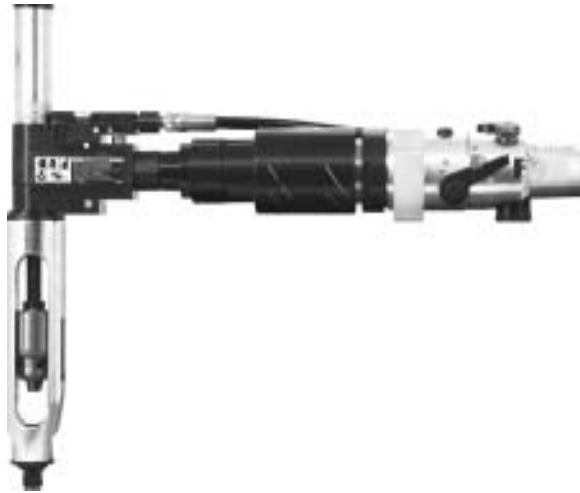


Quackenbush®

140QGDA-RA-SU-MS & 140QDA-RA-SU-MS RIGHT ANGLE DRILLS



For additional product information visit our website at www.coopertools.com

NORTH AMERICA

CooperTools
P.O. Box 1410
Lexington, SC 29071-1410

EUROPE

Recoules Operation
Zone Industrielle - B.P.28
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77831 Ozoir-la-Ferriere Cedex, France

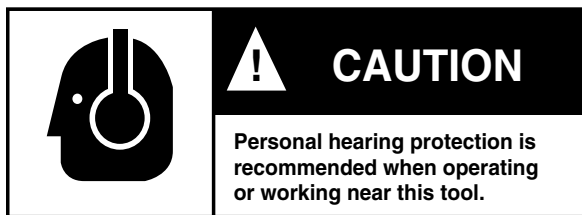
Safety Recommendations

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

Always wear protective equipment:



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 Z87.1, Occupational and Educational Eye and Face Protection. Z87.1 is available from the American National Standards Institute, Inc., 11 West 42nd Street, New York, NY 10036.



Hearing protection is recommended in high noise areas, 85 dBA or greater. The operation of other tools and equipment in the area, reflective surfaces, process noises and resonant structures can 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.



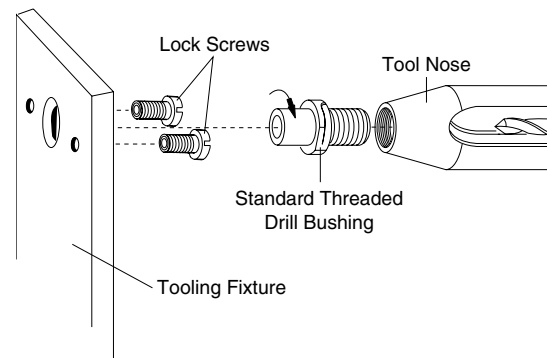
Follow good machine shop practices. Rotating shafts and moving components entangle and entrap, and may result in serious injuries. Never wear long hair, loose-fitting clothes, gloves, ties, or jewelry when working with or near a drill of any type.

! CAUTION

- Quackenbush drills are designed to operate on **90psig (6.2 bar) air pressure**. Excessive air pressure can increase the loads and stresses on tool parts and drills, and may result in breakage. The installation of a filter-regulator-lubricator in the air supply line is highly recommended.
- Before removing a tool from service or changing drill bits, 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.
- Cutting tools used with these Quackenbush drill motors are sharp. Handle them carefully to avoid injury.

! CAUTION

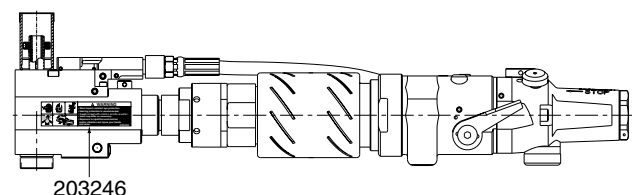
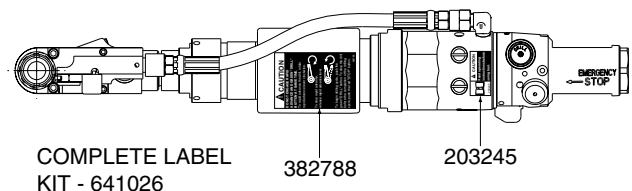
Before mounting any positive feed drill, check the lock screws in the tooling fixture and drill bushing. Make sure both are in good condition and securely tightened.



Positive feed drills can exert high torques and high thrust loads. If failure of the lock screws or drill bushing occurs, the drill may suddenly spin and back away from the drill fixture.

Warning Labels

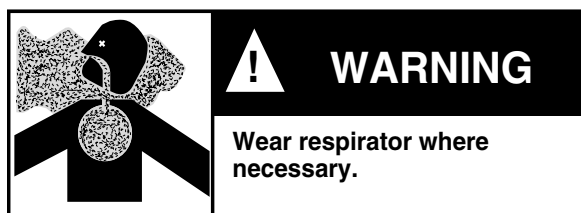
The warning labels found on these tools are an essential part of this product. Labels should not be removed. Labels should be checked periodically for legibility. Replace warning labels when missing or when the information can no longer be read. Replacement labels can be ordered from the manufacturer.



Safety Recommendations

! CAUTION

The spindle on right angle positive feed drills retracts at a much faster rate than it feeds. Care should be taken to avoid entrapment. Nose pieces usually used with these drills are generally slotted for visibility and access to chuck, cutter, and retract stop adjustments. A spindle guard should be used when operating tool. Spindle guards in one inch increments are available to accommodate any length spindle. Slotted spindle guards are available for tools with fluid swivels.

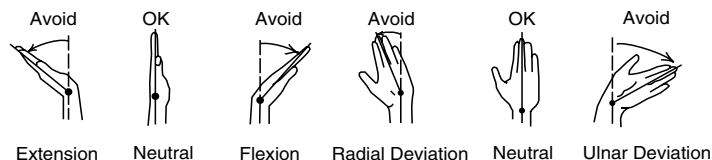


Drilling or other use of this tool may produce hazardous fumes and/or dust. To avoid adverse health effects utilize adequate ventilation and/or a respirator. Read the material safety data sheet for any cutting fluids or materials involved in the drilling process.

! WARNING

- Most dusts are combustible. See material safety data sheets for combustibility of a specific dust.
- Non ferrous metal dusts are particularly hazardous.
Examples: Aluminum, Magnesium, Titanium, Zirconium
(Never collect Magnesium in a dry dust collector)
- Never collect spark generating material in the same dust collector with combustible material.
Examples: Collecting both steel and Aluminum dust or Steel and Titanium dust.
- Never use flammable finishing lubricants.

Some individuals are susceptible to disorders of the hands and arms when exposed to tasks which involve repetitive work motions. Those individuals predisposed to vasculatory or circulatory problems may be particularly susceptible. Cumulative trauma disorders such as carpal tunnel syndrome and tendinitis can be caused or aggravated by repetitious, 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.**

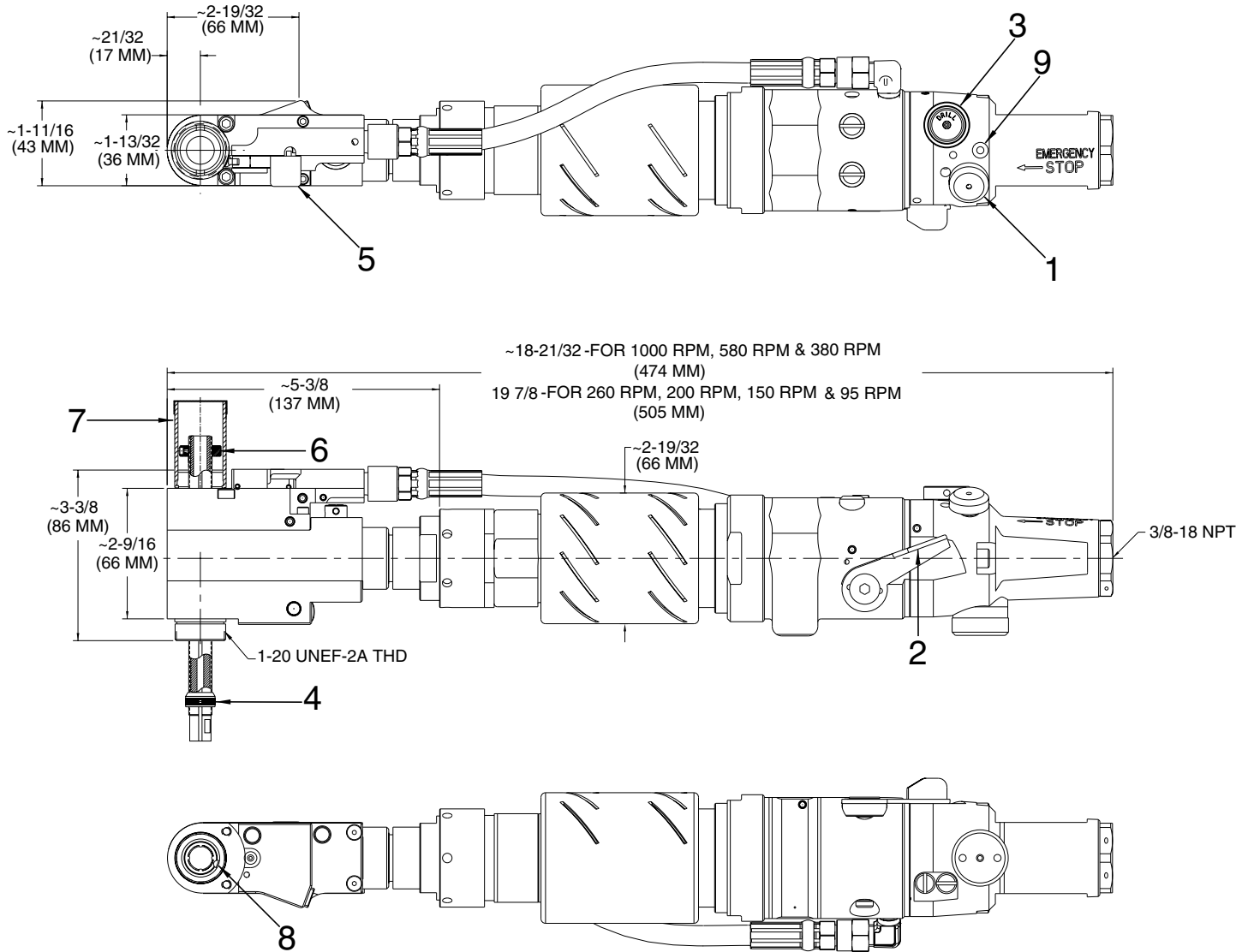
- **Stressful postures should be avoided and can be controlled through tool selection and work location.**

Any tool operator should be aware of the following warning signs and symptoms so that a problem can be addressed before it becomes a debilitating injury. Any user suffering 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, or fingers is advised to consult 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 further occurrences. These steps might include, but are not limited to, repositioning the workpiece or redesigning the workstation, reassigning workers to other jobs, rotating jobs, changing work pace, and/or changing the type of tool used 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. The operator of any drill should:

- Use a minimum hand grip force consistent with proper control and safe operation
 - Keep body and hands warm and dry
 - Avoid anything that inhibits blood circulation
 - Smoking Tobacco
 - Cold Temperatures
 - Certain Drugs
 - Avoid awkward postures
 - Keep wrists as straight as possible
 - Interrupt work activities, or rotate jobs to provide periods free from repetitive work motions.

