BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In Re: Petition on behalf of Citizens of the State of Florida to require Progress Energy Florida, Inc. to refund to customers $143 million

DOCKET NO. 060658
Submitted for filing: January 16, 2007

DIRECT TESTIMONY
OF
CLIFFORD WAYNE TOMS
ON BEHALF OF
PROGRESS ENERGY FLORIDA

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IN RE: PETITION ON BEHALF OF CITIZENS OF THE STATE OF FLORIDA TO REQUIRE PROGRESS ENERGY FLORIDA, INC. TO REFUND CUSTOMERS $143 MILLION

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DIRECT TESTIMONY OF

CLIFFORD WAYNE TOMS

I. INTRODUCTION AND QUALIFICATIONS

Q. Please state your name and business address.

A. My name is Wayne Toms. My business address is 15760 West Power Line St., Crystal River, Florida 34428.

Q. Please tell us how you are employed and describe your background.

A. I am employed by Progress Energy Florida ("PEF" or the "Company"), currently serving as the Manager of Shift Operations for the Crystal River fossil units. Prior to this role, I was the operations and maintenance superintendent at Anclote Power Plant, the superintendent of technical services for Crystal River fossil units, and the training manager for Florida Power Corporation. I have a Bachelors of Science in Human Resources and management and an MBA. I have been employed by PEF since 1992.

II. PURPOSE AND SUMMARY OF TESTIMONY

Q. What is the purpose of your testimony?

A. I will explain the current and historical operation of Crystal River Units 4 and 5 ("CR4" and "CR5") as part of PEF's generation system. CR4 and CR5 are base load units and as such they are important to PEF's generation fleet and to PEF's customers. I will also discuss the generation output from these units, how these units have historically performed, and how they are expected to perform. I will explain that the historical and current performance and Company expectations for the performance of CR4 and CR5 are dependent on the quality and efficiency of our operation and maintenance of the units and the quality of the coal product put in the units.

I will also describe the process that PEF uses when it considers burning a new type of coal in CR4 and CR5. From our perspective, with the operational obligations at the plant, we will require some demonstration of the probable performance impacts of any new coal and especially a new coal type at CR4 and CR5, so that we can evaluate those impacts and make a decision about the coal. Typically, this means a "test burn" needs to be conducted. I will explain why test burns are needed from an operational and safety perspective. I will also explain our goals with respect to any such test burn.

Finally, I will discuss issues raised by the potential use of PRB coal blends at CR4 and CR5. These issues have been addressed by expert consultants retained by the Company, first Sargent & Lundy and now Rod Hatt, but I will again provide a perspective from fossil operations.

Q. Are you sponsoring any exhibits with your testimony?

A. Yes. I am sponsoring the following exhibits that I prepared or that were prepared under my supervision and control, or they represent business records prepared at or near the time of the events recorded in the records, which records it was a regular practice for me or those who worked with me to keep to perform our responsibilities:

- Exhibit No. ___ (CWT-1), which is an aerial map of the Crystal River Energy Complex; and
- Exhibit No. ___ (CWT-2), which are the original Babcock & Wilcox boiler design documents for CR4 and CR5.

These exhibits are true and correct.

Q. Please summarize your testimony.

A. CR4 and CR5 are base load, coal-fired units that have historically operated at overpressure to produce between a gross 750 megawatts (MW) and 770MW at full capacity when called on to provide that level of capacity and energy to customers. The original boiler and turbine design was 665MW gross energy production at full capacity. The design and construction of the units, in particular the large boilers, and the high quality, high Btu content bituminous coal historically used by PEF, have allowed PEF to achieve these levels of gross energy production. Customers have benefited from this level of production by receiving additional base load generation capacity and energy at a lower relative cost to other generation on PEF's system.

We are, as a result, concerned with changes in the quality and type of coals for CR4 and CR5. Such changes can impact the safe and efficient operations at the units and their performance. Before coals with different qualities or of a different type than what we have specified and used are burned, we will want to evaluate the impact of those differences on the operations at and production in the units before making any commitment to purchase such coals. This is particularly true with respect to sub-bituminous coals from the Powder River Basin (PRB), which are dusty, volatile, difficult to handle, low Btu content, and high moisture content coals. We will want to know how these PRB coals affect our responsibility to safely and efficiently operate the units, affect their commercial availability when called upon to produce energy, and affect their production at between a gross 750MW and 770MW when called upon to produce at full capacity to meet customer load.

There are safety issues, cost issues, and performance issues with PRB coals at CR4 and CR5. Capital upgrades are necessary to safely and efficiently handle such coals on site. Capital upgrades are also necessary to ensure that the coals can be safely and efficiently burned in the units. De-rates or loss of load can be expected. Finally, there will additional training of employees to handle PRB coals and additional maintenance at all points on site affected by the PRB coals. Time is required to implement the additional capital and maintenance necessary to safely and efficiently handle the PRB coals and operate the units with PRB coal blends. An estimate of the time to accomplish the necessary changes for PRB coals is between 18 months and 30 months.

III. CR4 AND CR5 OPERATION

Q. What are Crystal River Units 4 and 5?

A. CR4 and CR5 are two of four coal-fired units located at the Crystal River Energy Complex. They are located north of the other units, coal-fired units 1 and 2 and unit 3, the nuclear unit, and thus are sometimes referred to as Crystal River North. They were built and operational in 1982 and 1984, respectively, and have been providing PEF and its customers with base load electrical capacity and energy ever since then. An accurate aerial photograph of the Crystal River Energy Complex showing the location of CR4 and CR5, as well as the other units and related facilities at the site, is Exhibit No. ___ (CWT-1) to my testimony.

Q. What are base load units?

A. Base load units are those units that are called on first to meet the load or customer demand for electrical energy on the system. They are called on first because they have a relatively low incremental cost for producing electrical energy. All units are placed in the dispatch stack and called on by the Energy Control Center (ECC) based on the incremental cost of producing energy from the unit.

ECC is responsible for ensuring that the production of energy is equal to the load, or demand for energy by PEF's customers, every hour of every day. The unit with the lowest incremental cost will be called on first, followed by the next lowest cost unit on the system, and so on until the customers' energy needs are met. CR4 and CR5 are very low in the dispatch stack, typically following only the nuclear unit.

Base load fossil units like CR4 and CR5 generally operate all hours over the course of the year except for forced outages due to equipment issues or failures or scheduled outages for maintenance.

Q. When Units 4 and 5 are called on, how much electrical energy do they produce?

A. Units 4 & 5 regularly produce at full capacity between 750MW and 770MW. These are gross numbers, however, representing the total production of electrical energy at full capacity. The units also supply the power to operate the units themselves and provide power for use at the Crystal River Energy Complex. If these power needs are accounted for, the production from the two units will typically produce about 735MW and 732MW at full capacity. This is called the net MW production and is what PEF customers receive.

Q. What were the boilers for Units 4 and 5 designed to produce?

A. The original Babcock & Wilcox design of the boilers and associated turbine was for a gross production of 665MW for each unit at full capacity, under perfect conditions. This design guaranty was based on a coal blend of western sub-bituminous coal and eastern bituminous coal with a heating value of 10,285 Btu/lb. The Btu content per ton measures the amount of energy that is derived from burning a ton of that coal. A copy of the Babcock & Wilcox design documents is Exhibit No. ___ (CWT-2) to my testimony.

Q. How can PEF obtain up to 770MW from Units 4 and 5 at full capacity if the design guaranty was only for 665MW at full capacity?

A. The design guaranty for the CR4 and CR5 boilers was for an equal blend of bituminous and western sub-bituminous coal. Bituminous coal has a higher Btu content than western sub-bituminous coal. The boiler design took this lower Btu content of western sub-bituminous coal into account by providing for larger boilers than you find in a boiler design for only bituminous coal. In other words, CR4 and CR5 were designed and built with over-sized boilers by industry standards for pulverized coal units that burn only bituminous coals.

Other elements of the units were also included in the design for this same reason, namely to accommodate burning the design blend of sub-bituminous and bituminous coals, and many but not all of these elements were included in the construction of the two units. These attributes of CR4 and CR5, in particular the large boilers, set the units apart from other pulverized coal units of the same vintage that were designed with smaller boilers to handle bituminous coals. The Company can burn large quantities of bituminous coal in the boilers because they are large boilers and, as a result, the Company can generate more thermal energy by burning more coal than other boiler units of the same vintage that were designed only for bituminous coals.

Another important contributing factor for the Company to obtain up to 770MW at full capacity in the units is the quality of the coal that PEF has burned at CR4 and CR5. PEF has typically burned a high Btu, low moisture, low volatility, bituminous compliance coal with good ash characteristics. For example, only recently has the Btu content dropped below 12,000 Btu/ton for the bituminous coals used at the plant, and historically the units have received bituminous coals above 12,500 Btu/ton. A higher Btu/ton content coal means more energy is generated per ton of coal burned than a lower Btu/ton content coal. CR4 and CR5 have also received low moisture bituminous coals, which means less thermal energy is necessary to dry and burn the coals, which also contributes to the energy per ton of coal burned. These quality characteristics have been incorporated into the coal specifications for the units and there is no doubt that a quality coal product, in particular a high Btu, low moisture content coal, plays a significant role in the ability of CR4 and CR5 to exceed their design basis in energy production.

With more thermal energy generated by the boilers from large quantities of high quality bituminous coals, the CR4 and CR5 units are capable of operating at "overpressure" on a sustained basis, thereby producing more steam and more energy. CR4 and CR5 typically operate at overpressure at full capacity and have done so for years. The result is sustained energy production at full capacity of between 750 and 770MW.

If PEF were burning a blend of even a high quality, high bituminous coal -- for example, a 12,500 Btu/ton bituminous coal -- and a high, 8,800 Btu/ton sub-bituminous coal at CR4 and CR5, however, the Company could not go to overpressure and generate the gross 750MW to 770MW at full capacity that it has historically produced at the units.

Q. What do you mean by "overpressure?"

A. Overpressure is the term we use to designate when we have deviated from the design bases pressure setpoint of 2,400 pounds pressure at the first stage steam turbine. When we have all the critical equipment in operation, we are allowed by Babcock & Wilcox to operate the boiler at 105 percent of design bases pressure setpoint. Applying 105 percent times 2,400 pounds pressure equals 2,520 pounds pressure at the first stage turbine blades. Once this pressure is reached by the boiler and turbine, the units are producing around 750MW. As I mentioned though, all critical equipment must be operable. We must have all six pulverizers, both condensate pumps, both high pressure and low pressure heater drain pumps, and all eight feed water heaters in service to be able by the technical manual to go to overpressure.

Q. Is it safe?

A. Absolutely. It merely reflects the ability to operate above what was considered "normal" operation of the units but still well within the design capabilities from a safety perspective. The units have been consistently operating at overpressure at full capacity for years; in fact back to the late 80's, and producing more energy than contemplated under the original design.

Q. You mentioned that some but not all of the design elements were included in CR4 and CR5. Was something included in the design that was needed that was not built?

A. No, nothing that was needed to operate the units safely and efficiently in the design documents for the units was excluded when the units were built. However, several years passed between the design and construction of the units. During that time, I understand that the Company determined a sufficient supply of bituminous coals existed and that it was economical to commence operations with bituminous coals. As a result, certain design elements that were necessary only if the units commenced operation with an equal blend of bituminous and sub-bituminous coals, such as, for example, a seventh pulverizer and the inert steam to the pulverizer, were not built.

