Enclosure 3

Proprietary Affidavit CAW-96-1040
concerning Westinghouse letter NSD-JLH-6384

Westinghouse Electric Corporation

Energy Systems

Nuclear Services Division

PO Box 855
Pittsburgh Pennsylvania 15230-0855

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

November 8, 1996
CAW-96-1040

Attention: Mr. Frank J. Miraglia

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: "Summary of Farley LWS Lower Joint Development - Task C Qualification Testing," NSD-JLH-6384, (Proprietary).

Dear Mr. Miraglia:

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-96-1040 signed by the owner of the proprietary information, Westinghouse Electric Corporation. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.790 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying Affidavit by Southern Nuclear Operating Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-96-1040, and should be addressed to the undersigned.

Very truly yours,

N. J. Liparulo, Manager
Regulatory & Engineering Networks

RJM/bbp

Attachment

cc: Kevin Bohrer/NRC(12H5)

Proprietary Information Notice

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) contained within parentheses located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.790(b)(1).

Copyright Notice

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

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COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Henry A. Sepp, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Corporation ("Westinghouse") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Henry A. Sepp

Henry A. Sepp, Manager
Regulatory and Licensing Initiatives

Sworn to and subscribed
before me this 8th day
of November, 1996

Lorraine M. Piplica

Notary Public

Notarial Seal
Lorraine M. Piplica, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Dec. 14, 1999
Member, Pennsylvania Association of Notaries

(1) I am Manager, Regulatory and Licensing Initiatives, in the Nuclear Services Division, of the Westinghouse Electric Corporation and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Energy Systems Business Unit.

(2) I am making this Affidavit in conformance with the provisions of 10CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Energy Systems Business Unit in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in "Summary of Farley LWS Lower Joint Development - Task C Qualification Testing," NSD-JLH-6384, (Proprietary), November, 1996 for Joseph M. Farley Units 1 and 2, being transmitted by the Southern Nuclear Operating Company (SNC) letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk, Attention Mr. Frank J. Miraglia. The proprietary information as submitted for use by SNC for the J. M. Farley Units 1 and 2 is expected to be applicable in other licensee submittals in response to certain NRC requirements for justification of laser welded sleeve qualification.

This information is part of that which will enable Westinghouse to:

(a) Provide qualification testing results for laser welded sleeving lower joints.

(b) Assist the customer in obtaining NRC approval for installing laser welded sleeves.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of steam generator repair.

(b) Westinghouse can sell support and defense of the information in the licensing process.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar methodologies and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing the methodology.

Further the deponent sayeth not.

WESTINGHOUSE NON-PROPRIETARY CLASS 3

NSD-JLH-6385

FROM: Steam Generator Design and Analysis
WIN: 224-5689
DATE: November 8, 1996

SUBJECT: SUMMARY OF FARLEY LWS LOWER JOINT DEVELOPMENT - TASK C QUALIFICATION TESTING

To: G.Whiteman
Cc: B.Nair L.Markle D.Kaniowski
R.Gold

References:

1. Letter ALA-96-527, W, D.Kaniowski, to D.Morey, Southern Nuclear Operating Company, "Southern Nuclear Operating Company Joseph M.Farley Nuclear Plant Units 1 and 2 Elevated and Tube Mouth LWS Lower Joint Development", 3/5/96

2. STD-QP-1996-7740 Rev. 0, Farley Laser Welded Elevated Tubesheet Sleeve: Lower Hard Roll Qualification Procedure, 5/96

3. Handout at Southern Nuclear Operating Company-Westinghouse Meeting at Pittsburgh, L.A. Nelson, 3/16/96

4. Letter NSD-JLH-6135, Summary of Farley LWS Lower Joint Development - Task C Scoping Testing, 4/30/96

5. WCAP-11178, J.M.Farley Units 1 and 2 Steam Generator Sleeving Report - Mechanical Sleeves, 5/86

6. Letter, NSD-JLH-6209, Farley ETS Contact Pressures, A.Thurman, to L.Nelson, 6/26/96

7. Letter, NSD-JLH-6202, Summary of Farley LWS Lower Joint Development - Task C Qualification Testing, 6/25/96

This letter is a 'proprietary' version of Ref. 7 above. It summarizes the qualification of the lower joint for sleeves elevated in the tubesheet (ETSs) for Farley Unit 1. This task is shown in the first three references as Task C.

