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DOCUMENT REVIEW:
IOWA ELECTRIC LIGHT & POWER
DESIGN ENGINEERING DEPARTMENT
1. ☐ WORK MAY PROCEED.
2. ☐ REVISE AND RESUBMIT. WORK MAY PROCEED SUBJECT TO INCORPORATION OF CHANGES INDICATED.
3. ☐ REVISE AND RESUBMIT. WORK MAY NOT PROCEED.
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SUPERVISING ENG. NUC. PROJ. ______ INITIAL DATE ______

~~NUCLEAR SAFE~~TY RELATED

INSTRUCTION MANUAL

FOR

RPS

ELECTRICAL PROTECTION ASSEMBLY

914E175

PER

GENERAL ELECTRIC COMPANY

NUCLEAR ENERGY DIVISION

RECEIVED
MAY - 4 1981
DESIGN ENGINEERING

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FROM

GENERAL ELECTRIC COMPANY

RE-ENTRY SYSTEMS DIVISION
FIELD SERVICE OPERATIONS
LOMPOC, CALIFORNIA

FOR INFORMATION ONLY

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GENERAL

This manual is provided as the basic manual for Operation and Maintenance of the Electrical Protection Assembly (EPA) per General Electric Drawing Number 914E175.

The Electrical Protection Assembly (EPA) is composed of two basic subsystems:

a) A General Electric Type TFJ-175A circuit breaker with companion TFK under-voltage release.

b) Electrical protection logic printed circuit card.

The TFJ circuit breaker and electrical protection circuit card may be referred to as the Electrical Protection Assembly (EPA). This manual provides essential information for the operation and maintenance of the EPA unit, and detailed information for the operation and maintenance of the electrical protection logic circuit card.

SPECIFICATIONS

System Definition

The Electrical Protection Assembly (EPA) provides redundant protection to the Reactor Protection System (RPS), and other essential circuits against over-voltage, under-voltage and under-frequency. The EPA consists of trip components which disconnect circuitry from input power whenever voltage or frequency exceeds their normal tolerance.

Front Panel Control/Indicators

1. **Indicators (Test/Maint.)**
   a) Over-voltage
   b) Under-voltage
   c) Under-frequency
   d) Power IN
   e) Power OUT
2. **Indicators (Operation)**
   a) Input Power
   b) Output Power
3. **Controls**
   a) Main circuit breaker ON/OFF
   b) Lockswitch for test maintenance use.

Electrical Requirements

Voltage: 120 Volts ±2%
Current Rating:
Start-up Current: 280MA for one second
Running Current: 250MA
Single Phase: Two Wire (plus ground)
Frequency: 50HZ/60HZ
Time Delay: Continuously Adjustable
0.1 to 3.0 Sec.
Circuit Breaker Max Load: 175 Amps A.C.

Operating Requirements

Temperature:	40° to 137°F
Humidity:	Up to 95% Relative
Radiation:	$2x10^4$ RAD, Silcon Total Integrated Dose (TID) for Group 1
	2.0×10^5 RAD, Silcon Total Integrated Dose (TID) for Group 2
Altitude:	0-10,000 feet above sea level.

Mechanical

Weight:	60 lbs.
Height:	20″
Depth:	8″
Width:	16″

A hasp and staple are provided for padlocking the EPA enclosure. External feet are furnished for mounting.

Cables

Cable and conduit access openings to be provided by user at time of installation.

Seismic Qualification

a) Operating base earthquake (OBE) 5.OG
b) Safe Shutdown earthquake (SSE) 7.OG
c) Frequency Spectrum 1 to 33 HZ

INSTALLATION

Mechanical Installation

The Electrical Protection Assembly (EPA) was designed for vertical wall mounting with external feet provided as an integral part of the enclosure, and provides protection from dirt, dust, oil and water. Preferred cable entrance and exit points are from top and bottom of assembly. The right side may be used as an alternate location if top and bottom prove to be impractical due to interference with proximity equipment.

Electrical Installation

Two EPA's are connected in series, on the output of each RPS motor-generator set.

Also, two EPA's are connected in series between each auxiliary power source which feeds auxiliary power to the RPS line.

OPERATION

General

Before attempting to operate the Electrical Protection Assembly (EPA), the operator should be thoroughly familiar with the operating instructions in this manual.

Front Panel Controls And Indicators Functional Description

1. **Controls**

   A. **Circuit Breaker**

   Controls output power to RPS bus and may be controlled manually or automatically by trip conditions.

   B. **Lockswitch**

   Provides administrative control of test mode when performing maintenance or calibration of trip points by tripping circuit breaker when lockswitch is in maintenance position. Lockswitch also transfers logic P.C. card transformer from circuit breaker power to front panel test jacks.

   C. **Test Jacks**

   Provides for calibration or test of trip parameters (over-voltage, under-voltage, and under-frequency).

2. **Indicators**

   A. **L.E.D. Data Lamps**

   Indicates a failure of the following motor generator parameters: Over-voltage, under-voltage, and under-frequency.

   B. **Incandescent Lamps**

   Indicates power into the EPA and power out of the EPA.

Logic Circuit Card Controls Functional Description

1. **Controls**
   - A. **Over-Voltage Trip Point Setting R5**
     Sets the over-voltage detection trip point through the range of 96VRMS to 138VRMS.
   - B. **Under-Voltage Trip Point Setting R6**
     Sets the under-voltage detection trip point through the range of 96VRMS to 138VRMS.
   - C. **Under-Frequency Trip Point Setting R35**
     Sets the under-frequency detection trip point through the range 51Hz to 60Hz, and 42.5Hz to 50Hz.
   - D. **Voltage to Frequency Gain Control R33**
     Sets frequency from voltage to frequency converter to 6000Hz (U3 out) for an input of 120 V nominal.
   - E. **Time Delay Control R40, R54, R53**
     Continously adjusts time delay through the range of 0.1 to 3.0 seconds. An independent time delay is provided for each of the over-voltage, under-voltage, and under-frequency functions.
2. **Indicators**
   - A. No indicators are provided on the logic card. See front panel indicators during calibration or test.

Preliminary To Operation

Prior to any Electrical Protection Assembly (EPA) operation, the installation procedure should have been accomplished and the operator should be knowledgeable as to the function of the EPA controls and indicators.

Initial Power Turn On

The following initial power up sequence should be followed:

1. Facing the EPA enclosure with the door open to the left, verify that the power line cables are connected to the circuit breaker as follows: The neutral conductor should be on the right terminal (top and bottom), hot conductor should be on left terminal (top and bottom), and ground conductor should be on the terminal lugs provided on inside panel.
2. Close the door. Verify lockswitch is in the normal position (CCW).
3. With power applied, verify that "power in" indicator is lighted, and observe that over-voltage, under-voltage, and under-frequency indicators, and "power out" indicator are out.
4. Activate EPA circuit breaker to the ON position, and verify that "power out" indicator is lighted.
5. The EPA is now on-line and operational.
   NOTE: If any of the three failure indicators are illuminated during the power-up sequence, the circuit breaker will not set, even if circuit breaker is held in "ON" position.

Power Turn Off

Power to the RPS bus can be removed by throwing the circuit breaker to "OFF". Power will remain on EPA logic circuit card as long as the "Power in" indicator remains lighted.

THEORY OF OPERATION

Introduction

This section deals with the overall theory of operation of the 914E175 Electrical Protection Assembly (EPA). General Electric Drawing 184C4476 is contained in this manual and provides a schematic for the EPA system.

General System Operation

A. The 914E175 Electrical Protection Assembly (EPA) is intended to provide protection for the Reactor Protection System (RPS) of a boiling water reactor power plant. The EPA provides redundant protection against power source transitory over-voltage, under-voltage, and under-frequency conditions. Two EPA's are connected between each of the two RPS motor-generator sets and the RPS buses; also two series-wired EPA's are connected between the auxiliary power source and the RPS buses.

B. The EPA's over-voltage and under-voltage trip points are adjustable over the range of 96 VRMS to 138 VRMS of the nominal 120 VRMS A-C for a sine wave of 40 to 70 Hz. The EPA under-frequency trip point is adjustable from 42.5 Hz to 60 Hz. Whenever the A-C voltage deviates from the nominal value by +10% or −10%, or the frequency decreases below the nominal value of 60Hz −5% or 50Hz −5%, the EPA shall disconnect the power to the RPS bus.

C. The EPA incorporates three independent continuously adjustable time delay trip mechanisms with a range from 0.1 second to 3.0 seconds, and are factory set at 0.1 second +0.03 seconds.

D. Prior to calibration/maintenance, control is exercised through the lockswitch on the EPA to disconnect the electrical source from the RPS bus.

Detection And Logic Card Operation

A. Circuit card power is provided from a power transformer with the primary across the upstream side of the circuit breaker. A trip condition of the circuit breaker will not disconnect the circuit card from line power.

B. **Under-Frequency Detection**

Line parameters are monitored via one transformer T2 and a resistive voltage divider on TB1 which provides 7.5 volts RMS nominal to the logic card.

The 7.5 volts is fed to both the precision full wave A-C to D-C rectifier (U1), and a signal conditioning circuit (U11). The conditioned 60 Hz nominal square wave is a reference for the Phase Lock Loop Multiplier (U12, 13 and 14) which outputs 6000 Hz for a 60 Hz nominal input. This 6000 Hz is used as a clock for the precision under-frequency detector (U15, U16A), which has an adjustable range (R35) from 5100 Hz to 6000 Hz and 4250 Hz to 5000 Hz. Under-frequency detection is accomplished by comparing alternately charging and discharging RC networks, with the discharge rate of the fixed reference network (C16, R49). When the frequency falls below the detection point, the output of the high speed comparator (U16A) is a pulse train whose repetition rate equals that of the clock input and whose width is proportional to the difference between the actual frequency and the frequency set of the detector.

As the frequency get lower, the pulse width increases. The pulse train is converted to a constant high level, using a pre-triggerable one-shot multi-vibrator (U17A) whose period is approximately 20% longer than the period of the lowest frequency. When the output of the one-shot goes high, it commands the time (U18) to start through its time sequence. The timer delay is variable from 0.1 to 3 seconds with R53. After the delay is finished, the output up-clock is converted to a high level with the dual D Flip Flop (U19A). The high level goes to a three input nor-gate (U20) which turns off Q4 and in turn removes the ground from one side of the under-voltage coil in the circuit breaker. With the removal of current through the under-voltage coil, the circuit breaker trips removing power from the RPS bus.

NOTE: If the line frequency returns to nominal before the timer sequence runs its full period, the detection and timer circuitry will reset to normal without tripping the circuit breaker.

C. **Under-Voltage Detection**

The A-C to D-C converter (U1) is a precision circuit that converts the nominal A-C voltage to a nominal D-C voltage which controls a precision voltage to frequency converter (U2) with a nominal output of 12000 Hz. The 12000 Hz branches at this point to the over-voltage circuit and under-voltage circuit. The over-voltage description will be discussed in the next section. The 12000 Hz is converted to 6000 Hz with a 50% duty cycle in the dual D Flip Flop (U3B) which generates the clock for the under-frequency detector (U6 and U5B).

As the nominal voltage decreases toward the detection trip point, it is precisely tracked by the A-C to D-C converter, and the voltage to frequency converter which proportionately lowers the 6000 Hz from its nominal value. Under-frequency detection is then accomplished by comparing alternately charging and discharging RC networks with the discharge rate of the fixed reference network (C23) (R23).

When the frequency falls below the detection point, the output of the high speed comparator (U5B) is a pulse train whose repetition rate equals that of the clock input and whose width is proportional to the difference between the actual frequency and the frequency set of the detector. As the frequency gets lower the pulse width increases. The pulse train from the detector circuit is converted to a constant high level, using a pretriggerable one-shot (U7B) whose period is selected to be approximately 20% longer than the period of the lowest frequency.

When the output of the one-shot multi-vibrator goes high, it commands the timer (U10) to start through its time sequence. This sequence is variable from 0.1 to 3 seconds with R54, and when the time sequence is finished, the output up-clock only is converted to a high level with the dual D Flip Flop (U8B). The high level is then gated through a three input nor-gate which turns off Q4 and in turn removes the ground from one side of the under-voltage coil tripping the circuit breaker.

NOTE: If the line voltage returns to nominal before the timer sequence runs its full period, the detection and timer circuitry will reset to normal without tripping the circuit breaker.

D. **Over-Voltage Detection**

Like the under-voltage circuit, the 12000 Hz is converted to 6000 Hz @ 50% duty cycle in a dual D Flip Flop (U3A) which generates the clock for the over-frequency detector. As the nominal voltage increases toward the detection trip point, it is precisely tracked by the A-C to D-C convertor which proportionately raises the 6000 Hz from its nominal value. Over-frequency detection is then accomplished by comparing alternately charging and discharging RC networks, with the discharge rate of the reference network (C22, R21) fixed. When the frequency rises above the detection point, the pulse train (whose repetition rate equals that of the clock input, and whose width is proportional to the difference between the actual frequency and frequency set of the detector) is removed from the pretriggerable one-shot (U7A) which makes the output return to a low level. The output goes to a high level at this time and commands the timer to start through its time sequence. This time sequence is variable from 0.1 to 3 seconds with R40.

When the time sequence is finished the output up-clock only is converted to a high level with the dual D Flip Flop (U8A). This high level is then gated through a three input nor-gate which turns off Q4 and in turn removes the ground from one side of the under-voltage coil in the circuit breaker. With the removal of current from the under-voltage coil, the circuit breaker trips removing power from the RPS bus.

NOTE: If the line voltage returns to nominal before the timer sequence runs its full period, the detection and timer circuitry will reset to normal without tripping the circuit breaker.

CALIBRATION AND ADJUSTMENT

General

A. The 914E175 Electrical Protection Assembly (EPA) has seven adjustable controls located on the printed circuit card assembly. One controls the gain of the voltage to frequency converter. Three adjust the trip points of the over-voltage, under-voltage, and under-frequency detectors. Three independently adjust the time delay of the over-voltage, under-voltage, and under-frequency functions.

NOTE: Before performing any test or adjustment on an EPA, verify that it is not in service.

B. The following is a list of minimum requirements for the motor generator simulator, used to calibrate and maintain the Electrical Protection Assembly.

Frequency Range	35 Hz to 100 Hz in a single decade range
Resolution	0.1 Hz for the 35 Hz to 100 Hz range
Frequency Stability	10PPM/°C— 20 PPM/year
Waveform	Sine wave + 5%, –5% distortion
Amplitude	Continuously adjustable from 0 to 150 Volts RMS (0 to 425 volts peak to peak)
Amplitude Stability	+.5%, –.5%

C. The nominal line voltage is defined here as the value of voltage measured at the input of the EPA while delivering sufficient current to the scram discharge coils to drop 115 volts RMS across the coils. The upper trip point is set at minus 10% below nominal line voltage.

D. Preventive maintenance checks shall be performed every one hundred eighty (180) days and consist of the following:

1. Verification of trip point settings (recalibrate if required).
2. Visual examination for dust, oil, and moisture (clean and dry internal components).
3. Visual examination of critical joint areas of circuit breaker terminals, and jumper bar for signs of corrosion (clean corrosion and apply liberal amounts of Penetrox "A" compound).

Adjustment Procedure

Voltage To Frequency Converter Gain Adjustment

With the Electrical Protection Assembly powered up, verify with a digital A-C voltmeter that there is 7.5 VRMS at ST1. (It is assumed that 120 VRMS exists at the input to the primary of T1, and that power from the power source is present.) Connect digital frequency meter at Pin 3 of U2, and adjust R33 until the frequency counter reads 1200 Hz(+) or (–)60 Hz. Move digital frequency meter to U3A and verify that 6000 Hz clock is present at Pins 1, 2, 12 and 13 of U3.

Over-Voltage Trip Point Adjustment

Connect an Oscilloscope or suitable logic level indicator to U7 Pin 7, and verify a low state exists when the line voltage is nominal. With R5 adjusted clockwise, raise the line voltage to the upper trip point, and slowly turn R5 counter-clockwise until the indicator at Pin 7 just changes state without blinking, or a solid unbroken line appears on Oscilloscope. This change of state indicates a trip condition, and is also the command to start the timer sequence. With R5 set at the trip point, readjust the line voltage back to nominal line voltage and verify U7A Pin 7 returns to a low state. Without changing R5, slowly raise the line voltage towards the trip point. The level at U7A Pin 7 should change states between the limits of the trip point and 2.5% below the trip point. Repeat this last procedure five (5) times to verify repeatability of trip point setting. Return the line voltage to nominal.

