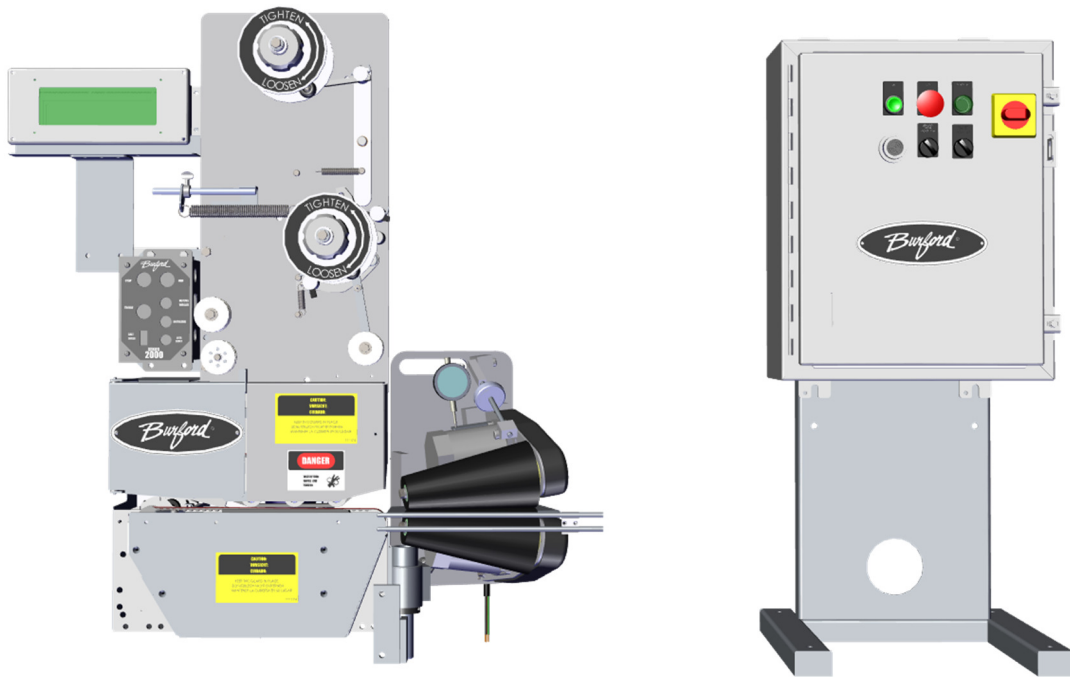




ELECTRONIC SERVO TYER MODEL 2000M/2100M



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Serial # _____

SAFETY PRECAUTIONS

As Burford® Corp. strives to promote safety in the maintenance and operation of Burford® equipment; we request that the following safety procedures be followed, along with any additional safety procedures set by the customer's in-plant safety officers or local codes.

1. Read the manual completely before attempting installation or operation of this unit.
2. This machine may contain programs that are password protected. Contact your supervisor or Burford® Corp. for password.
3. Incoming electrical power must be properly shielded, routed, and grounded. All safety codes should be followed. Study wiring diagrams before attempting installation.
4. Disconnect power to equipment before removing any guards or covers. Replace guards or covers before resuming operation of the unit.
5. Loose clothing, jewelry, and long hair should be considered a safety hazard around mechanical equipment. Ensure that they will not be entangled in the equipment.
6. Keep clear of moving machine parts. Bodily harm and/or serious injury may result from contact with moving gears, sprockets, chains or pneumatically controlled machine components.
7. Do not bypass safety switches.
8. Do not attempt repairs while equipment is running.
9. Use only original equipment parts designed for safe operation of the equipment.
10. Only authorized personnel should be allowed to operate or perform maintenance on the unit.
11. This unit is not wash-down ready. Do not wash the unit or any of its electrical or mechanical components, with any form of high pressure or running liquids.



Caution symbol indicates bodily harm may incur if instructions are not followed.



Stop symbol indicates important instructions to prevent unit damage or adverse effects.



Info symbol indicates useful information to assist in installation and operation of the unit.

DISCLAIMER WARNING

The descriptions and specifications contained in this Service Manual were in effect when this manual was approved for printing. Our policy is one of continuous improvements, and we do hereby reserve the right to discontinue models at any time, or to change specifications, prices, or design without notice and without incurring obligations.

Burford® Corp. expressly disclaims any liability for damages and/or injuries caused because of negligence or misuse of its product. Such negligence or misuse includes, but is not limited to, software/program alteration, removal of guards, faulty wiring due to improper installation, subjecting the unit to wash-down environments or any physical or mechanical changes made to a Burford® unit, by anyone other than a qualified Burford® Technician.

Burford® equipment should only be used for the purpose for which it was sold, and should not be modified in any way without notifying the General Manager of Burford® Corp. in writing of the modification.

The original language for this document is English. Translations to other languages may not be accurate.

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Chapter 1

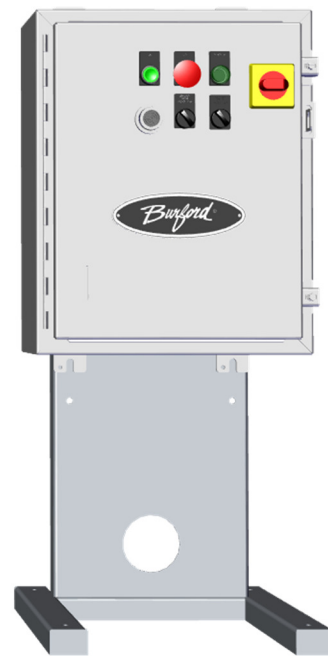
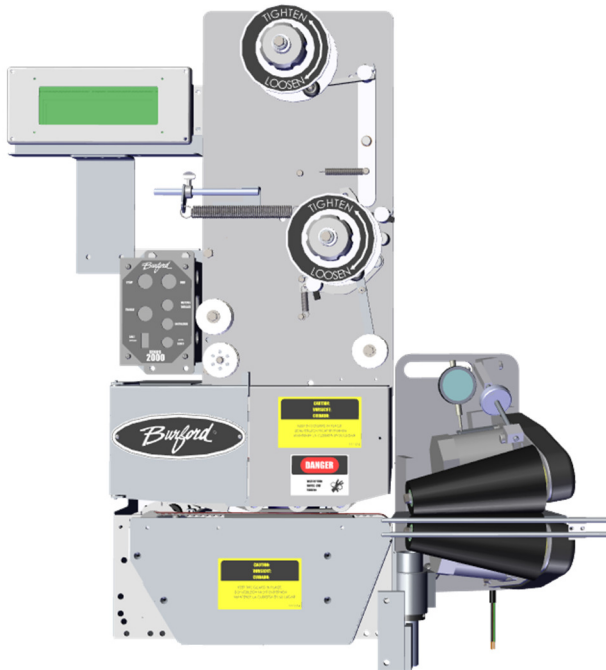
Introduction

CHAPTER 1: INTRODUCTION

The Burford® 2000M/2100M Series Electronic Servo Tyers are designed to close plastic bags with twist tie ribbon in a wide variety of automatic packaging applications. The Servo Tyer uses a microprocessor to control and coordinate the motion of four servo motors, which perform the twist tying function. This machine is normally installed onto a bagger or conveyor and interfaced into the existing control system to create a complete package closing system.

Model 2000M with Optional
Digital Display

#1 CONSUMER PREFERRED CLOSURE



- Package Recognition System
- Automatic Timing
- Modular Design
- Quick, Easy Threading
- Multiple Applications
- User Friendly
- New Quieter Brush Design
- No Lubrication Requirements
- One Model for All Systems

■ Specifications

ELECTRICAL

- ☐ 110 V_{AC}, 50/60 Hz, 1 Φ , 15 A
- ☐ 220 V_{AC}, 50/60 Hz, 1 Φ , 15 A
- ☐ 220 V_{AC}, 50/60 Hz, 3 Φ , 15 A
- ☐ 380/460 V_{AC}, 50/60 Hz, 1 Φ , 15 A
- ☐ 380/460 V_{AC}, 50/60 Hz, 3 Φ , 15 A

Air:

60 PSI

■ Models

MODELS

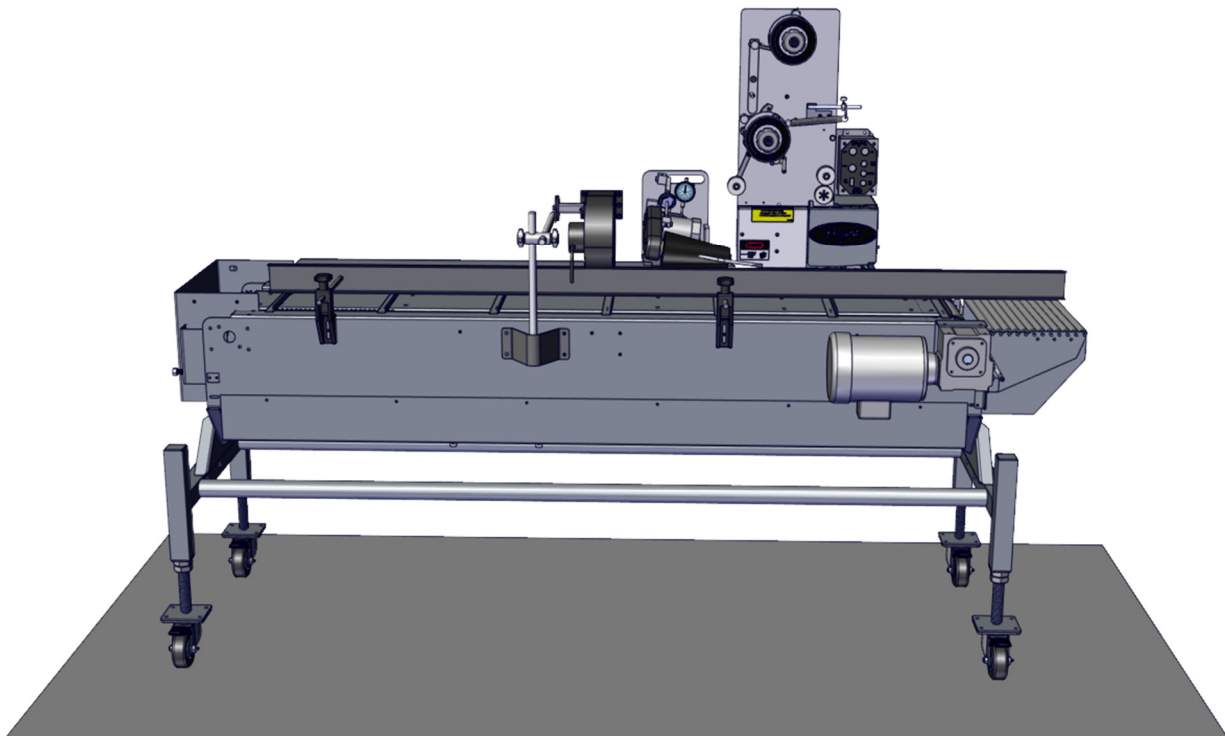
- ☐ 2100M Product flow moves left to right when viewing front of unit.
- ☐ 2000M Product flow moves right to left when viewing front of unit.



■ Conveyor Requirements

Depending on conveyor speed and flight spacing, the Servo Tyer is capable of operating speeds of up to 100 packages per minute. The Servo Tyer operates on a nominal 110 Volts, 60 Hz, single-phase alternating current. 15-amp service is recommended. Servo Tyer connections for bagger interlock and safety circuits are provided standard. A counter signal is provided which can be used in conjunction with an external counter (not provided).

On flighted conveyors, flight spacing up to 18" may be used, but the tyer can have a higher production rate (packages per minute) with a small flight spacing, such as nine inches. This tyer can also be used on belted conveyors that provide consistent spacing. All referenced measurements are in inches except as noted.

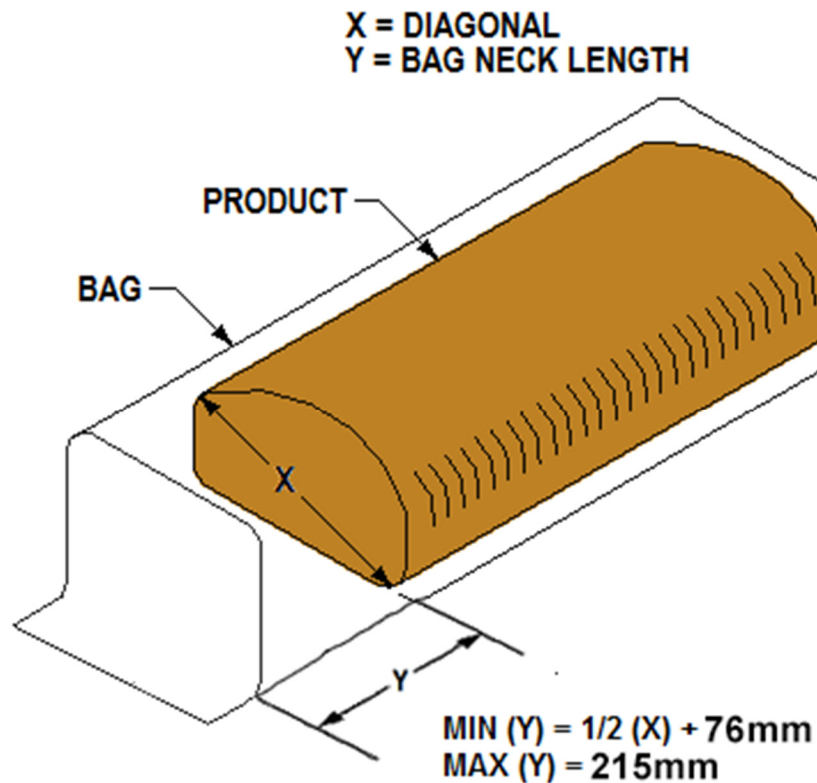


Minimum size for a service transformer must be rated at least 1.8KVA

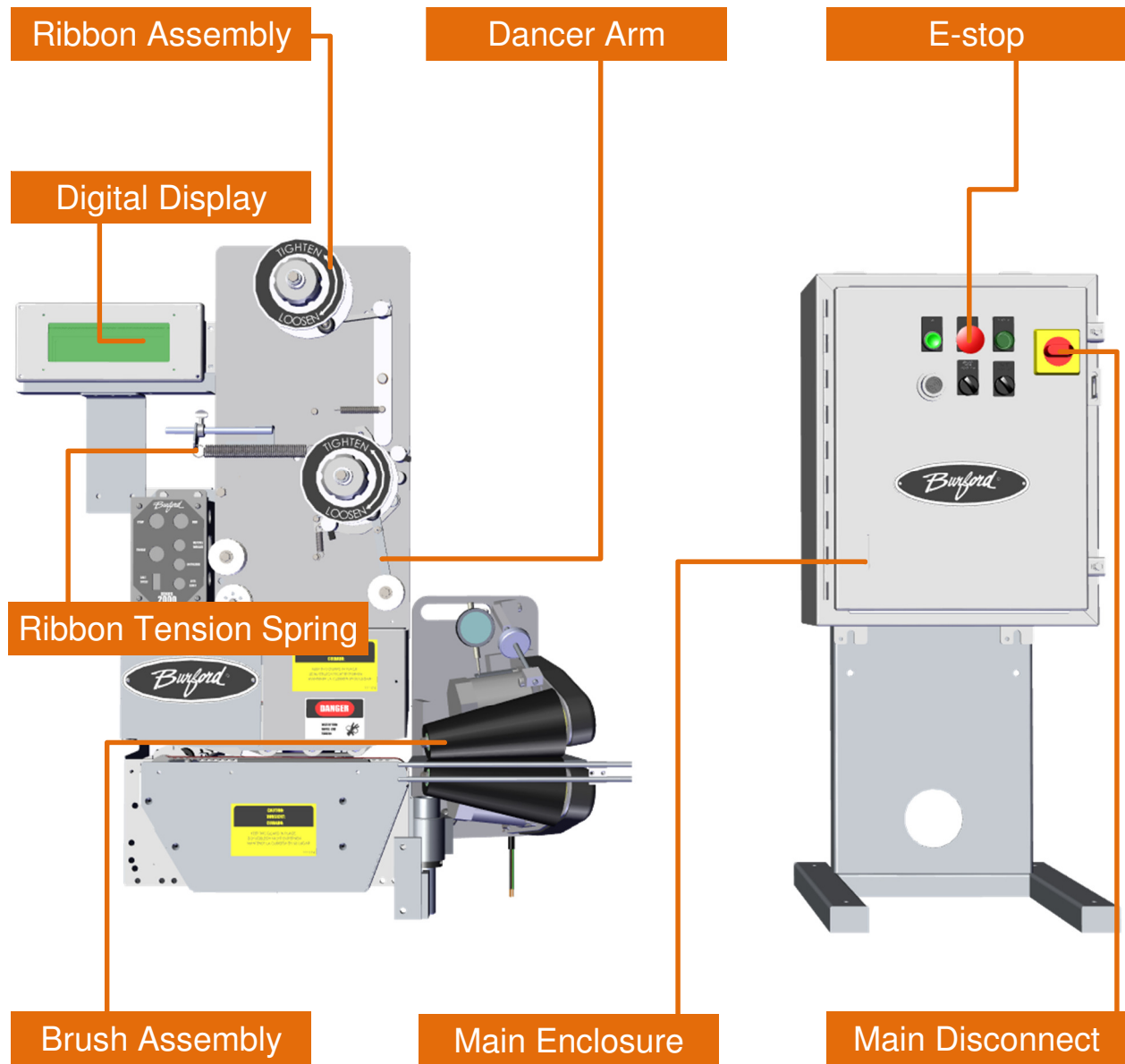
■ Bag Neck Length Requirements

The formula below is provided in the event that you are developing a new product package and need to calculate a bag neck length for your product. Please consult a reliable package manufacturer for your specific needs or contact Burford® Corp. if we can be of assistance.

1. Measure the diagonal across the end of the product.
2. Take one-half of the diagonal measurement and add 3 inches (76mm) to determine the required length of the bag neck.

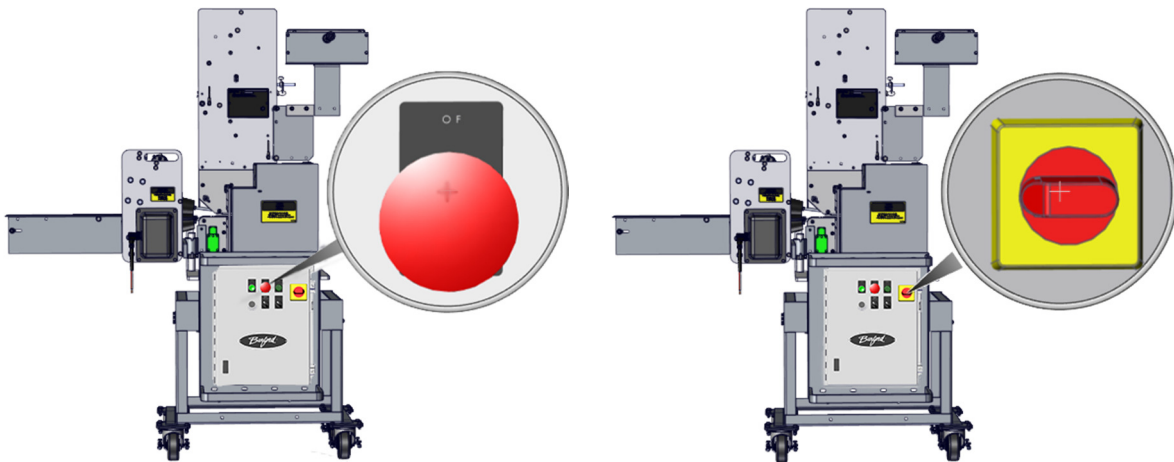


Short bag neck lengths may cause excessive package jams.

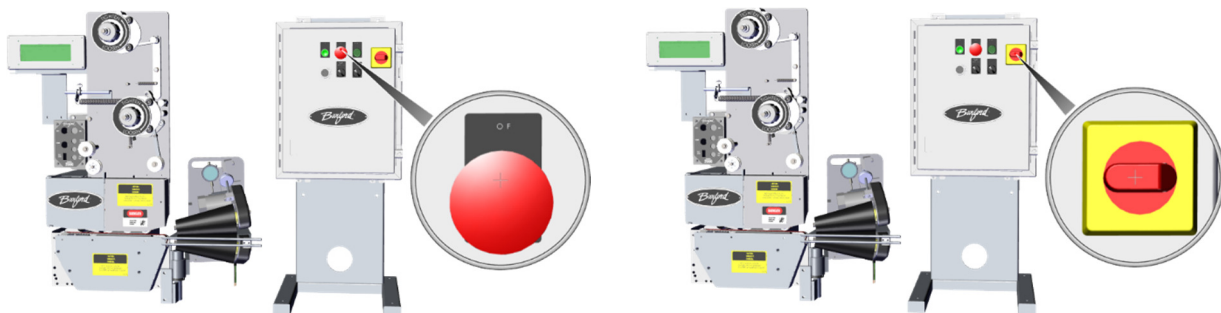
■ Unit Overview

■ E-Stop Location

Below are the locations for the Emergency Stops (E-Stop) and the Main Disconnect on the unit when on a stand. The E-Stop is located on the user interface panel of the tyer head. The Main Disconnect is located on the Electrical Panel. The operators should become familiar with these locations.



Below are the locations for the Emergency Stops (E-Stop) and the Main Disconnect on a standard unit. The E-Stop and the Main Disconnect are located on the Main Enclosure.



Chapter 2

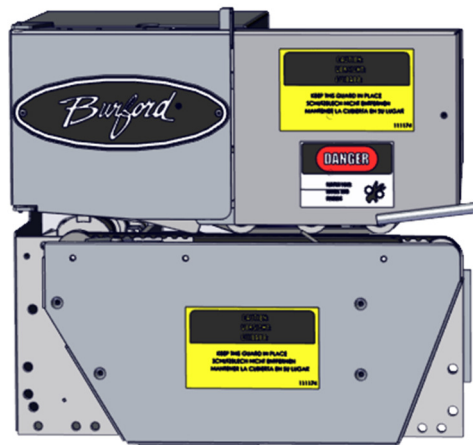
Key Components

CHAPTER 2: KEY COMPONENTS

Below is a list of key components that you must familiarize yourself with to gain a better understanding of how the Servo Tyer functions.

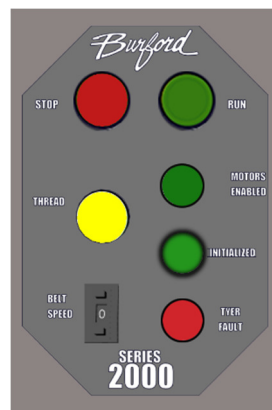
■ Tyer Head

The Tyer Head is made up of all the mechanical and electrical components necessary to perform a closure. The Tyer Head applies the ribbon to the product. When the bag trips the trigger arm, the 4 servo motors work together to apply ribbon with either 4 or 5 twists to the bag.



■ Control Panel

The Control Panel is located at the top of the tyer head. This is where the operator will control the machine. It houses the E-Stop for the Tyer head only, start button, Thread button, Motors Enabled Light, Initialized Light, Tyer fault light, and the Belt Speed Switch.

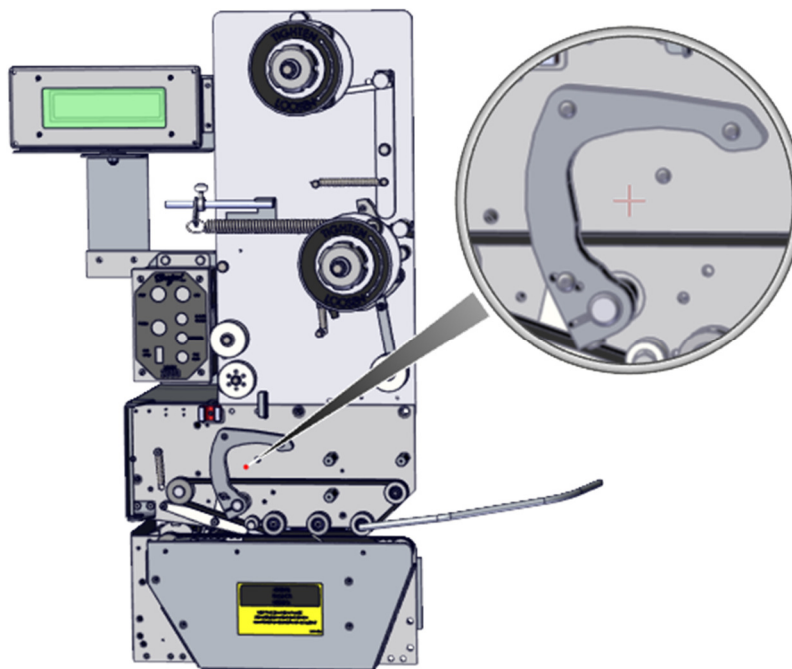


■ Needle

The Needle wraps the ribbon around the bag neck and places the ribbon into the Holder / Shear.



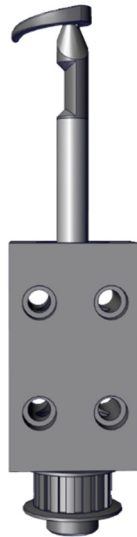
Needle



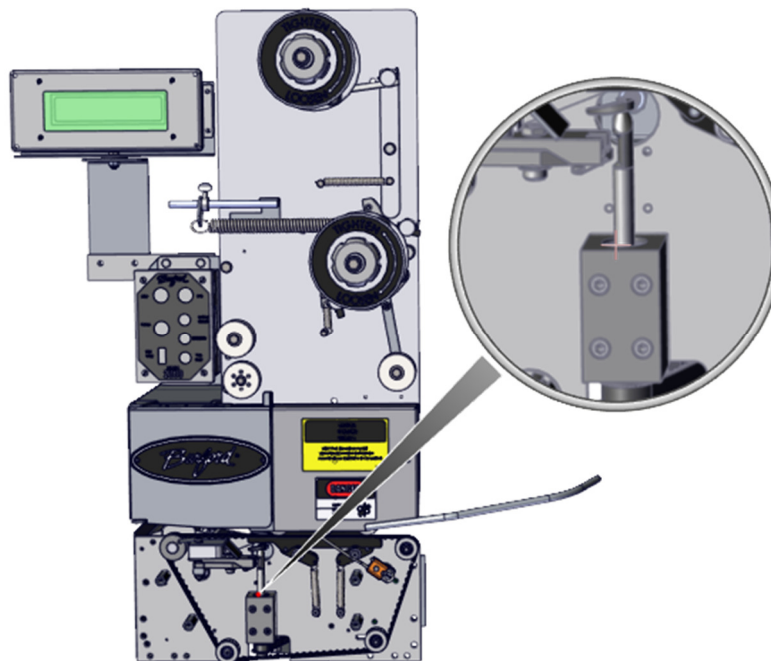
Cover removed for clarity of component location.

■ Twister Hook

The Twister Hook takes the ribbon and twists it to tie the ribbon.



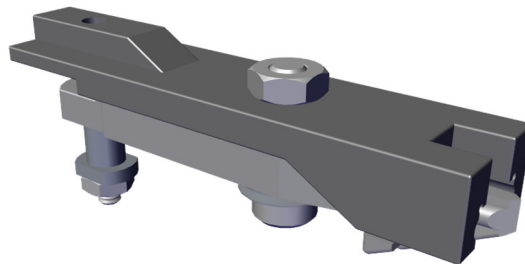
Twister Hook



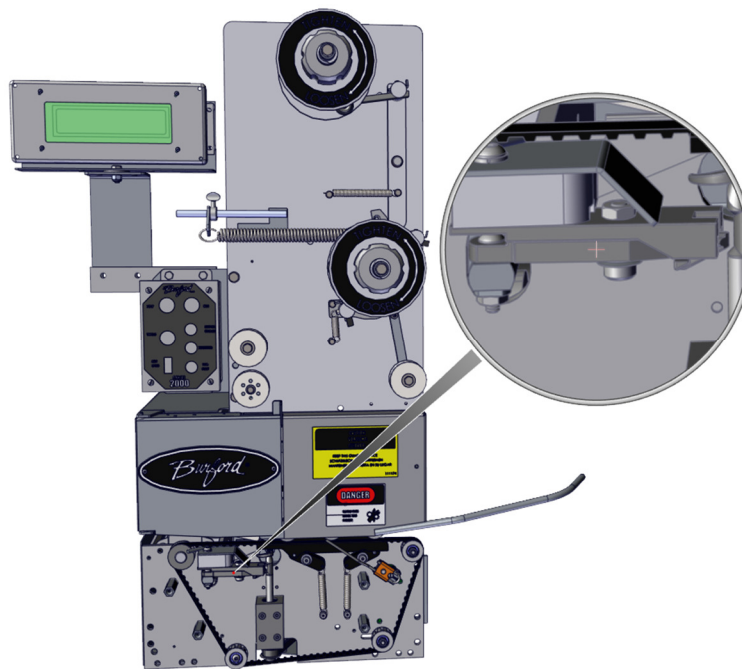
Cover removed for clarity of component location.

■ Holder / Shear

The Holder / Shear performs two functions. It shears, or cuts the ribbon for the current closure. It simultaneously holds the ribbon for the next closure. The Holder Shear cycles between the two sides. Each side performs the same function, to shear the ribbon for the current closure and to hold the ribbon for next closure.

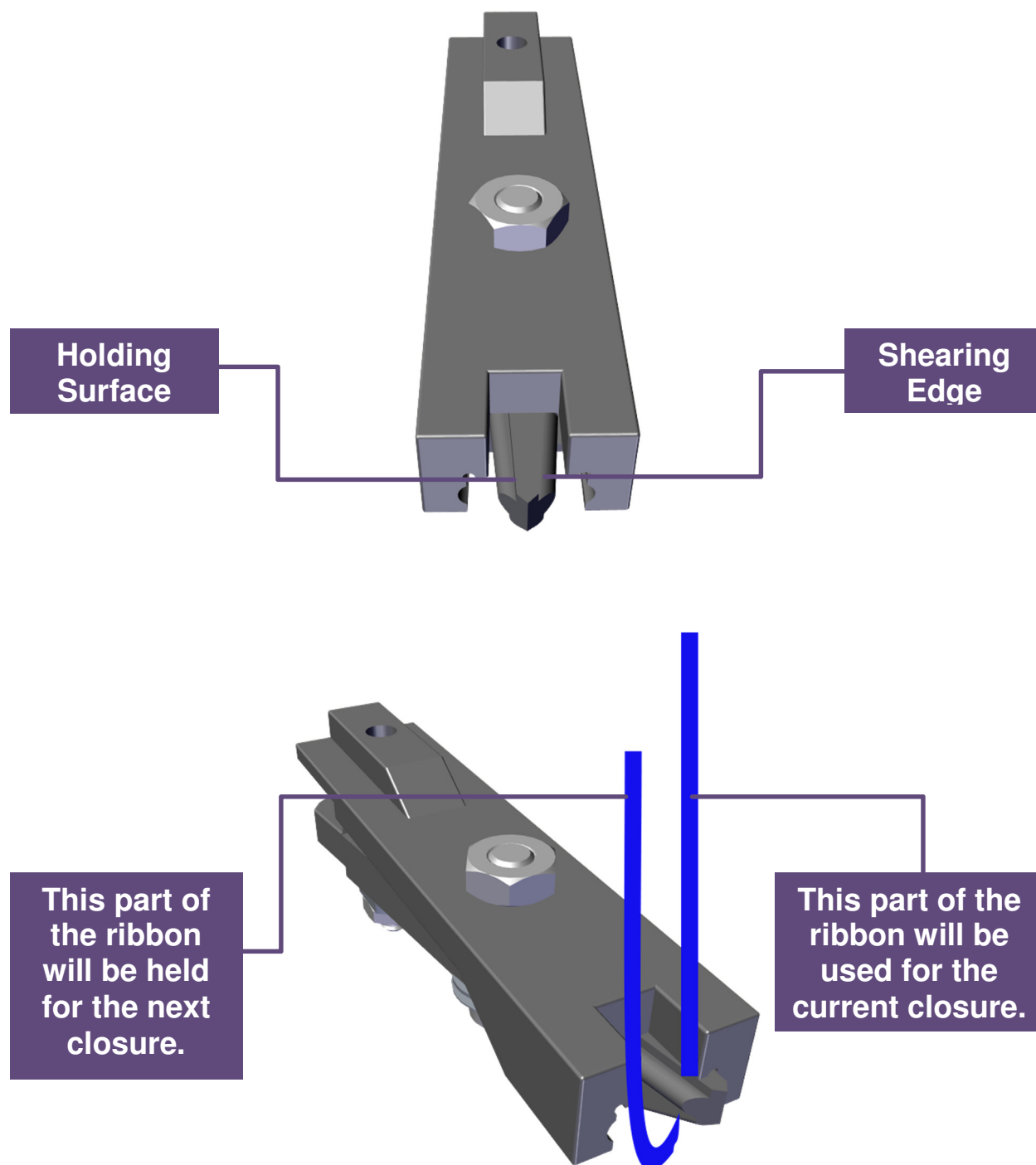


Holder / Shear



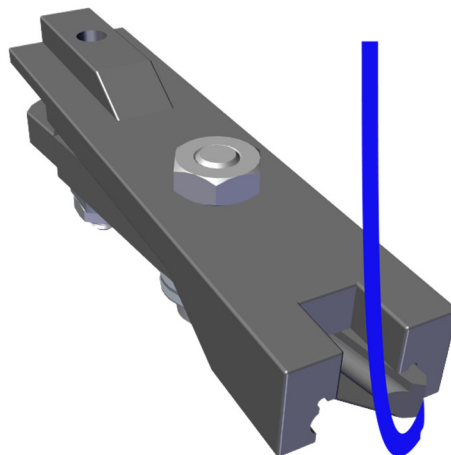
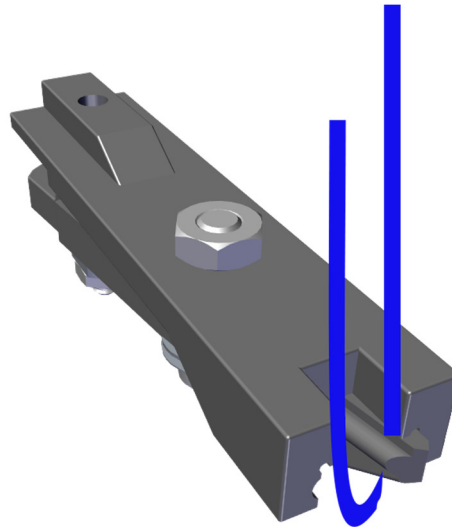
Cover removed for clarity of component location.

■ Holder / Shear, cont'd



■ Holder / Shear, cont'd

During the closing sequence, the needle will place the ribbon around the bag neck and into the Holder / Shear. The Holder / Shear will cycle, cutting the top of the ribbon to be tied around the current product.

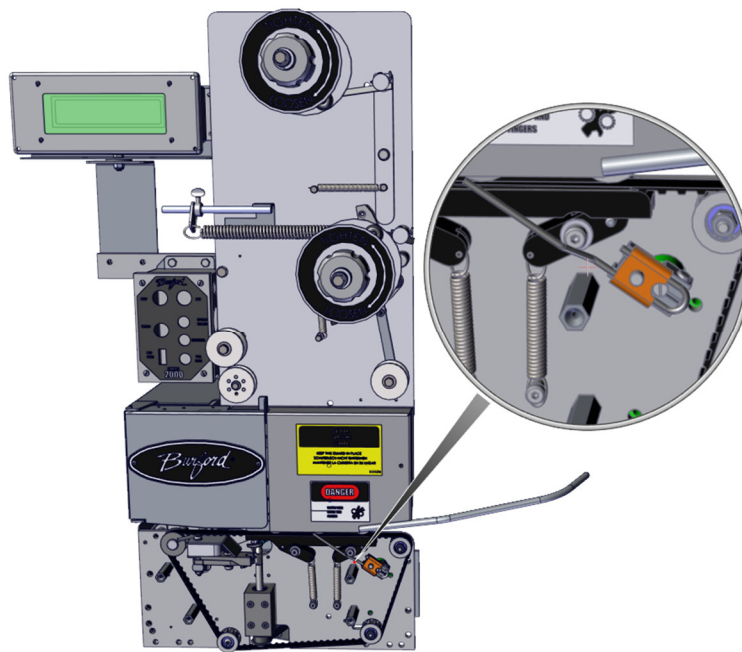


■ Bag Switch

The Bag Switch is actuated by the bag neck of the product. When product is being transferred by the conveyor to the gathering belts, the bag neck will force the bag switch to pivot downstream. The bag switch sends a signal to start the closure process.

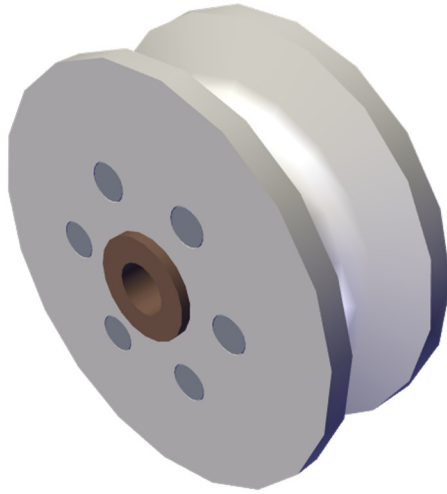


Bag Switch

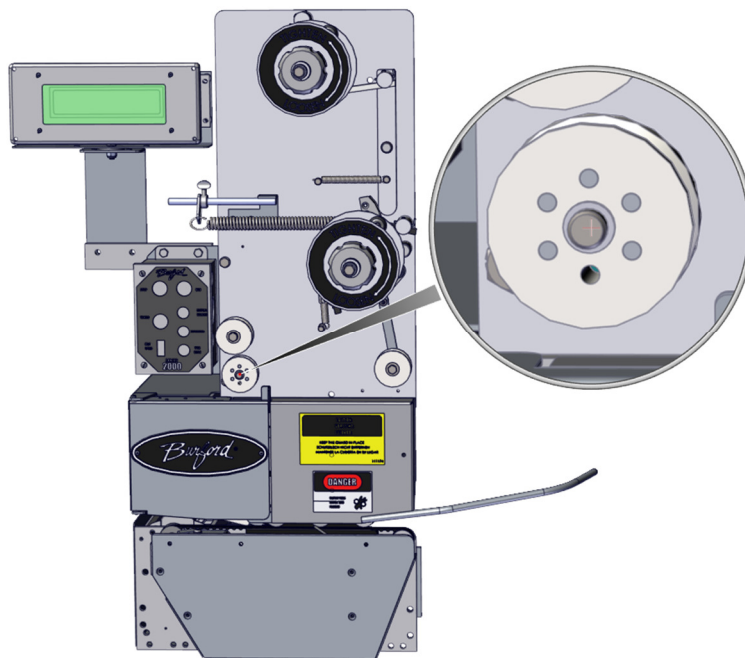


■ Ribbon Dispense Encoder

The Ribbon Dispense Encoder is an integral part of the Ribbon Tension assembly and the electronics. This system determines whether a bag neck has been properly presented in tying position. As the needle wraps the ribbon around the bag neck, the length of dispensed ribbon is measured.

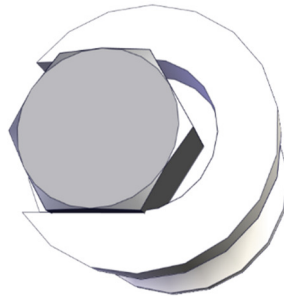


Ribbon Dispense Encoder

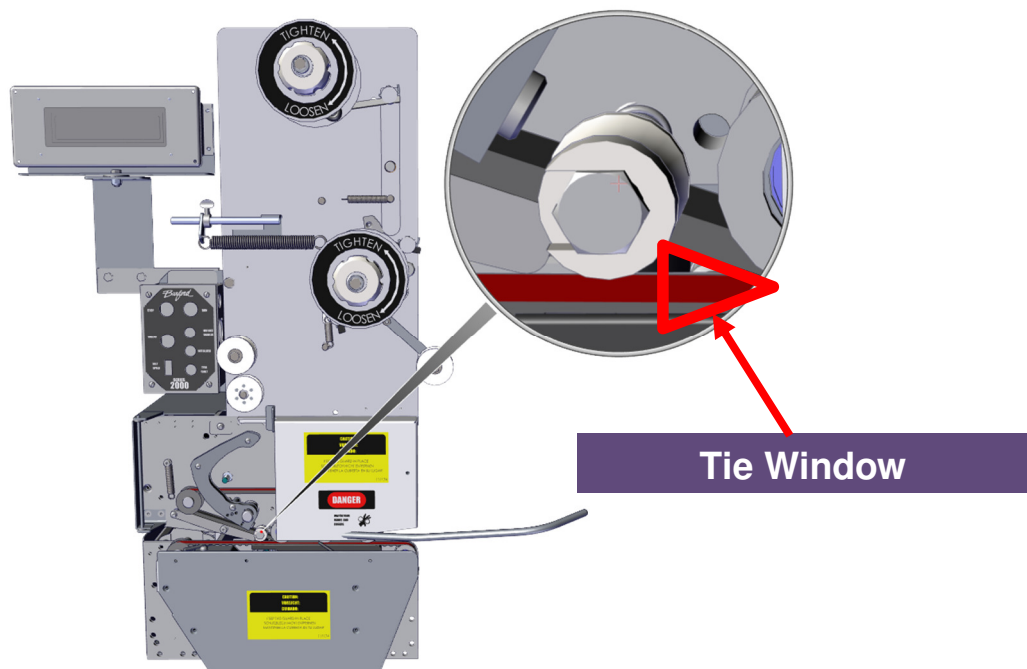


■ Ribbon Guide

The Ribbon Guide is positioned so the downstream side of the lobe is flush with the mounting block, with the belt pulley positioned so the upper belt is approximately 1/8" from the needle shaft. It is used to increase or decrease the tie window.

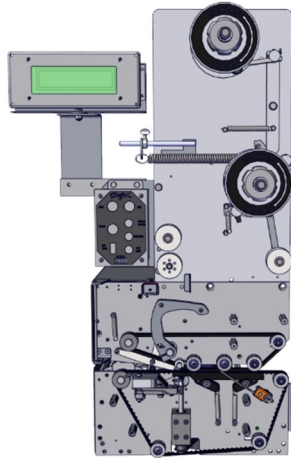


Ribbon Guide



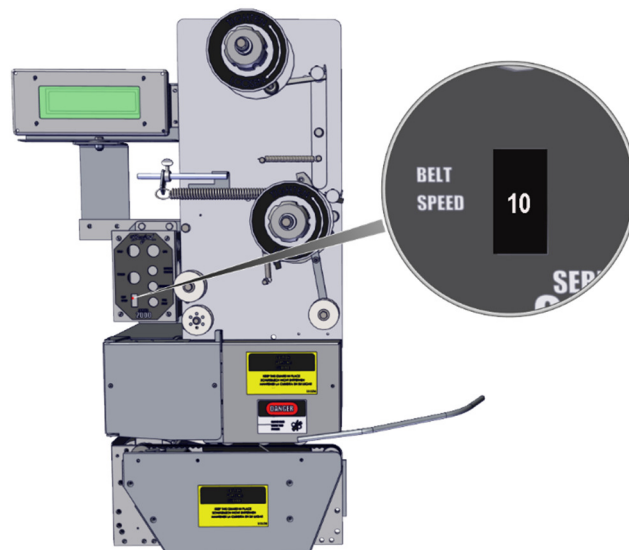
■ Gathering Belts

The Gathering Belts, which move at a selectable continuous rate of speed, transport the bag neck towards the tying position.



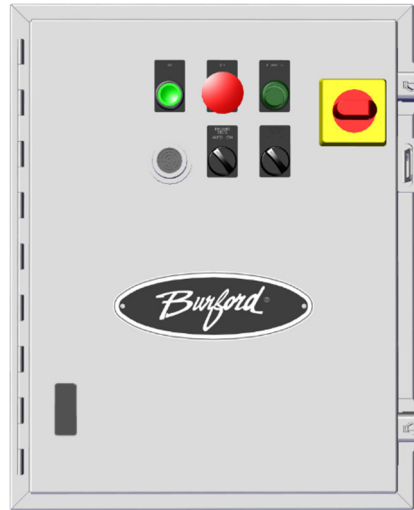
■ Belt Speed Switch

In normal operation, the Belt Speed switch enables the operator to adjust the speed of the gathering belts. The belt speed can be adjusted from a setting of zero to fifteen. (Some BCD switches may have A-D instead of 1-4) In normal operation, each speed setting is approximately 15 percent faster than the previous setting. Proper speed should pull the package 1"-2" ahead of the flight and finish tying as the flight catches up to the product.



■ Main Enclosure

The Main Enclosure controls the power to the unit. The Main Disconnect, E-Stop, Start, and audible alarm are housed on the door. This is where the machine is turned “ON” or “OFF”. Turn the Unit “ON” by turning the disconnect Switch to the “ON” position. The Interface for Baggers and / or conveyor interlocks are located in the Main Enclosure.



■ Main Disconnect

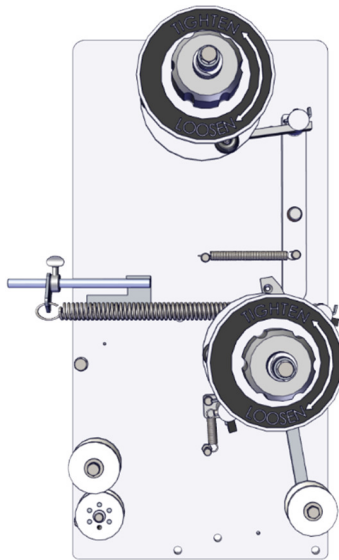
The main disconnect controls the power to the unit. This is where the machine is turned “ON” or “OFF”. Turn the Unit “ON” by turning the disconnect Switch to the “ON” position.



Shown above is the standard disconnect switch in the “OFF” position. Turn the handle 90° clockwise to turn the unit ON.

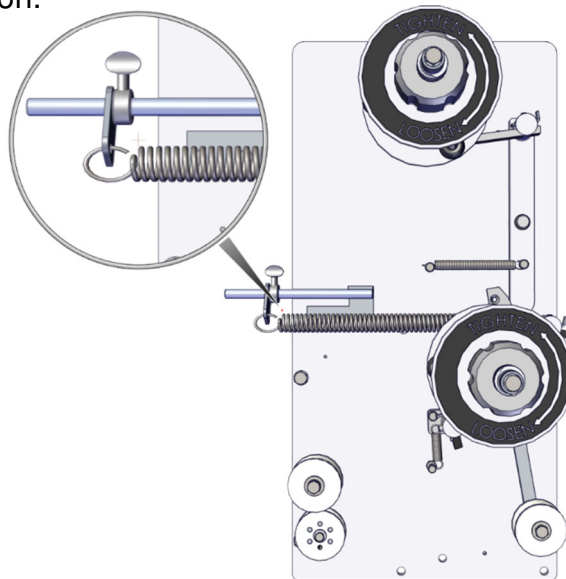
■ Ribbon Tension Assembly

The Ribbon Tension Assembly holds the ribbon spools and keeps the ribbon tension tight for a proper tie. It houses the ribbon tension spring, ribbon drop sensor, the ribbon brake, and the dancer arm. The Servo Tyer comes standard with a double ribbon spool holder.



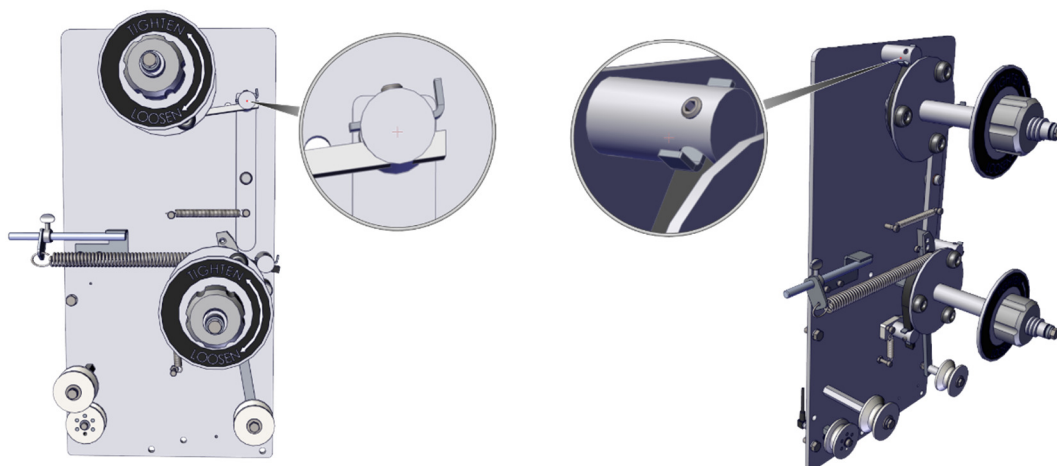
■ Ribbon Tension Spring

The Ribbon Tension Spring is used to increase or decrease brake tension and allow for a proper ribbon dispense. The thumb screw and cantilevered spring stop allows to relieve or maintain spring tension.

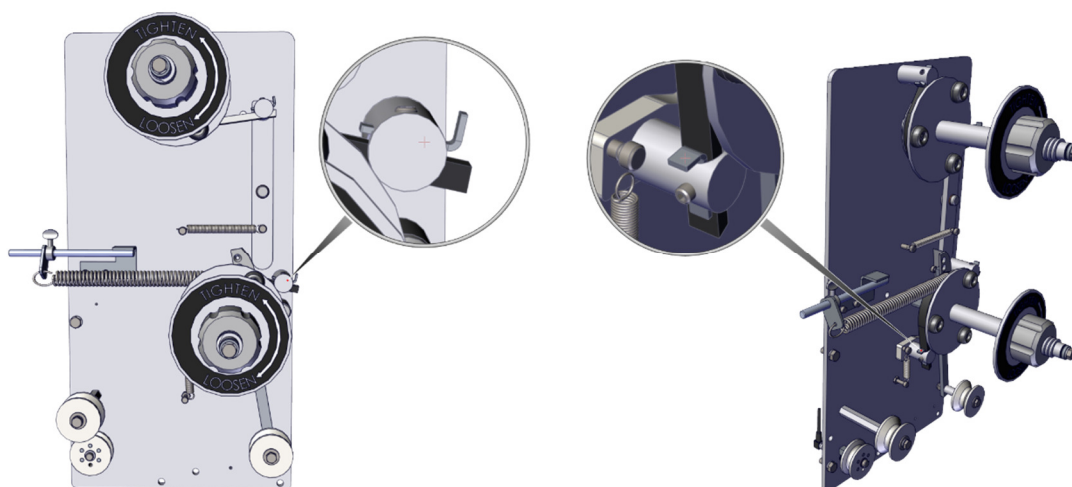


■ Brake

The brake should hold firm when the tyer is idle and rotate freely when the tyer is pulling ribbon. It can be adjusted by loosening the set screw at the upper or lower “V” belt clamps.



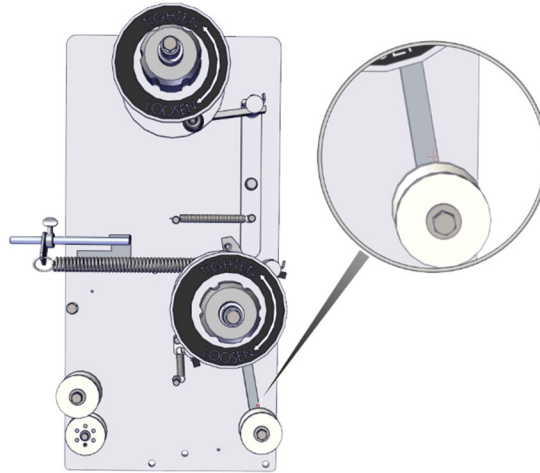
Upper Spool Holder “V” Belt clamps



Lower Spool Holder “V” Belt clamps

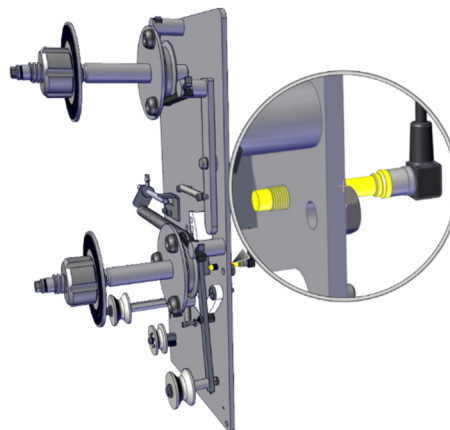
■ Dancer Arm

The Dancer Arm decreases ribbon tension by releasing the brake pressure. If properly adjusted, the ribbon drop sensor will not be active when the ribbon is threaded.



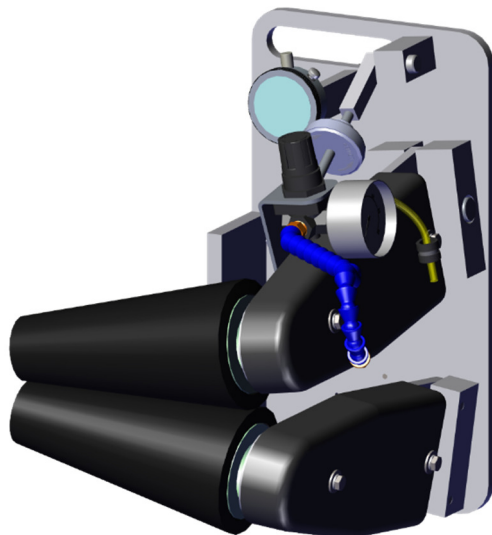
■ Ribbon Drop Sensor

The Ribbon Drop Sensor detects if the ribbon is no longer threaded during operations. A ribbon drop can occur for numerous reasons, but it is most common with poor presentation, improper ribbon tension, or debris in the Holder / Shear. A ribbon drop will cause the dancer arm to return to its home position, activating a lever that moves the ribbon drop tab over the sensor, energizing it. An alarm will notify the operator of a ribbon drop.



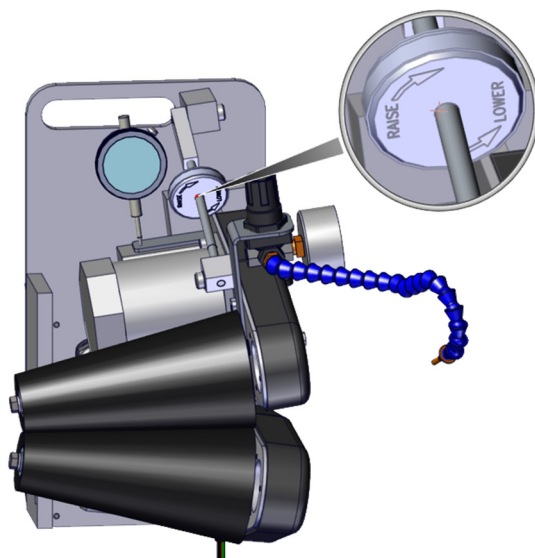
■ Gathering Brush

The Gathering Brushes help to flatten and straighten the bag neck. The brushes gently pull the bag neck and product against the inlet guide and main plate of the tyer.



■ Adjustment Knob

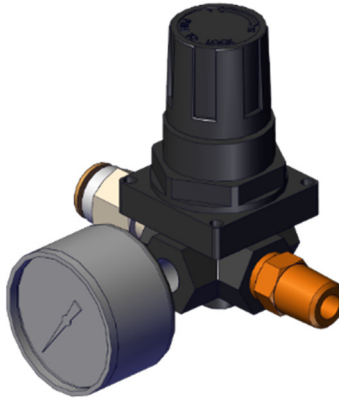
The Adjustment Knob varies the tension of the gathering brushes. This knob limits the amount of mesh between the upper and lower brushes.



Order your replacement brushes from Burford®.
Call 1-877-Burford (1-877-287-3673) Today

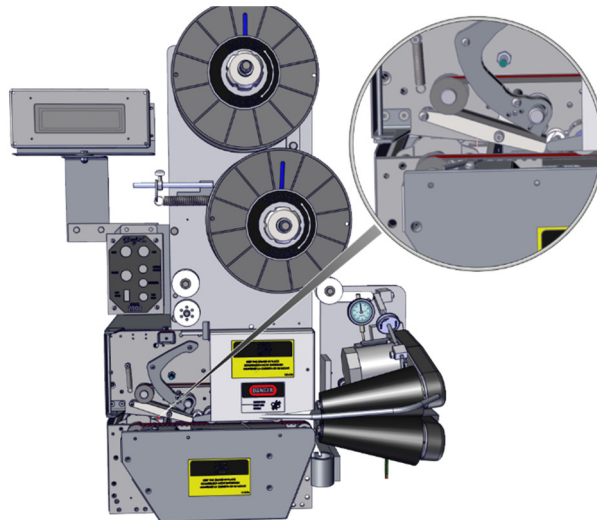
■ Pressure Regulator

The Pressure Regulator is a valve on the Gathering Brush that automatically meters the flow of air at a certain pressure. An adjustable knob is used to control the amount of pressure desired to help flatten the bag tail.



■ Bag Stop

The Bag Stop stops the bag tail while the unit is performing the tie process. It restrains the end of the bag neck as the needle wraps thread around the neck. It releases the bag neck when the twister hook completes its final rotation.



■ Optional Key Components

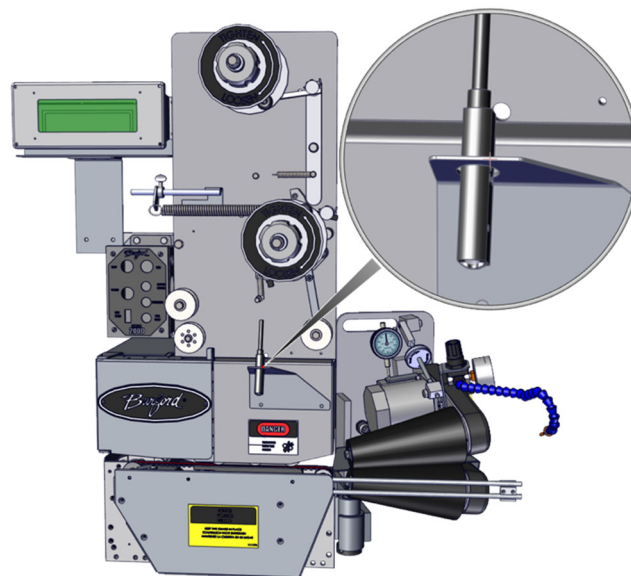
The following Key Components are items that may be purchased as an upgrade with the Burford® Servo Tyer. Your unit may or may not have these items on it. Contact Burford® for further information.



Order your Optional Components from Burford®.
Call 1-877-Burford (1-877-287-3673) or email Parts@Burford.com
today.

