3.5 OFFSITE UNITS

Unless stated otherwise, units are shown on Block Flow Diagram ZO-GEM-6894 in Sub-Section 3.4. In addition, units such as boilers, generators and water treaters are also included in Steam/BFW Balance ZO-GEM-6910 in Sub-Section 3.6. The schematic flow diagrams (SFD) are placed at the end of this section.

3.5.1 Oxygen Production Unit 121

Purpose of the Unit is to produce the oxygen required for the gasification of the coal.

Description

The oxygen production unit is an air separation unit including the following:

- air filter
- air compressor
- air cooling
- cold box
- power recovery turbine, including electric power generator
- oxygen compressor
- nitrogen release stack
- liquid nitrogen storage tank 5,000 ft^3 (for start-up, etc.)
- nitrogen evaporator, capacity 500 lb-mol/hr
- emergency liquid air evaporator
- liquid oxygen storage tank

Normal Capacity

Oxygen quantity (calculated as 100%): 14,060 lb-mol/hr
Oxygen purity: 98.06%

Design Capacity 105% of normal

Note: In addition, 600 lb-mol/hr of instrument air is supplied to the complex from this unit. (See Unit 127.)

3.5.2 Boiler Unit 122

Purpose of the Unit is to generate high pressure (HP) steam for the balance of the power requirements not provided by the various MP and LP steam generators using process waste heat.

Description

The boiler is a coal fired boiler complete with all necessary equipment required to produce 1609 psig steam, including provisions to burn the supplemental fuels and incinerate the sour offgases listed below. Efficiency assumed is 83%.

Main Fuel

Fine coal (composition listed in Sub-Section 2.3)	
Quantity	274.0 Mlb/hr
Low heating value, as received (See Unit 128 process description.)	7,893 BTU/lb

Supplemental Fuels

- Oil (from Gas Liquor Separation Unit 107)	
Quantity	35.90 Mlb/hr
Low heating value	16,700 BTU/hr
- Tar (from Gas Liquor Separation Unit 107)	
Quantity	42.85 Mlb/hr
Low heating value	15,700 BTU/lb
- Phenols (from Phenol Recovery Unit 108)	
Quantity	15.26 Mlb/hr
Low heating value	7,800 BTU/lb

Incineration Fuel

- Sour offgases (mainly from Sulphur Recovery Unit 106)	
Quantity	1,592.4 Mlb/hr
Low heating value	274 BTU/lb

Note: The heat content of these gases (30 BTU/SCF) has not been included in the boiler thermal balance.

Normal Capacity	2,291.2 Mlb/hr
Design Capacity	120% of normal

3.5.3 Main Superheater Unit 123

Purpose of the Unit is to superheat the HP steam generated in the boiler for more economic use in the various HP steam turbines.

Description

The main superheater consists of all equipment necessary to produce HP steam at outlet conditions of 986°F and 1,566 psig. It is an integral part of the boiler system. Unit 122 includes the fuel requirements for the superheater. A 43.2 Mlb/hr slip stream of boiler steam is not superheated.

3.5.4 Superheater Unit 124

Purpose of the Unit is to superheat surplus medium and low steam produced in the process units.

Description

The superheater consists of all equipment necessary to superheat MP and LP steam as follows:

	MP Steam	LP Steam
Inlet Pressure, psig	571	100
Outlet Pressure, psig	550	85
Inlet Temperature, °F	483	338
Outlet Temperature, °F	748	502

In addition, each coil is controlled individually and is able to be inactive while the other is fully operating.

The superheater is designed to burn part of the oil recovered in the Gas Liquor Separation Unit 107. Efficiency assumed is 79%.

Quantity of oil	15.81 Mlb/hr
Low heating value	16,700 BTU/lb

Normal Capacity

Coil 1: MP steam superheating	765.5 Mlb/hr
Coil 2: LP steam superheating	842.7 Mlb/hr

Design Capacity 105% of normal

3.5.5 Electrostatic Stack Gas Precipitator Unit 125

Purpose of the Unit is the removal of particulate matter to meet the state and federal environmental requirements for coal fired boilers. (See Sub-Section 2.6)

Description

The unit consists of all equipment required to remove the dust from Boiler Unit 122 stack gas to a level which is compatible with the downstream Stack Gas Clean Up Unit 126. The stack gas leaving Unit 126 will contain 0.1 pound of particulates per million BTU of fuel fired.

Normal Capacity 167.8 Mlb-mol/hr

Design Capacity 120% of normal

3.5.6 Stack Gas Clean-Up Unit 126

Purpose of the Unit is to remove SO_2 from the stack gas to meet the state and federal regulations for coal fired boilers. (See Sub-Section 2.6)

Description

The unit consists of all equipment required to remove SO_2 from the stack gas of Boiler Unit 122 to a level of 0.2 pounds SO_2 per million BTU of fuel fired. The SO_2 absorbant is a lime slurry. The clean stack gas is discharged to the atmosphere via a 300 foot stack.