Background:

Reference 1 provided the technical description of a program to develop three mechanical interference fit (MIF), two-roll-pass, non-welded sleeve lower joints. One of the MIF joints will be used for full length tubesheet sleeves (FLTSs) and two will be used with ETSs. Both types of sleeves will be used in both units. The engineering part of this program is

being performed in four tasks. (There is a separate part of this program, i.e., the licensing information such as the Safety Evaluation Checklist, being performed by Regulatory and Licensing Initiatives {Nuclear Safety.})

Task C, the subject of this communication, is being performed first and it addresses the lower joint in Unit 1 for a tube which is undegraded in the joint area. (Degradation of a tube in the joint area is defined as tube ID corrosion at the elevation of the portion of the joint which provides the pullout and leakage resistance, i.e, the roll expansion.)

Development of the lower joint for this ETS is based on selection of the "roll last" sleeve installation sequence. In this sequence, the sleeve-to-tube weld is performed before the lower joint roll expansion. Based on development of previous elevated joints for laser welded sleeves (LWSs), the "roll first" sequence was known to produce lower joints of greater tightness than those made by the reverse of this sequence, i.e., by the "roll last" sequence. The roll last sequence was selected because installation productivity for that sequence is h' her than for the roll first sequence. In the roll last sequence, the sleeve is immobilized the weld earlier in the process, thereby facilitating some of the subsequent process steps. In the two-roll-pass process selected for this design, the lower elevation pass is performed first, followed by the upper pass.

Reference 2, the procedure written for the qualification test, specifies criteria for three types of tests for the lower joint, 1) primary-to-secondary leak resistance testing, 2) secondary-to-primary "onset of significant leakage testing" (OSL) and 3) sleeve pullout testing. The purpose of the primary-to-secondary leak resistance testing is to determine the leakage for normal operation, for feedline break/steamline break (FLB/SLB) and for a higher pressure which approximates the SG initial primary side hydrostatic pressure test. The secondary-to-primary OSL test is performed to determine the sleeve-to-tube interference fit radial contact pressure (CP). It involves the use of fluid pressure to determine the MIF, "metal-to-metal" pressure, or simply, "metal" pressure, between the sleeve and tube. At the pressure level where the fluid pressure equals the metal pressure, and in the absence of significant axial scratches or other axially linear degradation on the sleeve OD and/or on the tube ID in the roll expansion, significant leakage will occur. The higher pressures used in this test are far higher than any pressures in the SG during any Technical Specification condition. The MIF pressure is multiplied by the area of contact of the sleeve with the tube and by the appropriate coefficient of friction, based on pullout tests for this joint and on previous tests for the same materials, to provide the sleeve pullout resistance.

Sleeve pullout testing is a direct determination of the resistance to pullout of the sleeve joint.

Design Aspects of Lower Joint:

For the sake of commonality, it is desirable that all three of the FLTS and ETS lower joints be of the same axial length. On this premise, the effective axial length of the joints would be determined by the axial space available in the vicinity of the tubemouth of Unit

1. (The effective length of a roll expanded joint is the finished axial length of the inner structure {for instance, sleeve} which is in high pressure contact with the outer structure {for instance, tube}. In this example the finished, rolled, inside surface or diameter (ID) of the sleeve will be essentially uniform throughout the effective length; the transitions from the expanded {rolled} to the unexpanded {non-rolled} portions of the sleeve are excluded.) Therefore, the sleeve roll common effective length for the entire project would be essentially limited by the length of the tube partial depth roll expansion of Unit 1. This is because a uniform sleeve ID will generally be unattainable if the effective length is partially placed in the factory rolled portion and partially in the explosive expanded (WEXTEX-ed", or simply WEXTEX) portion. The nominal axial length of the Unit 1 tube factory roll expansion is [ ]^{a,c,e}inches. However, part of that length was rolled to a small amount of thinning and part of that portion is also below the bottom face of the tubesheet and adds a smaller amount of integrity, compared to the hardrolled portion of the tube, to the sleeve-to-tube joint. Therefore, the actual effective length of the sleeve-to-tube joint is limited to approximately [

