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Final Public Design Report

Technical Progress Report
July 1996

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For
U.S. Department of Energy
Office of Fossil Energy
Federal Energy Technology Center
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INTRODUCTION

1.0 INTRODUCTION

This final Public Design Report (PDR) provides completed design information about Tampa Electric Company's Polk Power Station Unit No. 1, which will demonstrate in a commercial 250 MW unit the operating parameters and benefits of the integration of oxygen-blown, entrained-flow coal gasification with advanced combined cycle technology. Pending development of technically and commercially viable sorbent for the Hot Gas Cleanup System, the HGCU will also be demonstrated.

This project is partially funded by the U.S. Department of Energy (DOE) under Round III of its Clean Coal Technology (CCT) Program under the provisions of Cooperative Agreement DE-FC21-91MC27363 between DOE and Tampa Electric Company, novated on March 5, 1992. DOE's project management is based at its Morgantown Energy Technology Center (METC) in West Virginia.

PROJECT DESCRIPTION

2.0 PROJECT DESCRIPTION

Tampa Electric Company has developed a new major power generation station in Polk County, Florida. The initial generating facilities at the Polk Power Station site will be an Integrated Gasification Combined Cycle (IGCC) nominal net 250-MW demonstration project developed by Tampa Electric and supported in part through funding from the DOE. Additional generating units will be added according to a phased schedule designed to match the projected growth of Tampa Electric's customer power demands, subject to obtaining need for power certifications from the Florida Public Service Commission. The additional generating units are currently planned to include two 220-MW combined cycle (CC) generating units and six 75-MW simple cycle combustion turbines. Site capacity after full build-out is planned to be about 1,150 MW.

The scope of the project described in this report is the construction of the IGCC along with site development sufficient to meet full build-out requirements. The overall objectives of this demonstration project are two-fold. First, to meet the goals of the DOE CCT program, the project will demonstrate and evaluate the performance and benefits of an IGCC unit utilizing a new hot gas cleanup (HGCU) technology for sulfur removal from the syngas. Second, the project will meet the requirements of Tampa Electric's generation expansion plan and its obligation to provide reliable and economical electric power to its current and future customers.

The IGCC demonstration project is located on a 4,348-acre site in southwest Polk County, Florida. This location is in the middle of the phosphate rock mining region of Florida, and much of the plant has been built on reclaimed mined-out lands.

Major participants in the project include Tampa Electric Company, TECO Power Services, Inc. (TPS), DOE, Air Products and Chemicals, Inc., Bechtel Power Corporation acting as engineer and construction manager, General Electric Company, G.E. Environmental Services, Inc., MAN GHH, Monsanto Enviro-Chem, Raytheon Engineers and Constructors, L & C Steinmüller, and Texaco.

TPS is a subsidiary of TECO Energy, Inc. and an affiliate of Tampa Electric Company (TEC). TPS is responsible for overall project management for the DOE co-funded portion of the Polk IGCC Project. TPS will also concentrate on commercialization of this IGCC technology, as part of the Cooperative Agreement between TEC and DOE, novated on March 5, 1992.

The IGCC facilities consist of an oxygen-blown entrained flow coal gasification system to produce syngas for the combustion turbine (CT). The coal gasification system is based on Texaco's commercially available coal gasification technology. L & C Steinmüller and MAN GHH are the suppliers of the convective and radiant syngas coolers, respectively.

The CC power block facilities are based on a General Electric Company (GE) advanced 7F CT and a heat recovery steam generator (HRSG) and steam turbine (ST) configuration. The GE 7F CT is designed for an output of 192-MW when operating on syngas. The HRSG and ST are sized to result in an overall power plant nominal net 250 MW electric output.

The IGCC unit includes a new configuration to demonstrate the integration of coal gasification and CC technologies and to demonstrate and evaluate a more efficient method for removal of sulfur from syngas. The new technology to be demonstrated by this unit is called hot gas cleanup (HGCU), which involves the method by which the syngas is cleaned (of sulfur and trace halogens) prior to being sent to a CT. HGCU technology is supplied by G.E. Environmental Services, Inc. (GEESI). Conventional methods for IGCC sulfur removal, also called cold gas cleanup (CGCU), require that the gas be cooled prior to cleaning and then reheated. By comparison, the HGCU technology efficiently cleans the gas at high temperatures, thereby increasing the overall plant efficiency. Energy losses are reduced by reducing or eliminating the need to cool the syngas and to reheat it prior to injection into the CT, while achieving sulfur removal rates superior to current, advanced sulfur removal technologies such as flue gas desulfurization (FGD) systems on conventional coal-fired units. The demonstration project systems include the capability to use the new HGCU technology for approximately 45,000 lb/hr of the syngas fuel flow rate for the IGCC unit and the capability to use the CGCU technology for 100 percent of the fuel flow rate. By providing the conventional CGCU technology, the IGCC demonstration project is assured of maintaining reliable sulfur removal rates, complying with environmental requirements and standards, and meeting Tampa Electric's generation capacity needs.

Nitrogen and oxygen to meet the plant's needs are provided by an air separation unit (ASU) supplied by Air Products and Chemicals, Inc. Sulfur recovered in the CGCU and HGCU are converted to sulfuric acid for byproduct sales in a sulfuric acid plant supplied by Monsanto Enviro-Chem.

Bechtel began detailed engineering of the project in April 1993, and commercial operation is targeted for September 1996.

TECHNOLOGY OVERVIEW

3.0 TECHNOLOGY OVERVIEW

Polk Power Station Unit No. 1 consists of a highly integrated, nominal 250 MW (net) oxygen-blown, entrained-flow gasification/combined cycle power generation facility. Polk Power Station includes an air separation unit from which virtually all oxygen and nitrogen produced is efficiently and effectively used. The 95 percent pure oxygen from the ASU is the oxidant for the gasification of coal, slurried in water. The majority of the nitrogen, at 98 percent purity, is injected at the combustion section of the combustion turbine (CT). The addition of nitrogen in the CT combustion chamber has dual benefits. First, the addition of nitrogen increases the mass flow through and power output from the CT. Second, the nitrogen acts to control potential NO_x air emissions by reducing the combustor flame temperature which, in turn, reduces the formation of NO_x in the fuel combustion process. The process of using nitrogen to control the flame temperature and NO_x formation is similar to that achieved by steam or water injection NO_x control methods; however, the use of nitrogen does not require the use and consumption of water as with the water/steam injection methods.

The combined cycle (CC) technology is of a proven design with the exception of the combustion system for the GE 7F combustion turbine. The hardware and control philosophy are under development to prepare for the use of combined flows of hot and cold syngas to the CT, in concert with the injection of nitrogen at the head end of the combustors.

Also included for Polk Power Station is a new hot gas cleanup system (HGCU) capable of treating 45,000 lb/hr of the syngas, and a cold gas cleanup system (CGCU) sized to accept 100 percent of the gasifier output. Use of the HGCU will provide additional system efficiencies by demonstrating the technical improvements realized from cleaning syngas at a temperature of 900°F. The HGCU incorporates cyclone technology at the inlet to the unit and a barrier filter at the outlet to the CT.

Another important example of integration technology is embodied in the project's distributed control system (DCS), which brings the complex network of system data together in a way that enhances plant reliability and provides state-of-the-art control and diagnostic capability.

DESIGN BASIS DESCRIPTION

4.0 DESIGN BASIS DESCRIPTION

4.1 PROJECT PERFORMANCE DESIGN BASIS

4.1.1 Capacity

The gasification section designed to fully load GE's 7F combustion turbine at 90°F ambient, 60 percent relative humidity and 14.63 psia. The design capacity of each section is determined on the basis of the information shown in Table 4.1.

4.1.2 Availability/Reliability

Availability. In this context availability will mean the Equivalent Availability Factor (EAF) which represents the unit's total composite availability over a specified amount of period hours versus the units potential availability (100 percent) over the same period hours. All full outages (planned, unplanned, maintenance, etc.) as well as deratings are considered reductions to the unit's availability to produce at full load capacity. The plant has a design equivalent availability of 85%.

The equivalent availability factor as summarized above is as defined by the North American Electric Reliability Council. An example calculation is included in Table 4.2.

Reliability. In this context, reliability is defined as the ability of a unit to produce electricity upon demand. Downtimes are expected to result from 10 percent forced downtimes and 5 percent planned downtimes. The number of trains selected to provide acceptable availability and reliability is shown in Table 4.3.

Table 4.1

DESIGN CAPACITY BASIS

Section	Capacity Basis
Air Separation Unit (ASU)	Coal throughput of Pittsburgh #8 with a sulfur content of 3.5 wt% dry basis.
Coal Handling	Coal throughput of Pittsburgh #8 with a sulfur content of 3.5 wt% dry basis.
Slurry Preparation	Coal throughput of Pittsburgh #8 with a sulfur content of 3.5 wt% dry basis.
Gasification	Gas throughput of Pittsburgh #8 with a sulfur content of 3.5 wt% dry basis.
Convect. Cooling, Scrubbing	Gas throughput of Pittsburgh #8 with a sulfur content of 3.5 wt% dry basis.
Low Temperature Gas Cooling	Gas throughput of Pittsburgh #8 with a sulfur content of 3.5 wt% dry basis.
Slag Handling	Slag throughput of Pittsburgh #8 with a sulfur content of 3.5 wt% dry basis.
Black Water Handling	Fines throughput of Pittsburgh #8 with a sulfur content of 3.5 wt% dry basis.
Acid Gas Removal (AGR)	Gas throughput of Pittsburgh #8 with a sulfur content of 3.5 wt% dry basis.
Sulfuric Acid Plant	Pittsburgh #8 with 3.5% sulfur content
Brine Concentration	0.1 wt% Chlorine in the coal, dry basis
Power Block	Fuel gas, steam and nitrogen for Pittsburgh #8
Fresh Water Systems	NO_x control when firing No. 2 fuel oil
Industrial Wastewater Treatment	150% of 25-year, 24-hour rainfall with the capability of handling a second 9-inch rain storm after a 72-hour period.
Sanitary Wastewater Treatment	50 GPD per person for maximum staffing of 210 at future full build-out
Boiler Feed Water	Greater of CT fuel oil or syngas operation

Table 4.2

EQUIVALENT AVAILABILITY CALCULATION EXAMPLE

Condition	First Year Hours	Second Year Hours
Calendar Year	8760	8760
Scheduled Maintenance	0	438
Scheduled Operations	8760	8322
Unscheduled Downtime	1752	876
Expected Operations	7008	7446

1st Year Equivalent Availability = (7008/8760)*100 = 80%
2nd Year Equivalent Availability = (7446/8760)*100 = 85%

NOTE: These calculations are for example only and are not intended to reflect actual operations.

Table 4.3

NO. OF TRAINS AND CAPACITY INFORMATION

Section	No. of Trains
Air Separation Unit (ASU)	1 - 100%
Coal Handling System	1 - 100%
Gasification System	1 - 100%
Low Temperature Gas Cooling	1 - 100%
Slag Handling	1 - 100%
Black Water Handling	1 - 100%
Acid Gas Removal (AGR)	1 - 100%
Sulfuric Acid Plant	1 - 100%
Brine Concentration	1 - 100%
Power Block	1 - 100%
Fresh Water System	1 - 100%
Potable Water Treating	1 - 100%
Demineralizer	2 - 60%
Sanitary Water Treating	1 - 100%
Industrial Water Treating	1 - 100%

4.1.3 Design Basis Feed Composition

The design coal (the coal on which the design and sizing of equipment is based) for the Tampa Electric IGCC Project is a modified Pittsburgh #8 with 3.5 wt% (dry basis) sulfur. The normal operating coal is Pittsburgh #8 with 2.57 wt % (dry basis) sulfur. The coal analysis for Pittsburgh #8 is shown in Table 4.4. The design and normal operating case (NOC) coal analyses are shown in Table 4.5.

The maximum sulfur content of any coal specified for use at Polk Power Station Unit #1 is 3.5 wt% (dry basis). The design chlorine content is 0.1 wt% dry basis. The design coal trace element data is shown in Table 4.6. The specifications for the No. 2 fuel oil that is used as a startup fuel and as a backup fuel for the combustion turbine are shown in Table 4.7. The design and normal operating case coal rates are approximately 2000 STPD and 1900 STPD, dry basis, respectively.

4.1.4 Coal Handling Systems

The design of the coal handling system for this project is based on receipt of coal by truck. The conveyor from the unloading hopper is designed to operate at approximately 3000 TPH. The system is include a coal storage day bin with a capacity of approximately 20 hours of coal.

4.1.5 Preheat Fuel

Liquid propane is vaporized and used to preheat the gasifier and the sulfuric acid plant. The fuel is supplied from portable facilities on an as needed basis. The design propane composition is as follows:

Propane	99 Mol%
Butane	1 Mol%
Water	0 Mol%
Sulfur Compounds	0 Mol %
Total	100%

Table 4.4

COAL ANALYSIS DATA
(Pittsburgh #8)

Ultimate Analysis (wt %)	As Received	Dry Basis
Moisture	4.74	0
Carbon	73.76	77.43
Hydrogen	4.72	4.95
Nitrogen	1.39	1.46
Chlorine	0.10	0.10
Sulfur	2.45	2.57
Ash	7.88	8.27
Oxygen	4.96	5.22
Total	100.00	100.00
HHV (Btu/lb)	13290	13841 (Calc.)
Properties		
Ash (wt %)		
K_2O	1.32	
Na_2O	0.86	
Ash Fusion Temperature: (Reducing Atmosphere)		
Init (°F)	2100	
Soft (°F)	2150	
Hemi (°F)	2230	
Fluid (°F)	2340	
As Received Coal - Top Size	3/4" x 0 Normal 2" x 0 Maximum	
Hargrove Grindability Index	53	

Table 4.5

DESIGN AND NORMAL OPERATING COAL ANALYSES

Coal Analysis (Wt %, Dry Basis):

	Design	Normal
Carbon	77.43	77.43
Hydrogen	4.95	4.95
Nitrogen	1.46	1.46
Sulfur	3.50	2.57
Oxygen	5.22	5.22
Ash	7.44	8.37
	100.00	100.00

Table 4.6

DESIGN COAL TRACE ELEMENT DATA

	Maximum Content (wppm)
Aluminum	11300
Antimony	4.0
Arsenic	13
Barium	84
Beryllium	4.7
Boron	140
Cadmium	1.9
Calcium	3600
Chromium	28
Cobalt	9.3
Copper	26
Iron	10300
Lead	4.7
Magnesium	750
Manganese	45
Mercury	0.28
Molybdenum	10
Nickel	14
Potassium	1600
Selenium	8
Silicon	28500
Silver	0.04
Sodium	760
Strontium	280
Thallium	2.5
Tin	8
Titanium	1300
Vanadium	52
Zinc	54

Table 4.7

DESIGN NO. 2 FUEL OIL ANALYSIS

Parameter	Value
Specific gravity @60°F (maximum)	0.876
Viscosity, Saybolt (SUS) @ 100°F	
Minimum	40.2
Maximum	32.6
Flash Point, °F (minimum)	100
Pour Point, °F (minimum)	20
Minimum gross heating value, Btu/gal	
LHV	129,811
HHV	137,600
Water and sediment, percent by volume (maximum)	0.05
Ash, percent by weight (maximum)	0:01
Sulfur, percent by weight (maximum)	0.05
Fuel-bound nitrogen, percent by weight (maximum)	0.015
Trace constituents, ppm (maximum)	
Lead	1.0
Sodium	1.0
Vanadium	0.5

4.1.6 Air Separation Unit Requirements

The ASU is specified to produce approximately 2020 TPD of pure oxygen, 1985 TPD produced at 575 psig and 35 TPD produced at 50 psig. The purity requirement of the oxygen is 95 mol%. The design conditions for the unit are 90°F ambient dry bulb, 75°F ambient wet bulb and 14.63 psia.

The ASU has been designed for full nitrogen recovery, with a maximum total nitrogen production of approximately 6400 TPD. Approximately 6000 TPD of nitrogen is produced at a nominal 255 psig for syngas diluent, approximately 400 TPD is produced at high pressure for soot blowing. The minimum purity (N_2+Argon) required for the nitrogen is 98 mol% for diluent and 99.99 mol% for high pressure nitrogen.

4.1.7 Power Block Design Parameters and Product Specifications

The power block is designed to operate on both syngas and No. 2 fuel oil. During startup and other times when syngas is not available, the power block generates power from a No. 2 oil fired, water injected, GE Frame 7F combustion turbine. When available, the primary fuel is syngas made in the gasification section with nitrogen from the ASU for NO_x control. The syngas will come from either the CGCU process exclusively or from the CGCU and HGCU.

In addition to using the combustion turbine to generate electricity, the power block utilizes a HRSG, and a steam turbine and a condenser/hotwell in a combined cycle configuration to generate additional electricity. The HRSG is a three pressure level unit with superheater, reheater, evaporators, drums, economizers, boiler feed water preheaters and an integral deaerator. The steam turbine is a 1450 psig/1000°F reheat turbine with double flow condensing LP section.

High pressure saturated steam generated in the gasification section is routed to and superheated in the HRSG.

Intermediate and low pressure steam and water systems interface with the gasification section.

The HRSG is designed to handle the full load CT exhaust flow.

The power block generates three phase, 60 Hz electric power at 18 KV from the combustion turbine generator and at 13.8 KV from the steam turbine generator. The generator step-up transformers transforms the generator voltages to 230 KV.

4.1.8 Sulfuric Acid Plant

4.1.8.1 Feed Gas Conditions. The feed gas conditions are provided for the AGR acid gas, ammonia acid gas, HGCU offgas, HGCU air for drying, and oxygen.

The Normal Operating and Design Case 1 are for operation on 100% CGCU feed to the sulfuric acid plant. Design Case 2 is for operation on 90% CGCU feed and 10% HGCU feed to the sulfuric acid plant. The Normal Operating is for a gasifier feed of 2.5 wt% sulfur coal, the expected coal quality. Design Cases 1 and 2 are for a gasifier feed of 3.5 wt% sulfur coal. All of the cases are for a gasifier operating at a H_2S:COS ratio of 40:1. The sulfuric acid plant is designed to operate under all these cases as well as at a turndown of 50%.

AGR Acid Gas	**Normal Operating**	**Design Case 1**	**Design Case 2**
Temperature, °F	110	110	110
Pressure, PSIG	10.0	10.0	10.0
Ammonia Acid Gas			
Temperature, °F	200	200	
200			
Pressure, PSIG	10.0	10.0	
10.0			

The plant is capable of operating when there is no ammonia acid gas available.

HGCU Offgas	**Normal Operating**	**Design Case 1**	**Design Case 2**
Temperature, °F	---	---	600 min 650 max
Pressure, PSIG			85.0 min 105.0 max

The HGCU offgas is from a new developing technology and may be subject to unplanned outages. The plant design incorporates features to handle a potentially rapid transition from having HGCU offgas (Design Case 2) to not having the gas (Design Case 1).

The HGCU offgas may contain impurities detrimental to proper operation of the sulfuric acid plant. Because of this and the initially uncertain nature of the feed from the HGCU, the HGCU offgas will be introduced into the sulfuric acid plant upstream of the waste heat boiler. In addition, a blinded alternate feed point is provided down stream of the waste heat boiler for the HGCU offgas.

HGCU Air for Drying	**Normal Operating**	**Design Case 1**	**Design Case 2**
Temperature, °F	---	---	734 Min 800 Max
Pressure, PSIG	---	---	150

The HGCU air for drying stream is an offsite stream that is used in the regeneration of the solid reactant used in the HGCU and is only available when the HGCU is operating. The air drying requirement shown above may be required prior to the availability of the HGCU offgas.

Oxygen	**Normal Operating**	**Design Case 1**	**Design Case 2**
Temperature, °F	110	110	110
Pressure, PSIG	100	100	100
Maximum Available lbs/hr	5250	5250	5250

4.1.8.2 Product and Effluent Specifications. Product and effluent specifications are provided for sulfuric acid, dry HGCU air, vent gas (effluent gas), acid water (cooling system bleed), and flare header.

Sulfuric Acid

Concentration, Min Wt % H_2SO_4	98
Onsite Storage Capacity	5 days production

Dry HGCU Air

Dew Point, °F	-30
Acid Mist (H_2SO_4), Max PPMV	5
Temperature, °F	734
Min Temp., °F	650
Pressure, Min PSIG	115

Vent Gas (Effluent Gas)

Pressure, Minimum PSIG	1.0

The vent gas will meet the following Federal and State of Florida Air Quality Permit requirements:

- Max lbs SO_2/ton of 100% H_2SO_4 Product	4
- Max lbs Acid Mist/Ton of 100% H_2SO_4 Prod.	0.15

Acid Water (Cooling System Bleed)

SO_2 Content, Max PPMW	50
Pressure, Minimum PSIG	75

Flare Header

Offsite back pressure, Maximum PSIG (includes both static and developed)	10

Used for relief valve and relief system design.

4.1.9 Design Life of Equipment

Equipment Type	**Design Life**
Vessels	30 years
Non-removable internals	30 years
Removable internals	10 years
Trays	10 years
Exchangers Shells	30 years
Exchangers Tubes	
Removable Bundles	10 years
Nonremovable Bundles	30 years
Piping	
Clean Non-corrosive	30 years
Corrosive/erosive	10 years

4.2 SITE CONDITIONS

4.2.1 Project Location

The Polk Power Station is located in Polk County, Florida between State Road (SR) 37 on the west, County Road (CR) 663 (Fort Green Road) on the east, and SR 630 on the north. The location includes all or portions of Sections 1-4 and 7-12 in T32S, R23E and Sections 34 and 35 in T31S, R23E.

4.2.2 Elevation

General elevation in the region is approximately 135 to 140 feet above mean sea level. The finish grade on the site in the vicinity of the major structures and equipment is approximately 145 feet.

4.2.3 Current Site Development

Most of the property was part of Agrico's Fort Green Mine and has been extensively mined for phosphate matrix. Most of the mining was performed by the strip mining process using draglines. The overburden remains on the site. Sand and clay separated from the phosphate matrix were not generally returned to this portion of the mine. Development of the site was performed in accordance with Florida Department of Environmental Protection rules. The area of the site where the major structures are located has not been mined.

4.2.4 Access

The site is accessible from SR 37 and from CR 663. In addition, the CSX Railroad runs adjacent to the site along the east side of CR 663. A spur from the CSX Railroad has been built, crossing Fort Green Road and entering the site from the east.

4.2.5 Soil and Groundwater Conditions

The site is generally level with an elevation variation of El. 136 to El. 139 ft., based on the surveyed elevations at borehole locations. The subsurface soils encountered at the site can be divided into three generalized strata as follows:

- Stratum I contains silty fine sand which is generally extended to a depth of about 20 to 30 feet. Most materials are in medium dense to dense conditions. Partially cemented very dense silty fine sand (Hardpan) is encountered at shallow depths of some borings. Loose materials are occasionally encountered at surficial topsoils and at random depths of a few borings.

- Stratum II predominantly composes of a green colored soil mixture containing clay, silt, and phosphate pellets and pebbles. Most materials encountered are in medium dense to very dense conditions or in very stiff to hard consistency. Very silty fine sands with occasional clayey seams are encountered at random depths of a few borings.

- Stratum III composes of hard mottled, mostly white dolosilt interbedded with thin limestone and dolomite lenses. The top of this stratum is generally located at El. 90 to El. 95 feet.

For these soil conditions shallow foundations (spread footing or mat) are technically feasible and cost-effective in construction and have been used. In general, provision of deep foundations including a piling system were not necessary for the structure in terms of geotechnical considerations of bearing capacity and potential foundation settlement.

Design groundwater elevation is 136 feet.

4.2.6 Seismic Design Requirements

Facilities are designed for earthquake seismic risk zone 0.

4.3 CLIMATIC DESIGN DATA

4.3.1 Summer Design Temperatures

Design temperature:	90°F dry bulb, 75°F wet bulb
Maximum temperature:	100°F dry bulb, 80°F wet bulb

4.3.2 Winter Design Temperatures

Design temperature:	40°F dry bulb, 38°F wet bulb
Minimum temperature:	18°F dry bulb, 15°F wet bulb

4.3.3 Snowfall

Design snow load:	0 psf

4.3.4 Rainfall

Mean annual rainfall:	53.4 inches
Design rainfall in 1 hour:	3.0 inches (10-year occurrence)
Design rainfall in 24 hours:	13.5 inches (1.5 x 25-year occurrence rate of 9 inches)

Data obtained from the Rainfall Frequency Atlas of the United States, Technical Paper 40, 1961.

4.3.5 Barometric Pressure

Design barometric pressure: 14.63 psia

4.3.6 Wind Load

The wind loads are based on a design wind speed of 110 mph. Category III is used to determine importance factor and exposure C is used to determine velocity pressure coefficients.

4.4 UTILITY SPECIFICATIONS

4.4.1 Existing Utilities

The site is not served by any existing public or private water supply or wastewater collection and treatment systems. Water use permits have been obtained, as part of the site permitting efforts, to draw water from the Floridan Aquifer.

Wastewater treatment is part of the design of the IGCC plant with the restriction of zero discharge of process water.

A 69 KV, 60 Hz, 3-phase power line runs along the east side of SR 37 near the plant site. This will be the source for the construction power substation. This substation steps down the 69 KV to 13.8 KV and provide for two 600 amp distribution circuits.

A 230 KV, 60 Hz, 3-phase transmission line runs along Fort Green Road and connects TEC's Pebbledate substation to the Hardee Power Station. This line is routed through the Polk Power Station switchyard.

A 230 KV, 60 Hz, 3-phase transmission line connects TEC's Pebbledale and Mines substations. This line is routed through the Polk Power Station switchyard to each GSU.

4.4.2 Saturated Steam System

Saturated steam is produced and consumed at three general pressures; high pressure (1650 psig), intermediate pressure (400 psig), and low pressure (50 psig). The saturated steam system design pressures and temperatures are shown in Table 4.8.

Table 4.8

DESIGN PRESSURES OF SATURATED STEAM SYSTEMS

High Pressure System	Min.	Norm.	Max.
Saturated 1650 psig (2)			
Press. (psia)	415	1665	1665
Intermediate Pressure System			
Saturated 400 psig (2)			
Press. (psia)	415 (1)	415	415
Low Pressure System			
Saturated 50 psig (2)			
Press. (psia)	65	65	75

NOTES:

(1) Startup Operation
(2) All steam pressures are measured at the supply header for each piece of equipment.

4.4.3 Fresh Water System

Fresh water is supplied from onsite wells. This water is degasified to remove H_2S, chlorinated, filtered, and pumped to a service water tank for feed to the service water, the demineralized water, and the potable water systems.

The design analysis for water from the Floridan Aquifer in the area is summarized in Table 4.9.

4.4.4 Potable Water

Potable water system provides for drinking water, sanitary facilities, safety showers, and eyewash stations. It is degasified, chlorinated, and pumped from a storage tank to supply the system. A pressurized accumulator is used to maintain system pressure during power outages.

Hypochlorite is used to chlorinate the water upstream of the service water tank and upstream of the potable water tank.

Potable water specifications are in accordance with State of Florida Drinking Water Standard FAC-17-550.

4.4.5 Demineralized Water

Filtered well water from the service water system feeds the demineralized water system. A reverse osmosis system performs the primary demineralization. This treatment is followed by decarbonation, additional demineralization, and then transfer to the power block for distribution.

Demineralized water specifications are as follows:

Sodium, ppm as Na	0.005 maximum
Silica, ppm as SiO_2	0.02 maximum
Total solids, ppm	0.05 maximum
Conductivity, μho/cm at 25°C	0.1 maximum
pH at 25°C	6 - 8

4.4.6 Boiler Feed Water

The principal source of boiler feedwater is condensate from the steam turbine, with makeup from the demineralized water system.

Table 4.9

WATER QUALITY ANALYSIS

Parameter	Units	Well Water
B0D20	mg/L	0
COD	mg/L	390
TSS	mg/L	33
TDS	mg/L	237
pH, units		7.66
Alkalinity	mg/L	110
Ammonia, nitrogen	mg/L	0
Antimony	mg/l	0
Arsenic	mg/L	0
Barium	mg/L	0.092
Benzene	mg/L	0
Beryllium	mg/L	0
Cadmium	mg/L	0
Calcium	mg/L	37.1
Carbon tetrachloride	mg/L	0
Chloride	mg/L	13.4
Chlorine	mg/L	
Chromium	mg/L	0
Chromium VI	mg/L	0
Color, pt-co (units)		20
Conductivity	umhos/cm	330
Copper	mg/L	0
Cyanide	mg/L	0
Fluoride	mg/L	0.44
Gross Alpha	pCi/L	0

Table 4.9 (Continued)

WATER QUALITY ANALYSIS

Parameter	Units	Well Water
Total iron	mg/L	0.2
Lead	mg/L	0
Magnesium	mg/L	13.1
Total Manganese	mg/L	0
Mercury	mg/L	0
Nickel	mg/L	0
Nitrate	mg/L	0.26
Nitrite	mg/L	0
Phosphorus	mg/L	0.071
Potassium	mg/L	4.28
Radioactivity, Ra 226	pCi/L	1.4
Radioactivity, Ra 228	pCi/L	0
Selenium	mg/L	0
Silver	mg/L	0
Sodium	mg/L	15.7
Sulfate	mg/L	39.5
Sulfide	mg/L	1.88
Surfactants	mg/L	0.06
Total organic nitrogen	mg/L	0
Zinc	mg/L	0.014

4.4.7 Steam Condensate

Steam condensate from the gasification facilities is routed to an atmospheric flash drum. This condensate is recycled as boiler feedwater makeup.

Steam condensate from the steam turbine condenser is recycled within the power block to the boiler feedwater deaeration system.

4.4.8 Service Water

The service water system is supplied from the service water storage tank which is supplied by filtered and chlorinated wellwater. Service water system specifications are as follows:

Mechanical Design Pressure:	150 psig
Normal Operating Pressure:	100 psig
Minimum Operating Pressure:	90 psig

4.4.9 Fire Water System

The fire protection system is designed as a plant loop. Fire water is supplied from the cooling water reservoir by four firewater pumps. A low flow capacity motor driven jockey pump runs continuously to maintain firewater system pressure when demand is low. When the flow requirement increases beyond the jockey pump's capacity, the three main firewater pumps are sequentially started: first the motor driven pump, followed by the two diesel driven pumps.

Fire water system specifications are as follows:

Mechanical Design Pressure:	150 psig
Normal Operating Pressure:	100 psig
Minimum Operating Pressure:	90 psig

4.4.10 Cooling Water

Cooling water is supplied from a cooling reservoir with a capacity of approximately 10,185 acre-feet.

There are two types of cooling water systems:

- **Open Loop Circuits** - The Circulating Water System cools the steam turbine surface condenser. The Open Loop Cooling Water System supplies cooling water to the two closed loop heat exchangers, the ASU, the sulfuric acid plant, the condenser vacuum pumps, and some gasification area exchangers.

- **Closed Loop Circuits** - The Power Block Closed Loop Cooling Water System cools all exchangers in the power block and the air compressor area. This system exchanges heat with the open loop circuit through the Power Block Closed Loop Cooling Water Heat Exchangers.

  The Gasification Closed Loop System cools some exchangers in the Gasification, Acid Gas Removal, and Brine Concentration Areas. This system exchanges heat with the open loop circuit through the Closed Loop Exchanger.

The open loop cooling water is pumped from the cooling reservoir and returned to it. The closed loop systems are filled initially and sealed, never mixing with the open loop water.

The Circulating Water System is a low head high flow system. The water boxes on the condenser operate at a slight vacuum. The design maximum supply temperature is 85°F. The return temperature will be between 95°F and 100°F.

The design parameters for the Open Loop Cooling Water System are as follows:

	Temperature (°F)	Pressure (psig)
Design Supply	85	60
Design Return	110	5

The design parameters for the Power Block Closed Loop System are as follows:

	Temperature (°F)	Pressure (psig)
Design Supply	93	70
Design Return	103	30

The design parameters for the gasification Closed Loop System are as follows:

	Temperature (°F)	Pressure (psig)
Design Supply	95	70
Design Return	110	40

4.4.11 Plant and Instrument Air

Plant and instrument air is supplied from lubed, rotary screw compressors.

Instrument air is dried to a dew point of -40°F by a desiccant air dryer. Backup instrument air is supplied by letdown from the main air compressor in the ASU.

Plant and Instrument air design pressures are as follows:

	Plant Air PSIG	Instrument Air PSIG
Mechanical Design:	150	150
Normal:	110	110
Maximum:	125	115
Minimum:	65	65

4.4.12 Nitrogen

Nitrogen is supplied from the ASU and will be used in the following services with these design specifications:

Syngas Diluent:

Minimum Purity*, N_2 + Argon (mol %)	99+
Supply Pressure (psig)	255
Temperature (°F)	350-720

Soot Blowing:

Minimum Purity*, N_2 + Argon (mol %)	99.99

Inert Gas Blanket & Purge:

Minimum Purity*, N_2 + Argon (mol %)	98
Supply Pressure (psig)	35
Supply Temperature (°F)	100

High Pressure Nitrogen

Minimum Purity*, N_2 + Argon (mol %)	99.99
Supply Pressure (psig)	885
Supply Temperature (°F)	420

*Contaminants are either water or oxygen.

4.4.13 Electrical Supply

Nominal electrical system voltages are as follows:

13.8 KV, 3-phase, 60 Hz, WYE, resistance grounded

4160 Volt, 3-phase, 60 Hz, WYE, resistance grounded

480 Volt, 3-phase, 60 Hz, Delta, ungrounded

120/240 Volt, 1-phase, 60 Hz, solidly grounded

125 Volts, DC, ungrounded

PLANT DESCRIPTION

5.0 PLANT DESCRIPTION

5.1 SITE DESCRIPTION

The site layout plan for the entire 4,348-acre Polk Power Station site is presented in Figure 5.1-1. The IGCC is the first unit planned for this site, but the long-term plan calls for additional generating facilities to be on this site. This figure shows the locations of the proposed electric generating units and associated facilities on the site after full build-out (i.e., 1,150 MW capacity) as well as the land use/land cover classifications of the site areas which will be reclaimed by Tampa Electric Company. These reclaimed, undeveloped areas provide a combination of buffer, water management, and wildlife habitat/corridor functions on the site.

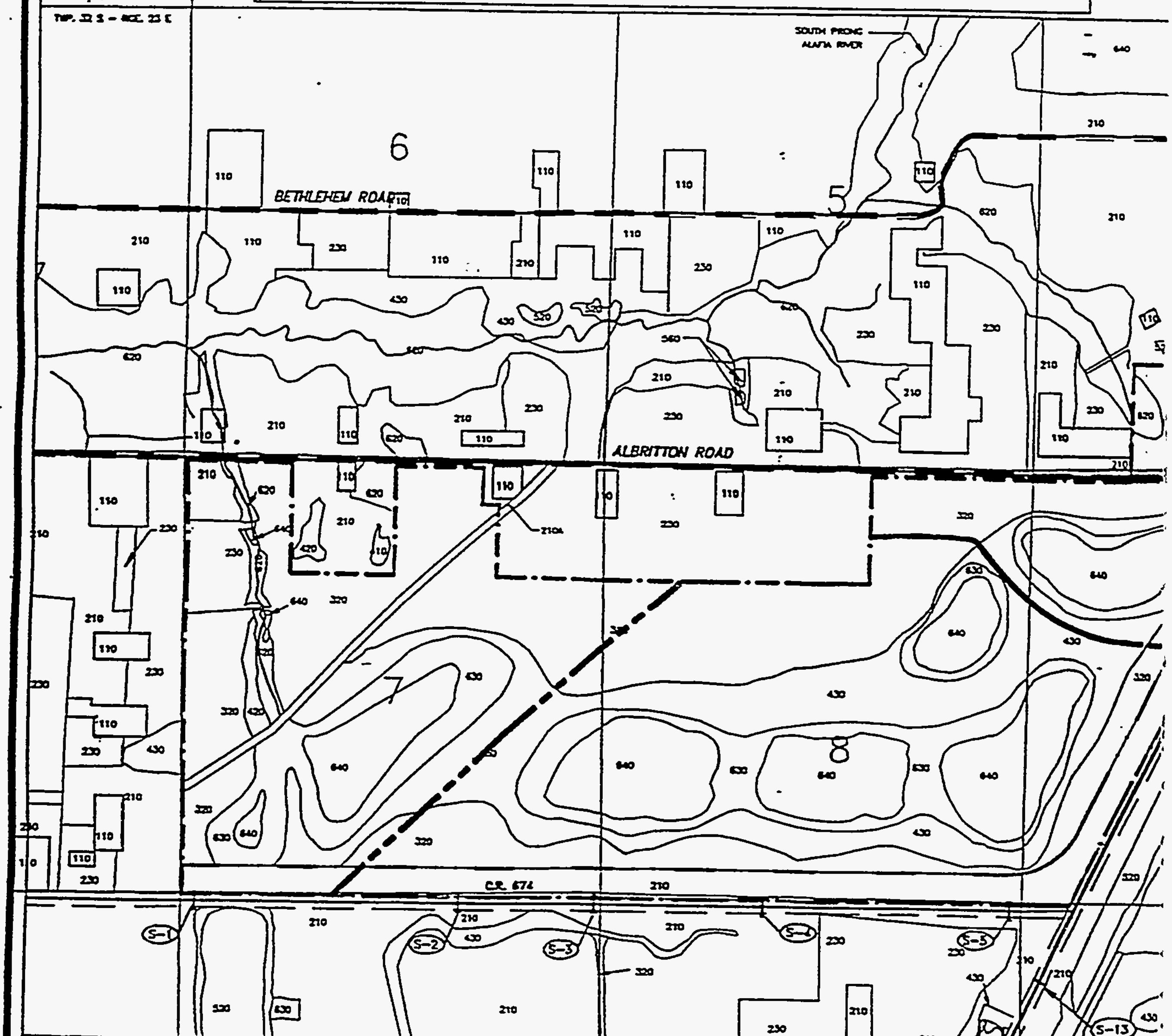
As shown in Figure 5.1-1, the main power plant facilities are located in the central area of the portion of the site to the east of SR 37. This plant site area was not mined for phosphate, but has been disturbed by the surrounding mining activities. The main power plant facilities (i.e., power block and fuel and by-product storage areas) are located more than 2,500 feet from offsite properties, more than 1.5 miles from residential areas to the west along Bethlehem Road and 2.8 miles from residential areas to the southeast along Mills Road. Also, as shown in the figure, a vegetated buffer area is provided along public roadways surrounding the eastern site tract (i.e., SR 37, CR 630, and CR 663 [Fort Green Road]).

The cooling reservoir is constructed in mined-out areas located to the east and south of the main facility site. The other mined-out portions of the eastern site tract to the west and north of the main facilities are reclaimed/developed into a series of wetlands and uplands which are used for management of stormwater runoff from the plant site and to restore pre-mining drainage conditions for the Little Payne Creek system. The remaining areas of the eastern tract (i.e., the southwest corner, the 775-acre area north of the main plant site and cooling reservoir extending to CR 663, and the reclaimed lake to the east of the reservoir) were be significantly altered by the project. The two transmission line corridors will run through the northern site area.

The 1,511-acre portion of the site to the west of SR 37 was reclaimed to a wildlife habitat/corridor system consisting of an integrated series of forested and non-forested wetlands and uplands. No power plant facilities are or will be located on this tract and, the area developed into a wildlife corridor between the headwater areas of the Little Manatee River and Payne Creek and the South Prong Alafia River system.

POST RECLAMATION VEGETATION WITHIN PROJECT BOUNDARY

Code		NON-MANDATORY ACRES	MANDATORY ACRES IMC	MANDATORY ACRES AGRICO	TOTAL ACRES
140	TRANSPORTATION	0	0	3	3
148	GAS TRANSMISSION SUBSTATION	0	1	13	14
151	ELECTRICAL POWER FACILITY	0	0	261	261
210	PASTURE	211	98	467	776
230	CITRUS	0	0	18	18
320	SHRUBLAND	4	0	540	544
330	MIXED RANGELAND	6	0	0	6
420	UPLAND HARDWOOD FOREST	29	9	17	55
430	UPLAND MIXED FOREST	34	74	666	774
520	LAKES	165	36	63	264
530	RESEVOIRS	0	0	834	834
620	WETLAND HARDWOOD FOREST	40	4	17	61
630	WETLAND MIXED FOREST	11	4	295	310
640	HERBACEOUS WETLAND	23	26	379	428
		TOTAL 523	TOTAL 252	TOTAL 3573	TOTAL 4348



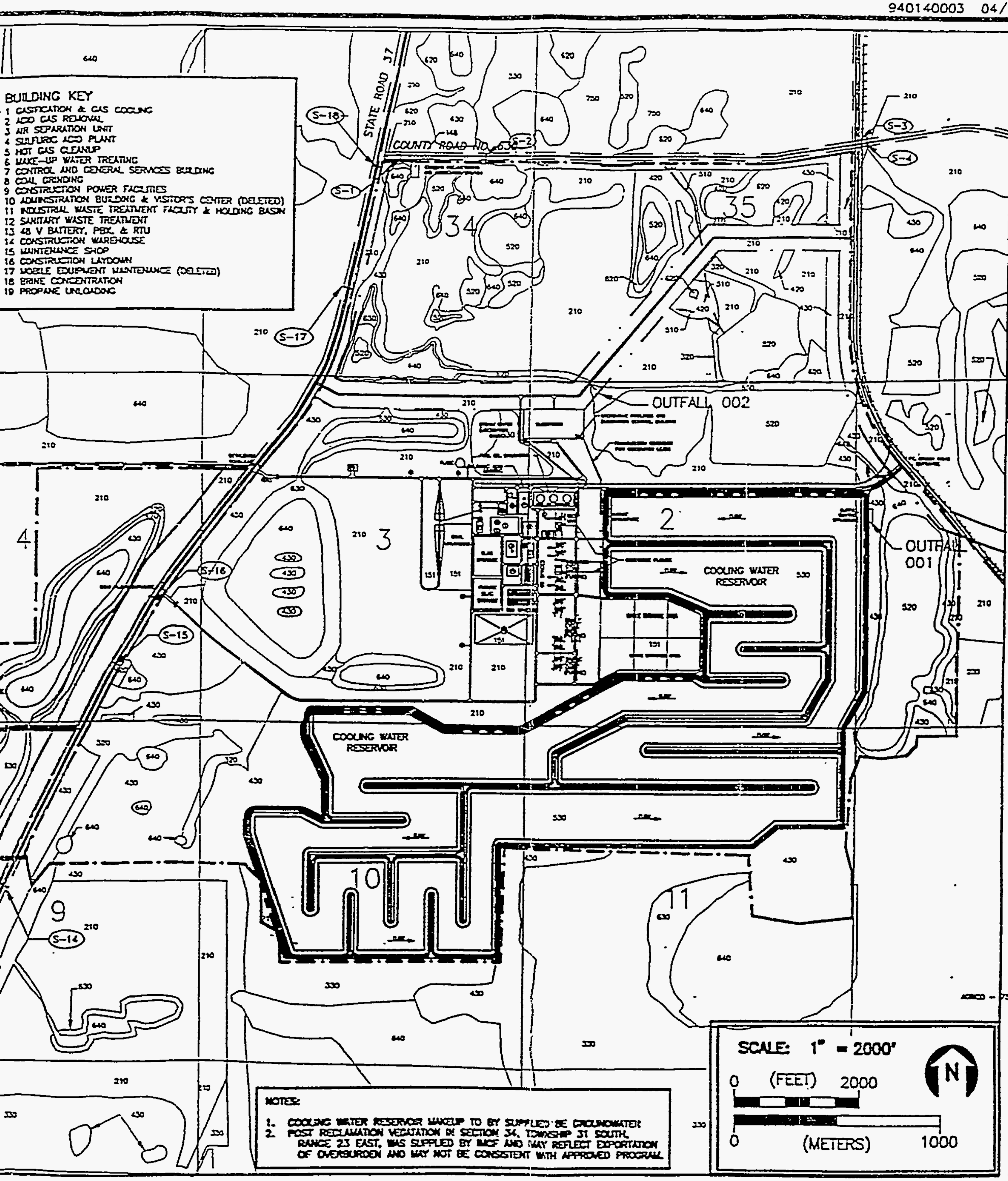


Figure 5.1-1

SITE LAYOUT PLAN

Approximately 261 acres (i.e., approximately 6 percent) of the entire site, excluding the cooling reservoir, are classified for power plant facilities after full build-out of the proposed Polk Power Station. Of this 261 acres, approximately 140 acres are actually used for the main power facilities and structures, including the coal, fuel oil, by-product, and brine storage areas, and industrial waste treatment (IWT) systems.

5.2 PLANT LAYOUT

The overall plant layout is presented in Figure 5.2-1. Several design features of the layout are noted below.

The location of the operating facilities in the center of the site provides a buffer between them and public areas.

The power block, the primary user of cooling water from the reservoir, is located as near to the cooling water intake structure as is permitted by the transmission corridor. With the large flow rates, cooling water lines are large, and it is important to minimize both length and pressure drop.

Space has been reserved for future expansion of power generation and slag storage facilities.

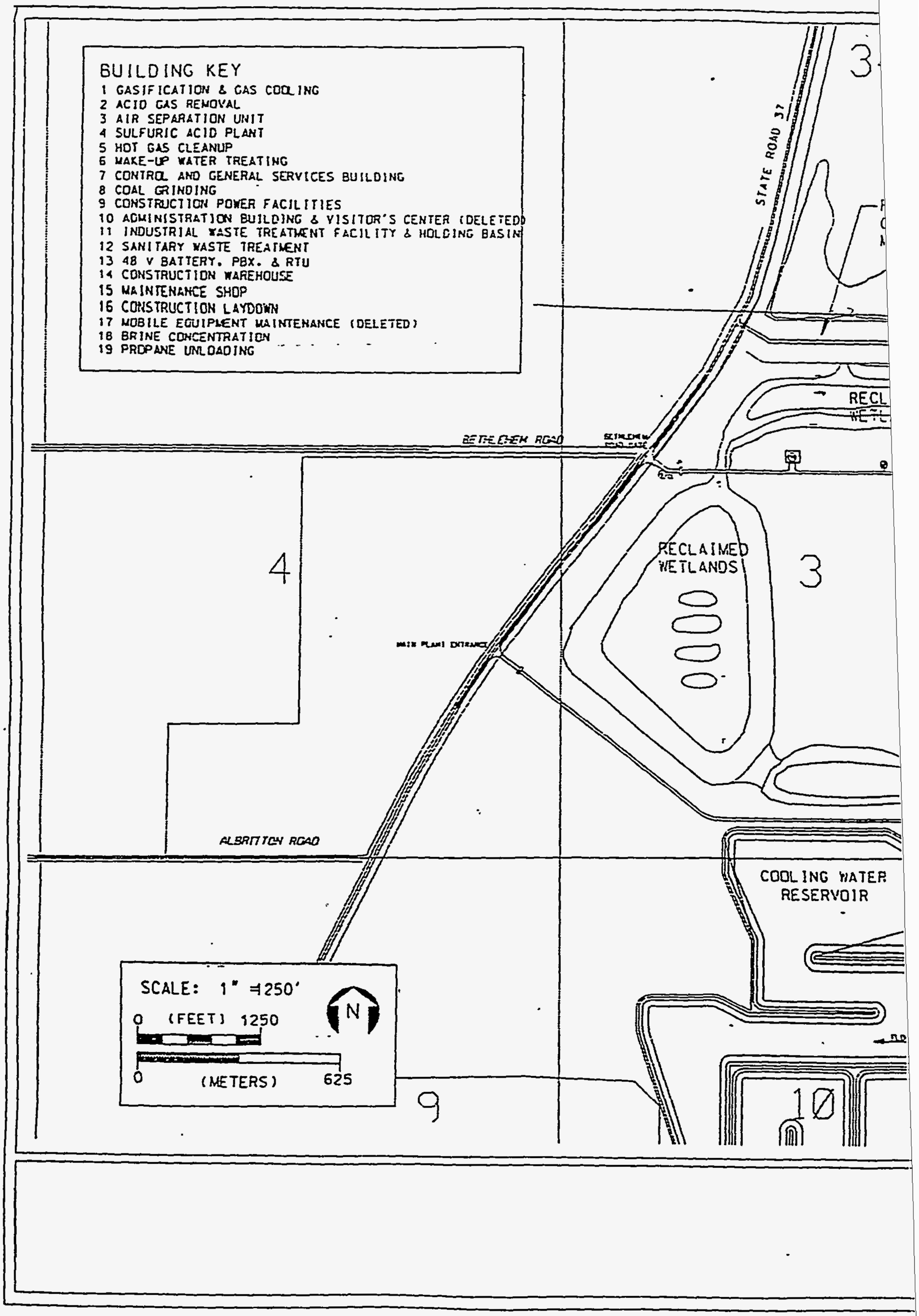
5.3 PROCESS DESCRIPTION

A general block flow diagram of the process is shown in Figure 5.3-1. The process begins with the delivery of fuels to the site. The startup and backup fuel for Polk Power Station is distillate oil which will be delivered by truck with sufficient onsite storage. The design fuel for the plant is Pittsburgh #8 which is transported by river and ocean-going barges to TEC's Big Bend Station, then transloaded to trucks for delivery to the Polk site, where silo storage is provided.

The coal is ground in rod mills, then slurried with water and combined with oxygen from the air separation unit to produce a high temperature (2600+°F), medium pressure (400 psig) syngas within a Texaco-designed, pressurized, oxygen-blown, entrained-flow gasifier. Approximately 2000 tons per day of coal (dry basis) is thus converted into a medium-Btu syngas with a heat content of about 250 Btu/scf (LHV).

Molten coal ash flows from the bottom of the gasifier vessel into a water-filled quench tank where it solidifies into slag. The slag is subsequently removed, crushed and dewatered prior to its sale as a multi-use by-product.

Syngas produced in the gasifier flows through a series of heat recovery units to partially cool the gas prior to its diversion to two separate clean-up systems. In one of these systems, approximately 45,000 lb/hr of the syngas is treated at approximately 900°F in an HGCU using


BUILDING KEY
1 GASIFICATION & GAS COOLING
2 ACID GAS REMOVAL
3 AIR SEPARATION UNIT
4 SULFURIC ACID PLANT
5 HOT GAS CLEANUP
6 MAKE-UP WATER TREATING
7 CONTROL AND GENERAL SERVICES BUILDING
8 COAL GRINDING
9 CONSTRUCTION POWER FACILITIES
10 ADMINISTRATION BUILDING & VISITOR'S CENTER (DELETED)
11 INDUSTRIAL WASTE TREATMENT FACILITY & HOLDING BASIN
12 SANITARY WASTE TREATMENT
13 48 V BATTERY, PBX, & RTU
14 CONSTRUCTION WAREHOUSE
15 MAINTENANCE SHOP
16 CONSTRUCTION LAYDOWN
17 MOBILE EQUIPMENT MAINTENANCE (DELETED)
18 BRINE CONCENTRATION
19 PROPANE UNLOADING
STATE ROAD 37
BETHLEHEM ROAD
RECLAIMED WETLANDS
MAIN PLANT ENTRANCE
4
3
ALBRITTON ROAD
COOLING WATER RESERVOIR
SCALE: 1" =1250'
0 (FEET) 1250
0 (METERS) 625
N
9
10

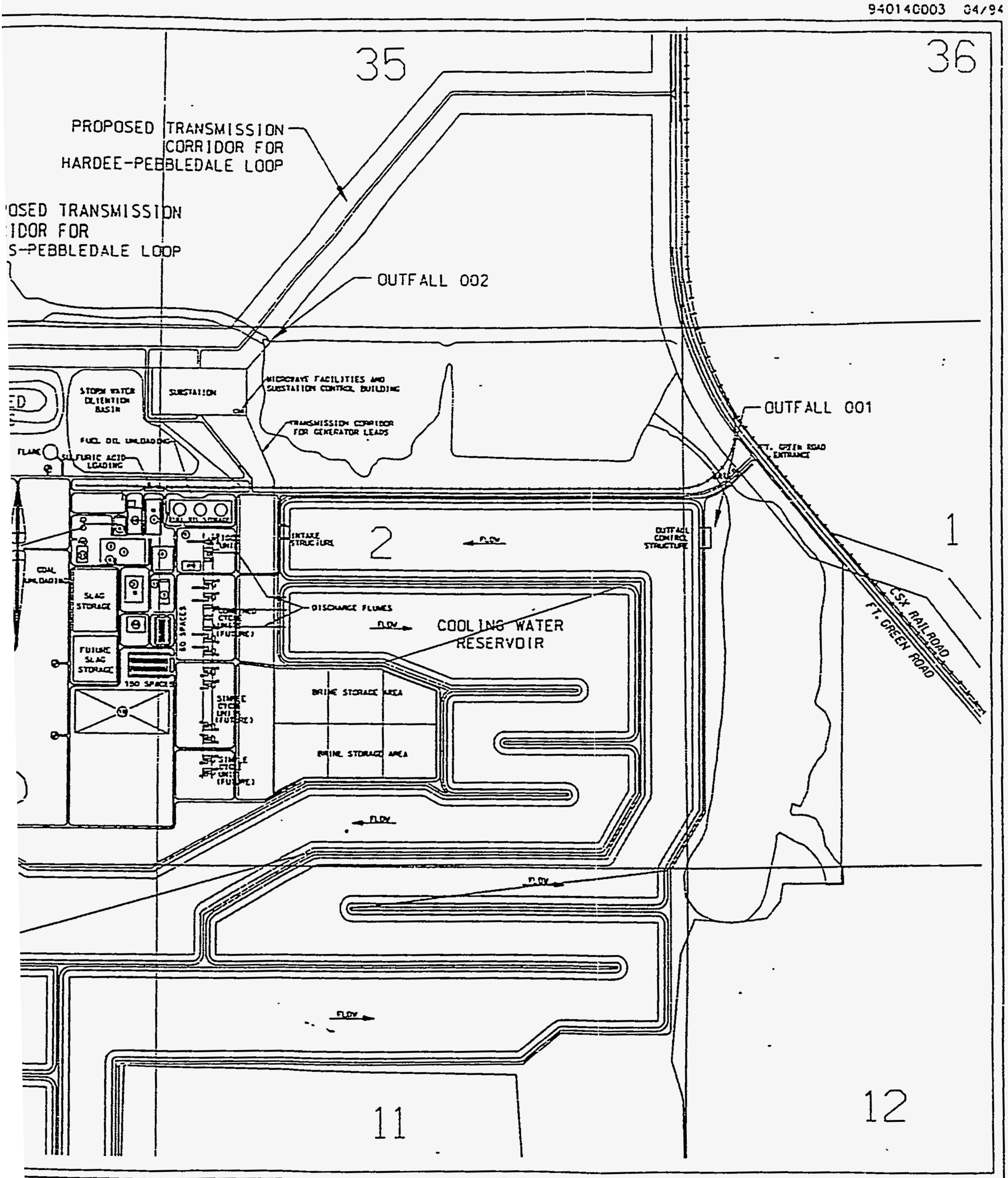


Figure 5.2-1

OVERALL PLANT LAYOUT PLAN

a metal oxide sorbent to capture sulfur-containing compounds. An associated regeneration system will produce a highly concentrated SO_2 stream which will in turn feed a sulfuric acid plant for production of a saleable acid by-product. Demonstration of this advanced metal oxide hot gas desulfurization technology at a commercial scale is a significant goal for the Polk IGCC Project and represents a first for the industry.

The remaining syngas continues to the CGCU system, where it is treated at 105°F in a conventional acid gas removal system, from which the resultant acid gas is sent to the sulfuric acid plant for conversion into saleable by-product. This portion of the plant is capable of processing 100% of the gasifier output of raw syngas.

From these syngas clean-up systems, the cleaned, medium-Btu syngas is routed to the combustion section of the advanced combustion turbine where it combines with compressor discharge air to be burned. At this point, nitrogen from the air separation unit is injected into the same combustion hardware to serve two purposes. The nitrogen acts as a diluent to control NO_x emissions, and adds substantial mass flow to combustion turbine throughput to increase power output. The mixture of syngas, air and nitrogen expands through the CT to produce about 192 MW from the combustion turbine generator.

As the exhaust gases exit the CT, heat is extracted in the heat recovery steam generator (HRSG) to produce high, medium and low pressure steam. This steam, along with high and medium pressure steam generated in the gasification process, expands through a double-flow reheat steam turbine to generate an additional 122 MW of power. Small streams of steam and condensate are also exchanged with the HGCU and sulfuric acid plant for overall process integration and optimization.