Normal Capacity	167.8 Mlb-mol/hr, containing 36.1 lb-mol/hr SO_2
Design Capacity	120% of normal

3.5.7 Instrument and Plant Air Unit 127 (not shown)

Purpose of the Unit is to supply instrument air for Air Separation Unit 121 and the boiler area only, and to supply plant air for maintenance purposes. (*)

Description

The unit consists of all equipment, such as compressors and dryers, to produce instrument and plant air. The instrument air is available at 85 psig and -10°F dew point. The plant air will be available at a pressure ranging from 85 to 140 psig.

Design Capacity

Plant air	100 lb-mol/hr
Instrument air	50 lb-mol/hr

(*) Instrument air for the total complex (estimated to be 600 lb-mol/hr, normal) is supplied by the Air Separation Unit 121, from a point where the air is pressured and dried.

3.5.8 Coal Handling Unit 128

Purpose of the Unit is to prepare the as mined coal into suitable feedstocks for the gasifiers and boiler and to provide coal storage.

Technology Used

Commercial-type coal crushing and screening facilities are used to produce well-sized coal for gasification and fines for boiler firing.

The well-sized coal is in the range of 1/4" to 2", containing approximately 15% oversize and 7% undersize.

Process Description (SFD ZO-GEM-6909)

The coal is delivered by trucks from the adjacent mine area. They operate six days per week delivering approximately 32,000 tons per day. Trucks flood unload into the truck dump station having four dump pockets, each with a feeder outlet designed to accommodate two trucks simultaneously. The coal drops into a bin and is fed into the four primary crushers by four plate feeders.

Crushers reduce the size to minus 8" with a minimum generation of fines. The product of the primary crushers discharges onto two belt conveyors for weighing and conveying to the primary screening station using 8" x 20" single deck screens. The minus 2" product is fed to two belt conveyors and the plus 2" product is discharged into secondary crushers, which reduce the oversize coal to minus 2".

The minus 2" coal is then conveyed to a transfer station from where the coal is directed to the live or dead storage piles or, through a by-pass conveyor, directly to secondary screening. Normally, the conveyor to the live storage will be used. The live storage area is sufficient for about six full days of plant production. The dead storage area is sufficient to feed the plant for approximately 30 days.

Coal is reclaimed from live storage via conveyors and is transferred to the secondary screening building for final sizing into gasifier and boiler feeds. In this building, the coal is fed to the screens through variable rate vibrating feeders. The oversize from each screen falls onto two collecting conveyors for sampling and transfer to the gasifier building feed conveyors. The undersize product (minus 1/4") also falls onto two collecting belts for transfer to the fines silo.

Two belt conveyors, equipped with scales and samplers, carry the fines from the storage silo to Boiler 122.

Normal Capacity

Gasifier feed (1/4" to 2")	1,901.3 Mlb/hr
Fine Coal (minus 1/4")	376.5 Mlb/hr

3.5.9 Ash Handling Unit 129

Purpose of the Unit is to receive hot ash from the gasifier ash locks and cool the ash to a suitable temperature for continuous transport and disposal without formation of dust.

Technology Used

The ash handling system is a hydraulic sluiceway system similar to the ash system used commercially by Sasol. It has proven to be very satisfactory for handling the ash from a large number of gasifiers.

Process Description (SFD ZO-GEM-6911)

The ash from the gasifiers discharges into totally enclosed sluiceways located below grade under the gasifiers. The ash from the gasifiers is quenched by a large circulating stream of water which is recycled from the thickener clear overflow. Exhaust Fan 129-C-01 exhausts a mixture of air and water (steam) from the sluiceway. The stream of air and water is quenched with water sprays before being released to the atmosphere to reduce the water content of the stream and to eliminate any dust.

The mixture of ash and water flows by gravity to Duplex Spiral Classifier 129-Y-01 which separates the bulk of the ash from the water. Fine ash and water from the classifier flow by gravity into Classifier Sump 129-F-01 while solids from the classifier are fed to Conveyor 129-Y-02.

The water and fines from the classifier sump are pumped to Thickener 129-F-02 which is a cone bottom center feed rake thickener. The clear overflow from the thickener flows to Thickener Overflow Sump 129-F-03. From this sump, water is pumped back to the sluiceway by Thickener Overflow Sump Pump 129-G-02. The bottoms of the thickener is pumped by 129-G-01 to Filter 129-F-04. Filtrate is recycled to the thickener by 129-G-04. Solids are fed to the conveyor. The conveyor discharges the solids from the filter and from the classifier into Ash Storage Bin 129-F-05.

3.5.10 BFW Preparation Unit 131

Deaerator (131/1)

Purpose of Section 131/1 is to deaerate the boiler feed water (BFW) before steam generation.

