



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

Central Files

April 14, 1977

Docket No. 50-346

MEMORANDUM FOR: K. V. *Smith*, Chief, Reactor Technical Assistance Branch
Office of Inspection and Enforcement

THRU: *W. H. Fa* G. Fiorelli, Chief, Reactor Operations and Nuclear
Support Branch

FROM: R. C. Knop, Chief, Reactor Projects Section 1

SUBJECT: INSTRUMENT SYSTEM - BUILDING ELECTRICAL GROUND SEPARATION
DAVIS-BESSE UNIT 1 (F30285H1)

On February 22, 1977, Toledo Edison Company requested relief from NRR on completion of several tests to be completed prior to fuel load. Among these tests requested to be deferred was TP-401.11 "Instrument ground grid system test" which is a test that determines the isolation between the instrument ground grid system and the building ground system. The request stated that relief was requested from the test until Mode 2 (critical) because of difficulty being experienced with ground currents between the instrument and the station ground systems.

On April 8, 1977, NRR granted their relief request on the provision that sufficient measurements in their engineering evaluation be completed prior to fuel loading which would enable the licensee to conclude that there is sufficient isolation between the grounding systems to preclude any adverse effects on instrumentation or equipment that will be required to be operable as specified in the Technical Specifications for Mode 6 through Mode 3. They also requested that the licensee complete all testing and satisfy the acceptance criteria for the test prior to entering Mode 2.

During a site inspection by RIII on April 8, 1977, the inspector determined that after a substantial amount of trouble shooting by the licensee, an effective resistance separated the two systems of only 77 ohms versus the test acceptance criteria of 10 megohms, that was specified in the test.

The original acceptance criteria that had been used for the first writing of TP-401.11 was based on a Bechtel startup test specification SUS 99 dated December 1974, which required a "isolation of the building ground from the instrument ground by measuring the instrument ground to the building ground and getting a value of infinity. Toledo Edison's interpretation of infinity at that time was greater than 20 megohms.

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Later the test was revised to show a 10 megohm isolation between the two grounds. This value was based on an excerpt from an AEC standard RDT STD CI-1T "instrumentation and control equipment grounding and shielding practices" dated, 1973.

Another point to be made for this system is that during normal operation a bus-link is wired between the two ground systems. The value of this bus-link is less than .003 ohms. During several tests the licensee determined that up to 2 amperes of current was flowing through this link. Normal current ranges are from 3-300 millamps. Because of the potential problem of burning out sensitive measuring equipment to measure the resistance with the ground link removed, an alternate test was proposed on March 8, 1977, by Bechtel. An alternate method is shown on the attached diagram. First, the resistance of the 10 ohm resistor was checked as close as possible with the best equipment the licensee could obtain, then the resistor was placed in parallel with the ground link, and then, the ground link was removed. The licensee then measured the current and voltage. Knowing the three factors, an equivalent resistance was obtained of 77 ohms between the two systems.

The licensee has been devoting many manhours in attempting to isolate the two ground systems. Among the problems being experienced were such things as finding the grounds connected on both ends of nuclear instrumentation cables. Another problem experienced was that the Bailly instrumentation utilizes a center tap type transmitter core with the center tap being grounded. In some cases, the licensee has found the center tap ground connected to the instrument chassis which in turn, is connected to the building ground.

RIII proposes to accept the licensee's current conditions with the assumption that the licensee can demonstrate that the ground currents being experienced on the nuclear instrumentation will not cause any safety problems for Modes 6 through 3. The licensee is very pessimistic that the value of 10 megohms can ever be attained. It is requested that your office review this subject and determine the position of I&E relative to the safety significance of operation of a ground grid with a separation of less than 10 megohms.

If there are any questions, please feel free to contact the author, T. N. Tambling, or T. L. Harpster.