]^{a,c,e}. Above the factory roll length, the remainder of the tube within the tubesheet hole of Unit 1 was WEXTEX-ed. The tube wall in the roll portion is thinned several percent; the tube wall in the WEXTEX portion is thinned to a lesser extent. Similarly, the rolled portion was coldworked to a certain extent in the factory; the WEXTEX portion was coldworked to a lesser extent. Due to the difference between these two processes, and especially due to the differing resulting IDs, it is good practice to avoid attempting to make a higher integrity MIF joint by locating it partly in both portions of the tube and that's why the sleeve joint will be located in the rolled portion.

The elevated joints of both units are not limited in axial effective length by being in two different types of factory joints. In Unit 1, the elevated joint will be completely within the WEXTEX; in Unit 2, the elevated joint will be completely within the factory tube roll expansion. Therefore, although there are implementation advantages of a common joint length, there were compelling reasons to make the elevated joints somewhat longer than the joints in the vicinity of the tubemouth. The effective length of the elevated joints is [ ]^{a,c,e} inches.

Everything else being equal, it is expected that the integrity of the joint installed in a WEXTEX tube, the subject of this task, will be higher than in a rolled tube. Therefore, the performance of the joint made in the WEXTEX tube is expected to bound the performance of the same joint made in a rolled tube and the roll last, undegraded, factory rolled tube configuration was not scheduled for testing. (The "same" joint is defined as the joint made using the same roll expander, torque, roller rpm, roll pass sequence, effective length, as well as tube, tubesheet and sleeve material and strength parameters.)

Primary Side Testing:

Rolled Joint Geometry and Torque:

[

]^{a,c,e} The large amount of coldwork can be best accomplished with a high-coldwork roller and a high torque. Everything else being equal, a three-pin rolling tool provides significantly more coldwork per unit of torque than a four-pin tool.

A roll expansion torque of [ ]^{a,c,e} was selected as the nominal value. This selection was based on the results of "scoping" tests documented in Ref. 4. The "nominal" torque is bounded by a range of [ ]^{a,c,e} This torque is applied to a [ ]^{a,c,e} [ ]^{a,c,e} rolling passes were made with a roller overlap of [ ]^{a,c,e} The nominal rolled joint is made with the top of the upper roll pass positioned [ ]^{a,c,e} above the top of the sleeve eddy current taper, thus producing an effective length of [ ]^{a,c,e} This roll expander positioning leaves [ ]^{a,c,e} of the roller extending below the sleeve eddy current taper during the initial roll pass. This rolled joint geometry is identified as [ ]^{a,c,e} on the attached test data sheets.

A small number of tests were made with rollers having an effective rolling length of [ ]^{a,c,e}, and an overlap of [ ]^{a,c,e} Not a baseline geometry, leak test results for these joints, identified as [^{a,c,e} are listed for comparison, but are not included in the data averages. Individual test samples were also made using a [ ]^{a,c,e} roller,]^{a,c,e} roller torque setting, and an condition producing a joint having an effective rolled height of [ ]^{a,c,e}. Leak test results for these joints are listed for comparison, but are not included in the data averages.

Primary-to-Secondary Side Leakage Testing:

Twenty three primary-to-secondary side "process qualification" leak tests were performed using a total of 19 test samples. Because the primary side testing tends to be non-destructive of the samples, four of the test samples were rerolled at a higher torque, and leak tested a second time. All samples exhibited small amounts of leakage.