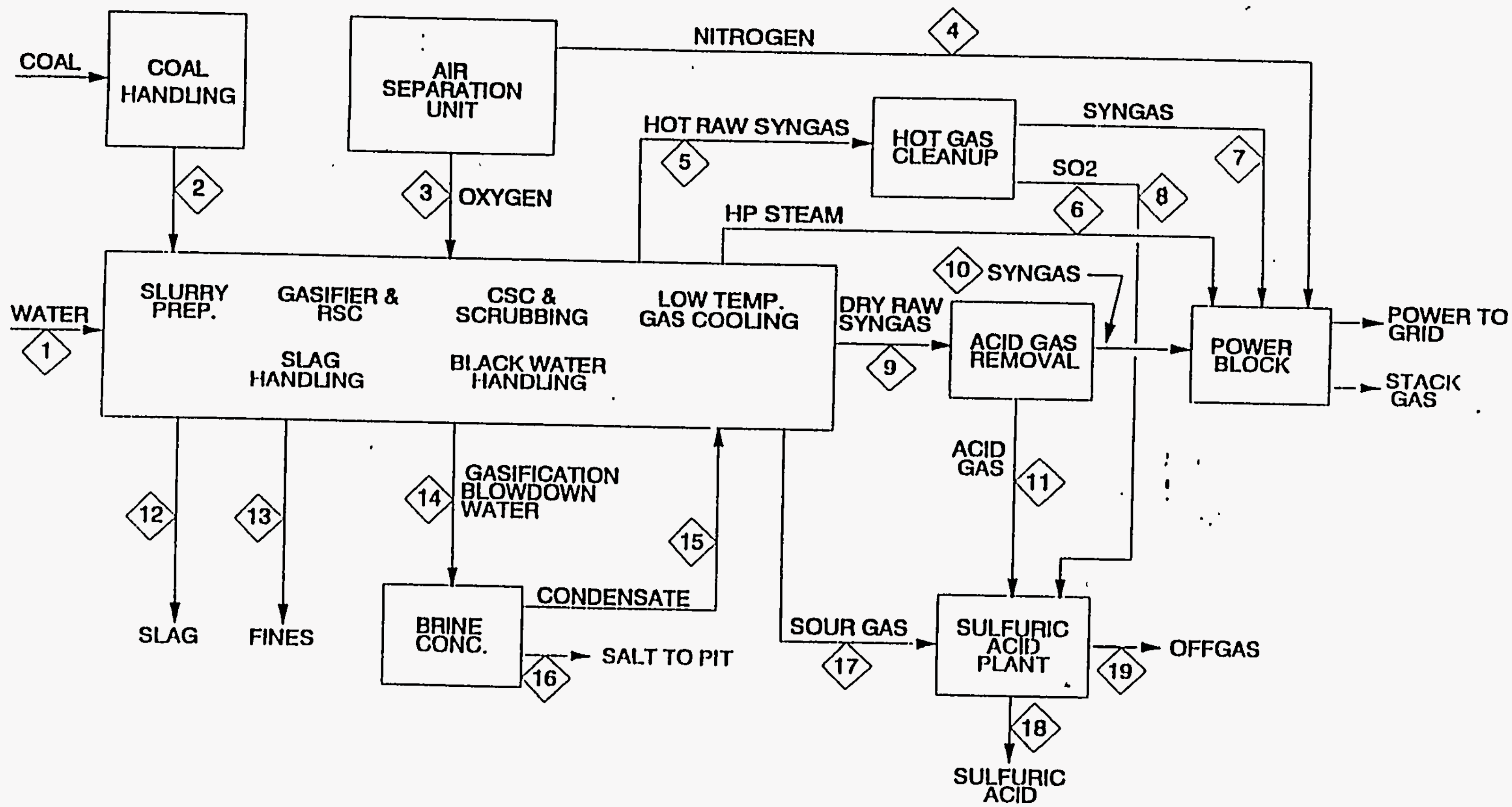
Auxiliary power consumption for the IGCC facility is approximately 64 MW, most of which is required for air separation. Nominal net power output from the IGCC demonstration plant will be 250 MW.

5.3.1 Gasification

5.3.1.1 Gasification and Cold Gas Cleanup. This unit utilizes commercially available gasification technology as provided by Texaco in their licensed oxygen-blown entrained-flow gasifier. In this arrangement, coal is ground to specification and slurried in water to the desired concentration (60-70% solids) in rod mills. The unit will be designed to utilize about 2,000 tons per day of coal (dry basis). This coal slurry and an oxidant (95% pure oxygen) are then mixed in the gasifier burner where the coal partially combusts in an oxygen deficient environment, at a temperature in excess of 2600°F. This produces syngas with a heat content of about 250 Btu/SCF (LHV). The oxygen will be produced from an air separation unit (ASU). The gasifier is expected to achieve greater than 95% carbon conversion in a single pass.

Figure 5.3-1

GENERAL BLOCK FLOW DIAGRAM



The raw syngas flows from the gasifier through the syngas cooling system where the temperature is reduced from about 2,600°F to about 900°F. A syngas stream of approximately 45,000 lb/hr is sent to the HGCU system and the remainder of the syngas, up to 100% of design flow, continues to the CGCU system, a traditional amine type scrubber. This flow arrangement was selected to provide assurance to TEC that the IGCC capacity would not be restricted due to the demonstration of the HGCU system.

Sulfur removed in both the HGCU and CGCU systems is recovered in the form of sulfuric acid, which has a ready market in the phosphate industry in the central Florida area. It is expected that the annual production of about 77,000 tons of sulfuric acid will have minimal impact on the price and availability of these products in the phosphate industry.

Most of the ungasified coal exits the bottom of the radiant syngas cooler into the slag lockhopper where it is quenched with water. These solids generally consist of slag and uncombusted coal products. As they exit the slag lockhopper, these non-leachable products are readily saleable for blasting grit, roofing tiles, and construction building products.

The water in the slag lockhoppers requires treatment before it can be reused. All of the water from the gasification process will be cleaned and reused, thereby giving the gasification system zero process discharge. The treatment consists of filtration, followed by concentration in several stages of evaporation. The remaining salt solids are crystallized and stored in an onsite landfill. The condensed water from evaporation is recycled to slurry coal.

5.3.1.2 Air Separation Unit. The ASU user ambient air to produce oxygen for use in the gasification system and sulfuric acid plant, and nitrogen which is sent to the advanced CT and to gasification for soot blowing. The addition of nitrogen in the CT combustion chamber has dual benefits. First, since syngas has a substantially lower heating value than natural gas, a higher fuel mass flow is needed to maintain heat input. This additional mass flow has the advantage of producing higher CT power output. Second, the nitrogen acts to control potential NO_x emissions by reducing the combustor flame temperature which, in turn, reduces the formation of thermal NO_x in the fuel combustion process.

The ASU is sized to produce 2,020 tons per day of 95% pure oxygen and 6,013 tons per day of 98% pure nitrogen for CT diluent, 401 tons per day of 99.99% pure nitrogen for gasification plant soot blowing, and 24 tons per day of 98% pure dry nitrogen for blanketing.

5.3.1.3 Hot Gas Cleanup. The HGCU system is being developed by General Electric Environmental Services, Inc. (GEESI). This process is undergoing pilot plant testing at GE's facilities in Schenectady, NY. The advantage of the HGCU over the CGCU is the ability to use the syngas directly from the gasification system. Instead of having to cool the gas prior to sulfur removal, the HGCU will accept gas at 900-1000°F. The successful demonstration of this technology will enable future IGCC systems to achieve higher efficiency.

An absorption/regeneration system produces a highly concentrated (about 13%) SO_2 stream. This feed a sulfuric acid plant for production of a saleable acid by-product.

Two other support processes will be demonstrated for potential improvements to this process. In addition to the high efficiency primary and secondary cyclones being provided upstream of the sulfur removal system, a high temperature barrier filter is installed downstream of sulfur removal to protect the combustion turbine.

Sodium bicarbonate, $NaHCO_3$, is injected upstream of the secondary cyclone for removal of chloride and fluoride species.

5.3.1.4 Sulfuric Acid Plant. The sulfuric acid plant takes the sulfur-containing gases from both the HGCU and the CGCU and recovers the sulfur in the form of sulfuric acid.

The sulfur in the CGCU gas is in the form of H_2S. The first processing step in the sulfuric acid plant is the oxidation of H_2S to SO_2 with air in the decomposition furnace. The gases leaving the furnace are combined with the HGCU feed gas, in which the sulfur is already in the form of SO_2. Oxygen is added to the gas before compression for flow through multiple catalyst beds where the SO_2 is converted to SO_3. The SO_3 is contacted with a circulating solution of sulfuric acid in a two-stage absorption process to form the product sulfuric acid.

5.3.2 Power Generation

The key components of the combined cycle are the advanced CT, HRSG, steam turbine (ST), and generators.

The HRSG is installed in the combustion turbine exhaust to complete the traditional combined cycle arrangement and provide steam to the 124 MW steam turbine.

No auxiliary firing is provided within the HRSG system. Hot exhaust from the CT is channeled through the HRSG to recover the CT exhaust heat energy. The HRSG high and medium pressure steam production are augmented by steam production in the coal gasification plant. All high pressure steam is superheated in the HRSG before delivery to the high pressure section of the ST.

The ST is designed as a double flow reheat turbine with low pressure crossover extraction. The ST generator is designed specifically for highly efficient combined cycle operation with nominal turbine inlet throttle steam conditions of approximately 1,400 psig and 990°F with 1,000°F reheat inlet temperature.

The operation of the combined cycle power plant is coordinated and integrated with the operation of the gasification plant. The initial startup of the power block is carried out on low-sulfur No.

2 fuel oil. Transfer to syngas occurs upon establishment of fuel production from the gasification plant.

Under normal operation, syngas from the gasification process and nitrogen from the ASU are provided to the CT. The syngas/nitrogen mix at the CT combustion chamber is regulated by the CT control system to control the NO_x emission levels from the unit.

Cold reheat steam from the high pressure turbine exhaust and HRSG intermediate pressure steam are combined before reheating in the HRSG and subsequent admission to the intermediate pressure section of the ST. Some intermediate pressure steam is also supplied to the HRSG from the sulfuric acid plant and the syngas cooling section of gasification.

6.0 PLANT SYSTEMS

The generalized flow diagram of IGCC systems and process has been given in Figure 5.3-1.

6.1 GASIFICATION

6.1.1 Gasifier System

The IGCC unit uses the Texaco proprietary oxygen-blown, entrained-flow, single-train gasification system to produce syngas for combustion in the advanced CT. Design processing rate is 2,000 tpd of coal, dry basis. While the gasification train is the largest Texaco train in operation to date, the system involves commercially proven technologies, processes, and equipment.

Figure 6.1-1 presents the process flow schematic for the gasification system. As shown in this figure, coal slurry from the slurry feed tank and oxygen from the air separation unit is fed to the gasifier and sent to the process burner. The gasifier is a refractory lined vessel capable of withstanding high temperatures and pressures. The coal slurry and oxygen react in the gasifier at high temperatures to produce syngas. The syngas consists primarily of hydrogen, CO, water vapor, and CO_2, with small amounts of H_2S, COS, methane, argon, and nitrogen. Coal ash and unconverted carbon in the gasifier form a liquid melt called slag.

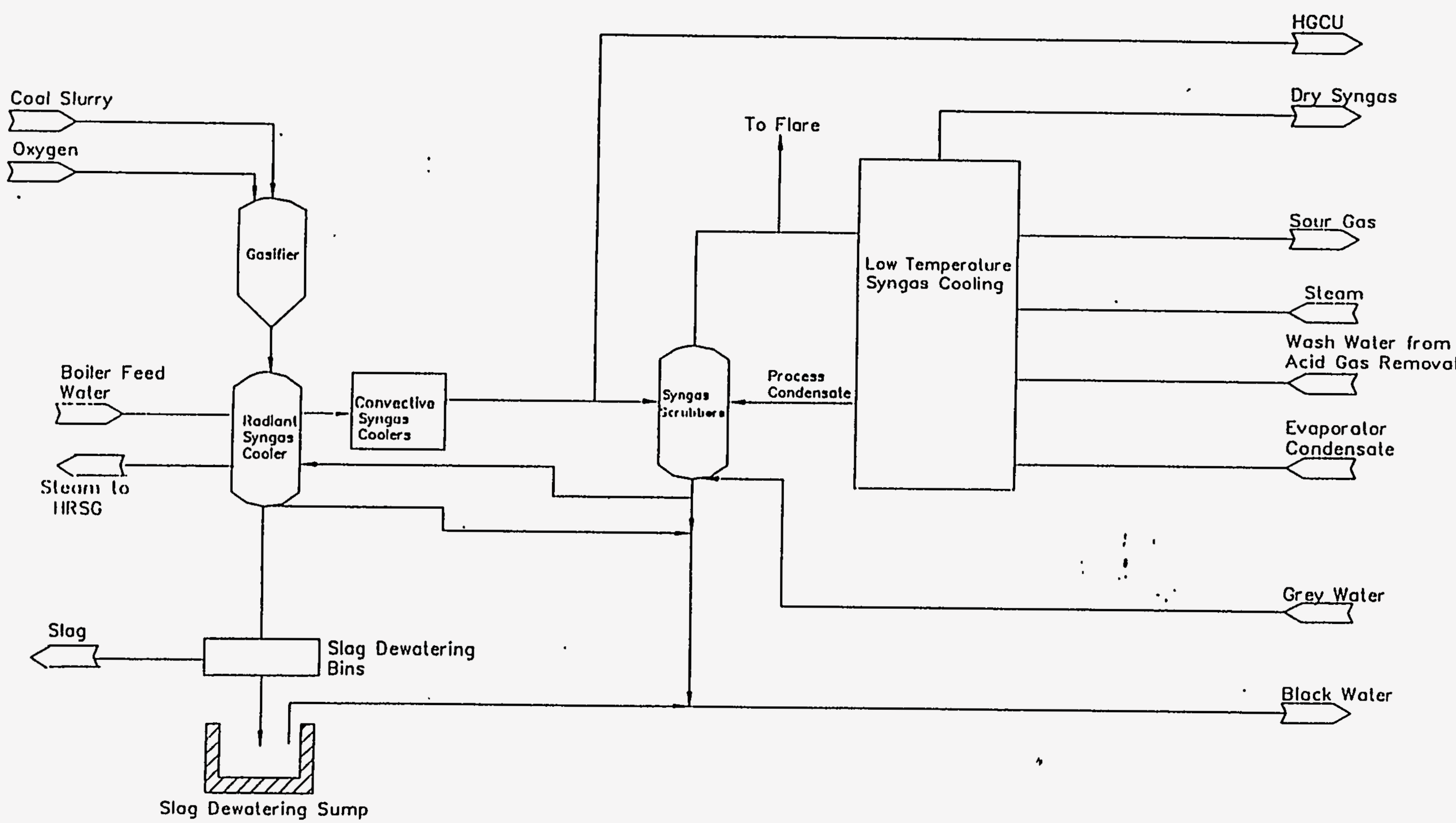
Hot syngas and slag from the gasifier flow downward into a radiant syngas cooler, which is a high pressure steam generator equipped with a water wall to protect the vessel shell. Heat is transferred primarily by radiation from the hot syngas to the boiler feed water circulating in the water wall. High pressure steam produced in this boiler is routed to the HRSG in the power block area which supplements the heat input from the CT to the HRSG and increase the efficiency of the generating unit.

The syngas passes over the surface of a pool of water at the bottom of the radiant syngas cooler and exit the vessel. The raw syngas is then be sent to the convective coolers and then to the low temperature syngas cooling system in the CGCU system for further heat recovery and to the demonstration HGCU system. The slag drops into the water pool and then fed to the slag dewatering bins.

Gasification process water called black water also collects with the slag in the bottom of the radiant syngas cooler and flows with the slag into the slag dewatering bins for separation of slag and water. The slag is transferred to storage, while the water is processed and reused.

Figure 6.1-1

GASIFICATION, SLAG HANDLING, AND SYNGAS COOLING SYSTEM SCHEMATIC



6.1.2 Coal Handling, Grinding, and Slurry Preparation

The coal handling, grinding, and slurry preparation system for the IGCC unit receives and prepare the coal for input to the gasifier. Figure 6.1-2 presents a schematic of this system.

Coal is delivered to the site from a coal transloading facility at Tampa Electric Company's Big Bend Station. The coal is delivered in covered, bottom-dump trucks with a 28-ton payload. A total of 80 to 100 trucks per day will be required at design rate. On the site, the trucks off-load in an enclosed unloading structure into an above-grade unloading hopper. Dust suppression sprays are provided at the top of the hopper to control dust emissions. Belt feeders transfer coal from the hopper outlets onto an enclosed unloading conveyor.

The unloading conveyor transport coal from the unloading structure up and into one of the two storage silos. A diverter gate and a silo feed conveyor feed coal to the second, adjacent silo. A dust collection system is provided at the top of the silos to collect dust at the conveyor/feeder/silo transfer points.

As shown in Figure 6.1-2 coal is conveyed from the coal silos and fed to the grinding mill with recycled process water and makeup water from the water supply system. The grinding mill is also be fed fine coal recovered by the dust collecting system. Ammonia is added to the mill for pH adjustment, if necessary. The pH of the slurry is maintained between 6 and 8 to minimize corrosion in the carbon steel equipment. A slurry additive for reducing viscosity is also be pumped continuously to the grinding mill.

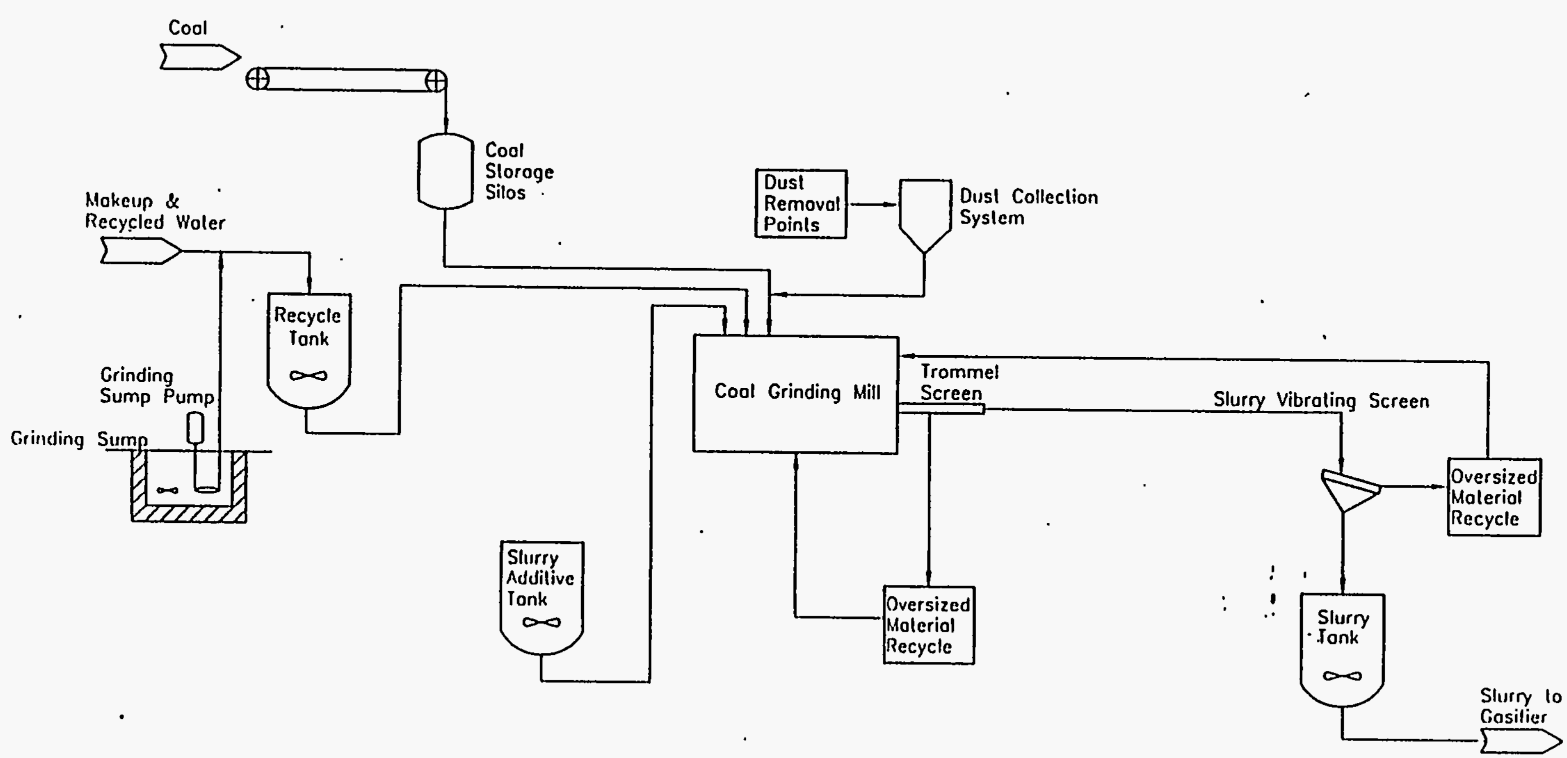
The grinding mill reduces the feed coal to the design particle size distribution. The mill is a conventional rod-type system with an overflow discharge of the slurry. Slurry discharged from the grinding mill passes through a trommel screen and over a vibrating screen to remove any oversized particles before entering the slurry tank. Oversized particles are recycled to the grinding mill.

A below-grade grinding sump is located centrally within the coal grinding and slurry preparation area to handle and collect any slurry drains or spills in the area. Materials collected in the sump are routed to the recycle tank for reuse in the process.

In order to minimize groundwater withdrawals and use, water for the slurry preparation system is provided from several sources. Water for the system is provided primarily by moisture contained in the coal feed, and by recycled feed and grinding sump water. Additional makeup water to the slurry system is provided from the overall plant service water system. Through the collection and recycling process, there is no water discharges from the coal grinding and slurry preparation system. All water from the system is fed to the gasifier in the coal slurry.

Figure 6.1-2

COAL GRINDING AND SLURRY PREPARATION SCHEMATIC



Potential particulate matter air emissions from the coal storage bin, grinding mill, and rod mill overflow discharge are primarily controlled by the wet nature of these subsystems and by the use of enclosures for the subsystems with vents through fabric filters or baghouses. The slurry tank vents are be equipped with carbon canisters for absorption of potential H_2S or ammonia (NH_3) emissions.

6.2 COLD GAS CLEANUP (CGCU)

The raw, hot syngas from the gasifier is routed to the separate conventional CGCU and demonstration HGCU systems for appropriate treatment. The CGCU system is designed to treat 100 percent of the syngas flows for the unit, while the HGCU system is capable of treating approximately 45,000 lb/hr of the syngas when the unit is operating at full capacity. The CGCU system is described in the following paragraphs, and descriptions of the HGCU system are provided in subsection 6.3.

The initial treatment process for the raw syngas within the CGCU system involves the syngas scrubbing and cooling systems.

The raw, hot syngas from the gasifier contains entrained solids or fine slag particles which must be removed to produce the clean syngas fuel. Also, the raw hot syngas needs to be cooled in order to be effectively cleaned in the acid gas removal unit or CGCU system. The flow schematic for these syngas scrubbing and cooling processes is presented in Figure 6.1-1.

As shown, the raw hot syngas from the gasifier is fed through the high temperature syngas cooling system to the syngas scrubbers where entrained solids are removed. The syngas is then be routed to the low temperature gas cooling section, where the syngas is cooled by recovering its useful heat by generating steam and preheating boiler feedwater. The syngas is further cooled with cooling water, which extracts much of the water from the syngas prior to its routing to the acid gas removal system.

The syngas scrubber bottoms streams contain all the solids which were not removed in the radiant syngas cooler sump. The solids in the bottoms streams are routed to the black water handling system.

In the gasification and slag handling systems, water removed from the slag contains fine particles of slag and ungasified solids. This process water is referred to as black water due to its coloration from the suspended particles. As discussed previously, the syngas scrubbers also generate black water, which contains the fine particles entrained in the syngas existing the gasifier and removed in the scrubbing process.

All black water from the gasification and syngas cleanup processes is collected, processed, recycled to the extent possible, and contained within the processes. There will be no liquid discharges of these process waters to other systems or to the cooling reservoir. The effluent remaining after processing of this black water is concentrated and crystallized into a solid consisting primarily of salt called brine which is stored in a lined landfill on the site with an appropriately designed leachate collection system. The water separated from the salts is recycled for slurrying coal feed.

After removal of the entrained solids, the syngas still contains sulfur compounds (H_2S and COS) which are removed prior to firing the syngas in the advanced CT unit to control potential SO_2 air emissions. The acid gas removal unit removes the acid gases from the syngas. The process flow schematic for this unit is provided in Figure 6.2-1.

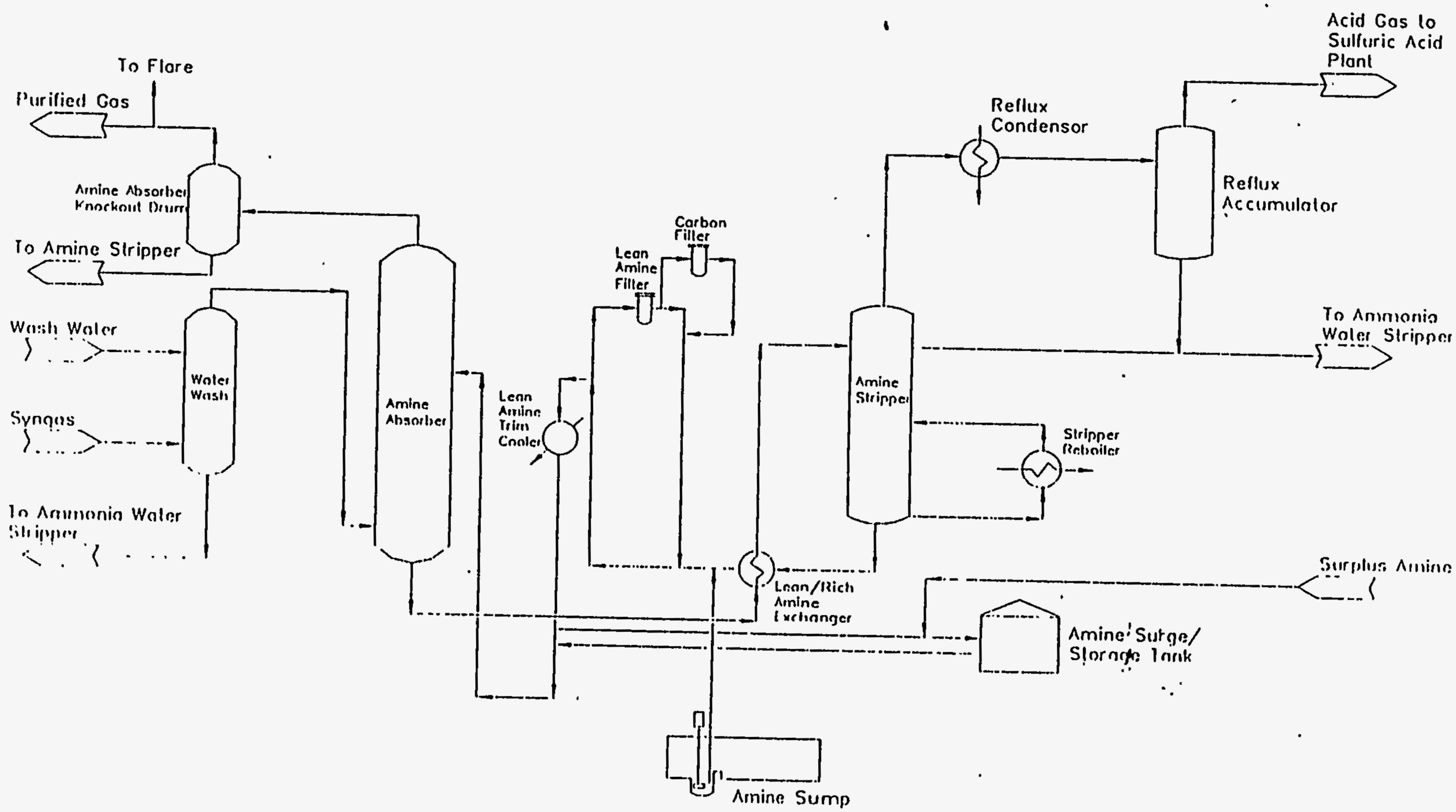
In the acid gas removal unit, the cooled syngas is first be water-washed in the water wash column. Wash water is pumped to the column to remove contaminants which would potentially degrade the amine from the syngas. The wash water from the column is sent to the NH_3 water stripper. The washed syngas then flows to the amine absorber.

The syngas is contacted with amine in the amine absorber. Acting as a weak base, the amine absorbs acid gases such as H_2S by chemical reaction. The purified syngas will flow through a knockout drum to remove entrained amine. The recovered liquid is returned to the amine stripper.

The rich amine is stripped of the acid gas in the amine stripper by steam generated in the stripper reboiler. The acid gas overhead is partially condensed by the reflux condenser and collected in the reflux accumulator. The acid gas, primarily H_2S and CO_2, from the reflux accumulator goes to the sulfuric acid plant and the condensed liquid reflux is returned to the amine stripper.

Figure 6.2-1

ACID GAS REMOVAL UNIT SCHEMATIC



6.3 HOT GAS CLEANUP (HGCU)

A schematic of the HGCU system is presented in Figure 6.3-1. For the system demonstration, approximately 45,000 lb/hr of the hot raw syngas is routed from the gasifier to the HGCU system for cleanup prior to firing in the combustion turbine.

6.3.1 Particulate Removal

Entrained fine particles in the hot syngas are removed in the primary high efficiency cyclone as shown in Figure 6.3-1 and recycled to the black water handling system. Following this cyclone is a secondary cyclone whose function is to remove the sodium bicarbonate which is introduced upstream for halogen removal. The collected solids from the secondary cyclone is sent to the onsite brine storage area. A large fraction of the remaining particulate matter (PM) entering the absorber is captured by the sorbent bed, reducing particle concentration to below 30 ppm. A small amount of sorbent fines is entrained from the absorber and collected in a high efficiency barrier filter. The barrier filter will effectively capture all of the high-density sorbent dust and will practically eliminate all fines larger than 5 microns. The high temperature barrier filter, employing pulse cleaning, will remove greater than 99.5 percent of the residual PM prior to the CT. The solids from the barrier filter are nonhazardous and are sent offsite for disposal. Larger fines are sieved on screens at the regenerator sorbent outlet. Fugitive fines from the screens are be collected in a small, low temperature bag filter. The sorbent fines from both collection points are recycled to the catalyst supplier.

6.3.2 Desulfurization

The absorber is the intermittently moving bed reactor shown schematically in Figure 6.3-1. The sulfur-laden syngas from the primary cyclone enters the absorber through a gas manifold at its bottom and flows upward countercurrent to the moving bed of sorbent pellets.

The sulfur compounds, mainly H_2S, in the syngas react with the sorbent generally according to:

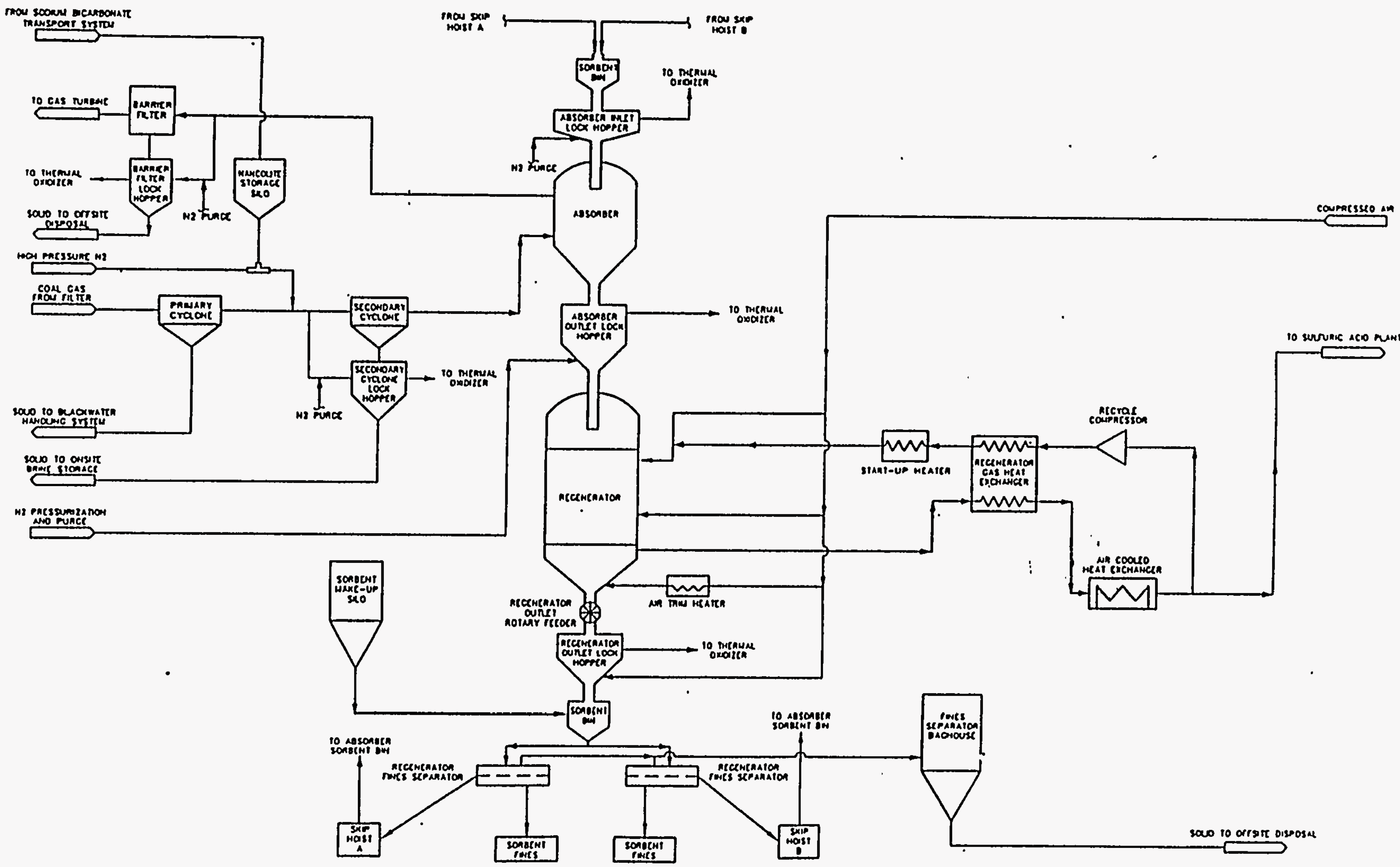
$$ZnO + H_2S \rightarrow ZnS + H_2O \ .$$

The syngas leaving the absorber is expected to contain less than 30 ppmv of H_2S and COS.

The absorber bed is stationary at low H_2S outlet concentrations and is moved upon H_2S breakthrough. The H_2S breakthrough control signal activates solids flow from the bottom of the absorber into the absorber's outlet lockhopper, causing the bed and the reaction zone to move downward by gravity. The displaced sulfided sorbent is replaced by regenerated sorbent from the absorber's inlet lockhopper.

Figure 6.3-1

HOT GAS CLEANUP SYSTEM SCHEMATIC



6.3.3 Regeneration

The ability to regenerate and recycle the sorbent is essential for economically viable hot syngas desulfurization. The regeneration step is a highly exothermic oxidation process requiring careful temperature control. Too high a temperature sinters and destroys the sorbent structure and reduces its ability to react with sulfur in consecutive absorption steps. Low temperature results in sulfate formation and a loss of reactive sorbent to the desulfurization process.

The reactor is divided into two stages: an upper stage and a lower stage. As the sorbent moves down the reactor, the reaction proceeds in a controlled atmosphere. Nearly continuous sorbent movement in the regenerator is controlled by the rotary feeder at its bottom. The chemical reactions in the regenerator are:

$$ZnS + 1.5O_2 \rightarrow ZnO + SO_2$$

$$ZnO + SO_2 + 0.5O_2 \leftrightarrow ZnSO_4$$

The sulfation reaction is reversible and favors the formation of sulfate at low temperatures in the presence of oxygen at the lower oxidation stage.

Sulfided sorbent is fed from the absorber's outlet lockhopper to the top of the regenerator where oxidation of the sulfided sorbent occurs. The sorbent moves down the regenerator in cocurrent flow with the regeneration gas. Oxygen concentration is controlled to limit the gas temperature.

The oxygen concentration is controlled by the ratio of air to recycle gas to limit the temperature in the bed. The recycle flow rate is controlled to maintain oxygen concentration in the upper stage.

The final polishing phase of regeneration is accomplished at the lower stage of the regenerator where dry air flows countercurrent to the sorbent. This stream cools the sorbent to a temperature acceptable for downstream equipment, purge the SO_2 - rich gas, and ensure complete regeneration. The gas streams from the cocurrent and countercurrent flows mixes to form the recycle gas stream.

6.3.4 Regeneration Gas Recycle Subsystem

The regeneration gas recycle is shown in Figure 6.3-1 and operates in a closed loop with dry air as an input and an SO_2 - rich gas as a product output. The regeneration gas recycle loop are designed as an internal diluent that reduce the oxygen concentration in the air to the desired levels without the use of externally provided diluents such as steam or nitrogen. Using recycle rather than external inert diluent also enriches the SO_2 concentration of the product stream.

The heat exchangers in the recycle loop are designed to control the temperature of the regenerator inlet streams. The steam generator removes the heat generated during the regeneration reaction by cooling the recycle gas stream. The recycle compressor operates at a sufficient suction temperature to avoid H_2SO_4 condensation and a regenerative gas heat exchanger reheats the compressed gas for recycle to the regeneration process. The heat of combustion of the sulfur is transferred to the CC power block through the steam generated prior to recycle compression of the recycle gas stream.

6.3.5 Halogen Removal

Commercial grade sodium bicarbonate is injected with a small quantity of high pressure nitrogen, upstream of the secondary cyclone as shown in Figure 6.3-1. Chloride and fluoride species are removed by a direct contact reaction with sodium bicarbonate, forming stable salts, and removed by the secondary cyclone. These salts are routed to the secondary cyclone hopper for disposal in an approved off site disposal area.

6.4 COMBINED CYCLE POWER GENERATION

Key components of the combined cycle power generation area are the CT generator, HRSG, and ST generator.

6.4.1 Combustion Turbine-Generator

The CT is a GE 7F, designed for low-NO_x emissions firing syngas, with low sulfur fuel oil for startup and backup. Rated output from the hydrogen-cooled generator when the CT is firing syngas is 192 MW.

The syngas is delivered to the combustion turbine via control valves on the syngas fuel control skid. Nitrogen is used as the diluent to reduce the formation of NO_x in the exhaust gas. The flow of nitrogen to the combustor is regulated by valves on the nitrogen control skid.

When operating on the fuel oil backup, demineralized water is used as a diluent to reduce the formation of NO_x in the exhaust gas. The flow of fuel oil and demineralized water is controlled by a separate skid, the fuel forwarding skid.

6.4.2 Heat Recovery Steam Generator

The heat recovery steam generator recovers the combustion turbine exhaust heat to produce steam for the generation of additional power in the steam turbine. The HRSG is of three-pressure level, reheat, natural circulation design. The HRSG generates high pressure (HP) superheated steam to supply the steam turbine and reheats the HP turbine exhaust steam for feed to the intermediate pressure (IP). The HRSG also generates IP steam which is combined with the HP turbine exhaust steam. Low pressure (LP) is generated for plant use in the latter sections of the HRSG, and boiler feed water (BFW) is preheated for additional heat recovery.

The HRSG consists of HP, reheat (RH), IP, and LP sections. The HP section heats BFW and generates superheated steam for feed to the HP steam turbine. It also provides HP economized BFW to the gasification area and receives HP saturated steam from gasification. The RH section combines HP turbine exhaust with IP superheated steam and adds superheat to the mixture for feed to the IP steam turbine. The IP section heats BFW and generates superheated steam to be mixed with cold reheat steam for feed to the RH section. The IP section also provides BFW and saturated steam to the fuel plant. The LP section heats and deaerates BFW for the HP and IP systems and provides saturated steam and deaerated LP feedwater for export to the gasification plant.

6.4.3 Steam Turbine Generator

The steam turbine generator is a double flow reheat unit with low pressure crossover extraction and a hydrogen-cooled generator. The steam turbine generator is designed specifically for highly efficient combined cycle operation with nominal turbine inlet conditions of approximately 1450 psig and 1000°F with 1000°F reheat inlet temperature. Rated capacity is 124.2 MW; rated speed is 3600 rpm. Expected output during normal operation is 122 MW.

The outlet from the last stage of the turbine is condensed by heat exchange with circulating water from the plant cooling water reservoir. Condensate from the steam turbine condenser is returned to the HRSG/integral deaerator by way of the coal gasification facilities, where some condensate preheating occurs.

6.4.4 Condensate System

The condensate system operates in this combined cycle power plant to:

- Return condensed steam to the cycle by pumping condensate from the condenser hotwell to the deaerator.
- Condense the steam from the steam turbine gland seals and return the condensate to the cycle.
- Provide sources of condensate to various miscellaneous systems.
- Provide a dump to condensate storage tank on a high hotwell level, and to provide condensate makeup to the condenser hotwell.

Condensate pump operation is required during combined cycle operation. One of the two 100 percent capacity condensate pumps is always in service during normal plant operation, while the other condensate pump is in the "auto" standby mode.

The auto standby condensate pump is started when the condensate system header pressure drops below the setpoint, as sensed by a pressure switch.

The condensate pump transfers condensate from the condenser hotwell through the gland seal condenser to the LP economizer by way of a heating loop in the gasification plant.

A minimum flow recirculation to the condenser is controlled by a recirculation flow control valve which protects the condensate pumps by keeping the flow rate above minimum requirements, when the system demand is low.

A hotwell dump line is connected from the condensate discharge line to the condensate storage tank for returning condensate in the event of a high level in the hotwell. Condensate supply to the hotwell is by way of vacuum drag under normal operation, and by the condensate make-up pump otherwise.

The condensate pumps also supply water to the:

- Steam Turbine Exhaust Hood Spray System
- Vacuum Pump Seals
- Condensate Receiver
- Condensate Return Unit
- Gland Seal Emergency Spray
- HRSG Chemical Injection Equipment
- Closed Cooling Water Head Tank
- Feedwater Pump Seals

6.4.5 Electrical Power Distribution System

For plant startup and periods when the plant is down, power is received at 230 KV and is backfed through the generator step-up transformers with the generator breakers in the open position. This provides power to the station 13.8 KV auxiliary transformers. The station 13.8 KV switchgear distributes power at 13.8 KV to the various plant loads including the power block 4160V and 480V auxiliary transformers. The 4160V switchgear provides power to the combustion turbine static starting system and to the 4160V motors.

During startup, power is back-fed through the CT generator step-up transformer or the steam turbine generator step-up transformer to power up the static starting unit. Once the combustion turbine is up to speed and self sustaining, the static starter is deenergized, and the generator can be synchronized to the 230 KV system by closing the 18 KV generator breaker. Similarly, when the steam turbine generator is up to speed, it can be synchronized to the 230 KV system by closing the appropriate 230 KV switchyard breakers first and then the steam turbine generator breaker.

Once the combustion turbine is started up and synchronized to the system, the combustion turbine can provide power to all of the station loads through the station 13.8 KV power distribution systems.

The 480V switchgear distributes power to the various 480V motors and motor control centers associated with the operation of the power generation system.

The power block 125VDC requirements are provided from two batteries. One battery is dedicated to the combustion turbine and is contained in the packaged electrical and electronic control cab. Other 125 VDC loads associated with the power generation are served from the station battery system.

Power is generated at 18 KV by the combustion turbine generator and at 13.8 KV by the steam turbine generator.

Each generator is connected via iso-phase bus duct to its respective generator step-up transformer through an SF6 generator breaker and disconnect switch. Bus duct taps are provided for connection to the station auxiliary transformers.

6.5 AIR SEPARATION UNIT

The air separation unit uses ambient air to produce oxygen for use in the gasification system and sulfuric acid plant, and nitrogen which is sent to the advanced CT.

Figure 6.5-1 presents process flow schematics of the air separation unit. As shown in the figure, ambient air is filtered in a two-stage air filter designed to remove particulate material. The first filter stage will consist of a fixed panel filter; the second filter stage consists of removable elements, which are periodically replaced. The air is compressed in a multistage centrifugal air compressor equipped with inter-cooling between stages and a condensate removal system.

The compressed air is cooled in an aftercooler. Chilled air from the aftercooler is fed to the molecular sieve contaminant adsorbers. The molecular sieves removes impurities, such as water vapor, CO_2, and some hydrocarbons from the air. The air is filtered in the dust filter to remove any entrained molecular sieve particles. Adsorbent regeneration gas is recovered and reused as CT diluent.

The air from the adsorbers is fed to the cold box where it is cooled against returning gaseous product streams in a primary heat exchanger (PHX). A small fraction of the air is extracted from the PHX and expanded to provide refrigeration for the cryogenic process. The expanded air is then fed to the low pressure distillation column for separation.

The remaining air exits the cold end of the PHX a few degrees above its dewpoint. The air is fed to the high pressure distillation column where it separates into a gaseous nitrogen vapor and an oxygen-enriched liquid stream. The nitrogen vapor is condensed in the high pressure distillation column condenser against boiling liquid oxygen. The liquid nitrogen is used as reflux in the high and low pressure distillation columns.

Oxygen and nitrogen is produced in the low pressure distillation column. Heat from the condensing nitrogen vapor will provide reboiler action in the liquid oxygen pool at the bottom of the low pressure distillation column. The oxygen vapor is warmed to near-ambient temperature in the PHX and fed to the oxygen compressor, where it will be compressed to the pressure required by the gasification unit.

Nitrogen vapor from the low pressure distillation column is warmed to near-ambient temperature in the PHX, and sent to the advanced CT.

As backup to the air separation unit, a liquid nitrogen storage system is provided for system purging and maintaining low temperature in the cold box. The backup liquid nitrogen system is maintained in a cold, ready-to-start state.

Figure 6.5-1

AIR SEPARATION UNIT SCHEMATIC
(Page 1 of 2)

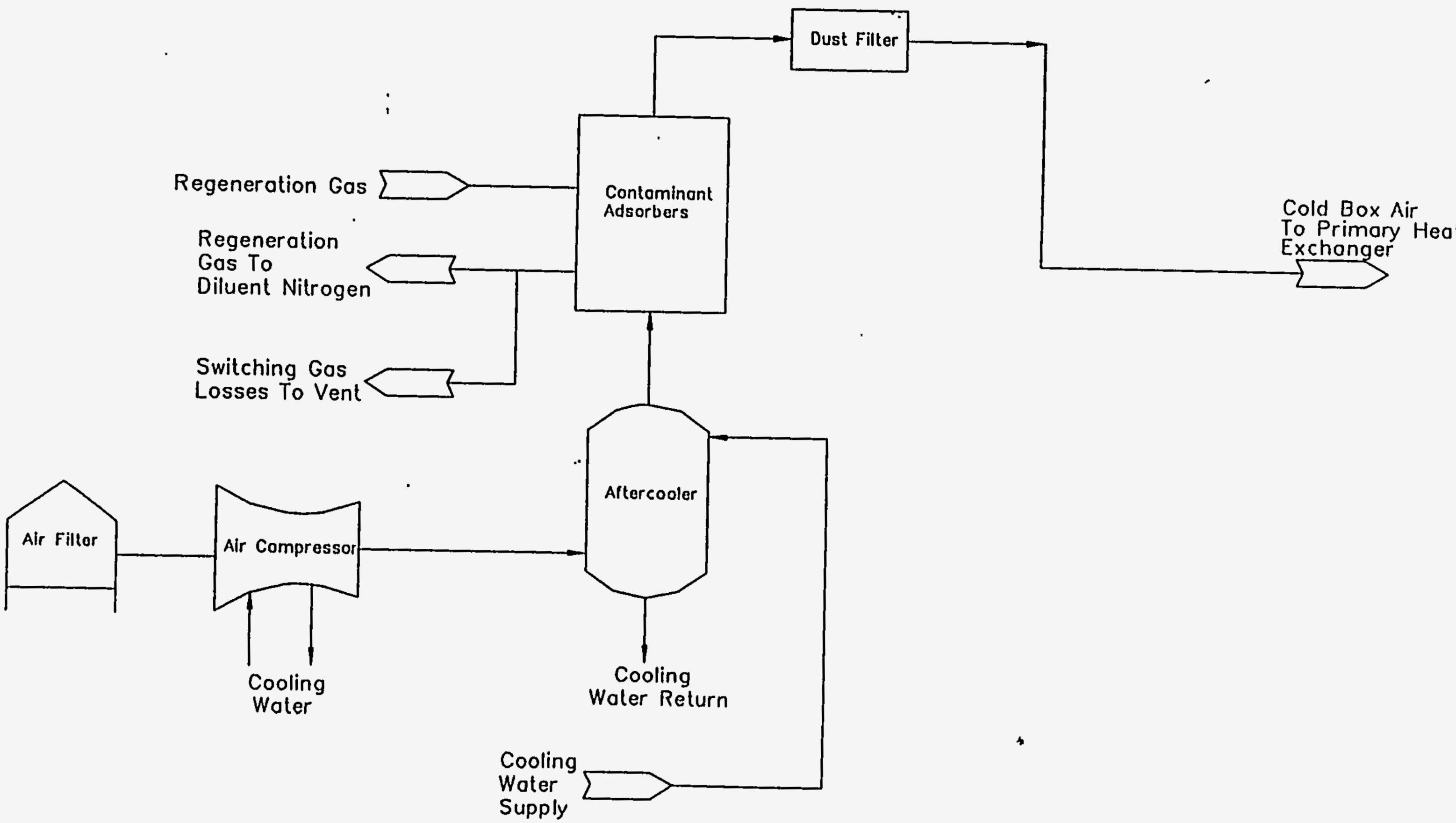
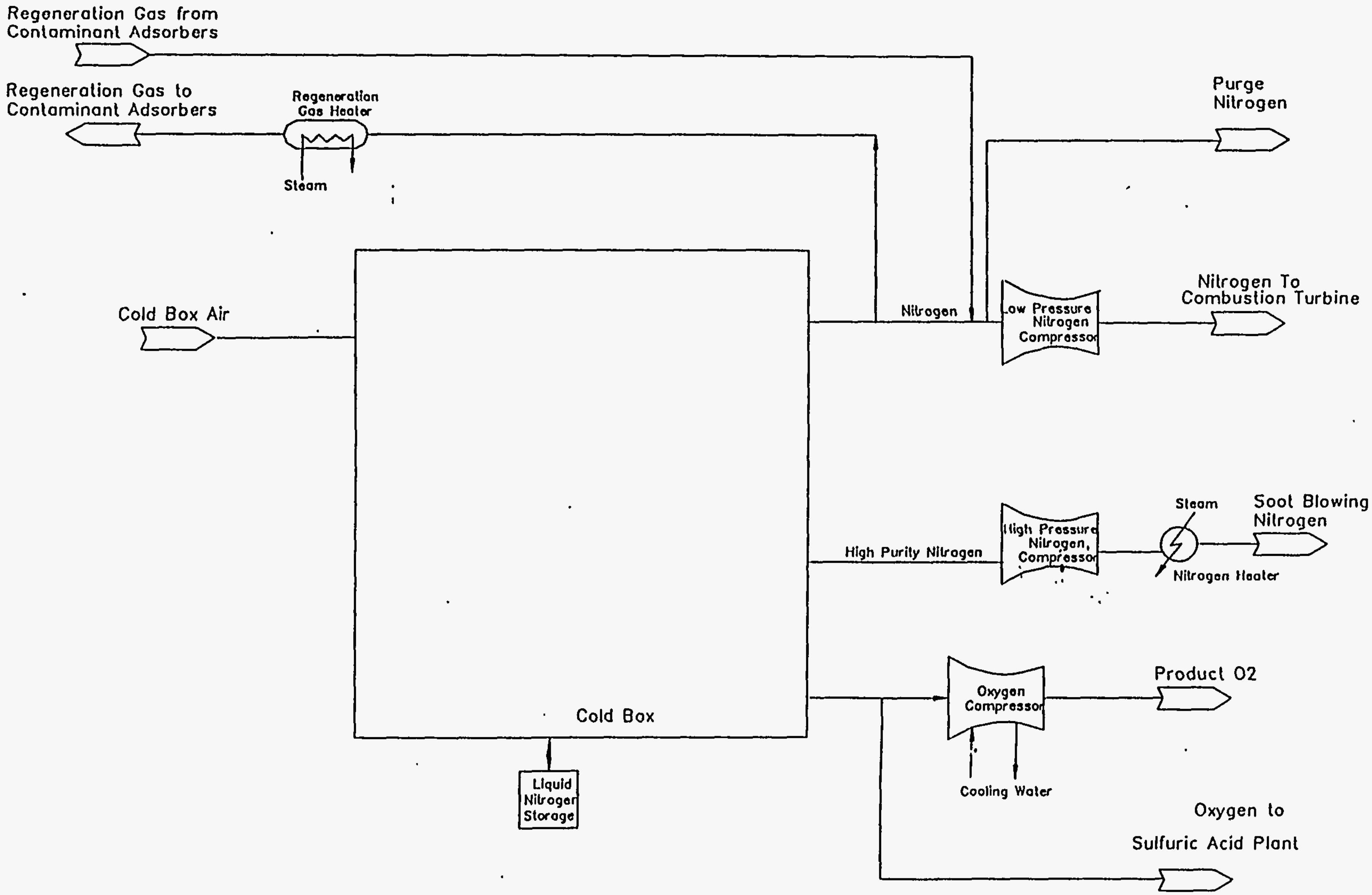


Figure 6.5-1

AIR SEPARATION UNIT SCHEMATIC
(Page 2 of 2)



The air separation unit process does consume water and produce only minor amounts of water from condensation in the main air compressor aftercooler. This water is sent to IWT. The unit requires water only for noncontact cooling purposes which is provided from the makeup water system and/or the cooling reservoir.

6.6 BY-PRODUCT HANDLING

6.6.1 Slag

The slag handling system removes ungasified solids from the gasification process equipment. These solids consist of the coal ash and unconverted coal components (primarily carbon) that exit the gasifier in the solid phase. The schematic presented in Figure 6.1-1 also shows the slag handling process flow.

In the gasification system, coarse solids and some of the fine solids are flushed from the radiant cooler into the slag dewatering bin. Solids flushed to the slag dewatering bin are piled and be dewatered by gravity into the slag dewatering sump. The concrete dewatering bin is bunkered to prevent runoff from the area. From the dewatering bin, the slag is either be loaded into trucks for transport and use offsite or transported to the temporary, onsite slag storage area which is described in subsection 6.6.2. The water removed from the slag and bins is pumped to the gasification process black water handling and processing system.

Again, all waters produced in this slag handling system are collected and routed to the black water handling system for processing reuse. Also, potential particulate matter air emissions from the system are minimal due to the wet nature of the slag and processes.

This system generates the coarse slag material at a maximum rate of approximately 210 short-tons per day (stpd) on a dry basis and the material contains approximately 25 percent moisture. The slag is classified as nonhazardous and nonleachable and will be marketed and sold for various offsite commercial uses such as abrasives, roof material, industrial filler, concrete aggregate, or road base material.

6.6.2 Slag Storage Area

During periods when the slag by-product cannot be sold in a timely manner, a temporary storage area has been developed on the site. Initially, the area is developed to be capable of storing slag generated by approximately 2-1/2 years of operation of the IGCC unit at full capacity. An additional 2-1/2 year storage area will be developed as needed in the unexpected event that sales of the slag for offsite uses are less than the slag production rates. The temporary slag storage area shown on the site layouts in Figures 5.1-1 and 5.2-1 provide sufficient capacity for developing storage cells for up to five years of slag production from the IGCC unit operating at 100-percent capacity. The slag storage area includes a stormwater runoff collection basin and surrounding berm to prevent runoff from reentering the area. Both the slag storage area and the runoff collection basin are lined with a synthetic material or other materials with similar low permeability characteristics. The runoff basin is designed to contain runoff water volumes equivalent to 1.5 times the 25-year, 24-hour storm event. Water collected in the runoff basin is routed to the industrial wastewater treatment (IWT) system for filtration.

6.6.3 Sulfuric Acid

The sulfuric acid plant converts gaseous sulfur compounds from the hot and cold gas cleanup systems to sulfuric acid by-product for sale to the local Florida fertilizer industry. The conversion of these gases involves a multi-step catalytic process based on proven technology in widespread commercial use.

In the HGCU process, an acid gas is produced which has a high SO_2 concentration. In the CGCU process, hydrogen sulfide (H_2S) containing gases from the acid gas removal unit and the NH_3 stripping unit is routed through knockout drums to remove any entrained water. The CGCU gases is then introduced into the decomposition furnace, along with combustion air. Supplemental fuel is added to maintain the proper operating temperature. The air is preheated to reduce the volume of fuel and thereby combustion products. Hot gases from the HGCU unit are introduced into the system downstream of the decomposition furnace and mixed with the combusted acid gas from the CGCU unit.

