Test Protocol for Medical and Veterinary Fluoroscopy X-ray Apparatus 2016

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This protocol provides the mandatory requirements for an accredited tester compliance testing medical and veterinary fluoroscopy X-ray apparatus, including apparatus capable of both fluoroscopy and plain radiography.

It should be read in conjunction with the Radiation Protection and Control Act 1982 (the Act) and the Radiation Protection and Control (Ionising Radiation) Regulations 2015 (the regulations).

Citation

This protocol may be cited as the Test Protocol for Medical and Veterinary Fluoroscopy X-ray Apparatus 2016.

Part 1—Interpretation

In this protocol, unless the contrary intention appears—

*accredited tester* means a person performing compliance testing who is a holder of an accreditation as a third party service provider under section 33B of the Act;

*aperture* means a gap in the protective material of a tube housing through which ionising radiation from an X-ray tube within the tube housing may pass with little or no attenuation;

*apparatus* means ionising radiation apparatus;

*at table protective screen* means a screen that—

(a) is of dimensions sufficient to provide adequate radiation protection for any person using the screen and for any orientation of the patient table, clinical factors being taken into account; and

(b) includes radiation shielding material that provides a shielding value of at least a 0.5 millimetres lead equivalent;

*EPA* means the Environment Protection Authority, South Australia;

*equivalent dose* means the absorbed dose delivered by a type of radiation averaged over a tissue or organ multiplied by the radiation weighting factor for the radiation type;

*fixed*, in relation to apparatus, means any apparatus that is neither a mobile apparatus nor a portable apparatus;

*general objective* means the requirements under section 23 of the Act. Applicable sections are indicated by the symbol †;

*grandfather clause* means that, in accordance with regulation 92(1)(a) and 99(1)(a) of the regulations, apparatus must—if the apparatus had been registered under the revoked Health Act regulations (i.e. prior to 1 April 1986)—comply with the regulations so indicated. Applicable sections are indicated by the symbol *.
mobile, in relation to apparatus, means apparatus that is designed and constructed so as to be moveable from place to place for use as required but does not include a portable apparatus;

plain radiography means the technique for obtaining, recording and processing directly or after transfer, static information contained in an X-ray image at an image receptor where the X-ray tube is stationary throughout the exposure;

portable, in relation to apparatus, means any apparatus that is designed to be carried manually from place to place for use as required;

primary beam means that part of the X-radiation that passes through an aperture of an tube housing by a direct path from an X-ray tube;

tube housing, in relation to an apparatus, means a container in which an X-ray tube is mounted for normal use, providing protection against electric shock and against ionising radiation except for an aperture for the useful beam;

X-ray tube, in relation to an apparatus, means an evacuated glass envelope in which electrons are accelerated for the purposes of the production of ionising radiation.

Part 2—General requirements

1—Application of protocol

This protocol applies to fixed and mobile apparatus used for medical and veterinary fluoroscopy, including apparatus capable of both fluoroscopy and plain radiography.

2—Exemptions applicable to this protocol

(1) The exemption notice pursuant to section 44 of the Act in the Government Gazette - 4 July 2013, page 2946—that exempts owners of medical and veterinary fluoroscopy apparatus fitted with a flat panel detector from the requirements of regulation 100(3) of the Protection and Control (Ionising Radiation) Regulations 2000—has been applied to the test method of section 21.1.

(2) The exemption notice pursuant to section 44 of the Act in the Government Gazette - 4 July 2013, page 2946—that exempts owners of fluoroscopic apparatus with an over table X-ray tube that is designed also for plain radiography from regulation 100(6) of the Radiation Protection and Control (Ionising Radiation) Regulations 2000—has been applied to the test method of section 53.1.

(3) The exemption notice pursuant to section 44 of the Act in the Government Gazette - 4 July 2013, page 2946—that exempts, subject to conditions, owners of fluoroscopic apparatus with an over table X-ray tube from the requirements of regulation 100(24)(c) of the Radiation Protection and Control (Ionising Radiation) Regulations 2000—has been applied to the test method of sections 35.1 and 36.1.

3—Complying with this protocol

The accredited tester must—

(a) perform compliance testing in accordance with the test methods specified in Part 3 and Part 4; and

(b) provide in a report—

(i) the details as specified in sections 4 to 7; and

(ii) the test parameters used and results obtained for the compliance tests performed under Part 3 and Part 4; and

(c) complete the approved Certificate of Compliance for Medical and Veterinary Fluoroscopy X-ray Apparatus document.
4—Owner details

Record, where known, the contact details of the owner of the apparatus including at least—

(a) the name of the owner; and
(b) the address of the owner; and
(c) the telephone number of the owner.