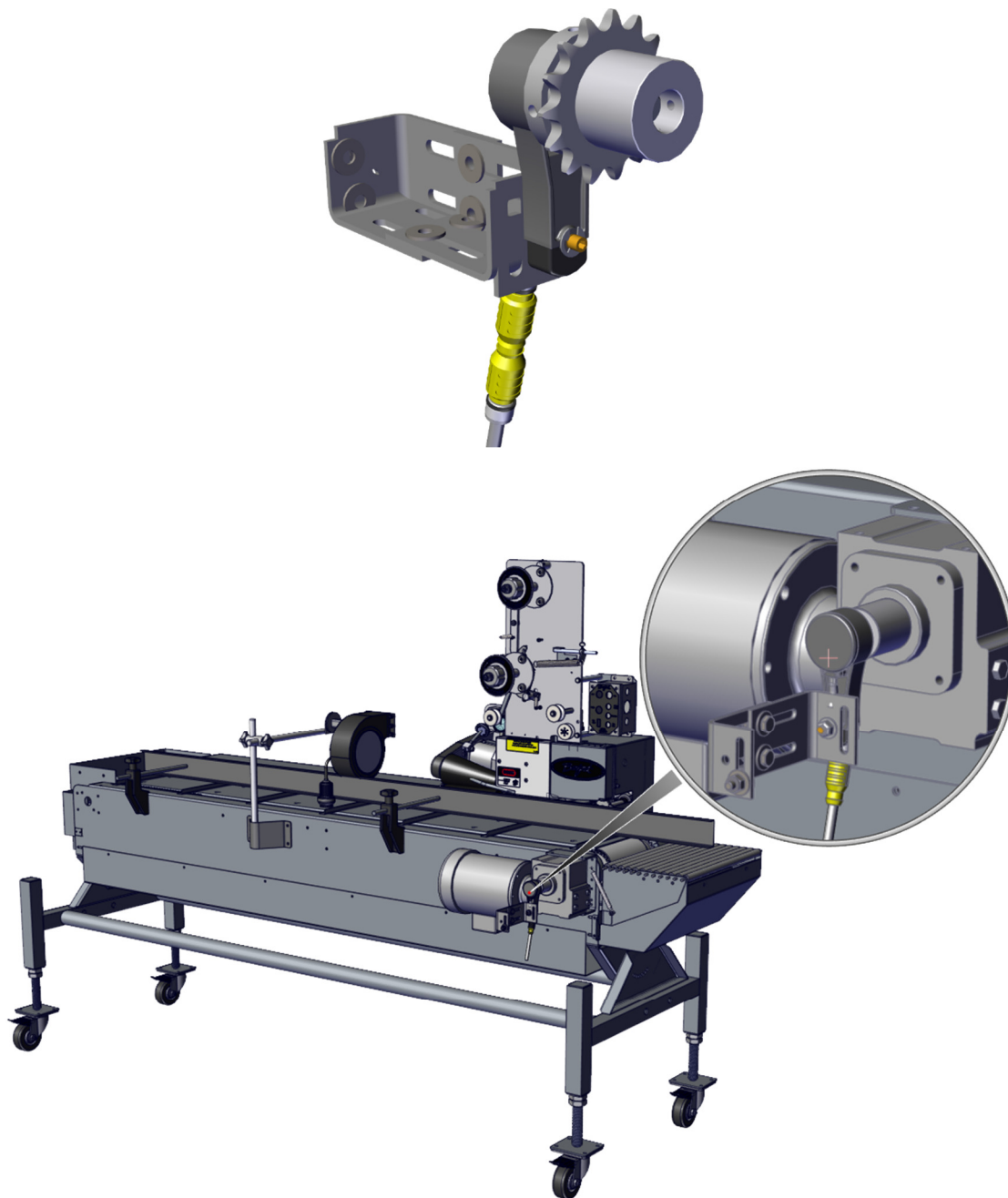
■ Package Detection Sensor

The Package Detection System monitors packages as they pass through the Burford® Model 2000M / 2100M Servo Tyer and stops the bagger or sounds an audible alarm depending on dip switch 6 on Amp board if a twist-tie is not applied. The system automatically resets after the next accepted package.



■ Speed Follower Encoder

The Speed Follower Encoder gives the tyer the ability to automatically adjust the speed of its gathering belts so that the belt speed changes as the conveyor speed changes. An Encoder is used to monitor a sprocket that rotates with the conveyor.



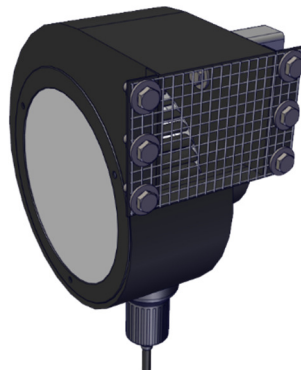
■ Operator Display

The Operator Display shows messages sent from the CPU Board program. It shows machine status, error message, as well as notifying the operator when the unit is ready to operate.



■ Bag Tail Blower

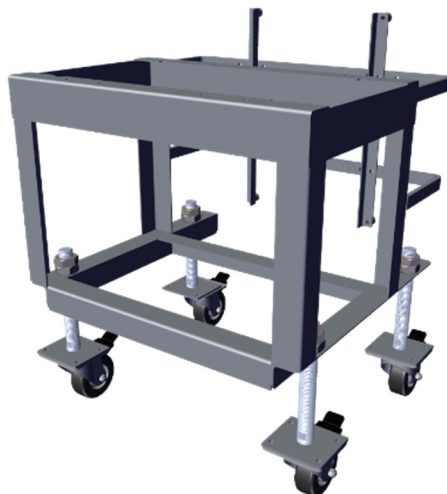
The Bag Tail Blower comes optional with the Servo Tyer. The blower is placed upstream from the gathering brush and blows the bag tail down prior to the entering the gathering brush.



Order your Bag Tail Blower from Burford®.
Email Sales@Burford.com or call 1-877-Burford (1-877-287-3673)
today. Part Number: 211002.

■ Stand

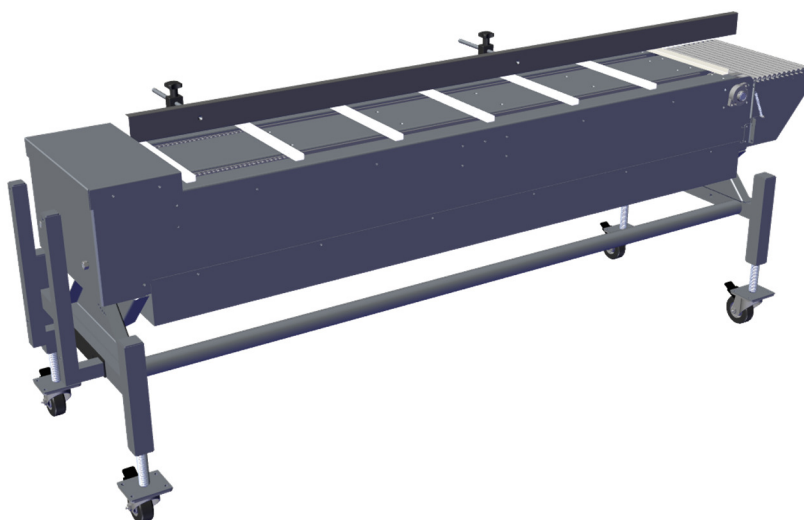
The Servo Tyer can be ordered on a stand. A static stand and an adjustable height stand are both available. These come with castors for portability.



Static Stand

■ Conveyor

An optional conveyor is available for your Servo Tyer. The conveyor transfers product through the unit so a closure can be applied. Burford conveyors feature flights that carry the product through the tyer. Different lengths of conveyors are available.



Chapter 3

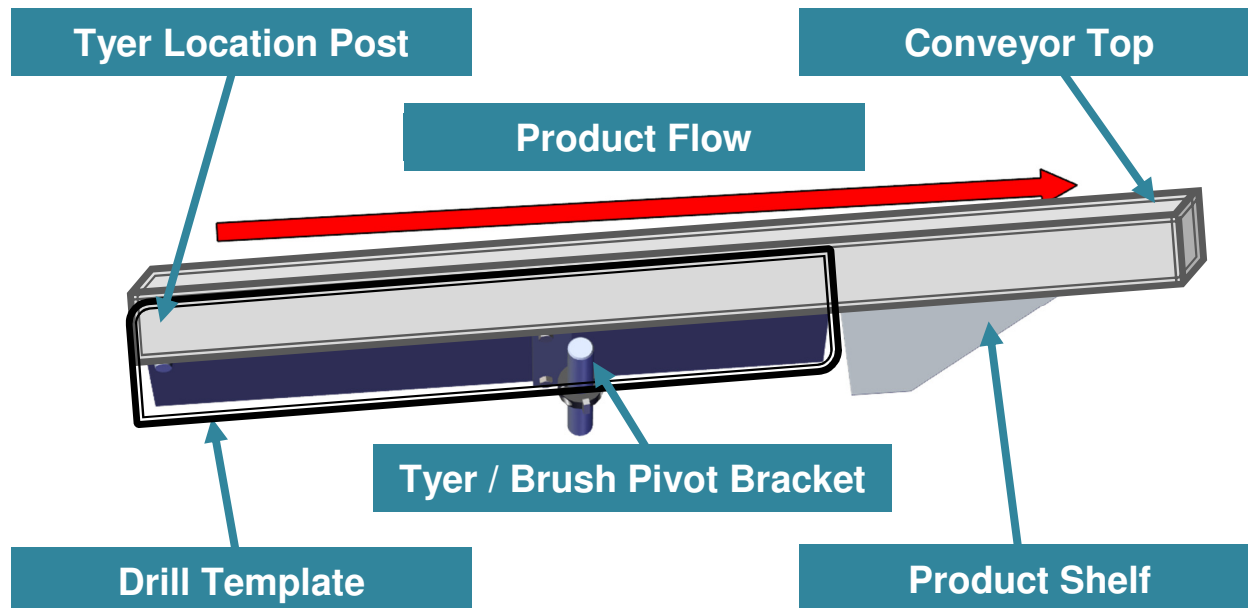
Installation

CHAPTER 3: INSTALLATION

These instructions are for a typical bagger. If your specific installation requirements are different from what is described here. Contact Burford® Corp. at (1-877-287-3673) or Service@Burford.com for assistance.

■ Mechanical Installation

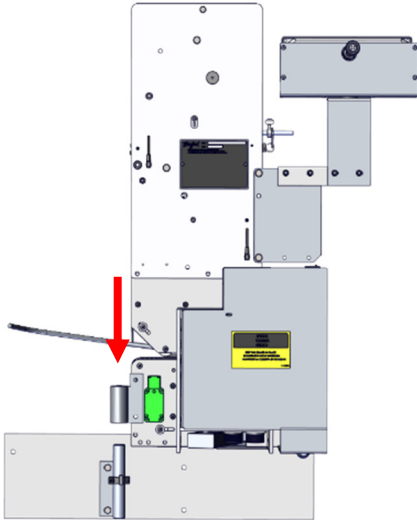
1. Locate the template drawing provided with your manual packet and review your application. Refer to pg. 18 for the general location.
2. Center punch the three hole locations indicated. Drill the three 3/8" diameter mounting holes required for the standard unit (clearance holes for 5/16" bolts).
3. Locate the Servo Tyer/Brush pivot bracket and bolt this assembly onto the conveyor as shown below with two (2) 5/16" bolts and nylon insert nuts provided. This post should include a set collar for adjusting the height of the Servo Tyer. Square bracket and tighten securely.
4. Locate the Servo Tyer location post, bolt to third hole, and secure loosely.



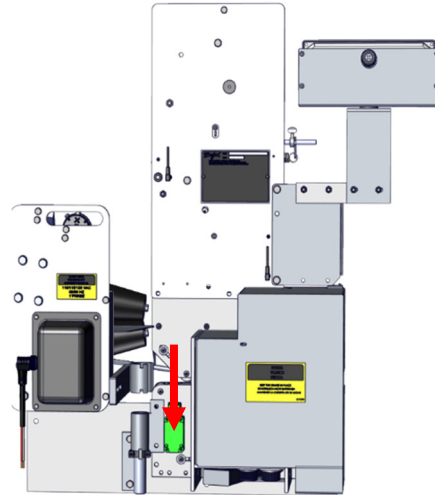
The template drawing is intended for use with standard bread packages. Depending upon your application, it may be necessary to raise or lower all three holes. Layout the bolt pattern as described on the drawing.

■ Mechanical Installation, cont'd

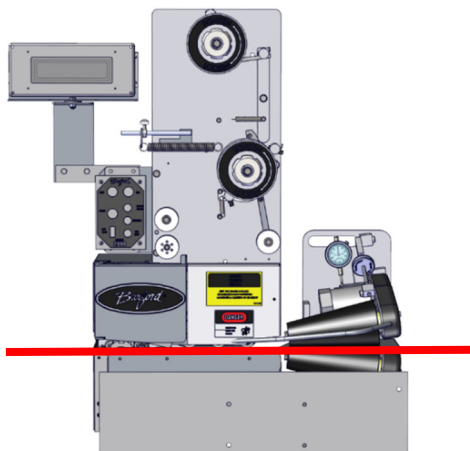
5. Remove the Servo Tyer from the shipping crate and slide the unit onto the Servo Tyer/Brush pivot bracket. Rotate the Servo Tyer toward the location post until the side of the lower plate is resting on top of the location post. The centerline of the gathering belts should align with the center of the package. For instance, the belts should be 2 inches above the conveyor for a 4-inch tall package. If necessary, raise or lower the set collar on the pivot bracket to give the proper height. The top of the Servo Tyers lower plate should be parallel to the conveyor top. To adjust the angle of the lower plate, loosen the Servo Tyer location post, and rotate it until the top of the lower plate is parallel with the top of the conveyor. Tighten the location post securely.
6. Remove the brush assembly from the shipping crate and slide it onto the Servo Tyer/Brush pivot bracket. See pg. 78 for proper adjustment.



Place brush on pivot bracket



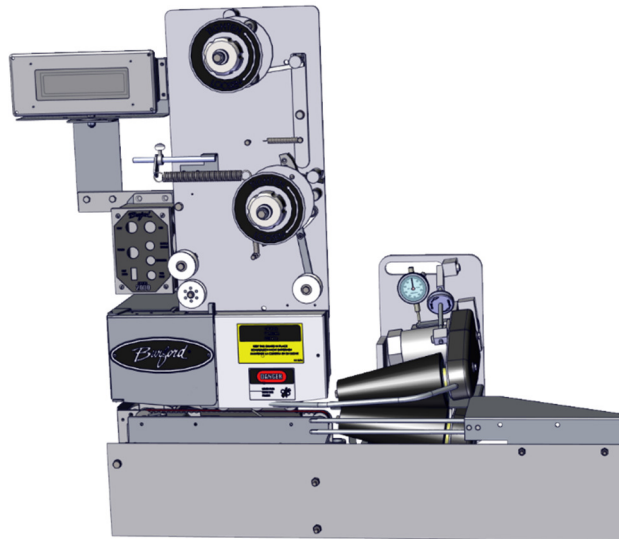
Place Tyer on pivot bracket



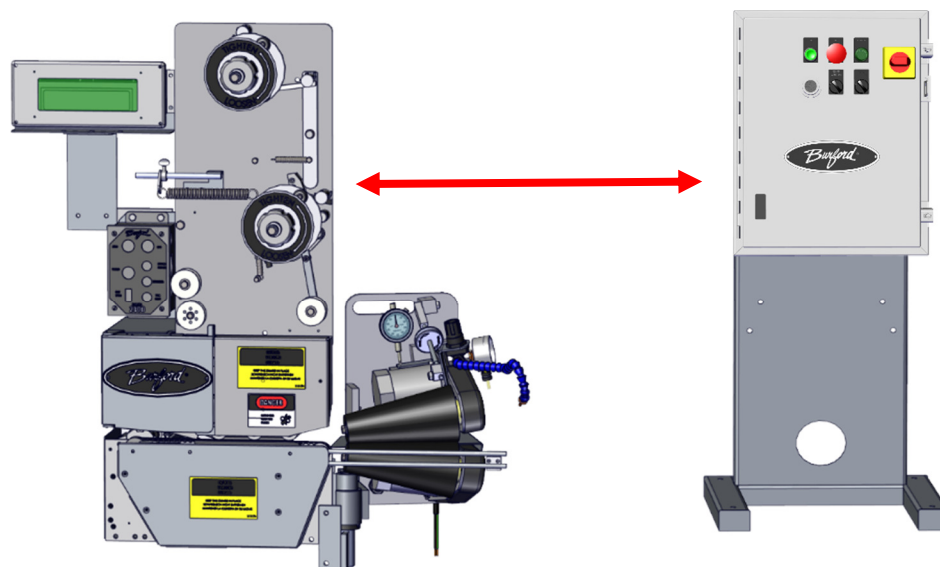
Center with center of the product

■ Mechanical Installation, cont'd

7. Position the product shelf. Secure with the flat washers, nuts, and bolts provided.



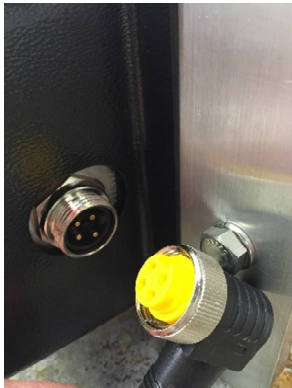
8. Position the Main Enclosure within six feet of the Servo Tyer.



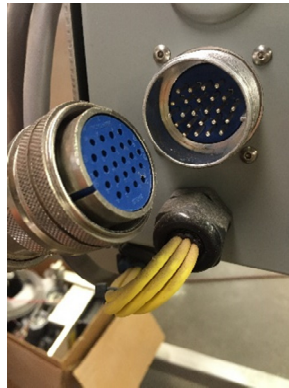
Must be less than 6' apart

■ Mechanical Installation, cont'd

Locate the eight (8) pin motor cable connector attached to the Main Enclosure and connect it to the mating bulkhead connector on the bottom of the Servo Tye. Locate the thirty-two (32) pin main control cable connector attached to the Main Enclosure and connect it to the mating bulkhead connector on the bottom of the Servo Tye. Locate the thirty-two (32) pin operator control box connector attached to the Main Enclosure and connect it to the mating bulkhead connector on the side of the control panel. Locate the 4 pin brush motor cable attached to the Main Enclosure and connect it to the brush bulkhead connector. These connectors are keyed so that they cannot be plugged into the wrong receptacles.



**4 Pin Brush
Motor Cable**



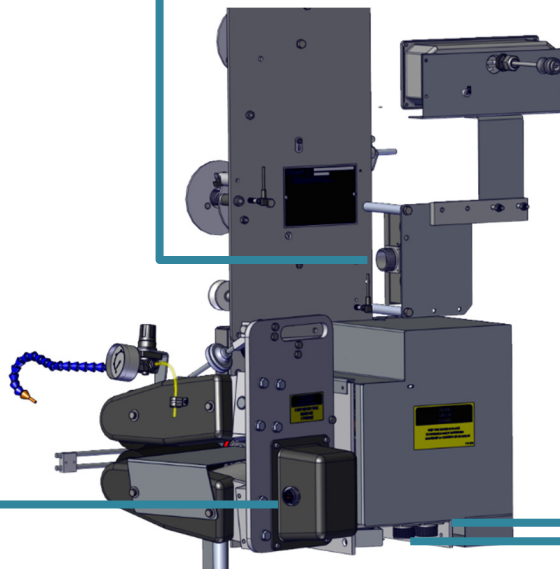
**32 Pin
Operator
Control Cable**



**8 Pin Motor
Cable**



**32 Pin Main
Control Cable**



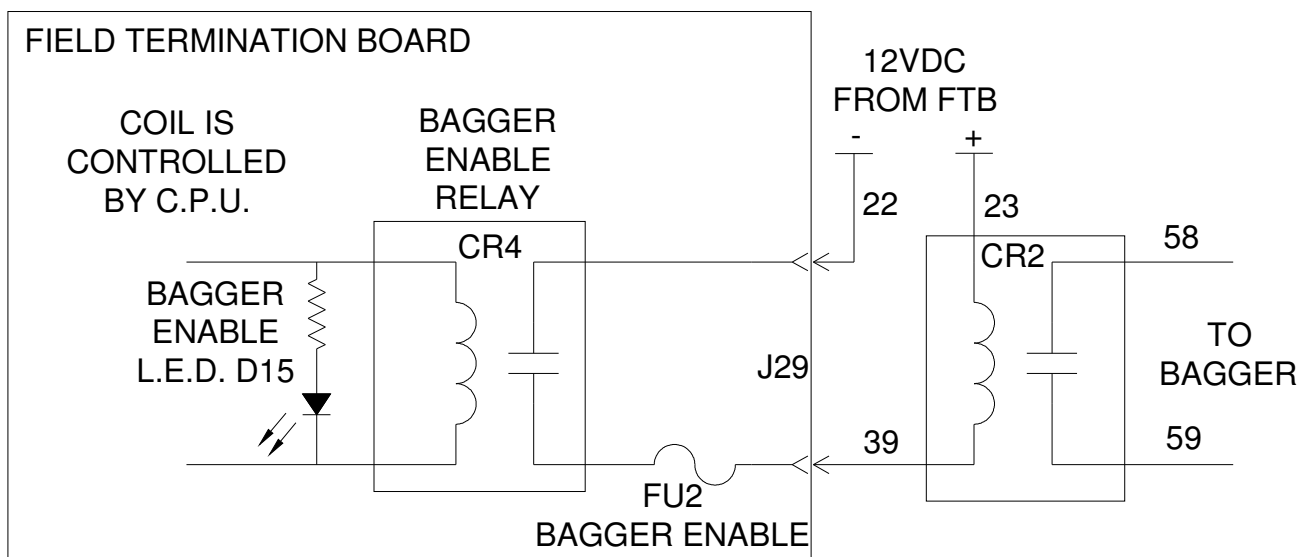
■ Electrical Interconnections

To make specific wiring connections to your bagger or conveyor system please refer to the wiring diagram provided. The Burford® 2000M/2100M Series Electronic Servo Tyer is nominally a 120VAC machine. If required, minimum service transformer size shall be 1.8KVA. A flexible conduit is provided to route Line, Neutral, and Ground into the Main Enclosure. Included in this conduit are conductors for other bagger connections. The following is a description of the other possible connections.

■ Bagger Enable Circuit (Safety Interlock)

The Servo Tyer provides a set of dry contacts that close when it is ready to tie packages. The Bagger Enable relay is mounted on the Servo Tyer Field Termination Board (FTB). The contacts can be accessed using wires 58 and 59 in the flexible conduit. These contacts will open if a fault occurs in the Servo Tyer or if a safety circuit is opened. These contacts should be wired in series with the bagger safety circuit to prevent the bagger from running if the Servo Tyer is not threaded, the ribbon supply has been depleted, or the Servo Tyer is not turned on.

BAGGER ENABLE CIRCUIT



■ Bagger-Active Circuit

This signal from the bagger to the Servo Tyer indicates the status of the bagger and it must be the same voltage as CR3 on the main electrical panel. This signal can be taken from across the coil of the clutch relay of most baggers. This signal drives the coil of a mechanical relay, which starts and stops the brush motor and gathering belts of the Servo Tyer. This connection is used to prevent the Servo Tyer gathering belts and brushes from running while the bagger is stopped. This will prevent a package from being pulled forward over a conveyor flight and will also reduce wear on the brushes and conserve energy during long breaks or periods of maintenance in other areas. This connection can be made using wires 40 and 43 in the flexible conduit coming from the Main Enclosure. Wire 40 should be connected to the Line side of the coil and wire 43 should be connected to the Neutral side of the coil. For setup and testing, the gathering belts and brushes can be made to run while the bagger is inactive by placing the switch on the front of the Main Enclosure marked "BELT/BRUSHES" in the "ON" position.

■ Counter Output / External Counter Output

The Servo Tyer comes standard with a relay (CR3), which toggles when a valid package is tied. This relay is normally used to drive a customer's external counter, but it can be adapted to serve other functions with external customer logic. This relay does not toggle if the tie cycle is aborted or if a heel is detected in the tie.

Wires 40 & 43 should be wired into the bagger so anytime the bagger is "CYCLING", 110 VAC is supplied to these wires.

If an external counter is desired, a set of dry contacts are supplied as an input to the customer's counter. The External Counter relay (CR3) is mounted in the Tyer's electrical enclosure. Connection can be made using wires 41 and 42 in the flexible conduit coming from the main enclosure. The contacts actuate for a period of about 1/4 second immediately after a successful tie has been completed. These contacts will not actuate if the tyer aborts its tie cycle or if the tyer determines that extra material is in the bag neck, such as a heel. The contacts can be configured to be normally open or normally closed by using DIP Switch 2 on the AMP board see pg.87.

■ Installation arrangements

A Burford® factory trained Technician may be hired for any installation. The arrangement can be made with the Service Manager Service@Burford.com or:

Burford® Corp.
Maysville, Oklahoma
Phone: 1-877-BURFORD® or 405-867-4467
Fax: 405-867-4219



Chapter 4

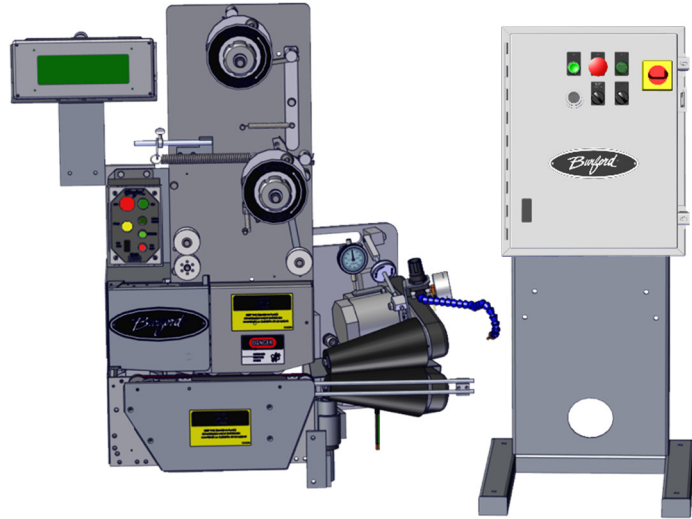
Operation

CHAPTER 4: OPERATION PROCEDURES

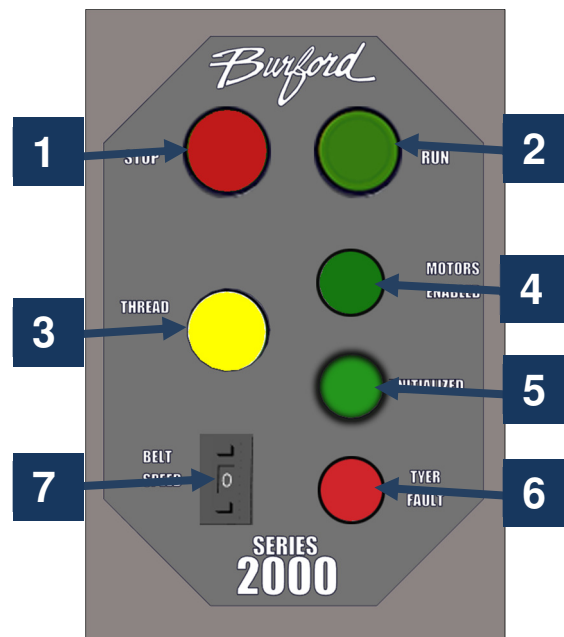
■ Theory Of Operation

Before discussing the specifics of the Burford® Model 2000M/2100M Electronic Servo Tyer, the overall operation of the Servo Tyer will be described to illustrate the principles of the tying cycle. The Servo Tyer is designed to gather and securely close the neck of a plastic bag by twist tying it with a piece of reinforced ribbon.

The plastic bag first encounters a set of gathering brushes, which are turning at a constant speed, that assist in flattening and straightening the bag neck. The brushes gently pull the bag neck and product against the inlet guide and main plate of the Servo Tyer. As the bag neck exits the brushes it is directed towards the gathering belts. The gathering belts, which move at a selectable continuous rate of speed, transport the bag neck towards the tying position. As it approaches the tying position, the bag neck depresses the bag switch, which readies the electronics for the start of the tie cycle. When the bag neck releases the bag switch, the Servo Tyer controller waits for a short time before commencing the tie cycle. This delay allows the bag neck to gather against the ribbon for a more secure tie. Then the needle begins to move downward and allows the spring-loaded bag stop to engage, thereby restraining the end of the bag neck. The needle continues to rotate and wraps the ribbon around the neck of the bag. As the needle nears its full stroke, the twister hook begins rotating. The twister hook catches the end of the ribbon held in the holder shear, and the part of the ribbon that is wrapped around the bag neck by the needle. As the hook twists the ribbon together, the holder shear transfers to cut and hold the part of the ribbon held by the needle, and simultaneously releases the end of the twist tie. The twister hook completes its selectable four or five rotations while the needle returns to the home position, releasing the bag stop. After the twister hook has tightly secured the neck of the bag, it reverses rotation for one revolution to discharge the tie from the throat of the hook. The tied package is then carried away by the conveyor.



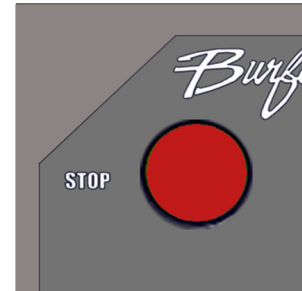
■ Control Panel



Ref	Function	Description
1	"STOP"	This button is used to disable the Servo Tyer during operation.
2	"RUN"	The first time this button is pushed after power up, the homing sequence is initiated. Any other time the RUN button is pushed; power will be applied to the servo motors without going through the homing sequence.
3	"THREAD"	This button has two functions. The main function is to complete the threading procedure after being pushed and quickly released. The second function is to force the Servo Tyer to re-initiate the homing sequence by holding the "THREAD" button in for three seconds.
4	"MOTORS ENABLED"	This light indicates when the servo motors have power.
5	"INITIALIZED"	This light will be "OFF" when the Servo Tyer is first powered up.
6	"TYER FAULT"	This light will indicate problems with the Servo Tyer.
7	"BELT SPEED"	In normal operation, this switch enables the operator to adjust the speed of the gathering belts. If the Tyer is set up with a speed following kit, the belt speed automatically adjusts to compensate for conveyor speed; this switch provides a fine adjustment for conveyor speed.

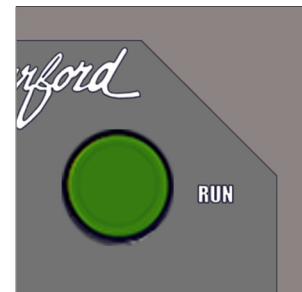
■ “STOP” pushbutton

This button is used to disable the Servo Tyer during operation. The “TYER FAULT” light will turn “ON” and the “MOTORS ENABLED” light will turn “OFF”. If the “STOP” button is pushed or the front access cover is opened, servo motor power will be turned off. Power is removed from the servo motors until the “RUN” button is pushed. Pushing the “STOP” button should not turn “OFF” the “INITIALIZED” light.



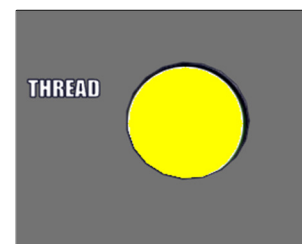
■ “RUN” pushbutton

The first time this button is pushed after power up, the homing sequence is initiated. This sequence locates the position of each axis relative to its home proximity sensor. Once the homing sequence is successfully completed, the “INITIALIZED” light should turn on and the belts may start running. If the brushes are turning and the belt speed is set to anything other than zero, the belts should run. Any other time the “RUN” button is pushed; power will be applied to the servo motors without going through the homing sequence. The Servo Tyer is now in the run mode.



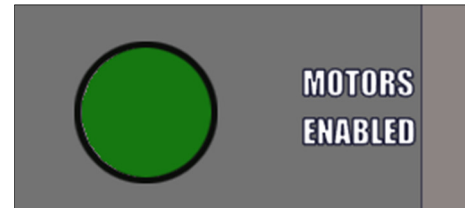
■ “THREAD” pushbutton

This button has two functions. The main function is to complete the threading procedure after being pushed and quickly released. The second function is to force the Servo Tyer to re-initiate the homing sequence. If for any reason, a previous homing sequence did not prove satisfactory, the Servo Tyer can be re-homed by holding the “THREAD” button in for three seconds. For this button to function the Servo Tyer must be in the run mode with the “MOTORS ENABLED” and “INITIALIZED” lights on.



■ “MOTORS ENABLED” light

This light indicates when the servo motors have power, and should turn on when the “RUN” button is pushed and stays on until the “STOP” button is pushed or the front cover is opened.



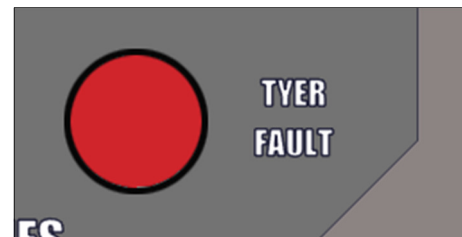
■ “INITIALIZED” light

This light will be “OFF” when the Servo Tyer is first powered up. It will turn “ON” and stay “ON” when homing sequence has been successfully completed. This light must be “ON” before the Servo Tyer can be threaded.



■ “TYER FAULT” light

This light will indicate problems with the Servo Tyer. During normal operation, the light should be off. The light will turn on for any reason if the Servo Tyer drops out of the run mode. For example, if the “STOP” button is pushed, the front cover is opened, a ribbon drop is detected (the fault light will also turn on, but the Servo Tyer will stay in the run mode). This light toggles on and off whenever the audible alarm is beeping and assists the operator in identify which machine is currently registering an alarm.



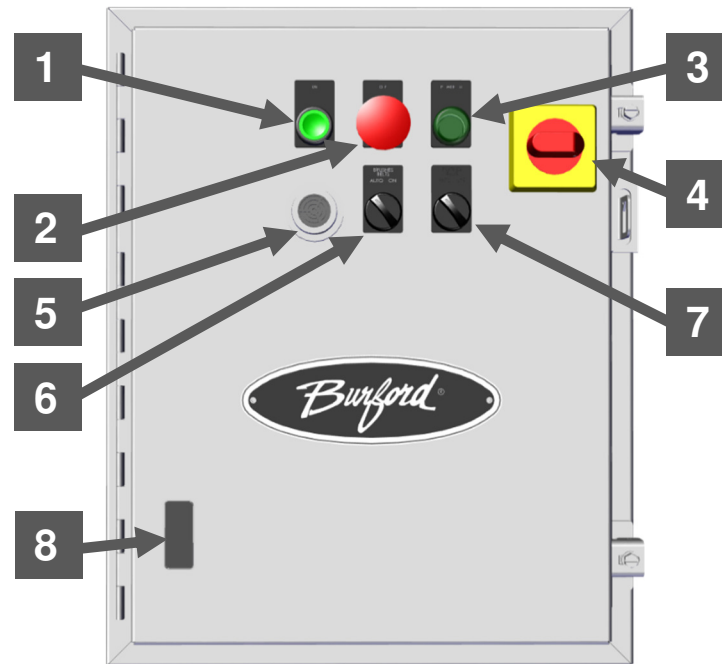
■ “BELT SPEED” push wheel switch

In normal operation, this switch enables the operator to adjust the speed of the gathering belts. The belt speed can be adjusted from a setting of zero to fifteen. In normal operation, each speed setting is approximately 15 percent faster than the previous setting (see table below for approximate values). A proper speed setting should pull the product 1”-2” ahead of the flight and finish tying as the flight catches up with the product. If the Servo Tyer is setup so that the belt speed automatically adjusts to compensate for conveyor speed changes (pg. 66), this switch provides a fine adjustment for conveyor speed.



BCD Setting	EST. Belt FPM
1	18
2	22
3	27
4	33
5	40
6	48
7	58
8	70
9	85
A	103
B	125
C	151
D	182
E	221
F	267

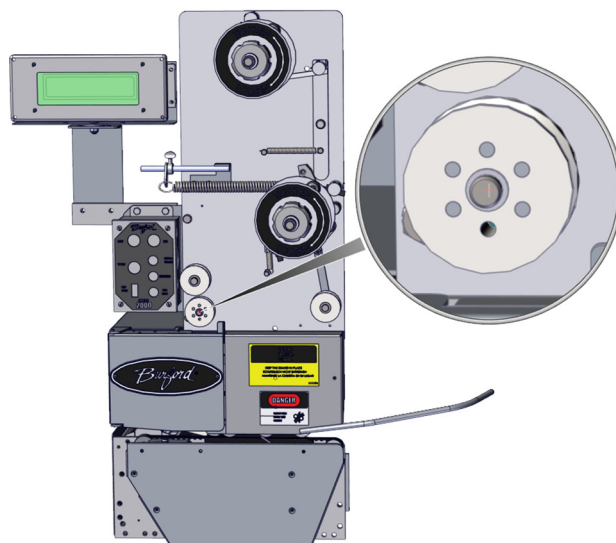
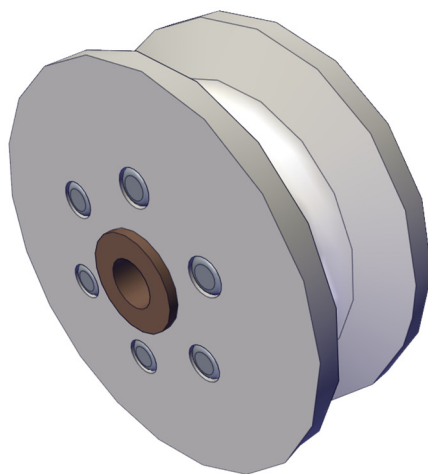
■ Main Enclosure



Ref	Function	Description
1	"On"	Pulls in the master control relay contacts and supplies power to the Servo Tyer electronics. Does not supply power to the servo motors.
2	"Off"	Drops out the master control relay. Removes power from the Servo Tyer electronics and the servo motors.
3	"Power On"	This lamp indicates that the master control relay contacts are active and supplying power to the Servo Tyer electronics.
4	Main Disconnect	Disconnects the AC power coming to the Servo Tyer controls. This does not disconnect any interlock connections coming from the bagger or conveyor.
5	Audible Alarm	This gives the operator audible feedback as to the status of the Servo Tyer. Audible alarm codes are described on pg. 115
6	"Brushes/ Belts Auto On"	This is a two position maintained selector switch. During normal operation, it should be in the "AUTO" position. If the interlock signal from the bagger is connected properly, the brushes and belts will only run when the bagger is active. To override this interlock signal and run the brushes and belts continuously, move the switch to the "ON" position.
7	"Twists 4/5"	Allows the operator to quickly switch between 4 twist and 5 twist settings without changing DIP switch settings between configurations. Feature must be enabled on CPU board.(pg. 88)
8	Seven Segment Led	This device is used to display various codes that give the Servo Tyers status (pg. 112).

■ Package Recognition System

The Package Recognition System is an integral part of the Ribbon Tension assembly and the electronics. This system determines whether a bag neck has been properly presented in tying position. As the needle wraps the ribbon around the bag neck, the length of dispensed ribbon is measured. If the amount of ribbon dispensed is significantly less than that required by a normal package, the processor aborts the current tie cycle before the twister hook and holder shear begin their motion. An audible alarm is sounded to alert the operator of a possible problem. If the length of dispensed ribbon is significantly more than normal, the Servo Tyer completes its tie, but the alarm is sounded to indicate that a heel may be contained in the tie. This feature can be disabled with DIP Switches 4 and 6 on the AUX board. See pg. 87 for details.



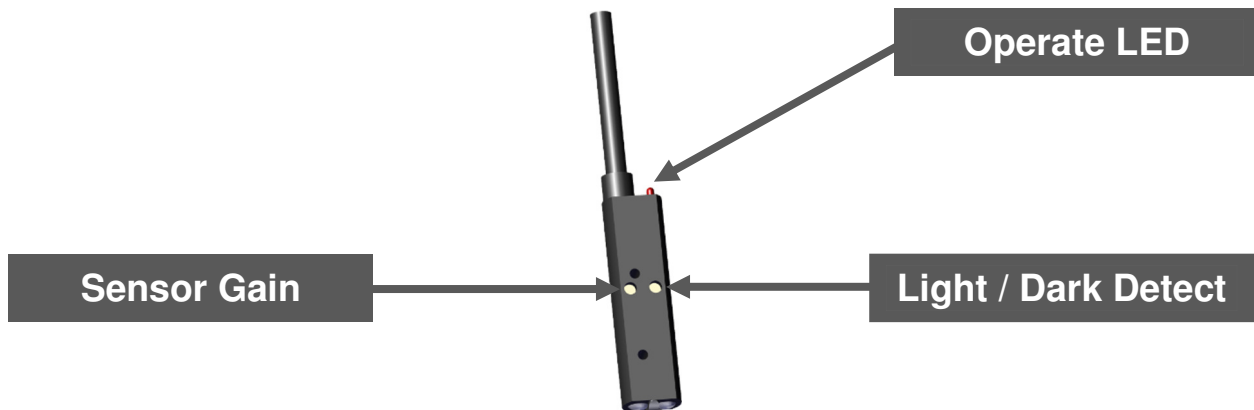
■ Package Detection System (PDS)

The Package Detection System monitors packages as they pass the Burford® Model 2000M/2100M Servo-Tyer and stops the bagger if a twist-tie is not applied. The system automatically resets after the next accepted package.

The PDS operates by monitoring the package sensor to determine when a package is in the operating area of the Servo-Tyer. Once a package is present, the system waits for the Servo-Tyer to actuate its counter contacts. If the Servo-Tyer has not counted the package as good before a preset time period has expired, the PDS will open the bagger safety circuit, stopping the bagger.

This feature can be disabled with DIP SWITCH 7 on the CPU board see pg. 88.

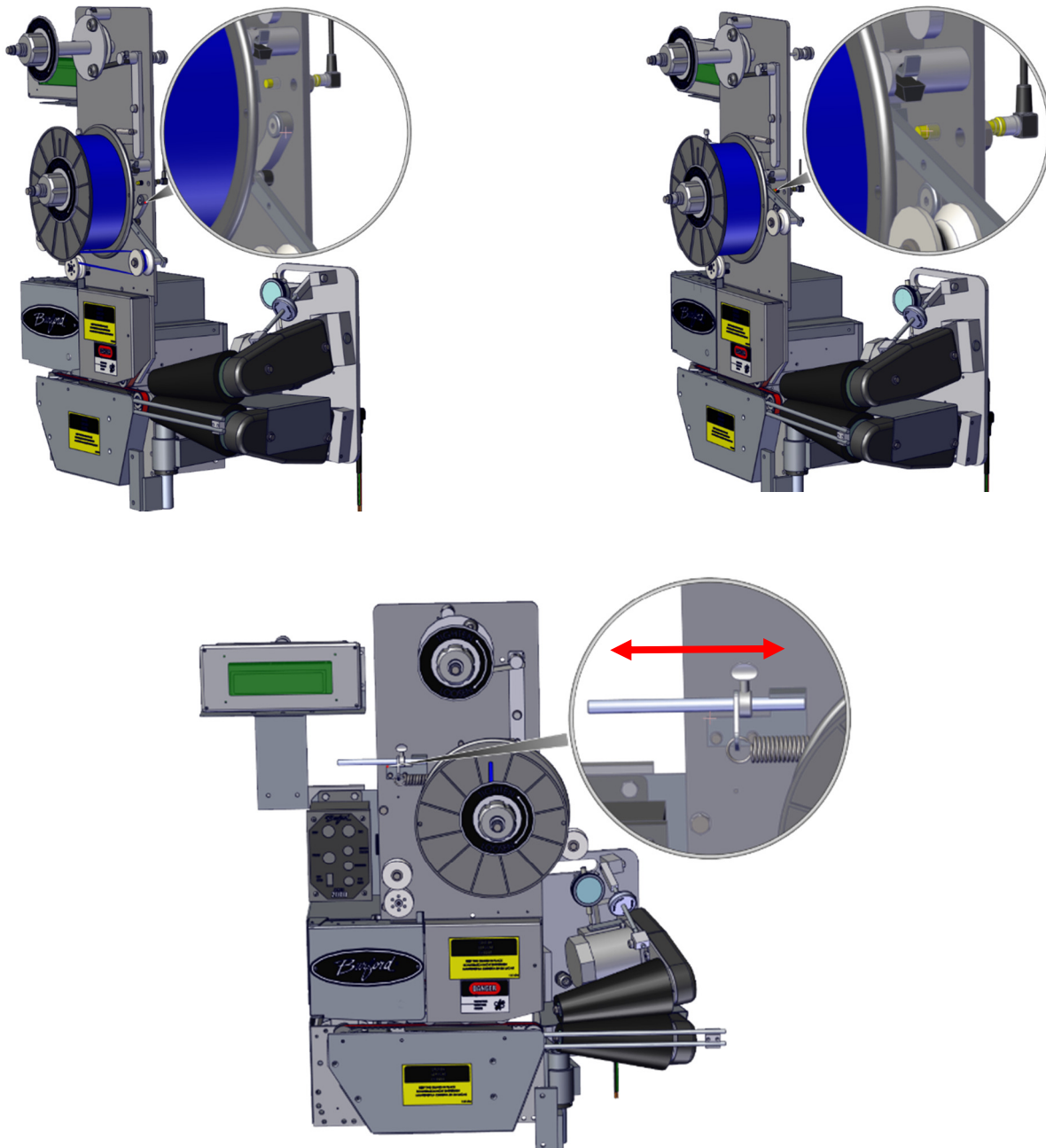
The Package Sensor is an advanced retro-reflective photo-proximity type. The sensor is factory preset to accommodate a large range of bag types and conveyor surfaces. However, for optimal operation, it is likely that some user adjustment may be required. Verify that the sensor does not detect the conveyor flights and does detect both the longest and shortest package that is run on the line.



If adjustments to the package sensor are required, turn the sensor gain and light / dark detect potentiometers until satisfactory operation is obtained. The sensor bracket may also be bent to extend or decrease the detection distance across the conveyor. Please note that bending the bracket will often require the sensitivity of the package sensor to be readjusted for optimal operation. See above figure for the location of the adjustment potentiometers and operate LED.

■ Ribbon Tension

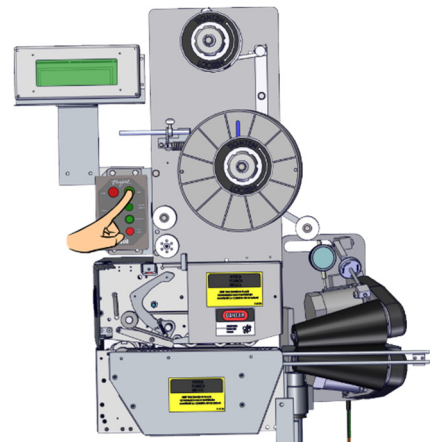
The ribbon tension spring should be adjusted so that when the unit is threaded, the dancer arm is flexing down and not positioned over the ribbon drop proximity sensor. If the ribbon tension is too low, an increase in ribbon drops and jams may occur. If the ribbon tension is too high, an increase in ribbon drops and breakage may occur. Moving the ribbon tension spring adjuster towards the discharge end of the unit will increase tension while moving it towards the infeed end of the unit will decrease tension.



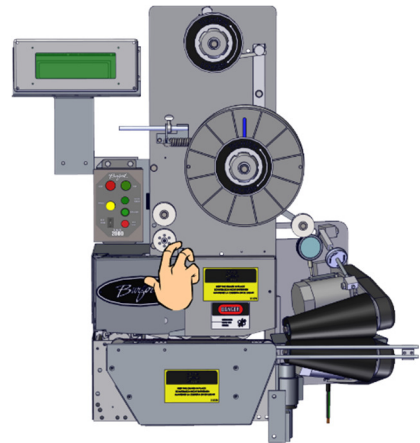
■ Changing And Threading The Ribbon

To replace a ribbon spool, turn the ribbon chuck in the loosen direction until it comes off the spindle. Pull the ribbon spool off the spindle. Replace the spool so that the ribbon is fed to the tyer from the top of the spool. Place the ribbon chuck on the spindle and turn it in the tighten direction until it is snug. Untie the ribbon from the spool and unwind about three feet. As you route the ribbon around each spool, let the ribbon glide through your finger, do not hold the ribbon taut.

1. Press and release the “RUN” button to home the unit.

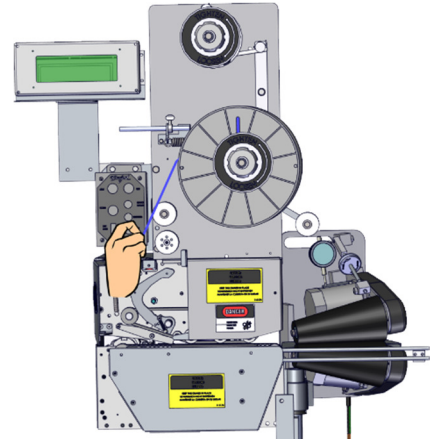


2. Open the discharge cover.

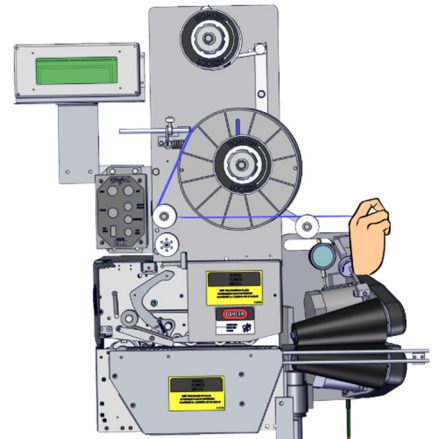


■ Changing And Threading The Ribbon, cont'd

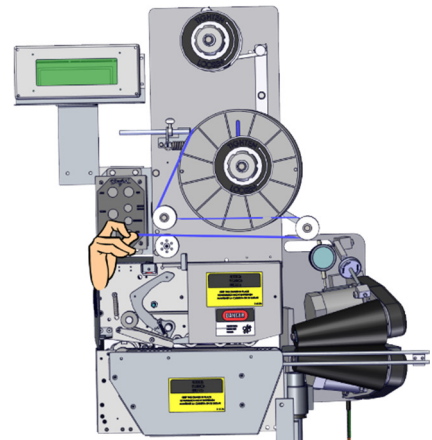
3. Route the thread over and around the ribbon roller.



4. Guide the thread over and around the dancer arm roller.

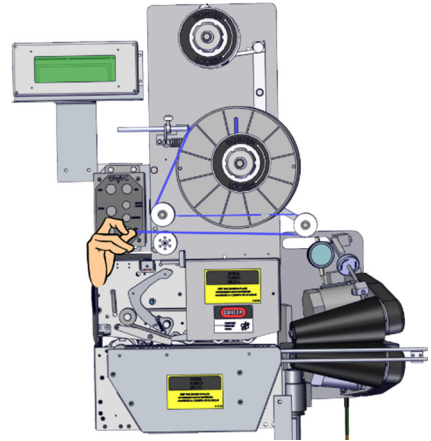


5. Guide the thread over and around the ribbon dispense roller.

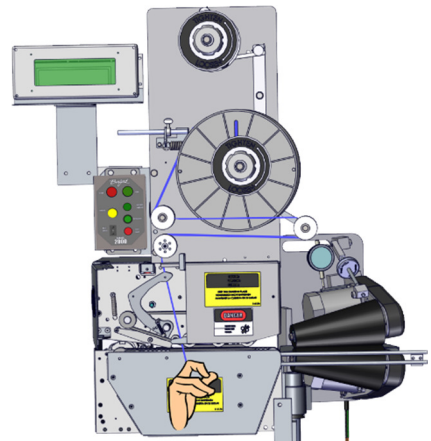


■ Changing And Threading The Ribbon,cont'd

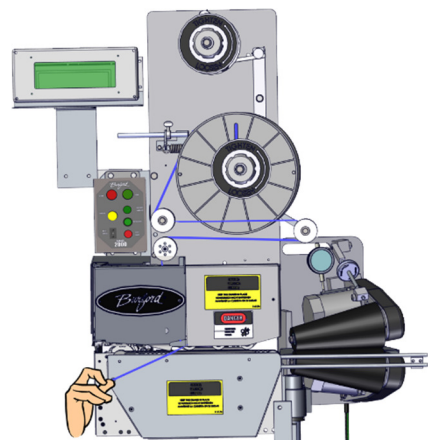
6. Next, guide the ribbon over the needle roller.



7. Guide the ribbon behind the cover deflector and around the eccentric knob.

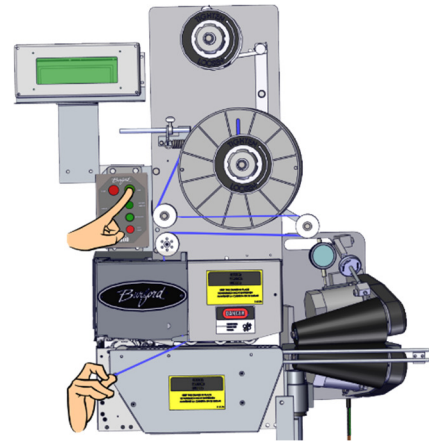


8. Close the discharge cover and pull the ribbon along the bottom edge of the cover towards the discharge end of the unit.

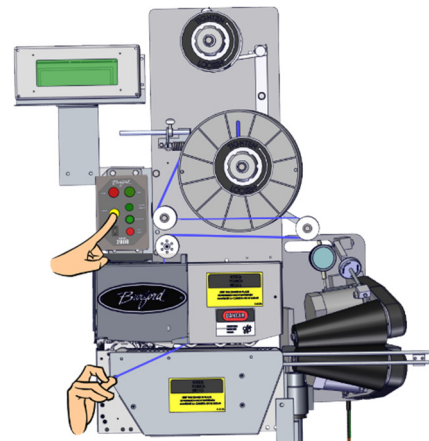


■ Changing And Threading The Ribbon,cont'd

9. Close the discharge cover and press the "RUN" button to home the unit.



10. While letting the dancer arm relax to its extended position, hold the ribbon firmly and press the "THREAD" button on the front of the control panel. The needle will activate and push the ribbon into the open jaw of the holder/shear. The holder/shear will rotate and catch the ribbon and the needle will move back to home position. The ribbon will automatically be adjusted to the proper tension.



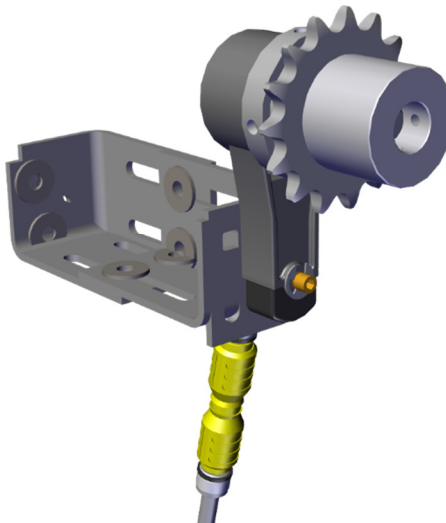
■ Speed Following Feature

The tyer has the ability to automatically adjust the speed of its gathering belts so that the belt speed changes as the conveyor speed changes. This minimizes the amount of operator input required to operate the tyer. However, it may be necessary for the operator to fine tune the belt speed, as explained later, to achieve the most desirable package.

Some baggers slowly ramp up to full speed when they are started. The Tyer's speed-following capability allows the speed of the belts to slowly ramp up to full speed as the speed of the bagger is increasing. This prevents damaging of bags by pulling them too far ahead of the flights as might occur if the conveyor started slowly and the belts started quickly.

In order for the tyer to use automatic speed following, the tyer requires an additional input signal to determine the conveyor speed. An Encoder is used to monitor a sprocket that rotates with the conveyor.

If the encoder is not connected, or if the tyer senses that it is not getting any pulses from the encoder, the Tyer's controller will use only the settings of the BCD thumbwheel switch on the operator's control box to set the belt speed. If the encoder is connected and producing pulse signals, the tyer will automatically adjust the belt speed to follow the conveyor speed and the BCD thumbwheel switch can be used to fine-tune the ratio between conveyor speed and tyer belt speed. The speed of the belts needs to be considerably faster than the conveyor speed, but the exact ratio of speeds depends upon the package being run.

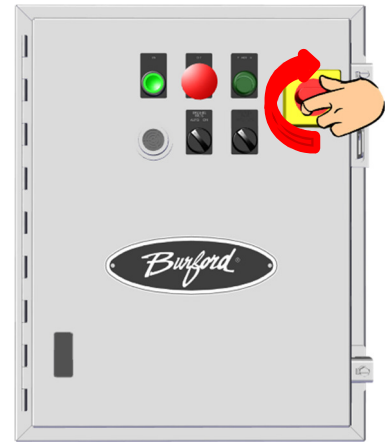


Encoder

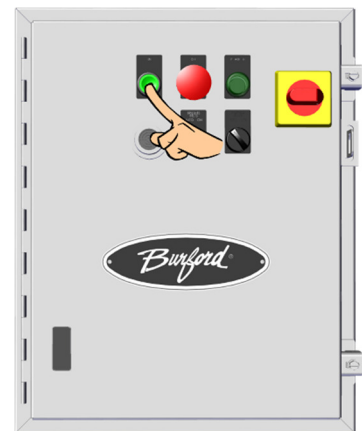
■ Daily Startup

This is an example of a normal operator start up procedure.

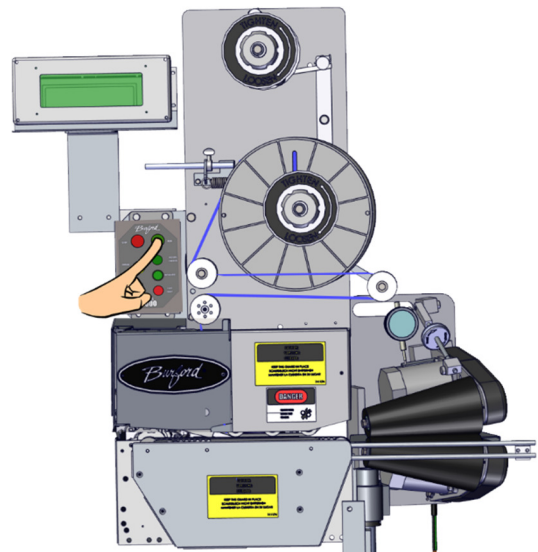
1. Check that the Servo Tyer main disconnect on the main enclosure is turned on.



2. Push the master "ON" button on the front of the Main Enclosure. This will supply power to the Servo Tyer electronics, but does not supply power to the servo motors.

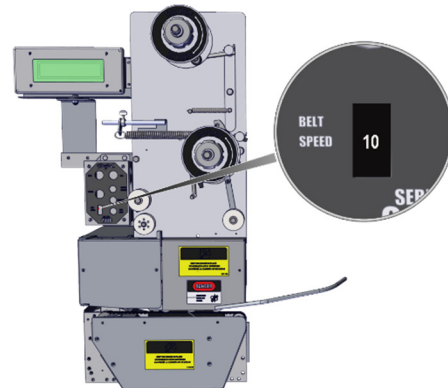


3. Push the "RUN" button on the control panel. This will supply power to the servo motors and start the homing sequence. When the homing sequence is successfully completed, the Servo Tyer is in the run mode.



■ Daily Startup, cont'd

4. Check the belt speed setting to ensure that it is correct for the current conveyor speed.



5. If the ribbon is not threaded the operator should follow the procedure to thread the Servo Tye.
6. The Servo Tye is now ready to automatically tie packages.



Chapter 5

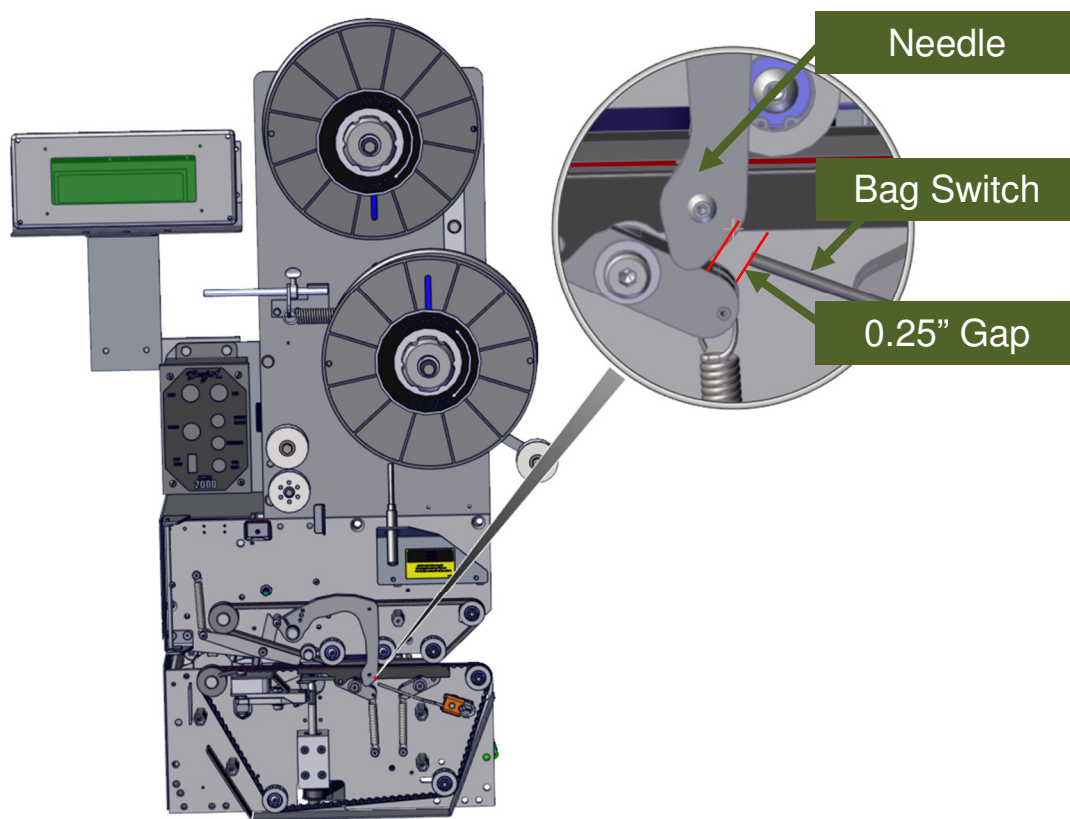
Settings and Adjustments

CHAPTER 5: TIMING AND ADJUSTMENTS

The design of the Servo Tyer is based on precise computer control of servo motors. The electronic nature of the Servo Tyer is unique in that it does not require any mechanical timing adjustments. The CPU contained in the proprietary electronics monitors each of the four motors hundreds of times every second to verify their relative position. Corrections to motor position are made during the tie cycle to ensure the package is properly tied.

