

BAB 6

KESIMPULAN DAN SARAN

Pada Bab ini, akan dibahas hasil kesimpulan dan saran dari peneilitian yang telah dilakukan.

6.1. Kesimpulan

Rancangan program *preventive maintenance* dengan pendekatan *Total Productive Maintenance* (TPM) di PT Rama Gombang Sejahtera untuk mencegah terjadinya *breakdown* di mesin *jumping saw* dilakukan dengan langkah-langkah sebagai berikut:

- a. Identifikasi *six big losses* dengan menggunakan model OEE
 - i. Pengukuran tingkat efektivitas mesin *jumping saw* 1 menggunakan dasar OEE di PT Rama Gombang Sejahtera didapatkan nilai rata-rata untuk bulan Juni 2016 adalah 55,13%. Sedangkan untuk mesin *jumping saw* 2 didapatkan nilai rata-rata untuk bulan Juni 2016 adalah 53,80. Nilai OEE ini masih berada dibawah standar nilai OEE menurut *Japan Institute of Plant Maintenance* yaitu 85%.
 - ii. Faktor yang sangat berpengaruh terhadap rendahnya nilai OEE pada mesin *jumping saw* 1 dan 2 adalah nilai *quality*
 - iii. Persentase nilai *quality* terbesar pada *jumping saw* 1 yaitu 79,13% dan yang terendah yaitu 57,27%, sedangkan pada *jumping saw* 2 nilai *quality* terbesar yaitu 92,6 % dan yang terendah yaitu 47,73%.
 - iv. Kerugian terbesar pada perusahaan terdapat pada *reduce speed* mesin *jumping saw* 1 dengan *losses* yaitu sebesar 34,2%. Sedangkan pada mesin *jumping saw* 2 kerugian terbesar terdapat pada *defect losses* yaitu sebesar 31,36%.
 - v. *Reduce speed losses* disebabkan oleh operator menunggu bahan baku balok, pengambilan bahan baku tumpukan balok yang berjarak 2 meter di belakang operator mesin *jumping saw*, selain itu karena adanya pemadaman listrik.
 - vi. *Defect losses* disebabkan oleh kerusakan *blade*/mata pisau, proses memasukan balok kayu yang akan dipotong terlalu terburu-buru
- b. Pengumuman manajemen atas di PT. Rama Gombang Sejahtera mengenai penerapan TPM.
- c. Pengenalan dan Pendidikan TPM

- d. Pembentukan Organisasi TPM
- e. Penerapan Pilar-pilar TPM
 - i. Pilar Pertama: 5S
 - ii. Pilar Kedua: *Autonomous Maintenance / Jishu Hozen*
 - iii. Pilar Ketiga: Kaizen (*Focus Improvement*)
 - iv. Pilar Keempat: *Planned Maintenance*

6.2. Saran

- a. PT. Rama Gombong Sejahtera perlu melakukan perbaikan mengenai pencatatan data sesegera mungkin
- b. Perlu dilakukan pengawasan terhadap jalannya penerapan pilar-pilarTPM.

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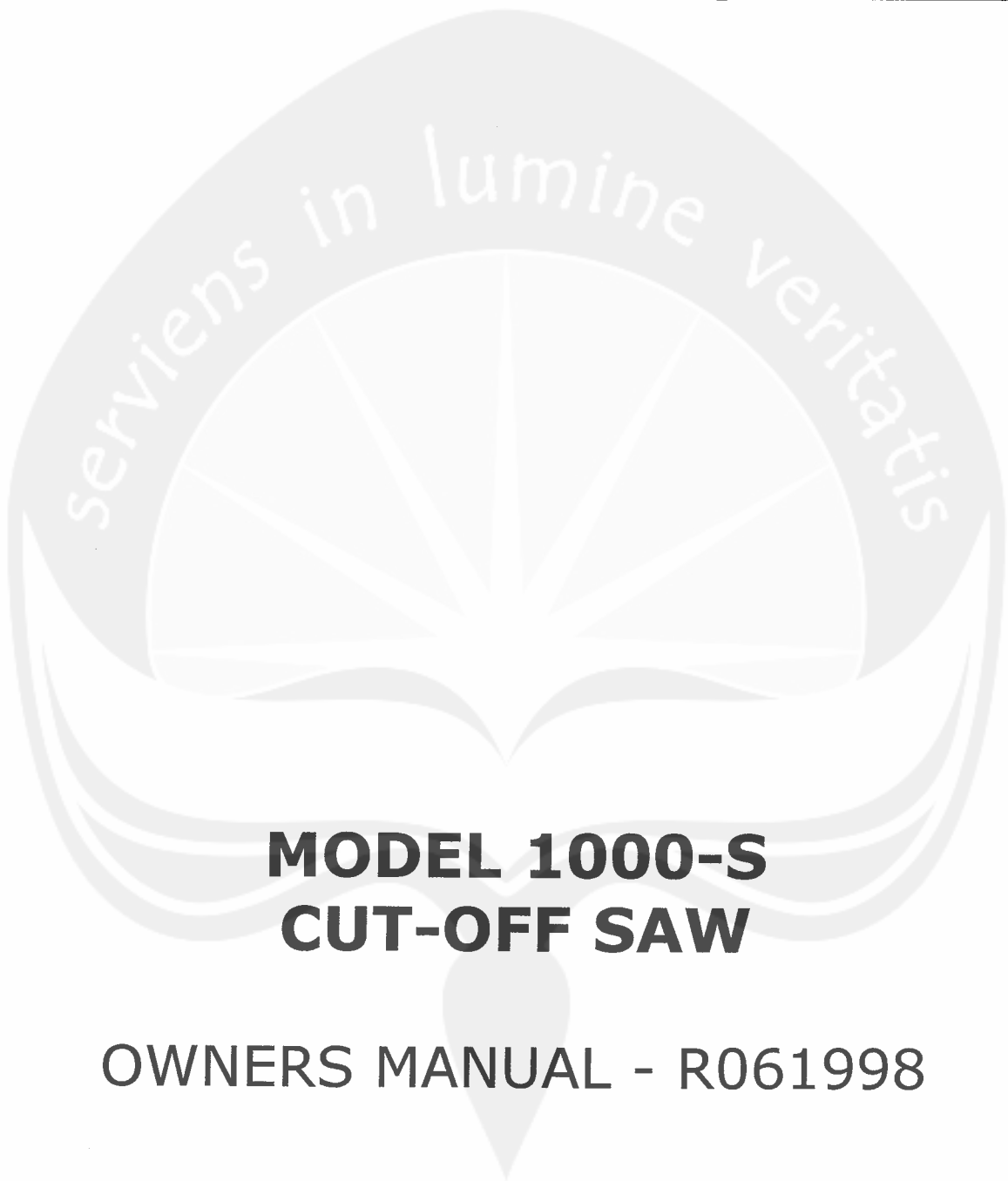
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WHIRLWIND, INC.



MODEL 1000-S CUT-OFF SAW

OWNERS MANUAL - R061998

Whirlwind Inc.

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Owners Manual For Whirlwind Model 1000-S Cut-Off Saws

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General Safety Rules For Operating Whirlwind Saws

- 1) **READ AND UNDERSTAND THE OPERATING INSTRUCTIONS BEFORE OPERATING THE SAW.**
- 2) If you are not thoroughly familiar with the operation of the equipment assigned to you, obtain advice from your supervisor, instructor or other qualified person. You may also refer to the Operator's Manual.
- 3) Do not operate any piece of equipment while under the influence of any type of medication, alcohol or drugs.
- 4) Always wear eye protection. (Safety glasses or a face shield.)
- 5) Remove loose clothing, tie, rings, watch and other jewelry, and roll up shirt sleeves.
- 6) Guards and other safety devices should be in place and used at all times.
- 7) **KEEP HANDS OUT OF BLADE PATH. NEVER PUT HANDS UNDER YELLOW GUARD / CLAMP OR SENSOR.**
- 8) Always use a "push stick" or air "blow-gun" to clear away chips and sawdust.
- 9) Avoid awkward positions and hand operations where a sudden slip could cause your hand to move into the blade area.
- 10) Do not work with material that is too large or too small to handle safely.
- 11) Make all adjustments with the power off. (Air and electricity.)
- 12) Lock-out the machine from all power sources (air & electricity) and wait for blade to come to a **complete stop** before making repairs or performing maintenance.
- 13) Never attempt to free a stalled saw blade without first turning the saw off.
- 14) Shut off all power sources (air & electricity) and clean the machine before you leave it.
- 15) Check saw for damaged parts before using it. **REPORT ANY PROBLEMS** to your supervisor.
- 16) Never leave tool running-unattended. Turn off power (air & electricity). Don't leave saw until blade comes to a complete stop.
- 17) If in doubt as to what you should do, call Whirlwind Inc. The telephone number is located on the Caution Label on the air cut-off valve.

SAFETY FIRST!

Set-Up and Maintenance Instructions for

Whirlwind Model 1000-S Cut-Off Saws

Before we get started, a word of thanks is in order for your purchase of a Whirlwind Model 1000-S cut-off saw. We have a lot of competition in this field and we certainly thank you for choosing our products.

In preparing this manual we've tried to provide the answers to most problems that might arise. However, if we've missed something, please give us a call. You should also be aware of the fact that an Operator's Manual has been provided with this machine. We urge you to have each and every operator spend a little time becoming familiar with it. We also have an Instructional Video available for those firms who use audio-visual training devices.

This machine, like every Whirlwind, was tested under power for 4-5 hours prior to shipment. Nothing but the best components and raw materials were used in its construction. Like any quality tool, it must be properly maintained to give peak performance. The Operator's Manual addresses a few pre-operational tests which should be performed regularly. Any malfunctions should be corrected immediately.

A number of safety devices including our patented "Work Presence Sensor" are on this machine. These devices are for the protection of the operator.

CAUTION: THESE DEVICES MUST NOT BE REMOVED OR TAMPERED WITH.

The "Work Presence Sensor" will prevent the saw from cycling unless material is in place and the guard / clamp is adjusted properly. This device prevents the operator from inadvertently getting his fingers between the lumber and the guard / clamp.

CAUTION: NEVER PUT FINGERS UNDER GUARD / CLAMP OR SENSOR.

Again, I would like to thank you for choosing Whirlwind and for buying an American product! I'm confident you will be impressed with our products and with our service. With proper care, your Whirlwind model 1000-S cut-off saw should give your company many years of service.

For your records, please fill in the following information:

Date machine purchased _____

Serial number _____

Model number _____

Set-Up Instructions for Model 1000-S Cut-Off Saws

1. Position machine and bolt to floor. If infeed and outfeed tables are to be used, these should be aligned with saw top and fence. After alignment is satisfactory, bolt table legs to floor.
2. Have a certified electrician bring in power, connect machine and check voltage level. Rotation of motor should be checked while electrician is present. This should be done prior to blade installation. An arrow indicating proper rotation is affixed to the arbor access cover. All wiring must conform to the National Electrical Code, state laws and O.S.H.A.

Power Requirements

Voltage	230	OR	460
Phase	3		3
Service Current (Amps)	30		55
Motor Running Current (Amps)	13		6.5

3. Connect air line to the air cut-off valve on the machine table top (1/4 inch female pipe thread). Pressure gauge on the regulator should indicate 90 PSI. Adjust as needed.

CAUTION: DO NOT OPERATE SAW WITH LESS THAN 60 P.S.I.

The air cut-off valve is provided so the air supply to the machine can be turned off when the saw is not in use. This valve also bleeds the system and allows the guard / clamp to lower. This is a worthwhile safety feature and its use should be encouraged by supervisors.

SAFETY NOTE: An airline interlock has been provided with this machine. This interlock must be locked when performing any maintenance or repair work.

4. A 4 inch dia. dust chute has been provided at the back of the saw. This outlet makes it easy to hook your saw up to a dust collection system. We suggest a minimum of 400 C.F.M. for dust collection. Adequate hose must be provided to allow for the movement of the guard / clamp while the saw is cycling.
5. Install blade on saw. The model 1000-S uses a 14" X 1" blade. Loosen both bolts on front blade cover and swing clear. Loosen bolt on arbor access cover and swing cover clear. Remove front access door. Slide blade through blade access slot. Verify that tips will be turning in the proper direction for cutting. Tighten arbor bolt through the arbor access cover. Left hand saws use right hand threads on arbor bolt. Right hand saws use left hand threads on arbor bolt. Replace door, arbor access cover and blade access cover.

Set-Up Instructions for Model 1000-S Cut-Off Saws (Cont'd.)

6. Check work area to be sure it is clear. Turn air cut-off valve to the on position. The guard / clamp should come up quickly.

CAUTION: DO NOT PUT FINGERS UNDER GUARD / CLAMP OR SENSOR.

