

# Single Roll Bead Expander

4480 Series



Tube & Pipe Cleaners ◦ Tube Testers ◦ Tube Plugs ◦ Tube Removal ◦ Tube Installation



## Operating and Maintenance Instructions



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# **INTRODUCTION**

Thank you for purchasing this Elliott product. More than 100 years of experience have been employed in the design and manufacture of this tool, representing the highest standard of quality, value and durability. Elliott tools have proven themselves in thousands of hours of trouble free field operation.

If this is your first Elliott purchase, welcome to our company; our products are our ambassadors. If this is a repeat purchase, you can rest assured that the same value you have received in the past will continue with all of your purchases, now and in the future.

Your Elliott Single Roll Beading Expander has been designed and manufactured to the highest standards, using the latest in materials and technology. If the guidelines in this manual are followed, this tool will provide many years of trouble free operation.

The Single Roll Beading Expander will in one operation quickly and quietly expand and bead tubes.

Successful operation is readily achieved by following three (3) simple rules.

1. The guide roll and the beading roll must be the proper size for the tube wall being expanded and beaded.
2. Tubes must have the correct amount of projection from tube sheet before starting expansion (refer to specifications)
3. Both tube and tool must be totally free of any anti-rust oil or lubricant.

# THEORY OF OPERATION

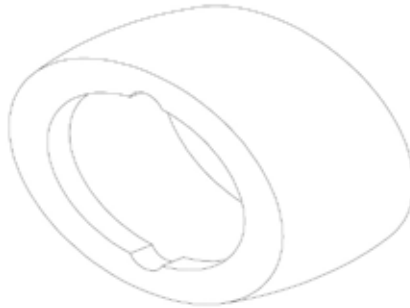
The Single Roll Beading Expander simultaneously expands and beads the tube end in a single operation. Operating as it does, the tool assures the creation of a joint, which is both pressure-tight and has a bead in intimate contact with the tube sheet. The tool achieves this objective by utilizing the natural feed force built into the expander to force the beading roll against the end of the tube while expansion is taking place. The ability of the tool to satisfactorily accomplish this depends upon the amount of beading force available being of sufficient magnitude to enable feeding forces to be developed which will enable the beading roll to deform the end of the tube and press the bead tightly against the sheet. The beading force is made a maximum by utilizing five or four expansion rolls in place of the three normally used in expanders of this type and by the use of a coolant, which has the quality of minimum lubricity. If the beading roll or expander is set so that full expansion is accomplished before the bead has been formed, it will not be possible to complete a proper bead without further expansion of the tube. Once the beading roll has come into contact with the end of the tube, the entire inward force of the tool is available to form the bead. However, this force is not always of sufficient magnitude to perform the required operation. The force is at a minimum initially while the expander is expanding the tube to a metal-to-metal condition. At this point, the beading force increases sharply and builds to a maximum as the expansion progresses. When the stop nut on the mandrel engages the thrust bearing on the cage housing preventing any further axial movement of the mandrel, this force stabilizes and then diminishes as continued rotation of the expander forms the tube bead. This is why it is necessary that the beading operation be completed before final expansion of the tube since it will require the maximum beading force available to perform this beading. Because of normal manufacturing practices, it would be possible to perform a proper beading and expanding operation with the tool without necessarily setting it so that the beading roll was in contact with the end of the tube. How far back would be determined by two factors, one would be by the amount of clearance between the tube sheet hole and the O.D. The greater this clearance, the further back the beading roll could be set since effective beading forces will not be developed until the tube has been expanded to the metal to metal condition. The second factor would be the effective thickness of the tube sheet. However, the safest course to follow in the use of this tool would be to set the tool with the beading roll close to or in contact with the tube end. It must be emphasized that no expanding tool can do a satisfactory job unless the following three items are complied with.

1. Tool of the correct size
2. Tube ends and tube sheet have been properly prepared and are clean
3. The tool is properly lubricated

Compliance with these three requirements is even of more critical nature when using the Single Roll Beading Expander.

# GUIDE ROLL

Guide rolls of different diameters are made to bracket the range of tube diameters that the expander can handle. Pick the correct guide roll for the gauge of tube to be expanded and beaded. See Figure 1 which shows the proper guide roll for each tool size available. Guide rolls that are too large or small will prevent proper bead formation. Guide rolls are mounted eccentrically on the body of the expander. This means that a guide roll that is too large may prevent entry of the expander into the tube even though the guide roll itself is smaller than the tube I.D. Guide roll that are too small will not centralize the expander in the tube and this excessive cocking of the expander will be reflected in the forming a poor bead or marking of tube I.D. by the cage. Actual I.D. is the only factor controlling guide roll selection.

