

CLARK ASSOCIATES, INC.
QUALITY ASSURANCE DEPARTMENT
AUDIT OF THE ERECTION OF THE SOUTHEAST
NORTHEAST AND SOUTHWEST QUADRANTS OF THE CONTAINMENT
VESSEL BOTTOM LINER, SKUCKLE
AND TORICONICAL SECTIONS TO
ELEV. 95' ± 3"

AUDIT REPORT #10

CLIENT: Florida Power Corporation

UNIT: Crystal River Unit #3

CONTRACTOR: Chicago Bridge & Iron Company

SURVEILLANCE CONDUCTED BY: C. E. Hoffman, Welding Inspector

DATE: April 19 to April 23, 1971

PERSONS CONTACTED: Mr. John Barman, Field Engineer, CB&I

PROCEDURES: CB&I Quality Control Manual, Volume III

AREA OF AUDIT: Containment liner bottom, knuckle and toriconical section up to Elevation 95' ± 3" and from 0° to 90° to 180° to 270°, clockwise. Also bottom, knuckle and toriconical, channelled feet seams and sump, plus CB&I Site Office Files.

OBJECTIVES: The objective of the audit was to review the completeness of the Contractor's records and documentation for the erection, welding and testing for the area being audited and to perform a Final Quality Assurance inspection of the area before and after placement of concrete.

SUMMARY: The records and documentation that were maintained by the Contractor are complete and readily available at the jobsite. Workmanship of welds and welding in some areas such as plate and attachments to the generator ring foundations, the sump and its channeling system and tack welding of bottom plates, was less than satisfactory and resulted in many repairs before the liner was accepted.

DESCRIPTION OF THE AUDIT:

The audit was conducted by reviewing the various reports, documentation and as-built drawings of the erection, welding and testing and examinations of the containment liner. Inspection reports were also checked for completeness. Special attention was directed towards the following items:

1. List of welders, welding operators and takers and their identifications in connection with the documentation of welds.
2. Welder's, welding operator's and taker's qualification documents.
3. As-built drawings with plate and welder identifications of bottom plates, structural column base plates, knuckle and sump plates, toriconical plates and all connecting welds, radiography locations, radiograph identifications.

END, 4/20/73

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4. Non-destructive testing personnel records and qualifications.
5. Material receipt records.
6. X-ray reports covering the welding in these segments of the containment liner.
7. Liquid Penetrant and Magnetic Particle examination records covering this portion of the liner.
8. Vacuum Box Testing reports.
9. Fluid Solution Halogen and Strength Tests and Pressure Hold Tests of channel covered welds in the bottom, ramp, knuckle and toriconical sections.
10. Certificates of Analysis for welding electrodes.
11. Visual Inspection Test Reports.
12. Checks of erection dimensions in accordance with the Job Specifications.

FINDINGS:

1. Welders, welding operators and tackers were not permitted to weld on any parts of these three quadrants until either a Site Qualification was successfully completed or until their qualification papers, issued by other CH&I projects, were on file at this job site. A list of all qualified welders is kept on file in the site CH&I office for ready reference.
2. Each plate in the 0° to 270° quadrants, including the ramp, is identifiable with stenciled, serialized numbers traceable to CH&I as-built drawings and a Mill Test Report. The as-built drawings identify the welders of each main seam. The radiograph locations are also marked on these as-built drawings together with the radiograph numbers. However, the fillet welds attaching the main channels and canopy angles plus the submergent angles on the outside of the liner are not documented as to specific welders. These welds are identified only to groups of qualified welders. (See Action Taken for further details.) ASME Section VIII, Div-3 (f)
3. Up-to-date records for all NDT personnel are on file and copies of their qualification certificates are posted for viewing at all times.

Liquid Penetrant, Magnetic Particle and Radiographic personnel are qualified to CH&I's "Level A" which is equal to SNT-TC-1A, Level II. The Leak Testing Operator is also qualified to Level "A". All of these men are responsible to Level 3 certified technicians.
4. All material arriving on site, was checked for non-conformance. These materials had also been checked and Certificates of Inspection issued, at the point of manufacture. If the shipping papers did not accompany the shipments these materials were placed on "hold" and not permitted to be used in erection until such papers were on file at the job site.
5. Before welding consumables were used, the Certificates of Analysis were on file at the site. Random certificates were checked for compliance to applicable AWS specifications.

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6. The radiographs were first graded by the Contractor and repairs made as required by the Code. Tracer radiographs were performed as per Code when required. The original exposures, tracer exposures and the repair exposures were then evaluated and accepted by the CAI Inspector and the OWNER. Report forms of all radiographs were filled out by the Contractor and stamped by the CAI Inspector. These forms and radiographs were then accepted by the OWNER for his documentation.
7. Vacuum Box testing reports for the butt joint in the bottom, knuckle and portions of the horizontal section and sump are in order and on file.
8. Liquid Penetrant and Magnetic Particle Examination reports for the main seams and channel fillet welds are up-to-date and on file in the CAI site office.
9. The low pressure soap, strength, halide detection and pressure hold test reports for the main seam, channel and angle canopy welds are in order and on file. These tests were witnessed on a periodic basis by CAI/QA personnel.
10. The Visual Test reports for these three quadrants are up-to-date and on file. These reports cover the visual inspection of welding and adjacent plate surfaces before and after repairs.
11. Reports are on file to cover the periodical check of erection dimensions which were held within the tolerances of Job Specification 5366. Repairs and revisions in the knuckle and horizontal sections are documented.
12. Repair procedures and sketches were submitted by the Contractor for approval, to Florida Power Corporation prior to the repair of leaks through the bottom plating and/or seams of Channel Zone #19 and #56. Corrective Action Request No. 0004 was initiated to cover the method of repair to Zone #19 as the method suggested by the Contractor and approved by Florida Power Corporation did not fulfill the ASME Code requirement. A waiver of this Code requirement is needed to substantiate the method of repair. After the final testing of the repaired seam section a request by Florida Power Corporation to the Contractor necessitated the reopening of the repair area for magnetic particle examination of the beveled bottom plate edges to ascertain that no defects still existed that could cause crack propagation. This examination was carried out by the Contractor and after replacement of repair parts another complete set of tests were carried out that were acceptable. Corrective Action Request No. 0004 was also initiated to cover the repair of the leak through the bottom plate in Zone #56. An acceptable method of repair and examination was proposed by the Contractor and the work was carried out. Final testing of this zone was acceptable.
13. Florida Power Corporation requested the Contractor to move the test pipe connections for Zones #19, #16, #53 and #58 to new locations. This work was carried out by the Contractor and a complete set of acceptable retests were performed on these zones. Test connection pipes to Zones #11, #43 and #10 had been either bent or altered in some way that could effect the integrity of the initial tests. These zones required either complete retesting or pressure hold retests. This rework was satisfactorily carried out by the Contractor. Corrective Action Request No. 007 was initiated when the test connection pipe to Zones #9, #15 and #50 were used in a manner which could produce loss of integrity of previous tests. As no physical damage to these test connections could be observed later, they were accepted in their present condition and pressure was maintained during concrete placement.
14. All internal and external sump zones required a considerable amount of repair as noticeable leaks were evident. Zone #70, in this group, included two 3/4"

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O.D. test pipes, that would necessitate the later testing of the recirculation pipe attachment cavities and the outer liner to cavity canopy angles at the ends of these pipes, inside the Decay Heat pits. To eliminate this latter test procedure the sharp ends of these 1/8" tubes were sealed off by welding, thus incorporating the cavities and canopy angles into Zone #70 channeling. This rearrangement of test points was approved by Florida Power Corporation and will be shown on as-built drawings by the Contractor.

15. The documentation to specific welders, of the fillet welding between the embedment angles and the liner (outside) the channel and canopy angles of the bottom, knuckle and toriconical plates has not been performed.

ACTION TAKEN/REQUIRED:

1. The lack of identification for the welders to specific welds between embedment angles and liner plates and channels and canopy angles to bottom, knuckle and toriconical plates was documented on CAL/QA "Corrective Action Request" number 0010. This problem is not resolved and it may include an approval of a waiver before the quadrants are accepted.
2. The waiver covering the method of repair for Zone #19 is still needed to substantiate the method used.

Prepared by

C. E. Hall
C. E. Hall
Welding Inspector
Quality Assurance

Reviewed by

Franky [Signature]
F. S. Allen
Project Engineer
Quality Assurance

CMM/cmc

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GILBERT ASSOCIATES, INC.

ENGINEERS AND CONSULTANTS

April 15, 1971

WPC #3364
300-M-3.1

51-5560

NAME	DATE

Mr. M. E. Kleinman
Manager Quality Product
Florida Power Corporation
Post Office Box 14042
St. Petersburg, Florida 33733

Re: Florida Power Corporation
Crystal River Unit #3
Containment Vessel Liner

Dear Mr. Kleinman:

This is in answer to your telephone request of 4/14/71 for our interpretation and justification for welder identification and traceability on attachment and butt channel welds.

The Specification W-500 Paragraph 4.04 requires that details of fabrication and workmanship shall conform to ASME Section III Class B. The ASME Section III Class B code Paragraph B-1110 in turn refers to ASME Section VIII. Paragraph W-371 requires traceability of welder to weld. It does not distinguish types of welds. Paragraphs W-304 and W-310 discuss attachment welds and these paragraphs do not take exception to traceability requirements in fact they indicate that the rest of the code requirements on welds apply. Therefore, the specification and referenced codes require traceability of welders on attachment welds and butt channel welds as well as butt joints.

The technical reasons for our insistence upon this requirement are as follows:

1. Attachment welds of reinforcement angles - If during the testing of the containment vessel these welds fail, there will be a need to isolate some possible causes of failure and what welds might be involved.
2. Butt channel welds - If during any subsequent testing of the channels there develops a leak, it will not matter whether the leak is in the channel or the main stem. The plant will have to be shut down while concrete is removed, the leak located and the area repaired. At that point it may become necessary to test other channels welded by the same welder.

In general the emphasis on traceability of structural welds is increasing on all nuclear jobs.

Very truly yours,

Frank Hillman
F. S. Hillman

Project Engineer
Quality Assurance

FSA/cii

Regarding welder identification on the line.
The latter obviously is his interpretation of the code.

Another interpretation could be in that VW-37f applies to pressure weld joints & not specifically attachments. I believe this is the intent. VG 30d & VWH discuss attachment welds in the form of ripples etc again pressure vessels or to stiffening rings again a strengthened part of the line related to its ability to hold pressure is not as a structural member.

I have no reservations about meeting the code on the above items.

I believe the phrase that we have is attachment welds such as clip angle for

doct. language etc. My interpretation of the code is that ~~no~~ identification is not required for items such as this and if required would be beyond the scope of the CB & P document.

I suggest that we (FPC) will have to sit down and identify all items (except the above) that we want identification on as a matter of good judgement. In other words we're right back where we started.

W. Knight

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CEMENT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT
SUPPLEMENTARY SHEET

CLIENT Florida Power Corporation
UNIT Crystal River #3

DATE April 22, 1972

PREPARED BY C. E. Hoffman

SHEET NO. 1 of 1

STRUCTURE Containment Liner

NOTATION

COMMENTS

About 70 radiographs were read this evening and all punched summaries. The reports will be stamped tomorrow evening.

One new welder took his qualification test this shift.

The test connection pipe for Zone #57 will be moved tomorrow afternoon.

Penetration Assembly #53-1 is being installed this evening.

Workmen worked on the pick-ups that were marked yesterday evening between El. 130' and 140'.

Several channelled zones on the shell were halogen tested on the outside this evening. No leaks were found.

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**CHILBERT ASSOCIATES, INC.
QUALITY ASSURANCE DEPARTMENT
SURVEILLANCE OF THE ERECTION OF THE NORTHWEST
QUADRANT OF CONTAINMENT VESSEL BOTTOM LINER,
KNUCKLE AND TORICOMICAL SECTION TO ELEV. 93' + 3"
SURVEILLANCE REPORT 04**

CLIENT: Florida Power Corporation

Plant: St. Johns River Unit #3

Contractor: Chicago Bridge & Iron Company

SURVEILLANCE CONDUCTED BY: C. R. Hoffman

DATE: February 25th to March 3rd, 1971

PERSONS CONTACTED: Mr. John Harman of CBI

PROCEDURES: CBI Quality Control Manual Vol. III

AREA OF SURVEILLANCE: Northwest Quadrant (270° to 0°) of Containment liner bottom, knuckle, portion of toricomical section and channelled rest house, CBI Site Office Files

OBJECTIVES: The objective of the surveillance was to review the completeness of the contractor's records and documentation for the erection, welding and testing of area under surveillance and to perform a final Quality Assurance Inspection of the Area before concrete placement.

SUMMARY:

The records and documentation that were maintained by the contractor are complete and readily available. However, some records should have been kept that weren't. Workmanship of welds in general and knuckle to bottom plate weld in particular was less than satisfactory.

DESCRIPTION OF THE SURVEILLANCE:

The surveillance was conducted by reviewing various reports from all phases of documentation on the erection, welding and testing of the area under surveillance and inspection of the finished welds and markings. Special attention was directed towards the following items:

1. List of welders, welding operators and tackers and their identification in connection with the documentation of welds and welding.
2. Welder's qualification documents
3. As-built drawings with plate and welder identifications of bottom plates and structural column base plates, knuckle plates and connecting welds, toricomical plates and connecting welds, Radiograph locations and film numbering.

4. Non-destructive testing personnel records and qualifications
5. Material receipt records
6. Certificates of Analysis for welding consumables
7. X-ray reports covering the welding in this segment of the containment liner
8. Liquid Penetrant examination records for this portion of the liner
9. Vacuum box testing reports
10. Fluid Solution tests, Halogen tests, strength tests and pressure hold tests of the structural channels covering all butt welds in bottom, haunches and toriconical plate seams.
11. Visual test reports

12. See specifications.

FINDINGS:

1. Welders, welding operators and takers were not permitted to weld until a site qualification was successfully completed and a qualification document was on file or a qualification document initiated at another CHAI job was on file. A list of qualified welders, operators and takers is kept up-to-date. This information is on file and ready for immediate reference. However, the weld procedure using submerged automatic welding was not approved prior to use on bottom liner butt welds. See "Action Taken" for details.
2. Each plate in the northeast quarter is identified with attached, serialized numbers traceable to a CHAI as-built drawing and a mill test report. All welding of these plate seams is marked on the as-built drawings as to the welder identification both inside and outside. The radiograph locations and numbers are located on these drawings. However fillet welds of the test channels to the plates are not documented as to the welder identification nor are the fillet welds of the anchor angles on the outside. This is a violation of the specification and referenced codes. See "Action Taken" for further details.
3. Up-to-date records for all NDT personnel and copies of their certificates are on file. Liquid Penetrant, Magnetic Particle and Radiograph examinations are performed by or under the direct supervision of a Level A personnel which is equivalent to ASNT-TC-1A Level II. However, the vacuum box, halogen test and pressure test was not performed by certified personnel.
4. All material arriving at the job site was checked for conformance to codes and specifications. If the shipping papers did not accompany the shipment, the materials were put on "HOLD" and not permitted to be used in fabrication until such papers were on file at the site.
5. Before welding consumables were used the certificates of analysis were

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on file at the site. Several certificates were checked on a random basis and found to be in conformance to the applicable AWS specifications.

