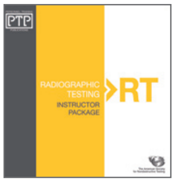

Radiographic Testing Lecture Guide
Second Edition

Errata – 2nd Printing 03/19

The following text correction pertains to the second edition of the *Radiographic Testing Lecture Guide*. Subsequent printings of the document will incorporate the corrections into the published text.

The attached corrected page applies to the second printing. In order to verify the print run of your book, refer to the copyright page. Ebooks are updated as corrections are found.

Page **Correction**

30 In Table 2, the incorrect value for the half-value layer for X-ray tube potential of 50 kVp is shown as 0.5 mm for lead. The correct value is 0.05 mm.

52 Question #29 should be revised as follows:

Calculate the geometric unsharpness given the following: Object thickness of 1 in. (25.4 mm), source-to-film distance of 14 in. (355.6 mm), and source effective size of 0.125 in. (3.175 mm).

a. 0.01 in. (0.25 mm)
b. 0.18 in. (4.57 mm)
c. 0.17 in. (4.32 mm)
d. 0.1 in. (2.54 mm)

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263 The answer to Question #16 should be "b" as follows:

Determine the minimum SFD given a focal spot size of 0.118 in. (3 mm), a distance from the source side of the object to the film of 3 in. (76 mm), and a maximum allowable unsharpness of 0.02 in. (0.5 mm).

a. 17.7 in. (450 mm)
b. 20.7 in. (526 mm)
c. 30.4 in. (772 mm)
d. 36.4 in. (925 mm)

Catalog #1654
Book printed 03/19
Errata created 01/20

Table 2: Approximate X-ray half-value layers.

Shielding material	Half-value layer for X-ray tube potential of:							
	50 kVp	70 kVp	100 kVp	125 kVp	150 kVp	200 kVp	250 kVp	300 kVp
Lead (mm)	0.05	0.15	0.24	0.27	0.29	0.48	0.9	1.4
Concrete (in.)	0.168	0.33	0.59	0.79	0.88	1	1.11	1.23

Table 3: Approximate gamma ray half- and tenth-value layers.

Shielding material in. (cm)	Radioisotope source					
	Co-60		Ir-192		Cs-137	
	1/10	1/2	1/10	1/2	1/10	1/2
Lead	1.62 (4.1)	0.49 (1.2)	0.64 (1.6)	0.19 (0.5)	0.84 (2.1)	0.25 (0.6)
Steel	2.9 (7.4)	0.87 (2.2)	2 (2.5)	0.61 (1.5)	2.25 (5.7)	0.68 (1.7)
Concrete	8.6 (21.8)	2.6 (6.6)	6.2 (15.6)	1.9 (4.8)	7.1 (18)	2.1 (5.3)
Aluminum	8.6 (21.8)	2.6 (6.6)	6.2 (15.7)	1.9 (4.8)	7.1 (18)	2.1 (5.3)

Exposure Area

1. Enclosed exposure areas should consist of a room with thick concrete walls, completely lined with lead or other suitable shielding material of sufficient thickness for protection, as necessary.
2. If the construction of such a room is not feasible, then the equipment should be housed in a suitably shielded cabinet large enough to also contain the test objects.
3. When radiography is practiced outside a designated shielded exposure area, the simplest, most effective safety consideration is distance. All personnel must be kept at a safe distance from the radiation source.

X-Ray Tube Shielding

1. In theory, the lead housing around an X-ray tube effectively shields, to safe levels, all primary radiation except the useful beam. Practically, this is not always the case.
2. The only way to ensure the safety of an X-ray tube is to measure leakage (unwanted) radiation. To limit the unwanted radiation, the area of primary radiation should be fixed by a cone or diaphragm at the tubehead.

Radiation Protective Construction

1. The most common materials used to protect against radiation are lead and concrete. Shielding measurements are usually expressed in terms of thickness. Particular care must be exercised to ensure leak-proof shielding.
2. The thickness of the lead shield depends on the energy of the radiation requiring shielding and the use (occupancy) of the surrounding areas.
3. Though lead is the most efficient of the readily available shielding materials, other structural materials such as concrete and brick are often used.

25. Discontinuity enlargement occurs:

a. when the discontinuity is closest to the film/imaging plate/detector.
b. when the discontinuity is farthest from the film/imaging plate/detector.
c. when the discontinuity is farthest from the radiation source.
d. never; enlargement doesn't occur in radiographic imaging.

