Operation and Maintenance Manual for the

Poly Bag Inserter Model 1575 D, E, F, G & H

(A-B SLC-150)

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1575-D & E POLY BAG INSERTER

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1.0 GENERAL SAFETY INFORMATION

Throughout this manual,

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and

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*  WARNING  *
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messages may appear.

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=  CAUTION  =
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appears where failure to observe its message could cause DAMAGE TO EQUIPMENT.

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*  WARNING  *
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appears where failure to observe its message could cause DAMAGE TO EQUIPMENT AND/OR INJURY TO PERSONNEL.

WARNING DO NOT OPERATE THIS MACHINE UNTIL YOU HAVE BEEN INSTRUCTED IN ITS SAFE USE BY YOUR SUPERVISOR.

WARNING IF SO EQUIPPED, DETERMINE LOCATION OF ALL "EMERGENCY" SWITCHES.

WARNING MAINTENANCE AND ADJUSTMENT MUST NOT BE PERFORMED UNLESS ALL ELECTRICAL AND AIR POWER HAVE BEEN DISCONNECTED.

WARNING DO NOT OPERATE MACHINE WITHOUT ALL GUARDS IN PLACE.

WARNING OBSERVE EXTREME CAUTION WHEN SWITCHES ARE TURNED "ON". OPERATION MAY START AUTOMATICALLY AFTER A TIME DELAY.

WARNING STOP MACHINE AND DISCONNECT POWER SUPPLY BEFORE OILING, WIPING OR REPAIRING.

WARNING DISCONNECT ALL ELECTRICAL AND AIR POWER BEFORE REMOVING COVERS OF CONTROL BOXES, STARTERS, SWITCHES, ETC.

WARNING WHEN MACHINE IS DOWN FOR ADJUSTMENT OR REPAIR, PLACE A SIGN "DANGER, MEN WORKING - DO NOT START" ON THE CONTROL PANEL OF THE MACHINE.

2.0 MACHINE DESCRIPTION AND SPECIFICATIONS

2.1 MACHINE DESCRIPTION

The Bemis Packaging Machinery Company's Poly Bag Inserter is a fully automatic machine which separates a poly bag poly bag from a roll of perforated and sealed poly bags, opens the bag, inserts the bag into a formed and bottom-sealed case, and cuffs the top of the bag over the vertical top flaps of the case.

An eight-foot long indexing conveyor is furnished to receive erected and sealed cases from a case erector and properly position the case in the bag-inserting station. Once a case is in position, a signal is given to allow the bag inserter to complete a cycle.

2.2 MACHINE SPECIFICATIONS

2.2.1 OVERALL MACHINE DIMENSIONS (APPROXIMATE)

Width:	4'5" (1346 mm) without conveyor 5'3" (1600 mm) with lift
Length:	6'9" (2057 mm) 7'10" (2388 mm) with lift
Overall Height:	9'4" (2845 mm) with minimum stroke inserting cylinder

2.2.2 ELECTRICAL REQUIREMENTS

Input Power:	230/440 Volt, 3 Phase, 60 Hertz
Control Circuit:	115 volt power is obtained through a control transformer.
Maximum Machine Current Draw (Including Conveyor):	
	230 Volts = 15 Amps.
	460 Volts = 11 Amps.
Optional Roll Lift (Includes 1/3 H.P. Motor):	
	230 Volts = Add 3.6 Amp.
	460 Volts = Add 1.8 Amp.

2.2.3 AIR REQUIREMENTS

Operating Pressure:	60 psi (414 kPa)
Line Pressure:	70 psi (483 kPa)
Maximum Free Air Consumption:	1 cu.ft. (28.3 liters) free air per cycle

2.2 MACHINE SPECIFICATIONS (Cont.)

2.2.4 CASE SIZE RANGE

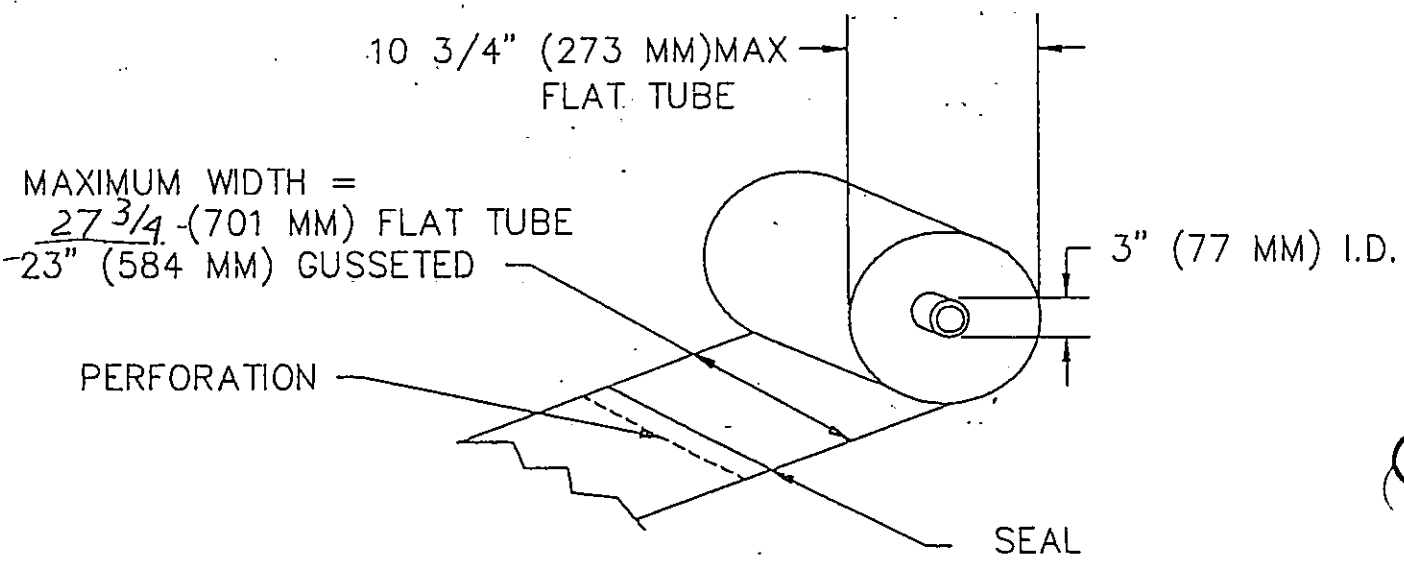
Length		8" to 20" (204 mm to 508 mm)
Width:		4" to 16" (102 mm to 407 mm)
*Depth -	34" stroke:	10" to 22" (254 mm to 559 mm)
	40" stroke:	10" to 28" (254 mm to 631 mm)
	46" stroke:	10" to 34" (254 mm to 864 mm)

*Depth dimensions given pertain to the vertical height of the case including the top flaps in the vertical position and the bottom of the case sealed. Greater depths may be accommodated on a special basis by increasing machine height and inserting cylinder stroke.

2.2.5 BAG ROLL SPECIFICATIONS

Maximum Diameter:	10-3/4" (273 mm)
Flat tube Maximum Width:	27-1/4" (692 mm) (for liquid bulk)
	27-3/4" (705 mm) (for nonliquid bulk)
Gussetted Maximum Width:	23" (575 mm)
Core I.D.:	3" (77 mm)

NOTE: Bags must be rolled so sealed end of bags will unwind from roll first, core must be flush with ends of bag roll for nonliquid bulk (for liquid bulk, core extends 1/4" (6 mm) beyond bag on each end), and rolls must be wound within 1/4" (6 mm) variation or less at ends.



2.2 MACHINE SPECIFICATIONS (Cont.)

2.2.6 BAG SIZING AND SPECIFICATIONS

Bag Material: Low-density polyethylene
Bag Gauge: 1-1/2 mil to 3 mil
Bag Sizing:
Flat Tube: Width = Case Length + Case Width + 3-1/2" (89 mm)
*Flat Tube: Length = Case Depth + Case Width + 5" to 7" (127 mm to 178 mm)

Gussetted (Preferred):
Face Width = Case Length + 3-1/2" (89 mm)

Gusset = Case Width
*Length = Case Depth + Case Width + 5" to 7" (127 mm to 178 mm)

*Formula given is for RSC-style cases. Add an additional one-half case width for FOL-style cases. Use one-half width case for HSC-style cases.

1. Bags must be free of static electricity and internal blocking.

2. Perforations must be cut clean with the land between slits 1/16" to 3/32" (1.6 mm to 2.4 mm). Typical slit width is 1/4" to 5/16" (6.3 mm to 8 mm)

3. Bag length variation must not exceed ± 1/8" (± 3 mm).

4. Severe roll tightness contributes to blocking. The minimum roll tightness that can be handled effectively is desirable.

5. Special consideration must be taken in the packing and shipping of rolls to prevent telescoping and edge damage.

2.2.7 PRODUCTION SPEED

Up to 12 cases per minute, depending upon case depth and width.

2.2.8 SHIPPING WEIGHT

Approximately 2400 lbs. (1091 kg); includes 8'0" (2438 mm) indexing conveyor.

1575

3.0 INSTALLATION INSTRUCTIONS

3.1 GENERAL

The Poly Bag Inserter is shipped from the factory with the inserting head and the vertical switch mount removed. The indexing conveyor is also shipped separately from the poly bag inserter. The following information is provided to assist in installing the equipment. The unit has been initially tested and adjusted at the factory.

3.2 PREPARATION FOR SERVICE

1. Remove all shipping brackets and shipping tape.

2. Attach inserting head, vertical switch mount and conveyor in proper location. (See Figure 3.2-1.)

3. Connect tubing support (spring steel) to inserting head with two (2) #10-24 N.C. screws and connect two (2) 1/4" o.d. air lines to inserting head manifolds. Also connect photo eye to head. (See Figure 3.2-1.)

4. Attach case stop and case spacing mechanism to the conveyor in their proper location. (See Figure 3.2-1.)

5. Once the machine has been located in its operating position, the machine must be made level for a good operation.

6. The conveyor must be mounted to the bag inserter; all wires, junction box, and motor connected to bag inserter control box. (See Figure 3.2-1.)

3.0 INSTALLATION INSTRUCTIONS

3.2 PREPARATION FOR SERVICE (Cont.)

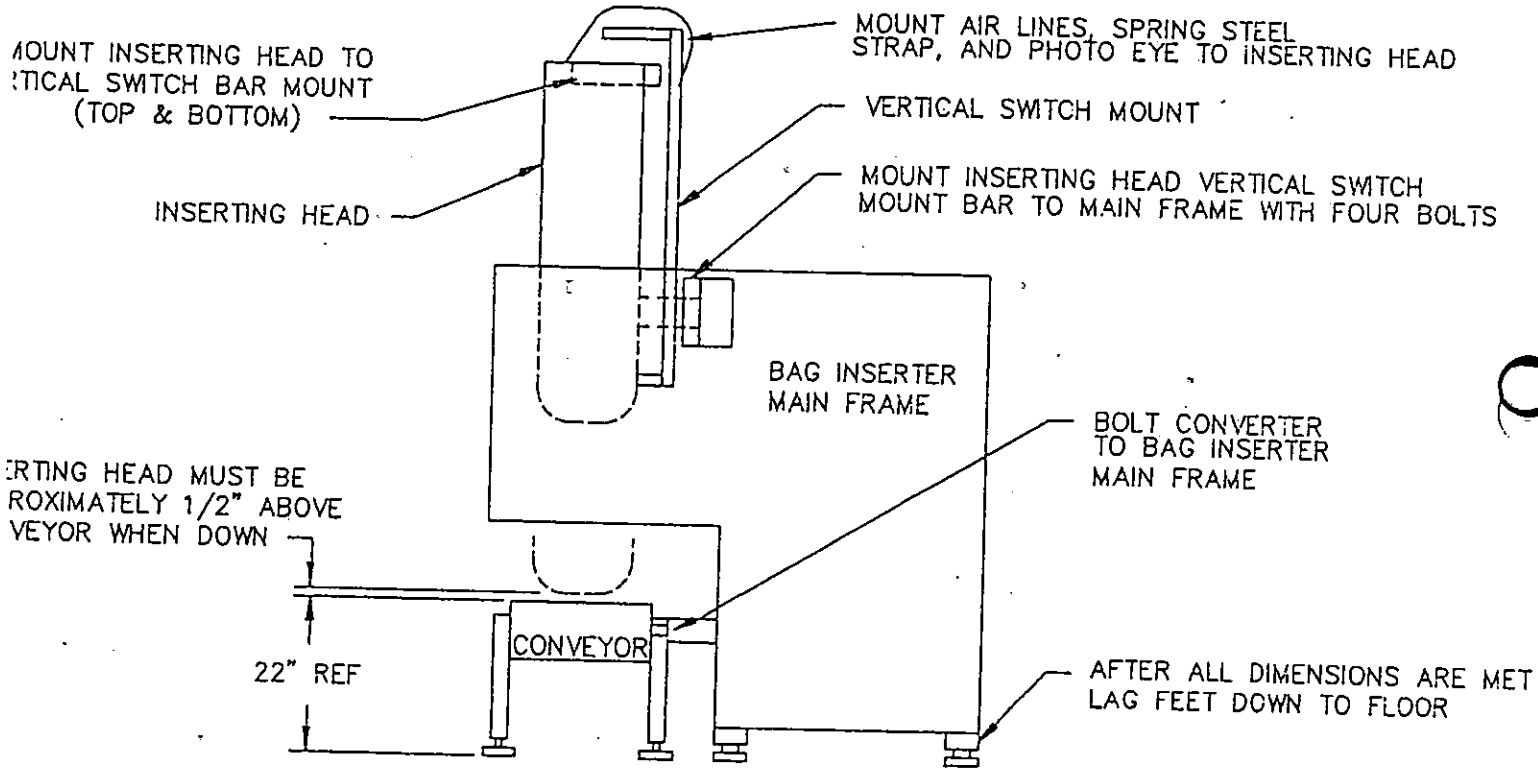


FIGURE 3.2-1

3.0 INSTALLATION INSTRUCTIONS (Cont.)

3.3 AIR SUPPLY CONNECTION

The air supply connection is made at the manual shutoff valve located on the incoming side of the filter, regulator, and lubricator. The incoming line should have a minimum i.d. of 3/8" (10 mm). the line pressure should be a minimum of 70 psi (483 kPa). The pressure regulator should be set at 60 psi (414 kPa).

3.4 ELECTRICAL CONNECTIONS

Power is brought directly to the main control box. See wiring diagram for proper terminal connections. The 115 A.C. and 24 A.C. volt power is provided through a control transformer.

4.0 OPERATING PROCEDURES

The Bemis Series 1575 Poly Bag Inserter is designed to automatically separate, open, insert, and cuff a poly bag into a previously opened and bottom-sealed case.

4.1 MACHINE START-UP AND SHUTDOWN PROCEDURES

1. Place a roll of perforated and sealed poly bags on a mandrel and between the bag roll guides provided. Position mandrel on bag roll mounts (nylon V-blocks). (See Section 4.5 in this manual for Size Changeover Procedure.)

   NOTE: If optional roll lift is supplied, see that section in this manual.

2. Lift the upper feed roll up into its latched position and manually feed end of bag roll through feed rolls and down behind bag separator. Unlatch upper feed roll. (See Section 4.5 in this manual for Size Changeover Procedures.)

3. Make sure the electrical safety disconnect is in the "ON" position.

4. Make sure the manual air shutoff valve is in position (this is with the handle parallel to the valve flow) and the main pressure regulator is set at 60 psi (414 kPa).

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THE INSERTING HEAD COULD FALL WHEN MACHINE IS SHUT DOWN.

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AIR MUST BE TURNED "ON" BEFORE STARTING MACHINE.

5. Depress the "START" pushbutton to start the machine. The conveyor motor will start which allows a case to be conveyed to the inserting position; also, the vacuum pump motor will start.

   NOTE: There is a two-second delay to assure all motions are in their "HOME" positions before any motion occurs.

4.1 MACHINE START-UP AND SHUTDOWN PROCEDURES (Cont.)

6. Turn the "BAG FEED OFF-ON" selector switch to the "ON" position; the feed rolls will feed the end of the bag roll down between bag guides until an electric eye is energized; when the eye is energized, the bag feed jam timer will be de-energized unless there is a jammed bag.

7. Once the electric eye is energized and the inserting head is in its retracted position, the bag-opening mechanism (outer set of vacuum cups) retracts and clamps the top of the bag, energizing a proximity switch which extends the separating mechanism (inner set of vacuum cups) and separating a bag from the bag roll.

8. As the separating mechanism extends, it de-energizes a proximity switch which applies vacuum to the cups and, also, will not allow the bag feed to feed another bag.

9. When the separating mechanism is fully extended, the bottom of the bag is pulled away from the electric eye which extends the bag opening mechanism and opens the bag.

10. Once the bag opening mechanism is fully extended, a proximity switch is energized to extend inserting head into the bag and then into the box (if a box is in position to be inserted).

11. When the inserting head is fully into the bag, the separating mechanism is retracted which allows another bag to be fed down, and also turns off the vacuum.

12. Once the inserting head is fully extended into the box, the cuffing fingers are extended to cuff the bag and, after a delay, the cuffing fingers are retracted. Then the inserting head is retracted.

13. As the inserting head is retracting, the case stop is retracted to allow the "bag inserted" case to leave.

14. When the inserting head is fully retracted, the cycle repeats.

4.1 MACHINE START-UP AND SHUTDOWN PROCEDURES (Cont.)

15. SHUTDOWN

A. To stop the machine from cycling, turn "BAG FEED OFF-ON" selector switch to "OFF", stopping the bags from feeding, but allowing the last cycle to be completed and the inserted case to exit.

B. Depress the "STOP" pushbutton to stop the complete machine including the conveyor motor.

Note that "STOP" pushbuttons remain depressed until "pulled out" and the machine will not start.

NOTE: When the "STOP" pushbutton is pushed, all air to the air cylinders will be shut off.

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BEFORE DEPRESSING E-STOP, THE INSERTING HEAD SHOULD BE COMPLETELY UP OR DOWN.

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DO NOT STOP MACHINE WHILE THE BAG OPENING CYLINDERS ARE EXTENDING OR RETRACTING.

4.2 MACHINE SAFETIES

1. BAG FEED SAFETY

A bag feed safety is built into the bag feed down circuit. The bag has a certain amount of time to energize the electric eye when feeding down. If a bag does not feed down properly, time will run out and stop the machine cycle.

2. CASE-IN-POSITION SAFETY

The machine will only complete a portion of the complete cycle unless a case is in position. (The bag will stop in the open position on the cups until a case is present.)

4.3 SEQUENCE OF OPERATION

The following steps are the programmable controls' programmed circuit that is the brains of the machine (the line numbers correspond to the rung numbers on the wiring schematic):

RUNG: 1 This is the cycle start timer that is energized when the machine is started (through conveyor motor starter contact). It will stay energized until the "STOP" pushbutton is pushed or either bag feed or insert jam timer has timed out, indicating a jam or that the "START" pushbutton is depressed.

RUNG: 3 This is the bag feed motor drive output that, when energized, will feed a bag into position to be opened. To energize this output, the following conditions must be met:

A. Cycle start timer must be energized.

B. Bag feed selector switch must be "ON".

C. Separate cylinder extended retracted timer is de-energized.

D. Bag feed eye is not blocked by bag.

E. Opening cylinders must be extended.

RUNG: 4 This is the bag feed jam timer that is energized (starts timing) when bag feed motor output is energized. If it times out before bag is in position, it will signal a jam.

RUNG: 6 This is a latching relay that signals when the separating cylinder is not completely retracted. It is energized when the separating proximity switch is de-energized as the separating cylinder begins to extend. It is reset if the machine is shut off or a jam condition is signaled (normally closed cycle start timer), or when separating reset relay is energized and separating proximity is energized.

RUNG: 8 This is the separating extend relay that signals when the separating cylinder is completely extended. It is energized when latching relay KRO and separating proximity are energized; it will hold itself until latching relay KRO is de-energized.

4.3 SEQUENCE OF OPERATION (Cont.)

RUNG: 9 This is the separating cylinder reset relay that will be energized when separating extend relay is energized and, as the separating cylinder is retracting, separating proximity switch is de-energized. It will hold itself until separating extend relay is de-energized.

RUNG: 10 This is the separating cylinder extend output. When energized, the separating cylinder will be extended. The following conditions must be made to initially energize it:

A. Back-up eye is energized (not blocked by a case).

B. Bag opening cylinder retracted proximity switch is energized.

C. Bag feed eye is blocked by bag.

D. Inserting head moving down counter is not energized.

E. Cycle start time is energized.

It will hold itself until either inserting head counter is energized or cycle start timer is de-energized.

RUNG: 11 This is the bag-opening cylinder's retract output which, when energized, will retract the bag-opening bar and vacuum cups. The following conditions must be met for it to be energized:

A. Bag feed switch must be energized but, once it is energized, it will override bag feed switch input.

B. Bag feed motor output must be de-energized.

C. Separating cylinder extend relay must be de-energized.

D. Insert up relay must be energized.

E. Cycle start timer must be energized.

F. Separating cylinder relay must be de-energized.

G. Delay relay is energized.

4.3 SEQUENCE OF OPERATION (Cont.)

RUNG: 12 This is the delay relay that is energized when cycle start timer is energized.

RUNG: 13 This is the vacuum valve output which, when energized, will turn vacuum "ON" to the vacuum cups. It is energized when the bag-separating cylinder extend output is energized and if cycle start timer is energized.

RUNG: 14 This is the inserter up counter which signals that the inserting head is completely retracted.

It counts every time that inserting head proximity switch is energized by a target, as long as the bag-opening cylinder retracted proximity is de-energized.

The insert up counter is reset if the machine is shut down, or a jam condition is signaled (cycle start timer is de-energized), or when insert up counter is counted out (7 counts).

RUNG: 15 This is the inserter up relay which signals that the inserting head is completely retracted. One of the following conditions must be met to energize this relay:

A. if inserter up counter is energized.

B. if conveyor start input is de-energized and inserter proximity is energized.

C. if there is an inserter jam (timer 2 has timed out) and inserter proximity is energized.

Inserter up relay will hold itself in as long as inserter proximity is energized. Also, if the inserter is down, counter is energized; it will de-energize inserter up relay.

RUNG: 16 This is the insert down counter which signals that the inserting head is completely extended.

When the insert head down output is energized, then every time the insert head proximity switch is energized, a count signal is sent to the insert down counter.

4.3 SEQUENCE OF OPERATION (Cont.)

RUNG: 16 (Cont.)

It is reset when energized and insert head proximity is de-energized (insert head begins to retract), or when the machine is stopped, or when a jam condition is indicated (cycle start timer is de-energized).

RUNG: 17 This is the insert moving down counter which signals that the inserting head has moved down (extended) far enough to relieve vacuum to the bag and, also, to retract the separating cylinder.

When the insert head down output is energized, then every time the insert head proximity switch is energized, a count signal is sent to the insert moving down counter. The insert moving down counter is reset by any one of the following conditions:

A. when the insert moving down counter is energized and nsert head proximity is de-energized.

B. when machine is shut down or a jam condition is signaled (cycle start timer is de-energized).

C. when insert down counter is energized.

RUNG: 18 This is the insert moving up counter which signals that the inserting head has moved up (retracted) far enough to release the case in position and allows the next case to feed in.

When the insert head down output is de-energized and the insert head proximity is energized, it will send a count signal to the insert moving up counter. The insert moving up counter is reset by any one of the following conditions:

A. when the insert moving up counter is energized and insert head proximity is de-energized.

B. when machine is shut down or a jam condition is signaled (cycle start timer is de-energized).

C. when insert down counter is energized.

4.3 SEQUENCE OF OPERATION (Cont.)

RUNG: 19 This is the insert down output which energizes the inserting head cylinder to extend down. It is energized when the following conditions are met:

A. Vacuum safety switch is energized.

B. Separating cylinder extend relay is energized.

C. Bag opening extend proximity switch is energized.

D. There is a case in position; proximity switch is de-energized.

NOTE: When insert down output is energized, it will override conditions "A", "B", "C", and "D".

E. Insert up delay timer is not energized.

F. Cycle start timer is energized.

RUNG: 20 This is the double insert safety that ensures that the inserter will not insert two (2) bags into the same case. Double insert safety output is energized when inserter down counter is energized. It will hold itself in until case-in-position proximity is de-energized.

RUNG: 21 This is the insert jam timer output which specifies that there is an inserter head jam. It is energized when the inserter down output is energized and, if it times out before the head is all the way down, it will indicate a jam and hold itself in until the "START" pushbutton is pushed.

RUNG: 22 This is the cuffing fingers in output which is energized when insert down counter is energized; it stays energized until the cuffing finger timer times out or the machine is shut down.

4.3 SEQUENCE OF OPERATION (Cont.)

RUNG: 23 This is the case stop retract output which, when energized, will release the case that has had a bag inserted into it. It is energized when inserting head moving up counter is energized. Case stop output will hold itself in until the case-in-position input is no longer blocked by case or machine is shut down (cycle start timer is de-energized).

RUNG: 24 This is the case clamp output which will not allow the second case to move into position until the first case is moved out. It is energized whenever case-in-position input is blocked by a case.

RUNG: 25 This is the insert up delay timer which is energized when the inserting head is completely down; also, it energizes double load safety relay. When the insert up delay timer times out, it sends the inserting head up (de-energizes insert head output), setting the length that the cuffing fingers stay out. It is energized by double insert safety output.

RUNG: 26 When energized, this timer will send the cuffing fingers out.

When the double load contact is energized, it energizes the timer to start timing.

RUNG: 27 This is the bag feed time delay that assures that the separating cylinder is back before allowing bag feed motor to begin feeding a bag down. It is energized when separating cylinder extend relay is de-energized.

4.4 INITIAL SETUP AND ADJUSTMENTS

4.4.1 TRACKING CONVEYOR BELT

To check the tracking of the conveyor belt, remove all cases from the conveyor, turn bag feed "ON-OFF" selector switch to the "OFF" position. Next, start machine and, if the belt does not track properly, adjust either side of the take-up pulley. Once this is done, let run five minutes to be sure of no creepage.

4.4.2 INSERTING HEAD

NOTE: See Bag Changeover Section in this manual or any adjustment on the inserting head that pertains to the bag or case size.

1. INSERTING HEAD DOWN POSITION

Adjust the inserting head rod end so that, when the head is completely down, it is 1/2" (13 mm) above the conveyor's belt. This will prevent the inserting head from applying any pressure on the conveyor when inserting a bag into a box. See Figure 4.4.2-1.

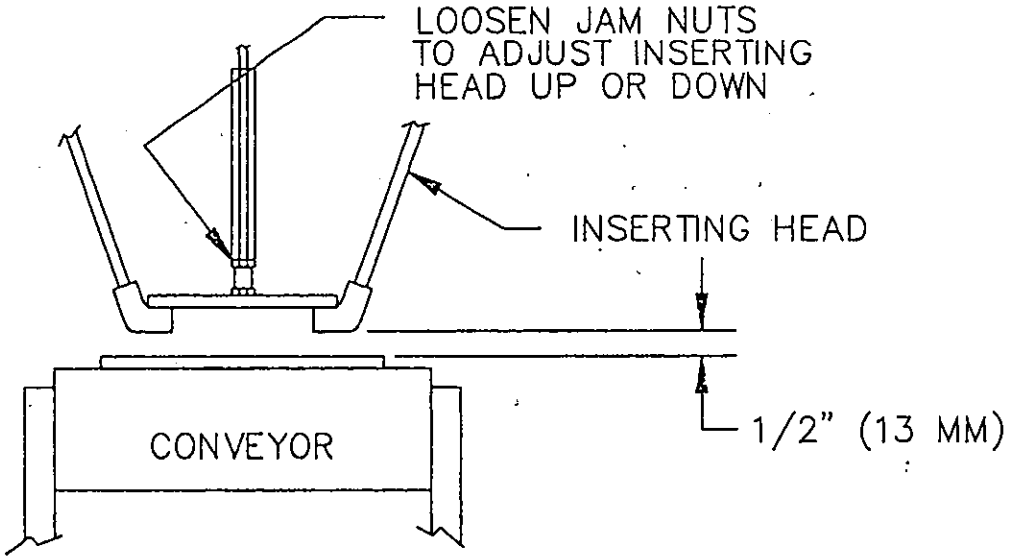

FIGURE 4.4.2-1

4.4.2 INSERTING HEAD (Cont.)

2. INSERTING HEAD UP-AND-DOWN TARGETS

NOTE: These flags pertain only to the photo reflective targets that indicate inserting head is completely up or down.

A. INSERTING HEAD UP

Turn on machine (with air "ON") and, with head up, be sure the reflective photo eye is approximately in the center of the inserting head up target. See Figure 4.4.2-2.

B. INSERTING HEAD DOWN

Shut off machine when the inserting head is completely down; be sure reflective photo eye is approximately in the center of the inserting head down target. See Figure 4.4.2-2.

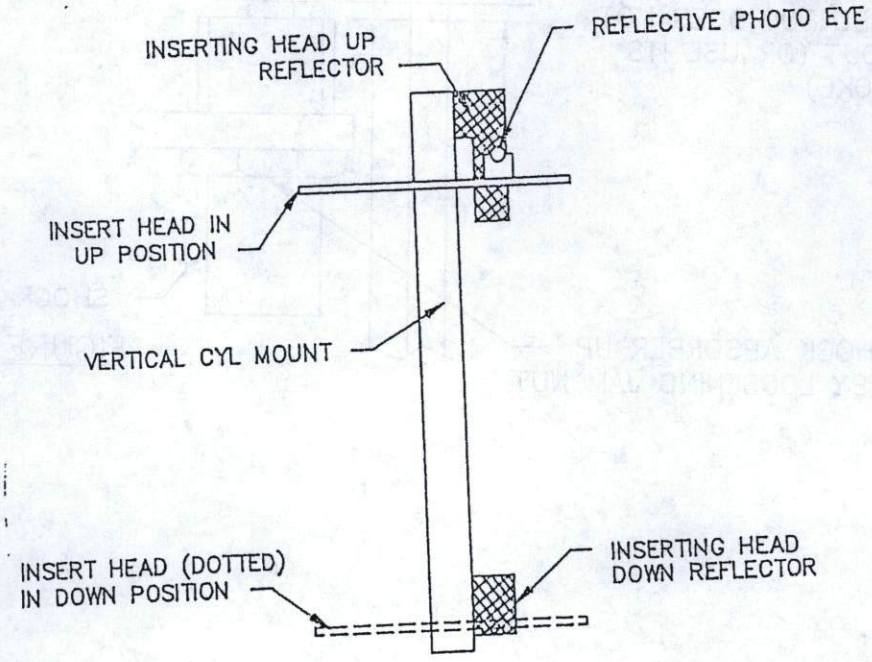

FIGURE 4.4.2-2

4.4.2 INSERTING HEAD (Cont.)

3. INSERTING HEAD'S SHOCK ABSORBERS

The shock absorbers must be mounted in a position such as -- when the head is completely up or down, it contacts the shock absorber rod but the shock absorber is not bottomed out. See Figure 4.4.2-3.

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IF THE SHOCK ABSORBER BOTTOMS OUT, THERE WILL BE A DEFINITE LIMITATION AS TO THE LIFE SPAN.

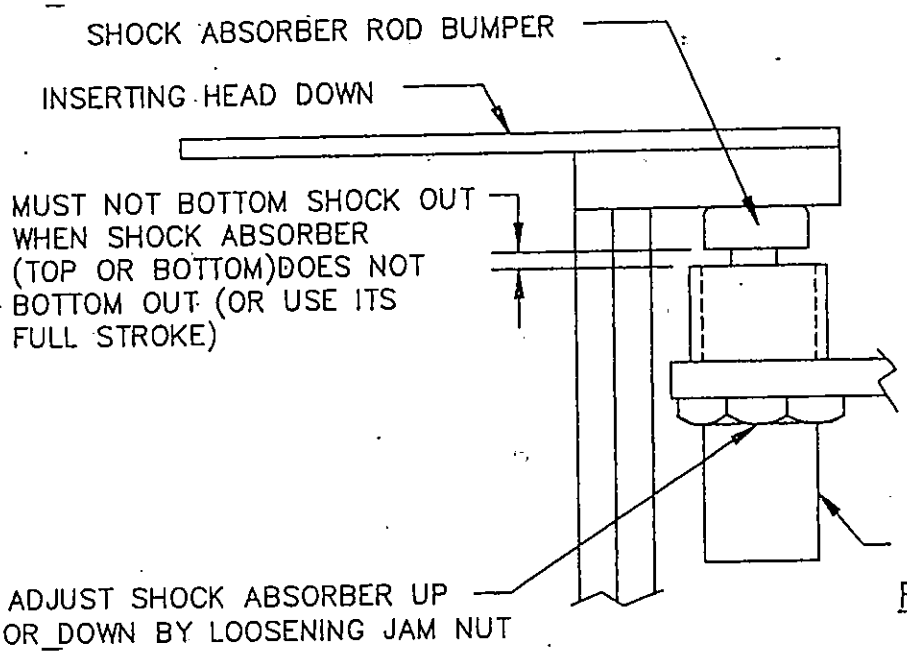


FIGURE 4.4.2-3

FIGURE 4.4.2-3

4.4.2 INSERTING HEAD (Cont.)

4. The insert mount brackets should be tapered from the cuffing brackets to the lower tie plate. The taper should be angled as much as possible and still fill out the box with the bag. See Figure 4.4.2-4.

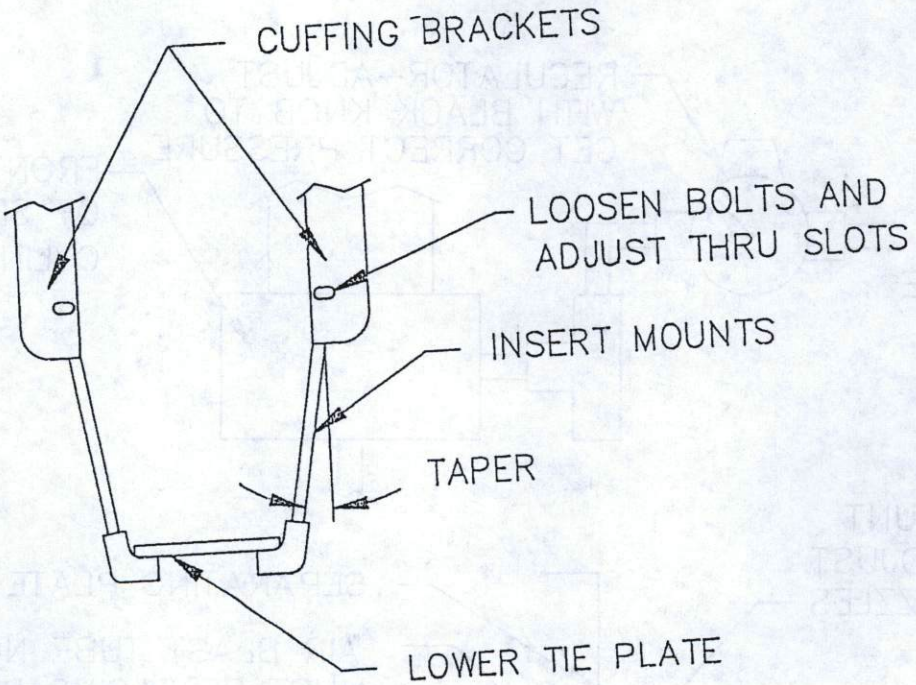


FIGURE 4.4.2-4

4.4.3 AIR BLAST REGULATOR

Locate the air blast nozzle (located in front of the bag feed roller on the separating plate) and the small regulator (located on the front port of the separating cylinder). With machine running and bag feed "OFF", adjust this regulator to approximately 3 - 5 psi of flow. Physically, be sure there is some air flow coming through the air blast nozzle at this time. See Figure 4.4.3-1.

NOTE: If there is a definite air circulation problem within the plant, this regulator may have to be readjusted.

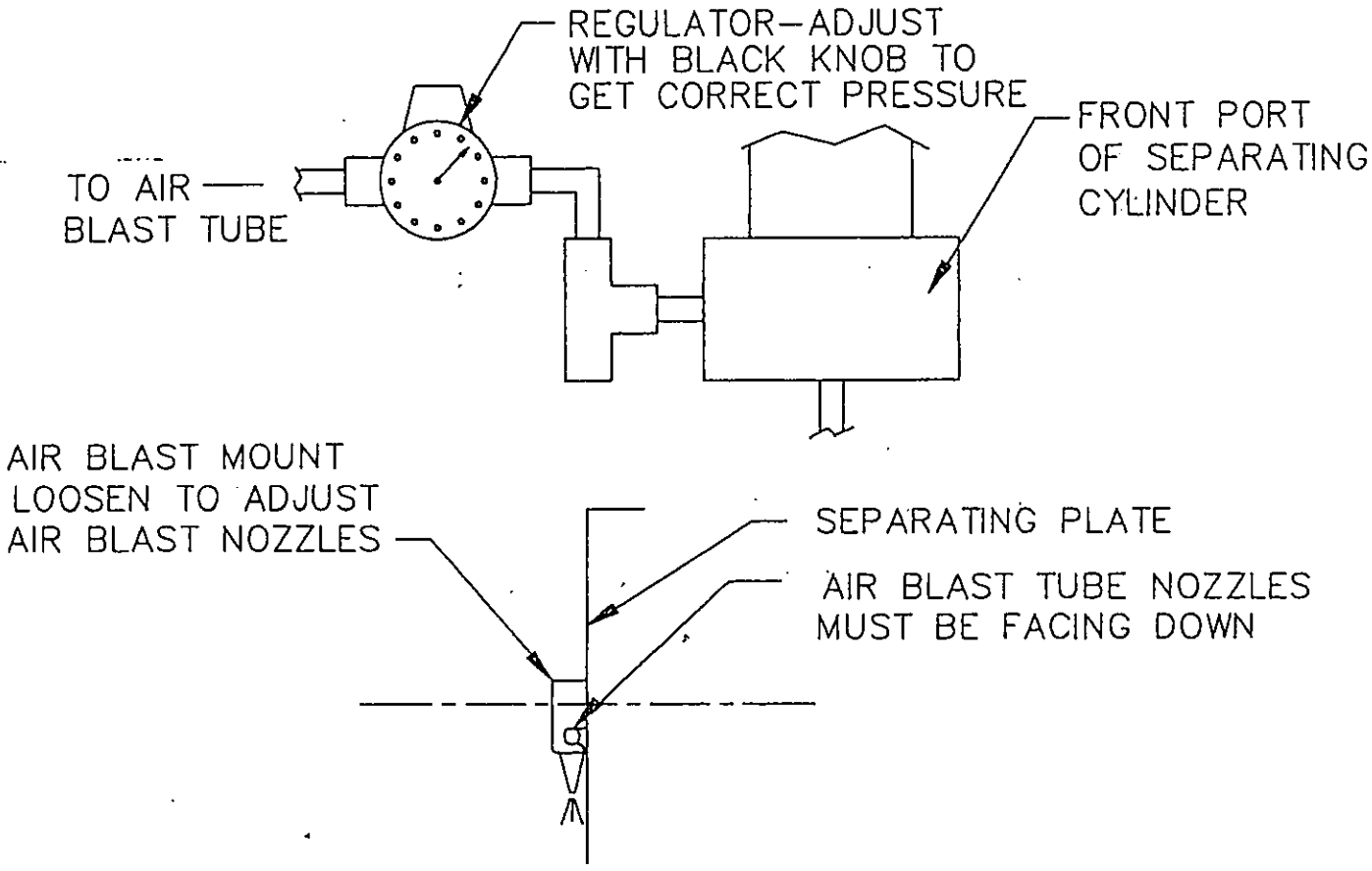


FIGURE 4.4.3-1

4.4.4 VACUUM VALVE RELIEF VALVE

Locate this relief valve (near the vacuum pump) and adjust in or out until the vacuum reads at least 25" of vacuum when no vacuum is at the vacuum cups. See Figure 4.4.4-1.

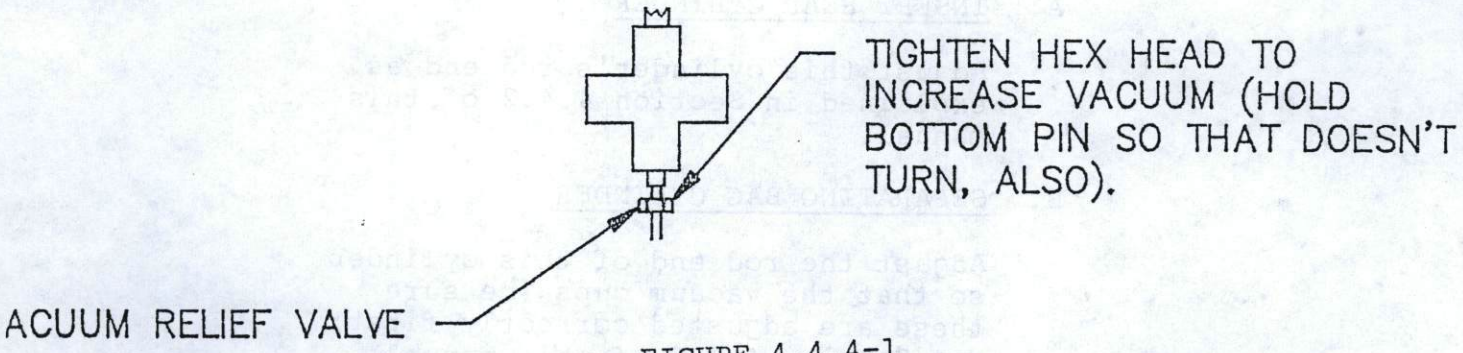


FIGURE 4.4.4-1

4.4.5 CYLINDER CUSHIONS, SPEED, AND ROD END SETTINGS

1. AIR CYLINDER CUSHIONS

Adjust cushion on all cylinders (both front and rear cap -- except for small bore or stroke cylinders which do not have cushions). By adjusting the cushions properly, all abrupt stopping will be removed at the end of the cylinder strokes.

To adjust the cushion, turn screw in completely; next, turn out approximately one-quarter turn at a time until a smooth, quiet action takes place at the end of the cylinder strokes. See Figure 4.4.5-1.

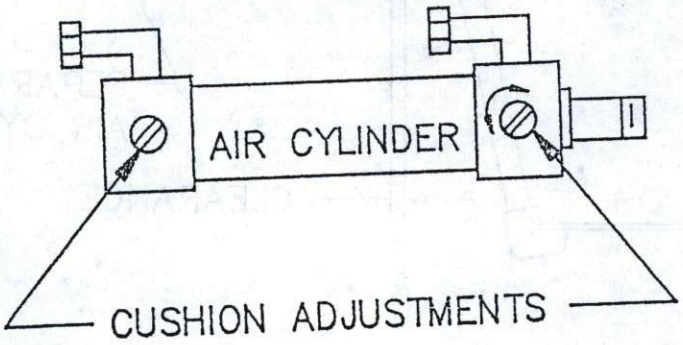


FIGURE 4.4.5-1

4.4.5 CYLINDER CUSHIONS, SPEED, AND ROD END SETTINGS (Cont.)

2. CYLINDER ROD END SETTINGS

A. INSERT HEAD CYLINDER

Adjust this cylinder's rod end as explained in Section 4.4.2 of this manual.

B. SEPARATING BAG CYLINDER

Adjust the rod end of this cylinder so that the vacuum cups (be sure these are adjusted correctly first; see Section 4.4.6 of this manual) do not interfere with the inserting head going down when the cylinder is completely extended. See Figure 4.4.5-2.

