Brandy Branch Generating Station
ST4- Excitation Transformer Replacement-Technical Specification

Table of Contents
Excitation Transformer

1.0 GENERAL

1.1 Work Included

1.1.1 Vendor's Scope of Work

a. Design, manufacture, testing, documentation, and shipment of new excitation transformer in accordance with this specification. The transformer shall be designed so that the existing cables, mounting pad and fire suppression system can be reused without any modifications.
b. The Vendor shall schedule a design review with JEA
c. Send all submittal drawings for approval
d. Provide as built drawings in CAD and PDF format

1.1.2 Electrical Contractor Scope of Work

a. The electrical contractor shall disconnect and remove the existing transformer for salvage. Special care must be taken as to not damage the existing power cables and field wiring.
b. Electrical contractor shall install the new transformer in accordance with OEM drawings and installation manual.

1.2 System Description

This specification applies to a transformer for supplying power to a generator excitation system. The purpose of this transformer is to provide AC power to the exciter (controlled rectifier excitation system) which supplies DC current to the generator field.

a. The excitation transformer will be used to provide power to a generator field excitation system. The generator excitation system is a silicon controlled rectifier (SCR) type with three phase bridge circuits. The AC load current will be approximately rectangular with 120 degree conduction and will have harmonics at $N = 6K \pm 1$ (where K = 1, 2, 3....) with a magnitude of approximately 1/N per unit of rated current at full load.
b. Special attention shall be given to the suppression of the 3rd and 5th harmonics. The increased eddy and stray current losses due to harmonic currents should be minimized. Any additional loses due to fundamental and high frequency harmonics (such as eddy losses, circulation current losses, etc.) shall be taken into account. Due to the load characteristics, the transformer shall be designed to minimize the effect of the harmonics relevant to the rectifier.
c. The transformer core shall be of three-legged core construction. The transformer windings cores, and all other functioning and supporting members shall be designed and braced to withstand the forces produced by repetitive/impulse loads. Also, the winding, the core, and all other affected members must be braced to withstand repeated asymmetrical faults on the secondary windings.
d. The additional harmonics and increased dynamic stresses due to thyristor equipment loads shall be considered in the design of the transformer. Tolerances for impedance voltages and arrangements of parallel windings shall be adjusted to minimize the creation of harmonics. All parallel windings must be transposed at the winding center to assure division of harmonic current. Generally, harmonic losses cause the transformer to be approximately 10% larger than its equivalent fundamental rating even with the transposed windings. Features such as stranding of the winding conductors that have been designed to be effective in reducing winding losses for fundamental frequency currents will not be as effective for higher harmonic currents. Depending on the winding design, the effective AC resistance of the windings, accounting for all harmonics, may be as much as twice that of the AC resistance for fundamental frequency currents. Harmonics will also cause added losses in structural components.
e. The transformer shall be capable of withstanding the thermal and mechanical duty imposed by a three-phase, bolted short circuit on the secondary side of the transformer per ANSI/ IEEE C57.116, F1 = 1.1pu, F2 = l.25pu, and T'do=6.3 seconds @ 125C. Fault source shall be considered an infinite bus and the DC offset shall be taken to be 1.6 pu.

1.3 References

1.3.1 Reference Documents

The following documents are attachments to these specifications and shall be adhered to by the vendor.

a. BGS ST4 Transformer Specification
b. Excitation Transformer Foundation 625S100
c. One Line Diagram 207D1746
d. Transformer Control Circuit 411A015
e. Outline of Excitation Transformer 13-10845
f. Transformer Nameplate data

1.3.2 Codes and Standards

Vendor shall conform to the following Codes and Standards using the latest edition at the time of the PO.

1. IEEE C57.12.00-2015 Requirements for Light-Immersed distribution & Power Transformers
2. IEEE C57.12.10 Standard Requirements for Liquid-Immersed Power Transformers
3. IEEE C57.12.90-2015 Test Code for Liquid Immersed Distribution and Power Transformers

4. IEEE C57. 91 Requirements for Loading Mineral-Oil-Immerse Transformers
5. IEEE C57.110-2018 Recommended Practice for Establishing Liquid Immersed and Dry-Type Power and Distribution Transformer Capability When supplying Nonsinusoidal Load Currents
6. IEEE C57.116-2014 Guide For Transformers Directly Connected to Generators
7. NEMA TR-1 Transformers, Regulators and Reactors.
8. NFPA-70 National Electric Code

1.4 Submittals

The vendor shall provide submittals to JEA for approval and schedule a design review meeting.

2.0 PRODUCTS

2.0.1 Approved Transformer Manufacturers

- Niagara Power Transformer
- Virginia – Georgia Transformer

2.1 Design and Conditions

The transformer shall be designed in accordance with this specification to meet the requirements and ratings indicated in the Equipment Data Sheets. The design shall conform to the Applicable Codes and Standards specified in Section 1.3.2.

2.1.1 Site Conditions

The transformer shall be suitable for a non-hazardous outdoor environment

2.1.2 General Requirements

a. Transformer tank shall be of welded, leak-proof, construction. All welds shall comply with AWS (American Welding Society). Cover may be bolted type
b. Transformer windings shall be suitably clamped by mechanical means at the top and bottom to prevent shifting under short circuit conditions
c. Core clamping arrangement to be equipped with core and coil lifting eyes
d. Core steel shall be grain-oriented steel.
e. Core shall be grounded with a removable test connection accessible from a man hole
f. Transformer winding conductor shall be copper, selected to minimize losses. Losses will be considered in the buyer's equipment evaluation.
g. Transformer core and windings shall be suitably mounted in the tank to prevent movement during faults, shipping, or installation.
h. Transformer winding leads shall be connected to porcelain apparatus bushings using flexible connections
i. Jacking, lifting, pulling, rolling, and skidding provisions must be provided to allow for installer's choice of installation methods.
j. Transformer cover shall be equipped with lifting eyes.
k. Transformer's radiators to be tube or panel design
l. The transformer shall be designed to withstand the site conditions stated above as minimum.
m. All non-current carrying parts of the electrical equipment shall be electrically bonded to the transformer structure to prevent a shock hazard. The transformer structure in turn is grounded to the station ground grid (by others).
n. The unit shall be equipped with two (2) NEMA 2-hole ground pads located at opposite corners of the base. The ground pads shall be welded or otherwise suitably attached to the base.

2.1.3 Tap Changer

A three phase tap changer shall be provided for de-energized operation in the high voltage winding. Taps shall be externally selected by mechanical means. Any devices required to operate the taps shall be provided. Means for storing the tap changing tool shall be provided near the tap changer.

2.1.4 Instrumentation

j. All instruments, gauges, and indicators shall be marked in metric units for temperature gauges and dual units for all others. They shall be located so that a person standing on the ground can read them without visual aids.
k. Service life of accessories shall be comparable with the transformer.
l. All gauges, meters, relays, recorders, thermal breakers, or other instruments sensitive to vibration and mounted on the transformer shall be either "shock-mounted" to protect them from damage or wear which could be caused by normal transformer vibration, or they shall be sufficiently rugged in construction to be functionally unaffected by transformer shock and vibration.
m. Contacts for DC operation shall be rated 125 volts DC, 1/2 amp continuous and suitable for operation in a

2.1.5 Control Compartment and Wiring

n. A weather-tight NEMA 4X control compartment shall be integrally mounted to the transformer tank and shall contain all control circuits, auxiliary relays, terminal boards, etc., as required to provide a single interface location for field installed wiring to the transformer.

o. Control compartment door hinge pins shall be stainless steel.

p. Hinged front access doors shall be lockable.

q. All alarm device contacts for Buyer's use shall be routed to screw type terminal boards located in the control compartment. Alarm contacts shall be wired in series, in an open to alarm configuration. The series string of contacts shall be factory wired, to two adjacent TB points and on the drawings clearly marked as field connections

r. All factory installed wiring shall be rated for 600 V service. Cable insulation shall be heat resistant cross linked 90°C synthetic polymer (type XHHW-2). Conductor material shall be stranded tinned copper with minimum sizes as follows:

Control and alarm circuits	14 AWG
Power circuits	12 AWG

s. Crimp ring type terminals are to be used on all leads.

t. All wiring routed on the exterior of the tank shall be routed in galvanized electrical steel conduit. Conduits shall be securely fastened to the transformer tank using fittings approved for the purpose. Short pieces (less than 4 feet) of flex conduit may be used to connect to instruments or gauges. Where flex conduit is used, the instrument or gauge must be electrically bonded to the transformer.

u. The control compartment shall have a field removable plate for conduit entrance.

v. Wiring shall meet the requirements of NFPA 70 (NEC).

2.1.6 Insulating Liquid

w. The transformer shall be shipped oil-filled.

x. Welding directly to radiator surfaces in direct contact with insulating oil is prohibited. Welding to radiator surfaces not in direct contact with insulating oil is permitted as long as the welded location cannot, under normal conditions experienced during transit, installation, operation , or maintenance create a leak from which oil can be discharged into the environment.

