

User Guide

Servo Knife Cutters

SCE and SCX Models

Installation

Operation

Maintenance

Troubleshooting



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UGE047/0299

Record your equipment's model and serial number(s) and the date you received it in the spaces provided.

It is important to record the model and serial number(s) of your equipment and the date you received it in the User Guide. Our service department uses this information, along with the manual number, to provide help for the specific equipment you installed.

Keep this User Guide and all manuals, engineering prints and parts lists together for documentation of your equipment.

Date:
Document Number: UGE047/0299
Serial number(s):
Model number(s):
Power Specifications: Amps
Volts
Phase
Cycle

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This section has been provided for you to store spare parts lists and diagrams.

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PURPOSE OF THE USER GUIDE

This User Guide describes the Conair SCE/SCX Servo Knife Cutters and explains step-by-step how to install, operate, maintain and repair this equipment.

Before installing this product, please take a few moments to read the User Guide and review the diagrams and safety information in the instruction packet. You also should review manuals covering associated equipment in your system. This review won't take long, and it could save you valuable installation and operating time later.

HOW THE USER GUIDE IS ORGANIZED

Symbols have been used to help organize the User Guide and call your attention to important information regarding safe installation and operation.



Symbols within triangles warn of conditions that could be hazardous to users or could damage equipment. Read and take precautions before proceeding.



Numbers within shaded squares indicate tasks or steps to be performed by the user.



A diamond indicates the equipment's response to an action performed by the user.



An open box marks items in a checklist.



A shaded circle marks items in a list.

YOUR RESPONSIBILITY AS A USER

You must be familiar with all safety procedures concerning installation, operation and maintenance of this equipment. Responsible safety procedures include:

- Thorough review of this User Guide, paying particular attention to hazard warnings, appendices and related diagrams.
- Thorough review of the equipment itself, with careful attention to voltage sources, intended use and warning labels.
- Thorough review of instruction manuals for associated equipment.
- Step-by-step adherence to instructions outlined in this User Guide.

We design equipment with the user's safety in mind. You can avoid the potential hazards identified on this machine by following the procedures outlined below and elsewhere in the User Guide.

 **ATTENTION:**
**READ THIS SO NO
ONE GETS HURT**



DANGER: Sharp blades!

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.



- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out the cutter before opening the cutting chamber.
- Always wait until the cutter head has stopped completely before opening the knife guard.

SCE/SCX cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

- When the knife guard is opened, the knife guard switch stops the cutter and prevents starting the cutter again.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The STOP button activates a circuit that stops the knife.



WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial plate.

**ATTENTION:
READ THIS SO NO
ONE GETS HURT**



WARNING: Voltage Hazard

This equipment is powered by three-phase alternating current, as specified on the machine serial tag and data plate.

A properly-sized conductive ground wire from the incoming power supply must be connected to the chassis ground terminal inside the electrical enclosure. Improper grounding can result in severe personal injury and erratic machine operation.

Always disconnect and lockout power before opening the electrical enclosure or performing non-routine procedures such as maintenance.



WARNING: Electrical hazard

Before performing maintenance or repairs on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.

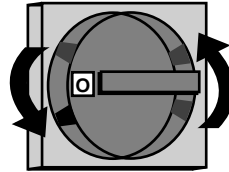
HOW TO USE THE LOCKOUT DEVICE

Lockout is the preferred method of isolating machines or equipment from energy sources. Your Conair product is equipped with the lockout device pictured below. To use the lockout device:

1 Stop or turn off the equipment.

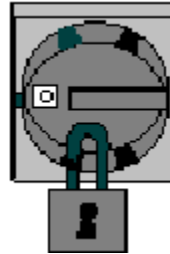
2 Isolate the equipment from electrical power.

Turn the rotary disconnect switch to OFF or O position.



3 Secure the device with an assigned lock or tag.

4 The equipment is now locked out.



CAUTION: Moving parts

Before removing lockout devices and returning switches to the ON position, make sure that all personnel are clear of the machine, tools have been removed and all safety guards are reinstalled.

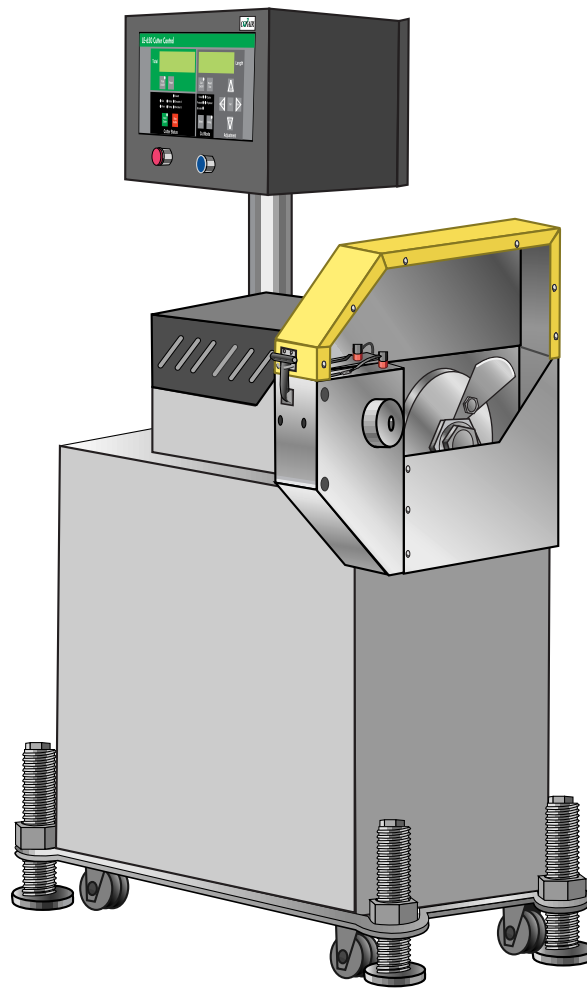
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WHAT IS THE SERVO KNIFE CUTTER?

The Conair SCE/SCX Series Servo Knife Cutter is an on- or off-line cutting device capable of both on-demand and continuous cutting modes.

SCE cutters utilize a velocity-controlled servo motor to achieve park position repeatability within 1 millisecond. SCX cutters have even better park position repeatability (less than 0.1 millisecond) because they use position-controlled servo-motors.



Conair SCE/SCX Series Servo Knife Cutters can cut extrudable plastics and rubber both on- and off-line. Other extrudable materials-foods, ceramics, magnets, soaps, etc.-may also be cut depending on specific application requirements.

TYPICAL APPLICATIONS

SCE/SCX cutters are available with different cutting capacities (2, 3, 4, and 5 inches) to suit your specific needs. The servo motor size and cutter head material may also be optimized for specific applications. While the standard cutter orientation is right-to-left, cutters can also be made with a left-to-right orientation ([see Specifications, page 2-7](#)). (The illustrations in this User Guide represent the standard right-to left configuration.)

SCE/SCX cutters are limited to a specific range of product sizes based on each unit's cutting capacity. SCE cutters are limited to a single speed, while SCX cutters can operate over a range of speeds (depending on which options are present.) See the product specifications, page 2-7.

Different materials, line speeds, temperatures and material cross-sections can result in different cutting torques. If you are changing any of these parameters, consult your Conair service personnel to be sure your equipment can handle the changes.

HOW THE SERVO CUTTER WORKS

Extruded material that has been sized and cooled enters the cutter from the upstream side (see [step 1, page 2-5](#)). Typically, a puller is placed just before the cutter; the puller pulls the extrudate through the sizing and/or cooling tanks and feeds it into the cutter.

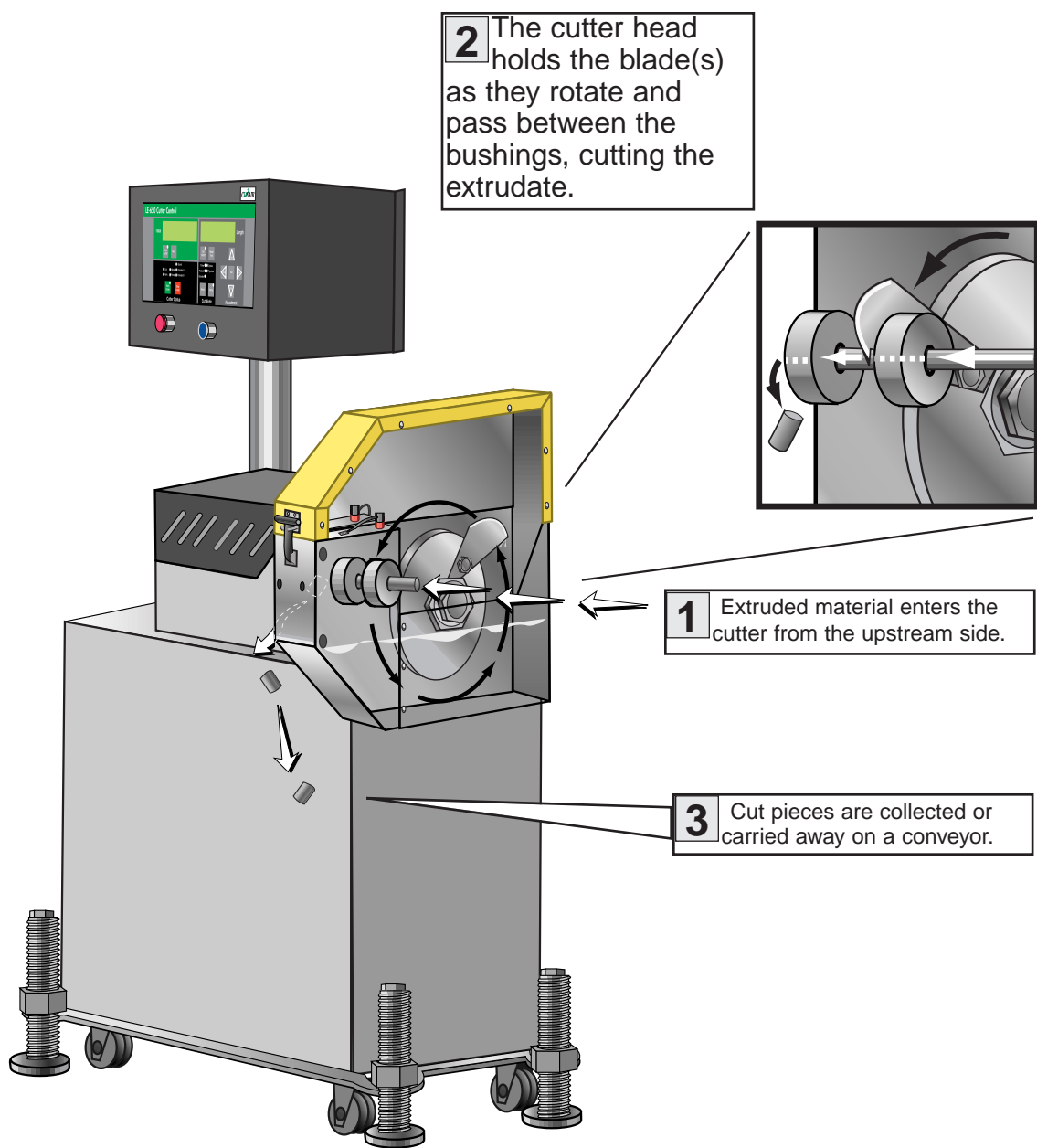
The servo motor, which is either velocity control (SCE cutters) or positional control (SCX cutters), is direct coupled to an in-line planetary gear reducer and drives the cutter head. This arrangement increases cutting torque, improves servo motor efficiency, and offers improved bearing load ratings.

The cutting knife, attached to the cutter head, is driven by the servo motor (step 2). Two cutter bushings guide and support both the extrudate and the cutting knife. The cutter head is mounted directly to the in-line planetary gear reducer shaft using a Trantorque coupling device, and may have as many as eight optional blade positions.

Two types of cutting modes are available. On-demand cutting modes (Timer, Encoder, and Product) provide a single rotation cut cycle. However, in continuous cutting modes (Flywheel and optional Follower) the cutting mechanism rotates continuously.

The knife guard includes a stainless steel lower tray, which can be used for blade lubrication. The upper knife guard includes a clear polycarbonate window. This allows you to watch the cutting blade during operation.

Cut pieces are collected or carried on to further processing by an optional conveyor (step 3).



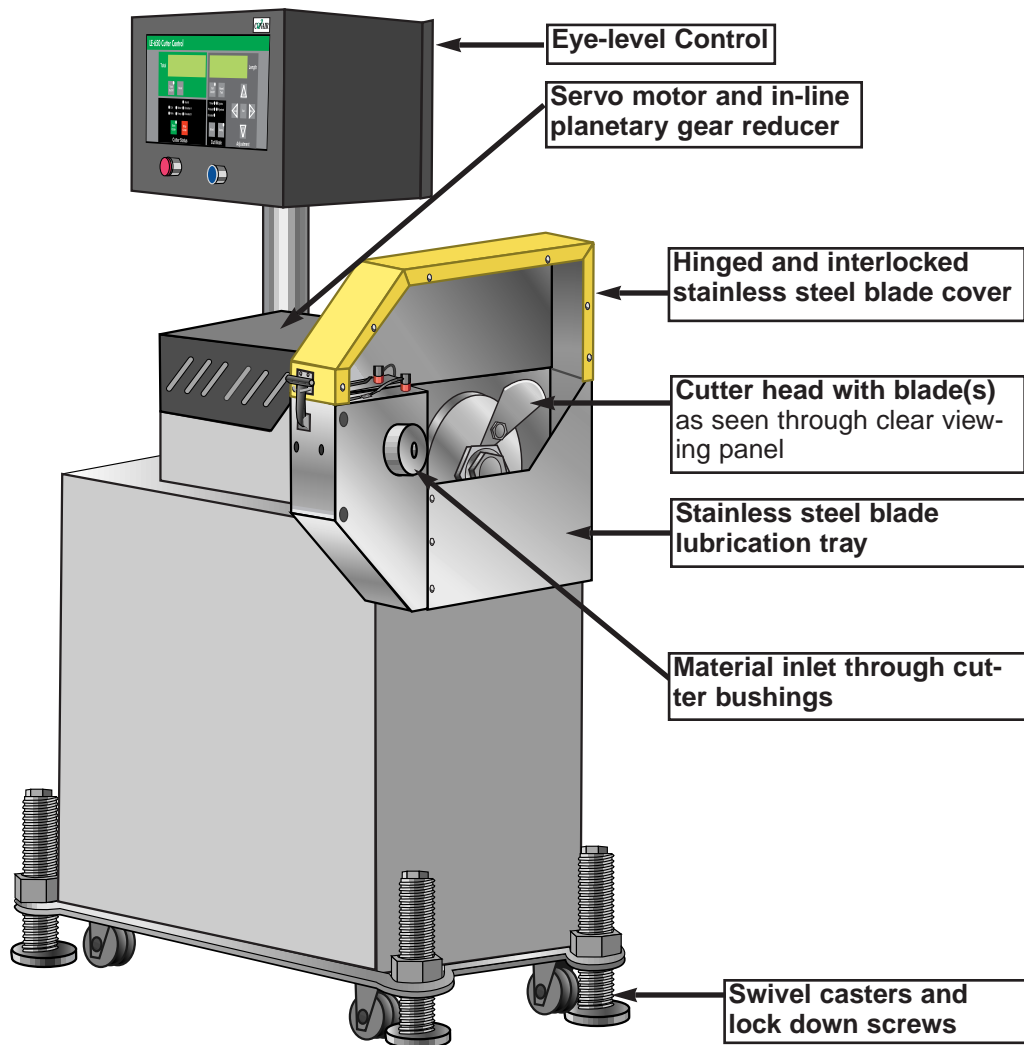
2 The cutter head holds the blade(s) as they rotate and pass between the bushings, cutting the extrudate.

