

# SERVICE BULLETIN SB - 250



## 855 SMART BENDER<sup>TM</sup> and 38650 Optional Deluxe Pendant

Serial No. ZW0001 - ZW1999



**Read and understand** this material and the Smart Bender<sup>TM</sup> Instruction Manual (IM 1187) before operating or servicing this bender. Failure to understand how to safely operate the bender could result in an accident causing serious injury or death.

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## Introduction

This document is provided to describe how to disassemble and replace parts in the Greenlee 855 Smart Bender™. It is to be used in conjunction with the 855 Smart Bender™ Instruction Manual (IM 1187) which describes how the unit operates and the safety precautions to be observed when using the bender.

Parts must be ordered from Greenlee Textron, 4455 Boeing Drive, Rockford, IL 61109-2988.

The 855 Smart Bender™ warranty will become void if unauthorized repairs are attempted or non-specified parts are used in repairs. For information on parts or repair procedures not shown in this document, contact your nearest authorized Greenlee service station or call 800-435-2932.

## Bender Head Disassembly



### ⚠️ WARNING

Disconnect power supply before servicing bender.

Failure to observe this warning could result in severe injury or death.

### ⚠️ CAUTION

Service bender head on the trunnion base.

Failure to observe this precaution could result in injury or property damage.

## Electronics

### Power Generation Board (PGU).

1. Remove four screws securing top cover and remove cover.
2. Disconnect power cord neutral (white) wire (3) and white I/O Board power lead (15).
3. Disconnect power lead (black) from switch (1) and black I/O Board power lead (16).
4. Disconnect green power lead to I/O board (17).
5. Disconnect PGU-I/O cable (13) from J2 on PGU Board.
6. Disconnect motor leads (2).
7. Remove four screws securing PGU subplate and remove subplate.
8. Assemble in reverse order, noting the proper polarity of all wires as shown.

### Rectifier

1. Remove PGU subplate (follow instructions 1-7 above).
2. Disconnect red, black and two yellow wires to the rectifier (18) (19) (20).
3. Remove screw, lockwasher and nut securing rectifier.
4. Assemble in reverse order, using heat transfer grease between rectifier and subplate.

### Relay

1. Remove PGU subplate (follow instructions 1-7 above).
2. Disconnect the red and black PGU-relay wires (11) (12).
3. Disconnect relay wire unit (8) from relay.
4. Remove red and black relay wires (9) (10).
5. Remove two screws, lockwashers and nuts and remove relay.
6. Assemble in reverse order.

### Transformer

1. Remove four screws securing top cover and remove cover.
2. Disconnect transformer from J2 on I/O board (21).
3. Remove two screws securing transformer.
4. Assemble in reverse order.

### Input/Output Board (I/O)

1. Remove four screws securing top cover and remove cover.
2. Disconnect both receptacle units (4) from J7 & J9.
3. Disconnect selector switch (22) from J8.
4. Disconnect unload lockout switch (7) from J10.
5. Disconnect limit switch (5) from J5.
6. Disconnect optical encoder (23) from J11.
7. Disconnect brake wire (6) from J3.
8. Disconnect PGU-I/O cable (13) from J6.
9. Disconnect transformer cable (21) from J2.
10. Disconnect power leads to I/O board (15) (16) and ground leads (14) (17).
11. Compress the locking tabs on the eight standoffs. Pull the board just past the locking tabs until all eight are free, and remove the board completely.

*Note: If replacement I/O board is to be used with original Microprocessor board, follow Steps 2 and 3 under Microprocessor.*

12. Assemble in reverse order, noting proper polarity of all wires as shown.

See Electrical Control System Layout for location of key numbers.

**Microprocessor****CAUTION**

Service only in a static-free environment.

1. Remove four screws securing top cover and remove cover.
2. Compress locking tabs on four standoffs. Pull board (26) just past tabs until all four are free and then remove board completely.
3. Assemble in reverse order, making sure multi-pin connectors mate correctly.

**Rotary Selector Switches**

1. Remove four screws securing top cover and remove cover.
2. Unplug selector switch unit (22).
3. Loosen set screws and remove knobs.
4. Remove two hex nuts.
5. Pull out selector switch unit.
6. Reassemble in reverse order, noting that flats on shafts go to the bottom.

**Front Pendant Receptacle**

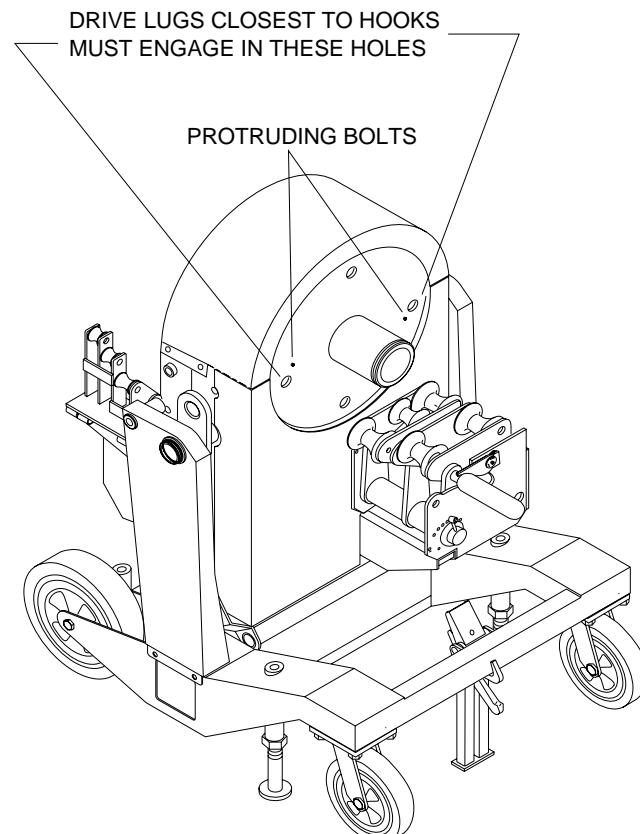
1. Remove four screws securing top cover and remove cover.
2. Unplug receptacle units (4).
3. Remove three screws securing receptacle mounting plate.
4. Pull out receptacle with plate.
5. Remove nut and remove plate from receptacle.
6. Reassemble in reverse order, noting that the two plug-in points on the I/O board are interchangeable.

**Rear Pendant Receptacle**

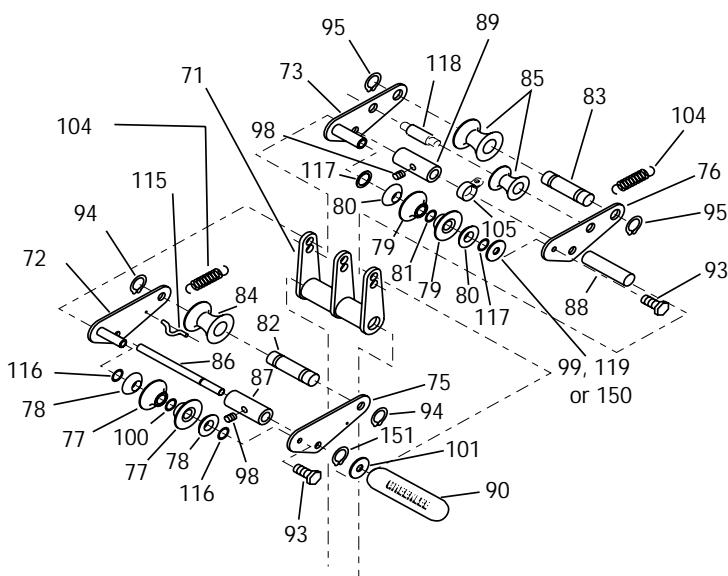
1. Remove motor (see motor removal).
2. Unplug receptacle units (4).
3. Remove nut on receptacle and pull receptacle out.
4. Reassemble in reverse order, noting that the two plug-in points on the I/O board are interchangeable.

**Shoes**

1. Remove retaining ring.
2. Support weight of shoe and pull off spindle.
3. Assemble in reverse order, noting the following:  
On the 1-1/2" - 2" shoe, the two drive lugs closest to the hooks must engage in the two (of four) holes nearest the bolts protruding from the sprocket. On the 1/2"-1-1/4" shoe, the two drive lugs closest to the hooks must engage in the two drive plate holes.



## **Roller Supports**



## **1-1/2" - 2" Roller Support Unit - 500 0145.0**

1. Remove 1-1/2" - 2" shoe (see shoe removal).
  2. Disconnect two springs that attach to 1-1/2" and 2" roller assemblies (104).
  3. Remove squeeze adjustment arm screw and remove arm (97) (74).
  4. Remove three screws securing pivot shaft bushing and slide bushing off shaft (96) (92).
  5. Support the roller support assembly weight and pull out pivot shaft (91).
  6. Lift out roller support assembly by holding the 1-1/2" and 2" tail rollers in one hand to prevent them from pivoting; lift upon the front rollers or the forked support arms with the other hand to remove.
  7. Loosen the set screw securing the collar to the engagement handle (98).
  8. Remove the handle (86) (90) (101) (102), collar (87) and 1-1/2" roller assembly.
  9. Remove the hex head bolt and retaining ring and lift off the plate (93) (94) (75).
  10. Remove the tail roller, tail shaft, clip, pivot ball, O-ring, roller, two Belleville washers, roller, O-ring and pivot ball (84) (82) (115) (78) (116) (77) (100) (77) (116) (78).
  11. Loosen the set screw securing the collar to the pivot pin on the 2" roller assembly (98).
  12. Remove the pin (88), collar (89), and 2" roller assembly.
  13. Remove the hex head bolt and retaining ring and lift off the plate (93) (95) (76).

14. Remove the tail roller and shaft, middle roller and shaft, pivot ball (and any shims that might be used), O-ring, roller, spacer, roller; O-ring and pivot ball (85) (83) (85) (118) (80) (117) (79) (81) (79) (117) (80).
  15. Assemble 2" roller assembly in reverse order noting the following:
    - Slip each O-ring over side plates until reassembly is complete and then slip O-rings between rollers and pivot balls.
    - Clean and lubricate all mating surfaces with a high quality grease.
    - If new front roller parts are used, use shim washers to control axial free play to less than 1/32". If rollers do not pivot freely, use 905 2644.9 or 905 2645.7 shim to add clearance. Use 905 3918.4 shim if play exceeds 1/32".
    - **Use Loctite 271 on hex head bolt. Tighten to 40-45 foot-pounds.**
  16. Assemble 1-1/2" roller assembly in reverse order noting the following:
    - Slip each O-ring over side plates until reassembly is complete and then slip O-rings between rollers and pivot balls.
    - Clean and lubricate all mating surfaces with a high quality grease.
    - **Use Loctite 271 on hex head bolt. Tighten to 40-45 foot-pounds.**
  17. Reassemble roller assemblies to support arms (71), making sure that the tail rollers are to the right if the narrow gap of the support arms are towards you.
  18. Reassemble support roller assembly to bender. Adjust end clearance with set screw (107) as necessary to allow non-binding retraction of roller assembly in the horizontal position.
  19. Reattach springs.

## **1/2" - 1-1/4" Roller Support**

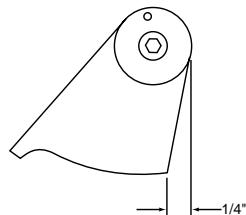
1. Remove retaining ring on shaft and push out shaft.
  2. Remove roller support.
  3. Lubricate rollers with chain lube spray.
  4. Reassemble in reverse order.

## Retention Cam

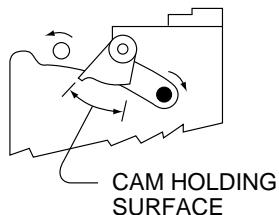
1. Remove bolt securing retention cam and remove washer, spring, shaft and cam (113) (111) (112) (109) (108).
2. Remove switch cover screws and switch cover (42) (38).
3. Remove four screws securing top cover and remove cover.
4. Unplug unload lockout switch from I/O board.
5. Remove screws and nuts securing unload lock-out switch.
6. Pull switch unit from bender.

*Note: Attach a wire or string to the unload lockout switch wire at the I/O board to serve as a retrieval line to pull the new wire up through the unit.*

7. Reassemble in reverse order noting the following:
  - With the bender oriented in the vertical position, rotate the round plate (111) until the right side edge of the cam is pointed straight down or within 1/4" left of being straight down. Make sure both ends of the spring are engaged in the holes of the cam and round plate. Tighten the screw while holding the round plate in position with pliers to prevent it from rotating.

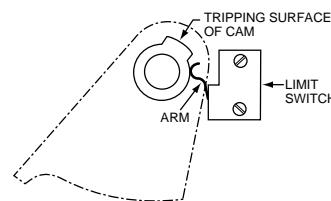


- Check to make sure the roller support handle will fully engage and retract without catching on the cam holding surface. This should be done in both the vertical and horizontal bending positions. It should also be done with the cam positioned as far left and as far right as friction will allow it to stay.



- Once everything is tightened down in the proper position, push in the limit switch trip arm. You should hear the switch click on. If not, loosen the two screws and nuts (40 and 41) and slide the switch to the right and retighten. Push the cam towards the switch to make sure any free play will not trip the switch. Rotate the cam until the switch

trip arm rides up on top of the tripping surface of the cam. You should hear the switch trip on. If not, move the switch to the left to a point where it does. You should hear the switch click off when the cam is released. If you cannot move the switch enough to get it to trip properly, use needlenose pliers to slightly bend the arm.



## Chain

If chain breaks, replace with new chain (not another Master Link). This is due to the high stress on the chain. The addition of a second Master Link will only weaken the chain further. If the Master Link breaks, it can be replaced with a new Master Link (905 4251.7).

1. Remove four screws securing top cover and remove top cover.
2. Remove 1-1/2" - 2" shoe (see shoe removal).
3. Remove seven screws securing front guard and remove guard.
4. Remove nine screws securing motor cover and remove motor cover.
5. Rotate motor until chain master link is accessible at top of bender.
6. With the bender head in the horizontal position, loosen the four bolts and nut securing the motor and turn the eccentric adjusting bolt to allow chain slack.
7. Tap the motor toward the spindle to slack the chain, taking care not to allow the encoder to contact the frame.
8. Remove cotter pins, master link and chain.
9. Reassemble in reverse order noting the following:
  - **Torque eccentric adjusting bolt to 60 foot-pounds** while tightening two front bolts and nut to maintain chain tension.
  - Use new master link and cotter pins.

## Spindle

1. Remove chain (see chain removal).
2. Loosen 1/2 - 1-1/4" drive plate hub set screw.
3. Remove drive plate and key.
4. Use a file to remove any raised edges from the spindle to prevent bearing damage.
5. Remove spindle/sprocket.
6. Reassemble in reverse order.

## Limit Switch Bracket

1. Remove spindle (see spindle removal).
2. Remove four screws securing two limit switches and remove switches.
3. Remove two screws securing bracket and remove bracket.
4. Reassemble in reverse order noting the following:
  - Limit switch with red wires goes on top.
  - Install top switch so that trip roller is as far left as possible, as viewed with the switch behind the bracket.
  - Install bottom switch (black wires) with the trip roller as far right as possible, as viewed with the switch behind the bracket.
  - Temporarily install both shoes before installing chain.
  - Place 2" IMC in bender and rotate shoe until conduit locks up against tail roller. (Do not raise support rollers as is normal for IMC).
  - Slide top limit switch until contacts trip and tighten in that position.
  - Place 1/2" rigid in bender and rotate shoe until conduit locks up against support roller.
  - Slide bottom switch until contacts trip and tighten in that position.
  - Rotate spindle, checking that the limit switch trip bolts do not snag the trip rollers. Re-adjust bracket mounting if necessary.