MAJOR TOOL CONTROLS



MAJOR TOOL CONTROLS

- 1 Emergency Stop Button
- 2 Rapid Advance Lever
- 3 Drill Button
- 4 Retract Stop Collar
- 5 Manual Retract Lever
- 6 Adjustable Depth Stop
- 7 Rear Spindle Guard
- 8 Signal Valve
- 9 Throttle Piston

AIR SUPPLY

AIR PRESSURE, HOSES, AND COUPLINGS:

This tool is designed to operate on 90-110 psig (6.2-7.6 bars) supply pressure using a 1/2" hose up to 20 ft. in length. If additional hose is needed, a 5/8" or larger diameter hose

should be connected to the 1/2" in. hose. Quick disconnect couplings (if used) should have flow capacity ratings exceeding 60 SCFM.

LOW PRESSURE:

This drill will shut-off automatically (while drilling or when retract begins) if the pressure at the tool inlet drops below 65 psig (4.5 bars). Manual restart is required. The drill will not continue to run when the green drill button is released if the pressure at the tool inlet is low.

HIGH PRESSURE:

This drill shuts off automatically at the end of the retract cycle. If the pressure at the tool inlet is over 115 psig (7.9 bars) the tool may continue to retract, jamming the retract stop collar into the housing cover causing the tool to either stall or shear the shear pin.

OPERATING INSTRUCTIONS

If the tool has been shipped recently, been in storage, or repaired or disassembled; it should be run (without spindle) through a "tool crib check" of functions (See Below).

EMERGENCY STOP—Depressing the red emergency stop button **1** will stop the tool, except when the rapid advance mode is being utilized. Releasing the rapid advance lever **2** will stop the tool during rapid advance.

RAPID ADVANCE—Depressing the rapid advance lever **2** will bring the cutting tool to the work surface faster than the regular feed rate.

DRILLING—Press the green drill button **3** firmly and release it to start the cycle. The cutter will feed to a predetermined depth, dwell, and then retract. The drill motor will shut off automatically at the end of the retract stroke. The cutter may be manually retracted at any time by depressing the manual retract lever **5**.

IMPORTANT: The spindle retracts at a much faster rate than it feeds. Care should be taken to avoid entrapment.

Do not hold the drill button down during the retract cycle—this prevents "motor stop" and will jam the tool.

DEPTH ADJUSTMENT:

DEPTH COLLAR—Has three (3) holes for adjusting depth in increments of .004". Tighten lock screw after each depth adjustment. Tip of lock screw must go into a spindle slot.

IMPORTANT NOTE: To insure maximum repeatability, the work surface, fixtures, and depth stop must be cleared of any chips or foreign material before beginning the next hole. Always replace the rear spindle guard after making a depth adjustment.

TOOL CRIB CHECK

1. With air supply shut off, remove rear spindle guard.

2. Remove depth stop **6** (left hand threads).

WARNING: Keep hands and clothing clear of rotating spindle, turn air supply on and use rapid advance to remove spindle.

3. Shut off air supply pressure.

4. Depress 5/16" diameter steel end of throttle piston **9**. The throttle piston must spring return quickly when released.

5. With air supply on, fully depress the rapid advance lever **2**. Motor should run and spindle feed gear (threaded I.D.) must not rotate. Spindle drive gear (splined I.D.) rotates. If the motor runs and the splined ID does not rotate, verify that the shear pin is whole and intact.

6. Release rapid advance lever **2** and press green drill button **3** all the way in. Motor starts. Release green drill button **3**. Motor continues to run. Both gears should (splined and threaded) rotate.

7. Depress manual retract lever **5** and release. An audible "snap" indicates the retract valve is shifting as desired. Spindle feed gear (threaded I.D.) stops rotating.

8. Depress signal valve **8** with screwdriver and release. Motor stops and retract valve must reset (manual retract lever **5** should rise). Depress red emergency stop button **1** slowly. There should be no venting of air as the emergency stop button **1** is depressed.

9. Press green drill button **3** and release. Motor starts. Press emergency stop button **1**. Motor stops.

10. Inspect the manual retract lever **5**. It should move freely when depressed and return quickly when released. The thumb pad is adjusted at the factory to be even with the top of the head.

Do not proceed with test if steps **1** through **9** indicate malfunction.

WARNING: Keep hands and clothing clear of rotating spindle.

11. Turn air supply off. Using tool 382593, install spindle (with retract stop collar **4** locked in place and **tapered side of stop collar 4 is toward the head**). Remove tool 382593. Turn on air supply. Depress the green drill button **3**. Tool will start. Depress the manual retract lever **5**. The spindle will retract fully into the head and the motor will stop automatically. Depress the emergency red stop button **1** slowly. There should be no venting of air when the emergency stop button **1** is depressed.

12. Screw depth stop **6** (left hand threads) onto the rear end of the spindle and lock in place. Rapid advance until depth stop **6** comes into contact against the back of the thrust bearings in drill head. The spindle should stop rotating and the rapid advance overload clutch should "chatter". The manual retract lever **5** should not drop as the clutch "chatters". Release the rapid advance lever **5**.

13. Depress green drill button **3** and release. Motor starts. Retract lever **5** drops and spindle retracts automatically to full retract position. Motor will stop automatically. Verify that the manual retract valve has reset properly.

14. Replace rear spindle guard.

NOTE: If the tool does not function properly, check for excessive leakage in the air control system as follows.

LOCATING EXCESSIVE LEAKAGE IN THE A.C.S.

Most air leaks create a hissing noise that is easily heard if background noise is not too loud. With the air supply on, place a small punch against the bottom end of the throttle piston (place the punch through the hole in the throttle cylinder end cap). This will prevent the throttle from opening if you push firmly. Now push the drill button a small amount until the A.C.S. is holding pressure. Remove the punch. You will now be able to locate leaking air audibly. Some leakage at the retract valve is normal. By lifting the retract lever you can detect excess leakage at the signal valve, or in the retract piston air circuit. Missing "O"-rings or a damaged signal valve are the most common sources of excessive leakage.

INSTALLING A SPINDLE:

Run a "Tool Crib Check" (see page 5)

Important: Retract stop collar **4** 629375 must be in place and locked on the spindle. Install the spindle in the spindle drive gear 622950 and use spindle "in & out" tool 382593 to push the spindle "in". Depress the green drill button **3** to start the motor and depress the manual retract lever **5**. The spindle will retract. Release the green drill button **3**. The spindle will continue to retract until the retract stop collar **4** depresses the signal valve **8** and the tool will automatically shut off. Note: When the retract stop collar **4** is near or touching the signal valve **8**; Do not press the green drill button **3**; as this will prevent tool shutoff and jam the spindle into the head. Install depth stop collar **6** 617962 and adjust for proper depth.

CHANGING FEED GEARS:

Remove (left hand threads) the adjustable depth stop **6** from the rear of the spindle. Using the spindle "in & out" tool 382593 to support the front of the spindle, depress the rapid advance lever **2** and feed the spindle forward until the spindle feeds itself out of the spindle feed gear. Release the rapid advance lever, shut off the air supply, and pull the spindle out of the spindle drive gear. Remove the side hose assembly. Unscrew the head from the clutch housing and remove the bevel gear 622947 and bearing 847095. Remove the two small cap screws in the thrust pack body. Unscrew the two large screws 864415 holding the thrust pack body to the head assembly. Note: Clamping the tool in a vise will make removal of the two large screws more convenient. Remove the thrust pack body. Remove the thrust pack case 629344 (with bellville springs). Remove the fourteen balls 629352. Unscrew and remove the two screws 617166 in the bottom of the head assembly. Remove the right angle head cover 629343. The gears will come out with the cover. Remove the small retaining ring 847653 from the feed/retract piston shaft 629380. Do not over expand the retaining ring. Press the shaft out of the differential feed gear bearing 863582. Refer to the feed chart on assembly drawing for the appropriate feed gears. The right angle head should be securely clamped in the vise and compressed so that the two cap screws 864415 can be firmly tightened.

SHEAR PIN MAY SHEAR BECAUSE:

1. Motor doesn't stop at full retract, or the retract valve did not reset. Retract collar **4** jams against the bearing 622400. Pin shears.

2. Packed chips or dull cutter may overload the spindle. Feed rate may be too high. Drilling or reaming may be beyond the torque capability of this right angle drill. Pin shears.

3. Improper adjustment of manual retract lever may prevent automatic retract when the depth stop **6** contacts the drill head. If this occurs possible damage to gears and shearing of pin will result.

4. Gear teeth have broken, spindle threads have been damaged, or parts inside the drill head have failed.

CAUSES 1 & 2 DO NOT REQUIRE DISASSEMBLY OF DRILL HEAD:

1. For cause 1 spindle may be freed in this manner:

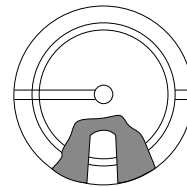
- A. Turn off air supply.
- B. Remove tool from drilling fixture.
- C. Rotate spindle with wrench (CCW from rear). . . opposite drilling direction 2 or 3 turns. This will require high torque.
- D. When spindle is free, replace shear pin. Supply air pressure and rapid advance the spindle out of the drill head.
- E. Correct malfunction and run "Tool Crib Check".

2. For cause 2 spindle may be freed in this manner:

- A. Turn off air supply.
- B. Remove tool from drilling fixture.
- C. Correct torque overload problem.
- D. Replace shear pin.
- E. Return tool to service.

3 and 4 require disassembly, cleaning, inspection, and replacement of damaged parts inside the drill head. All parts inside the drill head should be washed and re-greased. When cause of malfunction is corrected, run "Tool Crib Check".

SHEAR PIN INSTALLATION AND REMOVAL

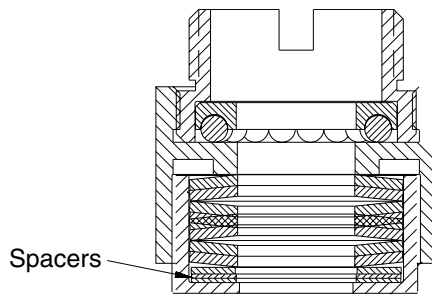


Align the "V" notch on the shaft with the "V" notch on the bevel gear. Insert a 3/32" diameter pin into the hole on the side of the bevel gear and into the shaft to maintain shear pin hole alignment while installing or removing the shear pin.

CHANGING THRUST PACKAGE:

Remove the upper block assembly following the instructions for changing feed gears.

Lift out the spring washers, the thrust race and any spacers from the thrust package. The retract thrust is changed by the addition or removal of spacers under the thrust race. Install the correct number of spacers. Reinstall the spring washers. Reinstall the upper block and side hose assembly.



Note: Spring washers must be stacked exactly as shown. Two down, two up, two down, two up. One or two spacers may be included in the spring stack and must be installed under the thrust race against the spring case. Align the bore of the spring washers to clear the 1/2" O.D. of the spindle.

