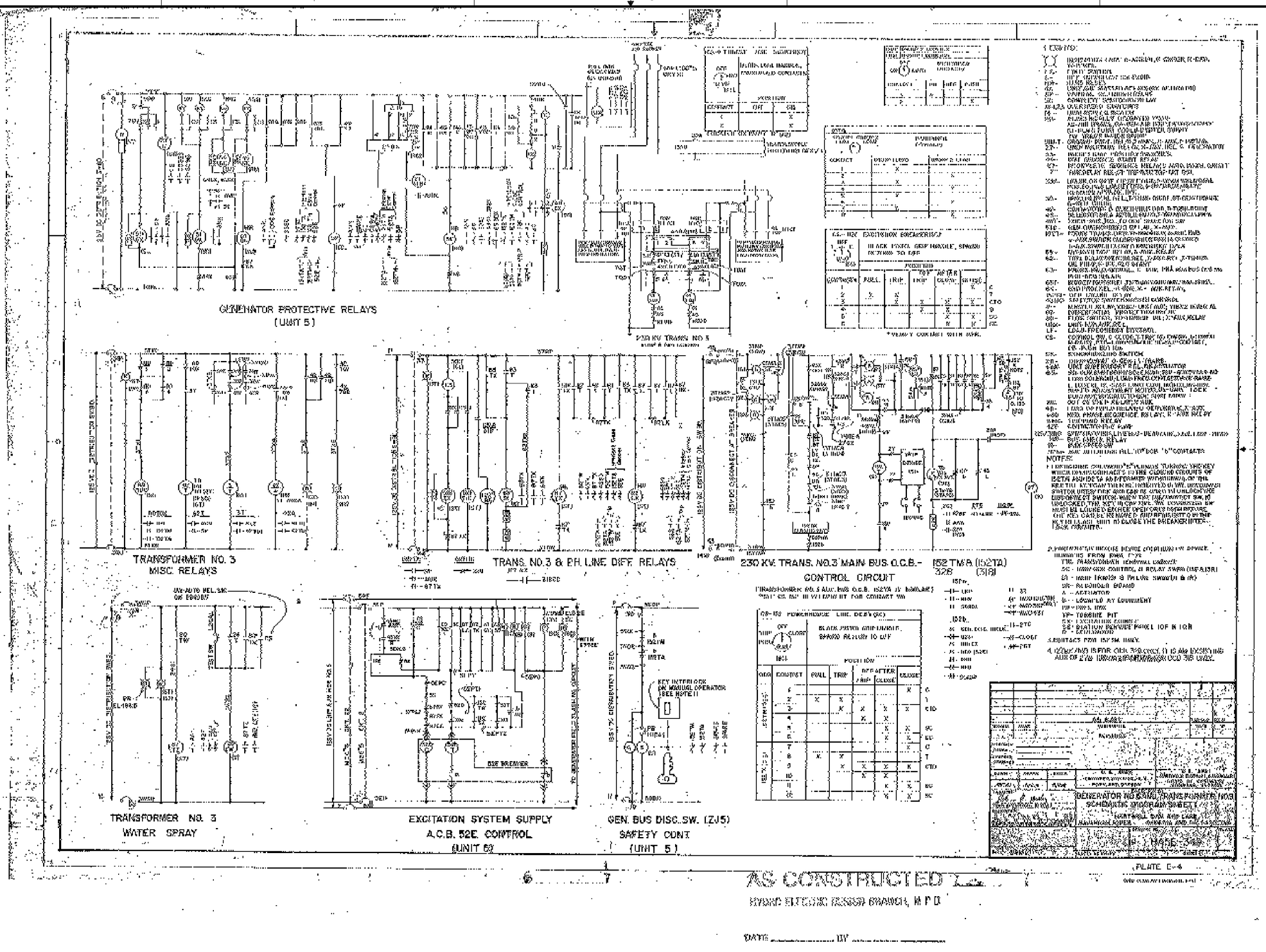

INFORMATION ONLY

SHEET 127

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
GEN NO. 5 & TRANSF. NO. 3
SCHEMATIC DIAGRAM SHEET 1
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-19

SCALE: SHEET 00

REF HA6E-349.TIF HA5E-349.DGN

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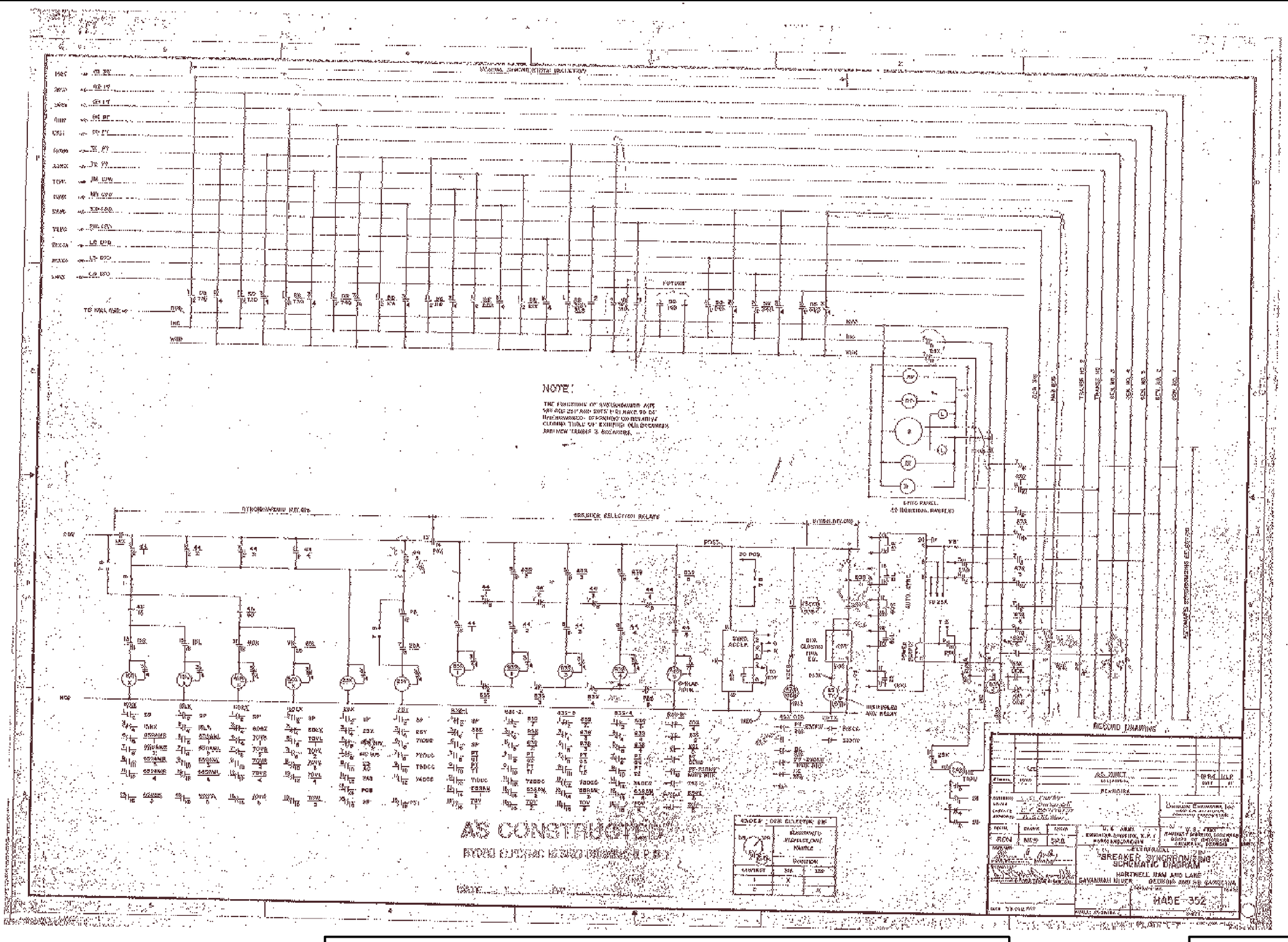

INFORMATION ONLY

SHEET 128

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
BREAKER SYNCHRONIZING
SCHEMATIC DIAGRAM
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-20

SCALE: SHEET 00

13 Nov 2002
07-58421

REF HA5E-352.TIF HA5E-352.DGN

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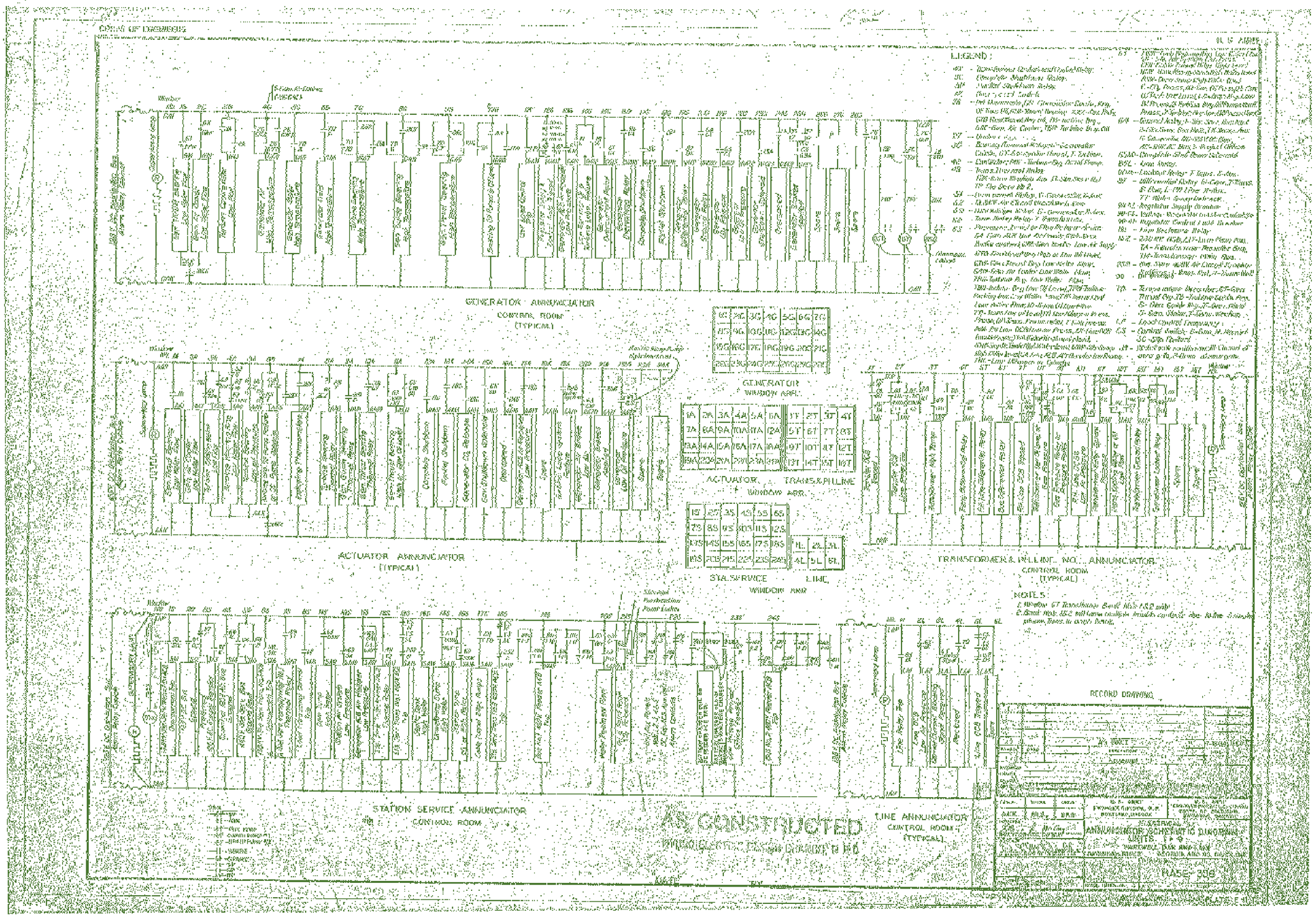


INFORMATION ONLY

SHEET 129

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

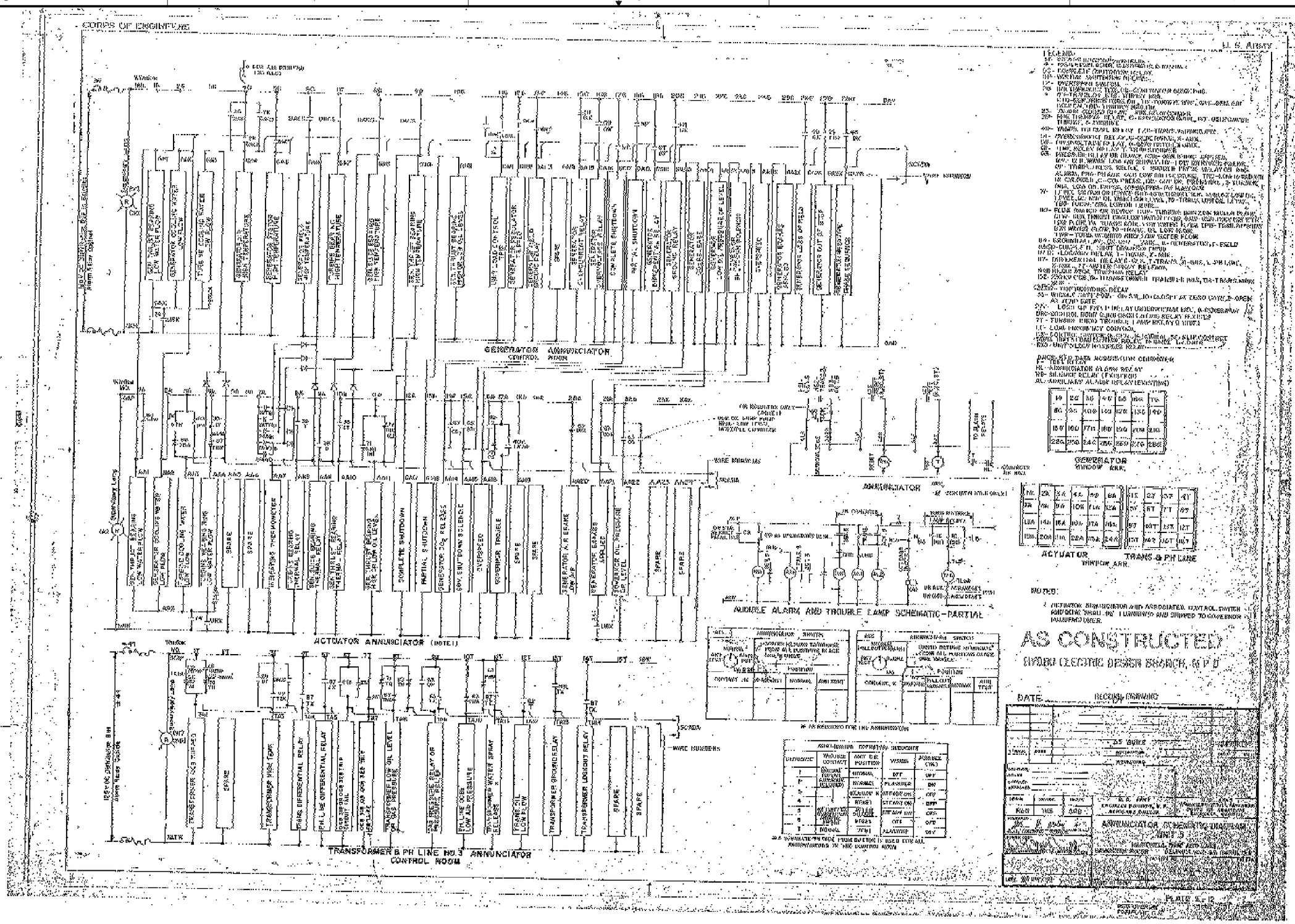
HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
ANNUNCIATOR SCHEMATIC DIAGRAM
UNITS 1 & 4
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-21
SCALE:		SHEET 00	

13 Nov 2002
07:40:42

REF HA5E-356.TIF HA5E-356.DGN

...\03B07w\REFERENCES\ha5e-356.dgn 03/24/2003 01:00:40 PM



INFORMATION ONLY

SHEET 130

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
ANNUNCIATOR SCHEMATIC DIAGRAM
UNIT 5
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-22

SCALE: SHEET 00

13 Nov 2002
07:48:21

REF HA5E-357.TIF HA5E-357.DGN

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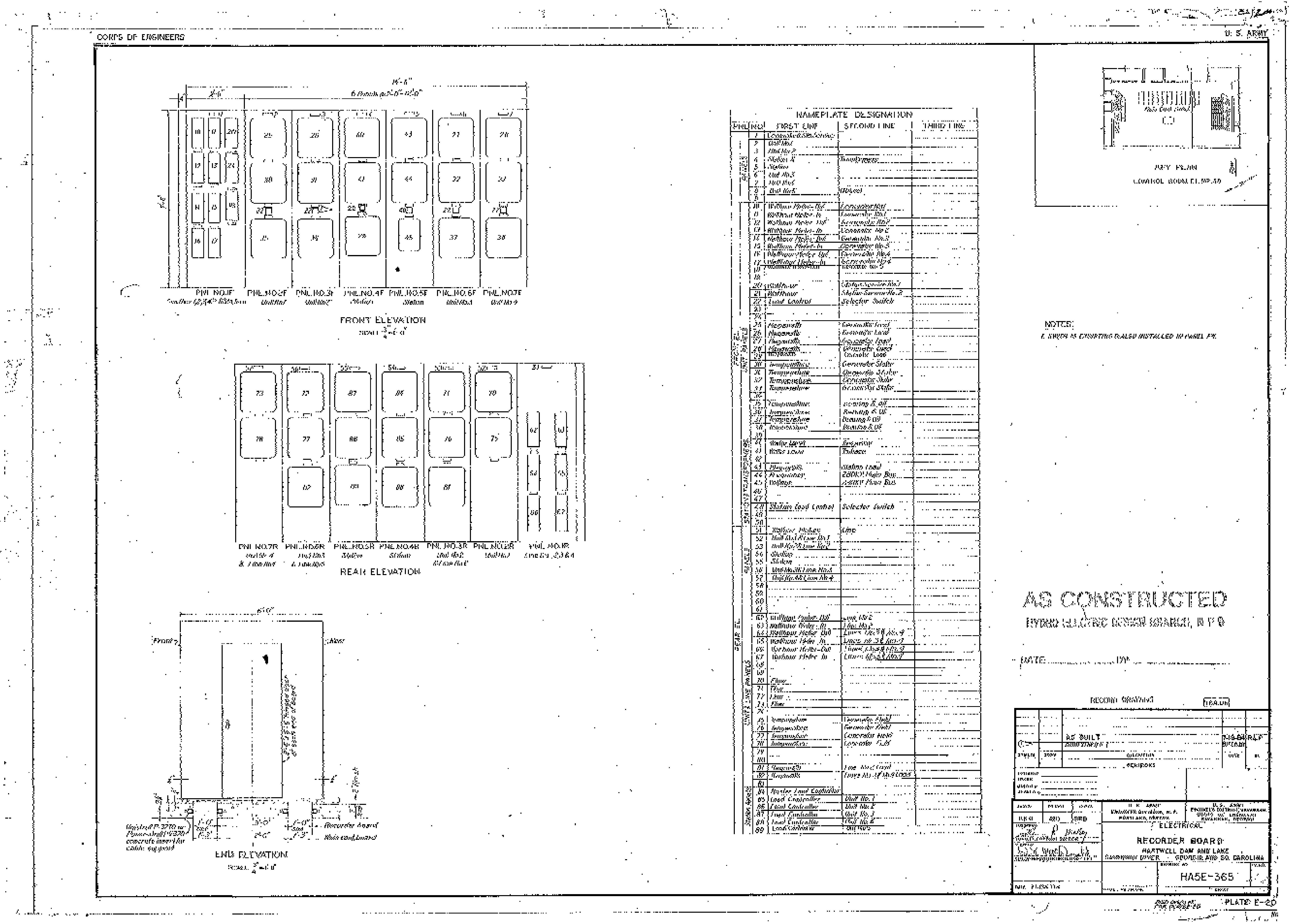

PNL	NO	FIRST LINE	SECOND LINE	THIRD LINE
	1	[illegible]		
	2	Unit No.1		
	3	Unit No.2		
	4	Station	Transformer	
	5	Station		
	6	Unit No.3		
	7	Unit No.4		
	8	Unit No.5	(Spare)	
	9			
	10	Wattmeter Meter-Out	Generator No.1	
	11	Wattmeter Meter-In	Generator No.1	
	12	Wattmeter Meter-Out	Generator No.2	
	13	Wattmeter Meter-In	Generator No.2	
	14	Wattmeter Meter-Out	Generator No.3	
	15	Wattmeter Meter-In	Generator No.3	
	16	Wattmeter Meter-Out	Generator No.4	
	17	Wattmeter Meter-In	Generator No.4	
	18			
	19			
	20	Wattmeter	Station Service No.1	
	21	Wattmeter	Station Service No.2	
	22	Load Control	Selector Switch	
	23			
	24			
	25	Megawatts	Generator Load	
	26	Megawatts	Generator Load	
	27	Megawatts	Generator Load	
	28	Megawatts	Generator Load	
	29			
	30	Temperature	Generator Stator	
	31	Temperature	Generator Stator	
	32	Temperature	Generator Stator	
	33	Temperature	Generator Stator	
	34			
	35	Temperature	Bearing & Oil	
	36	Temperature	Bearing & Oil	
	37	Temperature	Bearing & Oil	
	38	Temperature	Bearing & Oil	
	39			
	40	Water Level	Reservoir	
	41	Water Level	Tailrace	
	42			
	43	Megawatts	Station Load	
	44	Frequency	230KV Main Bus	
	45	Voltage	230KV Main Bus	
	46			
	47			
	48	Station Load Control	Selector Switch	
	49			
	50			
	51	Wattmeter Meter	Line	
	52	Unit No.1 & Line No.1		
	53	Unit No.2 & Line No.2		
	54	Station		
	55	Station		
	56	Unit No.3 & Line No.3		
	57	Unit No.4 & Line No.4		
	58			
	59			
	60			
	61			
	62	Wattmeter Meter-Out	Line No.2	
	63	Wattmeter Meter-In	Line No.2	
	64	Wattmeter Meter-Out	Lines No.3 & No.4	
	65	Wattmeter Meter-In	Lines No.3 & No.4	
	66	Wattmeter Meter-Out	Lines No.3 & No.4	
	67	Wattmeter Meter-In	Lines No.3 & No.4	
	68			
	69			
	70	Flow		
	71	Flow		
	72	Flow		
	73	Flow		
	74			
	75	Temperature	Generator Field	
	76	Temperature	Generator Field	
	77	Temperature	Generator Field	
	78	Temperature	Generator Field	
	79			
	80			
	81	Megawatts	Line No.2 Load	
	82	Megawatts	Lines No.3 & No.4 Load	
	83			
	84	Master Load Controller		
	85	Load Controller	Unit No.1	
	86	Load Controller	Unit No.2	
	87	Load Controller	Unit No.3	
	88	Load Controller	Unit No.4	
	89	Load Controller	Unit No.5	

INFORMATION ONLY

SHEET 131

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

RECORDER BOARD

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-23

SCALE: SHEET 00

13 Nov. 2002 07:58:21

REF HA5E-365.TIF

HA5E-365.DGN

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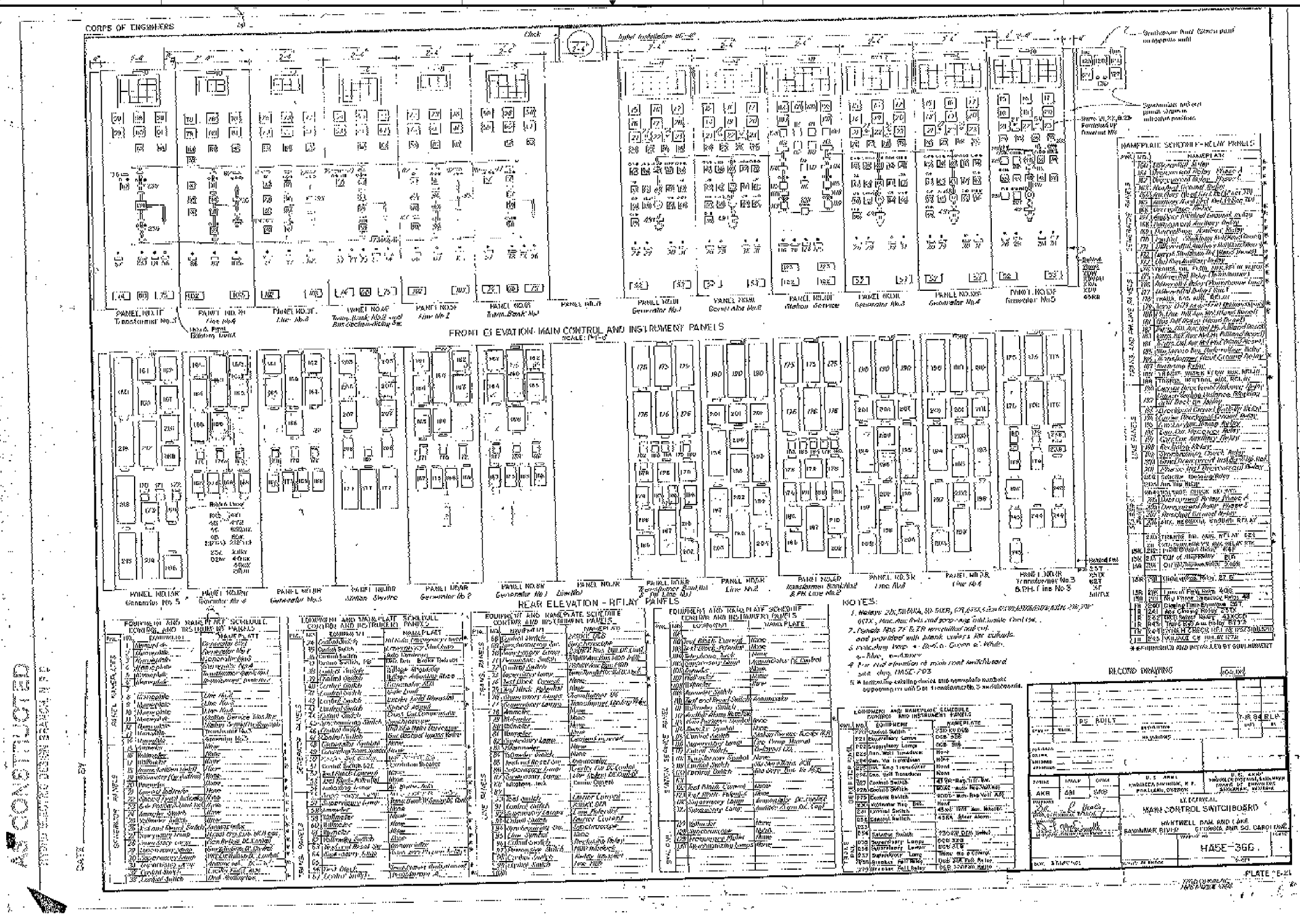