1 Extruded material enters the cutter from the upstream side.

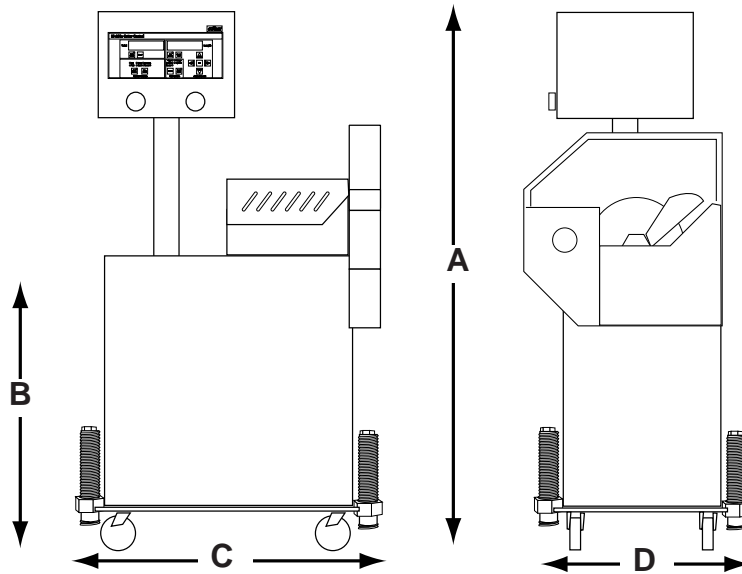
3 Cut pieces are collected or carried away on a conveyor.

SERVO CUTTER FEATURES

The SCE and SCX Servo Cutter models have these features:



SPECIFICATIONS



MODELS	SCE2	SCE3	SCE4	SCE5	SCX2	SCX3	SCX4	SCX5
Performance characteristics								
Extrudate capacity, in. {mm} dia.	1 3/4 {445}	2 3/4 {699}	3 3/4 {953}	4 3/4 {1207}	1 3/4 {445}	2 3/4 {699}	3 3/4 {953}	4 3/4 {1207}
Blade drive motor, Hp {kW}	2.5 {1.86}	2.5 {1.86}	3.8 {2.8}	3.8 {2.8}	1.95 {1.45}	1.95 {1.45}	3.3 {2.5}	3.3 {2.5}
High torque motor*	3.8 {2.8}	3.8 {2.8}	N/A	N/A	3.3 {2.5}	3.3 {2.5}	N/A	N/A
Feed direction	right->left	right->left	right->left	right->left	right->left	right->left	right->left	right->left
Dimensions, in. {mm}								
A - Height	63 {1600}	63 {1600}	63 {1600}	63 {1600}	63 {1600}	63 {1600}	63 {1600}	63 {1600}
B - Height to centerline ±2 {±50.8}	40 {1016}	40 {1016}	40 {1016}	40 {1016}	40 {1016}	40 {1016}	40 {1016}	40 {1016}
C - Width	36 {914}	36 {914}	36 {914}	36 {914}	36 {914}	36 {914}	36 {914}	36 {914}
D - Length	24 {614}	24 {614}	24 {614}	24 {614}	24 {614}	24 {614}	24 {614}	24 {614}
Weight, lbs. {kg}								
Installed	600 {272}	600 {272}	600 {272}	600 {272}	600 {272}	600 {272}	600 {272}	600 {272}
Shipping	700 {317}	700 {317}	700 {317}	700 {317}	700 {317}	700 {317}	700 {317}	700 {317}
Total Amps for Volt/phase/Frequency								
230V/1/60Hz	18A	18A	N/A	N/A	15A	15A	N/A	N/A
208V/1/60Hz*	20A	20A	N/A	N/A	17A	17A	N/A	N/A
460V/1/60Hz*	9A	9A	N/A	N/A	7.5A	7.5A	N/A	N/A
575V/1/60Hz*	7A	7A	N/A	N/A	6A	6A	N/A	N/A
230V/3/60Hz	N/A	N/A	18A	18A	N/A	N/A	20A	20A
208V/3/60Hz*	N/A	N/A	20A	20A	N/A	N/A	22A	22A
460V/3/60Hz*	N/A	N/A	9A	9A	N/A	N/A	10A	10A
575V/3/60Hz*	N/A	N/A	7A	7A	N/A	N/A	8A	8A
Cutter Head								
Aluminum 2-position	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aluminum 4-position*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
S Steel 2-position*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
S Steel 4-position*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutter Control								
	650	650	650	650	650s	650s	650s	650s
	850*	850*	850*	850*	850*	850*	850*	850*
Slide Base*								
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

OPTIONAL EQUIPMENT

Cutting torque upgrades

Several options can be used to increase the cutting torque:

- SCE-2, 3 cutters can be upgraded from a 2.46 HP (MGE-455) to a 3.75 HP (MGE-490) servo motor. (The larger servo motor is standard on SCE-4, 5 cutters.)
- SCX-2, 3 cutters can be upgraded from a 1.95 HP (DXE-455) to a 3.33 HP (DXE-490) servo motor.
- The standard aluminum cutter-head can be replaced with a heavier stainless steel one. When this option is picked, the maximum number of cuts per minute decreases from 350 to 250. Inertia, and thus cutting torque, is increased significantly.

Follower Cutting Mode (SCX only)

Follower mode allows the operator to program the desired cut length and the number of blades. The controller then automatically follows the encoder and adjusts the speed of the flywheel to maintain cut length. This is known as an electronic gearlock system. The cut length accuracy is maintained even if the puller changes speed. A 5,000 pulse per revolution encoder is used for this option using the Quadrature (x-4) mode, giving 20,000 pulses per foot for extreme accuracy and repeatability.

Slide Base

This option is highly recommended for cutting flexible extrudates. While the cutter base is fixed and aligned with the puller, the cutter itself is mounted on a set of linear slides that allow as much as 6 inches of movement. The cutter can be moved away from the puller for startup, then moved close to the puller to enhance delivery to the cutter bushings.

Bushing Lubrication

This is a self-contained spray system, which includes a reservoir and air inlet for operation at 20-30 psig (air source not included). A flexible nozzle directs lubricant onto the extrudate as it enters the cutter bushings. This decreases bushing drag and helps lubricate the blade. This option is particularly recommended for processing sticky/soft (low durometer) materials.

Blade Wipe

The blade wipe system keeps the cutting blade clean by removing lubricant and particles from the blade. A felt pad sandwiched between two pieces of stainless steel and mounted in the stainless steel blade lubrication tray wipes the knife before each cut.

LE-850 Cutter Control

This advanced cutter control offers many additional features:

- Four preset cut lengths with individual outputs
- Four preset batch counters with individual outputs
- Automatic scrap sorting when interfaced with in-line gauge monitor or control system (gauge not included)
- Automatic shut down mode for off-line cutting
- Cuff sequencing mode for multiple cutting per cuff (up to three cuts per cuff, and up to four separate cuffs per chain)
- Recipe storage of cutting programs
- RS-485 serial communications

End Sense

This option allows the use of an electric eye to produce a cut signal. Two types of electric eye brackets are included:

- A bracket for cutting parts 3.5-24 inches long. This bracket is mounted on the bushing holder, and uses a triple-beam eye with a red dot for easy setup and alignment. Coarse and fine adjustments are provided with the eye positioned above the extrudate.
NOTE: With this bracket and eye mounting, the part must be rigid enough not to sag or flex at the cut distance.
- A bracket for cutting parts up to 10 feet long. This bracket is designed to mount on a discharge conveyor. The electric eye used with this bracket is a through beam type and can be adjusted to pick up products that are at least 0.100" high (height of piece above the conveyor).

OPTIONAL EQUIPMENT

Discharge Conveyor

A discharge conveyor offers support before, during, and after cutting, and facilitates the removal of cut parts. Discharge conveyors are available in the following sizes:

- 4 inches wide by 4 feet long
- 4 inches wide by 6 feet long
- 4 inches wide by 8 feet long
- 4 or 6 inches wide by 10 feet long
- 4 or 6 inches wide by 12 feet long
- 4 or 6 inches wide by 16 feet long

NOTE: Conair strongly recommends the use of an isolation transformer. Ensuring clean and proper power can help avoid the need for costly service calls.

Isolation Transformer

The isolation transformer protects sensitive electronics from incoming power, which helps prevent errors caused by electrical noise. It also protects equipment from electrical noise generated by the servo motor and associated amplifier.

NOTE: An isolation transformer will not compensate for a ground that does not meet code requirements.

Clam Shell Clamping System

This option replaces the bushing holder's standard set screw arrangement with a clam shell type clamping system. This clamping system makes it easier to properly gap the cutter bushings.

Left to Right Machine Operation

This option changes the machine direction from the standard right to left extrusion flow.

Special Paint Type or Color

This option covers any change from the standard Conair Tan paint.

Your Conair sales representative can analyze your needs and recommend the options that are right for your system.

INSTALLATION

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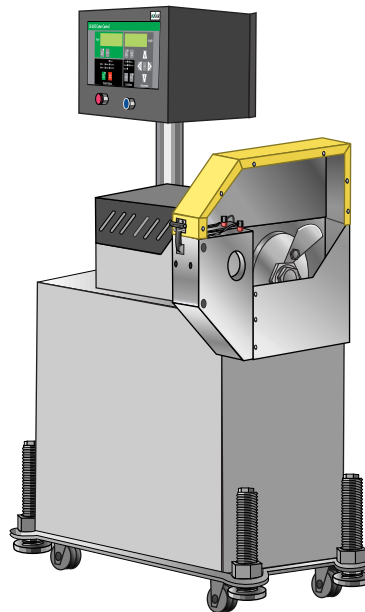
UNPACKING THE BOXES

The SCE/SCX Series Servo Knife Cutter comes fully assembled in a single crate.



CAUTION: Lifting

To avoid personal injury or damage to the cutter, lift the cutter using a forklift or hoist with straps that have been positioned at the cutter's center of gravity.



- 1 Carefully uncrate the cutter and its components.**
- 2 Remove all packing material**, protective paper, tape, and plastic. Compare contents to the shipping papers to ensure that you have all the parts.
- 3 Carefully inspect all components** to make sure no damage occurred during shipping. Check all wire terminal connections, bolts, and any other electrical connections, which may have come loose during shipping.
- 4 Record serial numbers and specifications** in the blanks provided on the back of the User Guide's title page. This information will be helpful if you ever need service or parts.
- 5 You are now ready to begin installation.** Complete the preparation steps on page 3-3.

PREPARING FOR INSTALLATION

1 You need these tools for installation:

- wire strain relief
- 16- or 18-inch adjustable wrench
- set of Allen wrenches
- set of feeler gauges
- ½ inch open or box end wrench
- flashlight

2 Plan the location. Make sure the area where the servo cutter is installed has the following:

- **A grounded power source.** Check the cutter's serial tag for the correct amps, voltage, phase and cycles. All wiring should be completed by qualified personnel and should comply with your region's electrical codes.
- **Clearance for safe operation and maintenance.** Make sure there is enough clearance around the servo cutter for maintenance and servicing. If the servo cutter has the optional slide base, be sure to check for clearance by extending the slide system in both directions.



WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

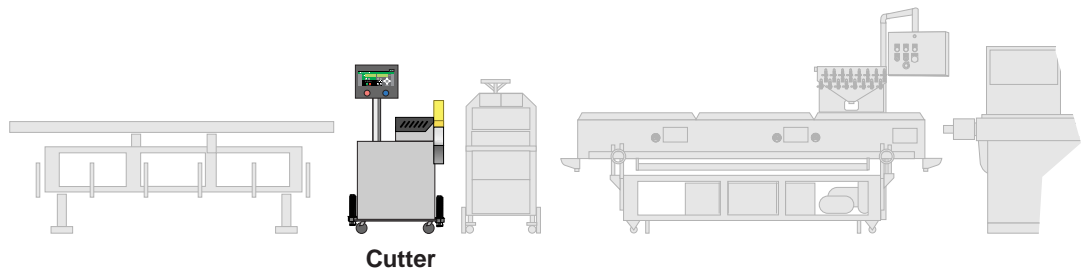
POSITIONING THE SERVO CUTTER

- 1 Move the servo cutter into position.** Place the servo cutter in position downstream of the belt puller.



CAUTION: Lifting

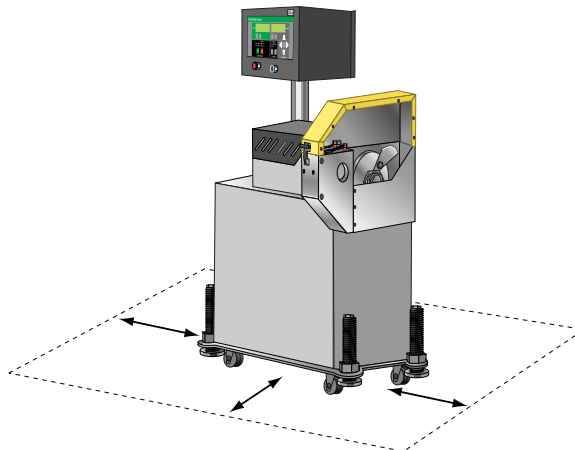
To avoid personal injury or damage to the cutter, lift the cutter using a forklift or hoist with straps that have been positioned at the cutter's center of gravity.



- 2 Determine the best distance** from the belt puller to the SCE/SCX cutter.

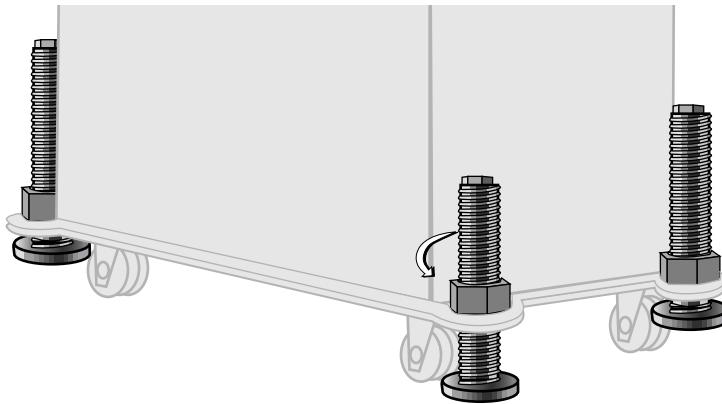
- **For flexible products,** the cutter should be as close as possible to the puller.
- **For rigid products,** leave enough space to allow the product to flex during the cutting cycle. In some cases, it may be necessary to allow 6-8 feet between the puller and cutter.

