Installation Practices Guide

Safe-T-Cable® *Application/Installation information which appears on these pages was adapted from a U.S. Military Handbook. It is intended for reference only. It is the responsibility of the user to verify and confirm that the installation of* **Safe-T-Cable®** *is safe and appropriate for the application.*

1. Safe-T-Cable®

1.1. General Instructions for the selection of Safe-T-Cable®. The selection of materials shall be in accordance with AS4536 (SAE), available from SAE International, 400 Commonwealth Avenue, Warrendale, PA 15096-0001, and shall be in accordance with the service limitations outlined herein.

NOTE

Minimize mixing of safety wire and Safe-T-Cable®.

1.1.1. AS3510 series (UNS S32100 CRES) Safe-T-Cable® shall be selected for general purpose use on all applications up to 800° F.

1.1.2. AS3509 series (UNS N6600 Nickel Alloy) Safe-T-Cable® shall be selected for applications where temperature range is between 800° F and 1500° F or electrical related applications where magnetic materials cannot be used.

1.1.3. AS3655 Series (UNS N0625) Safe-T-Cable® shall be selected for applications where corrosion resistance is required. This includes fasteners in direct contact with salt water or chemicals.

1.1.4. Only Safe-T-Cable® and ferrules supplied by a manufacturer that meets all the requirements of AS4536 shall be allowed.

1.1.5. Safe-T-Cable® shall not be used for any shear, or break away applications.

1.1.6. Safe-T-Cable® shall be installed with a calibrated tool which is supplied by the Safe-T-Cable® manufacturer for the purpose of applying a predetermined cable tension, crimping the ferrule, and cutting the excess cable without allowing tension to be lost.

1.2 The size of Safe-T-Cable® shall be in accordance with the following requirements:

1.2.1. 0.022 inch diameter Safe-T-Cable® is intended for use on parts having a nominal hole diameter of 0.045 inch (1.14 mm) or smaller.

1.2.2 0.032 inch diameter Safe-T-Cable® is intended for use on parts having a nominal hole diameter of 0.075 inch (1.91mm) or smaller.

1.2.3. 0.040 inch diameter Safe-T-Cable® is intended for use on parts having a nominal hole diameter of 0.095 inch (2.41 mm) or smaller.

1.2.4. The specified length of the cable shall be selected to accommodate the span between fasteners added to the length of cable required to correctly engage the application tool.

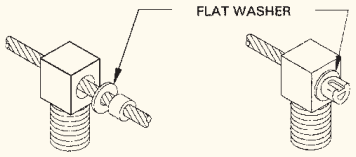


FIGURE 1: FLAT WASHER SAFE-T-CABLE

FIGURE 1: Flat Washer Safe-T-Cable® Installation

1.2.5. Applications where Safe-T-Cable® is to be installed through a hole having a nominal diameter of greater than .095 inch (2.41 mm), but less than .200 inch (5.08 mm) shall require a flat washer (same material composition as the Safe-T-Cable®) which is supplied by the Safe-T-Cable® manufacturer for this purpose, and shall be used as shown in Figure 1.

1.2.6. Safe-T-Cable® shall be installed with an application tool which has been calibrated to meet the performance requirements of AS4536 (SAE) and this manual.

1.3. Safe-T-Cable® Installation. Safe-T-Cable® may be used as a substitute for Safety Wire to prevent loosening during service. Threaded parts, such as drilled-head bolts, fillister head screws, turnbuckles, thumbscrews, hose fittings and electrical connectors, plugs, caps, and similar items are within the scope of the Safe-T-Cable® application. The following rules shall apply when using Safe-T-Cable®.

NOTE

Routing of Safe-T-Cable® may vary from that of Safety Wire in order to achieve a proper installation.

1.3.1. When Safe-T-Cable® is being substituted for Safety Wire in an existing installation (maintenance, rework, etc.), equivalent diameter Safe-T-Cable® to that of the Safety Wire shall be selected for use, providing that selection criteria for Safe-T-Cable® as defined in the section 1.1 (General Instructions) are met.