The mixed gases from the CGCU and HGCU systems are cooled in a waste heat boiler, recovering as much usable energy as possible. The boiler steam side operates at 400 psig to avoid condensing acid in the tubes. The gases from the waste heat boiler cooled in a quench tower with a circulating stream of weak acid, i.e., a conventional open spray tower. The gas then flows through the gas cooling tower, a packed column, for further cooling and water condensation.

Reaction air in the form of low-pressure 95% purity oxygen is added to the process stream to provide the required amount of oxygen for the SO_2 to SO_3 reaction.

The gases leaving the cleaning and cooling system and the reaction air flow to a drying tower, where the remaining water is removed. The gases from the drying tower go to the main blower, which provides the necessary pressure for flow through the reactor beds and absorber towers.

The gases from the blower are then heated in the reactor feed/effluent exchangers to achieve the proper reaction temperature and sent through catalytic reactor beds. There is additional heat removal and recovery equipment in the reactor section between the reactor beds. An indirect propane-fired heater is used to supplement the reaction heat for startup. The gases from the reactor is cooled and sent to the absorber towers, where 98-percent acid absorbs the SO_3 from the process gas stream. The high concentration H_2SO_4 is circulated from the absorber towers bottoms, through the acid coolers, and then returned to the top of the absorber towers. The gases from the absorber towers pass through mist eliminators to remove acid mist, and the gas from the final absorber tower is then vented to atmosphere.

The H_2SO_4 unit is constructed adjacent to the gasification facilities on the site. The facilities include an aboveground tank to provide for temporary storage of the H_2SO_4 by-product and appropriate handling and loading equipment. The H_2SO_4 is transported offsite in specially designed rail cars or trucks for commercial use. The unit produces approximately 77,000 tons per year (tpy) of liquid H_2SO_4 by-product.

6.6.4 Sulfuric Acid Storage Facilities

Both the CGCU acid gas treatment system and the demonstration HGCU system produce offgases containing sulfur compounds which require treatment. These offgases are treated by converting the sulfur compounds in the gas to H_2SO_4 which is a marketable by-product especially with the central Florida chemical fertilizer industry.

The H_2SO_4 by-product is produced in a H_2 SQ plant. As necessary, the H_2 SQ is temporarily stored onsite in a tank or in specially designed railcars prior to shipment offsite. The fixed storage tank will provide for 5 days of storage on the site.

Stormwater runoff from the H_2SO_4 storage, handling, and loading area are directed to the IWT system for appropriate treatment prior to being routed to the cooling reservoir for reuse.

6.7 BALANCE OF PLANT SYSTEMS

6.7.1 Cooling Water

The steam electric generating components of the IGCC unit require water to cool or condense the exhaust steam from the ST. Cooling water is also required for gasification, ASU, sulfuric acid, and other miscellaneous users. The waste heat transferred to the cooling water must then be rejected to the atmosphere. The cooling/heat rejection system for the Polk Power Station is a cooling reservoir.

The cooling reservoir has been constructed in areas which were mined for phosphate. The reservoir occupies an area of approximately 860 acres, including the areas of the surrounding and internal earthen berms. The reservoir is primarily a below-grade facility. The maximum elevation of the bottom of the reservoir is approximately 123 feet with an average elevation of 120 feet, and the top of the surrounding berms is 145 feet. The internal berms have a top elevation of approximately 141 feet. The finish grade on the main power plant facility area is between 140 and 145 feet. Under normal operating conditions, water levels in the reservoir are approximately

136 feet, and the total water surface area is approximately 727 acres. Reference point for the elevations given is mean sea level.

The top of the surrounding and internal earthen berms are approximately 25 and 17 feet wide, respectively, to provide access for inspection and maintenance purposes. The berms are constructed with gentle slopes (4 feet horizontal to 1 foot vertical) to minimize potential erosion and visual quality effects. The berms are also re-vegetated after construction and the vegetation will be appropriately controlled and maintained to prevent future erosion.

Intake and discharge structures to provide and subsequently discharge the cooling water are constructed within the cooling reservoir. The estimated circulating cooling water flow requirements are approximately 130,000 gpm for the steam turbine condenser and 40,000 gpm for the remainder of the plant including the air separation unit. One set of two 50 percent pumps supplies water for the condenser, and another set of two 50 percent pumps supplies water for the other users. This warmed return water is routed throughout the reservoir area by the internal berm system and cooled through evaporation prior to intake and reuse in the system.

For users that require higher quality water than that provided by the cooling reservoir, two closed loop cooling water systems are provided: one for the power generation area and one for the gasification area. Heat is rejected from these loops to the reservoir cooling water.

6.7.2 Fuel Oil Storage

The plant has storage for 2,350,000 gallons of No. 2 fuel oil, which is used to fire the auxiliary boiler and the combustion turbine when gasification is down.

Fuel oil is unloaded from the tank trucks and pumped by the fuel oil truck unloading pumps to the fuel oil storage tank. From the fuel oil storage tank, the fuel oil is pumped to either the combustion turbine fuel forwarding skid or to the auxiliary boiler.

The unloading area is curbed and the storage tank area is diked. All rainfall and spills in these areas are collected and sent to an oily-water separation system.

6.7.3 Utility Summary

Major plant utility requirements are power, steam, cooling water, well water, propane, and No. 2 fuel oil. The consumptions of these units are summarized in Table 6.1.

Table 6.1

SUMMARY OF ESTIMATED UTILITY CONSUMPTION

Area	Motor HP	Electricity (KW)	Steam (1000) Lb/hr			Water (GPM)		Fuel (Lb/Hr)	
			LP	IP	HP	Well	Cooling	Propane	Fuel Oil
Gasification Area	2,176	1,299	18.0	(8.8)	(496.1)	0	4,598	884*	0
Acid Gas Removal	403	241	38.9	0.0	0.0	0	5,989	0	0
Sulfuric Acid Plant	1,137	679	0.0	(25.7)	0.0	0	4,600		926
Air Separation Plant	78,700	54,300	7.0	0.0	0.0	0	17,340	0	0
Hot Gas Cleanup	1,137	679	0.0	0.0	0.0	0	210	0	0
Brine Concentration Area	789	471	8.1	0.0	0.0	0	1,482	0	0
Coal Handling/Slurry Prep	2,158	1,288	2.0	0.0	0.0	0	0	0	0
Power Block	4,928	2,941	0.0	0.0	0.0	0	134,295	0	81,500*
Utility	3,661	2,185	(3.5)	0.0	0.0	1,300	415	46	2,766*
Total	95,089	64,081	70.5	(34.5)	(496.1)	1,300	168,719	46	926

* Indicates intermittent consumption, not included in totals
() Indicates normal utility production

6.8 DISTRIBUTED CONTROL SYSTEM

The Distributed Control System (DCS) planned for Polk Power Station Unit 1 is a highly modular, microprocessor based system which will provide both continuous and sequential control for most of the equipment at the station. Approximately 6800 inputs and outputs are connected to the DCS. Typical input signals include pump and motor vibrations, pressure and level transmitters, process analyzers, and relay contacts. The operator interface is through color CRT and operator consoles located in the main control room. With the operator interface the operator can adjust unit loads, start and stop motors, monitor and trend all plant operations. All plant alarming is directed through the DCS and indicated on CRT screens and printers.

Control graphics are the key to controlling plant processes. Since the overall plant logic has been designed so that most equipment can be started or stopped from the control room graphics, local control panels are be kept to a minimum.

The DCS has been used in integrating the different plant areas. For example, a decrease in the output of the air separation unit effects equipment in other areas. The DCS automatically adjusts the gasifier output or power block generation to compensate for air plant changes.

Process Control Units contain the plant operating configuration. These units are distributed throughout the plant. Communication between the Process Control Units, Operators Consoles and the VAX historian computer is accomplished through redundant fiber optic cables creating a plantwide communication network. This network has also been designed to include communication with other plant control units such as the Mark V turbine control systems and the Gasification Emergency Shutdown System.

The historian has have two major functions. First, the historian contains steam and gas property libraries for use in a variety of calculations. These calculations include efficiency for a particular piece or stage of equipment, overall area, and unit efficiencies. Secondly, the historian provides long term storage of all important data plantwide. Sequence of events are stored and displayed for identifying the cause of plant shutdowns. Long term storage of critical data is used to identify the degradation in equipment performance. Maintenance schedulers rely on this information. Alarm histories and operator event logs are used to improve or correct operating practices.

6.9 EMERGENCY SHUTDOWN SYSTEM

The Emergency Shutdown System (ESD) planned for the Polk Power Station is a Triple Modular Redundant (TMR) Architecture, Fault tolerant, microprocessor based system which will provide for equipment and personnel protection in the Gasifier and Coal Slurry areas.

Approximately 250 inputs and outputs are connected to the ESD System. Many of the inputs to the system are triplicate measurements of the same process parameter, and many of the outputs are to dual in-line solenoid valves in the field. ESD System solenoids are connected to control valve pneumatic signal lines, and, when deenergized due to a trip condition detected by the ESD program, vent the control valves to their fail-safe positions.

The ESD system includes an engineering workstation for program development. The primary operator interface to the system is through a one-way serial communication link from the ESD system to the Distributed Control System (DCS). Required communication from the DCS to the ESD System is hard-wired. Communications from the ESD system to the DCS include transmitter readings, process alarms, first-out alarms, trip alarms, and system diagnostic alarms.

The TMR architecture of the ESD system with all functions of the system triplicated into three separate operational legs, provides the fault tolerance required for this safety application. No single point of failure will cause the system to fail. Extensive diagnostic capabilities will help maintenance personnel pinpoint any faults in any one of the three legs of the system. TMR input/output boards can be replaced online without affecting the process and without the need for shutting down the system. The calculated system reliability is greater than 99.99%

PROJECT COSTS AND SCHEDULE

7.0 PROJECT COSTS AND SCHEDULE

7.1 PROJECT COSTS

The total project costs for the Polk Power Station Unit 1 are summarized in Table 7.1. The values are actual dollar expenditures with no escalation. Costs are summed from the planning phase in 1991 through the commencement of commercial operation in 1996; of course, the bulk of the expenditures were incurred in the detailed engineering and construction phase from April 1993 to July 1996.

TAMPA ELECTRIC COMPANY
POLK POWER STATION
June 1996 Project Reforecast
($ x 1,000)

c:\doe-696 - b

		PRIOR TO 1996	Actuals Jan-Jun 96	Forecast Jul-Dec 96	Forecast 1997	TOTAL PROJECT
COMMON & GENERAL						
0.1	Project Management & Common	41,324	3,128	5,838	3,119	53,410
0.2	Environmental & Permitting	5,894	155	208		6,257
0.3	Sitework Engineering	1,087	24	70		1,181
0.4	Construction Management	9,900	3,045	1,845		14,790
0.5	Field Distributables	7,570	6,961	11,748		26,279
0.6	TEC Prior to 6/92 Costs	1,482	0			1,482
0.7	TPS - Prior to Turnover Costs	3,197	0			3,197
0.8	DOE Project Reimbursements	(98,394)	(8,216)	(15,265)	(1,019)	(122,894)
0.9	Operator Training	1,207	1,338	734	0	3,279
	Subtotal - Common	**(26,734)**	**6,435**	**5,180**	**2,100**	**(13,019)**
HGCU & SULFURIC ACID PLANT						
1.1	Hot Gas Cleanup	19,073	1,898	2,248		23,220
1.2	Sulfuric Acid Plant	17,842	2,334	173	0	20,350
	Subtotal - HGCU & Sulfuric Acid	**36,915**	**4,233**	**2,422**	**0**	**43,569**
COLD GAS CLEANUP						
2.0	CGCU - Common/Engineering	2,333	(100)	(125)		2,108
2.1	Syngas Scrubbing	1,449	45	16		1,510
2.2	Low Temp Gas Cooling	957	29	11		997
2.3	Acid Gas Removal	4,148	1,012	469		5,629
2.4	Sulfur Recovery - Claus	61				61
2.5	Tail Gas Treating - Scot	51				51
2.6	Clean Gas Heating	953	478	143	0	1,574
	Subtotal - CGCU	**9,951**	**1,464**	**514**	**0**	**11,930**
OXYGEN PLANT						
3.0	ASU - Common\Engineering	266		10		276
3.1	Air Separation Unit	36,275	1,215	473	0	37,964
	Subtotal - ASU	**36,541**	**1,215**	**483**	**0**	**38,240**

TAMPA ELECTRIC COMPANY
POLK POWER STATION
June 1996 Project Reforecast
($ x 1,000)

c:\doe-696 - b

		PRIOR TO 1996	Actuals Jan-Jun 96	Forecast Jul-Dec 96	Forecast 1997	TOTAL PROJECT
GASIFICATION PLANT						
4.0	Gasification - Common\Engr	26,149	210	2,217		28,576
4.1	Coal Supply	5,180	663	315		6,159
4.2	Slurry Prep & Coal Grinding	9,677	1,407	508		11,592
4.3	Gasification & High Temp Cooling	45,323	6,560	3,719		55,602
4.4	Slag Handling	2,276	1,219	241		3,735
4.5	Blackwater Handling	4,398	1,551	706		6,656
4.6	Fines Filtration	533	142	242		917
4.7	Process Wastewater Treating	5,468	1,005	420		6,893
4.8	Auxiliary Boiler	1,295	279	53	0	1,628
	Subtotal - Gasification	**100,299**	**13,036**	**8,422**	**0**	**121,757**
POWER GENERATION						
5.0	Power Generation - Common\Engr	5,064		5		5,069
5.1	Combustion Turbine & Generator	51,188	708	1,353		53,249
5.2	Steam Turbine & Generator	19,649	523	(748)		19,424
5.3	Fuel Oil Supply	1,492	5	4	0	1,501
	Subtotal - Power Generation	**77,394**	**1,236**	**614**	**0**	**79,243**
HEAT RECOVERY STEAM GENERATOR (HRSG)						
6.0	HRSG - Common\Engineering	1,545		5		1,550
6.1	Heat Recovery Steam Generator	24,304	2,306	54		26,664
6.2	Condensate and Boiler Feed Water	6,791	1,708	410		8,909
6.3	Demineralized Water	1,385	123	52		1,559
6.4	Circulating Water	8,104	512	341	0	8,958
	Subtotal - HRSG	**42,129**	**4,649**	**863**	**0**	**47,641**
PLANT ELECTRICAL						
7.0	Electrical - Common\Engineering	287		5		292
7.1	Auxiliary Power - Low Voltage	2,586	224	58		2,868
7.2	Auxiliary Power - 4.14kV	5,812	180	6		5,997
7.3	Auxiliary Power - 13.8kV	6,040	79	(13)		6,107
7.4	Generator Step-up Transformers	2,111	0	0		2,112
7.5	Wire & Cable Holding Account	3,661	248	45		3,954
7.6	Temporary Power Substation	604	2	1	0	607
	Subtotal - Electrical	**21,102**	**734**	**101**	**0**	**21,937**

TAMPA ELECTRIC COMPANY
POLK POWER STATION
June 1996 Project Reforecast
($ x 1,000)

c:\doe-696 - b

		PRIOR TO 1996	Actuals Jan-Jun 96	Forecast Jul-Dec 96	Forecast 1997	TOTAL PROJECT
SITE DEVELOPMENT & BUILDINGS						
8.0	Sitework - Common\Engineering	1,053		10		1,063
8.1	Site Development & Reclamation	33,791	8,243	2,913		44,948
8.4	Warehouse	1,180	166	165		1,511
8.5	Control Building	2,628	247	50		2,925
8.6	Maintenance Building	973	299	707		1,979
8.7	Land Acquisition Costs	19,840	0	0	0	19,840
	Subtotal - Site Development	**59,465**	**8,955**	**3,846**	**0**	**72,266**
PLANT UTILITIES						
9.0	General Wastewater Treating	7,727	556	147		8,430
9.1	Uninterruptable Power Supply	0				0
9.2	Plant & Instrument Air	1,629	381	38		2,048
9.3	Plant Water Requirements	3,937	936	287		5,160
9.4	Chemical Fire Protection	25	24	(0)		49
9.5	Flare	2,026	932	296		3,254
9.7	Plant Monitoring & Communications	450	275	49		773
9.8	Plant Control & Management Info	5,596	1,606	1,972		9,174
9.9	Pipe Racks	2,893	438	1,001	0	4,331
	Subtotal - Plant Utilities	**24,283**	**5,146**	**3,790**	**0**	**33,220**
FUEL INVENTORY				9,355	0	9,355
SWITCHYARD and T&D		9,229	487	50	0	9,766
STORES INVENTORY				3,700	1,964	5,664
BIG BEND TRANSLOADER		2,431	931	50	0	3,412
	Total Capitalized Costs	**393,007**	**48,523**	**39,389**	**4,064**	**484,983**

7.2 PROJECT SCHEDULE

Listed below are key project milestones and their dates.

Milestone	Date
Petition filed with Florida Public Service Commission (FPSC) to determine Need for Electrical Power Plant and Related facilities	September 5, 1991
Architect/Engineer (A/E) selected for development of Preliminary Engineering Package (PEP)	March 1, 1992
U.S. Department of Energy (DOE) approved Amendment M001 to the Cooperative Agreement between DOE and TEC	March 2, 1992
FPSC issued order to approve Need for Polk Power Station Unit #1	March 5, 1992
Submitted Environmental Information Volume to EPA	June 8, 1992
Submitted Site Certification Application to Florida Department of Environmental Regulation	July 31, 1992
Awarded Combined Cycle System Contracts	November 6, 1992
PEP Complete	December 7, 1992
Awarded Air Separation Unit Turnkey Contract	April 14, 1993
Awarded Contract for Detailed Engineering	April 22, 1993
Awarded Syngas Cooling System Contracts	May 25, 1993
Awarded Hot Gas Cleanup System (HGCU) Design Contract	June 2, 1993
Awarded Construction Management Contract	June 24, 1993
Site Certification Application, approved	January 25, 1994
Award Sulfuric Acid Plant Contract	April 10, 1994
Award Brine Concentration System Contract	June 7, 1994
Receive Army Corp. Of Engineers 404 Permit	July 19,1994
Begin Site Development Work	August 19, 1994
Begin Foundation Construction	November 4, 1994
Begin Construction 230KV Switchyead	December 12, 1994
Begin ASU Foundation Construction	January 1, 1995
Deliver Combustion Turbine & Generator	March 10, 1995
Complete A/E Detailed Engineering	April 1, 1995
Begin Gasification Structure Erection	April 3, 1995
Deliver Steam Turbine & Generator	April 13, 1995
Begin Sulfuric Acid Plant Construction	April 17, 1995
Complete HGCU Detailed Engineering	April 17, 1995
Deliver Main Air Compressor	May 1, 1995

Milestone	Date
Deliver Radiant Syngas Cooler	July 1, 1995
Energize 230KV Switchyard	July 27, 1995
Startup of Air Separation Unit	December 4, 1995
Startup of Gasification System	June 17, 1996
IGCC Commercial Operation Date	September 15, 1996
Startup of Combined Cycle Equipment	December 29, 1996

HEAT AND MATERIAL BALANCES

8.0 HEAT AND MATERIAL BALANCES

Heat and material balances are provided for two cases: (1) normal operating case on Pittsburgh #8 coal (with 2.57% sulfur) and HGCU not in operation (Table 8.1) and (2) normal operating case on Pittsburgh #8 coal (with 2.57% sulfur) and HGCU in operation (Table 8.2). The flow diagram stream numbers refer to those of the block flow diagram (Figure 5-3-1).

PROJECT : Polk Power Station Unit No. 1
LOCATION : Polk County, Florida

HEAT AND MATERIAL BALANCE

NORMAL OPERATING CASE

REV.	ISSUE DATE	DESCRIPTION	ORIG.	ORIG. DATE	CHECK'D	APPR.	APPR. DATE
2		GENERAL REVSION					
1	10-18-93	Partial Revision to Change Solid Content in Syngas	SAM		RC	SYC	10/15/93
0	6/22/93	ISSUE FOR DESIGN PER TEXACO PEP	RC	6/17/93		SYC	6/17/93

TAMPA ELECTRIC COMPANY
POLK POWER STATION UNIT NO. 1

JOB NO. : 22269
DRAWING NO. DS-B-1-002
REV. 2
SHEET OF

HEAT AND MATERIAL BALANCE - PITT 8, NOC
COAL GRINDING SECTION 92127-PFD-8-10A

Stream ID:	101	102	103	104
Name:	Coal from Storage	Coal to Mill	Slurry Water to Mill	Slurry from Mill
Phase:	Mixed	Mixed	Liquid	Mixed
Fluid rates, lb-mol/hr				
(1) CO	0.000	0.000	0.000	0.000
(2) H_2	0.000	0.000	0.000	0.000
(3) CO_2	0.000	0.000	0.000	0.000
(4) H_2O	437.200	218.600	2,044.614	2,263.214
(5) C_1	0.000	0.000	0.000	0.000
(6) AR	0.000	0.000	0.000	0.000
(7) N_2	0.000	0.000	0.000	0.000
(8) H_2S	0.000	0.000	0.000	0.000
(9) COS	0.000	0.000	0.000	0.000
(10) O_2	0.000	0.000	0.000	0.000
Total fluid, lb-mol/hr	437.200	218.600	2,044.614	2,263.214
NMW solid rates, lb/hr				
(11) Coal	158,292.984	79,146.492	0.000	79,146.492
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	158,292.984	79,146.492	0.000	79,146.492
Total rate, lb/hr	166,169.266	83,084.633	36,834.293	119,918.930
Temperature, °F	90.000	90.000	183.759	188.543
Pressure, psia	14.700	14.700	34.700	14.700
Enthalpy, MM Btu/hr	-65.273	-32.636	5.792	-24.327
Molecular weight*	18.015	18.015	18.015	18.015
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.953	0.953	0.000	0.660
——— VAPOR ———				
Flow, M ft^3/hr	N/A	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A	N/A
——— LIQUID ———				
Flow, gal/min	15.974	7.987	78.354	86.959
CP, Btu/lb-f	1.053	1.053	0.995	0.994
Density, lb/ft^3	61.472	61.472	58.610	58.456
Surface tension, dyne/cm	71.3790	71.3790	61.2494	60.7359
Thermal cond, Btu/hr-ft-f	0.35598	0.35598	0.38565	0.38664
Viscosity, cp	0.75906	0.75906	0.32739	0.31744
——— SOLID ———				
CP, Btu/lb-f	0.250	0.250	N/A	0.250
Density, lb/ft^3	84.000	84.000	N/A	84.000

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
COAL SLURRY SECTION 92127-PFD-8-10B

Stream ID:	201	202	203
Name:	Evaporator Condensate to Grind	Slurry Water to Pump	Slurry to Gasifier
Phase:	Liquid	Liquid	Mixed
Fluid rates, lb-mol/hr			
(1) CO	0.000	0.000	
(2) H_2	0.000	0.000	
(3) CO_2	0.000	0.000	
(4) H_2O	3,489.227	4,089.228	
(5) C_1	0.000	0.000	
(6) AR	0.000	0.000	
(7) N_2	0.000	0.000	
(8) H_2S	0.000	0.000	
(9) COS	0.000	0.000	
(10) O_2	0.000	0.000	
Total fluid, lb-mol/hr	3,489.227	4,089.228	4,526.428
NMW solid rates, lb/hr			
(11) Coal	0.000	0.000	158,292.984
(12) Slag	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	158,292.984
Total rate, lb/hr	62,859.402	73,668.586	239,837.859
Temperature, °F	179.000	183.737	188.543
Pressure, psia	20.000	14.700	14.700
Enthalpy, MM Btu/hr	9.583	11.578	-48.654
Molecular weight*	18.015	18.015	18.015
Mole frac vapor*	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000
Weight frac NMW solid	0.000	0.000	0.660
——— VAPOR ———			
Flow, M ft^3/hr	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A
——— LIQUID ———			
Flow, gal/min	133.376	156.711	173.917
CP, Btu/lb-f	0.997	0.995	0.994
Density, lb/ft^3	58.759	58.609	58.456
Surface tension, dyne/cm	61.7599	61.2518	60.7359
Thermal cond, Btu/hr-ft-f	0.38461	0.38564	0.38664
Viscosity, cp	0.33791	0.32744	0.31744
——— SOLID ———			
CP, Btu/lb-f	N/A	N/A	0.250
Density, lb/ft^3	N/A	N/A	84.000

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
GASIFICATION SECTION 92127-PFD-23-1

Stream ID:	301	302	303	304
Name:	Oxygen to Burner	Burner CW to Pump	Burner CW From Cooler	Syngas at Gasification Exit
Phase:	Vapor	Liquid	Liquid	Mixed
Fluid rates, lb-mol/hr				
(1) CO	0.000	0.000	0.000	
(2) H_2	0.000	0.000	0.000	
(3) CO_2	0.000	0.000	0.000	
(4) H_2O	0.000	6,741.833	6,741.833	
(5) C_1	0.000	0.000	0.000	
(6) AR	186.240	0.000	0.000	
(7) N_2	68.875	0.000	0.000	
(8) H_2S	0.000	0.000	0.000	
(9) COS	0.000	0.000	0.000	
(10) O_2	4,847.200	0.000	0.000	
Total fluid, lb-mol/hr	5,102.315	6,741.833	6,741.833	18,742.297
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	
(12) Slag	0.000	0.000	0.000	
(13) Char	0.000	0.000	0.000	
(14) NaCl	0.000	0.000	0.000	
Total NMW solid, lb/hr	0.000	0.000	0.000	15,087.098
Total rate, lb/hr	164,473.922	121,455.992	121,455.992	404,299.500
Temperature, °F				
Pressure, psia	544.700	14.700	209.700	414.700
Enthalpy, MM Btu/hr	8.681	11.278	10.118	490.579
Molecular weight*	32.235	18.015	18.015	20.766
Mole frac vapor*	1.000	0.000	0.000	1.000
Mole frac liquid*	0.000	1.000	1.000	0.000
Weight frac NMW solid	0.000	0.000	0.000	0.037
——— VAPOR ———				
Flow, M ft^3/hr	69.286	N/A	N/A	1,527.048
Cp, Btu/lb-f	0.231	N/A	N/A	0.4479
Density, lb/m ft^3	2,373.836	N/A	N/A	254.878
TH cond, Btu/hr-ft-f	0.01865	N/A	N/A	0.12173
Viscosity, cp	0.02494	N/A	N/A	0.05579
——— LIQUID ———				
Flow, gal/min	N/A	249.992	248.709	N/A
CP, Btu/lb-f	N/A	1.027	1.034	N/A
Density, lb/ft^3	N/A	60.572	60.884	N/A
Surface tension, dyne/cm	N/A	68.1048	69.1736	N/A
Thermal cond, Btu/hr-ft-f	N/A	0.36760	0.36401	N/A
Viscosity, cp	N/A	0.54703	0.60466	N/A
——— SOLID ———				
CP, Btu/lb-f	N/A	N/A	N/A	0.249
Density, lb/ft^3	N/A	N/A	N/A	149.704

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SYNGAS COOLER SECTION 92127-PFD-23-2

Stream ID:	401	402	403	404
Name:	Soot Blow Gas	Grey Water to RSC Sump	Syngas at RSC Exit	Syngas at CSC Exit
Phase:	Vapor	Mixed	Mixed	Mixed
Fluid rates, lb-mol/hr				
(1) CO	0.000			
(2) H_2	0.000			
(3) CO_2	0.000			
(4) H_2O	0.000	3,876.536		
(5) C_1	0.000			
(6) AR	0.000			
(7) N_2	862.000			
(8) H_2S	0.000			
(9) COS	0.000			
(10) O_2	0.000	0.000		
Total fluid, lb-mol/hr	862.000	3,879.326	9,868.718	9,868.718
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000		
(12) Slag	0.000	0.000		
(13) Char	0.000	0.000		
(14) NaCl	0.000	162.385		
Total NMW solid, lb/hr	0.000	162.385	1131.532	1131.532
Total rate, lb/hr	24,147.619	70,090.750	209,010.810	209,010.810
Temperature, °F	320.000	293.035	1,300.000	900.000
Pressure, psia	900.000	449.700	410.000	400.000
Enthalpy, MM Btu/hr	1.520	18.582	133.247	100.372
Molecular weight*	28.014	18.026	21.064	21.064
Mole frac vapor*	1.000	0.000	1.000	1.000
Mole frac liquid*	0.000	1.000	0.000	0.000
Weight frac NMW solid	0.000	0.002	0.005	0.005
——— VAPOR ———				
Flow, M ft^3/hr	8.329	N/A	458.103	363.186
Cp, Btu/lb-f	0.263	N/A	0.404	0.386
Density, lb/m ft^3	2,899.061	N/A	453.781	572.374
TH cond, Btu/hr-ft-f	0.02001	N/A	0.07115	0.05730
Viscosity, cp	0.02336	N/A	0.03805	0.03160
——— LIQUID ———				
Flow, gal/min	N/A	158.722	N/A	N/A
CP, Btu/lb-f	N/A	1.002	N/A	N/A
Density, lb/ft^3	N/A	54.928	N/A	N/A
Surface tension, dyne/cm	N/A	49.2697	N/A	N/A
Thermal cond, Btu/hr-ft-f	N/A	0.39536	N/A	N/A
Viscosity, cp	N/A	0.19052	N/A	N/A
——— SOLID ———				
CP, Btu/lb-f	N/A	0.220	0.246	0.246
Density, lb/ft^3	N/A	134.600	147.478	147.478

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SYNGAS COOLER SECTION 92127-PFD-23-2

Stream ID:	405	406	407	408
Name:	Syngas at RG/CGE Exit	Syngas at RSC Exit	Syngas at CSC Exit	Syngas at RG/NE Exit
Phase:	Mixed	Mixed	Mixed	Mixed
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	9,868.718	9,868.718	9,868.718	9,868.718
NMW solid rates, lb/hr				
(11) Coal				
(12) Slag				
(13) Char				
(14) NaCl				
Total NMW solid, lb/hr	1132.532	1132.532	1132.532	1132.532
Total rate, lb/hr	209,010.810	209,010.810	209,010.810	209,010.810
Temperature, °F	440.000	1,300.000	900.000	443.000
Pressure, psia	390.000	410.000	400.000	390.000
Enthalpy, MM Btu/hr	64.258	133.247	100.372	64.489
Molecular weight*	21.064	21.064	21.064	21.064
Mole frac vapor*	1.000	1.000	1.000	1.000
Mole frac liquid*	0.000	0.000	0.000	0.000
Weight frac NMW solid	0.005	0.005	0.005	0.005
——— VAPOR ———				
Flow, M ft^3/hr	245.968	458.103	363.186	246.803
Cp, Btu/lb-f	0.370	0.404	0.386	0.370
Density, lb/m ft^3	845.142	453.781	572.374	842.285
TH cond, Btu/hr-ft-f	0.04134	0.07115	0.05730	0.04144
Viscosity, cp	0.02299	0.03805	0.03160	0.02305
——— LIQUID ———				
Flow, gal/min	N/A	N/A	N/A	N/A
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A
Surface tension, dyne/cm	N/A	N/A	N/A	N/A
Thermal cond, Btu/hr-ft-f	N/A	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A	N/A
——— SOLID ———				
CP, Btu/lb-f	0.246	0.246	0.246	0.246
Density, lb/ft^3	147.478	147.478	147.478	147.478

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SYNGAS COOLER SECTION 92127-PFD-23-2

Stream ID:	409	410	411	412
Name:	Clean Gas to Steam Preheater	Clean Gas from Steam Preheater	Clean Gas from RG/CGE	RSC Blowdown
Phase:	Vapor	Vapor	Vapor	Mixed
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	16,477.940	16,477.940	16,477.940	4.035.334
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	
(12) Slag	0.000	0.000	0.000	
(13) Char	0.000	0.000	0.000	
(14) NaCl	0.000	0.000	0.000	
Total NMW solid, lb/hr	0.000	0.0000	0.000	1,101.047
Total rate, lb/hr	344,336.594	344,336.594	344,336.594	73,839.954
Temperature, °F	240.000	350.000	641.785	291.536
Pressure, psia	306.000	304.000	300.000	412.700
Enthalpy, MM Btu/hr	37.669	51.059	87.174	18.619
Molecular weight*	20.897	20.897	20.897	18.026
Mole frac vapor*	1.000	1.000	1.000	0.000
Mole frac liquid*	0.000	0.000	0.000	0.000
Weight frac NMW solid	0.000	0.000	0.000	0.015
——— VAPOR ———				
Flow, M ft^3/hr	407.980	475.593	655.061	N/A
Cp, Btu/lb-f	0.353	0.355	0.364	N/A
Density, lb/m ft^3	844.000	724.015	525.656	N/A
TH cond, Btu/hr-ft-f	0.03776	0.04148	0.05134	N/A
Viscosity, cp	0.01960	0.02200	0.02774	N/A
——— LIQUID ———				
Flow, gal/min	N/A	N/A	N/A	164.949
CP, Btu/lb-f	N/A	N/A	N/A	1.001
Density, lb/ft^3	N/A	N/A	N/A	54.979
Surface tension, dyne/cm	N/A	N/A	N/A	49.4396
Thermal cond, Btu/hr-ft-f	N/A	N/A	N/A	0.39542
Viscosity, cp	N/A	N/A	N/A	0.19161
——— SOLID ———				
CP, Btu/lb-f	N/A	N/A	N/A	0.245
Density, lb/ft^3	N/A	N/A	N/A	147.058

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SYNGAS COOLER SECTION 92127-PFD-23-2

Stream ID:	413	414
Name:	N_2 from STM Preheater	N_2 from RG/NE
Phase:	Vapor	Vapor
Fluid rates, lb-mol/hr		
(1) CO	0.000	0.000
(2) H_2	0.000	0.000
(3) CO_2	0.000	0.000
(4) H_2O	0.000	0.000
(5) C_1	0.000	0.000
(6) AR	0.000	0.000
(7) N_2	17,714.299	17,714.299
(8) H_2S	0.000	0.000
(9) COS	0.000	0.000
(10) O_2	178.920	178.920
Total fluid, lb-mol/hr	17,893.219	17,893.219
NMW solid rates, lb/hr		
(11) Coal	0.000	0.000
(12) Slag	0.000	0.000
(13) Char	0.000	0.000
(14) NaCl	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000
Total rate, lb/hr	501,964.375	501,964.375
Temperature, °F	356.000	635.961
Pressure, psia	275.000	270.000
Enthalpy, MM Btu/hr	36.241	72.124
Molecular weight*	28.053	28.053
Mole frac vapor*	1.000	1.000
Mole frac liquid*	0.000	0.000
Weight frac NMW solid	0.000	0.000
——— VAPOR ———		
Flow, M ft^3/hr	576.255	786.758
Cp, Btu/lb-f	0.254	0.258
Density, lb/m ft^3	871.076	638.013
TH cond, Btu/hr-ft-f	0.02077	0.02634
Viscosity, cp	0.02418	0.02975
——— LIQUID ———		
Flow, gal/min	N/A	N/A
CP, Btu/lb-f	N/A	N/A
Density, lb/ft^3	N/A	N/A
Surface tension, dyne/cm	N/A	N/A
Thermal cond, Btu/hr-ft-f	N/A	N/A
Viscosity, cp	N/A	N/A
——— SOLID ———		
CP, Btu/lb-f	N/A	N/A
Density, lb/ft^3	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SYNGAS SCRUBBING SECTION 92127-PFD-23-3

Stream ID:	501	502	503	504
Name:	Syngas at Scrubber Exit	Syngas at Scrubber Exit	Scrubber Blowdown	Scrubber Blowdown
Phase:	Vapor	Vapor	Mixed	Mixed
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	10,216.742	10,227.614	1,175.078	1,175.078
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000		
(12) Slag	0.000	0.000		
(13) Char	0.000	0.000		
(14) NaCl	0.000	0.000		
Total NMW solid, lb/hr	0.000	0.000	1,114.839	1,114.839
Total rate, lb/hr	214,122.656	214,318.438	22,296.787	22,296.787
Temperature, °F	288.494	288.828	292.703	293.035
Pressure, psia	355.000	355.000	359.900	359.900
Enthalpy, MM Btu/hr	60.214	60.470	4.688	4.694
Molecular weight*	20.958	20.955	18.026	18.026
Mole frac vapor*	1.000	1.000	0.000	0.000
Mole frac liquid*	0.000	0.000	1.000	1.000
Weight frac NMW solid	0.000	0.000	0.050	0.050
—— VAPOR ——				
Flow, M ft^3/hr	230.718	231.049	N/A	N/A
Cp, Btu/lb-f	0.371	0.372	N/A	N/A
Density, lb/m ft^3	928.068	927.583	N/A	N/A
TH cond, Btu/hr-ft-f	0.03557	0.03557	N/A	N/A
Viscosity, cp	0.01958	0.01959	N/A	N/A
—— LIQUID ——				
Flow, gal/min	N/A	N/A	48.079	48.079
CP, Btu/lb-f	N/A	N/A	1.002	1.002
Density, lb/ft^3	N/A	N/A	54.928	54.916
Surface tension, dyne/cm	N/A	N/A	49.3071	49.2698
Thermal cond, Btu/hr-ft-f	N/A	N/A	0.39537	0.39536
Viscosity, cp	N/A	N/A	0.19075	0.19052
—— SOLID ——				
CP, Btu/lb-f	N/A	N/A	0.247	0.247
Density, lb/ft^3	N/A	N/A	148.265	148.265

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SYNGAS SCRUBBING SECTION 92127-PFD-23-3

Stream ID:	505	506	507	508
Name:	Water to Scrubber Circ. Pump	Water to Scrubber Circ. Pump	Grey Water to RSC Sump	Water to Nozzle Scrubber
Phase:	Mixed	Mixed	Mixed	Mixed
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	15,783.267	15,783.957	1,939.664	13,844.166
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	660.700	660.694	81.193	579.508
Total NMW solid, lb/hr	660.700	660.694	81.193	579.508
Total rate, lb/hr	285,168.406	285,180.688	35,045.398	250,133.203
Temperature, °F	292.703	293.035	292.860	292.860
Pressure, psia	359.900	359.900	449.700	449.700
Enthalpy, MM Btu/hr	75.452	75.550	9.285	66.272
Molecular weight*	18.026	18.026	18.026	18.026
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.002	0.002	0.002	0.002
——— VAPOR ———				
Flow, M ft^3/hr	N/A	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A	N/A
——— LIQUID ———				
Flow, gal/min	645.773	645.944	79.352	533.367
CP, Btu/lb-f	1.002	1.002	1.001	1.001
Density, lb/ft^3	54.928	54.916	54.934	54.934
Surface tension, dyne/cm	49.3071	49.2698	49.2894	49.2894
Thermal cond, Btu/hr-ft-f	0.39537	0.39536	0.39537	0.39537
Viscosity, cp	0.19075	0.19052	0.19064	0.19064
——— SOLID ———				
CP, Btu/lb-f	0.220	0.220	0.220	0.220
Density, lb/ft^3	134.600	134.600	134.600	134.600

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SYNGAS SCRUBBING SECTION 92127-PFD-23-3

Stream ID:	509	510	511	512
Name:	Grey Water to RSC Sump	Water to Nozzle Scrubber	Grey Water to Scrubber	Grey Water to Scrubber
Phase:	Mixed	Mixed	Mixed	Mixed
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	1,939.663	13,844.263	1,722.710	1,722.710
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	81.191	579.500	64.498	64.498
Total NMW solid, lb/hr	81.191	579.500	64.498	64.498
Total rate, lb/hr	35,045.352	250,134.781	31,118.065	31,118.065
Temperature, °F	293.210	293.210	169.229	169.229
Pressure, psia	449.700	449.700	419.700	419.700
Enthalpy, MM Btu/hr	9.297	66.360	4.013	4.013
Molecular weight*	18.026	18.026	18.016	18.016
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.002	0.002	0.002	0.002
——— VAPOR ———				
Flow, M ft^3/hr	N/A	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A	N/A
——— LIQUID ———				
Flow, gal/min	79.370	566.502	65.508	65.508
CP, Btu/lb-f	1.002	1.002	0.999	0.999
Density, lb/ft^3	54.922	54.922	59.101	59.101
Surface tension, dyne/cm	49.2500	49.2500	62.8065	62.8065
Thermal cond, Btu/hr-ft-f	0.39536	0.39536	0.38231	0.38231
Viscosity, cp	0.19039	0.19039	0.36162	0.36162
——— SOLID ———				
CP, Btu/lb-f	0.220	0.220	0.220	0.220
Density, lb/ft^3	134.600	134.600	134.600	134.600

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SYNGAS SCRUBBING SECTION 92127-PFD-23-3

Stream ID:	517
Name:	Cond to Scrubber Sump
Phase:	
Fluid rates, lb-mol/hr	
(1) CO	
(2) H_2	
(3) CO_2	
(4) H_2O	
(5) C_1	
(6) AR	
(7) N_2	
(8) H_2S	
(9) COS	
(10) O_2	
Total fluid, lb-mol/hr	
NMW solid rates, lb/hr	
(11) Coal	
(12) Slag	
(13) Char	
(14) NaCl	
Total NMW solid, lb/hr	
Total rate, lb/hr	
Temperature, °F	
Pressure, psia	
Enthalpy, MM Btu/hr	
Molecular weight*	
Mole frac vapor*	
Mole frac liquid*	
Weight frac NMW solid	
——— VAPOR ———	
Flow, M ft^3/hr	
Cp, Btu/lb-f	
Density, lb/m ft^3	
TH cond, Btu/hr-ft-f	
Viscosity, cp	
——— LIQUID ———	
Flow, gal/min	
CP, Btu/lb-f	
Density, lb/ft^3	
Surface tension, dyne/cm	
Thermal cond, Btu/hr-ft-f	
Viscosity, cp	
——— SOLID ———	
CP, Btu/lb-f	
Density, lb/ft^3	

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
LOW TEMPERATURE GAS COOLING 92127-PFD-23-4

Stream ID:	601	602	603	604
Name:	Mixed Syngas at Scrubber Exit	Syngas at LTGC Exch 1 Exit	Syngas at LTGC Exch 2 Inlet	Syngas at LTGC Exch 2 Exit
Phase:	Vapor	Mixed	Vapor	Mixed
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	20,444.357	20,444.357	19,614.621	19,697.883
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	428,441.094	428,441.094	413,484.531	414,984.531
Temperature, °F	288.154	269.956	269.956	190.000
Pressure, psia	335.000	330.000	330.000	322.500
Enthalpy, MM Btu/hr	120.684	104.085	100.446	51.594
Molecular weight*	20.956	20.956	21.080	21.068
Mole frac vapor*	1.000	0.959	1.000	0.887
Mole frac liquid*	0.000	0.041	0.000	0.113
Weight frac NMW solid	0.000	0.000	0.000	0.000
——— VAPOR ———				
Flow, M ft^3/hr	489.016	465.799	465.798	380.180
Cp, Btu/lb-f	0.371	0.365	0.365	0.348
Density, lb/m ft^3	876.125	887.687	887.687	986.263
TH cond, Btu/hr-ft-f	0.03555	0.03551	0.03551	0.03463
Viscosity, cp	0.01957	0.01939	0.01939	0.01823
——— LIQUID ———				
Flow, gal/min	N/A	33.450	N/A	85.437
CP, Btu/lb-f	N/A	0.994	N/A	0.993
Density, lb/ft^3	N/A	55.743	N/A	58.406
Surface tension, dyne/cm	N/A	51.8480	N/A	60.5295
Thermal cond, Btu/hr-ft-f	N/A	0.39528	N/A	0.38610
Viscosity, cp	N/A	0.20876	N/A	0.31402
——— SOLID ———				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
LOW TEMPERATURE GAS COOLING 92127-PFD-23-4

Stream ID:	605	606	607	608
Name:	Syngas at LTGC Exch 3 Inlet	Syngas at LTGC Exch 3 Exit	Syngas to Acid Gas Wash	Cond fro LTGC KC
Phase:	Vapor	Mixed	Vapor	Liquid
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	17,477.909	17,616.680	16,997.705	829.738
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	374,959.906	377,459.969	366,291.031	14,956.571
Temperature, °F	190.000	105.000	105.000	269.956
Pressure, psia	322.500	317.500	317.500	330.000
Enthalpy, MM Btu/hr	45.026	25.332	24.461	3.639
Molecular weight*	21.453	21.426	21.549	18.026
Mole frac vapor*	1.000	0.965	1.000	0.000
Mole frac liquid*	0.000	0.035	0.000	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
——— VAPOR ———				
Flow, M ft^3/hr	380.180	325.590	325.590	N/A
Cp, Btu/lb-f	0.348	0.344	0.344	N/A
Density, lb/m ft^3	986.263	1,125.002	1,125.002	N/A
TH cond, Btu/hr-ft-f	0.03463	0.03228	0.03228	N/A
Viscosity, cp	0.01823	0.01635	0.01635	N/A
——— LIQUID ———				
Flow, gal/min	N/A	22.828	N/A	33.452
CP, Btu/lb-f	N/A	1.039	N/A	0.994
Density, lb/ft^3	N/A	60.998	N/A	55.743
Surface tension, dyne/cm	N/A	69.6382	N/A	51.8480
Thermal cond, Btu/hr-ft-f	N/A	0.36112	N/A	0.39528
Viscosity, cp	N/A	0.63733	N/A	0.20876
——— SOLID ———				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
LOW TEMPERATURE GAS COOLING 92127-PFD-23-4

Stream ID:	609	610	611	612
Name:	NH_3 Stripper Bottoms	Cond from LTGC KO 2	Cond from LTGC KO 3	Cond to NH_3 Stripper Preheater
Phase:	Vapor	Mixed	Vapor	Mixed
Fluid rates, lb-mol/hr				
(1) CO	0.000			
(2) H_2	0.000			
(3) CO_2	0.000			
(4) H_2O	4,232.026			
(5) C_1	0.000			
(6) AR	0.000			
(7) N_2	0.000			
(8) H_2S	0.000			
(9) COS	0.000			
(10) O_2	0.000			
Total fluid, lb-mol/hr	4,232.026	2,219.974	618.975	1,808.269
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	76,241.133	40,024.621	11,168.896	32,628.486
Temperature, °F	250.459	190.000	105.000	105.060
Pressure, psia	30.000	322.500	317.500	295.500
Enthalpy, MM Btu/hr	17.024	6.569	0.871	2.544
Molecular weight*	18.015	18.029	18.044	18.044
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
——— VAPOR ———				
Flow, M ft^3/hr	N/A	N/A	N/A	7.426E-04
Cp, Btu/lb-f	N/A	N/A	N/A	0.340
Density, lb/m ft^3	N/A	N/A	N/A	1,060.391
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	0.03189
Viscosity, cp	N/A	N/A	N/A	0.01635
——— LIQUID ———				
Flow, gal/min	168.489	85.437	22.828	66.691
CP, Btu/lb-f	0.991	0.993	1.039	1.039
Density, lb/ft^3	56.415	58.406	60.998	60.995
Surface tension, dyne/cm	54.0326	60.5295	69.6382	69.6334
Thermal cond, Btu/hr-ft-f	0.39509	0.38610	0.36112	0.36116
Viscosity, cp	0.22755	0.31402	0.63733	0.63694
——— SOLID ———				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
LOW TEMPERATURE GAS COOLING 92127-PFD-23-4

Stream ID:	613	614	615	616
Name:	Cond from NH_3 Stripper	Cond to Cond Pump	Sour Water from AGR	Cond from Cond Pump
Phase:	Mixed	Liquid	Mixed	Liquid
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	1,808.269	3,488.696	213.600	3,488.696
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	32,628.486	62,858.438	3,877.271	62,858.438
Temperature, °F	197.699	218.714	180.000	218.856
Pressure, psia	290.500	317.500	50.000	414.700
Enthalpy, MM Btu/hr	5.597	12.107	0.599	12.134
Molecular weight*	18.044	18.018	18.152	18.018
Mole frac vapor*	0.000	0.000	0.006	0.000
Mole frac liquid*	1.000	1.000	0.994	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
——— VAPOR ———				
Flow, M ft^3/hr	4.585E-03	N/A	0.165	N/A
Cp, Btu/lb-f	0.296	N/A	0.239	N/A
Density, lb/m ft^3	1,108.942	N/A	286.370	N/A
TH cond, Btu/hr-ft-f	0.02648	N/A	0.01415	N/A
Viscosity, cp	0.01845	N/A	0.01669	N/A
——— LIQUID ———				
Flow, gal/min	69.953	136.282	8.134	136.267
CP, Btu/lb-f	0.991	0.988	0.996	0.988
Density, lb/ft^3	58.144	57.505	58.703	57.511
Surface tension, dyne/cm	59.6745	57.4777	61.6027	57.4624
Thermal cond, Btu/hr-ft-f	0.38698	0.39159	0.38418	0.39161
Viscosity, cp	0.29921	0.26606	0.33520	0.26586
——— SOLID ———				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
LOW TEMPERATURE GAS COOLING 92127-PFD-23-4

Stream ID:	617	618	619	620
Name:	Makeup to Cond Drum	Recycle Cond to Grinding	NH_3 Stripper Over Head	NH_3 Stripper Reflux to Pump
Phase:	Liquid	Liquid	Mixed	Liquid
Fluid rates, lb-mol/hr				
(1) CO	0.000	0.000		
(2) H_2	0.000	0.000		
(3) CO_2	0.000	0.000		
(4) H_2O	195.503	600.000		
(5) C_1	0.000	0.000		
(6) AR	0.000	0.000		
(7) N_2	0.000	0.000		
(8) H_2S	0.000	0.000		
(9) COS	0.000	0.000		
(10) O_2	0.000	0.000		
Total fluid, lb-mol/hr	195.503	600.000	9.816	7,918.206
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	3,522.043	10,809.167	289.243	142,654.641
Temperature, °F	179.000	210.406	180.000	235.797
Pressure, psia	414.700	340.000	25.000	26.000
Enthalpy, MM Btu/hr	0.541	1.994	0.090	29.781
Molecular weight*	18.015	18.015	29.465	18.016
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.000	0.0	0.000	0.000
——— VAPOR ———				
Flow, M ft^3/hr	N/A	N/A	2.189	N/A
Cp, Btu/lb-f	N/A	N/A	0.273	N/A
Density, lb/m ft^3	N/A	N/A	117.336	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	0.01708	N/A
Viscosity, cp	N/A	N/A	0.01605	N/A
——— LIQUID ———				
Flow, gal/min	7.468	23.321	6.883E-02	312.506
CP, Btu/lb-f	0.995	0.988	0.996	0.989
Density, lb/ft^3	58.796	57.786	58.718	56.912
Surface tension, dyne/cm	61.7599	58.3842	61.6341	55.6321
Thermal cond, Btu/hr-ft-f	0.38461	0.39056	0.38459	0.39379
Viscosity, cp	0.33791	0.27856	0.33549	0.24383
——— SOLID ———				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
LOW TEMPERATURE GAS COOLING 92127-PFD-23-4

Stream ID:	621	622	623	624
Name:	NH_3 Stripper Reflux from Cooler	Purge to Cond Drum	Spray to LTGC Exch 2	Condensate to Cond Drum
Phase:	Liquid	Liquid	Liquid	Liquid
Fluid rates, lb-mol/hr				
(1) CO		0.000	0.000	0.000
(2) H_2		0.000	0.000	0.000
(3) CO_2		0.000	0.000	0.000
(4) H_2O	7,917.925	241.462	83.263	2,221.993
(5) C_1	0.000	0.000	0.000	0.000
(6) AR	0.000	0.000	0.000	0.000
(7) N_2	0.000	0.000	0.000	0.000
(8) H_2S	0.118	0.000	0.000	0.000
(9) COS	0.000	0.000	0.000	0.000
(10) O_2	0.000	0.000	0.000	0.000
Total fluid, lb-mol/hr	7,918.206	241.462	83.263	2,221.993
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	142,654.641	4,350.000	1,500.000	40,029.820
Temperature, °F	139.730	150.000	210.406	210.406
Pressure, psia	36.000	400.000	340.000	340.000
Enthalpy, MM Btu/hr	16.128	0.542	0.277	7.386
Molecular weight*	18.016	18.015	18.015	18.015
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
—— VAPOR ——				
Flow, M ft^3/hr	N/A	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A	N/A
—— LIQUID ——				
Flow, gal/min	296.550	9.085	3.236	86.365
CP, Btu/lb-f	1.014	1.007	0.988	0.988
Density, lb/ft^3	59.974	59.693	57.786	57.786
Surface tension, dyne/cm	65.9726	64.8707	58.3842	58.3842
Thermal cond, Btu/hr-ft-f	0.37412	0.37721	0.39056	0.39056
Viscosity, cp	0.45602	0.41857	0.27856	0.27856
—— SOLID ——				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
LOW TEMPERATURE GAS COOLING 92127-PFD-23-4

Stream ID:	625	626	627	628
Name:	Stripper Btms to Cooler	Spray to LTGC Exch 3	NH_3 Stripper Btms from Preheater	AGR Wash Water Blowdown
Phase:	Liquid	Liquid	Liquid	Liquid
Fluid rates, lb-mol/hr				
(1) CO	0.000	0.000	0.000	
(2) H_2	0.000	0.000	0.000	
(3) CO_2	0.000	0.000	0.000	
(4) H_2O	1,188.000	138.771	4,232.026	
(5) C_1	0.000	0.000	0.000	
(6) AR	0.000	0.000	0.000	
(7) N_2	0.000	0.000	0.000	
(8) H_2S	0.000	0.000	0.000	
(9) COS	0.000	0.000	0.000	
(10) O_2	0.000	0.000	0.000	
Total fluid, lb-mol/hr	1,188.000	138.771	4,232.026	1,189.293
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	21,402.150	2,500.000	76,241.133	21,459.590
Temperature, °F	210.406	210.406	210.000	105.058
Pressure, psia	340.000	340.000	28.000	295.500
Enthalpy, MM Btu/hr	3.949	0.461	13.971	1.673
Molecular weight*	18.015	18.015	18.015	18.044
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
—— VAPOR ——				
Flow, M ft^3/hr	N/A	N/A	N/A	4.724E-04
Cp, Btu/lb-f	N/A	N/A	N/A	0.340
Density, lb/m ft^3	N/A	N/A	N/A	1,059.945
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	0.03190
Viscosity, cp	N/A	N/A	N/A	0.01635
—— LIQUID ——				
Flow, gal/min	46.176	5.394	164.545	43.862
CP, Btu/lb-f	0.988	0.988	0.990	1.039
Density, lb/ft^3	57.786	57.786	57.768	60.995
Surface tension, dyne/cm	58.3842	58.3842	58.4280	69.6337
Thermal cond, Btu/hr-ft-f	0.39056	0.39056	0.39049	0.36116
Viscosity, cp	0.27856	0.27856	0.27919	0.63696
—— SOLID ——				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
LOW TEMPERATURE GAS COOLING 92127-PFD-23-4

Stream ID:	629	630	631	632
Name:	Clean Gas from LTGC Preheater	Clean Gas to TGTU	NH_3 Stripper Bottoms to Reboiler	NH_3 Stripper Bottoms from Reboiler
Phase:	Vapor		Liquid	Mixed
Fluid rates, lb-mol/hr				
(1) CO			0.000	0.000
(2) H_2			0.000	0.000
(3) CO_2			0.000	0.000
(4) H_2O			5,290.700	5,290.700
(5) C_1			0.000	0.000
(6) AR			0.000	0.000
(7) N_2			0.000	0.000
(8) H_2S			0.000	0.000
(9) COS			0.000	0.000
(10) O_2			0.000	0.000
Total fluid, lb-mol/hr	16,477.940		5,290.700	5,290.700
NMW solid rates, lb/hr				
(11) Coal	0.000		0.000	0.000
(12) Slag	0.000		0.000	0.000
(13) Char	0.000		0.000	0.000
(14) NaCl	0.000		0.000	0.000
Total NMW solid, lb/hr	0.000		0.000	0.000
Total rate, lb/hr	344,336.594	DELETED	95,313.453	95,313.453
Temperature, °F	240.000		249.459	250.249
Presre, psia	306.000		30.000	30.000
Enthalpy, MM Btu/hr	37.669		21.188	39.203
Molecular weight*	20.897		18.015	18.015
Mole frac vapor*	1.000		0.000	0.197
Mole frac liquid*	0.000		1.000	0.803
Weight frac NMW solid	0.000		0.000	0.000
——— VAPOR ———				
Flow, M ft^3/hr	407.980		N/A	261.418
Cp, Btu/lb-f	0.353		N/A	0.460
Density, lb/m ft^3	844.000		N/A	71.982
TH cond, Btu/hr-ft-f	0.03776		N/A	0.02042
Viscosity, cp	0.01960		N/A	0.01362
——— LIQUID ———				
Flow, gal/min	N/A		210.510	169.052
CP, Btu/lb-f	N/A		0.991	0.991
Density, lb/ft^3	N/A		56.450	56.415
Surface tension, dyne/cm	N/A		54.1422	54.0326
Thermal cond, Btu/hr-ft-f	N/A		0.39501	0.39509
Viscosity, cp	N/A		0.22859	0.22754
——— SOLID ———				
CP, Btu/lb-f	N/A		N/A	N/A
Density, lb/ft^3	N/A		N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
BLACK WATER FLASH SECTION 92127-PFD-23-5

