

Page A-6

AREVA

Document No.: 01-9198306-004

Installation Instruction Manual for MOX Penetration Seal Test Program

A.2 Quality Verification for Installation of Caulk and Fiber Seals

Page 5 of 5

01-9198306-F02 (QC-F02)

Attribute	Requirement	Initial / Date
9.1.2	Record the test penetration's unique identification number Test Penetration Number 9217966 - P1	[redacted] 3-4-14
QC	Verify critical attributes of the test slab and the applicable penetration are correct. Critical attributes are identified in the test plan (i.e., dimensions marked with an asterisk).	[redacted] 3-4-14
9.1.5	Record the lot number for the Durablanket® S damming material Lot Number: 33274 76452 1000	[redacted] 3-4-14
QC	Verify the dam depth is as specified in the test plan and confirm that the penetration is clean and free of dirt, oil, and any other foreign materials.	[redacted] 3-4-14
9.2.1	Record the material type, lot number and expiration date for the sealant Material Type: DC-732 Lot Number: 0007251823 Expiration Date: 29 MAY 15	[redacted] 3-4-14
QC	Verify that the completed seal assembly is in accordance with the test plan design (i.e., temporary damming has been removed, and the installed seal configuration(s) and depth(s) are per the test plan. **Any approved deviations from the test plan shall be clearly noted below**	[redacted] 3-4-14

Comments (can be continued on back):

THIS COVERS BOTH CONDUITS, PENETRATING ITEMS #5 & #6, TOP & BOTTOM.

Penetration Seal Assembly Complete: [redacted] 3-4-14 Date

Penetration Ready for Testing: [redacted] 3/4/14 Date

AREVA Test Engineer

Page A-4

PCI PROMATEC

PO Box 710290, Houston, TX 77271-0290
11707 S Sam Houston Parkway W, Ste K, Houston, TX 77031
Phone: 281-933-7222 Fax: 281-933-7774
info@promatec.com
www.promatec.com

CERTIFICATE OF CONFORMANCE

CERTIFICATION NUMBER:	45550/13-630	CERT DATE:	JULY 2, 2013
JOB NUMBER:	2860	SHIP DATE:	JULY 2, 2013
CUSTOMER:	AREVA NP INC. c/o INTERTEK TESTING SERVICES NA, INC. 16015 SHADY FALLS ROAD ELMENDORF, TX 78112-9784	PRODUCT:	PART NO. 56493F031 Arlon Boot Material, Blue Black Fabric Silicone
CUSTOMER ORDER NUMBER:	P.O. No. 1013037393, Rev. 01 ITEM 20	VENDOR:	PCI PROMATEC
CUSTOMER SPECIFICATION NUMBER:	N/A	QUANTITY:	1 ROLL @ 36" WIDE X 2 LY 1 ROLL @ 36" WIDE X 4 LY 1 ROLL @ 36" WIDE X 5 LY 1 ROLL @ 8 ½" WIDE X 3LY
IDENTIFICATION NUMBER:	100512Z9F – 1 ROLL @ 2 LY 080212Z7F – 1 ROLL @ 4 LY 100512Z9F – 1 ROLL @ 5 LY 050313Z7BF – 1 ROLL @ 3 LY	EXPIRATION DATE:	N/A

CERTIFICATION REQUIREMENTS:

We hereby certify that all items furnished herein meet the requirements of the applicable product specifications, the above referenced customer order number, and supporting specifications. Vendor material certification on file and available upon written request.

Shelf Life – Not applicable to this item.

This material is provided in accordance with Promatec Quality Assurance Program QAM20188, Issue F, dated 06/20/03.

[redacted]
QUALITY ASSURANCE DEPT.
DORCAS SMITHWICK COMBS
QUALITY ASSURANCE MANAGER

Form QC-8
Rev. 5 – 11/01/88

WORLD-CLASS CONSTRUCTION®

PCI PROMATEC

11707 S Sam Houston Parkway
Phone: 281-933-7222 Fax: 281-933-7714
info@promatec.com
www.promatec.com

CERTIFICATE OF CONFORMANCE

CERTIFICATION NUMBER:	45550/13-631	CERT DATE:	JULY 2, 2013
JOB NUMBER:	2860	SHIP DATE:	JULY 2, 2013
CUSTOMER:	AREVA NP INC. c/o INTERTEK TESTING SERVICES NA, INC. 16015 SHADY FALLS ROAD ELMENDORF, TX 78112-9784	PRODUCT:	CLAMP SS, IDEAL P/N 64104 CLAMP SS, IDEAL P/N 6488 CLAMP SS, IDEAL P/N 6472 CLAMP SS, IDEAL P/N 6444 CLAMP SS, IDEAL P/N 6420 CLAMP SS, IDEAL P/N 6408
CUSTOMER ORDER NUMBER:	P.O. No. 1013037393, Rev. 01 ITEM 20	VENDOR:	PCI PROMATEC
CUSTOMER SPECIFICATION NUMBER:	N/A	QUANTITY:	10 BOXES @ 10 CLAMPS PER BOX 100 CLAMPS TOTAL IDEAL P/N 64104 – 30 EACH IDEAL P/N 6488 – 10 EACH IDEAL P/N 6472 – 30 EACH IDEAL P/N 6444 – 10 EACH IDEAL P/N 6420 – 10 EACH IDEAL P/N 6408 – 10 EACH
IDENTIFICATION NUMBER:	P/N 64104 – 30 EACH P/N 6488 – 10 EACH P/N 6472 – 30 EACH P/N 6444 – 10 EACH P/N 6420 – 10 EACH P/N 6408 – 10 EACH	EXPIRATION DATE:	N/A

CERTIFICATION REQUIREMENTS:

We hereby certify that all items furnished herein meet the requirements of the applicable product specifications, the above referenced customer order number, and supporting specifications. Vendor material certification on file and available upon written request.

Shelf Life – Not applicable to this item.

This material is provided in accordance with Promatec Quality Assurance Program QAM20188, Issue F, dated 06/20/03.

