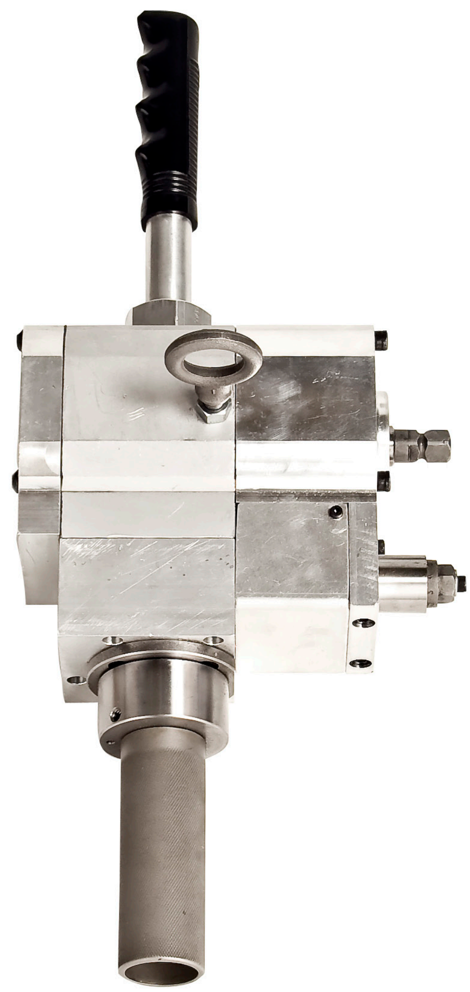
9017 Super Maxi-Torq® Pneumatic Rolling Control

(For serial numbers starting with 9017-100)

For 3/4” – 1-1/2” (19.1mm – 38.1mm) Tube O.D.

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 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 Elliott Model 901700 Super Maxi-Torq® Pneumatic Rolling Control has been designed for expanding tubes in the following types of equipment:

Heat Exchangers

Condensers

Chillers

Evaporators

Air Conditioners

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 RECOMMENDATIONS

For your safety and the safety of others, read and understand the safety recommendation and operating instructions before operating.

ALWAYS WEAR PROTECTIVE EQUIPMENT

⚠WARNING

IMPACT RESISTANT EYE PROTECTION MUST BE WORN WHILE OPERATING OR WORKING NEAR THIS TOOL.

For additional information on eye and face protection, refer to Federal OSHA Regulations, 29 Code of Federal Regulations, Section 1910.133., Eye and Face Protection and American National Standards Institute, ANSI A87.1, Occupational and Educational Eye and Face Protection. Z87.1 is available from the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

⚠ Caution

Personal hearing protection is recommended when operating or working near this tool.

Hearing protectors are required in high noise areas, 85 dba or greater. The operation of other tools and equipment in the area substantially contribute to, and increase the noise level in the area. For additional information on hearing protection, refer to Federal OSHA Regulations, 29 Code of Federal Regulations, Section 1910.95, Occupational Noise Exposure, and American National Standards Institute, ANSI S12.6 Hearing Protectors.

These tools are designed to operate on 90 psi (6.2 bar) maximum air pressure. If the tool is properly sized and applied, higher air pressure is unnecessary. Excessive air pressure increases the loads and stresses on the tool parts, sockets, and fasteners and may result in breakage. Installation of a filter-regulator-lubricator in the air supply line ahead of the tool is recommended.

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SAFETY RECOMMENDATIONS

Before the tool is connected to the air supply, check the throttle for proper operation (i.e. throttle moves freely and returns to closed position.) Clear the air hose of accumulated dust and moisture. Be careful not to endanger adjacent personnel. Before removing a tool from service or changing sockets, make sure the air line is shut off and drained of air. This will prevent the tool from operating if the throttle is accidentally engaged.

It is essential for safe operation that any operator of a rolling motor use good balance, sure footing, and proper posture in anticipation of a torque reaction. Ensure that the operator's hand will not be wedged or pinched between the work and the tool when operation.

Caution
Tools with clutches can stall rather than shut-off if adjusted over maximum power of output of tool, or if there is a drop in air pressure. Operator must then resist stall torque until throttle is released.

⚠ WARNING

Repetitve work motions and/or vibrations can injure hands and arms.
Use minimum hand grip force consistent with proper control and safe operation.
Keep body and hands warm and dry.
Avoid anything that inhibits blood circulation.
Avoid continuous vibration exposure.
Keep wrists straight.
Avoid repeated bending of wrists and hands.

Some individuals are susceptible to disorders of the hands and arms when exposed to tasks which involve highly repetitive motions and/or vibration. Those individuals predisposed to vasculatory or circulatory problems may be particularly susceptible. Cumulative trauma disorders such as carpal tunnel syndrome and tendonitis can be caused or aggravated by repetitions, forceful exertions of the hands and arms. These disorders develop gradually over periods of weeks, months, and years.

- Tasks should be performed in such a manner that the wrists are maintained in a neutral position which is not flexed, hyperextended, or turned side to side.
- Stressful postures should be avoided and can be controlled through tool selection and work location.

