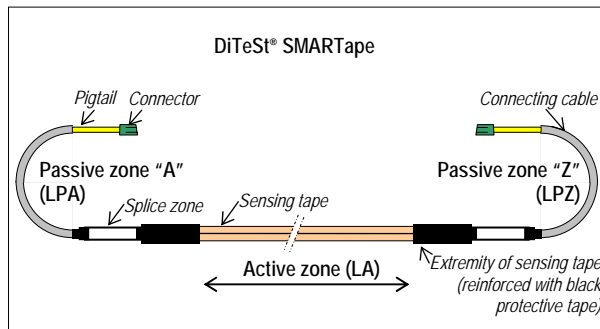


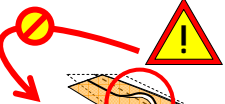
HOW TO INSTALL YOUR DiTeSt® SMARTAPES

Thank you for purchasing DiTeSt® SMARTape sensors. This brochure gives you basic information on how the DiTeSt® SMARTape sensors should be installed in the most common types of applications. If this brochure does not cover your type of installation please contact SMARTEC SA or your local SMARTEC Certified Solution Provider to obtain additional information. Non-specified uses are prohibited.

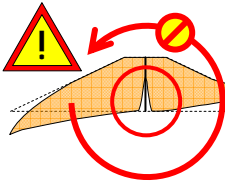
The SMARTape sensor is composed of an active and two passive zones. The active zone (LA) contains the composite sensing tape and it is the part of the sensor that measures deformations hence it is to be in mechanical contact with the structure. The passive zones (LP) contain (i) extremity of sensing tape (reinforced with black protective tape), (ii) splice zone, (iii) connecting cable that guide the optical signal from the reading unit to the sensor and back, and (iv) pigtail with standard E-2000 APC (8°) connectors with a built-in protective cover. In some cases the passive zone(s) is delivered without connectors and the connectorization is performed by splicing. For the reasons of easy identifications, the two passive zones are labelled with letters "A" and "Z" (LPA and LPZ). The passive zones are delivered with plastic protection that is supposed to be kept until the sensor is installed and put in service.



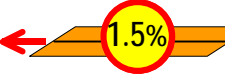
CAUTION



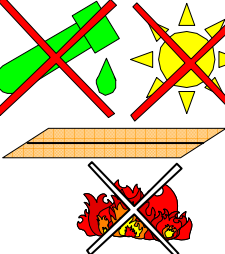
Do not squeeze nor bend the sensing tape in its plane; local buckling of tape can cause delamination of optical fiber



Do not twist nor bend the sensing tape with respect to its axis; it can cause delamination of optical fiber



Do not strain the sensor more than 1.5 %



Do not expose the sensor to acids, fire or permanent sunshine



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DiTeSt® SMARTape Sensor

Installation and Handling
Instructions

Read Carefully Before
Using this Sensor

GENERAL RECOMMENDATIONS

DiTeSt® SMARTape sensors are built to withstand rough handling in typical building site conditions. There are however a few precautions that must be followed to avoid damage and ensure accurate measurements.

The sensing tape part must not be bent nor squeezed in its plane, and must not be twisted nor bended with respect to its axis. These operations can cause delamination of the optical fiber and permanent damage to the sensor.

Bending in plane perpendicular to sensing tape and its axis, as well as bending of pigtails (yellow or green cables) must not be performed with radii lower than 50 mm.

Avoid pulling of the pigtails during the installation. Connectors must be protected from dust and glue during the installation (keep plastic protection during installation).

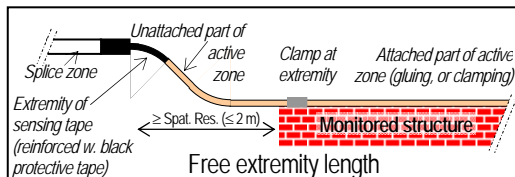
During handling, connecting part must not be excessively bent to prevent local buckling. A sensor with a buckled zone does not work properly. In most cases, restoring the straightness of the sensor also restores its functionality. However, buckling in some cases can cause a permanent damage to the sensor.

Once the sensor is installed, the sensing tape must smoothly follow the surface of monitored structure. After connection to the connection box, protect pigtails (yellow cables) and connectors from water, mechanical, thermal and chemical actions.

The sensing tape is in general installed by gluing, and this procedure is presented in further text. Other installation methods (e.g. embedding, clamping, etc.) do require more specific installation procedure.

The distributed sensor by its nature measures average value of measurand (strain) over certain length (called "spatial resolution").