Description

The deaerator section uses commercial-type deaeration equipment to remove dissolved gases from steam condensate and fresh water.

The dissolved gases in these streams are removed by heat supplied from Heat Exchanger 150-E-06. (See PFD ZO-GEM-6915.)

After deaeration, the BFW is pumped to the various steam generators. Stripped dissolved gases are vented to the atmosphere.

Normal Capacity

	Temp., °F	Flow, Mlb/hr
MP condensate	483	86.5
LP condensate	284	972.3
Vacuum condensate	207*	2,461.3
Methanation Unit 112 process condensate	288	103.0
BFW make-up water	207*	2,066.9
Total	221	5,690.0

* After heating in 150-E-06

Design Capacity — 120% of normal capacity

Operating Pressure — 17.6 psia

Demineralizer (131/2)

Purpose of Section 131/2 is to provide the high quality water required for high pressure steam generation.

Description

Commercial-type equipment is used. The fresh water is filtered, softened and demineralized before flowing to Deaerator 131/1. (The assumed fresh water analysis is reported in Sub-Section 2.3).

Normal Capacity	2,066.9 Mlb/hr
Design Capacity	120% of normal
Operating Temperature	68°F (*)

(*) The difference of 20°F in the fresh water temperature listed in Sub-Section 2.3 results from the use of this fresh water stream for direct cooling of air in the Oxygen Production Unit 121.

3.5.11 Cooling Water Make-Up Preparation Unit 132

Purpose of the Unit is to treat the fresh water required to replace losses in the cooling water system.

Description

The fresh water is softened and chemically treated to become suitable for make-up to the cooling tower system. Commercial-type equipment is used. In addition to treated fresh water, the biologically treated water from Waste Water Treatment Unit 135 and the humidity of the air condensed in Air Separation Unit 121 are also used as cooling tower make-up.

The CW make-up requirement has been estimated as follows:

	Percent of CW Circulation
Evaporation losses	2.60
Drift	0.07
Blow-down (*)	0.33
Total	3.00

(*) Blow-down is based on a hardness of the softened water of 35 ppm $CaCO_3$.

Normal Capacity

	Mlb/hr
Treated fresh water	2,090.5
Treated water from Unit 135 and humidity from Unit 121	1,994.9
Total	4,085.4

Design Capacity

Softening	200% of fresh water
Chemicals	115% of total water

3.5.12 Cooling Water Tower Unit 133

Purpose of the Unit is to supply the cooling water necessary for the steam turbine condensers and for the process/offsite unit trim coolers.

Description

Standard commercial-type cooling towers and pumps are used to provide 75°F cooling water. The cooling towers are designed for a maximum wet bulb temperature of 66°F. Make-up water is supplied to the cooling towers from Cooling Water Make-Up Preparation Unit 132.

Normal Capacity (*)

	GPM
Steam turbine condenser duty (temperature rise 75 to 100°F and discharge pressure 50 psig)	191,400
Trim cooler duty (temperature rise 75 to 97°F avg. and discharge pressure 64 psig)	81,725
Total	273,125

Design Capacity 115% of normal

(*) The CW capacity is based on air cooling to 130°F and trim cooling below 130°F.

3.5.13 Electric Power Generation Unit 134

Purpose of the Unit is to generate the electric power requirements for the plant complex.

Description

Electric power is generated from commercial-type power generators driven by steam turbines using waste steam from the process units. Two levels of steam are used to generate electric power. Generator 134-M-01 uses 48 psig, 378°F steam with Condensing Turbine 134-T-01. Generator 134-M-02 uses superheated 85 psig steam with Back Pressure Turbine 134-T-02 exhausting to 50 psig.

Electric power is generated at 6,000 Volts; stepdown transformers are provided.

Normal Capacity

	MW	Steam Flow, Mlb/hr
134-M-01	43.5	883.4
134-M-02	7.9	842.7

Design Capacity: 110% of normal

3.5.14 Waste Water Treatment Unit 135

Purpose of the Unit is to treat the waste and acid waters of the total complex so that they can be used as part of the cooling water make-up requirements.

Description

The waste water treatment unit is a commercial-type, biological treatment process using air. In addition, the acid water will be neutralized using caustic soda.

Normal Capacity

Composition	Flow, Mlb/hr
Organic acids and phenols	4.8
Acetone plus C_6^+ containing some H_2S	2.2
Ammonia	1.3
Water	1,974.8
Total	1,983.1

Design Capacity

110% of normal capacity regarding to water flow rate
130% of normal capacity regarding to components.

3.5.15 Flare and Blow-Down Facilities 136 (not shown)

Purpose of the Unit is to provide relief for all liquid and gaseous effluents from the complex.

Description

A commercial-type flare system burns all gaseous streams coming from either process vents or safety valves. The blow-down facility consists of a holding pond to collect the cooling tower and steam system blow-down streams.