- 3 Align the cutter with the extrusion line.**



4 Measure the centerline height of the extrudate as it exits the extrusion die. Adjust all equipment on the extrusion line (sizing tank, cooling tanks, belt puller, and cutter) to this height.

5 Adjust the cutter's floorlock/caster assembly to the center height of the extrusion line using a 16- or 18-inch adjustable wrench. Once the correct height is reached, adjust the pad assembly to remove the weight from the casters for operation. This minimizes machine vibration during the cutting cycle.



6 Use a plumb line or laser to check for a straight line from the extrusion die through each line component to the cutter bushings. Adjust as necessary.

CONNECTING THE MAIN POWER SOURCE



WARNING: Electrical hazard

Before performing any work on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.



WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

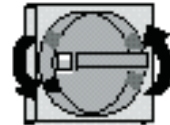
This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

IMPORTANT: Always refer to the wiring diagrams that came with your servo cutter before making electrical connections. The diagrams show the minimum size main power cable required for your cutter, and the most accurate electrical component information.

1

Open the servo cutter's electrical enclosure. Turn the disconnect dial on the door to the OFF or O position and open the door.



2

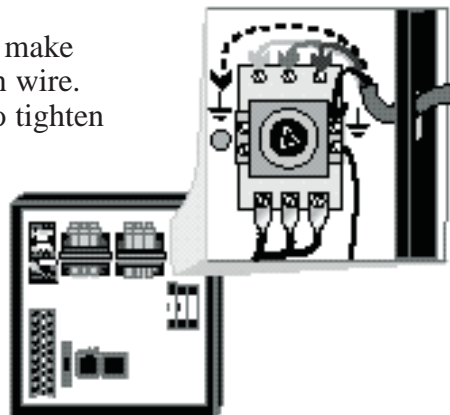
Insert the main power wire through the knockout in the side of the enclosure. Secure the wire with a rubber compression fitting or strain relief.

3

Connect the power wires to the terminals indicated on the wiring diagram that came with your machine.

4 Check every terminal screw to make sure wires are secure. Gently tug each wire. If a wire is loose, use a screwdriver to tighten the terminal.

5 Connect the ground wire to either grounding point shown in the diagram.



CAUTION: Handle with care.

The encoder is a delicate piece of equipment and must be handled gently.

INSTALLING THE ENCODER

Conair uses bi-directional encoders to ensure that only product that moves forward is counted.

Installing the encoder consists of several parts:

- the encoder
- the measuring wheel
- the connecting cable



Encoder



Wheels

The encoder is fitted with a 1 foot circumference wheel which rides on either the upper belt of the belt puller or (for rigid profiles and pipe) on the extrudate itself upstream of the puller.



Connecting Cable

The encoder is supplied with an integral mounting bracket. How and where you attach the encoder to the puller depends on your particular puller and application.

- If the wheel rides on the puller belt, make sure that its linear alignment is the same as the belt. Place the wheel near the center of the belt to minimize bouncing. Try to avoid cracks and other belt features that may affect accuracy.
- Make sure the location allows you to keep the wheel clean. Any small buildup on the wheel will affect its circumference and change the cut length.

After the encoder is installed, attach it to the cutter control using the supplied cable. The cable has been hard-wired to the control at the factory.

INSTALLING THE CUTTER BLADES



DANGER: Sharp blades!

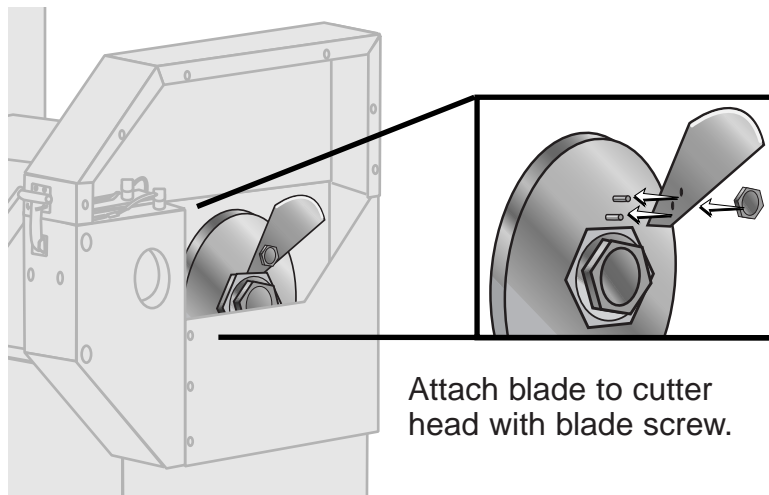
Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.



- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out power to the cutter before opening the cutting chamber.
- Always wait until the cutter head has completely stopped before opening the knife guard.

SCE/SCX cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

- When the knife guard is opened, the knife guard switch stops the cutter and prevents starting the cutter again.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The STOP button activates a circuit that stops the cutter head.



Attach blade to cutter head with blade screw.

For more information about choosing the appropriate blade for your material, [see the Appendix, pages B-1, B-3, B-4.](#)



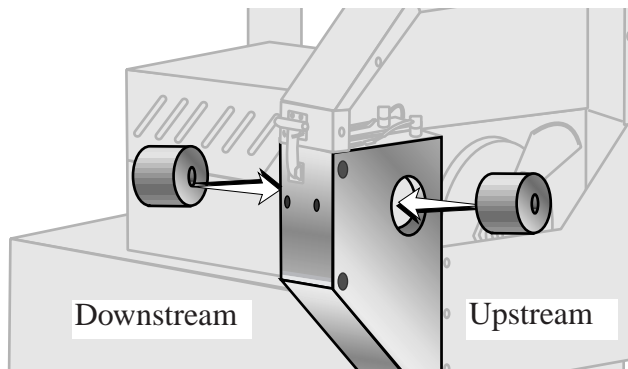
DANGER: Sharp blades!

Always wear cut-resistant gloves when the cutting chamber is open and when handling blades. Never open cutting chamber without locking out the cutter power and waiting until the cutter head stops spinning.

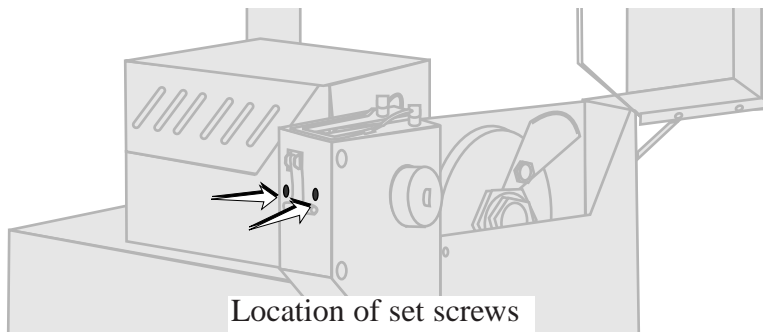


MOUNTING THE CUTTER BUSHINGS

- 1 Rotate the cutter head** until the blade is positioned in the gap between where the bushings go.
- 2 Slide the downstream bushing into position**, positioning it up to and barely touching the blade (use feeler gauge). **NOTE:** the blade should not be deflected.



- 3 Tighten the set screw** against the flat side of the bushing to hold the bushing in position.



For more information about setting and adjusting the gap for the bushings, see [About Cutter Bushings in the Appendix, page C-1](#).

- 4 Slide the upstream bushing into position**, positioning it up to but not touching the blade (using feeler gauge).
- 5 Tighten the set screw** against the flat side of the bushing to hold the bushing in position.
- 6 Rotate the cutter head by hand** to make sure the bushings did not move, and the the blade still passes through the gap between the bushings.

CHECKING REPEATABILITY

Before any Conair puller/cutters are shipped, they are tested for cut time repeatability to be sure they are within performance specifications. The repeatability test checks the performance of the rotary knife cutter to return the home park position after a complete cut. Acceptable repeatability times allowed for each cutter model prior to shipping are:


Type of Cutter	Repeatability Time
AC Pneumatic Cutter	Less than 1 millisecond
DC Pneumatic Cutter	Less than 1.5 millisecond
Velocity Servo (E Drive)	Less than 1 millisecond
Positional Servo (FX)	Less than 0.1 millisecond

Note: 1-millisecond at 60 feet per minute is equal to .012 inches.

The repeatability mode is built into the Conair cutter controls and allows you to perform similar tests, without any external test equipment. It is recommended that you check repeatability on a regular basis. Acceleration/deceleration delays of the servo do not contribute to repeatability error; any error is attributed solely to motor stability, couplings, assembly, power, and proximity sensor alignment.

Use any blade speed and line speed. The line speed is only seen while in the Encoder or Product modes. It is recommended that the tests be performed at cut intervals between 0.5 and 5-seconds. Do not change the blade speed or the line speed after starting the test.

To test repeatability:

- 1 Turn on the cutter.** Performing the test with the cutter off-line shows problems with the cutter; performing the test with the cutter on-line shows a problem with the puller.
- 2 Place the cutter in any mode except follower mode.**
- 3 Press the Cut On/Off button;** the cutter is activated automatically.
- 4 Press and hold the Move Right button** for a minimum of 5 seconds. 
- 5 Read the results on the display.**

Repeat the test by pressing the Reset/Test Cut button to begin a new sample period.

To end the Repeatability test, press any button except the Reset/Test Cut button. The LED returns to its normal display.

REPEATABILITY TEST RESULTS

Results in Flywheel mode

The display shows "Repeat Test" and the park-to-park (PP) reading. This is the total (peak) variance of a full revolution of the cutter head. The reading is in milliseconds, to the third decimal place, i.e. 0.010 is 0.01 milliseconds (or 10 microseconds). If the reading exceeds 9.999 the unit automatically resets the repeatability test, displays "Over Run", and attempts to begin the test again. If this occurs the error is too large and there is a fault in the cutter drive that must be corrected.

Results in Timer mode

When testing repeatability in Timer mode, the cutter is making on-demand cuts at a set time interval (i.e. one-second intervals). The display shows "Repeat Test", and then the cut-to-park (CP) reading and the cut-to-cut (CC) reading. The reading is in milliseconds, to the third decimal place, i.e. 0.010 is 0.01 milliseconds (or 10 microseconds).

CP is the peak time variance between the cut signal output (preset time) to the servo amplifier, and the proximity switch just prior to the end of the cut cycle. This is the repeatability of the cutting system to return to the home park position. This value is higher than the PP reading since it includes the acceleration and deceleration contributed by the servo motor.

CC is the peak time variance between cuts. Record and compare the cut-to-cut number to the CC value recorded in encoder or product mode shows how much error is by external influences (i.e. variation in belt puller speed, encoder mounting problem, etc.).

If the reading exceeds 9.999, the unit automatically resets the repeatability test, displays the message "Over Run", and attempts to begin the test again. If this occurs the error is too large and there is a definite fault that must be corrected.

Results in Encoder or Product mode

The display shows "Repeat Test", and then the cut-to-park (CP) reading and the cut-to-cut (CC) reading. The reading is in milliseconds, to the third decimal place, i.e. 0.010 is 0.01 milliseconds (or 10 microseconds).

Compare the cut-to-park (CP) reading to the CP reading in the other modes. There should be very little difference in these readings.

Compare the cut-to-cut (CC) reading to the CC reading in the other modes. Since the Encoder and Product modes are influenced by external signals, this reading will reflect the speed stability of the puller.

PREPARING FOR TESTING

- 1 Make sure all components** are installed according to assembly drawings. Make sure that all bolts on the cutter have been tightened.
- 2 Check that cutter is firmly locked** into position with the anchoring screws.
- 3 Check that all wiring conforms to electrical codes**, and all wiring covers are in place.

TESTING THE INSTALLATION

- 1 Turn on the main disconnect.** Plug in the main power cord and turn on the main disconnect. The display should fully illuminate and perform its bootup routine.
- 2 Check that the E-Stop button is in the out, extended position.** NOTE: If the E-Stop button is pushed in, the guard LED on the control will not illuminate, even if all other safety features are in the proper positions.
- 3 Press the Reset button next to the E-Stop button.** The light on the button should go out.
- 4 Make sure that the Cut On\Off LED is Off.** If necessary, press button to turn off LED.
- 5 Press Start Cutter button.** The LED in the button should light. On SCX cutters, the cutter head will make one or two slow revolutions until it finds its home offset position.
- 6 Open the knife guard.** The Machine Reset push button should light.

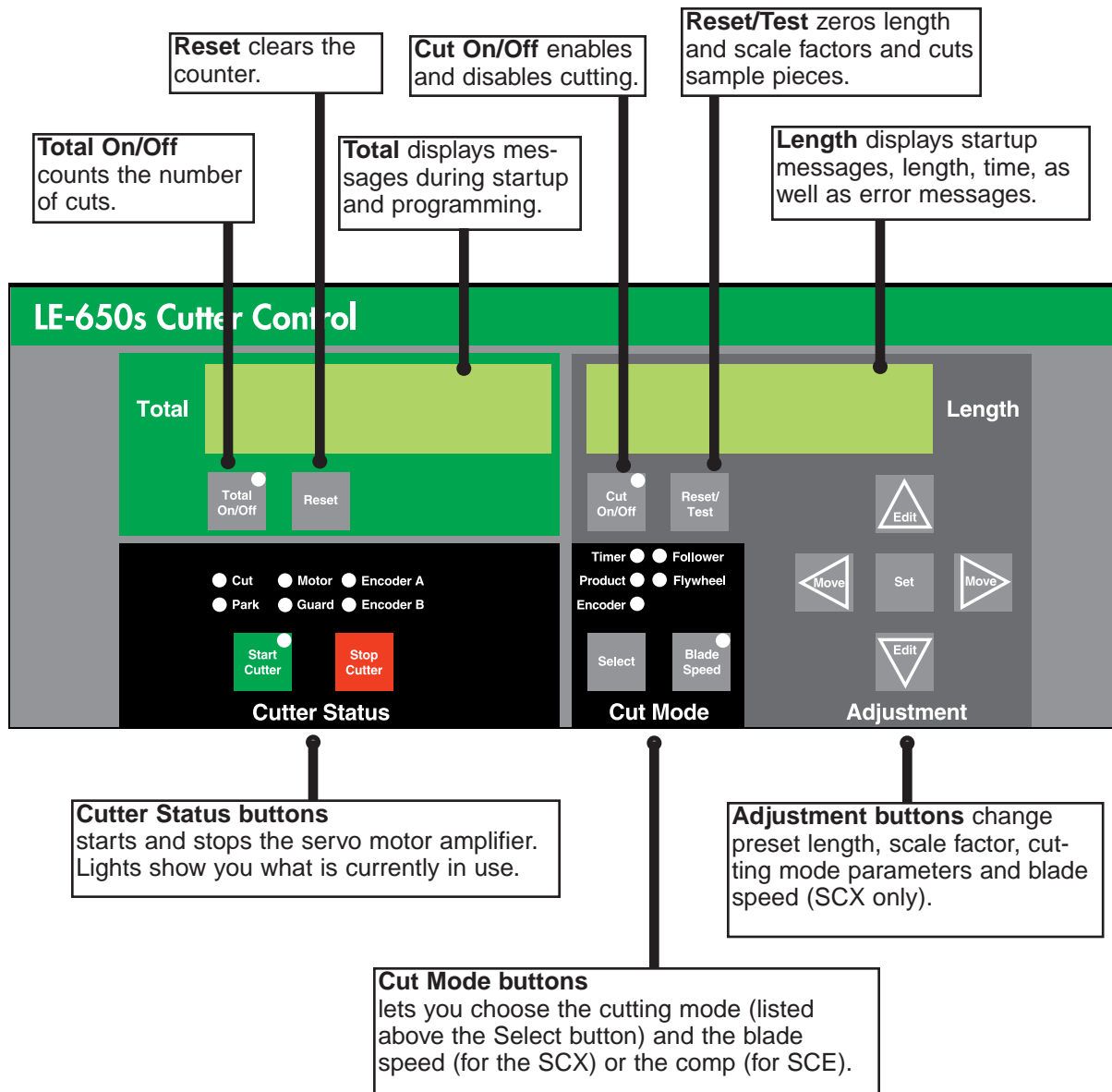
If the cutter is not working properly at any time, turn it off immediately and refer to the Troubleshooting section of this User Guide.