LUBRICATION:

An automatic in-line filter-lubricator is highly recommended. This will supply the tool with clean, lubricated air; keep it in sustained operation; and increase tool life.

The in-line lubricator should be regularly checked and filled with a good grade of 10W machine oil. In the event an in-line lubricator is not used, the tool should be disconnected from the air supply several times daily and several drops of oil poured into the tool's air inlet bushing.

The right angle drill head should receive a generous amount of "Lubriplate #907" grease every fifteen (15) to twenty-five (25) hours of "actual motor running" time through the two (2) flush type grease fittings in the right angle head. "Lubriplate #907" may be purchased in a 5 gallon can using Part No. 107210.

GENERAL MAINTENANCE:

Air control system filter 382505 located in the handle 382480 should be replaced every 2000 drilling cycles or when low air control system pressure is suspected.

Spindle threads should be blown clean and lubricated every 100 drilling cycles.

DISASSEMBLY—DRILL HEAD:

Remove (left hand threads) the adjustable depth stop 6 from the rear of the spindle. Using the spindle "in & out" tool 382593 to support the front of the spindle, depress the rapid advance lever 2 and feed the spindle forward until the spindle feeds itself out of the spindle feed gear. Release the rapid advance lever, shut off the air supply, and pull the spindle out of the spindle drive gear. Remove the side hose assembly. Unscrew the head from the clutch housing and remove the bevel gear 622947 and bearing 847095. Remove the two small cap screws in the thrust pack body. Unscrew the two large screws 864415 holding the thrust pack body to the head assembly. Note: Clamping the tool in a vise will make removal of the two large screws more convenient. Remove the thrust pack body. Remove the thrust pack case 629344 (with bellville springs). Remove the fourteen balls 629352. Unscrew and remove the two screws 617166 in the bottom of the head assembly. Remove the right angle head cover 629343. The gears will come out with the cover.

DISASSEMBLY—RAPID ADVANCE CLUTCH:

Firmly clamp the gear case in a vise. Use a pin spanner wrench to turn the positioning ring 629307 and a appropriate wrench to turn the clutch housing 629602. NOTE: The positioning ring has right hand threads and the clutch housing has left hand threads. The clutch mechanism can be disassembled by removing the retaining ring 867924 which retains the spring and washer on the outside and the retaining pin on the inside.

DISASSEMBLY—GEAR TRAIN:

Clamp the governor housing in a vise and unscrew the gear case from the motor housing. Slip the 1st reduction spider and bearing out of the gear case.

For a double reduction gear case, clamp the gear case in a vise and remove retainer ring 864240 with two screwdrivers. Push the second reduction spider and bearing out of the gear case. Turn the gear case over and remove the retaining ring 844364 and bearing 843615.

After removing the spider bearings with a suitable bearing puller, the idler gears may be removed by driving the idler gear pins out the rear of the spiders. The pinion gear 864239 used in 4200 rpm, 3000 rpm and 620rpm power units can then be removed from the 1st reduction spider.

DISASSEMBLY - MOTOR

Slide the exhaust deflector off the motor housing. Clamp the governor housing in a vise and unscrew the clamp ring 629318. Press down on the rotor shaft while sliding the motor housing and clamp ring off the motor. Lift the motor out of the governor housing. Hold the motor cylinder and use a soft hammer to tap the rotor out of the front bearing 844772. Clamp the rotor shaft in a vise (be careful not to damage the gear teeth) and unscrew the governor assembly (or, for non-governed tools, the rotor nut). Be careful to keep the rotor collar that was in the rear bearing plate separate from the one used to space the governor body.

The governor can be disassembled by removing the two small groove pins 864821 and pushing out the two dowel pins 867388 that retain the governor weights.

DISASSEMBLY - GOVERNOR HOUSING

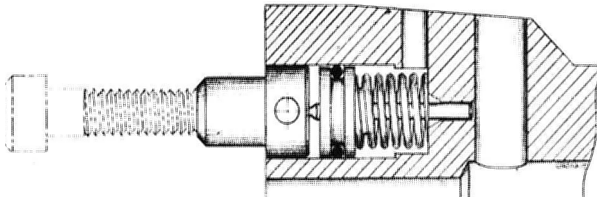
Remove the two cap screws 382524 that hold the handle to the governor housing. Remove pin 843280 from the bore. Remove retaining ring 204775 which retains rapid advance plug 629315 and spring 844869. Gently tap the housing on a wooden bench top to remove piston 629317.

Unscrew the two Pressure Caps (382380) and remove the springs 843250, balls 812156, vent piston 629320, and two pins 843280. Remove retaining ring 613126 and slide rapid advance cylinder 629321 out of the housing.

DISASSEMBLY—HANDLE

Unscrew plug 864387 and remove drill button spring 622833. Depress the drill button 382484 and use a 1/8" diameter rod to unscrew button guard 382671. Unscrew inlet bushing 867758 and remove spring 863072 and throttle valve 202365.

Unscrew end cap 382668 and spring 382489. Push out throttle piston 382677. Screw a 1/4-20 cap screw into the metering seat 382491. Clamp the cap screw in the vise and use a soft faced hammer to drive the handle off.



Filter 382505 located in 13/32" dia. hole adjacent to the metering seat should be checked and replaced if necessary.

The emergency stop button 381243 should not be removed unless the O-ring 844301 needs replacing. Clamp the stop button in the vise and use a soft faced hammer to drive the handle off. Tap the bushing 202354 with a 1/4-20 thread. Screw a 1/4-20 bolt into the bushing, clamp the bolt in the vise and use a soft faced hammer to drive the handle off.

Unscrew the check valve seat 382487 and remove O-ring 844302, 3/16" steel ball 842161 and check valve spring 382488. NOTE: Spring is very small.

REASSEMBLY— GENERAL

The tool is reassembled in the reverse order of disassembly. Clean all parts thoroughly in a solvent and inspect for damage or wear. Check all bearings for wear which can be detected by excessive end play and/or roughness which would indicate a brinelled condition. Inspect and replace any O-ring that is damaged or worn. Rotor blades should be replaced at every repair cycle or if they measure less than 7/32" (5.56mm) at either end. All gear teeth, bearings, and pins should receive a close inspection and be replaced if necessary.

All gears and bearings in the planetary gear train should receive a generous amount of NLGI 2-EP grease during reassembly.

All gears and bearings in the right angle drill head should receive a generous amount of "Lubriplate #907" grease during reassembly.

Lubricate all O-rings during reassembly with 10W machine oil.

HANDLE REASSEMBLY:

Insert throttle piston 382677 (with O-rings) into throttle piston cylinder 382676. Replace spring 382489 and end cap 382668.

Rotate the throttle piston 382677, to line up the slot for the throttle valve 202365. Replace spring 863072, O-ring, and inlet bushing 867758. If the screen in the inlet bushing is torn or clogged, replace the inlet bushing.

Insert spring 382489, O-ring 844307, and latch piston 382490, into handle. Line up the air ports in the metering seat 382491, and handle 382480, and tap the metering seat into the handle until the shoulder on the seat is flush with the surface of the handle. Use a 1/4-20 bolt to tap or press the metering seat.

Install the drill button and shaft assembly 381171, using a thread retaining compound. Install the drill button spring 622833 and plug 864387 with O-ring.

Press the stop button assembly 381243, into the handle until the shoulder on the bushing is flush with the handle.

When installing the check valve assembly, the spring 382488, should be installed with the small coil up. Use a slender rod. Place the 3/16" steel ball 842161, on the small coil and the O-ring 844302, on the top of the ball. Install the check valve seat 382487, and O-ring 844303, and tighten firmly.

GOVERNOR HOUSING REASSEMBLY:

Install snap ring 204776 in the large bore with the gap at the top.

Install O-rings 615645 on piston 629317. Lube O-rings with grease and insert piston, solid end first, into piston bore until the small hole is visible through slot in the main bore.

Install a dowel pin 843280 round end up in the small hole in the piston with some grease to retain it. The piston should slide freely in the bore.

Install spring 844869 and plug 629315 into the piston bore and secure them with retaining ring 204775.

Mount the Lever 382503 to the Rapid Advance Cylinder 629321 with Screw 382504. Mount the Lever so that the thumb pad is on the opposite side from the two cutouts on the cylinder.

Grease the cylinder and install it in the cylinder bore. Secure with Snap Ring 613126.

Install Screw 386090 into back of housing.

Install Pins 843280, round end down into valve bores. Lightly lube Piston 629320 and install it on the pin 843280 in the valve bore nearer the lever. Insure that the piston moves freely in the bore.

Install a ball 812156, spring 843250 and cap 382380 in each valve bore.

Install Right Angle Fitting 382664 in NPT port on side of housing. Align it to face the front of the housing.

When assembled, one should be able to depress the rapid advance lever till it hits the positive stop, and the lever should snap back to the starting position.

FINAL REDUCTION ASSEMBLY:

Reassemble in the reverse order of disassembly. Grease all parts with a good grade of NLGI 2-EP grease. For the 4200rpm and 620 power units, the pinion gear 864239 must be installed in the spider before the idler gears.

POWER UNIT REASSEMBLY:

Apply a thin film of grease to both sides of gasket 382492. Assemble handle subassembly to governor housing subassembly with the gasket between. Secure with two screws 382524 .

MOTOR:

Measure the length of the cylinder 629324. Size four rotor blades 625577 .005 inches shorter than the cylinder.

Measure the length of the cylinder and the length of the body of the rotor. Subtract the rotor body length from the cylinder length and divide the difference by two. This is the rotor end clearance.

Install bearing 847095 in rear bearing plate 629325. Lightly load the inner race of the bearing. Using a depth micrometer, measure the distance from the flat face of the bearing plate to the inner race. Add the rotor end clearance to get the rotor collar thickness. Select the rotor collar that most closely matches the calculated thickness.

Rotor Collar	Thickness	Part Number
.1850		869260
.1860		869261
.1870		869262
.1880		204778
.1890		843913

Place the rotor collar selected on the threaded end of the rotor with the large chamfer facing the rotor body. Install set screw 867086 in rotor with hex into hole first. For the 1100 rpm motor (380 rpm spindle) and the 230 rpm motor (75 rpm spindle) the set screw must be inserted normally.

Insert the governor stem 629329 into governor spider 865686 from the non-threaded end. Place the two governor weights 865663 in the spider slots and insert two governor weight pins 867388. Press the two lock pins 864821 in the small holes to retain the weight pins.

Place the rear bearing plate with the bearing in place on the threaded end of the rotor. Install Rotor collar 843913, to act as a spacer, and the Reversing Valve 629327 (with the small pocket facing away from the bearing plate) against the rear bearing plate. Insert the governor spring 867084 into the rotor. Screw the governor assembly onto the rotor and tighten.

Lubricate the rotor blades with 10 wt. oil and insert them into rotor slots. Slide cylinder 629324 over the rotor and insert the alignment pin in the cylinder into the hole in the rear bearing plate. Install front bearing plate 864235 and press front bearing 844772 into place. While lying in a V-block, the rotor should turn with no indication of dragging or rubbing.