6. The radiographs were reported on a reader report form after being graded, after repaired and reradiographed. All the radiographs were presented to CAL/QA and the Owner's representative for approval and stamping. The films are on file at the site. The CB&I report forms with welder identification have been signed and stamped by the CAL/QA.
7. Liquid Penetrant Examination of the main seams and fillet were reported on CB&I Liquid Penetrant Inspection Reports. These reports are up-to-date and on file at the site.
8. Vacuum Box testing reports for the butt joints are in order and on file.
9. The low pressure soap test, the strength test, halide detection test and the pressure hold tests for the channels are reported in the "Leak Test Record". This documentation for the H.W. is complete, witnessed by CAL/QA, signed off and on file. A description of this testing and the necessary repair work is documented by CB&I and on file.
10. The visual test reports for this quadrant are up-to-date and on file. These reports cover the visual inspection of all welding including the repairs and subsequent reinspection.
11. Reports were initiated to cover the erection dimensions which are specified with appropriate tolerances in specification 5566. Repairs and deviations in the knuckle and toriconical sections are documented.

ACTION TAKEN/REQUIRED:

1. The lack of approval for the submerged automatic welding procedure for the bottom liner butt welds was documented on CAL/QA Deficiency Report 0010. CB&I qualified the procedure after welding most of the bottom liner and obtained approval after several revisions to that procedure.
2. The lack of identification for the welders on the test channel fillets and the anchor angles welds was documented on CAL/QA "Corrective Action Request" number 0010. The corrective action and disposition for this problem may include an approval of a waiver before the quadrant is approved.
3. The very poor general workmanship of the welding by CB&I was documented on Corrective Action Request number 0001 by CAL/QA. CB&I reinspected the areas and corrected the condition as much as possible. This item will be watched more closely in the future by CB&I and CAL/QA.
4. The vacuum box, halogen test and pressure test personnel should be certified by CB&I or watched more closely by CB&I QC supervisor.

Prepared by

C. R. Hoffman

Resident Welding Inspector
Quality Assurance

Approved by

F. S. Adams

Project Engineer
Quality Assurance

CAL/QA/CNC

OLSEN ASSOCIATES, INC.
DAILY QA QUALITY ASSURANCE REPORT
SUPPLEMENTARY SHEET

CLIENT: Florida Power Corporation
NEW Crystal River #3

DATE: March 19, 1971

PREPARED BY: G. E. Hoffman

TEST NO. 1
STRUCTURE: Containment 3007

REVISION: COMMENTS

Channel repair and testing continued this night shift with the following results.

- Zone #19 WFO had ordered CHAI to move the test connection, which was located directly on the north-south pour line of the north-west quarter that is to be poured on Monday, March 22nd. The connection was gauged off and moved about four feet east, in the north-east quarter. The replaced channel section over the doubler repair could not be halogen tested due to too much water laying on the bottom. The operator performed a Hold Test but it failed. As this zone had passed the Hold Test prior to the repair channel being removed the last time, it should pass the Hold Test if there are no "fine leaks" normally only found by halogen testing. This latter testing can be performed after the pour of the north-west quarter as all the revisions to the zone will be testable.
- Zone #16 Orders were also given CHAI to remove the test connection of this zone, which is at the edge of the box-out for "reactor control", and install it east of the box-out. This was completed but this zone will now require a complete retest.
- Zone #71 CHAI was requested to complete the testing of the bottom portion of this dump zone so that the dump bottom can be poured. The vertical escape angle in the north-west corner was cut out and channel near the horizontal channels. A pressure test was then conducted on this portion to ascertain if any repairs should be needed. The results of this "preliminary" test are not known for this report.
- Zone #2 The test connection for this zone also falls on the line of the first pour (north-south line) and should be moved prior to the start of the pour. No WFO personnel were available at 5 PM this evening to authorize a change by CHAI.
- Zone #28 It was noted this evening that the test connection for this zone also falls directly on the north-south pour line but in the south-west quarter.

A final check was made by this writer this evening to ascertain if all the welding of embedded angle fillets below EL. 25' has been accomplished before pouring the north-west quarter. One angle was marked for completion this shift.

Four new welders started this evening. All had their papers from other CHAI jobs.

GILBERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SUPPLEMENTARY SHEET

Client: Florida Power Corporation
Unit: Crystal River #3

DATE: March 18, 1973

SHEET NO. 1 OF 1

PREPARED BY: E. J. Hoffman

STRUCTURE: Containment Liner

NOTATION

COMMENTS

Testing and repairs of channelled seams continued this shift as follows:

Zone #19 The replaced channel over the repair area was fluid solution tested and one leak was noted and repaired. This writer was informed by Mr. Dan Padrick this afternoon that the test connection for Zone #19, which is located directly on the pour edge of the northwest quadrant, will be relocated. Instructions for this work will be given to CHM Area #70.

Zone #26 The reworking of the channel over the repaired area was completed this shift. Testing or retesting of this zone is expected to start tomorrow.

Zone #71 The lower portion of this dump zone is being segregated for testing tomorrow.

Zone #55 Rebuilding of the damper connection between the bottom and wing side plate in the areas where the damper angle had been gouged off was carried out this shift. CHM is waiting for a delivery of damper angle in order to replace these portions of angle.

A final inspection of the girth weld(s) at EL. 103' (inside) was carried out this shift.

Installation and welding of sections of battens is continuing.

70 beam stiffeners for around construction opening (Mark 18-1, Fig. 38) are being prepared for installing. Part 18-7 have been welded to the shell.

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GILBERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SURVEILLANCE OF CONTAINMENT VESSEL LINER ERECTION

CLIENT Florida Power CorporationUNIT Crystal River #3PREPARED BY G. E. Hootman TITLE Welding InspectorSHEET 1 OF 1DATE March 18, 1977 CONTRACTOR Chicago Bridge & Iron CompanyITEM AND/OR AREA BEING INSPECTED Containment liner erection, welding and testing.

A. RECEIPT INSPECTION

YES NO

1. Lot or plate markings checked on arrival X —
2. Component markings checked X —
3. Mill analysis certificates received with material — X
4. Mill analysis certificates available for reference — X
5. Elongation specimens checked with Certificates of Analysis X —
6. Elongation other than low-hydrogen tested — X
7. For what purpose — —
8. Nonconforming and damaged material segregated and tagged X —

B. STORAGE AND HANDLING

1. Plate and component stored properly See Comment
2. Storage stored according to procedure X —
3. What storage temperature for low-hydrogen storage 20°F Min.
4. Acid wetting flux stored in procedure X —
5. Does Contractor recycle low-hydrogen electrodes — X NE
6. At what temperature — —
7. Storage and handling show good housekeeping X —

C. QUALIFICATIONS

YES NO

1. Welder's tests supervised adequately X —
2. Requirements of ASME Section IX fulfilled X —
3. Adequate quality evidence of low welders X —
4. NDT personnel qualified periodically as required X —
5. Leak testing apparatus supervised by Level II X —
6. NDT interpretation by Level II X —
7. All leak welders qualified X —
8. Any attempts made to use unqualified procedures NE NE

D. CLEANING, FITUP AND WELDING REQUIREMENTS

1. Water, dirt, paint, scale, etc. being removed X —
2. Weld prep and fitup surfaces being cleaned X —
3. Cleaning interpass X —
4. Completed welds being cleaned X —
5. Correct root opening being maintained X —
6. Correct bevel angle being maintained X —
7. Plate alignment within code limits X —
8. Plate fitup to backing bar correct N/A —

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CLIENT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SURVEILLANCE OF CONTAINMENT VESSEL LINER ERECTION

CLIENT Florida Power Corporation

UNIT Crystal River #3

PREPARED BY J. E. Hoffman TITLE Welding Inspector

DATE March 18, 1978

CONTRACTOR Chicago Bridge & Iron Company

ITEM AND/OR AREA BEING INSPECTED Containment liner erection, welding and testing.

YES		NO		YES		NO	
1. Splice angles fitted correctly	<u>N/A</u>			6. Operator appears experienced	<u>—</u>	<u>—</u>	
10. Inert gases fitted according to design drawings	<u>X</u>	<u>—</u>		7. Surveillance furnished	<u>—</u>	<u>—</u>	
11. Direction of welding according to procedure	<u>X</u>	<u>—</u>		8. Next cycle starts suitable for reference	<u>—</u>	<u>—</u>	
12. Only low-hydrogen electrodes being used	<u>X</u>	<u>—</u>		F. WELD AND ERECTION TOLERANCES			
13. Welders authorized elsewhere for one shift	<u>X</u>	<u>—</u>		1. Area weld sequence correct	<u>X</u>	<u>—</u>	
14. Unused electrodes returned to storage at end of shift	<u>X</u>	<u>—</u>		2. Area weld reinforcement in	<u>X</u>	<u>—</u>	
15. Wet electrodes dropped	<u>X</u>	<u>—</u>		3. Area weld reinforcement according to code	<u>X</u>	<u>—</u>	
16. Primary voltage constant	<u>X</u>	<u>—</u>		4. Filled weld cavity within code limit	<u>X</u>	<u>—</u>	
17. Welding equipment and cables kept in good order	<u>X</u>	<u>—</u>		5. Size of fillets correct	<u>X</u>	<u>—</u>	
18. Each welder's work being recorded	<u>X</u>	<u>—</u>		6. Weld appearance acceptable	<u>X</u>	<u>—</u>	
19. Preheating carried out to spec.	<u>N/A</u>			7. Any undercutting	<u>X</u>	<u>—</u>	
20. Temperature monitoring being used	<u>N/A</u>			8. Flare and component identification being transferred to sketch drawings	<u>X</u>	<u>—</u>	
G. POSTWELD TREATMENT				9. Overall out-of-roundness within spec.	<u>X</u>	<u>—</u>	
1. Thermocoupling attached correctly	<u>—</u>	<u>—</u>		10. Flare line deviation within limit	<u>X</u>	<u>—</u>	
2. Thermocoupling located correctly	<u>—</u>	<u>—</u>		11. Temperature to design condition held	<u>N/A</u>	<u>—</u>	
3. Withstand supported correctly	<u>—</u>	<u>—</u>		12. Deviation from round is 10 ft within spec.	<u>X</u>	<u>—</u>	
4. Insulation adequate	<u>—</u>	<u>—</u>		G. LEAK TESTING			
5. Recorder operating correctly	<u>—</u>	<u>—</u>		1. Helium	<u>N/A</u>	<u>—</u>	
				2. Xenon tested	<u>N/A</u>	<u>—</u>	

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CLIENT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT
SURVEILLANCE OF CONTAINMENT VESSEL LINER ERECTION

CLIENT Florida Power CorporationUNIT Crystal River #3PREPARED BY C. H. Hoffman TITLE Welding Inspector SHEET 504 17DATE March 18, 1971 CONTRACTOR Chicago Bridge & Iron CompanyITEM AND/OR AREA BEING INSPECTED Containment Liner erection and welding, and testing.

1. <u>2.</u> <u>Shap Inspect</u>	<u>Zone #19</u>	1. DOCUMENTATION	YES NO
<u>Zone tested</u>	<u>Repair Area</u>	1. NDT reports recorded on sketch drawings	<u>X</u> <u>—</u>
3. <u>Visual Exam</u>	<u>None</u>	2. Test areas recorded by contractor	<u>X</u> <u>—</u>
<u>Area tested</u>	<u>None</u>	3. Documentation available for reference	<u>X</u> <u>—</u>
M. NDT EXAMINATIONS		K. NONCONFORMANCE	
1. <u>Liquid penetrant</u>	<u>None</u>	Contractor's QA or QC immediately initiate corrective action when advised verbally	<u>X</u> <u>—</u>
<u>Areas examined</u>	<u>None</u>	2. Issues of DOR's	<u>See Comment</u>
2. <u>Magnetic Particle</u>	<u>See Comment</u>		
<u>Areas examined</u>	<u>Quadrant 2 Outside</u>		
3. <u>Radiographic</u>	<u>None</u>		
<u>Scans examined</u>	<u>None</u>		
4. <u>Ultrasonic</u>	<u>N/A</u>		
<u>Area or item examined</u>	<u>N/A</u>		
L. DESTRUCTIVE TESTS			
<u>Welds tested</u>	<u>None</u>		
<u>Test coupon bending</u>	<u>None</u>		

COMMENTS: 1. The 17-A, B, C and D Shell Plate Assemblies have been carefully secured to railroad cars for shipment and have been stacked carefully here at jobsite. In view of this it is possible that this form of handling could have some bearing on the irregular shape that these assemblies take at the top edge, after they are erected. This improper stacking is being corrected.

2. Considerable undercutting appears after manual welding of joint seams but these defects are marked and repaired. No undercutting is permitted to remain.

3. The fillet welding of 15 angle embeddings in each quadrant are being

NOTE: USE SUPPLEMENTARY SHEET SAQA001115 FOR ADDITIONAL COMMENTS

SAQA001115
02/70

ATTACH 'B'

SNEs 90-0532

Rb. 5/1/73

GILBERT ASSOCIATES, INC.
EARLY ON QUALITY ASSURANCE REPORT
SUPPLEMENTARY SHEET

CLIENT Florida Power Corporation
Unit Crystal River 23

DATE March 18, 1973

SHEET NO. 17

OF 27

PREPARED BY C. E. Hoffman

STRUCTURE Containment Diner

NOTATION

COMMENTS

examined by RT plus 20% of the shell seams (inside and outside) in all quadrants. Areas are being marked for repair.

K. 2: "Corrective Action Request" No. 0010 was given to OMI on March 15th. An answer to this request has not been received at this writing.