5—Apparatus details

Record the details of the apparatus including at least—

(a) the make and model of the apparatus; and
(b) the serial number—
   (i) of the generator, where it is practical to do so; and
   (ii) the serial number of the X-ray tube, where it is practical to do so; and
   (iii) the serial number of the tube housing, where it is practical to do so; and
(c) the location of the apparatus (e.g. surgery 1, room 1).

6—Accredited tester details

Record the details of the accredited tester including at least—

(a) the name of the accredited tester; and
(b) the accreditation number of the accredited tester; and
(c) the date on which the accredited tester performed the compliance tests.

7—Test instrument details

Record for each test instrument used, at least—

(a) the make and model; and
(b) the serial number; and
(c) the date of the next calibration or the date of the last calibration.

Part 3—Construction and installation of fixed and mobile fluoroscopy apparatus when used in fluoroscopy mode and plain radiography mode

8—Application of part

This part of the protocol applies to fixed and mobile fluoroscopy apparatus when used in fluoroscopy mode and in plain radiography mode.

9—Apparatus to be in good working order

9.1 Test method

Verify that there is no abnormality, fault, or condition, that is not subject to another section of this protocol, that prevents the apparatus from functioning or performing in a manner for which it has been designed.

9.2 Legislative reference

Regulation 8(2) of the regulations is applicable.

10—Labelling of apparatus

10.1 Test method

Verify that the apparatus has a label—
(a) that complies with the requirements of AS 1319–1994 Safety Signs for the Occupational Environment applying to warning signs; and
(b) bears the words “RADIATION PRODUCED WHEN ENERGISED” or words to that effect; and
(c) bears the radiation symbol as specified in Schedule 1; and
(d) is clearly legible at a distance of 2 metres.

10.2 Legislative reference
Regulation 63 of the regulations is applicable.

11—Radiation area sign

11.1 Test method
(1) Verify that a sign is clearly displayed, at each entrance, walkway or access route to the room or area in which the apparatus is located—other than an entrance to the room from a place or another room which can only be entered from the room.
(2) Verify that the sign—
(a) complies with the requirements of AS 1319–1994 Safety Signs for the Occupational Environment applying to warning signs; and
(b) if it does bear words, the words are "RADIATION AREA" or "X-RAYS" sign or words of similar effect; and
(c) has a total surface area of not less than 4500 square millimetres; and
(d) bears the radiation symbol as specified in Schedule 1; and
(e) is clearly legible at a distance of 2 metres.

11.2 Legislative reference
Regulation 64 of the regulations is applicable.

12—X-ray tube potential*

12.1 Test method
Verify that, for a range of set X-ray tube potentials, the measured value of the X-ray tube potential is within ±5 kilovolts peak or ±5 percent, whichever is the greater, of the indicated value.

12.2 Legislative reference
Regulation 99(4) and 92(4) of the regulations are applicable. These regulations are subject to the grandfather clause.

13—Half value layer*

13.1 Test method
(1) For a range of set X-ray tube potentials, measure the half value layer of the primary beam.
(2) Verify that the measured half value layer, for the selected tube potential, is not less than value specified in Table 1.

<table>
<thead>
<tr>
<th>Indicated X-ray tube potential (kilovolts peak)</th>
<th>Half value layer (millimetres of Aluminium)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>0.3</td>
</tr>
<tr>
<td>40</td>
<td>0.4</td>
</tr>
<tr>
<td>49</td>
<td>0.5</td>
</tr>
<tr>
<td>50</td>
<td>1.2</td>
</tr>
<tr>
<td>60</td>
<td>1.3</td>
</tr>
<tr>
<td>70</td>
<td>1.5</td>
</tr>
</tbody>
</table>
### Indicated X-ray tube potential (kilovolts peak) vs. Half value layer (millimetres of Aluminium)

<table>
<thead>
<tr>
<th>X-ray tube potential (kilovolts peak)</th>
<th>Half value layer (millimetres of Aluminium)</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
<td>2.1</td>
</tr>
<tr>
<td>80</td>
<td>2.3</td>
</tr>
<tr>
<td>90</td>
<td>2.5</td>
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<tr>
<td>100</td>
<td>2.7</td>
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<tr>
<td>110</td>
<td>3.0</td>
</tr>
<tr>
<td>120</td>
<td>3.2</td>
</tr>
<tr>
<td>130</td>
<td>3.5</td>
</tr>
<tr>
<td>140</td>
<td>3.8</td>
</tr>
<tr>
<td>150</td>
<td>4.1</td>
</tr>
</tbody>
</table>

### 13.2 Legislative reference

Regulation 99(10) and 92(5) of the regulations are applicable. These regulations are subject to the *grandfather clause*.

