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MOUNTING GUIDELINES

ST-675-SIAD-001 TAG

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1 INTRODUCTION

This document provides general mounting guidelines for the modified 675 tag. The modified 675 tag is designed to fit non-ISO standard containers; specifically refrigeration containers.

1.1 Project Background

The DLA has contracted Savi to develop a tracking and sensor solution for refrigerated containers.

1.2 Purpose

The purpose for this Installation Document is to give general guidelines for mounting the modified 675 tag.

1.3 Intended Audience

This document is mainly intended for the end user who will be commissioning tags and placing them on containers.

2 Components

The section contains facts about each component that makes up the modified 675 tag.

2.1 Modified ST-675 Tag

This section contains facts pertaining to the modified 675 tag.

2.1.1 Description

The Savi SensorTag™ ST-675 is the latest innovation for tracking ISO shipping containers, providing new levels of door security monitoring, with active RFID intrusion and environmental sensors. More than a simplistic inspection automation system, the Savi SensorTag ST-675 enables shippers, carriers and logistics service providers to actively monitor the security and integrity of shipments as their containers move throughout the global supply chain. The Savi SensorTag ST-675 provides both security tampering sensors to detect potential theft and prevent terrorist threats, and detects environmental changes to prevent spoilage or the damage of goods.

The modified ST-675 tag maintains the same feature set but is modified to fit non-ISO standard containers, specifically refrigeration containers. This is accomplished by replacing the C-clamp used for mounting onto ISO containers with a Kevlar protected flex circuit and specially designed mounting plates. The Kevlar protected flex circuit is designed to form to the differing shapes and sizes of the various refrigeration container models. The flex circuit connects the externally mounted antenna with the internally mounted sensor tag.

2.1.2 Features

The Modified Savi SensorTag St-675 design includes:

- Universal mounting capability for non-ISO standard containers.
- Tag compartment resides inside the container.
- Removable battery, hermetically sealed within the tag compartment.
- Externally mounted, low profile antenna encasement.
- Audio beeper for location notification and alarms.

Transportation Security

The Savi SensorTag ST-675 consists of a high performance active RFID tag for real-time ISO container tracking during transit, including sensors that detect any unauthorized opening of the container, alerting security personnel immediately of problems. The Savi SensorTag ST-675 provides two different sensor mechanisms to determine container intrusion or tampering via the container doors. The Savi SensorTag ST-675's sensor arm detects the open status of the adjacent door, and the intrusion light sensor monitors the amount of light entering the container near the doors.

Environmental Monitoring

The Savi SensorTag ST-675 also monitors the environmental conditions inside the container. Any change in temperature is detected as the container moves through ports, terminals and key transportation routes worldwide. To monitor the acceptable environmental condition, the user sets the condition range within the Savi SensorTag.

If the collected data should rise above or fall below this set range, the Savi SensorTag writes the data, time, and date of this alarm event to an event log in the Savi SensorTag memory. A real-time alarm is then sent to a fixed or mobile RF reader and the temperature condition change is escalated via a web application, cell phone or email notification, allowing it to be addressed immediately before spoilage or damage occurs. In addition, the unit provides a sensor expansion port (Wireline RS-485 Port Expansion) for adding local or remote sensor capabilities, as required.

2.2 Adhesives

2.2.1 3M 5952 VHB Tape

The 3M 5952 VHB tape is utilized to fasten the mounting hardware to the container. This tape provides a semi permanent bond without compromising the integrity of the container. This particular tape was chosen based on its performance on painted surfaces.

3M™ VHB™ Tapes provide the convenience and simplicity of a tape fastener and are ideal for use in many interior and exterior bonding applications. In many situations, they can replace rivets, spot welds, liquid adhesives and other permanent fasteners. These 3M™ VHB™ Tapes are made with acrylic foam which is viscoelastic in nature. This gives the foam energy absorbing and stress relaxing properties which provides these tapes with their unique characteristics. The acrylic chemistry provides outstanding durability performance.