Now depress the start button on the start / stop switch to turn on the motor. With both hands in the recessed area of the table top, depress the foot valve. Nothing should happen. Now, place a piece of material under the guard / clamp. Turn the air cut-off valve to the off position. The guard / clamp should lower onto the material. Adjust the guard / clamp so it will clear the material by approximately 1/4" when air pressure is restored. This is done by turning the large hand knob at the rear of the guard / clamp. Clockwise rotation lowers the guard / clamp. Counter clockwise rotation raises the guard / clamp.

CAUTION: DO NOT PUT FOOT INTO FOOT VALVE AREA UNTIL READY TO CUT.

7. After adjusting the guard / clamp height, turn the air cut-off valve to the on position. With both hands in the recessed area of the table top, depress the foot valve and hold it down. Saw should clamp material, blade should come up and make cut, blade should lower back into base and the guard / clamp should release material. If this cycle does not take place, call us. The automatic retract feature should also be checked at this time. Again, with the guard / clamp adjusted and with material in place, depress foot valve and then quickly release it. The saw should immediately return to the at rest position.
8. Installation of your Whirlwind model 1000-S cut-off saw is now complete. Prior to putting the saw into production, have every operator **read and understand** the Operator's Manual. It is suggested that you **document this training** and **have all operators sign a statement** that they have read and understand the instructions. Should you have any questions or comments on this machine, please feel free to give us a call. Our phone number is located on the air cut-off valve caution tag.

Troubleshooting Guide for Whirlwind Model 1000-S Cut-Off Saws

Cut Off Electricity and Lock Out Disconnect Box Before Working on Saw.

PROBLEM	CAUSE	CHECK
Air on, but guard does not move up.	<p>A. Air pressure too low.</p> <p>B. If pilot valve has been rebuilt, piston may be in wrong.</p> <p>C. Guard binding at table top or cylinder pin.</p>	<p>A. Must be full regulated pressure at inlet of cylinder. (90 P.S.I.)</p> <p>B. Remove cap on top of pilot valve. Push piston all the way down and replace cap.</p> <p>C. Apply lubricating oil. Check movement of guard with air off. Should be firm, but free.</p>
Guard is up, foot valve is depressed, guard or blade does not move	<p>A. Guard out of adjustment.</p> <p>B. Foot valve faulty</p> <p>C. One shot valve faulty</p> <p>D. Amplifier faulty</p> <p>E. Pilot valve faulty. Indicated by constant air flow out of pilot valve muffler.</p>	<p>A. Adjust guard to within 1/4" of lumber.</p> <p>B. Break joint at one shot depress foot valve & check for air flow. If no air flows to valve, Foot valve is faulty.</p> <p>C. Disconnect line between one shot and amplifier at the amplifier. Depress the foot valve and check for short blast of air. If air flow is constant, adjust one shot valve. If no air flows, one shot valve is probably bad.</p> <p>D. Break joint "3" on amplifier <u>with board under sensor</u> depress foot valve. If no air flows, the sensor or amp are bad. Then break joint "1" on amplifier. If sensor sends very light signal, sensor is OK.</p> <p>E. Remove pilot valve & inspect. Rebuild or replace.</p>

Troubleshooting Guide for Whirlwind Model 1000-S Cut-Off Saws

Cut Off Electricity and Lock Out Disconnect Box Before Working on Saw.

PROBLEM	CAUSE	CHECK
Guard is up. Foot valve is pressed. Guard comes down, but blade doesn't come up.	<p>A. Shock absorber is locked up.</p> <p>B. Mechanical binding.</p> <p>C. Pilot valve problem.</p>	<p>A. Disconnect lower end of shock absorber. Check for freedom of movement.</p> <p>B. Check for foreign matter lodged between clevis and yoke or hinge bracket and lower end of cylinder.</p> <p>C. Check for constant air flow at pilot valve mufflers.</p>
All other valves	<p>A. Pilot valve</p> <p>B. Cylinder</p>	<p>A. Remove, clean & inspect. Piston must move freely in housing. Housing shouldn't show excessive wear.</p> <p>B. Remove pilot valve & apply air pressure to cylinder ports. Cylinder should expand & contract freely. If not, disassemble & inspect piston & bore. Replace seals & apply pneumatic grease.</p>
Slow cycle	<p>A. Clogged muffler on pilot valve.</p> <p>B. Dust in top of pilot valve.</p> <p>C. Water in cylinder.</p> <p>D. Speed adjustment screws in too far.</p>	<p>A. Remove muffler. Clean with solvent or replace muffler.</p> <p>B. Remove cap, clean & inspect</p> <p>C. Clean and inspect.</p> <p>D. Re-adjust speed adjustment screws and secure locknuts.</p>
Air on, machine will cycle one time only when foot valve is depressed.	<p>A. Air not exhausting at foot valve.</p> <p>B. Foot valve stuck in open position.</p>	<p>A. Clean with solvent or replace foot valve. (Contact block can be replaced on Linemaster foot valve.)</p> <p>B. Replace contact block or foot valve.</p>

Troubleshooting Guide for Whirlwind Model 1000-S Cut-Off Saws

Cut Off Electricity and Lock Out Disconnect Box Before Working on Saw.

PROBLEM	CAUSE	CHECK
Blade goes up, but does not return.	<p>A. One shot valve is faulty.</p> <p>B. Roller valve out of adjustment.</p> <p>C. Roller valve not exhausting.</p> <p>D. Mechanical binding</p>	<p>A. Break joint at one-shot outlet then depress foot valve and check air flow. Should get a short blast of air. If flow is constant, adjust one shot valve.</p> <p>B. Depress lever by hand, if blade moves down & guard moves up, roller valve needs adjustment. Do not over travel valve.</p> <p>C. Feel for air from muffler on roller valve. If no air, remove roller valve, check for air flow. If no flow, roller valve is clogged.</p> <p>D. Check and lubricate clevis, yoke and guard.</p>
Blade goes up And hits top and then returns.	<p>A. Air blast from one shot valve is too long.</p> <p>B. Roller valve not exhausting properly.</p> <p>C. Roller valve and / or muffler clogged.</p> <p>D. Cycle speed is too fast.</p>	<p>A. Adjust one shot valve.</p> <p>B. Adjust valve. Do not over travel lever.</p> <p>C. Clean valve and muffler. Failing that, replace valve.</p> <p>D. Adjust speed controls on pilot valve. Make sure locknuts are tight after making adjustment. (DO NOT OVER TIGHTEN!)</p>

Troubleshooting Guide for Whirlwind Model 1000-S Cut-Off Saws

Cut Off Electricity and Lock Out Disconnect Box Before Working on Saw.

PROBLEM	CAUSE	CHECK
Blade retracts before roller valve is depressed.	A. Air leak in system. B. One-shot valve not releasing long enough blast of air.	A. Spray every air connector with soapy water. Check for air escaping. B. Re-adjust one shot valve for longer blast of air.

Electrical Problems

1. If reset button must be depressed to re-start machine:

- A. Check wire connections on magnetic starter.
- B. Check wires to motor.
- C. Check incoming wire, connections and voltage.
- D. Verify correct heaters for voltage are installed.

2. If machine re-starts by depressing start / stop button:

- A. Check wire connections on start / stop switch.
- B. Check connections on door interlock switch.
- C. Follow these wires to box and check connections at box.

NOTES:

- 1. Closely examine rubber seals for damage.
- 2. Repair kits available for cylinder and some valves. Please call us for availability and pricing.
- 3. Do not allow sawdust or any foreign matter to enter valves or hoses while the machine is being serviced.
- 4. Do not remove or tamper with any safety devices.

Pneumatic Operation Of Whirlwind Cut-Off Saw

The Whirlwind model 1000-S cut-off saw is a semi-automatic cut-off saw using a pneumatic cylinder and valves to operate each cycle. Incoming air is first cleaned and dried in the filter, regulated from line pressure to 90 PSI and then sent through a coalescing filter. Regulated pressure is then taken to two locations: The foot valve (1000-46) and the pilot valve (212-37A) which is the inlet of the cylinder.

Note: Whirlwind saws use a dry air system. DO NOT add lubricant to the air system.

With air pressure on and the saw "idle" the cylinder is closed. The guard is up and the blade is down. When the foot valve is depressed and held down, (open) air passes to the one shot valve (212-39) and to the proximity sensor (212-158). The one shot valve allows air to pass through initially, then closes to prevent further air flow. The one shot will remain closed as long as the foot valve is depressed (pressure is on the inlet port). This air then goes to the amplifier (212-129) which is normally closed. The amplifier will be opened if the guard / clamp is adjusted to within 1/4" of the material by the proximity sensor. If the guard / clamp is not adjusted to within 1/4" of the material, the sensor will not allow the saw to cycle.

Caution: Tampering with the sensor is dangerous and may damage other valves.

The saw will return to "idle" i.e. guard up, blade down if the foot valve is released. Air from the amplifier goes to two valves: The roller valve (1000-44) and the pilot valve (located on the main air cylinder).

The pilot valve does two things. First it directs the regulated air pressure to either end of the cylinder, depending on its position. Second, it exhausts the opposite end of the cylinder. The speed of the cylinders actuation is determined by the rate of exhaust flow. This flow is adjusted by a separate bleeder screw for each direction. These adjustment screws are located on the pilot valve housing. Air pressure from the one shot valve pushes the pilot valve piston upward which allows regulated air to flow to the bottom of the cylinder. It also allows the upper end of the cylinder to exhaust. The cylinder then begins to extend. The guard / clamp moves down and the blade moves up. The duration of this half cycle is adjusted by the upper bleed screw.

The cylinder will extend until the spindle trips the roller valve. This exhausts the air from the one shot valve to the pilot valve. The pilot valve piston shifts and exhausts the air on the bottom of the cylinder. It also directs regulated pressure on the top of the cylinder. The blade moves down and the guard / clamp moves up. The lower bleed screw on the pilot valve determines the duration of this half cycle.

When the saw is not in use, the air cut-off valve (212-126) must be turned to the "Air Off" position to bleed the system for safety.

Changing V-Belts on Whirlwind Model 1000-S Cut-Off Saws

Cut Off Electricity and Lock Out Disconnect Box Before Working on Saw.

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1. Loosen four bolts which mount the motor to the table top and slide the motor forward.
2. Remove shock clevis (1000-47) from yoke (1000-4). **Note:** On model 1000 counter-balance spring (1000-25) must also be removed.
3. Remove belt access cover on side of saw. Using access hole, remove two bearing hanger bolts.
4. On left hand saw, loosen two bolts which mount the left hand bearing hanger (1000-3) to the table top. **Note:** On a right hand saw, loosen bolts which hold right hand bearing hanger.
5. On left hand saw, remove two bolts which mount the right hand bearing hanger. **Note:** On a right hand saw, remove bolts which hold left hand bearing hanger.
6. On left hand saw, swing right hand bearing hanger down and remove V-belts. Opposite on RH saw.
7. Install new V-belts and reassemble. If desired, an extra set of V-belts can be looped around the yoke and tied out of the way. This will make the next belt change much easier.
8. Pulleys must be parallel within 1/32 of an inch.
9. V-belt tightness should be 5/32 inch deflection with three (3) pounds of pressure.
10. **Note:** Improper alignment or tension will result in excessive wear on V-belts or bearings.

### **SUGGESTED MAINTENANCE:**

1. Check filter, regulator and coalescing filter daily for moisture in bowl. Drain as needed. If your air is fairly moist, an air dryer is highly recommended. Valves that fail due to excessive moisture are not covered under warranty.

**Note: Whirlwind saws use a dry air system. DO NOT ADD ANY LUBRICANTS TO AIR SYSTEM.**

2. Lubricate external moving parts with lubricating oil.
3. Check V-belts and tighten if necessary. (See item 9 above.)
4. Keep inside of machine free of excessive sawdust. Special attention should be given to keeping footvalve area clean.
5. Keep saw blades properly sharpened. Carbide tipped blades are highly recommended. Whirlwind Inc. maintains these blades in stock at very reasonable prices.

## **Adjustment of Valves for Whirlwind Model 1000-S Cut-Off Saw**

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The Whirlwind model 1000-S saw will give many years of useful service with a minimum of maintenance. There are some adjustments which should be checked periodically to assure trouble free operation. No electrical power is needed to check these pneumatic systems.

**CAUTION: CUT OFF ELECTRICITY & LOCK OUT DISCONNECT BOX BEFORE ADJUSTING VALVES.**

### **Roller Valve**

The roller valve (212-38) exhausts air captured between the one shot valve and the pilot valve which allows the cylinder to close. It is triggered by the spindle housing (212-5). The roller valve on the model 1000-S saw is mounted on a bracket. Adjustment is accomplished by sliding the valve in the slots in this bracket. There should be 1/4" clearance between the table top and the spindle housing when the spindle housing is at the top of its stroke. If the spindle housing is hitting the cast portion of the roller valve, the roller valve bracket can be adjusted by loosening the two 1/4-20 bolts which mount it to the table top.