POWER UNIT ASSEMBLY:

Insert the motor, governor end first, into the governor housing. The reversing valve should lie on the large retaining ring in the housing bore, and the pin in the reversing piston should engage the small pocket on the face of the reversing valve. The alignment button on the rear bearing plate should fit in the small cutout at the top of the governor housing bore.

Slide the motor housing 629319 over the motor. Align the pin in the motor housing to the hole in the governor housing. Clamp the motor housing to the governor housing using clamp nut 629318.

Install two muffler elements 629323 in exhaust deflector 629322, covering the exhaust slots. Install two muffler elements 203632 inside of the 629323 elements. Of the three cavities in the exhaust deflector, the middle one remains empty. Install O-ring 617754 in the groove. Slide the exhaust deflector over the motor.

REASSEMBLE AND INSTALL THE GEAR TRAIN:

FOR THE 4200rpm, 3000rpm and 620rpm power units, the pinion gear 864239 must be installed in the spider before the idler gears. Plug the right angle fitting and run the power unit. The output RPM should be no more than 10% above or below the rated speed. Adjust governor if necessary. For 1100 rpm motor (380 rpm spindle) and 230 rpm motor (75 rpm spindle), the power unit must be disassembled and the governor removed to adjust the set screw. Turn the screw counterclockwise to increase motor speed, and clockwise to decrease motor speed. For all other power units, remove the gear train and use a long Allen wrench to turn the governor set screw. Turn the screw clockwise to increase motor speed, and counter clockwise to decrease motor speed.

RAPID ADVANCE OVERLOAD CLUTCH ASSEMBLY:

Insert two 616503 bushings into 629312 spindle (The bushings might be slight press fits in the spindle.) Lubricate the large spline on the spindle and install 382536 Clutch Jaw. The clutch jaw should slide freely. Install 629309 driving clutch jaw and secure with 629310 retaining pin. Pin should sit flush with or slightly below the spindle surface. Install 204349 spring, 852264 washer and 867924 retaining ring. With the spline clamped in a vise, use a torque wrench to turn the hex on the driving jaw. The clutch should trip between 3 and 5 inch pounds. If the clutch torque is too light, disassemble the unit and press the shaft of the driving jaw in to shorten its length by .020 inches. Install 203339 Belleville Spring Washer over the small spline of the clutch spindle with the dished side towards the clutch.

Thread 629307 Positioning Ring onto 629302 Clutch Housing with the holes in the ring towards the smaller threads.

If the subassembly is to be checked into stock or sent out as spare parts, place both components in a plastic bag to keep them together.

RIGHT ANGLE HEAD ASSEMBLY: BOTTOM COVER PLATE:

Install bearing 622400 in the large bore of the right angle head cover 629343. Press the bearing 847609 into the differential drive gear 629367. Insert gear post 629365 into the bore of the bearing and press the post into the housing cover. Press the spindle drive gear 622950 into the bore of bearing 622400. Press the idler gear post 629359 into the head cover. Insert the signal valve shaft 629355 and the spring 867895 into the angled bore of the head cover. Install plug 843434. Insert bearing 847609 into the small bore at the end of the plate.

Install bearing 617980 and two retaining rings 619016 into idler gear 622948. Slip the idler gear on the idler gear post. Slide idler gear spacer 629351 onto the idler gear post.

Press shear pin gear 627628 into bearing 629353. Insert pinion 629376 into the shear pin gear and install shear pin 629377. Insert the small diameter of the pinion into the bore of bearing 847609.

HOUSING:

Install O-ring 844305 in the stop collar in housing 629384 and lubricate with grease.

Insert bearing 863582 into the differential feed gear and secure with retaining ring 844568.

Install spring 832595 and feed/retract piston 629380 into right angle head housing 629384. Compress the spring and install the differential feed gear on the shaft of the feed/retract piston. The bearing should have a press fit on the piston shaft, and the gear should be installed with the snap ring facing the small diameter end of the shaft. Install washer 623538 and secure with retaining ring 847653.

THRUST PACK BODY:

Clean and lubricate the valve bore of the thrust pack body 627851. Insure that the retract valve 382333 slides freely in the bore. Install O-ring 844306 on the retract valve and grease the valve and O-ring. Install spring 382540 on the end of the retract valve. Insert the retract valve, spring end first, into the bore in the thrust pack body. Thread air tube fitting 629366 into the valve bore and tighten.

Lubricate retract sensor piston 629378 and insert it stepped side first into the thrust pack body. Rotate the piston so that the piston does not protrude into the thrust pack bore.

Insert spring 843030 into the blind hole in the recess for the retract lever. Install retract lever 629374, Retract trigger 629379 and slotted pin 619154. Insure that the lever and trigger move freely.

FINAL ASSEMBLY OF THE HEAD:

Lubricate the small diameter of the feed/retract piston and the teeth of all the gears on the cover plate and the differential feed gear with grease.

Place the housing over the bottom cover plate. The bottom face of the housing should meet the face of the cover plate. Secure with two screws 617166.

Install O-ring 844310 on the feed/retract piston and lubricate with grease.

Grease the teeth and bottom surface of the spindle feed gear, and install in the head.

Install retaining ring 629387 in the large bore of the housing. Align the gap in the retaining ring towards the gear stop.

Grease the ball race on the differential feed gear. Install fourteen balls 629352 in the ball race of the spindle feed gear.

Grease the outside and the ball race of thrust pack case 629358. Set the thrust pack case on the spindle feed gear and rotate it to make sure the balls are properly aligned in the races.

Install the proper number of spacers 629344 for the head being built. (High thrust - 2, Standard thrust - 1, Low thrust - 0) Install 883975.

Install eight Bellvilles 629372 in the thrust pack case. The bellvilles should be stacked in pairs. The first and third pairs should be set with the dished side facing up. The second and fourth pairs should face down.

Place O-ring 844301 on top of the idler gear post.

Place the thrust pack body on top of the head assembly. Insure that the retract piston is aligned such that the small step will land on the thrust pack case. Guide the feed/retract piston into the bore in the thrust pack body. Install two screws 617166, 382539, and 617396 finger tight. Tighten the two larger screws alternately to pull the thrust pack body evenly to the head assembly. Tighten the two smaller screws.

Temporarily insert a spindle into the differential drive gear and insure that everything turns freely and evenly.

Adjust the small set screw in the retract lever to set the pad of the lever even with the top of the thrust pack body. Secure with Loc-Tite 290.

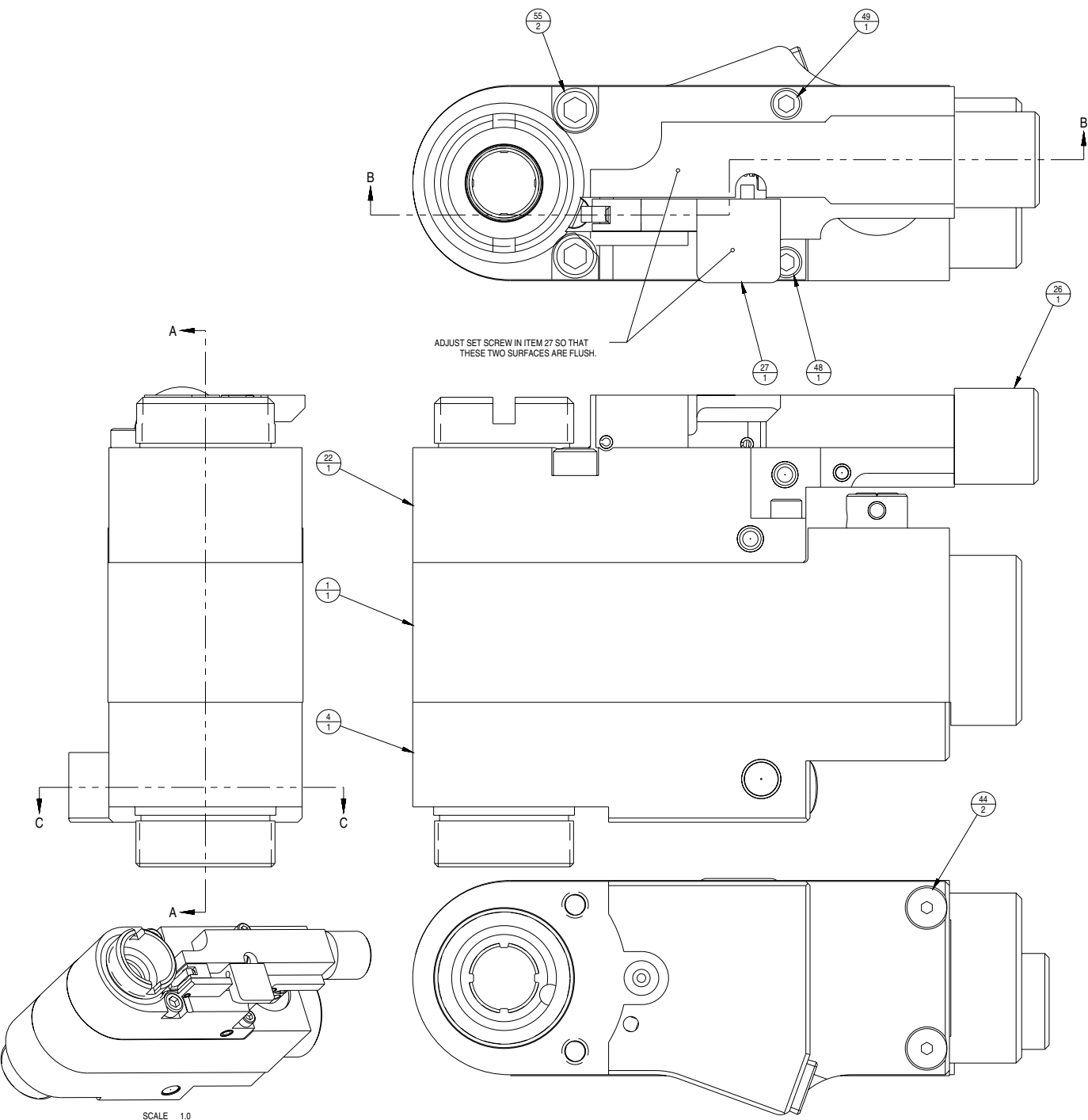
Grease the ball race of stop collar thrust race 629356. Place eighteen balls 844265 in the race. Install the thrust race and guard coupling 629357 in the thrust pack body.

Press bearing 847095 onto driving bevel gear 622947. Grease the gear teeth and insert the gear into the housing.