This is not unusual. The actual construction of power plants often differs from the design because any number of factors can affect the expected actual operation of the units and lead to construction changes. There is no reason to construct and charge the utility customers for something in the design of the units, for example, that is not expected to be needed for the actual safe and efficient operation of the units.

There is, however, space at CR4 and CR5 to add these additional design elements should the Company decide to go to operation with an equal blend of sub-bituminous and bituminous coals. But the units were not constructed with everything that would be needed to safely and efficiently operate with an equal blend of sub-bituminous and bituminous coals because that was not the expected operation of the units at the time of construction.

Q. Has PEF relied on the extra megawatts of energy production from CR4 and CR5 for its generation system?

A. Yes. The Company has three expectations for the CR4 and CR5 units. First, we are expected to safely and efficiently handle the coal and operate the units. Our employees are our most valuable resource so their safety is a primary concern. Of course, safety issues can affect unit operation as well if a problem with safely handling the coal product requires us to take the unit off line to deal with the problem.

Second, the units are expected to be commercially available all the time when they are not out of service for maintenance. This means that they are expected to respond when called upon by the ECC for service. As I mentioned, the ECC controls the order of bringing units on line and up to the required production to meet the load 24 hours a day, every day of the year. ECC will call on units based on their incremental cost of energy production. Because CR4 and CR5 have a low relative incremental cost of producing energy to most other units on PEF's generation system, they are expected to be commercially available most of the time during the course of the year. This is what it means for them to be base load units.

Additionally, the Company expects CR4 and CR5 to produce energy at between 750MW and 770MW when called on by ECC. More recently the units have been generating 768MW and 763MW, respectively, when called on by ECC for commercial availability at full capacity. This gross energy production is necessary for the Company to meet its expected net production. I understand that the Company's resource planning group relies on the production today of 735MW and 732MW, respectively, from CR4 and CR5. These are the net energy production numbers if the units produce 768MW and 763MW, respectively, on a gross basis at full capacity.

It is my obligation as the Manager of Shift Operations for the fossil units, including CR4 and CR5, to ensure that the Company's expectations for CR4 and CR5 are met.

Q. What do you need to satisfy the Company's expectations for CR4 and CR5?

A. I must continue to maintain and operate the units as efficiently and effectively as we have been doing for years to continue to meet the expectations for base load energy production that the Company has for CR4 and CR5. Any changes in the coal product or units themselves that alter the maintenance and operation of the units will have an impact on the ability to maintain the energy production that is expected from the units.

The quality of the coal product will have an impact on the ability to meet the expectations for energy production from CR4 and CR5. Changes in the Btu content, moisture content, or other characteristics of the coal procured for the units will affect the maintenance, operation, and energy production at CR4 and CR5. We know, for example, that if the Btu content of the coal burned at CR4 and CR5 falls below a range between 11,000 Btus/ton and 11,300 Btus/ton, we will not be able to operate at overpressure and meet the expected energy production requirements at full capacity. Other changes in the quality of the coal burned at CR4 and CR5, such as higher moisture content than specified and generally expected, will also have an adverse impact on the energy production from the units. As a general rule, then, from an operational perspective we prefer to have a coal product that more closely matches the typical specifications that we have historically burned at the units.

Q. Do customers benefit if the Company's expectations for CR4 and CR5 are met?

A. Yes, they do. As I have explained, CR4 and CR5 are base load units because they are relatively more economical than other generation alternatives on PEF's system. Therefore, more production from a base load unit, like CR4 and CR5, to meet the load means less energy production is needed from more expensive production sources available to PEF to meet customer energy needs. By producing energy at overpressure at full capacity on a consistent basis, PEF has provided its customers with a more economical source of energy production than they otherwise would have had at the production level the units were originally designed to achieve at full capacity.

IV. CHANGES IN COAL PRODUCTS AT CR4 AND CR5

Q. Are you concerned about changes in the type and quality of coal products for CR4 and CR5?

A. Yes. From an operational perspective, we always want to understand what is being procured for CR4 and CR5 and how it will affect the maintenance and operation of the units and the production of energy from the units. So, we will want to know what the supplier considers to be the "typical" quality of the coal offered and how that "typical" coal offered varies from our coal specifications and historical experience.

We have even been wary when existing suppliers of bituminous coals switch mines or new bituminous suppliers are added. In those situations, we have asked for smaller shipments of their coals to be brought on site and evaluated those limited shipments before the full shipments of what has been purchased is brought on site. This is because there can be variations in the quality of the coal product provided, even from existing suppliers with new mines, from what they have provided to the Company in typical specifications for their coal products.

When the quality of the coal or type of coal changes on the typical specifications offered by the supplier from what we have specified and historically used, we will want to evaluate the impact of those changes on the units and the production from those units before any commitment is made to purchase coal of that quality or type. We have required this evaluation even for significant changes in the quality of bituminous coals. In the past few years, we have been offered import bituminous coals that had a lower Btu and higher moisture content from our specification and experience with domestic bituminous coals. Before those low Btu content, higher moisture content import coals were purchased we requested and performed a test burn of the coals at one of the units to evaluate the impact of those coals on operation and energy production.

Q. What are "test burns?"

A. A test burn is a process where PEF obtains a small quantity of a new quality or type of coal that it is considering burning on a long-term basis and burns that coal in one of the units for which the coal is being considered. During this time, PEF monitors handling and safety issues, unit operation and performance, and environmental emissions. The test burn can either be on a short-term or long-term basis. Typically, when first evaluating a coal product of different quality or type, a short-term test of two to three days will be conducted. The purpose of a short-term test burn is to see if any immediate handling, performance, environmental, or safety issues are present. Short-term test burns are also sometimes required for environmental permitting.

A long-term test burn can last anywhere between three and six months. The purpose of a long-term test burn is to see how the unit will perform over a sustained period of operation and under variations in environmental conditions that the units typically experience over a longer period of time. With long-term test burns, PEF can get a good idea of whether a new type of coal will be suitable for PEF to use in the plants on an extended basis.

Q. Why is it important for PEF to conduct test burns prior to introducing a new type or quality of coal into the units?

A. Certain equipment in the plants, such as the boiler and electrostatic precipitator for example, are especially sensitive to changes in coal quality and types. It is important, therefore, for PEF to know how the plants will react to new types and qualities of coal on a short- and long-term basis. New coal products may cause de-rates (or loss of energy production or load) or forced outages in the units. Either way, the units are not producing the energy that is expected from them. Test burns allow PEF to identify any such operational and production issues prior to making a full-scale commitment to switch to or use a new coal product.

The Company further needs to know if changes in the quality or type of coal will affect the cost of handling the coal or operating the units. Coals with higher moisture content than historically specified and used at the units, for example, create handling and operational issues. Additional effort will need to be made on the coal piles in handling the coal to assist in drying it out, and more heat will need to be used at the pulverizers to dry the coal out before it is blown into the boilers to be burned. This will increase the maintenance costs and increase the wear and tear on certain equipment, like the pulverizers, in the units. These impacts are important to know because they may lead to additional forced outage and maintenance time and cost.

Test burns can also be important from a safety perspective because certain types of coal require different handling and use procedures. This is particularly true for sub-bituminous coals from the PRB, which are dustier, more volatile, and thus more difficult to handle from a safety standpoint than bituminous coals. Test burns allow PEF to become accustomed to such changes in use and handling procedures, and to adjust them as necessary from actual experience, prior to full-scale use.

Q. What are your goals with respect to test burns for new coal products at CR4 and CR5?

A. I want to know how the new coal product is going to affect my responsibilities to safely and efficiently operate CR4 and CR5, make CR4 and CR5 commercially available for ECC, and to achieve full capacity production at between 750MW and 770MW when called upon to do so to meet customer load. If there is an impact on our ability to safely and efficiently handle the new coal product, or our ability to operate the plants and meet our performance obligations, we would expect our concerns and costs to be taken into account in any decision weighing the costs and benefits of using the new type or quality of coal at CR4 and CR5.

V. PRB COALS AT CR4 AND CR5

Q. Are you aware that the Company has considered PRB coals for CR4 and CR5?

A. Yes. I am aware of and I have had some involvement with the Company's evaluation of a possible switch to a PRB coal blend at Crystal River.

Q. Was a test burn conducted for PRB coals?

A. Yes, a short-term test burn was conducted at CR5 with a small blend of PRB with bituminous coals in May 2006. I also am aware of an earlier test burn at CR4 in 2004 using a blend of PRB and bituminous coals.

Q. Has the Company evaluated the use of PRB coals at CR4 and CR5?

A. Yes. The Company has designated internal engineers and other employees from various operational groups in the Company to focus on evaluating the issues surrounding the use of a PRB blend of coal at CR4 and CR5, and the Company hired an outside consultant, Sargent & Lundy, to assist the Company in this evaluation. I further understand that the Company has hired a recognized PRB coal expert, Mr. Rod Hatt, to look at the issues surrounding the use of PRB coals at CR4 and CR5. The retention of such experts to assist the Company in evaluating potential fuel and other changes that impact the operation and performance of the Company's fossil units is typical Company practice and consistent with the utility industry practice.

Q. What do you know about PRB coals?

A. I know that PRB coals have different qualities from the bituminous compliance coal products we are used to handling and burning at CR4 and CR5 that will present a number of safety, handling, operational, and performance issues for us at CR4 and CR5. PRB coals are more volatile and dustier, they have a higher moisture content and are more susceptible to absorbing moisture, they have a lower Btu content, and they have a lower ash quality than the bituminous coal products we have historically used at CR4 and CR5.

Q. What are your issues with PRB coals?

A. I have a number of issues with the use of PRB coals at CR4 and CR5. First, the volatility and dustiness of PRB coals presents significant safety and handling issues for the operational group at CR4 and CR5. PRB coals can spontaneously combust. As a result, additional care and maintenance will have to be taken with the PRB coals from the moment they arrive on site at the barge unloader, to their placement on the conveyors to the north yard for blending, to the coal piles and blending operations, and to their placement on conveyors to the units for storage and burning. As you can see from Exhibit No. ___ (CWT-1) to my testimony, the use of PRB coals in CR4 and CR5 would involve nearly the entire Crystal River site.

This is a safety issue and a cost issue. We would have to improve the barge unloader, conveyors, and transfer stations on the conveyors to suppress the dust and control spillage. We would have to have additional employees trained specifically in handling PRB coals to monitor and control for dust and spillage to prevent potential fires. We would also need additional equipment and trained employees to monitor and take care of any PRB coal pile for the same reason. This would require constant packing of the PRB coal on the pile and maintenance of the pace of the PRB coal use in the yard and to the plants.

Our current equipment on site is inadequate to handle PRB coal piles and blend PRB coals. The existing dozers and stacker reclaimers were acquired and are used for dealing with less volatile and dusty bituminous coals. Stacker reclaimers are large pieces of equipment with spinning buckets to move coal from piles onto conveyor belts. The stacker reclaimers are not and never were intended to be precision blending equipment since there real purpose is simply to move coal quickly from the piles on the ground onto the conveyors. We would need equipment for pile maintenance and blending specifically designed for handling and blending PRB coals.

I have similar safety and cost issues when the PRB coal is transported to the cascade rooms in the units and then to the silos until the coals can be sent to the pulverizers for grinding and burning in the units. Dust and fire suppression upgrades and additional maintenance by employees trained to deal with PRB coals are necessary there too in order to prevent PRB dust and coals from spontaneously combusting and causing fires.