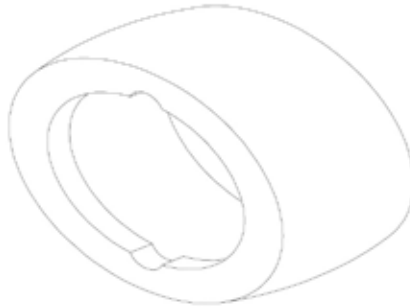


Roll Bead Tool No.	Size	Guide Roll No.
4480-2010	2" - 10	4480-20110
4480-2011	2" - 11	4480-20111
4480-2012	2" - 12	4480-20112
4480-2013	2" - 13	4480-20113
4480-2510	2.5" - 10	4480-25110
4480-2511	2.5" - 11	4480-25111
4480-2512	2.5" - 12	4480-25112
4480-2513	2.5" - 13	4480-25113
4480-3010	3" - 10	4480-30110
4480-3011	3" - 11	4480-30111
4480-3012	3" - 12	4480-30112

# **BEADING ROLL**

Beading rolls will operate on a range of wall thickness but the best results will be obtained by using the correct beading roll for the tube gauge to be rolled.

See Figure 2, which shows the proper beading roll for each tool size available.



<b>Beading Tool No.</b>	<b>Size</b>	<b>Beading Roll No.</b>
4480-2010	2" - 10	4480-20110-011
4480-2011	2" - 11	4480-20111-011
4480-2012	2" - 12	4480-20112-013
4480-2013	2" - 13	4480-20113-013
4480-2510	2.5" - 10	4480-25110-011
4480-2511	2.5" - 11	4480-25111-011
4480-2512	2.5" - 12	4480-25112-013
4480-2513	2.5" - 13	4480-25113-013
4480-3010	3" - 10	4480-30110-011
4480-3011	3" - 11	4480-30111-011
4480-3012	3" - 12	4480-30112

# TUBE PROJECTION

The best bead will be formed when the tube projects the proper amount from the tube sheet before it is expanded. The amount of projection can vary depending on tube diameter, wall thickness, tube sheet thickness and whether or not the tube is cut off square or has a flare due to use of an internal type tube cutter. Normal range of tube projection is 3/16" to 9/32". When the tube sheet is bowed or warped so that it is not parallel to the end of the tube, the desired projection should be measured at the mid point so that half of the tube will have greater and half will have less than the desired projection.

# TUBE AND TOOL CLEANLINESS

Both the tube and Single Roll Beading Expander should be free of any lubricant, oil, grease and anti-rust. The presence of any such material will prevent the expander rolls from having the traction required to develop the force needed to feed the beading roll against the end of the tube and form a proper bead. Swabbing out the ends of the tubes with a good solvent to prevent any anti-rust or oils is recommended prior to tool use.

# TOOL COOLANT

The presence of bead formation, due to tube and material deformation, impart extreme heat to the tool. This heat must be removed by the use of a good water-soluble coolant. Dipping the roll end of the expander in a bucket of coolant between tube expansions is recommended. This will not only prevent the tool from overheating but will assist in maintaining the cleanliness, which extends the service life of the highly stressed rolls and mandrel. Tool overheating will cause tube material flaking, cage rotation stoppage due to beading roll-gouging tube and (excessive feed), seizure of expander feed action due to roll and mandrel glazing and poorly formed beads.

"Bead Coolant" is available from Elliott Tool in the following quantities.

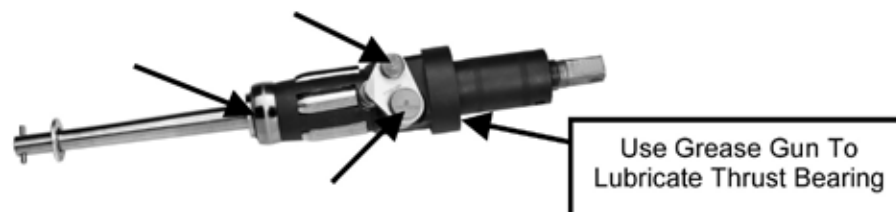
One gallon size  
Five gallon size

Part No. P8784A  
Part No. P8784B

Recommended mixture ratio is 16 parts water to 1 part coolant.