If you do not encounter any problems, proceed to the Operation section.

OPERATION

- *The Cutter Control4-2*
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THE CUTTER CONTROL



NOTE: Separate Machine Reset and Emergency Stop buttons are located below the control face (not shown).

THE CONTROL FEATURES

The cutter control has several features that allow you to input setup information, monitor cutting process, and view errors.

Total information is located in the upper left of the control and consists of:

- **Total LED** displays messages during startup and programming. During normal operation, it shows the number of cuts if the counter has been activated. It also displays error messages. [See Troubleshooting](#) for more details about error messages.
- **Total On/Off button** activates a counter that allows you to monitor the number of cuts. This button is ON when the LED in the corner is lit.
- **Reset button** clears the counter and resets count to zero.

Length information is located on the right of the control and consists of:

- **Length LED** displays messages during startup. During programming, it shows the value of adjustable parameters. During normal operation, it shows either current length or elapsed time depending on the cutting mode. It also displays error messages. [See Troubleshooting](#) for more details about error messages.
- **Cut On/Off button** enables/disables automatic cutting.
- **Reset/Test button** has several functions:
 - ◆ It produces a sample cut during normal operation at the set blade speed while resetting the length count (SCX model only). The cut piece is not counted on the total counter.
 - ◆ It sets the length and scale factor presets to zero in programming mode.
- **Set button and Adjustment arrows** are used to:
 - ◆ Change preset length
 - ◆ Change preset scale factor
 - ◆ Change cutting mode parameters
 - ◆ Set the blade amount (SCX Follower mode only)
 - ◆ Set blade speed (SCX only)

The adjustment arrows adjust some cutter parameters on a digit-by-digit basis:



Use the up Edit button to increase the values of the flashing digit. The digit steps one unit with each press (0 follows 9). This button can also be used to adjust cut length during normal operation.



Use down Edit button to decrease the value of the flashing digit. This button can also be used to adjust cut length during normal operation.



Use left Move button to select the digit to the left of the flashing digit. The new digit flashes, indicating it can be edited.



Use right Move button to select the digit to the right of the flashing digit. The new digit flashes, indicating it can be edited.

NOTE: You must press the Set button first before the arrow buttons. Press the Set button again after using the arrow buttons to enter the new data.

The Cutter Status buttons and lights provide information about the status of the cutting process:

- **Start Cutter button** enables the drive.
- **Stop Cutter button** disables the drive. **NOTE:** The servo motor amplifier is powered when the main disconnect is turned on. The cutter head cannot be rotated by hand until the machine has been electrically isolated.

The lights above these two buttons let you know the status of the cutter.

- **Cut light** lets you know when a cut output signal is generated during an on-demand mode.
- **Park light** lights when the flag on the cutter head passes the park sensor proximity switch or is given a signal from a simulated blade position that is generated by the drive.
- **Motor light** lights when the Start Cutter button is pushed. It lets you know the servo motor is enabled.

-
- **Guard light** lights when all safety devices (including the E-Stop and machine Reset buttons) are in the correct operating positions.
 - **Encoder A, B lights** indicate that the encoder is sensing signal changes and operating in a bi-directional mode.

The Cut Mode button and lights let you select the cut mode, see which cut mode the cutter is in, and set the blade speed (for the SCX only). They include:

- **Select button** lets you choose the cutting mode. Pressing the button moves you through the list of available cutting modes. The cutting mode is active when the light next to it is lit.
- **Timer light** tells you the cutter is in the timer mode. The timer mode uses a timer to produce a cut signal. When a pre-set time is reached, a signal activates a single cut cycle. In timer mode, accuracy depends on the consistency of the belt puller or feeding device. If the speed of the extrudate changes, the length also changes.
- **Product light** tells you the cutter is in the product mode. Product mode uses an electric eye to sense the end of the extrudate and signal a cut. The electric eye is mounted either on a bracket after the downstream cutter bushing, or on the discharge conveyor. If properly set up, this is the most accurate on-demand cutting mode.
- **Encoder light** tells you the cutter is in the encoder mode. Encoder Mode uses a digital encoder to count the number of items per unit of measure of forward extrudate movement. The cut signal is generated when the number of counts equal to the desired length is reached. Conair uses bi-directional encoders to ensure that only the product that moves forward is counted.
- **Follower light** tells you the cutter is in the follower mode. Follower mode (option available on SCX cutters only) is a continuous cutting mode. The operator enters the number of blades on the flywheel and enters the desired cut length into the control. The servo motor is then gear-locked to the encoder signal, which allows it to automatically speed up or slow down to follow the puller speed. Even if the puller is being adjusted to change wall thickness or outside diameter, the cut length remains constant.

-
- **Flywheel light** tells you the cutter is in the flywheel mode. Flywheel mode is a continuous cutting mode; the blade spins continuously. The speed is set at 750 rpm for SCE cutters but can be adjusted on SCX cutters (from 200-750 rpm).
NOTE: If the puller speed changes, the cut length will also change. In most cases the puller speed consistency has a larger effect on cut length accuracy than the flywheel speed.
 - **Blade Speed button** allows you to select the blade (flywheel) speed (SCX model only).
 - **Comp button** is a non-functioning button (SCE model only).

BEFORE STARTING

Before you start daily operation of the servo cutter, you need to perform preventative maintenance. Necessary maintenance is described in the Maintenance section of this Users Guide, beginning on page 5-1.



WARNING: Be sure that power to the servo cutter is OFF when doing any maintenance on the servo cutter. Follow all safety rules when performing any maintenance on this equipment.

Daily maintenance includes:

- Inspecting the cutter blades
- Inspecting the blade mounting hardware
- Making sure the cutter bushings are properly secured
- Inspecting the closure latch on the knife guard
- Checking cutter alignment with extrusion line
- Performing any floor lock adjustments as needed

These items and weekly, monthly, and semi-annual maintenance procedures are detailed in the Maintenance section of this User Guide.

- 1 Plug in the power cord** to restore power after any required maintenance.
- 2 Turn on the main power.** The cutter control performs its bootup routine.
 - The Total and Length displays show "Good day," followed by "LE650" or "Servo" and EPROM version number, "Test good" (or an error, if encountered, i.e. "Length Error"), then "Set to" and the machine type (for SCE cutters) or servo version (for SCX cutters).
 - At the end of the bootup routine the displays shows the current total count and the most recent length display.

NOTE: You can watch the servo motor amplifier's status screen during bootup through the window on the back of the electrical enclosure. This display gives information that may be useful if you have a problem. [See the Troubleshooting section.](#)

While the cutter is booting up, perform the next three steps:

- 3 Make sure the E-Stop button is in the out, extended position.**

NOTE: If the E-stop is pushed in, the Guard light on the cutter control will not light, even if all other safety features are in the proper positions for operation.

- 4 Push the blue lighted machine Reset button** (next to the E-stop button). The light should turn out.

NOTE: The blue Reset button lights any time power is disconnected, either by pushing the E-stop or turning off power using the disconnect. The cutter won't run if the Reset button is lit.

- 5 Make sure that the Cut On/Off button is off** (i.e. the light should not be lit). If necessary, press the button to turn the light off.

- 6 Press the green Start Cutter button** to start the servo motor amplifier program mode once the cutter control completes its bootup procedure. The green light in the corner of the Start Cutter button illuminates. On SCX cutters, the blade may make one or two rotations to find its home offset position.

SETTING THE BLADE SPEED

TIP: To find the minimum and maximum blade speeds for your particular cutter, first enter a number under 100. The minimum blade speed displays as the default value. Record this number as the minimum blade speed for your cutter. Next, enter a number greater than 1000 and record the resulting default value as the maximum blade speed.

On SCX cutters, the blade speed can be adjusted to suit your particular application. If you're not sure what blade speed to use, start fast and work your way down to slower speeds. More information is available in the Appendix, pages B-1, B-3, and C-1.

To set the cutter blade speed:

- 1 Press the Blade Speed button.** The Total LED displays the message "Blade." The Length displays the previously set value; one of the digits is flashing.
NOTE: You can access blade speed ONLY when this button is ON.
- 2 Use the adjustment arrows to set the blade speed** to the desired value. [See Control Features](#), beginning on page 4-3, for an explanation of how to use the arrow keys.
- 3 Press either the Set button or the Blade Speed button** to accept this value and return to normal operation. Pressing either button has the same effect. *NOTE: If the value entered is outside the blade speed range for your cutter, the blade speed defaults to either the maximum or the minimum.*

CHOOSE THE CUTTING MODE

Choose on-demand modes (Timer, Encoder, Product) for lower-speed cutting and continuous modes (Flywheel or Follower) when making more than 350 cuts per minute.

- **Timer Mode** cuts based on time. When the preset time is reached, the cutter control signals the cutter head to rotate and make a cut. If the extrudate delivery speed changes, the length will also change.
- **Encoder Mode** monitors the forward movement of the extrudate and signals a cut based on a set number of counts per unit of measure.
- **Product Mode** uses an electric eye to sense the end of the extrudate and signals a cut.
- **Flywheel Mode** is a continuous cutting mode; you set the speed of the blade (on SCX models only).
- **Follower Mode** (option available on SCX cutters only) is a continuous cutting mode. The servo motor automatically speeds up or slows down to follow the puller speed.

SETTING THE CUTTING MODE

- 1 Be sure that the Cut On/Off button is OFF.**
- 2 Press the Select button** to activate the cutting mode you want. A mode is active when the LED next to it is lit. Each time you press Select the controller activates the next available mode. Continue pressing the Select button until you get the mode you want. Then go on to the next step.
- 3 Make any additional entries** required for the cutting mode you have selected. Press the Set button. Use the adjustment arrows to change the number listed on the Length or Time display. Press Set button to return to normal operating mode.
 - **For Timer mode:** Use the Set button and Adjustment arrows to change the time (in seconds, to three decimal places). NOTE: the decimal point cannot be moved.
 - **For Encoder mode:** Use the Set button and Adjustment arrows to change the cut length. If the cut length does not equal the set length, adjust the Scale Factor.
 - **For Product mode:** Use the Set button and Adjustment arrows to change the hold-off time. In Product mode, the length is set by the electric eye that senses the end and initiates a cut. To prevent unwanted double cuts, a hold-off (or one-shot) timer is built into the cutter control. After a cut is made, the hold-off time displays in the Display window (in seconds, to three decimal places) and begins counting down to zero. No cutting occurs until the count-down is completed. Make sure the new value is less than the time between cuts. NOTE: 70-80% of the expected time between cuts is recommended.
 - **For Flywheel mode:** Use the Set button and Adjustment arrows to change the cutter blade speed. Begin with a fast speed and work your way to slower speeds. [See Appendix: All About Cutter Blades, page B-1.](#)
 - **For Follower mode:** Press the Blade Speed button; use the Adjustment arrows to enter the number of blades (1, 2, 4, or 8). Press the Set button to accept the value. Use the Set button and Adjustment arrows to set the cut length.

SETTING THE PRESCALE VALUE

The Encoder mode uses a scale factor (called the prescale value) to compensate for configurations that differ from the standard (a measuring wheel with a 1 foot circumference; a 1200 pulse encoder; and English units of measure). The prescale value is set at the factory for your equipment and typical unit of measurement. However, it may occasionally be necessary to adjust the prescale value.

To check the length of the cut piece:

- 1 Use the Select button to choose the Encoder mode.**
- 2 Press the Set button** and use the Adjustment arrows to set the length equal to 12.00 inches.
- 3 Produce several trial cuts.** Measure the length of these pieces to within your tolerance (usually to the nearest thousandth). If the pieces are not the correct length, you will have to change the prescale value.

NOTE: You can affect the cut length by changing the clamping force on the puller. Increasing the belt tension results in less slippage and longer cut length. Decreasing belt tension results in more slippage and shorter cut lengths.

To adjust the prescale value:

- 1 Make sure you are in encoder mode,** the Cutter On/Off is off, and the Start light is off.
- 2 Quickly press Set twice.** The current prescale value displays in the Display window. The word “Scale” displays in the Total window.
- 3 Adjust the prescale value** using the Adjustment arrows. NOTE: the decimal place cannot be moved.
- 4 Continue adjusting and cutting pieces** until the length is within your requirements. The adjustment process is done by trial and error.

NOTE: The cutter must be in the stop condition to change the prescale value.

- 5 Press the Set button.** When all modes are set, press the Set button to accept the new values.

CHECKING CUT QUALITY

- 1 Press the Reset/Test button** and observe the movement of the cutter blade. The cutter head makes a single rotation and the blade moves through the cutter bushings without interference.
- 2 Insert a piece of extrudate through the cutter bushings.**
- 3 Press the Reset/Test button.** A single cut is made at the preset blade speed. (This works even if Cut On/Off is off.)
- 4 Inspect the cut.** If necessary, adjust the blade design or blade speed (SCX only). [See Appendix: All About Cutter Blades.](#)

If you have not already done so, check the cutter hardware, power up the cutter, select cutting mode and blade speed (SCX only), and make a test cut to check cut quality.

When you are satisfied with cut quality, press the Cut On/Off button to illuminate the LED and begin automatic operation.

When the extrudate is running within tolerance, cut it with a knife or saw and feed it through the cutter bushings.

STARTING THE SERVO CUTTER

MAKING ADJUSTMENTS DURING OPERATION

There are several adjustments you can make during normal cutting. Press the Set button and use the Adjustment arrows to fine-tune a preset value during normal operation:

- **In Timer mode**, adjust the time between cuts
- **In Encoder and Follower modes**, adjust the length
- **In Product mode**, adjust the hold-off time
- **In Flywheel mode**, adjust blade speed (SCX only)

Use the Adjustment arrows to:

- **Count up one digit** when you Press and release Up Edit adjustment arrow.
- **Increase the preset more rapidly** by pressing and holding the Up Edit adjustment arrow.
- **Count down one digit** when you press and release Down Edit adjustment arrow.
- **Decrease the preset more rapidly** by pressing and holding the Down Edit adjustment arrow. When the arrow is released the display holds the preset for an additional five seconds before returning to display the count in progress.
- **Perform a manual cut and reset the length** by pressing the Reset/Test button at any time during on-demand cutting. Pressing Reset/Test has no effect during continuous cutting.
- **Count the number of cuts** by pressing the Total On/Off button. Use the Reset button to return the count to zero. This feature is useful for collecting samples during a production run.
- **Stop cutting temporarily** by setting Cut On/Off to off. This allows you to view the cutting blade (through the window) or perform other tasks without shutting down the cutter.