**NOTE: THE SPINDLE HOUSING SHOULD NEVER STRIKE THE TOP DURING NORMAL OPERATION.**

### **Pilot Valve**

The speed of the cycle is controlled by two slotted screws in the pilot valve. The upper screw adjusts the speed of the cylinder expanding and the lower screw adjusts contraction. The speed of expansion and contraction should be equal. The model 1000-S should be adjusted to 60 cycles per minute with no material under the guard. When the saw has material in place, the cutting speed will increase. Maximum cycle time while cutting is approximately 90 cuts per minute. Excessive cycle speed may reduce the life of the machine.

### **One Shot Valve**

The one shot valve is constructed so that when air is admitted into the inlet port, it initially allows flow through the valve which then closes preventing further flow. Once closed, the one shot valve will remain closed until inlet pressure has been exhausted. Should you suspect this valve is not working properly, it should be tested as follows:

1. Apply 80 PSI to inlet port. With outlet open, valve should allow flow briefly and then close. The valve should remain closed until inlet pressure is exhausted. (It may be necessary to restrict outlet slightly to cause valve to close.)
2. Apply pressure to outlet port. With inlet open, air should pass freely through the valve.

August 23, 1982

## **Whirlwind Inc. Limited Warranty**

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Whirlwind Inc. hereby warrants, subject to the conditions set forth below, that it will repair or replace without charge for parts or labor, F.O.B. our factory, any part of the product accompanied by this warranty which proves defective by reason of improper workmanship and / or material within ninety (90) days from the date of the original purchase at retail.

### **Conditions:**

- (a) This warranty is extended to the original purchaser only.
- (b) This warranty shall not apply to any defects or other malfunctions caused by accident, neglect, misuse, abuse, alteration, modification, unusual physical, environmental or electrical stress, or use contrary to instructions accompanying this product.
- (c) This warranty applies only where the purchaser establishes that the product was properly installed, maintained and operated within the limits of normal usage. Any defective part shall be returned promptly to Whirlwind Inc. upon discovery of a defect.

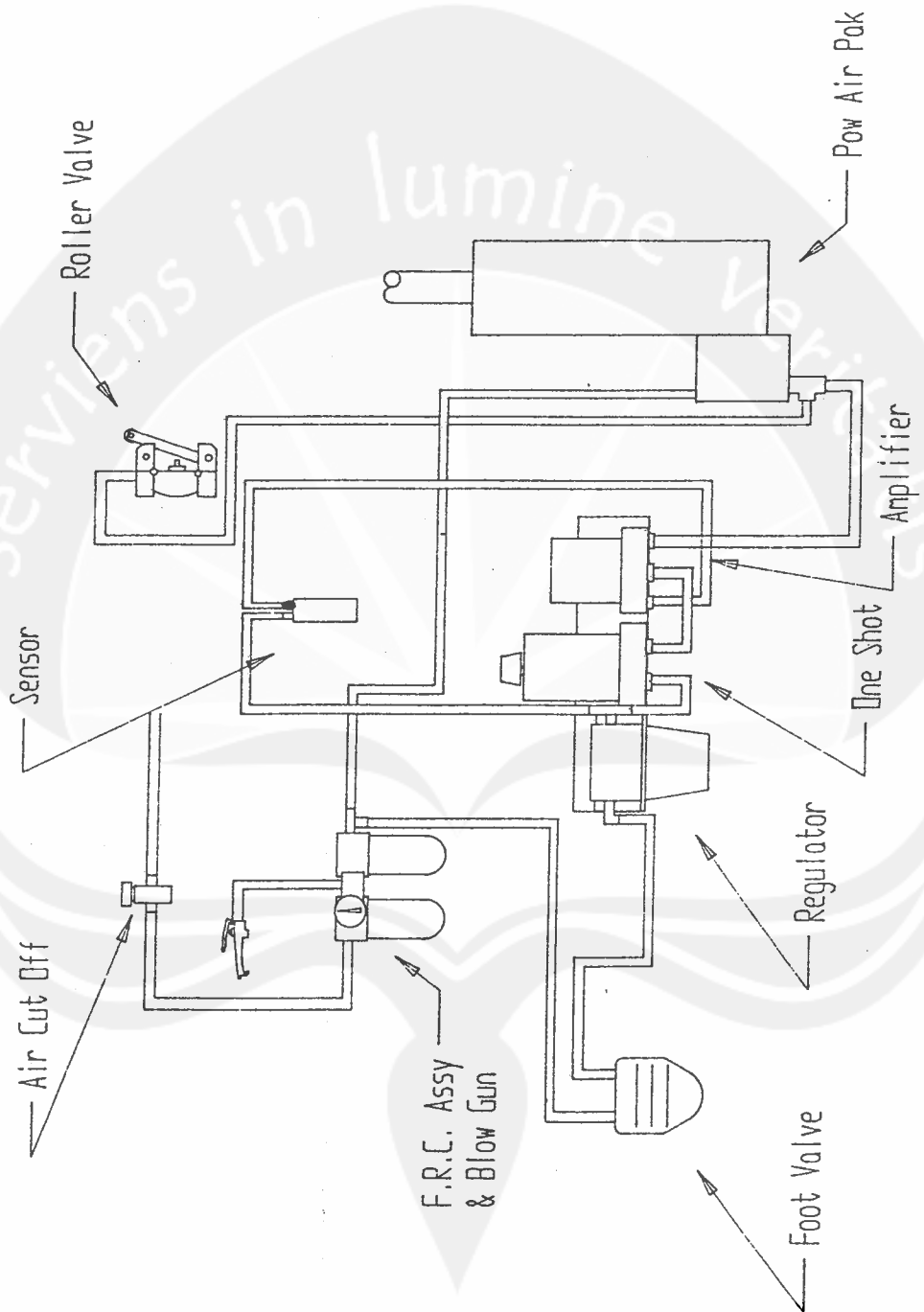
### **Disclaimer:**

This warranty is in lieu of all other warranties of any kind and any other representations or warranties, whether expressed or implied, including any implied warranties of merchantability or fitness for any particular purpose shall not apply, and are disclaimed with respect to the goods sold.

Whirlwind Inc. shall not have any responsibility for loss of use of the product, loss of time, inconvenience, incidental or consequential damages. The liability of Whirlwind Inc. is limited to the cost of repair or replacement of defective parts.

For information concerning warranty service, please contact the distributor from whom the machine was purchased or Whirlwind Inc., 4302 Shilling Way, Dallas, TX U.S.A. 75237 Phone (214) 330-9141 FAX (214) 337-9572.

