

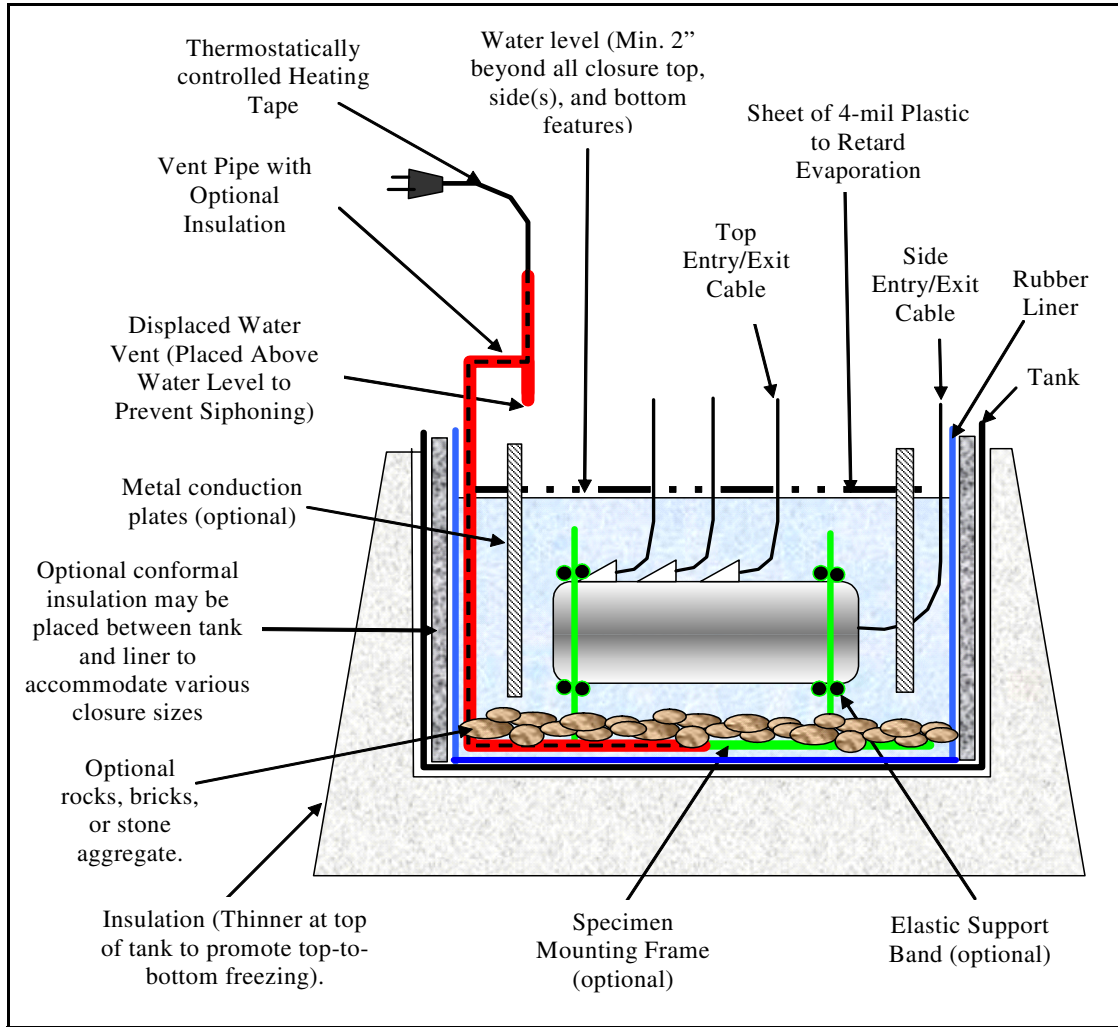
#### 5.4.4.1 Freeze/Thaw Test Method

1. Place the samples into a water tank containing a water soluble fluorescent dye (sodium-fluorescein or equivalent water detection means) to a depth that exceeds all of the closure surfaces by at least 50 mm (2 inches). The ends of the cable stubs must be kept above the water level to prevent water migration through the cable (see **Figure 5-20**).
2. Alternately freeze and thaw the water in the tank for a total of 10 cycles. Maintain a constant water level throughout the test.
3. Visually inspect and verify that a buried or underground closure shows no evidence of water intrusion into the compartment after it is immersed in water and subjected to 10 freeze/thaw cycles.

