

ENCLOSURE 1

ATTACHMENT 5

**"Steam Dryer Vibration Instrument Installation," GE Nuclear Energy,
Installation Specification, 26A6487-NP, Revision 3, dated April 22,
2005**



REVISION STATUS SHEET

DOCUMENT TITLE STEAM DRYER VIBRATION INSTRUMENT INSTALLATION

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CONTENTS IN THIS DOCUMENT**

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Work step sequences in this procedure can be changed or altered at the discretion of the GE Project Manager or Site Engineer, provided they do not affect quality or violate any approved specifications.

Unless a +/- tolerance is specified, gauges and measurement devices do not need to be calibrated. Gauges are for reference only. "Approximately" in this procedure is defined as roughly +/- 10% of necessary gauge reading. When instruments requiring calibration are needed, the instrument identification number and calibration due date will be documented on the appropriate work document.

This is a non-proprietary version of the document 26A6487-P, Revision 3, which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [[]].



VIBRATION INSTALLATION PLAN

1.0 SCOPE

- 1.1 **Purpose:** The purpose of this document is to detail the requirements for installing the vibration instrumentation on the new steam dryer for Quad Cities Unit 2, taking place at the dryer fabrication shop (JT Cullen) and under the approved QA plan of US Tool and Die. This document covers the installation and attachment of all sensor strings up to and including preparation of the dryer for shipment to Quad Cities. The vibration instrumentation is associated with the steam dryer vibration and acoustic pressure measurements during reactor operation. The final installed configuration shall be documented and included in the GE Design Record File.
- 1.2 As used herein, the term “Installer” refers to GE Nuclear Energy (GENE) and their subcontractors.
- 1.3 As used herein, the term “Vendor” refers to US Tool & Die, JT Cullen and/or their subcontractors.
- 1.4 As used herein, the term “Plant Owner” refers to Exelon or Plant Owners Approved Alternate.
- 1.5 As used herein, the term Responsible Engineer (RE) refers to the individual assigned responsibility to implement the vibration installation at JT Cullen as defined by the GE Site Project Manager.
- 1.6 As used herein, the term GE Site Project Manager refers to the individual who authorizes the program and is responsible for defining the needs and purpose of the program at UST&D.

2.0 APPLICABLE DOCUMENTS

- 2.1 Applicable Codes, Standards. The following documents form a part of this installation procedure to the extent specified herein.
 - 2.1.1 ASME Boiler and Pressure Vessel Code, Section III, for Nuclear Power Plant components.
 - 2.1.2 ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.
 - 2.1.3 National Electrical Manufacturer’s Association (NEMA) Standards
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2.1.4 Any Applicable Local Codes, Requirements, and Procedures required by US Tool and Die Shop.

2.2 Reference Documents. The following documents may assist the user.

- 2.2.1 23A6395, Reactor Internal Vibration Instrumentation Design Specification
 - 2.2.2 234C6821, FIV Installation Drawing (UST&D/Fabrication Shop)
 - 2.2.3 124D1518, New Steam Dryer (top assembly make from drawing)
 - 2.2.4 209A7243P004, Clip for Vibration Test Instrumentation
 - 2.2.5 112D4859, Test Brackets, Conduit Clamps with Bolted Latch
 - 2.2.6 352B2248 Mounting Pads (2"x3", 1"x2"), Conduit Clamp/Accel Mounts
 - 2.2.7 143-104-000-D601, Pressure Transducer Type CP-104
 - 2.2.8 143-211-000-D072, Pressure Transducer Type CP-211 (Internal)
 - 2.2.9 809-104-000-D011, Floating Clamp Nut Type MA-104 (for CP-211)
 - 2.2.10 144-901-000-D501, Accelerometer Type CA-901
 - 2.2.11 KHC-10-120-G9, Kyowa Strain Gage (with 321SS Flange)
 - 2.2.12 Reuter-Stokes Outline RS-E8-1000-208 String Assembly A (A,B,C,D)
 - 2.2.13 Reuter-Stokes Outline RS-E8-1000-209 String Assembly B (E,F,G,H)
 - 2.2.14 Reuter-Stokes Outline RS-E8-1000-210 String Assembly C (J,K,L,M)
 - 2.2.15 234C6971, Mast Assembly with Welded Parts
 - 2.2.16 284X898, Mast Master Parts List
 - 2.2.17 234C7084, Mast Assembly with Parts List
 - 2.2.18 234C7001, Mast Base Arrangement on the Dryer (Dryer Weld)
 - 2.2.19 343A2292, Lock Washer for Mast Clamp (Material Inconel X-750L)
 - 2.2.20 DS-C-5056, R-S QC1 Penetration Bolt & FIV Sensor String Design Spec.
 - 2.2.21 DS-C-5057, R-S QC1 FIV Instrument Flange Design Specification
 - 2.2.22 E8-1000-203-81, Reuter-Stokes Washer for Penetration Bolt
 - 2.2.23 E8-1000-208-83, Reuter-Stokes Nut for Penetration Bolt
 - 2.2.24 26A6159, Dyn Press & Vib Monitor Sys, RPV Penbolt Assy Design Spec
 - 2.2.25 P50YP102, Arc Welding, Austenitic Stainless Steel Process Specification
 - 2.2.26 21A8675, Resistance Spot Welding (RSW) of Strain Gages
 - 2.2.27 26A5975, Instrument Flange Design Specification
 - 2.2.28 P50YP211, Cleaning and Cleanliness Control of Reactor Sys Components
 - 2.2.29 P50YP215, Capacitor Discharge Resistance Spot Welding (RSW)
 - 2.2.30 E50YP38, Resistance Spot Weld, Peel Test
 - 2.2.31 234C7124, Pressure Sensor Mount Bracket (6" cover, 1-slot, CP-104)
 - 2.2.32 234C7125, Pressure Sensor Mount Brkt (6" cover, 2-slots, CP-104/CP-211)
 - 2.2.33 234C7126, Press Sensor Mount Pad for Dryer Hood Covers (flat ring)
 - 2.2.34 234C7127, Press Sensor Mount Pad for Dryer Skirt Covers (R119.5")
 - 2.2.35 234C7128 Sh 1, Pressure Sensor Mounting (CP104 inside cover)
 - 2.2.36 234C7128 Sh 2, Pressure Sensor P23 Skirt Mounting Pad for CP-104
 - 2.2.37 352B2245, Nut Lock CP-211 for Floating Clamp Nut at P13, P14
 - 2.2.38 EE1-10-1010010, Flange Mockup Tripod Type Stand (Top assy dwg)
 - 2.2.39 E8-1000-208-81, Instrument Flange (with 3 holes on 3.00" B.C.)
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2.3 Supplemental Documents. The following documents may assist the user to understand the installation and testing procedure to the extent specified herein