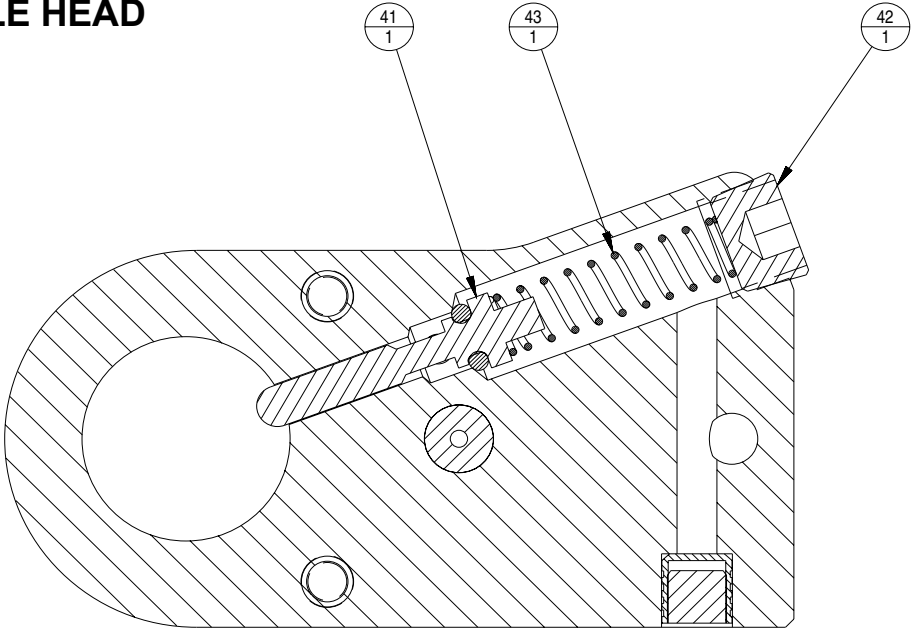
FINAL ASSEMBLY:

Screw the Rapid advance clutch housing into the right angle head and tighten. Insert the clutch into the bevel gear in the right angle head. Unscrew the positioning ring until one or two threads are showing. Thread the clutch housing into the gear case making sure that the hex of the clutch is inserted into the gear train spider. Thread the clutch housing until it bottoms out against the gear case. Unscrew the clutch housing until the top of the right angle head is aligned with the top of the green drill button. With the power unit clamped in a vise, hold the clutch housing with a wrench and tighten the positioning ring. Install the side hose.

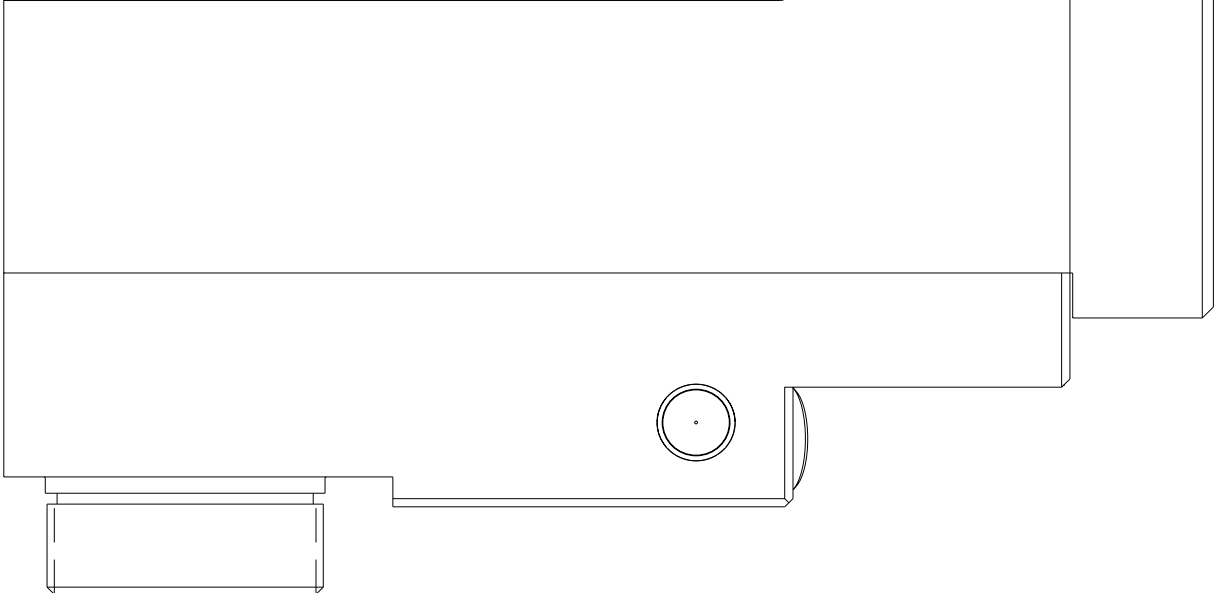
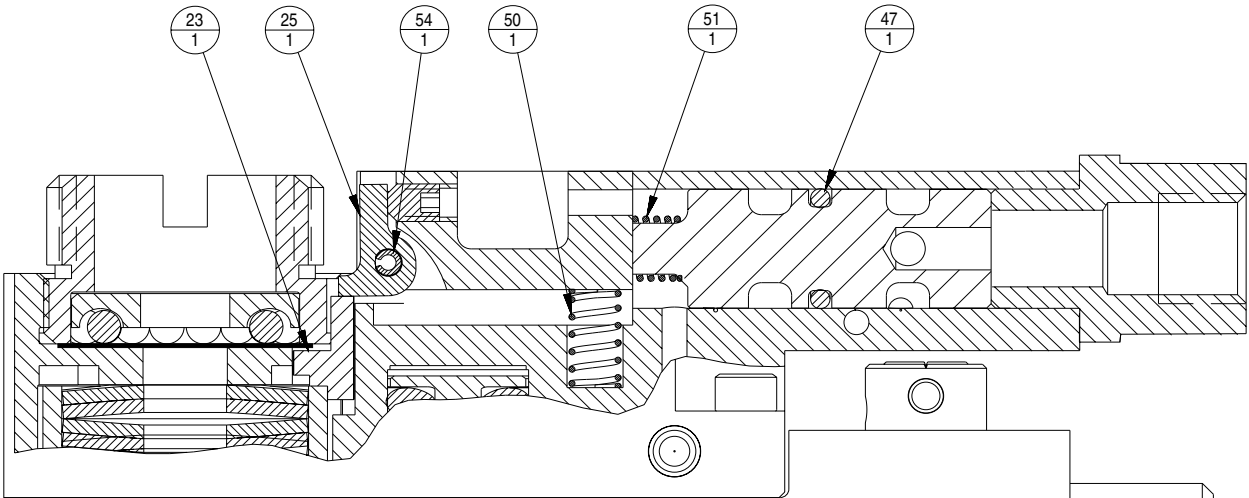
RIGHT ANGLE HEAD



