

**REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE
(AMENDS IN ITS ENTIRETY)**

NO.: NC-646-D-134-S

DATE: July 31, 2006

PAGE: 1 of 6

DEVICE TYPE: 4300 Series Portable Depth Moisture Gauges

MODEL No.: 4301 & 4302

MANUFACTURER/DISTRIBUTOR: Troxler Electronic Laboratories, Inc.
P.O. Box 12057
Research Triangle Park, NC 27709
(919) 549-8661

SEALED SOURCE MODEL DESIGNATION:

AEA Technology
Model No. AMN.V997
Capsule Type X.1
Special Form Certificate No. USA/0632/S
Troxler Drawing No. A-102700

ISOTOPE:

Am-241:Be

MAXIMUM ACTIVITY:

11 millicuries (407 MBq)

Isotope Product Laboratories

Model No. AM1.NO2
Capsule X.1
Special Form Certificate No. CZ/1009/S
Troxler Drawing No. A-102700

Am-241:Be

11 millicuries (407 MBq)

LEAK TEST FREQUENCY: 12 months

PRINCIPAL USE: G (Portable Moisture Density Gauge)

CUSTOM DEVICE: _____ YES X NO

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NO. : NC-646-D-134-S

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PAGE: 2 of 6

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DESCRIPTION:

The 4301 and 4302 depth moisture measuring devices are a series of self-contained, portable gauges used to measure moisture content at varying depths in mediums such as soil. The gauges consist of an aluminum case which houses the gauge electronics, a polyethylene radiological shield and the probe in which the source material is contained. The bottom section of the probe houses a helium-3 detector tube to which a sealed source is secured. The detector and source are secured in the bottom section of the probe with a threaded retainer. A special tool is required to install and remove this retainer. This bottom section is screwed into a top section which contains pre-amplification electronics. The 4301 and 4302 probe is approximately twelve inches in length and either 1.5 inches (4301) or 2.0 inches (4302) in diameter. The bottom end of the probe is stamped with the radiological information including source material type, date of activity measurement and source serial number. The probe is attached to the gauge by means of an electrical cable running from the top of the probe to the top panel of the gauge. The probe resides in a hole through the center of the gauge. The probe is secured in the shielded position inside the gauge by means of a padlock in the top of the gauge. In its locked position, this lock prevents a spring-loaded bit, which mates with a groove in the top of the probe, from being retracted. A lever on the top of the gauge allows the probe to be raised or lowered. In order to take a reading with this device, a length of tubing must be installed in the medium to be tested (usually soil). A portion of the tubing is left protruding from the medium and acts as a support for the gauge while a reading is being taken. When the gauge is placed on this tubing, the tubing passes through the base of the gauge and the probe can be indexed down through the tubing to the desired measuring depth by unlocking and manually retracting the bit. The probe is lowered to the desired depth by means of the cable attached to the probe, a reading is taken and the probe is pulled back into the gauge and locked in the shielded position.

The 4301 and 4302 gauges use identical isotopes and shielding techniques. The difference between the models is the electronic capability and the size of the probe. The model 4301 has a 1.5 inch diameter probe whereas the model 4302 has a 2.0 inch diameter probe.

DETAILS OF CONSTRUCTION:

The shield unit for the Model 4301 and 4302 are identical. The unit measures 8.7" x 6" x 13". The shielding for the probe containing the sources is a right cylinder of polyethylene, with a wall thickness of 0.75". The shielding unit weighs 14.5 pounds.

The probe is essentially identical for the Model 4301 and 4302, with probe length being the only difference. Dimensionally, the probes are 1.5" diameter and 12.25" in length (4301) and 2.0" diameter and 12.25" in length (4302). The probe construction is as follows: A right cylinder of aluminum is shielded with polyethylene and lead and contains three (3) Helium-3 (He-3) detectors equidistantly spaced around the perimeter of the probe. Once the probe is introduced into the access tube, the measurement of thermalized neutrons occurs within the He-3 detectors.

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PAGE: 3 of 6

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DETAILS OF CONSTRUCTION (Continued):

In these models, the sealed source is inserted between two aluminum source ring holders. Each source ring holder contains a cylindrical slot 0.20 in. deep and 0.32 in. in diameter to secure the source. The source ring holders, which have an inner diameter of 0.765 in., slide over a Helium-3 detector that is 0.750 in. in diameter. A setscrew through each source ring holder secures the holder to the detector. A retaining ring is placed on each side of the source holder assembly for added security. This assembly is covered with an aluminum probe housing. When in its shielded position, the probe rests inside an aluminum tube with a minimum wall thickness of 0.175 in. The tube is wrapped with 0.0625-in. thick lead and surrounded by a cylindrical high-density polyethylene block with an outer diameter of 6.00 in.

LABELING:

The Model 4301 & 4302 are labeled in accordance with 15A NCAC 11 .1626. The labels contain the radiation symbol, isotope, activity, model number, serial number, name of distributor, and the words "CAUTION-RADIOACTIVE MATERIAL."

DIAGRAM:

See Attachments 1 & 2

CONDITIONS OF NORMAL USE:

The Model 4301 & 4302 gauges are designed to be used by trained personnel to make depth moisture measurements, typically at temporary job sites. The user will normally be near the device only for the time period necessary to set up the gauge and perform the measurement. The gauge has a recommended working life of 15 or more years under normal use conditions and with proper maintenance. However, the gauge should be returned to Troxler Electronic Laboratories every five years for a thorough manufacturer's inspection.

