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ABCD-4088

TEST REPORT

GENERAL ELECTRIC COMPANY - HAMFORD WORKS

REACTOR DIVISION

Photostat Price \$ 3.30
Microfilm Price \$ 2.40
Available from the
Office of Technical Services
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Test Project No.: 15

Title: EFFECT OF RADIATION ON TELEVISION EQUIPMENT

(FINAL REPORT)

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TEST PROJECT NO. 15

TITLE: EFFECT OF RADIATION ON TELEVISION EQUIPMENT

Summary

A wired image dissector television system, manufactured by the Diamond Power Specialties Corporation, was exposed to pile irradiation at the 105-F rear face. The "Utiliscope" camera unit was unaffected by the exposure, both on the basis of usual observations of the television equipment and as judged by photographic records of the monitor image.

Although relatively inexperienced with such equipment, the technical personnel who conducted the tests were capable of installing, adjusting, and operating the television system. Protection against contamination of the camera unit during these tests was accomplished by relatively simple methods.

Purpose of Test

To determine the effect upon image fidelity by exposing a television camera to high intensity radiation over an extended period.

These tests were initiated to investigate the feasibility of a wired television system to facilitate manipulation and alignment of a proposed new type of discharging equipment. Such equipment must be remotely controlled, since it would be required to function at the back face during normal pile operation.

The "Utiliscope" camera, manufactured by the Diamond Power Specialties Corporation of Detroit, was selected for these tests because of several desirable design features which are noted later in the report.

Apparatus

A. Electronic Equipment

The Utiliscope television assembly included three major components; the camera unit, the power pack (amplifier), and the viewer (cathode-ray monitor). The camera was separated from the power unit by approximately 50' of shielded lead and the power pack from the viewer by approximately 150' of lead. This equipment was of the Farnsworth image dissector type and was provided with a remote-control switch at the viewer for focussing the camera lens. The monitor unit and remote-focussing switch (small black box in foreground) are shown in Figure 1.

An image dissector system was used in preference to an image orthicon for reasons of simplicity of construction and less complicated adjustments. The chief disadvantage of the type used, compared with the orthicon, is its inferior depth of focus and the higher intensity of (object) illumination required.

B. Photographic Equipment

All photographic records of the television image were taken with a Speed Graphic focal-plane shutter type of camera which is to be seen in Figure 1. Eastman Panchromatic Super XX film pack was used throughout the tests.

C. Auxiliary Test Equipment

Several special pieces of apparatus were fabricated to facilitate these tests. One was a wooden platform with suitable reinforcements and braces to permit the television camera to be mounted in close proximity to the rear face nozzle caps. This necessitated suspending the platform above the storage basin, as is shown diagrammatically in Figure 2.

It was necessary to construct a sealed wooden box to protect the television camera from possible radioactive contamination. This box was provided with a plate glass window adjacent to the camera lens. A lighting unit was attached which was made up of a steel framework supporting six sealed-beam lamps. Various arrangements of 300 watt spotlights and floodlights were used in this assembly.

Test Method and Procedure

Tests were conducted in two phases; exposure of the camera to "hot" slugs and rear-face radiation during a normal discharge operation, and exposure to rear-face radiation during normal pile operation between standard shut-downs. All tests were performed at the 105-F Building during portions of July and August, 1949. The execution of this investigation would not have been possible without the very excellent assistance and cooperation of "P" Division and "HI" personnel at 100-F, and without the interest, expediting and "know-how" of the Maintenance Division and Electrical Division shops and their supervision.

For both phases of testing the television camera was mounted at the level of the 20' balcony in the 105-F rear face. The 50' of power leads between camera and power pack permitted the latter unit to be located away from high intensity radiation and out of the range of probable contamination from the discharge operation. The monitor (viewing) unit was set up in the "Y" level sampling room where observations could be made at any time during the operating cycle of the pile. The power pack unit was placed in the space between the locked doors at the far side of the balcony.

Details concerning the sequence of activities and observations are given below, as divided into the two phases of the test.

Phase I

The television camera was set up on the 20' balcony, approximately as shown in Figure 2. This position was adjacent to one of the process tubes that was discharged (Tube 2492). A few preliminary

Phase I (Continued)

pictures were taken of the monitor image in an effort to adjust lighting intensity and distribution at the object.