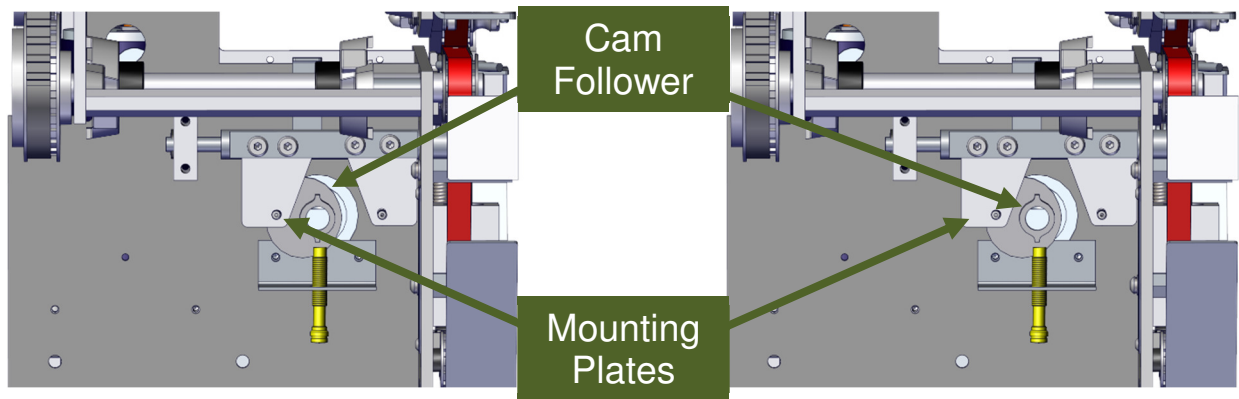
■ Bag Switch Adjustment

The arm on the bag switch is adjustable in length and angle. It should be extended so that the end of the arm is about 1/4 inch away from the tip of the needle when the needle and arm are in their closest possible positions. In the normal position, the end of the arm should be 1-1/4 inches above the bag path. This assures that any package will activate the bag switch.



■ Holder Shear Adjustment

The force with which each side of the holder shear holds the ribbon is adjustable. This adjustment is made simply by loosening and moving the cam follower mounting plates closer or farther away from the cam (with the cam turned towards the desired plate). Due to minor variations in castings, it is usually necessary to make these adjustments if the holder shear is being replaced.



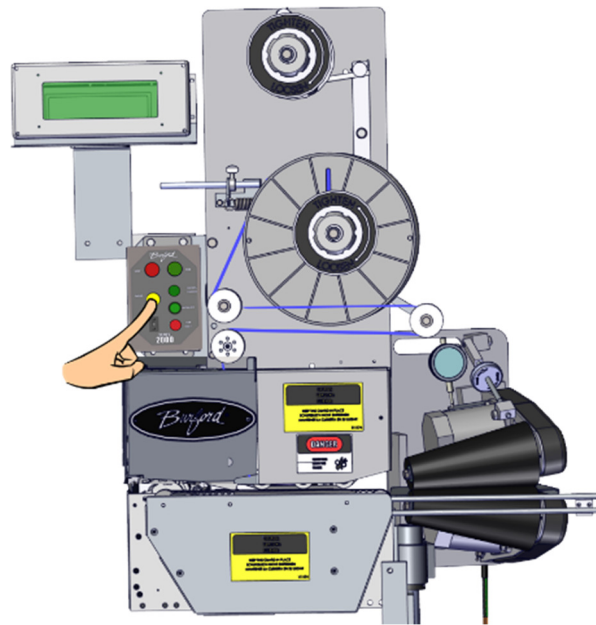
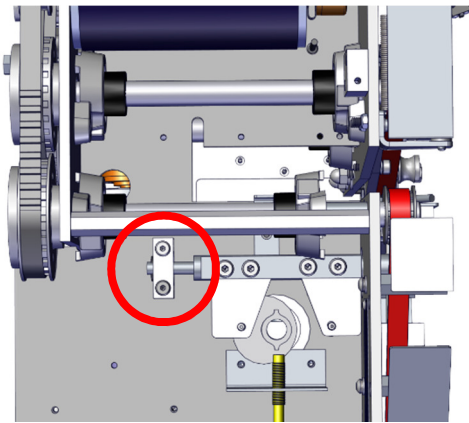
While it is important to have sufficient tension to hold the ribbon, it is also important not to have too much force on the cam followers. When there is no ribbon being held in the holder shear, the cam should be able to be easily rotated 360° by hand with no slack in the holder shear. If binding is felt at either end of movement, then that side is adjusted too tightly and should be loosened. However, there should be no side-side movement.

After adjusting the holder shear, always verify that the ribbon is being held tightly enough on each side by threading the Servo Tyer and pulling on the ribbon by hand. Normally the ribbon will break before being pulled out of the holder shear.

Adjusting the holder shear to tightly may result in damage to the holder shear pivot bolt, motor and/or encoder.

■ Shuttle Bar Alignment

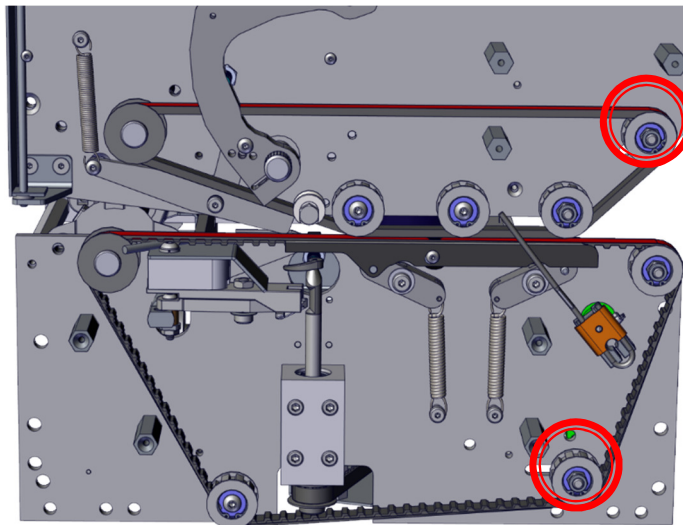
1. Loosen the fasteners on the shuttle bearing block approximately $\frac{1}{4}$ turn.
2. Cycle the Servo Tyer 10-20 times by pressing the "THREAD" button located on the Control Panel.
3. Retighten fasteners loosened in step 1 and run a few packages to determine if the shuttle bar moves freely.



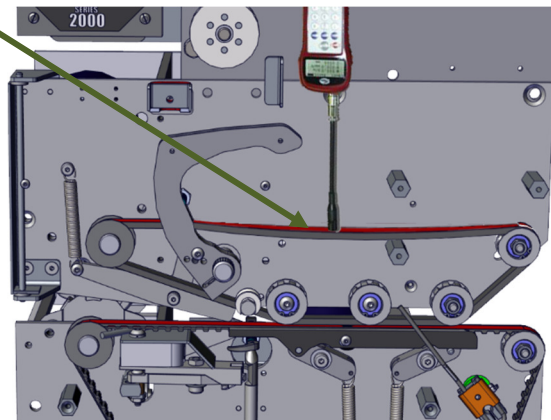
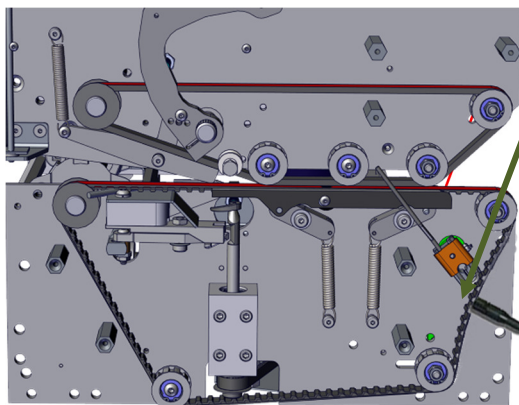
If the Servo Tyer is still experiencing ribbon drops, Contact Burford® Corp. at (1-877-287-3673) or Service@Burford.com for assistance.

■ Gathering Belts Tension Adjustment

The top and bottom gathering belts are tensioned by moving idler pulleys in slotted holes. These belts should not be run very tight because that would place excess load on the belt motor, resulting in a blown fuse on the Auxiliary board. Light finger pressure of about 1 pound applied at mid-span of the upper belt should yield a deflection of about 3/8 inch. The lower belt should have a similar tension.



3/8" 1 lb.
Force



■ Gathering Belts Speed Adjustment

In normal operation, the push wheel switch on the Control Panel enables the operator to adjust the speed of the gathering belts. The belt speed ranges from a setting of zero to fifteen. In normal operation, each speed setting is approximately 15 percent faster than the previous setting (see table below for approximate values). A proper speed setting should pull the product 1"-2" ahead of the flight and finish tying as the flight catches up with the product (see pg. 56 on how to adjust the belt speed).

BCD Setting	EST. Belt FPM
1	18
2	22
3	27
4	33
5	40
6	48
7	58
8	70
9	85
A	103
B	125
C	151
D	182
E	221
F	267

In most installations, the belts will not normally run when the conveyor is stopped. For testing, you may make the belts run with the conveyor stopped by turning the selector switch on the operator panel to the "ON" position. Be sure to return the switch to the "AUTO" position after testing. To properly set the speed of the gathering belts, you must be running product at normal speed. The speed of the belts should be adjusted so that the end of the bag is pulled slightly forward from the flights. As soon as the tyer completes its tie of the package, the conveyor flight should be just catching up with the package. The flight then carries the tied package away from the tyer.

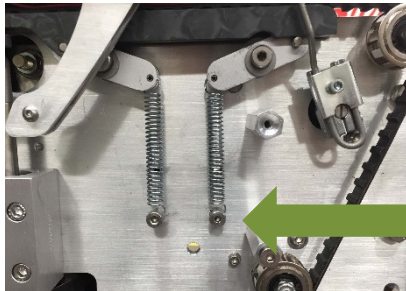
The belts should not be run any faster than necessary to ensure that the tie is completed just before the flight pushes the tied package out of the tyer. If the belts are running too fast, a bag may be pulled into the tying position before the previous package has been removed by its flight. This can cause two packages to be tied together or excess wear on the belts.

If the belts are running too slowly, the package will tend to drag back against its flight as it is being tied. In addition, it will appear as if the tyer is not keeping up with the needed production rate.

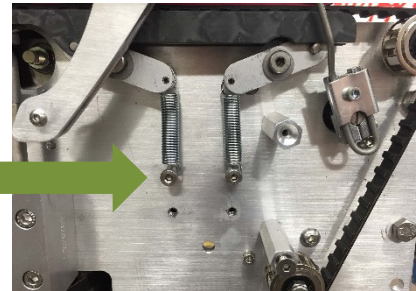
■ Belt Guide Tension Adjustment

Depending on the speed of the gathering belts, it may be necessary to adjust the spring tension on the belt guide. At lower speeds, more belt tension is required to transfer the package. At belt speeds above 12, the increased tension can cause excessive wear on the belts and blow fuses.

When running belt speed above 12 (e.g. bun packaging), place the belt guide springs in high-speed mode. When running belt speed at or below 12 (e.g. bread packaging), place the belt guide springs in low-speed mode (see pg. 74 on how to adjust gathering speed).



Low-speed mode

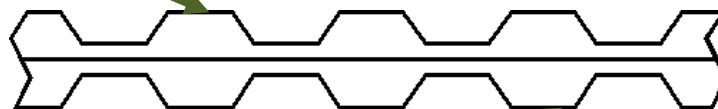


High-speed mode

■ Gathering Belts Teeth Mesh

The gathering belts should be adjusted so that the teeth of the top belt are directly above the teeth of the lower belt. This arrangement minimizes the relative motion between the two belts and increases the lifetime of the upper rubber-coated belt.

Upper gathering



Lower gathering

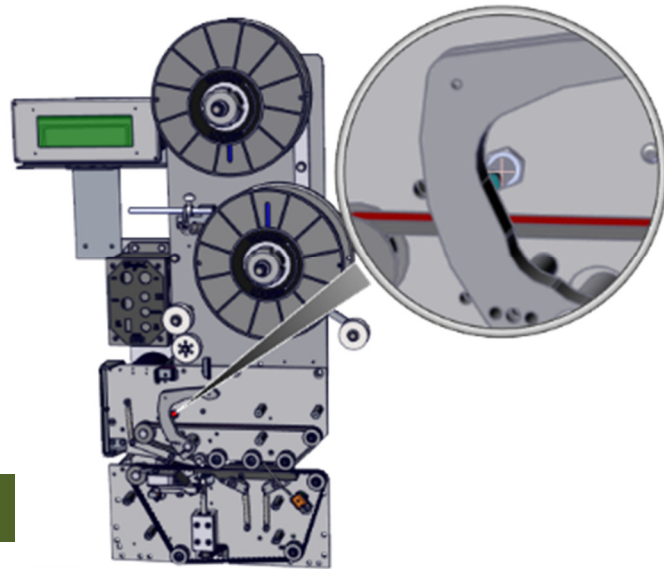
The upper belt teeth are directly above the lower belt teeth.

■ Proximity Sensor Adjustment

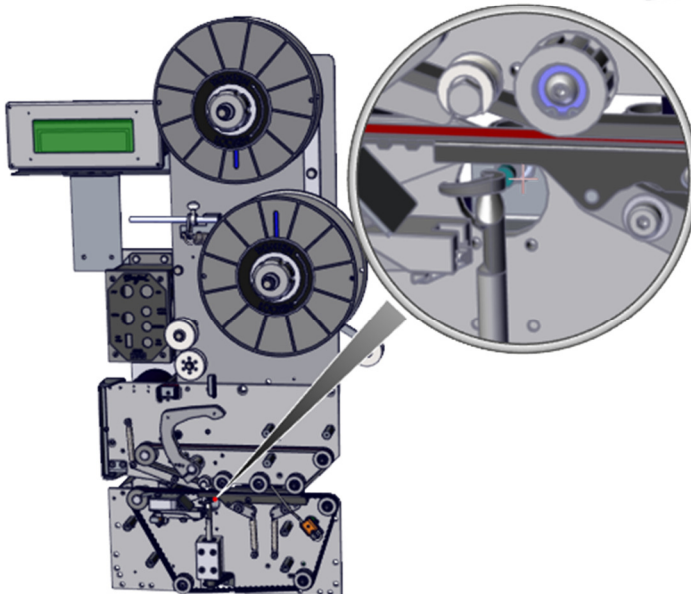
The Servo Tyer has five proximity sensors; three are used to locate the relative position of the needle, holder shear, and twister hook. The fourth and fifth sensors are used to measure the amount of ribbon dispensed, and to detect ribbon drop. All five sensors are small 8 mm diameter inductive proximity sensors. Each sensor should be adjusted so it is 0.030 - 0.050 inch from its target.

Refer to Diagram in Chapter 10 for specifics on each Proximity Sensor.

Needle Prox

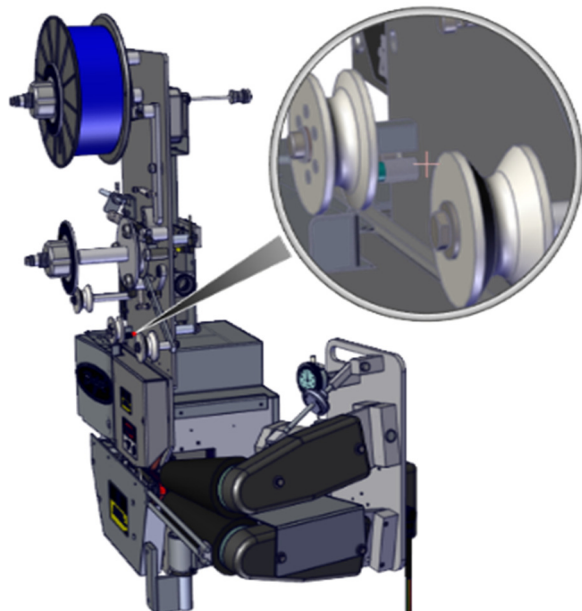


Twister Hook Prox

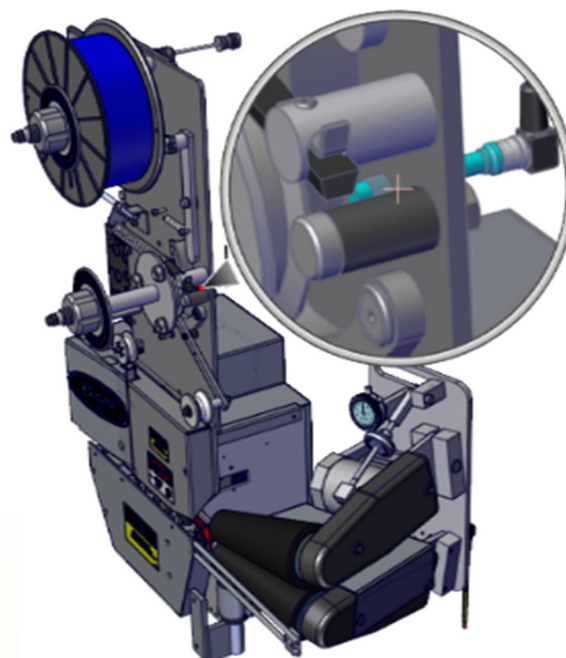


■ Proximity Sensor Adjustment, cont'd

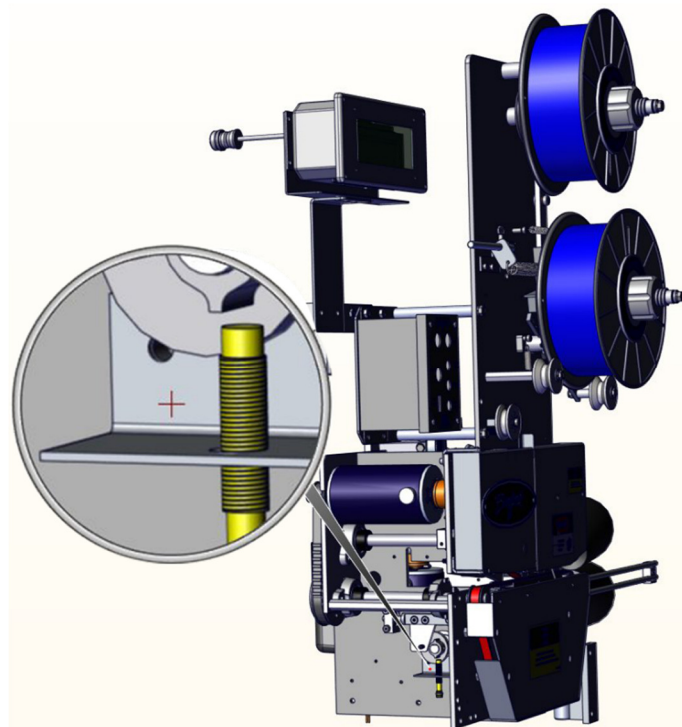
Ribbon Dispense Prox



Ribbon Drop Prox



Holder Shear Prox

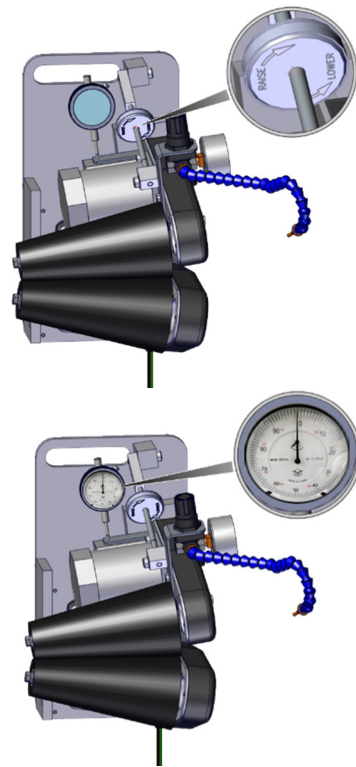


■ Gathering Brush Tension Adjustment

The tension of the gathering brushes can be varied by using the adjustment knob and tension gauge provided on the top of the brush assembly. This knob limits the amount of mesh between the upper and lower brushes.

Record value setting in the chart below.

The amount of mesh between the brushes depends upon the application. On bread bags, the brushes are usually adjusted to give a gentle pull on the bag neck as the bag passes through the brushes. This takes slack out of the bag and pulls the bag neck straight to properly enter the tyer belts. On bun bags, it is usually not desired to pull on the bag with the brushes. Rather, the objective is merely to feed the bag neck smoothly into the tyer belts. In this case, the gathering brushes should have very little or no mesh. In all cases, the brush mesh must be limited so that the bag neck tension does not tend to pull the product through the guides and into the brushes.



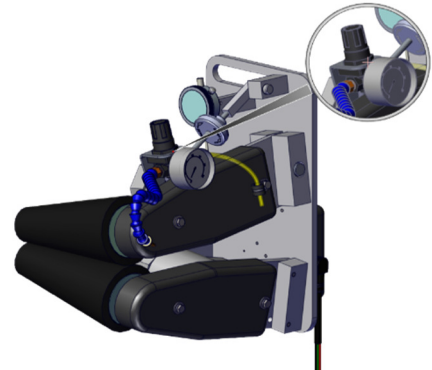
ROLLER TENSION CHART

Machine performance will determine the proper value the tension will be set at. Record this value in the space below each time the roller tension is recalibrated.

[illegible]

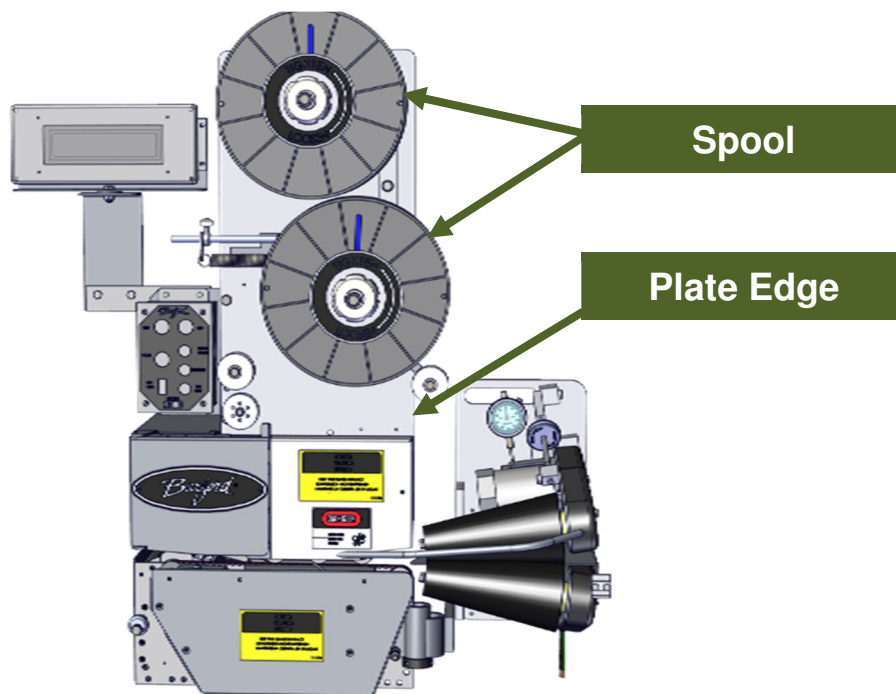
■ Gathering Brush Air Adjustments

The gathering brush comes standard with an air regulator. The air blows the bag tail down, prior to the gathering brush gathering the bag tail tight against the brush. The amount of air can be adjusted by turning the knob on the regulator to increase or decrease the airflow.



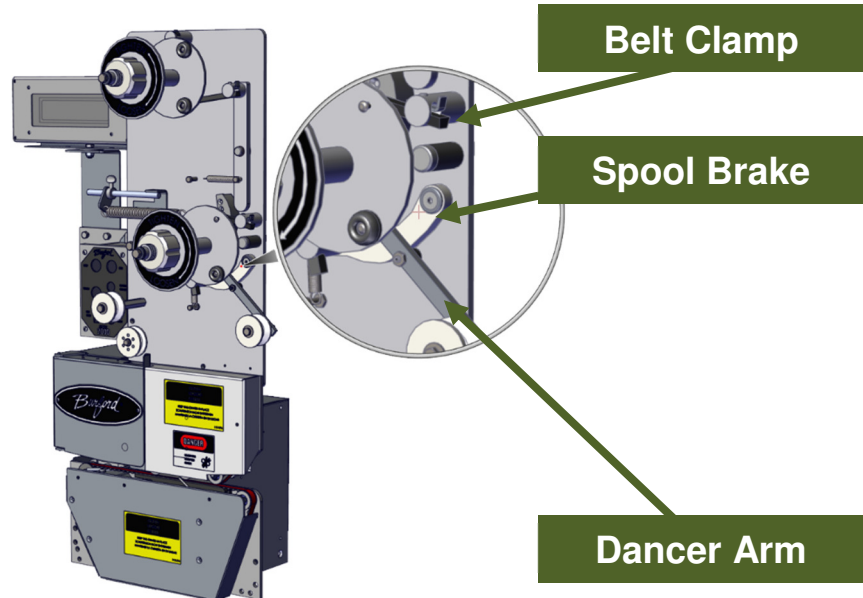
■ Ribbon Dispenser Adjustment

Determine if the spool assembly needs to be adjusted by turning each of the spools while depressing the dancer arm. If each spool does not turn freely, when the dancer arm Nyloc nut aligns with the edge of the plate, adjustments will be needed.

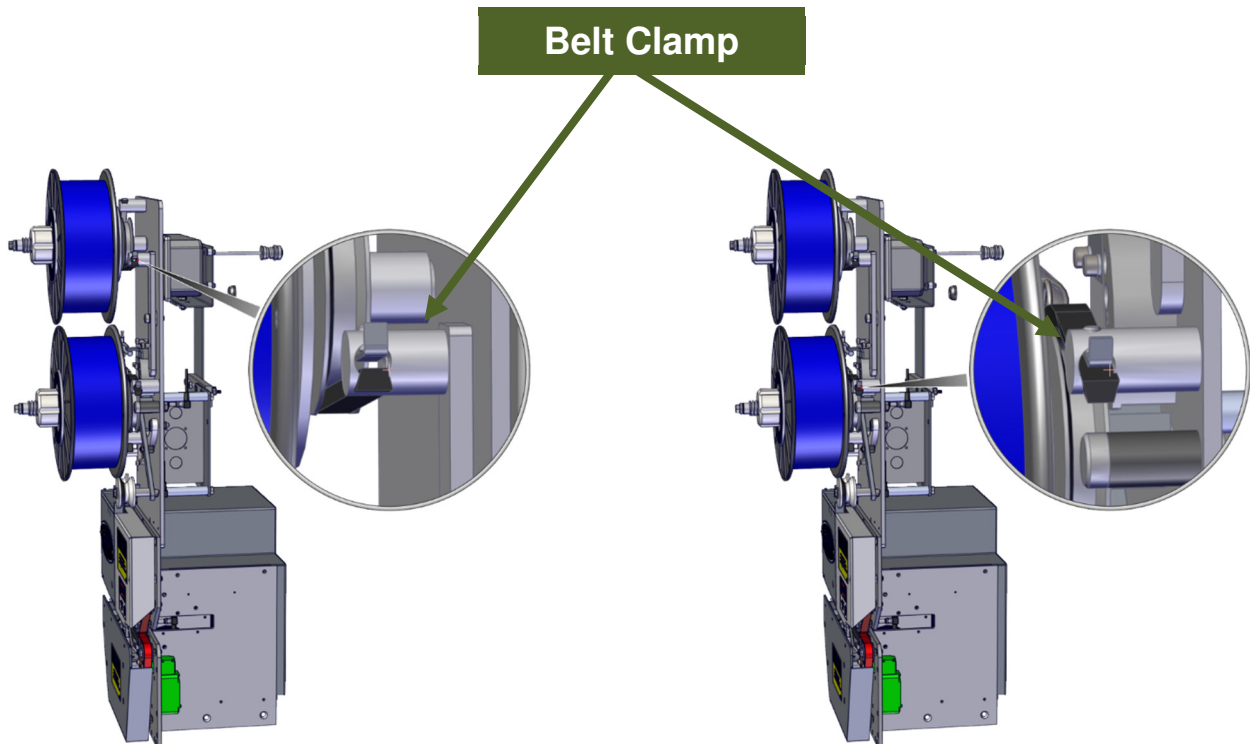


■ Ribbon Dispenser Adjustment, cont'd

Adjust spool break by loosening the belt clamp and adjusting the belt until the break releases the spool allowing it to spin freely. At the point, which the spool turns freely, the dancer arm Nyloc nut, located on the back of its pulley, should be aligned with the edge of the main plate.



Both the upper and lower ribbon assemblies are adjusted in the same manner.



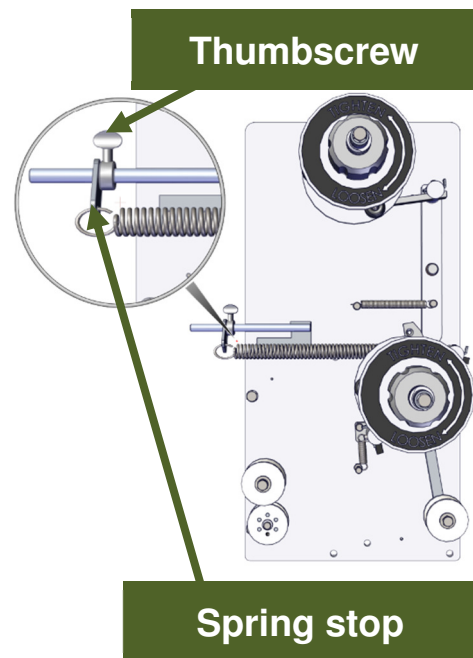
■ Ribbon Dispenser Adjustment, cont'd

The Ribbon Tension Spring is used to lift the dancer arm back into position to trigger the Ribbon Drop Proximity Sensor.

To adjust this spring loosen the securing thumbscrew, and release all tension on the spring. Observe where the dancer arm comes to rest.

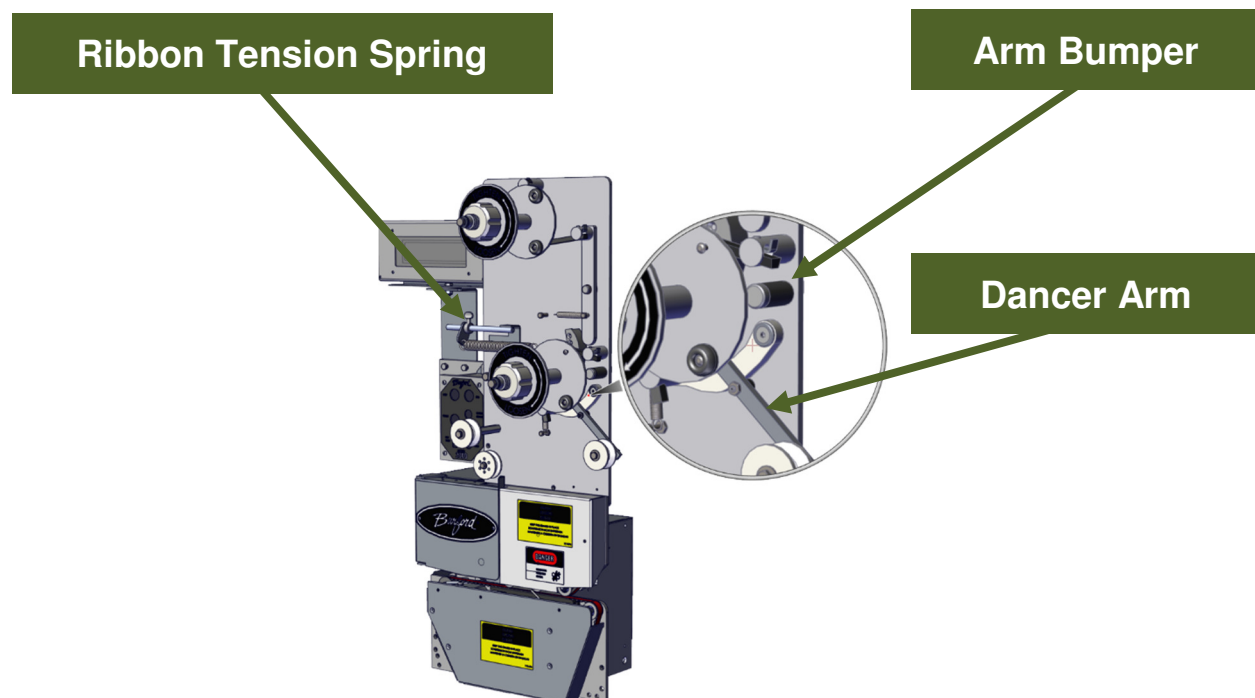
Adjust the spring tension until the dancer arm is raised against the Ribbon Tension Arm Bumper.

Position thumbscrew next to spring stop and securely tighten.



After the spring is adjusted, the Ribbon Tension Spring may be used to increase tie tightness by increasing the spring tension. No more than one inch of adjustment should be used when increasing spring tension for tie tightness.

Once the adjustments are satisfactory, run several test packages using both the upper and lower spools. The brake should hold firm when the Servo Tyer is idle and rotate freely when the Servo Tyer is pulling ribbon.



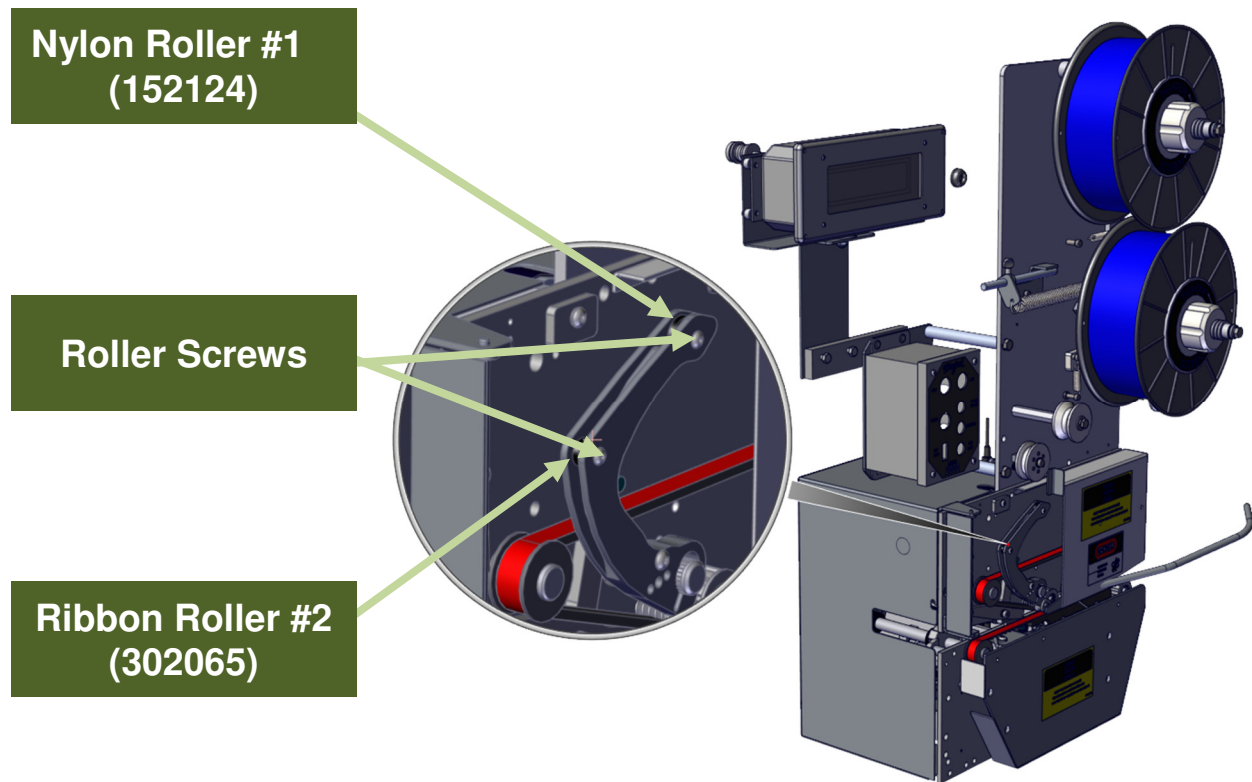
■ Needle Roller Replacement

To change the rollers, power down machine and open cover to expose needle assembly. Unthread the needle, then rotate needle to appropriate angle to access screws.

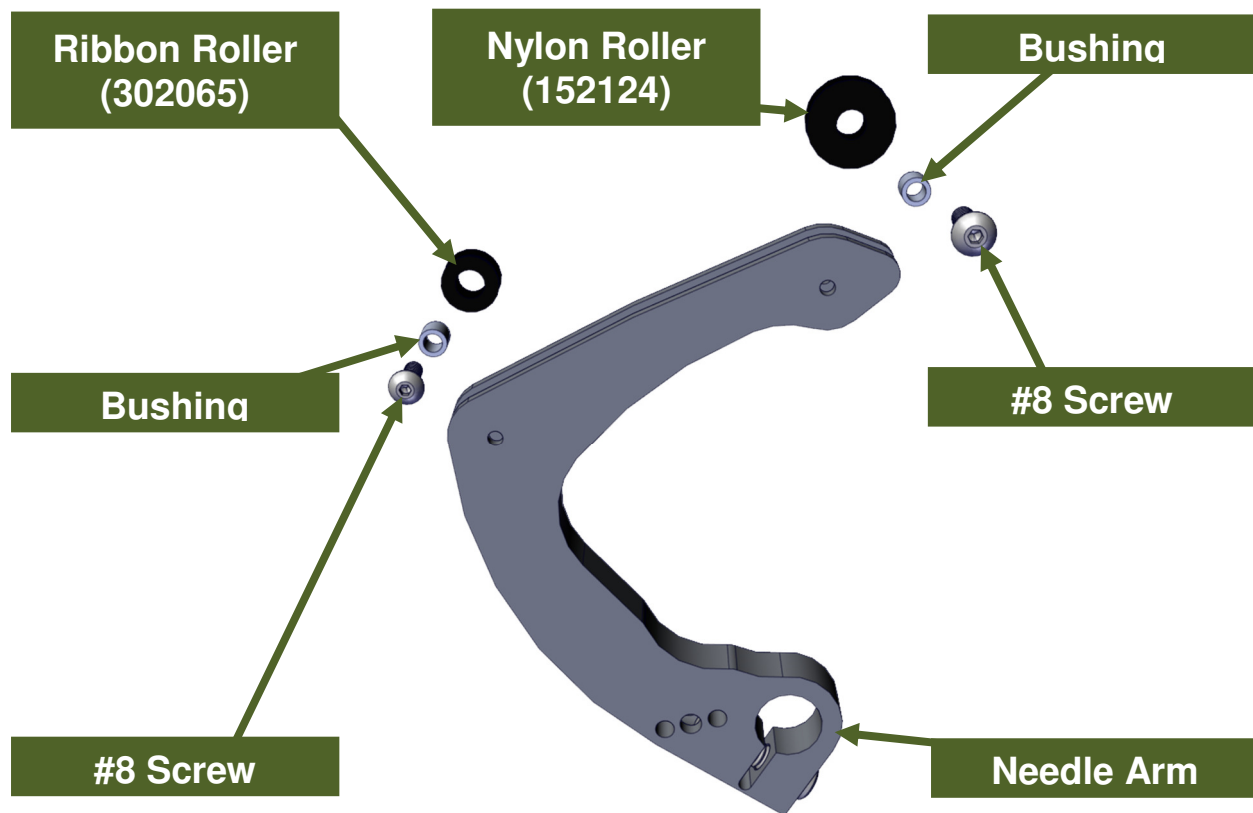
There are two rollers on the needle assembly (152124) and (302065). Each roller is attached to the assembly with a #8 Button Head Screw (986908) that uses a 3/32 Allen Head Wrench.

Each roller also has a bushing (152125) that fits in the middle of the roller over the screw between the needle arm.

See next page for exploded view of assembly and steps on how to access rollers and bushings.



The rollers used in the needle assembly are different and have differing descriptions and part numbers.

■ Needle Roller Replacement, cont'd

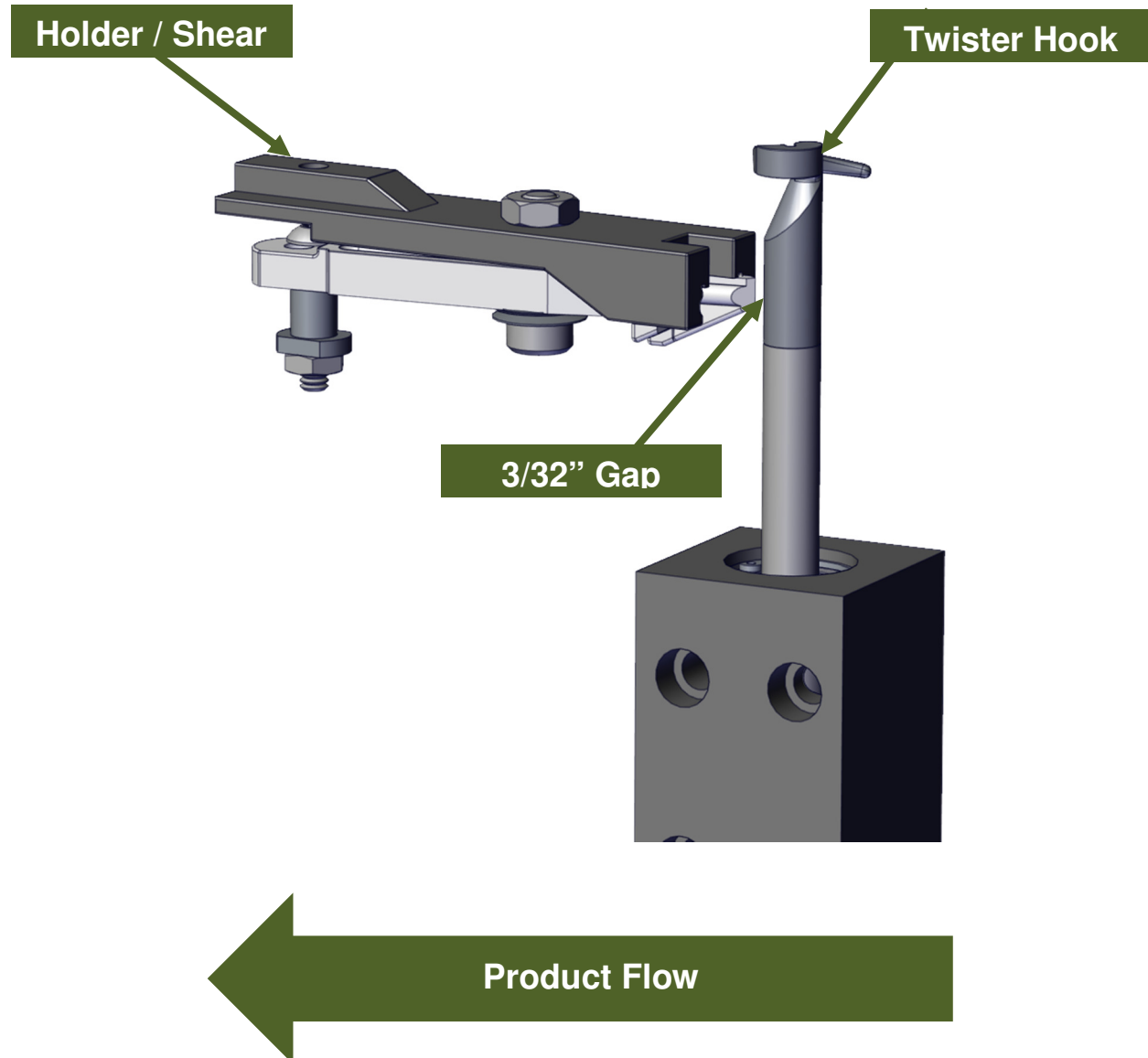
Carefully loosen screw taking care not to round screw shoulders and remove roller and bushing.

Replace worn parts with careful observation of both the bushing and the roller with their respective part numbers and placement.

Apply Blue Lock Tight for reinsertion of screws being sure to keep roller free to move.

■ Spacing of Twister Hook Shaft to Tip Of Holder Shear

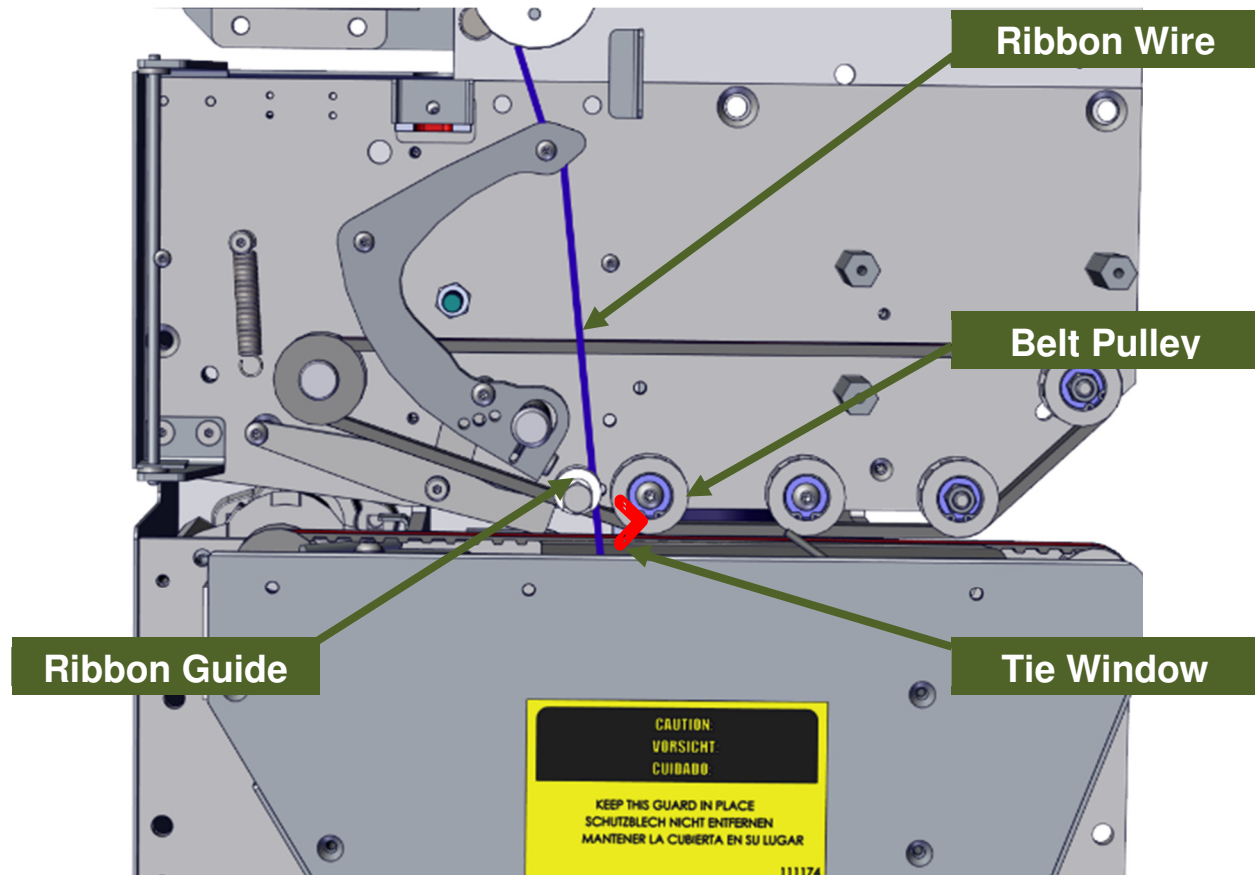
The proper spacing is $\frac{3}{32}$ as shown below. If the twister hook shaft and the tip of the holder shear are too close, the ribbon will sometimes wrap around the shaft of the hook. The only adjustment available is the play in the mounting holes for the twister hook bearing tower and the holder shear mounting.



The Holder / Shear must be on the inside position and the Twister Hook notch facing away for proper measurement.

■ Adjusting Tie Tightness

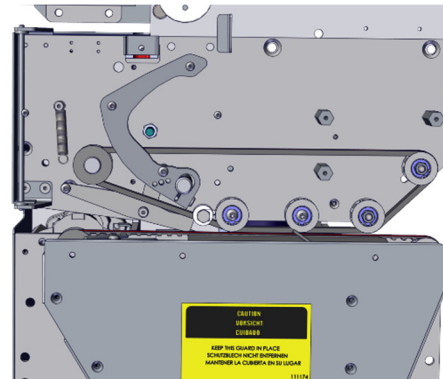
There are two adjustments on the Servo Tyer to adjust the tie tightness. One adjustment is the eccentric ribbon guide and the other is the belt idler pulley.



Correctly adjusting these is important to understand how this area of the Servo Tyer works. The bag neck is gathered into an area called the window. The window is shaped like a sideways "V". The "V" opens up to the discharge end with the lower belt forming the horizontal, the ribbon wire forming the vertical, and the upper belt forming the diagonal. By increasing or decreasing the size of the window, the tension around the bag neck can be determined. If the tie around the bag neck is too loose, the window area should be decreased. If the tie around the bag is too tight, as to cause tears or holes in the bag neck, the area of the window should be increased. The window may also need to be adjusted when changing bag size or thickness.

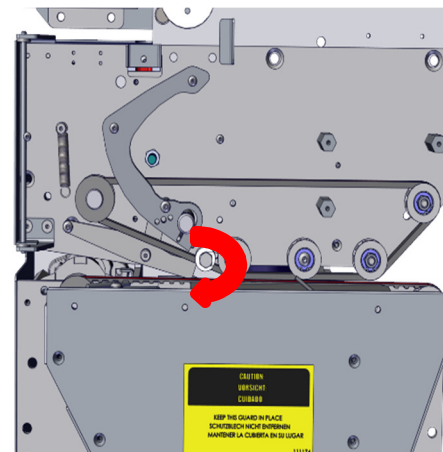
■ Nominal Adjustment

Normally for a bag that is 1-1/4 to 1-3/4 mil thick the eccentric ribbon guide is positioned so the lobe is towards the infeed, with the belt pulley positioned so it almost touches the eccentric ribbon guide's support bolt.



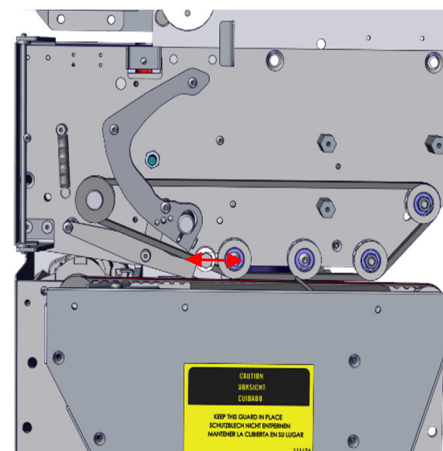
■ Adjusting the Eccentric Ribbon Guide

The eccentric ribbon guide adjustment is for fine-tuning the window area and can be adjusted by opening the front cover, pushing on the eccentric ribbon guide to disengage the guide from the hex bolt, and rotating the guide to change the position of the ribbon wire. Moving the ribbon downstream increases the window area and loosens the tie. Moving the ribbon wire upstream decreases the window area and makes a tighter tie. When you have found the proper position for the guide be sure it seats back into the flats of the hex bolt.



■ Adjusting the Belt Pulley

If after adjusting the eccentric ribbon guide the bag is still not tied with the proper tension, the belt pulley will need to be adjusted. First, it is essential that the guide not interfere with the rotation of the belt pulley. Disengage and rotate the eccentric ribbon guide to its closest position to the belt pulley. Next, loosen the mounting bolt and nut of the belt pulley. Slide the belt pulley downstream to decrease the area of the window and tighten the tie and upstream to increase the window area and loosen the tie. When the pulley is in the proper position, tighten the mounting bolt and nut.

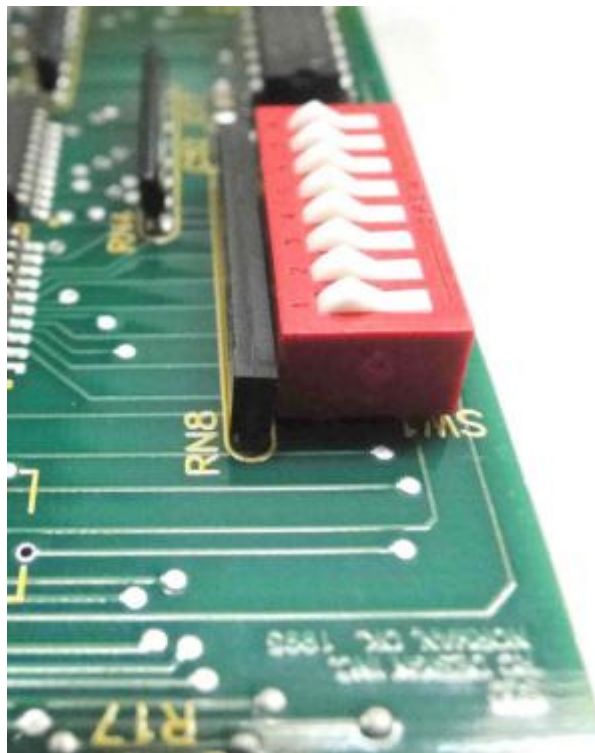


CAUTION: Never allow the eccentric ribbon guide or mounting bolt to rub against the belt pulley or damage to the unit will occur.

■ Auxiliary DIP Switch Settings

The Auxiliary board, P/N C01267, has a group of eight DIP switches on the bottom left, labeled SW1, which are used to configure Servo Tye parameters. The following table identifies the switch functions.

SWITCH #	“OFF” POSITION	“ON” POSITION
1	RIGHT HAND MACHINE, MODEL 2000M	LEFT HAND MACHINE, MODEL 2100M
2	COUNTER’S CONTACTS CLOSE TO COUNT	COUNTER’S CONTACTS OPEN TO COUNT
3	NOT USED	NOT USED
4	HEEL DETECTION INACTIVE	HEEL DETECTION ACTIVE
5	USE DATA IN BATTERY BACKED RAM	USE DATA IN PROM (DEFAULT SET- UP)
6	PACKAGE RECOGNITION CYCLE ABORT INACTIVE	PACKAGE RECOGNITION CYCLE ABORT ACTIVE
7	NORMAL TIE CYCLE SPEED	MAXIMUM TIE CYCLE SPEED
8	FOUR TWISTS BY TWISTER HOOK	FIVE TWISTS BY TWISTER HOOK



All eight (8) DIP switches shown in the “OFF” position.

■ CPU DIP Switch Settings

The CPU board, P/N C01410, has a group of eight DIP switches labeled S1. The following table identifies the switch functions.

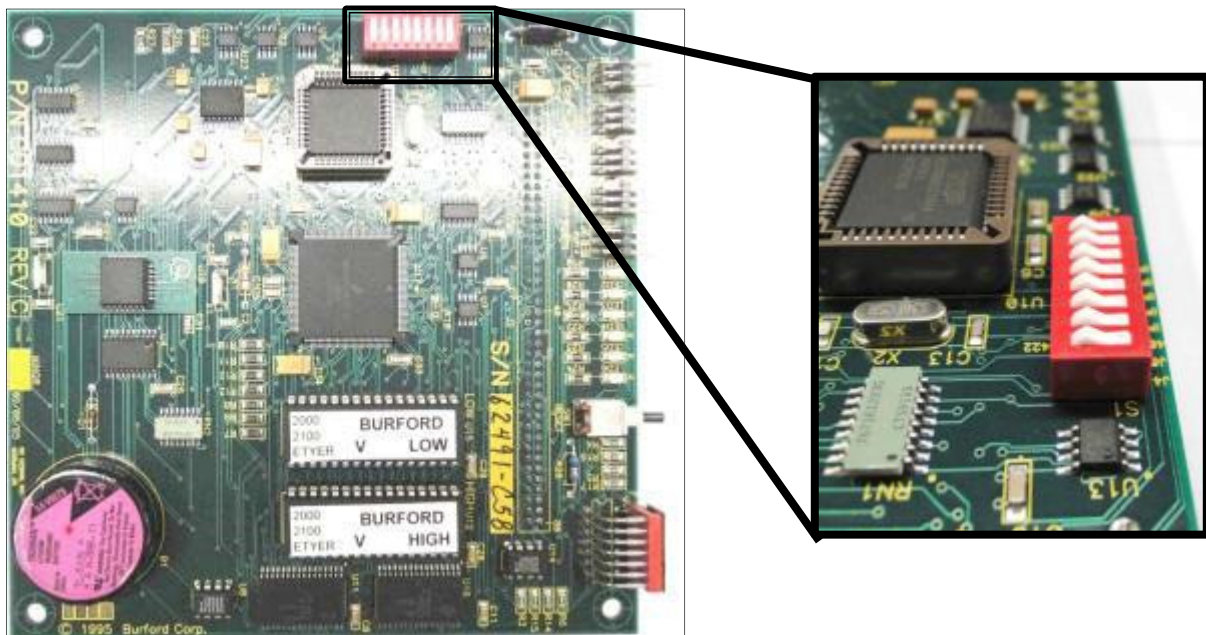
SWITCH #	“OFF” POSITION	“ON” POSITION
1	NOT USED	NOT USED.
2	NOT USED	NOT USED.
3*	NORMAL SPEED	GO TO HIGH SPEED WHEN BCD IS ABOVE 9
4*	INTERNAL HIGH SPEED CONTROL	EXTERNAL HIGH SPEED CONTROL
5*	INTERNAL TWISTER HOOK CONTROL	EXTERNAL TWISTER HOOK CONTROL
6	NORMAL MOTION	WIRELESS MOTION
7	PDS WILL NOT STOP BAGGER (3 BEEP ALARM)	NORMAL PDS (STOPS CONVEYOR)
8	COMMUNICATES WITH LAPTOP	COMMUNICATES WITH OPTIONAL ERROR DISPLAY

*Switches 3 & 4 cannot be on simultaneously.

*When speed following is on, Auto High Speed (switch 3) must be off.

*Switches 4 & 5 should not be on without a switch or other input.

*When on, switch 4 on the CPU board overrides switch 7 on the aux board, and switch 5 on the CPU board overrides switch 8 on the aux board.



All eight (8) DIP switches shown in the “OFF” position.

■ Fuse And Circuit Breaker List

There are fourteen (14) fuses and circuit breakers in the Main Enclosure. Four (4) fuses reside on the Aux. board, six (6) are mounted on a DIN rail below the disconnect, and four (4) are located on the Field Termination Board.

