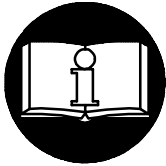


# OPERATION AND MAINTENANCE MANUAL FOR MODELS ES60T, ES70T, ES90T, AND ES100T ELECTRIC ANGLE SCREWDRIVERS (DELVO)

## NOTICE

Models ES60T, ES70T, ES90T and ES100T Electric Screwdrivers are designed for installing threaded fasteners in light industrial and appliance manufacturing applications. Ingersoll-Rand is not responsible for customer modification of tools for applications on which Ingersoll-Rand was not consulted.



## WARNING

**IMPORTANT SAFETY INFORMATION ENCLOSED.  
READ ALL THESE INSTRUCTIONS BEFORE PLACING TOOL IN SERVICE OR  
OPERATING THIS TOOL AND SAVE THESE INSTRUCTIONS.  
IT IS THE RESPONSIBILITY OF THE EMPLOYER TO PLACE THE  
INFORMATION IN THIS MANUAL INTO THE HANDS OF THE OPERATOR.  
FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.**

**WHEN USING ELECTRIC TOOLS, BASIC SAFETY PRECAUTIONS SHOULD ALWAYS BE  
FOLLOWED TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK AND PERSONAL INJURY,  
INCLUDING THE FOLLOWING.**

### PLACING TOOL IN SERVICE

- Always operate, inspect and maintain this tool in accordance with all regulations (local, state, federal and country), that may apply to hand held/hand operated pneumatic tools.
- Inspect tool cords periodically and if damaged, have them repaired by an authorized service facility. Inspect extension cords periodically and replace if damaged.
- Do not remove any labels. Replace any damaged label.

### USING THE TOOL

- Always wear eye protection when operating or performing maintenance on this tool.
- Power tools can vibrate in use. Vibration, repetitive motions, or uncomfortable positions may be harmful to your hands and arms. Stop using any tool if discomfort, tingling feeling or pain occurs. Seek medical advice before resuming use.
- **Guard Against Electric Shock.** Prevent body contact with earthed or grounded surfaces. For example; pipes, radiators, ranges, refrigerator enclosures.
- **Don't abuse Cord.** Never carry tool by cord or yank it to disconnect from receptacle. Keep cord from heat, oil, and sharp edges.

- **Keep work area clean.** Cluttered areas and benches invite injuries.
- **Consider work area environment.** Don't expose power tools and chargers to water. Keep work area well lighted. Do not use tool in explosive or flammable atmospheres.
- **Keep bystanders and children away.** Do not permit unauthorized personnel to operate this tool, or touch tool or cord.
- **Store idle tools.** When not in use, tools should be stored in a dry, high or locked up place, out of reach of children.
- **Don't force tool.** It will do the job better and more safely at the rate for which it was intended.
- **Use the right tool.** Do not force a small tool or attachment to do the job of a heavy-duty tool.
- **Do not use a tool for a purpose for which it is not intended.** Example: Do not use a screwdriver as a drill.
- **Dress properly.** Do not wear loose clothing or jewelry. They can be caught in moving parts. Rubber gloves and non-skid footwear are recommended when working outdoors. Wear protective hair covering to contain long hair.

## NOTICE

The use of other than genuine Ingersoll-Rand replacement parts may result in personal injury, decreased tool performance and increased maintenance, and may invalidate all warranties.

Have your tool repaired by a qualified person. This electric tool is in accordance with the relevant safety requirements. Repairs should only be carried out by qualified persons using original spare parts; otherwise this may result in considerable danger to the user.

Repairs should be made only by authorized, trained personnel. Consult your nearest Ingersoll-Rand Authorized Servicenter.

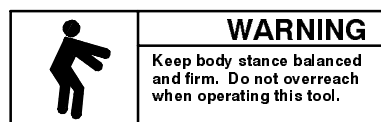
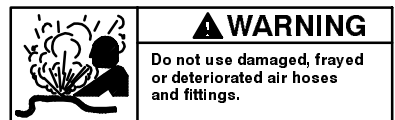
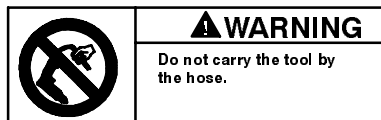
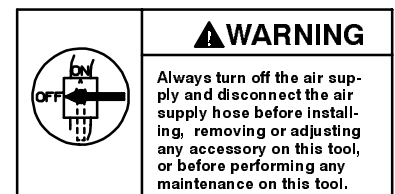
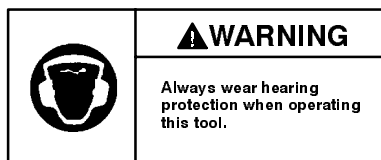
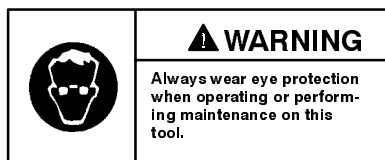
**⚠ WARNING**

**FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.**

**USING THE TOOL (Cont'd)**

- **Secure work.** Use clamps or a vise to hold work. Operators often need both hands to perform job functions.
- **Don't overreach.** Keep proper footing, balance, and a firm grip on the tool at all times.
- **Maintain tools with care.** Keep tools clean for better and safer performance. Follow instructions for lubricating and changing accessories. Inspect tool cords periodically and if damaged, have them repaired by an authorized service facility. Inspect extension cords periodically and replace if damaged. Keep handles dry, clean, and free from oil and grease.
- **Remove adjusting keys and wrenches.** Form habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.
- **Avoid unintentional starting.** Don't carry tool with finger on switch.
- **Do not drop or abuse the tool.**
- **Whenever a tool is not being used, position the Power Switch to the "OFF" position and unplug the power cord.**
- **Stay alert.** Watch what you are doing. Use common sense. Do not operate tool when you are tired.
- **Check damaged parts.** Before further use of the tool, a guard or other part that is damaged should be carefully checked to determine that it will operate properly and perform its intended function. Check for alignment of moving parts, binding of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced by an authorized service center unless otherwise indicated elsewhere in this operation manual.
- **Have defective switches replaced by an authorized service center.**
- **Do not use the tool if the switch does not turn it on and off.**
- **Do not drop or abuse the screwdriver.**
- **Whenever changing a bit, make certain the Forward/Reverse Switch is in the "OFF" position and the tool is unplugged.**
- **Do not allow chemicals such as acetone, benzene, thinner, ketone, trichloroethylene or other similar chemicals to come in contact with the screwdriver housing as damage will result.**
- **Do not adjust the torque setting higher than 9 on the Torque Scale.**
- **There should be a tool rest interval when cycles are three seconds or longer.**
- **Do not tighten more than 900 tapping screws (size: 2 mm, length: 4 mm) per hour.**
- **Do not use this screwdriver for tightening wood screws.**
- **Do not operate the Forward/Reverse Switch when the motor is running.**
- **Whenever a tool is not being used, move the Forward/Reverse Switch to the "OFF" position and unplug the screwdriver.**
- **The use of any accessory or attachment other than recommended in this manual can present a risk of personal injury.**

**WARNING LABEL IDENTIFICATION**



## PLACING TOOL IN SERVICE

### LUBRICATION



#### Ingersoll-Rand No. 67

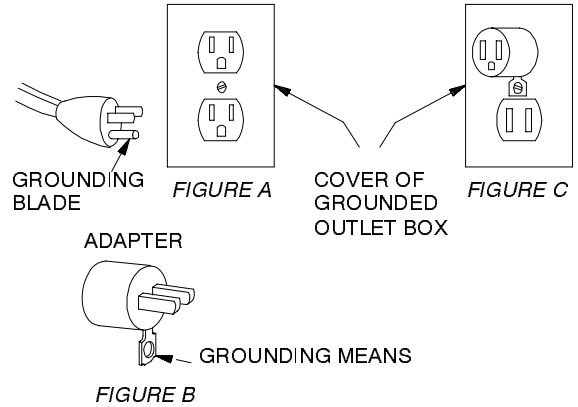
Every 40,000 cycles or one month, whichever occurs first, inject 2 to 4 cc of Ingersoll-Rand No. 67 grease into the grease fitting (101) on the angle attachment.

### GROUNDING INSTRUCTIONS

The tool should be grounded while in use to protect the operator from electric shock. The tool is equipped with a three-conductor cord and three-prong grounding-type plug to fit the proper grounding-type receptacle. The green (or green and yellow) conductor in the cord is the grounding wire. Never connect the green (or green and yellow) wire to a live terminal.

If your unit is for use on less than 150V, it has a plug that looks like that shown in Figure A.

An adapter (see Figure B) is available for connecting Figure A-type plugs to 2-prong receptacles. The green colored rigid grounding strap must be connected to a permanent ground such as to a properly grounded outlet box as shown in figure C.



(Dwg. TPD446-1)

#### WARNING

For safe use of adapters, the outlet box must be grounded. If there is any doubt, have a qualified electrician check connections.

Use only 3-wire extension cords that have 3-prong grounding type plugs and 3 pole receptacles that accept the controllers plug. Replace or repair damaged cords.

## ADJUSTMENTS

### TORQUE ADJUSTMENT

To adjust the torque on these screwdrivers, proceed as follows:

1. Determine the torque output of the tool by checking a tightened fastener with a torque wrench.
2. Increase or decrease the torque output by rotating the Spring Adjusting Ring (37 or 39). Rotating the Ring **clockwise** to a higher number on the Torque Scale increase torque output while rotating the Ring **counterclockwise** to a lower number decreases the torque output.

#### NOTICE

The numbers from zero to seven on the Torque Scale are reference numbers only and are not an indication of actual torque output.

3. Check the adjustment with a torque wrench. A number of factors will affect torque output from one job to another. Final torque adjustment should be made at the job through a series of gradual increase. Always start below the desired torque and work upward.

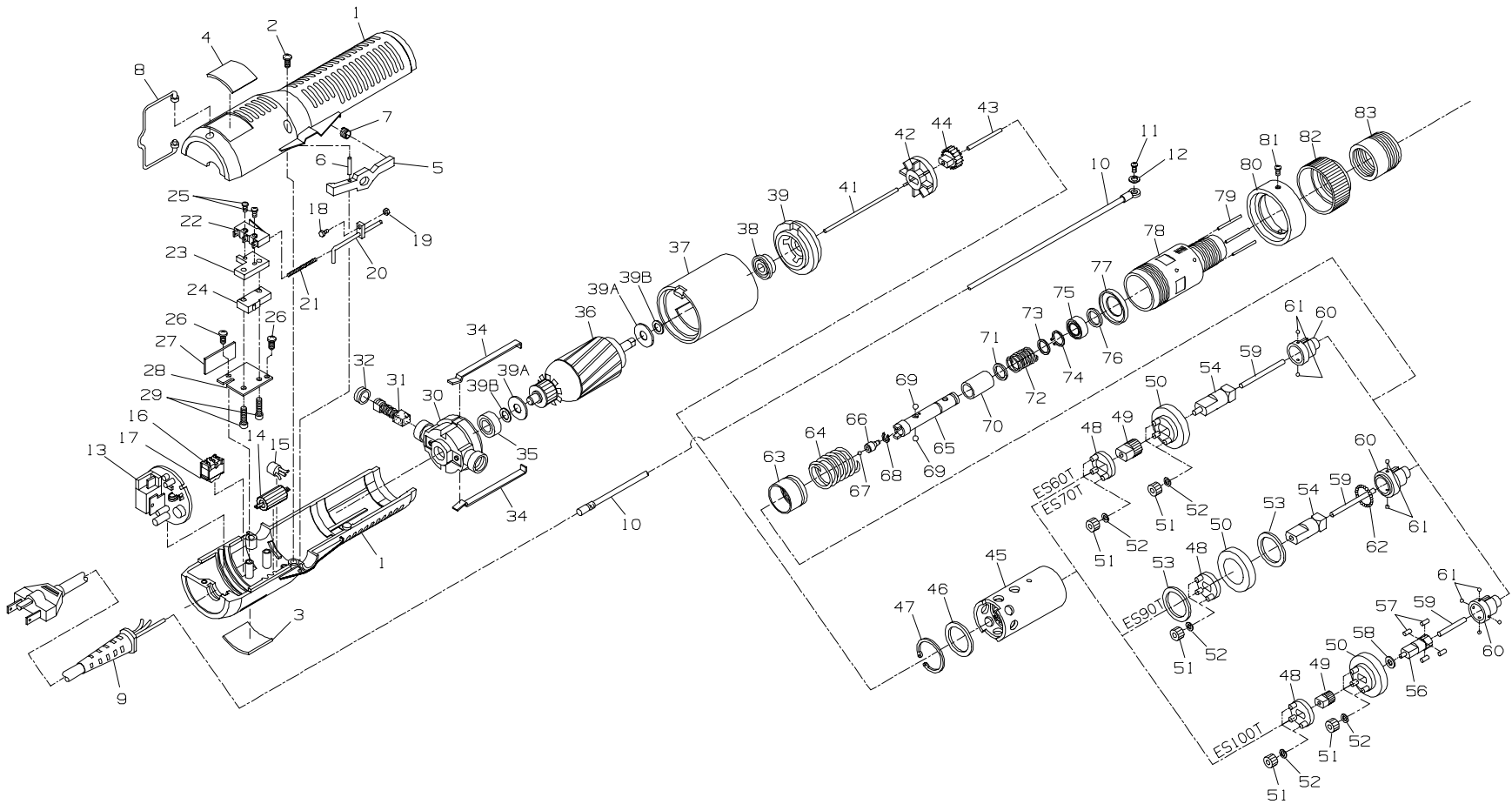
#### NOTICE

#### DO NOT ATTEMPT TO REPAIR THIS TOOL.

All repairs and maintenance of this tool and its cord must be performed by an authorized service center. Contact Sales Office listed on last page of this form.

