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

VENDOR INSPECTION REPORT

Pipe

Vendor: Cameron Iron Works, Incorporated
Houston, Texas

Report No.: Cameron Iron Works 70-1

Components Inspected For: Duke Power Company
Oconee No. 1

Dates of Inspection: May 26-27, 1970

Inspector: W A Crossman 06.25.70
W. A. Crossman, Reactor Inspector, CO:II Date
(In Charge)

W A Crossman for 06.25.70
R. L. Brown, Reactor Inspector, CO:I Date

Licensee Representative: J. L. L. Ostertag, Engineer
Duke Power Company

Other Persons Contacted: D. S. Brzowski - Senior Engineer, QC
P. R. Davis - Manager, Technical Pipe Marketing
V. M. Spiller, Jr. - Supervisor, NDT
R. E. Hodgin - QC Engineer, Tubular Products
P. F. Pernoud - Sales Engineer, Sales Department
R. Clark - Chief Chemist, Chemical Test Laboratory
T. A. McDonald - Applications Engineer, Product Engineering
E. P. Robert - Sales Engineer, Sales Department
J. Kiefer - Manager, Heat Treatment Department
L. Harvey - Assistant Chief Engineer

VI Rpt. No.
Cameron Iron Works 70-1

Report Reviewed By: W. C. Seidle, Senior Reactor Inspector — 6/25/70 Date

G. W. Reinmuth, Reactor Inspector (Program Standards) — 7/28/70 Date

Proprietary Information: The vendor considers Sections D, F, H, and K as proprietary.

SCOPE

An announced inspection was made of Cameron Iron Works, Incorporated (CIW), in Houston, Texas, on May 26-27, 1970, as a part of the Compliance vendor inspection program.

The visit was arranged through Duke Power Company. The specific purpose of this inspection was to examine pipe and review available records for components supplied to the Oconee project.

An evaluation of the CIW QA program and plant production capabilities are included in the details of the report.

SUMMARY

Significant Items -

1. CIW employs approximately 3,300 people in its Katy Road and Cypress plants. It alloys its own steel. Nuclear components comprise approximately 5% of its production. (See Section A.)

2. CIW does not have code stamp authority. Pipe is the only finished product manufactured. (See Section B.)

3. Facilities for UT examination of forged and extruded components are excellent. RT is contracted to Conam Inspection, Incorporated. (See Section C.)

4. The Manufacturing Process Instruction system utilized by CIW for process control was found to be adequate to produce a quality product. The system outlines all control points, processes, and procedures. (See Section D.)

5. Component identification is maintained by restamping the serial number on the part after each forming or cutting operation. (See Section E.)

6. Document control procedures place the responsibility for recall and/or destruction of obsolete copies from the operation floor on the department supervisors. (See Section F.)

7. CIW does not have a formal procedure for control of weld filler metal. Brzowski indicated that although only a very small amount of welding is performed, CIW management will want to establish a control procedure. (See Section G.)

8. Heat treatment procedures are generated by the engineering department and accompany the Manufacturing Process Instructions. (See Section H.)

9. Repairs to one section of Duke pipe was adequate and well documented. (See Section K.1.)

10. CIW furnished documentation which verified Velan Engineering Company had been provided solution heat treatment records of valve forgings for Duke valves. (See Section K.2.)

Management Interview - Brzowski and Pernoud met with the inspectors for the debriefing. Four major areas were discussed:

1. The inspectors reiterated that CIW should explore the necessity for partial N stamp authority. It was pointed out that in order for Duke to meet all provisions for erection certification of the Oconee main loops utilizing CIW pipe and valve bodies, Duke must certify that the components were manufactured in accordance with ASME code.

   Brzowski and Pernoud indicated that Davis would follow up on this point.

2. Brown pointed out that the need for a formal weld metal control procedure existed. Although the CIW performs only a small amount of code welding, the need to govern issue and return of weld filler metal is essential.

   Brzowski restated his position that he believes that CIW management will want to establish a control procedure in this area. Also that CIW will be in contact with Duke in this regard.

3. Document control was discussed. Although no formal control procedure exists, the department supervisors appear to be well acquainted with their responsibilities concerning document control. Brown pointed out that a possible weakness is that each supervisor is responsible for recall and/or destruction of the obsolete copies of process control procedures from the operation floor.

Brzowski seemed to think the method worked very well but indicated he would explore formalization of the process.