Normal Capacity

Blow down water to holding pond	508.8 Mlb/hr

Design Capacity 130% of normal

3.5.16 Storage 137 (not shown)

The following is a summary of the intermediate, product and chemical storage tank capacities which are not located within the process and offsite units:

Product Storage (15 days)

Anhydrous ammonia	1,700 ton (refrigerated)
Sulphur	1,000 ton (covered)
Gasoline	364,000 Bbl (floating roof)
Propane LPG	26,000 Bbl (pressure)
Mixed butane	37,000 Bbl (pressure)

Intermediate Storage (15 days)

Methanol	870,000 Bbl (floating roof)
Raw gasifier naphtha	22,000 Bbl (floating roof)

Chemical Storage

Diisopropyl ether	1,500 Bbl

Coal Fines (7 days) 8,700 T (silo)

3.5.17 Interconnecting Pipeway 138 (not shown)

Purpose of the Unit is to provide piping and racks for connection between the various process units and between the process and offsite units.

3.5.18 Refrigeration Unit 141

Purpose of the Unit is to supply the refrigeration requirements for the plant complex.

Description

An ammonia absorption refrigeration system is used. This process uses the 20 psig waste steam which cannot be utilized in another way. Two temperature levels of refrigeration are provided.

Normal Capacity

	---Duty, MMBtu/hr---	
Temperature Level	+32°F	-45°F
Purification Unit 105 and ammonia storage	25.5	70.5

Design Capacity 110% of normal

3.5.19 Gasoline Blending Unit 154

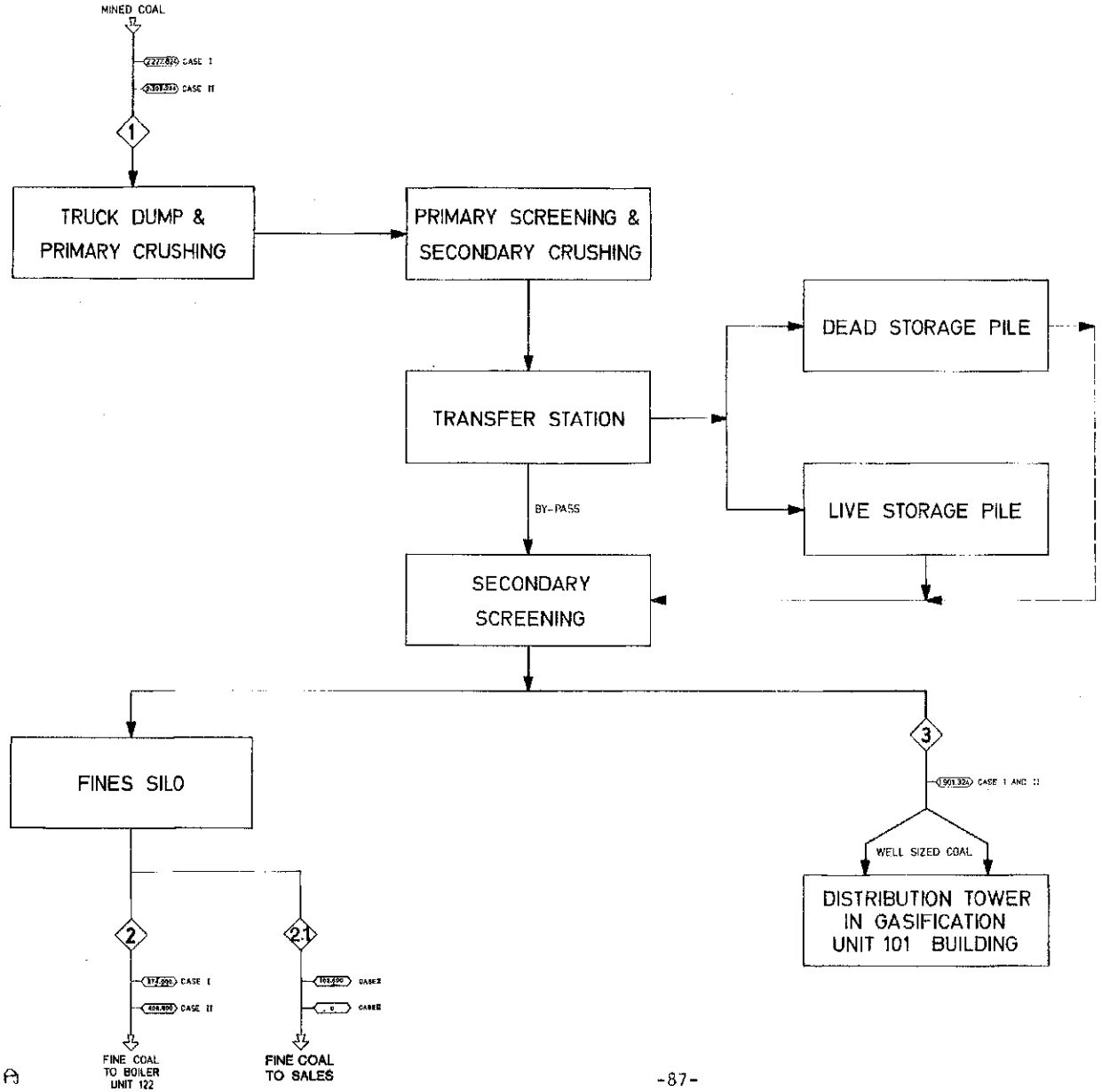
Purpose of the Unit is to blend in-line the various components continuously and automatically into a 10 RVP gasoline product.