### 14—Exposure switch – closed circuit contact*

14.1 Test method

Verify that—

(a) continuous pressure must be maintained on the exposure switch in order to maintain radiation exposure; and

(b) after a radiation exposure has terminated, another exposure is not possible without releasing the exposure switch; and

(c) in the case of programmed exposures, there is a means of interrupting the programme.

14.2 Legislative reference

Regulation 99(11) and 92(7) of the regulations are applicable. These regulations are subject to the *grandfather clause*.

### 15—Mains switch*

15.1 Test method

Verify that the apparatus has a mains switch—

(a) that controls the supply of mains power to the apparatus; and

(b) is readily accessible; and

(c) a mains indicator light to indicate when the control panel is energised and the mains switch is in the "ON" position.

15.2 Legislative reference

Regulation 99(14) and 92(12) of the regulations are applicable. These regulations are subject to the *grandfather clause*.

### 16—Focal spot

16.1 Test method

Verify that the position of the focal spot is clearly indicated on the tube housing.

16.2 Legislative reference

Regulation 99(19) and 92(18) of the regulations are applicable.
17—Leakage from the X-ray tube housing and the beam limiting device

17.1 Test method

(1) Cover the end of the beam limiting device with lead of sufficient thickness to ensure that the primary beam contribution to the measurements is negligible.

(2) Subject to subsection (3), verify that the leakage radiation, at a distance of 1 metre from the focus of the X-ray tube and from the beam limiting device, measured at sufficient points around the tube housing and the beam limiting device to provide appropriate coverage, does not exceed 1 millisievert in 1 hour at every rating specified by the manufacturer for that X-ray tube and tube housing combination.

(3) For purposes of verifying compliance, leakage radiation may be measured using test parameters, being—
   (a) the maximum rated (i.e. available) X-ray tube potential; and
   (b) the maximum available X-ray tube current, with due consideration to the manufacturers cooling requirements of the X-ray tube and tube housing combination; or
   (c) a set X-ray tube current that is less than maximum available X-ray tube current, as long as the measured leakage radiation is scaled to a value corresponding to one that has been measured at the maximum available X-ray tube current; or
   (d) the maximum continuous tube current specified by the manufacturer of the apparatus or derived from manufacturers data, as long as the measured leakage radiation is appropriately scaled to a value corresponding to one that has been measured at the maximum available X-ray tube current; and
   (e) an exposure time of less than one hour, as long as the measured leakage radiation is scaled to a value corresponding to one that has been measured in 1 hour; and
   (f) at a distance of other than 1 metre, as long as the measured leakage radiation is corrected for distance using the inverse square law for radiation intensity.

17.2 Legislative reference

Regulation 99(20), 99(21), 92(13), and 92(14) of the regulations are applicable.

18—Multiple X-ray tubes

18.1 Test method

Except in the case of apparatus specifically designed for two tube techniques, verify that if more than one X-ray tube can be operated from a single control panel—
   (a) it is not be possible to energise more than one X-ray tube at the same time; and
   (b) there is an indication on the control panel showing which X-ray tube is selected; and
   (c) except in the case of fluoroscopy apparatus with under table and associated over table X-ray tubes there is an indication, at or near each tube housing showing which X-ray tube is selected.

18.2 Legislative reference

Regulation 99(22) and 92(16) of the regulations are applicable.

Part 4—Special requirements for the construction and installation of fixed and mobile fluoroscopy apparatus when used in fluoroscopy mode

19—Application of part

This part of the protocol applies to fixed and mobile fluoroscopy apparatus when used in fluoroscopy mode but does not include apparatus when used in plain radiography mode.
20—Automatic collimation system*

20.1 Test method
Except for a mini C-arm apparatus, that has a maximum X-ray tube current not exceeding 200 microamperes, verify the apparatus is fitted with an automatic exposure control with a manual override that permits the selection of a smaller radiation field.