Any user suffering from prolonged symptoms of tingling, numbness, blanching of fingers, clumsiness or weakened grip, nocturnal pain in the hand, or any other disorder of the shoulders, arms, wrists,

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SAFETY RECOMMENDATIONS

or fingers is advised to consult with a physician. If it is determined that the symptoms are job related or aggravated by movements and postures dictated by the job design it may be necessary for the employer to take steps to prevent future occurances. These steps might include, but are not limited to, repositioning the workpiece or redesigning the workstation, reassigning workers to other jobs, rotating jobs, altering work pace, and/or changing the type of tool used so as to minimize stress on the operator. Some tasks may require more than one type of tool to obtain the optimum operator/tool/task relationship.

The following recommendations will help reduce or moderate the effects of repetitive work motions and/or extended vibration exposure.

- Use a minimum hand grip force consistent with proper control and safe operation.
- Keep wrists as straight as possible.
- Keep body and hands warm and dry.
- Avoid anything that inhibits blood circulation (smoking tobacco, cold temperatures, certain drugs, etc.)
- Avoid highly repetitive movements of hands and wrists, and continuous vibration exposure.

TECHNICAL DATA

Operating Pressure	–	90 psi (6.2 Bars)
Air Consumption	–	75 cfm (2123.8 L/min.)
Motor Free Speed	–	850 RPM
Lubrication	–	Use Light Machine Oil
Motor Weight	–	21 lbs. (3.6 kg)
Torque Range	–	12 – 33 ft. lbs. (16.27 – 44.74Nm)
Spindle Drive	–	1/2” (12.7mm) Male Square
Drive Size	–	3/8” (9.5mm) Sq. Quick Release Chuck
	–	1/2” (12.7mm) Sq. Quick Release Chuck
	–	3/4” (19.0mm) Sq. Quick Release Chuck
Tube O.D. Range	–	3/4” to 1-1/2” (19.1mm – 38.1mm)

9017 Super Maxi-Torq® Kit Consists Of:	
901700	Super Maxi-Torq® Control
901754P	Muffler Unit
901755	Exhaust Hose Assembly
P5224-13	Hose Adapter
858400-3/8	Quick-Release Chuck – 3/8”
858400-1/2	Quick Release Chuck – 1/2”
858400-3/4	Quick-Release Chuck – 3/4”
P5224-12	7 ½ ft. (2.3M) Air Hose Whip
901717P	Filter-Lubricator
900082P	16 oz. (0.47L) Can Lube Oil (Grade 10W/NR)
153J	Carrying Box
9017SH	Roll Throttle Side Handle

SET-UP AND OPERATING INSTRUCTIONS

PREPARATION: The Super-Maxi Torq Control requires clean, dry lubricated air at 90 psi @ 75 CFM. An air filter, a separator, and an airline lubricator are required. The supplied lubricator should be filled with a non-fluid oil made expressly for air motors.

ASSEMBLY: The air hose should be blown out to eliminate dirt. Connect the Exhaust Hose Assembly to the base of the valve block and secure into place by tightening the set screw in the valve block. Attach the Super-Maxi Torq Control to the airline. Adjust the lubricator with the control running full open until a barely noticeable mist comes out of the exhaust opening.

Attach the expander to the control by inserting the square of the mandrel into the quick-release chuck. Pull the chuck ring toward the expander to allow the squares to mate securely.

ADJUSTMENT (See Fig. 1): Torque is adjusted while the control is in the off position. Loosen the locking Slot Head Set Screw (69) located in the center of the graduated Spring Housing cylinder (23). Apply a wrench to the Adjusting Knob (25) and rotate. (Counter-clockwise rotation increases the torque and clockwise rotation lowers the torque setting.) Retighten the locking Slot Head Set Screw in the graduated Spring Housing cylinder. Repeat the procedure as necessary until the desired tripping torque is achieved.

To determine the desired torque setting, start with the setting in the zero position. With the expander full forward on the mandrel, insert the expander into the tube until the collar is against the tube sheet. Turn the control handle forward to start the rolling. When the rolling action stops, turn back on the handle to reverse & remove the expander. Check for tube tightness in customary manner. Increase the torque setting, if necessary, and repeat as required to achieve the proper tightness. Note that the numbers on the scale are for reference only and do not represent actual foot-pounds of torque.

NOTE: When torque adjustment is being made, maximum movement of the Adjusting Knob will stop before the Slot Head Set Screw travels the full length of the Spring Housing Cylinder slot.

WARNING: Do not exceed the maximum rotation of the Adjusting Knob. Serious damage will occur to the torque control mechanism by forced over rotation.