1.3.2. Adjacent Units: Safe-T-Cable® shall be installed in such a manner that any tendency for a fastener to loosen will be counteracted by an additional tension on the cable. Safe-T-Cable® shall be threaded through the fasteners in such a way as to produce installed Safe-T-Cable® with either positive or neutral pull.

1.3.3. Maximum Span: The maximum span of Safe-T-Cable® between two termination points shall be 6 inches (152.4 mm) unless otherwise specified.

1.3.4. Installing Defects: Any cable defect (nick, fray, kink, or any other mutilation of the Safe-T-Cable®) found prior to, during, or subsequent to installation, is not acceptable.

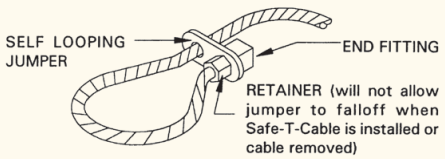


FIGURE 2: Self Looping Safe-T-Cable®

NOTE

Avoid kinks or sharp bends while handling and threading Safe-T-Cable®.

1.3.5. Installing Holes: Safe-T-Cable® must be installed through the holes intended for this purpose in the part being secured, or through the holes provided in a self looping device (Figure 2) secured to the Safe-T-Cable® by the Safe-T-Cable® manufacturer. In applications where holes are not provided for Safe-T-Cable® in the component to which it is attached the self looping Safe-T-Cable® may be used in a manner like, or similar to, Figure 3.

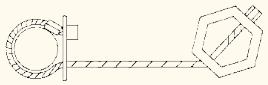


FIGURE 3: Self Looping Safe-T-Cable® Anchored to a PIN Assembly

1.3.6. Safe-T-Cable®/Ferrule Reuse: Safe-T-Cable® and ferrule shall be new upon each application. Reuse is not allowed.

1.3.7. Installation: Various examples of Safe-T-Cable® installation are shown in this section. All possible combinations and applications are not shown. Unless otherwise specified in the application engineering drawing, Safe-T-Cable® shall be installed in two or three bolt patterns with two bolt patterns being the preferred method where an even number of fasteners are to be secured. The installer must adhere to the basic rules outlined in this manual.

1.3.8. Hose Fittings and Electrical Connector Requirements: Hose Fittings and electrical coupling nuts shall have Safe-T-Cable® installed in the same manner as tube coupling nuts.

1.3.9. Excess Cable: After installing Safe-T-Cable®, excess cable from the crimped ferrule shall be cut by the installation tool. The maximum allowable length of cable extending beyond the ferrule shall be .031 inch (0.79 mm).

1.3.10. Crimping Requirements (Pull-Off Load, refer to Table 1): Safe-T-Cable® shall be installed with the Safe-T-Cable® manufacturers recommended tool, which has been tested and calibrated in accordance with procedures specified in this manual.

TABLE 1 - Safe-T-Cable® Minimum Crimp Requirements (Pull-Off Load)		
Nominal Cable Diameter inch (mm)	Safe-T-Cable® Construction	Minimum Pull-Off Load lbf (N)
.022 (0.51)	1 X 7	30 (133.4)
.032 (0.81)	3 X 7	70 (311.4)
.040 (1.02)	7 X 7	110 (489.3)
.062 (1.57)	7 X 19	280 (1245.4)

1.3.11. Hole Alignment: Undertorquing or overtorquing to obtain proper alignment of the holes is not permitted. Apply recommended torque values to parts to be secured and alignment of holes shall be evaluated before attempting to proceed with Safe-T-Cable® installation.

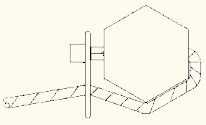
CAUTION

The maximum bend exit limit of Safe-T-Cable®, when applied to a threaded fastener head, shall be 135°. This does not apply to hose fittings, electrical connector coupling mechanisms, turnbuckles, and similar applications where the Safe-T-Cable® is constrained by the shape of the component being secured.

1.3.12. In applications where Safe-T-Cable® shall be required to exceed the 135° maximum bend exit limit in order to achieve neutral to positive pull on a threaded fastener head, a self looping device which is secured to the Safe-T-Cable® by the Safe-T-Cable® manufacturer may be used to obtain a secured installation as shown (Figure 4).