A Several Changes

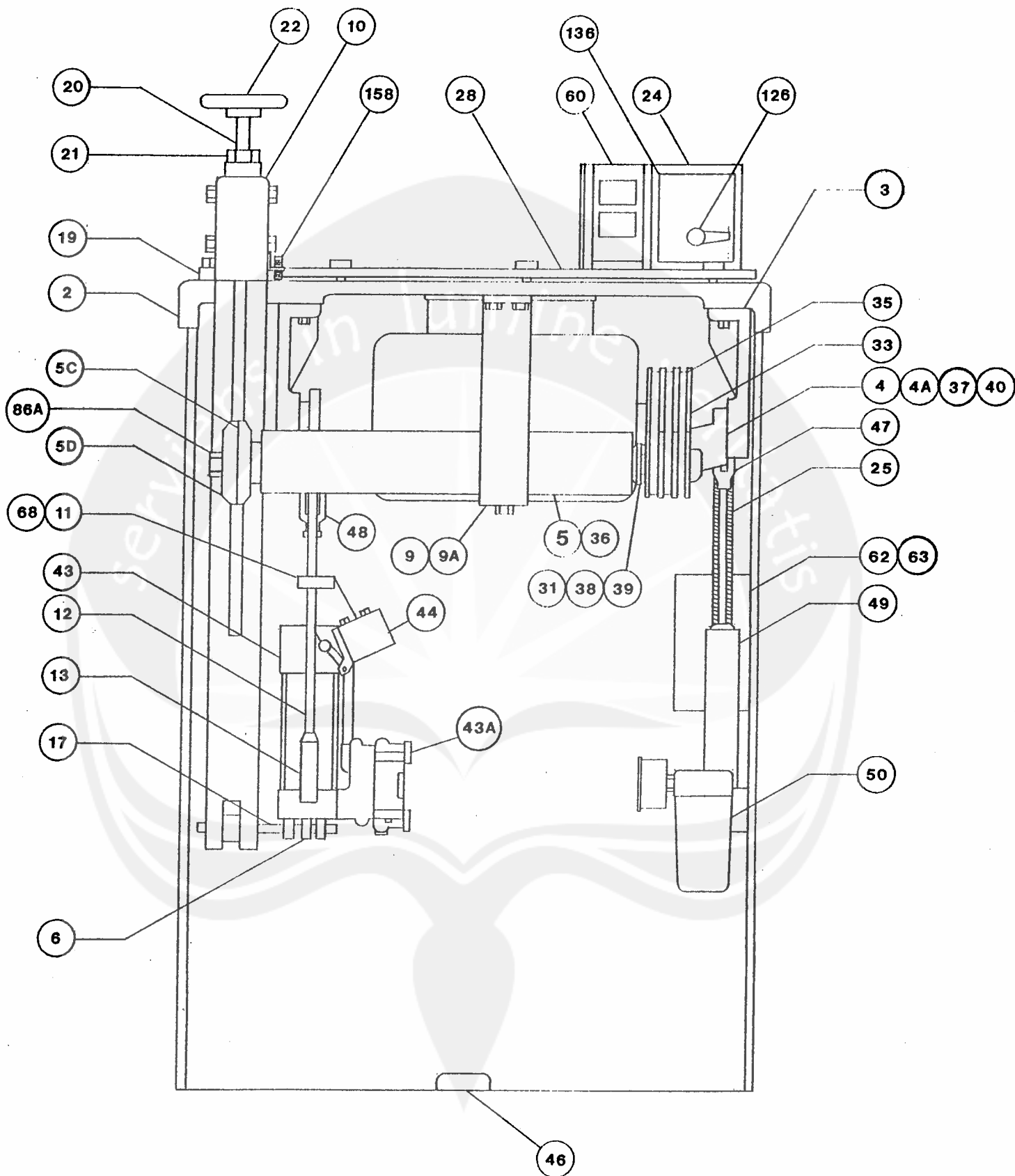


RCR 08/93

Whirlwind Inc.  
4302 Shilling Way Dallas, TX

Pneu. Diagram  
For Sows

A SMF-75B



SHEET 1 OF 2

Series S Saw

DWG. Ramsden 02-88

**Whirlwind, Inc.**

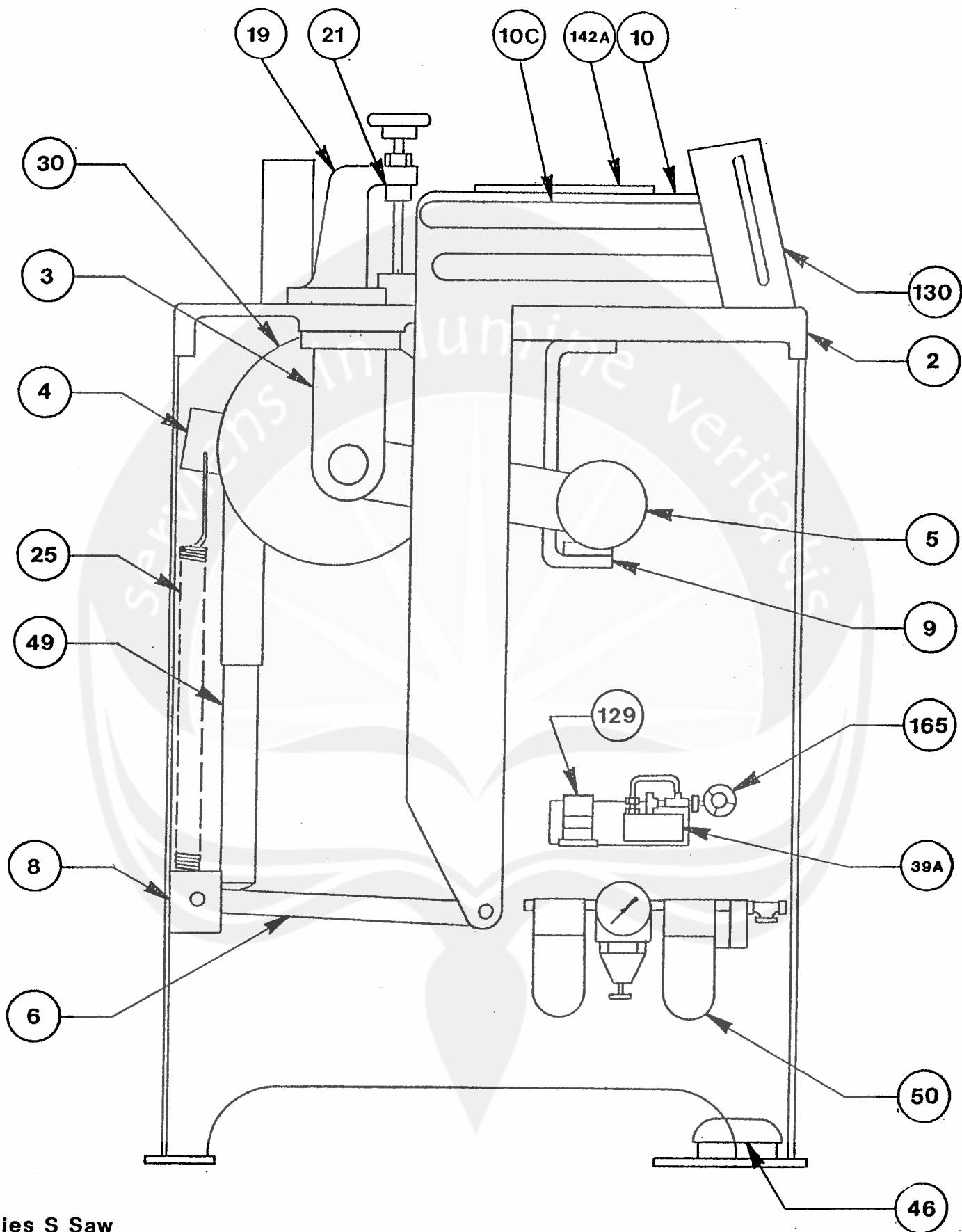
4302 Shilina Way

Dallas, Texas 75217

TITLE

ASSY. MODEL 1000 SAW

T NO SMA-01A



**Series S Saw**

|                |                                                                   |                      |     |
|----------------|-------------------------------------------------------------------|----------------------|-----|
| DWG: RGR 04-91 | <b>Whirlwind Inc.</b><br>4302 Shilling Way<br>Dallas, Texas 75237 | ASSY. MODEL 1000 SAW |     |
| MTL:           |                                                                   | T                    | NO. |
| FIN:           |                                                                   | SMA-01A              |     |
| SHEET 2 OF 2   |                                                                   |                      |     |

## Model 1000-S Cut-Off Saw Parts Identification List

| Item            | Part No.                   | Description                                 | Qty |
|-----------------|----------------------------|---------------------------------------------|-----|
| 0002            | 1000-002B-1-000            | Table Top Left Hand Saw                     | 1   |
| ----            | 1000-002B-2-000            | Table Top Right Hand Saw                    | 1   |
| 0003            | 1000-0003-0-000            | Bearing Hanger (SMA-25A)                    | 2   |
| 0004            | 1000-0004-1-000            | Yoke Assy. - Left Hand Saw                  | 1   |
| ----            | 1000-0004-2-000            | Yoke Assy. - Right Hand Saw                 | 1   |
| 004A            | 1000-004A-0-000            | Pivot Pin (SMA-12A)                         | 2   |
| 0005            | 1000-0005-1-000            | Spindle Assy. - Left Hand Saw               | 1   |
| ----            | 1000-0005-2-000            | Spindle Assy. - Right Hand Saw              | 1   |
| 005C            | 1000-005C-0-000            | Rear Washer - Casting                       | 1   |
| 005D            | 1000-005D-1-000            | Front Washer - Left Hand Saw                | 1   |
| ----            | 1000-005D-2-000            | Front Washer - Right Hand Saw               | 1   |
| 0006            | 1000-0006-1-000            | Hinge Bracket - Left Hand Saw (SMA-29A)     | 1   |
| ----            | 1000-0006-2-000            | Hinge Bracket - Right Hand Saw (SMA-29A)    | 1   |
| 0007            | 1000-0007-0-000            | Anchor Pin (SMA-21A)                        | 1   |
| 0008            | 1000-0008-0-000            | Anchor Bracket (SMA-09A)                    | 2   |
| 0009            | 1000-0009-0-000            | Stop Bracket Assy.                          | 1   |
| <del>009A</del> | <del>1000-009A-0-000</del> | Rubber Cushion                              | 2   |
| 009B            | 0212-009B-1-000            | Valve Bracket for Left Hand Saw (SMF-43A-L) | 1   |
| 0010            | 1000-0010-0-000            | Guard / Clamp Assy. (SMF-03B)               | 1   |
| 0013            | 0212-0013-0-000            | Fence (SMA-38A-1)                           | 1   |
| 0014            | 1000-0014-0-000            | Dust Chute (SMF-10B)                        | 1   |
| 0015            | 1000-0015-0-000            | Front Door Assy. (SMA-18B)                  | 1   |
| 0017            | 1000-0017-0-000            | Cylinder Pin (SMA-20A)                      | 1   |
| 0019            | 1000-0019-0-000            | Height Adjust Bracket (SMF-05B)             | 1   |
| 0020            | 1000-020A-0-000            | Height Adjustment Screw (SMF-19B)           | 1   |
| 0021            | 1000-0021-0-000            | Adjustment Nut (SMA-16A)                    | 1   |
| 0022            | 1000-0022-0-000            | Height Adjustment Knob (SMA-28A)            | 1   |
| 0023            | 1000-0023-0-000            | Front Blade Access Cover (SMF-09A-3)        | 1   |
| 0024            | 0212-0024-0-000            | Air Cut-Off Bracket (SMF-08B)               | 1   |
| 0025            | 1000-0030-0-000            | 5 HP Motor ODP Baldor 1750 RPM              | 1   |
| 0026            | 1000-0031-0-000            | Pulley - 3.00" O.D. x 1" I.D. - (Spindle)   | 1   |
| 027A            | 0212-027A-0-000            | Caution Tag for Blade Guard                 | 1   |
| 0028            | 1000-0033-0-000            | Pulley - 6.00" O.D. x 1 1/8 I.D. - (Motor)  | 1   |
| 0029            | 1000-0035-0-000            | Vee Belts (3 Per Saw)                       | 3   |

## Model 1000-S Cut-Off Saw Parts Identification List (Cont'd.)

---

| Item | Part No.        | Description                                | Qty |
|------|-----------------|--------------------------------------------|-----|
| 0037 | 0212-0043-0-000 | Pow-Air-Pak (Main Cylinder w. Pilot Valve) | 1   |
| 037A | 0212-037A-0-000 | Pilot Valve Only                           | 1   |
| 0039 | 0212-0039-0-000 | One-Shot Valve                             | 1   |
| 0044 | 1000-0044-0-000 | Roller Valve                               | 1   |
| 0046 | 1000-0046-0-000 | 3-Way Foot Valve                           | 1   |
| 0048 | 0212-0048-0-000 | Clevis Assembly for Cylinder (SMF-31A-2)   | 1   |
| 0049 | 1000-0049-0-000 | Shock Absorber                             | 1   |
| 0050 | 1000-0050-0-000 | F.R.C. Assembly                            | 1   |
| 054A | 1000-054A-0-000 | 1/4 PVC Hose 36" for Air Cut-Off Valve     | 1   |
| 0059 | 1000-062B-0-230 | Starter Assembly (230 V)                   | 1   |
| 0059 | 1000-062C-0-460 | Starter Assembly (460 V)                   | 1   |
| 0060 | 0212-0060-0-000 | Start / Stop Switch                        | 1   |
| 086A | 1000-086A-1-000 | Spindle Bolt (LH Saw)                      | 1   |
| 086A | 1000-086A-2-000 | Spindle Bolt (RH Saw)                      | 1   |
| 0126 | 0212-0126-0-000 | Air Cut-Off Valve                          | 1   |
| 0129 | 0212-0129-0-000 | Amplifier Only for Work Presence Sensor    | 1   |
| 129A | 1000-0130-0-000 | Front Shield                               | 1   |
| 0136 | 0212-0136-0-000 | Caution Tag for Air Cut-Off Valve          | 1   |
| 0158 | 0212-0158-0-000 | Proximity Sensor Only                      | 1   |
| 0165 | 0212-0165-0-000 | Regulator Only for Work Presence Sensor    | 1   |

# SAFETY GUIDES

## for the operation of CARBIDE TIPPED SAW BLADES

Read Completely Before Attempting To Operate Carbide Tipped Saw Blades

This leaflet of safety and operating instructions is not intended to be and is not totally comprehensive; that is, it does not, and cannot, cover every possible safety problem which may arise in using specialized and standard tooling on varying machines and applications. This leaflet is rather intended to generally describe many of the basic safety and operating procedures which should be followed, and to describe the types of safety considerations which should be considered in operating cutting tools.

None of the statements or information presented in this leaflet should be interpreted to imply any warranty or safety protection.

The drawings do not depict any particular design, type, or size of tools, equipment or machines. The drawings are illustrative only and are not to be construed to establish any exact mode, method or procedure.

All Federal and State laws and regulations having jurisdiction covering the safety requirements of cutting tools at the point of usage take precedence over the statements and information presented in this leaflet. Users of cutting tools must, of course, adhere to all such regulations. As an aid to cutting tool users a number of such regulations are listed below. The list does not include all regulations that may apply:

1. The Federal Register dated June 27, 1974, Dept. of Labor, Office of Safety and Health Administration (The OSHA Act)
2. American National Standards Institute, 01.1-1975 (Safety Regulations for Woodworking Machinery)
3. American National Standards Institute, 02.1-1969 (Safety Requirements for Sawmills)
4. American National Standards Institute, P1.1-1969 (Safety Requirements for Pulp, Paper and Paper-board Mills)
5. Other ANSI, State and/or Federal Codes and Regulations which may apply in your operation

### SAFETY RULES WHICH APPLY TO THE OPERATION OF ALL CARBIDE TIPPED CUTTING TOOLS

1. Always inspect the cutting tool completely before mounting. Never attempt to operate a tool which has chipped or bent teeth or cutting edges or teeth that are not sharp. You must be familiar with normal wear conditions for the type of tooling to be used. The tool must be completely clean to allow proper visual inspection.

2. Do not attempt to operate cutting tools or machinery with which you are not familiar or have not received operational training—get assistance from your supervisor, his designated representative or a trainer who is familiar and properly trained and experienced on the machine to insure your safety. Become completely familiar with all of the machinery manufacturer's written instructions, guides and manuals before operating machine. You must use and be familiar with all controls, safety devices and emergency stop mechanisms to operate a machine safely.

3. Never operate a cutting tool that is not properly aligned to the direction of feed. Do not allow sideward, twisting or other than forward pressure on the cutting tool in feeding material into a cut.

4. Make sure the tool is mounted to rotate in the proper direction before cutting any material. The tool must rotate against, rather than with, the direction of feed on all hand feed machines. Do not climb on hand feed machines.

5. Do not cut materials of a type, hardness<sup>1</sup> or density<sup>2</sup> other than that which the cutting tool was designed to cut. Never attempt to cut materials with a tool unless you have personally checked with your supervisor to make sure the cutting tool was designed for the specific type of material you wish to cut, and for the depth of cut desired. This is particularly important when attempting to cut "stacked" material, i.e., cutting more than one piece at a time.

6. Never force-feed materials into a cutting tool such that it causes the tool or machine motor to slow down below operating speeds. A safe and proper cutting operation will not require much force in feeding material. If material begins to "ride up" on the cutting tool, or requires undue pressure to feed the material into the tool, or if undue vibration is experienced, do not continue the cut—turn off all power and correct the condition.

7. Keep body and clothing well clear of all cutting tools and other moving parts while the machine is in operation. Use work holding fixtures and mechanical feed devices in all possible cases. When cutting material of such size, shape or type that it necessitates close approximation to the cutter and mechanical feed

1. **Hardness** is the resistance of a material to being cut or the strength of a material to resist tearing or breaking.
2. **Density** is the compactness of a material compared to its volume.

mechanisms cannot be used, use a wood "push stick" to feed the material so that no part of your body or clothing comes close to the cutting tool.

8. Never attempt to clean a cutting tool or clear pieces of material from the cutting area while machine power is "on" or when cutting tools, material or any part of the machine is moving. Allow cutter rotation to stop by itself, or by use of a brake if supplied on the machine. Never attempt to stop or slow a rotating cutting tool by applying a hand-held or any other object to the cutter, arbor, spindle or drive as a brake.

9. Do not place your body in the rotational path of a cutting tool unless absolutely necessary, and then only if there is a complete and adequate barrier between you and the cutting tool. Remember that carbide tips are very hard and, therefore, brittle. The tips can break away under incorrect side thrust or twisting forces, or if foreign material is allowed to contact the tips. An operator can reduce the danger of being hurt by a "kickback" of the material if he always stands beside the material he is feeding into the machine rather than in back of it.

10. Never leave machines unattended while cutting tools are still rotating or any part of the machine or material is moving.

11. Never operate a machine without using all of the hoods, guards, hold-downs and safety devices for the machine being operated.

