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

Report of Inspection

CO Report Nos. 50-269/69-6
50-270/69-5
50-287/69-5

Licensee: Duke Power Company
Oconee 1, 2, 3
License Nos. CPPR-33, 34, 35
Category A

Date of Inspection: April 23-24, 1969

Date of Previous Inspection: April 9-11, 1969 (Site)
April 22, 1969 (B&W, Mt. Vernon)

Inspected By: W. B. Swan — May 26, 1969
W. B. Swan, Reactor Inspector (Construction) — Date

Reviewed By: W. C. Seidle — 5/26/69
W. C. Seidle, Senior Reactor Inspector — Date

Proprietary Information: None

SCOPE

An announced, vendor shop inspection was made of the Barberton, Ohio, manufacturing plant of the Power Generation Division of the Babcock and Wilcox Company. The inspection was made with the cognizance of R. E. Oller, Metallurgist of Region III, who is the assigned inspector for B&W plants. It was made in the company of J. R. Wells, Principal Field Engineer for Duke Power Company Oconee Station.

The scope of the inspection covered the following:

1. Evaluation of B&W's quality assurance organization and specific implementation program for fabrication of critical equipment and piping for Duke's Oconee Station.

2. Inspection of manufacturing facilities and observation of work in process.

3. Inspection of testing facilities and observation of QC procedures, followed by a sampling of QC records.

4. Inspection of specific items of piping and equipment being fabricated for Duke.

SUMMARY

Safety Items - None

Nonconformance Items - None were noted separate from flaws already detected by B&W QC and being corrected.

Other Significant Items -

1. Facilities

The Barberton plant has been in operation for many years. It consists of old and new shop structures and offices covering a large area. The shop equipment varies from the sophisticated, ultramodern to the ancient and simple. It appears to average about ten to fifteen years in age.

2. Work Force

The work force is stable, adequate, and well trained. Average age is probably in the forties. Production supervision is unobtrusive but effective, and is well backed by detailed engineering planning of all processes.

3. QA and QC

The quality assurance group is well organized and trained, adequately equipped and backed up by written procedures and a good record system. Although it is not generally considered desirable to have a Manager of Quality Assurance reporting to a Vice President of Manufacturing, the evidence is that at this plant, the QA and QC, in fact, have the authority and independence to compel compliance with quality requirements.

The QC records are kept in unusual detail for all types of tests. The system of preparing a separate sheet for each squawk, flaw disposition, and process step makes tracing of the flow of QC

work time consuming. Also, the practice of disclosing to the licensee's inspector only the records of final, acceptable tests leaves some doubt as to the product integrity. Recent changes in top management of operations and in QA is reflected in some work delay and employee attitudes. As at Mt. Vernon, QC's zealousness in detecting and correcting flaws is seemingly not supplemented by similar zeal in helping manufacturing avoid generation of work flaws.

QA and QC at this plant are effective and capable of producing nuclear power plant quality heavy piping and equipment.

4. Product

One completed shepherd's hook shaped section of 36-inch steam line was ready for shipment, and work was nearing completion on a pressurizer and on a steam generator. Visual inspection and sampling of test records indicated that completed work and in-process work released for the next process was flawless.

5. Receiving Inspection, Storage and Shipping

A walk-through inspection was made of the various areas and typical forms were reviewed, but the inspection was inadequate in depth to honestly evaluate the efficacy of controls on these functions.

Management Interview - No formal exit interview was held. The inspector had severe laryngitis and the licensee's representative, Wells, felt that interim discussions had sufficed since no items of nonconformance had been found. Wells later expressed to the inspector some concern about schedules and the possibility of undesirable impact of B&W management changes on quality control. His in-plant inspector, Curtis, will monitor closely in the weeks ahead.

