GPU Nuclear

GPU Nuclear Corporation
100 Interpace Parkway
Parsippany, New Jersey 07054-1149
(201) 263-6500
TELEX 136-482
Writer's Direct Dial Number:

September 28, 1984

Mr. Walter A. Paulson, Acting Chief
Operating Reactors Branch #5
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Paulson:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
Request for Additional Information for
Evaluation of Safety Parameter Display
System (SPDS)

Reference: Letter, W. A. Paulson to P. B. Fiedler
dated July 19, 1984

By the referenced letter you requested that GPU Nuclear Corporation respond to questions on the Oyster Creek SPDS. This information was to allow the Staff to complete their evaluation of the Oyster Creek SPDS.

Please find enclosed with this l-.cer the requested information. It should be remembered that these respon.es are describing the preliminary SPDS since the displays are still in the design phase. Even after the basic SPDS is installed and operational (mid-1986), we expect that enhancements to the SPDS will be made, along with the development of additional software.

If you have any questions, please contact me or Mr. Drew Holland, the Oys Creek Licensing Manager at (609) 971-4643.

Very tr , , rs,

P. B. Fiedler
Vice President and Director
Oyster Creek

RPJ:dls:0741f
Enclosure

cc: Dr. Thomas E. Murley, USNRC Region I
NRC Resident Inspector, OC

A001
1/1

<u>ENCLOSURE</u>

ISOLATION DEVICES--

<u>Question a</u>: For each type of device used to accomplish electrical isolation, describe the specific testing performed to demonstrate that the device is acceptable for its application(s). This description should include elementary diagrams when necessary to indicate the test configuration and how the maximum credible faults were applied to the devices.

<u>Response</u>: Types of Devices Used:

Class 1E: TEC Analog Isolators
Reference TEC Qualification Test Report No. 31041-QP-01
and Appendices A through I
Isolation Scheme: Transformer Isolation

Class 1E: RIS Digital Isolators
Reference RIS Qualification Test Report No. A-357-81
Isolation Scheme: Optical Isolator

Find herein, excerpts from the vendors qualification tests for electrical isolation. These excerpts are not intended to exhaustively represent the contents of the referenced qualification efforts.

The drawings and other photocopied pages are designated thusly:

RIS $(a)_1$

Where:	RIS	Are the vendor's initials
	(a)	is the question being answered
	1	is the page number for that specific vendor under that question

Pages RIS(a)1-4 represent the method and diagrams for the RIS Digital Isolator testing and TEC(a)1-4 represent the same for the TEC Analog Isolators.

RIS(a) 1

E14400
Class IE Isolator Module Test Procedure

: This device may be used in Safety Related Nuclear Applications and complete testing must be performed and recorded.

Prior to testing, visually inspect module and record model type, S/N, and input voltage requirements of the module. CAUTION: Improper input voltage and/or loading can damage the module.

Test equipment required (or equivalent)

a. Rochester Instrument Systems Test Set TMM34.
b. Digital Voltmeter.
c. Hi-Pot Test Set.

Hi-Pot Test

Insert the module in the hi-pot position. The hi-pot connector has all pins wired together and the two input terminals at the end of the module are wired together.
Attach the Hi-Pot Terminal block to the module.

Apply 4000 VAC RMS between input and output with a 1 ma trip point. Verify and record successful testing of the module.

Functional Test

Prior to installing the module in the test position, select the required field contact voltage with Input V SW of the test set per the suffix table below:

Suffix	Field Contact Voltage
-X	24 VDC
-J	48 VDC
-D	125 VDC
-S	117 VAC (Note 1)

REVISIONS	
DCO AN-1100-666 RPM 7/1/77	RPM
DCO AN-1100-633 5-4-79	
DCO AN-1100-620 3-24-79	
DESCRIPTION	CHK.

ROCHESTER INSTRUMENT SYSTEMS
255 NORTH UNION STREET, ROCHESTER, NEW YORK 14605

E14400
Class IE Isolator Module Test Procedure

DRAWN	CHECKED	A-1032-814	REV C
APPR.		SHEET 1 OF 2	

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Note 1: The 117 VAC connection is via the jacks on the panel and an external variac must be used to generate this voltage.

Select the output load using switches SW1 and SW2 per the table below:

Module	Output 1	Output 2
El 4401	100 MA (Relay Contact Out)	10 MA (High Speed Iso. Out)
El 4402	100 MA (Relay Contact Out)	10 MA (Relay Contact Out)
El 4403	10 MA (High Speed Iso. Out)	10 MA (High Speed Iso. Out)
El 4404	10 MA (High Speed Iso. Out)	10 MA (High Speed Xistor Out)
El 4405	100 MA (Relay Contact Out)	10 MA (High Speed Xistor Out)

Turn power on. Install module in the test position and attach the terminal block to the modules handle.

5. Go-No-Go Test

Verify that the green light emitting diodes (LED's) illuminate and the red "10MA" LED's are off when switch SW3 is "ON".

6. Full Test

With the module installed and SW3 "ON", set the input voltage over the range of input voltage as shown below. Verify that the green LED's illuminate over the full range of the modules specified input voltage.

Nominal Voltage	Range
24 VDC	20 to 30 VDC
48 VDC	38 to 60 VDC
125 VDC	105 to 140 VDC
117 VAC	105 to 132 VAC

Measure the output voltage at the Output 1 and Output 2 terminals, referenced to the output return test point. The voltage, when on should be less than 1.5 volt DC.

