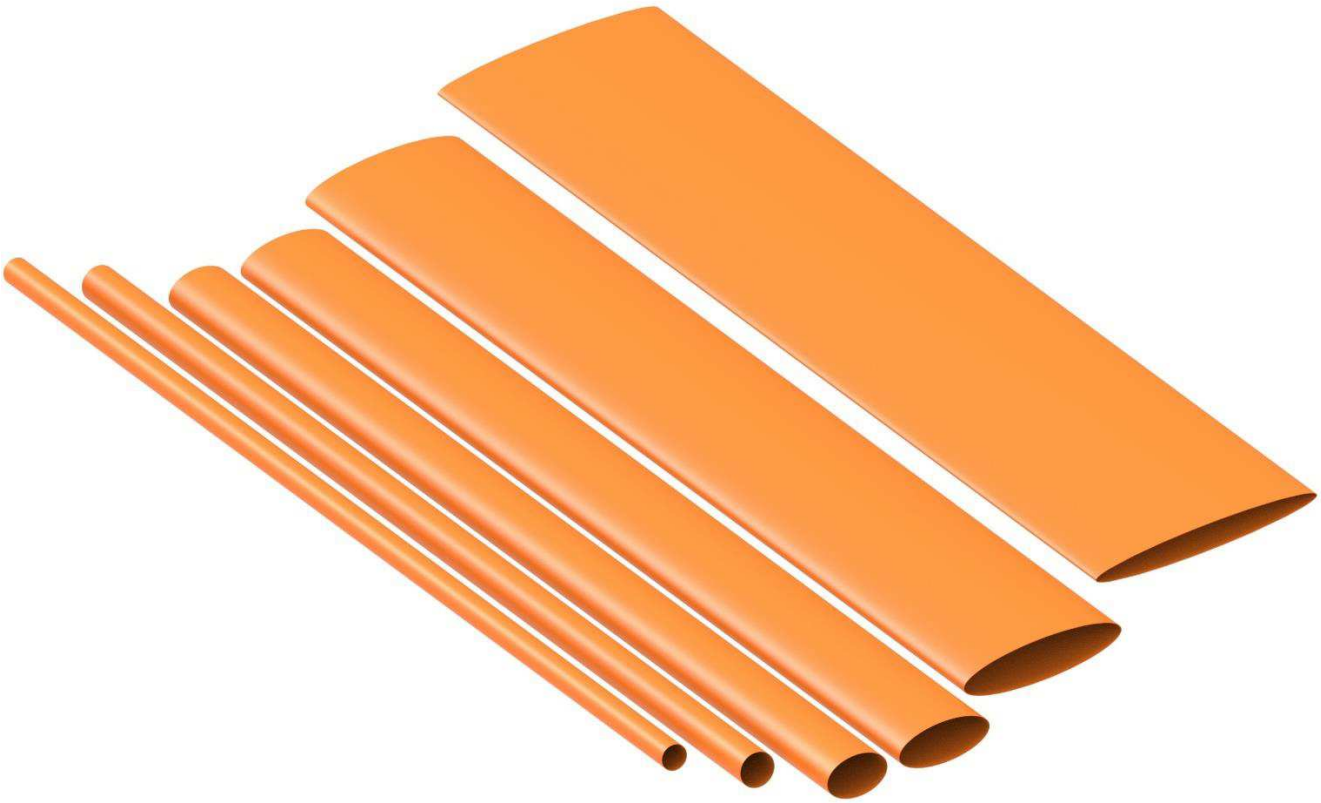
Size Selection & Installation of EV Single Wall (EVSW) Heat Shrink Tubing



NB: The recommendations presented here are based on general industry information.

Since TE Connectivity does not have knowledge of the specific application and the end use conditions of all users, each user should determine the correct size of tubing together with the installation conditions for their own application and evaluate against their individual requirements.

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1. SCOPE

This document outlines the general guidelines for selection and installation of EV Single Wall (EVSW) heat shrink tubing from TE Connectivity.

2. REVISION HISTORY / REASON FOR CHANGE / RELATED DOCUMENTS

Rev	Date	Prepared By	Approved By	Remarks
A	Mar 2023	Kamalasaravanan	Richard Kewell	New document

2.1. Customer Assistance

Reference Product Base Part Number and Product Code are representative of. Use of these numbers will identify the product line and help you to obtain product and tooling information when visiting www.te.com or calling the number at the bottom of page 1.

2.2. Drawings

Customer drawings for product part numbers are available from www.te.com. The information contained in Customer Drawings takes priority if there is a conflict with this specification.

2.3. Specifications

Latest revision of Product Specification 108-120071 available from www.te.com provides product performance and test results.

2.4. Shelf Life

Refer document Global Dimensional Life for Heat Shrink Tubing Standard Size Products 408-32191-APL for details regarding the shelf life.

2.5. Safety

Appropriate Personal Protective Equipment (PPE) should be worn, and installation should take place with fume extraction or in a well-ventilated area.

3. TUBING SIZE SELECTION AND INSTALLATION GUIDELINES

3.1. Introduction

This guide has been produced to aid in the application of the range of EVSW heat shrink tubing for cabling, fixtures, and busbars. This product is flame retardant (UL224 VW-1) and is generally suitable for utilization within electrical vehicle applications on voltage systems up to 2500V and a maximum continuous operating temperature of 135ºC.

