

MIL-STD-202G

METHOD 209

RADIOGRAPHIC INSPECTION

1. **PURPOSE.** Radiographic inspection is generally a nondestructive (see 1.1) method for detecting internal physical defects in small component parts which are not otherwise visible. Radiographic techniques are intended to reveal such flaws as improper positioning of elements, voids in encapsulating or potting compounds, inhomogeneities in materials, presence of foreign materials, broken elements, etc.

1.1 Precautions. Radiographic inspection may be performed on most parts; however, radiation may cause changes in electrical behavior of some materials.

2. **APPARATUS AND MATERIALS.**

2.1 Radiographic equipment. The radiographic equipment used shall be capable of producing the required radiographic quality as specified in the individual specification. When using X-ray equipment, X-ray tubes with small effective focal-spot sizes and low inherent filtration are recommended.

2.2 Film holder. A lightproof film holder of low inherent filtration to radiation is recommended when using voltages of 50 kilovolts. A lead backing plate should be used behind the film holder to minimize fogging due to secondary back-scatter.

2.3 Image-quality indicator. The image-quality indicators used to indicate radiographic sensitivity shall be as specified in the individual specification. The sensitivity is the combined measure of the definition and contrast of the radiograph and should be such that the maximum allowable defect shall be shown. The image-quality indicator may be made from a sample part of the same type as the part being radiographed and should contain either an actual or simulated defect which is at least 10 percent smaller than the smallest defect to be detected.

2.4 Film. The film shall be compatible with the sensitivity required in 2.1. In general, finer detail is achieved by the use of finer grain films with lower exposure indexes. If extreme magnification techniques are required, the use of single emulsion films is recommended.

2.5 Nonfilm techniques. Nonfilm techniques may be used if required sensitivity levels, and records (when specified) can be obtained (see 2.1).

2.6 Personnel safety precautions. The safety precautions described in National Bureau of Standards (NBS) Handbook 76 - X-Ray Protection; NBS Handbook 73 - Protection Against Radiations From Sealed Gamma Sources; Atomic Energy Commission Book Title 10, Part 20 - Standard for Protection Against Radiation, Part 30 - Licensing of By-product Material, Part 31 - Radiation Safety Requirements for Radiographic Operations, shall be complied with when applicable.

3. **PROCEDURE.**

3.1 Positioning of specimen. The leaded film holder is backed up by the lead plate (see 2.2), and the specimen to be radiographed shall be placed in the position or positions specified in the individual specification.

3.2 Exposure parameters. The following exposure parameters may be varied to obtain the radiographic quality specified in 2.1:

- a. Source - film distance.
- b. Kilovoltage or type of isotope.
- c. Milliamperage or source strength of isotope.
- d. Exposure time.
- e. Film speed.
- f. Intensifying screen.

The detail sensitivity is affected by the following:

- a. Focal spot size.
- b. Film grain size.
- c. Nature of the specimen.
- d. Placement of the specimen.

The above factors should be taken into consideration when determining the exposure parameters.

3.3 Intensifying screens. In general, metallic intensifying screens should be used at X-ray tube voltages above 125 kilovolts to minimize fogging and for intensifying effects.

3.4 identification of radiographs. Suitable means shall be employed to identify individual specimens on the radiographic record.

3.5 Marking of radiographed specimens. If required, suitable marking shall be specified in the individual specification indicating that specimens have been inspected radiographically.

4. EVALUATIONS. The final image shall be examined with suitable viewing equipment, which may include magnification, to determine such defects as improper positioning of elements, voids in encapsulating or potting compounds; inhomogeneities in materials; presence of foreign materials; broken elements; and other defects as specified in the individual specification.

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5. SUMMARY. The following details are to be specified in the individual specification:
- a. Required radiographic quality (see 2.1 and 4).
  - b. Image-quality indicator to be used (see 2.3).
  - c. Records, if required for nonfilm techniques (see 2.5).
  - d. Position or positions of specimen (see 3.1).
  - e. Marking indicating that specimens have been radiographed, if required (see 3.5).
  - f. Evaluation of images (see 4).
    - (1) Specific kind of viewing equipment, if required.
    - (2) Magnification, if required.
    - (3) Defects to be sought in the specimen.