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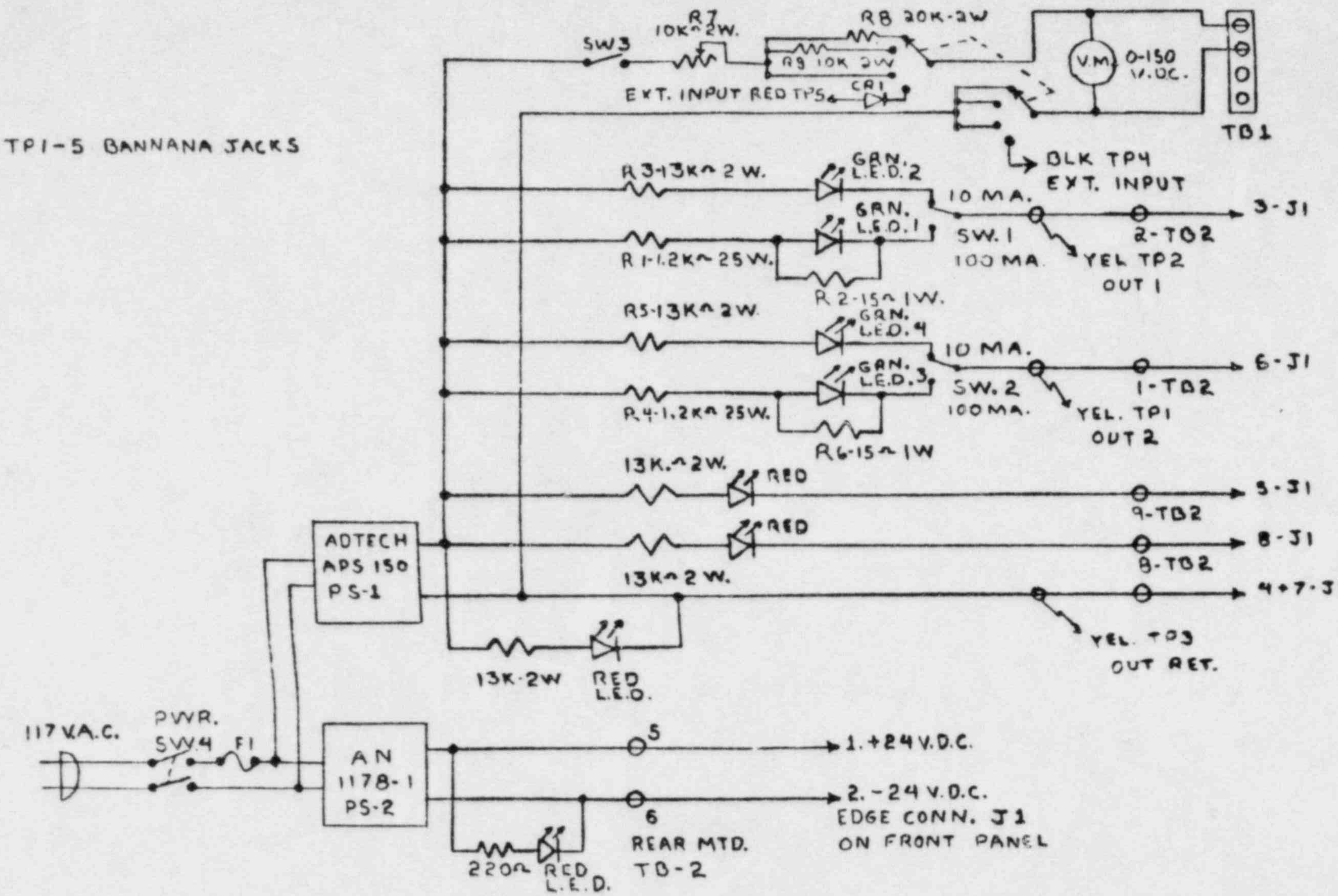
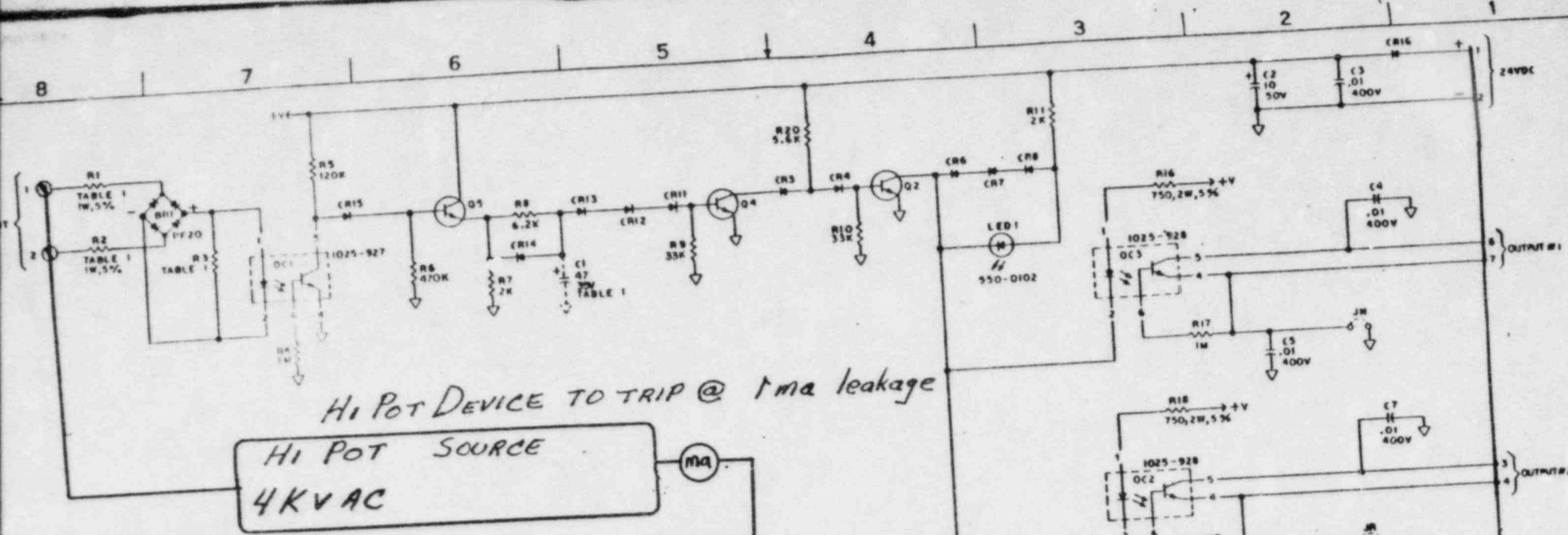
TP1-5 BANNANA JACKS



RIS(a)3

1E ISOLATOR
GO/NO-GO TEST

RIS(a)4



JUMPER CHART	JUMPERS	SUFFIX
FIRST OUTPUT REFERENCED TO POWER COMMON	JN	N
SECOND OUTPUT REFERENCED TO POWER COMMON	JR	R

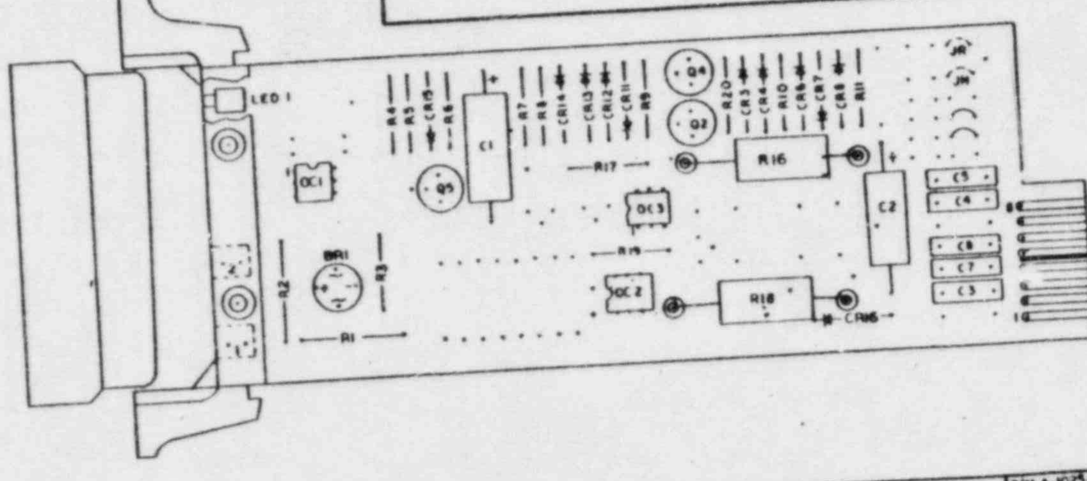


TABLE I				
INPUT VOLTAGE	R1, R2	R3	C1	SUFFIX
24VDC	1.8K	430	OUT	-1
48VDC	3.9K	560	OUT	-2
125VDC	11K	1.2K	OUT	[illegible]
117VAC	11K	2.2K	IN	-5

NOTES:

1. UNLESS OTHERWISE SPECIFIED
   - 1.1 ALL RESISTORS ARE 1/2W, 5%
   - 1.2 ALL RESISTANCE VALUES ARE IN OHMS
   - 1.3 ALL DIODES ARE IN2070
   - 1.4 ALL TRANSISTORS ARE B 1019-985
   - 1.5 ALL CAPACITANCE VALUES ARE IN MICROFARADS
2. MODULE TO BE COATED WITH HUMISEAL 1A20 ONLY

