**CE IGCC Repowering Project
Controls & Instrumentation**

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MASTER

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Appendices: (confidential)

Start Up / Shutdown Procedures

Combined Cycle Controls...Low Fuel Gas Pressure Control

GE PATENT NO. 4,922,710 LOW

Pressure Fuel System

SK-DATA-HWY.....IGCC DATA-HWY Diagram sht 1 of 1

Gasifier Sys - SAMA Diagram

SK-COALFLW-4.....Pulv Coal Lockhopper Sys

SK-COALFLW-1.....Coal Flow Controller sht 1 of

SK-COALFLW-2.....Coal Flow Controller sht 2 of

SK-COALFLW-3.....Coal Flow Controller sht 3 of

SK-COALFLW-6.....Coal Flow Controller sht 4 of

SK-COALFLW-5.....Coal Flow Controller sht 5 of

SK-DUCT-BNR.....Pulverizer Coal Mill Temp Controller
sht 1 of 1

SK-N2-FLOW-1.....N2 Flow Controller sht 1 of

SK-N2-FLOW-2.....N2 Flow Controller sht 2 of

SK-N2-FLOW-3.....N2 Flow Controller sht 3 of 3

SK-PRESS-5.....Pulverized Coal Feed Bin Press Controller
sht 1 of 1

SK-GASFLOW.....Natural Gas Flow Controller

SK-AIRFLOW-1.....Air Flow Controller sht 1 of 3

SK-AIRFLOW-2.....Air Flow Controller sht 2 of

SK-AIRFLOW-3.....Air Flow Controller sht 3 of 3

SK-DPRESS-1.....Gasifier / Annulus Press Controller
sht 1 of 1

SK-STMFLOW-1.....Process Steam Flow Controller

SK-LVL-2.....Gasifier Slag Tank Water Level Controller

SK-TEMP-3.....Process Water Emergency Temp Controller
sht 1 of

SK-STMTEMP-1.....Superheat Steam Temperature Controller
sht 1 of

SK-DRUMLVL-1.....Drum Level / Feedwater Flow Control
w/ Press Compensation sht 1 of 1

SK-STMFLOW-3.....Gasifier Total Steam Flow sht 1 of 1

SK-DRUM-P.....Steam Drum Pressure Controller

SK-GASTEMP-1.....Gasifier Heat Exch Bypass Temp
Controller sht 1 of 1

SK-GASLVL-1.....Gasifier Surge Tank Level
Controller sht 1 of 1

SK-GASPRES-1.....Surge Tank FA-30-041 Press
Controller sht 1 of 1

SK-GASPRES-2.....Cooling Water Pumps Recirc Press
Controller sht 1 of 1

SK-LVL-1.....Char Seal Hopper Level
Controller sht 1 of 1

SK-CHRFLW-4.....Char Recycle Lockhopper Sys.1

SK-N2-FLOW-1.....N2 Flow Controller sht 1 of 1

SK-N2-FLOW-2.....N2 Flow Controller sht 2 of 2

SK-N2-FLOW-3.....N2 Flow Controller sht 3 of 3

SK-CHRFLW-1.....Charflow Controller sht 1 of 3

SK-CHRFLW-2.....Charflow Controller sht 2 of 3

SK-CHRFLW-3.....Charflow Controller sht 3 of 3

SK-PRESS-4.....Char Feed Bin Press Controller sht 1 of 1

HRSG - SAMA Diagram

SK-HRSGFW-1.....Drum Level / Feedwater Flow Control w/
Press Compensation sht 1 of 2

SK-HRSGFW-2.....Drum Level / Feedwater Flow Control w/
Press Compensation sht 2 of 2

SK-HRSGNGFC.....Natural Gas Flow Controller sht 1 of 1

SK-HRSGOGT.....HRSG Gas Outlet Temp
Controller sht 1 of 1

SK-HRSGSHT.....HRSG Superheat Steam Temperature
Control

Introduction

The IGCC Control System is used to provide operator interface and controls for manual and auto operation of the IGCC Repowering Project located at Springfield, Illinois DOE Contract No. DE-FC21-90MC26308.

A Distributed Control System (DCS) is provided for analog (process control) loop functions and to provide the operator interface.

A Data Acquisition System (DAS) is provided for gathering performance data and optimization.