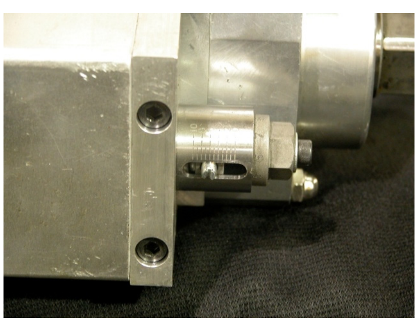

Fig. 1
Torque Adjustment Set at Maximum

SET-UP AND OPERATING INSTRUCTIONS

OPERATION: Tubes must not be permitted to rotate while being expanded. They can be held by a convenient means. Make certain that all air and exhaust lines are properly connected to the control. Keep both lines free of kinks that may restrict the airflow, which will reduce power to the control. Grasp the handle grip (42) in the left hand and the short, knurled handle (14) with the right hand. Rotate the knurled handle forward to start the rolling process. When the pre-set torque is reached. The control will shut off automatically. To reset the torque-tripping mechanism, rotate the knurled handle in the opposite direction. This reverses the spindle rotation, backing the expander from the tube, and sets the control back into the operation mode.
(Note: The torque output is controlled in the forward direction only.)

Always shut the control off when it is not in use or when making an adjustment.

Should assistance be required, contact Elliott Tool Technologies at the number listed below.

LUBRICATION: Elliott Filter-Lubricator 901717P is recommended for use with the control and should be located within 15 ft. (4.6 M) of the control. Non-fluid oil (grade 10W/NR), such as Elliott lubricant 900082P, made expressly for use with pneumatic motors is recommended. Lubricator should be set to allow 5 to 10 drops of oil per minute. Or, adjust the lubricator with control running full open until a barely noticeable mist comes out of the exhaust hose.

RECOMMENDED EXPANSION OF TUBES

Use expansion listed in tube expansion column plus clearance between the tube OD and sheet hole ID.
Recommended expansion may be plus or minus .001".

OD Size	GA	Tube Expansion	OD Size	GA	Tube Expansion	OD Size	GA.	Tube Expansion
½"	14	.006"	¾"	12	.008"	1 ¼"	8	.010"
½"	15	.006"	¾"	13	.008"	1 ¼"	10	.010"
½"	16	.006"	¾"	14	.008"	1 ¼"	12	.009"
½"	17	.005"	¾"	15	.007"	1 ¼"	14	.008"
½"	18	.005"	¾"	16	.006"	1 ¼"	16	.007"
½"	19	.004"	¾"	17	.005"	1 ¼"	18	.006"
½"	20	.004"	¾"	18	.005"			
½"	21	.004"	¾"	19	.005"	1 ½"	8	.012"
			¾"	20	.005"	1 ½"	10	.012"
5/8"	12	.006"	¾"	21	.004"	1 ½"	12	.010"
5/8"	13	.006"				1 ½"	14	.010"
5/8"	14	.006"	1"	8	.009"	1 ½"	16	.008"
5/8"	15	.006"	1"	9	.009"	1 ½"	18	.008"
5/8"	16	.006"	1"	10	.009"			
5/8"	17	.005"	1"	12	.009"	2"	8	.012"
5/8"	18	.005"	1"	13	.008"	2"	10	.012"
5/8"	19	.004"	1"	14	.008"	2"	12	.011"
5/8"	20	.004"	1"	15	.007"	2"	14	.010"
5/8"	21	.004"	1"	16	.006	2"	16	.008"
			1"	17	.005"	2"	18	.008
¾"	10	.008"	1"	18	.005"			
¾"	11	.008"						

Additional Sizes
¼" OD tubes- expand all gauges 0.003" after contact with tube sheet hole.
3/8" OD tubes- expand all gauges 0.004" after contact with tube sheet hole.

Example
¾" OD x 14 gauge tubes

Recommended expansion…………………………………………………...008"
Tube sheet hole……………………………………………………………….760"
Therefore, expand as follows:
Tube ID before expanding…………………………………………………….584"
Recommended expansion………………………………………………...…. 008"
Clearance between tube & tube sheet hole……………………………….010"
Finished ID .602"

The above recommendation is based on our experience. However, this does not constitute a guarantee because of the great variety of materials, tubes and tube sheets used. Some conditions will require experimental rolling to be certain that the rolled joints will be satisfactory.

BASIC PRINCIPLES OF TUBE EXPANDING

Tube expanding is the art of reducing a tube wall by compressing the OD of the tube against a fixed container, such as, rolling tubes 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 for determining the correct tube wall reduction.

This list shows a typical 3/4" - 16 gauge tube. Before rolling this tube you would find the proper rolling dimension as shown.

1. First determine the tube hole size.
2. Then determine the tube outside diameter.
3. Substract the tube outside diameter from the tube hole dimension.
4. With an Elliott Tube Gauge, determine the inside diameter of the tube before rolling.
5. By adding the dimension found in "4" to the clearance between the tube OD and the tube hole, you will then know the tube's inside diameter at metal to metal contact.
6. Roll the tube to what you feel is a good tube joint. This example was rolled and then the ID of the tube was checked with an Elliott Tube Gauge.
7. By subtracting "5" from the rolled diameter you determine the actual amount of expansion (tube wall reduction) on the inside diameter of your tube.
8. This can be converted to a % of wall reduction by dividing the actual wall thickness ("2 minus 4") 0.130" into the amount of roll 0.009 as shown in "7" above.