Over-Voltage Time Delay Adjustment

Connect an Oscilloscope or suitable logic level indicator to ST5 and verify a low state exists when the line voltage is nominal. With R40 adjusted fully clockwise, slowly raise the line voltage towards the upper trip point. When the trip point is reached, verify by observing U7A Pin 7. The time from trip to a change in state at ST5 to a high level should not be less than 0.1 second nor more than 0.133 seconds. Return the line voltage to nominal, and adjust R40 fully counter-clockwise, and slowly raise the line voltage toward the upper trip point. When the trip point is reached, the time from trip to a change in state at ST5 should not be less than 3 seconds nor more than 4 seconds. Return the line voltage to nominal, and readjust R40 fully clockwise.

NOTE: This sets in minimum delay.

Under-Voltage Trip Point Adjustment

Connect an Oscilloscope or suitable logic level indicator to U7B Pin 10, and verify a low state is present when the line voltage is nominal. With R6 adjusted clockwise, lower the line voltage to the lower trip point, and slowly turn R6 counter-clockwise until the indicator at Pin 10 changes state without blinking or a solid unbroken line appears on Oscilloscope. This change of state indicates a trip condition, and is also the command to start the timer sequence. With R6 set at the trip point, readjust the line voltage back to nominal and verify U7B Pin 10 returns to a low state. Without changing R6, slowly lower the line voltage towards the lower trip point. The level at U7B Pin 10 should change states between the limits. Repeat this last procedure five (5) times to verify repeatability of trip point setting. Return the line voltage to nominal.

Under-Voltage Time Delay Adjustment

Connect an Oscilloscope and/or suitable logic level indicator to ST6 and verify a low state exists when the line voltage is nominal. With R54 adjusted fully clockwise, slowly lower the line voltage toward nominal. When the trip point is reached (verify by observing U7B Pin 10 per Section 5) the time from trip to a change in state at ST6 to a high level should not be less than 0.1 seconds or more than 0.133 seconds. Return the line voltage to nominal, and adjust R54 fully counter clockwise. Slowly lower the line voltage toward the lower trip point. When the trip point is reached, the time from trip to a change in state at ST6 should not be less than 3 seconds nor more than 4 seconds. Return the line voltage to nominal, and readjust R54 fully clockwise.

NOTE: This sets minimum delay.)

Under-Frequency Trip Point Adjustment (60HZ)

Connect an Oscilloscope to U12 Pin 4, and verify that the Phase Lock Loop is outputing 6000Hz ± 10Hz. Move Oscilloscope and/or frequency counter to U11 Pin 10 and verify that 6000Hz clock is present at the under-frequency detector. Move the Oscilloscope and/or a suitable logic level indicator to U17A Pin 6. Verify a low state exists when the line frequency is 60Hz nominal, and R35 is adjusted fully counter clockwise. Using the digital selector switches on the power source simulator, adjust the line frequency to 57.60Hz. Slowly adjust R35 clockwise until the indicator at Pin 6 changes state without blinking or a solid unbroken line appears on the Oscilloscope. This change of state indicates a trip condition, and also starts the timer sequence. Without changing R35 return the line frequency to 60Hz. Lower the line frequency toward 57.00Hz. Repeat this last procedure five times to verify repeatability of the trip point setting. Return line frequency to 60Hz when finished.

Under-Frequency Trip Point Adjustment (50HZ)

The procedure will be the same as in the above section, except the motor generator simulator will use 50Hz as a nominal frequency. When adjusting R35 the trip point setting will be 47.8Hz with a trip range of 47.5Hz minimum to 48.45Hz maximum.

Under-Frequency Time Delay Adjustment

Connect an Oscilloscope and/or suitable logic level indicator to ST7 and verify a low state exists when the line frequency is 60Hz nominal or 50Hz nominal as in the above two sections. With R53 fully clockwise, and using digital switches on simulator adjust the frequency toward 57.00Hz. With R53 fully clockwise, and using digital switches on simulator adjust the frequency toward 57.00Hz or 47.5Hz (60Hz or 50Hz sections above). When the trip point is reached (verify by observing U17A Pin 6 as per above two sections) the time from trip to a change in state at ST7 to a high level should not be less than 0.1 seconds nor more than 0.133 seconds. Return the line frequency to 60Hz/50Hz nominal, and adjust R54 fully counter clock-wise. Lower the frequency toward 57.00Hz/47.5Hz. When the trip point is reached the time from trip to a change in state at ST7 should not be less than 3 seconds nor more than 4 seconds. Return the line frequency to 60Hz/50Hz nominal, and readjust R53 clockwise.

NOTE: This sets minimum delay.

This concludes the calibration and adjustment of the Electrical Protection Assembly (EPA).

TROUBLESHOOTING

Philosophy

Troubleshooting should only be preformed by qualified technical personnel. The troubleshooting portion of this manual is provided to assist a troubleshooter in pinpointing a specific problem to a specific section of the assembly. If the assembly is on line and operational, the troubleshooter will have to first take the EPA out of service, then insert the assembly key into the lockswitch and turn it clockwise to "Cal/Maintenance" position. This will remove power from the EPA output, and place the logic card input across the two test jacks on the front panel.

A simulated signal may be inserted at the test jacks for troubleshooting the EPA.

CAUTION: Don't bet your life on the "power in" incandescent light bulb being good. After opening the front door, verify that zero voltage is present on the 120 volt input to the circuit breaker. There is no interlock switch in the EPA.

Initial Troubleshooting

Place a proper signal in the input test jacks with the lockswitch in the "Cal/Maintenance" position. If the over-voltage, under-voltage and under-frequency light emitting diodes (LED'S) are off, reset the circuit breaker. If the circuit breaker fails to reset, check the voltage at terminals 4 and 5 of TB1.

If approximately 14 volts D-C is present, then the circuit breaker is defective. If no voltage is present, then check for A-C voltage across ST2 and ST4 on the printed circuit board. If no A-C voltage is present, possibly transformer T1 is defective.

If the over-voltage or under-voltage LED is on, check for approximately 8 volts RMS at ST1 and ST3 on the printed circuit card. If incorrect, check resistors RS1 and RS2. If the resistors are all right, then check transformer T2 for proper operation.

If the under-frequency LED is on when the correct frequency is at terminal ST1 on the P.C. Card, the P.C. Card is defective and must be replaced.

NOTE: Field Service maintenance is at the printed circuit card level only. For component level maintenance, the faulty printed circuit card should be returned to GE Field Service Operation for repair, and return to spares.

Setpoint Verification

1. Transfer applicable RPS to a different power source.

   NOTE: Since an RPS bus can be connected to only one power source at a time, this will cause a brief half scram condition.

2. Put "keylock" switch in "Test" position. (Circuit breaker will trip.)

   NOTE: Opening of the EPA Panel door is not required for setpoint verification.

3. Insert test source signal in Test Jacks and adjust to required voltage to simulate proper voltage at scram coils. Reset the circuit breaker.

4. Increase voltage until over-voltage logic and circuit breaker trips. Verify that logic trips within technical specification limits. Reset circuit breaker. If trip point is not within limits, adjust the setpoint according to the procedure on page 9 of this manual.

5. Repeat procedure for under-voltage and under-frequency.

6. Remove test source, return "keylock" switch to "Normal" position and reset circuit breaker.

7. Transfer RPS bus back to original power source.

DOMESTIC PACKING AND SHIPPING PROCEDURE

1.0 **Scope**

This document defines the specific requirements for the domestic packing and shipping of "Electrical Protection Assemblies".

2.0 **Cleaning**

Each item to be packaged shall be carefully examined, any dirt, oil, grease, or other foreign material shall be removed prior to packaging.

3.0 **Packaging**

The materials to be shipped shall be packaged four (4) or six (6) to a container, and shall contain the following items:

4/6 - EPA Enclosures
4/6 - Pairs of lockswitch keys (one pair per enclosure).

Each pair of lockswitch keys shall be packaged in a stock control envelope with complete part identification clearly marked on the outer surface. The envelope shall then be taped on the inside of the enclosure door.

4.0 **Vapor Barrier**

4.1 The enclosure shall be placed in a bag-like container made from MIL-B-131 material. Also, the container will include in this bag, a one-pound bag of desiccant (MIL-D-3464, Type II). Install the humidity indicator in skin of vapor barrier bag with the indicator side out to provide visibility for inspection for desiccant saturation.

4.2 The vapor barrier bag shall then be evacuated using a suitable vacuum pump and sealed using a leak-proof heat sealing method.

4.3 Place the sealed leak-proof baglike container in the box constructed per paragraph 5.0 making sure the bag is sufficiently blocked, braced, and secured within the container so as to prevent shifting during transit. Also, make sure the bag is adequately cushioned in a manner that will protect its integrity during transportation and handling.

4.4 Place one copy of the packing list sealed in a vapor barrier material envelope. This envelope shall be clearly marked "Packing List" with a minimum 1/2" letter size.

4.5 Seal the box using procedures described in paragraph 5.3. Securely attach one copy of the packing list, sealed in a waterproof envelope, to the outside surface of the shipping container.

5.0 **Box Construction**

5.1 The shipping container shall be built to the dimensions shown in Shipping Container Drawing #147D7802 as applicable.

5.2 The box shall be constructed as shown in Drawing # 147D7802. All lumber shall be sound, well seasoned, commercial grade. Any knots shall be sound and not in excess of 1/3 the width of any board. Nails shall be driven into cleats in a staggered pattern. When assembling the panels, nails shall be driven in a straight pattern.

5.3 All nails shall be cement-coated or chemically etched cooler, sinks or standard box noils. Nails shall be sized so that there will not be less than 33 percent penetration of the secondary box member. For maximum strength, they shall be driven into the side grain of the lumber used for packaging. End grain nailing shall not be permitted. Lag screws or bolts and nuts may be used, instead of nails.

6.0 **Marking**

All marking described below shall appear on one side and the top of each container.

1. Control Number: Shipping notice number.
2. Case Number: _____ *X/ ____
   *X denotes box number
3. MPL#: _____
4. Part Number: _____ Rev _____
5. Part Name: Electrical Protection Assembly
6. Legend: "Made in U.S.A."
7. From: General Electric Co.
   Nuclear Energy System Division
   San Jose, CA U.S.A.
8. Dimensions: in
   Length ____
   Width ____
   Height ____
9. Cube: cu. ft. _____
10. LB.
    Gross Weight _____
    Legal Weight _____
    Net Weight _____
11. Handling Marks
    Fragile: (Wine glass)
    Sling Here: (Segments of chain links)
    No Hooks: (Grappling hook with cross)
    Up: (Two vertical arrows with underscore)
    Keep Dry: (Umbrella with rain drops)
    Center of Gravity: (Triangle with horizontal bar centered at apex.)
12. Desiccant: Desic _____ (No. of bags installed)
13. Dote:
14. Procedure Number:
15. Do not stack over 4 high.

EXPORT PACKING AND SHIPPING PROCEDURE

1.0 Scope

This document defines the specific requirements for the export packing and shipping of "Electrical Protection Assemblies".

2.0 Cleaning

Each item to be packaged shall be carefully examined and any dirt, oil, grease, or other foreign material shall be removed prior to packaging.

3.0 Packaging

The materials to be shipped shall be packaged four or six to a container, determined by shipping container group number used and shall contain the following items:

4 or 6 - E.P.A. Enclosures
4 or 6 - Sets of lockswitch keys

Lockswitch keys shall each be packaged in a stock control envelope with complete part identification clearly marked on the outer surface. The package shall then be taped to the inside of the enclosure door.

4.0 Vapor Barrier

4.1 The enclosure shall be placed in a bag-like container made from Mil-B-131 material. Also, include in this bag, a one pound bag of desiccant Mil-D-3464, Type II, non-dusting type. Install the humidity indicator in skin of vapor barrier bag with the indicator side out to provide visibility for inspection of desiccant saturation.

4.2 The vapor barrier bag shall then be evacuated using a suitable vacuum pump and sealed using a leak-proof heat sealing method.

4.3 Place the sealed leak-proof bag in the box constructed per paragraph 5.0 making sure the bag is sufficently blocked, braced, and secured within the container so as to prevent shifting during transit. Also, make sure the bag is adequately cushioned in a manner that will protect its integrity during transportation and handling.

4.4 Place one copy of the packing list inside the container sealed in a vapor barrier material envelope. This envelope shall be clearly marked "Packing List" with a minimum 1/2" letter size.

4.5 Seal the box using procedures described in paragraph 5.0. Securely attach one copy of the packing list, sealed in a waterproof envelope, to the outside surface of this shipping container.

5.0 Box Construction

5.1 The shipping container shall be built to the dimensions shown in DWG #147D7802.

5.2 The box shall be constructed as shown in DWG #147D7802. All lumber shall be sound, well seasoned, commercial grade. Any knots shall be sound and not in excess of 1/3 the width of any board. Nails shall be driven into cleats in a staggered pattern. When assembling the panels, nails shall be driven in a straight pattern.

5.3 All nails shall be cement-coated or chemically etched cooler, sinks, or standard box nails. Nails shall be sized so that there will be not less than 33 percent penetration of the secondary box member. For maximum strength, they shall be driven into the side grain of the lumber used for packaging. End grain nailing shall not be permitted. Lag screws or bolts and nuts may be used, instead of nails.

5.4 Each panel of shipping container must be lined with a laminated asphaltic waterproof kraft paper and all kraft joints shall be waterproof glued when assembling. (use PPP-B-1055, Class L-2b or Buyer approved equivalent.)

6.0 Cushioning will be provided by strapping and bolting (use rubber washer and contact cement under washer for waterproofing) the wooden shipping container to a "floating deck" type skid base. Follow details outlined below for construction of the skid base. See Figure 1 for example.

NOTE: Strap shipping container to "floating deck" only - not to skid base.

6.1.1 Fabricate a deck whose length and width is dimensionally the same as the base of the shipping container. Use 3/4 inch CD-X plywood for material.

6.1.2 Fabricate a skid base whose length and width is 2 inches larger than the floating deck described in step "1" above.

6.1.3 Cut strips of shock cushioning material. Material may be 2 inch thick ethafoam, 2 lb./ft. or 2" thick polyester polyurethane foam, 4 lb./ft. Quantity of cushioning material is dependent upon the weight of the item being shipped. If using ethafoam, the static loading should be approximately 2 lbs./in. (i.e., unit weighs 400 lbs., then 200 total square inches of foam required). If using polyester foam, the static loading should be approximately 4 lbs./in. (i.e., unit weighs 400 lbs., then 1,000 total square inches of foam required.)

6.1.4 The assembly sequence should begin first by locating and nailing 1/4 in. (min.) plywood "land strips" to waterproof skid base. These plywood strips will be dimensionally the same size as the foam strips. Spacing of these plywood strips to be equal distant with the end two strips ALWAYS on the edge of the deck.

6.1.5 Bond respective foam strips to plywood strips using contact adhesive (Scotch Insulation Adhesive #34 or "Weldwood Contact Cement, U.S. Plywood Corp.) or Engineering approved equivalent. Follow precautionary instructions printed on label, specifying product usage carefully. When using contact cements, it is important to roll or brush on adhesive on <u>both</u> contacting surfaces; allow a 10-15 minute drying time or until tacky, then bond together.

6.1.6 Bond plywood deck to foam strips in the same manner as described in step "5" above.

6.1.7 The four 1/2" carriage bolts in each corner of the deck will be tightened until foam cushioning material just starts to compress then locked with the double nuts. This completes the "floating deck" assembly.

7.0 <u>Marking</u>

All marking described below shall appear on one side and the top of each container.

1. Control Number: Shipping notice number.
2. Case Number: _____ *X/ _____
   **X denotes box number*
3. *MPL #:* _____
4. Part Number: _____ *Rev* _____
5. Part Name: Electrical Protection Assembly
6. Legend: "Made in U.S.A."
7. From: General Electric Co.
   Nuclear Energy System Division
   San Jose, CA U.S.A.
8. Dimensions:

	in.	cm.
Length	____	____
Width	____	____
Height	____	____

9. Cube: cu. ft. _____ cu. m _____
10.

	LB.	KG.
Gross Weight	_____	_____
Legal Weight	_____	_____
Net Weight	_____	_____

11. Handling Marks

    Fragile: (Wine glass)
    Sling Here: (Segments of chain links)
    No Hooks: (Grappling hook with cross)
    Up: (Two vertical arrows with underscore)
    Keep Dry: (Umbrella with rain drops)
    Center of Gravity: (Triangle with horizontal bar centered at apex.)

