

8.5 NATURAL GAS

Natural gas will be used for gasifier startup and to assist in the burning of waste gases in the flare system.

8.6 ENGINEERING DESIGN DATA

Design data pertinent to the above utilities are detailed in the Process Flow Diagrams immediately following this page, in the Equipment List beginning on Page 8/14, and in the Drawings following Page 8/32.

DRAWINGS RELATED TO PLANT UTILITIES

<u>DRAWING NO.</u>	<u>TITLE</u>
<u>PLANT STEAM SYSTEM</u>	
5530-300-Y-001	Power Plant
5530-302-Y-001	Boiler Feed Water System
5530-305-Y-001	Plant Steam System
<u>ELECTRICAL POWER SYSTEM</u>	
5530-309-Y-001	System One Line Diagram
<u>RAW WATER TREATMENT</u>	
5530-301-Y-001	Raw Water Treatment
5530-301-Y-002	Raw Water Treatment
<u>COOLING WATER SYSTEM</u>	
5530-103-Y-001	Cooling Water System
5530-103-Y-002	Cooling Water Distribution
<u>EQUIPMENT LIST</u>	
<u>PLANT STEAM SYSTEM</u>	
5530-300-P-001	Power Plant General Arrangement
5530-300-P-002	Power Plant General Arrangement, Elevation

ELECTRICAL POWER SYSTEM

5530-309-N-001	Electrical Single Line Legend & Symbols
5530-309-N-002	Electrical Single Line Legend & Symbols
5530-309-N-003	Electrical Single Line Diagram - Main Single Line Diagram
5530-309-N-004	Electrical Single Line Diagram - 13.8 KV Substation
5530-309-N-005	Electrical Single Line Diagram - 4160 V Secondary Selective Substation (typical)
5530-309-N-006	Electrical Single Line Diagram - 4160 V Radial Substation (typical)
5530-309-N-007	Electrical Single Line Diagram - 480 V Secondary Selective Substation (typical)
5530-309-N-008	Electrical Single Line Diagram - 480 V Radial Substation (typical)

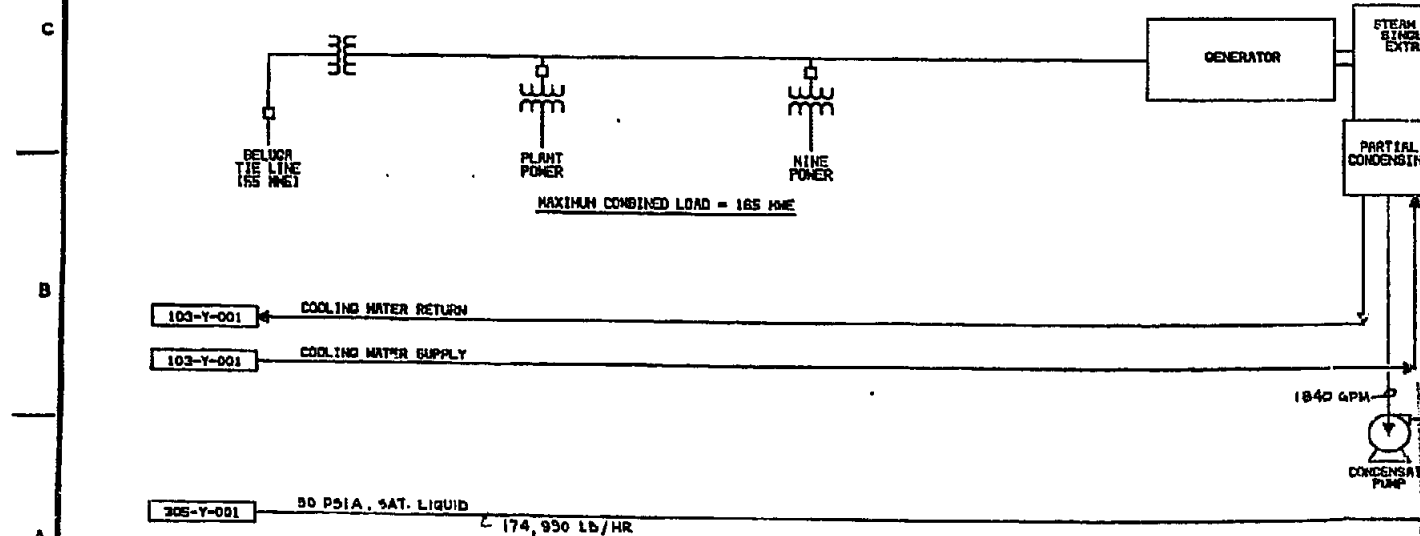
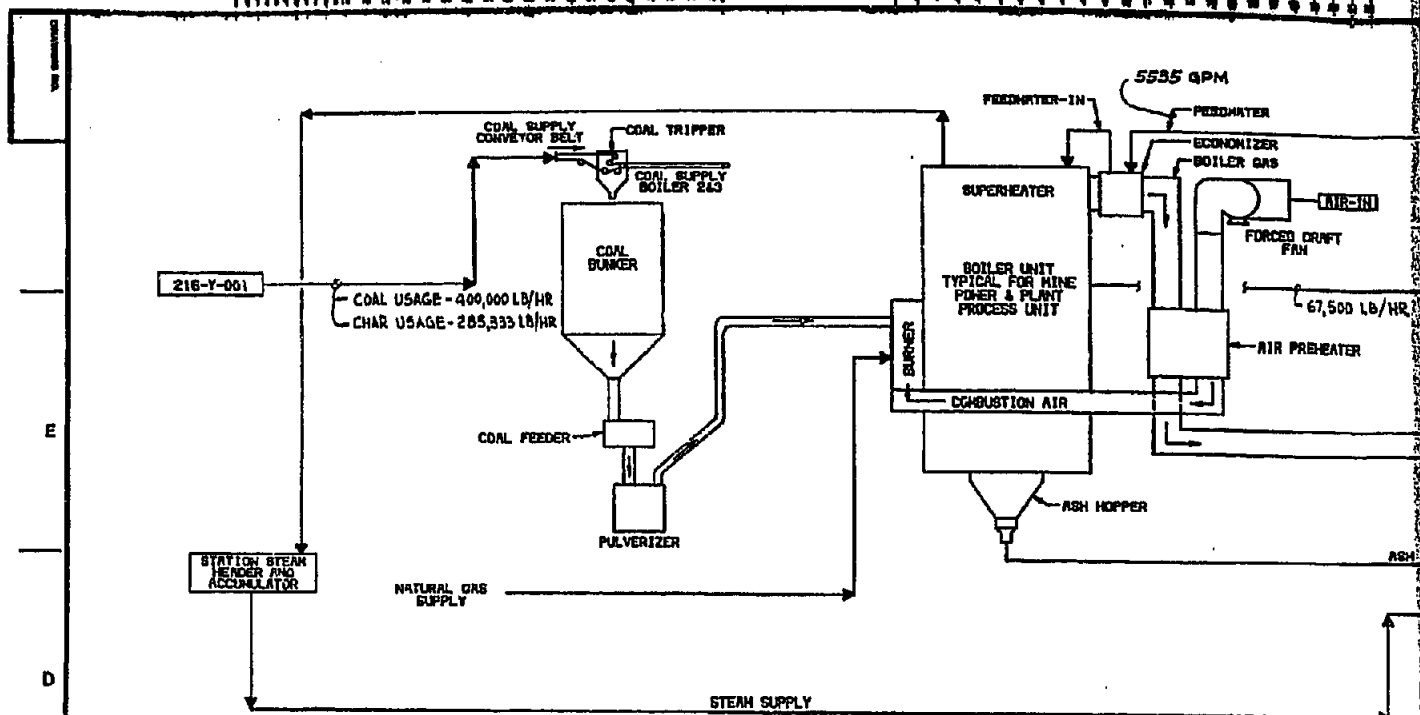
RAW WATER TREATMENT

5530-301-P-001	Raw Water & BFW Treatment - Plan at Grade
5530-301-P-002	Raw Water & BFW Treatment - Plan at Grade & 21'-0"
5530-301-P-003	Raw Water & BFW Treatment - Section A-A
5530-301-P-004	Raw Water & BFW Treatment - Section B-B

COOLING WATER SYSTEM

5530-103-P-001	Cooling Water Pumps - Plan & Section
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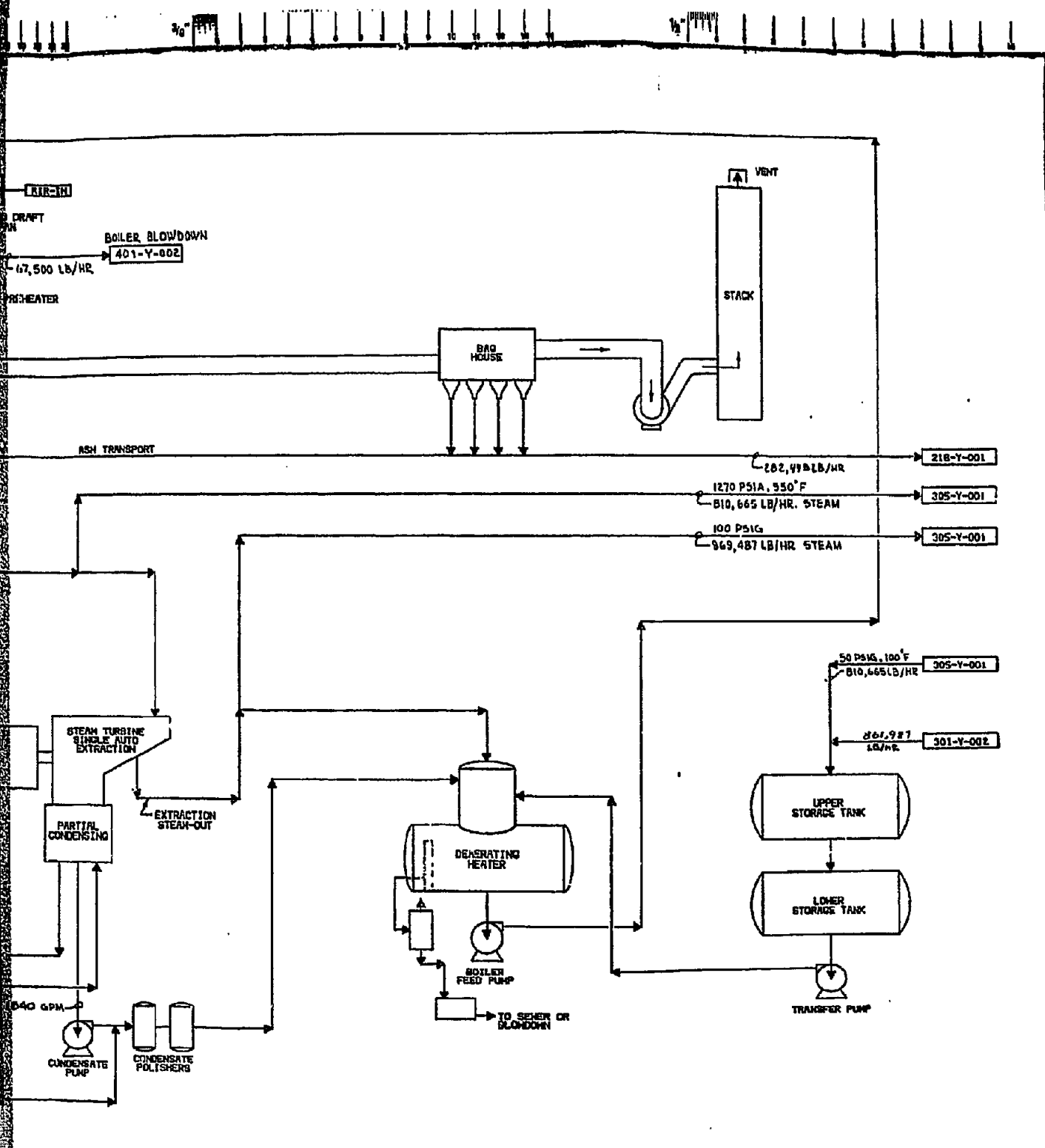
SCALING RULES



FC1444

300 2501 3
OFFSITE STEAM AND
GENERATION PACKAGE

REVISIONS	NO.	DESCRIPTION	BY	CHK.	APPROVED	DATE	NO.	DESCRIPTION	BY	CHK.	APPROVED	DATE	NO.	DESCRIPTION
1	1	ISSUED FOR FINAL REPORT	J.D.			10/2/81	1						1	
2							2						2	
3							3						3	
4							4						4	
5							5						5	



2501.3
STEAM AND POWER
ON PACKAGE

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COOK INLET, ALASKA

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ENGINEERS AND CONSTRUCTORS
200-1000 (Rev. 3-79)

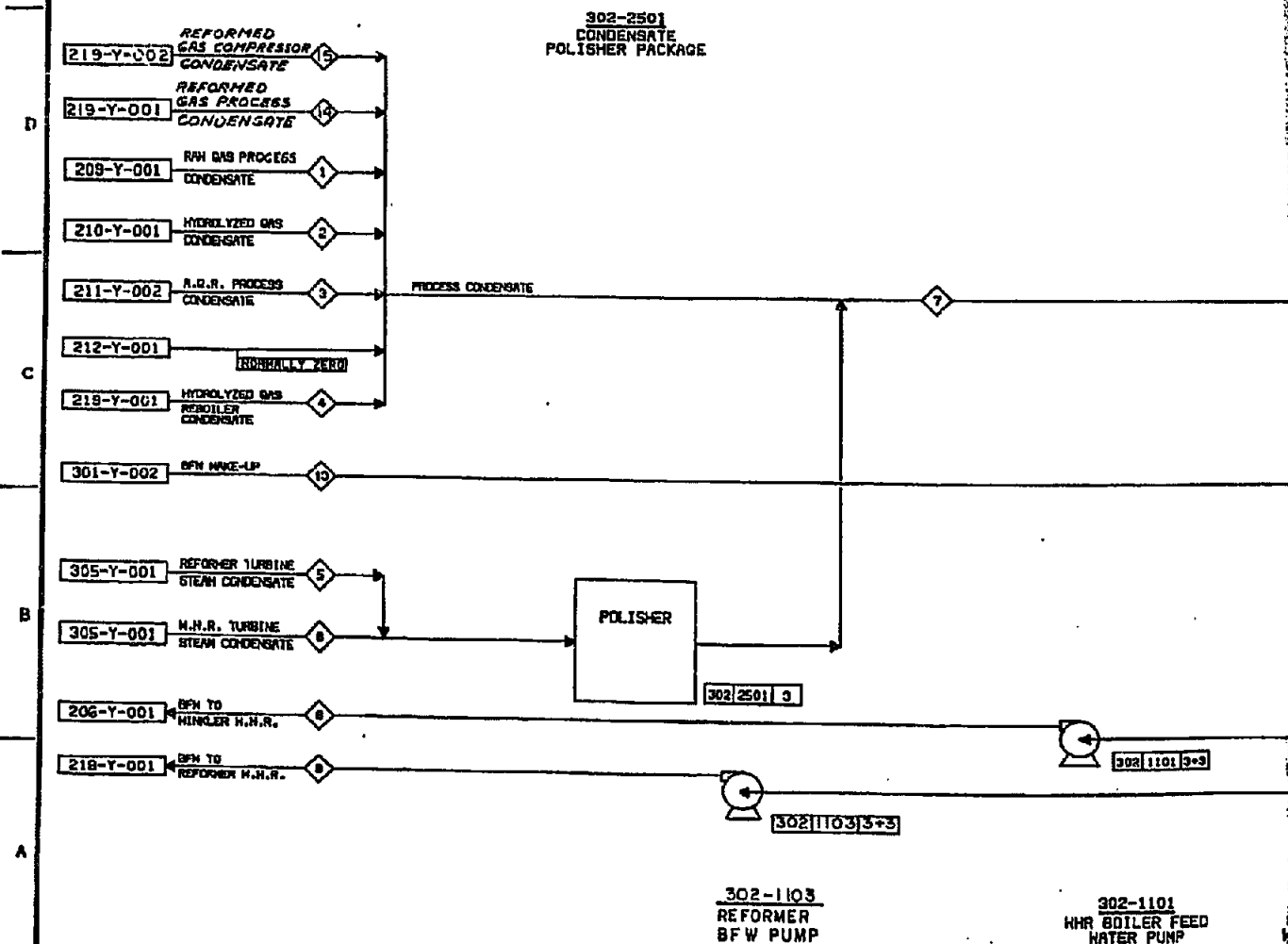
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	DRAWN																												
	CHECKED	SH	7/9																										
	APPROVED 1	TS	7/8																										
	APPROVED 2																												
	APPROVED 3																												