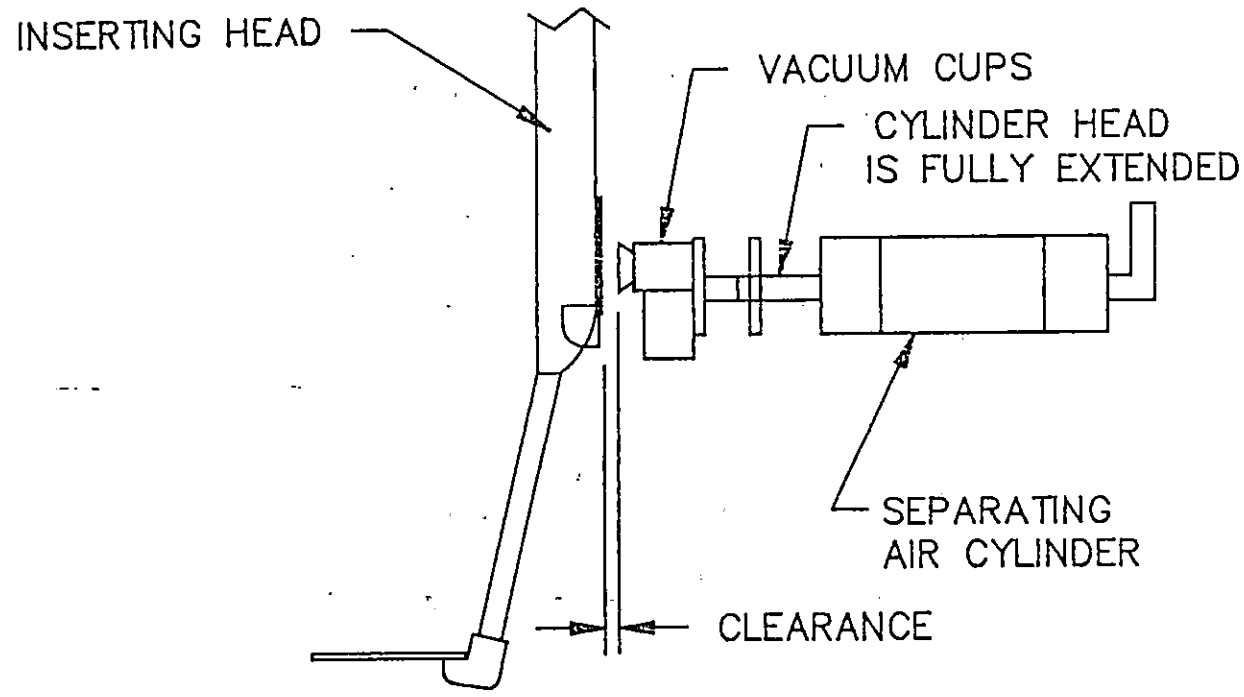


FIGURE 4.4.5-2

4.4.5 CYLINDER CUSHIONS, SPEED, AND ROD END SETTINGS (Cont.)

2. CYLINDER ROD END SETTINGS (Cont.)

C. BAG-OPENING CYLINDERS

These cylinders are set automatically at assembly. To recheck this, be sure the cylinder's rod stud is completely threaded into the mating hexagon spacer on the outer opening bar. If there is binding on these cylinders as they extend, check the shim spacer on the outer vacuum bar to be sure they are properly assembled. See Figure 4.4.5-3.

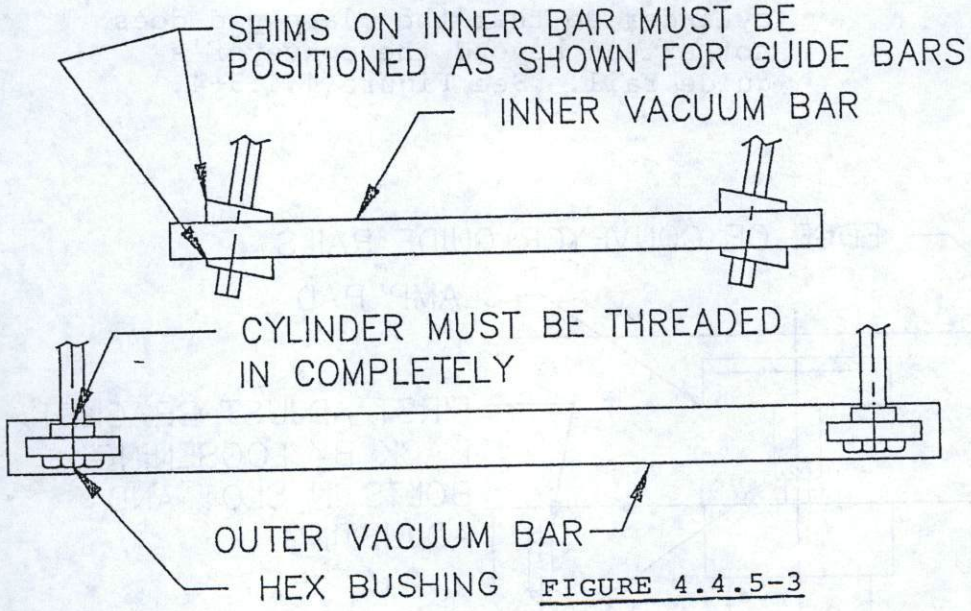


FIGURE 4.4.5-3

D. CUFFING CYLINDERS

These four cylinders should retract and extend to approximately same position.

NOTE: If a cylinder seems to be sticking, first check to see that there is no binding of the cuffing finger mount as it travels through the nylon guides. If so, loosen nylon guides and let cylinder self-adjust the guides and then retighten.

4.4.5 CYLINDER CUSHIONS, SPEED, AND ROD END SETTINGS (Cont.)

2. CYLINDER ROD END SETTINGS (Cont.)

E. CASE STOP CYLINDER (ON CONVEYOR)

Adjust the rod end of this cylinder so that, when it is completely retracted, the case stop does not extend beyond conveyor guide rail. See Figure 4.4.5-4.

F. CASE CLAMP CYLINDER (ON CONVEYOR)

Adjust the threaded rod on this cylinder so that the clamp pad does not extend beyond the conveyor's guide rail. See Figure 4.4.5-4.

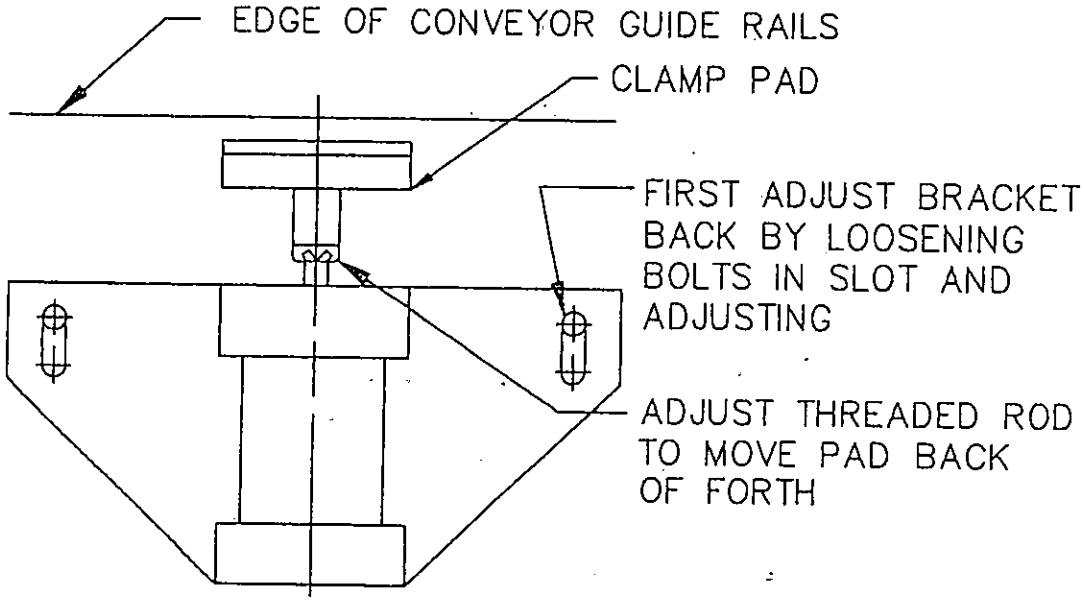


FIGURE 4.4.5-4

4.4.5 CYLINDER CUSHIONS, SPEED, AND ROD END SETTINGS (Cont.)

3. FLOW CONTROL SETTINGS

The location of the flow controls are explained and illustrated as follows:

A. ALL CYLINDERS (EXCEPT BAG OPENING AND CUFFING FINGERS)

The flow controls for these cylinders are located on the valve bank in back of the machine. See Figure 4.4.5-5.

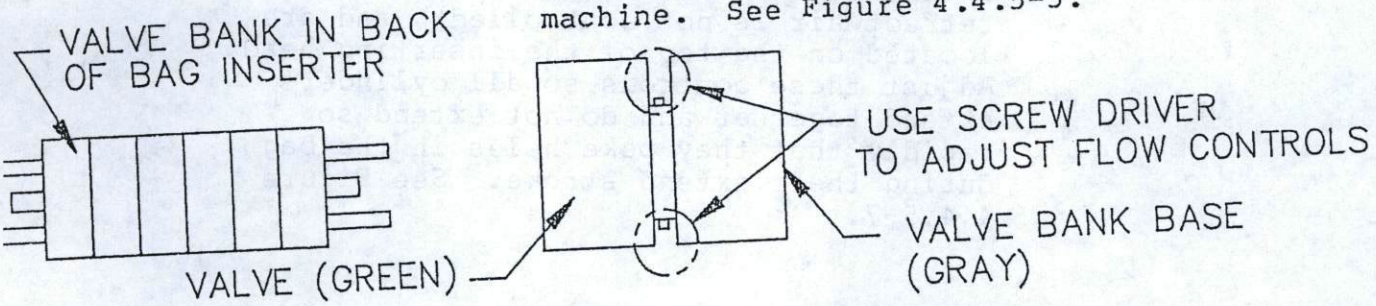


FIGURE 4.4.5-5

B. BAG-OPENING CYLINDERS

The flow controls for these two cylinders are under the main mount plate for the separating and opening portion of the bag inserter. They can be accessed from the front of the machine. See Figure 4.4.5-6.

Adjust these cylinders for an extend stroke speed that is a moderate speed but not too fast that the bag does not open. The retract stroke speed can be faster than the extend stroke (as long as it is not so fast that it is detrimental to the machine's life expectancy).

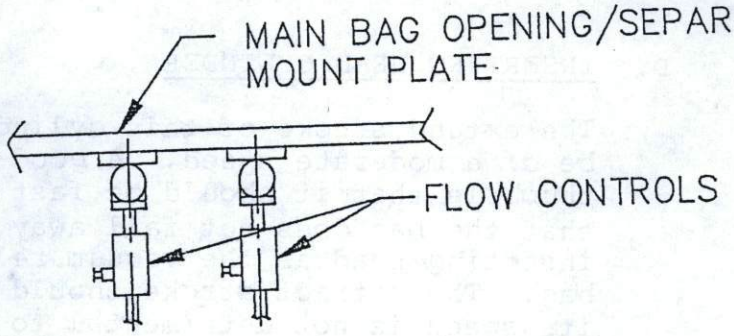


FIGURE 4.4.5-6

4.4.5 CYLINDER CUSHIONS, SPEED, AND ROD END SETTINGS (Cont.)

3. FLOW CONTROL SETTINGS (Cont.)

C. CUFFING FINGERS

The flow controls for these four cylinders are needle valves which just control the extend stroke of the cylinders (the retract air is not controlled), and are located on the top of the inserting head. Adjust these controls so all cylinders extend together and do not extend so rapidly that they poke holes in the bag during their extend stroke. See Figure 4.4.5-7.

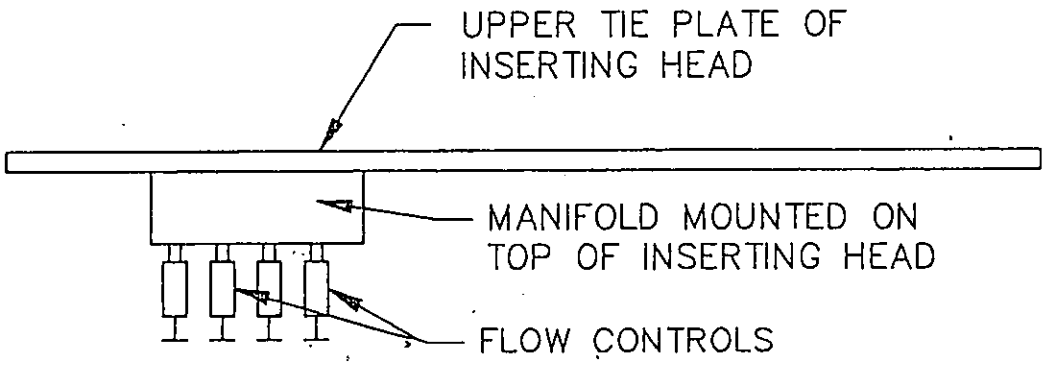


FIGURE 4.4.5-7

D. INSERTING HEAD CYLINDER

The extend stroke of this cylinder should be of a moderate speed. A good rule of thumb is that it should be fast enough so that the bag does not fall away from the inserting head as the vacuum releases the bag. The retract stroke should be set so its speed is not detrimental to the life expectancy of the machine.

4.4.5 CYLINDER CUSHIONS, SPEED, AND ROD END SETTINGS (Cont.)

3. FLOW CONTROL SETTINGS (Cont.)

E. ALL OTHER CYLINDERS

The cylinders on the conveyor and the separating cylinder should all have a moderately rapid extend and retract stroke. Two reasons for this are -- so that the separating cylinder separates the individual bag from the roll quite abruptly and retracts completely before the next bag is fed down; the cylinders on the conveyor should be able to bring in the next case to be inserted without much hesitation so that the operational speed is not slowed down.

4.4.6 INITIAL VACUUM CUP AND BAG-SHIFTING BUMPER ADJUSTMENT

With air "OFF":

1. Loosen cup clamp screw and position the bellows of each rear cup 3/4" (18 mm) from the front edge of rear vacuum bar. Also, pivot the outside rear shifting bumpers until the top of each bumper is flush with the top of the vacuum cups. Lock cups in place. See Figure 4.4.6-1.

2. Loosen jam nuts on threaded rod bumper mounts and adjust until bumpers are flush with the bellows of the rear vacuum cups. Lock in position. See Figure 4.4.6-1.

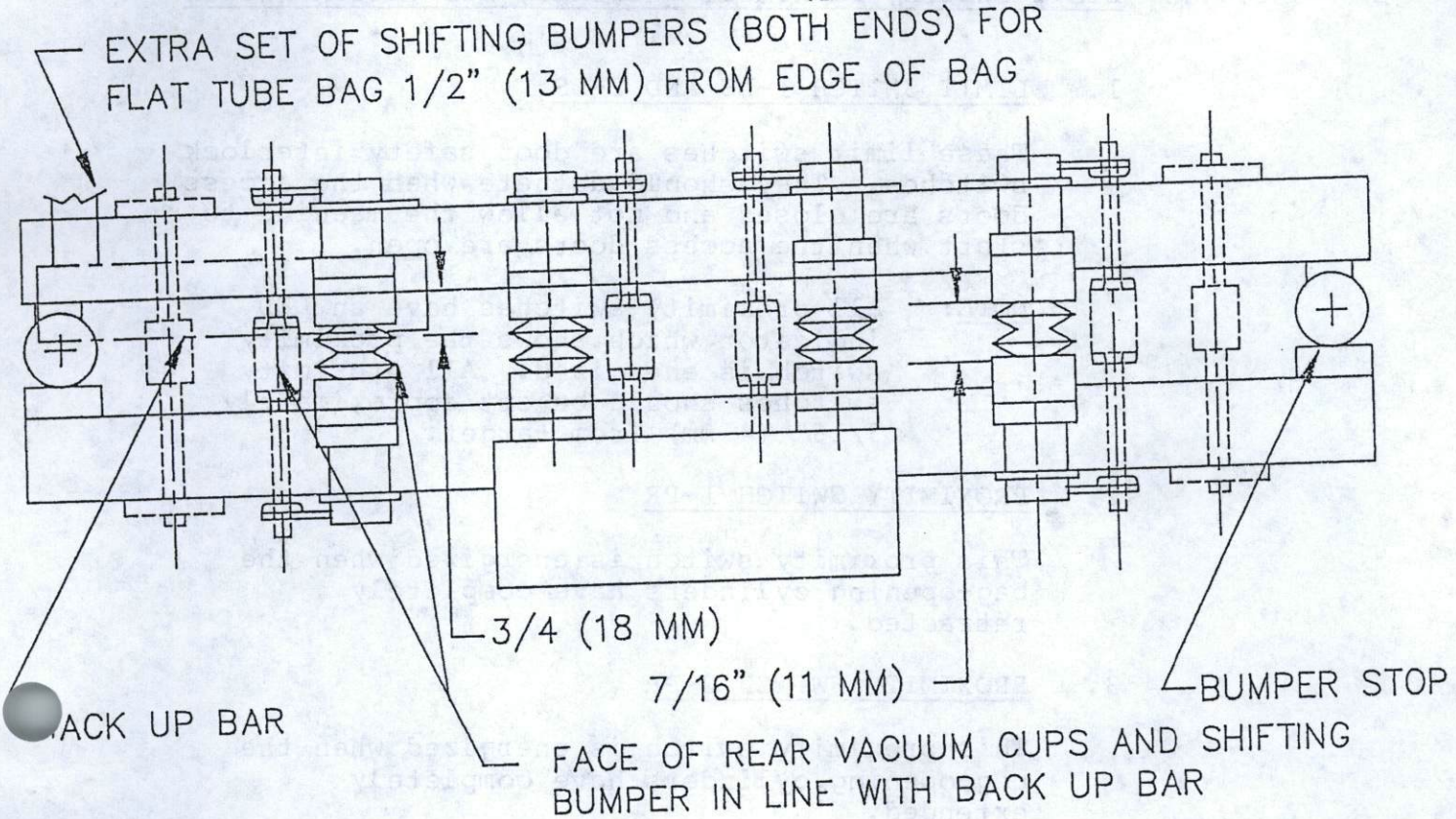
3. Manually retract the front vacuum bar until the cam follower contacts the stop pad. Loosen and adjust the front vacuum cups to a 7/16" (11 mm) dimension between front and rear cup mount, keeping the front shifting bumpers flush with the top of the vacuum cups. See Figure 4.4.6-1.

4.4.6 INITIAL VACUUM CUP AND BAG-SHIFTING BUMPER ADJUSTMENT (Cont.)

4. Loosen jam nuts on threaded rod bumper mounts and turn out the front shifting bumpers until they contact the rear shifting bumpers plus one turn to allow the bumpers to compress when the machine is in operation. See Figure 4.4.6-1.

NOTE: Shifting bumpers are located on 'inside' of adjustable vacuum cup when using gusseted tube and on 'outside' when using flat tube bags.

4.4.6 INITIAL VACUUM CUP AND BAG-SHIFTING BUMPER ADJUSTMENT (Cont.)



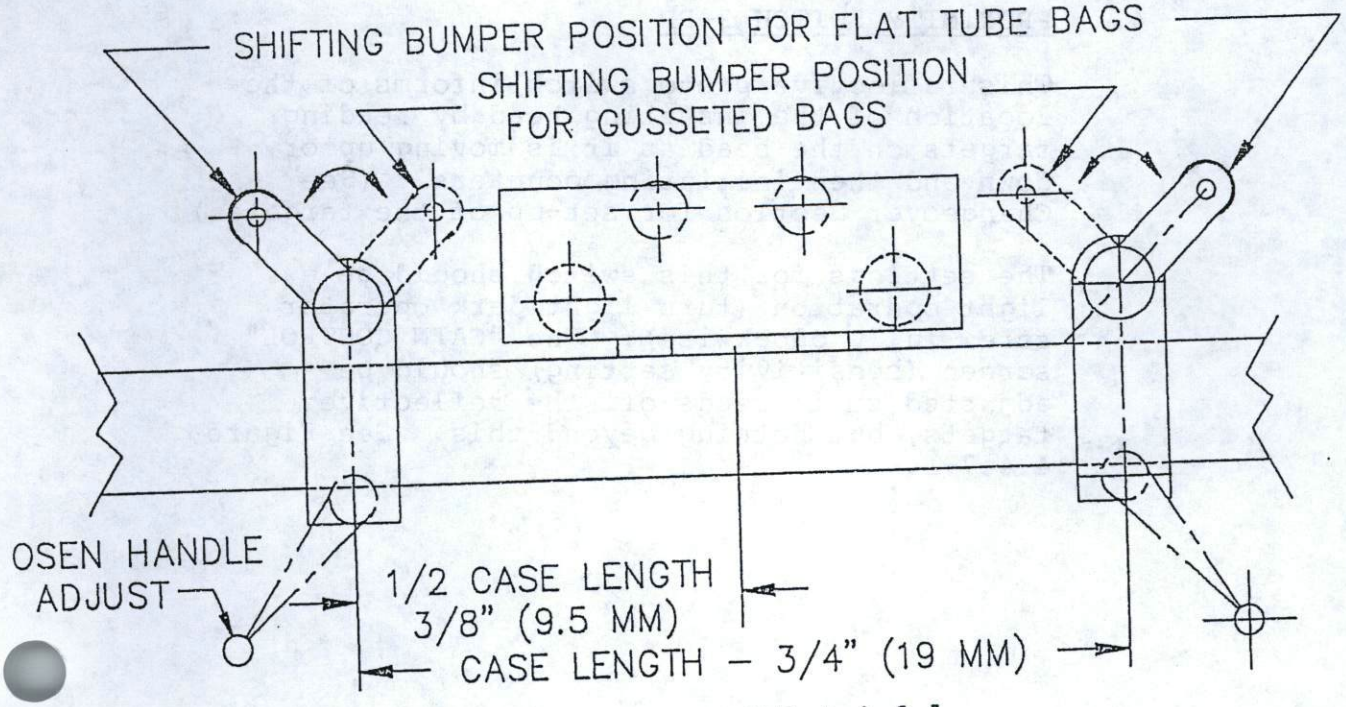


FIGURE 4.4.6-1

4.4.7 LIMIT SWITCH, PROXIMITY SWITCHES, AND VACUUM SWITCH

1. LIMIT SWITCH 1-LS AND 2-LS

These limit switches are door safety interlock switches. They should actuate when the access doors are closed and not allow the machine to start when the access doors are open.

NOTE: All proximity switches have an LED indicator which shows the proximity switch is energized. All proximity switches should be set approximately 3/16" (4 mm) from target.

2. PROXIMITY SWITCH 1-PR

This proximity switch is energized when the bag-opening cylinders have completely retracted.

3. PROXIMITY SWITCH 2-PR

This proximity switch is energized when the bag-opening cylinders have completely extended.

4. PROXIMITY SWITCH 3-PR

This reflective photo switch informs of the location of the inserting head by reading targets on the head as it is moving up or down and then initiating counters. (See Changeover Section for set-up of the targets.)

The settings for this switch should be a light operation (turn light/dark operator screw fully clockwise). The "GAIN CONTROL" screen (sensitivity setting) should be adjusted so it reads off the reflective targets, but nothing beyond this. See Figure 4.4.7-1.

4.4.7 LIMIT SWITCH, PROXIMITY SWITCHES, AND VACUUM SWITCH (Cont.)

4. (Cont.)

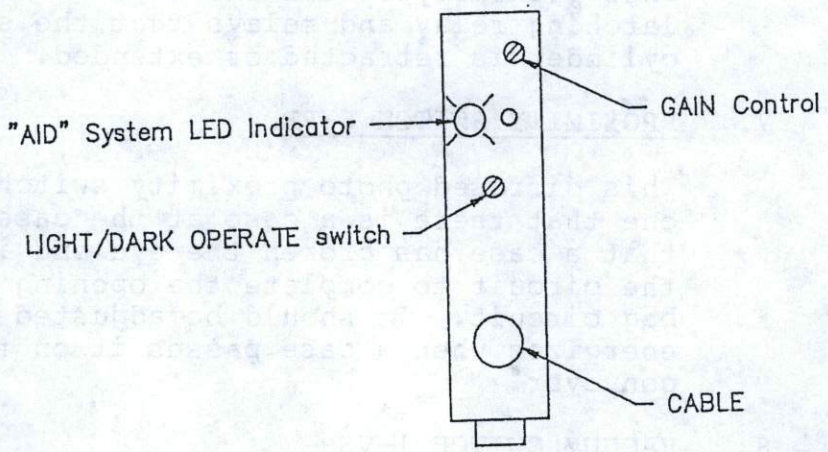


FIGURE 4.4.7-1

5. PROXIMITY SWITCH 4-PR

This reflective photo proximity switch checks to make sure a case is in position so a bag can be inserted. It should be set so a case energizes the switch as it is coming into position and is energized until case is completely clear of case stop. See Figure 4.4.7-2.

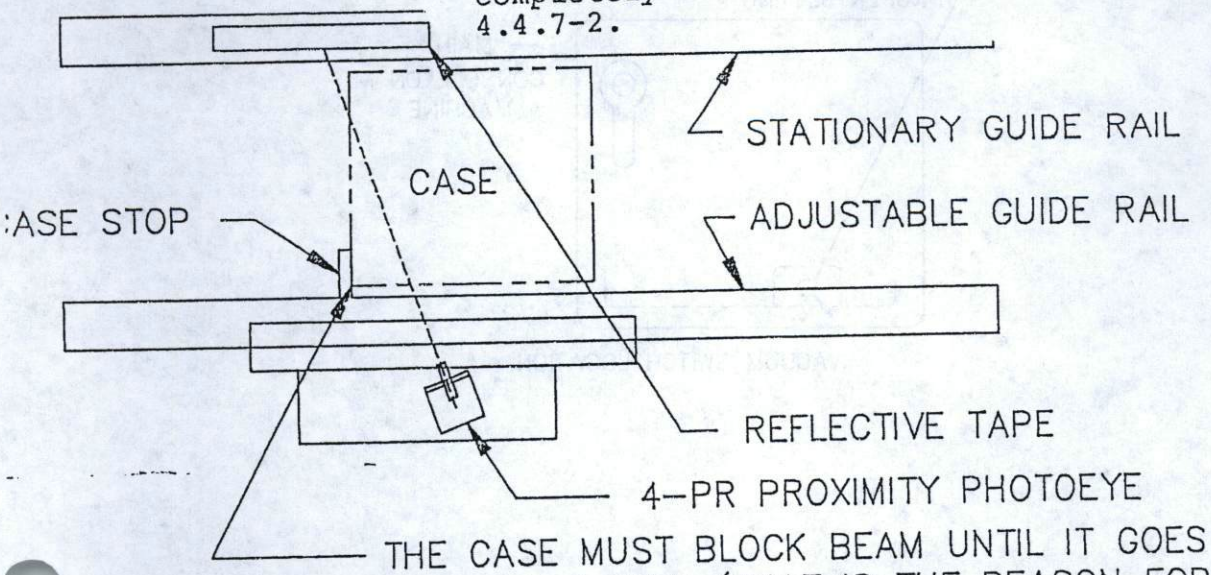


FIGURE 4.4.7-2

4.4.7 LIMIT SWITCH, PROXIMITY SWITCHES, AND VACUUM SWITCH (Cont.)

6. PROXIMITY SWITCH 5-PR

This proximity switch indicates through a latching relay and relays that the separating cylinder is retracted or extended.

7. PROXIMITY SWITCH 6-PR

This diffused photo proximity switch informs one that there is a case at the case stop or that a case has broken the eye and initiated the circuit to complete the opening of the bag circuit. It should be adjusted so it energizes when a case passes it on the conveyor.

8. VACUUM SWITCH 1-VS

This vacuum switch checks to be sure that a bag has been opened by the vacuum cups. It should be set so its contacts close when there is vacuum and open when vacuum fails on the cups. See Figure 4.4.7-3.

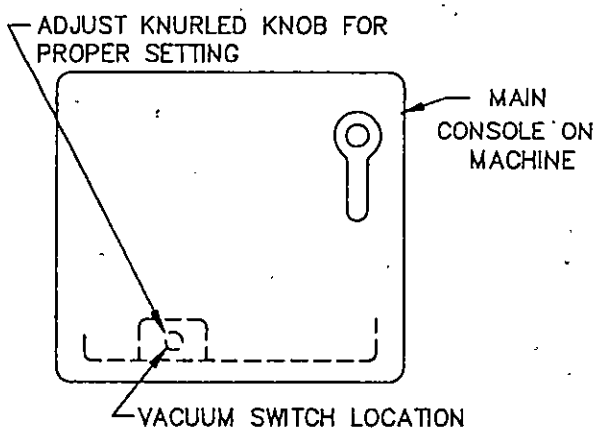


FIGURE 4.4.7-3

4.4.7 LIMIT SWITCH, PROXIMITY SWITCHES, AND VACUUM SWITCH (Cont.)

9. BAG FEED EYE 1-PC

NOTE: See Changeover Section of this manual for adjustment when changing bag size.

To set the sensitivity, place poly bag in front of eye. After turning sensitivity screw completely down, turn until LED light comes "ON"; next, make an addition one-half turn to assure sensitivity is adequate. See Figure 4.4.7-4.

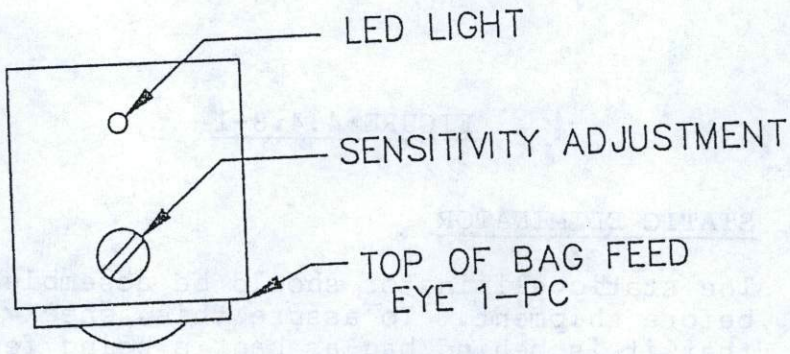


FIGURE 4.4.7-4

4.4.8 MOTOR CONTROL 1-MC

This motor control controls the speed of the bag feed rolls. The initial setting of the dial should be set at 80% and may be increased or decreased to accomplish optimum speed or machine operation. (See Trouble-shooting Section for changing time on programmable controller to prevent false jam condition.)

Refer to separate motor control operation instructions in Section 9.0 of this manual for general operation and troubleshooting.

For proper d.c. motor acceleration and deceleration, the current limit forward and current limit reverse potentiometers should be set at 1/4 turn from maximum (fully clockwise). See Figure 4.4.8-1.

4.4.8 MOTOR CONTROL 1-MC (Cont.)

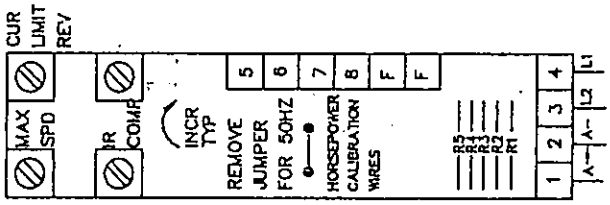


FIGURE 4.4.8-1

4.4.9 STATIC ELIMINATOR

The static eliminator should be assembled properly before shipment. To assure this, check to see that it is behind bag as bag is being fed from roller. Its best location is approximately 1/8" (4 mm) from bag. Also, check to be sure static points are directly perpendicular to bag as it is being fed down. See Figue 4.4.9-1.

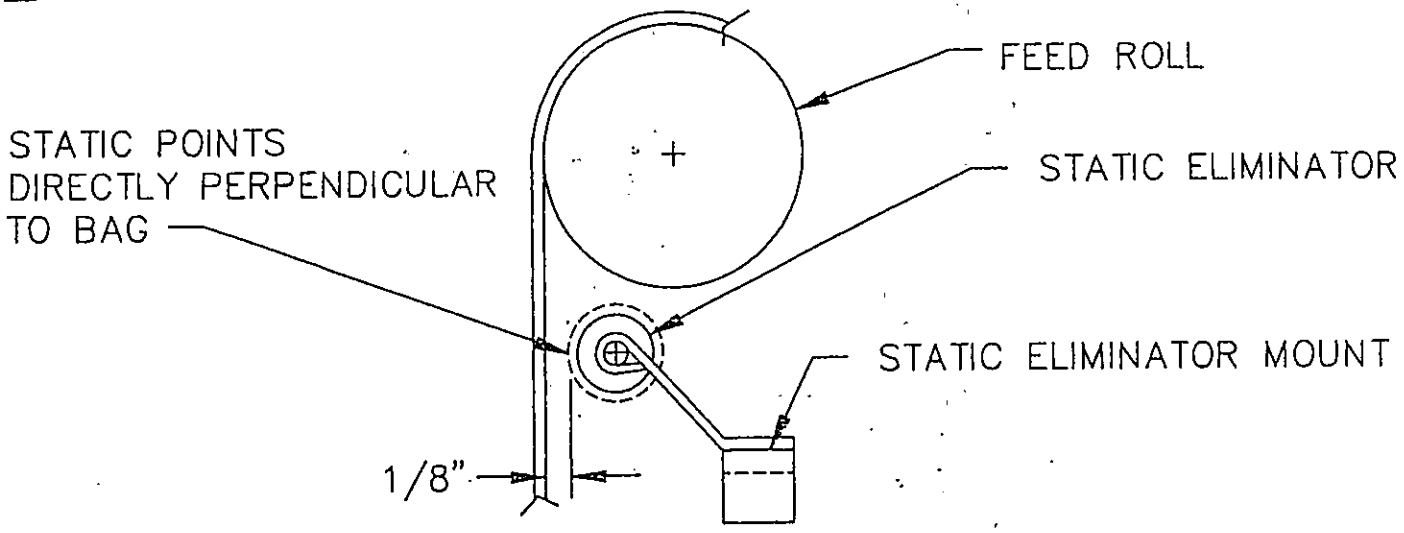


FIGURE 4.4.9-1

4.4.10 EASE-ON VALVE

This valve is located in back of inserter; its purpose is to allow air to slowly build up in cyinders so there is no slamming after a restart.

To set this time, turn the adjusting screw, located at the top side of valve, until a desired buildup to full pressure is obtained. See Figure 4.4.10-1.

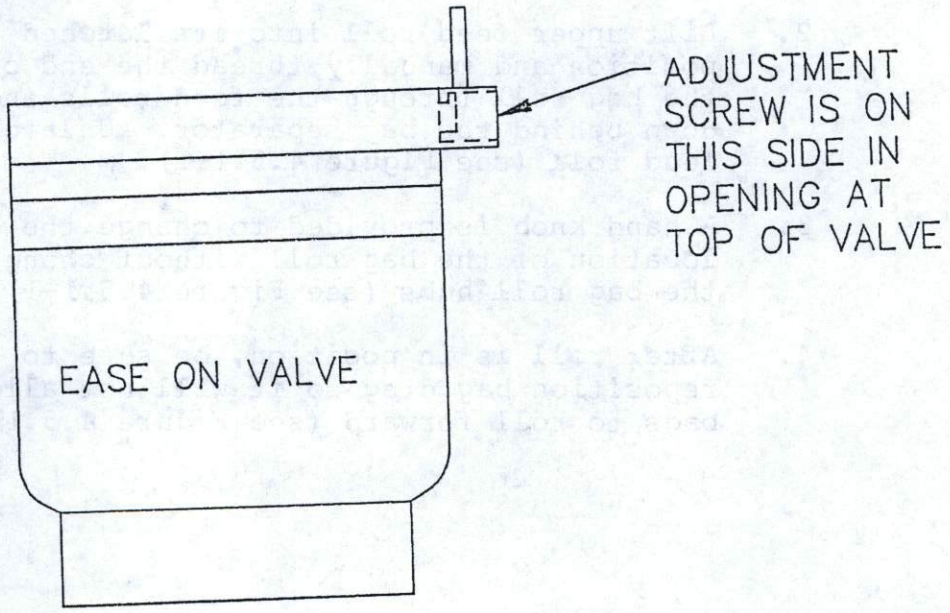


FIGURE 4.4.10-1

4.5 BAG SIZE CHANGEOVER

********** ALL ADJUSTMENTS SHOULD BE MADE WITH AIR
* WARNING * AND ELECTRICAL POWER TURNED TO "OFF".
****

4.5.1 BAG ROLL SETUP

1. Place a roll of perforated and sealed poly bags on mandrel provided and set on bag roll mounts with end of bag roll coming off of bottom toward feed rolls first. Center roll of bags on machine by loosening bag roll hubs and moving bag roll to proper location (see Figure 4.5.1-1).

2. Lift upper feed roll into its latched position and manually thread the end of the bag roll through the feed rolls and down behind the bag separator. Unlatch feed roll (see Figure 4.5.1-1).

3. A hand knob is provided to change the location of the bag roll without changing the bag roll hubs (see Figure 4.5.1-1).

4. After roll is in position, be sure to reposition bag drag so it will not allow bags to roll forward (see Figure 4.5.1-1).

4.5 BAG SIZE CHANGEOVER (Cont.)

4.5.1 BAG ROLL SETUP (Cont.)

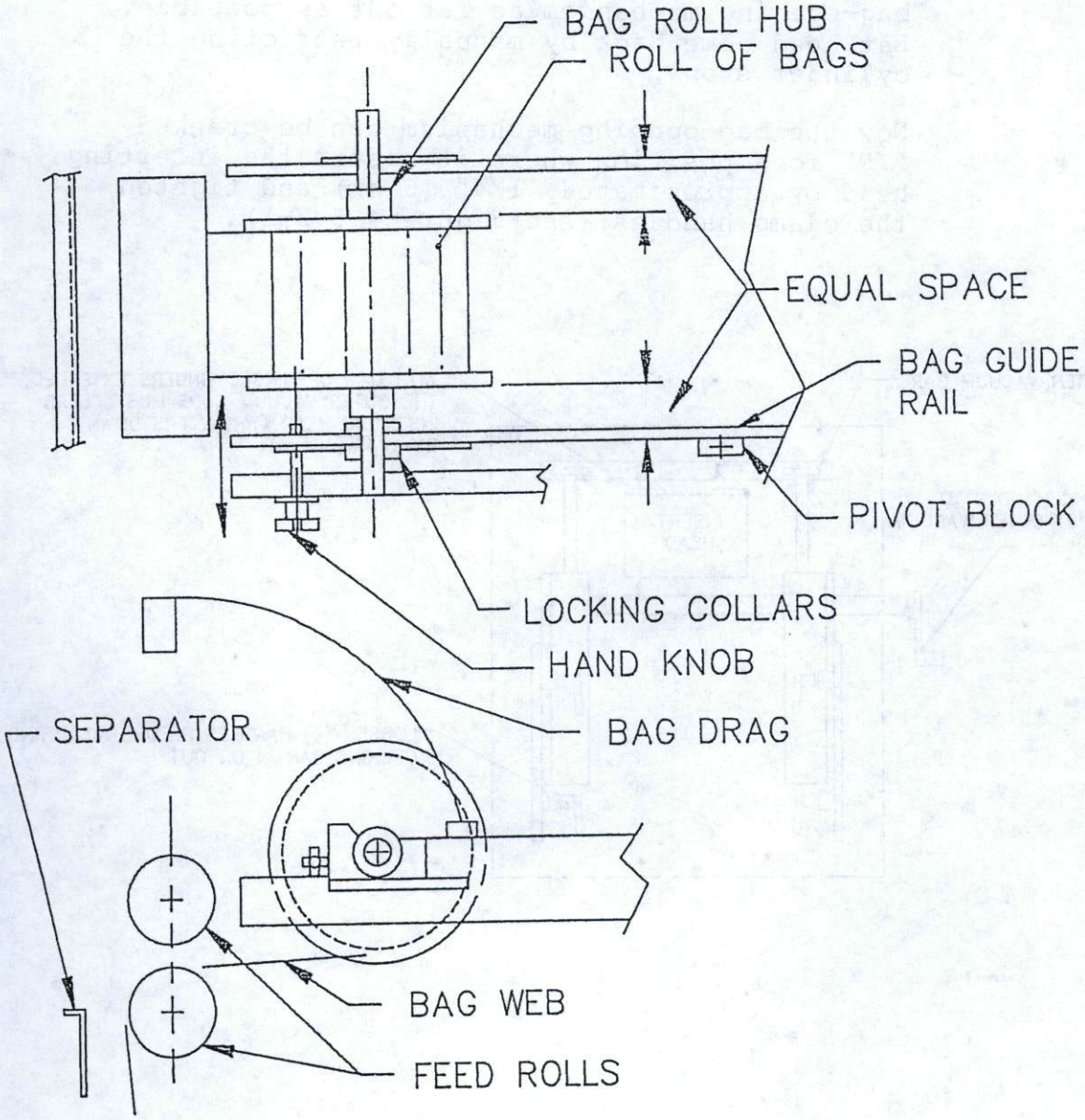


FIGURE 4.5.1-1

4.5 BAG SIZE CHANGEOVER (Cont.)

4.5.2 BAG-OPENING (CASE WIDTH) ADJUSTMENT

The case width change is made by first loosening four (4) clamp handles located on the inside of the machine (two on each side) and cranking the bag-opening mechanism as far out as possible. Let head come back by manually retracting the cylinder stop.

Now the bag-opening mechanism can be cranked "IN" to a position where it clears the inserting head by approximately 1/4" (6 mm) and tighten the clamp handles (see Figure 4.5.2-1).

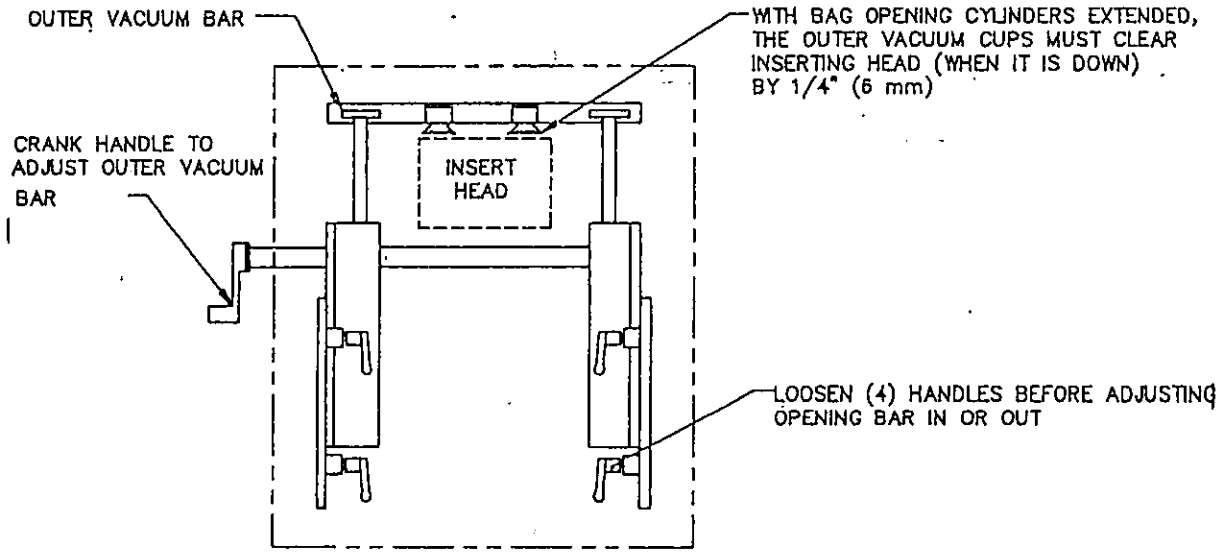


FIGURE 4.5.2-1

4.5 BAG SIZE CHANGEOVER (Cont.)

4.5.3 VACUUM CUP AND BAG-SHIFTING BUMPER CHANGEOVER

1. When setting vacuum cups for size change, only the outer cups have to be adjusted. Adjust these cups to a dimension equal to the case length and an equal distance from the center of the machine (see Figure 4.5.3-1).

2. An extra set of shifting bumpers are provided with flat tube bags. These should be adjusted in line with existing shifting bumpers and 1/2" (13 mm) dimension from the edge of the face of the bag (see Figure 4.5.3-1).

4.5 BAG SIZE CHANGEOVER (Cont.)

4.5.3 VACUUM CUP AND BAG-SHIFTING BUMPER CHANGEOVER (Cont.)

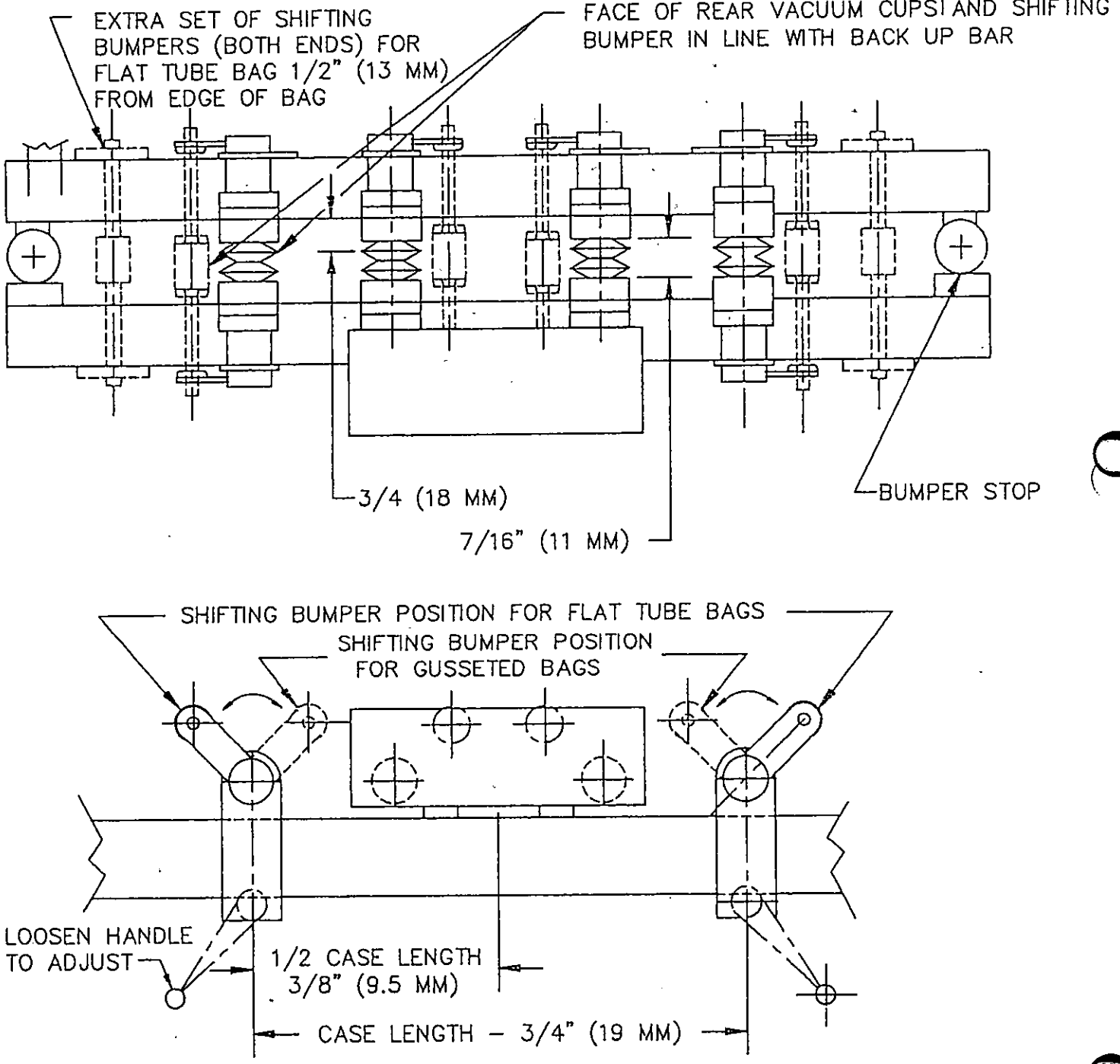


FIGURE 4.5.3-1

4.5 BAG SIZE CHANGEOVER (Cont.)

4.5.4 BAG LENGTH CHANGE ADJUSTMENT

The bag length change is accomplished by loosening the hand knob that mounts the bag feed stop eye to the bag guides, and moving the eye either up or down so the eye is actuated when the top of the bag is 1/4" (6 mm) above top of vacuum cups or approximately even with bottom of separator (see Figure 4.5.4-1).

