Design and general information
The shipping case (packaging) container is designed to secure the Model 4640-B Surface Thin Layer Density Gauge and protect it from incidents during normal transportation and shipping. The case provides cavities to secure the gauge and accessories.

Construction
The Troxler Model 105169 Shipping Case is a single-wall case manufactured of low-density polyethylene (LDPE). It has an internal partition of plywood and medium-density foam inserts for padding and component separation. The container is constructed of ultraviolet (UV)-stabilized rotational grade polyethylene intended for rugged industrial use in material handling and shipping cases.

The case is constructed by rotational molding, wherein the material is heated and distributed throughout the mold. When cooled and solidified, the material forms a continuous homogenous structure. Hardware attachment inserts are placed in the mold prior to molding to provide reinforced mounting locations for post-installed hardware. Recessed areas are provided to protect labeling.

Other items included in the package are components such as a gasket for weather resistance, plated steel hinges and draw latches for opening and securing the lid, a steel stay lid, and other components for construction.

Dimensions and weight
- The dimensions of the case are 26.5 in. (L) x 16 in. (W) x 16 in. (H).
- The weight of an empty shipping case is 21 lb.
- The weight of a fully loaded case (i.e., a case that contains a gauge and its accessories) is 78 lb.

Closures and closure system
Packing of the case and placement of materials should be done following the closure instructions for the Model 4640-B gauge. The case incorporates a silicon gasket in the lid to provide weather protection. The container closure is accomplished with hinges and “butterfly” hook-and-clasp latches constructed of heavy-duty, corrosion-protected steel. Closures are attached to the case walls with blind rivets installed into molded-in inserts. Integral security features are incorporated within the latch construction to permit the use of padlocks or security devices.

Shielding
The case itself does not provide any shielding. The gauge has internal shielding that consists of a tungsten shield around the source and a tungsten sliding block.

Packing material
The case is packed in accordance with the closure instructions for the Model 4640-B gauge. The items packed in the case include a Model 4640-B gauge (containing a sealed source), an air gap spacer, a reference block, other accessories, and a documentation packet. Finally, the case is sealed with a security seal or a padlock.
This is to certify that the shipping container described above was tested in accordance with US Department of Transportation (USDOT) requirements and complies with the requirements and specifications set forth in the following sections in "Title 49 - Transportation" of the Code of Federal Regulations (2017):

- 49 CFR 173.410 - General design requirements
- 49 CFR 173.412 - Additional design requirements for Type A packages
- 49 CFR 173.461 - Demonstration of compliance with tests
- 49 CFR 173.465 - Type A packaging tests
General
The package was loaded with the gauge and all accessories in accordance with the closure instructions for the Model 4640-B gauge. The package was then subjected to the performance tests of § 173.455 and evaluated against the successful test criteria specified in § 173.412(j).

Prior to all tests, a radiation survey was performed on the package, and a wipe test was performed to determine if the sealed source was compromised and leaking. Upon completion of the tests, the case was examined, a radiation survey was performed, the gauge was examined, and another leak test was performed.

Water spray test
The package was packed and closed per the closure instructions. The test package was sprayed with water on all four sides for a period of two hours. The simulated rainfall was measured using cylinders adjacent to the test package. The rate of simulated rainfall exceeded the minimum requirement of 2 in. (5 cm) per hour.

Results and damage noted
The water spray had no impact on the case. There was no water found inside the case. There was no damage to the case. There was no loss or dispersal of the radioactive contents, nor was there any significant increase in the radiation levels recorded at the external surfaces for the condition before the test.

Test Performed by: Matt Morehouse
Name
Signature
Date 2/28/18

Test Reviewed by: Michael Veihl
Name
Signature
Date 2/28/18

Test Performed at: Troxler Electronic Laboratories, Inc.
3008 E. Cornwallis Road, Research Triangle Park, NC
Troxler Electronic Laboratories, Inc.
Type A Packaging Tests per 49 CFR 173.465
Model 105169 Case and Model 4640-B Gauge

Free drop test
The package was subjected to the water spray test, and the free drop test was performed immediately after.