Description

A typical commercial in-line blending operation is carried-out as follows:

- Component samples are test blended in the laboratory to determine the proper blending and additive recipe.
- Blending recipe requirements are entered into the blending control system.
- After initial checking, operation is placed on-stream and the gasoline product is sent to final storage.

Equipment consists of rundown tanks, the blending control system with valves, flow meters, analyzer and controllers, and pumps.



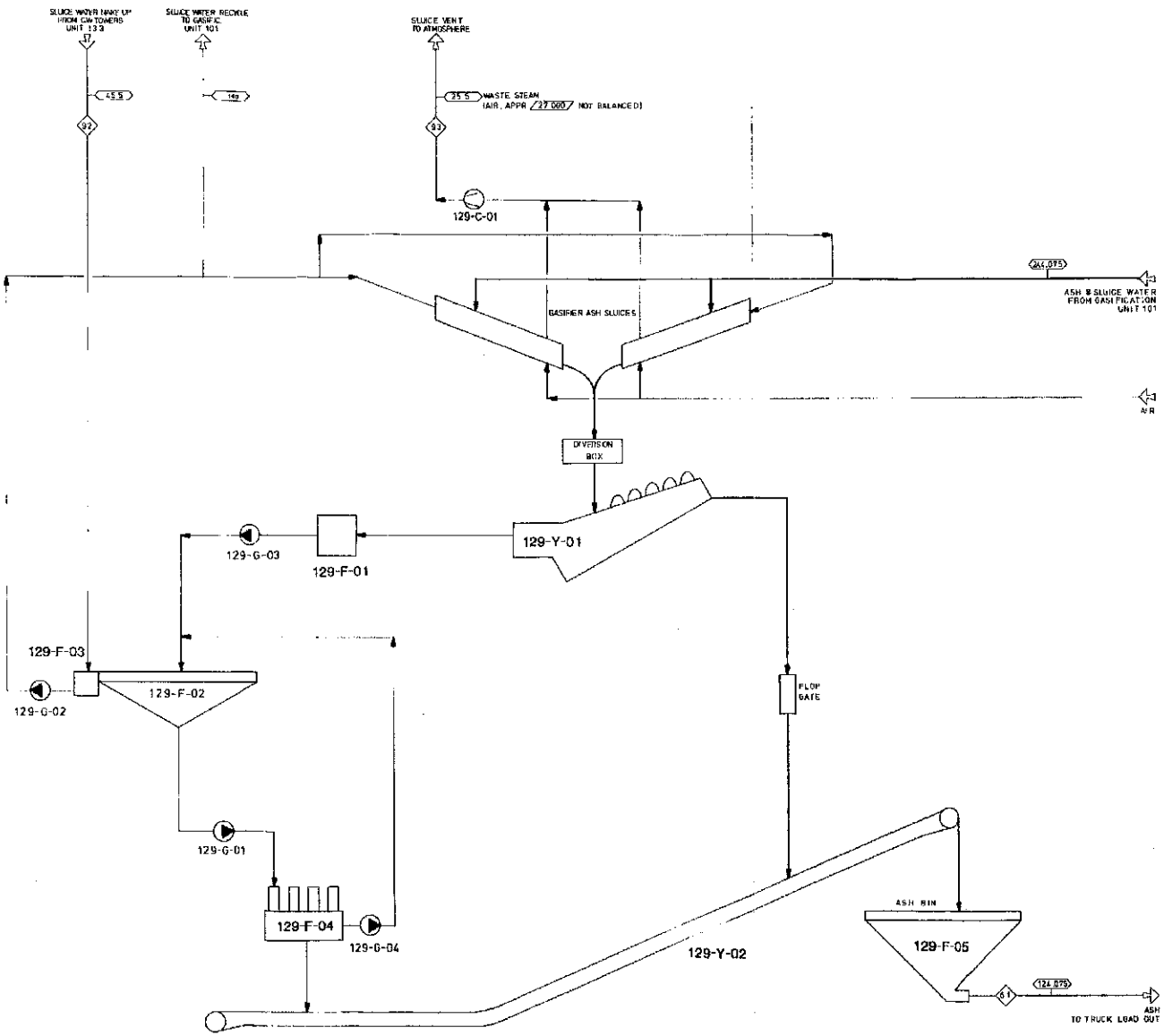
NOTES
STREAMS WITHOUT STREAM NUMBERS ARE NOT INCLUDED IN THE OVERALL MATERIAL BALANCE.