RIGHT ANGLE HEAD

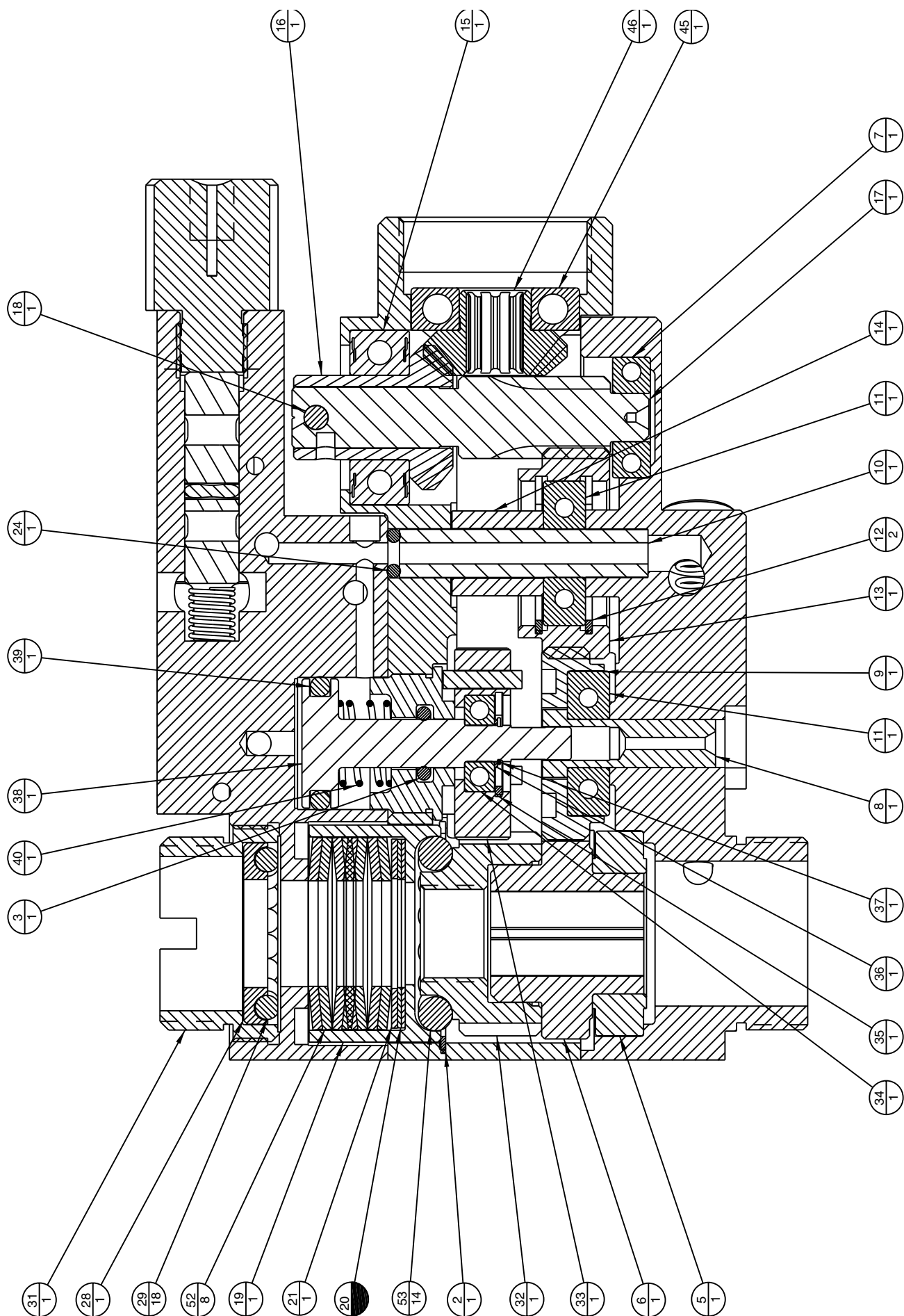


SECTION C-C



SECTION B-B

RIGHT ANGLE HEAD



SECTION A-A

PARTS LIST FOR RIGHT ANGLE HEAD

ITEM	PART NO.	PART NAME	QTY.
1	629384	HOUSING, RIGHT ANGLE HEAD	1
2	629387	RING, RETAINING (1-3/16 UR SERIES)	1
3	844305	RING, O (.070 CROSS SECTION)	1
4	629343	COVER, RIGHT ANGLE HEAD	1
5	622400	BEARING, BALL	1
6	629640	GEAR, SPINDLE DRIVE	1
7	847609	BEARING, BALL	1
8	629365	POST, GEAR	1
9	629367	GEAR, DIFFERENTIAL DRIVE	1
10	629359	POST, IDLER GEAR	1
11	617980	BEARING, BALL	1
12	619016	RING, RETAINING	2
13	622948	GEAR, IDLER	1
14	629351	SPACER, IDLER GEAR	1
15	629353	BEARING, BALL	1
16	627628	GEAR, DRIVEN	1
17	629376	PINION	1
18	629377	PIN, SHEAR	1
19	629358	CASE, THRUST PACK	1
20	629344	SPACER	*
21	883975	RACE, THRUST	1
22	627851	BODY, THRUST PACK	1
23	629378	PISTON, RETRACT SENSOR	1
24	844301	RING, O (.070 CROSS SECTION)	1
25	629379	TRIGGER, REVERSE	1
26	629366	FITTING, AIR TUBE	1
27	629374	LEVER, RETRACT	1
28	629356	RACE, STOP COLLAR THRUST	1
29	844265	BALLS	18
31	629357	COUPLING, GUARD (incl. 883975)	1
32	SEE TABLE 1	GEAR, SPINDLE FEED	1
33	SEE TABLE 1	GEAR, DIFFERENTIAL FEED	1
34	863582	BEARING, BALL	1
35	844568	RING, RETAINING	1
36	623538	WASHER, FLAT	1
37	847653	RING, RETAINING	1
38	629380	PISTON, FEED/RETRACT	1
39	844310	RING, O	1
40	832595	SPRING, RETURN	1
41	629355	SHAFT, SIGNAL VALVE	1
42	843434	PLUG, PRESSURE	1
43	867895	SPRING, RESET PIN	1
44	617166	SCREW, SFCHC	2
45	847095	BEARING, BALL	1
46	622947	GEAR, BEVEL DRIVING	1
47	844306	RING, O (.070 CROSS SECTION)	1
48	617396	SCREW, SHC (6-32UNC)	1
49	382539	SCREW, SHC (6-32UNC)	1
50	843030	SPRING, SOCKET LOCK PIN	1
51	382540	SPRING, RETRACT VALVE	1
52	629372	WASHER, BELLEVILLE SPRING	8
53	629352	BALL	14
54	844234	PIN, SLOTTED SPRING	1
55	864415	SCREW, SHC (10-24UNC-3A)	2
56	844833	BEARING, BALL	1

TABEL 1				
SUBASSEMBLY PART NO.	SPINDLE FEED GEAR	DIFFERENTIAL FEED GEAR	NO. OF SPACERS	FEED RATE/ RETRACT THRUST
631956	629347	629361	0	.0005 I.P.R./LOW THRUST
631942	629348	629362	0	.001 I.P.R./LOW THRUST
631943	629349	629363	0	.002 I.P.R./LOW THRUST
631944	629346	629360	0	.003 I.P.R./LOW THRUST
631945	629350	629364	0	.006 I.P.R./LOW THRUST
631946	629347	629361	1	.0005 I.P.R./STD. THRUST
631947	629348	629362	1	.001 I.P.R./STD. THRUST
631948	629349	629363	1	.002 I.P.R./STD. THRUST
631949	629346	629360	1	.003 I.P.R./STD. THRUST
631950	629350	629364	1	.006 I.P.R./STD. THRUST
631951	629347	629361	2	.0005 I.P.R./HIGH THRUST
631952	629348	629362	2	.001 I.P.R./HIGH THRUST
631953	629349	629363	2	.002 I.P.R./HIGH THRUST
631954	629346	629360	2	.003 I.P.R./HIGH THRUST
631955	629350	629364	2	.006 I.P.R./HIGH THRUST

SUBASSEMBLY INCLUDES: SPINDLE FEED GEAR, DIFFERENTIAL FEED GEAR & SPACERS.

* SEE TABLE 1 *

PARTS NOT SHOWN ON DRAWINGS

Label - 613828

Screw (2) - 834228

Grease Fitting (2) - 843589

Retract Stop Collar - 629375

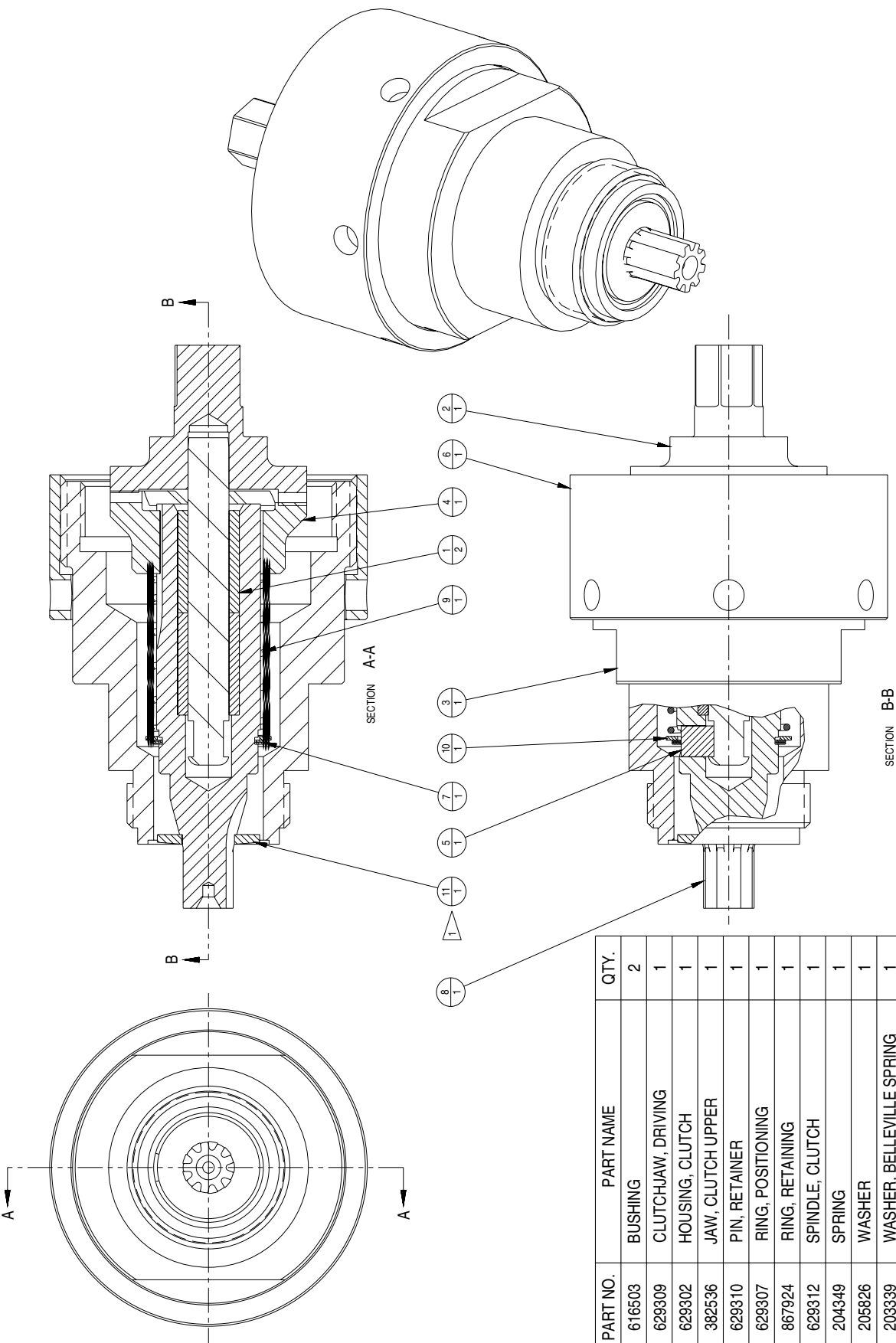
Adustable Depth Stop - 617962
(incl.617785)

Side Hoses - Power Unit RPM

629316 - 230, 360, 475, 620

382376 - 1100, 1740, 3000, 4200

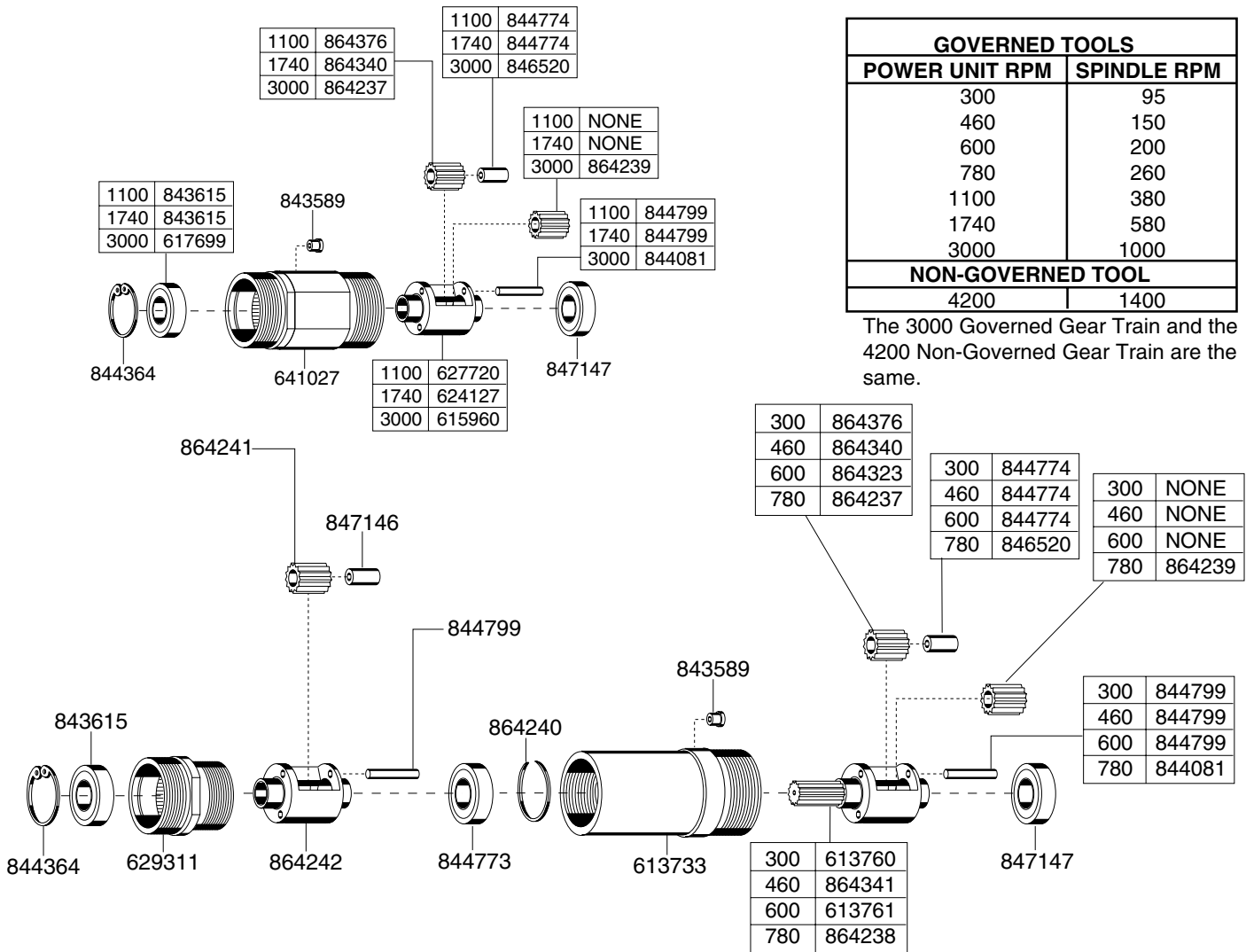
RIGHT ANGLE CLUTCH - 631928



ITEM	PART NO.	PART NAME	QTY.
1	616503	BUSHING	2
2	629309	CLUTCHJAW, DRIVING	1
3	629302	HOUSING, CLUTCH	1
4	382536	JAW, CLUTCH UPPER	1
5	629310	PIN, RETAINER	1
6	629307	RING, POSITIONING	1
7	867924	RING, RETAINING	1
8	629312	SPINDLE, CLUTCH	1
9	204349	SPRING	1
10	205826	WASHER	1
11	203339	WASHER, BELLEVILLE SPRING	1

