470
7/6/81
M.E.

②

Received - 470
Bills - 176
Supplement - 136
NTIS - 25

DR-2802

DOE/ET/10417-T2

ENGINEER, DESIGN, CONSTRUCT, TEST AND EVALUATE A
PRESSURIZED FLUIDIZED BED PILOT PLANT USING HIGH
SULFUR COAL FOR PRODUCTION OF ELECTRIC POWER

Phase III—Pilot Plant Construction

Quarterly Report for Period June 1—August 31, 1980

MASTER

Work Performed Under Contract No. AC21-76ET10417

Curtiss-Wright Corporation
Wood-Ridge, New Jersey

U. S. DEPARTMENT OF ENERGY

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ENGINEER, DESIGN, CONSTRUCT, TEST AND EVALUATE
A PRESSURIZED FLUIDIZED BED PILOT PLANT
USING HIGH SULFUR COAL FOR PRODUCTION OF ELECTRIC POWER

PHASE III - PILOT PLANT CONSTRUCTION

QUARTERLY REPORT FOR THE
PERIOD JUNE 1 TO AUGUST 31, 1980

Curtiss-Wright Corporation
Power Systems Division
Wood-Ridge, New Jersey 07075

Prepared for the United States
Department of Energy
Under Contract No. DE-AC21-76ET10417

ABSTRACT

Technical progress during the period June 1 through August 31, 1980 included the following activities:

The PSD permit approval was obtained from the U.S. Environmental Protection Agency. The building permit was obtained from the Borough of Wood-Ridge.

Installation designs incorporating modifications to the Total Energy System, Gas Turbine, Free Power Turbine and Waste Heat Boiler are in an advanced stage. Procurement has been initiated on all long lead material. The upper and lower PFB Vessel fabrication was started.

Quotations for the Substructure Construction (Bid Package No. 1) are under review in preparation for issuing a purchase order in October 1980.

Request for Quotation on Structural Steelwork have been issued to potential bidders.

Groundbreaking ceremonies took place on June 30, 1980 with the Assistant Secretary of the Department of Energy presiding and the Governor of New Jersey, a Congressional delegation and State Commissioner of Energy and Environment, Borough Officials among other dignitaries in attendance.

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Section 1.0 INTRODUCTION

1.1 OBJECTIVE AND SCOPE OF WORK

Production of clean, cost-competitive electric power from coal requires advances in combustion and power conversion technology. One promising approach to improved power cycle efficiency involves application of a Pressurized Fluidized Bed (PFB) Combustor for combustion of high sulfur coal in the presence of a sulfur sorbent material. Bed temperature is controlled to maintain the bed temperature below 1750°F by removing heat from the PFB with heat exchanger tubes using a portion of incoming compressed air as coolant, while the balance of compressed air is used for combustion. The coolant air is heated substantially to bed gas temperature and mixes with the products of combustion after they are cleaned of particulates but prior to entering a gas turbine expander. The reduced percentage of turbine gas directly involved in coal combustion results in substantially less gas to be cleaned of particulates.

The most obvious application of the PFB combustor to commercial, base load power production is in a combined-cycle system. The PFB combustor, in this concept, would supply energy to a gas turbine-generation unit, and a waste heat boiler at the exit of the gas turbine system would supply steam for a steam turbine-generator unit. A simplified flow diagram for the air-cooled PFB combined-cycle steam is shown in Figure 1.1.

The objective of this program is to evaluate the commercial potential of a power generating concept that includes the pressurized fluidized bed combustion of coal in conjunction with a combined gas-steam turbine cycle. The capability to burn high sulfur coal in an environmentally acceptable manner is a major objective of the program. The program involves conceptual commercial design, supporting experimental work, and the design, construction and operation of a PFB pilot plant that can be used to evaluate the commercial concept.

[illegible]

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The pilot plant will be located at Wood-Ridge, New Jersey, and will utilize the existing MOD POD 8 Total Energy Power Generation Station. Where applicable, existing systems and equipment for materials receiving, laboratories and facilities will be used for the pilot plant program.