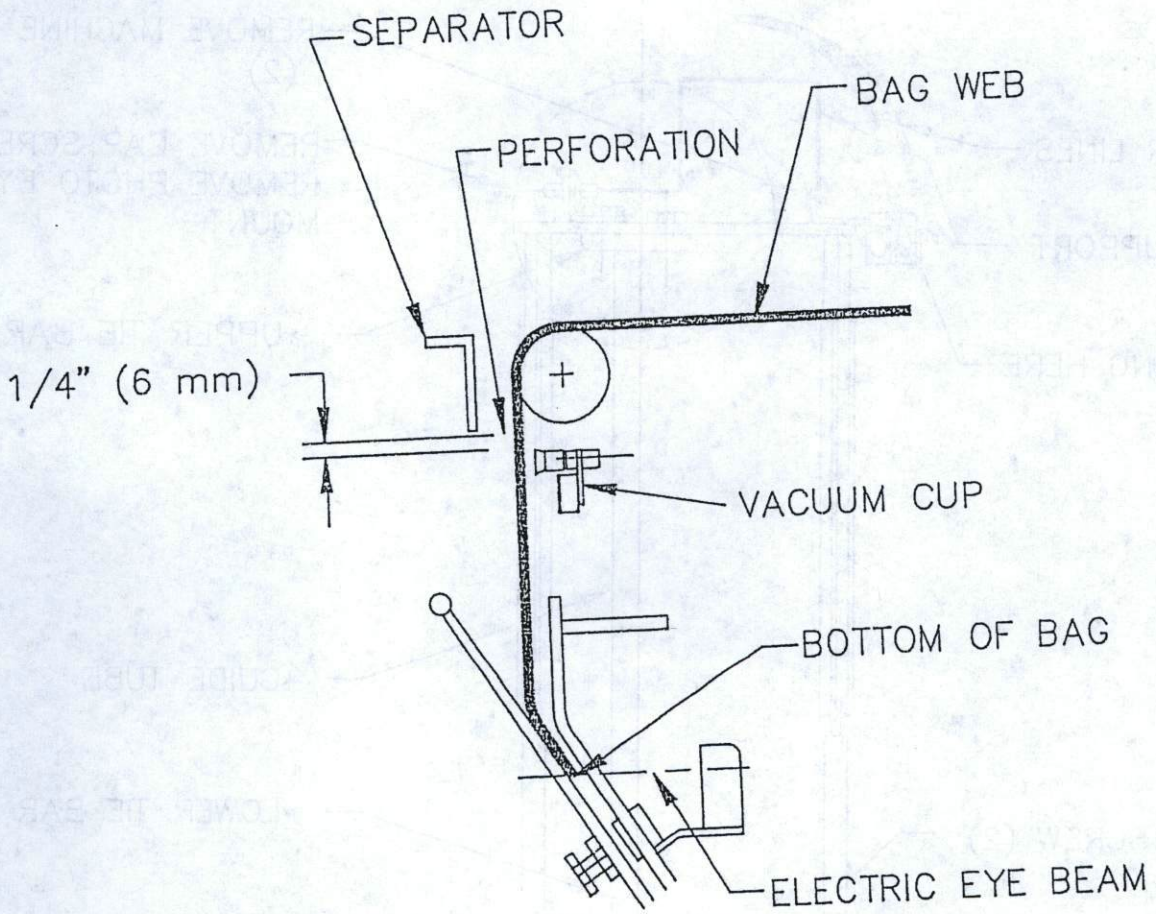


FIGURE 4.5.4-1

4.5.5 INSERTING HEAD CHANGE AND ADJUSTMENT

1. To change the inserting head, two (2) 1/4" o.d. air lines, tubing support, six (6) cap screws, and photoeye 3PR must be removed. Once this is completed, the complete inserting head assembly including the cuffing fingers can be removed and replaced by the new inserting head assembly (see Figure 4.5.5-1).

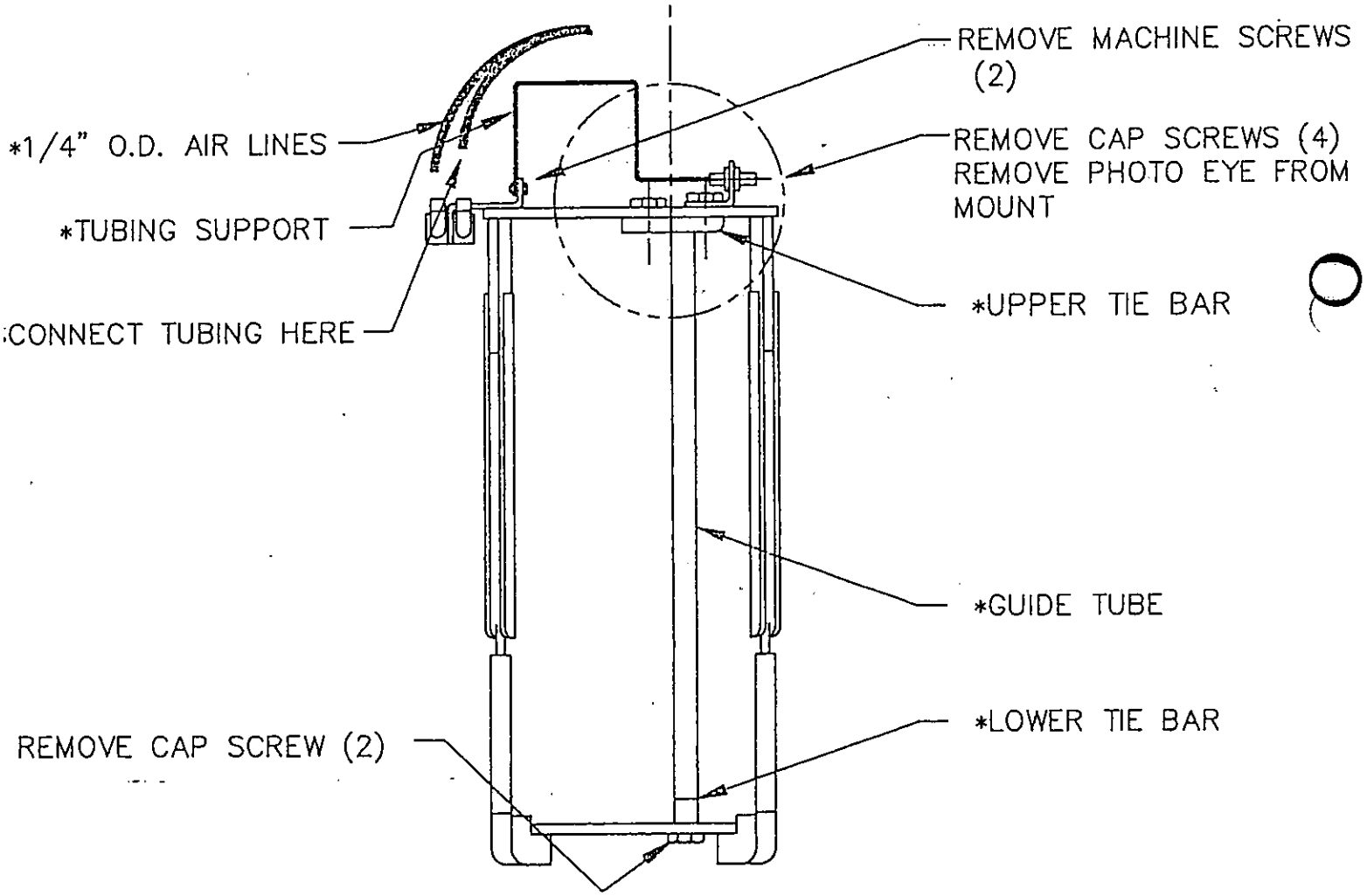
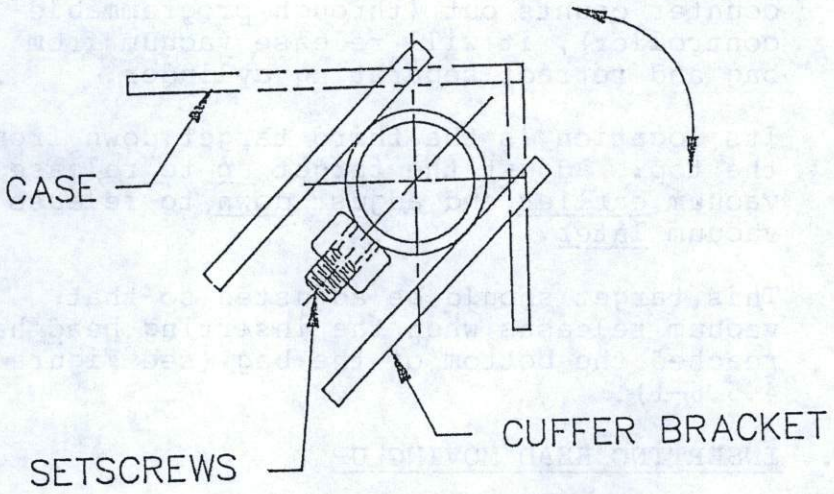


FIGURE 4.5.5-1

4.5.5 INSERTING HEAD CHANGE AND ADJUSTMENT (Cont.)

2. When adjusting cuffing fingers to cuff the top of the bag properly, loosen two (2) setscrews in each plunger tube and one (1) cap screw at top of inserting head assembly. This allows the cuffing finger assembly to be pivoted to a point in line with the corner of the case (see Figure 4.5.5-2).



NOTE: Cuffing fingers may also be raised or lowered at this point by loosening a cap screw at top of inserting head. The initial setting for vertical adjustment should be 3/4" (19 mm) from the top of the case flaps to the bottom of the cuffer bracket side plates (this dimension may have to be increased if the bag pushes the case flaps while cuffing).

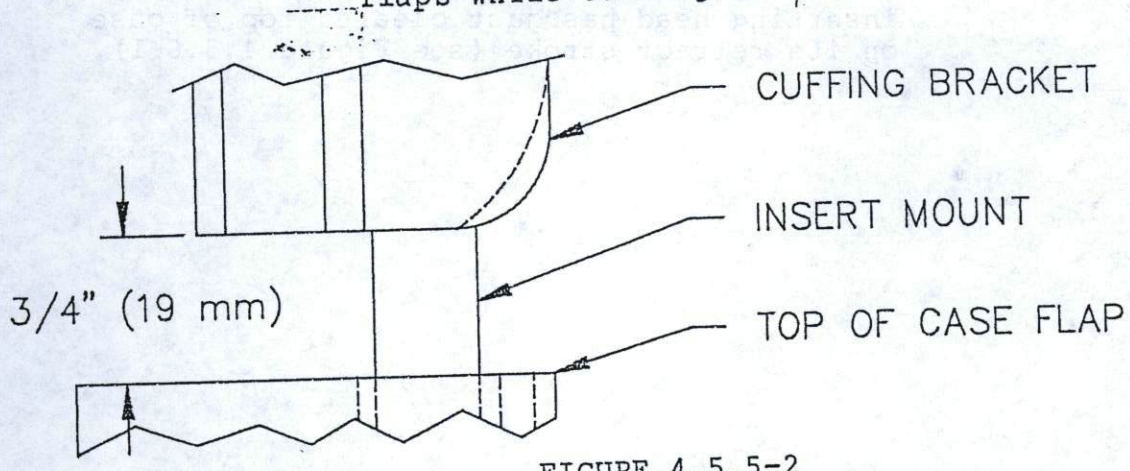


FIGURE 4.5.5-2

4.5.6 INSERTING HEAD TARGET ADJUSTMENT

NOTE: See Initial Adjustment Section for head-up-and-down target adjustments.

1. INSERTING HEAD MOVING DOWN

When this target is seen by the eye and its counter counts out (through programmable controller), it will release vacuum from bag and retract separating cylinder.

Its location is the third target down from the top. Adjust the target up to release vacuum earlier and adjust down to release vacuum later.

This target should be adjusted so that vacuum releases when the inserting head has reached the bottom of the bag (see Figure 4.5.6-1).

2. INSERTING HEAD MOVING UP

When this target is seen and its counter counts out (programmable controller), it will release the case and allow a new case to advance.

Its location is the second target from the top. Adjust the target up to release case later and adjust the target down to release case earlier.

This target should be adjusted so that the inserting head has just cleared top of case on its retract stroke (see Figure 4.5.6-1).

4.5.6 INSERTING HEAD TARGET ADJUSTMENT (Cont.)

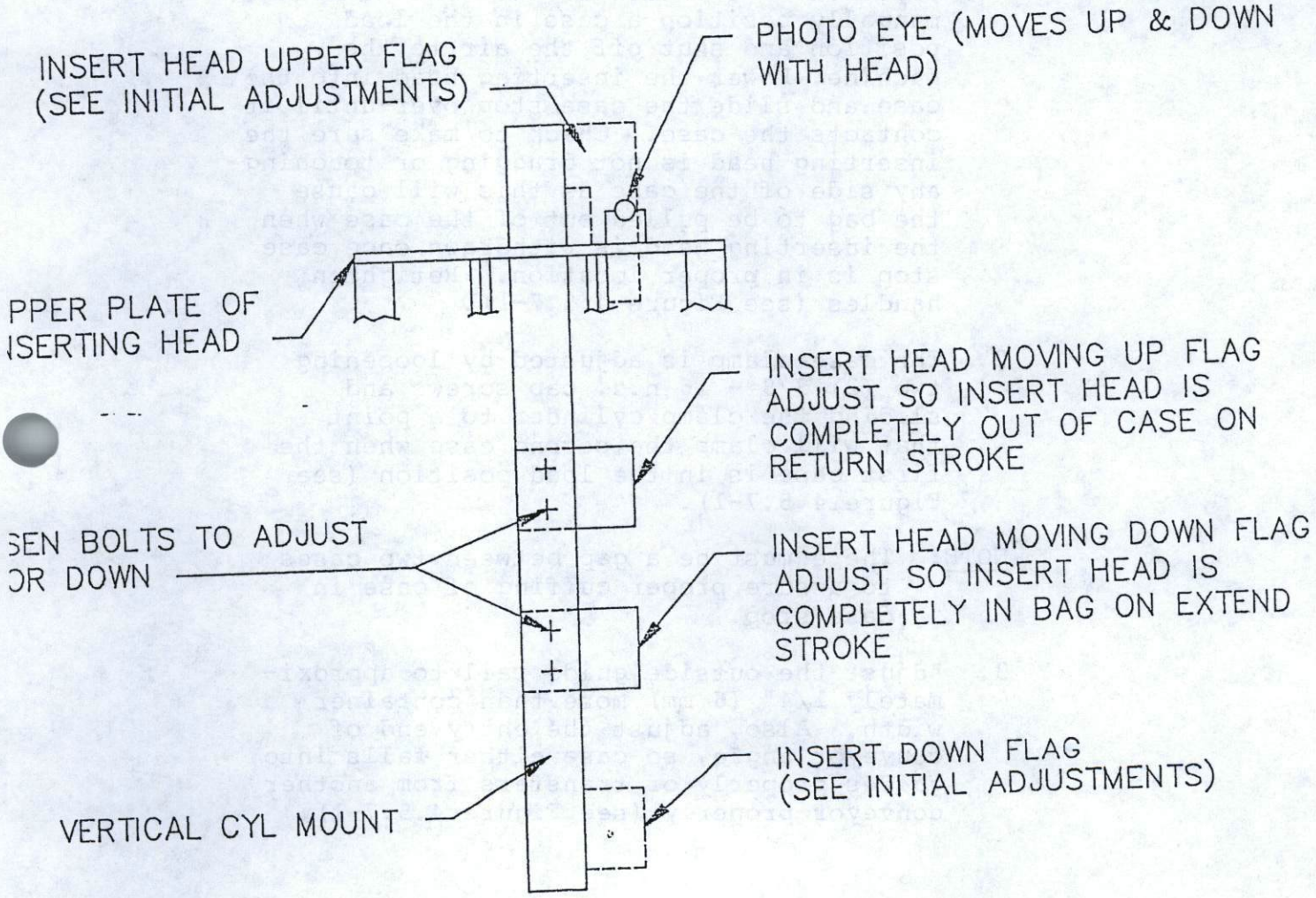


FIGURE 4.5.6-1

4.5.7 CASE STOP CLAMP ADJUSTMENT AND GUIDE RAIL ADJUSTMENT

1. The case stop is adjusted by loosening two (2) handles and sliding it to desired location. To determine the best location, manually position a case in the load position and shut off the air to the machine. Lower the inserting head into the case and slide the case stop over until it contacts the case. Check to make sure the inserting head is not dragging or touching any side of the case as this will cause the bag to be pulled out of the case when the inserting head is withdrawn once case stop is in proper location. Retighten handles (see Figure 4.5.7-1).

2. The case clamp is adjusted by loosening two (2) 3/8 - 16 n.c. cap screws and sliding the clamp cylinder to a point that will clamp the second case when the first case is in the load position (see Figure 4.5.7-1).

NOTE: There must be a gap between two cases to assure proper cuffing of case in case stop.

3. Adjust the outside guide rail to approximately 1/4" (6 mm) more than container width. Also, adjust the entry end of conveyor angle, so case either falls into guides properly or transfers from another conveyor properly (see Figure 4.5.7-1).

4.5.7 CASE STOP CLAMP ADJUSTMENT AND GUIDE RAIL ADJUSTMENT (Cont.)

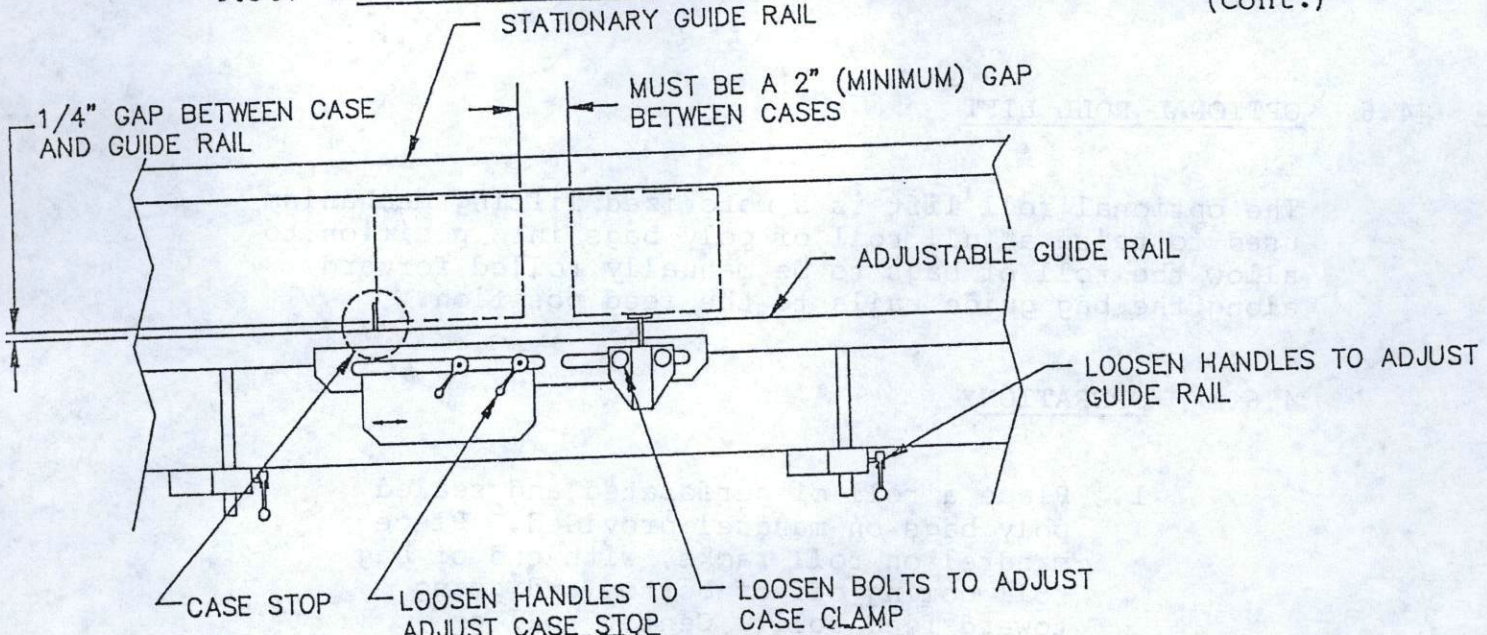


FIGURE 4.5.7-1

4.5.8 ROLLOVER BAR (OPTIONAL WITH FLAT TUBE BAG)

Adjust the rollover bars so they are directly above each minor flap. The distance between minor flap and rollover will vary depending upon case depth (see Figure 4.5.8-1).

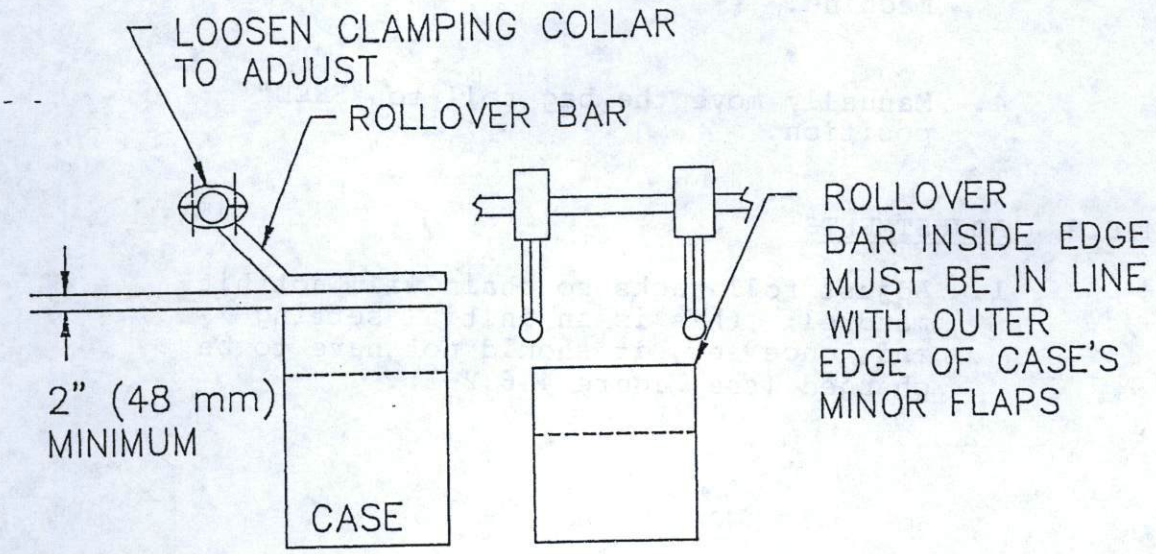


FIGURE 4.5.8-1

4.6 OPTIONAL ROLL LIFT

The optional roll lift is a motorized lifting mechanism used to raise a full roll of poly bags into position to allow the roll of bags to be manually rolled forward along the bag guide rails to the feed position.

4.6.1 OPERATION

1. Place a roll of perforated and sealed poly bags on mandrel provided. Place mandrel on roll racks, with end of bag roll coming off of bottom and going toward feed roll. Center roll on machine (see Changeover Section).

2. Press roll into lift mechanism until mandrel drops into notches in the roll racks.

3. Press "ROLL LIFT" pushbutton and hold until roll is lifted and drops onto bag guide rails at the top of the machine.

4. Manually move the bag roll to "FEED" position.

4.6.2 ADJUSTMENTS

1. Adjust roll racks so chain will not hit mandrel; this is an initial setting and, once set, it should not have to be changed (see Figure 4.6.2-1).

4.6.2 ADJUSTMENTS (Cont.)

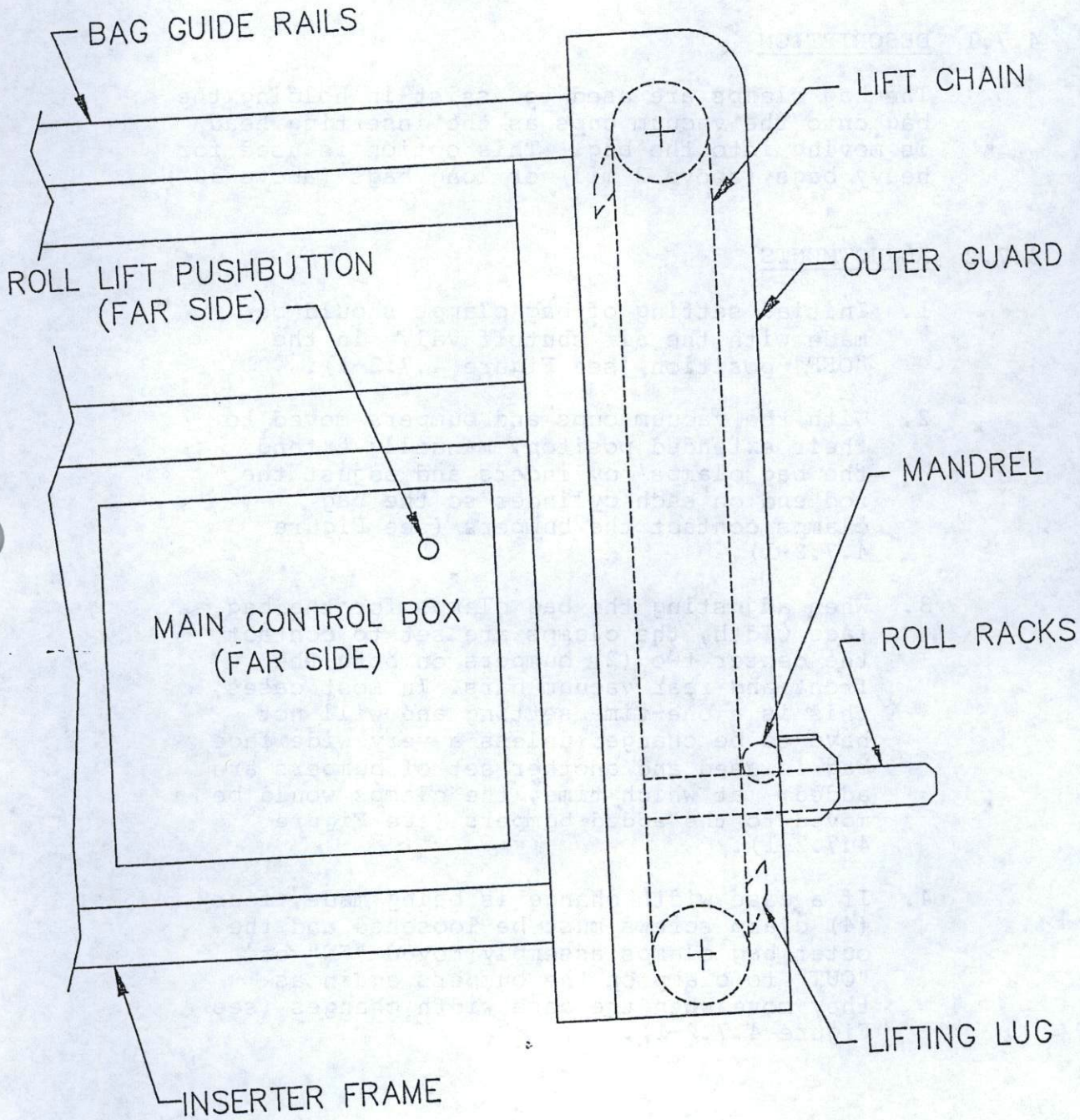


FIGURE 4.6.2-1

4.7 OPTIONAL BAG CLAMP

4.7.1 DESCRIPTION

The bag clamps are used to assist in holding the bag onto the vacuum cups as the inserting head is moving into the bag. This option is used for heavy bags (above 2 mil) or long bags (above 30").

4.7.2 ADJUSTMENTS

1. Initial setting of bag clamps should be made with the air shutoff valve in the "OFF" position (see Figure 4.7.2-1).

2. With the vacuum cups and bumpers moved to their extended positon, manually extend the bag clamps' cylinders and adjust the rod end on each cylinder so the bag clamps contact the bumpers (see Figure 4.7.2-1).

3. When adjusting the bag clamps for the bag face width, the clamps are set to contact the center two (2) bumpers on both the front and rear vacuum bars. In most cases, this is a one-time setting and will not have to be changed unless a very wide face bag is used and another set of bumpers are added; at which time, the clamps would be moved to the added bumpers (see Figure 4.7.2-1).

4. If a case width change is being made, four (4) clamp screws must be loosened and the outer bag clamps assembly moved "IN" or "OUT" to clamp on the bumpers again as they move when the case width changes (see Figure 4.7.2-1).

1575

4.7 OPTIONAL BAG CLAMP (Cont.)

4.7.2 ADJUSTMENTS (Cont.)

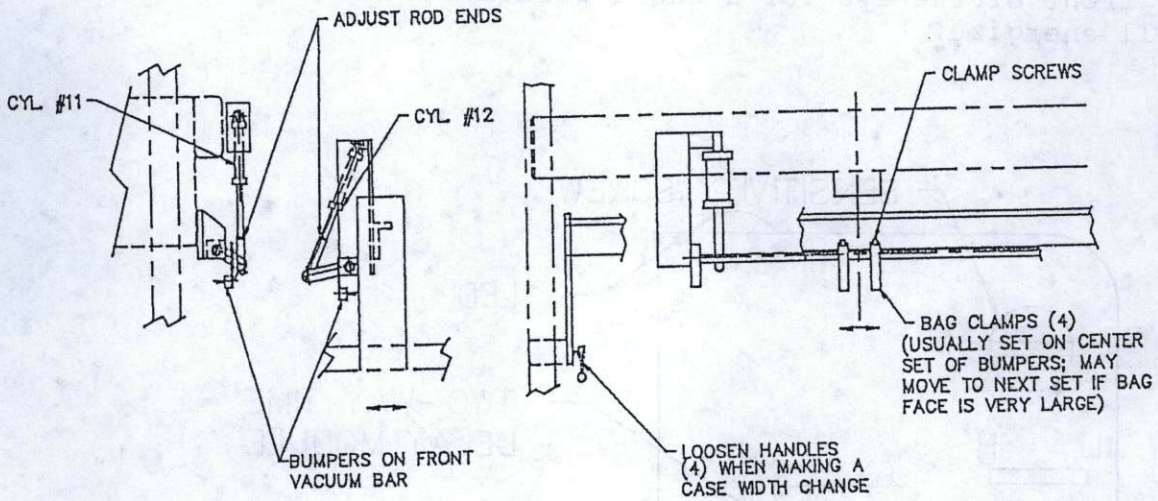


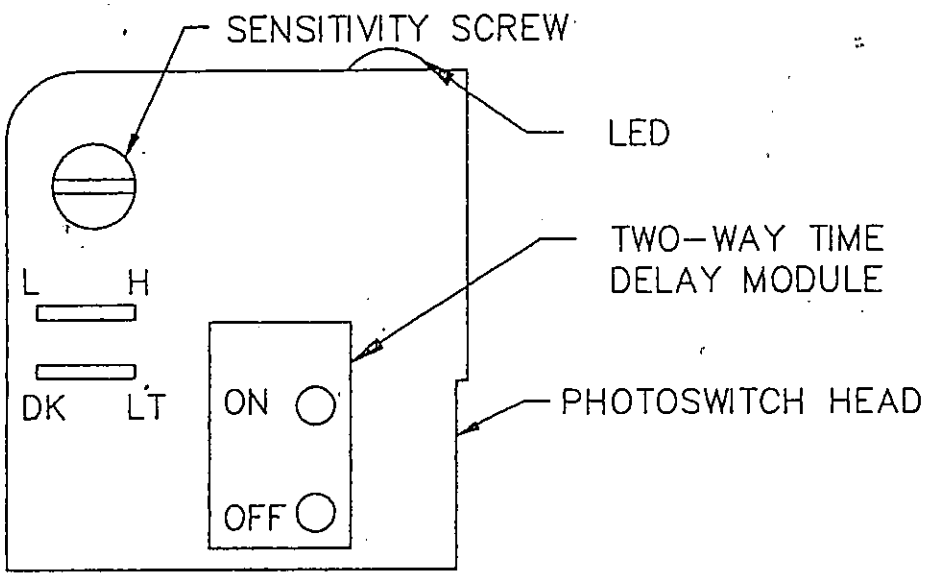
FIGURE 4.7.2-1

4.8 OPTIONAL BACK-UP EYE 2-PC

This optional photo eye 2-PC will check upstream conveyor to see boxes (that have had bags inserted in them) and, in turn, will not allow bag inserter to insert bag in box until the eye is clear of box.

Set this eye on "LOW" and "DARK". Also, adjust the sensitivity so it energizes when it sees a case but does not give a false signal for anything beyond the conveyor.

Adjust the on delay timer so that, as a case passes the eye, it will not energize, but if a case remains in front of the eye for a short period of time, it will energize.



5.0 SAFETY PRECAUTIONS

5.1 GENERAL PRECAUTIONS

1. Whenever making machine adjustments, always stop the machine by depressing the "STOP" pushbutton and exhaust the air supply.

2. Maintenance must not be performed unless all power (air and electrical) has been disconnected.

3. Do not operate the machine without all guards in place.

5.2 SPECIFIC CAUTIONS AND WARNINGS

```
**********
* WARNING *
**********
```
DO NOT THREAD A NEW ROLL OF BAGS THROUGH FEED ROLLS UNLESS ALL POWER HAS BEEN DISCONNECTED.

```
**********
* WARNING *
**********
```
WHEN THE "STOP" PUSHBUTTON IS DEPRESSED, THE MACHINE WILL RESET TO ITS "START" POSITION.

```
**********
* WARNING *
**********
```
THE INSERTING HEAD WILL FALL WHEN MACHINE IS SHUT OFF ELECTRICALLY.

```
**********
* WARNING *
**********
```
STOP THE MACHINE WHEN THE INSERTING HEAD IS COMPLETELY UP OR DOWN.

```
==========
= CAUTION =
==========
```
AFTER A SIZE CHANGE, BE SURE THAT ALL MACHINE ADJUSTMENTS HAVE BEEN PROPERLY MADE BEFORE TURNING ON THE AIR AND STARTING THE MACHINE.

```
==========
= CAUTION =
==========
```
DO NOT MANUALLY OPERATE THE INSERTING HEAD "DOWN" AND THE BAG OPENING "IN" AT THE SAME TIME.

```
==========
= CAUTION =
==========
```
DO NOT TURN MACHINE "ON" WITHOUT FIRST TURNING ON AIR.

5.0 SAFETY PRECAUTIONS (Cont.)

5.2 SPECIFIC CAUTIONS AND WARNINGS (Cont.)

```
===========
= CAUTION =
===========
```

WHEN INSERTING HEAD IS COMPLETELY DOWN, BE SURE IT DOES NOT RUB ON CONVEYOR BELT.

```
===========
= CAUTION =
===========
```

DO NOT STOP MACHINE WHILE THE BAG OPENING CYLINDERS ARE EXTENDING OR RETRACTING.

6.0 MACHINE MAINTENANCE REQUIREMENTS

6.1 CONTROL-RELATED MAINTENANCE

1. Check vacuum hose filter periodically for accumulations of dirt and dust.

2. Check pnuematic air line filter once a day for accumulations of dirt and water. Water left in the filter will overflow into air lines and damage valves and cylinders.

3. Be sure to periodically add 10W SAE oil to the air lubricator to keep valves and cylinders lubricated. Set lubricator to about one drop every 15 to 20 cycles (see Data Sheets in rear of manual for this setting).

4. Periodically check vacuum pump oil level and add as required. Special replacement oil is available from Bemis (see Data Sheets in rear of manual for additional maintenance concerning vacuum pump). Also, check vacuum pump gauge for adequate vacuum (at least 25" of vacuum). Readjust per manual if necessary.

5. Photo eyes, proximity switch settings, and tightness should be checked monthly and readjusted as required.

6. Check for the proper setting of the static eliminator monthly and adjust as required. Clean the static eliminator needles with contact cleaner, 3M Scotch Brite pad, and 1/4" socket wrench.

7. Every three months, go through cylinder speeds (flow control settings) and general motion of air cylinders. Repair or replace if necessary.

8. Every three months, check for cracked air lines, loose fittings, or any other area that may have an air leak.

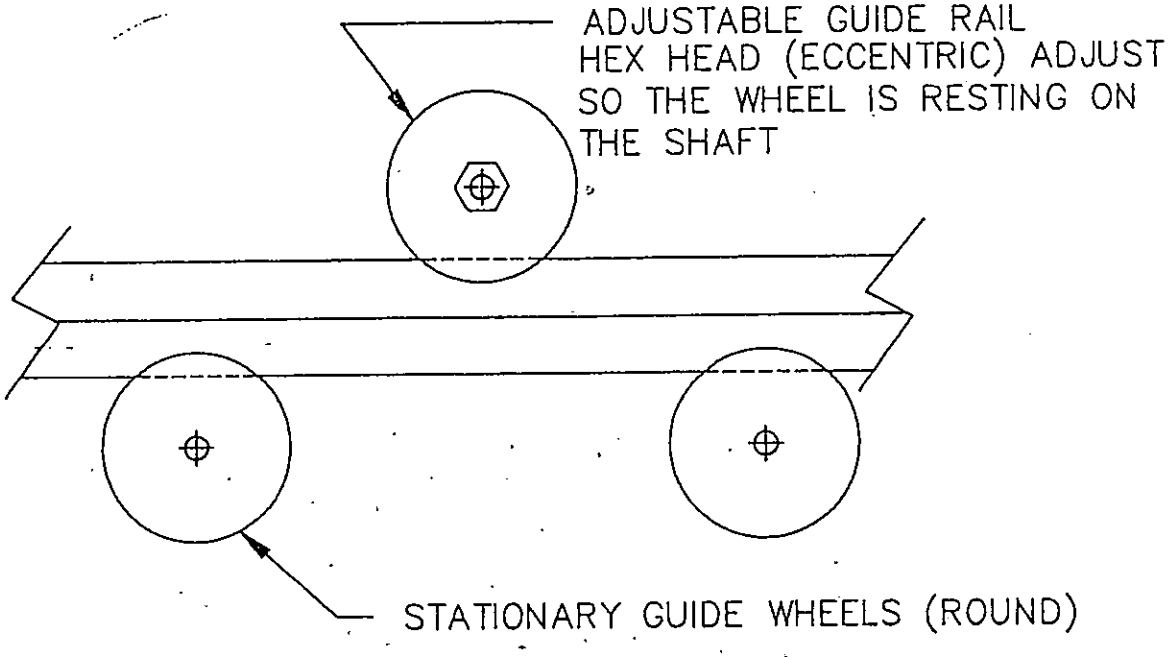
6.2 MECHANICAL MAINTENANCE

1. Check all gear reducers for proper oil level at least once a month. Use 90W gear oil as replacement. Change oil in gear reducers every six months.

2. Check the vacuum cups and their screws twice a month for any dirt buildup and tearing of cups. Replace if necessary.

3. Check vacuum cup bumpers once a month for any wear; also, check for proper adjustment.

4. Adjust dual Vee-rollers and their guide shafts on the separating, bag-opening, and inserting heads for any wear or misadjustment once a month. See illustration below for adjustment.



5. Check for proper belt tracking on conveyor every week. Readjust if necessary. See section in manual for Belt Tracking.

6.2 MECHANICAL MAINTENANCE (Cont.)

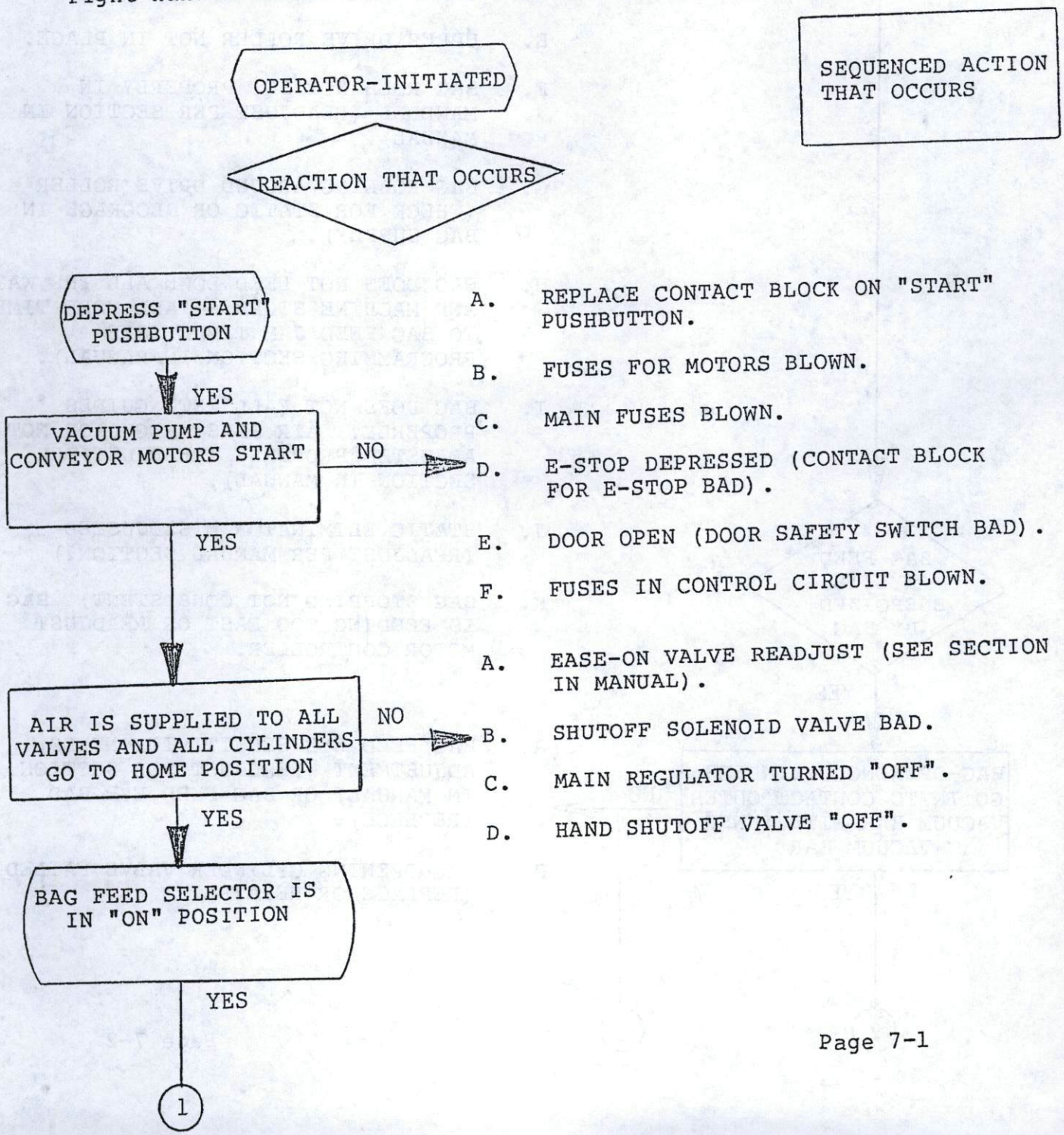
6. Monthly, check over inserting head for proper adjustments and tightness of all nuts and bolts. Readjust as shown in this manual. Replace if necessary.

7. Every three months, go through the Initial Adjustments and Bag Changeover Adjustments as explained in this manual. Replace any worn parts.