INFORMATION ONLY

SHEET 132

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

MAIN CONTROL SWITCHBOARD

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-24

SCALE: SHEET 00

13 Nov 2002
07:58:21

REF HA5E-366.TIF HA5E-366.DGN

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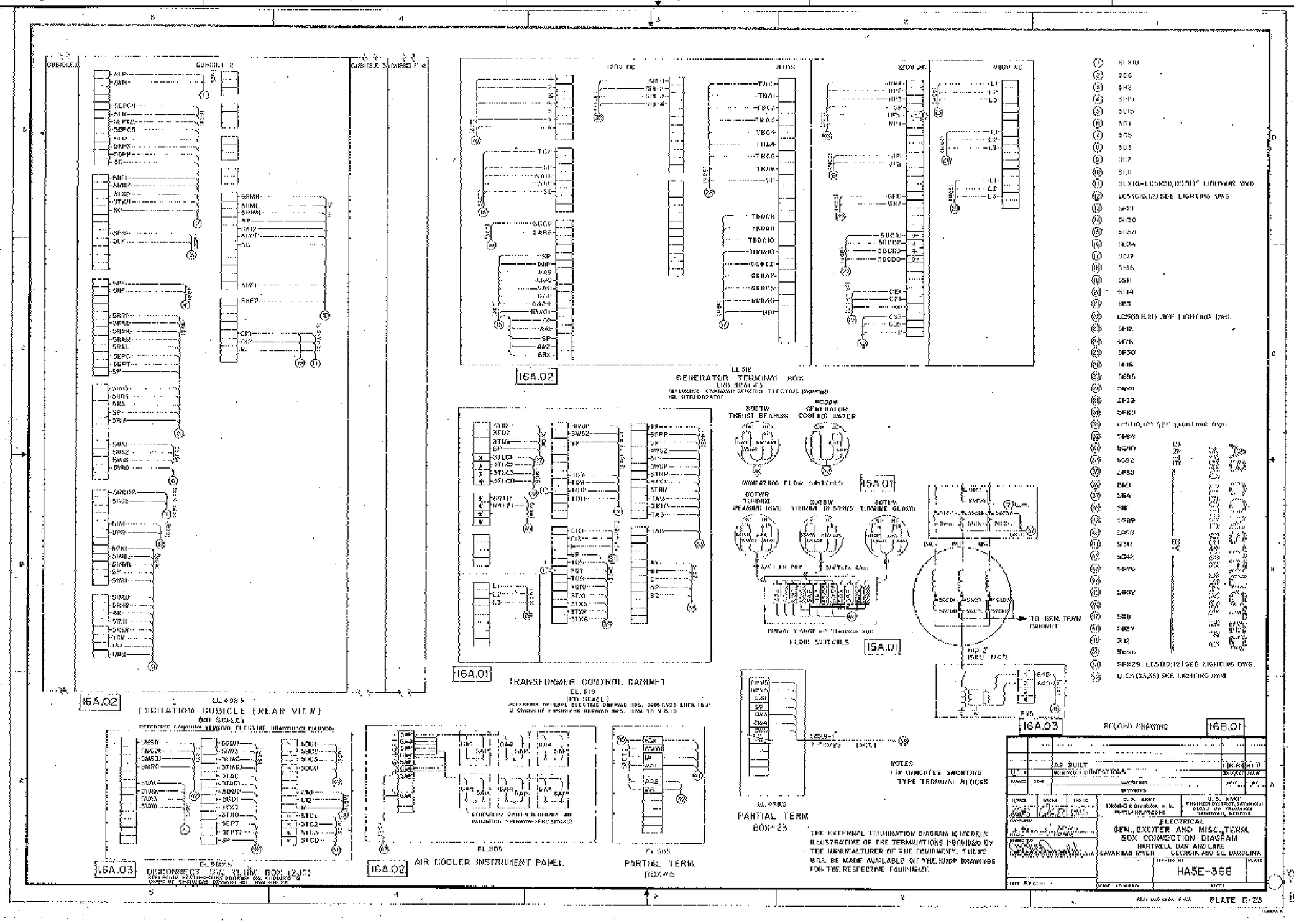

INFORMATION ONLY

SHEET 133

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
GEN & EXCITER & MISC., TERM
BOX CONNECTION DIAGRAM
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-25
SCALE:			SHEET 00

13 Nov 2002
07:48:41

REF HA5E-368.TIF HA5E-368.DGN

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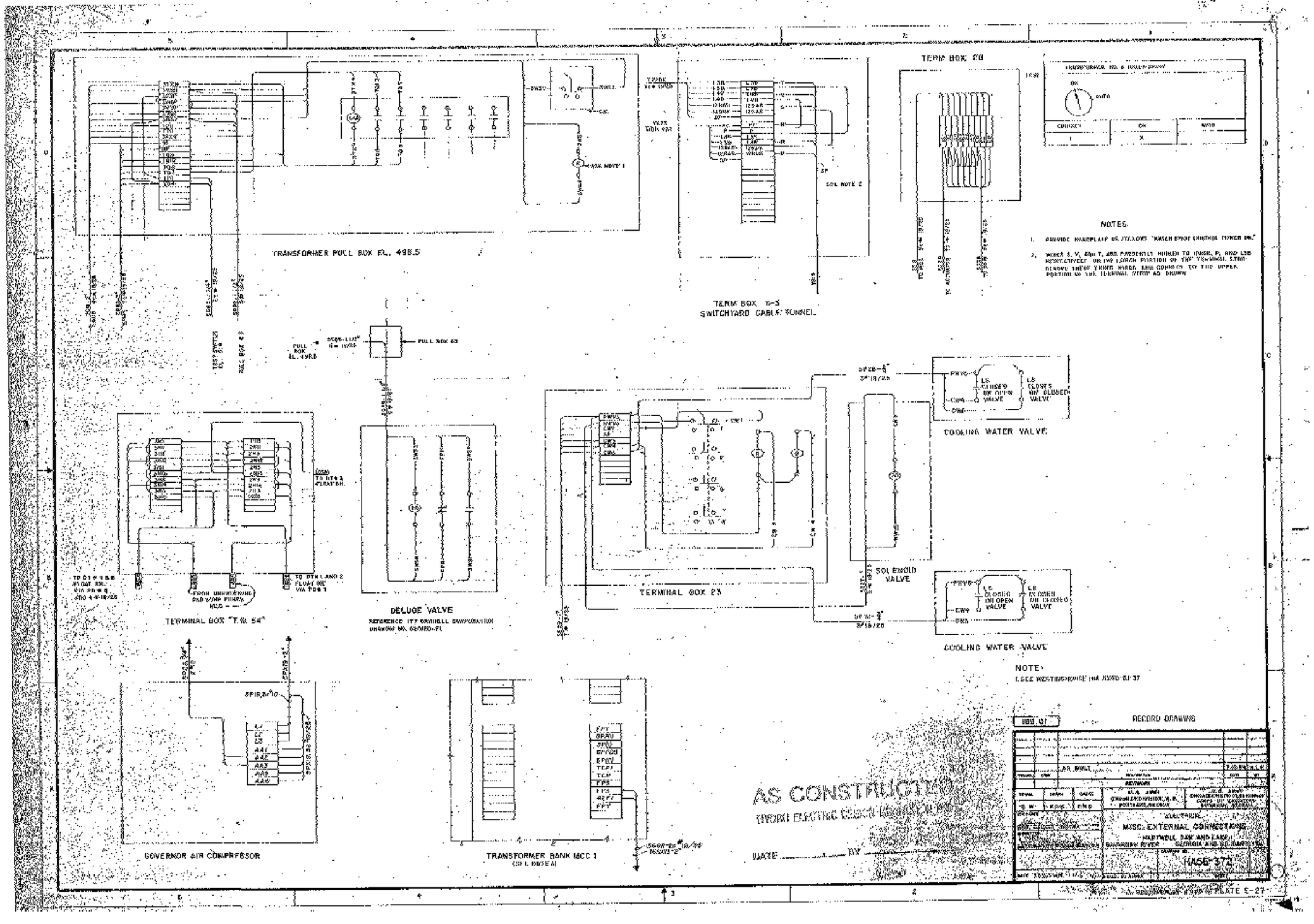

INFORMATION ONLY

SHEET 134

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

MISC. EXTERNAL CONNECTIONS

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-26

SCALE: SHEET 00

13 Nov 2002
07:48pt

REF HA5E-372.TIF HA5E-372.DGN

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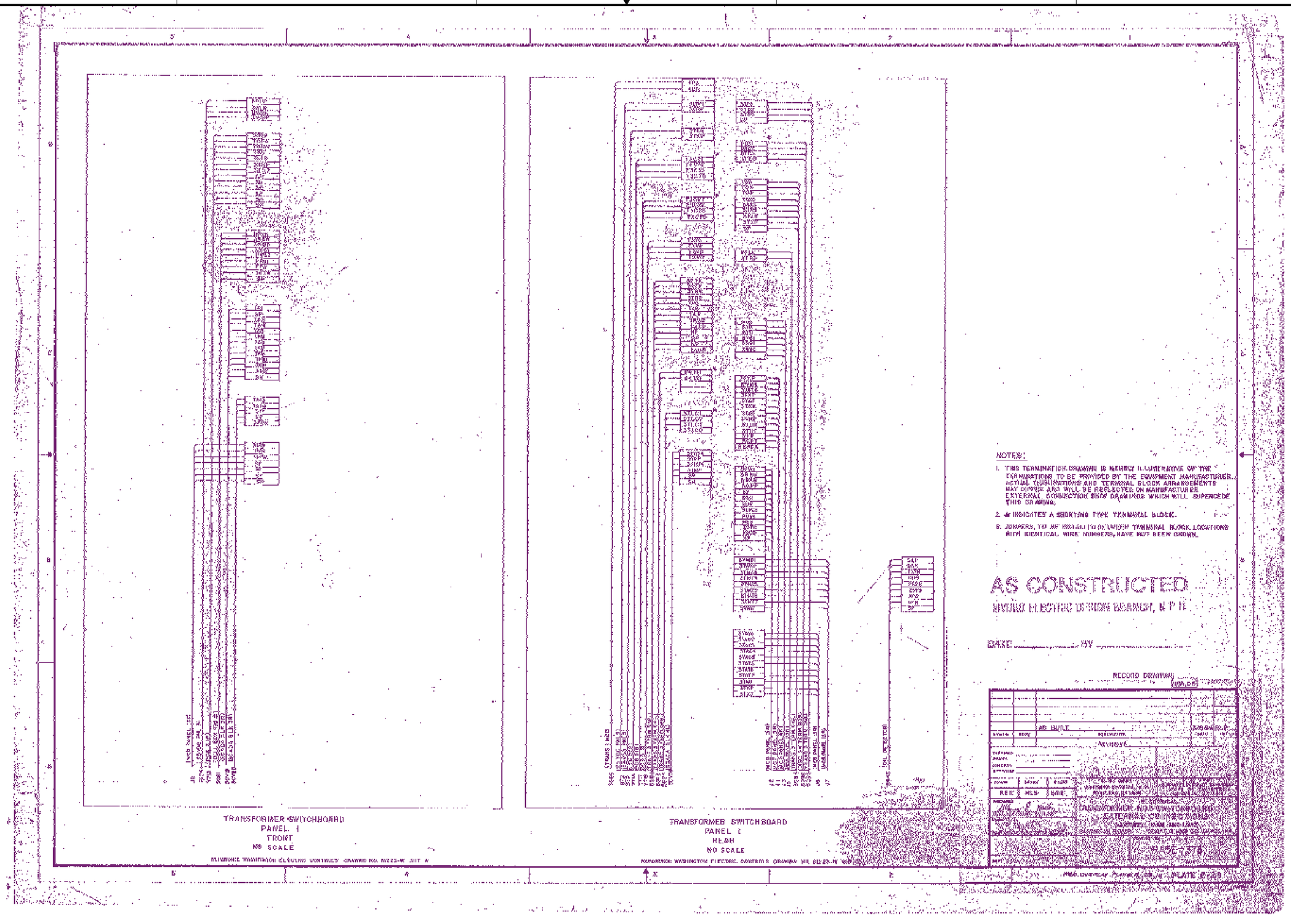

INFORMATION ONLY

SHEET 135

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
TRANFORMER NO. 3
EXTERNAL CONNECTIONS
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-27

SCALE: SHEET 00

03 Nov 2002

REF HA5E-373.TIF HA5E-373.DGN

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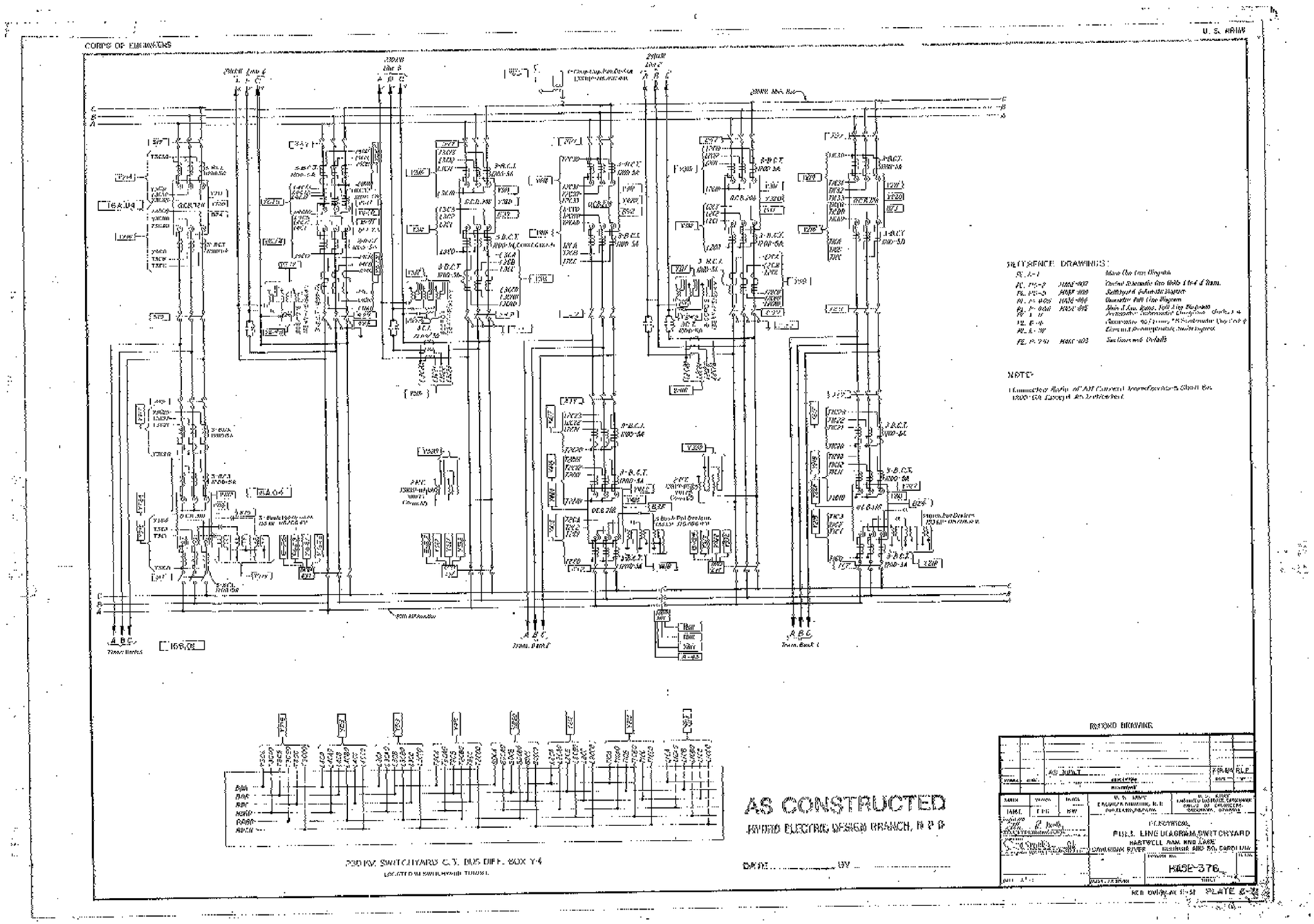

INFORMATION ONLY

SHEET 136

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

FULL LINE DIAGRAM SWITCHYARD

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-28

SCALE: SHEET 00

REF HA5E-376.TIF HA5E-376.DGN

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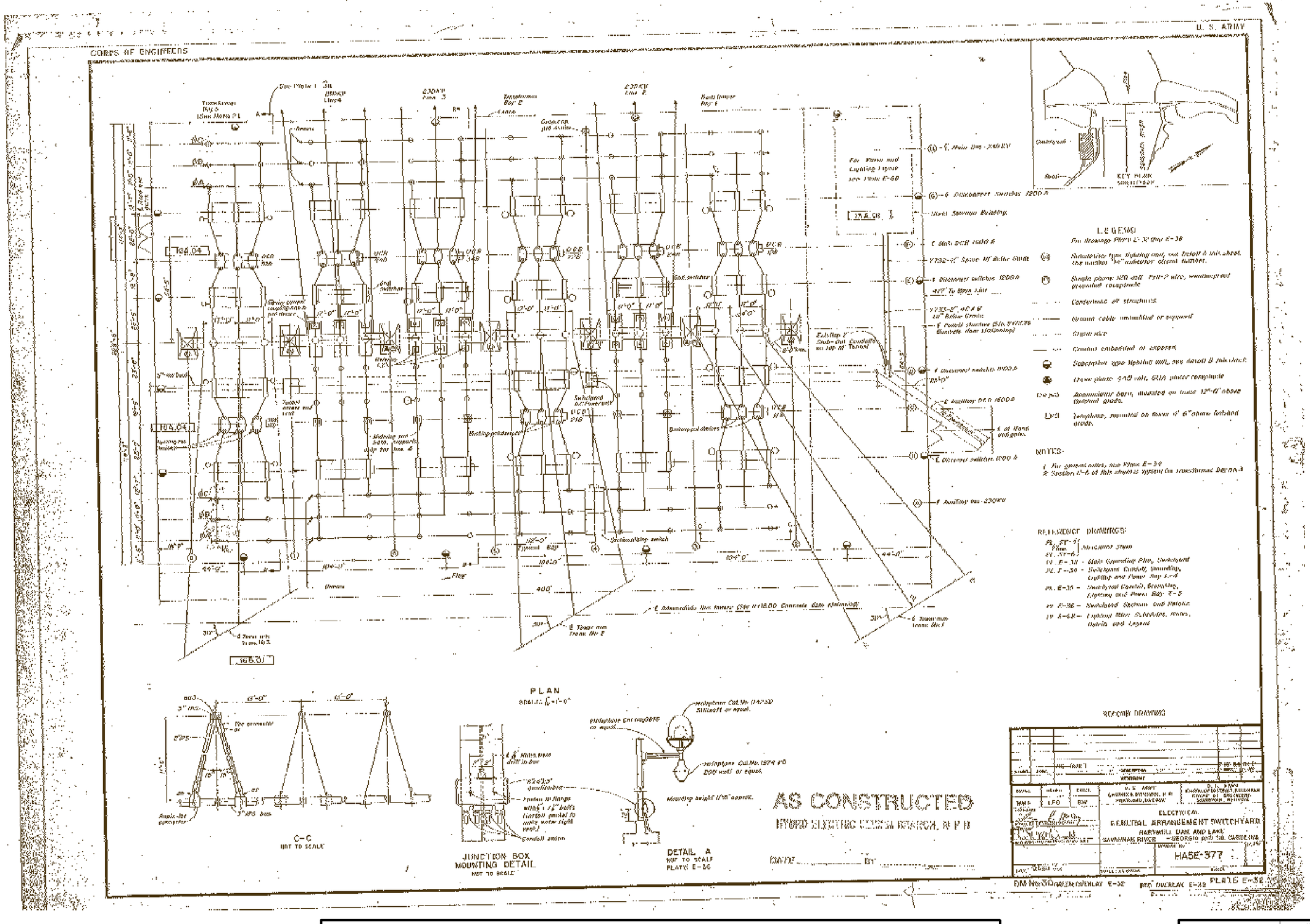

INFORMATION ONLY

SHEET 137

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

GENERAL ARRANGEMENT SWITCHYARD

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-29

SCALE: SHEET 00

13 Nov 2002
07:40:42

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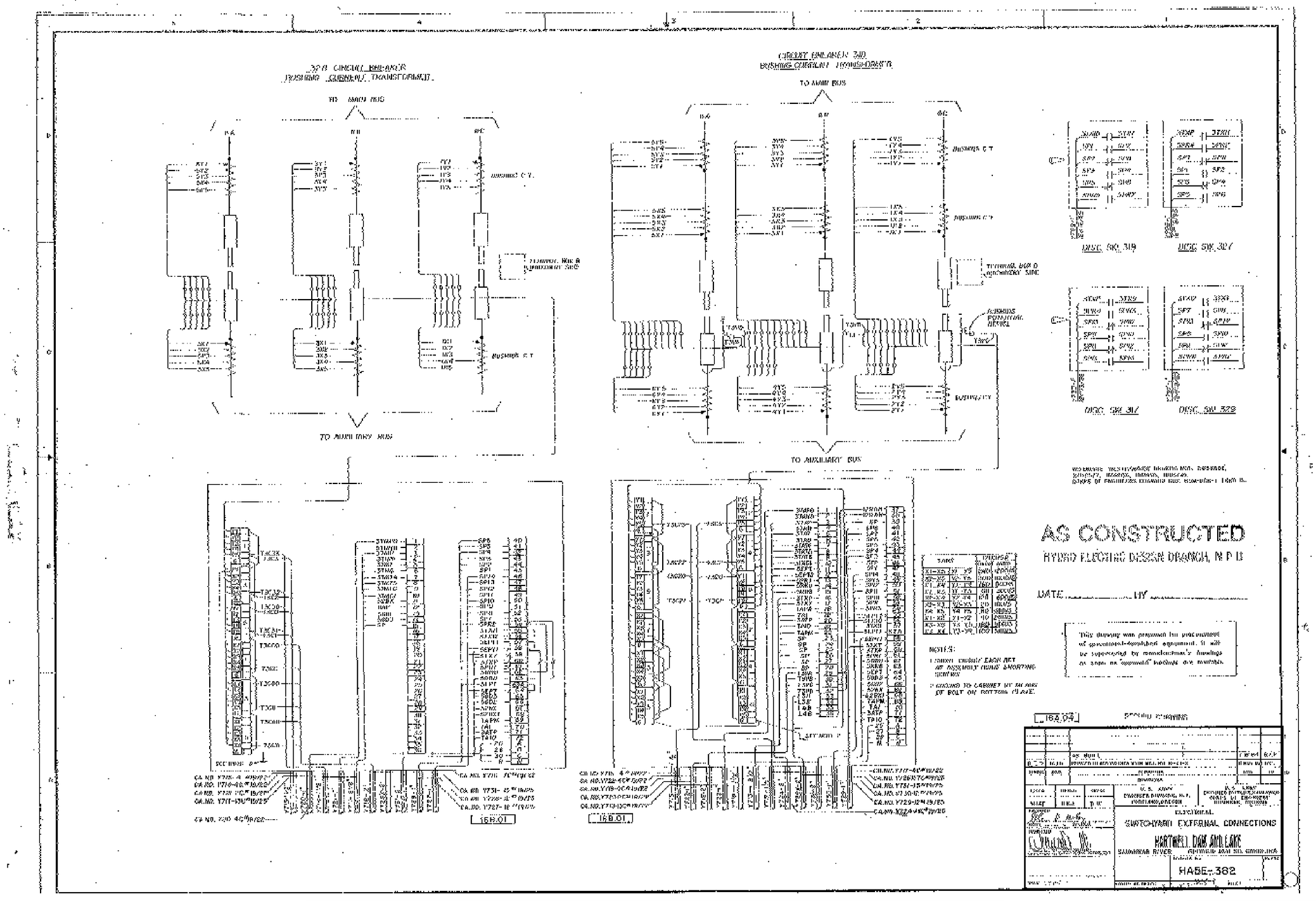

INFORMATION ONLY

SHEET 138

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

SWYD EXTERNAL CONNECTIONS

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-30

SCALE: SHEET 00

REF HA5E-382.TIF HA5E-382.DGN

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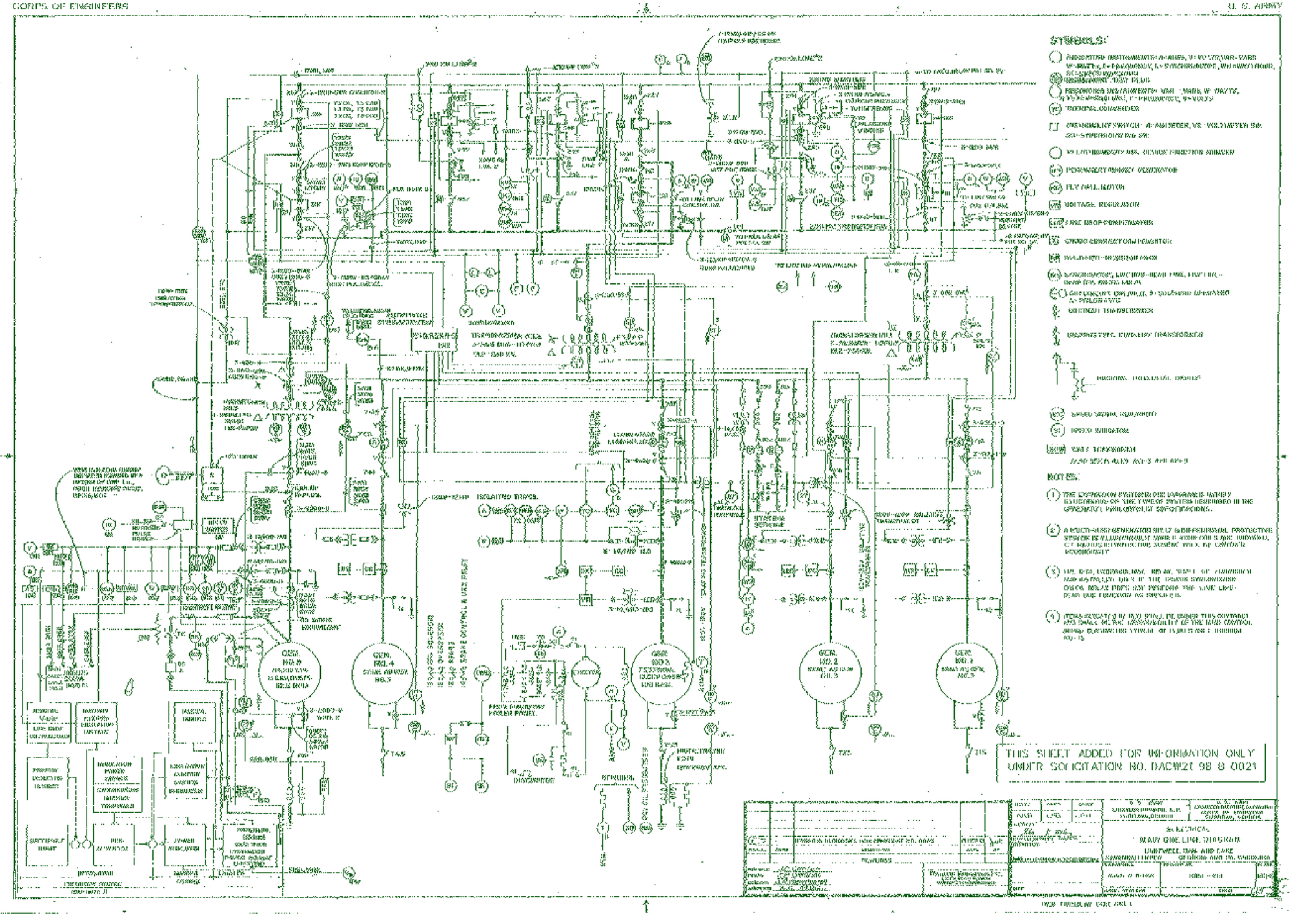
CORPS OF ENGINEERS

U. S. ARMY



INFORMATION ONLY

SHEET 139

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA
HARTWELL MAJOR REHABILITATION - PHASE 2 HARTWELL DAM AND LAKE SWITCHYARD MAIN ONE LINE DIAGRAM	
SAVANNAH RIVER	GEORGIA AND S. CAROLINA
SIZE F / INVITATION NO. / FILE NO. HAR0157	PLATE R-31
SCALE:	SHEET 00