Continual observation was made of the screen during the discharge operation and photographic records were taken at frequent intervals. Several tubes at a higher level were pushed first. During the discharge of one of these, a slug became stuck. During the time efforts were being made to free this tube, a hot process slug remained on the discharge tip-off for approximately two hours. The distance between this slug and the television camera was approximately 18 feet. The actual pushing operation for the tube upon which the apparatus was focussed lasted approximately 15 minutes. The slugs were pushed slowly to permit observations and photographs to be taken during the operation.

Phase II

At the conclusion of the discharge the television camera was moved to the platform, as shown in Figure 2, in which location it was left for the entire period of normal operation between shutdowns from July 28 until August 8.

Photographic records were taken at frequent intervals during start-up, approximately 5 to 10 minutes apart. After the pile had reached normal power, pictures were taken first at semi-hourly intervals and then at hourly intervals until a total of 18 hours operation was attained. Subsequently, records were made daily of the image characteristics at the monitor. Throughout Phase 2, the camera was focussed on an artificial target which consisted of a painted metal disk, approximately 6" in diameter, upon which 1/16" wide black "crosshairs" appeared against a flat white background. The target disk was located in the plane of the nozzle caps and was attached to them by wires, approximately centered between 4 nozzles.

At the conclusion of Phase 2 (August 8, 1949, shut-down), the equipment was removed, carefully monitored for contamination, crated and re-shipped to the supplier.

Results and Discussion

For the entire duration of these tests with the television camera unit, exposed to radiation under the conditions outlined above, no deleterious effects either upon image characteristics or upon the television apparatus itself could be directly attributed to irradiation. The minor difficulties which arose were of the nature of routine adjustments and corrections which would have presented no problem to more experienced operators. In each case when aberrations of the image occurred, such as light and dark

Results and Discussion (Continued)

areas, "snow", or total disappearance of the image, it was found that the image could be corrected by such minor operations as repairing electrical connections which had been disturbed, adjusting gain or synchronizing controls, or by altering "brilliance" or "contrast" knobs. All of these adjustments were made at the monitor unit.

The general over-all performance of the apparatus was satisfactory in that the quality of the image (photographically recorded) was as good at the conclusion of the tests as at the beginning. Although there was much to be desired, over the duration of these tests, with regard to uniformity of illumination and clarity of the image background, still these characteristics did not alter. It is believed that more effective illumination of the object might have rectified these discrepancies.

To demonstrate the consistency of image characteristics over the duration of the tests, Figures 3 and 4 are shown. Figure 3 is a view of the target at the end of the discharging operation (July 27) and Figure 4 is a similar picture taken on August 8, immediately before the conclusion of the tests. These views spanned the period of normal pile operation during which the camera was exposed to an estimated total radiation dosage of 548 R. Figure 5 is an example of the photographs taken during the discharge operation. None of this series satisfactorily showed the actual slugs passing over the tip-off. However, the visual observation of the monitor screen was far more distinct than Figure 5 would indicate. The discharge was intentionally slowed to facilitate observation of slugs and to permit photographic records to be made. The television image was sufficiently clear to identify visually the various types of slugs as they passed the tip-off; solid dummies, perforated dummies, and active slugs.

At the conclusion of tests, all components of the television apparatus which could conceivably have been exposed to contamination were carefully monitored. The camera, which had been contained in a sealed wooden box, was found entirely clean. The same was true of the power pack unit. A short portion of the co-axial lead between the television camera and power pack was found to be dirty and was subsequently sacrificed. The bulk of the cabling and leads contained in the protective section of fire hose was clean and useable. All borrowed equipment was recreated and shipped to the vendor.

Conclusions

1. On the basis of visual observations and photographic records, the television apparatus was not affected by the irradiation to which it was exposed.
2. Problems of installation, adjustment, and operation of this wired-type image dissector system were within the abilities of Technical personnel who were relatively inexperienced with such equipment.

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Conclusions (continued)

3. Protection against contamination of the camera unit, power pack, power leads, and cables can be accomplished by relatively simple provisions for boxing and sheathing these components.

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B-III-6

WRAP LEAD-IN WIRE WITH PROTECTIVE COVERING TO PREVENT CONTAMINATION

HN 2-1630
3-21-50

DWG. NO.	TITLE
REFERENCE DRAWINGS	

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OFFICIAL USE ONLY

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Figure 3

Attached to
HPC 1630 C.3, C.4

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Figure 5

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Figure 5

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