CAUTION

This method should only be used in applications where the Safe-T-Cable® can not "flip" over the corner or over the head



of the fastener being secured.

FIGURE 4: Self Looping Safe-T-Cable® in High Bend Exit Application

1.3.13. Cable Flex Limits: After installing Safe-T-Cable®, the maximum flex between termination points shall be no greater than that specified in the Cable Flex Limit Table (Table 2).

NOTE

Light finger pressure of approximately 2 pounds shall be applied at mid-span when inspecting total flex limit of installed Safe-T-Cable®.

TABLE 2 - FLEX LIMITS - Inch (mm)		
A	B	C
0.5 (12.7)	0.125 (3.18)	0.062 (1.59)
1.0 (25.4)	0.250 (6.35)	0.125 (3.18)
2.0 (50.8)	0.375 (9.52)	0.188 (4.76)
3.0 (76.2)	0.375 (9.52)	0.188 (4.76)
4.0 (101.6)	0.500 (12.70)	0.250 (6.35)
5.0 (127.0)	0.500 (12.70)	0.250 (6.35)
6.0 (152.4)	0.625 (15.88)	0.312 (7.94)

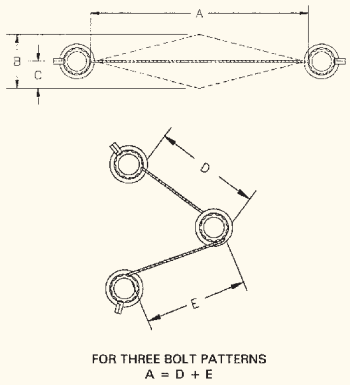


FIGURE 5: Safe-T-Cable® Flex Limits

It is important to hold the tool as steady and perpendicular to the fastener as possible during the crimp/cut cycle in order to maintain consistent tensioning of the cable after the tool is removed.

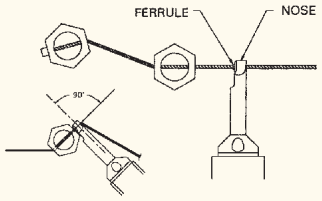


FIGURE 6: Correct Application of Safe-T-Cable®

1.4. Elongated Ferrules: Ferrules of extra length, having a radius* at one end and a straight surface at the other end, may be used in applications which restrict the clearance for the installation tool nose to be placed in correct alignment with the fastener (such as low profile fastener heads, recess locations, or obstructions by structures or installed components).
*Radius not required for .022 Elongated Ferrules

NOTE

Always install elongated ferrules with the radius end toward the fastener and the straight end in the tool crimp cavity. Double check cable tension between fasteners after removal of application tool.