[redacted]

QUALITY ASSURANCE DEPT.
DORCAS SMITHWICK COMBS
QUALITY ASSURANCE MANAGER

Form QC-8
Rev. 5 – 11/01/88

WORLD-CLASS CONSTRUCTION®

PCI PROMATEC

PO Box 710290, Houston, TX 77271-0290
11707 S Sam Houston Parkway W, Ste K, Houston, TX 77031
Phone: 281-933-7222 Fax: 281-933-7774
info@promatec.com
www.promatec.com

CERTIFICATE OF CONFORMANCE

CERTIFICATION NUMBER:	45550/14-116	CERT DATE:	NOVEMBER 7, 2013
JOB NUMBER:	2933	SHIP DATE:	NOVEMBER 5, 2013
CUSTOMER:	AREVA NP INC. c/o INTERTEK TESTING SERVICES NA, INC. 16015 SHADY FALLS ROAD ELMENDORF, TX 78112-9784	PRODUCT:	DURABLANKET S Unifrax Fiberfrax Durablanket S 6-lb Density, 1"x24"x25' 50SF/Roll
CUSTOMER ORDER NUMBER:	P.O. No. 1013037393, Rev. 5 ITEM 3	VENDOR:	PCI PROMATEC
CUSTOMER SPECIFICATION NUMBER:	N/A	QUANTITY:	1 BOX @ 50 SF Per Box 1" x 24" X 25 Feet Per Roll 50 SQUARE FEET TOTAL
IDENTIFICATION NUMBER:	33274	EXPIRATION DATE:	N/A

CERTIFICATION REQUIREMENTS:

We hereby certify that all items furnished herein meet the requirements of the applicable product specifications, the above referenced customer order number, and supporting specifications. Vendor material certification on file and available upon written request.

Shelf Life – Not Applicable for This Item.

This material is provided in accordance with Promatec Quality Assurance Program QAM20188, Issue F, dated 06/20/03.

[redacted]

DORCAS SMITHWICK COMBS
QUALITY ASSURANCE MANAGER

Form QC-8
Rev. 5 – 11/01/88

WORLD-CLASS CONSTRUCTION®

PCI PROMATEC

PO Box 710290, Houston, TX 77271-0290
11707 S Sam Houston Parkway W, Ste K, Houston, TX 77031
Phone: 281-933-7222 Fax: 281-933-7774
info@promatec.com
www.promatec.com

CERTIFICATE OF CONFORMANCE

CERTIFICATION NUMBER:	45550/13-579	CERT DATE:	JUNE 12, 2013
JOB NUMBER:	2860	SHIP DATE:	JUNE 12, 2013
CUSTOMER:	AREVA NP INC. c/o INTERTEK TESTING SERVICES NA, INC. 16015 SHADY FALLS ROAD ELMENDORF, TX 78112-9784	PRODUCT:	DC-732-BLACK, 10.1oz Dow Corning 732 Multi-Purpose Sealant; 10.1oz Tubes BLACK in color
CUSTOMER ORDER NUMBER:	P.O. No. 1013021586, REV. 1 ITEM 2	VENDOR:	PCI PROMATEC
CUSTOMER SPECIFICATION NUMBER:	N/A	QUANTITY:	4 CASES @ 12 EA 10.1oz Tubes 48 TUBES TOTAL
IDENTIFICATION NUMBER:	0007251823	EXPIRATION DATE:	29 MAY 2015

CERTIFICATION REQUIREMENTS:

We hereby certify that all items furnished herein meet the requirements of the applicable product specifications, the above referenced customer order number, and supporting specifications. Vendor material certification on file and available upon written request.

Shelf Life – Thirty (30) months from date of manufacture, December, 2012. Note – Dow Corning calendar year based on 360-day cycle.

This material is provided in accordance with Promatec Quality Assurance Program QAM20188, Issue F, dated 06/20/03.

[redacted]
QUALITY ASSURANCE DEPT.
DORCAS SMITHWICK COMBS
QUALITY ASSURANCE MANAGER

Form QC-8
Rev. 5 – 11/01/88

WORLD-CLASS CONSTRUCTION®

Intertek

Q/A RECEIVING REPORT

Client/Project Name:	Areva NP	Report No:	14-G101147165SAT-001
Client or Project No.:	G101147165SAT-001	Date Received:	7/5/2013
Received From:	Areva NP c/o PCI Promatec	Date Inspected:	7/11/13
Project Location:	INTERTEK –Elmendorf, TX	Inspected By:	MABrown [redacted]

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	QUANTITY Rec'd	QUANTITY B/O	I.D. NO.	Cont Mat'l Y/N	Cer. Rec'd Y/N	Safety Ref'd Y/N	Con. Integrity	ACCEPTANCE Accpt.	ACCEPTANCE Rej.	ACCEPTANCE Hold	REMARKS
56493F031 Boot Material - 1 Roll - 36" x 2LY Lot: 100512Z9F	Client	1	1	–	SAT1307051532-001	Y	Y	Y	G	✓			Receiving Only: Receiving Bay
56493F031 Boot Material - 1 Roll – 8-1/2" x 3LY Lot: 050313Z7BF	Client	1	1	–	SAT1307051532-002	Y	Y	Y	G	✓			
56493F031 Boot Material - 1 Roll - 36" x 4LY Lot: 080212Z7F	Client	1	1	–	SAT1307051532-003	Y	Y	Y	G	✓			
56493F031 Boot Material - 1 Roll - 36" x 5LY Lot: 100512Z9F	Client	1	1	–	SAT1307051532-004	Y	Y	Y	G	✓			

9/12-NQAP-005.7.1

Q/A RECEIVING REPORT

Intertek

Client/Project Name: Areva NP
Client or Project No.: G101147165SAT-001
Received From: Areva NP c/o PCI Promatec
Project Location: INTERTEK –Elmendorf, TX

Report No: 15-G101147165SAT-001
Date Received: 7/5/2013
Date Inspected: 7/11/13
Inspected By: MABrown [redacted]

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	QUANTITY Rec'd	QUANTITY B/O	I.D. NO.	Cont Matl Y/N	Cer. Recd Y/N	Safety Rel'd Y/N	Cen. Integrity	ACCEPTANCE Accpt.	ACCEPTANCE Rej.	ACCEPTANCE Hold	REMARKS
3 boxes - IDEAL 64104 Clamps	Client	3	3	–	SAT1307051643-001	Y	Y	Y	G	✓			Receiving Only: Receiving Bay
					SAT1307051643-002	Y	Y	Y	G	✓			
					SAT1307051643-003	Y	Y	Y	G	✓			
1 box - IDEAL 64880 Clamps	Client	1	1	–	SAT1307051643-004	Y	Y	Y	G	✓			
3 box - IDEAL 64720 Clamps	Client	1	1	–	SAT1307051643-005	Y	Y	Y	G	✓			
					SAT1307051643-006	Y	Y	Y	G	✓			
					SAT1307051643-007	Y	Y	Y	G	✓			
1 box - IDEAL 64440 Clamps	Client	1	1	–	SAT1307051643-008	Y	Y	Y	G	✓			
1 box - IDEAL 64200 Clamps	Client	1	1	–	SAT1307051643-009	Y	Y	Y	G	✓			
1 box - IDEAL 64080 Clamps	Client	1	1	–	SAT1307051643-010	Y	Y	Y	G	✓			