- 2.3.1 GE-NE-0000-0030-1244-01, Steam Dryer Instrumentation Philosophy
- 2.3.2 26A6380, Dryer Hammer Test Specification
- 2.3.3 105E3902, Instrumentation and Data Acquisition Wiring Diagram
- 2.3.4 26A6366, FIV Sensors, Signal Conditioner & Data Acq Sys for Dryer Test
- 2.3.5 352B2191, Penetration Bolt A, Sensor String Drawing
- 2.3.6 352B2192, Penetration Bolt B, Sensor String Drawing
- 2.3.7 352B2193, Penetration Bolt C, Sensor String Drawing
- 2.3.8 25A5900, Foreign Material Exclusion Design Specification
- 2.3.9 WPS-8.43.3/PQR-27, Weld Austenitic SS and Inconel
- 2.3.10 22A4202, Rx Assy, Welding, Cleaning, Exam, and Storage Specification
- 2.3.11 26A5734, Reactor Internals Modifications, Fabrication Specification
- 2.3.12 Welding of CP-104 (P23) to Mounting Pad Attached to Skirt with Hole
- 2.3.13 New Dryer Installation Procedure
- 2.3.14 Reuter-Stokes E8-1000-208-110X Conduit Clamp (A=1, B=2V, C=2H)
- 2.3.15 Steam Dryer with Vibration Instrumentation Modification Drawing (later)
- 2.3.16 Kyowa Strain Gage – Construction, Features and Gage Installation
- 2.3.17 26A6484 Functional Test Procedure for Sensors in String Assy @Fab Shop



3.0 MATERIALS REQUIRED

- 3.1 The following is an installation list of the equipment, instruments, tools, tooling, mockups, spare parts and materials for the project. These items may be used for preparation, checkouts and installing the vibration instrumentation on the dryer at the steam dryer fabrication shop.
- 3.2 These items should be stored in a protected and secure warehouse or storage area, set aside for vibration installation equipment and testing instruments.