There are also a number of operational and performance concerns with burning a PRB coal blend. The higher moisture and lower Btu content of PRB coals means that there will be problems pushing enough coal through the pulverizers, drying and crushing it, and blowing it into the boilers on a consistent basis to maintain our load at overpressure. We can expect de-rates then from the units if an equal blend of PRB coals and bituminous coals are used. Also, the PRB coals are a higher slagging and fouling coal than bituminous coals, which means that we may also suffer de-rates from additional time off line to clean the boilers. These issues also mean that all boiler-related equipment in the units used to generate energy, from the pulverizers to the soot blowers to the boilers themselves, will have to work harder and require more maintenance because PRB coals are being used. This adds additional wear and tear and additional maintenance costs to these internal parts of the units if PRB coals are used.

These are some of the issues that I am concerned about if PRB coals are used at CR4 and CR5. Sargent & Lundy and Mr. Hatt have addressed some of these same issues, and additional issues, in greater detail. In sum, though, I can say that PRB is a maintenance and operational nightmare from my perspective as the person responsible for the operation and performance of CR4 and CR5. In addition, the units will be scrubbed in 2009 and 2010 so I am not sure if it makes sense to continue to consider PRB coals for CR4 and CR5. With scrubbers on the units we will be able to move to higher sulfur coals and burn them at the units.

Q. Have you reviewed the modifications that Mr. Hatt says are necessary to safely handle and burn PRB coals at the Crystal River site?

A. Yes, I have.

Q. How would you go about making these modifications if you had to do them?

A. Before making any modifications to the coal handling and operational systems at CR4 and CR5, a significant amount of planning must be done to ensure that the work can be done efficiently so that the base load units are taken off line for as short a time as possible. Scheduled maintenance for the units, for example, occurs during the "shoulder," not the "peak" months of the year. The "peak" months are the months where the customer demand for energy is at its highest, in the winter and summer months, and the units are needed to produce energy to meet the load. The "shoulder" months occur in the spring and fall when temperatures and conditions in Florida are mild and not all generation units are needed to meet customer demand for energy. Still, care is taken to ensure that both base load units are not down at the same time, even in the "shoulder" months, because they are still base load units and generally needed whenever there is customer demand for energy on the Company's system.

As a result, the necessary work to handle and operate with PRB coals at CR4 and CR5 will probably occur sequentially at the units so that they are not off line at the same time. Additionally, there are other operating units at the site, including the nuclear unit, which present issues regarding the scheduling of work for CR4 and CR5 to handle and operate on PRB coals. Careful planning will be necessary to ensure that any work for CR4 and CR5 does not interfere with the operation of these other units, which are also base load units. The fact that there is a nuclear unit on site will also present security issues that must be taken into account in any construction project at the site requiring off-site employees, material, and equipment being brought onto the site.

Finally, there are always the issues of including the time to design or identify, order, and purchase necessary equipment and material for the work and to identify and contract for the necessary labor and contractors. All of this needs to be included in developing any timeline for the work contemplated to ensure that the PRB coals can be safely and efficiently handled and burned in the CR4 and CR5 units.

Q. How long would it take to make the modifications?

A. No determination has been made because no decision has been made for a fuel switch. The Company, however, has engaged in other large construction and maintenance projects at the fossil units at the Crystal River Energy Complex in the past and, based on that experience, I have provided a rough estimate of the time to make the modifications recommended by Mr. Hatt to the units in order for them to handle and burn PRB coals at the site. That estimate is anywhere from 18 months to 30 months.

Q. Does this conclude your testimony?

A. Yes.

Docket No. 060658
Progress Energy Florida
Exhibit No. ____ (CWT-1)
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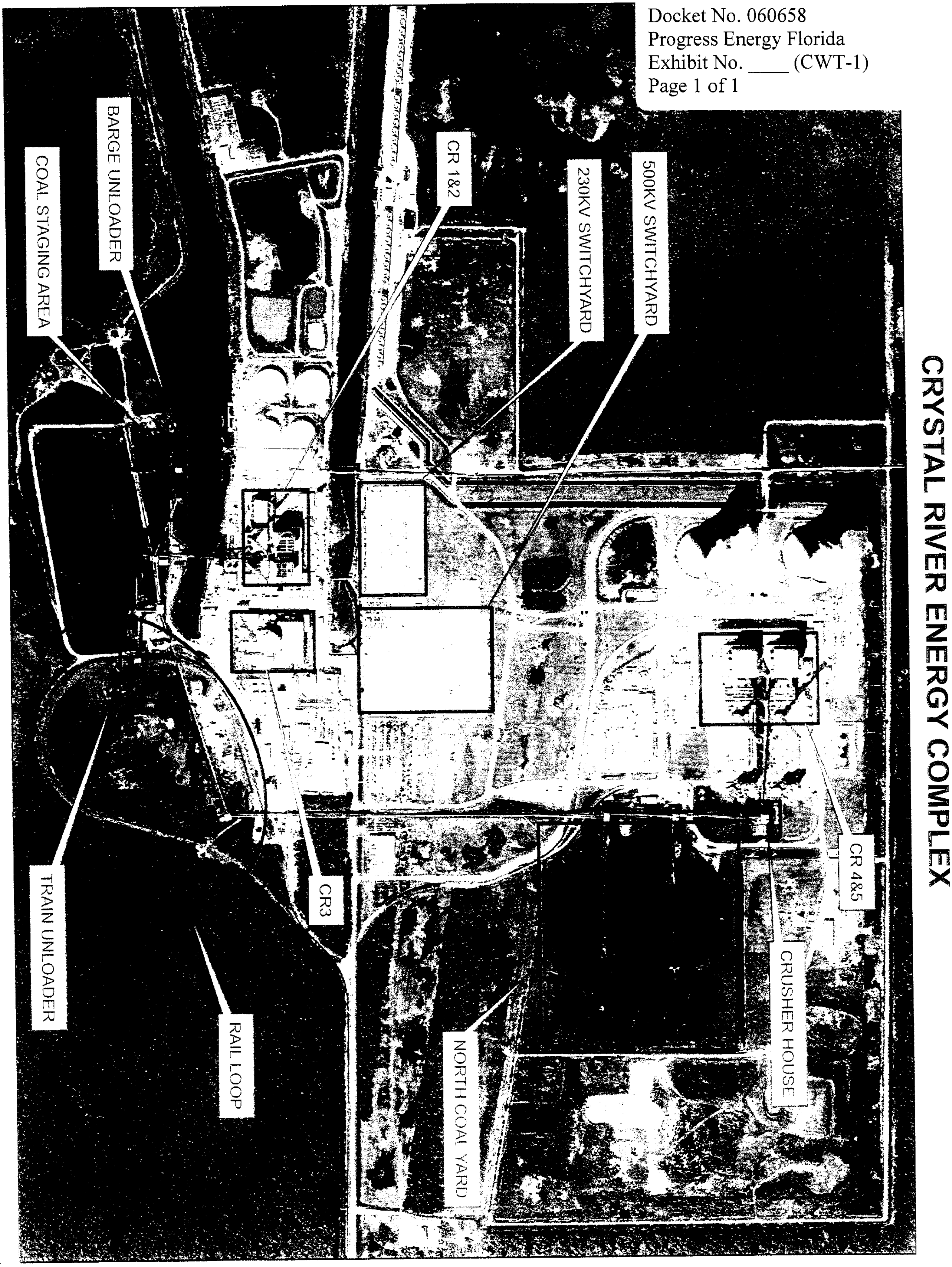


Instructions

for the

Care and Operation

of

Babcock & Wilcox Equipment

furnished on Contract

RB-588

for

Florida Power Corporation

Crystal River Plant
Unit 4

Progress Energy

9

UNIT DESCRIPTION

PLANT

This unit is installed as Unit No. 4 at the Crystal River Plant located near Crystal River, Florida. Plant elevation is 11 feet above sea level.

The unit supplies steam to a GE turbine rated at 665 MW. The consulting engineer is Black & Veatch, Kansas City, Missouri.

BOILER

This is a semi-indoor, balanced draft Carolina Type Radiant Boiler designed for pulverized coal firing. The unit has 54 Dual-Register burners arranged in three rows of nine burners each on both the front and rear walls. Furnace dimensions are 79 feet wide, 57 feet deep, and 201 feet from the centerline of the lower wall headers to the drum centerline. The steam drum is 72 inches ID.

The maximum continuous rating is 5,239,600 lb/hr of main steam flow at 2640 psig and 1005° F at the superheater outlet with a reheat flow of 4,344,700 lb/hr at 493 psig and 1005° F with a normal feedwater temperature of 546° F. This is a 5% overpressure condition. The full load rating is 4,737,900 lb/hr of main steam flow at 2500 psig and 1005° F with a reheat flow of 3,959,800 lb/hr at 449 psig and 1005° F with a normal feedwater temperature of 535° F. Main steam and reheat steam temperatures are controlled to 1005° F from MCR load down to half load (2,368,900 lb/hr) by a combination of gas recirculation and spray attemperation.

The unit is designed for cycling service and is provided with a full boiler by-pass system. The unit can be operated with either constant or variable turbine throttle pressure from 63% of full load on down.

The design pressures of the boiler, economizer, and reheater are 2975, 3050, and 750 psig respectively.

Steam for boiler soot blowing is taken off the primary superheater outlet header. Steam for air heater soot blowing is taken off the secondary superheater outlet.

SCOPE OF SUPPLY

The major items of equipment supplied by B&W include:

- RBC unit pressure parts including boiler, primary and secondary superheater, economizer, and reheater.
- Fifty-four Dual-Register burners and lighters.
- Six MPS-89GR pulverizers and piping to burners.
- By-pass system including valves and piping.
- Two stages of superheat attemperators (first stage tandem) and one stage of reheat attemperation (2 nozzles); nozzles only, no block or control valves or spray water piping.
- Three Rothemuhle air heaters (one primary and two secondary).
- Ducts from secondary air heaters to windbox.

- Primary air system: two TLT centrifugal PA fans and ducts from fans to pulverizers.
- Gas recirculation system: one TLT centrifugal GR fan, one dust collector and flues.
- Six Stock gravimetric coal feeders and drives.
- Bailey burner controls.
- Safety valves and ERV.
- Brickwork, refractory, insulation and lagging (BRIL).
- Seal air piping and fans.
- Erection.
- Recommended spare parts.