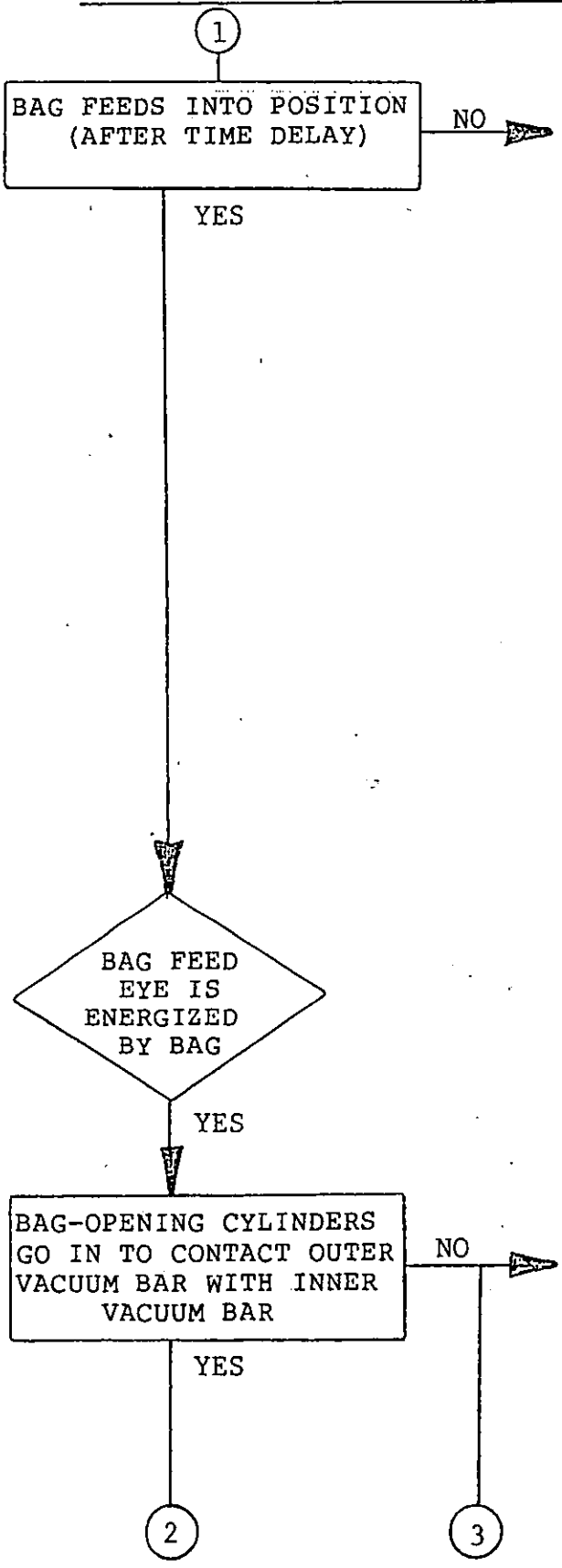
7.0 TROUBLE-SHOOTING GUIDE

7.1 MACHINE TROUBLESHOOTING SEQUENCED GUIDE

The following section uses a flow chart to explain the sequenced operation of the Bag Inserter. For each reaction, there is a list of possible reasons (in the right-hand column) as to why the reaction did not occur.



7.1 MACHINE TROUBLESHOOTING SEQUENCED GUIDE (Cont.)



A. BAG FEED SELECTOR SWITCH IS "OFF", OR CONTACT BLOCK FAILED (REPLACE).

B. MOTOR CONTROLLER FUSE BLOWN (REPLACE).

C. MOTOR CONTROLLER NOT ADJUSTED.

D. MOTOR BAD (REPLACE).

E. UPPER DRIVE ROLLER NOT IN PLACE.

F. BAG ROLL NOT SET PROPERLY IN MANDREL (READJUST PER SECTION IN MANUAL).

G. BAG ROLLING AROUND DRIVE ROLLER (CHECK FOR STATIC OR BLOCKAGE IN BAG SUPPLY).

H. BAG DOES NOT FEED DOWN ALL THE WAY AND MACHINE STOPS -- ADD MORE TIME TO BAG FEED JAM TIMER (SEE PROGRAMMING SECTION IN MANUAL).

I. BAG DOES NOT FALL INTO GUIDES PROPERLY. AIR BLAST REGULAOR NOT ADJUSTED PROPERLY (READJUST PER SECTION IN MANUAL).

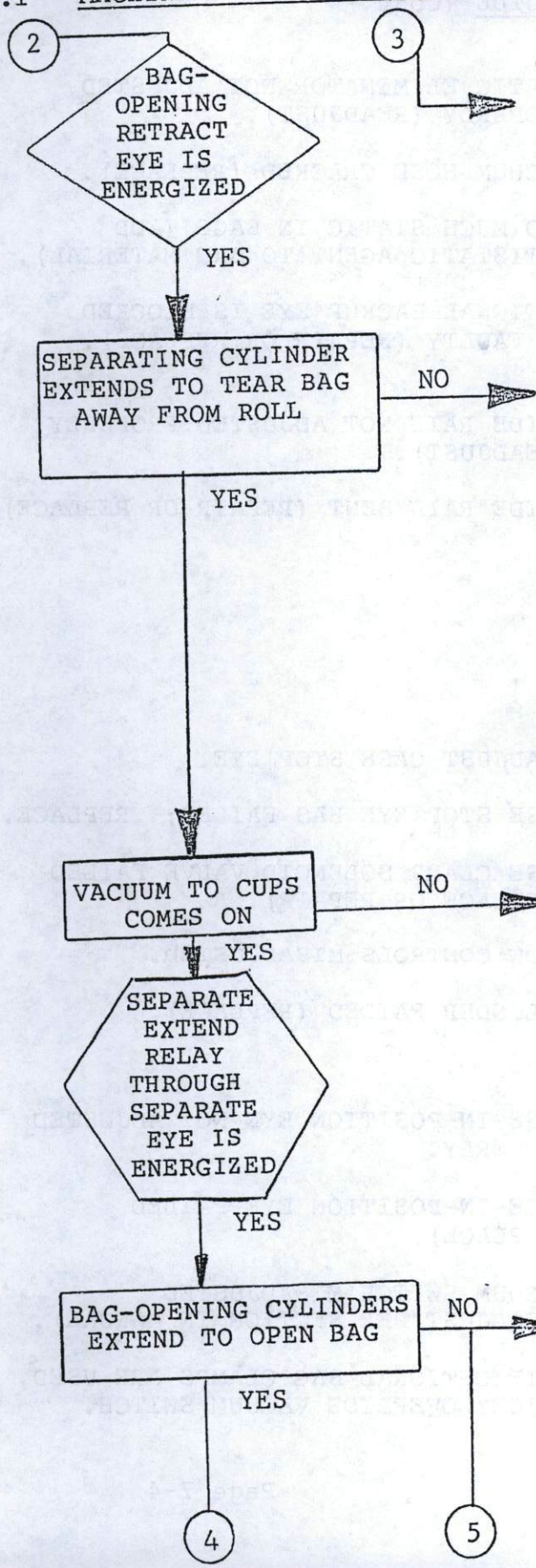
J. STATIC ELIMINATOR MISADJUSTED (READJUST PER MANUAL SECTION.)

K. BAG STOPPING NOT CONSISTENT; BAG IS FEEDING TOO FAST OR READJUST MOTOR CONTROLLER.

A. BAG FEED EYE SENSITIVITY NEEDS ADJUSTMENT (READJUST PER SECTION IN MANUAL) OR BAG FEED EYE BAD (REPLACE).

B. BAG-OPENING CYLINDER VALVE FAILED (REPLACE OR REPAIR).

7.1 MACHINE TROUBLESHOOTING SEQUENCED GUIDE (Cont.)



C. FLOW CONTROLS ON BAG-OPENING CYLINDER NOT ADJUSTED PROPERLY.

D. CYLINDER FAILED (REPLACE).

A. BAG-OPENING RETRACTED PROXIMITY NOT ADJUSTED PROPERLY (READJUST) OR FAILED (REPLACE).

B. BAG-SEPARATING CYLINDER VALVE FAILED (REPLACE OR REPAIR).

C. BAG IS NOT PERFORATED PROPERLY (RE SPEC BAG).

D. FLOW CONTROLS IMPROPERLY ADJUSTED.

E. BAG FED EYE IS STOPPING; BAG IN WRONG POSITION (READJUST).

F. BUMPERS AND CUPS ARE NOT SET UP PROPERLY (READJUST).

G. CYLINDER FAILED (REPAIR OR REPLACE).

A. VACUUM VALVE FAILED (REPAIR OR REPLACE).

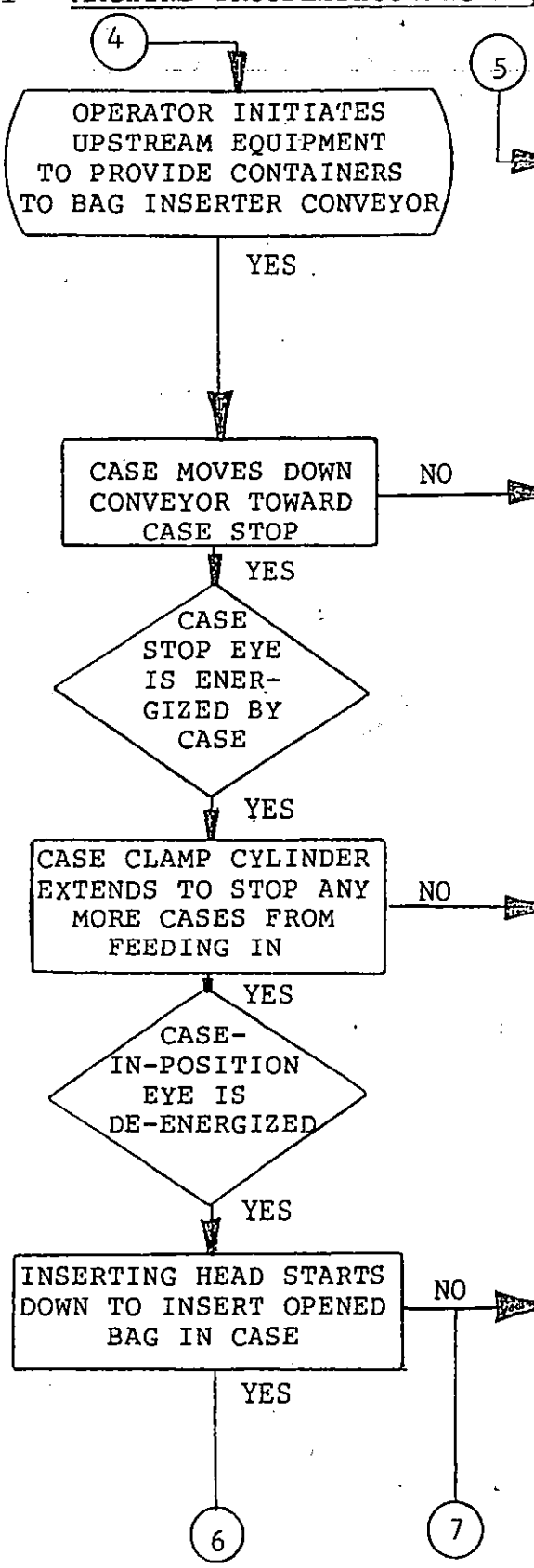
B. VACUUM PUMP NOT OPERATING PROPERLY (CHECK WITH DATA SHEETS IN THIS MANUAL).

A. BAG-OPENING VALVE FAILED (REPLACE OR REPAIR).

B. CHECK FOR ADEQUATE VACUUM; IF NOT, ADJUST VACUUM RELIEF VALVE.

C. CHECK FOR DAMAGED OR MISADJUSTED VACUUM CUP (REPLACE OR READJUST).

7.1 MACHINE TROUBLESHOOTING SEQUENCED GUIDE (Cont.)



D. STATIC ELIMINATOR NOT ADJUSTED PROPERLY (READJUST).

E. VACUUM HOSE CRACKED (REPLACE).

F. TOO MUCH STATIC IN BAGS (ADD ANTISTATIC AGENT TO BAG MATERIAL).

G. OPTIONAL BACKUP EYE IS BLOCKED OR FAULTY (REPAIR OR REPLACE).

A. GUIDE RAIL NOT ADJUSTED PROPERLY (READJUST).

B. GUIDE RAIL BENT (REPAIR OR REPLACE).

A. READJUST CASE STOP EYE.

B. CASE STOP EYE HAS FAILED; REPLACE.

C. CASE CLAMP SOLENOID VALVE FAILED (REPLACE OR REPAIR).

D. FLOW CONTROLS MISADJUSTED.

E. CYLINDER FAILED (REPLACE).

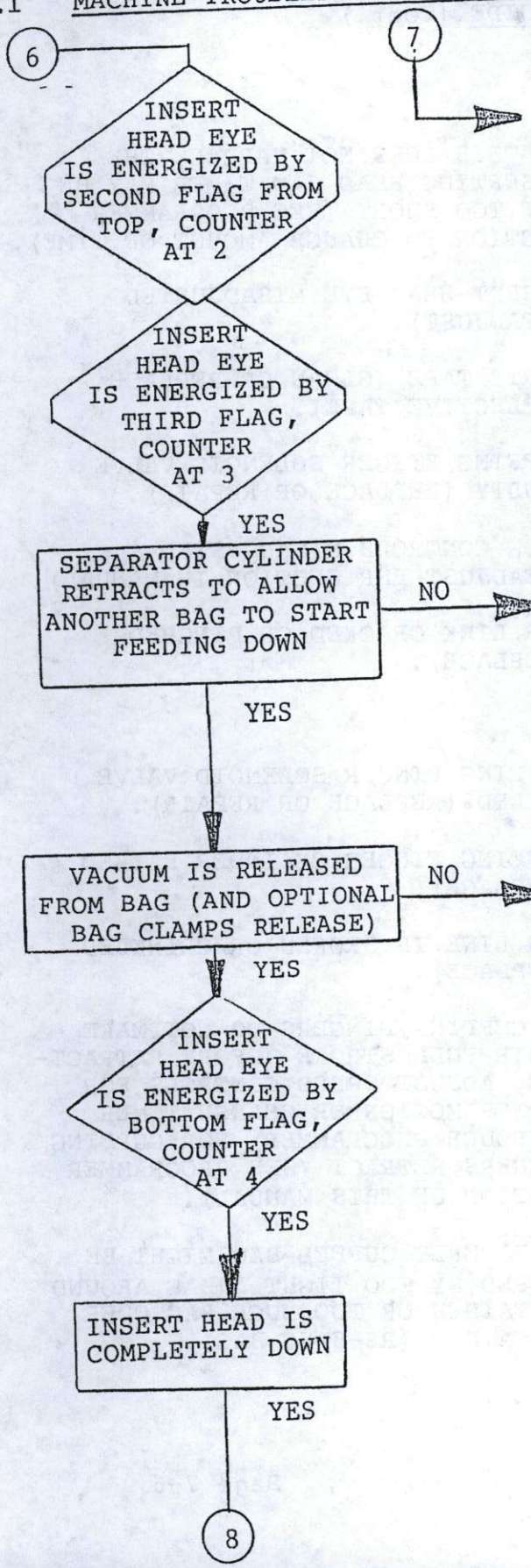
A. CASE-IN-POSITION EYE NOT ADJUSTED PROPERLY.

B. CASE-IN-POSITION EYE FAILED (REPLACE).

C. VACUUM SWITCH MISADJUSTED (READJUST PER SECTION IN MANUAL).

NOTE: IF OPTIONAL BAG CLAMPS ARE USED, THEY OVERRIDE VACUUM SWITCH.

7.1 MACHINE TROUBLESHOOTING SEQUENCED GUIDE (Cont.)



D. INSERTING HEAD SOLENOID VALVE FAULTY (REPLACE OR REPAIR).

E. INSERTING HEAD CYLINDER FAULTY (REPLACE OR REPAIR).

A. INSERTING HEAD EYE MISADJUSTED (READJUST).

B. DIRTY TAPE (CLEAN OR REPLACE REFLECTIVE TAPE).

C. SEPARATING CYLINDER FLOW CONTROLS MISADJUSTED.

D. SEPARATING CYLINDER FAILED (REPLACE OR REPAIR).

E. SEPARATING SOLENOID VALVE FAILED (REPLACE OR REPAIR).

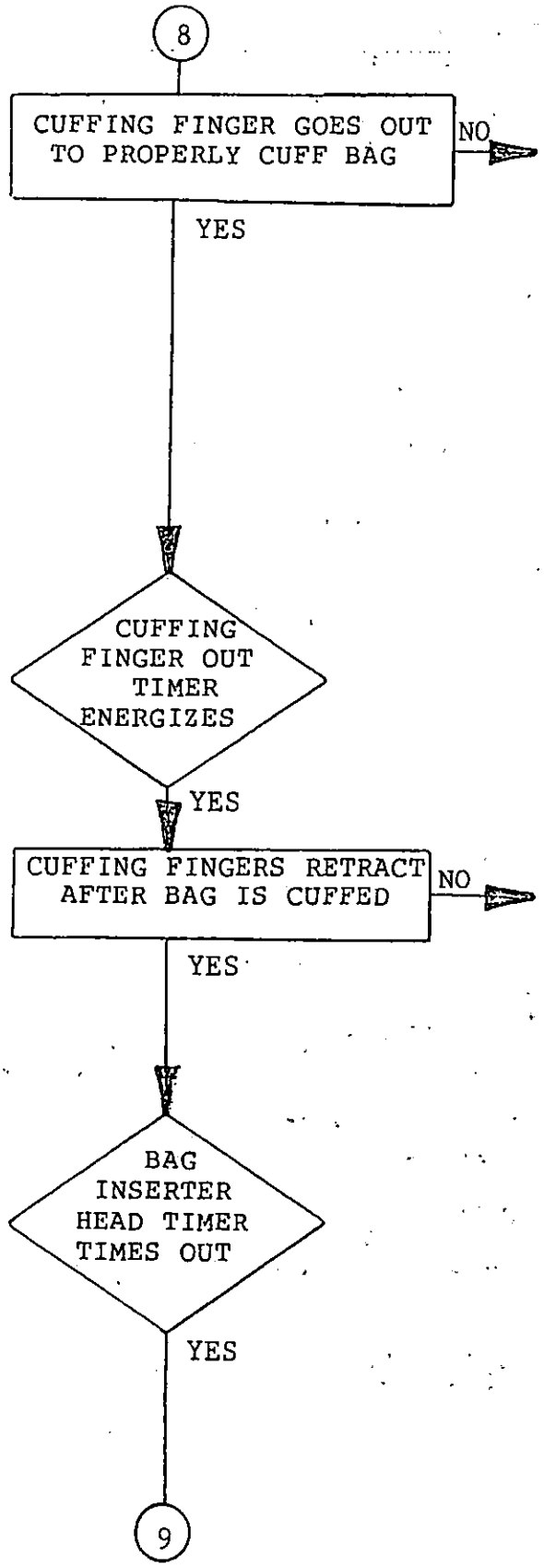
A. IF BAG IS COMING OFF TOO SOON OR TOO LATE, READJUST FLAG (SEE SECTION IN MANUAL).

B. IF BAG FALLS OFF PREMATURELY, CHECK VACUUM GAUGE FOR PROPER VACUUM (READJUST VACUUM RELIEF VALVE IF NOT ENOUGH VACUUM). ALSO, CHECK TO SEE THAT CUPS ARE PROPERLY ASSEMBLED AND NOT TORN OR DAMAGED.

C. TOO MUCH STATIC IN BAG OR TOO LONG A BAG (READJUST STATIC ELIMINATOR OR RESPECIFY AND SIZE BAGS).

D. IF CUPS ARE DAMAGED BY INSERTING HEAD, READJUST OUTER VACUUM BAR (PER SECTION IN MANUAL), OR READJUST INNER VACUUM BAR (WITH SEPARATING CYLINDER ROD END).

7.1 MACHINE TROUBLESHOOTING SEQUENCED GUIDE (Cont.)



A. IF THIS DOES NOT HAPPEN, THE INSERTING HEAD JAM TIMER MAY BE SET TOO SHORT (SEE PROGRAMMER SECTION TO CHANGE AMOUNT OF TIME).

B. INSERT HEAD EYE MISADJUSTED (READJUST).

C. DIRTY TAPE (CLEAN OR REPLACE REFLECTIVE TAPE).

D. CUFFING FINGER SOLENOID VALVE FAULTY (REPLACE OR REPAIR).

E. FLOW CONTROLS MISADJUSTED (READJUST PER SECTION IN MANUAL).

F. AIR LINK CRACKED OR PINCHED (REPLACE).

A. CUFFING FINGER SOLENOID VALVE FAILED (REPLACE OR REPAIR).

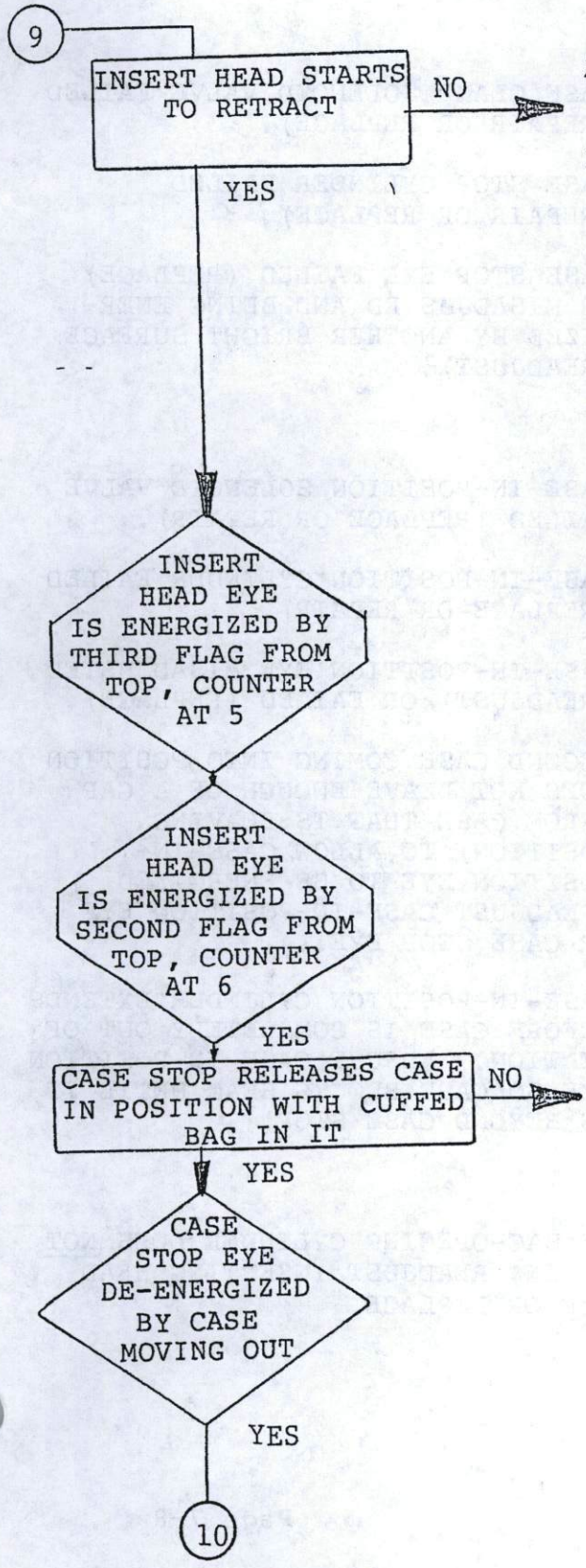
B. CUFFING FINGER CYLINDER FAILED (REPLACE).

C. AIR LINE IS BROKEN OR CRINKLED (REPLACE).

D. IF CUFFING FINGERS DO NOT MAKE THEIR FULL STROKE BEFORE RETRACTING, ADJUST SPEED CONTROLS FOR FASTER MOTION OR CHANGE TIMER (THROUGH PROGRAMMER) FOR CUFFING FINGERS RETRACT (SEE PROGRAMMER SECTION OF THIS MANUAL).

E. IMPROPERLY CUFFED BAG MIGHT BE CAUSED BY TOO TIGHT A BAG AROUND CONTAINER OR TOO MUCH BAG OVER CONTAINER (RE-SPEC BAG).

7.1 MACHINE TROUBLESHOOTING SEQUENCED GUIDE (Cont.)



A. INSERTING HEAD SOLENOID VALVE FAILED (REPAIR OR REPLACE).

B. INSERTING HEAD CYLINDER FAILED (REPAIR OR REPLACE).

C. FLOW CONTROLS NOT ADJUSTED PROPERLY (READJUST PER SECTION IN THIS MANUAL).

D. IF INSERTING HEAD RETRACT HAS TOO MUCH DELAY BEFORE RETRACTING, CHANGE INSERTING HEAD DELAY UP TIMER (WITH PROGRAMMER). SEE PROGRAMMING SECTION IN THIS MANUAL.

E. IF INSERTING HEAD STARTS RETRACTING BEFORE THE CUFFING FINGERS ARE COMPELTELY RETRACTED, ADJUST EITHER INSERTING HEAD UP DELAY TIMER OR CUFFING FINGER DELAY TIMER (SEE PROGRAMMING SECTION IN THIS MANUAL).

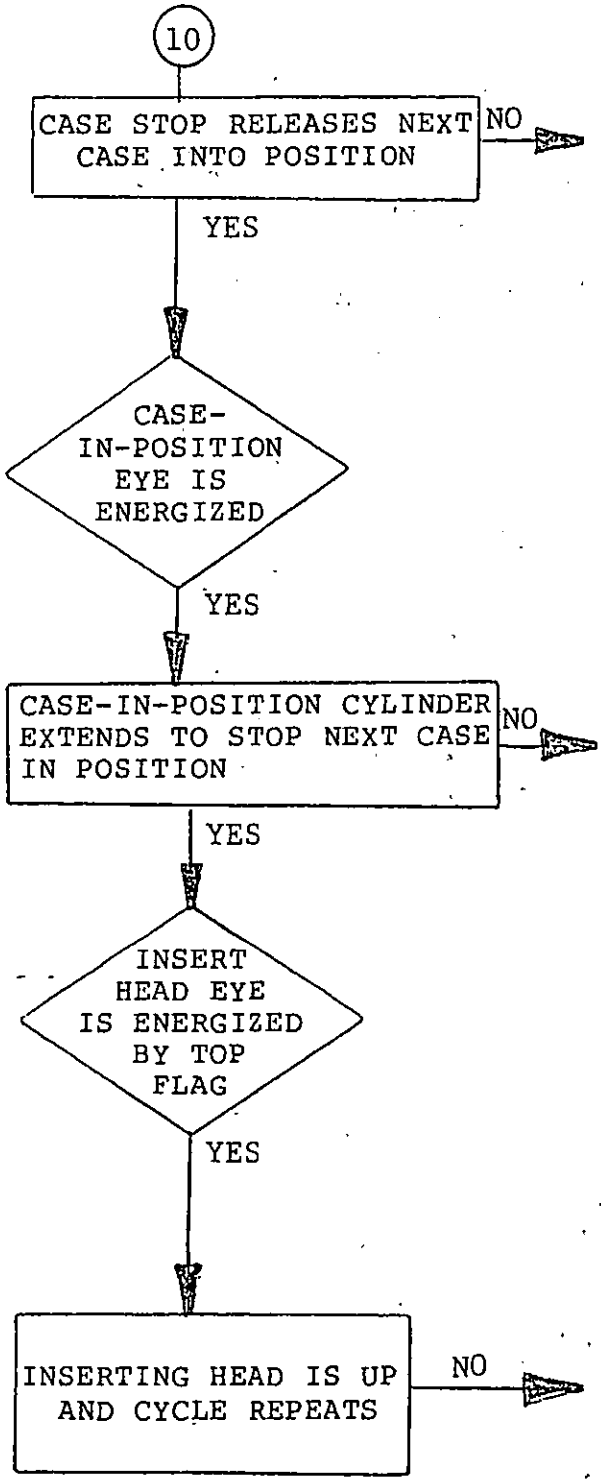
A. CASE STOP SOLENOID VALVE FAILED (REPAIR OR REPLACE).

B. CASE STOP CYLINDER FAILED (REPAIR OR REPLACE).

C. INSERTING HEAD EYE IMPROPERLY ADJUSTED OR FAILED (READJUST OR REPLACE).

D. FLOW CONTROLS MISADJUSTED (READJUST).

7.1 MACHINE TROUBLESHOOTING SEQUENCED GUIDE (Cont.)



A. CASE CLAMP SOLENOID VALVE FAILED (REPAIR OR REPLACE).

B. CASE STOP CYLINDER FAILED (REPAIR OR REPLACE).

C. CASE STOP EYE FAILED (REPLACE) OR MISADJUSTED AND BEING ENERGIZED BY ANOTHER BRIGHT SURFACE (READJUST).

A. CASE-IN-POSITION SOLENOID VALVE FAILED (REPLACE OR REPAIR).

B. CASE-IN-POSITION CYLINDER FAILED (REPLACE OR REPAIR).

C. CASE-IN-POSITION EYE MISADJUSTED (READJUST) OR FAILED (REPLACE).

D. SECOND CASE COMING INTO POSITION DOES NOT LEAVE ENOUGH OF A GAP (FROM CASE THAT IS LEAVING POSITION) TO ALLOW CASE-IN-POSITION EYE TO BE ENERGIZED (READJUST CASE-IN-POSITION EYE OR CASE STOP EYE.

E. CASE-IN-POSITION CYLINDER EXTENDS BEFORE CASE IS COMPLETELY OUT OF STATION. ADJUST CASE-IN-POSITION EYE SO CASE BLOCKS BEAM UNTIL IT IS BEYOND CASE STOP.

A. IF BAG-OPENING CYLINDER DOES NOT GO IN, READJUST INSERTING HEAD EYE OR REPLACE.

7.2 LEARNING YOUR PROGRAMMER

The following section will try to explain how to use the Programmable Controller as a useful tool for troubleshooting a faulty switch, solenoid valve, loose wire, etc.

This section will also explain how to change the time segment on the timers set up in the program.

7.2.1 PLUGGING IN THE PLC

Turn main disconnect to the "OFF" position. Open control box door and remove cap on programmable controller that is covering the plug-in for the controller. Next, plug in programmer and run programmer cable out the bottom (opposite side of hinge) of the main control box. Close control box cover loosely until the disconnect latches (see Figure 7.2.1-1).

!WARNING **DO NOT LEAVE CONTROL BOX OPEN WHEN POWER IS TURNED "ON".**

SLC-150

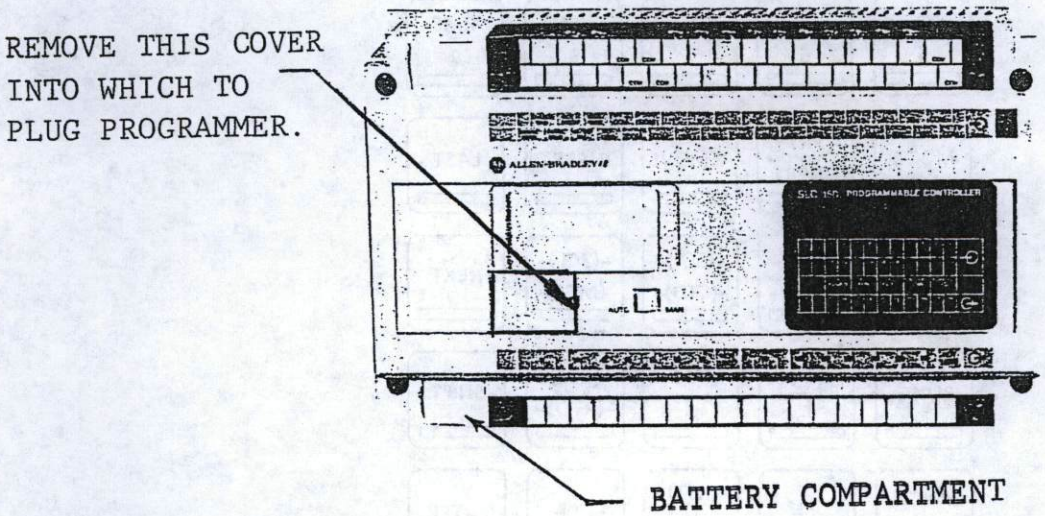


Figure 7.2.1-1

7.2 LEARNING YOUR PROGRAMMER (Cont.)

7.2.2 APPLYING FUNCTIONS

In the following paragraphs, one will learn how to edit one's program using the "NEXT" and "LAST" keys (cursor control), the "SEARCH" key, and the "REMOVE" and "INSERT" keys. The following keystroke examples do not cover all of the editing techniques. See Figure 7.2.2-1.

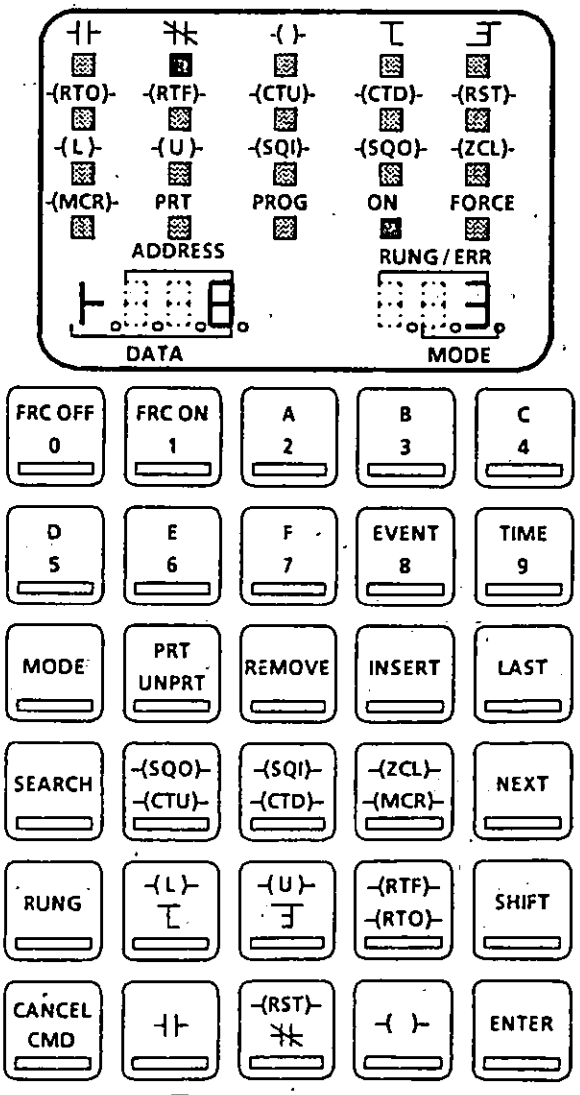


Figure 7.2.2-1

7.2 LEARNING YOUR PROGRAMMER (Cont.)

7.2.2 APPLYING FUNCTIONS (Cont.)

1. Cursor Control

The programmer indicates the cursor location by the particular instruction LED lit, the address number, and the rung number. The cursor location is moved by pressing the "NEXT" key or the "LAST" key.

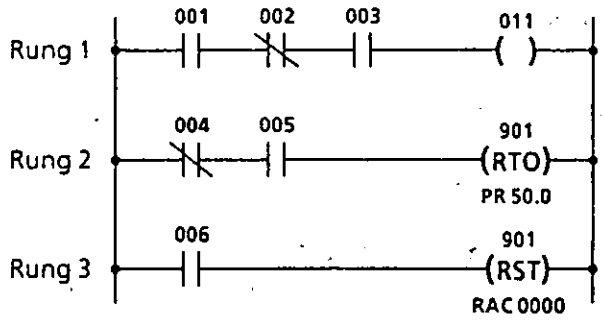
Each time the "NEXT" key is pressed, the cursor moves to the following instruction, that is, one instruction to the right. Each time the "LAST" key is pressed, the cursor moves to the preceding instruction, one instruction to the left. This method can be used to move from instruction to instruction through the rungs of one's program.

When the cursor is positioned on a timer, counter, or sequencer instruction, pressing the "NEXT" key displays the data associated with that instruction (PR value, AC value, and other data) in the order in which it was entered.

The cursor can now be moved to the start of the next run by pressing "RUNG,NEXT", or to the start of the preceding rung by pressing "RUNG,LAST".

The keystroke example of Figure 7.2.2-2 illustrates use of the "NEXT" and "LAST" keys.

Keystroke Example – Program the ladder diagram below.



Ladder Diagram

Press these keys	This LED will be lit (In addition to PROG)	Display will show: Address Data / Rung/Err Mode	Explanation
		875 End	Arbitrarily, we are using an SLC 150. After you enter the ladder diagram, there will be 875 words remaining.
LAST 7 times	-] [-	3 1	You have located the cursor on the Examine ON instruction in rung 1.
NEXT 2 times	-] / [-	4 2	The cursor is now on the Examine OFF instruction in rung 2. The start rung symbol shown at the left in the display indicates this is the first instruction in the rung.
RUNG, NEXT	-] [-	6 3	You have moved the cursor to the first instruction in rung 3.
RUNG, LAST	-] / [-	4 2	The cursor has returned to the first instruction in rung 2.
NEXT 2 times	-(RTO)-	901 2	You have moved the cursor to the RTO instruction in rung 2.
NEXT	-(RTO)-	50.0 Pr	The display is showing the PR value you entered earlier.
NEXT	-] [-	6 3	The cursor has moved to the next instruction in your program.
LAST	-(RTO)-	901 2	The cursor has moved back to the RTO instruction. Notice that you did not return to the PR value. You must use the NEXT key to access data.

Figure 7.2.2-2

7.2 LEARNING YOUR PROGRAMMER (Cont.)

7.2.2 APPLYING FUNCTIONS (Cont.)

2. Search Function

The search function can be used to locate:

A. A specific instruction.
B. A specific rung number.
C. The start or end of a program.
D. The start or end of a rung.
E. A specific sequencer step.

When searching for a specific instruction, the search begins at the cursor location; one can select the start of the program or any other point in the program. When the instruction is found, press "SEARCH,ENTER" to find the next occurrence of the instruction.

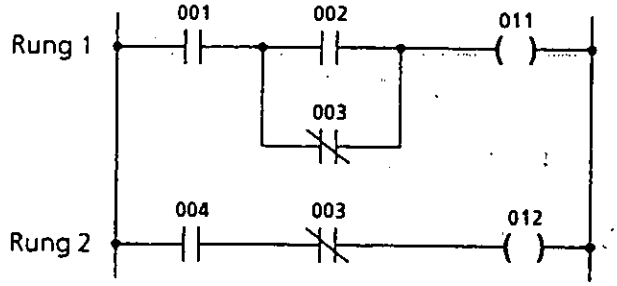
To move the cursor to a specific rung, press "SEARCH,RUNG", then the rung number. Specifying run number 1 will locate the cursor at the beginning of the program; rung number 999 will locate the cursor at the end of the program.

To move to the start of a rung, press "SEARCH,LAST". To move to the end of the rung, press "SEARCH,NEXT".

To move to a specific sequencer step, locate the cursor on any sequencer data, then press "SEARCH", the step number, "ENTER".

The keystroke example of Figure 7.2.2-3 illustrates the use of the "SEARCH" key.

Keystroke Example – Program the ladder diagram below.



Ladder Diagram

Press these keys	This LED will be lit (In addition to PROG)	Display will show: Address / Data	Display will show: Rung/Err / Mode	Explanation
		875	End	Arbitrarily, we are using an SLC 150. After you enter the ladder diagram, there will be 875 words remaining.
SEARCH		Srch		You are in a search operation.
-] / [-	-] / [-	---		An Examine OFF instruction is specified. Dashes are prompting you for an address.
3	-] / [-	--3		Address 003 is entered.
ENTER	-] / [-	3	1	Search begins at cursor location. The rung number is displayed when the instruction is found.
SEARCH, ENTER	-] / [-	3	2	Pressing SEARCH, ENTER will locate the next occurrence of the specified instruction.
SEARCH		Srch		You have initiated a new search operation.
RUNG, 1		--1		You are searching for rung 1, the start of your program.
ENTER	-] [-	⊢	1	Search is completed. The cursor is on the first instruction of rung 1.
SEARCH, RUNG, 9, 9, 9		999		To find the end of the program, you enter a rung number which is certain to exceed the number of rungs in your program. 999 is a good choice.
ENTER		875	End	The cursor is at the end of your program.

Figure 7.2.2-3

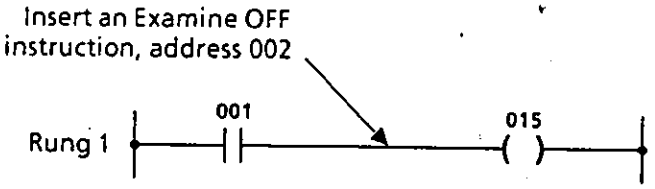
7.2 LEARNING YOUR PROGRAMMER (Cont.)

7.2.2 APPLYING FUNCTIONS (Cont.)

3. Insert and Remove Functions

While in the Program mode, one can insert and remove instructions, branches, rungs, or sequencer steps by using the "INSERT" and "REMOVE" keys. The keys also allow one to copy a rung and insert it anywhere in the program. See Figures 7.2.2-4, 7.2.2-5, and 7.2.2-6 for illustrated instructions.

Keystroke Example – Program the ladder diagram below. The keystroke example will show you how to insert and remove an instruction.

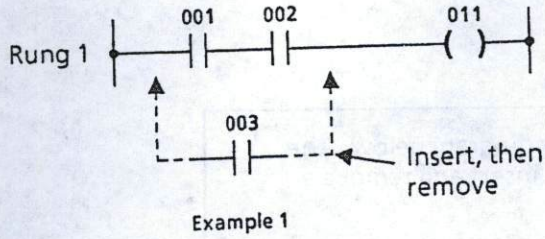


Ladder Diagram

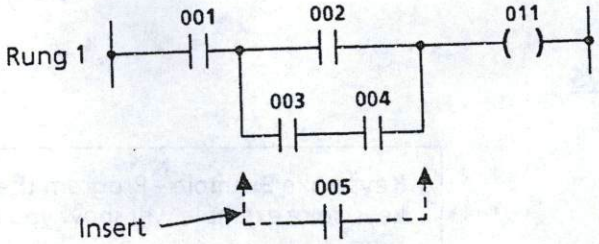
Press these keys	This LED will be lit (In addition to PROG)	Display will show Address / Data ! Rung/ Err / Mode 883 End	Explanation Arbitrarily, we are using an SLC 150. After you enter the ladder diagram, there will be 883 words remaining.
LAST	–( )–	15	The cursor is positioned on the instruction following the point where the new instruction is to be.
INSERT		In	Display is prompting you to insert an instruction.
–]/[–	–]/[–	___	Prompt for an address.
2	–]/[–	__2	Address 002 is entered.
ENTER	–( )–	15	The instruction has been entered. The cursor has moved to the next instruction.
LAST	–]/[–	2	Cursor is positioned on the newly entered instruction. Now we'll remove it.
REMOVE	–]/[–	rE	Display indicates the remove function.
ENTER	–( )–	15	The instruction has been removed. The cursor has moved to the next instruction.
LAST	–] [–	⊢	The cursor has moved to the first instruction in the rung, verifying the removal of the Examine OFF instruction.

Figure 7.2.2-4

Keystroke Example – Program these rungs. The keystroke example will show you how to insert and remove branches.



Example 1



Example 2

Example 1:

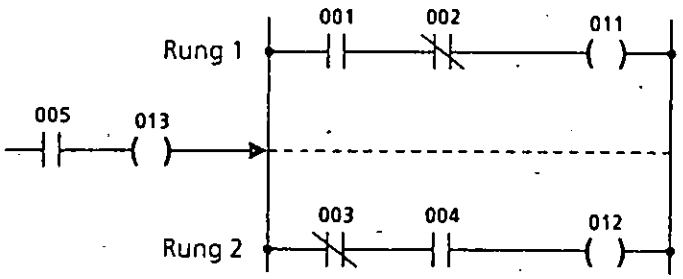
Press these keys	This LED will be lit (In addition to PROG)	Display will show: Address Data / Rung/Err Mode	Explanation
		882 End	Arbitrarily, we are using an SLC 150. After you enter the ladder diagram, there will be 882 words remaining.
LAST 3 times	-][-	⊢ 1 1	We must first insert a branch open instruction preceding instruction 001. Cursor is on instruction 001.
INSERT, ⊥	⊥	bro 1	Display indicates **i n**, Insert, then **b r o**, branch open.
ENTER	-][-	1 1	Branch open instruction entered. Cursor moves to next instruction.
NEXT, NEXT	-( )-	1 1	Cursor is now on the instruction following the point where the new branch will be inserted.
INSERT, ⊥	⊥	bro 1	The branch open instruction is entered. We can now enter instruction 003. **Note:** Any number of examine instructions could be entered without pressing ENTER after each one.
-][-, 3	-][-	--3 1	Examine ON, address 003 has been entered.
⊣	⊣	bnd 1	To complete the branch, we've pressed the branch close key. Display **b n d** indicates branch end.
ENTER	-( )-	1 1	Cursor has moved to the instruction following the branch close.
LAST, LAST	-][-	3 1	Cursor is on the examine instruction in the branch we just entered. We will now remove this branch.
REMOVE, ENTER	⊣	bnd 1	The examine instruction is removed. Cursor is on the branch close. This instruction and the 2 branch open instructions in the program must be removed. We can do this very simply, with 2 keystrokes.
MODE	⊣	rE ? E64	First, we attempt to move off the rung. The display indicates a branch error E64 (short circuit). It is asking whether we want to remove it.
ENTER		prog 2	Next, we press ENTER, which removes the branch instructions. We could also have removed the 3 branch instructions individually.