16. 52/73

For Das strig

~~Vacuum Box Test Knap in Case~~

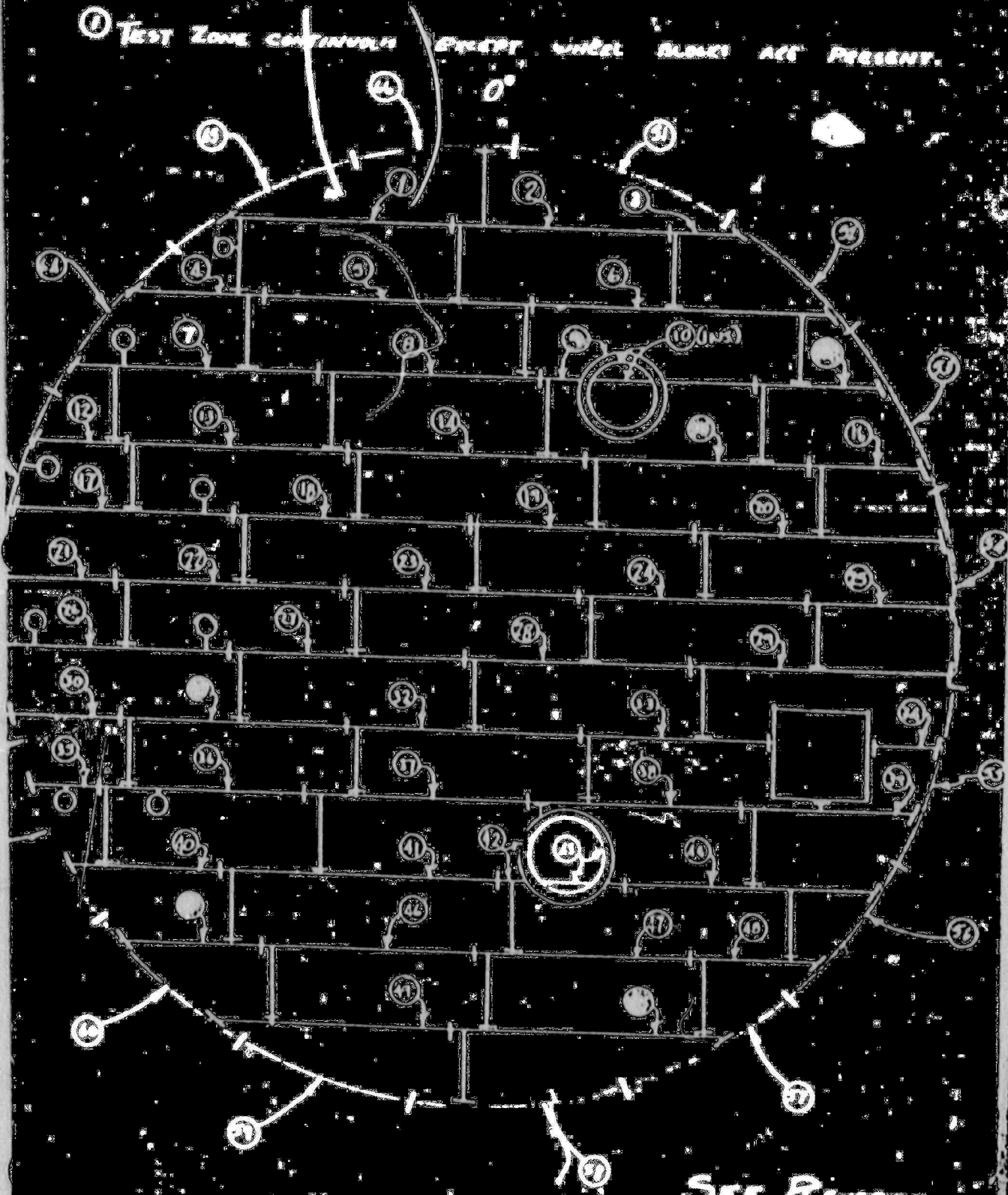
607/2000, on
down grade
S. 1
3-22-71

ATTACH 'B'

SWES

9-0532

① Test Zone continuous except under blank air present.



SEE REVERSE

GILBERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT
SUPPLEMENTARY SHEET

CLIENT Florida Power Corporation
UNIT Crystal River #3

DATE March 11, 1973

PREPARED BY C. R. Hoffman

NOTATION

COMMENTS

SHEET NO. 1 OF 1
STRUCTURE Containment Liner

Channel zone testing continued this evening with some progress being made in the Bump. The following operations were carried-out:

Zone #67 was Fluid Solution tested and is acceptable.

" #68 was cleaned and a test connection will now be welded in place.

" #69 was Helogen Tested and two leaks were found and repaired. The zone was retested and is now ready for a Hold Test.

" #70 was cleaned and Helogen Tested. No leaks were found so this test passed.

" was Hold Tested but failed the test. Another Hold Test will be run tomorrow evening as the failure this evening may have been caused by temperature change.

" #71 The canopic angle in two places had been removed and leaks found with the vacuum box and then repaired. These areas were liquid penetrant examined and no indications were noted. This zone had previously been sectioned for testing to locate leaks and is now being reconnected for further testing.

Zone #19 The channel over the former repair was gouged off. The doubler will be gouged off and the bottom plate edges around the area of the gouged crack will be liquid penetrant examined and magnetic particle examined.

Zone #56 Awaiting final instructions to go ahead with the repair or rewelding of the gouged bottom plate.

Splicing of Battress sections was started this evening.

Vacuum box testing of the toriconical seams was completed this evening. Operators tested outside the sections of vertical seams way of wind-girder in Ring #4 that cannot be tested inside due to this wind-girder passing over the seams. CB&I will try to vacuum box test the vertical seams of each ring before the wind-girders are erected then all the testing can be done inside the liner.

ATTACH 'B'

SALES 90-0532

R6. 54/73

GILBERT ASSOCIATES, INC.
QUALITY ASSURANCE
SUPPLEMENTARY SHEET

CLIENT Florida Power CorporationUNIT Crystal River #5DATE March 4, 1971PREPARED BY G. R. HoffmanSHEET NO. 1 OF 1

NOTATION

COMMENTS

STRUCTURE Containment Liner

Channel zone testing and crack examination continued this evening with three Hold Tests of Zones 37, 58 and 76. All passed the test. This leaves only two more zones to complete testing besides the five Sump zones.

Zone #56 where the defect in the bottom plate has been found has been ground off smooth and then was liquid penetrant inspected. This examination showed the defect distinctly. This writer talked with Mr. James Sisk of CH&I over a long distant telephone circuit to Birmingham relative to our request for them to cut out the defect in such a manner that it would have the plate material from one side of the defect, for examination. Mr. Sisk then instructed their QA Supervisor here to gouge out the section but to give the one side piece to FPC for handing over to GAI.

A rectangular section about 1" wide and a little more than the length of the visible defect was gouged out with a chipping gun. This produced two separate pieces, one for each side of the defect. Upon the removal of the rectangular section it exposed the embedded tee but the inward side of the gouged plate section did not quite come to the inward edge of the tee flange. It was impossible to use a regular grinder to pre-smooth with a chipping tool. A liquid penetrant examination was then performed on the beveled edges of the opening. Some linear indications were noted by this writer and he requested the Contractor to remove these. The latter were removed with a high-speed burring tool and then the surfaces reexamined again by liquid penetrant method and magnification examination. No further indications were noted. Another liquid penetrant examination will be performed on this same area tomorrow afternoon. Other pictures should now be taken of the present preparation.

During this writer's conversation with Mr. James Sisk he was requested not to make any repair to Zone #56 until all parties (FPC, GAI and CH&I) had agreed on the manner of repair.

Several transmittal photos were taken by Mr. John Herman this evening of the top of Ring #4 in preparation for the erection of Ring #5.

Penetration Assembly which contains Penetration #206 and #207 was fitted into Ring #1 this evening.

This writer requested a copy of the Field Repair Procedure for altering Penetration Assembly #205.

GILBERT ASSOCIATES, INC.
 QUALITY ASSURANCE DEPT.
 SUPPLEMENTARY SHEET

CLUNA Florida Power Corporation
 UNIT Crystal River #3

DATE March 2, 1971

PREPARED BY C. N. Hoffman

SHEET NO. 1 OF 1
 STRUCTURE Containment Liner

NOTATION

COMMENTS

Channelled zone testing continued this Night Shift with the following results:

Zone #77 Hold Test passed.

#42 Hold Test of the reconnected sections (#7) passed with only a .4 loss for the two hours. Evidently (and just by chance) the serious leak that was originally found in this zone, was accidentally repaired in the damming of the split section.

#58 Halogen Tested inside and outside and passed.

#59 Halogen Tested outside and passed.

#78 " " " " " "

#60 " " " " " "

#79 " " " " " "

#56 This zone, as reported previously, had a serious leak but with no observable leak either with fluid solution or halogen. This zone channel covers the weld between the knuckle and bottom plate and has four knuckle verts within the zone. This evening the NDT operator pressurized the zone with halogen and air and tested the outside. The Freon leakage was so volatile that the leak itself could not be pin-pointed from the outside. The zone was then cut in half with a dam and retested. The pressure continued to drop rapidly indicating that the leak was in the portion with the test connection. This section was then halved and when the dam was being installed a crack was noted next to the dam, starting at the inward edge of the knuckle to bottom butt weld and progressing for approximately 1" into the bottom plate or transversely to the weld. The crack had propagated to the fillet weld of the channel to bottom plate but had been held from progressing further by the fillet weld. The crack was exposed by grinding to the plate surface and removing the channel for a distance of about 2 1/2" each side of the crack. The crack was then dye-checked. No further work was done in this zone. The defect was reported to Mr. James Sisk. Pictures of the defect will be taken tomorrow morning.

Workmen continued to fair the shell plate, 6" strip repair in the southeast quadrant this evening.

Penetration Assembly #105 was installed this PM but build-up of the 3/8" transition to 3/4" for a length of about 6" will have to be done and a tapering of the 3/4" insert plate edge for the same length will also have to be done before welding can commence.

Section of channel to bottom fillets were liquid penetrant examined this shift.

ATTACH 'B'

SUES 90-0532

PC. 56/73

GILBERT ASSOCIATES, INC.

QUALITY ASSURANCE REPORT

SUPPLEMENTARY SHEET

Client: Florida Power Corporation

Unit: Crystal River #3

DATE: March 1, 1971

PREPARED BY: C. H. Hoffman

SHEET NO. 1 of 1

STRUCTURE: Containment Liner

NOTATION

COMMENT

Testing of channels began continued this Night Shift with the following results:

Zone #50 Hold Test passed

" #77 " " "

" #60 " " "

" #42 Hold Test of the 4th part of the canopy angle (Northwest) passed. After this fourth section was Hold Tested the other three sections of this zone were reconnected and a Hold Test performed. This test also passed. Tomorrow evening all four sections of this zone will be reconnected for another Hold Test.

Zone #56 Helogen Tested (inside) and pressure could not be maintained due to a serious leak. This will be probed further tomorrow evening.

Zone #57 Helogen Test (inside) passed.

" #55 Helogen Test passed.

" #76 " " (inside) passed.

CB&I workmen continued to fair areas of the 6" strip repair at El. 103'.

CB&I has been instructed by their Birmingham office to install Penetration Assembly #105 and make the necessary alterations to rectify mislocation of the insert plate, after tacking in position in the shell.

March '8'

5229 90-0532

Pg. 57/73

OLBERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SURVEILLANCE OF CONTAINMENT VESSEL LINER ERECTION

CLIENT Florida Power Corporation

UNIT Crystal River 23

PREPARED BY C. R. Hoffman TITLE Welding Inspector

SHEET 1 OF 3

DATE February 26, 1971 CONTRACTOR Chicago Bridge & Iron Company

ITEM AND/OR AREA BEING INSPECTED Containment Liner

A. RECEIPT INSPECTION		YES	NO			YES	NO
1.	Linear plate identities checked on arrival	<u>X</u>	<u>—</u>	C. QUALIFICATIONS			
2.	Component identities checked	<u>X</u>	<u>—</u>	1.	Welder's tests supervised adequately	<u>X</u>	<u>—</u>
3.	MW analysis certificates received with material	<u>—</u>	<u>X</u>	2.	Requirements of ASME Section IX fulfilled	<u>X</u>	<u>—</u>
4.	MW analysis certificates available for reference	<u>—</u>	<u>X</u>	3.	Adequate quality evidence of new welders	<u>X</u>	<u>—</u>
5.	Electrode containers checked with Certificates of Analysis	<u>X</u>	<u>—</u>	4.	NDT personnel qualified periodically as required	<u>X</u>	<u>—</u>
6.	Electrodes other than low-hydrogen received	<u>XXX</u>	<u>X</u>	5.	Leak testing operators supervised by Level II	<u>X</u>	<u>—</u>
7.	For what purpose	<u>—</u>	<u>—</u>	6.	NDT interpretation by Level II	<u>X</u>	<u>—</u>
8.	Nonconforming and damaged material segregated and tagged	<u>X</u>	<u>—</u>	7.	All tack welders qualified	<u>X</u>	<u>—</u>
B. STORAGE AND HANDLING				8. Any attempts made to use unqualified procedures			
1.	Plate and components stored orderly	<u>X</u>	<u>—</u>	D. CLEANING, FITUP AND WELDING REQUIREMENTS			
2.	Electrodes stored according to procedure	<u>X</u>	<u>—</u>	1.	Water, dirt, paint, scale, etc. being removed	<u>X</u>	<u>—</u>
3.	What storage temperature for low-hydrogen electrodes	<u>250 F° Min.</u>	<u>—</u>	2.	Weld prep. and fitup surfaces being cleaned	<u>X</u>	<u>—</u>
4.	Auto welding flux stored to procedure	<u>X</u>	<u>—</u>	3.	Cleaning inspection	<u>X</u>	<u>—</u>
5.	Does Contractor recycle low-hydrogen electrodes	<u>—</u>	<u>X</u>	4.	Completed welds being cleaned	<u>X</u>	<u>—</u>
6.	At what temperature	<u>—</u>	<u>—</u>	5.	Correct root openings being maintained	<u>X</u>	<u>—</u>
7.	Storage and handling show good housekeeping	<u>X</u>	<u>—</u>	6.	Correct bevel angle being maintained	<u>X</u>	<u>—</u>
				7.	Plate alignment within code limits	<u>X</u>	<u>—</u>
				8.	Plate fitup to backing bars correct	<u>N/A</u>	<u>—</u>

ATTACH 'B'

SNES 90-0532

R6. 58/73

OILBERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SURVEILLANCE OF CONTAINMENT VESSEL LINER ERECTION

CLIENT Florida Power CorporationUNIT Crystal River #3PREPARED BY G. R. Hoffman TITLE Welding Inspector

SHEET 3 OF 3

DATE February 26, 1971 CONTRACTOR Chicago Bridge & Iron CompanyITEM AND/OR AREA BEING INSPECTED Containment Liner