SCHEMATIC & ASSEMBLY
IE ISOLATOR

RIS ROCHESTER INSTRUMENT SYSTEMS

D-1025-820 C

TEC (a),

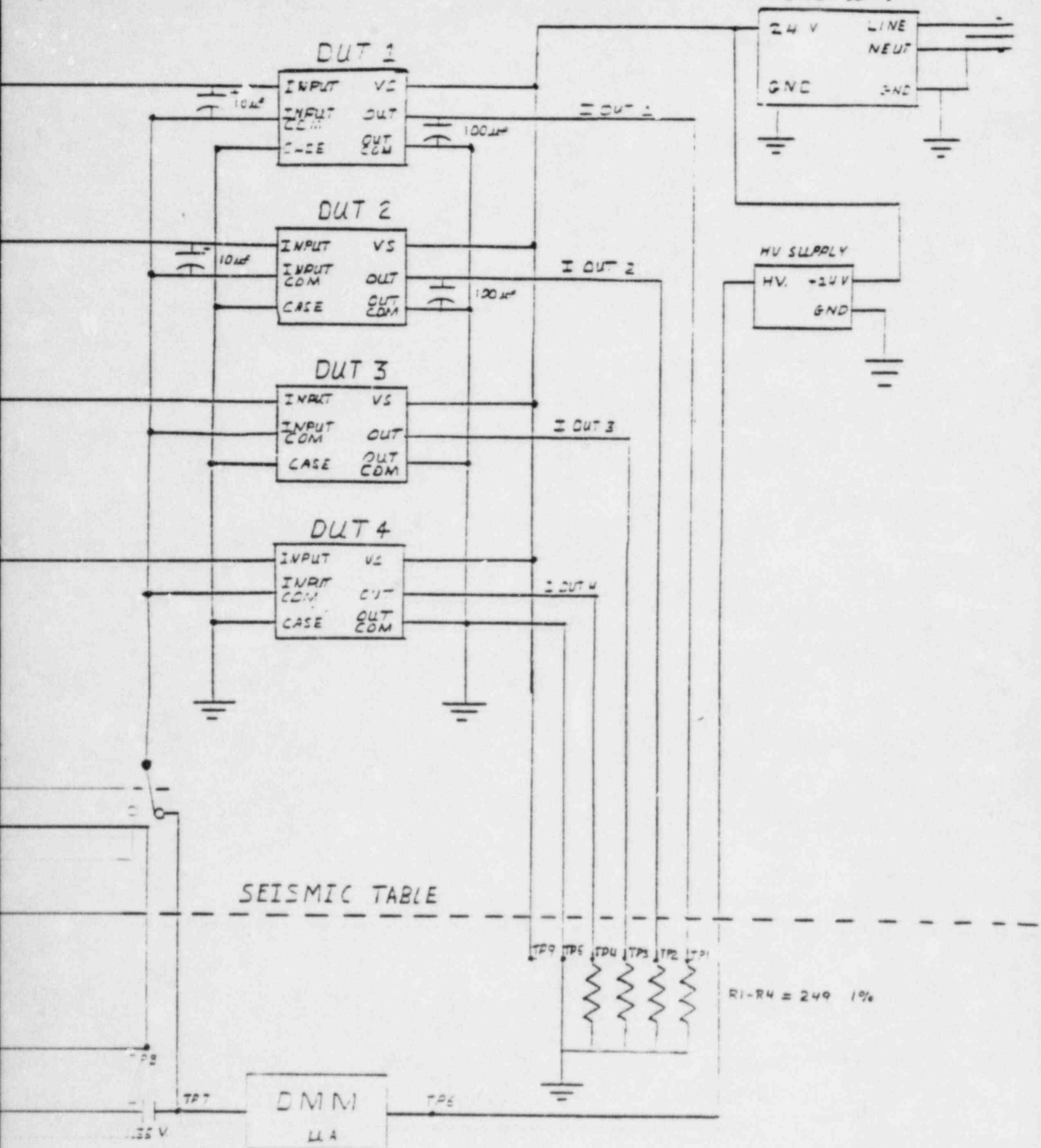
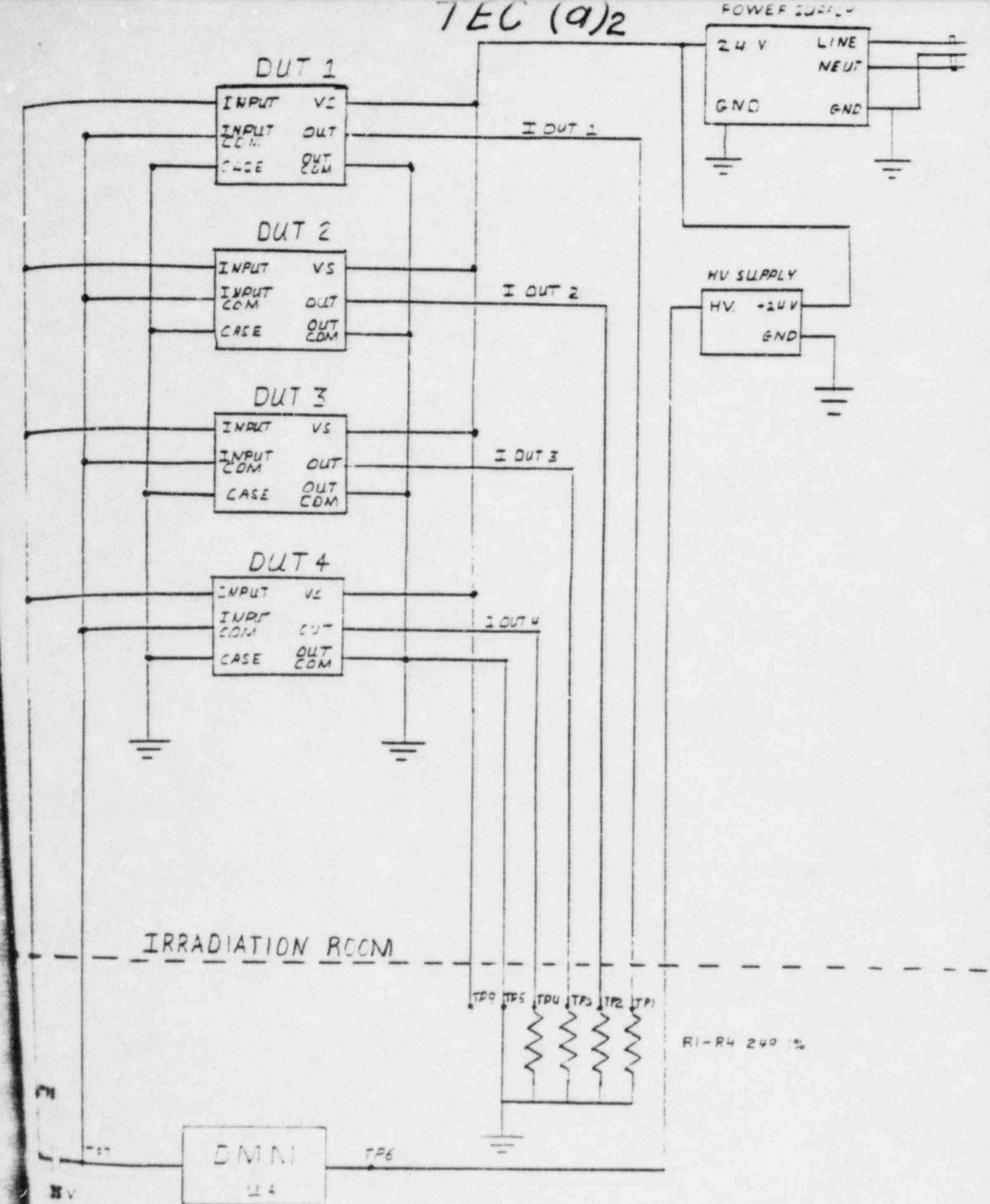