NOTE: While the controller will allow you to switch modes during operation, this is not recommended.

Press the Set button to accept changes.

STOPPING THE SERVO CUTTER



WARNING: Never stop the servo cutter by opening the knife guard.

This can cause damage to the equipment and injury to personnel.



CAUTION: Always turn Cut On/Off to Off first.

This is especially important in Flywheel mode; otherwise the blade may come to a stop in the extrudate.

Use this procedure to safely stop the servo cutter:

- 1 Press Cut On/Off button** to stop cutting (light is off).
- 2 Press Stop Cutter button** to de-energize the servo motor (light is off).
- 3 Turn the rotary disconnect to the off position.**



WARNING: Never turn off the rotary disconnect first.

Doing so will turn off all power to the unit, and the cutter will not be brought to a controlled stop. For safe stopping, always follow the sequence given above.

- 4 Disconnect the power cord** if it is equipped with a plug on the end.
- 5 Lock out the rotary disconnect.**
- 6 Clean the lubricant reservoir** if you are shutting the servo cutter down for the day.

MAINTENANCE

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- ***Maintenance Overview***5-4
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MAINTENANCE FEATURES

The Servo Cutter SCE and SCX models need regular, scheduled maintenance for peak performance. Among the features that require maintenance are:

- Cutter blades
- Blade mounting hardware
- Cutter bushings
- The knife guard hardware
- Cutter alignment
- Floor locks
- Lubrication tray
- Shafts of optional slide rail system
- Electrical cables
- Control panel lights

WARNINGS AND CAUTIONS

To maintain the best performance of the servo cutter, it must be cleaned and inspected regularly. Maintenance includes a daily, weekly, quarterly, and semi-annual (every 6 months) schedule.

Use this maintenance schedule as a guide. You may need to shorten the time of the maintenance schedule, depending on how often you use the servo cutter, and the types of material flowing through it.

Follow all precautions and warnings when working on the equipment.



WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region.



WARNING: Voltage Hazard

This equipment is powered by alternating current, as specified on the machine serial tag and data plate. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

A properly-sized conductive ground wire from the incoming power supply must be connected to the chassis ground terminal inside the electrical enclosure. Improper grounding can result in severe personal injury and erratic machine operation.

Before performing maintenance or repairs on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.



DANGER: Sharp blades!

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.



- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out the cutter before opening the cutting chamber.
- Always wait until the cutter head has stopped completely before opening the knife guard.

SCE/SCX cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

- When the knife guard is opened, the knife guard switch stops the cutter and prevents starting the cutter again.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The STOP button activates a circuit that stops the knife.

MAINTENANCE OVERVIEW

This section describes the daily, weekly, monthly and semi-annual maintenance schedules that should be performed when changing materials or lines, or when changing equipment, as well as the maintenance procedures to follow.

Cutting either flexible or rigid materials generates tremendous shock and vibration to the entire unit. Anything that can loosen, will over time.

To maintain the best performance, follow this maintenance schedule and develop an effective preventative maintenance program.

PREVENTATIVE MAINTENANCE SCHEDULE

● Daily

☐ **Checking cutter blade(s)**

Clean, sharpen or replace as needed ([see page 5-6](#)).

☐ **Inspecting the blade mounting hardware**

The blade securing bolt should use both a lock washer and flat washer, and be tightened enough to fully compress the lock washer. Replace the holding pins if they appear worn.

☐ **Inspecting the cutter bushing screws**

Check that the cutter bushing screws are secure ([see page 5-7](#)).

☐ **Checking the closure latch on the knife guard**

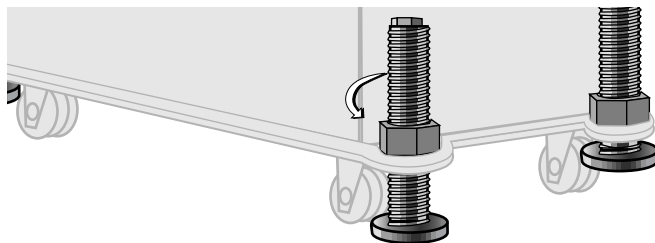
[See page 5-7](#).

☐ **Inspecting cutter alignment**

Proper cutter alignment is critical for optimum performance. Use a plumb line or laser to check for a straight line from the extrusion die to the cutter bushings.

☐ **Check floor locks**

It is always recommended that the weight be removed from the casters for optimum stability during cutting cycles. Check to see if the floor locking mechanism is properly adjusted.



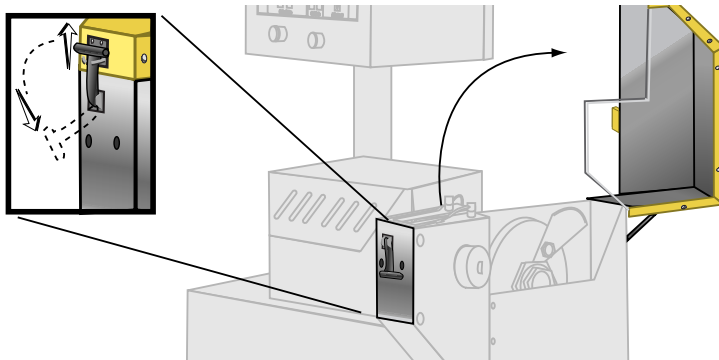
PREVENTATIVE MAINTENANCE SCHEDULE CONTINUED

● Weekly

- Cleaning the blade lubrication tray**
[See page 5-8.](#)
- Lubricating shafts on optional slide rail system**
[See page 5-8.](#)

● Monthly

- Checking hardware on the knife guard**
Inspect the hardware on the knife guard (fasteners on hinge and the clear blade guard window). Tighten as needed.
- Checking bushing holder proximity switches**
Inspect the sets screws which retain the bushing holder proximity switches for tightness. Adjust as needed. [See Adjusting the Proximity Switches, page 5-9.](#)
- Checking the metal draw latch**
Inspect the latch on knife guard for wear and proper tension. Readjust or replace as needed.



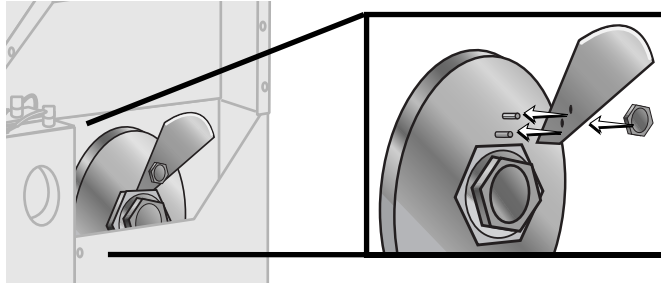
- Clean the clear blade guard window**
Clean using glass cleaner or plain water. Other materials may cause premature loss of clarity or crazing.

● Semi-annual (every 6 months)

- Inspecting electrical terminals**
Check all electrical terminals for tightness; adjust as needed. [See Checking Electrical Connections, page 5-10.](#)
- Checking torque on Trantorque coupling device**
Check the tightness (torque) of the Trantorque coupling device with a torque gauge. This device connects the cutter head to the Micron reducer shaft. [See Checking Torque, page 5-12.](#)
- Checking all electrical cables**
Inspect all electrical cables for cuts and abrasions. Replace as needed.
- Inspecting control panel lights**
Check to make sure no LEDs or lights are burned out on the control panel. Replace as needed.

CHECKING BLADES

Blades become dull over time depending on the material being cut, cut rate, blade speed, and blade material and thickness. Check blades regularly for sharpness as well as scratches, nicks, burrs, and material buildup. Clean, sharpen or replace as needed (see [Installing Cutter Blades](#), page 3-8).



DANGER: Sharp blades!

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.

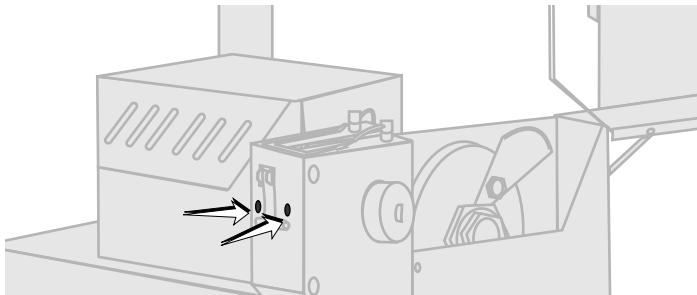


- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out the cutter before opening the cutting chamber.
- Always wait until the cutter head has stopped completely before opening the knife guard.

SCE/SCX cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

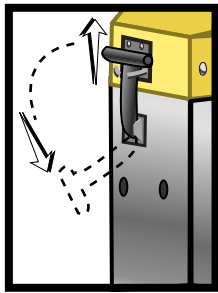
- When the knife guard is opened, the knife guard switch stops the cutter and prevents starting the cutter again.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The STOP button activates a circuit that stops the knife.

Check the set screws that secure the cutter bushings. If bushings move during cutting, cutting blades and possibly the drive chain could be damaged.



INSPECTING CUTTER BUSHING SCREWS

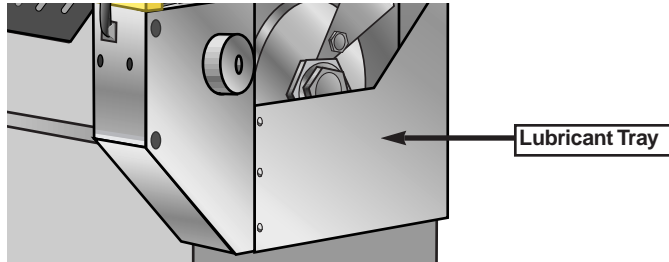
Check the latch and adjust it so the knife guard closes completely. This prevents false triggering of the safety switch.



CHECKING THE CLOSURE LATCH

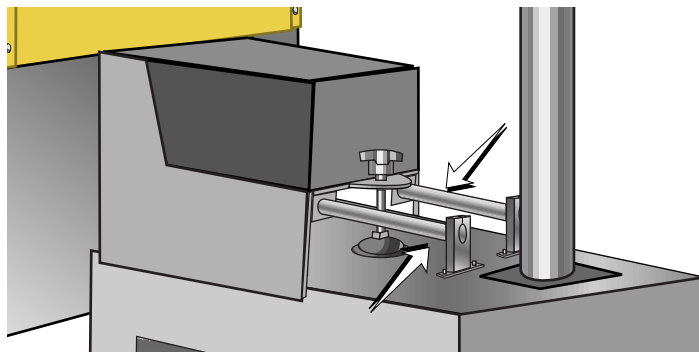
CLEANING THE BLADE TRAY

This tray is built into the cutter assembly as a simple method of applying lubrication to your blade during cutting cycles. Depending on cut rate and type of material and lubrication, the area will need to be cleaned on a regular basis and the lubricant replaced. Open the knife guard and, using a shop vac or other similar equipment, remove all liquid and solids from the cutting chamber and around the bushings. Replace the lubricant. For more information, [see the appendix, Blade and Bushing Lubrication, page D-1.](#)



LUBRICATING THE SLIDE RAIL SYSTEM

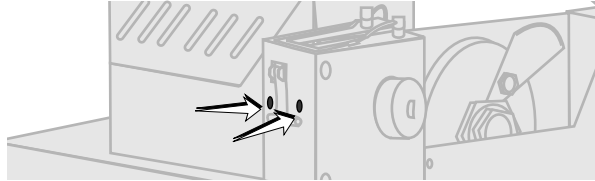
Check the shafts on the slide rail system. Even though these shafts are stainless steel, it is recommended that a light oil (WD-40 or similar) be applied to the shafts as needed. Wipe off any excess.



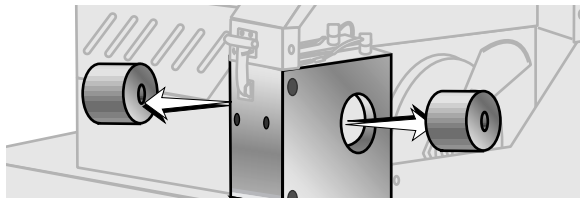
Follow all warnings and cautions listed at the beginning of the Maintenance section of this User Guide.

ADJUSTING THE PROXIMITY SWITCHES

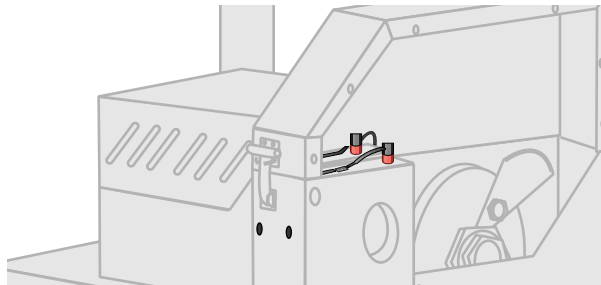
- 1 Be sure the main power is disconnected** and the cutter is locked out.
- 2 Loosen the set screws** that hold the cutter bushings.



- 3 Remove the cutter bushings.**



- 4 Check the depth of the proximity switch face** for each bushing. It should be recessed no more than 0.010 inches, but should not interfere with the bushings themselves.



- 5 Use an Allen wrench to check the tightness** of each proximity switch's retaining screw.

NOTE: You can damage the proximity switch if you over-tighten the retaining screw.

- 6 Replace cutter bushings** and check for proper cutting blade alignment. [See page 3-9, Mounting the Cutter Bushings](#), and the [Appendix, pages C-1 to C-5](#).
- 7 Plug in the power cord** and turn the main power disconnect to the on position if all other maintenance is completed.

CHECKING ELECTRICAL CONNECTIONS



WARNING: Electrical hazard

Before performing any work on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.

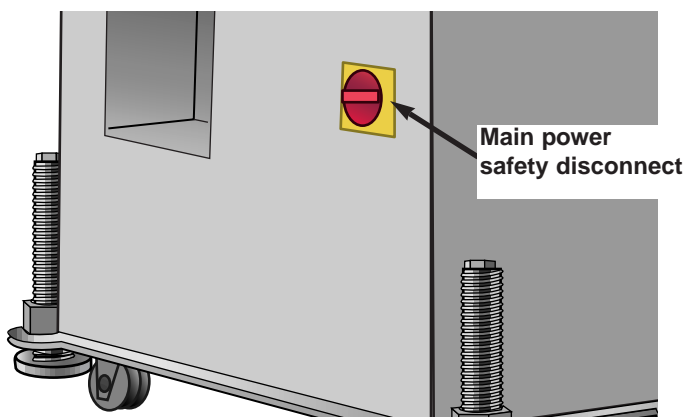


WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

- 1 Be sure the main power is disconnected and the cutter is locked out.** Always disconnect and lock out the main power source before opening the unit or servicing.
- 2 Turn the main power disconnect to the off position** before opening the electrical enclosure on the back of the cutter, or the back of the control. This is a safety device to prevent you from opening the doors if the power is still on.



