

DOCKET NO. 70-36

**MALLINCKRODT
NUCLEAR
CORPORATION**

SAINT LOUIS 7, MISSOURI • U.S.A. • CENTRAL 1-8980
EXTRA

July 24, 1959

HEB Project File

Mr. Lyall Johnson
Chief, Licensing Branch
Division of Licensing & Regulation
U. S. Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Johnson:

Reference is made to your letter of June 26, 1959, 70-36, LRL:GPM, requesting further information on the nuclear alarm system at Fenatite. For background information concerning detailed design of the system and its components, reference to our letter of January 22, 1959, and enclosures may be helpful.

Your first question concerns the response times of the system for various radiation levels. We have five radiation detectors located at different parts of the plant. They are wired in parallel with each other, and each is set to sound an alarm throughout the plant should radiation rise to above ten milliroentgens per hour.

set at 10 mrad/h

The detector actually does not keep up with an almost instantaneous rise in radiation, but lags to the extent that only 63% of a sudden change is read two seconds after the change has occurred. Thus, if the change is to a point only slightly above 10 mr/hour the detector will probably not set off an alarm until some three or even four seconds after the change has occurred. On the other hand, should the change be to the region of, let us say, 1000 mr/hour the detector will trip in a very small fraction of a second after the advent of the radiation. This means that the response is practically instantaneous in the case of any severe outburst of radiation, although it is slightly delayed in the minimum cases.

2 sec. time constant

Your second interest is in the fail-safe features of the alarm system. Our instruments are so constructed that while some electrical failures will cause the general alarm to sound, others will merely actuate signal lights. In this way, supported by our own close routine inspection of the system, we hope to avoid false alarms and the confusion and anxiety they would cause, while still being immediately aware of any irregularity in the system.

OK

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The instruments are set to operate normally at a very low range of gamma radiation, most of which is provided by a tiny radiation source within each instrument case. A high level electrical contact is actuated if the range being measured by any one of the detectors rises to 10 mr/hour, and a low level contact is actuated if the range falls to the neighborhood of approximately 0.2 mr/hour. If the high level contact is actuated the alarm sounds for evacuation of the work area and office. If the low level contact is actuated a light on the main panel of the alarm system comes on, indicating which detector sent in the signal. In addition, an amber light shows in the panel of the detector itself.

Attached is a copy of "Component Failure Study for Nuclear Measurements Corporation Model GA-2 Gamma Alarm". While you will not be interested in each individual condition considered, the study as a whole indicates the overall high safety of our equipment. In the case of about half of the possible failures listed only the low level light will come on. In many of the other cases, the alarm will sound. Thus, only the most unusual circumstance could render our equipment inoperative without our being immediately aware that something is wrong. The circuit diagram which accompanies the study is up-to-date. It differs in a few minor details from Drawing C-196 sent you on January 22, which is now supplanted.

To minimize failures, the vacuum tubes will be replaced every six months on a preventative maintenance basis. The third tube, the photomultiplier, is too expensive to replace at this frequency, but, as explained above, should this tube become inactive the low contact signal light will come on, which will alert us to look for the trouble and change the tube.

The system is tested weekly by the application of a gamma source to one of the detector units. The five units are tested in this way in rotation; thus, the entire system is checked in actual practice ten times per year.

A practice drill for each work shift is planned to familiarize all personnel with the procedure to be followed in the event of an alarm. Thereafter it is not expected that practice drills will be required more often than every six months, and perhaps on an annual basis, depending on circumstances. Drills will be held on an annual basis at least.

Test 5-weekly
Practical drill every 6 months
1 yr

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We will be glad to furnish any further information which you may need for your evaluation of our proposed procedures.