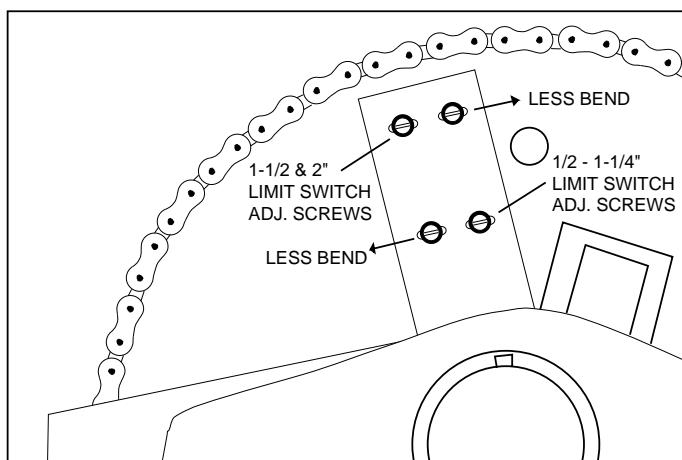
If the accuracy of all sizes of conduit on one shoe is off in the same direction, the limit switch needs to be adjusted. To do so, first unplug the bender. Remove the four screws that secure the top round guard and remove the guard to expose the two limit switches. The top switch controls the 1-1/2" - 2" shoe. Loosen the two screws and move it to the right side of the bender (as shown above) to prevent overbending. The bottom switch controls the 1/2" - 1-1/4" shoe. Loosen the two screws and move it to the left side of the bender (as shown above) to prevent overbending. Move either switch the opposite direction if the bender is underbending. Every 1/8" of switch movement approximates 1 degree of change. Tighten the screws and replace the guard.

## Squeeze Adjustments

Proper squeeze adjustment on the 1-1/2" - 2" roller system is achieved when the tail roller shaft is 1/4" above the support frame with IMC conduit installed but not under load and the leading roller is not contacting the hook. Proper squeeze adjustment for EMT is set when the tail roller shaft does not contact the support frame while bending. If the conduit wrinkles or excessive ovalness is experienced, the squeeze should be increased in one step (hole) increments. To increase squeeze, rotate the shaft counterclockwise. To decrease squeeze, rotate the shaft clockwise.

## Brake

1. Remove eleven screws securing motor cover and remove cover.
2. Loosen two set screws securing brake rotor and remove rotor.
3. Remove power supply leads.
4. Remove four screws securing brake housing and remove housing.
5. Reassemble brake housing and power leads.
6. Use shims to set the brake rotor gap at .002" - .015" and tighten.
7. Replace motor cover.





## Optical Encoder

1. Remove four screws securing top cover and remove cover.
2. Remove seven screws securing front guard and remove guard.
3. Remove nine screws securing motor cover and remove cover.
4. For Dynapar Encoder:
  - Remove encoder cover.
  - Rotate motor until both hub set screws are accessible.
  - Press on self-aligning bridge (obtain service kit #503 9046.5).
  - Loosen two hub set screws using Bristol wrench from service kit.
  - Unplug encoder from I/O board.

*Note: Attach a wire or string to the encoder plug at the I/O board to serve as a retrieval line to pull the new wire and plug up through the unit.*

- Remove two screws securing encoder and pull off encoder.
4. For DRC Model TK730-6E20 Encoder:
  - Remove encoder cover.
  - Rotate motor until hub set screw is accessible.
  - Loosen the set screw on the side of the base that secures the gapping plug.
  - Raise the gapping plug until it seats against the hub.
  - Loosen the hub set screw.
  - Unplug encoder from I/O board.

*Note: Attach a wire or string to the encoder plug at the I/O board to serve as a retrieval line to pull the new wire and plug up through the unit.*

- Remove two screws securing encoder and pull off encoder.
4. For DRC Model K52H6E20 Encoder:
  - Rotate motor until both hub set screws are accessible.
  - Loosen two set screws in the drive hub.
  - Unplug encoder from I/O board.
  - Remove two mounting screws and round plastic spacers securing encoder and pull off encoder.

*Note: Attach a wire or string to the encoder plug at the I/O board to serve as a retrieval line to pull the new wire and plug up through the unit.*

5. Reassemble in reverse order, noting the following:
  - **Torque hub set screws to 22 inch-ounces.**
  - Rotate motor by hand to make sure that encoder disk does not scrape against base.
  - Jog motor and check quad 1 and quad 2 LEDs for ON/OFF pulsing.

## Motor Disassembly

1. Remove optical encoder (see optical encoder removal).
2. Remove chain (see chain removal).
3. Remove brake (see brake removal).
4. Loosen motor sprocket set screws and remove sprocket and key.
5. Disconnect motor leads at relay and the ground wire.
6. Remove five motor mounting bolts and nut.
7. Remove motor.
8. Assemble in reverse order.

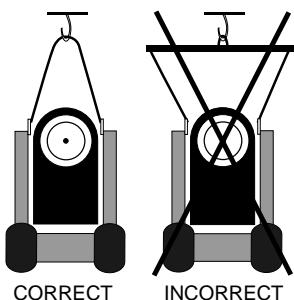
## Trunnion Disassembly



4. Remove remaining support tower from base.
5. Pull out detent pin, knob and spring.
6. Remove four bolts and swivel casters on each side.
7. Remove stationary wheels.
  - Remove retaining rings on axle.
  - Press out axle.
  - Remove wheel and washers from each side.
8. Remove kickstand.
  - Loosen set screw in collar.
  - Press out pin.
  - Remove kickstand weldment.
9. Assemble in reverse order, except for leaving out the detent pin, knob and spring. After all else is assembled, rotate the bender head so the top of the bender is pointed toward the kickstand and insert the detent pin assembly. Hold the detent pin in while rotating the bender head back to one of its normal positions.

1. Support entire weight of bender (approx. 500 lbs.) at lifting eyes but do not lift above floor.

*Note: Lifting slings must attach to lifting mechanism within the width boundaries of the bender to prevent the lifting eyes from sliding off once the retaining rings are removed.*

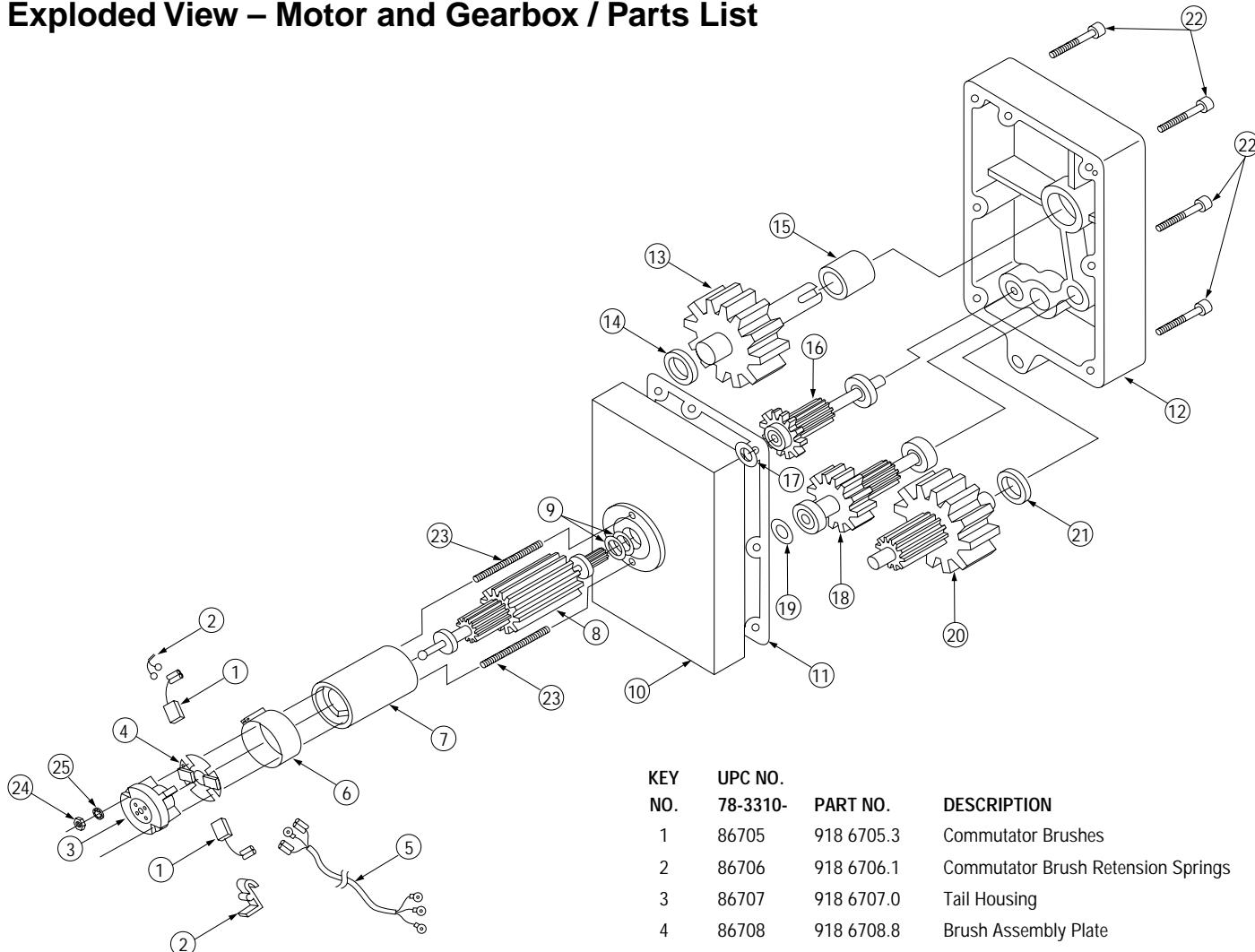


2. Remove support tower on power switch side.
  - Remove four bolts, two nuts and crossbar at base of tower.
  - Remove outer retaining ring on each side of the bender.
  - Slide tower off of pivot spindle.
3. Slide the remainder of the trunnion assembly off the opposite pivot spindle.

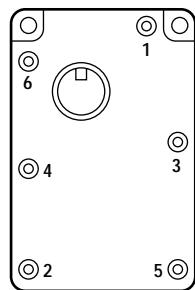
### CAUTION

Bender head may rotate a bit when locking detent pin is disengaged. Keep hands clear.

## Exploded View – Motor and Gearbox / Parts List



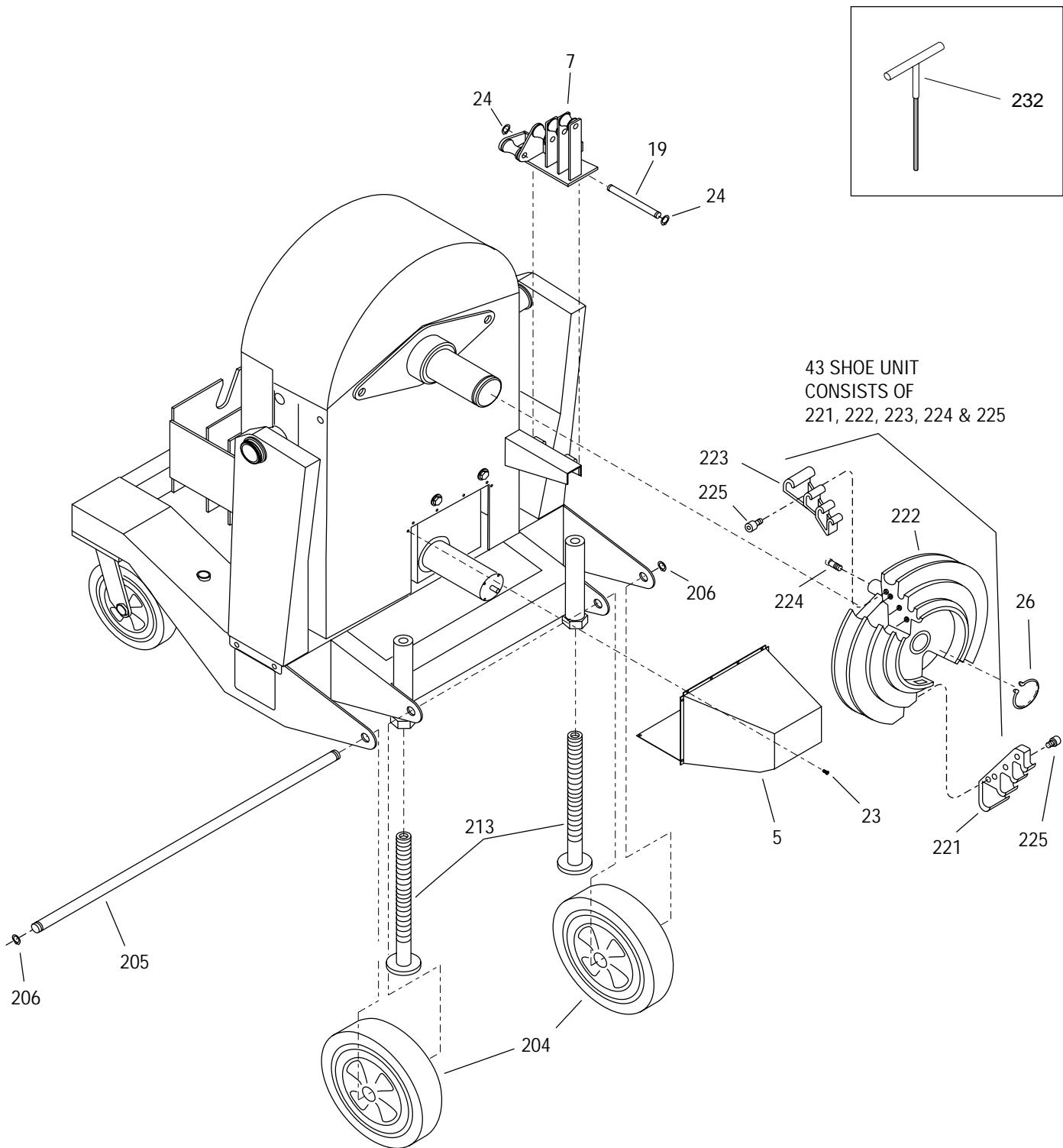
Bolt Tightening sequence for Gearbox Cover



1. Torque gearbox bolts to 100/80 inch-pounds in sequence shown.
2. Assemble all Belleville washers so that i.d.'s butt and o.d.'s contact bearings.
3. Tighten motor nuts (24) to 30-35 inch-pounds in sequence shown.
4. Insert commutator brushes before connecting push-on terminals.

| KEY NO. | UPC NO.  | PART NO.   | DESCRIPTION                         |
|---------|----------|------------|-------------------------------------|
| 1       | 78-3310- | 918 6705.3 | Commutator Brushes                  |
| 2       | 86706    | 918 6706.1 | Commutator Brush Retension Springs  |
| 3       | 86707    | 918 6707.0 | Tail Housing                        |
| 4       | 86708    | 918 6708.8 | Brush Assembly Plate                |
| 5       | 86709    | 918 6709.6 | Cord                                |
| 6       | 39092    | 503 9092.9 | Shroud                              |
| 7       | 86710    | 918 6710.0 | Magnet Housing                      |
| 8       | 86711    | 918 6711.8 | Armature                            |
| 9       | 54348    | 905 4348.3 | Belleville Washers                  |
| 10      | 39073    | 503 9073.2 | Rear Gear Housing                   |
| 11      | 39074    | 503 9074.0 | Gasket                              |
| 12      | 39075    | 503 9075.9 | Front Gear Housing                  |
| 13      | 39076    | 503 9076.7 | Output Gear Shaft                   |
| 14      | 39077    | 503 9077.5 | Short Spacer                        |
| 15      | 39078    | 503 9078.3 | Long Spacer                         |
| 16      | 39079    | 503 9079.1 | 2nd Reduction Pinion Shaft w/ BRG's |
| 17      | 53323    | 905 3323.2 | Wave Washer                         |
| 18      | 39080    | 503 9080.5 | 3rd Reduction Pinion Shaft w/ BRG's |
| 19      | 54248    | 905 4248.7 | Belleville Washer                   |
| 20      | 39081    | 503 9081.3 | 4th Reduction Pinion Shaft          |
| 21      | 39082    | 503 9082.1 | Small Spacer                        |
| 22      | 54043    | 905 4043.3 | 1/2-20 x 2-1/2 Screw                |
| 23      | 02298    | 500 2298.9 | 1/4" - 28 x 9-1/4" Stud             |
| 24      | 51705    | 905 1705.9 | 1/4" - 28 Hex Nut                   |
| 25      | 50749    | 905 0749.5 | 1/4" Internal Tooth Lockwasher      |