The major tasks of this program are summarized as follows:

1. A conceptual design for a central station power plant consisting of a PFB combustor with a combined-cycle power conversion system will be conducted.
2. A preliminary design of a pilot plant suitable for simulating and evaluating the central station design concept will be prepared. Supporting experiments to provide technical data for the pilot plant design will be conducted.
3. The PFB pilot plant suitable for evaluation of the economic and engineering feasibility of the central station power plant concept will be designed and constructed.
4. A test program with the pilot plant to assess the validity of a full-scale design concept, to identify design or component characteristics, to establish operating characteristics under nominal and off-design running conditions, and to provide a firm engineering base for full-scale plant development decisions will be conducted.
5. Engineering assessments of the commercial potential of the PFB concept for central station electric power production will be conducted and major design specifications for a plant using high sulfur (<3 percent by weight as received) coal while meeting applicable environmental standards will be provided.

1.2 SUMMARY

Phase III, Pilot Plant Construction, was initiated on May 19, 1980. Program accomplishments during the eighteenth quarter, June 1 through August 31, 1980, are summarized in succeeding paragraphs.

Groundbreaking ceremonies for the PFB Pilot Plant were held at Wood-Ridge, New Jersey, on June 30, 1980 with Dr. John Sawhill, Assistant Secretary of Energy presiding and representatives from DOE, Congress, State of New Jersey, Borough of Wood-Ridge, Electric Power Industry, Press and Construction Team in attendance.

Preliminary information on Fiscal 1981 funding for the Pressurized Fluidized Bed Pilot Plant Construction Program indicate that the proposed allocation of funds are insufficient to sustain the planned 24-month construction cycle. Current budgetary allocation would result in a 33-month period for construction causing an overall increased cost. A 33-month construction schedule (CPM) is currently being prepared.

All material handling system design drawings, except for the compressed air system, have been submitted by the vendors for review and approval.

Purchase orders have been placed with the fabrication vendors for the upper and lower PFB combustor vessel, and windbox.

Purchase orders for all process valves and heat exchanger tubes have been placed.

Quotations have been received from two vendors for Bid Package No. 1, Sub-structure Construction, and are being reviewed.

Request for quotations on structural steel work have been issued to potential bidders.

Section 2.0
PRECONSTRUCTION

2.1 MATERIAL HANDLING EQUIPMENT

1. Coal and Dolomite Feed Systems

Stone & Webster Engineering Company (SWEC) and Curtiss-Wright (C-W) reviewed the certified drawings from Petrocarb. The drawings were approved or marked for revision. Upon receipt of finalized drawings, a purchase order for procurement of equipment will be issued.

2. Ash Handling Equipment

Several design iterations of the ash handling system were completed and submitted for review. The final design is to be completed next quarter. This design incorporates the ash cooling system which contains a water-cooled screw, cyclone and gas cooler. Final design of the components is in process.

3. Coal Crushing and Drying System

This system arrangement and design was reviewed and approved and incorporated into the PFB system. A modification to the control panel is in process. Upon completion, procurement of this system will be initiated.

4. Lifting Rig

The design to incorporate this equipment into the structural steel was completed. The review of the drawings which were submitted are in process.

5. Coal Handling Equipment

All comments and revisions have been submitted to the vendor for final revision to the design. These revisions incorporated equipment in the existing bunkers in the boiler house.

6. Electric Elevator

Design review and comments are complete. All the drawings required at this time are completed.

7. Dolomite Handling

All comments and revisions have been submitted to the vendor. Final design revisions are in process.

2.2 INSTRUMENTATION AND CONTROLS

2.2.1 Process and Instrumentation Diagrams

Up-dating of P&ID Drawings has continued as development of the overall process control system has progressed and new information has been received from sub-system vendors.

Additional P&ID, Sheet Nos. 8, 13, 18 and 19, have been revised and released through the document control system.

The power turbine bypass valve, HV-0228, has been eliminated from the system requirement.

2.2.2 Loop Diagrams

Generation of Loop Diagrams is in progress. Current estimate is that there will be approximately 300 loops. Approximately 10% of the loop diagrams have been completed to date.