#	ITEM DESCRIPTION	Ref ID Dwg #	Qty	SUPPLIER/RESP	NOTES
1	VIB Sensor String w/ Certificate	RS-E8-1000-208	[[Reuter-Stokes	Give Certs to QC
2	VIB Sensor String w/ Certificate	RS-E8-1000-209		Reuter-Stokes	Give Certs to QC
3	VIB Sensor String w/ Certificate	RS-E8-1000-210		Reuter-Stokes	Give Certs to QC
4	5 Tube (Conduit) Bracket Assembly	112D4859G002		Reuter-Stokes	
5	4 Tube (Conduit) Bracket Assembly	112D4859G003		Reuter-Stokes	
6	3 Tube (Conduit) Bracket Assembly	112D4859G005		Reuter-Stokes	
7	2 Tube (Conduit) Bracket Assembly	112D4859G004		Reuter-Stokes	
8	Conduit Clamp (Single Tube)	E8-1000-208-110A		Reuter-Stokes	
9	Conduit Clamp (Double-Vertical)	E8-1000-208-110B		Reuter-Stokes	
10	Conduit Clamp (Double-Horizontal)	E8-1000-208-110C		Reuter-Stokes	
11	Pad 3- Permanent 2"x3"x1/4" 304L	352B2248P003		General Electric	Give Certs to QC
12	Pad 4- Permanent 1"x2"x1/4" 304L	352B2248P004		General Electric	Give Certs to QC
13	Clips - for RSWelding MI Cable	209A7243P004		General Electric	Give Certs to QC
14	Resistance Spot Weld Equipment	N/A		General Electric	Give Certs to QC
15	RSW Qual Pieces, any spacing gage	N/A		General Electric	
16	Conduit Bender (with 4" R mandrel)	N/A		General Electric	
17	Welding Machines	N/A		UST&D/Shop/MTE	
18	Weld Filler Rods (SS-SS) w/ Certs	N/A		UST&D/Shop/MTE	Give Certs to QC
19	Weld Filler Rods (Inco-SS) w/ Certs	N/A		UST&D/Shop/MTE	Give Certs to QC
20	Mast Bracket for Press Assy (P26)	234C6976		General Electric	
21	Mast Bracket Assy (Conduit Clamp)	234C6983		General Electric	
22	Mast Gusset Bracket (5-Cond Clamp)	234C6987		General Electric	
23	Mast Base (Main Base on Bank D)	234C6996		General Electric	
24	Long Gusset Base (Base on Bank C)	234C6997		General Electric	
25	Union Support Bracket (Block H1)	234C6982		General Electric	
26	Pad 2-Mast Mounting Bases	234C6994		General Electric	
27	Pad 1-Mast Gusset Mounting Base	234C6995		General Electric	
28	Mast Base Arrangement-Dryer Weld	234C7001		General Electric	
29	Mast Mounting Fastener-Screw 1	343A2289		General Electric	Use only @Quad2
30	Mast Mounting Fastener-Screw 2	343A2290		General Electric	Use only @Quad2
31	Special Hex Nut	343A2291		General Electric	Use only @Quad2
32	Mast Star Washers (X-750L Mat'I)	343A2292		General Electric	Use only @Quad2
33	Mast Mounting Fastener-Screw 3	343A2293		General Electric	Use only @Quad2
34	Washer, 1"ODx.53"IDx.09" 304L)	343A2294		General Electric	Use only @Quad2
35	Instrument Flange (with 3 holes)	E8-1000-208-81		Reuter-Stokes	Use only @Quad2
36	Penbolt Kit (2-nut, 2-gasket, 2-wshr)	E8-1000-208-98		Reuter-Stokes	Use only @Quad2



37	Torq Wrench 200Ft-lb w/ Calib Cert	N/A		UST&D/Shop/MTE	Calib Cert to QC
38	Torq Wrench Hex Crowfoot	N/A		General Electric	
39	Instr Flange Mockup, Stand on Dryer	later		General Electric	
40	Cover Plate 6" Dome (single slot)	234C7124		General Electric	Matl Cert to QC
41	Cover Plate 6" Dome (dual slot)	234C7125		General Electric	Matl Cert to QC
42	Sensor Mounting Pad (flat ring)	234C7126		General Electric	Matl Cert to QC
43	Sensor Mounting Pad (skirt R119.5")	234C7127		General Electric	Matl Cert to QC
44	Skirt Pad, Mounting (P23, CP104)	352B2246		General Electric	Matl Cert to QC
45	Nut Lock CP211 (Inside P13, P14)	352B2245		General Electric	
46	Mockup Flange Stand Assembly	N/A		General Electric	Re-use at Quad-2
47	Spot Welding System w/ Accessories	N/A		General Electric	

4.0 RESPONSIBILITIES

- 4.1 The Installer shall accept responsibilities for one's work. The Installer shall comply with the requirements of this document and the supporting documents listed herein.
- 4.2 The Installer shall take the responsibility for coordination of one's work with others, including the coordination of work planning with the Vendor at the Vendor's shop.
- 4.3 The Installer shall be responsible for providing all specialized handling, alignment, and installation equipment, as may be necessary to perform this work, except as otherwise agreed to by the Plant Owner.
- 4.4 The Installer shall supply qualified personnel for supervision and for performing the required tasks to complete the steam dryer installation of the vibration instrumentation and preperation for transport to the site.

5.0 REQUIREMENTS (PRE-INSTALLATION)

- 5.1 The new steam dryer work area for installing the vibration instruments shall be reviewed for safety and UST&D/JT Cullen shop practices and procedures.
- 5.2 The dryer shall have safe access for personnel, by erecting scaffolding and ladders for side access. The top shall be reviewed for use of a work platform. Handrails and other personnel safety devices and items shall be provided as required.
- 5.3 An overhead crane shall be operable and available for use during vibration installation, along with slings and rigging devices.
- 5.4 The top of the dryer shall be accessible for mounting vibration instrumentation routed on top and side of tie bars, along top of banks, down the hood, end plates, around the mid ring, down the skirt and drain channel. The top platform may require removable sections for working access.



- 5.5 The mockup of the instrument nozzle flange may be mounted or attached to the top of the dryer for sensor string installation. (Adjust mockup height if mounted on top of working platform).
- 5.6 The area shall be approved for arc welding and resistance spot welding.
- 5.7 The dryer surface and installed vibration instrumentation should not come into contact with non-reactor approved materials such as carbon steel. This includes tooling, test equipment, hand tools, rigging, lifting devices, etc.

