Heat Exchanger & Condenser Expanders

23, 24, HX24, and HT24 Series

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

Operating and Maintenance Instructions

www.elliott-tool.com

ELLIOTT TOOL TECHNOLOGIES

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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 control, 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.

The Heat Exchanger & Condenser Expanders have been designed for the following types of equipment:

Air Cooled Heat Exchangers

Heat Exchangers

Chillers

Oil Coolers

If you have any questions regarding this product, manual or operating instructions, please call Elliott at +1 800 332 0447 toll free (USA only) or +1 937 253 6133, or fax us at +1 937 253 9189 for immediate service.

SAFETY GUIDELINES

Read and save all instructions. Before use, be sure everyone using this machine reads and understands this manual, as well as any labels packaged with or attached to the machine.

⚠ WARNING

Remove the expander from any motor or machine before performing cleaning or maintenance.

- Keep Work Area Clean and Well Lit. Cluttered, dark work areas invite accidents.
- Dress Properly. Do not wear loose clothing or jewelry. Wear a protective hair covering to contain long hair. It is recommended that the operator wear safety glasses with side shields or a full face shield eye protection. Gloves and water repellant, nonskid footwear are also recommended. Keep hands and gloves away from moving parts.
- Use Safety Equipment. Everyone in the work area should wear safety goggles or glasses with side shields complying with current safety standards. Wear hearing protection during extended use, respirator for a confined space and a dust mask for dusty operations. Hard hats, face shields, safety shoes, respirators, etc. should be used when specified or necessary. Keep a fire extinguisher nearby.
- Keep Bystanders Away. Bystanders should be kept at a safe distance from the work area to avoid distracting the operator and contacting the blade.
- Use The Right Tools. Do not force a tool or attachment to do a job or operate at a speed it was not designed for.
- Use Proper Accessories. Use Elliott accessories only. Be sure accessories are properly installed and maintained.
- Check for Damaged Parts. Inspect parts before use. Check for misalignment, binding of moving parts, improper mounting, broken parts or any other conditions that may affect operation. If abnormal noise or vibration occurs, turn the tool off immediately and have the problem corrected before further use. Do not use a damaged tool.
- Keep Hands Away from All Moving Parts.
- Do Not Overreach. Maintain Control. Keep proper footing and balance at all times.
- Stay Alert. Watch what you are doing, and use common sense. DO NOT use a tool when you are tired, distracted or under the influence of drugs, alcohol or any medication causing decreased control.
- Maintain Tool Carefully. Keep tools sharp and clean for best and safest performance. Follow instructions for lubrication, maintenance and changing accessories.
- Maintain Labels and Nameplates. These carry important information and will assist you in ordering spare and replacement parts. If unreadable or missing, contact an Elliott service facility for a replacement.