20.2 Legislative reference
Regulation 99(2) of the regulations is applicable. These regulations are subject to the grandfather clause.

21—Image detector type*

21.1 Test method
Verify that the apparatus is fitted with an image intensifier or a flat panel detector.

21.2 Legislative reference
(1) Regulation 99(3) of the regulations is applicable. This regulation is subject to the grandfather clause.
(2) The exemption referred to in section 2(1) has been applied to the test method of section 21.1.

22—Exposure parameters during fluoroscopy*

22.1 Test method
Verify that the apparatus is fitted with visual indicators on the control panel that provide a continuous indication of X-ray tube potential and X-ray tube current.

22.2 Legislative reference
Regulation 99(4) of the regulations is applicable. This regulation is subject to the grandfather clause.

23—Exposure switch – image explorator*

23.1 Test method
Except in the case of an over table fluoroscopic X-ray tube, verify that there is a fluoroscopic exposure switch located at the image explorator.

23.2 Legislative reference
Regulation 99(5) of the regulations is applicable. This regulation is subject to the grandfather clause.

24—High level control

24.1 Test method
If the apparatus is fitted with a high level control, verify that the control—
(a) requires continuous activation by the operator of the apparatus for its operation; and
(b) has a continuous signal audible to the operator to indicate that the high level control is being employed.

24.2 Legislative reference
Regulation 99(7) of the regulations is applicable.

25—Equivalent dose rate*

25.1 Test method
(1) Measure the equivalent dose rate—
(a) in the case of an under table X-ray tube, when the patient support is permanently between the X-ray tube and the patient, at a distance of 10 millimetres from the patient support on the patient side of the support; and
(b) in the case of an over table X-ray tube, when a patient support is permanently between the patient and the X-ray image receptor, at a distance of 300 millimetres above the patient support on the X-ray tube side of the support; and

c) in the case of fixed arm systems, where the X-ray tube and image receptor are mechanically linked and where a patient support may or may not be permanently in the radiation beam, at a distance of 300 mm from the front surface of the image detector but not less than 400 millimetres from the focal spot; and

d) in the case of any other fluoroscopy system, where no patient support is permanently in the radiation beam, at a distance of 400 millimetres from the focal spot or the minimum distance, whichever is greater.

(2) Verify that the measured equivalent dose rates do not exceed the limits specified in Table 2 for the specified control type.

<table>
<thead>
<tr>
<th>Control type</th>
<th>Equivalent dose rate limit (milligray per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>50</td>
</tr>
<tr>
<td>Automatic</td>
<td>100</td>
</tr>
<tr>
<td>High level (boost)</td>
<td>150</td>
</tr>
</tbody>
</table>

25.2 Legislative reference
Regulation 99(8) of the regulations is applicable. This regulation is subject to the grandfather clause.

26—Drapes — subject to grandfather clause*

26.1 Test method
In the case of a fixed under table fluoroscopic X-ray tube, verify that the apparatus has drapes that—

(a) are removable; and

(b) have a lead equivalent of no less than 0.5 millimetres; and

(c) are designed to attach to the lower edge of the image explorator; and

(d) consist of overlapping sheets; and

(e) are attached to the image explorator in such a way that there is no gap between the drape and the image explorator; and

(f) reach the table top when the image explorator is in its maximum vertical position; and

(g) are adjustable to protect the operator of the apparatus when the table is in the tilted position.

26.2 Legislative reference
Regulation 99(9) of the regulations is applicable. This regulation is subject to the grandfather clause.

27—Warning device during fluoroscopy

27.1 Test method
Except in the case of apparatus operated in plain radiography mode, verify that the apparatus has incorporated into it a device that provides a warning to the operator whenever the X-ray tube is energised and that warning consists—

(a) clearly distinguishable red or amber light; or

(b) an audible signal provided by a device incorporated into the apparatus for that purpose.

27.2 Legislative reference
Regulation 99(12) of the regulations is applicable.
28—Prohibition of certain control panel lights during fluoroscopy

28.1 Test method
If the apparatus has a red or amber light as the warning device referred to in section 27, verify that there is no other red or amber indicator light on the control panel of the apparatus while the apparatus is in fluoroscopy mode.

