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DEC 11 1969

J. P. O'Reilly, Chief, Reactor Inspection and Enforcement Branch
Division of Compliance

VENDOR INSPECTION REPORT - CRANE COMPANY, CHICAGO, ILLINOIS

The enclosed report of an inspection of the Crane Company in Chicago, Illinois on October 14-15, 1969, is forwarded for information. Our purpose for conducting the inspection was to examine the vendor's capabilities for manufacturing nuclear quality valves. The inspection was arranged through the Duke Power Company whose purchase of valves for the Oconee reactors was considered representative of current valve procurement and manufacturing practices.

Our inspector selected for audit 18 Class I swing check valves which will be used in the core flooding systems. It was determined that these valves were purchased to the new USAS B31.7 and the ASME Pump and Valve (draft July 1968) Code requirements. With respect to these requirements our inspectors found the following three items of nonconformance:

- a. Weld repair procedures and welders were qualified to NavShips 250-1500-1 instead of to the ASME Section IX code as required by paragraph 1-727.5.1 of USAS B31.7 and paragraph 512.5.1 of the Pump and Valve Code.
- b. Dye penetrant tests of all machined surfaces of cast pressure components could not be verified as required by paragraph 314.5 of the ASME Pump and Valve Code.
- c. Nondestructive testing personnel were not qualified to SNT-TC-1A as required by Appendix B, paragraph B-5-120 of USAS B31.7 and the same paragraph reference in the ASME Pump and Valve Code.

In considering the specific circumstances of this situation, we believe that the valves supplied for the Oconee reactors are suitable for service. We base that conclusion on the fact that the Duke Power Company elected to impose higher than required standards (USAS B31.7 and ASME Pump and Valve Code) upon the supplier and that the NavShip standards to which the Crane personnel and procedures are qualified, are probably equivalent

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to the ASME Section IX and SNT-TC-IA rules. However, because the non-qualification of welders and welding procedures is also in nonconformance with current ASME Codes (ASA B31.1.0), we plan to notify the licensee of these construction deficiencies. A secondary objective is to inform the Crane Company indirectly, through the licensee, that an updating of their manufacturing procedures to ASME Code rules is required if they intend to continue to supply nuclear components to licensed facilities.



G. W. Reinmuth
Reactor Inspector (Program
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Division of Compliance

Enclosure:

Crane Company Report 69-1

cc w/enclosure:

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U. S. ATOMIC ENERGY COMMISSION
REGION III
DIVISION OF COMPLIANCE

Vendor Inspection Report

PWR Core Flooding System Check Valves

Vendor: Crane Company - Chicago Plant

Report No: Crane-Chicago 69-1

Dates of Inspection: October 14 - 15, 1969

Components Inspected For: Ocone -1, 50-269
Ocone -2, 50-270
Ocone -3, 50-287

Inspectors: *H. D. Thornburg*
R. E. Oller Metallurgical Engineer (Responsible)
J. W. Sutton, Jr.
J. W. Sutton, Jr. Reactor Inspector (Construction)

Licensee Representatives: J. R. Wells Principal Field Engineer
J. M. Curtis OA Engineer

Report Reviewed By: *H. D. Thornburg*
H. D. Thornburg Senior Reactor Inspector

Proprietary Information: Entire Report

Licensee Application Requirements:

FSAR lists governing Code for Safeguard Systems, Class I & II to be USAS B31.7 per CO:II. Crane Company's specification (G-2) accepted by Duke Power as the contractual document defines tests, inspections, and records of results as called out in USAS B31.7 and Draft of Proposed Pump and Valve Code dated July 1968.

SUMMARY

Crane's Chicago plant management organization is typical of other valve manufacturing plants. The QC manager is independent of manufacturing and reports directly to the plant manager. The QC program is integrated into all phases of engineering design, material procurement, in-process manufacturing, assembly, final cleaning, inspection, and shipment. Suppliers are initially audited and retained on performance record. No provisions are made for periodic inspection of suppliers. Crane has applied for an ASME N stamp survey. (Section II, A.)

Crane has a definitive QC manual covering the Chicago, Chattanooga, and Indian Orchard plants but is oriented to Navships Standards. Welding procedures and welder qualifications are qualified to Navships 250-1500-1 Standard but not to Section IX, ASME Code as required in contractual specifications.

No evidence could be found that tests, inspections, and records of results (specifically PT inspection) were conducted as defined in Draft of the Proposed ASME Pump and Valve Code, dated July 1968. The above requirements were specified in Specification CG-2 Revision 1. Crane Specifications CG-2, "Manufacturing," and CG-3, "Cleaning," were accepted by Duke as the contractual documents for the Oconee Units 1, 2, and 3 valves.