4. The inspectors commented that the weld repairs to the section of Oconee pipe to be used in the core flooding system was well documented.

Brzowski stated that the request for waiver of final heat treatment was made because the repairs were to a small area and were shallow. Also, the danger of invalidating the dimensions by additional heating was imminent.

DETAILS

A. Description of the Facility

CIW produces its own steel (carbon, low-alloy, stainless, and various high-nickel alloys) for its product line of pipe, valves, and specialty items.

CIW is a young plant as foundries go - 47 years. Annual production is approximately 120 million dollars. Employment is approximately 3,300 in the Special Products Division.

The plant is presently expanding to a new site (approximately 1,600 acres) at Cypress, Texas, which is just northwest of Houston. The plant at Cypress has assumed the steel production and testing (product control) responsibilities.

Equipment installed at the Cypress facility includes a 50-ton air melt furnace and a 60-ton vacuum induction furnace. Testing equipment includes a computerized X-ray luminescence analyzer. This instrument was capable of analysis and printout of the composition in percent by weight of at least a dozen chemicals. The test equipment is utilized for control rather than certification of materials.

Pernoud stated that CIW is the largest producer of rotating parts for jet engines. Roughly, production endeavors are divided equally between valve bodies (15 to 20% forged stainless steel), oil field tools, and special items which are produced by either the closed die forging or extrusion process. Approximately 5% of its production volume is for nuclear application.

CIW has been extruding pipe for approximately five years. Large diameter pipe for main coolant loops is presently being extruded at the Houston plant on a 20,000 psi press. Pernoud stated that a larger extrusion press, 35,000 psi, is being installed at the Cypress plant.

B. Code Stamp Authority

Davis replied to the question regarding CIW's position regarding code stamp authority. He stated that he had posed the question to several of the B31 Executive Committee members (specifically W. R. Call) and was informed that it was not necessary since CIW does not manufacture a completed product.

Davis stated that he was very interested in establishing the necessity of an N stamp since CIW will supply an increasing number of components to the nuclear industry.

The inspectors commented that he should check again with the code committees to be assured that they do not need a partial N stamp, since the systems containing CIW pipe must be code stamped by their customer and, consequently, all materials must meet all code requirements.

C. QC Organization and In-Plant NDT Capability

The CIW QC organization is the same as that experienced by Compliance inspectors during May 1969.1/ A plant organization chart and a QC organization chart are attached as Exhibit A.

Wyche, Manager of QC, was not available at the time of the inspection. Pernoud and Hodgin were on hand to accompany the inspectors and designate individuals of the correct disciplines to provide information.

Administration of the facility is divided between two managers who report to a vice president. One manager heads what is essentially metallographic research, testing, and control. The second manager supervises plant activities which include manufacturing, sales, and quality control.

Many of the in-process product controls are directly related to and overlap quality controls. For example, chemical analyses are performed as outlined in Section A and are also performed for certification in the chemical test laboratory facilities at the Houston plant. In-process dimensional checks are made by the product control personnel who work out of the product metallurgical control group.

1/ CO Report No. 50-275/69-5.

All nondestructive testing is the responsibility of the QC department. CIW performs only PT and UT on nuclear products. If RT is performed, it is usually contracted to Conam Inspection, Incorporated (subsidiary of Automation Industries, Incorporated, of Sperry Laboratories).

Liquid penetrant testing procedures and testing personnel are qualified to NAVSHIPS 250-1500.

Ultrasonic testing procedures and personnel are qualified to ASME Section III, Appendix IX. All examiners are Level II, SNT-TC-1A except Spiller who is formally qualified to the applicable SNT-TC-1A requirements as a Level III ultrasonic instructor.

D. Process Control

CIW utilizes a system referred to as Manufacturing Process Instructions (MPI) for control of product and quality. An MPI is prepared by the engineering department for each component to be manufactured. The completed MPI is reviewed by the manufacturing and QC departments. The customer must approve the MPI before it is released to the manufacturing departments for production. Finally, the customer receives the MPI in a package which accompanies the rough machined part.

An MPI form is attached as Exhibit B. The MPI identifies the part, customer, drawings (internal), e.g., rough machine or forging, reference specification(s), and material (CIW code). Procedures and specifications which pertain to a specific component accompany the MPI (such as special heat treatment process). Those process operations which are generalized are designated by Operation No. such as S-1 for sawing mults, W-58 for welding identification plates, or I-53 for final inspection. The letter designates the department performing the operation.