Stream ID:	701	702	703	704
Name:	RSC & Scrubber Blowdown	Black Water from Dewatering Sump	Vac Flash Btms to Pump	Sour Gas from Brine Concentration
Phase:	Mixed	Mixed	Mixed	Vapor
Fluid rates, lb-mol/hr				
(1) CO		0.000	0.000	0.000
(2) H_2		0.000	0.000	0.000
(3) CO_2		0.000		
(4) H_2O		1,571.495	7,266.316	96.999
(5) C_1		0.000	0.000	0.000
(6) AR		0.000	0.000	0.000
(7) N_2		0.000	0.000	0.000
(8) H_2S		0.000		
(9) COS		0.000	0.000	0.000
(10) O_2		0.000	0.000	0.000
Total fluid, lb-mol/hr	6,385.377	1,571.495	7,266.320	97.181
NMW solid rates, lb/hr				
(11) Coal				
(12) Slag				
(13) Char				
(14) NaCl				
Total NMW solid, lb/hr	3,330.528	903.701	4,234.426	0.000
Total rate, lb/hr	118,433.528	29,214.628	135,137.182	1,754.506
Temperature, °F	292.057	177.333	179.579	179.858
Pressure, psia	359.900	32.000	7.500	7.500
Enthalpy, MM Btu/hr	28.000	3.641	17.449	2.028
Molecular weight*	18.026	18.015	18.015	18.054
Mole frac vapor*	0.000	0.000	0.000	1.000
Mole frac liquid*	1.000	1.000	1.000	0.000
Weight frac NMW solid	0.028	0.031	0.031	0.000
——— VAPOR ———				
Flow, M ft^3/hr	N/A	N/A	N/A	88.688
Cp, Btu/lb-f	N/A	N/A	N/A	0.451
Density, lb/m ft^3	N/A	N/A	N/A	19.783
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	0.01732
Viscosity, cp	N/A	N/A	N/A	0.01203
——— LIQUID ———				
Flow, gal/min	261.145	60.014	277.844	N/A
CP, Btu/lb-f	1.002	0.997	0.996	N/A
Density, lb/ft^3	54.952	58.814	58.739	N/A
Surface tension, dyne/cm	49.3806	61.9387	61.6978	N/A
Thermal cond, Btu/hr-ft-f	0.39540	0.38423	0.38474	N/A
Viscosity, cp	0.19123	0.34174	0.33659	N/A
——— SOLID ———				
CP, Btu/lb-f	0.245	0.248	0.246	N/A
Density, lb/ft^3	147.436	148.757	147.933	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
BLACK WATER FLASH SECTION 92127-PFD-23-5

Stream ID:	705	706	707	708
Name:	Vac Flash Over Head	Vapor to Vac Flash Condenser	Vapor from Vac Flash Condenser	Vapor from Vac Cond KO Drum
Phase:	Vapor	Vapor	Mixed	Vapor
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	690.991	788.172	788.172	17.408
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	12,510.974	14,258.031	14,258.031	375.795
Temperature, °F	179.579	179.627	164.579	164.579
Pressure, psia	7.500	7.500	7.000	7.000
Enthalpy, MM Btu/hr	14.198	17.188	2.236	0.291
Molecular weight*	18.106	18.090	18.090	21.587
Mole frac vapor*	1.000	1.000	0.021	1.000
Mole frac liquid*	0.000	0.000	0.979	0.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
——— VAPOR ———				
Flow, M ft^3/hr	628.993	717.494	13.226	16.600
Cp, Btu/lb-f	0.449	0.450	0.379	0.379
Density, lb/m ft^3	19.890	19.872	22.639	22.639
TH cond, Btu/hr-ft-f	0.01734.	0.01734	0.01799	0.01799
Viscosity, cp	0.01207	0.01206	0.01324	0.01324
——— LIQUID ———				
Flow, gal/min	N/A	N/A	29.393	N/A
CP, Btu/lb-f	N/A	N/A	1.002	N/A
Density, lb/ft^3	N/A	N/A	59.208	N/A
Surface tension, dyne/cm	N/A	N/A	63.3047	N/A
Thermal cond, Btu/hr-ft-f	N/A	N/A	0.38114	N/A
Viscosity, cp	N/A	N/A	0.37403	N/A
——— SOLID ———				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
BLACK WATER FLASH SECTION 92127-PFD-23-5

Stream ID:	709	710	711	712
Name:	Sour Gas from Vac Pump	Cond to Vac Cond KO Drum Pump	Cond from Vac Pump	Vac Pump Purge
Phase:	Vapor	Liquid	Liquid	Liquid
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	4.922	770.752	116.564	104.078
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	150.020	13,885.868	2,100.775	1,875.000
Temperature, °F	150.000	164.579	150.000	150.000
Pressure, psia	25.000	7.000	25.000	100.000
Enthalpy, MM Btu/hr	0.035	2.035	0.259	0.232
Molecular weight*	30.477	18.016	18.023	18.015
Mole frac vapor*	1.000	0.000	0.000	0.000
Mole frac liquid*	0.000	1.000	1.000	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
——— VAPOR ———				
Flow, M ft^3/hr	1.284	N/A	N/A	N/A
Cp, Btu/lb-f	0.273	N/A	N/A	N/A
Density, lb/m ft^3	116.857	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	0.02063	N/A	N/A	N/A
Viscosity, cp	0.01604	N/A	N/A	N/A
——— LIQUID ———				
Flow, gal/min	N/A	29.240	4.391	3.918
CP, Btu/lb-f	N/A	1.002	1.009	1.008
Density, lb/ft^3	N/A	59.208	59.649	59.667
Surface tension, dyne/cm	N/A	63.3047	64.8493	64.8707
Thermal cond, Btu/hr-ft-f	N/A	0.38114	0.37698	0.37721
Viscosity, cp	N/A	0.37403	0.41834	0.41857
——— SOLID ———				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
GREY WATER HANDLING SECTION 92127-PFD-23-6

	801 Settler Bottoms to Pump Mixed	802 Settler Over Flow Mixed	803 Grey Water to HP Grey Water Pump Mixed	804 Grey Water to LP Grey Water Pump Mixed
, lb-mol/hr				
(1) CO	0.000	0.000		0.000
(2) H_2	0.000	0.000		0.000
(3) CO_2	0.000			
(4) H_2O	822.968	7,369.177	3,447.263	5,468.736
(5) C_1	0.000	0.000	0.000	0.000
(6) AR	0.000	0.000	0.000	0.000
(7) N_2	0.000	0.000	0.000	0.000
(8) H_2S	0.000			
(9) COS	0.000	0.000	0.000	0.000
(10) O_2	0.000	0.000	0.000	0.000
Total fluid, lb-mol/hr	822.969	7,369.181	3,447.332	5,468.739
NMW solid rates, lb/hr				
(11) Coal				
(12) Slag				
(13) Char				
(14) NaCl				
Total NMW solid, lb/hr	3,767.683	527.924	128.997	398.927
Total rate, lb/hr	18,593.703	133,283.931	62,236.126	98,919.824
Temperature, °F	179.672	179.672	168.811	179.672
Pressure, psia	39.000	20.000	20.000	20.000
Enthalpy, MM Btu/hr	0.789	16.676	7.938	12.398
Molecular weight*	18.015	18.015	18.016	18.015
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.203	0.004	0.002	0.004
——— VAPOR ———				
Flow, M ft^3/hr	N/A	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A	N/A
——— LIQUID ———				
Flow, gal/min	31.469	281.783	131.070	209.963
CP, Btu/lb-f	0.996	0.996	1.000	0.996
Density, lb/ft^3	58.738	58.738	59.007	58.738
Surface tension, dyne/cm	61.6878	61.6878	62.8513	61.6878
Thermal cond, Btu/hr-ft-f	0.38476	0.38476	0.38220	0.38476
Viscosity, cp	0.33639	0.33639	0.36271	0.33639
——— SOLID ———				
CP, Btu/lb-f	0.250	0.220	0.220	0.220
Density, lb/ft^3	149.722	134.600	134.600	134.600

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
GREY WATER HANDLING SECTION 92127-PFD-23-6

Stream ID:	805	806	807
Name:	Grey Water to Brine Concentration	Grey Water to Lock Hopper	Grey Water Tank Make-up
Phase:	Mixed	Mixed	Liquid
Fluid rates, lb-mol/hr			
(1) CO	0.000	0.000	0.000
(2) H_2	0.000	0.000	0.000
(3) CO_2			0.000
(4) H_2O	2,990.838	2,477.896	612.080
(5) C_1	0.000	0.000	0.000
(6) AR	0.000	0.000	0.000
(7) N_2	0.000	0.000	0.000
(8) H_2S			0.000
(9) COS	0.000	0.000	0.000
(10) O_2	0.000	0.000	0.000
Total fluid, lb-mol/hr	2,990.840	2,477.898	612.080
NMW solid rates, lb/hr			
(11) Coal	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000
(14) NaCl	214.707	184.220	0.000
Total NMW solid, lb/hr	214.707	184.220	0.000
Total rate, lb/hr	54,095.568	44,824.273	11,026.789
Temperature, °F	179.705	179.705	150.000
Pressure, psia	50.000	50.000	100.000
Enthalpy, MM Btu/hr	5.640	6.768	1.363
Molecular weight*	18.015	18.015	18.015
Mole frac vapor*	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000
Weight frac NMW solid	0.004	0.004	0.000
—— VAPOR ——			
Flow, M ft^3/hr	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A
—— LIQUID ——			
Flow, gal/min	114.819	94.749	23.041
CP, Btu/lb-f	0.996	0.996	1.008
Density, lb/ft^3	58.739	58.739	59.667
Surface tension, dyne/cm	61.6843	61.6843	64.8707
Thermal cond, Btu/hr-ft-f	0.38476	0.38476	0.37721
Viscosity, cp	0.33631	0.33631	0.41857
—— SOLID ——			
CP, Btu/lb-f	0.220	0.220	N/A
Density, lb/ft^3	134.600	134.600	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SLAG HANDLING SECTION 92127-PFD-23-7

Stream ID:	901	902	903	904
Name:	Slag Water to Lock Hopper	Slag Water from Lock Hopper	Black Water to Slag Dewatering Sump	Water to Lock Hopper Circ Pump
Phase:	Mixed	Mixed	Mixed	Mixed
Fluid rates, lb-mol/hr				
(1) CO	0.000	0.000	0.000	0.000
(2) H_2	0.000	0.000	0.000	0.000
(3) CO_2	0.000	0.000	0.000	0.000
(4) H_2O	2,883.162	2,188.749	1,571.495	3,172.309
(5) C_1	0.000	0.000	0.000	0.000
(6) AR	0.000	0.000	0.000	0.000
(7) N_2	0.000	0.000	0.000	0.000
(8) H_2S	0.000	0.000	0.000	0.000
(9) COS	0.000	0.000	0.000	0.000
(10) O_2	0.000	0.000	0.000	0.000
Total fluid, lb-mol/hr	2,883.162	2,188.749	1,571.495	3,172.309
NMW solid rates, lb/hr				
(11) Coal				
(12) Slag				
(13) Char				
(14) NaCl				
Total NMW solid, lb/hr	12,121.219	12,069.590	903.701	235.849
Total rate, lb/hr	64,062.190	51,500.516	29,214.628	57,385.891
Temperature, °F	224.795	177.301	177.301	177.301
Pressure, psia	412.700	14.700	14.700	412.700
Enthalpy, MM Btu/hr	5.438	0.919	3.638	8.586
Molecular weight*	18.015	18.015	18.015	18.015
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.189	0.234	0.031	0.004
—— VAPOR ——				
Flow, M ft^3/hr	N/A	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A	N/A
—— LIQUID ——				
Flow, gal/min	112.971	83.859	60.016	121.076
CP, Btu/lb-f	0.987	0.997	0.997	0.996
Density, lb/ft^3	57.322	58.812	58.812	58.849
Surface tension, dyne/cm	56.8289	61.9422	61.9422	61.9422
Thermal cond, Btu/hr-ft-f	0.39257	0.38422	0.38422	0.38422
Viscosity, cp	0.25775	0.34182	0.34182	0.34182
—— SOLID ——				
CP, Btu/lb-f	0.249	0.250	0.248	0.220
Density, lb/ft^3	149.714	149.782	148.757	134.600

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
SLAG HANDLING SECTION 92127-PFD-23-7

Stream ID:	905	906	907
Name:	Slag from Dewatering Bin	Grey Water to Lock Hopper Cooler	Grey Water from Lock Hopper Cooler
Phase:	Mixed	Mixed	Mixed
Fluid rates, lb-mol/hr			
(1) CO	0.000	0.000	0.000
(2) H_2	0.000	0.000	0.000
(3) CO_2	0.000		0.000
(4) H_2O	617.254	2,477.896	2,477.896
(5) C_1	0.000	0.000	0.000
(6) AR	0.000	0.000	0.000
(7) N_2	0.000	0.000	0.000
(8) H_2S	0.001	0.001	0.000
(9) COS	0.000	0.000	0.000
(10) O_2	0.000	0.000	0.000
Total fluid, lb-mol/hr	617.254	2,477.898	2,477.896
NMW solid rates, lb/hr			
(11) Coal			
(12) Slag			
(13) Char			
(14) NaCl			
Total NMW solid, lb/hr	11,165.890	184.220	184.222
Total rate, lb/hr	22,285.891	44,824.277	44,824.223
Temperature, °F	177.301	179.705	120.000
Pressure, psia	14.700	50.000	14.700
Enthalpy, MM Btu/hr	-2.719	6.768	4.070
Molecular weight*	18.015	18.015	18.015
Mole frac vapor*	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000
Weight frac NMW solid	0.501	0.004	0.004
——— VAPOR ———			
Flow, M ft^3/hr	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A
——— LIQUID ———			
Flow, gal/min	23.573	94.749	91.882
CP, Btu/lb-f	0.997	0.996	1.027
Density, lb/ft^3	58.812	58.739	60.572
Surface tension, dyne/cm	61.9422	61.6843	68.1048
Thermal cond, Btu/hr-ft-f	0.38422	0.38476	0.36760
Viscosity, cp	0.34182	0.33631	0.54703
——— SOLID ———			
Solid, CP, Btu/lb-f	0.220	0.220	0.220
Density, lb/ft^3	149.929	134.600	134.600

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
FINES HANDLING SECTION 92127-PFD-23-8

Stream ID:	1001	1002	1003	1004
Name:	Settler Btms from Pump	Settler Btms to Filter Feed Pump	Filter Cake to Pad	Filtrate to Pump
Phase:		Mixed	Mixed	Mixed
Fluid rates, lb-mol/hr				
(1) CO		0.000	0.000	0.000
(2) H_2		0.000	0.000	0.000
(3) CO_2		0.000	0.000	0.000
(4) H_2O		822.968	205.742	925.839
(5) C_1		0.000	0.000	0.000
(6) AR		0.000	0.000	0.000
(7) N_2		0.000	0.000	0.000
(8) H_2S		0.000	0.000	0.000
(9) COS		0.000	0.000	0.000
(10) O_2		0.000	0.000	0.000
Total fluid, lb-mol/hr		822.969	205.742	925.839
NMW solid rates, lb/hr				
(11) Coal		0.000	0.000	0.000
(12) Slag		0.000	0.000	0.000
(13) Char		3,706.499	3,706.499	0.000
(14) NaCl		61.184	0.000	61.184
Total NMW solid, lb/hr		3,767.683	3,706.499	61.184
Total rate, lb/hr		18,593.703	7,413.000	16,740.451
Temperature, °F		179.798	180.261	180.261
Pressure, psia		14.700	14.700	14.700
Enthalpy, MM Btu/hr		0.791	-0.886	2.539
Molecular weight*		18.015	18.015	18.015
Mole frac vapor*		0.000	0.000	0.000
Mole frac liquid*		1.000	1.000	1.000
Weight frac NMW solid		0.203	0.500	0.004
——— VAPOR ———				
Flow, M ft^3/hr		N/A	N/A	N/A
Cp, Btu/lb-f		N/A	N/A	N/A
Density, lb/m ft^3		N/A	N/A	N/A
TH cond, Btu/hr-ft-f		N/A	N/A	N/A
Viscosity, cp		N/A	N/A	N/A
——— LIQUID ———				
Flow, gal/min		31.742	7.870	35.414
CP, Btu/lb-f		0.996	0.996	0.996
Density, lb/ft^3		58.733	58.719	58.719
Surface tension, dyne/cm		61.6743	61.6246	61.6246
Thermal cond, Btu/hr-ft-f		0.38478	0.38489	0.38489
Viscosity, cp		0.33610	0.33506	0.33506
——— SOLID ———				
CP, Btu/lb-f		0.250	0.250	0.220
Density, lb/ft^3		149.722	150.000	134.600

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
FINES HANDLING SECTION 92127-PFD-23-8

Stream ID:	1005
Name:	Filter Purge
Phase:	Liquid
Fluid rates, lb-mol/hr	
(1) CO	0.000
(2) H_2	0.000
(3) CO_2	0.000
(4) H_2O	308.613
(5) C_1	0.000
(6) AR	0.000
(7) N_2	0.000
(8) H_2S	0.000
(9) COS	0.000
(10) O_2	0.000
Total fluid, lb-mol/hr	308.613
NMW solid rates, lb/hr	
(11) Coal	0.000
(12) Slag	0.000
(13) Char	0.000
(14) NaCl	0.000
Total NMW solid, lb/hr	0.000
Total rate, lb/hr	5,559.749
Temperature, °F	179.000
Pressure, psia	414.700
Enthalpy, MM Btu/hr	0.854
Molecular weight*	18.015
Mole frac vapor*	0.000
Mole frac liquid*	1.000
Weight frac NMW solid	0.000
——— VAPOR ———	
Flow, M ft^3/hr	N/A
Cp, Btu/lb-f	N/A
Density, lb/m ft^3	N/A
TH cond, Btu/hr-ft-f	N/A
Viscosity, cp	N/A
——— LIQUID ———	
Flow, gal/min	11.789
CP, Btu/lb-f	0.995
Density, lb/ft^3	58.796
Surface tension, dyne/cm	61.7599
Thermal cond, Btu/hr-ft-f	0.38461
Viscosity, cp	0.33791
——— SOLID ———	
CP, Btu/lb-f	N/A
Density, lb/ft^3	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
ACID GAS REMOVAL SECTION 92127-PFD-25-1A

	1301 Syngas to Acid Gas Absorber Vapor	1302 Clean Gas from AGR Mixed	1303 AGR Wash Water to Pump Mixed	1304 Stripper Btms to AGR Wash Tower Liquid
lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
Total fluid, lb-mol/hr	16,996.413	16,477.940	5,558.638	1,188.000
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	366,233.625	344,336.594	100,299.984	21,402.152
Temperature, °F	105.000	105.000	105.058	105.000
Pressure, psia	315.500	310.000	295.500	330.000
Enthalpy, MM Btu/hr	24.464	21.068	7.821	1.676
Molecular weight*	21.548	20.897	18.044	18.015
Mole frac vapor*	1.000	0.999	0.000	0.000
Mole frac liquid*	0.000	0.001	1.000	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
—— VAPOR ——				
Flow, M ft^3/hr	327.621	323.478	2.208E-03	N/A
Cp, Btu/lb-f	0.344	0.351	0.340	N/A
Density, lb/m ft^3	1117.853	1063.757	1059.946	N/A
TH cond, Btu/hr-ft-f	0.03228	0.03319	0.03190	N/A
Viscosity, cp	0.01635	0.01641	0.01635	N/A
—— LIQUID ——				
Flow, gal/min	N/A	0.476	205.009	43.708
CP, Btu/lb-f	N/A	1.039	1.039	1.038
Density, lb/ft^3	N/A	61.009	60.995	61.049
Surface tension, dyne/cm	N/A	69.6631	69.6337	69.7353
Thermal cond, Btu/hr-ft-f	N/A	0.36132	0.36116	0.36205
Viscosity, cp	N/A	0.63771	0.63696	0.63898
—— SOLID ——				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
ACID GAS REMOVAL SECTION 92127-PFD-25-1A/B

Stream ID:	1305	1306	1307	1308
Name:	Rich Amine from Absorber	Lean Amine to Tankage	Carbon Filter Bypass	Amine to Carbon Filter
Phase:	Liquid	Liquid	Liquid	Liquid
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
(11) MDEA				
Total fluid, lb-mol/hr	12,052.574	11,493.223	10,847.316	1,205.257
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	383,507.873	360,887.708	345,157.086	38,350.787
Temperature, °F	130.915	105.000	130.915	130.915
Pressure, psia	315.500	14.700	280.500	280.500
Enthalpy, MM Btu/hr (1)	-223.497	-219.220	-201.147	-22.350
Molecular weight*	31.820	31.400	31.820	31.820
Mole frac vapor*	0.000	0.000	0.000	0.000
Mole frac liquid*	1.000	1.000	1.000	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
—— VAPOR ——				
Flow, M ft^3/hr	N/A	N/A	N/A	N/A
Cp, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/m ft^3	N/A	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	N/A	N/A
Viscosity, cp	N/A	N/A	N/A	N/A
—— LIQUID ——				
Flow, gal/min	752.094	700.113	676.885	75.209
CP, Btu/lb-f	0.835	0.814	0.835	0.835
Density, lb/ft^3	63.570	64.262	63.570	63.570
Surface tension, dyne/cm	45.205	47.217	45.205	45.205
Thermal cond, Btu/hr-ft-f	0.200	0.194	0.200	0.200
Viscosity, cp	3.215	5.355	3.215	3.215
—— SOLID ——				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

(1) REFERENCE 70°F

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
ACID GAS REMOVAL SECTION 92127-PFD-25-1A/B

Stream ID:	1309	1310	1311	1312
Name:	Lean Amine to Absorber	Rich Amine to Stripper	Stripper Overhead	Steam Condensate Make-up
Phase:	Liquid	Liquid	Vapor	Liquid
Fluid rates, lb-mol/hr				
(1) CO				
(2) H_2				
(3) CO_2				
(4) H_2O				
(5) C_1				
(6) AR				
(7) N_2				
(8) H_2S				
(9) COS				
(10) O_2				
(11) MDEA				
Total fluid, lb-mol/hr	11,562.935	12,052.574	1,171.649	39.532
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	362,160.890	383,507.873	33,651.071	711.571
Temperature, °F	105.015	223.000	213.496	105.000
Pressure, psia	329.700	265.500	27.700	19.700
Enthalpy, MM Btu/hr (1)	-220.495	-191.577	1.431	-0.720
Molecular weight*	31.321	31.820	28.721	18.000
Mole frac vapor*	0.000	0.000	1.000	0.000
Mole frac liquid*	1.000	1.000	0.000	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
—— VAPOR ——				
Flow, M ft^3/hr	N/A	N/A	305.249	N/A
Cp, Btu/lb-f	N/A	N/A	0.303	N/A
Density, lb/m ft^3	N/A	N/A	110.241	N/A
TH cond, Btu/hr-ft-f	N/A	N/A	0.015	N/A
Viscosity, cp	N/A	N/A	0.015	N/A
—— LIQUID ——				
Flow, gal/min	702.588	771.274	N/A	1.434
CP, Btu/lb-f	0.814	0.887	N/A	0.998
Density, lb/ft^3	64.262	61.989	N/A	61.881
Surface tension, dyne/cm	47.215	38.057	N/A	69.454
Thermal cond, Btu/hr-ft-f	0.195	0.209	N/A	0.365
Viscosity, cp	5.315	1.155	N/A	0.646
—— SOLID ——				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

(1) REFERENCE 70°F

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
ACID GAS REMOVAL SECTION 92127-PFD-25-1A

Stream ID:	1313	1314	1315	1316
Name:	Acid Gas to H_2SO_4 Plant	Stripper Reflux	Stripper Bottoms	Cooled Stripper Bottoms
Phase:	Vapor	Liquid	Liquid	Liquid
Fluid rates, lb-mol/hr				
(1) CO	1.543			
(2) H_2	1.107			
(3) CO_2	406.239			
(4) H_2O	27.765			
(5) C_1	0.007			
(6) AR	0.000			
(7) N_2	0.157			
(8) H_2S	122.613			
(9) COS	0.015			
(10) O_2	0.000			
(11) MDEA	0.000			
Total fluid, lb-mol/hr	559.447	612.270	11,493.127	11,493.127
NMW solid rates, lb/hr				
(11) Coal	0.000	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000	0.000
Total NMW solid, lb/hr	0.000	0.000	0.000	0.000
Total rate, lb/hr	22,608.457	11,045.908	360,899.417	360,899.417
Temperature, °F	110.000	110.004	257.843	162.826
Pressure, psia	25.700	25.700	29.700	19.700
Enthalpy, MM Btu/hr (1)	0.195	-11.179	-169.186	-201.107
Molecular weight*	40.412	18.041	31.401	31.401
Mole frac vapor*	1.000	0.000	0.000	0.000
Mole frac liquid*	0.000	1.000	1.000	1.000
Weight frac NMW solid	0.000	0.000	0.000	0.000
—— VAPOR ——				
Flow, M ft^3/hr	132.943	N/A	N/A	N/A
Cp, Btu/lb-f	0.218	N/A	N/A	N/A
Density, lb/m ft^3	170.061	N/A	N/A	N/A
TH cond, Btu/hr-ft-f	0.010	N/A	N/A	N/A
Viscosity, cp	0.015	N/A	N/A	N/A
—— LIQUID ——				
Flow, gal/min	N/A	21.476	728.638	715.671
CP, Btu/lb-f	N/A	0.818	0.898	0.857
Density, lb/ft^3	N/A	64.120	61.748	62.867
Surface tension, dyne/cm	N/A	46.828	35.352	42.728
Thermal cond, Btu/hr-ft-f	N/A	0.368	0.209	0.205
Viscosity, cp	N/A	0.560	1.079	1.969
—— SOLID ——				
CP, Btu/lb-f	N/A	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A	N/A

(1) REFERENCE 70°F

* SOLIDS FREE BASIS

HEAT AND MATERIAL BALANCE - PITT 8, NOC
ACID GAS REMOVAL SECTION 92127-PFD-25-1A

Stream ID:	1317	1318	1319
Name:	Stripper Reboiler Feed	Reboiler Vapor Return	Reboiler Liquid Retrun
Phase:	Liquid	Vapor	Liquid
Fluid rates, lb-mol/hr			
(1) CO			
(2) H_2			
(3) CO_2			
(4) H_2O			
(5) C_1			
(6) AR			
(7) N_2			
(8) H_2S			
(9) COS			
(10) O_2			
(11) MDEA			
Total fluid, lb-mol/hr	13,517.089	2,023.962	11,493.127
NMW solid rates, lb/hr			
(11) Coal	0.000	0.000	0.000
(12) Slag	0.000	0.000	0.000
(13) Char	0.000	0.000	0.000
(14) NaCl	0.000	0.000	0.000
Total NMW solid; lb/hr	0.000	0.000	0.000
Total rate, lb/hr	397,7673.805	36,774.379	360,899.426
Temperature, °F	256.119	257.843	257.843
Pressure, psia	29.533	29.700	29.700
Enthalpy, MM Btu/hr (1)	-201.090	3.097	-169.186
Molecular weight*	29.420	18.170	31.401
Mole frac vapor*	0.000	1.000	0.000
Mole frac liquid*	1.000	0.000	1.000
Weight frac NMW solid	0.000	0.000	0.000
——— VAPOR ———			
Flow, M ft^3/hr	N/A	524.190	N/A
Cp, Btu/lb-f	N/A	0.454	N/A
Density, lb/m ft^3	N/A	70.155	N/A
TH cond, Btu/hr-ft-f	N/A	0.018	N/A
Viscosity, cp	N/A	0.013	N/A
——— LIQUID ———			
Flow, gal/min	802.789	N/A	728.638
CP, Btu/lb-f	0.898	N/A	0.898
Density, lb/ft^3	61.756	N/A	61.748
Surface tension, dyne/cm	35.486	N/A	35.352
Thermal cond, Btu/hr-ft-f	0.223	N/A	0.209
Viscosity, cp	0.962	N/A	1.079
——— SOLID ———			
CP, Btu/lb-f	N/A	N/A	N/A
Density, lb/ft^3	N/A	N/A	N/A

(1) REFERENCE 70°F

* SOLIDS FREE BASIS

GENERAL ARRANGEMENT DRAWINGS

9.0 GENERAL ARRANGEMENT DRAWINGS

9.1 SITE PLOT PLAN

92127-EM-001B	IGCC Unit Overall Plot Plan

9.2 GASIFICATION STRUCTURE ARRANGEMENT

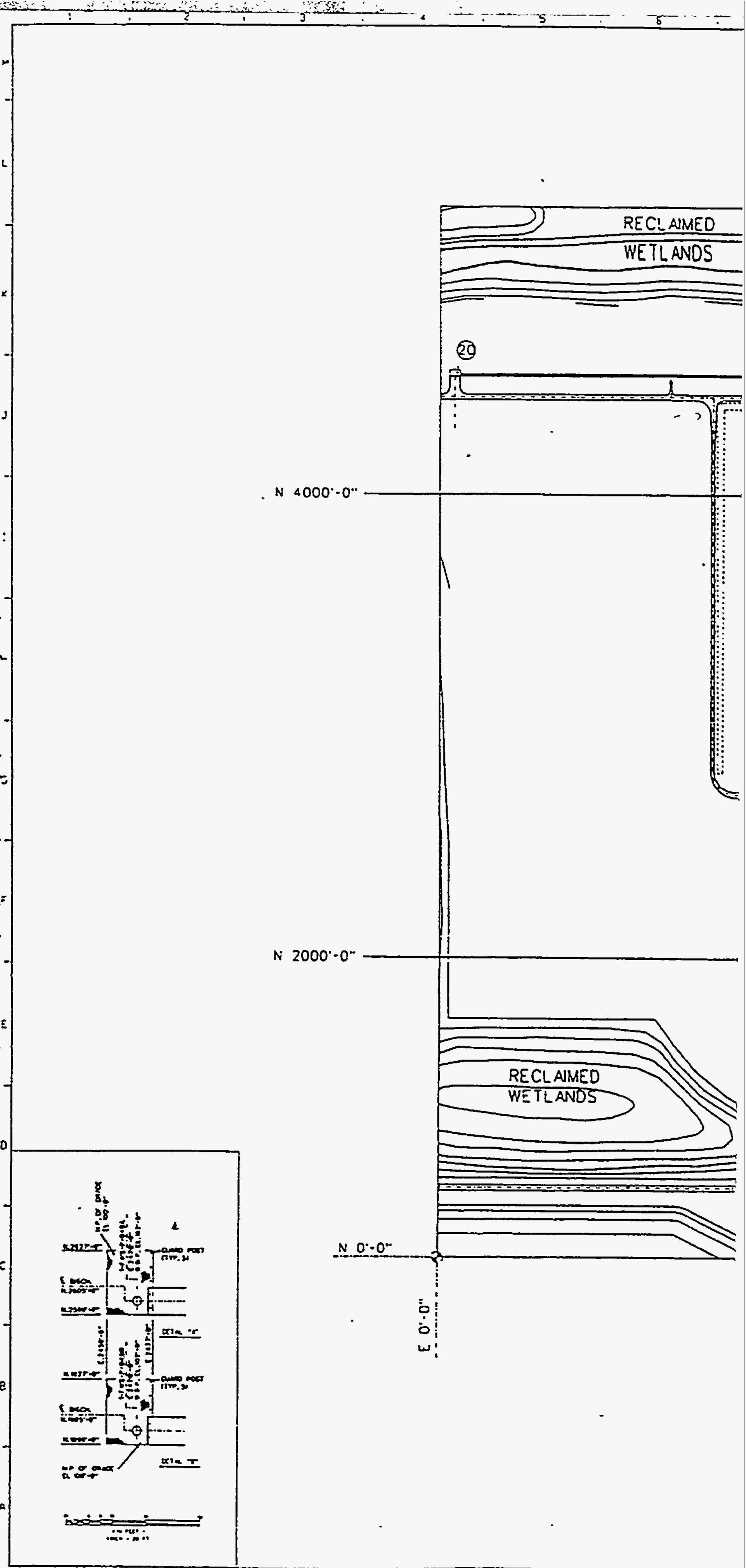
92127-SK-011	Gasifier Planning Study

9.3 POWER BLOCK ARRANGEMENT DRAWINGS

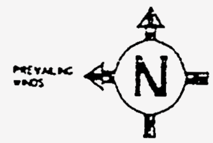
92127-EM-161A	Area Plot Plan - Power Block
M010	Equipment Arrangement (sheet 1) Equipment Arrangement (sheet 2) Sections and Elevations

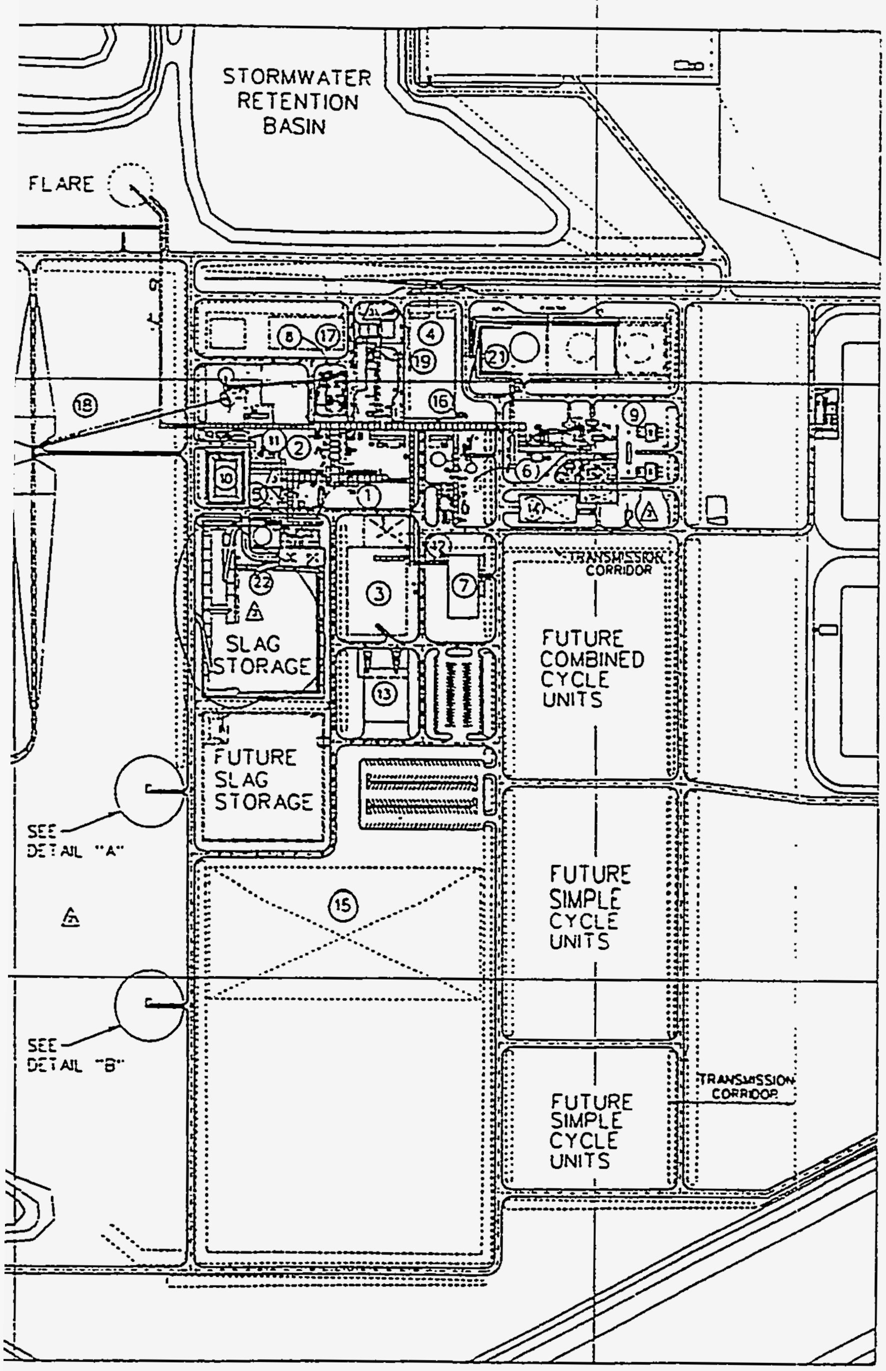
9.4 AIR SEPARATION UNIT PLOT PLAN

92127-EY-241A	Facility Arrangement



RECLAIMED
WETLANDS
20
N 4000'-0"
N 2000'-0"
RECLAIMED
WETLANDS
N 0'-0"
E 0'-0"





NOTES

1. BECHTEL COORDINATE N.0'-0", E.0'-0" EQUALS FLORIDA STATE PLANE COORDINATES N.1,230,000, E.656,000.
2. H.P. FINISHED GRADE EL. 100'-0" EQUALS TRUE PLANT EL. 143'-6" MSL.

LEGEND

- LIGHT DUTY PAVING
- HEAVY DUTY PAVING
- GRAVEL
- BARRIERS
- ASPHALT
- SAFETY SHOWER/EYEWASH 50'-0" HOSE RADIUS INDICATED AT EACH STATION
- [W] SERVICE WATER
- [A] PLANT AIR
- [S] LOW PRESURE STEAM
- [N] LOW PRESURE NITROGEN
- [PW] POND WATER

PLOT AREA KEY

1. GASIFICATION
2. ACID GAS REMOVAL
3. AIR SEPARATION UNIT
4. SULFURIC ACID
5. HOT GAS CLEAN-UP
6. MAKE-UP WATER TREATING
7. CONTROL AND GENERAL SERVICES BUILDING
8. COAL GRINDING
9. CONSTRUCTION POWER FACILITIES
10. I.W.T. FACILITY AND HOLDING BASIN
11. SANITARY WASTE TREATMENT
12. 48V BATTERY,PBX AND RTU
13. WAREHOUSE
14. MAINT. SHOP
15. CONSTR. LAYDOWN AND TEMP. CONSTR PERSON PARKING
16. INSTR. AIR/PLANT AIR
17. FUTURE FUEL CELL
18. COAL UNLOADING
19. BRINE CONCENTRATION
20. PROPANE UNLOADING
21. FUEL OIL STORAGE
22. SLAG HANDLING

200 0 100 200 500 1000

(IN FEET)
1 INCH = 200 FT

NO.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPR
5								
4	8/28/95	Rev'd to reflect changes per DCN 053, Incl. C-006 & C-008						
3	3-20-95	REVISED AS NOTED						
2	3-2-95	REVISED AS NOTED						
1	11-18-94	ISSUE FOR CONSTRUCTION						

BECHTEL JOB NO. 22269

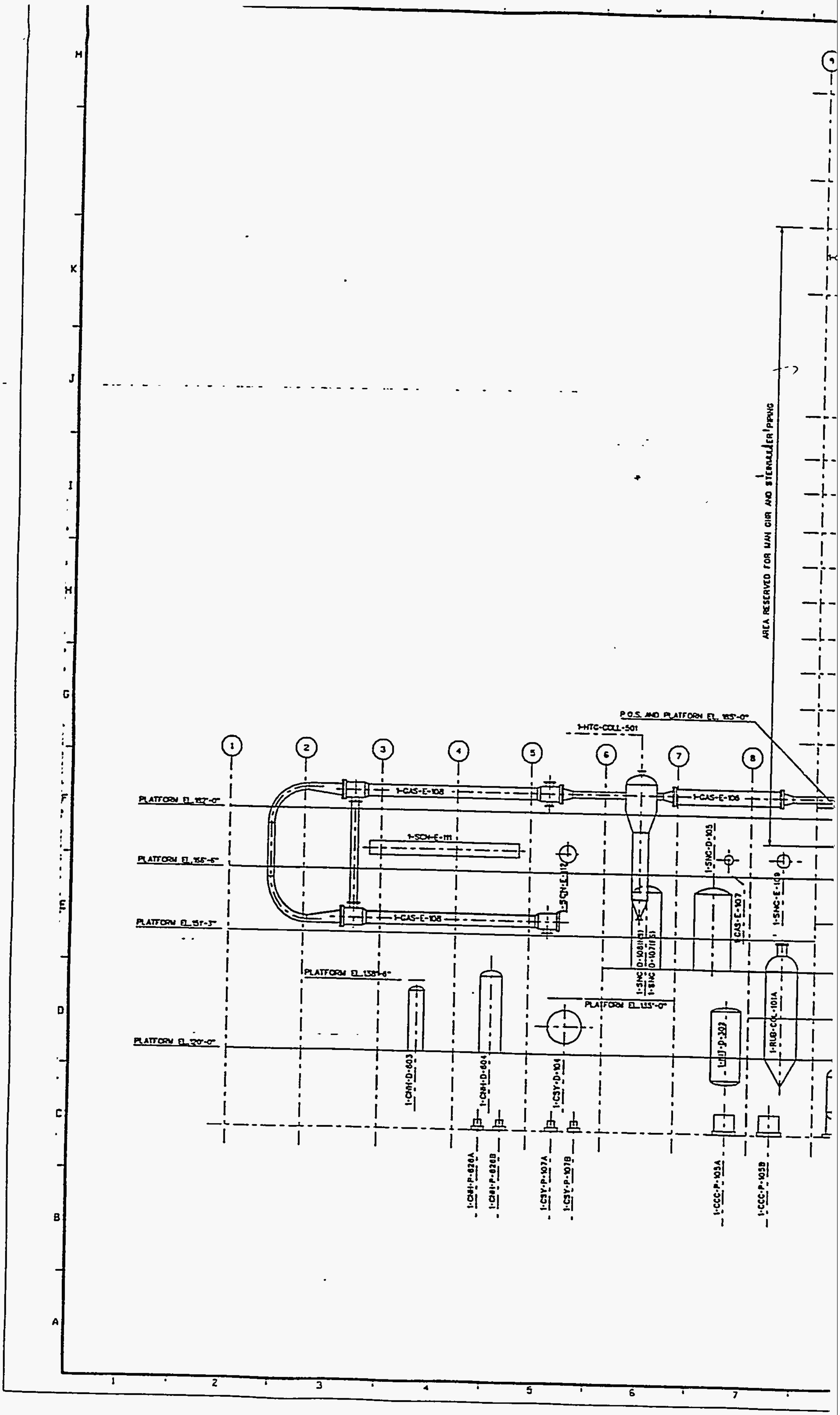
TAMPA ELECTRIC
A TECO ENERGY COMPANY

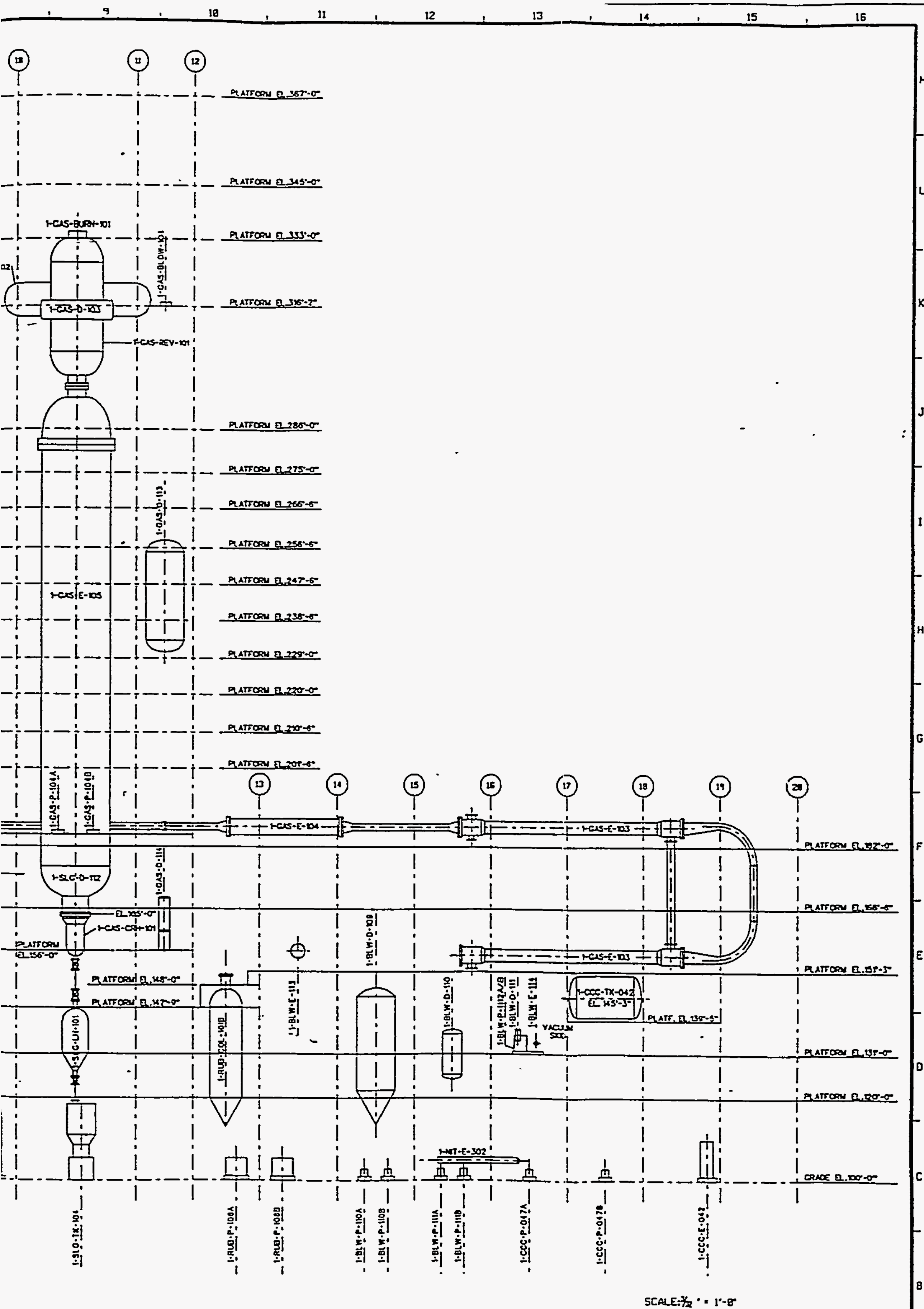
POLK POWER STATION UNIT # 1
I.G.C.C. UNIT
OVERALL PLOT PLAN

DRAWN / DATE
DESIGNED / DATE
CHECKED / DATE
APPROVED / DATE

DRAWING NO. 92127-EM-001B
REV. 3

TAMPA8OR.DWG 06/15/93


PLATFORM EL. 162'-0"
PLATFORM EL. 156'-6"
PLATFORM EL. 151'-3"
PLATFORM EL. 138'-6"
PLATFORM EL. 135'-0"
PLATFORM EL. 120'-0"
1-GAS-E-108
1-SCN-E-111
1-HTC-COLL-501
1-CNH-D-603
1-CNH-D-604
1-C3Y-D-104
1-CNH-P-626A
1-C3Y-P-107A
1-C3Y-P-107B
1-CCC-P-105A
1-CCC-P-105B
1-SNC-D-105



NO.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPR
A		ISSUE FOR INFORMATION ONLY						

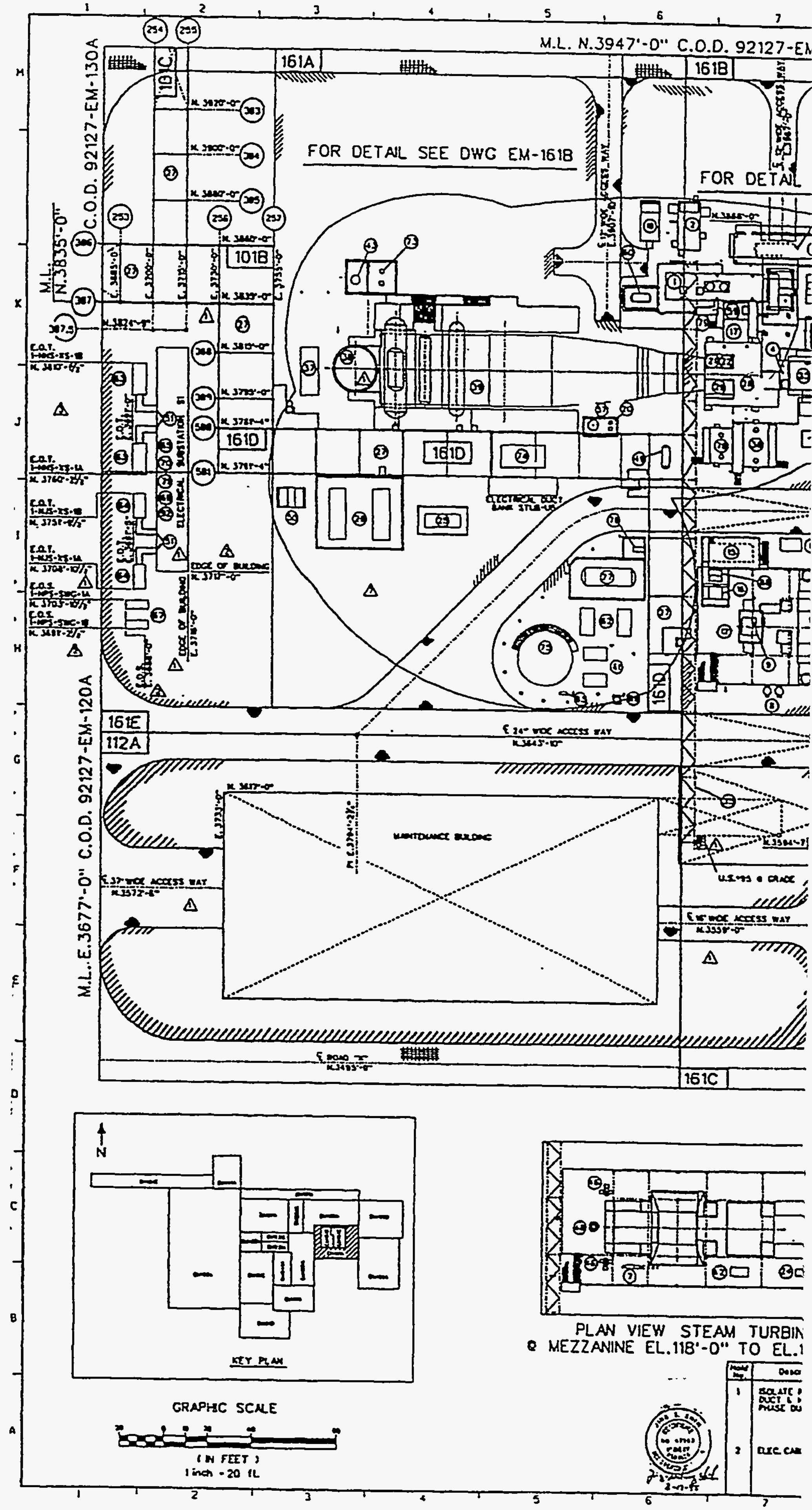
BECHTEL JOB NO. 22269

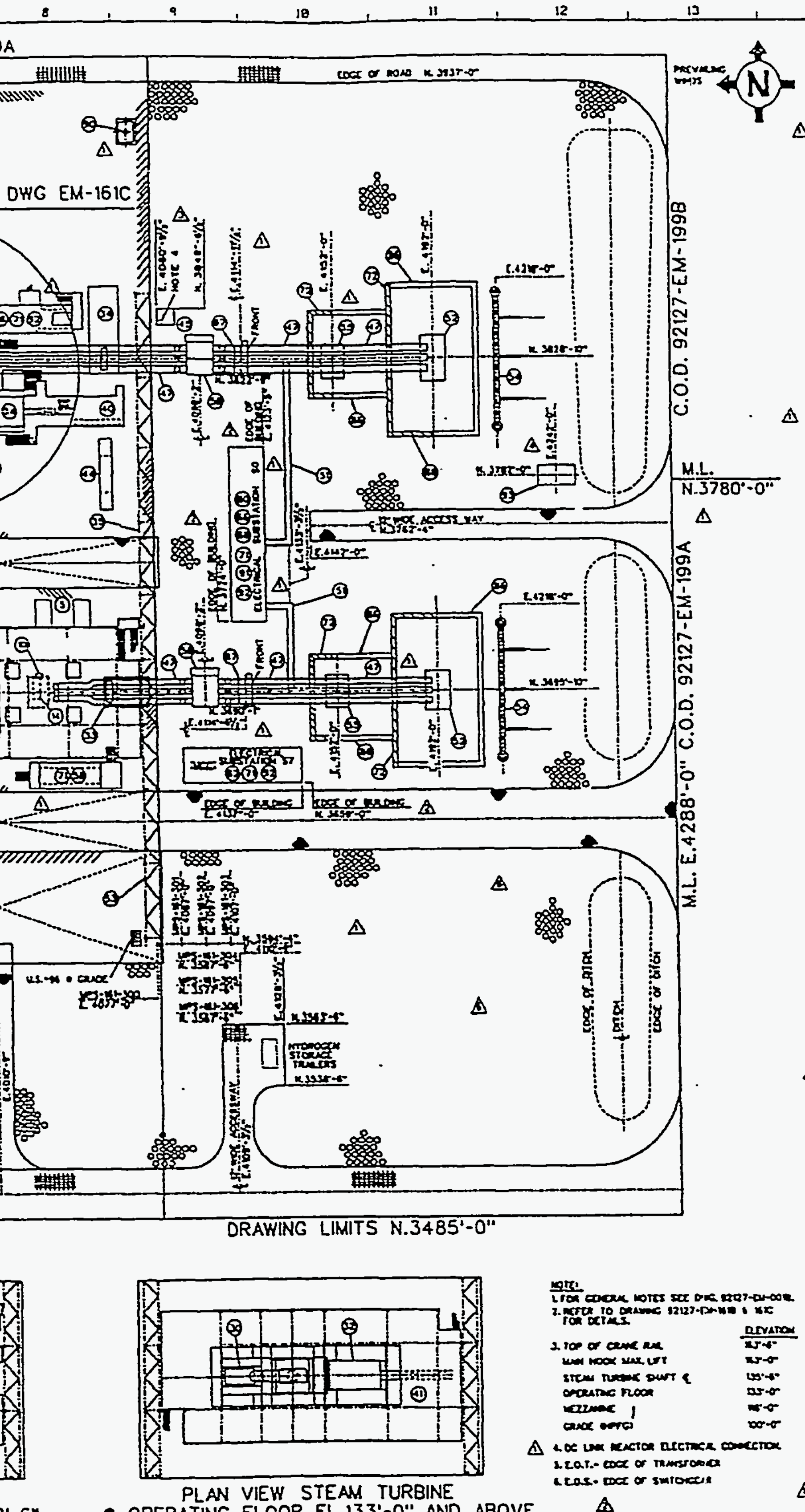
TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
GASIFICATION UNIT
SECTION STRUCTURE LOOKING NORTH

DRAWN MORROW DATE
DESIGNER OCHOA DATE
CHECKED DATE
APPROVED DATE

DRAWING NO. 92127-SK-011
REV. A


M.L. N.3947'-0" C.O.D. 92127-EM
C.O.D. 92127-EM-130A
M.L. N.3835'-0"
M.L. E.3677'-0" C.O.D. 92127-EM-120A
FOR DETAIL SEE DWG EM-161B
FOR DETAIL
161A
161B
161C
161D
161E
112A
101B
MAINTENANCE BUILDING
ELECTRICAL SUBSTATION
EDGE OF BUILDING
KEY PLAN
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.
PLAN VIEW STEAM TURBIN
@ MEZZANINE EL.118'-0" TO EL.1



NOTES:
1. FOR GENERAL NOTES SEE DWG. 92127-EM-001B.
2. REFER TO DRAWING 92127-EM-161B & 161C FOR DETAILS.