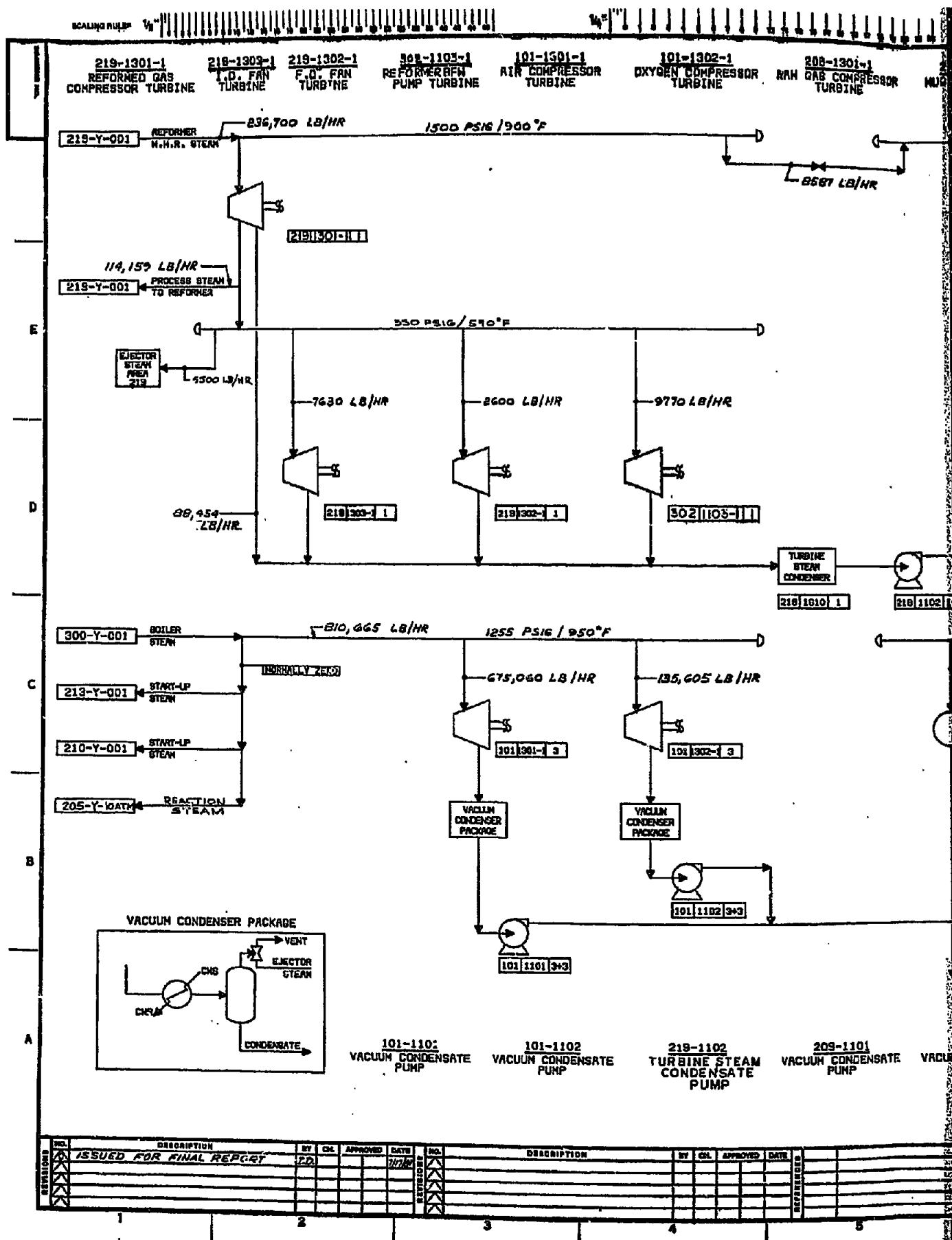
TITLE	SCALE	SHEET NO.
POWER PLANT		

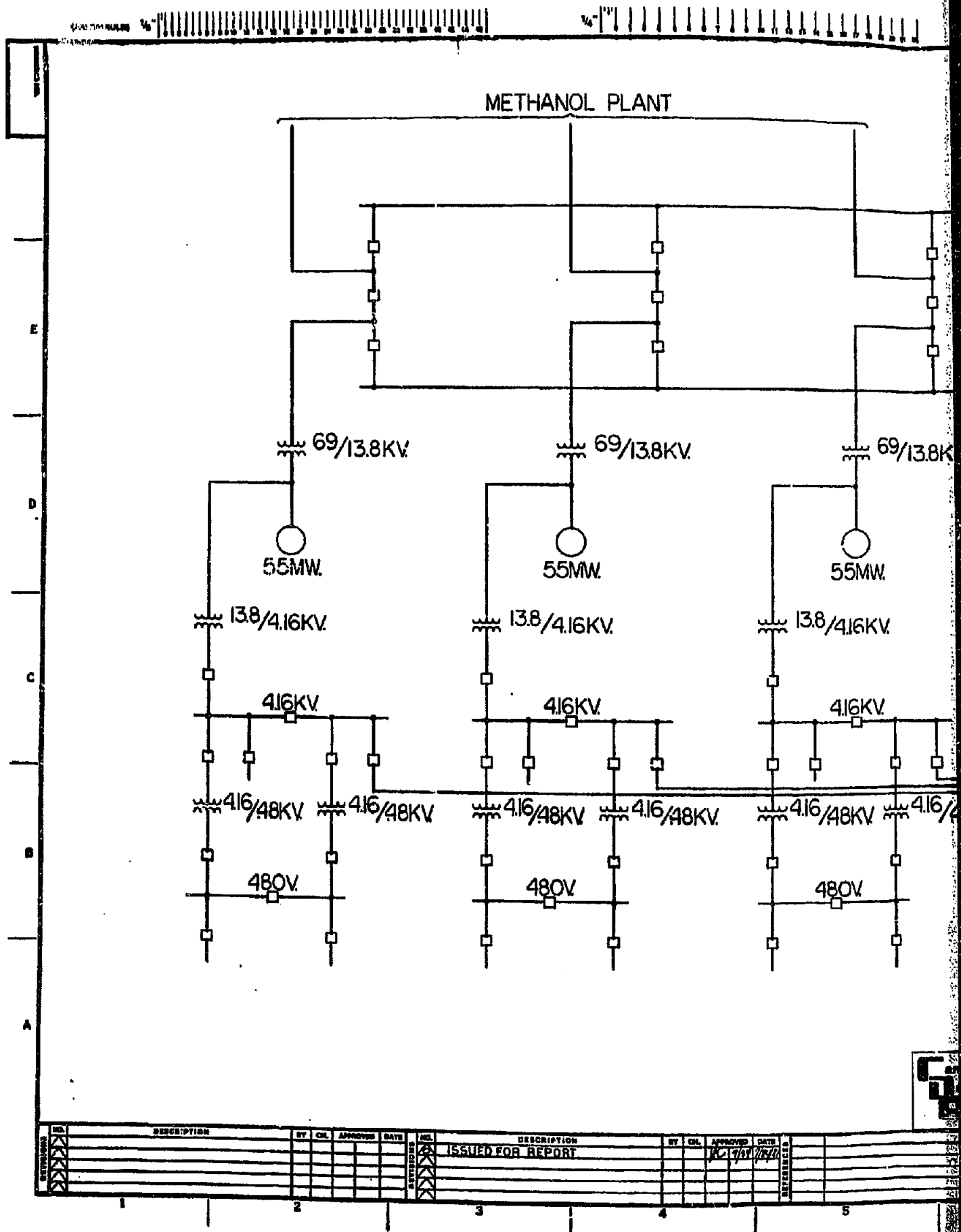
PROJECT NO.	5530-300-Y-001
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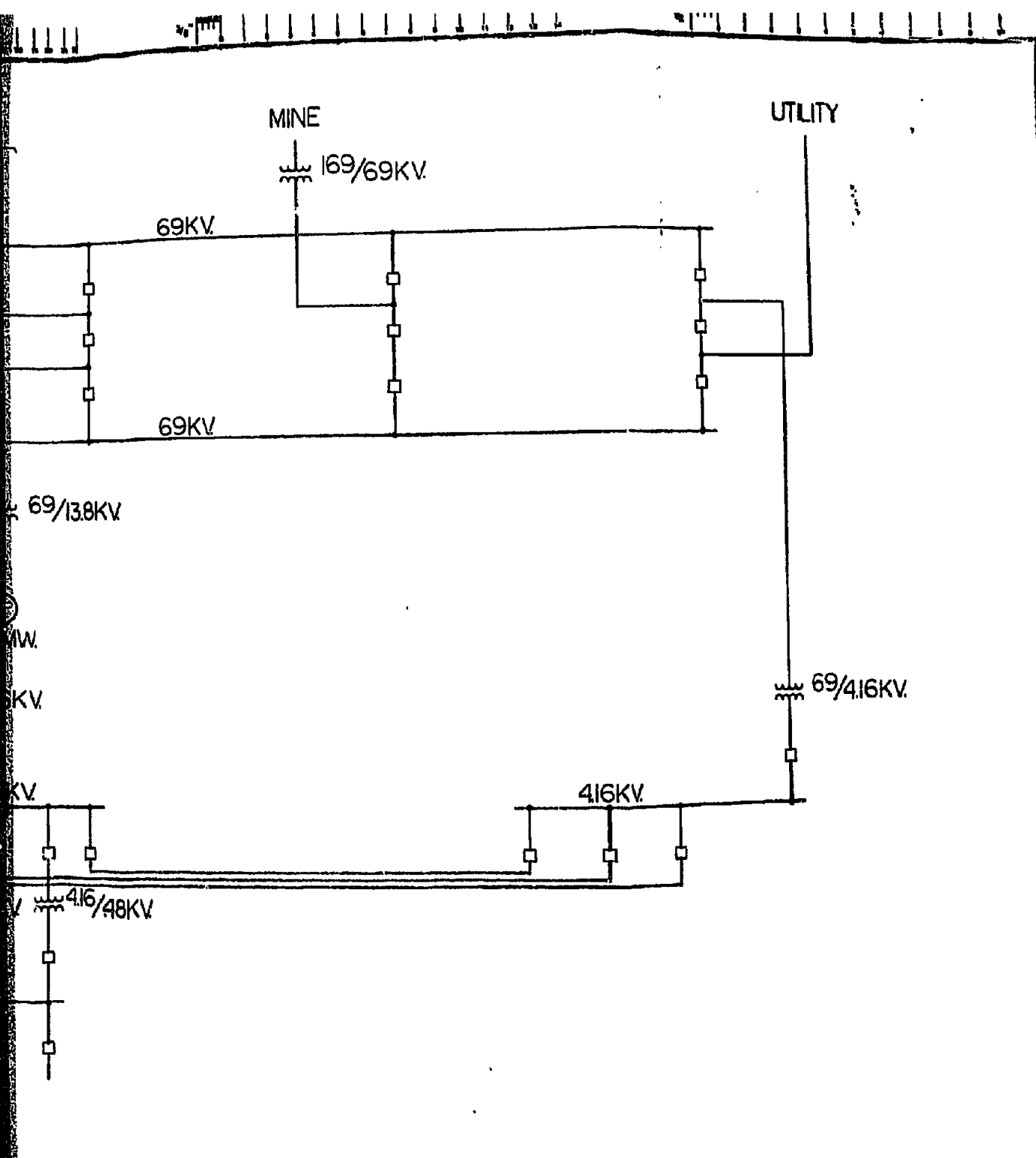


STREAM NO.	1	2	3	4	5	6	7	8	9
STREAM DESCRIPTION	RAW GAS PROCESS COND.	HYDROLYSED GAS COND.	A.G.P. PROCESS CONDENSATE	HYDROLYSED GAS REBOILER COND.	REFORMER TURBINE STEAM COND.	H.C.H. TURBINE STEAM COND.	TOTAL CONDENSATE	SPIN TO WALKER COND.	SPIN TO RECYCLER COND.
PHASE	L	L	L	L	L	L	L	L	L
COMPONENT	MO. WT.								
CARBON	12.011								
HYDROGEN	2.016								
NITROGEN	28.016								
OXYGEN	32.000								
WATER	36.033								
CHLORINE	35.453								
ASH	-								
WATER	18.016	100.00 300.85	100.00 101.150	100.00 1760	100.00 249.779	100.00 108.354	100.00 1291.839	100.00 1291.839	100.00 1291.839
CARBON MONOXIDE	28.011								
CARBON DIOXIDE	44.011								
METHANE	16.043								
HYDROGEN SULFIDE	34.076								
CARBONYL SULFIDE	60.071								
SULFUR DIOXIDE	64.068								
METHANOL	32.041								
DIMETHYL ETHER	48.063								
HIGHER ALCOHOL	74.120								
(SOLIDS CARRYOVER)	WATER								
(SOLIDS CARRYOVER)	LEAK								
TOTAL (WGT)		100.00 300.85	100.00 101.150	100.00 1760	100.00 249.779	100.00 108.354	100.00 1291.839	100.00 1291.839	100.00 1291.839
FLOW (GPH)	BCFH								
TOTAL FLOW	LB/HR	30.684	101.150	1760	249.779	108.354	1291.839	1291.839	1291.839
PREHEAT	PRTR	100	55	60	100	65	100	100	100
TEMPERATURE	°F	100	100	50	100	100	100	100	100
HHV	BTU/LB								
HHV (GPH)	BTU/BCF								

[illegible]







Campbell, DeSoo & Associates
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 Engineers Toledo, Ohio

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 5530-309-Y-001

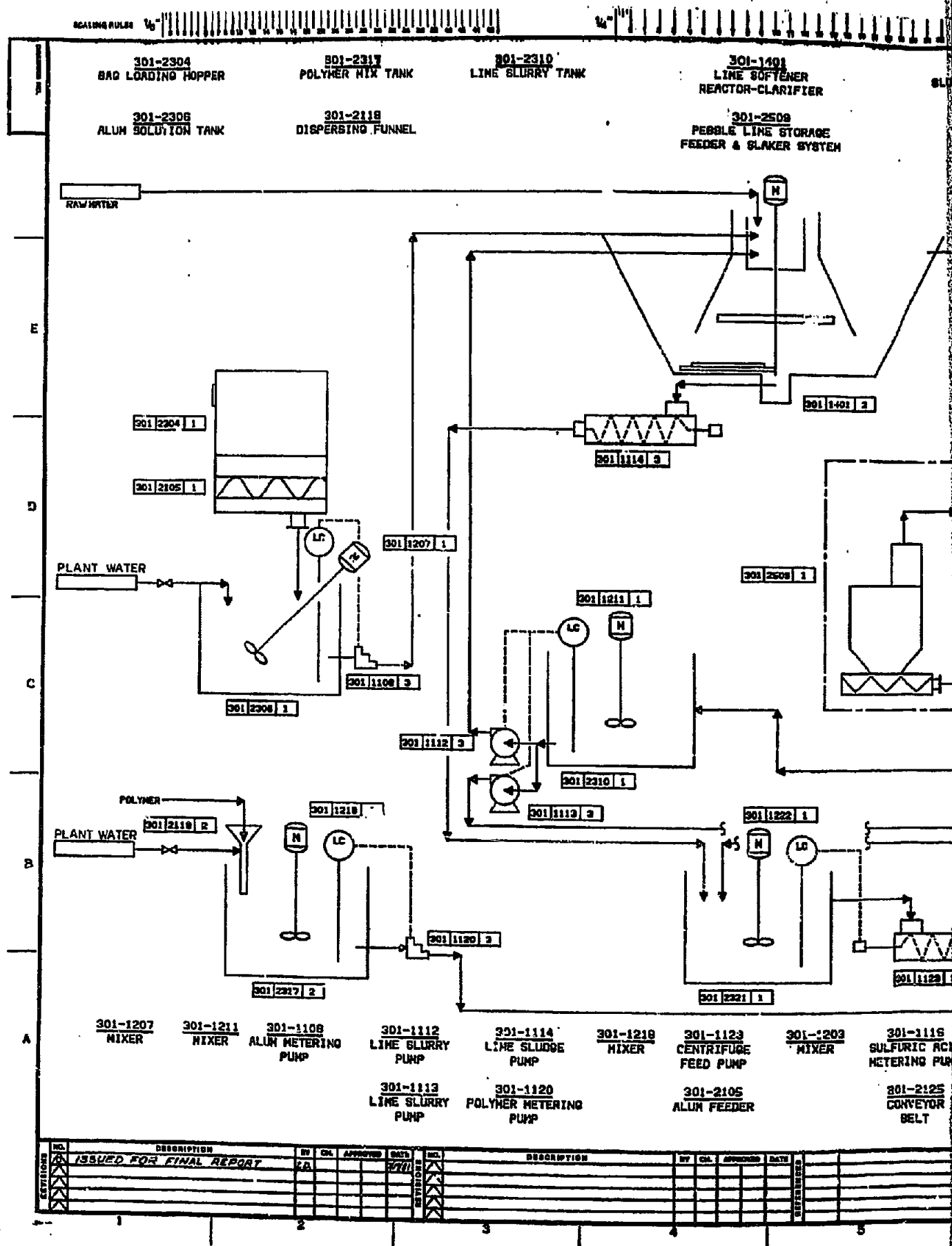
DESIGNED	BY:~	DATE	DATE TO	1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
DRAWN	GNC																			
CHECKED	HTL	1/1/78	FIELD																	
APPROVED 1																				
APPROVED 2																				
APPROVED 3																				

6

7

TITLE
 SYSTEM ONE LINE
 DIAGRAM
 SCALE: NONE



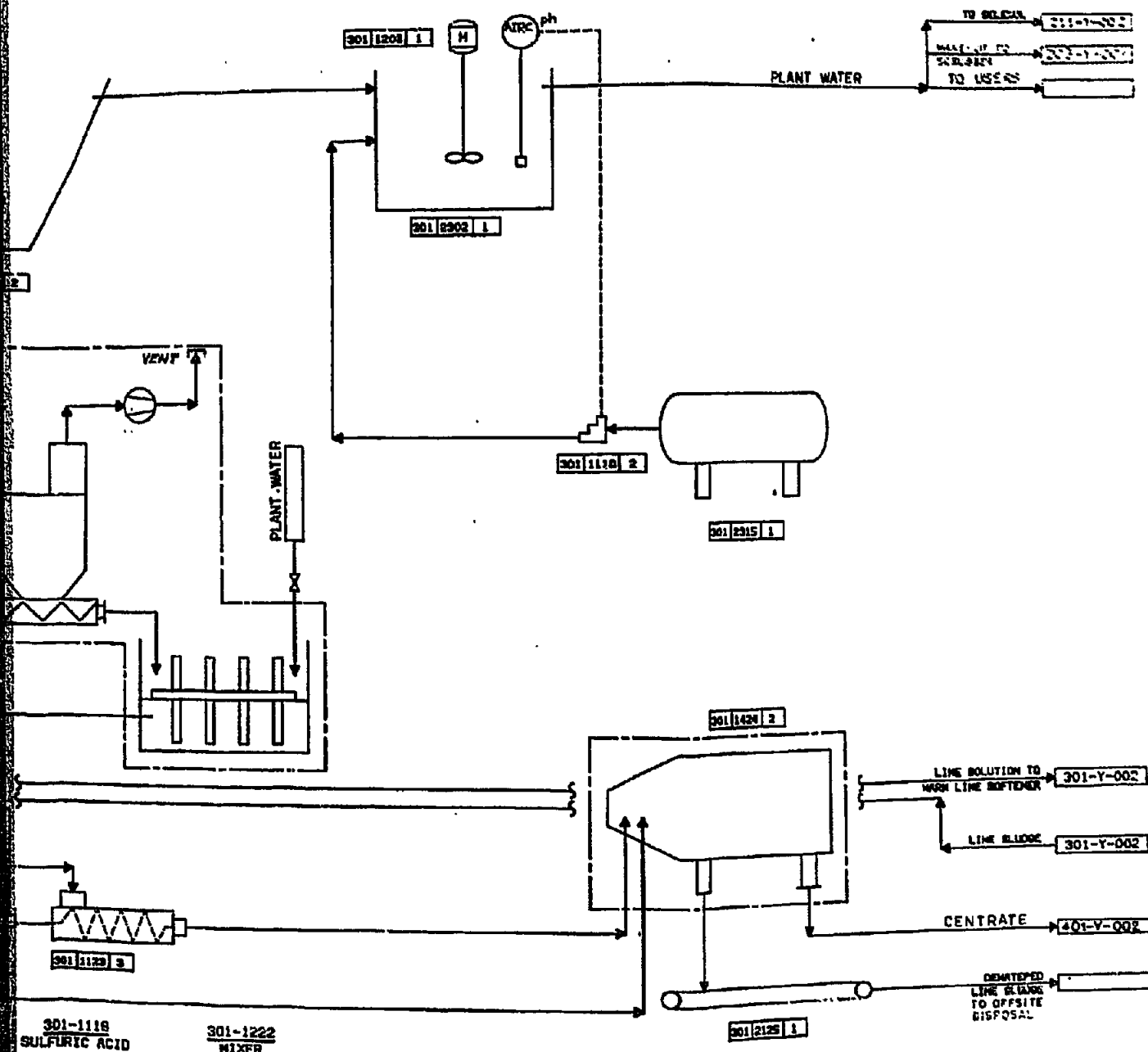


301-2321
SLUDGE MIX TANK

301-2302
NEUTRALIZATION TANK

301-2315
SULFURIC ACID
STORAGE TANK

301-1424
CENTRIFUGE



301-1118
SULFURIC ACID
METERING PUMP

301-1222
MIXER

301-2125
CONVEYOR
BELT

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RAW WATER TREATMENT

5530-301-Y-001



REVISION	BY	DATE	REASON	APPROVED
1	DAVY	1/1/75	ISSUED	
2	DAVY	1/1/75	REVISION	
3	DAVY	1/1/75	REVISION	
4	DAVY	1/1/75	REVISION	
5	DAVY	1/1/75	REVISION	
6	DAVY	1/1/75	REVISION	
7	DAVY	1/1/75	REVISION	
8	DAVY	1/1/75	REVISION	
9	DAVY	1/1/75	REVISION	
10	DAVY	1/1/75	REVISION	

REVISION	BY	DATE	REASON	APPROVED
1	DAVY	1/1/75	ISSUED	
2	DAVY	1/1/75	REVISION	
3	DAVY	1/1/75	REVISION	
4	DAVY	1/1/75	REVISION	
5	DAVY	1/1/75	REVISION	
6	DAVY	1/1/75	REVISION	
7	DAVY	1/1/75	REVISION	
8	DAVY	1/1/75	REVISION	
9	DAVY	1/1/75	REVISION	
10	DAVY	1/1/75	REVISION	

SCALE 1/8" = 1'-0"

301-2311
MOO SOLUTION
TANK

301-2310
ACID STORAGE
TANK

301-2518
ACID REGENERATION
SYSTEM

301-2335
CATION
EXCHANGERS

301-2303
SUMP

301-2336
ANION
EXCHANGERS

301-2308
FILTERED WATER
COLLECTION SUMP

301-2309
REGENERANT
COLLECTOR
TANK

RAW WATER
STEAM
LINE
SOLUTION

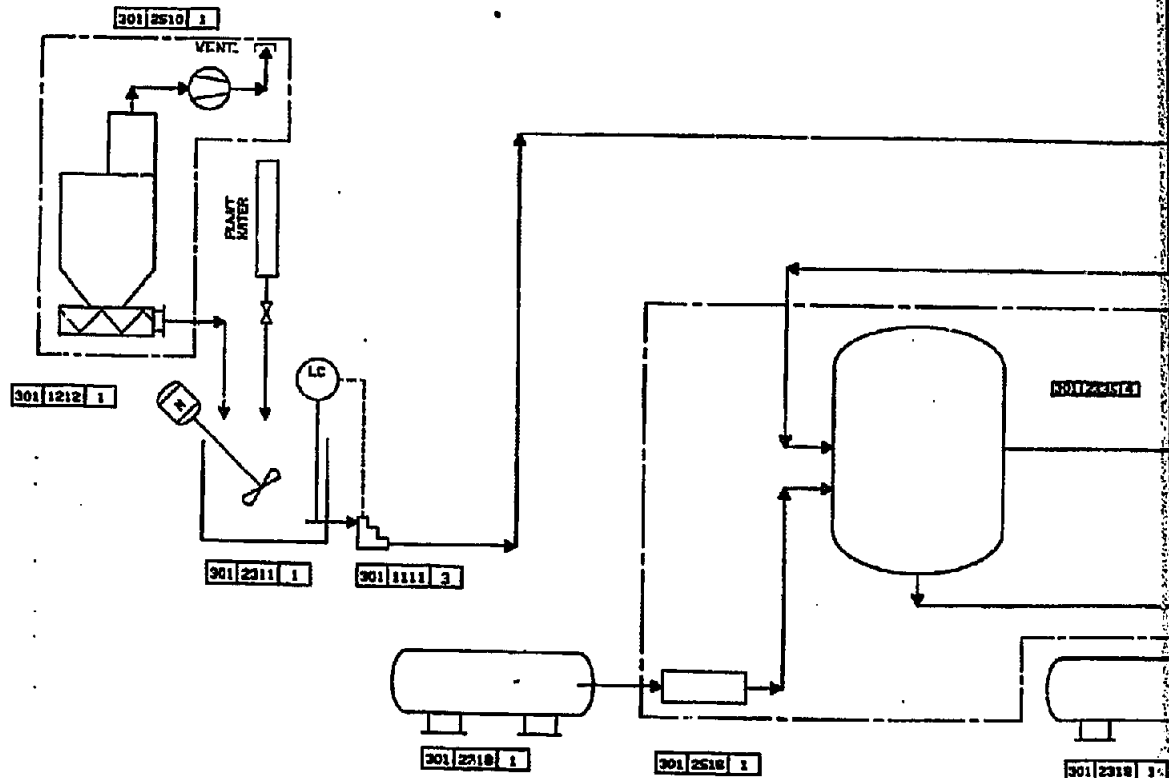
E

D

C

B

A



301-1212
MIXER

301-1111
MOO SOLUTION
METERING PUMP

301-1104
FILTER FEED
PUMP

301-1109
ION EXCHANGER
FEED PUMP

301-1122
REGENERANT
TRANSFER PUMP

301-1223
MIXER

301-1102
LINE SLUDGE
PUMP

301-1107
BACKWASH WATER
TRANSFER PUMP

301-1121
CAUSTIC FEED
PUMP

NO.	DESCRIPTION	BY	CHK	APPROVED	DATE	NO.	DESCRIPTION	BY	CHK	APPROVED	DATE
1	ISSUED FOR FINAL REPORT					2					
3						4					
5						6					