YES		NO		YES		NO	
9. Splice angles fitted correctly	<u>N/A</u>			6. Operator appears experienced	<u>—</u>	<u>—</u>	
10. Insert plates fitted according to design drawings	<u>X</u>	<u>—</u>		7. Surveillance furnished	<u>—</u>	<u>—</u>	
11. Direction of welding according to procedures	<u>X</u>	<u>—</u>		8. Heat cycle charts available for reference	<u>—</u>	<u>—</u>	
12. Only low-hydrogen electrodes being used	<u>X</u>	<u>—</u>		F. WELD AND ERECTION TOLERANCES			
13. Welders withdrew electrode for one shift	<u>X</u>	<u>—</u>		1. Auto weld sequence correct	<u>X</u>	<u>—</u>	
14. Unused electrodes returned to storage at end of shift	<u>X</u>	<u>—</u>		2. Auto weld reinforcement to code	<u>X</u>	<u>—</u>	
15. Wet electrodes scrapped	<u>X</u>	<u>—</u>		3. Butt weld reinforcement according to code	<u>X</u>	<u>—</u>	
16. Primary voltage constant	<u>X</u>	<u>—</u>		4. Fillet weld contour within code limit	<u>X</u>	<u>—</u>	
17. Welding equipment and cabling kept in good order	<u>X</u>	<u>—</u>		5. Size of fillets correct	<u>X</u>	<u>—</u>	
18. Each welder's work being recorded	<u>X</u>	<u>—</u>		6. Weld appearance acceptable	<u>X</u>	<u>—</u>	
19. Preheating carried out to spec.	<u>N/A</u>	<u>—</u>		7. Any undercutting	<u>X</u>	<u>—</u>	
20. Temperature recorder being used	<u>N/A</u>	<u>—</u>		8. Plate and component identities being transferred to as-built drawings	<u>X</u>	<u>—</u>	
E. POSTHEAT TREATMENT <u>N/A</u>				9. Overall out-of-roundness within spec.	<u>X</u>	<u>—</u>	
1. Thermocouples attached correctly	<u>—</u>	<u>—</u>		10. Plumb line deviation within limit	<u>X</u>	<u>—</u>	
2. Thermocouples located correctly	<u>—</u>	<u>—</u>		11. Tangent line to dome transition held	<u>N/A</u>	<u>—</u>	
3. Weldment supported correctly	<u>—</u>	<u>—</u>		12. Deviation from round in 10 ft within spec.	<u>X</u>	<u>—</u>	
4. Insulation adequate	<u>—</u>	<u>—</u>		G. LEAK TESTING			
5. Recorder operating correctly	<u>—</u>	<u>—</u>		1. Halogen	<u>—</u>	<u>—</u>	
				2. Zones tested	<u>Zone #77</u>	<u>—</u>	

OILBERT-41.27
2/2/71

ATTACH 'B'

SHEETS 90-0532

PG. 59/73

DILBERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SURVEILLANCE OF CONTAINMENT VESSEL LINER ERECTION

CLIENT Florida Power Corporation

UNIT Crystal River #3

PREPARED BY C. B. Hoffman TITLE Welding Inspector

SHEET 308 OF 3

DATE February 26, 1971 CONTRACTOR Chicago Bridge & Iron Company

WELD AREA BEING INSPECTED Containment Liner

2. Edge bubble
Zone(s) tested

None

3. Vacuum Box
Area tested

Orbit welds

M. NDT EXAMINATIONS

1. Liquid penetrant
Areas examined

None

2. Magnetic Particle
Areas examined

None

3. Radiographic
Seams examined

Rephotos

4. Ultrasonic
Area or item examined

N/A

I. DESTRUCTIVE TESTS

Welder(s) tested

None

Test coupon bending

None

J. DOCUMENTATION

YES NO

1. NDT reports recorded on
as-built drawings

X

2. Test areas recorded by
contractor

X

3. Documentation available
for reference

X

K. NONCONFORMANCE

1. Contractor's QA or QC
immediately initiate cor-
rections when advised
verbally

X

2. Status of PDR's

None

COMMENTS:

NOTE: USE SUPPLEMENTARY SHEET GAUCHPT 115 FOR ADDITIONAL COMMENTS

GAUCHPT 115/27
8/2/70

ATTACH 'E'

SALES 90-0532

Pg. 60/73

GILBERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT
SUPPLEMENTARY SHEETCLIENT Florida Power Corporation
UNIT Crystal River #3DATE February 26, 1971PREPARED BY C. R. HoffmanSHEET NO. 1 OF 1STRUCTURE Containment Liner

NOTATION

COMMENTS

Channel zone testing continued this evening with a Hold Test of #48 and #59. Both zones passed. Hold type tests were also performed on three sections of Zone #42 which is around the outside of generator ring south. All tests passed which indicated that the leak in this zone is not in these three sections. The balance of the zone consists of a section of angle canopic around the west side. A test connection was then welded into this remaining part and a hold type test conducted. There was some loss of pressure which would have failed an official hold test. It is undecided at this point what will be done. The canopic angle can be gouged away to expose the bottom plate to ring, groove weld but I still do not know the location of the leak. The only solution could be to weld across over the old weld hoping that the additional weld would seal the leak. This situation could be avoided altogether if the channeling system was embedded in the concrete and the bottom plates laid on top to expose all pressure barrier welds for positive tests.

Zone #77 which failed the Hold Test last night was again halogen tested. No observable leaks were found but tests of the adjacent Zone #58 revealed a strong response with the halogen gun. Holes were then gouged near the tops of the only two channels covering the knuckle welds between Zone #77 and #58 and then Zone #58 was purged. Even after purging and with no pressure in #77 a strong response was recorded with the halogen gun thru one of these holes. This could indicate that the weld of the Zone #77 channel under the knuckle channel of Zone 58 is leaking. This will be probed more extensively next Monday.

Penetration assembly #105 which I reported as being installed in the liner last night was another penetration. Penet. #105 was to be installed this evening but was found to be defective. The insert plate is not oriented correctly in relation to the embedment items welded to the sleeve. It is off about 10" and may have to be returned to Birmingham for removal and reorientation.

Mr. Herman shot several of the "eye-clip" locations on the inside of the liner this evening. These clips are Part No. 28-16 on CB&I Drawing 28.

ATTACH 'B'

SWS 90-0532

Pg. 6/73

GLDERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SUPPLEMENTARY SHEET

CLIENT Florida Power Corporation
SMT Crystal River #3

DATE February 25, 1973

SHEET NO. 1 OF 1

PREPARED BY G. E. Hoffman

STRUCTURE Containment Duct

NOTATION

COMMENTS

Testing of channeled zones continued on this night shift with two Hold Tests. Zone #79 passed and Zone #77 failed. Zone #42 which contains the outside canopic angle for the month generator ring and some small sections of channel had a serious leak so the zone was divided in two half sections for separate testing. The east section held pressure but the west lost pressure. The latter was further reduced in size but at this writing the operator is still not sure where the leak is located.

With only one gang of fitters working this shift considerable progress was made in the fitting of single and double penetration assemblies. The fitting is being done in strict accordance with the Detail "A" of C&I Drawing #13.

ATTACH 'B'

SNES 90-0532

Pg. 62/73

GILBERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SUPPLEMENTARY SHEET

CLIENT Florida Power CorporationUNIT Crystal River #3DATE February 16, 1971PREPARED BY C. E. HoffmanSHEET NO. OF 1STRUCTURE Containment Liner

NOTATION

COMMENTS

Channel zone testing and explanation follows:

Zone #13 Hold Test passed

" #11 " " "

" #26 " " "

" #75 " " passed

" #72 " " failed.

As several hold tests of Zone #73 have failed it was expected that there was a leak in the dam between #72 and #73. The dam weld in #73 was exposed by gouging and #72 pressured. A leak was found, repaired and retented OK. Zone #73 was then resealed and tested with fluid and in light.

Zone #36 Halogen tested OK

" #37 " " "

" #38 This zone had a serious pressure loss a week ago. It was halogen tested today and had a pressure drop again but it appears that it was the test connection. Pressure drop was stopped, Halogen test was OK.

" #63 Retented with halogen and passed. Hold Test again but workman broke a thermometer so this test failed. Hold tested again. Passed.

Zone #19 Pictures taken of doubler repair. New channel fabricated and new end plates welded in place. Channel tanked and welded then cleaned and pictures taken of completed repair. Fluid tested and leaks found in new weld. Being repaired.

" #18 Several days of testing of canopy left in place but ratholed. Zone retented with fluid and many leaks found. Leaks being repaired.

Automatic welding of the 3rd to 4th ring girth started today.

Installation of the 6" wide X 3/8" strips started this afternoon east and west. It appears from observation that the job will be done as per procedure.

Welding of angle stiffeners continuing.

ATTACH 'B'

SAMS 9-0532

Rb. 63/73

GILBERT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SUPPLEMENTARY SHEET

CLARK Florida Power Corporation
UNIT Crystal River #3

DATE February 12, 1973

SHEET NO. 1 OF 1

PREPARED BY G. E. McLean

SYNOPSIS Containment Liner

NOTATION

COMMENTS

Channel zone testing continued today with the following tests:

- Zone #22 Hold Test passed
- " #32 Hold Test passed
- " #54 Hold Test passed
- " #64 Hold Test passed
- " #74 Hold Test passed
- " #82 Hold Test passed
- " #73 Hold Test failed

Zone #62 was halogen tested and two leaks were found. These will be repaired later.

Zone #36 test connection pipe had not been welded in place but the hold in the channel had been cut. With the heavy rain water had entered the channel zone and practically filled it. The test pipe was welded in place this morning then a small hole was cut in the channel at the end of the zone for the water to drain out. The testing operator then attached a pressure hose to the connection and the water was blown out of the zone. While this was being done it was noticed that water was also coming out of the adjacent zone #40 test connection. This meant that there must be a serious leak between these two zones. The junction of Zone #36 and #40 was gauged away and it was found that there was no weld under the Zone #36 channel which connects the top of the Zone #40 channel to the bottom. This was repaired and Zone #36 retested and is now tight.

Zone #33 was fluid isolation tested and one leak found, repaired and the zone retested OK.

A welding repair was made at the test connection of Zone #34 and this zone was then retested and is now tight with fluid isolation. Zone #31 Halogen Test proved satisfactory.

Zone #10: This is a problem zone. The channel over the butt weld inside this north generator ring was segregated with two dams and then hold tested. The Hold Test passed. This meant that any suspected leaks into the bottom would be in the weld between the bottom platen and the inside edge of the generator ring. Two dams were installed to separate the east half of the angle canopy from the west half. A hold test was prepared on the east half and it failed with considerable pressure drop. Work will continue in this zone tomorrow.

The erection of Ring #4 was completed today. Mr. Cornelissen, the new Quality Assurance Supervisor started today with GMAI. It is expected that closer control of the weld quality can be expected.

DEBURY ASSOCIATES, INC.

QUALITY ASSURANCE REPORT

SUPPLEMENTARY SHEET

CLIENT Florida Power CorporationUNIT Crystal River ASDATE February 8 thru 11SHEET NO. 1 OF 2PREPARED BY G. J. HoffmanSTRUCTURE Containment LinerLOCATION COMMENTS

The following series of tests of channelled seams (in numerical order) were conducted by CMHI and witnessed by the noted inspectors:

Test No.	Date	Test Description	Inspector
Test #9	Feb. 9	Hold Test failed	Hoffman
	Feb. 11	Hold Test passed	Duckingham
Test #10	Feb. 9	Hold Test failed	Duckingham
	Feb. 11	Halogen Test again and no observable leaks.	Hoffman
Test #11	Feb. 9	Hold Test failed	Duckham
Test #16	Feb. 10	Hold Test passed	Duckingham
" #18	" 10	Hold Test passed	Duckham
Test #19	" 11	Transverse crack across butt weld in bottom plate was chipped out with CMHI saving the chips for analyzing. The area was then ground in the same line as the weld. It was found that an unsealed joint in the embedded tee came at that point and it appeared to be the possible cause of crack propagation. Pictures of this area were taken and distributed to FPD, CMHI and GAY. A repair procedure has been written by CMHI and the repair will later be made. This area will be fully tested after removal from testing of the proposed doubler and installation of a new section of channel.	Hoffman
Test #20	Feb. 10	Hold Test passed	Duckham
" #21	" 10	Halogen Test passed	Duckham
" #22	" 10	Hold Test passed	Duckham
" #22	" 9	Halogen Test passed	Duckham
" #23	" 9	Halogen Test passed	Duckham
" #24	" 11	Hold Test passed	Hoffman
" #24	" 9	Halogen Test passed	Duckham
" #25	" 10	Hold Test passed	Duckham
" #25	" 9	Halogen Test passed	Duckingham
" #26	" 10	Hold Test passed	Duckingham
" #26	" 10	Halogen Test (2 leaks)	Duckham
" #27	" 11	Leaks repaired and retested & passed	Hoffman
" #27	" 11	Halogen Test passed	Hoffman

ATTACH 'B'

LWS 90-0532

Pg. 65/73

CLBERT ASSOCIATES, INC.
 GAS QUALITY ASSURANCE REPORT
 SUPPLEMENTARY SHEET

CLIENT Florida Power Corporation
 West Central River #3

DATE February 8 thru 11, 1977

SHEET NO. 2 of 2

PREPARED BY G. J. Hoffman

STRUCTURE Containment Dams

NOTATION

COMMENTS

Item	Date	Test	Inspector
#27	Feb. 11	Hold Test passed	Hoffman
#28	" 11	Halogen Test passed	Hoffman
#29	" 11	Halogen Test passed	Beckingham
#31	" 11	Halogen Test failed	Beckingham
#32	" 11	Halogen Test passed	Hoffman
#33	" 11	Halogen Test passed	Hoffman
#34	" 11	Halogen Test failed (leak at test connection)	
#51	" 9	Halogen Test (inside) passed	Beckingham
		Hold Test (overnight) passed	Dunne
#52	" 9	Halogen Test (inside) passed	Beckingham
	" 10	" " (outside) passed	Dunne
#53	" 10	Halogen Tested (inside) passed	Dunne
		" " (outside) passed	Dunne
#54	" 10	Halogen Test (inside) passed	Dunne
		" " (outside) passed	Dunne
#55	" 10	Halogen Test (outside) passed	Dunne
#72	" 9	Halogen Test (inside) passed	Beckingham
	" 10	" " (outside) passed	Dunne
#73	" 9	Halogen Test (inside) passed	Dunne
	" 10	Halogen Test (outside) passed	Dunne
	" 11	Hold Test failed	Beckingham
#74	" 9	Prepared for Halogen Test but pressure dropped rapidly. Leak in weld outside.	Beckingham
	" 10	Leak repaired outside and retested. Outside halogen test passed.	Dunne
	" 10	Halogen Test (inside) passed	Dunne
#82	" 11	Hold Test failed	Hoffman

ATTACH 'B'

SUES 90-0532

Re. 6/6/73

OLPST ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SUPPLEMENTARY SHEET

CLIENT Florida Power Corporation
UNIT Crystal River #3

DATE February 6, 1971PREPARED BY H. R. HoffmanSHEET NO. 1 OF 1STRUCTURE Containment Liner

NOTATION

COMMENTS

Testing continued in the channelled zones of the bottom today with three hold tests. Zones #63 and #14 passed but Zone #62 failed. The operator then pressurized Zone #62 with a halogen mixture and he got a strong response at the test connection of #63. It is still difficult to say whether or not there is a leak in the dam between the two zones as #63 has passed the hold test and it would not seem logical for it to pass if there is a leak between these zones. Even after purging #63 several times with air he still got a strong response with the halogen gun. It is now suspected that the operator will cut a small hole in Zone #62 right next to the dam between the two zones. This hole will not be a part for flushing out Zone #62. In these channel zones at the top edge of the knuckle and where the channels extend up to El. 95' plus about 4", it is very difficult to flash out the zones once halogen has been put into them. The reason for this is that Freon is heavier than air and it tends to stay in the longitudinal channel and not come up to the test connection outlet which are at the top of the sections of vertical channel. In future liners of this kind it would be advisable to install a coupling which can be plugged with a steel screw plug at the far end of each zone and right next to the dam. This would permit a free flow of air from the test connections of each zone down to the longitudinal channel and along its entire length and out the coupling hole.