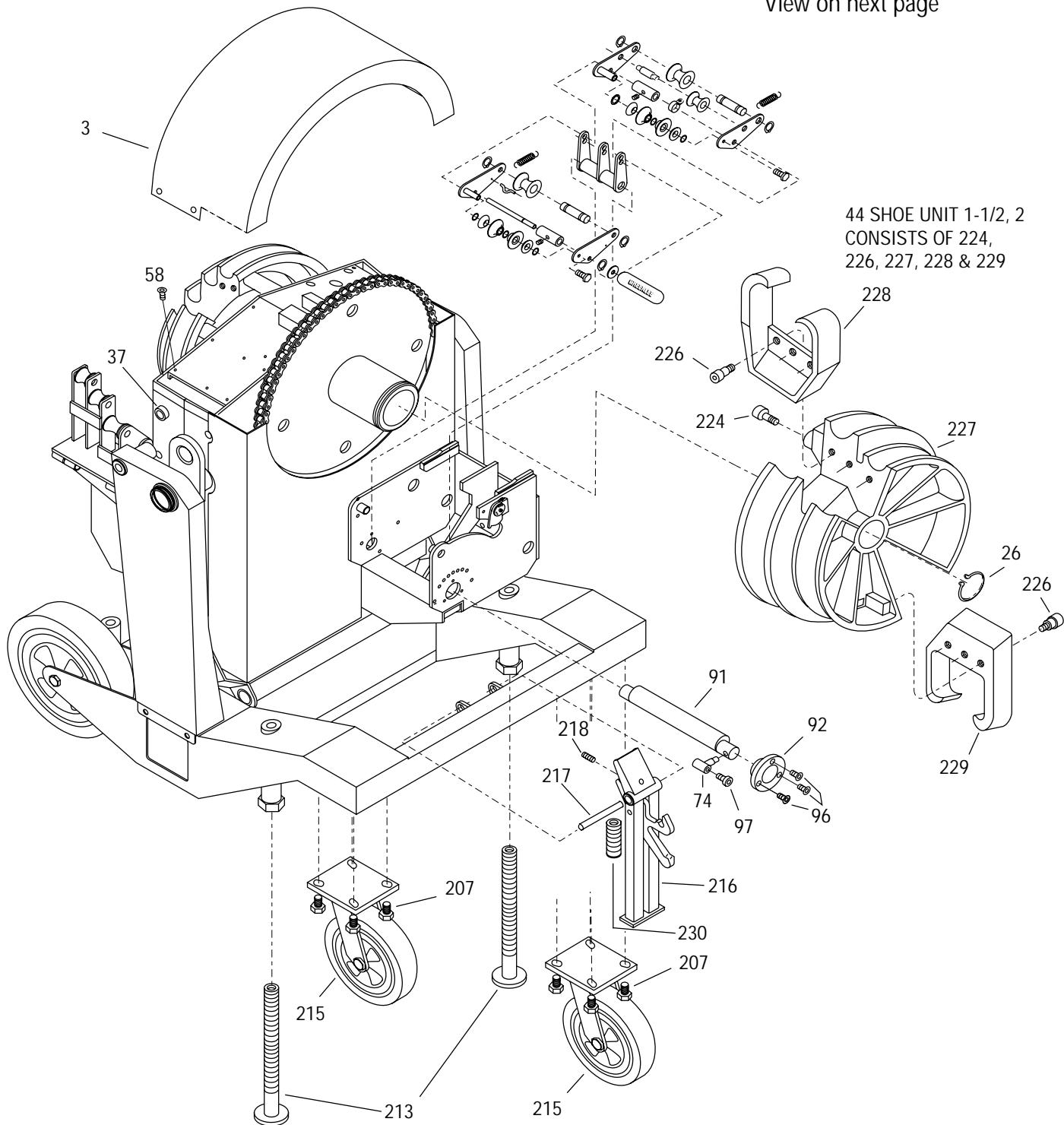
## **Exploded View – 1/2" Thru 1-1/4" Side**



See page 13 for parts list.

**Exploded View – 1-1/2", 2" Side**

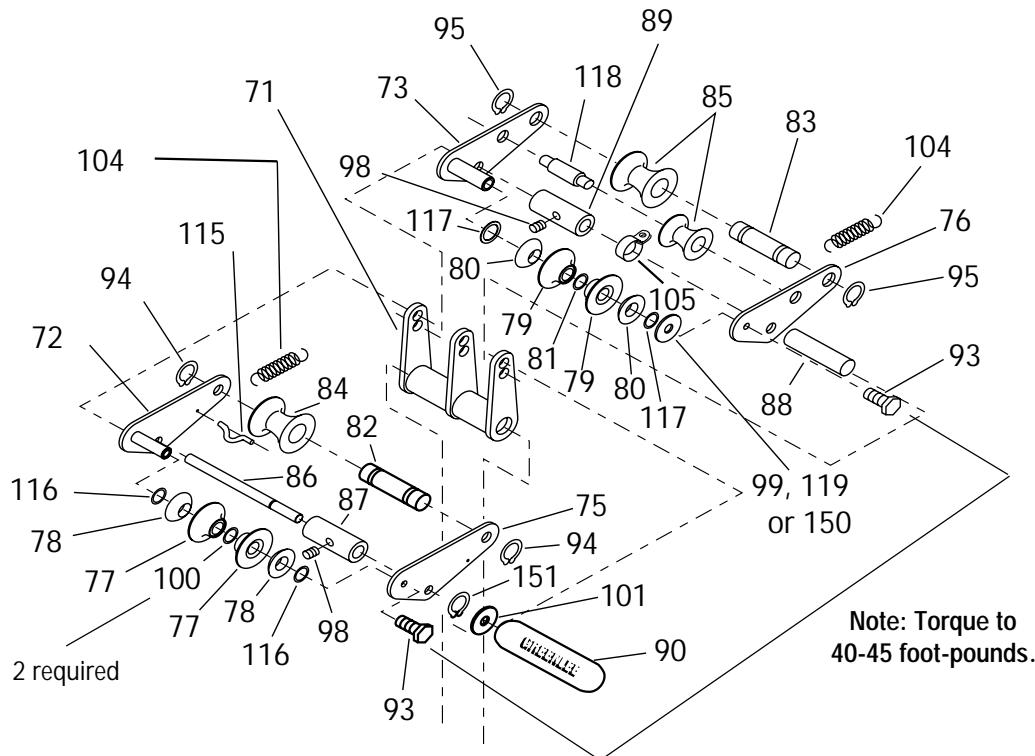
Roller Support Exploded  
View on next page



See page 13 for parts list.

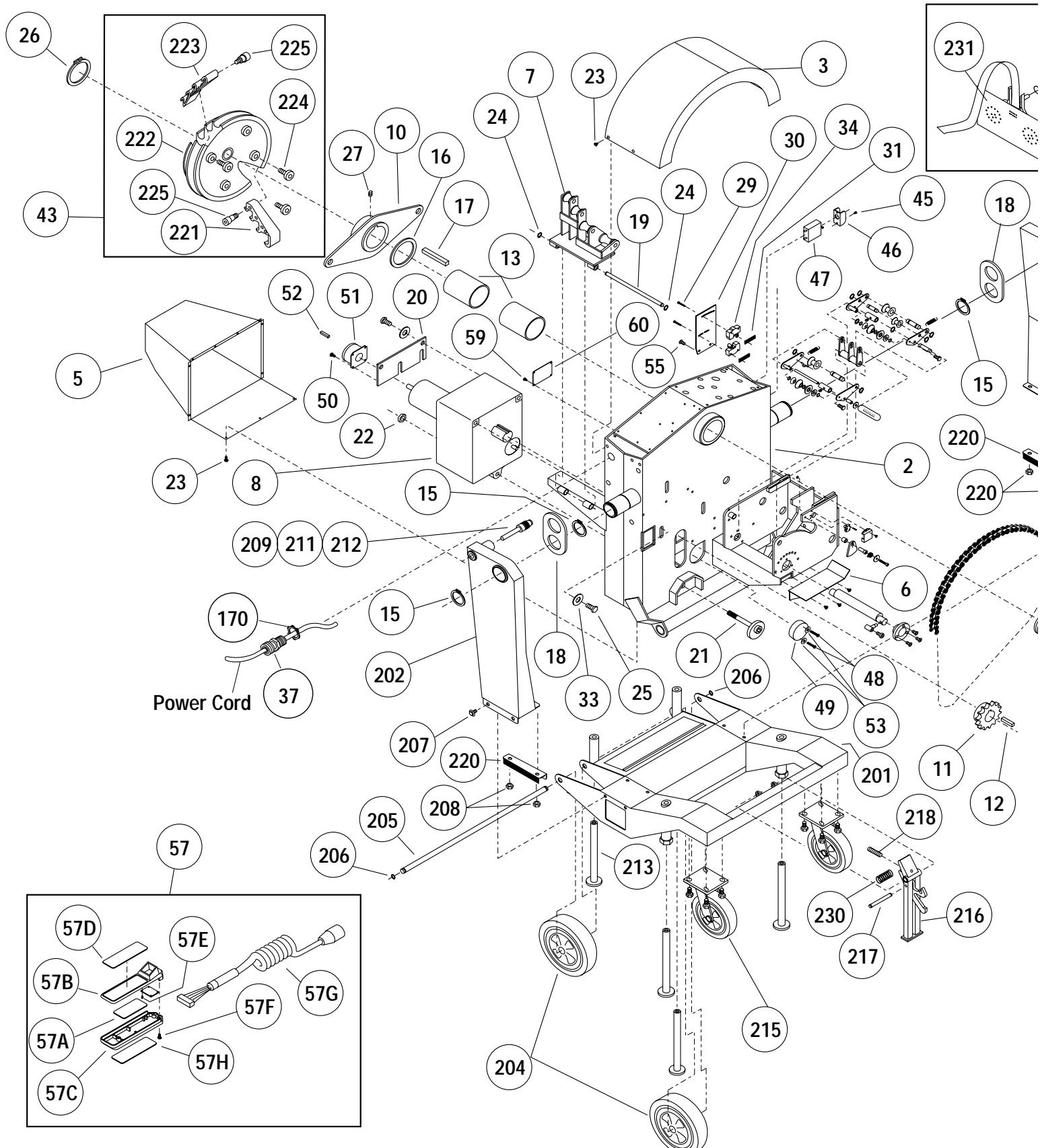


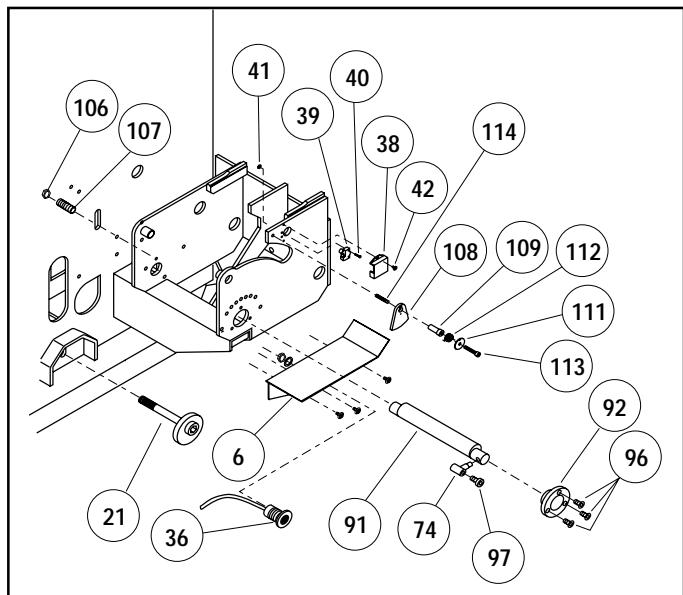
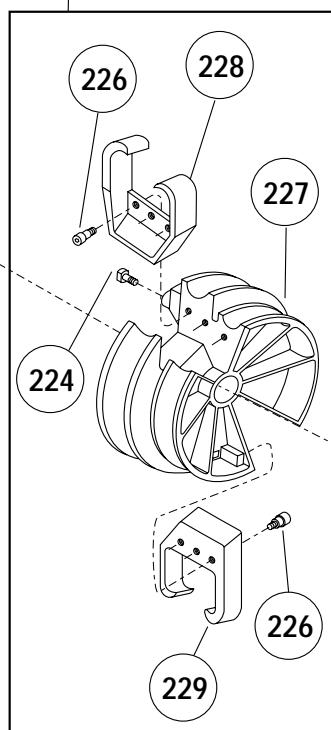
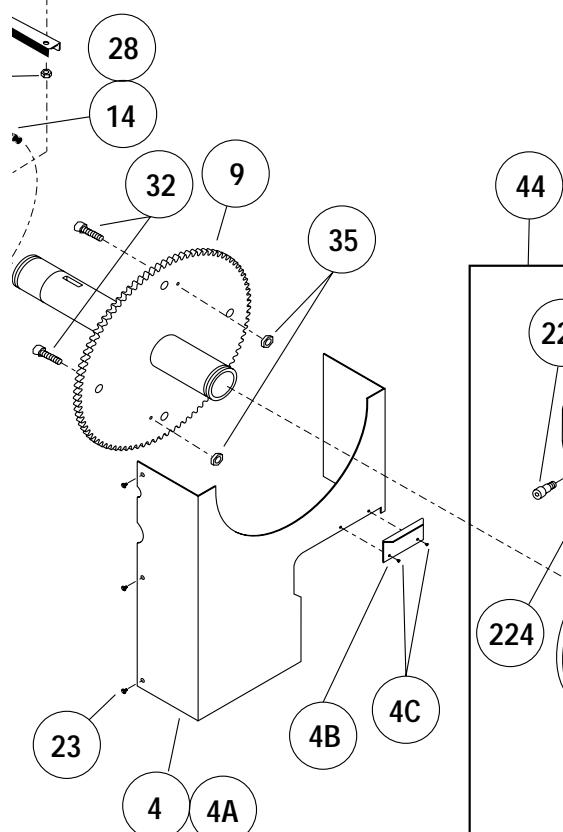
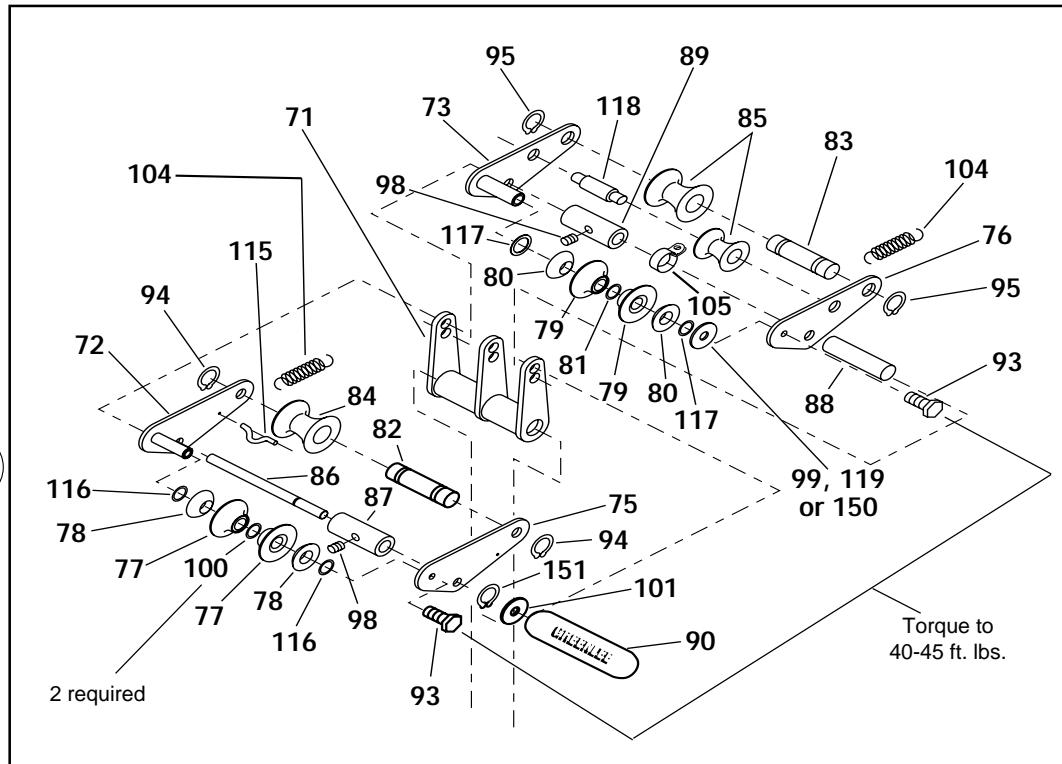
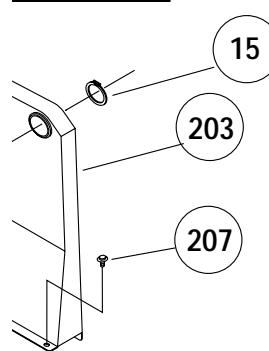
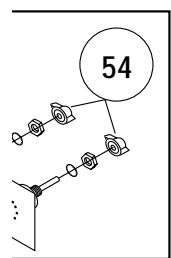
## Exploded View – 1-1/2", 2" Roller Support Unit – 500 0145.0