The package was loaded and closed per the closure instructions. The test package was lifted to a height of at least 4 ft. and then dropped onto an unyielding concrete floor. The case was dropped on each of the six sides of the case, and then it was dropped on each corner of the case.

Results and damage noted
The case protected the radioactive material. Minor scuffing on the exterior of the case where it impacted the concrete floor was observed. There was no loss or dispersal of the radioactive contents, nor was there any significant increase in the radiation levels recorded at the external surfaces for the condition before the test.

Test Performed by: Matt Macchese
Name ____________________________
Signature ____________________________
Date 2/28/18

Test Reviewed by: Michael Vessi
Name ____________________________
Signature ____________________________
Date 2/28/18

Test Performed at: Troxler Electronic Laboratories, Inc.
3008 E. Cornwallis Road, Research Triangle Park, NC
Stacking test
The package was subjected to the water spray test, and the stacking test was performed immediately after.

The package was loaded and closed per the closure instructions. The stacking weight was calculated as the higher of five times the loaded weight of the package or the "footprint" of the gauge in square inches multiplied by 1.9. An empty case was placed on top of the case, and then the case was filled with weights to the desired total weight. The package was subjected to the load for at least twenty-four hours.

Results and damage noted
The case protected the radioactive material. The stacking did not cause any failure of the case or latches. Minor bulging was observed when stacked, but it disappeared as the weight was released. There was no loss or dispersal of the radioactive contents, nor was there any significant increase in the radiation levels recorded at the external surfaces for the condition before the test.

Test Performed by: Matt Marchese
Name
Signature
Date

Test Reviewed by: Michael Kohl
Name
Signature
Date

Test Performed at: Troxler Electronic Laboratories, Inc.
3008 E. Cornwallis Road, Research Triangle Park, NC
Penetration test
The package was subjected to the water spray test, and the penetration test was performed immediately after.

The package was loaded and closed per the closure instructions, then placed on an unyielding horizontal surface (i.e., a concrete floor). A test bar with a hemispherical end and a mass of 13.9 lb. (6 kg) was raised to a height of 3.3 ft. (1 m). The bar was allowed to free fall so that the hemispherical end struck the center of the case face. Drops were performed on all faces of the case, as well as on the location most likely to impact the radioactive material.

Results and damage noted
The case protected the radioactive material. The impact of the bar created a small mark at the impact site, but it did not penetrate the case. There was no loss or dispersal of the radioactive contents, nor was there any significant increase in the radiation levels recorded at the external surfaces for the condition before the test.

Test Performed by: [Signature]
Test Reviewed by: [Signature]

Test Performed at: Troxler Electronic Laboratories, Inc.
3008 E. Cornwallis Road, Research Triangle Park, NC

Conclusion
The packaging protects the contents under conditions incidental to transportation. There was no loss or dispersal of the radioactive contents, nor was there any significant increase in the radiation levels recorded at the external surfaces for the condition before the test.
Troxler Electronic Laboratories, Inc.
Package Closure Instructions
Model 105169 Case and Model 4640-B Gauge

49 CFR 178.2 - Applicability and responsibility (c) requires that closure instructions be provided “to effectively assemble and close the packaging for the purpose of preventing leakage in transportation. Closure instructions must provide for a consistent and repeatable means of closure that is sufficient to ensure the packaging is closed in the same manner as it was tested.”

Troxler has prepared the following closure instructions in accordance with this guidance.

1. Visually inspect the transport case and contents. Per § 173.461, look for divergence from the specifications or drawings, defects in construction, corrosion or other deterioration, and/or distortion of features. The package and its contents must be evaluated against the guidance of 49 CFR 173.475 - Quality control requirements prior to each shipment of Class 7 (radioactive) materials. (Please see the information regarding this evaluation at the end of the closure instructions.)