By cutting a small hole thru the longitudinal channel next to the dam to Zone #63 then #63 can be pressurized with halogen. The leak found or recognized thru the small hole and if there is a true leak then a larger slot can be cut in #62 to make the repair. This work would then not affect the integrity of the completely tested Zone #63.

Zone #61 was halogen tested and one extremely small leak found and repaired. It was retasted and found OK.

Zone #23 was halogen tested again because it was thought that a previous test found a drop in pressure. This pressure today remained the same. Zone #30 was again pressurized with air but no observable leaks were found nor was there leaks into adjacent zones. It is thought now that this zone may have a similar leak to Zone #19.

One of CH2I's workmen took a welding test today but one of the horizontal side-bend specimens failed at the center from lack of fusion. I failed that part of the test and permitted him to be "immediately" retasted and four coupons cut out of the test plate and bent. If all these four pass then he is qualified. This man will be a tacker if he passes.

After calculations it was found by CH2I that Zones 12, 17, 66 and 83 passed the hold tests.

OLBERT ASSOCIATES, INC.
DAILY QUALITY ASSURANCE REPORT
SUPPLEMENTARY SHEET

CLIENT Florida Power Corporation
UNIT Crystal River #3

DATE February 2, 1977

PREPARED BY D. E. Hoffman

SHEET NO. 1 OF 1

STRUCTURE Containment Liner

NOTATION

COMMENTS

Channel zone testing continued today with considerable accomplishment. Zone #6 was Hold Tested again and it passed. Zones #12 and #17 were Hold Tested but the results will not be known until tomorrow. Zone #84 was Hold Tested and it passed. Zones #66 and #63 were Hold Tested and we will know the results tomorrow morning. Zone #82 Helogen Test passed. Zone #63 had been Helogen tested but the operator tested it again and found a "trace leak" which would not need a repair in accordance with the specification but might upset a hold test so the operator had it repaired. Zone #64 was Helogen tested again and passed.

Yesterday's report told of Zone #19 having no observable leak but it's leaking of pressure very rapidly. This indicated a leak into the bottom because none of the connecting zones had any build-up of pressure from #19. It was decided by CMHI to install a new midsection of the zone then pressurize again. This was done and the leak showed on the side of the test connection. Another dam was installed three feet closer to the test connection than when the pressure was raised it maintained a pressure in the rest of #19. The leak was somewhere under the three feet of channel. The channel was then removed by air-gauging and the butt weld of the bottom plates was vacuum box tested. A bad leak immediately showed and it was a transverse crack across the automatically welded butt, about 3/4" long. An irregularly shaped crack and not exactly at right angles to the weld. This is a very unusual occurrence in low carbon steel plate welded with low carbon steel back-up material.

Pictures were taken of the above mentioned crack with black and white Polaroid film and a "close-up attachment" on the camera. The crack shows quite well in the pictures taken with a dime laying alongside the crack for reference dimensioning.

Nineteen radiographs were read of Ring #2 verta and girth weld between Rings #1 and #2. These were read and punched in the presence of Mr. Ed Proats of Florida Power. As one film had to be reshot, this film will be read later and the documents stamped acceptance for all film mentioned above.

CMHI continues to ignore the yellow crayon marks written on the areas of girth weld that should be either ground, chipped or dressed in accord with ASME Section VIII, UW-35 and 36. Mr. Copeland and Mr. Bacheler refuse to understand that the liner is or should be fabricated and inspected to the rules of Section VIII of the ASME Code. Mr. Copeland keeps saying: "The liner is not a Section VIII vessel." We know that it isn't but this does not prevent it being built to the rules of Section VIII.

The suggestions and advice given to CMHI personnel at their Birmingham plantia regard to proper protection of plate edges while in shipment was not observed by them. The top plate of shipment #4 was damaged again by the hold-down rods installed in Birmingham.

ATTACH 'B'

Sales 90.0532

Pg. 68/73

CHERRY ASSOCIATES, INC.

QUALITY ASSURANCE REPORT

SUPPLEMENTARY SHEET

Client Florida Power Corporation

Unit Orlando River #3

Date February 5, 1972

Prepared by C. L. Hoffman

NOTATION

COMMENTS

Sheet No. 1

Structure Orlando River #3

Testing continued today with a repeat Cold Test of Zone #7. As the dam between this zone and Zone #6 was repaired yesterday we expected it to pass and it did. The operator also Cold Tested zones #13 and #14 and both of these passed. Halogen tests were run on zones #15, #16, #17 and #18. The first three had been halogen tested before and passed so there was no reason to test them again today. Number 18 was a new test.

Zone #19 was halogen tested and there was no observable leaks but the pressure drop was severe. The pressure drop by 12:50 psi dropped to about 30 psi in a matter of 15 minutes. As zones adjacent to #19 had been halogen tested today, they had to be purged completely before he response was obtained or no response from the pressure of #19. The operator thought there may be a burn-thru in one of the fillets of the channel to both walls another probe was likely even with the air-air leak without violating the exposed bottom. This leakage may not have a ready solution as there may be leakage thru the main butt weld under the channel and there to look in the main question.

Leakage completed the creation of Ring #3 today.

The automatic welding machine is again in operation on #2 Girth Weld.

Other Copeland, CHA's Quality Assurance Supervisor was advised this morning in regard to "dross-up" of the horizontal to Ring #1 girth weld on the outside. Parts of the weld have been marked for repair of surface defects and reduction of reinforcement.

ATTACH 'B'

SAVES 90-0532

R. 69/73

OLDEST ASSOCIATES, INC.
 QUALITY ASSURANCE REPORT
 SUPPLEMENTARY SHEET

Client: Florida Power Corporation
Unit: Crystal River #3

DATE: February 3, 1971PREPARED BY: C. E. HoffmanSHEET NO. 1 OF 1
STRUCTURE: Containment Liner

NOTATION

COMMENTS

Channel Zone Testing continued today with hold tests of Zones #9 and #6 and both failed. Two other hold tests in Zones #9 and #11 also failed. The operator has received two more test gages from Birmingham enabling a greater spread for the testing. Zone #23 was fluid solution tested and no leaks were observed but a pressure drop indicated a dam leak. This will be probed further later.

Zone #24 Fluid Test Acceptable:

- #32 " " " "
- #33 " " " "
- #34 " " " "
- #37 " " " One bad leak repaired, retested and is acceptable.
- #38 " " " Two bad leaks not repaired yet.
- #39 " " " Two leaks repaired but still has pressure drop. Will investigate later.
- #40 " " " Two leaks repaired, retested and is acceptable.

Penetration Assembly 36-A was finally positioned today with the Manitowoc crane and the other plates of 3/8" thickness were erected. Workmen are getting the automatic welder ready to weld girth joint #2.

Loading and tracking of angle stiffeners is continuing. CH2I was requested to stop the angles about 2" from penetration sleeves when the latter obstruct a complete angle being positioned then start the angles again in the same line between upper and lower penetrations always keeping the angle ends about 2" from the sleeves to prevent porosity of concrete. All center to center distances between the angle stiffeners will be held in accordance with the CH2I drawings.

ATTACH 'B'

SURS 90-0532

Pg. 70/73

QUALITY ASSURANCE REPORT

SUPPLEMENTARY SHEET

CLIENT Florida Power CorporationUNIT Capital Ring #3DATE January 29, 1972PREPARED BY C. D. HoffmanSHEET NO. 1 OF 1STRUCTURE Containment Liner

NOTATION

COMMENTS

Testing of Test Channels continued today and the following zones, signs of test and number of leaks are listed below:

Zone #5 Hold Test OK

The FPO letter to O&G requesting them to concentrate on testing of horizontal and vertical welds up to Elevation 95' and the channels covering them was being carried out today. The action areas are as follows:

Zone #4	Field Solution	Test	Leakage	Being Repaired
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9
10	10	10	10	10
11	11	11	11	11
12	12	12	12	12
13	13	13	13	13
14	14	14	14	14
15	15	15	15	15
16	16	16	16	16
17	17	17	17	17
18	18	18	18	18
19	19	19	19	19
20	20	20	20	20
21	21	21	21	21
22	22	22	22	22
23	23	23	23	23
24	24	24	24	24
25	25	25	25	25
26	26	26	26	26
27	27	27	27	27
28	28	28	28	28
29	29	29	29	29
30	30	30	30	30
31	31	31	31	31
32	32	32	32	32
33	33	33	33	33
34	34	34	34	34
35	35	35	35	35
36	36	36	36	36
37	37	37	37	37
38	38	38	38	38
39	39	39	39	39
40	40	40	40	40
41	41	41	41	41
42	42	42	42	42
43	43	43	43	43
44	44	44	44	44
45	45	45	45	45
46	46	46	46	46
47	47	47	47	47
48	48	48	48	48
49	49	49	49	49
50	50	50	50	50
51	51	51	51	51
52	52	52	52	52
53	53	53	53	53
54	54	54	54	54
55	55	55	55	55
56	56	56	56	56
57	57	57	57	57
58	58	58	58	58
59	59	59	59	59
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61	61	61	61	61
62	62	62	62	62
63	63	63	63	63
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66	66	66	66	66
67	67	67	67	67
68	68	68	68	68
69	69	69	69	69
70	70	70	70	70
71	71	71	71	71
72	72	72	72	72
73	73	73	73	73
74	74	74	74	74
75	75	75	75	75
76	76	76	76	76
77	77	77	77	77
78	78	78	78	78
79	79	79	79	79
80	80	80	80	80
81	81	81	81	81
82	82	82	82	82
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86	86	86	86	86
87	87	87	87	87
88	88	88	88	88
89	89	89	89	89
90	90	90	90	90
91	91	91	91	91
92	92	92	92	92
93	93	93	93	93
94	94	94	94	94
95	95	95	95	95
96	96	96	96	96
97	97	97	97	97
98	98	98	98	98
99	99	99	99	99
100	100	100	100	100

and one to outside of liner.

The operator attempted to perform another possible leak test on Zone #5 but this test failed.

Workmen cut out the shell plate to accept Penetration Assembly 51-A and cut more than was required for the top radius. O&G has a suggested procedure for repairing this mistake that they will present to FPO and G&I.

Automatic welding of the girth weld between Rings #1 and #2 was started today. Sections of the automatic weld are excellent in contour but where imperfections of true curvature of the 3/4" plate such as at the vertical welds, the weld proper flux coverage is difficult and the molten metal often gets out of control with resultant sections that must be gouged out and repaired manually.

Before automatic welding was started Mr. Copeland was advised to be watchful in regard to excess reinforcement and smooth contour and try to maintain weld configuration within the limitations of Paragraph WM-35 (a) of Section VIII of the ASME Code.

ATTACH 'B'

Sales 90-0532

Rc. 7/1/73

CLIENT ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SURVEILLANCE OF CONTAINMENT VESSEL LINER ERECTION

CLIENT Florida Power Corporation

UNIT Crystal River Unit #3

PREPARED BY H. E. Hoffman TITLE Welding Inspector

SHEET 100 2

DATE December 21, 1970 CONTRACTOR Chicago Bridge & Iron Company

ITEM AND/OR AREA BEING INSPECTED Installation of Test Channels; NDT tests of fusion erection and welding of toriconical sub-assemblies

W/A A. RECEIPT INSPECTION

YES NO

1. Low plate identifies checked on arrival

2. Component identifies checked

3. NDT certificates rechecked with material

4. NDT methods verification available for reference

5. Electrode containers checked with Certificates of Analysis

6. Electrodes other than low-hydrogen tested

7. For what purpose

8. Nonconforming and damaged material segregated and tagged

W/A B. STORAGE AND HANDLING

1. Place and components stored orderly

2. Electrode stored according to procedure

3. What storage temperature for low-hydrogen electrodes

4. Auto welding flux stored to procedure

5. Does Contractor recycle low-hydrogen electrodes

6. At what temperature

7. Storage and handling show good housekeeping

QUALIFICATIONS

1. Welder's tests supervised adequately

2. Requirements of ASME Section IX followed

3. Adequate quality evidence of all welders

4. NDT personnel qualified periodically as required

5. Leak testing operators supervised by Level II

6. NDT Interpretation by Level II

7. All test welders qualified

8. Attempts made to use certified procedures

D. CLEANING, FITUP AND WELDING REQUIREMENTS

1. Water, dirt, paint, scale, etc. being removed

2. Weld prep. and fitup surfaces being cleaned

3. Cleaning interval

4. Completed welds being cleaned

5. Correct root opening being maintained

6. Correct bevel angle being maintained

7. Plate alignment within code limits

8. Plate shop to backing bars correct

Completed

ATTACH 'B'

SAR 90-0532

B. 72/73

JOSEPH ASSOCIATES, INC.
QUALITY ASSURANCE REPORT

SURVEILLANCE OF CONTAINMENT VESSEL LINE ERECTION

CLIENT Florida Power CorporationUNIT Crystal River Unit #3PREPARED BY U. R. Hoffman FIELD Welding Inspector

SHEET 2 OF 2

DATE December 21, 1990CONTRACTOR Chicago Bridge & Iron CompanyFROM ABOVE AREA BEING INSPECTED Installation of Test Channels, EDT Test of BottomErection and Welding of Horizontal Sub-assemblies.