13 Nov 2002
07:48:42

REF HA5E-413_1.TIF

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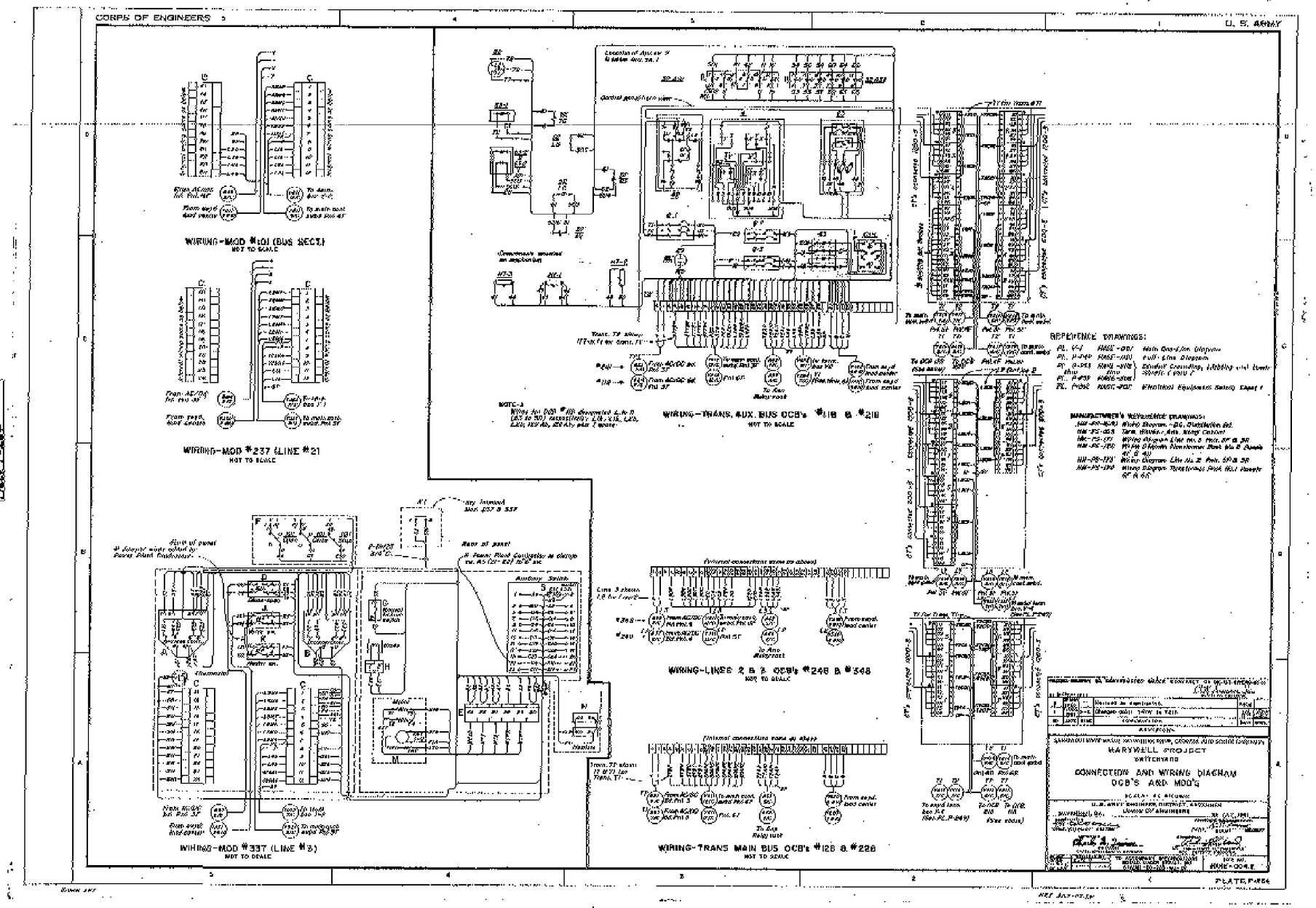

INFORMATION ONLY

SHEET 140

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
CONNECTION AND WIRING DIAGRAM
OCB'S AND MOD'S
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-32
SCALE:		SHEET 00	

13 Nov 2002
07:40:42

REF HA6E-004_2.TIF HA6E-004_2.DGN

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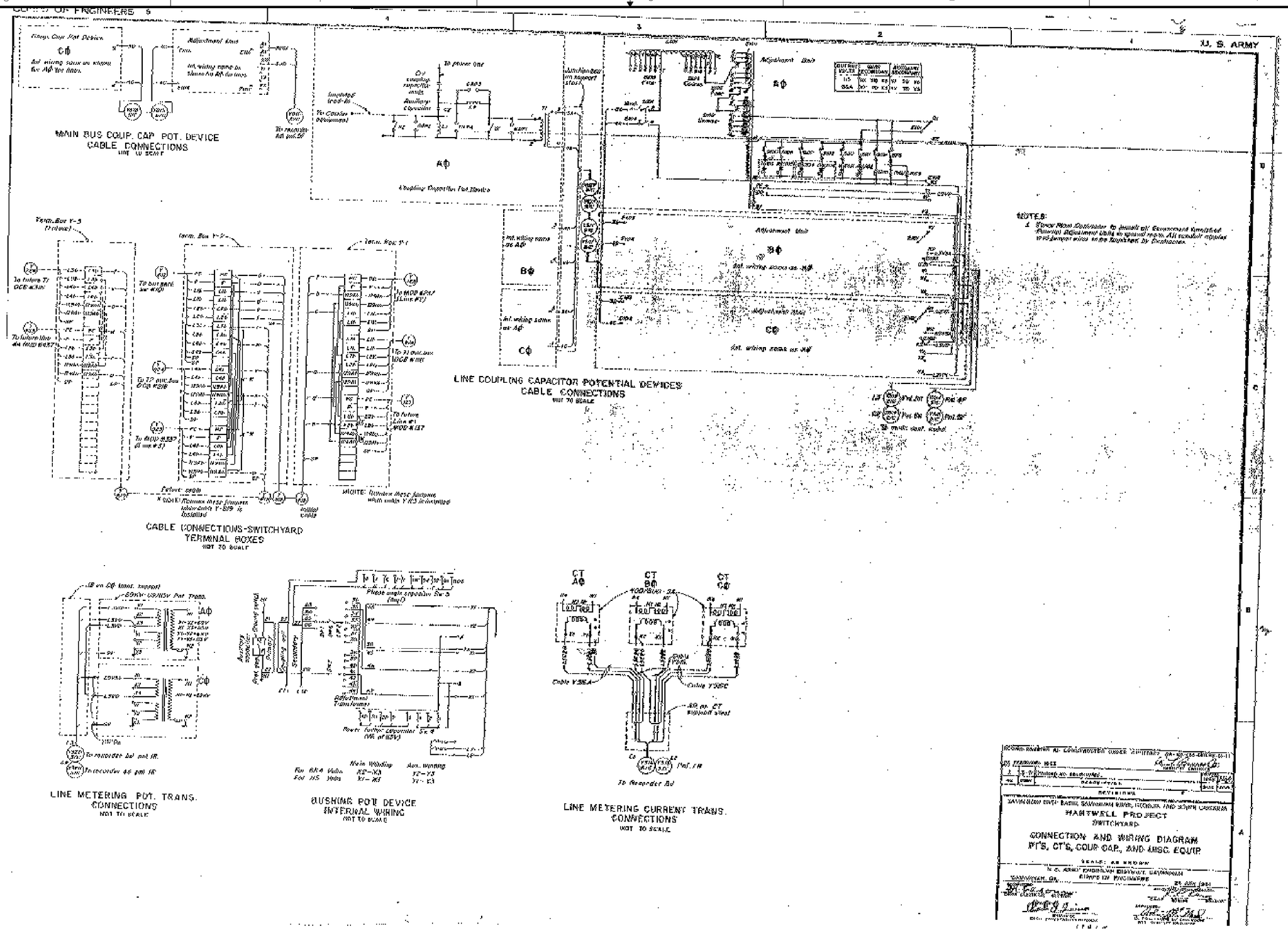

INFORMATION ONLY

SHEET 141

HYDROELECTRIC DESIGN CENTER PORTLAND, OR		U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA
HARTWELL MAJOR REHABILITATION - PHASE 2 HARTWELL DAM AND LAKE SWITCHYARD CONNECTION AND WIRING DIAGRAM PT'S, CT'S, COUP. CAP., & MISC. EQUIP SAVANNAH RIVER GEORGIA AND S. CAROLINA		
SIZE F	INVITATION NO.	FILE NO. HAR0157	PLATE R-33
SCALE:		SHEET 00

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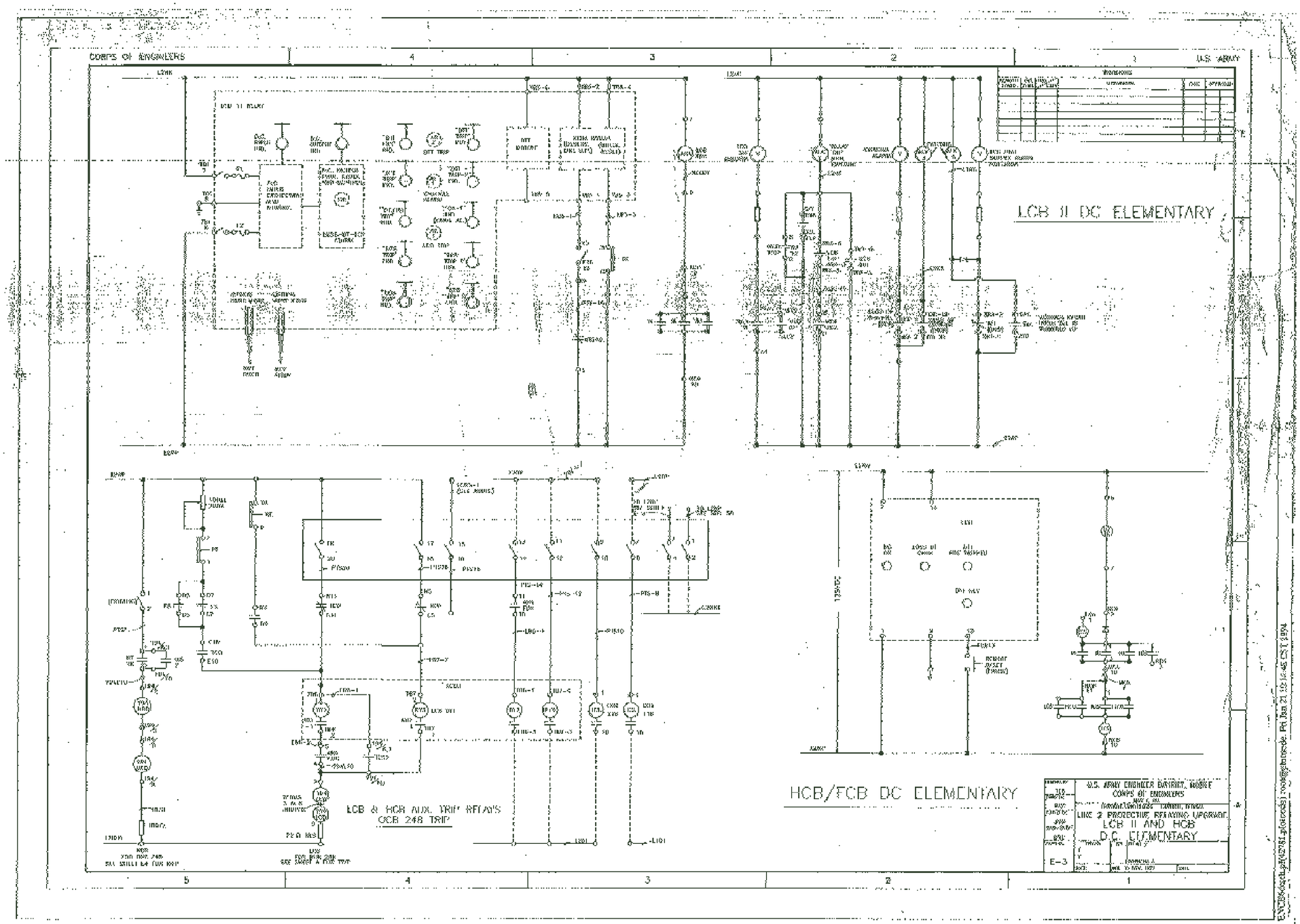

INFORMATION ONLY

SHEET 142

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
LCB II ANDHCB
D.C. ELEMENTARY
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-34

SCALE: SHEET 00

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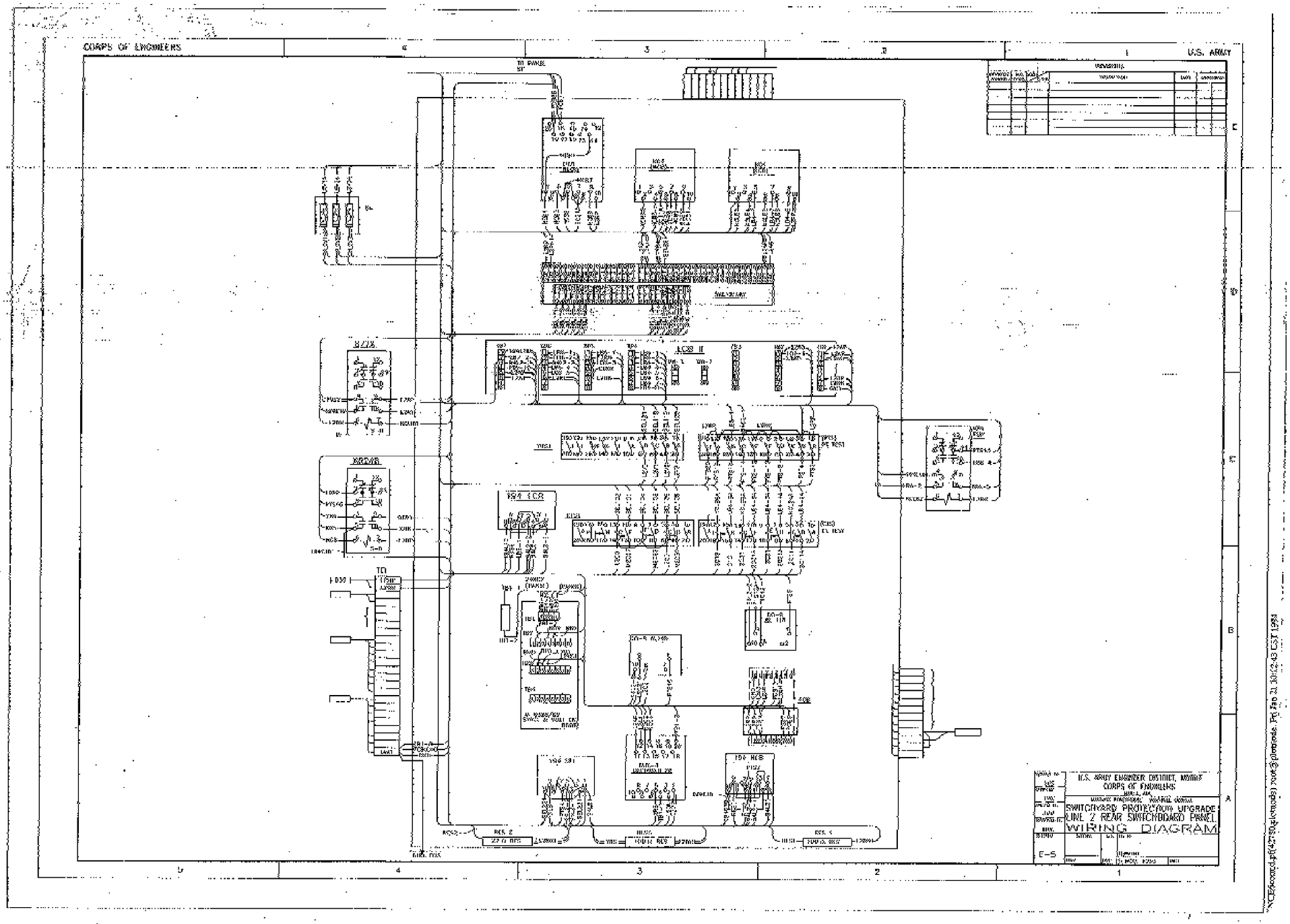

INFORMATION ONLY

SHEET 143

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
LINE 2 REAR SWITCHBOARD PANEL
WIRING DIAGRAM
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-35

SCALE: SHEET 00

REF LCB2&HCB-5.TIF LCB2&HCB-5.DGN

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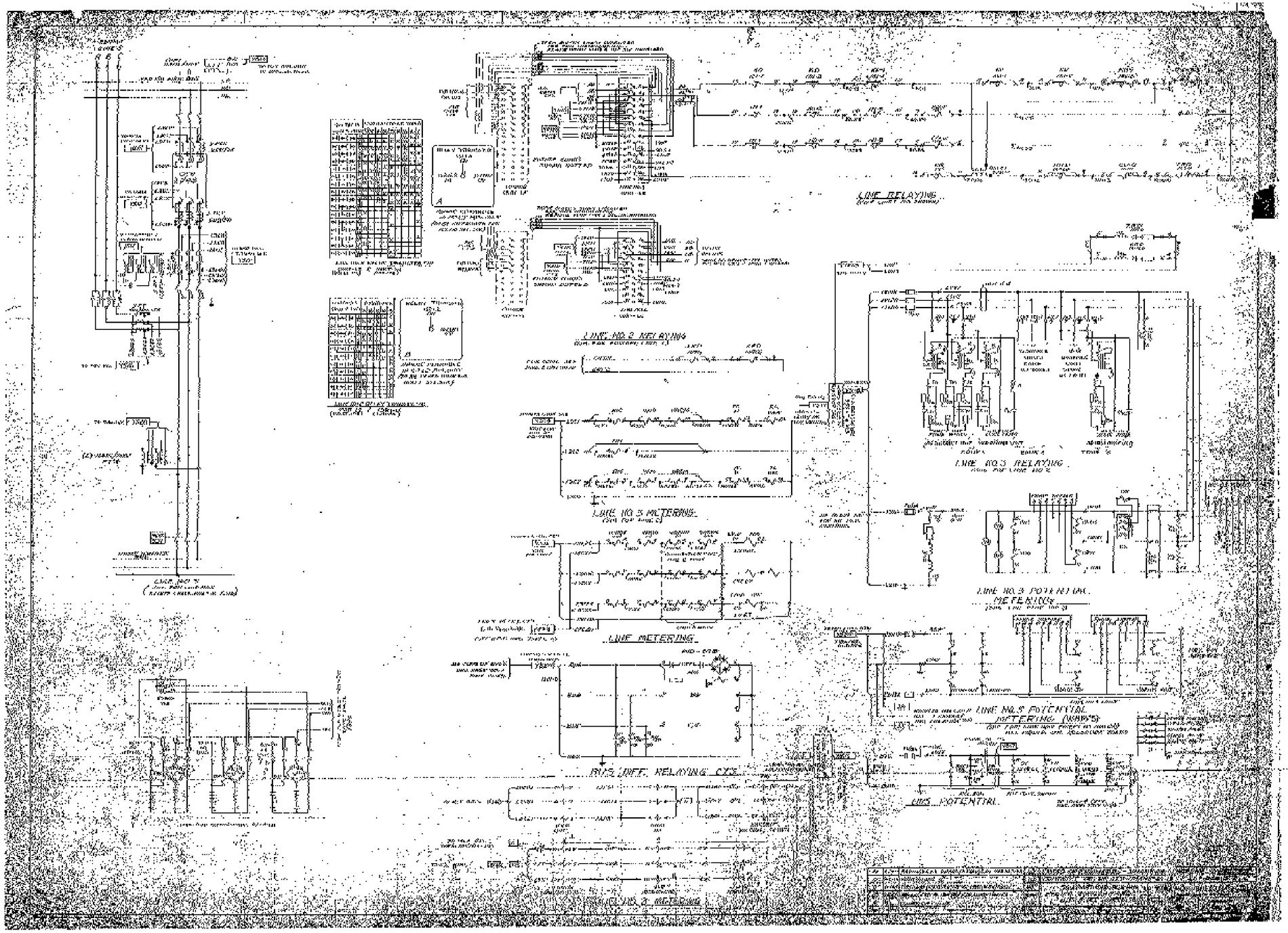

INFORMATION ONLY

SHEET 144

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
SCHEMATIC DIAGRAM
230 KV SWITCHYARD
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-36

SCALE: SHEET 00

13 Nov 2002
07:46:21

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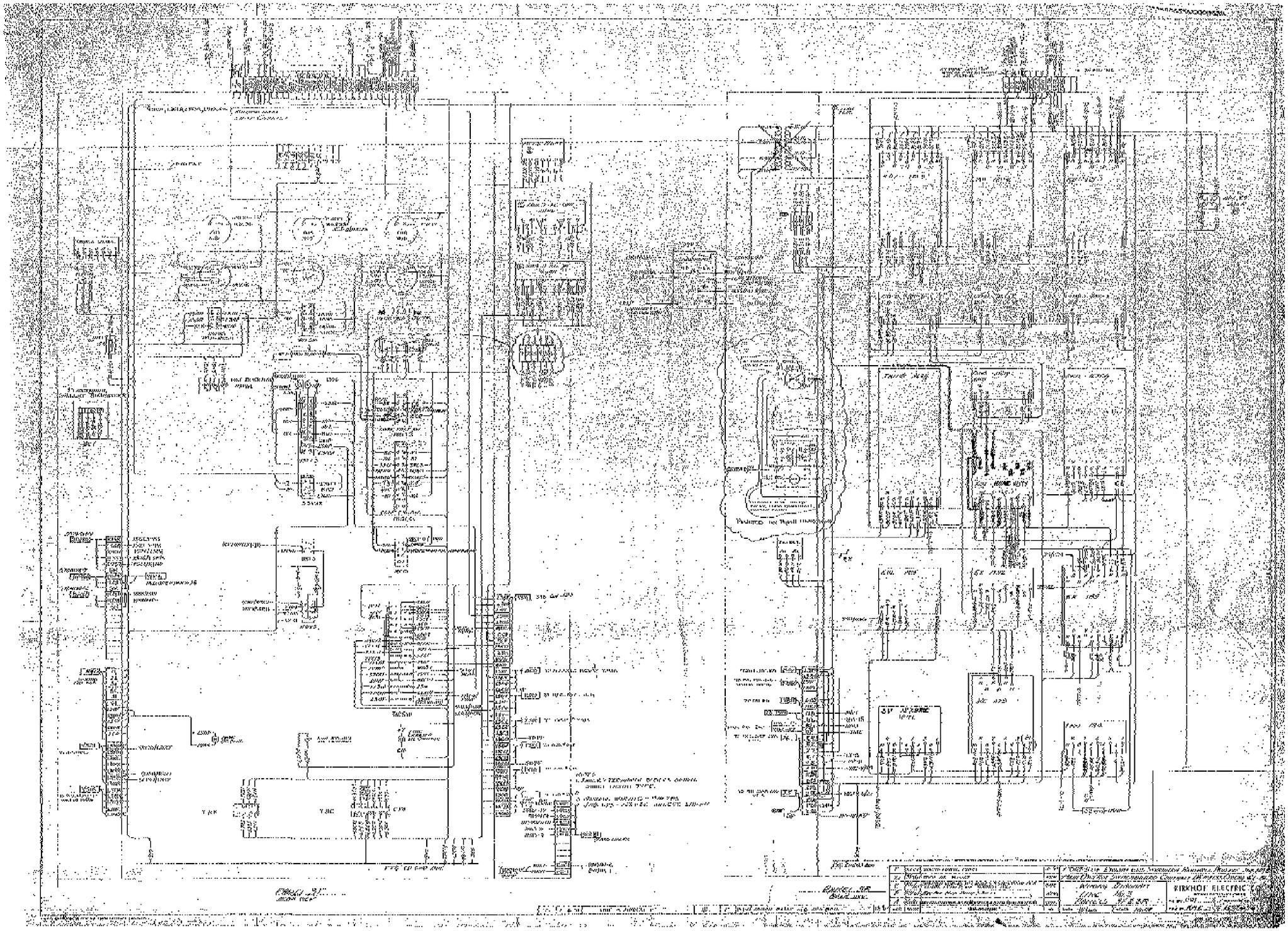

INFORMATION ONLY

SHEET 145

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
WIRING DIAGRAM LINE NO.3
PANELS 3F & 3R
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-37

SCALE: SHEET 00

13 Nov 2002
07:08:21

REF E1592-16_G.TIF E1592-16_G.DGN

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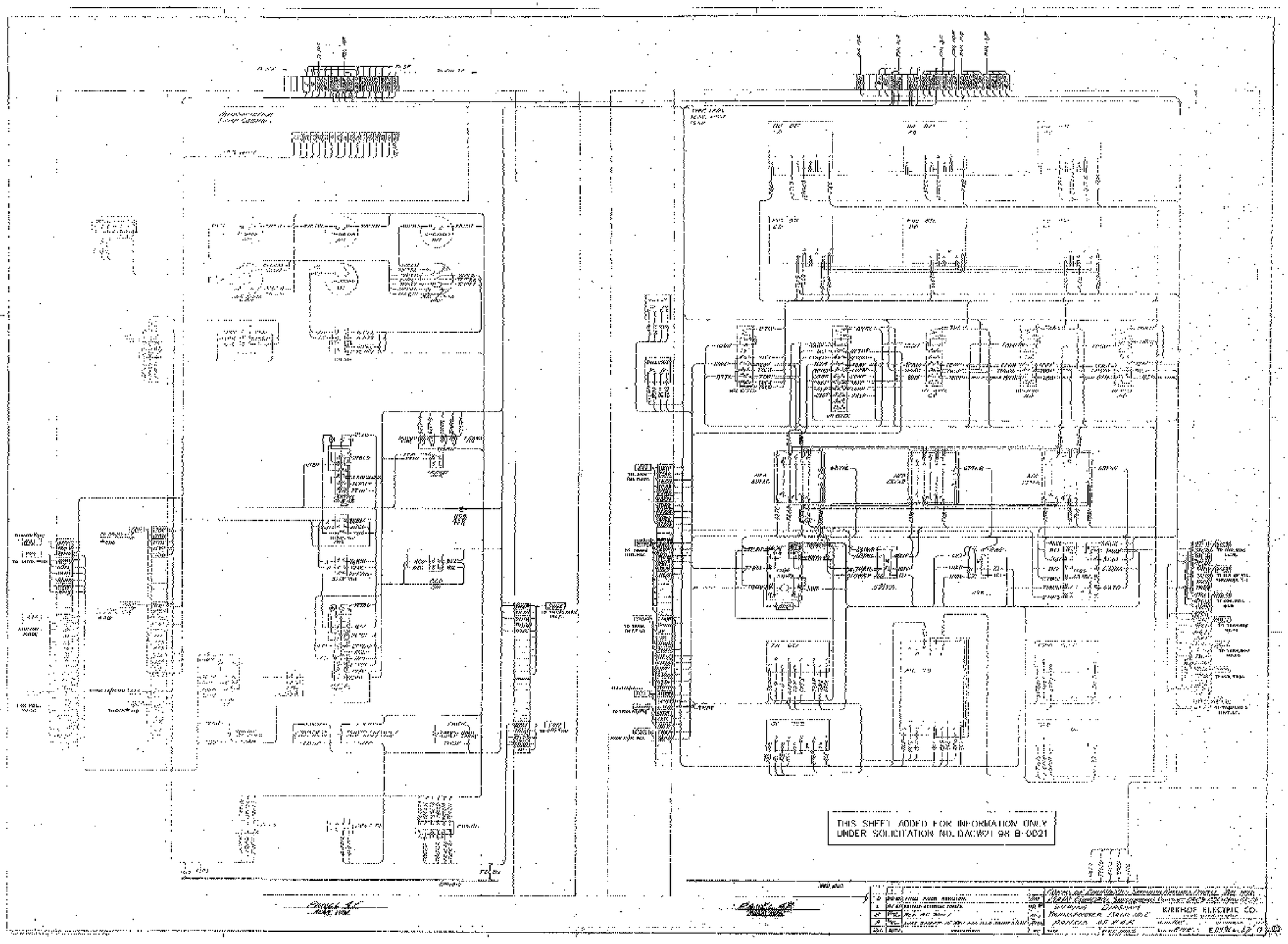

INFORMATION ONLY

SHEET 146

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
WIRING DIAGRAM TRANF. BANK NO.2
PANELS 4F & 4R
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-38

SCALE: SHEET 00

13 Nov 2002
07:48:42

REF E1592-17_D.TIF E1592-17_D.DGN

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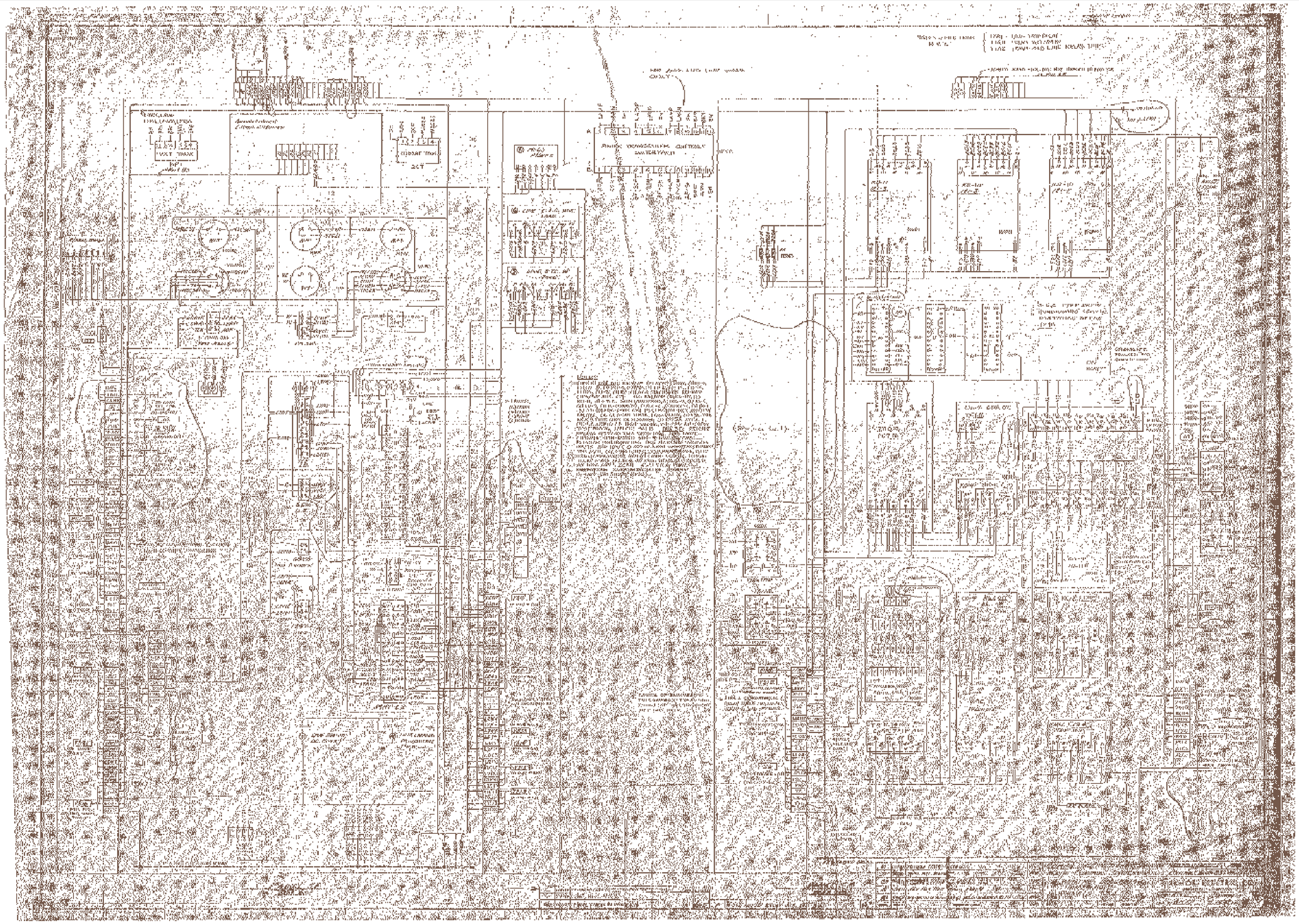