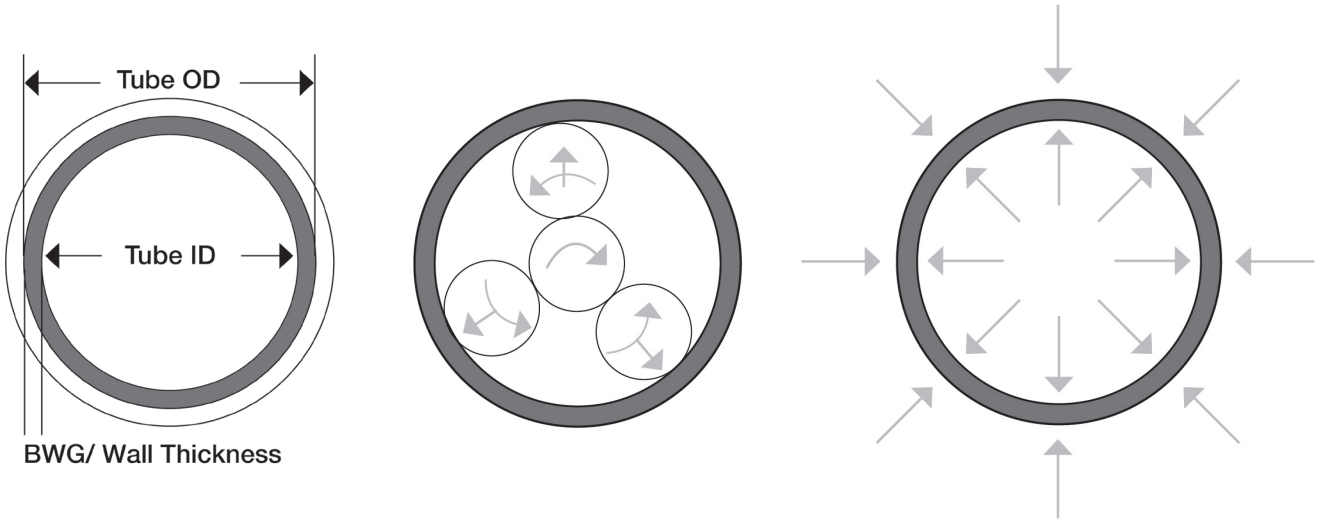
GENERAL INFORMATION

Determining Wall Reduction
Tube Expanding is the process of reducing a tube wall by compressing the outer diameter (OD) of the tube against a fixed container, such as rolling into tube sheets, drums, ferrules, or flanges. To assure a proper tube joint, the tube wall must be reduced by a predetermined percentage. The following chart can be used to calculate proper wall reduction.

Calculating Wall Reduction

	Tube Test Number	Sample	1	2	3	4
A	Tube Sheet Hole Inside Diameter (ID)	0.757				
B	Tube Outside Diameter (OD)	0.750				
C	Clearance (A - B)	0.007				
D	Tube Inside Diameter (ID)	0.620				
E	Tube ID When Metal-To-Metal Contact Is Reached (D + C)	0.627				
F	Tube ID After Rolling	0.636				
G	Wall Reduction (F - E)	0.009				
H	Actual % Wall Reduc-tion (G / (B-D) *100)	7%				
Sample Tube Size 3/4” x 16 BWG						

GENERAL INFORMATION



1. Measure the tube sheet hole ID.
2. Determine the tube OD.
3. Subtract the tube OD from the tube hole ID.
4. Using a tube hole gauge, determine the ID of the tube before rolling.
5. Add the “D” to the clearance (“C”) between the tube OD and the tube hole to determine the tube’s ID at metal-to-metal contact.
6. Roll the tube to what you estimate to be a good tube joint (by feel or an estimated torque setting) and check the ID of the tube with a tube gauge. Take caution not to over roll as it can cause damage.
7. Subtract “F” from the rolled diameter to determine the actual amount of expansion (tube wall reduction) on the inside diameter of your tube.
8. This can be converted to a % wall reduction by dividing the actual wall thickness (“B - “D”) into the amount of roll as shown in “G”.

Once metal to metal contact occurs (“E”) any additional increase of the inside diameter of the tube will result in actual wall reduction. Since the amount of wall reduction greatly determines the quality of the tube joint, you should know what percent of wall reduction is optimal for the application.

This technique is an excellent way to set torque rolling devices. Begin with the first sample tube and roll, measure rolled ID, calculate wall reduction, and determine if more or less wall reduction is required. Adjust torque as needed; roll the next tube, etc until proper torque is set. It is better to error on the side of under rolling. Once torque is set these tubes can then be re-rolled to achieve proper tube wall
reduction.

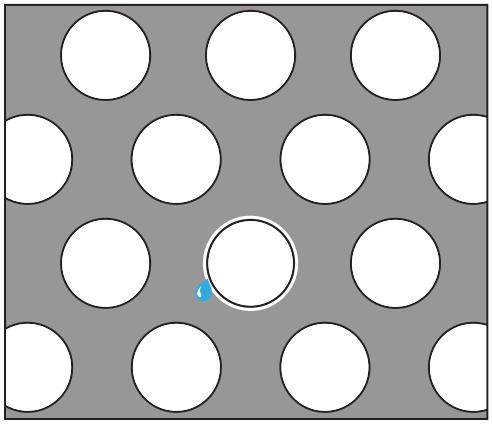
Lubrication
Lubrication is critical in rolling a consistently tight tube joint. Tube expanding creates a great deal of heat and friction, so it is important to use the proper lubrication to obtain good tool life and consistent expansions.