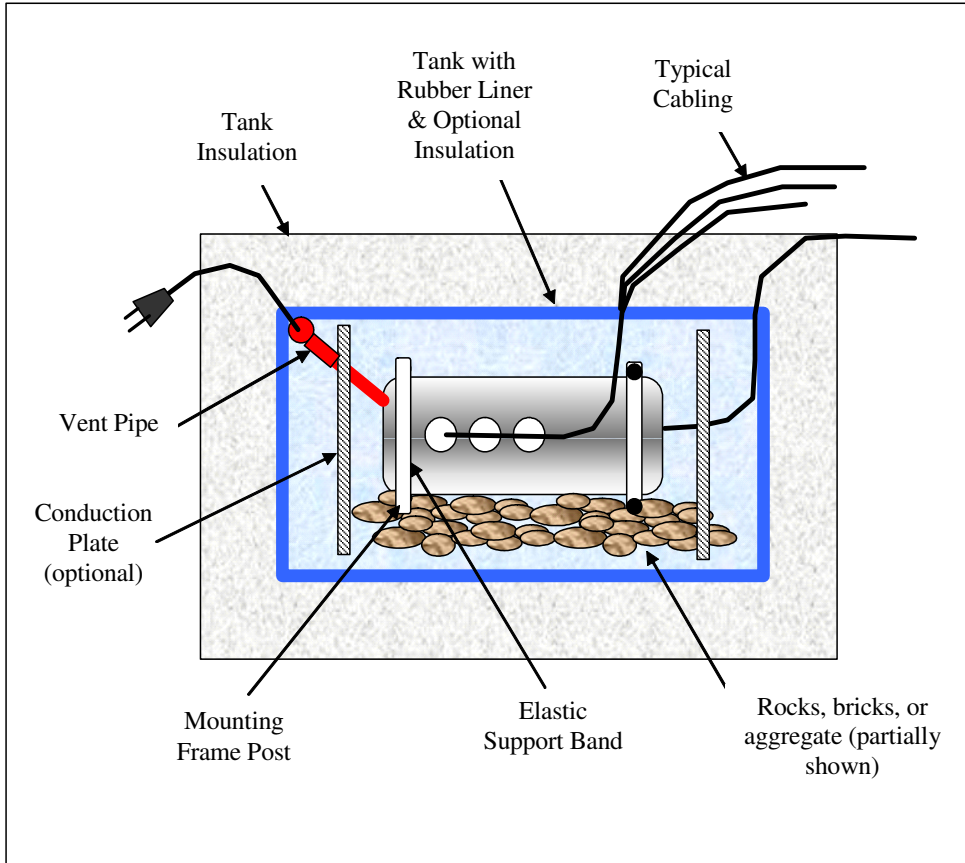
**NOTE:** For sealed products, inspection may have to be postponed until after other tests in the sequence.