2.2 Terminal Points

a. HV Bushings (Cable)

b. LV Bushings (Cable)

c. Ground Terminals

d. Control Wiring TB' s

e. Auxiliary Power Wiring TB' s

2.3 Noise Levels

a. Near field noise level produced by the transformer and its accessories shall be not greater than 70dBA measured 1 meter in the horizontal plane and at an elevation of 1.5 meters from the transformer's base.

3.0 EXECUTION

3.1 Inspection

Vendor shall notify Buyer 14 calendar days in advance of test performance for witness testing.

3.2 Test

a. The Vendor shall describe all his standard factory tests. Factory tests required for certification and proof that the equipment furnished under this specification conforms to all applicable codes and standards shall be made at the expense of the vendor.

b. Any tests not witnessed by the Buyer shall be certified that they have been satisfactorily carried out. With a copy of the certificate forwarded to the Buyer prior to shipment. The Vendor shall furnish a list of any field tests.

c. The following minimum routine production tests shall be performed in accordance with ANSI/IEEE C57.12.90. Tests shall be performed with the specified bushings in place. Production tests are required to be performed on every piece of fabricated equipment:

a. Resistance measurements of all requirements

b. Ratio tests on the rated voltage connections and on all tap connections

c. Polarity and phase relation tests

d. No load tests at rated voltage.
e. Impedance voltage and load loss.
f. Low frequency dielectric tests.
g. Insulation power factor tests.
h. Insulation resistance tests.
i. Leak test.

3.3 Painting and Corrosion Protection

Painting and corrosive protection of equipment shall be in accordance with the Vendor's Standard Practice and shall include shot-blast metal preparation as a minimum. Finish paint color shall be ANSI 70 Light Gray. Primer: Amercoat PSX 7000 engineered Siloxane Coating. Minimum dry thickness (DFT) 3-mils

3.4 Spare Parts

a. Provide quote on recommended spare parts

3.5 Special Tools

Vendor shall supply all special tools required to install and maintain the transformer.

4.0 EQUIPMENT DATA SHEET – EXCITATION TRANSFORMER

4.1 General

a.	Quantity	One (1)
b.	Transformer Class	Power Class I. Rectifier Duty
C.	Transformer Type	Step-Down
d.	Installation	Outdoor
e.	Coolant	Type II Mineral Oil
f.	Oil Preservation System	Sealed Tank
g.	Cooling Class	ONAN
h.	Winding Material	Copper
I.	Number of windings	Two
J.	Number of Phases	Three
k.	Frequency	60HZ
I.	Vector Group	Yd1
m.	Auxiliary Power	
I.	Control	125 VDC. 2-wire. single feed (supplied by others)
n.	Junction Box	NEMA4X

4.1.1 Tap Changer

The high voltage winding shall be provided with two (2). 2-1/2% taps above and below rated winding voltage as well as a neutral position. The taps shall be located so as to result in minimum axial unbalance.

4.1.2 Transformer Rating

a.	HV Winding	1200 kVA
b.	LV Winding	Same as HV winding
C.	Insulation Class	Class A (minimum)
d.	Temperature Rise	65°C Winding rise above 30°C, average daily temperature with 40°C **maximum ambient**
e.	Hot Spot Temp Rise	80°C above ambient
f.	Transformer Impedance	6%
g.	Impedance Tolerance	±7.5%

4.1.3 High Voltage Section

4.1.3.1 High Voltage Winding

Rated Voltage	4.16 kV(nominal)
Connection	Wye. ungrounded
BIL	75 kV
Neutral	Not brought out

4.1.3.2 High Voltage Bushing

Location	Side wall mounted in air filled terminal enclosure

Voltage Class	5 kV (Minimum)
BIL	75 kV
Creepage Distance	Vendor Standard
Insulation	Porcelain

4.1.3.3 High Voltage Incoming Line Connection

Connection Type	Cable connection from below (by others)

4.1.4 Low Voltage Section

4.1.4.1 Low Voltage Winding

Rated Voltage	570 V(nominal)
Connection	Delta
BIL	45kV

4.1.4.2 Low Voltage Terminations

Location	Vendor Standard
Voltage Class	600V
BIL	45 kV nominal
Creepage Distance	Vendor standard
Insulation	Vendor Standard

4.1.4.3 Low Voltage Outgoing Line Connection

Connection Type	Cable connection from below (by others)

4.1.5 Other Features and Accessories

a. All windings to be ungrounded
b. Core must be effectively grounded
c. All terminals must be clearly labeled
d. Efficiency shall be greater than 99% at full load
e. Design Life shall be 20 years
f. Continuous voltage capability shall be 110% of voltage rating
g. Gas sampling valve/vent.
h. Automatic pressure relief device 63PR with alarm contacts to protect tank against excessive internal pressure. The relief device shall include a mechanical indication that the device has operated
1. Removable dial-type liquid level gauge for main tank, device 71Q, with alarm contacts. Gauge shall be marked to indicate when oil level is unsafe for transformer operation. The device shall be mounted such that it can be removed without breaking the tank seal
J. Removable dial-type thermometer to indicate top-liquid temperature, device 26Q, with adjustable alarm and trip contacts. Dial shall read 0-120°C and shall be equipped with a resettable drag hand. The device shall be mounted such that it can be removed without breaking the tank seal.
k. Access covers as required to provide access to the interior of the transformer tank.
I. Lifting lugs, pulling eyes, and jacking facilities for field installation of the transformer shall be provided per vendor standard.
m. Two two-hole welded grounding pads located at the lower diametrically opposite corners of the tank.
n. Upper and full drain lower valves to permit filling and emptying of the tank. Lower drain valve to contain a 3/8", or larger valve to permit easy sampling of the insulating liquid
o. Contacts 63PR, 71Q, and 26Q shall be normally closed and factory connected in series to form a common alarm that activates on opening of the listed contacts.

4.1.6 Excitation Transformer Operating Characteristics

4.1.6.1 Secondary Line Current Harmonic Content

Harmonic Number "h"	Nonlinear Load Current Ih (%)	(Ih)^2	ih	(ih)^2	(ih)^*h^2
1	100	1	0.96096335	0.92345	0.9234506
5	20	0.04	0.19219267	0.03694	0.9234506
7	14	0.0196	0.13453487	0.0181	0.8868819
11	9	0.0081	0.0864867	0.00748	0.9050739
13	7.5	0.00563	0.07207225	0.00519	0.8778552
17	5.8	0.00336	0.05573587	0.00311	0.8977749
19	5	0.0025	0.04804817	0.00231	0.8334141
23	4.5	0.00203	0.04324335	0.00187	0.9892233
25	4.1	0.00168	0.0393995	0.00155	0.9702003
TOTAL		1.0829		1	8.2073248
K = ∑ (ih^2 * h^2)	ih = Ih/ ∑ (Ih^2)^(1/2)			K-Factor	8.2073248

***Design K-Factor shall be no less than 8.5**

4.1.6.2 Thermal Secondary Current Overload* Duty

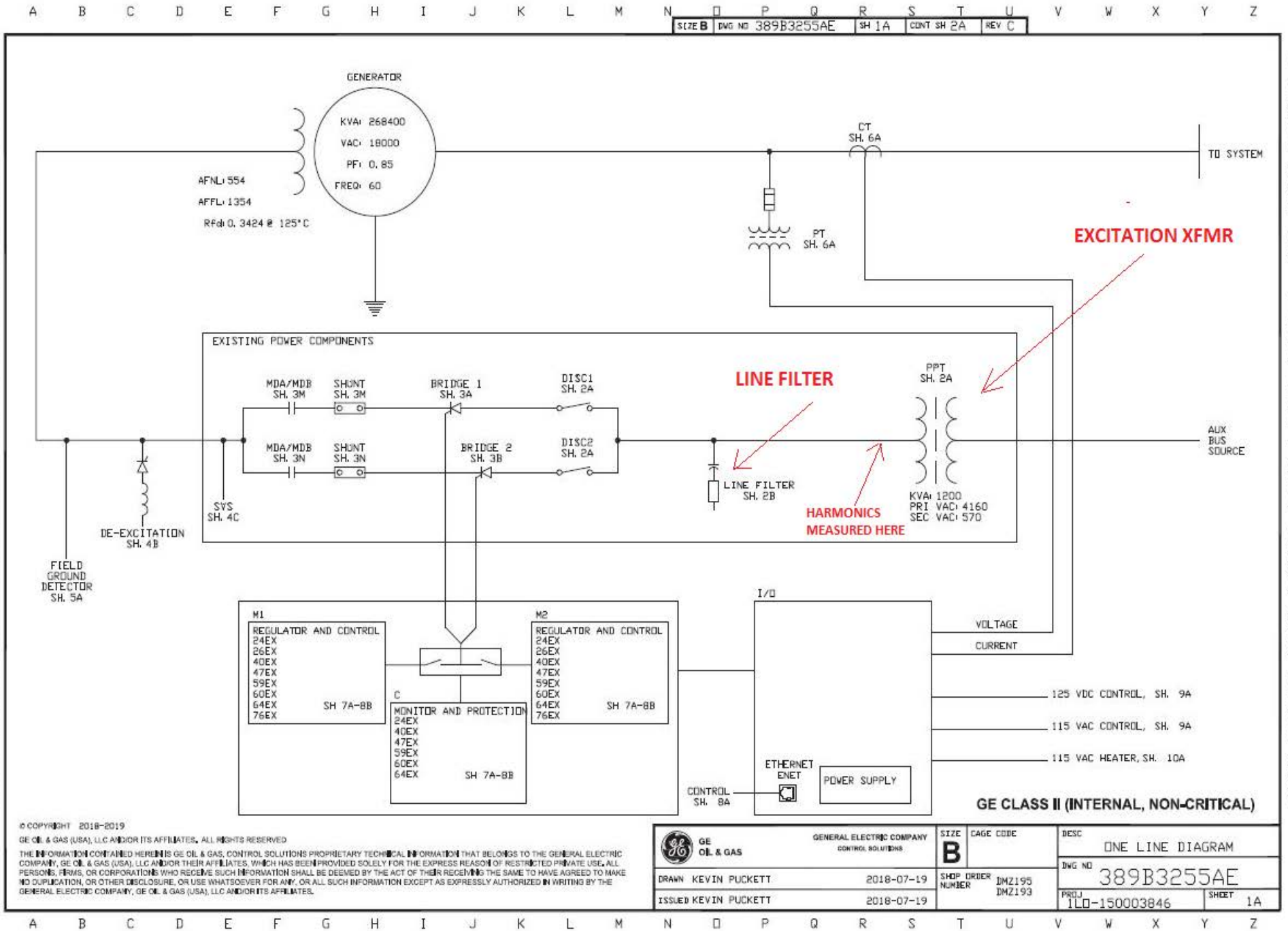
% of Secondary Current	Time
115	120 sec
150	60 sec
210	10 sec