Leak test results should be compared with the leak rate criteria value of 0.500 drops per minute per sleeve (dpm) specified in Ref. 2.[1] (There are approximately 75,000 drops in one gallon.) The maximum leakage recorded at the primary-to-secondary differential pressure applicable to normal operation (1900 psi) was [ ]^{a,c,e} dpm for the "nominal" tubesheet hole diameter (as compared with an overall average leak rate value of

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[1] This leakage criterion is conservatively taken as a fraction of the leakage criterion proposed in Ref. 1. The criterion proposed is an average of 1.22 dpm per sleeve, an arbitrary allocation of one-third of the 140 gallon per day (gpd) primary-to-secondary Technical Specifications limit, apportioned to 2,000 of these sleeves per SG. The 140 gpd limit applies to the bounding unit, Unit 1; the Unit 2 limit is 150 gpd.

[.][a,c,e] dpm). The maximum leakage recorded at the primary-to-secondary differential pressure applicable to normal operation (1900 psi)[2] was [ ][a,c,e] dpm for the "maximum" tubesheet hole diameter (as compared with an overall average leak rate value of [ ][a,c,e] dpm).

The following test geometries, and torque values are well outside the tolerance band, but are presented as an indication of the overall effectiveness of the "baseline" joint. The low torque value of [ ][a,c,e] inch-lbs produced a leak rate of [ ][a,c,e] dpm at 1900 psi. The short ([ ][a,c,e] inch roll height) setups produced leak rates of [ ][a,c,e] dpm at 1900 psi. The (embedded [ ][a,c,e]) setup produced a leak rate of [ ][a,c,e] dpm at 1900 psi. A [ ][a,c,e] inch roll pass produced a leak rate of [ ][a,c,e] dpm at 1900 psi.

In the laboratory room temperature leakage testing, the most stringent location in the tubesheet, where the upward bending causes the most tubesheet hole dilation, [0.65][a,c,e] inches below the elevation of the sleeve joint top, was addressed. In this testing, the thermal growth mismatch contribution to increasing contact pressure and the decrease in contact pressure due to tubesheet bending loosening, in going from the as-installed condition to normal operation (N.Op.), were absent. The differential pressure tightening was present. Therefore, the test joint was approximately [ ][a,c,e] psi "too tight". This is a non-conservative effect. However, the [ ][a,c,e] psi is a small fraction of the average as-installed interference fit contact pressure, expected to approximate [ ][a,c,e] psi, plus the [ ][a,c,e] psi N.Op. effects, for a total contact pressure of approximately [ ][a,c,e] psi; the [ ][a,c,e] psi is less than [ ][a,c,e] percent of this value. Therefore the effect on leak resistance would be negligible and no adjustment needs to be made in leakage prediction. (The as-installed contact pressure, [ ][a,c,e] psi, the average of all of the OSL testing, is shown in the appropriate section below.)

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(2) This pressure differential is used as the normal operation {N.Op.} value; it is used in this room temperature test so that direct comparisons (not shown here) can be made with data previously recorded at prototypical temperatures for the N.Op. condition for tubemouth joints. The 1900 psi primary side pressure resulted in the water being subcooled as it entered the potential leak path between the sleeve and tube. In some previous testing, two-phase entering flows potentially caused inaccuracies. These potential inaccuracies were avoided in this testing. All leak testing was performed at room temperature. This has been determined to be conservative, relative to prototypical, elevated temperatures, due to a lack of beneficial effects for joint integrity at room temperature. This effect is shown for the sleeve lower joints in Ref. 5, a joint which is very similar to this joint.

Contributions to Sleeve-to-Tube Contact Pressure
for
Comparison of Laboratory Test Configuration with Plant Configuration

Parameter	*Contact Pressure, psi	Note
Thermal growth mismatch	[ ]a,c,e	Beneficial effect
Differential pressure tightening	[ ]a,c,e	"
Tubesheet bow loosening	[ ]a,c,e	Detrimental effect
Net Effect	[ ]a,c,e	

* Location in tubesheet: At maximum-rotation radius from bundle vertical centerline. [ ]a,c,e inch below top of sleeve joint. See Reference 6.