28.2 Legislative reference
Regulation 99(13) of the regulations is applicable.

29—Collimation during fluoroscopy*

29.1 Test method
(1) Subject to subsection (3), verify that under all operating conditions, during fluoroscopy, the X-ray field at the input phosphor of the image intensifier or at the input of the flat panel detector is not larger than the area being imaged on the monitor to the extent that none of the error distances, measured in the way described in subsection (2), exceed 1 percent of the focal spot to image receptor distance.

(2) Measurements of the error distance are—
(a) in the case of a polygonal X-ray field, taken perpendicularly from the midpoint of each side of the X-ray field, which is outside of the area being imaged, to the corresponding boundary of the area being imaged; and
(b) in the case of an X-ray field with a curved boundary (for example a circular X-ray field) the error distance is defined for all points on the boundary of the X-ray field which lie outside of the area being imaged. For any such point the error distance is measured perpendicularly from the tangent to the boundary at that point to the corresponding boundary of the area being imaged.

(3) For the purposes of this section—
(a) area being imaged means the area of the input phosphor of the image intensifier or the area of input of the flat panel detector which produces an image on the monitor;
(b) error distance means the lack of alignment between the X-ray field and the area being imaged, where the X-ray field lies outside the area being imaged.

29.2 Legislative reference
Regulation 99(15)(b) of the regulations is applicable. These regulations are subject to the grandfather clause.

30—Receptor interlock

30.1 Test method
Verify that the apparatus is interlocked so that the fluoroscopic X-ray tube is de-energised whenever the image receptor is taken out of the path of the primary beam.

30.2 Legislative reference
Regulation 99(16) of the regulations is applicable.

31—Fluoroscopy timer

31.1 Test method
Verify that the apparatus is fitted with an adjustable timing device that is activated when the X-ray tube is activated for fluoroscopy, and has a maximum setting of 10 minutes in order to give the operator of the apparatus an audible signal at the termination of a preset time.

31.2 Legislative reference
Regulation 99(17) of the regulations is applicable.
32—Exposure switch during fluoroscopy – foot operated

32.1 Test method
In the case of an exposure switch designed to be operated with the foot, verify that the switch has a cover designed to prevent accidental activation.

32.2 Legislative reference
Regulation 99(18) of the regulations is applicable.

33—Drapes – not subject to grandfather clause

33.1 Test method
In the case of a fixed under table fluoroscopic X-ray tube, verify that the drapes, referred to in section 26—
(a) consist of overlapping sheets; and
(b) are attached to the image explorator in such a way that there is no gap between the drape and the image explorator; and
(c) reach the table top when the image explorator is in its maximum vertical position; and
(d) are adjustable to protect the operator of the apparatus when the table is in the tilted position.

33.2 Legislative reference
Regulation 99(23) of the regulations are applicable.

34—Light beam unit for an over table fluoroscopic X-ray tube

34.1 Test method
In the case of apparatus with an over table fluoroscopic X-ray tube verify that the collimator has a light beam unit.

34.2 Legislative reference
Regulation 99(24)(a) of the regulations is applicable.

35—Exposure switch for an over table fluoroscopic X-ray tube

35.1 Test method
In the case of apparatus with an over table fluoroscopic X-ray tube verify that an exposure switch is located at the control panel.

35.2 Legislative reference
(1) Regulation 99(24)(b) of the regulations is applicable.
(2) The exemption referred to in section 2(3) has been applied to the test method of section 35.1.

36—Protective screen for over table fluoroscopic X-ray tube

36.1 Test method
In the case of an over table fluoroscopic X-ray tube verify that an at table protective screen is available at the patient table.

36.2 Legislative reference
(1) Regulation 99(24)(c) of the regulations is applicable.
(2) The exemption referred to in section 2(3) has been applied to the test method of section 36.1. Note that the requirement of an at table protective screen is a condition of the exemption.
37—Image storage device

37.1 Test method
Verify that the apparatus is fitted with an image storage device that is capable of storing an image and maintaining that image on a monitor without subjecting the patient to further irradiation.

37.2 Legislative reference
Regulation 99(25) of the regulations is applicable.

38—Focus to skin distance

38.1 Test method
(1) Measure the distance from and the X-ray tube focus and the closest point the patient’s skin could make contact with the beam limiting device.

(2) Except for a mini C-arm apparatus, that has a maximum X-ray tube current not exceeding 200 microamperes, verify that fluoroscopic apparatus have a minimum focus to skin distance—
   (a) in the case of fixed apparatus—
      (i) if the apparatus has a patient support permanently between the X-ray tube and the patient—is not less than 400 millimetres; and
      (ii) in the case of any other fixed apparatus—is not less than 300 millimetres; and
   (b) in the case of mobile apparatus is not less than 200 millimetres.

