Primary Cable Preparation

1. Scope

This work practice provides basic instructions to prepare the end of a piece of primary cable for the installation of a cable accessory, such as an elbow, splice, or termination.

These instructions are general in nature. It is very important to read, understand, and follow the specific instructions provided with the cable accessory to be installed.

For an example, these instructions outline the steps for preparing 28 kV, 1/0 aluminum, jacketed, round wire, concentric neutral cable, Seattle City Light (SCL) Stock No. 012098, for the installation of a silicone rubber termination. Different types of cable and accessories will require slightly different steps and/or tools.

Only qualified electrical workers shall prepare primary cable and install accessories.

Personal protective equipment is outside the scope of this practice.

The balance of this work practice is divided into nine sections:

- Getting Ready
- Procedure:
  - Removing the Outer Jacket
  - Removing the Insulation
  - Removing the Semi-Con Layer
  - Cleaning
  - Changing the Blade in a Speed Stripper
- Required and Optional Tools
- Required Material
- Sources

2. Getting Ready

The first two tasks to perform are: inspect tool blades and determine cable cutback length.

2.1 Inspect Tool Blades

Visually inspect tool blades for sharpness and damage. Spare blades may be obtained from the tool room.

Speed Systems 1542-2CL Speed Stripper tools contain a spare blade and an Allen wrench in a compartment on the tool.

Speed Systems 1542-2CL Speed Strippers can accept two different types of blades. The wedge blade is better for cutting cross-linked polyethylene (XLPE) insulated cable; the straight blade is better for cutting ethylene propylene rubber (EPR) insulated cable. Refer to Section 7, Changing the Blade in the Speed Stripper, and Section 8, Required and Optional Tools.

If the Speed Systems Model-1700 Series Adjustable Blade Scorer requires a new blade, return it to the tool room and exchange the entire tool for a new one.

2.2 Determining Cable Cutback Length

When determining cutback length, remember to take "lug growth" into account. Refer to Table 2 for aluminum lug growth allowances:

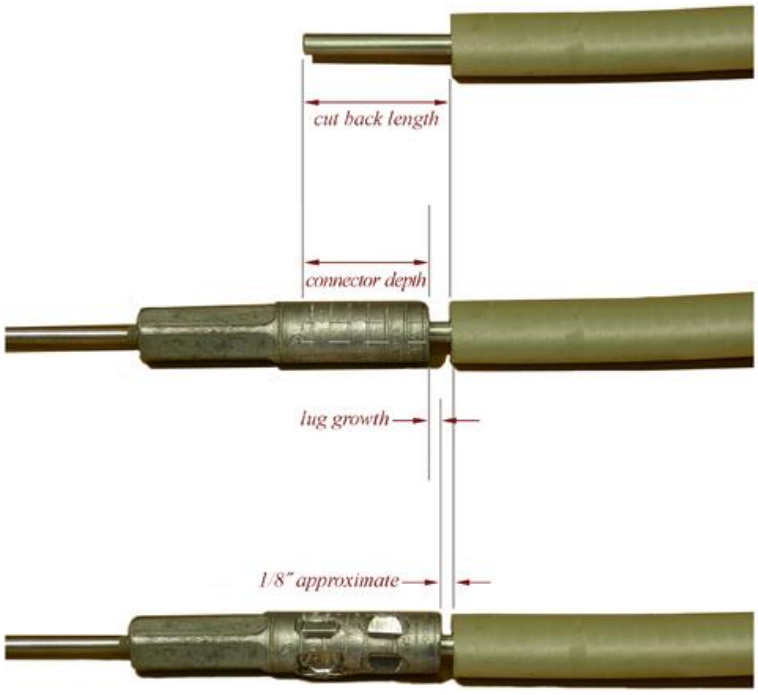
Table 2. Aluminum Lug Growth Allowances

Conductor Size (AWG/kcmil)	Growth Allowance (in)
#2 - 350	1/4
400 - 650	3/8
750 - 1000	1/2

Cutback length is calculated as follows:

Cutback length = connector depth + lug growth + 1/8"

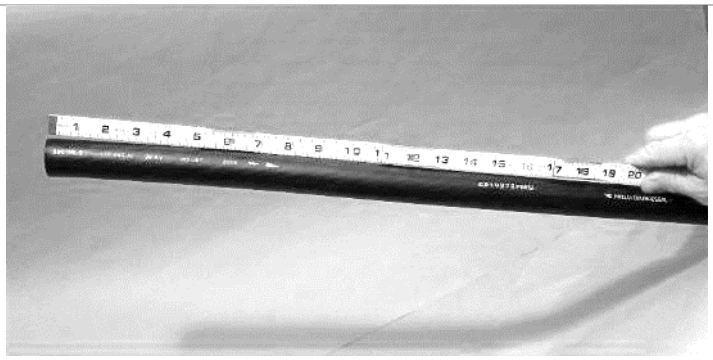
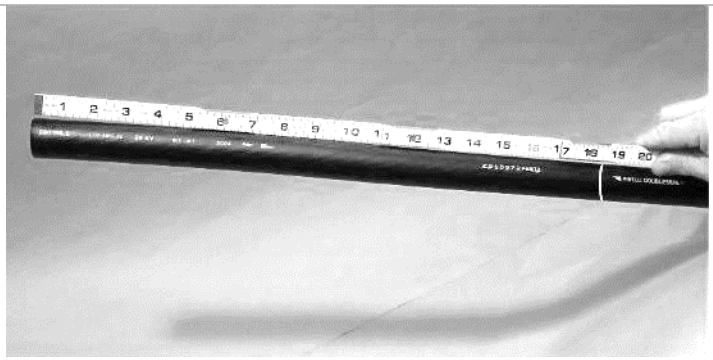
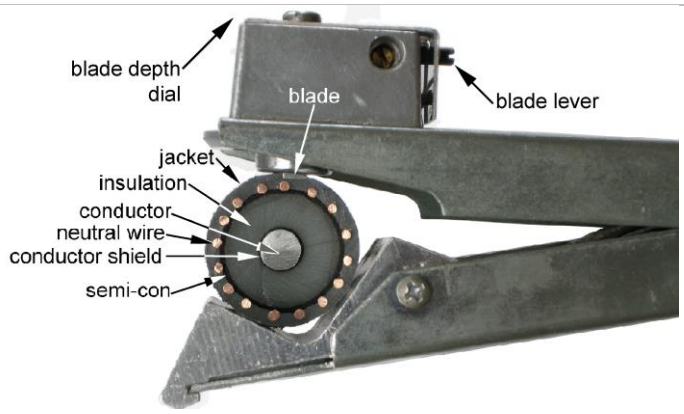
Figure 2. Cutback Length Measurements