A computerized Control Loop Diagram Status Index has been designed to monitor progress of the loop diagram development and apprise SWEC of the status.

2.2.3 Instrument Index

Revision and up-dating of the Instrument Index to reflect the latest revisions in P&ID Drawing 255086, Sheet Nos. 3, 7, 8, 9 and 12, is in progress.

2.2.4 Technical Specifications

Two new Technical Specifications were prepared during the reporting period.

<u>Specification No.</u>	<u>Title</u>
E-90093	Gas Generator Control - Double Fuel Rack-Mounted Fuel Control System
M-90094	Hydraulic Power Package

1. Gas Generator Control - Double Fuel Rack-Mounted Fuel Control System

This specification establishes the design and performance requirements of a rack-mounted electronic package and electro-hydraulic control system for governing of the PFB pilot plant start-up combustor, gas generator, and power turbine. The system is comprised of various electronic loop subsystems, motor-driven actuators for gas and liquid fuel valves, and pneumatic positioning of two (2) critical paralleled power turbine air bypass valves to control power turbine speed or gas generator speeds. This specification also defines the required control system action during emergency conditions, including sudden loss of electrical loads.

The control system is to be capable of modulating fuel flow to the combustor and varying the actuating signal to the power turbine control valve system in order to satisfactorily complete the following functions:

- a. Limiting the maximum values of engine compressor speed (N_1), power turbine speed (N_2), engine compressor discharge pressure (CDP), engine exhaust gas temperature (EGT), and fuel flow.
- b. Starting, acceleration and deceleration of the gas generator without exceeding EGT limitations, flameout, or compressor stall, accepting instantaneous full load rejection within the dynamic capabilities of the generator set without exceeding an overspeed trip limit of 110% power turbine speed and stabilizing within 10 seconds.
- c. Automatic or manual setting of engine compressor and power turbine speed limits.
- d. Control mode indication signals: N_1 (start combustor loop), N_1 (valve #8 loop), N_2 CDP, EGT, accel., time ramp, and N_2 speed ramp.
- e. Any failure which will cause an overcurrent command signal to the actuators (examples: failure of final driver circuit, loss of electrical power or any control input signal), will cause the fuel valves to go to the minimum position and the power turbine bypass valves to close. A ground fault in the fuel valve actuator wiring will cause the fuel valve to operate in a safe manner and provide a shutdown signal through the single shutdown contact and annunciate the cause on the control front panel LED's.
- f. Light-off fuel valve position indication switches (to be used as a start permissive).
- g. Provide visual indication of fuel valve position.
- h. Provide external manual adjustment of the minimum and maximum fuel valve travel stops.

- i. Incorporate limit switches for all three N_1 (start combustor loop), N_1 (valve #8 loop) and N_2 minimum and maximum reference input speed datums.
- j. Produce stable control, as defined in NEMA Standards Publication No. SM32-1960, when operating between zero and maximum capability.
- k. Provide internal relay contacts for N_1 (5 including overspeed and a spare), N_2 (5 including overspeed and a spare), EGT (3 including independent primer light-off switch) sequencing switch points.
- l. Provide analog readout signals proportional to engine speed (N_1), turbine speed (N_2), compressor discharge pressure (CDP), exhaust gas temperature (EGT), actuator/fuel valve position capable of supplying instrumentation and control equipment with external grounds.
- m. Instantaneous reset of the N_1 and N_2 references to selected position above minimum upon external command, also the capability of instant reset of the N_2 reference to the minimum position.
- n. Failsafe override below a gas generator speed of 3500 rpm and latching type failsafe trip signals which will reset only upon external command (applicable to final driver, valve position feedback, N_1 , T_2 , CDP and EGT). A separate failsafe override shall be supplied for the N_2 speed governor.
- o. Provide separate shutdown signals for overtemperature (EGT) and overspeed (N_1 and N_2) and a main light-off signal (EGT) for sequencer logic.
- p. Provide optical isolation for all control input commands.