3.	ELEVATION
TOP OF CRANE RAIL	163'-6"
MAIN HOOK MAX. LIFT	163'-0"
STEAM TURBINE SHAFT ℄	135'-6"
OPERATING FLOOR	133'-0"
MEZZANINE	116'-0"
GRADE (HPFG)	100'-0"

4. DC LINK REACTOR ELECTRICAL CONNECTION.
5. E.O.T. - EDGE OF TRANSFORMER
6. E.O.S. - EDGE OF SWITCHGEAR

EQUIPMENT #	ITEM	DESCRIPTION
	1	GT. ACCESSORY MODULE
	2	GT. WATER INJECTION SKID
	3	GT. AIR INLET COMPARTMENT
	4	GT. LOAD COMPARTMENT
1-ARC-P-901A/B	5	VACUUM PUMP SKID A/B
1-FPL-D-901	6	CO2 FIRE PROTECTION TANK
1-TME-CND-901	7	GLAND STEAM CONDENSER
1-CNH-P-901A/B	8	CONDENSATE PUMPS
1-HAS-PKG-902	9	S.T. HYDRO. POWER UNIT COOLERS
1-GMO-BLOW-901	10	BEARING DRAIN EXHAUSTER
1-ARC-PKG-902	11	COND. WATERBOX VAC. PRIMING SKID
1-DET-D-902	12	CONDENSATE RECEIVER
1-PWR-E-901	13	CONDENSER
	14	ST. SEAL OIL UNIT
1-TLM-TK-901	15	S.T. LUBE OIL RESERVOIR
1-TML-V-901	16	S.T. LUBE OIL PURIFIER SKID
	17	GT. INTERCONNECTING MODULE
	18	GT. PEECC. & MARK V CONTROL CAB
	19	GT. WATER WASH SKID
1-DET-P-901A/B	20	CONDENSATE RETURN PUMPS
	21	GT. #2 BEARING BLOWERS
	22	GT. EXHAUST FRAME BLOWERS
	23	
	24	STG NEUTRAL GROUNDING COMPARTMT.
1-WTS-PKG-900	25	FEED WATER TREATMENT PACKAGE
1-FWT-P-901A/B	26	FEEDWATER TRANSFER PUMPS
	27	PIPE RACK
1-PWR-GTG-901	28	GAS TURBINE
	29	GT. COMPARTMENT VENT FANS
1-PWR-STG-901	30	STEAM TURBINE
	31	GAS TURBINE GENERATOR
	32	STEAM TURBINE GENERATOR
	33	STG. BUS ACC. COMPARTMENT (BAC)
	34	GT. BUS ACC. COMPARTMENT [illegible]
1-PWR-CRN-901	35	OVERHEAD CRANE
	36	GT. SYNGAS FUEL SKID
(BY TEC)	37	CONTINUOUS EMISSION MONITOR SYST.
	38	HRSG EXHAUST STACK
1-SHP-SG-901	39	HEAT RECOVERY STEAM GENERATOR
	40	GAS TURBINE WALKWAY
	41	STEAM TURBINE OPERATING FLOOR
	42	ST. HYDROGEN CONTROL CABINET
1-DET-D-901	43	HRSG BLOWDOWN TANK
	44	GT. ISO./EXCIT. TRANSFORMERS
	45	GT. DC. LINK REACTOR
	46	RE-HEAT INTERCEPT VALVES
1-GML-IPB-1A/B	47	ISOLATED PHASE BUS DUCT
	48	MAIN STEAM STOP VALVE
1-CCC-TK-901	49	POWER BLOCK CLOSED LOOP COOLING WTR. HEAD EXPANSION TK
1-HOL-P-901A/B	50	L.P. ECONOMIZER RECIRC. PUMPS
	51	NON SEGREGATED PHASE BUS DUCT
1-MTX-XM-1A/B	52	GAS TURBINE GSU TRANSFORMERS
	53	POWER BLOCK LAYDOWN SHED
(BY TEC)	54	GSU 230KV DEAD END TOWERS
1-STX-XHS-1A/B	55	GAS TURBINE SST TRANSFORMERS
1-GML-BKR-1A/B	56	GENERATOR BREAKERS
1-DET-D-903	57	CONDENSATE RETURN TANK
	58	ST. SPEDC. & MARK V CONTROL CAB
	59	GT. LUBE OIL DEMISTER
1-DET-TK-901	60	GAS TURBINE DRAINS TANK
1-CCC-E-901A/B	61	POWER BLOCK CLOSED LOOP HEAT EXCHANGER
1-CCC-P-901A/B	62	POWER BLOCK CLOSED LOOP COOLING WATER PUMPS
1-HMS-XS-1A/B	63	4160V TRANSFORMERS
1-HUS-XS-1A/B	64	480V TRANSFORMERS
1-HMS-SWG-1	65	4160 V SWITCHGEAR
1-HPS-SWG-A	66	13.8 KV SWITCHGEAR
1-HPS-SWG-1A/B	67	13.8KV FUSED SWITCH GEAR LINEUP
1-HMS-MCC-1STA1/2	68	STATION 480V MCC'S
1-HUS-HSE-1	69	ELECTRICAL SUBSTATION S1
1-HUS-US-1	70	480V SWITCHGEAR
	71	ITC (INTERMEDIATE TERMINAL CABINET)
	72	FIREWALL
1-DET-P-902A/B	73	HRSG BLOWDOWN SUMP PUMPS
1-WTS-A-901	74	STEAM/WATER SAMPLING AND MONITORING PANEL
1-CNH-TK-901	75	CONDENSATE STORAGE TANK
	76	GT. NITROGEN SKID
1-LOS-TK-901	77	CLEAN AND DIRTY L.O. TANK
1-LOS-P-901	78	LUBE OIL TRANSFER PUMP
	79	G.T. AIR PROCESS SKID
1-HUS-HSE-0	80	ELECTRICAL SUBSTATION S0
1-HAS-PKG 901	81	GAS TURBINE HYDRAULIC POWER UNIT COOLERS
1-HUS-HSE-7	82	ELECTRICAL SUBSTATION S7
1-CNH-P-902	83	CONDENSATE MAKE-UP PUMP
	84	GT. GEN. COLLECTOR COMPARTMENT
	85	G.T. GEN. TERMINAL ENCLOSURE
	86	TRANS. SUMP W/CRUSHED STONE
1-GML-XP-1A/B	87	LINE POTENTIAL TRANSFORMERS
1-TML-FLT-901	88	STEAM TURBINE DUPLEX LUBE OIL FILTER
1-CWS-FLT-901	89	POWER BLOCK OPEN LOOP COOLING WATER FILTER
1-WOW-P-901	90	POWER BLOCK OILY WATER SUMP PUMP
	91	RTU (REMOTE TERMINAL UNIT)
	92	DCS I/O CABINET
	93	DELUGE VALVE HOUSE #5

Description/Reason	Resp. Engr.	Release Date	Ref'd
... BUS ... SEGREGATED ... SUPPORTS	LK	8-22-94	LK 10-24-94
... TRAY RACKS	LK	8-22-94	LK 10-24-94

NO.	DATE	REVISIONS	BY	CHK'D	DESIGN SUPV	ENGR	PROJ ENGR	APPR
	5/3/95	REVISED AS NOTED INCORPORATES OCR# 762	MK	DS	WCK	JSS	MRE	JB
	9/11/95	Revised to show Equipment Outlines for EM-161B Drawing Area	RCB	[illegible]	[illegible]	[illegible]	[illegible]	
	7/21/95	For Hand. Chem. Storage Facility moved to Brine Concentration Area, See CY-314	RCB	WV	WCK	JSS	JET	ME
	3/20/95	REVISED AS NOTED INCORPORATES OCR# 36	MK	DRS	WCK	JSS	NOK	JB
	7/27/94	ISSUED FOR CONSTRUCTION	MK	CW	WCK		NOK	JB

BECHTEL JOB NO. 22269

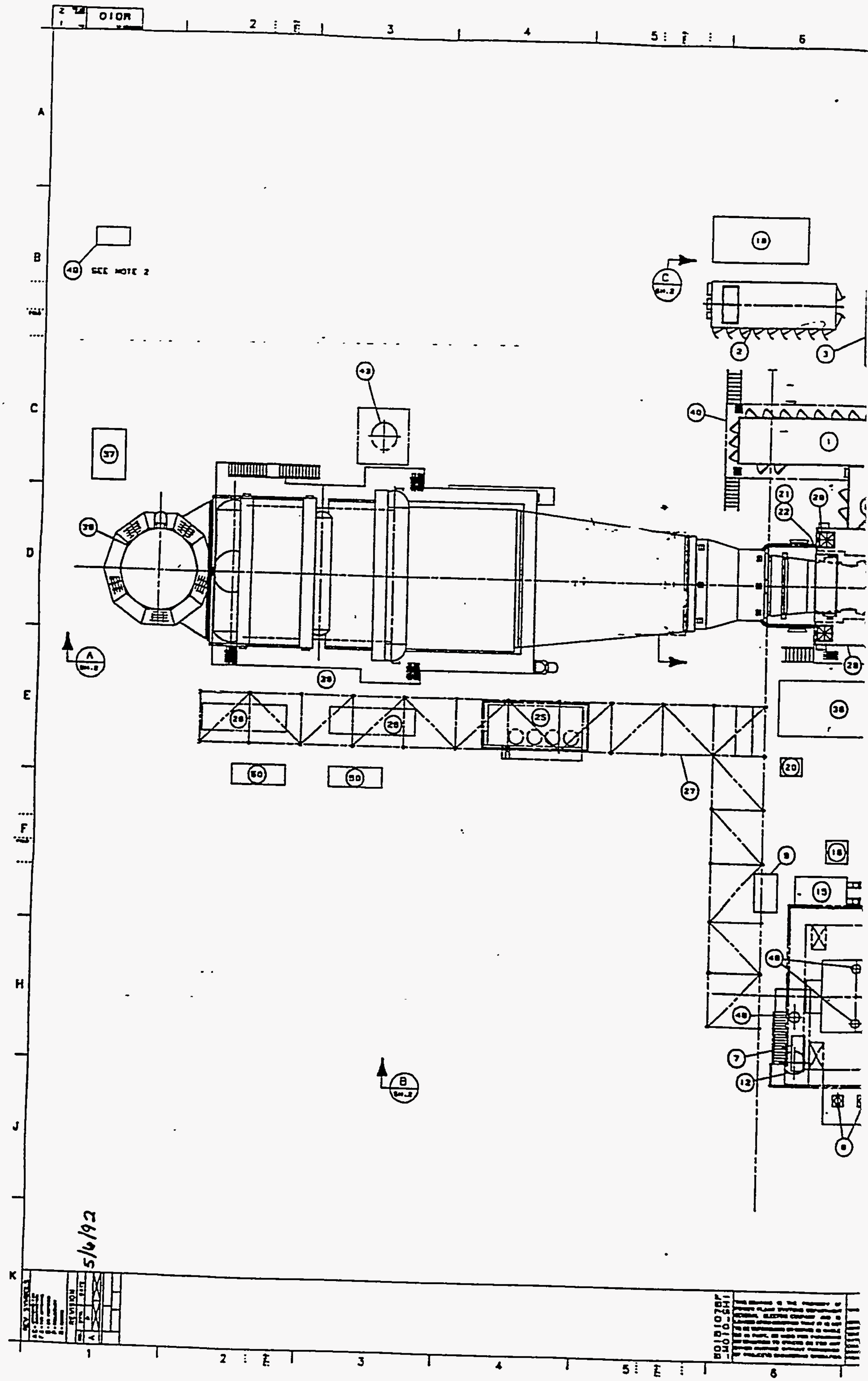
TAMPA ELECTRIC
A TECO ENERGY COMPANY

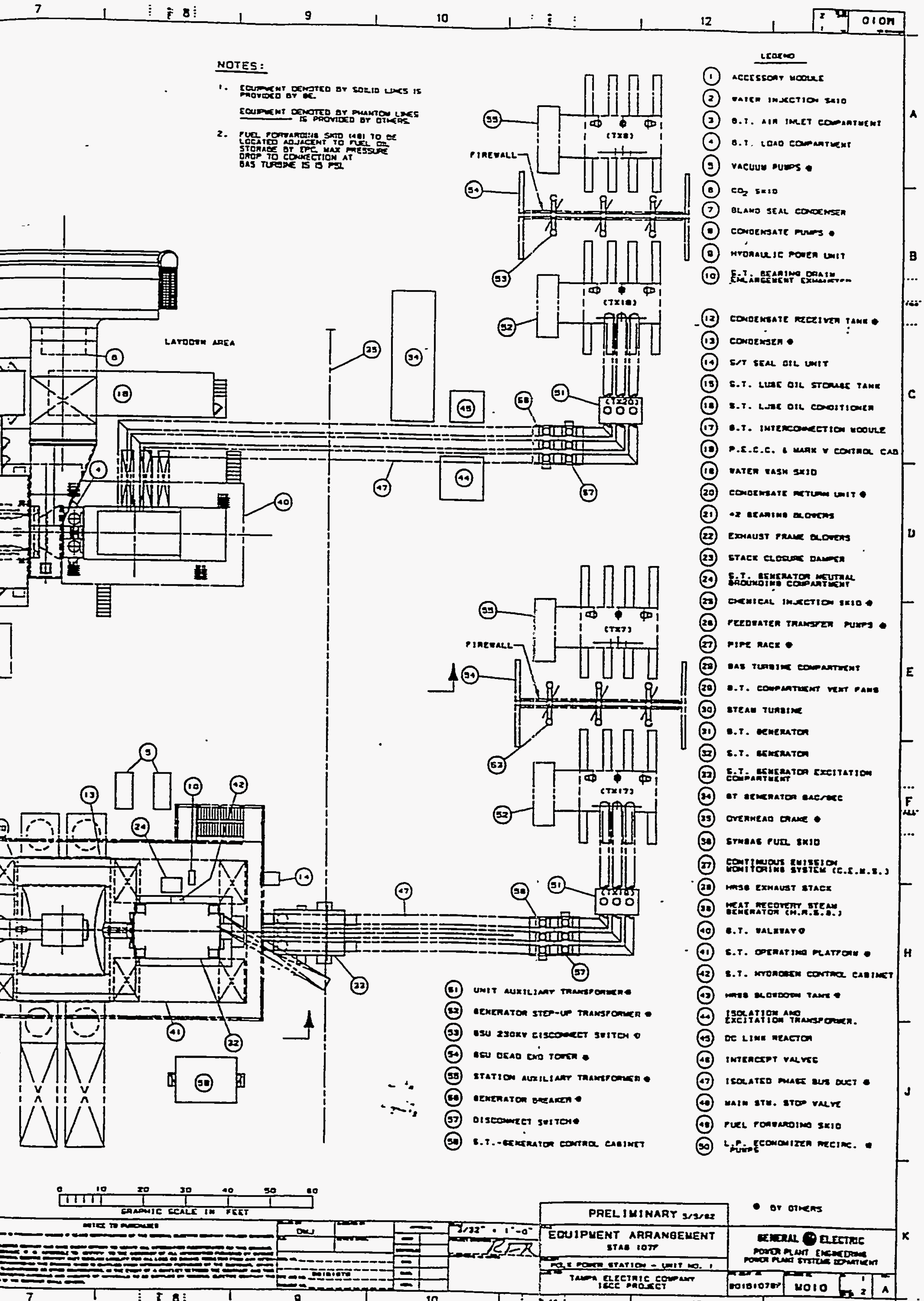
POLK POWER STATION UNIT # 1
EQUIPMENT LOCATION PLAN
POWER BLOCK

	DATE
DRAWN	DATE
DESIGNER	DATE
CHECKED	DATE
APPROVED	DATE

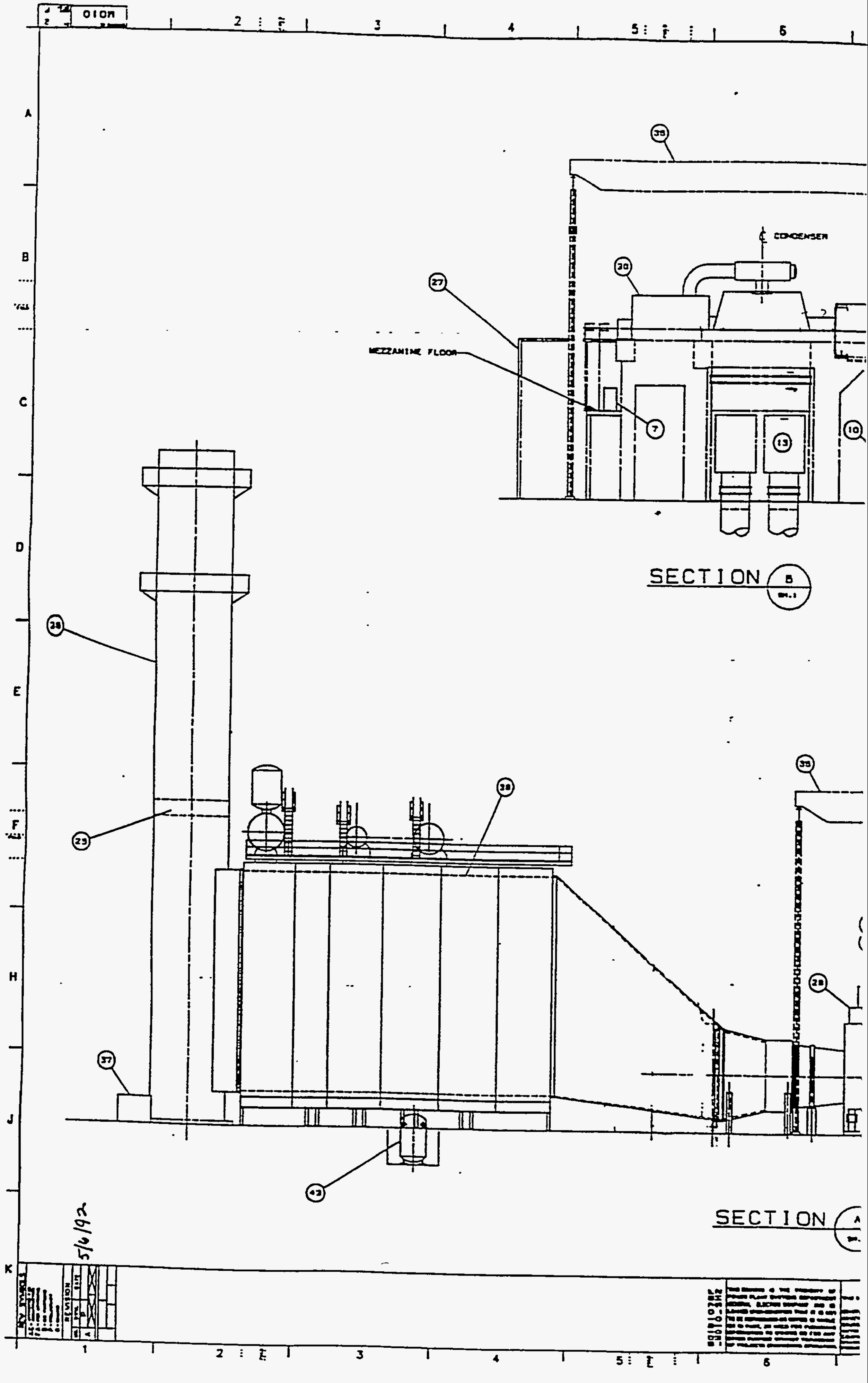
DRAWING NO. 92127-EM-161A

REV. 7

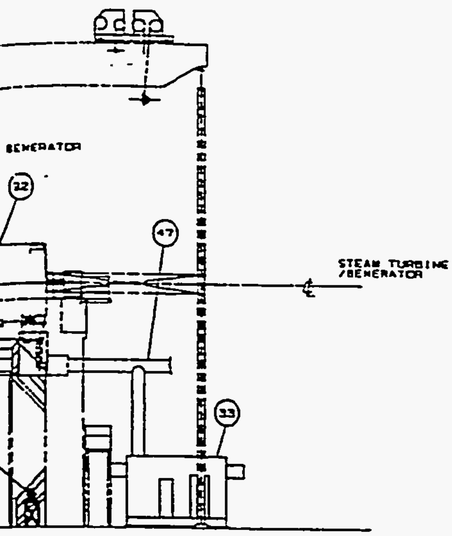

010R
SEE NOTE 2
5/6/92

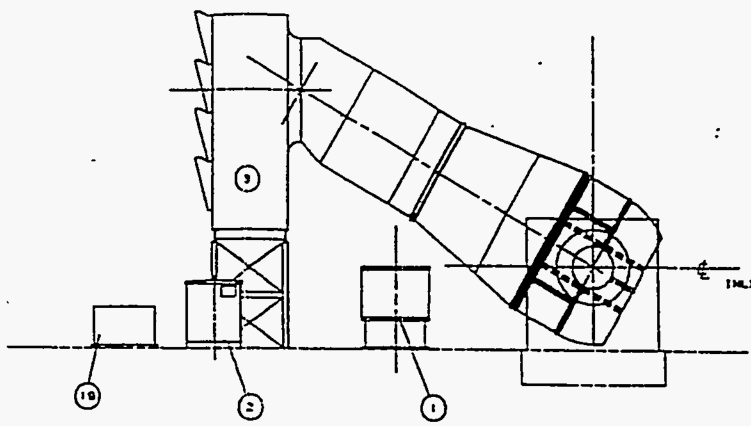


NOTES:
1. EQUIPMENT DENOTED BY SOLID LINES IS PROVIDED BY GE.
EQUIPMENT DENOTED BY PHANTOM LINES IS PROVIDED BY OTHERS.
2. FUEL FORWARDING SKID (49) TO BE LOCATED ADJACENT TO FUEL OIL STORAGE BY EPC. MAX PRESSURE DROP TO CONNECTION AT GAS TURBINE IS 15 PSI.
LEGEND
1 ACCESSORY MODULE
2 WATER INJECTION SKID
3 G.T. AIR INLET COMPARTMENT
4 G.T. LOAD COMPARTMENT
5 VACUUM PUMPS ●
6 CO_2 SKID
7 GLAND SEAL CONDENSER
8 CONDENSATE PUMPS ●
9 HYDRAULIC POWER UNIT
10 S.T. BEARING DRAIN ENLARGEMENT EXHAUSTER
12 CONDENSATE RECEIVER TANK ●
13 CONDENSER ●
14 S/T SEAL OIL UNIT
15 S.T. LUBE OIL STORAGE TANK
16 S.T. LUBE OIL CONDITIONER
17 G.T. INTERCONNECTION MODULE
18 P.E.C.C. & MARK V CONTROL CAB
19 WATER WASH SKID
20 CONDENSATE RETURN UNIT ●
21 #2 BEARING BLOWERS
22 EXHAUST FRAME BLOWERS
23 STACK CLOSURE DAMPER
24 S.T. GENERATOR NEUTRAL GROUNDING COMPARTMENT
25 CHEMICAL INJECTION SKID ●
26 FEEDWATER TRANSFER PUMPS ●
27 PIPE RACK ●
28 GAS TURBINE COMPARTMENT
29 G.T. COMPARTMENT VENT FANS
30 STEAM TURBINE
31 G.T. GENERATOR
32 S.T. GENERATOR
33 S.T. GENERATOR EXCITATION COMPARTMENT
34 GT GENERATOR GAC/GEC
35 OVERHEAD CRANE ●
36 SYNGAS FUEL SKID
37 CONTINUOUS EMISSION MONITORING SYSTEM (C.E.M.S.)
38 HRSG EXHAUST STACK
39 HEAT RECOVERY STEAM GENERATOR (H.R.S.G.)
40 G.T. VALVEWAY
41 S.T. OPERATING PLATFORM ●
42 S.T. HYDROGEN CONTROL CABINET
43 HRSG BLOWDOWN TANK ●
44 ISOLATION AND EXCITATION TRANSFORMER.
45 DC LINK REACTOR
46 INTERCEPT VALVES
47 ISOLATED PHASE BUS DUCT ●
48 MAIN STM. STOP VALVE
49 FUEL FORWARDING SKID
50 L.P. ECONOMIZER RECIRC. PUMPS ●
51 UNIT AUXILIARY TRANSFORMER ●
52 GENERATOR STEP-UP TRANSFORMER ●
53 GSU 230KV DISCONNECT SWITCH ●
54 GSU DEAD END TOWER ●
55 STATION AUXILIARY TRANSFORMER ●
56 GENERATOR BREAKER ●
57 DISCONNECT SWITCH ●
58 S.T.-GENERATOR CONTROL CABINET
● BY OTHERS
FIREWALL
LAYDOWN AREA
(TX8)
(TX18)
(TX20)
(TX7)
(TX17)
(TX19)
0 10 20 30 40 50 60
GRAPHIC SCALE IN FEET
PRELIMINARY 3/3/92
3/32" = 1'-0"
EQUIPMENT ARRANGEMENT
STAG 107F
POLK POWER STATION - UNIT NO. 1
TAMPA ELECTRIC COMPANY
IGCC PROJECT
GENERAL ELECTRIC
POWER PLANT ENGINEERING
POWER PLANT SYSTEMS DEPARTMENT
M010
NOTICE TO PURCHASER

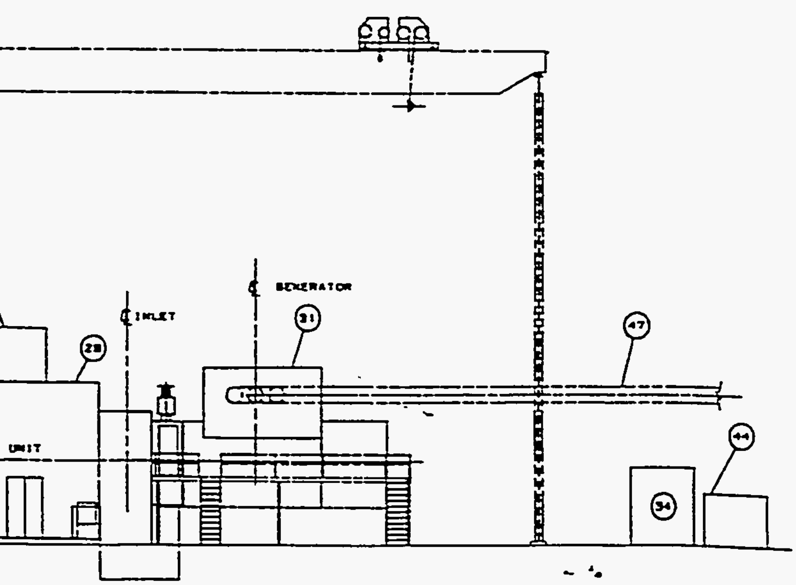


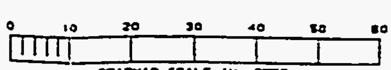
CONDENSER
MEZZANINE FLOOR
SECTION B
SECTION
5/6/92





SECTION C





NOTICE TO PURCHASER

PRELIMINARY

EQUIPMENT ARRANGEMENT

SECTIONS & ELEVATIONS

POLK POWER STATION - UNIT NO. 1

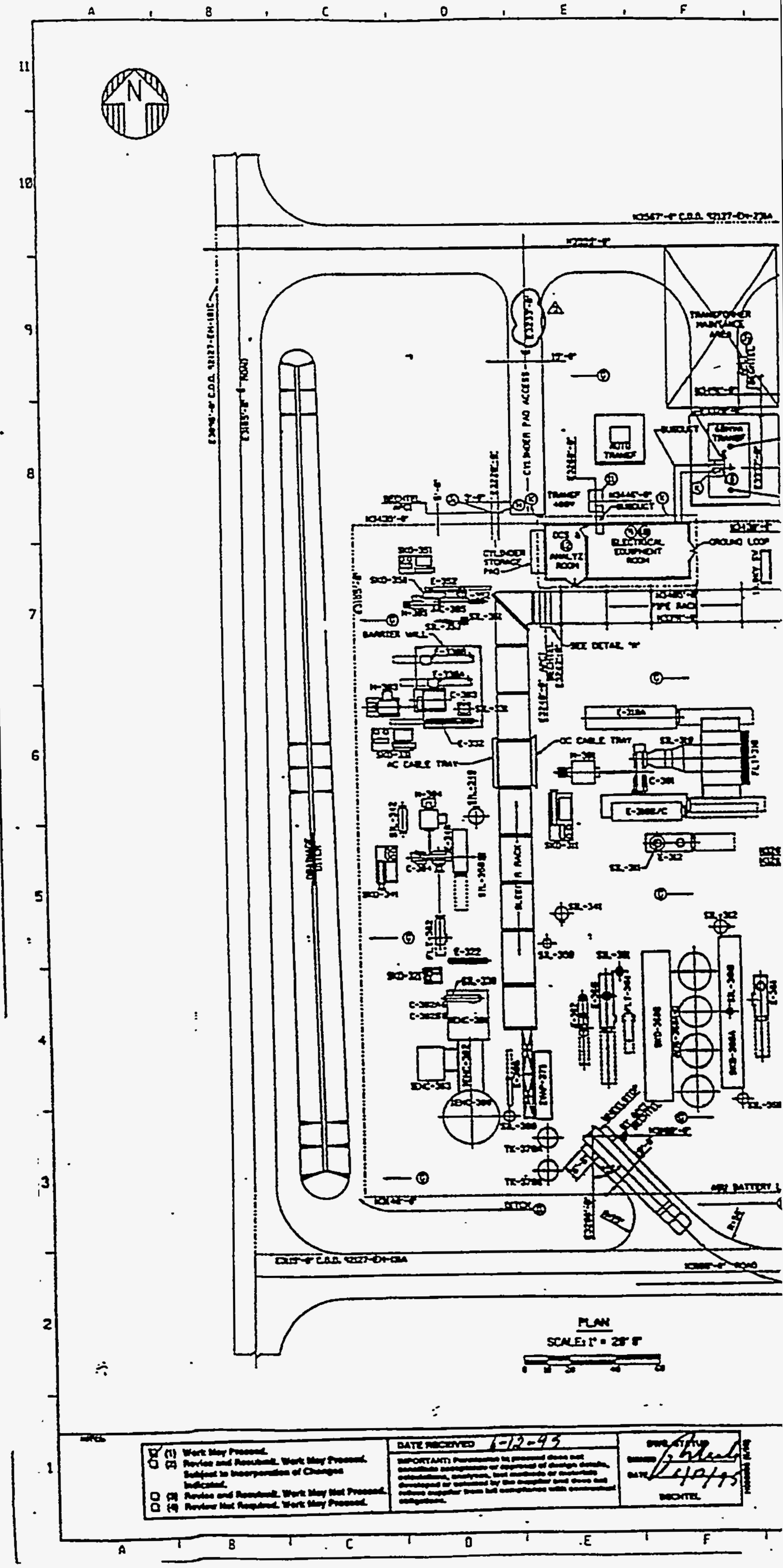
TAMPA ELECTRIC COMPANY
IGCC PROJECT

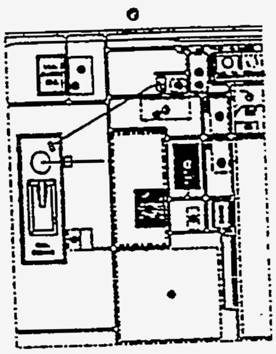
GENERAL ELECTRIC

POWER PLANT ENGINEERING
POWER PLANT SYSTEMS DEPARTMENT

M010

010R


N
TRANSFORMER MAINTENANCE AREA
AUTO TRANSF
BECHTEL APCI
CYLINDER PAD ACCESS
CYLINDER STORAGE PAD
DCS & ANALYZ ROOM
ELECTRICAL EQUIPMENT ROOM
GROUND LOOP
PIPE RACK
BARRIER WALL
SEE DETAIL "A"
DC CABLE TRAY
AC CABLE TRAY
DRAINAGE DITCH
ELECTRICAL RACK
DITCH
PLAN
SCALE: 1" = 20' 0"
DATE RECEIVED 6-12-95
(1) Work May Proceed.
(2) Revise and Resubmit. Work May Proceed. Subject to Incorporation of Changes Indicated.
(3) Revise and Resubmit. Work May Not Proceed.
(4) Review Not Required. Work May Proceed.
BECHTEL



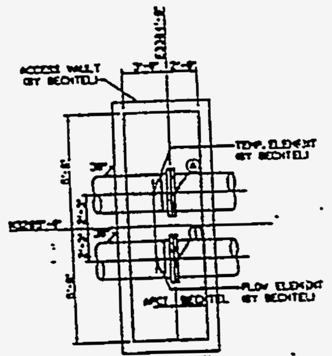
KEY PLAN

KEY PLAN LEGEND

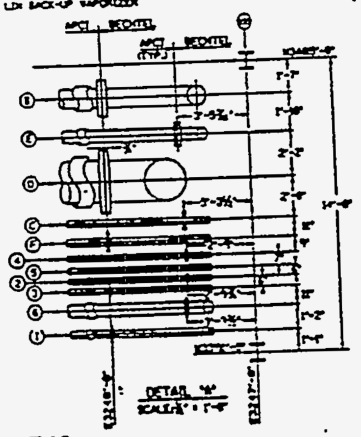
1. GASIFICATION AND SLAG HANDLING
2. ACID GAS REMOVAL
3. AIR SEPARATION UNIT
4. SULFUR RECOVERY
5. HOT GAS CLEAN-UP
6. MAKE-UP WATER TREATING
7. CONTROL AND GENERAL SERVICES BUILDING
8. COAL GRINDING
9. CONSTRUCTION POWER FACILITIES
11. I.W.T. FACILITY AND HOLDING BASIN
12. SANITARY WASTE TREATMENT
13. 4KV BATTERY, PBX, AND RTU
14. WAREHOUSE
15. MAINTENANCE SHOP
16. CONSTRUCTION LAYDOWN AND TEMPORARY CONSTRUCTION PERSONNEL PARKING
17. MOBILE EQUIPMENT MAINTENANCE SHOP
18. OFF GAS TREATMENT
19. ASU MATERIAL LAYDOWN AND FABRICATION AREA

EQUIPMENT LIST

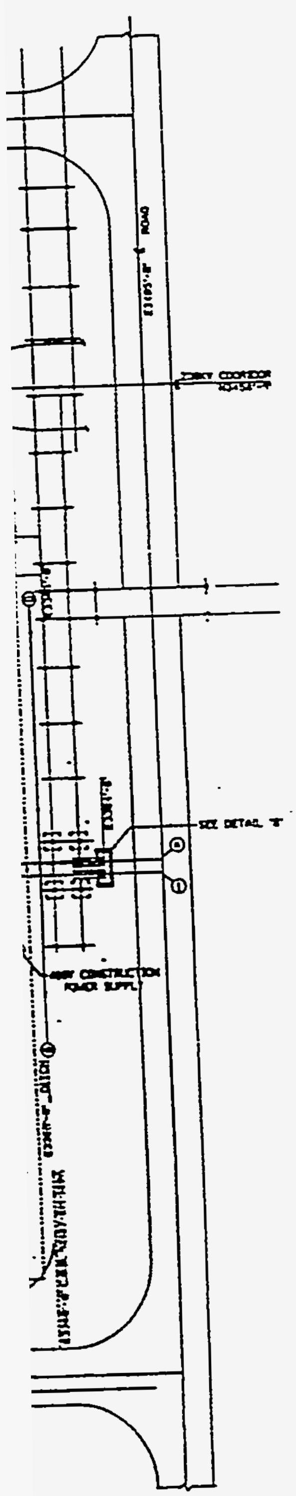
1-ASU-C-301	MAIN AIR COMPRESSOR
1-ASU-M-301	MAIN AIR COMPRESSOR MOTOR
1-ASU-E-30A/B/C	MAC INTERCOOLERS
1-ASU-FLT-318	MAC AIR INLET FILTER
1-ASU-SIL-318	MAC AIR INLET SILENCER
1-ASU-SIL-311	MAC DISCHARGE SILENCER
1-ASU-E-312	MAC AFTERCOOLER
1-ASU-SIL-312	MAC DISCHARGE VENT SILENCER
1-ASU-SKD-311	MAC LUBE OIL SKID
1-ASO-C-323	OXYGEN COMPRESSOR
1-ASO-M-323	OXYGEN COMPRESSOR MOTOR
1-ASO-E-330A/B	O2 COMPRESSOR INTERCOOLERS
1-ASO-E-332	O2 COMPRESSOR RECYCLE COOLER
1-ASO-SIL-330	L.P. OXYGEN VENT SILENCER
1-ASO-SIL-331	O2 COMPRESSOR DISCHARGE VENT SILENCER
1-ASO-SKD-331	O2 COMPRESSOR LUBE OIL SKID
1-ASN-C-304	DILUENT GAN COMPRESSOR
1-ASN-M-304	DILUENT GAN COMPRESSOR MOTOR
1-ASN-E-340	DILUENT GAN COMPRESSOR INTERCOOLER
1-ASN-SIL-340	DILUENT GAN COMPRESSOR DISCHARGE VENT SILENCER
1-ASN-SKD-341	DILUENT GAN COMPRESSOR LUBE OIL SKID
1-ASN-SIL-341	DILUENT GAN VENT SILENCER
1-ASN-SIL-342	DILUENT GAN DISCHARGE SILENCER
1-ASN-C-305	H.P. GAN COMPRESSOR
1-ASN-M-305	H.P. GAN COMPRESSOR MOTOR
1-ASN-E-350	H.P. GAN COMPRESSOR INTERCOOLER
1-ASN-SIL-350	H.P. GAN VENT SILENCER
1-ASN-SKD-351	H.P. GAN COMPRESSOR LUBE OIL SKID
1-ASN-SIL-351	H.P. GAN COMPRESSOR DISCHARGE VENT SILENCER
1-ASN-SIL-352	H.P. GAN COMPRESSOR SUCTION SILENCER
1-ASN-C-352	H.P. GAN COMPRESSOR RECYCLE COOLER
1-ASN-SIL-353	H.P. GAN COMPRESSOR DISCHARGE SILENCER
1-ASU-ADS-360A-D	AIR ADSORBER VESSELS
1-ASU-SKD-360A/B	ADSORBER VALVE SKIDS
1-ASU-E-360	ADSORBER AIR AFTERCOOLER
1-ASU-FLT-361	ADSORBER AIR AFTERFILTER
1-ASU-E-362	ADSORBER REGENERATION HEATER
1-ASU-FLT-362	REGENERATION GAN AFTERFILTER
1-ASU-E-364	GAN REGENERATION AFTERCOOLER
1-ASU-SIL-361	AIR BY-PASS SILENCER
1-ASU-SIL-368	AIR ADSORBER VENT SILENCER
1-ASU-SIL-369	DEFROST VENT SILENCER
1-ASU-ENC-380	COLUMN CAN
1-ASU-ENC-381	HEAT EXCHANGER ENCLOSURE
1-ASU-ENC-382	CROSSOVER
1-ASU-ENC-383	SUBCOOLER ENCLOSURE
1-ASU-E-385	DISPOSAL VAPORIZER
1-ASU-C-352A/B	ASU COMPANDERS
1-ASU-E-322	COMPANDER AFTERCOOLER
1-ASU-SKD-321	COMPANDER LUBE OIL SKID
1-ASU-TK-370A/B	LIN BACK-UP TANKS
1-ASU-EVAP-371	LIN BACK-UP VAPORIZER



DETAIL "B"
SCALE: 3/8" = 1'-0"



DETAIL "A"
SCALE: 3/8" = 1'-0"



ASU PIPING/UTILITY INTERFACE SCHEDULE

INCOMING UTILITIES					
ITEM	DESCRIPTION	SIZE & CONN. TYPE	MATERIAL & SCHEDULE	BOP ELEV.	P & ID LINE NUMBER
1	COOLING WATER SUPPLY	30"-150# FF	FCD STL ASME B16.47A	94'-10"	[illegible]
2	SERVICE WATER	2"-150# RF	FCD STL ASME 16.5	102'-1½"	[illegible]
3	LOW PRESSURE CONDENSATE	2"-300# RF	FCD STL ASME 16.5	102'-1½"	[illegible]
4	BACK-UP INSTRUMENT AIR	3"-150# RF	FCD STL ASME 16.5	102'-0"	[illegible]
5	PLANT UTILITY AIR	2"-NPT	C.STL SCH 80	102'-0"	[illegible]
6	STEAM	6"-150# RF	FCD STL ASME 16.5	102'-0"	[illegible]
7	TELEPHONE/INTERCOM SYS. (BY BECHTEL)				
8	ELECTRIC POWER 13.8 KV [illegible]				
9	ELECTRIC POWER 13.8 KV [illegible]				
10	ELECTRIC POWER 4.16 KV [illegible]				
11	ELECTRIC POWER 480V				
12	DCS DATA HIGHWAY(S)				

OUT-GOING PRODUCTS/DISCHARGES					
ITEM	DESCRIPTION	SIZE & CONN. TYPE	MATERIAL & SCHEDULE	BOP ELEV.	P & ID LINE NUMBER
A	COOLING WATER RETURN	30"-150# FF	FCD STL ASME B16.47A	94'-10"	[illegible]
B	HP O2 PROD. PURGE	12"-600# RF	FCD ST STL ASME B16.5	102'-0"	[illegible]
C	LP O2 PROD. PURGE	6"-150# RF	FCD STL ASME B16.5	102'-0"	[illegible]
D	DILUENT GAN PROD. PURGE	24"-300# RF	FCD STL ASME B16.5	102'-0"	[illegible]
E	H.P. GAN PROD. PURGE	6"-600# RF	FCD STL ASME B16.5	102'-0"	[illegible]
F	[illegible] PROD. PURGE	6"-150# RF	FCD STL ASME B16.5	102'-0"	[illegible]
G	STORM WATER SURFACE DRAIN TO DITCH				
H	PROCESS CONDENSATE DRAINS	8"-P.E.	CAST IRON [illegible]	[illegible]	[illegible]
I	STEAM CONDENSATE RETURN	4"-150# RF	FCD STL ASME 16.5	102'-0"	[illegible]
J1	EQUIPMENT DRAINS (OILY WATER)	8"-P.E.	CAST IRON [illegible]	96.50'*	[illegible]
J2	EQUIPMENT DRAINS (OILY WATER)	4"-P.E.	CAST IRON [illegible]	94.95'*	[illegible]
K	GROUNDING LOOP (TO BECHTEL SUBSTATION GROUND GRID)				

* INVERT ELEVATION

NOTE:
HIGH POINT OF FINISH GRADE ELEV. 100'-0" EQUALS PLANT ELEV. 143'-6"

V.P. - 22269-V-004-HAC 306/7

EQUIP. NO.

AIR PRODUCTS
ALLENTOWN, PENNSYLVANIA

TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT 1
FACILITY ARRANGEMENT
AIR SEPARATION UNIT
TAMPA ELECTRIC - POLK COUNTY, FL

92127-EY-241A 3
3-7836-6299E 1

EQUIPMENT LIST

10.0 EQUIPMENT LIST

The equipment list for the Polk Power Station is included on the following pages.

TAG	EQUIPMENT NAME
UTILITIES	
AUXILIARY BOILER	
1-ABM-B -001	AUXILARY BOILER PACKAGE
1-ABF-DN -001	AUXILIARY BOILER DEAERATOR
1-ABA-FN -001	AUXILIARY BOILER COMBUSTION AIR FAN
1-ABF-P -001A/B	AUXILIARY BOILER FEEDWATER TRANSFER PUMP
GASIFICATION CLOSED LOOP COOLING WATER	
1-CCC-E -042	CLOSED LOOP EXCHANGER (GASIF.)
1-CCC-P -047A/B	CLOSED LOOP CIRCULATING PUMP (GASIF.)
1-CCC-TK -042	CLOSED LOOP EXPANSION TANK (GASIF.)
OPEN LOOP COOLING WATER	
1-CWS-CRN-041	TRAVELING WATER SCREEN GANTRY
1-CWS-FLT-009	GASIFICATION POND COOLING WATER FILTER
1-CWS-P -043A/B	CONDENSER COOLING WATER PUMPS
1-CWS-P -042A/B	OPEN LOOP COOLING WATER PUMPS
1-CWS-P -044A/B	TRAVELING SCREEN SPRAY PUMP
1-CWS-SCR-001A/B	TRAVELING WATER WASH SCREENS
1-CWS-SCR-003	TRAVELING WATER WASH SCREEN
FUEL OIL	
1-FOY-P -091A/B	FUEL OIL TRUCK UNLOADING PUMPS
1-FOY-P -092A/B	AUX. BOILER/THERMAL OXIDIZER FUEL OIL PUMPS
1-FOY-PKG-091	FUEL OIL TANK TRUCK UNLOADING STATION
1-FOY-TK -091	FUEL OIL STORAGE TANK
FIREWATER	
1-FPP-P -031A/B/C	FIREWATER PUMPS
1-FPP-P -032	FIRE WATER JOCKEY PUMP
1-FPP-TK -033A/B	DIESEL TANK FOR FIREWATER PUMPS
WELL WATER	
1-FWS-P -040A/B	WELLWATER PUMPS
1-FWS-P -041A/B	RESERVOIR MAKEUP WELLWATER PUMPS
PILOT GAS SYSTEM (PROPANE)	
1-PRO-E -001	PROPANE VAPORIZER
FLARE	
1-RSY-D -042	HOT GAS FLARE QUENCH DRUM
1-RSY-D -041	FLARE KNOCKOUT DRUM
1-RSY-FLR-041	ELEVATED FLARE
1-RSY-P -041A/B	FLARE KNOCKOUT DRUM PUMPS
1-RSY-P -042A/B	FLARE KNOCKOUT DRUM PUMPS
GASIFICATION	
BLACK WATER	
1-BLW-D -109	VACUUM FLASH DRUM
1-BLW-D -110	VACUUM FLASH KNOCKOUT DRUM
1-BLW-D -111	VACUUM PUMP KNOCKOUT DRUM
1-BLW-E -113	VACUUM FLASH OH CONDENSER
1-BLW-E -114	VACUUM PUMP HEAT EXCHANGER
1-BLW-P -110A/B	SETTLER FEED PUMPS
1-BLW-P -111A/B	VACUUM FLASH CONDENSATE PUMPS

1-BLW-P -112A/B	SOUR GAS VACUUM PUMPS
1-BLW-TK -102	GRAVITY SETTLER
SYNGAS CONDENSATE	
1-CSY-E -116	AMMONIA STRIPPER PREHEATER
1-CSY-P -107A/B	CONDENSATE RETURN PUMP
1-CSY-P -108A/B	STRIPPED CONDENSATE PUMPS
1-CSY-D -104	PROCESS CONDENSATE DRUM
BURNER COOLING WATER	
1-CWB-D -117	BURNER COOLING WATER KNOCKOUT DRUM
1-CWB-E -101	BURNER COOLING WATER COOLER
1-CWB-P -102A/B	BURNER COOLING WATER PUMP
1-CWB-TK -101	BURNER COOLING WATER TANK
FINES HANDLING	
1-FIN-BIN-102A/B	FINES DEWATERING BINS
1-FIN-CNV-104	FILTER CAKE CONVEYOR
1-FIN-D -117	FINES FILTER FILTRATE RECEIVER
1-FIN-FLT-101	FINES FILTER
1-FIN-MIX-102	FILTER FEED TANK AGITATOR
1-FIN-P -120A/B	FILTER FEED PUMPS
1-FIN-P -126	FINES FILTER FILTRATE PUMP
1-FIN-P -127	FINES FILTER VACUUM PUMP
1-FIN-P -131A/B	FINES SUMP PUMPS
1-FIN-SUMP-104	FINES SUMP
1-FIN-TK -105	FILTER FEED TANK
GASIFIER AND GAS COOLING	
1-GAS-BLOW-101	PREHEAT AIR BLOWER
1-GAS-BURN-102	PREHEAT BURNER
1-GAS-BURN-101	PROCESS BURNER
1-GAS-CRH-101	SLAG CRUSHER
1-GAS-D -102	HP STEAM DRUM
1-GAS-D -103	MP STEAM DRUM
1-GAS-D -113	SOOT BLOWING DRUM
1-GAS-D -114	SYNGAS COOLER BLOWDOWN DRUM
1-GAS-E -103	RAW GAS/NITROGEN EXCHANGER
1-GAS-E -104	CONVECTIVE SYNGAS COOLER
1-GAS-E -105	RADIENT SYNGAS COOLER
1-GAS-E -106	CONVECTIVE SYNGAS COOLER
1-GAS-E -107	CLEAN GAS PREHEATER
1-GAS-E -108	RAW GAS/CLEAN GAS EXCHANGER
1-GAS-E -109	RAW GAS CONNECTING DUCT I
1-GAS-E -110	RAW GAS CONNECTING DUCT II
1-GAS-E -111	TRANSFER LINE OUTLET
1-GAS-E -112	TRANSFER LINE INLET
1-GAS-E -113	CSC INLET CONE (RGCGE-SIDE)
1-GAS-E -114	TRANSFER PIPE
1-GAS-E -115	TRANSFER PIPE
1-GAS-E -116	CSC INLET CONE (RGNE-SIDE)
1-GAS-E -117	TRANSFER LINE INLET RGCGE-SIDE

1-GAS-E -118	TRANSFER LINE OUTLET RGNE-SIDE
1-GAS-E -119	RAW GAS CONNECTING DUCT I
1-GAS-E -120	RAW GAS CONNECTING DUCT II
1-GAS-E -121	SEAL WATER COOLER
1-GAS-EL -102	RSC MANLIFT
1-GAS-EL -101	GASIFIER FREIGHT ELEVATOR
1-GAS-LFT-101	GASIFIER LIFT REMOVAL WINCH
1-GAS-P -103A/B	SYNGAS COOLER CIRCULATING PUMP
1-GAS-P -104A/B	TRANSFER LINE CIRCULATING PUMP
1-GAS-P -130A/B	GASIFICATION SUMP PUMPS
1-GAS-REF-101	GASIFIER REFRACTORY
1-GAS-REV-101	GASIFIER
1-GAS-SUMP-103	GASIFICATION SUMP
GREY WATER	
1-GRW-P -114A/B	LOW PRESSURE GREY WATER PUMPS
1-GRW-P -115A/B	HIGH PRESSURE GREY WATER PUMPS
1-GRW-P -128A/B	GREY WATER FORWARDING PUMPS
1-GRW-TK -103	GREY WATER TANK
1-GRW-TK -108	GREY WATER STORAGE TANK
SYNGAS SCRUBBING	
1-RUB-COL-101A/B	SYNGAS SCRUBBER
1-RUB-NOZ-101A/B	START-UP ASPIRATOR
1-RUB-NOZ-102A/B	NOZZLE SCRUBBER
1-RUB-P -105A/B	SYNGAS SCRUBBER CIRCULATING PUMP
1-RUB-P -106A/B	SYNGAS SCRUBBER CIRCULATING PUMP
SLAG HANDLING	
1-SLG-BIN-101A/B	SLAG DEWATERING BINS
1-SLG-D -112	LOCKHOPPER FLUSH DRUM
1-SLG-DIV-101A/B	SLAG DIVERTER
1-SLG-E -115	LOCKHOPPER FLUSH WATER COOLER
1-SLG-LH -101	LOCKHOPPER
1-SLG-P -116A/B	LOCKHOPPER CIRCULATING PUMP
1-SLG-P -126A/B	FINES FILTER FILTRATE PUMP
1-SLG-P -127A/B	FINES FILTER VACUUM PUMP
1-SLG-P -129A/B	SLAG DEWATERING SUMP PUMPS
1-SLG-SUMP-102	SLAG DEWATERING SUMP
SLURRY PUMPING	
1-SLR-P -101A/B	SLURRY FEED PUMP
SYNGAS COOLING	
1-SNC-D -105	CLEAN GAS PREHEATER KNOCKOUT DRUM
1-SNC-D -107	EVAPORATOR CONDENSATE KO DRUM
1-SNC-D -108	TRIM COOLER KNOCKOUT DRUM
1-SNC-E -109	CLEAN GAS PREHEATER
1-SNC-E -111	STEAM TURBINE CONDENSATE HEATER
1-SNC-E -112	TRIM COOLER
SLAG PILE RUNOFF HANDLING	
1-SRW-P -190A/B	SLAG PILE AREA RUNOFF RETENTION BASIN PUMPS
1-SRW-P -191	SLAG PILE LEACHATE SUMP PUMP

1-SRW-SUMP-190	SLAG PILE AREA RUNOFF RETENTION BASIN
1-SRW-SUMP-191	SLAG PILE LEACHATE SUMP
AMMONIA STRIPPING	
1-STP-E -110	AMMONIA STRIPPER REBOILER
1-STP-D -115	AMMONIA STRIPPER REBOILER CONDENSATE POT
1-STP-COL-102	AMMONIA STRIPPER
1-STP-E -117	AMMONIA STRIPPER REFLUX COOLER
1-STP-P -109A/B	AMMONIA STRIPPER REFLUX PUMPS
FLOCCULANT INJECTION	
1-WTL-P -132A/B	FLOCCULANT PUMPS
1-WTL-PKG-101	FLOCCULANT INJECTION PACKAGE
1-WTL-MIX-104	ANIONIC FLOCCULANT TANK MIXER
1-WTL-MIX-103	CATIONIC FLOCCULANT TANK MIXER
1-WTL-TK -109	CATIONIC INJECTION TANK
1-WTL-TK -110	ANIONIC INJECTION TANK
ACID GAS REMOVAL	
1-USY-COL-201	WATER WASH COLUMN
1-USY-COL-202	ACID GAS ABSORBER
1-AMR-COL-203	AMINE STRIPPER
1-TSY-D -201	CLEAN GAS KNOCKOUT DRUM
1-CNH-D -202	AMINE STRIPPER REBOILER POT
1-ACG-D -203	AMINE STRIPPER REFLUX DRUM
1-AML-E -201A/B	LEAN AMINE COOLER
1-AMR-E -202	LEAN/RICH AMINE EXCHANGER
1-ACG-E -203	REFLUX CONDENSER
1-STP-E -204	STRIPPER REBOILER
1-PCW-E -205	WASH WATER COOLER
1-AMR-FLT-202	RICH AMINE CARTRIDGE FILTER
1-AMR-FLT-203	RICH AMINE CARBON FILTER
1-AMR-FLT-204	RICH AMINE CARBON AFTER FILTER
1-AML-FLT-205	AMINE SUMP FILTER
1-PCW-FLT-206	WASH WATER MAKEUP FILTER
1-PCW-P -201A/B	CIRCULATION WASH PUMP
1-AML-P -202A/B	LEAN AMINE PUMPS
1-AML-P -203A/B	AMINE STRIPPER BOTTOMS PUMPS
1-AML-P -204	AMINE SOLVENT SUMP PUMP
1-SRH-P -205A/B	AMINE REFLUX PUMPS
1-AML-P -206	AMINE SUMP PUMP
1-AML-SUMP-201	AMINE SUMP
1-AML-TK -201	AMINE STORAGE TANK
AIR SEPARATION UNIT	
1-ASU-ADS-360	AIR ADSORBER SYSTEM
1-ASU-C -301	MAIN AIR COMPRESSOR
1-ASU-C -303	GOX COMPRESSOR
1-ASU-C -304	DILUENT GAN COMPRESSOR
1-ASU-C -305	HP GAN COMPRESSOR
1-ASU-COL-381	HP COLUMN
1-ASU-COL-382	LP COLUMN

1-ASU-P -311A/B	MAC LUBE OIL PUMPS
1-ASU-P -331A/B	GOX COMPRESSOR LUBE OIL PUMPS
1-ASU-P -341A/B	DILUENT GAN COMPRESSOR LUBE OIL PUMPS
1-ASU-P -351A/B	HP GAN COMPRESSOR LUBE OIL PUMPS
1-ASU-RESV-311	MAC LUBE OIL RESERVOIR
1-ASU-RESV-331	GOX COMPRESSOR LUBE OIL RESERVOIR
1-ASU-RESV-341	DILUENT GAN COMPRESSOR LUBE OIL RESERVOIR
1-ASU-RESV-351	HP GAN COMPRESSOR LUBE OIL RESERVOIR
1-ASU-SIL-310	MAC INLET SILENCER
1-ASU-SIL-311	MAC DISCHARGE SILENCER
1-ASU-SIL-312	MAC DISCHARGE VENT SILENCER
1-ASU-SIL-330	GOX COMPRESSOR SUCTION VENT SILENCER
1-ASU-SIL-331	GOX COMPRESSOR DISCHARGE VENT SILENCER
1-ASU-SIL-340	DILUENT GAN COMPRESSOR DISCHARGE VENT SILENCER
1-ASU-SIL-350	PURE GAN VENT SILENCER
1-ASU-SIL-351	HP GAN VENT SILENCER
1-ASU-SKD-306	ASU ADSORBER SKID
1-ASU-SKD-311	MAC LUBE OIL SKID
1-ASU-SKD-331	GOX LUBE OIL SKID
1-ASU-SKD-341	DILUENT GAN LUBE OIL SKID
1-ASU-SKD-351	HP GAN LUBE OIL SKID
1-ASU-SKD-360	ASU ADSORBER SKID
1-ASU-SP -312	MAC AFTERCOOLER SEPARATOR
1-ASU-TK-360	GAN RINSE BOTTLE
1-ASU-TK-370	LIN BACKUP TANK
	OTHER ASU EQUIPMENT
HOT GAS CLEAN-UP (HGCU)	
1-HTG-ADS-501	ABSORBER
1-HTG-BIN-502	REGENERATOR SORBENT BIN
1-HTG-BIN-503	SORBENT MAKE-UP SILO
1-HTG-BIN-504	SODIUM BICARBONATE STORAGE SILO
1-HTG-BLOW-501	FINES SEPARATOR BAGHOUSE FAN
1-HTG-BLOW-502	SODIUM BICARBONATE MILL/CLASSIFIER BAGHOUSE FAN
1-HTG-C -501	RECYCLE GAS COMPRESSOR
1-HTG-C -502	PURGE RE-COMPRESSION SYSTEM RECEIVER COMPRESSOR
1-HTG-CH-501	START-UP HEATER
1-HTG-COLL-501	PRIMARY CYCLONE WITH INTEGRAL KO DRUM
1-HTG-COLL-503	SECONDARY CYCLONE
1-HTG-CRN-501A	SKIP HOIST A
1-HTG-CRN-501B	SKIP HOIST B
1-HTG-E-501	REGENERATOR GAS GAS HEAT EXCHANGER
1-HTG-FDR-501	SODIUM BICARBONATE ROTARY FEEDER
1-HTG-FDR-502	REGENERATOR OUTLET ROTARY FEEDER
1-HTG-FDR-503	SODIUM BICARBONATE SCREW FEEDER
1-HTG-FLT-501	BARRIER FILTER
1-HTG-FLT-502	FINES SEPARATOR BAGHOUSE
1-HTG-FLT-503	SODIUM BICARBONATE STORAGE SILO BAGHOUSE
1-HTG-FLT-504	SODIUM BICARBONATE MILL/CLASSIFIER BAGHOUSE BIN