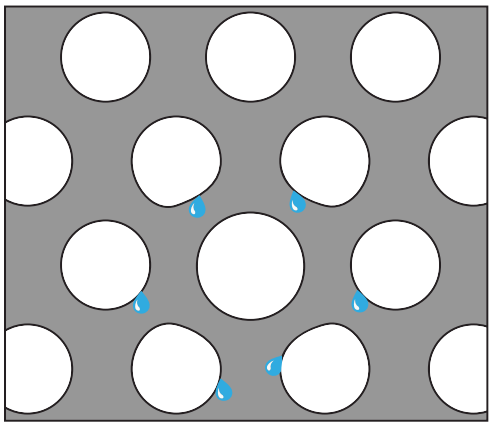
TUBE MATERIAL, TUBE LEAKS, & PRE-EXPANSION

Tube Material
In general, you want to roll to the lowest wall reduction possible where a tight tube to tube sheet joint can be achieved. The harder the material the less wall reduction required to obtain a tube joint. You should always consult the manufacturer of the heat transfer vessel for specific information before undertaking any maintenance procedures. Reference TEMA & API 660 for updated specifications by material.

Tube Material Properties
Metals such as Titanium, Stainless Steel, and other exotics tend to work hard very quickly due to their elasticity. Elasticity refers to a material's ability to stretch and return to its original state. Materials behave elastically until the force increases beyond the material's elastic limit, meaning it cannot return to its original shape. During the expansion process, the tube material and tube sheet hole will expand until the tube reaches its plastic state and is contained by the tube sheet's elastic properties.

Major Causes Of Tube Leaks
Tube leaks are usually caused by under-rolling, over-rolling, improper preparation of tube sheets, and differential thermal expansion. Improperly rolled tube joints can cause several challenges, such as necessary reworking and loss of vessel efficiency.





Under-Rolling Tubes
Under-rolling occurs when the proper amount of wall reduction is not reached. If left uncorrected, this will cause leaks between the tube OD and tube sheet hole ID. Under-rolled tubes can usually be fixed by rolling a second time to obtain the proper amount of wall reduction. Be sure to use a tube gauge to periodically check the amount of wall reduction during rolling.

Over-Rolling Tubes
Over-rolling of tubes occurs when the expansion of the tube surpasses the expansion required for the proper wall reduction. Over-rolling can cause considerable damage to the tube sheet and adjacent tubes. Once a ligament is over-rolled, it will deform the ligaments of the tube joints surrounding it. This deformation can cause adjacent tubes to leak.

In addition to impacting tubes, over-rolling can cause distortion in tube sheets or drums. Over-rolling can potentially cause a tube sheet to bow or warp to the point where the standard length tube could not be used in the vessel until the bowing is returned to normal. This can be corrected in some cases by placing stay rods in the vessel and pulling the tube sheets back to their original position.

TUBE MATERIAL, TUBE LEAKS, & PRE-EXPANSION

Lastly, over-rolling can have a significant impact on expander tool life. It can cause the tube material to flake off, which can get trapped in between the rolls and mandrel. If this debris is not cleaned from the expander, it can reduce the life of the rolls and mandrel.

Over-rolling tubes is not something that can be easily corrected. Once ligaments become deformed, the entire tube sheet has an increased chance of leaks, higher maintenance costs, and decreased efficiency. As a result, it is important to avoid over-rolling by using an electronic or pneumatic torque control or an assisted rolling system. These systems will ensure you roll to an exact wall reduction every time.