301-2322
REGENERANT
COLLECTION
TANK

301-2516
MAGNETIC OXIDE
STORAGE & FEED SYSTEM

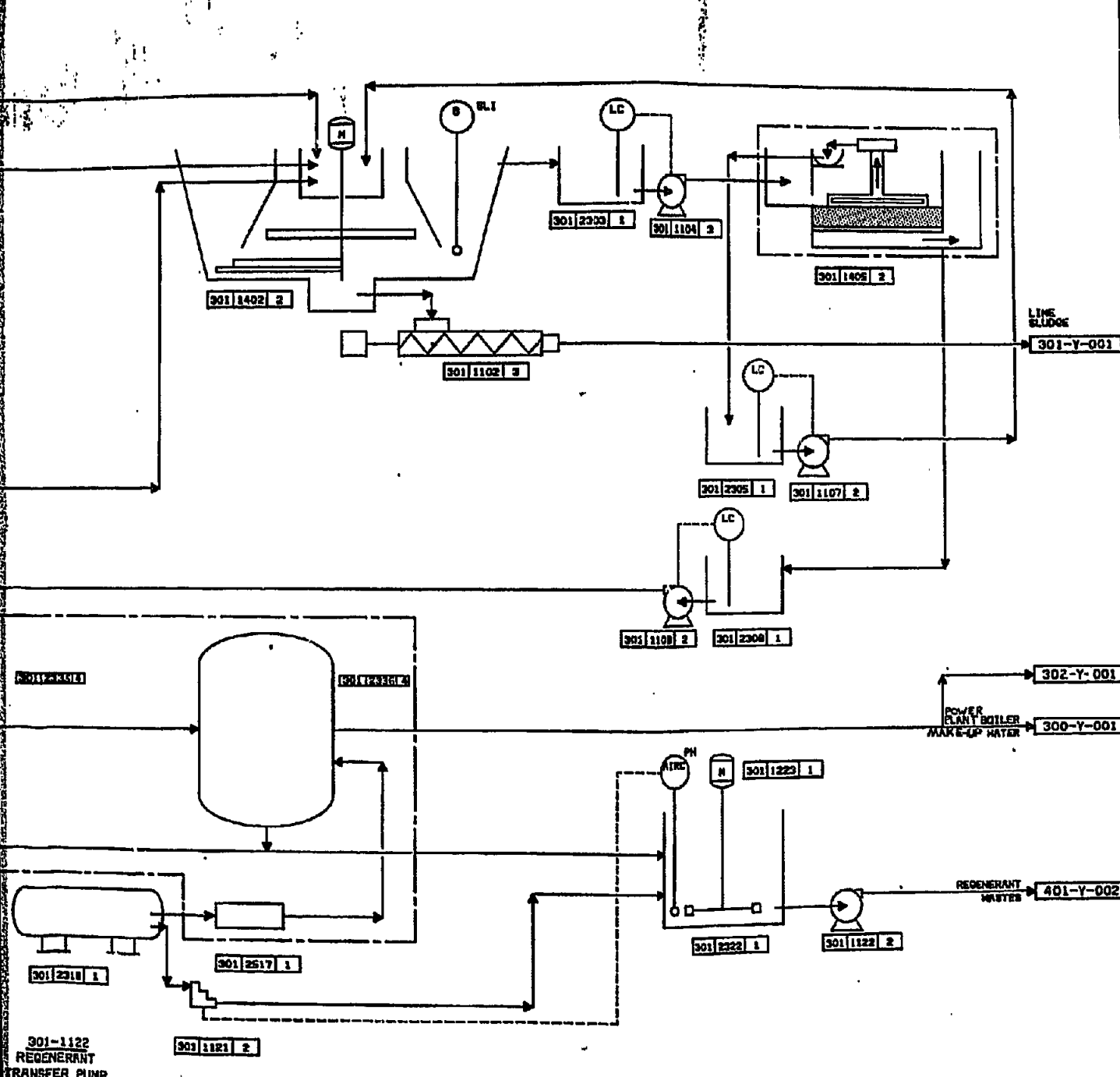
301-1402
HARM LIME SOFTENER
REACTOR-CLARIFIER

301-2517
CAUSTIC REGENERATION
SYSTEM

301-2318
CAUSTIC STORAGE
TANK

301-2305
BACKWASH WATER
PUMP

301-1405
GRAVITY FILTER



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220-1042 Rev. 10/69

DESIGNED BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
DRW	7/71	SPC	7/71		
CHKD		TEL			
APPRD					
APPRD					

SCALE
ACT 1083

RAW WATER TREATMENT
5530-301-Y-002



2501
THER
KIT

103-2201
SULFURIC ACID DRY
TANK

EVAPORATION AND
WINDAGE LOSSES

10,224 GPM

FAN

320,607 GPM

FROM CH. UBERB

103-Y-002

15,000 GPM

MAKE-UP WATER

WELL

103-2501 S

1104
BO
IMP

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220-5002 Rev. 7/78

DESIGNED BY	DATE	DATE TO	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
DRAWN																						
CHECKED	6/24	7/77	CLIENT																			
APPROVED 1	7/25	7/77	FIELD																			
APPROVED 2																						
APPROVED 3																						
APPROVED 4																						

TITLE

COOLING WATER
SYSTEM

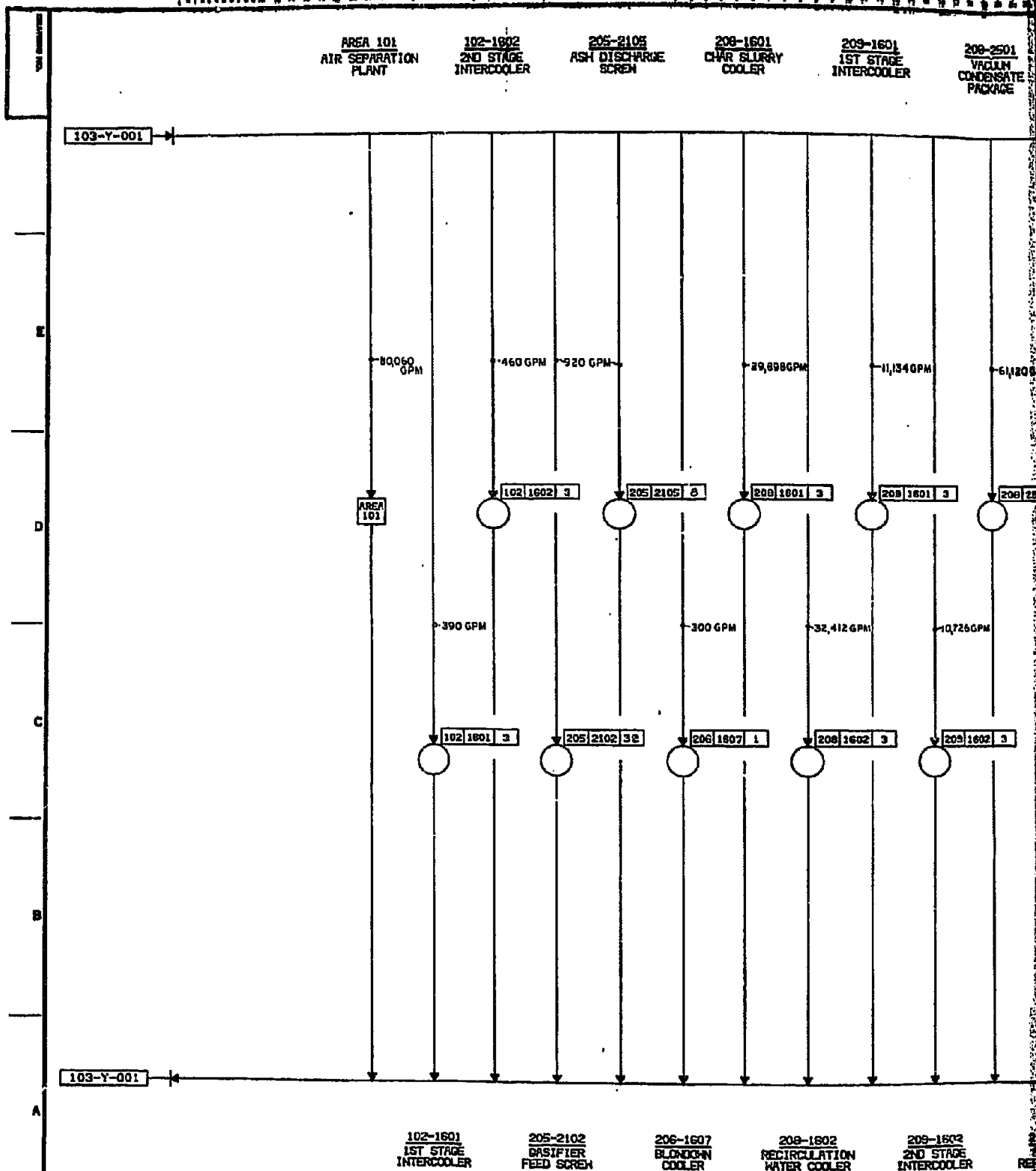
5530-103-Y-001



SCALE
AC1420

SH. NO.

10

[illegible]

208-2501
VACUUM
CONDENSATE
PACKAGE

211-1804
RECYCLE COMPRESSOR
GAS COOLER

211-1621
RECYCLE
GAS COOLER II

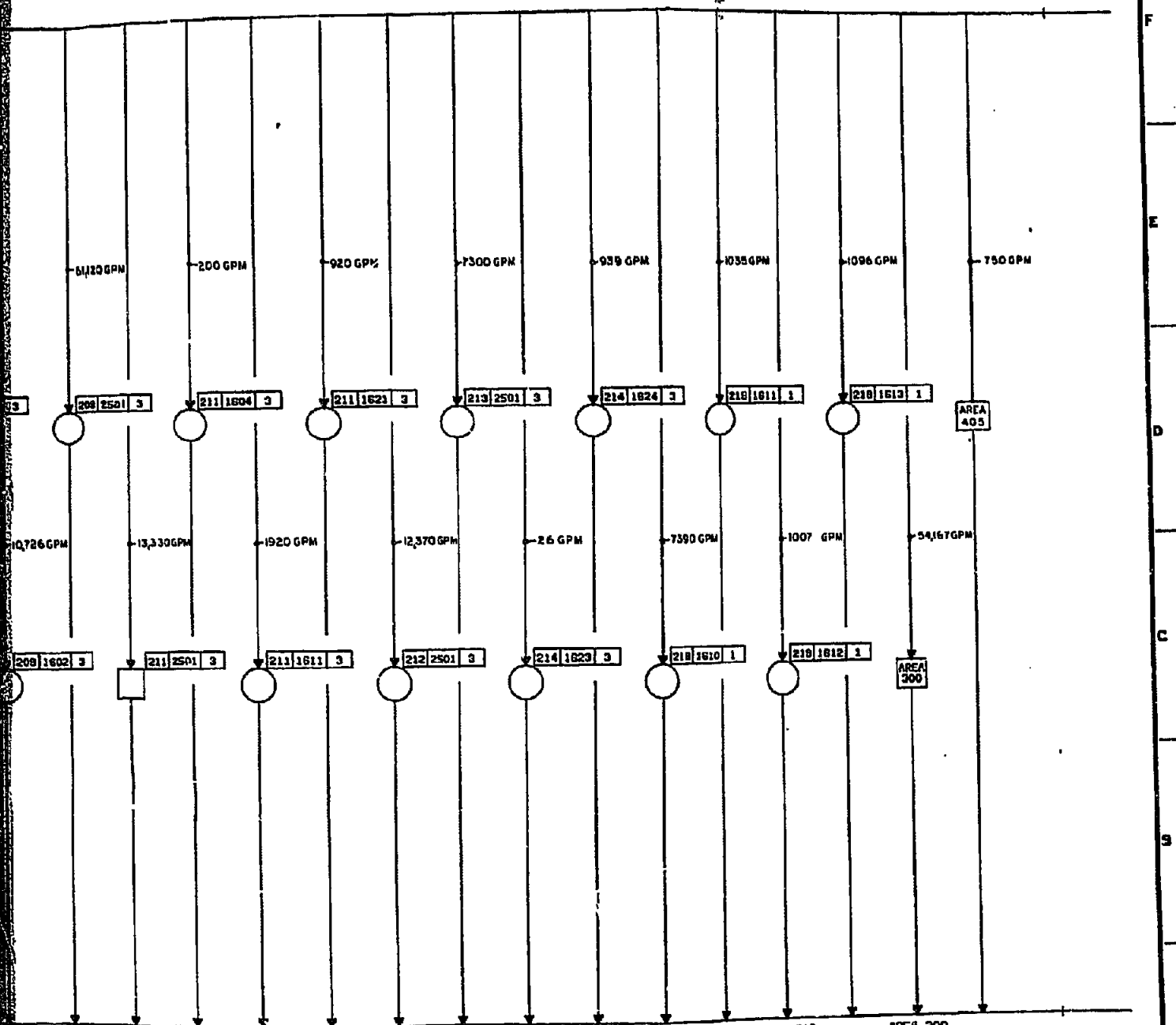
213-2501
VACUUM
CONDENSATE
PACKAGE

214-1624
BOTTOMS
COOLER

218-1611
1ST STAGE
INTERCOOLER

218-1613
REFORMED GAS
COMPRESSOR
AFTERCOOLER

AREA 405
SULFUR
RECOVERY



G02
STAGE
COOLER

211-2501
SELEXOL
REFRIGERANT
PACKAGE

211-1611
H₂S STRIPPER
CONDENSER

212-2501
VACUUM CONDENSATE
PACKAGE

214-1623
FUEL OIL
COOLER

218-1610
TURBINE
STEAM CONDENSER

218-1612
2ND STAGE
INTERCOOLER

AREA 300
STEAM POWER
GENERATION

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COOK INLET, ALASKA

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605-2042 FAX 1070

DESIGNED	BY	DATE	CHECKED	DATE	APPROVED	DATE
CHART	CH	7/71	CHART	7/71	CHART	7/71
CHECKED	GPA	7/71	FIELD	7/71	FIELD	7/71
APPROVED 1	TXS	7/71				
APPROVED 2						
APPROVED 3						

TITLE
COOLING WATER DISTRIBUTION

5530-103-Y-002



NO1428

10

COOLING WATER SYSTEM - AREA 103

EQUIPMENT LIST

NOMENCLATURE:
T - TYPE
C - CAPACITY
S - SIZE
P/T - OPERATING PRESSURE/
TEMPERATURE
M - MATERIAL
CS - CARBON STEEL
SS - STAINLESS STEEL
CI - CAST IRON
D - DRIVE
W - WEIGHT
ACC - ACCESSORIES

ITEM	NO. REQUIRED	DESCRIPTION
103-1101	5 + 1	<u>Circulation Pump</u> T - Vertical Turbine C - 66,000 GPM @ 55 psig, 150°F ΔP = 50 psi M - Carbon Steel D - 2,400 hp, Electric
103-1104	1 + 1	<u>H₂SO₄ Pump</u> T - Horizontal Centrifugal C - 0 - 5 GPM S - Delivery = 25 psig M - Carbon Steel D - 0.5 hp, Electric
103-2201	1	<u>H₂SO₄ Day Tank</u> T - Horizontal, Cylindrical C - 4,000 Gallons T/P - Ambient M - Carbon Steel
103-2501	5	<u>Cooling Tower Unit</u> T - Forced draft, open recirculation C - 66,000 GPM P/T - Hot water Temp. = 95°F Range = 30°F Approach = 7°F D - Fan hp - 1,680. Electric

COOLING WATER SYSTEM - AREA 103

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
103-2502	5	<u>Chemical Addition Package I</u> Each package to consist of a 500 gallon carbon steel tank with agitator and a metering pump, 0 - 3 GPM.
103-2505	5	<u>Chemical Addition Package II</u> Package unit consisting of 200 gallon carbon steel mixing tank with agitator and 0 - 5 GPM metering pump.
103-2506	1	<u>Chlorine Vaporizer</u> Package unit with necessary valves and controls to vaporize 4,000 lb/hr max. liquid chlorine using hot water.

POWER PLANT - AREA 300

EQUIPMENT LIST

NOMENCLATURE:
T - TYPE
C - CAPACITY
S - SIZE
P/T - OPERATING PRESSURE/
TEMPERATURE
M - MATERIAL
CS - CARBON STEEL
SS - STAINLESS STEEL
CI - CAST IRON
D - DRIVE
W - WEIGHT
ACC - ACCESSORIES

ITEM	NO. REQUIRED	DESCRIPTION
300-2501	1	<u>Offsite Steam and Power</u> <u>Generation Package</u>
	3	Boiler-Furnace - T - Pulverized coal-char fired with natural gas igniters and alternate fuel. - C - 900,000 lb/hr steam at 1255 psig, 950°F - M - Std. boiler materials of construction - D - All accessory and auxiliary equipment fans, pulverizers, pumps, controls, baghouse, etc.
	3	Turbine- Generator - T - Single auto-extraction partial condensing - C - 55MW output @ 629,762 #/hr inlet throttle steam @ 1255 psig, 950°F. Auto extraction of 323,162 #/hr steam @ 100 psig - M - Std. materials of construction all accessories, controls, lube, etc.
	3	Condenser - T - Surface - C - Condensing rate of 306,600 #/hr steam ea. @ 3.5"Hg Abs. Cooling water requirements of 18,055 GPM at a 30°F temperature rise. - M - Steel case, admiralty brass heat exchanger tubes. - D - N.A.