Programmable Logic Controllers will be provided for the following digital control systems:

- a. GSSS (Gasifier Supervisory Safety System) including pulverized coal handling and char handling
- b. Coal Pulverization System
- c. HRSG (Heat Recovery Steam Generation)
- d. Hot Gas Cleanup System
- e. Steam Turbine
- f. Combined Cycle Operation

In general all systems are provided for auto / manual cascade operation; upstream equipment is interlocked to be proven in service operation and / or valve position before downstream equipment may operate.

General

The IGCC Control System consists of the operator interface and cabinets: see the sketch SK-DATAHWY for a diagram of the system. The IGCC Operator Interface located within the IGCC Control Room consists of the following:

- CRT Screens provided for:
- graphic presentation of each control system
- graphic indication of operating status of field devices
- operator remote control via keyboard input alarm status
- analog controller operation via keyboard input
- controller status screens
- analog indicators
- DAS Trending and remote data

The DCS (Distributed Control System) contains all of the control logic and the PID (Proportional, Integral and Derivative) algorithms for actual operation of the field devices. The individual PLC'S (Programmable Logic Controllers) provide the I/O (Input / Output) interface to the field devices via twinaxial communication cable to the Remote I/O panels. Data-highway communications are provided between the PLC, the operator interface, the DCS and the DAS via twinaxial communication cable and RS-232-C / RS-422-A asynchronous interface devices.

At remote field locations cabinets are provided. Each cabinet is a NEMA IV enclosure with heaters for outside installation. Each location is provided with a remote field I/O panel and a field termination panel. The termination panel provides the actual interface to the field devices. Digital devices are connected to their respective PLC Remote I/O via internal cabinet wiring from the field terminations to a connection on their respective field I/O devices.

Analog devices are connected to the DCS Remote I/O via twisted pairs run directly to I/O in their respective Field I/O cabinets.

Power Distribution

Power distribution for the IGCC Control System is being provided as follows:

Plant UPS, Uninterruptable Power Service is utilized for the DCS (Distributed Control System), the DAS (Data Acquisition System) the IGCC operator interface, the IGCC main control (processor) panels and remote field I/O cabinets in order to minimize coal and char line plugging during incidental loss-of-power. The UPS service will allow for a controlled shut-down to occur.

IGCC Power Consumption

Watthour and current transducers will be provided as required to determine power consumption rates for the individual major processes noted below:

Gasifier Island including pulverized coal and char handling

HRSG - Heat Recovery Steam Generator

HGCU - Hot Gas Cleanup System

Gas Turbine - Combined Cycle

Gas Compressor

Loss of 24 VDC Power

Loss of any 24 VDC power supply within any of the remote I/O panels will result in the following:

The respective alarm indication will be energized.

All controllers will have a zero dumped into their outputs and simultaneously will be automatically switched over to manual.

The gasifier system and feed systems will subsequently be removed from service.

Loss of Operator Interface

Loss of the IGCC operator interface (CRT) or an MFT (MAIN FUEL TRIP) signal from the combined cycle control system will result in the following:

The respective alarm indication will be energized.

All controllers will have a zero dumped into their outputs and after 5 seconds will be auto switched over to manual.

The gasifier system and feed systems will subsequently be removed from service.

Loss of Data Acquisition System

Loss of the DAS system will result in the following:
The respective alarm indication will be energized.
All controllers will be automatically switched over to manual.

DAS Interface

Communications between the DAS and the PLC are provided via RS-232-C / RS-422-A asynchronous interface devices and twinaxial communication cable.

Data Logger Trend Reports

{to be defined later}

Process Controls Description

Coal Milling

- The coal milling system is depicted by the following drawings.

PFD DWG.	D-06851-020001A
P&ID DWG.	D-06851-020006A
	D-06851-020006C
SAMA DIAG	SK-COALFLW-1
	SK-COALFLW-5
	SK-COALFLW-6
	SK-DUCT-BNR

Controls

The raw coal volumetric feeder (FH-20-091X) feed rate is controlled by a speed controller which is reset as a function of the unit load demand. A trim signal, either a volume or weight control signal (depending on hand switch position) is used to automatically compensate for increasing or decreasing volumetric rate of increase or decrease in the pulverized coal receiving bin (FE-20-011) equal to the volumetric rate of decrease in the pulverized coal feed bin (FA-20-011). The weight controller functions in the same manner except that the measured variable is the weight of the material. The speed controller of the raw coal gravimetric feeder is reset by the volume or the weight trim signal to maintain this balance.

