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Single Blade Reamers

**“COMBINATION ROLL
BEADING EXPANDER”**

(Series M5787)



Operating and Maintenance Instructions



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DISASSEMBLY AND MAINTENANCE **INSTRUCTIONS**

Remove the mandrel by aligning the small drive-square with the ligaments between the rolls, and pulling from the large drive-square. No tools are required for this, as the mandrel is not mechanically retained.

Using retaining ring pliers, remove the retaining ring from the front of the cage. Slide the roll retainer bushing out of the front of the cage. The expanding and overlapping rolls can now be removed through the cage ID.

Loosen the set screw (3mm) in the roll bead collar and rotate the collar backwards, (left hand thread) to remove the beading rolls. Note: This can be done without removing the mandrel and expanding rolls as needed.

Loosen the set screw (3mm) in the mandrel stop collar, and unthread the collar (right hand thread) from the cage extension to remove.

Loosen the set screw (3mm) in the cage extension and unthread (left-hand thread) the cage extension from the cage.

Continue removing the roll bead collar to access the roller bearing assembly. This assembly consists of (1) roller bearing and (2) thrust races. This bearing assembly requires periodic lubrication with a moly based grease or equal.

To access the roller bearing assembly in the rear of the mandrel stop collar, remove the retaining ring with retaining ring pliers. Slide the bearing assembly out of the collar. This bearing assembly consists of (1) roller bearing and (2) thrust races. This bearing assembly requires periodic lubrication with a moly based grease or equal.

For re-assembly, reverse the above instructions. Note: All threaded connections should be hand tight only. Excessive force may damage the tool.

Before each use, the Elliott Roll Beading Expander should be disassembled and all components checked for wear or damage. Any worn, chipped, cracked or discolored rolls or mandrels should be replaced. Any roller bearings or thrust races that appear worn, damaged, or discolored should be replaced. Any worn or damaged set screws should be replaced. If any components are questionable, return the tool to Elliott Tool Technologies for an evaluation.

TROUBLE SHOOTING GUIDE

Bead is incomplete or not tight to the tube sheet.

The amount of expansion may be insufficient. Check the wall reduction and increase mandrel travel / wall reduction as required.

The tube sheet may not be parallel to the bead. Check alignment.

The tube end may not be parallel to the tube sheet face. Check the tube end profile.

The tube projection may be incorrect at the start. Check the projection.

The rolling motor Torque and RPM may be insufficient. Check that the minimums are being met or exceeded.

Excessive Bead Formed

The tube projection is excessive at the start. Decrease the projection accordingly.

Tube Galling or Flaking

There may be excessive heat build up in the roll-bead expander. Allow the expander to cool between tube joints and alternate tools if possible.

There may be excess dirt on the Roll Beading Expander. Clean properly.

Roll Beading Expander stops rotating / feeding.

Both excessive heat and excessive lubrication can cause this. Allow the Roll Beading Expander to cool down and assure that all components are properly cleaned per instructions.

Tube expansion is completed before bead is formed.

Position the Roll Beading Expander with the beading roll approximately 9/16" (14.3mm) away from the end of the tube and "drift roll" the tube, allowing partial expansion to take place before starting the bead process. Increase this gap by 1/16" increments as required.

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INTRODUCTION

Thank you for purchasing this Elliott product. The design and manufacture of this tool represents 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 be assured that the same value you received in the past will continue with all of your purchases.

The Elliott Combination Roll Beading Expander, will in a single operation, expand and bead standard fire tube boiler tubes. This roll-bead process is much quicker and much quieter than the "old" percussion method, and will eliminate the ergonomic problems associated with percussion beading. This undeniably creates an increase in overall productivity.

Four basic criterion allow for trouble free operation:

- The roll-bead expander must be sized to the proper tube OD and wall gauge. No troublesome pilots or guide bearings to change - one tool covers several wall gauges. (Ref: Tool Specifications)
- Proper tube projection and tube-end profile must be maintained. (Ref: Start-Up)
- Proper cleanliness is required. (Ref: Start-Up)
- Proper drive motor specifications are required. (Ref: Tool Specifications)

We at Elliott want you to be completely satisfied with this tool and therefore recommend that this instruction manual be thoroughly read prior to use.