12. Machines must be maintained to the manufacturer's standards and current safety standards.

13. Always wear safety glasses or face shield to completely protect your eyes when operating cutting tools.

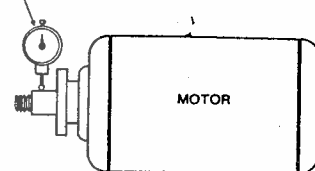
### CIRCULAR SAW BLADES AND SAW MACHINE TOOLS MOUNTING INSTRUCTIONS

1. **TURN OFF AND LOCK OUT ALL MACHINE POWER.** Clean the saw arbor, saw collars, sleeve and arbor nut. Remove nicks and burrs by very lightly honing any nicked or burred area. (Do not use coarse files or abrasives).

2. **WITH ALL MACHINE POWER OFF AND LOCKED OUT,** pull and push on the machine arbor sideways in and out by hand (without rotating the arbor). There should be no feeling of movement. Next, rotate the arbor by hand. If the bearings are in proper condition, the arbor should turn freely with no sticking or rubbing. To check the arbor, set up a dial indicator as shown in Fig. 1. The arbor should run true within the motor manufacturer's

Fig. 1

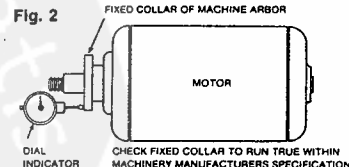
DIAL INDICATOR



CHECK ARBOR TO RUN TRUE WITHIN MOTOR MANUFACTURERS SPECIFICATION:

specifications. Set the dial indicator to bear on the fixed collar of the arbor and turn the arbor (Fig. 2). The collar

Fig. 2

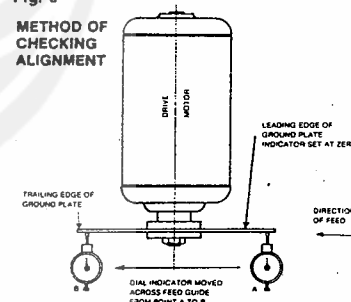


should run true within the machine manufacturer's specifications.

3. **WITH ALL POWER OFF AND LOCKED OUT,** align the saw blade with the direction of feed. A method of checking alignment is to mount a flat ground plate of 10 or 12 inches diameter by 1/4 inch thick on the saw arbor in the same manner as a saw blade (see Fig. 3). Set up a dial

Fig. 3

METHOD OF CHECKING ALIGNMENT



indicator so it can be moved by hand along the guide rail or feed mechanism. Position the dial indicator so it can traverse across the plate either above or below the mounting collars. Set the dial indicator to zero at the leading edge of the plate (Position A, Fig. 3) and move it across the plate to the trailing edge (Position B, Fig. 3).

PROFIT THROUGH AMERICAN TECHNOLOGY  
WOOD MACHINERY  
MANUFACTURERS  
OF AMERICA  
Cutting Tool Manufacturers' Division

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Any error in the plate flatness can be eliminated by rotating the plate by hand so that point A is moved to point B when reading the indicator. Any deviation in angularity between the saw blade and the direction of feed should be maintained within the machine manufacturer's recommendations. On double cut-off and panel trim machines any slight angularity in alignment should be controlled so that the trailing edge of the saw blades do not re-cut the material.

**4. WITH ALL MACHINE POWER OFF AND LOCKED OUT,** inspect the saw blade before mounting. The bore (center hole) must be the correct size and fit snugly. Do not force a saw or other type of tool on an arbor. Do not tighten mounting screws unequally, or use incorrectly fitted keys. Incorrect mounting of saws or other tools can cause tool breakage and create dangerous operating conditions. Never mount a saw blade with a damaged (deeply scored or out of round) bore or arbor. Inspect the teeth carefully. Do not mount blades with damaged bodies, dull or damaged (bent or chipped) teeth. Never use anything other than accurate metal shims or spacers if saw blades have to be positioned on the arbor. Never use shims to "wobble" a saw blade.<sup>3</sup> Be sure that all saw collars used match exactly in diameter. Closely check to see that the arbor nut threads are not worn and the wrench surfaces of the arbor nut are not rounded off.

**5. WITH ALL MACHINE POWER OFF AND LOCKED OUT,** mount the saw blade on the arbor making sure that the saw blade is turning in the correct rotation and that the arbor nut tightens in a direction opposite to the blade rotation (See Fig. 4A & 4B). Unless the

Fig. 4A

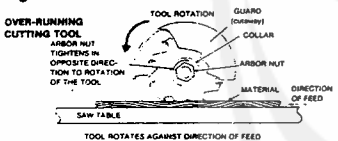
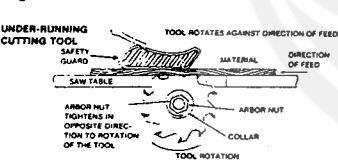


Fig. 4B



machine is specifically designed for such cutting, never mount saw machine tools to "climb cut" (teeth cutting in the same direction of feed) on manually fed machines. Never use saw blades on operations for which they were not designed; for example, do not use rip design blades to cut across the grain, etc.

### CIRCULAR SAW BLADES AND SAW MACHINE TOOLS START-UP PROCEDURES

- 1. TURN OFF AND LOCK OUT ALL MACHINE POWER.** Never assume previously set machine or tool conditions to be correct. Be sure that
- Mounting a saw blade to "wobble" means to shim the blade body unequally on one side, throwing the saw out of alignment with the arbor. This causes the saw to make a wider cut and dangerously increases pressures on the tool.

the tool is correctly mounted, properly locked on the arbor (See Fig. 4A & 4B), turns freely (no foreign objects in tool rotation path) and is properly positioned for the cutting operation required (See Fig. 3). Check to see that the cutting tool is not dull or damaged. Check to see that the body of the saw blade is not cracked.<sup>4</sup> Take special precaution to check "stacked cutters" to be sure that all bolts, pins and threaded parts are not worn or damaged, and are properly mounted. Be sure that hubs on all "split" circular tools are properly fitted and pinned and that the locking collars are in place and fit properly. Do not use locking collars that are not matched to the "split tool." Split collars on split tools are not recommended.

**2. WITH ALL MACHINE POWER OFF AND LOCKED OUT** insure that you are not attempting to operate tools that do not conform to the machine manufacturer's machine load specifications in either size or weight, or that do not mount according to the machine design limitations. Operate saw machine tools only on the type of materials, cutting loads and operation applications for which the tools were designed. (If you don't know this information, ask your supervisor.) Do not operate saw blades or saw machine tools in excess of the machine or tool manufacturer's specifications, or current applicable OSHA standards, or in excess of 18,000 sfm (surface feet per minute).<sup>5</sup> (See Charts A and B following).

**3. WITH ALL MACHINE POWER OFF AND LOCKED OUT** position the cutting tool, material guides and material hold-downs so that the material to be cut is fully supported. This will insure there will be minimal material vibration. Next, follow the machine manufacturer's instructions to mount all guards over the tools such that the guards are close to, but properly clear, the material being cut. Mount and activate all of the machine safety devices such as anti-kickback mechanisms, spreaders, dust hoods and safety switches. Make sure all personnel and all loose or foreign objects are clear of the machine and cutting tools.

**4. TURN ON MACHINE POWER,** start the tool rotation slowly before feeding material. This is done by "jogging" (that is, pressing the start button and immediately after that pressing the stop button). At a safe distance, observe the operating condition of the tools (by sight and sound) as they rotate slowly. Next, **TURN ALL MACHINE POWER OFF AND LOCKED OUT,** wait until all cutting tools stop rotating by themselves (do not attempt to stop their rotation yourself unless a brake is specifically provided for that purpose on the machine), and make any necessary corrections. Go through all steps noted in paragraph 3, just above, before you **TURN THE MACHINE POWER ON.** Press the start button and allow the machine to operate at

- "All cracked saws shall be removed from service," Department of Labor OSHA Standards, Federal Register 29 CFR Part 1910.213(S) (7)
- The term "surface feet per minute" refers to the peripheral or rim speed of a cutting tool. See "Operating Speeds for Carbide Tipped Rotary Cutting Tools" below.

full speed for at least one minute before feeding material.

### OPERATING SPEEDS FOR CARBIDE TIPPED CIRCULAR SAW BLADES

Carbide tipped circular saw blades of the types commonly used in the machining of materials typical of the toughness and density range of most wood species, composition boards, medium hard plastics, and the softer non-ferrous metals must never be operated in excess of the machinery or tool manufacturer's recommendations, or current applicable OSHA standards, or in excess of 18,000 sfm (surface feet per minute) whichever is lowest. Surface feet per minute (sfm) refers to the peripheral or rim speed of a cutting tool, that is, the speed at which the outer cutting teeth are rotating when the tool is at full speed. This speed increases as the tool diameter and/or motor arbor or spindle rpm increase. The maximum speed of 18,000 sfm is allowable only when the machinery being used is in excellent operating condition and is excellently maintained. When using older or worn machinery, or when cutting materials of an unusual toughness<sup>6</sup> or density<sup>7</sup> the surface feet per minute or material feed rate, or both, should be reduced to speeds where the tool cuts easily and freely without excessive vibration or high tooth impact shock. Most woods, plastics and the medium-hard non-ferrous metals will cut better with longer tool life at surface feet per minute ranging from 8,000 sfm to

- Toughness is the resistance of a material to being cut or the strength of a material to resist tearing or breaking.
- Density is the compactness of a material compared to its volume.

16,000 sfm, depending on the hardness and machining characteristics of the material being cut. As the rim speed (surface feet per minute) of a circular saw blade is decreased, feed rates must be decreased accordingly to prevent the forcing of material into the cutting tool and overloading of the cutting teeth.

The method of determining the surface feet per minute (sfm) of a rotary cutting tool is as follows:

$$.26 \times D \times \text{RPM} = \text{SFM}$$

where D = diameter of the tool in inches  
RPM = rotating speed, in revolutions per minute  
SFM = rim speed, in surface feet per minute  
.26 = this number is used to convert the tool circumference from inches to feet (3.14 divided by 12)

Remember that changing to a larger diameter cutting tool at the same machine spindle or arbor speed increases the surface feet per minute rim speed of the tool. Never make assumptions as to any machine motor rpm since machines and individual motors can be modified. **WITHOUT ANY CUTTING TOOLS MOUNTED ON THE MACHINE,** check the rpm of each motor using an rpm tachometer. Once the cutting tool diameter and motor rpm are known, you can check Chart A (following) to see if a saw blade will be operating within the 18,000 surface feet per minute maximum rim speed specified. For diameters not covered by Chart A, use the sfm (surface feet per minute) formula above. For the circular sawing of magnesium, copper, lead, brass, or bronze, note the **LOWER** surface speed limitations on Chart B. For harder or more difficult to cut materials, consult the tool manufacturer.

CHART A

| 18,000 SFM (SURFACE FEET PER MINUTE) MAXIMUM RPM ROTATING SPEEDS FOR CARBIDE TIPPED CIRCULAR SAW BLADES TYPICAL OF COMMERCIAL DESIGN, THICKNESS AND GRADE STANDARDS (DO NOT OPERATE CARBIDE TIPPED CIRCULAR SAW BLADES ABOVE THE RPM ROTATING SPEEDS SHOWN) |             |                   |             |                   |             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------|-------------|-------------------|-------------|
| SAW DIA. (INCHES)                                                                                                                                                                                                                                           | MAXIMUM RPM | SAW DIA. (INCHES) | MAXIMUM RPM | SAW DIA. (INCHES) | MAXIMUM RPM |
| 6                                                                                                                                                                                                                                                           | 11538*      | 24                | 2885        | 44                | 1573        |
| 7                                                                                                                                                                                                                                                           | 9890*       | 26                | 2663        | 46                | 1505        |
| 8                                                                                                                                                                                                                                                           | 8654*       | 28                | 2473        | 48                | 1442        |
| 10                                                                                                                                                                                                                                                          | 6923*       | 30                | 2308        | 50                | 1385        |
| 12                                                                                                                                                                                                                                                          | 5769*       | 32                | 2163        | 52                | 1331        |
| 14                                                                                                                                                                                                                                                          | 4945*       | 34                | 2036        | 54                | 1282        |
| 16                                                                                                                                                                                                                                                          | 4327*       | 36                | 1923        | 56                | 1236        |
| 18                                                                                                                                                                                                                                                          | 3846*       | 38                | 1822        | 58                | 1194        |
| 20                                                                                                                                                                                                                                                          | 3461        | 40                | 1731        | 60                | 1154        |
| 22                                                                                                                                                                                                                                                          | 3147        | 42                | 1648        |                   |             |

\* Operation of saw blades in excess of 3600 RPM is not recommended and will generally result in poor tool life and cut quality.  
Note: Most materials will cut better with longer tool life at speeds well below the maximum RPM rotating speed.