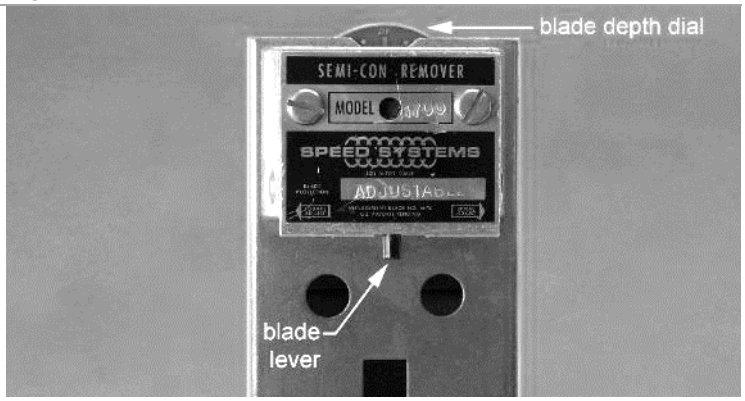
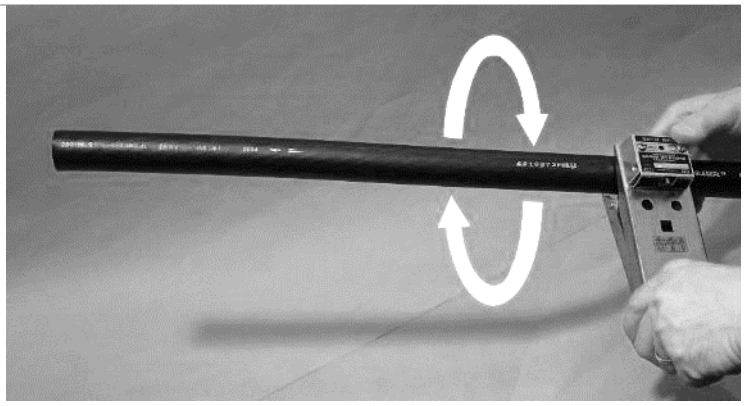
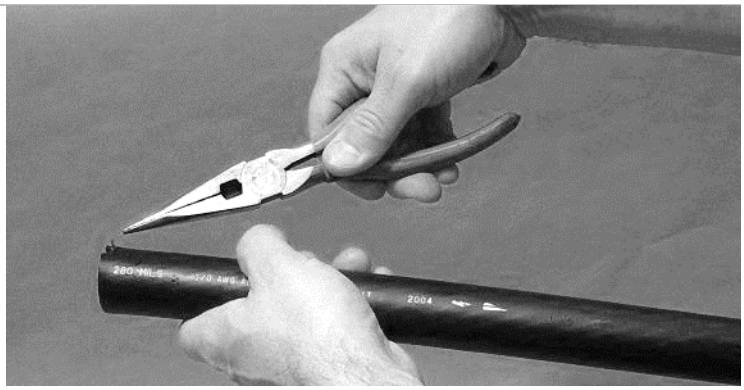


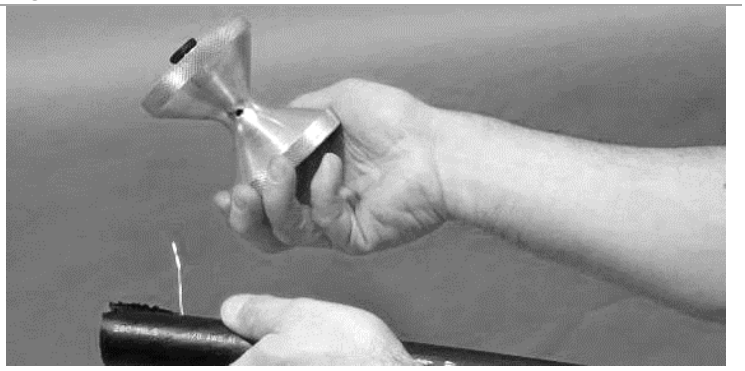
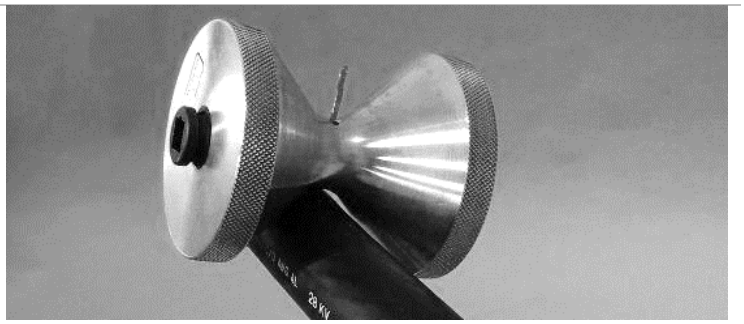
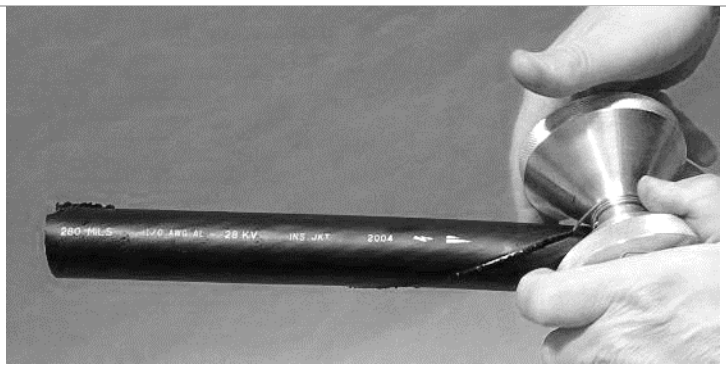
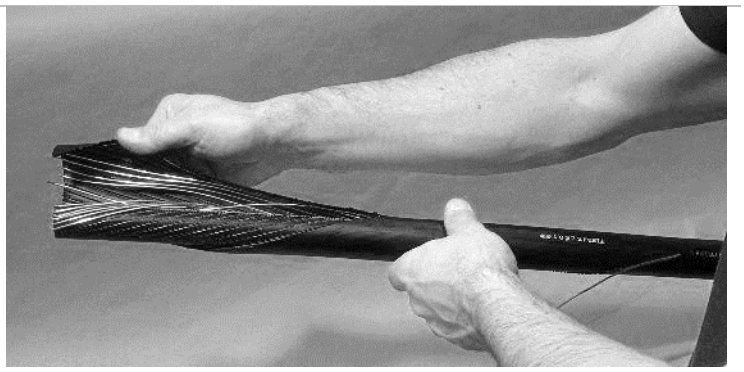
Notes
1. For aluminum conductors, always brush prior to installing lug.
2. For copper conductors, brush if needed.
3. During the crimping process, aluminum lugs grow in length when crimped. This growth needs to be taken into account. Bi-metallic lugs should be treated as aluminum. Allowances for growth do not need to be made for copper lugs.
4. After the crimping process is completed, approximately 1/8 inch should remain between the lug and the end of the cable insulation.
5. Wipe off excess oxide inhibitor.