POWER PLANT - AREA 300

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
	6	Boiler Feed Pumps
		T - Diffuser type, balanced thrust, multistage centrifugal
		C - 2,000 GPM @ 1450 psig-100% capacity with backup
		M - Electric motor, 2200 hp each
	3	Deaerating Feed Water Heaters
		T - Horizontal direct-contact tray type
		C - 1,000,000 lb/hr; 20,000 gal storage
		M - Steel pressure vessel
		D - N.A. - venting, nozzles & aux. equipment
	1	Overhead Crane
		T - Turbo-gen. room - traveling bridge
		C - 40 ton capacity hoist
		M - Std. materials
		D - Electric motor, winch 25 hp
	3	Boiler Controls
		T - Electric analog/digital boiler combustion, feedwater, steam temp., burner management, annunciators, power generation and process steam monitoring.
	3	Condensate System
		T - Condensate pumps, feedwater heaters, gland steam condensers, flash and blowdown tanks, etc.
		C - 1,000,000 lb/hr with make-up
		M - Varied as required
		D - As applicable

POWER PLANT - AREA 300

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
	3	Conveyor-Ash Handling
		T - Pneumatic, enclosed
		C - 143 tons/hr
		M - Same as process plant
		D - Motor driven blower

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

NOMENCLATURE:
T - TYPE
C - CAPACITY
S - SIZE
P/T - OPERATING PRESSURE/
TEMPERATURE
M - MATERIAL
CS - CARBON STEEL
SS - STAINLESS STEEL
CI - CAST IRON
D - DRIVE
W - WEIGHT
ACC - ACCESSORIES

ITEM	NO. REQUIRED	DESCRIPTION
301-1102	3	<u>Lime Sludge Pump</u> T - Progressive Cavity C - 50 GPM M - Steel Rotor/Buna N Stator D - 5 hp, Electric
301-1104	3	<u>Filter Feed Pump</u> T - Horizontal, Centrifugal C - 1425 GPM M - Cast Iron D - 20 hp, Electric
301-1107	2	<u>Backwash Transfer Pump</u> T - Horizontal, Centrifugal C - 55 GPM M - Cast Iron D - 1.5 hp, Electric
301-1108	3	<u>Alum Solution Metering Pump</u> T - Diaphragm Reciprocating C - 18 GPH M - Alloy 20 D - 1/4 hp, Electric
301-1109	2	<u>Ion Exchange Feed Pump</u> T - Horizontal, Centrifugal C - 2800 GPM M - Cast Iron D - 50 hp, Electric
301-1111	2	<u>Magnesium Oxide Metering Pump</u> T - Diaphragm Reciprocating C - 22 GPH M - Steel D - 1/2 hp, Electric

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
301-1112	3	<u>Lime Slurry Pump</u> T - Horizontal, Centrifugal C - 2 GPM M - Cast Iron D - 1.5 hp, Electric
301-1113	3	<u>Lime Slurry Pump</u> T - Horizontal, Centrifugal C - 4 GPM M - Cast Iron D - 1.5 hp, Electric
301-1114	3	<u>Lime Sludge Pump</u> T - Progressive Cavity C - 25 GPM M - Steel Rotor/Buna N Stator D - 3 hp, Electric
301-1116	2	<u>Sulfuric Acid Metering Pump</u> T - Diaphragm Reciprocating C - 10 GPH M - Alloy 20 D - 1/4 hp, Electric
301-1120	3	<u>Polymer Metering Pump</u> T - Diaphragm Reciprocating C - 10 GPH M - Stainless Steel D - 3/4 hp, Electric
301-1121	2	<u>Caustic Feed Pump</u> T - Diaphragm Reciprocating C - 5 GPH M - Steel D - 1/4 hp, Electric

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
301-1122	2	<u>Regenerant Transfer Pump</u> T - Horizontal, Centrifugal C - 200 GPM M - Cast Iron with Acid Resistant Impeller D - 5 hp, Electric
301-1123	3	<u>Centrifuge Feed Pump</u> T - Progressive Cavity C - 65 GPM M - Steel Rotor/Buna N Stator D - 7.5 hp, Electric
301-1203	1	<u>Neutralization Tank Mixer</u> T - Propeller M - Steel D - 1 hp, Electric
301-1207	1	<u>Alum Mixer</u> T - Propeller M - Stainless Steel D - 1/4 hp, Electric
301-1211	1	<u>Lime Tank Mixer</u> T - Propeller M - Steel D - 1 hp, Electric
301-1212	1	<u>Mixer</u> T - Propeller M - Steel D - 1/4 hp, Electric

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
301-1218	2	<u>Polymer Tank Mixer</u> T - Propeller M - Stainless Steel D - 1/2 hp, Electric
301-1222	1	<u>Sludge Tank Mixer</u> T - Propeller M - Steel D - 2 hp, Electric
301-1223	1	<u>Mixer</u> T - Propeller M - Stainless Steel D - 5 hp, Electric
301-1401	2	<u>Lime Softener Reactor-Clarifier</u> T - Circular, Open C - 725 GPM M - Steel D - 2 hp, Electric Acc - Feed well, sludge collecting mechanism, weir
301-1402	2	<u>Lime Softener Reactor-Clarifier</u> T - Circular Open C - 1425 GPM S - 50' dia x 15' deep M - Steel D - 2 hp, Electric Acc - Feed Well, Weir, Sludge Collecting Mechanism

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
301-1405	2	<u>Gravity Filter</u> T - Rectangular Gravity Filter C - 1415 GPM S - 16' Wide x 45' long M - Reinforced Concrete D - 7.5 hp, Electric Acc - Filter Media, Travelling Backwash Mechanism, Backwash Pumps
301-1424	2	<u>Centrifuge</u> T - Solid Bowl Scroll C - 65 GPM M - Stainless Steel D - 75 hp, Electric S - 35' dia x 15' deep
301-2105	1	<u>Alum Feeder</u> T - Screw Feeder C - Up to 0.23 cu ft/hr M - Steel with Stainless Steel helix screw D - Fractional hp, Electric
301-2119	2	<u>Polymer Dispensing Funnel</u> T - Circular, Open S - 12" dia x 18" T-T M - Synthetic Molded Resin
301-2125	1	<u>Conveyor Belt</u> T - Horizontal Belt C - To convry 55 cft/hr of dewatered sludge M - Nylon D - 2.75 hp, Electric Acc - Idlers, Pulleys, Winch

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
301-2302	1	<u>Neutralization Tank</u> T - Rectangular, Open C - 7050 Gallon S - 10' x 16' x 8' (2' FB) M - Reinforced Concrete
301-2303	1	<u>Sump</u> T - Rectangular, Oper. C - 8500 Gallon S - 10' x 14' x 10' (2' FB) M - Reinforced Concrete
301-2304	1	<u>Bag Loading Hopper</u> T - Rectangular, Closed C - To empty 50-100 lb bag S - 8" wide x 24" long x 40" high M - Steel
301-2305	1	<u>Backwash Collection Sump</u> T - Rectangular Open C - 8500 Gallon S - 10' x 14' x 10' (2' FB) M - Reinforced Concrete
301-2306	1	<u>Alum Solution Tank</u> T - Circular, Open C - 50 Gallon S - 24" dia x 30" high M - Polyethylene
301-2308	1	<u>Filtered Water Collection Sump</u> T - Rectangular, Open C - 8500 Gallon S - 10' x 14' x 10' (2' FB) M - Reinforced Concrete

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
301-2310	1	<u>Lime Slurry Tank</u> T - Circular, Open C - 750 Gallon S - 5' dia x 6' deep (1' FB) M - Steel
301-2311	1	<u>Magnesium Oxide Solution Tank</u> T - Circular, Open C - 100 Gallon S - 30" dia x 38" deep M - Steel
301-2315	1	<u>Sulfuric Acid Storage Tank</u> T - Horizontal, Closed C - 4500 Gallon S - 8.5' dia x 12' long M - Steel
301-2317	2	<u>Polymer Mix Tank</u> T - Circular, Open C - 500 Gallon S - 48" dia x 70" deep M - Stainless Steel
301-2318	1	<u>Acid Storage Tank</u> T - Horizontal, Closed C - 15,000 Gallon S - 10.5' dia x 25' Length M - Steel
301-2319	1	<u>Caustic Storage Tank</u> T - Horizontal, Closed C - 15,000 Gallons S - 10.5' dia x 25' length M - Steel

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
301-2321	1	<u>Sludge Mix Tank</u> T - Circular, Open C - 4200 Gallon S - 8' dia x 12' deep (2' FB) M - Steel
301-2322	1	<u>Regenerant Collection Tank</u> T - Rectangular, Open C - 45,000 Gallon S - 20' x 30' x 12' deep (2' FB) M - Reinforced Concrete, Lined
301-2335	4	<u>Cation Exchangers</u> T - Vertical, Cylindrical Pressure Tank (75 psig) C - 925 GPM S - 12' dia x 6' S/S M - Steel Lined Acc - All Internal Resin, Valves, Instrumentation & Controls
301-2336	4	<u>Anion Exchangers</u> T - Vertical, Cylindrical Pressure Tank (75 psig) C - 925 GPM S - 12' dia x 6' S/S M - Steel Lined Acc - All Internals, Resin, Valves, Instrumentation & Controls
301-2509	1	<u>Lime Storage & Feed Facility</u> Package consists of: . Storage silo with dust collector . Volumetric feeder

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
		. Lime Slaker
		Storage Silo
		T - Vertical, Cylindrical with Cone Bottom
		C - 3335 cu ft
		S - 12' dia x 50' T-T
		M - Carbon Steel
		Acc - Bin Vibrator, Dust Collector, Ladder
		Volumetric Feeder
		T - Screw Feeder
		C - Up to 51 cu ft/hr
		M - Stainless Steel Anger and Tube
		D - 1/4 hp, Electric
		Lime Slaker
		C - Up to 1000 lbs/hr
		M - Welded Steel
		D - 2.5 hp, Electric
		Acc - Breaker Bar, Stainless Steel Wire, Mesh Screw, Water Jacket
301-2510	1	<u>Magnesium Oxide Storage & Feed Facility</u>
		Package consists of:
		Storage Silo with Dust Collector
		Volumetric Feeder
		<u>Storage Silo</u>
		To Vertical Cylindrical with Cone Bottom
		C - 520 cu ft
		S - 8' dia x 15' T-T

RAW WATER TREATMENT - AREA 301

EQUIPMENT LIST

<u>ITEM</u>	<u>NO. REQUIRED</u>	<u>DESCRIPTION</u>
		M - Carbon Steel D - 4 hp, Electric M - Carbon Steel Acc - Bin Vibrator, Dust Collector, Ladder
		<u>Volumetric Feeder</u>
		T - Screw Feeder C - Up To 2.4 cu ft/hr M - Stainless Steel Anger and Tube D - 1/2 hp, Electric
301-2516	1	<u>Acid Regeneration System</u> Package Consists of Acid Pump, Mixing Tee, Valves, Flow Indicators & Instrumentation
301-2517	1	<u>Caustic Regeneration System</u> Package Consists of Caustic Flow Pump, Mixing Tee, Heat Exchanger with Temperature Controller, Flow Indicators and Instrumentation

BOILER FEEDWATER SYSTEM - AREA 302

EQUIPMENT LIST

NOMENCLATURE:
 T - TYPE
 C - CAPACITY
 S - SIZE
 P/T - OPERATING PRESSURE/
 TEMPERATURE
 M - MATERIAL
 CS - CARBON STEEL
 SS - STAINLESS STEEL
 CI - CAST IRON
 D - DRIVE
 W - WEIGHT
 ACC - ACCESSORIES

ITEM	NO. REQUIRED	DESCRIPTION
302-1101	3+3	<u>Waste Heat Recovery BFW Pump</u> T - Centrifugal C - 900 GPM @ 228°F, 5 psig $\Delta P=1095$ psi M - Carbon Steel D - 700 hp, Electric
302-1102	3+3	<u>Saturator Water Pump</u> T - Centrifugal C - 500 GPM @ 228°F, 5 psig $\Delta P=820$ psi M - Carbon Steel D - 350 hp, Electric
302-1103	1+1	<u>Reformer BFW Pump</u> T - Centrifugal C - 200 GPM @ 228°F, 5 psig $\Delta P=1795$ psi M - Carbon Steel D - 350 hp, Steam Turbine
302-2501	3	<u>Condensate Polisher Package</u> T - Activated Carbon C - 1000 GPM M - Carbon Steel Des P/T - 75 psig/120°F
302-2502	3	<u>Deaerator Package</u> T - 1500 psig steam BFW Quality C - BFW, 1600 GPM M - Carbon Steel P/T - 5 psig/228°F

NOMENCLATURE:
 T - TYPE
 C - CAPACITY
 S - SIZE
 P/T - OPERATING PRESSURE/
 TEMPERATURE
 M - MATERIAL
 CS - CARBON STEEL
 SS - STAINLESS STEEL
 CI - CAST IRON
 D - DRIVE
 W - WEIGHT
 ACC - ACCESSORIES

ELECTRICAL DISTRIBUTION - AREA 309

EQUIPMENT LIST

<u>No. Required</u>	<u>Description</u>
3	Line-ups of 13.8 KV switchgear 500 MVA rating. Each line-up consisting of two 2000 amp incoming line breakers, one 2000 amp bus tie breaker, two auxiliary sections and fourteen 1200 amp feeder breakers.
12	Low voltage radial substations. Each substation consists of a heated, insulated and lighted prefabricated building containing the following equipment: A. One 480 volt, 1600 amp incoming bus duct. B. One line-up of 480 volt switchgear consisting of an incoming line breaker, three feeder breakers and metering. C. Three motor control centers each containing an incoming line disconnect switch, metering, 31 starters and 4 circuit breakers. D. One 30 KVA lighting transformer and 24 circuit panel. E. One emergency lighting system consisting of batteries, inverter, charger and automatic transfer system. F. One four point annunciator.
35	Low voltage secondary selective substations. Each substation consists of a heated, insulated and lighted prefabricated building containing the following equipment: A. Two 480 volt 1600 amp incoming bus ducts B. One line-up of 480 volt switchgear consisting of two incoming line breakers, six feeder breakers and metering. C. Six motor control centers each containing an incoming line disconnect switch, metering, 31 starters and 4 circuit breakers.

ELECTRICAL DISTRIBUTION - AREA 309

EQUIPMENT LIST

No. Required

Description

- D. One 30 KVA lighting transformer and 24 circuit panel.
 - E. One emergency lighting system consisting of batteries, inverter, charger and automatic transfer system.
 - F. One 12 point annunciator.
 - G. One 48 volt D.C. power supply consisting of batteries, charger and 14 circuit distribution panel.
-
- 12 Transformer 7500 KVA, 13.8 KV-4.16 KV, 3 phase, 60 Hertz oil filled, fan cooled.
 - 82 Transformer 1000 KVA, 13.8 KV-480 volts, 3 phase, 60 Hertz oil filled, fan cooled.
 - 3 Transformer 50 MVA 69 KV-13.8 KV, 3 phase, 60 Hertz, double secondary, oil filled, forced oil cooled and fan cooled.
 - 2 Transformer 70 MVA, 161 KV-69 KV, 3 phase, 60 Hertz oil filled, forced oil cooled and fan cooled.
 - 2 Medium voltage radial substation. Each substation consists of a heated, lighted and insulated prefabricated building containing the following equipment:
 - A. One 2000 amp, 4160 volt incoming bus duct.
 - B. One line of 4160 volt switchgear containing one incoming line breaker and one transition section.
 - C. One line of 16 motor controllers for 4000 volt induction motors.
 - D. One 30 KVA lighting transformer and 24 circuit panel.
 - E. One emergency lighting system consisting of batteries, inverter, charger and automatic transfer system.
 - F. One 12 point annunciator.

ELECTRICAL DISTRIBUTION - AREA 309

EQUIPMENT LIST

No. Required

Description

- G. One 48 volt D.C. power system consisting of batteries, charger and eight circuit distribution panel.

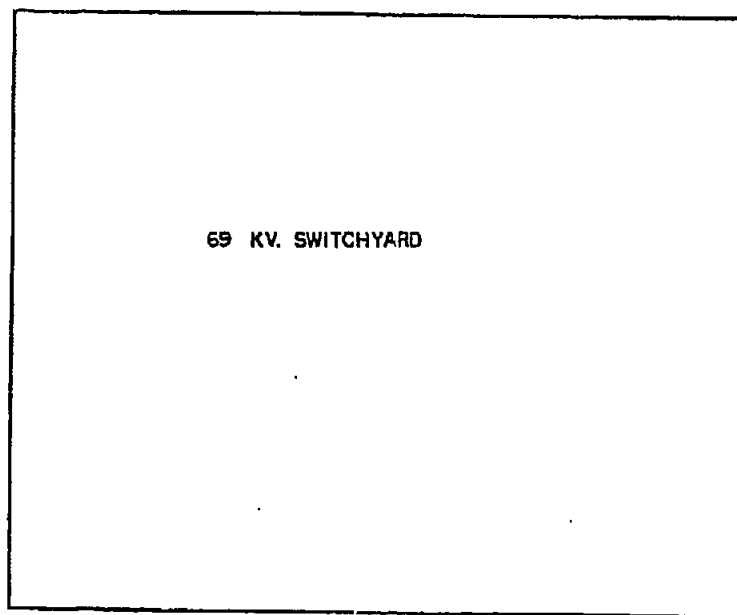
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Medium voltage secondary selective substation. Each substation consists of a heated, lighted, and insulated prefabricated building containing the following equipment:

- A. Two 2000 amp, 4160 volt incoming bus ducts.
- B. One line of 4160 volt switchgear containing two incoming line breakers, one tie breaker and three transition sections.
- C. One 2000 amp, 4160 volt bus duct from the switchgear to the 4160 volt motor controllers.
- D. Two lines of 16 motor controllers each for 4000 volt induction motors.
- E. One 30 KVA lighting transformer and 24 circuit panel.
- F. One emergency lighting system consisting of batteries, inverter, charger and automatic transfer system.
- G. One 12 point annunciator.
- H. One 48 volt D.C. power system consisting of batteries, charger and 12 circuit distribution panel.