#### SAVE THESE INSTRUCTIONS. DO NOT DESTROY.

**MAINTENANCE SECTION**



PART NUMBER FOR ORDERING

PART NUMBER FOR ORDERING

|     |  |               |      |   |             |
|-----|--|---------------|------|---|-------------|
|     | Housing Package . . . . .                  | ES60T-ULA40   |      | Switch Package . . . . .                        | ES60T-A613  |
| 1   | Housing (includes right and left side) . . | ----          | 22   | Microswitch . . . . .                           | ----        |
| + 2 | Housing Screw (3) . . . . .                | ----          | 23   | Switch Plate . . . . .                          | ----        |
| 3   | Warning Label                              |               | 24   | Microswitch . . . . .                           | ----        |
|     | for model ES60T, ES70T                     |               | 25   | Pilot Screw (2) . . . . .                       | ----        |
|     | or ES100T . . . . .                        | ES60T-UL99    | 26   | Switch Base Screw (2) . . . . .                 | ----        |
|     | for model ES90T . . . . .                  | ES80P-UL99    | 27   | Insulating Plate . . . . .                      | ----        |
| *   | Warning Label . . . . .                    | WARNING-13-99 | 28   | Switch Base . . . . .                           | ----        |
| 4   | Nameplate                                  |               | 29   | Base Screw (2) . . . . .                        | ----        |
|     | for model ES60T . . . . .                  | ES60T-UL301   |      | Motor Assembly                                  |             |
|     | for model ES70T . . . . .                  | ES70T-UL301   |      | for model ES60T, ES70T                          |             |
|     | for model ES90T . . . . .                  | ES90T-UL301   |      | or ES100T . . . . .                             | ES60T-ULB53 |
|     | for model ES100T . . . . .                 | ES100P-UL301  |      | for model ES90T . . . . .                       | ES90T-ULB53 |
|     | Trigger Assembly . . . . .                 | ES60T-A93     | 30   | Rear End Plate . . . . .                        | ES60T-620   |
| 5   | Trigger . . . . .                          | ----          | + 31 | Brush Assembly (2) . . . . .                    | --          |
| 6   | Trigger Pin . . . . .                      | ----          | 32   | Brush Cap (2) . . . . .                         | ES60T-618   |
| 7   | Trigger Spring . . . . .                   | ----          | 34   | Motor Assembly Spring (2) . . . . .             | ES60T-108   |
| 8   | Suspension Bail . . . . .                  | ES60T-365     | 35   | Rear Armature Bearing . . . . .                 | ES60T-22    |
| 9   | Cord Assembly . . . . .                    | ES60T-UL239   | 36   | Armature Assembly                               |             |
|     | Ground Wire Package . . . . .              | ES80P-ULA154  |      | for model ES60T, ES70T                          |             |
| 10  | Ground Wire . . . . .                      | ----          |      | or ES100T . . . . .                             | ES60T-004   |
| 11  | Ground Screw . . . . .                     | ----          |      | for model ES90T . . . . .                       | ES90T-009   |
| 12  | Ground Washer . . . . .                    | ----          | 37   | Yoke Assembly                                   |             |
| 13  | Control Base Package . . . . .             | ES60T-ULB616  |      | for model ES60T, ES70T                          |             |
| 14  | Resistor (R10) . . . . .                   | ES60T-615     |      | or ES100T . . . . .                             | ES60T-002   |
| 15  | Coil (L2) . . . . .                        | ES60T-614     |      | for model ES90T . . . . .                       | ES90T-008   |
|     | Reverse Switch Assembly . . . . .          | ES60T-ULA666  | 38   | Front Armature Bearing . . . . .                | ES60T-24    |
| 16  | Reverse Switch . . . . .                   | ES60T-UL666   | 39   | Front End Plate . . . . .                       | ES60T-105   |
| 17  | Reverse Switch Rocker . . . . .            | ----          | 39A  | Insulator (2) . . . . .                         | ES80P-681   |
|     | Adjusting Rod Package . . . . .            | ES60T-A617    | 39B  | Washer (2) . . . . .                            | ES80P-683   |
| 18  | Adjusting Screw . . . . .                  | ----          | 41   | Pilot Rod "F" (2.465" [62.6 mm] long) . . . . . | ES60T-611   |
| 19  | Adjusting Screw Nut . . . . .              | ----          | 42   | Armature Fan . . . . .                          | ES60T-62    |
| 20  | Pilot Rod "D" . . . . .                    | ----          | 43   | Pilot Rod "G" (.385" [9.8 mm] long) . . . . .   | ES60T-609   |
| 21  | Pilot Rod Spring . . . . .                 | ----          |      |   |             |

MAINTENANCE SECTION

\* Not illustrated.

+ Can be purchased in quantities of ten. Refer to non-illustrated listing of parts section for an ordering part number.

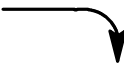
PART NUMBER FOR ORDERING

PART NUMBER FOR ORDERING

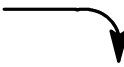
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|----|--|------------|--|----|--|-------------|
| 44 | Fan Sun Gear                                   |            |  | 56 | Cam Package (for model ES100T) . . . . .         | ES100P-A589 |
|    | for model ES60T (16 teeth) . . . . .           | ES60T-610  |  | 57 | Cam . . . . .                                    | ----        |
|    | for model ES70T (13 teeth) . . . . .           | ES70T-610  |  | 58 | Cam Pin (4) . . . . .                            | ----        |
|    | for model ES90T (11 teeth) . . . . .           | ES90T-610  |  | 59 | Cam Washer . . . . .                             | ----        |
|    | for model ES100T (11 teeth) . . . . .          | ES100P-610 |  |    | Pilot Rod "H" (2.36" [60 mm] long) . . . . .     | ES60T-606   |
| 45 | Gear Case Assembly                             |            |  |    | Cam Guide Package                                |             |
|    | for model ES60T (44 teeth) . . . . .           | ES70P-37   |  |    | for model ES60T or ES70T . . . . .               | ES60T-A605  |
|    | for model ES70T (47 teeth) . . . . .           | ES70T-37   |  |    | for model ES90T . . . . .                        | ES90T-A605  |
|    | for model ES90T (49 teeth) . . . . .           | ES90T-37   |  |    | for model ES100T . . . . .                       | ES100P-P605 |
|    | for model ES100T (49 teeth) . . . . .          | ES100P-37  |  | 60 | Cam Guide . . . . .                              | ----        |
| 46 | Gear Head Seat . . . . .                       | ----       |  | 61 | Cam Guide Ball (.156" [4 mm] dia.) (4 for        |             |
| 47 | Gear Head Seat Retainer . . . . .              | ----       |  |    | model ES100T; 2 for all other models) . . . . .  | 2U-696      |
| 48 | Gear Head Assembly . . . . .                   | ES60T-A216 |  | 62 | Cam Guide Ball (for model ES90T only) (23)       | ----        |
| 49 | Gear Head Sun Gear                             |            |  | 63 | Taper Ring Assembly                              |             |
|    | for model ES60T (16 teeth) . . . . .           | ES60T-622  |  |    | for model ES60T, ES70T or ES90T . . .            | ES60T-A604  |
|    | for model ES70T (13 teeth) . . . . .           | ES70T-622  |  |    | for model ES100T . . . . .                       | ES100P-A604 |
|    | for model ES100T (11 teeth) . . . . .          | ES100P-622 |  | 64 | Clutch Spring                                    |             |
| 50 | Spindle Assembly                               |            |  |    | for model ES60T or ES90T . . . . .               | ES60T-583   |
|    | for model ES60T, ES70T or ES100T . .           | ES60T-A8   |  |    | for model ES70T . . . . .                        | ES70T-583   |
|    | for model ES90T . . . . .                      | ES90T-A8   |  |    | for model ES100T . . . . .                       | ES100P-583  |
|    | Spindle Gear Package                           |            |  |    | Bit Holder Assembly . . . . .                    | ES60T-A586  |
|    | for model ES60T (14 teeth) . . . . .           | ES60T-A10  |  | 65 | Bit Holder . . . . .                             | ----        |
|    | for model ES70T (17 teeth) . . . . .           | ES70T-A10  |  | 66 | Pilot . . . . .                                  | ES60T-133   |
|    | for model ES90T (19 teeth) . . . . .           | ES90T-A10  |  | 67 | Pilot Ball (.062" [1.6 mm] dia.) . . . . .       | ES60T-705   |
|    | for model ES100T (19 teeth) . . . . .          | ES100P-A10 |  | 68 | Pilot Retaining Ring . . . . .                   | ----        |
| 51 | Spindle Gear                                   |            |  | 69 | Pilot Cam Ball (.156" [4 mm] dia.) (2) . . . . . | 2U-696      |
|    | for model ES60T (6) . . . . .                  | ES60T-116  |  | 70 | Slide Ring . . . . .                             | ES60T-129   |
|    | for model ES70T (6) . . . . .                  | ES70T-202  |  | 71 | Slide Ring Washer (.032" [0.8 mm] thick) . . .   | ES60T-130   |
|    | for model ES90T (3) and                        |            |  | 72 | Slide Ring Spring . . . . .                      | ES60T-305   |
|    | for model ES100T (6) . . . . .                 | ES90T-002  |  | 73 | Washer (.013" [0.3 mm] thick) . . . . .          | ES60T-667   |
| 52 | Gear Washer (6 for models ES60T,               |            |  | 74 | Stop Ring . . . . .                              | ES60T-668   |
|    | ES70T or ES100T; 3 for model ES90T) . . . . .  | ES60T-733  |  |    |  |             |
| 53 | Spindle Washer (for model ES90T) (2) . . . . . | ES90T-680  |  |    |  |             |
| 54 | Cam  |            |  |    |  |             |
|    | for model ES60T or ES70T . . . . .             | ES60T-589  |  |    |  |             |
|    | for model ES90T . . . . .                      | ES90T-589  |  |    |  |             |