INFORMATION ONLY

SHEET 147

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
WIRING DIAGRAM LINE NO.2
PANELS 5F & 5R
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-39
SCALE:			SHEET 00

13 Nov 2002
07-4842

REF E1592-18_i.TIF

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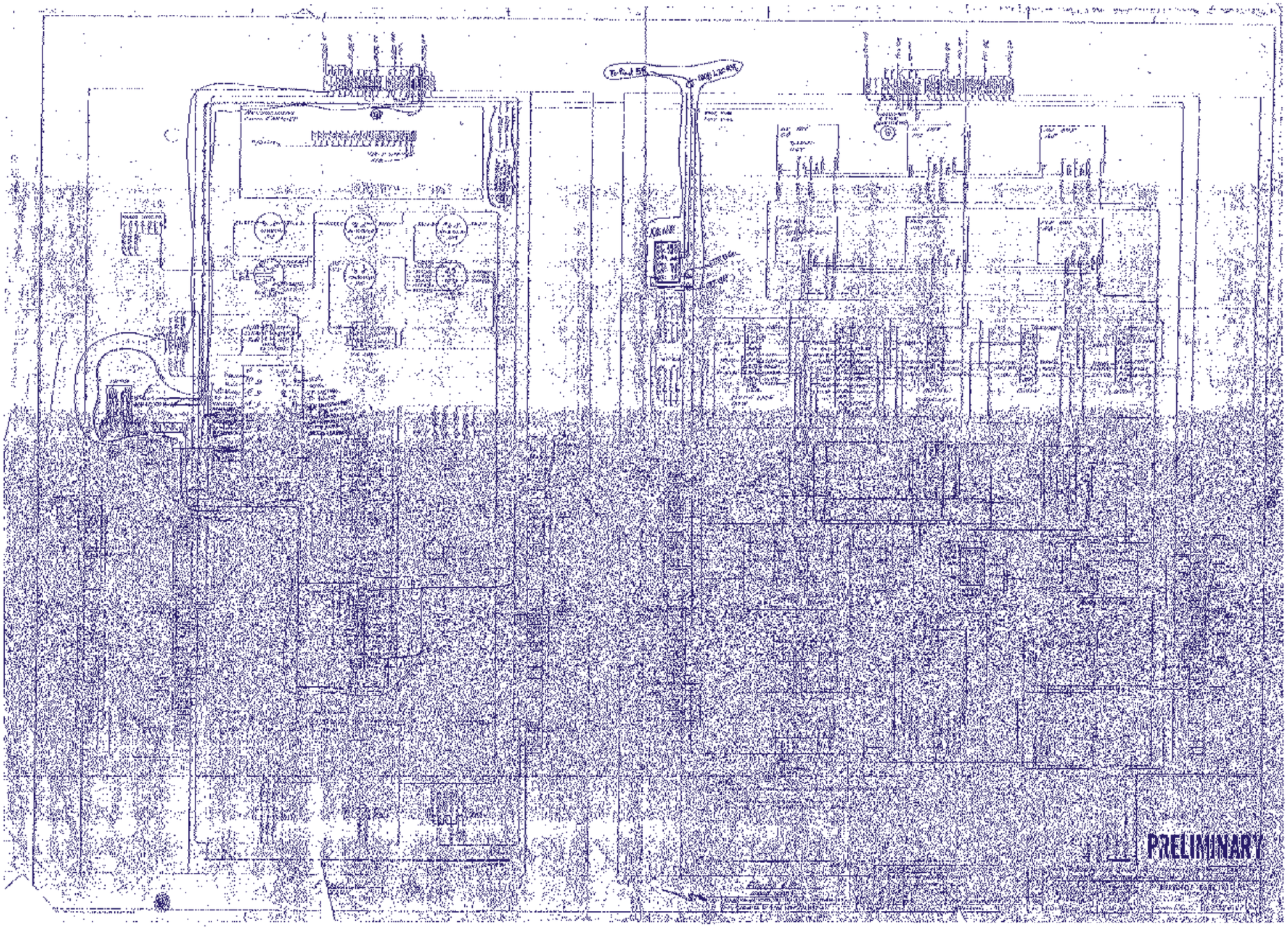
...\REFERENCES\e1592-18_i.dgn 03/24/2003 12:37:06 PM



INFORMATION ONLY

SHEET 148

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
WIRING DIAGRAM TRANF. BANK NO.1
PANELS 6F & 6R
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-40
SCALE:			SHEET 00

13 Nov 2002
07:48:42

REF E1592-19_G.TIF

E1592-19_G.DGN

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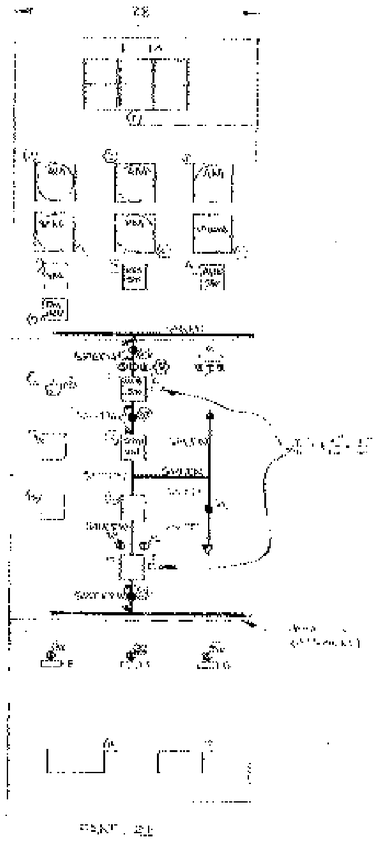

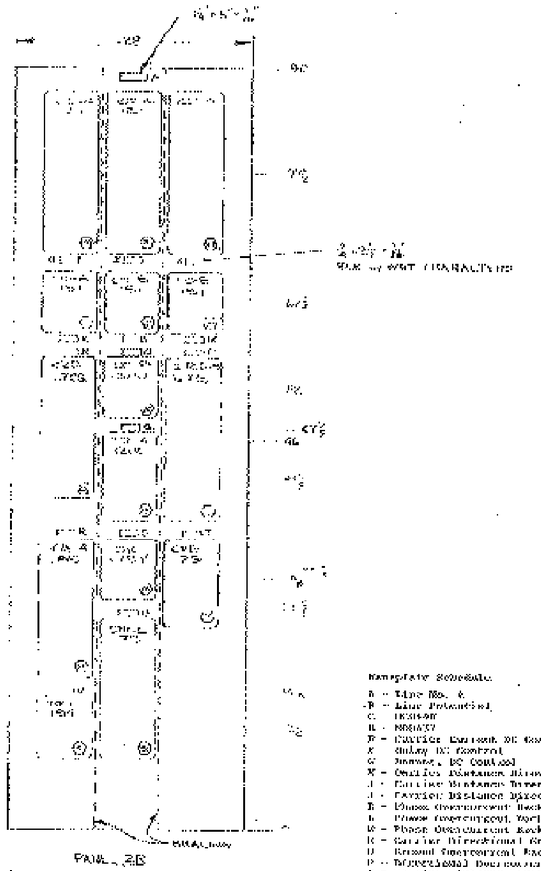

Nameplate Schedule

A - Type No. 6
B - Line Potential
C - 1638-9F
D - 8081A57
E - Carrier Current DC Control
F - Relay DC Control
G - Power, DC Control
H - Carrier Distance Directional Relay, 121 Zone 1
I - Carrier Distance Directional Relay, 121 Zone 2
J - Carrier Distance Directional Relay, 121 Zone 3
K - Phase Overcurrent Back up Relay 351, A Phase
L - Phase Overcurrent Back-up Relay 351, B Phase
M - Phase Overcurrent Back-up Relay 351, C Phase
N - Carrier Directional Ground Relay, 167DG
O - Ground Overcurrent Backup Relay, 151N
P - Directional Overcurrent Ground Relay, 167DG
Q - Carrier Distance Timing Relay, 121T
R - Carrier Distance Timing Relay, 165
S - Instantaneous Relay Auxiliary, 199T
T - Synchronism Check Relay, 325
U - Instruments Relay 178
V - Auxiliary Trippage Relay, 184

Item No.	Quantity req.	Note	Description	Manufacturer	Catalog or style number
1	1		Annunciator, Lamp type, 8 windows, "Alarm Panel"	Electro Devices	Electro-Devices Inc. 1700-1300
2	1		D.C. Voltmeter, 0-150VDC range, Type KS241	West Instruments	[illegible]
3	1		Voltmeter, 3Ø, 3W, 60cycle line to line use with 120/0-4VDC and 133,000/dt.9 volt PTs connected Y-Y. Scale marked (-) to (+) and (1) to 25000 of arms, Type HT241	West Instruments	[illegible]
4	1		A.C. Voltmeter, expanded scale, 4-20mA, for use with 133,000/dt.9 volt PTs. Connected Y-Y to 230kV Type HT241	West Instruments	Similar to [illegible]
5	1		Wattmeter 3Ø, 3W, 480 0-480 mAdc scale for use with 120/0-5 CTs and 133,000/dt.9 PTs, Y-Y. Scale to read load (-) - 0 - (+) Left to right Type HT241 (with P.F.T.)	West Instruments	[illegible]
6	1		Milliammeter 0 300 mA DC Type HT241	West Instruments	[illegible]
7	1		Voltmeter 0-3V, 3W broken handle, Type K	Hoffman Engineering	[illegible]
8	1		Control switch, 7-stage, maintained, "Point Off-Point Remote Off" handle, Type W (See Note.)	West Instruments	[illegible]
9	2		Telephone Jack assembly	West Instruments	[illegible]
10	2		Carrier Test Receptacle with T.C.C. contact block. Ground plate mounted. "Carrier Test"	West Instruments	[illegible]
11	1		TM Control Sw. Type K, 2-stage, Not Rev.T. 220mV time to D.C.B. Control Switch	West Instruments	[illegible]
12	1		Indication Light, 120Vac, Type RX-6, white lens	General Electric	[illegible]
13	1		Carrier "On Off" switch, 2-position, 2D-stage, Type W	West Instruments	[illegible]
14	1		Synchronizing Switch, 2-stage, Type W	West Instruments	[illegible]
15	1		Recloser "Non-OFF" sw., 2-position, 4-stage, Type W	West Instruments	[illegible]
16	3		N.O.B. Momentary sw., 2-stage, "Off-On" spring return to "OFF", handle removable in "OFF" position with removable Seal Ring Up, Type W	West Instruments	Similar to [illegible]
17	1		N.O. Momentary Control sw., 3-stage, maintained, pistol grip handle, Type W	West Instruments	[illegible]
18	1		Test Block, 6-pole, Type FK-2	General Electric	[illegible]
19	1		Test Block, 4-pole, Type FK-2	General Electric	[illegible]
20	2		Distance Relay 0.75-20 ohms, 120V, 60 cycles, [illegible]	West Instruments	[illegible]
21	1		Distance Relay 0.35-20 ohms, 120V, 60 cycles, [illegible] Type HM-1	West Instruments	[illegible]
22	3		Overcurrent Phase Relays, 4-12 amperes inverse time and 10-40 amperes instantaneous, Type CO-8	West Instruments	[illegible]
23	1		Carrier Directional Ground Relay 0.5-2 amp. Range, Type KRD	West Instruments	[illegible]
24	3		Overcurrent ground relay, 0.5-2.5 amperes inverse time trip and 10-40 amperes instantaneous trip, Type CO-8	West Instruments	[illegible]
25	1		Timing relay, 0-3 seconds, 48/125/250 vdc Type TD-A	West Instruments	[illegible]
26	1		Directional Ground Backup Relay 0.5-2.5A inverse trip and 10-40 amp. Instantaneous trip, KRD-5	West Instruments	[illegible]
27	1		Carrier aux. relay, 125 VDC, Type AR-A	West Instruments	[illegible]
28	2		Selective reclosing relay, 2 amp DC operate coil, 120VAC reset coil, Type SR	West Instruments	[illegible]
29	1		Synchronism verifier relay, 125 volts, 60 cycles, Type CVE-1	West Instruments	[illegible]
30	1		Type TR-2 aux. trip relay, 1 amp, DC with 20 ohm resistor, 3D4490	West Instruments	[illegible]
31	1		Reclosing relay, 125VDC, Type UBC	West Instruments	[illegible]
32	4		Timer, 0-60 sec, 120Vac, 60-8, 2 screws, 8-32, Type [illegible]	General Electric	[illegible]
33	4		Normally open test block Disconnect switches.	UEC	
34	3		Phase shifting transformers Type 2W832	W.D.C.	[illegible]
35	1		Phase shifting transformers Type [illegible]	W.D.C.	[illegible]
36	3		Alarm Relay, 125VDC, Front connection with power	W.D.C.	[illegible]
37	3		Alarm Relay, 12, 2 [illegible]	W.D.C.	[illegible]
38	3		Auxiliary Relay, 125V DC type DG, front connection with power	W.D.C.	[illegible]
39	3		Static Tripping Unit, Type VAR [illegible] DC	W.D.C.	[illegible]
40	3		Thermal Converter type CR10	Sensitron	[illegible]
41	3		Thermal Converter, type CR10	Sensitron	[illegible]

Notes:
1. Control voltage - 125VDC
2. Enclosures - 11 ga. CRC, to be built as shown on Wiring Diag. Dr. Dwg. No. XY 261 Sheet 6
3. Finish - ASA 26, 62 light gray
4. Wire - #12 Tyon GLF, #18 wire for CT circuits
5. Terminal Blocks - Sorts 12 Size
6. Lugs - T.T.C., ring type, insulated
7. Nameplates - 1/16" Plexi 6025 Laminate, Black with white letters

Rev. No.	Date	Description
7	[illegible]	[illegible]
6	[illegible]	[illegible]
5		REV AS BUILT
4	6-26-80	REVISED TO 1MAR TYPICAL WIRING
3	6-3-80	CHANGED TO "SAVANNAH" TO "GEORGIA"
2	6-27-80	REVISED PER [illegible]
1	[illegible]	REV PER DWG. [illegible]

UNIT ELECTRIC CONTROL, INC.
ORLANDO FLORIDA

HUPE, JOHN C.P.
NO. 4 LINE RELAY PANEL
HARTWELL HYDRO PLANT
HARTWELL, GEORGIA

Drawn: [illegible]
Design: [illegible]
Checked: [illegible]
Project Eng.: [illegible]
Reference Dwg. 7569C-1

B.O. NO. 7569

INFORMATION ONLY

SHEET 149

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

NO. 4 LINE RELAY PANEL

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-41
SCALE:			SHEET 00

13 Nov 2002
07:42:42

REF 7569C-1_7.TIF 7569C-1_7.DGN

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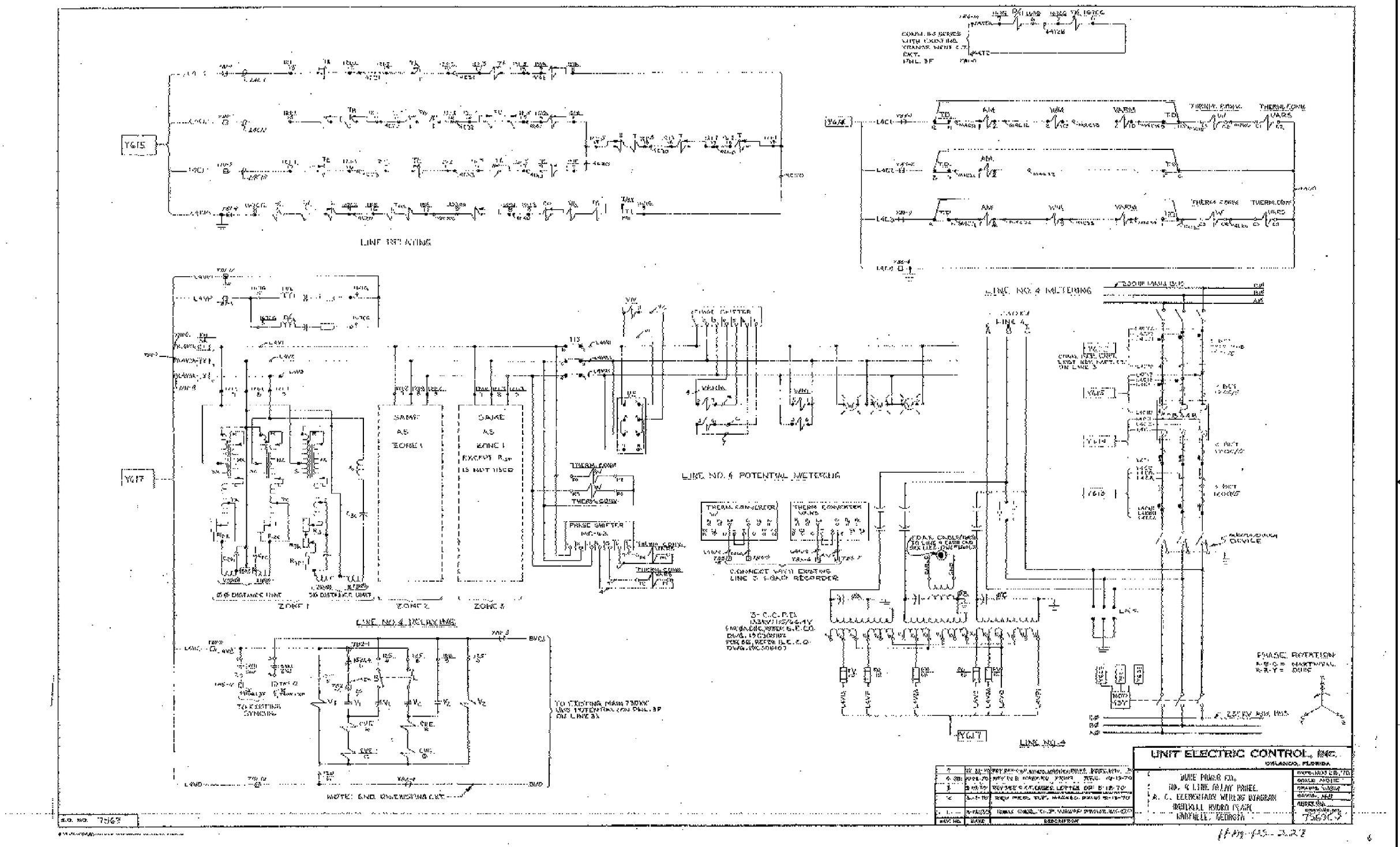

INFORMATION ONLY

SHEET 150

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
NO.4 LINE RELAY PANEL
A.C. ELEM. WIRING DIAGRAM
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-42

SCALE: SHEET 00

REF 7569C-2_5.TIF 7569C-2_5.DGN

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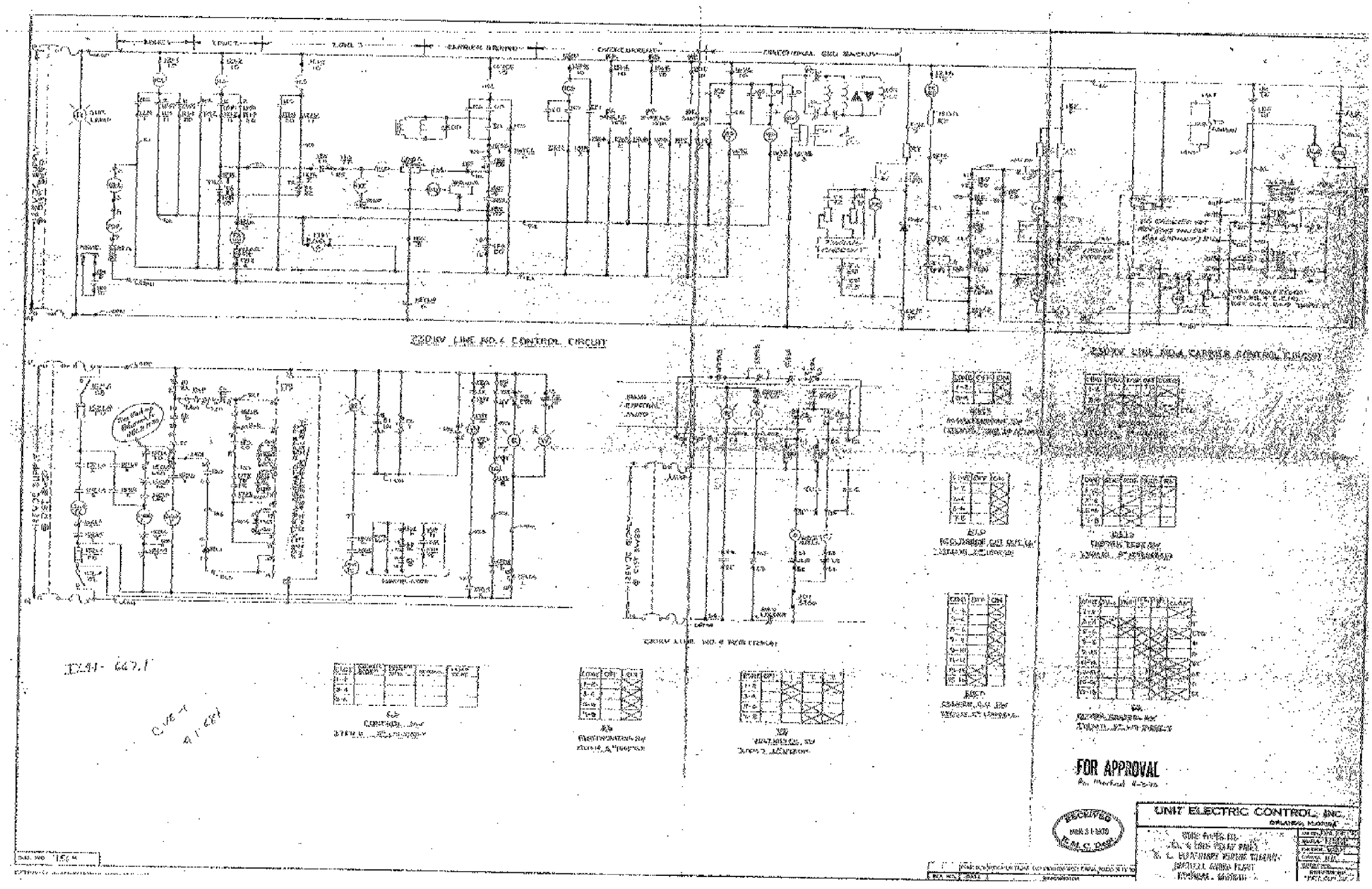

INFORMATION ONLY

SHEET 151

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
NO. 4 LINE RELAY PANEL
D.C. ELEM. WIRING DIAGRAM
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-43
SCALE:		SHEET 00	

REF 7569C-3_1.TIF 7569C-3_1.DGN

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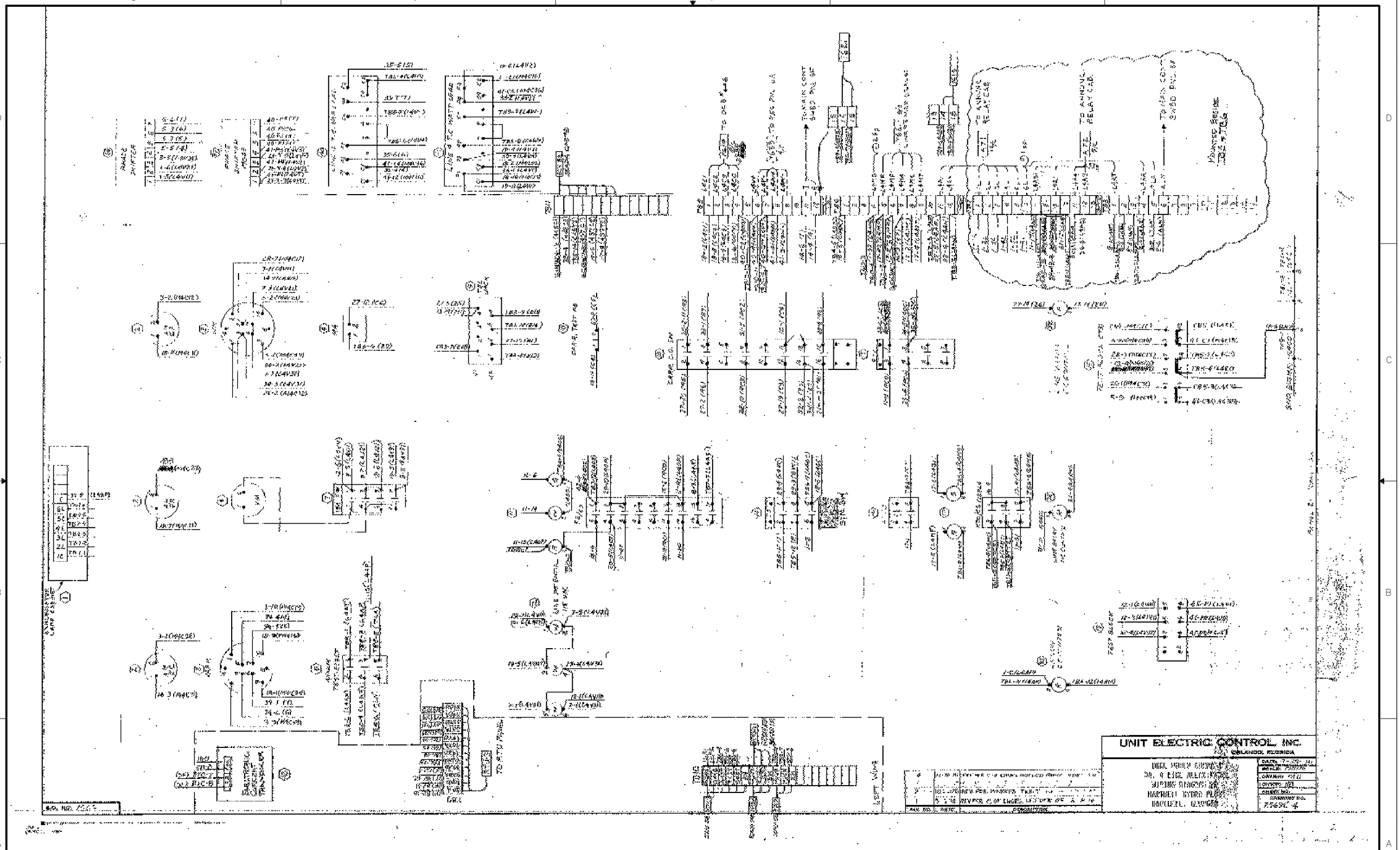

INFORMATION ONLY

SHEET 152

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
NO.4 LINE RELAY PANEL
WIRING DIAGRAM 2F
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-44