DETAILS

A. Persons Contacted

Babcock and Wilcox Company

J. Lang, Section Head of Quality Assurance Engineering
J. Gershom, Section Head of Quality Control Engineering
H. C. Graber, Section Head of Nondestructive Testing
C. E. Jessen, Chief Inspector
Jung, Project Engineer, Design, for Duke Oconee Material
Laver, Design Engineer, Preparation at Process Instructions

Bob Sprattling, Lead Engineer
M. J. Hoover, Contract Supervisor (Project Expediter) for Duke Oconee Material
O. E. Phoenix, QC Supervisor for Radiography
J. D. Kelley, QC Supervisor for Ultrasonic
H. L. Belton, Supervisor of Magnetic Particle and Dye Penetrant Testing
F. W. Kane, QC Liaison between Mt. Vernon and Barberton

Duke Power Company

J. R. Wells, Principal Field Engineer, Oconee Station
J. Malcolm Curtis, Resident Inspector at B&W Plants

B. Quality Assurance Organization

1. Management Changes

At the time of the inspection, the Vice President of the Manufacturing Department, A. T. Fragomen, had recently resigned after a long tenure. He has now been replaced by Gerald A. Profita. The Manager of Quality Control, W. A. Hansen, reports to him. B&W's President, George Zipf, is also acting as head of the Power Generation Division. C. T. Smith has been elected Vice President and is head of Power Generation Sales, replacing S. T. McKenzie, retired. The head of Nondestructive Testing, H. C. Graber, was helpful to the inspector, but he was shaken up badly by a just-announced split of his group with half of the personnel going to a new section designated as Quality Control Engineering to be headed by Graber's long-term subordinate, J. Gershom. Ripples of apprehension and distraction affected the inspection on both days.

2. QA Documentation

Jim Lang reviewed with Wells and the inspector the utilization of B&W's "Standard Practices Instructions," "Quality Assurance Manual," and a project pamphlet entitled "Codes, Design Data, and Non-Destructive Testing for Major Components for Oconee 1, 2, and 3."

The inspector was given, at the request of Wells, a print of each of two reactor coolant piping assembly drawings, and a print of a sketch for a pipe assembly with piece numbers and weld joint identification numbers.

As a placebo in lieu of permission to photograph hardware, Sprattling gave the inspector an outdated (1964) B&W brochure entitled "Manufacturing at Barberton" which pictures some of the manufacturing and testing equipment and procedures still in use.

A few days after the inspection, Hoover mailed to the inspector a March 1968 B&W brochure entitled "Dependable and Economical Nuclear Power" which explains B&W's philosophy and experience in nuclear power plant design, management, and supplemental services.

These documents were helpful in reviewing operations, testing, records and hardware. Copies are on file in Region II.

3. Use of Codes in QC and QA

Lang and Graber of B&W and Wells of Duke discussed and agreed on the intent during design, QA planning and QC implementation to conform not only with the applicable ASME Boiler and Pressure Vessel Codes as written but also to incorporate recommendations of a recent ASME Audit Team which had inspected B&W plants. In addition to Code B.31.1 for High Pressure Piping, they are utilizing Code B.31.7, issued unofficially in February, for nuclear piping.

C. Discussion on Schedule for Duke Material

Prior to the initial shop tour, Wells held a discussion with Hoover, Sprattling and Jung about scheduled deliveries. He was told that one assembly of the 36-inch steam loop was scheduled to be shipped to Oconee on June 1, followed by a section of 28-inch recirculation piping to be shipped on July 20, but he asserted, and they agreed, that these two pieces would miss those dates and that the following more complex equipment would miss their shipment schedules by two months or more. No B&W man, including the Oconee project "expediter" seemed to feel guilty or apprehensive about the schedule slippages.

D. Shop Tour on April 23

Hoover took the inspector on a shop tour in the afternoon during which various manufacturing operations were observed on pipe extrusion and fabrication of large vessels including their installation of very large number of tubes in a tube header plate.

A large Duke pressure vessel central section was awaiting receipt of the heads.

Part No. 4-203-59-1, a tube section, was marked "Heater Belt Shell" and had one head installed.

Inconel penetrations were being installed on a section of core flooding tank equipped with a spun head. The part number was A12-203-61-2.