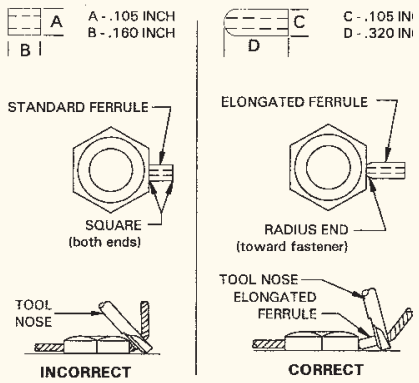


FIGURE 7: Low Profile Application For .022, .032 and .040 Inch Safe-T-Cable®

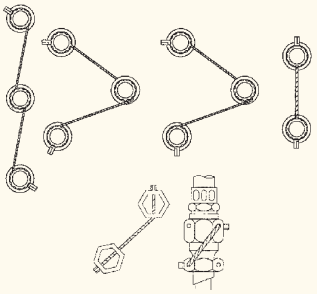


FIGURE 8: Standard Hardware

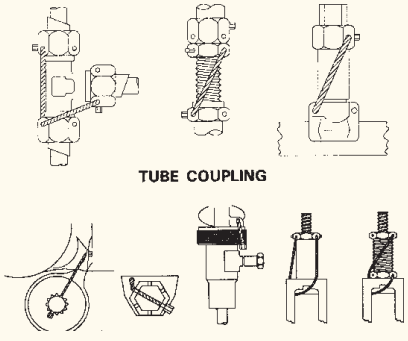


FIGURE 9: Examples of Installed Safe-T-Cable®

1.5. Safe-T-Cable® identification stamp: In applications where the user requires a logo or ID code to be a permanent part of the Safe-T-Cable® installation (for warranty or traceability), it shall be applied by the Safe-T-Cable® manufacturer to one or more surfaces of the square end fitting of the Safe-T-Cable®. Only impression stamping is permitted, no paint, ink or labels are acceptable (Figure 10).

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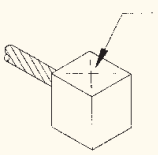

FIGURE 10: Safe-T-Cable® Identification Stamp

1.6 Safe-T-Cable® on Turnbuckles: The standard procedure for securing turnbuckles with Safe-T-Cable® is shown in Figure 11 and 12.

1.6.1 A self looping cable is threaded through the turnbuckle. One end shall be wrapped in one direction around the turnbuckle. The Safe-T-Cable® is then threaded through the hole in the self-looping jumper, and terminated with the appropriate application tool.

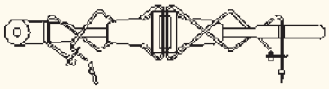

FIGURE 11: Routing of Safe-T-Cable® on Turnbuckles

FIGURE 12: Example of Final Safe-T-Cable® Turnbuckle Installation

NOTE

Safe-T-Cable® diameter selection for turnbuckle applications: .032 inch (diameter) cable shall be used on assemblies where cable diameter in 1/16 inch (1.6 mm) or smaller, and .040 inch diameter cable or greater shall be used on turnbuckle cable diameters greater than 1/16 inch.

1.7 Safe-T-Cable® Jacketing for Protection: It is recommended to use a tubular jacket over Safe-T-Cable® when it is installed in a location where it is in contact with (or may contact) surfaces which may damage the cable (shown in Figure 13). The tubular jacket material shall be capable of meeting the temperature range of the application and shall be resistant to oil and chemical environments.

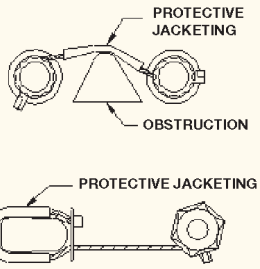

FIGURE 13: Safe-T-Cable® Jacketing for Protection

2. Safe-T-Cable® Application Tools

2.1 Procedures: When Safe-T-Cable® is used, the following basics apply for the application tools and calibration equipment.

2.1.1. Minimize mixing of safety wire and Safe-T-Cable®.

2.1.2. Install the ferrule cartridge into the tool body under the handle grip.

NOTE

When loading and using the Safe-T-Cable® hand tool, be certain that the correct size Safe-T-Cable® kit is being used with the tool.

2.1.3. Install the Safe-T-Cable® through the fasteners to be secured.

2.1.4. The nose can index to any position. To select the position grasp the nose and rotate to the desire position (Figure 14).

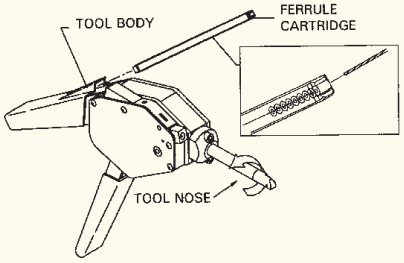

FIGURE 14: Safe-T-Cable® Tools

2.1.5. Insert the free end of the cable through the ferrule in the cartridge and remove the ferrule by pulling the cable away from the end of the cartridge (Ref. Figure 14).

NOTE

Do not release the free end of the cable until it has been inserted through the tool nose.

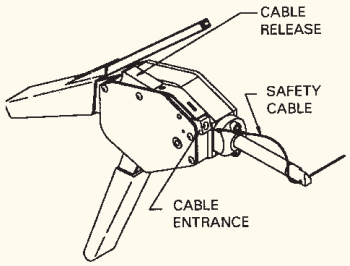

FIGURE 15: Pre-Set Tension Safe-T-Cable® Tool

2.1.6. Insert the free end of the cable through the tool nose (Figure 15) and slide the tool along the cable to the fastener being secured (Figure 16).