The MPI accompanies the part to all work stations during production. After each operation is completed, it is documented on a "Travel Ticket" (Exhibit C) and sent to the next work station. Two "Travel Tickets" are completed; one is sent to production control and the other accompanies the part to the next work station.

E. Component Identification

Component identity through the various stages of manufacture appears to be satisfactorily controlled. Each item from a heat of material is assigned an individual serial number (S/N). This S/N is restamped on the part after each forming or cutting operation before it is permitted to progress to the next operation. This identity control is by the MPI, "Travel Ticket," and "Serial Checkoff Sheet."

A S/N is assigned to the component at the time it is saw cut and the heat number is correlated to the S/N by use of the "Serial Checkoff Sheet." This checkoff sheet identifies the part number, order number, product class in addition to the CIW S/N "mult" weight (also by whom cut) heat number, etc. These are reproduced and sent to all departments which have an input to these records.

Metallurgical certification of the material in the metal heat is entered on an IBM format and correlated to the heat number. The metallurgical department is responsible for entering the chemical analysis and mechanical test results into the computer. Continuing identity is maintained by the production control group which receives the second copy of the "Travel Ticket."

F. Document Control

Document control appears to be satisfactory. Although the program does not include a procedure for implementation of document control, every department supervisor appears to know all control procedures are originated and distributed by the engineering department.

The weakness in this system is that each department supervisor is responsible for recall and/or destruction of the obsolete copies from the operation floor.

Revisions to the MPI's are sent to all departments and the supervisor in each department is designated to be responsible for insertion of the revision and destruction of the old copy. (Brzewski stated that this period is approximately eight hours.) All departments have an input for modification of MPI's.

G. Welding

According to CIW management, the only welding it performs in its nuclear production is repair welding.

A repair weld procedure for each defect repair occurrence is established by the engineering department. Each repair procedure and the weldor is qualified in accordance with ASME Code, Section IX. A weld repair record for defect repair is attached as Exhibit D.

Weld electrode control is a very questionable area. CIW does not have a formal procedure governing electrode issue and return. It is handled by word of mouth only between the engineering department (which has

the material certification of the electrode) which is responsible for repair to nuclear components, and according to Harvey and Brzowski, is the only department authorized to issue electrodes for nuclear repair.

The need for a formal control procedure does exist; however, CIW appears to be able to control the minor amount of repair welding that is performed by the informal word-of-mouth approach. This would not be possible if the process required more than one welder or a major amount of repair welding or any production fabrication welding.

Brzowski stated he personally believes that CIW management will want to establish a control procedure in this area. He further stated that CIW will be in contact with Duke in this regard.

Review of the repair welding procedure established for defect repair in a length of 14-inch Schedule 140, Type 304 H pipe, procedure qualification, and welder qualification records indicated they were acceptable and in accordance with ASME Section IX, 1968 Edition.

H. Heat Treatment

CIW furnaces are natural gas (domestic) fired.

The furnace heat is recorded from 18 thermocouples: 16 TC + 1 (master TC) measuring chamber temperature and 1 (alarm TC) measuring the temperature in the area of the product. Alarm TC is set 25°F above nominal heat treat temperature and is capable of activating an alarm and shutting down the furnace if excessive temperature is encountered.

Thermocouples are replaced routinely every 30 days, or more often if necessary, with new calibrated thermocouples.

According to Kiefer, the maximum elapsed time for transfer of a part from the heat treat furnace to the quench pit is one minute, but in most cases the average is thirty seconds.

Heat treat procedures are generated by the engineering department and accompany the manufacturing process instructions.

Temperature of the part during the extrusion or forging operation and the transfer time from furnace to quench pit is continually monitored by a member of the metallurgical department. This person does not have the authority to make metallurgical decisions but he can stop an operation (forging or extrusion) if the temperatures are not as specified.

I. Maintenance and Calibration of Inspection Equipment

Hedgin stated that ultrasonic test equipment is calibrated every 90 days and the test plates are resurfaced annually.

Dimensional digital readout equipment is calibrated every 90 days.