Figure 1

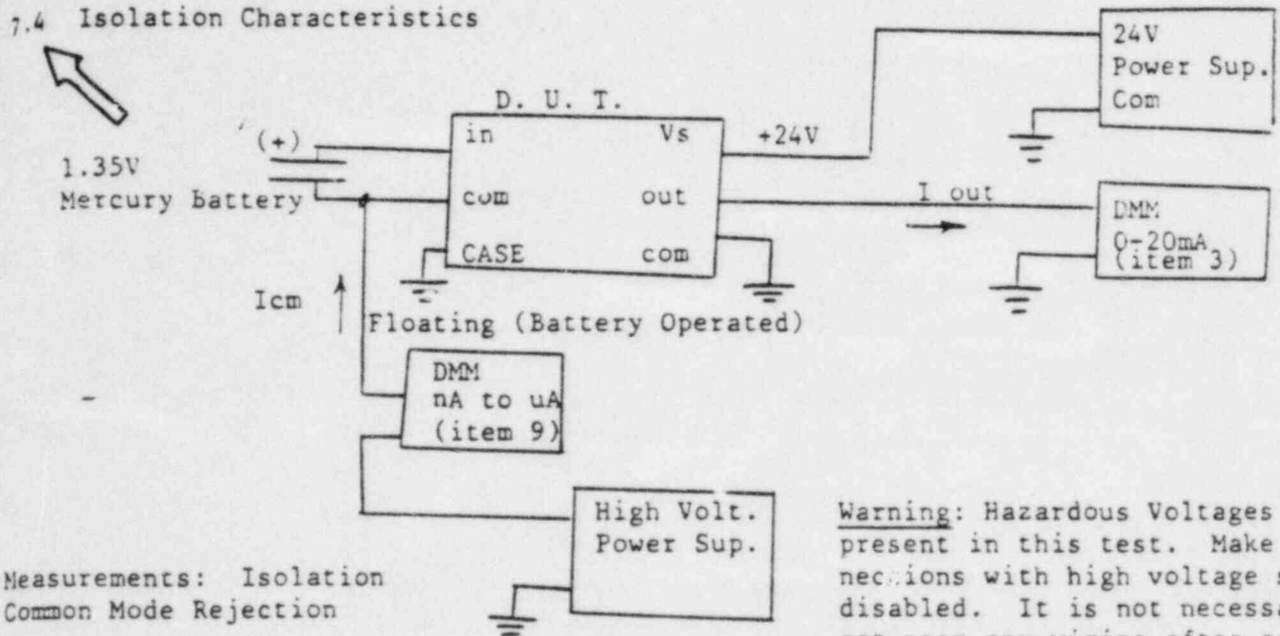
TEC (a)2


POWER SUPPLY
24 V
LINE
NEUT
GND
GND
DUT 1
INPUT
VS
INPUT COM
OUT
CASE
OUT COM
I OUT 1
DUT 2
INPUT
VS
INPUT COM
OUT
CASE
OUT COM
I OUT 2
HV SUPPLY
HV
+24V
GND
DUT 3
INPUT
VS
INPUT COM
OUT
CASE
OUT COM
I OUT 3
DUT 4
INPUT
VS
INPUT COM
OUT
CASE
OUT COM
I OUT 4
IRRADIATION ROOM
TP9
TP5
TP4
TP3
TP2
TP1
R1-R4 240 1%
DMM
TP6

TEC(a)3

TEC Technology for Energy Corporation	TITLE TESTING PROCEDURE FOR TEC MODEL 156 ANALOG ISOLATORS	NO. 156-OP-03 REV. 1

7.4 Isolation Characteristics



Measurements: Isolation
Common Mode Rejection

Warning: Hazardous Voltages are present in this test. Make connections with high voltage supply disabled. It is not necessary to get near any wiring after set up.

8.0 OPERATIONAL TEST

This test is divided into two sections: Section 8.1 is for testing prior to potting and Section 8.2 is for final testing. The steps a through i are common to both tests except that the "prior to potting" test (Section 8.1) omits some of the steps.

The result sheet details which steps are performed and provides a place to log data. Also, all limits are on the results sheet.

8.1 PRIOR TO POTTING TEST

Perform steps, a,b,c, and h as indicated on the results sheet.

8.2 FINAL TEST

Perform all steps (a-i) as indicated on the results sheet.

REF.
(8.1, 8.2) OPERATIONAL TEST STEPS

USE THE TEST CONNECTION SHOWN IN SECTION 7.1 FOR STEPS A,B, AND C, BELOW.

a. Input Resistance: With the DMM, measure the input resistance of the unit. Record value and see that it is within limits.

842A10

g. (cont.)

Measure supply current and output current at a supply voltage of 18V, 24V, and 30V and record results on the results sheet.

Verify the supply current is within limits. Calculate power supply rejection as follows:

$$\text{PSRR in db} = 20 \log_{10} \frac{Iout2 - Iout1}{V_{s_2} - V_{s_1}}$$

Where $Iout_2$ is the output current at a supply voltage of 30V. $Iout_1$ is the output current at a supply voltage of 18V. Vs_2 = 30V, V_{s_1} = 18V.

Record the power supply rejection and verify that it is within limits.

⇨ USE THE TEST CONNECTION SHOWN IN SECTION 7.4 FOR STEPS H AND I BELOW.

AVOID CONTACT WITH THE HIGH VOLTAGE INPUT CIRCUITY OF THE DEVICE UNDER TEST.

⇨ h. Isolation: Slowly turn up the high voltage supply to 2000VDC and measure the common mode input current on the floating DMM. Record this reading on the results sheet. Calculate the isolation resistance as follows:

$$R_{isolation} = \frac{2000V}{Ic.m.}$$

Record this reading in Ω on the results sheet and verify that it is within limits.

i. Common Mode Rejection: With the high voltage supply at 2000VDC, measure the output current. Record this value on the results sheet. Now turn the high voltage supply off, and measure the output current. Record this value also. Common mode rejection is calculated as follows:

$$CMRR_{in\ db} = 20 \log_{10} \frac{Iout_2 - Iout1}{Vcm_2 - Vcm_1}$$

where

$Iout_2$ is the output current with the high voltage supply set at 2000V.

$Iout_1$ is the output current with the high voltage supply set at 0V.

Vcm_2 = 2000V, Vcm_1 = 0V.

Record CMRR on the results sheet and verify that it is within limits.

642A10

<u>Question b</u>: Data to verify that the maximum credible faults applied during the test were the maximum voltage/current to which the device could be exposed, and define how the maximum voltage/current was determined.

<u>Response</u>: The maximum credible voltage to be accidentally applied to the non-1E side of the Isolation Devices is assumed to be 480 volts 60 Hz, AC. This is considered extremely unlikely in view of separation practices between power and signal circuits; however, it should constitute a "Worst Case" since it is the highest power distribution voltage readily accessed in the plant. (4,160 VAC, because of its restricted use, is considered an incredible accidental contact mode).

The peak voltage associated with 480 VAC is 678 volts phase to ground. (Phase to phase peak, which is a considerably less credible fault, is 1,175 volts peak).

The transformer insulation tests of 1 Kv and 2 Kv for the TEC isolators, leave significant margin for safety, as tested, and the manufacturers specification claims 2.5 Kv insulation rating.

The Digital Isolators provided by RIS had the insulation of their optical isolation scheme tested with 4,000 VAC.

<u>Question c</u>: Data to verify that the maximum credible fault was applied to the output of the device in the transverse mode (between signal and return) and other faults were considered (i.e., open and short circuits).

<u>Response</u>: The only faults of interest are those faults that may occur on, or propagate to, the class 1E side of the isolators. Given sufficient isolation by the primary isolation device, (i.e., transformers or optical isolators for the TEC and RIS devices respectively) the consequences of open circuit, short circuit, or transverse mode output faults, become immaterial.

The high voltage tests from input to output as discussed under question "a" affirm the level of isolation as adequate.

RIS(c)1

DATA SHEET

RIS
ISOLATION MODULES
SEE BELOW
N/A
N/A
N/A
N/A

Amb. Temp. N/A
Photo N/A
Test Med. N/A
Specimen Temp. N/A

Corporate Consulting and Development Company, Ltd.

Job No. 1361
Report No.
Start Date 12/12/79

CLASS 1E ISOLATOR MODULE FUNCTIONAL DATA SHEET

SAMPLE NUMBER	CUSTOMER PART NUMBER	LOCATION IN CHASSIS	Hi POT TEST P=PASSED F=FAILED	Go No Go TEST P or F	FULL TEST LIGHTS LIGHT P or F	OUTPUT VOLTAGE < 1.5V 1 to R	2 to R	COMMENTS
-000-000	EI4401-S	A1	P	P	P	0.0	0.8	
-000-001	EI4401-D	A2	P	P	P	0.0	0.8	
-000-002	EI4401-J	A3	P	P	P	0.0	0.2	
-000-003	EI4401-X	A4	P	P	P	0.0	0.4	
-000-004	EI4402-S	A5	P	P	P	0.0	0.0	
-000-005	EI4402-D	A6	P	P	P	0.0	0.0	
-000-006	EI4402-J	A7	P	P	P	0.0	0.0	
-000-007	EI4402-X	A8	P	P	P	0.0	0.0	
-000-008	EI4403-S	A9	P	P	P	0.2	0.2	
-000-009	EI4403-D	A10	P	P	P	*3.2	0.6	*ROA ALLREADY WRITTEN
-000-010	EI4403-J	A11	P	P	P	0.4	0.2	
-000-012	EI4404-S	A13	P	P	P	0.2	0.0	
-000-013	EI4404-D	A14	P	P	P	0.2	0.0	
-000-014	EI4404-J	A15	P	P	P	0.2	0.0	
-000-015	EI4404-X	A16	P	P	P	0.4	0.0	
-000-016	EI4405-S	A17	P	P	P	0.0	0.0	
-000-017	EI4405-D	A18	P	P	P	0.0	0.0	
-000-018	EI4405-J	A19	P	P	P	0.0	0.0	

When Failed
When Passed
Written

Tested By WMF Date: 12/12/79
Witness R. [illegible] Date: 12/12/79
Sheet No. 1 of 2
Approved

Revise From µa to na

WORST CASE 3.07×10^{12} OHMS Per Pending TEC Rev.