Improper Preparatino Of Tube Sheet Holes
The smoother the tube seat or tube hole, the easier it is to roll an optimum tube joint. If the tube sheet or drum is gouged, it is extremely hard to expand the tube to fill these gouges without over-rolling. It is important that light ligaments and thin tube walls are mated to a tube hole that has a low micro range finish. Many manufacturers today are drilling, reaming and sizing or burnishing to get the micro-finish desired for tube holes.

Differential Thermal Expansion
Expansion due to heat varies noticeably between a thinner tube and the tube sheet, a shift of the tube results. One of the most important steps for guaranteeing a safe and permanent tube joint is to thoroughly clean the surfaces of the tube end and the tube hole wall. These two surfaces must be clean and free of all dust, mill scale and pits or scratches. Note: It is extremely important to eliminate any longitudinal scratches or cracks in the tube sheet hole wall. These longitudinal lines will cause leaky tubes.

Preparation of Tube Sheet Holes

1. Drill and ream tube sheet holes to TEMA or ASME codes.
2. Be certain the tube sheet material and ligaments are sufficient to guarantee a safe and permanent tube joint.
3. When conditions permit, utilize a sizing or burnishing tool to further assure a good finish in the tube hole. This will also slightly increase the tensile strength of the ligament.
4. The serrations or grooves to be used will determine the joint strength of the tube joint. It is extremely important when retubing that the grooves be cleared of all metals or any foreign material.

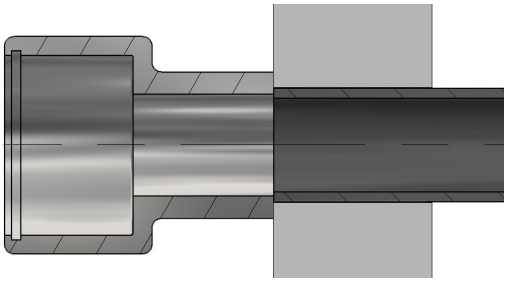
After tube holes have been prepared they are usually coated with a rust preventative compound. Before inserting any tube it is important to remove all traces of this coating. It is extremely important that great care be taken in handling the tubes for insertion in all of the vessels discussed above. Be certain that the tube ends are clear of any foreign material. Be especially certain that there are no chips on the tubing which may gouge the tube sheet or tube seat when the tube is placed in the vessel.

SELECTING THE RIGHT EXPANDER

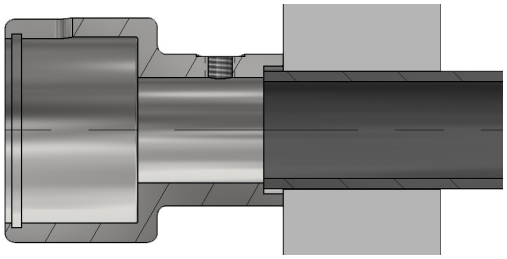
Before you can start rolling, you will need to select the right expander for the job. Tube OD, and Wall/ BWG will determine the size of the expander. However, there are some other factors to consider, such as tube projection, roll length, reach requirements, space constraints, and whether it's minimum or average wall tubing.

Tube Projection

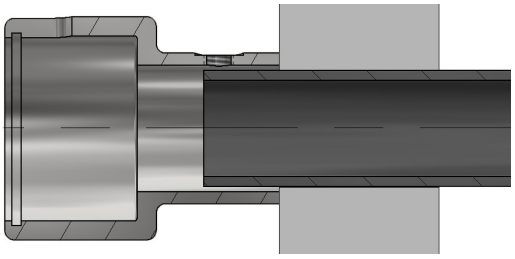
It's important to consider if the tube is going to be expanded flush to the tube sheet or if it will have a projection. The most common tube projection for shell and tube heat exchangers is 1/8" from the tube sheet. In situations where all tubes will be rolled to the same projection, an expander with a recess collar should be used. This will accommodate the projection and prevent the tube from being pulled into the expander. The outlet side of surface steam condensers can have varying projections, up to 1X's the tube diameter in length. In this case a telescoping or full recess collar should be used. If no tube projection is specified, the tube expander will come with a flush collar to expand the tube flush to the tube sheet.