SCALE: | SHEET 00

13 Nov 2002
07:40:42

REF 7569C-4_4.TIF 7569C-4_4.DGN

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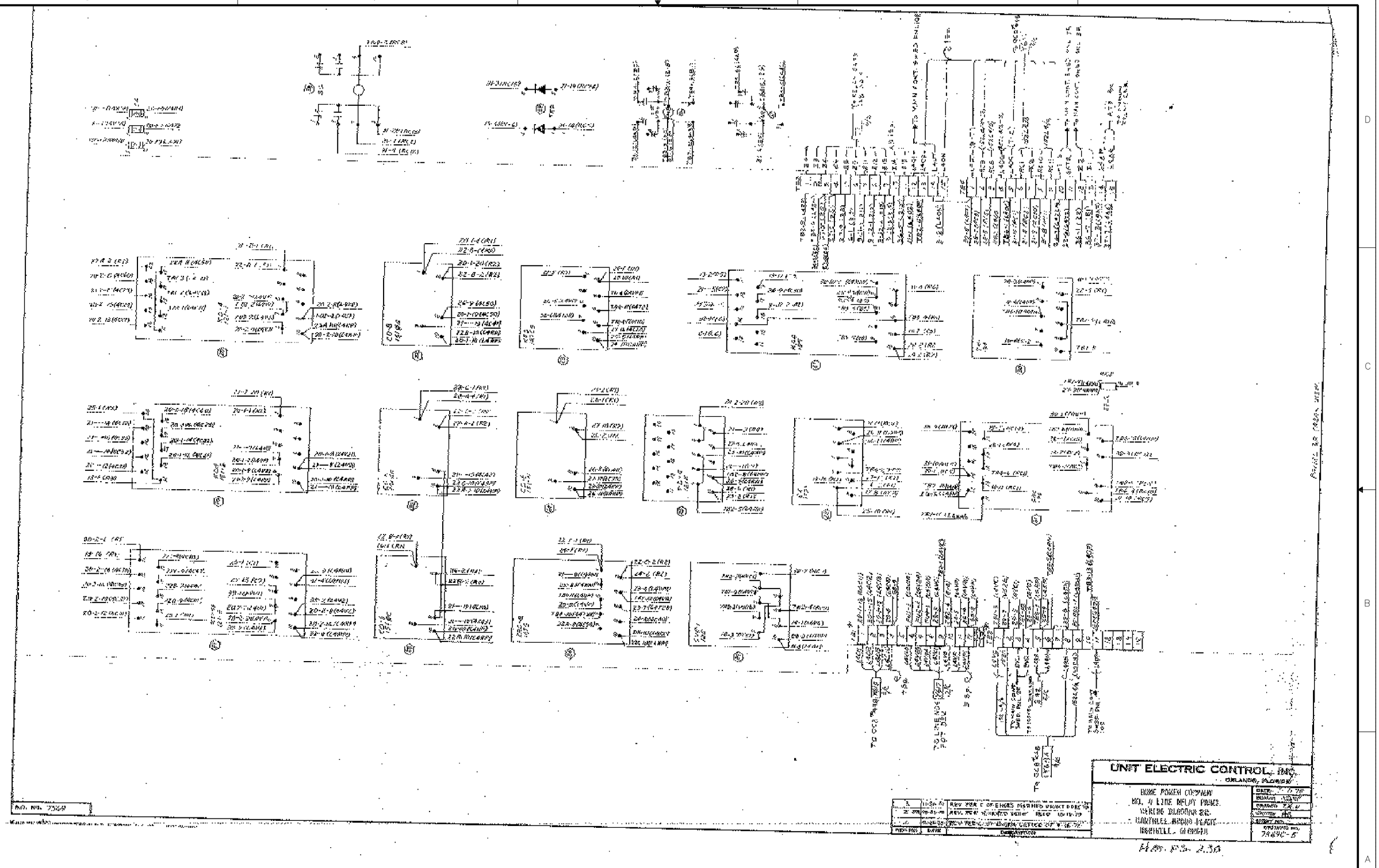

INFORMATION ONLY

SHEET 153

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
NO.4 RELAY PANEL
WIRING DIAGRAM 2R
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-45

SCALE: SHEET 00

REF 7569C-5_3.TIF 7569C-5_3.DGN

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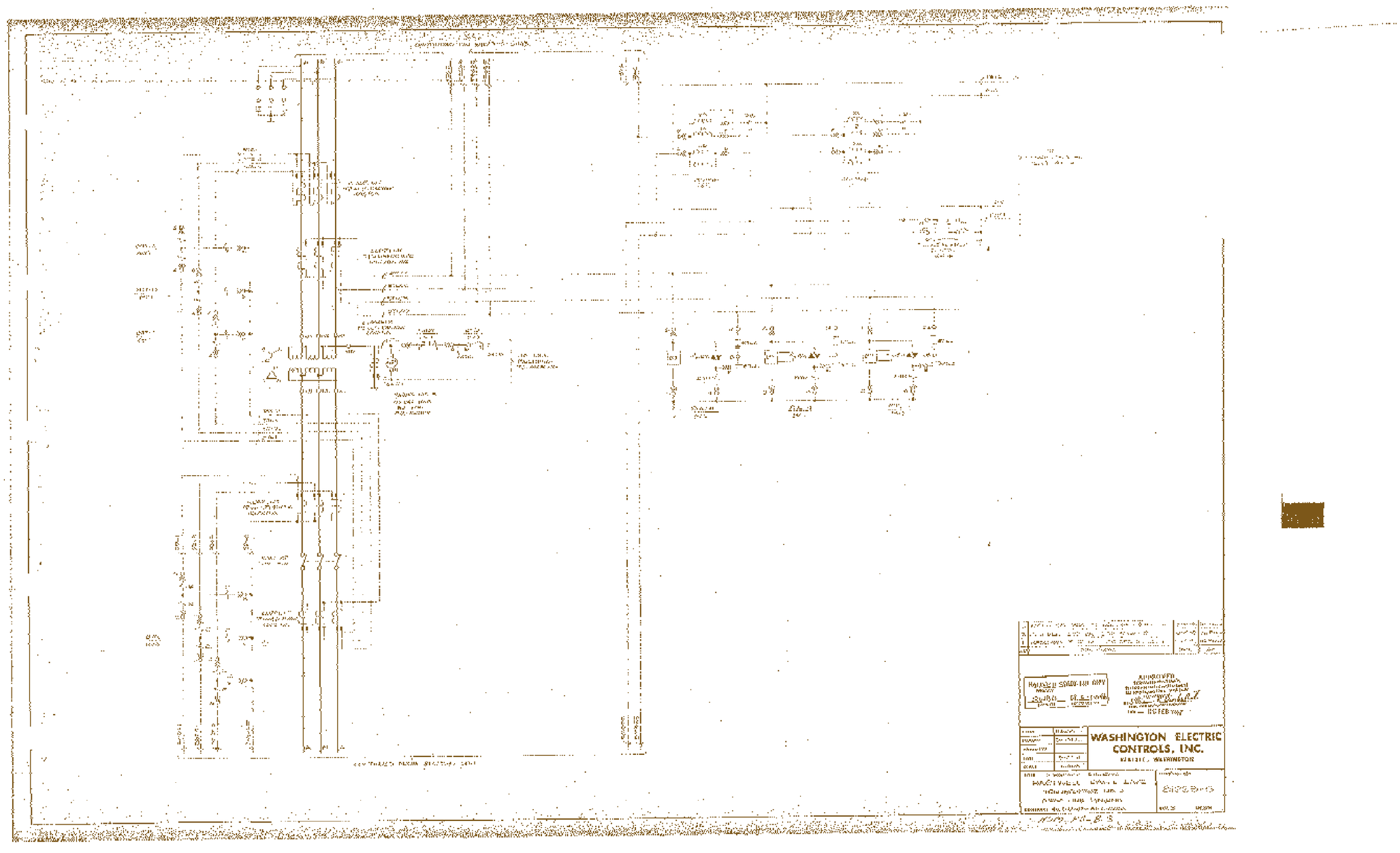

INFORMATION ONLY

SHEET 154

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
TRANSFORMER NO. 3
THREE LINE DIAGRAM
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-46

SCALE: SHEET 00

13 Nov 2002
07:48:21

REF 81223-S2_3.TIF 81223-S2_3.DGN

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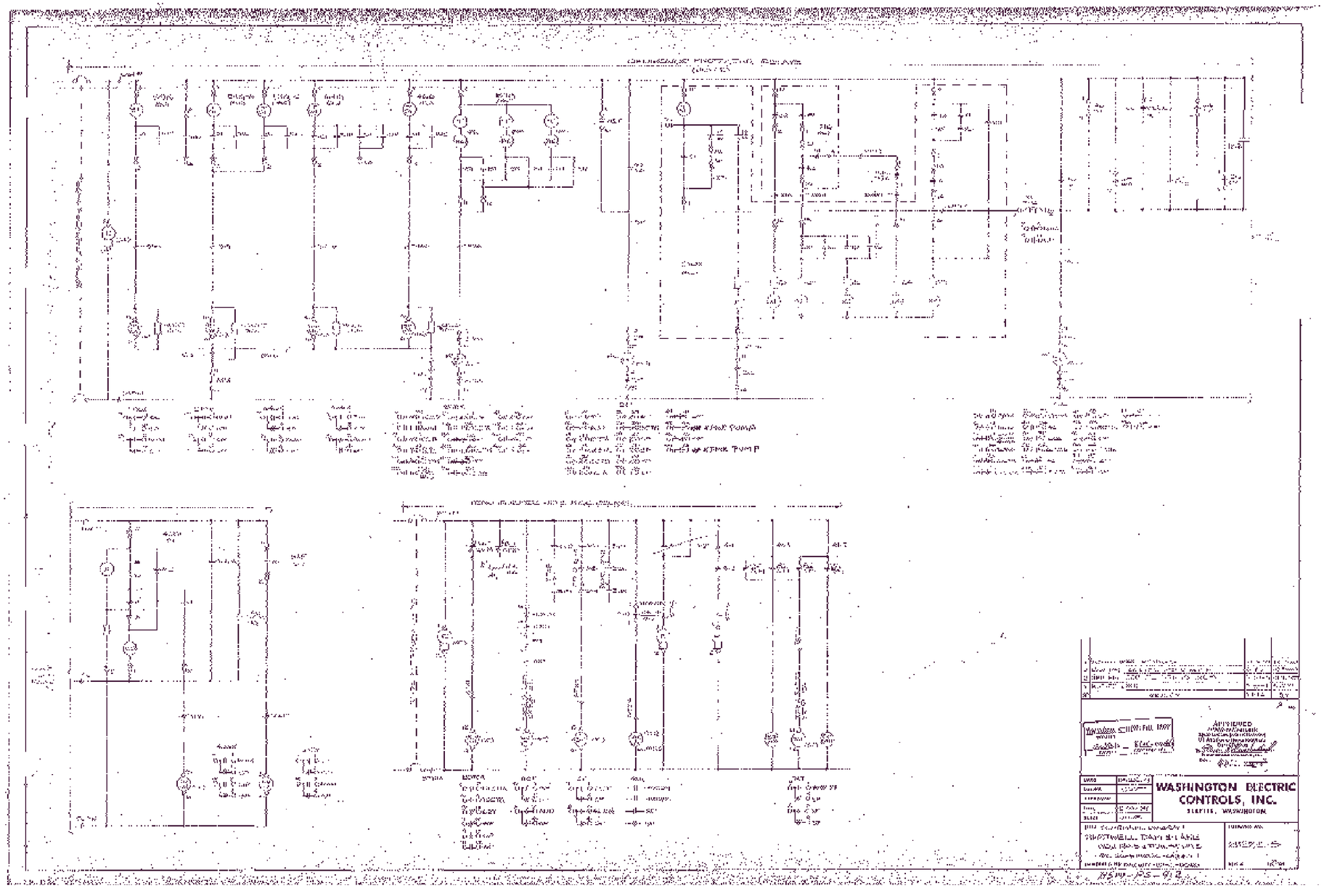

INFORMATION ONLY

SHEET 155

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
GEN NO. 5 & TRANF. NO. 3
DC SCHEMATIC-SHEET 1
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-47

SCALE: SHEET 00

REF 81223-S3_4.TIF 81223-S3_4.DGN

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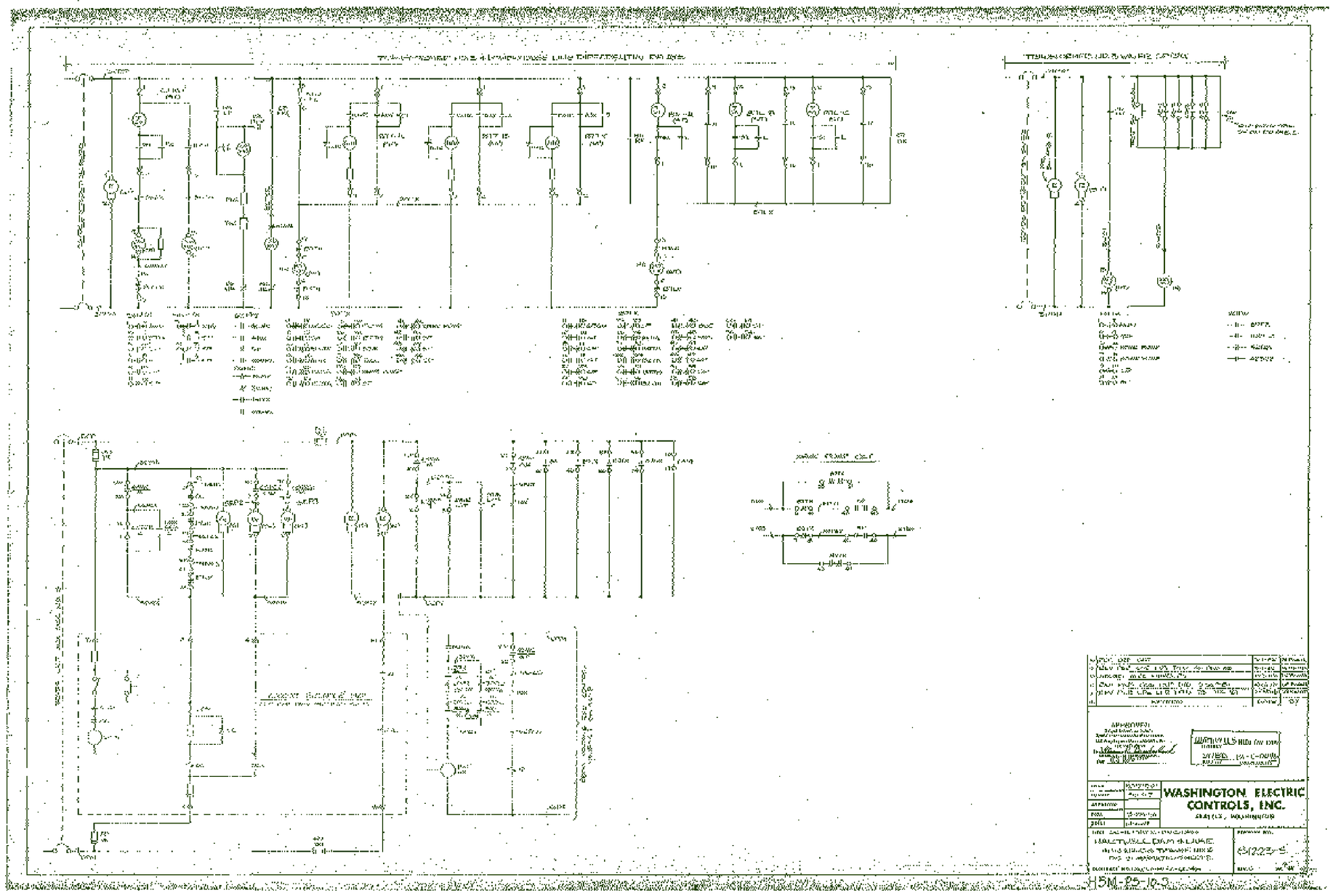

INFORMATION ONLY

SHEET 156

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
GEN NO.5 &TRANSF. NO.3
DC SCHEMATIC SHEET 2
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-48

SCALE: SHEET 00

13 Nov 2002
07:58:41

REF 81223-S4_5.TIF 81223-S4_5.DGN

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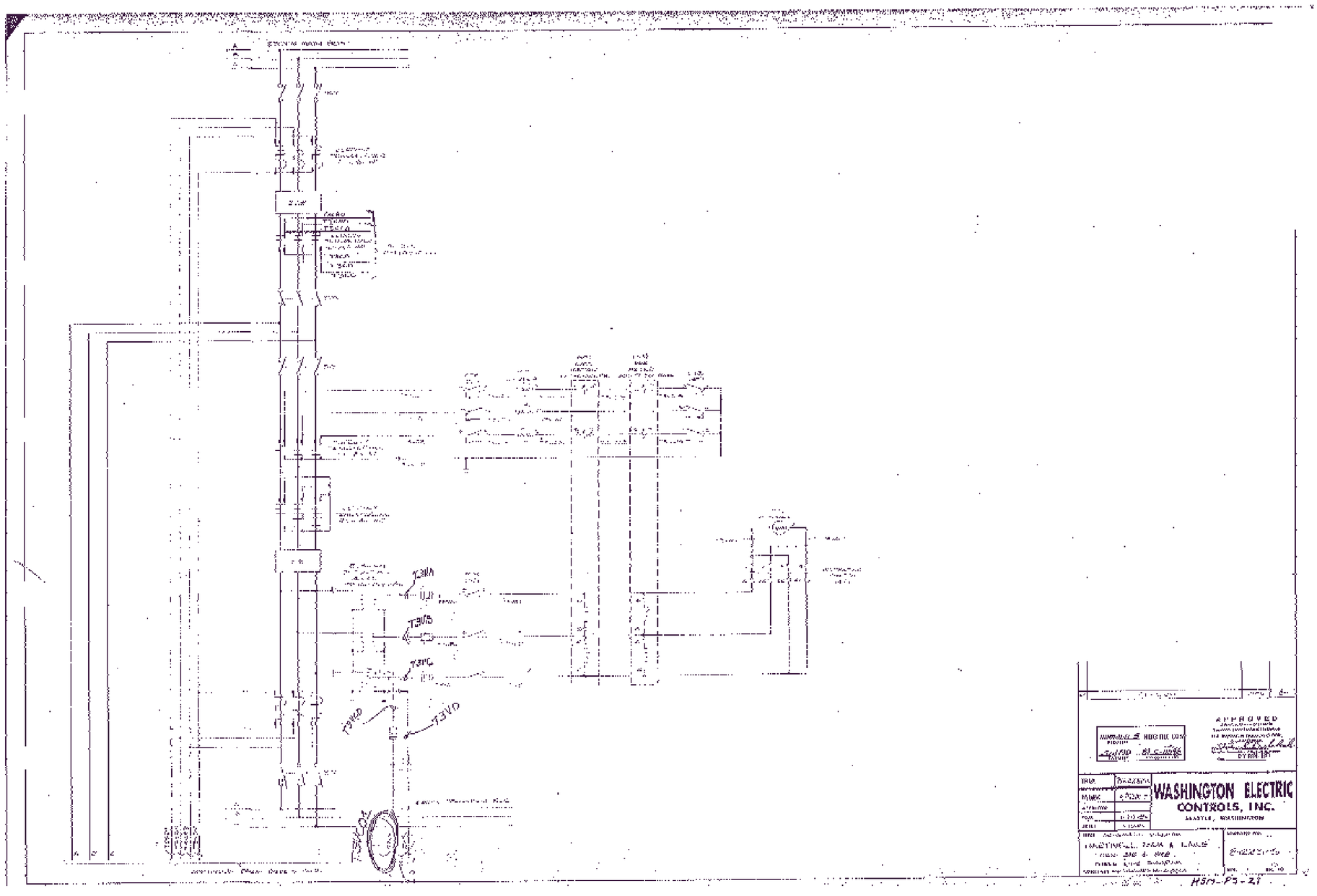

INFORMATION ONLY

SHEET 157

HYDROELECTRIC DESIGN CENTER PORTLAND, OR		U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA
HARTWELL MAJOR REHABILITATION - PHASE 2 HARTWELL DAM AND LAKE SWITCHYARD OCB 318 & 328 THREE LINE DIAGRAM SAVANNAH RIVER GEORGIA AND S. CAROLINA		
SIZE F	INVITATION NO.	FILE NO. HAR0157	PLATE R-49
SCALE:		SHEET 00	

REF 81223-S13_0.TIF 81223-S13_0.DGN

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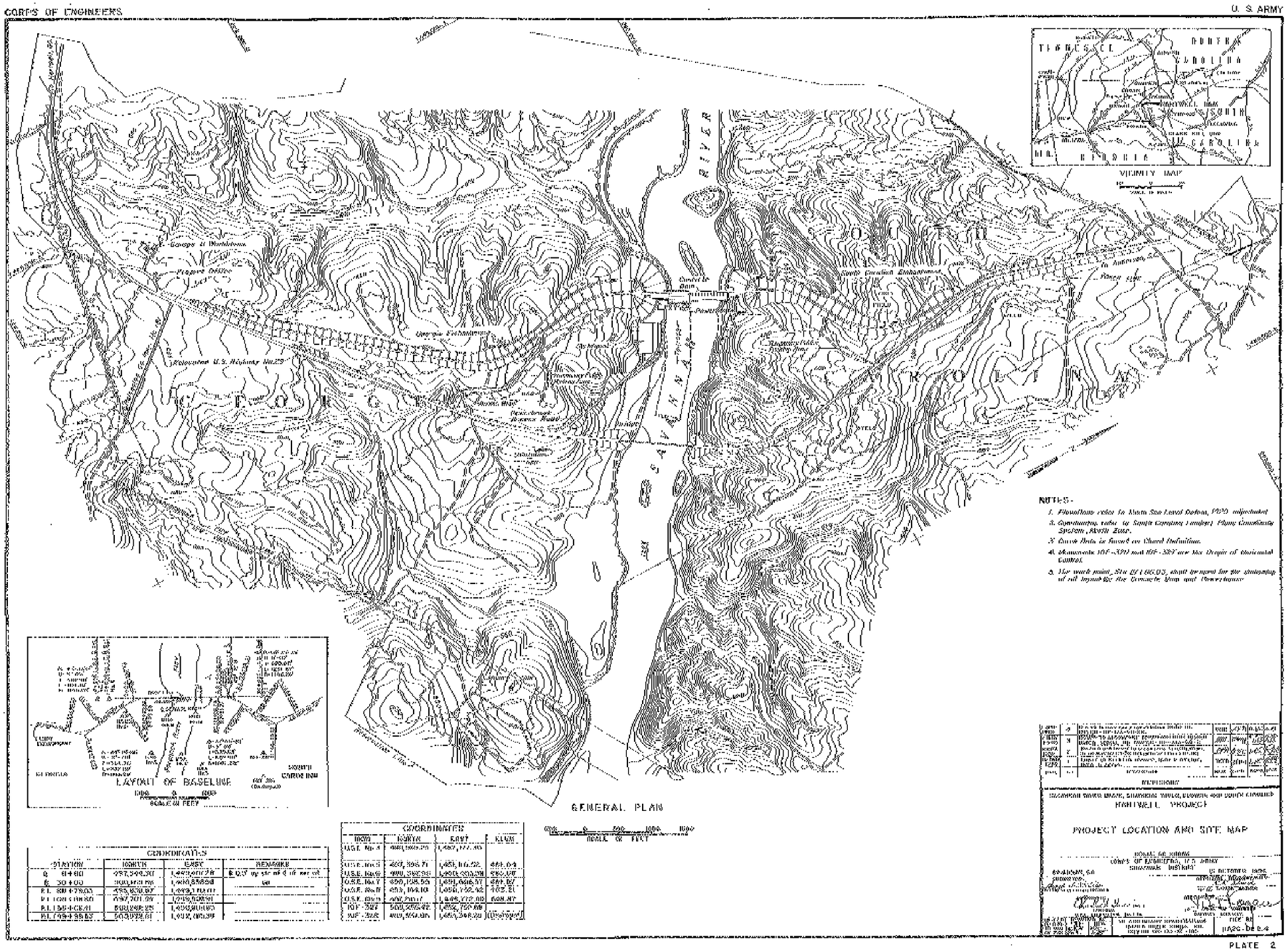
CORPS OF ENGINEERS

U. S. ARMY



COORDINATES			
STATION	NORTH	EAST	REMARKS
0 + 00	957,349.20	1,499,000.78	
30 + 00	1,000,000.00	1,499,000.00	
P.I. 80+79.00	1,029,630.87	1,499,1[illegible]	
P.I. 108+00.00	1,057,701.59	1,499,[illegible]	
P.I. 158+00.91	1,107,[illegible]	1,499,[illegible]	
P.I. 199+98.82	1,147,[illegible]	1,499,[illegible]	

COORDINATES			
NOW	NORTH	EAST	ELEV.
U.S.E. No. 3	[illegible]	1,[illegible]	[illegible]
U.S.E. No. 5	1,[illegible]	1,[illegible]	[illegible]
U.S.E. No. 6	[illegible]	1,[illegible]	[illegible]
U.S.E. No. 7	[illegible]	1,[illegible]	[illegible]
U.S.E. No. 8	[illegible]	1,[illegible]	[illegible]
U.S.E. No. 9	[illegible]	1,[illegible]	[illegible]
10F-3W	[illegible]	1,[illegible]	[illegible]
10F-3W	[illegible]	1,[illegible]	[illegible]

INFORMATION ONLY

SHEET 158

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
PROJECT LOCATION AND SITE MAP

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-50

SCALE: SHEET 00

REF HA2-C022_4.TIF HA2C-022_4.DGN

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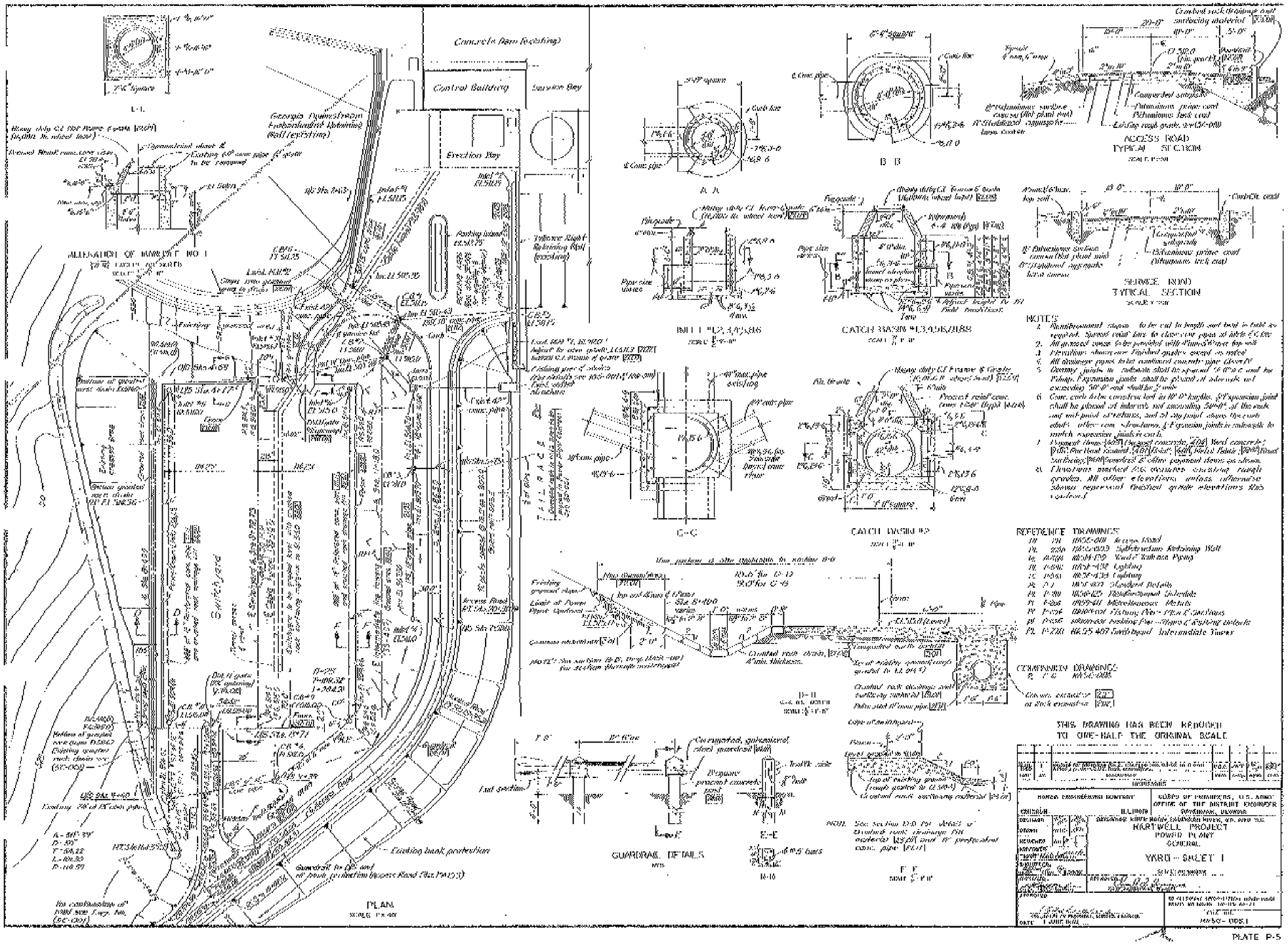