J. Customers for Nuclear Components

CIW supplies components to the following major nuclear contractors:

Blaw-Knox Company, Copes-Vulcan Division
Crane Company, Chapman Valve Division
Velan Engineering Company
Chemetron Corporation, Tube Turns Division
Westinghouse Electric Corporation
Babcock and Wilcox Company, Tubular Products Division
(for KAPL)

K. Components for Oconee

1. Pipe

The inspectors reviewed the repair of one 14' 8-1/2" length of pipe to be used in the core flood system (System No. 53).

The pipe is included in Customer Order No. 32196 and identified by Forge Serial No. 5190 as follows:

14" OD, S-140, T-304H, A-376, Heat No. F 2143

Certification of chemical analysis and mechanical properties are attached as Exhibit E.

Records indicate that the section of pipe was rejected because the wall did not meet minimum thickness requirements in three areas. Repairs were accomplished by building up the areas with weld metal, finishing, and then PT and RT examination to determine if the repairs were effective.

Inasmuch as the three weld repairs were relatively shallow and small in size, CIW requested that Duke waive the requirement set forth in Weld Repair Procedure W-57, which requires heat treatment following completion of welding. (See Exhibit F.) Subsequent information revealed that Duke waived the heat treatment.

Weld Repair Procedure W-57 was reviewed by the inspectors and assessed for adequacy. The procedure was dated October 16, 1969, and revised November 12, 1969. The procedure was qualified in accordance with ASME B&PV Code Section IX. Weldors utilizing the procedure were required to be qualified by the same code. Base metal is P-No. 8 material; filler metal is to be E 308-15 in accordance with SA-298.

Inspection requirements were described as follows:

a. Weld areas are to be prepared by grinding or machining and PT examined to insure removal of defect.

b. The entire area shall be PT examined for one-half inch on each side.

   (1) PT after each weld pass for noninjurious defects.

   (2) PT after completed weld before RT for injurious defects.

   (3) PT per CIW Procedure P-13.

   (4) PT acceptance standard for the weld and surrounding base metal:

      (a) RT of injurious weld defects shall be applied to those encroaching in excess of one-fourth inch minimum wall.

      (b) Either RT or progressive PT shall be performed on those injurious defects which encroach on less than one-fourth inch minimum wall.

RT of the three repair areas was by Conam Inspection, Incorporated. The acceptance standard was by USASI B31.7, "Nuclear Piping." Technique was in accordance with ASTM E94 utilizing an 86 cu Ir-192 source for five minutes.

The inspectors reviewed three X-ray film (14" x 17") labeled 5190-1, 2, and 3. The sensitivity was 2T using a No. 25 penetrameter. Film type D-7 was utilized with a front screen of .005" Pb and a back screen of .010" Pb.

No defects were observed.

2. Valves

Drzewski provided the inspectors with documentation concerning the solution heat treatment of valve forgings shipped to Velan Engineering Company (Velan). (See Exhibit G.)

The letter states specifically that records furnished covered all valve forgings shipped to Velan for Duke valves in the past and will be included on valves shipped in the future.