***Frequency of overload is once per hour with a return to full load**

4.1.6.3 Voltage Range at Rated Frequency

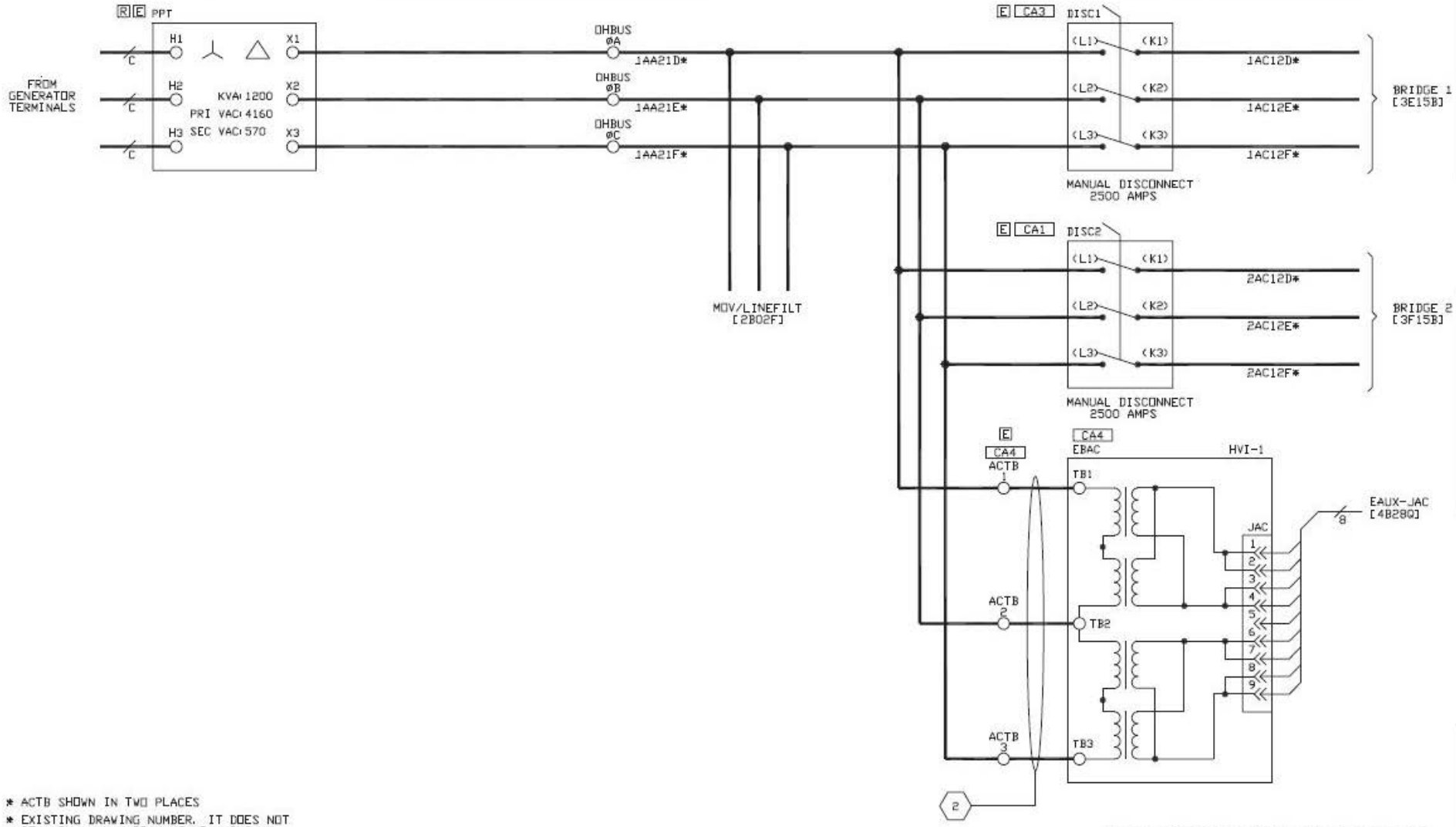
% of Primary Voltage	Time
110	Continuous
118	60 sec
130	10 sec
160	2 sec

EXCITATION ONELINE DIAGRAM



GE OIL & GAS — GENERAL ELECTRIC COMPANY, CONTROL SOLUTIONS	SIZE B	CAGE CODE	DESC: ONE LINE DIAGRAM
DRAWN KEVIN PUCKETT 2018-07-19	SHOP ORDER NUMBER DMZ195 DMZ193		DWG NO: 389B3255AE
ISSUED KEVIN PUCKETT 2018-07-19			PROJ: ILO-150003846 SHEET: 1A

SIZE B	DWG NO 389B3255AE	SH 2A	CONT SH 2B	REV C



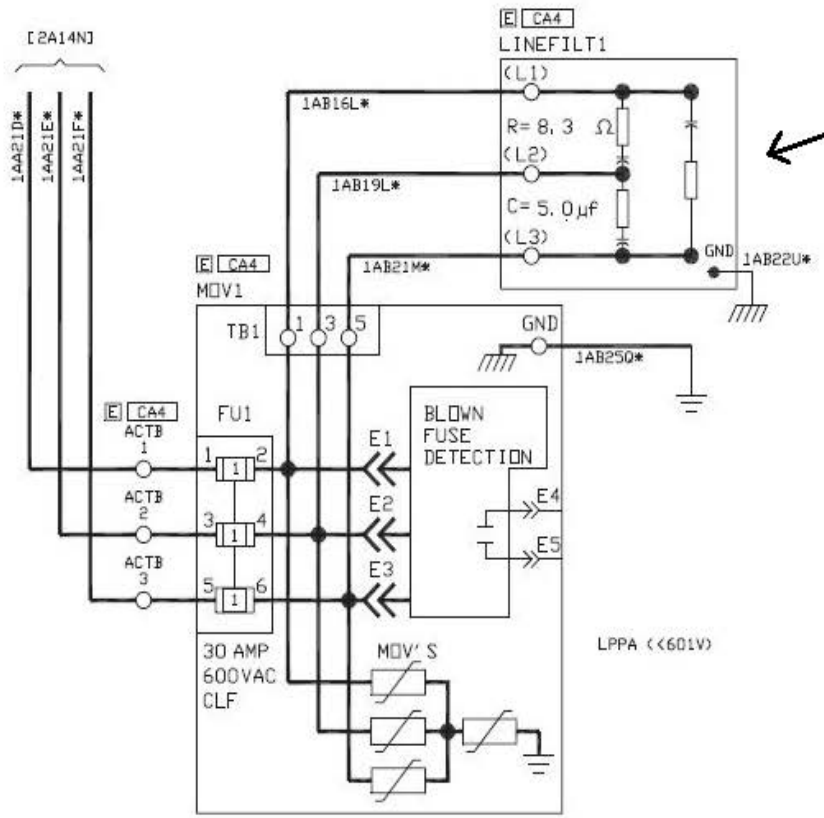
* ACTB SHOWN IN TWO PLACES

* EXISTING DRAWING NUMBER. IT DOES NOT CONFORM TO NEW DRAWING XREF SYSTEM

GE CLASS II (INTERNAL, NON-CRITICAL)

