

Radiation Safety Standard: Computed tomography scanners



This Radiation Safety Standard deals with computed tomography equipment, used for human diagnostic purposes.

Required testing frequency: Every 12 months

This document contains the Radiation Safety Standard and relevant radiation safety tests that have been specified under the *Radiation Act 2005* by the Secretary to the Department of Human Services in respect of computed tomography scanners.

Computed tomography scanners are prescribed radiation sources under the *Radiation Act 2005*.

Under the Act the role of an approved tester is to conduct tests on prescribed radiation sources to determine whether the prescribed radiation sources meet the relevant Radiation Safety Standard and issue certificates of compliance if the prescribed radiation sources meet the relevant Radiation Safety Standard.

A certificate of compliance must not be issued if the prescribed radiation source does not comply with any part of the Radiation Safety Standard.

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* The specification of Radiation Safety Standards under the *Radiation Act 2005* is reviewed periodically to ensure they are up to date. The latest version can be downloaded from the website at:

**[www.health.vic.gov.au/
environment/radiation](http://www.health.vic.gov.au/environment/radiation)**



Terms

Item

Refers to the compliance standard number.

Criteria

The Radiation Safety Standard that must be met by the prescribed radiation source when it is tested, in order for a certificate of compliance to be issued and where relevant the radiation safety tests that must be used.

Australian Standards

A reference in the Radiation Safety Standard to the letters 'AS' followed by a number and/or a number and year is a reference to the Standard so numbered and published by or on behalf of Standards Australia as amended from time to time.

Relevant Australian Standards are listed under Reference Documents on the back page. Copies of Australian Standards can be obtained online from:

www.saiglobal.com/shop

Item	Criteria
1	Indicators
1.1	Mains A mains indicator must be clearly identified. 'ON' and 'OFF' positions must be indicated by a suitable indicator light or other unambiguous means.
1.2	Energised X-ray Tube A visible signal must be displayed at the control panel to indicate when the X-ray tube is energised.
1.3	Audible Signal Provision must be made for a signalling device audible at the location from which the equipment is operated to indicate the duration or termination of the exposure.
1.4	Beam-on Indicator When and only when radiation is produced, visible indication must be provided on the control panel from which the X-rays are actuated and on or near the housing of the scanning mechanism.
1.5	Radiation Warning Sign and Light Radiation warning signs must be displayed on the outside of all entrances to the CT room. The entrance to the CT room must also have a light that is illuminated when the X-ray tube is placed in the preparation and exposure mode.
2	Mechanical Accuracy
2.1	Agreement Between Internal and External Scan Plane Lights The external scan plane lights must coincide with the internal scan plane lights to within ± 2 mm.
2.2	Co-incidence of Internal Scan Plane Lights and Scan Plane. The internal scan plane lights must coincide with the X-ray beam to within ± 2 mm.
2.3	Coronal and Sagittal Plane Lights. The coronal and sagittal plane lights must intercept at the $x = 0, y = 0$ on the corresponding axial image. Error must not exceed ± 2 mm.
2.4	Axial Scan Incrementation Accuracy When the scanner is used in axial mode, the incrementation accuracy between successive axial slices must not exceed ± 1 mm.
2.5	Positioning of the Patient Support Positional accuracy of the patient support, including both positioning and backlash must be tested in accordance with AS/NZS 4184.2.6:1995, Clause 5.5 a) Longitudinal positioning of the patient support. L_{for} and L_{back} must not deviate by more than ± 2 mm from the fixed indicated distances. b) Backlash of the patient support C_{for} and C_{back} must not be greater than ± 2 mm.
3	Image Quality
3.1	Baseline Values Base line values for noise, mean CT number, uniformity, reconstructed slice thickness, high contrast resolution and CT dose index must be established when equipment is first brought into use or following any maintenance likely to affect these parameters (including tube change).