You can use this list to your advantage by predetermining both the % of wall reduction required and the actual inside diameter which should be rolled. After the completion of "5" you realize 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 arrive at the % required for your application prior to tube rolling.

By subtracting the tube inside diameter "4" from "2", you determine actual wall thickness. This example would therefore be 0.130". If you then take the 7% wall reduction times the wall thickness, you arrive at 0.0091". Adding 0.0091" ("7") to 0.627" ("5") we get "6" the inside diameter of the tube after rolling (0.636").

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BASIC PRINCIPLES OF TUBE EXPANDING

This technique is an excellent way to set torque rolling devices. Once you have arrived at the rolled dimension for four or five tubes, you can roll them and very simply determine if more or less wall reduction is required. Knowing how to determine wall reduction is important; however, it is equally important to know the characteristics of the popular tubing materials. We should know the proper wall reduction which would apply to each metal. A simple rule of thumb is the harder the material, the less wall reduction is required to obtain a tube joint. For example, you can assign these as approximate percentages of wall reduction when rolling pressure vessels:

Tubing Material	
Copper & Cupro Nickel	8-10%
Steel, Carbo Steel & Admiralty Brass	7-8%
Stainless Steel & Titanium	4-5%

These materials and percentages can be your guide line to rolling tubes of like materials.

Here is a summary of important factors in rolling certain alloys: When rolling 3003 or 4004 Aluminum you should not reduce the walls over 5%. When rolling 6061-T Aluminum, which is one of the most popular materials used in aircraft fittings, you can reduce the wall 10 to 12% for a mechanical joint.

There is a tube process called Alonizing. It is stated that Alonized steel combines the heat and corrosion resistant properties of the iron aluminum alloy with the strenth and rigidity of the steel. When rolling this tubing it is extremely important to lubricate each tube end and make certain that the tube expanders are kept clean. Remove all particles of the tubing materials from the expanders to decrease tool fatigue. When rolling Alonized tubing, abrasive particles are removed from the inside diameter of the tubing and gathered in the expander. It is recommended that two expanders be used. One should be cleaned and lubricated while the other is being used.

Admiralty Brass is widely used in condensers. This material should be well lubricated. The tube wall reduced approximately 7% to 8% for optimum tube joints. In general only a 4% to 10% reduction in wall thickness is necessary to produce a tight tube in a serrated hole. On the other hand, reduction in excess of 15% may cause leaking, splits, or flaked tubes.

Carbon Steel is used in almost every type of pressure vessel built today. Tube wall reduction should be approximately 7% to 8%. Heavy lubrication is a must. If the tube is cracking or tooling shows excessive wear, tube hardness should be checked. Carbon Steel tubes should be 90 to 120 Brinnel hardness for rolling. It is possible to roll tubes up to 150 Brinnel; however, flaking and cracking are more likely to occur as the tube hardness increases.

When rolling Copper and Cupro Nickel, consider approximately 8-10% wall reduction to be a proper tube joint. Copper, since it is one of the softer tubes used in pressure vessels, can be easily rolled. Use plenty of lubrication because copper has an abrasive action on tube expanders.

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BASIC PRINCIPLES OF TUBE EXPANDING

When rolling Stainless Steel and Titanium, approximately 4 to 5% wall reduction is sufficient to produce a tight tube in a serrated hole. When rolling these alloys the entire wall reduction should be done quickly. These materials have a greater tendency to work harden; therefore, minimal or no rerolling should be done.
When rolling Titanium, it is recommended to use an expander with four rolls or more. This will decrease diaphram of a thin wall and help eliminate tube end cracking. There are however, exceptions to the above rule.

This discussion of alloys has been related to those used in pressure vessels such as boilers, heat exchangers, and condensers. These factors would be approximately the same in a mechanical joint for industrial use. However, a greater percent of wall reduction is usually considered when making a mechanical joint. Higher quality tubes are used in industrial applications.

Major Causes Of Tube Leaks
Tube rolling leakage is usually caused by one of the following: under-rolling, over-rolling, improper preparation of tube sheets and differential thermal expansion can lead to serious difficulties for both the manufacturer and the repair service men.

Under-Rolling:
Under-rolling is when the tube is not expanded to fill the tube sheet hole and the proper amount of wall reduction is not obtained. It is better to under-roll than to over-roll.

Over-Rolling:
Over-rolling is when the expansion of the inside diameter of the tube surpasses the expansion required for the proper percentage of wall reduction for the ultimate tube joint. Over-rolling will decrease the dimensions of the ligament between tubes and weaken this bridge. Once a ligament is weakened it will cause a reaction in all ligaments surrounding that ligament. If we decrease the strength of the ligament the tube next to the tube being rolled will leak.