These tapes utilize a variety of specific foam, adhesive, color and release liner types to provide each product/family with specific features. These features can include adhesion to specific or a broad range of materials, conformability, high tensile strength, high shear and peel adhesion, resistance to plasticizer migration, and UL746C recognition. All 3M™ VHB™ Tapes have excellent durability and excellent solvent and moisture resistance.

The 3M 5952 family matches the modified acrylic adhesive on both sides of very conformable foam, providing adhesion to the broadest range of substrates, including most powder coated paints.

Dynamic Adhesion Performance

90° Peel Adhesion	Normal Tensile	Dynamic Overlap Shear
20 lb/in 350 N/100 mm	90 lb/in ² 620 kPa	80 lb/in ² 550 kPa

Operating Temperature Range

-35°C to 90°C

3 Installation of Tag

The tag's mounting method is designed to be installed once for the duration of the containers service. The modified ST-675 tag can then be attached and removed rapidly for efficient tracking. There are several varying models of refrigeration containers, as such; various component placements will be employed. The following sequence should be followed for each new container model:

1. Determine best tag location
2. Surface Preparation
3. Tag installation

3.1 Determine Best Tag Location

The tag shall always be mounted on the left container door. The tag can be mounted anywhere along the edge, however mid door is most common. The location should be clear of any obstruction or damage.



For the antenna, some container models may not have adequate space between the edge of the door and the locking bar. In these instances, the antenna may be mounted on the far side of the locking bar.

3.2 Surface Preparation

The tag shall be fastened to the container utilizing 3M 5952 family VHB tape; as such surface preparation is key to the success of the bond. Further information can be found at 3M's website.

3.2.1 Summary

Most substrates are best prepared by cleaning with a 50:50 mixture of isopropyl alcohol (IPA) and water* prior to applying 3M™ VHB™ Tapes. Exceptions to this general procedure that may require additional surface preparation include:

- **Heavy Oils:** A degreaser or solvent-based cleaner may be required to remove heavy oil or grease from a surface and should be followed by cleaning with IPA/water.
- **Abrasion:** Abrading a surface, followed by cleaning with IPA/water, can remove heavy dirt or oxidation and can increase surface area to improve adhesion.
- **Adhesion Promoters:** Priming a surface can significantly improve initial and ultimate adhesion to many materials such as plastics and paints.
- **Porous Surfaces:** Most porous and fibered materials such as wood, particleboard, concrete etc. need to be sealed to provide a unified surface.
- **Unique Materials:** Special surface preparation may be needed for glass and glass-like materials, copper and copper containing metals and plastics or rubber that contain components that migrate (e.g. plasticizers).

3.2.2 General Procedure

- To obtain optimum adhesion, the bonding surfaces must be well unified, clean and dry. Typical surface cleaning solvents are IPA/water mixture (rubbing alcohol) or heptane.*
- Bond strength is dependent upon the amount of adhesive-to-surface contact developed. Firm application pressure develops better adhesive contact and helps improve bond strength. Generally, this means that the tape should experience at least 15 psi (100 kPa) in roll down or platen pressure.
- After application, the bond strength will increase as the adhesive flows onto the surface. At room temperature, approximately 50% of the ultimate strength will be achieved after 20 minutes, 90% after 24 hours and 100% after 72 hours. In some cases, bond strength can be increased and ultimate bond strength can be achieved more quickly by exposure of the bond to elevated temperatures (e.g. 150°F [66°C] for 1 hour).

3.3 Tag Installation

The Tag should be attached prior to cooling the container. This will allow for the fastest cure time. To fasten the tag to the container:

1. Remove red liner from 3M VHB tape to back of mounting plate. Make sure tape is located so it will make good contact with metal surface and NOT any rubber gasket material.
2. Press Tag half into position.

3.4 Setting Door Alarm Lever

Once the tag is attached into the container the door sensor alarm must be adjusted. Utilizing the SMM handheld, and the supplied adjustment tool, adjust the extension arm as to set the door sensor to 75.

3.5 Flex circuit

Ensure that the flex circuit is inserted in the container as the right side door is shut, not allowing any excess that may exist to extrude to the outside.