6.0 INSTALLATION PROCEDURE

- 6.1 Installation Staging. Tooling, tools and equipment shall be staged for installation.
 - 6.2 Receiving Inspection. Area set aside for performing receiving inspection.
 - 6.2.1 Perform receiving inspection of strain gages and mark test results. Suggested resistance test only, no bending.
 - 6.2.2 Perform receiving inspection of accelerometers and mark test results.
 - 6.2.3 Perform receiving inspection of pressure transducers and mark test results.
 - 6.2.4 Receiving inspection report shall be given to QC for record keeping.
 - 6.3 Preparation for Installation.
 - 6.3.1 Prepare installation activity and review safety work plan, schedule.
 - 6.3.2 Clean the dryer surface per specification of Cleaning and Cleanliness Control of Reactor Systems Component before installing and maintain cleanliness during and following final installation, to eliminate any foreign material exclusion (FME) concerns (see reference Design Spec 25A5900).
 - 6.3.3 Confirm safe working area ready with platform and scaffolding setup.
 - 6.3.4 Complete required training of conduit benders, welders, RSW personnel, torquing, electronic checking equipment, and other required tasks.
-



- 6.3.5 Stage available materials with certification (i.e. mounting pads, cable clips for spot welding, conduit clamps, pads, proper weld rods issued for stainless or Inconel welding, torque wrench/crowfoot for penbolt nut, etc).
 - 6.3.6 Review daily work plan, pre-job reviews, schedule, any specific UST&D/JT Cullen shop or project safety issues/procedures, any required personnel protective equipment, etc.
 - 6.3.7 Quality – QA performed by QC Inspectors, note hold points for inspection and signoffs/acceptance before proceeding to final inspection approved.
 - 6.3.8 Check if any special work permits are required, such as firewatch or burn permit for welding/RSW, etc.
 - 6.3.9 Review top view of the dryer in Attachment Figure B4-1 and note sensors identified in approximate locations. Also note the dryer orientation and dryer bank numbering from Bank A through Bank F on the 270 deg side.
 - 6.3.10 Attachment Figure B4-2 is a top view showing the N6A instrument nozzle flange in relation to the mast on Bank D. N6A is 48” from center of vessel head on 0 deg azimuth. Location of the mockup flange center may be checked using a plum bob. The nozzle center is 24.1” to the mast center. Also see Detail B in Appendix B1, Figure 2.
 - 6.3.11 Complete welder qualification for Austenitic Stainless and Inconel welds.
 - 6.3.12 Perform RSW qualification peel test per P50YP215, paragraph 4.1.4.
 - 6.3.12.1 A minimum of 6 peel tests required to qualify procedures.
 - 6.3.12.2 A minimum of 3 peel tests to qualify each RSW operator.
 - 6.3.12.3 Peel tests performed and accepted per criteria per E50YP38.
 - 6.3.12.4 Production RSW peel testing to be performed at every production start and stop
 - 6.3.12.5 All peel test coupons shall be visually inspected and conform to requirements of paragraph 4.1.3 and 4.1.4 of P50YP215. QC shall document and put into records package.
 - 6.3.13 [[]]
 - 6.3.14 Hardware installation sequence and procedure may be changed with the approval of the site responsible engineer or site project manager, provided the change does not compromise quality or integrity in providing dryer vibration data during reactor startup operation.
-



6.4 Install Mast

Review mast assembly, parts list, instructions, shim details, bolt torque, weld size, location and orientation on top of dryer bank, vertical angular position and tolerances shall be specified on drawings or contact responsible engineer. (see dwg 234C6821).

[[



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6.4.12 QC to approve final welds and inspect the mast for proper installation before proceeding.

6.5 Install Pressure Sensor Mounting Pads

6.5.1 Install external pressure transducer mounting pads on upper hood. The approximate location of 23 pressure sensor locations are described in Attachment B4, Figures B4-3 thru B4-6. The final locations shall be measured, recorded as changed and then documented to QC. (See ref dwg 234C6821).

[[



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6.6 Internal Pressure Opening
[[



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6.7 Instrument Flange Mockup Install [[

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Instrument Flange (3 Penetration Bolt Holes)



6.8 General Pre-Installation Checkout, Sensor String Preparation

6.8.1 Check mockup flange for proper fitting, location, orientation and height by calculated measurements. [[

]]

6.8.2 Check mounting of the mockup flange assembly is secure onto the top of dryer for sensor string installation/routing/mounting. This will assure proper fitup into flange and nozzle on the reactor head. [[

]]

6.8.3 Check first string completely before installing. Verify receiving inspection completed, including the receiving Functional Test Procedure for Sensors in the String Assembly before installation. Record the receiving pre-installation data and give to QC for record keeping and later addition of post-installation data. Replace and maintain sensor protectors installed at all times until final required removal for actual sensor installation.

6.8.4 Conduit may be pre-bent to assist installation on the top of the dryer. This suggestion is risky with RE deciding orientation may best be determined after the penetration bolt is installed and attached to the flange on the mockup stand. Note some vertical flexibility is required for final insertion into the instrument flange for actual site installation.

6.8.5 Check three holes in flange mockup, match orientation of actual flange. Mark or note which hole is Penbolt-A, for Penbolt-B, and Penbolt-C. Also note the proper orientation of each particular penbolt, which is critical for proper orientation in mounting of all blocks on the string.