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

OPERATION

Thoroughly clean the expander to remove any rust preventative residue or machine oil residue that may be present. Loosen the set screw (3mm) on the mandrel stop collar (Item 9). Adjust the stop collar by threading clockwise to set the expander diameter to the target expanded ID. Once positioned, retighten the set screw (3mm). You are now ready to Roll-Bead the first tube joint.

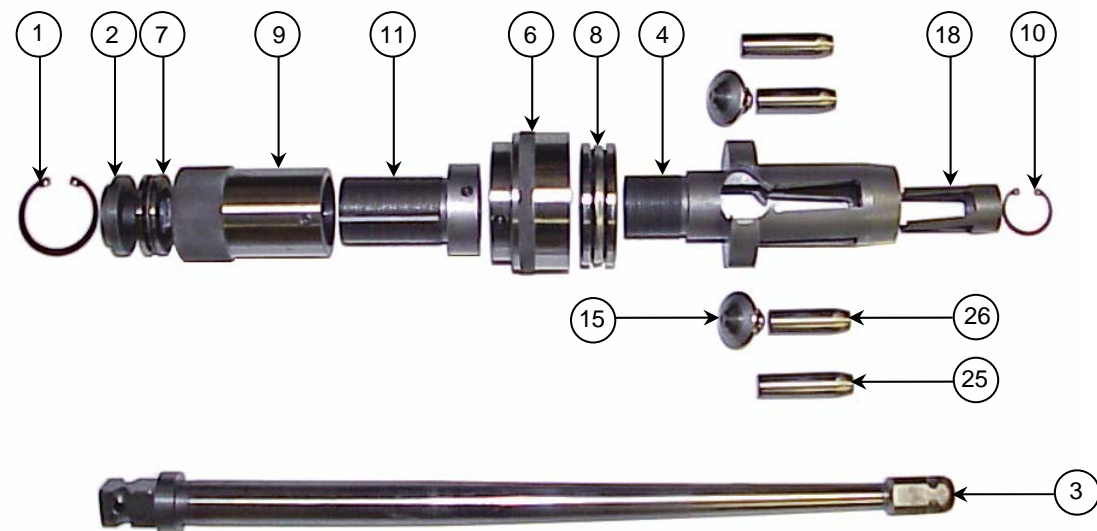
IMPORTANT: Inspect Bead Roll Collar (Item 6) to ensure it is in the proper position. The Bearing (Item 8) must be in contact with Bead Rolls (Item 15) and ensure the Bead Rolls are free to rotate. Be sure the set screw in the Bead Roll Collar (Item 6) is tight. Inspect the Bead Roll Collar's position frequently. Improper position may cause premature tool failure. Inspect the Roll Beading Expander's mandrel and rolls for "pitting" or "cracks", and replace if evident.

Insert the roll-bead expander into the tube to be expanded and beaded. Position the beading roll so it is 9/16" (14.3mm) from the tube to be beaded. Manually push the mandrel forward until it becomes tight in the roll-bead expander. Connect the rolling motor to the mandrel drive square and start the roll-bead process by activating the roll motor rotation. When the bead is securely formed against the tube sheet, stop the motor rotation. Disconnect the roll motor from the mandrel to facilitate the final tool adjustment. Loosen the set screw (3mm) in the mandrel stop collar and rotate it counter-clockwise until the collar comes in contact with the mandrel drive square shoulder. Re-tighten the set screw (3mm) in the stop collar. Reconnect the roll motor to the mandrel and continue expanding for 3 to 4 revolutions of the roll-bead expander. This will iron out the bead and improve the finish. When finished, reverse the roll motor to remove the roll-bead expander from the tube. The roll-bead expander is now set for consistent roll-bead tightness on future tube joints.

NOTE: If additional tightness of the joint is required, rotate the stop collar clockwise one revolution and re-tighten. This allows the mandrel to travel deeper into the expander, increasing the expansion. To reduce the joint tightness, rotate the stop collar counter-clockwise (one revolution equals .002" (.05mm) change on diameter) and re-tighten. This keeps the mandrel from going as deep into the expander, which reduces the amount of expansion. These adjustments should be done in 3-4 revolution increments of the stop collar to avoid damage to the tube, tube sheet, or roll-bead expander. These adjustments will be required anytime the tool is being first used, since the wall thickness (BWG - Gauge) and sheet hole clearance may be different from job to job.