9/12-NQAP-005.7.1

Q/A RECEIVING REPORT

Intertek

Client/Project Name: AREVA NP
Client or Project No.: G101266224SAT-003A
Received From: c/o PCI-Promatec
Project Location: INTERTEK –Elmendorf, TX

Report No: 03-G101266224SAT-003A
Date Received: 11/06/2013
Date Inspected: 11/18/2013
Inspected By: MA Brown [redacted]

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	QUANTITY Rec'd	QUANTITY B/O	I.D. NO.	Cont Matl Y/N	Cert. Rec'd Y/N	Safety Rel'd Y/N	Con. Integrity	ACCEPTANCE Accpt.	ACCEPTANCE Rej.	ACCEPTANCE Hold	REMARKS
1" x 24" x 300" - 6# Durablanket S 2300 deg.; Lot # 33274; CTN 0493	(Client)	1 Roll	1 Roll	–	SAT1311061548-001	Y	Y	Y	G	✓			Receiving Only: Materials stored in the conditioning room
"DC/790/GY/C" Dow Corning 790, Gray - 10.3 FL. OZ tubes; Lot # 0007520261; CTNs 0088, 0089, 0091; Exp. Date 8/16/2014	(Client)	36 Tubes	36 Tubes	–	SAT1311061850-001	Y	Y	Y	G	✓			

9/12-NQAP-005.7.1

Intertek

Q/A RECEIVING REPORT

Intertek

Client/Project Name: Areva NP
Client or Project No.: G101147165SAT-001
Received From: Areva Federal Services, c/o PCI
Project Location: INTERTEK –Elmendorf, TX

Report No: 07-G101147165SAT-001
Date Received: 6/13/2013
Date Inspected: 6/17/2013
Inspected By: MAB [redacted]

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	QUANTITY Rec'd	QUANTITY B/O	I.D. NO.	Cont Matl Y/N	Cer. Recd Y/N	Safety Rel'd Y/N	Con. Integrity	ACCEPTANCE Accpt.	ACCEPTANCE Rej.	ACCEPTANCE Hold	REMARKS
DC Sylgard 170 Elastomer Part A 3 5çal Pails, # DC-170-063B01	Client	6	6	–	SAT1306131125-001	Y	Y	Y	G	✓			Receiving Only: Materials stored in the Conditioning Room
DC Sylgard 170 Elastomer Part B 3 5çal Pails, # DC-170-063B01	Client	6	6	–	SAT1306131125-002	Y	Y	Y	G	✓			
DC-732 Black 10.1 oz Tube 4 cases @ 12ea # 0007251823	Client	4	4	–	SAT1306131125-003	Y	Y	Y	G	✓			
DC-790 Gray 10.3oz Tube 2 cases @ 12ea # 0007390959	Client	2	2	–	SAT1306131125-004	Y	Y	Y	G	✓			
Unifrax Durablanket S 6lb density 1 Roll # 33068	Client	1	1	–	SAT1306131125-005	Y	Y	Y	G	✓			

9/12-NQAP-005.7.1

LIST OF CALIBRATED EQUIPMENT: FIRE TEST

Description	Serial No.	Calibration Due Date
Thermo-Hygrometer	130548237	9/19/2015
Data Acquisition System	48JF0082	3/11/2014
Pressure Transducer	3588750	3/26/2014
Stop watch	130176939	3/29/15

Build B
Horizontal

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4096-5373559

Calibration Certificate No. 1750.01

Traceable® Certificate of Calibration for Digital Humidity/Temp. Meter

Manufactured for and distributed by: Fisher Scientific, 300 Industry Drive, Pittsburgh, PA 15275-1001

Instrument Identification:

Model Numbers: 11-661-13, FB61254, 245C5 S/N: 130548237 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Chilled Mirror Hygrometer	31874/H2048MCR	6/14/15	11081
Digital Thermometer	41334977/41335007	9/26/13	4000-4643062

Certificate Information:

Technician: 104 Procedure: CAL-17 Cal Date: 9/19/13 **Cal Due: 9/19/15**

Test Conditions: 23.0°C 51.0 %RH 1013 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
%RH		N.A.		42.95	42	Y	39	47	1.30	3.1:1
°C		N.A.		24.218	24	Y	23	25	0.590	1.7:1

This Instrument was calibrated in compliance with ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994 Part 1.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

The calibration results published in this certificate were obtained using equipment capable of producing results that are traceable to NIST and through NIST to the International System of Units (SI).

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

[redacted]
Nicol Rodriguez, Quality Manager

[redacted]
Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Digital Humidity/Temp. Meter should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Humidity/Temp. Meters change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

This device was calibrated using a single test point. Should additional test points be required, please contact Control Company for factory calibration and re-certification traceable to National Institute of Standards and Technology.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Intertek

16015 Shady Falls Road
Elmendorf, TX 78112
210-635-8100 210-635-8101 fax

Certificate of Verification

Verification Date:	**9/11/2013**
Re-verification Date:	**3/11/2014**
Manufacturer:	**Yokogawa**
Model No.:	**300 Channel DAU**
Serial No.:	**48JF0082**
Equipment Description:	**300 Channel Data Acquisition System**
Calibration Sources:	**Tegam SN: T-156701, due 6/13/2014.**
Performance:	**See the attached sheet**

Verification Performed By:

[redacted]

Verification Approved By:

[redacted]

Project Engineer

This Data Acquisition System was verified following the Draft "Work Instruction for Verifying Yokogawa Darwin Data Acquisition Systems" dated 8/28/2013

CERTIFICATE NO: 54676-0009

Page 1 of 1

SYSTEM SCALE CORPORATION
SSC LAB DIVISION

CERTIFICATE OF CALIBRATION

ACLASS ACCREDITED CALIBRATION
Certificate # AC-1756

SSC LAB DIVISION certifies that this instrument conforms to original manufacturers specifications or to tolerances indicated below and has been calibrated using standards with accuracies traceable to a National Measurement Institute, or to accepted values of natural physical constants, or have been derived by ratio techniques. This certificate complies with ISO / IEC 17025:2005 & ANSI/NCSLI Z540-1. Unless otherwise stated, the M & T E for which this certificate is issued, based on interpretation of data, was found to meet the required specification. The expanded measurement uncertainty is reported at k=2, 95% confidence level.

Customer:	INTERTEK	Date Received:	02/21/2013
Location:	16015 SHADY FALLS RD. ELMENDORF TX 78112	Date of Issue/Calibration:	03/26/2013
		Next Calibration Due:	03/26/2014
PO #:02192013		Metrologist:	Sean Rainey

Manufacturer:	SETRA	Model:	2641R25WB2ST1C
Nomenclature:	TRANSDUCER- PRESSURE	Serial Number:	3588750
Range:	± 0.25"WC	Equipment ID:	3588750

Calibration Data Temp 68°F ± 1°F Humidity <50%RH

Calibration Accuracy± 1% FS

Note:A=Reading plus Uncertainty exceeds tolerance limits.