12. Desiccant: Desic _____ (No. of bags installed)
13. Date:
14. Procedure Number:
15. Do not stack

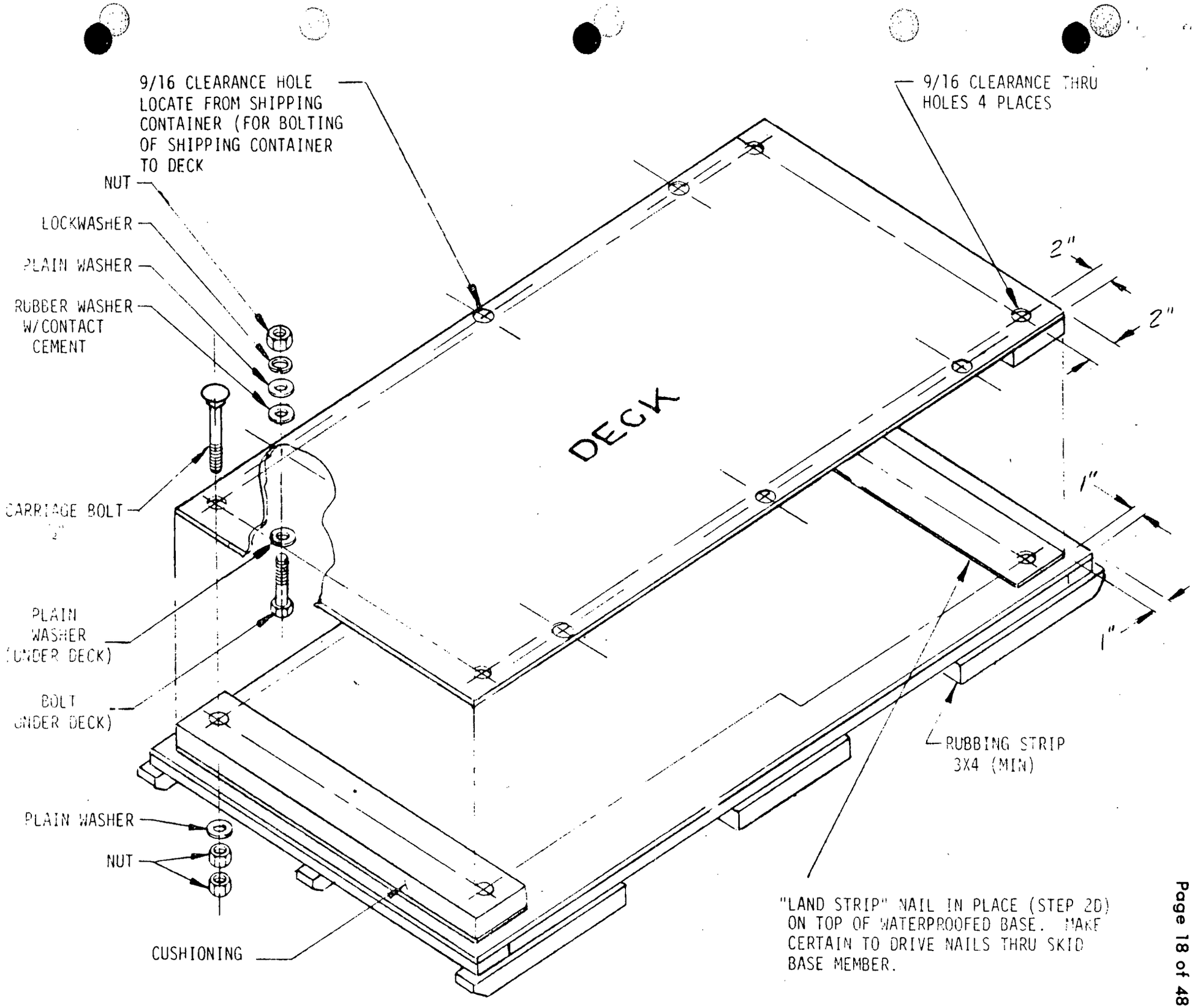

9/16 CLEARANCE HOLE LOCATE FROM SHIPPING CONTAINER (FOR BOLTING OF SHIPPING CONTAINER TO DECK
9/16 CLEARANCE THRU HOLES 4 PLACES
NUT
LOCKWASHER
PLAIN WASHER
RUBBER WASHER W/CONTACT CEMENT
DECK
2"
2"
1"
1"
CARRIAGE BOLT
PLAIN WASHER (UNDER DECK)
BOLT (UNDER DECK)
RUBBING STRIP 3X4 (MIN)
PLAIN WASHER
NUT
CUSHIONING
"LAND STRIP" NAIL IN PLACE (STEP 20) ON TOP OF WATERPROOFED BASE. MAKE CERTAIN TO DRIVE NAILS THRU SKID BASE MEMBER.

FIGURE 1

STORAGE INSTRUCTIONS

1.0 **Scope**

1.1 This document defines the specific requirements for inspection and preventive maintenance for the Electrical Protection Assembly during storage. The product's integrity shall be protected with provisions for both short term (0-1 year) and long term (1 to 5 year) storage.

1.2 The G.E. supplied storage instructions will be used to convey to the storage agencies the required protective measures to ensure stored equipment is suitable for eventual installation in the reactor complex.

2.0 **Applicable Documents**

21A8754 Seller (Vendor) Supplied Storage instructions.

3.0 **Storage Environments**

3.1 The Electrical Protection Assembly Shipping container shall be stored off the floor on suitable skids, pallets, or racks in a permanent or "Butler" type building which affords environmental protection. Each E.P.A. enclosure is sealed (at time of shipping) in a vapor barrier bag, together with a bag of Type II silica gel desiccant as controlled protection against internal condensation.

3.2 Further protection against internal moisture is provided with humidity indicators installed in the skin of the vapor barrier bag.

4.0 **Inspection of Humidity Indicators**

4.1 The humidity indicators shall be inspected once every six months to determine if there is any danger of the desiccant being saturated (change desiccant if 30% RH dot turns pink).

4.2 When reading the indicator, note that when the humidity is below the stated calibration of the particular spot that spot will be a distinct blue. When the humidity is higher than this calibration, the spot will be a distinct pink. The bluer the color, the drier is the air, and vice versa.

4.3 The indicators, if exposed to extreme heat, prolonged exposure to the sun, and normal outside conditions for six months or over, will turn from a blue indication to a greenish-blue. This is caused by the yellowing of the blotter paper combining with the blue color of the chemical. This however, does not affect its calibration.

5.0 Preventive Maintenance Procedure

If a dangerous moisture level is determined to be present by a reading on the humidity indicator, the following procedure should be followed by storage facility personnel to reestablish the low moisture environment inside the vapor barrier bag.

A. Open vapor barrier bag with a minimum amount of destruction. (Will be resealed if practical.)

B. Visually inspect EPA enclosure and components for moisture damage.

C. If condensation is present, use forced heated air to dry enclosure and/or components. (Heated air shall be no greater than 165°F.)

D. Replace the vapor barrier bag, and include a new bag (1 lb.) of desiccant.

E. If using a new vapor barrier bag, install a new humidity indicator in skin of bag.

F. The vapor barrier bag shall then be reevacuated using a suitable pump and resealed using a leak-proof heat sealing method.

6.0 Delivery

One copy of this storage instruction shall be attached securely to the crate, using a weatherproof envelope.

The weatherproof envelope shall be marked in 1/2 inch bold letters "Seller's Storage Instructions Inside".

ELECTRICAL PROTECTION ASSY

FIRST MADE FOR ELECTRICAL PROTECTION ASSY

PL ISSUED

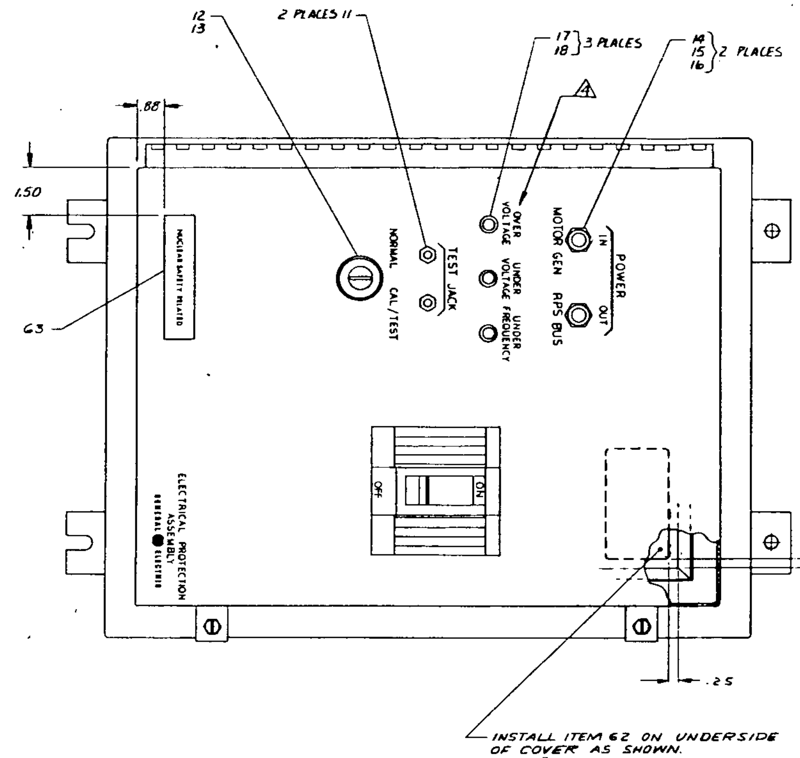
NUCLEAR SAFETY RELATED

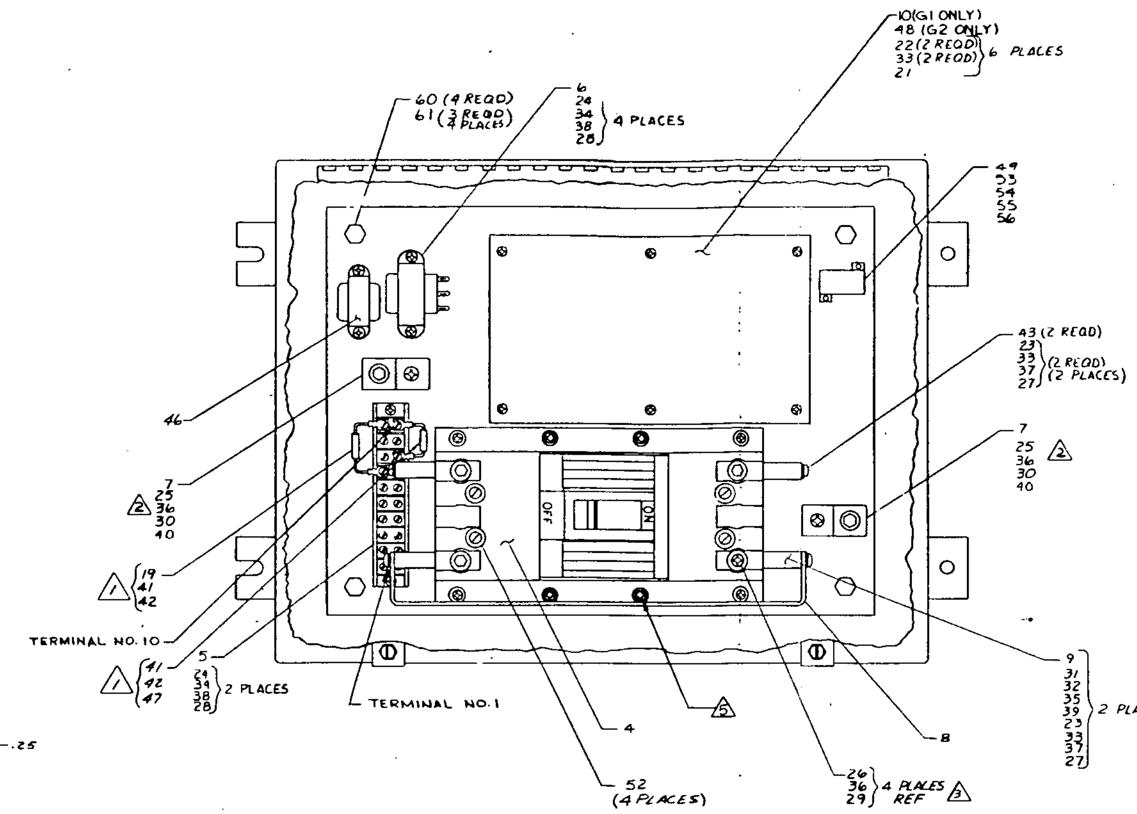
NOTES: UNLESS OTHERWISE SPECIFIED

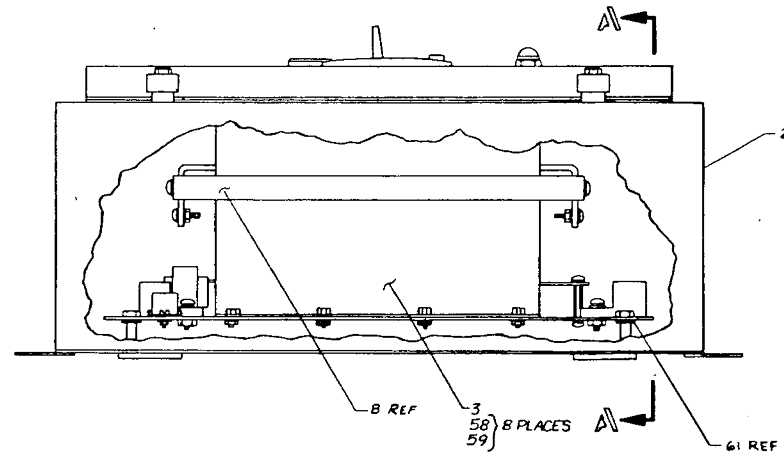
1. INSTALL RESISTORS PER MANUFACTURING STANDARD PRACTICE M.038 REQUIREMENTS NO.6.0 THRU 6.5 USING ITEMS 41, PVC TUBING AND 42, TERMINAL.
2. APPLY 20, COMPOUND, TO BIND SURFACES OF ITEM 7, TERMINAL GROUND AND ENCLOSURE PANEL.
3. REMOVE EXISTING SCREW IN ITEM 4 TRANSFORMER AND REPLACE WITH ITEM 26.
4. FOR ENCLOSURE ARTWORK SEE SILK SCREEN MASTER DRAWING NO 147D7801, CHARACTER COLOR: BLACK
5. MATCH DRILL AT ASSEMBLY AFTER LOCATION HAS BEEN DETERMINED. DRILL .196 DIA 4 PLACES USING MTG PLATE AS A GUIDE.