Internal Crane shop orders and test procedures did not define 100% PT of all machined surfaces of castings. Cleaning with demineralized water, as required by CG-3, was also omitted. Weld repairs on Oconee valve castings were performed by welders qualified to Navships 250-1500-1 instead of Section IX, ASME Code. Crane RT technique was acceptable, and the Oconee valves were 100% RT inspected.

Hydro tests and valve certifications were complete and in accordance with specifications. (Section II. B.)

Shop facilities, personnel, and in-process manufacturing procedures were adequate for nuclear valve manufacturing. (Section II. C.)

The following items are considered to be in nonconformance with USAS B31.7:

1. Weld repair procedures and welders are qualified to Navships 250-1500-1 instead of Section IX, ASME B&PV Code.
2. PT of 100% of all machined surfaces could not be verified as required by USAS B31.7.
3. NDT personnel were not qualified to SNT-TC-1A as specified by USAS B31.7.

DETAILS

I. Scope of Inspection

On October 14 - 15, 1969, an announced vendor inspection was performed at the Crane Company's Chicago plant in connection with manufacture of valves for Oconee Units 1, 2, and 3. Inspection was made by R. E. Oller, Metallurgical Engineer, and J. W. Sutton, Jr., Reactor Inspector (construction). The purpose of this inspection was to audit Crane Company's QAL in nuclear valve fabrication and QA activities, with specific reference to the 18 - 1500# Type 316 ASTM A351 GR CF8M swing check valves for Oconee 1 - 2 - 3.

Inspection included Crane Company's organization and records of their conformance to purchaser's specifications, applicable codes, welding fabrication, heat treatment, nondestructive testing (NDT) inspection, hydrostatic testing, and material receiving and control, including disposition of nonconforming material.

The following personnel were contacted during the course of this inspection:

Crane Company (Crane)

J. Darlington - Manager of Power Industry Sales
M. J. Smolek - Manager of Quality Control
C. W. Lange - Superintendent of Quality Control
G. Nesbitt - Metallurgist
O. Paral - Chief Inspector

The Taubman Company - Vendor Sales Representative

J. A. Welb - Sales Engineering
C. Hurst - Sales Engineering

Duke Power Company

J. R. Wells - Principal Field Engineer, Oconee Site
M. Curtis - Quality Assurance Engineer, Charlotte, North Carolina

II. Results of Inspection

A. Crane

1. General Background Information

The Crane Chicago plant is a large complex of buildings producing valves of all sizes and types. The plant is approximately 50 years old. No foundry operations are currently performed at this location. The plant is well equipped with all necessary machine tools (lathes, shapers, boring mills, grinders, heat treatment facilities) to manufacture valves of all sizes. The plant produces both commercial and nuclear valves. Castings are purchased from outside sources. The nuclear valve section is Navy-orientated in all phases of production and inspection. The commercial nuclear valves production has been integrated into this section. Housekeeping of the manufacturing section of the plant is satisfactory. The nuclear inspection areas were found to be clean and well organized.

2. Organization and QC Program

a. Plant Management

The Chicago plant management is typical of other valve manufacturing plants audited by the CO inspectors. Division managers for manufacturing, personnel, materials, metallurgical QC, controller, and product engineering are on the same level of authority. All managers report directly to the plant manager. (See Exhibit 1, attached.)

The QC manager is responsible for QC procedures, vendor audits, receiving inspection, NDT inspection and functional testing, and the metallurgical department. (See Exhibit 2, attached.) Mr. Smolek, QC Manager, stated he has absolute authority to stop work in cases involving discrepant materials or workmanship.

b. QC Program

Through discussion, the CO inspectors learned that QC starts with integration of the customer's specification requirements, with approved changes, into a Crane specification which becomes the contractual document (as in the case of the Duke valves). Materials are procured by purchasing, based on a specification and data list prepared by the engineering and metallurgical departments. The receiving department (under QC) inspects the material visually and dimensionally, also checking against the specification. All MTR's and NDT reports are checked by both the receiving department and the metallurgical laboratory before the material is released to either stockroom bins or a shop work area.

Nuclear parts are identified by a pink tag and accompanied by a "release sheet" and shop specification through each operation. NDT inspection points are specified on the shop specification. After all parts are complete, the valve is assembled in a special area and inspected and tested in accordance with the shop specification. Inspection hold points and tests are witnessed by a customer's representative. For the Duke valves, Pittsburgh Testing Laboratory does the witnessing. Crane's QC

department verifies the manufacturing records, heat numbers, marking, inspection, and NDT results prior to release for shipment. Shipping papers are then prepared with certificates to the customer that all NDT has been performed in accordance with the contractual specification. Data from the suppliers MTR's is transferred to a Crane form and supplied to the customer for each valve.