Over-rolling also causes distortion in tube sheets or drums, such as egg-shaped holes. It will also cause diametrical expansion which is the overall increase of a tube sheet or drum. Over-rolling has been known to 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 or warpage is returned to normal. This is usually corrected by placing stay rods in the vessel and pulling the tube sheets back to their original position.

Improper Preparation Of Tube Holes:
Improper preparation of tube holes is another major cause in tube leakage. If the tube sheet or drum is gouged, it is extremely hard to expand the tube to fill these gouges or tears without over-rolling. The smoother the tube seat or tube hole the easier it is to roll an optimum tube joint. The ligaments and light tube walls make it more important that the finish of the tube hole be in the low micro range. We find many manufacturers today are drilling, reaming and sizing or burnishing to get the microfinish desired for tube holes.

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BASIC PRINCIPLES OF TUBE EXPANDING

Differential Thermal Expansion:
Differential thermal expansion can result with thicker tube sheets. When the expansion due to heat varies noticeably between the thinner tube and 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. It is extremely important to eliminate any longitudinal cracks in the tube hole wall. These longitudinal lines will cause leaky tubes.

Preparation of Tube Holes
Preparation of tube holes in heat exchangers and condensers is as follows:

1. Drill and ream tube sheet holes to 0.007” to 0.010” over the outside diameter of the tube to be used.
2. Be certain the 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 increase the tensile strength of the ligament.
4. The serrations or grooves to be used will determine the holding power of the tube.
5. It is extremely important when retubing that the grooves be cleared of all metals or any foreign material.

Preparation of Tube Seats
Preparation of tube seats in drums, tube sheets, and headers are as follows:

1. Tube holes are normally drilled and reamed to approximately 1/32” larger than the nominal outside diameter of the tubes.
2. It is extremely important during this operation that there are no longitudinal cracks left in the tube seat.
3. In cases where out-of-roundness is extreme, pre-rolling of the tube holes is advised.
4. Be certain that the tube hole walls and the grooves in the tube walls are cleaned down to bare metal before tubes are inserted. Be certain all foreign material such as oil, grease, rust, or just plain dirt are removed. Special attention during this cleaning will prevent serious trouble later.

After tube holes have been properly prepared they are usually coated with a rust preventative compound. Before inserting any tube it is imporant 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 alignment will prevent future troubles.

PADDLE REPLACEMENT PROCEDURE

Before performing any maintenance function on the Rolling Motor be sure to remove the air supply by physically disconnecting the air supply hose from the motor.

1. Locate the Rear Cap (4) on the back side of the rolling motor and remove the four Button Head Socket Screws (57).

2. Carefully remove the Rear Cap (4) from the motor body and keep the Gasket (10) intact as you remove this cap.

3. Tilt the motor body (Rear Cap side down) and tap the motor body onto a bench top to partially eject the motor shell assembly from the motor body.

4. Grip onto the Flex-Lock Nut (77) with pliers and pull the motor shell assembly completely free from the motor body. [IMPORTANT: When removing the motor shell assembly, pull in a straight & even motion. Otherwise, the shell assembly will cock inside the motor body.]

5. Remove the Retaining Ring (59) from the spline end of the Rotor (6).

6. Remove the End Plate (34) from the spline end of the Rotor (6). This will allow access to the Paddles (7).

7. Remove the old Paddles (7) by tilting the shell assembly to allow the paddles to slide out.

8. Before installing the new paddles in the Rotor slots, lightly coat the new paddles with Elliott Lube Oil Grade 10W/NR.

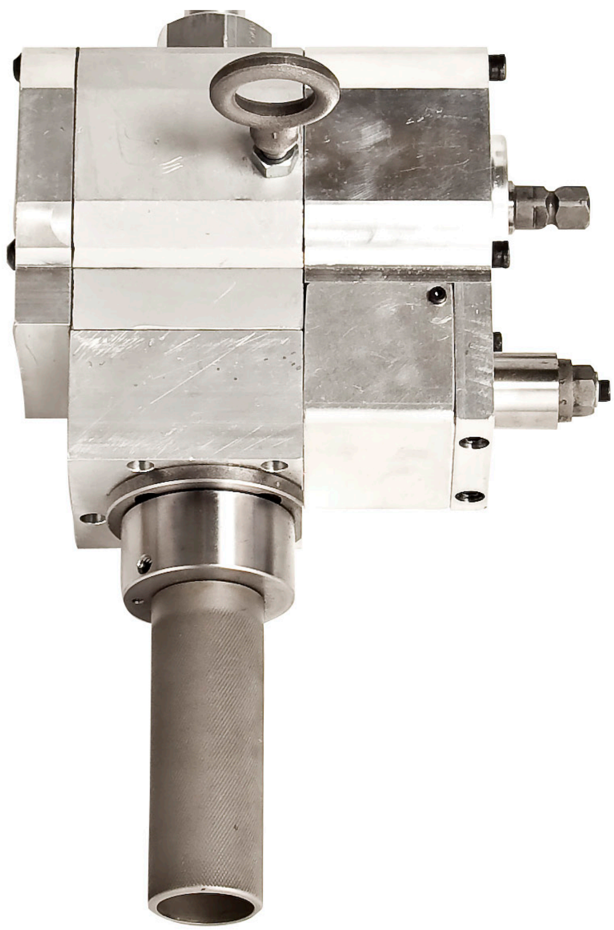
9. Once the new paddles are installed, reassemble the shell assembly & reinstall into the motor body by reversing steps 1 thru 6. [**IMPORTANT:** Do Not over torque the Button Head Socket Screws (57). If the Gasket (10) is damaged, replace it before reassembly by ordering part number 901710P.]