Note: if the AS LEFT column is blank, no adjustments were required.

Note: Many factors may cause out of calibration condition prior to due date.The Calibration interval has been specified by the Customer. Current procedures and methods utilized by SSC Lab Division are approved by the Customer.

APPLIED	AS FOUND	AS LEFT	UNCERTAINTY	PROCEDURE #
2.5 V 0" W.C.	2.507	2.507	± 0.035 VDC	NA17-20MX-157 1 AUG 2011
0 V -0.25" W.C.	0.001	0.001	± 0.035 VDC	
5 V 0.25" W.C.	5.019	5.019	± 0.035 VDC	

Standard(s)	Description	Calibration Date	Expiration Date	Traceability Number
SSC30LD029	CALIBRATOR- PRESSURE	5/4/2011	5/4/2013	50650-0010
SSC30LD113	TRANSDUCER- PRESSURE	10/15/2012	10/15/2014	CAL122077

[redacted]

Cindy Glover
Production Supervisor

Comments:

CERTIFICATE NO: 55020-0001

Page 2 of 2

SYSTEM SCALE
CORPORATION
SSC LAB DIVISION

CERTIFICATE OF CALIBRATION

ACLASS ACCREDITED
CALIBRATION
Certificate # AC-1756

SSC LAB DIVISION certifies that this instrument conforms to original manufacturers specifications or to tolerances indicated below and has been calibrated using standards with accuracies traceable to a National Measurement Institute, or to accepted values of natural physical constants, or have been derived by ratio techniques. This certificate complies with ISO / IEC 17025:2005 & ANSI/NCSLI Z540-1. Unless otherwise stated, the M & T E for which this certificate is issued, based on interpretation of data, was found to meet the required specification. The expanded measurement uncertainty is reported at k=2, 95% confidence level.

Standard(s)	Description	Calibration Date	Expiration Date	Traceability Number
SSC30LD029	CALIBRATOR- PRESSURE	5/8/2013	5/8/2015	55040-0002
SSC30LD031	TRANSDUCER- PRESSURE	5/9/2013	5/9/2015	55040-0003

[redacted]

Cindy Glover
Production Supervisor

Comments:

[redacted] 9/4/13

ilac-MRA ACCREDITED Calibration Certificate No. 1750.01

Calibration complies with ISO 9001
ISO/IEC 17025 AND ANSI/NCSL Z540-1

Cert. No.: 1045-5005294

Traceable® Certificate of Calibration for Watr/Shock Res Stpwch

Manufactured for and distributed by: Fisher Scientific, P.O. Box 1768, Pittsburgh, PA 15230

Instrument Identification:

Model: S40799-7 S/N: 130176939 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Non-Contact Frequency Counter	26.66879	7/02/13	1000320243

Certificate Information:

Technician: 150 Procedure: CAL-01 Cal Date: 3/29/13 **Cal Due: 3/29/15**

Test Conditions: 22.5°C 42.0 %RH 1020 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
Sec/24hr		N.A.		0.000	-0.300	Y	-8.640	8.640	0.130	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = Nominal(Rounded) - Tolerance; Max = Nominal(Rounded) + Tolerance; Date=MM/DD/YY

[redacted] Nicol Rodriguez, Quality Manager

[redacted] Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Watr/Shock Res Stpwch should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Watr/Shock Res Stpwchs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

TE Wire & Cable LLC

"Two great brands coming together."

107 North Fifth Street • Saddle Brook, NJ 07663-6167 • 888-4TE-WIRE • 201-845-9400 • www.tewire.com

REPORT OF CALIBRATION

To: INTERTEK TESTING SERVICES

16015 SHADY FALLS ROAD
ELMENDORF, TX
78112

Date of Calibration: 2/14/2013
Job #: P99193-SJ
Item #: 1
Spool #: S0134186
Footage: 1100
Part #: PW30080 G/G-24-KK SP
Customer PO: USA20-0000215766Q

All Temperatures in this report are based on the International Temperature Scale of 1990 (ITS-90) with reference junctions maintained at 0°C (32°F) The product listed above was calibrated utilizing techniques consistent with the guidelines set forth in ANSI/NCSL Z540-1, ASTM E220-07A, ASTM E230-03, ANSI MC96.1, and AMS-2750 rev D, and are in compliance. Calibration results are traceable to the National Institute of Standards and Technology (NIST) and meet the deviation tolerances for acceptable calibration, if authorized below.

Nominal Value Set Point °F	UUT/Inside Test Sensor °F	Correction Factor Inside °F	UUT/Outside Test Sensor °F	Correction Factor Outside °F	Average In/Out Correction Factor °F	Special Tolerance °F
200.0	200.0	0.0	200.0	0.0	0.0	2.0
400.0	400.1	-0.1	400.0	0.0	-0.1	2.0
600.0	599.6	0.4	599.4	0.6	0.5	2.4
800.0	800.5	-0.5	800.3	-0.3	-0.4	3.2
1000.0	1001.2	-1.2	1000.9	-0.9	-1.1	4.0

The calibration results apply to the item(s) listed. Calibration is ISO:IEC17025:2005 Accredited unless calibration points and/or profile falls outside of the stated Scope of Accreditation. *Correction factor is used to adjust measurement instrumentation readings to match NIST reference values. ISO 9001:2008 certified by LRQA. Certificate Number: UQA0111712.

Measurement uncertainty is expressed as an expanded uncertainty at 95% confidence level K=2 and is +/- 0.5°C from -196°C to 0°C, +/- 1.3°C to 1100°C and +/- 2.0°C from 1100°C to 1400°C

THIS IS TO CERTIFY THE MATERIAL FURNISHED ON THIS SHIPMENT IS IN SATISFACTORY CONDITION, AND IN CONFORMANCE WITH THE REQUIREMENTS, SPECIFICATIONS, & DRAWINGS OF THE ABOVE REFERENCED CUSTOMER PURCHASE ORDER. SAMPLING WAS PERFORMED PER CUSTOMERS REQUEST. AS APPLICABLE, INSPECTION AND TEST RECORDS ARE ON FILE AND AVAILABLE FOR CUSTOMER REVIEW

DIGITAL MULTIMETER
MODEL: AGILENT: 3458A
SERIAL NUMBER: US28032293
CALIBRATION DUE DATE: APRIL 30, 2014
Room Temperature: 72°F (±5°F)
Relative Humidity: < 60%

Calibrated by: AM

REFERENCE STANDARD THERMOCOUPLE TYPE K

NIST TRACEABILITY AVAILABLE UPON REQUEST
TEST # 279113

[redacted]

Approved By: Dante Bediones Cal. Lab. Manager

Page 8 of 22

TE Wire & Cable LLC
"Two great brands coming together."