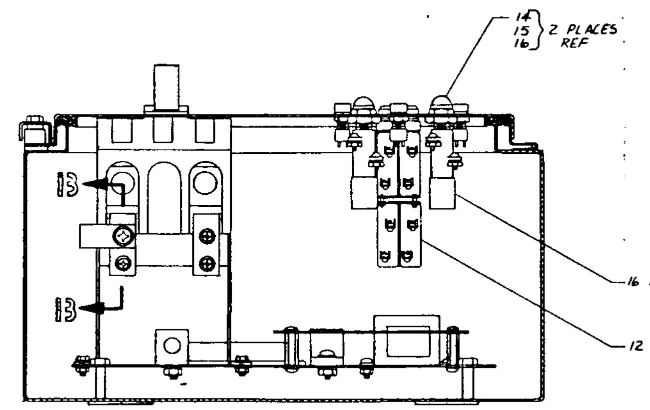
G1

G2

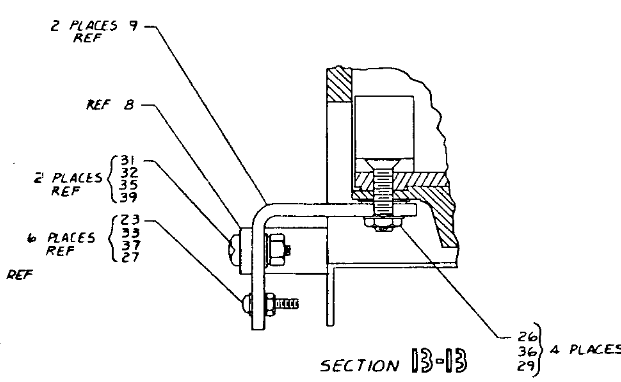








SECTION A-A



SECTION B-B

H	G	F	E	D	C	B	A
CHANGES PER AN-7 TO P/L ONLY		CHANGED PER AN-6	CHANGED PER AN-5	CHANGED PER AN-4 ADDED G3	REVISED PER AN 914E175-3	REVISED PER AN 914E175-2	SPO-001 6-2-79

RESD/SPO

LOMPOC

914E175

REV NO. X B C D E F H

PARTS LIST FOR 914E175
CONT ON SHEET 2 SH NO. 1

TITLE ASSEMBLY
ELECTRICAL PROTECTION ASSY

FIRST MADE FOR ELECTRICAL PROTECTION ASSY

GROUP NO. AND QUANTITY						PART NO.	NAME	DRAWING NO., DESCRIPTION, MATERIAL, WEIGHT
				G2	G1			
				X	X	1	ASSEMBLY	914E175 ELECTRICAL PROTECTION
				1	1	2	ENCLOSURE, MOD	147D7800P001
				1	1	3	MOUNT BRACKET	184C4475G001
				1	1	4	CIRCUIT BREAKER	184C4494P1
				1	1	5	TERMINAL STRIP	219B4600P010
				1	1	6	TRANSFORMER	219B4603P001
				2	2	7	TERMINAL, GND	287A5900P001
				1	1	8	BUSS BAR	219B4602P001
				2	2	9	BUSS ANGLE	219B4601P001
					1	10	PCB ASSY	47D523796G001
				2	2	11	TIP JACK	287A5901P001
				1	1	12	SWITCH	164C5274P027, TANDOM BLOCKS
				1	1	13	SWITCH	164C5274P006, CYLINDER LOCK DEVICE
				2	2	14	LAMP INDICATING	209A5610G42
						15		NOT USED
						16		NOT USED
				3	3	17	INDICATOR LIGHT	287A5902P001, DATA LAMP CARTRIDGE
				3	3	18	LAMP BASE	287A5903P001, DATA LAMP HOLDER
				1	1	19	RESISTOR	184C4489P65H2001FR
				1	1	20	COMPOUND	287A5904P003, PENETROX A
				6	6	21	SPACER	287A5906P001, #6-32 HEX 1" LONG
				14	14	22	SCREW	N80P13008C, PAN HEAD #6-32 UNC X 1/2"
				6	6	23	SCREW	N80P13012C PAN HEAD #6-32 UNC X 3/4"
				6	6	24	SCREW	N80P15008C, PAN HEAD #8-32 UNC X 1/2"
				2	2	25	SCREW	N80P24012C, PAN HEAD 5/16-24 UNF X 3/4"
				4	4	26	SCREW	N84P23016C, FLAT HEAD 5/16-18 UNC X 1"
				8	8	27	NUT	N210P013C, #6-32 UNC STL

DESCRIPTION OF GROUPS

REVISIONS I

F P.J. CASANO — CHANGE PER AN-6 — ENGR L.G. Hodgson 8/20/80 — CHK L.G. Hodgson

D P. MURPHY — CHANGED PER AN-4 — MECH L.G. Hodgson — ENGR L. HODGSON

H P. MOREND 12 JAN 81 — CHANGED PER AN-7 — CHK'D BY: S. Hansel 11/12/81 — ENG L. Hodgson 11/12/81

E R.J. CRAWFORD — CHANGED PER AN-5 — CHK'D S. Hansel — ENGR L. Hodgson — SHANSEL L. HODGSON

PRINTS TO

MADE BY D. SWEM DS JUNE 26-79
ISSUED J. LEWIS J. Lewis 13 July 79

APPROVALS J. White 7/13/79 J. WHITE

RESD-SPO — DIV. OR DEPT
LOMPOC — LOCATION

PARTS LIST FOR 914E175
CONT ON SHEET 2 SH NO. 1

FF-801-F (12-78) PRINTED IN U.S.A.

CHK: S. Hansel 13 JULY 79

REV NO. A B C D E F H

PARTS LIST FOR 914E175

CONT ON SHEET 3 SH NO. 2

TITLE ASSEMBLY
ELECTRICAL PROTECTION ASSY

FIRST MADE FOR ELECTRICAL PROTECTION ASSY

GROUP NO. AND QUANTITY						PART NO.	NAME	DRAWING NO., DESCRIPTION, MATERIAL, WEIGHT
				G2	G1			
				6	6	28	NUT	N210P015C, #8-32 UNC STL
				4	4	29	NUT	N229P023C 5/16-18 UNC JAM STL
				2	2	30	NUT	N210P022C 5/16-24 UNF STL
				2	2	31	SCREW	N80P21012C, 1/4-20 UNC PAN HD X 3/4
				2	2	32	NUT	N210P021C 1/4-20 UNC STL
				20	20	33	WASHER	N405P007C #6 SPRING LOCK
				6	6	34	WASHER	N405P008C #8 SPRING LOCK
				2	2	35	WASHER	N405P011C 1/4 SPRING LOCK
				6	6	36	WASHER	N405P012C 5/16 SPRING LOCK
				8	8	37	WASHER	N402AP007C, #6 PLAIN
				6	6	38	WASHER	N402AP008C, #8 PLAIN
				2	2	39	WASHER	N402P011C 1/4 PLAIN
				6	6	40	WASHER	N402P012C 5/16 PLAIN
				X	X	41	TUBING, PVC	
				4	4	42	TERMINAL, CRIMP	[illegible]D7100P007 (AMP ONLY)
				X	X	44	SCHEMATIC	184C4476P001
				2	2	43	BUSS ANGLE	219B4601P002
				X	X	45	SILKSCREEN	147D7801
				1	1	46	TRANSFORMER	219B4606P1
				1	1	47	RESISTOR	184C4489P65H3401FR
				1		48	PCB ASSY	47D523796G002 (RCA 1X10^5 RAD HARD)
				1	1	49	RESISTOR, POWER	145C3232P60F3R00
						50		NOT USED
				AR	AR	51	WIRE	272A7917P016K006
				4	4	52	SCREW	N37P16064 ROUND HEAD #10-32 UNC X 4"
				2	2	53	SCREW	N80P5006C, #2-56 STL X 3/8 LNG.
				2	2	54	WASHER	N402AP033C, #2 STL PLAIN

DESCRIPTION OF GROUPS

REVISIONS

PRINTS TO

MADE BY D. SWEMO 20 JUNE 79

ISSUED J. LEWIS 13 July 79

APPROVALS J. WHITE 7/14/79

DIV. OR DEPT RESD-SPO

LOCATION LOMPOC

PARTS LIST FOR 914E175

CONT ON SHEET 3 SH NO. 2

FF-801-F (12-76) PRINTED IN U.S.A.

CHK: S. HANSEL 13 JULY 79

REV NO. A B C D E F H

PARTS LIST FOR 914E175 CONT ON SHEET F SH NO. 3

TITLE
ASSEMBLY
ELECTRICAL PROTECTION ASSY

FIRST MADE FOR ELECTRICAL PROTECTION ASSY

GROUP NO. AND QUANTITY				G2	G1	PART NO.	NAME	DRAWING NO., DESCRIPTION, MATERIAL, WEIGHT
				2	2	55	WASHER	N405P063C, #2 STL SPRING LOCK
				2	2	56	NUT	N210P005C, #2 STL
						57		NOT USED
				8	8	58	SCREW, FLANGE	213A7093P048
				8	8	59	NUT, FLANGE	249A1140P004
				4	4	60	NUT, FLANGE	249A1140P009
				12	12	61	WASHER, PLAIN	N402AP43C
				1	1	62	NAMEPLATE	NP-206427
				1	1	63	NAMEPLATE	287A5907P001

DESCRIPTION OF GROUPS

REVISIONS

PRINTS TO

MADE BY T. WALLIN T Wallin

ISSUED J.G. LEWIS J G Lewis 4 Jan 80

APPROVALS J. White J. WHITE

RESD-SPO DIV. OR DEPT

LOMPOC LOCATION

FF-801-F (3-78)
PRINTED IN U.S.A.

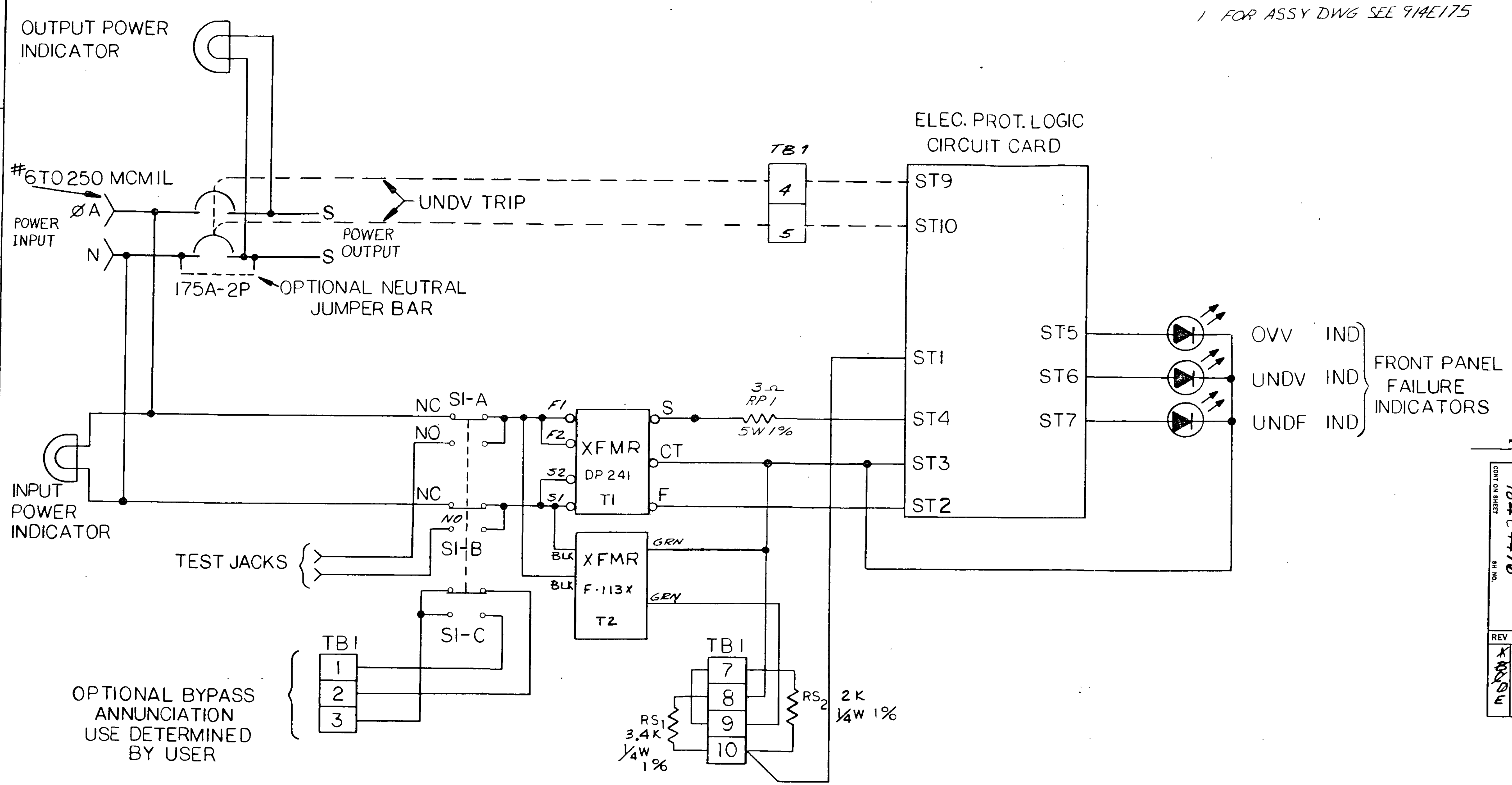
S Harris 4 JAN 80

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING:– APPLIED PRACTICES | SURFACES ✓ | TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS ± DECIMALS ± ANGLES ±

TITLE ASSEMBLY
SCHEM ELEC PROT
FIRST MADE FOR ELECTRICAL PROTECTION ASSY

NUCLEAR SAFETY RELATED

/ FOR ASSY DWG SEE 914E175



REVISIONS

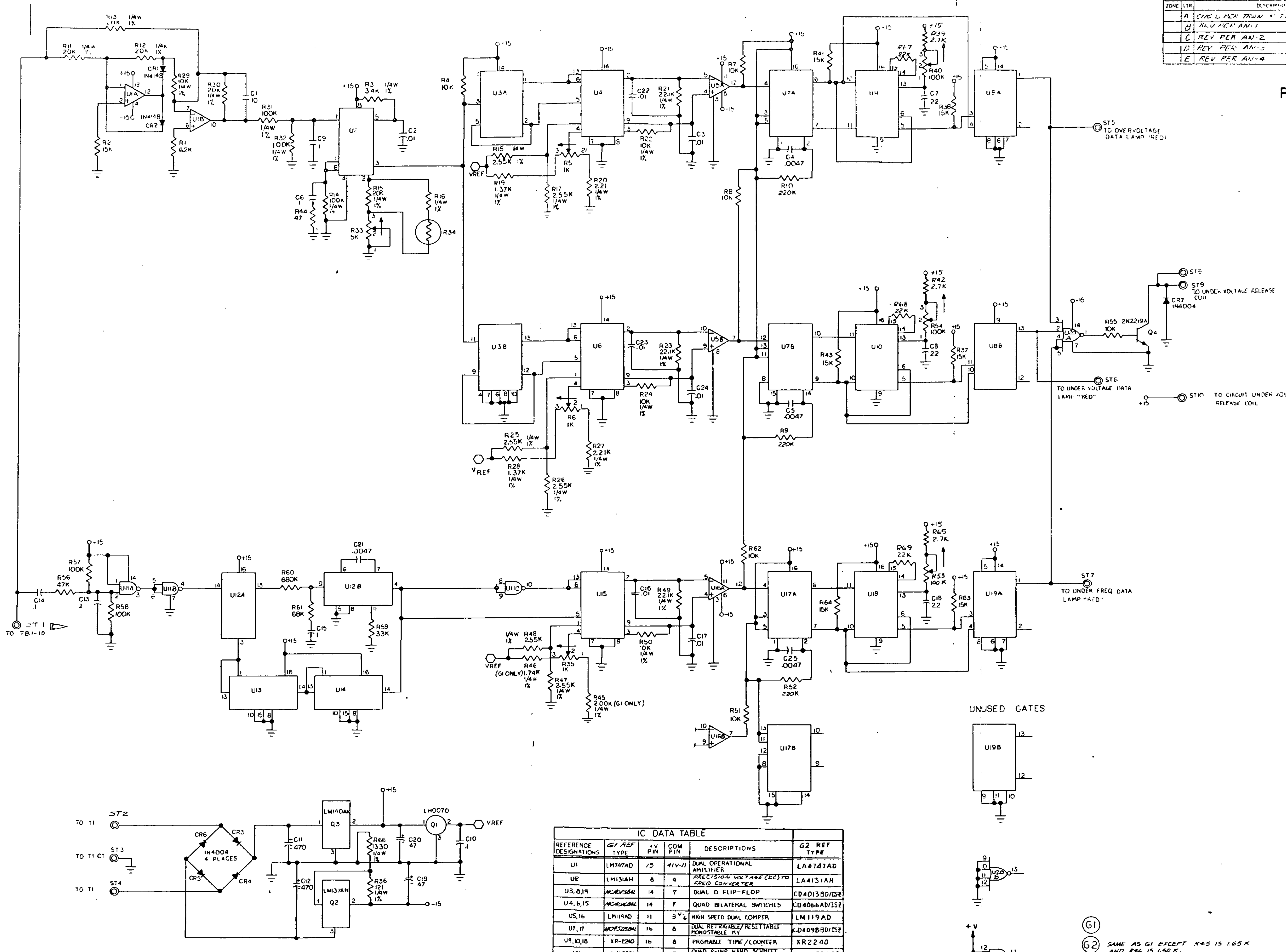
D GAMELSH 12 MAR 80 — CHGD PER AN-4 — CHKD BY L. HODGSON	C S. MURACA 2 JAN 80 — REVISED PER AN-3 — CHK'D BY A. SALCIDO L. HODGSON	B PHIL PEARSON 19 SEP 79 — REVISED PER AN 184C4476-2 — CHK: PJ CASANO L. HODGSON	NOTE SPO-001 JGB 8-2-79 — A S. CUDAROS 28 AUG 79 — CHANGED PER AN 184C4476-1 — CHK BY S. HANSEL L. HODGSON
E PJ CASANO 29 JUL 80 — CHANGED PER AN-5 — CHKD BY J.G. Hodgson L. HODGSON			