Attachments:
Exhibits A thru G

ORGANIZATION CHART

CAMERON IRON WORKS

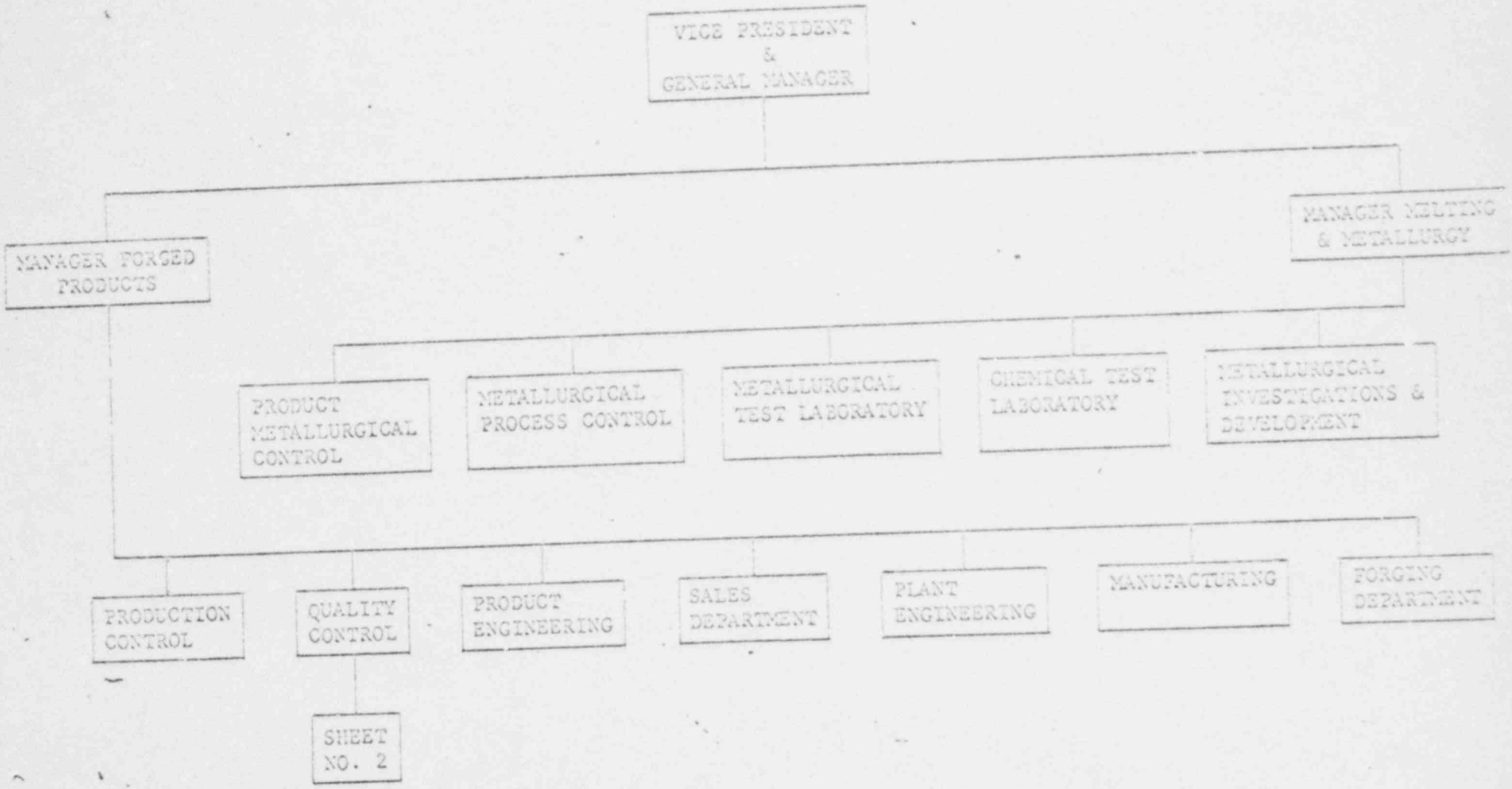

Exhibit A
Page 1 of

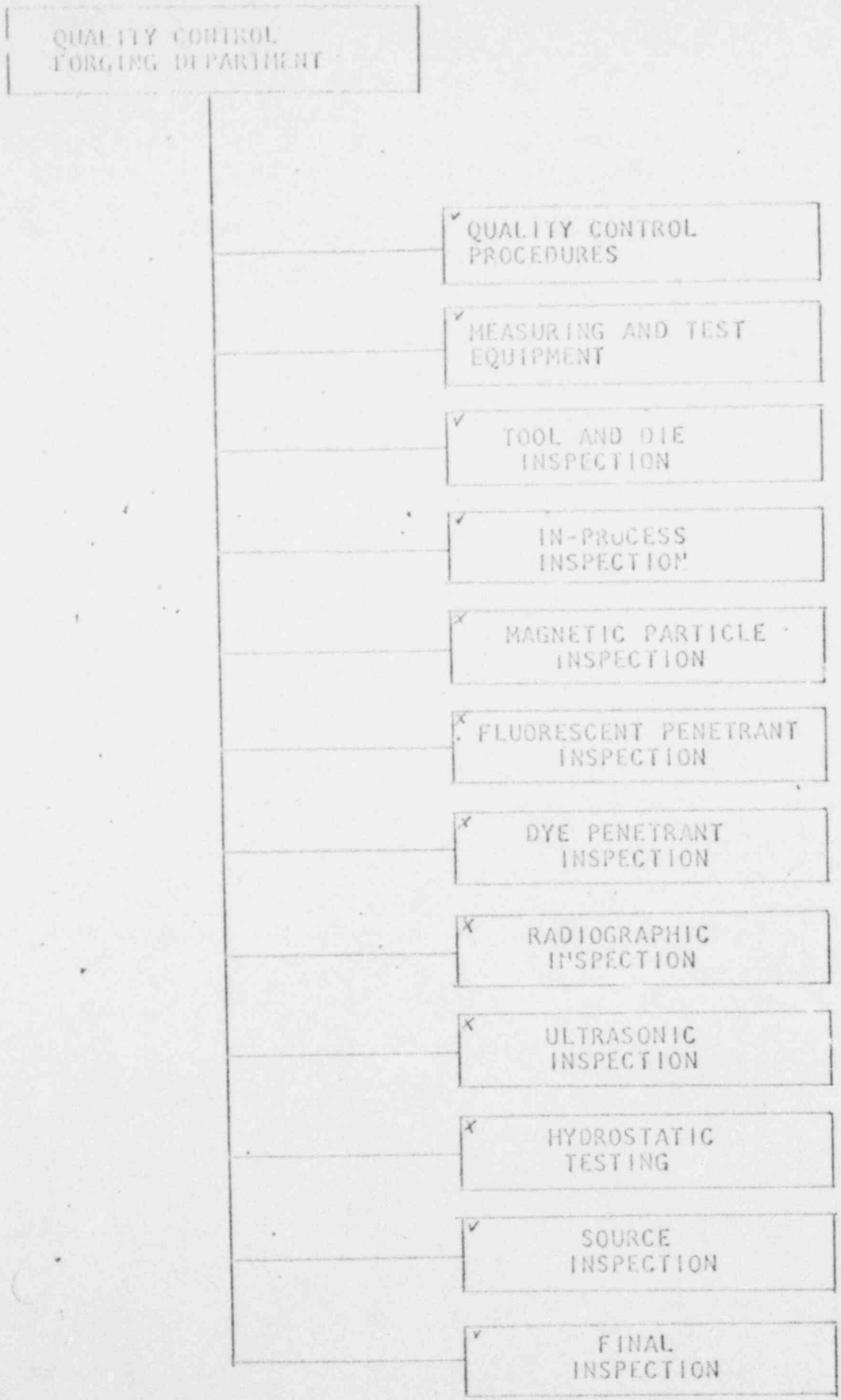
QUALITY CONTROL
FORGING DEPARTMENT
QUALITY CONTROL PROCEDURES
MEASURING AND TEST EQUIPMENT
TOOL AND DIE INSPECTION
IN-PROCESS INSPECTION
MAGNETIC PARTICLE INSPECTION
FLUORESCENT PENETRANT INSPECTION
DYE PENETRANT INSPECTION
RADIOGRAPHIC INSPECTION
ULTRASONIC INSPECTION
HYDROSTATIC TESTING
SOURCE INSPECTION
FINAL INSPECTION

Exhibit A

CAMERON IRON WORKS, INC.

ENGINEERING DEPARTMENT

MANUFACTURING PROCESS INSTRUCTIONS

Part:

Customer:

C. I. W. Part Drawings:

Ref. Specs:

Matl:

OPER. No.	DEPT. No.	MFG. CTR.	PROCESS	REFERENCE

REVISION		Date	P. I. No.
		By:	