SEALING RULES

1/10



TRANSFORMERS

TURBOGENERATOR NO. 1

TURBOGENERATOR NO. 2

TURBOGENERATOR NO. 3

E

D

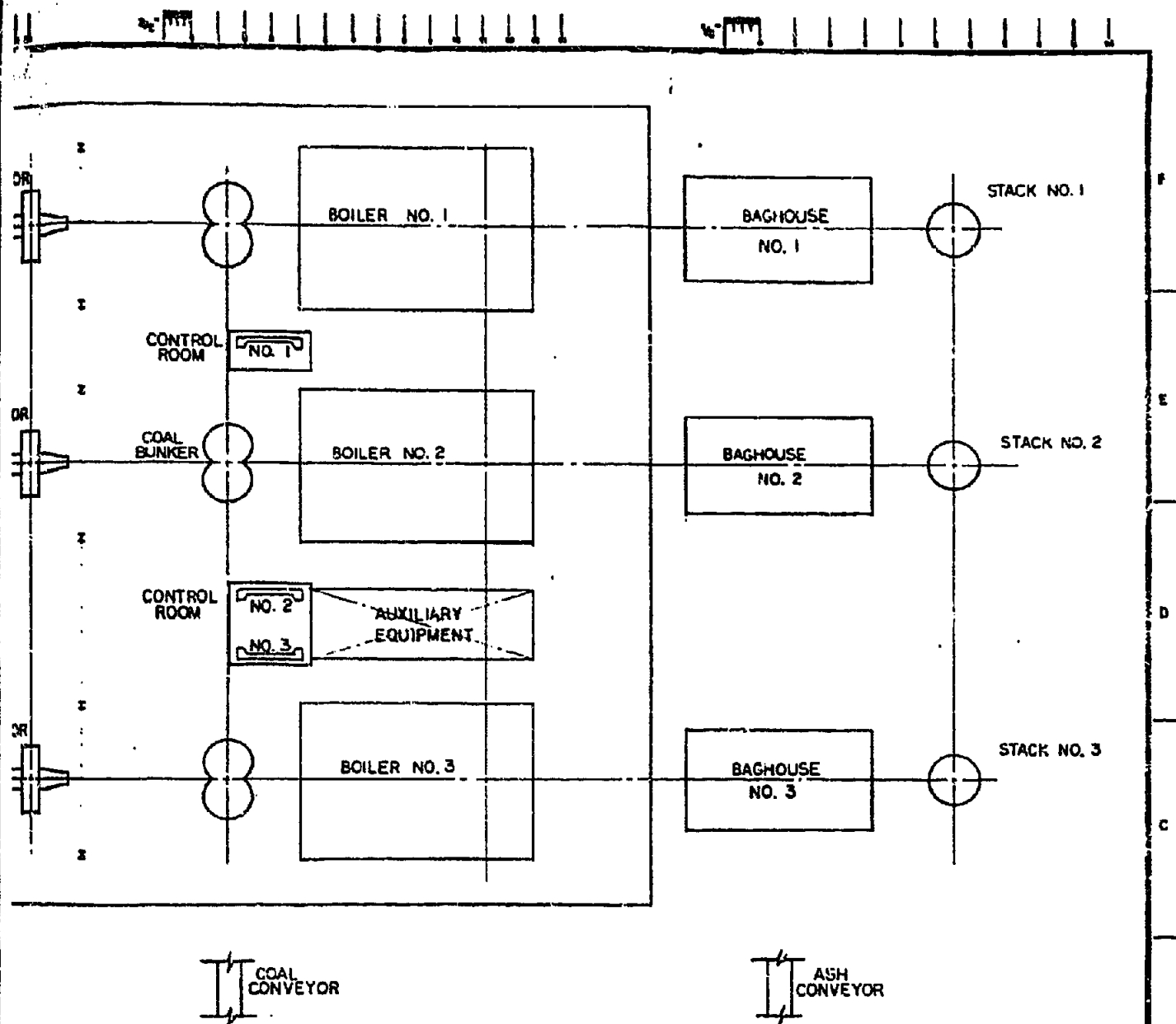
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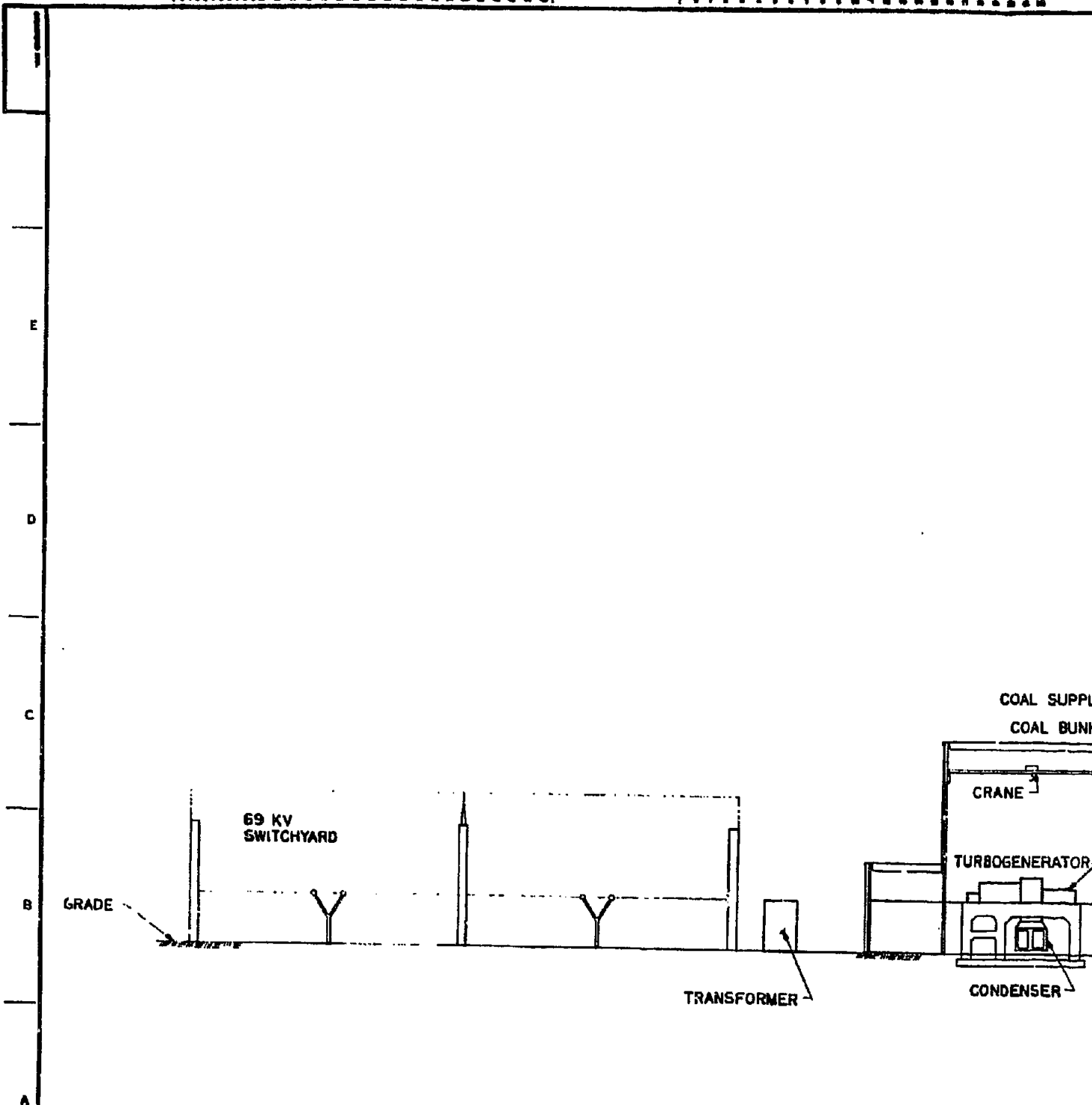
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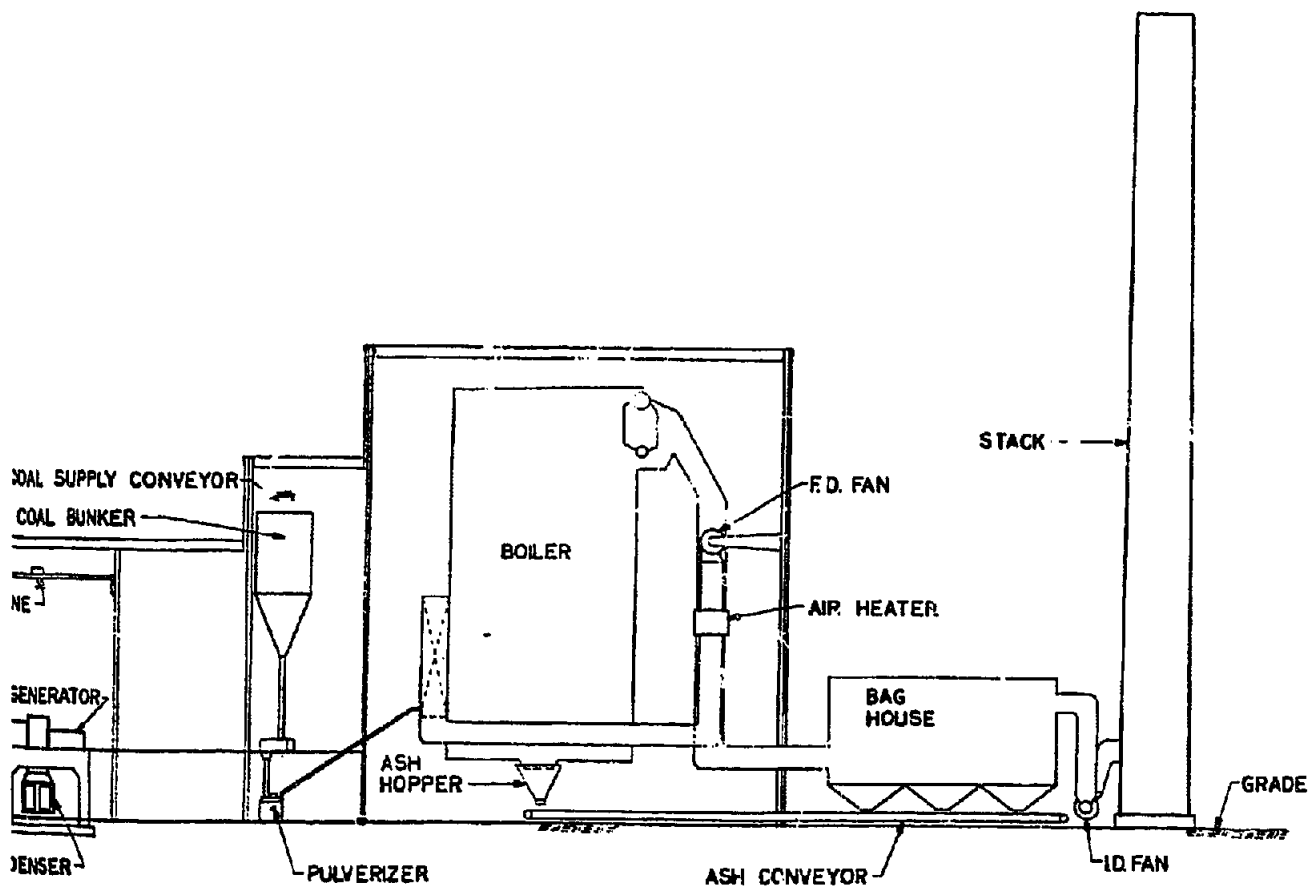
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ENGINEERS DESIGNED BY: [Signature] CHECKED BY: [Signature] APPROVED BY: [Signature]		DATE 12-21-57 12-11-57		SCALE 1" = 30'-0"		SHEET NO. 10	

SCALE: 1" = 100'



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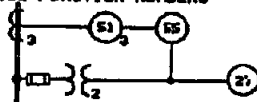


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APPROVED 2									
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POWER PLANT
 GENERAL ARRANGEMENT
 ELEVATION
 SCALE: 1"=30'

SCALING RULES

DEVICE FUNCTION NUMBERS

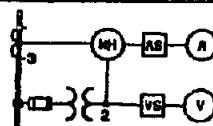


THE FOLLOWING IS A COMPLETE LIST OF ANSI DEVICE FUNCTION NUMBERS.

- 1 MASTER ELEMENT
- 2 TIME DELAY STARTING OR CLOSING RELAY
- 3 CHECKING OR INTERLOCKING RELAY
- 4 MASTER CONTACTOR RELAY
- 5 STOPPING DEVICE
- 6 STARTING CIRCUIT BREAKER, CONTACTOR OR SWITCH
- 7 ANODE CIRCUIT BREAKER
- 8 CONTROL POWER DISCONNECTING DEVICE
- 9 REVERSING DEVICE
- 10 UNIT SEQUENCE SWITCH
- 11 RESERVED FOR FUTURE APPLICATION
- 12 OVERSPEED DEVICE
- 13 SYNCHRONOUS SPEED DEVICE
- 14 UNDERSPED DEVICE
- 15 SPEED OR FREQUENCY MATCHING DEVICE
- 16 RESERVED FOR FUTURE APPLICATION
- 17 SHUNTING OR DISCHARGE SWITCH
- 18 ACCELERATING OR DECELERATING DEVICE
- 19 STARTING TO RUNNING TRANSITION CONTACTOR OR RELAY
- 20 ELECTRICALLY OPERATED VALVE
- 21 DISTANCE RELAY
- 22 EQUALIZER CIRCUIT BREAKER OR CONTACTOR
- 23 TEMPERATURE CONTROL DEVICE
- 24 RESERVED FOR FUTURE APPLICATION
- 25 SYNCHRONIZING OR SYNCHRONISM CHECK DEVICE
- 26 APPARATUS THERMAL DEVICE
- 27 UNDERVOLTAGE RELAY
- 28 FLAME DETECTOR
- 29 ISOLATING CIRCUIT BREAKER, CONTACTOR, OR SWITCH
- 30 ANNUNCIATOR RELAY
- 31 SEPARATE EXCITATION DEVICE
- 32 DIRECTIONAL POWER RELAY
- 33 POSITION SWITCH
- 34 MASTER SEQUENCE DEVICE
- 35 BRUSH SHORT CIRCUITING OR SLIP-RING SHORT CIRCUITING DEVICE
- 36 POLARITY OR POLARIZING VOLTAGE DEVICE
- 37 UNDERCURRENT OR UNDERPOWER RELAY
- 38 BEARING PROTECTIVE DEVICE
- 39 MECHANICAL CONDITION MONITOR
- 40 FIELD RELAY
- 41 FIELD CIRCUIT BREAKER, CONTACTOR, OR SWITCH
- 42 RUNNING CIRCUIT BREAKER, CONTACTOR, OR SWITCH
- 43 MANUAL TRANSFER OR SELECTOR SWITCH
- 44 UNIT SEQUENCE STARTING CONTACTOR OR RELAY
- 45 ATMOSPHERIC CONDITION MONITOR
- 46 REVISE PHASE, PHASE BALANCE CURRENT
- 47 PHASE SEQUENCE VOLTAGE RELAY
- 48 LTIC SEQUENCE RELAY
- 49 MACHINE OR TRANSFORMER THERMAL RELAY
- 50 INSTANTANEOUS OVERCURRENT OR RATE OF RISE RELAY
- 51 A-C TIME OVERCURRENT RELAY
- 52 A-C CIRCUIT BREAKER
- 53 EMITTER OR D-C GENERATOR RELAY
- 54 RESERVED FOR FUTURE APPLICATION
- 55 POWER-FACTOR RELAY
- 56 FIELD APPLICATION RELAY
- 57 SHORT CIRCUITING OR GROUNDING DEVICE
- 58 RECTIFICATION FAILURE RELAY
- 59 OVERVOLTAGE RELAY
- 60 VOLTAGE OR CURRENT BALANCE RELAY
- 61 RESERVED FOR FUTURE APPLICATION
- 62 TIME-DELAY STOPPING OR OPENING RELAY
- 63 PRESSURE SWITCH
- 64 GROUND PROTECTIVE RELAY
- 65 GOVERNOR
- 66 NOTCHING OR JOGGING RELAY
- 67 A-C DIRECTIONAL OVERCURRENT RELAY
- 68 LOCKING RELAY
- 69 PERMISSIVE CONTROL DEVICE
- 70 RHEOSTAT
- 71 LEVEL SWITCH
- 72 D-C CIRCUIT BREAKER OR CONTACTOR
- 73 LOAD MOTOR CIRCUIT BREAKER OR CONTACTOR
- 74 ALARM RELAY
- 75 POSITION CHANGING MECHANISM
- 76 D-C OVERCURRENT RELAY
- 77 PULSE TRANSMITTER
- 78 PHASE ANGLE MEASURING OR OUT OF STEP PROTECTIVE RELAY
- 79 A-C RECLOSING RELAY
- 80 FLOW SWITCH
- 81 FREQUENCY DEVICE
- 82 D-C RECLOSING RELAY
- 83 AUTOMATIC SELECTIVE CONTROL OR TRANSFER, RELAY
- 84 OPERATING MECHANISM
- 85 CARRIER OR PILOT WIRE RECEIVER RELAY
- 86 LOCKING OUT RELAY
- 87 DIFFERENTIAL PROTECTIVE RELAY
- 88 AUXILIARY MOTOR OR MOTOR GENERATOR
- 89 LINE SWITCH
- 90 REGULATING DEVICE
- 91 VOLTAGE DIRECTIONAL RELAY
- 92 VOLTAGE AND POWER DIRECTIONAL RELAY
- 93 FIELD CHANGING CONTACTOR OR RELAY
- 94 TRIPPING OR TRIP-FREE RELAY
- 95
- 96
- 97
- 98
- 99

(RESERVED FOR SPECIAL APPLICATIONS)

LIST OF ABBREVIATIONS FOR METER AND INSTRUMENT FUNCTIONS

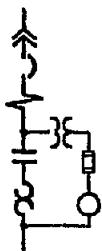


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|---------|----------------------------------|
| AM | AMMETER |
| AS | AMPERE-HOUR METER |
| F | AMMETER SWITCH |
| MO | FREQUENCY METER |
| I/I | GROUND DETECTOR |
| LHM | INDICATING |
| OP | CURRENT TRANSDUCER LEVEL |
| PI | OHMMETER |
| PF | OIL PRESSURE |
| RD | POSITION INDICATOR |
| REC | POWER FACTOR METER |
| RPM | RECORDING DEMAND METER |
| RTO | RECORDING |
| S | RPM INDICATOR |
| T | RESISTANCE TEMPERATURE DETECTOR |
| TH | INDICATOR OR RELAY |
| TT | SYNCHROSCOPE |
| VH | TEMPERATURE METER |
| VA | TACHOMETER GENERATOR |
| VAS | TOTAL TIME |
| VAR/VAR | VARIOMETER |
| VS | VOLTMETER |
| V/V | VOLT-AMMETER |
| N | VAR TRANSDUCER |
| M | VOLTMETER SWITCH |
| MHD | VOLTAGE TRANSDUCER |
| N/M | WATTMETER |
| | WATTMETER WITH DEMAND ATTACHMENT |
| | WATT TRANSDUCER |

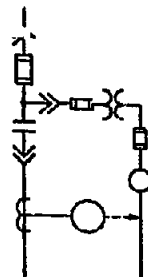
- | | |
|--|---------------------------------|
| | AUTOMAT (2 POS) |
| | DISCON |
| | LOAD BR SWITCH |
| | HIGH VO CIRCUIT |
| | MEDIUM CIRCUIT (NUMBER UNIT 13) |
| | LOW VOL |
| | NORMALL |
| | NORMALL |
| | MOTOR - 1 HORSEPO |
| | PANEL N LOADS |
| | PANEL N |
| | RELAY (3) |
| | 120 VAC |
| | 220 VAC |
| | WELDING |
| | STEPPED REACCELE |

12

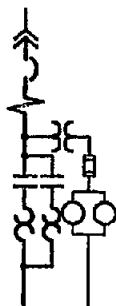
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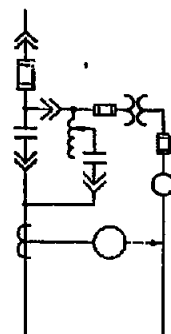
FULL VOLTAGE NON REVERSING
DRUM OUT TYPE MAGNETIC
MOTOR STARTER WITH
INSTANTANEOUS TRIP CIRCUIT
BREAKER, THERMAL OVERLOAD
RELAY AND CONTROL POWER
TRANSFORMER
(LOW VOLTAGE)



FULL VOLTAGE NON REVERSING
DRUM OUT TYPE CONTROLLER
WITH CURRENT LIMITING
POWER FUSES, 3 CURRENT
TRANSFORMERS, 3 POLE AMBIENT
COMPENSATED THERMAL OVERLOAD
RELAY, CONTROL POWER TRANSFORMER
WITH PRIMARY AND SECONDARY
FUSES
(MEDIUM VOLTAGE)



FULL VOLTAGE NON REVERSING
DRUM OUT TYPE TWO SPEED
MAGNETIC MOTOR STARTER WITH
INSTANTANEOUS TRIP CIRCUIT
BREAKER, THERMAL OVERLOAD
RELAYS AND CONTROL POWER
TRANSFORMER
(LOW VOLTAGE)



REDUCED VOLTAGE NON-REVERSING
DRUM OUT TYPE CONTROLLER WITH
CURRENT LIMITING POWER FUSES, 3
CURRENT TRANSFORMERS, 3 POLE
AMBIENT COMPENSATED THERMAL
OVERLOAD RELAY, CONTROL POWER
TRANSFORMER WITH PRIMARY AND
SECONDARY FUSES
(MEDIUM VOLTAGE)

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CLIENT
CIRI./PLACER
BELUGA METHANOL PROJECT
COOK INLET, ALASKA

Davy McKee
ENGINEERS AND CONSTRUCTORS
Om 1042 Rev. 1/79

DESIGNED	BY	DATE	CHECKED	DATE	APPROVED	DATE

TITLE	SCALE	DATE	REV	NO
ELECTRICAL SINGLE LINE LEGEND AND SYMBOLS	NONE			

1530-309-N-002	
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4



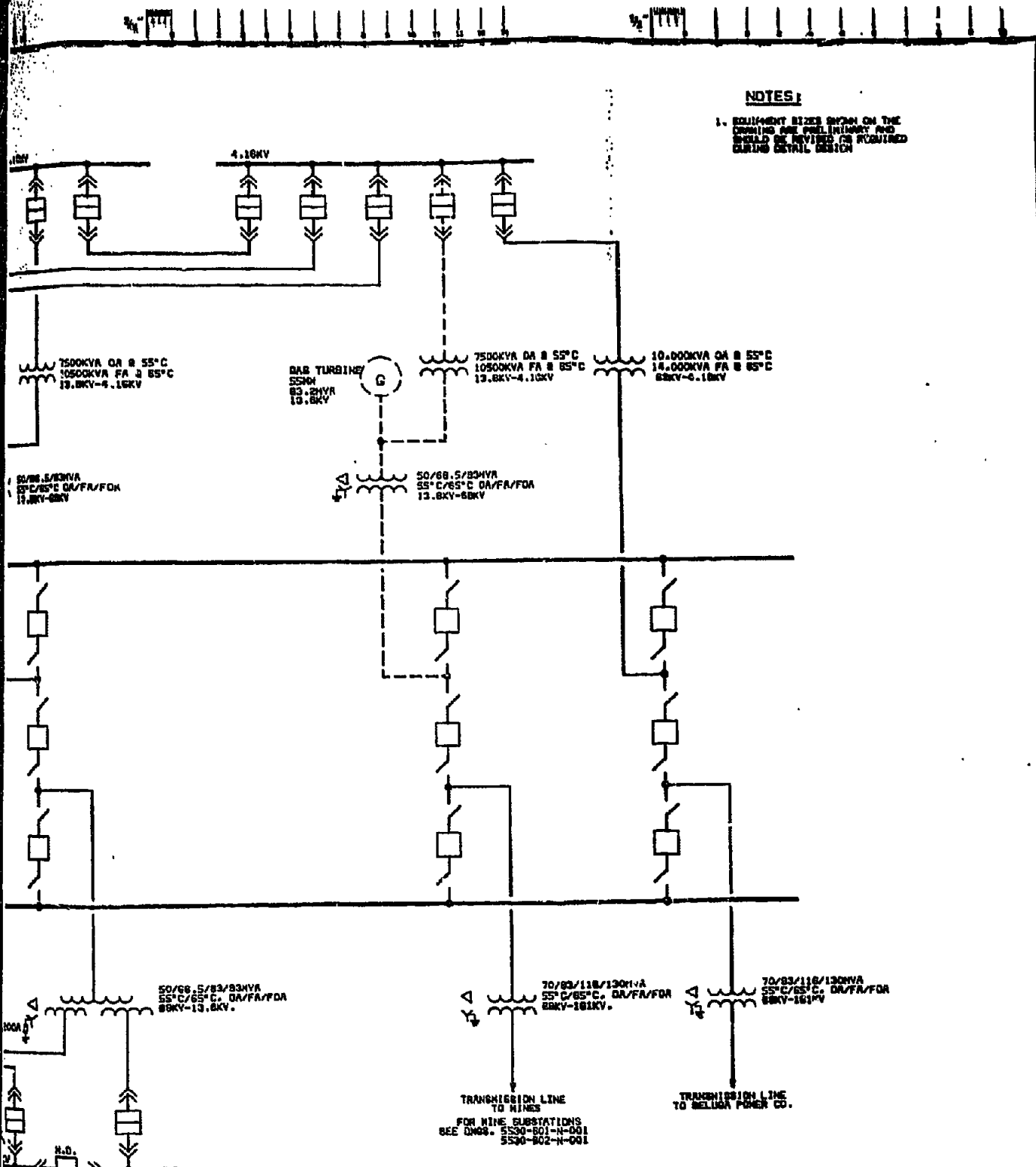
FOR ADDITIONAL DETAIL
SEE DMO. 5C30-305-N-C04

FOR ADDITIONAL
SEE OM2, 5530-3

[illegible]