4. Record the test results.

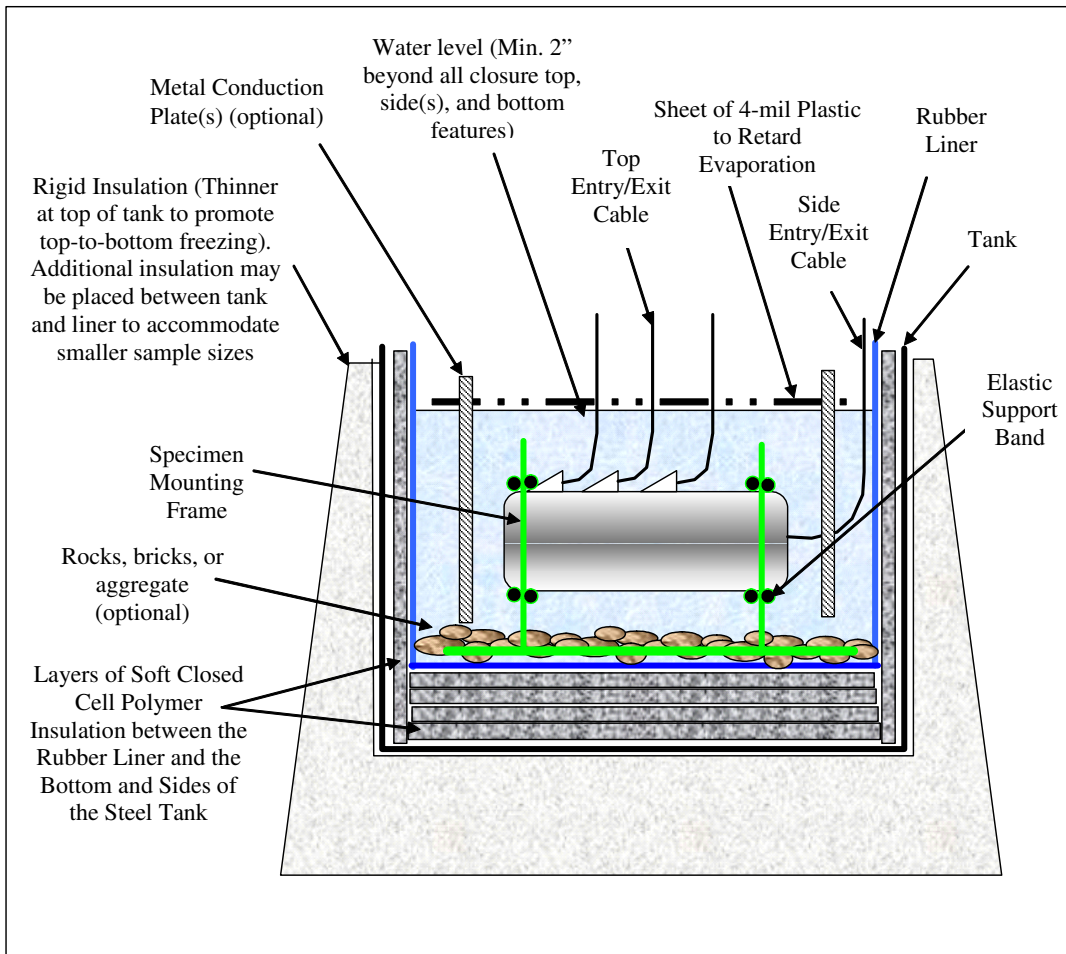
**Figure 5-19** Sectional Side View of Freeze/Thaw Test Setup #1