PNEUMATIC MOTOR TROUBLESHOOTING

	Air Leakage	Air Strainers Clogged	Air Pressure Too Low	Dirty Air	Water In Air	Incorrect Lubrication	Insufficient Lubrication	Hose Too Small	Long Paddles	Worn Paddles	Rotor Rubbing	Worn Bearing Plates	Worn Valve Seat	Throttle Pin Sticking
Motor Will Not Run		X	X				X		X		X			
Lack Of Power	X	X	X			X		X		X	X	X		
Speed Too Low		X	X					X			X			
High Air Consumption	X									X		X		
Excessive Paddle Wear				X		X	X							
Excessive Bearing Wear				X		X	X							
Rusting Of Parts					X	X	X							
Delamination Of Paddles				X	X	X								
Paddles Chipping				X		X	X							
Motor Continues To Run, Throttle Off													X	X

MOTORS:
Pneumatic motors have assemblies built to very close tolerances. Under constant use and with the possibility of foreign parts moving through the air line, these tolerances have a tendency to suffer. Air motor maintenance is critical. Dirt should not be allowed to collect around exhaust ports or fitting connections.

ROTOR & END PLATE SPACING PROCESS



Tools Required

- Workbench with Vise with Jaw Guards made from brass or aluminum
- Combination Open/Box End Wrench Set, Imperial Sizes
- Allen Wrench Set
- Internal & External Snap Ring Pliers
- (2) Feeler Gage Sets with .005” Blade
- Elliott 900082P Air Motor Oil, or Grade 10W/NR equivalent

To properly set the distance from the end of the Rotor to the End Plate, follow the following process.

Place the Rotor in a vise fitted with "Soft Jaws" made from Brass or Aluminum as shown.

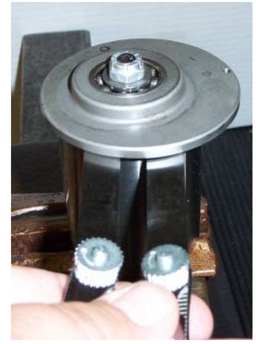
Position (2) two .005" Feeler Gage Blades on the large diameter end of the rotor.

Place the End Plate with the ball bearing on the Rotor resting on the (2) two Feeler Gage Blades.

Install the Thrust Race, then the Nut onto the Rotor Stud.

Tighten the Nut on the Rotor Stud with a ½" wrench. Take care when tightening, checking frequently the tightness of the .005" Feeler Gages. Proper tightness is achieved when there is significant friction when the .005 Feeler Gage is moved but not so tight, to not allow the .005" Feeler Gage to be removed.

Both Feeler Gages can now be removed from between the Rotor and End Plate.



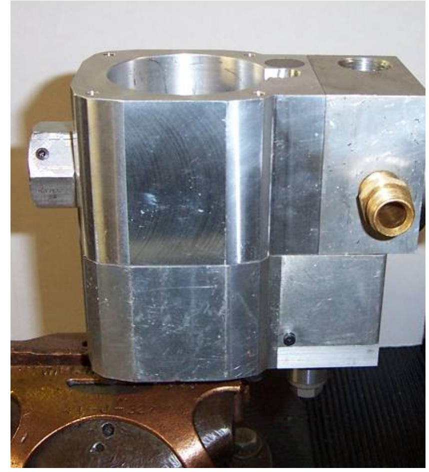
Position the Shell over the Rotor / End Plate Assembly and engage the long spring pin pressed in the end of the Shell into the hole in the End Plate as shown.

Coat the Paddles with Elliott 900082P Air Motor Oil, or Grade 10W/NR equivalent and install the Paddles into the Rotor Slots. The chamfered or radius edge must be placed to the outside diameter of the Rotor.

Slide the other End Plate over the Rotor Shaft and align the short spring pin with the hole in the End Plate.

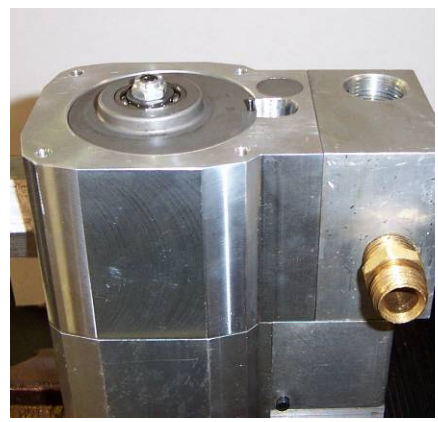
Use the Snap Ring Pliers to position the Snap Ring in the groove on the Rotor Shaft to retain the End Plate.