107 North Fifth Street • Saddle Brook, NJ 07663-6167 • 888-4TE-WIRE • 201-845-9400 • www.tewire.com

REPORT OF CALIBRATION

To: INTERTEK TESTING SERVICES

16015 SHADY FALLS ROAD
ELMENDORF, TX
78112

Date of Calibration: 2/14/2013
Job #: P99193-SJ
Item #: 1
Spool #: S0134189
Footage: 1000
Part #: PW30080 G/G-24-KK SP
Customer PO: USA20-0000215766Q

All Temperatures in this report are based on the International Temperature Scale of 1990 (ITS-90) with reference junctions maintained at 0ºC (32ºF) The product listed above was calibrated utilizing techniques consistent with the guidelines set forth in ANSI/NCSL Z540-1, ASTM E220-07A, ASTM E230-03, ANSI MC96.1, and AMS-2750 rev D, and are in compliance. Calibration results are traceable to the National Institute of Standards and Technology (NIST) and meet the deviation tolerances for acceptable calibration, if authorized below.

Nominal Value Set Point °F	UUT/Inside Test Sensor °F	Correction Factor Inside °F	UUT/Outside Test Sensor °F	Correction Factor Outside °F	Average In/Out Correction Factor °F	Special Tolerance °F
200.0	199.9	0.1	199.9	0.1	0.1	2.0
400.0	400.1	-0.1	400.0	0.0	-0.1	2.0
600.0	599.6	0.4	599.7	0.3	0.4	2.4
800.0	800.3	-0.3	800.3	-0.3	-0.3	3.2
1000.0	1000.8	-0.8	1000.9	-0.9	-0.9	4.0

The calibration results apply to the item(s) listed. Calibration is ISO:IEC17025:2005 Accredited unless calibration points and/or profile falls outside of the stated Scope of Accreditation. *Correction factor is used to adjust measurement instrumentation readings to match NIST reference values. ISO 9001:2008 certified by LRQA. Certificate Number: UQA0111712.

Measurement uncertainty is expressed as an expanded uncertainty at 95% confidence level K=2 and is +/- 0.5ºC from -196ºC to 0ºC, +/- 1.3ºC to 1100ºC and +/- 2.0ºC from 1100ºC to 1400ºC

THIS IS TO CERTIFY THE MATERIAL FURNISHED ON THIS SHIPMENT IS IN SATISFACTORY CONDITION, AND IN CONFORMANCE WITH THE REQUIREMENTS, SPECIFICATIONS, & DRAWINGS OF THE ABOVE REFERENCED CUSTOMER PURCHASE ORDER. SAMPLING WAS PERFORMED PER CUSTOMERS REQUEST. AS APPLICABLE, INSPECTION AND TEST RECORDS ARE ON FILE AND AVAILABLE FOR CUSTOMER REVIEW

DIGITAL MULTIMETER
MODEL: AGILENT: 3458A
SERIAL NUMBER: US28032293
CALIBRATION DUE DATE: APRIL 30, 2014
Room Temperature: 72°F (±5°F)
Relative Humidity: < 60%

Calibrated by: AM

REFERENCE STANDARD THERMOCOUPLE TYPE K

NIST TRACEABILITY AVAILABLE UPON REQUEST
TEST # 279113

[redacted]

Approved By: Dante Bedlones Cal. Lab. Manager

Page 11 of 22

LIST OF CALIBRATED EQUIPMENT: PRESSURE TEST

Description	Serial No.	Calibration Due Date
Thermo-Hygrometer	130548237	9/19/2015
Data Acquisition System	18041FE	8/11/2014
Pressure Transducer	406707	1/30/2015
Mass Flowmeter	4270050001001	1/30/2015
Mass Flowmeter	4270050003001	1/30/2015
Stop watch	1230176939	3/29/2015

Build B
Horizontal

ilac-MRA ACCREDITED Calibration Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4096-5373559

Traceable® Certificate of Calibration for Digital Humidity/Temp. Meter

Manufactured for and distributed by: Fisher Scientific, 300 Industry Drive, Pittsburgh, PA 15275-1001

Instrument Identification:

Model Numbers: 11-661-13, FB61254, 245C5 S/N: 130548237 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Chilled Mirror Hygrometer	31874/H2048MCR	6/14/15	11081
Digital Thermometer	41334977/41335007	9/26/13	4000-4643062

Certificate Information:

Technician: 104 Procedure: CAL-17 Cal Date: 9/19/13 **Cal Due: 9/19/15**

Test Conditions: 23.0°C 51.0 %RH 1013 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
%RH		N.A.		42.95	42	Y	39	47	1.30	3.1:1
°C		N.A.		24.218	24	Y	23	25	0.590	1.7:1

This instrument was calibrated in compliance with ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994 Part 1.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

The calibration results published in this certificate were obtained using equipment capable of producing results that are traceable to NIST and through NIST to the International System of Units (SI).

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

[redacted]

[redacted]

Maintaining Accuracy:

In our opinion once calibrated your Digital Humidity/Temp. Meter should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Humidity/Temp. Meters change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

This device was calibrated using a single test point. Should additional test points be required, please contact Control Company for factory calibration and re-certification traceable to National Institute of Standards and Technology.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Intertek

16015 Shady Falls Road
Elmendorf, TX 78112
210-635-8100 210-635-8101 fax

Certificate of Verification

Verification Date:	02/11/2014
Re-verification Date:	08/11/2014
Manufacturer:	National Insturments
Model No.:	USB-6210 (Only use 3 channels)
Serial No.:	18041FE
Equipment Description:	Data Acquisition System
Calibration Sources:	Ronan SN: 11380 due 4/6/2014
Performance:	See the attached sheet

Verification Performed By:

[redacted]

Staff Engineer

Verification Approved By:

[redacted]

Jeff Patterson
Test Engineer

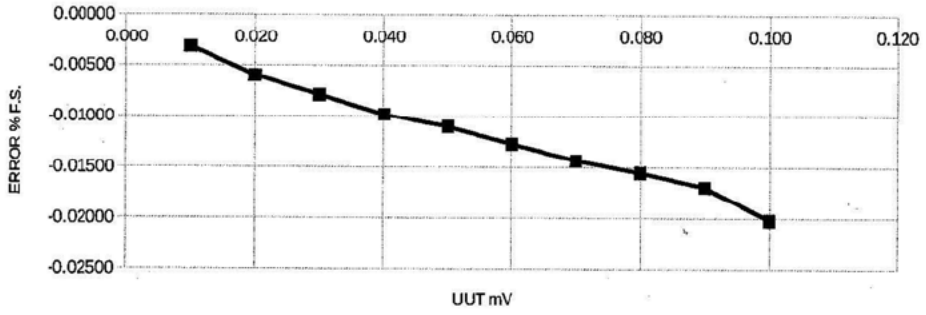
This Data Acquisition System was verified following the Draft "Work Instruction for Verifying Yokogawa Darwin Data Acquisition Systems" dated 8/28/2013