The hot air flow is controlled by a flow controller located at the inlet to the pulverizer mill. This flow controller resets the inlet vanes to the mill fan to admit the required volume of air through the mill fan. This flow is a function of the amount of material being fed through the system. The flow controller itself is reset as a function of the unit load demand. A trim

signal, either a volume or weight control signal (depending on hand switch position), is used to automatically compensate for increasing or decreasing volumetric rate of increase or decrease in the pulverized coal receiving bin (FE-20-011) equal to the volumetric rate of decrease in the pulverized coal feed bin (FA-20-011). The weight controller functions in the same manner except that the measured variable is the weight of the material. The speed controller of the raw coal gravimetric feeder is reset by the volume or the weight trim signal to maintain this balance.

The temperature of the coal / air mixture leaving the pulverized coal mill outlet is controlled to about 200 DEG.F. The air temperature is controlled by a natural gas fired duct burner via a temperature controller located in the pulverized coal mill outlet (PW-20-011X). This temperature controller regulates the natural gas flow as a function of the mill outlet temperature.

Pulverized Coal Lockhoppers and Gasifier Feed System

- The P.C. Lockhoppers and gasification feed system are described by the following drawings:

PFD DWG.	D-06851-020001C
	D-06851-020001D
	D-06851-020001E
P&ID DWG.	D-06851-020006F
	D-06851-020006G
	D-06851-020006H
	D-06851-020006J-1
	D-06851-020006J-2
	D-06851-020006K
	D-06851-020006L
	D-06851-020006M
SAMA DIAG	SK-COALFLW-1
	SK-COALFLW-2
	SK-COALFLW-3
	SK-COALFLW-4
	SK-N2FLOW-1
	SK-N2FLOW-2
	SK-N2FLOW-3
	SK-PRESS-5

Controls

The pulverized coal receiving bin has a high level switch (LSH) which will activate the next lockhopper filling when this switch detects a level at this point. The receiving bin also has a level (volume) transmitter and a weight transmitter, which send signals to a volume controller and a weight controller respectfully. The pulverized coal feed bin also sends weight and volume signals to these same controllers. The function of the controllers is to maintain a material balance between the

receiving bin and the feed bin.

On each lockhopper and feed bin vessel pressurizing nitrogen (N2) flow is individually controlled to each of 3 levels to ensure proper distribution of the nitrogen flow. A fixed orifice bypass is provided for initial pressurization to handle sonic flow. When a lockhopper is full, as detected by the high level switch located on the lockhopper; valves 14A and 14B are closed in that order. The vent line remains open in order to maintain the pressure in the lockhopper equal to the pressure in the receiving bin.

When it is time to pressurize the lockhopper, the vent lines are closed, the pressurizing nitrogen is started and the lockhopper pressure increased to equal the pressure in the feed bin. When the pressures are equal the pressurizing nitrogen valves are closed and the equalizing line between the lockhopper and the feed bin is opened to allow the pressures to remain equal. The fluidizing nitrogen valves remain open.

A pressure differential controller is provided to ensure there is no pressure differential between the lockhopper and the feed bin. An interlock prevents opening the feed valves should the lockhopper and the feed bin pressures not be equal.

The pulverized coal is transferred from the lockhopper to the feed bin by opening valves 11B and 11A in that order. When the lockhopper is empty, as indicated by the low level switch; the valve action and operating sequence is as follows:

- . Close valve (11A)
- . Close valve (11B)
- . Close fluidizing and pressuring nitrogen valves (6-1) and (9-1)
- . Close equalizing line valve (8-1)
- . Open the vent valve (12-1)
- . Depressurize through the restriction orifice to the

receiving bin

- . On pressure equalization open the vent valve (13)

An interlock with the pressure switch will prevent the vent valve from opening should the lockhopper not be depressurized.

Pressurizing and fluidizing nitrogen are admitted through individual flow control valves. One flow controller is provided for startup purposes, for initial pressurization, and the second controller is provided for maintaining the operating pressure fluidization rate.

A pressure controller maintains the pressure in the feed bin by resetting a pressure control valve in the vent line back to the pulverized coal baghouse, or by admitting pressurizing nitrogen as required to maintain the pressure. A level (volume) transmitter and a weight transmitter send signals to a volume controller and a weight controller respectfully. A hand switch is provided to select the mode of control. The volume controller maintains the volumetric rate of increase in the receiving bin equal to the volumetric rate of decrease in the feed bin. The weight controller maintains the rate of weight increase in the receiving bin equal to the rate of weight decrease in the feed bin. As mentioned previously, the weight and volume transmitters in the receiving bin also send signals to these controllers. These controllers maintain this balance by resetting the speed controller on the raw coal volumetric feeder. A low level switch in the feed bin will activate the feed valves when a transfer of material is required from the lockhopper to the feed bin.