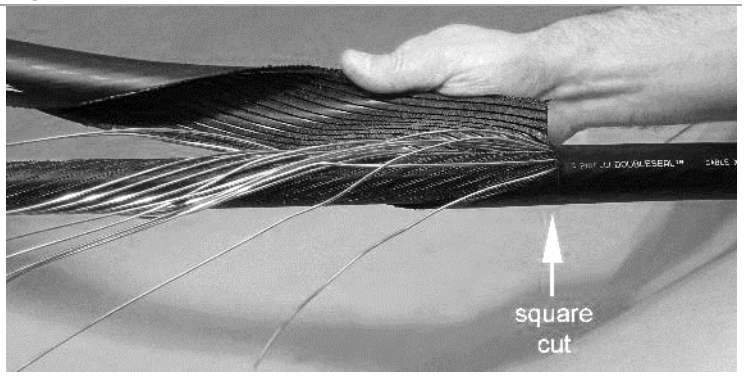
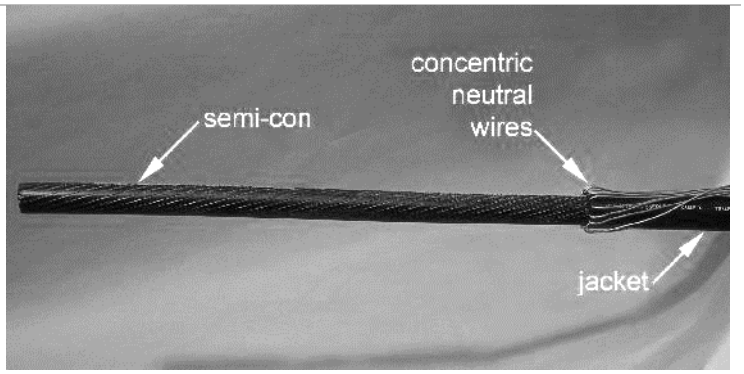
3. Procedure

3.1 Removing the Outer Jacket

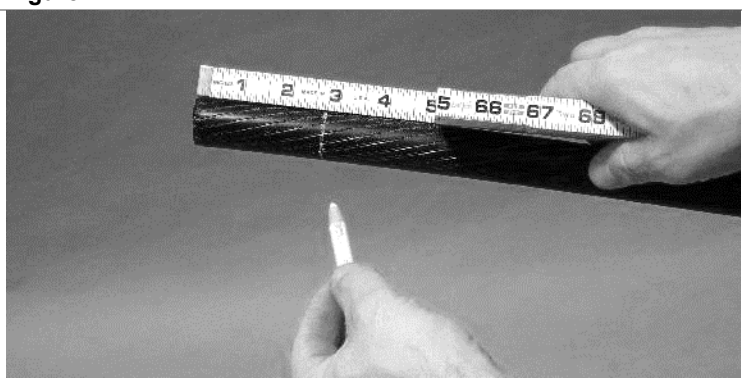
Notes	Figure
3.1a This is a cable end with jacket in place.	
3.1b Measure and mark the length of the outer jacket to be removed according to the instructions provided with the cable accessory.	
3.1c **CAUTION**: If a knife is used for marking, be careful to not damage the underlying material. Using tape to mark the outer jacket may interfere with the operation of the scorer tool.	
3.1d Remove the outer jacket by using the Model-1700 Series Adjustable Blade Scorer to make a square cut at the point marked. Make sure the blade lever is in the square cut position.	

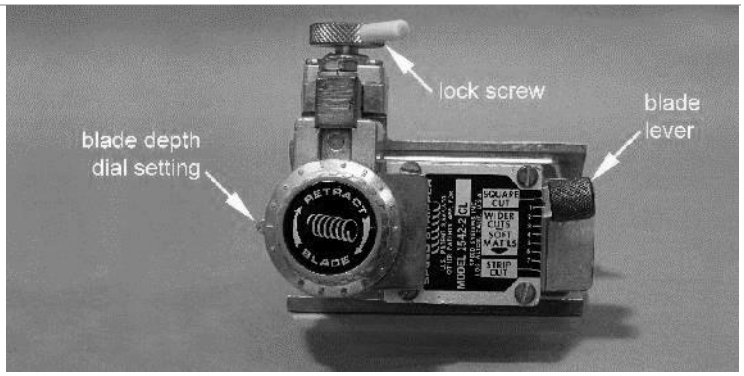
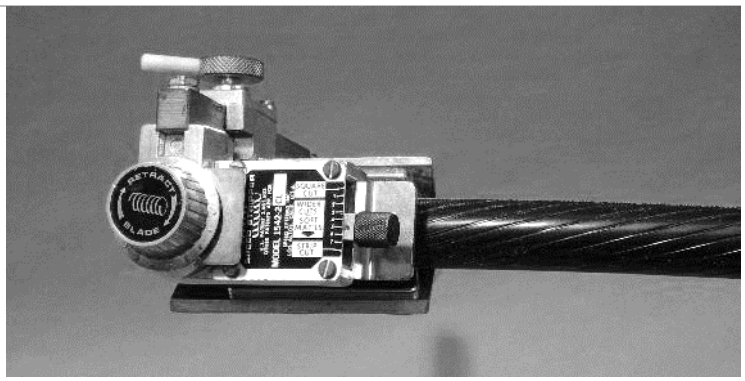
Notes	Figure
3.1e Set the scorer's blade depth with the dial so that the blade does not cut completely through the jacket and nick any of the neutral wires. For the Model-1700 Series Adjustable Blade Scorer, start with a dial setting of **40** and check results. Once the blade depth is set correctly, open the jaws of the scorer by turning the black knob counter-clockwise.	
3.1f Set the scorer on the cable and release the tension in the jaws by turning the black knob clockwise until it turns freely. Make several revolutions with the scorer. Open the scorer jaws and remove it from the cable.	
3.1g With a knife, make a small cut on either side of one neutral wire at the end of the cable	
3.1h With a pair of pliers, pull back the end of one neutral wire about 1-1/2 inches.	

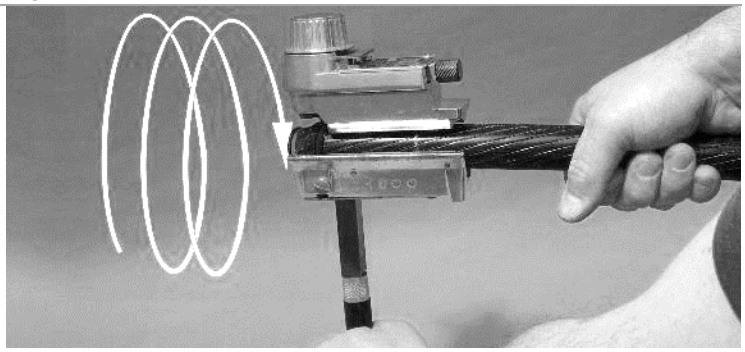
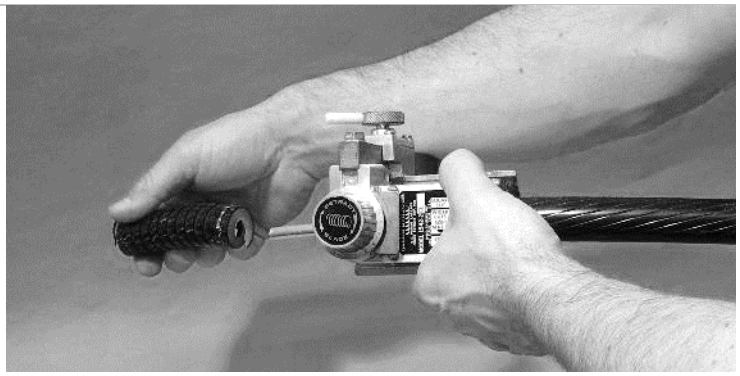
Notes	Figure
3.1i Speed Systems Model NW-15 Neutral Winder. Using a neutral winder tool preserves the neutral wire from accidental breakage.	
3.1j Insert the neutral wire into the center hole of the wire winder.	
3.1k Cut the cable jacket by ratcheting the tool down and around the cable until the neutral wire reaches the square cut. Unwind and remove the neutral wire from the neutral winder tool.	
3.1l Remove the outer jacket.	