CERTIFICATE OF CALIBRATION

CUSTOMER:	**INTERTEK** ELMENDORF TX	**CALIBRATION DATE:**	01/30/14
PO NUMBER:	REF.# 01292014	**CALIBRATION DUE:**	01/30/15
INST. MANUFACTURER:	OMEGADYNE	**PROCEDURE:**	NAVAIR17-20MG-20
INST. DESCRIPTION:	PRESSURE TRANSDUCER	**CALIBRATION FLUID:**	70 F
MODEL NUMBER:	PX409-005DWUV	**STANDARD(S) USED:**	A49A, A24, A321 DUE 8-14
SERIAL NUMBER:	406707	**NIST TRACE #' S:**	1361269146,1360578741, 1360586185, 1236086968
RATED UNCERTAINTY:	+/- 0.05 % FS	**AMBIENT CONDITIONS:**	759 mm HGA 55 % RH 70 F
UNCERTAINTY GIVEN:	FLOW measurement uncertainty: +/- .011 % F.S. K=2	**CERTIFICATE FILE #:**	456353.14

NOTES: AS RECEIVED/ AS LEFT WITHIN SPECS. NO ADJUSTMENTS MADE . REFERENCE CONDITIONS ARE: 760 mm HGA 70 F

TEST POINT NUMBER	UUT INDICATED mV OUT	DM.STD. ACTUAL PSID	ERROR % F.S.	
1	0.010	0.49984	-0.00318	
2	0.020	0.99970	-0.00602	
3	0.030	1.49960	-0.00792	
4	0.040	1.99951	-0.00984	
5	0.050	2.49945	-0.01105	
6	0.060	2.99936	-0.01272	
7	0.070	3.49928	-0.01435	
8	0.080	3.99922	-0.01552	
9	0.090	4.49915	-0.01692	
10	0.100	4.99899	-0.02020	



All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) used and the unit under test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed per the shown procedure number, in accordance with ISO 10012:2003, ISO 17025:2005, ANSI/NCSL-Z-540.3, and/or MIL-STD-45662A. Test methods: API2530-92 & ASME MFC-3M-1989.

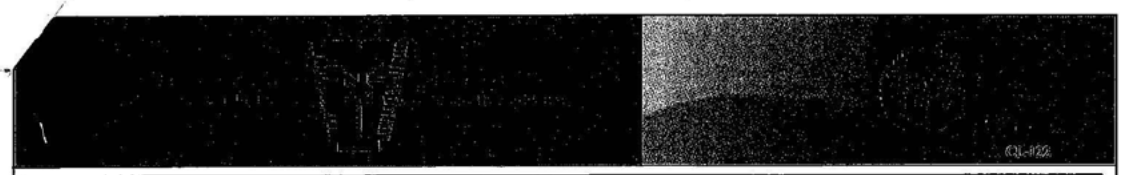
Dick Munns Company • 10572 Calle Lee #138 • Los Alamitos, CA 90720
[redacted] • Fax (714) 827-0823

This Calibration Certificate [redacted] PANY. The data shown applies only to the instrument being calibrated and under the stated conditions of calibration.

Date: 1/30/2014

Calibration Technician: [redacted]

Page 1 of 1

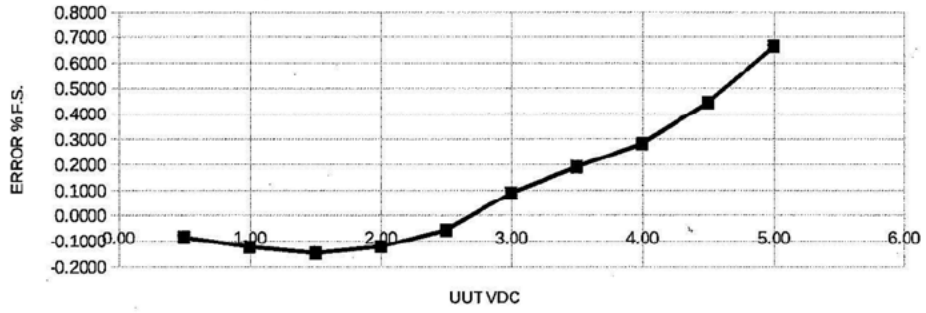


CERTIFICATE OF CALIBRATION

CUSTOMER:	**INTERTEK** ELMENDORF TX	**CALIBRATION DATE:**	01/30/14
PO NUMBER:	REF.# 01292014	**CALIBRATION DUE:**	01/30/15
INST. MANUFACTURER:	OMEGA	**PROCEDURE:**	NAVAIR17-20MG-20
INST. DESCRIPTION:	MASS FLOWMETER	**CALIBRATION FLUID:**	GN2 @ 70 F
MODEL NUMBER:	FMA-872A-V-NIST	**STANDARD(S) USED:**	A1-A4, A24, A321 DUE 8-14
SERIAL NUMBER:	4270050001001	**NIST TRACE #' S:**	1361269184, 1360578741, 1360585185
RATED UNCERTAINTY:	+/- 1 % FS	**AMBIENT CONDITIONS:**	759 mm HGA 55 % RH 70 F
UNCERTAINTY GIVEN:	FLOW measurement uncertainty: +/- .204 % F.S. K=2	**CERTIFICATE FILE #:**	456355.14

NOTES: AS RECEIVED/ AS LEFT WITHIN SPECS. NO ADJUSTMENTS MADE . REFERENCE CONDITIONS ARE: 760 mm HGA 70 F

TEST POINT NUMBER	UUT INDICATED VDC OUT	DM.STD. ACTUAL SLPM	ERROR % F.S.	
1	0.50	1.983	-0.0855	
2	1.00	3.975	-0.1231	
3	1.50	5.971	-0.1460	
4	2.00	7.976	-0.1217	
5	2.50	9.988	-0.0579	
6	3.00	12.018	0.0889	
7	3.50	14.038	0.1908	
8	4.00	16.056	0.2817	
9	4.50	18.089	0.4444	
10	5.00	20.133	0.6634	



All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) used and the unit under test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed per the shown procedure number, in accordance with ISO 10012:2003, ISO 17025:2005, ANSI/NCSL-Z-540.3, and/or MIL-STD-45662A. Test methods: API2530-92 & ASME MFC-3M-1989.