DATA SHEET FOR IRRADIATION OF
MODEL 156 ANALOG SIGNAL ISOLATOR

TIME	ISOLATOR 1 S/N 1		ISOLATOR 2 S/N 3		ISOLATOR 3 S/N 2		ISOLATOR 4 S/N 4		P.S.			REMARK
3-16-81	E In	E Out	E In	E Out	E In	E Out	E In	E Out	H.V.	L.V.	HV I ~~µa~~	
12:35	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.53V	2KV	24	.04	No Source
12:43	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.53V	2KV	24	.65	Source
12:45	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.53V	2KV	24	.45	Source
12:59	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.52V	2KV	24	.45	Source
13:14	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.52V	2KV	24	.47	Source
13:31	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.52V	2KV	24	.47	No Source (DOSE RATE .0[illegible] MCG/R-Approx.
13:[illegible]6	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.52V	2KV	24	.44	Source
14:00	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.52V	2KV	24	.44	No Source
14:35	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.52V	2KV	24	.42	Source
14:15												No Source
14:48												Source
15:08	1.35V	1.33V	1.35V	2.6V	1.35V	1.33V	1.35V	1.52V	2KV	24	.45	Source
15:13												No Source
15:43												Source
16:00	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.52V	2KV	24	.44	Source
16:30	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.52V	2KV	24	.08	No Source
17:38	1.35V	1.33V	1.35V	2.06V	1.35V	1.33V	1.35V	1.52V	2KV	24	.37	Source

Time Start 3/16/81 12:35

Time Stop 3/17/81 02:37

Tested By VWL & JTS

Certification ____________

NOTE #1 Temp. In Cell Approximately 100 °F

NOTE #2 Dose = Approximately 200 R/HR

TEC(C)1

TEC (C)2

TABLE 1

MODEL 156 ANALOG SIGNAL ISOLATOR

TIME		ISO-1 S/N___	ISO-2 S/N___	ISO-3 S/N___	ISO-4 S/N___		ISO-1 S/N___	ISO-2 S/N___	ISO-3 S/N___	ISO-4 S/N___			Revise From μa to na	
	SIGNAL E_{IN}	E_1 OUT	E_2 OUT	E_3 OUT	E_4 OUT	TEST E_{IN}	E_1 OUT	E_2 OUT	E_3 OUT	E_4 OUT	H.V.	L.V.	HV_1 ~~μa~~	REMARKS
2:27	1.35V	1.32	1.33	2.05	1.51						1KV	24.1	.120	During SSE #2
*10:55	1.35V	1.33	1.33	2.05	1.52	2.7	2.65	2.66	3.11	2.05	1KV	24.1	.120	Tests performed at TEC following seismic testing

8.3×10^{12} ohms
Per Pending Revision from TEC

TEST EQUIPMENT USED

ITEM	TEC #
DMM	7906
DMM	7908
O'Scope	8014

<u>Question d</u>: Define the pass/fail acceptance criteria for each type of device.

<u>Response</u>: Pertinent pass/fail data are attached.

During this review of TEC's data, a question arose Their isolation resistance acceptance criteria is listed as greater than 5 x 10^{10} ohms. Generally, they measured 4 of these devices in parallel with a worst case of 2 Kv/0.65 ua = 3.07 x 10^{9} ohms. Multiplying this by 4 for an assumed evenly distributed average still does not meet their acceptance criteria. In fact, no data checked meets the criteria.

Upon contacting TEC by telephone, GPU Nuclear was informed that the current involved was in nanoamperes and not the microamperes indicated. The problem was a typrographical error; pending confirmation of this information, in writing, from TEC this question should be considered open.

4.0 MINIMUM ACCEPTANCE CRITERIA

The acceptance criteria for each tested model is shown below:

MODEL	ACCEPTANCE CRITERIA	NOTES
155	2 & 3	
⇨ 156	⇨ 1 & 3	
157	4	
⇨ 158	⇨ 4	
701	1 & 3	
704	1 & 3	
715	2 & 3	
717	2 & 3	
718	2 & 3	
TI100	5	
DE210	2 & 3	

1. No loss of function or ability to function properly before, during, or after test.
2. No loss of function after test.
3. No structural or electrical failure.
4. No structural or electrical failure which would compromise component integrity.
5. Enclosure remains intact.

5.0 DESCRIPTION OF EQUIPMENT MOUNTING

The Model 158 Isolation Cabinet will be mounted as shown in Figure 2. The Model 157 Train Enclosure will be mounted as shown in drawing 158C1006, except for train A3. Train A3 will be replaced with three racks of equipment. The first rack (highest) will contain the Model 1201 Area Monitor readout equipment. The second rack will contain the Model 1204 High Range Noble Gas Monitor readout equipment. The third rack will contain the TIGRAPH recorder. Train A1 will contain four Model 156 Isolators, full terminal block, and wiring. One Model 1501 display will be mounted in train A2 and one Model 1501-S panel will be mounted in train A5. The Model 155, 701, 717 will be bolted on the outside of the isolator cabinet 48" from the bottom. This equipment was not tested.

TEC(d)2

TEC Technology for Energy Corporation	TITLE MODEL 156 ANALOG ISOLATORS	NO. 156-OP-03 REV. 1

Input Voltage (volts) -B	-C	Output Current (mA) Min.	Actual	Max.
0.000	0.000	3.992	______ (4)	4.008
0.500	1.000	5.589	______ (5.6)	5.611
1.000	2.000	7.186	______ (7.2)	7.214
1.500	3.000	8.782	______ (8.8)	8.818
2.000	4.000	10.379	______ (10.4)	10.421
2.500	5.000	11.976	______ (12)	12.024
3.000	6.000	13.573	______ (13.6)	13.627
3.500	7.000	15.170	______ (15.2)	15.230
4.000	8.000	16.766	______ (16.8)	16.834
4.500	9.000	18.363	______ (18.4)	18.437
5.000	10.000	19.960	______ (20)	20.040

Isolation (8h)

Common Mode Current: ______________

Isolation Resistance: ______________ ($>5 \times 10^{10}\,\Omega$)

Technician: ______________

Approved: ______________

Date: ______________

OPERATIONAL TEST (FINAL) (Ref. Section 8.2)

Input Resistance (8a): ______ (9.5 MΩ - 10.5MΩ)

OFFSET and GAIN calibration (8b): __________ (write ok if unit calibrates)

Transfer Characteristics (8c):

-A

Input Voltage (volts)	Output Current (mA) Min.	Actual	Max.
1.000	3.992	______ (4)	4.008
1.500	5.988	______ (6)	6.012
2.000	7.984	______ (8)	8.016
2.500	9.980	______ (10)	10.020
3.000	11.976	______ (12)	12.024
3.500	13.972	______ (14)	14.028
4.000	15.968	______ (16)	16.032
4.500	17.964	______ (18)	18.036
5.000	19.960	______ (20)	20.040

RIS(d),

E14400
Class IE Isolator Module Test Procedure

[illegible]: This device may be used in Safety Related Nuclear Applications and complete testing must be performed and recorded.

Prior to testing, visually inspect module and record model type, S/N, and input voltage requirements of the module. CAUTION: Improper input voltage and/or loading can damage the module.

Test equipment required (or equivalent)

a. Rochester Instrument Systems Test Set TMM34.
b. Digital Voltmeter.
c. Hi-Pot Test Set.

Hi-Pot Test

Insert the module in the hi-pot position. The hi-pot connector has all pins wired together and the two input terminals at the end of the module are wired together.
Attach the Hi-Pot Terminal block to the module.

Apply 4000 VAC RMS between input and output with a 1 ma trip point.
Verify and record successful testing of the module.

No TRIP = Acceptable

Functional Test

Prior to installing the module in the test position, select the required field contact voltage with Input V SW of the test set per the suffix table below:

Suffix	Field Contact Voltage
-X	24 VDC
-J	48 VDC
-D	125 VDC
-S	117 VAC (Note 1)

REVISIONS	
DCO AN-1100-666 RPM 7/1/79	RPM
DCO AN-1100-633 5-4-79	
DCO AN-1100-620 3-24-79	
DESCRIPTION	CHK.