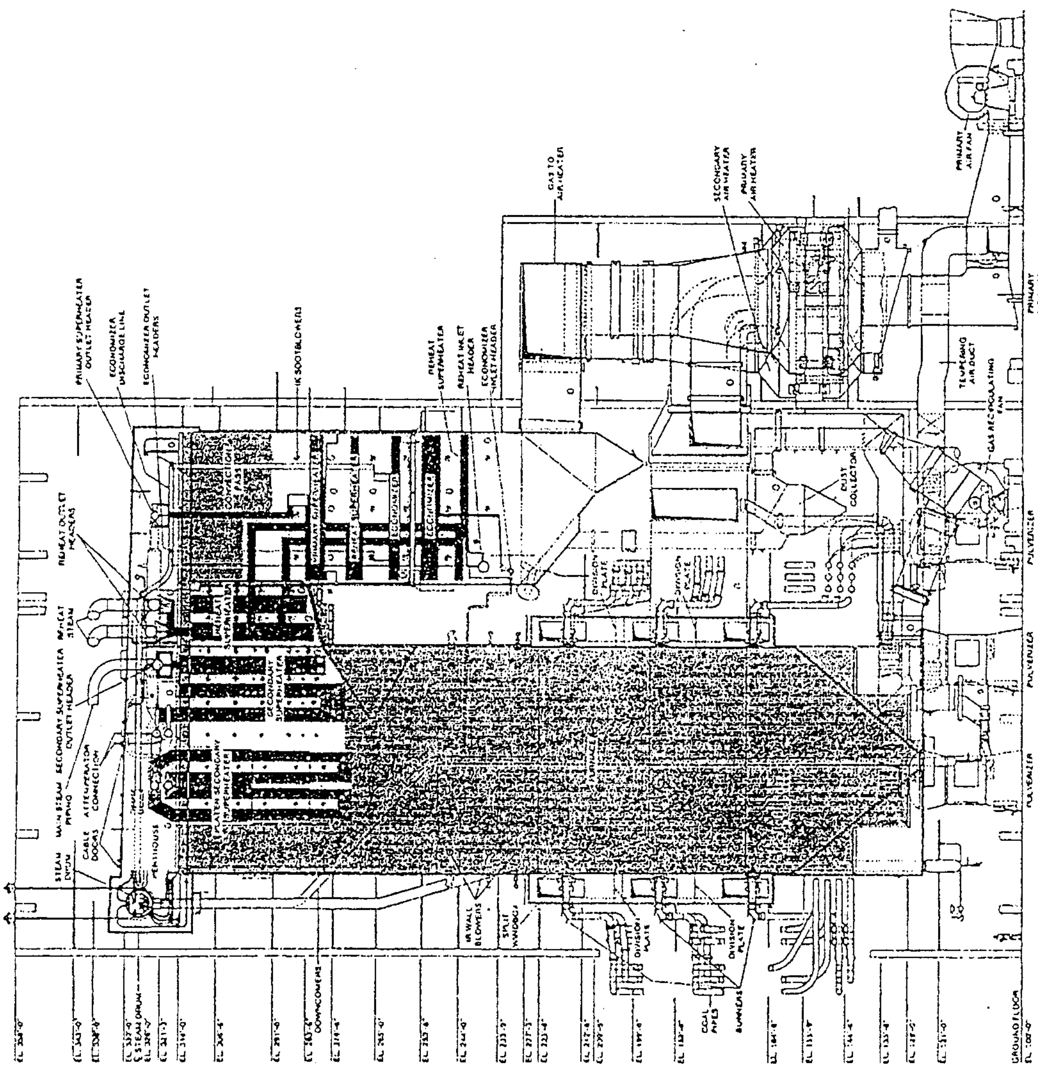
FUEL

The guarantees for this unit are based on firing a 50/50 blend of Eastern bituminous and Western sub-bituminous coal. The performance coal is classified as high slagging and medium fouling. Performance was also checked on Illinois deep-mined coal which is classified as severe slagging and high fouling. The furnace and convection pass are designed for a severe slagging and severe fouling coal.

Ultimate Analysis: % by Weight

	Performance	Illinois
Ash	7.90	13.00
Sulfur	0.49	4.20
Hydrogen	3.90	4.40
Carbon	58.80	62.00
Chlorine	0.03	0.02
Water	18.50	10.00
Nitrogen	1.10	1.38
Oxygen	9.28	5.00
Total	100.00	100.00
Higher Heating Value	10285 Btu/lb	11000 Btu/lb

Progress Energy



FLORIDA POWER CORPORATION
CRYSTAL RIVER PLANT, UNIT NO. 4
CRYSTAL RIVER, FLORIDA

A — FUEL AS FIRED

SAMPLES				
ANALYSES 50/50 BLEND, EASTERN & WESTERN				
KIND				
RANK — CLASS				
RANK — GROUP				
SOURCE — MINE				
SOURCE — SEAM				
SOURCE — DISTRICT				
SOURCE — COUNTY				
SOURCE — STATE				
SIZE				
GRINDABILITY				48
SURFACE MOISTURE, %				
				PERF:
ASH SOFT. TEMP., F (REDUCING)				
PROXIMATE — MOISTURE, TOTAL				18.5
VOLATILE MATTER				31.0
FIXED CARBON				42.6
ASH				7.9
TOTAL				100.0

FUEL	BIT.	SUB-BIT.		
% BY	WT.	WT.		WT.
ASH	10.0	5.0		7.90
S	0.5	0.48		0.49
H_2	4.4	3.4		3.90
C	69.0	48.5		58.60
CH_4				
C_2H_4				
C_2H_6				
C_3H_8				
C_4H_{10}				
C_5H_{12}				
C_6H_{14}				
CO				
CO_2				
Cl	0.05	0.02		0.03
H_2O	7.0	30.0		18.50
N_2	1.4	0.7		1.10
O_2	7.65	11.1		9.28
TOTAL	100.00	100.00		100.00
BTU/LB	12,450	8,125		10,285
BTU/CU FT AT 60F 30 IN.HG				

*EXCLUDING VALVES AND STATIC HEAD.

B — PREDICTED PERFORMANCE

STEAM LEAVING SH, M LB/HR	2368.9	4737.9	5239.6
STEAM LEAVING RH^1, M LB/HR	2063.8	3959.8	4344.7
STEAM LEAVING RH^2, M LB/HR			
TYPE OF FUEL	PC	PC	PC
LOAD CONDITION	CONT.	CONT.	CONT.
EXCESS AIR LEAVING ECON., %	35	20	20
NO. OF BURNERS IN OPERATION	45	54	54
FUEL INPUT, MKB/HR	3348	6053	6581
HEAT AVAIL. MKB/HR (FUEL & HEATED AIR)	3615	6367	6886
QUANTITY, M LB/HR — FUEL (MCFH-NAT. GAS)	325.5	588.6	639.8
FLUE GAS ENTERING AIR HEATER	3728	6051	6579
AIR TO BURNING EQUIPMENT	3327	5419	5891
AIR HEATER LEAKAGE PRI/SEC	107/210	128/272	131/286
PRESSURE, PSIG — STEAM AT SH OUTLET	2425	2500	2640
STEAM AT RH^1 INLET	240	474	520
STEAM AT RH^2 INLET			
PRESSURE DROP — REHEATER 1	13	25	27
REHEATER 2			
ECONOMIZER *	5	20	25
DRUM TO SH OUTLET	39	155	189
TEMPERATURES, F — STEAM — LEAVING SUPERHEATER	1005	1005	1005
LEAVING REHEATER 1	1005	1005	1005
ENTERING REHEATER 1	528	598	604
LEAVING REHEATER 2			
ENTERING REHEATER 2			
FLUE GAS — LEAVING ECONOMIZER	630	689	697
LEAVING AH (EXCL. LKG) PRI/SEC	280/260	280/278	280/279
LEAVING AH (INCL. LKG) PRI/SEC	258/249	261/267	262/269
WATER ENTERING ECONOMIZER	459	535	546
AIR — ENTERING UNIT PRI/SEC	85/99	95/82	95/80
LEAVING AIR HEATER PRI/SEC	555/555	575/596	579/601
RESISTANCE, IN. OF WATER — GAS — FURNACE & CONVECTION BANKS	1.7	3.5	3.9
FLUES TO AH OUTLET	0.4	0.9	1.1
AIR HEATER	1.7	3.6	4.1
TOTAL FURN. TO AH OUTLET	3.8	8.0	9.1
AIR — FUEL BURNERS & WINDBOX	1.0	2.5	2.9
DUCTS & FLOW METER	1.2	3.3	3.8
AIR HEATER	1.7	4.0	4.6
TOT. FROM AH INLET TO FURN	3.9	9.8	11.3
HEAT LOSS, % — DRY GAS	4.23	4.34	4.43
H_2 & H_2O IN FUEL	5.80	5.89	5.91
MOISTURE IN AIR	0.11	0.11	0.11
UNBURNED COMBUSTIBLE	0.30	0.30	0.30
RADIATION	0.31	0.17	0.15
UNACC. FOR & MFRS. MARGIN	1.50	1.50	1.50
TOTAL HEAT LOSS	12.25	12.31	12.40
EFFICIENCY OF UNIT, %	87.75	87.69	87.60
PULVERIZER — NO. IN USE PER BOILER	5	6	5 6
TOTAL POWER, KW HP/TON MOTOR OUTPUT			
% THRU 200 U.S.S. SIEVE	74	69	65 68

PREDICTED PERFORMANCE IS BASED ON COMBUSTION AIR ENTERING UNIT WITH 0.013 LB MOISTURE/LB DRY AIR, ON 29.92 IN. HG. BAROMETRIC PRESSURE, ON CONDITIONS & EQUIPMENT GIVEN ON THIS SUMMARY SHEET & ON ARRANGEMENT SHOWN ON DRAWING P12-4657-16Y0

C — EQUIPMENT PER UNIT

TYPE	RADIANT
SIZE	RBC 57 79/HB
DESIGN PRESSURE - 2,975 PSIG	
PRESSURE PART HEATING SURFACE, SQ FT — FURNACE — WATER COOLED SCREEN (CIRCUMFERENTIAL)	
WATER COOLED (PROJECTED)	48,736
SUPERHEATER (CIRCUMFERENTIAL)	
SUPERHEATER (PROJECTED)	46,442
TOTAL FURNACE HEATING SURFACE	95,178
CONVECTION — SATURATED (CIRCUMFERENTIAL)	10,586
SUPERHEATER (CIRCUMFERENTIAL)	243,015
REHEATER 1 (CIRCUMFERENTIAL	331,919
REHEATER 2 (CIRCUMFERENTIAL)	
ECONOMIZER	46,519
TOTAL CONVECTION HEATING SURFACE	634,039
TOTAL FURN. & CONV. PRESSURE PART. HTG. SURF.	729,217
FLAT PROJECTED FURNACE HEATING SURFACE	
TO FACE OF PLATENS (24" CTR)	73,581
TO FACE OF CONVECTION SURFACE	101,501
FURNACE VOLUME, CU FT	734,185
AIR HEATER — TYPE ROTHEMUHLE REGENERATIVE	NO. 1-PRI. 2-SEC.
TOTAL HEATING SURFACE, SQ FT	PRI.-250,522
	SEC.-824,850
PRI. SIZE-10.6 Vu 56	
SEC. SIZE-12.5 Vu 68	
FUEL BURNER — TYPE DUAL REGISTER	
NO. 54	
PULVERIZER — TYPE MPS SIZE 89G NO. 6	
CAPACITY OF 5 PULV. IS 5239 M LB STEAM/HR BASED ON 48 GRIND	
10,285 BTU COAL AT 65 % THRU 200 U.S.S. SIEVE	
FOR 1092M LB COAL/PULV.-HR AT 65% THRU 200 U.S.S. SIEVE MIN. GRIND	
IS 42 MAXIMUM TOTAL MOISTURE IS 18% REQUIRING 570 F AIR	
STEAM TEMP. CONTROL — MAIN STEAM BY SPRAY ATTEMPERATION	
REHEAT BY GAS RECIRCULATION	
UNIT CONSTRUCTION FEATURES — MEMBRANE WALLS	
BALANCE DRAFT	