Leakage Testing Conclusions:

A torque of [ ]a,c,e inch-lbs is suitable, based on minimization of primary-to-secondary leakage.

Pullout Testing:

Pullout test results should be compared with the criteria of the larger of three times the maximum endcap load during normal operation, (3ΔP) or 1.43 times the endcap load during FLB/SLB. The larger of these two loads is usually the N.Op. case and for this summary, this load will be used for comparison with the test results. For this plant, the maximum N.Op. pressure differential is 1506 psi; therefore, the maximum endcap load during N.Op. is approximately 2,892 lbs. Six pullout test samples were fabricated, all at torque values of [ ]a,c,e inch-lbs. All of the four samples rolled at the [ ]a,c,e had pullout "breakaway" values between [ ]a,c,e lbs. force. The "short" sample rolled at [ ]a,c,e had a breakaway of [ ]a,c,e lbs. force, while the [ ]a,c,e sample rolled at [ ]a,c,e had a breakaway of [ ]a,c,e lbs. force. All of these test values exceeded the criterion of approximately 2,892 lbs. There is ample margin in this design, as determined by direct pullout testing, insofar as pullout resistance is concerned.

The testing was performed on sleeve/tube/tubesheet unit cells (collars) at ambient pressure and room temperature. In the RT testing, all of the N.Op. effects, i.e., the [ ]a,c,e psi for thermal growth mismatch, the [ ]a,c,e psi for differential pressure tightening and the [ ]a,c,e psi for tubesheet bow loosening, were absent. Therefore, the test joint was "too loose" relative to the plant condition; this is a conservative effect. The joint would have more resistance to pullout in the plant than in the laboratory. Refer to the contact pressure table above.

Onset of Significant Leakage (Contact Pressure) Testing:

Secondary Side Pressure Testing:

Secondary Side leak testing does not prototype any operating condition, but is performed to determine, conservatively, the interfacial contact pressure between the rolled sleeve and the tube. These results are then used to calculate sleeve rolled joint pullout forces. As the interfacial contact pressure of the rolled portion of the sleeve is approached, a significant increase in leak rate will be observed. In this type of test, the leak test pressures are raised to exceed the collapse pressure of the sleeve away from the roll expansion, collapse initiates and propagates to the rolled portion of the joint, resulting in premature failure of the joint. In order to remove this artifact of the test method and to measure the OSL, the current test uses a loose fitting internal plug to reinforce the sleeve in the region away from the rolled joint. This prevents the interference of collapse with measurement of joint integrity. The summaries of the results are shown below.

The minimum interfacial contact pressure value is calculated on the basis of a coefficient of friction of [ ]^{a,c,e}, a typical large tube ID of 0.800 inch and the 3ΔP value of 2,892 lbs (from above). The resulting minimum allowable contact pressure value is approximately [ ]^{a,c,e} psi. (The consideration of end effects on the sleeve portion in contact with the tube in the joint would increase the [ ]^{a,c,e} psi slightly, reducing the ample margin slightly.) The test results are summarized below.

Onset of Significant Leakage (Sleeve-to-Tube Contact Pressure)
For
Nominal Diameter Tubesheet Hole Sizes:

Torque, inch-lbs.	OSL, psi, Minimum	Note:
[ ]^{a,c,e}	[ ]^{a,c,e}	
[ ]^{a,c,e}	[ ]^{a,c,e}	-Nominal torque case -[ ]^{a,c,e} psi case was out of range; with a short effective roll length
[ ]^{a,c,e}	[ ]^{a,c,e}	

Onset of Significant Leakage (Sleeve-to-Tube Contact Pressure)
For
Maximum Diameter Tubesheet Hole Sizes:

Torque, inch-lbs.	OSL, psi, Minimum	Note:
[135]^{a,c,e}	[ ]^{a,c,e}	
[ ]^{a,c,e}	[ ]^{a,c,e}	Nominal torque case
[ ]^{a,c,e}	[ ]^{a,c,e}	

All secondary side OSL test values exceed the limiting criterion value by a wide margin.

