

*Radiation Protection Act 2005 – Section 17*

**CERTIFICATE OF COMPLIANCE:  
STANDARD FOR SEALED RADIATION SOURCE -  
PORTABLE MASS GAUGE**

SECTION 1: REQUIREMENTS FOR CERTIFICATES OF COMPLIANCE FOR CLASSES OF RADIATION SOURCES

SECTION 2: PARTS OF STANDARDS AND CODES OF PRACTICE ADOPTED BY THIS STANDARD

**This information can also be accessed at**  
[http://www.dhhs.tas.gov.au/peh/radiation\\_protection](http://www.dhhs.tas.gov.au/peh/radiation_protection)

## **Section 1 – REQUIREMENTS FOR CERTIFICATES OF COMPLIANCE FOR CLASSES OF RADIATION SOURCES.**

**This Standard is to be used when assessing Radiation Sources, classified by Radiation Protection Act 2005 licences as “Sealed Portable Mass Gauge”, for the purpose of issuing a certificate of compliance.**

**In order for a certificate of compliance to be issued the Radiation Source must be shown to fully comply with the requirements in Section 2.**

**† Where an item was demonstrated to comply at the time of manufacture or supply, on going compliance for that item may be stated only if it is reasonable to assume there have been no changes, modifications, damage or unacceptable wear and tear to that item since the time of manufacture. Such items will be denoted by “†” in Section 2**

**The requirements in Section 2 are taken from the following:**

- RPS 13**     *Code of Practice for Safe Use of Fixed Radiation Gauges (2007).*
- RPS 2**     *Code of Practice - Safe transport of radioactive material (2001)*
- RAR**       *Regulatory Authority Requirements – Department of Health and Human Services*

Information from NDC Infrared Engineering (manufacturer of these types of gauges) and the Californian Department of Health, “Registry of Radioactive Sealed Sources and Devices – Safety Evaluation of Device April 29 1998” assisted in the preparation of this document.

## Section 2 – PARTS OF STANDARDS AND CODES OF PRACTICE ADOPTED BY THIS STANDARD

ITEM	Requirements
<b>Radioactive Sources</b>	
Only appropriate sources †	Radioactive material used in a portable mass gauge must be appropriate for the particular application, with regard to its activity, half-life, energy and type of radiations emitted. <b>RPS 13 B I.1 (a)</b>
Toxicity †	The radioactive source must not be a radioactive material of high committed effective dose per unit of intake activity ( $\text{Sv Bq}^{-1}$ ), such as those listed below, unless: (i) it is necessary for the production of neutron radiation for the particular gauging use; or (ii) a radioactive material of low committed effective dose per unit of intake activity, that produces radiation of the required type and energy for the particular gauging application, is unavailable or is otherwise impracticable for use as the source. <b>Radioactive materials of high committed effective dose per unit of intake:</b> $^{210}\text{Pb}$ , $^{210}\text{Po}$ , $^{226}\text{Ra}$ , $^{228}\text{Ra}$ , $^{227}\text{Ac}$ , $^{228}\text{Th}$ , $^{230}\text{Th}$ , $^{231}\text{Pa}$ , $^{232}\text{U}$ , $^{233}\text{U}$ , $^{234}\text{U}$ , $^{237}\text{Np}$ , $^{238}\text{Pu}$ , $^{239}\text{Pu}$ , $^{240}\text{Pu}$ , $^{241}\text{Pu}$ , $^{242}\text{Pu}$ , $^{241}\text{Am}$ , $^{243}\text{Am}$ , $^{242}\text{Cm}$ , $^{243}\text{Cm}$ , $^{244}\text{Cm}$ , $^{245}\text{Cm}$ , $^{246}\text{Cm}$ , $^{249}\text{Cf}$ , $^{250}\text{Cf}$ , $^{252}\text{Cf}$ <b>RPS 13 B I.1 (b)</b>
Chemical and physical form †	The radioactive material must be in a chemical and physical form that, throughout the projected useful life of the portable mass gauge in which it is used, will minimise: (i) corrosion and build up of internal pressure; and (ii) dispersal and solubility of the radioactive material if the source capsule is ruptured. <b>RPS 13 B I.1 (c)</b>
Minimum activity †	The radioactive material must not have an activity that is greater than necessary to ensure that the portable mass gauge operates effectively during its projected useful life and the activity will depend on the: (i) effective radiation path length between the source and detector; and (ii) detector sensitivity and the proposed conditions of its use, where an allowance may be made for a 25% loss of detection sensitivity during the lifetime of the portable mass gauge; and (iii) shielding effects of intra-beam material; and (iv) half-life of the radioactive material used. <b>RPS 13 B I.1 (d)</b>
Collimator requirements †	Where a collimator insert or diaphragm is required to limit the size of the useful beam, such a modification must: (a) only be fitted by the manufacturer or authorised service representative; and (b) not interfere with the effective operation of the gauge; and (c) not reduce the shielding properties or other safety features of the containment. <b>RPS 13 C I.3</b>