NB: The recommendations presented here are based on general industry information. Since TE Connectivity does not have knowledge of the specific application and the end use conditions of all users, each user should determine the correct size of tubing together with the installation conditions for their specific individual requirements.
(Refer to TE Connectivity to ensure latest issue of this document)

3.2. Tube Size Selection

a. Always select the largest size of the tube that will snugly fit onto the substrate. This will maximise the installed wall thickness and provide better protection. Ensure not to force fit the size for the application.

b. Carefully cut the tubing to the required length using a sharp knife or other suitable cutting equipment ensuring that it is a clear cut having the cut edges clean and free from burrs. An improper cut may result in a possibility of a split at the tubing end

c. Longitudinal shrink depends on the amount of radial shrink happened while shrinkage. In general, for a lesser radial shrink application, longitudinal shrink will be of 1-2% and for larger radial shrink application, longitudinal shrink will be of 3-4%

d. The below dimensions are for guidance only and that the actual values are available on the latest version of the Product Specification or Customer drawings available from www.te.com.

Size	Inside Diameter as Supplied (Min) - D		Inside Diameter after recovery (Max) - d		Nominal wall thickness after recovery (W)	
	mm.	in.	mm.	in.	mm.	in.
10/5	10.00	0.394	4.50	0.177	0.64	0.025
12.7/6.4	12.70	0.500	6.40	0.252	0.64	0.025
20/9.5	20.00	0.787	9.50	0.374	0.76	0.030
26/12.7	26.00	1.024	12.70	0.500	0.88	0.035
40/19	40.00	1.575	19.00	0.748	1.01	0.040
50/25	50.00	1.969	25.00	0.984	1.14	0.045

3.3. Installation Guidelines

It is recommended that local safety regulations are adhered too, and that installations are carried out in a well-ventilated area with adequate fume extraction. It is further recommended that operators wear heat resistant gloves when installing and handling hot heat shrink products, and that contact with molten material be avoided. Wash hands before eating, drinking, or contacting the face with the hands.

Installation of the EVSW product can be achieved via a heated air circulating oven, heat gun, or belt heater, dependent on specific application circumstances. In general, the length of time and the precise temperature required to fully shrink the product will be dependent on the associated thermal masses and thermodynamics. A piece of tubing will require more heating to achieve full recovery if it is associated with a large thermal mass, such as a large metal conductor. When recovered, the minimum wall thickness should not be less than 0.4mm on a flat or circular surface where the applied voltage is intended at 2500V, Wall thickness should be more than this minimum value if it is intended to cover sharp corners of bends.

a. Locate the tubing into place on the substrate e.g., cable or conductor. Ensure not to stretch the tube whist positioning.

b. Start to shrink the tubing starting from one end of the assembly. See figure 1.
Figure 1.

c. Work progressively to the end of the tubing ensuring uniform heat application. This can be achieved by either rotating the assembly or the heat gun. See figure 2. Ensure there is no air entrapment inside.

Figure 2.

d. Ensure that the end of the heat gun does not touch the exterior of the tubing otherwise splitting may occur. Considering the temperature profile of hot air from the heat gun, maintain appropriate distance between hot gun and the tubing.

e. Avoid overheating the product after shrinkage has occurred. Stop heating immediately if the product blisters, chars or shows other signs of degradation. As a warning, tubing will start to turn glossy or shiny on overheating. Avoid inhaling fumes which may be released and ventilate the area thoroughly before resuming work.

f. The completed assembly should be free from cold spots and wrinkles and conform to the shape of the substrate. See figure 3.

Figure 3.

Note:

- Supplied tubes will be of a pale shade of recovered colour. Please note that the colour of the tubing concentrates during shrinking
- Nature of the substrate dictates the installation time. For example, metal substrate will take away a part of heat supplied due to their thermal conductivity and hence will take longer time compared to a plastic substrate.
- Ensure that the substrate is clean before application of the tubing. Usage of wires after long storage time in substrate may cause split in the tubing during longitudinal shrinkage
- Similar philosophies should be used when using ovens or belt heaters.
- For air circulating ovens the heating is more uniform and should not require mechanical manipulation of the product. Ensure that the product is appropriately positioned within the oven, which should be pre-heated. The temperature and time required within the oven will be dependent on the characteristics of the substrate, as is the case for operation within a belt heater.
- For installations with other types of equipment, please consult your TE Connectivity representative.

4. TROUBLE SHOOTING

Fault	Possible Cause	Solution
Tube not fully shrunk onto substrate	Insufficient heat	Increase heat.
	Insufficient time	Increase heating time
	Wrong tube size	Consult Tube Selection

Tube mislocated after installation	Incorrect location prior to installation Tube unbalanced	Locate correctly (offset) Consult local TE Connectivity rep
Tube partially recovered at one end	Tube did not align centrally in application equipment	Use guidelines on machine for centralisation Check calibration
Tubing or wire overheated	Excessive heat Excessive time	Reduce heat Reduce heating time
Tubing scorched on one side	Excessive wire curvature Tube located incorrectly in machine	Use straightened wire Reposition tubing
Tubing splits	Sharp edge of nugget/crimp Wire strand loose Tube overheated Wrong tube size selected	Check tooling Reduce heat/time Reassess
Wire strand pokes through tube	Wire strand loose from welding	Check welder tooling Check splice construction
Cannot cover	Inadequate heat Incorrect size of tube Too many wires Contamination on wires Inadequate covering zone	Increase heat Refer to sizing guide Reconstruct tubing Clean substrate Check process
Wire damage at tubing edge but tubing visually OK	Overheat Excessive time Tube not centred in machine Mismatch of tube/wire Temperature rating	Reduce heat Reduce time Use guides on machine Reduce heat/time