CHART B

| MAXIMUM RIM SPEEDS, IN SURFACE FEET PER MINUTE (SFM), FOR CARBIDE TIPPED CIRCULAR SAW BLADES CUTTING THE MATERIALS LISTED BELOW                        |                         |            |                         |                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------|-------------------------|--------------------------|
| MAGNESIUM                                                                                                                                              | COPPER                  | LEAD       | UNDER 150 BRINELL BRASS | UNDER 150 BRINELL BRONZE |
| 15,000 SFM                                                                                                                                             | 10,000 SFM              | 14,000 SFM | 10,000 SFM              | 12,000 SFM               |
| Note: Most metals, including those listed, will cut better with longer tool life at speeds below the maximum surface feet per minute (sfm) rim speeds. |                         |            |                         |                          |
| SOFT & MEDIUM-HARD ALUMINUM                                                                                                                            | HARD, ANODIZED ALUMINUM |            |                         |                          |
| 18,000 SFM                                                                                                                                             | 12,000 SFM              |            |                         |                          |

# Schrader Bellows®

Pneumatic Division North America  
Richland, Michigan 49083

Installation and Service  
Instructions: 2FR100CSB

06E, 07E, 12E  
Filter/Regulator Series  
ISSUED: November, 1996  
Supersedes: May, 1995  
ECN# P25905



## WARNING

To avoid unpredictable system behavior that can cause personal injury and property damage:

- Disconnect air supply and depressurize all air lines connected to this product before installation, servicing, or conversion.
- Operate within the manufacturer's specified pressure, temperature, and other conditions listed on these instructions.
- Medium must be moisture-free if ambient temperature is below freezing.
- Service according to procedures listed in these instructions.
- Installation, service, and conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.
- After installation, servicing, or conversion, air supply should be connected and the product tested for proper function and leakage. If audible leakage is present, or the product does not operate properly, do not put into use.
- Warnings and specifications on the product should not be covered by paint, etc. If masking is not possible, contact your local representative for replacement labels.

## Introduction

Follow these instructions when installing, operating, or servicing the product.

## Application Limits

These products are intended for use in general purpose compressed air systems only.

### Operating Inlet Pressure:

|                         | kPa  | psig | bar  |
|-------------------------|------|------|------|
| with Polycarbonate Bowl | 1000 | 150  | 10.3 |
| with Metal Bowl         | 1700 | 250  | 17.0 |

Note: The maximum recommended pressure drop for a particulate filter is 70 kPa (10 psig, 0.7 bar).

### Ambient Temperature Range:

|                         |                             |
|-------------------------|-----------------------------|
| with Polycarbonate Bowl | 0°C to 52°C (32°F to 125°F) |
| with Metal Bowl         | 0°C to 80°C (32°F to 175°F) |

## Symbols



Filter/Regulator  
06E & 07E



Filter/Regulator 12E  
(Coalescing Element)

## Installation

1. The filter/regulator should be installed with reasonable accessibility for service whenever possible – repair service kits are available. Keep pipe or tubing lengths to a minimum with inside clean and free of dirt and chips. Pipe joint compound should be used sparingly and applied only to the male pipe – never into the female port. Do not use Teflon® tape to seal pipe joints – pieces have a tendency to break off and lodge inside the unit, possibly causing malfunction. Also, new pipe or hose should be installed between the filter/regulator and equipment being protected.
2. The upstream pipe work must be clear of accumulated dirt and liquids.
3. Select a filter/regulator location as close as possible to the equipment being protected.
4. Install filter/regulator so that air flows in the direction of arrow on body.
5. Install filter/regulator vertically with the bowl drain mechanism at the bottom. Free moisture will thus drain into the sump ("quiet zone") at the bottom of the bowl.
6. Gauge ports are located on both sides of the filter/regulator body for your convenience. It is necessary to install a gauge or socket pipe plugs into each port during installation.

\* Trademark E.I. Du Pont de Nemours & Co.

## Operation

1. Both free moisture and solids are removed automatically by the filter. Units with coalescing elements (e.g. 12E series) also remove oil. For coalescing units, a 5 micrometer pre-filter is recommended to protect and prolong the life of the coalescent filter element.
2. Manual drain filters must be drained regularly before the separated moisture and oil reaches the bottom of the baffle or end cap.
3. The filter element should be removed and replaced when pressure differential across the filter is 69 kPa (10 psig).
4. Before turning on the air supply, turn the knob counterclockwise until compression is released from the pressure control spring. Then turn knob clockwise and adjust regulator to desired downstream pressure. This permits pressure to build up slowly in the downstream line.
5. To decrease regulated pressure settings, always reset from a pressure lower than the final setting required. Example, lowering the secondary pressure from 550 to 410 kPa (80 to 60 psig) is best accomplished by dropping the secondary pressure to 350 kPa (50 psig), then adjusting upward to 410 kPa (60 psig).
6. When desired secondary pressure settings have been reached, push the knob down to lock this pressure setting.

## Service



**Caution:** Disconnect or shut off air supply and exhaust the primary and secondary pressures before servicing unit. Turning the adjusting knob counterclockwise does not vent downstream pressure on non-relieving regulators. Downstream pressure must be vented before servicing regulator.

**Note:** Grease packets are supplied with kits for lubrication of seals. Use only mineral based grease or oils. Do not use synthetic oils such as esters. Do not use silicones.

**Note:** After servicing unit, turn on air supply and adjust regulator to the desired downstream pressure. Check unit for leaks. If leakage occurs, do not operate - conduct repairs and retest.

## Servicing Filter Element -

### A. 06E & 07E Units (Refer to Figure 1.)

1. Unscrew the bottom threaded collar and remove bowl.
2. Unscrew the baffle and then remove element.
3. Clean all internal parts and bowl before reassembling. See polycarbonate bowl cleaning section. **IMPORTANT:** The 06E Filter/Regulator will not operate properly if the deflector (or rubber spacer if using an 06E adsorber) is not installed properly. The 06E deflector (or rubber spacer) must be installed between the filter stem and the filter body.
4. Install new element.
5. Attach baffle and finger tighten firmly.
6. Replace bowl seal. Lightly lubricate new seal to assist with retaining it in position.
7. Install bowl into body and tighten collar; torque:  
06E collar - from 3.2 to 3.6 N·m (28 to 32 in-lbs),  
07E collar - from 5.4 to 5.9 N·m (48 to 52 in-lbs).



## WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from The Company, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application, including consequences of any failure and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by The Company and its subsidiaries at any time without notice.

EXTRA COPIES OF THESE INSTRUCTIONS ARE AVAILABLE FOR INCLUSION IN EQUIPMENT / MAINTENANCE MANUALS THAT UTILIZE THESE PRODUCTS. CONTACT YOUR LOCAL REPRESENTATIVE.

## 06E, 07E, 12E Filter/Regulator Series

2FR100CSB

### B. 12E Units (Refer to Figure 2.)

1. Hold bowl collar stationary while unscrewing and removing bowl.
2. Unscrew end cap and then remove element. (Do not remove threaded rod.)
3. Clean all internal parts and bowl before reassembling.
4. Install new element.
5. Attach end cap and finger tighten firmly.
6. Replace bowl seal. Lightly lubricate new seal to assist with retaining it in position.
7. Thread bowl into collar; hand tighten until bowl stops against collar.

### Servicing Regulator -

#### A. 06E & 07E Units - (Refer to Figure 1.)

1. Disengage the adjusting knob by pulling upward. Turn adjusting knob counterclockwise until the compression is released from the pressure control spring.
2. Remove the bonnet and bowl assemblies by unscrewing the two threaded collars.
3. Remove diaphragm assembly from bonnet assembly.
4. Remove filter stem, filter element, poppet assembly, poppet return spring, (seat) insert and its o-rings.
5. Clean and carefully inspect parts for wear or damage. If replacement is necessary, use parts from service kits. Clean bowl. See polycarbonate bowl cleaning section.
6. Lubricate o-ring and vee packing seals with grease found in service kits.
7. Install poppet return spring, poppet assembly, (seat) insert and its o-rings, and filter stem. IMPORTANT: The 06E Filter/Regulator will not operate properly if the deflector (or rubber spacer if using an 06E adsorber) is not installed properly. The 06E deflector (or rubber spacer) must be installed between the filter stem and filter body.
8. Install filter element and firmly tighten baffle onto the filter stem.
9. Install diaphragm assembly into bonnet assembly. Assemble bonnet assembly to body and tighten threaded collar from 5.4 to 5.9 N·m (48 to 52 in-lbs).
10. Install bowl into body and tighten collar; torque:  
06E collar - from 3.2 to 3.6 N·m (28 to 32 in-lbs),  
07E collar - from 5.4 to 5.9 N·m (48 to 52 in-lbs).

#### B. 12E Units - (Refer to Figure 2.)

1. Disengage the adjusting knob by pulling upward. Turn adjusting knob counterclockwise until the compression is released from the pressure control spring.
2. Remove the bonnet assembly by unscrewing its threaded collar.
3. Remove the bottom collar and bowl as an integral unit. Note: The reverse flow adapter and element assembly should remain in proper alignment with the collar; they are held in place by the o-ring between the adapter and the collar.
3. Remove diaphragm assembly from bonnet assembly.
4. Remove poppet assembly, poppet return spring, (seat) insert and its o-rings.
5. Clean and carefully inspect parts for wear or damage. If replacement is necessary, use parts from service kits.
6. Lubricate o-ring and vee packing seals with grease found in service kits.

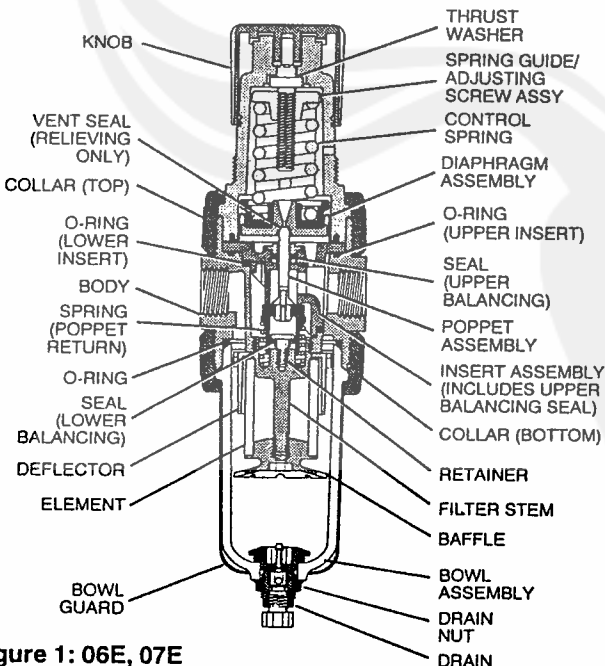


Figure 1: 06E, 07E

7. Install poppet return spring, poppet assembly, (seat) insert and its o-rings.
8. Install diaphragm assembly into bonnet assembly. Assemble bonnet assembly to body and tighten threaded collar from 5.4 to 5.9 N·m (48 to 52 in-lbs).
9. Install bottom collar and bowl subassembly into body. Tighten collar from 5.4 to 5.9 N·m (48 to 52 in-lbs) of torque.

### Safety: Polycarbonate Bowls

#### CAUTION

Polycarbonate bowls, being transparent and tough, are ideal for use with Filters and Lubricators. They are suitable for use in normal industrial environments, but should not be located in areas where they could be subjected to direct sunlight, an impact blow, nor temperatures outside of the rated range. As with most plastics, some chemicals can cause damage. Polycarbonate bowls should not be exposed to chlorinated hydrocarbons, ketones, esters and certain alcohols. They should not be used in air systems where compressors are lubricated with fire-resistant fluids such as phosphate ester and di-ester types.

Metal bowls are recommended where ambient and/or media conditions are not compatible with polycarbonate bowls. Metal bowls resist the action of most such solvents, but should not be used where strong acids or bases are present or in salt laden atmospheres. Consult the factory for specific recommendations where these conditions exist.

**TO CLEAN POLYCARBONATE BOWLS USE MILD SOAP AND WATER ONLY! DO NOT** use cleansing agents such as acetone, benzene, carbon tetrachloride, gasoline, toluene, etc., which are damaging to this plastic.

Bowl guards are recommended for added protection of polycarbonate bowls where chemical attack may occur.