Example 2:

Press these keys	This LED will be lit (In addition to PROG)	Display will show: Address Data / Rung/Err Mode	Explanation
		877 End	Arbitrarily, we are using an SLC 100. After you enter the ladder diagram, there will be 877 words remaining.
LAST, LAST	⊣	bnd 1	In this case, the instruction beginning the new branch (003) is already preceded by a branch open instruction. Begin by moving the cursor to the instruction following the point where the branch will be inserted.
INSERT, ⊥	⊥	bro 1	Display indicates branch open. We can now enter instruction 005.
-][-, 5	-][-	--5 1	Examine ON, address 005 has been entered.
ENTER	⊣	bnd 1	New branch is entered. Cursor moves to the next instruction.

Figure 7.2.2-5

Keystroke Example – Program the ladder diagram below. The keystroke example will show you how to insert and remove a rung.



Ladder Diagram

Press these keys	This LED will be lit (In addition to PROG)	Display will show: Address Data	Display will show: Rung/Err Mode	Explanation
		879	End	Arbitrarily, we are using an SLC 150. After you enter the ladder diagram, there will be 879 words remaining.
LAST	-( )-	12	2	You can move the cursor to any instruction in the rung which follows the location where you will insert the new rung. The cursor is located on the output instruction in rung 2.
INSERT, RUNG		In r		The display is prompting you to insert a rung.
-] [-, 5	-] [-	--5	2	Examine ON instruction is inserted. This will be rung 2, as indicated.
-( )-, 1, 3	-( )-	-13	2	The output instruction is entered.
NEXT	-]/[-	F 3	3	Cursor has moved to the first instruction in rung 3. This was formerly rung 2.
LAST	-( )-	13	2	Cursor is back to the output instruction of the newly entered rung. We'll remove this rung.
REMOVE, RUNG	-( )-	rE r		Display is prompting you to remove a rung.
ENTER	-]/[-	F 3	2	Rung is removed. Cursor has moved to the following rung, which is now rung 2 again.

Figure 7.2.2-6

7.2 LEARNING YOUR PROGRAMMER (Cont.)

7.2.2 APPLYING FUNCTIONS (Cont.)

4. Program Editing Techniques

The following procedures can be used to move about the program while one is in the Program, Run, or Test modes. See Figures 7.2.2-7, 7.2.2-8, and 7.2.2-9 for illustrated instructions.

When you want to	Press these keys	Explanation
Move to the following instruction.	NEXT	Handy when you want to move to a nearby instruction or review your program instruction-by-instruction.
Move to the previous instruction.	LAST	
Move to the following rung.	RUNG, NEXT	If the cursor is on a branch or condition instruction, you will move to the start of the next rung. If the cursor is on the output, you will move to the output of the next rung.
Move to the previous rung.	RUNG, LAST	If the cursor is on a branch or condition instruction, you will move to the start of the last rung. If the cursor is on the output, you will move to the output of the last rung.
Move to the start of the rung.	SEARCH, LAST	This saves time when the rung is complex, where you would otherwise have to press LAST or NEXT many times to go thru the instructions and/or data.
Move to the end of the rung.	SEARCH, NEXT	
Move to a specific rung, number 5 for example. Two methods can be used.	RUNG, 5, ENTER	If the cursor is on a branch or condition instruction, you will move to the start of rung 5. If the cursor is on the output, you will move to the output of rung 5.
	SEARCH, RUNG, 5, ENTER	You will move to the start of rung 5.
Move to the start of the program.	SEARCH, RUNG, 1, ENTER	You will move to the start of rung 1.
Move to the end of the program.	SEARCH, RUNG, 9, 9, 9, ENTER	You will move to the end statement after the last rung.
Move to a specific instruction, –] [–, 001 for example.	SEARCH, –] [–, 1, ENTER	Search begins at cursor location. If the instruction is not found in the program, **n F** is displayed.
Move to next occurrence of the specific instruction.	SEARCH, ENTER	If the instruction occurs only once in the program, the display of the first occurrence reappears.

Figure 7.2.2-7

4. Program Editing Techniques (Cont.)

The following procedures can be used to add, delete, or change instructions and rungs while you are in the **Program** mode.

When you want to	Cursor location	Press these keys	Explanation
Correct an error while entering an instruction, address, or data.	You can correct errors as long as the cursor position has not been moved (pressing ENTER, NEXT, LAST, or another instruction key moves the cursor).	CANCEL CMD (as often as required)	Each time you press the key, a previous keystroke is "wiped out". An instruction and its address can be canceled and changed in this way.
Insert an instruction in a completed rung. Example: –] [–, 008	Locate the cursor on the instruction following the point where you want to add the new instruction to the rung.	INSERT, –] [–, 8, ENTER	Cursor moves to the instruction following the new instruction.
Delete an examine instruction.	Locate the cursor on the instruction to be deleted.	REMOVE, ENTER	Cursor moves to the instruction which followed the deleted instruction.
Change an instruction or its address in a completed rung. Example: –(RTO)–, 901 to –( )–, 012	Locate the cursor on the instruction to be changed.	–( )–, 1, 2, ENTER	We have changed the instruction and its address. Cursor moves to the following instruction.
Another example: –] [–, 002 to –] [–, 702	Locate the cursor on the instruction to be changed.	–] [–, 7, 0, 2, ENTER	We have changed the address only.
Insert or remove a branch.	Refer to the keystroke example of Figure 15.4 on Page 15-7.		
Insert a rung. Example: 003 016 —] [—( )—	Locate the cursor on any instruction in the rung which follows the point where you want to enter the new rung.	INSERT, RUNG, –] [–, 3, –( )–, 1, 6, NEXT	Rung is inserted. Cursor has moved to the next rung. Rung numbers have been automatically changed.
Add a rung to the end of the program.	Locate the cursor on the End display.	–] [–, 3, –( )–, 1, 6, ENTER	We have entered the example rung at the end of the program.
Delete a rung.	Locate the cursor on any instruction in the rung you want to delete.	REMOVE, RUNG, ENTER	Rung is removed. Cursor has moved to the following rung.
Copy a rung. Example: Insert a copy of rung 2 after rung 5.	Locate the cursor on any instruction in rung 2.	REMOVE, RUNG, INSERT, 6, ENTER	Rung 2 is repeated and placed after rung 5. The following rungs are re-numbered accordingly.
Delete your entire program. (Select Clear Memory, mode 1.)	We will assume you are entered in the Program, Run, or Test mode. Cursor can be on any instruction in the program.	MODE, 1, ENTER	The prompt message Sure ? gives you the opportunity to change your mind. You would press CANCEL CMD to avoid clearing your program.
		ENTER	You have automatically entered the Program mode. 885 words (SLC 100) or 1200 words (SLC 150) of memory are available to you.

Figure 7.2.2-8

4. Program Editing Techniques (Cont.)

The following procedures can be used to change or protect time/counter data while in the **Program** mode. The table also lists procedures for changing, protecting, adding, and deleting sequence data.

When you want to	Cursor location	Press these keys	Explanation
Change the PR value of a timer or counter. Example: change timer PR to 20.0.	Locate the cursor on the PR value.	**2, 0, 0, ENTER**	Value is changed to 20.0 sec. Cursor has moved to the next instruction. **NOTE:** If PR value was protected, you must protect it again after changing the value.
Protect the PR value of a timer or counter (this also protects AC value).	Locate the cursor on the PR value.	**SHIFT, PRT**	Cursor moves to next instruction. The PRT LED will be lit while cursor is on the PR value (Program, Run, Test modes) *and the AC value* (Run, Test modes).
Remove protection from the PR value.	Locate the cursor on the PR value.	**UNPRT**	PR and AC values have returned to the unprotected state.
Change the RAC value of the RST instruction. Example: change RAC to 9.	Locate the cursor on the RAC value.	**9, ENTER**	Value is changed. Cursor has moved to the next instruction.

Changing, protecting, adding, and deleting sequencer data while in the Program mode (Procedure for changing RAC value is the same as for timers and counters)

When you want to	Cursor location	Press these keys	Explanation
Access data in a specific step. Example: access data in step 5.	Cursor can be located on sequencer group, mask, step, or PR data.	**SEARCH, 5, ENTER**	Cursor has moved to the step data of step 5.
Change group number, mask data, step data, or PR values. Example: change step data for step 5 to 5, 7.	Locate the cursor on step 5. Display shows current data and **d 5**	**5, 7, ENTER**	Value is changed to 5, 7. Cursor has moved to PR value of step 5. Other data is changed in this same way. Just locate cursor on data, enter new data, and press ENTER.
Protect the PR value of a sequencer step.	Locate the cursor on the PR value of the step.	**SHIFT, PRT**	Cursor moves to next instruction. PRT LED will be lit while cursor is on protected PR value (Program, Run, Test modes).
Remove protection from the PR value.	Locate the cursor on the PR value of the step.	**UNPRT**	The PR value has returned to the unprotected state.
Add a step after the final step. Example: step data of 7, 3; PR of 1.0 second.	Locate the cursor on the PR data for the final step.	**INSERT, NEXT, 7, 3, ENTER, 1, 0, ENTER, ENTER**	New step is added. You can add as many steps as you want before pressing the final ENTER.
Insert a step somewhere before the final step.	Locate cursor on the PR data of the step following the point where you will insert a step	**INSERT, 7, 3, ENTER, 1,0, ENTER**	We have added the same data as in the example above. Cursor has moved to the next step.
Delete a step.	Locate cursor on the step data or PR value of the step to be deleted.	**REMOVE, ENTER**	Step is removed. Following steps are re-numbered.

Section 8

Parts & Service

CUSTOMER SERVICE (TOLL FREE) 1-800-932-3647

Ordering Parts

To order repair parts, the following information is required to avoid delay and the possibility of error.

1. Machine Serial Number _____
2. Machine Model Number_____

Note: Serial and Model Numbers are stamped on the nameplate affixed to the machine. (See the "WARRANTY ADMINISTRATION POLICY" on page 8-3.)

3. Finding a Thiele Technologies Part Number and the Description.
   a. Using the Assembly Drawing, locate the circled item number of the part.
   b. Next, refer to the Bill of Materials, either immediately preceding the assembly drawing or on the drawing itself.
   c. When using a detached Bill of Materials, the item number will appear in the left-hand column, and the part number and description in the right-hand column.
4. Your Purchase Order and shipping and billing address.
5. Thiele Technologies parts may be ordered by mail, by telephone, by FAX or by e-mail.

Parts Department Phone Numbers and Address

Toll Free: 800-932-3647
Direct Dial: 612-782-1200
FAX: 612-782-1207

Thiele Technologies Inc.
315 - 27th Avenue N.E.
Minneapolis, MN 55418
Attn: Customer Service Department

e-mail: **CustomerService@ThieleTech.com**

Service Calls

Should you have problems or questions about your Thiele Technologies machine, our Service Department is here to help. Service technicians are available for phone assistance, installation, training, and field service.

Service Department Phone Numbers and Address

Toll Free: 800-932-3647
Direct Dial: 612-782-1200
FAX: 612-782-1203

Thiele Technologies Inc.
315 - 27th Avenue N.E.
Minneapolis, MN 55418
Attn: Service Department

Mailing Address and Remit-To Address

Please update mailing and remit-to addresses in your system as shown below.

Mailing Address:

Thiele Technologies
315-27th Avenue NE
Minneapolis, MN 55418

Remit-to Address:

Thiele Technologies
P.O. Box 71949
Chicago, IL 60694-1949

Wire Transfer Remit-To-Destination

Payments via wire transfer should be remitted to the following bank destination:

Harris Bank Corp.
Chicago, IL
ABA #071-000-288
Account #184-686-4

WARRANTY ADMINISTRATION POLICY

All parts and equipment purchased by Thiele Technologies and covered by manufacturer's warranty are, in turn, warranted to the purchaser per the provisions of the Thiele Technologies standard "Terms and Conditions of Sale." In summary, this warranty provides protection for the purchaser of Thiele Technologies packaging and palletizing equipment against defects in material and workmanship for ninety (90) days from the date of shipping in the case of electronic components, and one (1) year from the date of shipping for other components, excluding those parts of the equipment considered expendable such as plastic wear guides, hoses, lamps, belts, cutting knives, connecting pins, elastomeric components, vacuum cups, etc.

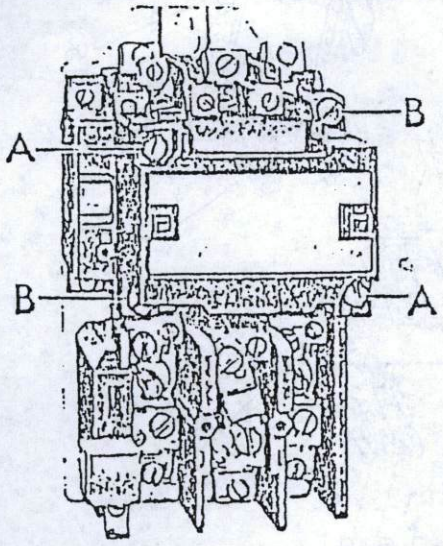
Thiele Technologies will, at the sole option of each of the operating companies, repair or replace those components found to be defective and covered by original equipment manufacturers according to the provisions of their warranties. Physical removal and installation of replaced or repaired parts is not included in the warranty. However, service personnel are available to perform these services for parts covered by warranty at currently published service rates.

Labor and expenses related to replacement or installation of parts under warranty will be invoiced at applicable standard rates.

NOTE: **Changes to programmable controller logic (program) made by purchaser without prior knowledge and written approval of the appropriate operating company may result in undesirable machine operation and may void the warranty. All program changes must be approved prior to installation to prevent possible equipment damage and personal injury. Thiele Technologies assumes no liability for changes made without prior approval.**

9.0 DATA SHEETS

RENEWAL PARTS AND INSTRUCTION PUBLICATION FOR NEMA SIZE "0" 3 POLE STARTER WITH BI-METAL NON-AMBIENT COMPENSATED OVERLOAD RELAY



Typical Starter Three Pole with Two Circuit Electrical Interlock

INTRODUCTION

This publication is designed to simplify inspection and maintenance. It features . . .

1. A publication number keyed to the ordering number of the device . . . to simplify filing and fact finding.
2. A nameplate inscription keyed to the specific renewal parts publication . . . to eliminate cross referencing.
3. An exploded view for easy, positive identification of parts with illustrated steps on "how to assemble and disassemble" . . . to conserve time and eliminate guesswork.
4. Comprehensive maintenance information to provide maximum performance. This information should be read carefully.

DESCRIPTION

These are three pole, three phase, non-reversing A.c magnetic starters for across the line applications within the ratings shown on the nameplate of the equipment.

CARE

These starters require no mechanical maintenance. Any maintenance required can be performed with an electricians screwdriver. For continued uninterrupted performance, renew all of the power contacts and springs at the same time before the contact tip material has worn away.

When renewing the contacts check all terminal screws to insure they are tight and secure.

Suggestion — refer to publication 14183 for helpful information on inspecting and determining when to replace contacts.

RENEWAL OF OPERATING COIL

The operating coil is epoxy encapsulated and so constructed to provide long service life. Should the coil require changing, the entire operation can be performed in a few minutes.

1. Unfasten the two pan head cover screws "A" and remove the cover item 16.
2. Tilt the top of the armature item 11 away from the coil.
3. Slide the armature up and out.
4. Remove the spring plate item 12.
5. Pull the coil straight out.
6. Install the new coil with the coil terminal blades engaging the coil terminal clips.
7. Install and seat the spring plate.
8. Slide the armature (narrow end to the right) into its seated operating position.
9. Install the cover.

RENEWAL OF POWER UNIT

NOTE — The power unit item 1 consists of a factory assembly of all the magnetic parts, movable contacts, and their carrier assembly. This unit usually permits immediate restoration to service of a device which may have become inoperative.

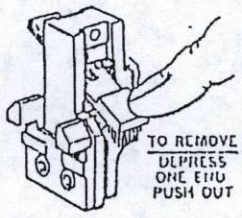
Unfasten the two gold colored Hex. Head screws "B", pull out the power unit, plug-in the new and retighten the screws "B". A set of stationary contacts is included with the power unit. It is advisable to install these stationary contacts at the same time, particularly if visual inspection indicates that both the movable and stationary contacts need replacement. Specify coil by suffix letter selected from coil table on page 4.

RENEWAL OF POWER CONTACTS

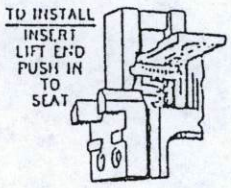
The power contacts when used within their rating will provide long trouble free life. They should not be filed or dressed.

1. Remove the power unit assembly by loosening the two gold colored slotted hex. head screws "B" and pull the power unit straight out.

MOVABLE CONTACTS

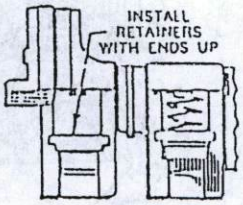


SKETCH "A"

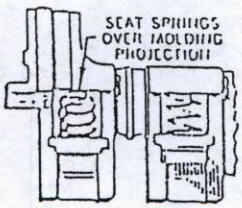


SKETCH "B"

2. Depress one end of the movable contact and push the contact out (see sketch "A").
3. Remove the springs item 10.
4. Remove the retainers item 9.



SKETCH "C"



SKETCH "D"

5. Install the new retainers item 9. (see sketch "C").
   Note — the retainer must be installed so the springs will seat over the extruded hole, with the retainer ends extending away from the contacts.
6. Install the spring item 10. (see sketch "D").
7. Install the contact (see sketch "B"). Insert contact, raise end slightly and push in to seat.

STATIONARY CONTACTS

NOTE — It is not necessary to disconnect any wiring.

8. Remove the screws securing the stationary contacts.
9. Slide the contact out of the groove in the molding. A hole in the contact plate is provided for convenient removal with a screwdriver.
10. Install the new contacts.

CAUTION — The stationary contacts must be installed so they seat on top of the terminal plates. (See typical assembly top of page 2).

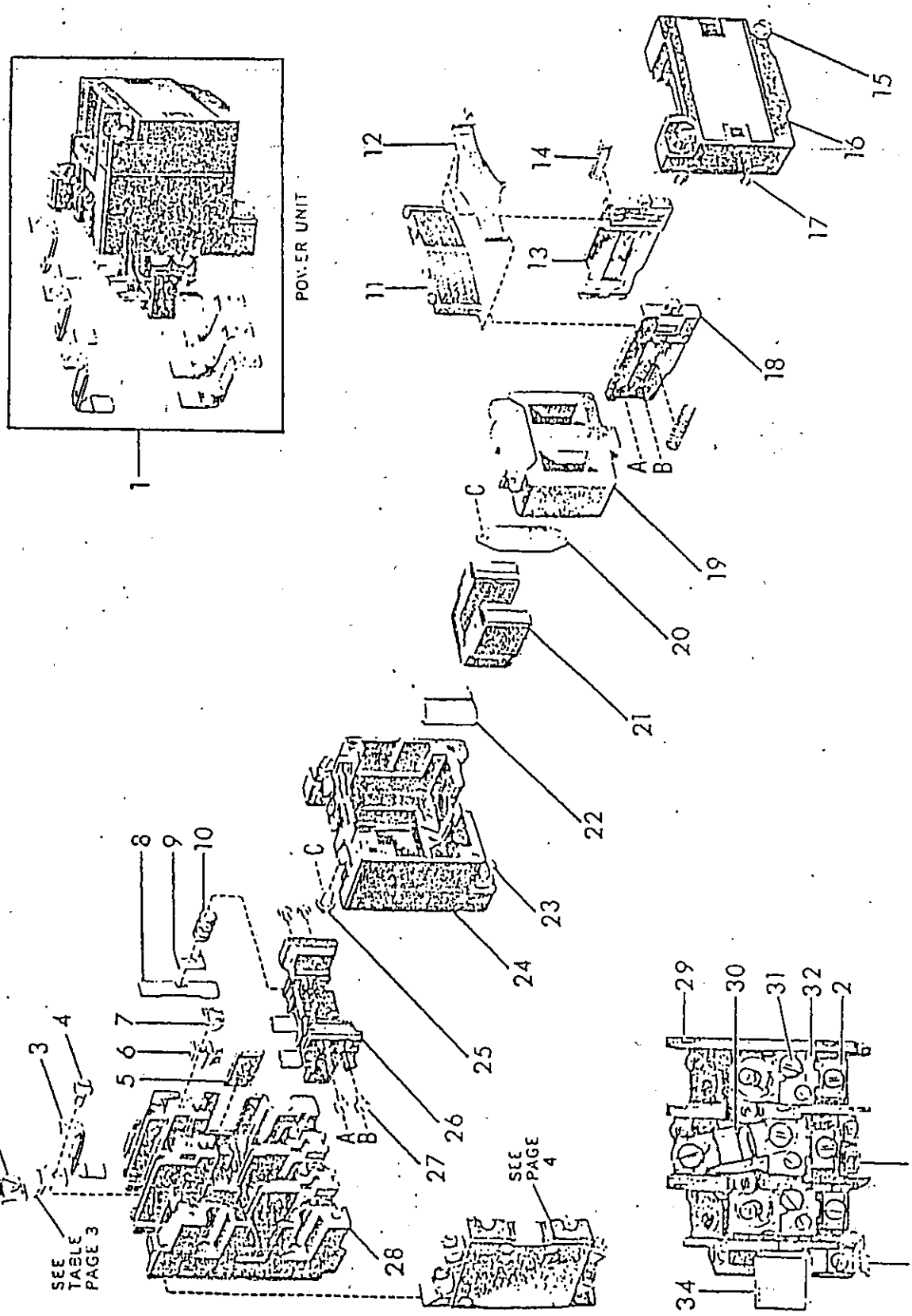
ELECTRICAL INTERLOCKS

The electrical interlocks are renewable as a complete assembly. See page 4 for the various electrical interlocks.

LUBRICATION

Do not lubricate any part of this equipment.

Continued on page 4



OVERLOAD RELAY

The parts listed and illustrated are available for repairs. Should other parts be required order a complete overload relay.

RENEWAL PARTS — Information Required

To insure prompt handling of renewal parts orders, please include the following: DESCRIPTION, PART NO., AND QUANTITY REQUIRED.

PARTS LIST

▲Recommended Spare Parts.
A Renewal Set of Contacts for 3 Poles, Part No. 6-22-2 (includes items 3, 4, 8, 9 and 10).

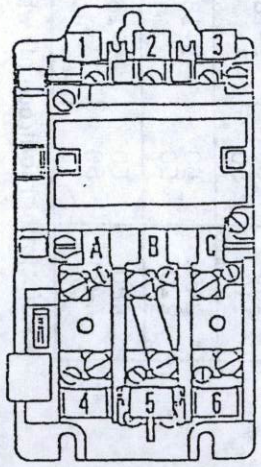
Item No.	Description of Part	No. Req.	Part No.
• 1	Power unit (includes items 3, 4, 8 thru 27) (see coil table p. 4)	1	C108X
2	Power Terminal Clamp	*	55-1763
▲ 3	Stationary Contact	6	23-3479
4	Contact Mounting Screw	6	11-2280
5	Insulator	1	56-3493
6	Coil Terminal Clip	2	55-1681
7	Auxiliary Terminal Clamp	*	55-1743
▲ 8	Movable Contact	3	23-3480
9	Retainer	3	55-1956
10	Spring	3	69-2715
*11	Armature	1	48-1019
12	Spring Plate	1	69-2765
13	Push Bars (includes items 14, 18 and 27)	1	61-1857
14	Spring	2	69-2507
15	Pan Head Sems Screw	2	11-2517
16	Cover (includes items 15 and 17 w/o nameplate) (give complete nameplate data for cover with nameplate)	1	49-4114
17	Spring	4	69-2508
18	Push Bar (see item 13)	1	.....
19	Coil (see table on page 4)	1	.....
20	Strap	1	19-1723
*21	Magnet Frame	1	17-8911
22	Spring	1	69-2766
23	Slotted Hex. Head Screw	2	11-2518
24	Magnet Housing	1	49-3606
25	8—32 x .50 Pan Head Screw	2	11-2515
26	Contact Bar (does not include items 8, 9, 10)	1	23-3481
27	6—32 Pan Head Screw	4	11-2378
28	Molded Base	1	17-9014
29	Overload Relay (includes items 2, 7, 31 thru 34)	1	10-3537-3
30	Connector	1	25-2217
31	Screw	6	11-2582
32	Terminal Plate 6—20 x .438 P. H. Thd. Cutting Screw	3	80-2749
33	Indicating Plate	6	11-2669
	Cover Plate	1	30-4138
	6-32 x .50 Pan Head Screw	1	47-21095
34	Button (Gray)	1	11-2722
		1	53-1236-4

•Coil must be specified by suffix letter selected from coil table on page 4. The power units are supplied only with 3 power poles

*As Required.

*It is Recommended that items 11 and 21 be replaced together.

TERMINAL POSITIONS



Selection and arrangement see adjacent table.

TERMINALS

	POSITION 1	POSITION 2	POSITION 3	TERMINAL CLAMPS POWER	TERMINAL CLAMPS AUXILIARY
WITH PROVISION FOR AUXILIARY TERMINAL				 ⅛10-32 Item 2 in Parts List	 ⅛6-32 Item 7 in Parts List
PART NO.	80-3167	80-3168	.....	55-1763	55-1743
WITHOUT PROVISION FOR AUXILIARY TERMINAL				POWER  ⅛10-32	
PART NO.	.....	80-2786	80-2783	55-1763	

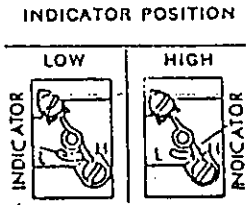
CONNECTORS (Contactor to Overload Relay)	
POSITION	PART NO.
A	25-2212
B	25-2213
C	25-2214

TERMINALS (On Overload Relay)		
POSITION	 Item 32 in Parts List	TERM. CLAMP  Item 2 in Parts List
4, 5, 6		
PART NO.	80-2749	55-1763

ntinued from page 1

I-METAL NON-AMBIENT OMPENSATED OVERLOAD RELAY

his overload relay has two steps of djustment obtained by LOCATING HE INDICATORS in the extreme 'L" (low) or "H" (high) position as hown in the adjacent illustrations nd in the heater coil selection able furnished with the starter.



he indicators must be in the same osition for each heater coil used in a given overload elay. Set the indicator in the position as instructed on he publication furnished with the starter.

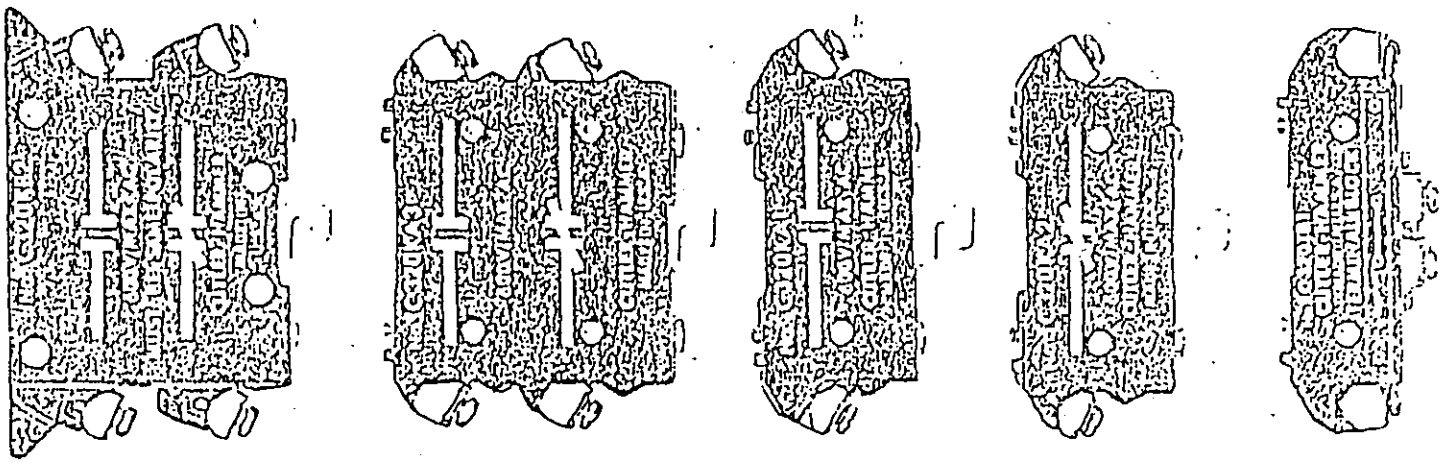
Hand or Automatic Reset Overload Relays — The overload relay as shipped from the factory is set for "Hand" reset operation.

For automatic reset operation — loosen the screw fastening the "hand-auto" legend plate; depress the reset button and slide the legend plate into the notch in the reset operator; tighten the legend plate screw.

Automatic reset operation is not intended for use with two wire control devices.

The parts called out on page 2 and listed on page 3 are available for repairs. If parts are required other than those listed replace the complete relay.

ELECTRICAL INTERLOCKS, TERMINAL BLOCK AND COIL TABLE



ADD ON TYPE

BASE MOUNTED

Circuit	Catalog No.
None (Dummy)	10 3640 3
1 N.O.	C320KB1
1 N.O.-1 N.C.	C320KB2

FOR MOUNTING ABOVE BASE MOUNTED INTERLOCK

Circuit	Catalog Number
1 N.O.	C320KA1
1 N.C.	C320KA2
1 N.O.-1 N.C.	C320KA3

TERMINAL BLOCK

Cat. No.
C320TB1

Operating Coils Selection Table

Volts	Cycles	Part Number	*Suffix Letter	Volts	Cycles	Part Number	*Suffix Letter
120 110	60 50	9-1887-1	A	600 550	60 50	9-1887-4	D
240 220	60 50	9-1887-2	B	208	60	9-1887-5	E
480 440	60 50	9-1887-3	C	380	50	9-1887-8	L

*Suffix letter required only when power unit is ordered.

Installation Instructions
for
Simco Equipment

IMPORTANT -- DO NOT DESTROY

PLEASE READ THESE INSTRUCTIONS
CAREFULLY BEFORE PROCEEDING WITH
THE INSTALLATION AND OPERATION,
OF THIS EQUIPMENT.

a TRANSDYNE company

the SIMCO company, Inc., 2257 North Penn Road, Hatfield, PA 19440

ICS
10M-H

The points of the Induction Bar should be about 1/4" to 5/16" from the material to be discharged. Try to locate the bar where this distance can be maintained. The material should not hit the points so as to prevent their becoming damaged. They are made purposely fragile so that they will not rip or tear the material if accidental contact should be maue. If the bar must be mounted where sag, whip or flutter of the material makes it impossible to maintain an average distance of 1/4" to 5/16" without contact, then the bar will have to be kept farther from the material, but no more than 1/2".

IMPORTANT ----- The points of the bar should look at the material where the material is in free air and not in contact with a roller, plate or other surface.

Since the electric charges are to be conducted into ground, it is required that the metal channel of the Induction Bar be metallically connected, by the perforated supports furnished, to the frame of the machine which in turn should be metallically connected to a known ground. Be sure to clean off any paint from the machine frame at the location where the perforated strips are bolted to the frame.

The Induction Bar reduces charges on the material to a threshold value where its action ceases. For complete neutralizing, the Induction Bar should be followed up with an electrically operated static bar.

Our New Address
as of Sept. 1, 1981
2257 North Penn Road
Hatfield, PA 19440
Ph: (215) 822-2171

the SIMCO company, inc.
920 Walnut Street, Lansdale, Pa. 1944(
Phone 215-368-2220 Telex 846130

SIMCO®
a RANSBURG company

the SIMCO company, Inc.
2257 North Penn Road Hatfield, PA 19440

INSTRUCTIONS

INSTALLATION-OPERATION-MAINTENANCE

SIMCO POWER UNITS (ALL POTTED MODELS)

SECTION 1 INTRODUCTION

1-1 General Description

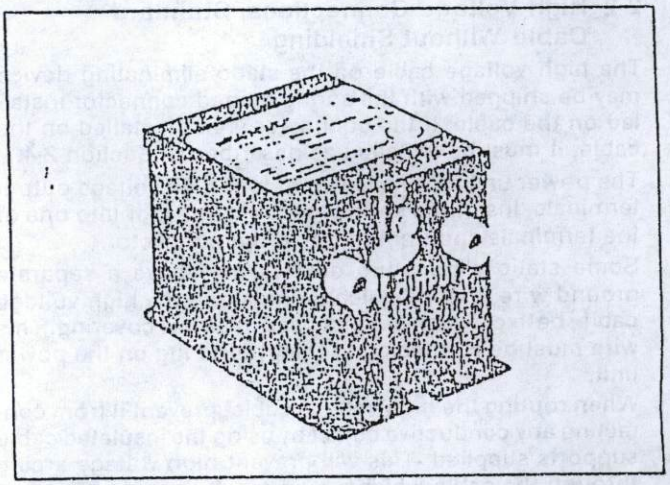
The Simco Power Unit provides a high voltage output for powering various types of Simco static eliminating equipment.

Although there are many individual models, all are basically the same with respect to mounting, connections, and operation. These power units are internally potted and require no maintenance or adjustments.

Each power unit operates on a specific line voltage and frequency and provides a specific high voltage output. The power unit model supplied, is selected by the factory depending upon the type of static eliminating device it is to power, therefore the power unit must be used only with the device for which it was originally supplied. Do not add any other device to the power unit without consulting Simco.

If it should become necessary to contact the factory regarding the power unit, please be sure to reference the power unit "Model Number" and "Unit Number." These numbers are listed on the nameplate affixed to the power unit. Line voltage and frequency requirements, and output ratings are also listed on the nameplate.

All Simco Power Units are UL and CSA listed.



Typical Power Unit

1-2 Receipt of Equipment

Remove the envelope containing the shipping list. Carefully remove the equipment from the shipping container and inspect for any damaged or missing parts. Make certain any spare or replacement parts are not discarded with the packing material.

If any damage has occurred during shipment, the local carrier should be notified at once regarding his liability. A report should also be submitted to The Simco Company, Inc., 2257 North Penn Road, Hatfield, PA 19440.

1-3 Return Shipment

If any equipment or component part is to be returned to The Simco Company, Inc. for any reason, it must be accompanied by a letter describing the reason the item is being returned, repairs or work to be performed by the factory. Prior to returning any goods, contact Simco for an Authorized Returned Goods Number. This number must be referenced in the packing slip or correspondence included with the shipment. Any items being returned should be prepaid and properly packed to provide adequate protection during handling and shipment.

SECTION 2 INSTALLATION

2-1 Mounting and Grounding the Power Unit

The power unit is designed for flat surface mounting and can be easily mounted using the mounting flanges at the base of the unit.

When locating the power unit, please note that proper grounding of the power unit case is essential for safe and efficient operation of the equipment. Proper grounding can be accomplished by one of the following methods:

Caution: Failure to properly ground the power unit may result in electrical shock hazard to personnel and inefficient operation of the equipment. Do not apply line power until all grounds and H.V. connections have been completed.

IMPORTANT

Even the best equipment will fail to provide complete satisfaction and safe operation unless it is properly installed and maintained. It is important that these instructions be completely read and understood before attempting to install or operate this equipment. Failure to do so could result in serious personal injury and/or damage to the equipment.

a. If the static eliminating unit is to be mounted on a machine, bolt the power unit to a well grounded member of the machine frame. Make certain the machine frame is properly grounded.

b. Connect a copper ground wire between the ground lug on the power unit and a good earth ground such as a cold water pipe, sprinkler system piping, or grounded electrical conduit.

c. The power unit is equipped with a 3-conductor line cord. On power units designed for 120 volts ac operation, the line cord is fitted with a standard 3-prong plug and should be plugged into a 3-terminal grounded receptacle. Make certain the receptacle is grounded.

On power units designed for operation on 220 volts ac and above, the ac line cord is not normally supplied with a plug. The green wire provides the ground connection to the power unit and should be connected to a good earth ground.

2-2 High Voltage Connections, Standard Cable Without Shielding

The high voltage cable on the static eliminating device may be shipped with the spring loaded connector installed on the cable. If the connector is not installed on the cable, it must be installed as described in Section 2-4.

The power unit may have two or four high voltage output terminals. Insert the spring loaded connector into one of the terminals and finger-tighten the connector.

Some static eliminating devices may have a separate ground wire (green) which is run along the high voltage cable, both of which are enclosed in a vinyl covering. This wire must be connected to the ground lug on the power unit.

When routing the high voltage cable, prevent it from contacting any conductive object by using the insulated cable supports supplied. This will prevent high voltage arcing through the cable which would result in cable burn-out.

2-3 High Voltage Connections, Cable With Optional Stainless Steel Shielding

Some static eliminating devices equipped with shielded high voltage cable have a separate ground lead which provides the ground connection for the shielding. Connect this ground lead to the ground terminal on the power unit. Insert the spring loaded connector into the high voltage output terminal on the power unit and finger-tighten.

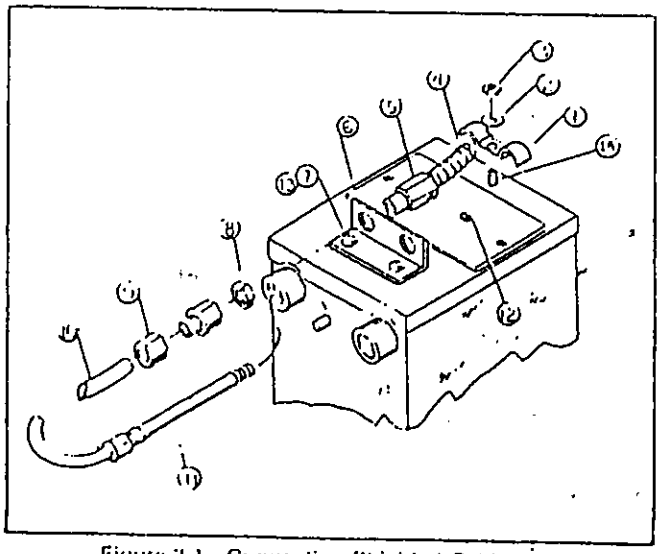


Figure 2-1 Connecting Shielded Cable to "L" Bracket on Power Unit

Ionizing air guns and some Type HS Nozzles with shielded cable are shipped with all connections completed by the factory. These units use a mounting arrangement on the power unit as shown in Figure 2-1. If equipment using this mounting configuration has not been connected at the factory, it must be connected by the user as described below.

Note: Do not alter the length of shielded cable. Should this become necessary, contact Simco for further information.

a. Refer to Figure 2-1. Insert the end of the high voltage cable through the angle bracket (item 6) on the power unit.

b. Install and tighten hex nut (item 8).

c. Install male half of nylon compression fitting (item 9) as shown, and tighten securely onto the hex bushing (item 5).

d. Install and tighten female half of the compression fitting (item 9).

e. Install the spring loaded connector (item 11) on the high voltage cable as described in Section 2-4.

f. Insert the spring loaded connector into the high voltage output terminal on the power unit and finger-tighten.

g. Install strain relief clamp (items 1, 2, 3).

Removal

If it becomes necessary to remove the shielded cable from the power unit, disconnect line power and proceed as follows:

a. Refer to Figure 2-1 and remove hex nut (item 3) and remove cable clamp (item 1).

b. Unscrew spring loaded connector (item 11) and remove from high voltage output terminal.

c. Using a 5/64" allen wrench, remove set screw from the spring loaded connector and remove the connector.

d. Unscrew nylon compression fitting (item 9) and remove both halves of the fitting. The protective sleeve (item 10) should remain on the cable.

e. Remove hex nut (item 8). The entire cable assembly may now be removed from the power unit.

2-4 Removal and Installation of Spring Loaded Cable Connector (P/N 5050001 and 5050002)

Removal

a. Refer to Figure 2-2. Disconnect line power to the power unit and unscrew the spring loaded cable connector.

b. Using a 5/64" allen wrench, remove the set screw from the connector body and remove the connector.

Installation

Two types of high voltage cables, are used on Simco equipment. The larger diameter (black cable) requires the 5050001 connector and the smaller diameter (red cable) uses the 5050002 connector. Installation of both connectors is the same with exception of step "a" below. Follow the procedure for the type of cable supplied with your equipment.

achine to the power unit. Cable should always be kept at least ¼" away from machine frame and parts, walls, and eiling; but if it must touch at any points, it should be encased in protective plastic tubing, available from Simco. o install the cable supports, press the split plastic bushing out of the metal support and apply bushing to cable at esired location. Mount the support, then press the bushing with cable back into the support. Be sure that a cable upport is located to remove all strain and motion from the cable where it enters a static bar and the power unit.

UNDING

Frame of the machine — It is essential for successful operation of the equipment that the frame of the machine e electrically grounded, either through well-grounded electrical conduit, or by heavy copper wire connecting the rame to a water pipe.

Static Bars — The metal casing must be grounded. If the casing is not grounded, personnel may receive a shock by touching it and, in addition, the equipment will not function properly. Grounding is automatic when metal nounting clamps and brackets support the bars directly from the grounded metal machine frame. When the bars re supported from wooden or other non-conductive members, a separate wire must connect the mounting bracket on one end of the bar to a metal part of the grounded machine frame or to a well-grounded electrical conduit or vater pipe.

Power Unit — The power unit must be grounded by inserting the 3-prong plug into an AC receptacle of the voltage and frequency marked on the nameplate and with a good ground connection for the ground pin of the plug. If a grounded socket is not available, either bolt the power unit to a well-grounded metal machine frame or connect a heavy copper wire from the ground terminal K on the front of the box to a well-grounded electrical conduit or water pipe.

CHECKING FOR PROPER OPERATION

To determine if a Type "ME" Shockless Static Bar is functioning properly, place the metal shaft of a screwdriver against the edge of a hole in the metal casing and approach a sharp corner of the blade toward a point until sparking occurs. The spark that jumps from the point to the blade should be very faint and thin. The spark should be as follows: 1/16" diameter bars—1/16" long; 1" diameter bars—⅛" long; 1¼" diameter bars—3/16" long; 1 5/16" diameter bars—3/16" long. Be sure the corner of the blade is very sharp or the resulting spark will be deceptively short. Each point is isolated and must be tested individually.

MAINTENANCE

Turn equipment "Off" before cleaning, removing static bars from machine, or breaking any ground connection. If metal filings or fragments fall into the holes of the static bars, they are apt to short-circuit that section of the bar and make it inoperative until the particles are removed. Loosen the bar brackets and revolve the bar to face downd, tapping it to dislodge the particles. Revolve the bar back into position and tighten the brackets. Compressed may be used to keep the inside of the bar clean. Periodic use of a soft brush or compressed air will prevent the nts from accumulating hardened balls of lint, grease, and other foreign matter that reduce their sharpness and ecrease efficiency. One easy way to remove built-up deposits is to occasionally press a soft pencil eraser down over each point in turn and twist slightly. Remove ink and resistant coatings by wiping points with "Renuzit" (other commercial cleaners may damage plastic parts). Including the static bars in the regular procedure of cleaning the machine will pay dividends in service and excellence of performance. The manufacturer has complete repair facilities for all parts of the eliminator.

TROUBLE SHOOTING

When equipment fails to function properly — Check connections to be sure they are tight before proceeding with the following tests.

When the spark test produces a spark at only some of the points of the static bars, check these particular points without spark for metal fragments or other contamination that should be removed as outlined under "Maintenance" listed above. When the spark test produces a very heavy and long spark from one of the points of a bar, the bar is defective due to a breakdown in the insulation of the bar. When the spark test produces no spark at all, the trouble is either defective bars or power unit. To locate the faulty equipment, disconnect all bars from the power unit by unscrewing knurled plugs M from the plastic receptacle G and pulling out high voltage cables. After all bars have been unplugged, attach a piece of insulated wire or cable to ground terminal K and insert the other end of the wire into one of the holes in plastic receptacle G. As the conductor approaches the screw at the back of the exposed hole, a spark should occur. If no spark occurs nor any arcing heard, the trouble is in the power unit. If a spark does occur, the fault is in one or more of the bars.

To find the faulty bar or bars, insert the high voltage cable from one of the bars into the exposed hole of plastic receptacle G and screw knurled plug M FINGER TIGHT ONLY. Try the spark test at several points of the bar. If the proper spark occurs, add another bar to the power unit. Repeat this process until the spark test fails at all points. The last bar added is defective and must be removed from the power unit. All equipment found defective by the above test procedures must be sent to Simco for repairs.