1-HTG-GDR-501	SODIUM BICARBONATE MILL/CLASSIFIER
1-HTG-GDR-502	SODIUM BICARBONATE MILL/CLASSIFIER
1-HTG-LH-501	ABSORBER INLET LOCKHOPPER
1-HTG-LH-502	ABSORBER OUTLET LOCKHOPPER
1-HTG-LH-503	REGENERATOR OUTLET LOCKHOPPER
1-HTG-LH-506	BARRIER FILTER LOCKHOPPER
1-HTG-LH-507	SECONDARY CYCLONE LOCKHOPPER
1-HTG-LH-508	SODIUM BICARBONATE CHARGE LOCKHOPPER
1-HTG-LH-509	SODIUM BICARBONATE RUN LOCKHOPPER
1-HTG-PWRS-501	HYDRAULIC POWER UNIT FOR VALVES
1-HTG-REV-501	REGENERATOR
1-HTG-SG-501	STEAM GENERATOR
1-HTG-SP-501A	REGENERATOR FINES SEPARATOR A
1-HTG-SP-501B	REGENERATOR FINES SEPARATOR B
1-HTG-TC-501A	FINES SEPARATOR A OVERFLOW TELESCOPING CHUTE
1-HTG-TC-501B	FINES SEPARATOR B OVERFLOW TELESCOPING CHUTE
1-HTG-TC-502A	SKIP HOIST A TELESCOPING CHUTE
1-HTG-TC-502B	SKIP HOIST B TELESCOPING CHUTE
1-HTG-TC-503	BARRIER FILTER LOCKHOPPER TELESCOPING CHUTE
1-HTG-TC-504A	FINES SEPARATOR A UNDERFLOW TELESCOPING CHUTE
1-HTG-TC-504B	FINES SEPARATOR B UNDERFLOW TELESCOPING CHUTE
1-HTG-TC-505	PURGE RECOMPRESSION TELESCOPING CHUTE
1-HTG-TK-501	PURGE RE-COMPRESSION SYSTEM RECEIVER TANK
1-HTG-TK-502	ELECTRICALLY HEATED BLOWBACK NITROGEN RECEIVER
CAUSTIC STORAGE AND	PUMPING
1-CAU-TK -606	CAUSTIC STORAGE TANK
1-CAU-P -622A/B	DEGASIFIER CAUSTIC METERING PUMPS
CONDENSATE COLLECTI	ON
1-CNH-D -603	LOW PRESSURE FLASH DRUM
1-CNH-D -604	ATMOSPHERIC FLASH DRUM
1-CNH-P -626A/B	CONDENSATE TRANSFER PUMPS
POTABLE WATER	
1-DWS-ACC-601	POTABLE WATER ACCUMULATOR
1-DWS-FLT-604A/B	POTABLE WATER ACTIVATED CARBON FILTERS
1-DWS-P -607A/B	POTABLE WATER PUMPS
1-DWS-TK -602	POTABLE WATER STORAGE TANK
INSTRUMENT AIR/PLANT	AIR
1-IAS-C -601A/B	PLANT AND INSTRUMENT AIR COMPRESSOR PACKAGE
1-IAS-D -605	INSTRUMENT AIR RECEIVER
1-SAS-D -605	AIR RECEIVER
1-IAS-DRY-601	INSTRUMENT AIR DRYER PACKAGE
STORMWATER COLLECT	ION AND TREATMENT
1-SRW-FLTM-684	WASTEWATER FILTER CARRIAGE DRIVE
1-SRW-FLT-684	WASTEWATER FILTER
1-SRW-P -007A/B	PROCESS UNIT AREA RUNOFF DIVERSION BOX PUMPS
1-SRW-P -019	LABORATORY WASTES LIFT STATION PUMP
1-SRW-P -683A/B	WASTEWATER TRANSFER PUMPS
1-SRW-P -685A/B	IWT EFFLUENT PUMPS

1-SRW-P -686	WASTEWATER FILTER BACKWASH PUMP
1-SRW-P -687	WASHWATER PUMP
1-SRW-SUMP-007	PROCESS UNIT AREA RUNOFF DIVERSION BOX
1-SRW-SUMP-016	BRINE SOLIDS LANDFILL LEACHATE SUMP
1-SRW-SUMP-019	LABORATORY WASTES LIFT STATION
1-SRW-SUMP-683	WASTEWATER EQUALIZATION BASIN
1-SRW-SUMP-685	CLEARWELL
1-SRW-TK -020	CHEMICAL CLEANING WASTE TANK
SANITARY WASTE	
1-TSW-BLOW-650A/B	VENDOR PACKAGE AIR BLOWERS
1-TSW-FLT-650A/B	SAND FILTER (VENDOR PACKAGE)
1-TSW-P -001A/B	CONTROL ROOM SANITARY SUMP PUMP
1-PBS-P -651A/B	CHOPPER/LIFT PUMP
1-TSW-P -652	VENDOR PACKAGE AIR PUMP
1-TSW-PKG-650	SANITARY WASTEWATER TREATMENT PACKAGE
1-TSW-SUMP-001	CONTROL ROOM SANITARY SUMP
1-PBS-SUMP-650	LIFT STATION SUMP WITH BAR SCREEN
1-TSW-TK -650A/B/C	AERATION/CLARIF./SLUDGE THICKENING/DIGESTION TANKS
DEMINERALIZED WATER	
1-WDD-BLOW-602A/B	DECARBONATOR BLOWERS
1-WDD-D -602	DECARBONATOR/ SURGE TANK
1-WDD-FLT-602A/B	ACTIVATED CARBON FILTERS
1-WDD-FLT-603A/B	RO CARTRIDGE FILTERS
1-WDD-FLT-606	RO CLEAN IN-PLACE CARTRIDGE FILTER
1-WDD-MIX-602	SCALE INHIBITOR MIXER
1-WDD-P -608A/B/C	RO FEED PUMPS
1-WDD-P -609A/B/C	DEMINERALIZER FEED PUMPS
1-WDD-P -610A/B	DEMINERALIZED WATER TRANSFER PUMPS
1-WDD-P -618A/B	SCALE INHIBITOR METERING PUMPS
1-WDD-P -619	RO CLEAN IN-PLACE PUMP
1-WDD-PKG-600	BOILER FEEDWATER TREATMENT SYSTEM
1-WDD-RO -601A/B	REVERSE OSMOSIS TRAINS
1-WDD-SUMP-601	WELLWATER TREATMENT CHEMICAL STORAGE AREA SUMP
1-WDD-TK -603	DEMINERALIZED WATER STORAGE TANK
1-WDD-TK -608	SCALE INHIBITOR STORAGE TANK
1-WDD-TK -610	RO CLEAN IN-PLACE TANK
OILY WATER SYSTEM	
1-WOW-CLR-698	DAF SKIMMER/SCRAPER
1-WOW-P -002	SPCC TANK PUMP
1-WOW-P -697A/B	DAF RECYCLE PUMPS
1-WOW-P -699	DAF POLYMER FEED PUMP
1-WOW-SP -693	OILY WASTEWATER OIL/WATER SEPARATOR
1-WOW-SP -694	DISSOLVED AIR FLOTATION UNIT
1-WOW-TK -002	SPILL PREVENTION CONTROL COUNTERMEASURE TANK
1-WOW-TK -696	SKIMMED OIL TANK
1-WOW-TK -697	DAF AIR SATURATION TANK
1-WOW-TK -698	DAF CLARIFIER TANK
SERVICE WATER	

1-WSR-P -123	SERVICE WATER BOOSTER PUMP
1-WSR-P -606A/B	SERVICE WATER PUMPS
1-WSR-TK -601	SERVICE WATER STORAGE TANK
WATER TREATMENT SULFURIC ACID STORAGE AND PUMPING	
1-WTA-P -613A/B	RO SULFURIC ACID METERING PUMPS
1-WTA-P -623A/B	DEGASIFIER SULFURIC ACID METERING PUMPS
1-WTA-P -625	NEUTRALIZING SULFURIC ACID METERING PUMP
1-WTA-TK -605	SULFURIC ACID STORAGE TANK
WELL WATER TREATMENT	
1-WTF-BLOW-601A/B	H2S DEGASIFIER BLOWERS
1-WTF-D -601	H2S DEGASIFIER WITH SURGE CAPACITY
1-WTF-FLT-601A/B	WELL WATER FILTERS
1-WTF-P -602A/B	FILTER FEED PUMP
HYPOCHLORITE STORAGE AND PUMPING	
1-WTH-P -044A/B	OPEN LOOP HYPOCHLORITE METERING PUMP
1-WTH-P -045A/B	CONDENSER HYPOCHLORITE METERING PUMP
1-WTH-P -603A/B	SERVICE WATER HYPOCHLORITE METERING PUMPS
1-WTH-P -605A/B	POTABLE WATER HYPOCHLORITE METERING PUMPS
1-WTH-P -621	SANITARY SYSTEM HYPOCHLORITE METERING PUMP
1-WTH-P -687	WASTEWATER FILTER HYPOCHLORITE METERING PUMP
1-WTH-TK -041	COOLING WATER HYPOCHLORITE STORAGE TANK
1-WTH-TK -604	WELLWATER TREATMENT HYPOCHLORITE STORAGE TANK
1-WTH-TK -609	WASTEWATER TREATMENT HYPOCHLORITE STORAGE TANK
BRINE CONCENTRATION	
1-BRC-C -701	EVAPORATOR VAPOR COMPRESSOR
1-BRC-D -701	EVAPORATOR CONDENSATE KO DRUM
1-BRC-D -702	EVAPORATOR CONDENSATE DRIER VAPOR SCRUBBER
1-BRC-D -703	VACUUM PUMP KNOCKOUT DRUM
1-BRN-DRY-701	ROTARY DRUM DRYER
1-BRC-DSU-701	DESUPERHEATER
1-BRN-E -701	GREY WATER PREHEATER
1-BRC-E -702	BACKUP CONDENSER
1-BRN-E -703	FORCED CIRCULATION EVAPORATOR HEATER
1-BRC-E -704	FORCED CIRCULATION EVAPORATOR CONDENSER
1-BRC-E -705	SCRUBBER CIRCULATION COOLER
1-BRC-E -706	VACUUM PUMP HEAT EXCHANGER
1-BRN-EV -701	GREY WATER EVAPORATOR
1-BRN-EV -702	FORCED CIRCULATION EVAPORATOR
1-BRN-P -701A/B	BRINE RECIRCULATION PUMPS
1-BRC-P -702A/B	EVAPORATOR CONDENSATE PUMPS
1-BRC-P -710A/B	SOUR GAS VACUUM PUMP
1-BRN-TK -702	BRINE STORAGE TANK
1-BRC-TK -703	EVAPORATOR CONDENSATE STORAGE TANK
1-BRN-TK -704	CONCENTRATED BRINE STORAGE TANK
COAL HANDLING/SLURRY PREPARATION	
1-CYH-BIN-801	TRUCK HOPPER AND GRATING
1-FCS-BIN-801	COAL STORAGE BIN
1-CYC-BIN-802A/B	COAL STORAGE SILOS

1-DSS-PKG-801	DUST SUPPRESSION SYSTEM (TRUCK HOPPER)
1-AMM-PKG-801A/B	COAL AMMONIA INJECTION PACKAGE
1-CYH-S -801	MAGNETIC SEPARATOR
1-FCS-SCR-801A/B	TROMMEL SCREENS
1-SLR-SCR-802A-D	SLURRY VIBRATING SCREEN
1-CYH-SUMP-801	UNLOADING AREA SUMP
1-SLR-SUMP-801	GRINDING SUMP
1-CYH-SUMP-802	RECLAIM AREA SUMP
1-SLA-TK -801	SLURRY ADDITIVE TANK
1-SLR-TK -802A/B	MILL DISCHARGE TANK
1-SLW-TK -803	RECYCLE WATER TANK
1-SLR-TK -804A/B	SLURRY RUN TANK
1-SLW-TK -805	FLUSH WATER TANK
1-SLW-TK -806	PURGE WATER TANK
POWER GENERATION	
1-WTS-A -901	STEAM/WATER SAMPLING AND MONITORING PANEL
1-PWR-CRN-901	DOUBLE GIRDER ELEC. OVHD. TRAVELING CRANE
1-DET-D -901	HRSG BLOWDOWN TANK
1-DET-D -902	CONDENSATE RECEIVER
1-DET-D -903	CONDENSATE RETURN UNIT
1-SLP-DES-901	LOW PRESSURE ATTEMPERATOR
1-PWR-E -901	CONDENSER
1-ABM-E -901	ELECTRIC SUPERHEATER PACKAGE
1-CCC-E -901A/B	POWER BLOCK CLOSED LOOP HEAT EXCHANGER
1-CWS-FLT-901	POWER BLOCK OPEN LOOP COOLING WATER FILTER
1-PWR-GTG-901	GAS TURBINE
1-WTS-MIX-903	PHOSPHATE MIXER
1-WOW-P -901	POWER BLOCK OILY WATER SUMP PUMP
1-LOS-P -901	LUBE OIL TRANSFER PUMP
1-CNH-P -901A/B	CONDENSATE PUMP
1-ARC-P -901A/B	CONDENSER VACUUM PUMPS
1-DET-P -901A/B	CONDENSATE RETURN PUMPS
1-HOL-P -901A/B	LOW PRESSURE ECONOMIZER RECIRC. PUMPS
1-CCC-P -901A/B	POWER BLOCK CLOSED LOOP COOLING WATER PUMPS
1-FWT-P -901A/B	FEEDWATER TRANSFER PUMPS
1-WTS-P -901A/B	HYDRAZINE METERING PUMPS
1-WTS-P -901A/B	AMMONIA STRIPPER REBOILER CONDENSATE POT PUMPS
1-CNH-P -902	CONDENSATE MAKE-UP PUMP
1-DET-P-902	CONDENSATE RETURN UNIT SUMP PUMP
1-WOW-P -902	BLOWDOWN SUMP PUMP
1-DET-P -902A/B	HRSG BLOWDOWN SUMP PUMPS
1-HOL-P -902A/B	LOW PRESSURE BFW PUMPS
1-WTS-P -902A/B	AMMONIA METERING PUMPS
1-ARC-P -902A/B	CONDENSER WATERBOX AIR REMOVAL VACUUM PUMPS
1-HOL-P-902A/B	LOW PRESSURE BFW PUMPS
1-WTS-P -903A/B/C	PHOSPHATE METERING PUMPS
1-HAS-PKG-901	GAS TURBINE GENERATOR HYDRAULIC POWER UNIT
1-HAS-PKG-902	STEAM TURBINE GENERATOR HYDRAULIC POWER UNIT

1-SHP-SG -901	HEAT RECOVERY STEAM GENERATOR
1-PWR-STG-901	STEAM TURBINE
1-WOW-SUMP-901	POWER BLOCK OILY WATER SUMP
1-DET-SUMP-901	HRSG BLOWDOWN/NEUTRALIZATION SUMP
1-DET-SUMP-902	CONDENSATE RETURN UNIT SUMP
1-LOS-TK -901	CLEAN AND DIRTY LUBE OIL TANK
1-WTS-TK -901	HYDRAZINE STORAGE TANK
1-CNH-TK -901	CONDENSATE STORAGE TANK
1-DET-TK -901	GAS TURBINE DRAINS TANK
1-CCC-TK -901	POWER BLOCK CLOSED LOOP COOLING WATER HEAD EXP. TANK
1-WTS-TK -902	AMMONIA STORAGE TANK
1-WTS-TK -903	PHOSPHATE STORAGE TANK
1-TML-V -901	STG LUBE OIL CONDITIONER

MISCELLANEOUS DRAWINGS

11.0 MISCELLANEOUS DRAWINGS

11.1 PROJECT SCHEDULE

11.2 ELECTRICAL ONE-LINE DIAGRAM

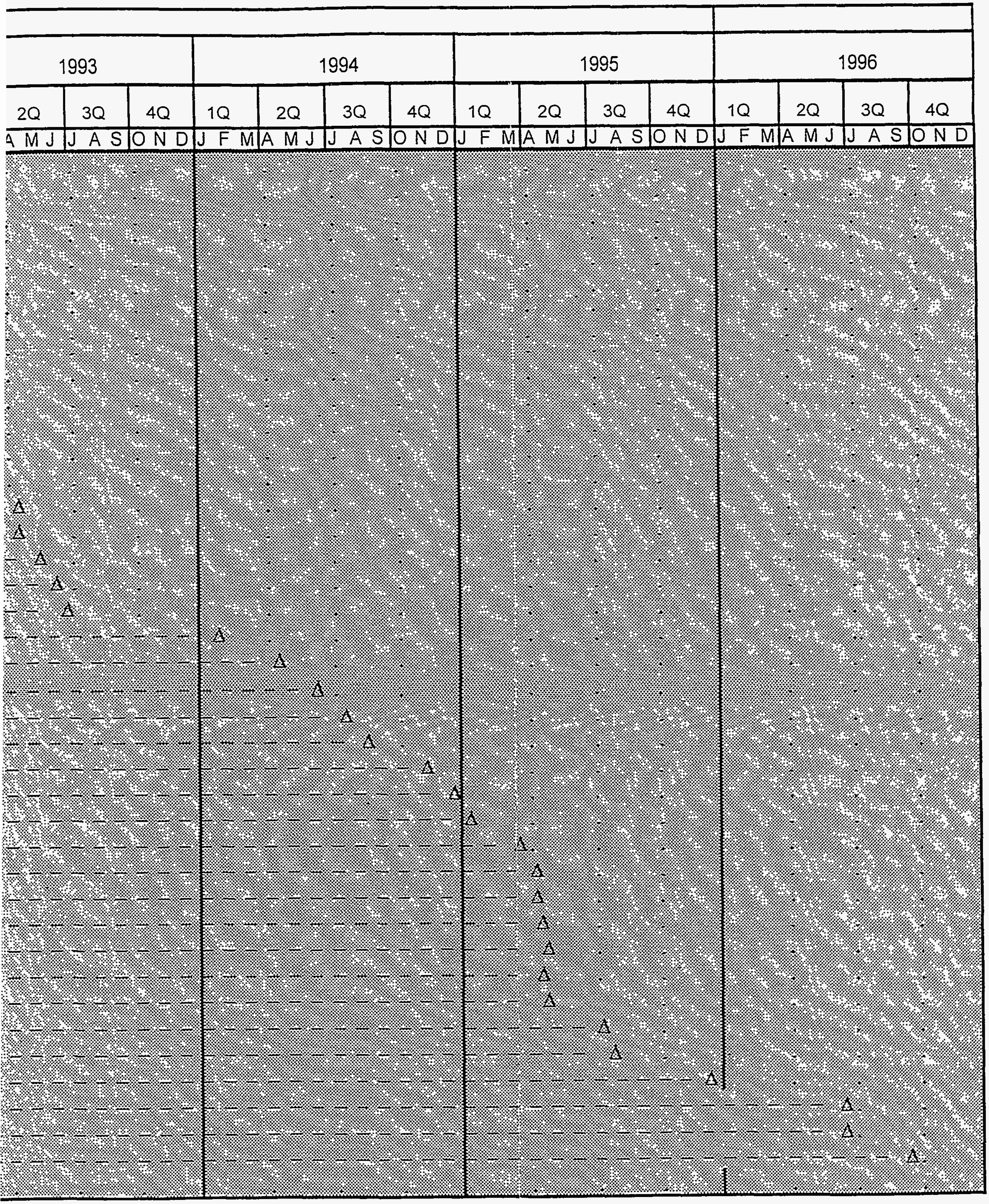
11.3 PROCESS FLOW DIAGRAMS

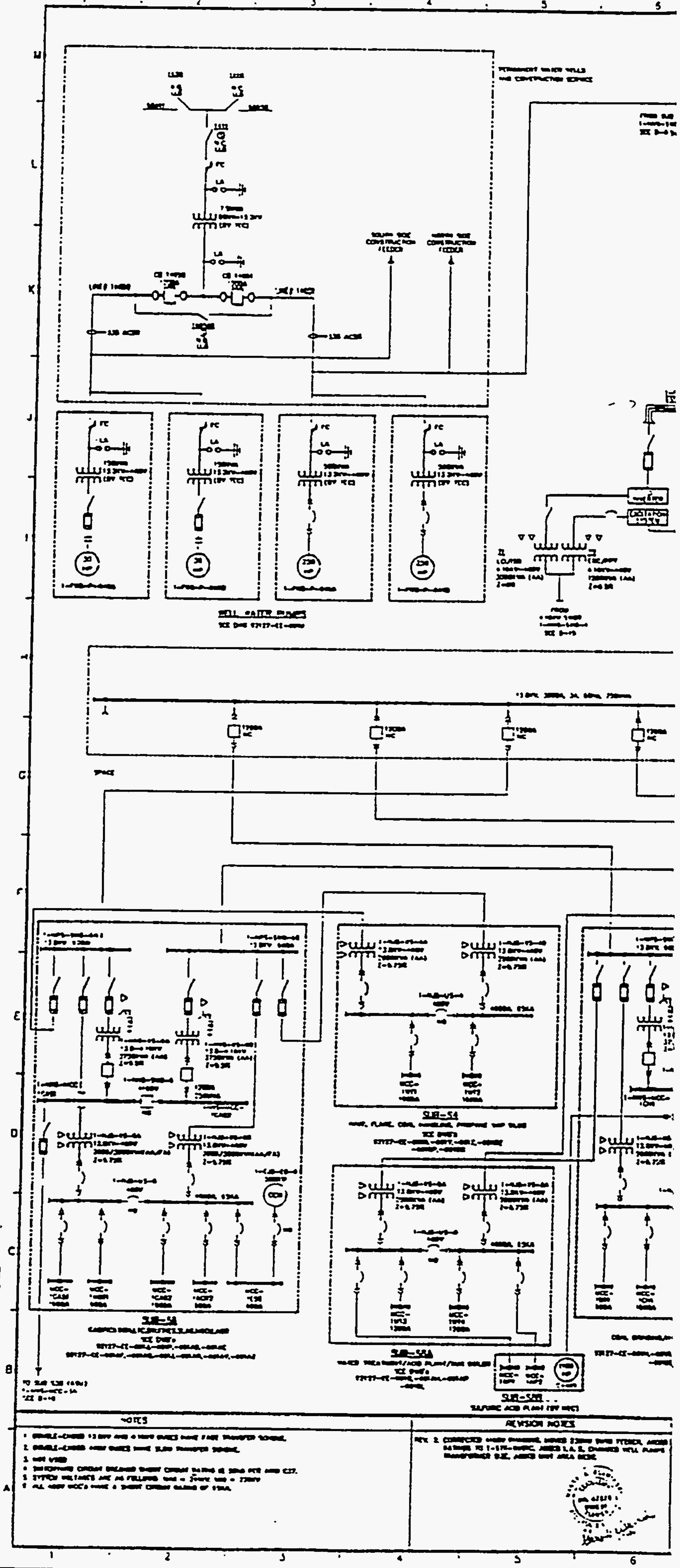
92127-PFD-1-1B	Overall Process Flow Diagram (Sheet 1 of 2)
92127-PFD-1-1C	Overall Process Flow Diagram (Sheet 2 of 2)

01-Jul-96

POLK POWER STATION - # 1
PUBLIC STATION REPORT

	1991						1992													
	3Q			4Q			1Q			2Q			3Q			4Q			1Q	
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Petition filed with Florida Service Commission (FPSC) to determine Need for Electrical Power plant and Related facilities		Δ																		
Architect/Engineer (A/E) selected for development of Preliminary Engineering Package (PEP)									Δ											
U.S. Dept. of Energy approved Amend M001									Δ											
FPSC issued order to approve Need for Polk Power Station Unit 1									Δ											
Submitted Environmental Information Volume to EPA.												Δ								
Submitted Site Cert. Application to Florida Dept of Environ. Regu													Δ							
Awarded Combined Cycle System Contract																	Δ			
PEP Complete																		Δ		
Awarded Air Separation Unit turnkey Contract																				
Awarded Contract for Detailed engineering																				
Awarded Gasificaton System Contract																				
Awarded Hot Gas Clean-up System (HGCU Design Contract																				
Awarded Construction Management Contract																				
Site Certification Application approved																				
Award Sulfuric Acid Plant Contract																				
Award Brine Concentration System Contract																				
Receive Army Corp. of Engineer's 404 Permit																				
Begin Site Development Work																				
Begin Foundation Construction																				
Begin Construction 230kv Switchyard																				
Begin ASU Foundation Construction																				
Deliver Combustion Turbine & Generator																				
Complete A/E Detailed Engineering																				
Begin Gasification Structure Erection																				
Complete HGCU Detailed Engineering																				
Delever Main Air Compressor																				
Deliver Steam Turbine & Generator																				
Begin Sulfuric Acid Plant Construction																				
Deliver Radiant Syngas Cooler																				
Energize 230kv Switchyard																				
Startup of Air Separation Unit																				
Startup of Combined Cycle Equipment																				
Startup of Gasification System																				
IGCC Commercial Operation Date																				


1993
1994
1995
1996
2Q 3Q 4Q
1Q 2Q 3Q 4Q
1Q 2Q 3Q 4Q
1Q 2Q 3Q 4Q
A M J J A S O N D
J F M A M J J A S O N D
J F M A M J J A S O N D
J F M A M J J A S O N D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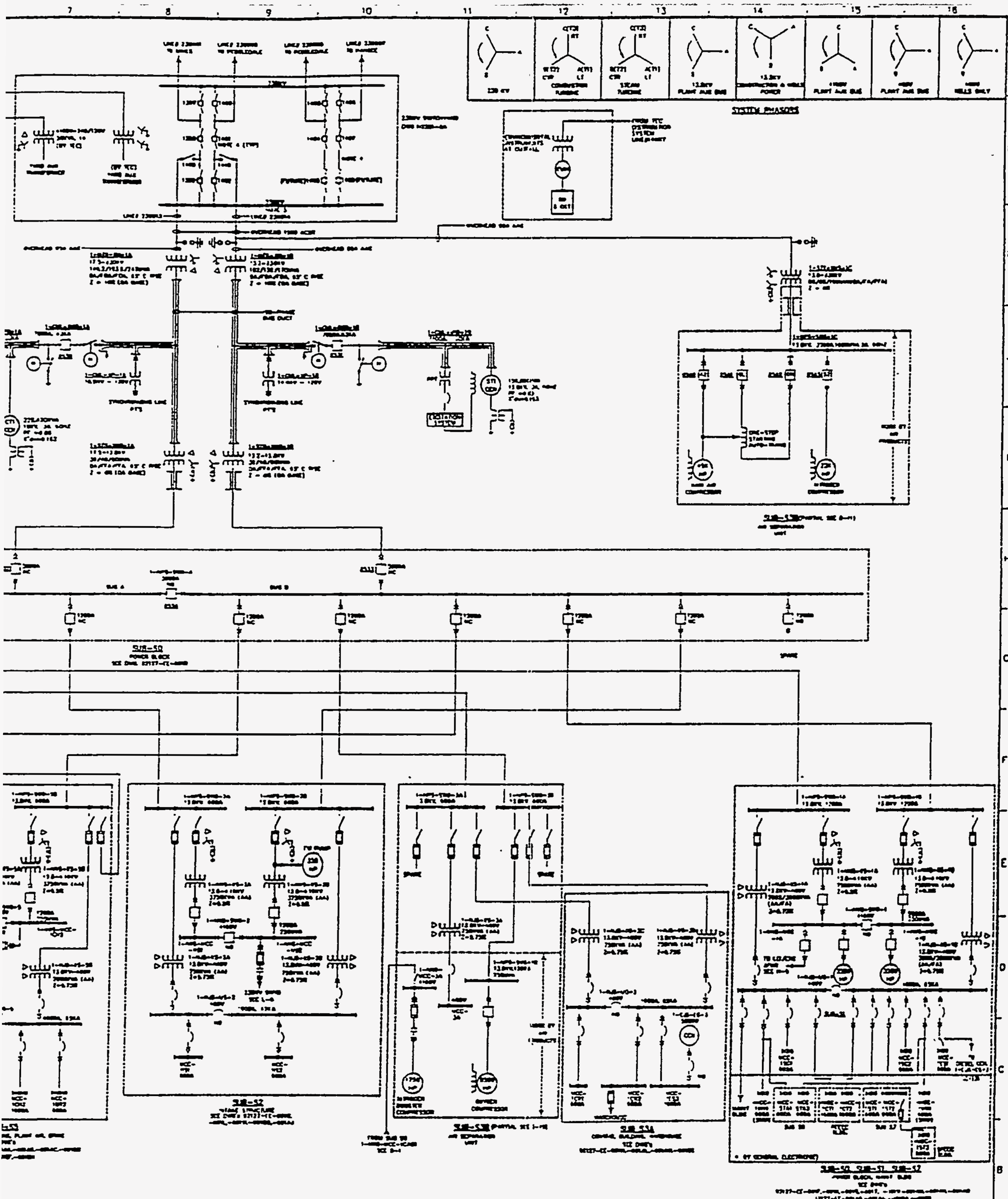
REVISION NOTES



REFERENCE DRAWINGS

TITLE	DRAWING NO.

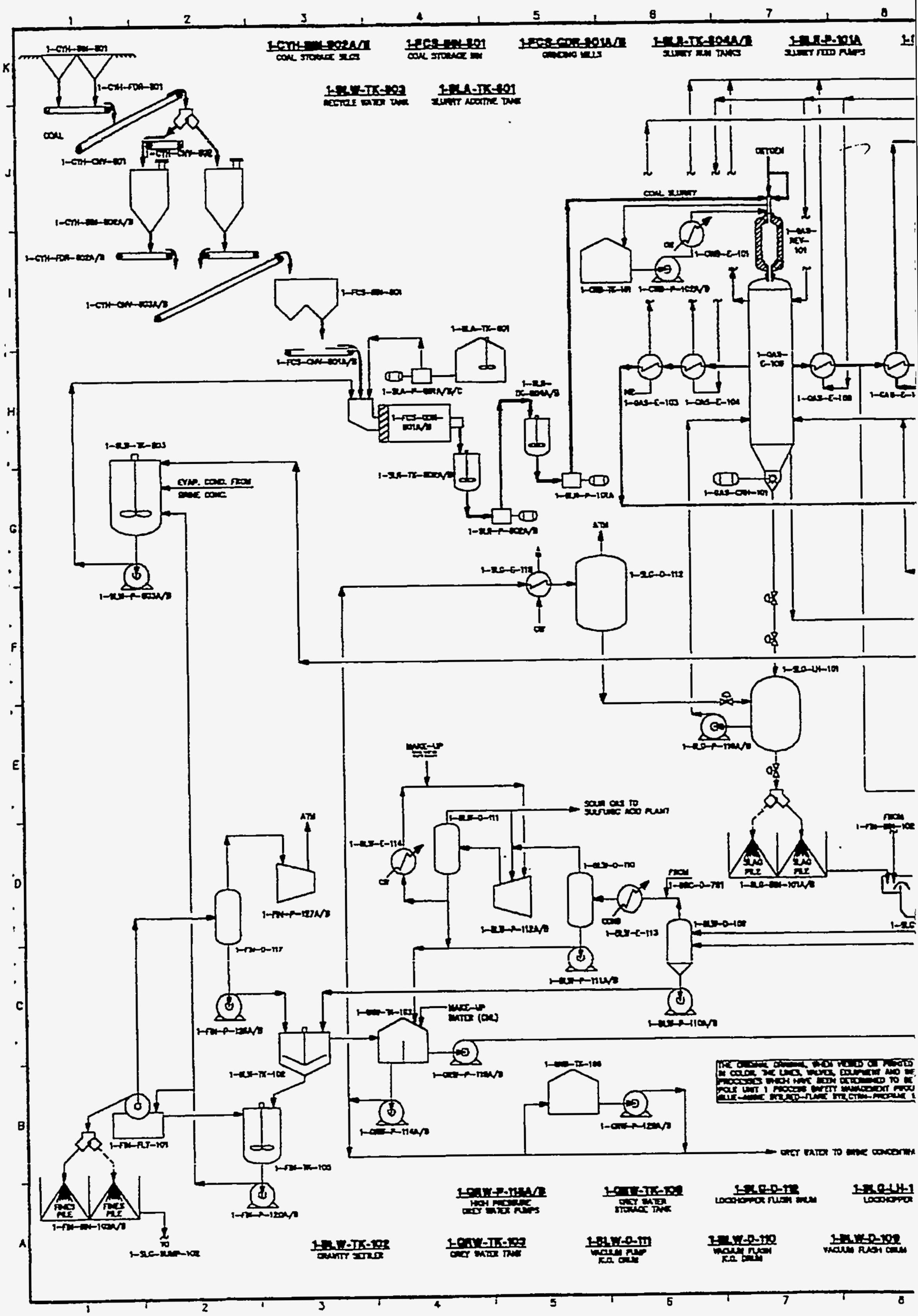
BECHTEL JOB NO. 22269

POLK POWER STATION UNIT # 1
ELECTRICAL
OVERALL
ONE LINE DIAGRAM

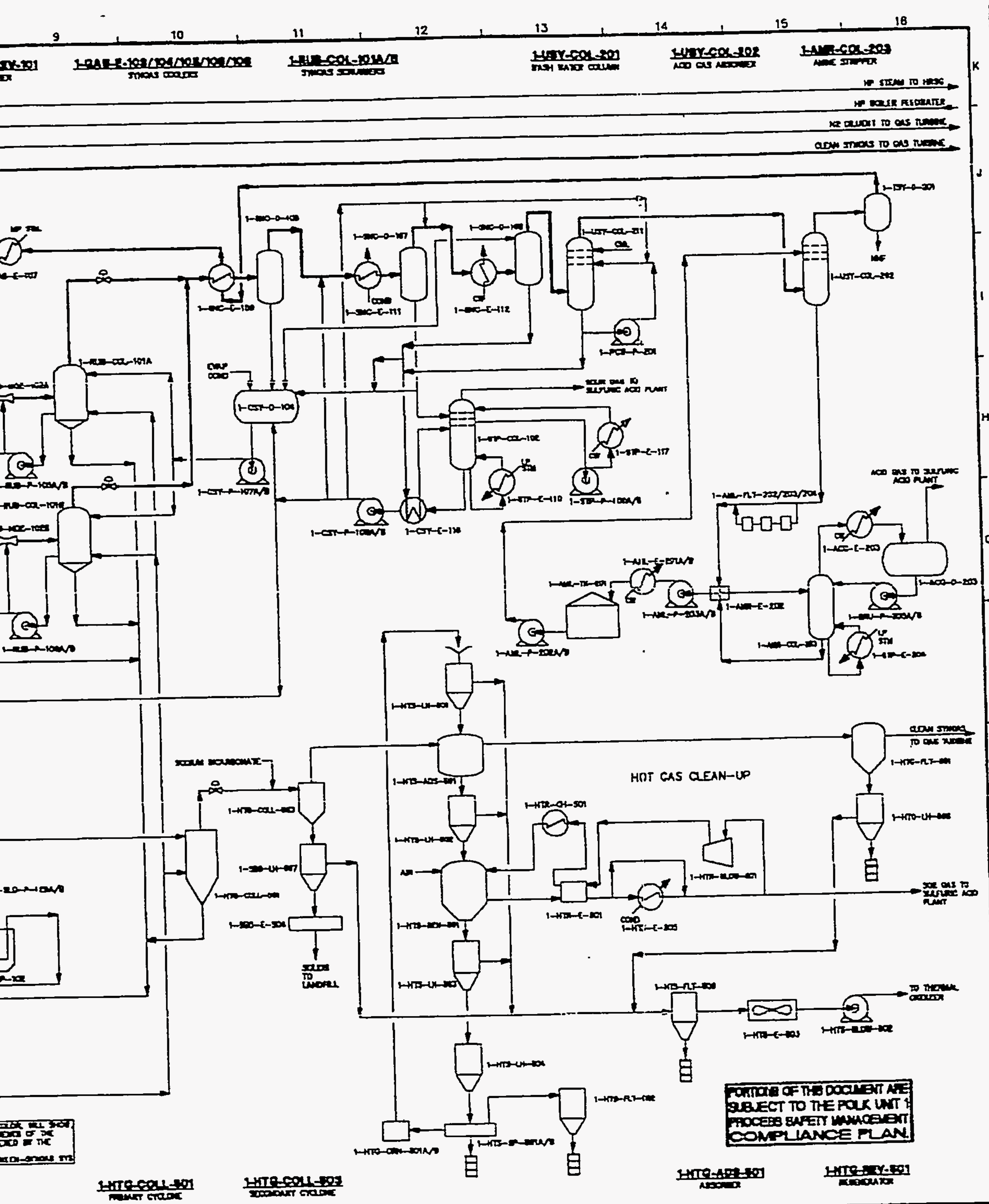
TAMPA ELECTRIC
A TECO ENERGY COMPANY

DRAWING NO. 92127-EE-001A

REV. 2



COAL STORAGE SILOS
COAL STORAGE BIN
GRINDING MILLS
SLURRY RUN TANKS
SLURRY FEED PUMPS
RECYCLE WATER TANK
SLURRY ADDITIVE TANK
COAL
COAL SLURRY
OXYGEN
ATM
MAKE-UP
SOUR GAS TO SULFURIC ACID PLANT
GREY WATER TO BRINE CONCENTRA
HIGH PRESSURE GREY WATER PUMPS
GREY WATER STORAGE TANK
LOCKHOPPER FLUSH DRUM
LOCKHOPPER
GRAVITY SETTLER
GREY WATER TANK
VACUUM PUMP K.O. DRUM
VACUUM FLASH K.O. DRUM
VACUUM FLASH DRUM



NO.	DATE	REVISION	BY	CHKD					
5	04/25/96	REVISED, PROCESS SAFETY MANUAL	RMC			—		DAC
4	11/23/94	REVISED 1-HTG-C-808	SAM	RC		SYC	JB	
3	08/27/94	REVISED SLAG HANDLING AND FINES FILTER AREAS	SAM	RC		SYC	JB	
2	02/15/94	RE-ISSUED FOR INFORMATION	SAM	RC		SYC		
1	07/22/93	ISSUED FOR INFORMATION	SAM			SYC		

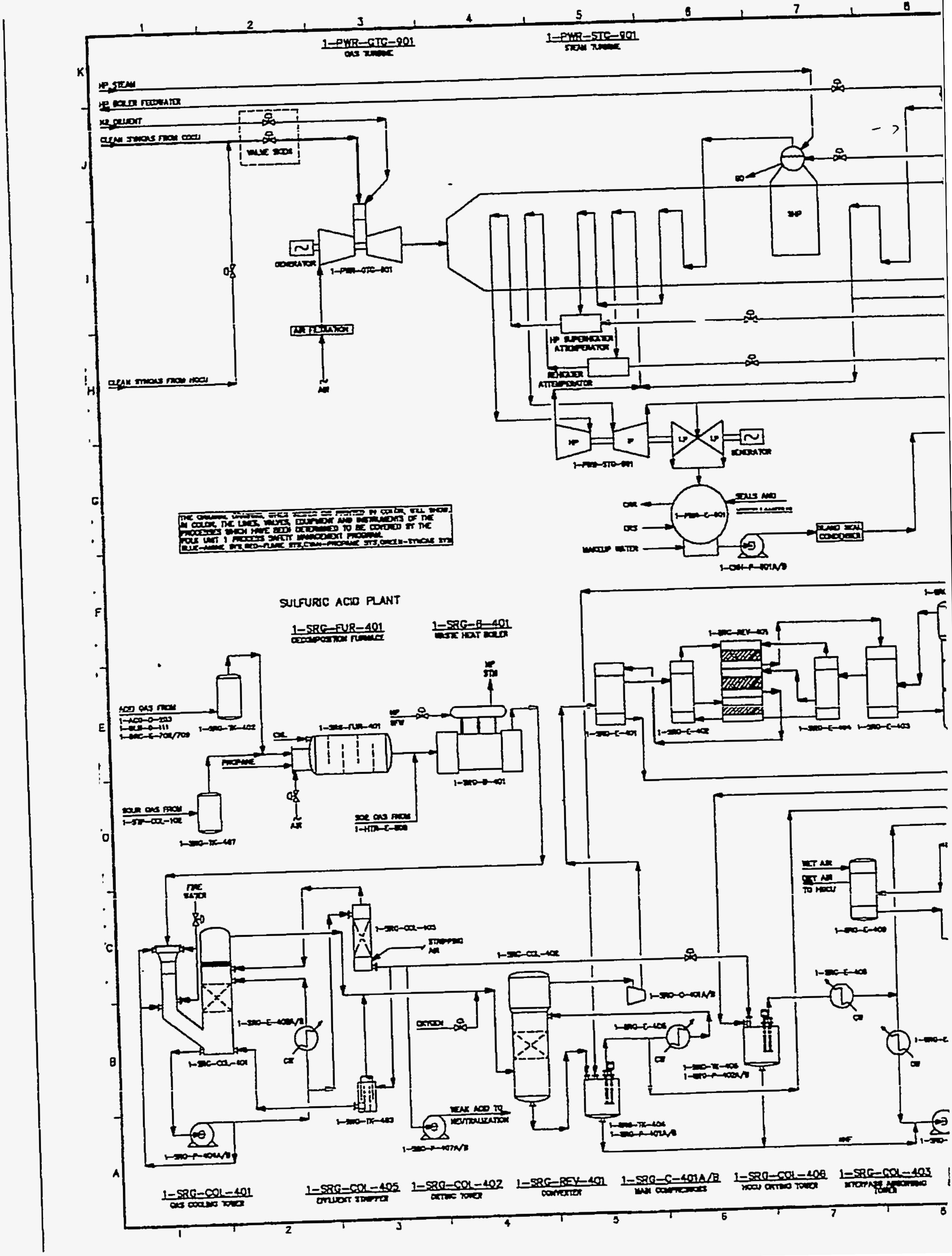
BECHTEL
JOB NO.
22269

TAMPA ELECTRIC
A TECO ENERGY COMPANY

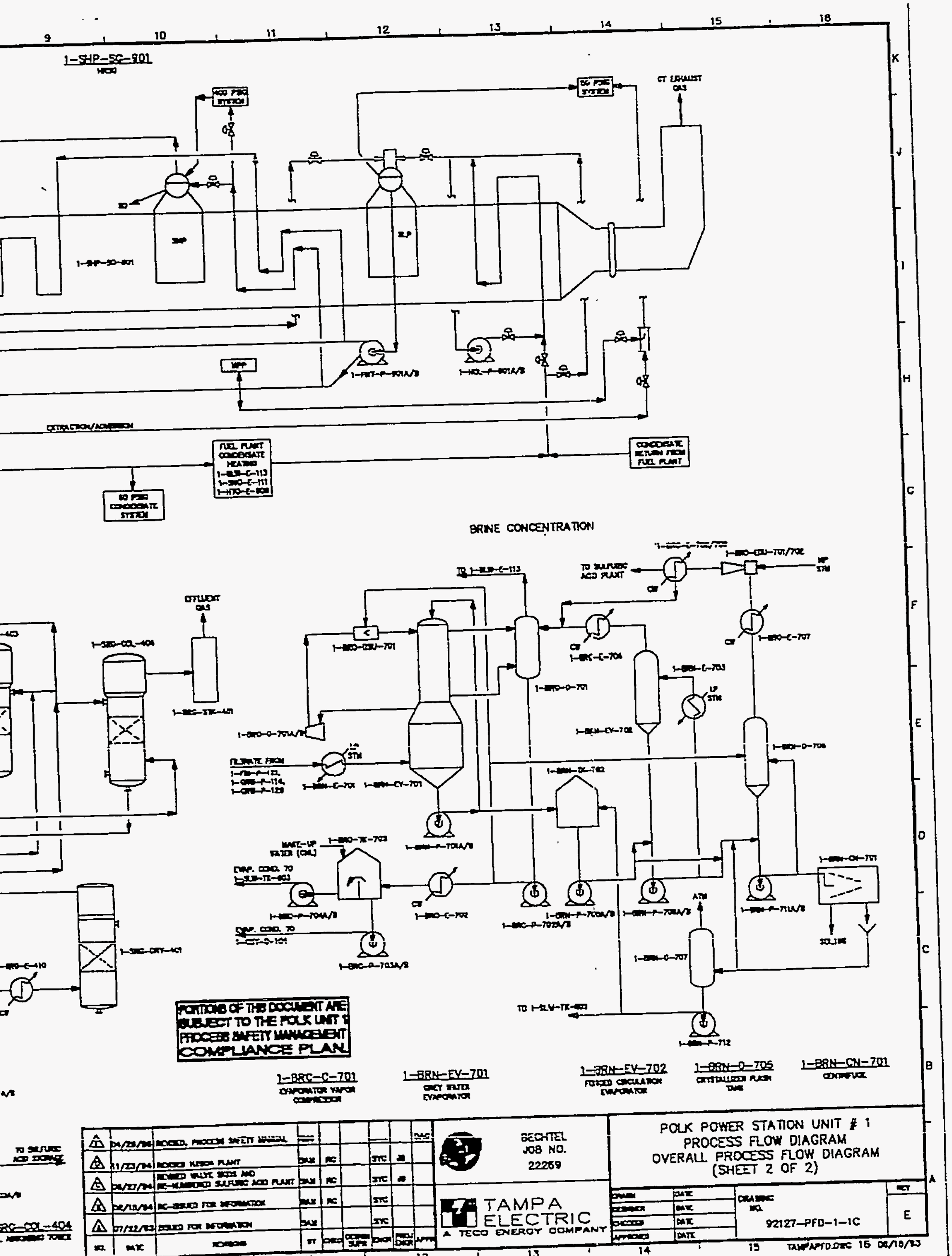
POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
OVERALL PROCESS FLOW DIAGRAM
(SHEET 1 OF 2)

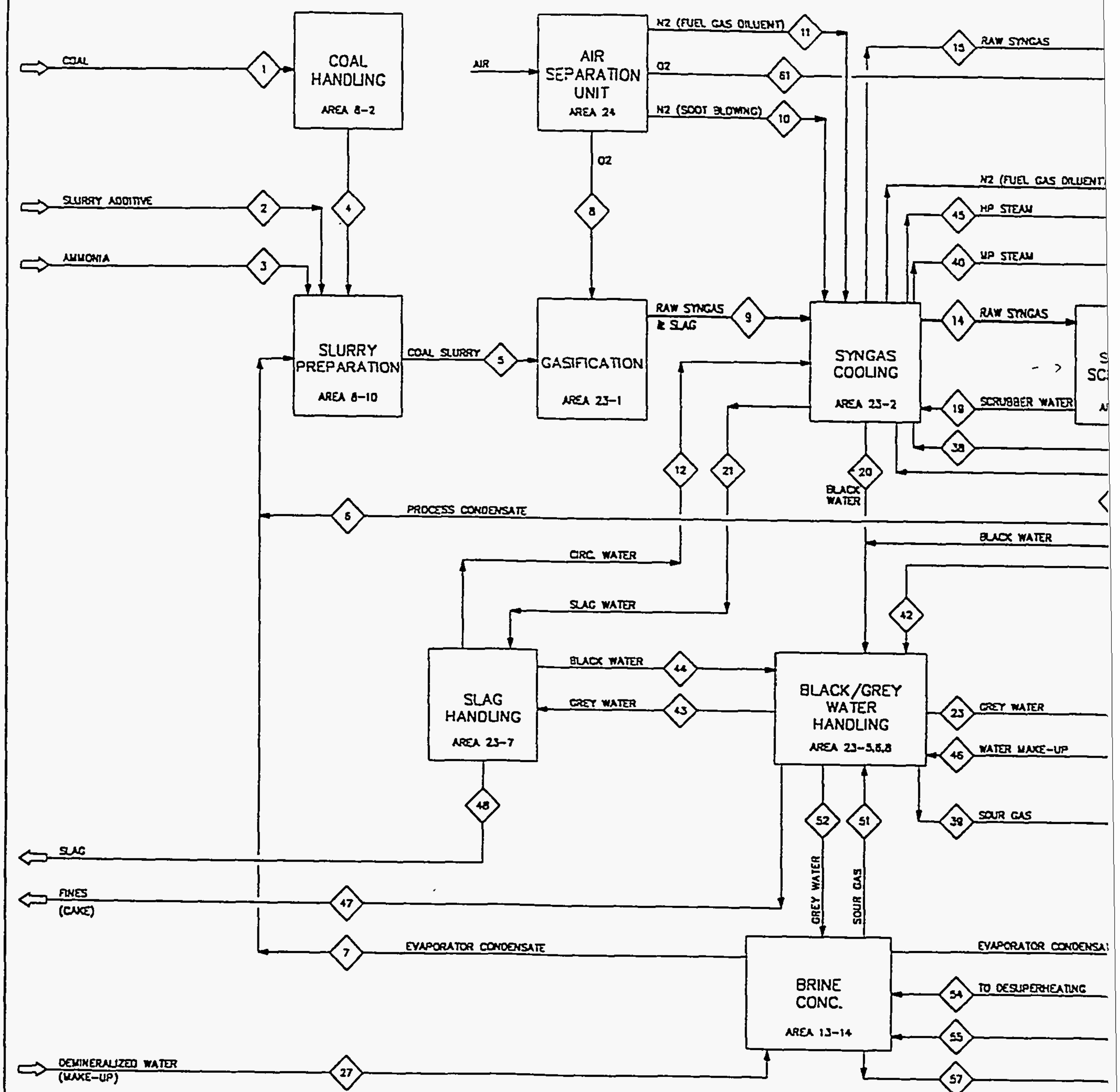
DRAWING NO. 92127-PFD-1-18
REV E

TAMPAPFD.DWG 16 08/15/93



1-PWR-GTC-901
GAS TURBINE
1-PWR-STC-901
STEAM TURBINE
HP STEAM
HP BOILER FEEDWATER
N2 DILUENT
CLEAN SYNGAS FROM COCU
VALVE SKIDS
GENERATOR
AIR FILTRATION
AIR
CLEAN SYNGAS FROM HOCU
HP SUPERHEATER ATTEMPERATOR
REHEATER ATTEMPERATOR
HP
IP
LP
GENERATOR
SEALS AND
MAKEUP WATER
GLAND SEAL CONDENSER
SULFURIC ACID PLANT
1-SRG-FUR-401
DECOMPOSITION FURNACE
1-SRG-B-401
WASTE HEAT BOILER
ACID GAS FROM
PROPANE
SOUR GAS FROM
AIR
FIRE WATER
STRIPPING AIR
OXYGEN
WEAK ACID TO NEUTRALIZATION
WET AIR
DRY AIR TO HOCU
1-SRG-COL-401
GAS COOLING TOWER
1-SRG-COL-405
EFFLUENT STRIPPER
1-SRG-COL-402
1-SRG-REV-401
CONVERTER
1-SRG-C-401A/B
MAIN COMPRESSORS
1-SRG-COL-406
HOCU DRYING TOWER
1-SRG-COL-403


1-SHP-SG-901
CT EXHAUST GAS
EXTRACTION/ADMISSION
FUEL PLANT CONDENSATE HEATING
CONDENSATE RETURN FROM FUEL PLANT
BRINE CONCENTRATION
TO SULFURIC ACID PLANT
EFFLUENT GAS
PORTIONS OF THIS DOCUMENT ARE SUBJECT TO THE POLK UNIT 1 PROCESS SAFETY MANAGEMENT COMPLIANCE PLAN
1-BRC-C-701
EVAPORATOR VAPOR COMPRESSOR
1-BRN-EV-701
1-BRN-EV-702
FORCED CIRCULATION EVAPORATOR
1-BRN-D-705
CRYSTALLIZER FLASH TANK
1-BRN-CN-701
CENTRIFUGE
POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
OVERALL PROCESS FLOW DIAGRAM
(SHEET 2 OF 2)
BECHTEL
JOB NO.
22269
TAMPA ELECTRIC
A TECO ENERGY COMPANY
92127-PFD-1-1C
E



STREAM NO (LB/HR)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CASE 1	166169	TRACE	TRACE	166169	239838	10609	62859	164474	404300	24148	501964	57386	649	418022	0
CASE 2	166169	TRACE	TRACE	166169	239838	9728	63940	164474	404300	24148	501964	57386	649	373022	45000

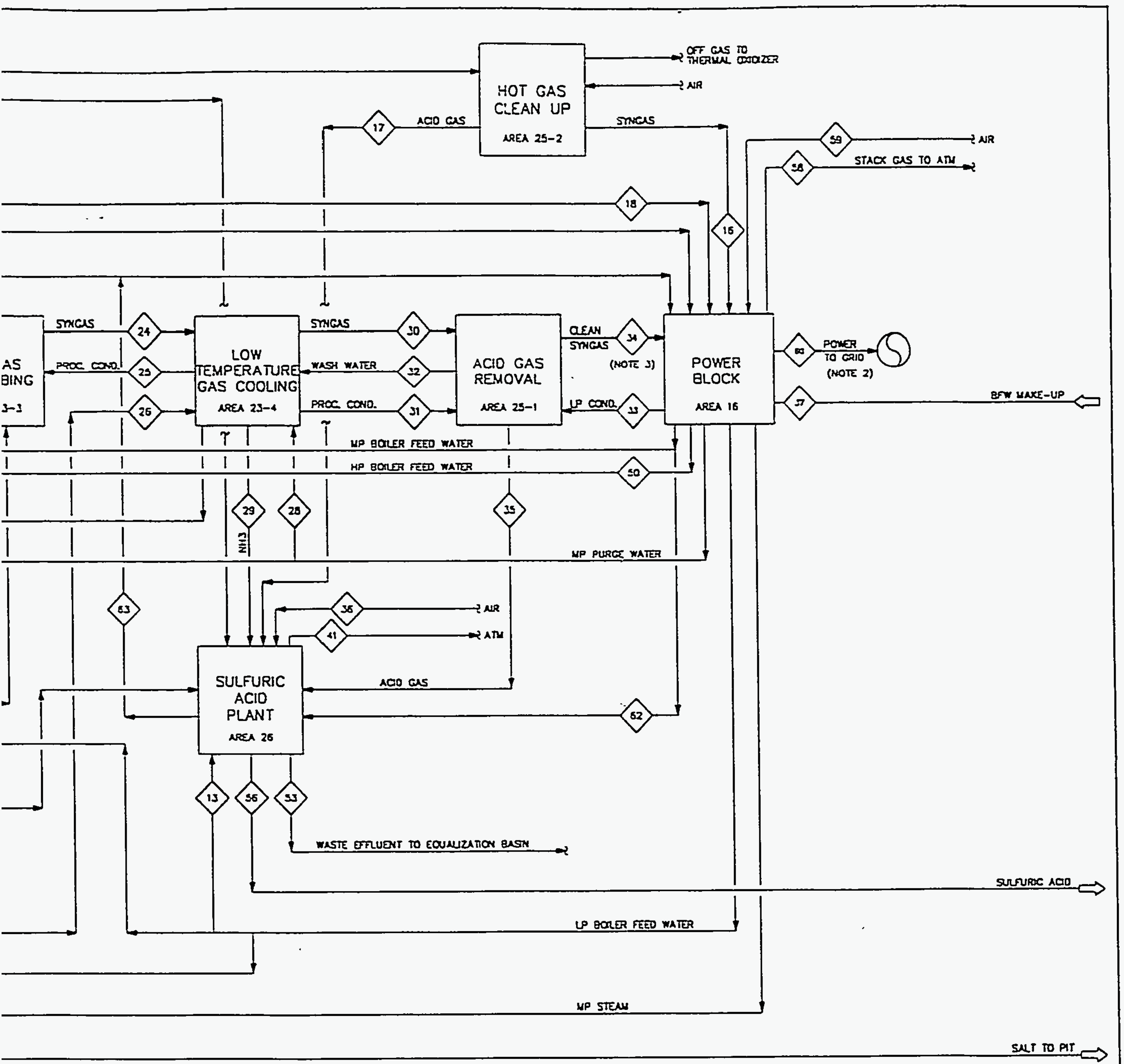
STREAM NO (LB/HR)	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
CASE 1	44594	62236	428441	82858	3522	12948	8227	289	366291	21402	21460	712	344337	22608	31744
CASE 2	40135	66228	385597	56593	2755	14640	7839	260	329662	19262	19314	640	309903	20348	28921

STREAM NO (LB/HR)	43	44	45	46	47	48	49	51	52	53	54	55	56	57	58
CASE 1	44824	29215	489145	13751	7413	22286	489145	1758	54095	1788	1147	180	12178	231	3911901
CASE 2	44824	29215	489145	21361	7413	22286	489145	2609	54095	1788	1388	180	12261	231	3922344

NOTES:

1. CASE DESIGNATION:
   CASE 1: 100% COLD GAS CLEAN UP (CGCU)
   CASE 2: 90% CGCU + 10% HGCU
2. POWER TO GRID REPRESENTS NET POWER PRODUCTION WITH AMBIENT TEMP @ 90F
3. STREAM 34 GOES BACK TO SYNGAS COOLING FOR HEATING PRIOR TO GOING TO POWER BLOCK.