Item	Criteria								
3.1	<p>Baseline Values (cont.)</p> <p>Baseline values must be established in accordance with AS/NZS 4184.2.6:1995, Clause 4.2</p> <p>Note:</p> <ol style="list-style-type: none"> These figures can be provided by the supplier. If these figures have not yet been determined the tests must be carried out at the first compliance test to establish them. As such, the requirements specified in section 3.2 do not apply for that initial test. This must be noted in the assessment report. When establishing baseline values the same test procedures, test conditions and test device must be used for future tests. All selectable values of scan parameters, the area of the test device to be imaged and the position of the test device during irradiation must be recorded in the assessment report. The same conditions must be used for tests 3.2 and 3.3. 								
3.2	<p>Noise, Mean CT number, Uniformity</p> <p>Noise, mean CT number and uniformity must be evaluated in accordance with AS/NZS 4184.2.6:1995, Clause 5.1</p> <p>Deviations from baseline values must not exceed the values specified in Table 1.</p> <p>Table 1</p> <table border="1" data-bbox="373 853 948 1010"> <thead> <tr> <th>Parameter</th> <th>Deviation</th> </tr> </thead> <tbody> <tr> <td>Noise</td> <td>$\pm 10\%$ or 0.2 HU whichever is larger</td> </tr> <tr> <td>Mean CT number</td> <td>± 4 HU</td> </tr> <tr> <td>Uniformity</td> <td>± 2 HU</td> </tr> </tbody> </table>	Parameter	Deviation	Noise	$\pm 10\%$ or 0.2 HU whichever is larger	Mean CT number	± 4 HU	Uniformity	± 2 HU
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3.3	<p>Reconstructed Slice Thickness</p> <p>Reconstructed slice thickness must be evaluated according to AS/NZS 4184.2.6:1995, Clause 5.3</p> <p>The difference between the reconstructed slice thickness values and the nominal values must not exceed:</p> <p>± 1.0 mm for thicknesses above 2 mm; $\pm 50\%$ for thicknesses of 2 mm or less.</p> <p>Note:</p> <ol style="list-style-type: none"> Slice thicknesses must be determined for all nominal slice thicknesses available on the CT Scanner. Assessment of slice thickness should be carried out in axial mode. 								
4	<p>Dosimetry</p>								
4.1	<p>Computed Tomography Dose Index in Air (CTDI)</p> <p>The CTDI must be determined in accordance with AS/NZS 4184.2.6:1995, Clause 5.4</p> <p>The CTDI must be within $\pm 10\%$ of the baseline value.</p> <p>Note: The CTDI measured in air may be used to confirm that the X-ray beam collimation has not altered significantly.</p>								
5	<p>Exposure Control</p>								
5.1	<p>Safety Measures Against Excessive Radiation</p> <p>A device must be incorporated in the X-ray equipment to terminate the exposure after the elapse of a preset time.</p> <p>Means must be provided so that the operator can terminate the exposure at any time during a scan.</p>								
5.2	<p>Control from a Protected Area</p> <p>X-ray equipment must be provided with means to select and control modes of operation, select exposure factors, actuate the exposure switch from a protected area.</p> <p>Note: This requirement is waived for CT Fluoroscopy.</p>								

Reference documents

AS/NZS 3200.1.0:1998 Medical Electrical Equipment.
Part 1.0: General requirements for safety – Parent Standard.

AS/NZS 3200.2.7:1999 Medical Electrical Equipment.
Part 2.7: Particular requirements for safety –
High voltage generators of diagnostic X-ray generators

AS/NZS 3200.1.3:1996 Medical electrical equipment.
Part 1.3: General requirements for safety – Collateral Standard.
Requirements for radiation protection in diagnostic X-ray
equipment.

AS/NZS 4184.2.6:1995 Evaluation and routine testing in medical
imaging departments – Constancy tests – X-ray equipment
for computed tomography

AS/NZS 3200.2.44:2005 Medical electrical equipment –
Particular requirements for safety – X-ray equipment for
computed tomography.

NRL C 5 1994. Code of Safe Practice for the Use of X-rays in
Medical Diagnosis, National Radiation Laboratory, New Zealand

ImPACT, Information Leaflet No. 1:CT Scanner Acceptance Testing.

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