2. Hydraulic Power Package

This specification defines a hydraulic power package for providing hydraulic power to operate the power turbine isolating valve which controls gas flow at the inlet to the power turbine. The hydraulic power package includes a hydraulic reservoir, electric motor-driven pump, pressure regulating and control valves and a gas pressurized hydraulic accumulator to provide continuously available hydraulic pressure during normal operation and a hydraulic pressure source for closing the isolation valve in the event of electrical or hydraulic pump system failure.

2.2.5 Vendor Technical Coordination

Conferences were held with subsystem vendors and SWEC to coordinate operating requirements and control components. The subsystem vendors have provided operating sequence descriptions and preliminary P&ID drawings applicable to their systems.

Section 3.0
PROCUREMENT AND CONSTRUCTION

3.1 PFB COMBUSTOR COMPONENTS

1. PFB Combustor - Upper and Lower Vessel

The purchase order was issued on 6-19-80. The fabrication vendor completed preparation of the shop travelers, inspection checklist, welding procedures, and bill of materials.

All long lead material including the plate, heads, and flanges were received by the fabrication vendor.

Rolling of the plates for the main shell was initiated and is scheduled for completion September 15, 1980.

2. Windbox - Upper and Lower Assemblies

A purchase order was placed with the selected fabrication vendor on 7-16-80.

Procurement of long lead raw material continues on schedule with completion expected by December 1980.

3. Heat Exchanger Tubes - Inner

Procurement of long lead raw material continues on schedule with completion expected by September 1980.

4. Heat Exchanger Tubes - Outer

Procurement of long lead material continues on schedule with completion expected by early 1981.

5. Requests for quotation for fabrication have been initiated for the following combustor recycle components. Purchase orders are scheduled for placement during October-November 1980.

- a. Primary Cyclone
- b. Tee - Primary Cyclone
- c. Tee - Freeboard
- d. Spool - Ash Return Upper
- e. Spool - Ash Return Lower
- f. Bellows - Ash Return
- g. Trickle Valve

6. Process Piping

Request for quotation for fabrication has been initiated. A purchase order is scheduled for placement during October 1980.

7. Secondary Air Cleanup System Components

Request for quotation for fabrication has been initiated for the 1st, 2nd and 3rd stage collector units. Purchase orders are scheduled for placement during October 1980.

Schedule dates for long lead raw material are shown on Figure 3.1, and Figure 3.2 provides fabrication schedule dates for each of the components.

A schedule showing fabrication of the component parts and assembly of the heat exchanger tubes to the windbox is shown in Figure 3.3.

3.2 TOTAL ENERGY SYSTEM

The procurement and fabrication activity in the area of the Total Energy System is reflected by the attached Figures 3.4 and 3.5. Figure 3.4 shows the procurement items associated with long term or raw materials. Figure 3.5 indicates the major items of engineering procurement for the Total Energy System.

PFB PILOT PLANT COMBUSTOR
LONG LEAD RAW MATERIAL PROCUREMENT

<u>Part Number</u>	<u>Description</u>	<u>Purchase Order Released</u>	<u>Fabrication Scheduled</u>
475139-1	Flange - Center Section	1-17-80	Completed 6-80
LS-34906-1	Flange - Bore Vessel	1-17-80	Completed 6-80
475223 475224	Plate - Windbox	6-11-80	12-5-80
255343	Inner Tube 2"	7-2-80	9-24-80
475322-1	Inner Tube 4"	7-2-80	9-24-80
255340N2	Outer Tube 5"	7-15-80	12-15-80
255338	Channel (Fin)	6-24-80	11-26-80
475223-4 475224-8	Spool - Windbox	7-25-80	12-26-80