# TOOL LUBRICANT

Use Elliott 4480-20-30 bearing grease to lubricate all the tool bearings prior to each use of the tool. The special Grease Gun is supplied with each tool purchase. Arrows indicate grease fittings.



# OPERATION INSTRUCTIONS

The expansion and beading of the tube ends can only be accomplished successfully by use of a properly equipped Single Roll Beading Expander Assembly and correct operating procedures. The minimum requirements of a proper operating procedure are as follows:

1. The Single Roll Beading Expander must have the proper gauge guide roll and beading roll for the tube to be expanded.
2. Thoroughly clean the Single Roll Beading Expander Assembly to remove all anti-rust oil or grease.
3. All tubes to be expanded and beaded must be clean and have the proper tube projection from the tube sheet as listed in specifications. Swabbing the tube I.D. with a good solvent to remove oil or grease is recommended.
4. Set the mandrel stop nut for the calculated required tube I.D. expansion.  
(Refer to the section on Calculating the Required Expansion.)  
A simple method of setting this tool would be to insert the Single Roll Beading Expander into the tube so that the beading roll groove rests against the tube end. Use caution to avoid throwing expander body off center but allow expanding rolls to centralize body when mandrel is thrust forward. The mandrel can then be pushed into the tube until the expanding rolls contact the I.D. of the tube. At this point, the mandrel stop nut can be adjusted to approximately the position for the required expansion. To do this, it is only necessary to measure the distance from the thrust bearing face to the mandrel allowing for each inch of mandrel movement a .031 inch increase in the tube I.D. (1/32 inch mandrel movement equals .001 inch increase in tube I.D.)
5. The Single Roll Beading Expander should now be set approximately to the required expansion and is ready to be tried.
6. After swabbing tube with coolant, insert cleaned expander assembly into tube to be expanded until the beading roll groove touches the tube end. Attach the drive motor to the mandrel square and begin expanding and beading. Continue this clockwise rotation of the drive motor for several turns of the expander cage after the mandrel stop nut engages the thrust bearing face. Indicating that the expansion has been accomplished and the beading of the tube and is complete. Do not stop drive rotation until this point. Continued rotation will not over expand tube I.D. or degrade bead formation.
7. If expansion or bead is not sufficient, the mandrel stop can be readjusted and the tube can be expanded and beaded to the required setting.
8. If the bead is not completely against the tube sheet, it may be necessary to do one of two things to correct.
  - A) Decrease the tube projection by 1/32 of inch increments.
  - B) Adjust the mandrel stop nut to allow further expansion.
9. It is highly recommended that a coolant be used for each tube as it is expanded. It is also recommended that the front end of the Single Roll Beading Expander be dipped into a bucket of coolant mixture between each tube expansion to remove as much heat from the tool as possible and to keep it clean, a prime necessity for this operation. Do not immerse the entire tool to a depth which permits the lubricant from being washed out of the thrust bearing. The use of two expander assemblies alternating between each tube beaded is recommended.
10. The tool has been designed such that the only adjustment necessary is the movement of the mandrel stop for the proper expansion required. All other adjustments have been designed into the tool.
11. Replacement of any part of this tool can be accomplished easily. All parts are designed such that the proper assembly is evident. Two indicators, which have been added to prevent any misinterpretation, are:
  - A) A notation TOP inscribe on the beading rolls to clearly indicate proper placement of rolls.
  - B) A stamped "V" on the support roll holders to indicate the setscrew dimple position so that the mandrel clearance grooves are located in their proper positions.

# CALCULATING THE REQUIRED EXPANSION

The amount of expansion desired may usually be determined from past experience. Records will indicate that there is quite a variable between installations. This variable may be due to personal preference as well as service conditions. The type and hardness of tube metal and the tube sheet will also have a bearing on the amount of expansion. Depending on tube O.D., sheet thickness, pressure and service, etc., a ten per cent wall reduction (thinning of the tube wall after expanding) may suffice. In another case, a fifteen percent reduction or greater may be required.

The amount of tube wall reduction generally considered most desirable for the average ferrous tube application is approximately ten to fifteen percent. Extensive experimentation has established that the most reliable method of determining what a joint should be and its effectiveness is to measure displacement of tube metal, after metal-to-metal contact of tube wall with tube seat has been made.

An example of how to determine the desired expanded diameter for a 2" x 12 gauge (.109) tube is shown.