## Parts List

| KEY | UPC NO.  | NO.        | UPC NO.                            | DESCRIPTION                                       | QTY. |
|-----|----------|------------|------------------------------------|---------------------------------------------------|------|
|     | 78-3310- | 78217      | 503 8217.9                         | Guard Weldment, Top Chain .....                   | 1    |
| 3   |          | 38217      | 503 8217.9                         | Guard Weldment, Top Chain .....                   | 1    |
| 5   |          | 38232      | 503 8232.2                         | Guard Weldment, Motor .....                       | 1    |
| 7   |          | 38199      | 503 8199.7                         | Sppt Wldt, 1/2 - 1-1/4" RLR .....                 | 1    |
| 19  |          | 38465      | 503 8465.1                         | Pin, 1/2 - 1-1/4" Sprt Pvt .....                  | 1    |
| 23  | 51655    | 905 1655.9 | Screw, #10-16 x.50 Hex Hd .....    | 25                                                |      |
| 24  | 54228    | 905 4228.2 | Ring, Rtngr Truarc #5160-42 .....  | 2                                                 |      |
| 26  | 52501    | 905 2501.9 | Ring, Rtngr Truarc #5100-287 ..... | 2                                                 |      |
| 43  | 38780    | 503 8780.4 | Shoe Unit, 1/2 - 1-1/4" .....      | 1                                                 |      |
| 44  | 38148    | 503 8148.2 | Shoe Unit, 1-1/2 - 2" .....        | 1                                                 |      |
| 71  | 38221    | 503 8221.7 | Support Weldment, Roller .....     | 1                                                 |      |
| 72  | 38230    | 503 8230.6 | Support Weldment, 1-1/2 .....      | 1                                                 |      |
| 73  | 38233    | 503 8233.0 | Support Weldment, 2 .....          | 1                                                 |      |
| 74  | 38225    | 503 8225.0 | Arm Weldment, Adjustment .....     | 1                                                 |      |
| 75  | 38240    | 503 8240.3 | Plate, 1-1/2 Outer Roller .....    | 1                                                 |      |
| 76  | 38242    | 503 8242.0 | Plate, 2 Outer Roller .....        | 1                                                 |      |
| 77  | 38254    | 503 8254.3 | Split Rollers, 1-1/2 .....         | 2                                                 |      |
| 78  | 38264    | 503 8264.0 | Ball, 1-1/2 .....                  | 2                                                 |      |
| 79  | 38255    | 503 8255.1 | Split Rollers, 2 .....             | 2                                                 |      |
| 80  | 38263    | 503 8263.2 | Ball, 2 .....                      | 2                                                 |      |
| 81  | 38262    | 503 8262.4 | Spacer, 2 Roller .....             | 1                                                 |      |
| 82  | 38259    | 503 8259.4 | Shaft, 1-1/2 Rear .....            | 1                                                 |      |
| 83  | 38261    | 503 8261.6 | Shaft, 2 Rear Roller .....         | 1                                                 |      |
| 84  | 38252    | 503 8252.7 | Roller, 1-1/2 I.M.C .....          | 1                                                 |      |
| 85  | 38253    | 503 8253.5 | Roller, 2 Tail .....               | 2                                                 |      |
| 86  | 38260    | 503 8260.8 | Shaft, 1-1/2 Pivot Roller .....    | 1                                                 |      |
| 87  | 32027    | 503 2027.0 | Sleeve, 1-1/2 .....                | 1                                                 |      |
| 88  | 31728    | 503 1728.8 | Shaft, 2 Pivot .....               | 1                                                 |      |
| 89  | 38151    | 503 8151.2 | Sleeve, 2 .....                    | 1                                                 |      |
| 90  | 23258    | 502 3258.4 | Grip .....                         | 1                                                 |      |
| 91  | 38256    | 503 8256.0 | Shaft, Eccentric .....             | 1                                                 |      |
| 92  | 38251    | 503 8251.9 | Sleeve, Adapter .....              | 1                                                 |      |
| 93  | 50540    | 905 0540.9 | Screw, 7/16-14 x 1.00 Hex Hd ..... | 2                                                 |      |
| 94  | 50283    | 905 0283.3 | Retaining Ring #5100-75 .....      | 2                                                 |      |
| 95  | 50985    | 905 0985.4 | Retaining Ring #5100-100 .....     | 2                                                 |      |
| 96  | 54242    | 905 4242.8 | Screw, Cap 1/4-20x.37 Btn Hd ..... | 3                                                 |      |
|     |          | 97         | 50224                              | Screw, 5/16-18 x 1.00 Skt Hd .....                | 1    |
|     |          | 98         | 50881                              | Screw, 1/4-28 x .25 Set .....                     | 2    |
|     |          | 99         | 53018                              | Washer, 1.00 x 1.37 x .03 Shim .....              | 1    |
|     |          | 100        | 54248                              | Washer, Belleville 1.362x.803 .....               | 2    |
|     |          | 101        | 39440                              | Washer, .62x2.00x.06 Flat .....                   | 1    |
|     |          | 104        | 54243                              | Spring, Extension .75 x 3.50 .....                | 2    |
|     |          | 105        | 54252                              | Clamp, Loop Type .....                            | 1    |
|     |          | 115        | 38592                              | Guide, Spring .....                               | 1    |
|     |          | 116        | 51130                              | O-Ring, 1.50x1.62x.062 .....                      | 2    |
|     |          | 117        | 51537                              | O-Ring, 1.75x1.87x.062 .....                      | 2    |
|     |          | 118        | 38657                              | Shaft, 2 Middle Roller .....                      | 1    |
|     |          | 119        | 52644                              | Washer, 1/32 Shim .....                           | 1    |
|     |          | 150        | 52645                              | Washer, 1/16 Shim .....                           | 1    |
|     |          | 151        | 53216                              | Retaining Ring #5100-62 .....                     | 1    |
|     |          | 204        | 53390                              | Wheel .....                                       | 2    |
|     |          | 205        | 38166                              | Axle, Long .....                                  | 1    |
|     |          | 206        | 51528                              | Ring, Retaining #5160-75 .....                    | 2    |
|     |          | 207        | 54237                              | Screw, Flange 3/8-16x1.00 Hx .....                | 16   |
|     |          | 213        | 38464                              | Pad Weldment, Jack Bolt .....                     | 4    |
|     |          | 215        | 54276                              | Caster, 8 Swivel .....                            | 2    |
|     |          | 216        | 38743                              | Stand, Anti-Movement .....                        | 1    |
|     |          | 217        | 31732                              | Pin, Pivot .....                                  | 1    |
|     |          | 221        | 31710                              | 1/2 thru 1-1/4 IMC, Rigid Hook .....              | 1    |
|     |          | 222        | 33493                              | 1/2 thru 1-1/4 Shoe .....                         | 1    |
|     |          | 223        | 31712                              | 1/2 thru 1-1/4 EMT Hook .....                     | 1    |
|     |          | 224        | 52479                              | Drive Bolt 1/2-13x.62 Socket Head Cap Screw ..... | 6    |
|     |          | 225        | 51088                              | 1/2 thru 1-1/4 Hook Bolts 3/8-16 x 1-1/4 .....    | 6    |
|     |          |            |                                    | Socket Head Cap Screw .....                       | 8    |
|     |          | 226        | 53396                              | 1-1/2, 2 Hook Shoulder Bolts 3/4 x 1-1/2 .....    | 6    |
|     |          | 227        | 38144                              | 1-1/2, 2 Shoe .....                               | 1    |
|     |          | 228        | 31716                              | 1-1/2, 2 EMT Hook .....                           | 1    |
|     |          | 229        | 38779                              | 1-1/2, 2 IMC & Rigid Hook .....                   | 1    |
|     |          | 230        | 54297                              | Spring .....                                      | 1    |
|     |          | 232        | 54880                              | Wrench, 5/16" Hex "T" Handle .....                | 1    |





If chain breaks, replace with new chain (not another master link). This is due to the high stress on the chain. The addition of a second master link will only weaken the chain further. If the master link breaks, it can be replaced with a new master link (905 4251.7).

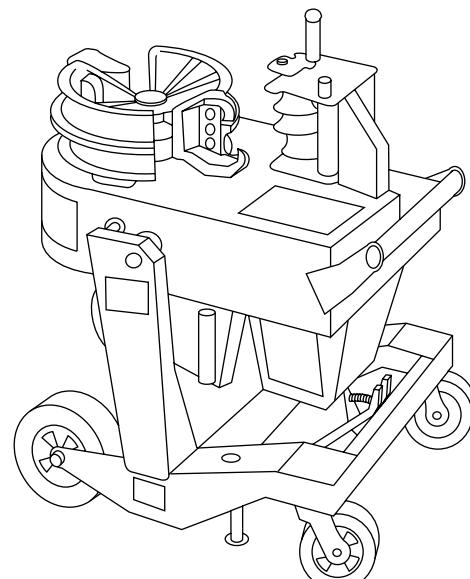
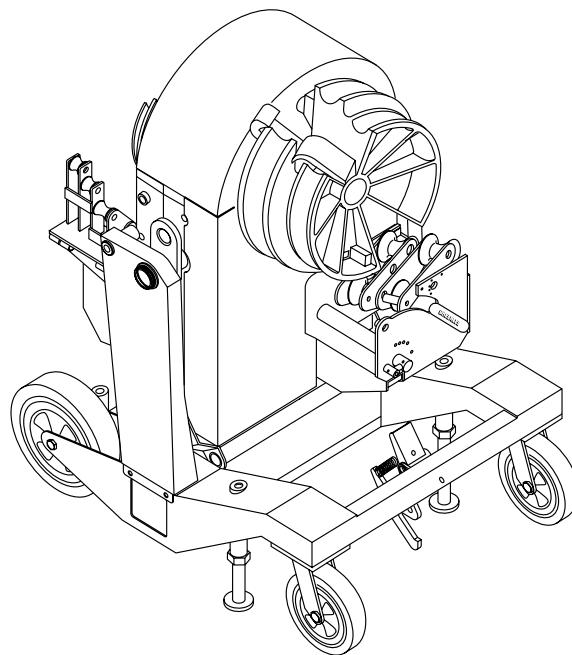