Conclusion on Contact Pressure Qualification Test Results:

Adequate pullout resistance, with adequate margin, will be provided by this joint at the nominal torque, [ ]^{a,c,e} inch-lbs and within the torque range of[ ]^{a,c,e} through [ ]^{a,c,e} inch-lbs.

Conclusion on Leakage and Contact Pressure Qualification Test Results:

The test results show that the [ ]^{a,c,e} joint identified above meets all design criteria. It is to be installed with the specific roll expander used in the qualification and a roll torque value of [ ]^{a,c,e} inch-lbs. +/- [ ]^{a,c,e} inch-lbs.

If you have any comments on this summary, please contact us ASAP.

L.A. Nelson
L.A.NELSON
SG Design and Analysis

H.W. Yant
H.W.YANT
SG Design and Analysis

RF Keating for
Approved: J.L.HOUTMAN, Mgr.,
SG Design and Analysis

snctest.135/laprcfnl/JLH6386

Farley MIF AWT Task C Qual Test Results

a,c,e

Item	Ident.	Appar. W/T	Technique	Force	Elev. for AWT meas.	Roll Ht.	1910 psi leak: dpm	Primary 2650 psi leak: dpm	3110 psi leak: dpm	3110 psi leak: dpm	4000 psi leak: dpm	4500 psi leak: dpm	Secondary 5000 psi leak: dpm	Leak 5500 psi leak: dpm	6000 psi leak: dpm
Collar	lt. 1 unit 9														
Tube	8161-29		Tube Hyd.												
Sleeve	48017-7		Slv. Hyd.												
Sleeve	48017-7		Slv. Roll												
Sleeve	48017-7		Slv. Roll												
Sleeve	48017-7		Re-Roll												
Sleeve	48017-7		Re-Roll												
Collar	lt. 1 unit 10														
Tube	9482-46		Tube Hyd.												
Sleeve	48017-32		Slv. Hyd.												
Sleeve	48017-32		Slv. Roll												
Sleeve	48017-32		Slv. Roll												
Collar	lt. 1 unit 11														
Tube	8161-32		Tube Hyd.												
Sleeve	48017-20		Slv. Hyd.												
Sleeve	48017-20		Slv. Roll												
Sleeve	48017-20		Slv. Roll												
Sleeve	48017-20		Re-Roll												
Sleeve	48017-20		Re-Roll												
Collar	lt. 1 unit 12														
Tube	8161-30		Tube Hyd.												
Sleeve	48017-21		Slv. Hyd.												
Sleeve	48017-21		Slv. Roll												
Sleeve	48017-21		Slv. Roll												
Collar	lt. 1 unit 13														
Tube	8161-33		Tube Hyd.												
Sleeve	48017-24		Slv. Hyd.												
Sleeve	48017-24		Slv. Roll												
Sleeve	48017-24		Slv. Roll												
Collar	lt. 1 unit 14														
Tube	7368-30		Tube Hyd.												
Sleeve	48017-26		Slv. Hyd.												
Sleeve	48017-26		Slv. Roll												
Sleeve	48017-26		Slv. Roll												
Collar	lt. 1 unit 15														
Tube	7368-31		Tube Hyd.												
Sleeve	48017-28		Slv. Hyd.												
Sleeve	48017-28		Slv. Roll												
Sleeve	48017-28		Slv. Roll												

a,c,e

Farley MIF AWT Task C Qual Test Results

Item	Ident.	Apper. W/T	Technique	Force	Elev. for AWT meas.	Roll Ht.	1910 psi leak: dpm	Primary 2650 psi leak: dpm	3110 psi leak: dpm	3110 psi leak: dpm	4000 psi leak: dpm	4500 psi leak: dpm	Secondary 5000 psi leak: dpm	Leak 5500 psi leak: dpm	6000 psi leak: dpm
Collar	lt. 1 unit 16														
Tube	7968-32		Tube Hyd.												
Sleeve	48017-30		Slv. Hyd.												
Sleeve	48017-30		Slv. Roll												
Sleeve	48017-30		Slv. Roll												
Collar	lt. 1 unit 18														
Tube	9482-41		Tube Hyd.												
Sleeve	48017-33		Slv. Hyd.												
Sleeve	48017-33		Slv. Roll												
Sleeve	48017-33		Slv. Roll												