MAINTENANCE SECTION

PART NUMBER FOR ORDERING



PART NUMBER FOR ORDERING



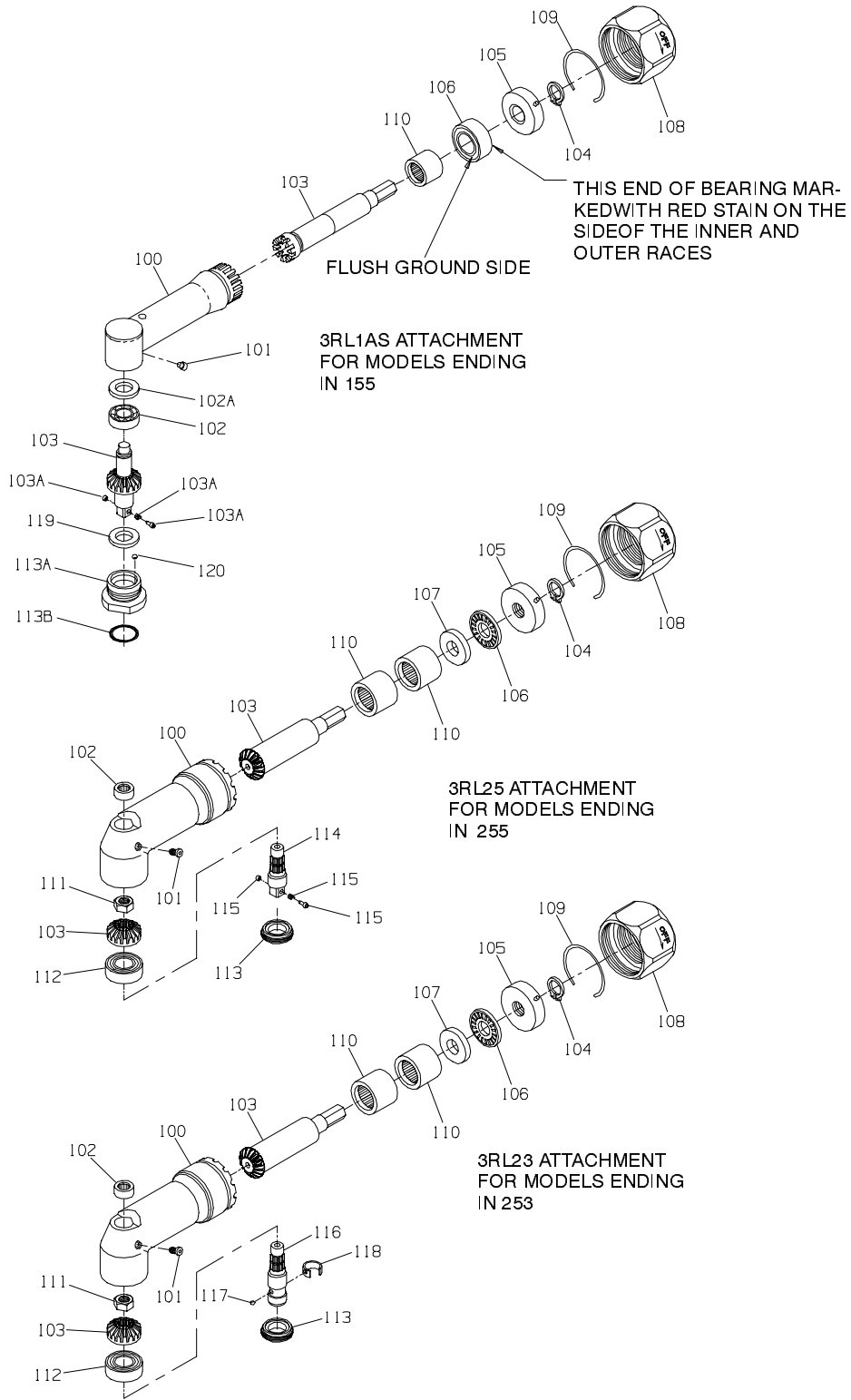
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|------|--|---------------|----|---|--------------|
|      | Holder Bearing Assembly (for model ES60T, ES70T or ES90T only) . . . . .       | ES60T-A603    | 82 | Spring Adjusting Ring . . . . .   | ES60T-582    |
| 75   | Holder Bearing . . . . .   | ----          | *  | Angle Head Coupling . . . . .   | ES60T-AHC    |
| 76   | Holder Washer (.012" [0.3 mm] thick) (2) . . . . .                             | ----          |    | Housing Screw Package (includes [10] Housing Screws, illustration number 2) . . . . .   | ES60T-670-10 |
| 77   | Spring Plate . . . . .   | ES60T-623     | *  | Brush Package (includes [10] Brush Assemblies illustration number 31). . . . .          | ES60T-619-10 |
| 78   | Clutch Housing Assembly<br>for model ES60T, ES70T or ES90T . . . . .           | ES60T-ULA580  | *  | Coupling Screw Package (includes [10] Coupling Screws, illustration number 81). . . . . | ES60T-671-10 |
|      | for model ES100T . . . . .   | ES100P-ULA580 | *  | Microswitch Adjustment Wrench Set . . . . .   | ES60T-MSW    |
| 79   | Clutch Adjusting Pin Package<br>(includes [3] clutch adjusting pins) . . . . . | ES60T-601-3   |    |   |              |
|      | Coupling Package . . . . .   | ES60T-UL600   |    |   |              |
| 80   | Coupling . . . . .   | ----          |    |   |              |
| + 81 | Coupling Screw (2) . . . . .   | ES60T-711     |    |   |              |

\* Not illustrated.

+ Can be purchased in quantities of ten. Refer to non-illustrated listing of parts section for an ordering part number.

# MAINTENANCE SECTION

## SERIES 3 ANGLE ATTACHMENTS FOR ES60T, ES70T, ES90T AND ES100T ELECTRIC ANGLE SCREWDRIVERS



(Dwg. TPA1318)



# MAINTENANCE SECTION

## PART NUMBER FOR ORDERING



|       |  | For Models<br>Ending in 1S5 | For Models<br>Ending in 2S3 | For Models<br>Ending in 2S5 |
|-------|--|-----------------------------|-----------------------------|-----------------------------|
|       | Angle Attachment . . . . .   | 3RL1A5                      | 3RL23                       | 3RL25                       |
| 100   | Angle Housing Assembly . . . . .   | 3RL1A-A550                  | 3RL2-A550                   | 3RL2-A550                   |
| 101   | Grease Fitting . . . . .   | D0F9-879                    | D0F9-879                    | D0F9-879                    |
| 102   | Spindle Upper Bearing . . . . .  | -----                       | 120A4-603                   | 120A4-603                   |
| 102   | Spindle Upper Bearing . . . . .  | 7L1A-603                    | -----                       | -----                       |
| 102A  | Shim Packet . . . . .  | 7L1A-P448                   | -----                       | -----                       |
| 103   | Matched Gear Set (Bevel Gear and Pinion<br>not sold separately) . . . . .      | 3RL1A5-A591                 | 3RL2-A552                   | 3RL2-A552                   |
| 103A  | Socket Retainer Assembly (consists<br>of Plunger, Spring and Washer) . . . . . | 500B-816A                   | -----                       | -----                       |
| 104   | Thrust Bearing Retainer . . . . .  | 3RL2-705                    | 3RL2-705                    | 3RL2-705                    |
| 105   | Rear Thrust Bearing Seat . . . . .   | 3RL2-682                    | 3RL2-682                    | 3RL2-682                    |
| 106   | Bevel Pinion Thrust Bearing . . . . .  | 3RL1A-514                   | 3RL2-105                    | 3RL2-105                    |
| 107   | Front Thrust Bearing Seat . . . . .  | -----                       | 3RL2-683                    | 3RL2-683                    |
| 108   | Coupling Nut . . . . .   | 3RL2-27                     | 3RL2-27                     | 3RL2-27                     |
| 109   | Coupling Nut Retainer . . . . .  | 3RL2-29                     | 3RL2-29                     | 3RL2-29                     |
| 110   | Bevel Pinion Bearing (2 for 3RL23<br>and 3RL25; 1 for 3RL1A5) . . . . .        | 7AH-24                      | H54U-511B                   | H54U-511B                   |
| 111   | Bevel Gear Retainer Nut . . . . .  | -----                       | 120A4-578                   | 120A4-578                   |
| 112   | Spindle Lower Bearing . . . . .  | -----                       | 120A4-593                   | 120A4-593                   |
| 113   | Angle Housing Cap . . . . .  | -----                       | 120A4-531                   | 120A4-531                   |
| 113A  | Angle Housing Cap Assembly . . . . .   | 3RL1A-A531                  | -----                       | -----                       |
| 113B  | Angle Housing Cap Seal . . . . .   | 3RL1A-513                   | -----                       | -----                       |
| 114   | 1/4" Square Drive Spindle Assembly . . . . .                                   | -----                       | -----                       | 141A9-607-1/4               |
| • 115 | Socket Retainer (consists of<br>Plunger, Spring and Washer) . . . . .          | -----                       | -----                       | 500B-816A                   |
| 116   | 1/4" Hex Bit Holder Spindle Assembly<br>(for standard bits) . . . . .          | -----                       | 5L2C3-B586                  | -----                       |
| 117   | Bit Retaining Ball (.125" diameter). . . . .                                   | -----                       | AV1-255                     | -----                       |
| 118   | Bit Retaining Spring . . . . .   | -----                       | 102A60-241                  | -----                       |
| 119   | Ball Race . . . . .  | 3RL1A-532                   | -----                       | -----                       |
| 120   | Steel Ball (1/16" diameter) (20). . . . .                                      | 3RL1A-512                   | -----                       | -----                       |
| *     | Housing Cap Wrench . . . . .   | -----                       | 141A12-26                   | 141A12-26                   |

\* Not illustrated.

- To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

## MAINTENANCE SECTION

### EQUIPMENT AVAILABLE AT EXTRA COST

PART NUMBER FOR ORDERING 

|     |   |                |
|-----|---|----------------|
|     | Spindle Assembly  |                |
| 114 | 1/4" square drive 141A9-A607-1/4 .....  | 141A9-A607-1/4 |
| *   | 3/8" square drive .....   | 141A12-A607    |
| *   | 1/4" hex recess (for insert bits) .....   | 5L2C4-B386     |
| 116 | 1/4" hex recess (for standard bits) .....   | 5L2C3-B586     |
| *   | 3/8-24 Thread Drill Chuck Spindle (requires 7L2A4-531 Angle Housing Cap).....               | 7L2A4-791      |
| 115 | Socket Retainer (consists of Plunger, Spring and Washer for No. 141A9-A607-1/4 Spindle).... | 500B-816A      |
| *   | Socket Retaining Plunger (for No.141A12-A607 Spindle) .....                                 | 5020-716       |
| *   | Socket Retaining Plunger Spring (for No.141A12-A607 Spindle).....                           | 401-718        |
| *   | Bit Retainer (for No.5L2C4-B386 Spindle) .....  | 5L2C4-425      |
| 117 | Bit Retaining Ball (.125" diameter for 5L2C3-B586 Spindle).....                             | AV1-255        |
| 118 | Bit Retaining Spring (for 5L2C3-B586 Spindle) .....   | 102A60-241     |
| *   | Angle Housing Cap (for use only with the 7L2A4-791 Spindle).....                            | 7L2A4-531      |

\* Not illustrated.

## MAINTENANCE SECTION

### DISASSEMBLY

#### Disassembly of Angle Attachment

##### For 3RL23 and 3RL25 Angle Attachments

1. Using the 141A12-26 Housing Cap Wrench, unscrew the Angle Housing Cap (113). This is a **left-hand thread**; rotate the Cap **clockwise** to loosen it.
2. Withdraw the Spindle Assembly (114 or 116) from the Angle Housing Assembly.

#### NOTICE

**If more than one angle head is disassembled at a time, take care not to mix the Matched Gear Sets (103) from different Angle Attachments. These gear sets are specially matched and are available only as matched sets.**

3. Inspect the Spindle Lower Bearing for looseness or roughness. If either of these conditions exists, remove the Bearing as follows:
  - a. Insert a 1/4" Allen Wrench in the Bit Holder Spindle Assembly or grasp the square drive or threaded end of the other Spindle Assembly in copper-covered vise jaws and unscrew the Bevel Gear Retainer Nut (111).
  - b. Lift off the Bevel Gear (103) from the Spindle.
  - c. Press the Spindle from the Spindle Lower Bearing.
4. **For 3RL25 Angle Attachment**, grasping the Spindle in copper-covered vise jaws and using a 1/16" (1.59 mm) punch, drive out the Socket Retainer (115) from the Washer on non-working side of the square on the Spindle.

#### NOTICE

**Do not remove the Socket Retainer unless you have a new retainer ready to install. The retainer is destroyed during removal.**

5. If the Spindle Upper Bearing appears rough or loose, press it from the Angle Head.

#### NOTICE

**Do not remove the Spindle Upper Bearing unless you have a new bearing ready to install. This type of bearing is always damaged during removal.**

6. Using snap ring pliers, remove the Thrust Bearing Retainer (104) and slide off the Rear Thrust Bearing Seat (105), and Bevel Pinion Thrust Bearing (106) from the pinion shaft.
7. Grasp the hex of the pinion shaft in copper-covered vise jaws and tap the rear face of the Angle Housing Assembly with a soft hammer to pull the Bevel Pinion Bearings (110).

#### NOTICE

**Do not remove the pinion shaft and bearings unless you have two new bearings on hand.**

After the Angle Attachment is disassembled, check all parts for damage or wear. If the gear teeth on either piece of the Matched Gear Set are worn or chipped, replace both parts. They are furnished in a matched set and must be replaced with a matched set.

8. Using a hooked tool, reach inside the Coupling Nut (108) and pull the Coupling Nut Retainer (109) from the Nut. Slide the Coupling Nut and Retainer off the motor end of the Angle Attachment.