## Parts List

| KEY | UPC NO.  |            | KEY                                | UPC NO. |       |            |                                     |                                        |      |
|-----|----------|------------|------------------------------------|---------|-------|------------|-------------------------------------|----------------------------------------|------|
| NO. | 78-3310- | PART NO.   | DESCRIPTION                        | QTY.    | NO.   | 78-3310-   | PART NO.                            | DESCRIPTION                            | QTY. |
| 2   | 38176    | 503 8176.8 | Frame Weldment .....               | 1       | 57B   | 33476      | 503 3476.0                          | Cover .....                            | 1    |
| 3   | 38217    | 503 8217.9 | Guard Weldment, Top Chain .....    | 1       | 57C   | 33472      | 503 3472.7                          | Housing, Lower .....                   | 1    |
| 4   | 38983    | 503 8983.1 | Guard Assy, Front Chain .....      | 1       | 57D   | 38649      | 503 8649.2                          | Switch, Membrane .....                 | 1    |
| 4A  | 38236    | 503 8236.5 | Guard, Front .....                 | 1       | 57E   | 34342      | 503 4342.4                          | Screw #4-20 .....                      | 3    |
| 4B  | 38244    | 503 8244.6 | Retainer .....                     | 1       | 57F   | 33580      | 503 3580.4                          | Screw #6-32 .....                      | 3    |
| 4C  | 50160    | 905 0160.8 | Rivet, 3/16" Pop .....             | 2       | 57G   | 38635      | 503 8635.2                          | Cord, Pendant .....                    | 1    |
| 5   | 38232    | 503 8232.2 | Guard Weldment, Motor .....        | 1       | 57H   | 38654      | 503 8654.9                          | Strip, Magnetic .....                  | 1    |
| 6   | 38238    | 503 8238.1 | Guard, Bottom .....                | 1       | 58    | 86644      | 918 6644.8                          | Support, Control Unit .....            | 8    |
| 7   | 38199    | 503 8199.7 | Sppt Wldt, 1/2 - 1-1/4" RLR .....  | 1       | 59    | 51751      | 905 1751.2                          | Screw, Drive .....                     | 4    |
| 8   | 38250    | 503 8250.0 | Drive Unit .....                   | 1       | 60    | 38868      | 503 8868.1                          | Nameplate .....                        | 1    |
| 9   | 38196    | 503 8196.2 | Spindle Weldment, Main .....       | 1       | 61    | 38892      | 503 8892.4                          | Decal, Warning (not shown) .....       | 1    |
| 10  | 38193    | 503 8193.8 | Plate Weldment, Drive .....        | 1       | 62    | 38893      | 503 8893.2                          | Decal, Lifting Eye (not shown) .....   | 1    |
| 11  | 54253    | 905 4253.3 | Sprocket, #60 14T .....            | 1       | 63    | 38894      | 503 8894.0                          | Decal, Kickstand (not shown) .....     | 1    |
| 12  | 38267    | 503 8267.5 | Key, Drive Sprocket .....          | 1       | 64    | 38975      | 503 8975.0                          | Decal, Deluxe (not shown) .....        | 1    |
| 13  | 54255    | 905 4255.0 | Bearing, Sleeve #48DU40 .....      | 2       | 65    | 38896      | 503 8896.7                          | Decal, Slct Switch Size (not shown) .. | 1    |
| 14  | 54250    | 905 4250.9 | Chain, #60 92P .....               | 1       | 66    | 38897      | 503 8897.5                          | Decal, Slct Switch Type (not shown) .. | 1    |
| 15  | 54462    | 905 4462.5 | Ring, Rtng Truarc #5100-200 .....  | 4       | 67    | 38898      | 503 8898.3                          | Decal, Bender Pivot Lock (not shwn) .. | 1    |
| 16  | 38265    | 503 8265.9 | Washer, Main Spindle .....         | 2       | 68    | 38899      | 503 8899.1                          | Decal, Roller Adjustment (not shwn) .. | 1    |
| 17  | 38268    | 503 8268.3 | Key, Shoe Drive .....              | 1       | 69    | 38900      | 503 8900.9                          | Decal, Roller Cam Lock (not shown) ..  | 1    |
| 18  | 38457    | 503 8457.0 | Plate, Hoist .....                 | 2       | 70    | 38901      | 503 8901.7                          | Decal, Operation (not shown) .....     | 1    |
| 19  | 38465    | 503 8465.1 | Pin, 1/2 - 1-1/4" Sprt Pvt .....   | 1       | 71    | 38221      |                                     |                                        |      |
| 20  | 38257    | 503 8257.8 | Spacer, Motor Mount .....          | 1       |       | 503 8221.7 | Support Weldment, Roller .....      | 1                                      |      |
| 20A | 39488    | 503 9488.6 | Spacer, Thin Motor Mount .....     | 1       | 72    | 38230      | 503 8230.6                          | Support Weldment, 1-1/2 .....          | 1    |
| 21  | 38228    | 503 8228.4 | Locator Weldment, Eccentric .....  | 1       | 73    | 38233      | 503 8233.0                          | Support Weldment, 2 .....              | 1    |
| 22  | 54265    | 905 4256.8 | Nut, 1/2 - 13 Lock .....           | 1       | 74    | 38225      | 503 8225.0                          | Arm Weldment, Adjustment .....         | 1    |
| 23  | 51655    | 905 1655.9 | Screw, #10-16x.50 Hex Hd .....     | 25      | 75    | 38240      | 503 8240.3                          | Plate, 1-1/2 Outer Roller .....        | 1    |
| 24  | 54228    | 905 4228.2 | Ring, Rtng Truarc #5160-42 .....   | 2       | 76    | 38242      | 503 8242.0                          | Plate, 2 Outer Roller .....            | 1    |
| 25  | 53903    | 905 3903.6 | Screw, Cap 1/2-13x1.00 .....       | 4       | 77    | 38254      | 503 8254.3                          | Rol, 1-1/2 .....                       | 2    |
| 26  | 52501    | 905 2501.9 | Ring, Rtng Truarc #5100-287 .....  | 2       | 78    | 38264      | 503 8264.0                          | Ball, 1-1/2 .....                      | 2    |
| 27  | 54345    | 905 4345.9 | Screw, Set 1/2-20 x .75 Skt .....  | 1       | 79    | 38255      | 503 8255.1                          | Rol, 2 .....                           | 2    |
| 28  | 54251    | 905 4251.7 | Link, Connecting #60 Chain .....   | 1       | 80    | 38263      | 503 8263.2                          | Ball, 2 .....                          | 2    |
| 29  | 54240    | 905 4240.9 | Screw, #6-32x1.00 Sltd Mch .....   | 4       | 81    | 38262      | 503 8262.4                          | Spacer, 2 Roller .....                 | 1    |
| 30  | 38246    | 503 8246.2 | Bracket, Limit Switch .....        | 1       | 82    | 38259      | 503 8259.4                          | Shaft, 1-1/2 Rear .....                | 1    |
| 31  | 38248    | 503 8248.9 | Back-Plate, Switch .....           | 2       | 83    | 38261      | 503 8261.6                          | Shaft, 2 Rear Roller .....             | 1    |
| 32  | 50226    | 905 0226.4 | Screw, 5/16-18x1.25 Skt. Cap ..... | 2       | 84    | 38252      | 503 8252.7                          | Roller, 1-1/2 I.M.C. .....             | 1    |
| 33  | 52597    | 905 2597.3 | Washer, Flat .56x1.37x.109 .....   | 4       | 85    | 38253      | 503 8253.5                          | Roller, 2 Tail .....                   | 2    |
| 34  | 85822    | 918 5822.4 | Switch, Limit #BZ-2RW822-A2 .....  | 2       | 86    | 38260      | 503 8260.8                          | Shaft, 1-1/2 Pivot Roller .....        | 1    |
| 35  | 50645    | 905 0645.6 | Nut, Hex 5/16-18 Reg Jam .....     | 2       | 87    | 32027      | 503 2027.0                          | Sleeve, 1-1/2 .....                    | 1    |
| 36  | 38634    | 503 8634.4 | Receptacle Unit .....              | 2       | 88    | 31728      | 503 1728.8                          | Shaft, 2 Pivot .....                   | 1    |
| 37  | 86683    | 918 6683.9 | Strain Relief .....                | 1       | 89    | 38151      | 503 8151.2                          | Sleeve, 2 .....                        | 1    |
| 38  | 38546    | 503 8546.1 | Cover, Switch .....                | 1       | 90    | 23258      | 502 3258.4                          | Grip .....                             | 1    |
| 39  | 38638    | 503 8638.7 | Switch Unit, Unload Lckt .....     | 1       | 91    | 38256      | 503 8256.0                          | Shaft, Eccentric .....                 | 1    |
| 40  | 54313    | 905 4313.0 | Screw, Mach #2-56X.75 .....        | 2       | 92    | 38251      | 503 8251.9                          | Sleeve, Adapter .....                  | 1    |
| 41  | 54314    | 905 4314.9 | Nut, Lock #2-56 Hex .....          | 2       | 93    | 50540      | 905 0540.9                          | Screw, 7/16-14 x 1.00 Hex Head .....   | 2    |
| 42  | 50763    | 905 0763.0 | Screw, Mach #8-32X.25 .....        | 2       | 94    | 50283      | 905 0283.3                          | Retaining Ring #5100-75 .....          | 2    |
| 43  | 38780    | 503 8780.4 | Shoe Unit, 1/2 - 1-1/4" .....      | 1       | 95    | 50985      | 905 0985.4                          | Retaining Ring #5100-100 .....         | 2    |
| 44  | 38148    | 503 8148.2 | Shoe Unit, 1-1/2 - 2" .....        | 1       | 96    | 54242      | 905 4242.8                          | Screw, Cap 1/4-20x.37 Btn Hd .....     | 3    |
| 45  | 52203    | 905 2203.6 | Screw, Mach #6-32x.25 .....        | 2       | 97    | 50224      | 905 0224.8                          | Screw, 5/16-18 x 1.00 Skt Hd .....     | 1    |
| 46  | 29708    | 502 9708.2 | Guard, Breaker Switch .....        | 1       | 98    | 50881      | 905 0881.5                          | Screw, 1/4-28 x .25 Set .....          | 2    |
| 47  | 86385    | 918 6385.6 | Breaker, Circuit 20 Amp .....      | 1       | 99    | 53018      | 905 3918.4                          | Washer, 1.00 x 1.37 x .03 Shim .....   | 1    |
| 48  | 54619    | 905 4619.9 | Screw, Cap #4-40x.62 Skt .....     | 2       | 100   | 54248      | 905 4248.7                          | Washer, Belleville 1.362x.803 .....    | 2    |
| 49  | 38646    | 503 8646.8 | Encoder Unit, Optical .....        | 1       | 101   | 39440      | 503 9440.1                          | Washer, .62x2.00x.06 Flat .....        | 1    |
| 50  | 50572    | 905 0572.7 | Screw, Cap #8-32x.50 Skt .....     | 4       | 104   | 54243      | 905 4243.6                          | Spring, Extension .75 x 3.50 .....     | 2    |
| 51  | 86646    | 918 6646.4 | Brake, Motor .....                 | 1       | 105   | 54252      | 905 4252.5                          | Clamp, Loop Type .....                 | 1    |
| 52  | 38807    | 503 8807.0 | Key, Brake .....                   | 1       | 106   | 52108      | 905 2108.0                          | Nut, Hex 1/4-20 .....                  | 1    |
| 53  | 54616    | 905 4616.4 | Spacer, Round Plastic .....        | 2       | 107   | 54239      | 905 4239.8                          | Screw, 1/4-20 x 3/4 Ovl Pt Set .....   | 1    |
| 54  | 54151    | 905 4151.0 | Knob, Plastic w/ Set Screw .....   | 2       | 108   | 39851      | 503 9068.6                          | Cam, Retention .....                   | 1    |
| 55  | 54335    | 905 4335.1 | Screw, Flng 1/4 x .37 Thd .....    | 2       | 109   | 38463      | 503 8463.5                          | Shaft, Cam Retention .....             | 1    |
| 57  | 38863    | 503 8863.0 | Switch, Pndt .....                 | 1       | 111   | 38544      | 503 8544.5                          | Plate, Cam Retention .....             | 1    |
| 57A | 38314    | 503 8314.0 | Board, Circuit .....               | 1       | 112   | 38566      | 503 8566.6                          | Spring, Cam Retention .....            | 1    |
|     |          |            |                                    | 113     | 54268 | 905 4268.1 | Screw, 1/4-20 x 1-3/8 Skt Cap ..... | 1                                      |      |

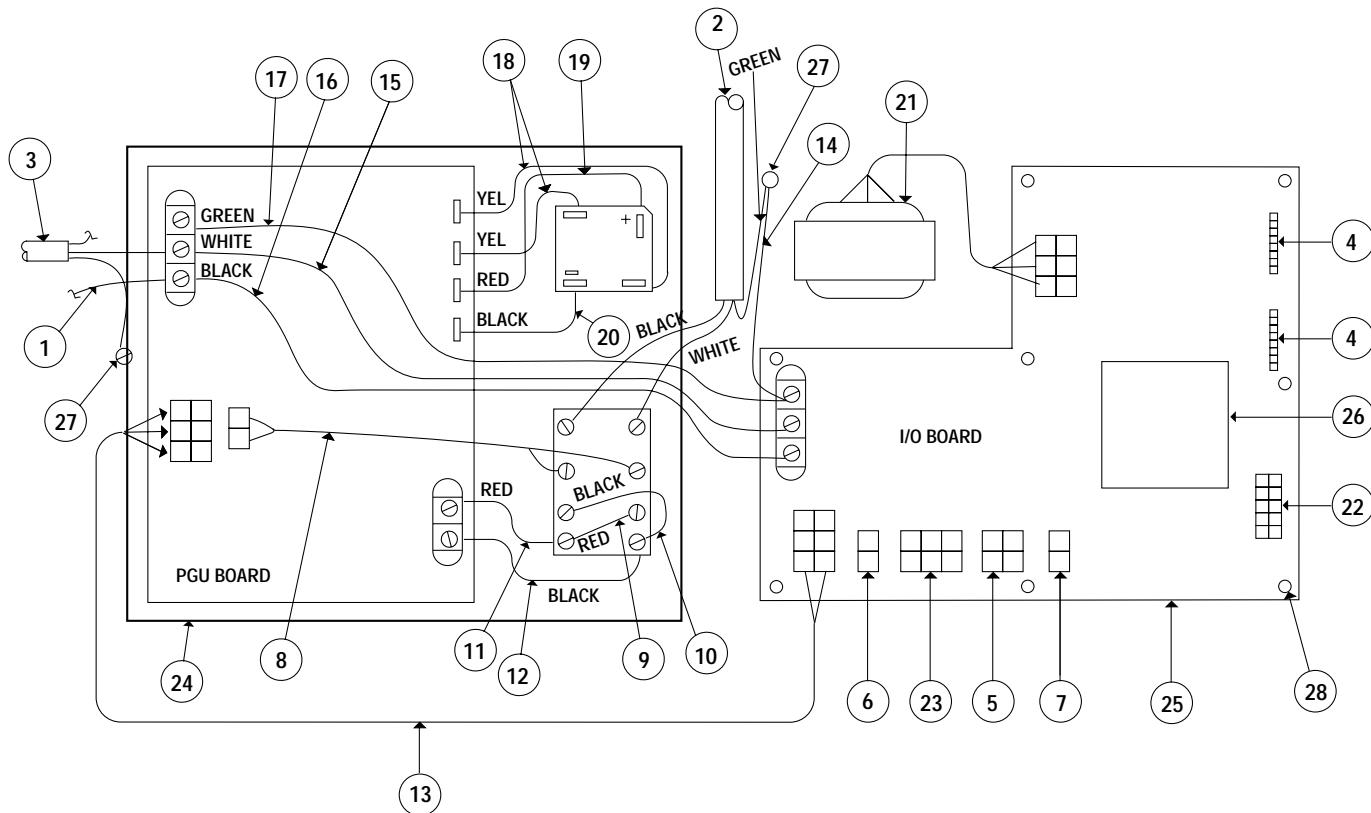


| KEY | UPC NO.  | PART NO.   | DESCRIPTION                            | QTY. |
|-----|----------|------------|----------------------------------------|------|
| NO. | 78-3310- |            |                                        |      |
| 114 | 50458    | 905 0458.5 | Rollpin, 1/8x.375 .....                | 1    |
| 115 | 38592    | 503 8592.5 | Guide, Spring .....                    | 1    |
| 116 | 51130    | 905 1130.1 | O-Ring, 1.50x1.62x.062 .....           | 2    |
| 117 | 51537    | 905 1537.4 | O-Ring, 1.75x1.87x.062 .....           | 2    |
| 118 | 38657    | 503 8657.3 | Shaft, 2 Middle Roller .....           | 1    |
| 119 | 52644    | 905 2644.9 | Washer, 1/32 Shim .....                | 1    |
| 150 | 52645    | 905 2645.7 | Washer, 1/16 Shim .....                | 1    |
| 151 | 53216    | 905 3216.3 | Retaining Ring .....                   | 1    |
| 170 | 51170    | 905 1170.0 | Nut, 3/4 Conduit Lock .....            | 1    |
| 171 | 38974    | 503 8974.2 | Decal, Circuit Breaker (not shown) ... | 1    |
| 201 | 38141    | 503 8141.5 | Base Weldment, Trunion .....           | 1    |
| 202 | 38157    | 503 8157.1 | Tower Weldment, L.H. Trunion .....     | 1    |
| 203 | 38161    | 503 8161.0 | Tower Weldment, R.H. Trunion .....     | 1    |
| 204 | 53390    | 905 3390.9 | Wheel .....                            | 2    |
| 205 | 38166    | 503 8166.0 | Axle, Long .....                       | 1    |
| 206 | 51528    | 905 1528.5 | Ring, Retaining #5160-75 .....         | 2    |
| 207 | 54237    | 905 4237.1 | Screw, Flange 3/8-16x1.00 Hex .....    | 16   |
| 208 | 52646    | 905 2646.5 | Nut, 3/8-16 Esna Hex .....             | 4    |
| 209 | 38167    | 503 8167.9 | Pin, Trunion Lock .....                | 1    |
| 211 | 54244    | 905 4244.4 | Spring, Trunion Lock .....             | 1    |
| 212 | 38168    | 503 8168.7 | Knob .....                             | 1    |
| 213 | 38464    | 503 8464.3 | Pad Weldment, Jack Bolt .....          | 4    |
| 215 | 54276    | 905 4276.2 | Caster, Swivel .....                   | 2    |
| 216 | 38743    | 503 8743.0 | Stand, Anti-Movement .....             | 1    |
| 217 | 31732    | 503 1732.6 | Pin, Pivot .....                       | 1    |
| 218 | 50881    | 905 0881.5 | Screw, 1/4-28x.250 Skt. Set .....      | 1    |
| 220 | 38156    | 503 8156.3 | Block, Reinforcement .....             | 2    |
| 221 | 31710    | 503 1710.5 | 1/2 thru 1-1/4 IMC, Rigid Hook .....   | 1    |
| 222 | 33494    | 503 3494.8 | 1/2 thru 1-1/4 Shoe .....              | 1    |
| 223 | 31712    | 503 1712.1 | 1/2 thru 1-1/4 EMT Hook .....          | 1    |
| 224 | 52479    | 905 2479.9 | Drive Bolt 1/2-13x.62 .....            | 1    |
| 225 | 51088    | 905 1088.7 | Socket Head Cap Screw .....            | 6    |
|     |          |            | 1/2 thru 1-1/4 Hook Bolts .....        |      |
|     |          |            | 3/8-16 x 1-1/4 .....                   |      |
|     |          |            | Socket Head Cap Screw .....            | 8    |
| 226 | 53396    | 905 3396.8 | 1-1/2, 2 Hook Shoulder Bolts .....     | 6    |
|     |          |            | 3/4 x 1-1/2 .....                      |      |
| 227 | 38147    | 503 8147.4 | 1-1/2, 2 Shoe .....                    | 1    |
| 228 | 31716    | 503 1716.4 | 1-1/2, 2 EMT Hook .....                | 1    |
| 229 | 38779    | 503 8779.0 | 1-1/2, 2 IMC & Rigid Hook .....        | 1    |
| 230 | 54297    | 905 4297.5 | Spring .....                           | 1    |
| 231 | 38645    | 503 8645.0 | Selector Switch Unit w/o knobs .....   | 1    |
| 232 | 54880    | 905 4880.9 | 5/16" Hex "T" Wrench .....             | 1    |