REVISIONS NO.	DESCRIPTION	BY	DATE

FLORIDA POWER CORP.
CRYSTAL RIVER, UNIT #4

UTILITY BOILER PERFORMANCE SUMMARY
BY RLC APPD. [illegible] DATE
THE BABCOCK & WILCOX COMPANY
P12-4657-16Y0-150

SHEET 6

A — FUEL AS FIRED

Samples
Analysis SPECIFIED
50/50 BLEND OF EASTERN & WESTERN

Kind			
ASTM Class			
ASTM Group			
Source: Mine			
Source: Seam			
Source: District			
Source: County			
Source: State			
Coal: Grindability		55	42
Surface Moisture, %			
		ILLINOIS	PERF. BLEND
Ash Soft. Temp., F (Reducing)		1950	
Prox. Analysis: Moisture, Total			18.5
Volatile Matter			31.0
Fixed Carbon			42.6
Ash			7.9
Total			100.0

Ultimate Analysis — Fuel	EASTERN	WESTERN	ILLINOIS	BLEND
% By	WT.	WT.	WT.	WT.
Ash	10.00	5.80	13.00	7.90
S	0.05	0.48	4.20	0.49
H_2	4.90	3.40	4.40	3.90
C	69.00	48.50	62.00	58.80
CH_4				
C_2H_4				
C_2H_6				
C_3H_8				
C_4H_{10}				
C_5H_{12}				
C_6H_{14}				
CO				
CO_2				
Cl	0.05	0.02	0.02	0.03
H_2O	7.00	30.00	10.00	18.50
N_2	1.40	0.7	1.38	1.10
O_2	7.65	11.10	5.00	9.28
Total	100.00	100.00	100.00	100.00
Btu/Lb	12450	8175	11000	10235
Btu/Cu Ft at 60F 30 In. Hg				

** NOT INCLUDING VALVES & STATIC HEAD.

UTILITY BOILER PERFORMANCE SUMMARY
By J.H. Appd. RSD Date 3-25-80
THE BABCOCK & WILCOX COMPANY
P12-4657-1670-350

B — PREDICTED PERFORMANCE

2	Steam leaving SH, M Lb/Hr	2369	4738	5240	2369	4738	5240
3	Steam leaving RH¹, M Lb/Hr	2064	3960	4345	2064	3960	4345
4	Steam leaving RH², M Lb/Hr						
5	Type of fuel	ILL	ILL.	ILL.	BLEND	BLEND	BLEND
6	Load condition	CONT-RHCL	CONT-GUAR	CONT-MCR	CONT-RHCL	CONT-GUAR	CONT-MCR
7	Excess air leaving econ., %	35	20	20	35	20	20
8	No. of burners in operation	45	54	54	45	54	54
9	Heat. avail., MKB/Hr (fuel & heated air)	3483	6295	6845	3481	6295	6849
10	Total input, MKB/Hr (fuel & ht. credits)						
11	Heat credits, MKB/Hr						
12	Fuel input, MKB/Hr	3334	6014	6533	3345	6049	6585
13	Quantity, Lb/Hr: Fuel MLB/HR	303.1	546.7	593.9	325.1	588.1	640.3
14	Flue gas entering air htrs.	3798	6061	6584	3723	6047	6583
15	Air to burning equipment	3381	5493	5967	3323	5414	5895
16	Air heater leakage PRI/SEC	112/239	121/262	125/271	114/238	124/159	127/271
17	Pressure, psig: Steam at SH outlet	2425	2500	2640	2425	2500	2640
18	Steam at RH¹ inlet	240	481	520	240	481	520
19	Steam at RH² inlet						
20	Pressure drop: Reheater 1	13	23	28	13	23	28
21	Reheater 2						
22	Economizer **	7	29	39	7	29	39
23	DRUM to SH outlet	36	145	176	36	145	176
24	Temperature, F — Steam: Leaving superheater	1005	1005	1005	1005	1005	1005
25	Leaving reheater 1	1005	1005	1005	1005	1005	1005
26	Entering reheater 1	529	600	606	529	600	606
27	Leaving reheater 2						
28	Entering reheater 2						
29	Flue gas: Leaving economizer	599	671	678	599	671	677
30	Leaving AH (excl. lkg) PRI/SEC	281/260	283/278	280/279	279/252	279/271	278/273
31	Leaving AH (incl. lkg) PRI/SEC	253/249	259/268	257/270	257/241	263/262	263/264
32	Water entering economizer	459	535	546	459	535	546
33	Air: Entering unit PRI/SEC	94/81	98/83	100/83	96/81	101/83	102/85
34	Leaving air heater PRI/SEC	545/537	416/586	441/588	539/530	529/582	545/584
35	Resistance, in. of water — Gas: Furnace & convection banks	1.8	3.5	3.4	1.8	3.5	3.4
36	Flues to AH outlet	0.5	0.9	1.0	0.5	0.9	1.0
37	Air heater	1.8	4.0	4.5	1.6	3.5	4.1
38							
39	Tot. from furn to AH outlet	4.1	8.4	9.4	3.9	7.9	9.0
40	Air: Fuel burners & windbox	1.2	3.2	3.7	1.2	3.0	3.4
41	Ducts & flow meter	1.2	3.5	4.1	1.2	3.2	3.9
42	Air heater	1.5	3.6	4.2	1.5	3.3	3.9
43							
44	Tot. from AH inlet to furn.	3.9	10.3	12.0	3.9	9.5	11.2
45	Heat loss, %: Dry gas	4.50	4.50	4.50	4.13	4.34	4.38
46	H_2 & H_2O in fuel	5.03	5.09	5.09	5.78	5.88	5.88
47	Moisture in air	0.11	0.11	0.11	0.10	0.11	0.11
48	Unburned combustible	0.30	0.30	0.30	0.3	0.30	0.30
49	Radiation	0.30	0.17	0.16	0.3	0.17	0.16
50	Unacc. for & mfrs. margin	1.50	1.50	1.50	1.5	1.50	1.50
51	Total heat loss	11.74	11.67	11.66	12.11	12.30	12.33
52	*Gross efficiency of unit, %	88.26	88.33	88.34	87.89	87.70	87.67
53	Heat credits adjustment, %						
54	Net efficiency A.S.M.E. PTC-4.1, %						
55	Fuel efficiency, % (output/fuel input)						
56	Pulverizer: No. in use per boiler	5	6/5	6/5	5	6/5	6/5
57	Total power, kW hr/ton motor output						
58	% thru 200 U.S.S. sieve	80	75/71	73/69	74	72/67	69/65

59 Predicted performance is based on combustion air entering unit with 0.013 lb moisture/lb dry air,
60 on 29.92 in. Hg. barometric pressure, on conditions & equipment given on this summary sheet &
61 by arrangement shown on drawing 4107 J & CONTRACT DRAWINGS

C — EQUIPMENT PER UNIT

2 Type RADIANT CAROLINA
3–4 Size RBC 57 29/NB
5 DESIGN PRESSURE = 2975 PSIG (DRUM & SH)
6 750 PSIG (RH ONLY) 2050 (ECONOMY)

7	Pressure part heating surface, sq ft — Furnace	Water cooled screen (circumferential)	
8		Water cooled (projected)	48820
9		Superheater (circumferential)	
10		Superheater (projected)	45631
11			
12		Total furnace heating surface	94451
13	Convection	Saturated (circumferential)	10534
14		Superheater (circumferential)	144836
15		Reheater 1 (circumferential)	240972
16		Reheater 2 (circumferential)	
17		Economizer	146570
18		Total convection heating surface	542412
19		Total furn. & conv. pressure part. htg. surf.	636863
20		Flat projected furnace heating surface	
21		To face of platens (24" CENTERS)	22782
22		To face of convection surface (12" CENTERS)	105963
23		Furnace volume, cu ft	229334
24	Air heater	Type ROTHEMUHLE REGENERATIVE No. 1-PRI. 2-SEC	
25		Total heating surface, sq ft	

26 PRIMARY - SIZE = 10.6 VI 36 HS = 250522
27 SECONDARY - SIZE = 12.5 VI 68 HS = 824850
28
29 Fuel burner: Type DUAL REGISTER - PULV. COAL
30 No. 54
31 Pulverizer: Type MPS Size 89G No. 6
32 Capacity of 5 pulv. is 5240M lb steam/hr based on 48 grind
33 10285 Btu coal at 65 % thru 200 U.S.S. sieve BLEND
34 for 128M lb coal/pulv.-hr at 65% thru 200 U.S.S. sieve min. grind
35 is 47. Maximum ~~surface~~ TOTAL moisture is 19 % requiring 565 F air
36–38
39 Steam temp. control: MAIN STEAM BY ATTEMPERATION
40 REHEAT STEAM BY GAS RECIRC. & ATTEMPERATION
43 Unit construction features: MEMBRANE WALLS
44 BALANCED DRAFT
45 COMPLETE BY-PASS SYSTEM
47 VARIABLE PRESSURE OPERATION POSSIBLE BELOW
48 63% of GUAR. LOAD.

52 *Corresponding to ABB. method par. 1.07 A.S.M.E. PTC-4.1

Revisions: No.	Description	By	Date

FLORIDA POWER CORPORATION
CRYSTAL RIVER UNIT # 4

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BWFP 31/51-3

THE BABCOCK & WILCOX COMPANY
FOSSIL POWER GENERATION DIVISION
CONTRACT INFORMATION SHEET

A.O.

TURBINE

MFG: G.E.
NAME PLATE RATING: 665,000 KW

HEAT BALANCE — PERFORMANCE DESIGN DATA

SPECIFIED BY: ☒ PURCHASER ☒ TURBINE ☐ BOILER DESIGN ☐

RATING: PERF. AT TERMINALS	GUAR. LOAD	PEAK LOAD ____ HRS.	MAX. CONTINUOUS LOAD	LOW LOAD CONTROL	20% Of Guar.		MAX CONT. HEAT INPUT
FUEL:	Blend		Blend	Blend	Blend		
FUEL QUANTITY MLB/HR							
MAIN STEAM FLOW MLB/HR	4737.9		5239.6	2368.9	947.6		
OPR. PRESS. @S.H. OUT. PSIG	2500		2640	2425	2406		
STEAM TEMP. @S.H. OUT. °F	1005		1005	1005	990		
1ST REHT. STEAM FLOW MLB/HR	3959.8		4344.7	2063.8	842.1		
1ST REHT. ENTR. PRESS. PSIG	474		520	240	84		
1ST REHT. ENTR. TEMP. °F	598		604	528	410		
1ST REHT. OUT. PRESS. PSIG	449		493	227	79		
1ST REHT. OUT. TEMP. °F	1005		1005	1005	950		
1ST REHT ENTR. ENTH	1298.7		1299.2	1279.3	1232.6		
2ND REHT. STEAM FLOW MLB/HR							
2ND REHT. ENTR. PRESS. PSIG							
2ND REHT. ENTR. TEMP. °F							
2ND REHT. OUT. PRESS. PSIG							
2ND REHT. OUT. TEMP. °F							
FEEDWATER ENTH. BTU/LB							
FEEDWATER TEMP. °F	534.8		546.4	459.4	372.3		
FEEDWATER FLOW M LB/HR	4737.9		5239.6	2368.9	947.6		
S.H. SPRAY WATER TEMP. °F	355		362	310	265		
PRESS @ SOURCE							
1ST REHT. SPRAY WATER TEMP. °F	355		362	310	265		
PRESS. @ SOURCE							
2ND REHT. SPRAY WATER TEMP. °F							
PRESS. @ SOURCE							

QTY., TYPE & SIZE CUST. FEED PUMPS:
QTY., TYPE & SIZE CUST. START UP PUMPS:

STEAM TEMPERATURE CONTROL

	METHOD	RANGE	REMARKS
MAIN STEAM	Spray Attemperation	2368.9M To 5239.6M	
1ST REHT.	Spray Attemperation and Gas Recirculation	2368.9M To 5239.6M	
2ND REHT.			