Figure 3.1

PFB PILOT PLANT COMBUSTOR

COMPONENT PROCUREMENT

<u>Part Number</u>	<u>Description</u>	<u>Purchase Order Release</u>	<u>Fabrication Estimate</u>	<u>Fabrication Required</u>
475139 475280N	Lower and Upper Vessel	Completed 6-19-80	5-81	4-81
475223 475224	Lower and Upper Windbox	Completed 7-16-80	7-81	7-81
475324	Windbox Assembly	12-30-80	11-81	11-81
475281N	Primary Cyclone	10-1-80	5-81	5-81
475284	Tee - Primary Cyclone	10-1-80	5-81	5-81
475318N	Tee - Freeboard	10-1-80	5-81	5-81
475330	Spool - Ash Ret. Upper	11-15-80	5-81	5-81
475282	Spool - Ash Ret. Lower	10-15-80	5-81	5-81
475285	Bellows - Ash Return	10-15-80	5-81	5-81
475283	Spool - Ash Removal	11-15-80	10-81	10-81
475331	Trickle Valve	10-15-80	5-81	5-81
475329	Cooler - Ash Removal	11-15-80	10-81	10-81
M-90079	Process Piping	10-17-80	11-81	11-81
M-90076	Cleanup 1st Stage (Dynatherm)	10-1-80	5-81	5-81
M-90077	Cleanup 2nd Stage (Ducon)	10-1-80	5-81	5-81
M-90078	Cleanup 3rd Stage (Aerodyne)	10-1-80	5-81	5-81
475280	Refrac. Upper Vessel	11-1-80	5-81	5-81

Figure 3.2

PFB PILOT PLANT - PHASE III **HEAT EXCHANGER TUBES AND WINDBOX FABRICATION & ASSEMBLY**

Figure 3.3

PFB PILOT PLANT

TOTAL ENERGY COMPONENTS

LONG LEAD RAW MATERIAL PROCUREMENT

<u>Part Number</u>	<u>Title</u>	<u>Details Released</u>	<u>Fab Required</u>	<u>P.O. Rel.</u>	<u>Remarks</u>
255353	Turbine Blades	3-18-80 E.O. 36860FY	11-1-81	12-1-80 (Final)	Raw material ordered. Forgings ordered. Hold machining P.O. until 12-1-80.
255352	Turbine Vanes	3-18-80 E.O. 36860FY	11-1-81	12-1-80 (Final)	P.O. for tooling re-work placed. Hold casting and machining until 12-1-80.
LS34899	Vanes-Isolator	3-25-80 E.O. 36860GG	8-15-81	10-1-80	Ready for P.O. placement.
LS34899	Turbine Exchange Housing and Isolator Raw Material	3-20-80 E.O. 36860GG	11-15-80	6-20-80	Raw material 409SS. P.O.'s placed for plate and forgings.

Figure 3.4

PFB PILOT PLANT

TOTAL ENERGY COMPONENTS - PROCUREMENTS ITEMS

<u>LS Number</u>	<u>Title</u>	<u>Details and E.O. Release</u>	<u>Fab Required</u>	<u>P.O. Release</u>	<u>Remarks</u>
34899	Turbine Modification (Air Exchange Housing)	5-16-80 E.O. 36860HW	11-1-81	7-15-80	P.O. main housing placed. P.O. FP-117315.
34899	Isolator Valve-Turbine	5-16-80 E.O. 36860HW	10-1-81	7-15-80	P.O. placed. P.O. FP-117315.
226C01415 (Vendor P/N)	Power Turbine Rework	8-21-80 E.O. 36860LD	9-7-81	9-15-80	Requote in mail, rework drawing due 9-12-80.
34911	Start-Up Combustor	1-28-80 Rev. 4-9-80 E.O. 36860FS and 36860GV	12-1-81	10-1 thru 12-15-80	Ready for placement.
34912	Auxiliary Combustor	4-11-80 E.O. 36860GJ	12-1-81	10-1 thru 1-15-80	Ready for P.O. placement.
	2nd Stage Turbine	4-17-80 E.O. 36860HC	8-1-81	12-1-80	Blades in crib, vane casting in crib fin. machine.
37031	Comp. Disc Trans. Spool Assemblies	5-22-80 E.O. 36860HU	10-1-81	12-1-80	Ready for P.O. placement.
34995	Turbine Bypass Act. System	E.O. 36860JY	9-1-81	12-1-80	RFQ being prepared.