INFORMATION ONLY

SHEET 159

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
GENERAL , YARD - SHEET 1

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-51
SCALE:			SHEET 00

REF HA5-C005_1.TIF HA5C-005_1.DGN

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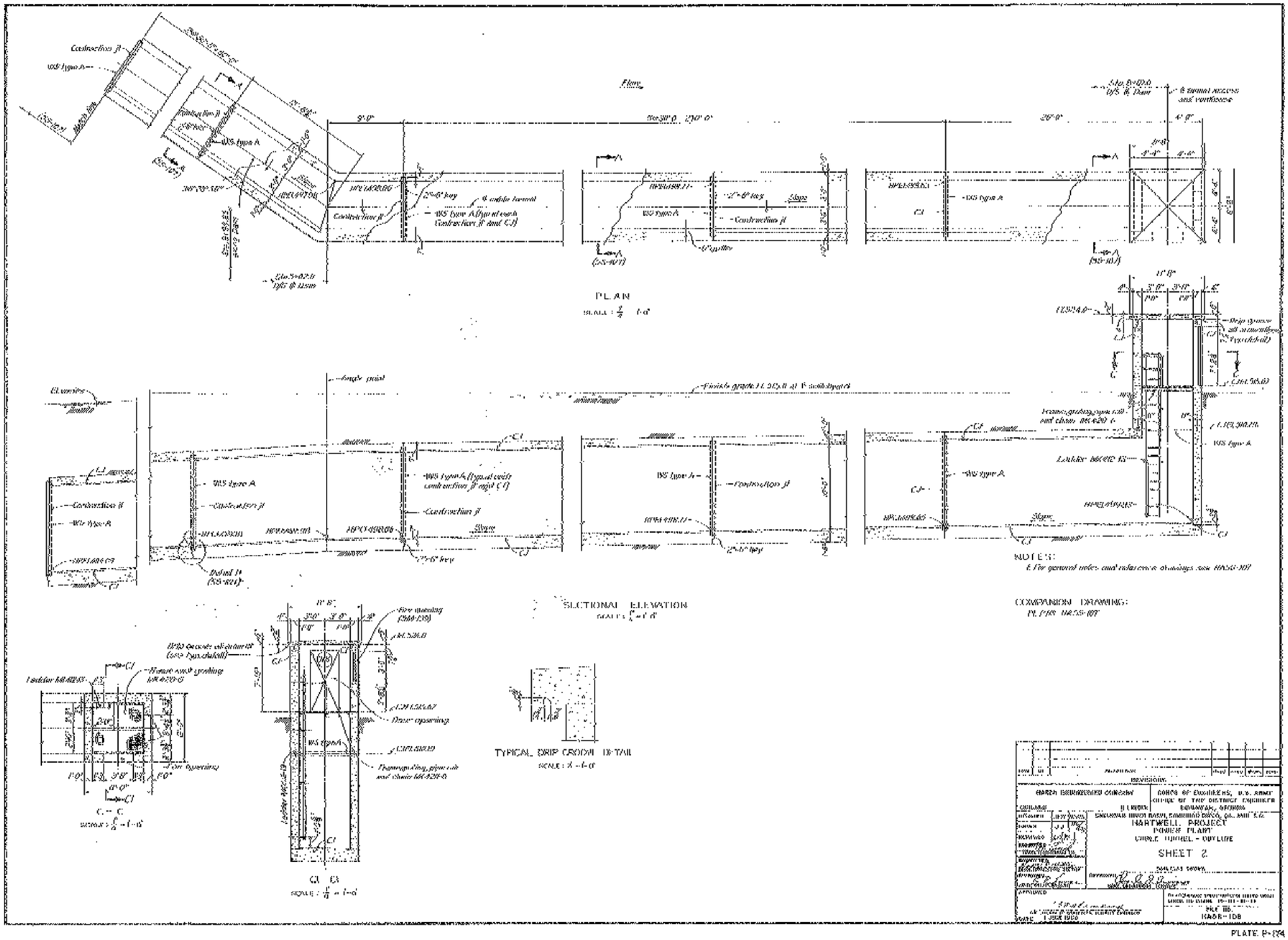
CORPS OF ENGINEERS U. S. ARMY



INFORMATION ONLY

SHEET 160

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
CABLE TUNNEL-OUTLINE
SHEET 2
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-52

SCALE: SHEET 00

REF HA5S-108.TIF HA5S-108.DGN

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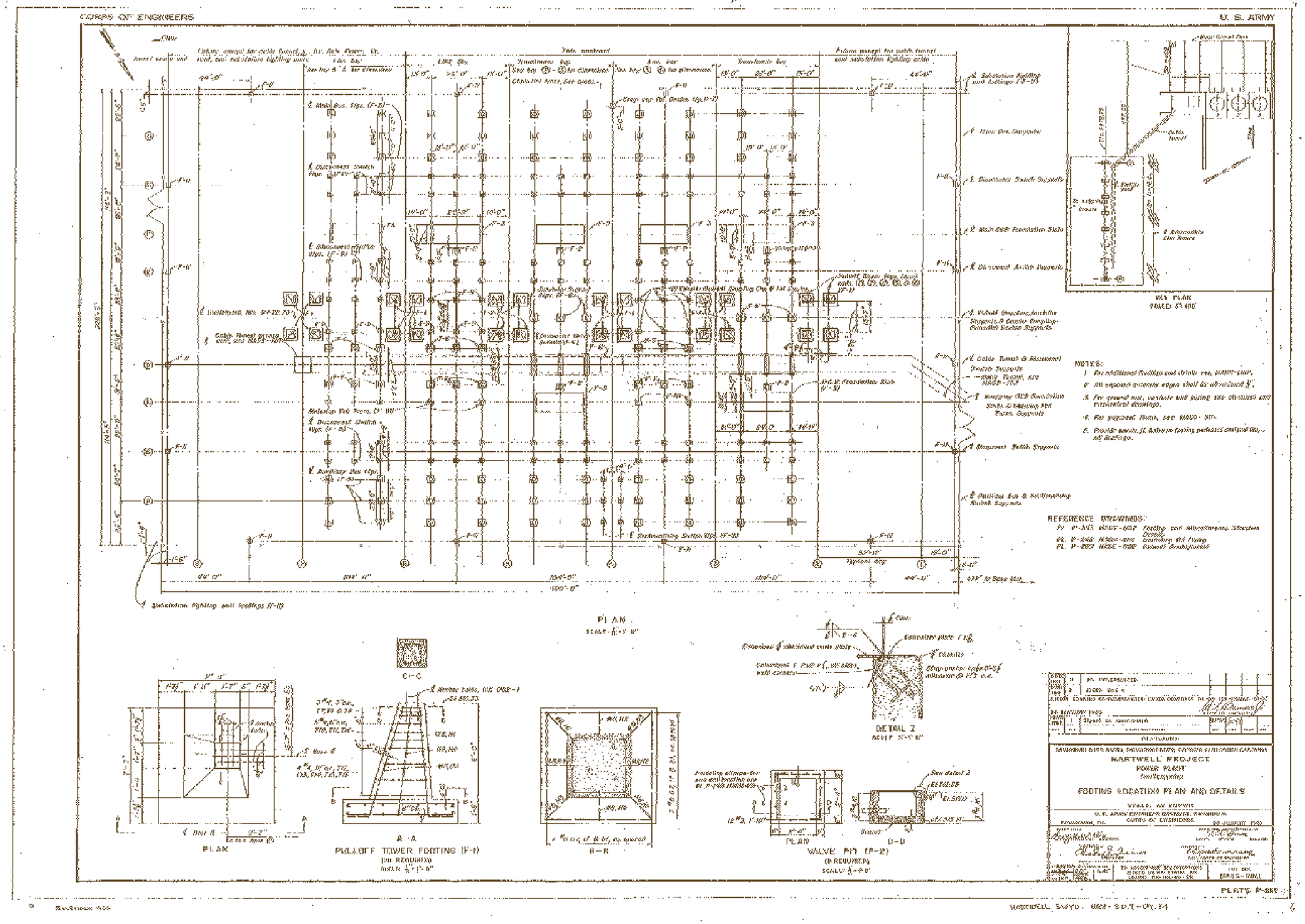

INFORMATION ONLY

SHEET 161

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
FOOTING LOCATION PLAN
AND DETAILS
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-53
SCALE:		SHEET 00	

REF HA6S-001_1.TIF HA6S-001_1.DGN

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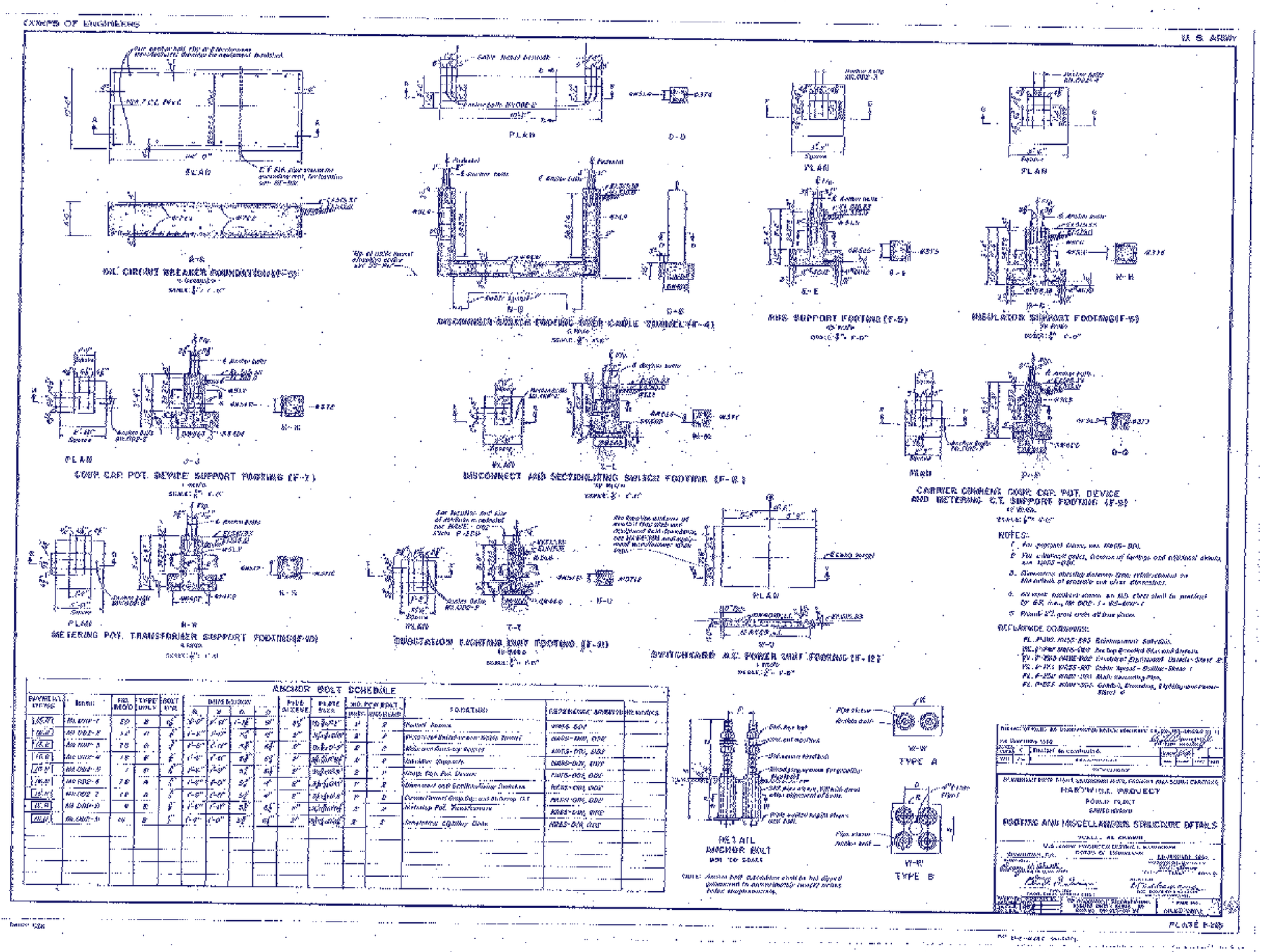


INFORMATION ONLY

SHEET 162

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

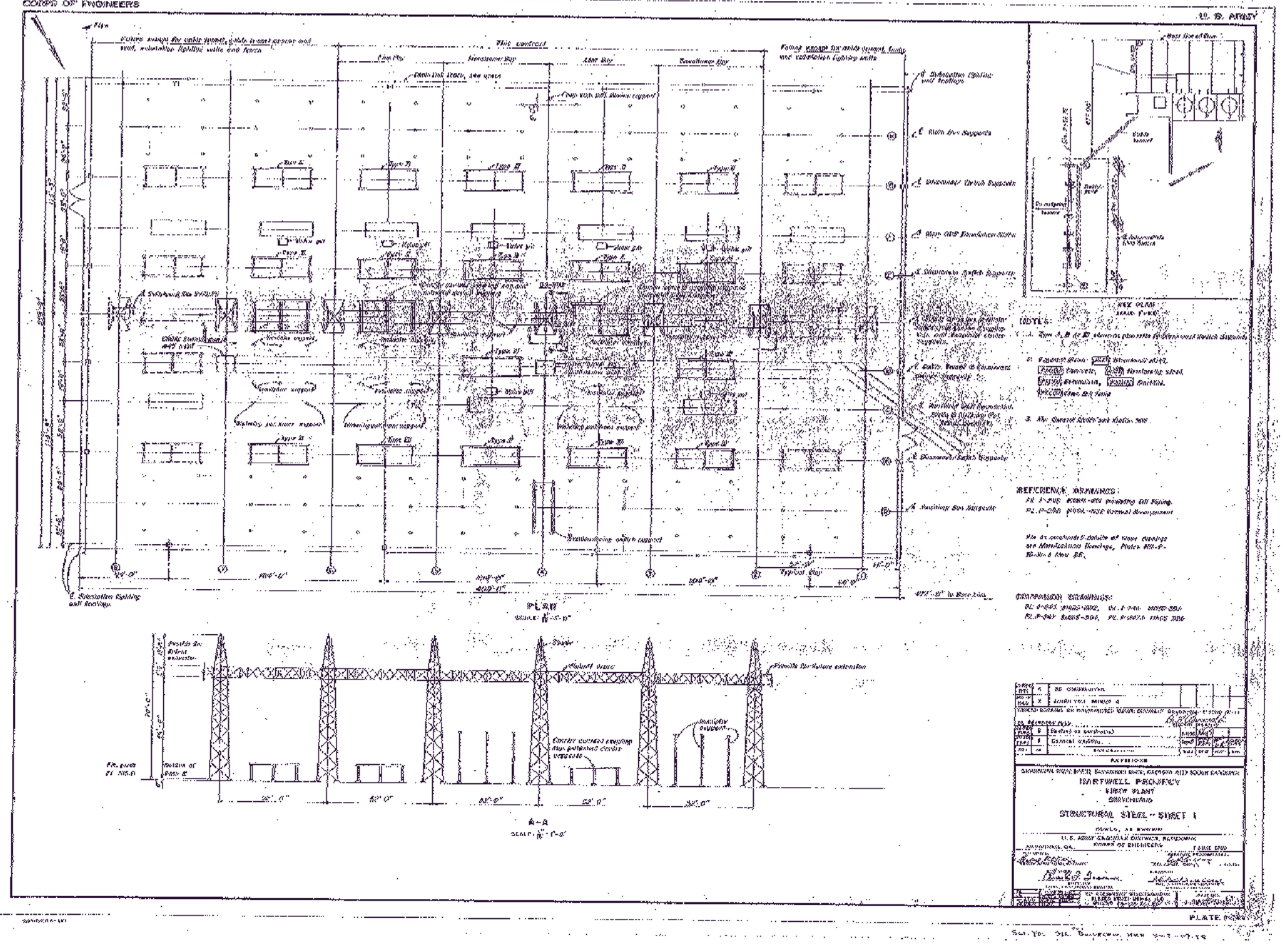
HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD
FOOTING PLAN AND
MISCELLANEOUS STRUCTURE DETAILS
SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-54

SCALE: SHEET 00

REF HA6S-002_1.TIF HA6S-002_1.DGN

...\REFERENCES\ha6s-002_1.dgn 03/24/2003 01:19:47 PM



INFORMATION ONLY

SHEET 163

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

STRUCTURAL STEEL-SHEET 1

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-55

SCALE: SHEET 00

13 Nov 2002
07:48:42

REF HA6S-301_2.TIF HA6S-301_2.DGN

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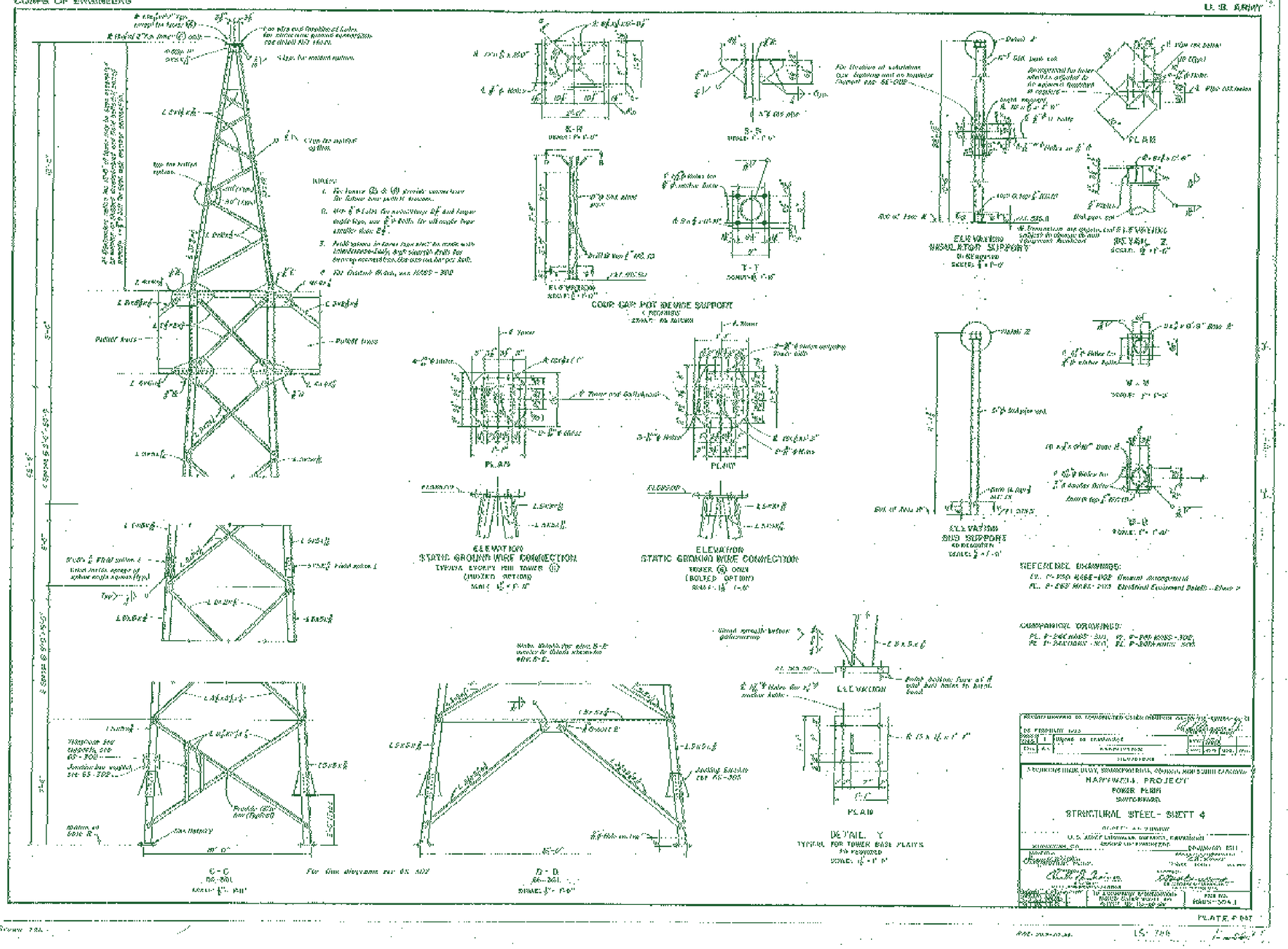


INFORMATION ONLY

SHEET 164

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

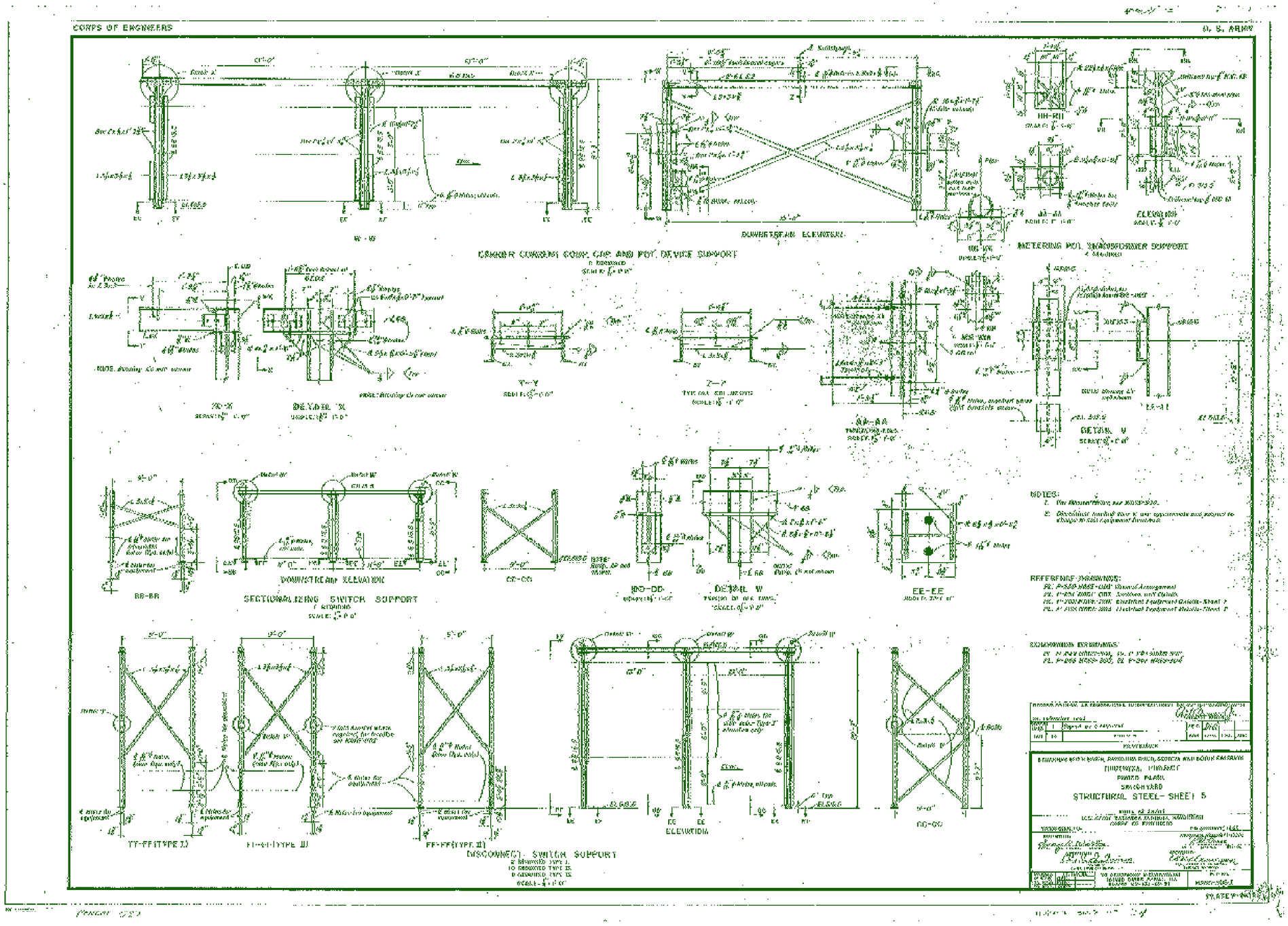
STRUCTURAL STEEL-SHEET 4

SAVANNAH RIVER GEORGIA AND S. CAROLINA

SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-56
SCALE:			SHEET 00

REF HA6S-304_1.TIF HA6S-304_1.DGN

...\REFERENCES\ha6s-304_1.dgn 03/24/2003 01:23:01 PM



INFORMATION ONLY

SHEET 165

HYDROELECTRIC DESIGN CENTER PORTLAND, OR		U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA
HARTWELL MAJOR REHABILITATION - PHASE 2 HARTWELL DAM AND LAKE SWITCHYARD		
STRUCTURAL STEEL-SHEET 5		
SAVANNAH RIVER	GEORGIA AND S. CAROLINA	
SIZE F	INVITATION NO.	FILE NO. HAR0157	PLATE R-57
SCALE:		SHEET 00

REF HA6S-305_1.TIF HA6S-305_1.DGN

...\REFERENCES\ha6s-305_1.dgn 03/24/2003 01:23:44 PM

DEVICE	DESCRIPTION
8-2	CONTROL POWER CIR. BRKR., CLOSE DC
8-3	CONTROL POWER CIR. BRKR., PRI. TRIP DC
8-4	CONTROL POWER CIR. BRKR., SEC. TRIP DC
8-5	CONTROL POWER CIR. BRKR., CHARGING MOTOR DC
8-6	CONTROL POWER CIR. BRKR., HEATERS AC
8-7	CONTROL POWER CIR. BRKR., UTILITY SUPPLY AC
23-1	THERMOSTAT, CONTROL HOUSE HEATERS
27-1	RELAY, HEATER AC SOURCE OPEN
27-2	RELAY, CLOSE DC SOURCE OPEN
27-3	RELAY, CHARGING MOTOR DC SOURCE OPEN
27-4	RELAY, PRI. TRIP DC SOURCE OPEN
27-5	RELAY, SEC. DC SOURCE OPEN
42-1	CONTACTOR, SPRING CHARGE MOTOR, DC
62-1	TIME DELAY RELAY, 60 SEC. TDPU
63-2-1,-2,-3	SF-6 GAS PRESSURE SWITCH, TEMP. COMPENSATED
63AX	AUTO TRIP & BLOCK CLOSE AUX. RELAY, PRIMARY
63BX	AUTO TRIP & BLOCK CLOSE AUX. RELAY, SECONDARY
69	EMERGENCY TRIP AND LOCKOUT SWITCH
88	MOTOR, SPRING CHARGING
52-1,2,3	AUXILIARY SWITCH ASSEMBLY
a or b	AUXILIARY SWITCH CONTACT
C	CLOSE
C1, C2	CAPACITOR
CC	CLOSING COIL
CS	CONTROL SWITCH
CTR	COUNTER, ELECTRIC
CTX	COUNTER, AUXILIARY RELAY
DS	DOOR SWITCH
CFI	GROUND FAULT INTERRUPTER
H1 TO H4	HEATERS, CONTROL HOUSING
LS1	LIMIT SWITCH, MOTOR START-STOP
LS2 & LS4	LIMIT SWITCH, SPRING DISCHARGED
LT	LIGHT
R1	RESISTOR
TB	TERMINAL BLOCK
TP	TRIP PRIMARY
TS	TRIP SECONDARY
TC-1,2	TRIP COIL
X	CLOSING RELAY
XA	AUX. CLOSING RELAY
Y	ANTI-PUMP RELAY
—●—	DEVICE TERMINAL
—○—	TERMINAL CUSTOMER

ELECTRICAL CHARACTERISTICS

ELECTRICAL COMPONENT	OPERATING VOLTAGE 125 VDC	OPERATING VOLTAGE 120/208 VAC
	±10% OPERATING CURRENT AMP	
SPRING CHARGING MOTOR	RUN-20	
CLOSING COIL CC, TRIP COIL TC-1, TC-2	4.7	
X,XA,Y,63AX,63BX CONTROL RELAYS AGASTAT GP	0.05	
62-1 CONTROL RELAYS KANSON 1017-SPT TDPU	0.33	
27-1, UNDERVOLTAGE RELAY P&B KRP		0.02 @ 208VAC
27-2,27-3,27-4,27-5 UNDERVOLTAGE RELAY P&B KRP	0.02	
CTX, LATCHING RELAY IDEC RR2KP SERIES	L-0.02 R-0.02	

THERMO	THERMOSTAT FUNCTION	OPERATING RANGE
23-1	CONTROL HOUSE HEATERS H-3 & H-4	ON AT +55°F OFF AT +70°F ±5°F

HEATER WATTAGE

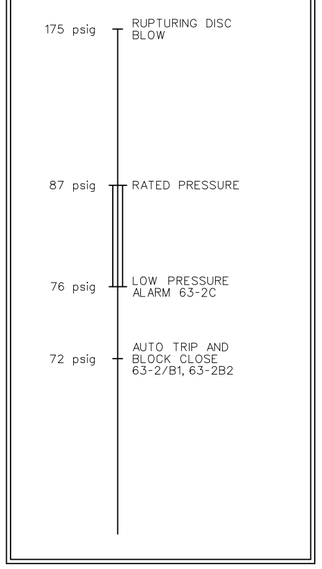
HEATER	WATTS
H-1, H-2	75W EA
H-3, H-4	75W EA

NOTES:

1. DIAGRAMS ARE SHOWN WITH NO SF6 GAS PRESSURE, BREAKER OPEN, SPRING MECHANISM DISCHARGED AND ALL CIRCUITS DE-ENERGIZED.
2. GROUND SYMBOL ⏚ INDICATES CONNECTION TO THE GROUND BAR IN THE CONTROL HOUSE.
   WARNING: IT IS IMPERATIVE TO ESTABLISH GROUND INTEGRITY WITH THE AC SOURCE PRIOR TO TESTING OR ENERGIZING BREAKER.
3. THERE ARE 18 SPARE AUXILIARY SWITCH CONTACTS FOR CUSTOMER USE. CONTACTS ARE MECHANICALLY REVERSIBLE FROM a TO b AND b TO a.
4. ON SCHEMATIC, DEVICES AND WIRING PROVIDED BY CUSTOMER IS INDICATED BY DASH LINES.