MADE BY R.L. JOHNSON JUNE 1973 — ISSUED J. LEWIS — APPROVALS J. WHITE — RESD-SPO — LOMPOC — 184C4476

PRINTS TO

REV NO. A B C D E

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	CHG'D PER TRAN ...	[illegible]	[illegible]
	B	REV PER AN-1	[illegible]	[illegible]
	C	REV PER AN-2	[illegible]/80	[illegible]
	D	REV PER AN-3	[illegible]	
	E	REV PER AN-4	/20/81	[illegible]



IC DATA TABLE					
REFERENCE DESIGNATIONS	G1 REF TYPE	+V PIN	COM PIN	DESCRIPTIONS	G2 REF TYPE
U1	LM747AD	13	4(V-1)	DUAL OPERATIONAL AMPLIFIER	LA4747AD
U2	LM131AH	8	4	PRECISION VOLTAGE (DC) TO FREQ CONVERTER	LA4131AH
U3,8,19	[illegible]	14	7	DUAL D FLIP-FLOP	CD4013BD/ISZ
U4,6,15	[illegible]	14	7	QUAD BILATERAL SWITCHES	CD4066AD/ISZ
U5,16	LM119AD	11	3 V-6	HIGH SPEED DUAL COMPTR	LM119AD
U7,17	[illegible]	16	8	DUAL RETRIGABLE/RESETTABLE MONOSTABLE MV	CD4098BD/ISZ
U9,10,18	XR-2240	16	8	PRGMABLE TIME/COUNTER	XR2240
U11	[illegible]	14	7	QUAD 2-INP NAND SCHMITT TRIG	CA4011BD/ISZ
U12	[illegible]	16	8	MICROPWR PHASE LOCKED LOOP	CD4046AD/ISZ
U13,14	[illegible]	16	8	PRESETTABLE DIV BY-N CNTR	CD4018BD/ISZ
U20	[illegible]	14	7	DUAL 4-INP NOR GATE	CD4002BD/ISZ

NOTES:
UNLESS OTHERWISE SPECIFIED -
1. ALL RESISTORS ARE 1/4W, 5%
2. ALL RESISTORS IN OHMS
3. ALL CAPACITANCE IN MICROFARADS
4. FOR ASSEMBLY DRAWING SEE 47D523796

(G1)

(G2) SAME AS G1 EXCEPT R45 IS 1.65 K AND R46 IS 1.50 K.

HIGHEST REF DES	
R72, U20, Q4 CR10, C29	
REF DES NOT USED	
R16, R34	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES— TOLERANCES ON: 2-PLACE DECIMALS ± 3-PLACE DECIMALS ± ANGLES ± FRACTIONS ± ALL SURF. ✓ MATERIAL—

SIGNATURES

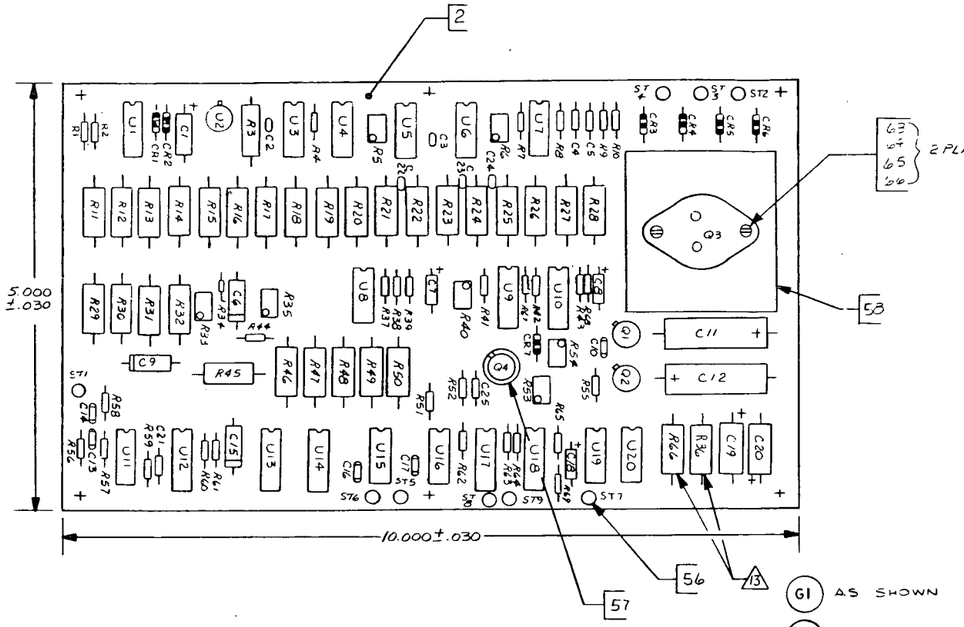
GENERAL ELECTRIC
RSD/SPO LOC. LOMPOC

SCHEMATIC DIAGRAM
ELECTRICAL PROTECTION
LOGIC CARD

SIZE E CODE IDENT NO. 15226 47E523794
SCALE NO N/E SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REV PER AN-1	79/1/29	P.J.Wagner
B10	B	ADDED DETAIL A FOR NEW G3 ITEMS G3-G7 ON PL FOR G3 AN-2	80/3/12	P.J.Wagner
B10	C	REMOVED DETAIL A.	80/4/17	P.J.Wagner
—	D	CHANGED P/L ONLY	80/8/29	P.J.Wagner
—	E	CHANGED P/L ONLY	80/11/3	P.J.Wagner
—	F	CHANGED P/L ONLY	81/1/12	P.J.Wagner

NUCLEAR SAFETY RELATED



COMPONENT SIDE

ITEM	REF. DESIGNATION
4	U1
5	U2
6	U5, 16
7	U3, 8, 19
8	U4, 6, 15
9	U13, 14
10	U12
11	U11
12	U7, 17
13	U9, 10, 18
14	CR3, 4, 5, 6, 7
15	CR1, 2
16	U20
17	C6, 9, 15
18	C2, 3, 16, 17, 22, 23, 24
19	C4, 5, 21, 25
20	C10, 13, 14
21	C7, 8, 18
22	C19, 20
23	C11, 12
24	R11, 12, 13, 15, 30
25	R22, 24, 50, 29
26	R14, 32, 31
27	R3
28	DELETED FROM PARTS LIST
29	R21, 23, 49
30	R66
31	R36
32	R17, 18, 25, 26, 47, 48
33	R19, 28
34	R45
35	R20, 27
36	R46
37	NOT USED THIS ASSY. (R16)
38	R39, 42, 65
39	R1
40	R7, 8, 51, 62, 55
41	R2, 37, 38, 41, 43, 63, 64
42	R59
43	R4, 56
44	R61
45	R58, 57
46	R60
47	DELETED FROM PARTS LIST
48	NOT USED THIS ASSY. (R34)
49	R5, 6, 35
50	R40, 53, 54
51	R33
52	Q3
53	Q1
13 54	Q2
55	Q4
56	ST1 THRU ST10
57	HEATSINK USED WITH ITEM 55
58	HEATSINK USED WITH ITEM 52
59	R67, 68, 67
60	C1
61	R9, 10, 52
62	R44

NOTES:

1. VERTICAL AXIS OF CERAMIC COMPONENTS MOUNTED VERTICALLY SHALL NOT BE GREATER THAN 15 DEGREES FROM PERPENDICULAR PLANE OF MOUNTING BASE
2. COATED OR SEALED CERAMIC OR PLASTIC COMPONENTS SHOULD BE MOUNTED SO THAT THE COATING OR SEALING MATERIAL DOES NOT ENTER THE SOLDER JOINT AREA.
3. SOLDER TURRETS TO BE ROLL FLARED, AND SOLDERED ON COMPONENTS SIDE OF BOARD.
4. TRANSISTORS TO BE SPACED ABOVE BOARD WITH SUITABLE SPACER. THE FEET OF THE SPACER SHALL BE AGAINST THE BOARD, AND BE A MINIMUM OF 0.150 INCHES TALL.
5. STRAIN RELIEF SHALL BE PROVIDED FOR ALL COMPONENTS MOUNTED ABOVE THE SURFACE OF THE CIRCUIT BOARD.
6. SOLDERER SHALL USE MAXIMUM CONTOUR SOLDERING ON ALL CONNECTIONS.
7. A SUITABLE POLYURETHANE CONFORMAL COATING SHALL BE APPLIED TO BOTH SIDES OF THE BOARD AND THICKNESS SHALL BE THE MINIMUM REQUIRED.
8. THERMAL JOINT COMPOUND SHALL BE APPLIED TO MOUNTING INTERFACE AREAS BETWEEN THE VOLTAGE REGULATOR (Q3) AND THE THERMALLOY (6061B) HEATSINK. THE MOUNTING HARDWARE SHALL HAVE A MINIMUM TORQUE OF 6 IN. LBS., AND A MAXIMUM OF 8 IN. LBS. APPLIED AT TIME OF ASSEMBLY.
9. EVERY EFFORT WILL BE MADE TO KEEP THE CONFORMAL COATING OFF HEATSINK FIN AREA.
10. For Schematic See 47E523794
11. FOR FABRICATION DWG SEE 47D523795
12. NOT USED
13. WHEN 79M15HM (FAIRCHILD), AN ENGINEERING APPROVED EQUIVALENT, IS USED FOR Q2 (ITEM 54) REMOVE R36 (ITEM 31) AND R66 (ITEM 30). REPLACE R66 WITH A JUMPER OF 24 AWG SOLID WIRE WITH POLY SLEEVING

AS MANUFACTURED BY GENERAL ELECTRIC CO LOMPOC, CALIF

SEPARATE PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES— TOLERANCES ON: 2-PLACE DECIMALS ± 3-PLACE DECIMALS ± ANGLES ± FRACTIONS ± ALL SURF. ✓ MATERIAL—

SIGNATURES	DAY	MO	YR
DRAWN	16	7	79
CHECKED	20	9	79
ENGR APPD	20	9	79
MFG APPD	30	9	79
QUALITY			
PROJECT	1	10	79

GENERAL ELECTRIC
RESD/SPO DEPT LOC LOMPOC

ELECTRICAL PROTECTION LOGIC CARD

SIZE	CODE IDENT NO.	
D	15226	47D523796

SCALE 1/1 SHEET

GENERAL ELECTRIC

RSD/FSO DEPT — LOMPOC, CALIFORNIA LOCATION

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G1	1	2	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
1			47D523796G1	ASSEMBLY		-				
2			47D523796P1N2	PC BOARD		1				
3			47E523794	SCHEMATIC		-				
4			184C4477P001	INTEGRATED CIRCUIT U1		1				
5			184C4478P001	INTEGRATED CIRCUIT U2		1				
6			184C4479P001	INTEGRATED CIRCUIT U5, U16		2				
7			169C8671P013	INTEGRATED CIRCUIT U3, U8, U19		3				
8			184C4480P001	INTEGRATED CIRCUIT U4, U6, U15		3				
9			184C4480P002	INTEGRATED CIRCUIT U13, U14		2				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca	24 DAY 09 MO. 79 YR.	[illegible] 7/23/80	PL 47D523796G1	1	2	F

CONTRACT NO.

DISTRIBUTION CODE

DRM RS 1918 (4-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G1	2	3	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
10			184C4480P003	INTEGRATED CIRCUIT U12		1				
11			169C8671P093	INTEGRATED CIRCUIT U11		1				
12			169C8671P528	INTEGRATED CIRCUIT U7, U17		2				
13			184C4484P001	INTEGRATED CIRCUIT U9, U10, U18		3				
14			176A1572P004	DIODE CR3-CR7		5				
15			175A7485P002	DIODE SWITCHING CR1, CR2		2				
16			169C8671P002	INTEGRATED CIRCUIT U20		1				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Murata FOR	24 DAY 09 MO. 79 YR.		PL 47D523796G1	2	3	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (7-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G1	3	4	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
17			184C4483P037	CAPACITOR C6, C9, C15		3				
18			184C4482P058	CAPACITOR C2, C3, C16, C17 C22, C23, C24		7				
19			157C4540P472	CAPACITOR C4, C5, C21, C25		4				
20			184C4492P030	CAPACITOR C10,C13, C14		3				
21			184C4491P42283	CAPACITOR C7, C8, C18		3				
22			112C2642P22-2295	CAPACITOR C19, C20		2				
23			184C4493P008	CAPACITOR C11, C12		2				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca	24 DAY 09 MO. 79 YR.		PL 47D523796G1	3	4	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (4-69) PARTS LIST (G.E.)

TITLE ELECTRICAL PROTECTION LOGIC CARD | CODE IDENT NO. 15226 | PL 47D523796G1 | SH NO. 4 | CONT ON SHEET 5 | REV F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
24			184C4489P65H2002FR	METAL FILM RESISTOR R11, R12, R13, R15, R30		5				
25			184C4489P65H1002FR	METAL FILM RESISTOR R22, R24, R50, R29		4				
26			184C4489P65H1003FR	METAL FILM RESISTOR R14, R32, R31		3				
27			184C4489P65H3401FR	METAL FILM RESISTOR R3		1				
28				NOT USED						
29			184C4489P65H2212FR	METAL FILM RESISTOR R21, R23, R49		3				

MADE BY S. Muraca FOR | DATE ISSUED 24 DAY 09 MO. 79 YR. | REVISION AUTHORITY | PL 47D523796G1 | SH NO. 4 | CONT ON SHEET 5 | REV F

CONTRACT NO. | DISTRIBUTION CODE

FORM RS 1918 (4-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRIC PROTECTION LOGIC CARD	15226	PL 47D523796G1	5	6	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS 5. SETS
1. PIECES 6. OUNCES
2. FEET 7. INCHES
3. POUNDS 8. PINTS
4. GALLONS 9. OTHER

REVISION CODES
1. ITEM ADDED 4. IDENT NO. CHGD 6. EDIT CORRECTION
2. ITEM DELETED 5. IDENT NO. AND QTY CHGD
3. QTY CHGD

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
30			184C4489P65H1331FR	METAL FILM RESISTOR R66		1				
31			184C4489P65H1210FR	METAL FILM RESISTOR R36		1				
32			184C4489P65H2551FR	METAL FILM RESISTOR R17, R18, R25 R26, R47, R48		6				
33			184C4489P65H1371FR	METAL FILM RESISTOR R19, R28		2				
34			184C4489P65H2001FR	METAL FILM RESISTOR R45		1				
35			184C4489P65H2211FR	METAL FILM RESISTOR R20, R27		2				
36			184C4489P65H1741FR	METAL FILM RESISTOR R46		1				
37				NOT USED						

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca	24 DAY 09 MO. 79 YR.		PL 47D523796G1	5	6	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (4-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G1	6	7	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
38			163C1862P272F	CARBON RES. R39, R42, R65		3				
39			163C1862P622F	CARBON RES. R1		1				
40			163C1862P103F	CARBON RES. R7, R8, R51, R62 R55, R4		6				
41			163C1862P153F	CARBON RES. R2, R37, R38, R41 R43, R63, R64		7				
42			163C1862P333F	CARBON RES. R59		1				
43			163C1862P473F	CARBON RES. R56		1				
44			163C1862P683F	CARBON RES. R61		1				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca	24 DAY 09 MO. 79 YR.		PL 47D523796G1	6	7	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (8-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G1	7	8	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
45			163C1862P104F	CARBON RES. R57, R58		2				
46			163C1862P684F	CARBON RES. R60		1				
47				NOT USED						
48				NOT USED						
49			184C4490P009	RESISTOR, VARIABLE R5, R6, R35		3				
50			184C4490P017	RESISTOR, VARIABLE R40, R53, R54		3				
51			184C4490P012	RESISTOR, VARIABLE R33		1				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca	24 DAY 09 MO. 79 YR.		PL 47D523796G1	7	8	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (6-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G1	8	9	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
52			184C4485P001	TRANSISTOR Q3		1				
53			184C4487P001	TRANSISTOR Q1		1				
54			184C4486P001	TRANSISTOR Q2		1				
55			184C4488P001	TRANSISTOR Q4		1				
56			287A5905P001	TERMINAL POST		10				
57			219B4604P001	HEATSINK		1				
58			219B4605P001	HEATSINK		1				
59			163C1862P223F	CARBON RES. R67, R68, R69		3				
60			112C2642P28	CAPACITOR C1		1				
61			163C1862P224F	CARBON RESISTOR R9, R10, R52		3				
62			163C1862P470F	CARBON RESISTOR R44		1				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca	24 DAY 09 MO. 79 YR.		PL 47D523796G1	8	9	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (4-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G1	9	F	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUT-ING	SHEET NO.	REV CODE
63			N80P9006C	SCREW 4-40 x .38 STEEL		2				3
64			N210P009C	NUT 4-40 HEX STEEL		2				3
65			N405P005C	LOCKWASHER NO. 4 STEEL		2				3
66			N402AP005C	FLAT WASHER NO. 4 STEEL		2				3
67			287A4931P001	PAD, TRANSISTOR		3				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca	24 DAY 09 MO. 79 YR.		PL 47D523796G1	9	F	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (7-69) PARTS LIST (G.E.)