Since the length of sensing tape extremity (usually 0.5 m) can be shorter than spatial resolution (usually ≤ 2 m), an alteration of measurement can be introduced at extremities of the SMARTape making confusion concerning the start and the end point of the sensor. In order to avoid these effects, it is recommended to leave the extremities of SMARTape free (unattached to monitored structure) in a length that is slightly longer than the spatial resolution of the system (usually ≤ 2 m), as shown in figure.



GLUING OF SENSING TAPE

The gluing is a delicate operation and must be performed carefully respecting gluing procedures. The glue to be used for gluing is to be compatible with both, the sensing tape material (PPS composite) and the construction material on which the tape is to be installed (steel, concrete, composite etc.). It is highly recommended to ask SMARTEC for advice.

Beside the glue, the following accessory material may be required for gluing: scotch tape, isopropyl alcohol, metallic clamps and depending on the construction material steel brush, sandpaper, compressed air and three-chlore-ethylene alcohol.

Before starting the installation, identify and mark on the monitored structure the positions of the sensing tape and connection box. Be sure that conditions presented in the General Recommendations are respected.

The surface on which the sensing tape is to be installed must be clean from any kind of dirtiness including dust, grease, corrosion, paint, etc. and irregularity such as degraded layers of material, sharp points, etc. The cleaning can be performed mechanically (using brush, sandpaper, compressed air, etc.) and / or chemically (using alcohols). It is recommended for gluing to be performed on slightly rough and not fully smooth surfaces in order to increase the adhesion of the glue.

In case of gluing to steel structure it is recommended that last cleaning (after mechanical cleaning) is made with three-chlore-ethylene alcohol. In case of concrete, since porous, the last cleaning is to be performed with compressed air. In case of composite material the last cleaning is to be performed using isopropyl alcohol. Before gluing, also the sensing tape is to be cleaned using isopropyl.

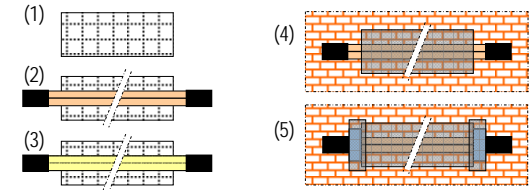
The optical fiber is not prestrained inside the sensing tape. In case of gluing, the sensing tape interacts with the monitored structure over all its length and there is no need to prestrain it.

The glue is to be applied on sensing tape or both sensing tape and the structure depending on type of the glue (read instructions delivered with the glue). Apply the glue only on the sensing tape and not on the extremities reinforced with black protective tape – they are not to be glued to the structure.

Since the glue is commonly very viscous before setting, it is necessary to prevent sliding of the sensing tape during the setting period using the aluminum scotch-tape. The scotch tape with a width of at least twice the sensing tape is to be deployed on a flat horizontal surface with the gluing part on the top (1); then the sensing tape placed and glued along the axis of the scotch (2); the glue is applied to the sensing tape (3) and assembly of the scotch and the sensing tape glued to the structure (4). The aluminum scotch tape in general should not be removed and remains as a protection of the SMARTape.

The glue guarantees good shear bonding between the sensing tape and the monitored structure. However, the peeling is often not

prevented. That is why it is recommended to ensure the extremities of the sensing tape with small metallic clamps, screwed or glued with the same glue and at the same time as the sensing tape (5). The gluing steps are presented in figure below.



The setting time of the glue varies depending on type of glue and temperature of the structure (read carefully the instructions delivered with the selected glue). The best performance is obtained in general for gluing at temperatures ranged between 15°C and 30°C. Gluing at low temperatures is not recommended and if it is necessary to be performed, please address to SMARTEC for more specific procedure.

When installing the connection box and the passive zone make sure it doesn't perturb the functioning of the sensor.

After the installation, the SMARTape sensor is to be protected against water, mechanical and thermal actions, and in the most cases the aluminum scotch-tape provides sufficient protection. Finally, installed and protected sensor is tested using the DiTeSt® reading unit.

CONNECTOR CLEANING

If the connectors are not handled properly or are directly exposed to a dusty environment, they might become dirty and need cleaning. It is a good practice to clean the connectors when permanent connections are made (sensor to connection box or to extension cable) or after a long time without using the sensors.

A sign that the connectors need cleaning is low voltage level indicated by DiTeSt® reading unit.

To clean a connector proceed like this:

- Open the connector protective lid by flipping it backwards.
- Gently rub the connector front surface on a clean tissue impregnated with Isopropyl alcohol. The tissue should not release fibers of particles.
- Gently rub the connector front surface on a dry clean tissue.
- Close the protective lid.

The connector surface can be examined with an adequate microscope (available through SMARTEC SA).