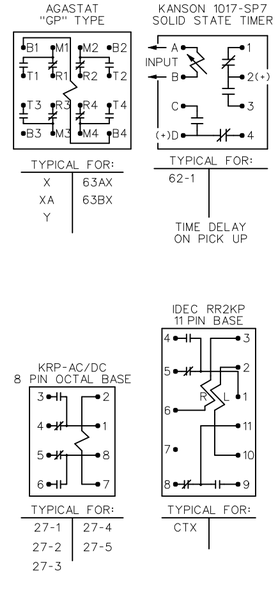
SF 6 GAS PRESSURE SYS
63-2-1, -2, -3 SWITCH

PRESSURES AT NORMAL AMBIENT, 68°F, REFER TO INSTRUCTION MANUAL FOR PRESSURES AT OTHER TEMPERATURES

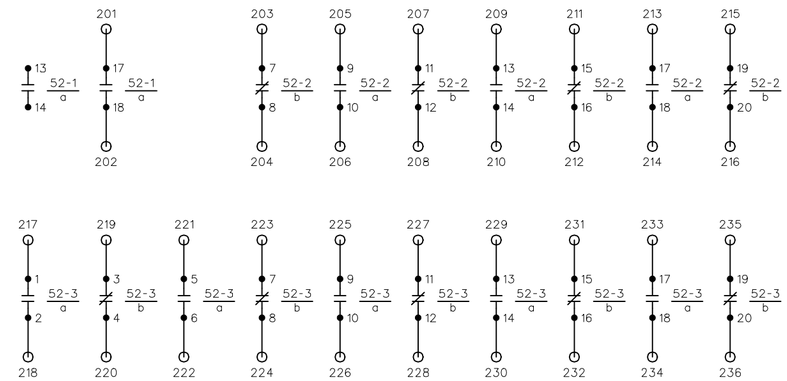


- NORMAL WORKING RANGE

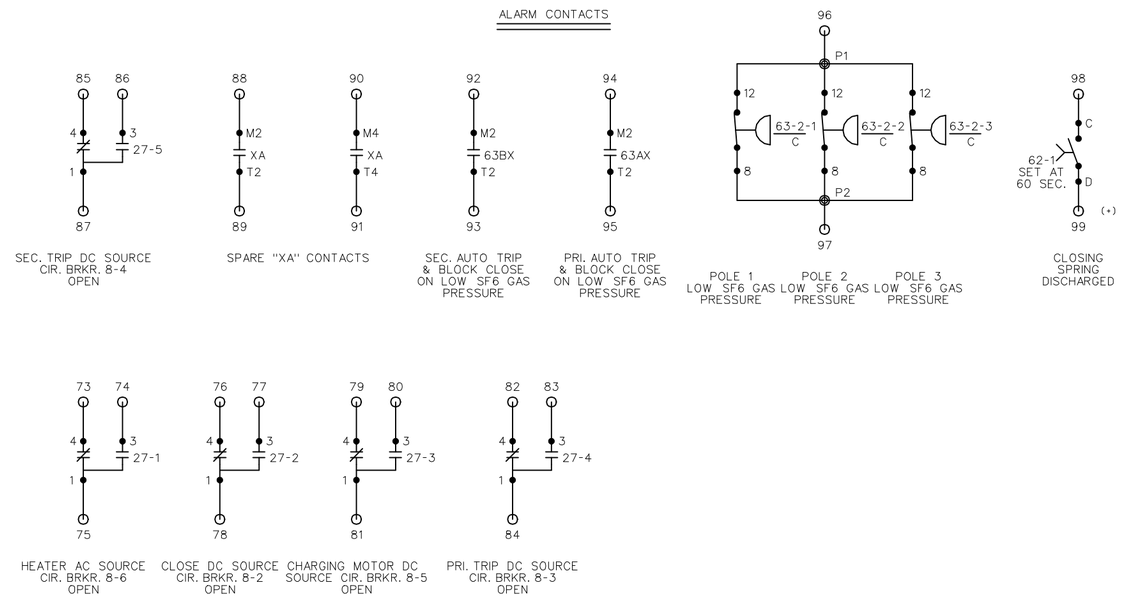
RELAY AND SOCKET
INTERNAL CONTACT ARRANGEMENTS



SPARE AUXILIARY SWITCH CONTACTS



ALARM CONTACTS



R-58

SHEET 166

997D372

SHEET NO 1 OF 5

AUG. 21, 2002

01

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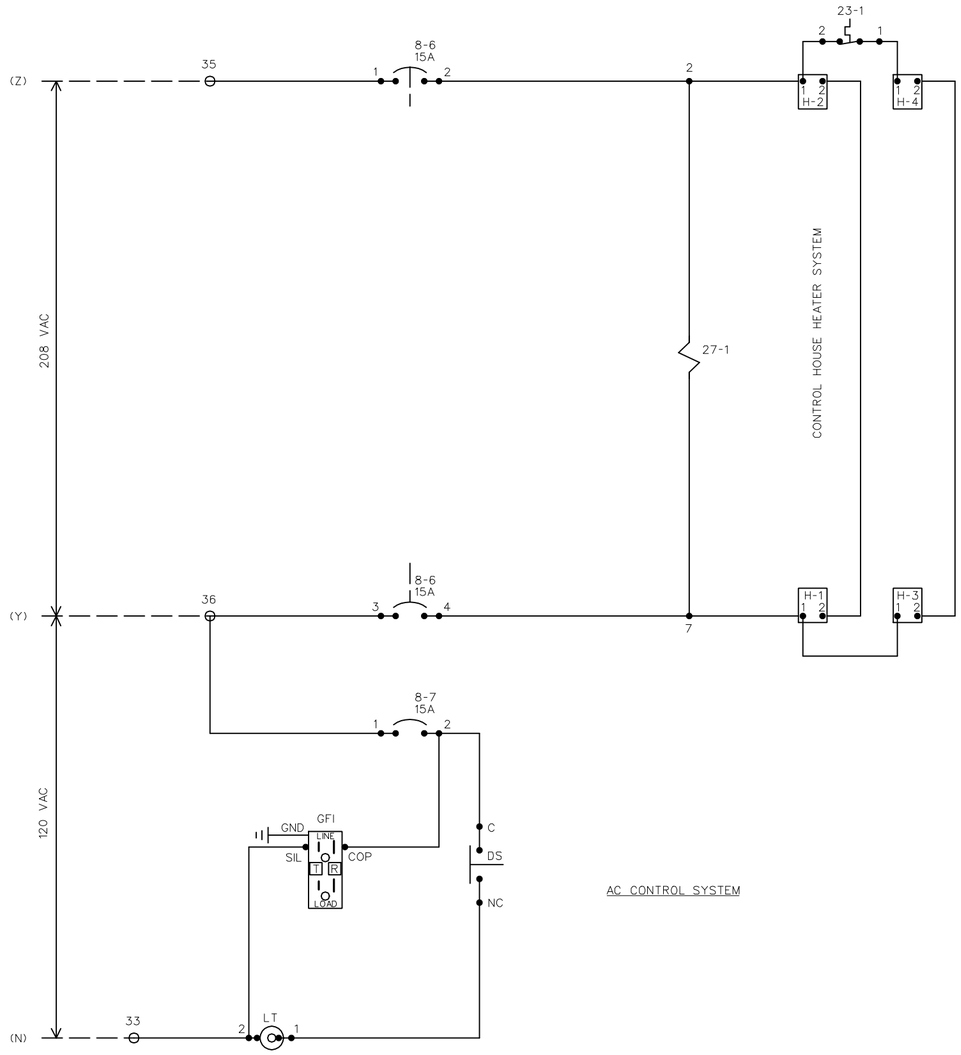
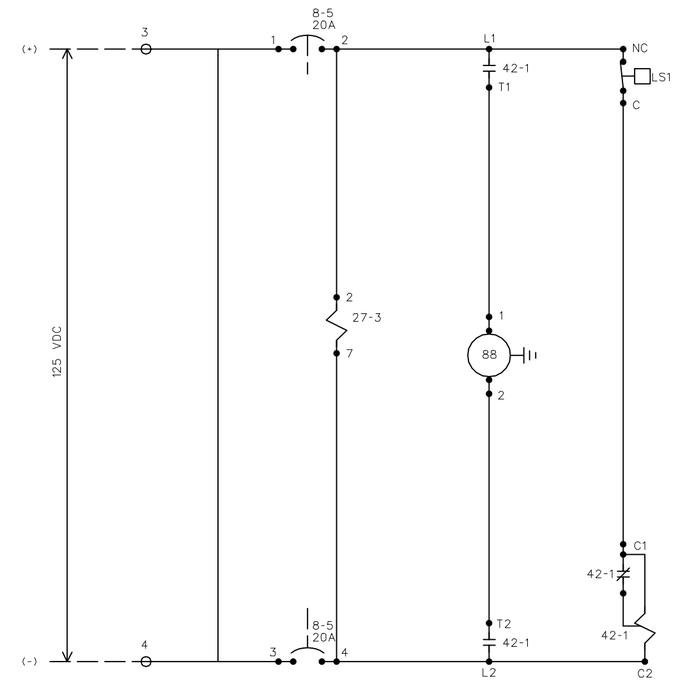


AC CONTROL SYSTEM



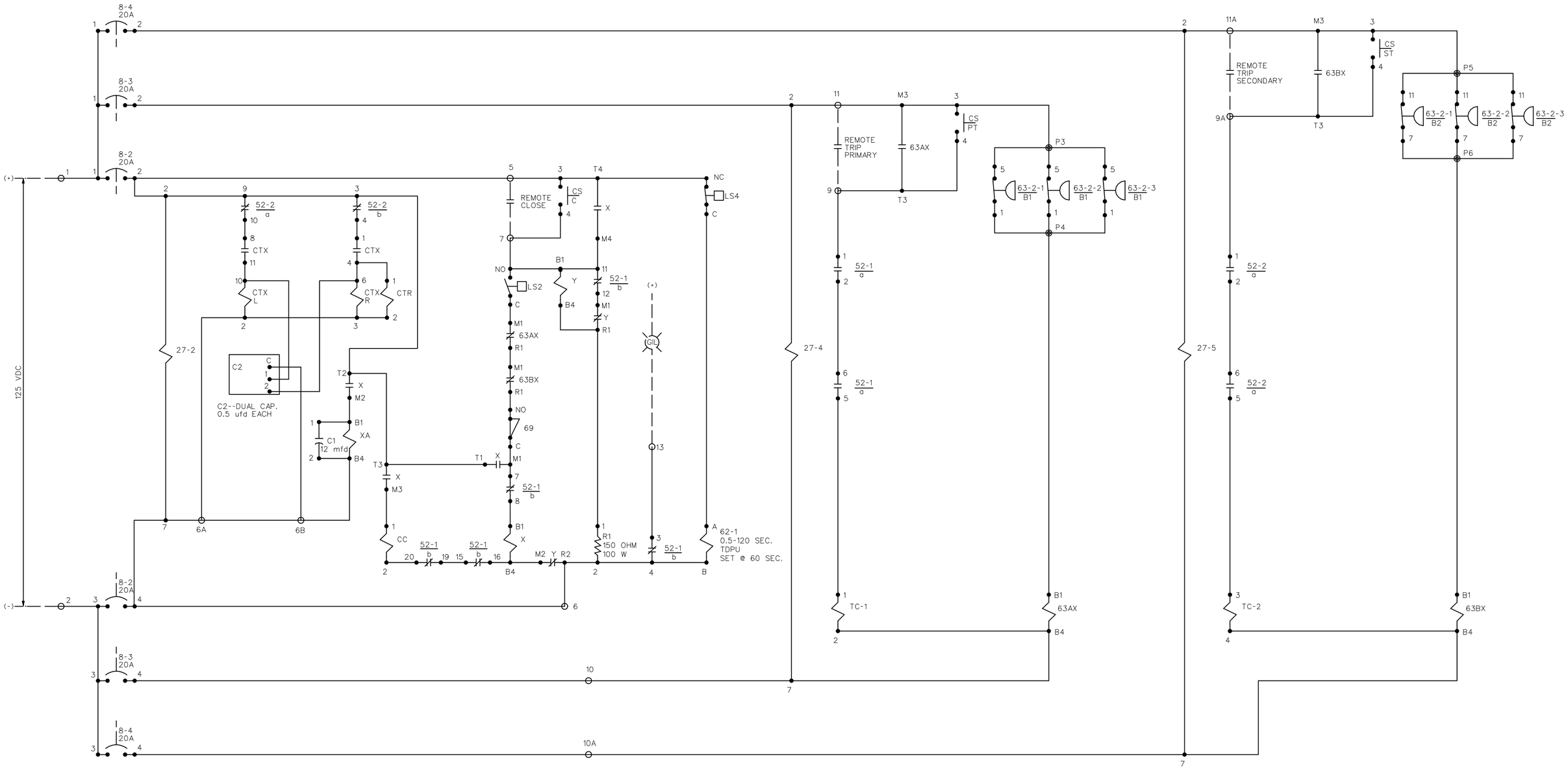
DC CHARGING MOTOR SYSTEM

R-59

SHEET 167

997D372

SHEET NO 2 OF 5



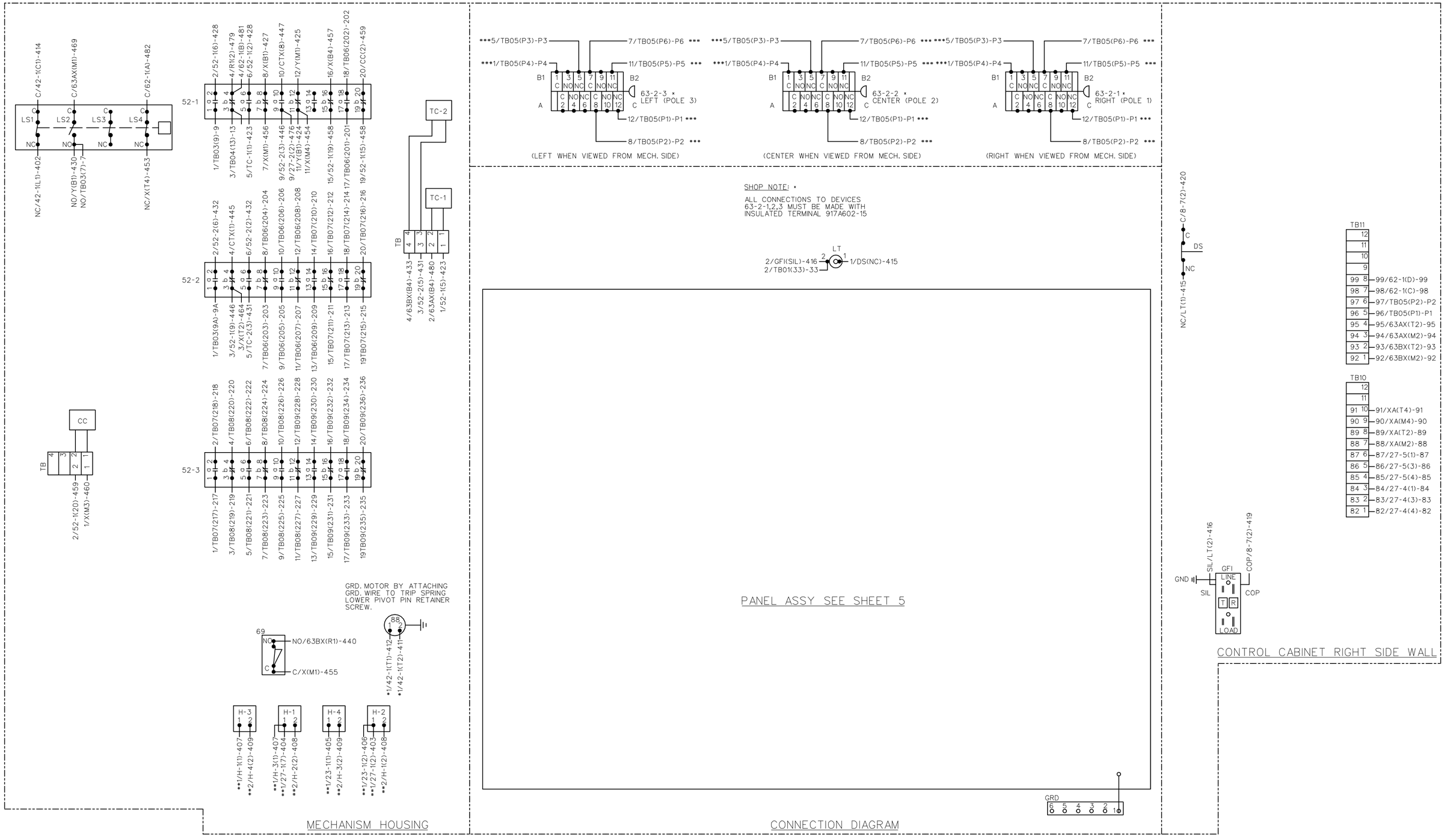
DC CONTROL SYSTEM

R-60

SHEET 168

997D372

SHEET NO 3 OF 5



SHOP NOTE:
* 12 AWG SIS
** 14 AWG HTR
*** 16 AWG SIS

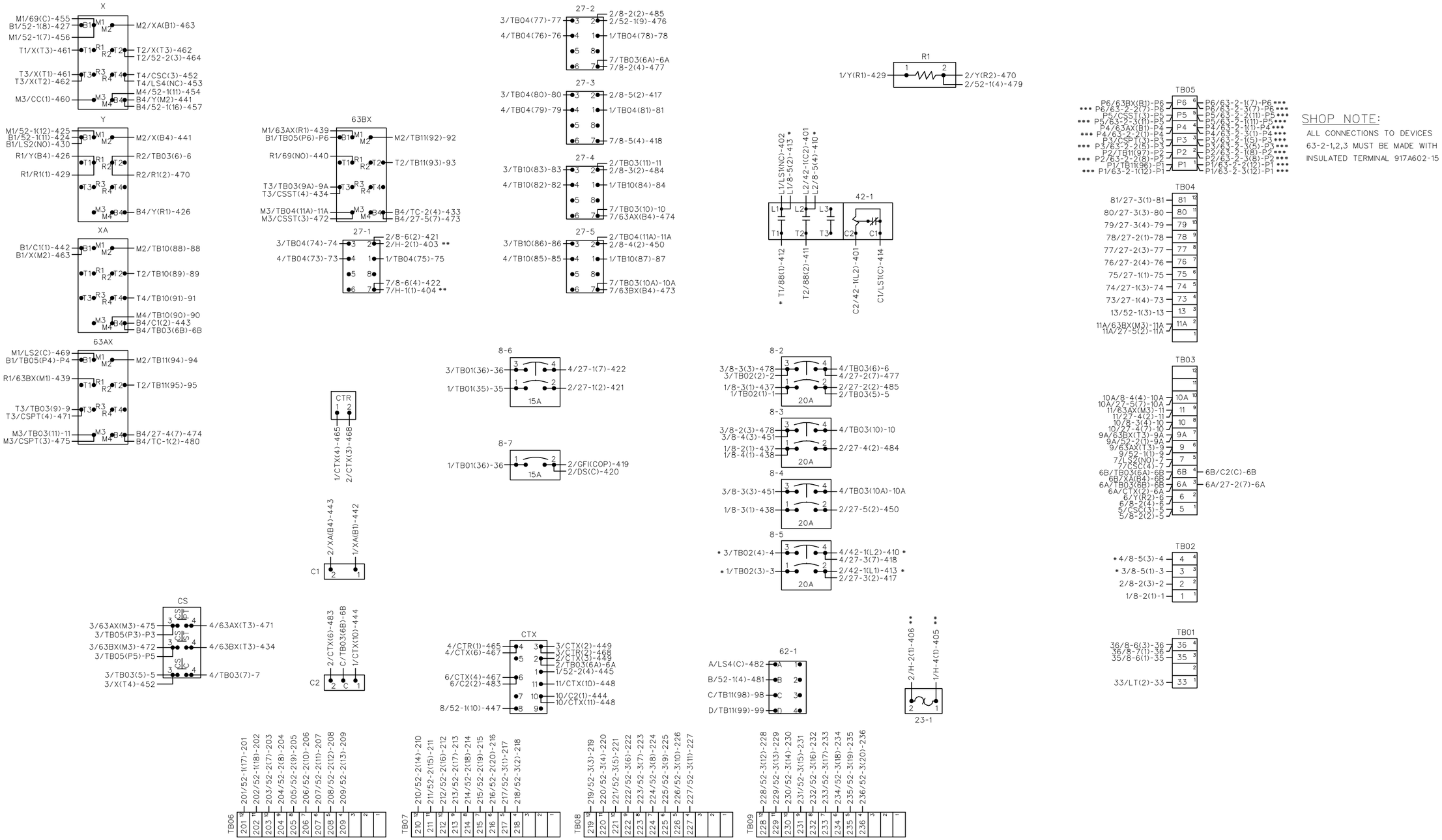
DESTINATION: COMPONENT & TERM. POINT
SOURCE TERM. POINT
WIRE NUMBER
XX/ XX-X-X- XXX

WIRE IDENTIFICATION

R-61

SHEET 169

997D372
SHEET NO 4 OF 5



PANEL ASSY

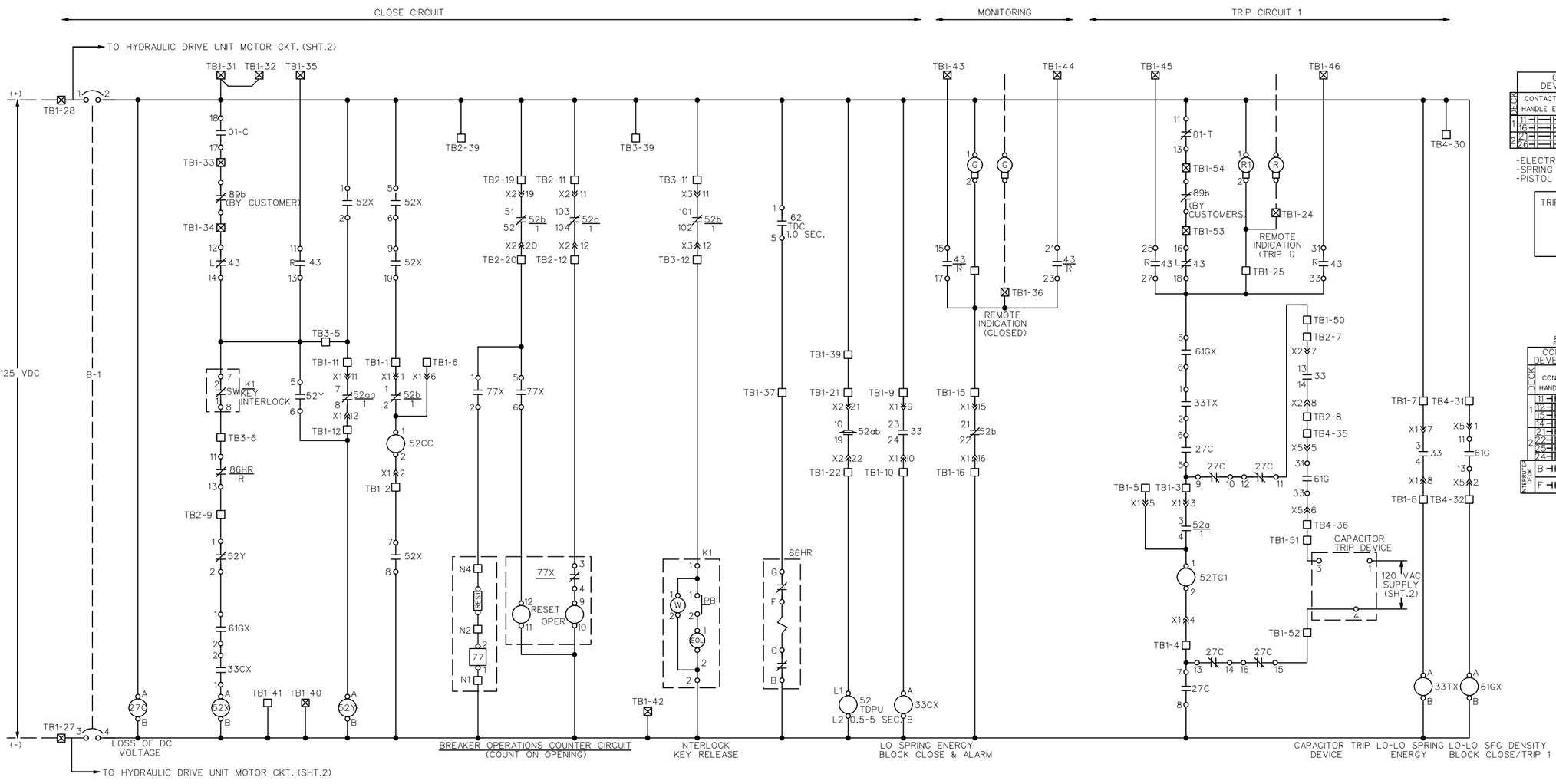
CONNECTION DIAGRAM

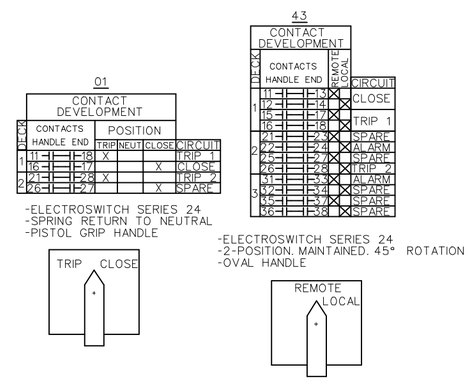
R-62

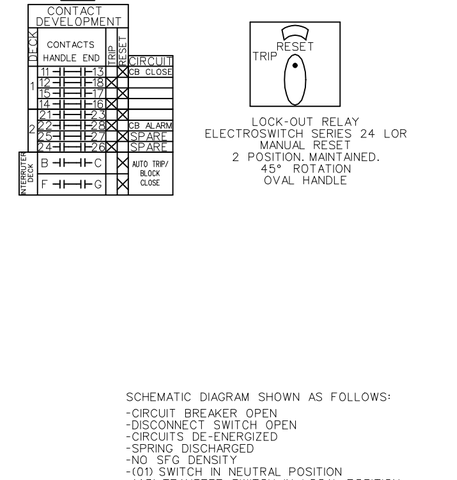
SHEET 170

997D372

SHEET NO 5 OF 5



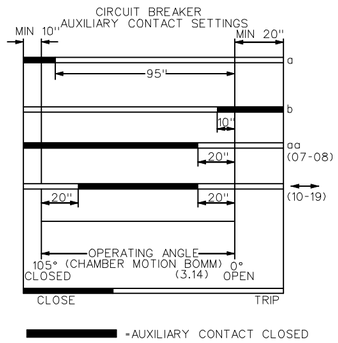


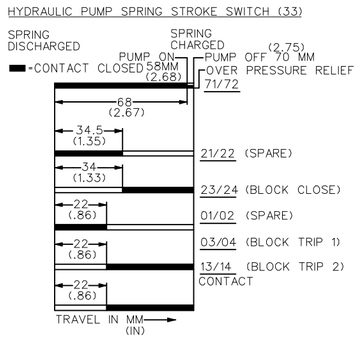


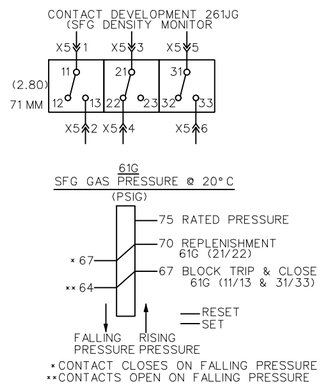
SCHEMATIC DIAGRAM SHOWN AS FOLLOWS:
- CIRCUIT BREAKER OPEN
- DISCONNECT SWITCH OPEN
- CIRCUITS DE-ENERGIZED
- SPRING DISCHARGED
- NO SFG DENSITY
- (01) SWITCH IN NEUTRAL POSITION
- (43) TRANSFER SWITCH IN LOCAL POSITION