GE OIL & GAS	GENERAL ELECTRIC COMPANY CONTROL SOLUTIONS	SIZE B	CAGE CODE	DESC	AC POWER INPUT
DRAWN KEVIN PUCKETT	2018-07-19	SHOP ORDER NUMBER	DMZ195 DMZ193	DWG NO	389B3255AE
ISSUED KEVIN PUCKETT	2018-07-19			PROJ	1LO-150003846
				SHEET	2A

SIZE B	DWG NO 389B3255AE	SH 2B	CONT SH 3A	REV C



LINE FILTER

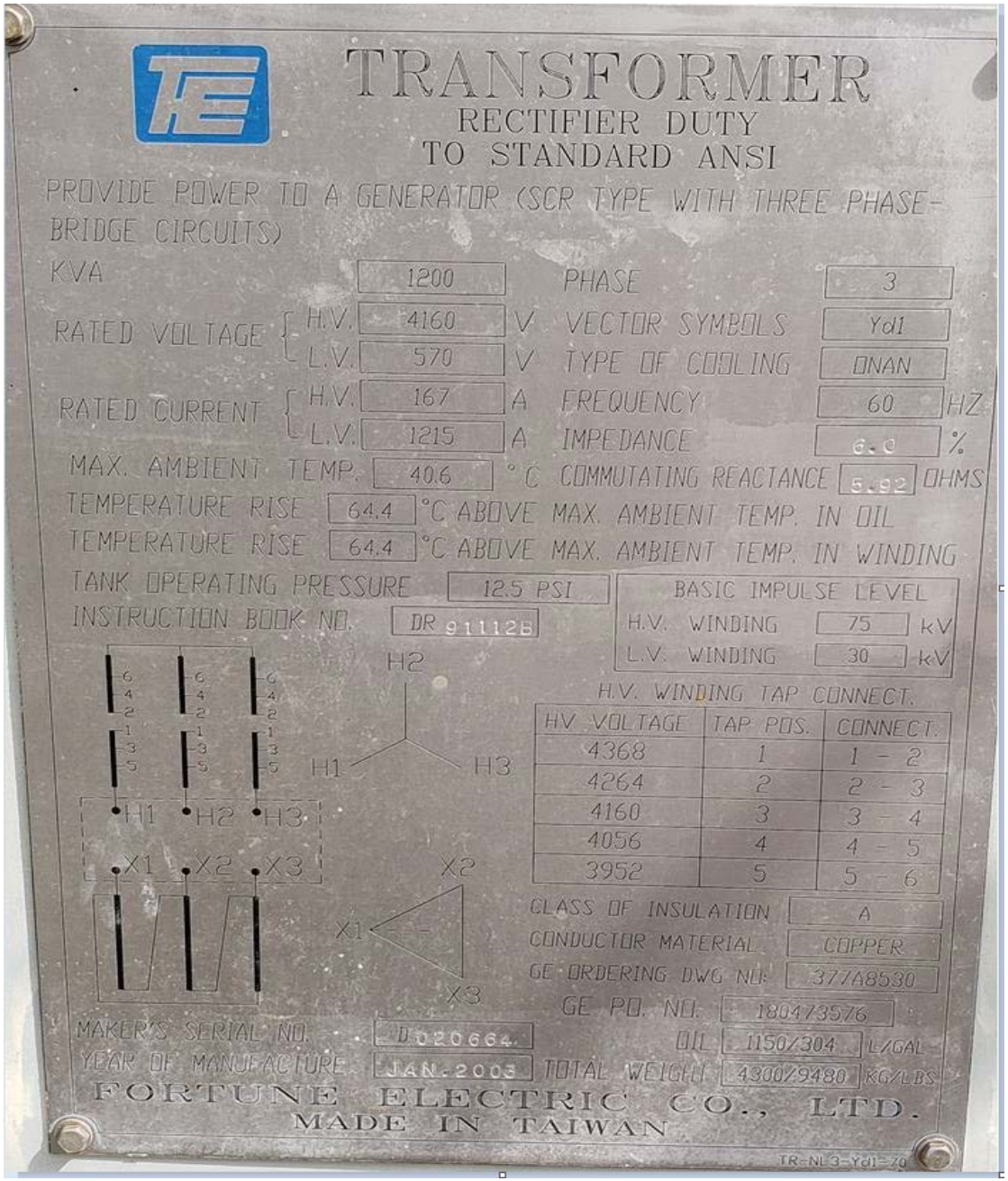
* ACTB SHOWN IN TWO PLACES

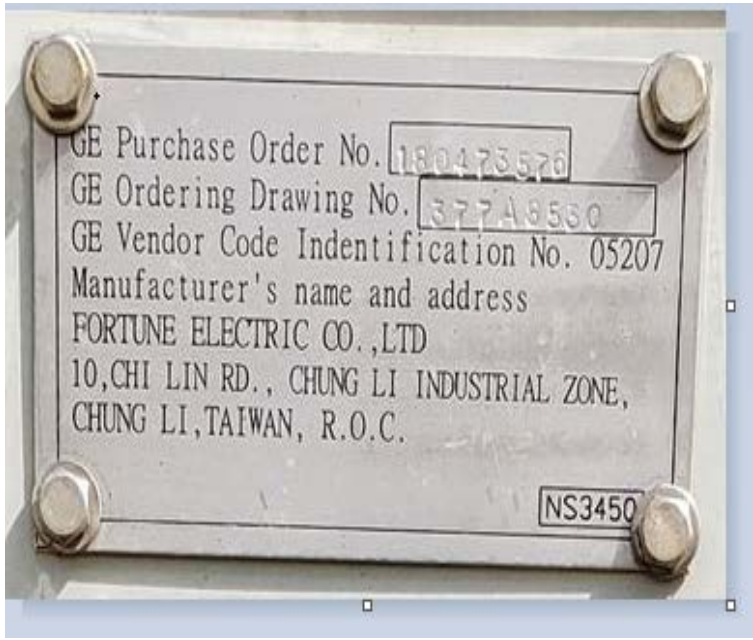
* EXISTING DRAWING NUMBER. IT DOES NOT CONFORM TO NEW DRAWING XREF SYSTEM

GE CLASS II (INTERNAL, NON-CRITICAL)

GE OIL & GAS — GENERAL ELECTRIC COMPANY, CONTROL SOLUTIONS		SIZE B	CAGE CODE	DESC: AC POWER INPUT
DRAWN KEVIN PUCKETT	2018-07-19	SHOP ORDER NUMBER	DMZ195 DMZ193	DWG NO: 389B3255AE
ISSUED KEVIN PUCKETT	2018-07-19			PROJ: ILD-150003846 SHEET: 2B

TRANSFORMER NAMEPLATE DATA





RELAY & DEVICE NOMENCLATURE
(SEE GPP ELEMENTARY FOR ADDITIONAL DETAILS)

26Q-( )	TRANSFORMER OIL TEMPERATURE ALARM
33ST	STEAM TURBINE STOP VALVE LIMIT SWITCH
50/51( )	EXCITATION TRANSFORMERS OVERCURRENT RLY
50RE	INSTANTANEOUS OVERCURRENT RELAY
50/62BF	BREAKER FAILURE RELAY
52G	GENERATOR BREAKER
52L	LINE BREAKER
59BN	BUS GROUND DETECTOR RELAY
60	VOLTAGE BALANCE RELAY
63PR( )	TRANSFORMER OIL PRESSURE RELIEF
71Q-( )	TRANSFORMER LIQUID LEVEL GAGE
86BF	BREAKER FAILURE LOCKOUT RELAY
86G1A	GENERATOR LOCKOUT RELAY
86RE	INADVERTANT ENERGIZATION LOR
86T	TRANSFORMER DIFF LOCKOUT RELAY
86U	UNIT OVERALL DIFF LOCKOUT RELAY
96G( )	TRANSDUCER (G)=WATTS/VARS

LPSO
MODEL: LPSOB35U123HE1N

21	DISTANCE RLY
78	LOSS OF SYNCH (OUT-OF-STEP)
VTFF	VOLTAGE TRANSFORMER FUSE FAILURE

LEGEND

IBF	INITIATE BREAKER FAILURE
LA	LIGHTNING ARRESTER
SR	SPARE
+	IF REQUIRED
*	TYPICAL
GE / CUSTOMER	TERMINATION POINT
TS	TEST SWITCH

EX2100e FUNCTIONS

30EX1	EX2100e GLOBAL ALARM OUTPUT
51L/AUX	BREAKER POSITION INPUT
86/41S	EXCITATION TRIP INPUT
94EX1	EX2100e TRIP OUTPUT

REGULATOR AND CONTROL (M1 & M2)

24EX	EX2100e V/HZ ALARM/TRIP
26EX	EX2100e BRIDGE OVER TEMPERATURE ALARM / TRIP
40EX	EX2100e LOSS OF EXCITER TRANSFER / TRIP
47EX	EX2100e BRIDGE AC PHASE UNBALANCE ALARM TRIP
59EX	EX2100e OVERVOLTAGE ALARM / TRIP
60EX	EX2100e PT (VTFF) FAILURE ALARM / TRANSFER / TRIP
64EX	EX2100e GENERATOR FIELD GROUND ALARM / TRIP
76EX	EX2100e OVER EXCITATION ALARM / TRIP