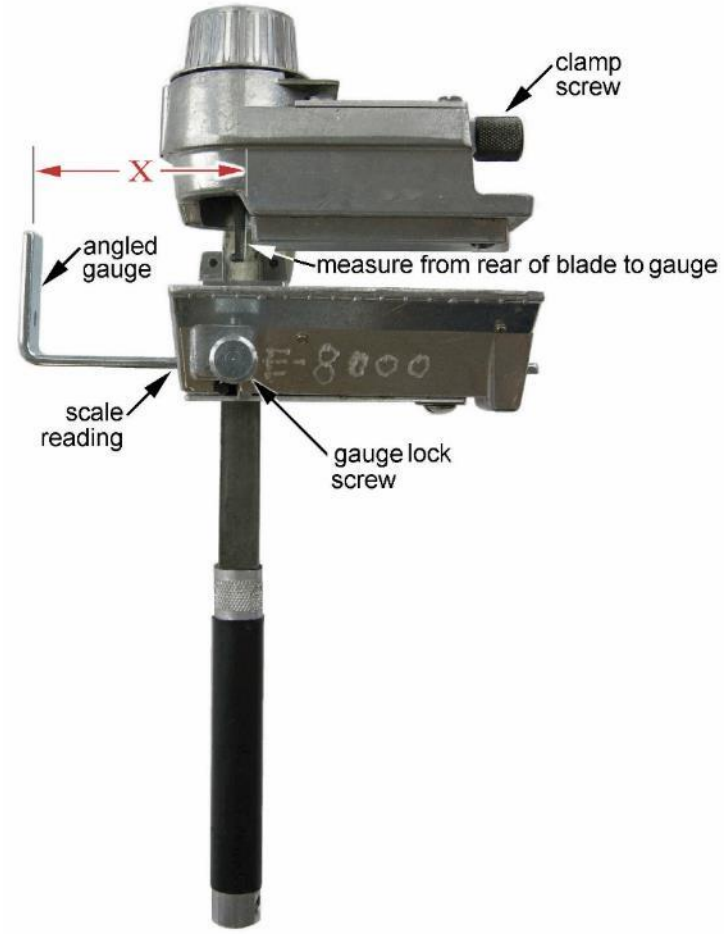
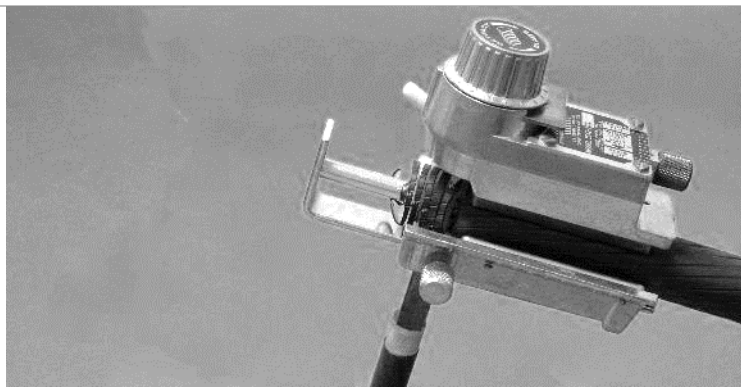
Notes	Figure
3.1m Pull the rest of the concentric neutral wires out of the way.	
3.1n The cable end is readied for next step.	

3.2 Removing the Insulation

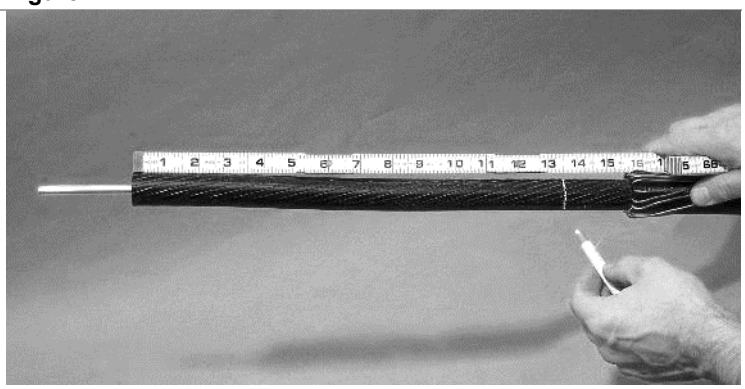
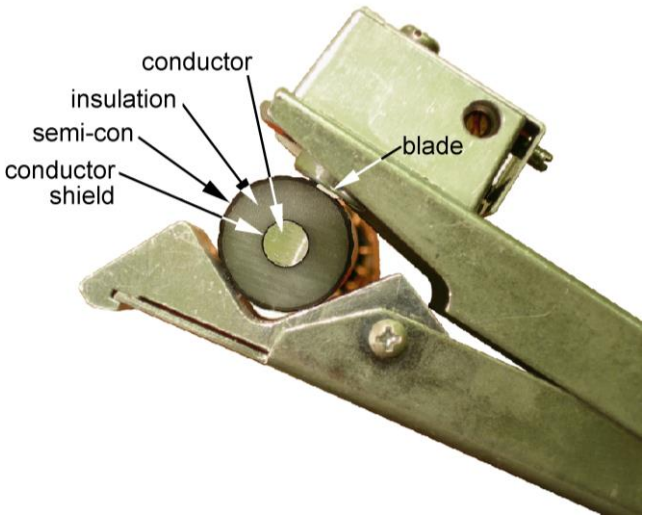
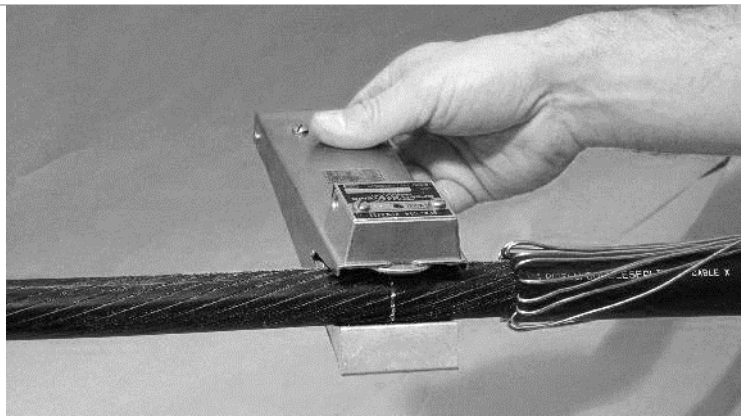
Notes	Figure
3.2a Measure and mark the cutback length on the exposed semi-con surface according to the instructions provided with the cable accessory or the requirements of the compression lug. This mark indicates the section of three layers to be removed down to the conductor. When measuring, remember to take lug growth into account. Refer to Section 2. Removing the insulation before the semi-con layer minimizes the chance of damaging the insulation with the stripper tool while removing the insulation or contaminating the insulation by handling it.	