DATE: 09-08-1994, 10:40 TVB



15	17	18	19	20	21
0	0	501964	70091	73840	64062
44877	5319	501964	70091	73840	64062
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25349	36491	150	36491	44287	5560
34125	36491	150	36491	44373	5560
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
3065600	250 MW	2812	22850	22850	
3065600	250 MW	2775	21450	21450	

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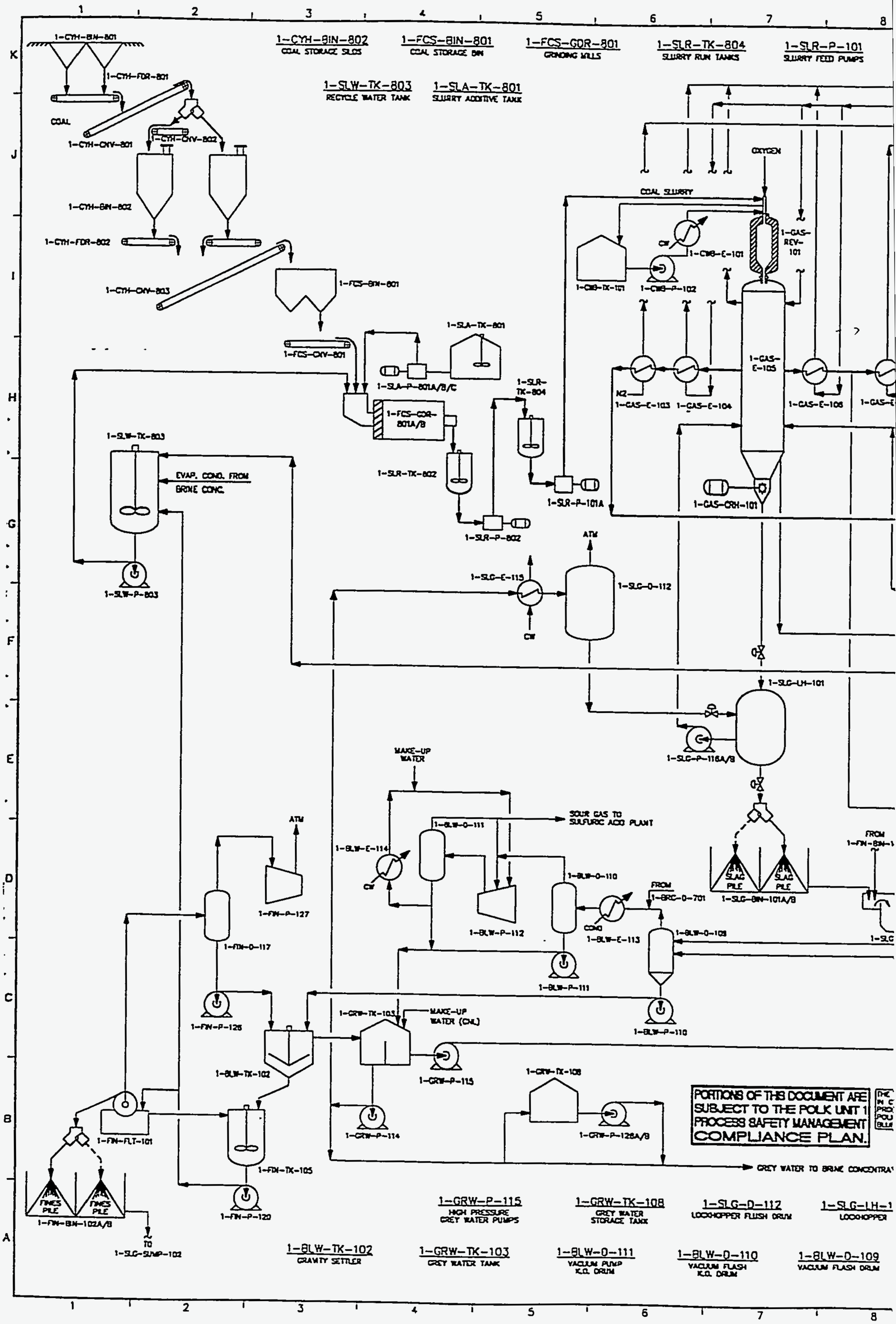
BECHTEL JOB NO. 22259

TECO

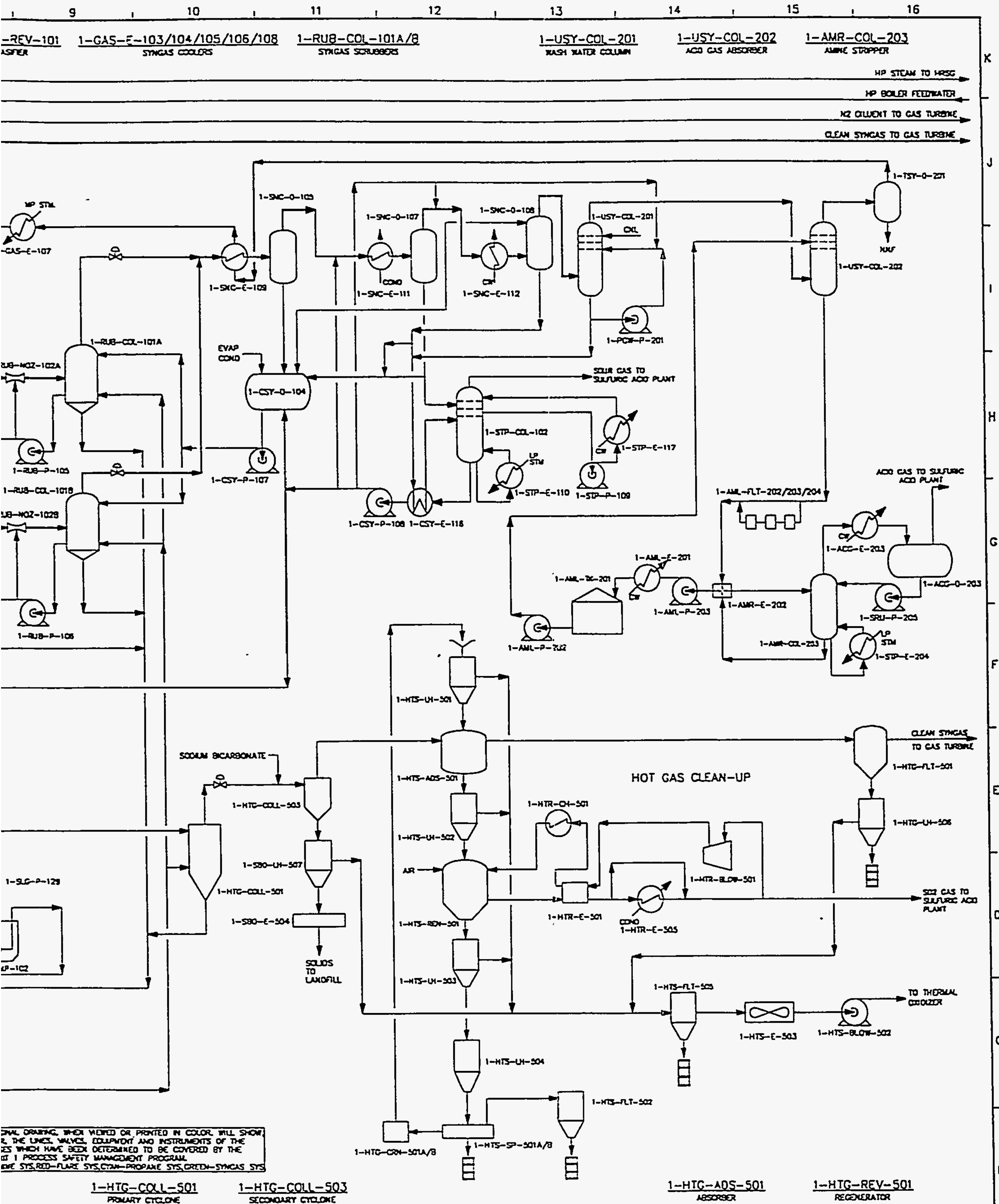
TAMPA ELECTRIC COMPANY
POLK POWER STATION UNIT # 1
OVERALL BLOCK FLOW DIAGRAM

DRAWING NO. 92127-PFD-1-1A

DOE



1-CYH-BIN-802
COAL STORAGE SILOS
1-FCS-BIN-801
COAL STORAGE BIN
1-FCS-GDR-801
GRINDING MILLS
1-SLR-TK-804
SLURRY RUN TANKS
1-SLR-P-101
SLURRY FEED PUMPS
1-SLW-TK-803
RECYCLE WATER TANK
1-SLA-TK-801
SLURRY ADDITIVE TANK
1-CYH-BIN-801
1-CYH-FDR-801
COAL
1-CYH-CNV-801
1-CYH-CNV-802
1-CYH-BIN-802
1-CYH-FDR-802
1-CYH-CNV-803
1-FCS-BIN-801
1-FCS-CNV-801
1-SLA-TK-801
1-SLA-P-801A/B/C
1-FCS-GDR-801A/B
1-SLR-TK-804
1-SLR-TK-802
1-SLR-P-802
1-SLR-P-101A
OXYGEN
COAL SLURRY
1-GAS-REV-101
1-CWB-TK-101
1-CWB-P-102
1-CWB-E-101
CW
1-GAS-E-105
N2
1-GAS-E-103
1-GAS-E-104
1-GAS-E-106
1-GAS-CRH-101
1-SLW-TK-803
EVAP. COND. FROM
BRINE CONC.
1-SLW-P-803
ATM
1-SLG-E-115
1-SLG-D-112
1-SLG-LH-101
1-SLG-P-116A/B
MAKE-UP
WATER
SOUR GAS TO
SULFURIC ACID PLANT
1-BLW-D-111
1-BLW-E-114
1-BLW-P-112
1-BLW-D-110
FROM
1-BRC-D-701
COND
1-BLW-E-113
1-BLW-D-109
1-BLW-P-111
1-BLW-P-110
SLAG
PILE
1-SLG-BIN-101A/B
FROM
1-FIN-BIN-1
1-FIN-P-127
1-FIN-D-117
1-FIN-P-126
1-GRW-TK-103
MAKE-UP
WATER (CNL)
1-BLW-TK-102
1-GRW-P-115
1-GRW-TK-108
1-GRW-P-114
1-GRW-P-128A/B
1-FIN-FLT-101
1-FIN-TK-105
FINES
PILE
1-FIN-BIN-102A/B
1-FIN-P-120
TO
1-SLG-SUMP-102
PORTIONS OF THIS DOCUMENT ARE
SUBJECT TO THE POLK UNIT 1
PROCESS SAFETY MANAGEMENT
COMPLIANCE PLAN.
GREY WATER TO BRINE CONCENTRA
1-GRW-P-115
HIGH PRESSURE
GREY WATER PUMPS
1-GRW-TK-108
GREY WATER
STORAGE TANK
1-SLG-D-112
LOCKHOPPER FLUSH DRUM
1-SLG-LH-1
LOCKHOPPER
1-BLW-TK-102
GRAVITY SETTLER
1-GRW-TK-103
GREY WATER TANK
1-BLW-D-111
VACUUM PUMP
K.O. DRUM
1-BLW-D-110
VACUUM FLASH
K.O. DRUM
1-BLW-D-109
VACUUM FLASH DRUM



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NO.	DATE	REVISIONS	BY	CHKD	DESIGN SUPR	ENGR	PROJ ENGR	APPR

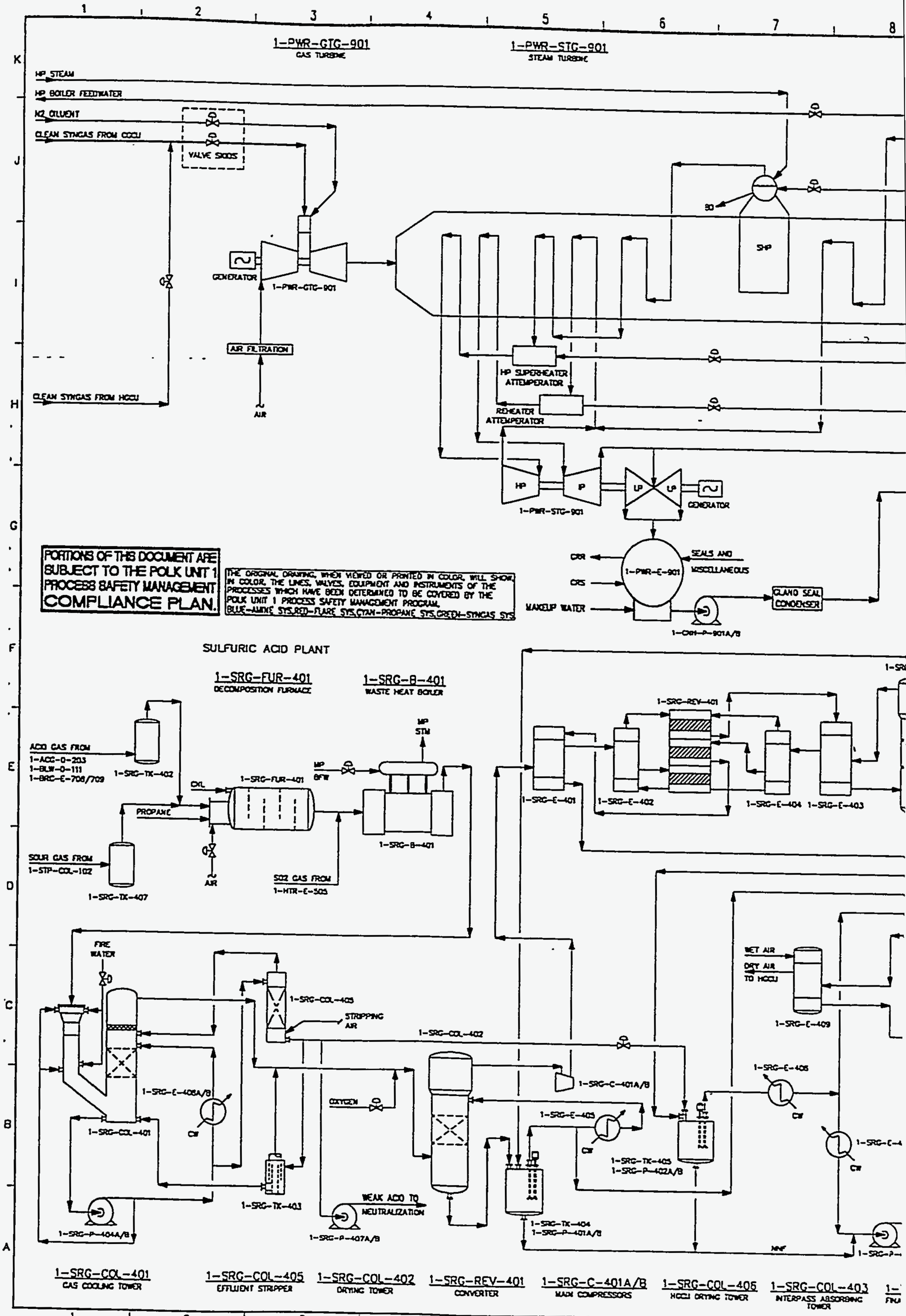
BECHTEL
JOB NO.
22269

TAMPA ELECTRIC
A TECO ENERGY COMPANY

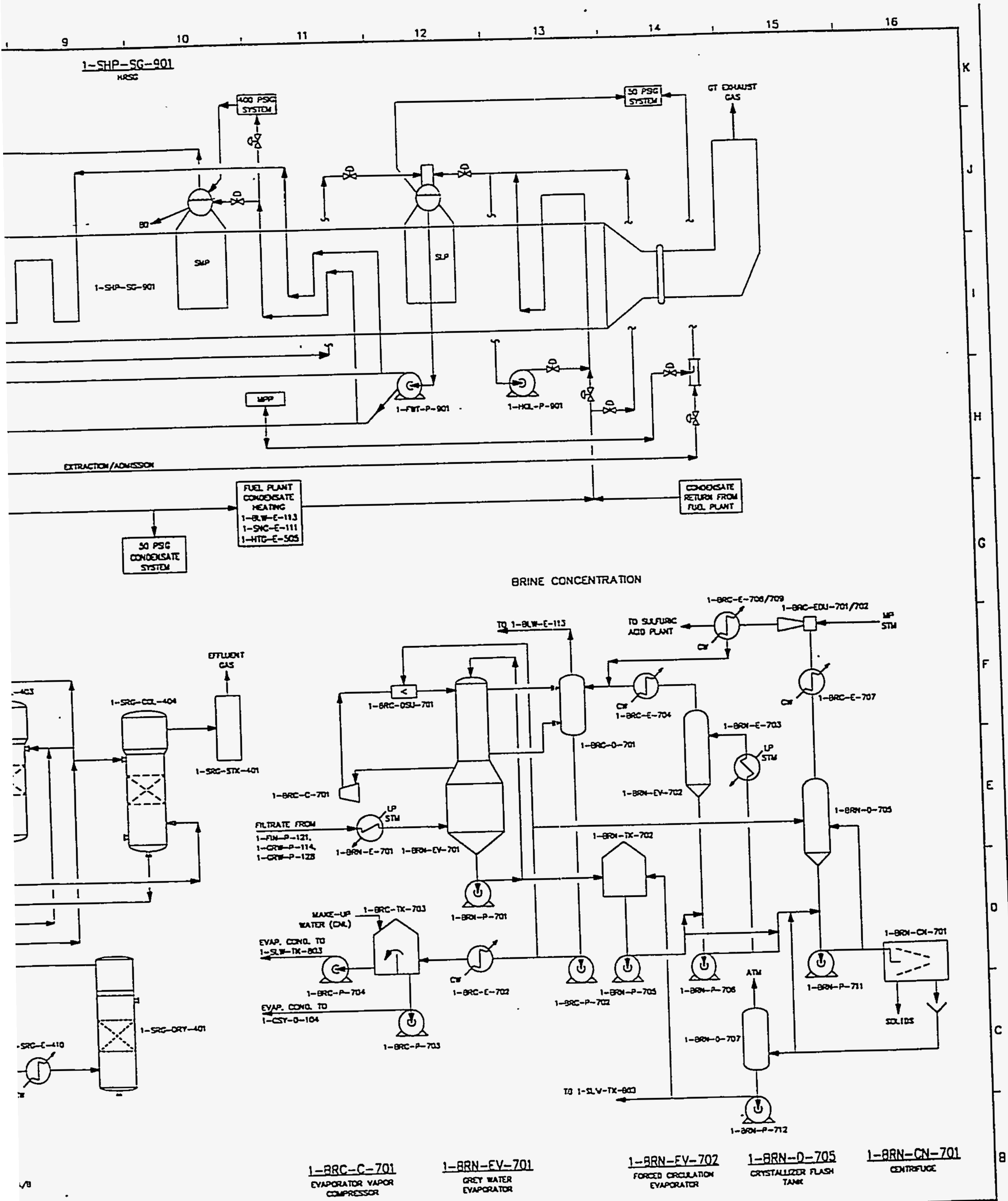
POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
OVERALL PROCESS FLOW DIAGRAM
(SHEET 1 OF 2)

DRAWN	DATE	DRAWING NO.	REV.
DESIGNER	DATE	92127-PFD-1-1B	DOE
CHECKED	DATE		
APPROVED	DATE		

TAMPAPFD.DWG 16 06/15/93



1-PWR-GTG-901
GAS TURBINE
1-PWR-STG-901
STEAM TURBINE
HP STEAM
HP BOILER FEEDWATER
N2 DILUENT
CLEAN SYNGAS FROM CCCU
VALVE SKIDS
GENERATOR
AIR FILTRATION
AIR
CLEAN SYNGAS FROM HGCU
SHP
HP SUPERHEATER ATTEMPERATOR
REHEATER ATTEMPERATOR
HP
IP
LP
1-PWR-STG-901
1-PWR-E-901
SEALS AND MISCELLANEOUS
MAKEUP WATER
GLAND SEAL CONDENSER
PORTIONS OF THIS DOCUMENT ARE SUBJECT TO THE POLK UNIT 1 PROCESS SAFETY MANAGEMENT COMPLIANCE PLAN.
THE ORIGINAL DRAWING, WHEN VIEWED OR PRINTED IN COLOR, WILL SHOW, IN COLOR, THE LINES, VALVES, EQUIPMENT AND INSTRUMENTS OF THE PROCESSES WHICH HAVE BEEN DETERMINED TO BE COVERED BY THE POLK UNIT 1 PROCESS SAFETY MANAGEMENT PROGRAM. BLUE-AMINE SYS, RED-FLARE SYS, CYAN-PROPANE SYS, GREEN-SYNGAS SYS
SULFURIC ACID PLANT
1-SRG-FUR-401
DECOMPOSITION FURNACE
1-SRG-B-401
WASTE HEAT BOILER
ACID GAS FROM
1-ACC-0-203
1-BLW-0-111
1-BRC-E-706/709
1-SRG-TK-402
PROPANE
SOUR GAS FROM
1-STP-COL-102
1-SRG-TK-407
SO2 GAS FROM
1-HTR-E-505
1-SRG-REV-401
1-SRG-E-401
1-SRG-E-402
1-SRG-E-404
1-SRG-E-403
FIRE WATER
1-SRG-COL-405
STRIPPING AIR
1-SRG-COL-402
1-SRG-E-406A/B
1-SRG-COL-401
OXYGEN
1-SRG-C-401A/B
1-SRG-E-405
1-SRG-TK-405
1-SRG-P-402A/B
WET AIR
DRY AIR TO HGCU
1-SRG-E-409
1-SRG-E-408
1-SRG-TK-403
WEAK ACID TO NEUTRALIZATION
1-SRG-P-404A/B
1-SRG-P-407A/B
1-SRG-TK-404
1-SRG-P-401A/B
1-SRG-COL-401
GAS COOLING TOWER
1-SRG-COL-405
EFFLUENT STRIPPER
1-SRG-COL-402
DRYING TOWER
1-SRG-REV-401
CONVERTER
1-SRG-C-401A/B
MAIN COMPRESSORS
1-SRG-COL-406
HGCU DRYING TOWER
1-SRG-COL-403
INTERPASS ABSORBING TOWER



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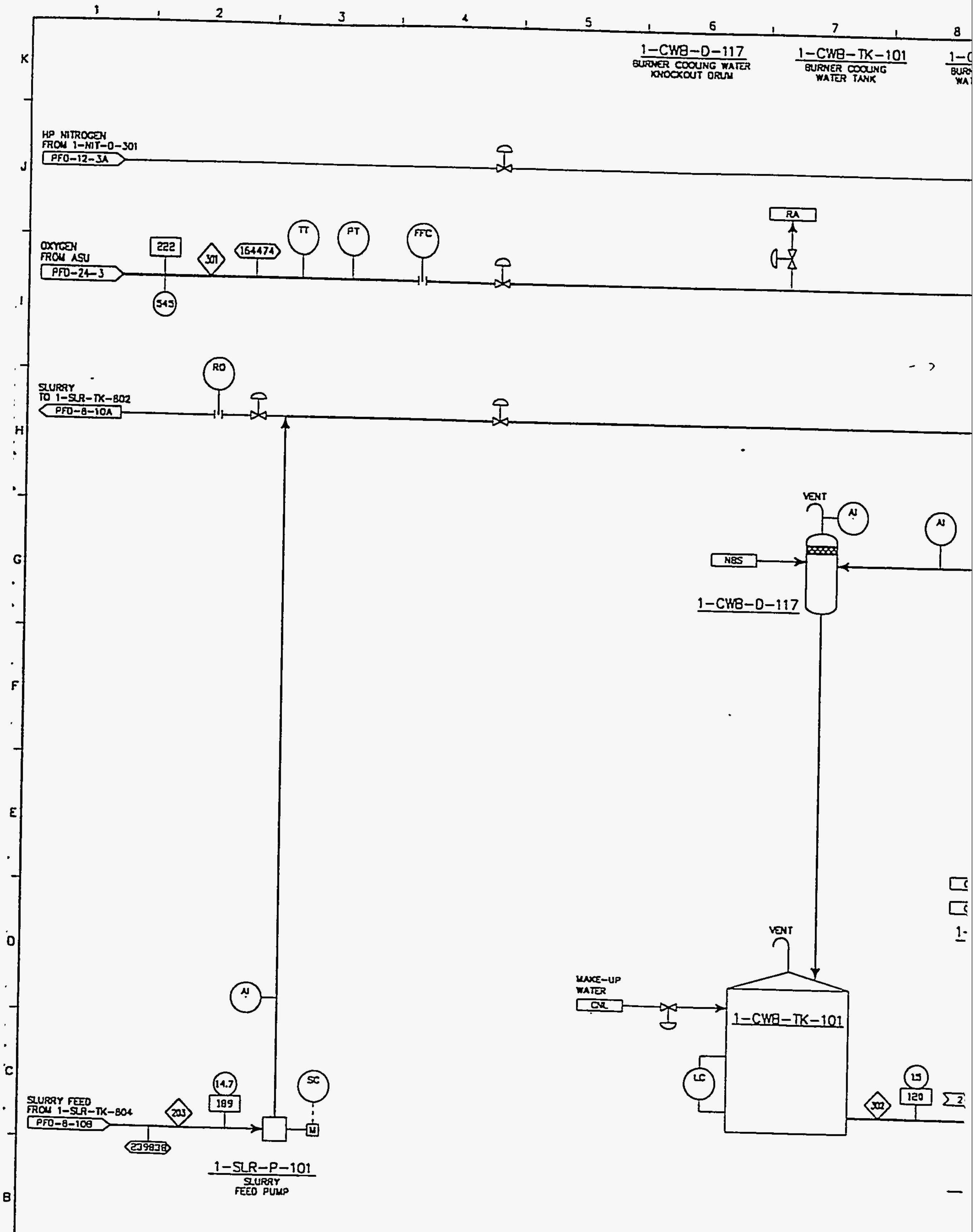
BECHTEL JOB NO. 22269

TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
OVERALL PROCESS FLOW DIAGRAM
(SHEET 2 OF 2)

DRAWN	DATE	DRAWING NO. 92127-PFD-1-1C	REV. 00E
DESIGNER	DATE		
CHECKED	DATE		
APPROVED	DATE		

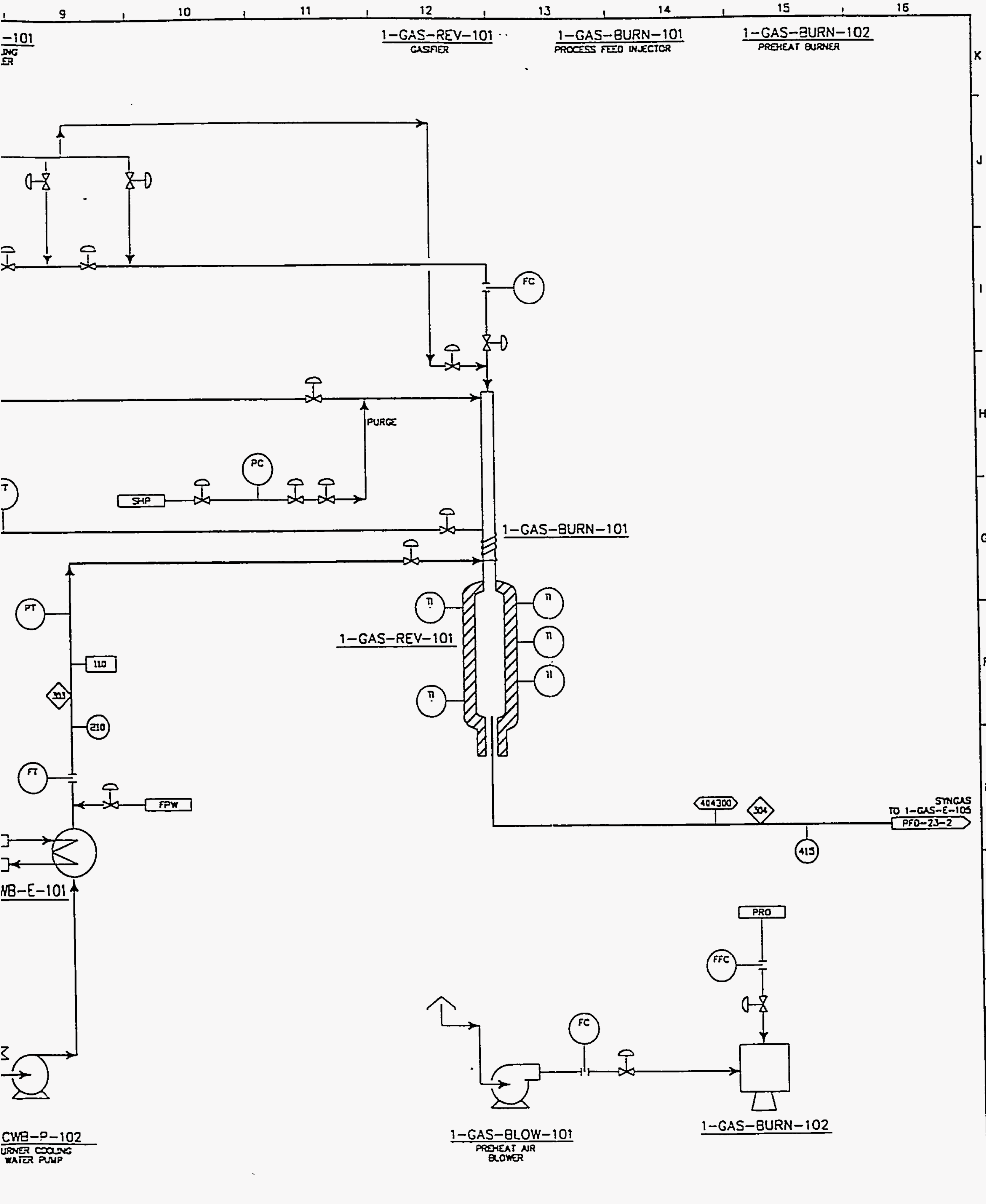
TAMPAPFD.DWG 16 06/15/93



NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).

LEGEND



REAM NO.
ESSURE, PSIA
MPERATURE, °F
OV, #/HR
OV, GPM

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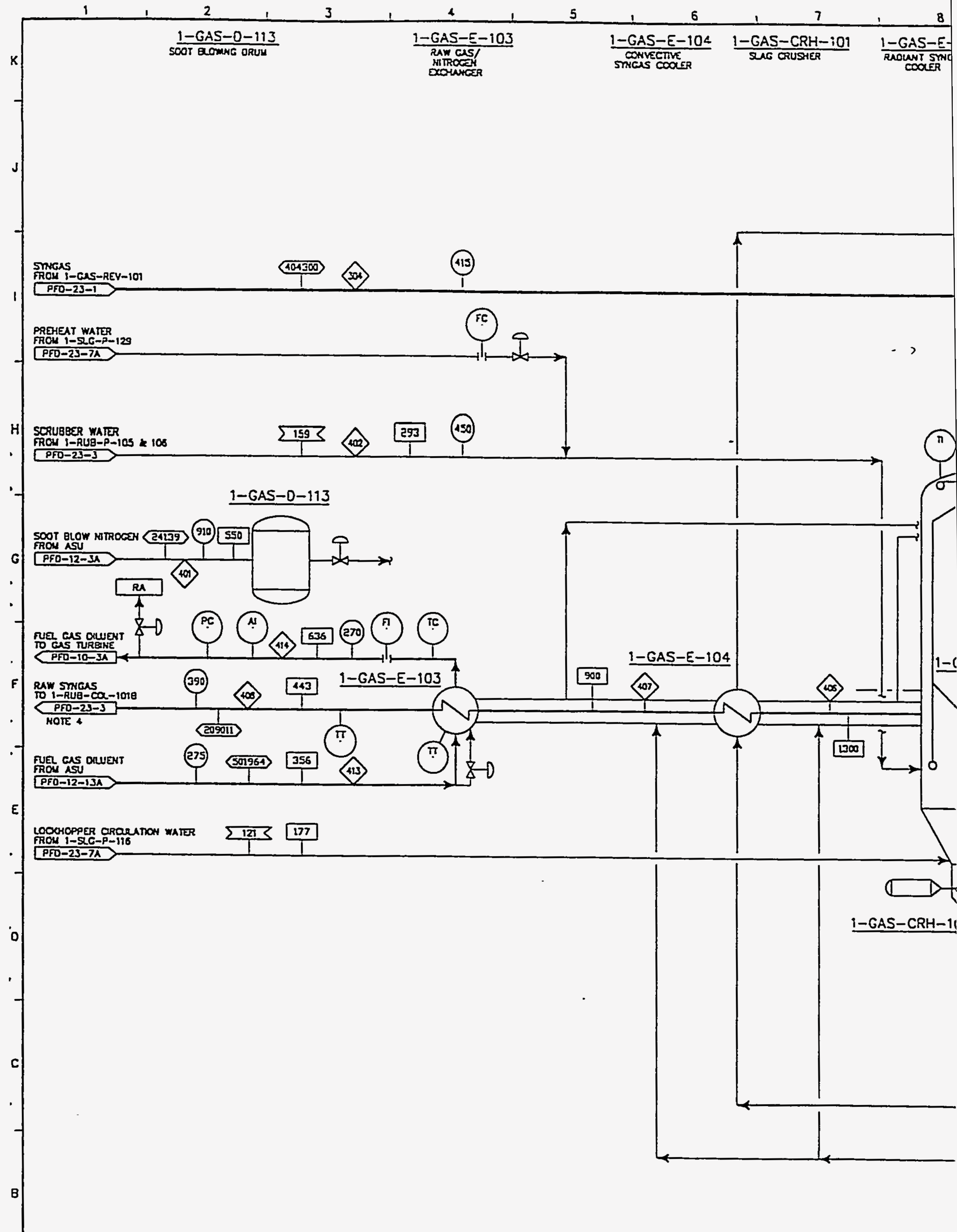
BECHTEL
JOB NO.
22269

TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
GASIFICATION

DRAWN	DATE	DRAWING NO.	REV.
DESIGNER	DATE	92127-PFD-23-1	DOE
CHECKED	DATE		
APPROVED	DATE		

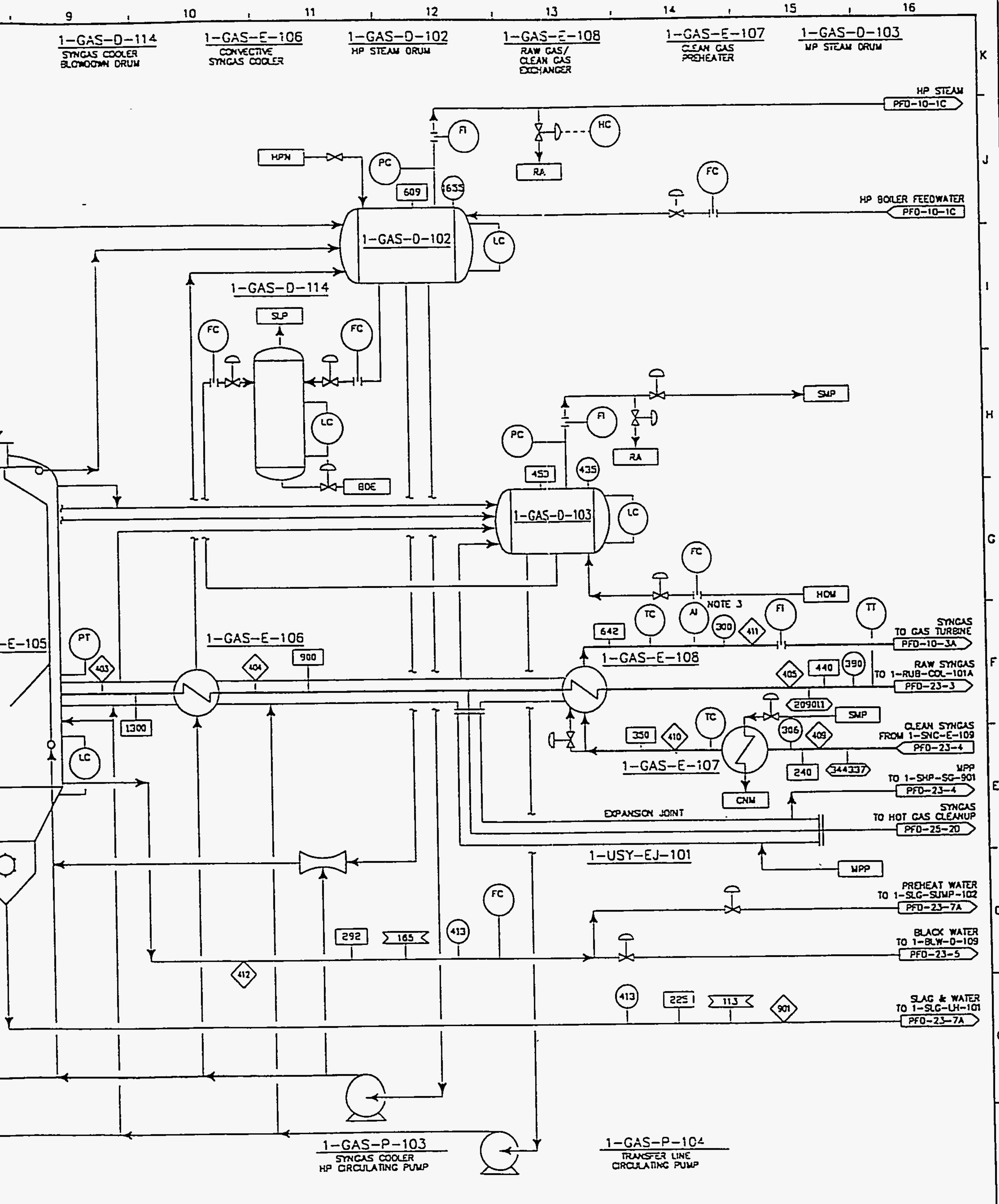
TAMPAPFD.DWG 16 06/15/93



NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).
3. MASS SPEC
4. LINE USED ONLY WHEN HGCU IS IN OPERATION.

LEGEND



STREAM No.	△								
PRESSURE, PSIA	△								
TEMPERATURE, °F	△								
FLOW, #/HR	△								
FLOW, GPM	△			DCO					
	NO.	DATE	REVISIONS	BY	CHKD	DESIGN SUPR	ENGR	PROJ ENGR	APPR

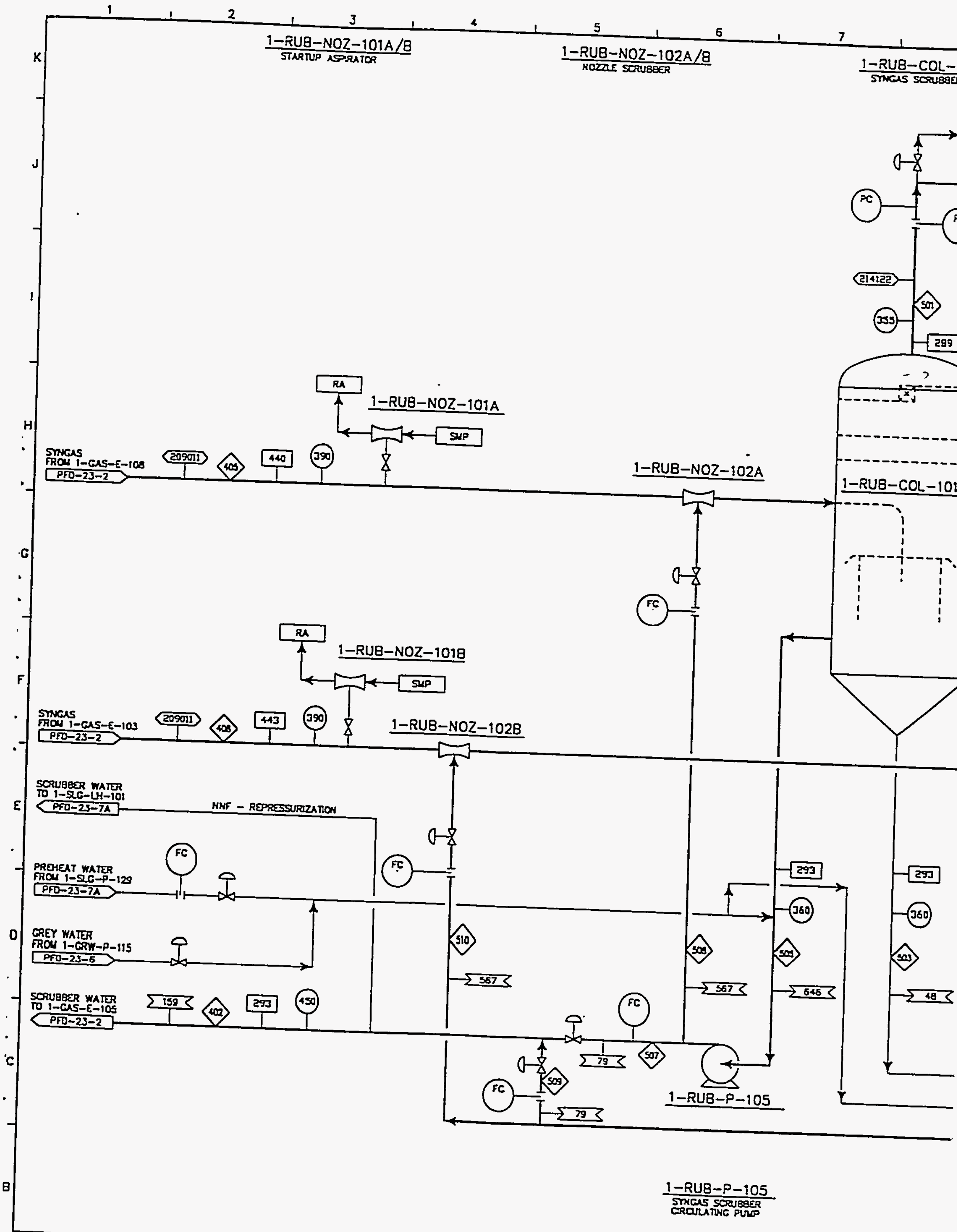
BECHTEL JOB NO. 22269

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
HIGH TEMPERATURE COOLING

TAMPA ELECTRIC
A TECO ENERGY COMPANY

DRAWN	DATE	DRAWING NO.	REV.
DESIGNER	DATE	92127-PFD-23-2	00E
CHECKED	DATE		
APPROVED	DATE		

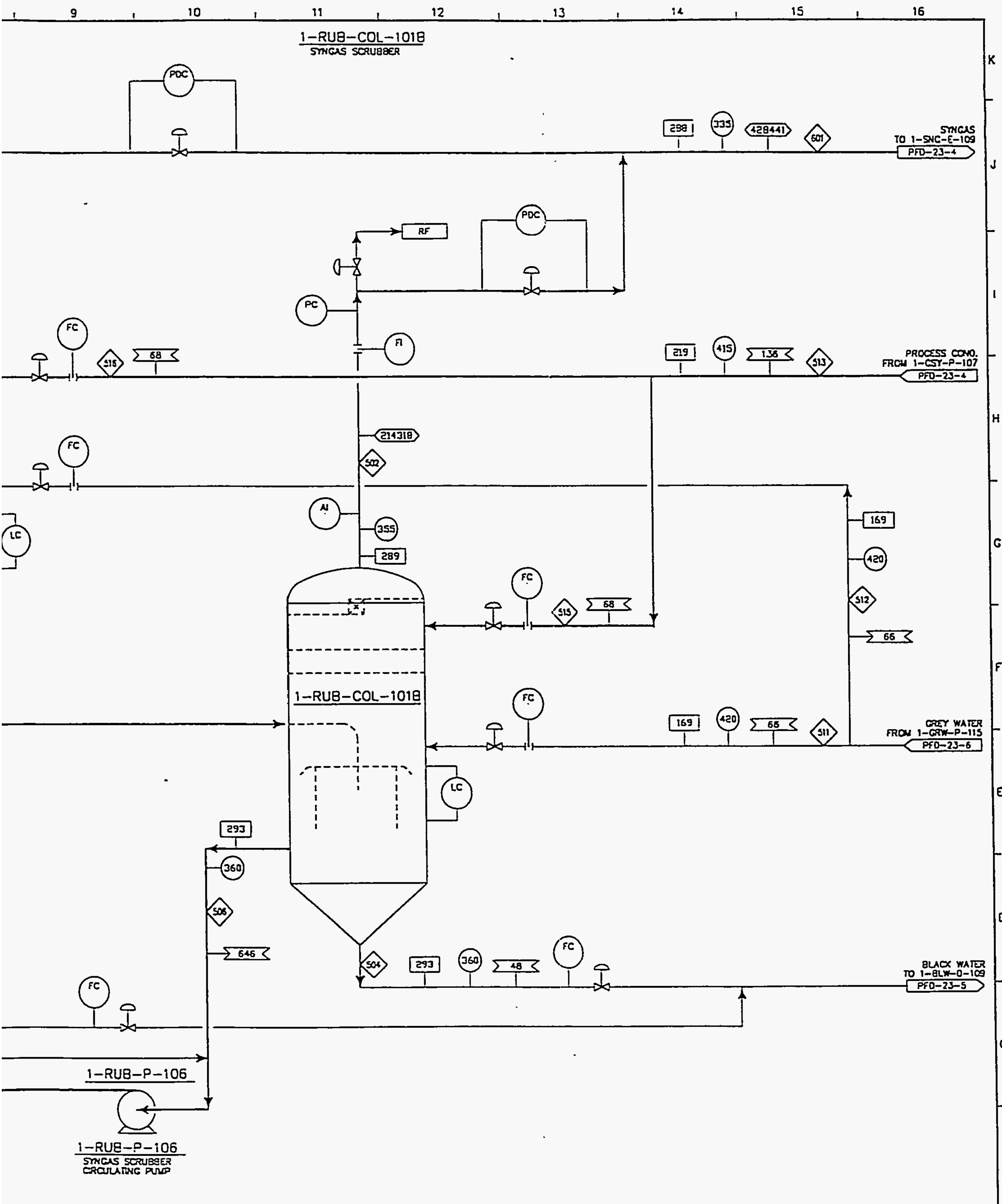
TAMPABCR.DWG 16 06/15/93



NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).

LEGEND



STREAM No.	△								
PRESSURE, PSIA	△								
TEMPERATURE, °F	△								
FLOW, #/HR	△								
FLOW, GPM	△			DCO					
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BECHTEL
JOB NO.
22269

TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
SYNGAS SCRUBBING

DRAWN	DATE	DRAWING NO.	REV.
DESIGNER	DATE	92127-PFD-23-3	00E
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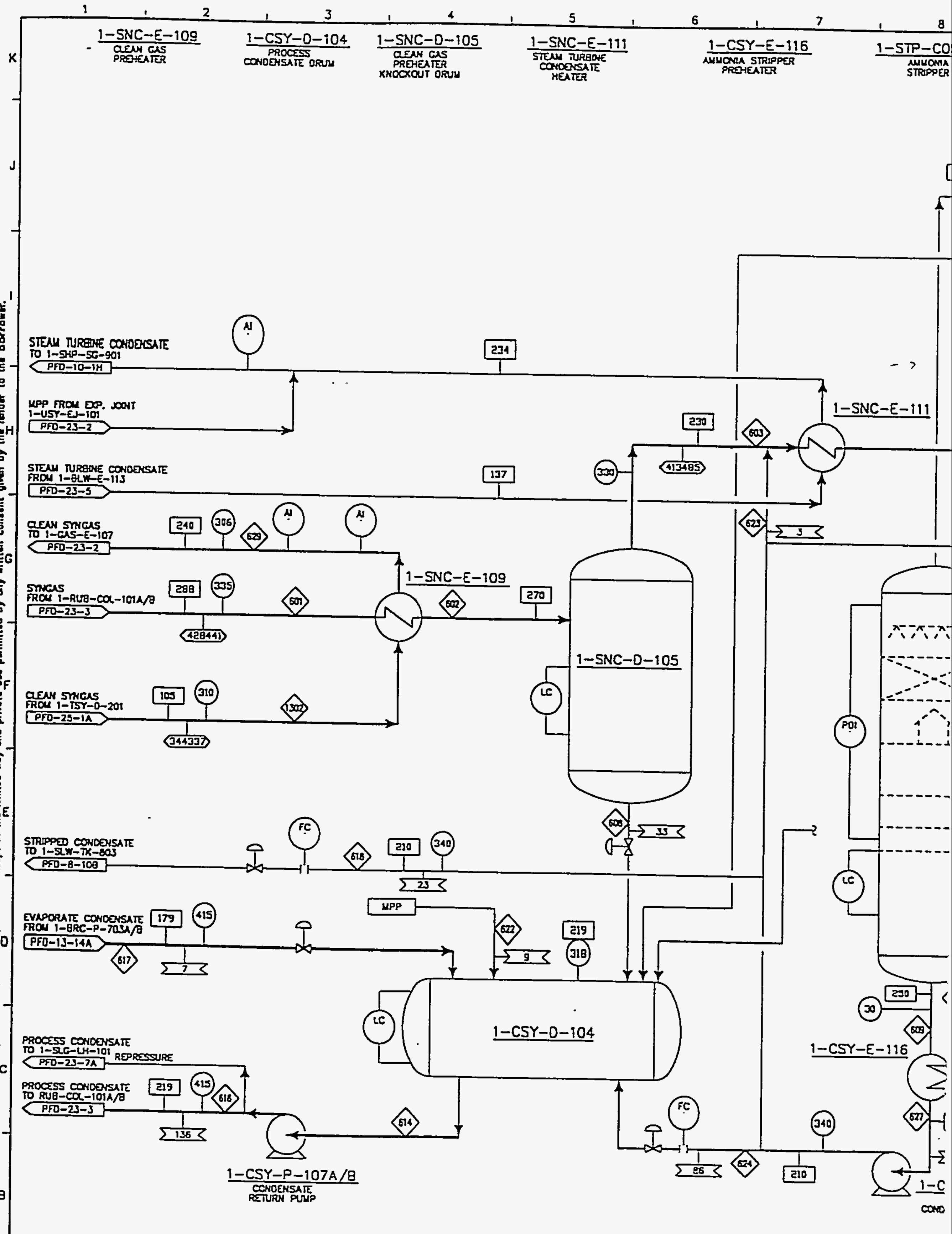
APPROVED	DATE		

TAMPAPFD.DWG 16 06/15/93



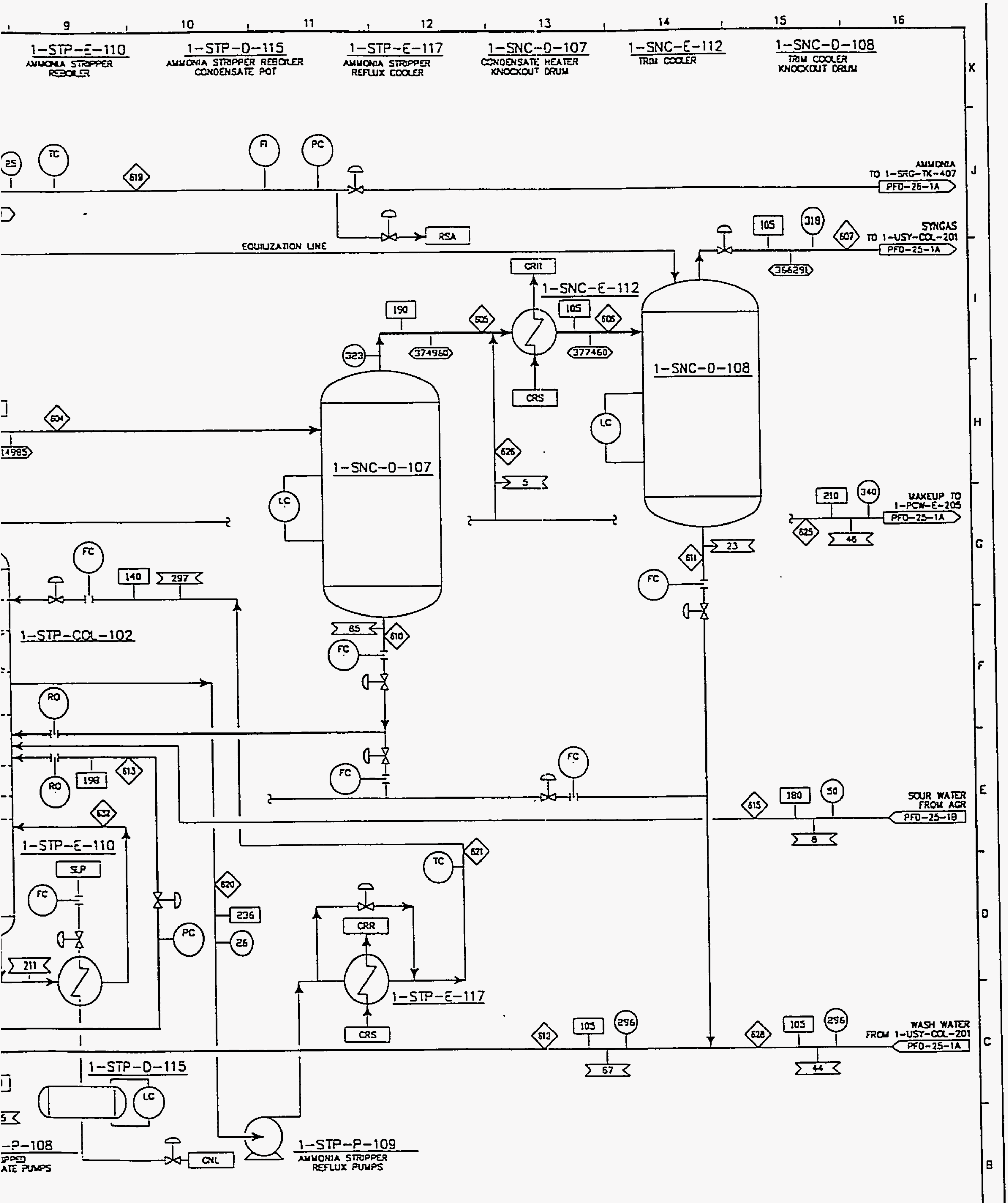
NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).