The feed to the gasifier is controlled by pulverized coal flow control valves (FH-20-081-082-083) which control the flow of coal into the pulverized coal pick-up "T"s (FR-20-021-022-023). The coal entering the pick-up "T"s is picked up by the transport nitrogen, which is also on flow control, and delivers the coal to

the appropriate level of the gasifier. The flow of coal to each of the three pick-up "T"s can be varied from 0 - 100% of the full load coal flow.

The pulverized coal flow control valves are reset by flow transmitters located in the coal lines, or by differential pressure transmitters, which measures the differential pressure across a length of the three pulverized coal lines. A hand switch is provided to select the mode of operation.

The transport nitrogen flow control valves are reset by flow controllers located in the transport nitrogen lines. When the system is fully automatic the unit load signal will control the feed system by resetting both the pulverized coal flow controllers and the transport nitrogen controllers, to regulate the feed to the gasifier, (gas production), based on the unit load.

A bias controller is provided to base load each of the 3 feed control systems, to change the individual flows going to the pulverized coal stream splitters (FR-20-011-012-013) and therefore the amount of pulverized coal being fed to the different levels of the gasifier, depending on operational requirements.

The pick-up "T"s are venturi devices in the transport system. The pulverized coal will be flowing into the pick-up "T"s at 360 PSIA and, typically, 200 DEG. F. The transport nitrogen will be at 410 PSIA and at 200 DEG. F. At design load, the transport nitrogen will transport coal at a ratio of 10:1 to 20:1 during maximum flow. The nitrogen flow will turndown as shown below.

Gasifier and Heat Exchanger

- The gasifier and heat exchanger system is depicted by the following drawings:

PFD DWG. D-06851-030001A
THRU
D-06851-030001E
P&ID DWG. D-06851-030006A
THRU
D-06851-030006N
SAMA DIAG SK-GASFLOW
SK-AIRFLOW-1
SK-AIRFLOW-2
SK-AIRFLOW-3
SK-DPRESS-1
SK-STMFLOW-1
SK-TEMP-1
SK-GASTEMP-1
SK-GASLVL-1
SK-GASPRES-1
SK-GASPRES-2

Controls

Air is injected only at the lower level feed points as primary and secondary air: the total air supply is injected at these locations.

The air is flow controlled by 4 flow controllers. Two of the controllers control the air to the char and steam injection nozzles at Level D/F; the other 2 controllers control the air to the coal and nitrogen injection nozzles at Level A. When the control system is on automatic control the unit load signal will reset the air controllers; increasing and decreasing the volume of air supplied as the coal feed rate also increases or decreases, (also set by the unit load signal), ratioing the

total volume of air to the total volume of coal. Each controller is provided with a bias control which can base load the air controllers at some percentage, as required by the operation.

The process steam injection into the gasifier is flow controlled, and when fully automatic the flow controller will be reset by the unit load signal, to inject steam at an amount determined by the load demand.

An emergency nitrogen line is connected to the air system to admit purge nitrogen to the gasifier in the event of a gasifier trip. The nitrogen flow is set by a flow controller and an on/off valve is interlocked to the system to admit nitrogen into the gasifier should the gasifier trip. The nitrogen purge is only activated after the gas train has been depressurized through the flare.

The system can operate at 30 to 100% load on coal alone. Below a 30% feed rate supplemental natural gas can be used. The natural gas flow to the natural gas burner is regulated by a flow controller.

The space or annulus between the waterwalls of the gasifier, the crossover and the heat exchanger, and the outside wall is maintained at a slightly higher pressure than the product gas stream, to prevent the hot product gas from coming in contact with the external walls of the pressure vessel. This pressure is controlled by admitting annulus pressurizing steam into the annulus between the inner water wall and the outside wall. The annulus pressurizing steam is admitted into the heat exchanger through a pressure differential control valve which is reset by a pressure differential controller that is located in the gasifier between the slag tap and the gasifier slag tank. The controller measures the difference in pressure between the product gas side and the space between the inner and outer walls, and will

maintain the pressure in the annulus at a slightly higher pressure than the product gas side. Annulus steam is started only after the gasifier is warmed up (to avoid condensation) and before making flamable gas in the gasifier.