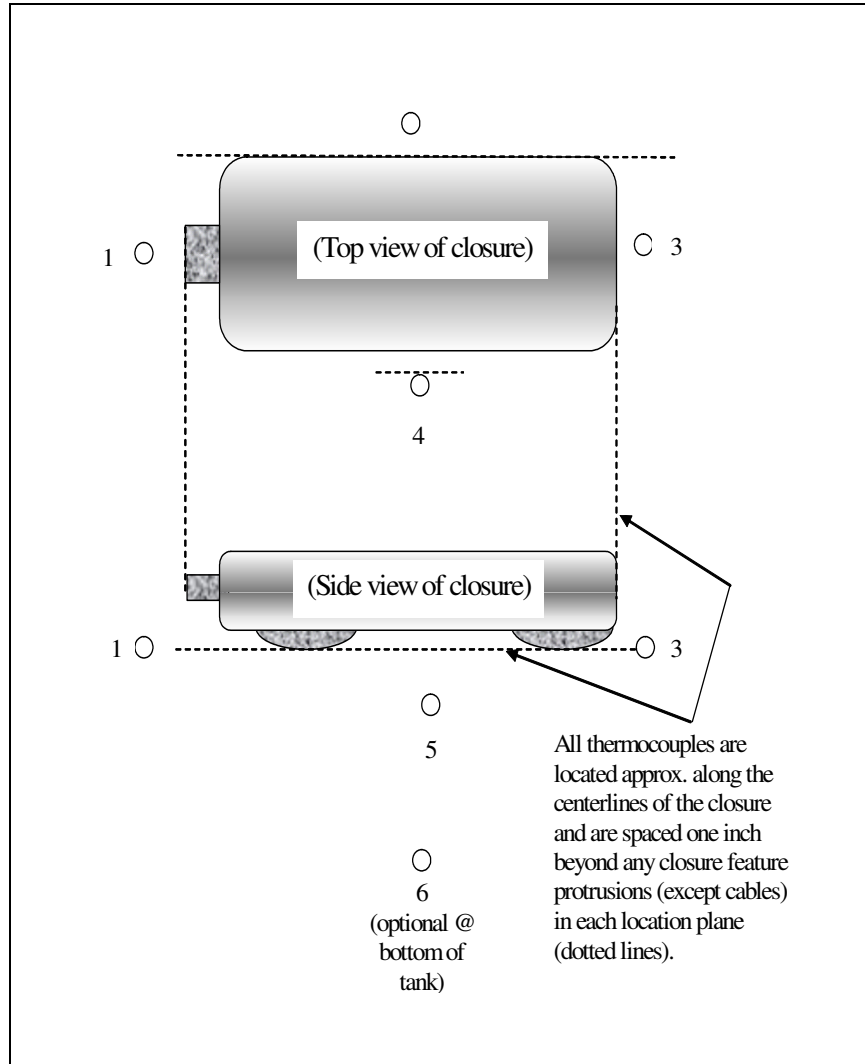
**Figure 5-20** Top View of Freeze/Thaw Test Setup #1



**Figure 5-21** Section Side View of Freeze/Thaw Test Setup #2



**Figure 5-22** Location of Thermocouples



## Criteria

There shall be no evidence of water intrusion upon opening the closure. An ultraviolet light source shall be used to detect the presence of the fluorescent dye.

## Conditional Test Procedure

If required by the end user, a handhole shall be used as the tank. A rubber liner may be used on the outside of the handhole. The smallest handhole that can accommodate the closure shall be used.

## Thermocouples to Identify Freeze/Thaw

Thermocouples located adjacent to the closure(s) shall be used to determine when the water is frozen and when it is thawed. The thermocouple readings will be used to determine the length of time for components of the freeze/thaw cycle. Therefore, the test setup should have the thermocouple readings used to drive the temperature controller of the test chamber.

Four (4) thermocouples shall be placed in a horizontal plane coincident with the bottom (or lowest) surface of the closure under test, with 1 thermocouple located in each of the 4 locations along the center of both sides, and both ends, and shall be spaced 1 inch from the closure. A fifth thermocouple shall be placed 1 inch below and be located at the center of the bottom of the closure under test. Freezing is considered to occur when thermocouples 1 through 5 reach  $-5^{\circ}\text{C}$ . Additional thermocouples may be added such as the optional sixth thermocouple shown in **Figure 5-22**.

Once freezing occurs, the samples shall then be kept at  $-5^{\circ}\text{C}$  or colder (as measured by the thermocouples) for 2 hours. The sample shall then be thawed. Thaw is considered to occur when thermocouples 1 through 5 reach  $+5^{\circ}\text{C}$ . After thaw, the samples shall be kept at  $+5^{\circ}\text{C}$  or higher (as measured by the thermocouples) for 2 hours. This is considered 1 freeze/thaw cycle of the required 10 freeze/thaw cycles.

**NOTE:** If multiple closures are tested in 1 tank, 5 thermocouples per closure shall be used.

## Optical Measurements

Where optical measurements are required, they shall be performed on a minimum of 10 individual fibers or 10% of the total fiber port count, whichever is greater. Optical readings shall be taken at a minimum once every hour.