Figure 3.5

As can be seen, these charts indicate the required dates along with quote and purchase order placement schedules. Major items which were placed during this reporting period include:

1. Total Energy Engine Air Exchange Housing Structure
2. Critical Raw Material for Air Exchange Housing
3. Power Turbine Isolator Valve Structure
4. Critical Material for the Isolator Valve
5. Raw Material for 1st Stage Turbine Blades
6. Tooling Modifications for 1st Stage Turbine Vanes

In conjunction with the procurement activities, the C-W and supplier manufacturing reviews, as reported in the last quarterly report, were continued. The objective of these reviews were to provide ease of manufacture and procurement cost reduction where possible.

3.3 MATERIAL HANDLING EQUIPMENT

The material purchase order placement schedule dates are shown on Figure 3.6 for each system and are compatible with the overall schedule.

The compressed air booster system is scheduled to be released for quotation on 9-30-80.

3.4 INSTRUMENTATION AND CONTROLS

1. General

The instrumentation and controls procurement summary, Figure 3.7, indicates anticipated release dates, estimated fabrication times and the requirement dates for the major instrumentation and controls components. Information for the individual main process valves is shown in Figure 3.8.

PFB PILOT PLANT LONG LEAD MATERIAL
MATERIAL HANDLING EQUIPMENT, ENGINEERING DRAWINGS

<u>System Description</u>	<u>Vendor</u>	<u>Purchase Order Placement</u>	<u>Delivery Schedule</u>	<u>Remarks</u>
Coal and Dolomite	Petrocarb, Inc.	9-5-80	5-1-81	
Ash Handling Equipment	Allen-Sherman-Hoff	10-24-80	8-24-81	
Coal Crushing and Drying	William Paterson Crush & Pulverizer	12-1-80	4-1-81	Revised Quote Review in Process
Lifting Rig	Abel & Company	10-30-80	5-4-81	Revised Quote Due 10-6-80
Coal Handling Equipment	Taunton Engineering	12-1-80	6-1-81	Revised Quote Due 9-30-80
Electric Elevator	Dover Elevator	11-3-80	1-18-82	Revised Quote Due 9-15-80
Dolomite Handling	Ducon Company	11-1-80	6-1-81	Revised Quote Due 9-15-80
Compressed Air Booster		12-15-80	5-11-81	Final Spec Issued by SWEC 9-12-80. RFQ Issue 9-30-80.

Figure 3.6

PFB PILOT PLANT INSTRUMENTATION AND CONTROLS

PROCUREMENT SUMMARY

<u>Item</u>	<u>Spec No.</u>	<u>Spec Release Date</u>	<u>Fab Time Weeks</u>	<u>Need Date</u>	<u>Remarks</u>
Programmable Controller					
Gas Turbine		October 80	16	5-81	Sizing in Progress:
Coal Feed		October 80	16	3-81	G.T.
Coal Crush/Dry		November 80	16	3-81	Patro
Ash Handling		January 81	16	6-81	
Gas Analysis System	E-90053	September 80	20	9-81	Out for Quote
Fuel Control	E-90093	July 80	20	9-81	Released
Process Computer	E-90077	October 80	24	9-81	
Main Control Panel	E-90054	December 80	20	9-81	
Analog Instrumentation	E-90057	December 80	16	5-81	
Transducers	M-90038 M-90039	December 80	20	9-81	
Process Valves	E-90030	Released	32	9-81	See Detail Summary
Hydraulic Power Package	M-90094	September 80	20	9-81	