38.2 Legislative reference
Regulation 100(1) and 100(2)(a) of the regulations are applicable. Note: regulation 100(3) is not included in this protocol as compliance with that regulation is the responsibility of the apparatus operator and only where it is reasonably practicable to do so.

39—Air kerma rate at the input field surface†

39.1 Test method
Verify that the air kerma rate at the input field surface of the image detector—
   (a) for a field size of 110 millimetres to less than 140 millimetres—does not exceed 120 microgray per minute; and
   (b) for a field size of 140 millimetres to less than 230 millimetres—does not exceed 80 microgray per minute; and
   (c) for a field size of 230 millimetres or greater—does not exceed 60 microgray per minute.

39.2 Legislative reference
The general objective is applicable. The field sizes and air kerma limits specified above are from Sec.29.209 AS/NZS 3200.1.3:1996.

40—High contrast spatial resolution†

40.1 Test method
Verify that the apparatus has a high contrast spatial resolution whose value, when measured using a high resolution test pattern in a phantom, is within the value specified by the manufacturer of the phantom.

40.2 Legislative reference
The general objective is applicable.
41—Low contrast resolution†

41.1 Test method
Verify that the apparatus has a low contrast resolution whose value, when measured using a low resolution test pattern in a phantom, is within the value specified by the manufacturer of the phantom.

41.2 Legislative reference
The general objective is applicable.

Part 5—Special requirements for the construction and installation of fixed and mobile fluoroscopy apparatus when used in plain radiography mode

42—Application of part
This part of the protocol applies to fixed and mobile fluoroscopy apparatus when used in plain radiography mode but does not include apparatus when used in fluoroscopy mode.

43—Exposure parameters in plain radiography mode*

43.1 Test method
(1) In the case of an apparatus that has exposure parameters that are capable of being varied, verify that the required value of the X-ray tube potential, X-ray tube current, and exposure time or a combination thereof can be set without a trial exposure being made.
(2) In the case of an apparatus that has exposure parameters that are not capable of being varied, verify that the values of the X-ray tube potential, X-ray tube current, and exposure time are clearly indicated on the control panel by means of analogue meters, digital displays or scales, or by calibrated permanent markings.

43.2 Legislative reference
Regulation 92(4) of the regulations is applicable. This regulation is subject to the grandfather clause.

44—Exposure termination in plain radiography mode*

44.1 Test method
Verify that the apparatus is fitted with a device that will terminate the exposure after a preset—
(a) time interval; or
(b) product of X-ray tube current and exposure time; or
(c) programmed exposure.

44.2 Legislative reference
Regulation 92(6) of the regulations is applicable. This regulation is subject to the grandfather clause.

45—Stationary tube housing in plain radiography mode*

45.1 Test method
(1) Place the tube housing in positions that would be typically used in radiography.
(2) Verify that for each position, the tube housing does not move.

45.2 Legislative reference
Regulation 92(8) of the regulations is applicable. This regulation is subject to the grandfather clause.

46—Consistency in plain radiography mode*

46.1 Test method
Verify that the apparatus produces a consistent radiation output—
(a) by making at least five measurements of radiation output performed at the same X-ray tube potential, X-ray tube current, and exposure time; and
(b) by calculating the coefficient of variation of at least five measurements; and
(c) by verifying that the calculated coefficient of variation is less than or equal to 0.05.

46.2 Legislative reference
Regulation 92(9)(a) of the regulations is applicable. This regulation is subject to the grandfather clause.

47—Linearity in plain radiography mode*

47.1 Test method
Verify that the apparatus produces a linear radiation output—
(a) by making at least five measurements of radiation output at a fixed X-ray tube potential where the charge, as indicated on the control panel, is varied from measurement to measurement; and
(b) by calculating the coefficient of variation of the ratio of radiation output to charge; and
(c) by verifying that the calculated coefficient of variation is less than or equal to 0.1.

47.2 Legislative reference
Regulation 92(9)(b) of the regulations is applicable. This regulation is subject to the grandfather clause.

48—Warning device in plain radiography mode*

48.1 Test method
Verify that when the X-ray tube is energised there is a warning device that consists of—
(a) a red or amber light that is clearly distinguishable from the operator position; and
(b) an audible signal that is audible from that operator position and indicates either the duration or termination of the exposure.