GENERAL ELECTRIC

RSD/FSO DEPT — LOMPOC, CALIFORNIA LOCATION

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G2	1	2	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
1			47D523796G2	ASSEMBLY		-				
2			47D523796P1N2	PC BOARD		1				
3			47E523794	SCHEMATIC		-				
4			184C4477P001	INTEGRATED CIRCUIT U1		1				
5			184C4478P001	INTEGRATED CIRCUIT U2		1				
6			184C4479P001	INTEGRATED CIRCUIT U5, U16		2				
7			184C4481P004	INTEGRATED CIRCUIT U3, U8, U19		3				
8			184C4481P005	INTEGRATED CIRCUIT U4, U6, U15		3				
9			184C4481P003	INTEGRATED CIRCUIT U13, U14		2				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca FOR	29 DAY 01 MO. 80 YR.		PL 47D523796G2	1	2	F

CONTRACT NO. | DISTRIBUTION CODE

FORM RS 1918 (6-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G2	2	3	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUT-ING	SHEET NO.	REV CODE
10			184C4481P006	INTEGRATED CIRCUIT U12		1				
11			184C4481P002	INTEGRATED CIRCUIT U11		1				
12			184C4481P007	INTEGRATED CIRCUIT U7, U17		2				
13			184C4484P001	INTEGRATED CIRCUIT U9, U10, U18		3				
14			176A1572P004	DIODE CR3-CR7		5				
15			175A7485P002	DIODE SWITCHING CR1, CR2		2				
16			184C4481P001	INTEGRATED CIRCUIT U20		1				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca for	29 DAY 01 MO. 80 YR.		PL 47D523796G2	2	3	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (4-69) PARTS LIST (G.E.)

GENERAL ELECTRIC

RSD/FSO DEPT — LOMPOC, CALIFORNIA LOCATION

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G2	3	4	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUT. ING	SHEET NO.	REV CODE
17			184C4483P037	CAPACITOR C6, C9, C15		3				
18			184C4482P058	CAPACITOR C2, C3, C16, C17 C22, C23, C24		7				
19			157C4540P472	CAPACITOR C4, C5, C21, C25		4				
20			184C4492P030	CAPACITOR C10, C13, C14		3				
21			184C4491P4-2283	CAPACITOR C7, C8, C18		3				
22			112C264222-2295	CAPACITOR C19, C20		2				
23			184C4493P008	CAPACITOR C11, C12		2				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Murata FOR	29 DAY 01 MO. 80 YR.		PL 47D523796G2	3	4	F

CONTRACT NO. | DISTRIBUTION CODE

FORM RS 1918 (4-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G2	4	5	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
24			184C4489P65H2002FR	METAL FILM RESISTOR R11, R12, R13 R15, R30		5				
25			184C4489P65H1002FR	METAL FILM RESISTOR R22, R24, R50, R29		4				
26			184C4489P65H1003FR	METAL FILM RESISTOR R14, R32, R31		3				
27			184C4489P65H3401FR	METAL FILM RESISTOR R3		1				
28				NOT USED						
29			184C4489P65H2212FR	METAL FILM RESISTOR R21, R23, R49		3				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca FOR	29 DAY 01 MO. 80 YR.		PL 47D523796G2	4	5	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (6-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G2	5	6	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
30			184C4489P65H1331FR	METAL FILM RESISTOR R66		1				
31			184C4489P65H1210FR	METAL FILM RESISTOR R36		1				
32			184C4489P65H2551FR	METAL FILM RESISTOR R17, R18, R25, R26, R47, R48		6				
33			184C4489P65H1371FR	METAL FILM RESISTOR R19, R28		2				
34			184C4489P65H1651FR	METAL FILM RESISTOR R45		1				
35			184C4489P65H2211FR	METAL FILM RESISTOR R20, R27		2				
36			184C4489P65H1501FR	METAL FILM RESISTOR R46		1				
37				NOT USED						

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca FOR	29 DAY 01 MO. 80 YR.		PL 47D523796G2	5	6	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (6-69) PARTS LIST (G.E.)

TITLE	CODE IDENT NO.	PL	SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	47D523796G2	6	7	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
38			163C1862P272F	CARBON RES. R39, R42, R65		3				
39			163C1862P622F	CARBON RES. R1		1				
40			163C1862P103F	CARBON RES. R7, R8, R51, R62 R55, R4		6				
41			163C1862P153F	CARBON RES. R2, R37, R38, R41 R43, R63, R64		7				
42			163C1862P333F	CARBON RES. R59		1				
43			163C1862P473F	CARBON RES. R56		1				
44			163C1862P683F	CARBON RES. R61		1				

MADE BY	DATE ISSUED	REVISION AUTHORITY	PL	SH NO.	CONT ON SHEET	REV
S. Muraca for	29 DAY 01 MO. 80 YR.		47D523796G2	6	7	F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (4-69) PARTS LIST (G.E.)

TITLE ELECTRICAL PROTECTION LOGIC CARD | CODE IDENT NO. 15226 | PL 47D523796G2 | SH NO. 7 | CONT ON SHEET 8 | REV F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS 5. SETS
1. PIECES 6. OUNCES
2. FEET 7. INCHES
3. POUNDS 8. PINTS
4. GALLONS 9. OTHER

REVISION CODES
1. ITEM ADDED 4. IDENT NO. CHGD 6. EDIT CORRECTION
2. ITEM DELETED 5. IDENT NO. AND QTY CHGD
3. QTY CHGD

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
45			163C1862P104F	CARBON RES. R57, R58		2				
46			163C1862P684F	CARBON RES. R60		1				
47				NOT USED						
48				NOT USED						
49			184C4490P009	RESISTOR, VARIABLE R5, R6, R35		3				
50			184C4490P017	RESISTOR, VARIABLE R40, R53, R54		3				
51			184C4490P012	RESISTOR, VARIABLE R33		1				

MADE BY S Muraca | DATE ISSUED 29 DAY 01 MO. 80 YR. | REVISION AUTHORITY | PL 47D523796G2 | SH NO. 7 | CONT ON SHEET 8 | REV F

CONTRACT NO. | DISTRIBUTION CODE

FORM RS 1918 (6-69) PARTS LIST (G.E.)

TITLE ELECTRICAL PROTECTION LOGIC CARD

CODE IDENT NO. 15226

PL 47D523796G2 | SH NO. 8 | CONT ON SHEET 9 | REV F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS
1. PIECES
2. FEET
3. POUNDS
4. GALLONS
5. SETS
6. OUNCES
7. INCHES
8. PINTS
9. OTHER

REVISION CODES
1. ITEM ADDED
2. ITEM DELETED
3. QTY CHGD
4. IDENT NO. CHGD
5. IDENT NO. AND QTY CHGD
6. EDIT CORRECTION

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
52			184C4485P001	TRANSISTOR Q3		1				
53			219B4607G001	VOLTAGE REFERENCE, ENCAPSULATED 01		1				
54			184C4486P001	TRANSISTOR Q2		1				
55			184C4488P001	TRANSISTOR Q4		1				
56			287A5905P001	TERMINAL POST		10				
57			219B4604P001	HEATSINK		1				
58			219B4605P001	HEATSINK		1				
59			163C1862P223F	CARBON RES. R67, R68, R69		3				
60			112C2642P028	CAPACITOR C1		1				
61			163C1862P224F	CARBON RESISTOR R9, R10, R52		3				
62			163C1862P470F	CARBON RESISTOR R44		1				

MADE BY S. Muraca FOR | DATE ISSUED 29 DAY 01 MO. 80 YR. | REVISION AUTHORITY

PL 47D523796G2 | SH NO. 8 | CONT ON SHEET 9 | REV F

CONTRACT NO.

DISTRIBUTION CODE

FORM RS 1918 (4-69) PARTS LIST (G.E.)

GENERAL ELECTRIC

RSD/FSO DEPT — LOMPOC, CALIFORNIA LOCATION

TITLE	CODE IDENT NO.		SH NO.	CONT ON SHEET	REV
ELECTRICAL PROTECTION LOGIC CARD	15226	PL 47D523796G2	9	F	F

DRAWING CODES
1. VENDOR ITEM - SPEC CONT DWG
2. VENDOR ITEM - SOURCE CONT DWG
3. ALTERED OR SELECTED PT

FOR GE USE ONLY
4. SHORT FORM DWG
5. INSEP ASSY
6. MTCHD PT
7. CUST FURN PT

UNIT OF MEASURE CODES
0. GRAMS 5. SETS
1. PIECES 6. OUNCES
2. FEET 7. INCHES
3. POUNDS 8. PINTS
4. GALLONS 9. OTHER

REVISION CODES
1. ITEM ADDED 4. IDENT NO. CHGD 6. EDIT CORRECTION
2. ITEM DELETED 5. IDENT NO. AND QTY CHGD
3. QTY CHGD

ITEM NO.	ZONE	DWG CODE	IDENTIFICATION NO.	DESCRIPTION/ NOMENCLATURE	CODE IDENT NO.	QTY	U/M	ROUTING	SHEET NO.	REV CODE
63			N80P9006C	SCREW, PAN HEAD 4-40 x .38		2				
64			N210P009C	NUT HEX, 4-40 STEEL		2				
65			N405P005C	LOCKWASHER, NO.4 STEEL		2				
66			N402AP005C	WASHER, FLAT NO.4 STEEL		2				
67			287A4931P001	PAD, TRANSISTOR		3				

MADE BY	DATE ISSUED	REVISION AUTHORITY		SH NO.	CONT ON SHEET	REV
S. Muraca for	29 DAY 01 MO. 80 YR.		PL 47D523796G2	9	F	F

CONTRACT NO.

DISTRIBUTION CODE:

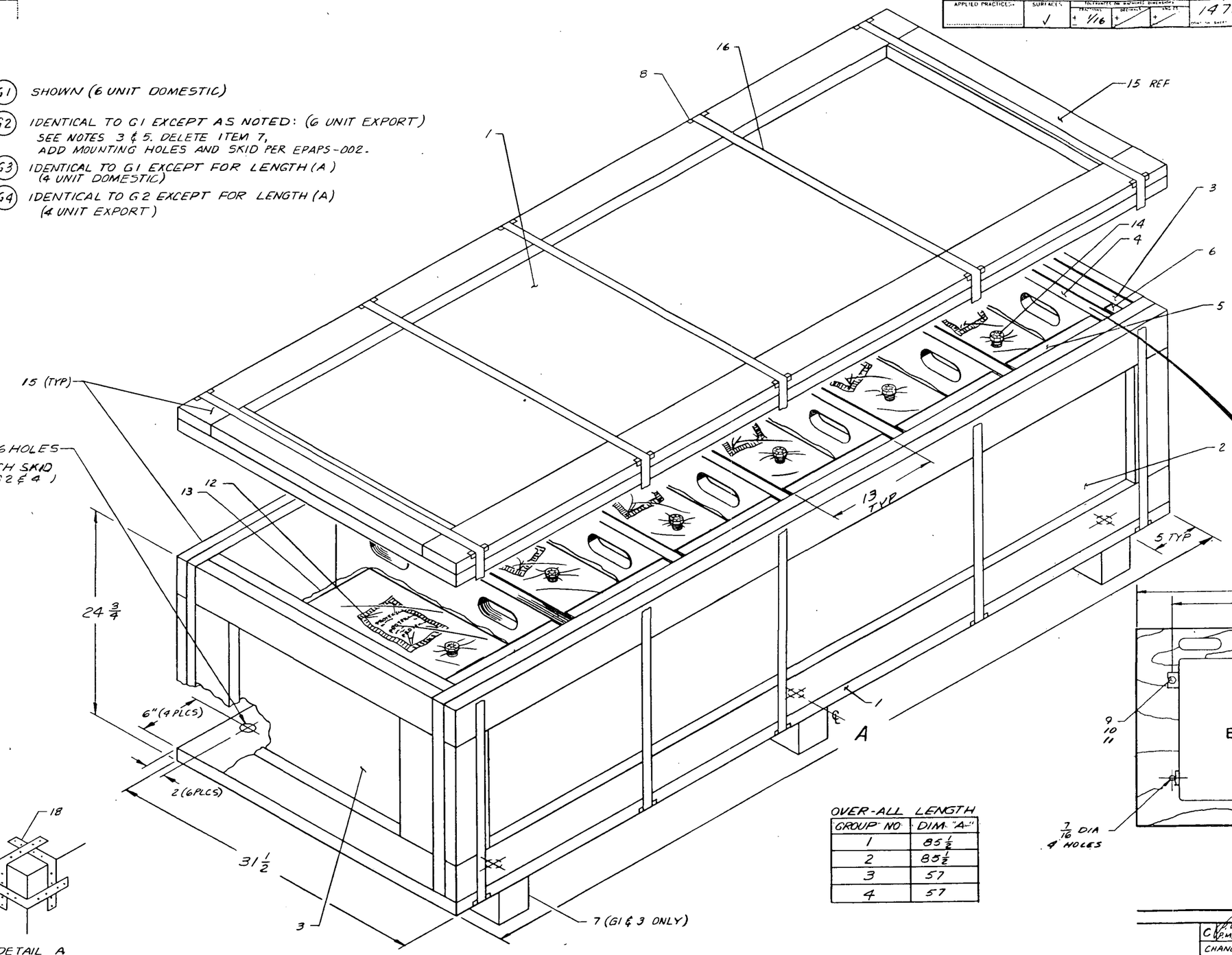
FORM RS 1918 (-69) PARTS LIST (G.E.)

(G1) SHOWN (6 UNIT DOMESTIC)

(G2) IDENTICAL TO G1 EXCEPT AS NOTED: (6 UNIT EXPORT)
SEE NOTES 3 & 5. DELETE ITEM 7,
ADD MOUNTING HOLES AND SKID PER EPAPS-002.