ROCHESTER INSTRUMENT SYSTEMS
255 NORTH UNION STREET, ROCHESTER, NEW YORK 14605

E14400
Class IE Isolator Module Test Procedure

DRAWN	CHECKED		REV
		A-1032-814	C
APPR.		SHEET 1 OF 2	

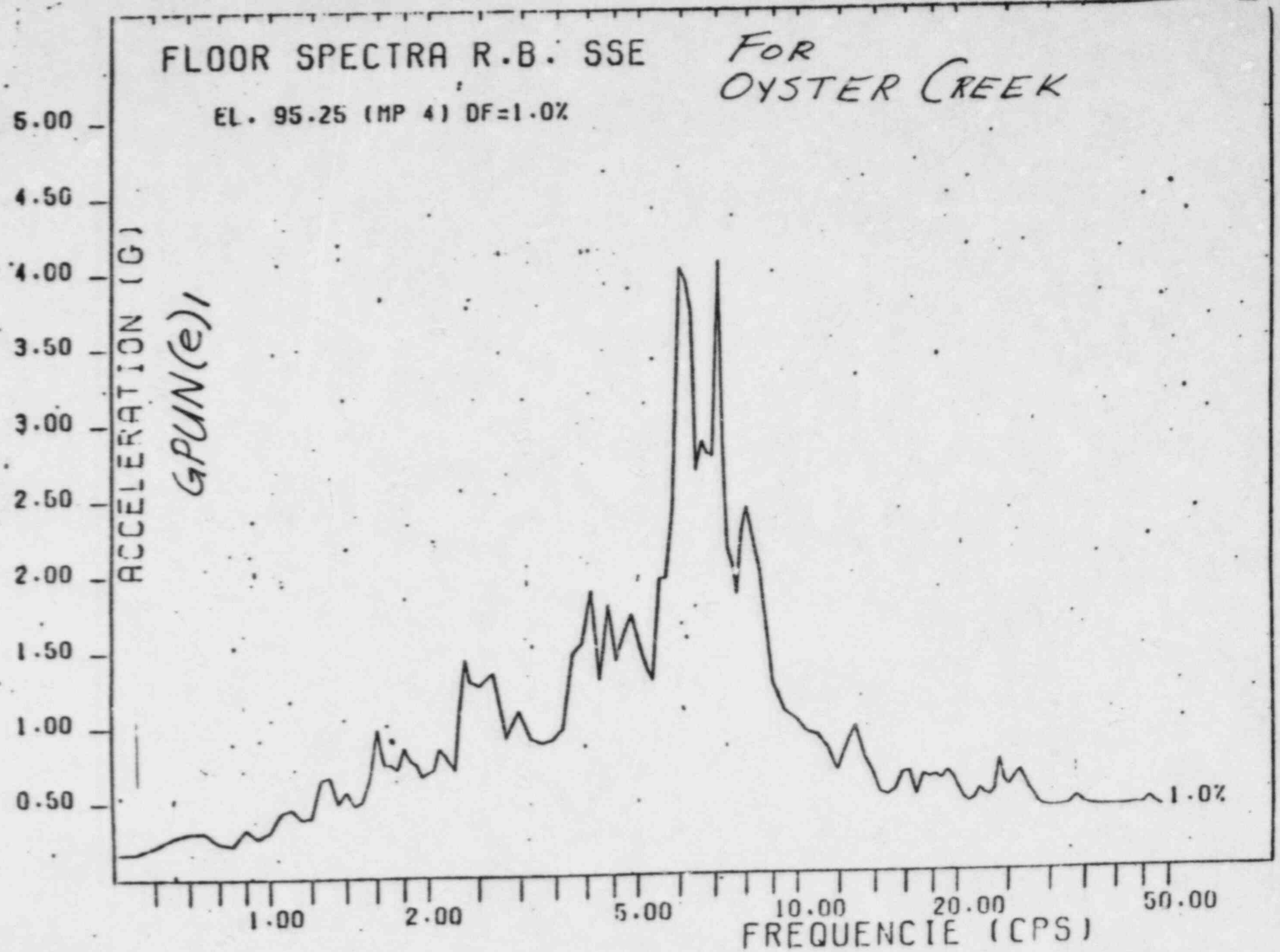
-406 9/77

Question e: Provide a commitment that the isolation devices comply with the environmental qualifications (10CFR50.49) and with the seismic qualifications which were the basis for plant licensing.

Response: Although the Isolators used were qualified for Harsh Environments, they are to be used in a mild environment, negating the need to review the environmental testing.

The attached Seismic Envelope for RIS and TEC, easily exceed the Oyster Creek floor spectra enclosed, which is for 95 ft. elevation, which is worse than the actual elevation used.

Attachment I
Procurement Spec 7192



Output No. 95:? vol I
01/25/78

RIS(e)

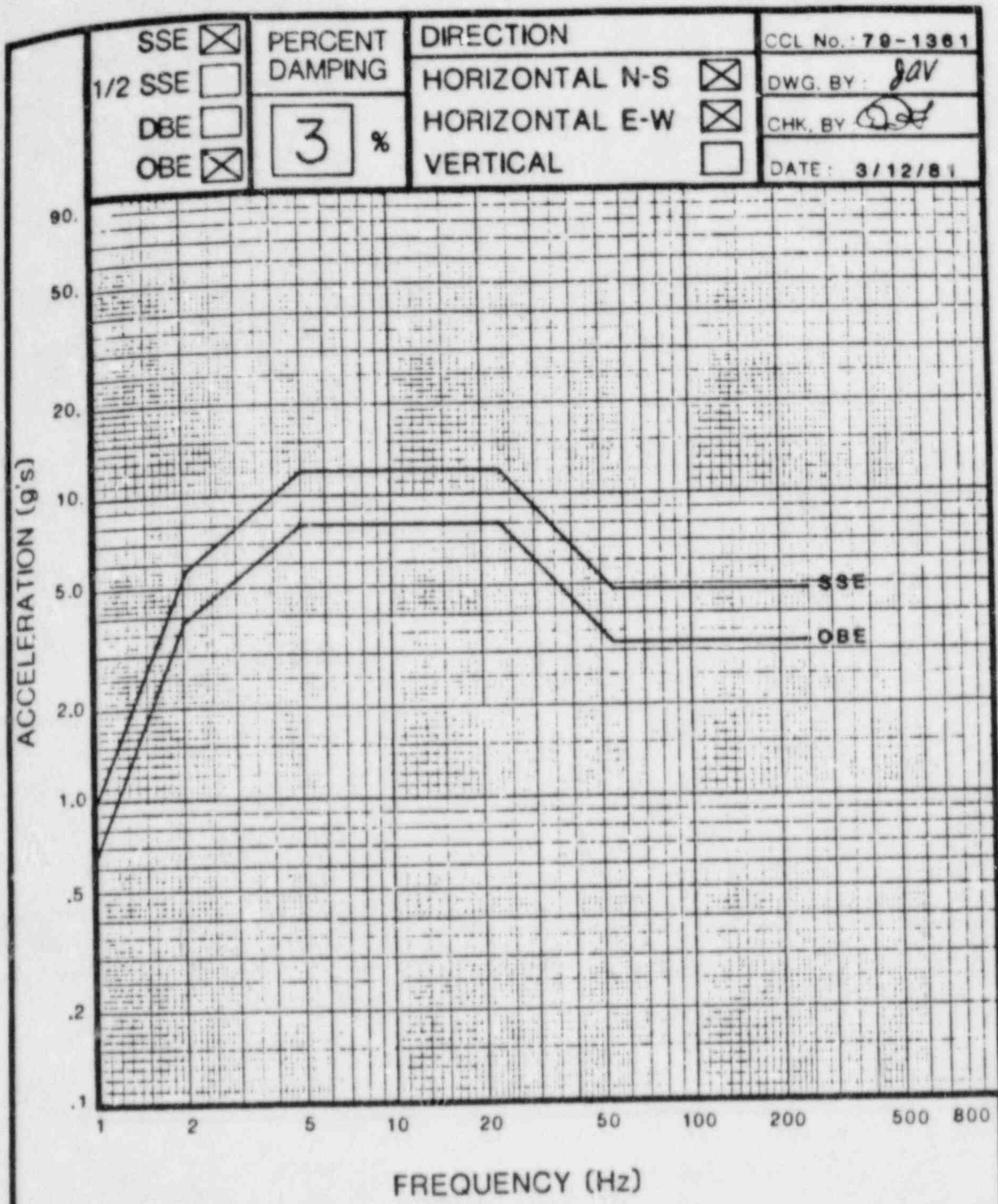


Figure 3.1 Horizontal Earthquake Required Response Spectrum

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RIS(e)2

SSE ☒	PERCENT DAMPING	DIRECTION	CCL No. 79-1361
1/2 SSE ☐		HORIZONTAL N-S ☐	DWG. BY: JAV
DBE ☐	3 %	HORIZONTAL E-W ☐	CHK. BY: [signature]
OBE ☒		VERTICAL ☒	DATE: 3/12/81