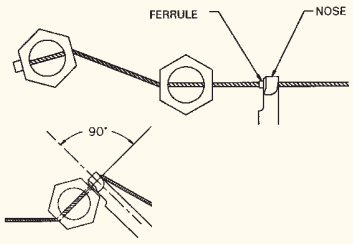

FIGURE 16: Position of Safe-T-Cable® Tool

3. Types of Safe-T-Cable® Tools

3.1. The pre-set tension tool (Figures 14 and 15). Insert the free end of the cable into the cable entrance and continue to push the cable into the cavity. When the free end of the cable appears at the bottom of the tool, grip the cable and pull the slack from the cable until resistance is felt. Begin removing slack from the cable by repeatedly closing the tool handle allowing the handle to open fully before closing again. When all slack is removed from the cable, snug the tool against the fastener by using several short strokes of the handle. Release the handle to the full open position and fully close the handle to crimp securely and cut flush.

CAUTION

It is important on this final stroke to hold the tool as steady and perpendicular to the cable as possible while completing a full stroke. This assures consistent tensioning of the cable (Figure 16).

3.2 Adjustable tension tool (Figure 17): Thread the Safe-T-Cable® through the fastener, ferrule, and tool nose in the same way as with other models. Wrap the cable one full revolution (clockwise) around the tension wheel and, with slight pressure applied by pulling the cable, secure the cable into the slot. Rotate the tension knob until several clicks are heard and felt. If additional tension is required, adjustment can be made with the tension adjuster on the opposite side of the tool.

CAUTION

Do not overtighten Safe-T-Cable®. It is a good practice to find a tension setting which removes the slack from the cable (in order to meet the flex limit requirement) without over stressing the Safe-T-Cable® components.

3.2.1 Completely close the handle to crimp and cut the cable. Hold the tool steady and perpendicular to the cable to maintain consistent cable tension. Release the handle and remove the tool from the crimped ferrule. Remove the excess cable segment from the tool prior to the next application.

3.2.2 If it is more convenient to use the adjustable tension tool with the wheel located on the opposite side, you may remove the retaining ring located below the tension adjuster, slide the knob assembly out of the tool body and re-insert it on the opposite side. Re-install the retaining ring (Figure 17).

NOTE

When using a hand tool, the tool handle is to remain fully open during the cable entry process (in both tool models). The handle is to be actuated in the pre-set tension model after the tension pawl is engaged with the cable and in the adjustable tension model only after the desired tension is achieved.

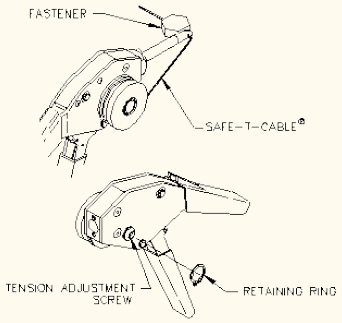

FIGURE 17: Adjustable Tension Safe-T-Cable® Tool

4. The SCTP Pneumatic Safe-T-Cable® application tool (Figure 18). Connect the Pneumatic Safe-T-Cable® Tool to a clean, dry air supply of 80 to 100 psi.

4.1. Install the Safe-T-Cable® through the fasteners which are to be secured.

4.2. The nose can be indexed in any position. To select the position grasp the nose and rotate to the desired position.

4.3. Insert the free end of the cable through the ferrule in the cartridge and remove the ferrule by pulling the cable away from the end of the cartridge. Insert the free end of the cable through the nose of the tool and slide the tool along the cable to the desired position.

4.4. Rotate the cable tensioning wheel clockwise if necessary to move the cable entry slot to an accessible position. Align the nose such that the ferrule is pressed squarely against the fastener. Make certain that the ferrule is fully seated into the nose. Insert the free end of the cable into the cable entry slot of the cable tensioning wheel. When the end of the cable exits the wheel, grip the cable and pull the slack from the cable. Do not leave more than 1-1/2" of total slack in the cable.