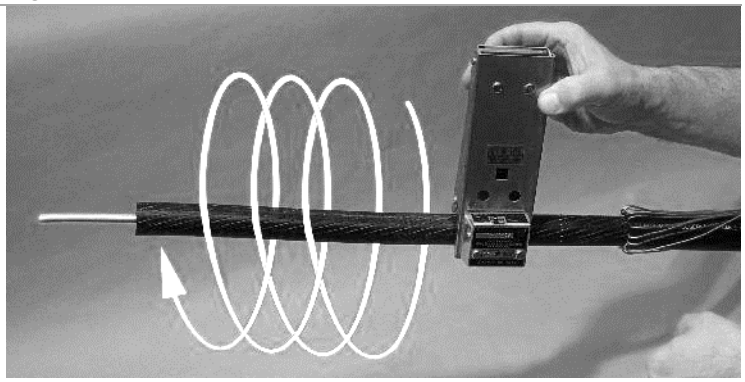
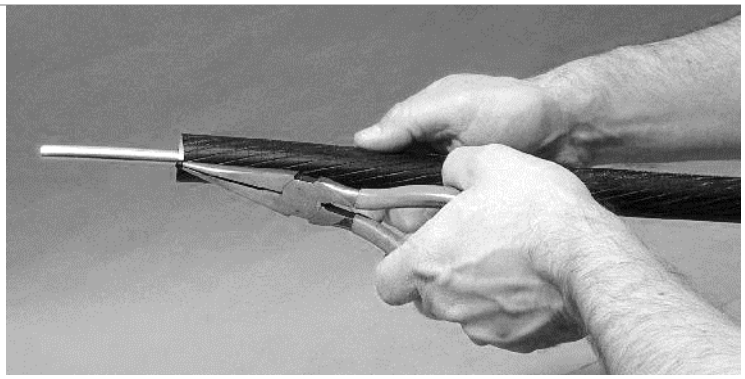
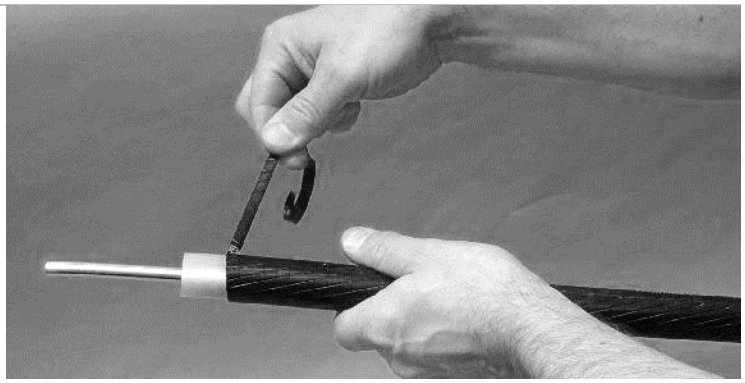
Notes	Figure
3.2b Verify 1542-2CL stripper is fitted with the correct blade for the type or insulation being cut. Refer to section 8, Required and Optional Tools. Place the 1542-2CL Speed Stripper onto the end of the cable and clamp the jaws firmly together. Lock the jaws in place with the lock screw. Set the stripper's blade depth so that it misses the main conductor by about 1/16th of an inch. With the blade lever set to the square cut position, rotate the tool around the cable 360 degrees before cutting the insulation to ensure that the blade does not nick the conductor at any point around the revolution.	
3.2c After the correct blade depth has been verified, set the blade angle with the blade lever at the back of the stripper.	
3.2d **Suggestion**: Start with a spiral cut width of approximately 1/4 inch. For the 1542-2CL Speed Stripper, start with a lever setting of **5** and check results.	

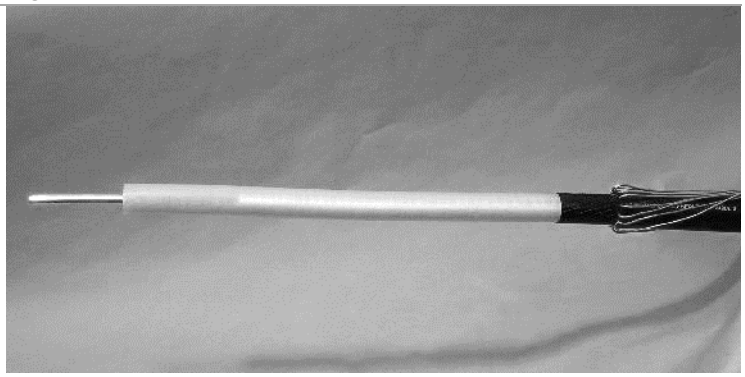
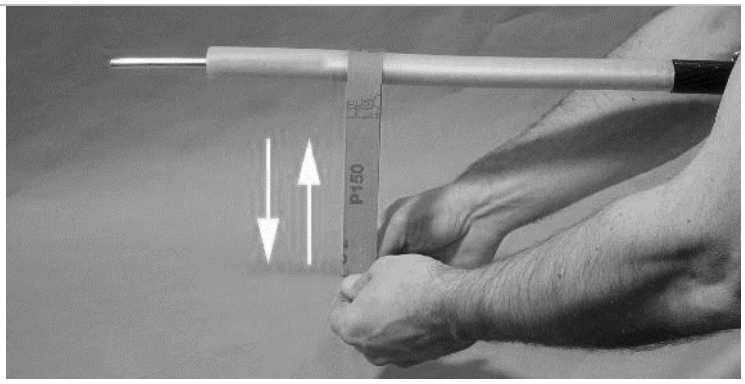
Notes	Figure
3.2e Spiral the tool down the cable.	
3.2f Move the stripper's blade lever to the square cut position at the point where the insulation needs to be squared off. Open the stripper's jaws and remove the tool and the cut insulation from the cable.	

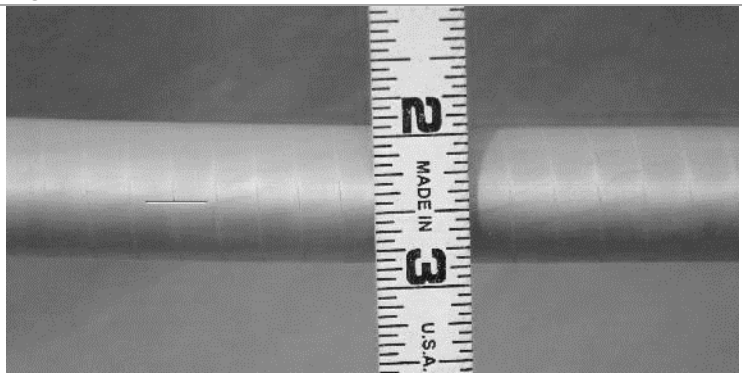
Notes	Figure
3.2g The Speed Systems 1646X Scale Gauge is an optional accessory that simplifies the task of removing the correct length of insulation. The accessory kit includes a rigid angled gauge bar with an embossed scale and a lock screw for securing the gauge bar at the desired insulation cutback length. To install, remove the 10-32 x ¼" screw located at the front edge of the stripper's saddle and replace it with the lock screw as shown. The scale should be read at the front edge of the saddle. The indicated dimension is the distance between the (rear) edge of the cutting blade and the angled end of the gauge (X in the figure). Once the desired insulation cutback length is set on the scale gauge and the lock screw is secured, follow normal procedure for setting blade depth and spiral cut.	
3.2h After three or four spirals, cut off the loosened insulation so that it does not obstruct the angled part of the gauge. The exposed conductor butts against the gauge angle during the final spiral cut and a clean square cut is made **without** resetting the clamp screw to the square cut position.	