503 8650.6  
Deluxe Pendant

# Electrical Control System Layout



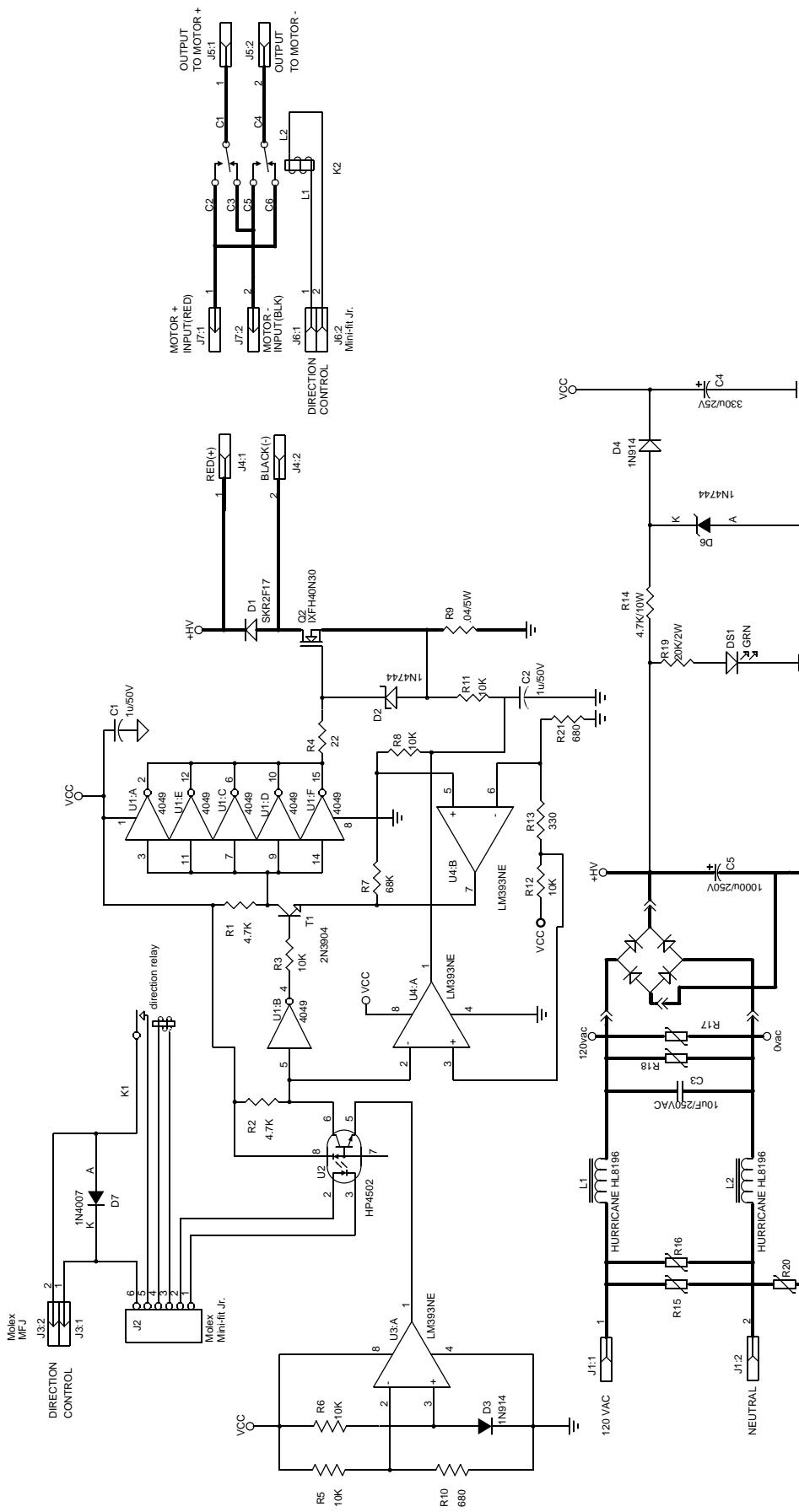
| <b>Key</b> | <b>Part Number</b> | <b>Description</b>              |
|------------|--------------------|---------------------------------|
| 1          | 503 8941.6         | PGU Power Wire                  |
| 2          | 503 8250.0         | Motor                           |
| 3          | 503 8603.4         | Power Cord                      |
| 4          | 503 8634.4         | Receptacle Unit                 |
| 5          | 503 8636.0         | Limit Switch Wire Unit          |
| 6          | 503 8637.9         | Brake Wire Unit                 |
| 7          | 503 8638.7         | Unload Lock-Out Switch Unit     |
| 8          | 503 8639.5         | Relay Wire Unit                 |
| 9          | 503 8640.9         | Red Relay Wire                  |
| 10         | 503 8175.0         | Black Relay Wire                |
| 11         | 503 8961.0         | Red Relay-PGU Wire              |
| 12         | 503 8960.2         | Black Relay-PGU Wire            |
| 13         | 503 8648.4         | IO-PGU Wire Unit                |
| 14         | 503 8942.4         | Ground Jump Wire                |
| 15         | 503 8887.8         | White I/O-PGU Wire              |
| 16         | 503 8888.6         | Black I/O-PGU Wire              |
| 17         | 503 8889.4         | Green I/O -PGU Wire             |
| 18         | 503 8643.3         | Yellow Rectifier Wires          |
| 19         | 503 8642.5         | Red Rectifier Wire              |
| 20         | 503 8641.7         | Black Rectifier Wire            |
| 21         | 503 8647.6         | Transformer Unit                |
| 22         | 503 8645.0         | Selector Switch Unit            |
| 23         | 503 8646.8         | Optical Encoder                 |
| 24         | 500 3645.9         | Power Generation Board Assembly |
| 25         | 503 8311.6         | Input-Output Board              |
| 26         | 500 1733.0         | Microprocessor                  |
| 27         | 905 4329.7         | Screw, #8-18x3/8 Ground         |
| 28         | 918 6644.8         | Support - I/O Board             |



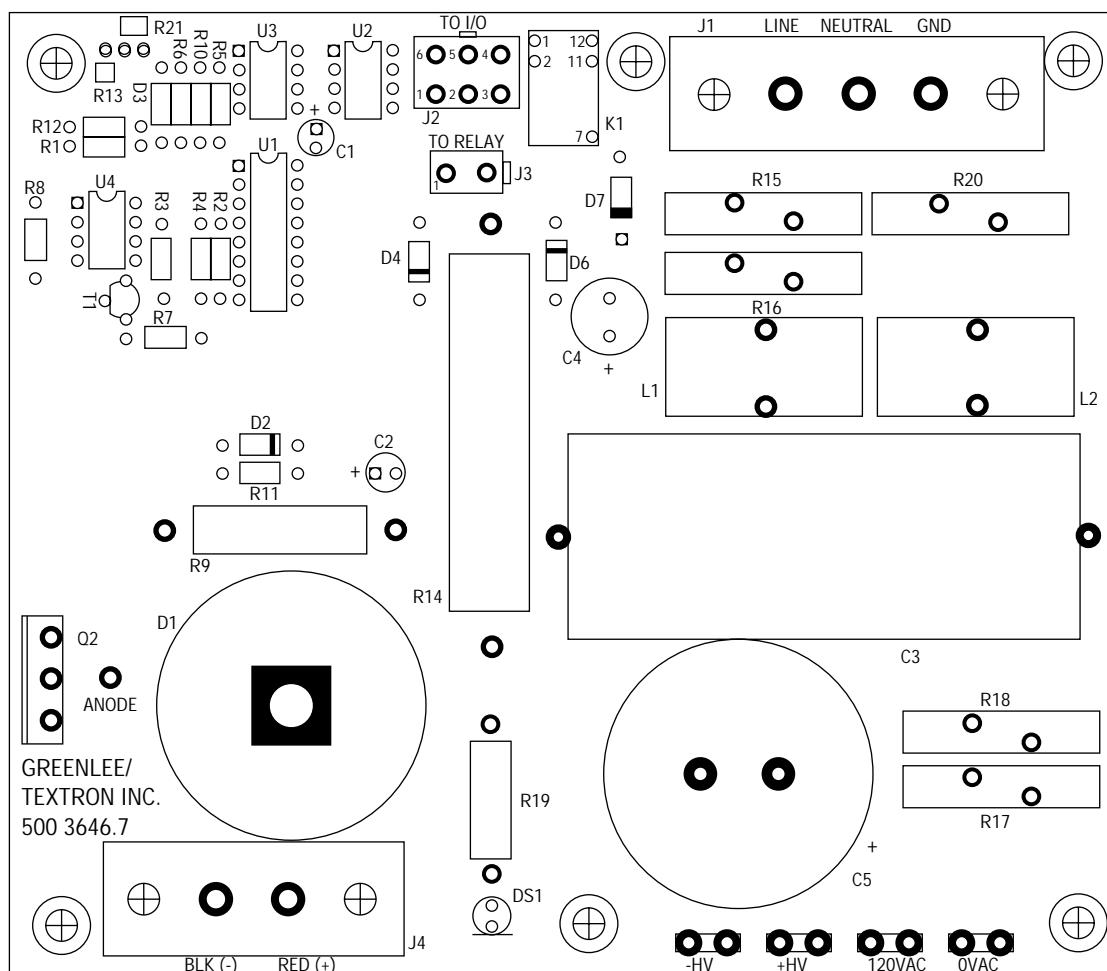
## Power Generation Unit – Parts List

| Greenlee No. | Location       | Description      | Value               | Manufacturer  | Part No.     |
|--------------|----------------|------------------|---------------------|---------------|--------------|
| –            | R1-R2          | Resistor         | 4.7 KΩ / 1/4 w / 5% | –             | –            |
| –            | R3, R5, R6, R8 | Resistor         | 10 KΩ / 1/4 w / 5%  | –             | –            |
| –            | R11, R12       | Resistor         | 22 Ω / 1/4 w / 5%   | –             | –            |
| –            | R4             | Resistor         | 68 KΩ / 1/4 w / 5%  | –             | –            |
| –            | R7             | Resistor         | .04 Ω / 5 w / 1%    | Dale          | LVR-5 .04Ω   |
| –            | R9             | Resistor         | 1 KΩ                |               |              |
| –            | R13            | Resistor         | 4.7 KΩ / 10 w / 5%  | Dale          | CW-10 4.7K   |
| –            | R14            | Resistor         | 680 Ω / 1/4 w / 5%  | –             | –            |
| –            | R10, 21        | Resistor         | V150LA20A           | GE            | V150LA20A    |
| –            | R15-R18, R20   | Varistor         | 20kΩ / 2w / 1%      | Dale          | RS-2B-20K    |
| 918 6687.1   | D1             | Diode            |                     | Semikron      | SKR2F17      |
| –            | D2, D6         | Zener Diode      | 1N4744-DO-41        | Motorola      | 1N4744       |
| –            | D3, D4         | Diode            | 1N914               | Motorola      | 1N914        |
| –            | D7             | Diode            | 1N4007              | Mototola      | 1N4007       |
| –            | C1, C2         | Capacitor        | 1μF / 50v           | Philips       | CY-30 C105M  |
| –            | C3             | Capacitor        | 10μF / 250 VAC      | Am. Radionics | MPPFW25-106  |
| –            | C4             | Capacitor        | 330μF / 25v         | Nichicon      | 1E331MPA     |
| 918 6862.9   | C5             | Capacitor        | 1000μF / 250v       | –             | –            |
| 918 6688.0   | K1             | Relay            | T81H5D312-05        | P & B         | T81H5D312-05 |
| 918 6645.6   | Off Board      | Relay            | PRD-11DY0-12        | P & B         | PRD-11DYU-12 |
| –            | L1, L2         | Inductor         | HL-8196             | Hurricane     | HL-8196      |
| –            | DSI            | LED              | LED T1-3/4 Green    | HP            | HLMP-3507    |
| 918 6690.1   | U1             | IC               | 4049                | Motorola      | MC14049UBCP  |
| 918 6691.0   | U2             | OPTO-Isolator    | 6N136N              | HP            | HCPL4502     |
| 918 6692.8   | U3, U4         | IC               | LM393               | Motorola      | LM393AN      |
| 918 5997.2   | Off Board      | Bridge Rectifier | GBPC3504            | GI            | GBPC3504     |
| 918 6661.0   | Q2             | Mosfet           | IXFH40N30           | IXYS          | IXFH40N30    |
| –            | D1             | Heat Sink        | –                   | Wakefield     | 695-1        |
| 503 8270.5   | Off Board      | Heat Sink        | –                   | Greenlee      | –            |
| –            | J1             | Connector        | –                   | Beau          | 72503        |
| –            | J2             | Connector        | Mini-Fit Jr.        | Molex         | 39-28-1063-P |
| –            | J3, J7         | Connector        | Mini-Fit Jr.        | Molex         | 39-28-1023-P |
| –            | J4             | Connector        | –                   | Beau          | 72502        |
| –            | J5, J6         | Connector        | Mini-Fit Jr.        | Molex         | 39-01-2020-P |
| 918 6693.6   | T1             | Transistor       | 2N3904              | Motorola      | 2N3904       |