MAIN PANEL			
SYMBOL	PART #	TYPE	DESCRIPTION
FU1	C06543	10 AMP (fuse)	MAIN POWER
FU2	C06543	10 AMP (fuse)	MAIN POWER
FU3	C07062	20 AMP (fuse)	TRANSFORMER SECONDARY
CB3	C07649-006	6 AMP (CIRCUIT BREAKER)	BRUSH MOTOR
CB4	C07649-002	6 AMP (CIRCUIT BREAKER)	BLOWER (IF EQUIPPED)

AUXILIARY BOARD FUSES			
SYMBOL	PART #	TYPE	DESCRIPTION
PC2 FU1	C07036	10 AMP, MDA	NEEDLE MOTOR OUTPUT
PC2 FU2	C07036	10 AMP, MDA	TWISTER HOOK MOTOR OUTPUT
PC2 FU3	C01268	5 AMP, MDA	HOLDER SHEAR MOTOR OUTPUT
PC2 FU4	C01268	5 AMP, MDA	GATHERING BELT MOTOR OUTPUT

FIELD TERMINATION BOARD FUSES			
SYMBOL	PART #	TYPE	DESCRIPTION
PC1 FU1	C06585	3 AMP, GLD	HORN RELAY
PC1 FU2	C06585	3 AMP, GLD	BAGGER ENABLE CIRCUIT
PC1 FU3	C06585	3 AMP, GLD	SERVO ENABLE (DC CONTACTOR)
PC1 FU4	C06585	3 AMP, GLD	COUNTER RELAY

CAUTION: Be careful when removing fuses from any of the circuit boards. Never use a metal screwdriver to pry out the fuses because this damages the traces on the board below the fuse holders.

■ Counter Output

The Servo Tyer comes standard with a relay, which toggles every time a valid package is tied. This relay is normally used to drive a customer's external counter, but it can be adapted to serve other functions with external customer logic. This relay does not toggle if the tie cycle is aborted or if a heel is detected in the tie. These contacts can be configured to be normally open or normally closed using Dip Switch 2 of SW1, on the Aux board (pg. 87). If the relay is configured to be normally open, the contacts will close for about 1/4 second when a valid tie cycle is completed.

■ PROM Replacement

The computer program for the Servo Tyer resides in two (2) Programmable Read Only Memory chips (PROMs), U12 and U15 on the CPU board. Each PROM contains half of the program. To upgrade the Servo Tyer to the latest program, the PROMs must be replaced with a new version. This is a simple process, which can be accomplished in 10 to 15 minutes. Before replacing the PROMs, note the positions of the Dip Switches on the lower left of the Auxiliary Board to ensure that they are not accidentally changed by handling the boards.

CAUTION: The PROM's are sensitive to static electricity and care should be taken not to expose them to static.

Remove power from the Servo Tyer and disconnect the Auxiliary board's 5V/12V connector from the power supply. Carefully pull the board set from the Field Termination Board. There should be enough slack in the motor cable to allow the board set to rotate out to the right without disconnecting the leads. The CPU board should now be facing out with the single character LED display on the bottom right of the board. The PROM's are the two (2) 32 pin chips in sockets on the right side of the CPU board. The program version is labeled on the top of each PROM. In general, you should use the PROM with the higher program version. For example, version 2.07 is newer than version 2.06. Each PROM will also be labeled either HIGH or LOW. Make sure that each is inserted in the socket with the same label.

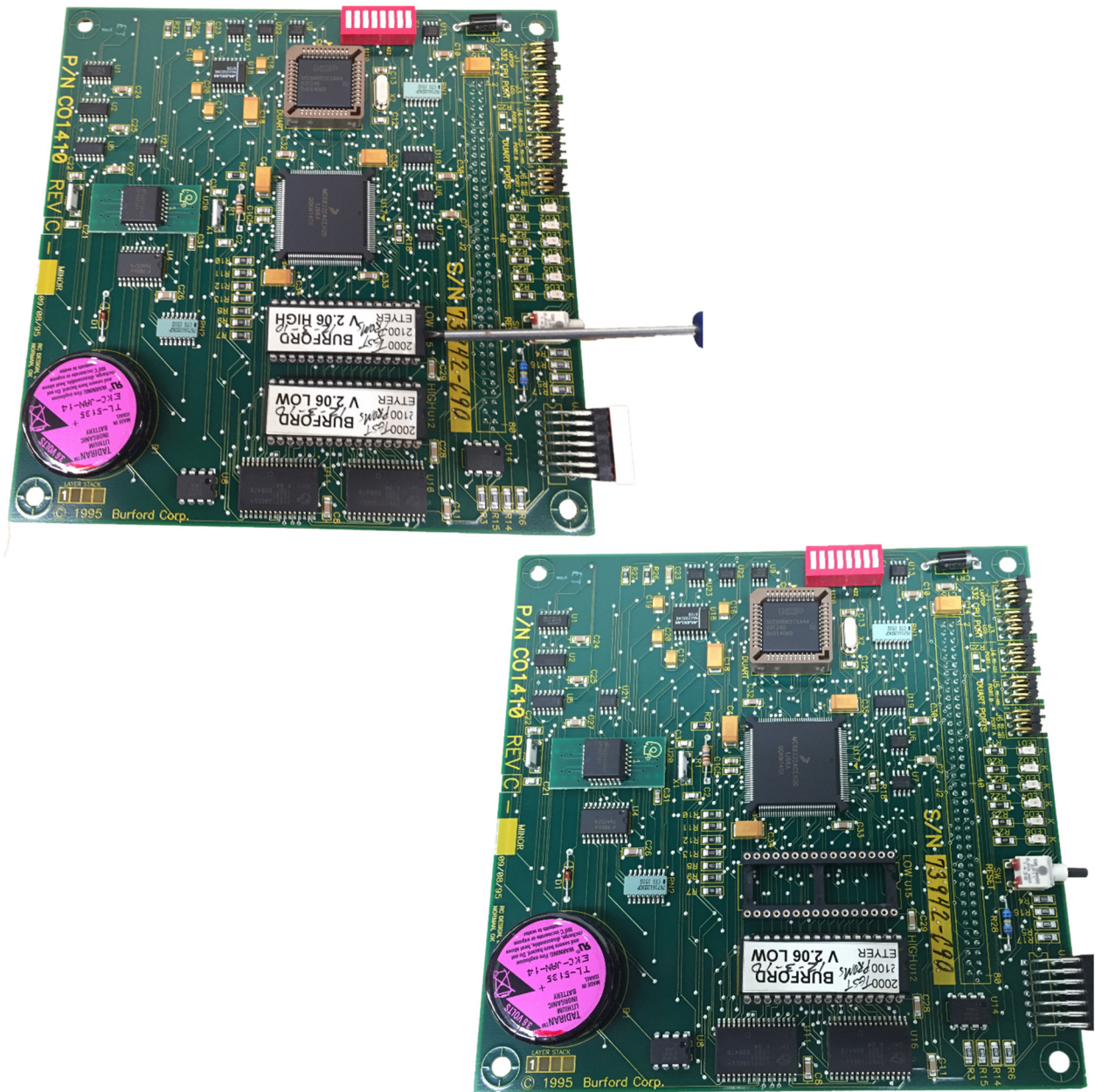
To remove a PROM from its socket, use a very small screwdriver to pry the PROM up from its socket. Never pull the PROM out by hand because one side will suddenly release before the other side and some of the pins will be bent.

CAUTION: The pins on the PROM's are delicate and will break if bent repeatedly.

■ PROM Replacement, cont'd

Slowly push the screwdriver under the PROM while twisting the blade. Work your way towards the back of the PROM. Do not pry the front of the PROM up too quickly or you will bend the pins in the back.

Carefully remove the PROM straight up from the socket, being careful not to bend any pins.

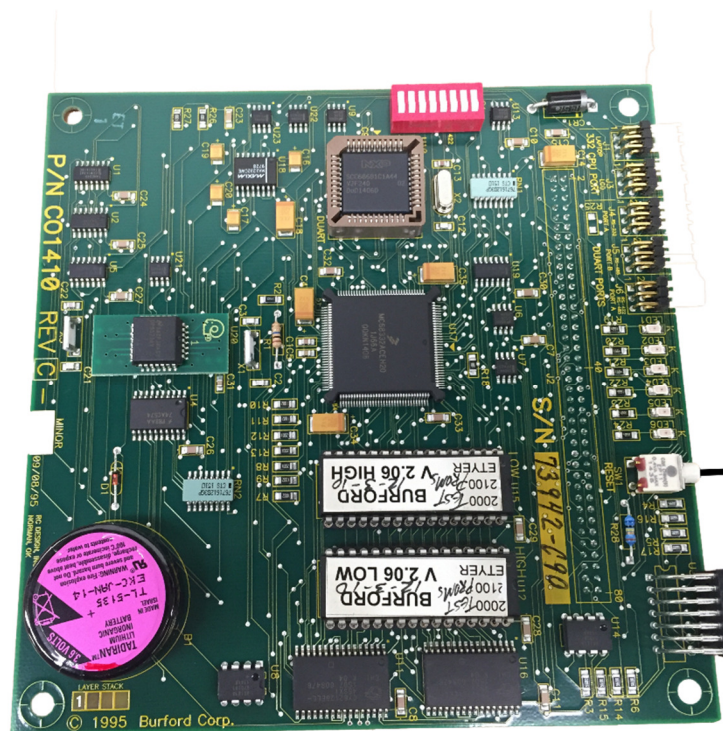


The notch on the PROM is to the right. Be sure to orient the new PROM in the same direction.

■ PROM Replacement, cont'd

With the notch on the PROM to the right, align it with the socket. Ensure each pin lines up with its receptacle. Usually the pins on new PROM's tend to be bent a little wider than the socket. If this is the case, lay the PROM on its side on a flat surface and bend the entire row of pins together to keep them all straight. Work the PROM into the socket by pressing it down little by little along its length. As you press, check that each pin is seating in the receptacle and not buckling.

After both PROM's have been replaced, insert the board set into the card guides and press it firmly into place. Verify that the Dip Switch settings have not changed. Reconnect the 5V/12V connector to the power supply. Apply power to the Servo Tyer and push the Main Enclosure "ON" button. If the Servo Tyer fails to perform its normal startup sequence, remove power, remove the board set, and check the PROMs for correct orientation, bent pins, or unseated pins.



WARNING: If a PROM is inserted with the notch towards the left, the PROM will be destroyed when power is turned on, and a replacement set will need to be ordered.

Chapter 6

Communications

CHAPTER 6: COMMUNICATIONS

■ Terminal Option

The Servo Tyer is capable of communicating with a terminal over the serial port located on the edge of the CPU board. The terminal must be connected to the CPU using a serial cable. Using the terminal, the Servo Tyer can be queried as to its status and controlled manually for troubleshooting. This terminal is not required for normal operation.

■ Communicating With the Controller

The Burford® Model 2000M/2100M Twist Servo Tyer has the ability to communicate with a terminal or a personal computer, which is running a terminal emulation program. When the Servo Tyer controller detects an unusual situation or an error, the controller sends diagnostic information to the terminal through its serial port. In addition, the Servo Tyer controller maintains a record of problems that have occurred. This information can be called up later and displayed on screen. It is also possible to capture this information into a text file on the PC. This text file can be viewed or printed at a later time. For these reasons, it is sometimes desirable to communicate with the Servo Tyer controller.

This section is intended to provide the basic information needed to communicate with the Servo Tyer. It is assumed that you are using a PC and that you have experience with the basic operation of a PC. A communications program and, a proper, cable for connection between the PC and Servo Tyer serial ports will also be needed.

Before a PC can communicate with the Servo Tyer controller, the PC must be running a terminal emulation program. Many different programs could be used, but this document will concentrate on two options, the Burford® Terminal program, and the terminal program in Microsoft Windows. No matter what program is being used, it must be configured with the proper settings for the Burford® Servo Tyer listed below.

Baud Rate	4800 (9600 if using Burford® Servo Tyer Prom Version 1.14 or earlier)
Parity	Even
Data Bits	8
Stop Bits	1
Com Port	Choose whichever serial port on the PC you will be using. This will usually be COM1

■ Burford® TERMINAL program

Burford® Corp. has developed a terminal emulation program specifically for use with the Model 2000M/2100M Servo Tyer. This program is simply called Terminal.exe and it provides the simplest and easiest way of communicating with the Servo Tyer controller and capturing data to files. The program is already configured for 4800 Baud, Even Parity, 8 Data Bits and 1 Stop Bit. It is also configured to use the COM1 serial port of the PC, which usually has a male DB9 connector. Any of these settings can be changed as necessary. This TERMINAL program is available on CD from Burford® Corp. ask for Part Number C01287.

The Servo Tyer controller automatically sends information to the serial port, some of which is intended to be displayed on an optional operator display provided by Burford® Corp. The Burford® Terminal program has been written to recognize the format of these statements and it displays them in a box near the bottom of the screen, away from the other output. Any other terminal emulation program cannot distinguish these statements and they appear on the screen among all the other text.

The Terminal program can be run from a floppy drive or from the hard disk of the PC. To start the program with the default settings, simply change to the directory containing the Terminal.exe file and type: Terminal.

With the Terminal program running, you can press Alt-h for help on the proper command to use if you need to use a different baud rate or a different serial port. The help screen will show you, for instance, that to start the Terminal program with a setting of 9600 baud instead of the normal 4800 baud, type: TERMINAL B9600 at the DOS command prompt. You can exit the program at any time by pressing Alt-x.

You will not be able to see anything that you type on the screen until the Servo Tyer is running. This is because the Servo Tyer controller must echo your typed commands back to the PC before they will be displayed.

■ Terminal Program in Microsoft Windows version 3.0 or 3.1

Most PC's being sold today include a copy of Microsoft Windows. Included with Windows is a terminal program, which can be used to communicate with the Burford® Model 2000M/2100M Servo Tyer. This terminal program is not as easy to use with the Burford® Servo Tyer as the Burford® Terminal program requires some time to configure the program. However, once it is configured, the configuration data can be saved for use later.

It is assumed that anyone using the Microsoft Windows Terminal program is familiar with this interface and that systematic instructions for maneuvering in Windows are not necessary. Configure the Microsoft Windows Terminal Program the following way.

Start the Windows program and open the Terminal program. It is usually located in the Accessories group of Program Manager. Under the Settings menu, choose Communications. Mark the appropriate boxes for the communication. Due to a peculiarity in this program, it may be necessary to first choose 7 data bits; then choose 2 stop bits; then choose 1 stop bit. In the field entitled Flow Control, choose XON/XOFF. The boxes labeled Parity Check and Carrier Detect should be left empty. With all settings correct, choose OK to close this box.

Under the Settings menu, choose Terminal Emulation and select DEC VT-100 (ANSI).

Under the Settings menu, choose Terminal Preferences. Make sure that Local Echo is turned off.

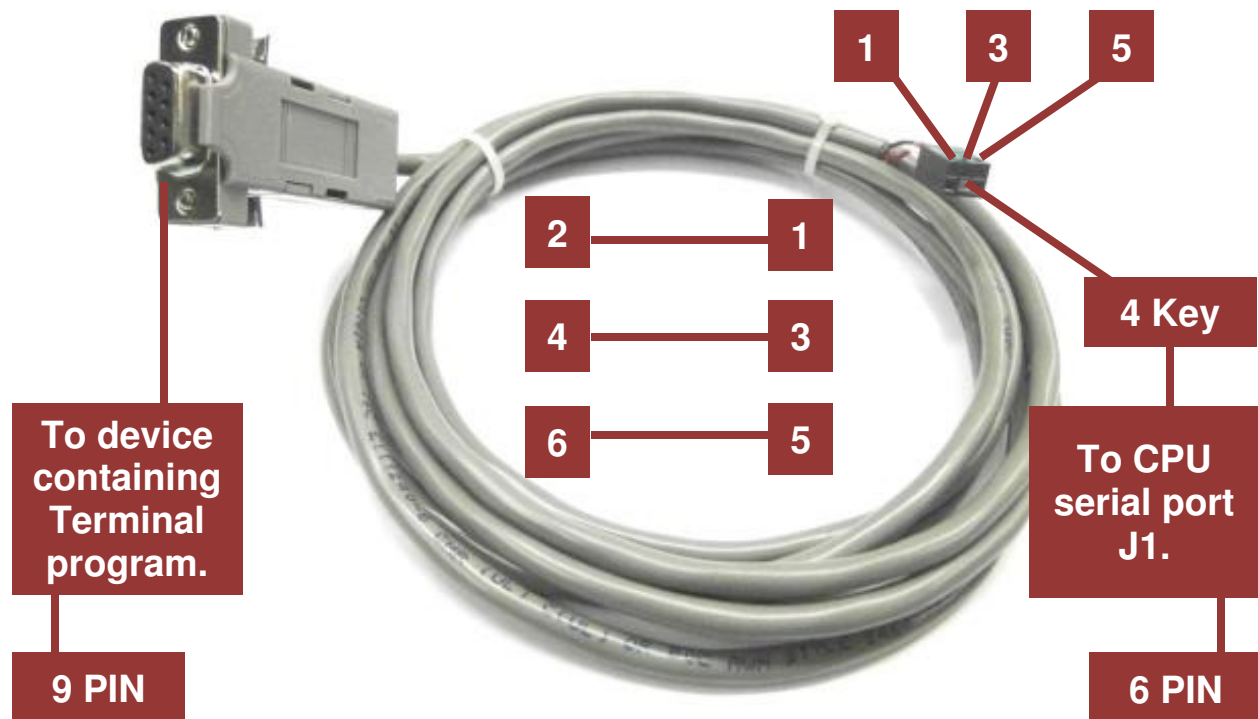
When you have everything configured as listed above, save your configuration information by choosing the Save command under the File menu. This allows you to save this configuration data for later use. Assign a name to your configuration, such as Servo Tyer or Burford®. In the future, when you start this terminal program, you may use the Open command under the File menu to recall your configuration data.

You will not be able to see anything that you type on the screen until the Servo Tyer is running. This is because the Servo Tyer must echo your typed commands back to the PC before they will be displayed.

The Servo Tyer controller sends some information to the serial port, which is intended to be displayed on the optional operator display provided by Burford® Corp. The Burford® TERMINAL program has been written to recognize the format of these statements and display them in a box near the bottom of the screen. Any other terminal emulation program (such as the terminal program in Microsoft Windows) cannot distinguish these statements from any other text and they appear on the screen among all the other text. This can be a little confusing.

■ Servo Tyer controller and PC communication cable

A cable like the one shown below is necessary to connect between the Servo Tyer and PC serial ports.



Order your communication cables from Burford®.
Email Parts@Burford.com or Call 1-877-Burford (1-877-287-3673)
Today. Part Number: C01286.

■ Servo Tyer Commands

Much of the time, it may not be necessary for you to issue any commands to the Servo Tyer because the Servo Tyer controller will automatically send statements to the screen regarding any problems it encounters as they occur. Often, this information is sufficient to identify a problem. However, if a previously encountered problem is not occurring now, it is sometimes desirable to command the Servo Tyer controller to output additional information, which may be helpful.

Not all of the possible Servo Tyer commands will be discussed in this document. Many of these are too technical to be helpful to anyone other than Burford® Service Personnel.

■ Starting the Servo Tyer

When power is first supplied to the Servo Tyer controller, it automatically sends out several lines of information, which look similar to the following.

TCR1interval= 0.238 μ sec

System Reset @ 10:35:47 on 03/06/95./

BURFORD® CORP.

Electronic Twist Servo Tyer

Version 1.30 - TIE SPEED SUPPORT (Feb 22 1995 11:47:23)

The following caused the last microprocessor reset:

Power switched off.

10:35:47> Initializing.

10:35:47> Initialization complete.

10:35:47>

Interlock open.

Waiting for reset.

■ When you start the Servo Tyer, cont'd

At this point, the controller is waiting for you to push the "RUN" button on the control panel and you are prevented from typing in commands. After the "RUN" button is pressed, the Servo Tyer begins to perform its homing sequence for 3 of the motors (the fourth servo motor drives the bag gathering belts and it does not have a home position). While the Servo Tyer is homing, several lines of information are written to the screen about the progress of the homing sequence. When the Servo Tyer successfully completes the homing sequence, the following prompt will appear on the screen.

MOTOR 1>

This indicates that the Servo Tyer is ready to receive commands and that any commands, which are motor-control commands, will be applied to Motor 1, the motor that drives the needle.

If, for any reason, the Servo Tyer does not successfully complete the homing sequence, this will be indicated on the screen. In that case, the MOTOR1> prompt will not appear and the controller will drop out power to all servo motors. The last two lines on the screen will then be.

Interlock open.

Waiting for reset.

At this point, you will not be able to type commands. Based upon the information printed to the screen during the homing sequence, it may be possible to repair the Servo Tyer so that it will successfully home.

■ TIME and DATE commands

The Servo Tyer controller has a battery-powered real-time clock that it uses to record the time and date of special events. It is good practice to check the time and date before going on to other activities. If the time and date are not accurate, then the time and date information recorded will be incorrect.

To check the time, type TIME the time will be displayed on the screen. Be sure not to type TIME= This would set the time to 00:00. To set the time, you must use a 24 hour format. To set the time to 9:15 a.m., for example, type: TIME=9:15 To set the time to 9:15 p.m., for example, type: TIME=21:15.

You can check the date the same way. To set the date to March 10, 1995, for example, type; DATE=3-10-95

■ TROUBLE command

The Servo Tyer controller keeps a record of important events and problems that it encounters during operation. This record is stored in battery-backed memory on the CPU board. This record provides a valuable history of operation for this machine, which can be very helpful in diagnosing problems.

This trouble buffer, when full, is 1000 lines long, about the equivalent of 17 printed pages. When this buffer gets full, the oldest information is discarded as new information is added. This ensures that this buffer contains the most up-to-date information possible. Depending upon the frequency of problems detected by this machine, this trouble buffer may contain information for a period of a few hours to several weeks. All the entries in the trouble buffer have their time and date recorded at the time of their occurrence.

To command the Servo Tyer to display the contents of the Trouble buffer, simply type: TROUBLE or this can be abbreviated by: TR

After a page of information has been displayed, you will be prompted to Press any key to continue. Pressing any key besides the Escape key will cause the next page of information to be displayed. You will notice from the times and dates displayed that the most recent information is displayed first and the information gets progressively older. When the entire contents of the buffer have been displayed, the buffer will loop around to the beginning and the most recent information will be shown again. At this time, or any time you wish to leave the Trouble Report, you should press the Escape key to exit this command. You can look at this Trouble Report as many times as you like. If you wish to save or print this information, you should capture this data into a text file.

■ QUERY command

Whenever the needle, twister hook or holder shear motors are commanded to make a move, information is stored in a QUERY buffer about all the servo motor positions, speeds, and motor commands during the move. This data can be displayed by using the QUERY command.

The information displayed by this command can be helpful in diagnosing certain complex problems. However, analyzing this data is very difficult for anyone not familiar with the inner workings of the Servo Tyer. It is easy to draw incorrect conclusions from the data. Therefore, the most likely customer use for this command is to display data, which can be captured into a text file. Then the customer would normally print the file and send the data to Burford® Corp. for analysis. Contact the Service Manager at Burford® Corp. if you wish to do this.

The information in the QUERY buffer is automatically overwritten when the next move occurs, so this buffer always contains information about the most recent move. When the MOT>1 prompt is displayed, the data displayed is for the needle motor only. When the MOT>2 prompt is displayed, the data displayed is for the twister hook motor only. When the MOT>3 prompt is displayed, the data displayed is for the holder shear motor only. When the MOT>4 prompt is displayed, the data displayed is for the gathering belts motor only. To change to a different motor, say the twister hook motor, simply type MOT=2. The MOT 2> prompt will then be displayed.

■ 4.9.4 QUERY command, cont'd

Type Q=0 to start at the beginning of the QUERY buffer. Then type Q each time you want to display another page of data. The QUERY buffer is 255 lines long. The exact format of the output depends upon the PROM version being run. However, the output from the QUERY command typically looks like the data below.

```
MOTOR 1>q=0
MOTOR 1>q
STEP TIME SET  ACT  VEL  CMD
0>0.0 0 -2 ---- -2.1 -2132.9
1>5.2 4 -2 0 0.5 504.8
2>10.5 17 -2 0 7.1 7122.3
3>15.7 37 -1 1 13.6 13560.3
4>21.0 66 3 4 21.4 21418.0
5>26.2 103 13 10 28.2 28246.5
6>31.5 149 33 20 34.1 34093.7
7>36.7 202 68 35 35.9 35859.8
8>42.0 264 121 53 36.1 36109.0
9>47.2 335 188 67 37.7 37705.0
10>52.5 413 271 83 36.0 35995.9
11>57.7 500 369 98 34.7 34655.3
12>63.0 595 480 111 32.7 32731.6
13>68.2 698 599 119 32.9 32859.0
14>73.5 803 723 124 30.7 30665.6
15>78.7 908 854 131 24.9 24947.6
16>84.0 1013 985 131 22.0 22016.0
17>89.2 1118 1114 129 19.8 19765.6
18>94.5 1223 1241 127 17.3 17271.8
19>99.7 1328 1369 128 12.6 12639.2
20>105.0 1433 1498 129 7.3 7301.5
```

If the last move caused a situation which resulted in the controller dropping out power to the servo motors (such as a motor jammed), the controller will not display the MOT 1> prompt and you will not be able to type the QUERY commands until you type the + command.

■ RESET command

This command causes the Servo Tyer controller to display the reason for the most recent controller reset. It does not cause the Servo Tyer controller to reset itself. The possible reasons for a reset are as follows.

1. Power turned off. This is the most common cause of a reset and it is quite normal for this to occur. It occurs when the power is turned off for more than a couple of seconds.
2. External reset. This can be caused by a momentary loss of power such as might occur from a loose power connector. It also occurs if someone presses the reset button on the CPU board or if someone turns the power switch on within a second after the power has been turned off. All occurrences of external resets are also recorded in the Trouble buffer.
3. Watchdog reset. This indicates a software error. These are indicated in the trouble buffer.
4. Halt monitor reset. This indicates an internal processor fault. These are indicated in the trouble buffer.

To invoke the RESET command, simply type: `RESET`

■ DEBUG command

When Debug is turned on, the Servo Tyer controller will write a statement to the screen to indicate every time that the bag switch closes when the Servo Tyer is ready to tie. It also writes another statement every time that the bag switch opens during normal operation. This is sometimes helpful, if you are experiencing erratic triggering of the Servo Tyer. Normally, Debug is turned off.

To turn on Debug, type: `DEBUG=1`

To turn off Debug, type: `DEBUG=0`

■ HOME command

When the screen is displaying a prompt such as MOT>1, typing HOME causes the Servo Tyer to begin a homing sequence. This can also be accomplished by holding the thread button on the Control Panel for 5 seconds.

■ DISPENSE command

Every time that the Servo Tyer is triggered, the Servo Tyer controller counts the number of pulses that it receives from the Bag Recognition System proximity switch. This pulse count indicates how much ribbon has been dispensed during the tie cycle. The controller compares the number of pulses for the latest package with the number of pulses for the previous 10 packages. The controller then decides whether it should do one of the following actions.

1. Abort the tie cycle because too little ribbon has been dispensed to indicate a proper package, thereby preventing the Servo Tyer from dropping the ribbon.

Or

2. Complete the tie cycle

The controller also checks the count to determine if a heel (or anything else that would produce an exceptionally long tie) has been detected in the twist tie area. If so, the alarm is sounded three times and that package is not indicated by the Servo Tyer counter output.

If this system is not working correctly, it will cause the Servo Tyer to abort ties or enunciate heels incorrectly. You may see two packages tied together, because the tie was aborted on the first package. To see the number of the dispense counts on the most recent package, simply type: DISPENSE or this can be abbreviated as: DI

■ DISPENSE command, cont'd

The exact format of the output depends upon which PROM Version you have. The output to the screen will look approximately like this.

PASSED: RIBBON DISPENSER TIE COUNT at checkpoint was 19 >17-3.

PASSED: RIBBON DISPENSER HEEL COUNT at checkpoint was 20 <18 +3.

In this example, the 19 in the first row means that the count was at 19 when the controller checked to see whether the most recent cycle should be aborted. The 17 represents the median value for the last 11 cycles. The -3 means that the Servo Tyer would abort any packages, producing a count, which is 3 less than the median value.

In the second row, the 20 means that the count was 20 when the controller checked to determine whether there appears to be a heel (or other foreign matter) inside the twist tie. The 18 represents the median value for the last 11 cycles. The +3 means that we would flag any packages, which are 3 more than the median value.

It should be understood that the median values may change slightly depending upon what type of bag and product is being run.

■ (+) command

This command provides a "back door" way of getting access to the Servo Tyer controller if the Servo Tyer will not successfully home or if you wish not to home the Servo Tyer. This command causes the Servo Tyer to bypass the homing sequence that normally must successfully complete before you can type commands. In particular, this command permits you to perform inquiries (Such as the QUERY command and to view the contents of the Trouble buffer).

Never attempt to run the Servo Tyer servo motors while the Servo Tyer is in this mode. After completing your inquiries, you should always turn off power to the Main Enclosure for a few seconds before continuing. This will reset the processor and assure safe operation.

■ (+) command, cont'd

To invoke this command, hold down the shift key and press the key with the (+) character. It is not necessary to press Enter. When the Motor 1> prompt appears, you will be able to enter other commands.

Capture data into a text file on the PC with the Burford® TERMINAL program as follows.

To begin capturing data, press Alt-F. A unique filename, based on the time and date, will be suggested in the dialog box in the center of the screen. You may use this filename or type in any other name permitted by DOS. If you choose your own file names, be sure to use a unique name each time so that you do not overwrite a previous file. A message will appear in the lower right-hand corner of the screen, which indicates that you are capturing data. Anything that is typed or written to the screen after you begin capturing will be saved into this file. As you are capturing a file, you can type in short notes to help in later understanding of what was happening. When you press ENTER, the display will show that you entered an invalid command, but your notes will be captured in the file. To stop capturing, press Alt-F again.

Capture data into a text file on the PC with Windows TERMINAL program as follows.

Be sure that you have the TERMINAL program properly configured. To begin capturing, select Transfers, then select Receive Text File. Enter a name for the file, being sure to type in the .txt file extension and return to the main screen. Anything that is typed or written to the screen after you begin receiving the text file will be captured to the file. As you are capturing a file, you can type in short notes to help in later understanding of what was happening. When you press ENTER, the display will show that you entered an invalid command, but your notes will be captured in the file. To stop capturing data, select the Stop button at the bottom of the screen.

Captured files may be reviewed or printed using any text editor, such as the DOS text editor EDIT or the Windows text editor NOTEPAD. It is a good idea at that time to type in a quick summary of the tests you conducted at the top of the file for later reference. Control codes embedded in the text may cause the document to be printed with page breaks at strange locations. You can edit these out of the document if you wish.

Chapter 7

Troubleshooting

CHAPTER 7: TROUBLESHOOTING

■ Troubleshooting Considerations

The Servo Tyer CPU board must be working properly for it to talk to the PC. If you are having a problem that prevents the CPU board from operating (such as a faulty power supply or a loose power connector), you cannot communicate with the Servo Tyer controller.

Communication with the Servo Tyer controller may be conducted while the Servo Tyer is operating and tying packages. In fact, operation of the Servo Tyer is often necessary to generate a situation of interest.

Any change in the Servo Tyer controller settings made from the PC except “TIME” and “DATE” will be forgotten when power to the Servo Tyer controller is turned off, providing that Dip Switch 5 on the Auxiliary Board of the Servo Tyer is in the “ON” position.

At various times, you will see statements on the screen of the PC that refer to Motor 1, Motor 2, Motor 3 and Motor 4. These refer to the 4 servo motors being controlled.

Motor 1 refers to the motor that drives the needle.

Motor 2 refers to the motor that drives the twister hook.

Motor 3 refers to the motor that drives the holder shear.

Motor 4 refers to the motor that drives the bag gathering belts.

The AC motor that drives the gathering brushes is not a servo motor and it is not under the command of the Servo Tyer controller.

■ Diagnostic LED's

The Field Termination Board (PN C01299) has thirty-four LED's to assist in troubleshooting the Servo Tyer. Twenty-three of these are on the left side of the FTB and indicate that the AUX board has received the signal. In addition, each relay and optional I/O connections on the FTB has a status LED mounted next to it. The Auxiliary Board has two status LED's that may also be helpful in troubleshooting. These are located next to CR1 and CR9 just below the middle of the AUX board.

L.E.D.	Description
FTB - D1, D2: NEEDLE Phase A and NEEDLE Phase B	Indicates input signals from the needle motor encoder. Each LED should blink on and off as the needle is moved back and forth.
FTB - D3, D4: TWISTER Phase A and TWISTER Phase B	Indicates input signals from the twister hook motor encoder. Each LED should blink on and off as the twister hook is rotated back and forth.
FTB - D5, D6: H/S Phase A and H/S Phase B	Indicates input signals from the holder shear motor encoder. Each LED should blink on and off as the holder shear motor is rotated back and forth.
FTB - D7, D8: BELT Phase A and BELT Phase B	Indicates input signals from the belt motor encoder. Each LED should blink on and off as the belt motor is rotated back and forth.
FTB - D9: THREAD SWITCH	Indicates when the "THREAD" switch is pushed.
FTB - D10: RIBBON DISP	Indicates when one of the steel dowels in the ribbon dispenser spool triggers the ribbon dispense proximity sensor.
FTB - D11: BAG SWITCH	Indicates when the bag switch is depressed.
FTB - D12: H/S HOME	Indicates when the holder shear home proximity sensor is triggered by the tabs on the holder shear shuttle cam.
FTB - D13: TWISTER HOME	Indicates when the tip of the twister hook triggers the twister hook home proximity sensor.

■ Diagnostic LED's, cont'd

L.E.D.	Description				
FTB - D14: NEEDLE HOME	Indicates when the needle triggers the needle home proximity sensor.				
FTB - D15: BAGGER ENABLE RELAY	Indicates when the bagger enable relay, CR4 on the FTB, is energized.				
FTB - D16: RIBBON DROP	Indicates when the dancer arm triggers the ribbon drop proximity sensor.				
FTB - D18/BCD 8, D20/BCD 4, D22/BCD 2, and D23/BCD 1:	Indicates the signals coming from the belt speed push wheel switch. The following table shows how the LED's should respond to each setting.				
	SETTING	BCD 8	BCD 4	BCD 2	BCD 1
	0	OFF	OFF	OFF	OFF
	1	OFF	OFF	OFF	ON
	2	OFF	OFF	ON	OFF
	3	OFF	OFF	ON	ON
	4	OFF	ON	OFF	OFF
	5	OFF	ON	OFF	ON
	6	OFF	ON	ON	OFF
	7	OFF	ON	ON	ON
	8	ON	OFF	OFF	OFF
	9	ON	OFF	OFF	ON
	A	ON	OFF	ON	OFF
	B	ON	OFF	ON	ON
	C	ON	ON	OFF	OFF
	D	ON	ON	OFF	ON
E	ON	ON	ON	OFF	
F	ON	ON	ON	ON	
FTB - D19: SERVO ENABLED RELAY	Indicates when the servos enabled relay, CR2 on the FTB, is energized. Also, implies that CR1 on the main panel should be energized and there should be power to the servo motors.				
FTB - D24, D27: CPU 2 and CPU1	Indicates CPU activity.				
FTB - D25: HORN RELAY	Indicates when the horn relay, CR5 on the FTB, is energized.				
FTB - D28: BRUSH/BELT RELAY	Indicates when the brush/belt relay, CR3 on the FTB, is energized.				
FTB - D29, D31: PCS1 and PCS0	Indicates CPU activity.				

■ Diagnostic LED's, cont'd

L.E.D.	Description
FTB - D30: COUNTER RELAY	Indicates when the counter relay, CR6 on the FTB, is energized.
FTB - D33, D34, and D35: OPTIONAL I/O STATUS	Indicates optional input or output signal status.
FTB - D36, D37, and D38: OPTIONAL INPUT STATUS	Indicates optional input signal status.
AUX - D1: RUN RELAY	Indicates that the run circuit has been energized. The run circuit is made up of the "RUN" button, "STOP" button, mag-lock on the front cover, and the CPU status relay CR9 on the AUX board. All of these contacts must be closed before the run circuit to energize.
AUX - D6: CPU STATUS RELAY	Indicates the CPU is active and ready to control the motors. This LED must be "ON" before the run circuit will energize.

■ Seven Segment LED Error Codes

Mounted on the edge of the CPU board inside the Main Enclosure is the seven segment LED which can display all of the numbers and most of the alphabet, one character at a time. This device is used to display various codes that give the Servo Tyer status and may be helpful in troubleshooting. The codes are divided into three categories: counter, status, and error. The CPU keeps a running count of the number of packages tied by the Servo Tyer. During normal operation, the letter 'C' will be displayed followed by this count. Status codes begin with the letter 'H'. These codes give general information pertaining to the current Servo Tyer status. Error codes begin with the letter 'E'. These codes will give information pertaining to a Servo Tyer fault. For more information on how to use the error codes to troubleshoot the Servo Tyer refer to pg.113.

The LED will flash the codes in the following manner (the dashes are for separation of characters for example only the LED will not show dashes).

Counter Codes: C-1-8-6

Status Codes: H-0-0-1

Error Codes: E-1-1-1

Motor Error Code Identification			
Motor (1) Needle	Motor (2) Hook	Motor (3) Shear	Motor (4) Belts
111-117	121-127	131-137	146

Error codes 111-146 deal with the electrical issues a motor might have. If one of these error codes is displayed the main areas to check are the fuse, encoder, prox and motor for the motor that the error code is indicating. Flow Charts 4-11 thru 4-26 deal with troubleshooting these error codes.

Once an Error Code has been displayed, it will be repeated until a new code replaces it or power is turned off. Generally, you will have to home the Servo Tyer or tie a package before the code will be removed. The following is a list of the codes and their descriptions.

The middle numbers of error codes 111-146 represent the motor involved with the error.

■ Seven Segment LED, Error Codes, cont'd

CODE	DESCRIPTION	CODE	DESCRIPTION
H001	Main Enclosure power switched on.	E123	Leading edge of hook prox not found.
H002	External reset detected.	E124	Can't move hook to home position.
H003	Servo Tyer homing sequence aborted by operator.	E125	Twister hook motor not moving.
H004	Servo Tyer not ready, close door and push "START".	E126	Twister hook jammed or encoder fault.
H005	Ribbon drop detected. Thread Servo Tyer.	E127	Twister hook home prox not detected.
H006	Two bags were too close together.	E131	Unable to control shear while homing.
H007	Tie cycle aborted, not enough ribbon used.	E132	Trailing edge of shear prox not found.
H008	Heel detected, too much ribbon used.	E133	Leading edge of shear prox not found.
H011	Needle at end of forward travel.	E134	Can't move holder shear to home position.
H012	Needle at end of backward travel.	E135	Holder shear motor not moving.
H021	Twister hook at end of forward travel.	E136	Holder shear jammed or encoder fault.
H022	Twister hook at end of backward travel.	E137	Holder shear home prox not detected.
H031	Holder shear at end of forward travel.	E146	Gathering belts jammed or encoder fault.
H032	Holder shear at end of backward travel.	E151	Spurious interrupt detected by CPU.
H051	Motor control loop ran out of time.	E152	General interrupt detected by CPU.
H052	Command table out of order.	E153	Bus error at 0x_____ from 0x_____.
H159	Loss of clock: push "RUN".	E154	Address error at 0x_____ from 0x_____.

■ Seven Segment LED, Error Codes, cont'd

CODE	DESCRIPTION	CODE	DESCRIPTION
H160	Reset instruction: push "RUN".	E155	Bad opcode at 0x_____.
H162	Test module reset: push "RUN".	E156	Divide by zero at PC 0x_____.
E001	Tie cycle aborted: ribbon not threaded.	E157	Watchdog reset. Push "RUN".
E101	CPU detected a problem and stopped Servo Tyer.	E158	Halt monitor reset. Push "RUN".
E102	Homing sequence failed.	E162	CPU detected IRQ 1.
E111	Unable to control needle while homing.	E163	CPU detected IRQ 2.
E112	Trailing edge of needle prox not found.	E164	CPU detected IRQ 3.
E113	Leading edge of needle prox not found.	E165	CPU detected IRQ 4.
E114	Can't move needle to home position.	E166	CPU detected IRQ 5.
E115	Needle motor not moving.	E167	CPU detected IRQ 6.
E116	Needle jammed or encoder fault.	E168	CPU detected IRQ 7.
E117	Needle home prox not detected.	E169	Privileged instruction at 0x_____.
E121	Unable to control hook while homing.	E201	None of the three motors are moving.
E122	Trailing edge of hook prox not found.	E300	Stack overflow error.

■ Audible Alarm Codes

A long beep is 1 second in duration. A short beep is 1/2 second in duration.

ALARM	CODE DISPLAYED	DESCRIPTION
1 SHORT	NONE	POWER TURNED ON, OR HOME SEQUENCE SUCCESSFUL.
2 SHORT	H006	BAG NECKS TOO CLOSE TOGETHER (TRIED TO START 2ND CYCLE BEFORE 1ST CYCLE WAS COMPLETED).
1 LONG	H007	ABORTED TIE CYCLE, NOT ENOUGH RIBBON USED.
2 LONG	E116, E126, E136 or E146	ONE OR MORE MOTORS JAMMED OR ENCODER FAULTS.
3 SHORT	H008	HEEL TIED IN PACKAGE, TOO MUCH RIBBON USED.

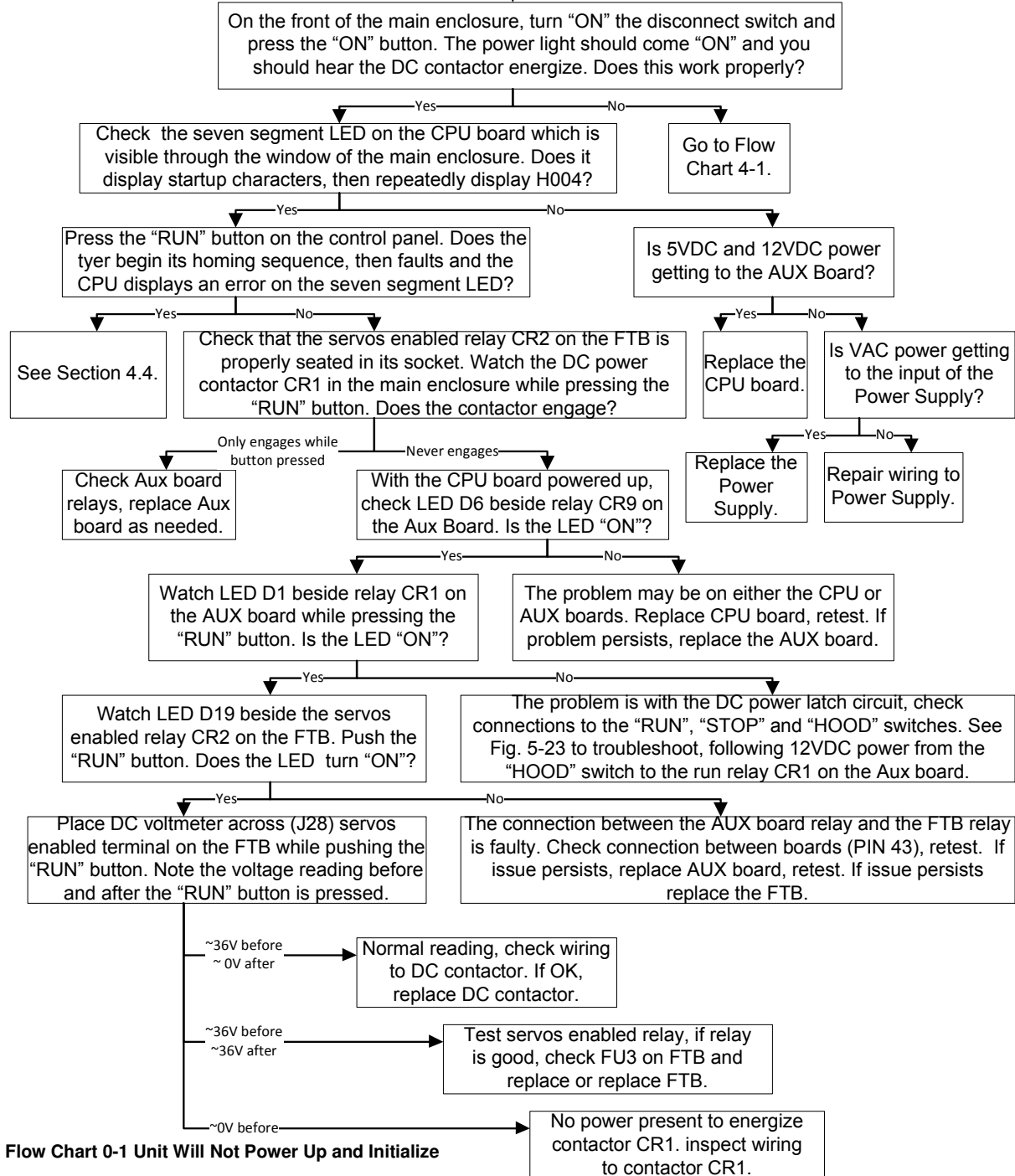
■ Troubleshooting Flow Charts

The troubleshooting flow charts on the following pages are intended to allow a serviceman to repair a problem and get the Servo Tyer running again as quickly as possible.

Unit will not power up and initialize

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

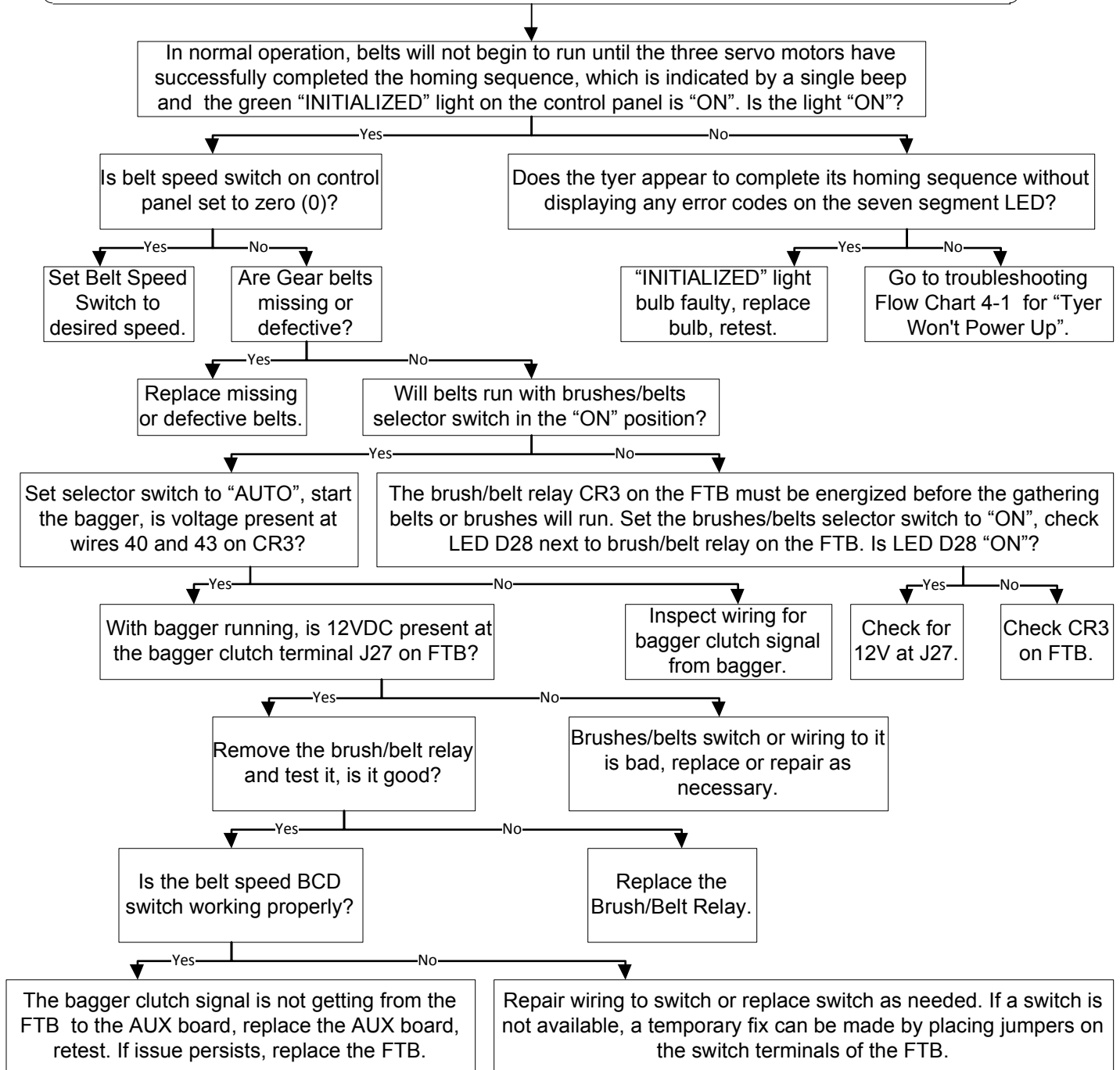


Flow Chart 0-1 Unit Will Not Power Up and Initialize

Gathering belts not running (no error code displayed)

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

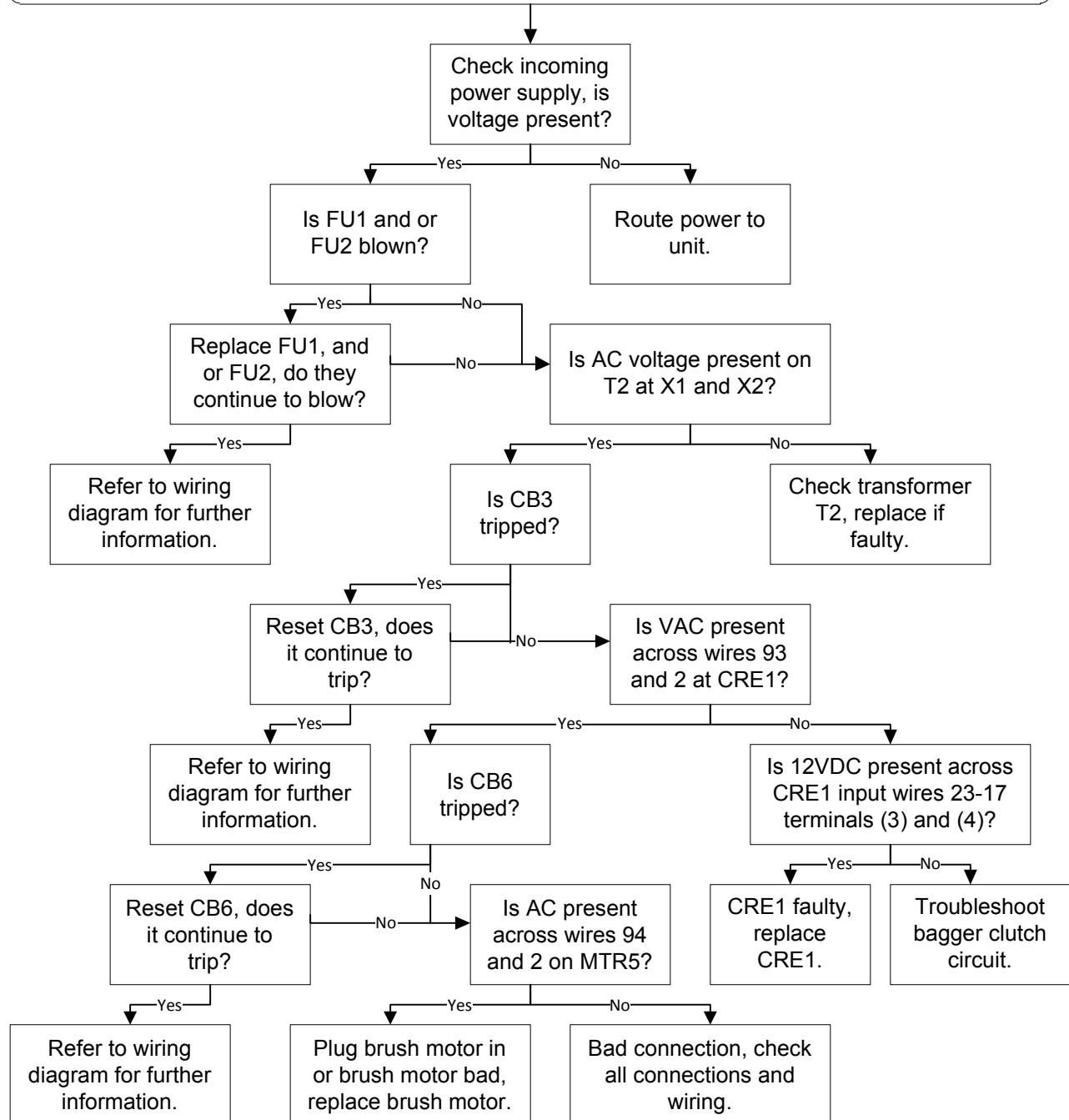


Flow Chart 0-2 Gathering Belts Will Not Run

Brush motor not running

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



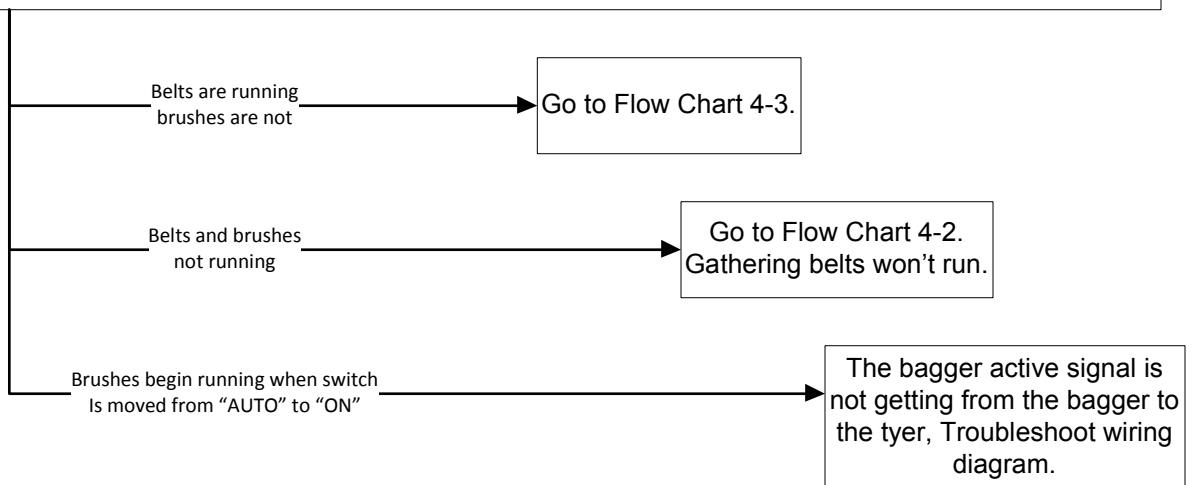
Flow Chart 0-3 Brush Motor Not Running

Motor for gathering brushes won't run

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The gathering brushes use an AC induction motor, it is not a servo motor and it is not controlled by the CPU. This test should be done with the gathering belts running. Start the tyer and turn the brushes belts to "ON". What is observed after turning brushes belts switch to "ON"?

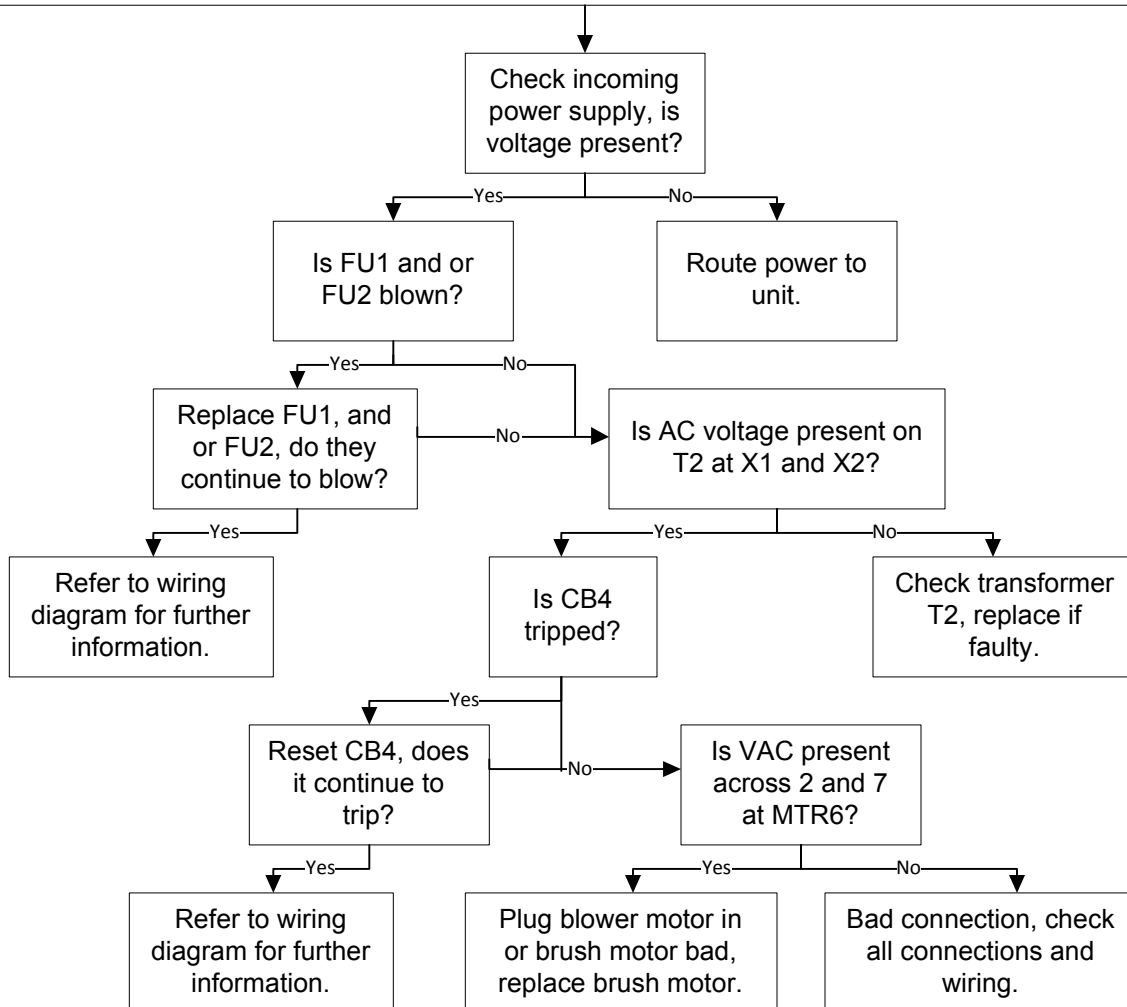


Flow Chart 0-4 Motor for Gathering Brushes Won't Run

Blower motor not running

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



Flow Chart 0-5 Blower Motor Not Running

Tyer won't allow bagger to start (no error code displayed)

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

When the tyer is ready to tie packages, it closes a set of dry contacts that completes a bagger circuit that allows the bagger to start and run. If these contacts are not closed, the bagger cannot run. The tyer must complete a homing sequence before the relay is closed to allow the bagger to start. Power up the tyer and press the "RUN" button on the operator control box.



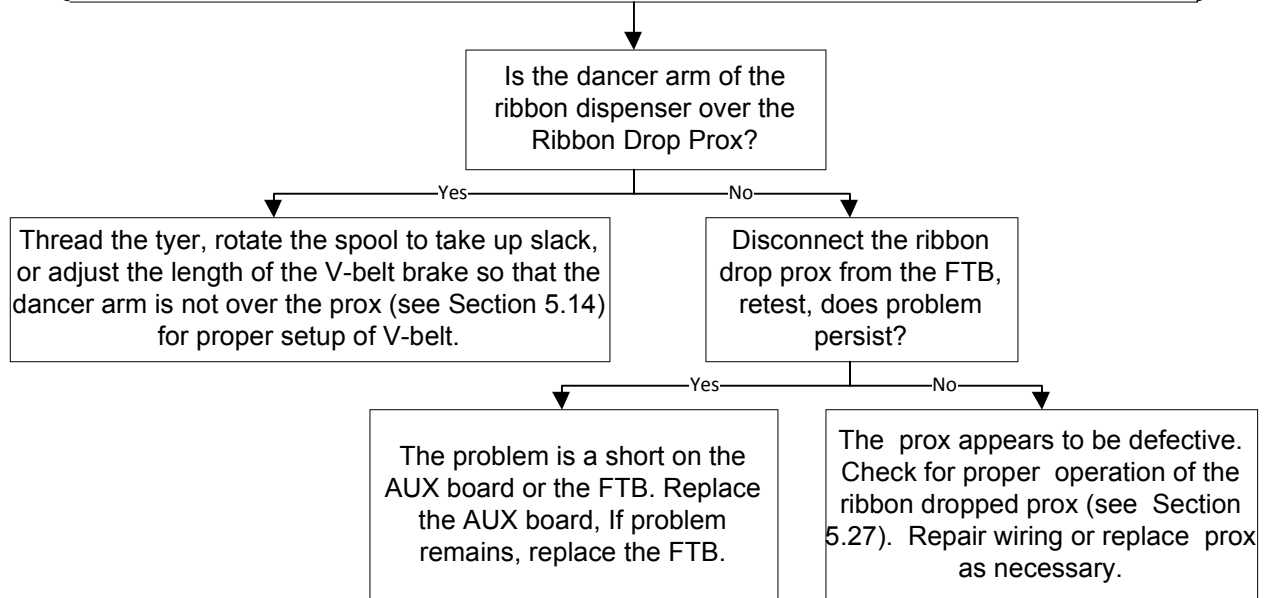
Flow Chart 0-6 Tyer Not Allowing Bagger to Start

E001**TIE CYCLE ABORTED BECAUSE THE RIBBON IS NOT THREADED**

This error occurs when the tyer is triggered and the Ribbon Dropped Prox input is "ON".