3. Selection and Audit of Suppliers

The program of supplier selection and audit was also reviewed through discussion with Mr. Lange. This is a purchasing department function utilizing engineering and metallurgical laboratory specifications. Crane maintains a current list of suppliers qualified on a performance record. Initial acceptance of a supplier is based on a Crane inspection, but no provisions are made for periodic reinspection.

4. ASME Survey

The inspectors asked if Crane - Chicago had been surveyed by the ASME. Mr. Smolek stated Crane has applied for the N stamp survey but had no idea when it would be done.

B. Documents Audited

1. QC Manual

The inspectors reviewed the Crane QC manual which covered QC functions for three plants: Chicago, Chattanooga, and Indian Orchard. The manual appeared to be well organized, containing all elements of a good QC program for manufacture of nuclear, nonnuclear and Navy valves but was referenced to Navships Standards. The manual contained the following subjects:

- a. Introduction, Organization Charts to Revisions
- b. QC Requirements (General)
- c. Receiving Inspection
- d. In-process Inspection
- e. Special Process Inspection
- f. Procedures and Systems for Control of Drawings and Engineering Changes

- g. Gage Inspection
- h. Assembly, Test and Final Inspection
- i. Packaging and Shipping

2. Welding Procedures and Welder Qualifications

All welding procedures and welder performance certificates reviewed were qualified to Navships 250-1500-1. No documents could be found which showed qualification to Section IX, ASME Code, as specified in Crane Specification CG-2 which had been accepted by Duke as the contractual document. Due to the welding engineer in charge of records being on vacation, the CO inspectors waited a week and then called Mr. Lange who stated no records were found showing welding procedures and welders were qualified to Section IX requirements. The deviation was then brought to Mr. Curtis' attention by the CO inspectors in a telephone call on October 22. Mr. Curtis stated he would take steps to resolve the deviation with Crane.

3. NDT Procedures and Personnel Qualification

A list of 27 Crane NDT inspectors was reviewed. The list certified that all personnel were qualified for PT and MT in accordance with Navship 250-1500-1 Standard. No evidence could be found that the nondestructive tests and examinations specified in Crane Specification CG-2, Revision 1, were in accordance with USAS B31.7 Code and the July 1968 Draft of the ASME Pump and Valve Code as required in CG-2. The P&V Code, Paragraph B-5-120, also specifies that personnel performing NDT examinations under the code shall be qualified in accordance with SNT-TC-1A. The Crane NDT personnel were not qualified to this standard.

It appeared to the CO inspectors that Crane was not in conformance with the contractual document with regard to NDT requirements. This discrepancy was also brought to the attention of Mr. Curtis.

4. PT, MT, and UT Procedures

Crane procedures covering RT, PT, MT, and UT were described by Mr. Nesbit, Metallurgist, as being spelled out in the Crane Engineering Department letter of instruction called a "B" sheet attached to the contractual document CG-2. Mr. Nesbit was unable to find the "B" sheets pertaining to the

Ocone work. However, he showed the inspectors copies of "B" sheets for another nuclear job. The sheets consisted of B-95362 for PT, B-97302 for MT, and B-100200 for UT. Review of these procedure/instructions showed them to be in accordance with Navships 250-1500-1 Standard and Mil-Std.-271.

5. Manufacturing and QC Procedures

The following two Crane specifications were reviewed:

- a. Manufacturing Specification CG-2, Revision 1, dated December 12, 1968, "Quality Assurance Requirements For Steel Valves 2½" and Larger For Use in Class I & II Nuclear Power Piping Systems."

This document defined the test, inspections, and records of results required for 2½" and larger valves in Class I & II nuclear piping systems as specified in USAS B31.7 and the July 1968 Draft of the Proposed ASME Code for Nuclear Pumps and Valves.

- b. Manufacturing Specification CG-3, "Cleaning For Stainless Steel Valves For Use in Critical Commercial Nuclear Systems."

This specification covers the procedure to be used to clean and maintain cleanliness in the manufacture, assembly, and tests of SS valves for critical commercial nuclear systems as set forth in the customer's order. The procedure applied only to "wetted" surfaces (internal surfaces and parts in contact with the line fluid).

Mr. Lange stated that Crane fits the customer's bid specification requirements into the above two procedures for QC. The material and in-process procedures are then spelled out in Crane shop order specifications to meet customer specifications.

6. MTR's for Ocone Valves

The CO inspector reviewed MTR's for 6 of the 18 stainless swing check valves. All of the 10" and all except one of the 14" valves had been previously shipped to the site.

MTR's showed all valve castings were supplied by Shenago Company, Columbus, Ohio. All chemical and physical properties were found to be in accordance with ASTM A-351, CF8M requirements. NDT tests were certified as having been completed, and the supplier's Certificate of Compliance was attached.