NOTES:

1. EQUIPMENT SIZES SHOWN ON THE DRAWING ARE PRELIMINARY AND SHOULD BE REVIEWED OR REVISITED DURING DETAIL DESIGN.



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GRI/PLACER
BELUGA METHANOL PLANT
COOK INLET, ALASKA

Davy McKee
ENGINEERS AND CONSTRUCTORS
JAN 1962 REG. 100

FOR ADDITIONAL DETAIL
SEE DWS. 5530-308-N-004

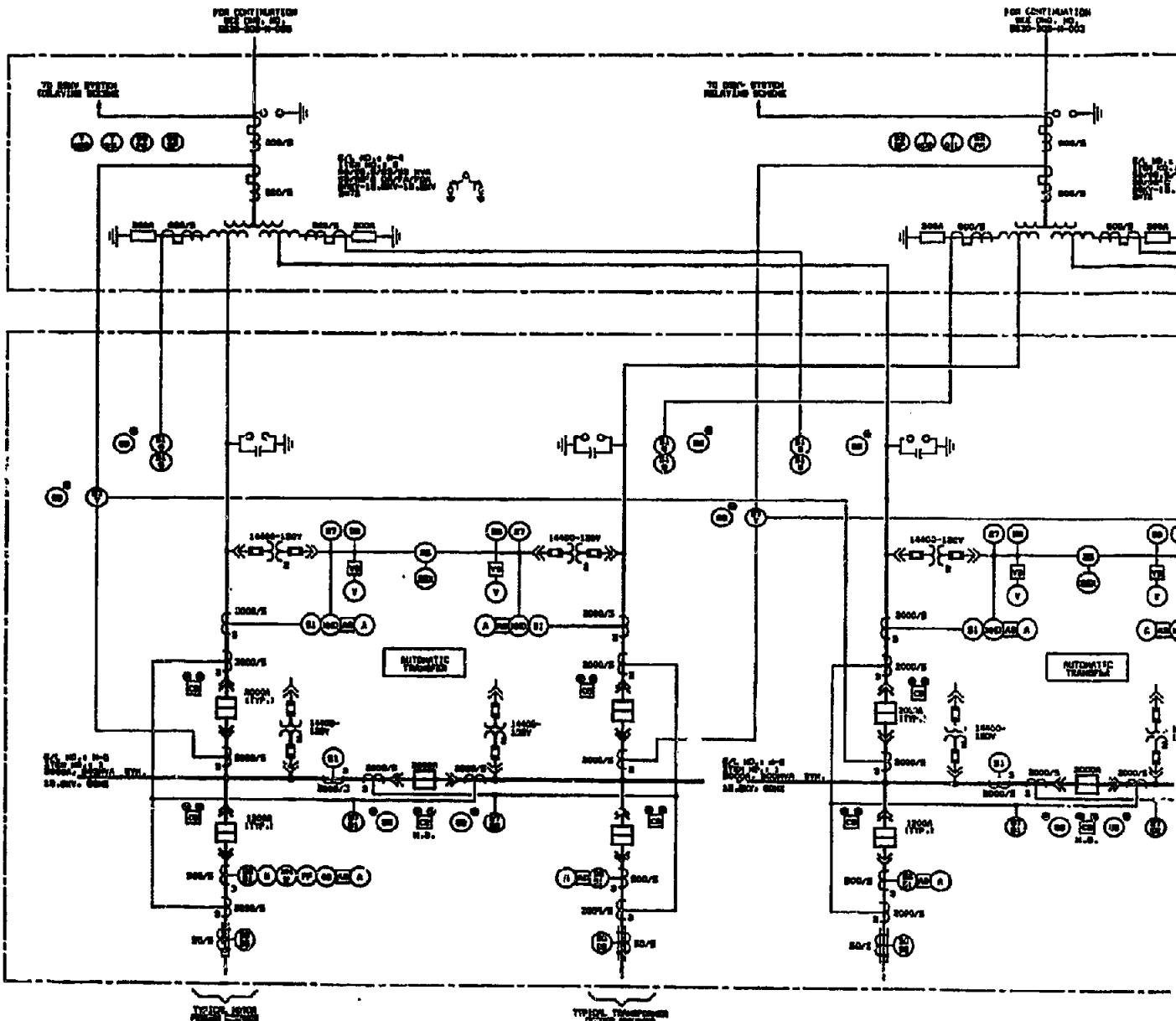
DESIGNED	BY (I.C.)	DATE	DATE TO	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
DRAWN	CP	10/61	CLASSY																										
CHECKED	J.P.C.	10/61	FIELD																										
APPROVED 1																													
APPROVED 2	J.P.C.	10/61																											
APPROVED 3																													

TITLE
ELECTRICAL
SINGLE LINE DIAGRAM
MAIN SINGLE LINE DIAGRAM
SCALE: NONE
SHEET NO. 10

5530-308-N-003



100-440-0035

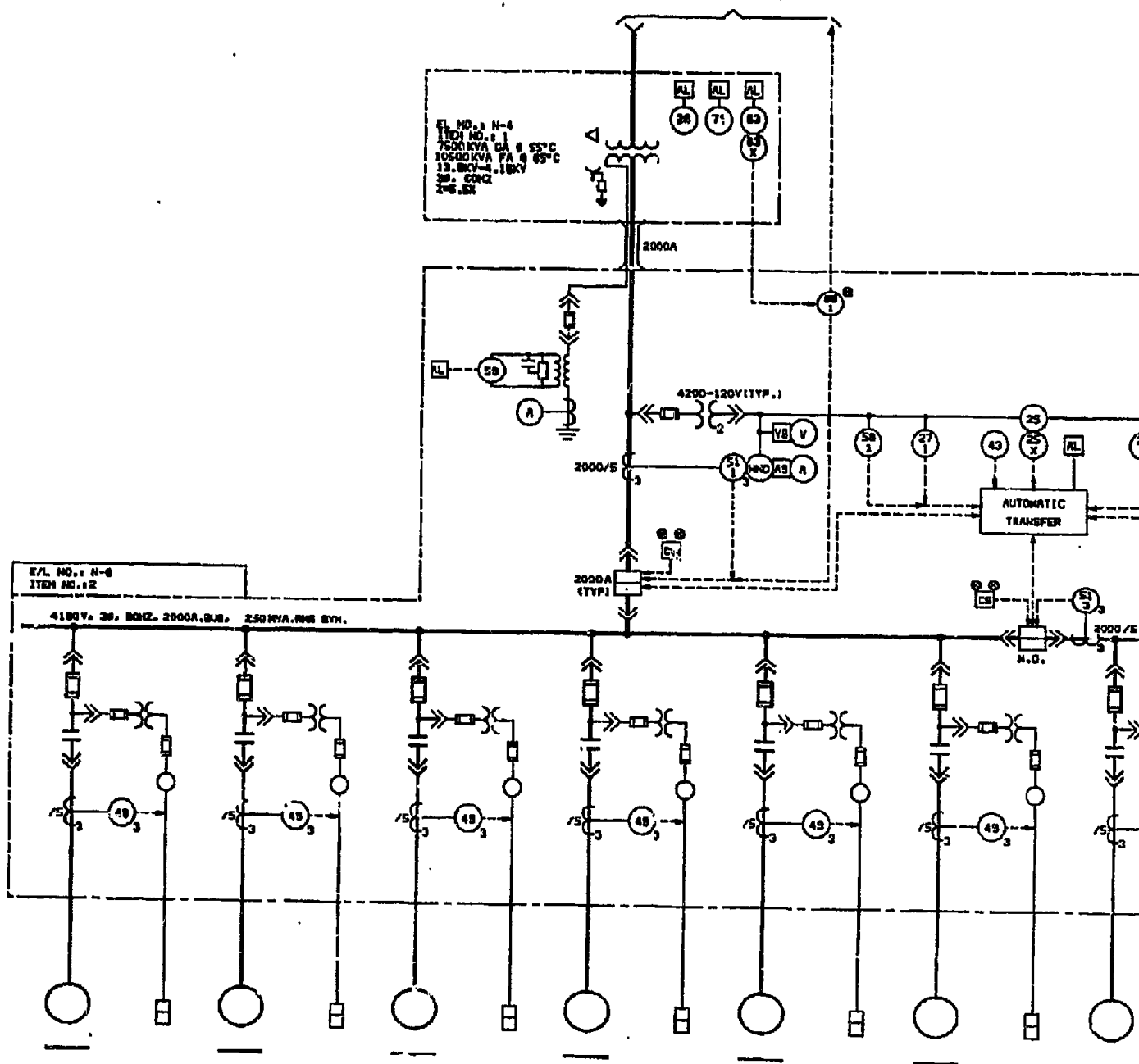


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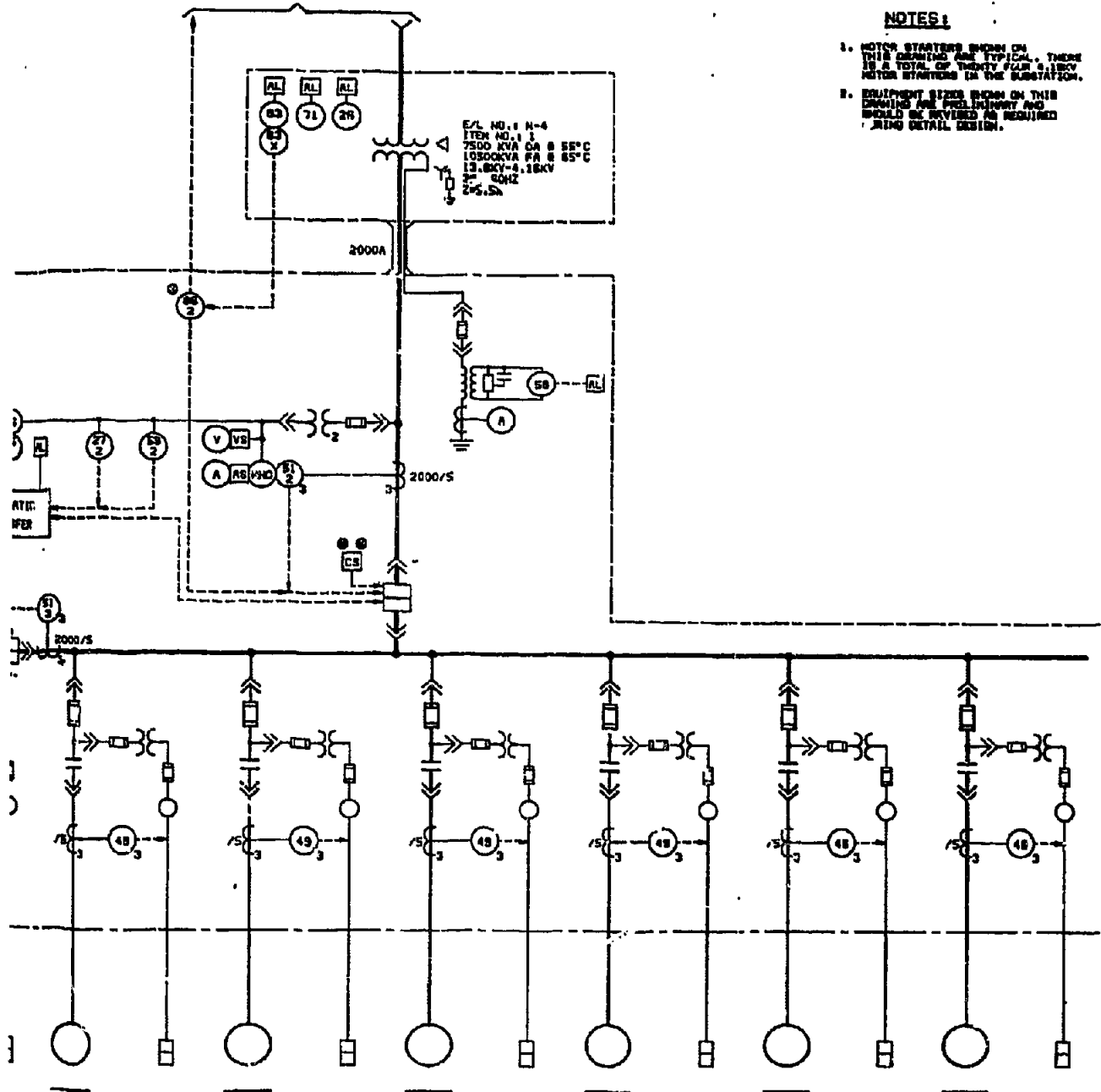
DESCRIPTION	BY	CHK	APPROVED	DATE	DESCRIPTION	BY	CHK	APPROVED	DATE
DESIGNED FOR FINAL REPORT									

1 2 3 4 5

FOR CONTINUATION
SEE DWG. NO.
E30-308-N-004

[illegible]

1. MOTOR STARTERS SHOWN ON THIS DRAWING ARE TYPICAL. THERE IS A TOTAL OF TWENTY FOUR (24) MOTOR STARTERS IN THE SUBSTATION.
2. EQUIPMENT SIZES SHOWN ON THIS DRAWING ARE PRELIMINARY AND SHOULD BE REVIEWED AS REQUIRED DURING DETAIL DESIGN.



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CURT

**GIRI/PLACER
RELUGA METHANOL PLANT
COOK INLET, ALASKA**

Davy McKee
ENGINEERS AND CONSTRUCTORS
1977-1978

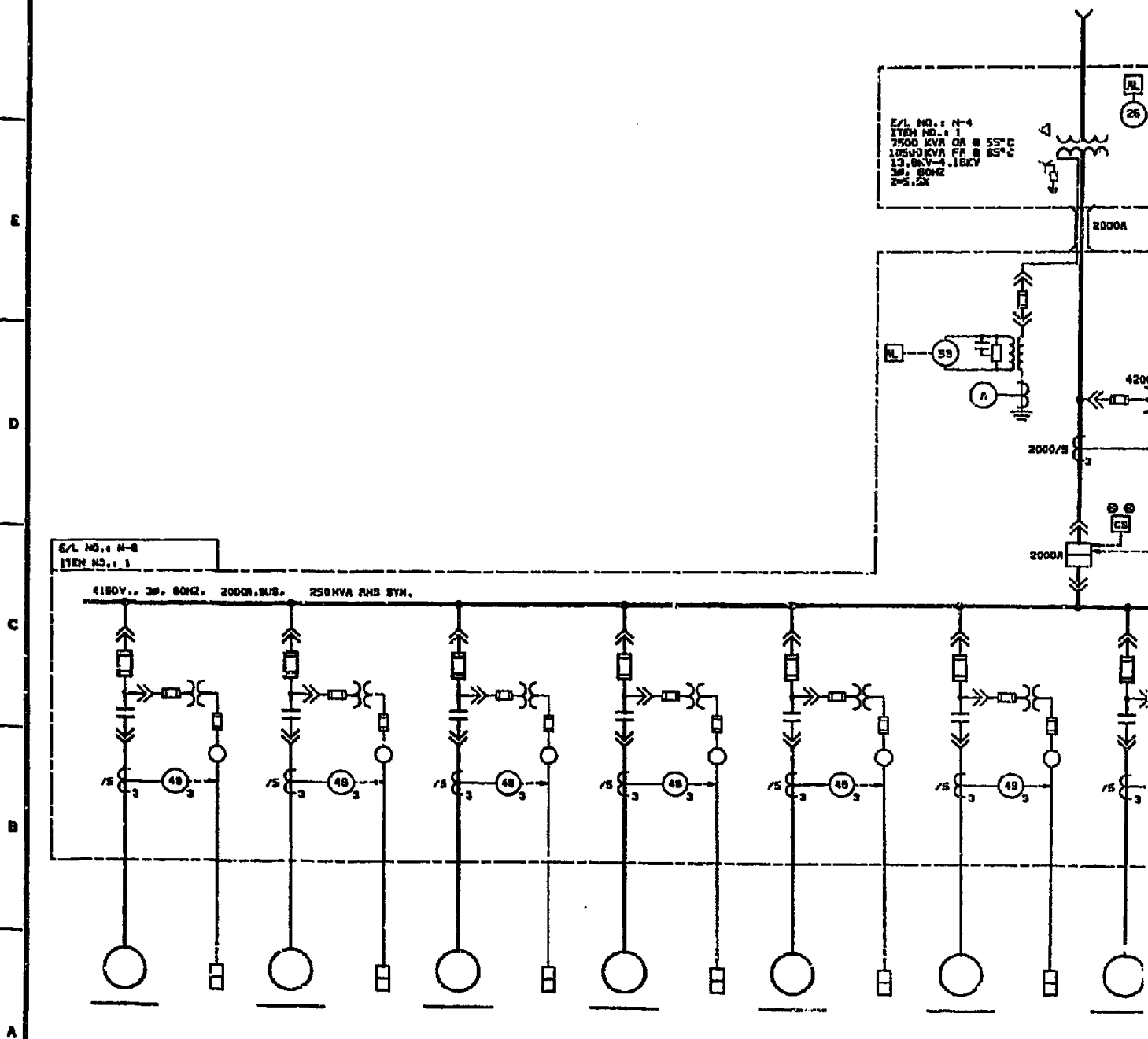
**ELECTRICAL
SINGLE LINE DIAGRAM
4160V. SECONDARY SELECTIVE SUB.
(TYPICAL)**

SCALE NONE AS SHOWN

5530-309-N-005

[illegible]

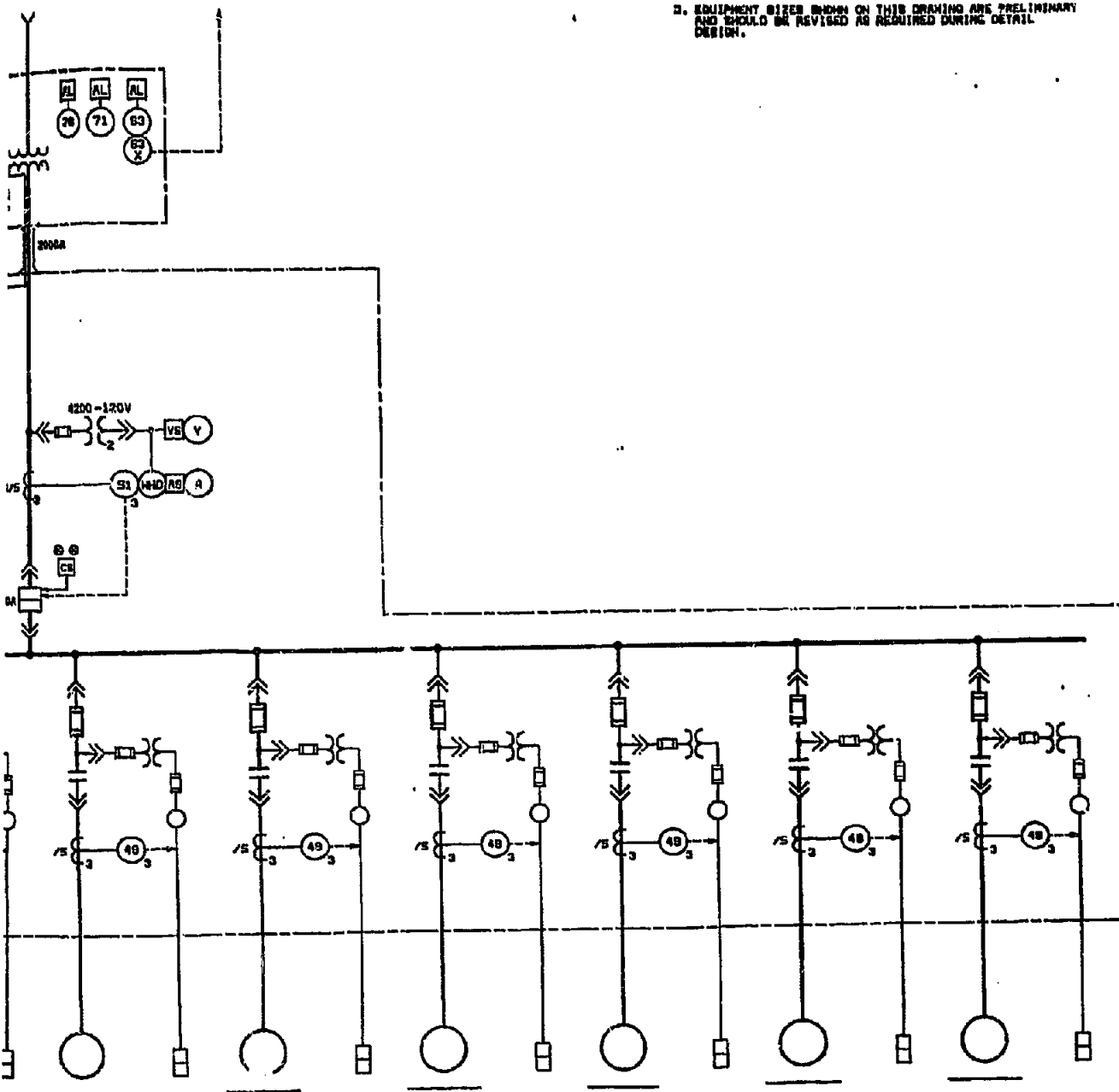
FOR CONTINUATION
SEE PAGE NO.
BX30-300-X-004

[illegible]

NOTES:

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2. EQUIPMENT SIZES SHOWN ON THIS DRAWING ARE PRELIMINARY AND SHOULD BE REVISED AS REQUIRED DURING DETAIL DESIGN.