(G3) IDENTICAL TO G1 EXCEPT FOR LENGTH (A)
(4 UNIT DOMESTIC)

(G4) IDENTICAL TO G2 EXCEPT FOR LENGTH (A)
(4 UNIT EXPORT)

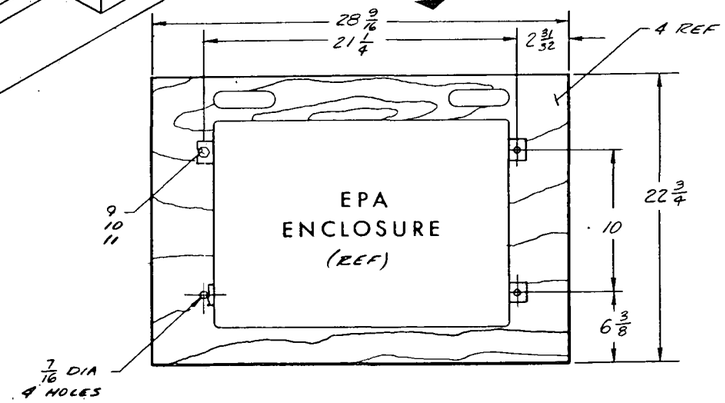


DETAIL A
TYPICAL CORNER

OVER-ALL LENGTH	
GROUP NO	DIM. "A"
1	85 1/2
2	85 1/2
3	57
4	57

NOTES:

1. DESICCANT BAG (ITEM 12) AND EPA ENCLOSURE ARE TO BE WRAPPED IN VAPOR BARRIER (ITEM 13) AND MOUNTED TO INTERIOR SHELF (ITEM 4) WITH 3/8 BOLTS, WASHERS AND LOCK NUTS, (ITEMS 9-11).
2. HUMIDITY INDICATOR, (ITEM 14) IS TO BE INSTALLED THROUGH VAPOR BARRIER WITH INDICATOR SIDE OUT FOR INSPECTION OF DESICCANT SATURATION.
3. LINE INTERIOR OF CONTAINER WITH KRAFT PAPER PER EPAPS-002 PARA 6.4 (GROUP 2 & 4) ITEM 17.
4. ITEM 16 TO BE INSTALLED WITHIN 4 IN. FROM EACH END AND ALONG LENGTH OF CASE SO THERE IS NOT MORE THAN 24 IN. BETWEEN STRAPS. EDGE PROTECTORS SHALL BE USED UNDER ALL STRAPS.
5. CORNER STRAPPING, (ITEM 18) TO BE INSTALLED AS SHOWN IN DETAIL A (G2 & 4).
6. MARKING WILL BE PER:
EPAPS-001 (G1 & 3)
EPAPS-002 (G2 & 4)



GENERAL ELECTRIC

PARTS LIST FOR 147D7802 CONT ON SHEET

REV NO. A B C

PARTS LIST FOR 147D7802

CONT ON SHEET SH NO.

TITLE ASSEMBLY
EPA SHIPPING CONTAINER

FIRST MADE FOR

GROUP NO. AND QUANTITY					PART NO.	NAME	DRAWING NO., DESCRIPTION, MATERIAL, WEIGHT
G4	G3	G2	G1				
2	2	2	2		1	TOP, BTM COVER	5/8 IN THK EXT GRADE PLYWOOD
2	2	2	2		2	SIDE COVER	5/8 IN THK EXT GRADE PLYWOOD
2	2	2	2		3	END COVER	5/8 IN THK EXT GRADE PLYWOOD
4	4	6	6		4	INT SHELF	5/8 IN THK EXT GRADE PLYWOOD
8	8	12	12		5	SHELF SPACER	5/8 IN THK EXT GRADE PLYWOOD
2	2	2	2		6	SHELF SPACER	5/8 IN THK EXT GRADE PLYWOOD
	3		3		7	SKID	4.00 X 4.00 STRAIGHT GRAIN FIR
AR	AR	AR	AR		8	EDGE PROTECTOR	*2046T12 McMASTER
16	16	24	24		9	BOLT	N18P250188
16	16	24	24		10	WASHER, FLAT	N402AP13B
16	16	24	24		11	NUT, LOCK	N264P25B
4	4	6	6		12	DESICCANT BAG	MIL-D-3464, Type II, Non-Dusting
AR	AR	AR	AR		13	VAPOR BARR	*MIL-B-131
4	4	6	6		14	HUMIDITY IND	*AEC B28596 Humidial Co.
AR	AR	AR	AR		15	NAILER	.75 x 3.50 Straight Grain Fir
AR	AR	AR	AR		16	BANDING, STEEL	.75 x .023 Min.
AR		AR			17	KRAFT PAPER	PPP-B-1055 CLASS L-2b
8		8			18	CORNER STRAPPING	.75 X .023 MIN.

*Buyer Approved Equiv.

DESCRIPTION OF GROUPS

C P. Moreno 10-15-80 LW
CHANGED PER AN-3
CHKD BY:
10-15-80 P.J. CASANO
10-15-80 R. BURNSIDE
P. Moreno R. Burnside

REVISIONS C

B P. Casano 10-7-80 LW
ADDED GR 3 & 4
PER AN-2
CHKD BY R. Burnside
P. Moreno - R BURNSIDE
7 OCT 80
9/11/79

NONE SPO-002 LW 9-13-79

A P. Casano 9-17-80
ADDED G2 PER AN-1
CHKD BY ENGRG
P. Moreno - L.A. Hodgson
18 SEP 80 9/18/80

PRINTS TO

MADE BY P. PEARSON 22 AUG 79
ISSUED 9/15/79

APPROVED L.A. Hodgson
L HODGSON

DIV. OR DEPT RESD/SPO
LOCATION LOMPOC

PARTS LIST FOR 147D7802
CONT ON SHEET SH NO.

FF-801-F (12-78) PRINTED IN U.S.A.

CHK: 11SEP79 P. Casano P.J. CASANO

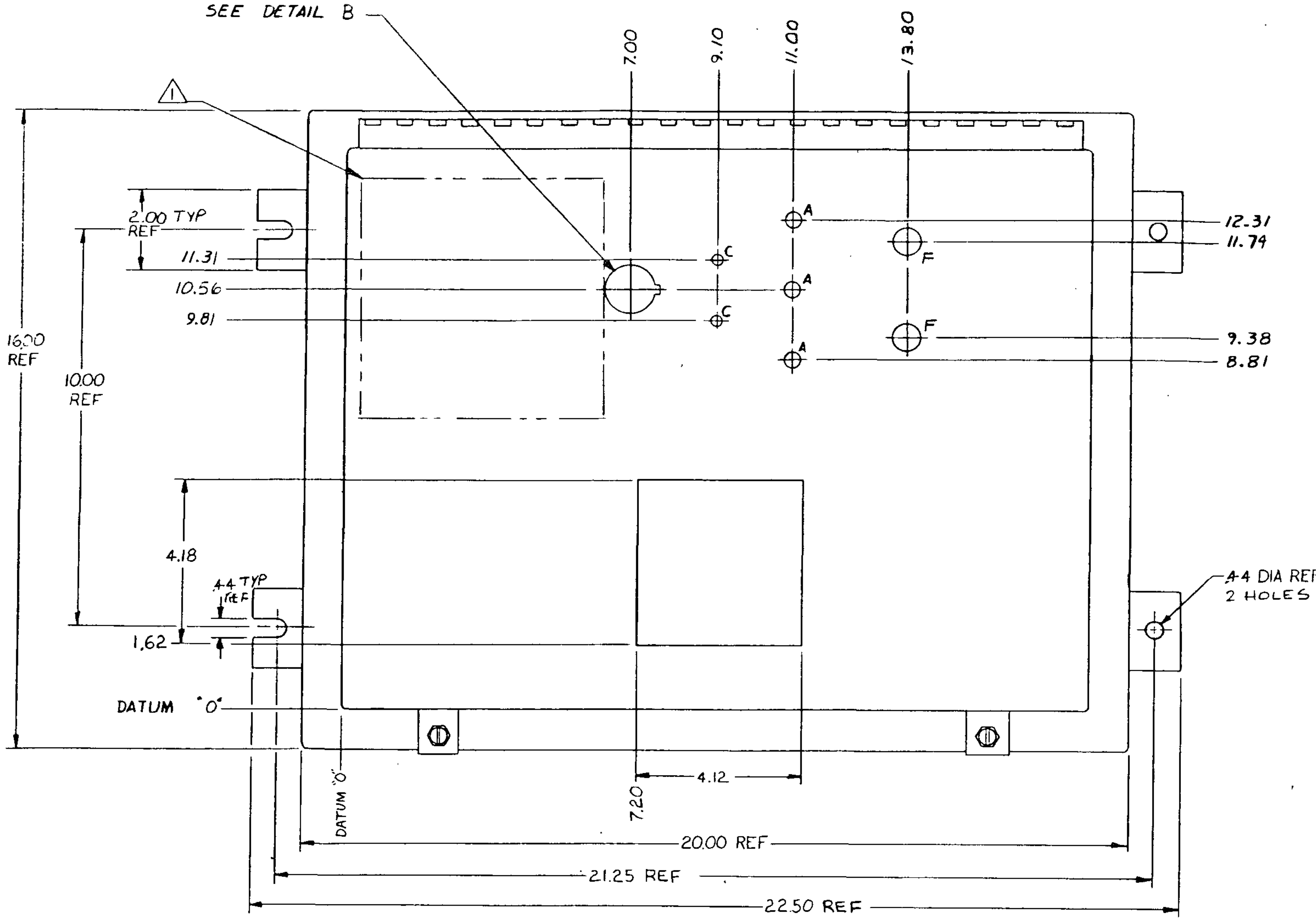
GENERAL ELECTRIC

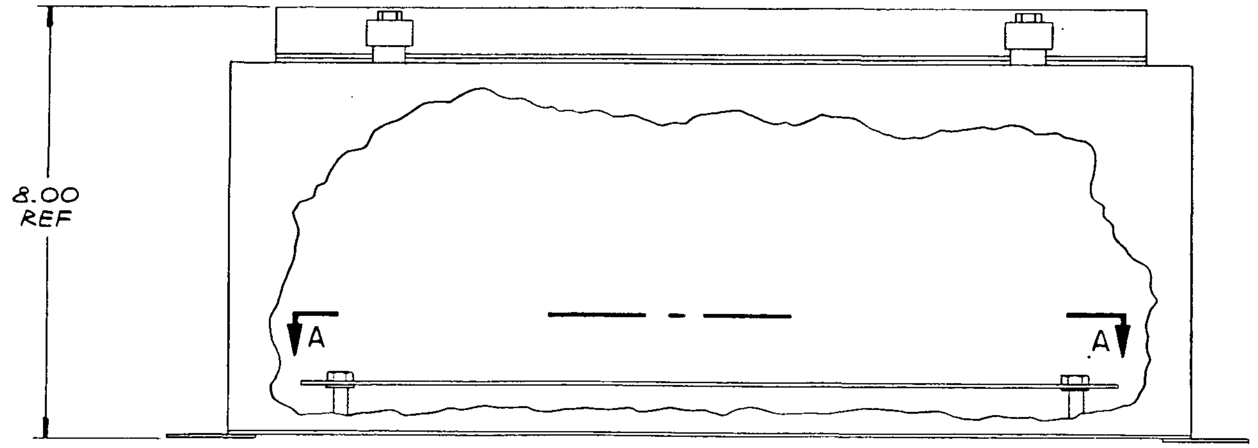
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING — APPLIED PRACTICES: 167A2400 | SURFACES: ✓ | TOLERANCES ON MACHINED DIMENSIONS: ±.XX .03, ±.XXX .010

147D7800

TITLE: ENCLOSURE MODIFICATION

FIRST MADE FOR: ELECTRICAL PROTECTION ASSY

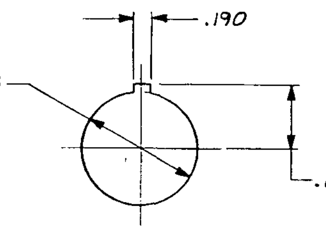




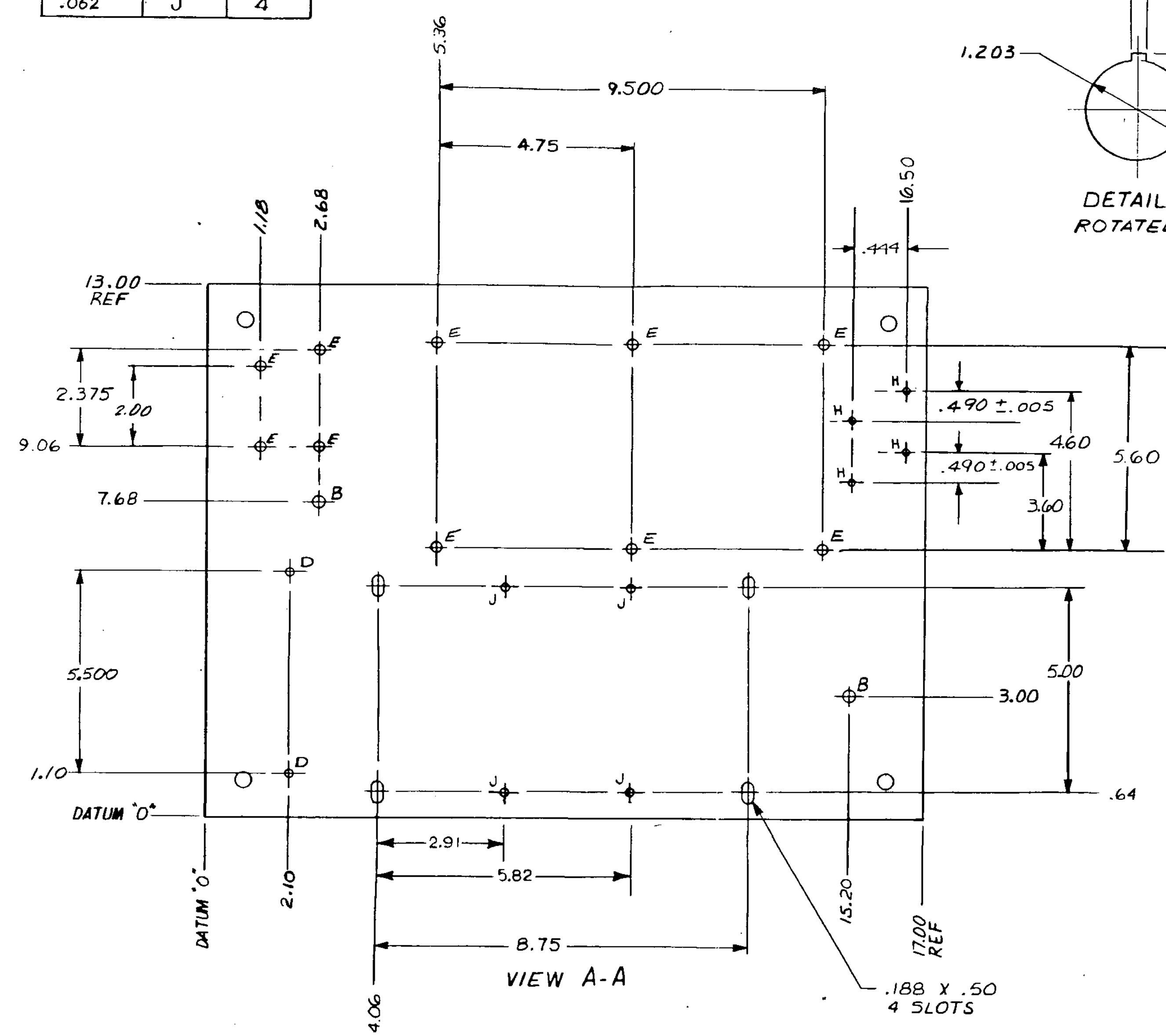
HOLE LEGEND		
DIA	LETTER	QTY
.406	A	3
.328	B	1
.272	C	2
.189	D	2
.166	E	10
.688	F	2
.089	H	4
.062	J	4

(1) MAKE FROM 117C2303P017

NOTES:
1. REMOVE EXISTING PRINT POCKET AND CUT-OFF EXISTING POCKET MOUNTING STUDS. GRIND FLUSH AND TOUCH UP REWORK AREAS WITH WHITE ENAMEL.



DETAIL B
ROTATED 90° CCW



VIEW A-A

REVISIONS

E G.PARKER 21 APR 80 JGL — CHANGED PER AN-5 CHKD BY: S. HANSEL ENGR: L. HODGSON	D E. RICE 7 FEB 80 JGL — REVISED PER AN 147D7800-4 CHKD BY S. HANSEL ENGR L. HODGSON	C D.R.DUDLEY 4 JAN 80 JGL — REVISED PER AN 147D7800-3 CHKD BY S. HANSEL ENGR L. HODGSON	B PHIL PEARSON JGL — REVISED PER AN147D7800-2 CHK: P. CASANO ENGR L. HODGSON	A S. LUNDBORG JGL — CHANGED PER AN 147D7800-1 CHK BY S. HANSEL L. HODGSON

SPO-001 8-2-79

D. SWAN 6.0. JUNE 7-79 — JACK A. LEWIS — RSD/SPO — LOMPOC — 147D7800 — 10

NEDO-24317
81NED301
CLASS I
JANUARY 1981

[illegible] REVIEW:
[illegible]
1. [illegible]
2. ☐ REVISE AND RESUBMIT. [illegible] PROCEED SUBJECT [illegible] OF [illegible] INDICATED.
3. ☐ [illegible] WORK MAY NOT PROCEED.
4. ☐ [illegible] WORK [illegible]

IMPORTANT: PERMISSION TO PROCEED DOES NOT CONSTITUTE ACCEPTANCE OR APPROVAL OF DESIGN DETAILS, CALCULATIONS, ANALYSES, TEST METHODS OR MATERIALS DEVELOPED OR SELECTED BY THE SUPPLIER AND DOES NOT RELIEVE SUPPLIER FROM FULL COMPLIANCE WITH CONTRACTUAL OBLIGATIONS.