3.3 Removing the Semi-Con Layer

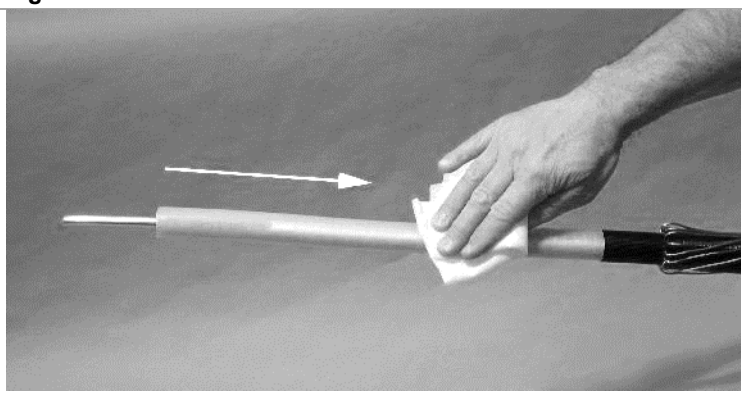
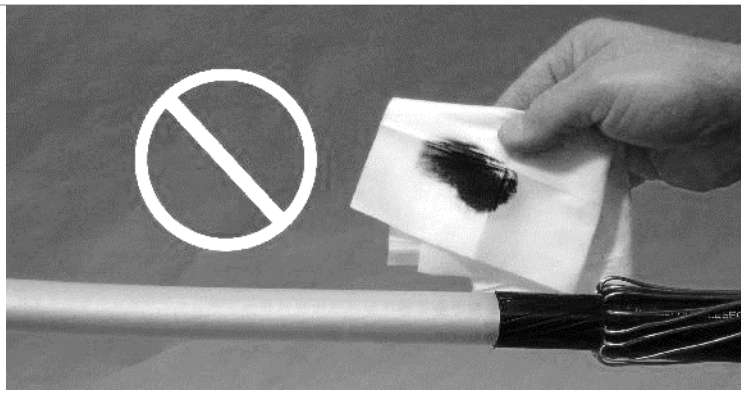
Notes	Figure
3.3a Measure and mark the cutback length of the semi-con layer according to the instructions provided with the cable accessory. **CAUTION**: If a knife is used for marking, be careful to not cut into the underlying insulation.	
3.3b Set the depth of the Model-1700 scorer's blade so that it does not cut through the semi-con layer. This can be accomplished by setting the tool's blade lever to the square cut position and setting the blade by sight to about 0.003 to 0.005 inches (3 to 5 mils) less than the thickness of the semi-con. For the Model-1700 Series Adjustable Blade Scorer, start with a dial setting of **20** and check results. **CAUTION**: Verify the scorer's blade depth on a scrap piece of cable before proceeding to ensure that the blade does not nick the insulation at any point around the revolution	
3.3c Before proceeding, make sure the cable is as straight as possible. Place the scorer at the point marked earlier and release the tension in the jaws. Revolve the tool around the cable counter-clockwise facing the cable end to make a square cut.	

Notes	Figure
3.3d Switch the blade lever to the spiral cut position. Revolve the tool around the cable to the end of the semi-con. Open the jaws and remove the scorer from the cable.	
3.3e With a knife, lift the edge of the semi-con.	
3.3f Grab the layer with a set of duck-bill or needle-nose pliers.	
3.3g Roll (or pull) the semi-con off the insulation until the square cut is reached. Take care not to lift any portion of the remaining semi-con past the square cut.	

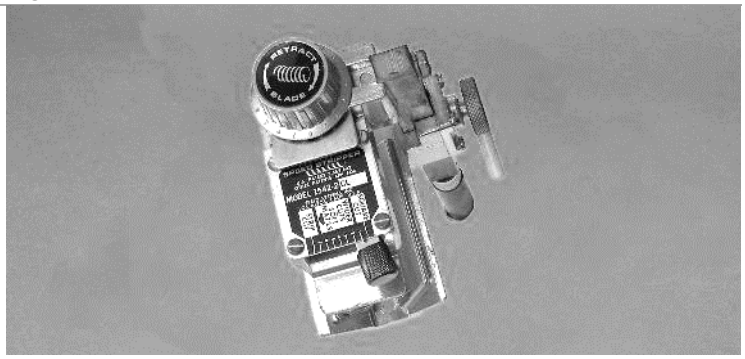
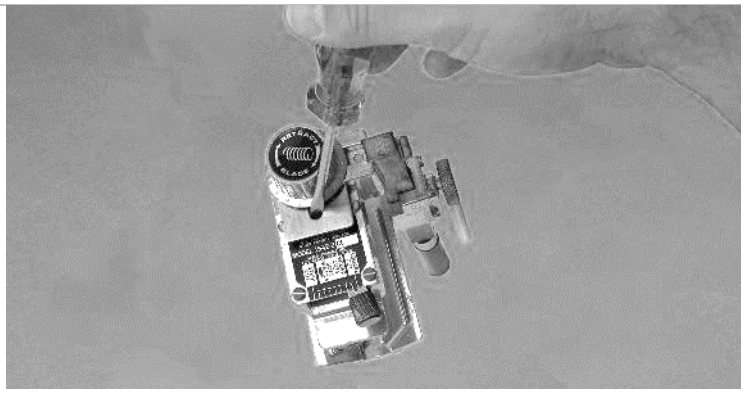
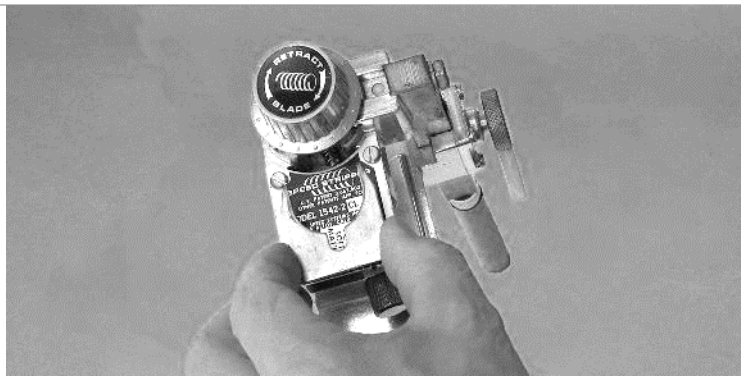
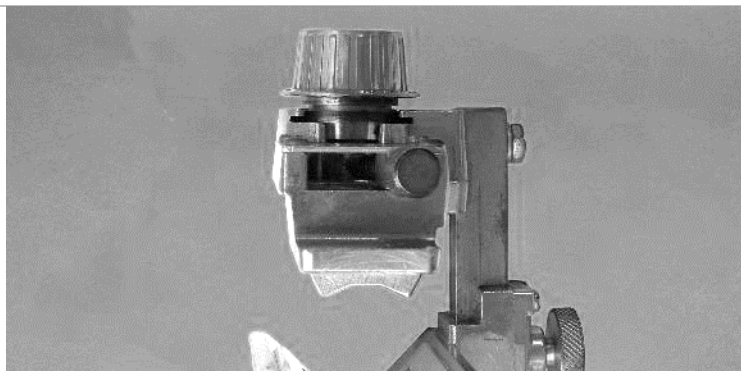
Notes	Figure
3.3h After the semi-con is removed, a spiral pattern on the surface of the insulation may be seen	
3.3i Verify the spiral pattern in the insulation is just a "shadow" and not a nick by dragging a thumbnail across the pattern. Shadow is the stress mark created at the score location when the semi-con layer is peeled off.	
3.3j Routine sanding is optional. If sanding is preformed, smooth insulation with a strip of 150 grit, aluminum oxide, abrasive cloth with a shoe-shining motion. Do not sand longwise (parallel to the conductor). Use only approved abrasive cloth; do not substitute. Do not use silicon grease to fill nicks. Cut the cable end off and start over from the beginning, if: ▪ Nicks cannot be sanded out. ▪ A radial ring cut is present. ▪ Sanding results in the insulation thickness going below minimum industry and SCL standards.	