##### For 3RL1A5 Angle Attachment

#### NOTICE

**In order to prevent the loss of the twenty Steel Balls (120), place a container under the Angle Attachment before removing the Angle Housing Cap Assembly (113A).**

1. Unscrew Angle Housing Cap Assembly. This is a **left-hand thread**; rotate the Cap **clockwise** to loosen it.
2. Remove Angle Housing Cap Seal (113B) from Angle Housing Cap.

## MAINTENANCE SECTION

3. Withdraw Spindle (103) and remove Shims (102A) from Angle Housing.

### NOTICE

**If more than one Angle Head is disassembled at a time, take care not to mix the Matched Bevel Gear Sets (103) from different Angle Attachments. These gear sets are especially matched and are available only as matched sets.**

4. Remove the Ball Race (119) and Steel Balls from the Angle Housing Cap.
5. Put the Spindle in copper-covered vise jaws and holding a 1/16" (1.59 mm) punch against the Washer (103A), drive out the Socket Retainer Assembly.

### NOTICE

**Do not remove the Socket Retainer Assembly unless you have a new Socket Retainer ready to install. The retainer is destroyed during removal.**

6. If the Upper Spindle Bearing (102) appears rough or loose, press it from the Spindle.
7. Using snap ring pliers, remove the Thrust Bearing Retainer (104) and slide off the Rear Thrust Bearing Seat Assembly (105) and Bevel Pinion Thrust Bearing (106).
8. Grasp the hex of the Bevel Pinion Shaft in copper-covered vise jaws and tap the rear face of the Angle Housing with a soft hammer to pull the Bevel Pinion Bearing (110).

### NOTICE

**Do not remove the Bevel Pinion Shaft and Bevel Pinion Bearing unless you have a new Bearing on hand.**

After the Angle Attachment is disassembled, check all parts for damage or wear. If the gear teeth on either piece of the Matched Bevel Gear Set are worn or chipped, replace both parts. They are furnished in a matched set and must be replaced in a matched set.

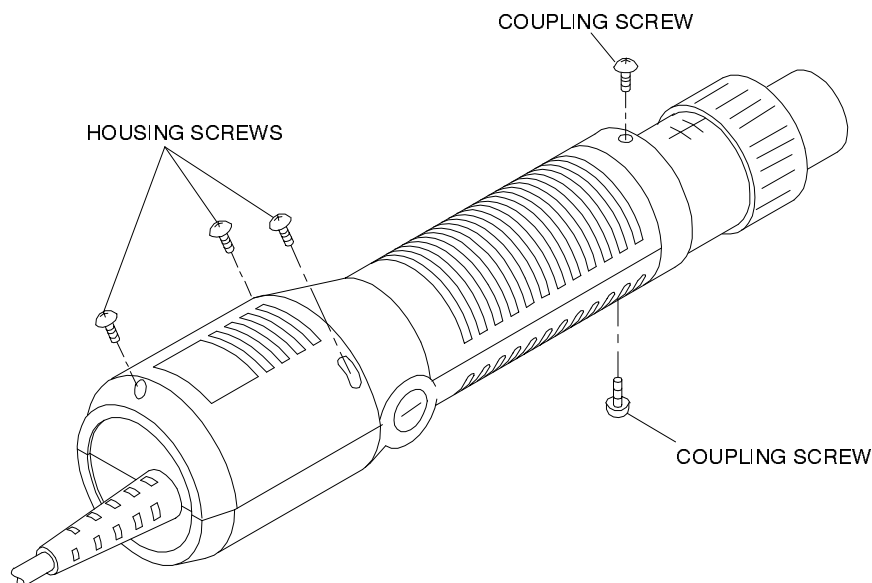
9. Using a hooked tool, reach inside the Coupling Nut (108) and pull the Coupling Nut Retainer (109) from the Nut. Slide the Coupling Nut and Retainer off the motor end of the Angle Attachment.

### Disassembly of the Motor

1. Using a No. 2 tip Phillips head screwdriver on the Housing Screws (2) and a No. 1 Phillips head screwdriver on the Coupling Screws (81), remove the two Coupling Screws and the three Housing Screws.

### NOTICE

**The screw threads are coated with Threadlocker 222®\*. It may be necessary to rapidly tap the end of the screwdriver handle with a hammer while backing the Screws out of the Housing.**

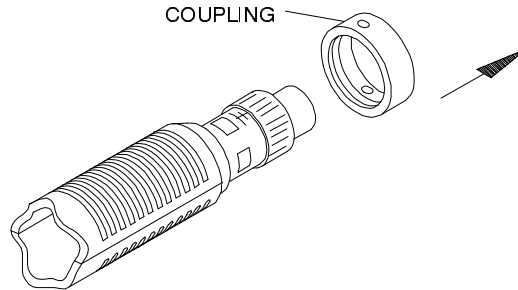


(Dwg. TPD1029)

\* Registered trademark of Loctite Corporation.

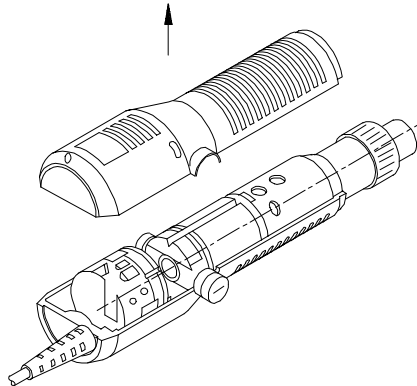
## MAINTENANCE SECTION

- Remove the Coupling (80) by pulling it off the front end of the Electric Screwdriver.



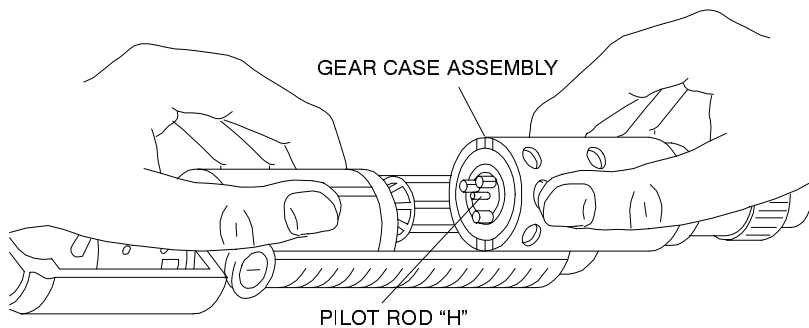
(Dwg. TPD1030)

- Carefully separate the two halves of the Housing (1) by using a thin blade screwdriver to pry them apart.



(Dwg. TPD1031)

- With the assembled motor elevated slightly from the Housing, pull the Gear Case Assembly (45) away from the assembled motor.

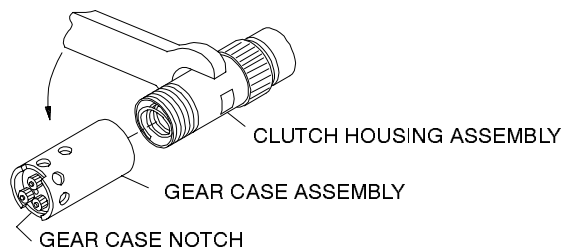


(Dwg. TPD1032)

- Remove the Pilot Rod "H" (59) from the Gear Case Assembly.
- Fit the two notches at the rear of the Gear Case Assembly (45) into an assembly fixture and using an open end wrench on the flats on the Clutch Housing Assembly (78), unscrew and remove the Clutch Housing Assembly.

### NOTICE

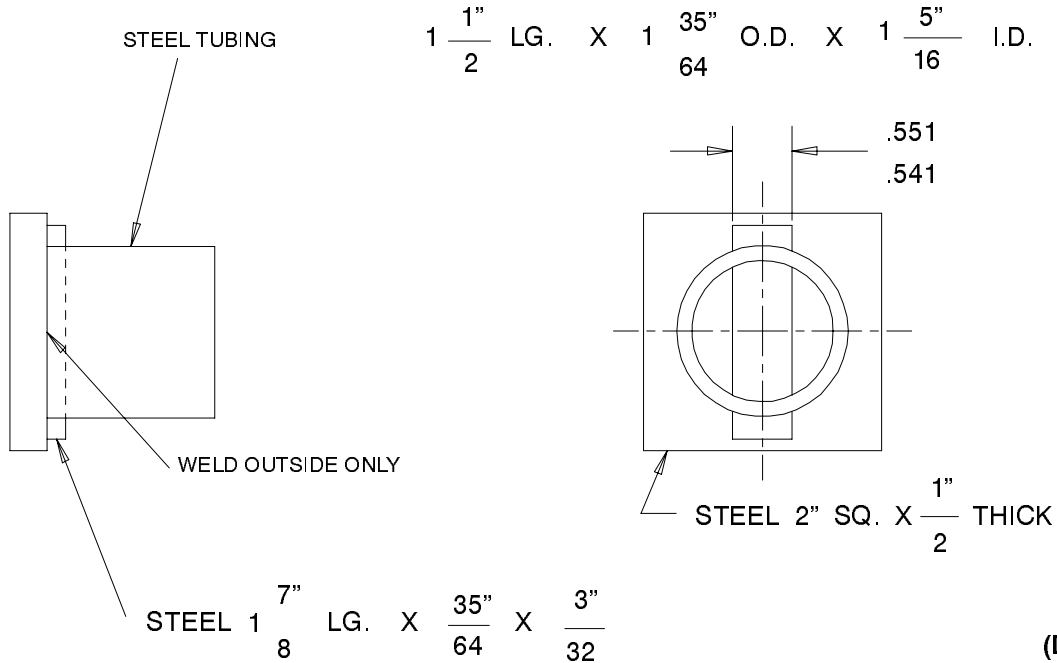
**This is a left-hand thread.**



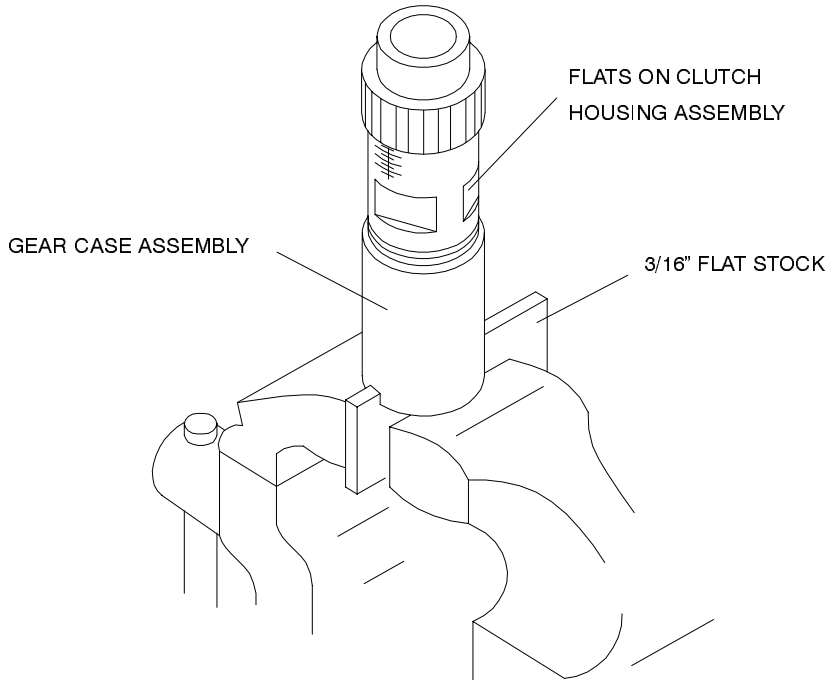
(Dwg. TPD1034)

## MAINTENANCE SECTION

### ES60T CLUTCH HOUSING FIXTURE



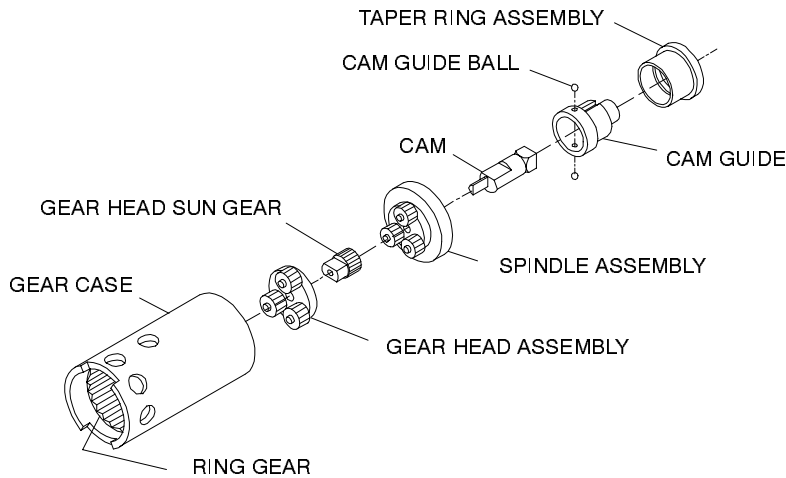
### REMOVING THE CLUTCH HOUSING FROM THE GEAR CASE



7. Remove the Taper Ring Assembly (63), Cam Guide (60) and Cam Guide Balls (61) from the Gear Case Assembly. **For Model ES100T**, remove the Cam (56), Cam Pins (57) and the Cam Washer (58). **For Model ES90T**, remove the Cam (54) and Cam Guide Ball (62). Remove the Spindle Assembly (50) and the two Spindle Washers (53) from the Gear Case Assembly.