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



E101**CPU DETECTED A PROBLEM AND STOPPED TYER**

This error code is related to the microprocessor. It may be caused by a software or hardware problem. Usually, this type of problem is caused by electrical noise and will go away when power is cycled.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

Turn "OFF" the disconnect switch on the main enclosure to reset the microprocessor, wait five (5) seconds, turn "ON" the disconnect switch, check for normal operation. If the problem persists, replace the CPU board.

E102

HOMING SEQUENCE FAILED

This error only occurs while the tyer is in its homing sequence. It indicates the homing sequence took too long. One or more of the Servo Motors were unable to complete their HOMING sequence.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing a motor from moving as needed. With power turned "OFF", turn each motor thru its complete range of motion, (MTR1) < 360°, (MTR2-4) ≥ 360° check for debris, is a jam present?

Yes

No

Clear jam.

Attempt another homing sequence while viewing motors (MTR1-3) and verify which motor is not moving, also E102 is often followed by another E-code which can assist in determining which motor is experiencing problems.

If needle not moving or E111-117 follows E102 see Flow Charts E111-E117.

If twister hook not moving or E121-127 follows E102 see Flow Charts E121-127.

If H/S not moving or E131-137 follows E102 see Flow Charts E131-137.

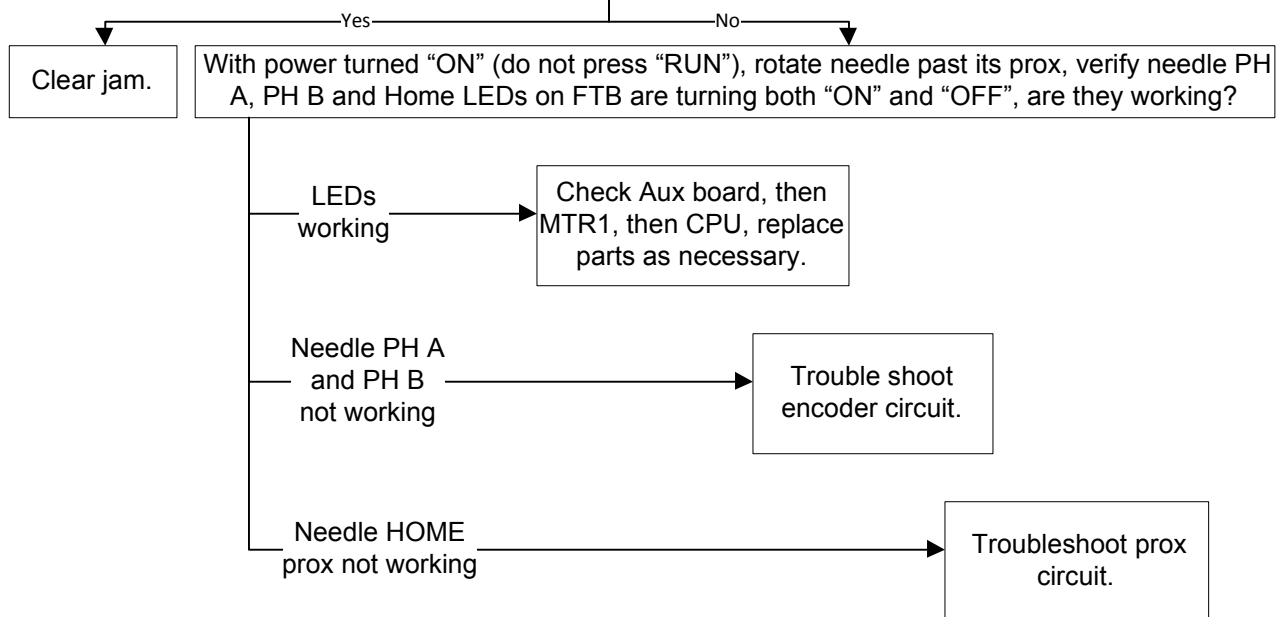
E111**UNABLE TO CONTROL NEEDLE WHILE HOMING**

This error only occurs while the tyer is in its homing sequence. It indicates either of two similar conditions. E112 indicates that the controller detected the needle's home prox turning "ON", but it cannot drive the needle past the prox to turn the prox "OFF". E113 indicates that the controller detected the needle's home prox turning "OFF", but it cannot drive the needle back over the prox to turn the prox "ON".

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the needle from moving as needed. With power turned "OFF", turn the needle motor thru its complete range of motion (MTR1) < 360°, check for debris, is a jam present?



E112-113

ONLY ONE EDGE OF NEEDLE'S HOME PROX IS DETECTED

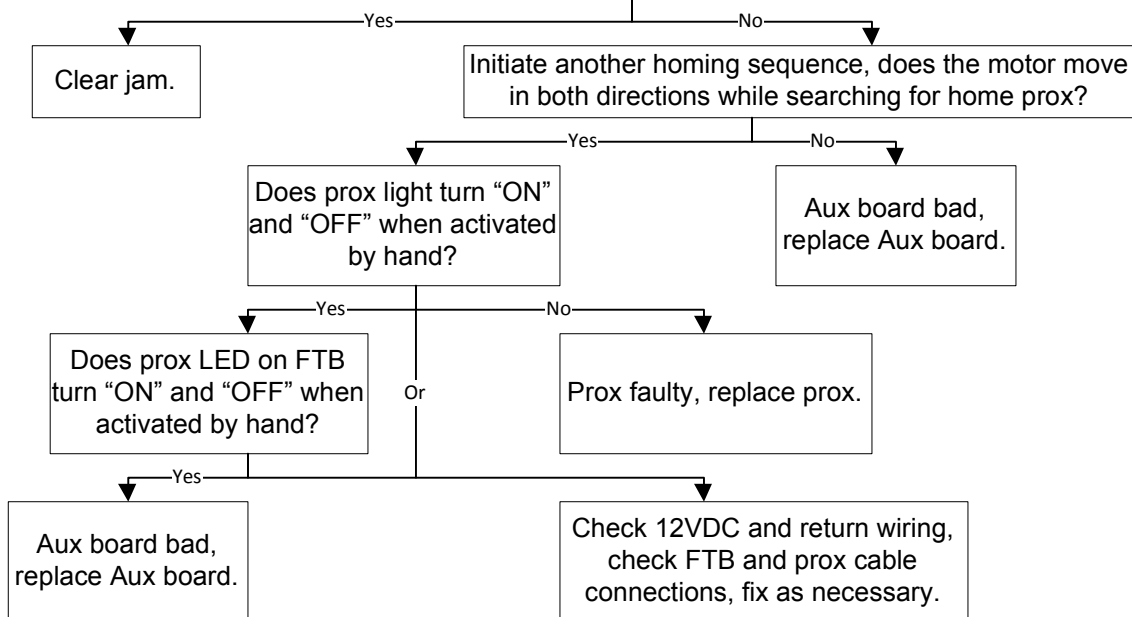
This error only occurs while the tyer is in its homing sequence. It indicates either of two similar conditions.

E112 indicates that the controller detected the needle's home prox turning "ON", but it cannot drive the needle past the prox to turn the prox "OFF". E113 indicates that the controller detected the needle's home prox turning "OFF", but it cannot drive the needle back over the prox to turn the prox "ON".

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the needle from moving as needed. With power turned "OFF", turn the needle motor thru its complete range of motion (MTR1) < 360°, check for debris, is a jam present?



Flow Chart 0-11 E112 Or E113 Error Code

E114**CONTROLLER IS NOT ABLE TO MOVE THE NEEDLE TO ITS STARTING POSITION**

This error only occurs while the tyer is in its homing sequence. After all motors have found their home proxes, the controller tries to move all motors to their starting positions. If the needle motor has not reached its starting position after trying for 30 seconds, then this error is set.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the needle from moving as needed. With power turned "OFF", turn the needle motor thru its complete range of motion (MTR1) < 360°, check for debris, is a jam present?

Yes

No

Clear jam.

Check for low voltage at the motor power supply, if problem persists replace Aux board.

E115-116

NEEDLE MOTOR FUSE BLOWN, MOTOR STALLED, OR BAD ENCODER

These error codes are set when the controller is trying to move the needle, but the needle either isn't moving or the controller cannot tell that the motor is moving. E115 occurs only during the homing sequence. E116 occurs only at other times.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the needle from moving as needed. With power turned "OFF", turn the needle motor thru its complete range of motion (MTR1) < 360°, check for debris, is a jam present?

Yes

Clear jam.

No

After checking for jams does motor:
A. not move at all?
B. move in only one direction?
C. take off (racing) before faulting?

Does MTR2 and
or MTR3 move?

Yes

Is F1 on Aux
board blown?

Replace F1, retest if
issue persists check
Aux board, MTR1 and
wiring, for wear and
damage, replace as
necessary.

No

See Flow
Chart 4-27.

Check wiring, MTR1,
Aux board and CPU for
wear and damage,
replace as necessary.

Is F1 on Aux
board blown?

Yes

Replace
F1.

No

Replace Aux board, if issue
persists replace CPU.

Check encoder LEDs PH A and PH B on FTB while
rotating motor by hand is LED sequence* good?

Yes

Check wiring
connection, if wiring
good replace motor
encoder.

Is 5VDC present at
MTR1 encoder?

Yes

Encoder faulty, replace
encoder.

No

Faulty wiring, check
CBL1, PL1 and CBL2,
replace as necessary.

Missing
both PH A
and PH B

Missing
PH A
Or
PH B

Is 5VDC present
on FTB across
J3(+) and J3(-)?

Yes

Replace FTB check Aux
board 96 PIN connector
for bent pins before
installing new FTB.

No

*FTB LED light sequence for MTR1

When PH A LED is	PH B LED should be	
Read sequence top to bottom when turning MTR in a counter clock wise direction.	OFF	OFF
	ON	OFF
	ON	ON
	OFF	ON
	OFF	OFF
		Read sequence bottom to top when turning MTR in a clock wise direction.

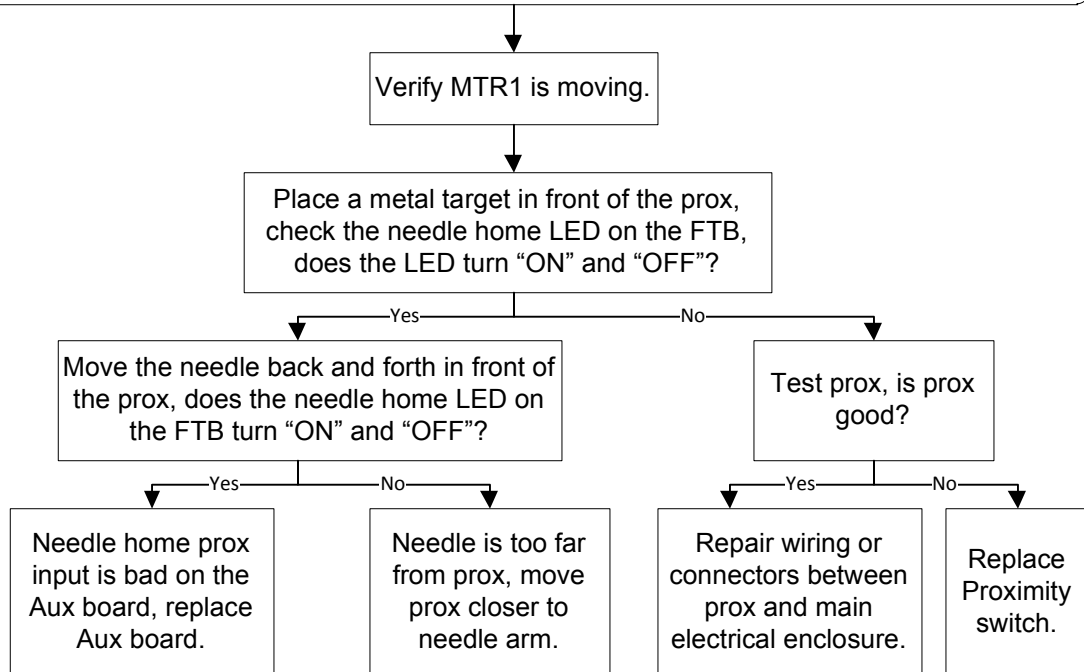
Flow Chart 0-13 E115 Or E116 Error Code

E117**NEEDLE MOTOR HOME PROX NOT DETECTED**

This error code is set when the controller is trying to home the needle and its motor is moving, but the home prox doesn't turn "ON" or "OFF" as expected.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



E121

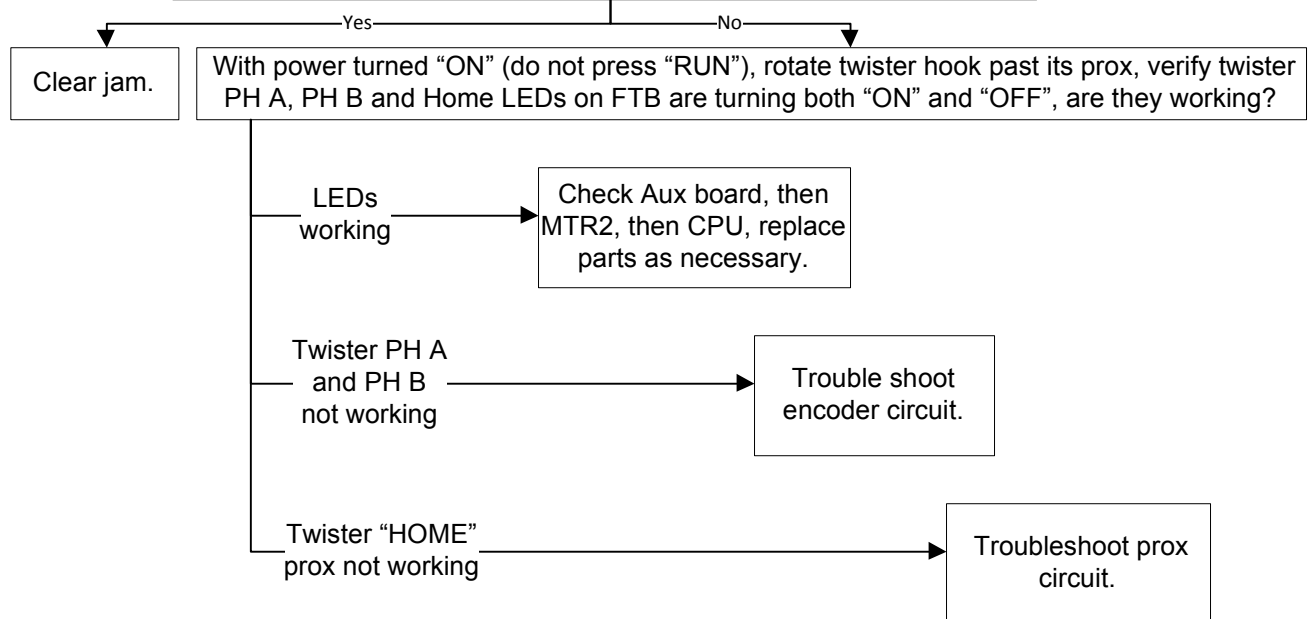
UNABLE TO CONTROL HOOK WHILE HOMING

This error only occurs while the tyer is in its homing sequence. It indicates either of two similar conditions. E122 indicates that the controller detected the hook's home prox turning "ON", but it cannot drive the hook past the prox to turn the prox "OFF". E123 indicates that the controller detected the hook's home prox turning "OFF", but it cannot drive the hook back over the prox to turn the prox "ON".

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the twister hook from moving as needed. With power turned "OFF", turn the twister hook motor thru its complete range of motion ($MTR2 \geq 360^\circ$), check for debris, is a jam present?



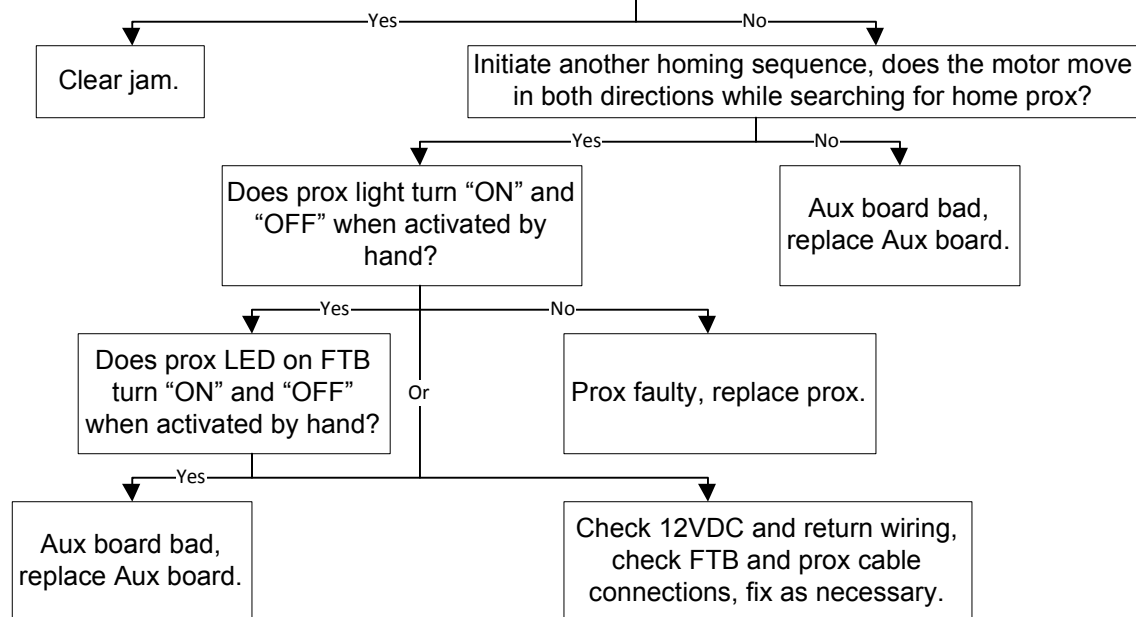
E122-123**ONLY ONE EDGE OF TWISTER HOOK'S HOME PROX IS DETECTED**

This error only occurs while the tyer is in its homing sequence. It indicates either of two similar conditions. E122 indicates that the controller detected the hook's home prox turning "ON", but it cannot drive the hook past the prox to turn the prox "OFF". E123 indicates that the controller detected the hook's home prox turning "OFF", but it cannot drive the hook back over the prox to turn the prox "ON".

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the twister hook from moving as needed. With power turned "OFF", turn the twister hook motor thru its complete range of motion (MTR2) $\geq 360^\circ$, check for debris, is a jam present?



E124**CONTROLLER IS NOT ABLE TO MOVE THE HOOK TO ITS STARTING POSITION**

This error only occurs while the tyer is in its homing sequence. After all motors have found their home proxes, the controller tries to move all motors to their starting positions. If the hook motor has not reached its starting position after trying for 30 seconds, then this error is set.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the twister hook from moving as needed. With power turned "OFF", turn the twister hook motor thru its complete range of motion (MTR2) $\geq 360^\circ$, check for debris, is a jam present?

Yes

No

Clear jam.

Check for low voltage at the motor power supply, if problem persists replace Aux board.

E125-126

HOOK MOTOR FUSE BLOWN, MOTOR STALLED, OR BAD ENCODER

These error codes are set when the controller is trying to move the hook, but the hook either isn't moving or the controller cannot tell that the motor is moving. E125 occurs only during the homing sequence. E126 occurs only at other times.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the twister hook from moving as needed. With power turned "OFF", turn the twister hook motor thru its complete range of motion (MTR2) $\geq 360^\circ$, check for debris, is a jam present?

Clear jam.

After checking for jams does motor:
A. not move at all?
B. move in only one direction?
C. take off (racing) before faulting?

Does MTR1 and or MTR3 move?

Is F2 on Aux board blown?

See Flow Chart 4-27.

Is F2 on Aux board blown?

Replace F2.

Replace Aux board, if issue persists replace CPU.

Check encoder LEDs PH A and PH B on FTB while rotating motor by hand is LED sequence* good?

Missing both PH A and PH B

Missing PH A Or PH B

Is 5VDC present on FTB across J4(+) and J4(-)?

Check wiring connection, if wiring good replace motor encoder.

Is 5VDC present at MTR2 encoder?

Replace FTB check Aux board 96 PIN connector for bent pins before installing new FTB.

Encoder faulty, replace encoder.

Faulty wiring, check CBL1, PL1 and CBL2, replace as necessary.

*FTB LED light sequence for MTR2

When PH A LED is		PH B LED should be	
Read sequence top to bottom when turning MTR in a counter clock wise direction.	OFF	OFF	Read sequence bottom to top when turning MTR in a clock wise direction.
	ON	OFF	
	ON	ON	
	OFF	ON	
	OFF	OFF	

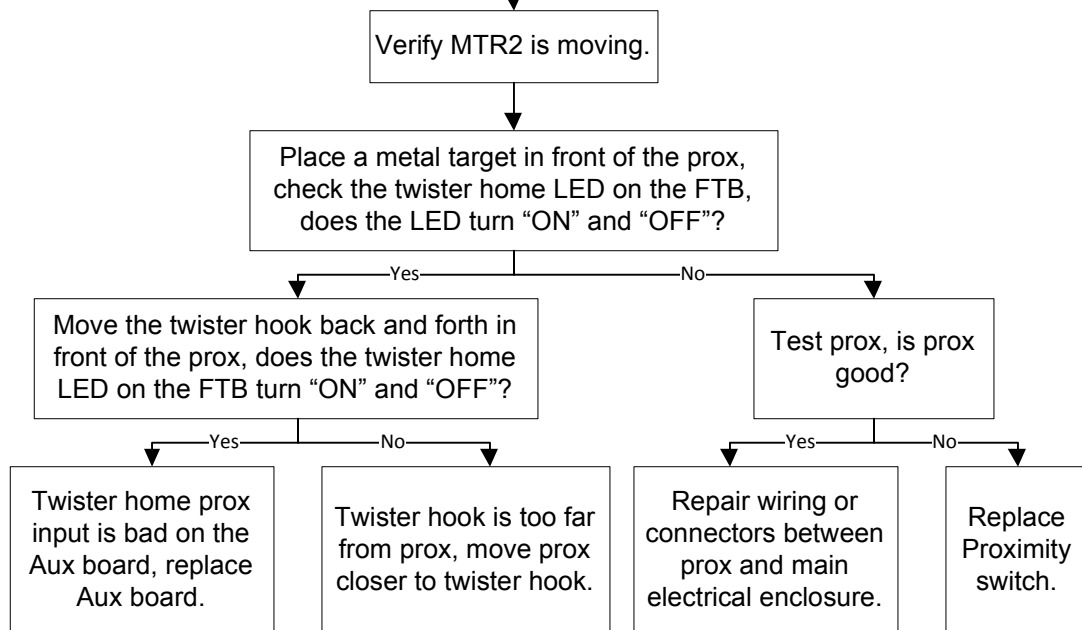
Flow Chart 0-18 E125 Or E126 Error Code

E127**HOOK MOTOR HOME PROX NOT DETECTED**

This error code is set when the controller is trying to home the hook and its motor is moving, but the home prox doesn't turn "ON" or "OFF" as expected.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



E131

UNABLE TO CONTROL SHEAR WHILE HOMING

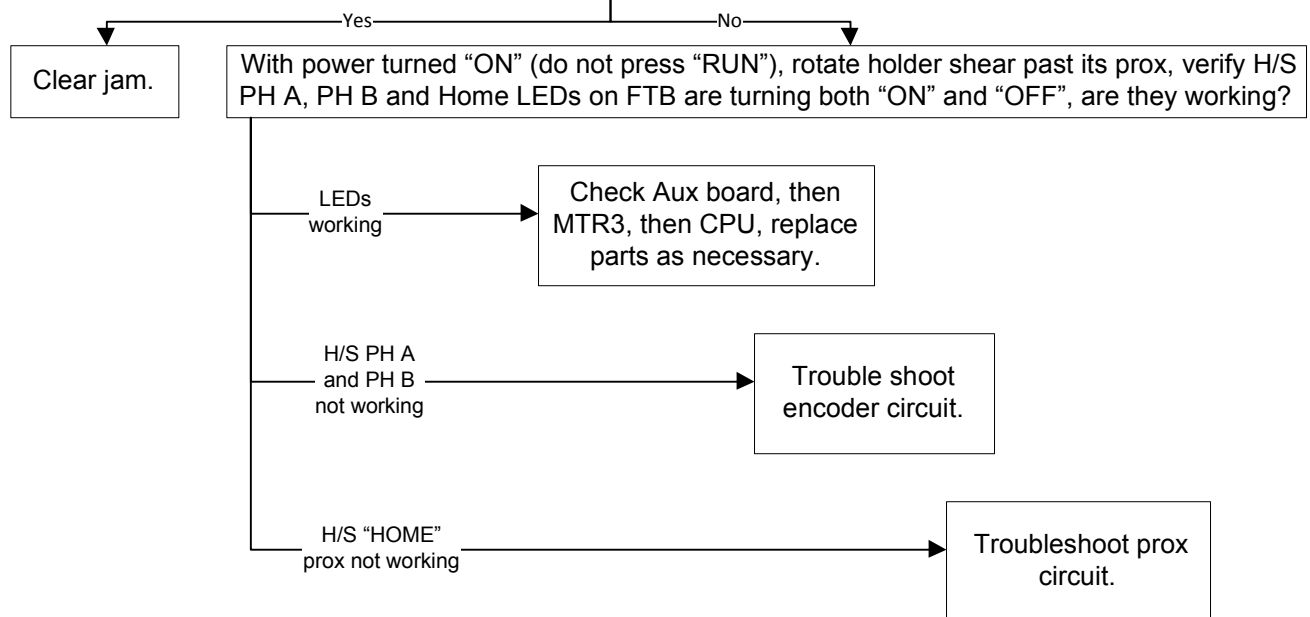
This error only occurs while the tyer is in its homing sequence. It indicates either of two similar conditions.

E132 indicates that the controller detected the shear's home prox turning "ON", but it cannot drive the shear past the prox to turn the prox "OFF". E133 indicates that the controller detected the shear's home prox turning "OFF", but it cannot drive the shear back over the prox to turn the prox "ON".

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the holder shear from moving as needed. With power turned "OFF", turn the holder shear motor thru its complete range of motion (MTR3) $\geq 360^\circ$, check for debris, is a jam present?



E132-133

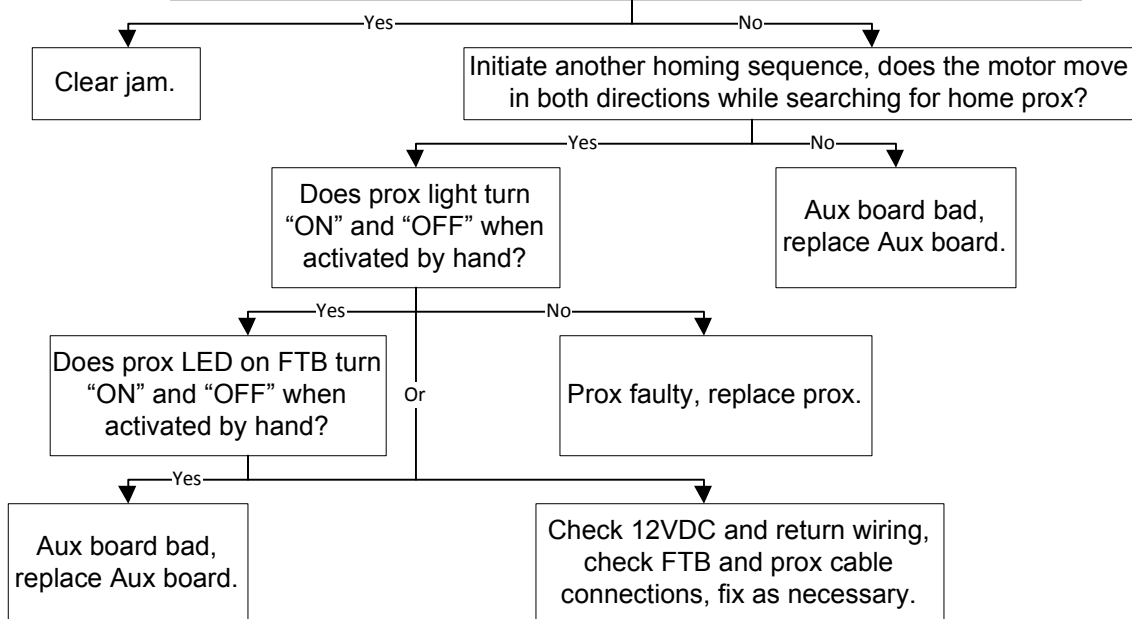
ONLY ONE EDGE OF HOLDER/SHEAR'S HOME PROX IS DETECTED

This error only occurs while the tyer is in its homing sequence. It indicates either of two similar conditions. E132 indicates that the controller detected the shear's home prox turning "ON", but it cannot drive the shear cam past the prox to turn the prox "OFF". E133 indicates that the controller detected the shear's home prox turning "OFF", but it cannot drive the shear cam back over the prox to turn the prox "ON".

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the holder shear from moving as needed. With power turned "OFF", turn the holder shear motor thru its complete range of motion (MTR3) $\geq 360^\circ$, check for debris, is a jam present?



E134**CONTROLLER NOT ABLE TO MOVE THE SHEAR MOTOR TO ITS STARTING POSITION**

This error only occurs while the tyer is in its homing sequence. After all motors have found their home proxes, the controller tries to move all motors to their starting positions. If the shear motor has not reached its starting position after trying for 30 seconds, then this error is set.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the holder shear from moving as needed. With power turned "OFF", turn the holder shear motor thru its complete range of motion (MTR3) $\geq 360^\circ$, check for debris, is a jam present?

Yes

No

Clear jam.

Check for low voltage at the motor power supply, if problem persists replace Aux board.

E135-136

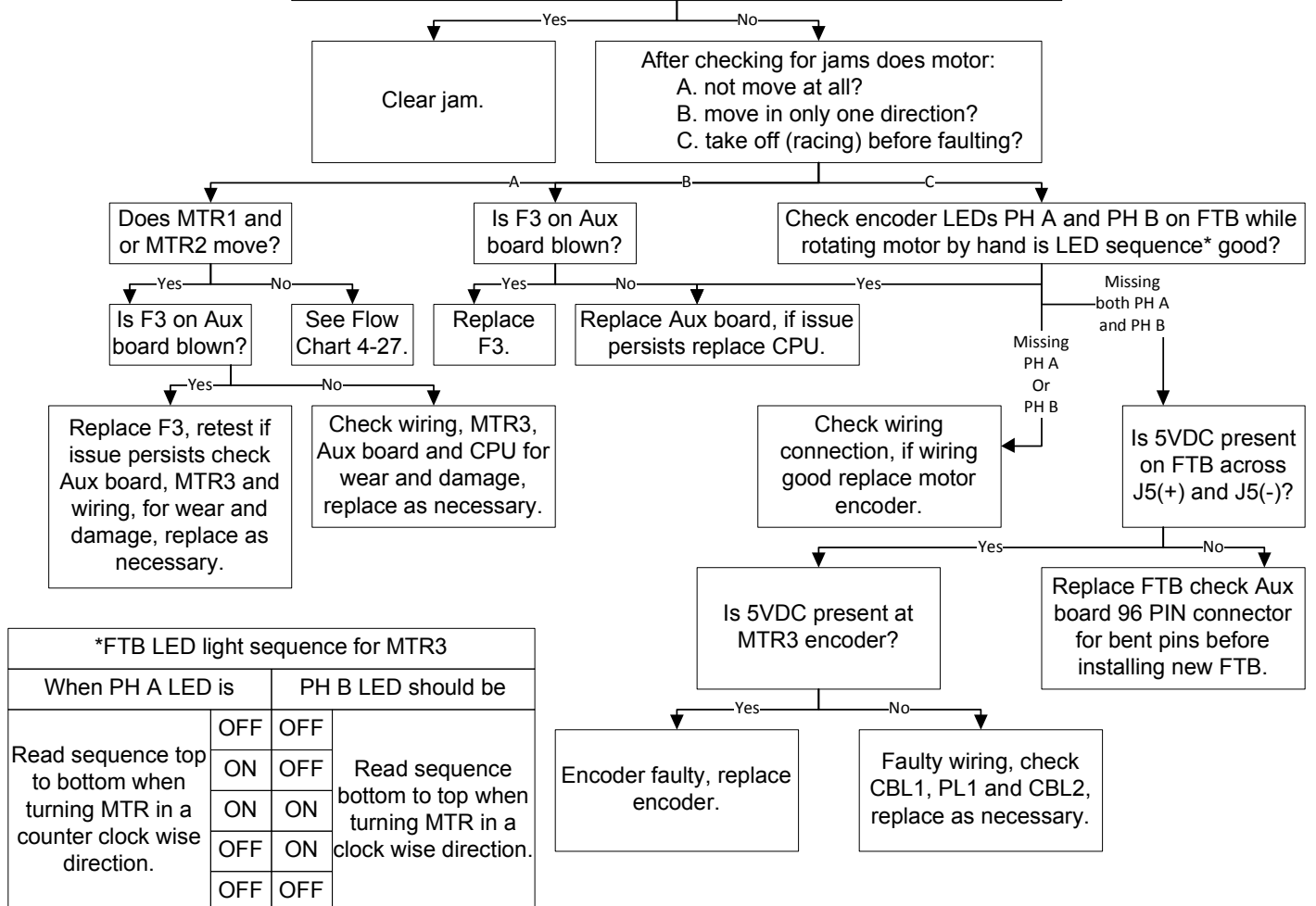
SHEAR MOTOR FUSE BLOWN, MOTOR STALLED, OR BAD ENCODER

These error codes are set when the controller is trying to move the shear motor, but the motor either isn't moving or the controller cannot tell that the motor is moving. E135 occurs only during the homing sequence. E136 occurs only at other times.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the holder shear from moving as needed. With power turned "OFF", turn the holder shear motor thru its complete range of motion (MTR3) $\geq 360^\circ$, check for debris, is a jam present?



*FTB LED light sequence for MTR3

When PH A LED is	PH B LED should be	
Read sequence top to bottom when turning MTR in a counter clock wise direction.	OFF	OFF
	ON	OFF
	ON	ON
	OFF	ON
	OFF	OFF
Read sequence bottom to top when turning MTR in a clock wise direction.		

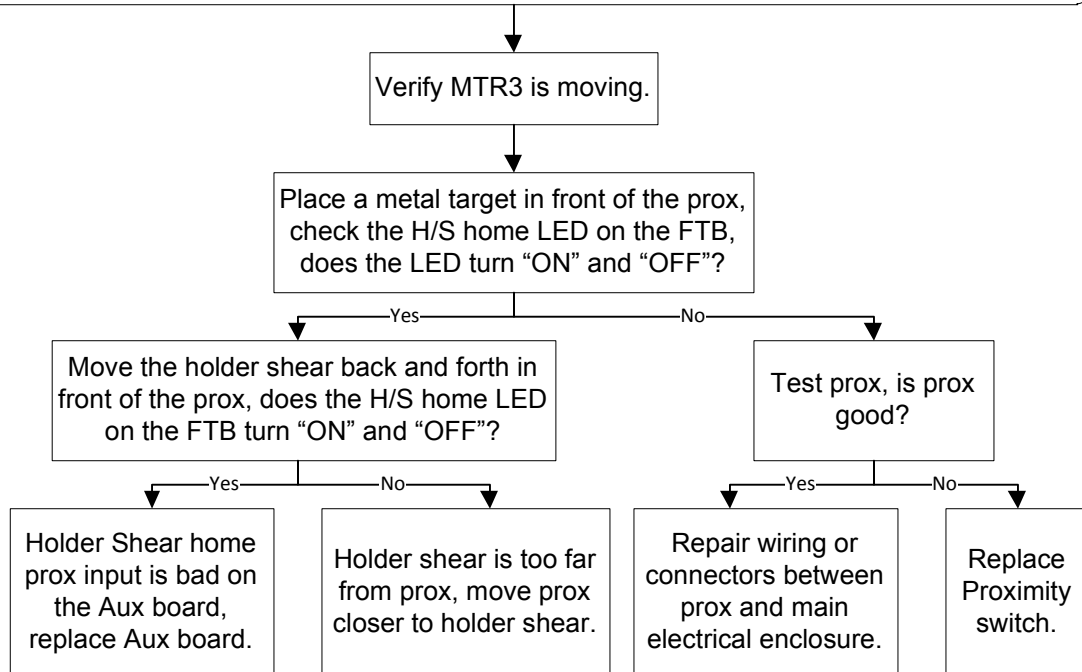
Flow Chart 0-23 E135 And E136 Error Code

E137**SHEAR MOTOR HOME PROX NOT DETECTED**

This error code is set when the controller is trying to home the shear motor and its motor is moving, but the home prox doesn't turn "ON" or "OFF" as expected.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



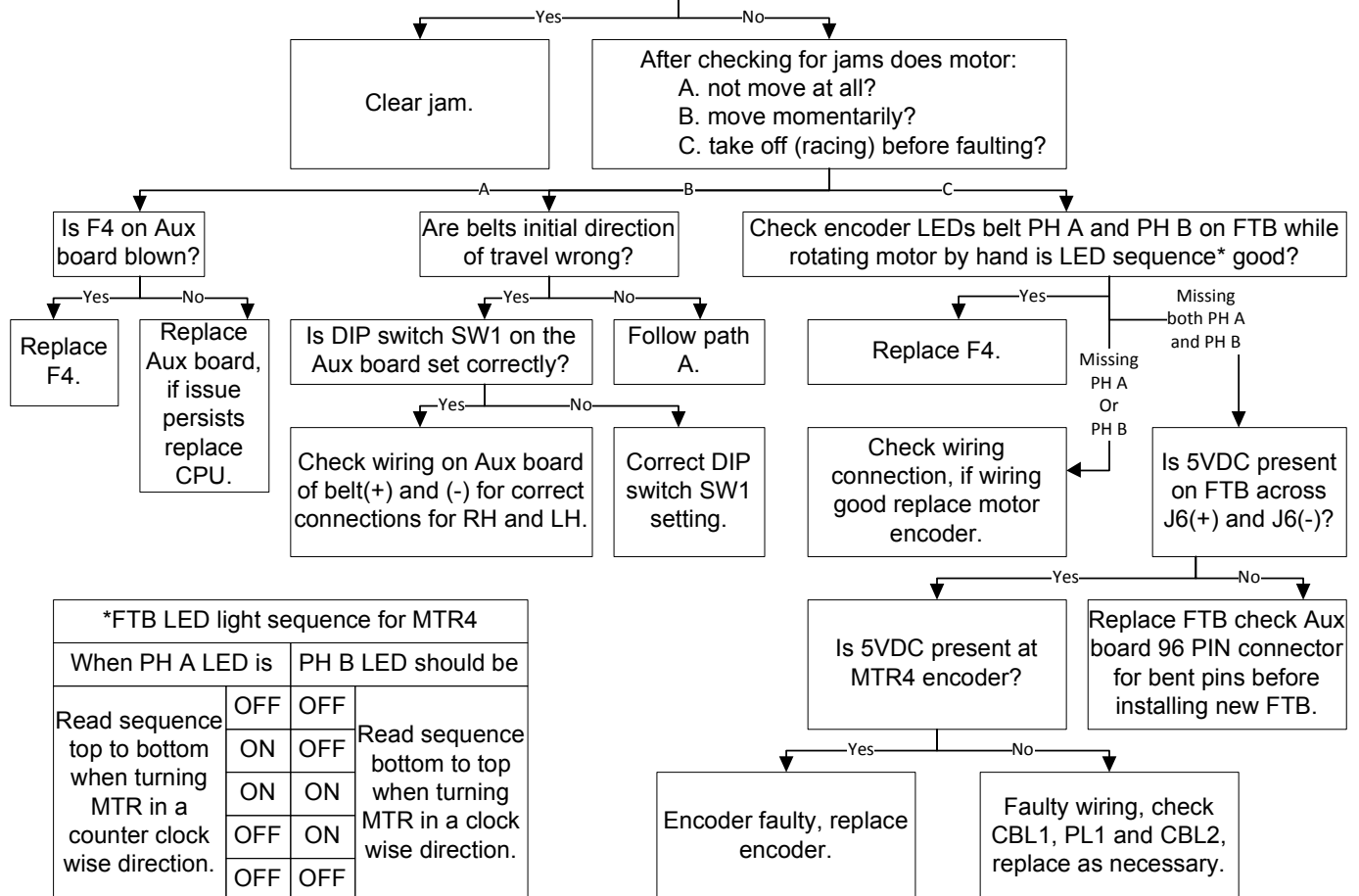
E146**BELT MOTOR FUSE BLOWN, MOTOR STALLED, OR BAD ENCODER**

These error codes are set when the controller is trying to move the belt motor, but the motor either isn't moving or the controller cannot tell that the motor is moving.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error is a mechanical obstruction or jam which is preventing the belts from moving as needed. With power turned "OFF", turn the belts motor thru its complete range of motion, (MTR4) > 360° check for debris, is a jam present?

***FTB LED light sequence for MTR4**

When PH A LED is	PH B LED should be	
Read sequence top to bottom when turning MTR in a counter clock wise direction.	OFF	OFF
	ON	OFF
	ON	ON
	OFF	ON
	OFF	OFF
	Read sequence bottom to top when turning MTR in a clock wise direction.	

E151-169**MICROPROCESSOR ERROR**

These error codes are all related to the microprocessor. They may be software or hardware problems. Usually, these problems are caused by electrical noise and will go away when power is cycled.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

Switch the disconnect switch on the main enclosure to "OFF" to reset the microprocessor, wait five (5) seconds, turn the disconnect "ON" and check for normal operation, if problem persists replace CPU, re-test, if problem persists replace Aux board.

E201**TWO OR MORE MOTORS APPEAR TO BE NOT MOVING**

This error code means that two or more of the Error Codes E115, E125, E135, and E146 have been detected at the same time.

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The most likely reason for this error code is that the DC power is not getting to the AUX board, is FU3 in the main enclosure blown?

Yes

No

Replace fuse.

Watch the DC power contactor CR1 in the main enclosure, push the "RUN" button, does the motor DC power contactor engage?

Yes

No

Measure motor supply voltage at the large capacitor CAP1, is 28-36VDC present?

Use Figure 5-23 to troubleshoot the DC power latch circuit.

Yes

No

Normal, re-start a homing sequence while measuring the voltage at the Aux board connector, is about 34VDC present?

Yes

No

Watch the four servo motors for erratic or abnormal movement, re-start the tyer, do one or more of the motors begin moving?

Repair wiring from DC power contactor to AUX board.

Yes

No

Depending upon which motor is acting erratic, troubleshoot the problem using the Flow Chart for error codes E115, E125, E135, and E146.

Check the PL3 is in good condition and seated properly before replacing AUX board.

Check for AC voltage at AC terminals of rectifier bridge, is 20-27VAC present?

Yes

No

Check DC voltage on DC terminals of bridge, if greater than 24V repair wiring from bridge to large capacitor, if less than 20 volts replace the bridge rectifier.

You have a bad connection to the transformer, or possibly a bad transformer.

Flow Chart 0-27 E201 Error Code

E300**MICROPROCESSOR STACK OVERFLOW ERROR**

This error code is related to the microprocessor. Usually, this problem will go away when power is cycled.

SAFETY WARNING:

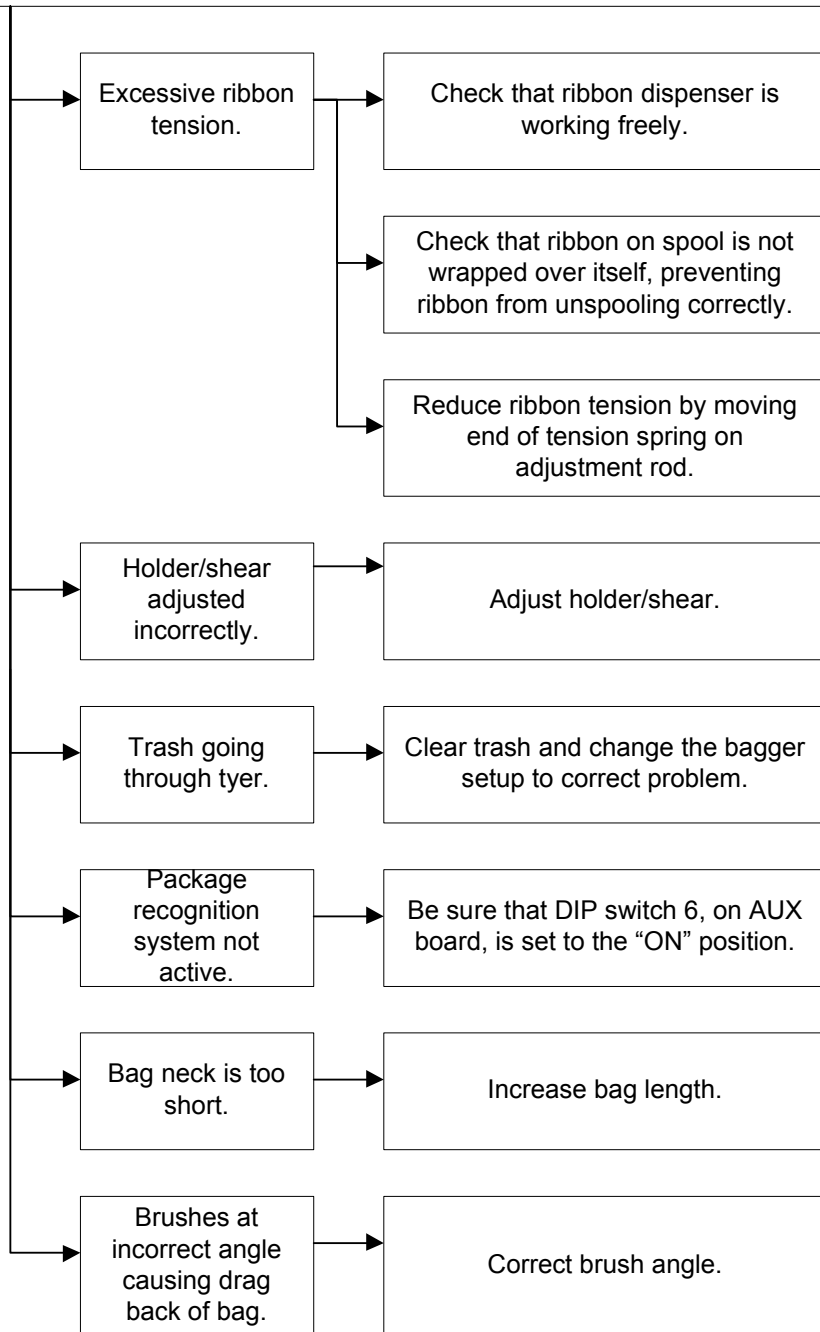
The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

Turn "OFF" the disconnect switch on the main enclosure to reset the microprocessor, wait five (5) seconds, turn "ON" the disconnect switch, check for normal operation. If the problem persists, replace the CPU board.

Excessive ribbon drops

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



Flow Chart 0-29 Excessive Ribbon Drops

Ribbon drops during homing sequence

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

Holder/shear
adjustment is
slightly too
loose.

Move cam
followers slightly
closer to cam.

Flow Chart 0-30 Ribbon Drops During Homing Sequence

Needle punches a hole through the bag neck

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

Bag switch arm
is set too low,
allowing false
indication of bag
trailing edge.

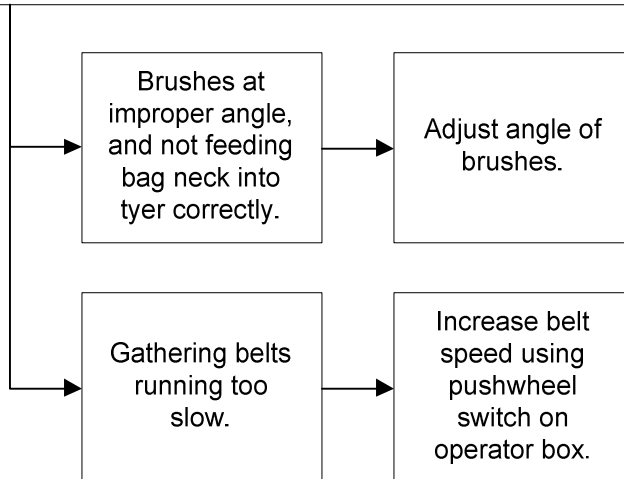
Raise the end of the
bag switch arm.
Reset bag switch
arm to factory
specification.

Flow Chart 0-31 Needle Punches Holes Through Bag Neck

Bags drag back hard against the flight after being tied

SAFETY WARNING:

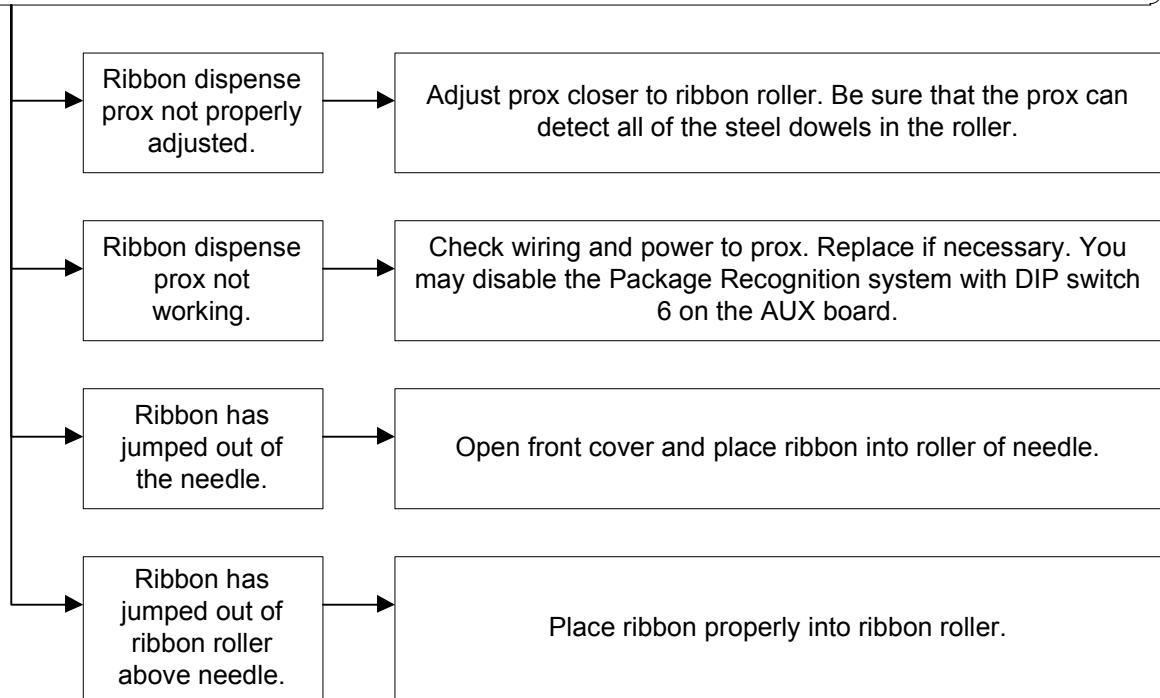
The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



Tyer aborts tie cycle of apparently good package

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

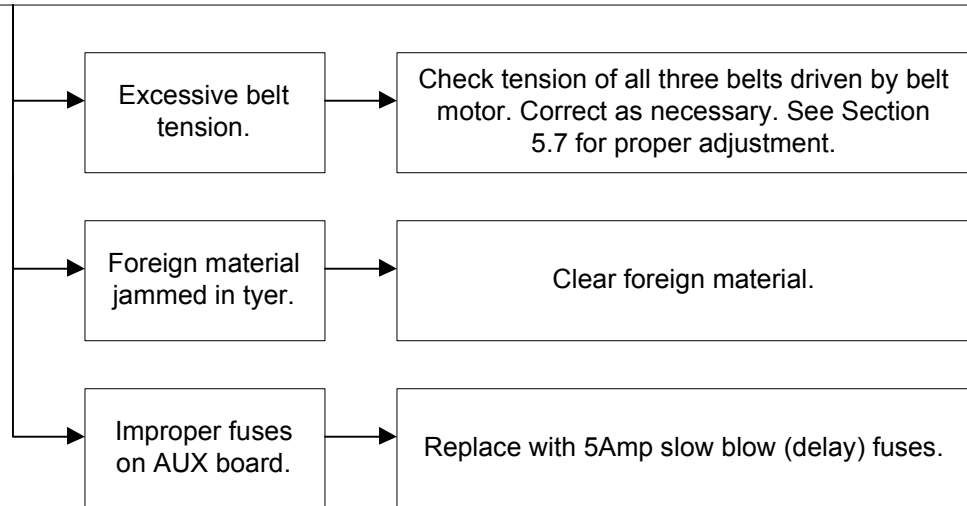


Flow Chart 0-33 Tyer Aborts Cycle On Good Package

Excessive Belt Motor fuse failures on AUX board

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

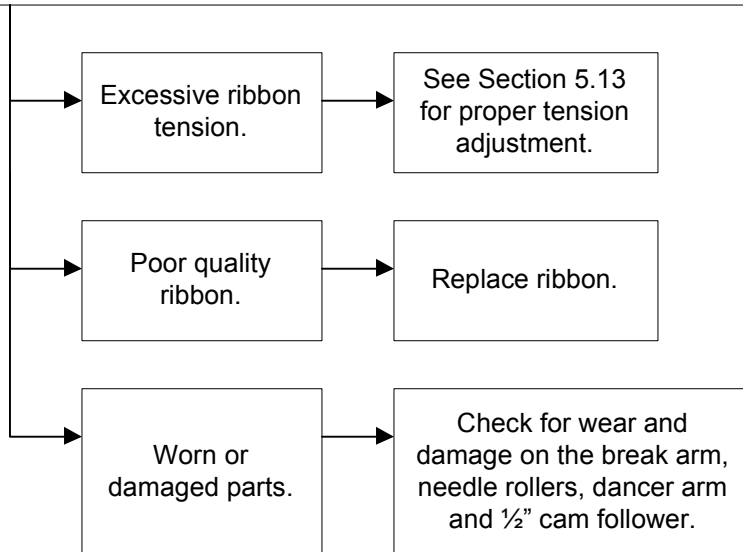


Flow Chart 0-34 Excessive Belt Fuse Failure

Twist tie ribbon breaks during tying operation

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

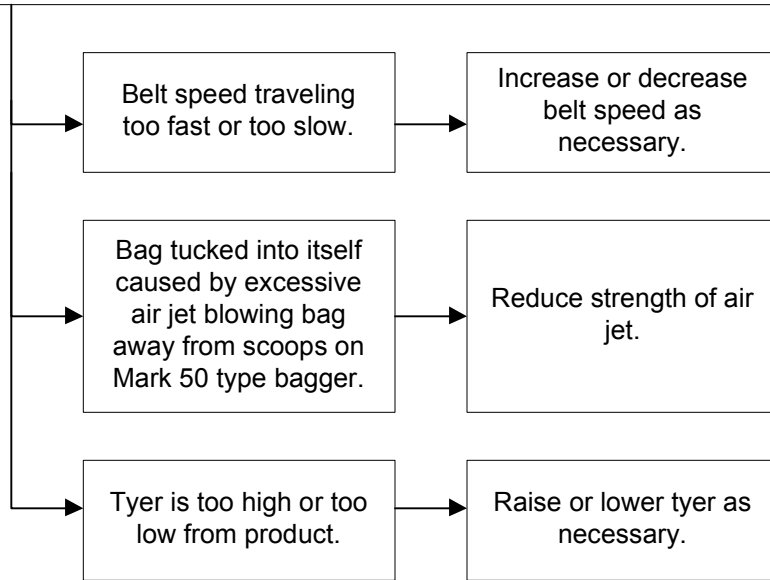


Flow Chart 0-35 Twist Tie Breaks During Tying

Ties are not centered on product

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

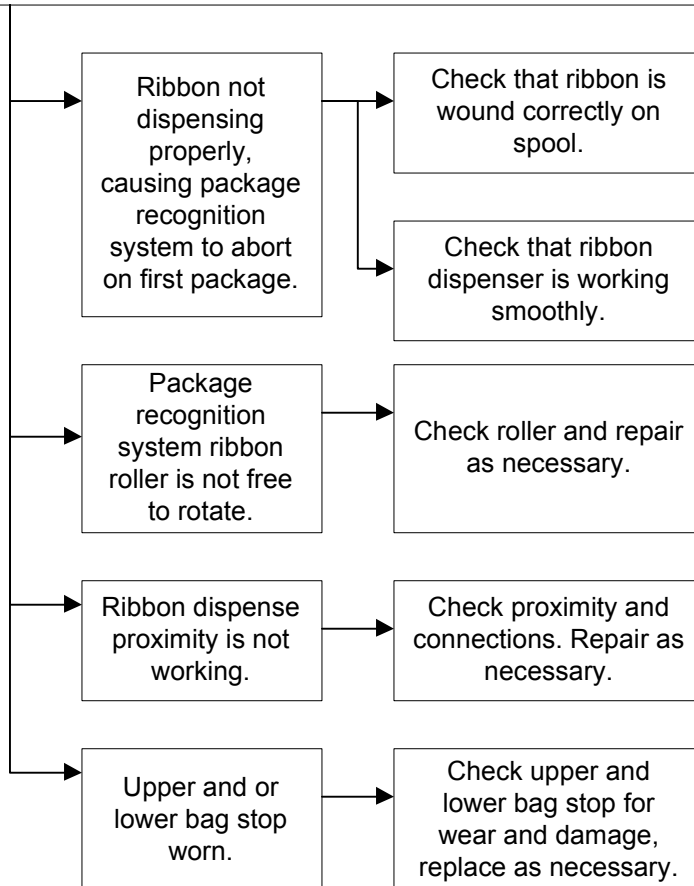


Flow Chart 0-36 Ties Not Centered On Product

Two packages tied together with one ribbon

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

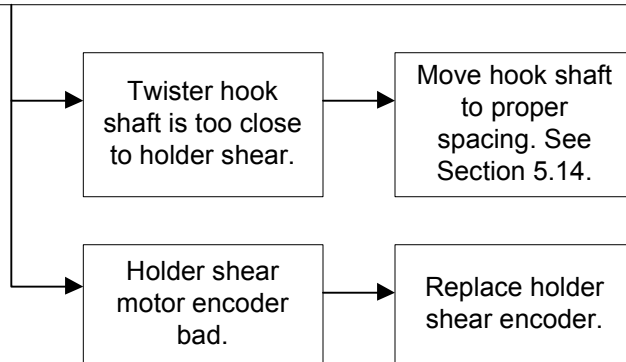


Flow Chart 0-37 Two Packages Tied Together

Ribbon wraps around twister hook shaft

SAFETY WARNING:

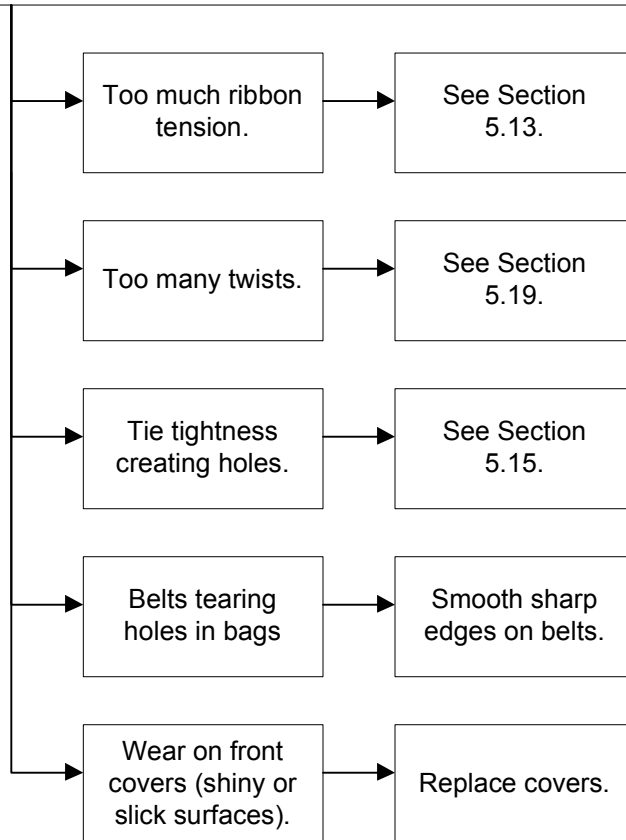
The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



Holes being formed in the bag

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

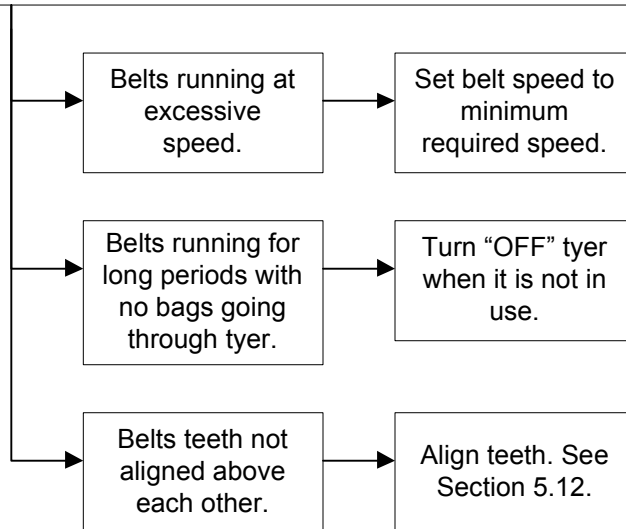


Flow Chart 0-39 Holes Being formed In Bag

Excessive wear on gathering belts

SAFETY WARNING:

The following troubleshooting procedure may require that tests be made with the electrical enclosures open and power turned "ON". These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.