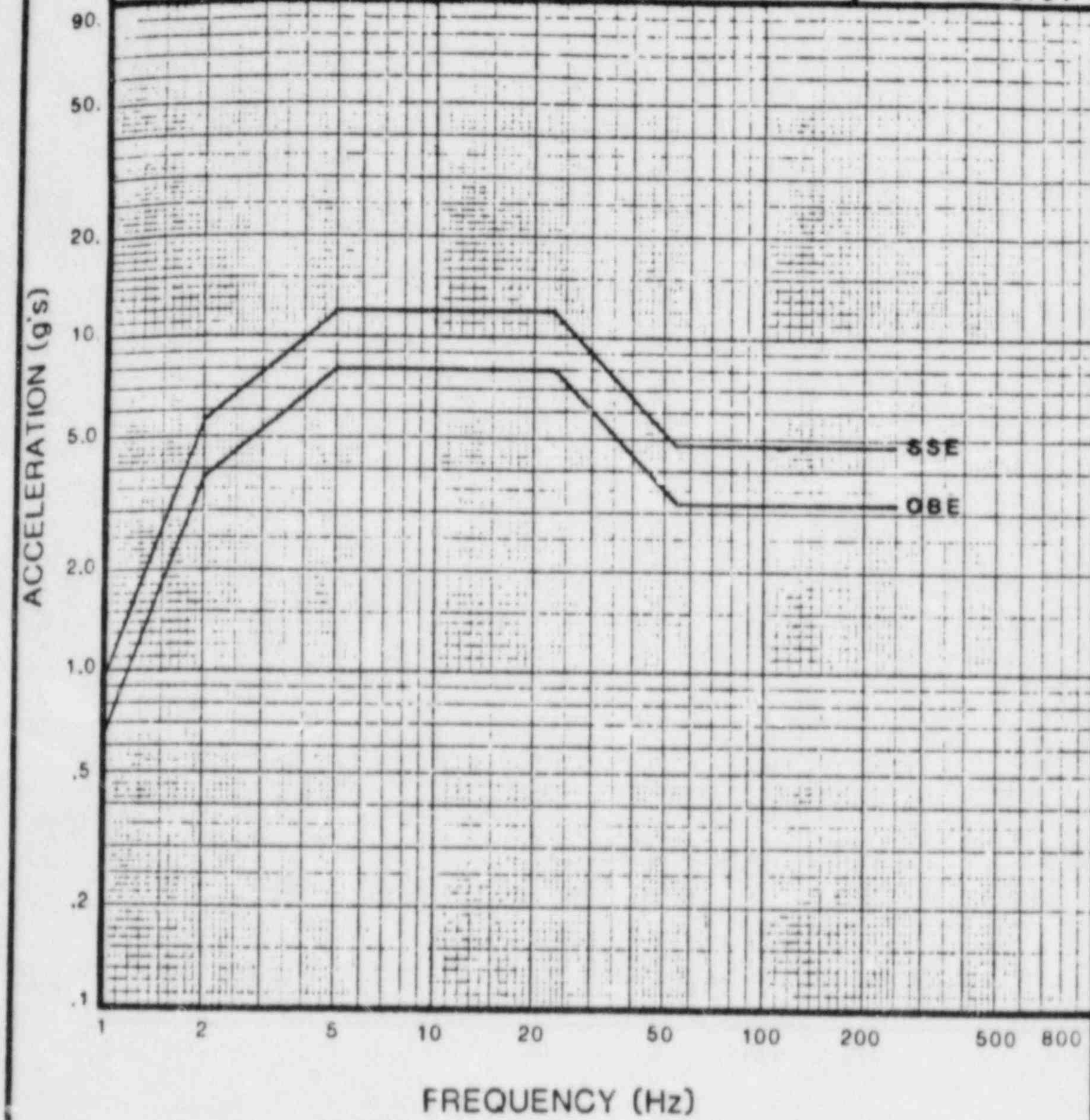

Figure 3.2 Vertical Earthquake Required Response Spectrum

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TEC(e)1

Safe Shutdown Earthquake (SSE)
Horizontal Acceleration
Vertical Acceleration is 2/3
of Horizontal Acceleration
Operating Basis Earthquake = 1/2 SSE

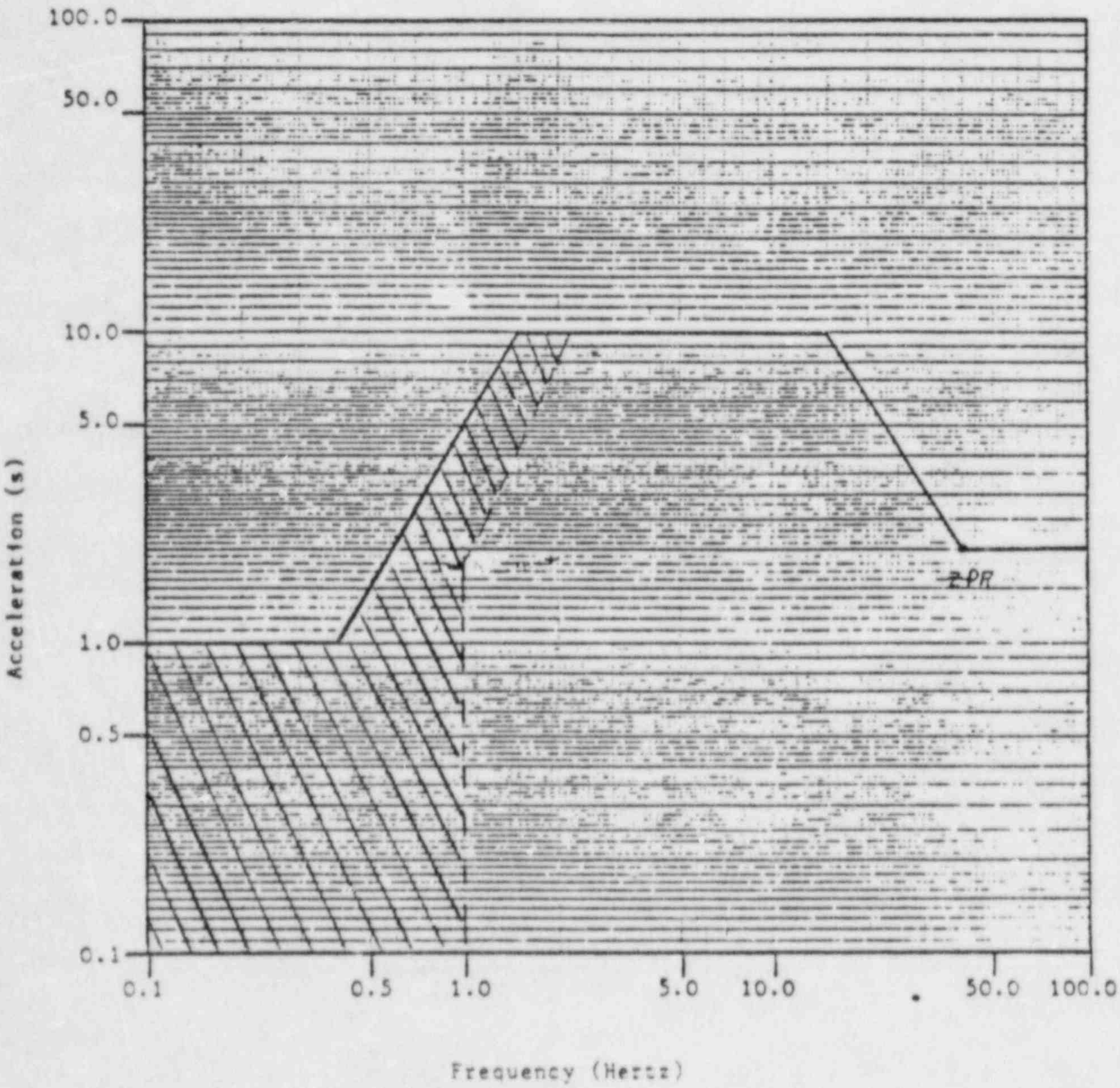

Figure 1. Required Response Spectra (RRS) for 2% of Critical Damping

TABLE LIMIT

Question f: Provide a description of the measures taken to protect the safety systems from electrical interference (i.e., Electrostatic Coupling, EMI, Common Mode and Crosstalk) that may be generated by the SPDS.