Means for terminating exposure ††	<p>The gauge must be fitted with:</p> <ul style="list-style-type: none"> <li>(a) a shutter; or</li> <li>(b) a means of moving the source to a safe position; or</li> <li>(c) a means of de-energising the radiation source.</li> </ul> <p><b>RPS 13 C 1.4</b></p>
Indication of beam on/off	<p>The source container must be designed so that whenever the shutter or source control mechanism is in either the 'beam on' or 'beam off' position, the beam condition is clearly and unambiguously indicated.</p> <p><b>RPS 13 C1.6</b></p>
Protection and operation of beam on/off indicator.	<p>The beam condition indicator must be protected against mechanical damage and:</p> <ul style="list-style-type: none"> <li>(a) where the indicator is mechanical, the 'beam on' and 'beam off' markings must be of a type that cannot be readily obscured by dust, precipitation, corrosion or paint; or</li> <li>(b) where the indicator is electrical, it must: <ul style="list-style-type: none"> <li>(i) include separate lamps or signals to indicate the 'beam on' and 'beam off' conditions; and</li> <li>(ii) be designed to be fail safe in the event of a lamp failure.</li> </ul> </li> </ul> <p><b>RPS 13 C1.7</b></p>
<b>Radioactive source encapsulation</b> †	<p>Each radioactive source used in a gauge must be:</p> <ul style="list-style-type: none"> <li>(a) a sealed source of durable design and construction; and</li> <li>(b) readily identifiable by use of appropriate markings and documentation.</li> </ul> <p><b>RPS 13 B 2.1</b></p> <p>The form and working life of each source used a gauge must be suitable for:</p> <ul style="list-style-type: none"> <li>(a) the particular application; and</li> <li>(b) the useful life of the portable mass gauge; and</li> <li>(c) environmental conditions of its use.</li> </ul> <p><b>RPS 13 B2.2</b></p> <p>The outermost capsule of a radioactive source that is used in a gauge (located inside a source container) must satisfy the American National Standard N 452.1977 (NBS Handbook 126) if the source pre dates 2000.</p> <p><b>RPS 13 B 2.4</b></p> <p>For radioactive sources post 2000 they must satisfy ISO (International Standard) 2919-1999(E); Note: A radioactive source that complies with the 'special form' design and test requirements of the IAEA (International Atomic Energy Agency) would satisfy the ISO test requirements.</p> <p><b>RAR</b></p>

<b>Source Containers</b>	
<b>Construction requirements for a source container</b>	
Shielding with depleted uranium †	Radiation source containment that incorporates depleted uranium in its construction must be durably marked to: (a) warn of the presence of depleted uranium; and (b) indicate the quantity incorporated; and (c) provide information on the relevant physical (i.e. may spontaneously catch fire when finely divided) and radiological safety requirements. <b>RPS 13 C1.1</b>
Useful beam aperture †	The useful beam aperture in the shielded container for a radioactive source or the tube housing for a tube insert must be limited to a size no larger than necessary for the effective operation of the portable mass gauge. <b>RPS 13 C1.2</b>
Collimator requirements †	Where a collimator insert or diaphragm is required to limit the size of the useful beam, such a modification must: (a) only be fitted by the manufacturer or authorised service representative; and (b) not interfere with the effective operation of the portable mass gauge; and (c) not reduce the shielding properties or other safety features of the containment. <b>RPS 13 C 1.3</b>
Means for terminating exposure †	A portable mass gauge must be fitted with: (a) a shutter; or (b) a means of moving the source to a safe position; or (c) a means of de-energising the radiation source. <b>RPS 13 C 1.4</b>
Exposure rates	When the source container is loaded with the source of greatest activity for which it is designed, the radiation level must not exceed 250 uGy/h at any point 5 cm from the external surface and 10 uGy/h at any point 1 metre for its surface. Determination of these radiation levels are to be made with the shutter or source control mechanism in the beam off position <b>RAR</b>
Source container resistant to heat †	The source container must have been tested and be found to function without degradation at temperatures up to 100 degrees Celsius <b>RAR</b>
Temperature variation while source container is in use †	The source container must be designed to withstand variations of temperature to which it may be subjected in use, without deterioration either of containment or ease of operation of the shutter or source control mechanism that may be fitted; and with due consideration given to brittle fracture of the materials used. <b>RPS 13 C 1.8 (a) (d)</b>
Lifting attachments for the source container †	The source container must be designed so that when any incorporated lifting attachments are used in the intended manner, they do not impose damaging stresses on the structure of the source container, shielded tube housing or shielded enclosure. <b>RPS 13 C 1.8 (b)</b>
Quality of welding and brazing used in constructing the source container †	Any welded, brazed or similar joint must: (a) be in accordance with published standards (AS2205.1 to AS2205.10) <b>RPS 13 C 1.9</b>