MONITOR AND PROTECTION

24EX	EX2100e V/HZ ALARM/TRIP
40EX	EX2100e LOSS OF EXCITER TRANSFER / TRIP
47EX	EX2100e BRIDGE AC PHASE UNBALANCE ALARM TRIP
59EX	EX2100e OVERVOLTAGE ALARM / TRIP
60EX	EX2100e PT (VTFF) FAILURE ALARM / TRANSFER / TRIP
64EX	EX2100e GENERATOR FIELD GROUND ALARM / TRIP
76EX	EX2100e OVER EXCITATION ALARM / TRIP

DGP DIGITAL GENERATOR PROTECTION
DGPS54AACA

24A/24T	VOLTS PER HERTZ ALARM/TRIP
27G	GENERATOR UNDERVOLTAGE
32-1,2	REVERSE POWER
40-1,40-2	LOSS OF EXCITATION
46A/46T	NEGATIVE SEQUENCE ALARM/TRIP
59G	OVERVOLTAGE RLY
64G1	GENERATOR STATOR GROUND FAULT
74( )	DGP ALARM OUTPUT CONTACT
81U-1/81O-1	UNDERFREQUENCY/OVERFREQUENCY
87G	GENERATOR DIFFERENTIAL RLY (DGP)
94G( )	DGP TRIP OUTPUT CONTACT
VTFF	VOLTAGE TRANSFORMER FUSE FAILURE

DIGITAL TRANSFORMER PROTECTION

CAT. NO. SR745W2P5G5HI (2 WINDING, ØCT INPUTS 5AMPS, GRD CT INPUT 5 AMPS, 125VDC POWER)

51TN-( )	GENERATOR XFMR NEUTRAL OVERCURRENT RELAY
63PTX-( )	CONFIGURE OUTPUT CONTACT TO LATCH CLOSE ON 63PT INPUT
87T	TRANSFORMER DIFFERENTIAL

DIGITAL TRANSFORMER PROTECTION

CAT. NO. SR745W3P5G5HI (3 WINDING, ØCT INPUTS 5AMPS, GRD CT INPUT 5 AMPS, 125VDC POWER)

63PTX-( )	CONFIGURE OUTPUT CONTACT TO LATCH CLOSE ON 63PT INPUT
87U	UNIT OVERALL DIFFERENTIAL

EQUIPMENT LOCATION KEY

VT	VT COMPARTMENT
EX	EXCITER (EX2000) BRIDGE W/EX2100e DFE
ET	EXCITATION TRANSFORMER (PPT)
NGD	NEUTRAL GROUND DEVICE
	GE EQUIPMENT MOUNTED SEPARATE FROM PACKAGE
	GENERATOR PROTECTION PANEL (GPP)
	GENERATOR COMPARTMENT
	GENERATOR BUSHING
	TURBINE CONTROL PANEL (TCP)
	CUSTOMER'S EQUIPMENT

NOTES:

1a. GENERATOR DIGITAL MULTI-METER (GEN DMM) (NEXUS 1250) SELECTABLE DISPLAYS:
- VOLTS 3Ø PHASE-PHASE AND PHASE-NEUTRAL
- AMPS 3Ø
- FREQUENCY, MW, MVAR, PF, MVA, MVARHR, MWHR

- 4-20mA OUTPUTS ARE FIELD CONFIGURABLE TO CURRENT, VOLTAGE, PF, VAR, MW AND/OR FREQUENCY
- INCLUDED ONE MODULE OF 4 OUTPUTS

1b. 4 TO 20mA ANALOG OUTPUTS FOR MW, MVAR, PF, FREQ AS WELL AS OTHER TURBINE PARAMETERS ARE AVAILABLE AS FIELD SELECTABLE OUTPUTS OUT OF THE TURBINE CONTROL PANEL; SEE MLI 4108.

2. GENERATOR PROTECTION REQUIRES (3) NORMALLY OPEN AND (3) NORMALLY CLOSED CONTACTS FOR 52G STATUS.

3. VT'S ARE NON-DRAWOUT.

4. ALL LOCKOUT RELAY (86) FUSES ARE MONITORED BY ALARM TO TURBINE CONTROL PANEL. THE 125VDC GENERATOR PANEL POWER SUPPLY IS MONITORED BY ALARM IN THE TURBINE CONTROL PANEL.

5. CT'S ARE C800, 0.3B-1.8

6. TEST SWITCHES TO BE PROVIDED ON NORMALLY OPEN LOCKOUT OUTPUT CONTACTS.

GEN DL 290T630

ML ITEM F049

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	SHEET 1 1. UPDATED REVISION STATUS BLOCK SHEET 2 1. UPDATED REVISION STATUS BLOCK 2. MADE CHANGE TO EX2000	02-01-16	DMJ
B	CHG'D STATUS OF DRAWING TO 'APPROVED FOR CONSTRUCTION' SHEET 1: 1. ADDED NOTE 6 2. UPDATED REVISION STATUS BLOCK SHEET 2: 1. ADDED TEST SWITCHES TO 87T AND 87U 2. ADDED CT RATIOS ZONE D7 3. ADDED 52 BKR AND 86 RELAY TO EXCITATION TRANSFORMER 4. REVISED VT1 5. ADDED 521A AND 521B 6. ADDED NOTE REFERENCE TO OUTPUT OF ALL LOCKOUT RELAYS 7. ADDED INITIATE BKR FAILURE TO 86G1A OUTPUT 8. ADDED DESCRIPTION OF REVISION B	02-08-22	ABG/ALK
C	SHEET 1 1. UPDATED REVISION STATUS BLOCK 2. UPDATED EX2100e FUNCTIONS & EQUIPMENT LOCATION KEY. SHEET 2 1. UPDATED REVISION STATUS BLOCK 2. UPDATED TO EX2000e BRIDGE W/EX2100e DFE	11-08-18	RJ

C	C	REV	REV STATUS OF SHEETS
2	1	SH	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL DECIMALS ±
3 PL DECIMALS ±
ANGLES ±
FRACTIONS ±

PROJECT: BRANDY BRANCH

MADE FOR: JEA

APPROVED FOR CONSTRUCTION

	SIGNATURES	DATE
DRAWN	A L KENDALL	02-03-25
CHECKED	A GEORGE	02-03-25
PROJ ENG	E NELSON	02-03-25
ISSUED	D. JACOBS	02-03-25
CIVIL	N/A	N/A
ELECTRICAL	A GEORGE	02-03-25
MECHANICAL	N/A	N/A
CONTROLS	N/A	N/A

GE POWER SYSTEMS
GENERAL ELECTRIC COMPANY
GENERAL ELECTRIC INTERNATIONAL, INC.
GLOBAL POWER PLANT SYSTEMS DEPARTMENT
Schenectady, NY - USA

ONE LINE DIAGRAM
STEAM TURBINE

FIRST MADE FOR ML- ML-512M1186 F049

SIZE D | CAGE CODE | DWG NO 207D1746 | REV C
SCALE NONE | SHEET 1

PPE JN: 512M1186
IPS96377

THIRD ANGLE PROJECTION

DT-7N

NAME: R:\2001\512m1186\ F049-207d1746.dwg DATE: AUG 22, 2002 TIME: 11:50 AM

SIZE	DWG NO	SH	REV
D	207D1746	2	C

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
C	FOR DESCRIPTION OF REVISION SEE SHEET 1	11-08-18	RJ