26. Calculate the radiation intensity at 20 ft (6 m) using the inverse square law if the original distance was 10 ft (3 m) with an initial intensity of 50 mR/h (500 µSv/h).

a. 10 mR/h (100 µSv/h).
b. 15 mR/h (150 µSv/h).
c. 12.5 mR/h (125 µSv/h).
d. 14.5 mR/h (145 µSv/h).

27. With other variables unchanged, an increase in kilovoltage (kV) of an X-ray machine will generate:

a. high-intensity hard X-rays.
b. low-intensity hard X-rays.
c. same-intensity hard X-rays.
d. high-intensity soft X-rays.

28. Which of the following types of radiation is determined by the composition of the disturbed atom?

a. Continuous X-rays.
b. Characteristic X-rays.
c. Bremsstrahlung radiation.
d. Co-60 gamma radiation.

29. Calculate the geometric unsharpness given the following: Object thickness of 1 in. (25.4 mm), source-to-film distance of 14 in. (355.6 mm), and source effective size of 0.125 in. (3.175 mm).

a. 0.01 in. (0.25 mm)
b. 0.18 in. (4.57 mm)
c. 0.17 in. (4.32 mm)
d. 0.1 in. (2.54 mm)

30. The principle of geometric unsharpness is that:

a. all radiographic exposures have equal sharpness.
b. results may vary greatly due to various factors.
c. the farther the distance between the test object and the film, with the source in the same position, the greater the penumbral shadow.
d. the farther the distance between the test object and the film, with the source in the same position, the greater possibility of image distortion.

31. Optimum geometrical image sharpness in film radiography is obtained with a combination of a:

a. smaller source, greater distance between the source and the test object, and a shorter distance between the test object and the film.
b. larger source, greater distance between the source and the test object, and a shorter distance between the test object and the film.
c. smaller source, shorter distance between the source and the test object, and a larger distance between the test object and the film.
d. smaller source, shorter distance between the source and the test object, and a shorter distance between the test object and the film.

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    a. when the discontinuity is closest to the film/imaging plate/detector.
    b. when the discontinuity is farthest from the film/imaging plate/detector.
    c. when the discontinuity is farthest from the radiation source.
    d. never; enlargement doesn't occur in radiographic imaging.

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    a. Continuous X-rays.
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16. Determine the minimum SFD given a focal spot size of 0.118 in. (3 mm), a distance from the source side of the object to the film of 3 in. (76 mm), and a maximum allowable unsharpness of 0.02 in. (0.5 mm).

a. 17.7 in. (450 mm)
b. 20.7 in. (526 mm)
c. 30.4 in. (772 mm)
d. 36.4 in. (925 mm)

17. A technician has to radiograph 20 parts with two exposures for each part. Only one part fits on the film per shot. If the initial technique was for 10 mA, but the unit has a maximum of 20 mA, which setting could save the technician the most exposure time?

a. Resetting the mA to 5 and adjusting the time.
b. Resetting the mA to 15 and adjusting the time.
c. Resetting the mA to 20 and adjusting the time.
d. Changing the mA has no effect on shooting time.

18. Increasing the kilovolts of an X-ray exposure will generally:

a. increase the contrast.
b. decrease the contrast.
c. decrease the film graininess.
d. increase detail.

19. The formula $M_1 \times T_1 = M_2 \times T_2$ is the:

a. reciprocity law for radiography.
b. inverse square law for radiography.
c. exposure factor for radiography.
d. unsharpness formula for radiography.

20. A 3 min shot at 10 mA produced a radiograph with a density of 2.5 characteristic curve (H&D) units. In order to keep the density the same, what is the mA required to reduce the exposure to 1 min?

a. 5
b. 10
c. 15
d. 30

21. A technician is using a 90 Ci iridium source to radiograph a 1 in. thick welded plate. The guide tube is positioned so that the source is 3 ft (0.9 m) from the film. The technician uses an exposure chart to determine an exposure factor of 78 will produce 2.0 density. How long should the exposure be to produce a film with a density of 2.0?

a. 7.8 min
b. 10.3 min
c. 3.6 min
d. 2.6 min

22. Which of the following is equivalent to a 600 mAs exposure?

a. 20 mA for 3 min.
b. 15 mA for 1 min.
c. 10 mA for 2 min.
d. 5 mA for 2 min.

23. The thickness variation that corresponds to the useful density range is known as:

a. contrast.
b. resolution.
c. latitude.
d. sensitivity.