## Power Generation Unit – Schematic Diagram



## Power Generation Board – Layout Diagram

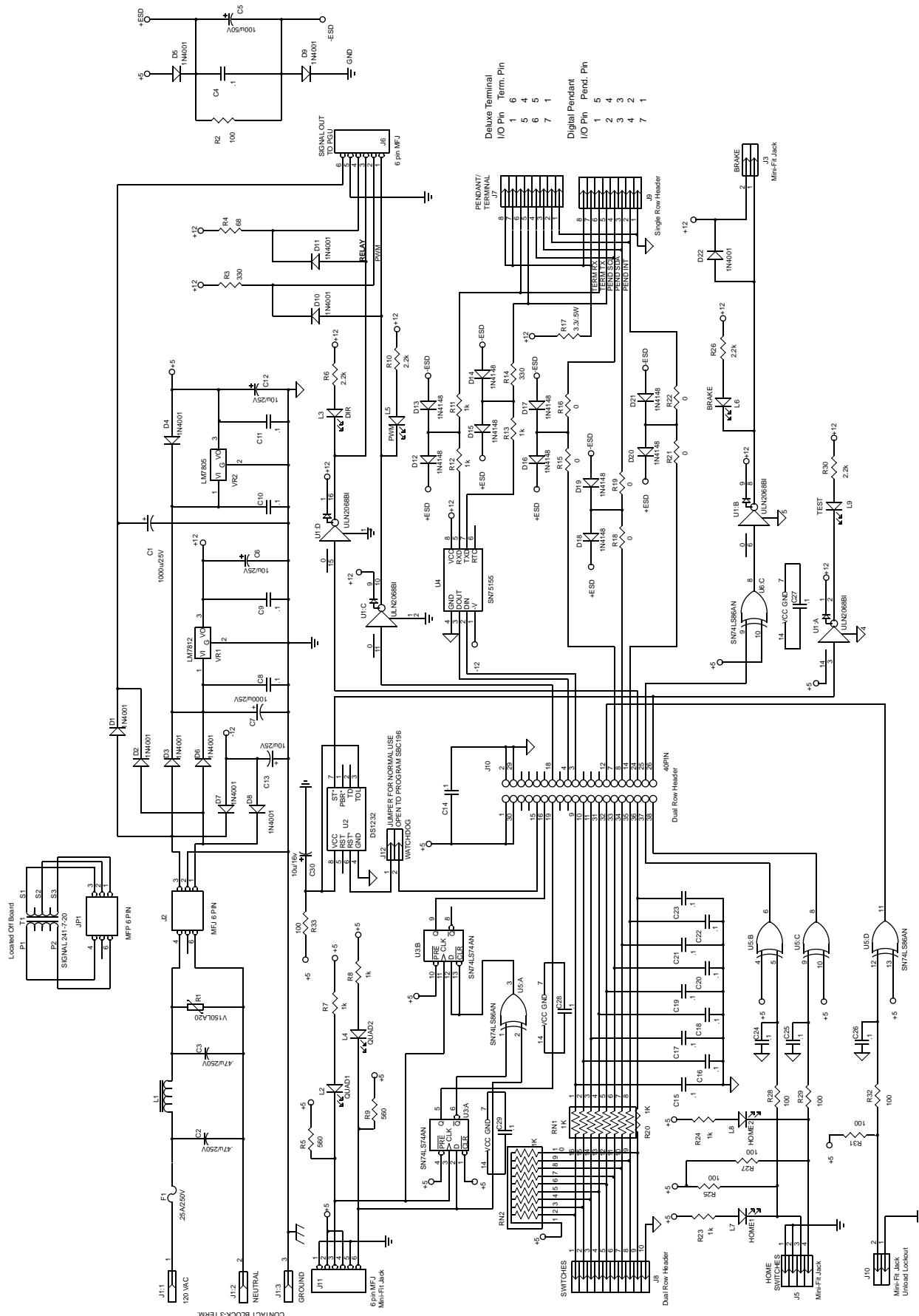




## Input - Output Board – Parts List

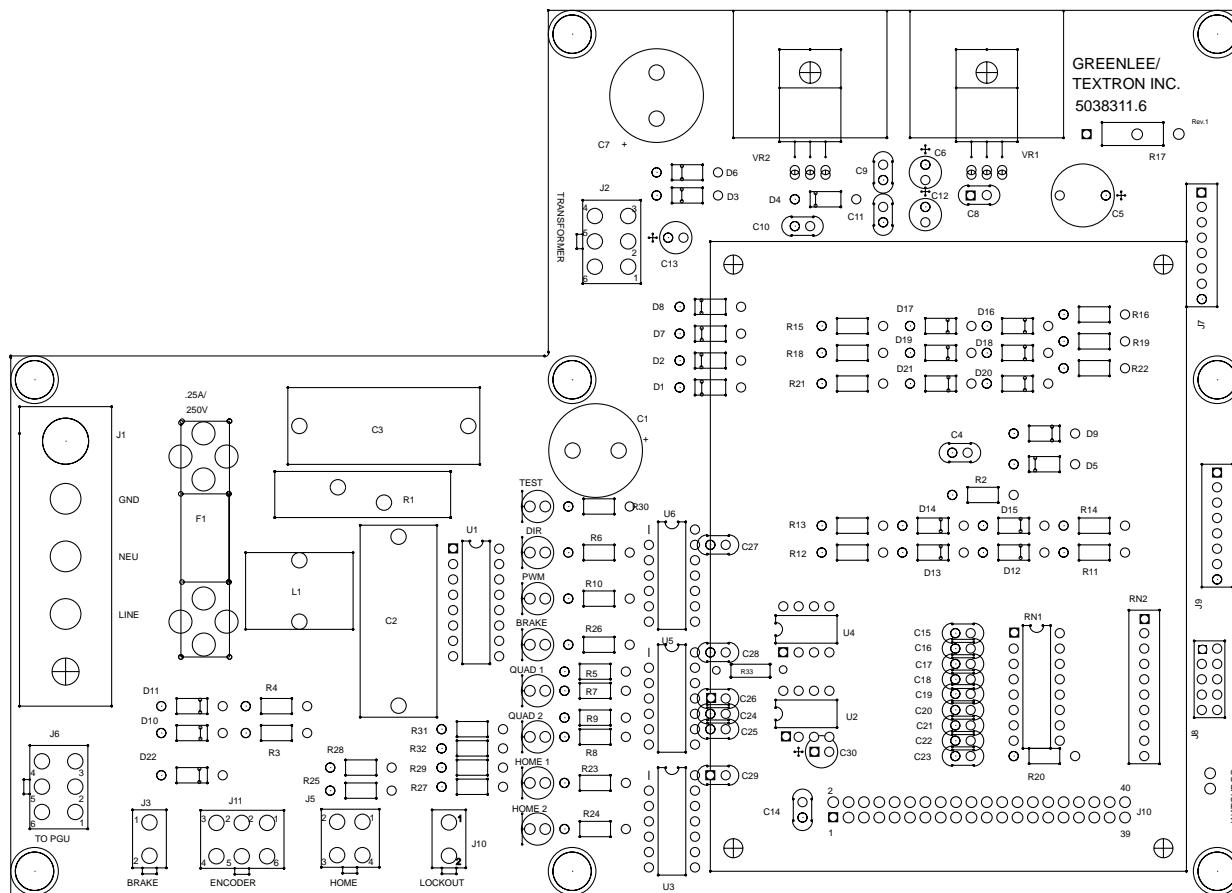
| Greenlee No. | Location                | Description       | Value               | Manufacturer | Part No.        |
|--------------|-------------------------|-------------------|---------------------|--------------|-----------------|
| –            | R1                      | Varistor          | V150LA20            | GE           | V150LA20        |
| –            | R2, 25, 27-29, 31, 32   | Resistor          | 100Ω / 1/4 w / 5%   | –            | –               |
| –            | R3, R14                 | Resistor          | 330Ω / 1/4 w / 5%   | –            | –               |
| –            | R4                      | Resistor          | 68Ω / 4 w / 5%      | –            | –               |
| –            | R5, R9                  | Resistor          | 560Ω / 1/4 w / 5%   | –            | –               |
| –            | R6, R10, R26, R30       | Resistor          | 2.2 KΩ / 1/4 w / 5% | –            | –               |
| –            | R7, 8, 11-3, 20, 23, 24 | Resistor          | 1 KΩ / 1/4 w / 5%   | –            | –               |
| –            | R17                     | Resistor          | 3.3 Ω / 5 w / 5%    | –            | –               |
| –            | R15, 16, 18, 19, 21, 22 | Jumper            | 0Ω                  | –            | –               |
| –            | RN1                     | Resistor Network  | 1KΩ                 | Dale         | MDP1603-102G    |
| –            | RN2                     | Resistor Network  | 1KΩ                 | Bourns       | 10X-1-102       |
| –            | D1-D11, D22             | Diode             | 1N4001              | Motorola     | 1N4001          |
| –            | D12-D21                 | Diode             | 1N4148              | Motorola     | 1N4148          |
| –            | C1, C7                  | Capacitor         | 1000μF / 25 VAC     | Nichicon     | 1E102MHA        |
| –            | C2, C3                  | Capacitor         | .47μF / 250 VAC     | Mallory      | 158474M250Q     |
| –            | C4, C7-C11, C14-C29     | Capacitor         | .1μF / 50v          | Centralab    | CY20C144M       |
| –            | C6, C12, C13            | Capacitor         | 10μF / 25VDC        | Nichicon     | VKBIE100KAA     |
| –            | C5                      | Capacitor         | 100μF / 50 VDC      | Nichicon     | 1H101MPA        |
| –            | L1                      | Inductor          | HL-8146             | Hurricane    | H68146          |
| –            | –                       | LED               | LED-T1 Red          | Dialight     | 521-9216        |
| 918 6694.4   | U1                      | IC                | ULN2068B            | Sprague      | ULN2068B        |
| 918 6695.2   | U2                      | IC                | 1232                | Dallas       | DS1232          |
| 918 6696.0   | U3                      | IC                | 74LS74              | Motorola     | SN74LS74AN      |
| 918 6697.9   | U4                      | IC                | 75155               | TI           | SN75155P        |
| 918 6698.7   | U5, U6                  | IC                | 74LS86N             | Motorola     | SN74LS86AN      |
| 918 6699.5   | VR1                     | Voltage Regulator | 12V, 7812           | Motorola     | MC7812CT        |
| 918 6700.2   | VR2                     | Voltage Regulator | 5V, 7805            | Motorola     | MC7805CT        |
| –            | F1                      | Fuse              | .25A / 250A         | Littlefuse   | 313.250         |
| –            | J1                      | Connector         | –                   | Beau         | 72503           |
| –            | J2, J6, J11             | Connector         | Mini-fit Jr.        | Molex        | 39-28-1063-P    |
| –            | J3, J4                  | Connector         | Mini-Fit Jr.        | Molex        | 39-28-1023-P    |
| –            | J5                      | Connector         | Mini-Fit Jr.        | Molex        | 39-28-1043-P    |
| –            | J7, J9                  | Connector         | Mini-Fit Jr.        | Molex        | 22-23-2081      |
| –            | J8                      | Connector         | 2x5 Header          | Molex        | 10-89-1103      |
| –            | J10                     | Connector         | 2x20 Header         | 3M           | 929852-41-20-10 |

# **Input - Output Board – Schematic Diagram**

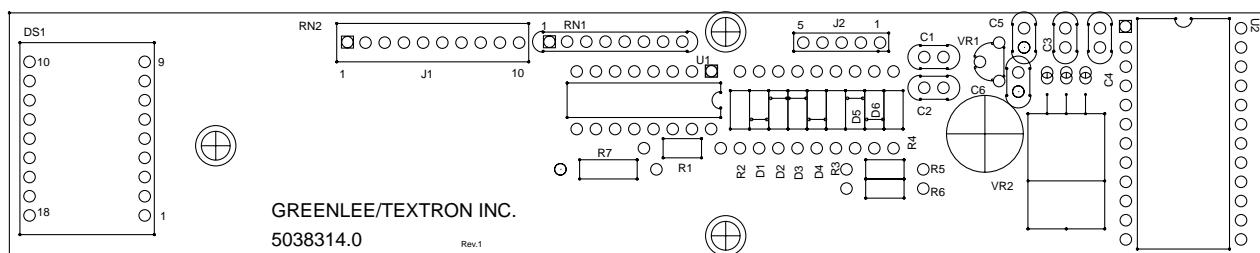


**NOTES:** All resistors .25W unless noted.  
All capacitors are 50V unless noted.

## **Input - Output Board – Layout Diagram**



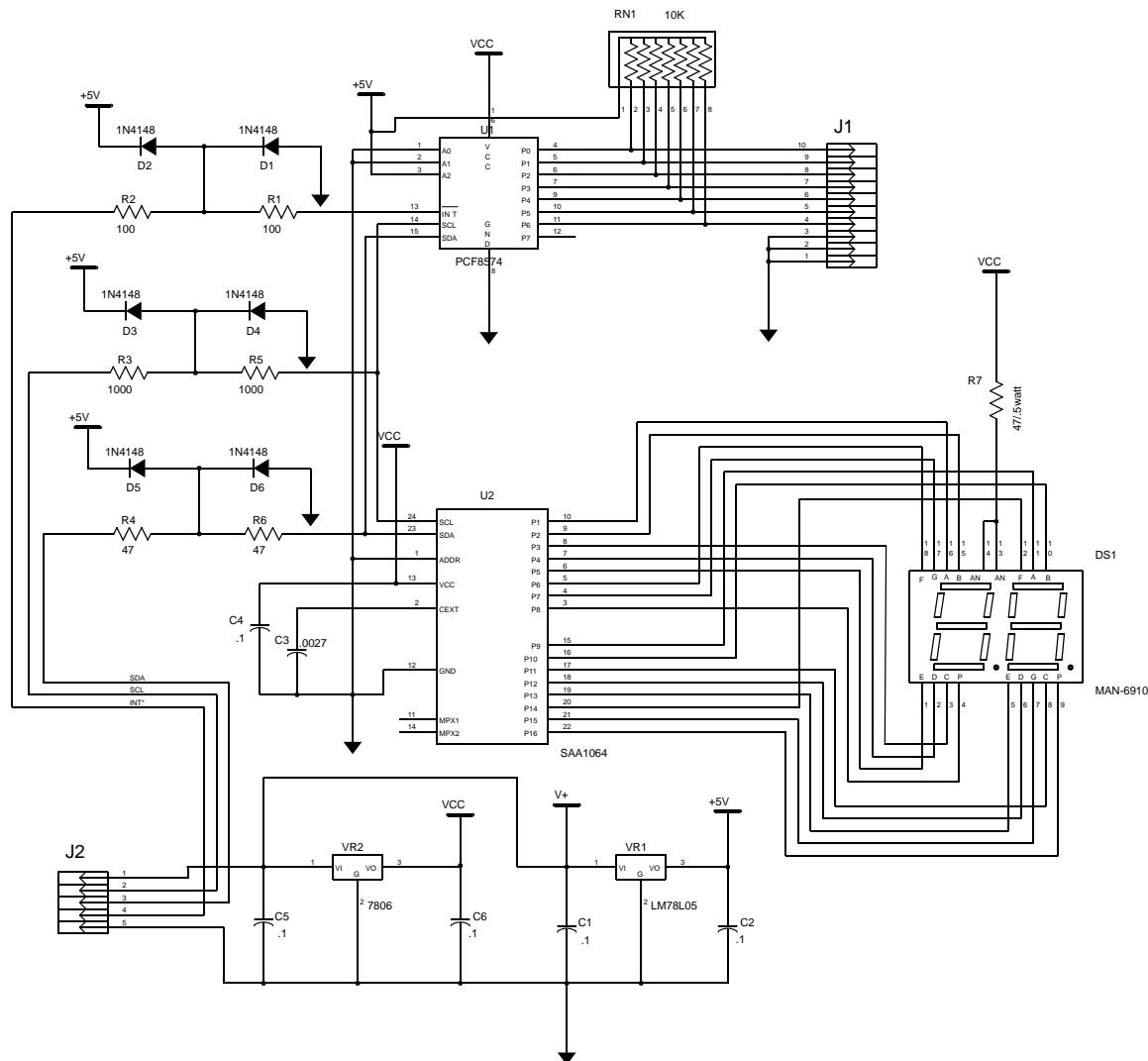
## **Pendant Board – Layout Diagram**



## Pendant Board – Parts List

| Greenlee No. | Location           | Description       | Value             | Manufacturer | Part No.    |
|--------------|--------------------|-------------------|-------------------|--------------|-------------|
| –            | R1, R2             | Resistor          | 100Ω / 1/4 w / 5% | –            | –           |
| –            | R3, R5             | Resistor          | 1KΩ / 1/4 w / 5%  | –            | –           |
| –            | R4, R6             | Resistor          | 47 Ω / 1/4 w / 5% | –            | –           |
| –            | R7                 | Resistor          | 47 Ω / 1/2 w / 5% | –            | –           |
| –            | RN1                | Resistor Network  | 10K               | Bourns       | 81C103      |
| –            | D1-D6              | Diode             | 1N4148            | Motorola     | IN4148      |
| –            | D51                | LED               | MAN-6910          | HP           | MAN-6910    |
| –            | C1, C2, C4, C5, C6 | Capacitor         | .1μF / 50v        | Philips      | CY-20C104M  |
| –            | C3                 | Capacitor         | .0027μF / 50v     | Philips      | CW-15 C272m |
| 918 6701.0   | U1                 | IC                | PCF8574           | Philips      | PC8574PN    |
| 918 6702.9   | U2                 | IC                | SAA1064           | Philips      | SAA1064PN   |
| 918 6703.7   | VR1                | Voltage Regulator | LM78L05ACZA       | Motorola     | LM78L05ACZA |
| 918 6704.5   | VR2                | Voltage Regulator | LM7806CTB         | Motorola     | MC7806      |
| –            | J1                 | Connector         | –                 | Dupont       | 69191-410   |
| –            | J2                 | Connector         | –                 | Dupont       | 69191-405   |