Flow Chart 0-40 Excessive Wear on Gathering Belts

Chapter 8

Maintenance

CHAPTER 8: MAINTENANCE

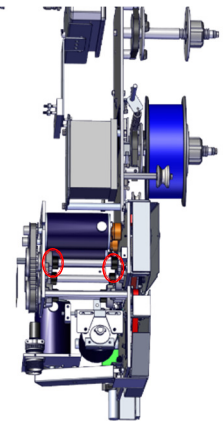
This Unit is NOT wash-down ready. Do NOT use any form of high pressure cleaning systems on this unit.

When working with the Servo Tyer, the following points should be observed.

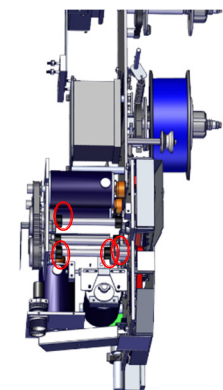
1. This activity should only be conducted by qualified personnel. When troubleshooting a problem, it may be necessary to have the Main Enclosure open in order to view the status lights or to make voltage checks while the machine is operating. Proper safety precautions should be taken.
2. Never place your hands in a position where you can be injured if a motor suddenly started running at high speed.

■ Lubrication

The two-flanged bearings supporting the needle shaft should be lubricated twice a year.



The three bearings supporting the drive shafts for the gathering belts should be lubricated once a month when the tyer is normally running at speed settings of 12 or more. When the tyer runs at lower speeds, lubricating once every 3 months is sufficient.



■ Preventive Maintenance

Burford® Corp. recommends the following preventive maintenance schedule to insure proper performance of your Servo Tyer.

■ Daily

1. Clear bags and excess debris from brush assembly.

■ Weekly

1. Check to insure cable connectors, located on the control panel and under the Servo Tyer, are tight.
2. Insure all ribbon rollers turn freely and the dancer arm releases ribbon in the proper position.
3. Insure all switches and lights function properly.

■ Monthly

1. Check all belts for wear and proper tension.
2. Check to insure belt guide moves freely.
3. Check bag switch arm for proper function and gap setting from needle pg. 70.
4. Check "V" belt adjustment, adjust as necessary.

■ Quarterly

1. Check and replace upper and lower belt if necessary (check idler pulleys while changing belt).
2. Check and replace needle rollers and their bushings if necessary.
3. Properly adjust ribbon tension.
4. Ensure proximity switches are working properly by testing with LED's.
5. Ensure encoders are working properly by testing with LED's.
6. Check mechanical gaps and adjustments: 3/32" between twister and Holder/Shear, .030-.050 inch on all proximity gaps, adjust as necessary.

■ Preventive Maintenance, cont'd

■ Semi-Annually

1. Check DIP switches for proper settings (pg.88).
2. Check bag stop for wear, replace as necessary (pg.37).
3. Check brake arms and cam followers on dancer arms (pg. 34).
4. Check bag switch wear, replace as necessary (pg. 28).
5. Check Holder/Shear wear, replace as necessary (pg. 25).
6. Check dancer arm (bushing wears out causing arm to rub frame plate).

■ Yearly

1. Check the twister hook assembly for wear, replace as necessary.
2. Check the shuttle bar bearing block for wear, replace as necessary.
3. Check the shuttle bar bushing and holder shear for wear, replace as necessary.
4. Check "V" belt for wear, replace as necessary.
5. Check front covers (upper and lower excessive shine will cause holes in the bags), replace as necessary.
6. Check drive shaft bearings for excessive wear, replace as necessary.

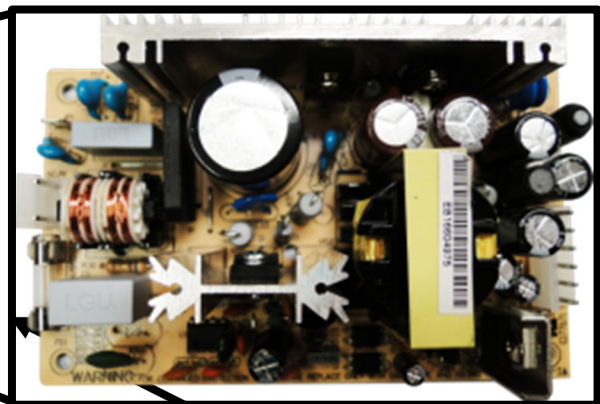
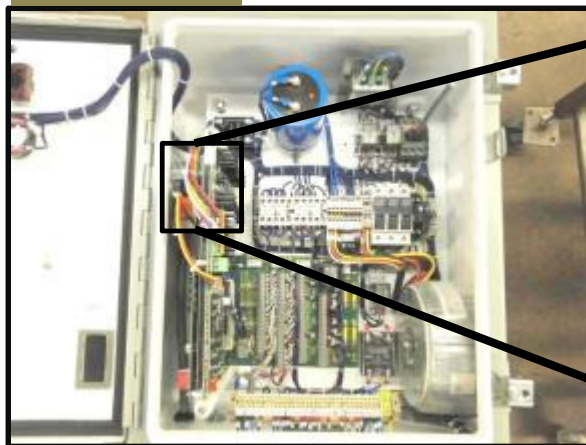
■ 24 Month

1. Check motor assemblies for wear or damage, replace as necessary.
2. Check all motor drive belts for wear and damage, replace as necessary.
3. Check needle for wear and damage, replace as necessary.

■ Power Supply Board Fuse Replacement

1. The power supply board (PN#-C07170) is secured to a plate located behind the Aux board. To replace the fuse, follow the steps listed below.
2. Turn the disconnect switch on the main enclosure to off.
3. Unscrew the two (2) screws securing the Aux board to the main enclosure.
4. Carefully remove the Aux board gently pulling it straight out so as not to bend the connection pins.
5. Unscrew the two (2) screws securing the plate securing the power supply to the main enclosure.
6. Replace the 2 Amp fuse (PN#-C07138).
7. Reverse this process to reinstall boards.

**Main
Enclosure**



**Power Supply
Board Fuse**

■ Operating Voltages

The following voltages should be referenced from DC common, wire 22.

NAME	WIRE NUMBER	VOLTAGE
5 VDC	15	4.7 – 5.3 VDC
12 VDC	23	11.5 – 12.5 VDC
36 VDC	24	32.0 – 36.0 VDC
36 RET	20	0.0 – 0.2 VDC

Chapter 9

Test Procedures

CHAPTER 9: TEST PROCEDURES

■ Motor Encoders Test Procedure

SAFETY WARNING: The following procedure may require that tests are made with the electrical enclosures open and power turned “ON”. These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

An encoder can be checked for proper operation by following these steps.

1. Open the Main Enclosure.
2. Turn the disconnect switch ON.
3. Push the “ON” button located on the door to engage power.
4. While turning the shaft of the motor very slowly, observe the Light Emitting Diodes (LEDs) on the Field Termination Board. The eight (8) encoder LEDs are labeled “BELT Phase A”, “BELT Phase B”, “H/S Phase A”, “H/S Phase B”, “NEEDLE Phase A”, “NEEDLE Phase B”, “TWISTER Phase A”, and “TWISTER Phase B”. As you turn a motor, its encoder LEDs should be turning on and off. Only one of the LED's should toggle at any given time. However, the motor must be turned very slowly in order to observe this sequence because each LED turns ON and OFF 500 times per motor revolution.

Main Enclosure



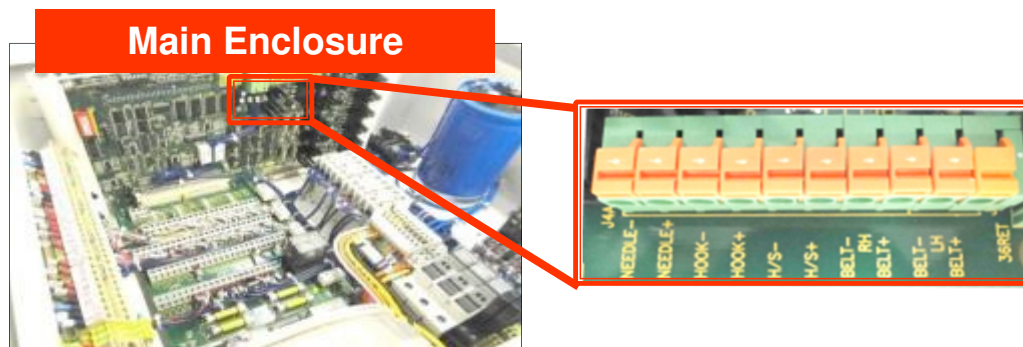
If an encoder lead is broken or disconnected that LED will be ON all the time.

■ Motor Continuity Test Procedure

The following procedure may require that tests are made with the electrical enclosures open and power turned “ON”. These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The servo motor leads are attached to the connector on the edge of the Auxiliary Board. A motor can be tested for continuity by following these steps.

4. Turn the disconnect switch located on the Main Enclosure to “OFF”.
5. Note the location and wire numbers of the motor to be tested. Disconnect the wires of the motor from the Auxiliary board.
6. Attach ohmmeter leads to the motor wires. The ohmmeter reading should be 1 ohm or less. If not, go to Step 5.
7. While continuing to measure the resistance, wiggle the motor connector that goes into the bottom of the Servo Tyer. If your meter reading changes drastically while you are wiggling the connector, disconnect the connector and check for motor pins that are arcing or not making good contact. Sometimes, the pins in the connector tend to get pushed out of the connector when it is connected to the Servo Tyer.
8. If the test in Step 3 indicates an open circuit, disconnect the motor connector that goes into the bottom of the Servo Tyer and determine whether the break in continuity is in the cable or on the motor side of the connector. Check for motor pins that are arcing or not making good contact. Sometimes, the pins in the connector tend to get pushed out of the connector when it is connected to the Servo Tyer.

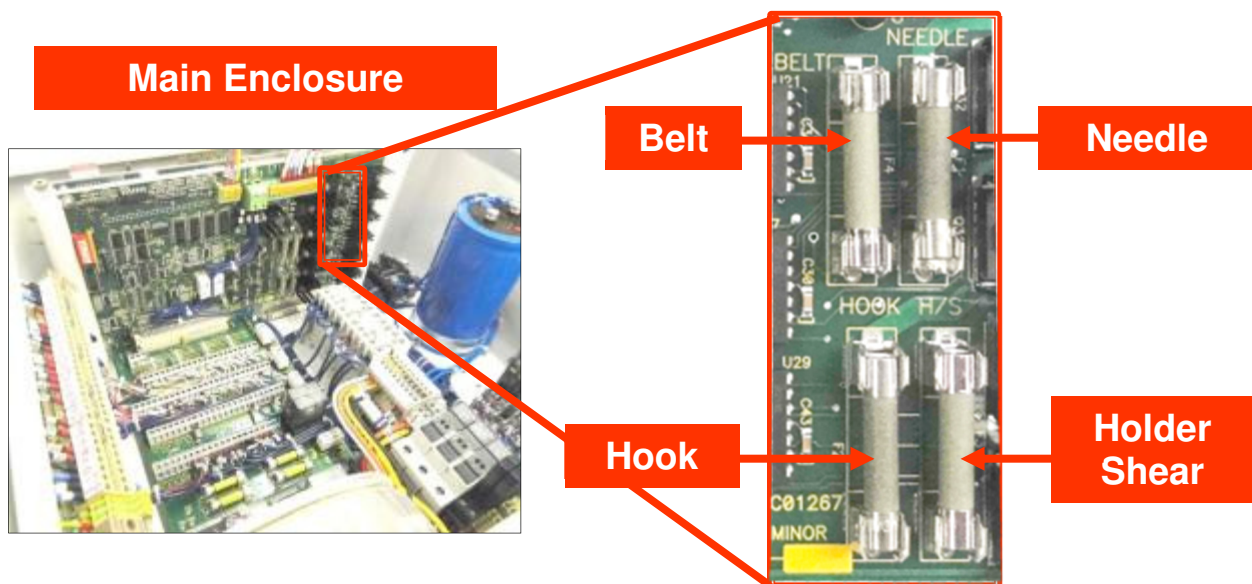


■ Servo Motor Fuses Test Procedure

The following procedure may require that tests are made with the electrical enclosures open and power turned “ON”. These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The fuses for the four (4) servo motors are located on the Auxiliary board. The motor fuses can be checked by following these steps.

1. Turn the disconnect switch located on the Main Enclosure to “OFF”.
2. Locate the Auxiliary board on the electrical panel.
3. Remove the desired fuse from the Auxiliary board. The Auxiliary board is labeled for fuse identification. This should be done carefully so as not to damage the traces under the fuses. Never use a metal screwdriver.
4. With the fuse removed, check it with an ohmmeter. The resistance of any of these fuses should be less than 1 ohm.



■ 36 Volt DC Power For Motors Test Procedure

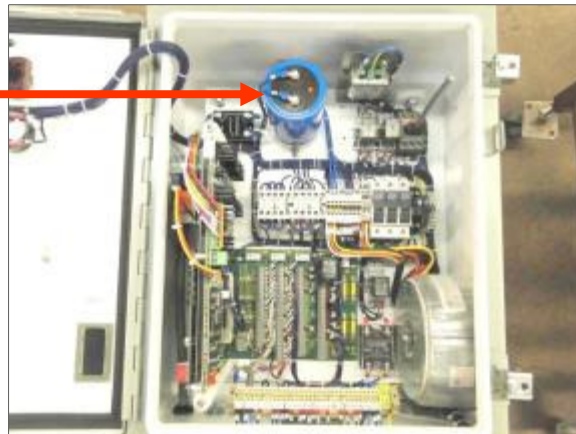
The following procedure may require that tests are made with the electrical enclosures open and power turned “ON”. These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The 36-volt DC power can be checked by following these steps.

1. Open the Main Enclosure.
2. Turn the disconnect switch on.
3. Push the “ON” button located on the door to engage main power.
4. Using a DC voltmeter, measure the voltage across the terminals of the large 75VDC capacitor (CAP1). The voltage should be 32 to 36 VDC.

Main Enclosure

**75VDC
Capacitor
(CP1)**



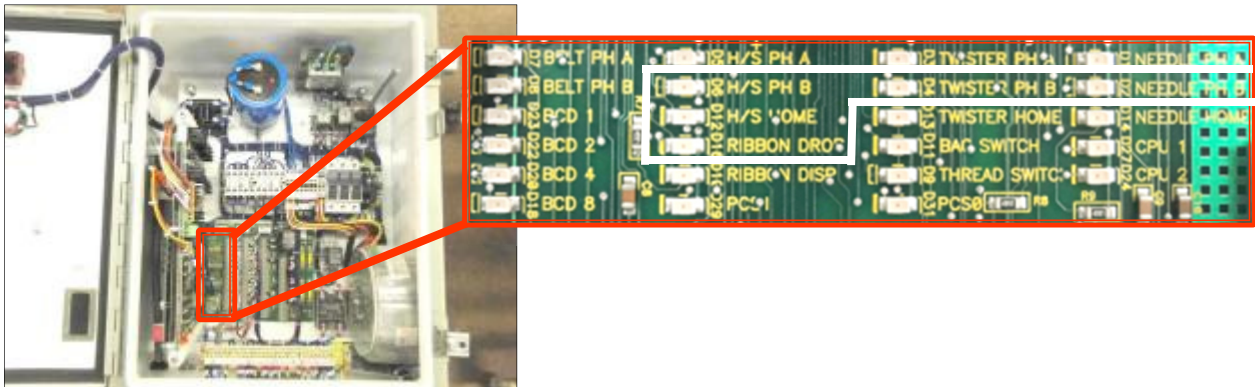
■ Proximity Switch LEDs Test Procedure

The following procedure may require that tests are made with the electrical enclosures open and power turned “ON”. These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

A proximity sensor can be checked for proper operation by following these steps.

1. Open the Main Enclosure.
2. Turn the disconnect switch on.
3. Push the “ON” button located on the door to engage main power.
4. The 5 proximity LEDs are labeled “NEEDLE HOME”, “TWISTER HOME”, “H/S HOME”, “RIBBON DROP” and “RIBBON DISP”.
5. While triggering the proximity switch with a piece of metal, observe the LED on the Field Termination Board. The LED corresponding to the proximity switch being triggered should come on when the proximity switch is triggered.

Main Enclosure



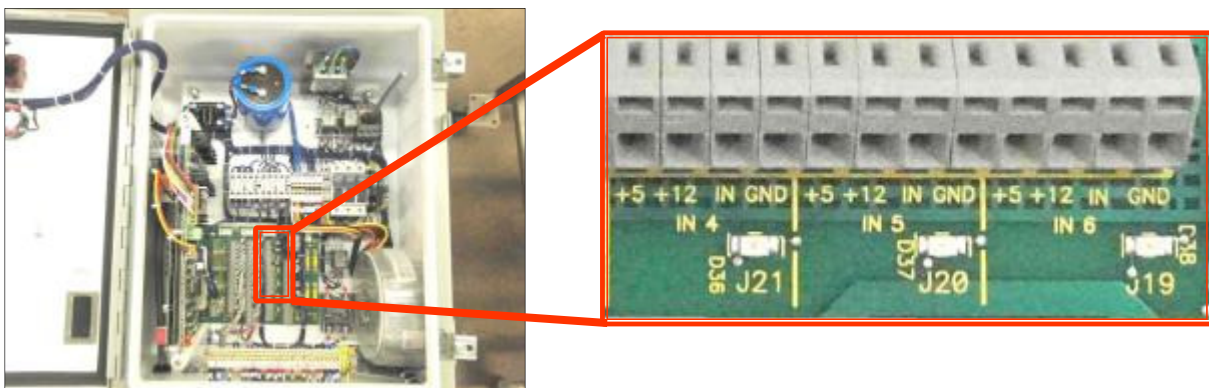
■ 5 And 12 Volt D.C. Power Supply Test Procedure

The following procedure may require that tests are made with the electrical enclosures open and power turned “ON”. These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The 5 volt and 12 volt D.C. power supply can be checked for proper operation by following these steps.

1. Open the Main Enclosure.
2. Turn the disconnect switch ON.
3. Push the “ON” button located on the door to engage main power.
4. Locate I/O terminal blocks J19, J20 and J21 on the FTB, each of these contain a +5VDC, +12VDC, and GND (COM) access point. Use any of these to test the 5V and 12V power supply.
5. Measure the voltage between the common (GND) and +5VDC terminals, this should read 4.9VDC to 5.1VDC.
6. Measure the voltage between the common (GND) and +12VDC terminals, this should read 11.5VDC to 12.5VDC.

Main Enclosure



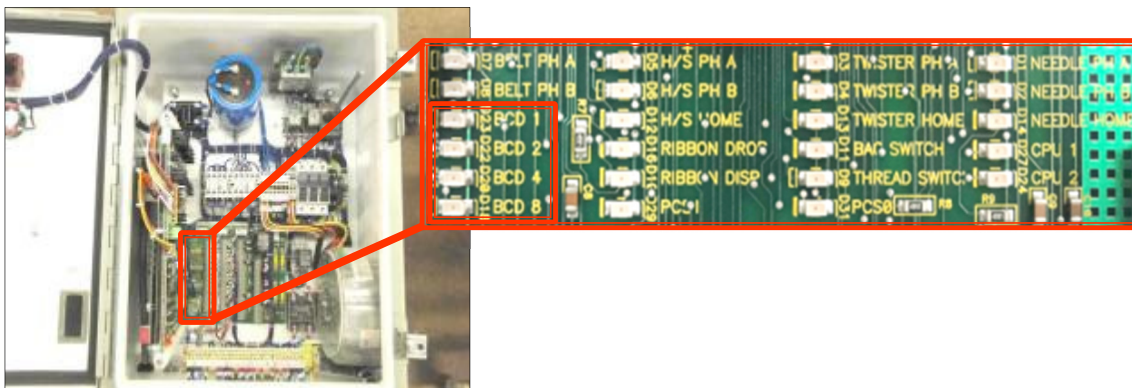
■ BCD Switch Test Procedure

The following procedure may require that tests are made with the electrical enclosures open and power turned “ON”. These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The BCD switch controls the speed of the gathering belts. It can be checked for proper operation by following these steps.

1. Open the Main Enclosure.
2. Turn the disconnect switch on.
3. Push the “ON” button located on the door to engage power.
4. Locate the BCD LEDs on the Field Termination Board. The 4 BCD LEDs are labeled “BCD 1”, “BCD 2”, “BCD 4” and “BCD 8”.
5. Observe the LEDs while changing the setting of the BCD switch, located on the Control Panel. The LEDs should display in binary whatever is set on the switch. For example, if the switch is set at 11 the LEDs labeled “BCD 1”, “BCD 2”, and “BCD 8” (1+2+8=11) should be on. All the BCD LEDs should be on at the setting of 15, and they all should be off at the setting of 0.

Main Enclosure



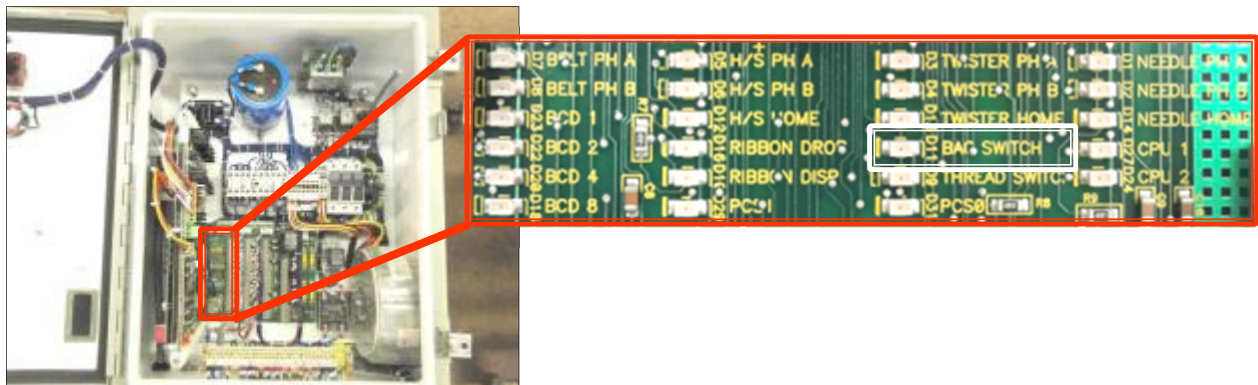
■ Bag Switch Test Procedure

The following procedure may require that tests are made with the electrical enclosures open and power turned “ON”. These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

The bag switch can be checked for proper operation by following these steps.

1. Open the Main Enclosure.
2. Turn the disconnect switch on.
3. Push the “ON” button located on the door to engage power.
4. Locate the bag switch LED on the Field Termination Board. The bag switch LED is labeled “BAG SWITCH”.
5. Observe the LED while pressing the wand of the bag switch down. The LED should light up when the wand is pushed down.

Main Enclosure

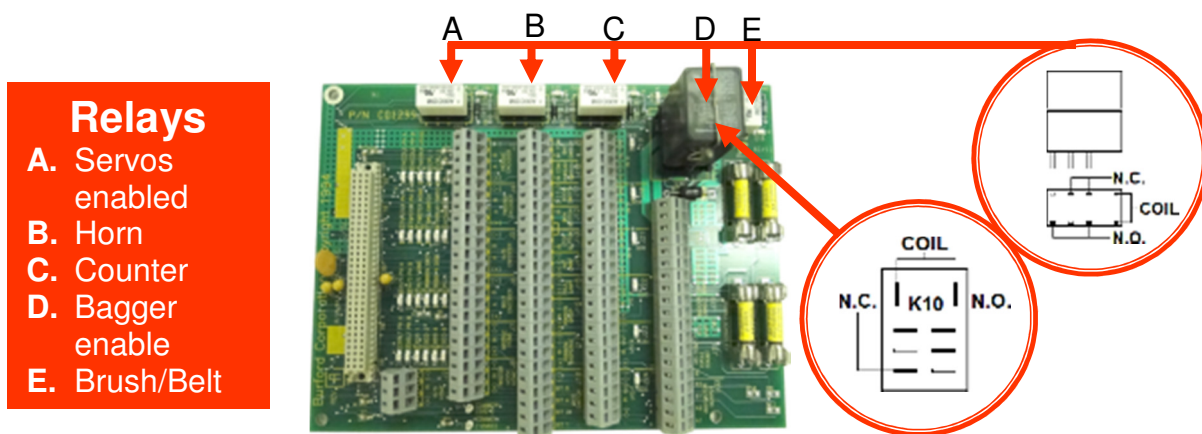


■ Field Termination Board Relays Test Procedure

The following procedure may require that tests are made with the electrical enclosures open and power turned “ON”. These tests should only be conducted by authorized personnel who are aware of the electrical and mechanical hazards present.

There are two different types of relays on the Field Termination Board. “CR2”, “CR4”, “CR5”, and “CR6” are 12VDC relays and CR3 is a Potter & Brumfield K10P-11D15-12 (K10) relay. The K10 is a 12VDC relay. The relays can be tested by following these steps.

1. Turn the disconnect switch located on the Main Enclosure to “OFF”.
2. Remove the desired relay from the board (make note of the position in which it is plugged in).
3. Use figure below to identify the pins for the coil of each relay. Check the coil of the relay with an ohmmeter. The resistance of the dc relay coils should be about 925 Ohms. The resistance of the K10 relay coil should be about 4000 Ohms.
4. Check the resistance of the Normally Closed (NC) contacts. The resistance should be less than 1 Ohm. Check the resistance of the Normally Open (NO) contacts. The resistance should be infinite.



All relays must be inserted correctly, note pin out on circuit board silk screen.

■ Operator Test

- 1. Brush settings remain the same for all varieties.**
 - a) True
 - b) False
- 2. The belt speed should pull the package how far in front of the flight?**
 - a) 1-2 feet
 - b) 1-2 inches
 - c) 9.43 inch
 - d) 0 inches
- 3. To Home the Tyer which button should be pressed and held?**
 - a) The Home button
 - b) The Thread button
 - c) The Run button
 - d) The Stop button
- 4. Which side of the spool should the ribbon feed from?**
 - a) Top
 - b) Bottom
 - c) Doesn't matter
- 5. What happens when excessive tension is applied to the spool system?**
 - a) Ribbon Drop
 - b) Off-center tie
 - c) Too much ribbon used
 - d) Nothing whatsoever

■ Mechanics Test**1. What is the main cause of two bags being tied together?**

- a) Upper and/or lower bag-stop worn out
- b) Belt Speed set to fast
- c) Bag hanging on twister hook
- d) All of the above

2. What are the signs of worn or wearing out gathering belts?

- a) Plenty of red material
- b) The belts don't really matter
- c) Slick or scalloping with black showing through the red
- d) Visible writing on the belts

3. When you have an error code of 111 through 146 what does the middle number represent?

- a) Name of motor involved
- b) Ribbon color
- c) Placement of Prox
- d) Not a thing

4. When dealing with a motor error code what are the four main check points?

- a) Ribbon, Belts, Encoder, Motor
- b) Belt speed, Ribbon Tension, Brush Settings, Cam Followers
- c) Fuse, Prox, Motor, Encoder
- d) Boards, Wiring, Prox, Drive Belt

- 5. Adjusting the holder/shear to tightly could result in a broken pivot bolt in the holder/shear or possible motor/encoder damage.**
- a) True
 - b) False
- 6. When adjusting the holder/shear you should be able to rotate the cam on the motor 360° by hand with no slack in the holder/shear.**
- a) True
 - b) False
- 7. DIP switch number one effects what function of the tyer?**
- a) Ribbon Drop
 - b) Belt speed
 - c) Tie Cycle Abort
 - d) Left/Right hand select
- 8. What is the proper gap between the needle and bag switch arm?**
- a) As wide as possible
 - b) 2 inches
 - c) .25 inches
 - d) As close as possible
- 9. What is the proper gap between the holder/shear and twister hook?**
- a) 1 inch
 - b) 5/32
 - c) 1/2 inch
 - d) 3/32 inch

10. When setting the dancer arm, the Nyloc nut at the end of the dancer arm should be in what position relative to the edge of the ribbon tension plate as the cam follower contacts the brake arm?

- a) Even with
- b) 1 inch in front
- c) 1 inch behind
- d) This setting doesn't matter

Operator Test Key
1. (a) True 2. (b) 1-2 inches 3. (b) The Thread button 4. (a) Top 5. (a) Ribbon Drop
Mechanics Test Key
1. (a) Upper and/or lower bag-stop worn out 2. (c) Slick or are scalloping with black showing through the red 3. (a) Name of motor involved 4. (c) Fuse, Motor, Encoder 5. (a) True 6. (a) True 7. (d) Left/Right hand select 8. (c) .25 inches 9. (d) 3/32 inch 10. (a) Even with

Chapter 10

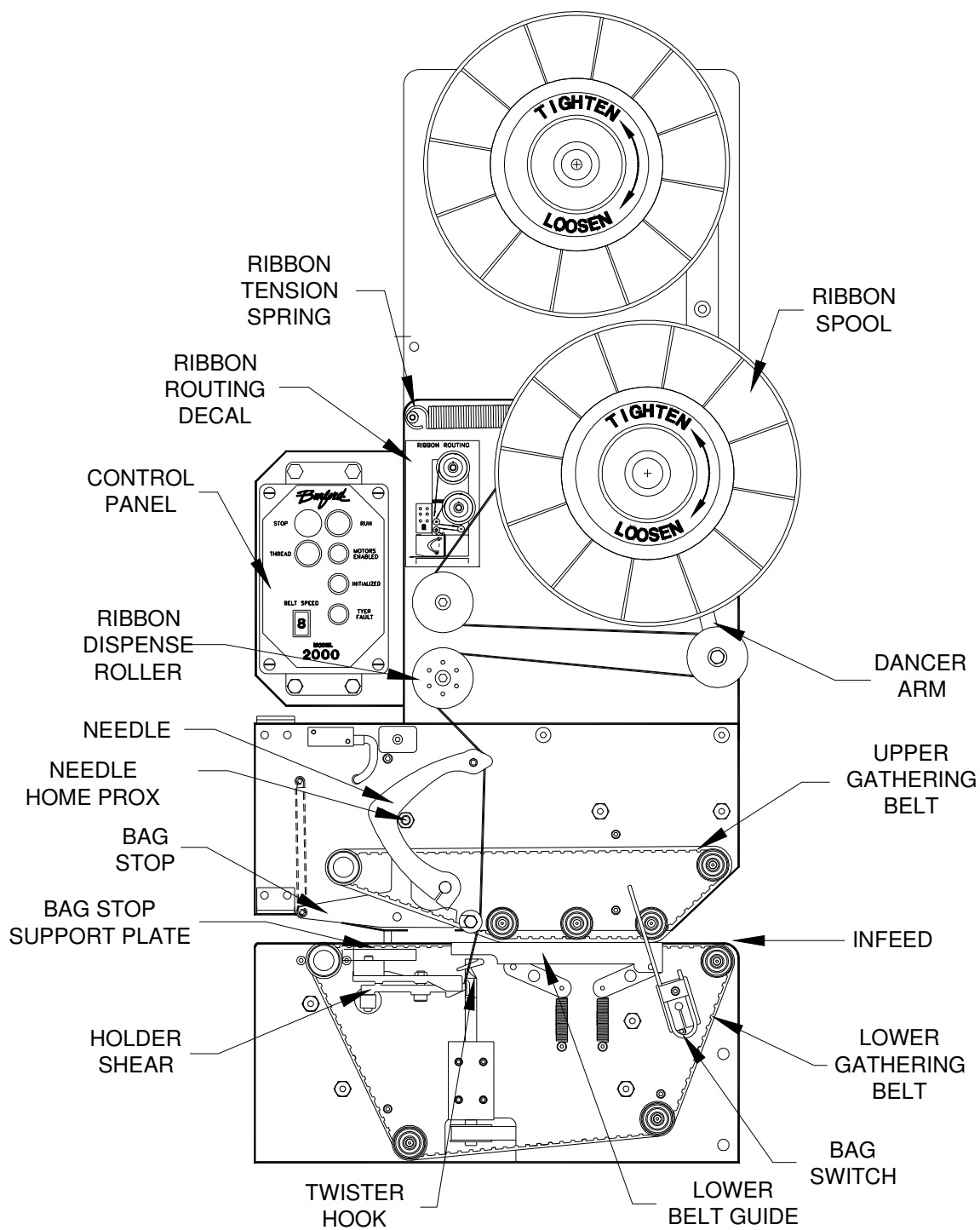
Parts and Drawings

CHAPTER 10: PARTS AND DRAWINGS.

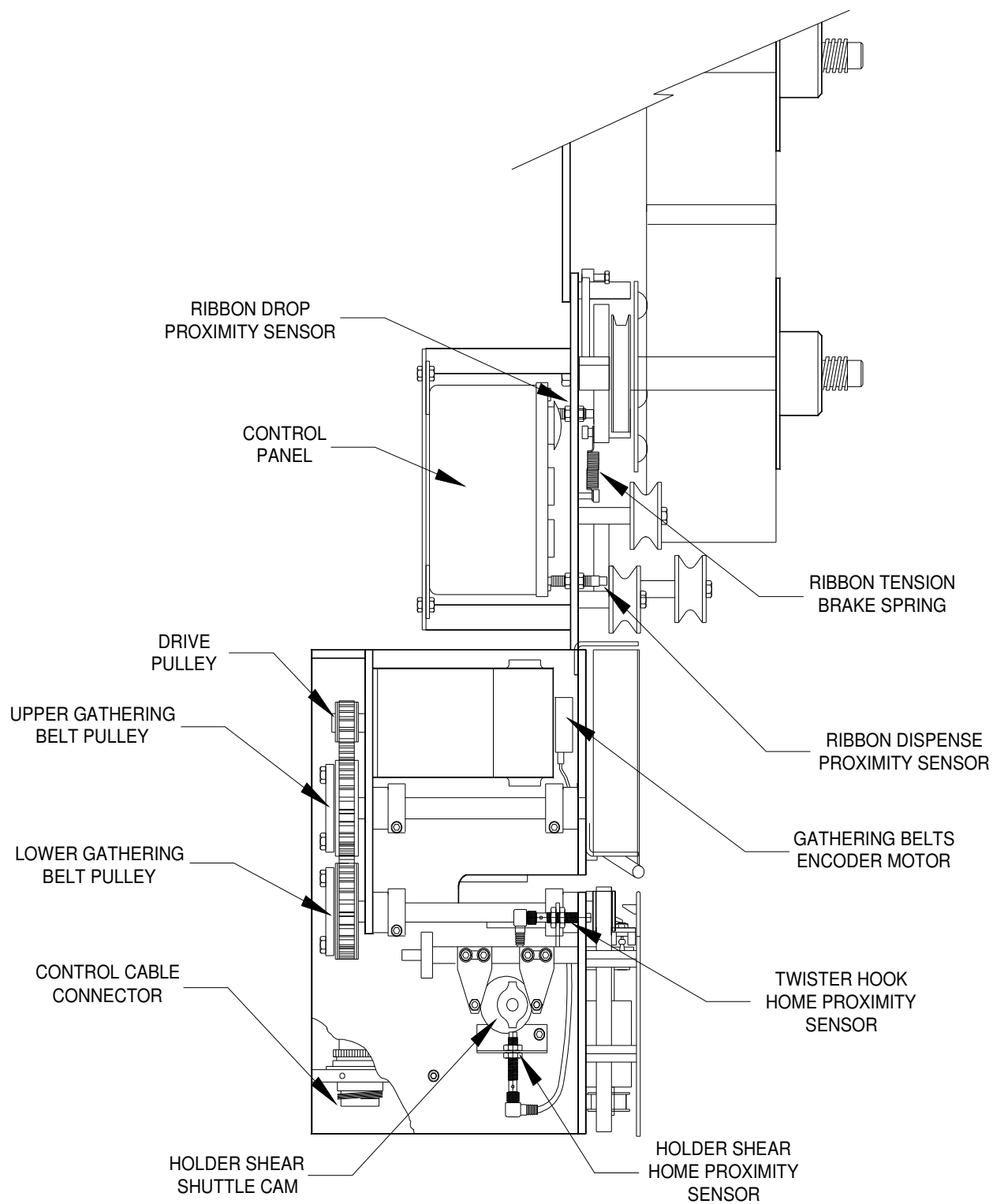
■ RECOMMENDED SPARE PARTS LIST

In order to prevent unnecessary down time, Burford® Corp. recommends the list of parts located in the Drawings and Parts section be kept in stock.

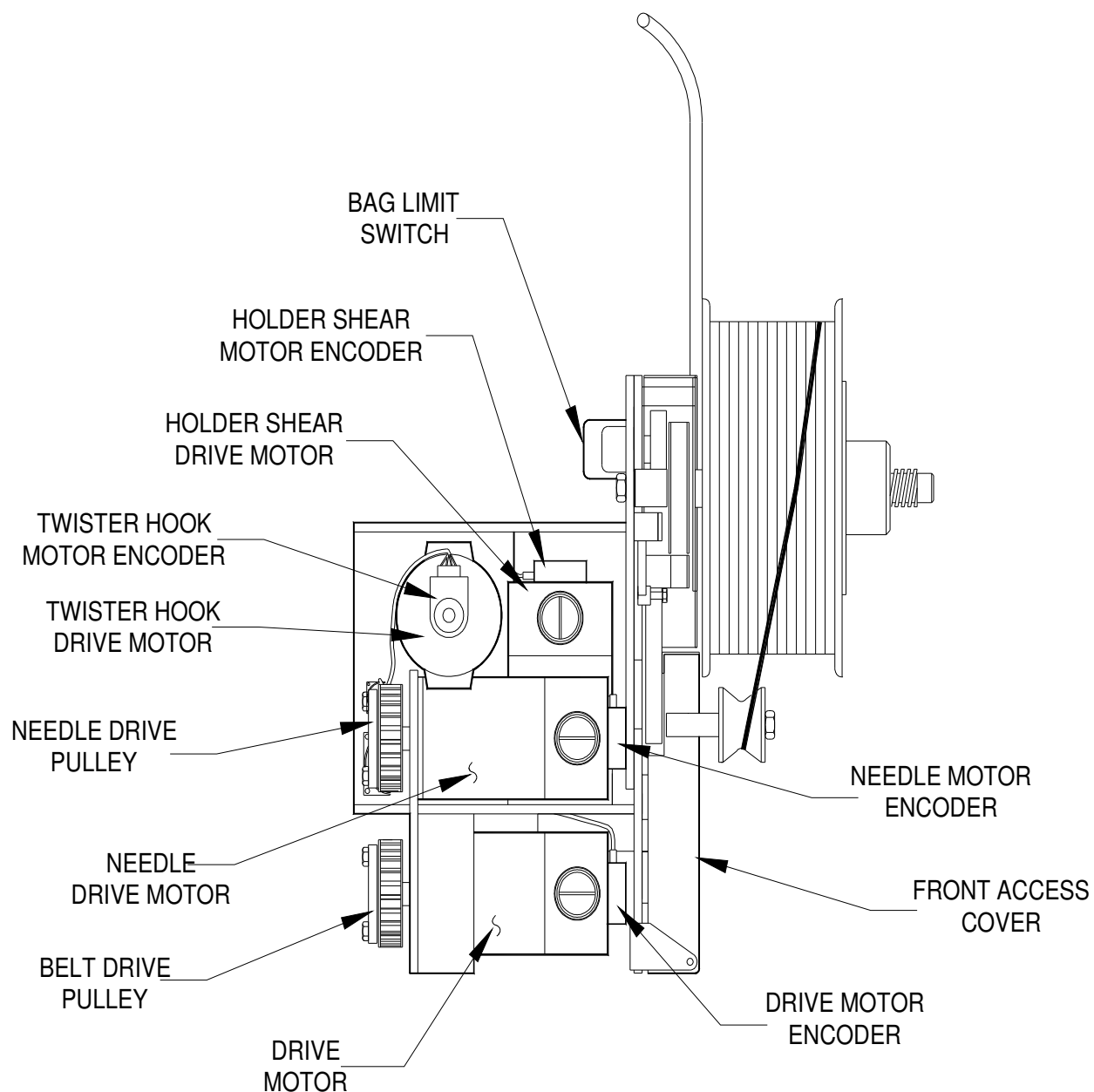
Machine Diagrams



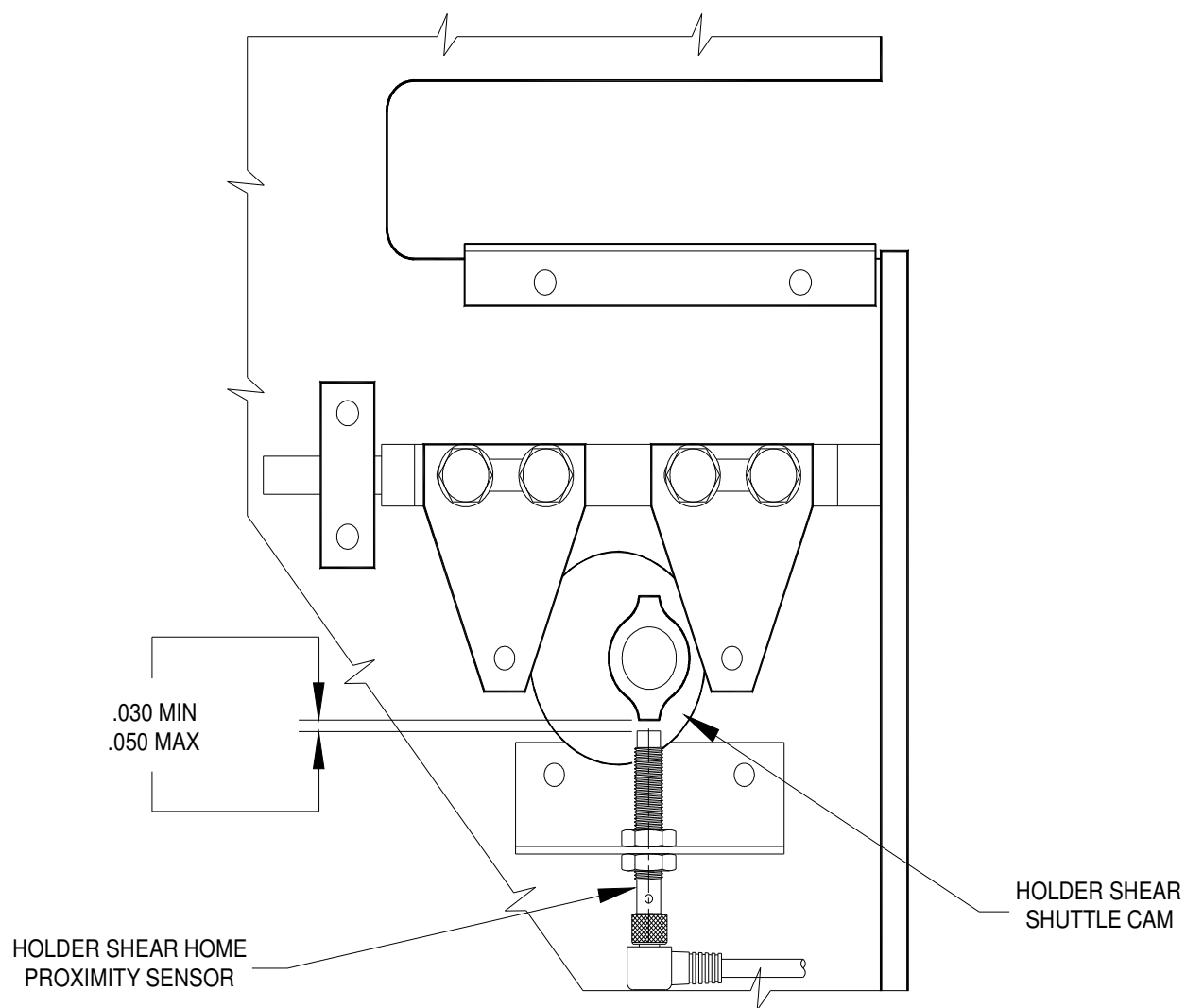
■ Machine Side Diagram



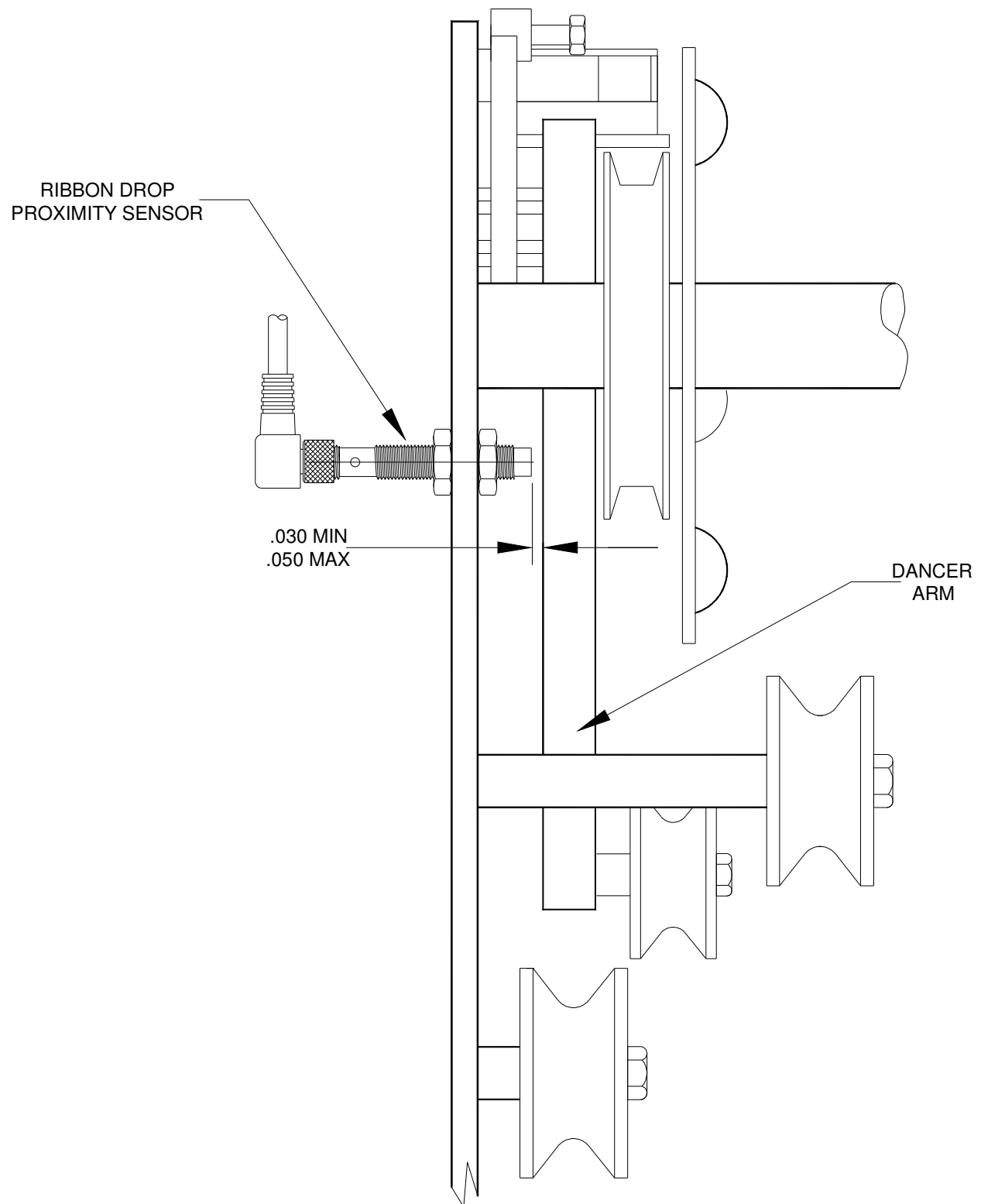
■ Motor Diagram

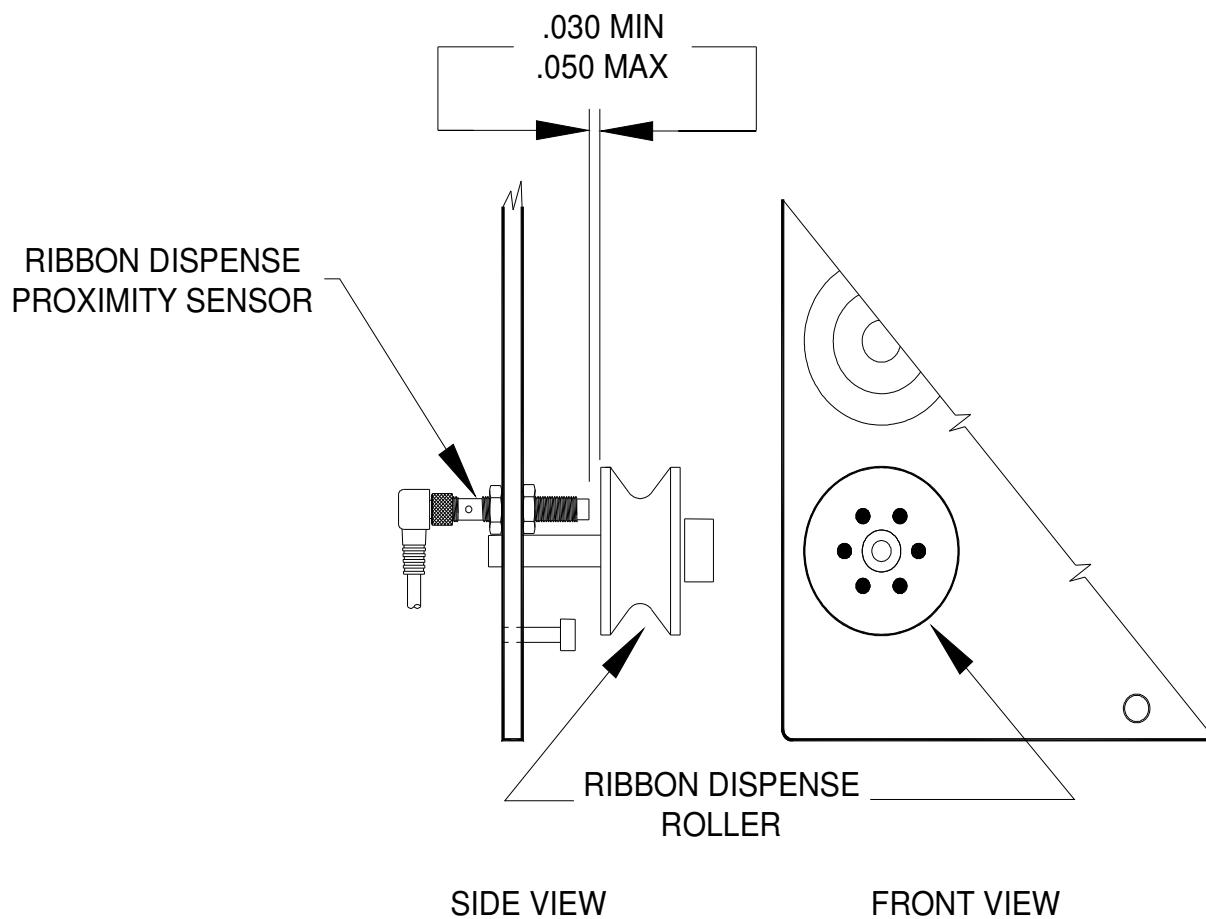


■ Holder Shear Proximity Sensor

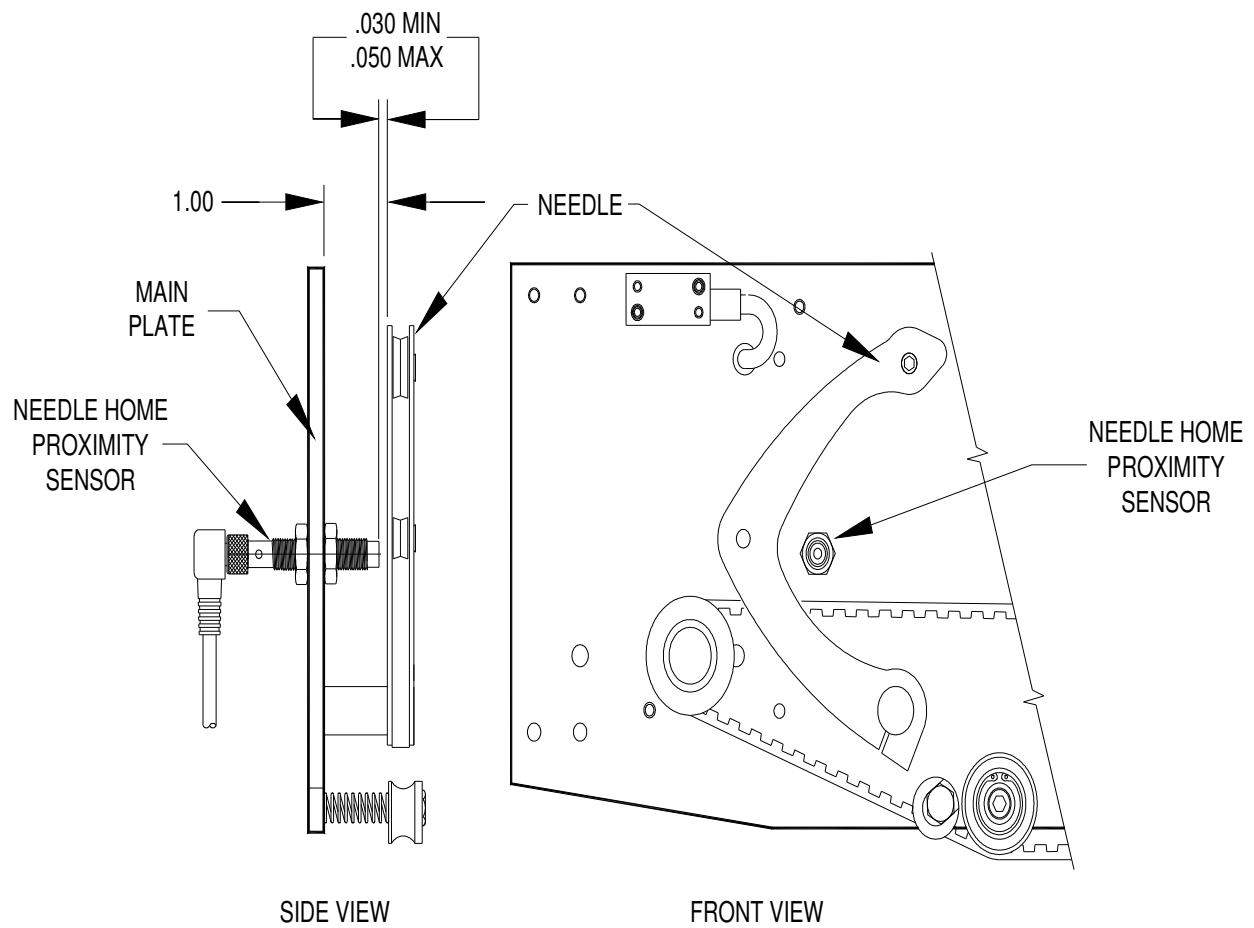


■ Ribbon Drop Proximity Sensor

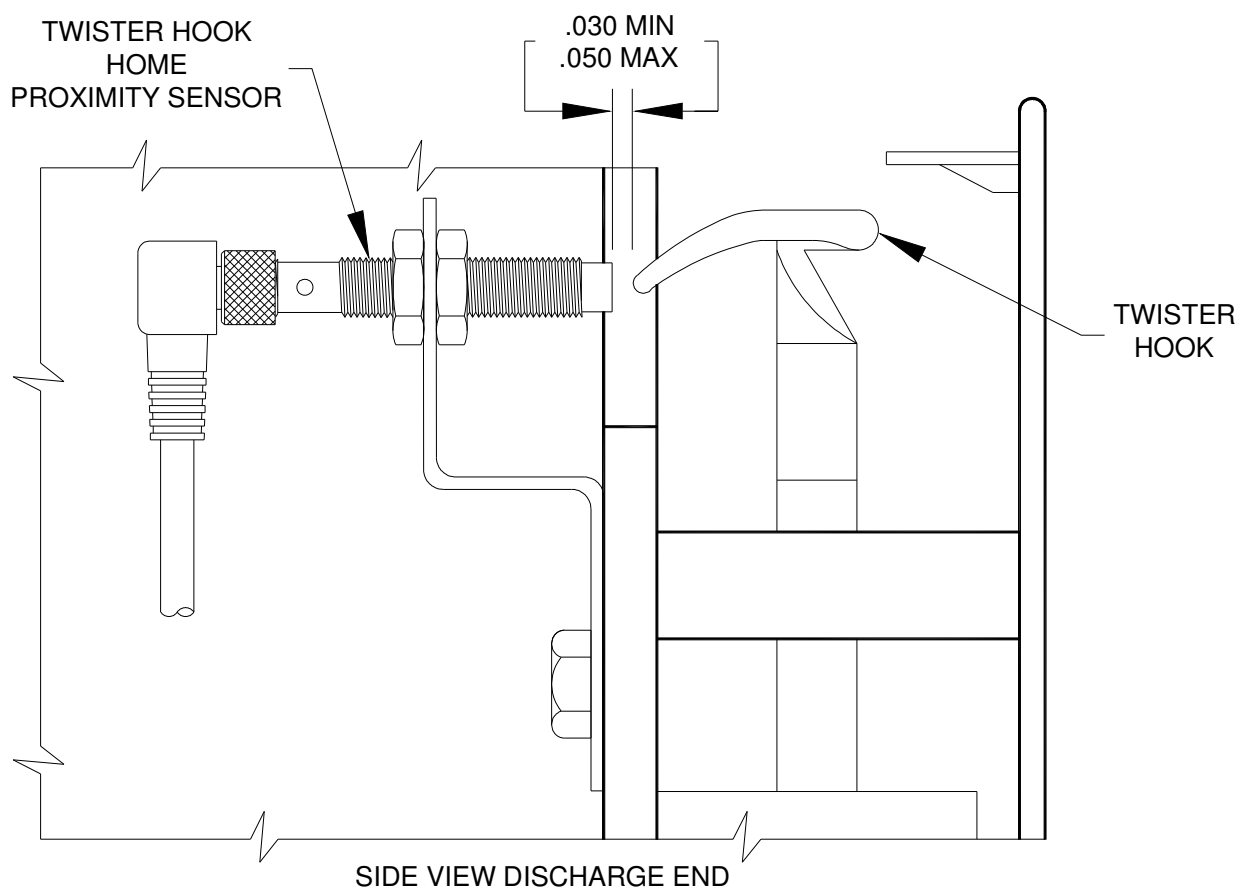


■ Ribbon Dispense Proximity Sensor

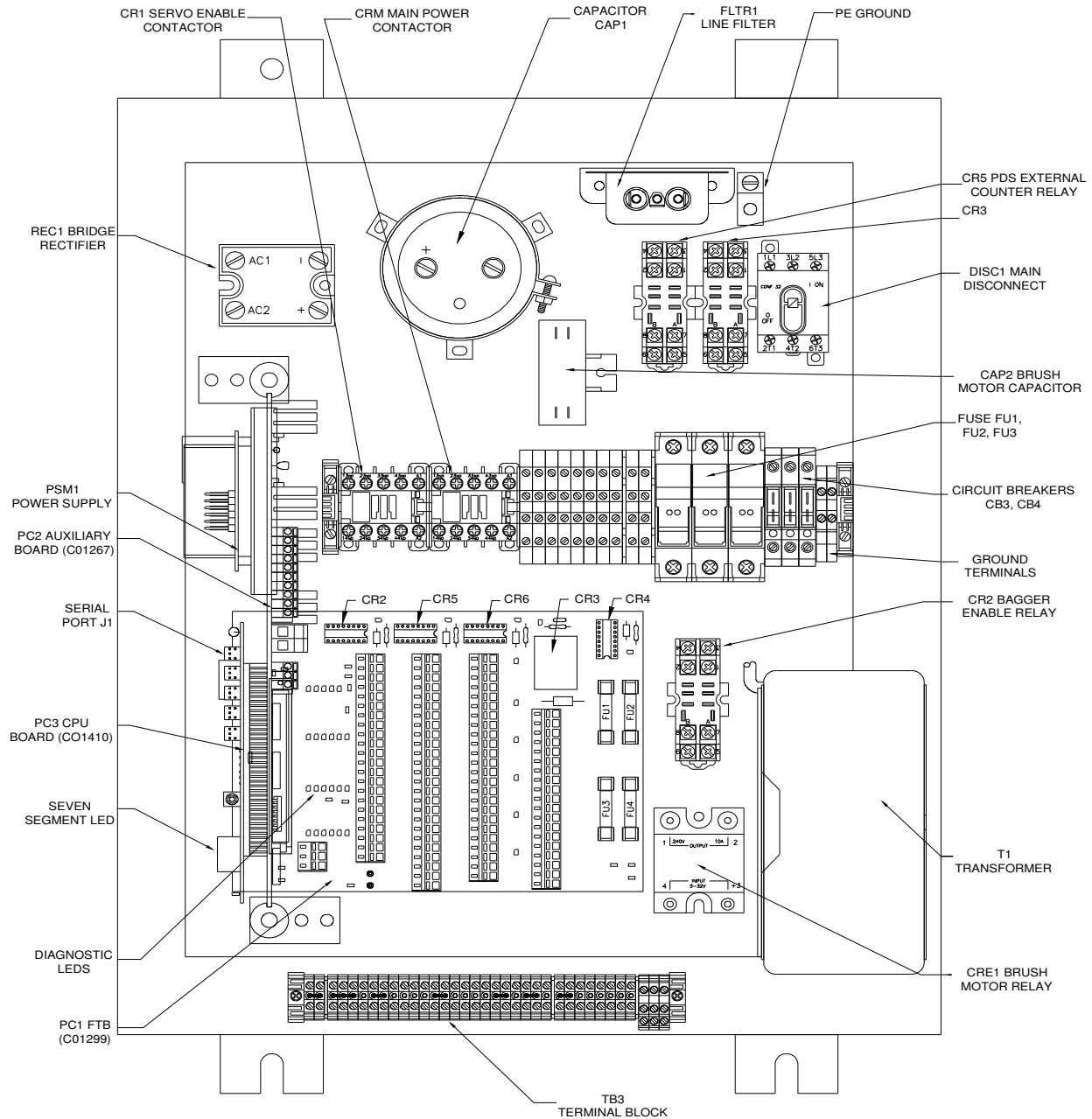
Needle Home Proximity Sensor



■ Twister Hook Proximity Sensor



■ Main Enclosure



■ Central Processing Unit board (PN-C01410)

The Central Processing Unit (CPU) Board is a six (6) inch by six (6) inch circuit board that contains the main processor and program memory. It has total control over the Servo Tyer and can communicate with a dumb terminal using the serial port *connector on the front edge of the board*. *The CPU Board is attached to the Auxiliary Board* with four (4) mounting screws. Signal connections between these two boards are made through the eighty (80) pin connector J2. The CPU Board has a seven-segment LED display that can display machine status one (1) character at a time (see pg. 112). The CPU board is considered a replacement unit. The proprietary software used to control the Servo Tyer was developed by Burford® and cannot be altered in the field.