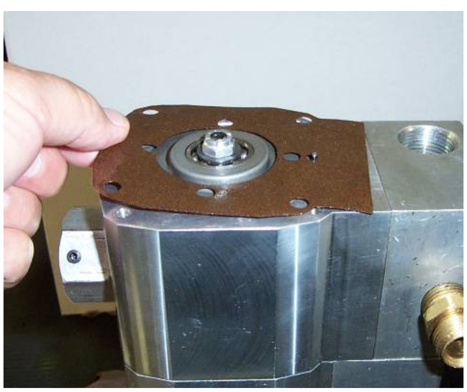
Place the Torque Control vertically in a vise fitted with “Soft Jaws” made from brass or aluminum as shown.



Slide the Motor Assembly into the body of the Torque Control. Carefully align the Motor Assembly during this operation, do not hammer or press this assembly into the torque control.

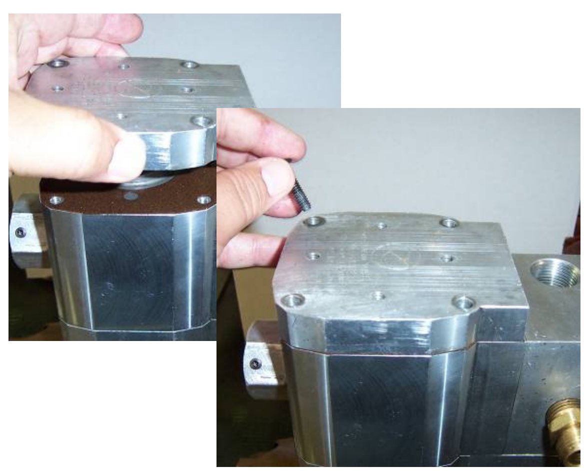
To engage the Rotor Spline with the gears the Torque Control may require a slight rotation of less than 1/8 revolution to allow the Motor Assembly to seat fully into the Torque Control Body as shown.





Place the Paper Gasket properly on the back of the Torque Control.

Place the Rear Cap on the Torque Control.



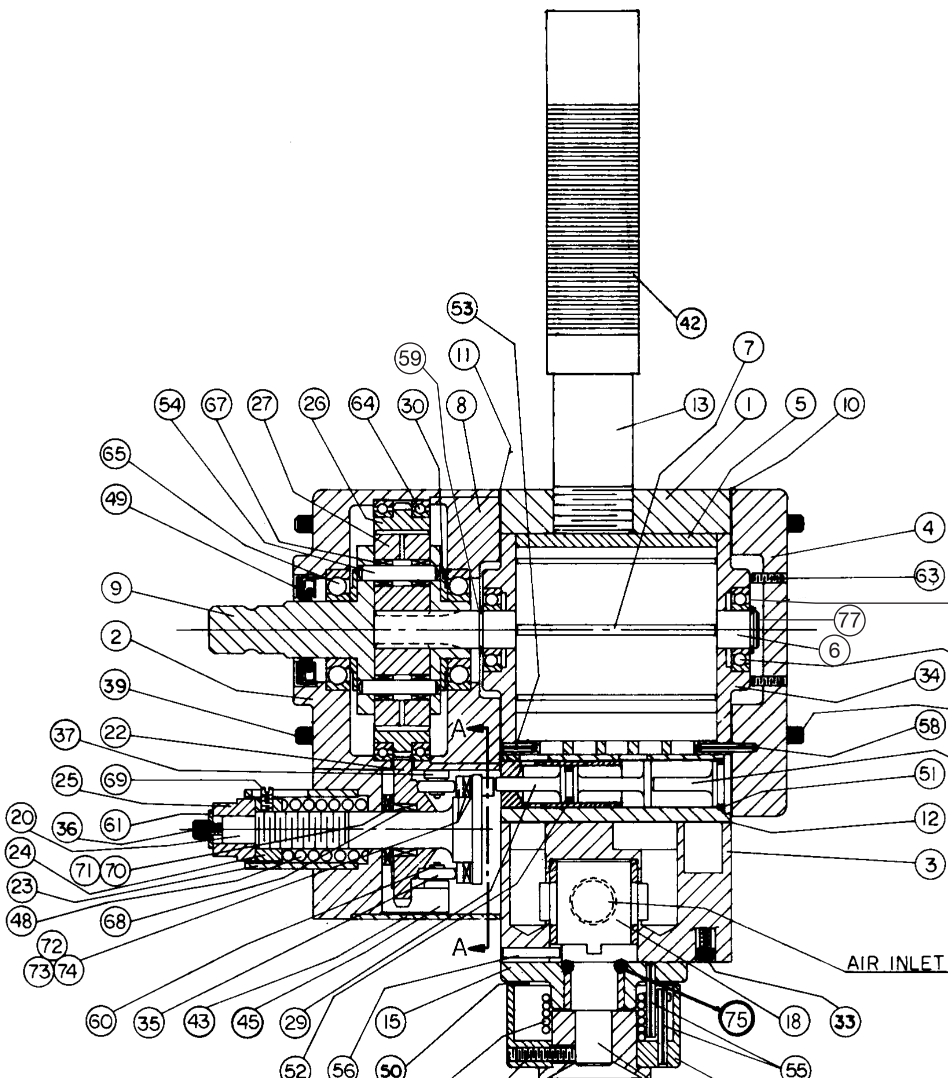
Insert and tighten the (4) four Rear Cap Screws into the assembly.