	2.015 Tube Sheet Hole
minus	- 2.000 Tube O.D.
equals	.015 Clearance (On Diameter)
plus	+ 1.782 Tube I.D.
equals	1.797 Tube I.D. at metal-to-metal contact
plus	+ .022 Increase in I.D. to obtain 10% tube wall reduction (10% x .109) wall x 2)
equals	1.819 Desired expanded diameter of I.D.

If a 10% tube wall reduction is satisfactory, expanding may continue, otherwise the mandrel stop nut must be reset. (each 1/32 inch mandrel movement equals .001 inch change in tube expansion I.D.)

# TOOL MAINTENANCE

The tremendous force to simultaneously expand and bead the tubes, results into an extremely heated tool. This requires a proper schedule of maintenance to lubricate the bearings involved to prevent their premature failure. Lubricate the support roll assembly bearings and the front guide roll assembly frequently. Apply Elliott 4480-20-30 bearing grease through the grease fittings provided. It is recommended to lubricate prior to each days use of the tool.

# REWORK TECHNIQUES

Certain conditions will arise which are not acceptable and require the bead or expansion be reworked. This rework can and should be accomplished with the Single Roll Beading Expander. Under no circumstances should it become necessary to utilize hand methods to rework the expanded beaded joint. Some of these conditions are:

## **A) Bead not tight against tube sheet**

This condition requires an increase in the tube I.D. expansion to pull the bead against the sheet. It is only necessary to readjust the mandrel stop nut to provide an increased expansion from the setting used in the original expansion/beading operation. It is recommended that approximately five turns of the mandrel stop nut be the initial increase to expansion.

## **B) Leaking or bleeding tube joints**

The repair of leaking or bleeding tubes can be accomplished by the use of the Single Roll Beading Expander if leaking is not due to over expansion. To seal the tube joint, it will be necessary to increase the tube I.D. expansion to seal. Therefore, readjusting the mandrel stop nut to increase the expansion from the initial setting used is required. Three to four turns of the mandrel stop nut is recommended as the initial starting point to seal leaking or bleeding tube joints.

# FRONT DRIVE SQUARE MANDREL OPTION



Tube Size	Mandrel w/ Collar	Mandrel	Collar
2"	4480-20-02FS	4480-20-02-SQ	4480-20-50
2.5"	4480-25-02FS	4480-25-02-SQ	4480-25-50
3"	4480-30-02FS	4480-30-02-SQ	4480-30-50

# OVERSIZE TUBE SHEET HOLES

If the tube sheet hole diameter is 1/16" or larger than the tube outside diameter, ferrules or sleeves must be used to obtain proper tube expansion without excessive thinning of the tube wall thickness. The Single Roll Beading Expanding Expander has been designed to provide sufficient expansion for tube sheet holes up to 1/16" over the tube outside diameter. Therefore, ferrules or sleeves are required to perform the expansion of the tube end in oversize tube sheet holes.

## PROBABLE CAUSE OF FAILURES

### 1. **Bead not completely formed or tight against tube sheet**

This condition is caused by one of three reasons:

- A) The amount of tube expansion may not be sufficient; therefore, check, and if necessary, reset the mandrel stop nut for further expansion.
- B) Tube sheet projection is not correct. The initial tube sheet projection was not sufficient to provide enough material to form the bead tight against the tube sheet. It would be necessary to increase the tube projection in increments of 1/32".
- C) Lubricant or anti-rust in tube or on expander rolls. Clean tube or expander assembly thoroughly to remove lubrication or anti-rust.

### 2. **Excessive bead formed**

This condition is evidenced by the outer diameter of the bead being flattened against the tube sheet. This has resulted from an excessive tube sheet projection. It will be necessary to decrease the tube projection in increments of 1/32" until the proper bead is formed.

### 3. **Tube galling or flaking**

This condition of excessive galling and flaking evidenced on the tube bead is caused by excessive heat being retained in the tool from the prior tube's expansion and beading. The elimination of this problem requires the use of a coolant and that the tube be dunked into a container of coolant to remove as much heat as possible. It is recommended that the alternate use of tube tools be considered to completely eliminate any heat buildup problems. If flaking inside of tube, this usually indicates over expansion. Correct by resetting stop nut of mandrel.