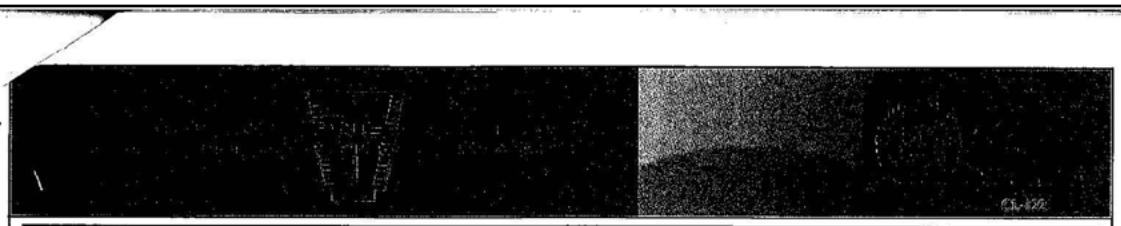
Dick Munns Company • 10572 Calle Lee #138 • Los Alamitos, CA 90720
[redacted] • Fax (714) 827-0823

This Calibration Certificate [redacted] ANY. The data shown applies only to the instrument being calibrated and under the stated conditions of calibration.

Date: 1/30/2014

Calibration Technician: [redacted]

Page 1 of 1

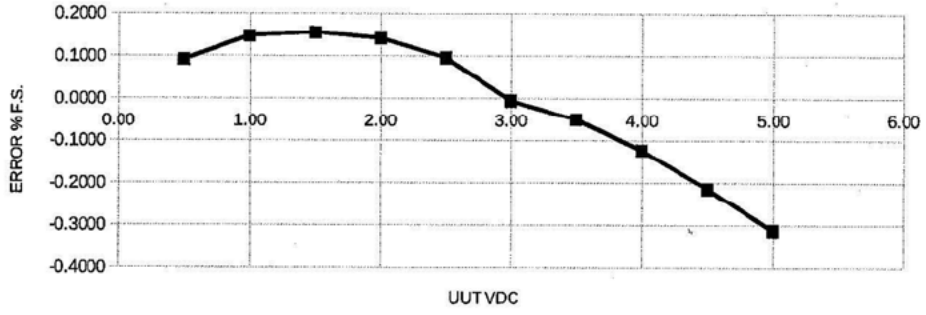


CERTIFICATE OF CALIBRATION

CUSTOMER:	**INTERTEK** ELMENDORF TX	**CALIBRATION DATE:**	01/30/14
PO NUMBER:	REF.# 01292014	**CALIBRATION DUE:**	01/30/15
INST. MANUFACTURER:	OMEGA	**PROCEDURE:**	NAVAIR17-20MG-20
INST. DESCRIPTION:	MASS FLOWMETER	**CALIBRATION FLUID:**	GN2 @ 70 F
MODEL NUMBER:	FMA-875A-V-NIST	**STANDARD(S) USED:**	A1-A4, A24, A321 DUE 8-14
SERIAL NUMBER:	4270050003001	**NIST TRACE #' S:**	1361269184, 1360578741, 1360586185
RATED UNCERTAINTY:	+/- 1 % FS	**AMBIENT CONDITIONS:**	759 mm HGA 55 % RH 70 F
UNCERTAINTY GIVEN:	FLOW measurement uncertainty: +/- .204 % F.S. K=2	**CERTIFICATE FILE #:**	456354.14

NOTES: AS RECEIVED/ AS LEFT WITHIN SPECS. NO ADJUSTMENTS MADE . REFERENCE CONDITIONS ARE: 760 mm HGA 70 F

TEST POINT NUMBER	UUT INDICATED VDC OUT	DM.STD. ACTUAL SLPM	ERROR % F.S.	
1	0.50	20.183	0.0913	
2	1.00	40.294	0.1471	
3	1.50	60.311	0.1553	
4	2.00	80.282	0.1411	
5	2.50	100.191	0.0957	
6	3.00	119.988	-0.0059	
7	3.50	139.899	-0.0505	
8	4.00	159.754	-0.1230	
9	4.50	179.573	-0.2138	
10	5.00	199.373	-0.3133	



All instruments used in the performance of the shown calibration have traceability to the National Institute of Standards and Technology (NIST). The uncertainty ratio between the calibration standards (DM.STD.) used and the unit under test (UUT) is a minimum of 4:1, unless otherwise noted. Calibration has been performed per the shown procedure number, in accordance with ISO 10012:2003, ISO 17025:2005, ANSI/NCSL-Z-540.3, and/or MIL-STD-45662A. Test methods: API2530-92 & ASME MFC-3M-1989.

Dick Munns Company • 10572 Calle Lee #138 • Los Alamitos, CA 90720
[redacted] • Fax (714) 827-0823

This Calibration Certificate shall [redacted]. The data shown applies only to the instrument being calibrated and under the stated conditions of calibration.

Date: 1/30/2014

[redacted] alibration Technician: [redacted]

Page 1 of 1

[redacted] 9/4/13

ilac-MRA ACCREDITED Calibration Certificate No. 1750.01

Calibration complies with ISO 9001
ISO/IEC 17025 AND ANSI/NCSL Z540-1

Cert. No.: 1045-5005294

Traceable® Certificate of Calibration for Watr/Shock Res Stpwch

Manufactured for and distributed by: Fisher Scientific, P.O. Box 1768, Pittsburgh, PA 15230

Instrument Identification:

Model: S40799-7 S/N: 130176939 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Non-Contact Frequency Counter	26.66879	7/02/13	1000320243

Certificate Information:

Technician: 150 Procedure: CAL-01 Cal Date: 3/29/13 **Cal Due: 3/29/15**

Test Conditions: 22.5°C 42.0 %RH 1020 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
Sec/24hr		N.A.		0.000	-0.300	Y	-8.640	8.640	0.130	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = Nominal(Rounded) - Tolerance; Max = Nominal(Rounded) + Tolerance; Date=MM/DD/YY

[redacted] Nicol Rodriguez, Quality Manager

[redacted] Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Watr/Shock Res Stpwch should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Watr/Shock Res Stpwchs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

TEST ARTICLE ATTRIBUTE CHECKLIST

PROJECT NO: G101266224SAT-014 **CLIENT :** AREVA

Project Description FIRE - PRESSURE #2 (FIRE TEST)

	SAT	UNSAT

I. ASSEMBLY

Proper materials used .....
Material documentation complete.....
Configuration/dimensions in accordance w/ approved drawings....
Description of assembly: MOX AREVA PRESSURE - FIRE #2

II. ELECTRICAL CABLE

Correct material used .....
Material documentation complete .....
Correct cable lay-in and fill requirements .....
Description of electrical cable: per TEST PLAN

III. THERMOCOUPLES

Correct thermocouple type, certs received .....
Thermocouples positioned in accordance with test plan .....
Adequately labeled and secured .....
Quality Assurance verification done .....
Description of thermocouples:

N/A

IV. FIRE BARRIER

Name or type of material CaSiC + PRIMER #3 + BOOT + CCR
INTERTEK received material documentation provided by Client.....
Materials provided by INTERTEK properly documented .....
Materials installed by INTERTEK in accordance with test plan .....
INTERTEK Quality Assurance responsibilities determined .....
QA responsibilities of Client installation determined .....
Moisture check required ..... Yes ___ No X
Special requirements

V. FINAL PREBURN VERIFICATION

Final visual inspection & approval (initials) INTERTEK [redacted] Client [redacted]

CALIBRATION DOCUMENTATION (S/N and calibration due date)
Data Acquisition Equipment:
Other Measurement Devices: ~~SEE TEST DATA PACKAGE~~

Temperature 61 Humidity 51 Date 3/5/14 Time of Test start 2:28?