3 **Open the electrical enclosure.**

4 **Inspect all wires and connections.** Look for loose wires, burned contacts, and signs of over-heated wires. Have a qualified electrician make any necessary repairs or replacements.

5 **Close the electrical enclosure door.**

6 **Inspect the exterior power cords.** Cords should not be crimped, exposed, or rubbing against the frame. If the main power cord runs along the floor, make sure it is not positioned where it could rest in pooling water or could be run over and cut by wheels or casters.

CHECKING TORQUE

The Trantorque coupling device connects the servo motor to the cutter head. It is important that it is tightened to the proper torque.



WARNING: No lubricants!

Use no lubricants on the Trantorque coupling device.

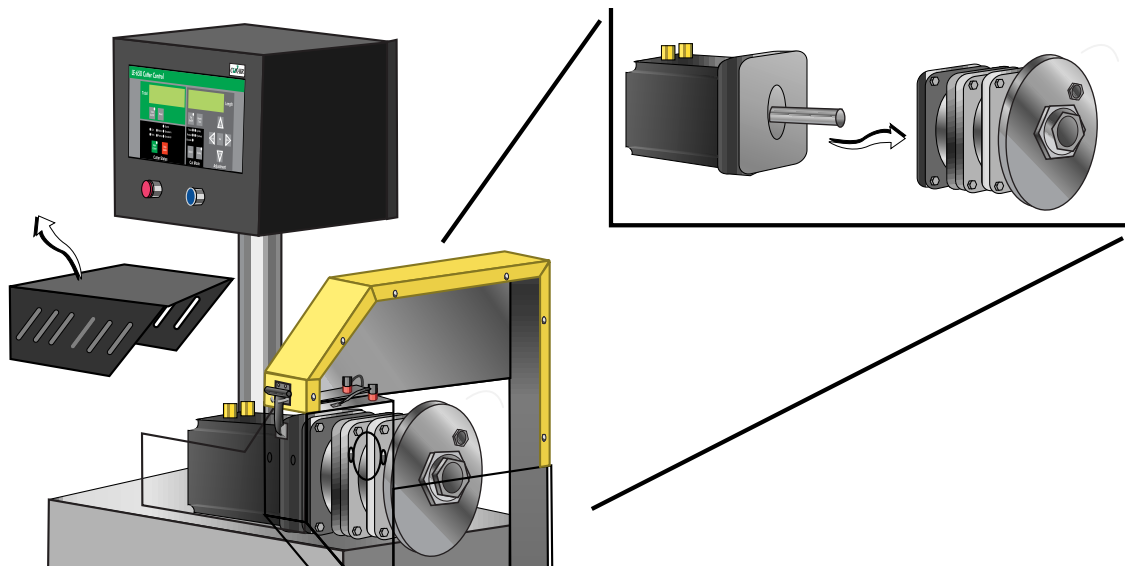
1 Carefully remove the cutter blade.



DANGER: Sharp blades!

Always wear cut-resistant gloves when the cutting chamber is open and when handling blades. Never open cutting chamber without locking out the cutter power and waiting until the cutter head has stopped completely. Handle blades with care at all times.

2 Check to make sure both the shaft and component bore of the Trantorque coupling device are completely free of paint, grease, oil, and dirt. If necessary, clean the surfaces with a non-petroleum based solvent, such as isopropyl alcohol.



3 Use a torque wrench to make sure the nut is tightened to the proper installation torque (2000 in-lb or 225 N-m). do not overtighten; it can cause damage to the unit.

TROUBLESHOOTING

- *Before Beginning*6-2
- *A Few Words of Caution*6-2
- *Identifying the Cause of a Problem*6-3
- *Electrical Problems*6-4
- *Product Quality Problems*6-8

Repair

- *Replacing Safety and Proximity Switches*6-12
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- *Checking Repeatability*6-16
- *Repeatability Test Results*6-17

BEFORE BEGINNING

You can avoid most problems by following the recommended installation, operation and maintenance procedures outlined in this User Guide. If you have a problem, this section will help you determine the cause and tell you how to fix it.

Find any wiring, parts, and assembly diagrams that were shipped with your equipment. These are the best reference for correcting a problem. The diagrams will note any custom features or options not covered in this User Guide.

Verify that you have all instructional materials related to the servo knife cutter. Additional details about troubleshooting and repairing specific components are found in these materials.

Check that you have manual for other equipment connected in the system. Troubleshooting may require investigating other equipment attached to, or connected with the cutter.

A FEW WORDS OF CAUTION



WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed and adjusted by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.



WARNING: Electrical hazard

Before performing maintenance or repairs on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.



DANGER: Sharp blades!

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.



- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out power to the cutter before opening the cutting chamber.
- Always wait until the cutter head has stopped completely before opening the knife guard.

SCE/SCX cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

- When the knife guard is opened, the knife guard switch stops the cutter and prevents starting the cutter again.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The STOP button activates a circuit that stops the knife.

The Troubleshooting section covers problems directly related to the operation and maintenance of the servo cutter. This section does not provide solutions to problems that originate with other equipment. Additional troubleshooting help can be found in manuals supplied with the other equipment.

The main problems you will see with the servo cutter are:

- **Cutter operation problems**, which focus on problems that are clearly related to the operation of the cutter's electrical control systems.
- **Plastic product quality concerns**, which deal with product characteristics that may be related to cutter operation. Of course, other sections of the extrusion line also influence the quality of the extruded product. This section does not provide solutions to problems originating with other equipment on the extrusion line.

Additional troubleshooting help can be found in the manufacturer's manuals included with this User Guide.

IDENTIFYING THE CAUSE OF A PROBLEM

ELECTRICAL PROBLEMS

Look in this section when you have problems such as lights on the control that are working improperly, buttons that do not execute the function properly, and when information input is not executed properly.

Symptom	Possible cause	Solution
<p>◆ The lighted Reset button does not go out when pressed.</p>	The E-stop button is pushed in.	Pull out the E-stop button.
	Guard light not illuminated.	<p>Check to see if:</p> <ul style="list-style-type: none"> <input type="checkbox"/> The blade guard is closed. <input type="checkbox"/> Master Control relay (MCR) has failed. Replace relay.
	A safety switch has failed.	Check connections and replace if needed.
<p>◆ Pressing Start Cutter had no effect. The LED in the corner does not light and “Guard Error” message displays.</p>	There is a loose connection.	Check wiring between cutter control and the relay.
	The relay is bad.	Repair or replace the relay.
	The guard circuit failed.	Check guard circuit, repair or replace components.
<p>◆ Pressing the Reset/Test button does not produce a cut when in an on-demand mode.</p>	The servo amplifier is not in Program mode.	Check servo, if necessary, reboot main power.
	There is a loose connection.	Check wiring and tighten connection.

ELECTRICAL PROBLEMS CONTINUED

Symptom	Possible cause	Solution
◆ After pressing Start Cutter, the cutter head rotates slowly but does not stop (SCX only).	The Blade Home proximity switch failed or the connection to it is loose.	Check connections and replace switch if needed.
◆ Guard trouble light on cutter does not illuminate.	Guard circuit is open.	Check to see if: <ul style="list-style-type: none"> <input type="checkbox"/> The blade guard is closed. <input type="checkbox"/> Loose connection to guard circuit. Tighten connection. <input type="checkbox"/> Guard switch is bad. Replace switch.
◆ Encoder A, B LEDs do not light.	Input from encoder failed.	Check encoder cable for continuity. Connect any loose wires.
	Encoder failed.	Replace encoder.

ELECTRICAL PROBLEMS

CONTINUED

Symptom	Possible cause	Solution
<p>◆ In encoder or timer modes, the display shows the count which resets, but a cut does not occur at the point of reset.</p>	There is a problem with the cutter control.	Check for control output.
	There is a problem with the servo amplifier.	See Checking the Servo Amplifier.
	There is a loose connection.	Check wiring for loose connections.
<p>◆ Cutter control displays “Blade error”.</p>	There is an anti-jam circuit signal.	<p>This error appears when the blade does not go through the cut cycle in the required time.</p> <p>Check for:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Loose connection on cutter control or servo amplifier. <input type="checkbox"/> Fault on Amplifier preventing cut cycle. <input type="checkbox"/> Blade is stuck in extrudate/bushings.
	There is a problem with the home proximity switch.	See Adjusting the Proximity Switches, page 5-9.

ELECTRICAL PROBLEMS CONTINUED

Symptom	Possible cause	Solution
◆ Blade speed does not change when new speed is entered into the control (SCX only).	There is a communication failure between the control and drive.	Check for wiring for loose connections and tighten.
◆ Cutter mode selection does not change cut mode.	There is a communication failure between the control and drive.	Check for wiring for loose connections and tighten.
◆ The park (home) position is drifting, i.e. the blade parks further away from the original park site (SCX only).	The coupling between the servo motor and the Micron reducer has slipped.	See Checking the Motor/reducer assembly, page 6-15
	The Trantorque coupling has slipped.	Refer to the Trantorque instructions, page 5-12.
	The home proximity switch is bad.	Replace the proximity switch.
◆ The park position is erratic (SCE only)	The home proximity switch is not properly gapped.	See Adjusting the Proximity Switches, page 5-9.

PRODUCT QUALITY PROBLEMS

Look in this section when the final product does not meet standards: has strings, burrs, cracks, or is misshaped.

Symptom	Possible cause	Solution
◆ Hairs or strings.	Blade speed is too low.	Increase the blade speed or decrease the blade cut path area (blade width)
	The blade is too thick.	Excessive blade thickness can cause frictional heat. Use a thinner blade.
	The blade is wrong for the application.	Change angle of the blade attack or the blade style to decrease the cut path area.
	Material is building up on the blade and wiping off on the cut site.	Use blade lubrication (water, etc.) or change lubricants. Consider a blade wiping system.
	There are imperfections on the blade.	The cutting edge should not have grind marks, burrs or other imperfections. Check the blade and replace if necessary.
	A hole or slot in the blade cut path is causing a 'cheese grater' effect.	Change blade design.
	The extrudate is too cold.	If the extrudate is too cold, it can fracture during cutting. Raise the extrudate's temperature.

PRODUCT QUALITY PROBLEMS CONTINUED

Symptom	Possible cause	Solution
◆ Burrs at cut site.	The bushings are not providing enough support during cutting.	Change bushing design to make them more supportive.
	The bushing gap is too wide.	The bushing gap should be no more than .001-.003 inch larger than the blade. Check and adjust if necessary.
	The blade speed is too low.	Low blade speeds can cause excessive blade interruption. Increase blade speed or decrease the blade cut path area.

PRODUCT QUALITY PROBLEMS

CONTINUED

Symptom	Possible cause	Solution
◆ Cracks at cut site.	The extrudate is too cold.	If the extrudate is too cold, it can fracture or whiten during cutting. Raise the extrudate's temperature.
	The blade speed is too high.	High blade speeds can cause too much impact. Lower the blade speed.
	The bushings are not providing enough support during cutting.	Change the bushing design to make them more supportive.
	The cutting blade is too sharp.	A blade that is too sharp can fracture some materials, especially rigid PVC and nylons. Slightly dull the blade.
	If using Nylon, it may be cooling too quickly.	If nylon is cooled too quickly, its molecular structure may become unstable, leading to poor physical properties. Try more gradual cooling.

PRODUCT QUALITY PROBLEMS CONTINUED

Symptom	Possible cause	Solution
◆ Cut is not square.	The blade speed is too low.	Low blade speeds can cause excessive blade interruption. Increase blade speed or decrease the blade cut path area.
	The blade is misaligned.	Check that blade is 90 degrees relative to the bushing holder.
	The cutter bushings are not properly gapped.	If the cutter bushings are not properly gapped, the blade may be free to move with the extrudate. Check and adjust if necessary. See page C-5.
	The knife bevel is not symmetric.	If the knife bevel is asymmetric, the blade will tend to move in the direction of the smaller bevel. Be sure that the bevel is symmetric. NOTE: You can use this to your advantage with some rigid products.
	For rigid products the puller is too close to the cutter.	There must be enough space between the puller and cutter to allow for extrudate stoppage that occurs during cutting. Allow enough space so no cut shock is detectable at the input to the belt puller with your fingernail.

REPLACING SAFETY AND PROXIMITY SWITCHES

Three safety switches are included in SCE/SCX cutters: a keyed safety switch on the knife guard, and a proximity switch on each cutter bushing. A failure in any of these switches will prevent the cutter from running.

● Safety Switch

If you suspect a problem with the keyed safety switch on the knife guard, check for loose or damaged wires. Replace the switch if wires appear to be undamaged.

● Proximity Switches

The proximity switches on the cutter bushings have LEDs that light when the bushing is sensed. If an LED does not light when the bushing is in place:

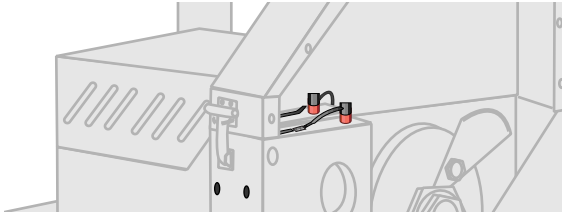
- 1 Check for loose or damaged wires.**
- 2 Remove the cutter bushing** and make sure the proximity switch is properly positioned, i.e. 0.010" from the bushing surface.
- 3 Remove the proximity switch** by loosening the set screw. Test it by bringing some object close to the sensor when the power is turned on. If the LED does not light, replace the proximity switch.

CHECKING THE SERVO AMPLIFIER

The servo amplifier is equipped with a digital readout that can be seen through the viewing window on the electrical enclosure. This display shows amplifier status and error messages. Refer to the supplier's documentation included with this User Guide.

NOTE: Make sure you look for servo amplifier messages before you shut off the power.

The home position proximity switch should be 0.010" from the 5/16" thread rod on the cutter head for proper operation.



ADJUSTING THE PROXIMITY SWITCHES

- 1 Open the knife guard.**
- 2 Locate the 5/16" thread rod on the cutter head.** It should be 0.010" from the proximity switch sensor when it passes that location. If necessary, loosen the jam nuts, readjust the distance, and re-tighten the jam nuts.



DANGER: Sharp blades!

Always wear cut-resistant gloves when the cutting chamber is open and when handling blades. Never open cutting chamber without locking out the cutter power.



Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.

- 3 If the proximity switch does not sense** the cutter head after this adjustment, remove the switch and test it outside the cutter. Replace if necessary.

CHECKING THE ENCODER

When the encoder is working properly, the encoder LEDs on the control panel light or flicker as the encoder wheel moves and generates signals. If the LEDs do not light when the encoder wheel moves:

- 1 Check all connections.**
- 2 Check the encoder cable for damage.** If necessary, replace.
- 3 Check the connector that attaches the cable to the encoder.** Internal wiring may be shorted out if this connector is not handled properly.
- 4 Check the encoder itself.** There should be no play in the shaft.



WARNING: Delicate equipment

The encoder is a delicate piece of equipment. Any rough handling can damage fragile parts.