THIS SFD IS IDENTICAL FOR BASE CASE I AND II EXCEPT AS NOTED

	2.8.79		GEM 00-0865	LUROI
			SCHEMATIC FLOW DIAGRAM COAL HANDLING	ZO-GEM-6909
			UNIT 120/720 BASE CASE I/II	

87 A

87 B



EQUIPMENT LIST

ITEM NO.	NAME	OPER. (SPARE)
129-C-01	EXHAUST FAN	1 + 0
129-F-03	CLASSIFIER SUMP	2 + 0
129-F-05	THICKENER	1 + 0
129-F-03	THICKENER OVERFLOW SUMP	2 + 0
129-F-04	SILTLO	1 + 0
129-F-05	ASH STORAGE BIN	0 + 0
129-G-01	THICKENER UNDERFLOW PUMP	1 + 0
129-G-02	THICKENER OVERFLOW SUMP PUMP	2 + 2
129-G-03	CLASSIFIER SUMP PUMP	2 + 2
129-G-04	FILTRATE PUMP	1 + 0
129-Y-01	TWIN SPIRAL CLASSIFIER	1 + 0
129-Y-02	CONVEYOR	1 + 1

STREAM NUMBER
PRESSURE
TEMPERATURE
FLOW RATE DRY GAS
FLOW RATE STEAM AND LIQUIDS

NOTES:
STREAMS WITHOUT STREAM NUMBERS ARE NOT INCLUDED IN THE OVERALL MATERIAL BALANCE

THIS SFD IS IDENTICAL FOR BASE CASE I AND II

Prepared	Date 26/02/91	GEM 00-0865	Lurgi
Checked			
Standard			
Orig. Scale 1/	SCHEMATIC FLOW DIAGRAM ASH HANDLING SYSTEM (OFF SITE UNIT)	Drawing No. ZO-GEM-6911	
Orig. Size A	UNIT 129/229 BASE CASE I/II	MRODERCA STUDY EF-75-C-01-2447	

88 B

88 B

3.6 UTILITY REQUIREMENTS AND STEAM/BFW BALANCE

3.6.1 Utility Requirements

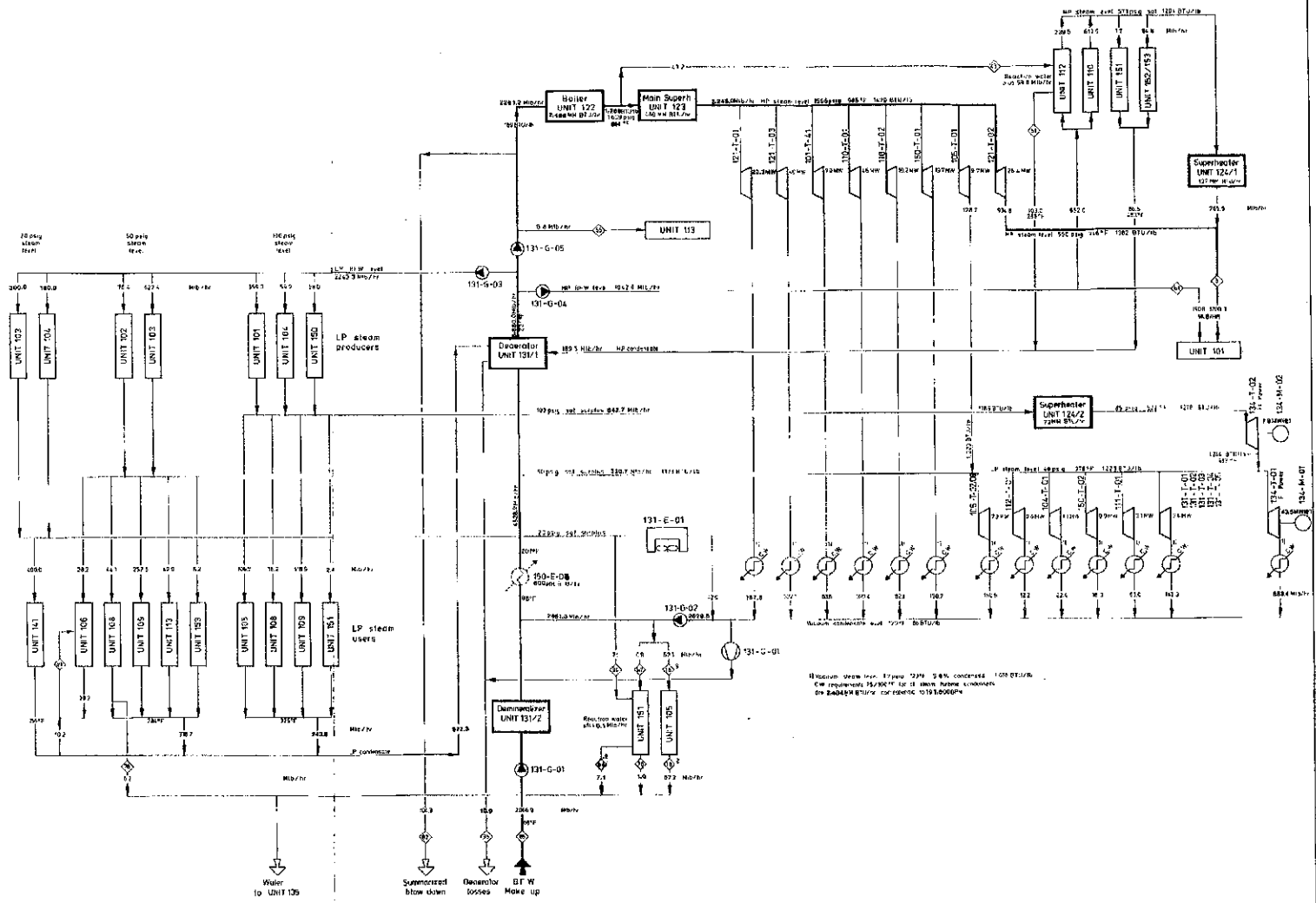
Utility requirements for the individual units can be found as follows:

Utility	Source
Fuel	Type and stream number: BFD ZO-GEM-6894 (Sub-Section 3.4) Quantity and composition: Material balance sheets (Appendix A)
Power	BFD ZO-GEM-6894
Cooling water	BFD ZO-GEM-6894
Boiler feed water	Steam/BFW Balance ZO-GEM-6910 (Sub-Section 3.6)
Steam	Steam/BFW Balance ZO-GEM-6910

In addition, offsite Sub-Section 3.5 contains utility information.

3.6.2 Steam/BFW Balance

The steam and boiler feed water flows are shown on Drawing ZO-GEM-6910. The steam/electric power balance is acceptable in accordance with the study bases. Only about 6 MW(e) is surplus in comparison with 249 MW of total electric and steam power required in the plant complex. In addition, except for about 43 Mlb/hr of 20 psig steam, all steam produced is utilized.



EQUIPMENT LIST

ITEM NO.	NAME	QUAN. /UNIT
131 G-01	VACUUM BLOWER STEAM TURBINE CONDENSERS	1 + 1
131-G-02	BFW MAKE-UP PUMP	1 + 1
131 G 02	VACUUM CONDENSATE PUMP	2 + 1
131-G-03	LP BFW PUMP	2 + 1
131-G-04	MP BFW PUMP	1 + 1
131-G-05	HP BFW PUMP	1 + 1
131-T-01	LP STEAM CONDENSER	1 + 0
134-M-01	MAIN ELECTRIC POWER GENERATOR	2 / 0
134-M-02	STEAM TURBINE GENERATOR	1 + 0
101-T-41	COKE GAS COMPRESSOR STEAM TURBINE	2 + 0
104-T-01	RECTISOL GAS BOOSTER COMPRESSOR STEAM TURBINE	1 + 0
105 T 01	RECTISOL VACUUM NITROGEN MP STEAM TURBINE	1 + 0
105-T-02	RECTISOL VACUUM NITROGEN LP STEAM TURBINE	1 + 0
109-T-04	RECTISOL NITROGEN MAIN FEED PUMP STEAM TURBINE	1 + 0
110 T 01	METHANOL SYNTHESIS SYSTEMS CENTRIFUGAL STEAM TURBINE	2 + 0
110-T-02	METHANOL SYNTHESIS RECYCLE COMPRESSOR STEAM TURBINE	2 + 0
114-T-01	PRESSURE RATIO OXYGEN RECOMPRESSOR STEAM TURBINE	1 + 0
112-T-01	NITROGEN VACUUM RECYCLE COMPRESSOR	1 + 0
121-T-01	SULFUR CONDENSER	1 + 0
121-T-02	OXYGEN COMPRESSOR STEAM TURBINE	1 + 0
123-T-02	AIR COMPRESSOR STEAM BACK PRESSURE TURBINE	1 + 0
123 T 03	AIR TURBOBLOWER STEAM CONDENSER TURBINE	1 + 1
131-T-01	BFW MAKE-UP PUMP STEAM TURBINE	1 + 1
131-T-02	VACUUM CONDENSATE PUMP STEAM TURBINE	1 + 0
131-T-03	LP BFW PUMP STEAM TURBINE	1 + 0
131 T-04	MP BFW PUMP STEAM TURBINE	1 + 0
131 T-05	HP BFW PUMP STEAM TURBINE	1 + 0
134-T-01	MAIN ELECTRIC POWER GENERATOR STEAM TURBINE	2 / 0
134-T 02	SECOND ELECTRIC POWER GENERATOR STEAM TURBINE	1 + 0
150	BOILER	1 + 0
150	MAIN SUPERHEATER	1 + 0
124/1	1255 PSIG STEAM SUPERHEATER	1 + 0
124/2	450 PSIG STEAM SUPERHEATER	1 + 0
131/1	DEAERATOR	1 + 0
131/2	DEMINERALIZER	1 + 0