6.8.6 Check proper hole diameters in flange for penbolt installation.

6.8.7 Check proper wrench crowfoot available for tightening penbolt nut.

6.8.8 Check penbolt torque wrench has valid calibration, fitup with crowfoot.

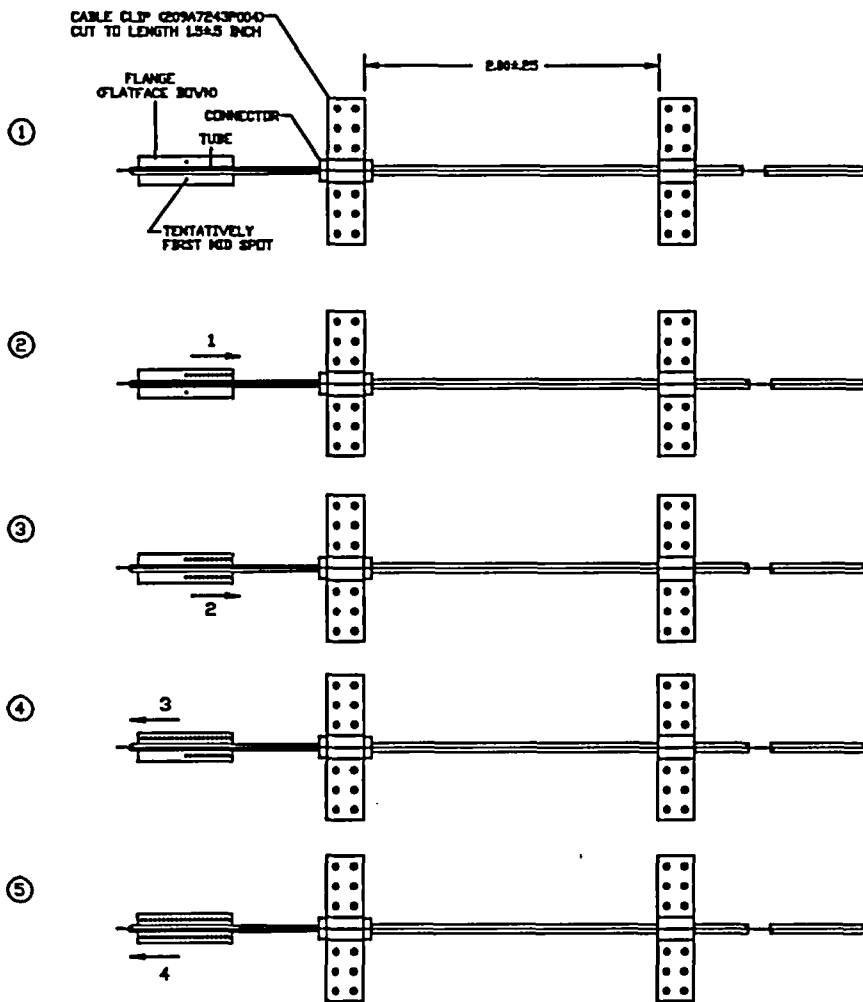
6.8.9 Check to verify hole location and orientation with responsible engineer.



- 6.8.10 Check work plan ready for installation. Plan ahead for proper routing and location of next clamp and sensor routing. Minimize “crossing” of conduit by planning string routing.
 - 6.8.11 Check all three sensor strings to verify the sequence of installation and routing before start of conduit bending.
 - 6.8.12 Check final strain gage location, to weld or structure, note the required position of horizontal or vertical, note seams and welds to be avoided.
 - 6.8.13 Add “S-bend” near the strain gage cable for allowing any thermal expansion and to relieve stress in protecting the mineral insulated (MI) cable. The S-bend has specific design and clips for support.
 - 6.8.14 S-bends can be applied to either cable or conduit to install any excessive lengths. Any short lengths will require some “cutting of corners” or adjustment of bend radii to compensate routing.
 - 6.8.15 Suggest use of a marked guide for Resistance Spot Welding (RSW) of strain gages and clips, to assist spot weld spacing and perhaps be a heat sink to reduce heat input. Note the strain gage has a flanged flat surface that must be installed toward the surface of the dryer.
 - 6.8.16 Resistance spot weld requires qualification of RSW welder and weld equipment, with qualifying MI cable clip peel tests using the actual clip material. Acetone, 180 grit emery cloth or equivalent, lint free tissue paper and clip required. (see 21A8675 for strain gage application).
 - 6.8.17 The following are Kyowa instructions for handling and spot welding the strain gages (Kyowa Model KHC-10-120-G9):
 - 6.8.17.1 Take care not to bend the strain gage element when stretching the MI cable.
 - 6.8.17.2 When bending the MI cable, do not bend within 0.2” (5mm) from the connection. The connection is a larger diameter sleeve coupling which houses silver brazed wires. Recommended is (~4”) 100mm to first bend from connection
 - 6.8.17.3 Do MI cable bending before installing the strain gage.
 - 6.8.17.4 RSW cautions include cleaning the area to be in contact with the strain gage, set proper output to spot welder and also maintain proper electrode contact pressure.
 - 6.8.17.5 Clean the flange (flat side) of the strain gage. This is the surface towards the dryer surface for spot welding.
 - 6.8.17.6 The G9 strain gage has a sensor flange of SUS321 and MI cable is SUS347 material.
-