An emergency nitrogen supply is connected to the pressurizing steam line. If necessary nitrogen can be injected to purge out the system. The nitrogen is controlled by a flow controller. There is also a line connected between the pressurizing steam line and the bottom of the heat exchanger.

Provision has been made for the injection of process water into the raw product gas stream, on temperature control. This is for emergency temperature control only.

Below the slag tap, from both the annulus and the raw gas side, gases are purged to the char system on flow control.

Slag Handling and Disposal

- The slag handling system is depicted by the following drawings:

PFD DWG. D-06851-030001C

D-06851-045001A

P&ID DWG. D-06851-030006G

D-06851-045006A

D-06851-045006B

SAMA DIAG D-SK-LVL-2

Controls

The make up water to the slag tank is on level control as required to maintain a water level within the tank.

The circulating slag tank water is on flow control with the flow determined by the temperature of the water in the gasifier slag tank. The seal water supply is also on flow control.

A high level switch is located above the water seal in the annulus to provide further protection for the system.

Discharge of slag from the slag lockhopper will be operator initiated once a shift as follows valves 1B and 1A will close in that order; valve 5 will open to depressurize the vessel and valves 2B and 2A will open in that order and the water and slag are drained to the slag scraper conveyor (JD-45-011). After a preprogrammed time the hopper is considered empty, valve 3 will be opened and the lockhopper and valves 2A and 2B are flushed clean. The flushing water is controlled by a flow controller.

After a time delay valves 2A and 2B are closed in that order. The lockhopper fills with water and when the high level switch detects a water level, valve 3 will close. Valve 4 is then opened and the lockhopper is pressurized to equal the gasifier

pressure. The pressurizing air is controlled by a pressure controller located in the lockhopper. When the pressures are equal as detected by a pressure differential switch between them, valve 4 is closed and valves 1A and 1B will open in that order, and the system is returned to normal operation.

In addition an infared camera is provided in the gasifier above the high water level to detect slag backup into the gasifier. A monitor in the control room is used by the operator to detect slag projecting above the waterline. If slag is detected a blockage has occurred and the operator must initiate a shutdown to remove the same.

Char Removal

- The char removal system is depicted by the following drawings:

PFD DWG. D-06851-035001A

P&ID DWG. D-06851-035006A

D-06851-035006B

SAMA DIAG SK-LVL-1

Controls

From the char seal hopper the char is discharged on level control, through the char level control valve (FH-35-061).

Char Lockhoppers and Gasifier Feed System

- The char lockhopper system is depicted by the following drawings:

PFD DWGS.	D-06851-040001A
	D-06851-040001B
	D-06851-040001C
P&ID DWGS.	D-06851-040006A
	THRU
	D-06851-040006F
SAMA DIAG	SK-CHRFLW-1
	SK-CHRFLW-2
	SK-CHRFLW-3
	SK-CHRFLW-4
	SK-N2FLOW-4
	SK-N2FLOW-5
	SK-N2FLOW-6
	SK-PRESS-4

Controls

The char receiving bin has a high level switch (LSH) which will activate the next lockhopper filling when this switch detects a level at this point. The char receiving bin also has a level (volume) transmitter and a weight transmitter, which send signals to a volume controller and a weight controller respectfully. The char feed bin also sends signals to these same controllers. The function of the controllers is to maintain a material balance between the receiving bin and the feed bin.

On each vessel the fluidizing steam flow is individually controlled to each of 3 levels to ensure proper distribution of the steam flow.

On the lockhopper and feed bin vessel pressurizing steam flow is

individually controlled to each of 3 levels to ensure proper distribution of the steam flow. A fixed orifice bypass is provided for initial pressurization to handle sonic flow.

When a lockhopper is full, as detected by the high level switch located on the lockhopper; valves 14A and 14B are closed in that order. The vent line remains open in order to maintain the pressure in the lockhopper equal to the pressure in the receiving bin.

When it is time to pressurize the lockhopper, the vent lines are closed, the pressurizing steam is started and the lockhopper pressure increased to equal the pressure in the feed bin. When the pressures are equal the pressurizing steam valves are closed and the equalizing line between the lockhopper and the feed bin is opened to allow the pressures to remain equal. The fluidizing steam valves remain open. A pressure differential controller is provided to ensure there is no pressure differential between the lockhopper and the feed bin. An interlock prevents opening the feed valves should the lockhopper and the feed bin pressures not be equal.