7. Shop Order and Shop Order Book for Oconee Valves

a. Shop Order

The shop order consisted of a complete description of the valves to be manufactured with all necessary dimensional data. Inspection and NDT procedure changes, shop order numbers, and tag numbers for all valves were included. The CO inspectors noted that a change in the cleaning procedure (use of demineralized water) for twelve-14" valves was not on the shop order, although it was called for in the CG-3 Cleaning Procedure. This item was discussed with Mr. Lange who acknowledged that it was an omission in internal paper work but stated that demineralized water was used.

b. Shop Order Book

Review of this document showed it contained the original manufacturing specification and all change order letters in addition to the following records:

- (1) Shop Inspection Sign-Off Sheets
- (2) QC Department Inspection and NDT Records
- (3) Engineering Letters of Instruction

8. Test Records for Oconee

Review of the inspection records for both 10" and 14" valves showed the following test data was complete and in accordance with specifications except as noted:

- a. Chemical and Physical Properties
- b. RT, MT, and PT
- c. Hydrostatic Test
- d. Operating Test

e. Final Cleaning and Inspection

f. Heat Treatment

A discrepancy was noted in PT requirements of CG-2. This specification detailed that the valves would be tested and inspected in accordance with the July 1968 Draft of the ASME Pump and Valve Code, Appendix B-4-100, Paragraph 314.3.5 which requires all external and internal surfaces of cast products shall be examined by MT or PT including final machined surfaces. However, CG-2 stated the following: "After heat treatment and prior to machining, each austenitic steel valve body, bonnet, disc, and cap shall be inspected over all accessible surfaces. After final machining, body weld ends shall be inspected." The CO inspectors advised Crane and Duke representatives that a discrepancy existed in that the P&V Code requires all accessible machined surfaces, including internal machined surfaces, to be PT examined. The records at Crane did not show that the components were 100% PT after final machining. Mr. Lange of Crane was vague as to whether all internal machined surfaces had been PT inspected. By telephone, on October 22, the CO inspectors advised Mr. Curtis (Duke Company) that verification of 100% PT would be desirable as casting defects not picked up by RT could be exposed by machining, and CO had a significant interest in this area.

9. Weld Repair Records - Oconee

Weld repair records for two-14" 1500# valves selected at random were reviewed and found to be complete as to repair procedure, welder identification, filler metal, and final PT and RT inspection. However, on the welder who performed the repairs showed him to be qualified to Navships 250-1500-1 Standard rather than Section IX ASME Code as required.

10. Radiography - Oconee

Radiograph films for one-12" and one-14" valve were reviewed. Both valves were found to be 100% RT inspected. The RT technique was found to be acceptable and in accordance with ASTM procedures.

11. Hydrostatic Test Record - Ocone

Hydrostatic test records for one-14" valve showed the test to comply with CG-2 and MSS-SP-61 as specified. Records contained all required information.

12. QC Final Inspection Record - Ocone

The records for one-14" valve were complete for all components as to body, bonnet, and disk. It contained heat numbers, markings, number of pieces, RT and PT tests performed, specification number, shell and seat hydro test values. It was signed and dated.

13. Valve Certification - Ocone

Crane certifications for valves prior to shipment were examined and found to be complete in identification, description of material, heat treatment, NDT tests, hydro, and was certified and dated by Crane's QC superintendent.

C. Plant Inspection

The following areas of the plant involved in commercial nuclear manufacture were inspected:

1. Receiving Inspection
2. In-process Inspection
3. Finished Stockroom
4. Final Inspection
5. O Ring Testing
6. Valve Stamping
7. Demineralized Water Testing Station
8. Metallurgical Laboratory
9. Machining Areas

All areas appeared to have adequate facilities, personnel, written procedures, and in-process record files. Housekeeping was acceptable.

D. Exit Interview

An exit interview was held with personnel listed in the Scope Section.

The CO inspectors briefly stated CO's purpose for inspection of manufacturers of critical nuclear components was to establish a record of their QAL performance in respect to specification, codes, and standards. In addition, the following items were noted:

1. Crane's internal record system for control during manufacturing and inspection appeared acceptable, but contained discrepancies.
2. There was no evidence that welding procedures and welders were certified in accordance with Section IX as specified by contractual documents. Crane stated they would recheck their files as soon as the welding engineer who had charge of the files returned from vacation.
3. A discrepancy was noted in the requirements for use of demineralized water in cleaning. Crane stated they were aware of this and would review the requirements for this category of valves and would provide the licensee with a letter certifying the valves were cleaned with demineralized water.
4. The QC manual appeared complete in all aspects related to manufacture of nuclear valves but was oriented to Navships Standards rather than USAS and ASME Codes.
5. The NDT procedures and personnel were qualified to Navship Standards. Mr. Smolek stated they were in the process of requalifying procedures and personnel to ASME and USAS Codes.
6. Crane's QC superintendent stated he welcomed the audit and thought it had been conducted within the licensee's contractual limits.

Attachments:
Exhibits I and II