Very truly yours,



Frank Zeitlin
Assistant Vice President

FZ/lo

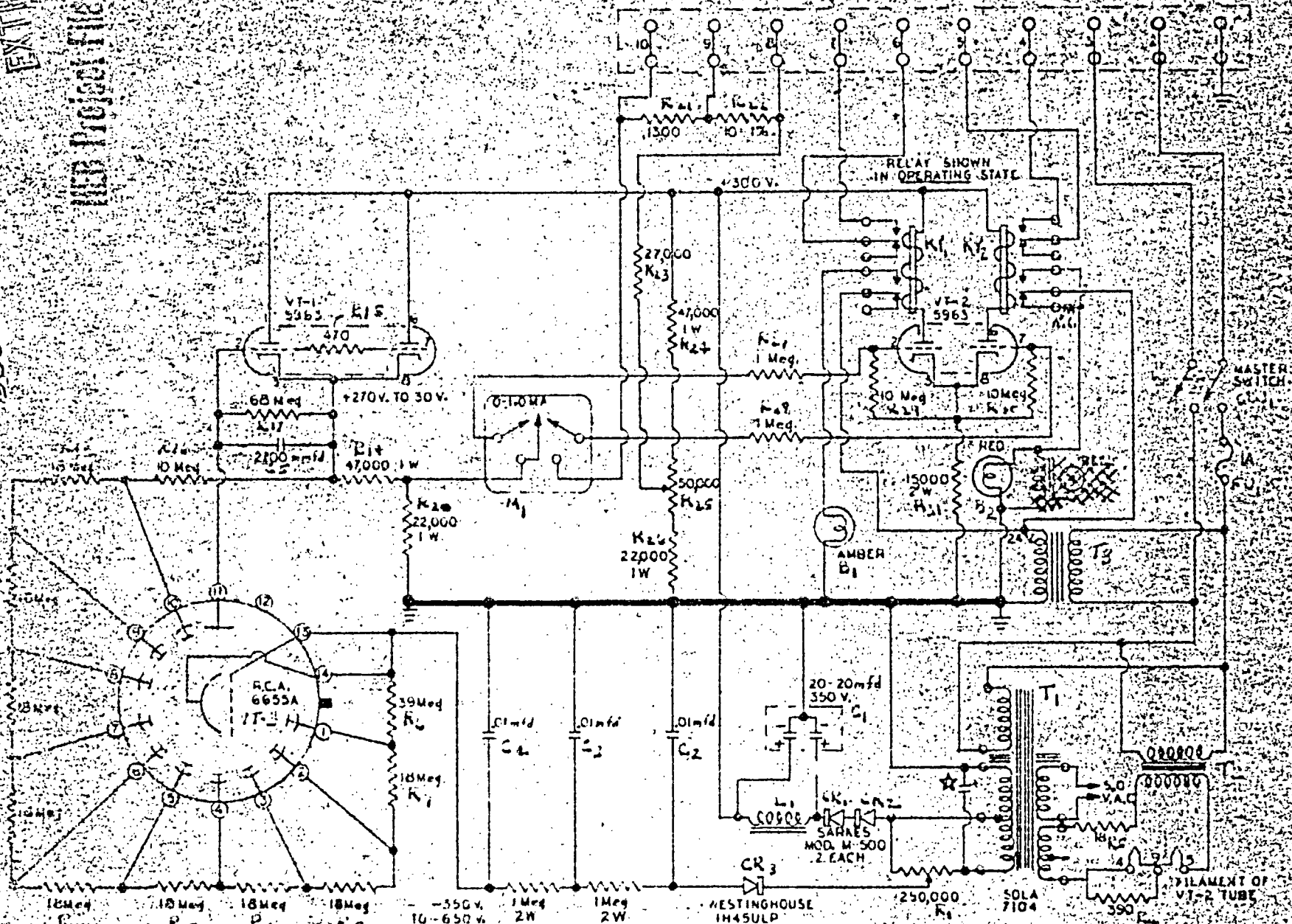
in quadruplicate

Enclosures 8

DRAWING NO. 20-36

EXTRA

REVISIONS



NOTE:
 CONDENSER MATCHES TRANSFORMER

NUCLEAR MEASUREMENTS CORP. 3845 N. UNIVERSITY INDIANAPOLIS, INDIANA	
CIRCUIT GA-2	
DATE: 7-20-53	DRAWN: C-20

COMPONENT FAILURE STUDY FOR
NUCLEAR MEASUREMENTS CORPORATION
MODEL GA-2 GAMMA ALARM

SECTION	COMPONENT	ESTIMATED RELIABILITY	PROBABLE TYPE OF FAILURE	ALARM RESULTS (See Note)
POWER SUPPLY	SW ₁	Excellent	Open	(6)
	FU ₁	Excellent	Open	(6)
	T ₁	Good	Open - Short	(1) or (3)
	T ₂	Excellent	Open - Short	(3)
	T ₃	Excellent	Open - Short	(6)
	R ₁	Good	Open	(1) or (2)
	R ₂	Excellent	Open	(1)
	R ₃	Excellent	Open	(1)
	R ₄	Excellent	Open	(1)
	R ₅	Excellent	Open	(3)
	C ₁	Fair	Short	(3)
	C ₂	Good	Short	(1)
	C ₃	Good	Short	(1)
	C ₄	Good	Short	(1)
	L ₁	Excellent	Open-Ground Short	(3)
	CR ₁ , CR ₂	Excellent	Short	(3)
CR ₃	Good	Short	(1)	
SCINTILLATION COUNTER AND VACUUM TUBE VOLTMETER	R ₆ thru R ₁₆	Excellent	Open	(1)
	R ₁₇	Excellent	Open	(2)
	C ₅	Excellent	Short	(1)
	R ₁₈	Excellent	Open	(1)
	R ₁₉	Excellent	Open	(1)
	R ₂₀	Excellent	Open	(4) or (2)
	VT-3	Fair	Reduced Emission	(1)
	VT-1	Fair	Reduced Emission	(2)
CURRENT AMPLIFIER	M ₁	Good	Contacts-Open-Short	Open-(4) Short-Either (1) or (2)
	R ₂₁ thru R ₂₃	Excellent	Coil-Open	(1)
	R ₂₄	Excellent	Open	(1)
	R ₂₅	Good	Open	(1)
	R ₂₆	Good	Open	(1) or (2)
	R ₂₇	Excellent	Open	(2)
	R ₂₈	Excellent	Open	(2)
	R ₂₉	Excellent	Open	(5)
	R ₃₀	Excellent	Open	(5)
	R ₃₁	Excellent	Open	(3)
	RY ₁	Good	Coil-Open	(1)
	RY ₂	Good	Contacts-Open	(4)
			Coil-Open	(2)
			Contacts-Open	(4)
	B ₁	Good	Open	(7)
	B ₂	Good	Open	(8)
VT-2	Fair	Reduced Emission	(3)	

DOUGLASS W. W. 20-36
EXTRA

NOTES -

Alarm Functions

- (1) Amber Lamp, B₁, "ON"
- (2) Red Lamp, B₂, and External Horn, "ON"
- (3) Both (1) and (2), "ON"
- (4) No Alarm
- (5) VT₂ would remain cutoff after system was cleared. (No grid leak)
- (6) External Horn Only
- (7) No alarm on low emission
- (8) External horn only on high gamma level

DUCKET NO. 20-3