45

SPECIAL PERFORMANCE OR DESIGN REQ'MNTS.
☐ NOT REQD. ☒ REQD.: SEE CIS-14.0

PERF. CURVES & DATA SHEETS
SEE CIS-100 SERIES

REL. NO. AND DATE	CONTRACT NO.	FILE NO.
1 5-25-78 2 6-5-79 3 4-15-80	334-0588	RB-588

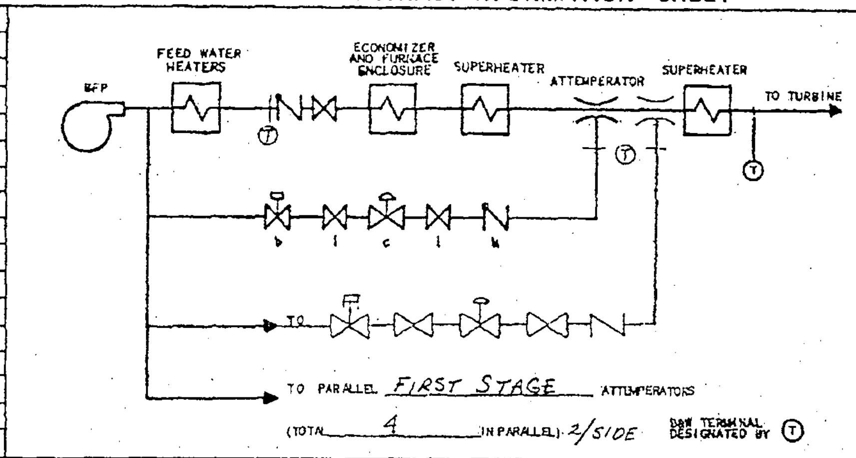
UNIT PERFORMANCE DESIGN DATA

THE BABCOCK & WILCOX COMPANY
FOSSIL POWER GENERATION DIVISION

BWFP 33027-3

CONTRACT INFORMATION SHEET

A.O.



PIPING DESIGN CONDITIONS

LOC.	PRESS	TEMP
ATTEMP	2975	850
SOURCE	*	*

ELEVATIONS

LOCATION	ELEVATION
ATTEMP NOZ	321'-6"
B&W FEED (T)	225'-9"
SOURCE	*

ATTEMP SYSTEM VALVES

	VALVE		CIS
c	CONTROL	CUST	
b	BLOCK	"	
i	ISOLATION	"	
k	CHECK	"	

		Units	Installed Capacity Min.	Installed Capacity Max.	Design Capacity	Installed Capacity Min.	Installed Capacity Max.	Design Capacity
	FUEL		P.C.			P.C		
	MAIN STEAM FLOW	MLB/HR	5240 (MCR)			4738 (GOAR)		
	AUXILIARY STEAM FLOW	MLB/HR						
	SPRAY WATER TEMPERATURE	F.	362			355		
	TOTAL SPRAY WATER FLOW AT SOURCE	MLB/HR	79.3	432.0	641.6	107.4	530.5	720.0
	SPRAY WATER FLOW THIS ATTEMPERATOR /NOZZLE	MLB/HR	26.2	108.0	117.4	26.9	132.6	132.6
	SPRAY WATER PRESS. AT SOURCE (Based on following)	PSIG *						
Boiler Press.	DRUM PRESSURE	PSIG	2829	2829	2829	2655	2655	2655
	ECONOMIZER ΔP (Incl. Static Head)	PSI	71.2	71.2	71.2	63.9	63.9	63.9
	FEED VALVES AND PIPING ΔP (Incl. Static Head)	PSI	12.7	12.7	12.7	10.1	10.1	10.1
	EXPECTED PRESS AT B&W FEED INLET TERMINAL	PSIG	2912.9	2912.9	2912.9	2729	2729	2729
	STEAM PRESSURE AT ATTEMPERATOR	PSIG	2785	2785	2785	2619	2619	2619
	ΔP THRU WATER NOZZLE NOTE 4	PSI	1	35.8	35.8	2.2	51	41
	REQ'D SPRAY WATER PRESS AT ATTEMP INLET	PSIG	2786	2820.8	2820.8	2621.2	2670	2660
	PRESS DROP AVAIL FOR ATTEMP. SYSTEM (26-33)	PSI *						
	STATIC HEAD, SOURCE TO ATTEMP. NOZZLE	PSI *						
	PRESS DROP AVAIL FOR PIPING AND VALVES (34-35)	PSI *						
Piping	ΔP B&W PIPING	PSI	0	0	0	0	0	0
	ΔP CUST PIPING	PSI *						
	TOTAL PIPING LOSS	PSI *						
	PRESS DROP AVAIL FOR VALVES (36-39)	PSI *						
Valves	ΔP B&W VALVES (Excluding control valve)	PSI	0	0	0	0	0	0
	ΔP CUST VALVES (Excluding control valve)	PSI *						
	TOTAL VALVE LOSS (Excluding control valve)	PSI *						
	PRESS DIFF. ACROSS CONTROL VALVE (40-43)	PSI *						
	MIN. REQ'D PRESS DROP ACROSS CONTROL VALVE	PSI	40	155	195	40	242	242

Notes

1. * Indicates information to be completed by customer. → SUGGESTED CONTROL VALVE ΔP
2. Piping and valves to be sized for design capacity.
3. Control valve internals may be sized for "Installed maximum capacity" provided internals suitable for design capacity may be installed in the control valve body.
4. DESIGN CAPACITY NOZZLE PRESSURE DROP IS BASED ON REDRILLING ORIFICE TO SIZE SHOWN ON CIS 37.00

ATTEMPERATOR TYPE: ☐ SINGLE STAGE ☒ TANDEM FIRST STAGE ☐ TWO STAGE

ATTEMPERATOR IDENTIFICATION: ☐ DOWNSTREAM (1st in Control) ☐ UPSTREAM (2nd in Control) ☒ FIRST STAGE ~~(1st in Control)~~ ☐ SECOND STAGE (2nd in Control)

REL. NO. AND DATE	CODE NO.	COMP. NO.	FILE NO.
4(3-19-80) 5(4-24-80)	334-0588		RB-588

SUPERHEATER ATTEMPERATOR SYSTEM DATA SHEET **FPGD CIS-38.0 0**

(FIRST STAGE ATTEMPERATOR)

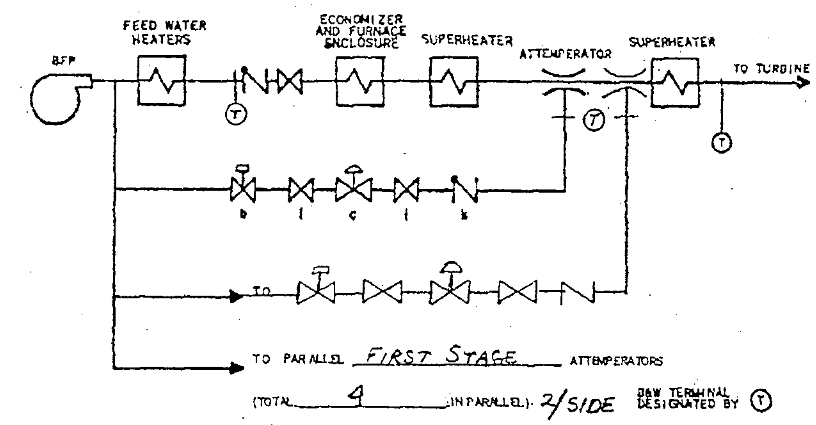
PEF-FUEL-003741

THE BABCOCK & WILCOX COMPANY
FOSSIL POWER GENERATION DIVISION

BWFP 33027-3

CONTRACT INFORMATION SHEET

A.C.



PIPING DESIGN CONDITIONS

LOC.	PRESS	TEMP
ATTEMP	2975	850
SOURCE	*	*

ELEVATIONS

LOCATION	ELEVATION
ATTEMP NOZ	321'-6"
B&W FEED (T)	225'-9"
SOURCE	*

ATTEMP SYSTEM VALVES

	VALVE	BY	CIS
c	CONTROL	CUST	
b	BLOCK	〃	
i	ISOLATION	〃	
k	CHECK	〃	

No.	Item	Units	Installed Capacity Min.	Installed Capacity Max.	Design Capacity	Installed Capacity Min.	Installed Capacity Max.	Design Capacity
18	FUEL		P.C.			P.C.		
19	MAIN STEAM FLOW	MLB/HR	2369 (RHCL)			2369 (RHCL-V.P)		
20	AUXILIARY STEAM FLOW	MLB/HR						
21	SPRAY WATER TEMPERATURE	F	310			310		
24	TOTAL SPRAY WATER FLOW AT SOURCE	MLB/HR	239.8	398.5	493.2	312.4	466.8	561.6
25	SPRAY WATER FLOW THIS ATTEMPERATOR /NOZZLE	MLB/HR	59.9	97.6	99.2	75.5	98.1	99.1
26	SPRAY WATER PRESS. AT SOURCE (Based on following)	PSIG *						
27	Boiler Press. DRUM PRESSURE	PSIG	2446	2446	2446	1960	1960	1960
28	Boiler Press. ECONOMIZER ΔP (Incl. Static Head)	PSI	40.3	40.3	40.3	40.3	40.3	40.3
29	Boiler Press. FEED VALVES AND PIPING ΔP (Incl. Static Head)	PSI	2.4	2.4	2.4	2.4	2.4	2.9
30	Boiler Press. EXPECTED PRESS AT B&W FEED INLET TERMINAL	PSIG	2488.7	2488.7	2488.7	2002.7	2002.7	2002.7
31	STEAM PRESSURE AT ATTEMPERATOR	PSIG	2955	2455	2455	1973	1973	1973
32	ΔP THRU WATER NOZZLE NOTE 4	PSI	10.6	28.3	24.0	16.4	28.3	24.0
33	REQ'D SPRAY WATER PRESS AT ATTEMP INLET	PSIG	2965.6	2483.3	2479	1989.4	2001.3	199.7
34	PRESS DROP AVAIL FOR ATTEMP. SYSTEM (26-33)	PSI *						
35	STATIC HEAD, SOURCE TO ATTEMP. NOZZLE.	PSI *						
36	PRESS DROP AVAIL FOR PIPING AND VALVES (34-35)	PSI *						
37	Piping ΔP B&W PIPING	PSI	0	0	0	0	0	0
38	Piping ΔP CUST PIPING	PSI *						
39	Piping TOTAL PIPING LOSS	PSI *						
40	PRESS DROP AVAIL FOR VALVES (36-39)	PSI *						
41	Valves ΔP B&W VALVES (Excluding control valve)	PSI	0	0	0	0	0	0
42	Valves ΔP CUST VALVES (Excluding control valve)	PSI *						
43	Valves TOTAL VALVE LOSS (Excluding control valve)	PSI *						
44	PRESS DIFF. ACROSS CONTROL VALVE (40-43)	PSI *						
45	MIN. REQ'D PRESS DROP ACROSS CONTROL VALVE → SUGGESTED CONTROL VALVE ΔP	PSI	50	140	141	75	140	141

Notes

1. * Indicates information to be completed by customer.
2. Piping and valves to be sized for design capacity.
3. Control valve internals may be sized for "Installed maximum capacity" provided internals suitable for design capacity may be installed in the control valve body.
4. DESIGN CAPACITY NOZZLE PRESSURE DROP IS BASED ON REDRILLING ORIFICE TO SIZE SHOWN ON CIS 37.00