**NOTE:** For closures with hardened fiber connectors, there is also a requirement that 50% of the ports are capped, and 50% are connected to fiber optic cable. This requirement overrides the 10-fiber monitoring minimum.

Due to limitations in system repeatability, an attenuation change of  $\pm 0.05$  dB is permitted on at least 90% of all fibers monitored with the remaining 10% of the fibers not measuring a change greater than  $\pm 0.15$  dB.

When determining optical measurement pass/fail criteria, consideration should be given based on the components used (splice, connectors, etc.) and the number of these components in the product and test circuit. For environmental tests, all splices and connectors should be out of the environmental test chamber during testing.

### Test Notes

- The closure shall be mounted in the orientation and according to the manufacturer's instructions.
- Mounting hardware provided by the manufacturer shall be used. The portion of the handhole used in the field to secure the product shall be used. This may entail cutting the handhole to obtain the required portion.
- If required by the service provider, a handhole shall be used in the test setup. The handhole shall be part of the test fixture.
- Ensure that 2 inches of water is maintained around the closure, including all connectors and any mounting means.

**NOTE:** For a product mounted directly to the tank or handhole, 2 inches of water is not required between the closure and the tank or handhole surface where it is mounted.

- Ballasts such as rocks or bricks may be used to reduce the total water volume as long as they are not within 2 inches from the product.
- Tap water shall be used. The water level shall be checked after each freeze/thaw cycle. Add additional water if needed to maintain the 2 inches around the device under test. It is recommended that some type of water retention means be provided.
- A heated pressure-relief valve or closed cell foam within the setup (e.g, on the bottom of the test tank) may be used to accommodate at least 8% expansion of the frozen water volume.
- Cables shall be routed as they would be in the field, but be sure not to violate the bend radius of the cable. Samples shall incorporate the largest and smallest size cable being used. If the product is provided with dust caps, samples under test shall have half their ports with dust caps.
- Thermocouples shall be used to help assure a top-down freeze. If multiple products are tested in the same test tank, each product under test shall have its own set of thermocouples. The freeze or thaw is determined based on the highest temperature thermocouple for freeze and the lowest temperature thermocouple for a thaw.

- Metal plates or other methods may be used to facilitate freeze/thaw.  
**NOTE:** Top-down freezing must be maintained.
- Heating elements or other methods may be used to decrease the thaw time.

### End of Test Examination

No water is allowed inside the splice closure as a result of the freeze/thaw exposure. Examination shall be after the 10 freeze/thaw cycles. For sealed closures, this inspection may have to be postponed until after other tests in the test sequence.

### 5.4.5 Weathertightness

This criteria and test applies only to free-breathing closures. The purpose of the weathertightness (dust) test is to determine the extent to which a free-breathing closure prevents the ingress of wind-driven particulate matter.

- R5-28 [89]** A free-breathing closure shall prevent the ingress of wind-driven particulate matter when tested per the procedure described in [Section 5.4.5.1, “Weathertightness \(Dust\) Test Method.”](#) Dust accumulation shall not exceed a white coloration of sample #2 as shown in the Telcordia Observational Standard for Analyzing Dust Accumulation (refer to Appendix B, Figure B-1).

**Table 5-8** Weathertightness Criteria

Deployment Environment	Applicable
Aerial Pole & Strand Outdoor Wall Mount	Yes
All others	No

#### 5.4.5.1 Weathertightness (Dust) Test Method

1. The lab ambient conditions will have a Relative Humidity (RH) of less than 70%.
2. Prior to assembling the closures, place dust collectors inside the closure near all openings and seams. The collectors shall consist of 1.3-cm (1/2-inch) thick, 2.5 × 2.5 cm (1 inch × 1 inch) black conductive foam pads. These pads can be made from black, conductive, high-density, polyurethane foam sheet, Part No. W2754, available from Wescorp (Phone: + 1.650.969.7717), 144 South Whisman Road, Mountain View, CA 94041, or equivalent.