TO 86T
1200/5
10,000/5
TO CUSTOMERS SYSTEM
52L1
52L2
TO 51TN-3 87T
/5
FROM 63PT
87T
51TN-3
51TN-3
SELF TEST
SR745
TRIP 52L1(TC1)
TRIP 52L2(TC1)
ALARM
TRIP & BLOCK CLOSE 52G(TC1,TC2)
TRIP & BLOCK CLOSE 52L1(TC1,TC2)
TRIP & BLOCK CLOSE 52L2(TC1,TC2)
TRIP TURBINE
ALARM
EXCITATION
IBF
TRIP & BLOCK CLOSE 52-1A(TC1)
TRIP & BLOCK CLOSE 52-1B(TC1)
(SEE NOTE 6)
BKR TRIPS
TRIP 52G
ALARM
52G
DBF
50/ 62BF
50BF
READY
VT1
(3) VT'S
18,000-120V
400VA
120V
RES 60Ω 500W
10,000/5
CT'S 60,61,62
STATUS
TRIPS
GENERATOR BREAKER
TO 87U
52 1A
52 1B
4160V MAIN BREAKERS
59N
TRIP
READY
59BN MIV
TRIP 86U
ALARM
POWER SYSTEM FUNCTIONS
DISPLAY ON HMI : WATTS,VARS,PF, GEN VOLTS & FREQ,BUS VOLTS & FREQ
SYNCHRONIZATION: AUTO, MANUAL SYNCH CHECK
GENERATOR RTD MONITORING, ALARM, SHUTDOWN
DISPLAY, EXCITER CONTROL
CLOSE 52G
EXCITER DATA LINK
60
CUSTOMER GE
FROM 4160V FEEDER BREAKER
52
(3) LATER/5
VT
L.A. 21KV
VT2 18,000-120V
VT4 18,000-120V
15A
FROM 59BN
87U
SELF TEST
SR745
FROM AUX BUS CT'S
EXCITATION TRANSFORMER (PPT) TYPE OIL 4.16kV-570V 1200kVA Z=6%
ET
71Q
26Q
63PR
ALARM
EX
M1
REGULATOR AND CONTROL
24EX 47EX 64EX 26EX 59EX 76EX 40EX 60EX
M2
REGULATOR AND CONTROL
24EX 47EX 64EX 26EX 59EX 76EX 40EX 60EX
MONITOR AND PROTECTION
24EX 47EX 64EX 40EX 59EX 76EX 60EX
115VAC1 (CONTROL)
115VAC2 (CONTROL)
115VAC2 (HEATERS)
SHUNT
MDA(+)
MDB(-)
CONTROL
TRIP
52G/AUX
94EX
30EX
DATA LINK UDH
125VDC
52GX
86G1A
DE-EXCITATION
EX2000 BRIDGE W/ EX2100e DFE
SEE NOTE 1 (SHEET 1)
Nexus 1250
GEN DMM
96GG-1
RS232/RS485
PULSE OUTPUTS
4-20mA OUTPUTS
(3) 10,000/5 CT'S 21,22,23
TO DGP THIS SH.
(2) 10,000/5 CT'S 19A,19C
(3) 10,000/5 CT'S 16,17,18
TO CUSTOMER
(3) 10,000/5 CT'S 1,2,3
(3) 10,000/5 CT'S 4,5,6
(3) 10,000/5 CT'S 7,8,9
GEN FLD
GENERATOR
RTD'S
NGD
25KVA 12,000-240V DRY TYPE NEUTRAL GROUND TRANSFORMER
0.68 Ω 306A 1 MIN.
LPSD
T1
T2
T3
A1
A2
A3
A4
SR
ALARM
SELF-TEST
PWR SUPPLY
TRIP 52G(TC1)
TRIP 52G(TC2)
VTFF
50P 51P
50RE MIF
81RE
(SEE NOTE 6) TRIP & BLOCK CLOSE 52G (TC1,TC2) IBF ALARM
33ST 33ST 33ST
33 SYX
STEAM TURBINE STOP VALVE LIMIT SWITCHES
TO GEN PROTECTION FAILURE TRIP CIRCUIT
FROM LINE SIDE CT'S
AACA DIGITAL GENERATOR PROTECTION
24T 59G 40-1,2 64G1 46T 64G2 87G
27G 32-1,2 81U
94G
74G
94G1
74G1
94G2
74G2
94G3
74G3
74A
74B
74C
74D
(24A)
(46A)
810-1
VOLTS/HZ ALARM
NEG SEQ CURRENT ALARM
CRITICAL
NON-CRITICAL
SELF-TEST INDICATION
PWR SUPPLY
VTFF (20W)
RS232
TRIP TURB(ALARM)
TRIP 52G(TC1)
74 CRX
DGP FAILURE INITIATE NORMAL SHUTDOWN
TO GEN PROT FAILURE TRIP CIRCUIT

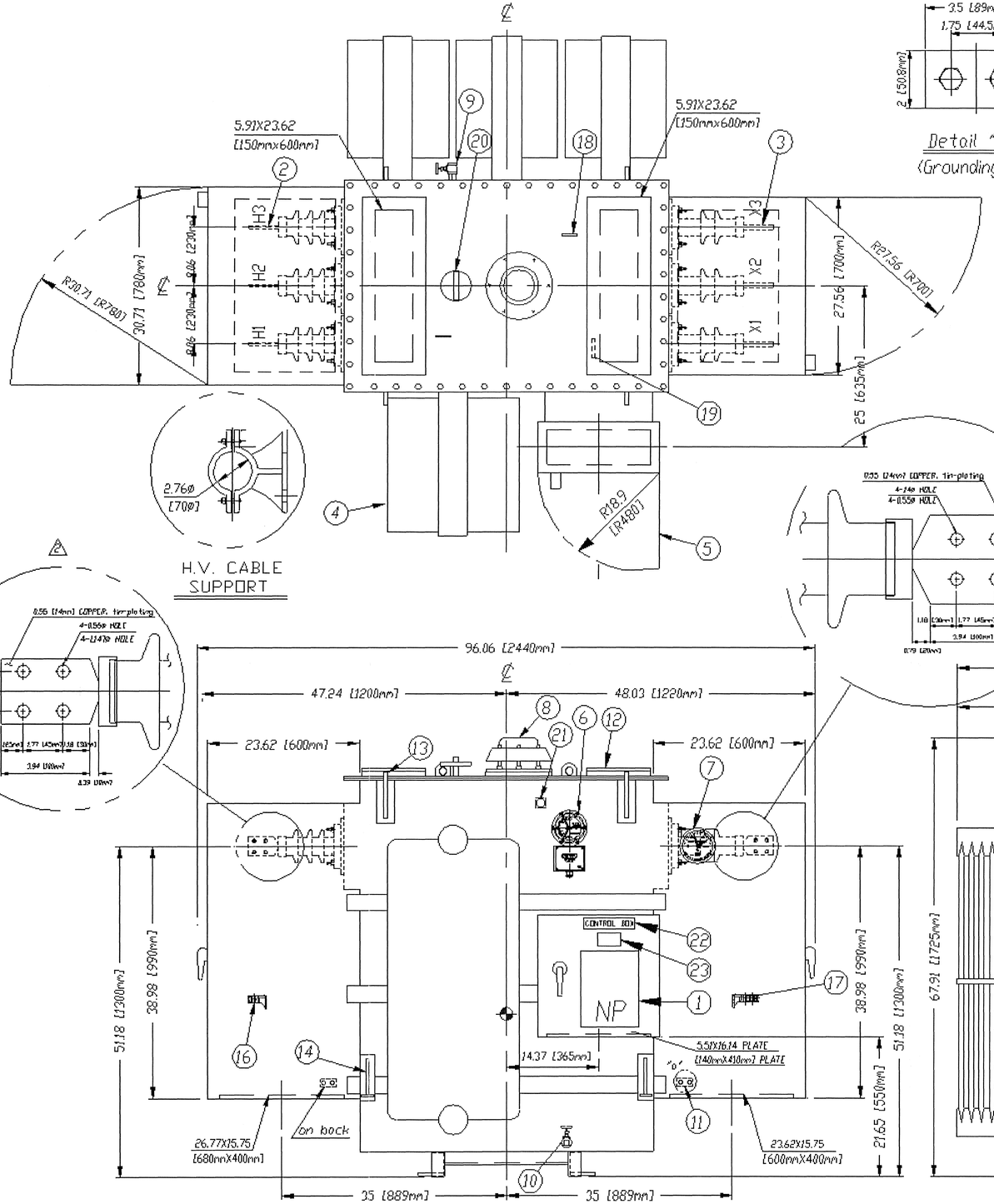
TYPICAL GEN BASE RATING AT 45 PSIG COLD GAS AND 88 FT ELEVATION	
KVA	268,400
P.F.	0.85
FREQ HZ	60
KV	18
GEN DESIGN NO.	G327T22

GEN DL 290T630
ML ITEM F049

GE POWER SYSTEMS — GENERAL ELECTRIC COMPANY, GENERAL ELECTRIC INTERNATIONAL, INC., GLOBAL POWER PLANT SYSTEMS DEPARTMENT, Schenectady, NY -USA

DRAWN A L KENDALL
ISSUED D. JACOBS
SIZE D
CAGE CODE
DWG NO 207D1746
SCALE NONE
SHEET 2

PPE JN: 512M1186
IPS96377



ACCESSORIES DESCRIPTION

ITEM	DESCRIPTION	Q'TY
1	NAME PLATE	1
2	PRIMARY BUSHINGS	3
3	SECONDARY BUSHINGS	3
4	RADIATORS	4
5	CONTROL BOX (NEMA 4X)	1
6	OIL LEVEL GAUGE WITH ALARM CONTACT (71Q)	1
7	DIAL THERMOMETER WITH ALARM AND TRIP CONTACTS (26Q)	1
8	PRESSURE RELIEF DEVICE WITH ALARM CONTACT (63PR)	1
9	OIL FILTER VALVE	1
10	OIL DRAIN VALVE WITH 3/8" SAMPLING VALVE	1
11	GROUNDING DEVICE	2
12	HAND HOLE	2
13	LIFTING LUG FOR TANK	4
14	JACKING BOSSES	4
15	SKID BASE	1
16	H.V. CABLE SUPPORT (70Ø)	3
17	L.V. CABLE SUPPORT(90Ø)	3
18	LIFTING LUG FOR COVER	2
19	REMOVABLE TEST CONNECTION FOR CORE GROUNDING	1
20	NO LOAD TAP CHANGER	1
21	GAS SAMPLING DEVICE	1
22	CONTROL BOX LABEL	1
23	MANUFACTURER INFORMATION LABEL	1