		Approved	Sht. of Sheets

Exhibit B
Page 1 of 1

TRAVEL TICKET

PART NO	ORDER NO	DATE

OPERATION	DEPT NO

SEND TO	QUANTITY

SERIAL NUMBERS

REMARKS

BY

Exhibit C

PRODUCTION CONTROL COPY Page 1 of 1

CAMERON 148 - 3/69 REV

BASE MATERIAL RECORD OF R IR WELD

-154

PART IDENTIFICATION

(1) NAME OF PART
(2) C.I.W. PART NO.
(3) HEAT NO.
(4) SERIAL NO.
(5) SALES ORDER NO.

AUTHORITY

(1) DATE SUBMITTED
(2) DATE APPROVED

DESCRIPTION OF DEFECT

(1) SIZE AND LOCATION (USE SEPARATE DWG. OR W-FORM)
(2) METHOD OF DISCOVERING DEFECT
(3) TYPE OF DEFECT

WELDING INFORMATION

(1) WELD PROCEDURE REV DATE
(2) BASE MATERIAL
(3) FILLER MATERIAL
(4) FILLER MATERIAL SUPPLIER
(5) FILLER MATERIAL LOT NO.
(6) WEIGHT OF FILLER MATERIAL APPLIED

WELDER NAME & NO.