The char is transferred from the lockhopper to the feed bin by opening valves 11B and 11A in that order. When the lockhopper is empty, as indicated by the low level switch; the valve action and operating sequence is as follows.

- . Close valve (11A)
- . Close valve (11B)
- . Close fluidizing and pressurizing steam valves (6-1) and (9-1)
- . Close equalizing line valve (8-1)
- . Open the vent valve (12-1) and (13a)
- . Equalize the pressure with the baghouses pressure through vent valve (13A)
- . When the pressure equals the baghouses pressure close

valve (13A) and open valve (13B) to equalize the pressure with the receiving bin.

Pressurizing and fluidizing steam are admitted through individual flow control valves. One flow controller is provided for startup purposes, for initial pressurization, and the second controller is provided for maintaining the operating pressure fluidization rate.

A pressure controller maintains the pressure in the feed bin by resetting a pressure control valve in the vent line back to the char baghouses or, by admitting pressurizing steam as required to maintain the pressure. A level (volume) transmitter and weight transmitter send signals to a volume controller and a weight controller respectfully. A hand switch is provided to select the mode of control. The volume controller maintains the volumetric rate of decrease in the feed bin equal to the volumetric rate of increase in the receiving bin. The weight controller maintains the rate of weight decrease in the feed bin equal to the rate of weight increase in the receiving bin. The weight and volume transmitters on the receiving bin also send similar signals to these controllers. The weight and volume controllers maintain the balance of material in the receiving bin and the feed bin by increasing or decreasing the flow of material out of the feed bin as the amount of material increases or decreases in the receiving bin.

The feed to the gasifier is controlled by char flow control valves (FH-40-031,-032), which control the flow of char into the char pick-up "T"s (FR-40-021,-022). The char entering the pick-up "T"s is picked up by the transport steam, which is also on flow control, and delivers the char to the appropriate level of the gasifier. Turndown of the char flow to "E" elevation, is 0 -50% of the total char flow, while the turndown of the char flow to the "D" elevation is 0 - 100% of the total char flow.

The char flow control valves are reset by flow transmitters located in the char lines, or by differential pressure transmitters, which measures the differential across the char lines. A hand switch is provided to select the mode of operation. These flow controllers are reset by the weight or volume controller which maintains the material balance between the receiving bin and the feed bin. As the amount of material increases in the feed bin (which would be the result of a greater amount of material entering the receiving bin) the volume or weight controller will open the flow control valves to increase the amount of char flowing to the gasifier.

The transport steam flow control valves are reset by flow controllers located in the transport steam lines. When the system is fully automatic the volume or weight controller will control the feed system by resetting both the char flow controllers and the transport steam controllers.

A bias controller is provided to base load each of the 2 char feed control systems, to change the individual flows going to the char stream splitters (FR-40-011,-012) and therefore the amount of char being fed to the 2 different levels of the gasifier.

The pick-up "T"s are venturi devices in the transport system. The char will be flowing into the pick-up "T"s at 360 PSIA and at a temperature of 800 - 1000 DEG.F. The transport steam will be at 410 PSIA and at a temperature of 672 DEG. F. The transport steam will transport char at a ratio of 10:1 to 20:1 during maximum flow and the steam flow will turndown as shown below.

Gasifier Steam Generation

- The gasifier steam system is depicted by the following drawings:

PFD DWG. D-06851-030001D

P&ID DWG. D-06851-030006H

D-06851-030006L

SAMA DIAG SK-DRUMLVL-1

SK-STMFLW-3

SK-STMTEMP-1

SK-DRUM-P

Controls

The steam drum level is controlled by a 3 point level control system; which takes into account the steam drum level, the boiler feed water make up flow and the steam flow from the steam drum. The temperature of the steam flowing out of the intermediate temperature superheater is controlled by a temperature controller located in the high temperature superheater outlet steam line. This controller resets a temperature control valve which injects feed water into a desuperheater located in the line out of the low temperature superheater. The high temperature superheated steam temperature is controlled by a temperature controller located in the high temperature superheater steam line. This controller resets a temperature control valve which injects feed water into a desuperheater located in the line out of the intermediate temperature superheater.

Superheated steam exits the heat exchanger on pressure control. A pressure controller located on the gasifier steam drum resets the pressure control valve located in the superheated steam line out of the intermediate temperature superheater.

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