Flush Collar



Recess Collar



Telescoping Collar

Roll Length

Tube expanders come in two different roll lengths: short and long roll. In order to determine the correct roll length, you will need to know the tube sheet thickness. Choose the roll length that will expand the tube sheet area in the least amount of expansions. If expanding tubes in a double tube sheet, the inner primary tube sheet thickness must be specified so the expander's rolls can be manufactured to allow for the proper effective expansion length. Whereas, the outer tube sheet would use standard rolls.

Reach Requirements

Generally, tube expanders come in 4", 8", 12", and 18" reaches, but can be made longer to accommodate specific applications. For optimum tool life, use the shortest reach expander that willaccommodate the application. Long reach expanders are used in heat exchangers with thick tube sheets or when reaching through water boxes, found in air coolers.

Space Constraints

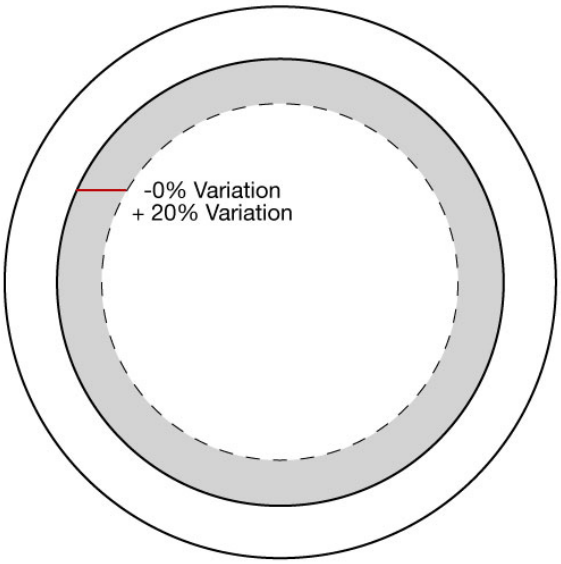
Heat exchangers with channel boxes or division plates where the tubes are positioned too close to a wall for the expander's collar to access perimeter tubes will require a friction collar. This collar is smaller in diameter than a standard collar, allowing more access to difficult areas. A friction collar should only be used as needed, as it's not a replacement for a bearing collar.

SELECTING THE RIGHT EXPANDER

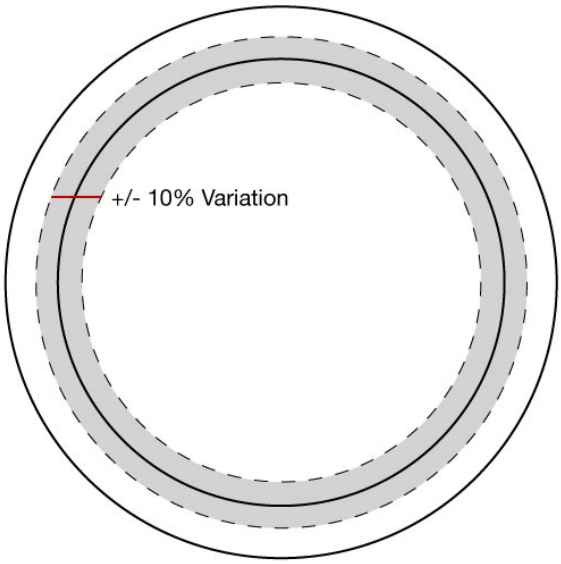
Average Wall v Minimum Wall
When ordering tubes, it is very unlikely that each tube wall thickness will be exactly the same. Industry tolerances allow for ±10% thickness. That's a total variation of up to 20% from the smallest to largest thickness, resulting in a wide range of sizes. For example, if you have .083" average wall tubes, the actual wall could be anywhere between .091" and .075". If you were to buy a 14 BWG expander to fit .083, it would likely still work for either extreme due to the expansion range that the tool is capable of achieving.