Tube welding to a thick tube "sheet" was being performed by B&W-developed pulse arc method which requires very precise preparation machining and arc control in tight quarters to install 15,600 tubes. Equally impressive was the highly precise drilling of holes, followed by complex broaching of each hole in the intermediate spacer plates so that each tube is in contact along four thin lines with the spacer plate, leaving clear areas for liquid flow past the tubes for good heat transfer and unrestricted axial movement of the tubes. A clever, effective, expensive, hard to control, and tedious process!

Steam generator for Duke Oconee No. 1 had its tubes in and one head on, with the head under post heat while the 480 ton assembly was slowly rotated. The tube sheet end head had not been installed. The assembly number was 203-55-1.

A second core flooding tank center section, part number B12-203-61-1 was inspected.

A massive base support skirt, part number A96-203-55-1, for the steam generator noted above, was under final machining. B&W men were very proud of the design of a J-weld for joining the base to the steam generator shell. The inspector noted that a J-weld joining the liquid oxygen tank forward bulkhead had been the most difficult fabrication problem on the Saturn II rocket booster vehicle for the lunar program.

An upper head, B-203-55-1, was being readied for a second steam generator.

A Lukens fabricated upper head, A10-203-61-2, was being dye penetrant tested by a technician who was standing in the inverted head, spreading the volatile penetrants while busily smoking a cigarette.

A hook-shaped 28-inch I.D. pipe section, B67-203-50-(?), for another site was ready for shipment.

E. Inspection of Records

To sample the QC test records, the inspector selected a reject sheet from the process records on part number B67-203-50 and one from part number A57-203-50-1.

One proved to be a flaw detected by radiograph. The weld had been repaired and rejected a second time by radiograph F-79606, reject sheet H-7646; then found acceptable by radiograph F-79652.

The rejection on the second part was found to have been based on an ultrasonic test. A detailed chart which had been prepared by the UT technician precisely locating the weld flaws in three dimensions was examined by the inspector. The defects had been removed on a process variation order, and a second UT test approved the work.

Retrieval of the records on the UT was laborious due to filing of the various types of test records and repairs and release orders in random order by dates, in several files rather than by reference numbers of the various types of papers. Once retrieved, the records were found to be thoroughly detailed.

F. Composite Metal Walls on Piping and Pressure Vessels

The designers of B&W, Bechtel, and Duke Power Company had chosen to have the pipe walls and pressure vessel walls and heads obtain their principal strength from carbon steel, while resistance to corrosion, scouring and cavitation is provided by a thick layer of stainless steel cladding. The cladding is deposited by automatic submerged arc process where six stringers of cladding metal are laid down in a helical pattern. Large pipe ells are formed in halves and closed with two seam welds, at the inner and outer radii, first on the carbon steel, then on the cladding. On some pipe section ends and faces of vessel penetrations, the cladding is done with Inconel.

Smoothing of the inner surface of the cladding is a laborious process, even though done principally by machining. On pipe sections and ells examined by the inspector, precise roundness and extreme smoothness are not obtained. The pressure vessels can be more precisely finished by large boring mills and other stationary machining.

The pipe sections are started by punching a hole through a white hot carbon steel billet, which is then forced by a large ram through a series of ring dies dropped successively in place by a boom crane. Reference was previously made to the use by B&W of some amazingly crude and ancient methods. As an example, in the pipe forming, as the work piece is started through each ring die, a man shovels borax out of a barrel and spreads it on top of the hot metal with his shovel. This is not precisely done, because of the heat, the reach he has to make, and breaks in rhythm by the crane and ram operators. The borax melts and runs down over the hot metal, some of it acting as lubricant between the hot steel and the ring die.

G. Final QA Discussions and Shop Tour

Prior to a final shop tour, a discussion was held with Lang, Jung, Spratt[illegible], Hoover, and others of B&W, and Wells of Duke. Wells discussed licensee versus vendor contract matters with Hoover; then he and the inspector reviewed the latest revisions of two drawings on reactor coolant piping assembly. Wells urged that the drawing change approval procedure be simplified to speed incorporation of required backfit changes without serious schedule impact. Hoover explained that Mt. Vernon was soon to have a design group, and that the concentration of engineering functions at Lynchburg was being lessened by this and relocation of some design functions to Barberton.