Figure 3.7

PFB PILOT PLANT

PROCESS VALVES

REF - SPEC NO. E-90030

<u>Tag Number</u>	<u>Service</u>	<u>Process Number</u>	<u>Vendor</u>	<u>P.O. No. and Date</u>	<u>Required By</u>	<u>Fab Time Weeks</u>	<u>Scheduled Delivery Date</u>	<u>Remarks</u>
FV-0205	Start Combustor	1	Fisher	FP-117337 7-17-80	9-81	30	2-81	
FV-0329	Fluidizing Control	2	Fisher	FP-117337 7-17-80	9-81	30	2-81	
FV-0306	Cooling Air	3	Fisher	FP-117337 7-17-80	9-81	30	2-81	
FV-0301	Fluidizing Air	4	Fisher	FP-117337 7-17-80	9-81	30	2-81	
FV-0302	Auxiliary Combustor	5	Fisher	FP-117337 7-17-80	9-81	30	2-81	
FV-0211	P.T. Bypass	8	Jamesbury	FP-117339 7-17-80	9-81	32	3-81	
FV-0212	P.T. Bypass	8	Jamesbury	FP-117339 7-17-80	9-81	32	3-81	
FV-0360	Diverter	10	Fisher		9-81	6		Actuator Only
FV-0219	Surge Control	12	Fisher	FP-117337 7-17-80	9-81	30	2-81	
XV-0227	Check Valve	—	Clow	FP-117338 7-17-80	9-81	32	3-81	
XV-0328 (XV-0302)	Check Valve	—	Clow	FP-117338 7-17-80	9-81	32	3-81	

2. Main Process Valves

Vendors for the main process control valves were selected on the basis of technical conformance of their proposals to the specification and on price quoted. The vendor selected, purchase order number, date required and estimated fabrication time and delivery dates are shown on Figure 3.8.

3.5 TOTAL ENERGY SYSTEM CONSTRUCTION

The Plant Engineering Department activity was directed to the continuation of preparing shop and installation drawings. Also, construction and procurement was initiated in areas indicated below. Figure 3.9 has been up-dated to show the status at the end of the reporting period.

Shop Drawings

1. Gas Generator and Turbine Housing Modification

- a. Detailing of the acoustic hood sliding door was completed.
- b. Detailing of piping for turbine bleed, turbine bypass and compressor bypass was completed.
- c. Revisions of electrical wiring was initiated and progressed to 50% completion.

2. Start-Up and Auxiliary Combustors

- a. Drawings for wiring and controls progressed to 50% completion.
- b. Design of terminals and junction boxes was initiated and progressed to 20% completion.

PFB PILOT PLANT - PHASE III TOTAL ENERGY SYSTEM - CONSTRUCTION SCHEDULE

Figure 3.9a

PFB PILOT PLANT - PHASE III TOTAL ENERGY SYSTEM - CONSTRUCTION SCHEDULE

Figure 3.9b

PFB PILOT PLANT - PHASE III **TOTAL ENERGY SYSTEM - CONSTRUCTION SCHEDULE**

Figure 3.9c

9/5/80

PFB PILOT PLANT - PHASE III TOTAL ENERGY SYSTEM - CONSTRUCTION SCHEDULE

Figure 3.9d

9/5/81

PFB PILOT PLANT - PHASE III **TOTAL ENERGY SYSTEM - CONSTRUCTION SCHEDULE**

Figure 3.9e

PFB PILOT PLANT - PHASE III TOTAL ENERGY SYSTEM - CONSTRUCTION SCHEDULE

PFB PILOT PLANT - PHASE III **TOTAL ENERGY SYSTEM - CONSTRUCTION SCHEDULE**

Figure 3.9a

PFB PILOT PLANT - PHASE III **TOTAL ENERGY SYSTEM - CONSTRUCTION SCHEDULE**

9/5/80

Figure 3.9h

3. Gas Generator and Turbine Control Module

- a. Drawings for wiring and controls were initiated and progressed to 20% completion.

4. Utilities

- a. Drawings for 480 V power distribution in the power house and 13.2 KV power supply to pilot plant progressed to 50% completion.

Construction

1. Task 1A - Modification of Gas Generator and Turbine Housing

Work is in progress and is approximately 10% complete.

2. Task 1B - Gas Generator Skid Extension

Work is in progress and is approximately 20% complete.

3. Task 5A - Disconnect and Remove the Waste Heat Boiler

Work is in progress and is approximately 50% complete.

4. Task 8 - Fuel Oil Fill Station Relocation

Work is in progress and is approximately 30% complete.

Procurement

- 1. Received structural steel and sheetmetal for Tasks 1A and 1B.
- 2. Received piping, fittings and valves for Tasks 8, 9D, 9E and 9F.
- 3. Specifications released to obtain quotations for procurement of combustor module enclosure (Task 2B), filter house (Task 1F), fire protection system (Task 3) and rework of waste heat boiler (Task 5B).