QUICK REFERENCE DIAGRAM

Elliott Combination Roll Beading Expander M5787 Series



TOOL DATA / INFORMATION			
1. Snap Ring	4. Cage	8. Bearing	11. Cage Extension
2. Collar	6. Bead Roll Collar	9. Mandrel Stop Collar	15. Bead Roll
3. Mandrel	7. Bearing	10. Snap Ring	18. Roll Retainer
25. Expanding Roll Set (sold only as a set of 2 Rolls)			
26. Overlap Roll Set (sold only as a set of 2 Rolls)			

SPARE PARTS LIST				
ITEM	DISCRIPTION	SIZE 2"	SIZE 2-1/2"	SIZE 3"
3	Mandrel	M5787-20-03	M5787-25-03	M5787-30-03
15	Beading Roll	M5787-20-15	M5787-25-15	M5787-30-15
25	Set of Expanding Rolls	M5787-20-05	M5787-25-05	M5787-30-05
26	Set of Overlap Roll	M5787-20-27	M4787-25-27	M4787-30-27

TOOL SPECIFICATIONS								
Model	Tube OD	Wall Thickness	Sheet Thickness	Rear Mdl Sq	Front Mdl Sq	OAL Mdl	OAL Cage Assembly	WT
M5787-20	2" (25 mm)	10 – 14 BWG	1/2" – 3/4"	3/4"	3/4"	17"	8-3/4"	8 Lb.
M5787-25	2-1/2" (62 mm)			3/4"	3/4"	19-1/2"	9"	13 Lb.
M5787-30	3" (75 mm)			1"	1"	22"	9-1/4"	18 Lb.

ROLL MOTOR SPECIFICATIONS							
Model	Power	Style	Drive	Stall Torq	RPM	Notes	WT
35-M5789-00	Pneumatic	Stall Right Angle	1" Male Sq		165	(Recond. Only) Available	48 Lb.
445-3450R154			1" Male Sq	400 Ft Lb.	150		35 Lb.
445L1752-90		Torque R. A.	3/4" Male Sq	305 Ft Lb.	90	2" OD Tubes Only	14.5 Lb.
446100	Electric	"T" Handle	1" Male Sq	N/A	100		24 Lb.

SAFETY

Every effort has been made to ensure the operation of the Elliott Combination Roll Beading Expander is safe, although it is impossible to remove all possibilities of accidents.

It is very important that all operators of this machine are fully aware of the following safety considerations.

- If you are unfamiliar with the Elliott Combination Roll Beading Expander, read this Operation Manual thoroughly before use.
- Always wear OSHA Approved safety glasses, gloves, safety shoes, and protective clothing when operating this tool.
- Do not allow other people in the area of the machine unless they are wearing suitable protective clothing and equipment also.
- As this Roll Beading Expander generates high reaction torque values, make sure that the work area is clear of all obstructions, and that proper operator balance is maintained at all times.
- Never attempt to roll bead at the internal tube sheet by reaching through the combustion chamber access opening. The reaction torque could cause injury to the operator. The internal tube ends should be roll beaded with the use of an extension drive shaft, and reversing roll motor from the opposite end of the boiler tube. The standard mandrels are furnished with a second "reverse drive square" for this purpose.
- Do not use the Combination Roll Beading Expander if there appears to be damage of any kind, if screws are loose or missing, or if the performance appears to be questionable.
- Never use the Elliott Combination Roll Beading Expander or any other power tool when under the influence of medication, drugs, or alcohol. Any of these will decrease concentration and impair operator control.

START-UP

TUBE PROJECTION

To assure optimum Roll-Bead performance, it is critical that all tube end projections be consistent. Proper tube projection should be 5/32" (4mm) minimum, up to 7/32" (5.6mm) maximum (NOMINAL 3/16" (4.8mm) RECOMMENDED). Request Elliott Model 8394-Size Tube End Setting tool to assist in this operation. If the tube-end requires being trimmed to length, request the Elliott Model 376-Size boiler tube cutter.

It is also critical that the tube ends be "Square" to the tube sheet. Tubes that are not square will create uneven side pressures, and the results will be uneven beads, and possibly damage to the Roll-Bead expander. Request the Elliott Model EP443010 End Prep tool, or the Elliott 376-Size boiler tube cutter, to assure that the tube ends are uniformly parallel ("Square") to the tube sheet.