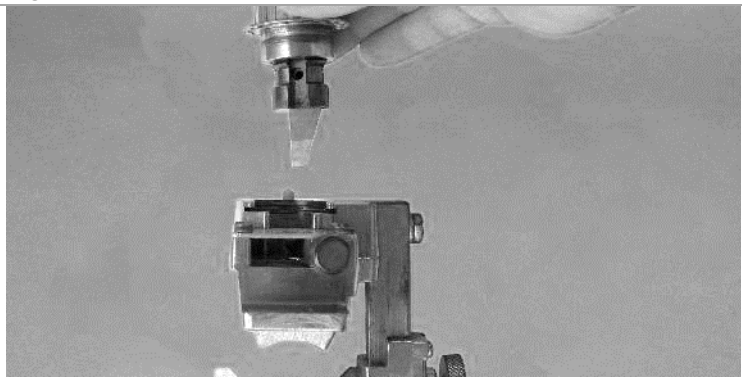
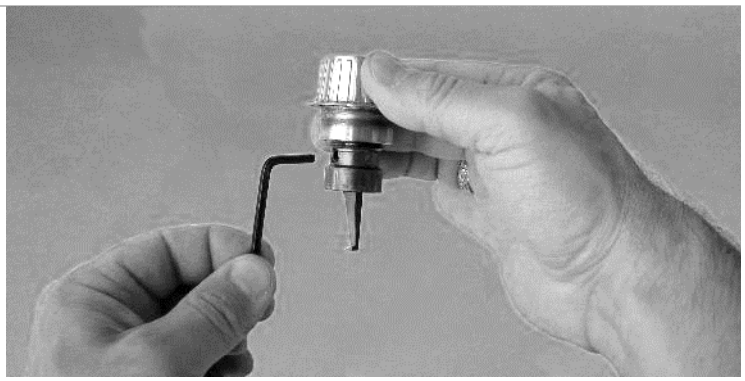
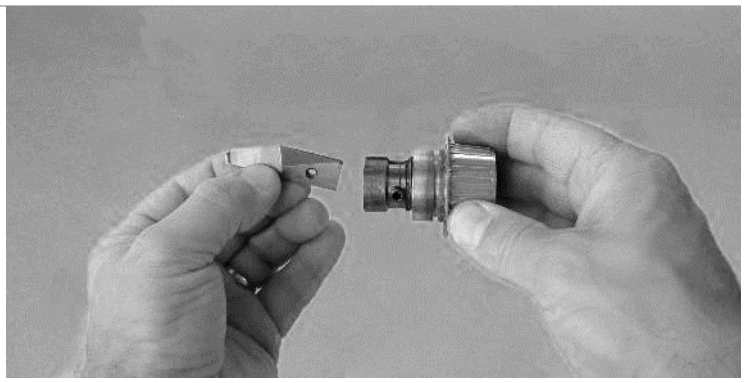
Notes	Figure
3.3k **CAUTION**: Knife nicks in the insulation are the most common cause of cable failure. Nicks in the insulation that are parallel to the conductor reduce a cable accessory's dielectric strength and can directly lead to accessory failure. Do not pencil or bevel the insulation at the end of the cable unless directed to by the cable accessory instructions.	

3.4 Cleaning

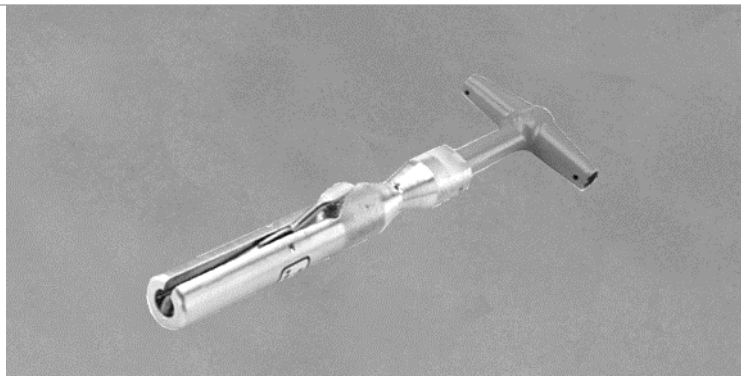
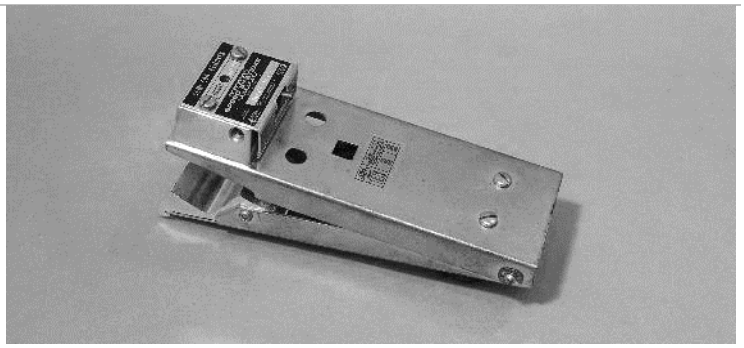
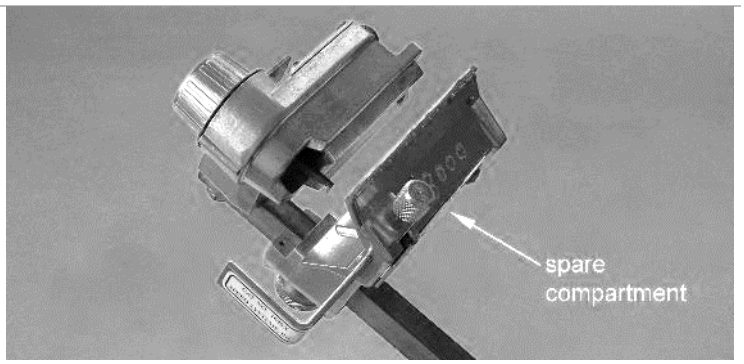
Notes	Figure
3.4a Finish cable preparation by cleaning the insulation with electrical insulation cleaner. Use only approved electrical insulation cleaner; do not substitute. To avoid dragging (conductive) semi-con particles onto the insulation, always wipe from the end of the insulation towards the semi-con.	
3.4b Do not wipe the exposed semi-con layer with electrical insulation cleaner. Do not pour electrical insulation cleaner directly onto cable. To speed evaporation, wipe insulation surface with a dry, lint-free wipe.	