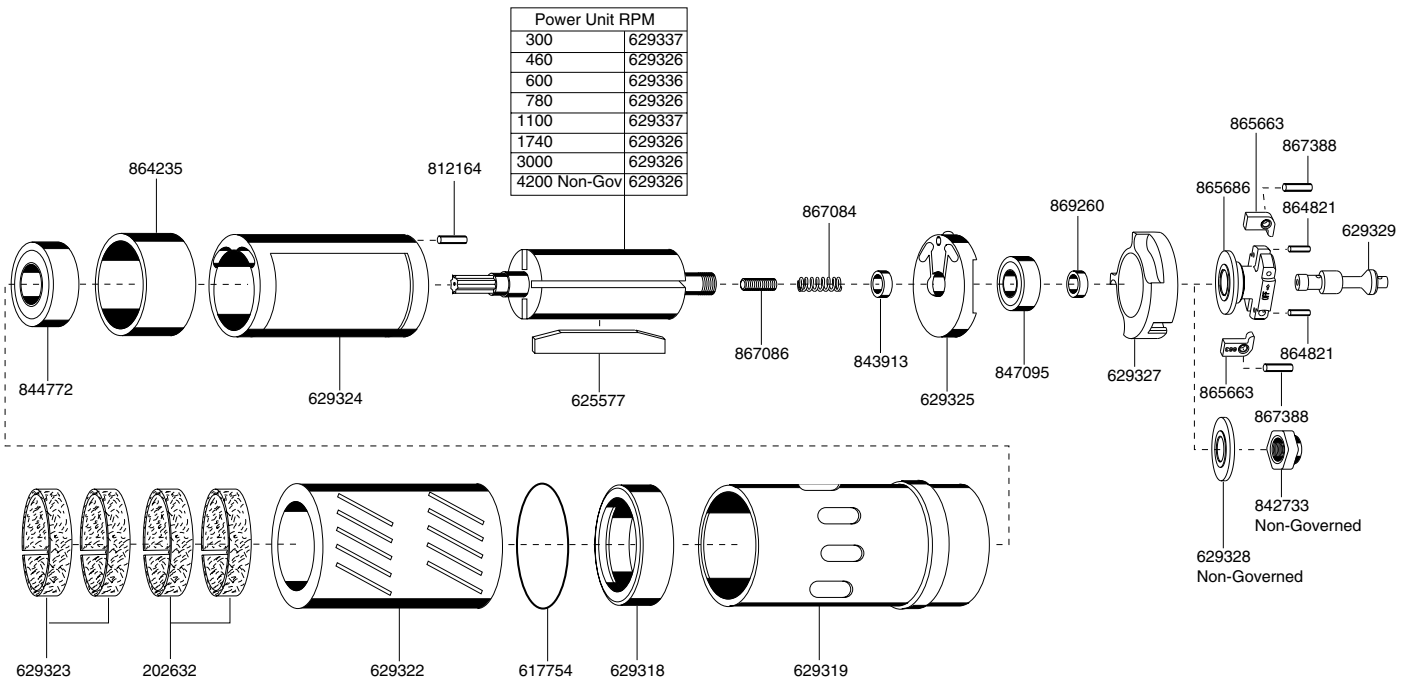
1 ORIENT ITEM 11 AS SHOWN.

RIGHT ANGLE POWER UNIT GEAR TRAINS



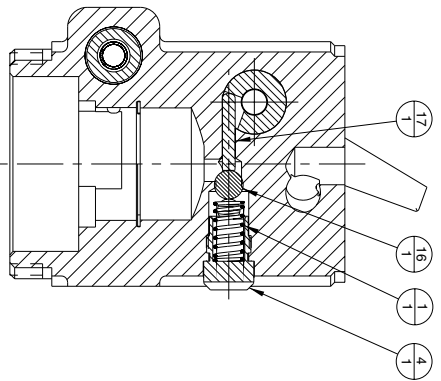
PART NO.	NAME OF PART	QUANTITY						
		POWER UNIT RPM						
		300	460	600	780	1100	1740	3000
613733	Double Reduction Gear Case	1	1	1	1	-	-	-
613760	1st Reduction Spider	1	-	-	-	-	-	-
613761	1st Reduction Spider	-	-	1	-	-	-	-
615960	Spider	-	-	-	-	-	-	1
617699	Front Bearing	-	-	-	-	-	-	1
624127	Spider	-	-	-	-	-	1	-
627720	Spider	-	-	-	-	1	-	-
629311	Adaptor	1	1	1	1	1	1	1
641027	Single Reduction Gear Case	-	-	-	-	1	1	1
843589	Grease Fitting	1	1	1	1	1	1	1
843615	Bearing	1	1	1	1	1	1	-
844081	Gear Pin	-	-	-	1	-	-	2
844364	Bearing Retainer Ring	1	1	1	1	1	1	1
844773	2nd Reduction Spider Bearing	1	1	1	1	1	1	1
844774	Gear Bearing	2	2	-	-	-	-	2
844799	Gear Pin	2	2	2	2	-	-	-
847146	Gear Bushing	2	2	2	2	-	-	-
847147	1st Reduction Spider Bearing	1	1	1	1	1	1	1
847183	Gear Bushing	-	-	2	2	-	-	2
864237	Idler Gear (incl. 846520)	-	-	-	2	-	-	2
864238	1st Reduction Spider	-	-	-	1	-	-	-
864239	Rotor Pinion	-	-	-	1	-	-	1
864240	Double Reduction Gear Case Snap Ring	1	1	1	1	-	-	-
864241	Idler Gear (incl. 847146)	2	2	2	2	-	-	-
864242	2nd Reduction Spider	1	1	1	1	-	-	-
864323	Idler Gear (incl. 844774)	-	-	2	-	-	-	-
864340	Idler Gear (incl. 844774)	-	2	-	-	-	2	-
864341	1st Reduction Spider	-	1	-	-	-	-	-
864376	Idler Gear (incl. 844774)	2	-	-	-	2	-	-

RIGHT ANGLE MOTOR & HOUSING

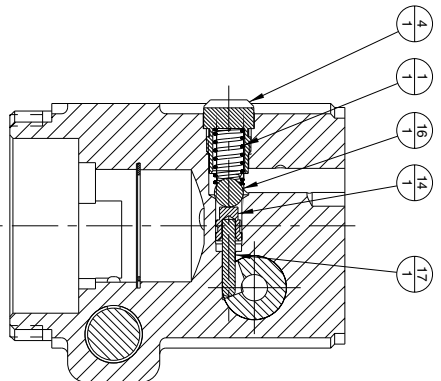
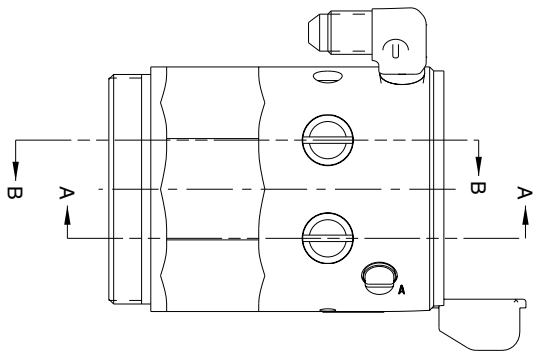


PART NO.	NAME OF PART	QTY.
202632	Muffler Pad	2
617754	O-ring	1
625577	Rotor Blade	4
629318	Clamp Ring	1
629319	Motor Housing	1
629322	Exhaust Deflector	1
629323	Muffler Element	2
629324	Cylinder	1
629325	Rear Bearing Plate	1
629326	Rotor (460, 780, 1740, 3000 & 4200Non-Governed RPM)	1
629327	Reversing Valve	1
629328	Non-Governed Spacer	1
629329	Governor Valve	1
629336	Rotor (600 RPM)	1
629337	Rotor (300 & 1100 RPM)	1
812164	Cylinder Pin	1
842733	Non-Governed Nut	1
843913	Rotor Collar	1
844772	Front Motor Bearing	1
847095	Rear Motor Bearing	1
864235	Front Bearing Plate	1
864821	Governor Weight Retainer Pin	2
865663	Governor Weight	2
865686	Governor Spider	1
867084	Governor Spring	1
867086	Set Screw	1
867388	Governor Weight Pin	2
869260	Rotor Collar	1

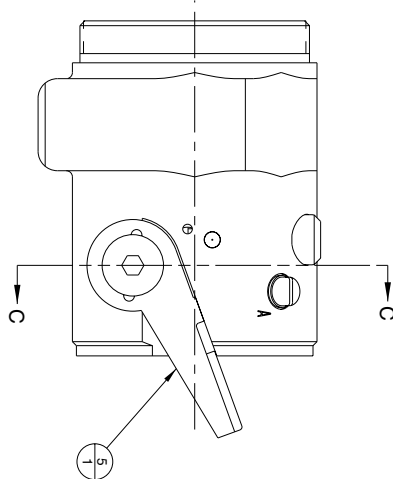
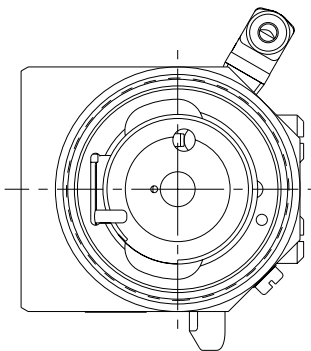
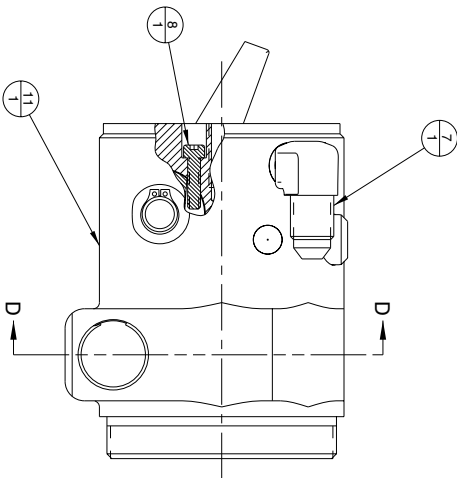
RIGHT ANGLE GOVENOR HOUSING - 631933