A walk-through tour was made of the plate receiving and storage areas, of the pressure vessel assembly area, and of the reactor vessel fabrication and rework areas. On the previous day, much work on fossil fuel plant boiler tube headers had been observed. On this tour, a large volume of a variety of sizes of used headers and heat exchanger tube banks were seen under repair and modernization. Most of this rework was for the Navy, as was the bulk of the reactor work.

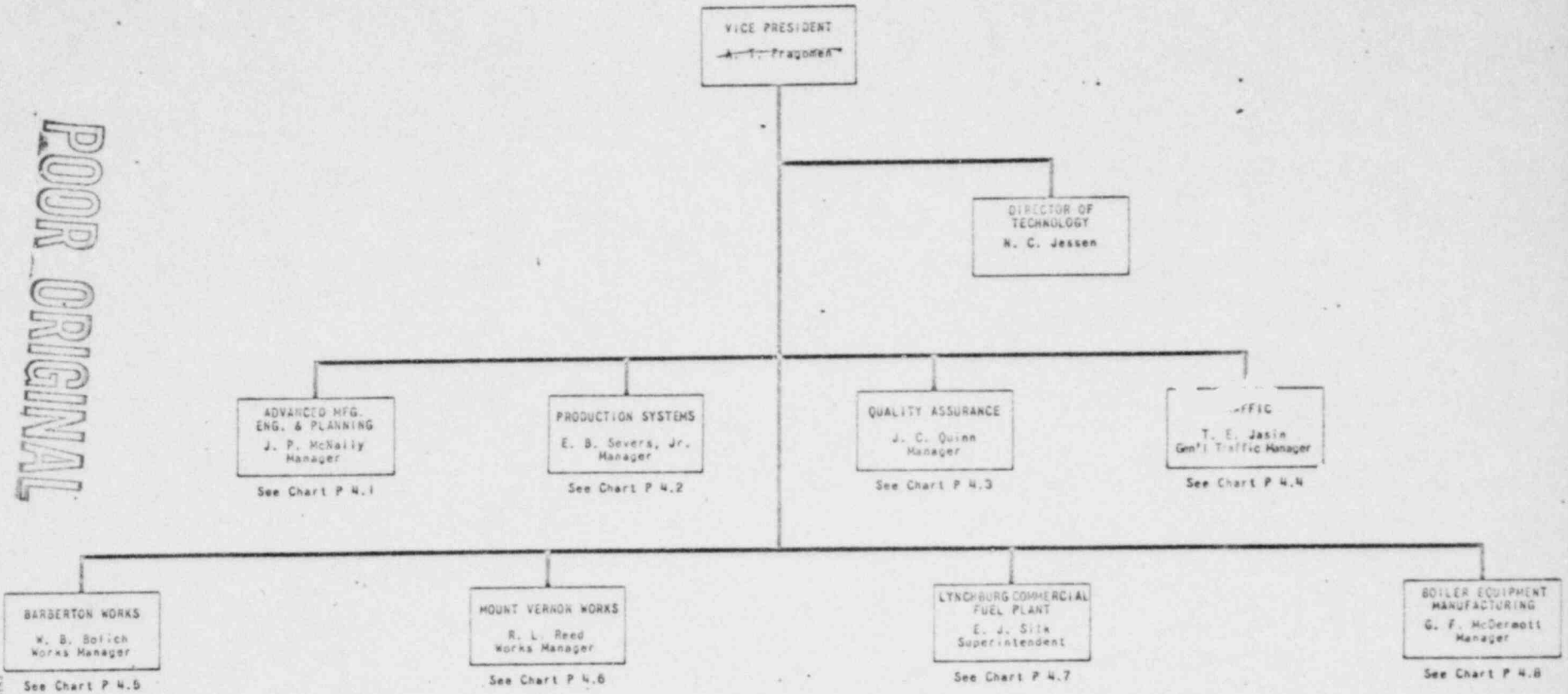
H. Plant Workload

The plant appears to be operating near capacity, as to area available, machine capacity, testing facilities and manpower. An estimate of the source of the work observed underway at Barberton would show a distribution as follows:

	%
New U.S. Navy work	45
Navy Repair and Modernization	15
Civilian Fossil Fuel Work, including Rework	20
Duke Oconee Fabrication	5
Other Nuclear Plant Effort	5
	100

Attachment:
Exhibit A

POWER GENERATION DIVISION
MANUFACTURING DEPARTMENT



This chart is prepared and maintained by Staff Division, N.Y.
Detail charts referred to are maintained by Staff Service Dept., Power Generation Division, Barberton.

3-6-69

ORGANIZATION CHART NO. P 4

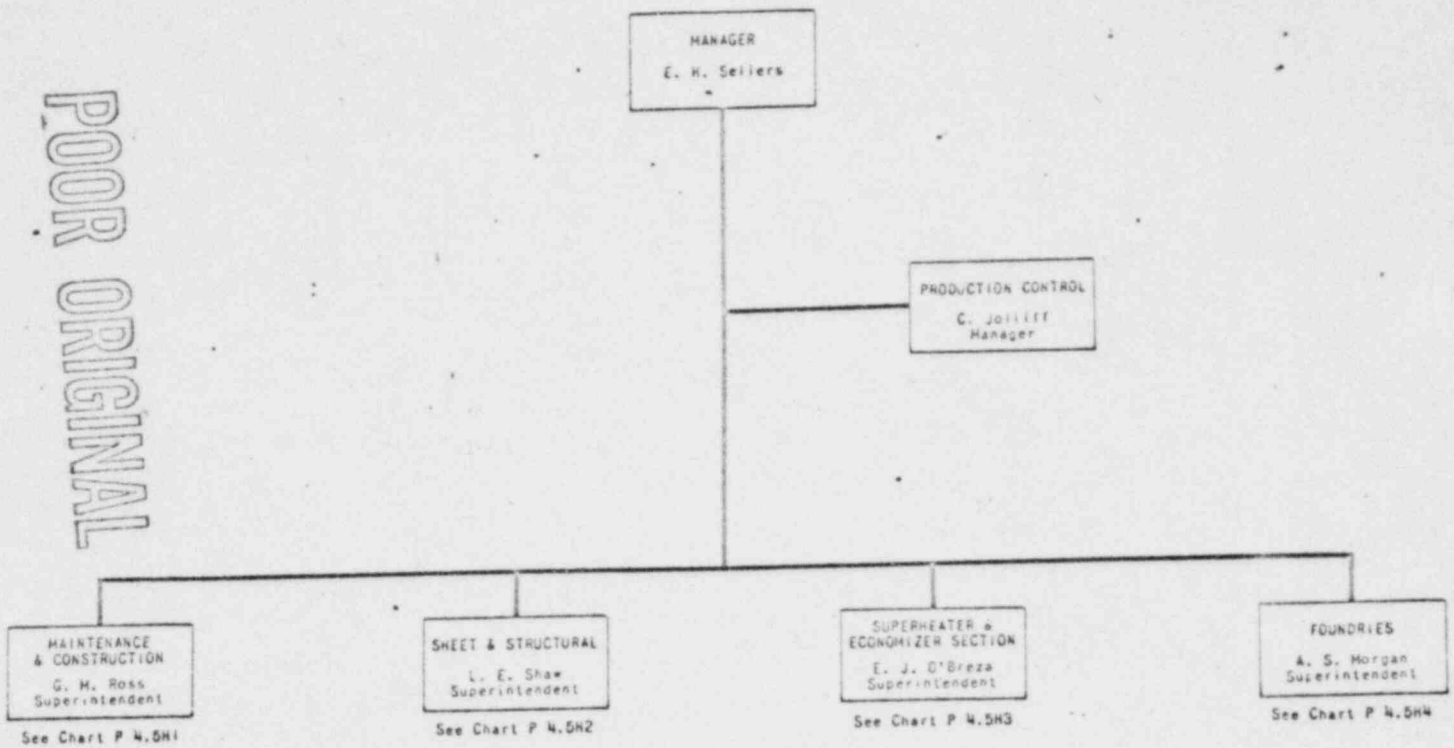
THE BABCOCK & WILCOX COMPANY

4-23-69

POWER GENERATION DIVISION

MANUFACTURING DEPARTMENT BARBERTON WORKS

BOILER EQUIPMENT MANUFACTURING



3-20-6

ORGANIZATION CHART NO. P 4.5