#### WARNING

To avoid polycarbonate bowl rupture that can cause personal injury or property damage, do not exceed bowl pressure or temperature ratings. Polycarbonate bowls have a 150 psig (1030 kPa) pressure rating and a maximum temperature rating of 52°C (125°F).

| MAINTENANCE SERVICE KITS           | 06E<br>1/4", 3/8" & 1/2" | 07E<br>3/8", 1/2" & 3/4" | 12E<br>3/8", 1/2" & 3/4" |
|------------------------------------|--------------------------|--------------------------|--------------------------|
| Element Kits                       |                          |                          |                          |
| 5 Micron                           | PS702SB                  | PS802SB                  | N/A                      |
| 40 Micron                          | PS701SB                  | PS801SB                  | N/A                      |
| Grade 6                            | N/A                      | N/A                      | PS884SB                  |
| Grade 10                           | N/A                      | N/A                      | PS885SB                  |
| Relieving Regulator Repair Kit     | PS710SB                  | PS810SB                  | PS886SB                  |
| Non-Relieving Regulator Repair Kit | PS711SB                  | PS811SB                  | PS887SB                  |

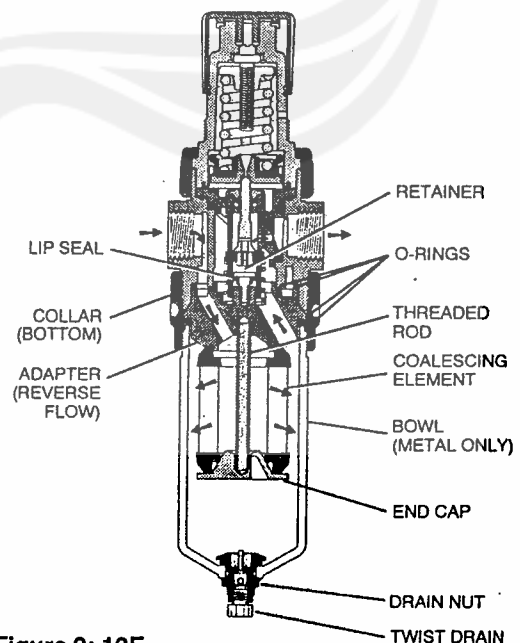


Figure 2: 12E

# Schrader Bellows®

Pneumatic Division North America  
Richland, Michigan 49083

Installation and Service  
Instructions: 2C100BSB

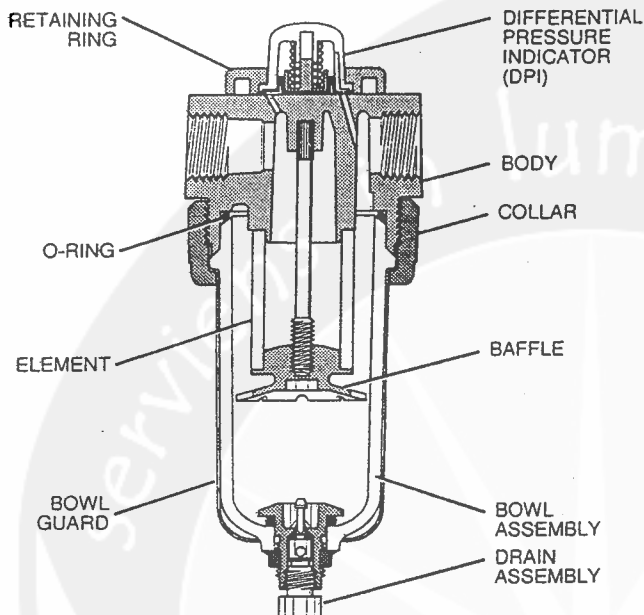
1/4", 3/8" & 1/2" 11F  
3/8", 1/2" & 3/4" 12F

Coalescing Filter

ISSUED: March, 1995

Supersedes: October, 1994

NPR# R06371



## Installation

1. The filter should be installed with reasonable accessibility for service whenever possible – repair service kits are available. Keep pipe or tubing lengths to a minimum with inside clean and free of dirt and chips. Pipe joint compound should be used sparingly and applied only to the male pipe – never into the female port. Do not use Teflon<sup>†</sup> tape to seal pipe joints – pieces have a tendency to break off and lodge inside the unit, possibly causing malfunction. Also, new pipe or hose should be installed between the filter and equipment being protected.
2. The upstream pipe work must be clear of accumulated dirt and liquids.
3. Select a filter location as close as possible to the equipment being protected and upstream of any pressure regulator.
4. Install filter so that air flows in the direction of arrow on body.
5. Install filter vertically with bowl drain mechanism at the bottom. Free moisture will thus drain into the sump ("quiet zone") at the bottom of the bowl.

## Application Limits

These products are intended for use in general purpose compressed air systems only.

### Maximum Recommended Pressure Drop:

|                   | psig | bar | kPa |
|-------------------|------|-----|-----|
| Coalescing Filter | 10   | 0.7 | 70  |

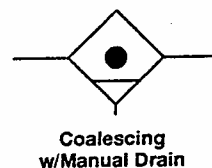
### With Polycarbonate Bowl

|                               | psig           | bar  | kPa  |
|-------------------------------|----------------|------|------|
| Operating Pressure Maximum    | 150            | 10.3 | 1000 |
| Operating Temperature Maximum | +125°F (+52°C) |      |      |
| Operating Temperature Minimum | +32°F (0°C)    |      |      |

### With Metal Bowl

|                               | psig           | bar  | kPa  |
|-------------------------------|----------------|------|------|
| Operating Pressure Maximum    | 250            | 17.0 | 1700 |
| Operating Temperature Maximum | +175°F (+80°C) |      |      |
| Operating Temperature Minimum | +32°F (0°C)    |      |      |

## ANSI Symbols



## WARNING

To avoid unpredictable system behavior that can cause personal injury and property damage:

- Disconnect air supply and depressurize all air lines connected to this product before installation, servicing, or conversion.
- Operate within the manufacturer's specified pressure, temperature, and other conditions listed in these instructions.
- Medium must be moisture-free if ambient temperature is below freezing.
- Service according to procedures listed in these instructions.
- Installation, service, and conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.
- After installation, servicing, or conversion, air supply should be connected and the product tested for proper function and leakage. If audible leakage is present, or the product does not operate properly, do not put into use.
- Warnings and specifications on the product should not be covered by paint, etc. If masking is not possible, contact your local representative for replacement labels.

## Operation and Service

1. Both free moisture and solids are removed automatically by the filter. There are no moving parts.
2. Manual drain filters must be drained regularly before the separated moisture and oil reaches the bottom of the lower baffle.
3. The coalescing filter element should be removed and replaced when pressure differential across the filter is 10 psid. The differential pressure indicator, located on top of the filter body, gives a visual indication of the pressure differential across the filter element. Change the filter element when half or more of the orange piston is above the retaining ring.
4. To replace the filter element.
  - A. Shut off air supply and depressurize the unit.
  - B. Unscrew the threaded collar and remove bowl.
  - C. Unscrew the lower baffle and remove filter element.
  - D. Clean all internal parts and bowl before reassembling. See polycarbonate bowl cleaning section.
  - E. Install element.
  - F. Attach lower baffle and tighten firmly.
  - G. Replace bowl seal; lubricate seal to assist in retaining it in position. Use only mineral base oils or grease. Do not use synthetic oils such as esters and do not use silicones.
  - H. Install bowl into body and tighten 11F collar to 28 – 32 inch pounds torque. Tighten 12F collar to 48 – 52 inch pounds torque.

| MAINTENANCE<br>SERVICE KIT | 11F<br>1/4", 3/8" & 1/2" | 12F<br>3/8", 1/2" & 3/4" |
|----------------------------|--------------------------|--------------------------|
| Element Kits               |                          |                          |
| Grade 6                    | PS724SB                  | PS824SB                  |
| Grade 10                   | PS730SB                  | PS830SB                  |
| DPI Repair Kit             | PS781SB                  | PS781SB                  |

Element kits include body/bowl seal.

## SAFETY: Polycarbonate Bowls

### CAUTION:

Polycarbonate bowls, being transparent and tough, are ideal for use with Filters and Lubricators. They are suitable for use in normal industrial environments, but should not be located in areas where they could be subjected to direct sunlight, an impact blow, nor temperatures outside of the rated range. As with most plastics, some chemicals can cause damage. Polycarbonate bowls should not be exposed to chlorinated hydrocarbons, ketones, esters and certain alcohols. They should not be used in air systems where compressors are lubricated with fire-resistant fluids such as phosphate ester and di-ester types.

Metal bowls are recommended where ambient and/or media conditions are not compatible with polycarbonate bowls. Metal bowls resist the action of most such solvents, but should not be used where strong acids or bases are present or in salt laden atmospheres. Consult the factory for specific recommendations where these conditions exist.

**TO CLEAN POLYCARBONATE BOWLS USE MILD SOAP AND WATER ONLY! DO NOT** use cleansing agents such as acetone, benzene, carbon tetrachloride, gasoline, toluene, etc., which are damaging to this plastic.

### WARNING

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This document and other information from The Company, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application, including consequences of any failure and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

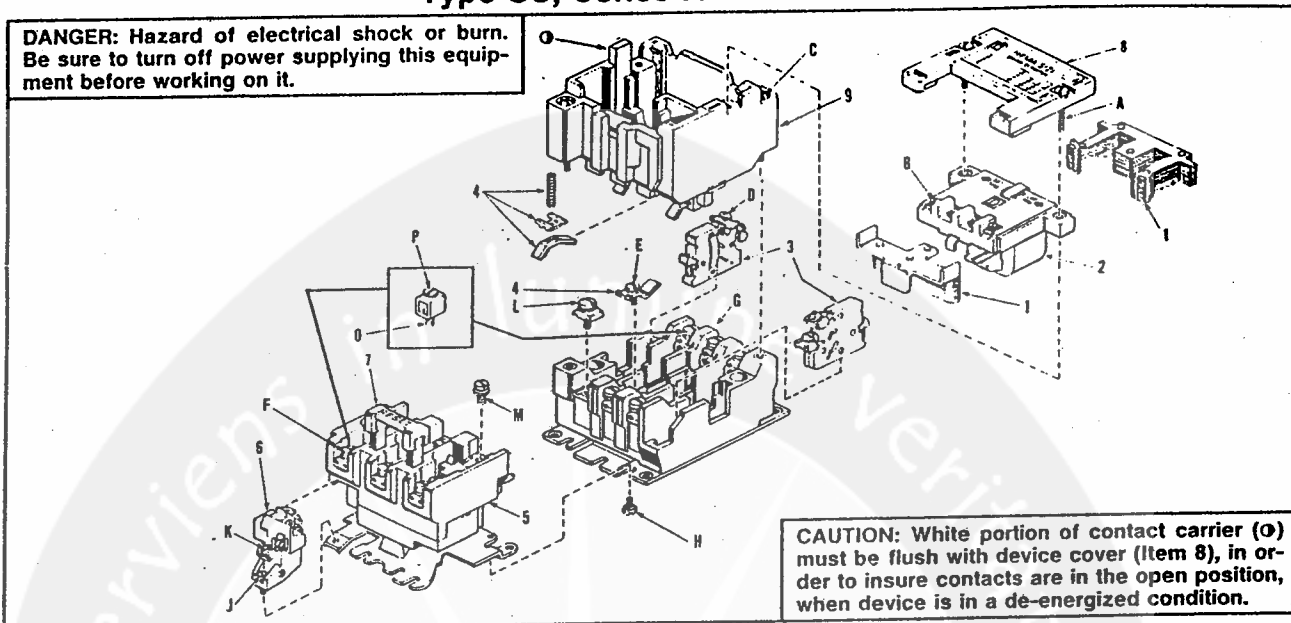
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## Classes 8502 and 8536 Sizes 1 and 1P — AC Magnetic Contactors and Starters Type SC, Series A or Series B

**DANGER:** Hazard of electrical shock or burn. Be sure to turn off power supplying this equipment before working on it.



**SERIES CHANGE** — Series B only applies to the Type S Starter Form B (3 ambient compensated overloads). All parts of Form B Series A and B starters are interchangeable; only the overload relay block differs. If the overload relay block of a Form B Series A starter is replaced with the Series B block, the overload relay thermal units must be selected from the Series B thermal unit selection tables for proper motor protection.

● **ACCESSORIES** — Auxiliary contacts, power pole kits and other field addable kits are available. Refer to the Square D Digest Class 9999 section for selection and application information.

● **OVERLOAD RELAYS** — Melting alloy overload relay blocks are supplied as standard with provisions for 1, 2 or 3 thermal units. The 2 thermal unit melting alloy overload block can be converted to a 3 thermal unit block by removing the center strap and installing a thermal unit in its place. The contact unit (Item 6) of the melting alloy overload block can be supplied with a N.O. or N.C. isolated alarm circuit contact in addition to the standard N.C. contact. The alarm circuit contact unit can be installed in the field. See Parts List.

Bimetallic overload relays are available as an optional feature. Starters with Form B1 (provisions for 2 thermal units) and Form B2 (provisions for 3 thermal units) use a non-compensated overload relay block. Form B starters (provisions for 3 thermal units) are supplied with an ambient temperature compensated overload relay block.

A SPDT contact is supplied as standard on all Type S bimetallic overload relays. The N.O. contact can be used in an alarm circuit and must be wired on the same polarity as the N.C. contact. Contacts are not replaceable. In order to directly replace a bimetallic overload relay, the appropriate part number listed on the Parts List should be used.

**TERMINALS** — Power and control terminals on standard devices are suitable for use with **copper wire only**.

**CONTACTS** — Are not harmed by discoloration and slight pitting. **DO NOT FILE THEM** as dressing wastes contact material. Replacement is necessary only when the contact has worn thin.

**CONTACT INSPECTION** — It is unnecessary to remove any wiring to inspect contacts. Merely loosen the two captive screws (Item C) which hold the contact actuator to the contact block. Lift the contact actuator to expose contacts.