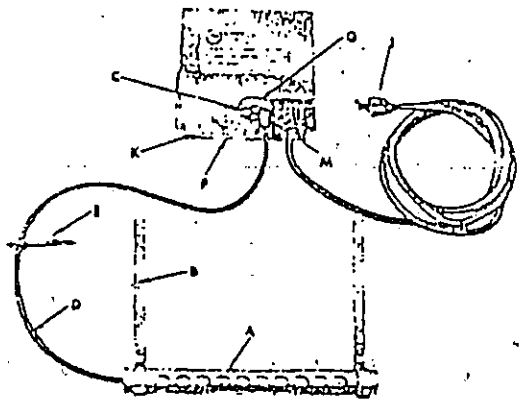
Attach Instruction — "SL"

For further information contact:

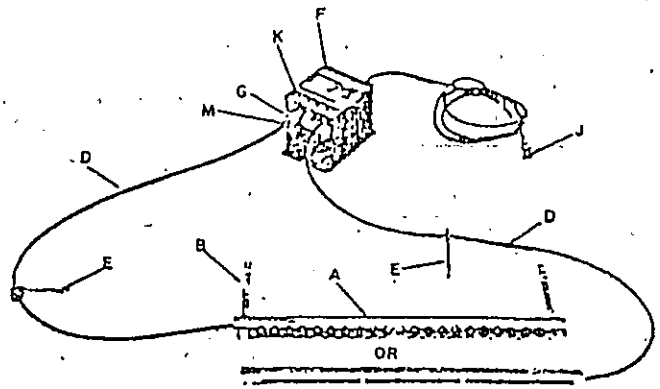
the SIMCO company, inc.
920 Walnut Street, Lansdale, Pa. 19446
Phone 215-368-2220 Telex 846130

Worldwide Manufacturer of Static Eliminators, Generators and Detectors

INSTALLATION INSTRUCTIONS FOR SIMCO TYPE "ME" SHOCKLESS STATIC BARS WITH MODEL D___7RY SERIES OR F___7 SERIES MIDGET POWER UNITS



D__7RY Power Unit



F__7 Power Unit

PLEASE READ INSTRUCTIONS COMPLETELY BEFORE STARTING INSTALLATION

Always turn off current to power unit before any work is done on the equipment unless instructions state otherwise.

Mount Static Bar A to machine with brackets B. Run high voltage bar cable D on insulators E along machine frame or wall to power unit F. After installing Spring Loaded Cable Connector on high voltage cable, as outlined on attached instructions "SL", plug cable into a hole of plastic receptacle G. Screw knurled plug M into plastic receptable G — FINGER TIGHT ONLY. Low voltage wiring of power unit terminates in polarized 3-prong plug J for connection into a corresponding AC receptacle having the same voltage and frequency as that marked on the nameplate and with a good electrical ground connection for the ground pin of the plug. If a grounded socket is not available, either bolt the power unit to a well-grounded metal machine frame or connect a heavy copper wire from ground terminal K on the front of the power unit to a well-grounded electrical conduit or to a water pipe. To add static bars to the installation, remove a plastic plug C from receptacle G by jabbing an insulated screwdriver through the center of the plug and prying out.

LOCATING TYPE "ME" SHOCKLESS STATIC BARS

(1) Best locations are usually just ahead of places where static gives trouble.

(2) The material to be neutralized should have a background of free air and not be in contact with another surface as it passes the static bar, since static charges cannot be easily neutralized from between two surfaces in intimate contact. If material must be discharged where it is in intimate contact with a flat plate or board, it may be done effectively by cutting a slot in the plate or board and mounting the static bar in this slot, or by drilling a series of holes through the plate corresponding to the holes in the static bar casing and mounting the static bar under the plate. Partial contact of the material with a background surface may not interfere with effective static elimination; however, this should be avoided as much as possible.

(3) Static bars may be mounted with points facing any angle, provided they face the material to be discharged.

(4) Distances of Static Bars from material to be discharged:
1⅝₁₆", 1¼", and 1" diameter bars — The metal casing should not be less than ⅛" nor more than 1¼" from the material. For best results, keep between ½" and 1".
⅝₁₆" diameter bars — The metal casing should not be less than ⅛" nor more than 1" from the material. For best results, keep between ¼" and ¾".
The material should not contact the bar.

(5) Mounting brackets are provided that can be bent and twisted to support static bars from the frame of the machine or from convenient stationary shafts that span the machine. A piece of ½" pipe attached to the side frames could serve as a shaft. Under no conditions should holes containing points be covered by clamps.

MOUNTING THE POWER UNIT. Mount the power unit to the machine frame (preferably on the side away from the operator) or to a convenient wall or post.

1184

MR

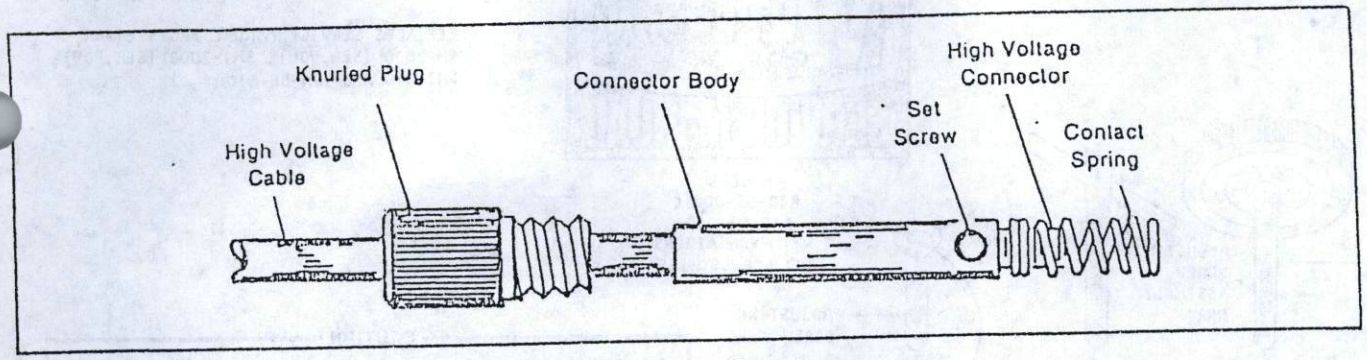


Figure 2-2 Spring Loaded Cable Connector
(P/N 5050001 and 5050002)

a. On black cable, measure and strip ½" insulation from end of cable. Straighten conductor strands. On red cable, measure and strip 1" insulation from end of cable. Straighten conductor strands and bend back to form a double thickness ½" long.
b. Slide the knurled plug onto the cable with the threaded end toward the end of the cable as shown in Figure 2-2.
c. Slide the connector body on the cable with the set screw hole positioned toward the end of the cable.
d. Slide the high voltage connector over the conductor until it butts against the cable insulation. Make certain all conductor strands are inside the connector.
e. Line up set screw holes in the connector body and high voltage connector. Insert and tighten the set screw. Pull firmly on the connector body to make certain the set screw is well seated.
f. Screw the contact spring (close turns end first) onto the high voltage connector as shown in Figure 2-2.

2-5 AC Line Power (Low Voltage) Connections

Caution: Do not apply line voltage to the power unit until all grounds and high voltage connections have been completed, and the static eliminating device has been installed.

The line cord is to be connected to a power source of the correct voltage and frequency as listed on the nameplate affixed to the power unit case.

Power units which operate on 120 volts ac are equipped with a line cord fitted with a 3-prong plug, and should be plugged into a grounded, 3-terminal receptacle.

Power units operating on 220 volts and above are equipped with a 3-conductor line cord. If a plug is to be used, it must be supplied by the user. The black and white wires are to be connected to the ac voltage source, and the green wire should be connected to ground.

If the static eliminating equipment is to be used on machinery, it is recommended the power unit line cord be connected to the machine's "Run" button. This will enable the static eliminating equipment to be turned "on" and "off" with the machine.

Some types of power units may be supplied with an ON/OFF switch (with or without a pilot lamp) which provides convenient ON/OFF control of the power unit.

SECTION 3 OPERATION

3-1 General

Before placing the equipment into operation, make certain all grounds, and connections have been completed as described in Section 2. Make certain the static eliminating device has been properly installed as described in the applicable instructions.

To place the equipment into operation, simply apply line power to the power unit. On power units equipped with an ON/OFF switch, place the switch in the "ON" or "Operate" position.

Caution: Never touch the high voltage outlet while the unit is in operation or hazardous electrical shock may result. Always turn the power unit "OFF" when the equipment is not in use.

SECTION 4 MAINTENANCE

4-1 General

Under normal conditions, the power unit requires no periodic maintenance. The user may occasionally check to make certain all grounds and electrical connections are clean and tight.

SECTION 5 TROUBLESHOOTING

5-1 Basic Power Unit Troubleshooting

If problems are encountered with operation of the equipment, it is recommended the user contact Simco for assistance. Since high voltages are present, it is important that troubleshooting and servicing be performed only by properly trained and qualified service personnel, familiar with handling high voltage equipment.

Procedures for checking the power unit are as follows:

a. Turn off ac line voltage to power unit.
b. Disconnect all static eliminating equipment from the high voltage outputs of the power unit.
c. Strip the insulation from both ends of a short length of insulated wire. Connect one end to the ground lug on the power unit. Make certain the power unit is properly grounded as described in the Installation section of this instruction.
d. Using a screwdriver with a well insulated handle, insert the screwdriver blade into the high voltage output and apply power to the power unit. Slowly approach the exposed part of the screwdriver blade with the free end of the ground wire. A strong, heavy arc should occur between the wire and the screwdriver blade. The arc should be approximately 1/16" to 1/8" long for power units with outputs from 2.5 KV to 4 KV, 1/8" to 3/16" for 4KV to 6KV, 3/16" to 1/4" for 6 KV to 7KV outputs.

   If there is no arc, or if the arc is not as described above, the power unit is defective and should be replaced.

   Caution: When performing this test, do not touch the H.V. outlet or the screwdriver blade or a hazardous electrical shock may result.

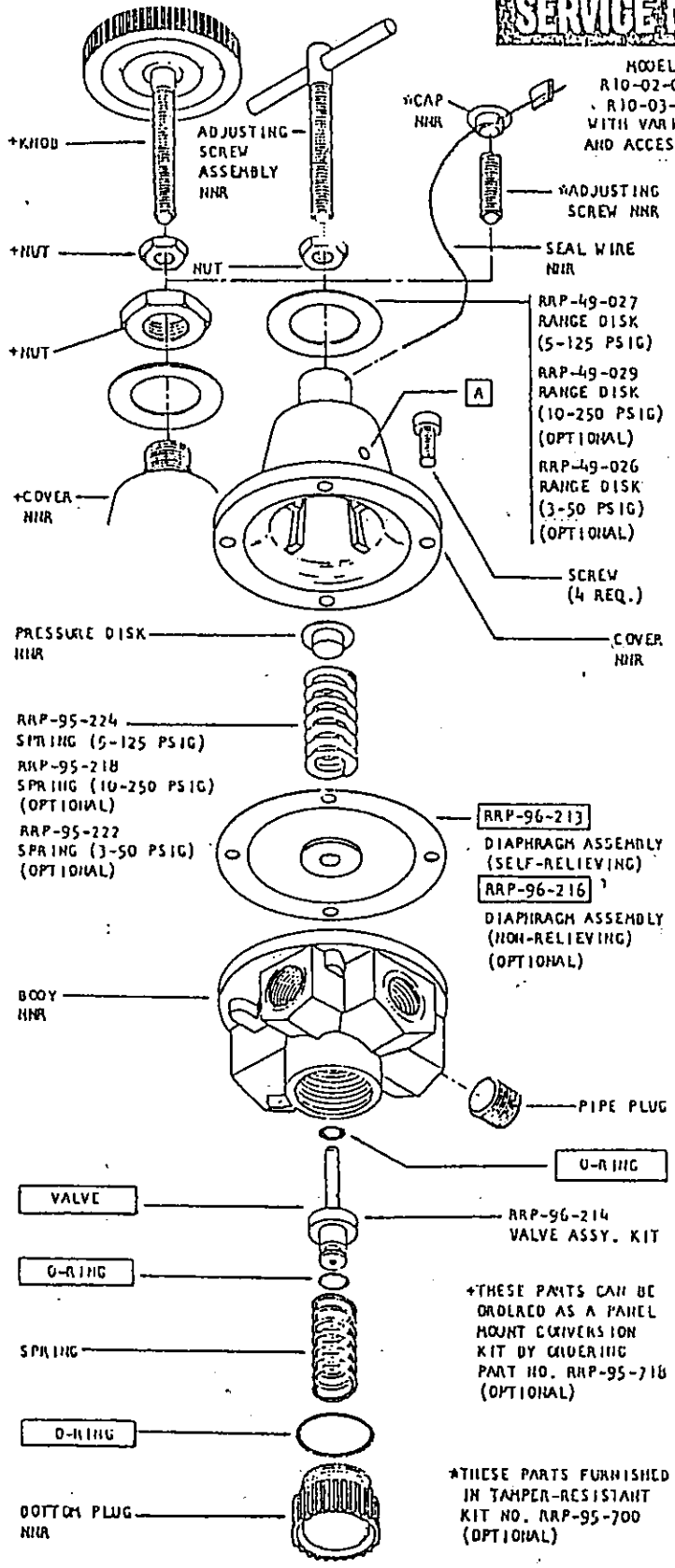
SEPTEMBER 1978

WILKERSON CORPORATION SERVICE MANUAL

CJ-R10-9SM

REPLACES SERVICE MANUAL PAGES E1-4A, SM-2000 (SER."D"), SM1-2000 (SER."D"), SM2-R10 AND 9SM-BE-R10

MODELS
R10-02-000 &
R10-03-000
WITH VARIATIONS
AND ACCESSORIES



+THESE PARTS CAN BE ORDERED AS A PANEL MOUNT CONVERSION KIT BY ORDERING PART NO. RRP-95-718 (OPTIONAL)

*THESE PARTS FURNISHED IN TAMPER-RESISTANT KIT NO. RRP-95-700 (OPTIONAL)

CAUTION

Except as otherwise specified by the manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication, and manufacturer assumes no responsibility for any resulting loss.

INSTALLATION

1. Maximum inlet pressure and operating temperature ratings are 300 psig (20,7 bar) and 175° F (79,4° C).
2. Install as close as possible to where regulated air is needed.
3. Install the unit with the air flowing through the body in the direction indicated by the arrow.
4. Install the same pipe size unit as the pipe line in use. Avoid using fittings, couplings, etc., that restrict the airflow, unless maximum flow is not needed.
5. Regulator may be installed so that adjusting handle is in any position. Attach gauge to one 1/4" female gauge port and plug the other 1/4" female port, or use it as a regulated outlet port.
6. Turning the adjusting screw clockwise raises the regulated pressure and turning it counterclockwise lowers the regulated pressure.
7. Panel mount regulators require a 5/8" diameter hole and are mountable on panels from 1/8" to 1/2" thick.

(Continued on reverse side.)

TO OVERHAUL SELF-RELIEVING MODELS, ORDER
REPAIR KIT NO. RRP-95-131

TO OVERHAUL NON-RELIEVING MODELS, ORDER
REPAIR KIT NO. RRP-95-132

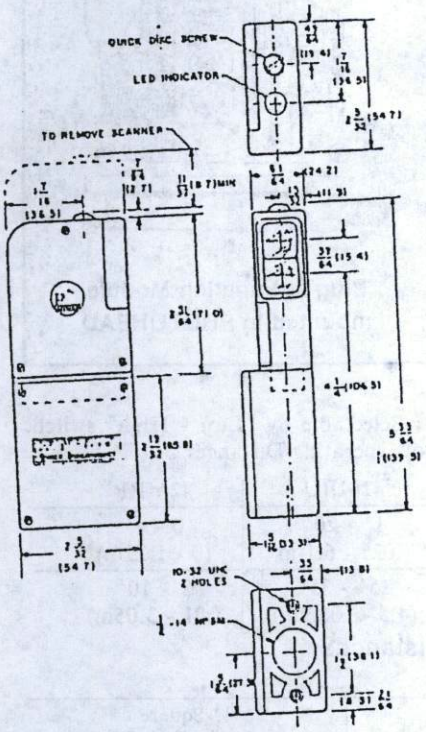
[ ] — THESE INDIVIDUAL PARTS FURNISHED IN REPAIR KIT

NHR = NOT NORMALLY REPLACED

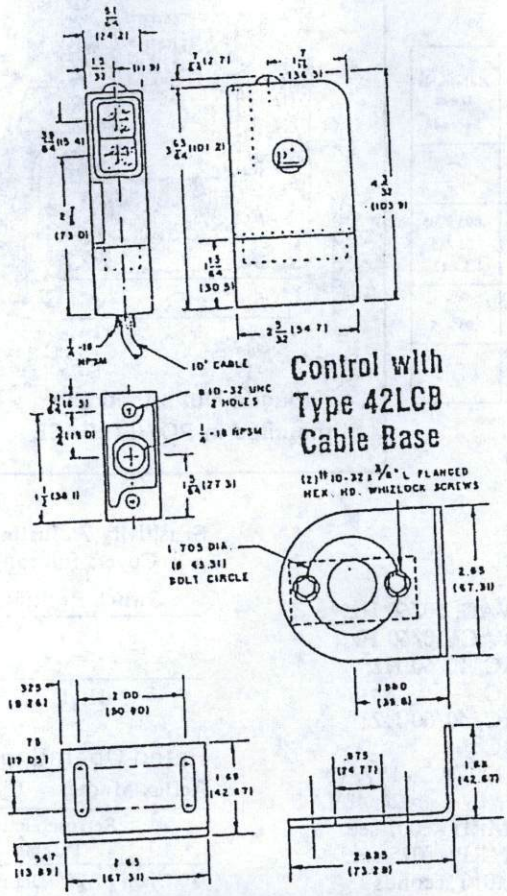
WILKERSON CORPORATION
ENGLEWOOD, COLORADO 80150

Form 9SA

DIMENSIONS

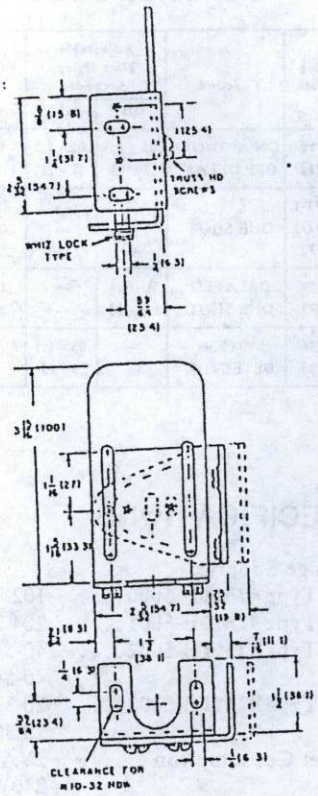


Control with Type 42LTB Terminal Base



Control with Type 42LCB Cable Base

Universal Duty Mounting Assy. #60-1785



Heavy Duty Mounting Assy. #60-1748

INSTALLATION

The control must be securely mounted on a firm, stable surface, or support. A mounting which is subject to excessive vibration or shifting may cause intermittent operation. For installation convenience, Heavy Duty Mounting Assembly #60-1785, is recommended. For excessive vibration environments, use Solid State Relay outputs.

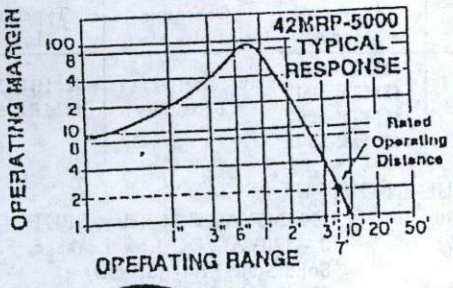
Wiring:

All external wiring should conform to the National Electric Code and applicable local codes. See wiring Diagram on Page 3 for electrical connections.

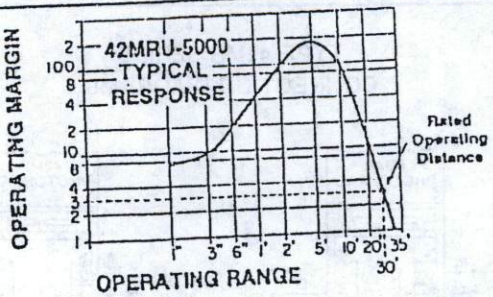
ALIGNMENT

Alignment of the Type 42MR LED control, which has an invisible beam, can be accomplished by visually sighting the control at the Reflector until the visible LED Indicator, on the top, lights with switch in the "LT" position or goes out when the switch is in the "DK" position.

To insure that the beam is centered on the reflector in Reflex or on the object using Proximity, it is desirable to sweep the beam across the reflector or object in the horizontal plane and determine at what points the indicator light goes on and the goes off. Set the beam half way between both points. Do the same in the vertical plane.



For reliable Service in dusty and dirty industrial environments, higher optical Operating Margins may be required, resulting in reduced Operating Range for the control. Use curves as approximate application guide only.



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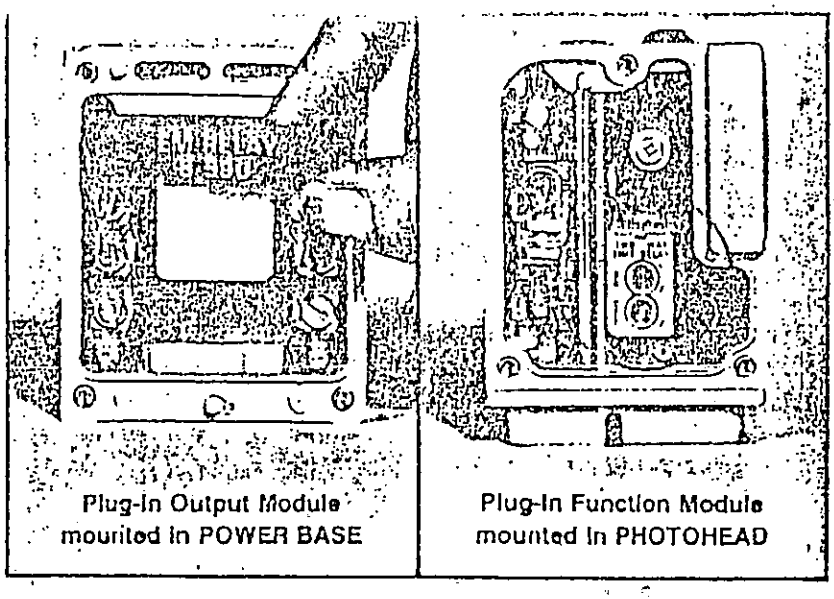
SELECTION CHART

PLUG-IN CONTROL FUNCTION MODULES

Catalog Number	Function	Adjustable Time Delay Seconds		Recycle Time	Adjustable Dwell
		ON	OFF	Seconds	Seconds
60-1790	ON AND/OR	.05 - 1.0	.05 - 1.5	.0025	—
60-1791	OFF DELAY	.5 - 10	.5 - 15	.025	—
60-1792-1	ONE SHOT	—	—	.0025	.005 - .05
60-1792-2		—	—	.0025	.05 - .5
60-1793		—	—	.0025	.5 - 15
60-1794	DELAYED ONE-SHOT	.1 - 1.5	—	.0025	
60-1795		1.0 - 15	—	.025	.05 - .5
60-1796	MOTION DETECTOR	—	.05 - 1.5	—	—
60-1797		—	.5 - 15	—	—



Plug-In Output Module mounted in POWER BASE

Plug-In Function Module mounted in PHOTOHEAD

SPECIFICATIONS

Voltage Supply:

Type 42MTB-5000	102-132VAC, 50/60 Hz;
Type 42MTB-5001	204-264VAC. 50/60 Hz;
Type 42MTB-5002	40-54VAC, 50/60 Hz; 40-54VDC
Type 42MTB-5003	20-30VAC, 50/60 HZ; 20-30VDC
Power Consumption	2VA @ 120VAC, 4VA @ 240VAC, 1VA @ 24/48VAC
Response Time:	Type 42MRU - .001 sec. Type 42MRP - .025 sec.
with E-M Relay #8-590	Operate .010 seconds additional Release .015 seconds additional
with SS Low Leakage Relay #8-591	.001 seconds additional
with SS Triac Relay #8-592	.008 seconds additional

Operating Environment:
Nema 3, 4, 5, 12 and 13 rated PHOTOHEADS and POWER BASES are made of very high impact and chemically resistant Valox 357.

Field of View: Type 42MRU - 2.5°, Type 42MRP - 3°

Turn On Pulse Suppression: Yes

Light/Dark Energized Option: Selectable by Switch on Photohead

Sensitivity Adjustment: Selectable by "Low - High" switch. Covers full range of Operating Distances.

Switch Position	42MRU	42MRP
Low	1" - 20' (.025 - 6.1m)	0 - 4' (0 - 1.22m)
High	15' - 35' (4.5 - 10.12m)	3' - 10' (.91 - 3.05m)

Rated Operating Distances:

Reflex Mode:

Retroreflective Targets			1" Square Reflective Tape (3M)			
3" Diam #92-39	1.25" Diam #92-47	.625 Diam #92-46	#3870	#7590	#7610	#7900
30' (9.15m)	20' (6.1m)	15' (4.5m)	Consult Factory			

Note: Minimum Operating Distance: 1" (2.5cm)

Proximity Mode:

Diffuse White Surface:. . . . . 7' (2.2m)

Distance Discrimination Range: 10" - 10' (.3 - 3m) 18" to 10' (.45 to 3m) with 15% minimum Distance Differential (Hysteresis) between surface to be detected and background. Distance Differential is defined as increase in distance required to deenergize output, measured from the point of energization.

ORDERING INSTRUCTIONS

SELECT POWER BASE

Voltage Supply	Type and Model
120VAC	42MTB-5000
240VAC	42MTB-5001
48VAC/DC	42MTB-5002
24VAC/DC	42MTB-5003

SELECT PHOTOHEAD

Operating Mode	Type and Model
Reflex	42MRU-5000
Proximity	42MRP-5000

SELECT PLUG-IN OUTPUT

Cat. #8-590	120/240VAC E-M Relay, SPDT
Cat. #8-591	0 - 120VAC/DC Low Leakage, F.E.T., Solid State Relay (SP-NO)
Cat. #8-592	120/240VAC Power Triac S.S. (SP-NO)

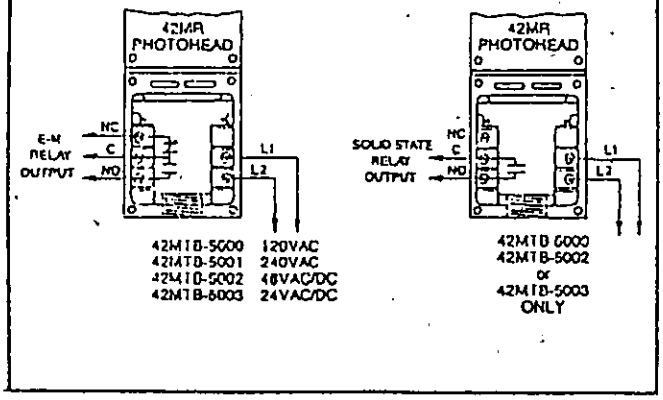
SELECT OPTIONAL CONTROL MODULE

See Plug-In Control Module Selection Chart.

SELECT OPTIONAL MOUNTING

Cat. #60-1785	Universal, 360° Adjustment
Cat. #60-1745	Heavy Duty, for mechanical protection

TYPE 42MR SERIES CONNECTION DIAGRAMS



GENERAL

Type 42MR Series 5000 GREEN LINE, the full feature miniature photoelectric controls, combine PHOTOSWITCH quality, reliability and versatility into a functional package of reduced size, lower cost and increased operating features.

Each Type 42MR control system consists of a modulated LED source, high speed silicon photodetector, a choice of functional plug-in control and output modules which can be used to interface with power loads as well as with programable controllers or digital logic. The small size plus its functional flexibility makes it ideally suited for space limited application on machinery and conveyors and other material handling systems.

The Type 42MR controls are modular in design and consist basically of two components — a plug-in **PHOTOHEAD** and a **POWER BASE**, which are selected to suit your functional requirements and assembled together at the point of installation. The **PHOTOHEAD** includes a unique **Quick Disconnect** feature so that it can be quickly mounted to or removed from the **POWER BASE** by simply turning a screw, without disrupting control wiring or alignment.

All Type 42MR controls are suitable for use in Nema 3, 4, 5, 12 or 13 environments. The control housings are made of high impact, corrosion resistant Valox 357. Combined with the **#60-1785 Universal** or the **#60-1748 Heavy Duty Mounting** Assembly (where mechanical protection is required) universal mounting in any position for installation flexibility is assured.

In addition, **Type 42MR PHOTOHEADS** include provisions for field mounting of plug-in Two Way Time Delay, One-Shot, Delayed One-Shot and Motion Detector modules. The **POWER BASE** provides the location for field installation of the desired output whether it be E-M Relay, Low Leakage F.E.T. or Power Triac Solid State Relays.

TYPE 42MR PHOTOHEADS

There are two different PHOTOHEADS available:

For **REFLEX** operations (with retroreflective target), specify **Type 42MRU Model 5000** which provides reliable operation to a distance of 30′ (9.15m).

For **PROXIMITY** operations (diffuse reflection off the object itself), specify **Type 42MRP Model 5000** offering reliable operation to 7′ (2.2m).

The PHOTOHEAD contains all functional electronics and optics. REFLEX and PROXIMITY models include **Synchronous Detection** circuitry which tends to restrict the control to operations with its own modulated LED source. The unique PHOTOHEAD circuitry precludes the possibility of false operations when power is first turned on. Adjustable input sensitivity adds to control application capability to those involving translucent and even transparent materials, such as plastic films and glass. A switch is provided to assure sensitivity adjustment throughout the entire control operating range.

Type 42MR controls provide either **Light Energized** or **Dark Energized** output energized modes with the flip of a switch. A visible LED indicator on the top of the PHOTOHEAD, visible in all directions, glows when the LED beam is made (i.e. on the retroreflective target in REFLEX operation, reflecting from the target in Proximity mode).

Plug-In Control Function Modules mounted in the PHOTOHEAD permit the Type 42MR controls to perform a variety of functions. Besides standard **On-Off** operation, control functions available include **Two-Way Time Delay, One-Shot, Delayed One-Shot and Motion Detectors.** For complete description and selection of these **Plug-In Control Function Modules**, see adjacent page of this bulletin.

TYPE 42MTB POWER BASES

All Type 42MRU REFLEX and 42MRP PROXIMITY PHOTOHEADS can be plugged into the Type 42MTB POWER BASE — a Terminal Type Power Base available in models for 120VAC, 240VAC, 48VAC/DC and 24VAC/DC.

The Type 42MTB Terminal Type Power Base makes it easy for the user to terminate his incoming and outgoing connections directly to the controls thus eliminating the need for a separate junction box. Wiring connections are made to easy-to-wire pressure type terminals with non-rotating clamps on the screws capable of handling #14AWG wires or crimp on terminals.

PLUG-IN OUTPUT MODULES

The POWER BASE includes provisions for a variety of physically interchangable PLUG-IN OUTPUT MODULES:

Cat. #8-590 A.C. Electromechanical Relay
2A, 120VAC, 1A, 240VAC (SP-DT), non-inductive

Cat. #8-591 Low Leakage, F.E.T. Solid State Relay
30ma cont., 0 to 120VAC/DC
10 Microamps max. leakage (SP-NO)

Cat. #8-592 Power Triac Solid State Relay
1A cont., 10A. surge, 120/240VAC (SP-NO)

PLUG-IN CONTROL FUNCTION MODULES

Type 42MR Series 5000 QD Controls are basic ON-OFF photoelectric sensing devices. However, they can be made to perform other control functions, such as Timing, One-Shot, Delayed One-Shot and Motion Detection by simply plugging in one of the Control Modules described below onto the socket provided in the PHOTOHEAD. No other connections, jumpers or switching is required.

The selection chart below describes the plug-in control modules available. The control functions are described as follows:

#60-1790 and #60-1791 TWO-WAY TIME DELAY
Plug-in modules include two independent adjustable timing circuits. The time adjustment potentiometer can be set to ZERO to provide OFF or ON or even NO Time Delay, if so desired.

#60-1792 and #60-1793 ONE-SHOT
Plug-in modules provide an adjustable output pulse independent of input signal duration. Also, there will be NO false pulse when power is turned on. Major applications are those which require that short input signals must be recognized.

#60-1794 and #60-1795 DELAYED ONE-SHOT
Plug-in modules provide an output signal of adjustable duration at an adjustable preset time after the Type 42MR sensor detects the presence or absence of a moving object. The output signal is uneffected by sustained or repeated input signals during the delay time. Most applicable where short input signals must be recognized but action is to be taken further down the line, such as in labeling, sorting or inspection functions.

#60-1796 and #60-1797 MOTION DETECTOR
Plug-in modules provide an output, which ceases, if the control does not receive an appropriate signal within an adjustable preset time. It is generally used to detect "stopped motion" on conveyor lines, etc., where the object can stop either inside or outside the sensing area. It can also detect a low limit in rates of product flow where objects are regularly spaced.

BUSCH

MAINTENANCE

AND

REPAIR MANUAL

MODELS
0010 THROUGH 0100
R5 - SERIES
SINGLE STAGE ROTARY VACUUM PUMPS

MAINTENANCE AND REPAIR MANUAL

R5 SERIES SINGLE STAGE ROTARY VANE VACUUM PUMPS

IMPORTANT INFORMATION

Please read the manual before disassembling the R5 Series Single Stage Rotary Vane Vacuum Pumps.

TABLE OF CONTENTS

BUSCH

516 Viking Dr.
Virginia Beach, VA 23452
Phone: (804) 463-7800

1.0 DESCRIPTION

1.1 General

This Maintenance and Repair Manual covers the following R5 Series Single Stage Rotary Vacuum Pumps:

NEW MODEL NUMBER	OLD MODEL NUMBER
RA0010	010-112
RC0010	010-118
RB0012	012-136
RC0012	012-138
RA0016	016-112
RC0016	016-118
RB0021	021-336
RC0021	021-338
RA0025	025-132
RC0025	025-138
RA0040	040-132
RC0040	040-138
RA0063	063-132
RC0063	063-138
RA0100	100-132
RC0100	100-138

The identification code for the New Model No. is as following.

Sample:

RA0063

R5 Pumps 0010-0100 — Pump Size $m^3/hr.$

Type Pump
A - Super (112, 132) (0.5 torr)
B - Plus (136, 336) (3.0 torr)
C - Standard (118, 138, 338) (15 torr)

Specialty Pump: RA (0025-0100) - 7005A
These pumps in the past have been identified with a suffix of 120 (micron pump). This pump is sold into specific areas and achieves an end vacuum of 0.1 Torr.

This Manual is designed to help optimize pump performance and reduce down time through proper maintenance. Instructions are given for complete disassembly and assembly.

A separate R5 Series instruction manual which covers installation and operating of the R5 Series Single Stage Rotary Vacuum Pumps is shipped from the factory with each vacuum pump. In case an additional copy is needed, please contact the factory.

1.2 Operating Principles and Construction

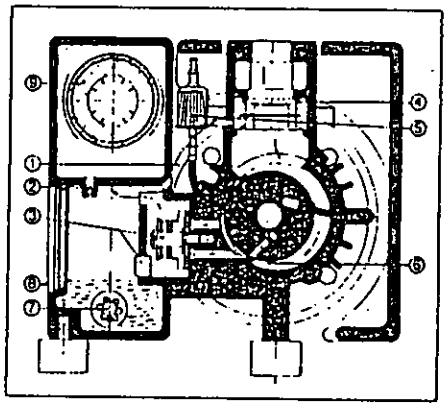


FIG. 1.

1. Oil Return Line (RC Standard, only)
2. Oil Return Check Valve (RA Super., only)
3. Exhaust Valve (RA Super, only)
4. Anti-suckback Valve
5. Gas Ballast Valve and Filter (RA Super only)
6. Gas Ballast Port
7. Oil Filter in Oil Supply Line
8. Oil Sight Glass
9. Exhaust Filter

All position numbers relate to Figure 2A, 2B, & 2C and position numbers on Parts List.

All R5 Series Single Stage Rotary Vacuum Pumps are direct-driven, air cooled, oil-sealed rotary vane pumps which operate as positive displacement pumps. As Figure 1 shows, they consist of a rotor (Pos 15) mounted concentrically on the drive shaft and positioned eccentrically in a cylindrical stator (Pos 1). The rotor has three radially sliding vanes (Pos 22) which divide the pump chamber into three segments. The gas to be pumped enters at the inlet port (Pos 260), passes through the open anti-suckback valve (Pos 251) and the inlet screen (Pos 261) into the pump chamber. As the rotor rotates, the inlet aperature is closed, the gas is compressed and forced out through exhaust openings between pump cylinder and exhaust box on Standard pumps or through one-way exhaust valves (Pos 159) on Super and 100 Micron models. This operation is repeated three times each revolution.

1.2.1 Inlet Check Valve (Pos 251-255)

All R5 Series Vacuum Pumps are equipped with an inlet check valve, often also called an anti-suckback valve.

When the pump is switched off, it is automatically vented internally to atmosphere. Simultaneously, the inlet check valve built into the inlet flange assembly (Pos 260) closes, isolating the system. Thus oil suckback into the system is prevented.

CAUTION: Do not use the anti-suckback valve as a check valve or shut-off valve for your vacuum system.

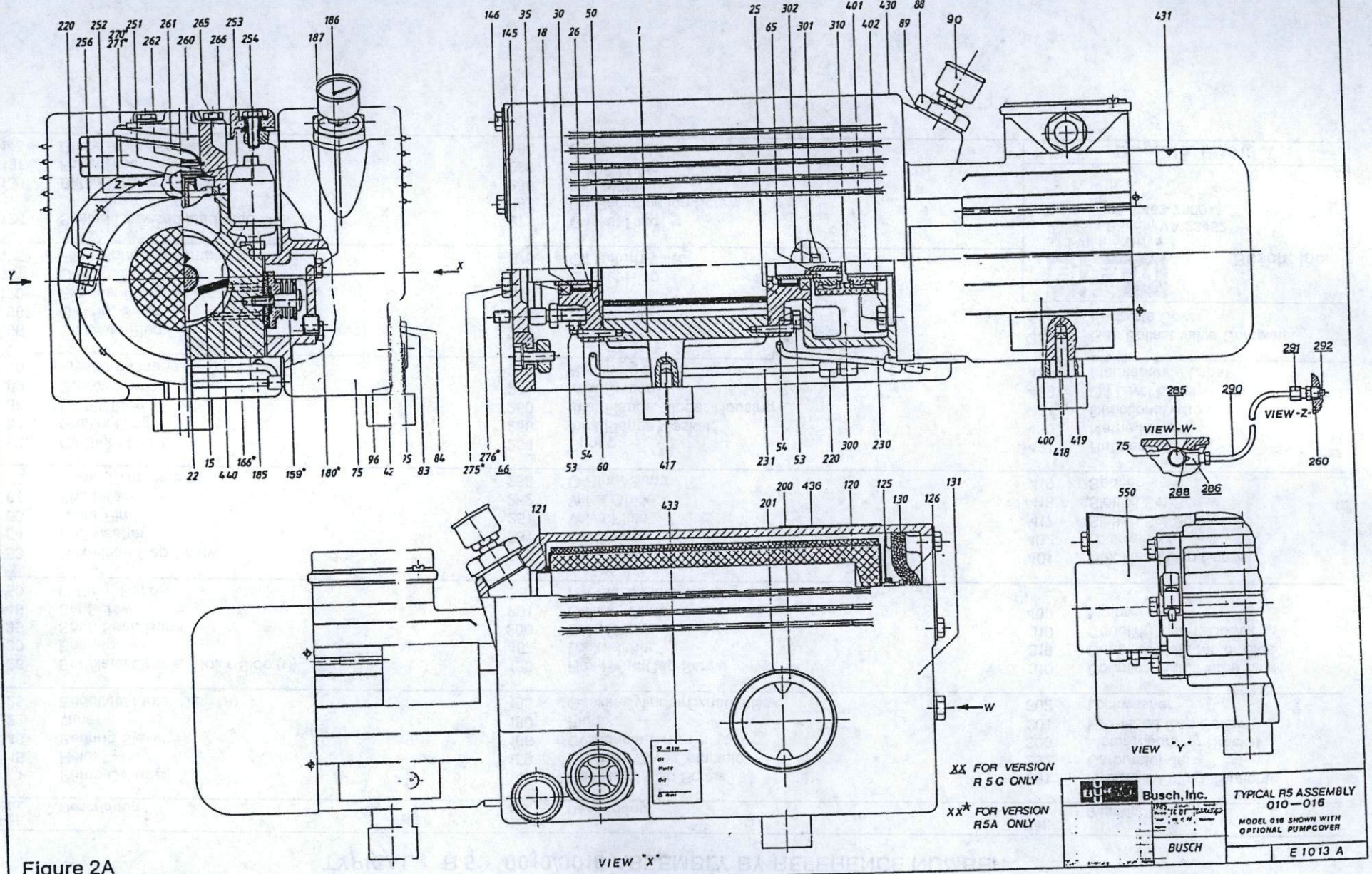

VIEW "X"
VIEW "Y"
VIEW -W-
VIEW -Z-
XX FOR VERSION R5C ONLY
XX* FOR VERSION R5A ONLY
Busch, Inc.
BUSCH
TYPICAL R5 ASSEMBLY 010—016
MODEL 016 SHOWN WITH OPTIONAL PUMPCOVER
E 1013 A

Figure 2A

TYPICAL R 5 0010/0016 ASSEMBLY BY REFERENCE NUMBER

Ref. No.	Description
1	Pump Cylinder
15	Rotor
18	Bearing Sleeve
22	Vane
25	Endplate, Motor Side (A)
26	Endplate, Oppos. Motor Side (B)
30	Bearing
35	Shaft Seal, Buna
46	Set Screw
50	O-Ring, Buna
53	Hex Head Cap Screw
54	Lockwasher
60	Taper Pin
65	Shaft Key
75	Pump Exhaust Box
83	Oil Sight Glass
84	Gasket Ring
88	Oil Fill Plug
89	Gasket Ring
90	Pressure Gauge
95	Oil Drain Plug
96	O-Ring, Buna
120	Exhaust Filter
121	O-Ring, Buna
125	Filter Spring Assembly
126	Slotted Cheese Head Machine Screw
130	Baffle Strainer
131	Foam Block
145	Cover Plate (Screen)
146	Hex Head Cap Screw
159	Exhaust Valve Complete
166	Cylindrical Pin
180	Plug
185	Gasket-Cylinder/Exhaust Box
186	Hex Head Cap Screw
187	Lockwasher
200	Drum Plug
201	O-Ring, Buna
220	Hydraulic Fitting, Straight
230	Oil Tubing
231	Oil Tubing
251	Valve Plate
252	Valve Guide
253	O-Ring, Buna
254	Spring
256	Inlet Flange Gasket
260	Inlet Flange, Upper Housing
261	Inlet Screen
262	Retaining Ring
265	Hex Head Cap Screw
266	Lockwasher
270	Plug
271	Gasket Ring
275	Oil Return Valve
276	Gasket Ring
285	Oil Recirculation Screw
286	Banjo Fitting
288	Gasket Ring
290	Oil Return Line
291	Hydraulic Fitting, Straight
292	Carburetor Jet
300	Motor Mounting Bracket
301	Hex Head Cap Screw
302	Lockwasher
310	Coupling Half, Pump Side
310	Coupling Half, Motor Side
310	Coupling Insert, Bowex
400	Motor
401	Hex Head Cap Screw
402	Lockwasher
417	Slotted Set Screw
418	Slotted Set Screw
419	Spacer
421	Rubber Foot
430	Name Plate
431	Directional Arrow
433	Oil Level Label
436	Maintenance Label
440	Gas Ballast Valve Complete
550	Endplate Cover