CONTINUATION
PAGE 2 OF 2
5530-309-N-006



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CLIENT

CIRI/PLACER
BZLUBA METHANOL PLANT
CORK INLET, ALASKA

Davy McKee
ENGINEERS AND CONSTRUCTORS
SINCE 1928

ELECTRICAL
SINGLE LINE DIAGRAM
4160V. RADIAL SUBSTATION
(TYPICAL)

5530-309-N-006

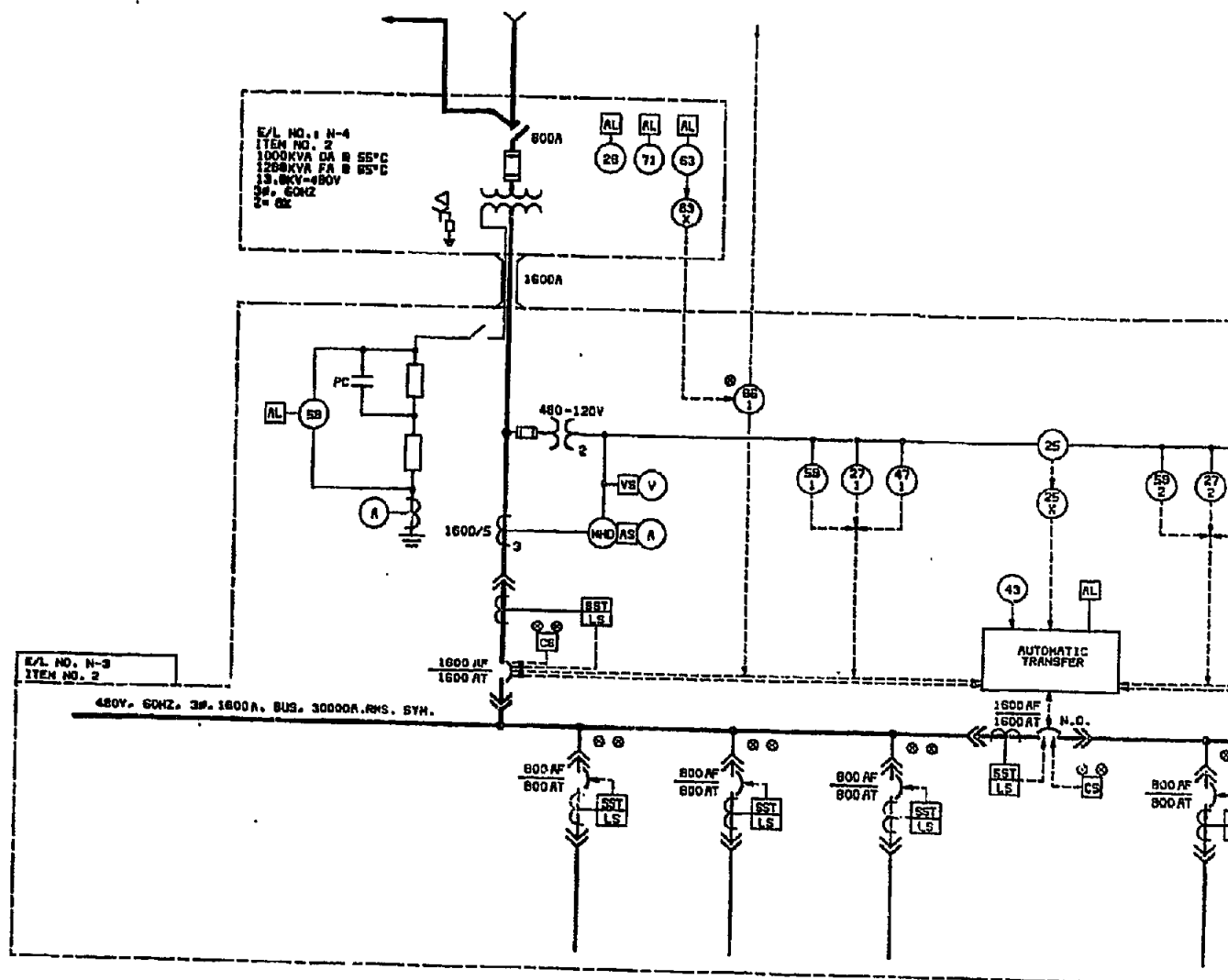


SCALE: NONE
NA1342

SHOWN AS SHOWN

10

5530-308-7-007



E/L NO. N-3
ITEM NO. 2

480V, 60HZ, 3Ø, 1600A, BUS, 30000A, RMS, 5YM

**AUTOMATIC
TRANSFER**

1600 AF
1600 AT N.O.

800 AF
800 AT

800 AF
800 AT

55T
LS

800 AF
800 AT

12

[illegible]

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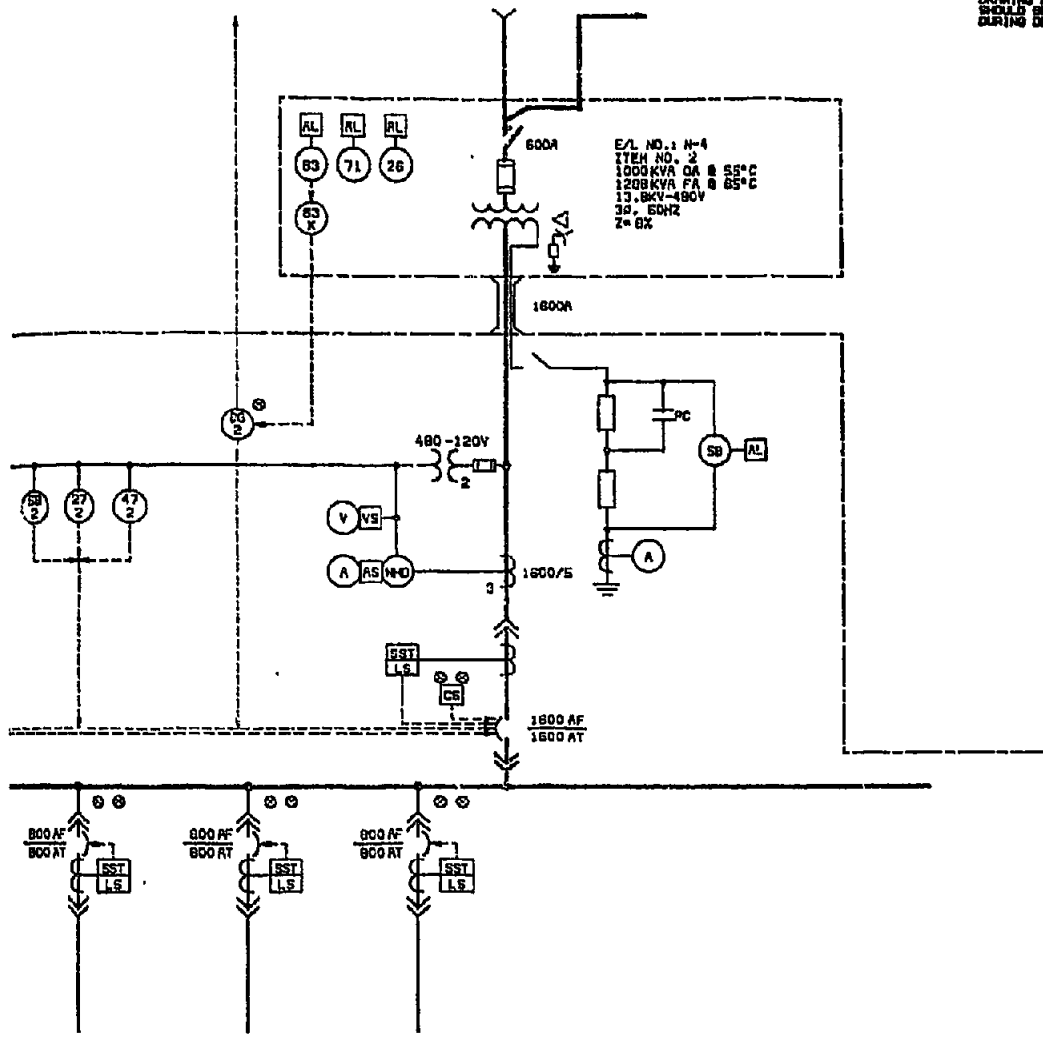
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1. EQUIPMENT SIZES SHOWN ON THE DRAWING ARE PRELIMINARY AND SHOULD BE REVISED AS REQUIRED DURING DETAIL DESIGN

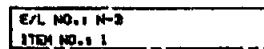


CLINICAL

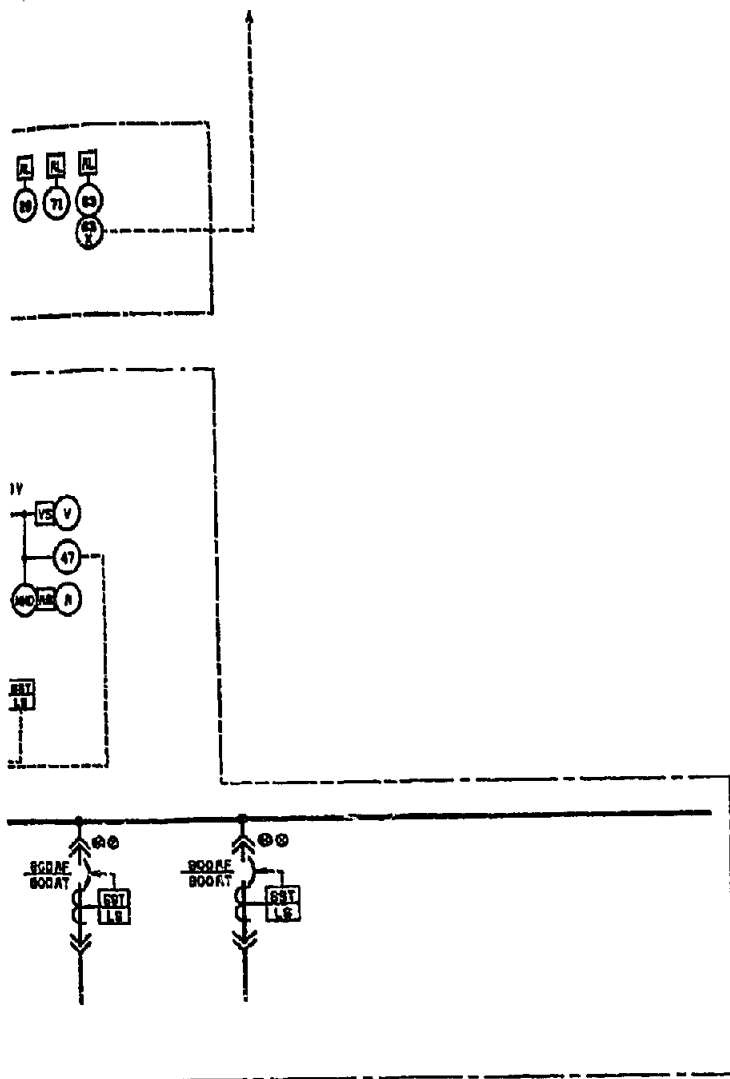
Davy McKee
ENGINEERS AND CONSTRUCTORS

5530-309-N-007

[illegible]

[illegible]

NOTES:
 1. EQUIPMENT SIZES SHOWN ON THIS DRAWING ARE PRELIMINARY AND SHOULD BE REVISED AS REQUIRED DURING DETAIL DESIGN.



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CLIENT
 GRI/PLACER
 DELUSA METHANOL PLANT
 COOK INLET, ALASKA

Davy McKee
 ENGINEERS AND CONSTRUCTORS
 555 West 10th Ave. S.F.

DESIGNED	BY	DATE	CHECKED	DATE
DRW	C.P.	4-1-68	CP	4-1-68
CHECKED	J.T.	4-1-68	FIELD	
APPROVED	J.T.	4-1-68		
APPROVED				

TITLE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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SCALE: NONE																										

5530-309-N-008



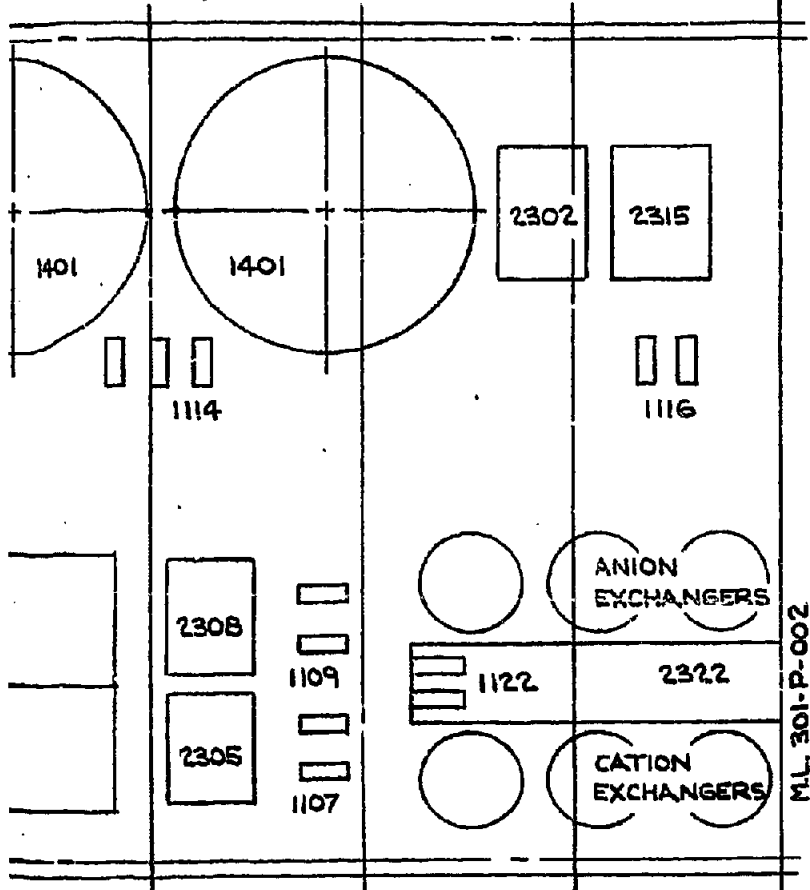
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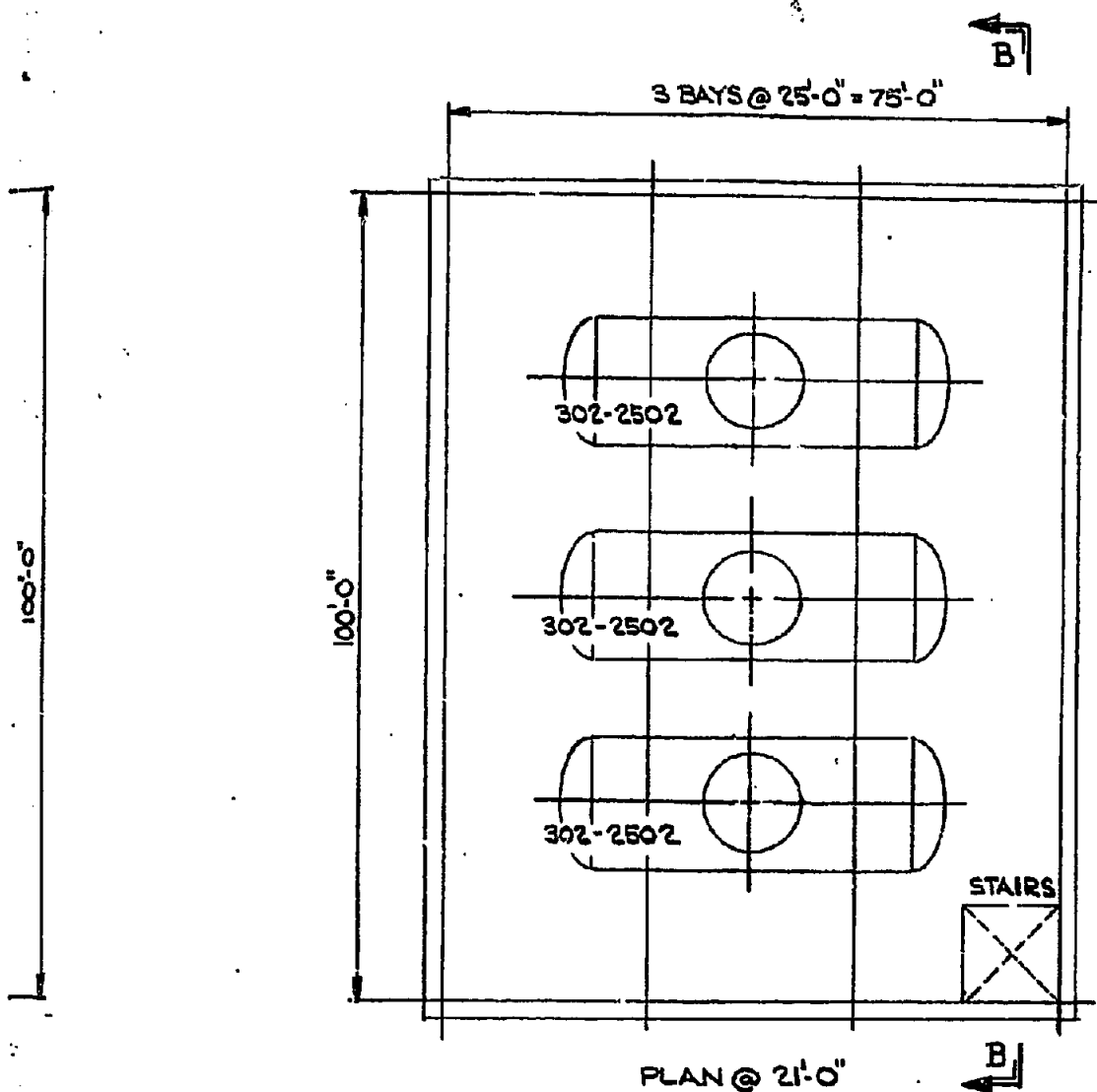
BAYS @ 25'-0" = 150'-0"

(301.B)



MODULES 301A & 301B

CLIENT		CIRI/PLACER BELUGA METHANOL PROJECT COOK INLET, ALASKA		Davy McKee ENGINEERS AND CONSTRUCTORS	
DES	BY	DATE	TITLE	SCALE 1"=20'	REV.
DRNN			RAW WATER & BFW TREATMENT PLAN @ GRADE	DRAWING NO. 5530-301-P-001	
CHK'D					
APP	<i>[Signature]</i>	7/20/91			