ATTEMPERATOR TYPE: ☐ SINGLE STAGE ☒ TANDEM FIRST STAGE ☐ TWO STAGE

ATTEMPERATOR IDENTIFICATION: ☐ DOWNSTREAM (1st in Control) ☐ UPSTREAM (2nd in Control) ☒ FIRST STAGE ~~(1st in Control)~~ ☐ SECOND STAGE (2nd in Control)

REL. NO. AND DATE	CODE NO.	COMP. NO.	FILE NO.
4 (3-19-80)	334-0588		RB 588

SUPERHEATER ATTEMPERATOR SYSTEM DATA SHEET FPGD CIS-38.01

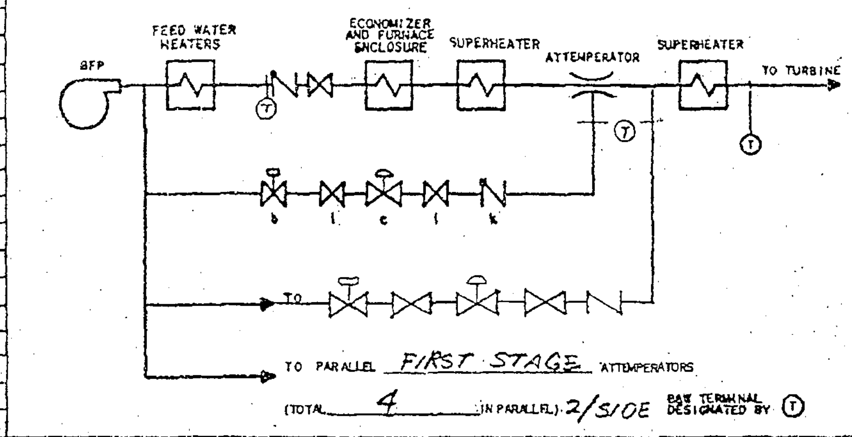
(FIRST STAGE ATTEMPERATOR)

THE BABCOCK & WILCOX COMPANY
FOSSIL POWER GENERATION DIVISION

BWFP 33027-3

CONTRACT INFORMATION SHEET

A.O.



PIPING DESIGN CONDITIONS		
LOC.	PRESS	TEMP
ATTEMP	2975	850
SOURCE	*	*

ELEVATIONS	
LOCATION	ELEVATION
ATTEMP NOZ	321'-6"
B&W FEED (T)	225'-9"
SOURCE	*

ATTEMP SYSTEM VALVES

	VALVE	[illegible]	CIS
c	CONTROL	CUST	
b	BLOCK	"	
i	ISOLATION	"	
k	CHECK	"	

No.		Item	Units	Installed Capacity Min.	Installed Capacity Max.	Design Capacity	Installed Capacity Min.	Installed Capacity Max.	Design Capacity
18		FUEL		P.C.					
19		MAIN STEAM FLOW	MLB/HR	1310 (25% - V.P.)					
20		AUXILIARY STEAM FLOW	MLB/HR						
21		SPRAY WATER TEMPERATURE	F	275					
24		TOTAL SPRAY WATER FLOW AT SOURCE	MLB/HR	159.1	262.9	315.3			
25		SPRAY WATER FLOW THIS ATTEMPERATOR/NOZZLE	MLB/HR	79.5	106.4	120.1			
26		SPRAY WATER PRESS. AT SOURCE (Based on following)	PSIG *						
27	Boiler Press.	DRUM PRESSURE	PSIG	1117	1117	1117			
28	Boiler Press.	ECONOMIZER ΔP (Incl. Static Head)	PSI	36.3	36.3	36.3			
29	Boiler Press.	FEED VALVES AND PIPING ΔP (Incl. Static Head)	PSI	0.7	0.7	0.7			
30	Boiler Press.	EXPECTED PRESS AT B&W FEED INLET TERMINAL	PSIG	1154	1154	1154			
31		STEAM PRESSURE AT ATTEMPERATOR	PSIG	1109	1109	1109			
32		ΔP THRU WATER NOZZLE NOTE 4	PSI	18.2	32.1	33.2			
33		REQ'D SPRAY WATER PRESS AT ATTEMP INLET	PSIG	1127.2	1141.1	1142.2			
34		PRESS DROP AVAIL FOR ATTEMP. SYSTEM (26-33)	PSI *						
35		STATIC HEAD, SOURCE TO ATTEMP. NOZZLE	PSI *						
36		PRESS DROP AVAIL FOR PIPING AND VALVES (34-35)	PSI *						
37	Piping	ΔP B&W PIPING	PSI	0	0	0			
38	Piping	ΔP CUST PIPING	PSI *						
39	Piping	TOTAL PIPING LOSS	PSI *						
40		PRESS DROP AVAIL FOR VALVES (36-39)	PSI *						
41	Valves	ΔP B&W VALVES (Excluding control valve)	PSI	0	0	0			
42	Valves	ΔP CUST VALVES (Excluding control valve)	PSI *						
43	Valves	TOTAL VALVE LOSS (Excluding control valve)	PSI *						
44		PRESS DIFF. ACROSS CONTROL VALVE (40-43)	PSI *						
45		MIN. REQ'D PRESS DROP ACROSS CONTROL VALVE → SUGGESTED CONTROL VALVE ΔP	PSI	85	150	192			

Notes

1. * Indicates information to be completed by customer.
2. Piping and valves to be sized for design capacity.
3. Control valve internals may be sized for "Installed maximum capacity" provided internals suitable for design capacity may be installed in the control valve body.
4. DESIGN CAPACITY NOZZLE PRESSURE DROP IS BASED ON REDRILLING ORIFICES TO SIZE SHOWN ON CIS 37.00

54 ATTEMPERATOR TYPE: ☐ SINGLE STAGE ☒ TANDEM FIRST STAGE ☐ TWO STAGE

55–56 ATTEMPERATOR IDENTIFICATION: ☐ DOWNSTREAM (1st in Control) ☐ UPSTREAM (2nd in Control) ☒ FIRST STAGE ~~(Not in Control)~~ ☐ SECOND STAGE (2nd in Control)

REL. NO. AND DATE	CODE NO.	COMP. NO.	FILE NO.
4 (3-19-80)	334-0588		RB-588

SUPERHEATER ATTEMPERATOR SYSTEM DATA SHEET FPGD CIS-38.02

(FIRST STAGE ATTEMPERATOR)

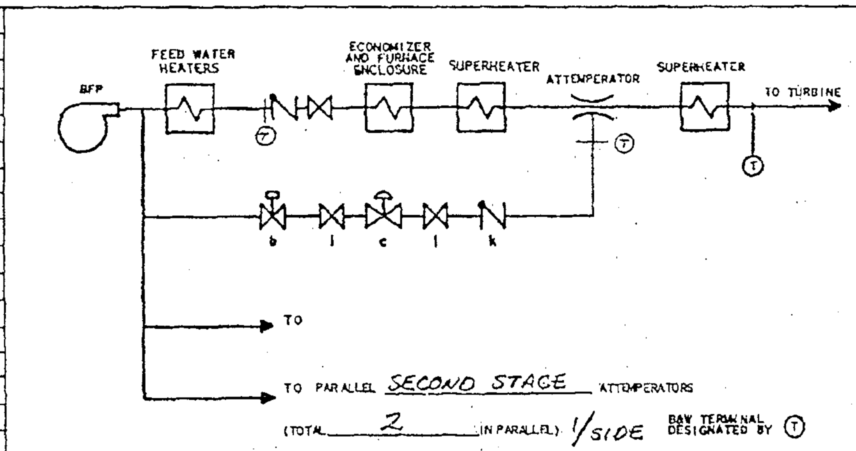
PEF-FUEL-003743

THE BABCOCK & WILCOX COMPANY
FOSSIL POWER GENERATION DIVISION

BWFP 33027-3

CONTRACT INFORMATION SHEET

A.O



PIPING DESIGN CONDITIONS		
LOC.	PRESS	TEMP
ATTEMP	2975	850
SOURCE	*	*

ELEVATIONS	
LOCATION	ELEVATION
ATTEMP NOZ	321'-6"
B&W FEED (T)	225'-9"
SOURCE	*

ATTEMP SYSTEM VALVES

	VALVE	[illegible]	CIS
c	CONTROL	CUST	
b	BLOCK	"	
i	ISOLATION	"	
k	CHECK	"	

No.	Item	Units	Installed Capacity Min.	Installed Capacity Max.	Design Capacity	Installed Capacity Min.	Installed Capacity Max.	Design Capacity
18	FUEL		P.C.			P.C.		
19	MAIN STEAM FLOW	MLB/HR	5290 (MCR)			4738 (GUAR)		
20	AUXILIARY STEAM FLOW	MLB/HR						
21	SPRAY WATER TEMPERATURE	F	362			355		
24	TOTAL SPRAY WATER FLOW AT SOURCE	MLB/HR	79.3	432.0	641.6	107.4	530.5	720.0
25	SPRAY WATER FLOW THIS ATTEMPERATOR /NOZZLE	MLB/HR	13.1	153.9	153.9	16.4	185.4	185.4
26	SPRAY WATER PRESS. AT SOURCE (Based on following)	PSIG *						
27	Boiler Press. DRUM PRESSURE	PSIG	2829	2829	2829	2655	2655	2655
28	Boiler Press. ECONOMIZER ΔP (Incl. Static Head)	PSI	71.2	71.2	71.2	63.9	63.9	63.9
29	Boiler Press. FEED VALVES AND PIPING ΔP (Incl. Static Head)	PSI	12.7	12.7	12.7	10.1	10.1	10.1
30	Boiler Press. EXPECTED PRESS AT B&W FEED INLET TERMINAL	PSIG	2912.9	2912.9	2912.9	2729	2729	2729
31	STEAM PRESSURE AT ATTEMPERATOR	PSIG	2725	2725	2725	2570	2570	2570
32	ΔP THRU WATER NOZZLE	PSI	1	42.6	42.6	1	63.3	63.3
33	REQ'D SPRAY WATER PRESS AT ATTEMP INLET	PSIG	2726	2767.6	2767.6	2571	2633.3	2633.3
34	PRESS DROP AVAIL FOR ATTEMP. SYSTEM (26-33)	PSI *						
35	STATIC HEAD, SOURCE TO ATTEMP. NOZZLE	PSI *						
36	PRESS DROP AVAIL FOR PIPING AND VALVES (34-35)	PSI *						
37	Piping ΔP B&W PIPING	PSI	0	0	0	0	0	0
38	Piping ΔP CUST PIPING	PSI *						
39	Piping TOTAL PIPING LOSS	PSI *						
40	PRESS DROP AVAIL FOR VALVES (36-39)	PSI *						
41	Valves ΔP B&W VALVES (Excluding control valve)	PSI	0	0	0	0	0	0
42	Valves ΔP CUST VALVES (Excluding control valve)	PSI *						
43	Valves TOTAL VALVE LOSS (Excluding control valve)	PSI *						
44	PRESS DIFF. ACROSS CONTROL VALVE (40-43)	PSI *						
45	MIN. REQ'D PRESS DROP ACROSS CONTROL VALVE → SUGGESTED CONTROL VALVE ΔP	PSI	40	350	350	40	470	470

Notes:
1. * Indicates information to be completed by customer.
2. Piping and valves to be sized for design capacity.
3. Control valve internals may be sized for "Installed maximum capacity" provided internals suitable for design capacity may be installed in the control valve body.