A min wall tube offers the same total variation in wall thickness that an average wall tube does, but the variation is applied differently. It allows for -0% and +20%. So the wall will never be less than the specified thickness. For example, a .083" min wall tube will range from .083" to .100" wall thickness.

At the upper end of that range, a normally sized tube expander will not have enough clearance to enter the tube. If you have min wall tubing, it is recommended that you drop down one expander size. So instead of ordering a 14 BWG expander, you would drop down to a 13 BWG. This ensures that the expander will fit inside of the tubes and still achieve the proper range of expansion.



Minimum Wall Tube



Average Wall Tube

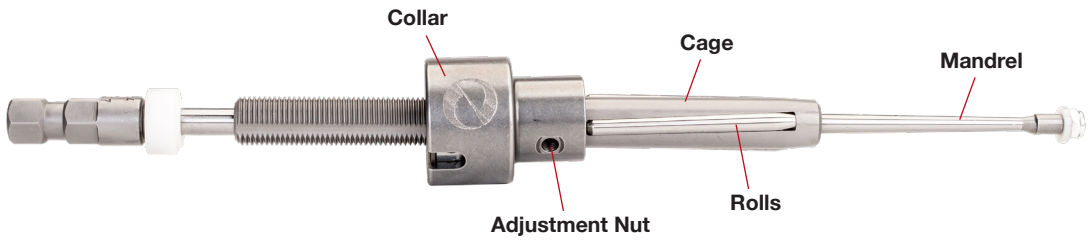
If you are unsure whether or not you have min wall or average wall tubing, it is important that you measure the inside diameter (ID) of your tubes prior to ordering tooling. If you do not take an average measurement, you may end up having to order additional sizes or spend time re-rolling tube joints later on.

SET-UP INSTRUCTIONS

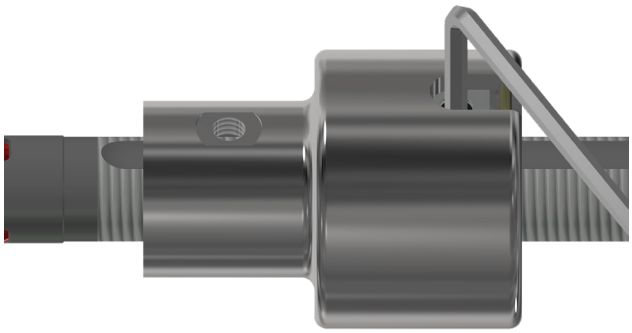
Setting Up A Condenser Expander
Once the right tool has been selected, the tube expander's collar will need to be set to the correct roll depth. Generally, you want to set the rolls 1/16" to 1/8" from the back of the tube sheet. This will ensure that the tool does not roll beyond the tube sheet. Simply, loosen the set screw on the collar, adjust the collar threads to the desired roll depth, and tighten the set screw on the expander's cage flat. This will allow the expander to be adjusted to other depths if necessary.

IMPORTANT: If you using an expander designed for the Rapid Hawk Assisted Tube Rolling System or the Ultra Hawk Assisted Tube Rolling System, please refer to the technical manual included with the system to complete expander setup.

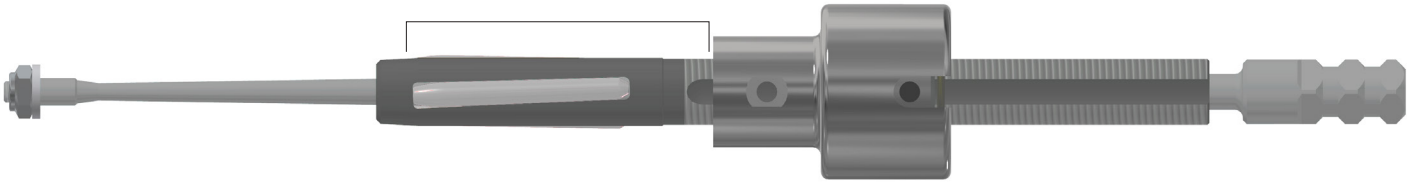
Collar Adjustment (Legacy Set Screw Design)



