

Testing and inspection of DENSOLEN[®] tape system at the job site

There are four tests to inspect the DENSOLEN[®] tape system:

1. Visual inspection
2. Thickness test
3. High voltage test (Holiday detection)
4. Peel test

1. Visual inspection

Inspect the wrapped pipe thoroughly from all sides for signs of application failures like wrinkles or incorrect overlap (less or more than 50%). Especially the bottom side (6 o' clock position) of the pipe, where most application failures occur, has to be inspected.

2. Thickness test

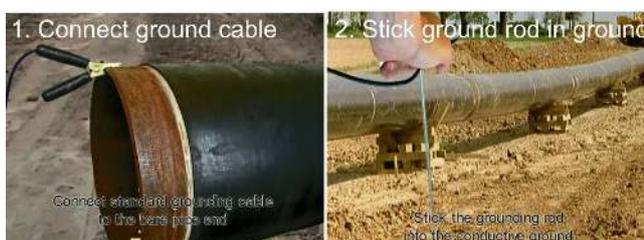
To measure the thickness of the applied coating system a special device, a calibrated coating thickness gauge is used. The thickness of the applied coating system has to be calculated by taking the average of 3 readings around the coated pipe. The result will be compared to the required thickness.



3. High voltage test (Holiday detection)

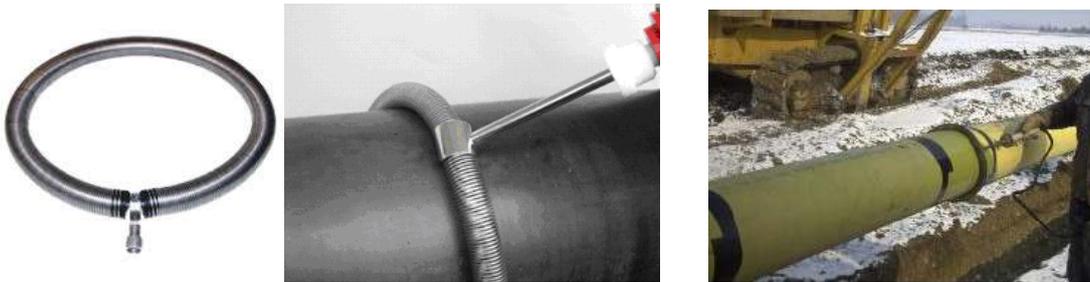
A high voltage test, commonly called Holiday detection test, is a non-destructive test method to detect defects or discontinuities in the coating such as pinholes, holidays (holes) or porosity. The high voltage test detects such coating defects by applying high voltage on the coating surface and checking where current flows to complete the circuit. The holiday detector will make an audible sound where current can flow and electrical arches are visible at coating defects like pinholes and holidays.

Ideally, the ground wire of the high voltage device must be connected directly to the bare steel of the pipe (direct grounding). If this is not possible, an indirect grounding can be done by sticking the grounding rod into the surrounding conductive ground.



There are different types of testing electrodes available:

- The **spring electrode** is the most common electrode used for holiday testing of pipeline coatings since they enable a smooth and constant rolling on the surface. The size of the spring electrode has to be according to pipe diameter to ensure an overall contact between surface and electrode.



- **Brush electrodes** are available in different shapes (flat, circular, semicircular, paint brush). When using a non-circular brush electrode, it has to be ensured that the whole surface of the coating is inspected.



Adjustment of test voltage

The applied test voltage depends upon the nature of the coating material, the thickness of the coating and the required reference standard. For each coating material there are different formulas to calculate the required test voltage.

For example, the test voltage for a PE-Polymeric Tape coating (according to ISO 21809-3:2016 standard, coating type 12) has to be calculated according to the following formula: test voltage = 5kV + 5kV/mm coating thickness with a maximum of 25KV.

i.e. for 2mm PE- Polymeric Tape coating, the test voltage = 15kV

For other specifications and coating materials e.g. coatings for fittings, please refer to manufacturers' information and the relevant standards.

If the voltage is set too high, the coating may be damaged.

Inspection speed

During the testing, the electrode has to be moved at a rate of about 0.3 m/s (1 ft/s) in a single pass. When the probe is moved too quick it is possible to may miss a defect, whilst moving too slow might damage the coating.

Observance of safety instructions

A proper testing device requires regular maintenance. Manufacturer Safety instructions must be observed.

CAUTION: Bearer of cardiac pacemakers is not allowed to operate high voltage test equipment.

4. Peel test

The peel test is a destructive test method by which the adhesion of the tape system can be evaluated. The test method consists of measuring the **peel strength** (peeling force per unit width) between the tape coating and the steel pipe or the factory coating.

As a second criterion of the peel test, it is desired to get a **cohesive failure**. A cohesive failure means that the break is within the butyl layer and hence that there is butyl rubber left on the steel surface so that the steel is still covered with a protecting layer of butyl rubber.

Procedure according to EN12068

The wrapping has to be cut with a double saw or knife around the circumference down to the pipe wall to an inside width of 50mm. This 50mm wide strip has to be cut and lifted on one end from the pipe so that this end can be clamped in the peeling device. Then the strip will be peeled off perpendicular to the axis of the pipe at a constant rate of separation of 10mm/min. For this, it is helpful and commonly used in practice to mark a scale besides the peeling cut. The peeling force has to be recorded continuously.

The first and last 50mm of the peeling length should be disregarded. The value of peel strength is calculated as a mean value in Newton per millimeter width. The coating temperature has to be recorded.



Equipment

- tensile testing
- cutting tool (e.g. knife);
- thermometer