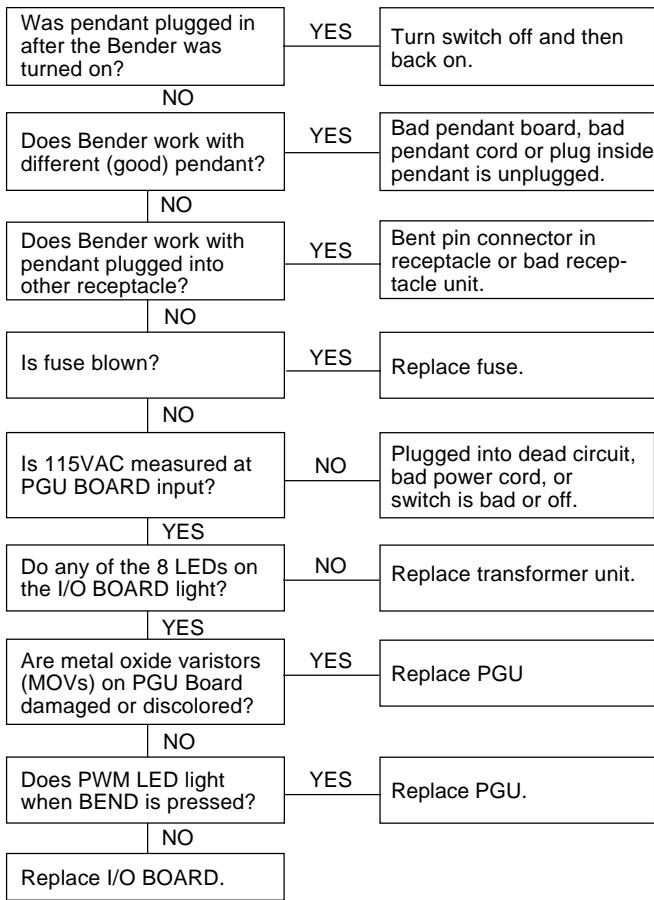
## Pendant Board – Schematic Diagram



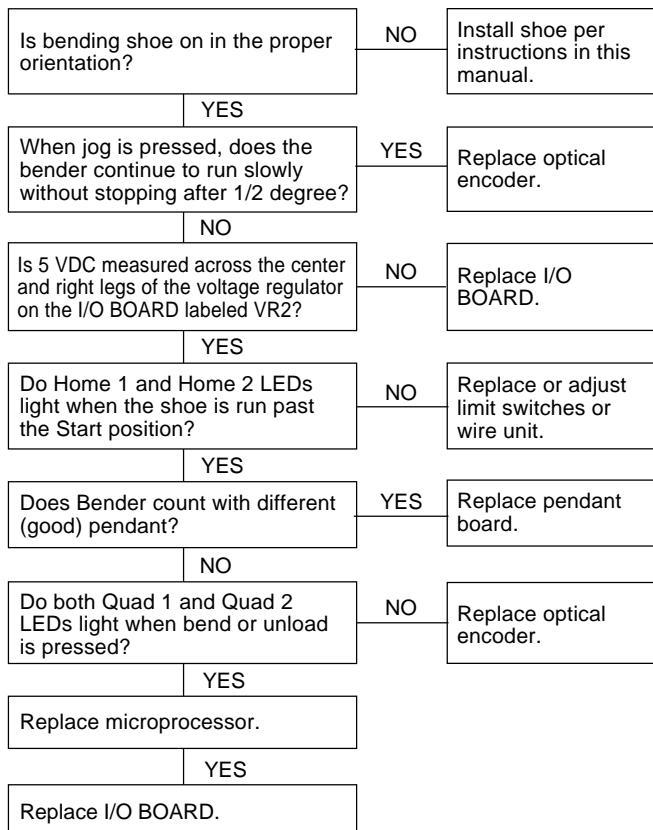
## Troubleshooting

The following flow charts will show some of the most likely areas to look at for certain problems. They by no means encompass all the possible problems or the only possible solutions.

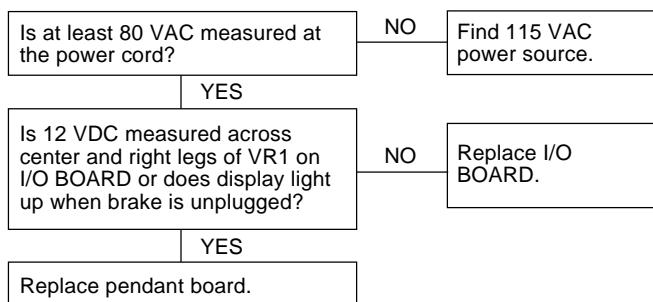
### WON'T BEND – DISPLAY BLANK



### WILL BEND – WON'T COUNT

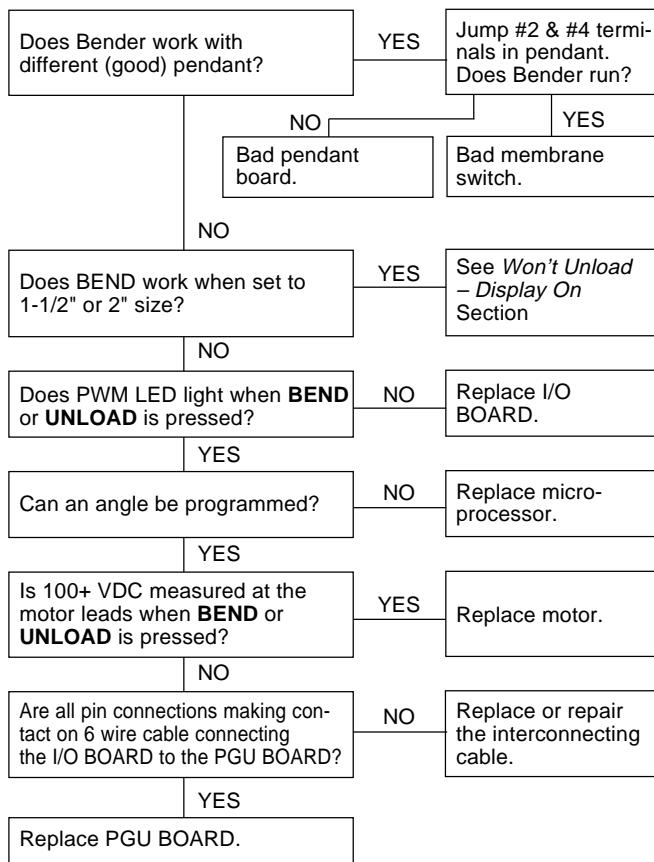


### WILL BEND – DISPLAY BLANK

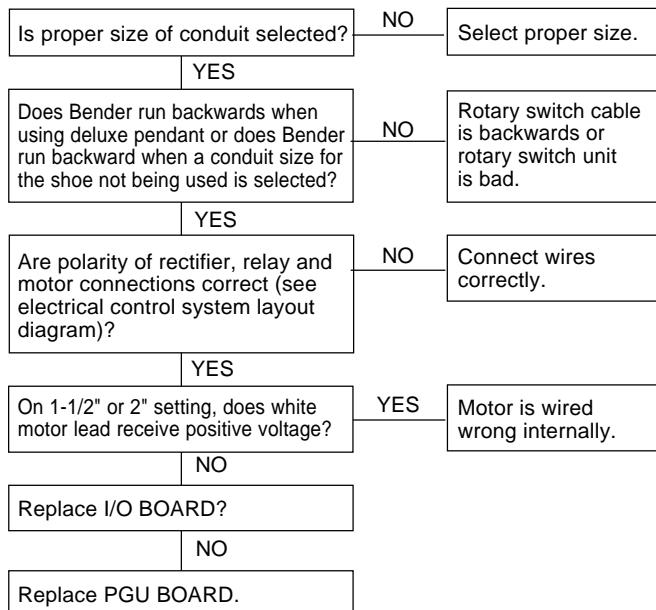


## Troubleshooting (cont'd)

### WON'T BEND – DISPLAY ON

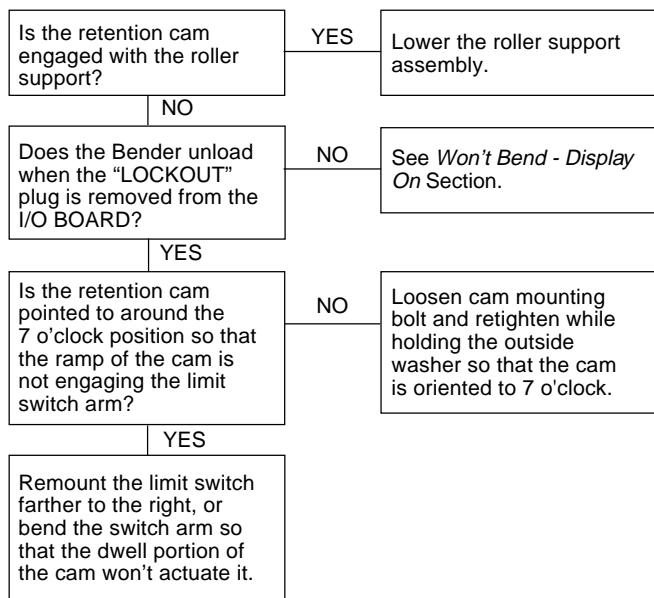


### BENDER RUNS BACKWARDS FOR BEND & UNLOAD

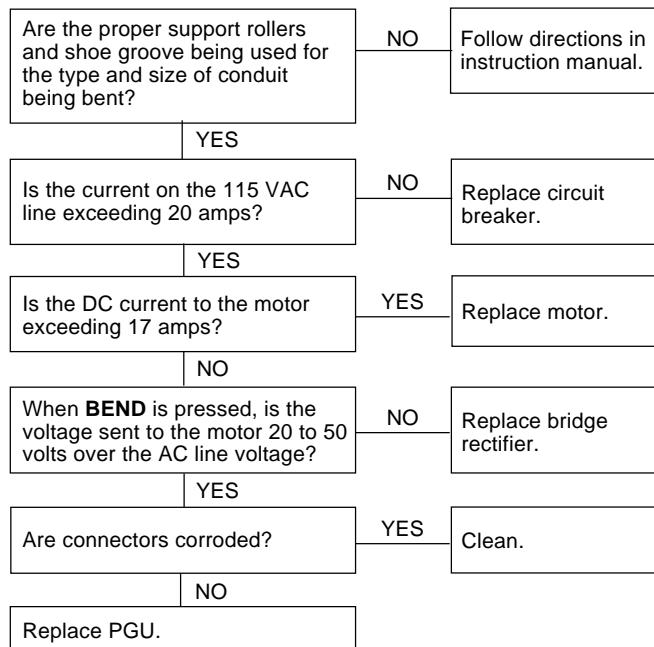


## Troubleshooting (cont'd)

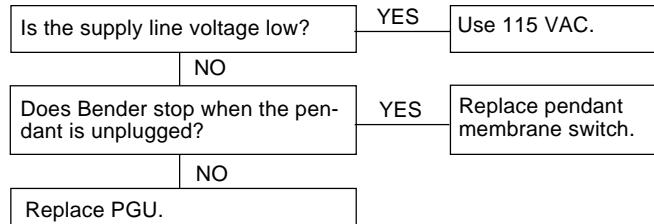
### WON'T UNLOAD – DISPLAY ON



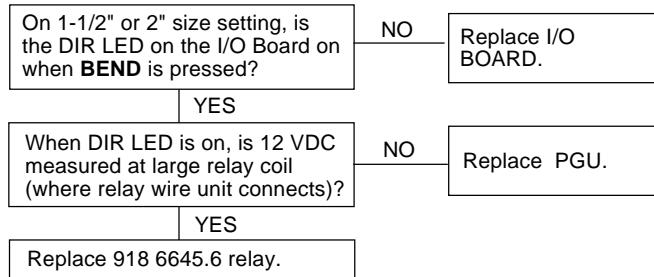
### TRIPS CIRCUIT BREAKER



### WON'T STOP

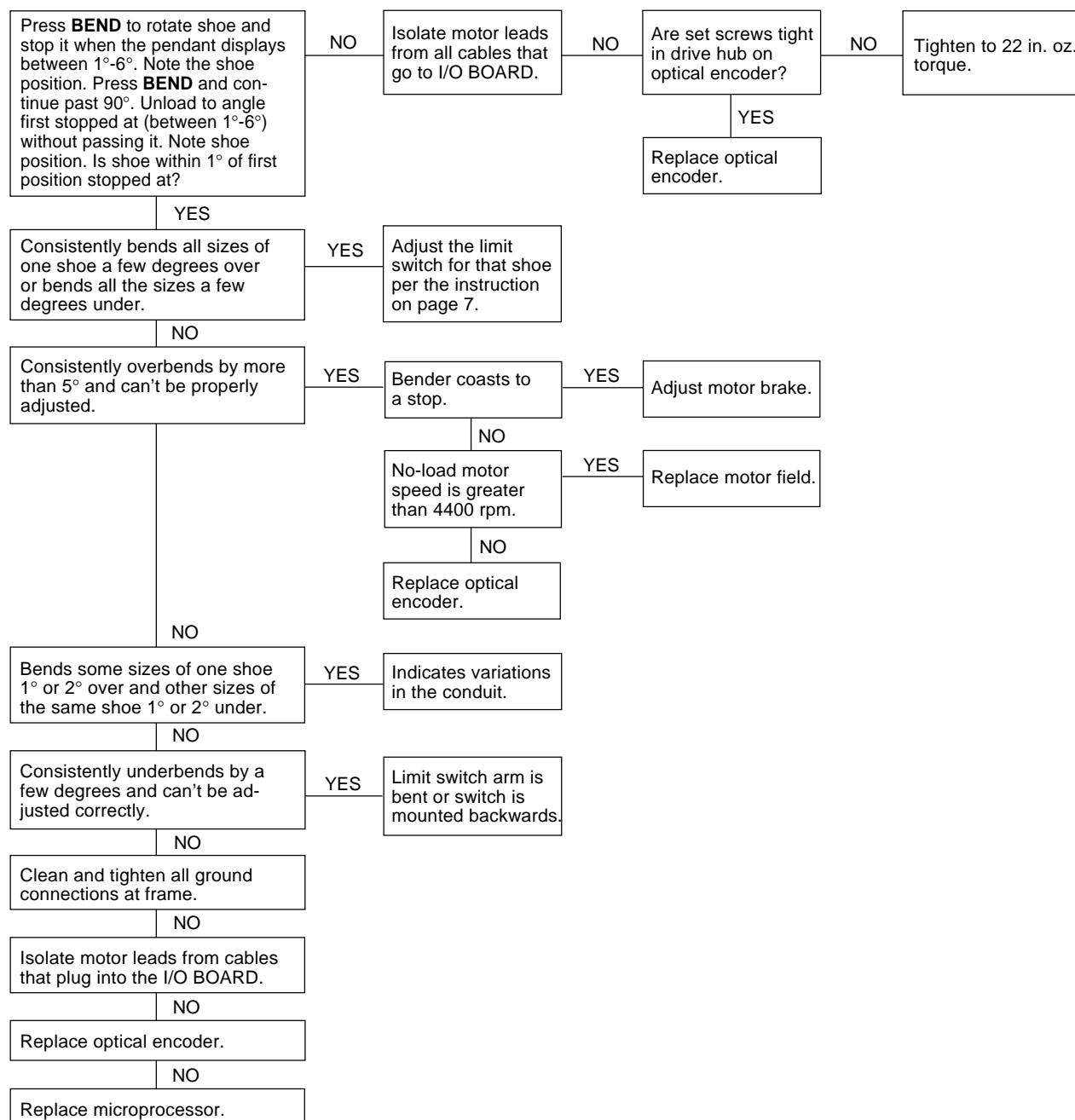


### BENDER ONLY RUNS IN ONE DIRECTION



## Troubleshooting (cont'd)

### MAKES INACCURATE BENDS



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