Damage to the source container from vibration, acceleration and vibrational resonance †	The source container must be designed and constructed so that it can withstand the effects of all vibrations, acceleration and vibration resonance likely to arise during its use, without damage, or reduction in ease of operation of the shutter, where fitted, or source control mechanism. <b>RPS 13 C 1.8 (c)</b>
Compatibility of materials used in constructing the source container †	The source container must be constructed of materials that: (a) are physically and chemically compatible with each other and, where applicable, the materials of the radioactive sources that it is designed to contain; and (b) can withstand the effects of prolonged irradiation without significant deterioration of any physical properties necessary for the safety of the portable mass gauge; and (c) are resistant to corrosion or other physical or structural damage which may occur during the use, transport and storage of the portable mass gauge. <b>RPS 13 C 1.10</b>
Manual and mechanical handling for the source container †	The source container must be provided with features to maintain safe: (a) manual handling, if it has a gross mass of 10 kilograms to 50 kilograms; or (b) mechanical handling, if it has a gross mass of greater than 50 kilograms. <b>RPS 13 C 1.11</b>
Shutter	A shutter or source control mechanism must be fitted. <b>RAR</b>  The shutter or source control mechanism and the associated mechanism for its operation, must be designed, constructed and, if necessary, protected by a rugged covering, so that its operation is not adversely affected by corrosive substances, dust, moisture, other contaminants, vibration or heat, to which it may be exposed during its projected useful life. <b>RPS 13 C2.1</b>
Lockable Shutter †	The shutter or source control mechanism must be: (a) provided with an effective lock so that it can be secured in the 'beam off' position; and (b) designed so that it cannot be locked in the 'beam on' position. <b>RPS 13 C2.2 (a),(b)</b>
Quality of locks †	Locks required for fitting to source containers must be so designed, constructed and mounted that they: (a) forcible interference using common hand tools; and (b) key cylinder picking. <b>RPS 13 C1.15</b>
Labels and markings required on the source container	Each label located on gauge be must be made of a material that can withstand the long-term effects of corrosion and general exposure to the environment in which it is to be used. <b>RPS 13 C 1.14</b>
Marked with trefoil and CAUTION or WARNING	The source container must be durably marked with a legibly stamped or engraved label incorporating the trefoil radiation hazard symbol followed by words of the general form: "Radiation Source, Portable Mass Gauge" <b>RPS 13 C 1.12</b> The symbol and markings on the label specified above must be black on a yellow background. <b>RPS 13 C 1.13</b>

Durable label on gauge must have information on	Radionuclide:  Activity and date measured Maximum radiation level at 1m Date on which max radiation level was measured Name and address of manufacturer <b>RAR</b>
<b>Test for non fixed contamination</b>	
	The source housing is to be wipe tested <sup>1</sup> and non fixed contamination levels must not to exceed those specified for transport in <b>RPS 2</b> .  Evidence that the source container is wipe tested at six (6) monthly intervals must also be obtained. <sup>2</sup> <b>RAR</b>
	Non fixed contamination levels not to exceed those specified for transport in <b>RPS 2</b>
<b>Preventative maintenance</b>	The source container must be inspected to ensure all control mechanisms, including the shutter or source control mechanism, operate properly. <b>RAR</b>

<sup>1</sup> WIPE TEST is based on taking with wet or dry tissue possible radioactive contamination from source surface. The tissue may be wetted with water, diluted nitric acid or another solution inactive for capsule material but actively removing radioactive contamination.