4.5. Press the trigger and hold. The tool will apply tension to the cable, crimp and cut. When the trigger is released, the crimp mechanism will retract (after the cycle is complete) and the tool nose can be moved from the ferrule. The excess cable shall be discarded.

4.6. The tension is adjustable by inserting the manufacturer supplied adjustment key into the adjustment port located on the tool handle. Clockwise rotation increases tension and counter clockwise rotation decreases tension.

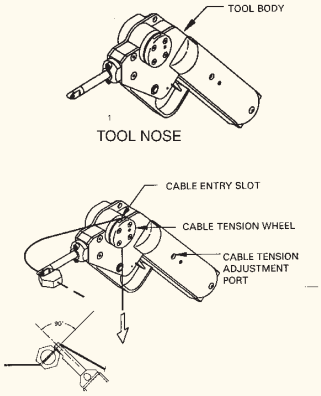

FIGURE 18: Pneumatic Safe-T-Cable®Application Tool

5. The SCTPRM Pneumatic Adjustable Tension Safe-T-Cable® application tool. Connect the Pneumatic Safe-T-Cable® Tool to a clean, dry air supply of 80 to 100 psi.

5.1. Install the Safe-T-Cable® through the fasteners which are to be secured.

5.2. The nose can be indexed any position. To select the position grasp the nose and rotate to the desired position.

5.3. Insert the free end of the cable through the ferrule in the cartridge and remove the ferrule by pulling the cable away from the end of the cartridge. Insert the free end of the cable through the nose of the tool and slide the tool along the cable to the desired position.

5.4. Wrap the cable around the tensioning wheel in a clockwise direction, while holding the tool nose perpendicular to the fastener. Make certain that the ferrule is still fully seated in the nose. Rotate the tensioning wheel in a clockwise direction until the internal clutch slips. A clicking noise can be heard and felt.

5.5. Press the trigger and hold. The tool will crimp the ferrule and cut the cable. When the trigger is released, the crimp mechanism will retract (after the cycle is complete) and the tool nose can be moved from the ferrule. Unwind the excess cable from the tensioning wheel and dispose of or recycle excess cable.

5.6. The tension is adjustable by the adjustment screw located on the opposite side of the tool from the tension wheel. Turning the tension adjustment screw clockwise increases cable tension. Turning the tension adjustment screw counterclockwise decreases cable tension.

6. The Battery Powered Adjustable Tension Safe-T-Cable® application tool.

6.1. Install the Safe-T-Cable® through the fasteners which are to be secured.

6.2. The nose can be indexed in any position. To select the position grasp the nose and rotate to the desired position.

6.3. Insert the free end of the cable through the ferrule in the cartridge and remove the ferrule by pulling the cable away from the end of the cartridge. Insert the free end of the cable through the nose of the tool and slide the tool along the cable to the desired position.

6.4. Wrap the cable around the tensioning wheel in a clockwise direction, while holding the tool nose perpendicular to the fastener. Make certain that the ferrule is still fully seated in the nose. Rotate the tensioning wheel in a clockwise direction until the internal clutch slips. A clicking noise can be heard and felt.

6.5. Press the trigger and hold. The tool will crimp the ferrule and cut the cable. When the trigger is released, the crimp mechanism will retract (after the cycle is complete) and the tool nose can be moved from the ferrule. Unwind the excess cable from the tensioning wheel and dispose of or recycle excess cable.

6.6. The tension is adjustable by the adjustment screw, located on the opposite side of the tool from the tension wheel. Turning the tension adjustment screw clockwise increases cable tension. Turning the tension adjustment screw counterclockwise decreases cable tension.

7. Safe-T-Cable® Application Tool Maintenance and Calibration. The Safe-T-Cable® tools should be stored in a clean, dry place when not in use. Clean any debris (especially in the crimp cavity in the tool nose) from the tool with a small brush and solvent if necessary. Lubricate the tool nose (in the crimp cavity) with a drop of oil on a regular basis.

7.1. Calibration instructions are supplied with each tool.