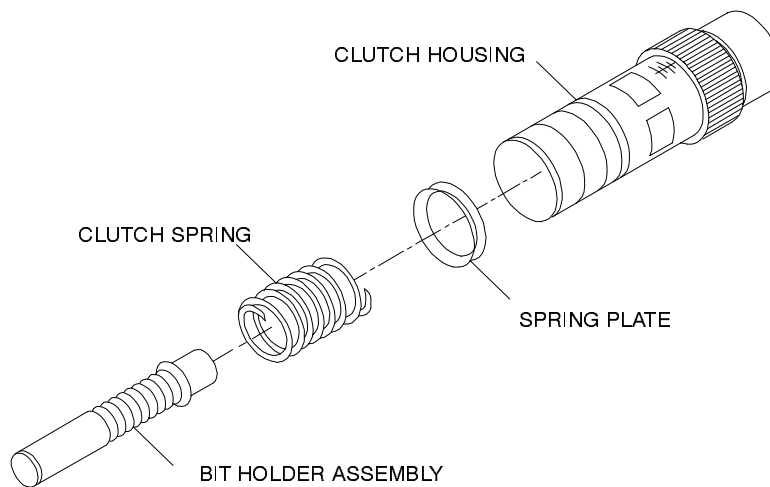
## MAINTENANCE SECTION

**For all other models**, remove the Cam (54). Remove the Spindle Assembly (50), Gear Head Sun Gear (49) and Gear Head Assembly (48) from the Gear Case Assembly. Do not attempt removal of the ring gear inside the Gear Case. It is a press fit into the Gear Case.



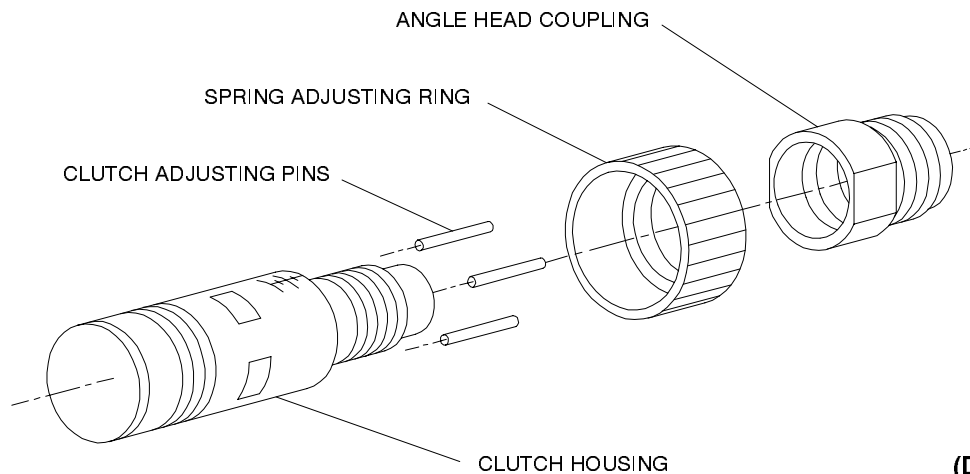
(Dwg. TPD1035)

- Slide the Bit Holder Assembly, Clutch Spring (64), Spring Plate (77) and Holder Bearing Assembly out of the Clutch Housing.



(Dwg. TPD1036)

- Unscrew and remove the Angle Head Coupling (83). Unscrew and remove the Spring Adjusting Ring (82) and pull the three Clutch Adjusting Pins (79) out of the Clutch Housing.



(Dwg. TPD1246)

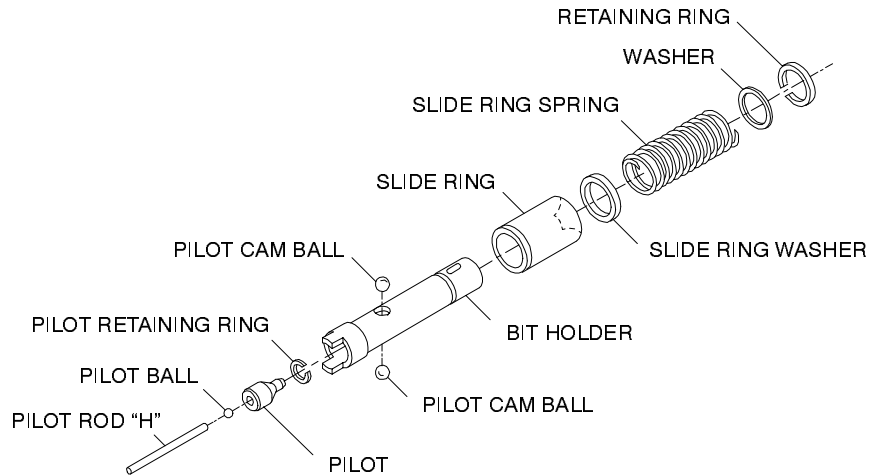
## MAINTENANCE SECTION

10. Pull the Pilot Rod "H" (59) out of the Bit Holder and using miniature, internal snap ring pliers, remove the Stop Ring (74) from the Bit Holder (65).

### NOTICE

Spread the Stop Ring only enough to remove it from the Bit Holder. Excessive expansion may damage the Stop Ring.

11. Remove the Washer (73), Slide Ring Spring (72), Slide Ring Washer (71) and Slide Ring (70) from the Bit Holder.



(Dwg. TPD1038)

12. When the Slide Ring is removed, the two Pilot Cam Balls (69) will come out of the Bit Holder. Removing the Balls allows the Pilot (66), Pilot Ball (67) and Pilot Retaining Ring (68) to be removed from the end of the Bit Holder.

### NOTICE

The Pilot Ball must be clean to be removed from the Pilot. However, only remove the Pilot Ball and Pilot Retaining Ring if it is necessary.

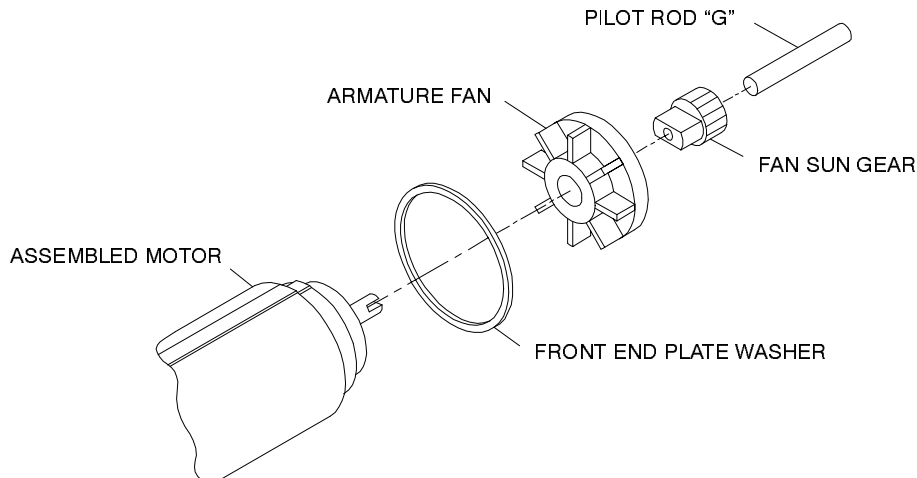
13. Remove the Fan Sun Gear (44) and the Armature Fan (42) from the front of the motor.

### NOTICE

Pull the Pilot Rod "G" (43) out of the Fan Sun Gear.

### WARNING

Do not lose, substitute or damage Pilot Rod "G". It is a critical component of the tool's electrical insulation system and any substitution, omission or damage could cause a shock.

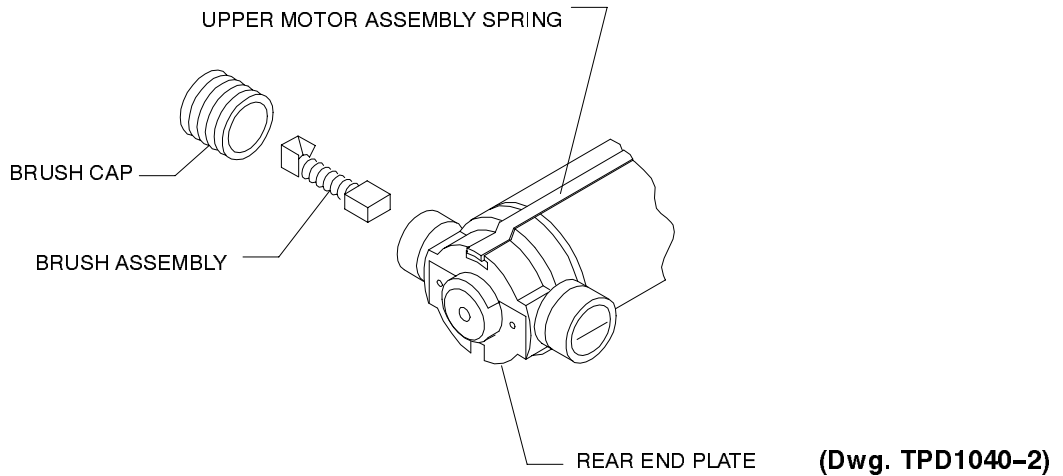


(Dwg. TPD1039)

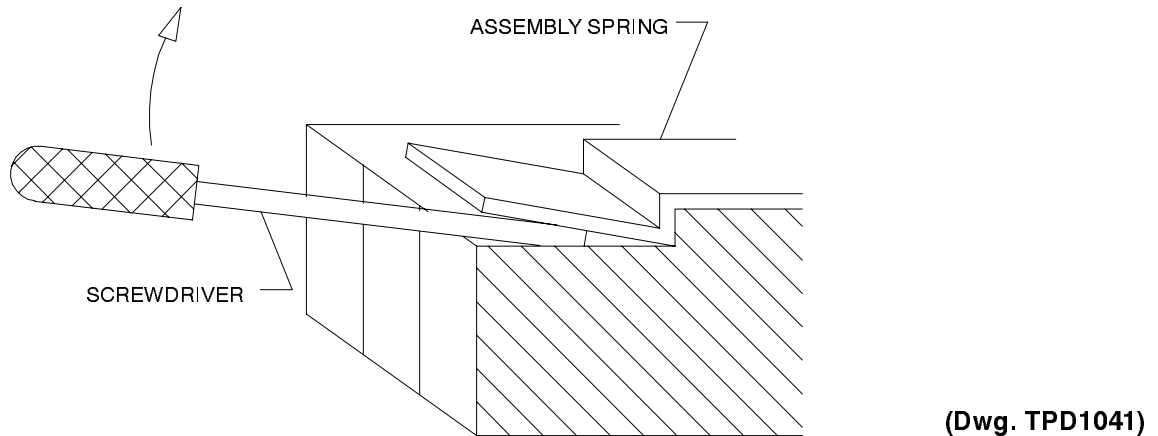


## MAINTENANCE SECTION

14. Unscrew and remove the two Brush Caps (32) and pull the two Brush Assemblies (31) out of the Rear End Plate (30). Mark the Brushes so they can be reinstalled exactly as they were removed unless they are replaced.