LEGEND

FILE: HS126:DKA300:[25703.1]7PFD234.DWG DATE: 12-08-1994, 11:08 TVB

H:\ASBUILT\DRAWINGS\BECHTEL\OTHER\DOE\7D0E234 Wed Apr 23 14:18:13 1997 Plotted By: Paul Gregg @ As-Built



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PRESSURE, PSIA	△								
TEMPERATURE, °F	△								
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BECHTEL JOB NO. 22269

TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
LOW TEMPERATURE GAS COOLING

DRAWN	DATE	DRAWING NO.	REV.
DESIGNER	DATE	92127-PFD-23-4	00E
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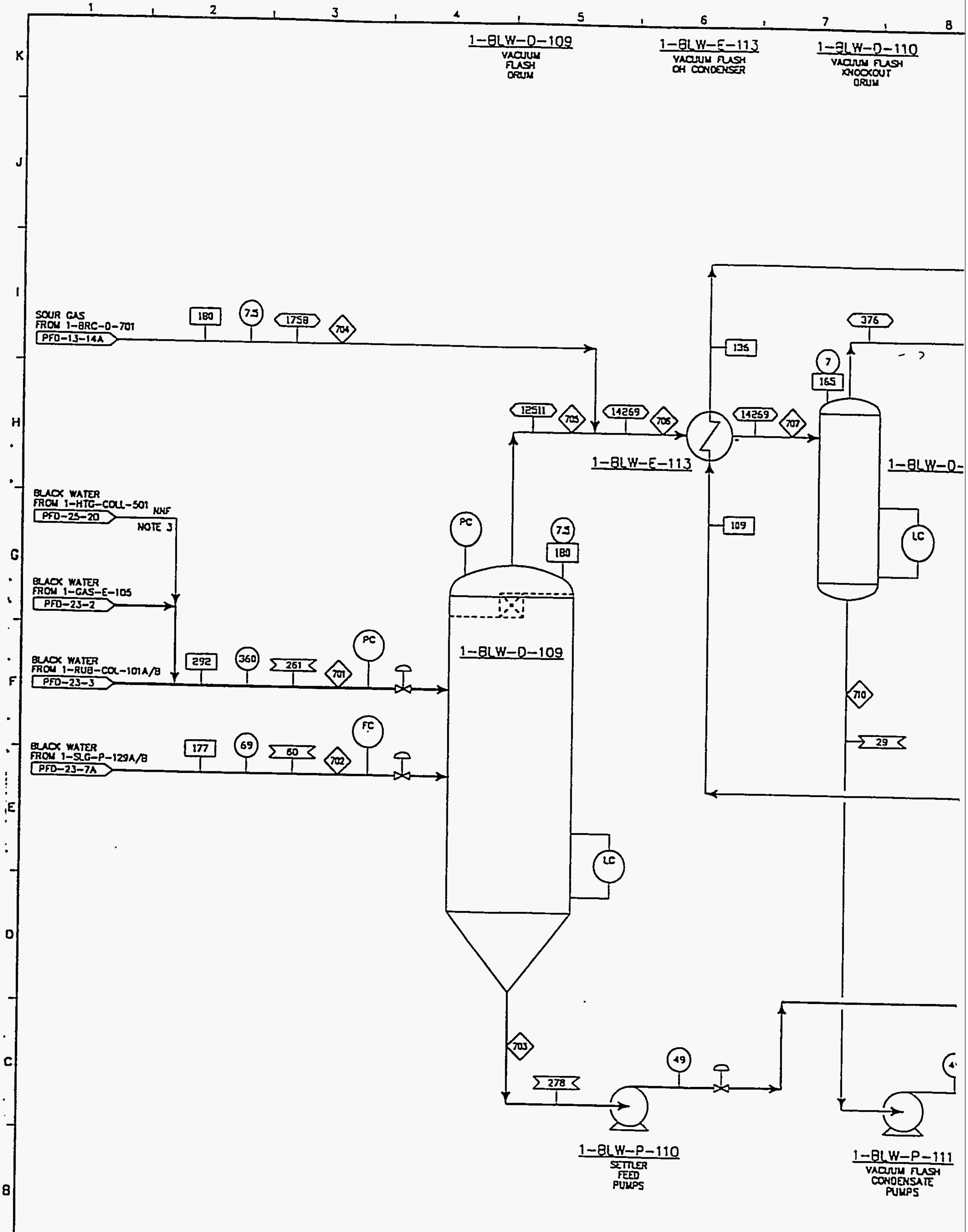
TAMPAPFD.DWG 06/15/93

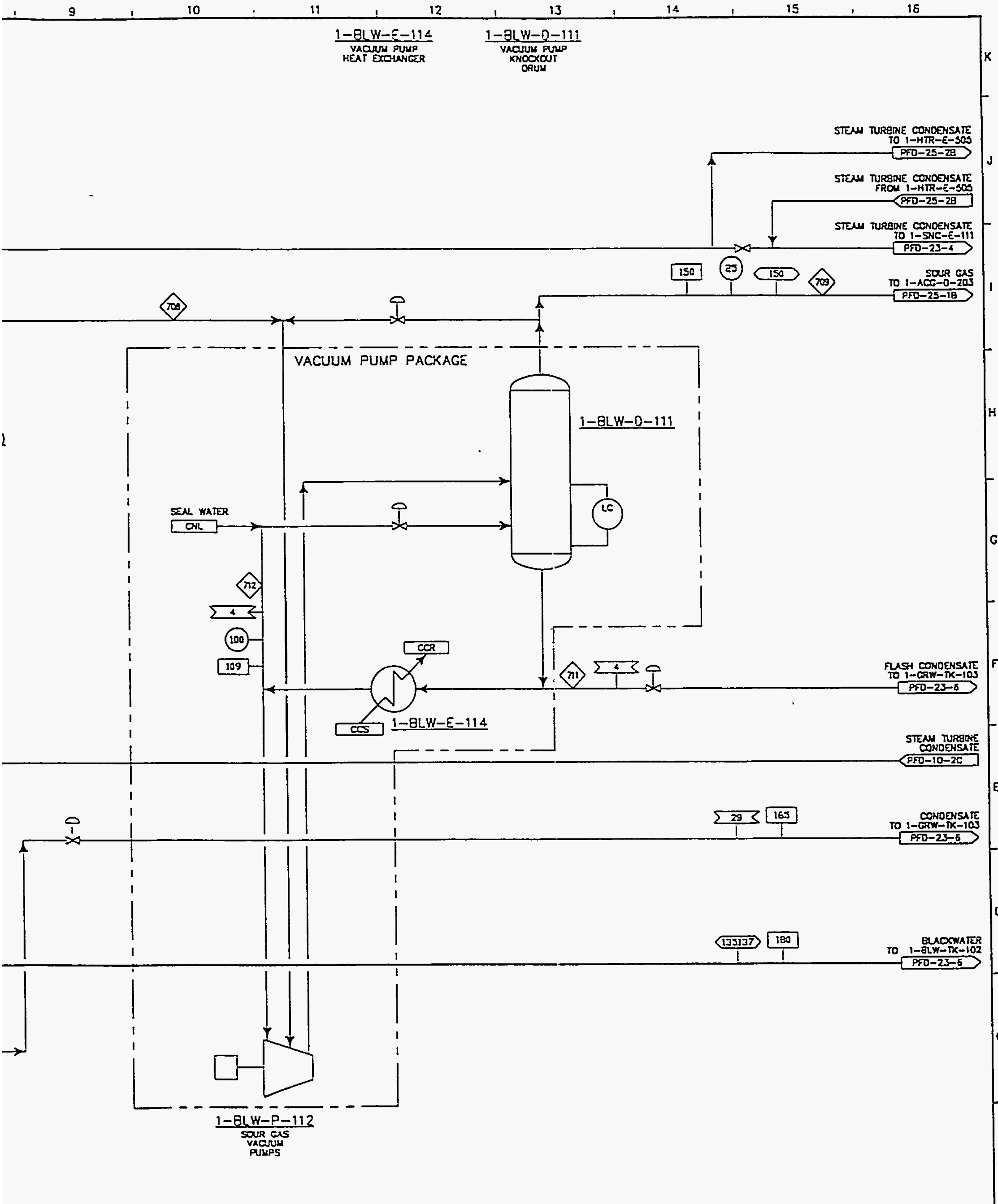


NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).

3. LINE USED ONLY WHEN HCCU IS IN OPERATION.

LEGEND



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PRESSURE, PSIA	△								
TEMPERATURE, °F	△								
FLOW, #/HR	△			DCO					
FLOW, GPM	△								

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BECHTEL JOB NO. 22269

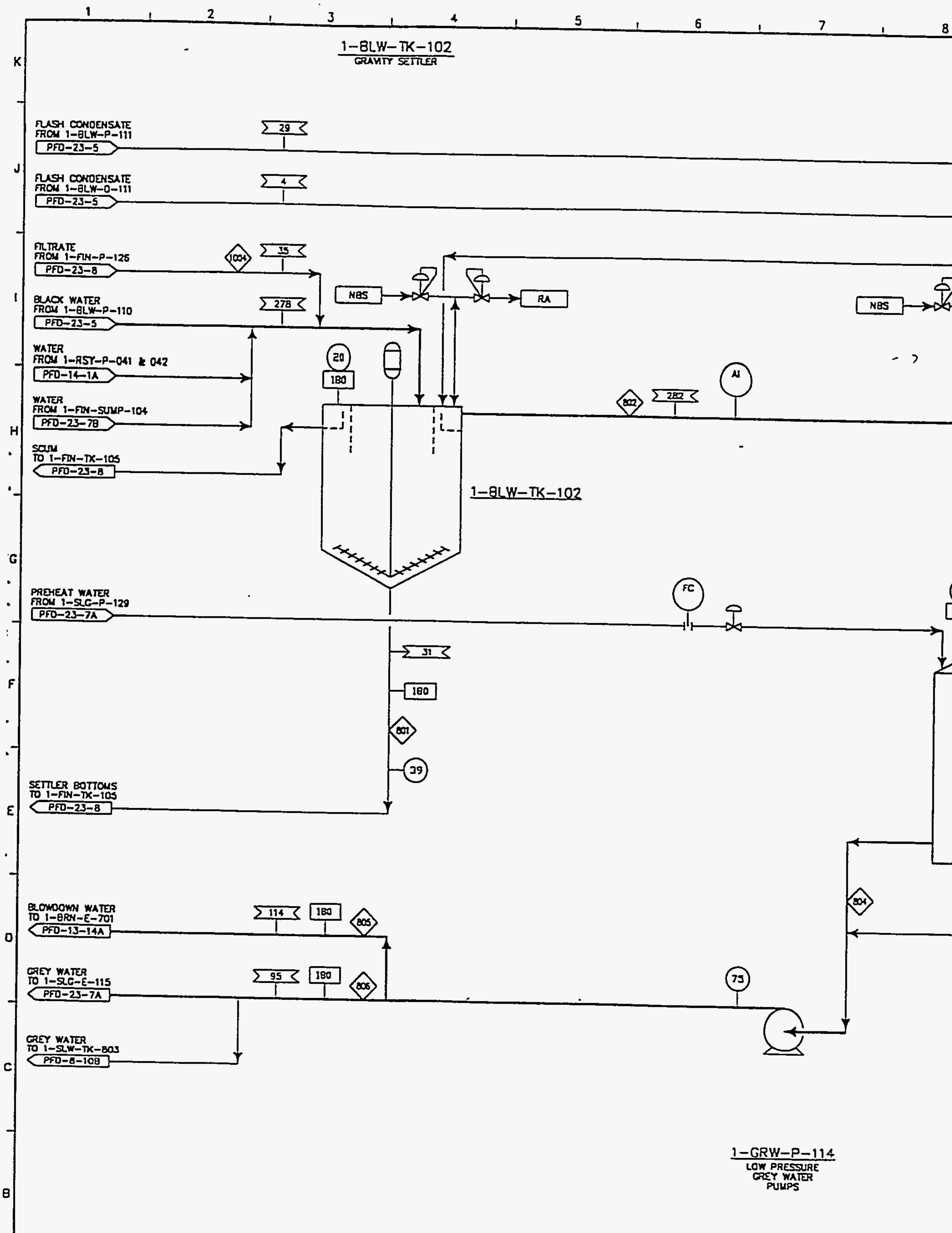
TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
BLACK WATER FLASH SYSTEM

DRAWN	DATE
DESIGNER	DATE
CHECKED	DATE
APPROVED	DATE

DRAWING NO. 92127-PFD-23-5 REV. 00E

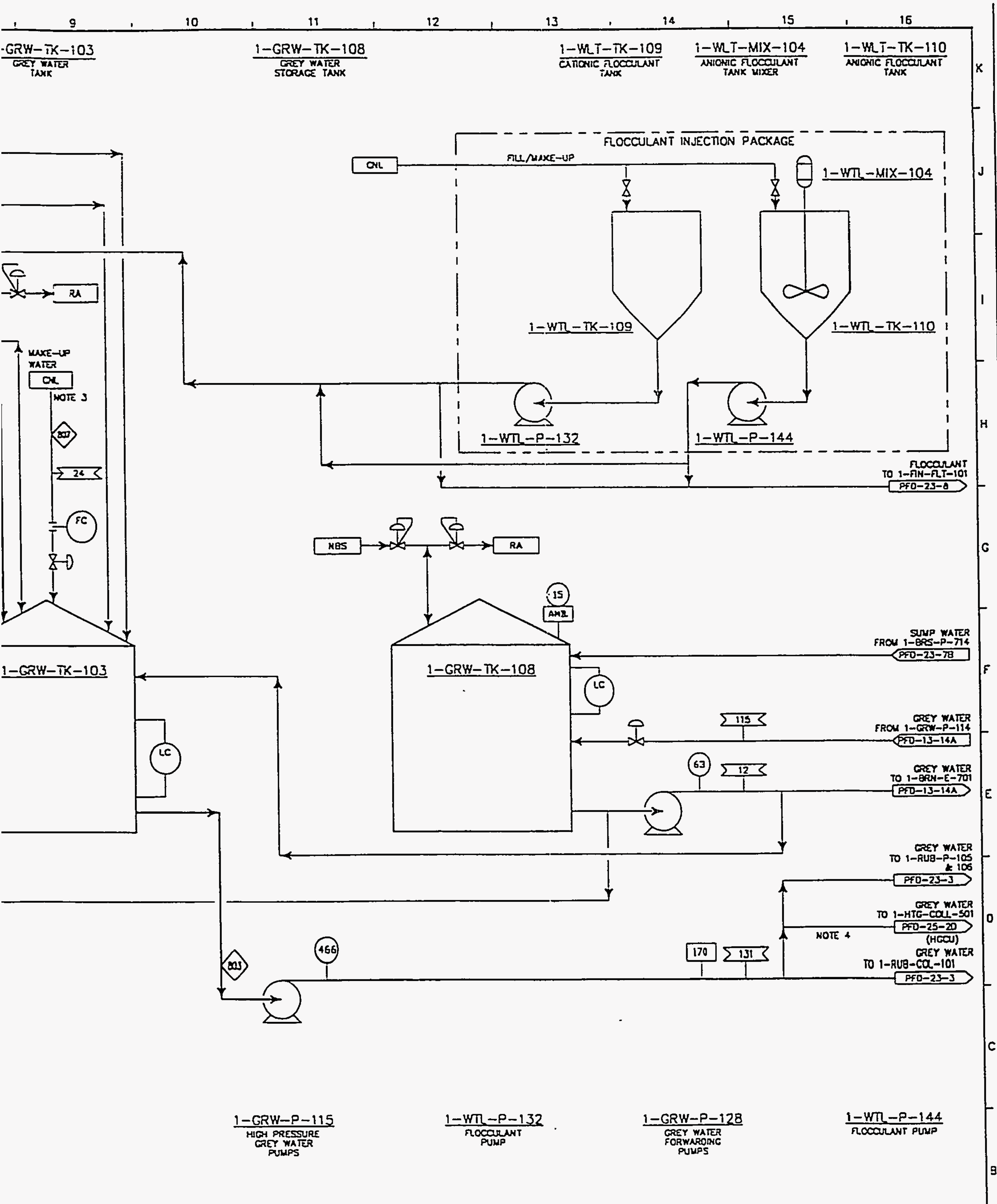
TAMPAPFD.DWG 16 06/15/93



NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).
2. DELETED.
3. DEAERATED WATER IS REQUIRED FOR MAKEUP. THIS RATE INCLUDES ESTIMATED FLUSH WATER RATES FOR PUMP SEALS AND INSTRUMENT TAPS.
4. LINE USED ONLY WHEN HGCU IS IN OPERATION.

LEGEND



STREAM NO.
PRESSURE, PSIA
TEMPERATURE, °F
FLOW, LB/HR
FLOW, GPM

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BECHTEL JOB NO. 22269

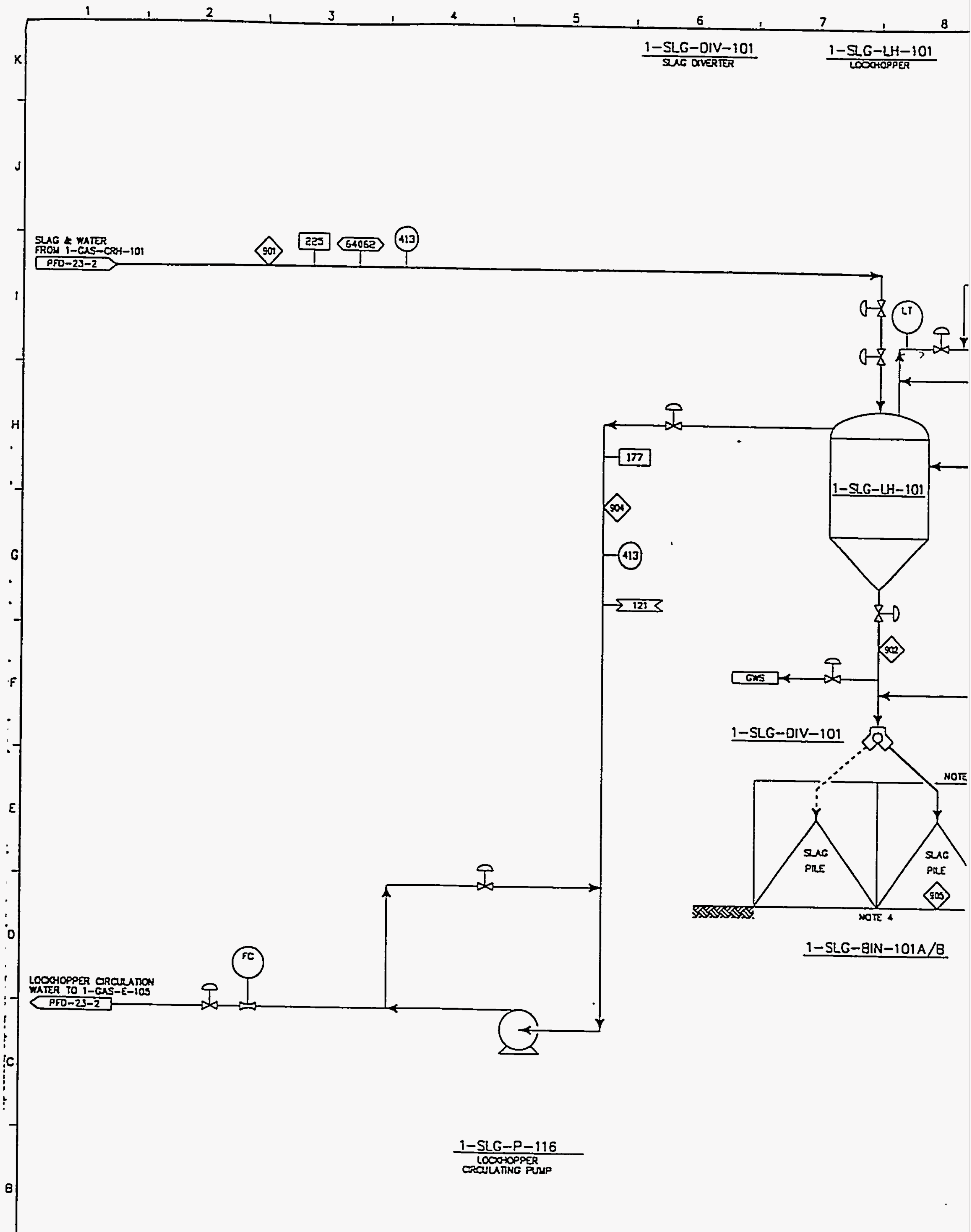
TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
GREY WATER HANDLING SYSTEM

DRAWN | DATE
DESIGNER | DATE
CHECKED | DATE
APPROVED | DATE

DRAWING NO. 92127-PFD-23-6
REV. 00E

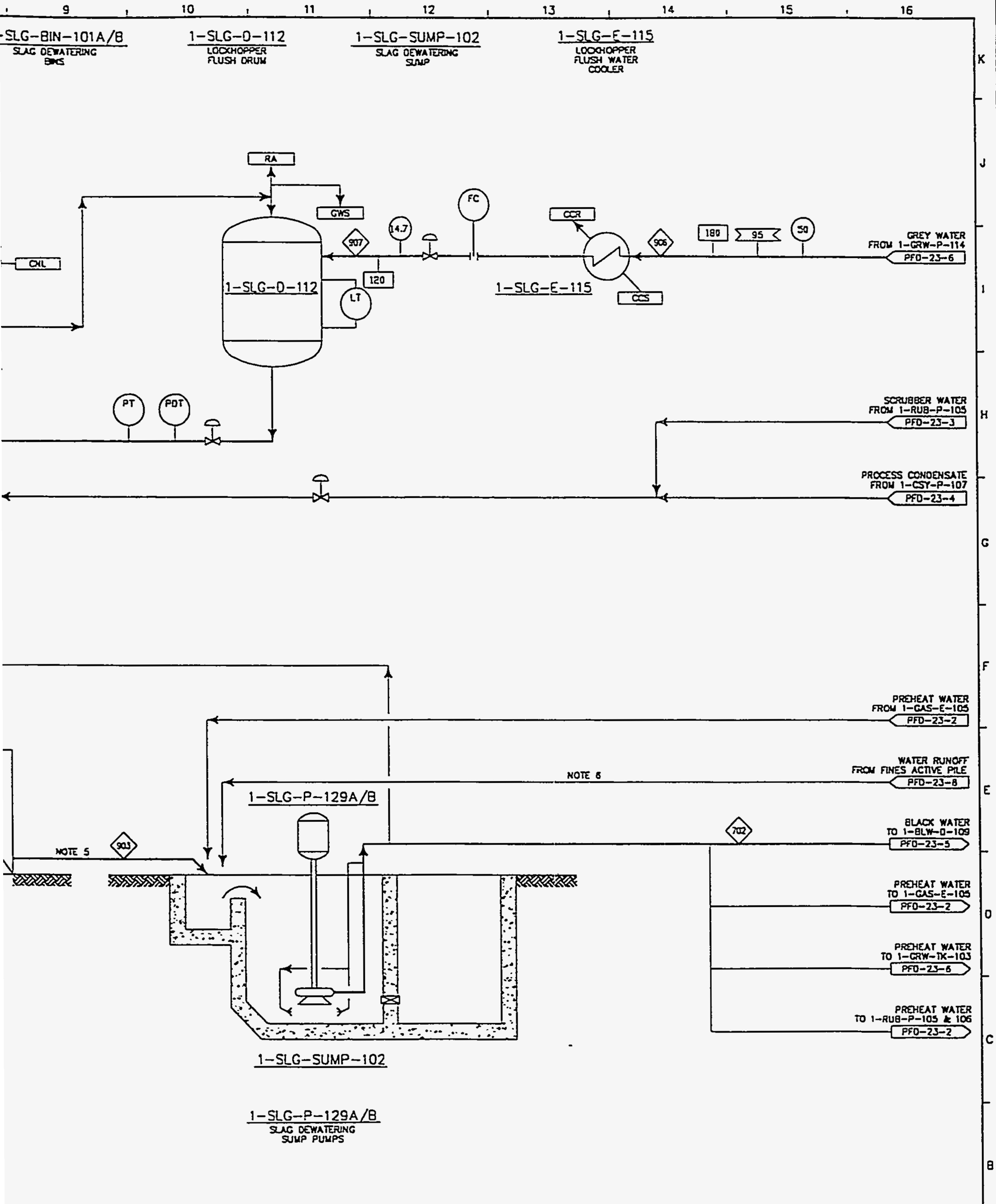
TAMPAPFD.DWG 16 06/15/93



NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).
3. BINS AND SUMPS TO BE COVERED TO PREVENT RAIN INFILTRATION.
4. TWO BINS – ONE IN SERVICE AND ONE BEING CLEANED-OUT BY FRONT END LOADER.
5. BINS ARE GRAVITY DRAINED VIA TRENCH INTO SUMP.
6. FINES PILE WATER RUNOFF GRAVITY DRAINED VIA TRENCH INTO SUMP.

LEGEND



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BECHTEL
JOB NO.
22269

TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
SLAG HANDLING SYSTEM

DRAWN	DATE
DESIGNER	DATE
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APPROVED	DATE

DRAWING NO. 92127-PFD-23-7A

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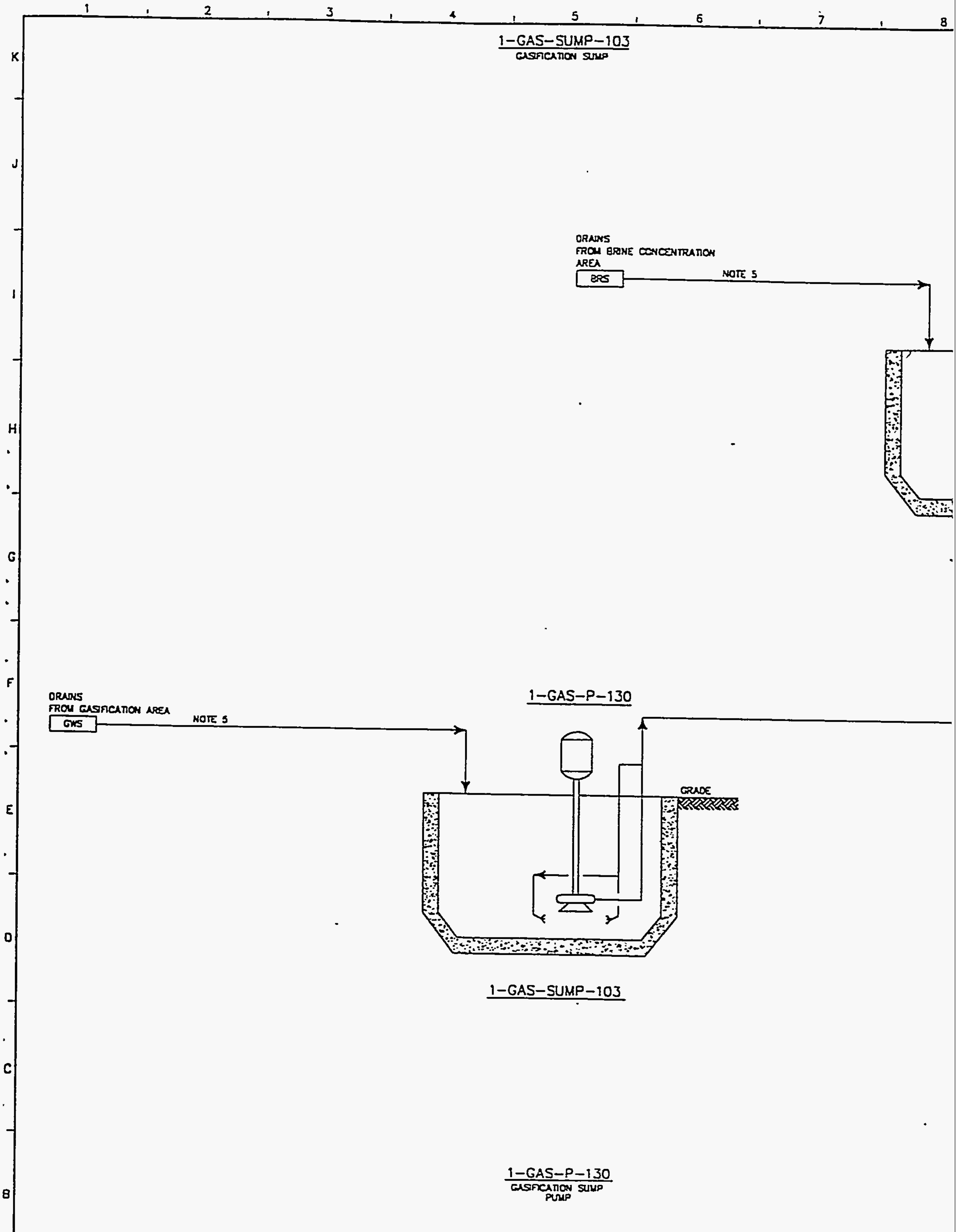
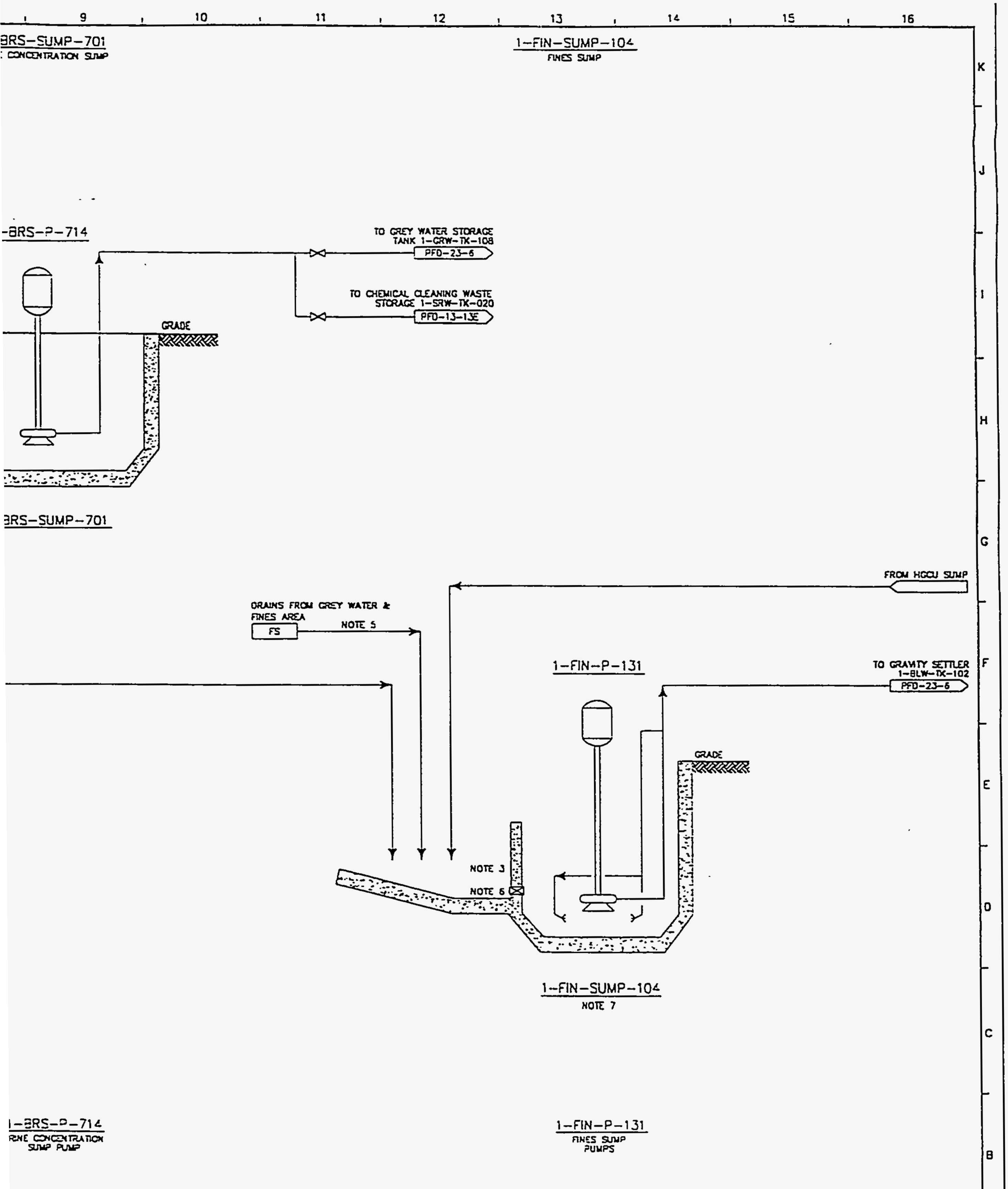
TAMPAPFD.DWG 16 06/15/93



NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).
2. DELETED.
3. PIT AREA TO ALLOW PERIODIC CLEANING BY WHEEL LOADER.
4. DELETED.
5. DRAINS GRAVITY DRAIN VIA TRENCHES.
6. DRAIN VALVE.
7. SUMPS ARE TO BE COVERED TO PREVENT RAIN INFILTRATION.

LEGEND



REAM No.
ESSURE, PSIA
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OV, #/HR
OV, GPM

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BECHTEL
JOB NO.
22269

TAMPA ELECTRIC
A TECO ENERGY COMPANY

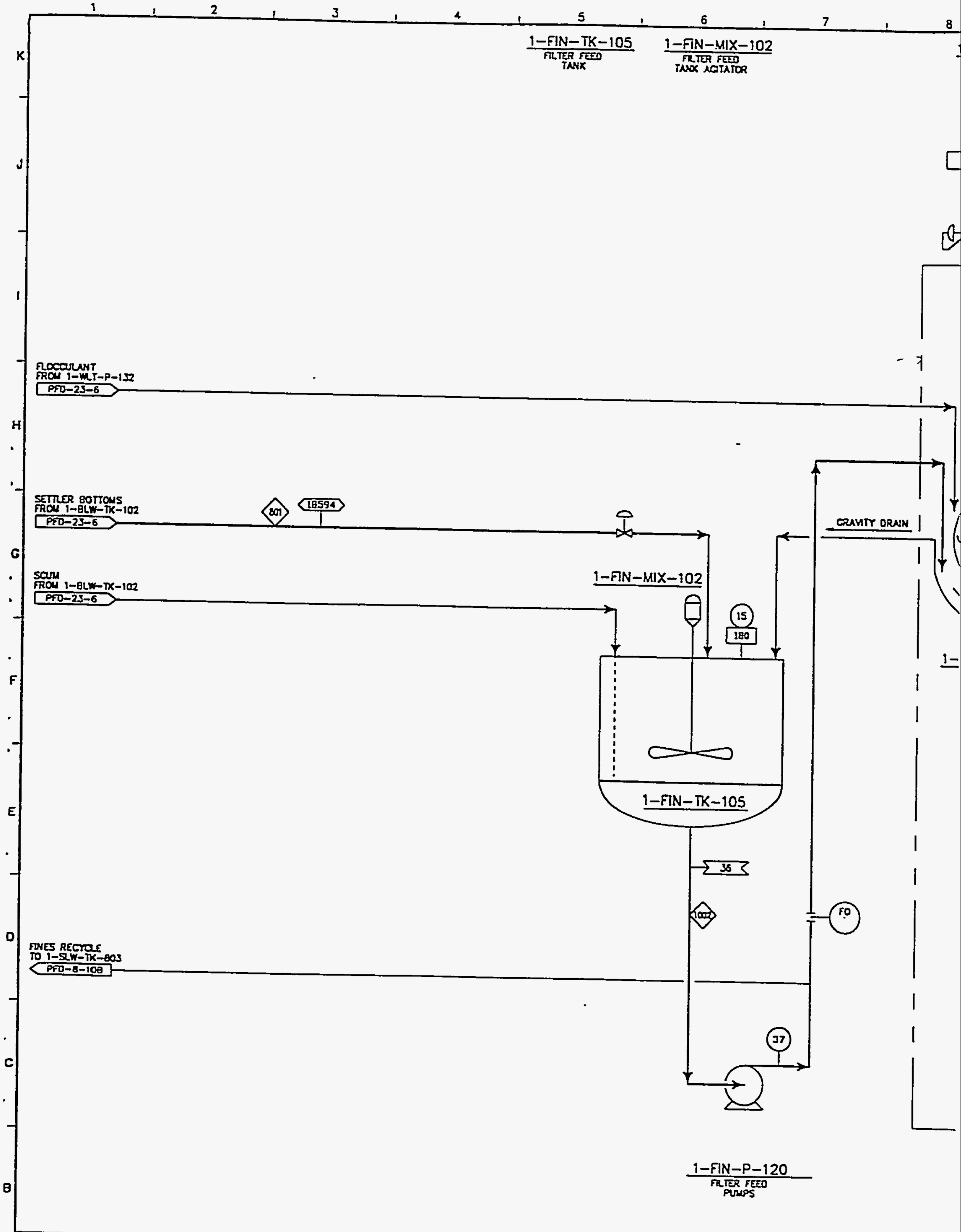
POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
SLAG HANDLING SYSTEM

DRAWN	DATE
DESIGNER	DATE
CHECKED	DATE
APPROVED	DATE

DRAWING NO. 92127-PFD-23-7B

REV. 00E

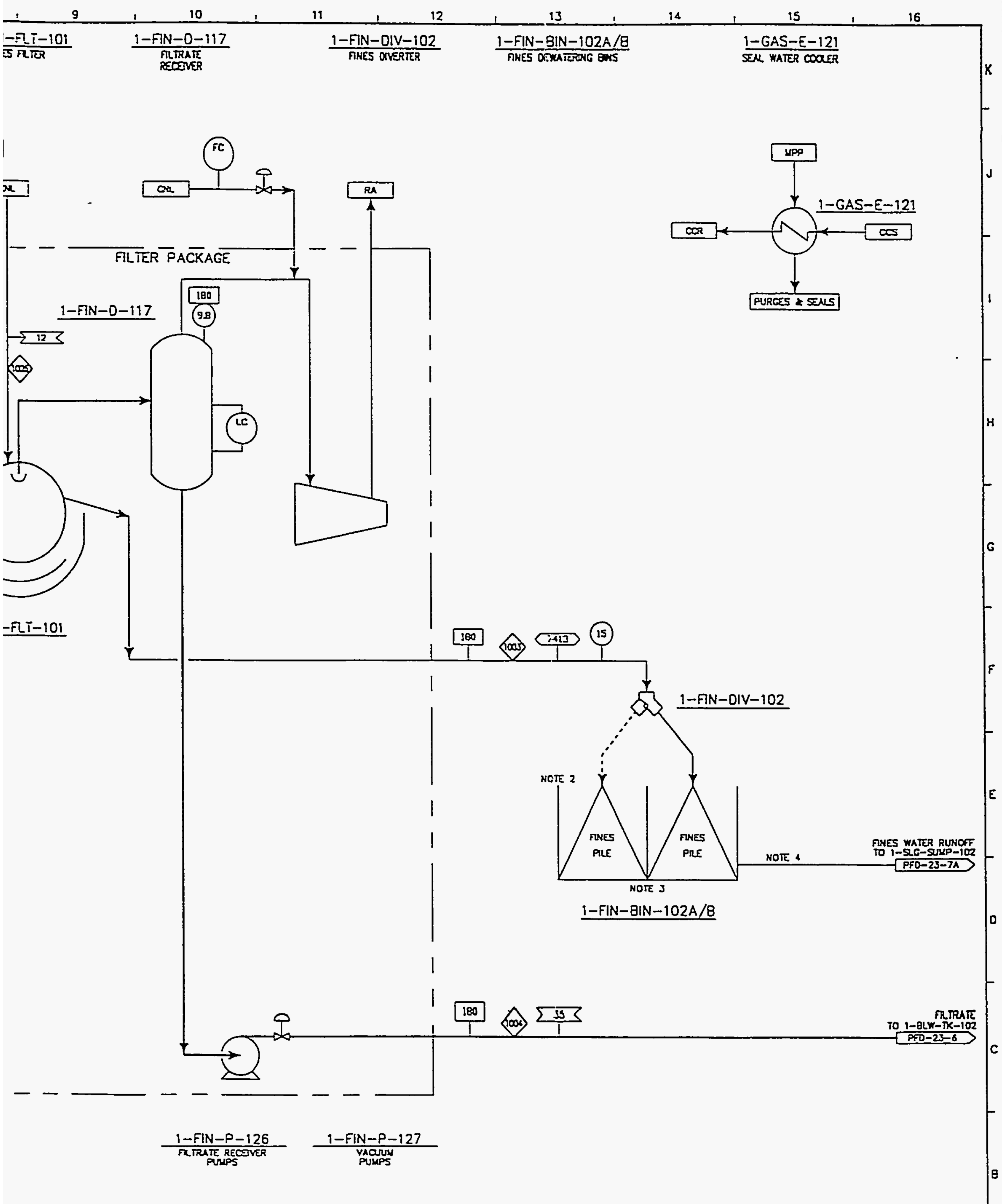
TAMPAPFD.DWG 16 06/15/93



NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).
2. BINS TO BE COVERED TO PREVENT RAIN INFILTRATION.
3. DEWATERED FINES TO BE REMOVED BY FRONT END LOADER OR TRUCK.
4. RUN-OFF WATER IS GRAVITY DRAINED VIA TRENCH.

LEGEND



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STREAM No.
PRESSURE, PSIA
TEMPERATURE, °F
... V, LB/HR
... V, GPM

BECHTEL JOB NO. 22259

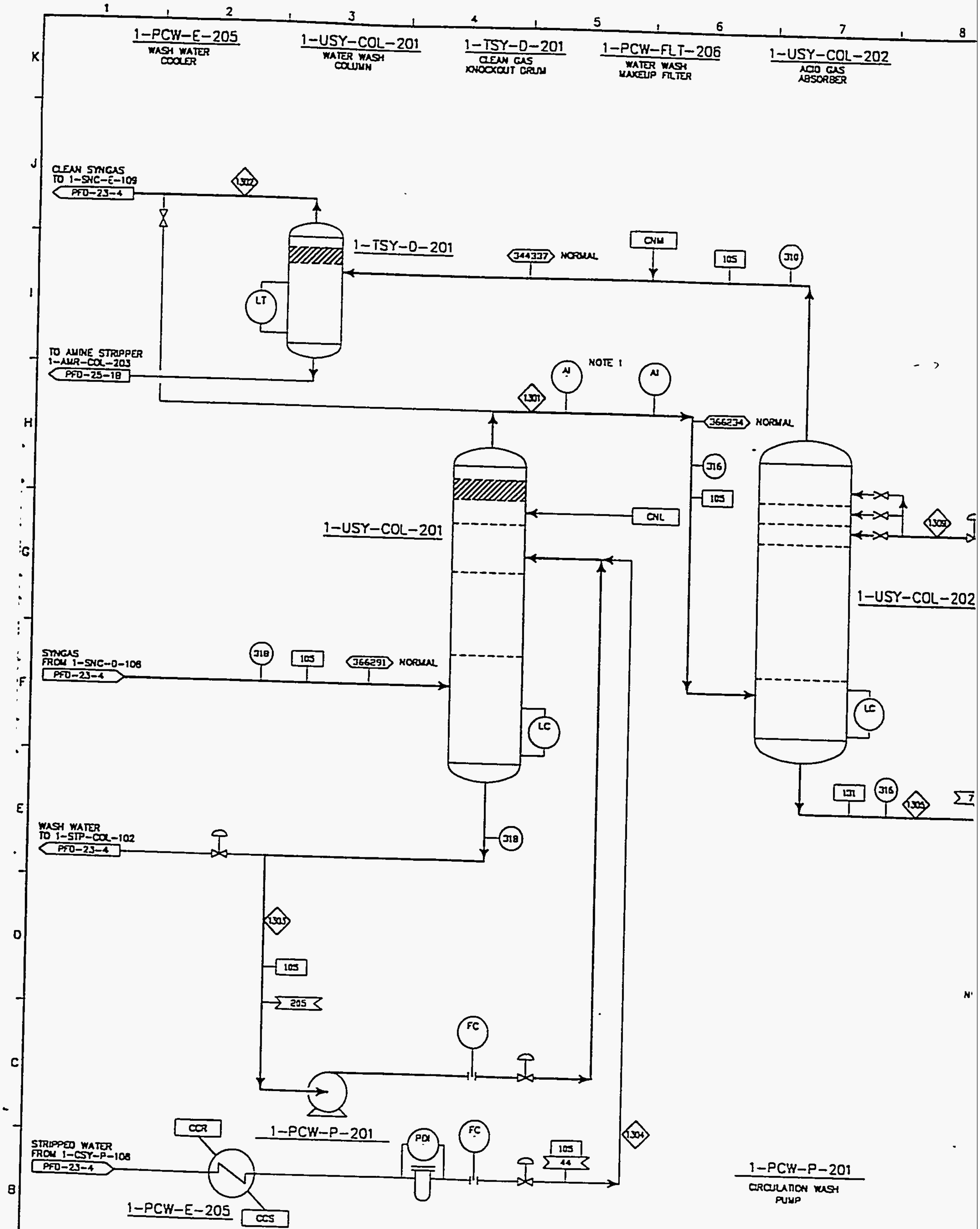
TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
FINES HANDLING

DRAWN	DATE
DESIGNER	DATE
CHECKED	DATE
APPROVED	DATE

DRAWING NO. 92127-PFD-23-8 REV. 00E

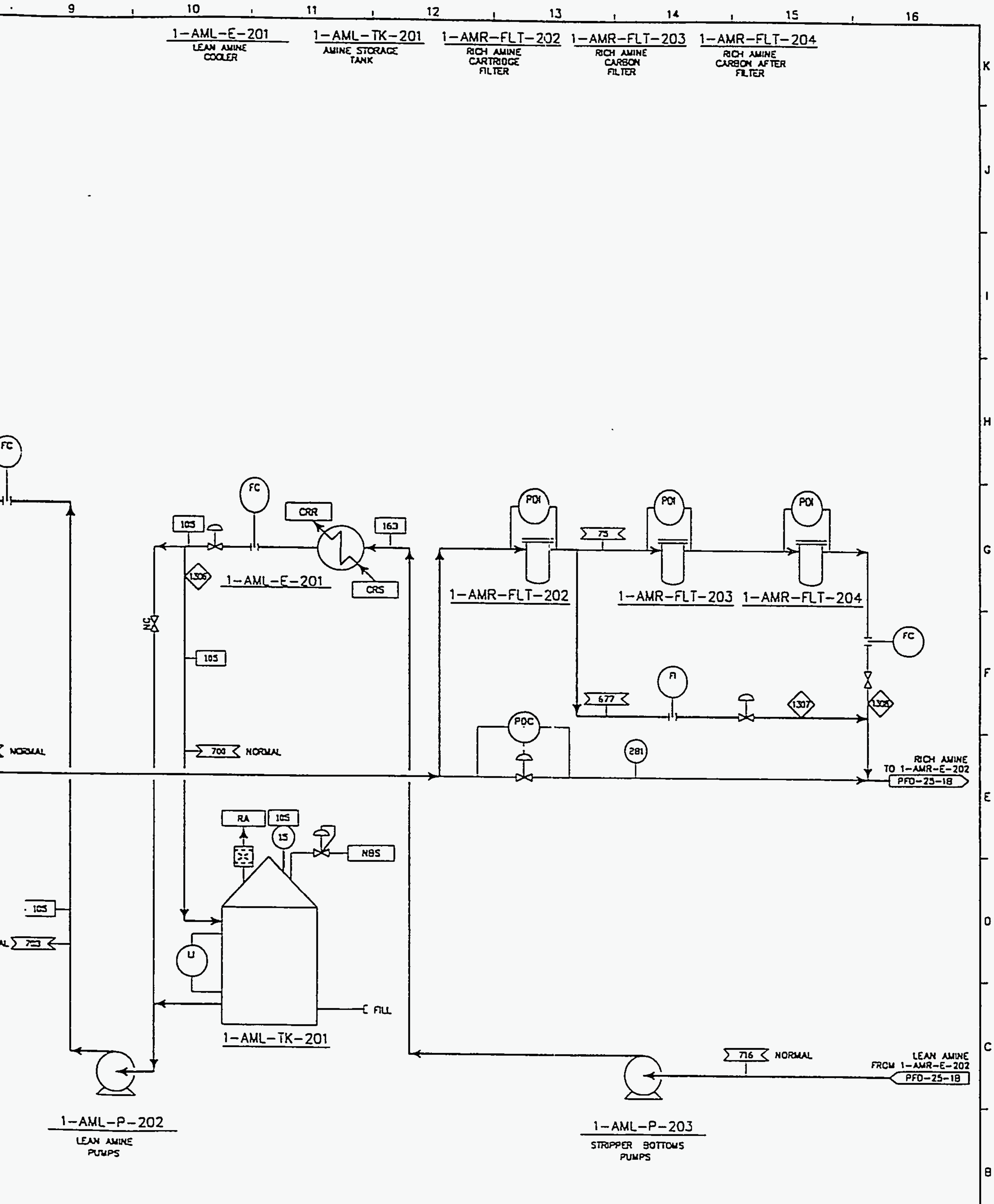
TAMPAPFD.DWG 16 06/15/93



NOTES:

1. DUAL STREAM MASS SPEC.
3. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).

LEGEND



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BECHTEL
JOB NO.
22269

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
ACID GAS REMOVAL SECTION

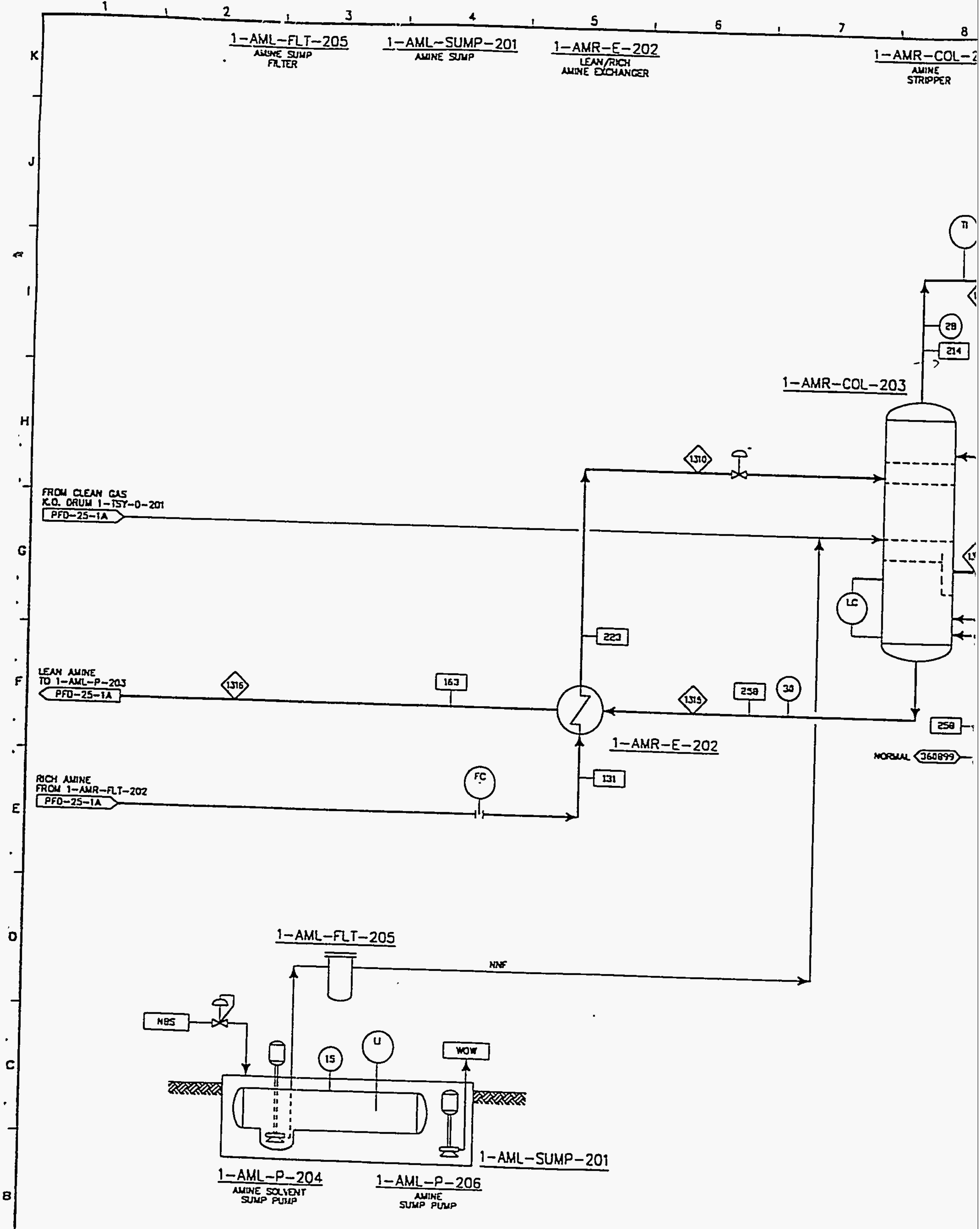
TAMPA ELECTRIC
A TECO ENERGY COMPANY

DRAWN	DATE
DESIGNER	DATE
CHECKED	DATE
APPROVED	DATE

DRAWING NO. 92127-PFD-25-1A

REV. DCO

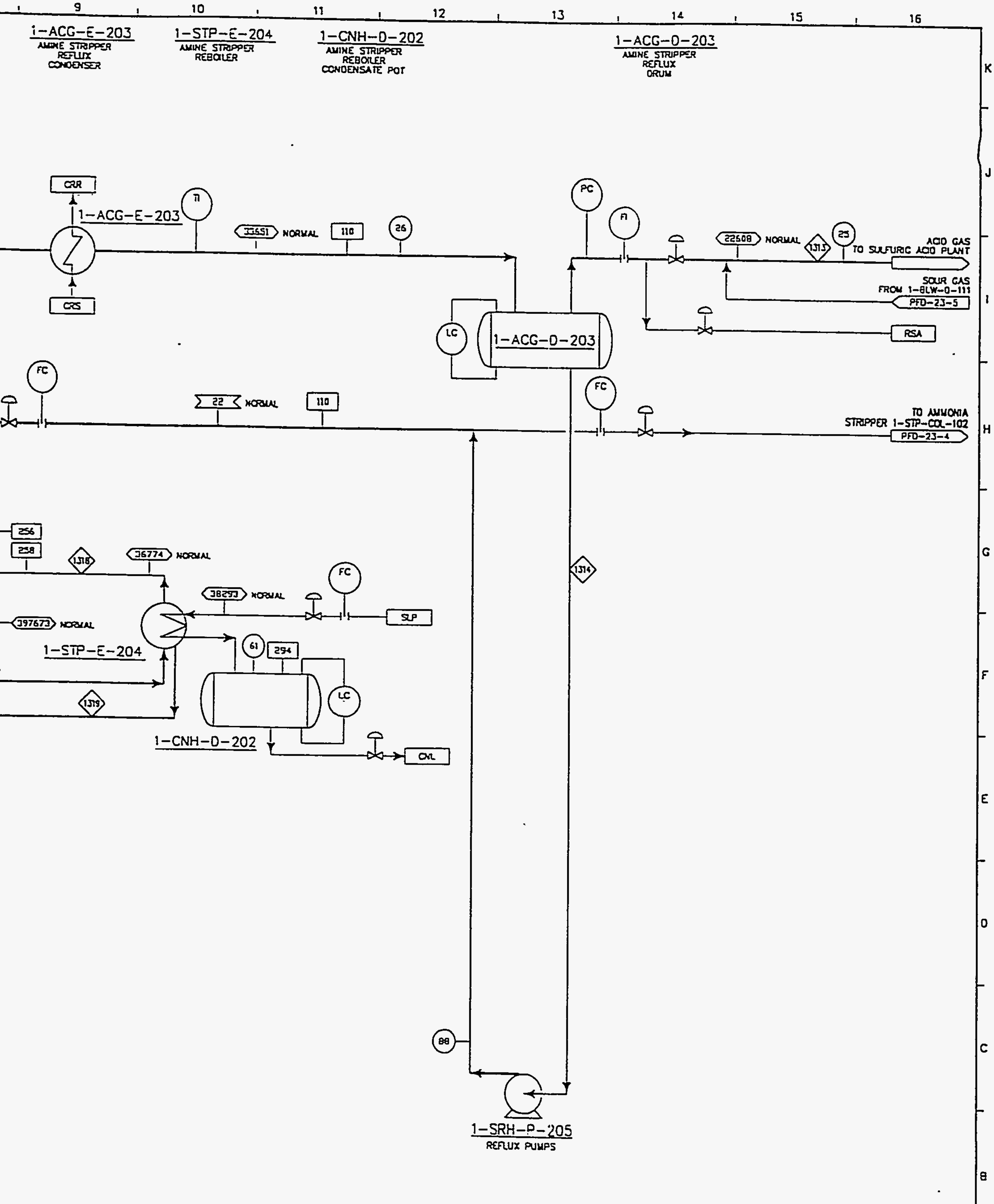
TAMPABOR.DWG 16 05/15/93



NOTES:

1. STREAM PROPERTIES SHOWN REFLECT THE NORMAL OPERATING CASE (NOC).

LEGEND



...AM No.	△								
...SURE, PSIA	△								
...ERATURE, °F	△								
..., LB/HR	△								
..., GPM	△			DCO					
	NO.	DATE	REVISIONS	BY	CHKD	DESIGN SUPR	ENGR	PROJ ENGR	APPR

BECHTEL
JOB NO.
22269

TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION UNIT # 1
PROCESS FLOW DIAGRAM
ACID GAS REMOVAL SECTION

DRAWN	DATE	DRAWING NO.	REV.
DESIGNER	DATE	92127-PFD-25-18	DOE
CHECKED	DATE		
APPROVED	DATE		

9 10 11 12 13 14 15 16

TAMPABORL.DWG 06/15/93