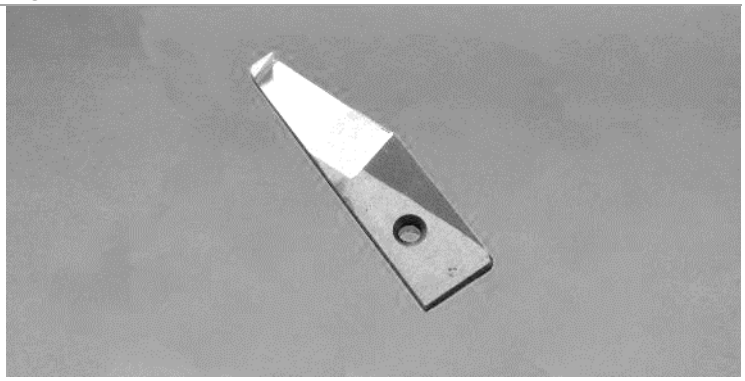
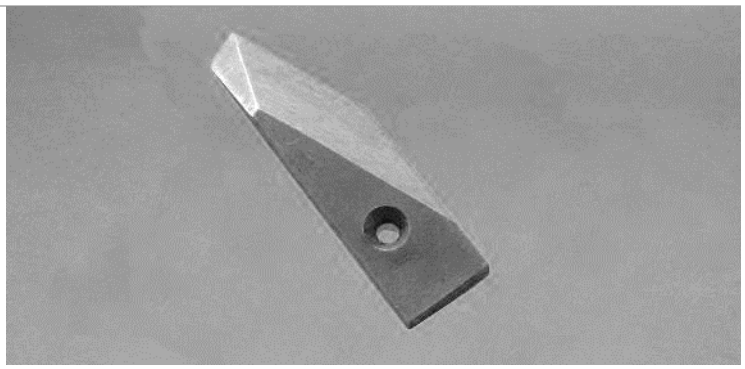
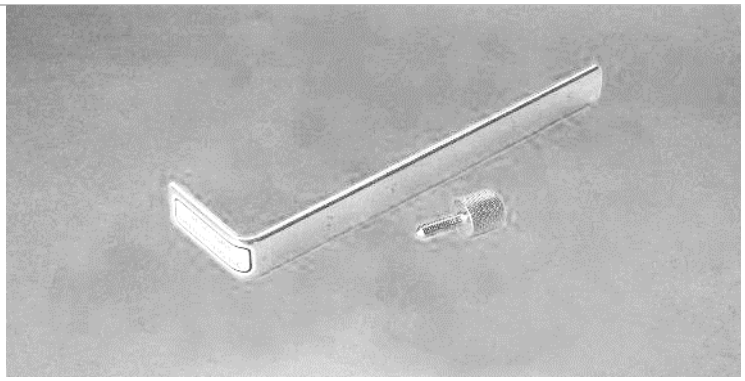
3.5 Changing the Blade in a Speed Stripper

Notes	Figure
3.5a Follow these instructions to change the blade in a Speed Systems 1542-2CL Speed Stripper.	
3.5b Remove the blade depth setting knob keeper by inserting a screw driver or the Allen wrench provided with the tool into the slot and leveraging it out.	
3.5c Remove the keeper.	
3.5d Expose the unsecured blade depth-setting knob.	

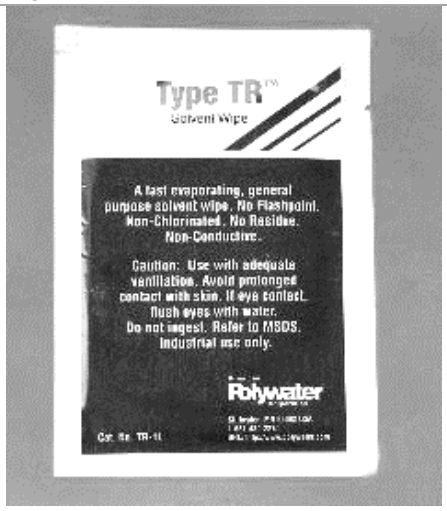
Notes	Figure
3.5e Remove the blade depth-setting knob assembly.	
3.5f Use the Allen wrench provided with the Speed Systems tool to loosen the blade set screw.	
3.5g Remove the blade and replace with a new blade. Reverse instructions to reassemble the tool.	

4. Required and Optional Tools

Notes	Figure
4a Speed Systems Model NW-15 Neutral Winder, for cable outside diameters 1.0 to 2.5 inches; suitable for 28 kV, jacketed, 1/0 solid aluminum cable.	
4b Speed Systems Model LPW1525/TK120X-N Probe Installation Tool with Tor-Key and Neutral Winder Option; suitable for 28 kV, jacketed, 1/0 solid aluminum cable. This is an alternate option to the Speed Systems Model NW-15 Neutral Winder tool.	
4c Speed Systems Model-1700 Series Adjustable Blade Scorer, for cable outside diameters 0.5 to 2.0 inches - suitable for 28 kV, jacketed, 1/0 solid aluminum cable (shown). The Speed Systems Model-1700 SS includes a dial locking set screw (not shown). The Model-1800 Series Scorer, for cable outside diameters 1.75 to 3.0 inches (not shown)	
4d Speed Systems 1542-2CL Speed Stripper, for cable outside diameters 0.5 to 1.75 inches - suitable for 28 kV, jacketed, 1/0 solid aluminum cable (shown with optional Scale Gauge Accessory). The tool is provided with 1562 wedge blade installed and a 1581 straight blade in the spare compartment. The spare compartment also contains a 1/8-inch Allen wrench.	

Notes	Figure
4e Speed Systems 1562 wedge blade for use with 1542-2CL Speed Strippers. Wedge blades are optimized for cutting cross-linked polyethylene (XLPE) insulated cable.	
4f Speed Systems 1581 straight blade use with 1542-2CL Speed Strippers. Straight blades are optimized for cutting ethylene propylene rubber (EPR) insulated cable.	
4g Speed Systems 1646X Scale Gauge Accessory (with lock screw), for use with Speed Systems 1542-2CL Speed Stripper tool (optional). Not shown: ▪ Skinning knife, Stock No. 764220. ▪ Duck-bill, needle-nose, or Speed Systems semi-con roller grip pliers number SC-13. ▪ Folding wood rule, Stock Nos. 764998 or 764999.	

5. Required Material

Notes	Figure
Electrical insulation cleaner wipe in sealed pouch, Stock No. 726157 Not shown: ▪ Electrical insulation cleaner, quart bottle, Stock No. 726163 (alternate to 726157) ▪ Electrical insulation cleaner, five-gallon pail, Stock No. 726158 (alternate to 726157) ▪ Dry, lint-free wipes. ▪ 150 grit, aluminum oxide, one-inch wide, abrasive cloth, Stock No. 722344.	

6. Sources

SCL Design Standard 9660.04; "Properties of Medium Voltage Cable"

Speed Systems product catalog; www.spdsystems.com

U5-2.81/NSP-290 (canceled); "Primary Cable Preparation, General"

3M Corporation, Instruction Sheet #78-8119-6027-3(B); QT-III Cold Shrink Silicon Rubber Termination, February 10, 1997