APPROXIMATE QUANTITY		
TOTAL WEIGHT	9480 lbs	4300 KG
TANK & FITTINGS	2458 lbs	1115 KG
CORE & WINDINGS	4740 lbs	2150 KG
TOTAL OIL (1150 LITERS)	2282 lbs	1035 KG

RATINGS

CLASS	PHASE / HZ	KVA	TERMINAL VOLTS H.V.	TERMINAL VOLTS L.V.
ONAN	3 / 60	1200	4160V Y	570 △

The windings will be made of copper

NOTE:
1. DIMENSION TOLERANCE IS ± 3%
2. ⊕ MEAN CENTER OF GRAVITY FOR COMPLETE ASSEMBLY
3. FINISH COLOR IS ANSI 61 LIGHT GRAY

M010322-411A014 R2
JEA BRANDY BRANCH 7/10/2002

Review does not relieve contractor from responsibility for errors or deviations from contract requirements
UTILITY ENGINEERING
DJP

- ☑ NO EXCEPTIONS NOTED Release for manufacture
- ☐ EXCEPTIONS NOTED Release for manufacture Revise and resubmit for distribution
- ☐ RETURNED FOR CORRECTION Do not proceed Revise and resubmit for authorization

Project Name : JEA Brandy Branch
PPE Project Number : 512M1186
Generator DL # : 290T630
MLI : C150

SYM.	DATE	REVISIONS	REVD.	CHKD.	APPD.
2	6-21-'02	CHANGE HV Terminal detail	S.F.Chou	C.J.Perng	J.H.Tzeng
1	4-30-'02	Add. BOLTS BY SUPPLIER	S.F.Chou	C.J.Perng	J.H.Tzeng

SCALE 1:30 UNIT inch(mm)
PROJECTION
DWN. S.F.Chou 04-25-'02
CHKD. C.J.Perng 04-25-'02
APPD. J.H.Tzeng 04-25-'02

FORTUNE ELECTRIC CO., LTD.

TITLE
3Ø-60HZ-4.16KV/570V-1200KVA

DWG. NAME:
OUTLINE OF GT EXCITATION TRANSFORMER

DWG. NO. 13-10845

REFER. DR91112B

REV.NO △2 △1

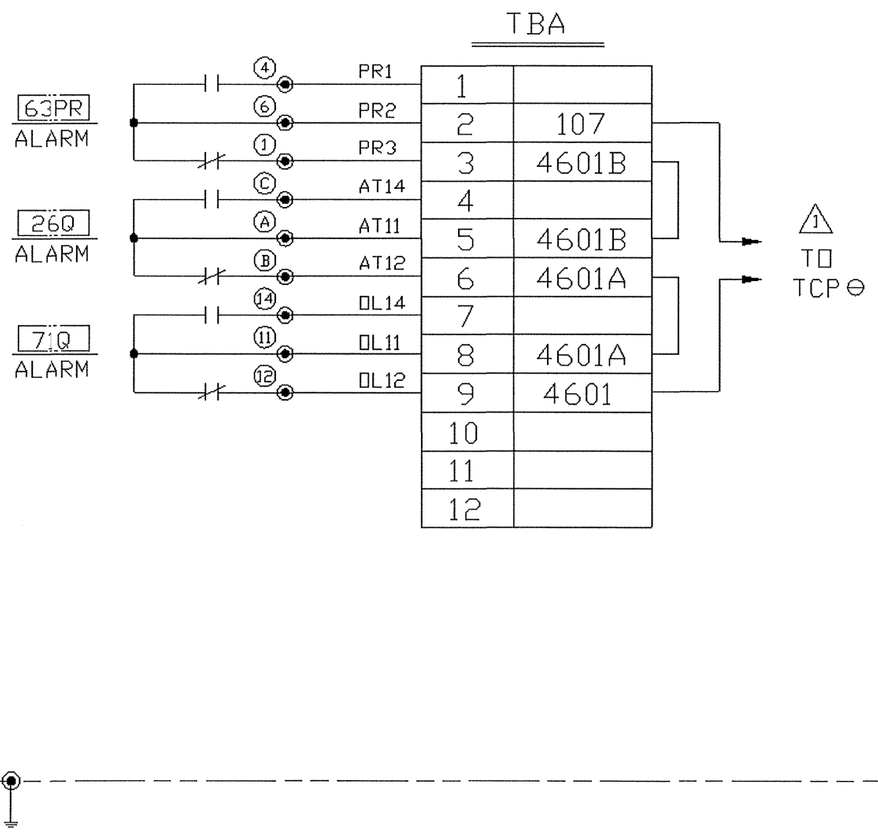
NOTE:
1. SIZE OF CONTROL WIRE

CONTROL AND ALARM CIRCUITS	14 AWG
CT CIRCUITS	10 AWG
POWER CIRCUITS	12 AWG

WIRE TYPE : XHHW-2

2. [ ] IS DEVICE CODE
   ○ IS DEVICE'S TB NUMBER

TERMINAL BOX



CIRCUIT	DESCRIPTION	RECOMMEMED FACTORY SETTING
63PR	PRESSURE RELIEF DEVICE	
26Q	DIAL TYPE THERMOMETER FOR OIL	ALARM-100 °C TRIP-105 °C
71Q	OIL LEVEL GAUGE	

M010322-411A015 R1

JEA BRANDY BRANCH **5/3/2002**

Review does not relieve contractor from responsibility for errors or deviations from contract requirements

UTILITY ENGINEERING

DJO

- [X] NO EXCEPTIONS NOTED
  Release for manufacture
- [ ] EXCEPTIONS NOTED
  Release for manufacture
  Revise and resubmit for distribution
- [ ] RETURNED FOR CORRECTION
  Do not proceed
  Revise and resubmit for authorization

Project Name : JEA Brandy Branch
PPE Project Number : 512M1186
Generator DL # : 290T630
MLI : C150

SYM.	DATE	REVISIONS	REVD.	CHKD.	APPD.
△1	4-30-'02	Delete C383A	S.F.Chou	C.J.Perng	J.H.Tzeng

SCALE 1/NTS UNIT mm
PROJECTION

DWN. S.F.Chou 4-25-'02
CHKD. C.J.Perng 4-25-'02
APPD. J.H.Tzeng 4-25-'02

FORTUNE ELECTRIC CO., LTD.