DATE

WELDING CHARACTERISTICS

(1) ELECTRODE DIAMETER
(2) AMPERAGE
(3) VOLTS
(4) POLARITY
(5) SHIELDING GAS
(6) GAS FLOW
(7) PREHEAT (IF REQUIRED)
(8) INTERPASS TEMPERATURE (IF REQUIRED)
(9) POST WELD TREATMENT (IF REQUIRED)

WELD INSPECTION

(1) INSPECTION METHOD REV DATE
(2) INSPECTION PROCEDURE
(3) FREQUENCY OF INSPECTION

	INSPECTOR	DATE
1ST LAYER		
2ND LAYER		
3RD LAYER		
4TH LAYER		

(4) INSPECTION RESULTS (INCLUDE FILM IF RADIOGRAPHY IS USED)
(5) INSPECTOR (FINAL)
(6) DATE

INSPECTION APPROVED BY

POOR ORIGINAL

PROPERTY OF CAMERON IRON WORKS, INC., HOUSTON, TEXAS

CHANGED	SUPERSEDES	DATE 3-5-63	SCALE
A7-24-63	SUPERSEDED BY	DRAWN BY LSH	FILE NO.
B2-13-68	WEIGHT	TRACED BY	
		CHECKED BY	
		APPROVED BY	

Form 1 Sept 1962

GRINNELL COMPANY
INC.
EXECUTIVE OFFICES PROVIDENCE, R.I.
1411 WEST MOREHEAD STREET
P. O. BOX 8248
CHARLOTTE, N. C. 28208

May 22, 1970

Duke Power Company
Post Office Box 2178
Charlotte, N. C.

Attention: Mr. W. H. Owen/R. E. Miller

Gentlemen:

Subject: Oconee 1 & 2
Core Flood System Piping
System #53
Order CHA 32196

By referring to our May 6th letter to Cameron Iron Works you will recall that the following pipe is being repaired at their Houston, Texas, plant:

1¼" S-1140 T-304H A-376 Heat #F2143, Serial 5190, length 14' - 8-1/8"

Inasmuch as the weld repair is relatively shallow and small in size, Cameron Iron Works has requested that you waive the requirement set forth in their Weld Repair Procedure W 57 calling for heat treatment following completion of welding.

Cameron understands that the repaired area is to be Penetrant and X-Ray tested, and that the entire length of pipe is to be tested Ultrasonically prior to re-shipment to Oconee.

Would you confirm also that you now feel it will not be necessary for our Examiner from Grinnell R & D, Providence, R. I., to re-inspect this piece of pipe and witness the sonic inspection.

Very truly yours,

GRINNELL COMPANY, INC.

C. S. Fullian

C. S. Fullian
Department Manager
Industrial Piping Division

CSF/mhw
CC: Mr. A. S. Laurenson (2)

Exhibit F
Page 1 of 1

DUKE POWER COMPANY
P. O. BOX 2178
GENERAL OFFICES
422 SOUTH CHURCH STREET
CHARLOTTE, N. C. 28201
TELEPHONE AREA 704
372-4721

May 25, 1970

Mr. John M. Blackmon
BURNS AND ROE, INC.
Repr Velan Engineering
Charlotte, North Carolina

RE: Oconee 1-3
MPSCo 1-30036
Forged Steel Valves
Velan Ref P-34000
Quality Control Information
Duke File OS-27-E

Dear Mr. Blackmon:

This is to confirm our telephone conversation of May 22, 1970 regarding heat treatment records of the valve forgings for the vendors of Velan Engineering. Please refer to our previous letter of March 31 and your letter of April 29, 1970.

We understand that the Cameron Iron Works of Houston, Texas has provided Velan Engineering the requested documentation on heat treatment for forgings. The records covered all valve forgings shipped to Velan for Duke valves in the past and will be included on forgings shipped in the future. We further understand that Velan is processing this information and it will be transmitted to Duke in order for it to be included in our valve records. Should this information come to your office please transmit to us as early as possible.

We appreciate your efforts in obtaining this information.

Very truly yours,

W. H. Owen, Principal Mechanical Engineer

By: D. S. Robbins

DSR/JMC/cf

Copy to: Mr. R. F. Smith
Mr. J. L. L. Ostertag
Mr. J. M. Curtis
Duke File OS-20.7

Exhibit G
Page 1 of

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