Once the proper projection has been established, the tube should be staked to assure that the projection does not change during the initial roll-bead process. This can be done in several ways. Common practices are:

- Manually holding the opposite end of the tube in place.
- Staking the opposite end of the tube with a flattened nail driven between the tube and tube sheet.
- Lightly expanding the tube end that is going to be roll-beaded with an Elliott expander. Wall reduction in this step should be limited to 1% maximum. Request Elliott Model 3400-Size Flare expander, or Model 40-Size Taper expander to perform this operation.

Excessive warpage of the tube sheet will also affect the quality of the final bead / tube sheet joint. Warpage should be kept to a minimum. Where warpage does exist, the projection should be measured at the mid-point, allowing the bead to be formed to the average optimum tightness.

COOLING AND CLEANING

To assure optimum roll bead performance, the tube ends, tube sheet holes, tube sheet, and the Roll-Bead Expander must be as clean as possible. Remove all dirt, grease, oil, metal chips, rust preventative solvents, etc from these surfaces. Any of these contaminants may prevent the Roll Beading Expander from achieving a proper mechanical joint / bead.

The Elliott Roll Beading Expander should be cleaned and cooled with a liquid coolant / cleaner. As this cleaning solution becomes contaminated with dirt, or becomes warm, it should be replaced.

Before roll beading each tube, submerge the front end of the expander including the expanding rolls and beading rolls into this solution. (**Note: DO NOT** immerse the bearings located behind the bead rolls. This will wash the lubricating grease from the bearings.) By allowing this to clean and cool the rolls, mandrel, and cage cavities you will enhance the tool performance and increase the expander life. Keeping the Roll Beading Expander components cool is critical for enhancing the tool performance and increasing the tool life. It is recommended to alternate Roll Beading Expanders, allowing one to cool in the solution while the other is being used. This will maximize tool performance and tool life.

WARNING: Never use solvents or degreasing liquids to clean these tools during operation. These solvents may eliminate the grease found on the internal thrust bearings, causing premature bearing failure, and excessive heat build up.

COMBINATION ROLL-BEAD EXPANDER SET-UP

To determine the proper tube expansion value, the following steps are required:

- Measure the Tube Sheet Hole ID (A).
- Measure the Tube OD (B).
- Measure the Tube ID (C).
- Calculate the tube to Tube Sheet Clearance (D). $[D = A-B]$
- Calculate the Tube Wall Thickness (E). $[E = \frac{B-C}{2}]$
- Calculate the Wall Reduction Required – 10% to 20% recommended (F). $[F = E \times .20]$
- Calculate the Finished Rolled ID (G). $[G = C+D+Fx2]$

NOTE: Standard industry practice is to average several measurements to determine these values.

Example for Tube Size of 2" OD – 12 BWG:

- 2.050"
- 2.000"
- 1.782"
- .050" $(2.050" - 2.000" = .050")$
- .109" $(2.000" - 1.782" = .218") (\frac{.218"}{2} = .109")$
- .109" $\times .020 = .022"$
- 1.876" $(1.782" + .050" + .044" = 1.876")$

Once the Target Expanded ID has been calculated the Roll Beading Expander can be prepared for the roll-bead process. Unpack the Elliott Roll Beading Expander and make sure all packing material has been removed from the cage cavity and roll slots. Make sure the mandrel will freely rotate while sliding back and forth, and that the rolls are free to rotate in the cage slots. Do not operate this tool if any interference is found. Verify that the Roll Beading Expander is sized to the Tube OD, Wall Thickness (BWG – Gauge), and tube sheet thickness of your application. Refer to the Tool Specifications sheet.

Thoroughly clean the expander to remove any rust preventative residue or machine oil residue that may be present. Loosen the set screw (3mm) on the mandrel stop collar (Item 9). Adjust the stop collar by threading clockwise to set the expander diameter to the target expanded ID. Once positioned, retighten the set screw (3mm). You are now ready to Roll-Bead the first tube joint.

ROLL MOTOR REQUIREMENTS

This tool requires a roll motor with 300 Ft Lbs. Minimum @ 150 RPM Minimum for proper performance in 2-1/2" OD and 3" OD tubes. 2" OD tubes require a roll motor with 300 Ft Lbs. Minimum @ 90 RPM Minimum. Motors that have less torque or lower RPM's will result in inferior tube / tube sheet joints and beads. Either an Electric or Pneumatic motor is acceptable, but a Torque Controlled motor is not required. A Stall Torque motor is recommended. If using a Torque Controlled motor, set the clutch to the highest setting, assuring maximum torque is available. Refer to the Tool Specifications sheet for details.