- 6.8.17.7 Remove rust, dust, grease and other foreign matter from the contact area prior to start.
 - 6.8.17.8 Use #100 or thereabout sandpaper to remove any rust. Then smooth the area using #320 or thereabout sandpaper.
 - 6.8.17.9 Thoroughly remove stain and grease from the area w/ acetone.
 - 6.8.17.10 After removal of grease from the strain gage, avoid touching the cleaned contact areas.
 - 6.8.17.11 During installation, prevent the cable from applying tension or torsion to the partially installed strain gage. Support the weight of the cable temporarily when installing the strain gage or add cable clips.
 - 6.8.17.12 A spot welder of 20 watts/second capacity permits welding of the strain gage to most materials. Set output of a welder at 10 to 12 watts/second and electrode pressure of 0.5 to 1/0 kgf (1-2 pounds).
 - 6.8.17.13 The optimum diameter of the electrode tip is 0.032" (0.8mm).
 - 6.8.17.14 The pitch for the strain gage G9 is 0.032" (0.8mm).
 - 6.8.17.15 Required strength of a welded joint to be made is such that when a spot-welded stainless steel plate is forcibly removed with a pair of pliers, weld spots stay on the mating material, making holes on the clip. This is the peel test.
 - 6.8.17.16 Set the **flat flange side down** towards the dryer surface to be spot welded. Note, the side away from the dryer has the tube.
 - 6.8.17.17 Start from one spot on either side of the tube in the middle. Then spot weld from center towards connector end. Start the second from from the center on other side of tubework towards the flange end. Then repeat for other the other flange.
 - 6.8.17.18 G9 only requires a single row of spot welds on each side of the flange.
 - 6.8.17.19 Take care to keep the tip of an electrode inside flange edges.
 - 6.8.17.20 Take care to keep equal intervals. Avoid overlapped spots.
 - 6.8.17.21 Avoid overlapped spots.
 - 6.8.17.22 Avoid the tip and side of the electrode on parts other than the flange. The sensor tube can be easily damaged.
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SPOT WELDING SEQUENCE

6.8.18 Production clip RSW Peel Test per P50YP215 paragraph 4.2.

6.8.19 Note the penbolt strings A/B/C can be installed in any sequence.

6.8.20 [[]]for all routings
except for locations limited by installation access.

6.8.21 [[]] Try to use recommended cable bend radii as much as possible unless there are circumstances that cannot be overcome or there are compelling reasons.

6.8.22 Avoid bending of conduit at welds, union and shield blocks.

6.8.23 Avoid bending of any conduit repeatedly in the same area. (see ref RS-E8-1000-2xx, specifies a minimum conduit bend radius of [[]]. Any conflicts, see table for recommended and minimum bend radii).



6.8.24 The recommended and minimum bend radii for MI cable are given below:

Sensors	MI Cable OD inch (mm)	Recommended Bend Radius inch (mm)	Minimum Bend Radius inch (mm)
Pressure Transducers	[[
Accelerometers			
Strain Gages]]

Note 1: Going below the minimum bend radius can lead to sensor failure.

Note 2: Bending of MI cable has to be made carefully and should not be repeated in the same area.

Note 3: Do not bend MI cable [[]]from the enlarged connection to prevent damage to the silver brazing.

Note 4: RS-E8-1000-2xx calls out min bend radius of [[]] for MI cable.

6.8.25 The maximum spans between MI cable spot welded clips are given below:

Max Span (in)	Cable Clamp Locations on the Steam Dryer
[[Horizontal spans on top of dryer bank or on the tie bar
	Vertical or horizontal runs on face of hood or side end plates
	Vertical or horizontal runs on middle support ring
]]	Vertical or horizontal runs on skirt or drain channel



6.9 Penetration Bolt A Installation

- 6.9.1 See reference Reuter-Stokes drawing RS-E8-1000-208 and string layout sketches and any Inventor screen captures for routing of conduit and cable, shown in Figures of Appendix B.
- 6.9.2 Verify pre-inspection and testing completed before proceeding with string installation.
- 6.9.3 Always keep sensor protectors attached to protect end sensors and cable.
- 6.9.4 Note union blocks and shield blocks are marked with “outside” facing away from the dryer.

6.10 Penetration Bolt B Installation

- 6.10.1 See reference Reuter-Stokes drawing RS-E8-1000-209 and string layout sketches and any Inventor screen captures for routing in Figures of Appendix B. Note the penbolt strings A/B/C may be installed on the dryer in any sequence with the approval of the responsible site engineer or the site project manager.
- 6.10.2 Verify pre-inspection and testing completed before proceeding with string installation.
- 6.10.3 Always keep sensor protectors attached to protect end sensors and cable.
- 6.10.4 Note union blocks and shield blocks are marked with “outside” facing away from the dryer.

6.11 Penetration Bolt C Installation

- 6.11.1 See reference Reuter-Stokes drawing RS-E8-1000-210 and string layout sketches and any Inventor screen captures for routing shown in Figures of Appendix B. Note the penbolt strings A/B/C can be installed in any sequence with the approval of the responsible site engineer or the site project manager.
 - 6.11.2 Verify pre-inspection and testing completed before proceeding with string installation.
 - 6.11.3 Always keep sensor protectors attached to protect end sensors and cable.
 - 6.11.4 Note union blocks and shield blocks are marked with “outside” facing away from the dryer.
-



6.12 Check Final Sensor Installation

- 6.12.1 Check all sensors after completion of installation. The sensors will be tested for insulation resistance, sensor element resistance and functionality. See separate sensor test procedure 26A6848, repeating strain gage testing as per receipt inspection, plus checking the pressure transducers (CP104, CP211), and accelerometer (CA901).
- 6.12.2 Final test data shall be recorded and a copy given to QC for project file record keeping.
- 6.12.3 Final sensor locations shall be dimensioned and recorded as red-line on installation drawings for later as-built records.
- 6.12.4 Recommended final sensor installation and routing with support clamps and clips be recorded by videotaping or photographing (digital preferred).