2. Lock the source rod in the SAFE position by squeezing the trigger on the handle and lifting the gauge until the source rod locks in the top position.

3. Install the gauge handle padlock through the hole in the handle and close the padlock.

4. Load the following items into the case in any order:
   a. **Air gap spacer**—Place the air gap spacer in the center cavity with the round dowel pins facing up.
   b. **Other accessories**—Place the box containing the chargers in the smaller cutout nested inside the air gap spacer.

   And then load the remaining items into the case in any order:

   c. **Model 4640-B gauge**—Place the gauge base first in the case with the source rod to the left of the case.
   d. **Reference plate**—Place the reference plate in the pocket at the back of the case with the handle on top facing the front.
   e. **Documentation**—Place documentation in the pocket on left side of the case.

5. Once all the items in the package are loaded, close the case lid.

6. To secure the lid, raise the bottom part of the draw (butterfly) catch so that the hook connects with the catch located on the lid. If necessary, extend the hook by rotating the butterfly handle anticlockwise.

7. Rotate the butterfly handles clockwise until the lid is pulled down.

8. Fold the butterfly handles down so that they do not extend from the case.

9. Repeat steps 6 through 8 with all catches.

10. Secure the gauge case with a padlock or a security seal.
Troxler Electronic Laboratories, Inc.  
Package Closure Instructions  
Model 105169 Case and Model 4640-B Gauge

Figure 1. Empty case (open) and items
(a) Air gap spacer  
(b) Other accessories (in a box)  
(c) Model 4640-B gauge  
(d) Reference plate  
(e) Documentation

Figure 2A. Partially loaded case (open)
(a) Air gap spacer  
(b) Other accessories (in a box)
Troxler Electronic Laboratories, Inc.
Package Closure Instructions
Model 105169 Case and Model 4640-B Gauge

Figure 2B. Fully loaded case (open)

(c) Model 4640-B gauge
(d) Reference plate
(e) Documentation

Figure 3. Fully loaded case (closed and locked)
§ 173.475
Before each shipment of any Class 7 (radioactive) materials package, the offeror must ensure, by examination or appropriate tests, that the requirements below are met.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) The packaging is proper for the contents to be shipped;</td>
<td>Evaluate the radioactive material being shipped in the package.</td>
</tr>
<tr>
<td>(b) The packaging is in unimpaired physical condition, except for superficial marks;</td>
<td>Evaluate the packaging.</td>
</tr>
<tr>
<td>(c) Each closure device of the packaging, including any required gasket, is properly installed, secured, and free of defects;</td>
<td>Ensure that each closure device is properly installed, secured, and free of defects.</td>
</tr>
<tr>
<td>(d) For fissile material, each moderator and neutron absorber, if required, is present and in proper condition;</td>
<td>*</td>
</tr>
<tr>
<td>(e) Each special instruction for filling, closing, and preparation of the packaging for shipment has been followed;</td>
<td>*</td>
</tr>
<tr>
<td>(f) Each closure, valve, or other opening of the containment system through which the radioactive content might escape is properly closed and sealed;</td>
<td>*</td>
</tr>
<tr>
<td>(g) Each packaging containing liquid in excess of an A2 quantity and intended for air shipment has been tested to show that it will not leak under an ambient atmospheric pressure of not more than 25 kPa, absolute (3.6 psia). The test must be conducted on the entire containment system, or on any receptacle or vessel within the containment system, to determine compliance with this requirement;</td>
<td>*</td>
</tr>
<tr>
<td>(h) The internal pressure of the containment system will not exceed the design pressure during transportation; and</td>
<td>*</td>
</tr>
<tr>
<td>(i) External radiation and contamination levels are within the allowable limits specified in this subchapter.</td>
<td>Evaluate external radiation and contamination levels.</td>
</tr>
</tbody>
</table>

* No action is required for this package.