Prepared	15.8.77	GEM	LURGI
Checked		GO-0865	
Standard			
Orig. Scale		STEAM/BFW BALANCE	ZO-GEM-6910
A0		COAL TO GASOLINE CONV. VIA METHANOL	MRDC/ERDA STUDY EF-76-C-01-2447
		BASE CASE I	

90-A

90-B

3.7 TRAIN PHILOSOPHY

The train philosophy for the various units was selected on the basis of providing a plant complex having an onstream factor of 92%. Consequently, parallel trains have been used for many units to give flexibility in both operation and maintenance. Also, because of the large size of the complex, some units must be divided into parallel trains. In the methanol conversion and hydrocarbon processing area, however, intermediate storage is used to provide this flexibility.

In addition, all normally operating pumps, reciprocating compressors and conveyors are provided with an 100% spare.

The following is a summary of the train philosophy used for each unit:

Gasification Unit 101

Two parallel trains, each containing 14 Lurgi gasifiers, are used. Each gasifier includes a wash cooler, waste heat boiler and other associated equipment.

Only 25 gasifiers will be required to produce the design snythesis gas quantity. The other three spare gasifiers can be withdrawn from service for maintenance.

Raw Gas Shift Unit 102

Two parallel trains are provided because of reactor size limitations and to provide operating flexibility.

Raw Gas Cooling Unit 103

Three parallel trains are provided due to the size limitation of the heat exchangers.

Shifted Gas Cooling Unit 104

One train is provided since the heat exchange equipment is small and a centrifugal booster compressor is provided.

Gas Purification Unit 105

The absorber and regenerator section is divided into four parallel trains to allow towers to be shop fabricated. All the other sections of the unit are divided into two parallel trains for operating flexibility.

Sulphur Recovery Unit 106

The absorber section is divided into four parallel trains due to the large size of the absorbers. In addition, because of the height requirements of the absorbers, each train will contain two absorbers in series. All other sections of this unit are divided into two parallel trains for operating flexibility.

Gas Liquor Separation Unit 107

The dusty gas liquor separation equipment is divided into three trains to provide operating flexibility and to keep the equipment reasonably sized.

Phenol Recovery Unit 108

The phenol extraction section is divided into two parallel trains for operating flexibility and for reasonably sized equipment.

Ammonia Recovery Unit 109

The total stripper and associated equipment is divided into two parallel trains because of size limitations.

Methanol Synthesis Unit 110

Because of manufacturing size limitations, this unit is divided into four parallel reactor trains. Also, two feed/recycle centrifugal compressors are provided for operating flexibility.

H_2 Recovery Unit 111

One train is provided.

Methanation Unit 112

Two parallel reactor trains are provided for operating flexibility.

CO_2 Removal Unit 113

One train is provided.

SNG Drying Unit 114

One train is provided.

Methanol Conversion Unit 150
Naphtha Hydrotreating Unit 151
Fractionation Unit 152
Alkylation Unit 153

All are single train units. They are decoupled from the gasification and methanol synthesis sections by 15 days of tank capacity for the crude methanol and raw naphtha. In addition, Unit 150 has the following reactor configurations for efficient operability:

Reactors	Design
First-stage DME	2 in parallel for possible 3 to 6 month regeneration
Second-stage M-Gasoline	6 in parallel for 14 day cyclic regeneration

Offsite Units

The offsite units are designed for a minimum of two parallel trains. In cases where commercial-sized equipment is too large with two trains, the number of trains has been increased.

SECTION 4

BASE CASE II

FISCHER-TROPSCH TECHNOLOGY

4.1 MATERIAL BALANCE

The overall material balance is shown below:

Input	Mlb/hr
Coal, as mined	2,308.2(1)
Air	6,820.8
Water	4,374.9
Other	7.9
	13,511.8

Output	Mlb/hr
Ash	147.4
Products, including alcohols	519.7(2)
Byproducts	13.7
Blowdown water	526.6
Stack and vent losses	12,298.5
Other	5.9
	13,511.8

(1) 27,698 T/SD

(2) 48,760 Bbl/SD

Overall plant consumptions per barrel of product, converting SNG into a FOE barrel, are:

Coal:	0.568	T
Water:	6.15	Bbl
Air:	1.68	T

Stack and vent losses amount to about 3.0 tons per barrel of product.

Appendix B contains the complete, detailed material balance for Base Case II.