INTERTEK pre-burn checklist performed by [redacted]

Client representative present to witness test [redacted]

Note: Verification to be made using initials by INTERTEK Quality Assurance or test personnel.

09-013-12/30/03

TEST ARTICLE ATTRIBUTE CHECKLIST

PROJECT NO: G101266224SAT-014 **CLIENT :** AREVA

Project Description FIRE PRESSURE #2

	SAT	UNSAT
I. ASSEMBLY		
Proper materials used	[redacted]	
Material documentation complete		
Configuration/dimensions in accordance w/ approved drawings		
Description of assembly:		
II. ELECTRICAL CABLE		
Correct material used	[redacted]	
Material documentation complete		
Correct cable lay-in and fill requirements		
Description of electrical cable: PER TEST PLAN		
III. THERMOCOUPLES		
Correct thermocouple type, certs received	N/A	
Thermocouples positioned in accordance with test plan		
Adequately labeled and secured		
Quality Assurance verification done		
Description of thermocouples:		
IV. FIRE BARRIER		
Name or type of material QSIL + BOOTS + PRIMER #3	[redacted]	
INTERTEK received material documentation provided by Client		
Materials provided by INTERTEK properly documented		
Materials installed by INTERTEK in accordance with test plan		
INTERTEK Quality Assurance responsibilities determined		
QA responsibilities of Client installation determined		
Moisture check required ..... Yes ___ No X		
Special requirements		

V. FINAL PREBURN VERIFICATION

Final visual inspection & approval (initials) INTERTEK [redacted] Client [redacted]

CALIBRATION DOCUMENTATION (S/N and calibration due date)

Data Acquisition Equipment: SEE TEST DATA PACKAGE

Other Measurement Devices:

Temperature 68 Humidity 42 Date 3/6/14 Time of Test start 1:50P

INTERTEK pre-burn checklist performed by [redacted]

Client representative present to witness test [redacted]

Note: Verification to be made using initials by INTERTEK Quality Assurance or test personnel.

09-013-12/30/03

Intertek

TEST ACTIVITIES EVENT LOG

Note:
This Log is used to document the date and note the significant events during the completion of Test Project #G101266224SAT-014 (Fire-Pressure Test 2) for AREVA NP, Inc.

Page 1 of 1

ITEM	DATE	INIT'L
Concrete poured by Alamo Concrete	7/12/13	MD
Concrete conditioned	7/19/13	MD
Critical attributes of test deck and test samples verified	9/18/13	MD
Completed seal assembly verified against the test plan	9/20/13	MD
Pressure Test 4 conducted (terminated due to leakage)	9/25/13	MD
Pressure Test 4 second attempt (terminated due to leakage)	9/26/13	MD
DC 732 caulk applied at the seal / commodities interface	10/11/13	MD
Pressure Test 4A conducted	10/15/13	MD
Test assembly re-purposed for use as Pressure 4B	11/5/13	MD
Critical attributes of test deck and test samples verified	11/6/13	MD
Completed seal assembly verified against the test plan	11/13/13	MD
Pressure Test 4B conducted	11/15/13	MD
Test assembly re-purposed for use as Pressure 4C	2/25/14	MD
Critical attributes of test deck and test samples verified	2/25/14	MD
Completed seal assembly verified against the test plan	2/27/14	MD
Pressure Test 4C conducted	2/28/14	MD
Assembly re-purposed for use as Fire-Pressure 2	2/28/14	MD
Fire-Pressure 2 (Fire Test) conducted	3/5/14	MD
Fire-Pressure 2 (Pressure Test) conducted	3/6/14	MD

9/12 NQAP-007.7.3

[redacted]

Certificate of Conformance

[redacted]

Client Name: AREVA NP Inc. Date: September 4, 2014

Project No: G101266224SAT-014

[redacted]

Intertek Testing Services NA (Intertek) has conducted testing for AREVA NP Inc., on the fire and pressure resistance capabilities of Quantum Silicones QSil Primer #3 (QSil Primer #3), Quantum Silicones QSil 5558MC Silicone Elastomer (QSil 5558MC), Arlon Silicone Impregnated Fiberglass Fabric (Boot Fabric), IDEAL Clamp 9/16" All Stainless Steel 64 Series, Unifrax Fiberfrax® Durablanket® S (Durablanket), and Dow Corning® 732 Multi-Purpose Sealant and through a 12" thick concrete deck for compliance with the applicable requirements of and in accordance with AREVA NP Inc. Document No. 51-9217966-000, *Detailed Test Plan for Conducting MOX Fire-Pressure Test 2*. This test took place on March 5 and March 6, 2014.

The materials, processes), and deliverable(s) in this project were managed under and conform to the test laboratory's 10CFR50 Appendix B Quality Assurance Program.

[redacted]

[redacted]

Michael A Brown
Quality Supervisor

September 4, 2014
Date

[redacted]

[redacted]

Intertek Testing Laboratory
16015 Shady Falls Road, Elmendorf TX 78112
210-635-8100

[redacted]

Quality Assurance Statement

Intertek is devoted to engineering, inspection, quality assurance and testing of building materials, products and assemblies. Intertek has developed and implemented a Quality Assurance Program designed to provide its clients with a planned procedure of order and document processing for inspection and testing services it provides to assure conformity to requirements, codes, standards and specifications. The Program is designed to meet the intent of ANSI 45.2 Quality Assurance Program Requirements for Nuclear Power Plants, and complies with the requirements of the ASME Code, SPPE, Military Standards and other less stringent programs. It is the Laboratory's intention to adhere strictly to this Program, to assure that the services offered to its clients remains of the highest quality and accuracy possible.

All QA Surveillance documents remain on file at the Laboratory, and are available for inspection by authorized personnel in the performance of an on-site QA Audit. All materials, services and supplies used herein were obtained with appropriate QA Certifications of Compliance.

REVISION SUMMARY

DATE	SUMMARY
September 4, 2014	Original Issue Date