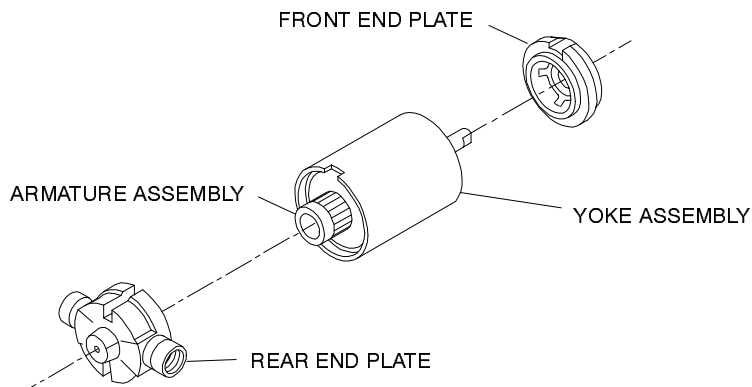
15. Using a thin blade screwdriver, remove the Motor Assembly Springs (34) by inserting the screwdriver between the Spring and Rear End Plate and prying upward.



16. Remove the Rear End Plate (30) and the Front End Plate (39) from the Yoke Assembly (37) and Armature Assembly (36). If Insulators (39A) or Washers (39B) are removed, replace them with new ones.

### CAUTION

**Do not separate the Armature Assembly from the Yoke Assembly. The magnet in the Yoke will become slightly demagnetized and adversely affect motor performance.**



## MAINTENANCE SECTION

### LUBRICATION

Whenever an Electric Screwdriver is disassembled for maintenance or repair, lubricate the following components in the recommended manner with Ingersoll-Rand No. 67 Grease.

1. Inject a tiny amount of grease into the hole in the Pilot (66) for the Pilot Ball (67).
2. Wipe a film of grease on the tapered inner surface of the Slide Ring (70) and the Taper Ring Assembly (63).
3. Apply a moderate amount of grease to the outer surfaces of the Cam (54 or 56), the Cam Guide (60) and the Cam Guide Balls (61 and/or 62).
4. Wipe a thin coat of grease on each of the Spindle Gears (51).

### CAUTION

**Do not pack the gearing with grease. Excess grease may be pulled into the motor by the Armature Fan (42).**

5. Wipe a very thin coating of grease onto Pilot Rod "H" (59).

### ⚠ WARNING

**Pilot Rod "G" (43) must be totally free of grease. Grease on this Rod could cause electric shock.**

### ASSEMBLY

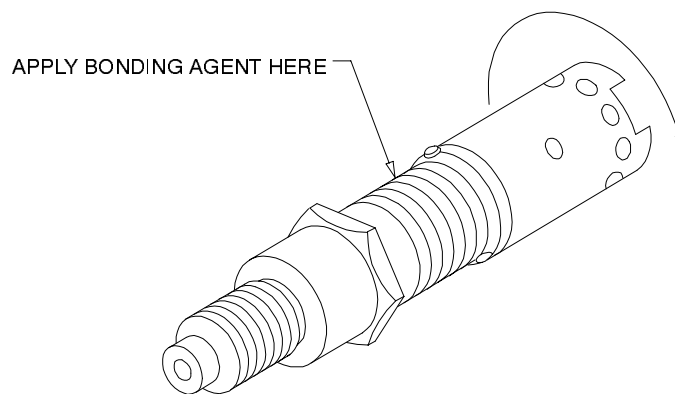
To assemble these tools, reverse the disassembly procedure. There are certain assembly and lubrication instructions which are important for optimum performance and they are as follows:

1. Keep the commutator surface of the armature free from all contaminants.
2. Use good quality, properly sized snap ring pliers when installing the Stop Ring (74) on the Bit Holder (65) and do not expand the Stop Ring more than required to install it on the Holder. Excessive expansion may cause the Ring to deform and fail.
3. To assemble the Clutch Housing Assembly (78) to the Gear Case Assembly (45), proceed as follows:
  - a. Apply 0.3 cc of Ingersoll-Rand No. 67 Grease to the Spindle Assembly (50).
  - b. Insert the Cam (54 or 56), small end first, into the Gear Case.
  - c. Inject a small amount of grease into the holes for the Cam Guide Balls (61) and insert a Cam Guide Ball into each hole.  
**For Model ES100T**, insert a Cam Pin between each of the four Cam Guide Balls and hold each in position with a small amount of grease.
  - d. Being careful not to dislodge the Cam Guide Balls or Cam Guide Pins, thread the Gear Case onto the Clutch Housing about two threads.

### NOTICE

**This is a left-hand thread.**

- e. At the middle of the Clutch Housing thread, apply Loctite Threadlocker 242, or equivalent, to approximately three threads.



(Dwg. TPD1044)

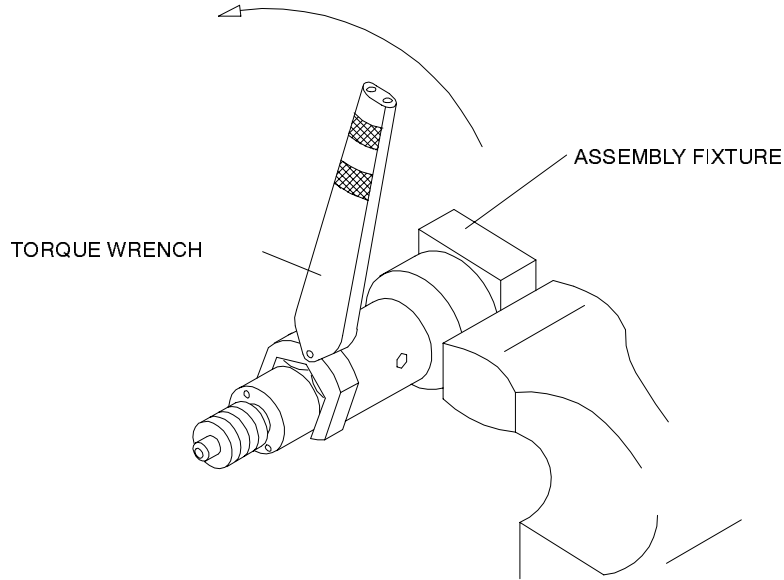
- f. Carefully thread the Clutch Housing into the Gear Case until contact is made with the Cam. When contact is made, unscrew the Clutch Housing two full thread revolutions.

## MAINTENANCE SECTION

- g. Insert a 1/4" tee wrench or hex wrench into the end of the Bit Holder (65). While pushing the Bit Holder inward with the wrench, rotate the Gear Case until the jaws of the Cam Guide (60) engage the Cam. The wrench will move inward noticeably when engagement occurs.
- h. While maintaining engagement with the wrench, hand tighten the Gear Case as much as possible.
- i. With the assembly fixture held in vise jaws, position the notches in the Gear Case onto the fixture and, using a torque wrench, tighten the Clutch Housing to 21 ft-lb (28.5 Nm) torque.

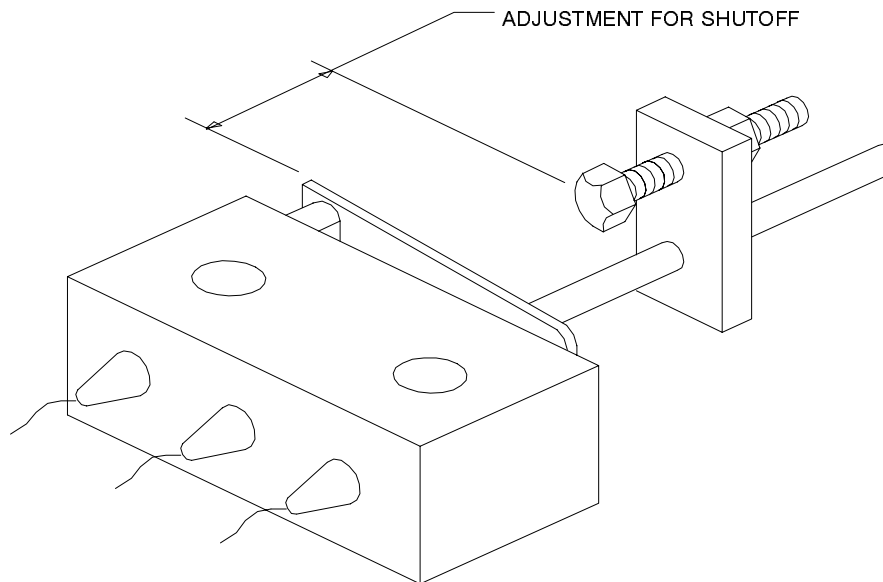
### NOTICE

Recalibrate the torque wrench every six months.



(Dwg. TPD1045)

4. The brake switch must be timed to actuate when the clutch cams over. To adjust the timing, loosen the Adjusting Screw Nut (19) and turn the Adjusting Screw (18) in or out until the microswitch (24) is actuated at the same time the clutch cams over or slightly before it cams over. If the motor lugs before the brake switch actuates, shorten the Adjusting Screw.



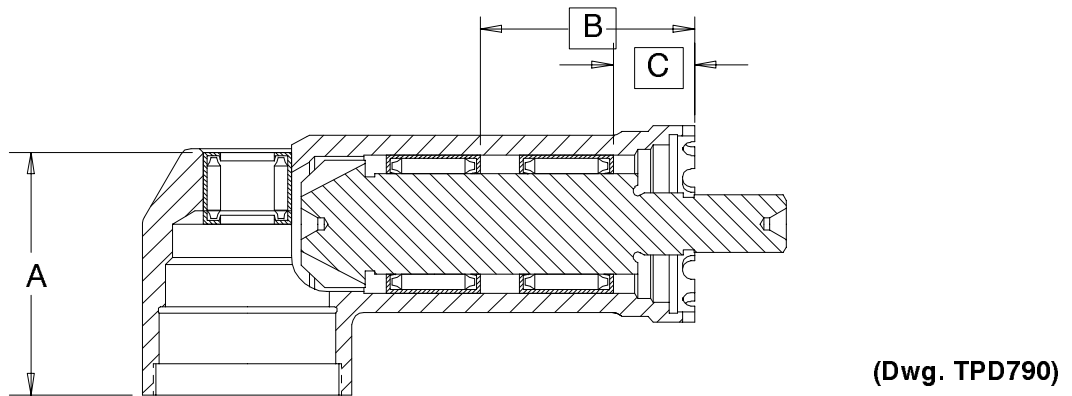
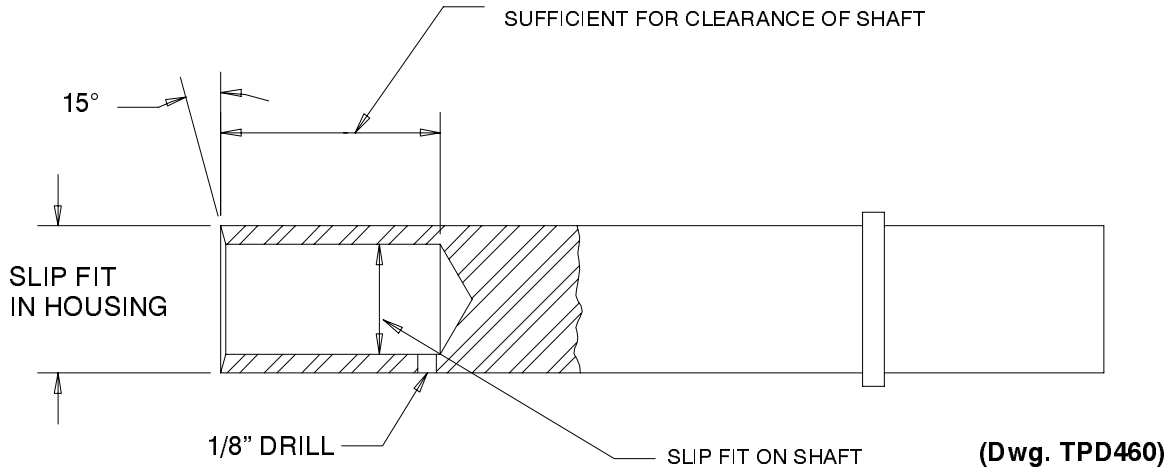
(Dwg. TPD1046)

## MAINTENANCE SECTION

### Assembly of the Angle Attachment

#### For 3RL23 and 3RL25

1. Apply 2 to 4 cc of Ingersoll-Rand No. 67 Grease to the gear and onto the shaft of the Bevel Pinion (103) and insert it, gear end first, into the long bore of the Angle Housing (100).
2. Coat the inside of the two Bevel Pinion Bearings (110) with a small amount of Ingersoll-Rand No. 67 Grease and insert one Bearing, unstamped end first, into the bore of the Angle Housing.
3. Using the bearing inserting tool shown in Dwg. TPD460, press the new Bearing to the "B" dimension shown in Dwg. TPD790.
4. Repeat the process with the second Bevel Pinion Bearing, pressing it to the "C" dimension shown in Dwg. TPD790.
5. Coat the inside of the new Spindle Upper Bearing (102) with a small amount of the recommended grease and coat the outside with a small amount of Loctite®\* No. 290.