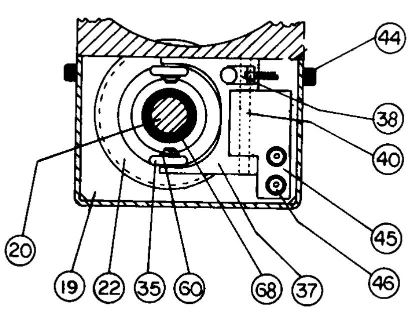
Insert the (4) four Set Screws into the Rear Cap. Use only 2 Inch Pounds of torque to tighten these Set Screws. DO NOT OVERTIGHTEN.

Fill in Set Screws after tightening with “Devcon Metal Patch & Fill”. This will prevent any further adjustments to these screws.

Operation Complete, the Torque Control is now ready for use.

PARTS & DIAGRAMS





SECTION A-A

PARTS & DIAGRAMS

(For serial numbers starting with 9017-100)

ITEM NO.	PART NAME	NO. REQ	PART NUMBER
1	Case Assembly	1	901701
2	Gear Case	1	901702
3	Valve Block Assembly	1	901712
4	Rear Cap	1	901703A
5	Shell	1	901706
6	Rotor	1	901705A
7	Paddle Set	1	901708P-5
8	Bearing Support	1	901704
9	Spider	1	901713
10	Gasket	1	901710P
11	Gasket	1	901709P
12	Gasket	1	901715P
13	Dead Handle	1	901714
14	Handle	1	901728
15	Handle Base Assembly	1	901735
16	Spring Cover	1	901734
17	Actuator	1	901733
18	Valve	1	901732
19	Torque Block	1	901702A
20	Adjusting Screw	1	901723
21	Eye Bolt (not shown)	1	512543
22	Trip Cam	1	901736
23	Spring Housing	1	901726
24	Adjusting Nut	1	901724
25	Adjusting Knob	1	901725
26	Ring Gear	1	901711
27	*Planet Gear	3	901739
28	Valve Stop	1	901741
29	Valve	1	901743
30	Pin Retainer	2	901738
31	Hex Nut (not shown)	1	171C
32	Hex Socket Head Cap Screw (not shown)	2	P8302-51
33	Hex Socket Head Cap Screw	5	P8302-55
34	End Plate	2	901707
35	Roller	2	901737
36	Hex Socket Head Cap Screw	1	P8302-15
37	Trip Arm Assembly	1	901716
38	Trip Pawl Bracket Assembly	1	901759
39	Hex Socket Head Cap Screw	4	P8302-75

*Includes item 67 which is not sold separately.

ITEM NO.	PART NAME	NO. REQ	PART NUMBER
40	Pin	1	901761P
42	Handle Grip	1	P512527
43	Trip Cover	1	901720P
44	Hex Socket Head Cap Screw	3	P8302-76
45	Bracket	1	901721
46	Hex Socket Head Cap Screw	2	P8302-49
47	Handle Spring	1	901730P
48	Torque Spring	1	901727P
49	Rawhide Seal	1	901746P
50	Hex Socket Head Cap Screw	4	P535-2
51	“O” Ring	1	P8309-10A
52	“O” Ring	1	P8309-7
53	Dowel Pin	1	P8381-6
54	Pin	3	P8573-9
55	Dowel Pin	2	P8382-16
56	Dowel Pin	1	P8382-12
57	Button Head Socket Screw	4	P8597-13
58	Dowel Pin	1	P8381-10
59	Retaining Ring	1	P8375-50
60	“E” Ring	2	P533-12
61	Washer	1	549-6
62	Set Screw	2	128D
63	Set Screw	4	128D
64	Ball Bearing	2	901747P
65	Ball Bearing	2	P8559-12
66	Ball Bearing	2	901748P
67	**Needle Bearing	6	900051P
68	Needle Bearing	1	901750P
69	Slot Head Set Screw	1	901751P
70	Thrust Bearing	1	P1067-0
71	Thrust Race	2	P1067A
72	Bearing Race	1	P1067S
73	Thrust Bearing	1	P1067-3
74	Thrust Race	1	P1067F
75	“O” Ring	1	P8309-12
76	Thrust Washer	1	P1067EE
77	Flex-Loc Nut	1	P8263B
78	Roll Throttle Side Handle (Not Shown)	1	9017SH

**Not sold separately

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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