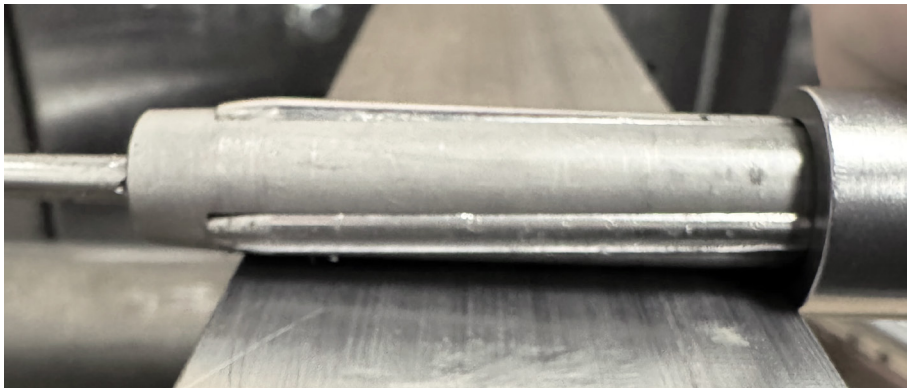
1. Using an allen key, loosen the set screw out of the adjustment nut until you're able to rotate the collar and adjustment nut at the same time.



2. After the screw is loosened, rotate the collar to the desired position. Ensure the rolls are past the tube sheet per the distance specified by the Heat Exchanger Manufacturer (typically 1/16" - 1/8").

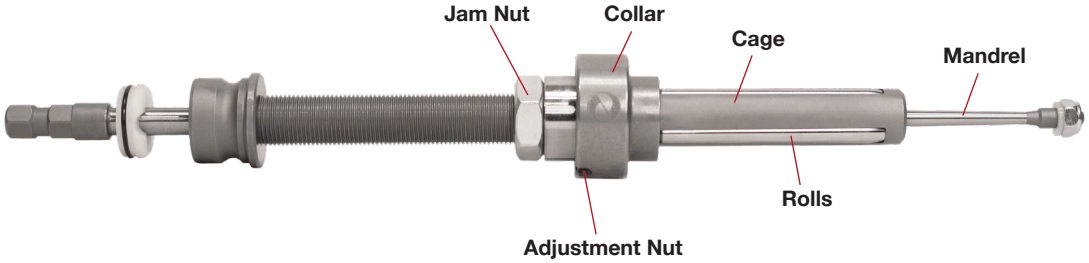


SET-UP INSTRUCTIONS



3. Once the collar is in the desired position, use the allen key to tighten the screw into the adjustment nut. Ensure that the collar and adjustment nut don't rotate together anymore.

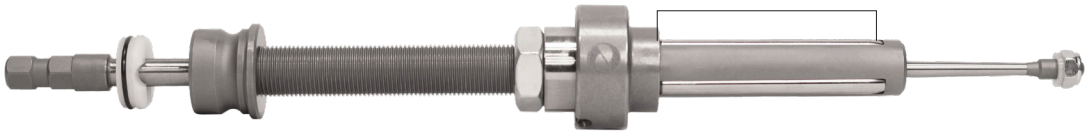
Collar Adjustment (Jam Nut Design)