### SPECIFICATIONS

| DISTANCE | MINIMUM DIMENSION |             | MAXIMUM DIMENSION |             |
|----------|-------------------|-------------|-------------------|-------------|
|          | in                | mm          | in                | mm          |
| <b>A</b> | <b>1.181</b>      | <b>30.0</b> | <b>1.201</b>      | <b>30.5</b> |
| <b>B</b> | <b>1.102</b>      | <b>28.0</b> | <b>1.122</b>      | <b>28.5</b> |
| <b>C</b> | <b>0.334</b>      | <b>8.5</b>  | <b>0.354</b>      | <b>9.0</b>  |

6. Install the Front Thrust Bearing Seat (107) on the Bevel Pinion with the beveled side of the seat toward the Pinion Bearings.
7. Grease the Bevel Pinion Thrust Bearing (106) and install it against the Seat.
8. Install the Rear Thrust Bearing Seat (105) with the flat face against the Thrust Bearing and the radial pin captured by an Angle Housing notch.

\* Registered trademark of Loctite Corporation.

## MAINTENANCE SECTION

9. Install the Thrust Bearing Retainer (104) in the groove on the Pinion to lock the components in position. Make certain the Retainer is completely seated in the groove.
10. The Socket Retainer (115) for the Square Drive Spindle (114) consists of a plunger, spring and washer. The hole through the square on the working end of the Spindle has an internal shoulder and the hole is deeper on one side of the square than it is on the opposite side. Place the spring into the deeper hole and insert the plunger into the spring until the plunger is flush with the face of the square. Holding the plunger side of the square against a steel block, place the washer, chamfered side away from the plunger, onto the plunger. With a rivet tool, rivet the washer to the plunger.
11. Work some grease into the Spindle Lower Bearing and on the Bevel Gear.
12. Using a sleeve that will contact only the inner ring of the Bearing, press the Spindle Lower Bearing (112), sealed side first, onto the Spindle.
13. Slide the Bevel Gear of the Matched Gear Set (103) onto the Spindle.
14. Apply Loctite®\* Primer Grade T to the threads on the Bevel Gear Retainer Nut (111) and Spindle. Allow to cure for five minutes. Apply Loctite® No. 242 to the threads of the Bevel Gear Retainer Nut and tighten it on the Spindle to 10.3 ft-lb (14 Nm) torque.
15. Install the assembled Spindle in the Angle Housing, making certain the teeth of the Matched Gear Set mesh and the Spindle turns freely.
16. Clean the threads of the Angle Housing and the Angle Housing Cap (113). Apply a uniform coat of VC3 No. 205 Vibra-Tite®\*\* to the threads of the Angle Housing Cap and allow the compound to cure between ten and twenty minutes. Install the Angle Housing Cap and tighten the Cap to a minimum of 15 to 18 ft-lb (20 to 24 Nm) torque.
17. Slide the Coupling Nut Retainer (109) and Coupling Nut (108), threaded end trailing, over the notched end of the Angle Housing.
18. Compress the Retainer and work it into the internal groove in the non-threaded end of the Nut.

### For 3RL1A5

1. Work a light coat of Ingersoll-Rand No. 67 Grease into the gear teeth of the Bevel Pinion (103) and insert it, gear end first, into the long bore of the Angle Housing (100).
2. Work 0.5 to 1 cc of Ingersoll-Rand No. 67 Grease into the Bevel Pinion Bearing (110) and insert it, unstamped end first, into the bore of the Angle Housing, after the Bevel Pinion.
3. Support the Angle Housing on an angled support as shown in Dwg. TPB853 on page 22. Use a bearing inserting tool and press the Bevel Pinion Bearing so the face is a maximum of 1.32" (33.50 mm) but not less than 1.30" (33.00 mm) below the end face of the Angle Head. Refer to Dwg. TPB853.
4. Lubricate the Bevel Pinion Thrust Bearing (106) with 0.5 to 1 cc of Ingersoll-Rand No. 67 Grease. Install the Bearing on the rear of the Bevel Pinion shaft with red-stained end of Bearing toward the rear of the Angle Head. Refer to Dwg. TPA1318 on Page 8. Secure Bearing on shaft with Thrust Bearing Retainer (104).
5. The Socket Retainer (103A) consists of a Plunger, Spring and Washer. The hole through the square on the working end of the Spindle has an internal shoulder and the hole is deeper on one side of the square than it is on the opposite side. Place the Spring into the deeper hole and insert the Plunger into the Spring until the Plunger is flush with the face of the square. Holding the Plunger side of the square against a steel block, place the Washer, chamfered side away from the Plunger, onto the Plunger. With a rivet tool, rivet the Washer to the Plunger.
6. Apply a small drop of Loctite® No. 601 to the small outside diameter of the spindle upper bearing shaft on the Spindle (103).
7. Apply 2 to 4 cc of Ingersoll-Rand No. 67 Grease to the Spindle Upper Bearing (102) and a light coat of Ingersoll-Rand No. 67 Grease to the gear teeth on the Spindle. Press the Spindle Upper Bearing onto the Spindle and allow the Loctite to dry a minimum of ten minutes.

### NOTICE

**Do not get any Loctite in the bearing; damage to the Bearing could result. Do not get any grease on the inside diameter of the Bearing; grease will prevent the Loctite from working.**

\* Registered trademark of Loctite Corporation.

\*\* Registered trademark of ND Industries.

## MAINTENANCE SECTION

- Insert the Spindle into the Angle Head until the Spindle Upper Bearing seats into the recess of the Angle Head.

### NOTICE

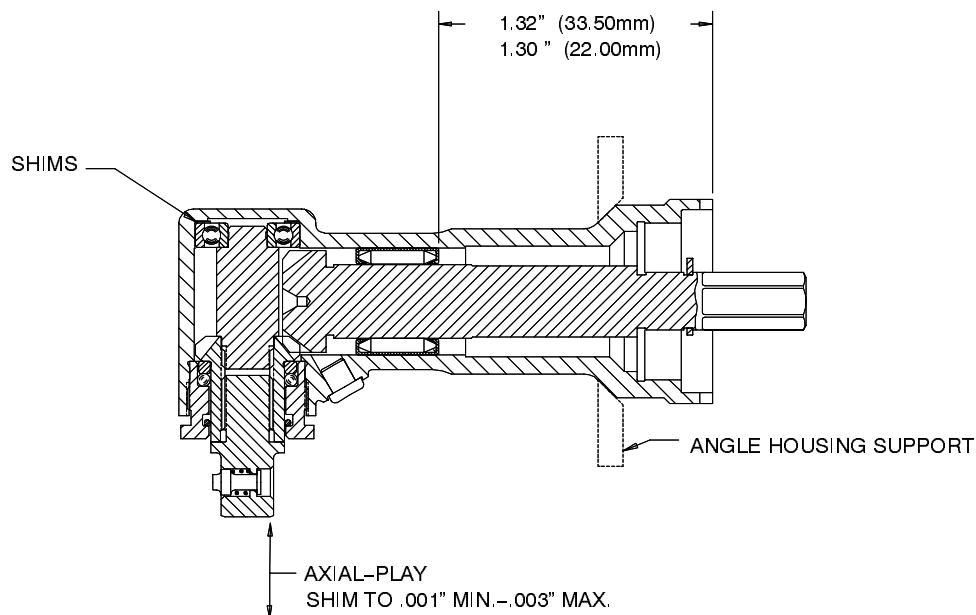
**Make sure that the Bevel Pinion is pulled outward toward the Bevel Pinion Bearing before inserting the Spindle into the Angle Head.**

- Install the Angle Housing Cap Seal (113B) in the bottom of the Angle Housing Cap (113A).
- Insert the twenty Steel Balls (120) into the Angle Housing Cap and install the Ball Race (119) in the Cap over the Steel Balls.
- Taking care not to tip the Angle Housing Cap, install the Angle Housing Cap finger tight.

### NOTICE

**Spindle must turn freely.**

- With the Bevel Gear on the Spindle out of mesh with the Bevel Pinion, measure the axial play of the Spindle (use .25 lb loads). Subtract .002" (.051 mm) from the reading for required shim thickness. Refer to Dwg. TPB853.
- Unscrew and remove the Angle Housing Cap, again taking care not to lose the Steel Balls from the inside of the Cap. While pulling the Bevel Pinion outward toward the Bevel Pinion Bearing, remove the Spindle from the Angle Head.
- Insert the required number of shims as determined from step 12 in the upper bearing recess of the Angle Head.
- Reassemble and test the Angle Head as indicated in steps 8, 11 and 12.
- Once proper shimming has been achieved, remove the Angle Housing Cap, clean the threads on the Angle Head and the Angle Housing Cap, and apply a film of Vibra-Tite® VC3 to the threads.
- Install the Angle Housing Cap and tighten to 35 in-lb (3.9 Nm) torque.
- Install the Rear Thrust Bearing Seat (105) on the Bevel Pinion shaft with the flat face against the Thrust Bearing.
- Slide the Coupling Nut Retainer (109) and the Coupling Nut (108), threaded end trailing, over the notched end of the Angle Housing.
- Compress the Coupling Nut Retainer, and work it into the internal groove in the nonthreaded end of the Coupling Nut.

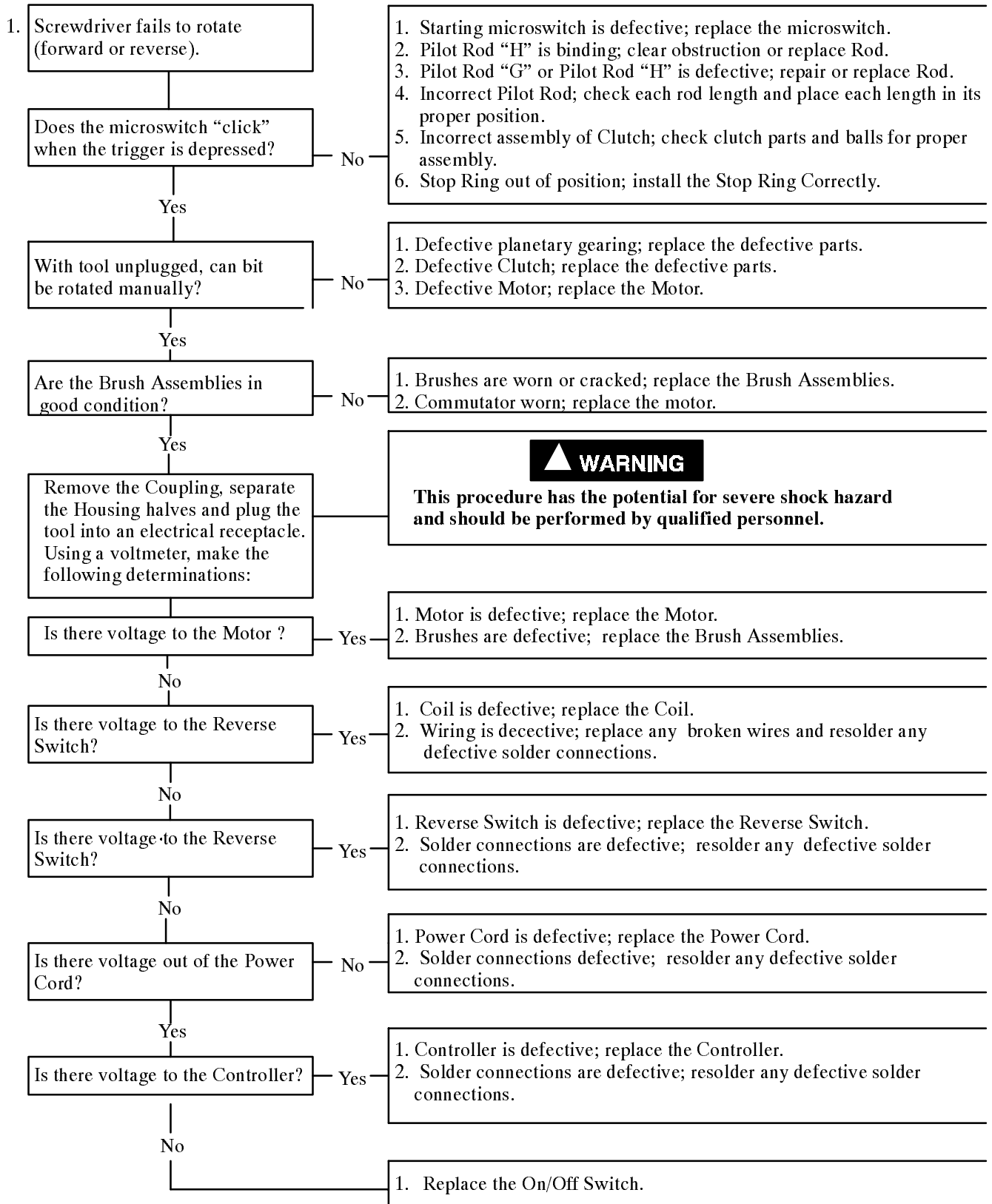


3RL1A5 Angle Attachment

(Dwg. TPB853)