Response: Analog cables consist of individually shielded twisted pairs in all external cable runs to attenuate Electrostatic and magnetic effects.

Digital cables employ twisted pairs, and cables have an overall shield.

Shielding techniques have been employed that should eliminate any tendency for ground loops.

The isolator input impedance is usually high compared to the class 1E source impedance, and this will tend to attenuate noise leakage.

Common mode rejection resulting from the primary isolation mechanism helps keep noise propagation from the non-1E side under control.

The digital signals are inherently more noise immune because of the lower impedances and higher voltages involved.

For the Analog isolators, radio frequency immunity tests were run. Initially they were run under TEC 156-QP-04 which addressed EMI and Surge Withstand tests. We have not reviewed these tests, but assume they are the basis for the 1 volt per meter recommendations, made by the vendor (TEC see Table 4-1 of Test Report).

Additional EMI tests were since run by TEC under their Program shown in Appendix E to 30152-TR-02. These tests demonstrated 10 v/meter EMI resistance; however, the configuration was not identical to ours. It does lend credence to the initial 1 volt per meter figures however.

HUMAN FACTORS--

Question: Provide a description of the display system, its human factored design, and the methods used and results from a human factors program to ensure that the displayed information can be readily perceived and comprehended so as not to mislead the operator.

Response: Description

The Safety Parameter Display System (SPDS) is an aid to the control room personnel in determining overall plant safety status during power operation and post trip along with identifying abnormal conditions. Since the SPDS provides an overview of the plant safety status, the primary users have been identified to be the Shift Supervisor and Shift Technical Advisor. The SPDS allows the user to obtain a minimum set of important parameters at one location. These parameters are organized into five (5) Critical Safety Functions and displayed to allow for easy and unambiguous interpretation of the information.

The user will interact with the SPDS by means of the Plant Process Computer System. The computer alarm processor will be used to alert the user of an abnormal condition identified by the SPDS logic. The user will respond to SPDS alarms using the same human communication system and methods as all other process computer alarms.

The SPDS interface will consist of ten additional points added to the alarm database. These ten points will consist of 5 priority 2 alarms and 5 priority 1 alarms. Thus each critical safety function will have a priority 1 and priority 2 alarm associated with it. The priority 2 alarm is meant to be a warning condition while the priority 1 alarm will alert the user to a more severe condition.

Once the user receives an alarm from the plant computer alarm processor he/she should go the specific SPDS display for the critical safety function in alarm. On the display the numerically displayed parameter(s) which are in alarm will be displayed in reverse video yellow for priority 2 alarms and reverse video red for priority 1 alarms. Graphically displayed parameters will be identified as being in alarm by the parameter plot crossing over an alarm line on the graphical display.

The SPDS displays will use CRT hardware in the Oyster Creek control room. A push button on the CRT console will provide access to the SPDS displays. If a CSF is in alarm the menu will show the alarming CSF in reverse video yellow for priority 2 and reverse video red for priority 1 alarms. When the user selects a display from the menu, the computer will decide whether the power operation or post trip display will be placed on the CRT.

A hard copy of any display should be able to be obtained upon request by the user. If a CRT is displaying an SPDS display, this display shall not be automatically preempted by another non SPDS display. An SPDS display may be preempted by another SPDS display.

Methods and Results

A committee was formed to develop the SPDS displays. Team members who contributed to this design process consist of Human Factors Engineers, STA's, Design Engineers, Computer Applications and Shift Supervisors. A functional analysis, following the general guidance of NUREG 0700, was performed and used for parameter selection and generation of displays. Only the strict need of the user was considered in adding data to the display.

Preliminary displays were created and provided the foundation for the development of the final displays. NUREG 0700 guidance was followed while developing the preliminary displays. The user's needs were evaluated with an initial survey and walkthrough. Final display criteria will be generated after multiple walkthroughs have been performed by Human Factors Engineers with designated users.

During the course of this program, more than one display may be presented incorporating the same information. In each case, the display will be consistent with NUREG 0700 guidelines. This will allow for a number of different ideas to be presented and evaluated.

A more detailed survey will be conducted using a set of displays. Results of this survey will be evaluated and translated to modify the displays. Walkthroughs will then be scheduled including all team members.

All the control room users will be trained on the philosophy and use of the SPDS. The training will allow the user to utilize the SPDS in determining whether the plant is responding in a normal or abnormal manner. It will also allow the user to interpret the adequacy of the actions taken by the operators. The training department will comment on the displays based on these criteria.

All walkthrough comments and survey results will be used by the display committee to finalize the displays. Display criteria will be generated and the final displays placed on the CRT for review. A final walkthrough will be performed once the displays are coded. This walkthrough will use transient data to show the response of SPDS to different situations.

Results of the Human Factors Program will be to consolidate the number of displays. The use of consistent formatting with regard to location of information, use of color, identifying labels and standardization of method of presentation of data will be effected. The principles of the checklist, Process Computers 6.7, NUREG 0700, were followed and principles of grouping, ordering and usability were adhered to. Structuring and organization of the displays is logical and consistent with its intended use.

DATA VALIDATION--

Question: Describe the method used to validate data displayed in the SPDS.

Response: The Data Acquisition System (DAS) will perform validity limit checking by comparing the newly acquired signal to a minimum and a maximum limit. If the signal exceeds one of the limits, the point quality is changed from GOOD to UNRELIABLE.

Where redundant sensors are available for SPDS parameters, a validity check will be performed by comparing the signals of the redundant sensors.

Question: Describe how invalid data is defined to the operator.

Response: Quality tags are used by the DAS to indicate the quality of all displayed values. The following tags are used:

Blank	=	GOOD (Sensor is reliable and on scan).
U	=	UNRELIABLE (Sensor exceeded a validity limit).
E	=	ENTERED (Manually substituted value).
D	=	DELETED (Sensor off scan).
F	=	FAILED (Scanning of sensor failed).

These tags (unless GOOD quality) are displayed in reverse video immediately following the engineering unit value.

Invalid data (other than GOOD quality) on X, Y plots will be indicated by displaying the last known value and the quality tag as described above. The plot trail will be displayed in a flashing color.

PARAMETER SELECTION--

Question: Provide a commitment to include SRMs as a parameter for monitoring events at low power or further justifications of why this parameter is unnecessary.

Response: The selection of reactivity monitoring instrumentation for the SPDS is considered consistent with the guidelines set forth in Supplement 1 of NUREG-0737. That is, the function of the Oyster

Creek SPDS is to aid the control room staff during abnormal and emergency conditions in determining the safety status of the plant in conjunction with Emergency Operating Procedures (EOPs). In considering this function, the modes of operation in which the SPDS would be utilized were power range operation and reactor trip. The startup mode was not considered and therefore, SRMs were not considered necessary.

UNREVIEWED SAFETY QUESTIONS--

Question: Provide conclusions regarding unreviewed safety questions and changes to technical specifications.

Response: At this time the design of the SPDS has not been finalized. Therefore, no conclusions can be firmly drawn. However, a current review of the SPDS has not uncovered any unreviewed safety questions. Also, there have not been any changes made to the Technical Specification or any pending due to the incorporation of the SPDS.