TERMINALS

- ☐ TERMINAL. CONTROL CABINET
- ☒ USACE TERMINAL. CONTROL CABINET
- SOCKET (S) / PLUG (B) X. CABLES
- ○ DEVICE TERMINAL
- ( ) =USACE WIRE NAME





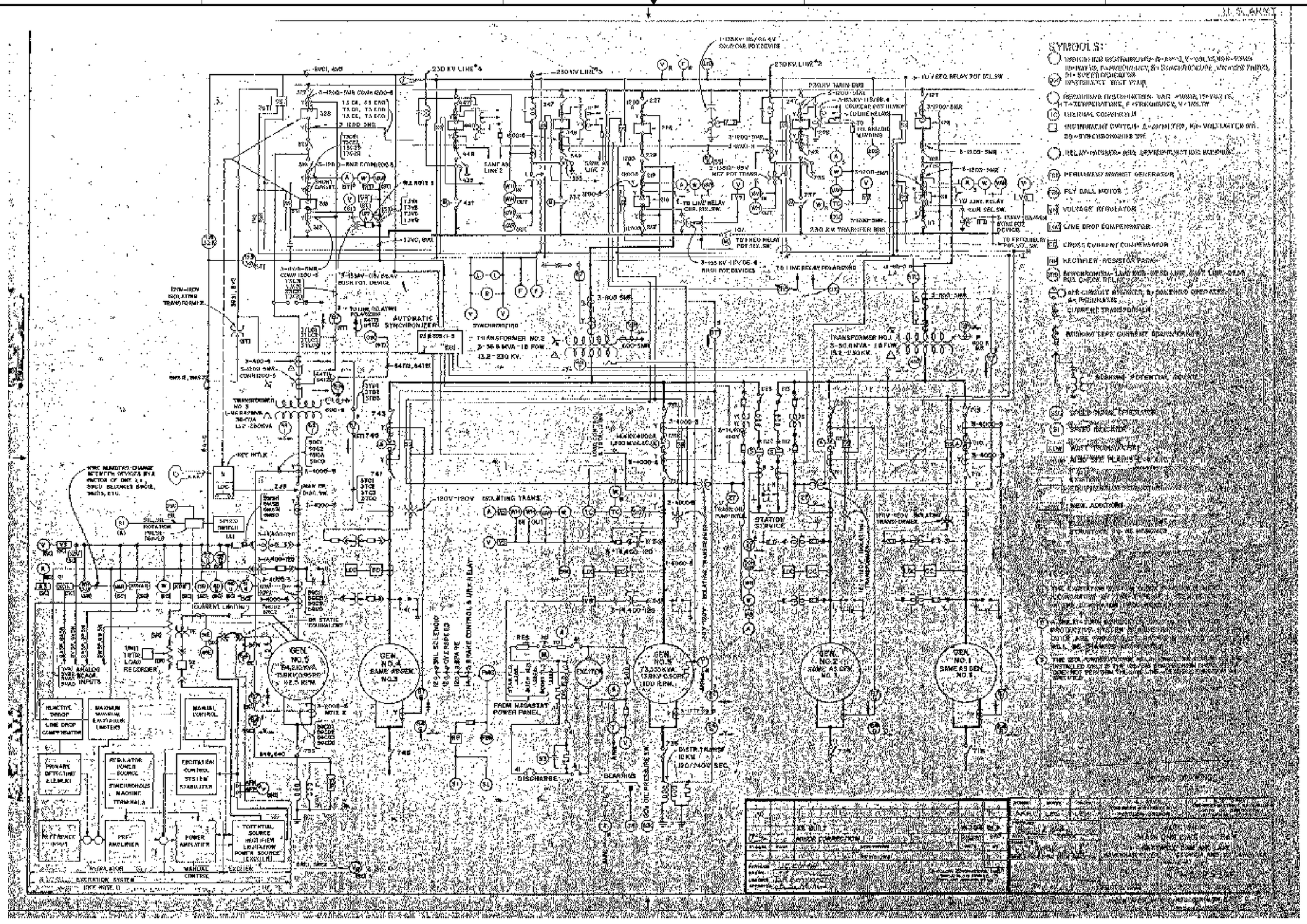


REFERENCE DRAWING UNITS 1,2,3,4	
SWITCHGEAR CUBICLE OUTLINE	BB80-5-0310-1
CONTROL CABINET OUTLINE	BB80-5-0311-1
SCHEMATIC DIAGRAM	BB80-5-0312-1,2
CONNECTION DIAGRAM	BB80-5-0313-1,2,3
INTERLOCK SCHEME (710)	BB80-5-0314-1
INTERLOCK SCHEME (720)	BB80-5-0331-1
INTERLOCK SCHEME (730)	BB80-5-0332-1
INTERLOCK SCHEME (740)	BB80-5-0333-1

R-63

SHEET 171

BB80-5-0312



INFORMATION ONLY

SHEET 172

HYDROELECTRIC DESIGN CENTER
PORTLAND, OR

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

MAIN ONE LINE DIAGRAM

SAVANNAH RIVER GEORGIA AND S. CAROLINA

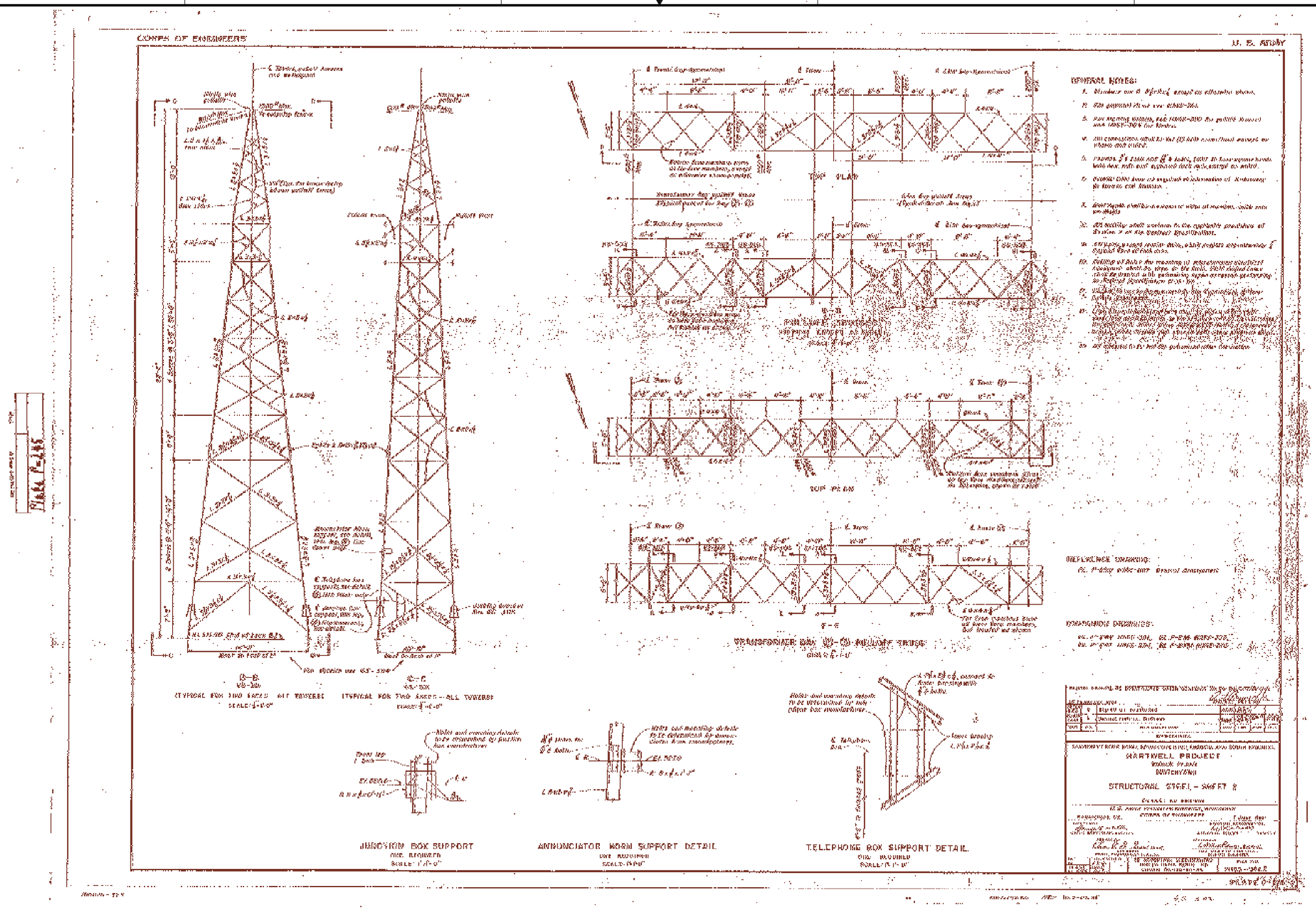
SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-64

SCALE: SHEET 00

13 Nov 2002
07:58:21

REF HA5E-346.TIF HA5E-346.DGN

...\03B07w\REFERENCES\ha5e-346.dgn 03/24/2003 02:05:04 PM



INFORMATION ONLY

SHEET 173

HYDROELECTRIC DESIGN CENTER PORTLAND, OR	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA

HARTWELL MAJOR REHABILITATION - PHASE 2
HARTWELL DAM AND LAKE
SWITCHYARD

STRUCTURAL STEEL-SHEET 2

SAVANNAH RIVER GEORGIA AND S. CAROLINA

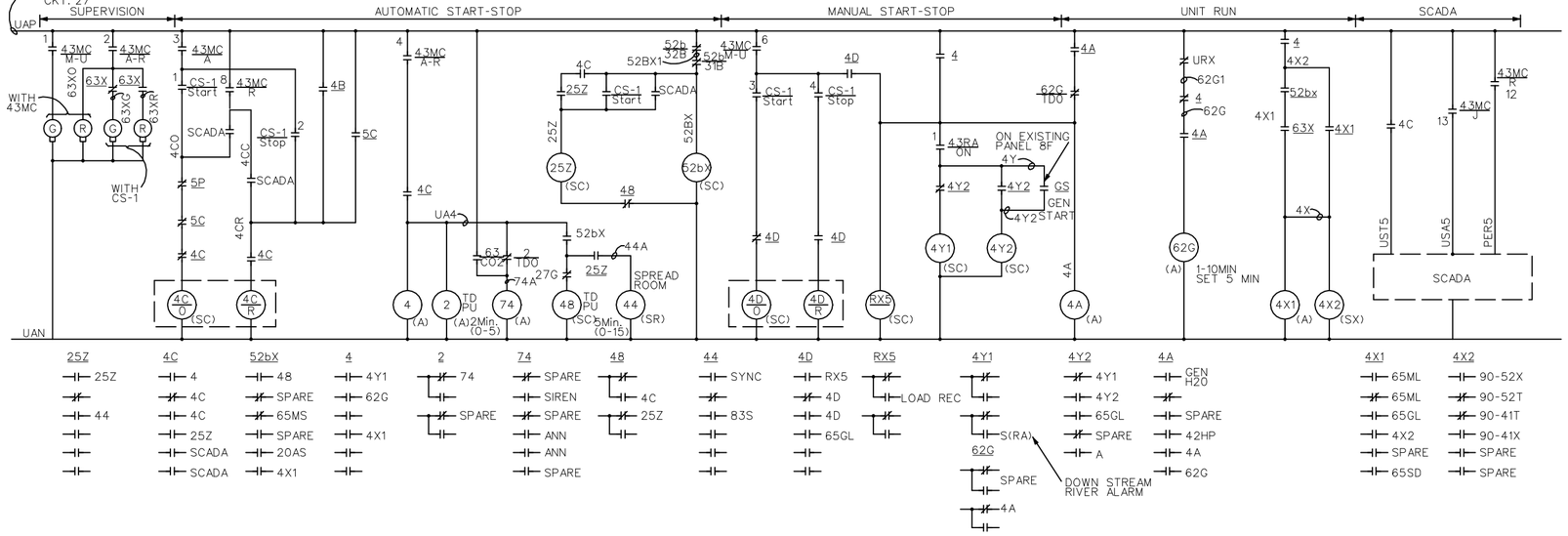
SIZE	INVITATION NO.	FILE NO.	PLATE
F		HAR0157	R-65
SCALE:			SHEET 00

13 Nov 2002
07:48:21

REF HA6S-302_2.TIF HA6S-302_2.DGN

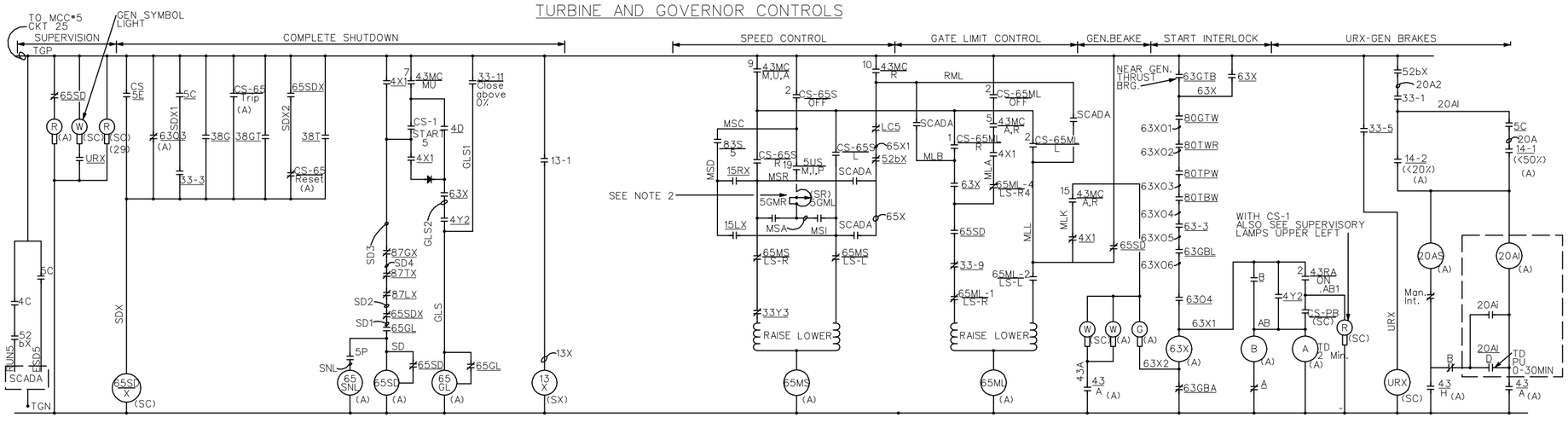
...\REFERENCES\ha6s-302_2.dgn 03/24/2003 02:06:07 PM

UNIT START-STOP-RUN CONTROLS



25Z	4C	52bX	4	2	74	48	44	4D	RX5	4Y1	4Y2	4A	4X1	4X2
25Z	4	48	4Y1	74	SPARE	4C	SYNC	RX5	LOAD REC	S(RA)	4Y1	GEN H2O	65ML	90-52X
44	4C	SPARE	62G	SPARE	SIREN	25Z	83S	4D		62G	4Y2	SPARE	65ML	90-52T
	4C	65MS	4X1		SPARE			4D		SPARE	65GL	42HP	65GL	90-41T
	25Z	SPARE			ANN			65GL		4A	SPARE	4A	4X2	90-41X
	SCADA	20AS			ANN						A	62G	SPARE	SPARE
	SCADA	4X1			SPARE								65SD	SPARE

TURBINE AND GOVERNOR CONTROLS



65SDX	65SD	65GL	13X	65MS	65ML	63X	B	A	URX (ENERGIZED-RUN)
65SD	SPARE	65SD	52T	65MS	65ML	63X	B	SPARE	ANN
	SPARE	56GL	52F	65MS	65ML	65ML	B		GEN LIGHT
65SDX	RIL	65SD	90VR	SPARE	65ML	4X1	20AS	B	CO_2
	65ML	RIL		SPARE		GIL			SPARE
	65ML					RIL			ANN
	ANN					65GL			62G
	152T/318								
	152T/328								

33 GATE POSITION SWITCH

CONTACT	GATE POSITION (0% SNL 100%)	CIRCUIT
1		20AS
2		152TA
3		65SDX
4		TC-152TM
5		URX
6		GEN HEAT
7		SPARE
8		SPARE
9		65ML
10		SPARE
11		65GL
12		SPARE
13		SPARE
14		SPARE

BARS INDICATED CLOSED CONTACT

CS-43MC UNIT AUXILIARIES MASTER CS (SC)

U N A (F.V.) R (SC) — BLACK OVAL HANDLE, MAINTAINED CONTACTS

CONTACT	POSITION: UNAVAIL	MANUAL	LOCAL AUTOMATIC	REMOTE CONTROL
1	X	X		
2			X	X
3			X	
4			X	X
5			X	X
6	X	X		
7	X	X		
8				X
9	X	X	X	
10				X
11	X	X	X	
12				X
13	X			
14				X
15			X	X
16				X
17			X	X
18				X
19				X
20	X	X	X	
21	X	X	X	
22				X

LOCATED ON PANEL 13F

CS-5E EMERGENCY SHUTDWN

NORMAL STOP (F.V.) (SC) — RED OVAL HANDLE, MOMENTARY CONTACTS, PULL TO TURN

CONTACT	POSITION: NORMAL	STOP
1		X
2		X
3		X
4		X
5		X
6		X

LOCATED ON PANEL 13F

CS-SS SYNCHRONIZING SWITH

OFF ON (F.V.) (SC) — WITHOUT HANDLE-USE KEY, MAINTAINED CONTACTS

CONTACT	POSITION: 318ON	OFF	328ON
1			X
2			X
3			X
4	X		
5	X		
6	X		

VOLTMETER SWITCH (SC)

OFF (F.V.) OFF (SC & ST) — MAINTAINED CONTACTS OVAL HANDLE

CONTACT	POSITION: OFF	1	2	3
1		X		X
2		X		
3			X	
4			X	X

AMMETER SWITCH (SC)

OFF (F.V.) OFF (SC) — BLACK ROUND HANDLE MAINTAINED CONTACTS

CONTACT	POSITION: OFF	INT	INT	1	INT	INT	2	INT	INT	3
1	X	X	X		X	X	X	X	X	X
2			X	X	X					
3			X	X	X					
4	X	X	X	X	X	X	X	X	X	
5									X	X
6									X	X
7	X	X	X	X	X	X		X	X	X
8						X	X	X		
9						X	X	X		

NOTES

1. SEE PLATES E-4 AND E-12 FOR LEGEND
2. GOVERNOR RESPONSE RHEOSTAT AND MOTOR RAISE/LOWER CONTACTOR LOCATED IN SEPARATE ENCLOSURE IN CABLE SPREADING ROOM.
3. * INDICATES THAT THE NUMBER OF CONTACTS REQUIRED MAY DIFFER FROM THAT SHOWN AND WILL BE DETERMINED AFTER CONTRACT AWARD.

CS-90DC REG. VOLT ADJ. (SC)
CS-90AC REG. VOLT ADJ. (SC)

OFF RAISE LOWER (F.V.) (SC) — BLACK PISTOL GRIP HANDLE, SPRING RETURN TO OFF

CONTACT*	POSITION: RAISE	OFF	LOWER
1	X		
2		X	
3			X
4	X		
5		X	
6			X

LOCATED ON PANEL 13F

CS HEAD GATE EMERG. LOWER

NORMAL EM. CLOSE (F.V.) (SC) — RED PISTOL GRIP HANDLE, SPRING RETURN TO NORMAL

CONTACT	POSITION: NORMAL	EM. CLS.
1	X	
2	X	
3		X
4		X

LOCATED ON PANEL 13F

CS-43RA RIVER ALARM (SC)

ON TEST (F.V.) (SC) — OVAL HANDLE MAINTAINED CONTACT

CONTACT	POSITION: ON	TEST
1	X	
2	X	
3	X	
4		X
5		X
6		X

ON REAR OF PANEL 13F

CS-1 UNIT AUXILIARIES CS (SC)

STOP MAN. START (F.V.) (SC) — BLACK OVAL HANDLE, MAINTAINED CONTACTS

CONTACT	POSITION: MANUAL	STOP	START
1			X
2		X	
3			X
4		X	
5			X
6		X	
7		X	
8			X

LOCATED ON PANEL 13F

CS-65S GOVERNOR SPEED ADJ.
CS-65ML GATE LIMIT ADJ.

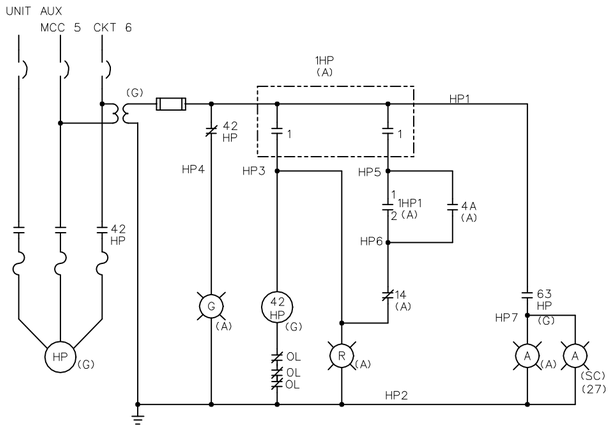
OFF RAISE LOWER (F.V.) (SC) — BLACK OVAL HANDLE, SPRING RETURN TO OFF

CONTACT	POSITION: RAISE	OFF	LOWER
1	X		
2		X	
3			X
4	X		
5		X	
6			X

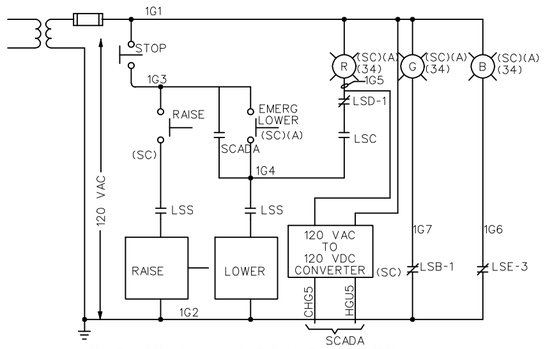
LOCATED ON PANEL 13F

R-66

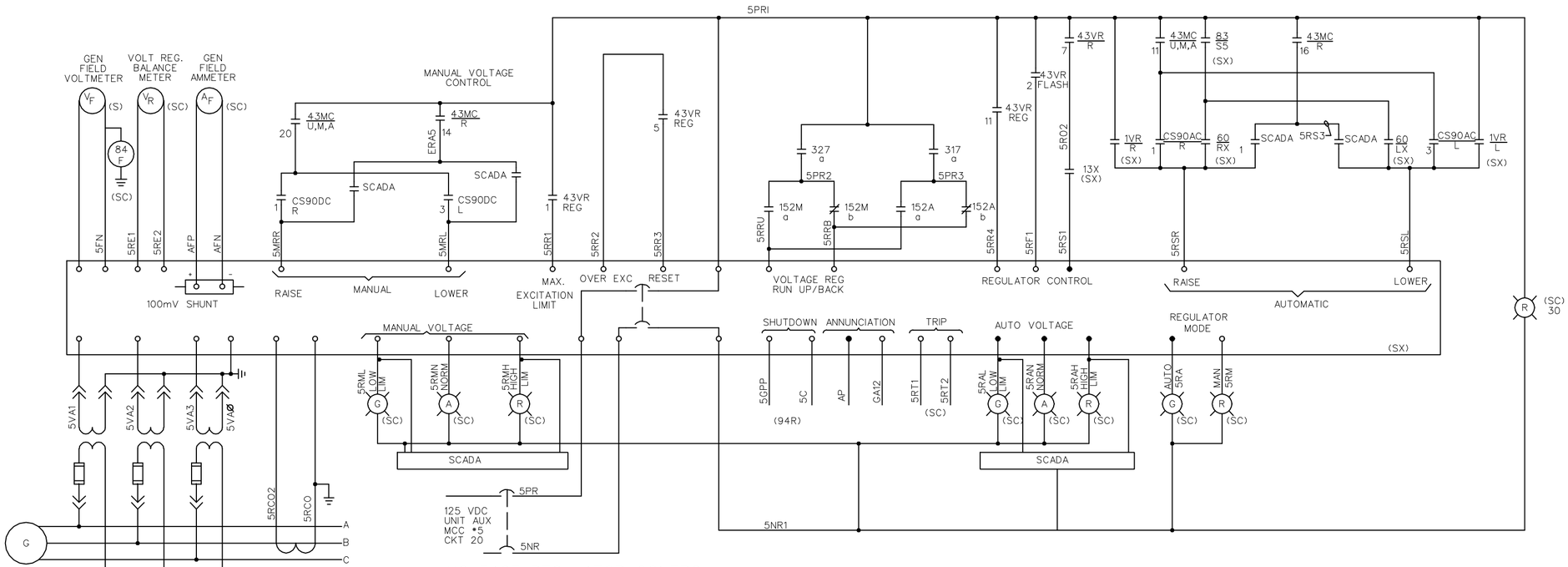
SHEET 174 HA5E-350



HIGH PRESSURE THRUST BRG OIL PUMP



EMERGENCY HEADGATE LOWER
(PARTIAL SCHEMATIC SEE NOTE 2)



VOLTAGE REGULATOR CONTROL

NOTES:

1. THE VOLTAGE REGULATOR SHOWN IS TYPICAL. SPECIFIC CONTROL INTERFACE DETAILS ARE TO BE COORDINATED WITH THE GENERATOR CONTRACTOR.

2. PARTIAL SCHEMATICS ILLUSTRATE THE INTERFACE OF SWITCHBOARD CONTRACT SUPPLIED EQUIPMENT WITH EQUIPMENT SUPPLIED BY OTHERS. THE CIRCUITS SUPPLIED BY OTHERS ARE NOT COMPLETE AND MEANT TO BE ILLUSTRATIVE OF THOSE TO BE FURNISHED.

3. × INDICATES THAT THE SPECIFIC NUMBER OF CONTACTS REQUIRED MAY DIFFER FROM THOSE SHOWN AND WILL BE DETERMINED AFTER CONTRACT AWARD.

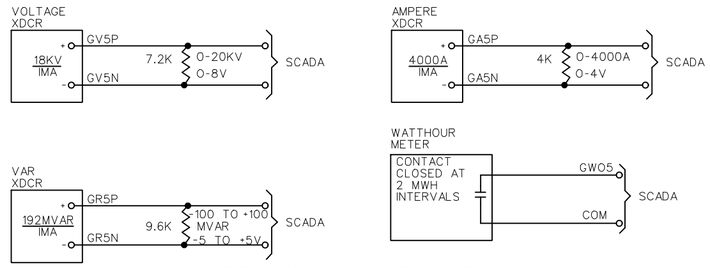
CS-43VR REGULATOR TRANSFER SW. (SC)

F MAN T OFF (F.V.) R (SC)

BLACK OVAL HANDLE. MAINTAINED CONTACTS

CONTACT ×	POSITION OFF	FLASH	MAN.	TEST	REG.
1		X	X	X	X
2		X	X	X	X
3				X	
4	X				
5					X
6	X		X		
7				X	X
8		X	X	X	X
9				X	
10	X				
11					X
12			X		

CONFIRMATION OF CONTACTS SUPPLIED AFTER GENERATOR CONTRACT AWARD



UNIT QUANTITY SCADA INPUT SCHEMATICS

R-67

SHEET 175

HA5E-351