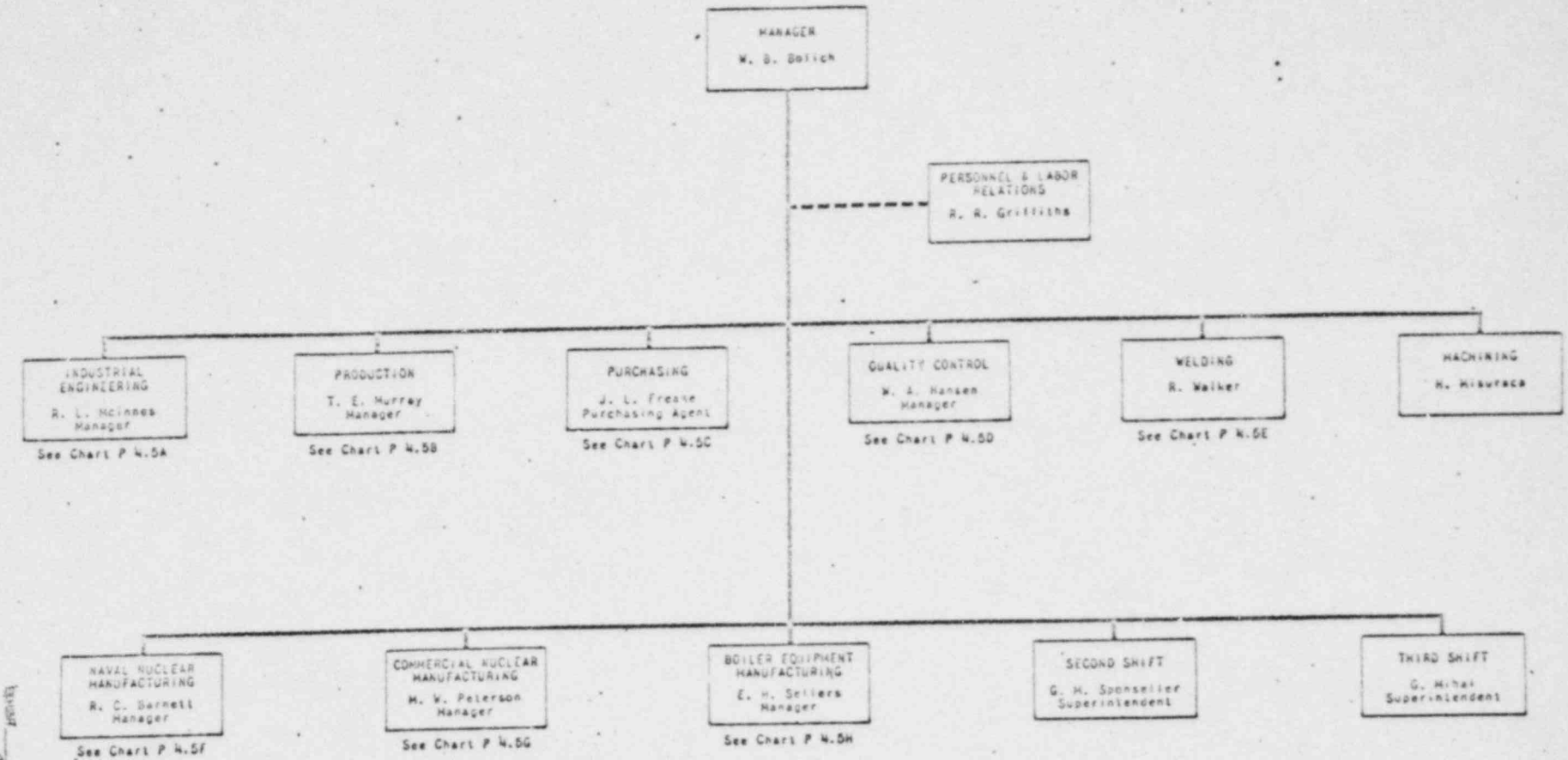
THE BABCOCK & WILCOX COMPANY

4-23-69

POWER GENERATION DIVISION

MANUFACTURING DEPARTMENT

BARBERTON WORKS



Denotes functional responsibility

3-20

ORGANIZATION CHART NO. P

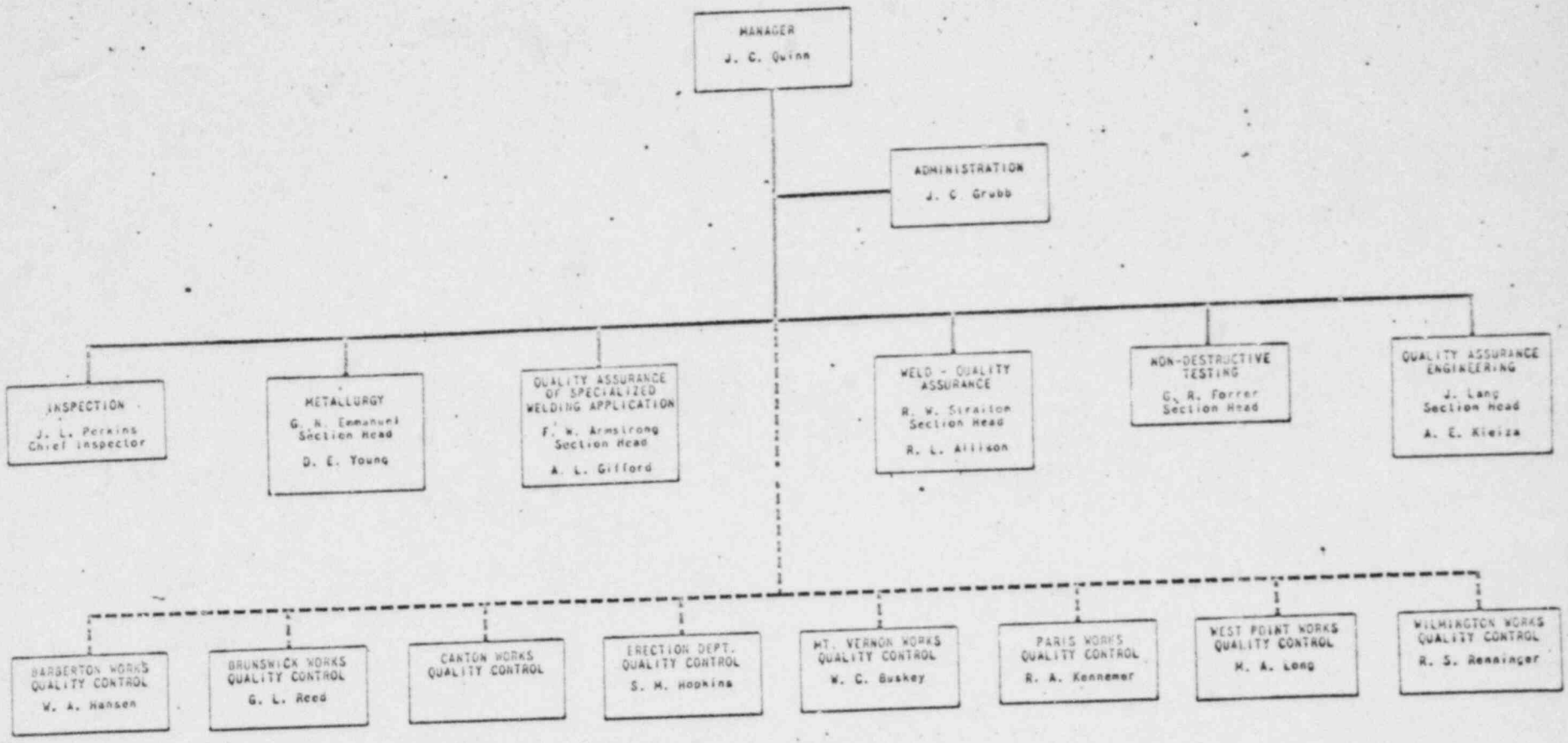
THE BABCOCK & WILCOX COMPA

2-23-67

POWER GENERATION DIVISION

MANUFACTURING DEPARTMENT