6.13 Check Final Documentation, QA Check

- 6.13.1 Verify all documents are received for installation, including changes for routing, mounting, attachment welds and RSW and all testing data of all sensors on the new steam dryer, both pre-installation and post-installation.
- 6.13.2 QC to confirm before continuing.

6.14 Prepare for Handling/Transport to Site

- 6.14.1 Verify all documentation and records complete before beginning this section.
 - 6.14.2 Review and coordinate plan to remove the mast and safe laydown with minimum acceptance clearance defined as the tops of the four lifting lugs. Conduit in clamps on top of the dryer may need to be released for safe unbending of strings to lay down the instrumentation. The maximum dryer height for installing into the side of the reactor building is [[]]. This leaves a [[]] on top. This does not consider use of the dryer lifting strongback. This will be the instrument laydown design window for moving into the side opening of the reactor building at Quad Cities.
 - 6.14.3 Review requirements should consider a protective cover or other requirements to protect the instruments and steam dryer during the transport to the site. A safe height and laydown plan will be reviewed in detail later.
-



- 6.14.4 Release sufficient numbers of conduit clamps to remove the instrument nozzle flange mockup, the mast, and the upper section of strings, for the laydown of the instrument strings on top of the dryer. (Dispose of all temporary SS bolts used in the installation at shop fitup and replace with designed screws for final site use).
 - 6.14.5 Vibration instrument laydown will require overhead crane to help support the sensor strings upright while the mast, flange mockup and other items are removed or loosened. Use extreme caution to minimize excessive tension on all sensor strings or cables.
 - 6.14.6 Use extreme caution to prevent damage to any sensors by adding sensor protectors and minimize conduit and cable bend radius (perhaps releasing more conduit clamps) and minimize bending (fatigue stress or excessive stress) by laydown once at the fabrication shop and raising into final position at the site. Suggest avoid excessive tension by use of chainfall and load cell or rig manually and handle with nylon rope and clevis.
 - 6.14.7 Clean any and all debris generated during the fabrication, installation, testing, inspection, documentation, laydown, and preparation process.
 - 6.14.8 Use additional approved packing material to secure any loose hardware.
 - 6.14.9 Soft cable with Lemo connectors in spools should be bagged or protected by approved material to prevent any moisture or debris from entering.
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7.0 QUALITY ASSURANCE

Quality Control Representatives shall provide surveillance and document the work performed for this modification, as necessary, to assure that the requirements of this procedure have been met.

This modification shall be accomplished under the QA Program approved by US Tool and Die.

The completed (as-built) modification shall be documented by sketches and photographs. As-built documents (e.g. captured images, sketches, or drawings) of the final modification configuration shall be filed in the GENE design record file.

Any deviations, substitutions, modifications of materials, engineering procedures or design shall be submitted by the Installer to GENE Engineering for concurrence.

7.1 Sensor Records: The following records shall be prepared for each sensor.

- a. As-installed sketch or drawing. The as-installed location and orientation of all sensors must be confirmed by a description, sketch, or updated drawing of their actual location and orientation, or a statement that they are in accordance with issued drawings. Photographs (digital preferred) should be taken of all sensors at their mounted locations and routings showing mounting hardware (clips and clamps).
 - b. Sensor data sheets and calibration information.
 - c. Sensor element and insulation resistance recorded at different times during the test.
-



STEAM DRYER VIBRATION STRING ROUTING
Attachment B, Figures (Computer Model Layouts, Sketches)

These are listed for reference in viewing computer model showing string routing on the dryer:

Attachment B1

Figure 1 – Layout of instrument nozzle, mast and top of dryer, elevation of [[]] from bottom of instrument flange to top of tie bars on the new steam dryer.

Figure 2 – Top view layout with Detail B showing dimensions from mast to instrument flange, with
- [[]] to Instrument Nozzle N6A.

Figure 3 – Elevation view showing instrument nozzle flange mating surface to RPV opening, with
 [[]] opening and elevations of [[]].

ATTACHMENT B2 (Deleted obsolete figures)

ATTACHMENT B3 (Deleted obsolete figures)

ATTACHMENT B4

Figure B4.1 – Dryer Sensor Locations – Top View

Figure B4.2 – Vessel Dryer – Top View

Figure B4.3 - Dryer Sensor Locations – Elevation View of 90 Degree Face

Figure B4.4 – Dryer Sensor Locations – Elevation View of 180 Degree Face

Figure B4.5 – Dryer Sensor Locations – Elevation View of 270 Degree Face

Figure B4.6 – Dryer Sensor Locations – Elevation View of 0 Degree Face

ATTACHMENT B5 – (Deleted figures)



STEAM DRYER VIBRATION STRING ROUTING
Attachment B, Figures (Computer Model Layouts, Prints, Sketches)

These are listed for reference in viewing computer model showing string routing on the dryer:

Attachment B1

[[

Figure 1 – Layout of instrument nozzle, mast and top of dryer, elevation of [[]] from
bottom of instrument flange to top of tie bars on the new steam dryer.