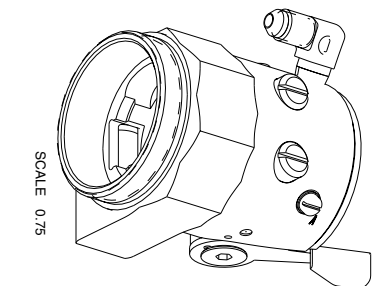
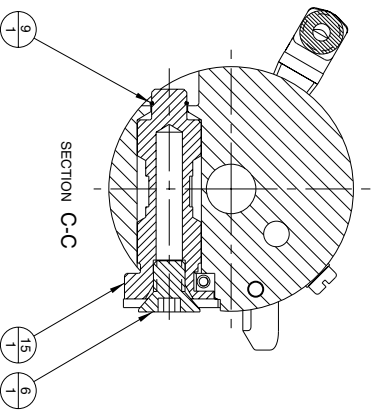
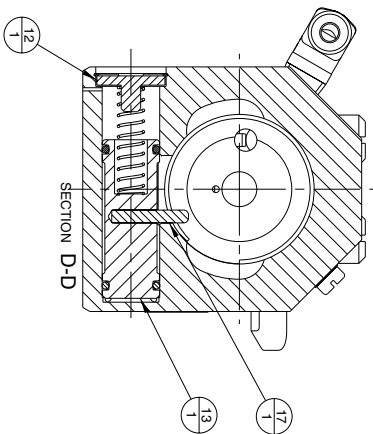
SECTION B-B



SECTION A-A

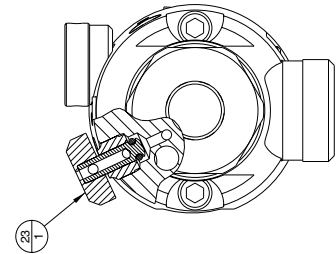
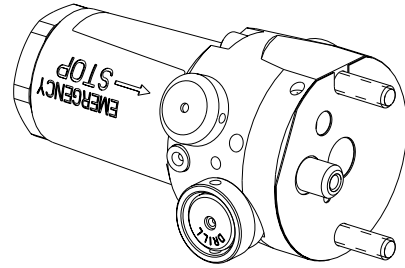
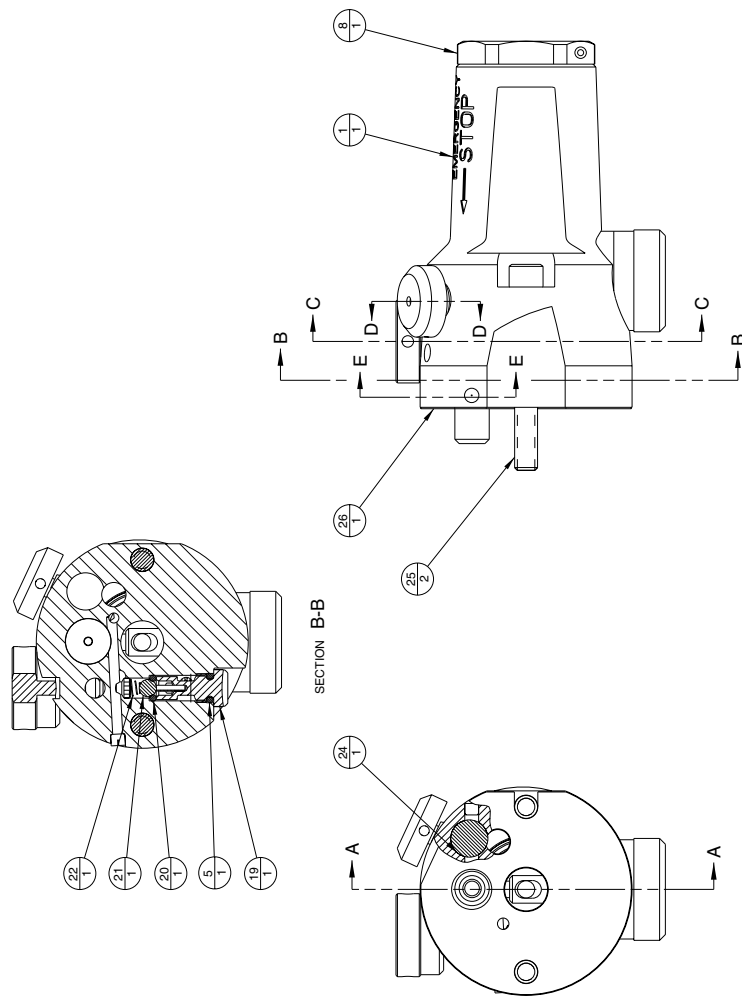


ITEM	PART NO.	PART NAME	QTY.
1	843250	SPRING, GOVERNOR VALVE	2
2	844869	SPRING (219 X 1 625)	1
3	204775	RING, RETAINING (UR SERIES)	2
4	382380	CAP, PRESSURE	2
5	382503	LEVER, RAPID ADVANCE	1
6	382504	SCREW, SFCHC	1
7	382664	ELBOW, TUBING	1
8	386090	SCREW, SHC (5-40UNC-2A)	1
9	613126	RING, RETAINING	1
10	615645	RING, O (070 CROSS SECTION)	2
11	629314	HOUSING, GOVERNOR	1
12	629315	PLUG, RAPID ADVANCE	1
13	629317	PISTON, RAPID ADVANCE	1
14	629320	PISTON, VENT	1
15	629321	CYLINDER, RAPID ADVANCE	1
16	812156	BALL	2
17	843280	PIN, DOWEL (.125 DIA)	3



SCALE 0.75

RIGHT ANGLE BACKHEAD - 631934



SECTION D-D

ITEM	PART NO.	PART NAME	QTY.
1	382460	HANDLE	1
2	382676	CYLINDER, THROTTLE	1
3	382668	CAP, END	1
4	382677	PISTON, THROTTLE	1
5	844303	RING, O (0.070 CROSS SECTION)	4
6	863009	RING, O (0.070 CROSS SECTION)	1
7	382469	SPRING, LATCH PISTON	1
8	623513	BUSHING, INLET	1
9	867732	RING, O	1
10	202365	VALVE, THROTTLE	1
11	863072	SPRING, THROTTLE VALVE	1
12	382491	SEAT, METERING	1
13	382460	LATCH AND PISTON, METERING	1
14	844307	RING, O (0.070 CROSS SECTION)	1
15	382469	SPRING, LATCH PISTON	1
16	381171	SUBASSY, DRILL BUTTON & SHAFT	1
17	864387	PLUG, OIL FILL	1
18	382732	SPRING, DRILL BUTTON (230 X .946)	1
19	382467	SEAT, CHECK VALVE	1
20	844302	RING, O (0.070 CROSS SECTION)	1
21	842161	BALL	1
22	382468	SPRING, CHECK VALVE	1
23	381243	SUBASSY, STOP BUTTON	1
24	382505	MUFFLER	1
25	382524	SCREW, SHC	2
26	382492	GASKET	1

SPINDLE GUARDS 140 RIGHT ANGLE DRILLS

SOLID SPINDLE GUARDS

Part No.	Name of Part	Qty.
624339	Spindle Guard 1"	1
624340	Spindle Guard 2"	1
624341	Spindle Guard 3"	1
624095	Spindle Guard 4"	1
624342	Spindle Guard 5"	1

Spindle Guard Caps 624355 are included with Spindle Guards.

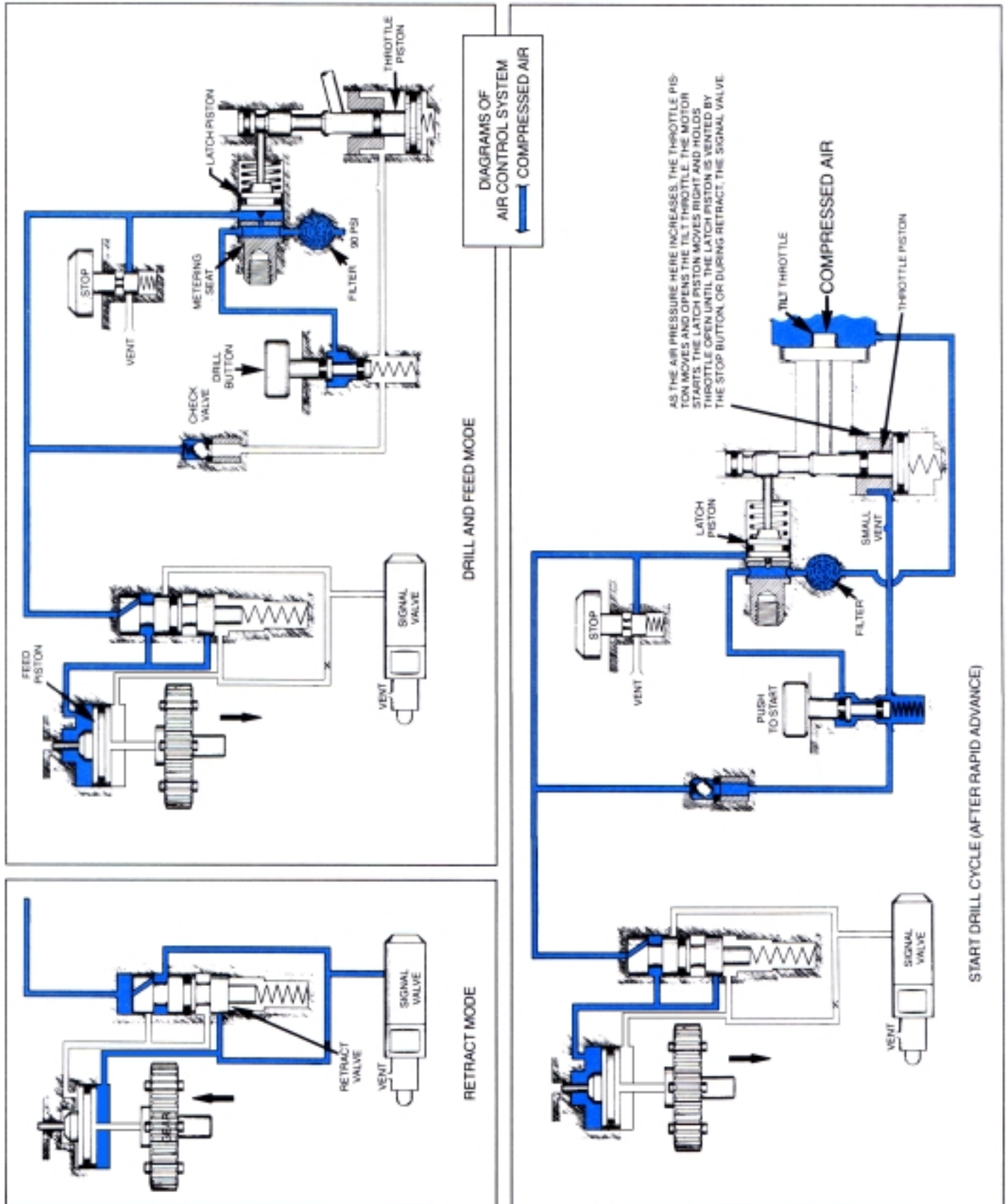
FLUID SPINDLE GUARDS

Part No.	Name of Part	Qty.
624328	Spindle Guard 2"	1
624329	Spindle Guard 3"	1
624330	Spindle Guard 4"	1
624331	Spindle Guard 5"	1

Positioning Shims 624351 and Spindle Guard Caps 624355 are included with Fluid Spindle Guards.

Other guards for special length spindles are available upon request.

140 RIGHT ANGLE DRILL AIR DIAGRAM



NOTES

[illegible]



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