	YES	NO		YES	NO
1. Electrodes stored correctly	<u>N/A</u>		6. Operator appears experienced	<u>—</u>	<u>—</u>
10. Insert pieces fitted according to design drawings	<u>N/A</u>		7. Surveillance furnished	<u>—</u>	<u>—</u>
11. Direction of welding in accordance to procedure	<u>—</u>	<u>—</u>	8. Heat cycle charts available for reference	<u>—</u>	<u>—</u>
12. Only low-hydrogen electrodes being used	<u>—</u>	<u>—</u>	F. WELD AND ERECTION TOLERANCES		
13. Welders withdraw electrodes for time shift	<u>—</u>	<u>—</u>	1. Auto weld sequence correct	<u>—</u>	<u>—</u>
14. Unused electrodes returned to storage at end of shift	<u>—</u>	<u>—</u>	2. Auto weld reinforcement to code	<u>—</u>	<u>—</u>
15. Wet electrodes wrapped	<u>—</u>	<u>—</u>	3. Butt weld reinforcement according to code	<u>—</u>	<u>—</u>
16. Primary settings constant	<u>—</u>	<u>—</u>	4. Fillet weld coniform within code limits	<u>—</u>	<u>—</u>
17. Welding equipment and cables kept in good order	<u>—</u>	<u>—</u>	5. Size of fillet correct	<u>—</u>	<u>—</u>
18. Each welder's work being recorded	<u>—</u>	<u>—</u>	6. Weld appearance acceptable	<u>—</u>	<u>—</u>
19. Postwelding carried out as spec.	<u>N/A</u>		7. Any undercutting	<u>—</u>	<u>—</u>
20. Temperature recorders being used	<u>N/A</u>		8. Parts and component identification being transferred to assembly drawings	<u>—</u>	<u>—</u>
N/A E. POSTHEAT TREATMENT			9. Overall out-of-roundness within spec.	<u>N/A</u>	
1. Thermocouples attached correctly	<u>—</u>	<u>—</u>	10. Plumb line deviation within 1/16 in	<u>N/A</u>	
2. Thermocouples located correctly	<u>—</u>	<u>—</u>	11. Tangent line to dome transition held	<u>N/A</u>	
3. Weldment supported correctly	<u>—</u>	<u>—</u>	12. Deviation from round in 10' ft within spec.	<u>N/A</u>	
4. Insulation adequate	<u>—</u>	<u>—</u>	G. LEAK TESTING		
5. Recorder operating correctly	<u>—</u>	<u>—</u>	1. Helogen		
			Zones tested		

DAVID I 1127
9/7/91

ATTACH 'B'

SWS 90-0532

PG. 73/73

QUALITY ASSURANCE REPORT

SUPERVISANCE OF CONTAINMENT VESSEL LINER ERECTION

CLIENT Florida Power Corporation

UNIT Crystal River Unit #3

PREPARED BY G. E. Hoffman TITLE Welding Inspector SHEET 106 E

DATE December 21, 1970 CONTRACTOR Chicago Bridge & Iron Company

ITEM AND/OR AREA BEING INSPECTED Installation of Test Channels, NDT Tests of Bottom Erection and Welding of Horizontal Plate Sub-assemblies.

2. Soap bubble Zones tested	N/A	J. DOCUMENTATION	YES	NO
3. Vacuum Box Area tested	Bottom Completed	1. NDT repairs recorded on as-built drawings	X	
		2. Test areas recorded by contractor	X	

K. NDT EXAMINATIONS

1. Liquid penetrant Areas examined	NDT of Bottom Completed	2. Documentation available for reference	X	
2. Magnetic Particle Areas examined	N/A	K. NONCONFORMANCE		
3. Radiographic Seams examined	Horizontal seams and vertical continuing.	1. Contractor's QA or QC immediately initiate corrections when advised verbally	X	
4. Ultrasonic Area or Seam examined	N/A	2. Status of DCR's		None

L. DESTRUCTIVE TESTS

Welds(s) tested _____
Test coupon bending _____

COMMENTS: Four pictures were taken of four concrete handle joints and two each of four welds. One repair was required and two additional shots were taken of this same welder in compliance with ASME Section VIII, 5B-52. Results of these shots will be noted in a later report. Areas were selected in the horizontal seams performed downflat to be radiographed and also the 3% of seams performed in the vertical position. This radiography is continuing and report of results noted in a later report. All sub-assembled horizontal section are erected or rather are in position. There will be one single horizontal plate

NOTE: SEE SUPPLEMENTARY SHEET DAWAHU 113 FOR ADDITIONAL COMMENTS

DAWAH 113.27
6276

ATTACHMENT C



Gilbert/Commonwealth engineers and consultants

P. O. Box 1498, Reading, PA 19603-1498 / Telephone 215-775-2600, Cable Gilasoc / Telex 836-431

ATTACH 'C'
SWES 90-0532
R. 1/18

July 23, 1990

Mr. R. T. Bowles
Nuclear Project Management Engineer
Florida Power Corporation
P. O. Box 14042/C21
St. Petersburg, Florida 33733

FCS-11733
W.O. 04-5515-704
Small Account #00057
Contract NPM007BD, WA #004

Attention: Mr. J. A. Lese

Re: Crystal River Unit 3
Containment Liner Test Channels
Stress Evaluation
Ref: Small Account No. 57
Action By: N/A

Dear Mr. Bowles:

The containment liner test channel system at inaccessible liner seam welds was physically tested during construction of the reactor building. Test pressures and conditions associated with the structural proof test, represent the controlling case of non-self limiting loads that the channel attachment to the liner will experience over the life of the plant. Calculations demonstrate that stresses in the test channels are low and within allowable limits when subjected to the pressure load of the containment structural proof test.

Test channel strains were also evaluated assuming strain deformation compatibility with the containment liner to evaluate the global response of the channel sections. Resultant strains are within permissibles of the ASME Boiler and Pressure Vessel Code, Section III, Division 2.

Documentation of the above analytical evaluations is contained in the following:

DI-5515-704.57-SE, Rev. 0
DC-5515-704.57-SE, Rev. 0

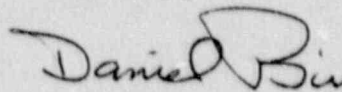
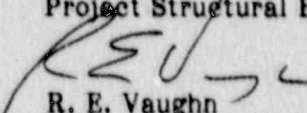
Copies of the above are attached for FPC's records.

If there are any questions, please advise.

TDB:REV:flg

cc: W. W. Nisula
R. T. Bowles (2)
J. A. Lese (W/Attachment)
A. Petrowsky
R. E. Vaughn (2)
D. D. Krause
P. M. Hevalow (2)

Very truly yours,


T. D. Biss
Project Structural Engineer

R. E. Vaughn
Project Manager



POWER AND INDUSTRIAL
SYSTEMS DIVISION - READING
DESIGN INPUT RECORD

PROJECT	CRYSTAL RIVER UNIT 3		W.O.	04-5515-704	IDENTIFIER	DI-5515-704.57-SE
SUBJECT	REACTOR BUILDING LINER - TEST CHANNELS					
DEPT./SECTION	STRUCTURAL 0414				PAGE 1 OF 2	
REVISION	0	1	2	3		
ITEM(S) REVISED	XXXXXXXXXX					
ORIGINATOR	JDK					
DATE	7-17-90					
PROJECT ENGINEER REVIEW	TD B					
DATE	7-20-90					
SECTION MANAGER APPROVAL	Chang Chen					
DATE	7/20/90					
FUTURE CONFIRMATION REQUIRED?	NO					
MICROFILMED/DATE						

INSTRUCTIONS: USE "N/A" FOR ITEMS NOT APPLICABLE. IDENTIFY ITEMS REQUIRING FUTURE CONFIRMATION BY CIRCLE OR CLOUD. IDENTIFY REVISED INFORMATION BY VERTICAL LINE IN RIGHT MARGIN AND REVISION NUMBER. USE ADDITIONAL SHEETS AS NECESSARY.

1. SCOPE OF THIS DIR; BASIC FUNCTIONS OF SYSTEM, STRUCTURE, OR COMPONENT:

THIS DIR INCLUDES THE REQUIREMENTS AND INPUTS NEEDED TO CHECK THE DESIGN OF THE PRESSURE TEST CHANNELS THAT ARE WELDED OVER CERTAIN LINER PLATE WELDS TO PROVIDE TEST CAPABILITY FOR THOSE LINER WELDS THAT ARE INACCESSIBLE TESTING AND INSPECTION AFTER THE CONTAINMENT IS CONSTRUCTED.

CONTINUED PAGE NA

2. CLASSIFICATION; DESIGN CODE(S) AND STANDARD(S):

SAFETY RELATED - ATTACHED TO THE SEISMIC CATEGORY I REACTOR BUILDING LINER.

AISC "STEEL CONSTRUCTION MANUAL" 7TH EDITION.

ASME BOILER AND PRESSURE VESSEL CODE SECTION III DIVISION 2, 1989

CONTINUED PAGE NA

3. PERFORMANCE REQUIREMENTS AND SOURCE:

TEST CHANNEL SYSTEM SHALL BE LEAK TIGHT

FSAR CR#3 5.2.5.2.2 P. 5-65

CONTINUED PAGE NA

4. DESIGN MARGINS OR SAFETY FACTORS:

AS PROVIDED BY CODES IN ITEM 2 ABOVE.

ATTACH 'C'

SWES 90-0532

Pg. 3/18



DESIGN INPUT RECORD

IDENTIFIER

DE-5515-204-57-54

PAGE 2 OF 2

5. DESIGN CONDITIONS AND SOURCE:

NA

CONTINUED PAGE NA

6. OPERATING CONDITIONS AND SOURCE:

NA

CONTINUED PAGE NA

7. AMBIENT CONDITIONS AND SOURCE:

NA

CONTINUED PAGE NA

8. MATERIAL(S):

TEST CHANNELS A 36
 LINER ASME SA 283 GRADE C

CONTINUED PAGE NA

9. OTHER REQUIREMENTS:

NONE

CONTINUED PAGE NA

10. REFERENCES:


1. LETTER DATED 12-22-87 FROM FPC TO USNRC. ~~(ATTACHED)~~
2. LETTER DATED 6-13-90 USNRC TO FPC ~~(ATTACHED)~~

CONTINUED PAGE NA

REV.	DISTRIBUTION RECORD											
	DISCIPLINE ENGINEERS								OTHERS			
	BSVC	CHEM	ELEC	I/C	LO/MOD	MECH	PIPING	STRUC	RECORDS	PM	RESPON. SM	
REVIEW								✓			X	
0								X	X			
1									X			
2									X			
3									X			

Gilbert/Commonwealth

THIS IS A PERMANENT DESIGN RECORDDO NOT DESTROY

POWER AND INDUSTRIAL SYSTEMS DIVISION CALCULATION		PAGE 1 OF 13		
	PROJECT:	CRYSTAL RIVER UNIT 3		IDENTIFIER DC-5515-704.57-SE
	SUBJECT:	REACTOR BUILDING LINER-TEST CHANNEL		CLASSIFICATION SR
	SECTION NAME AND NUMBER	STRUCTURAL 0414		W.O. 04-5515-704
REVISION	0	1	2	3
ITEM(S) REVISED	XXXXXXXXXX			
ORIGINATOR	D. Krause			
DATE	7-18-90			
REVIEWER/VERIFIER	P.W. Guit			
DATE	7-23-90			
APPROVAL	TD Bin			
DATE	7-23-90			
ASSUMPTIONS/PRELIMINARY DATA	NONE			
PAGES REFERENCE	NA			
THIS CALCULATION REQUIRES <input type="checkbox"/> REVIEW PER EI-9 RESULTS ARE NOTED BELOW. <input checked="" type="checkbox"/> VERIFICATION PER DCP 2.05				
THE REVIEW OF THE CALCULATION INCLUDED EVALUATION AGAINST THE FOLLOWING QUESTIONS:	REMARKS	REMARKS	REMARKS	REMARKS
WERE INPUTS, INCLUDING CODES, STANDARDS, AND REGULATORY REQUIREMENTS, CORRECTLY SELECTED AND APPLIED?				
ARE ASSUMPTIONS REASONABLE AND ADEQUATELY IDENTIFIED?				
HAVE APPLICABLE CONSTRUCTION AND OPERATING EXPERIENCES BEEN CONSIDERED?				
WAS AN APPROPRIATE CALCULATION METHOD USED?				
IS THE OUTPUT REASONABLE COMPARED TO INPUTS?				



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CALCULATION

SUBJECT CRYSTAL RIVER UNIT 3
REACTOR BLDG LINER-TEST CHANNELIDENTIFIER 5E
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DATE

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OBJECTIVE/PURPOSE :

PERFORM A CALCULATION TO DOCUMENT THE ACCEPTABILITY OF THE TEST CHANNELS THAT ARE LOCATED ON THE INSIDE SURFACE OF THE LINER PLATE OVER LINER WELDS WHICH ARE INACCESSIBLE FOLLOWING CONSTRUCTION.

DESIGN INPUTS/REFERENCES

1. DESIGN INPUT RECORD DI-5515-704.57-SE

ASSUMPTIONS

NONE THAT REQUIRE CONFIRMATION

COMPUTER OUTPUT

NONE

CONCLUSION

THE PRIMARY LOADING EXPERIENCED BY THE TEST CHANNELS WHICH ARE ATTACHMENTS TO THE LINER IS DUE TO THE PRESSURE OF THE REACTOR BUILDING STRUCTURAL PROOF TEST OR DURING A POSTULATED LOCA ACCIDENT. STRESSES IN THE CHANNEL SYSTEM ARE WELL WITHIN PERMISSIBLES FOR THOSE CONDITIONS AND THEREFORE THE TEST CHANNEL SYSTEM IS ACCEPTABLE AS INSTALLED.

REVIEW/APPROVAL

SEE DVR (ATTACHMENT A)

ATTACH 'C'
SWES 90-0532
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R.B. LINER - TEST CHANNELS

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CALCULATIONS

THE LOCATION, DETAILS, AND FUNCTION OF THE TEST CHANNELS ARE DESCRIBED IN REFERENCE 1 ATTACHED TO DI-5515-70451-SE. BASICALLY THE CHANNELS ARE INSTALLED OVER LINER SEAM WELDS WHICH WILL NOT BE ACCESSIBLE AFTER CONSTRUCTION. THE CHANNEL FORMS A CANOPY WHICH CAN BE PRESSURIZED AND TESTED TO ASSURE THERE ARE NO LEAKS IN THE LINER SEAM WELDS ENCLOSED BY THE CHANNELS. IN THE UNLIKELY EVENT THAT CONTAINMENT WOULD FAIL TO MEET THE REQUIRED LEAKAGE CRITERIA DURING TYPE A LEAK RATE TESTING, THE SYSTEM OF TEST CHANNELS IS AVAILABLE TO ASSURE THE LEAKS ARE NOT PRESENT IN THE INACCESSIBLE LINER SEAM WELDS. THEREFORE, THE USE OF TEST CHANNELS IN THE DESIGN IS A PRUDENT MEASURE TO AVOID THE POSSIBILITY OF HAVING TO REMOVE CONCRETE OR OTHER STRUCTURES TO INSPECT/TEST LINER WELDS. THIS IS ESPECIALLY IMPORTANT DURING THE INITIAL LEAK RATE TEST WHICH IS ON THE CRITICAL PATH NEAR THE TIME OF PLANT STARTUP. SUMMARIZING, THE TEST CHANNELS ARE PROVIDED AS A MEANS TO CREATE AN ENCLOSED SPACE OVER INACCESSIBLE LINER SEAM WELDS THAT CAN BE PRESSURIZED TO DEMONSTRATE THE LEAK TIGHTNESS OF THE LINER SEAM WELDS. THE CONTAINMENT LINER AND ASSOCIATED SEAM WELDS IS THE DESIGN BOUNDARY OF THE CONTAINMENT SYSTEM.