[[

]]Figure 2 – Top view layout with Detail B showing dimensions from mast to instrument flange,
with [[]] to Instrument Nozzle N6A.

[[

Figure 3 – Elevation view showing instrument nozzle flange mating surface to RPV opening, with
[[]] opening and elevations of [[]].





STEAM DRYER VIBRATION STRING ROUTING
Attachment B, Figures (Computer Model Layouts, Prints, Sketches)

Attachment B2

(Deleted).

Attachment B3

(Deleted).



Attachment B4

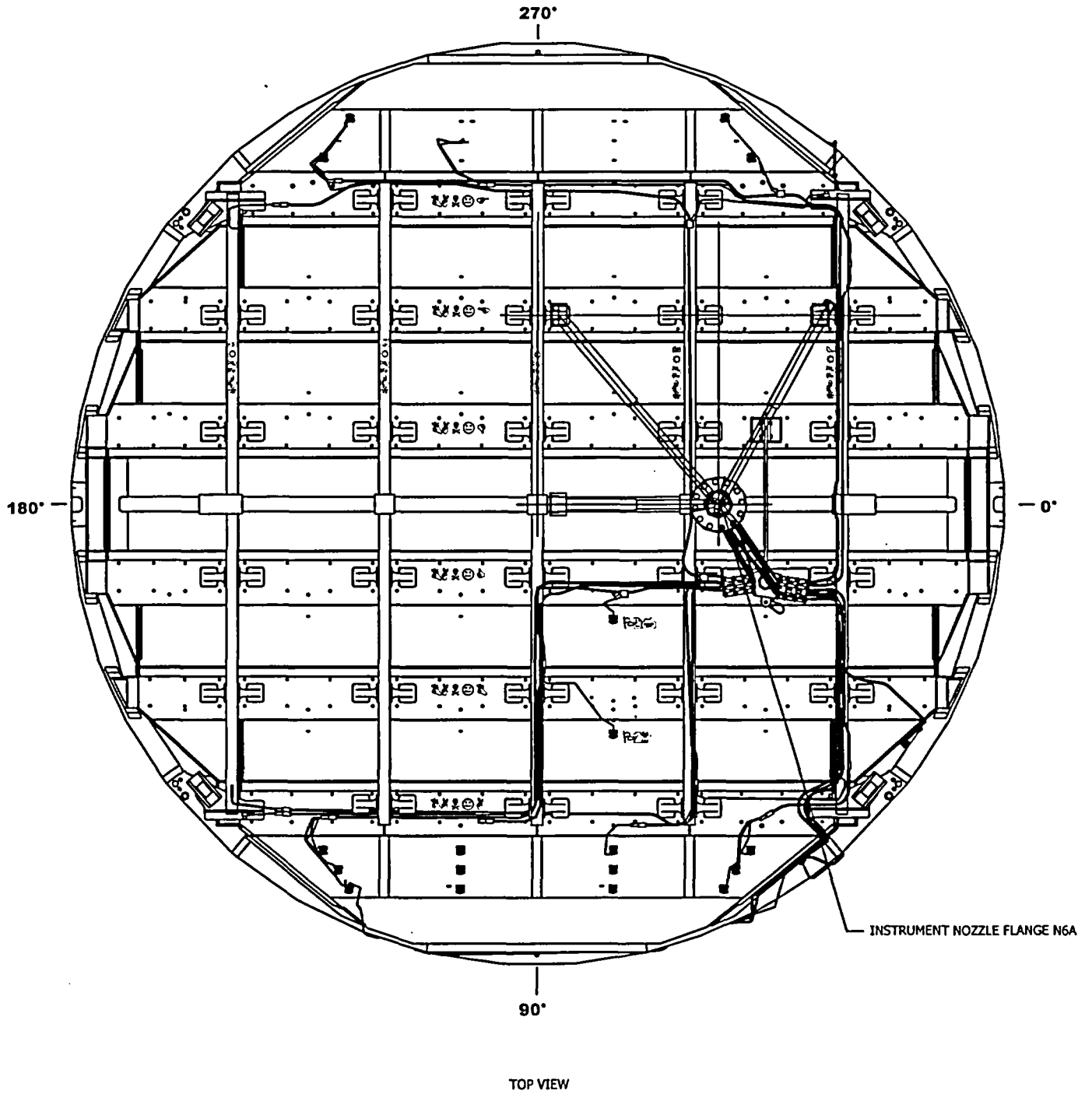
FIGURE B4-1: DRYER SENSOR LOCATIONS - TOP VIEW

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FIGURE B4-2: VESSEL DRYER - TOP VIEW





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FIGURE B4-3: DRYER SENSOR LOCATIONS - 90° FACE

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FIGURE B4-4: DRYER SENSOR LOCATIONS - 180° FACE

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FIGURE B4-5: DRYER SENSOR LOCATIONS - 270° FACE

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FIGURE B4-6: DRYER SENSOR LOCATIONS - 0° FACE

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Attachment B5

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