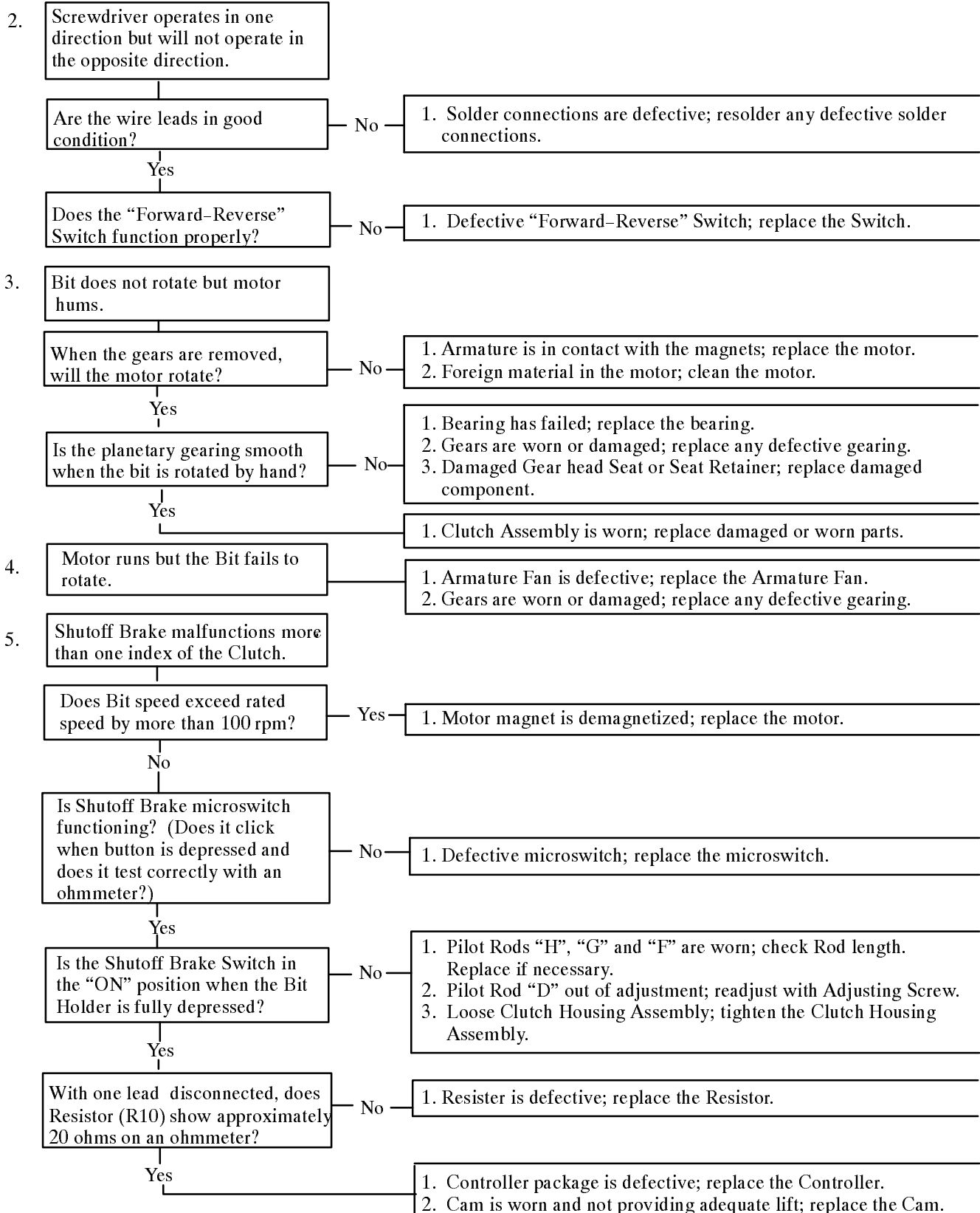
## MAINTENANCE SECTION

### TROUBLESHOOTING GUIDE



## MAINTENANCE SECTION

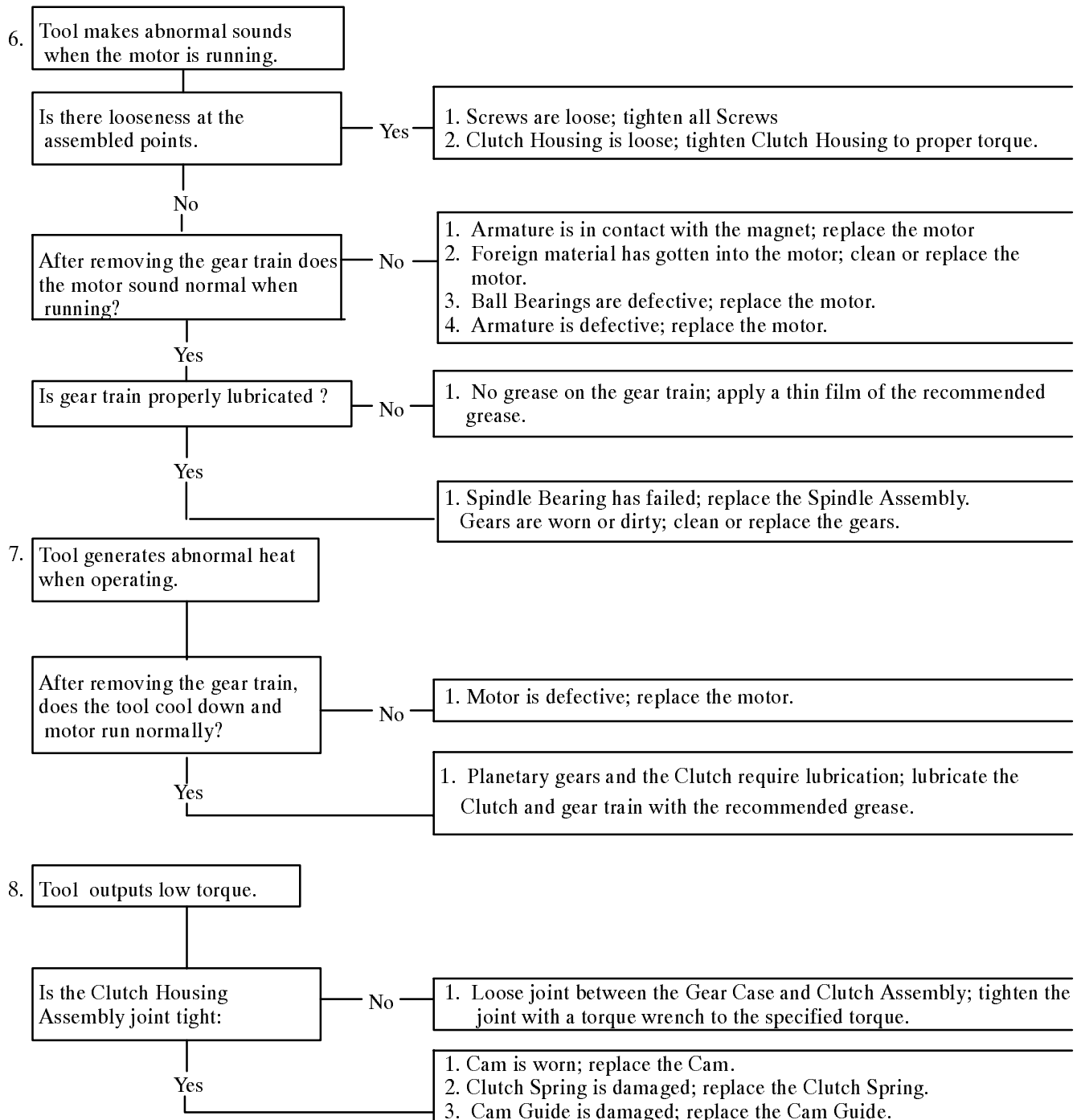
### TROUBLESHOOTING GUIDE (Continued)





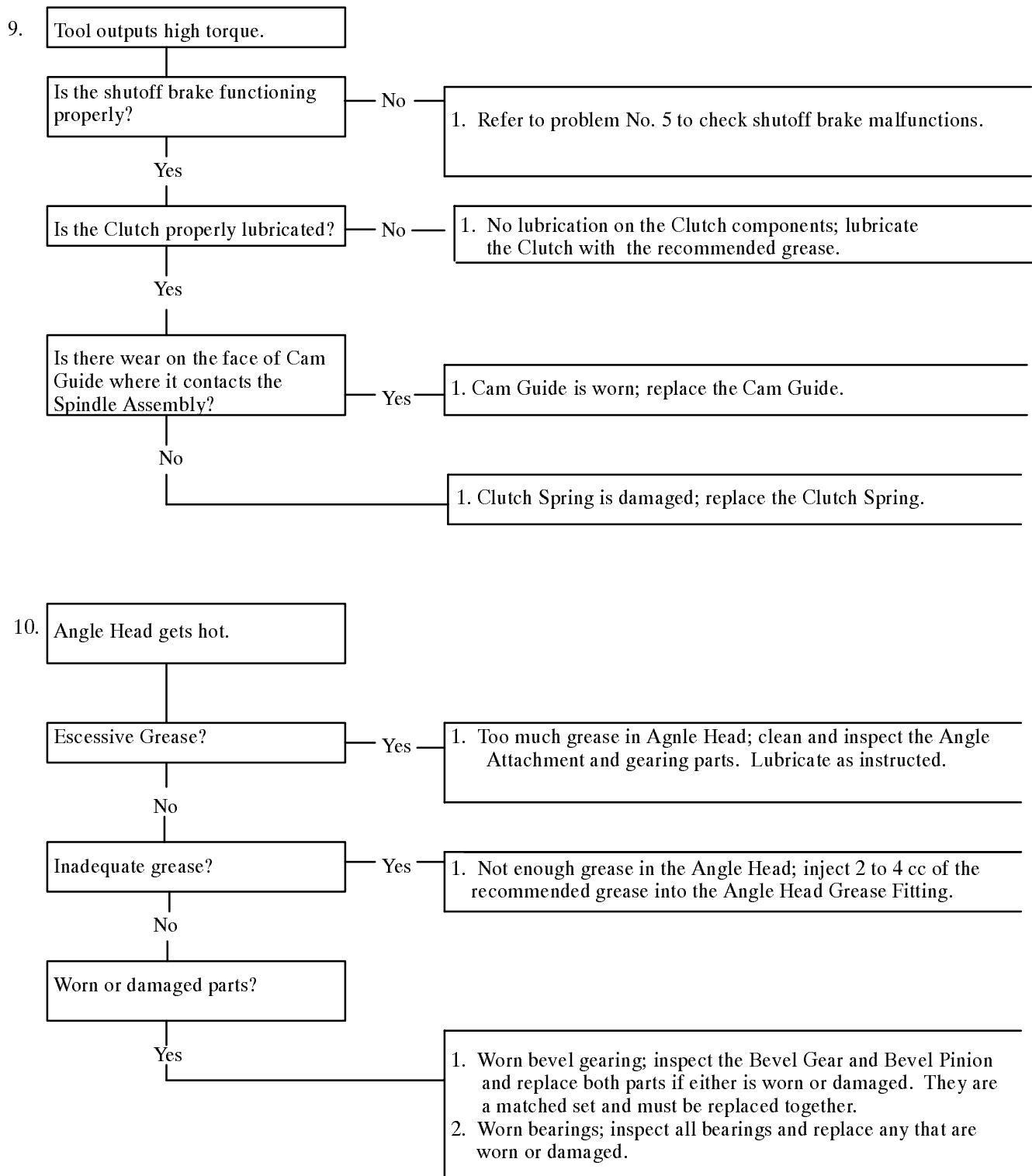
## MAINTENANCE SECTION

### TROUBLESHOOTING GUIDE (Continued)



# MAINTENANCE SECTION

## TROUBLESHOOTING GUIDE (Continued)



# MAINTENANCE SECTION