■ Auxiliary board (PN-C01267)

The Auxiliary (Aux) Board is a six (6) inch by eleven (11) inch circuit board that is controlled by the CPU Board through the eighty (80) pin connector J3. The Aux Board contains the decoder electronics for the motor encoders as well as the pre-drivers and motor drivers for each of the four (4) axis. This board converts sensor and encoder signals to five (5) volt logic and relays them to the CPU board. Connections to motor power and the motors are made at the edge of this board. Each motor output is fused individually to protect the board from a shorted output. The rest of the connections are made through the ninety-six (96) pin connector J2 to the Field Termination Board. The Aux board also contains two (2) relays, which are described on pg. 172

■ Field Termination Board (PN-C01299)

The Field Termination Board (FTB) is a six (6) inch by eight (8) inch circuit board that is a point of mass termination for the Main Enclosure. With the exception of the motors, all Servo Tyer signals are routed through the FTB to the Auxiliary board using the ninety-six (96) pin connector J1. The FTB contains five (5) control relays. In addition, there are thirty-four (34) status LED's that can be used for troubleshooting.

■ Main enclosure relays

- CRM, (C07245): Latches in main power.
- CR1, (C07245): Connects 34VDC motor power to Aux board.
- CR2, (C01269-003): Latches the bagger enable signal.
- CR5, (C01269-003): Package Detection System, external counter contacts.
- CRE1, (C05138): Latches in Brush Motor.

■ Field termination board relays

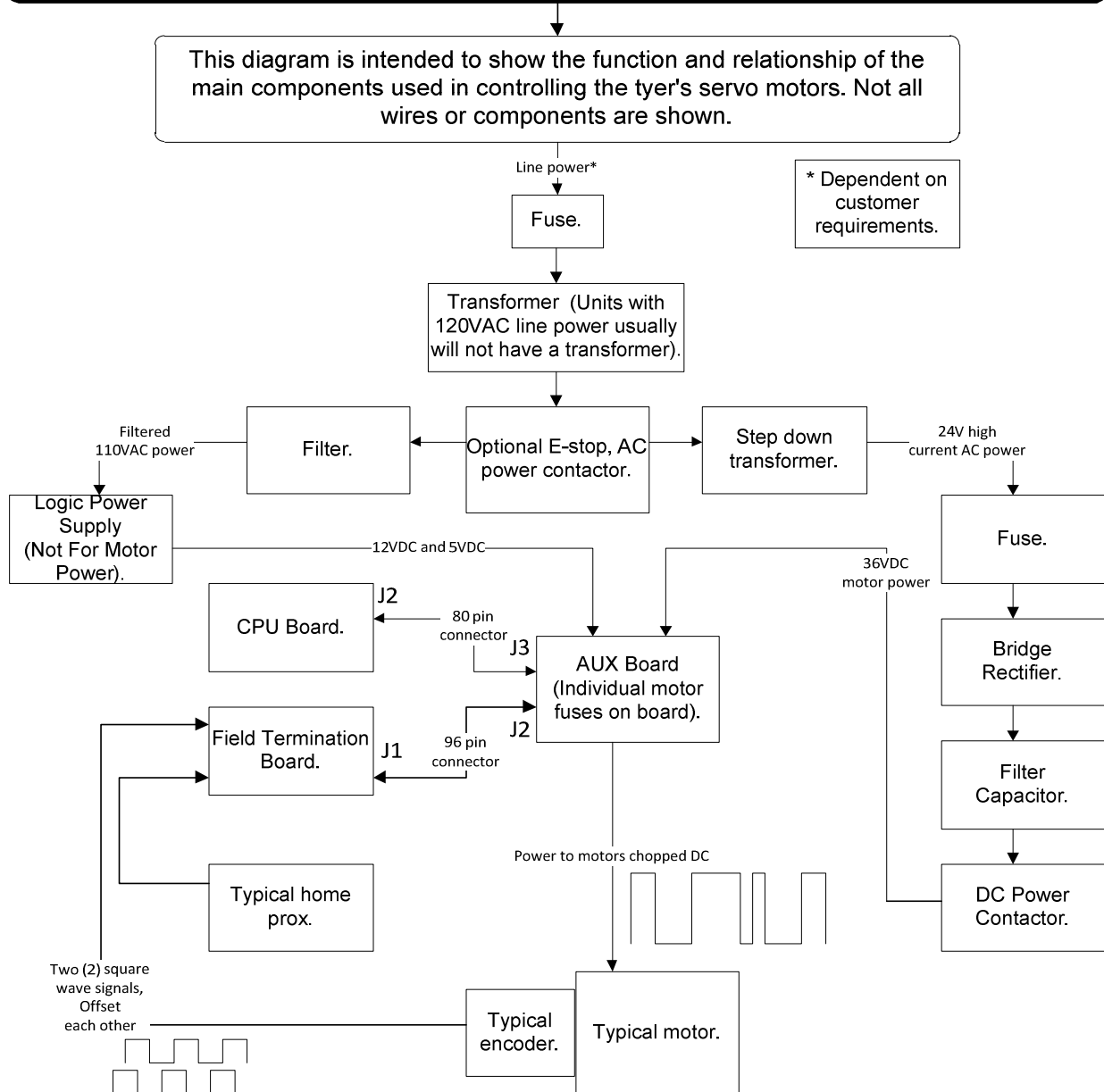
- CR2, (C01270): Servos Enabled Relay, energizes coil of CR1 (panel relay).
- CR3, (C01269-003): Brush/Belt Relay, bagger energizes this relay to start and stop brushes and belts.
- CR4, (C01270): Bagger Enable Relay starts and stops bagger run circuit.
- CR5, (C01270): Horn Relay, controls audible alarm.
- CR6, (C01270): Counter Relay, controls external counter output.

■ Auxiliary board relays

- CR1: Run Circuit Relay, operator "RUN" button latches in this relay.
- CR9: CPU Status Relay, CPU energizes this relay if it is ready to control the motors.

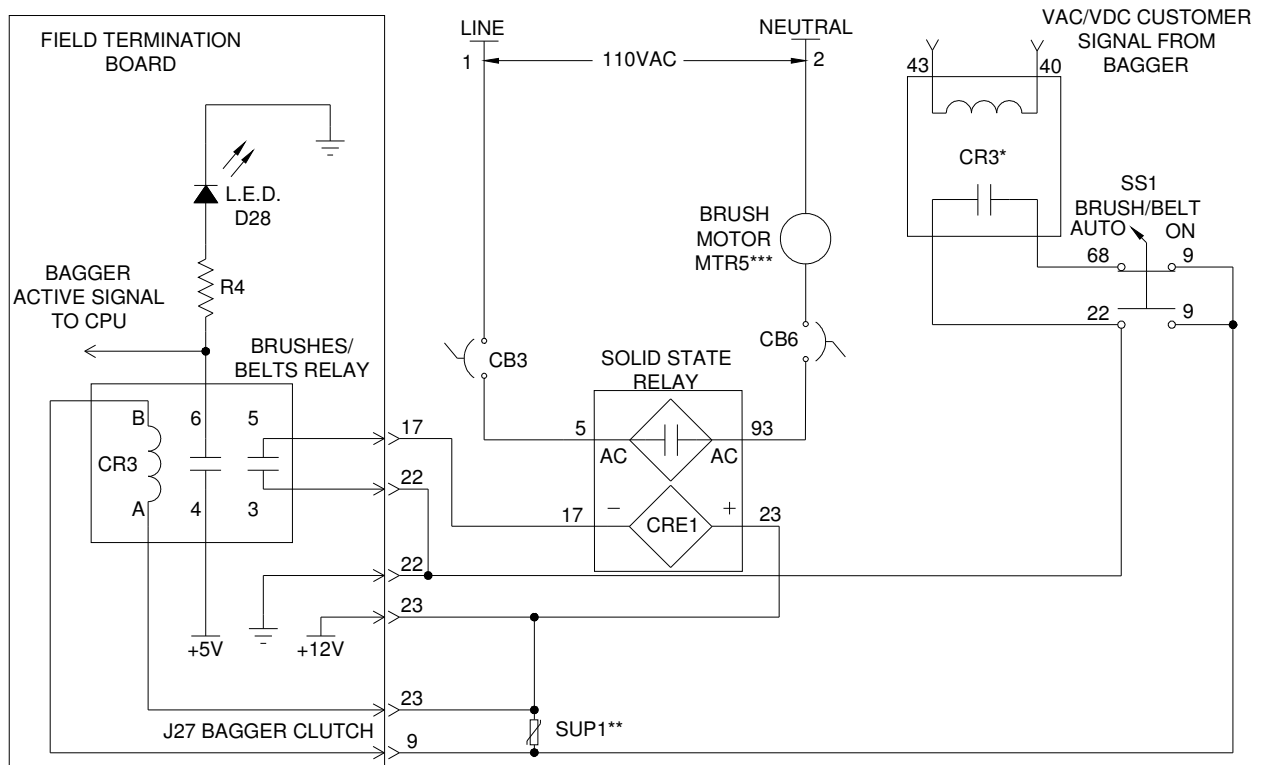
Motor Control Diagram

Functional diagram for motor control of Servo Tyer



■ Gathering Brush Power Diagram

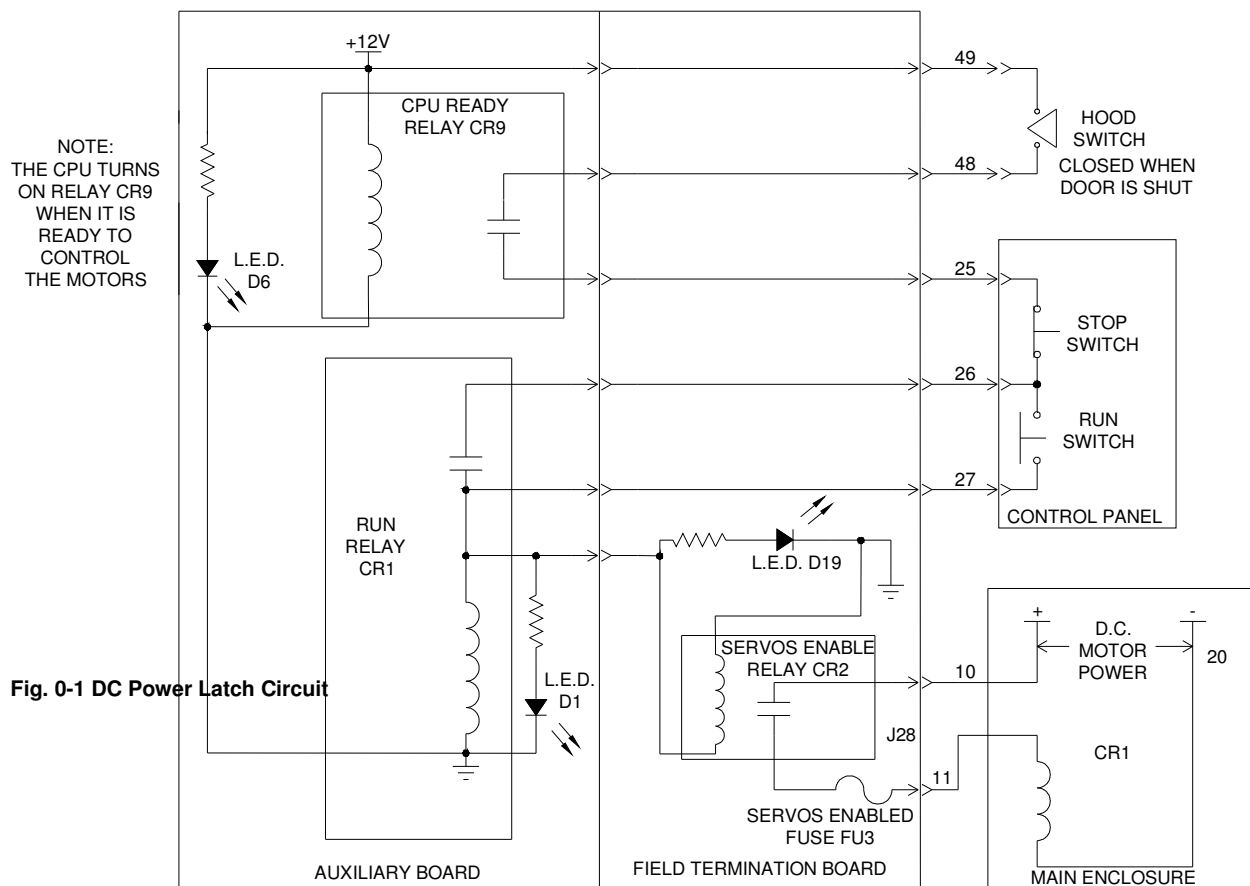
GATHERING BRUSHES POWER AND CONTROL CIRCUIT



- * LOCATED ON MAIN PANEL
- ** SUP1 INSTALLED WHEN CR3 (FTB) = 12V COIL,
NOT INSTALLED WHEN CR3 (FTB) = 120V COIL.
- *** 3A CB AND CAPACITOR LOCATED INSIDE BRUSH MOTOR.

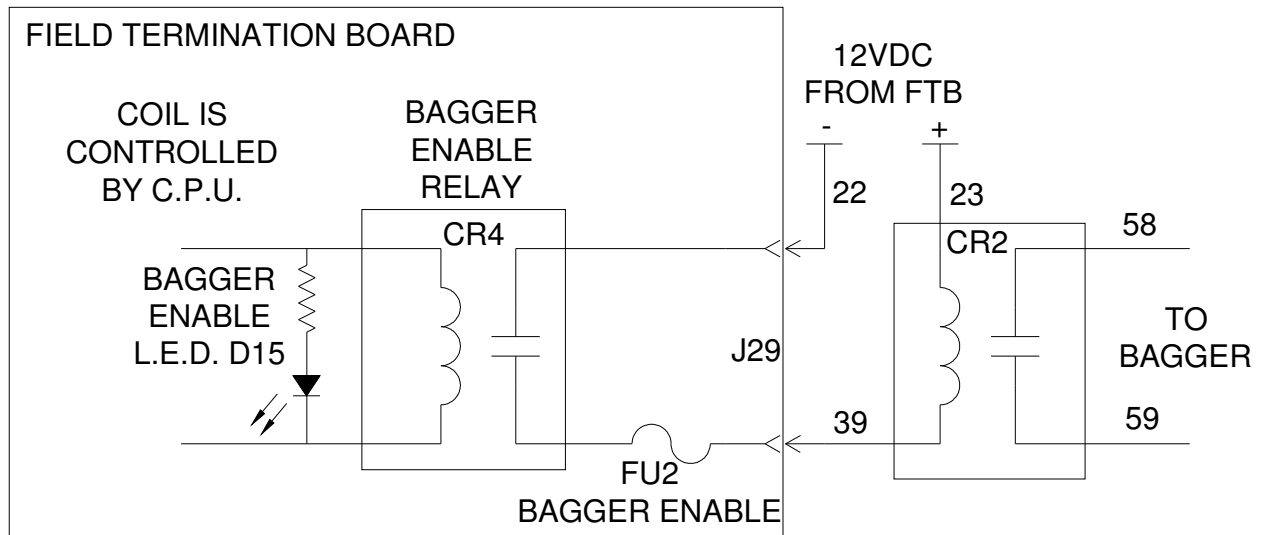
DC Power Latch Circuit Diagram

DC POWER LATCH CIRCUIT



■ Bagger Enable Circuit Diagram

BAGGER ENABLE CIRCUIT



Contents

Recommended Spare Parts	1
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Tyer Covers	8
Ribbon Tension Assembly	10
Tapered Brush Assembly	12
Tapered Brush Assembly Detailed	14
Adjustment Stand Assembly	16
Bread Shelf Kit	18
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Electrical Layout	26

Call 1-877-BURFORD or fax
405-867-4219 to order your parts.

Proprietary

The following information is the exclusive property of Burford Corp., Maysville, Oklahoma and is confidential, provided only for reference. Do not copy or reproduce.

Drawings & Parts

Frame Assembly
302000-6 Rev C RH
302001-6 Rev C LH

Recommended Spare Parts

Please have the following machine information on hand before calling Burford®

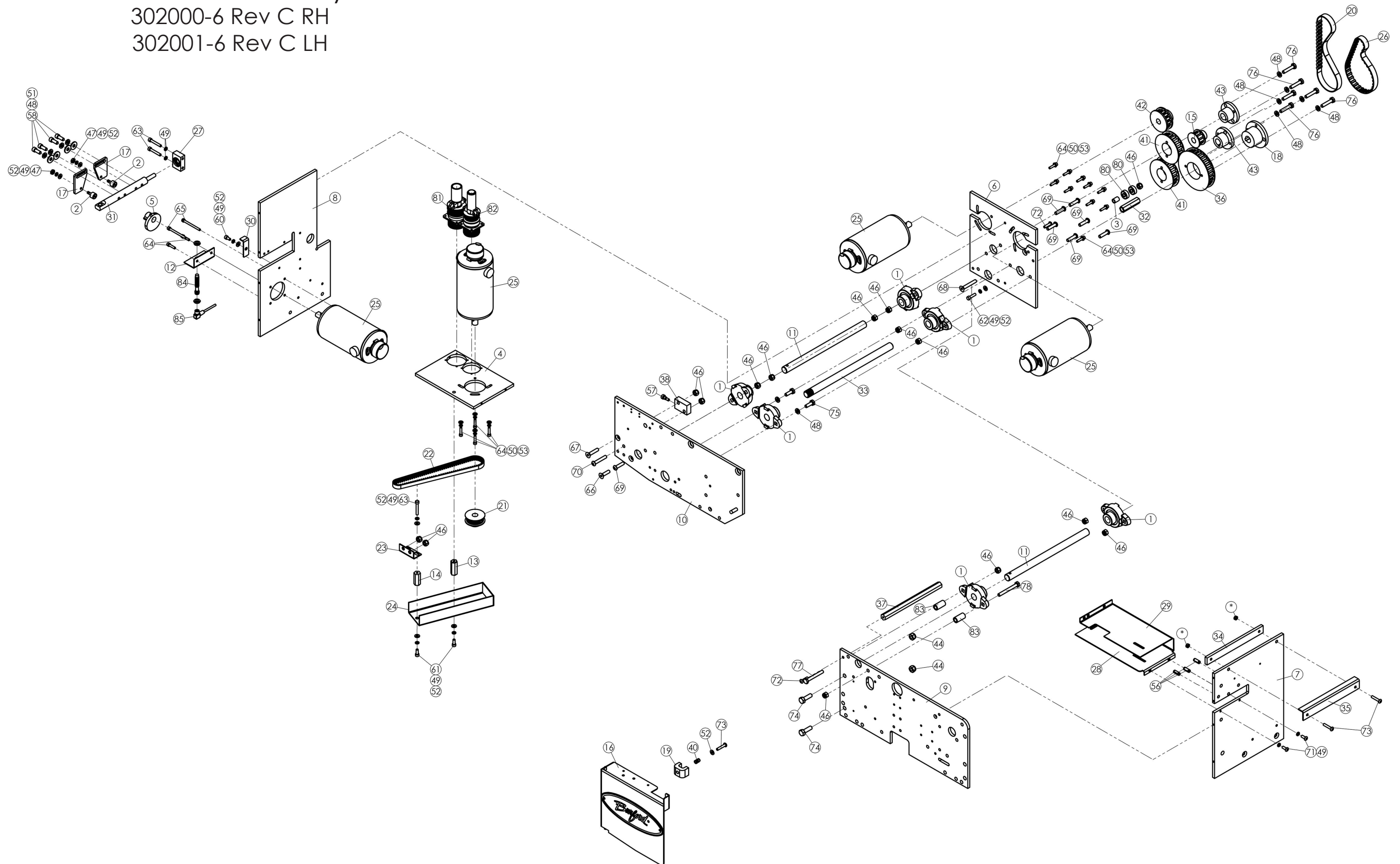
- Machine Voltage
- Model Number
- Serial Number

QTY.	2000M	2100M	DESCRIPTION
1	302526	302526	Holder/Shear Assy.
1	C01410V3-M	C01410V3-M	Board, CPU, 2000M HS (Eng)
1	C07170	C07170	Power Supply, Logic
1	C01230	C01230	Relay, Bridge Rectifier
1	C01267	C01267	Auxiliary Circuit Board
1	C07625	C07625	Proximity Switch, 8mm, N.O.
1	103972	103972	Sensor, Limit Switch
1	302020	302020	Belt, Upper Gathering
1	611929	611929	Belt, 5MM HTD,100T, 9MM Wide, Single
1	302034	302035	Twister Hook & Housing Assy.
1	302132	302132	Belt, Lower Gathering
1	302133	302133	Belt, Gathering Drive
1	302141	302141	Belt, Hook Drive
1	302210	302210	Motor W/ Encoder Assy.
1	302276	302276	Belt, Needle Drive
1	C01203	C01203	Capacitor, 33,000 MFD
1	C01269	C01269	Relay, 110VAC, K10
1	302204	302205	Needle Assy.
1	305111	305111	Actuator, 2nd Ribbon Tension
1	302456	302456	Lever, Bag Stop
1	302452	302452	Bag Stop Support
1	302196	302203	Trigger Arm
1	152124	152124	Large Needle Roller
1	302065	302065	Ribbon Roller
2	152125	152125	Bushing, Needle Roller
1	C01269-003	C01269-003	Relay, 12VDC, K10
1	C01295	C01295	Relay, Base, K10
1	C07245	C07245	Relay, Contactor
1	612141-001	612141-001	Assy, Suppress, Current Limiter

ITEM #	QTY.	PART#	DESCRIPTION	ITEM #	QTY.	PART#	DESCRIPTION
1	6	100380	BEARING, FLANGE 5/8, ENP	42	1	716703	PULLEY RWK 15T, 3/8 P 1/2 B PLT
2	2	152076	BEARING, 1/2" CAM FOLLOWER	43	2	716860	BUSHING, 5/8 BORE PLATED
3	1	204450	BUSHING, STRIPPER	44	2	955619	NUT HEX NYLOC 5/16-18 UNC SST
4	1	301178	PLATE, MOTOR / CONNECTOR	45	1	955621	NUT HEX NYLOC #10-24 UNC SST
5	1	302038	CAM, SHUTTLE	46	15	955661	NUT HEX NYLOC 1/4-20 UNC SST
6	1	302042	PLATE, BELT MOTOR	47	2	955822	NUT HEX MACH. #10-32 UNF SST
7	REF.	302043	PLATE, SMALL UPRIGHT	48	13	955940	WASHER LOCK 1/4" SST
8	1	302044	PLATE, LARGE UPRIGHT	49	14	955941	WASHER LOCK #10 SST
9	REF.	302045	PLATE, LOWER FRONT	50	18	955942	WASHER LOCK #8 SST
10	REF.	302046	PLATE, TOP FRONT	51	4	955977	WASHER FLAT 1/4" SST
11	2	302049	SHAFT, BELT DRIVE	52	10	955978	WASHER FLAT #10 SST
12	1	302058	SHEAR PROX. MOUNT	53	14	955979	WASHER FLAT #8 SST
13	1	302066	SPACER, GUARD	54	1	958412	PIN ROLL 3/16 X 3/4 SST
14	1	302067	SPACER, HOOK GUARD	55	1	958420	PIN ROLL 3/16 X 1 1/4 SST
15	1	302073	PULLEY, BELT MOTOR	56	3	958510	PIN, ROLL 1/4" X 5/8"
16 RH	1	302078	A/W, DISCHARGE COVER, R.H.	57	1	974904	SCREW SHLDR 1/4 X 1/4, #10-24 SST
16 LH	1	302079	A/W, DISCHARGE COVER, L.H.	58	4	978310	SCREW SOC HD CAP 1/4-20 X 5/8 SST
17	2	302098	PLATE, CAM FOLLOWER GUIDE	59	1	978320	SCREW SOC HD CAP 1/4-20 X 1 1/4 SST
18	1	302105	BUSHING, PLATED	60	3	978906	SCREW SOC HD CAP #10-24 UNC X 3/8 SST
19	1	302116	MAGNET HORSHOE	61	2	978908	SCREW SOC HD CAP #10-24 UNC X 1/2 SST
20	1	302133	GEARBELT,DBL,3/8 PITCH X 18.7	62	1	978912	SCREW SOC HD CAP #10-24 UNC X 3/4 SST
21	1	302139	PULLEY, 24T, 1/5 PITCH	63	5	978920	SCREW SOC HD CAP #10-24 UNC X 1 1/4 SST
22	1	302141	GEARBELT, 19", 1/5 PITCH	64	16	979512	SCREW SOC HD CAP #8-32 UNC X 3/4 SST
23	1	302147	MOUNT, GUARD ANGLE, SERVO	65	2	979532	SCREW SOC HD CAP #8-32 UNC X 2 SST
24	1	302197	COVER A/W, BELT HOOK	66	2	981716	SCREW FLT HD SOC 1/4-20 X 1 SST
25	4	302210	ASSY,MOTOR W/ ENCODER	67	1	981720	SCREW FLT HD SOC 1/4-20 X 1 1/4 SST
26	1	302276	GEARBELT, 3/8 P, 1/2 W, 15" LG.	68	1	981728	SCREW FLT HD SOC 1/4-20 X 1 3/4 SST
27	1	302279	ASSY, SHUTTLE BLOCK	69	7	985716	SCREW BUTT HD SOC 1/4-20 X 1 SST
28 RH	REF.	302280	MOUNT LOWER TUNNEL (RH)	70	1	985724	SCREW BUTT HD SOC 1/4-20 X 1 1/2 SST
28 LH	REF.	302281	MOUNT LOWER TUNNEL (LH)	71	2	986308	SCREW BUTT HD SOC #10-24 X 1/2 SST
29 RH	REF.	302284	GUIDE, INNER TOP, 2000	72	2	986312	SCREW BUTT HD SOC #10-24 X 3/4 SST
29 LH	REF.	302285	GUIDE, INNER TOP, 2100	73	3	986316	SCREW BUTT HD SOC #10-24 UNC SST
30	1	302286	GUIDE, DISCH. INNER HOLDER	74	2	989716	SCREW FIN HEX 5/16-18 X 1 SST
31	1	302295	ASSY, SHUTTLE BAR	75	2	989912	SCREW FIN HEX 1/4-20 X 3/4 SST
32	1	302319	STANDOFF, GUARD, 2"	76	6	989920	SCREW FIN HEX 1/4-20 X 1 1/4 SST
33	1	302320	SHAFT, NEEDLE	77	1	989932	SCREW FIN HEX 1/4-20 X 2 SST
34	1	302326	MOUNT, TRACK BAR	78	1	989936	SCREW FIN HEX 1/4-20 X 2 1/4 SST
35	REF.	302327	ANGLE, TRACK	79	1	A08049	NAMEPLATE,BURFORD LOGO,LARGE
36	1	302342	PULLEY, 30 TOOTH, PLATED	80	2	C00111	BEARING, .75 OD X .25 ID X .28 W
37	1	302438	STANDOFF, DISCHARGE, SERVO	81	1	C01369	CABLE,ASSY,BULKHEAD,LWR UNIT,ENCODE
38	1	302464	BLOCK, COVER PIN	82	1	C01370	CABLE,ASSY,BULKHEAD,SERVO MOTORS
39	1	302741	PIN, ROLL, HEAVY DUTY, 3/16 X 3/4	83	2	C03535	SPACER, PAN GUIDE 1"
40	1	610469	SPRING, COMP, .30 OD x .44L x .02WD	84	5	C07625	SENSOR,PROX,8MM,10-30VDC,NPN,NO,QC
41	2	716700	PULLEY, 21T 3/8 PITCH	85	5	C07626	SENSOR,CABLE,M8,3WIRE,F,QC,90

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302001-6 Rev C LH



Right Hand Shown

Belt Drive Assembly (Wireless)

302000-3 Rev M RH

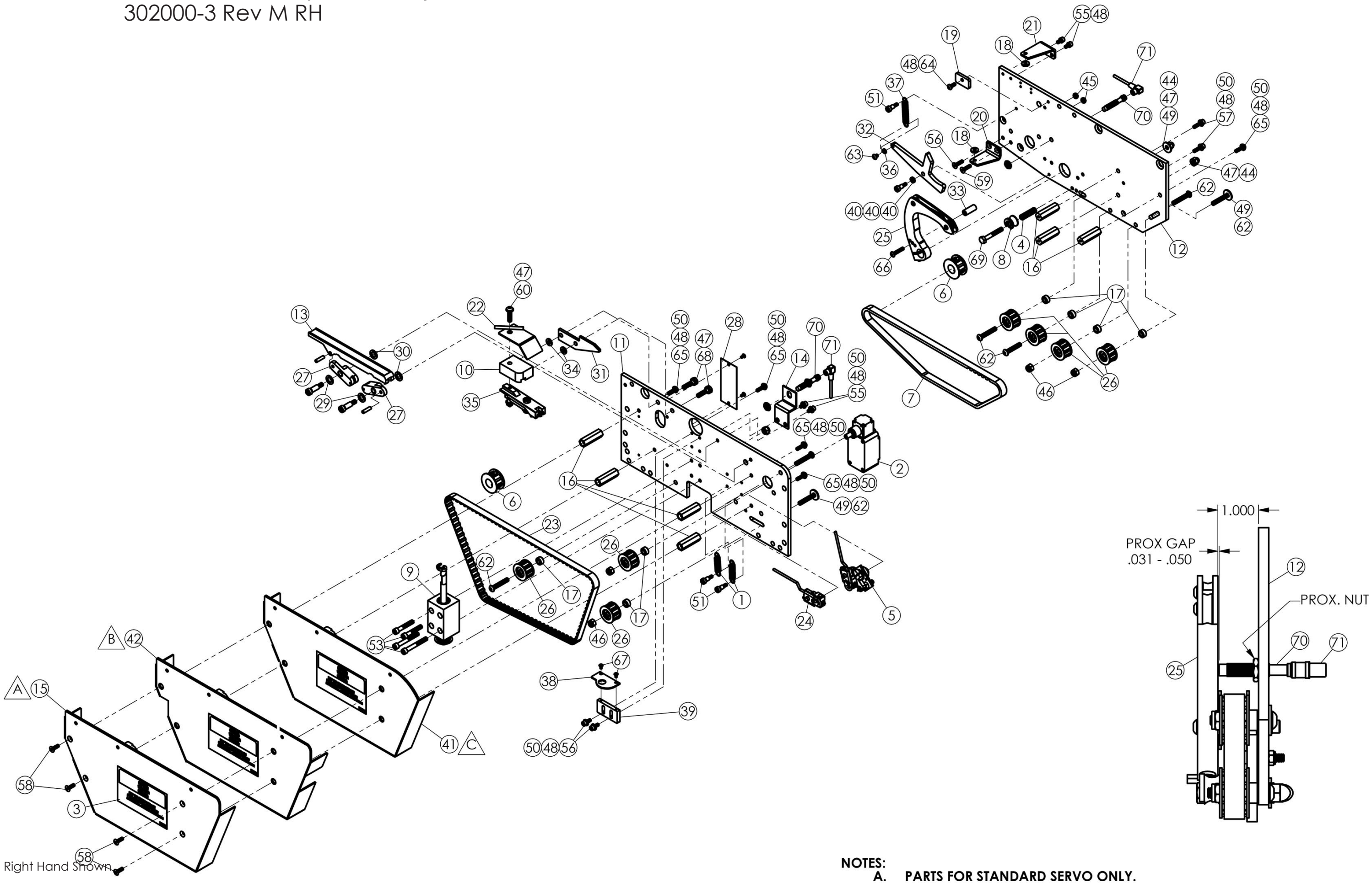
302001-3 Rev M LH

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ITEM #	QTY.	PART#	DESCRIPTION	ITEM #	QTY.	PART#	DESCRIPTION
1	2	103519	SPRING EXTENSION	33	1	302457	ROD, ACTUATION BAG STOP, SERVO
2	REF.	103972	SENSOR,MICRO SWITCH	34	2	302460	BUSHING MACH 1/4 X 1/2 X .060
3	1	111174	DECAL, KEEP THIS GUARD IN PLACE	35	1	302526	ASSY, ADVANCED HOLDER/SHEAR
4	1	115290	SPRING, COMPRESSION	36	1	302873	SPACER, BAG STOP SPRING
5 RH	REF.	210164	ASSY, BAG SWITCH RH	37	1	302874	SPRING-EXTENSION 3/8 OD 2" L .031
5 LH	REF.	210163	ASSY, BAG SWITCH LH	38	1	303190	BRACKET,RIBBON DEFLECTION
6	2	302019	PULLEY, BELT DRIVE	39	1	303191	BLOCK, RIBBON DEFLECTION
7	1	302020	BELT, 28.5" RED 3/8 P	40	3	401351	BUSH MACH 3/8OD X 1/4ID X .031
8	1	302029	RIBBON BLOCK	41	REF	401628	GUARD, SERVO LOWER A/W
9 RH	1	302034	ASSY, BEARING HOUSING TWIST HOOK RH	42 RH	REF	710496	A/W, LOWER GUARD, TEC, RH W/SEALER
9 LH	1	302035	ASSY, BEARING HOUSING TWIST HOOK LH	42 LH	REF.	710495	A/W, LOWER GUARD, TEC, LH W/SEALER
10 RH	1	302036	HOLDER / SHEAR MOUNT, R.H.	43	2	954712	PIN DOWEL, 3/16 DIA X 3/4 SST
10 LH	1	302037	HOLDER / SHEAR MOUNT, L.H.	44	2	955615	NUT HEX ACORN 1/4-20 UNC SST
11	1	302045	PLATE, LOWER FRONT	45	2	955621	NUT HEX NYLOC #10-24 UNC SST
12	1	302046	PLATE, TOP FRONT	46	5	955661	NUT HEX NYLOC 1/4-20 UNC SST
13	1	302056	GUIDE, LOWER	47	5	955940	WASHER LOCK 1/4" SST
14	1	302072	PROXIMITY MOUNT	48	14	955941	WASHER LOCK #10 SST
15 RH	REF.	302080	A/W, LOWER FRONT PLATE, R.H.	49	3	955977	WASHER FLAT 1/4" SST
15 LH	REF.	302081	A/W, LOWER FRONT PLATE, L.H.	50	11	955978	WASHER FLAT #10 SST
16	7	302096	STANDOFF, FRONT	51	4	974906	SCREW SHLDR 1/4 X 3/8, #10-24 SST
17	7	302106	SPACER, 1/2" DIA. X 1/4 ID X .283 L.	52	2	975012	SCREW SHLDR 5/16 X 3/4, 1/4-20 SST
18	2	302110	WASHER, COVER	53	2	978324	SCREW SOC HD CAP 1/4-20 X 1 1/2 SST
19	1	302111	MAGNET RECEIVER	54	2	978332	SCREW SOC HD CAP 1/4-20 X 2 SST
20 RH	1	302112	HINGE, COVER PLATE, R.H.	55	4	978906	SCREW SOC HD CAP #10-24 X 3/8 SST
20 LH	1	302113	HINGE, COVER PLATE, L.H.	56	2	978908	SCREW SOC HD CAP #10-24 UNC X 1/2 SST
21 RH	1	302114	HINGE, COVER PLATE, R.H.	57	2	978912	SCREW SOC HD CAP #10-24 UNC X 3/4 SST
21 LH	1	302115	HINGE, COVER PLATE, L.H.	58	4	982310	SCREW FLT HD SOC #10-24 X 5/8 SST
22 RH	1	302128	A/W, TYER RIBBON RELEASE, R/H	59	2	982312	SCREW FLT HD SOC #10-24 X 3/4 SST
22 LH	1	302129	A/W, TYER RIBBON RELEASE, L/H	60	1	985716	SCREW BUTT HD SOC 1/4-20 X 1 SST
23	1	302132	GEARBELT,3/8 PITCH,36.7 LONG	61	1	985722	SCREW BUTT HD SOC 1/4-20 X 1 3/8 SST
24 RH	REF.	302196	TRIGGER ARM REWORK R.H.	62	6	985724	SCREW BUTT HD SOC 1/4-20 X 1 1/2 SST
24 LH	REF.	302203	TRIGGER ARM REWORK L.H.	63	1	986304	SCREW BUTT HD SOC #10-24 X 1/4 SST
25 RH	1	302204	ASSY, NEEDLE R/H, 2000	64	1	986308	SCREW BUTT HD SOC #10-24 X 1/2 SST
25 LH	1	302205	ASSY, NEEDLE R/H, 2100	65	5	986312	SCREW BUTT HD SOC #10-24 X 3/4 SST
26	7	302206	ASSY, IDLER	66	1	986316	SCREW BUTT HD SOC #10-24 X 1 SST
27	2	302207	BUSHING ASSY GUIDE SUPPORT	67	4	987504	SCREW BUTT HD SOC #6-32 X 1/4 SST
28	1	302299	PLATE SERIAL,SERVO TYER	68	2	989916	SCREW FIN HEX 1/4-20 X 1 SST
29	2	302434	BUSHING, 3/8 X 5/8 X .047 MACH.	69	1	989928	SCREW FIN HEX 1/4-20 X 1 3/4 SST
30	2	302435	BUSHING, 3/8 X 5/8 X .062 MACH.	70	REF.	C07625	SENSOR,PROX,8MM,10-30VDC,NPN,NO,QC
31	1	302452	BAG STOP SUPPORT PLATE	71	REF.	C07626	SENSOR,CABLE,M8,3WIRE,F,QC,90
32	1	302456	LEVER - BAG STOP				

Belt Drive Assembly (Wireless)

302000-3 Rev M RH



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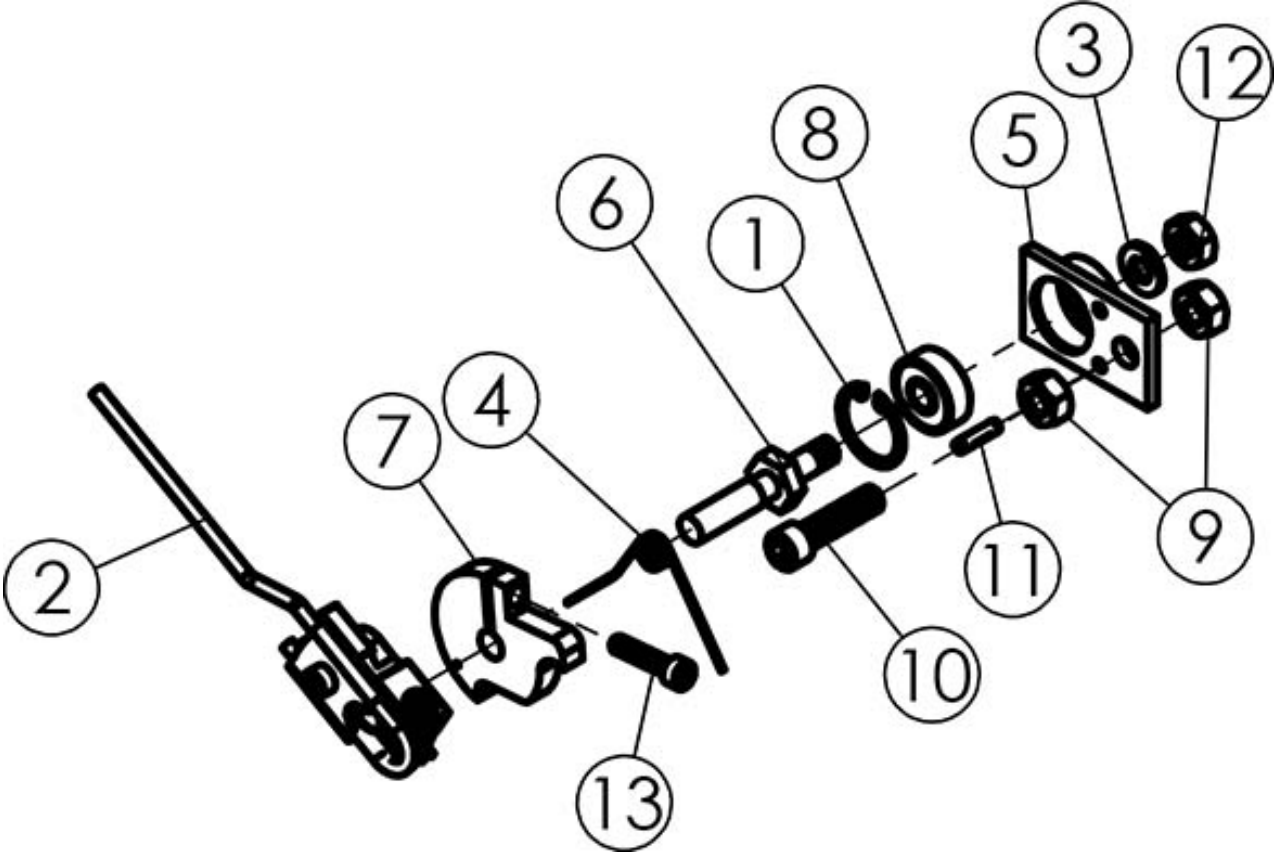
Bag Switch Assembly
210164 Rev B RH
210163 Rev B LH

ITEM #	QTY.	PART#	DESCRIPTION
1	1	115162	RETAINING RING, INT 3/4
2 LH	1	302203	TRIGGER ARM REWORKED L.H.
2 RH	1	302196	TRIGGER ARM REWORKED R.H.
3	1	302460	BUSHING MACH 1/4 X 1/2 X .060
4 RH	1	610216	SPRING, TORSION, .25 ID, .038 WIRE RH
4 LH	1	610215	SPRING, TORSION, .25 ID, .038 WIRE LH
5	1	710305	HOUSING, BEARING SWITCH
6	1	710310	SHAFT, LIMIT SWITCH
7	1	710312	STOP, LIMIT SWITCH
8	1	C00111	BEARING, .75 OD X .25 ID X .28 W
9	2	955409	NUT HEX JAM 1/4-20 UNC SST
10	1	978316	SCREW SOC HD CAP 1/4-20 X 1 SST
11	1	958608	PIN ROLL, 1/8 DIA X 1/2 SST
12	1	955408	NUT JAM 1/4-28 UNF SST
13	1	979512	SCREW SOC HD CAP #8-32 UNC X 3/4 SST

Needle Assembly
302204 Rev F RH
302205 Rev F LH

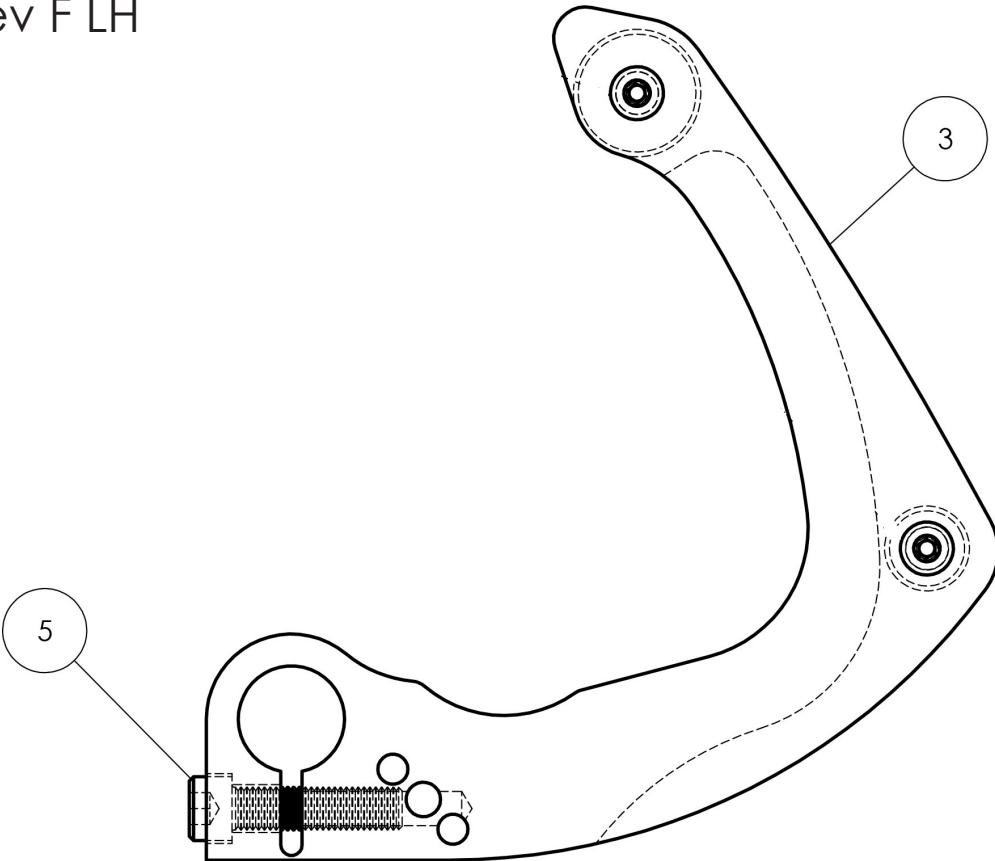
ITEM #	QTY.	PART#	DESCRIPTION
1	1	152124	ROLLER, NYLON
2	2	152125	BUSH, SST, .166 ID X 1/4 OD X 1/4 L
3	1	302060	NEEDLE MACHINE
4	1	302065	RIBBON ROLLER
5	1	978216	SCREW SOC HD CAP 1/4-28 X 1 SST
6	2	986908	SCREW BUTT HD SOC #8-32 X 1/2 SST

Bag Switch Assembly
210164 Rev B RH
210163 Rev B LH

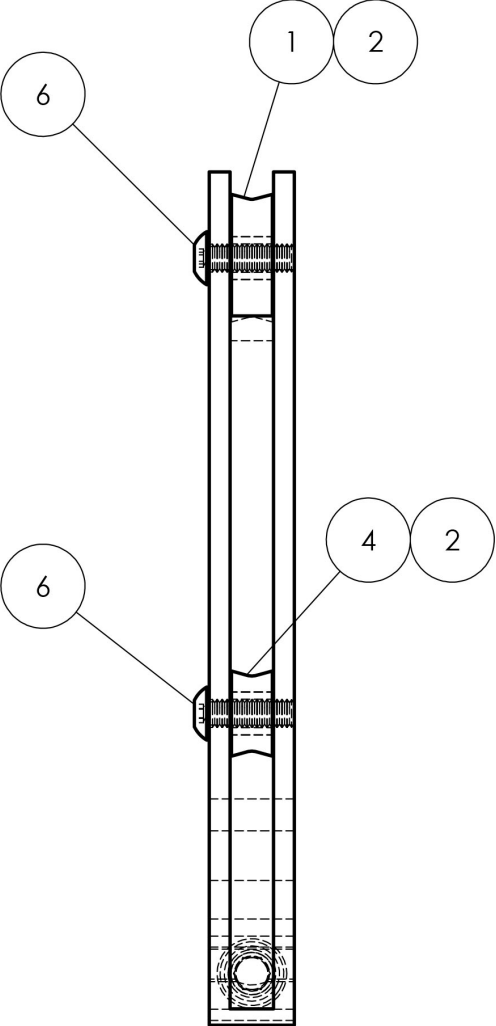


Right Hand Shown

Needle Assembly
302204 Rev F RH
302205 Rev F LH



Left Hand Shown



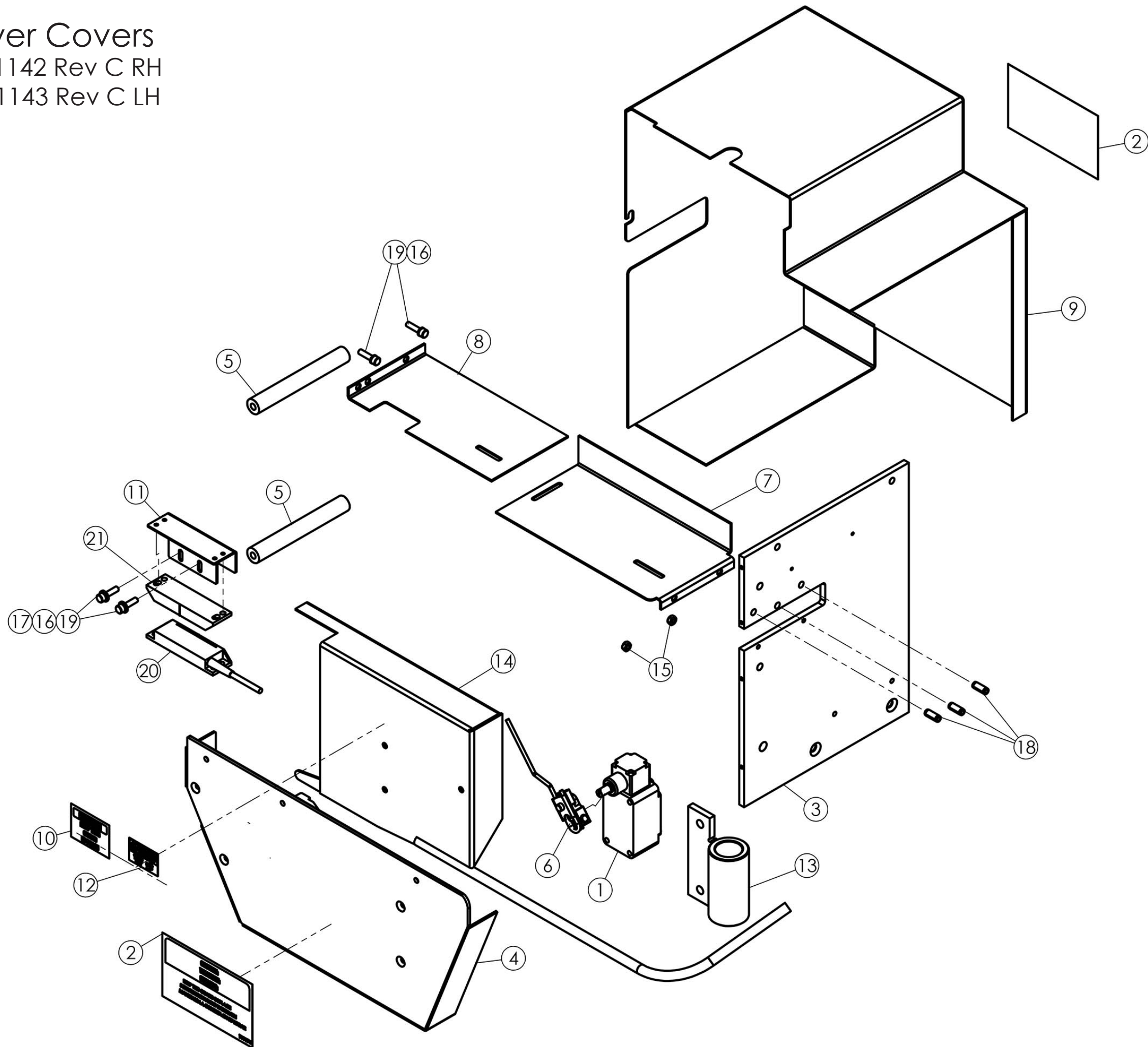
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Tyer Covers
211142 Rev C RH
211143 Rev C LH

ITEM #	QTY.	PART#	DESCRIPTION
1	1	103972	SENSOR,MICRO SWITCH
2	2	111174	DECAL, KEEP THIS GUARD IN PLACE
3	1	302043	PLATE, SMALL UPRIGHT
4 RH	1	302080	A/W, LOWER FRONT PLATE, RH
4 LH	1	302081	A/W, LOWER FRONT PLATE, LH
5	2	302180	STANDOFF, CONTROL BOX
6 RH	1	302196	TRIGGER ARM REWORK RH
6 LH	1	302203	TRIGGER ARM REWORK LH
7 RH	1	302280	MOUNT LOWER TUNNEL RH
7 LH	1	302281	MOUNT LOWER TUNNEL LH
8 RH	1	302284	GUIDE, INNER TOP, RH
8 LH	1	302285	GUIDE, INNER TOP, LH
9 RH	1	302323	A/W, GUARD SERVO, RH
9 LH	1	302324	A/W, GUARD SERVO, LH
10	1	302361	DECAL, SMALL, KEEP GUARD IN PLACE
11 RH	1	302388	MOUNT, CE MAGLOCK, RH
11 LH	1	302431	MOUNT, CE MAGLOCK, LH
12	1	302801-001	DECAL SMALL HAND DANGER
13	1	716191	A/W, MOUNT - TYER PIVOT T-BRUSH
14 RH	1	716450	A/W, INLET GUARD, 2000, TAPERED BRUSH
14 LH	1	716451	A/W, INLET GUARD, 2100, TAPERED BRUSH
15	2	955621	NUT HEX NYLOC #10-24 UNC SST
16	4	955941	WASHER LOCK #10 SST
17	2	955978	WASHER FLAT #10 SST
18	3	958510	PIN, ROLL 1/4" X 5/8"
19	4	978912	SCREW SOC HD CAP #10-24 UNC X 3/4 SST
20	1	C07219	SENSOR,INTERLOCK,MAGNETIC,KEYED
21	1	C07220	ACTUATOR, MAGNET