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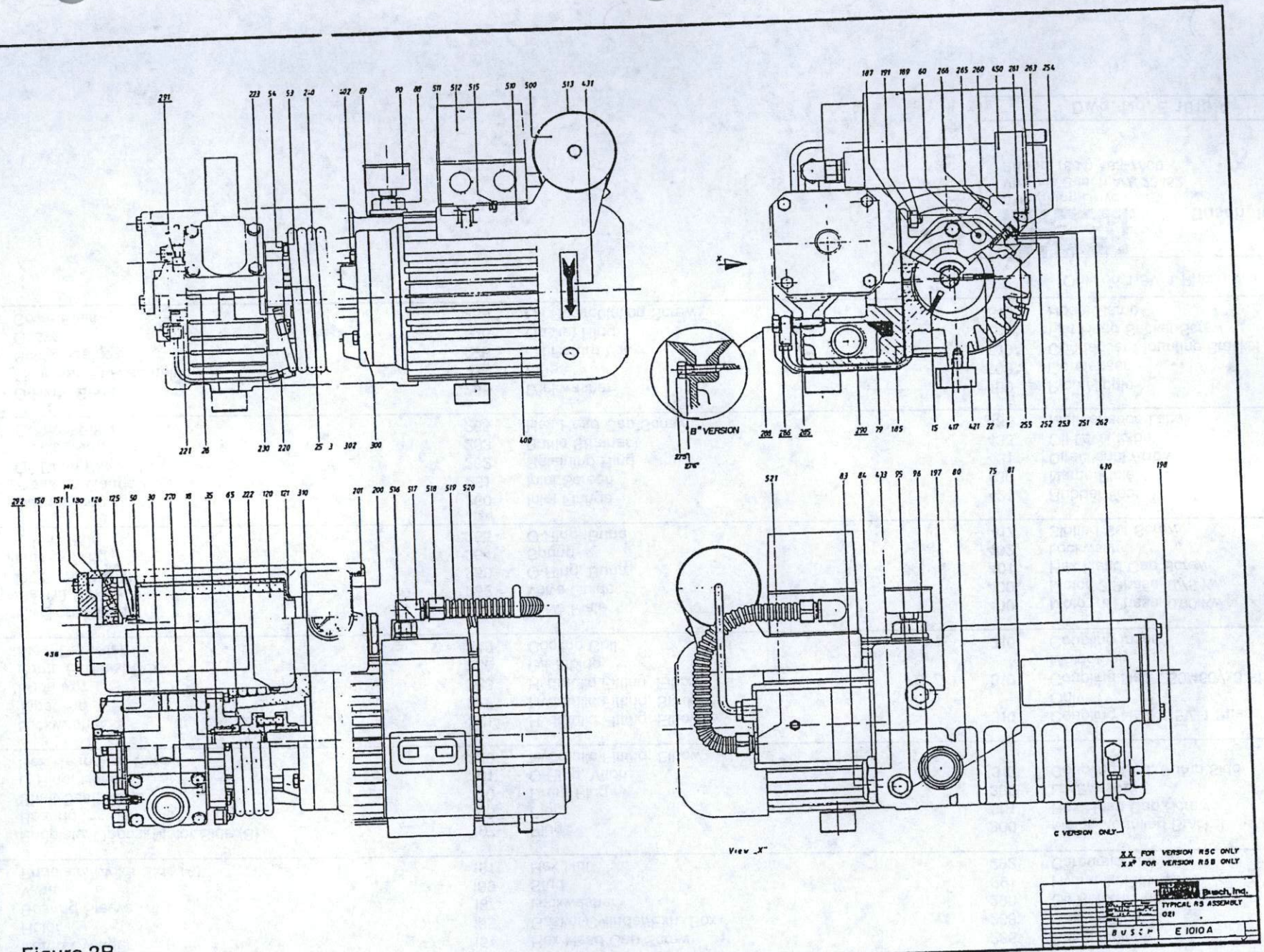
B" VERSION
View „X"
C VERSION ONLY
XX FOR VERSION RSC ONLY
XX FOR VERSION RSB ONLY
Busch, Inc.
TYPICAL RS ASSEMBLY
021
BUSCH
E 1010 A

Figure 2B

TYPICAL R 5 012/021 ASSEMBLY BY REFERENCE NUMBER

Ref. No.	Description
1	Pump Cylinder
15	Rotor
18	Bearing Sleeve
22	Vane
25	Endplate, Motor Side (A)
26	Endplate, Oppos. Motor Side (B)
30	Bearing
35	Shaft Seal, Buna
50	O-Ring, Buna
53	Hex Head Cap Screw
54	Lockwasher
60	Taper Pin
65	Shaft Key
75	Pump Exhaust Box
79	Steel Demister
80	Oil Sight Glass
81	Gasket Ring
83	Oil Sight Glass
84	Gasket Ring
88	Oil Fill Plug
89	Gasket Ring
90	Pressure Gauge
95	Oil Drain Plug
96	Gasket Ring
120	Exhaust Filter
121	O-Ring, Buna
125	Filter Spring Assembly
130	Baffle Strainer
141	Gasket
150	Cover Plate
151	Hex Head Cap Screw
185	Gasket-Cylinder/Exh. Box
187	Lockwasher
189	Stud
191	Hex Nut
197	Plug
198	Plug
200	Drum Plug
201	O-Ring, Viton
220	Hydraulic Fitting, Elbow
221	Hydraulic Fitting, Elbow
222	Hydraulic Fitting, Straight
223	Hydraulic Fitting, Elbow
230	Oil Tubing
240	Cooling Coil
251	Valve Plate
252	Valve Guide
253	O-Ring, Buna
254	Spring
255	O-Ring, Buna
260	Inlet Flange
261	Inlet Screen
262	Retaining Ring
263	Baffle Strainer
265	Hex Head Cap Screw
266	Lockwasher
270	Plug
275	Oil Return Valve
276	Gasket Ring
285	Oil Recirculation Screw
286	Banjo Fitting
288	Gasket Ring
290	Oil Return Line
291	Hydraulic Fitting
292	Carburetor Jet
300	Motor Mounting Bracket
301	Hex Head Cap Screw
302	Lockwasher
310	Coupling Half, Pump Side
310	Coupling Half, 115V, 1 Phase Motor Only
310	Coupling Half, 230/460V, 3 Phase Motor Only
310	Coupling Insert
400	Motor, 1 Phase, 0.90 Kw
400	Motor, 3 Phase, 0.75 Kw
401	Hex Head Cap Screw
402	Lockwasher
417	Slotted Set Screw
421	Rubber Foot
430	Name Plate
431	Directional Arrow
433	Oil Level Label
436	Maintenance Label
450	Pipe Nipple
500*	Condenser
510*	Condenser Mounting Bracket
511*	Flat Head Socket Screw
513*	Hose Clamp

*Only on 115V, 1 Phase Motor

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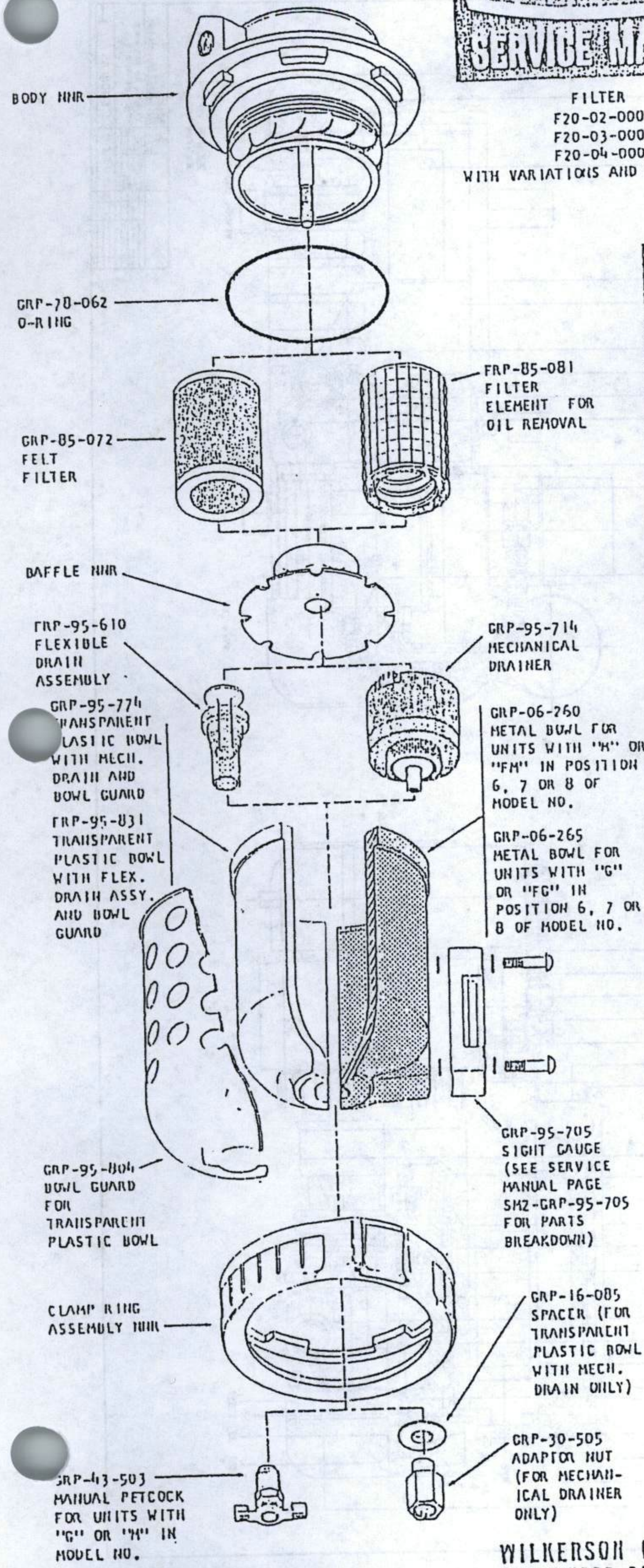
Dwg. No. E 1010 A

MAY 1976

9SM-AE-F20

WILKERSON SERVICE MANUAL

FILTER
F20-02-000
F20-03-000
F20-04-000
WITH VARIATIONS AND ACCESSORIES



WARNING

DO NOT PLACE PLASTIC BOWL UNIT IN SERVICE WITHOUT METAL BOWL GUARD INSTALLED.

Plastic bowl units are sold only with metal bowl guards. To minimize the danger of flying fragments in the event of plastic bowl failure, the metal bowl guards should not be removed. If the unit is in service without the metal bowl guard installed, manufacturer's warranties are void, and the manufacturer assumes no responsibility for any resulting loss.

IF UNIT HAS BEEN IN SERVICE AND DOES NOT HAVE A METAL BOWL GUARD, ORDER ONE AND INSTALL BEFORE PLACING BACK IN SERVICE.

CAUTION

Certain compressor oils, chemicals, household cleaners, solvents, paints and fumes will attack plastic bowls and can cause bowl failure. Do not use near these materials. When bowl becomes dirty replace bowl or wipe only with a clean, dry cloth. Reinstall metal bowl guard or buy and install a metal bowl guard. Immediately replace any crazed, cracked, damaged or deteriorated plastic bowl with a metal bowl or a new plastic bowl and metal bowl guard.

SOME OF THE MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS

Acetaldehyde	Cresol	Methyl salicylate
Acetic acid (conc.)	Cyclohexane	Milk of lime (CaOH)
Acetone	Cyclohexanone	Nitric acid (conc.)
Acrylonitrile	Cyclohexene	Nitrobenzene
Ammonia	Dimethyl formamide	Nitrocellulose lacquer
Ammonium fluoride	Dioxane	Phenol
Ammonium hydroxide	Ethane tetrachloride	Phosphorus hydroxy chloride
Ammonium sulfide	Ethyl acetate	Phosphorus trichloride
Antifreeze	Ethyl ether	Propionic acid
Benzene	Ethylamine	Pyridine
Benzoic acid	Ethylene chlorohydrin	Sodium hydroxide
Benzyl alcohol	Ethylene dichloride	Sodium sulfide
Brake fluids	Ethylene glycol	Styrene
Bromobenzene	Formic acid	Sulfuric acid (conc.)
Butyric acid	Freon (refrigerant & propellant)	Sulfuryl chloride
Carbolic acid	Gasoline (high aromatic)	Tetrahydronaphthalene
Carbon disulfide	Hydrazine	Thiophene
Carbon tetrachloride	Hydrochloric acid (conc.)	Toluene
Caustic potash solution	Lacquer thinner	Turpentine
Caustic soda solution	Methyl alcohol	Xylene
Chlorobenzene	Methylene chloride	Perchloroethylene and others.
Chloroform		

TRADE NAMES OF SOME COMPRESSOR OILS, RUBBER COMPOUNDS AND OTHER MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS.

Atlas "Perma Guard"	[illegible] Neoprene
Buna N	Petron PD287
Cellulube #150 and #220	Prestone
[illegible] #5 cement	Pydraul AC
Eastman 910	Sears Regular Motor Oil
[illegible] polyurethane	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Houghton & Co. oil #1120, #1130 and #[illegible]	[illegible]
[illegible] 1000	[illegible]
Keen Kool	[illegible]
[illegible] oil #7	[illegible]
[illegible]	[illegible]
[illegible]	Zerex
[illegible] Compound #[illegible]	
"[illegible]" VC 7	

WE CANNOT POSSIBLY LIST ALL HARMFUL SUBSTANCES. [illegible]

CAUTION

Except as otherwise specified by the manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication, and manufacturer assumes no responsibility for any resulting loss.

NNR = NOT NORMALLY REPLACED.

(continued on reverse side)

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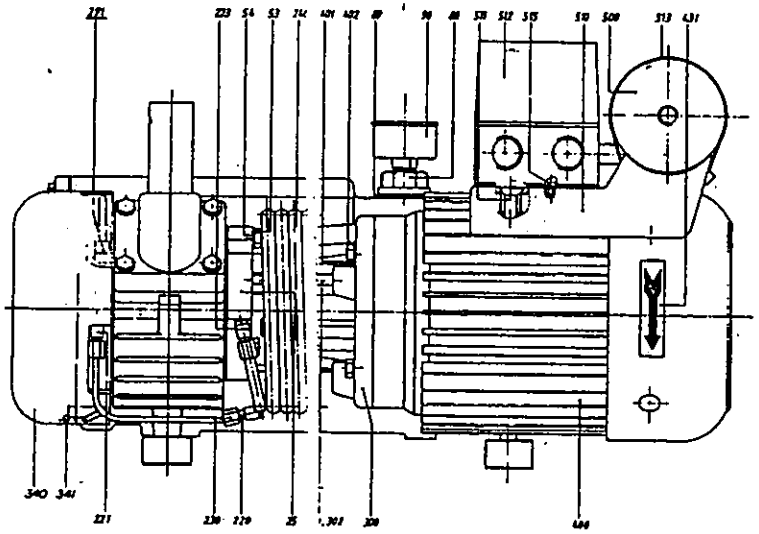

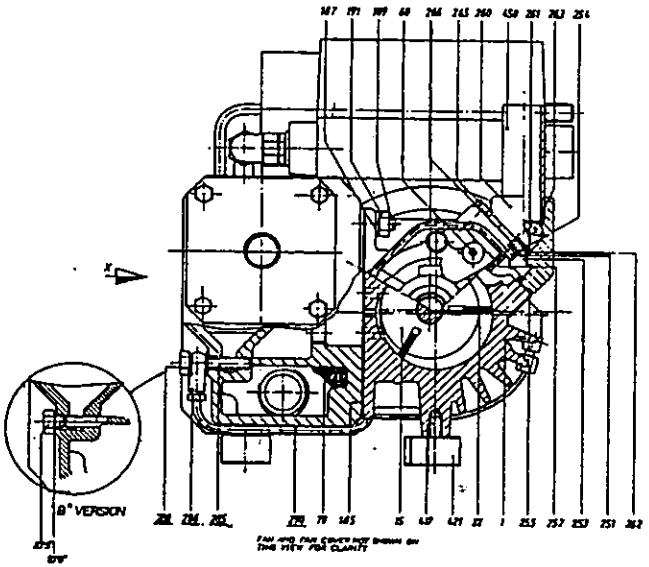

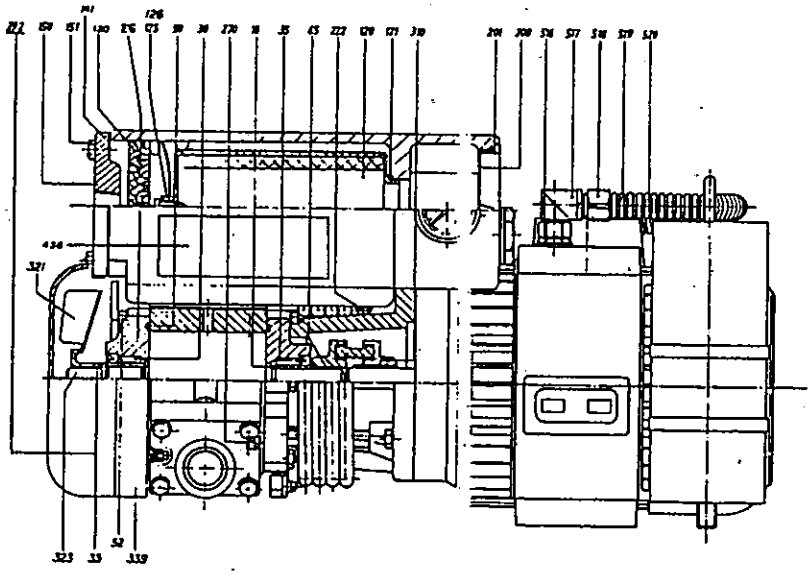

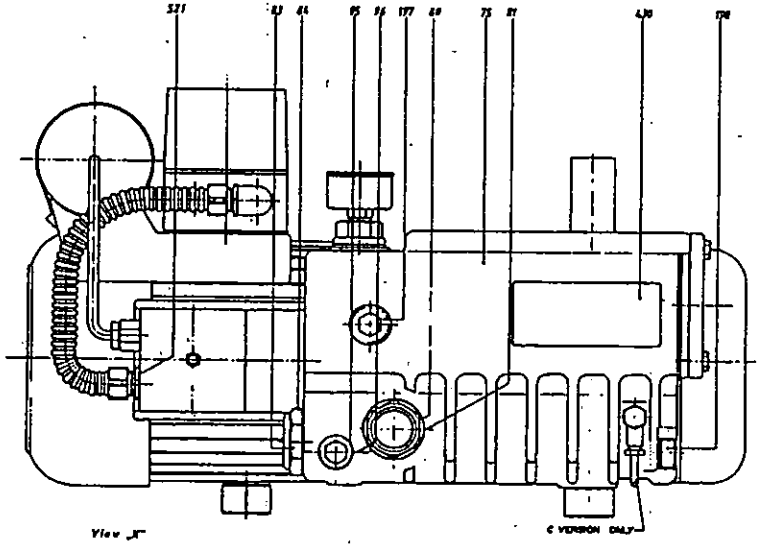

XX FOR VERSION RC ONLY
XX* FOR VERSION RB ONLY

Busch, Inc.
TYPICAL R5 ASSEMBLY
R5/C-0021-003
BUSCH
E 1018 A

TYPICAL R B/C 0021—S015 ASSEMBLY BY REFERENCE NUMBER

Ref. No.	Description
1	Pump Cylinder
15	Rotor
18	Bearing Sleeve
22	Vane
25	Endplate, Motor Side (A)
26	Endplate, Oppos. Motor Side (B)
30	Bearing
35	Shaft Seal, Viton
50	O-Ring, Buna
52	Hex Head Cap Screw
53	Hex Head Cap Screw
54	Lockwasher
60	Taper Pin
65	Shaft Key
75	Pump Exhaust Box
79	Steel Demister
80	Oil Sight Glass
81	Gasket Ring
83	Oil Sight Glass
84	Gasket Ring
88	Oil Fill Plug
89	Gasket Ring
90	Pressure Gauge
95	Oil Drain Plug
96	Gasket Ring
120	Exhaust Filter
121	O-Ring, Buna
125	Filter Spring Assembly
126	Machine Screw
130	Baffle Strainer
141	Gasket
150	Cover Plate
151	Hex Head Cap Screw
185	Gasket-Cylinder/Exh. Box
187	Lockwasher
189	Stud
191	Hex Nut
197	Plug
198	Plug
200	Drum Plug
201	O-Ring, Buna
220	Hydraulic Fitting, Elbow
221	Hydraulic Fitting, Elbow
222	Hydraulic Fitting, Straight
223	Hydraulic Fitting, Elbow
230	Oil Tubing
240	Cooling Coil
251	Valve Plate
252	Valve Guide
253	O-Ring, Buna
254	Spring
255	O-Ring, Buna
260	Inlet Flange
261	Inlet Screen
262	Retaining Ring
263	Baffle Strainer
265	Hex Head Cap Screw
266	Lockwasher
270	Plug
275	Oil Return Valve
276	Gasket Ring
285	Oil Recirculation Screw
286	Banjo Fitting
288	Gasket Ring
290	Oil Return Line
291	Hydraulic Fitting
292	Carburetor Jet
300	Motor Mounting Bracket
301	Socket Head Cap Screw
302	Lockwasher
310	Coupling Half, Pump Side
310	Coupling Half, 115V, 1 Phase, Motor Only
310	Coupling Half, 230/460V, 3 Phase, Motor Only
310	Coupling Insert
321	Fan
323	Spacer
339	Fan Center Ring
340	Fan Cover
341	Machine Screw
400	Motor, 1 Phase, 0.90 Kw
400	Motor, 3 Phase, 0.75 Kw
401	Hex Head Cap Screw
402	Lockwasher
417	Slotted Set Screw
421	Rubber Foot
430	Name Plate
431	Directional Arrow
433	Oil Level Label
436	Maintenance Label
450	Pipe Nipple
500 *	Condenser
510 *	Condenser Mounting Bracket
511 *	Flat Head Socket Screw
513 *	Hose Clamp

* Only on 115V, 1 Phase Motor

BUSCH

Busch, Inc.
516 Viking Drive
Virginia Beach, VA 23452
Phone: (804) 463-7800
Telex: 292872

Dwg. No. E 1018 A

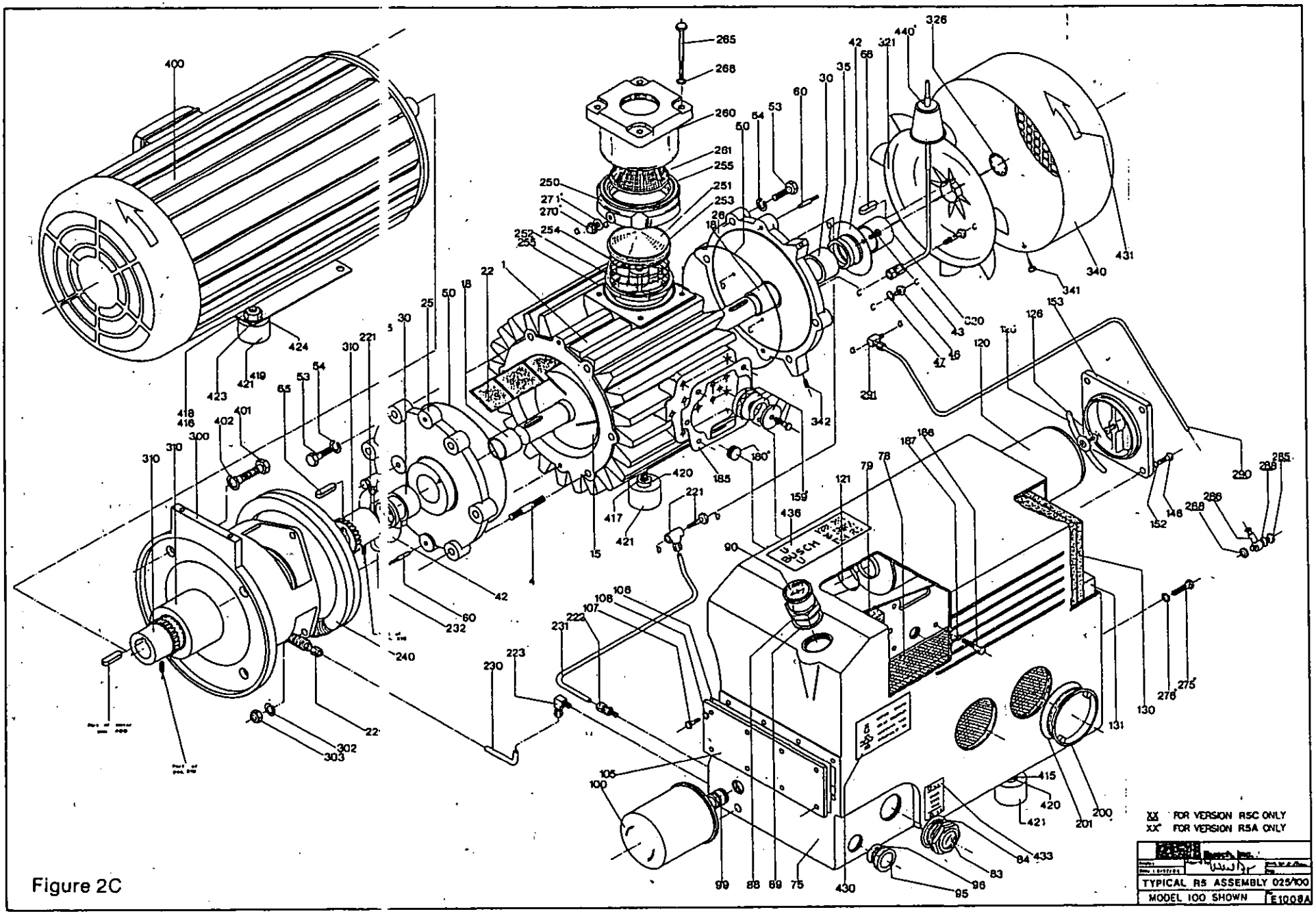
XX FOR VERSION R5C ONLY
XX' FOR VERSION R5A ONLY
TYPICAL R5 ASSEMBLY 025/100
MODEL 100 SHOWN
E1008A

Figure 2C

TYPICAL R 5 025/040/063/100 ASSEMBLY BY REFERENCE NUMBER

MODEL 100 SHOWN

Ref. No.	Description
1	Pump Cylinder
4	Stud
15	Rotor
18	Bearing Sleeve
22	Vane
25	Endplate, Motor Side (A)
26	Endplate, Oppos. Motor Side (B)
30	Bearing
35	Shaft Seal, Viton
42	Support Ring
43	Slotted Cheese Head Machine Screw
46	Plug
47	Gasket Ring
50	O-Ring, Viton
53	Hex Head Cap Screw
54	Lockwasher
60	Taper Pin
65	Shaft Key
66	Shaft Key
75	Pump Exhaust Box
78	Sheet Metal Baffle
79	Steel Demister
83	Oil Sight Glass
84	Gasket Ring
88	Oil Fill Plug
89	Gasket Ring
90	Pressure Gauge
91	Gasket Ring
95	Oil Drain Plug
96	O-Ring, Buna
99	Pipe Nipple
100	Automotive-Type Oil Filter
105	Cover Plate
106	Gasket
107	Hex Head Cap Screw
108	Gasket Ring
120	Exhaust Filter
121	O-Ring, Buna
125	Filter Spring Assembly
126	Slotted Cheese Head Machine Screw
130	Baffle Strainer
131	Foam Block
146	Hex Head Cap Screw
152	Lockwasher
153	Exhaust Silencer Complete
159	Exhaust Valve Complete
180	Plug
185	Gasket
186	Hex Head Cap Screw
187	Lockwasher
200	Drum Plug
201	O-Ring, Viton
220	Hydraulic Fitting, Straight
221	Hydraulic Fitting, Elbow
222	Hydraulic Fitting, Straight
223	Hydraulic Fitting, Elbow
230	Oil Tubing
231	Oil Tubing
232	Oil Tubing
240	Cooling Coil
250	Inlet Flange, Lower Housing
251	Valve Plate
252	Valve Guide
253	O-Ring, Buna
254	Spring
255	O-Ring, Buna
260	Inlet Flange, Upper Housing
261	Inlet Screen
265	Hex Head Cap Screw
266	Lockwasher
270	Plug
271	Gasket Ring
275	Oil Return Valve
276	Gasket Ring
285	Oil Recirculation Screw
286	Banjo Fitting
288	Gasket Ring
288	Gasket Ring
290	Oil Return Line
291	Hydraulic Fitting, Elbow
300	Motor Mounting Bracket
302	Lockwasher
303	Hex Nut
310	Coupling Half, Pump Side
310	Coupling Halt, Motor Side
310	Coupling Insert, Bowex
320	Spacer
321	Fan
326	Retaining Ring
340	Fan Cover
341	Sheet Metal Screw
342	Plastic Sleeve
400	Motor
401	Hex Head Cap Screw
402	Lockwasher
415	Slotted Set Screw
416	Stud
417	Slotted Set Screw
418	Slotted Set Screw
419	Spacer
420	Spacer
421	Rubber Foot
423	Lockwasher
424	Hex Nut
430	Name Plate
431	Directional Arrow
432	Busch Logo
433	Oil Level Label
436	Maintenance Label
440	Gas Ballast Valve Complete

BUSCH

Busch, Inc.

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Dwg. No. E 1008 A

Install a manual or automatic operated valve in front of the pump; particularly, if more than one vacuum pump is pumping on the same main line, or there is an extra large volume (approximately ten times larger than pump capacity) to which the pump is connected.

1.2.2 Lubrication System

The suction effect within the pump chambers is used to draw lubrication oil from near the bottom of the oil reservoir level in the exhaust box (Pos 75) to both endplates (Pos 25 and Pos 26) of the vacuum pump.

Proper location and size of the oil tubing effectively distributes the oil in the pump chamber for proper sealing between the vanes and the pump chamber, as well as for lubrication of the bearings (Pos 30) and shaft seals (Pos 35) on either end of the rotor.

Part of the lubrication oil is drawn through an automotive-type oil filter (Pos 100) before it enters the pump through one endplate, except Models 0010/0016/0021 which do not have an automotive-type oil filter.

1.2.3 Vanes (Pos 22)

On all R5 Series Single Stage Rotary Vacuum Pumps, the vane contact with the pump cylinder is affected and maintained by centrifugal force. Some vanes are equipped with grooves on the trailing side which carry and distribute the oil to the rotor slots for lubrication and sealing.

1.2.4 Exhaust Valve (Pos 159) and Exhaust Box/Oil Reservoir (Pos 75)

As the rotor rotates inside the pump chamber, the inlet aperature is isolated, the gas is compressed and forced out through one-way exhaust valves on Super models.

The number of exhaust valves used on R5 Super Model and 100 Micron Pumps depends on the size of the pump. For a specific size of pump, see the separate Spare Parts List for the correct number of valves.

R5 Series Standard and Plus Model Pumps do not have exhaust valves; however, the gas is forced through exhaust openings between the pump cylinder and exhaust box. R5 Series Standard Model Pumps, therefore, do not achieve as low a vacuum as the R5 Series Super Vacuum Pumps.

The oil and compressed gas is expelled into the exhaust box (Pos 75) where is passes first through a steel demister pad (Pos 79). There large oil droplets are trapped and flow back to the bottom of the exhaust box. The remaining oil mist passes through exhaust filter elements (Pos 120) where 99.9% or better separation of oil from the exhaust air is accomplished.

The number of exhaust filter elements used depends on the size of the pump. For a specific size of pump see the separate Spare Parts List for the correct number of exhaust filter elements for that size pump.

The oil separated by the exhaust filter element forms droplets on the outside of the exhaust filter which collect at a low point in the upper half of the exhaust box. From there collected oil is drained back to the oil sump via an oil return valve (Pos 275) which opens on R5 Series Super Model Pumps when the pump is shut off.

It is necessary to shut off the pump after every 10 hours of operation to allow the check valve to open. If the pump is not shut off after this time period, it is possible to starve the pump of oil and/or oil droplets may be blown out of the exhaust.

On R5 Series Standard Model Pumps the collected oil is drawn continuously during operation of the vacuum pump to the inlet flange (Pos 260) via the oil return line (Pos 290). The oil return line is connected directly to the area of the exhaust box, downstream of the exhaust filter, which is at atmospheric pressure. Therefore, a constant amount of air is sucked into the pump which is an additional reason that the R5 Standard Series Pumps do not achieve as low a vacuum as the R5 Series Super Vacuum Pumps.

1.2.5 Gas Ballast Valve (Pos 440)

All R5 Super Series Vacuum Pumps are equipped with a gas ballast valve, which gives a water vapor handling capacity of up to 28.7" Hg.

Water vapor tolerance of a vacuum pump is expressed in terms of the highest absolute pressure at which the pump will handle 100% water vapor. This means that for vacuums between 29.9" Hg. and 28.7" Hg., all of the water vapor going into the inlet of the pump will come out the exhaust of the pump without any condensation taking place in the pump, even if the load is 100% water vapor.

At vacuum between 28.7" Hg. and atmosphere, condensation can take place.

The gas ballast valve is located between the inlet port and the exhaust box. It is recommended that this gas ballast valve be left open,

if water vapors have to be pumped. The only time it is recommended that the gas ballast valve be closed is when a check is made on the achievable end vacuum or application condition does not warrant the use of the gas ballast valve.

1.3 Service and Parts

Following the instructions in this manual, one may completely service and repair the Model R5 Series pump.

A complete inventory of spare parts is maintained at Busch, Inc. at all times. Parts will be shipped immediately upon request.

The pumps may also be shipped to the Virginia Beach, Virginia factory or nearest authorized service center for repair. For the location of the nearest authorized service center, contact Busch, Inc. in Virginia Beach, Virginia.

Busch, Inc. maintains an excellent repair department staffed by factory-trained technicians who specialize solely in Busch products. Where it is not feasible to return the pump for repair, arrangements can be made to have a factory-trained technician repair the pump on site.

MAINTENANCE

...5 Series Single Stage Rotary Vacuum Pumps require very little maintenance; however, to insure optimum pump performance, it is recommended that the following steps be followed:

2.1 Pump Oil

2.1.1 Oil Level

With the pump running, installed relatively level, and the inlet completely closed, make sure that there is a sufficient amount of clean oil in the pump.

On pumps with one oil sight glass, fill between the 3/4 and the full position on the oil sight glass. On pumps with two oil sight glasses on top of each other, fill the top sight glass up to the 3/4 mark.

The oil level should be observed on a daily basis and be replenished if it drops on pumps with one oil sight glass below the 1/4 mark and on pumps with two sight glasses on top of each other below the 1/4 mark of the top oil sight glass.

All oil level readings should be done only when the pump is shut down.

Oil can be added to the oil fill port (Pos 88) if the pump is shut off and the circulating oil has sufficient time to return to the oil sump.

CAUTION: No oil should be added while the pump is running, since hot, unfiltered oil vapor may escape through the oil fill port.

Under normal circumstances, it should not be necessary to add or drain oil from the pump between recommended oil changes.

A significant drop in oil level means there is an oil leak or that an exhaust filter is broken, and the pump should be smoking excessively. It is normal for the oil to be foamy and light color in an operating pump. However, if the oil is milky colored, it is an indication that water is present in the oil. Normally, by operating the pump for an extended period, with the suction blanked off, the water will be purged from the oil. If the oil is dark colored, it is contaminated or burned and must be changed.

2.1.2 Oil Type and Quantity

Non-detergent oil is recommended. Additives in detergent oil could prematurely plug exhaust filter elements and shorten their life. Detergent oils can be used if non-detergent is not available.

The recommended oil for all R5 Series pumps except 0021 models is an SAE 30 non-detergent oil. The recommended oil for the 0012 or 0021 models is an SAE 20 non-detergent.

The recommended type oils can be obtained directly from Busch, Inc., Virginia Beach. The SAE 30 oil is designated as R-530 and the Synthetic oil for 0012 and 0021 pumps is designated as R-580.

Other recommended SAE 30 non-detergent oils are:

Exxon Oilex 30	Castrol 30 ND
Quaker State 30 ND	Gulf Saphire 30
Vaseline 30	Golden Shell 30
Kendall 30 ND	Western 30 ND

Using the Busch R-580 and R-530 oil will extend the life of your pump and will give you longer operating time between oil changes.

The following table gives the approximate quantities of non-detergent oil required for each pump:

Pump Type	Oil Capacity (Qt.)
0010/0012/0016/0021	0.5
0025/0040	1 (1.5 for Models 0120)
0063/0100	2 (2.5 for Models 0120)

Oil capacity chart should only be used as a guide since oil capacity may be slightly lower

depending on whether the pump was filled previously, and whether all components such as oil filter, oil lines, etc. were allowed to completely drain. Use only the sight glass reading for proper level. ***Never over-fill.***

Replace oil fill plug (Pos 88) making sure that the gasket (Pos 89) is in place and properly seated and secured. New pumps are equipped with an exhaust pressure gauge as an integral part of the oil fill plug. This gauge may be purchased separately and is interchangeable with existing plug.

DO NOT ADD OR FILL OIL THROUGH EXHAUST OR INLET PORTS!

For ambient operating temperatures lower than 5 degrees C (41 degrees F), use a 10W-40 motor oil. If this does not lower the viscosity sufficiently to permit starting, contact the factory.

2.1.3 Oil Change

Check the oil for contamination* on a weekly basis shutting the pump off and draining some of the oil into a small glass or similar transparent container through the oil drain port (Pos 95). To change the automotive type oil filter, see Sections 3.2.2 and 4.1.

Prior to any oil change, make sure that the pump has been running for at least 15 minutes, so that the oil is warm, then switch off the pump, remove oil drain plug (Pos 95), and drain the oil. Jog the pump two or three times while the oil drain port is open. Hold a wiping rag in front of the oil drain port in order to catch the remaining oil and to avoid splashing.

If the oil is contaminated, flush the pump with some fresh oil or with flushing oil. To do this, drain the contaminated oil through drain port (Pos 95) and fill the pump through the oil filling port (Pos 88) with flushing oil or regular pump oil. Run the pump for a period of approximately 30 minutes and shut it off. Drain the oil at once and, if necessary, repeat the operation as often as required to obtain correct color, viscosity, and lubricity (finger test). When pump has been flushed sufficiently, install a new automotive type filter per Section 4.1, tighten the oil drain plug, fill the pump with fresh oil through the oil filling port, and replace the oil fill plug or exhaust pressure gauge.

***CONTAMINATION:** Foreign particles may cause the oil to lose its original color and may change the viscosity (compare the lubricity of the new and old oil by rubbing it between your fingers). If the oil is contaminated, it has to be changed.

Every three months, 500 hours of operation, or as necessary shut the pump off, remove oil drain plug (Pos 95), and drain the hot oil. Also at the same time replace:

2.2 Automotive Type Oil Filter

All R5 Series Single Stage Rotary Vacuum Pumps, except Types 0010, 0012, 0016 and 0021 are equipped with an automotive type oil filter (Pos 100). Replace installed automotive type oil filter with the following Fram or equivalent type filter:

Pump Type	Filter Thread
0025/0040/0063/0100 - 112/118/120/132/138 RA, RB or RC models	PH 966 or (3/4 inch - 16) AC Type SD #7984256

2.3 Exhaust Filter (Pos 120)

Every nine to eighteen months, or as necessary replace the exhaust filter elements. The service life of the exhaust filters varies widely with pump application. It is only necessary to change the filters when the elements become clogged with foreign material or burned oil. Indications of clogged filters are: smoke and oil mist coming from the pump exhaust, higher than normal motor current, or oil leaking from the gas ballast valve on 112, 132, (Super RA) models.

The pressure gauge (Pos 90) has an effective green field between 0 and 0.6 bar (9 psi). Any pressure close to the 0.6 bar (9 psi) value (red field) requires an immediate change of the exhaust filter.

To field test an exhaust filter element, remove it from the pump, allow it to cool, clean the sealing (O-ring) end, put it to your mouth and attempt to blow through it. Your lungs can generate approximately 3-6 psi which is the same as the maximum allowable operating pressure across the filter. If you can blow through it, the element is good. If not, discard it and replace the element because it is not possible to successfully clean it. In case the filter element is cracked, discard and replace with a new one.

2.4 Vacuum Inlet Filter

If the pump is equipped with a special vacuum inlet filter in applications where powder, dust or grit is present, the filter cartridge should be cleaned on a weekly basis, depending on the amount of foreign particles to which the pump is exposed.

To clean the inlet filter, unsnap the lid clamps or remove the knobs and lift off the filter lid. Remove cartridge, being careful not to knock

ny foreign particles present inside canister into ump suction. Clean foreign particles from can- and with an air hose, carefully blow air ugh the filter cartridge. If the filter cartridge s been subject to moisture or is extremely irty, it may need replacement.

2.5 Maintenance Chart

Daily: Visually check oil level. See Section 2.1.1.

Weekly: Check oil for contamination. See Section 2.1.3. Inspect inlet filter. See Section 2.4.

Every three (3) months, 500 operating hours or as necessary: Drain and discard oil from hot pump. Replace automotive type oil filter and refill with fresh oil through fill plug. See Section 3.2.2 and Section 4.1.

Every nine (9) to eighteen (18) months or as necessary: Replace the exhaust filter elements. See Section 3.2.1 and Section 4.1.

Every two (2) years: Replace exhaust valve assembly on Super Series Pumps.

2.6 Overhaul Kit/Filter Kit

overhaul kit containing a set of gaskets and rings, vanes, bearings and bearing sleeves, haft seals and taper pins, is available from the factory.

Also, a filter kit containing oil sight glass and oil drain plug including gaskets, automotive type oil filter (except 0010, 0012, 0016, 0021) exhaust filter, foam block and synthetic baffle strainer in the exhaust filter area, is available from the factory. When ordering, please specify pump size (0010 through 0100), RA Model (112/132 Super), or RC Model 118/138 Standard) or (120, 100 micron), and serial number.

3.0 DISASSEMBLY

All R5 Series Single Stage Rotary Vacuum Pumps are easily dismantled and reassembled. Certain steps are recommended to be followed in the proper sequence outlined, and reasonable caution must be exercised to prevent damage to the parts, and to maintain proper operation after repair.

3.1 Tools

To disassemble/assemble all the R5 Series umps, the following tools are recommended:
llen Wrench: 2.5mm, 4mm, 6mm
Filter Wrench: (Strap wrench)
Open End Wrench: 10mm, 13mm,
Socket Wrench with Extension: 10mm, 13mm
Hex Head Nut, Regular Pitch: 6mm, 8mm
Screw Driver
Drum Plug Wrench
Rubber Mallet
Gear Puller (Fan and Coupling)
Dial Indicator with Dial Indicator holding Tool
Arbor Press to Install Bearings and Shaft Seals
Loctite 242 for Shaft Seal
Miscellaneous Feeler Blades (12 inches long)
Busch Shaft Seal and Bearing Installation Tools
Installation & Overhaul Tool Kits are available from Busch.

MODELS 025 THROUGH 100 ONLY

(Disassembly & Assembly Instructions for 0010/0012/0016/0021 are similar)

3.2 Exhaust Filter, Automotive Type Oil Filter, Exhaust Box-Exhaust Valves

3.2.1 Exhaust Filters (Figure 3)

In order to check or change the exhaust filter elements, shut the pump off and follow these directions:

(a) Remove the one (1) or two (2) cover plates, exhaust silencers or exhaust flange adapters from the gas exhaust port. Pos. 153
(b) Remove the synthetic baffle strainer (Pos 130) and the foam block (Pos 131) through the exhaust ports.
(c) Loosen the pan head machine screw (Pos 126).
(d) Push the filter spring (Pos 125) with a long screwdriver from the frame so that the spring assembly pops out.
CAUTION: When performing this operation wear safety glasses and be prepared for the possibility of the spring flying out of the exhaust box.
(e) Slide the filter(s) (Pos 120) including O-ring (Pos 121) out of the exhaust box.

3.2.2 Automotive Type Oil Filter (Figure 2)

To replace the automotive type oil filter (Pos 100), the pump should have been running for at least 15 minutes, so that the oil is warm. Then switch off the pump, remove the oil drain plug (Pos 95), and drain the oil. With an automotive type filter wrench (strap wrench), remove the oil filter and replace with a new one. Coat face of gasket on new filter with oil and hand tighten until gasket contacts base, then tighten two-thirds turn more. *Do not overtighten.*

3.2.3 Exhaust Box - Exhaust Valves (Figure 2)

Shut the pump off and drain the oil through the oil drain plug (Pos 95). Jog the pump a couple of times to get all oil out, especially on

Model 100's with oil cooling coils. Tilt the pump towards the oil drain plug by placing a 2" wooden block under the rubber foot below the pump cylinder and allow to drain.

To remove the exhaust box (Pos 75) from the pump cylinder (Pos 1), the following steps need to be followed:

(a) Loosen oil lines (Pos 230 and Pos 231) located between exhaust box and cylinder near automotive filter.

(b) Loosen oil return line (Pos 290) located on discharge end of pump (Models RC 118/138 only).

(c) Remove drum plugs (Pos 200) located to the right of the oil sight glass.

(d) With the inside of the exhaust box now visible from the oil sight glass side, the entire pump should be tilted on its side (i.e. lifted up on the exhaust box side so that the pump rotates around the pump module and motor longitudinal axis until the motor conduit box contacts the work surface). The pump will lay securely in this convenient tilted position for working on the valves.

(e) Remove the four (4) bolts (Pos 186) that hold the exhaust box to the pump cylinder. Bolts can be removed by using a 10mm socket wrench with an extension through the drum plug hole. Make sure that all lock washers are removed when the bolts are removed. (Pos 187)

(f) Lift the exhaust box away from the pump housing. The gasket (Pos 185) can be removed and replaced, if necessary.

On pumps with exhaust valves (Models RA 112/132 only), each exhaust valve is now accessible and can be checked or removed. They can be removed by loosening the machine screw with a screwdriver (plastic valves) or with a 10mm wrench (all steel valves).

The steel baffle (Pos 78) above the bottom of the oil reservoir and the steel demister (Pos 79) can be removed, if necessary, by removing the drum plug (Pos 200-Models 025 and 040) or cover plate (Pos 105-Models 063 and 100) located above the automotive type oil filter. The pieces may require bending for removal through the exhaust box openings.

3.3 Rotor - Vanes - Bearings - Shaft Seals - Coupling - Inlet Screen

Shut the pump off and drain the oil through the oil drain plug (Pos 95). Jog the pump a couple of times to get all the oil out. Tilt the pump towards oil drain plug by placing a 2" wooden block under the rubber foot below the pump cylinder.