● **MECHANICALLY INTERLOCKED UNITS** — Refer to Service Bulletin 9999-286 for mechanical interlock.

● **REPLACEMENT CONTACTS** — Replacement power contacts and springs for starters or contactors are available as kits. Order from Parts List.

Replacement contacts and springs for the **power pole kits only** are contained in a Class 9998 Type SL-22 Kit. One kit is required for each N.O. or N.C. contact.

**MANUAL OPERATION** — Manual operation of contactors and starters may be accomplished by pushing the contact carrier down with a screwdriver. A slot is provided in the contactor cover for this use. **DANGER** — Do not manually operate unless starter is isolated from the line.

**COIL REPLACEMENT** — To replace the coil loosen the two captive cover screws (Item A) and remove the cover. Disconnect wires from coil terminals. Remove the coil and magnet assembly. Separate the coil from the magnet assembly.

Reassembly is a reversal of the above. Manually operate (See Manual Operation, above) the device when reassembled to insure all parts are functioning properly. Follow recommended tightening torques when reassembling device.

● **ASSEMBLY INSTRUCTIONS** — Factory recommended torques for mechanical, electrical and pressure wire connections are listed in the Recommended Tightening Torque Table and Instruction Sheet. These must be followed to insure proper functioning of the device.

**SHORT CIRCUIT PROTECTION** — Branch-circuit overcurrent protection must be provided for each contactor or starter. For starters, refer to instructions furnished with the thermal unit selection table. For contactors (Class 8502 or 8702), provide branch-circuit overcurrent protection in accordance with the National Electrical Code, except do not exceed the maximum protective device ratings listed below.

| NEMA Size | Maximum Voltage | Time Delay Fuse (Ampere) | Non-Time Delay Fuse (Ampere) | Inverse-Time Circuit Breaker (Ampere) |
|-----------|-----------------|--------------------------|------------------------------|---------------------------------------|
| 1         | 600<br>250      | 30<br>40                 | 60<br>60                     | 40<br>60                              |

Supersedes 278AS dated April, 1985

**SQUARE D**

P.O. Box 27446  
Raleigh, N.C. 27611  
(919) 266-3671

● Revised

**DISTANT CONTROL OF CONTACTORS & STARTERS**

— To assure proper contactor operation, series impedance and shunt capacitance of the control circuit must be considered. Depending upon the voltage, wire size, and the number of control wires used, the limiting factor for figuring the maximum distance of the wire run may be series impedance or shunt capacitance. If distances to start or stop stations are longer than those listed, the wire run configuration and materials must be analyzed. For further information contact your

local Square D field office and ask for Product Data Bulletin M379.

| Coil Voltage<br>(60 Hz) | Maximum Control Distance (in feet) |                 |
|-------------------------|------------------------------------|-----------------|
|                         | #14 Copper Wire                    | #12 Copper Wire |
| 120                     | 845                                | 1300            |
| 240                     | 595                                | 495             |
| 480                     | 145                                | 120             |

**ORDERING INSTRUCTIONS** — Specify quantity, part number and description of part, giving complete nameplate data of the device. For example, one Armature and Magnet Kit 31041-605-50 for Class 8536 Type SCO-3, Series A starter.

| PARTS LIST |                                                                         |                      |          |        |        |        |        |
|------------|-------------------------------------------------------------------------|----------------------|----------|--------|--------|--------|--------|
| Item       | Description                                                             | Part Number          | Quantity |        |        |        |        |
|            |                                                                         |                      | 1 Pole   | 2 Pole | 3 Pole | 4 Pole | 5 Pole |
| 1          | Armature and Magnet Kit                                                 | 31041-605-50         | 1        | 1      | 1      | 1      | 1      |
| 2          | Coil                                                                    | See Table Below      | 1        | 1      | 1      | 1      | 1      |
| 3          | Internal Holding Circuit Contact                                        | Class 9999:          |          |        |        |        |        |
|            | Normally Open                                                           | Type SX-11           | *        | *      | 1      | 1      | 1      |
|            | Normally Closed                                                         | Type SX-12           | ....     | ....   | ....   | ....   | ....   |
| 4          | Contact Kit                                                             | Class 9999:          |          |        |        |        |        |
|            |                                                                         | Type SL-3            | 1        | 1      | 1      | ....   | ....   |
|            |                                                                         | Type SL-13           | ....     | ....   | ....   | 1      | ....   |
|            |                                                                         | Type SL-13 and SL-22 | ....     | ....   | ....   | ....   | 1      |
| 5          | Melting Alloy O.L. Relay Assembly                                       | Class 9065:          |          |        |        |        |        |
|            | 1 Element                                                               | Type SDO-4           | 1        | 1      | ....   | ....   | ....   |
|            | 2 or 3 Element                                                          | Type SDO-5           | ....     | ....   | 1      | 1      | 1      |
| 15         | Bimetallic O.L. Relay                                                   | Class 9065           |          |        |        |        |        |
|            | Non Compensated                                                         | Type SDO-5B1         | ....     | ....   | ....   | ....   | ....   |
|            | 2 Element (Form B1)                                                     | Type SDO-6B2         | ....     | ....   | ....   | ....   | ....   |
|            | 3 Element (Form B2)                                                     | Class 9065           |          |        |        |        |        |
|            | Compensated                                                             | Type SDO-6B          | ....     | ....   | ....   | ....   | ....   |
|            | 3 Element (Form B)                                                      | Class 9999 Type SO-1 | 1        | 1      | 1      | 1      | 1      |
| 6          | Melting Alloy O.L. Contact Unit                                         | Class 9999 Type SO-4 |          |        |        |        |        |
| 16         | Melting Alloy O.L. Contact Unit with Alarm Circuit                      | Class 9999 Type SO-5 |          |        |        |        |        |
|            | Normally Open Alarm Contact                                             | 31034-042-01         | 1        | 1      | 1      | 1      | 1      |
|            | Normally Closed Alarm Contact                                           | 31127-013-01         | 1        | 1      | 1      | 1      | 1      |
| 7          | Reset Bar                                                               | 31041-011-52         |          |        |        |        |        |
| 8          | Cover                                                                   | Class 9999:          |          |        |        |        |        |
| 9          | Actuator Assembly (Housing, Belcrank, Bearings, Contact Carrier, Cover) | Type SB-6            |          |        |        |        |        |
|            |                                                                         | Type SB-9            |          |        |        |        |        |
| †          | Power Pole Kit                                                          | 30018-018-50         |          |        |        |        |        |
|            | One Normally Open                                                       | 30018-018-50         |          |        |        |        |        |
|            | Two Normally Open                                                       | 48118-247-50         |          |        |        |        |        |
| F          | Wire Clamp and Screw                                                    | 48118-247-50         |          |        |        |        |        |
|            | Size 1 Contactor                                                        | 21920-16160          |          |        |        |        |        |
| L          | Wire Clamp and Screw                                                    | 30018-066-50         |          |        |        |        |        |
|            | Size 1 Contactor                                                        | 25054-13600          |          |        |        |        |        |
| M          | Overload Thermal Unit Fastening Screw                                   |                      |          |        |        |        |        |
| ★O         | Screw Assembly                                                          |                      |          |        |        |        |        |
| ★P         | Screw Lug                                                               |                      |          |        |        |        |        |

† Not Shown.

\* Furnished on 2 pole starters. However, 1 and 2 pole contactors are furnished with a holding circuit contact that is rated the same as a power pole.

★ Size 1P only.

| FACTORY RECOMMENDED TIGHTENING TORQUES |                                                                                                           |                           |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------|
| Item                                   | Description                                                                                               | Tightening Torque (lb-in) |
| A                                      | Cover Screws (2 per cover)                                                                                | 18-21                     |
| ●B                                     | Coil Terminal Pressure Wire Connector (2 per coil)                                                        | 9-12                      |
| C                                      | Power Plant Screws (2 per device)                                                                         | 18-21                     |
| ●D                                     | Internal Housing Circuit Contact Pressure Wire Connector (2 per contact)                                  | 9-12                      |
| E                                      | Stationary Contact Fasteners (2 per pole)                                                                 | 6-9                       |
| F                                      | Screw Lug (2 per pole)                                                                                    | ♦                         |
| ●G                                     | Auxiliary Wire Binding Screws                                                                             | 18-21                     |
| H                                      | Overload Relay Fastening Screw (2 per overload block)                                                     | 18-21                     |
| J                                      | Overload Switch Module Fastening Screw (1 per module)                                                     | 9-12                      |
| ●K                                     | Switch Module Pressure Wire Connectors (standard is 2 per module, with alarm circuit contact there are 4) | 9-12                      |
| L                                      | Overload to Contactor Fasteners (3 per device, except 2 on 2 pole starters)                               | 18-21▲                    |
| M                                      | Overload Thermal Unit Fastening Screw (2 per pole)                                                        | 18-21                     |
| O                                      | Lug Retaining Screw — Size 1P Only (1 per pole)                                                           | 18-21                     |

♦ See Instruction Sheet.

▲ For contactor, see Instruction Sheet.

| MAGNET COILS®   |       |             |              |           |               |           |              |           |               |           |           |              |           |              |
|-----------------|-------|-------------|--------------|-----------|---------------|-----------|--------------|-----------|---------------|-----------|-----------|--------------|-----------|--------------|
| Coil Prefix     | Hertz | COIL SUFFIX |              |           |               |           |              |           |               |           |           |              |           |              |
|                 |       | 24 Volts    | 110 Volts    | 120 Volts | 120/240 Volts | 208 Volts | 220 Volts    | 240 Volts | 240/480 Volts | 277 Volts | 380 Volts | 440 Volts    | 480 Volts | 550 Volts    |
| **<br>31041-400 | 60    | 20          | Use 120 Volt | 42        | †             | 48        | Use 240 Volt | 51        | †             | 52        | 56        | Use 480 Volt | 60        | Use 600 Volt |
|                 | 50    | 22          | 42           | 43        | ....          | ....      | 51           | 53        | ....          | ....      | 57        | 60           | ....      | 62           |

® When ordering replacement coils, give part number, voltage and frequency of coil being replaced.

\*\* Complete part number of coil consists of the prefix followed by the suffix. (Example: For 120 Volt, 60 Hertz coil, select a 31041-400-42).

† Dual Voltage coil. Order 120/240 volt, 60 Hertz, as 31041-402-02. Order 240/480 volt, 60 Hertz, as 31041-402-04.

●Revised

**SQUARE D**

Supersedes 278AS dated April, 1985

# Whirlwind Inc. Return Authorization Policy

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No returns will be accepted by Whirlwind Inc. without a return authorization number. A return number will be assigned by the Inside Sales Desk. No other person is to issue return authorization numbers. This number **MUST** appear on the shipping label and all associated paperwork. Shipments which do not have a Return Authorization Number will be refused.

After a Return Authorization Number has been issued, the customer may return the defective part for warranty **consideration**. Just because a part is returned does not guarantee that it will be replaced under warranty. A credit will only be issued after the item is examined and the Plant Superintendent or a company official **approves the credit**.

Any parts which are sent out as warranty replacements will be billed at the normal rate. Price of the part will be credited to the customer when the part is returned to Whirlwind Inc. and **if** the part is deemed as being under warranty. All **freight costs** are the **responsibility of the customer**. Any signs of abuse, misuse etc. will void any warranty claim. If parts are not returned within 30 days from date of return authorization, Whirlwind Inc. will require the invoice to be paid in full. **There will be no exceptions.**

Failure to pay an invoice for warranty claims which have been denied, when parts were not returned, or for freight will result in a shipping hold on future orders. We are **extremely** liberal on our warranty and will appreciate your cooperation with this policy.

**Hard Anodized Aluminum**  
Lightweight cylinder body:  
unique design provides  
strength and eliminates  
areas of contamination.

**Hard Anodized Aluminum**  
**Lightweight cylinder body:**

5" through 8" bore have aluminum tube with steel tie rods. See page 18 for construction.

• **Ports**  
N.P.T.F. ports are standard

• **Check Seal/Cushion\***

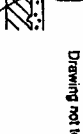
**Rounded lip piston seals glide on lubricant film to maximize life.**

### Piston-Rod — Hard chrome

**Cushion Needle Valves** make precise adjustment quick and easy. Captive cushion design allows for safe cushion adjusting while cylinder is under pressure. Brass material to resist corrosion.

## Anatomy of Econo-Ram II Sealing and Lubricant Retention Systems

Increased heel thickness  
outlets for extension and  
stability, resist rolling.



**Schrader  
Bellows**

**Schrader  
Bellows**

**Schrader  
Bellows**

Regional Plants  
 • Santa Fe Springs, CA  
 310/968-0985  
 • Emeryville, CA  
 202/740-2215

- Hillsborough, NC  
919-732-8371
- Akron, OH  
216-253-4500
- Portland, OR  
503-735-7355

**Schrad  
Below**