The device is designed for the following environments:

Operating temperature -10°C to 70°C ambient

Pressure Atmospheric

Vibration Ranges from zero to mild (tested at a displacement of 0.1" @ 12.5 Hz)

Corrosion Ranges from zero to corrosive

Fire +140°C (to melt the polyethylene shielding)
+1370°C (to melt the stainless steel)

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PAGE: 4 of 6

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PROTOTYPE TESTING:

The 4301 & 4302 gauges underwent prototype testing for mechanical, structural, and radiological integrity. No prototype testing was done to determine the effects of fire or explosion. Based on the melting point of the materials involved, it would take temperatures in excess of 1370 °C to melt the stainless steel source capsule and steel probe body and temperatures in excess of 586 °C to melt the aluminum casing. The results of the prototype testing support the assignment of an ANSI standard rating of ANSI-54-164-154-R1.

EXTERNAL RADIATION LEVELS:

See Attachment 1 for Model 4301 radiation profiles for the gauge, and the gauge in the transport case.
See Attachment 2 for Model 4302 radiation profiles for the gauge, and the gauge in the transport case.

QUALITY ASSURANCE AND CONTROL:

Troxler Electronic Laboratories maintains a quality assurance and control program which has been deemed acceptable for licensing purposes by the North Carolina Radiation Protection Section. A copy of the program is on file with the Radiation Protection Section.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

Distribution: This device will be distributed as a specifically licensed device in accordance with the requirements of section .0300 of 15A NCAC 11 and/or applicable regulations of the NRC or an Agreement State. This shall not preclude the exportation of this device to a foreign entity following the applicable regulations.

Leak Testing: The device shall be leak tested by the user following the instructions in the "Manual of Operation and Instruction" at intervals not to exceed **twelve** months using techniques capable of detecting the presence of 0.005 microcurie of removable contamination. If the level of contamination exceeds this limit, the device shall be returned to Troxler Electronic Laboratories for repair/disposal. Please note, Troxler Electronic Laboratories maintains a customer leak test service.

Servicing: The user should periodically inspect the probe release mechanism for dirt and debris. Cleaning and routine maintenance should be done in accordance with the manufacturer's instructions. The entire gauge should be inspected on a regular basis. This inspection should include tightening all screws on the gauge, in particular the screws that hold the handle. The device may be returned to Troxler Electronic Laboratories for preventative maintenance and cleaning.

Dosimetry: All authorized users of these gauges should wear personnel dosimetry (film badges or TLD) in accordance with NRC or Agreement State regulations.

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PAGE: 5 of 6

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Operating and Safety Instructions: The device shall be operated in accordance with the written operating and safety instructions given in the device manual. The access tube **shall** be inserted into the test medium prior to making a measurement. Troxler recommends that the "dummy probe" be used to ensure the patency of the access tube prior to using the probe to make a measurement. The access tube should be kept dry, as water will damage the probe electronics.

Training: Use of these gauges is limited to individuals who have completed an approved training class in the basic principles of radiation safety and the proper use of these gauges. Please note, Troxler Electronic Laboratories provides a training program for gauge users.

Use: The probe should not be removed from the shield except during normal operation of the device.

Reviewer Notes:

1. This registration sheet and the information contained within the references shall not be changed without the written consent of the North Carolina Radiation Protection Section, Radioactive Materials Branch.
2. **The Model 4350, which was part of the 4300 Series in previous iterations of this registration certificate, has been moved to inactive status and assigned SSD No. NC-646-D-831-S.**

DOCUMENTATION:

The documentation enclosed with the device upon shipment to the user shall include the following:

1. manual of operation and instruction,
2. special form certificate,
3. type "A" package testing results,
4. a copy of the final leak test results made prior to packaging,
5. bill of lading,
6. an emergency response information sheet,
7. 4301 or 4302 gauge certificate,
8. Troxler transportation guide.
9. Cable stops

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PAGE: 6 of 6

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SAFETY ANALYSIS SUMMARY:

The design of the 4301 & 4302 gauges makes the devices safe to operate by personnel trained in radiological safety. We conclude that the device can be safely operated by trained individuals and that this device would be expected to maintain its containment integrity for normal conditions of use and historically known accidental conditions which might occur..

REFERENCES:

The following supporting documents are hereby incorporated by reference into this SS&D registry document:

1. Troxler letter with attachments dated October 19, 2005 from Stephen A. Browne, Corporate R.S.O.; electronic messages with attachments dated November 07, 2005 from Stephen A. Browne, Corporate R.S.O., electronic messages with attachments both dated December 6, 2005, both from Stephen A. Browne, Corporate R.S.O., and Registry of Radioactive Sealed Sources and Devices Registration No. NC-646-D-134-S dated March, 1992.
2. Letter with attachments dated February 14, 2006, signed by Stephen A. Browne, Corporate R.S.O.

ISSUING AGENCY: North Carolina Radiation Protection Section, Radioactive Materials Branch

Principal Reviewer



J. Marion Eaddy III, Health Physicist

Date: July 31, 2006

Concurrence Reviewer:



Sharn M. Jeffries, Health Physicist

Date: July 31, 2006