QUALITY ASSURANCE



Denotes functional responsibility

3-20-69

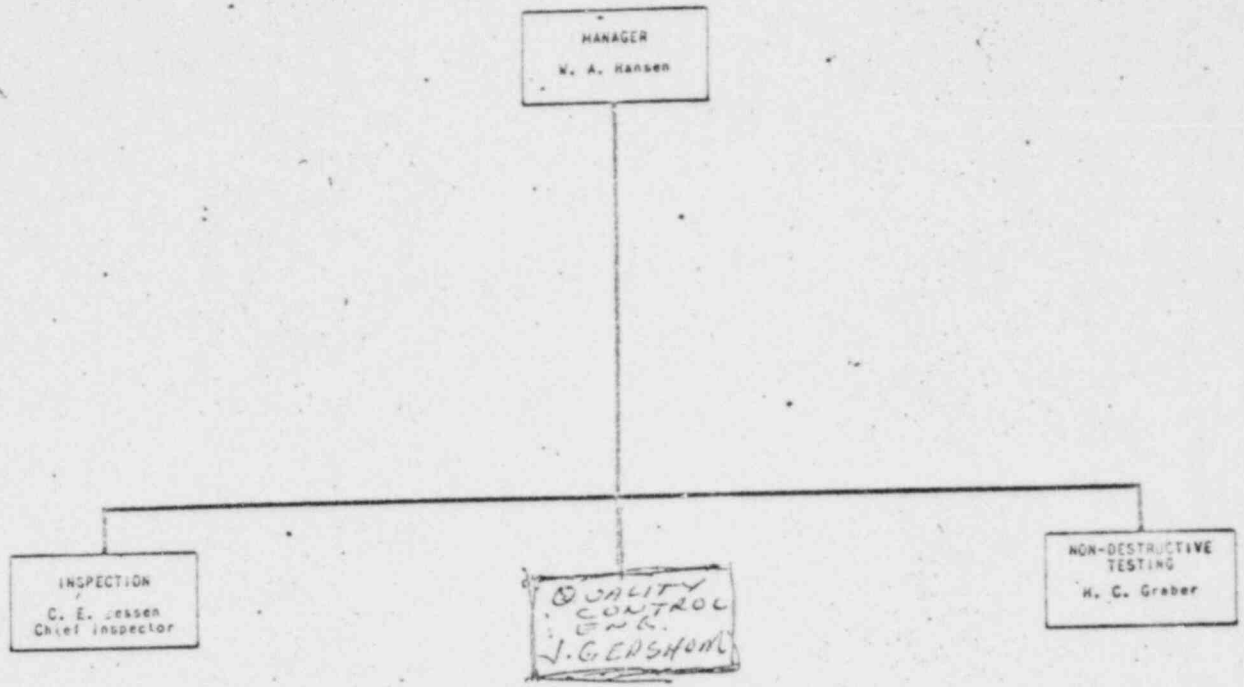
ORGANIZATION CHART NO. P 4.3

THE BABCOCK & WILCOX COMPANY

4-22-69

POWER GENERATION DIVISION
MANUFACTURING DEPARTMENT BARBERTON WORKS

QUALITY CONTROL



3-20
ORGANIZATION CHART NO. P 4
THE BABCOCK & WILCOX COMPA
4-23-69