- 5 If all else fails,** contact Conair Customer Service. See [Appendix page A-1](#).

CHECKING THE MOTOR/REDUCER ASSEMBLY

- 1 Open the knife guard.**
- 2 Remove the cutter head** by loosening the Trantorque assembly. Refer to the manufacturer's guide included with this User Guide for information about the Trantorque assembly.
- 3 Locate the four bolts** holding the motor/reducer assembly to the cutter. Remove them and carefully remove the assembly from the cutter.
- 4 Refer to the Micron installation** and maintenance information included with this User Guide to check and adjust the motor/reducer assembly.

TESTING

REPEATABILITY

Before any Conair puller/cutters are shipped, they are tested for cut time repeatability to be sure they are within performance specifications. The repeatability test checks the performance of the rotary knife cutter to return the home park position after a complete cut. Acceptable repeatability times allowed for each cutter model prior to shipping are:


Type of Cutter	Repeatability Time
AC Pneumatic Cutter	Less than 1 millisecond
DC Pneumatic Cutter	Less than 1.5 millisecond
Velocity Servo (E Drive)	Less than 1 millisecond
Positional Servo (FX)	Less than 0.1 millisecond

Note: 1-millisecond at 60 feet per minute is equal to .012 inches.

The repeatability mode is built into the Conair cutter controls and allows you to perform similar tests, without any external test equipment. It is recommended that you check repeatability on a regular basis. Acceleration/deceleration delays of the servo do not contribute to repeatability error; any error is attributed solely to motor stability, couplings, assembly, power, and proximity sensor alignment.

Use any blade speed and line speed. The Line speed is only seen while in the Encoder or Product modes. It is recommended that the tests be performed at cut intervals between 0.5 and 5-seconds. Do not change the blade speed or the line speed after starting the test.

To test repeatability:

- 1 Turn on the cutter.** Performing the test with the cutter off-line shows problems with the cutter; performing the test with the cutter on-line shows a problem with the puller.
- 2 Place the cutter in any mode except follower mode.**
- 3 Press the Cut On/Off button;** the cutter is activated automatically.
- 4 Press and hold the Move Right button** for a minimum of 5 seconds. 
- 5 Read the results on the display.**

Repeat the test by pressing the Reset/Test Cut button to begin a new sample period.

To end the Repeatability test, press any button except the Reset/Test Cut button. The LED returns to its normal display.

RESULTS OF REPEATABILITY TESTING

Results in Flywheel mode

The display shows "Repeat Test" and the park-to-park (PP) reading. This is the total (peak) variance of a full revolution of the cutter head. The reading is in milliseconds, to the third decimal place, i.e. 0.010 is 0.01 milliseconds (or 10 microseconds). If the reading exceeds 9.999 the unit automatically resets the repeatability test, displays "Over Run", and attempts to begin the test again. If this occurs the error is too large and there is a fault in the cutter drive that must be corrected.

Results in Timer mode

When testing repeatability in Timer mode, the cutter is making on-demand cuts at a set time interval (i.e. one-second intervals). The display shows "Repeat Test", and then the cut-to-park (CP) reading and the cut-to-cut (CC) reading. The reading is in milliseconds, to the third decimal place, i.e. 0.010 is 0.01 milliseconds (or 10 microseconds).

CP is the peak time variance between the cut signal output (preset time) to the servo amplifier, and the proximity switch just prior to the end of the cut cycle. This is the repeatability of the cutting system to return to the home park position. This value is higher than the PP reading since it includes the acceleration and deceleration contributed by the servo motor.

CC is the peak time variance between cuts. Record and compare the cut-to-cut number to the CC value recorded in encoder or product mode shows how much error is by external influences (i.e. variation in belt puller speed, encoder mounting problem, etc.).

If the reading exceeds 9.999, the unit automatically resets the repeatability test, displays the message "Over Run", and attempts to begin the test again. If this occurs the error is too large and there is a definite fault that must be corrected.

Results in Encoder or Product mode

The display shows "Repeat Test", and then the cut-to-park (CP) reading and the cut-to-cut (CC) reading. The reading is in milliseconds, to the third decimal place, i.e. 0.010 is 0.01 milliseconds (or 10 microseconds).

Compare the cut-to-park (CP) reading to the CP reading in the other modes. There should be very little difference in these readings.

Compare the cut-to-cut (CC) reading to the CC reading in the other modes. Since the Encoder and Product modes are influenced by external signals, this reading will reflect the speed stability of the puller.

Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

WE'RE HERE TO HELP

To contact Customer Service personnel, call:



From outside the United States, call: 814-437-6861

HOW TO CONTACT CUSTOMER SERVICE

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

If you do have a problem, please complete the following checklist before calling Conair:

- Make sure you have all model, serial and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- Make sure power is supplied to the equipment.
- Make sure that all connectors and wires within and between the cutter and related components have been installed correctly.
- Check the troubleshooting guide of this manual for a solution.
- Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- Check that the equipment has been operated as described in this manual.
- Check accompanying schematic drawings for information on special considerations.

BEFORE YOU CALL ...

Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Departments for a nominal fee.

EQUIPMENT GUARANTEE

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

PERFORMANCE WARRANTY

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated and maintained in the recommended manner as outlined in our quotation or specifications.

Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

WARRANTY LIMITATIONS

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

Cutter blade characteristics such as material, design, and thickness can have a large effect on cut quality.

Blade materials

Blue tempered spring steel is most commonly used because of its cost and availability over a wide range of thicknesses (0.010-0.062 inch). It is a very tough material with an HRC value of approximately 48-51 and fair wear characteristics.

Razor blade stainless steel is becoming very popular due to its HRC value of 57-58, which leads to improved wear resistance. This material retains good toughness, but will chip or break. It is available in 0.010-0.062 inch thicknesses. Because it is non-corrosive, stainless steel is a good choice for medical cutting applications, and may even be coated with Teflon to enhance cut quality.

A-2 is a good grade of tool steel with an HRC of 60. Its minimum thickness (0.031 inch) forces the blade manufacturer to grind it down for thinner applications, which adds cost. A-2 is more wear resistant than stainless, but is also more brittle.

M-2 is an excellent grade of tool steel with an HRC of 63-66. It is one of the best materials for coating with titanium nitride for improved wear resistance. (However, coatings generally cause some slight loss of sharpness.) 0.025 inch material is available, which covers many applications without the need for secondary grinding operations.

D-2 is another excellent tool steel with an HRC range of 58-60. It is tougher than M-2 but has slightly less wear resistance. Its minimum thickness (0.035 inch) and the need for specialized grinding materials, make it a relatively expensive material. It is the material of choice for cutting Kevlar-reinforced hose.

CPM 10-V is a form of carbide developed especially for the high speed punch industry. With an HRC of 60-62 and a toughness that far exceeds D-2, it is by far the best cutting blade material. Because its minimum thickness is 0.035 inch, and it requires the use of diamond grinding wheels, CPM 10-V is the most expensive of the blade materials.

CUTTER BLADE SELECTION AND USE

CUTTER BLADE SELECTION AND USE

Blade Design

Straight-edge knives have a straight cutting surface. A chopping action (which has cutting forces parallel to the cut) is typically obtained with straight-edge blades.

Because the blade is mounted on a rotary arm, some slicing action (which has additional force vectors at various angles to the cutting edge) is obtained, but generally not through the entire cutting action. If a slicing action is required, the angle of attack can be modified by mounting the blade on a 30-45 degree angle as close to the cut site as possible. In many cases the bushings must be modified to allow the blade holder to have close proximity to the cut site. This offers the steepest angle of attack throughout the entire cutting process. Generally straight knives can be obtained in thicknesses from 0.004-0.060 inch depending on the application.

Curved-edge knives offer increased slicing throughout the entire cutting action. They are generally used for cutting rubber preforms, rubber hose, flexible foams, and other materials that require slicing. Blade lubrication is often used to enhance the cut and minimize blade and bushing buildup.

As a general rule, curved-edge knives offer improved cut quality on rigid materials if additional heat can be used. However if used on cold rigid materials, curved knives have a tendency to produce wavy or angled cuts.

A curved edge knife can sometimes cut larger cross section profiles and tubing with the same horse power as a straight edge blade. However, the use of a curved blade increases product interruption. To overcome this effect, use a variable speed rotary knife cutter to vary the blade speed to obtain the desired cut quality.

Piercing blade (bat-wing, woodpecker) knives are specifically designed for cutting thin wall tubing. Their shape minimizes penetration marks caused by the flattening action of the blade prior to penetration of the extrudate. These are the most expensive type of blade, and the most susceptible to breakage. Because the point is exposed and not fully supported by the bushings, it may deflect into the bottom of the bushing bore and break off. For these reasons, piercing blade knives are usually used as a last resort.

Some rigid materials require warming when this type of blade is used because the impact of the point can cause cracking or whitening.

Blade thickness

Because material is displaced rather than removed in rotary knife cutting, think of the blade as a wedge. The thicker the blade, the greater the displacement. This displacement can cause fracture in rigid profiles and tubing, which is often observed as a whitening on all or a portion of the cut. You can reduce this fracturing by reducing the thickness of the blade.

(This effect can also be minimized by heating the profile or tube. However, if heat is used to enhance cut quality, the bushings must be supportive enough to minimize distortion.)

If the cutting blade is too thin, it may actually deflect within the bushing bore. This can lead to "S" shaped cuts or premature blade breakage.

Optimizing blade speed

Flexible extrudates generally require a very fast blade speed with a slicing action for best results. This is due to the fact that even minimal interruption can cause a blade jam on a product that has little or no internal strength.

On the other hand, rigid extrudates may require different blade speeds to obtain the desired cut quality. What's needed for a particular application depends on blade style, internal heat, and blade thickness. Speeds as slow as 300 rpm may be required if a curved blade is used with little or no heat.

Improving cut quality by adding heat to certain materials

All rigid extrudates can have their cut quality improved by the addition of heat. A few of the most common materials and the respective temperatures are listed below:

Rigid PVC	110°-125° F
Styrene ABS	120°-135° F
Polypropylene	160°-200° F

It is important to remember that as the temperature approaches the glassification zone, the degree of support offered by the bushing becomes more important.

CUTTER BLADE SELECTION AND USE

Calculating Blade Interruption

Blade interruption is the length of time which the blade interrupts the extrudate during the cutting process. Knowing blade interruption allows you to optimize blade speed and design for specific applications.

You can calculate blade interruption for your application if you know:

- the cutting blade width
- blade speed (cutter rpm)
- extrudate cross section.

The rotary knife cut path circumference is fixed for each cutter model:

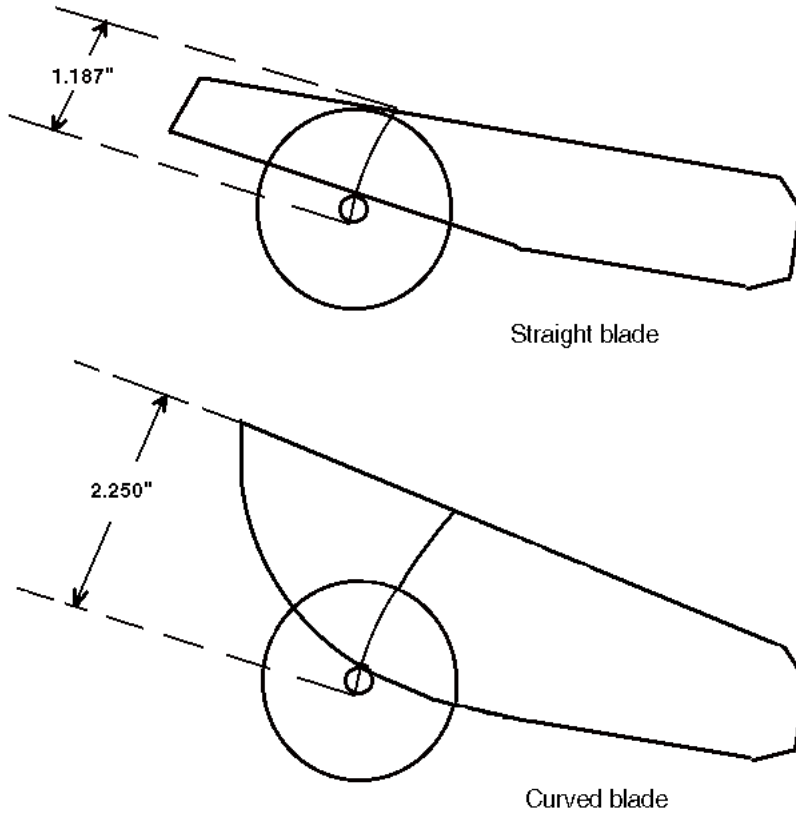
SCE/SCX Model	Bushing Diameter	Knife Cut Path Diameter	Knife Cut Path Circumference
2	2.25"	11"	34.6"
3	3.25"	12"	37.7"
4	4.25"	13"	40.8"
5	5.25"	14"	44.0"

As an example, calculate the blade interruption (in milliseconds) for an SCX2 cutter running 1/4" (0.250") OD tubing. The blade speed is 718 rpm and the cutting blade is 15/16" (0.937") width at the point where it passes through the extrudate, and the cut path circumference is 34.6" for the SCX2.

Calculate the blade interruption time. The interruption time starts when the blade makes its first contact with the extrudate and ends when the blade is totally clear of the product (i.e. no longer interrupting it). Because we know the blade travel speed, we can calculate the interruption time if we know how far the blade travels during period of interruption. This distance is equal to the sum of the extrudate outer diameter and the blade width at the point of contact.

$$\text{Blade interruption time, msec} = \frac{(\text{Product OD} + \text{Blade width})}{\text{Knife circumference}} \times \frac{60,000}{\text{rpm}}$$

CUTTER BLADE SELECTION AND USE



To calculate interruption time:

$$\frac{(0.937 \text{ in.} + 0.250 \text{ in.})}{34.6 \text{ in.}} \times \frac{60,000 \text{ msec/rev}}{718 \text{ rpm}} = 2.87 \text{ msec}$$

Knowing the interruption time and the line speed, you can calculate the amount of production deflection that must be accommodated during cutting. To calculate the amount of extrudate deflection between the cutter and puller, multiply line speed by interruption time:

$$\text{Blade Interruption time, msec} \times \text{Line speed, fpm} \times \frac{12}{60,000} = \text{Deflection, in.}$$

$$2.87 \text{ msec} \times 60 \text{ fpm} \times 12 = .034 \text{ in.}$$

In this example the puller and cutter must be set up to allow for 0.034" of product deflection during cutting. Failure to do this can lead to puller stoppage (which can form annular rings on the product), and poor-quality cuts (hairs or fuzz and angular cuts).