### 4. **Cage stops, mandrel continues to rotate prior to completion of expansion and beading**

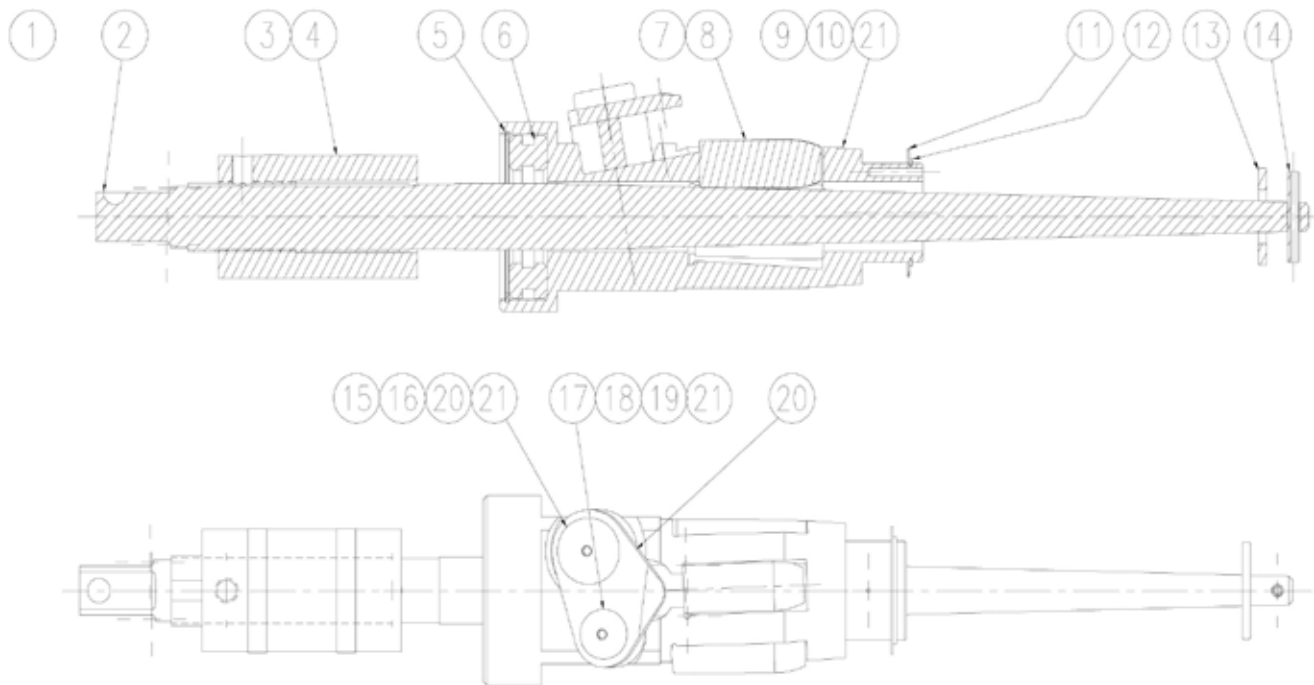
This condition is caused by excessive heat being retained in the tool. Continued rotation of the mandrel will cause the appearance of a glaze on the rolls and mandrel. The beading roll will appear to have sunk into the tube end; therefore, it is of utmost importance that coolant be used and the tool dunked into a container. The alternate use of two Combination Beading and Rolling Tools is highly recommended to prevent excessive heating.

### 5. **Needle bearing failure**

Failure of the needle bearings that are part of the beading roll support assemblies is an indication of insufficient lubrication. The tool should be lubricated at least twice per shift during its use. Use Elliott 4480-20-30 Grease to lubricate all grease fittings on the tool.