a,c,e

Farley MIF AWT Task C Qual Test Results

a,c,e

Item	Ident.	Appar. W/T	Technique	Force	Elev. for AWT meas.	Roll Ht.	1910 psi leak: dpm	Primary 2650 psi leak: dpm	3110 psi leak: dpm	3110 psi leak: dpm	4000 psi leak: dpm	4500 psi leak: dpm	Secondary 5000 psi leak: dpm	Leak 5500 psi leak: dpm	6000 psi leak: dpm
Collar	lt. 2 unit 9														
Tube	7368-29		Tube Hyd.												
Sleeve	48017-18		Slv. Hyd.												
Sleeve	48017-18		Slv. Roll												
Sleeve	48017-18		Slv. Roll												
Sleeve	48017-18		Re-Roll												
Sleeve	48017-18		Re-Roll												
Collar	lt. 2 unit 10														
Tube	7368-33		Tube Hyd.												
Sleeve	48017-19		Slv. Hyd.												
Sleeve	48017-19		Slv. Roll												
Sleeve	48017-19		Slv. Roll												
Collar	lt. 2 unit 11														
Tube	7368-34		Tube Hyd.												
Sleeve	48017-22		Slv. Hyd.												
Sleeve	48017-22		Slv. Roll												
Sleeve	48017-22		Slv. Roll												
Collar	lt. 2 unit 12														
Tube	7368-35		Tube Hyd.												
Sleeve	48017-23		Slv. Hyd.												
Sleeve	48017-23		Slv. Roll												
Sleeve	48017-23		Slv. Roll												
Sleeve	48017-23		Re-Roll												
Sleeve	48017-23		Re-Roll												
Collar	lt. 2 unit 13														
Tube	7368-36		Tube Hyd.												
Sleeve	48017-25		Slv. Hyd.												
Sleeve	48017-25		Slv. Roll												
Sleeve	48017-25		Slv. Roll												
Collar	lt. 2 unit 14														
Tube	7368-34		Tube Hyd.												
Sleeve	48017-27		Slv. Hyd.												
Sleeve	48017-27		Slv. Roll												
Sleeve	48017-27		Slv. Roll												
Collar	lt. 2 unit 15														
Tube	7368-35		Tube Hyd.												
Sleeve	48017-29		Slv. Hyd.												
Sleeve	48017-29		Slv. Roll												
Sleeve	48017-29		Slv. Roll												

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Farley MIF AWT Task C Qual Test Results

Item	Ident.	Appar. W/T	Technique	Force	Elev. for AWT meas.	Roll Ht.	Primary 1910 psi leak: dpm	2650 psi leak: dpm	3110 psi leak: dpm	3110 psi leak: dpm	4000 psi leak: dpm	4500 psi leak: dpm	Secondary 5000 psi leak: dpm	Leak 5500 psi leak: dpm	6000 psi leak: dpm
Collar	lt. 2 unit 16														
Tube	7368-36		Tube Hyd.												
Sleeve	48017-31		Slv. Hyd.												
Sleeve	48017-31		Slv. Roll												
Sleeve	48017-31		Slv. Roll												
Collar	lt. 2 unit 17														
Tube	9482-42		Tube Hyd.												
Sleeve	48017-34		Slv. Hyd.												
Sleeve	48017-34		Slv. Roll												
Sleeve	48017-34		Slv. Roll												
Collar	lt. 2 unit 18														
Tube	9482-45		Tube Hyd.												
Sleeve	48017-35		Slv. Hyd.												
Sleeve	48017-35		Slv. Roll												
Sleeve	48017-35		Slv. Roll												

a, c, e

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