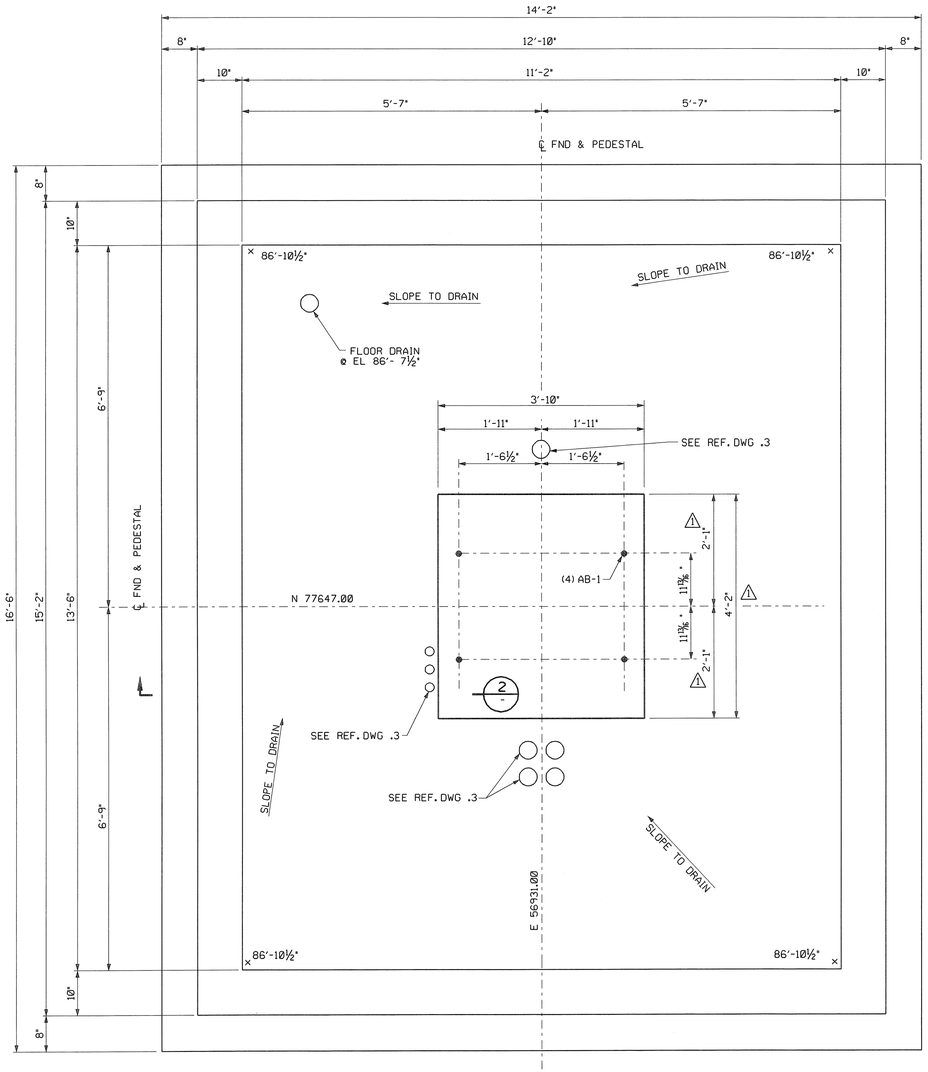
TITLE
3ø-60Hz-4.16KV/570V-1200KVA

DWG. NAME:
TR. CONTROL CIRCUIT

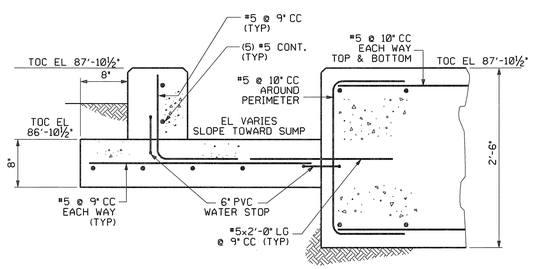
DWG. NO. 14-19935

REFER. DR91112B

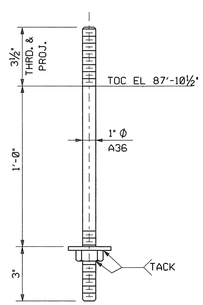
REV.NO △ △ △1



PLAN VIEW



SECTION (2)



AB-1

GALVANIZED

GENERAL NOTES

1. FOR GENERAL NOTES SEE DWG #1

REFERENCE DRAWINGS

1. GENERAL SITE RELATED SCOPE
   GENERAL CONSTRUCTION NOTES
   D010322-100S001
2. FORTUNE ELECTRIC CO.
   1200 KVA EXCITATION TRANSFORMER
   M010322-411A014 R2
3. SITE UNDERGROUND UTILITIES
   STUB UP DETAILS
   EXCITATION TRANSFORMER
   D010322-591E007
4. SITE UNDERGROUND UTILITIES - ZONE 4
   D010322-591L104 S01

1	FINAL ISSUE PER FM #186	081804	DD			
Ø	ISSUED FOR CONSTRUCTION					
NO	REVISIONS	DATE	BY	CHK	DSNR	APPR

UTILITY ENGINEERING
HEADQUARTERS
901 MARQUETTE, MINNEAPOLIS, MINNESOTA 55402
AMARILLO, TEXAS GROTON, CONNECTICUT DENVER, COLORADO

JEA | BE&K

JEA BRANDY BRANCH
EXCITATION TRANSFORMER FOUNDATION
PLAN, SECTIONS, & DETAILS

DRAWN	Ø91202	DESIGNED	Ø91602	CHECKED	Ø91302	CHECKED	Ø91602
K. BENDER		C. BURRIER		D. FANSHER		DK. VINSON	

APPROVED	CADD DRAWING NUMBER	SHEET	REV
DK VINSON FOR TLP	D010322-625S100		1

APPROVED

Chris S. Burrier 11/18/05

phtd 10/21/2004
10:33:07 AM
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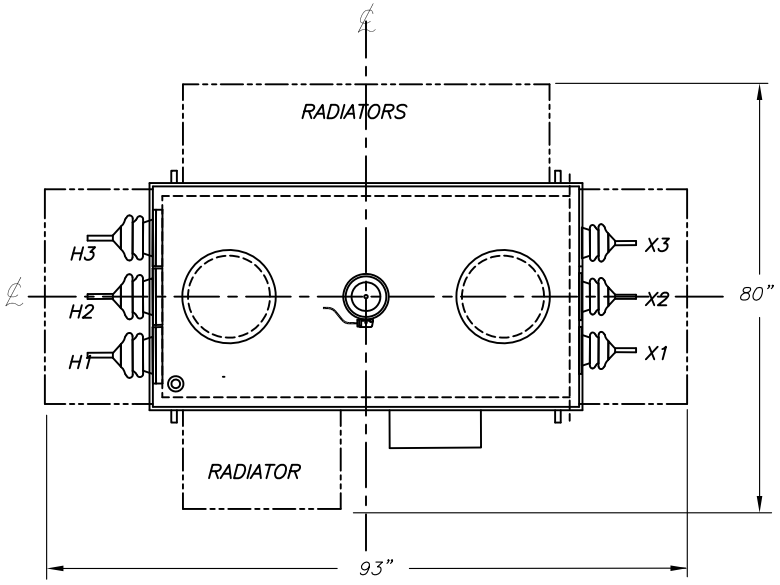

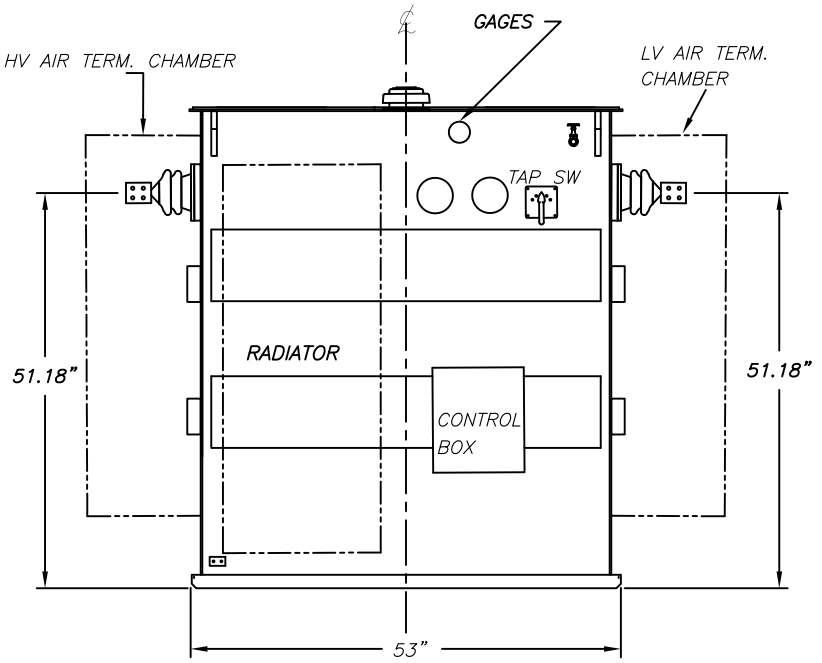

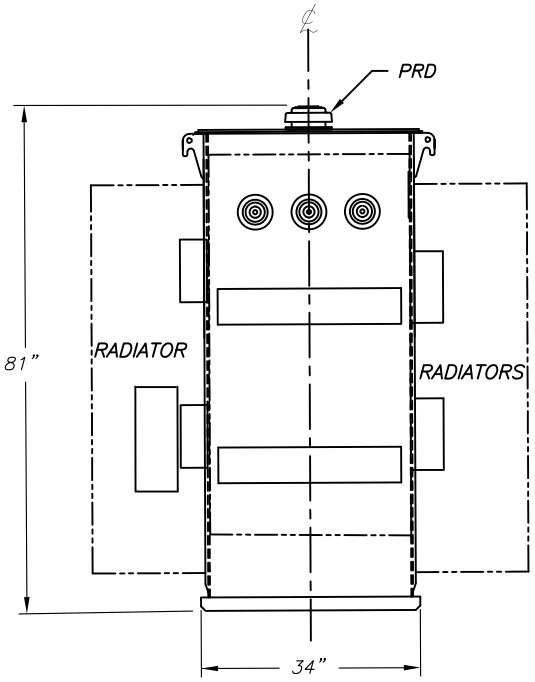

NIAGARA TRANSFORMER CORP.
1755 DALE RD. * P.O. BOX 233 * BUFFALO, N.Y. 14225

Title	TRANSFORMER SKETCH		
Dwn. NA	Date: 10/17/20	Dwg. No. WM47925	Rev 0
Chk.	Scale:		

TYPE II MINERAL OIL FILLED
SUBSTATION TRANSFORMER

1200 KVA, 60 Hz, 3 PHASE

CLASS: ONAN 65°C RISE.

PRIMARY VOLTS: 4160V WYE 75kV BIL
TAPS : (2) +/- 2.5%

SECONDARY VOLTS: 570V DELTA 45kV BIL

APPROX. OIL VOLUME : 358 Gals.
APPROX. TOTAL WEIGHT : 12,704 Lbs.
APPROX. SHIPPING WEIGHT (WITH OIL) : 12,704 Lbs.

NOT FOR CONSTRUCTION
NOT TO SCALE – APPROX. WEIGHTS & DIMS. – DETAILS NOT SHOWN