THE FLANGED ONLY HEADS PROVIDED OVER THE WELD BETWEEN THE LINER PLATE AND PENETRATION SLEEVES PERFORM A SIMILAR FUNCTION. THEY CREATE AN ENCLOSED SPACE OVER THE LINER SEAM WELDS THAT CAN BE PRESSURIZED TO LEAK TEST THE LINER WELDS. AGAIN, THE FUNCTION IS ^{TO} ASSURE THERE ARE NO LEAKS AT THESE DISCONTINUITY LOCATIONS PRIOR TO



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L.B. LINER - TEST CHANNEL

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THE ILRT (TYPE A TEST) AT WHICH TIME FINDING AND REPAIRING ANY LEAKS WOULD FALL SQUARELY ON THE CRITICAL PATH TO STARTUP AND COUL. RESULT IN A REQUIRED REPEAT OF THE ILRT. THESE TEST CANOPES WERE A PRUDENT DESIGN MEASURE TO MINIMIZE THAT POSSIBILITY. SEE CB&E DWG. 3 REV 6 FOR AN EXAMPLE OF THESE TEST FLANGES.

THE TEST CHANNELS ARE ATTACHMENTS TO THE LINER AND THEREFORE THE DESIGN CRITERIA FOR ATTACHMENTS TO THE LINER APPLIES. THE CHANNELS AND WELDS ARE CHECKED USING ACCEPTED TECHNIQUES FROM THE AISC STEEL CONSTRUCTION MANUAL. THE ALLOWABLE STRESSES ARE:

1.0 AISC ALLOWABLES FOR $\left\{ \begin{array}{l} \text{CONSTRUCTION} \\ \text{TEST} \\ \text{NORMAL} \end{array} \right\}$ LOADS

1.5 AISC ALLOWABLES FOR FACTORED LOADS.

USE AISC STEEL CONST. MANUAL 7TH ED. 1970 APPLICABLE AT TIME OF ORIGINAL DESIGN. IT IS NOTED THAT THE ABOVE APPROACH COMPLIES WITH THE ASME BOILER AND PRESSURE VESSEL CODE SECTION III DIVISION 2 1989 SUBSECTION CC 3700. FOR ATTACHMENTS TO STEEL LINERS FOR CONCRETE CONTAINMENTS.

ATTACH 'C'
SHEETS 90-0537.
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IT HAS BEEN STATED THAT THE TEST CHANNELS ARE ATTACHMENTS TO THE LINER. OTHER ATTACHMENTS TO THE LINER INCLUDE SMALL ATTACHMENT PLATES THAT ARE WELDED TO THE INSIDE SURFACE OF THE LINER TO SERVE AS ATTACHMENT POINTS FOR SYSTEM SUPPORTS SUCH AS PIPING OR DUCTS. THE ATTACHMENT PLATES SERVE TO PRECLUDE WELDING DIRECTLY TO THE LINER AND ALSO SERVE TO DISTRIBUTE THE SUPPORT REACTION(S). IN SOME CASES ATTACHMENT PLATES ARE PLACED OVER LINER WELD SEAMS. THE PLATES ARE FASTENED TO THE LINER USING FILLET WELDS CONTINUOUS ALL AROUND (SEE CBI DWG. 26, REV. 8 AS AN EXAMPLE). THUS, THE LINER SEAM WELD BEHIND THE ATTACHMENT PLATE IS NOT DIRECTLY SUBJECTED TO THE INTEGRATED LEAK RATE TEST PRESSURE. IN THIS CASE, THE LINER AND ITS SEAM WELD IS STILL CONSIDERED TO BE THE ACTIVE DESIGN ELEMENT IN THE CONTAINMENT SYSTEM PRESSURE BOUNDARY — NOT THE SURFACE ATTACHMENT PLATE AND ITS FILLET WELDS.

MANY OF THE TEST CHANNELS ARE COMPARABLE TO THE ATTACHMENT PLATES SINCE THE TYPE A INTEGRATED LEAK RATE TEST IS SUBJECTING THE CHANNEL, ITS FILLET WELDS, THE THREADED PIPE PLUG, HALF COUPLING (AND ITS WELD) TO THE TEST PRESSURE RATHER THAN THE LINER WELD. AND LINER COVERED BY THE CHANNEL — ASSUMING THE THREADED PIPE PLUG IS INSTALLED AND DOES NOT LEAK. JUST AS THE CASE OF LINER WELD BEHIND ATTACHMENT PLATE THIS CONFIGURATION IS ACCEPTABLE WITH THE CONTAINMENT BOUNDARY BEING THE LINER PLATE AND ITS SEAM WELD.

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IN FACT THE CASE OF LINER AND SEALED TEST CHANNEL SYSTEM IS A MORE CONSERVATIVE DESIGN THAN THE LINER SEAMS WITHOUT THE SEALED TEST CHANNEL. A SECOND BARRIER TO LEAKAGE IS PROVIDED BY THE SEALED TEST CHANNEL SYSTEM ALTHOUGH THIS SECOND BARRIER IS NOT REQUIRED BY THE DESIGN.

IT IS NOTED THAT IT IS UNLIKELY FOR LEAKS TO DEVELOP THROUGH FULL PENETRATION WELDS JOINING 3/8 INCH THICK STEEL LINER PLATE THAT HAVE BEEN 100% TESTED FOR LEAKS DURING CONSTRUCTION. LINER PLATE SEAM WELDS NOT COVERED WITH CHANNELS WERE 100% TESTED BY VACUUM BOX. WELDS COVERED WITH TEST CHANNELS WERE LEAK TESTED BY PRESSURIZING WITH HALOGEN AND CHECKING FOR LEAKS. TYPICALLY THE PRIMARY SOURCES OF LEAKAGE, IF ANY, ARE RESILIENT SEALS SUCH AS AT GASKETS AND ACCESS HATCHES, NOT LINER PLATE SEAM WELDS

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R.B. LINER - TEST CHANNEL

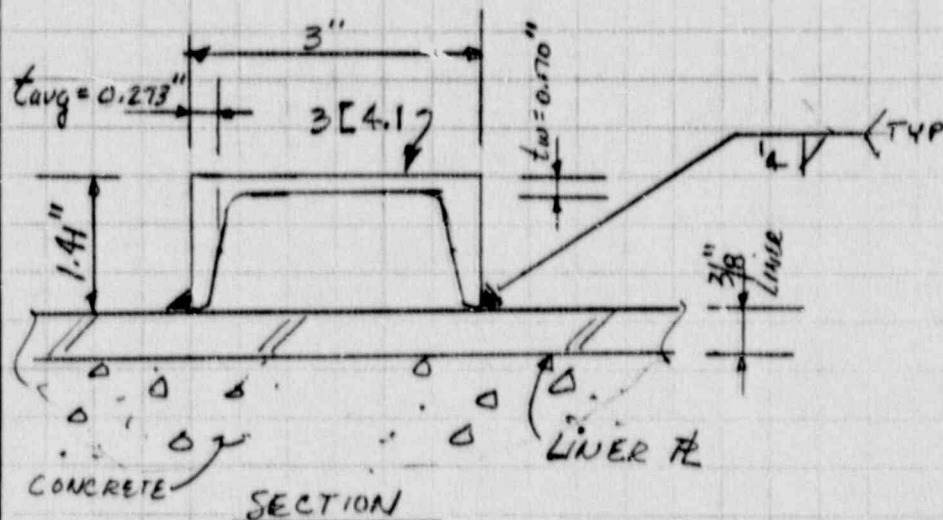
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CHECK TYPICAL CHANNEL ATTACHMENT FOR CONTROLLING LOAD⁺
CASE OF 1.15 TIMES THE DESIGN PRESSURE (63.3 psig)
DURING THE STRUCTURAL PROOF TEST.

REF. CBI DWG. 29 REV. 2 (SEE P. 10)
FOR TYPICAL TEST CHANNEL DETAILS



* FOR LINER AND
LINER ATTACHMENT DESIGN
THE LOAD FACTORS ARE
ONE IN ALL CASES.
THEREFORE, MAX. PRESSURE
EVER EXPERIENCED BY THE
TEST CHANNELS IS 1.15
TIMES DESIGN PRESSURE
AT STRUCTURAL INTEGRITY
TESTING.



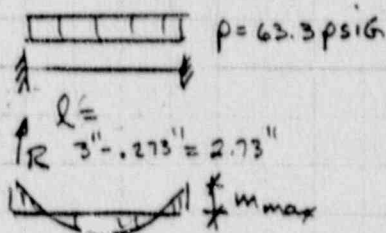
THE CONTROLLING ELEMENT OF THE CHANNEL IS THE
WEB. CONSIDER 1-WAY BEAM ACTION ACROSS THE
WEB

$$\text{ASSUME } M_{\max} = \frac{w l^2}{12}$$

$$S_{web} = \frac{b d^2}{6}$$

$$= \frac{1 \times 1.17^2}{6}$$

$$= 0.005 \text{ in}^3/\text{in}$$



$$R = \frac{63.3 \text{ psi} \times 2.73}{2} = 86.4 \text{ \#}$$

$$M = \frac{w l^2}{12} = \frac{63.3 \times 2.73^2}{12} = 39.3 \text{ \#}$$

$$f = \frac{M}{S} = \frac{39.3 \text{ \#}}{0.005 \text{ in}^3} = 7,860 \text{ psi}$$

$$< 27,000 \text{ psi}$$

AISC SECT. 15 $F_b = 0.75 F_y$ OK

$$= 0.75 \times 36 = 27,000 \text{ psi}$$

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CHECK WELD !

CONSERVATIVELY ASSUME, FULL PRESSURE ON CHANNEL FLANGE
IS ALSO ACCOUNTED FOR BY THE WELD.

$$\therefore F_w = R + 1.41" \times 63.3 \text{ psi} = 86.4\# + 89.25\# = 175.7\#$$

$$Z = \frac{F_w}{L_w \times W \times .707} = \frac{175.7\#}{1" \times .25" \times .707} = 994 \text{ psi} < 18,000 \text{ psi}$$

:OK

CONSERVATIVELY ASSUME E60 ELECTRODES WERE USED, WITH
A PERMISSIBLE STRESS OF 18,000 psi FOR SHEAR ONEFFECTIVE
THROAT. THIS PERMISSIBLE IS CONSISTENT WITH THE
BASE LINER PLATE SA 283 GRADE C MATERIAL WITH
30 KSI YIELD. SEE P. 9.

ATTACH 'c'
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FROM ASME B&PV CODE
SECTION III PART 2A FERROUS 1991

SPECIFICATION FOR LOW AND INTERMEDIATE TENSILE STRENGTH CARBON STEEL PLATES OF STRUCTURAL QUALITY



SA-283



(Identical with ASTM Specification A 283-67)

Scope

1. This specification covers four grades of carbon steel plates of structural quality for general application.

General Requirements for Delivery

2. Material furnished under this specification shall conform to the applicable requirements of the current edition of the Specification for General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use (ASTM Designation: A 6).

Process

3. The steel shall be made by one or more of the following processes: open-hearth, basic-oxygen, or electric-furnace.

Chemical Composition

4. When subjected to the ladle and check analyses, respectively, required by the provisions of Specification A 6, the steel shall conform to the requirements as to chemical composition prescribed in Table I.

TABLE I.—CHEMICAL REQUIREMENTS.

	Ladle Analysis	Check Analysis
Phosphorus, max, per cent:		
Acid	0.06	0.075
Basic	0.04	0.05
Sulfur, max, per cent	0.05	0.065
Copper, when copper steel is specified, min, per cent	0.20	0.18

Tensile Properties

5. (a) Material as represented by the

test specimens shall conform to the requirements as to tensile properties prescribed in Table II.

(b) For material under $\frac{1}{4}$ in. in thickness a deduction from the percentage of elongation in 8 in. specified in Table II of 1.25 percentage points shall be made for each decrease of $\frac{1}{16}$ in. of the specified thickness below $\frac{1}{4}$ in.

(c) For material over $\frac{1}{4}$ in. in thickness a deduction from the percentage of elongation in 8 in. specified in Table II of 0.50 percentage points shall be made for each increase of $\frac{1}{16}$ in. of the specified thickness above $\frac{1}{4}$ in. This deduction shall not exceed 3 percentage points.

(d) For material over $3\frac{1}{2}$ in. in thickness, a deduction from the percentage of elongation in 2 in. specified in Table III of 0.50 percentage points shall be made for each increase of $\frac{1}{16}$ in. of the specified thickness above $3\frac{1}{2}$ in. This deduction shall not exceed 3 percentage points.

Bending Properties

6. The bend test specimens shall stand being bent cold through 180 deg without cracking on the outside of the bent portion, to an inside diameter which shall have a relation to the thickness of the specimen as prescribed in Table III.

TABLE II.—TENSILE REQUIREMENTS.

	Grade A	Grade B	Grade C	Grade D
Tensile strength, psi	46 000 to 55 000	50 000 to 60 000	55 000 to 65 000	60 000 to 72 000*
Yield point, min, psi	24 000	27 000	30 000	33 000
Elongation in 8 in., min, per cent ^a	27	25	23	21
Elongation in 2 in., min, per cent	30	28	27	24

* The upper limit of 72,000 psi. shall be increased by 3000 psi for material over $1\frac{1}{2}$ in. in thickness.

^a See Sections 5 (b) and (c).

TABLE III.—BEND TEST REQUIREMENTS.

Thickness of Material, in.	Ratio of Inside Diameter of Bend to Thickness of Specimen*			
	Grade A	Grade B	Grade C	Grade D
$\frac{3}{8}$ and under	flat on itself	flat on itself	flat on itself	$\frac{1}{2}$
Over $\frac{3}{8}$ to 1, incl.	flat on itself	flat on itself	$\frac{1}{2}$	1
Over 1 to $1\frac{1}{2}$, incl.	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{2}$
Over $1\frac{1}{2}$ to 2, incl.	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$
Over 2 to 3, incl.	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
Over 3 to 4, incl.	2	$2\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$
Over 4	$2\frac{1}{2}$	3	3	4

* The above ratios apply to the bending performance of a test specimen only. This specimen is always taken in the longitudinal direction and usually has some edge preparation. Where plates are to be bent in a fabricating operation, more liberal bend radii must be used, particularly if this bend axis is in the unfavorable (longitudinal) direction.

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DISCUSSION

THE LINER AND TEST CHANNELS WILL BASICALLY FOLLOW THE DEFORMATION OF THE MUCH STIFFER CONCRETE SHELL. THEREFORE, THE STRAINS INDUCED IN THE LINER BY DEFORMATION OR CONSTRAINT OF THE CONCRETE SHELL ARE CHECKED FOR THE LINER PLATE ALLOWABLE STRAINS FROM SUBSECTION QC 3700 OF THE ASME BOILER AND PRESSURE VESSEL CODE SECTION 3 DIVISION 2. THE REACTOR BUILDING IS DESIGNED TO HAVE LOW STRAIN ELASTIC BEHAVIOR UNDER THE VARIOUS LOADS. THEREFORE, ASSUMING STRAIN COMPATIBILITY BETWEEN THE TEST CHANNELS AND LINER, CHECK LINER STRAINS.