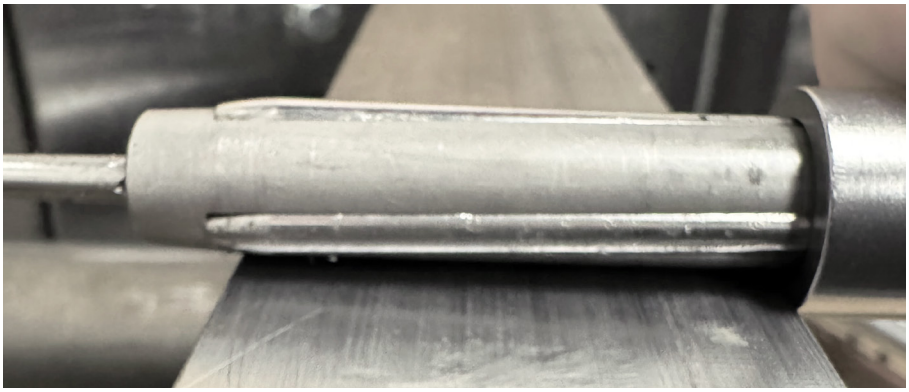


1. Using 2 wrenches, loosen the jam nut from the adjustment nut until you're able to move the collar.

SET-UP INSTRUCTIONS

2. After the jam nut is loosened, rotate the collar to the desired position. Ensure the rolls are past the tube sheet per the distance specified by the Heat Exchanger Manufacturer (typically 1/16” - 1/8”)

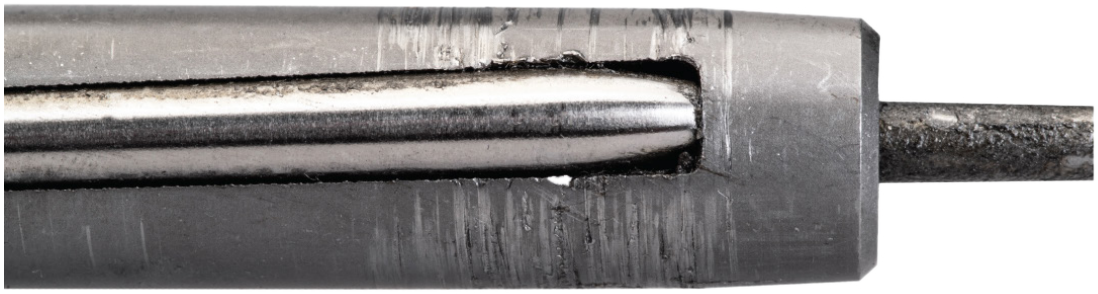




3. Once the collar is in the desired position, use the 2 wrenches to tighten the jam nut against the adjustment nut. Ensure the collar and adjustment nut don’t rotate together anymore.

MAINTENANCE INSTRUCTIONS

When inspecting the expander, regularly inspect mandrels and rolls for damage, such as scratches, pitting, galling, or spalling on the tapered surface. Replace any worn or damaged components immediately to prevent tube leaks, protect the tube and tube sheet, and avoid damage to other parts of the expander.



When the tool is not in use, store your tool in a dry, heated, secured place.

To maximize performance and extend tool life, ensure the expander is kept clean and free from debris, and always use an appropriate lubricant during tube expansion. Liquid lubricant is ideal for stainless steel or titanium tubes, particularly in industries like electronics and nuclear, due to its low sulfur content. Paste lubricant is preferred in air coolers or applications requiring access through header boxes, as it doesn't drip into vessels, and should be diluted when used with copper or brass tubing. Both lubricants help maintain a cooler, cleaner tool by preventing debris buildup on the mandrel and rolls, potentially doubling the expander's lifespan.

WARRANTY

Should any part, of Seller's own manufacture, prove to have been defective in material or workmanship when shipped (as determined by Seller), Seller warrants that it will, at its sole option, repair or replace said part f.o.b., point of manufacture, provided that Buyer notifies, in writing, of such defect within twelve (12) months from date of shipment from the manufacturing plant.

On request of Seller, the part claimed to be defective will be returned, transportation, insurance, taxes and duties prepaid, to the factory where made, for inspection. Any item, which has been purchased by Seller, is warranted only to the extent of the original manufacturer's warranty to Seller.
Seller shall not be liable for any damages or delays caused by defective material or workmanship.

No allowance will be made for repairs or alterations made by others without Seller's written consent or approval. If repairs or alterations are attempted without Seller's consent, Seller's warranty is void.

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Seller's total liability is limited to the lower of the cost of repair or replacement.

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