RC Knop
R. C. Knop, Chief
Reactor Projects Section 1

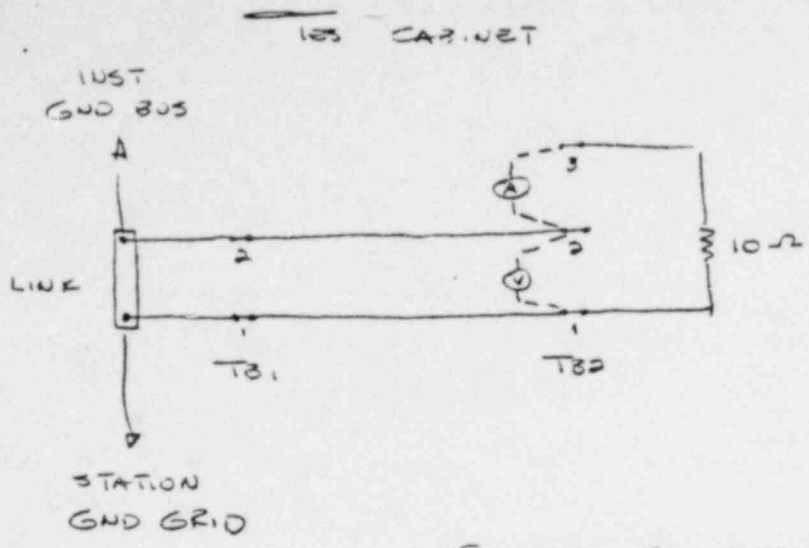
Attachment: Diagram

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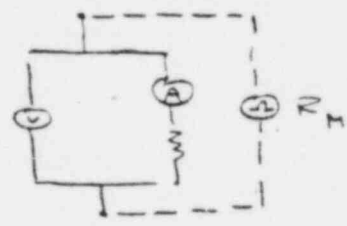
B. H. Grier, IE	D. Thompson, IE
H. D. Thornburg, IE	J. G. Keppler, Director
G. W. Roy, IE	T. N. Tambling
G. C. Gower, IE	T. L. Harpster

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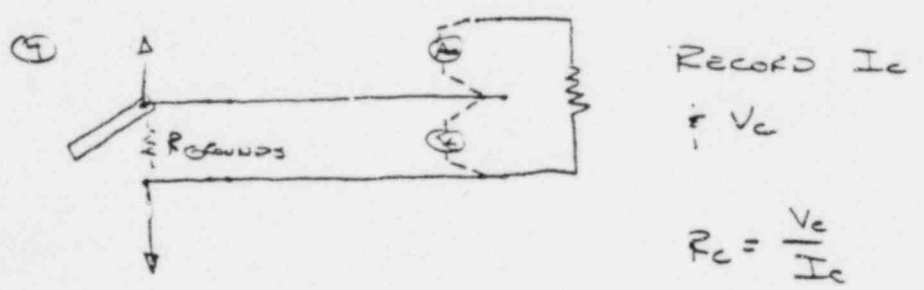
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- ① WITH CONNECTION TB1-2 TB2-2 OPEN
 MEASURE RESISTANCE OF 10Ω & A IN
 SERIES (TB2-1 TB2-2) & V IN PARALLEL



- ② RECONNECT TB1-2 TB2-2
 ③ DISCONNECT REMOVABLE LINE



⑤ $R_{MP} = \frac{R_M \times 100K}{R_M + 100K}$ (ASSUMES $R_{GROUNDS} > 100K$)

⑥ IF $R_c \geq R_{MP} \rightarrow R_{GROUNDS} \geq 100K$

$$R_M = 9.671$$

$$I_C = .0033$$

$$V_C = .0282$$

$$R_C = \frac{V_C}{I_C} = \frac{.0282}{.0033} = 8.545 \Omega$$

$$R_C < R_M \rightarrow R_{\text{GROUNDS}} < 100 K$$

AND IN FACT

$$\frac{R_{\text{GROUNDS}} \times R_M}{R_{\text{GROUNDS}} + R_M} = R_C \quad \text{OR REWRITTEN}$$

$$R_{\text{GROUNDS}} = \frac{R_M}{\frac{R_M}{R_C} - 1} = \frac{9.671}{\frac{9.671}{8.545} - 1}$$

$$R_{\text{GROUNDS}} = 77.39$$

THIS WAS REPEATABLE OVER 45 MINUTE
 MEASUREMENT INTERVAL. MAX I_C VARIATION
 $.0032 - .0034$

CHRONOLOGY OF ACCEPTANCE CRITERIA

ORIGINAL ACCEPT CRIT 20 M Ω THIS CAME FROM
FIRST WRITING OF TP 401.11 . THE ACCEPTANCE
TEST SPEC SUS 99 (BECHTEL FOR TECO 12/74)
HAD 2 ACCEPT CRIT. (1) STAT GND TO INST
GND CONNECTION $< 0.003 \Omega$ (2) ISOLATION OF
BUSES BY MEASURING CABLE TO GND ∞ . TECO
INTERPRETATION OF ∞ WAS $\geq 20 M\Omega$ PER
FIRST PROCEDURE 401.11 REV 0.

10 M Ω THIS WAS BASED ON EXCERPT FROM

AEC / (W) HANFORD RDT STD C1-1T

"INSTRUMENTATION & CONTROL EQUIPMENT

GROUNDING & SHIELDING PRACTICES" SEC 4.3.3

JAN 73

100K LETTER 3/8/77 BECHTEL TO TECO. RECOMMENDS

ALTERNATE METHOD, HOWEVER 10M Ω WAS STILL

RECOMMENDED IF 500 pA REQD FOR OHMMETER

PROTECTION COULD BE MET.

THESE SPECS WERE WITH THE INSTRUMENT GND CABLES

CONNECTED TO THE FOLLOWING SYSTEMS.

- A. MISC. ELECTRONIC INSTRUMENTATION
- B. COMPUTER
- C. NI & Rx PROT SYS
- D. SWITCHYARD CONTROL CONSOLE
- E. RADIATION MONITORING ACTUATION SYS
- F. SAFETY FEATURES
- G. INTEGRATED CONTROL SYS
- H. NON NUCLEAR INSTRUMENTATION SYS