CONAIR CUTTER BLADES

Part No.	Blade Type	Bushing Size	Blade Thickness	Blade Material
3515-30088	Straight	2 inch	0.010 in.	Stainless Steel
3515-30096	Straight	2 inch	0.015 in.	Stainless Steel
3515-30104	Straight	2 inch	0.020 in.	Stainless Steel
3515-30016	Straight	2 inch	0.025 in.	Stainless Steel
3515-30085	Curved	2 inch	0.010 in.	Stainless Steel
3515-30072	Curved	2 inch	0.015 in.	Stainless Steel
3515-30080	Curved	2 inch	0.020 in.	Stainless Steel
3515-30032	Curved	2 inch	0.025 in.	Stainless Steel
3515-30128	Straight	3 inch	0.020 in.	Stainless Steel
3515-30024	Straight	3 inch	0.025 in.	Stainless Steel
3515-30024-1	Straight	3 inch	0.025 in.	Spring Steel
3515-30136	Straight	3 inch	0.032 in.	Stainless Steel
3515-30136-1	Straight	3 inch	0.032 in.	Spring Steel
7130320101	Curved	3 inch	0.015 in.	Spring Steel
7130320102	Curved	3 inch	0.025 in.	Spring Steel
7130320103	Curved	3 inch	0.032 in.	Spring Steel
7130320301	Straight	4 inch	0.025 in.	Spring Steel
7130320302	Straight	4 inch	0.032 in.	Spring Steel
7130320201	Curved	4 inch	0.025 in.	Spring Steel
7130320202	Curved	4 inch	0.032 in.	Spring Steel
7130320501	Straight	5 inch	0.025 in.	Spring Steel
7130320502	Straight	5 inch	0.032 in.	Spring Steel
7130320401	Curved	5 inch	0.025 in.	Spring Steel
7130320402	Curved	5 inch	0.032 in.	Spring Steel

ALL ABOUT CUTTER BUSHINGS

Rotary knife cutter bushings are probably the most ignored aspect of cutting. Yet, they are probably the most important ingredient to obtaining clean, square, accurate cuts with minimal jamming and broken blades.

This appendix contains information about several aspects of cutter bushings:

- bore characteristics
- bushing length
- shear surface characteristics
- the bushing gap

Cutter bushing bore size

The cutter bushing bore size affects both the cutting process and the overall extrusion process.

Bushings with relatively large bores are often used to facilitate start-up and minimize bushing inventory. While this practice is acceptable for start-up, it will lead to premature blade failure because the bushings do not properly support the blade. For optimum cut quality, make sure the bore adequately supports the tube or profile.

When the blade first makes contact with the tube or profile, it pushes the part until it assumes the size and/or shape of the bushing bore. In the case of tubes this causes two marks on the tube (penetration marks) that show where the tube flattened before the blade actually penetrated it. The tighter the bushing bore size to tube size, the closer the marks become, making them less obvious.

If the bushing bore is too tight, excessive extrudate interruption or even jamming may occur. In turn, this can cause internal air blockage in free extruded flexible materials and thus extrudate size fluctuations. In the case of rigid profiles or tubes, belt puller slippage may occur during the cutting if the bushings are improperly configured. This can cause annular rings around the extrudate and size fluctuations.

- For rigid profiles or tubes, allow 0.010-0.020 inch clearance over the OD tolerance. Anything tighter than 0.010 inch will be difficult to process. For easier startup, allow as much as 1/4 inch above a rigid profile because the blade will force the profile to the bottom of the cutting bushing where the shearing action occurs. However, if perfect squareness is required, the clearance above the profile should be minimized to prevent bowing.

ALL ABOUT CUTTER BUSHINGS

Supportive bushings become more important if heat is used to minimize whitening (fracturing).

- If you are cutting a square or rectangular profile, whether rigid or flexible, a round bushing bore will not offer proper support and will often lead to an "S" shaped cut. A flat bottomed bushing will offer excellent support and enhance the shearing action of the blade.
- In the case of flexible extrudates, allow 0.010-0.050 in. clearance depending on durometer and surface; the softer durometers and tacky surfaces require the most clearance. In the case of softer durometer materials, bushing lubrication may be required to minimize drag and material build-up between the cutter bushing faces.

Cutter bushing bore surface quality

The internal surface of the cutter bushing must be smooth and glass-like when cutting flexible extrudates, otherwise excessive drag causes jamming and can lead to variations in cut-to-length accuracy.

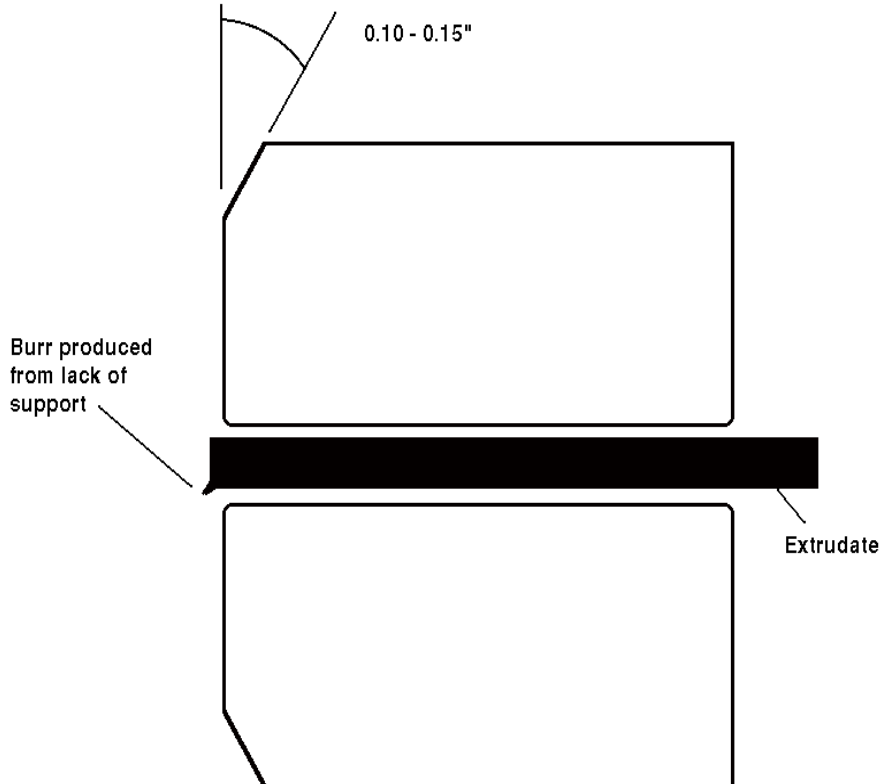
- When cutting flexible materials, have the internal surface machined to resemble glass. In many cases, medical processors will actually have the ID of their bushings either honed or burnished for best results.
- When cutting clear extrudates, it is also very important to have a smooth internal surface to minimize scratches. In some cases it may be necessary to make a Teflon or Delrin insert to further minimize drag and/or scratching.
- Bushing lubrication can also help minimize bushing drag.
- Be sure to have a lead-in angle machined into the entrance of the upstream cutter bushing. The transition from the bore to the lead-in angle should not be abrupt as it can cause variable drag.

Cutter bushing shear surface quality

ALL ABOUT CUTTER BUSHINGS

Similar to a dull pair of scissors, if the cutter bushing shear surface is not sharp the tube or profile is not supported to the side of the blade and the cut will not be clean. In some cases, the entrance of the downstream cutter bushing is slightly radiused to minimize jamming. While this practice helps accommodate bushing bores that are not quite aligned, it has a negative effect on cut quality.

- The shear surface of both the upstream and downstream cutter bushings should be sharp and bored to the same size. NOTE: In high speed cutting applications, the downstream bushing is sometimes bored 0.005" larger than the upstream bushing to minimize jamming. Deburr the edge after the boring operation, but be careful to remove only the burr and not the edge.
- Leave a minimum land of 1/8 - 1/4" on the face of the cutter bushing beyond the bore. Angle the rest of the bushing face with a 10-15 degree lead-in.



ALL ABOUT CUTTER BUSHINGS

Cutter bushing length



CAUTION: Blade hazard

In order to comply with OSHA regulations, the distance from the sidewall of the cutter to the blade (through the bushing) must be long enough to prevent fingers from reaching the blade.

On flexible extrudates, it is important to minimize the length of the cutter bushings. It is very difficult to push flexible extrudates through since it tends to compress as it is pushed, causing a marginal increase in the tube diameter. For this reason, bushing lubrication may be necessary to minimize drag as the length of the bushings increase. A discharge conveyor may also be helpful in removing longer cut parts. The exit bushing may be funneled to allow the cut part to drop out faster while still maintaining minimal bushing length for safety.

- For flexibles, the upstream cutter bushing should offer total support to the extrudate as close to the nip point of the puller as possible. In this way the part is not able to move from side to side or bow from the weight of the tube, which can, in turn, cause variable drag. You use the strength of the tube to push itself.
- The bore length of the exit bushing should not be shorter than $1\frac{1}{2}$ times the diameter of the tube with the remainder of the bushing length being tapered. On sticky flexible extrudates, the parts will actually stick back together if the new part has to push the cut part out very far.

For rigid extrudates, the length of the cutter bushings can result in a square cut or an angular cut. The cutter bushings support the extrudate keeping it from moving from side to side and bowing from the weight of the profile itself. Many processors make their bushings short to minimize cost of EDM which is determined by depth of cut.

- For rigid extrudates, a general rule is to make the length of the cutting bushings equal to two times the largest outside dimension. NOTE: In the case of full profile cutter bushings where maximum support is offered, the bushing length may be shortened depending on actual clearance.
- Be sure to have a lead-in angle machined into the entrance of the upstream cutter bushing. The transition from the bore to the lead-in angle should not be abrupt as it can cause variable drag.

Adjusting the cutter bushing gap

If the bushing gap is too big, material is dragged down between the bushings creating a burr, especially with flexibles. This may lead to jamming within the bushings where the upstream side of the cut extrudate actually hits against the downstream bushing surface. This is especially apparent with flexibles with non-concentric walls where a slight bow is present.

- Locate the downstream bushing such that it touches the blade without deflecting it. Lock it in place and rotate the blade to check proper gap.
- Locate the upstream cutter bushing with 0.001-0.002 inch of the blade and lock it in place. Rotate the blade through the set bushings to insure proper gap. NOTE: Because blades are rarely perfectly flat, it is possible that a swishing sound will be heard.
- If hairs are present on only the upstream cut end of a tube or profile, it may be necessary to allow a 0.002-0.005 inch gap on the downstream bushing to allow the blade to slightly move with the extrudate during the cutting cycle and not cause excessive frictional heat which actually melts the extrudate. NOTE: Blade/bushing lubrication can also help to solve this problem.

ALL ABOUT CUTTER BUSHINGS

Blade and bushing lubrication can nearly always improve the quality of cutting.

Description of the cutting process

Unlike sawing, a rotary knife cutter displaces material rather than removing it. When the knife blade first contacts the extrudate, it pushes it against the opposite side of the cutter bushings. If there is too much clearance the extrudate may crack or distort before cutting even begins. Tubing may develop two distinctive marks related to the compression of the tube.

Once the blade penetrates the part, material is displaced to either side of the blade. This displacement will vary in degree and visibility depending on the type of material, temperature, blade thickness, blade style, and blade speed. As the material is displaced, heat is generated and passed to the blade surface.

Flexible materials (flexible PVC, urethanes, and even LDPE) will generally compress during cutting, leaving little or no sign of displacement. The cut will appear uniformly glossy and free of fracture. However, a closer look will show very fine lines on the cut face. With flexible materials, these lines will typically show an arc or "S" pattern which can be attributed to compression of the part as the blade passed through.

Rigid materials such as rigid PVC and styrene will tend to fracture during cutting. The cut surface changes from glossy to dull, and finally becomes whitened and rough. Whitening occurs when cutting changes to fracturing: the cut begins to extend in front of the cutting blade, which acts as a wedge. At this point, you can only hope the fracture is controlled, allowing for a square cut.

Friction and heat during cutting

Because most rotary knife cutters don't travel with the flow of the extrusion line, forward motion is interrupted as the blade passes through the plastic tube or profile. This interruption causes friction, which generates heat in the cutting blade. As the temperature of the blade increases, plastic is melted at the cut site. This melted plastic can adhere to and coat the cutting blade, especially on the upstream side, and be transferred to the next part in the form of hairs or tissue-like film. This will be especially noticeable on the top inside of the tube or profile.

BLADE AND BUSHING LUBRICATION

BLADE AND BUSHING LUBRICATION

If the blade has a rough surface where the extrudate rubs against it, material will accumulate on the blade in a cheese grater fashion. This scratched material will also be passed from the blade to the next cut and be seen as hairs or flakes.

Some of the more flexible materials, such as silicones, soft urethanes and flexible PVCs, also exhibit drag against the blade during the cutting cycle. The part will actually stick to the side of the blade and drag down between the bushings. Typically a small "c" shaped tail of the tube will accumulate in the bottom of the cutting chamber. This tail actually tore off the tube rather than cut due to the excessive drag against the blade

The generation of heat during cutting can also lead to parts that stick to each other. They may appear to be welded together, and an extra operation may be required to separate them. This can be a real problem in materials such as latex, silicone, PP, and flexible PVC.

Benefits of using lubricants

The primary benefit of using a cutting lubricant is reducing friction. If the cutting blade is coated with a film of lubricant, the coefficient of friction between the blade and the plastic tube or profile is reduced, reducing the generation of frictional heat.

Lubricants also minimize the tendency for material to stick to the blade, thus minimizing the potential for material to be wiped on the next cut part. The coefficient of friction is reduced with varying degrees, depending on the type of lubricant, which in turn limits the increase in blade temperature. Over time this can lead to an increase in blade life because the cutting edge will last longer at cooler operating temperatures.

While lubricants can also help minimize problems caused by rough or poorly ground blades and cutter bushings, it is generally better to solve the problem than mask it with lubricants.

Common cutting lubricants

Commonly used general purpose lubricants include:

- Tap water
- Dish washing liquid (Joy, etc)
- Glycol (anti-freeze, coolant)
- Water-soluble silicone cutting oils
- Diesel fuel
- Mold release
- Mineral oil

Medical grade lubricants:

- Distilled water
- Isopropanol (isopropyl alcohol)
- Mixtures of isopropanol and water

Lubrication systems

The most basic blade lubrication system for rotary knife cutters is using a stainless steel tray filled with the lubricant. Because the cutting blade passes through the tray during every cutting cycle, the blade is lubricated before each cut. This approach limits material buildup on blade and bushing surfaces for most applications. Care must be taken to maintain the lubricant level within the tray and clean out accumulated cut residue on a regular basis.

Spray mist systems can be used to lubricate either the blade or the extrudate as it enters the cutter bushings. These systems allow the application of a minimum amount of lubricant with good consistency. If the mist is applied to the product as it enters the cutter bushings, the lubricant will minimize the drag between the bushing bore and the tube or profile, as well as wet the blade and bushing faces. With flexible and/or sticky materials this can improve both cut quality and cut-to-length accuracy.

The last method of blade lubrication (and the oldest) is the blade wipe system. Felt, sponge, or some other absorbent material is mounted so the rotary knife blade will pass through it, with interference, before making a cut. Typically a gravity drip or wick system is used to keep the absorbent material wet with lubricant. These systems not only lubricate the blade, but also wipe off residue before each cut. However, the operator must constantly observe the condition of the pads as they wear quickly and lose their function. Another concern (especially in medical applications) is what happens to wear particles from the pads. This material frequently ends up on the blade itself, and is then transferred to the very product it is meant to protect from contamination.