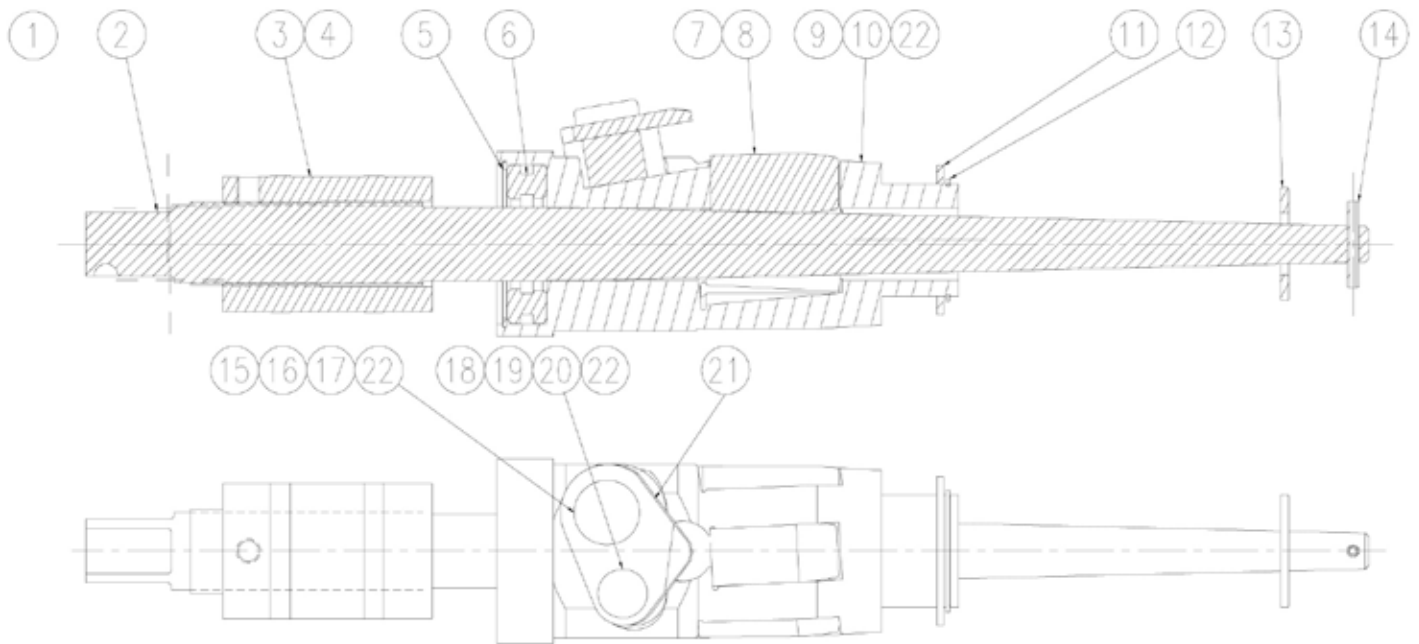


# 2.5" SINGLE ROLL BEAD EXPANDER PARTS LIST



	Part Name	Part Number	Qty
20	Roll Support Holder	4480-25-23	1
19	Small Roll Holder w/ Oiler Fitting	4480-25-22	1
18	Needle Rollers	P8573-25	46
17	Small Support Roll	4480-30-20	1
16	Large Roll Holder w/ Oiler Fitting	4480-25-19	1
15	Large Support Roll	4480-25-17	1
14	Spirol Pin	P8384-22	1
13	Washer	549-23	1
12	Retaining Ring	P8286-150	1
11	Front Bearing Seal	4480-25-13	1
10	Set Screw	P8505D	2
9	Cage w/ Oiler Fitting	4480-25-09	1
8	Overlapping Roll	4480-25-08	4
7	Expanding Roll	4480-25-07	1
6	Thrust Bearing	PC80D15	1
5	Retaining Ring	P8368-250	1
4	Set Screw	128A	1
3	Mandrel Stop Nut	4480-25-03	1
2	Mandrel	4480-25-02	1
1	Assembly		1

# 3" SINGLE ROLL BEAD EXPANDER PARTS LIST



	Part Name	Part Number	Qty
21	Roll Support Holder	4480-30-23	1
20	Small Roll Holder w/ Oiler Fitting	4480-30-22	1
19	Needle Rollers	P8573-25	19
18	Small Support Roll	4480-30-20	1
17	Large Roll Holder w/ Oiler Fitting	4480-30-19	1
16	Needle Rollers	P8573-26	21
15	Large Support Roll	4480-30-17	1
14	Spirol Pin	P8384-22	1
13	Washer	549-25	1
12	Retaining Ring	P8286-175	1
11	Thrust Race	P1067AP	1
10	Set Screw	P8505D	2
9	Cage w/ Oiler Fitting	4480-30-09	1
8	Overlapping Roll	4480-30-08	4
7	Expanding Roll	4480-30-07	1
6	Thrust Bearing	PC80D15	1
5	Retaining Ring	P8368-250	1
4	Set Screw	128A	1
3	Mandrel Stop Nut	4480-30-03	1
2	Mandrel	4480-30-02	1
1	Assembly		1





## Contact Us

Elliott Tool offers a complete line of precision tube tools to meet your needs. Contact us or your local support.

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