54 ATTEMPERATOR TYPE: ☐ SINGLE STAGE ☐ TANDEM ☒ TWO STAGE

55–56 ATTEMPERATOR IDENTIFICATION: ☐ DOWNSTREAM (1st in Control) ☐ UPSTREAM (2nd in Control) ☐ FIRST STAGE (1st in Control) ☒ SECOND STAGE ~~(2nd in Control)~~

REL. NO. AND DATE	CODE NO.	COMP. NO.	FILE NO.
4 (3-19-80)	334-1588		RB-588

SUPERHEATER ATTEMPERATOR SYSTEM DATA SHEET — FPGD CIS-38.0 3

(SECOND STAGE ATTEMPERATOR)

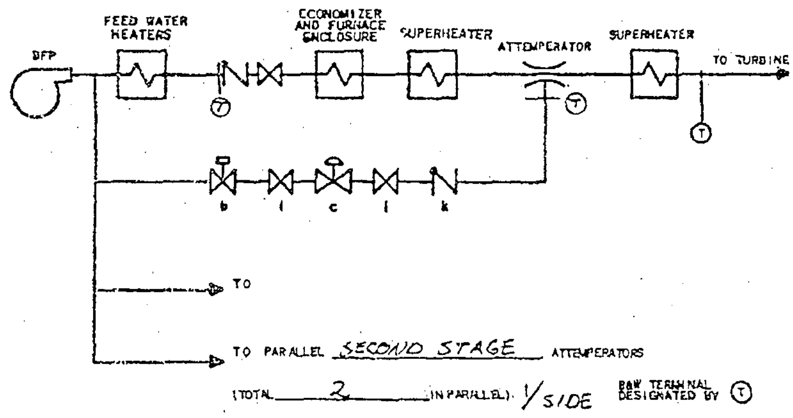
PEF-FUEL-003744

THE BABCOCK & WILCOX COMPANY
FOSSIL POWER GENERATION DIVISION

BWFP 33027-3

CONTRACT INFORMATION SHEET

A.O.



PIPING DESIGN CONDITIONS		
LOC.	PRESS	TEMP
ATTEMP	2975	850
SOURCE	*	*

ELEVATIONS	
LOCATION	ELEVATION
ATTEMP NOZ	321'-6"
B&W FEED (T)	225'-9"
SOURCE	*

ATTEMP SYSTEM VALVES			
	VALVE	[illegible]	CIS
c	CONTROL	CUST.	
b	BLOCK	"	
i	ISOLATION	"	
k	CHECK	"	

		Units	Installed Capacity Min.	Installed Capacity Max.	Design Capacity	Installed Capacity Min.	Installed Capacity Max.	Design Capacity
FUEL			P.C.			P.C.		
MAIN STEAM FLOW		MLB/HR	2369 (RHCL)			2369 (RHCL-V.P.)		
AUXILIARY STEAM FLOW		MLB/HR						
SPRAY WATER TEMPERATURE		F	310			310		
TOTAL SPRAY WATER FLOW AT SOURCE		MLB/HR	239.8	398.5	493.2	312.4	466.8	561.6
SPRAY WATER FLOW THIS ATTEMPERATOR /NOZZLE		MLB/HR	6.5	97.9	97.9	30.7	125.3	125.3
SPRAY WATER PRESS. AT SOURCE (Based on following)		PSIG *						
Boiler Press.	DRUM PRESSURE	PSIG	2446	2446	2446	1960	1960	1960
	ECONOMIZER ΔP (Incl. Static Head)	PSI	40.3	40.3	40.3	40.3	40.3	40.3
	FEED VALVES AND PIPING ΔP (Incl. Static Head)	PSI	2.4	2.4	2.4	2.4	2.4	2.4
	EXPECTED PRESS AT B&W FEED INLET TERMINAL	PSIG	2488.7	2488.7	2488.7	2002.7	2002.7	2002.7
STEAM PRESSURE AT ATTEMPERATOR		PSIG	2443	2443	2443	1956	1956	1956
ΔP THRU WATER NOZZLE		PSI	1	18	18	1.7	29.4	29.4
REQ'D SPRAY WATER PRESS AT ATTEMP INLET		PSIG	2444	2461	2461	1957.7	1985.4	1985.4
PRESS DROP AVAIL FOR ATTEMP. SYSTEM (26-33)		PSI *						
STATIC HEAD, SOURCE TO ATTEMP. NOZZLE		PSI *						
PRESS DROP AVAIL FOR PIPING AND VALVES (34-35)		PSI *						
Piping	ΔP B&W PIPING	PSI	0	0	0	0	0	0
	ΔP CUST PIPING	PSI *						
	TOTAL PIPING LOSS	PSI *						
PRESS DROP AVAIL FOR VALVES (36-39)		PSI *						
Valves	ΔP B&W VALVES (Excluding control valve)	PSI	0	0	0	0	0	0
	ΔP CUST VALVES (Excluding control valve)	PSI *						
	TOTAL VALVE LOSS (Excluding control valve)	PSI *						
PRESS DIFF. ACROSS CONTROL VALVE (40-43)		PSI *						
MIN. REQ'D PRESS DROP ACROSS CONTROL VALVE		PSI	40	180	180	40	250	250

Notes
1. * Indicates information to be completed by customer.
2. Piping and valves to be sized for design capacity.
3. Control valve internals may be sized for "Installed maximum capacity" provided internals suitable for design capacity may be installed in the control valve body.

ATTEMPERATOR TYPE: ☐ SINGLE STAGE ☐ TANDEM ☐ TWO STAGE

ATTEMPERATOR IDENTIFICATION: ☐ DOWNSTREAM (1st in Control) ☐ UPSTREAM (2nd in Control) ☐ FIRST STAGE (1st in Control) ☐ SECOND STAGE (2nd in Control)

REL. NO. AND DATE	CODE NO.	COMP. NO.	FILE NO.
3(3-19-80) 4(4-24-80)	334-0588		RB-588

SUPERHEATER ATTEMPERATOR SYSTEM DATA SHEET

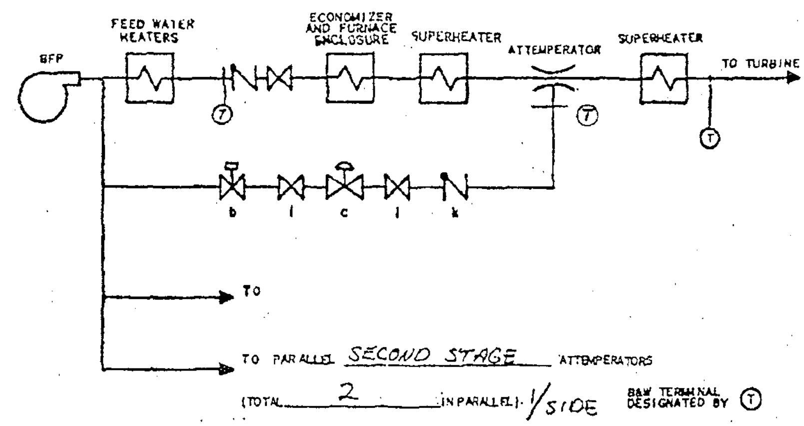
FPGD CIS-38.0 4

THE BABCOCK & WILCOX COMPANY
FOSSIL POWER GENERATION DIVISION

BWFP 33027-3

CONTRACT INFORMATION SHEET

A.O.



PIPING DESIGN CONDITIONS

LOC.	PRESS	TEMP
ATTEMP	2975	850
SOURCE	*	*

ELEVATIONS

LOCATION	ELEVATION
ATTEMP NOZ	321'-6"
B&W FEED (T)	225'-9"
SOURCE	*

ATTEMP SYSTEM VALVES

	VALVE	[illegible]	CIS
c	CONTROL	CUST	
b	BLOCK	"	
i	ISOLATION	"	
k	CHECK	"	

No.		Item	Units	Installed Capacity Min.	Installed Capacity Max.	Design Capacity	Installed Capacity Min.	Installed Capacity Max.	Design Capacity
18		FUEL		P.C.					
19		MAIN STEAM FLOW	MLB/HR	1310 (25% V.P.)					
20		AUXILIARY STEAM FLOW	MLB/HR						
21		SPRAY WATER TEMPERATURE	F	275					
24		TOTAL SPRAY WATER FLOW AT SOURCE	MLB/HR	159.1	262.9	315.3			
25		SPRAY WATER FLOW THIS ATTEMPERATOR /NOZZLE	MLB/HR	11.9	67.6	67.6			
26		SPRAY WATER PRESS. AT SOURCE (Based on following)	PSIG *						
27	Boiler Press.	DRUM PRESSURE	PSIG	1117	1117	1117			
28	Boiler Press.	ECONOMIZER ΔP (Incl. Static Head)	PSI	36.3	36.3	36.3			
29	Boiler Press.	FEED VALVES AND PIPING ΔP (Incl. Static Head)	PSI	.7	.7	.7			
30	Boiler Press.	EXPECTED PRESS AT B&W FEED INLET TERMINAL	PSIG	1154	1154	1154			
31		STEAM PRESSURE AT ATTEMPERATOR	PSIG	1099	1099	1099			
32		ΔP THRU WATER NOZZLE	PSI	1.1	34.2	34.2			
33		REQ'D SPRAY WATER PRESS AT ATTEMP INLET	PSIG	1100.1	1133.2	1133.2			
34		PRESS DROP AVAIL FOR ATTEMP. SYSTEM (26-33)	PSI *						
35		STATIC HEAD, SOURCE TO ATTEMP. NOZZLE	PSI *						
36		PRESS DROP AVAIL FOR PIPING AND VALVES (34-35)	PSI *						
37	Piping	ΔP B&W PIPING	PSI	0	0	0			
38	Piping	ΔP CUST PIPING	PSI *						
39	Piping	TOTAL PIPING LOSS	PSI *						
40		PRESS DROP AVAIL FOR VALVES (36-39)	PSI *						
41	Valves	ΔP B&W VALVES (Excluding control valve)	PSI	0	0	0			
42	Valves	ΔP CUST VALVES (Excluding control valve)	PSI *						
43	Valves	TOTAL VALVE LOSS (Excluding control valve)	PSI *						
44		PRESS DIFF. ACROSS CONTROL VALVE (40-43)	PSI *						
45		MIN. REQ'D PRESS DROP ACROSS CONTROL VALVE → SUGGESTED CONTROL VALVE ΔP	PSI	40	75	75			

Notes

1. * Indicates information to be completed by customer.
2. Piping and valves to be sized for design capacity.
3. Control valve internals may be sized for "Installed maximum capacity" provided internals suitable for design capacity may be installed in the control valve body.

ATTEMPERATOR TYPE: ☐ SINGLE STAGE ☐ TANDEM ☒ TWO STAGE

ATTEMPERATOR IDENTIFICATION: ☐ DOWNSTREAM (1st in Control) ☐ UPSTREAM (2nd in Control) ☐ FIRST STAGE (1st in Control) ☒ SECOND STAGE ~~(2nd in Control)~~

REL. NO. AND DATE	CODE NO.	COMP. NO.	FILE NO.
3(3-19-80)	334-0588		RB-588

SUPERHEATER ATTEMPERATOR SYSTEM DATA SHEET FPGD CIS-38.05

(SECOND STAGE ATTEMPERATOR)

PEF-FUEL-003746