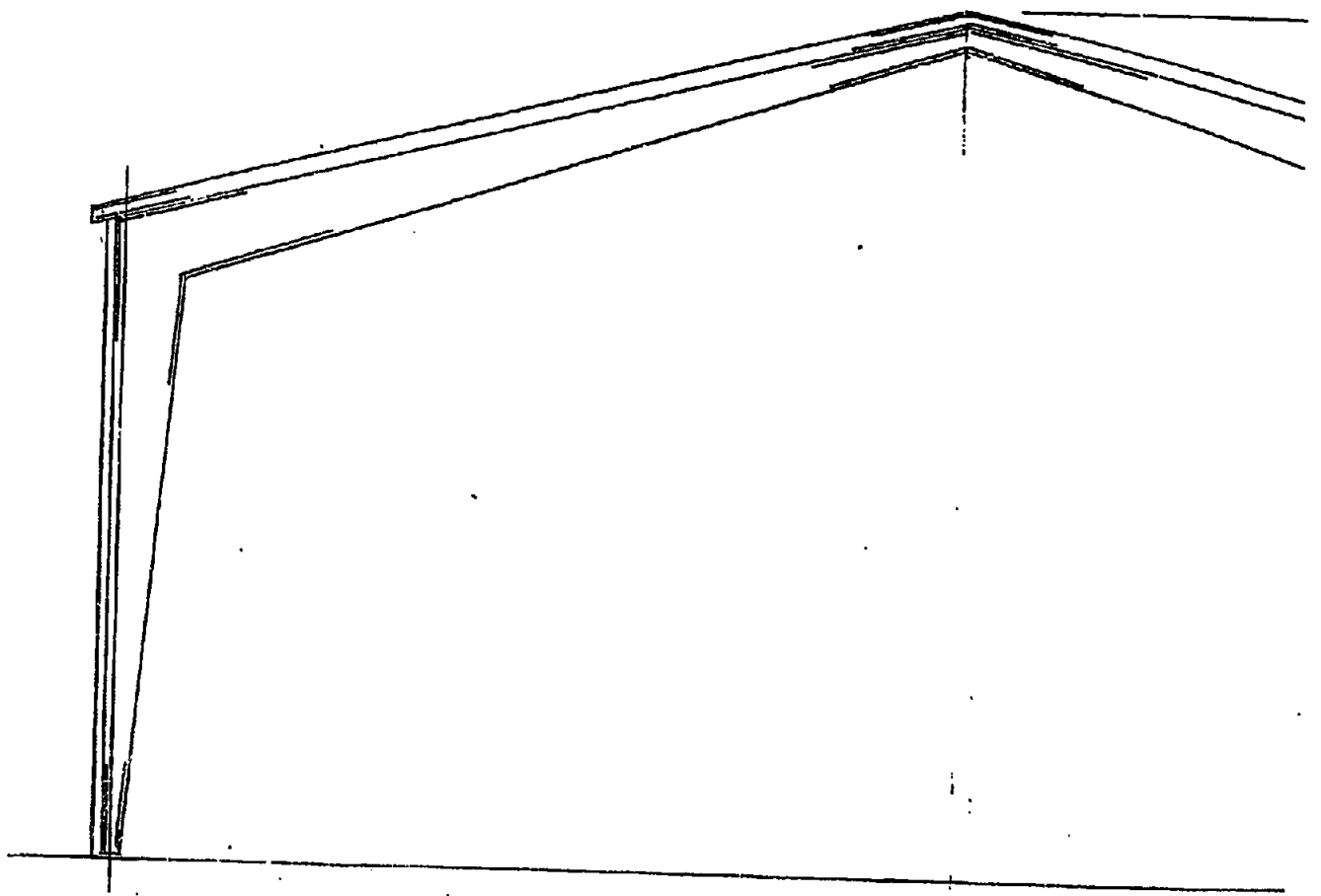


31-P-004

INCLUDES AREAS 301 & 302
MODULE 301C

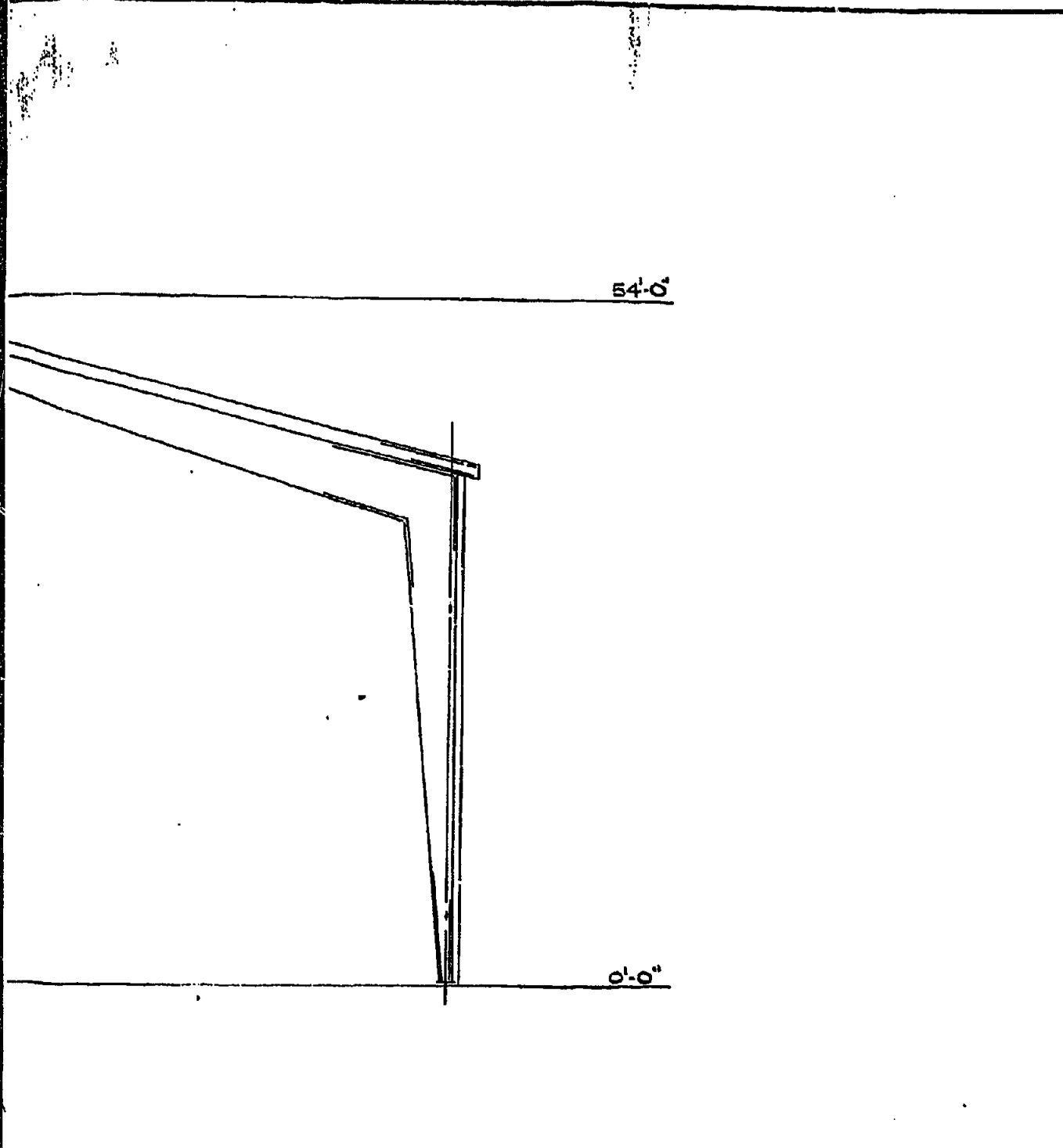
CLIENT CIRI/PLACER BELUGA METHANOL PROJECT COOK INLET, ALASKA			Davy McKee ENGINEERS AND CONSTRUCTORS	
TITLE RAW WATER & BFW TREATMENT PLAN @ GRADE & 2 1/2"			SCALE 1" = 20" DRAWING NO. 5530-301-P-002	REV.

DES	BY	DATE
DRNH		
CK'D		
APP	2/1/81	7/20/81
APP		



SECTION A-A

REVISIONS					REVISIONS					REFERENCES	
NO.	DESCRIPTION	BY	CHK.	DATE	NO.	DESCRIPTION	BY	CHK.	DATE	CHK. NO.	TITLE
A	PREL. REVIEW	GW		2-24-81	0	ISSUED FOR FINAL REPORT	GW		7/20/81		



CLIENT CIRI/ PLACER BELUGA METHANOL PROJECT COOK INLET, ALASKA			Davy McKee ENGINEERS AND CONSTRUCTORS		
DES	BY	DATE	TITLE	SCALE 1" = 10'	REV.
DRWN			RAW WATER & BFW TREATMENT SECTION A-A	DRAWING NO. 5530-301-P-003	
CHK'D					
APP	<i>[Signature]</i>	7/20/81			
APP					

67'-0"

21'-0"

0'-0"

302-2502

CLIENT
CIRI/PLACER
BELUGA METHANOL PROJECT
COOK INLET, ALASKA

Davy McKee
ENGINEERS AND CONSTRUCTORS

DES	BY	DATE
DESIGN		
CHECKED		
APP	<i>gfb</i>	7/20/81
APP	<i>/</i>	

TITLE
RAW WATER & BFW
TREATMENT
SECTION B-B

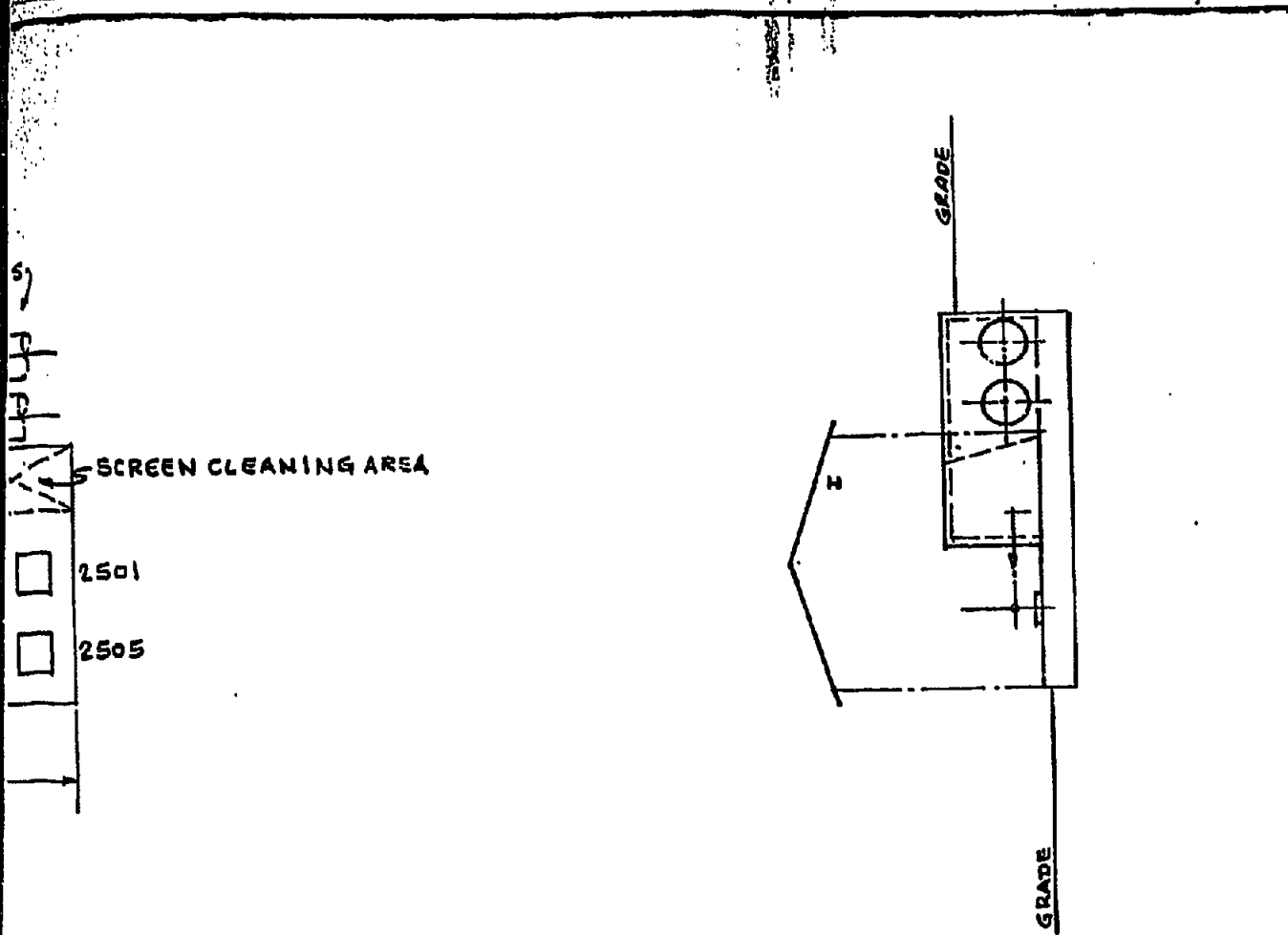
SCALE 1" = 10'
DRAWING NO.

5530-301-P004

REV.



[illegible]



CLIENT
CIRI/PLACER
BELUGA METHANOL PROJECT
COOK INLET, ALASKA

Davy McKee
ENGINEERS AND CONSTRUCTORS

TITLE
COOLING WATER PUMPS
PLAN & SECTION

SCALE 1"=20'
DRAWING NO.

5530-103-P-001

REV.



DES	BY	DATE
DRNH		
CK'D		
APP	<i>ms</i>	7/20/81
APP		

SECTION 9.0
WASTEWATER TREATMENT
(Area 401)

9.1 DESIGN BASIS

Wastewater discharges occur continuously from several processing and nonprocessing areas/operations, and intermittently from runoffs from coal storage and processing areas and from periodic cleaning of steam boilers. All contaminated wastewaters generated from operation of the coal gasification/methanol plant complex are treated before discharging the effluent, in an environmentally acceptable manner, to Cook Inlet. A summary of estimated wastewater flows and characteristics is given in Table 9-1 on Page 9/7.

All treated effluents are stored in a final treated effluent pond, and discharged through effluent diffusers to Cook Inlet during ebb tide only. A portion of the treated effluent is utilized for the conditioning of dry ash to minimize dust problems during load-out from ash silos. Stored treated effluent also serves to meet the plant fire water demand. A summary of effluent characteristics is given in Table 9-5 on Page 9/11.

9.2 PROCESS DESCRIPTION

(Dwgs 5530-401-Y-001, 002, 003, 004, 005, 006, 007)

9.2.1 Railroad Maintenance Area

Wastewater from the railroad maintenance shop is discharged to a grit chamber for the removal of grit. Grit removed from the wastewater is collected, by means of a grit screw collector, in a dumpster box for storage and subsequent disposal.

The degrittied wastewater is discharged to an oil separator for the removal of free oil. Oil which accumulates on the surface of the separator is removed by a belt oil skimmer and is discharged to a drum for storage and subsequent disposal. The oil separator effluent is pumped to a flocculator-clarifier for chemical treatment with lime.

Runoff from the railroad tracks adjoining the shop is conveyed to a stormwater storage pond. The runoff is pumped, at a controlled rate, to the flocculator-clarifier for chemical treatment with lime.

Treated effluent overflows the clarifier weir and is conveyed through a sewer to the process wastewater treatment facilities.

Settled lime sludge is pumped to a basket centrifuge for dewatering. Centrate from sludge dewatering is returned to the oil separator. Dewatered sludge is sent to the coal mines for disposal.

9.2.2 Process Area Stormwaters

Runoff from the processing areas of the plant flows through a trash rack to a lined earthen primary stormwater basin. The primary basin is used to remove any free oil present in the runoff. The runoff is then discharged from the bottom of the primary basin to an overflow chamber for discharge to a lined earthen stormwater storage pond. The runoff is subsequently discharged from the bottom of the storage pond to a sump, and pumped at a controlled rate to the process wastewater treatment facilities. The characteristics of process area runoff are shown in Table 9-4 on Page 9/10.

9.2.3 Boiler Cleaning Wastewaters

Wastewaters from boiler cleaning operations are discharged to a lined earthen basin storage pond. The boiler cleaning wastes are pumped at a controlled rate to the coal storage area stormwater runoff reactor-clarifier for chemical treatment with lime. Characteristics of boiler cleaning wastewaters are listed in Table 9-3 on Page 9/9.

9.2.4 Coal Storage Area Stormwaters

Stormwater runoff and washdown water (see drawing 5530-401-Y-007) from the coal storage area is discharged to a lined earthen basin storage pond. The contents of this pond are pumped at a controlled rate to the reactor-clarifier for chemical treatment with lime.

Treated effluent overflows to a sump and is pumped to the effluent mix tank, provided with the process wastewater treatment facilities, for ultimate discharge to Cook Inlet.

Settled lime sludge is pumped to two basket centrifuges for dewatering. The centrate resulting from dewatering is returned to the coal storage area runoff pond. The dewatered sludge is sent to the coal mines for disposal. A summary of coal area wastewater characteristics is given in Table 9-2 on Page 9/8.

9.2.5 Process Wastewater Treatment Facilities

Process wastewaters, pretreated effluents from the railroad shop and sanitary wastewater treatment, and controlled discharge of process area runoff are conveyed to a concrete sump, and from there they are pumped to a splitter box. Recycle sludge and nutrient solutions are also pumped to the

splitter box. The splitter box distributes the flow equally to two lined earthen aeration basins.

To promote biological treatment, the mixture of wastewaters, recycle sludge and nutrient is aerated. The oxygen necessary for biological treatment is supplied by three aerators in each aeration basin.

Adequate amounts of nutrients, nitrogen and phosphorus, are necessary for biological treatment. Ammonium phosphate is used as a single source nutrient.

The mixed liquor from the aeration basins is discharged to a splitter box which distributes the flow equally to two circular clarifiers. The clarifiers are used to settle the mixed liquor and separate the biological sludge from the treated effluent. Each clarifier is provided with a skimming mechanism to remove any accumulated skimmings from the surface of the clarifier. The skimmings are discharged to a sump and pumped to the sludge handling facilities. A majority of the settled biological sludge is returned to the inlet splitter box. The remainder of the settled sludge is pumped to the sludge handling facilities. The treated effluent overflows the clarifier weir to a sump and is pumped to two gravity sand filters for removal of suspended solids from the clarified effluent. The filtered effluent is discharged to an effluent mix tank.

The excess biological sludge and scum resulting from the process wastewater treatment is processed in the sludge handling and treatment facilities where it is aerobically digested, thickened and dewatered. The digested sludge is discharged

to a thickener. The supernatant from the thickener is collected in a sump and pumped to the splitter box. The thickened sludge is pumped to a sludge storage tank. The sludge from the sludge storage tank is pumped to a solid bowl centrifuge.

The centrate resulting from sludge dewatering is discharged to the splitter box. The dewatered sludge is sent to the coal mines for disposal.

9.2.6 Miscellaneous Wastewaters

Boiler blowdown, neutralized ion-exchange regenerant wastes, pretreated effluent from boiler cleaning and coal storage area runoff treatment, and centrate from water treatment facilities are also discharged to the effluent mix tank.

9.2.7 Cooling Tower Blowdown

This wastewater is discharged directly to the effluent storage pond.

9.2.8 Effluent Storage Pond

This is a rectangular lined earthen basin provided to store treated effluent for discharge over a 12-hour period to Cook Inlet during ebb tide through a multi-port effluent diffuser.

A portion of the treated effluent is pumped from the storage pond for emergency quenching of coal dryers and for conditioning of ash during loadout from the ash storage silos. Stored treated effluent also serves to meet the plant fire water demand.

An effluent monitoring station automatically collects composite samples, and automatically records flow, temperature and pH of all treated effluents discharged to Cook Inlet.

9.2.9 Effluent Diffuser

The multi-port effluent diffuser is approximately 1300' long, and is located in an area with a water depth of at least several fathoms even at dead low tide.

9.2.10 Clean Stormwater Runoff

Runoff from clean area of the plant is conveyed through a trash rack to a lined earthen stormwater basin. The runoff is discharged from the bottom of the basin to a sump for discharge to natural drainage channels.

An effluent monitoring station automatically records the flow and collects composite samples of all clean area runoff.

9.2.11 Construction Runoff

Stormwater runoff from the coal storage area and processing area which occurs during the period of construction will be directed to separate lined earthen detention ponds. Alum will be added, on a flow-proportional basis, to facilitate settling of silt. Treated effluent will be discharged to natural drainage channels.

Automatic samplers will collect composite samples of discharges from the ponds.