3.6 HEAT EXCHANGER TUBE MANUFACTURING DEVELOPMENT

The primary objective of the 5" diameter tubular samples processed during the report period was to initially demonstrate that the new resistance welding equipment, process and tooling will produce resistance welds with sufficient shear strength to prevent the occurrence of excessive braze joint gaps by shifting or loosening the 36 channels to be brazed.

Four large heat exchanger tube samples were processed and analyzed during this period. Visual and destructive examination did not reveal any channel separation or lack of braze on the tube.

Further process improvements and controls were introduced to insure quality resistance welds. A weld schedule certification test program was run on the Link machine with a specially devised tube/channel tensile test specimen. Based on these results a minimum tensile test requirement of 600 pounds was established.

A resistance weld quality monitor was also tested, calibrated and attached to the welding head on the Link machine to provide an on-going method of in-process inspecting the individual resistance welds. This device provides an alarm system when improper welds are made and a digital read-out made for documenting the results.

New high strength wear resistant electrodes were introduced for improved durability, and a manual UT inspection method for the individual channel braze joints was devised to supplement destructive analysis of the samples.

Two four-foot samples were fabricated, with preplaced No. 150 alloy tape attached to the individual channels on either side of the joint. The weld monitor was utilized to measure the resistance weld quality on both samples. A total of 1,030 welds were completed with a single electrode manufactured from a copper tungsten alloy introduced to improve wear.

Analysis of these samples after brazing indicated the following: All 2,300 resistance welds did not fail and no channels shifted. Utilizing the manual UT inspection for nondestructive examination of each braze joint all were acceptable, except for an eleven-inch area in the center of one sample in one channel.

This channel was positioned in the tube slightly tipped causing a .020" gap between the channel and pipe on one side. This condition will be eliminated when permanent process tooling is introduced. Destructive analysis of both samples indicates cross-sectional braze measurements on each channel measured a minimum of .100".

Excess braze alloy collected at the bottom of each tube sample exhibited more of this condition indicating reduced amounts of alloy could be utilized.

Section 4.0

CONSTRUCTION BID PACKAGES

1. Bid Package No. 1

During July an RFQ was submitted to all of the eleven (11) qualified bidders for Bid Package No. 1, Substructure. A bidders conference was held late July. Two (2) bids were received on the due date 8-22-80. The two (2) bids are now being reviewed by SWEC and C-W.

2. Bid Package No. 2

The RFQ for Bid Package No. 2 was sent to thirteen (13) bidders who had qualified for this package. A bidders conference was held on 8-20-80. Bid opening for this package is 9-19-80.

3. Bid Package No. 3

This Bid Package is currently undergoing revision.

Section 5.0

MANAGEMENT

The following PFB Pilot Plant Program Design, Construction and Test Evaluation Review Presentations were made by Curtiss-Wright:

Presentation to DOE Morgantown Representatives at Morgantown on June 19, 1980.

Presentations to DOE Morgantown and Washington Representatives and the Electric Power Research Institute in Washington, D.C. on July 9, 1980 and August 20, 1980.

Groundbreaking ceremonies for the PFB Pilot Plant were held at Wood-Ridge, New Jersey, on June 30, 1980 with representatives from DOE, Congress, State of New Jersey, Borough of Wood-Ridge, Electric Power Industry, Press and Construction Team in attendance.

DOE was notified that considerable cost savings for Pilot Plant Construction could be realized if the original 24-month construction schedule was retained. The 24-month construction schedule does require earlier release of construction funds than an alternative 33-month construction schedule.

Curtiss-Wright received the PFB Pilot Plant PSD (Prevention of Significant Deterioration) permit from the U.S. Environmental Protection Agency and the building permit from the Borough of Wood-Ridge.

The following documents were issued during the quarterly period:

1. Brochure for Presentation to DOE and EPRI dated August 20, 1980
2. Phase III - Construction - Security Program
3. Phase III - Construction - Draft CPM Construction Networks -
24-month and 33-month