Tyer Covers

211142 Rev C RH
211143 Rev C LH



Ribbon Tension Assembly

30200406 Rev B RH

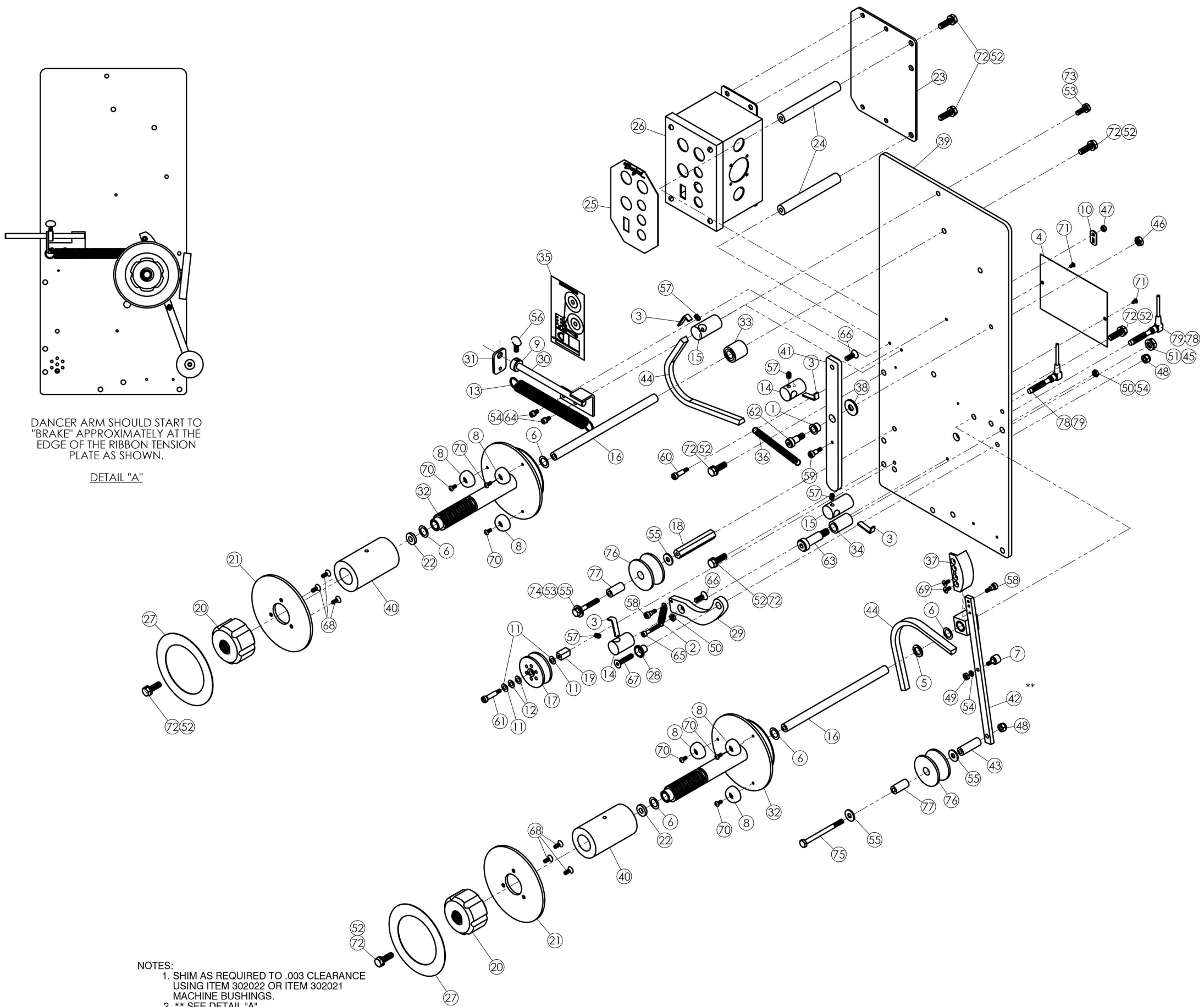
30200506 Rev B LH

FOLD OUT TO VIEW DRAWING

ITEM #	QTY.	PART#	DESCRIPTION	ITEM #	QTY.	PART#	DESCRIPTION
1	1	100578	BUSH,BRZ,FLG,3/8ID 1/2OD X3/8L	41	1	306082	ARM, PIVOT 2ND R.T. EXT
2	1	103519	SPRING EXTENSION	42	1	306084	ASSY, DANCER ARM, R.H. 300 MM
3	4	104239	CLAMP RIBBON FEED BELT	43	1	306088	SHAFT, 2ND ROLLER 300 mm
4	1	112643	SERIAL PLATE	44	2	504521	BELT, V 1/2 X 15"
5	2	122222	BUSHING, 1/2 X 3/4 X .074 MACH.	45	1	955405	NUT HEX JAM 3/8-16 UNC SST
6	6	122232	BUSHING 1/2 X 3/4 X .010 MACH	46	1	955407	NUT HEX JAM 5/16-18 UNC SST
7	1	152076	BEARING, 1/2" CAM FOLLOWER	47	1	955621	NUT HEX NYLOC #10-24 UNC SST
8	6	152148	MOLDED RECESS BUMPER	48	2	955661	NUT HEX NYLOC 1/4-20 UNC SST
9	1	152151	COLLAR,3/8" SET,ZINC PLATED	49	1	955822	NUT HEX MACH. #10-32 UNF SST
10	1	174248	MOUNT, CABLE	50	2	955823	NUT HEX MACH #10-24 NC SST
11	2	302021	BUSHING, MACH, ¼ X ½ X .010	51	1	955938	WASHER LOCK 3/8"
12	2	302022	BUSHING, MACH, 1/4 X 1/2 X .005	52	8	955939	WASHER LOCK 5/16" SST
13	1	302161	SPRING RIBBON TENSION	53	2	955940	WASHER LOCK 1/4" SST
14	2	302162	ROD, BELT CLAMP BRAKE	54	4	955941	WASHER LOCK #10 SST
15	2	302163	BLOCK, BELT CLAMP	55	4	955977	WASHER FLAT 1/4" SST
16	2	302164	SHAFT, RIBBON TENSION	56	1	962508	SCREW THUMB 1/4-20 UNC X 1/2 SST
17	1	302166	ASSY, RIBBON ROLLER	57	4	971206	SCREW SET SOC 1/4-20 X 3/8 SST
18	1	302168	SHAFT, RIBBON TENSION	58	2	974904	SCREW SHLDR 1/4 X 1/4, #10-24 SST
19	1	302170	SPACER, SENSOR ROLLER	59	1	974906	SCREW SHLDR 1/4 X 3/8, #10-24 SST
20	2	302171	NUT, RIBBON TENSION, R.H.	60	1	974910	SCREW, SHLDR 5/16 X 1 1/2, 1/4-20
21	2	302174	PLATE, OUTER SPOOL	61	1	974914	SCREW, SHLDR 5/16 X 1 1/2, 1/4-20
22	2	302178	RETAINER, RIBBON SPOOL	62	1	975108	SCREW, SHLDR 5/16 X 1/2, 1/4-20
23	1	302179	PLATE, CONTROL BOX	63	1	975220	SCREW SHLDR 1/2 X 1 1/4, 3/8-16 SST
24	REF.	302180	STANDOFF, CONTROL BOX	64	2	978906	SCREW SOC HD CAP #10-24 X 3/8 SST
25	REF.	302182	NAMEPLATE,OPERATOR BOX,2000/2100	65	1	978920	SCREW SOC HD CAP #10-24 X 1 1/4 SST
26	REF.	302185	ENCLOSURE,REWORK,2000 (A08369)	66	2	981712	SCREW FLT HD SOC 1/4-20 X 3/4 SST
27	2	302192	NAMEPLATE, RIBBON SPOOL, 2000	67	1	981720	SCREW FLT HD SOC 1/4-20 X 1 1/4 SST
28	1	302243	SLEEVE, BRAKE ARM, RIBBON TENSION	68	6	982308	SCREW FLT HD SOC #10-24 X 1/2 SST
29	1	302244	ARM, BRAKE RIBBON TENSION, SERVO	69	2	982906	SCREW FLT HD SOC #8-32 X 3/8 SST
30	1	302248	A/W, MOUNT, R.H.	70	6	986906	SCREW BUTT HD SOC #8-32 X 3/8 SST
31	1	302252	SPRING ADJUSTER	71	2	987504	SCREW BUTT HD SOC #6-32 X 1/4 SST
32	2	302370	ASSY, INNER SPOOL, R.H.	72	8	989716	SCREW FIN HEX 5/16-18 X 1 SST
33	1	302472	SPACER, DOUBLE SPOOL	73	1	989912	SCREW FIN HEX 1/4-20 X 3/4" SST
34	1	302479	BUMPER, RIBBON TENSION ARM	74	1	989928	SCREW FIN HEX 1/4-20 X 1 3/4 SST
35	1	302547	NAMEPLATE RIBBON ROUTING DBL RH	75	1	989952	SCREW FIN HEX 1/4-20 X 3 1/4 SST
36	1	302874	SPRING-EXTENSION 3/8 OD 2" L .031	76	2	A02359	RIBBON ROLLER
37	1	305111	ACTUATOR, 2ND RIBBON TENSION	77	2	A02363	BUSHING, RIBBON ROLLER
38	1	305113	WASHER, DELRIN RT ARM	78	REF.	C07625	SENSOR,PROX,8MM,10-30VDC,NPN,NO,QC
39	1	306080	PLATE FULL DOUBLE RIBBON 300 MM	79	REF.	C07626	SENSOR,CABLE,M8,3WIRE,F,QC,90
40	2	306081	HUB, SPOOL ADAPTER 300 MM				

Ribbon Tension Assembly

30200406 Rev B RH



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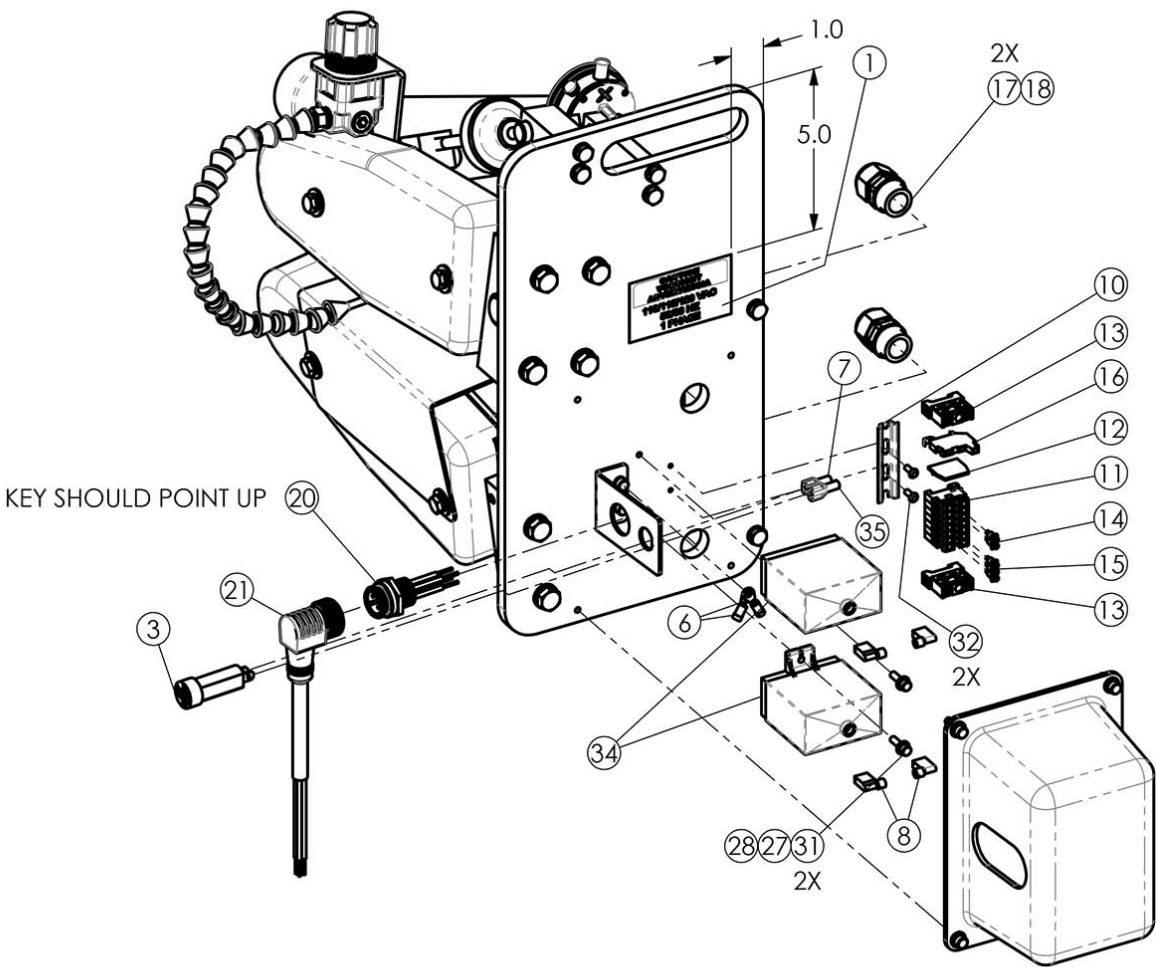
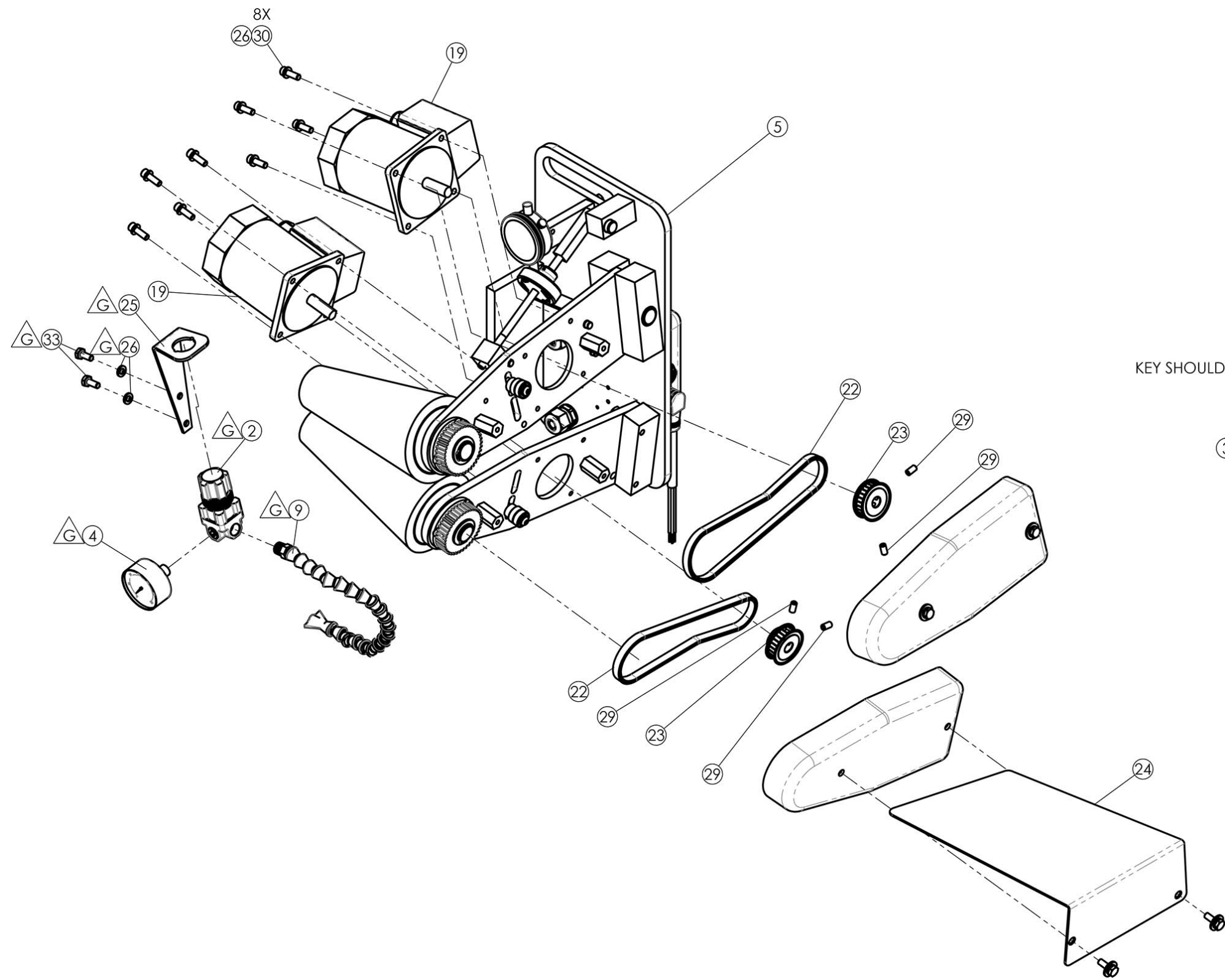
Tapered Brush Assembly
210999-001 Rev G LH
210999-002 Rev G RH

ITEM #	QTY.	PART#	DESCRIPTION
1	1	111177	DECAL,110/115/120 VOLTS,1 PHASE
2	1	112201	VALVE, AIR REGULATOR, 1/4NPT
3	1	114804	CIRCUIT BREAKER,250V,4AMP,PUSH-IN
4	1	118873	GAUGE,0-60 PSI,1/4 NPT,BACK MT,BRS
5	1 RH	210999-008	ASSY,TAPERED BRUSH RH
5	1 LH	210999-007	ASSY,TAPERED BRUSH LH
6	2	302463	CONNECTOR,RING TERM,#10,14-18GA
7	1	610160	FEMALE DISC., NYLON FULLY INS.
8	4	610193	FEMALE DISC., 90DEG. NYL. FULLY INS.
9	1	610309	LOC-LINE 1/4" ASSY
10	2.3"	610360	TERMINAL, DIN RAIL, MINI
11	7	610361	TERMINAL, BLOCK, MINI
12	1	610362	TERMINAL,END COVER,MINI
13	2	610363	TERMINAL,ANCHOR,END CLAMP,MINI
14	1	610532	JUMPER, TERMINAL, 2 POS, MINI
15	1	610533	JUMPER, TERMINAL, 3 POS, MINI
16	1	610534	TERMINAL,GROUNDING,MINI
17	2	610953	CONNECTOR, CORD, .20-.35, DOME, NYLON
18	2	610955	CONNECTOR,SEAL RING,1/2NPT,POLYETH
19	2	611158	MOTOR, 60W, 110V, 60Hz, 1450 RPM
20	1	611841	CABLE,POWERFAST,BULKHEAD,14-4,600V,15A
21	1	611842	CABLE,POWERFAST,14-4,600V,15A,5M,90°
22	2	611929	5MM HTD, 100 TEETH, 9MM WIDE SINGLE SIDED
23	2	715727	REWORK, 26T PULLEY, 12MM BORE
24	1 RH	715772	ANGLE, BAG TAIL SHELF TAPERED RH
24	1 LH	715773	ANGLE, BAG TAIL SHELF TAPERED LH
25	1	716406	BRKT, REGULATOR MNT.
26	10	955940	WASHER LOCK 1/4" SST
27	2	955942	WASHER LOCK #8 SST
28	2	955979	WASHER FLAT #8 SST
29	4	971308	SCREW SET SOC 1/4-28 UNF X 1/2 SST
30	8	978312	SCREW SOC HD CAP 1/4-20 X 3/4 SST
31	2	979510	SCREW SOC HD CAP #8-32 UNC X 5/8 SST
32	2	987506	SCREW BUTT HD SOC #6-32 X 3/8 SST
33	2	989910	SCREW FIN HEX 1/4-20 X 5/8 SST
34	2 REF.	C01294-002	CAPACITOR, 18uF, 250WVAC
35	1	C07287	FEMALE DISC., NYL. FULLY INS. WIRE RANGE 16-14

Tapered Brush Assembly

210999-001 Rev G LH

210999-002 Rev G RH



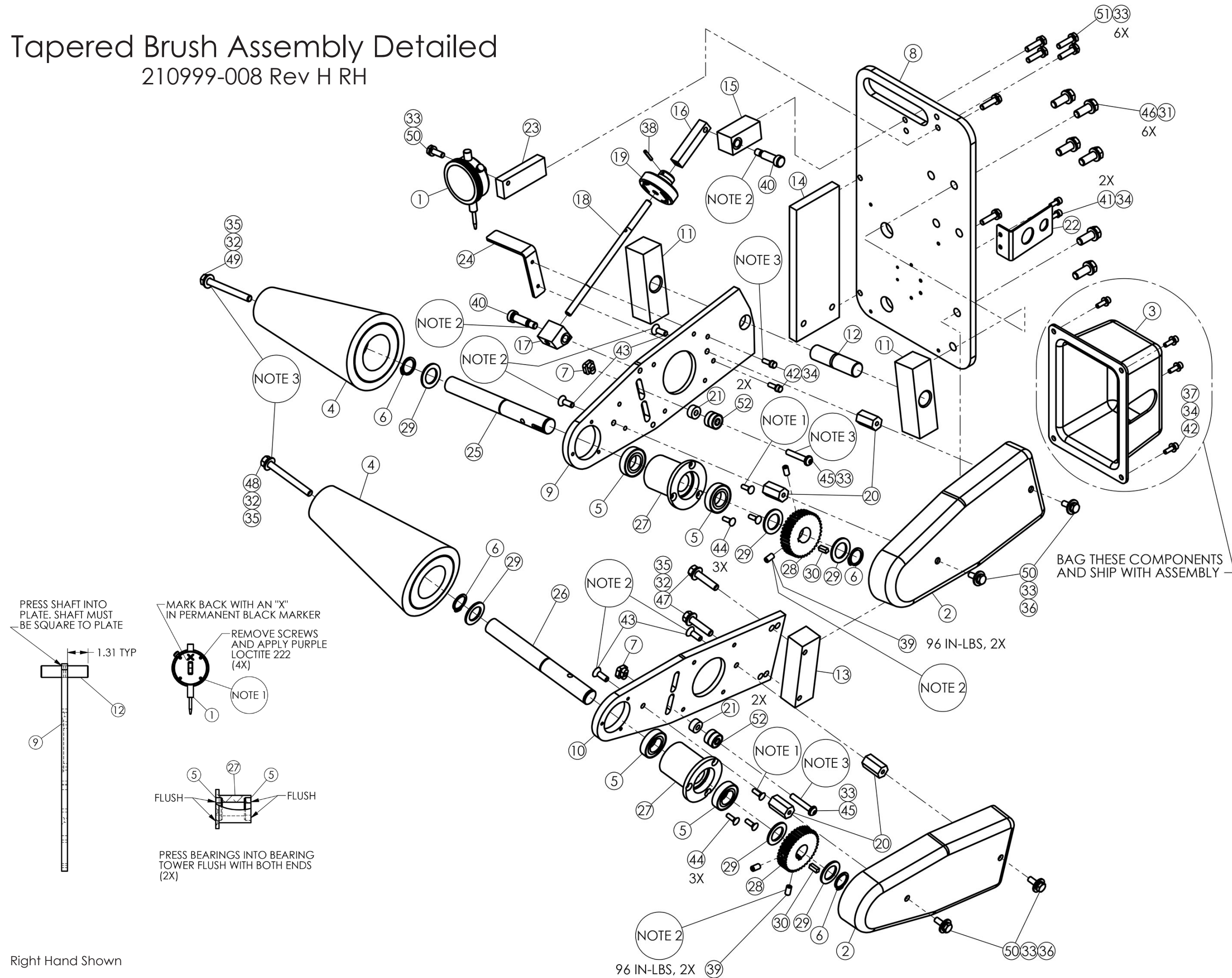
Tapered Brush Assembly Detailed
210999-008 Rev H RH
210999-007 Rev H LH

FOLD OUT TO VIEW DRAWING

ITEM #	QTY.	PART#	DESCRIPTION	ITEM#	QTY.	PART#	DESCRIPTION
1	1	611931	DIAL INDICATOR, 2-3/8 FACE, .25" RANGE	27	2	715731	HUB, TAPERED BRUSH MNT, 20MM
2	2	611932	COVER, TAPERED BRUSH ARM	28	2	715732	PULLEY, TAPERED BRUSH DRIVE, 20MM
3	1	612133	COVER, TAPERED BRUSH BACK, CB	29	6	715733	BUSH,MACH 20MM ID X 32MM OD X 1.91MM
4	2	611934	BRUSH, TAPERED 4-2 OD X 7.63, .010	30	2	955457	KEY SQ 3/16 X 1/2 .002 UNDER SIZE
5	4	611935	BEARING, 20MM ID X 37MM OD X 9MM	31	6	955938	WASHER, LOCK 3/8" SST
6	4	612028	SNAP RING, EXTERNAL, 20MM, SS	32	4	955939	WASHER, LOCK 5/16" SST
7	2	714034	NUT, PULLEY ADJUSTMENT	33	13	955940	WASHER LOCK 1/4" SST
8	1	715700	PLATE, TAPERED BRUSHES MAIN	34	8	955941	WASHER LOCK #10 SST
9	1	715701	PLATE, BRUSH ARM UPPER PIVOT	35	4	955976	WASHER FLAT 5/16 SST
10	1	715702	PLATE, BRUSH ARM LOWER FIXED	36	4	955977	WASHER FLAT 1/4" SST
11	2	715703	BLOCK, UPPER ARM PIVOT	37	4	955978	WASHER FLAT #10 SST
12	1	715704	SHAFT, UPPER BRUSH ARM PIVOT	38	1	958612	PIN ROLL, 1/8 DIA X 3/4 SST
13	1	715705	BLOCK, LOWER ARM FIXED MOUNT	39	4	971308	SCREW SET SOC 1/4-28 UNF X 1/2 SST
14	1	715706	BLOCK, T ARM MOUNT	40	2	975116	SCREW SHLDR 3/8 X 1, 5/16-18 SST
15	1	715707	BLOCK, BRUSH ADJUST MAIN PLATE	41	2	978908	SCREW SOC HD CAP #10-24 UNC X 1/2 SST
16	1	715708	BLOCK, 5/16-18 ADJUST PIVOT	42	6	978910	SCREW SOC HD CAP #10-24 UNC X 5/8 SST
17	1	715709	BLOCK, 5/16-24 ADJUST PIVOT	43	4	981712	SCREW FLT HD SOC 1/4-20 X 3/4 SST
18	1	715710	SHAFT, BRUSH ADJUSTMENT	44	6	982310	SCREW FLT HD SOC #10-24 X 5/8 SST
19	1	715711	KNOB, BRUSH ADJUSTMENT	45	2	985724	SCREW BUTT HD SOC 1/4-20 X 1 1/2 SST
20	4	715712	SPACER, 5/8 HEX X 1-1/8L, 1/4-20	46	6	988916	SCREW FIN HEX 3/8-16 X 1 SST
21	2	715713	SPACER, 5/8 OD X .257 ID X .3 L, AL	47	2	989724	SCREW FIN HEX 5/16-18 X 1 1/2 SST
22	1	715714	BRACKET, TAPERED BRUSH PLUG MOUNT	48	1	989748	SCREW FIN HEX 5/16-18 X 3 SST
23	1	715718	BAR, BRUSH INDICATOR MOUNT	49	1	989748L	SCREW FIN HEX 5/16-18LH X 3 SST
24	1	715719	ANGLE, BRUSH INDICATOR STRIKE	50	5	989912	SCREW FIN HEX 1/4-20 X 3/4 SST
25	1	715729	SHAFT, 20MM BRUSH, LH	51	6	989916	SCREW FIN HEX 1/4-20 X 1 SST
26	1	715730	SHAFT, 20 MM BRUSH, RH	52	4	C00111	BEARING, .75 OD X .25 ID X .28 W

Tapered Brush Assembly Detailed

210999-008 Rev H RH



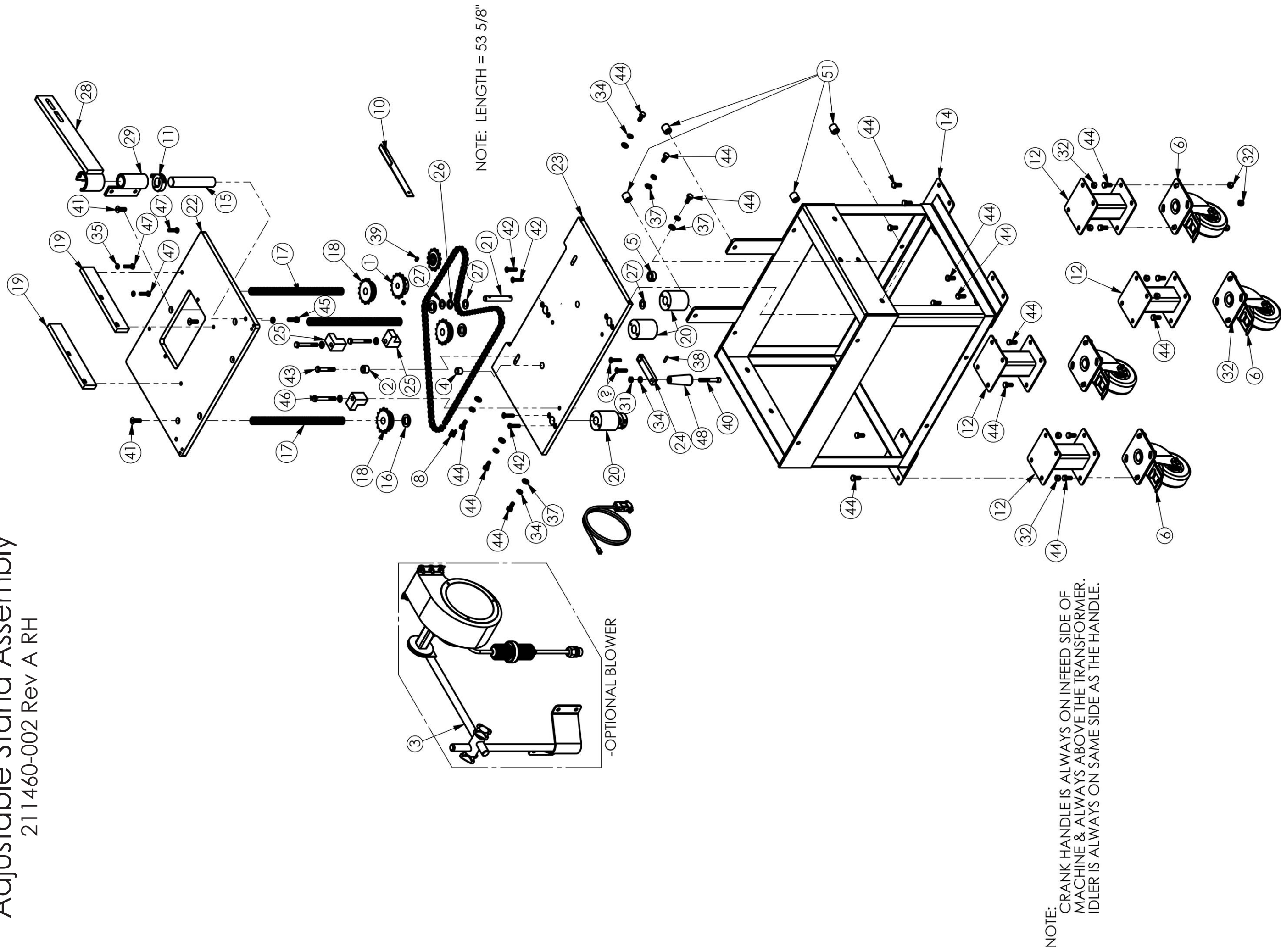
Adjustable Stand Assembly
211460-002 Rev A RH

FOLD OUT TO VIEW DRAWING

ITEM #	QTY.	PART#	DESCRIPTION	ITEM #	QTY.	PART#	DESCRIPTION
1	1	101127	SPROCKET, 41-B-15 1/2 BORE	27	3	401599	WASHER,THRUST 1/2ID X .030
2	1	101136	SPACER, .75 OD x .38 ID x .50 L	28	1	716190	A/W, 2000 TAPERED BRUSH MOUNT
3	REF	142018	ASSY, BLOWER, 110V.	29	REF	716191	A/W, MOUNT - TYER PIVOT T-BRUSH
4	1	152102	BUSH,BRZ,1/2 ID X 5/8 OD X 1/2LG	30	-	718002	A/W, RISER CASTER PAD 7.50"
5	1	152106	COLLAR,1/2" SET	31	1	955407	NUT HEX JAM 5/16-18 UNC SST
6	4	152161	CASTER, 4" SWIVEL LOCKING	32	36	955619	NUT HEX NYLOC 5/16-18 UNC SST
7	4.58'	152170	CHAIN ROLL #41 NICKEL PLATED	33	1	955620	NUT HEX NYLOC 3/8-16 UNC SST
8	1	152176	CHAIN LINK #41 CONNECTING N.P.	34	8	955939	WASHER LOCK 5/16" SST
9	1	181167	SPROCKET, 41-A-13 IDLER	35	3	955940	WASHER LOCK 1/4" SST
10	-	302294	MOUNT, TRACK SUPPORT R/H, SERVO	36	1	955975	WASHER FLAT 3/8" SST
11	1	302437	A/W, BRUSH MOUNT COLLAR	37	10	955976	WASHER FLAT 5/16 SST
12	-	302856	A/W, RISER CASTER PAD 5"	38	1	958412	PIN ROLL 3/16 X 3/4 SST
13	4	302878	A/W, RISER CASTER PAD, 2.5"	39	2	971206	SCREW SET SOC 1/4-20 X 3/8 SST
14	1	303375	A/W, SERVO STAND	40	1	977736	SCREW SOC HD CAP 5/16-18 X 2 1/4 SST
15	1	303389	SHAFT, TYER PIVOT HGT. ADJ.	41	3	981616	SCREW FLT HD SOC 5/16-18 UNC X 1 SST
16	3	304782	SPACER DELRIN LIFT	42	6	981720	SCREW FLT HD SOC 1/4-20 X 1 1/4 SST
17	3	304784	ALL THREAD 3/4-6 ACME STAND	43	1	989632	SCREW FIN HEX 5/16-24 X 2 SST
18	3	304785	SPROCKET RWK 41B15 3/4 ACME	44	38	989712	SCREW FIN HEX 5/16-18 X 3/4 SST
19	2	304786	BAR, SERVO STAND MOUNT	45	1	989716	SCREW FIN HEX 5/16-18 X 1 SST
20	3	304787	GUIDE ALL THREAD STAND	46	3	989740	SCREW FIN HEX 5/16-18 X 2 1/2 SST
21	1	304788	SHAFT, CRANK STAND	47	4	989916	SCREW FIN HEX 1/4-20 X 1 SST
22	1	304789	PLATE, UPPER SERVO MOUNT	48	1	A04735	HANDLE
23	1	304790	PLATE, LOWER LIFT, STAND	49	1	A05020	COLLAR,3/4" SPLIT,SST
24	1	304791	CRANK, ARM 3"	50	1	C01286	CABLE ASSY PC TO 2000/2100
25	3	304792	PLATE, RETAINER SPROCKET	51	4	C03845	SPACER. .34 ID, .75 OD .75 L, SST
26	1	401598	BEARING,THRUST 1/2ID				

Adjustable Stand Assembly

211460-002 Rev A RH

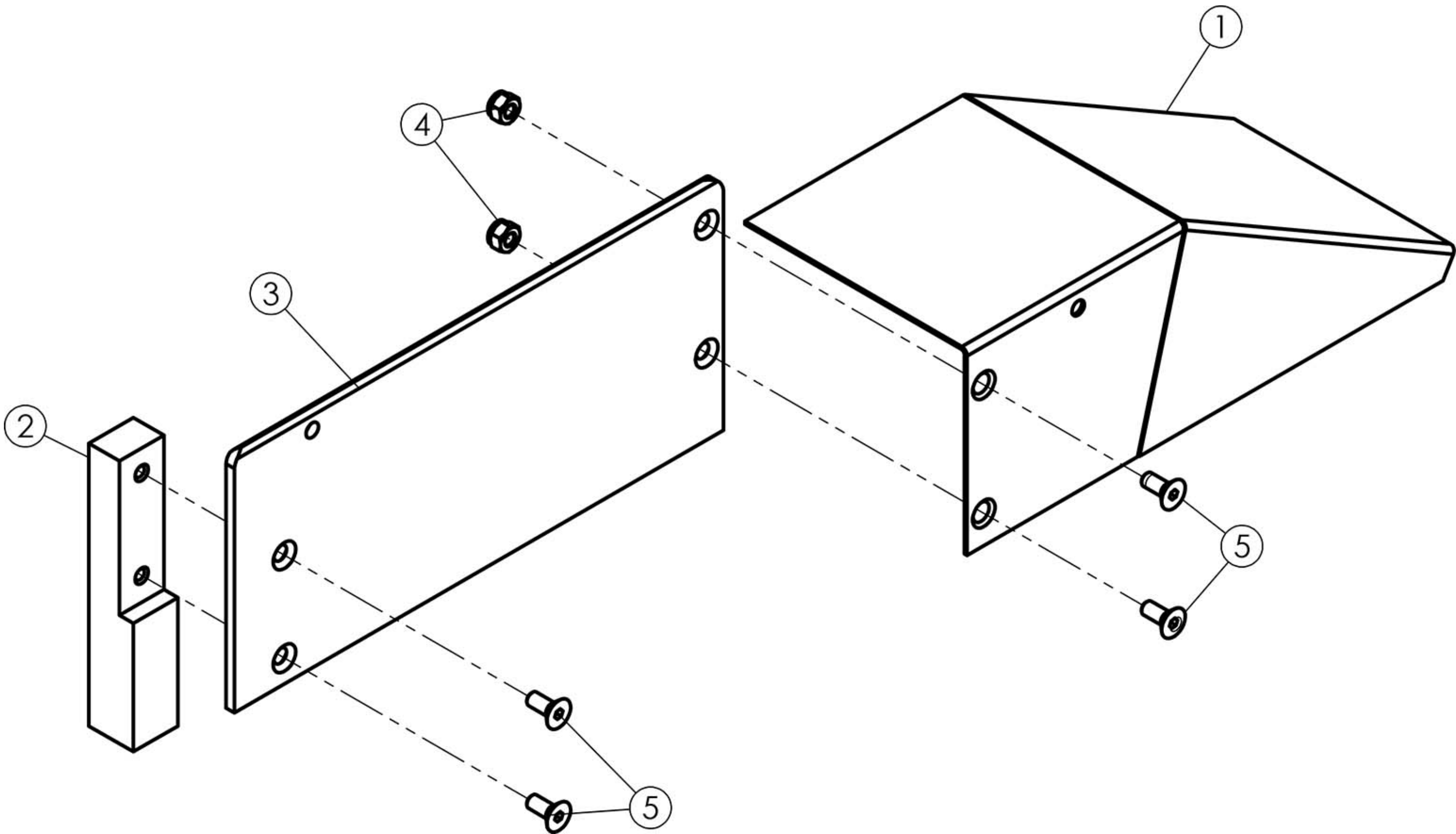


Bread Shelf Assembly
211468 Rev A

ITEM #	QTY.	PART#	DESCRIPTION
1	1	718024	SHELF BREAD 2000 W/STAND
2	1	718027	BAR, SHELF POST STAND TAPER BRUSH
3	1	718028	PLATE SHELF MOUNT TAPER BRUSH STAND
4	2	955661	NUT HEX NYLOC 1/4-20 UNC SST
5	4	981710	SCREW FLT HD SOC 1/4-20 X 5/8 SST

FOLD OUT TO VIEW DRAWING

Bread Shelf Assembly
211468 Rev A



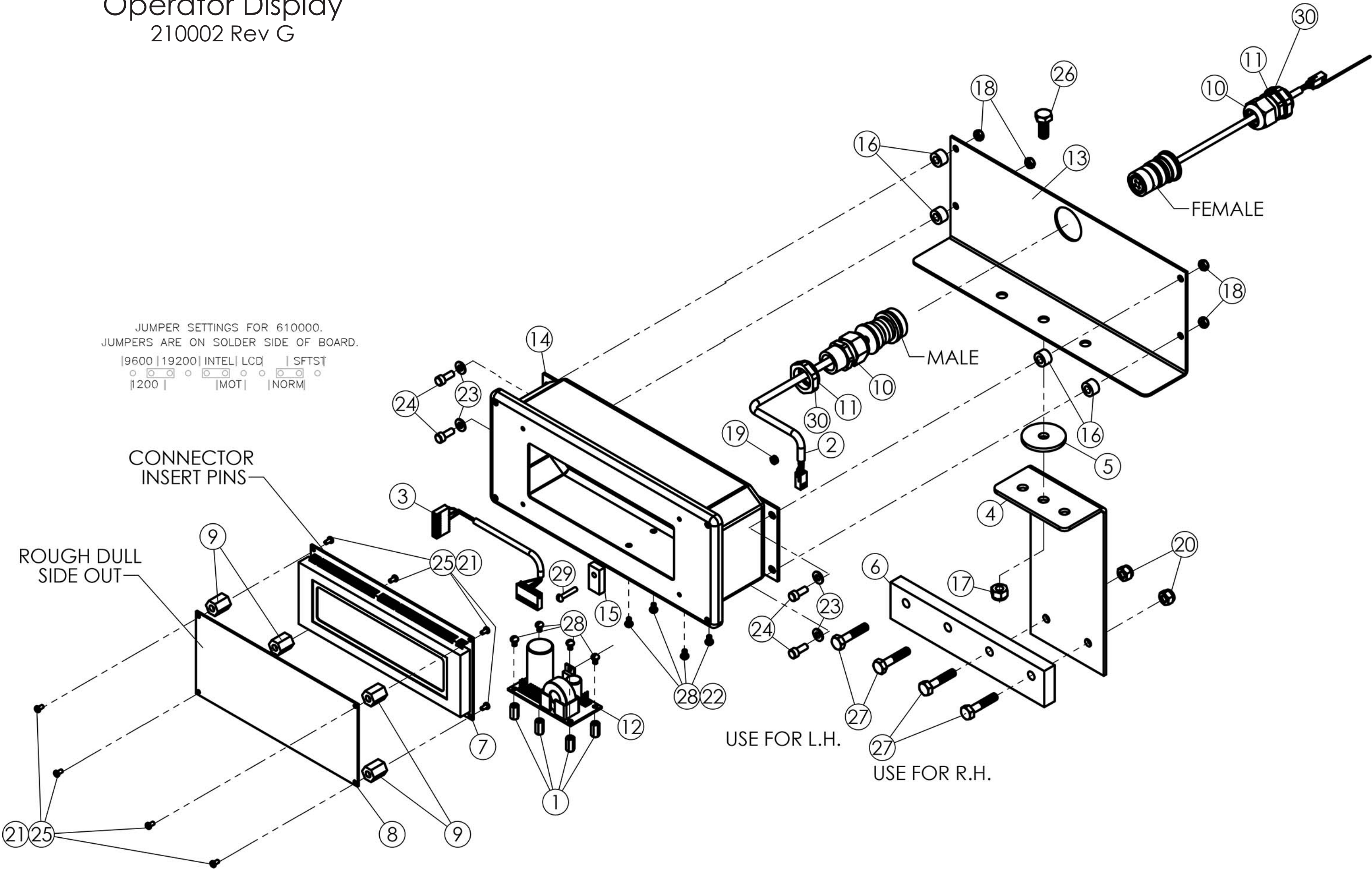
Right Hand Shown

FOLD OUT TO VIEW DRAWING

Operator Display
210002 Rev G

ITEM #	QTY.	PART#	DESCRIPTION
1	4	174069	STANDOFF,#6-32 X 1/2,ALUM,HEX
2	1	210001	CABLE,ASSY,DISPLAY (VFD)
3	1	210204	ASSY,CABLE,PWR,DISPLAY-POWER SUPPLY
4	1	302449	BRACKET, DISPLAY
5	1	302450	WASHER, DISPLAY PIVOT
6	1	302758	BAR, DISPLAY STANDOFF
7	1	610000	DISPLAY, VFD (PRODUCTION)
8	1	610001	DISPLAY, FILTER (GREEN)
9	4	610004	STANDOFF, #4-40 UNC, .625 L.
10	1	610953	CONNECTOR, CORD, .20-.35, DOME, NYLON
11	1	610955	CONNECTOR,SEAL RING,1/2NPT,POLYETH
12	1	611566	PCBA, CONVERTER 12V TO 5V
13	1	710000	BRACKET, (VFD) DISPLAY BOX
14	1	710001	ENCLOSURE,REWORK,2000 (610002)VFD
15	1	710003	SPACER, HEAT SINK, MOUNT PCBA
16	4	710208	SPACER, 1/2OD X .257ID X .281L
17	1	955619	NUT HEX NYLOC 5/16-18 UNC SST
18	4	955621	NUT HEX NYLOC #10-24 UNC SST
19	1	955624	NUT HEX NYLOC #6-32 UNC SST
20	4	955661	NUT HEX NYLOC 1/4-20 UNC SST
21	8	955935	WASHER LOCK #4 SST
22	8	955936	WASHER LOCK #6 SST
23	4	955978	WASHER FLAT #10 SST
24	4	978908	SCREW SOC HD CAP #10-24 UNC X 1/2 SST
25	8	984804	SCREW BUTT HD SOC #4-40 X 1/4 SST
26	1	989712	SCREW FIN HEX 5/16-18 X 3/4 SST
27	4	989920	SCREW FIN HEX 1/4-20 X 1 1/4 SST
28	8	999504	SCREW RD HD SLOT #6-32 X 1/4 SST
29	1	999512	SCREW RD HD SLOT #6-32 X 3/4 SST
30	1	C00174	LOCKING NUT, 1/2 NPT, NYLON

Operator Display
210002 Rev G



Electrical Schematics

FOLD OUT TO VIEW DRAWING

Electrical BOM
117228-WD

Electrical BOM

117228-WD

SERVO TYER TWIST 4 / 5				
REF	SYMBOL	PART #	QTY	DESCRIPTION
1	SS2 P/O	C07088	1	SWITCH SELECTOR,2POS.
2	SS2 P/O	C07102	1	CONTACT SWITCH,NORMALLY OPEN,GREEN
3	SS2 P/O	C07777	1	ENCLOSURE,REWORK,MAIN ENCLOSURE 4/5

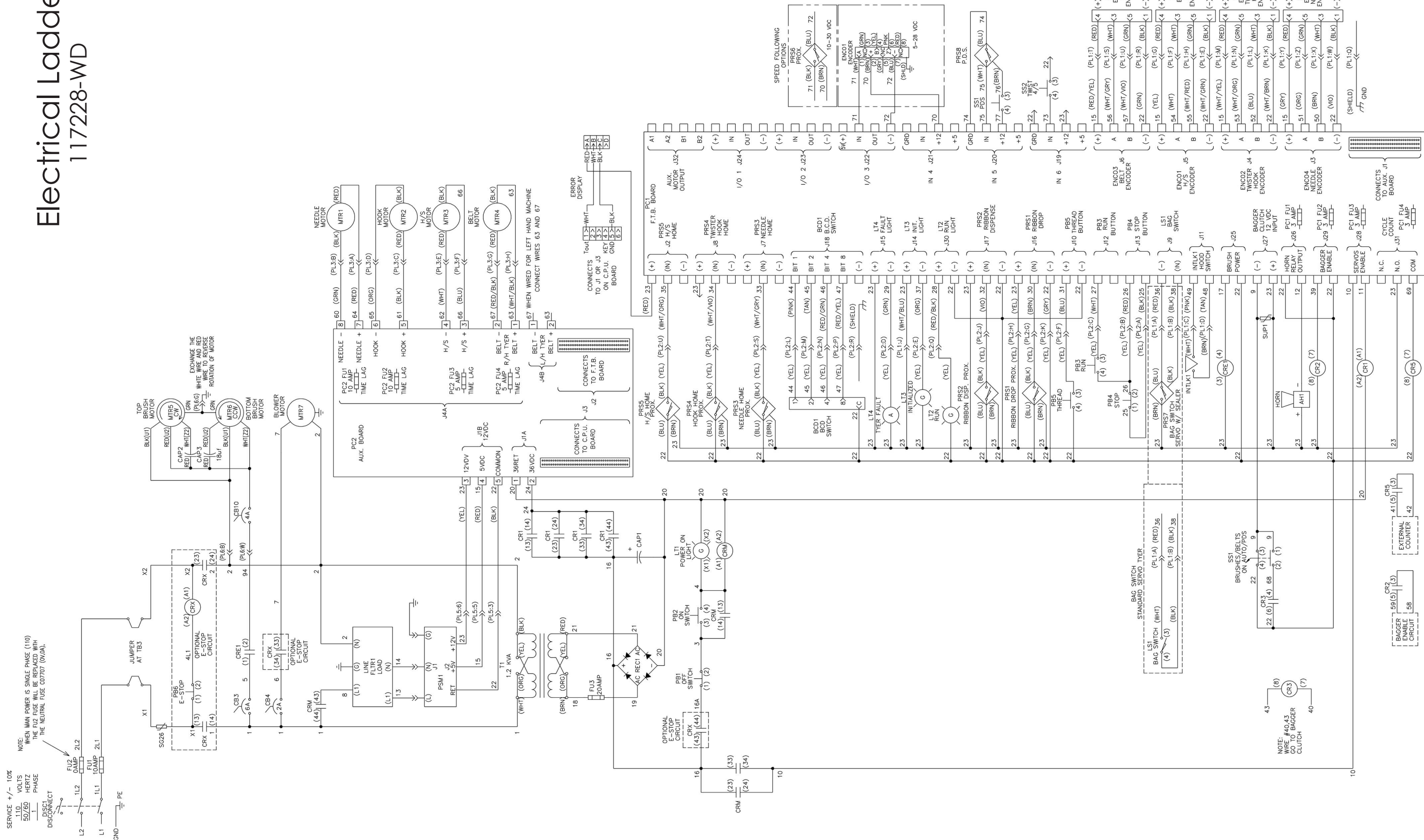
REF	SYMBOL	PART #	QTY	DESCRIPTION
1	AH1	C07214	1	SOMALERT,12 VDC
2	CB1	C01250	1	BRACKET MOUNT,55V
3	CAPT P/O	C01204	1	BRACKET MOUNT,CAPACITOR
4	CB3	C07648-006	1	CIRCUIT BREAKER,250V,5AMP
5	CB4	C07649-002	1	CIRCUIT BREAKER,250V,2AMP
6	CB11	C01360	1	CABLE ASSY,LOWER UNIT
7	CB13	C01359	1	CABLE ASSY,SERVO MOTORS
8	CB15	C01364	1	CABLE ASSY,OPERATOR BOX
9	CRM,CRT1	C07245	2	CONTACTOR,24 VOLT,10 AMP,4 POLE
10	CR2,CRS	C07289-003	2	RELAY,DP/DT,K10 STYLE,12 VDC
11	CR3	C07295	1	RELAY,DP/DT,K10 STYLE
12	CR4	C07295	3	RELAY,DP/DT,K10 STYLE
13	CRE1,5.5 P/O	C05136	1	RELAY,SOLID STATE,DC TO AC
14	CRE1 P/O	C01688	1	RELAY,SRR,COVER FINGER SAFE
15	DISC1	A02345	1	DISCONNECT
16	DISC1 P/O	A02346	1	HANDLE,DISCONNECT
17	DISC1 P/O	610342-001	1	SHAFT,DISCONNECT ASSEMBLY
18	ENC1	C01231	1	ENCLOSURE,REWORK,MAIN
19	ENC1 P/O	C01277	1	WINDOW,LEXAN
20	FBI,1,B2,FBI3	C07076	3	FUSE,HOLDER,600V
21	FBI,1	C05858	1	FUSE,1/2 AMP,120-240 V.
22	FIR1 P/O	C01362	1	BRACKET MOUNT,LINE FILTER
23	FUI,FU2	C06543	2	FUSE,600V,10AMP
24	FU2	C07707	1	FUSE,0V,0AMP
25	FU3	C07062	1	FUSE,600V,20AMP
26	GND	C06488	1	GROUND LUG
27	GND STRAP	C01156	1	GROUND STRAP,DOOR
28	LTI	C01301	1	LIGHT,24 VDC
29	LTI1 P/O	C01218	1	LENS ASSEMBLY,GREEN
30	LTI1 P/O	C01263	1	NAMEPLATE, POWER ON
31	PB1	C07104	1	RELAY,DP/DT,K10, MUSHROOM HEAD, RED
32	PB1 P/O	C07101	1	CONTACT SWITCH,NORMALLY CLOSED,RED
33	PB1 P/O	C01265	1	NAMEPLATE OFF
34	PB2	C01213	1	SWITCH, PUSH BUTTON, GREEN
35	PB2,SS1 P/O	C07102	2	CONTACT SWITCH,NORMALLY OPEN,GREEN
36	PB2 P/O	C01264	1	NAMEPLATE ON
37	PC1	C01289	1	PC BOARD,FIELD TERMINATION,12VDC
38	PC1 CR3	C07269-003	1	RELAY,DP/DT,K10 STYLE,12 VDC
39	PC1 CR2,4,5,6	C01270	4	RELAY,PB,12VDC,2POT 1B5
40	PC1	C07112,3,4	4	FUSE,1/2 AMP,120-240 V.
41	PC2 P/O	C06562	4	SPACER,NO,0.875 X 0.375 X 2
42	PC2	C01267	1	BOARD, CIRCUIT, AUXILIARY
43	PC2 FUI,2	C07036	2	FUSE,10 AMP,250 VOLT,TIME DELAY,TIME LAG
44	PC2 FUI,3,4	C01268	2	FUSE,5 AMP,250V,TIME DELAY,TIME LAG
45	PC2 P/O	C01235	2	CARD GUIDE, MOUNTING BLOCK
46	PC2 P/O	C01236	2	SHAFT, CARD GUIDE
47	PC2 P/O	302364	1	CARD RETAINER
48	PC3	C01410	1	BOARD, CIRCUIT, CPU -332
49	PC3 P/O	C01291	REF	EPROM LOW
50	PC3 P/O	C01292	REF	EPROM MEDIUM
51	PC3 P/O	C01293	REF	EPROM HIGH
52	PC3 P/O	174069	1	STAND OFF,PCB,HEX 6-32 UNC,1/2 LONG
53	PSM1	C01232	1	PANEL, REWORK, MAIN
54	PSM1 FUI	C07170	1	POWER SUPPLY +5V / +12V
55	PSM1 P/O	C07138	1	FUSE,2 AMP,250 VOLT,5 x 22 mm
56	PSM1 P/O	C01234	1	MOUNT PLATE, POWER SUPPLY
57	PSM1 P/O	174071	1	CONNECTOR,3 PIN,HOUSING,156
58	PSM1 P/O	A06661	4	CONNECTOR,6 PIN,HOUSING,156
59	SCC1	A06661	4	STAND OFF,PUSH-IN,3/8 LONG
60	SCC1	6101230	1	BRIDGE RECTIFIER,600 VOLT,1A
61	SS1	C07101-001	1	RELAY,SUPPRESSOR,12VDC
62	SS1 P/O	C01230	1	SWITCH, SELECTOR, 3 POSITION
63	SS1 P/O	C01222	1	CONTACT SWITCH,1-NO,1NC.
64	SUP1	C07123	1	DIODE,SUPPRESSOR,TRANSIENT,28V
65	T1	C01206	1	TRANSFORMER,TOROIDAL,120/240 AC,1.2KVA
66	TB1 P/O	C05843	22	MARKER,STRIP,BLANK
67	TB1 P/O	C06369	2	CENTER JUMPER, 2 POLE
68	TB1 P/O	C06464	10	TERMINAL,DIN RAIL
69	TB1 P/O	C06465	10	TERMINAL,CAPACITOR
70	TB1 P/O	C06595	2	TERMINAL,GROUND
71	TB1 P/O	C07117	9	TERMINAL,DUAL
72	TB1 P/O	C07118	2	TERMINAL,END COVER,DUAL
73	TB1 P/O	C07117-001	2	TERMINAL,DUAL A/B
74	TB1 P/O	C07118-001	2	TERMINAL,END COVER,DUAL A/B
75	TB3 P/O	610360	7/75	DIN RAIL,MINI
76	TB3 P/O	610361	30	TERMINAL BLOCK,MINI
77	TB3 P/O	610362	2	COVER,END PLATE,MINI
78	TB3 P/O	610363	2	CLAMP,END ANCHOR,MINI
79	TB3 P/O	610364	2	CLAMP,END ANCHOR,MINI
80	TB3 P/O	610533	1	JUMPER, 3-POS,MINI
81	TB3 P/O	610534	3	GROUND,TERMINAL,MINI
82	TB3 P/O	710829	1	BRACKET,MTC,TERMINAL,STRIP,MINI
83		A08049	1	NAMEPLATE, BURFORD
84		302299	1	SERIAL PLATE,SMALL
85		118325	1	DECAL,CERTIFIED BY BISSC
		30200250	1	SERVO TYER OPERATOR BOX

REF	SYMBOL	PART #	QTY	DESCRIPTION
1	BCD1	C01224	1	B.C.D. SWITCH ASSEMBLY
2	CB4	C01368	1	BULKHEAD ASSEMBLY, OPERATOR BOX
3	ENC2	302185	1	ENCLOSURE,REWORK,CONTROL BOX
4	ENC2 P/O	302182	1	NAMEPLATE CONTROL BOX
5	INTLK1	C07219	3	INTERLOCK, MAGNETIC,KEYED
6	INTLK1 P/O	C07220	1	ACTUATOR,MAGNET
7	MTR1,2,3,4	302210	4	MOTOR ASSY W/ENCODER
8	PR1,2,3,4,5 P/O	C07625	5	SENSOR PROXIMITY 8MM QUICK CONNECT
9	PR1,2,3,4,5 P/O	C07626	5	CABLE PROXIMITY 8MM QUICK CONNECT
10	PR1,2,3,4,5 P/O	C07625	5	CABLE PROXIMITY 8MM QUICK CONNECT
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131	PR1,2,3,4,5 P/O			

FOLD OUT TO VIEW DRAWING

Electrical Ladder
117228-WD

Electrical Ladder

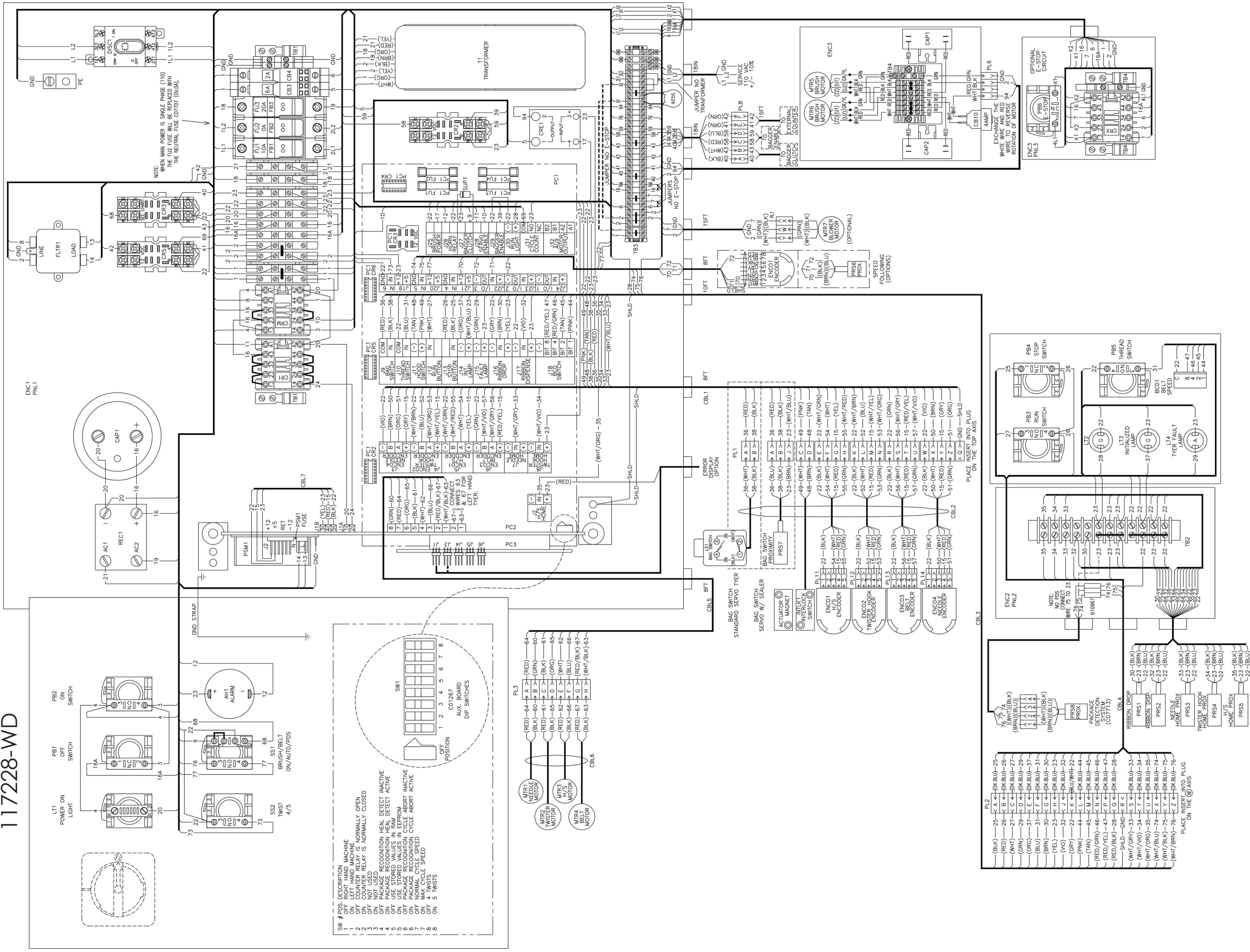


FOLD OUT TO VIEW DRAWING

Electrical Layout
117228-WD

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