ENGR. B.S. Shah GRP. LDR. O. Quan for T. Gucciardo
Q.A. [illegible] LICENSING N.K.
SUPERVISING NUC. PROJ. [illegible] for PDW INITIAL DATE 26 MAY 1981

REACTOR PROTECTION SYSTEM PROTECTIVE CIRCUIT UPGRADE DESCRIPTION

APPROVAL
CHK. ______ DATE ______
APPR. ______ DATE ______
ie: No. APED-C71-031-NI

FOR INFORMATION ONLY

R. S. De VREUGD

IELP P.O.# 42563
G.E. Quotation 416-5555-KE
DCR 1044
DDC 461

RECEIVED
MAY - 4 1981
DESIGN ENGINEERING

GENERAL ELECTRIC

DUPE ~~8104270284~~

NEDO-24317
81NED301
Class I
January 1981

REACTOR PROTECTION SYSTEM PROTECTIVE CIRCUIT UPGRADE DESCRIPTION

R. S. DeVreugd

Approved: R. J. Brandon, Manager
Nuclear Services Engineering
Nuclear Fuel and Services
Engineering Department

Approved: R. L. Gridley, Manager
Fuel and Services Licensing
Safety and Licensing
Operation

NUCLEAR POWER SYSTEMS DIVISION • GENERAL ELECTRIC COMPANY
SAN JOSE, CALIFORNIA 95125

GENERAL ELECTRIC

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NUCLEAR ENERGY DIVISIONS • GENERAL ELECTRIC COMPANY
SAN JOSE, CALIFORNIA 95125

GENERAL ELECTRIC

TECHNICAL INFORMATION EXCHANGE

TITLE PAGE

AUTHOR	SUBJECT	TIE NUMBER
R. S. DeVreugd	Nuclear Science and Technology	81 NED 301
		DATE: January 1981
TITLE: Reactor Protection System Protective Circuit Upgrade Description		GE CLASS: I
		GOVERNMENT CLASS:
REPRODUCIBLE COPY FILED AT TECHNICAL SUPPORT SERVICES, R&UO, SAN JOSE, CALIFORNIA 95125 (Mail Code 211)		NUMBER OF PAGES: 15

SUMMARY

A description of the Electrical Protection Assembly for plants with Reactor Protection System motor generator sets is presented.

By cutting out this rectangle and folding in half, the above information can be fitted into a standard card file.

DOCUMENT NUMBER NEDO-24317

INFORMATION PREPARED FOR Nuclear Power Systems Division

SECTION Nuclear Safety and Licensing Operation

BUILDING AND ROOM NUMBER K-2121 MAIL CODE 682

1. INTRODUCTION

This report describes the Electrical Protection Assembly (EPA) for plants with Reactor Protection System (RPS) Motor Generator (MG) sets.

The EPA provides redundant protection to the RPS and other essential circuits against overvoltage, undervoltage, and underfrequency. The EPA consists of trip components which disconnect circuitry from input power whenever voltage or frequency exceeds their normal tolerances. The unit is Class 1E qualified to IEEE standards.

2. HISTORY

Prior to the issuance of the Edwin I. Hatch Unit 2 operating license, the Nuclear Regulatory Commission (NRC) identified a concern regarding the RPS instrument MG set. It was noted that the existing RPS MG protective circuitry was not Class 1E. This fact lead to the conclusion that the system output voltage of 120 volts alternating current (Vac) could be varied sufficiently by a seismic event to cause a failure of the RPS.

Normally, the MG set's output voltage is maintained virtually constant by means of a voltage regulator (see Figure 2-1). Additionally, overvoltage and undervoltage protective devices isolate the MG's output from the RPS if the voltage exceeds ±10% of 120 Vac. Isolation also occurs if output voltage frequency drops by more than 5%.

The NRC's concern was that the overvoltage, undervoltage, and underfrequency devices were not seismically qualified and could become inoperable, along with the voltage regulator, as a result of a seismic event. The RPS could then receive an out-of-limits voltage supply and thereby sustain damage to the RPS which could prevent a required reactor scram.

The RPS instrument MG set concern applies to all plants where the RPS employs a relay system as opposed to the solid state RPS. The single exception to this rule is the Limerick plant which derives its RPS supply voltage from inverters. The design modification is generic for all affected plants, thus simplifying the review process and facilitating the procurement of the additional equipment.

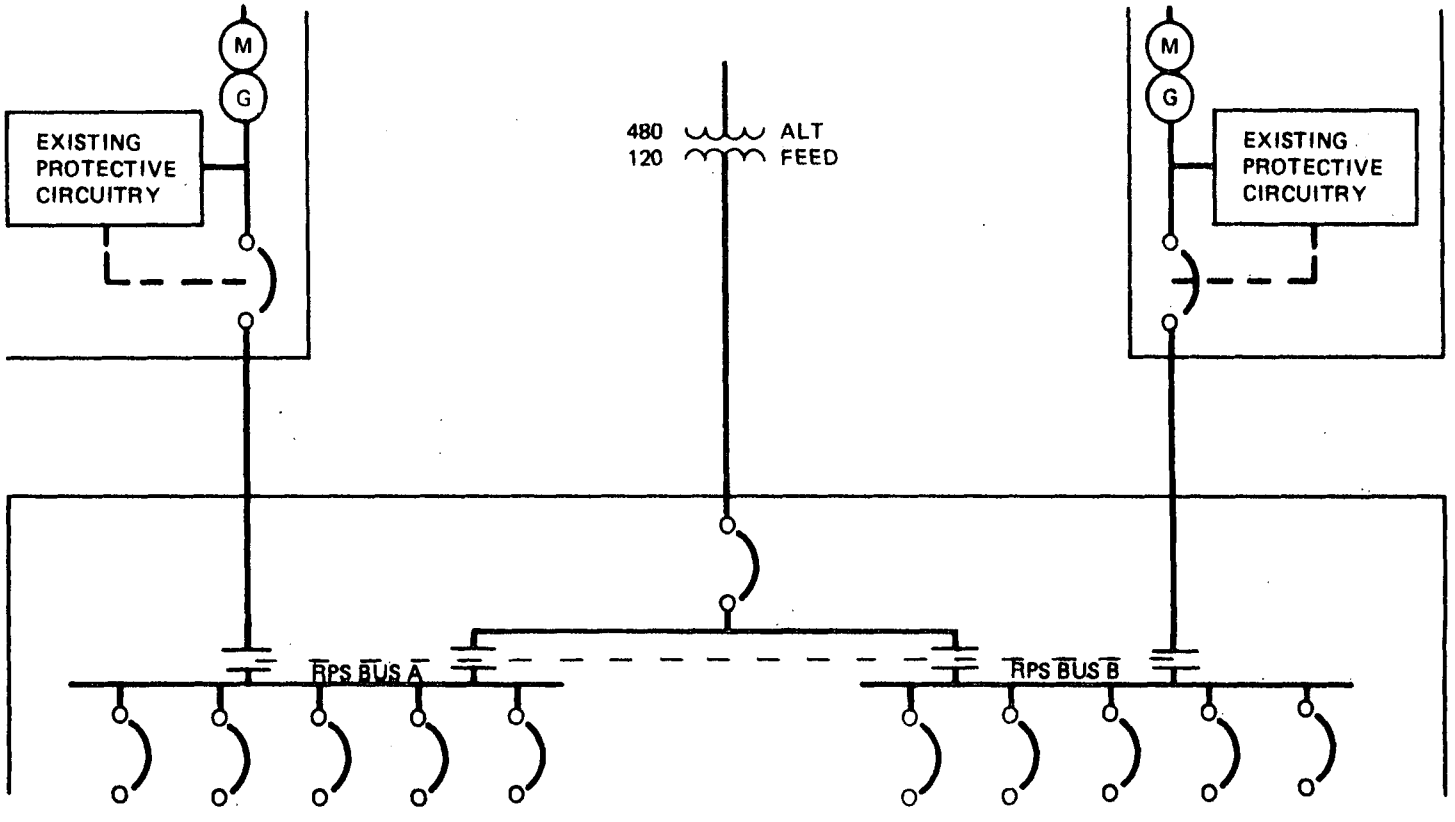

Figure 2-1. Existing RPS Protective Circuitry

3. HARDWARE QUALIFICATIONS

Seismically qualified protective circuits for undervoltage, overvoltage, and underfrequency are packaged in an enclosure designed to be wall mounted. Two of these assemblies will be connected in series, between the power source and the RPS. The enclosures will be mounted separately from the MG sets, and separate from each other. The circuits and enclosures are designed and manufactured to General Electric Company specifications.

The enclosures will be located in an area where the ambient temperature will be 40°F to 122°F. The circuits within the enclosures are qualified to operate up to 137°F at 95% relative humidity. The assemblies are seismically qualified per IEEE-344, 1975, to the Safe Shutdown Earthquake (SSE) and Operating Base Earthquake (OBE). The units are environmentally qualified to the requirements of IEEE-323, 1974.

Enclosure dimensions are 20 inches by 16 inches by 8 inches.

4. SYSTEM DESCRIPTION AND APPLICATION

The block diagram shown in Figure 4-1 functionally depicts the addition of the new assemblies to the RPS power supplies. Two assemblies will be connected in series to each RPS's power source, including auxiliary power. The protective circuit trip setpoints are plus and minus 10 percent of nominal alternating current (ac) voltage and minus 5 percent of nominal frequency.

At installation, voltage measurements will be taken to determine ac line losses between the motor generator set, protective circuits, and downstream components. The motor generator voltage regulators and the protective circuit trip points will be adjusted to voltage levels that reflect optimal operating conditions for the Reactor Protection System and associated system components.

Protecting the EPA from tripping due to low frequency, overvoltage or undervoltage transients is accomplished by three independent time delays. These variable time delays (from 0.1 to 3.0 seconds) prevent the EPA from immediately tripping with the occurrence of a transient. Thus, if the transient dissipates prior to tripping the EPA, the EPA remains untripped.

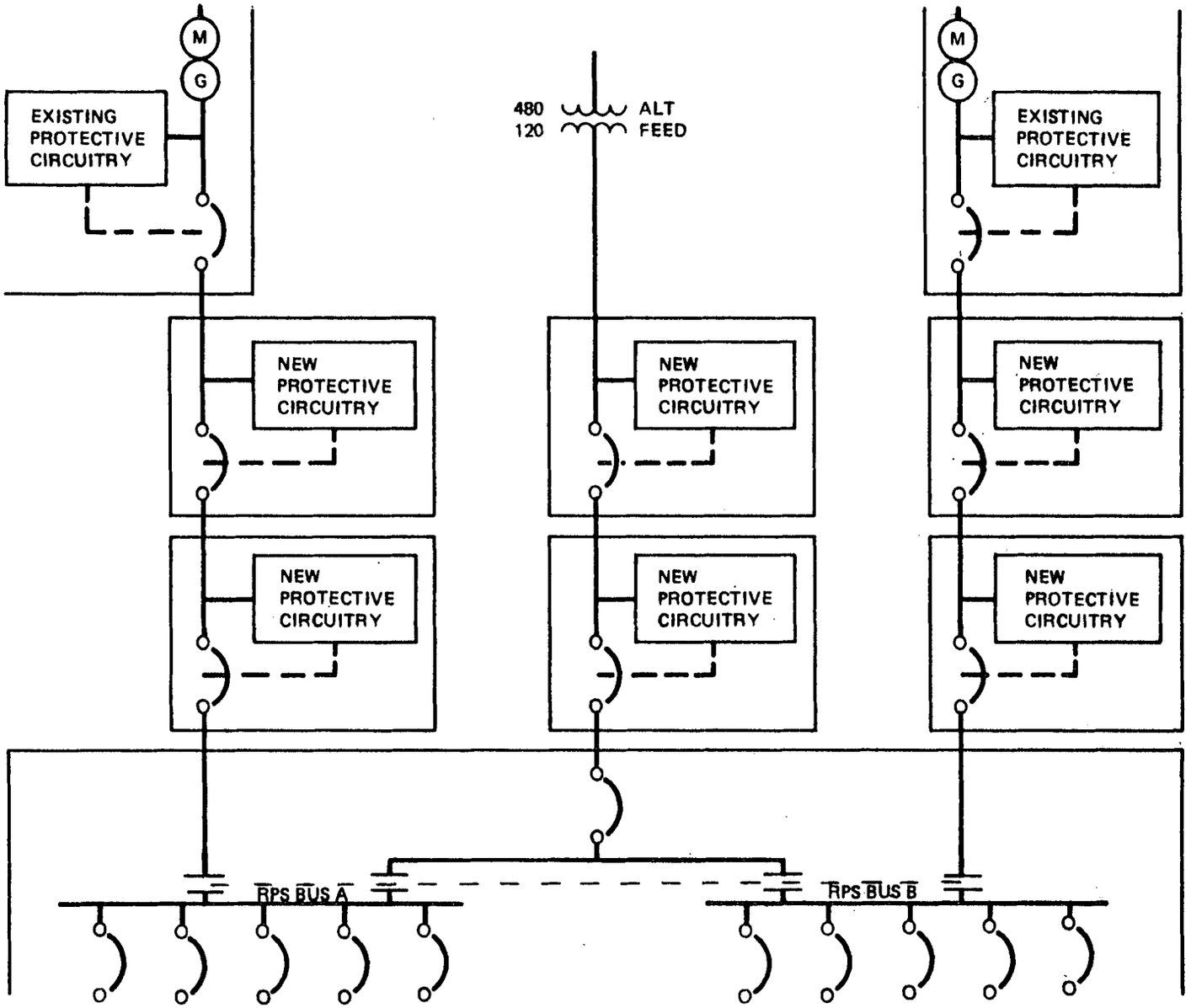

Figure 4-1. New RPS Protective Circuitry

5. SPECIFICATIONS

5.1 FRONT PANEL CONTROL/INDICATORS (see Figure 5-1)

5.1.1 Indicators (Test Maintenance)

a. Overvoltage

b. Undervoltage

c. Underfrequency

d. Power IN

e. Power OUT

5.1.2 Indicators (Operation)

a. Power IN

b. Power OUT

5.1.3 Controls

a. Main circuit breaker ON/OFF

b. Lockswitch for test maintenance use.

5.2 ELECTRICAL REQUIREMENTS

Nominal Voltage Range: 120 Vac (±2%)
Current Requirements:
Startup Current: 280 mA for one second
Running Current: 250 mA
Single Phase: Two Wire (plus ground)

Frequency: 50 hertz (Hz)/60 Hz
Time Delay: Continuously Adjustable 0.1 to 3.0 seconds
Circuit Breaker Max Load: 175 amperes ac

5.3 OPERATING REQUIREMENTS

Temperature: 40°F to 137°F
Humidity: Up to 95% Relative
Radiation: $2x10^4$ RAD, Silcon Total Integrated Dose (TID) Group I
$2x10^5$ RAD, Silcon Total Integrated Dose (TID) Group II
Altitude: 0 - 10,000 feet above sea level.

5.4 MECHANICAL

Weight: 60 pounds
Height: 20 inches
Depth: 8 inches
Width: 16 inches

A hasp and staple are provided for padlocking the EPA enclosure. External feet are furnished for mounting.

5.5 CABLES

Cable and conduit access openings to be provided by the user at time of installation.

5.6 SEISMIC QUALIFICATION

a. Operating base earthquake (OBE) 5.0 gravity (G)

b. Safe shutdown earthquake (SSE) 7.0 G

c. Frequency Spectrum 1 to 33 Hz

6. REFERENCES

General Electric Company Instruction Manual for the Electrical Protection Assembly, Vendor Print File (VPF) 3830-83-6, December 1980.

DISTRIBUTION

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