48.2 Legislative reference
Regulation 92(10) of the regulations is applicable. This regulation is subject to the grandfather clause.

49—Prohibition of certain control panel lights*

49.1 Test method
In the case of an apparatus that does not have the audible signal referred to in section 48, as might be the case for an apparatus subject to the grandfather clause, verify that there is no indicator light on the control panel of the apparatus that is the same colour as the warning light referred to in section 48.

49.2 Legislative reference
Regulation 92(11) of the regulations is applicable. This regulation is subject to the grandfather clause.

50—Collimator light beam and manual override

50.1 Test method
Verify that the continuously adjustable collimator fitted to the X-ray tube—
(a) has a light beam with an illuminance which is not less than 100 lux at a distance of 1 metre from the light source; and
(b) in the case where the collimator can be automatically adjusted, a manual override that permits the selection of a smaller area is possible.

50.2 Legislative reference
Regulation 92(15) of the regulations is applicable.
51—Automatic exposure control in plain radiography mode

51.1 Test method
(1) In the case of an apparatus fitted with an automatic exposure control (AEC) select the AEC and verify that there is a clear indication on the control panel that the AEC has been selected.
(2) Under AEC, verify that the AEC limits—
   (a) the exposure time to no more than 6 seconds; or
   (b) the product of the X-ray tube current selected and exposure time delivered is no more than 600 milliampere seconds.
(3) In the case of an exposure that terminates under AEC verify—
   (a) there is a visible or audible signal that indicates that termination has occurred; and
   (b) manual resetting of the AEC is required before further automatically timed exposures can be made.

51.2 Legislative reference
Regulation 92(17) of the regulations is applicable.

52—Exposure switch during plain radiography – foot operated†

52.1 Test method
In the case of an exposure switch designed to be operated with the foot, verify that the switch has a cover designed to prevent accidental activation.

52.2 Legislative reference
The general objective is applicable.

53—Bucky slot protective cover *

53.1 Test method
Except for an over table fluoroscopic X-ray tube verify that a fluoroscopic table designed also for plain radiography has a bucky slot radiation protective cover.

53.2 Legislative reference
(1) Regulation 99(6) of the regulations is applicable. This regulation is subject to the grandfather clause.
(2) The exemption referred to in section 2(2) has been applied to the test method of section 53.1.

54—Collimation in plain radiography mode*

54.1 Test method
(1) Subject to the definitions of subsection (3), verify that under all operating conditions, while the apparatus is in plain radiography mode, the X-ray field at the image receptor is not larger than the area being imaged on the image receptor to the extent that none of the error distances, measured in the way described in subsection (2), exceed 1.5 percent of the focal spot to image receptor distance.
(2) Measurements of the error distance are—
   (a) in the case of a polygonal X-ray field, taken perpendicularly from the midpoint of each side of the X-ray field, which is outside of the area being imaged, to the corresponding boundary of the area being imaged; and
   (b) in the case of an X-ray field with a curved boundary (for example a circular X-ray field) the error distance is defined for all points on the boundary of the X-ray field which lie outside of the area being imaged. For any such point the error distance is measured perpendicularly from the tangent to the boundary at that point to the corresponding boundary of the area being imaged.
(3) For the purposes of this section—
(a) **area being imaged** means the area of image receptor available for imaging but does not include any area of the image receptor covered by X-ray opaque masks or any area of the image receptor which has previously been imaged by X-rays; and

(b) **error distance** means the lack of alignment between the X-ray field and the **area being imaged**, where the X-ray field lies outside the **area being imaged**.

### 54.2 Legislative reference
Regulation 99(15)(a) of the regulations is applicable. This regulation is subject to the *grandfather clause*.

### 55—Plain radiography exposure switch for mobile apparatus

#### 55.1 Test method
In the case of **mobile apparatus**, verify that the **apparatus** is designed and constructed so that the exposure switch can be operated at a distance of not less than 2 metres from the **X-ray tube** and from the patient.

#### 55.2 Legislative reference
Regulation 100(2)(b) of the regulations is applicable.
Schedule 1—Radiation symbol

(1) The radiation symbol consists of the conventional three blade design shown below.

(2) The symbol and background colours must comply with the requirements of AS 1319–1994 Safety Signs for the Occupational Environment.