THE FOLLOWING SUMMARIZES STRESSES IN THE LINER AT ABOUT MIDHEIGHT OF THE CYLINDRICAL WALL FOR SEVERAL CONTROLLING LOAD COMBINATIONS FROM SHELL ANALYSES OF THE CONTAINMENT WITH LINER IN THE MODEL. OPERATING AND ACCIDENT TEMPERATURE RESULTS ARE FROM THREE MILE ISLAND UNIT 1 ANALYSES WHICH ARE CONSERVATIVE FOR THE CR#3 PLANT (SEE FSAR CR#3 S.2.1.2.1 C P5-11)

LC#1 DEAD + PRESTRESS @ + OPER. TEMP -
END OF PLANT
LIFE

LOAD	SØ psi	SØ psi	REFERENCE
DL + PREST. (@ 950.117" PART 6)	-12,231	-17,674	CR#3 C.O 1.01.19 BK 2 10-9-70 FSAR DATA
OP. TEMP.	-8,367	-8324	TMI BK 20 C.O REACTOR BLDG
	-20,598	-25,998	

PERMISSIBLE MEMBRANE STRAIN FOR SERVICE CONDITION

$$\epsilon_{ST} = 0.002 \text{ in/in}$$

$$\sigma = \epsilon_{ST} E = .002 \text{ in/in} \times 30 \times 10^6 = 60,000 \text{ psi} \quad \text{OK by INSPECTION}$$



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LC #2

DEAD + PREST. (FINAL) + ACCID. PRESSURE + ACCID. TEMP.
+ O.P. TEMP.

LOAD	SØ psi	SØ psi	REFERENCE
D + PREST. + PRESS. (AT 950.117" PART 6)	-5686	-6751	CR #3 C.O. 1.01.19 BK 2 10-9-70 PSAR DATA
O.P. TEMP. (AT 955.2" PART 6)	-8367	-8324	TMI 1 BK 2A C.O. R.B.
ALL. TEMP. AT 933.6" PART 5	-19441 -33494	-19852 -34927	TMI 1 BK 1 C.O. R.B.

FOR FACTORED CONDITIONS $E_{ST} = 0.003 \text{ in/in}$ FOR MEMBRANE
 $T = E_{ST} E = 0.003 \text{ in/in} \times 30 \times 10^6 = 90,000 \text{ psi}$ OK BY INSPECTION

FOR THIS CHANNEL CONFIGURATION THE THERMAL STRESSES (BOTH OPERATING AND ACCIDENT) CALCULATED BY AN ELASTIC APPROACH (KALNIN SHELL OF REVOLUTION PROGRAM) ARE CONSIDERED TO BE SECONDARY AND SELF-LIMITING AND ARE NOT COMBINED WITH THE OTHER STRESSES. EXAMINING THE RESULTS OF LC #1 AND LC #2 ABOVE ITS CLEAR THAT THE CONDITION FOR MAXIMUM STRESSES IN THE CHANNELS WAS DURING THE STRUCTURAL PROOF TEST, AND TO A LESSER DEGREE DURING THE INTEGRATED LEAK RATE TESTING. THE EFFECT OF ACCIDENT PRESSURE IN LC #2 WILL REDUCE THE COMPRESSIVE STRESSES INDUCED IN THE LINER (AND IN THE CHANNELS) BY THE PRESTRESS.



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CONCLUSION:

THE TEST CHANNEL SYSTEM OVER INACCESSIBLE LINER SEAM WELDS HAS BEEN PHYSICALLY TESTED DURING THE CONSTRUCTION OF THE REACTOR BUILDING. THE TEST PRESSURE AND CONDITIONS ASSOCIATED WITH THE STRUCTURAL PROOF TEST REPRESENT THE CONTROLLING CASE OF NON-SELF LIMITING LOADS THAT THESE ATTACHMENTS TO THE LINER WILL EXPERIENCE OVER THE LIFE OF THE PLANT. CALCULATIONS HAVE SHOWN THAT THE STRESSES IN THE TEST CHANNELS ARE RELATIVELY LOW UNDER THE PRESSURE ASSOCIATED WITH THE STRUCTURAL PROOF TEST AND THEREFORE ACCEPTABLE.

SECONDLY, TEST CHANNEL STRAINS WERE CHECKED ASSUMING STRAIN (DEFORMATION) COMPATIBILITY WITH THE LINER AND WERE FOUND TO BE WITHIN PERMISSIBLES OF THE ASME BOILER AND PRESSURE VESSEL CODE SECTION III DIVISION 2.

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POWER AND INDUSTRIAL SYSTEMS DIVISION
DESIGN VERIFICATION RECORD

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A

PROJECT:

CRYSTAL RIVER UNIT 3

SUBJECT:

REACTOR BUILDING LINER TEST CHANNEL

IDENTIFIER:

DC-5515-704.57-SE

SECTION NAME AND NUMBER

STRUCTURAL 0414

W.O.

04-5515-704

D. D. KRAUSE

ORIGINATOR

T. D. BISS

PROJECT ENGINEER

THIS DOCUMENT CONTAINS PRELIMINARY DATA/ASSUMPTIONS:

NO ☒ YES ☐ PAGE(S) _____

A COMPUTER PROGRAM WAS:

☒ NOT USED ☐ USED

PROGRAM SYSTEM NAME

REV.

VALIDATED & USED WITHIN
LIMITS OF VERIFICATIONMUST BE VERIFIED
TOGETHER WITH CALC

PROGRAM SYSTEM NAME	REV.	VALIDATED & USED WITHIN LIMITS OF VERIFICATION	MUST BE VERIFIED TOGETHER WITH CALC
(1) _____	_____	_____	_____
(2) _____	_____	_____	_____
(3) _____	_____	_____	_____

VERIFICATION PACKAGE (IDENTIFY EACH ITEM)

DOCUMENTS TO BE VERIFIED

REV.

REV.

DOCUMENTS TO BE VERIFIED	REV.		REV.
(1) DC-5515-704.57-SE	0	(4) _____	_____
(2) _____	_____	(5) _____	_____
(3) _____	_____	(6) _____	_____

SUPPORTING DOCUMENTS

REV.

REV.

SUPPORTING DOCUMENTS	REV.		REV.
(1) DC-5515-704.57-SE	0	(7) _____	_____
(2) _____	_____	(8) _____	_____
(3) _____	_____	(9) _____	_____
(4) _____	_____	(10) _____	_____
(5) _____	_____	(11) _____	_____
(6) _____	_____	(12) _____	_____

ORIGINATOR'S SIGNATURE

7-18-90

DATE

B

NO VERIFICATION REQUIRED PER DCP 2.05:

REASON: _____

VERIFICATION REQUIRED (CHECK METHOD(S)):

DESIGN REVIEW ☒ ALTERNATE CALCULATION ☐ QUALIFICATION TESTING ☐

IDENTIFICATION OF VERIFIER/VERIFICATION TEAM: P. W. Yeh

PROJECT ENGINEER'S SIGNATURE

7-20-90

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ATTACH 'C'

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Attachment A

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CONCURRENCE WITH SELECTION OF VERIFIER(S):

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SECTION MANAGER'S SIGNATURE

7/20/90

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EXTENT OF VERIFICATION:

COMPUTER PROGRAM USE (IF APPLICABLE):

- (1) N/A PROGRAM NAME(S) PROGRAM IS VALIDATED PER DCP 1.40 AND HAS BEEN USED WITHIN THE ESTABLISHED LIMITS OF VERIFICATION AS SHOWN ON THE PROGRAM VERIFICATION RECORDS. A COPY OF THE DVR HAS BEEN SENT TO THE MANAGER OF ENGINEERING SERVICES.
- (2) N/A PROGRAM NAME(S) PROGRAM IS NOT VALIDATED OR NOT USED WITHIN THE LIMITS OF VERIFICATION. THE PROGRAM IS VERIFIED TOGETHER WITH THIS CALCULATION AS DESCRIBED BELOW.

*Verified design inputs and appropriateness
of design approach.*

RESULTS OF VERIFICATION: *Calculations are complete/correct
and done in accordance with DCP 2.05*

ATTESTATION:

THIS DESIGN VERIFICATION WAS PERFORMED IN ACCORDANCE WITH DCP 2.05.

P.W. Yuel

VERIFIER'S SIGNATURE

7-23-90

DATE

E

COMPLETION OF VERIFICATION:

TDRBm

PROJECT ENGINEER'S SIGNATURE

7-23-90

DATE



ATTACHMENT D

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- c. Mill test reports.
- d. Tensile test reports of buttonheaded wire coupons tested in tension.
- e. Inspection reports prepared and submitted to the Owner for each visit to the Supplier's plant indicating the status of compliance for all inspections performed.
- f. Corrective action measures initiated as necessary to assure a quality product.
- g. Certificates of inspection indicating acceptance of completed items according to specifications submitted to the Owner.

5.2.2.4 Reactor Building Liner, Anchors, and Penetrations

The materials for the various portions of the containment liner system were as follows:

- a. The main liner shell excluding the basemat plate, the knuckle plate, and the thickened portion of the cylindrical wall plate in the area of the crane girder bracket, and reinforcement around some penetrations conformed to ASTM A 283 Grade C with a minimum copper content of 0.2% and 3/8 inch thick.
- b. The basemat plate and knuckle plate conformed to ASTM A 283 Grade C and were 1/4 inch thick and 3/4 inch thick, respectively.
- c. The thickened portion of the cylindrical wall plate in the area of the crane girder bracket, the reinforcement around penetrations, and the plate for fabricated penetration sleeves conformed to ASME-ASTM SA-516 Grade 60 or Grade 70¹ and the penetration sleeve material also met ASME-ASTM SA-300 for impact properties.

The plates which are welded into the containment and which are subject to significant design loads normal to their surface have been ultrasonically inspected to ensure that the steel is free from gross internal discontinuities such as pipes, ruptures, and laminations. The procedures and acceptance standards were in accordance with ASTM A-435.

NOTE: ¹ Interior closure plate for penetration no. 353 is SA-36 with chemical, physical, and impact tests. Impact testing was conducted at 5°F.

The remaining penetration sleeves met the requirements of ASME-ASTM SA-333 Grade 1 and SA-300.

- e. The liner attachments, anchors for polar crane support, and rolled sections, including test channels and stiffeners, conformed to ASTM A 36.
- f. The mechanical penetrations and the locks conformed to one of the following ASME-ASTM standards: SA-312, SA-358, SA-240 Type 304, SA-106 Grade B, SA-333 Grade 1, and SA-516 Grade 60 or Grade 70. All of the mechanical penetration materials met the impact requirements of SA-300. (See Note 1 on Page 5-33)
- g. The materials that constitute the pressure boundary of the electrical penetrations were as follows:
 1. Canister SA 333 Grade 1
 2. Header plate SA 240 Type 304
 3. Weld ring SA 516 Grade 70 to A 300

In addition, the materials and fabrication of the penetrations, the penetration sleeves, and the locks met the requirements of ASME Boiler and Pressure Vessel Code Section III Class B (3). (See Note 1 on Page 5-33)

5.2.2.4.1 Codes

The reactor building liner and penetrations conformed in all respects to the applicable Sections of ASA N 6.2-1965 (17). The personnel access locks, the portion of the equipment access door extending beyond the reinforced concrete shell, and the internal primary pressure boundary of all penetrations conformed to the requirements of the ASME Boiler and Pressure Vessel Code Section III Class B. The selection of materials considered a lowest service metal temperature of 120°F within containment and +25°F outside containment.

The principal load carrying components of ferritic materials for the reactor building liner, penetrations, and locks were selected and tested to conform to the impact requirements of ASME-ASTM SA-300 Class 1 and ASME Section III Class B which had a minimum impact test temperature of 0°F. (See Note 1 on Page 5-33)

5.2.2.4.2 Material Certification and Traceability

All materials in the liner, penetrations, and anchors had certified mill test reports. The weld materials had certificates of compliance or typical certificates of analysis. The plate materials for pressure parts of the personnel access locks including inserts were tested at the fabrication shop on a per slab basis to assure compliance with the applicable ASTM Specifications. These tests included the following:

- a. Impact testing to ASTM A-300 Class 1
- b. Tensile test
- c. Bend test
- d. Check analysis

By use of markings or as-built drawings, each part of the main liner and pressure boundaries is traceable to the actual mill test reports.

5.2.2.4.3 Welding Requirements

The qualification of the welding procedures and welders was in accordance with the requirements of ASME Boiler and Pressure Vessel Code Section IX. In addition, those welds designed and fabricated to ASME Section III Class B were qualified under Paragraph N-541 of Section III. The repair of welds was in accordance with Paragraph N-528 of ASME, Section III, and in accordance with repair procedures approved by the Owner and/or the Engineer. The weld porosity was controlled by proper weld control, and the acceptance criteria for porosity in welds that were radiographed was Appendix IV of Section III. Low hydrogen electrodes were used except for cover passes and submerged arc welding.

5.2.2.4.4 Quality Control and Nondestructive Testing

Butt-welded joints in the main liner shell and in the dome were examined by the following methods:

- a. 100% visual inspection
- b. 20% liquid penetrant examination
- c. 100% vacuum box testing or leak testing

d. 2% spot radiograph examination

Butt-welded joints in the personnel access locks and in the penetrations and the reinforcement around the openings were examined by full radiography and other methods called for by ASME Section III Class B and were also vacuum box tested or leak tested.

Nonradiographable joint details covered by the ASME Section III Class B requirements and the polar crane support welds were 100% examined by visual and either liquid penetrant or magnetic particle methods.

All other joint details in the liner, sumps, anchors, etc., which were nonradiographable were examined by the following methods:

- a. 100% visual inspection
- b. 20% liquid penetrant or magnetic particle examination
- c. 100% vacuum box or leak testing

Full radiography was in accordance with Paragraph N-1350 of ASME, Section III. The procedures and acceptance criteria conformed to Paragraph UW-51 of ASME, Section VIII.

Spot radiography was in accordance with approved procedures and governed by the acceptance criteria of Paragraph UW-52 of ASME, Section VIII and porosity charts of Appendix IV of ASME, Section III with the following conditions:

- a. Two percent of the welds covered by spot radiography were examined, excluding repairs.
- b. The 2% was approximately 2% of welds of each welder.
- c. The frequency was 12 inches in every 50 feet of welding.

Liquid penetrant examination methods and acceptance criteria were in accordance with Appendix VIII of ASME, Section VIII.

Magnetic particle examination methods and acceptance criteria were in accordance with Appendix VI of ASME, Section VIII.

5.2.2.4.5 Pressure Testing of Airlocks

Test connections are installed in the airlocks as a part of the permanent installation which will allow pressurization of the airlocks to the calculated peak containment pressure and in