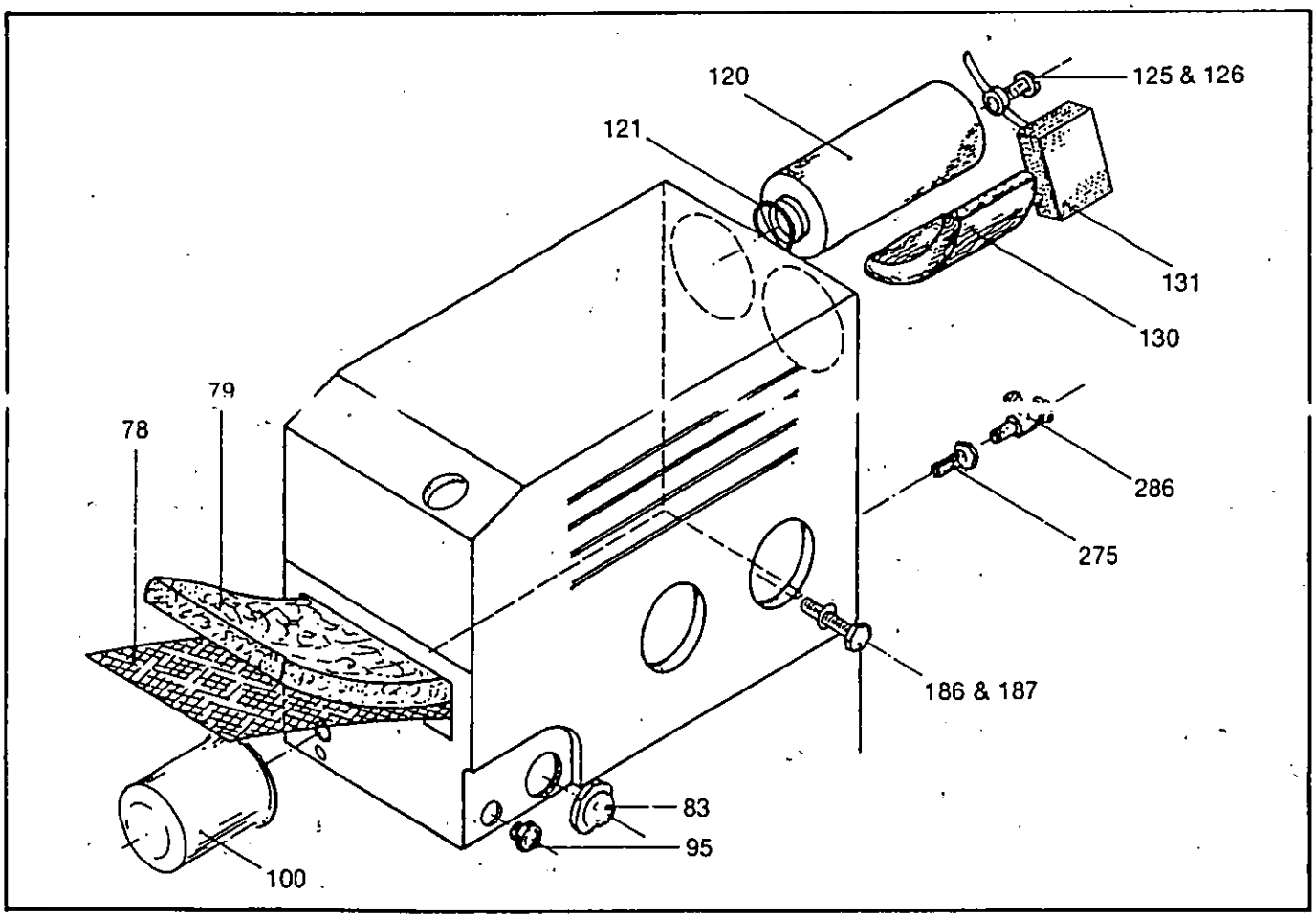


FIG. 3. EXHAUST BOX COMPONENTS INSTALLATION (100 model shown)

lemove wooden block and place pump on flat /orkbench surface but blocked up about 3".

ire mesh inlet screen (Pos 261) is placed ;tween the inlet flange (Pos 260) and the pump :ylinder (Pos 1) as a dirt trap for solid foreign)articles. It should be kept clean in order to ıvoid reduction of pumping speed.

The inlet screen (Pos 261) can be removed by osening the four (4) hex head cap screws (Pos 265) and lifting off the upper inlet flange (Pos 260).

The inlet flange (Pos 260) & (250) can easily be disassembled for cleaning and inspection of valve plate (Pos 251), O-ring (Pos 253), valve guide (Pos 252), spring (Pos 254) O-rings (Pos 255) and inlet screen (Pos 261).

NOTE: If the inlet flange assembly is excessively contaminated or corroded, the entire inlet flange assembly should be replaced.

Remove the fan cover (Pos 340). Remove the fan (Pos 321) by removing the retaining ring (Pos 326) and sliding fan off. A wheel puller may be necessary if fan does not slide off easily. The fan lastic and care should be taken in removal so ot to break it. Lift out shaft key (Pos 66) and move distance ring (Pos 320). Remove the gas ballast valve (Pos 440) from endplate (Models RA 112/132 only).

Loosen and remove all oil lines connecting the pump module (Pos 1) and the exhaust box (Pos 75). It is preferable to remove all lines and not just bend them out of the way. Bending tends to damage oil lines.

Remove the motor (Pos 400) by loosening the four (4) bolts (Pos 401) connecting the motor to the motor mounting bracket (Pos 300). On models with a cooling coil, disconnect the coil ends. This will allow the coil to be gently pushed to the side to facilitate the bolt removal.

Remove the motor mounting bracket (Pos 300) from the endplate (Pos 25) by removing the three (3) skrews or nuts which hold the bracket.

Remove cooling coil (Model 0100) (Pos 240) at the same time.

e entire coupling is now accessible. If the)upling insert (Pos 310) is the only part needed ıng replacement, it is only necessary to remove the motor as described above. To remove the pump side or motor side coupling half (Pos 310), loosen the set screw, pull the coupling off the shaft, and lift out shaft key (Pos 65).

Check to see that all connecting fittings on endplates (Pos 25 and Pos 26) have been removed.

One can work on the pump module in one of two ways:

(1) Leaving the pump module attached to the exhaust box and laying exhaust box on its side, or

(2) Removing the pump module from the exhaust box as described in Section 3.2.3 and clamping pump module in a vise with exhaust valve area facing downwards and inlet port facing assembler.

It is very easy to put rotor in backwards and endplates on wrong; therefore, one may wish to match-mark the end of shaft, endplates and cylinder before removal.

Remove threaded taper pins (Pos 60) by placing a washer or lockwasher over thread and then a 6mm nut, and tightening 6mm nut against the washer/lockwasher to loosen the taper pin. Use of a lockwasher acting as a spring may ease removal. In essence, the washer/lockwasher is used as a spacer and the 6mm nut is used as a jack screw to draw the pin out. (Some 0100 Model pumps may have 8mm threaded taper pins.)

Remove the hex head cap screws (Pos 53) so the endplates may be separated from the pump cylinder. Be careful not to damage the O-ring (Pos 50) or paper gaskets between the endplate and cylinder.

Do not use a screwdriver to pry the endplates from the cylinder. One may cause damage to the O-ring, gaskets, or sealing faces. If the endplates do not come off easily, tap gently with a rubber mallet or soft hammer, or remove all threaded studs from cylinder.

On pumps with gaskets between endplates and cylinder, take note how many and thickness of the gaskets used on each side. The same quantity and thickness will be used upon assembly.

The rotor (Pos 15) and vanes (Pos 22) can now be removed from the cylinder.

The endplates (Pos 25 and Pos 26) contain the shaft seals (Pos 35) and carbon sleeve or needle bearings (Pos 30).

NOTE: New model pumps have a support ring (Pos 42) held by two (2) machine screws (Pos 43), holding the shaft seals in place. Before the shaft seals and bearings may be pushed out (See Figure 4 and 4A) the support ring must be removed.

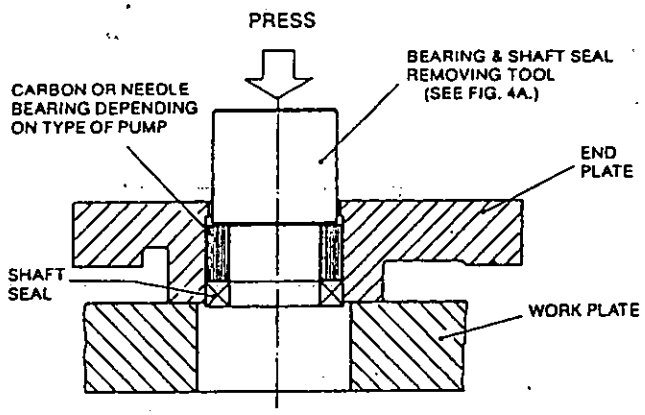
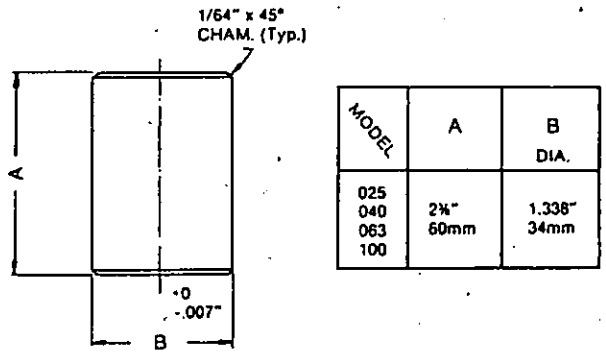


FIG. 4.
DISASSEMBLY OF BEARING AND SHAFT SEAL
(Not applicable for pumps 010, 016 or 021)



MODEL	A	B DIA.
025 040 063 100	2⅜" 60mm	1.338" 34mm

FIG. 4A.
BEARING AND SHAFT SEAL REMOVING TOOL

NOTE: Bearings and shaft seals for 010, 016 and 021 have to be removed via a screwdriver.

NOTE: Some older and all new pumps will have needle bearings instead of carbon sleeve bearings. The two (2) types of bearings are interchangeable.

To remove the bearing sleeve (Pos 18) from the rotor, stand the rotor on end with the end from which the sleeve is being removed, facing down. Heat the sleeve with a propane torch, being careful to concentrate heat on the sleeve. The sleeve will then fall off.

The sleeve can also be removed by use of a pencil grinder. Grind a slot, lengthwise, along the sleeve, being careful not to grind into shaft. Carefully pry off sleeve.

The above procedures may be used for both sleeves.

Once the pump has been disassembled, it is recommended that all parts be cleaned in a suitable solvent; such as benzene, acetone or trichlorethylene. While cleaning parts, carefully check them for damage or wear. Replace all damaged or worn parts.

If the pump vanes were broken and/or the rotor seized, it would be advisable to check the rotor for straightness before reassembly. This can be done by chucking the rotor in a lathe and checking the run-out or eccentricity (T.I.R.). The maximum allowable run-out is 0.02mm (0.001").

The standard overhaul kit contains all gaskets, shaft seals, taper pins, vanes, carbon sleeve or needle bearings and bearing sleeves. The kit is recommended when repairing an R5 Series Single Stage Rotary Vane Vacuum Pump.

The standard filter kit contains an oil drain plug including O-ring, oil sight glass including gasket, automotive type oil filter, exhaust filter(s) with O-rings, foam block and baffle strainer. The filter kit is recommended when performing maintenance work on the oil filtering system.

4.0 ASSEMBLY

4.1 Exhaust Valves - Exhaust Box - Exhaust Filters - Automotive Type Oil Filter

There are two (2) styles of exhaust valves. The exhaust valves supplied in the - 132 RA Models, are of all steel construction and the 120/7005 Model pumps have parts of plastic and neoprene.

Prior to assembling the exhaust valves, check to see which style (plastic or all steel) valve is supplied. Each style of exhaust valve has a critical detail to observe in installation.

With the plastic style exhaust valve, be sure that the cylindrical pin (a small metal pin that slips underneath the stem of the exhaust valve as a spacer (Pos 166) is placed in the threaded hole. This pin is no longer necessary in valves shipped in 1988 or after. Put Loctite 242 on the bottom of the valve stem thread and screw the valve assembly into the matching hole on pump cylinder. Check to see that the plastic valve plate can be lifted up easily by hand. Without the cylindrical pin placed in the threaded hole, it will be possible to tighten the valve so that it will be inoperable.

With the all-steel exhaust valve, it is critical that the valve itself be assembled correctly.

See Figure 5 for assembly.

Care must be taken to see that the spring washers with tabs are put together correctly and tabs fit into the slots. When screwing the valve together, be sure that Dia. A goes over Dia. B.

Prior to attaching the steel exhaust valve assembly to the cylinder, check to see that the valve plate (washer-type piece) moves freely.

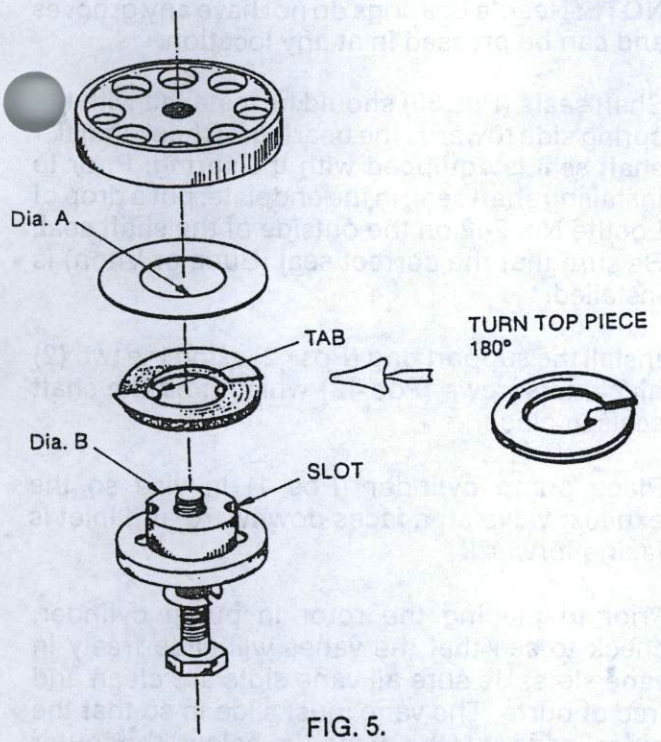


FIG. 5.
STEEL EXHAUST VALVE ASSEMBLY

With this style exhaust valve, it is not necessary to use the cylindrical pin in the threaded hole.

Put Loctite on the bottom of the valve stem thread and screw the valve assembly into the matching hole on pump cylinder.

Tilt the pump module and motor on its side towards motor conduit box using technique described in disassembly. Place gasket (Pos 185) between pump module and exhaust box (graphite side facing the exhaust box) and mount the exhaust box to the pump module, using the four (4) hex head cap screws (Pos 186). Do not use any Permatex or other sealant on this gasket.

Install sheet metal pieces (Pos 78) and the steel demister (Pos 79) through the same openings from which they were removed. To install the pieces through the openings, it may require bending of the pieces. After the pieces are through the openings, it is necessary to straighten them to fit properly.

Install drum plugs (Pos 200) and/or cover plate (Pos 105). Be sure that the drum plugs have the new O-rings (Pos 201) in place for proper sealing.

Set pump back on its feet on a level surface. Install automotive type oil filter (Pos 100) after filter mounting base has been cleaned. Coat face of gasket on new filter with oil and hand tighten until gasket contacts base, then tighten two-thirds turn more. *Do not overtighten.*

Reconnect oil lines (Pos 230 and Pos 231) and the return oil line (Pos 290 on RA Models 112/132).

Insert exhaust filter(s) (Pos 120) into exhaust box, making sure that the metal neck with O-ring (Pos 121) seats properly into exhaust base. Insert the filter spring (Pos 125) into exhaust box and turn to catch tabs on the inside of housing. Tighten slotted cheese head machine screw (Pos 126).

Install the synthetic baffle (Pos 130) and the foam block (Pos 131) through the exhaust ports. Be sure that the foam block, next to the recirculation valve, is in place.

Install cover plate (Pos 153D), or exhaust silencer (Pos 153B) or exhaust flange adapter (Pos 153C) and secure with the hex head cap screws (Pos 146).

4.2 Rotor - Vanes - Bearings - Shaft Seals - Coupling - Inlet Screen

If the bearing sleeves (Pos 18) have been removed or a new rotor needs to be installed, the bearing sleeves need to be preheated prior to installation. Preheat sleeves in oil bath (approximately 250° F) or use an induction bearing heater. Install the sleeves on the shaft so they touch the shoulder of the rotor. With the sleeves in place, chuck the rotor in a lathe and polish the outer half of each sleeve with fine (#180) emery paper. The polishing should be done creating a spiral pattern. See Fig. 6 for proper procedure and direction of rotation.

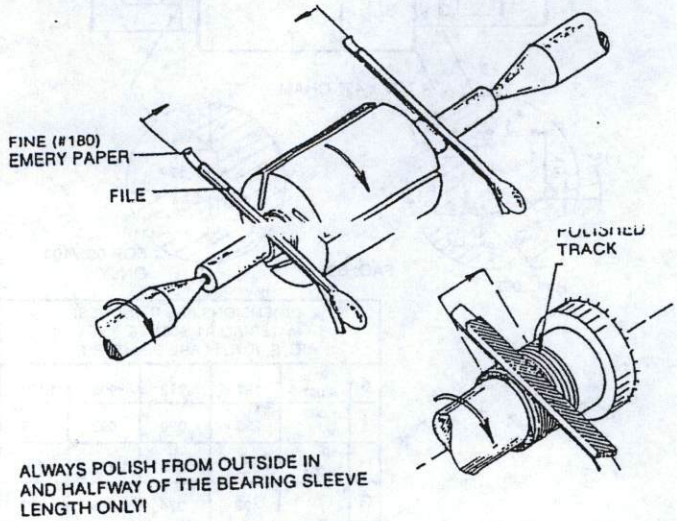


FIG. 6.
BEARING SLEEVE POLISHING

If the bearings (Pos 30) are being replaced or reinstalled, it is very important, for lubrication purposes on the carbon type sleeve bearing, that the bearings be installed properly. Lay both endplates, finished side down, in the position as shown in Figure 7.

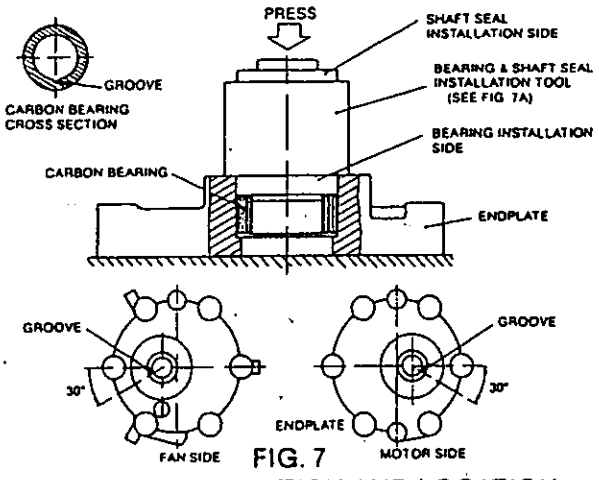


FIG. 7

BEARING INSTALLATION AND LOCATION OF GROOVE ON CARBON BEARING

The carbon bearings should be installed with the groove in the 8 o'clock position in the fan side endplate and the 4 o'clock position in the motor side endplate. Bearings should be installed using an arbor press and special tool, to insure proper depth of bearings. Using a hammer to install bearings may damage them. See Fig. 7A for dimensions of the special installation tool for bearings and shaft seals. (Carbon bearings will no longer be available from Busch.) Needle bearings are interchangeable, and no special placement is necessary.

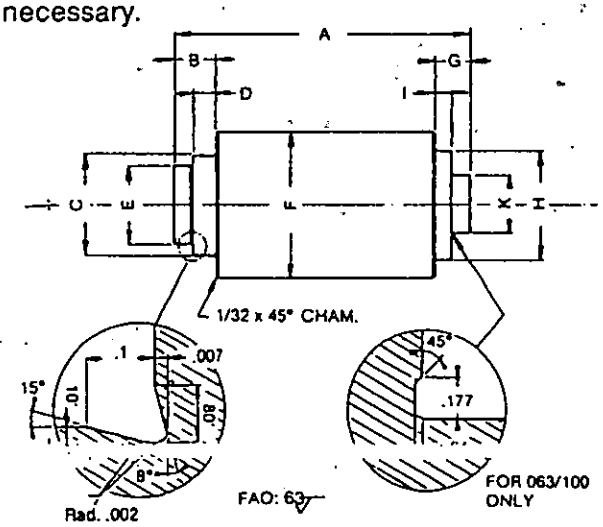


FIG. 7A.
BEARING AND SHAFT SEAL INSTALLATION TOOL

DIMENSIONS ARE IN INCHES MATERIAL: A1. 6061-T6 C, E, F, K, H ARE DIAMETER						
K	+0 -.007	.787	.772	.905	1.102
I	+.003 -0	.296	.099	099	.099
H	+0 -.007	1.063	1.252	1.377	1.614
G	—	492	.374	.295	.492
F	—	2	2	2	2
E	+0 -.007	787	.772	.984	1.141
D	+.003 -0	.098	.335	.354	.314
C	+0 -.007	1.259	.845	1.338	1.614
B	—	.334	.787	.551	.551
A	—	.2	2	.2	.2
	TOLERANCES	010/016	021	025/040	063/100

NOTE: Needle bearings do not have any grooves and can be pressed in at any location.

Shaft seals (Pos 35) should be installed with the spring side towards the bearings. Check that the shaft seal is equipped with the spring. Prior to installing shaft seal, in the endplate, put a drop of Loctite No. 242 on the outside of the shaft seal. Be sure that the correct seal (Buna or Viton) is installed.

Install the support ring (Pos 42) using the two (2) machine screws (Pos 43) which hold the shaft seals in place.

Place pump cylinder (Pos 1) in vise so the exhaust valve area faces downward and inlet is facing forward.

Prior to placing the rotor in pump cylinder, check to see that the vanes will slide freely in vane slots. Be sure all vane slots are clean and free of burrs. The vane must slide in so that the outer edge of the vane is below the outer diameter of the rotor.

Install rotor (Pos 15) in pump cylinder such that when looking into the pump cylinder from the fan side (the right side) the vane slots are pointing in the direction of clockwise rotation. See Figure 8.

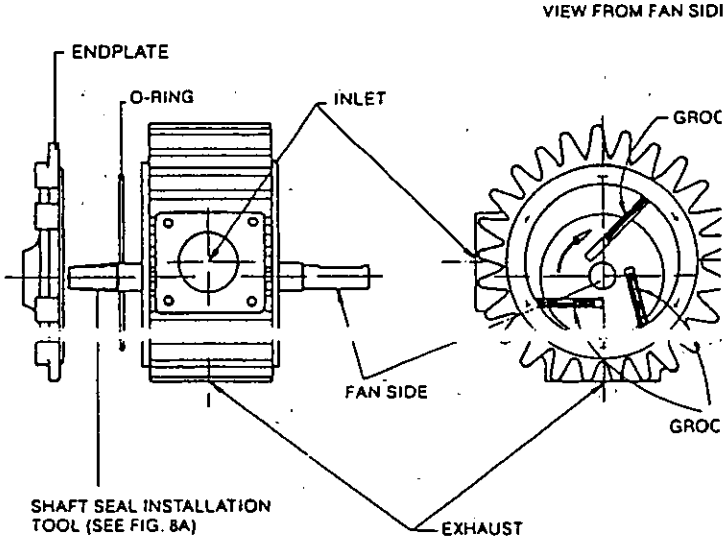


FIG. 8.
ENDPLATE INSTALLATION

Insert vanes in rotor so grooves in vanes if any will be on the trailing side with proper pump rotation. *Do not* lubricate vanes or rotor slots with oil.

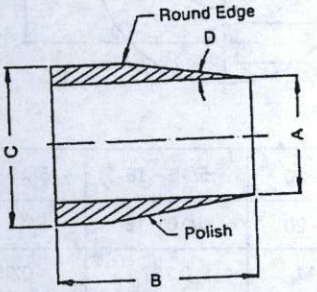
Place O-rings (Pos 50) in endplates with shaft seal and bearings already installed. Place a small

amount of grease on the O-rings to hold them in ce while installing endplates.

pumps with paper gaskets between end-ates and pump cylinder, use the same quantity and thickness on each side as were removed during disassembly. Cases in which it is not possible to identify what gaskets were removed, use one thick (0.1mm-.0004") gasket on each side. Place the paper gaskets over the studs in the pump cylinder.

Prior to installation of the endplates, put grease on the inside diameter of the shaft seals and oil the carbon or needle bearing area. On Buna seals use Silubrin Grease A or Arcanol LT1 or MolyKote G-N. Use Silubrin Grease S on the Viton shaft seals.

Carefully insert the endplates over the shaft. Care must be taken not to damage the shaft seal when sliding over the bearing sleeve. Preferably one should use a special shaft seal installation sleeve (see Figure 8A). If the special shaft seal installation sleeve is not available, use wax paper. Wrap the wax paper around the bearing sleeve shoulder and carefully slide the endplate over the sleeve and then remove the wax paper.



Tolerance	+.0 -.007	—	+.003 -0	—
063 100	0.992	1.15	1.182	5°
025 040	0.795	0.95	0.985	5°30'
010, 016 012, 021	0.598	0.67	0.788	9°30'
Type	Dia A"	B"	Dia C"	D°

FIG. 8A.
SHAFT SEAL INSTALLATION SLEEVE

With the endplate in place on motor side install taper pins (Pos 60) hand-tight, and temporarily tighten nuts and bolts by hand. Repeat operation for fan side endplate. Partially tighten all bolts and nuts and partially tap taper pins into place.

Finally tighten all nuts and bolts and tap taper pins all the way in.

On pumps with paper gaskets between end-plates and cylinders, it is necessary to check axial (end) clearances first. There is no adjustment to axial clearances that can be made with endplates sealed with O-rings between cylinder and endplates. Measurements should be made for record purposes.

Check axial clearance by putting a dial indicator on one (1) end of shaft as shown in Figure 9 & 10. Pull opposite end of shaft as far as it will go away from the dial indicator. Set indicator at zero (0). Push shaft toward dial indicator as far as it will go and read the indicator. This measurement is the total axial clearance. Clearances, depending on model, should be:

Type	Model	MM	Inches
RA or RC 0010	112/118	.043-.081	.0017-.0031
RA or RC 0016	112/118	.051-.095	.0020-.0037
RB or RC 0021, 0012	136/138/336/338	.043-.081	.0017-.0031
RA or RC 0025	112/132/118/138	.091-.135	.003 -.005
RA or RC 0040	112/132/118/138	.122-.172	.005 -.007
RA or RC 0063	112/132/118/138	.091-.135	.003 -.005
RA or RC 0100	112/132/118/138	.134-.184	.005 -.007
0025 thru 0100	120 or 7005	.06 -.08	.0023-.0031

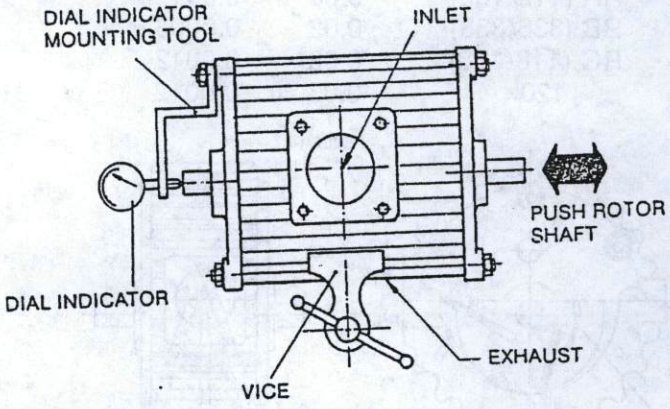
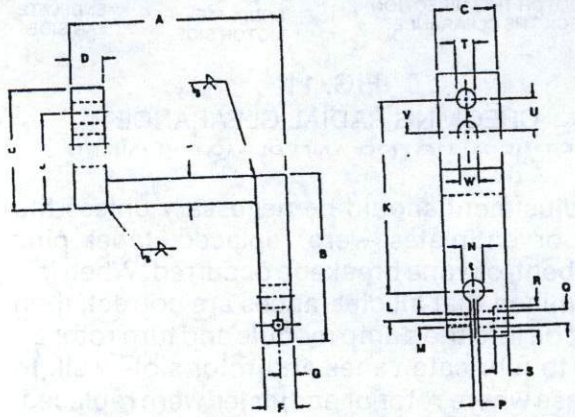


FIG. 9.
AXIAL CLEARANCE MEASURING



010-040	2-3/4	2-1/4	3/4	3/8	5/16	3/8	3/16	1-1/2	1-5/32	2-7/16
063-100	2-3/4	2-1/4	3/4	3/4	3/8	3/8	3/16	2-1/16	1-9/16	2-11/16
	A	B	C	D	E	F	G	H	J	K
010-040	8/32	8mm .375"	1/16		8/32	5/8	1/4	3/8	1/8	1/4
063-100	8/32	8mm .375"	1/16		8/32	5/8	3/8			
	M	N	P	Q	R	S	T	U	V	W

FIG. 10.
MOUNTING BRACKET FOR DIAL INDICATOR

If clearance is less than specified, add paper gaskets of appropriate thickness to meet clearance, between cylinder and motor side endplate (Pos 25); if clearance is more than specified, remove the thick (0.1mm-.004") gasket (Pos 50) and replace with thin gasket (.05mm-.002") between cylinder and fan side endplate (Pos 26). There should always be one paper gasket on either side of the cylinder. Do not use Permatex or grease on gaskets or endplate faces.

Check radial clearances by inserting a feeler gauge blade into inlet of pump in direction of smallest clearance between rotor and cylinder.

One should check radial clearance in three (3) locations along rotor. See Figure 11 for insertion of feeler gauge blade. Clearance, depending on model, should be:

Model	MM	Inches
RA (112/132)	0.03	0.0012
RB (336/338)	0.02	0.0008
RC (118/138)	0.03	0.0012
120	0.03	0.0012

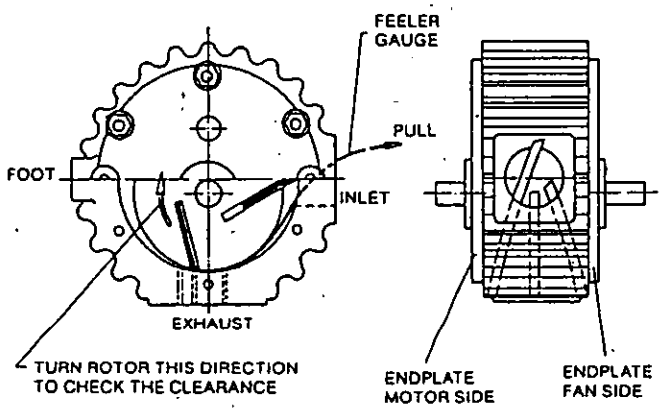


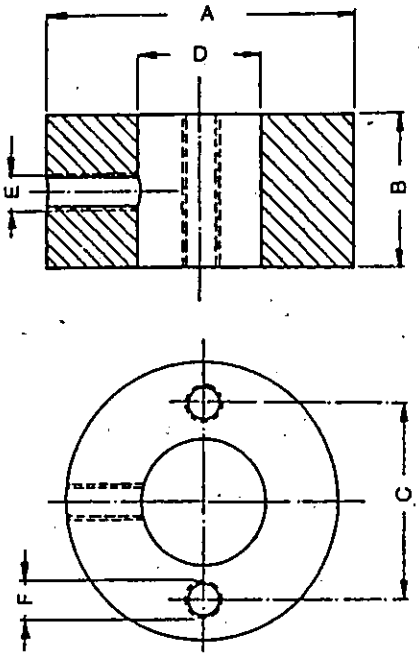
FIG. 11
CHECKING RADIAL CLEARANCE
BETWEEN ROTOR AND PUMP CYLINDER

No adjustment should be necessary unless the rotor or endplates were replaced, taper pins were bent, or vane breakage occurred. When it is determined that all clearances are correct, then squirt oil into the pump module and turn rotor by hand to lubricate vanes and rotor slots well. In the case where rotor or endplates were replaced, taper pins bent or vane breakage occurred, proceed as follows:

Chuck the rotor in a lathe and check for a bent rotor. The maximum allowable run-out or eccentricity (T.I.R.) is .02mm (.001").

Install fan side endplate and tighten nuts and bolts by hand and loosely install only the taper pin on the far side. Install rotor pulling tool (Fig. 12) on fanside shaft end, and tighten the two screws to pull the rotor against the inside face of the endplate. This is done to insure straightness of rotor in the pump cylinder. Install motor side endplate and tighten nuts and bolts by hand and install far side taper pin of motorside endplate. Remove rotor pulling tool.

Check axial clearances as described previously.



F	1/4 - 20	5/16 - 18	5/16 - 18
E	1/4 - 20	5/16 - 18	5/16 - 18
D	0.511	0.787	0.984
C	1-3/8	2	2
B	5/8	1.25	1.25
A	2.00	2.50	2.50
TYPE	010/016/021	025/040	063/100

FIG. 12
ROTOR PULLING TOOL

Check the radial clearance and adjust by turning appropriate endplate, by tapping endplate lightly around taper pin pivot. As before, three (3) locations along rotor should be checked. Retighten bolts and re-ream taper pin hole(s) closest to inlet. Insert that taper pin and tap until solid metal sound is heard. Tap taper pin on far side in fully.

In all cases, it is best to recheck the axial clearances after the radial clearances are set. This will insure that the rotor was not cocked during setting of radial clearances.

Squirt oil into the pump module and turn rotor by hand to lubricate vanes and rotor slots well.

Where the pump module was separated from the exhaust box for repair, they can now be reassembled together following instructions in Section 4.1. Be sure gasket (Pos 185) is between the pump module and exhaust box and the exhaust valves (Pos 159) are attached to the pump module on 112/120/132 and RA models.

Reassemble inlet flange assembly (Pos 250 through 266). Check to see that the valve plate (Pos 251) moves freely and seats properly. The conical spring (Pos 254) should be adjusted so it holds the valve plate (Pos 251) slightly ajar.

Attach inlet flange (Pos 250 & 260) to pump module using the four (4) hex head cap screws (Pos 265). Check to see that inlet screen (Pos 261) and O-ring (Pos 255) is between inlet flange and pump module.

Attach all oil lines between endplates and exhaust box. On pumps with cooling coils, attach the endplate end of the oil line before installing cooling coil.

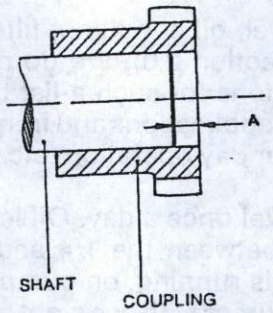
Install gas ballast (Pos 440) on fan side endplate (Pos 26) on 112/132 models. Prior to coupling installation, check serrated or "gear type" edges of coupling halves for burrs that would prohibit coupling insert from sliding freely.

Install pump coupling part (Pos 310) by inserting shaft key and tightening set screw. A distance of 4mm must be maintained between pump coupling half and motor coupling half when pump and motor are connected. Figure 13 shows the location of the coupling halves on the pump and motor shaft for 3 phase U.S.A. motors. On pumps with 3 phase European motors, the coupling halves should be installed flush with the end of the shafts.

Setting the proper 4mm clearance on pumps with special motors is done by special measurement.

Install pump coupling half flush with end of pump shaft. Measure distance from motor seating face on motor mounting bracket (Pos 300) to face of pump coupling, and subtract 4mm. Install motor coupling half, so dimension from motor seating face to face of motor coupling is the dimension just obtained.

Attach motor mounting bracket (Pos 300) to pump endplate (Pos 25). On Model 100's, be sure to slide cooling coil over mounting bracket prior



PUMP SIZE	MOTOR COUPLING A mm	PUMP COUPLING A mm
010/016	0	to bearing sleeve
021	1 ø 0 3 ø 9	to bearing sleeve
025	27	27
040	27	27
053	22	26
100	0	0

FIG. 13
COUPLING INSTALLATION DIMENSIONS

to attaching to pump. Reinstall motor and coupling insert. Actual measurements could vary depending on type of motor, 1 phase or 3 phase, and type of coupling used. Follow measuring instructions to determine proper distances.

When coupling insert is installed, check to see that it will slide freely from left to right, approximately 4-5mm.

Check to make sure all oil lines are connected and tightened. Replace pump fan (Pos 324) using distance ring (Pos 320), shaft key (Pos 66), and retaining ring (Pos 326).

Attach the fan cover (Pos 340) to endplate using screws (Pos 341).

Refill the pump with the required amount of fresh oil through the oil fill port (see Section 2.1.2).

5.0 OPERATING HINTS

In order to obtain optimum performance, the following preventive maintenance tips are suggested:

5.1 **A suggestion for developing good maintenance practice is to post a check list relating to periodic maintenance. The list should call for**

checks of oil level, oil condition, filter's condition, etc. (see section 2.0). We do not furnish specific instructions for such a list because of wide variance of applications and frequencies of operation (8-hour day operation, etc.)

5.2 Check oil level once a day. Oil level should be somewhere between the 1/4 and 3/4 mark when the pump is running, on pumps with one sight glass. On pumps with two sight glasses, the level, while running, should be between the 1/4 and 3/4 mark on the top sight glass. This level may change slightly with the viscosity of the oil which changes with the pump's temperature. The oil level drops slightly when the pump operates with inlet open and/or gas ballast valve open.

5.3 Check oil once a week for contamination (refer to Section 2.1.3). Water or dirt in the oil cuts pumping efficiency. If the pump has been idle for an extended period of time, it is suggested that the drain port be opened and check for water and sludge. Keep drain port open until normal oil appears, then add fresh oil equivalent to the amount drained.

5.4 If oil is contaminated, change it.

5.5 Every three (3) months, 500 hours of operation, or as necessary change the automotive type filter. See Section 3.2.2 and Section 4.1.

5.6. Every nine (9) to eighteen (18) months, or as necessary change the exhaust filter elements. See Section 3.2.1 and Section 4.1.

5.7 Once every two (2) years, change the exhaust valve assembly on (Super RA Models) or (100 Micron) Series Pumps that have constant or near constant operation. See Section 3.2.3 and Section 4.1.

5.8 The gas ballast valve for Super Series Pumps (RA Models), Sizes 010 through 100, is not adjustable and therefore, is always open. Check that gas ballast/filter is free of dirt and replace assembly, if contaminated. To check, place finger over gas ballast valve opening to see if vacuum is present.

6.0 TROUBLE SHOOTING

6.1 Trouble
Pump does not reach "blank-off" pressure which is the lowest absolute pressure (best vacuum) when running with the inlet closed via a blank flange or a valve; or pump takes too long to evacuate the system. The "blank-off" pressure can be measured by using a McLeod gauge, a Pirani type electrical gauge, or a good quality capsule gauge.

6.1.1 Cause
Contaminated oil is by far the most common cause of not reaching the ultimate pressure.

Remedy: Shut off the pump after operating temperature has been reached, drain the warm oil from the pump and exchange automotive type oil filter if necessary. Flush and fill (Section 2.1.3 and Section 2.2) with new oil and take new "blank-off" measurement after operating temperature is reached (at least 20-30 minutes).

6.1.2 Possible Cause
Vacuum System or vacuum piping not leak-tight.

Remedy: Check hose and pipe connections for possible leak.

6.1.3 Possible Cause
Wire mesh inlet screen plugged (Pos 261).

Remedy: Clean wire mesh inlet screen and reinstall (Sections 3.3 and 4.2). Install inlet filter if problem repeats frequently.

6.1.4 Possible Cause
No oil or not enough oil in oil reservoir.

Remedy: Shut off the pump, drain balance of oil from the pump, exchange automotive type oil filter and refill with fresh oil (Sections 2.1 and 2.2).

6.1.5 Possible Cause
Automotive type oil filter is dirty or clogged.

Remedy: Replace automotive type oil filter, exchange oil if necessary, refill with fresh oil (Sections 2.1 and 2.2).

6.1.6 Possible Cause
Inlet valve plate (Pos 251) stuck in closed or partially open position due to contamination.

Remedy: Disassemble inlet valve and screen. Clean as required (Section 3.3).

6.1.7 Possible Cause
Oil tubing defect and/or leaking. Oil return line broken on RC Model 118/138.

Remedy: Replace or retighten oil fittings or oil tubing. Replace only with same size tubing.

6.1.8 Possible Cause
Shaft seal leaking.

Remedy: Replace shaft seal following disassembly and assembly instructions in Sections 3.3 and 4.2. Check that shaft seal has a spring installed inside around the shaft sealing lip.

6.1.9 Possible Cause
Exhaust valve (Pos 159) not properly seated or partially stuck open (112/132 RA Models only).

Remedy: Follow disassembly and assembly instructions in Sections 3.2.3 and 4.1.

6.1.10 Possible Cause
Vanes stuck in rotor or otherwise damaged.

Remedy: Free vanes or replace with new ones following disassembly and assembly instructions in Sections 3.3 and 4.2.

6.1.11 Possible Cause
Radial clearance between rotor and cylinder no longer adequate.

Remedy: Follow disassembly and assembly instructions in Sections 3.3 and 4.2 on resetting radial clearance correctly.

6.1.12 Possible Cause
Internal parts worn or damaged.

Remedy: Follow disassembly and assembly instructions in Sections 3.0 and 4.0 and replace worn or damaged parts.

6.1.13 Possible Cause on RC 118/138 Models Only
The oil return line (Pos 290 on RC 118/138 Models only) is connected directly to atmospheric pressure in the exhaust area. On small model pumps, therefore, a fairly large amount of air is sucked through the oil return line and it may not be possible to reach 15 Torr or 29.3 inches Hg blank-off on the inlet of the pump under these conditions.

Blank-off of 29.3 inches Hg or 15 Torr can be reached by temporarily disconnecting and closing the oil return line. Also by squirting oil through the exhaust opening into the exhaust filter area. The oil will be sucked into the oil return line and no air will reach the inlet thus affecting the "blank-off" pressure.

6.2 Trouble
Pump will not start.

6.2.1 Possible Cause
Motor does not have proper supply voltage or is overloaded; motor starter overload settings are too low or wrong setting, fuses are burned; wire size is too small or too long causing a voltage drop at the pump.

Remedy: Check correct supply voltage; check overload settings in motor starter for size and setting according to motor nameplate data; check fuses; install proper size wire. If ambient temperature is high, use next larger size overloads or adjust setting 5% above nominal motor nameplate value.

6.2.2 Possible Cause
Pump or motor is blocked.

Remedy: Remove fan cover and try to turn pump and motor by hand. If frozen, remove motor from pump and check motor and pump separately. If pump is frozen, disassemble completely and remove foreign objects in pump or replace broken vanes (Sections 3.0 and 4.0).

6.3 Trouble
Pump starts, but labors and draws a very high current.

6.3.1 Possible Cause
Oil too heavy (viscosity too high) or ambient temperature below 5 degrees C (41 degrees F).

Remedy: Change to lighter grade oil such as 10W-40, if very cold (see Section 2.1.2), or warm up pump oil before filling.

6.3.2 Possible Cause
Pump runs in the wrong rotation.

Remedy: Check for correct rotation which is counterclockwise when looking at the motor from the motor's fan side.

6.3.3 Possible Cause
Pump is overfilled with oil, or wrong kind of oil is used.

Remedy: Correct oil level and quality per Section 2.1.2 and use recommended non-detergent motor oil such as Busch R-580 or other SAE 30 oil.

6.3.4 Possible Cause
Exhaust filters in exhaust are clogged and burned black with pump oil.

Remedy: Replace exhaust filters; maintain proper oil condition, oil level and use SAE 30 type non-detergent motor oil (Sections 3.2.3. and 4.1).

6.3.5 Possible Cause
Exhaust filter is clogged due to process material.

Remedy: Contact factory for recommendation or proper filter cartridge.

6.3.6 Possible Cause
Loose connection in motor terminal box, not all motor coils are properly connected. Motor operates on two phases only.

Remedy: Check motor wiring diagram for proper hook-up, especially on motors with 6 internal motor windings, tighten and/or replace loose connections.

6.3.7 Possible Cause
Foreign particle in pump; vanes broken; bearing seizing.

Remedy: Follow disassembly and assembly instructions in Sections 3.0 and 4.0 and remove foreign parts; replace vanes and bearings.

6.4 Trouble
Pump smokes at the exhaust side or expels oil droplets from the exhaust.

6.4.1 Possible Cause
Exhaust filter not properly seated with O-ring (Pos 121) in filter base or filter material cracked.

Remedy: Check condition and placement of exhaust filters in filter base. Replace if necessary (Sections 3.2.3 and 4.1).

6.4.2 Possible Cause
Exhaust filter clogged with foreign particles.

Remedy: Replace exhaust filter. Install other factory recommended filter cartridges if pump application requires other filter cartridges (Sections 3.2.3 and 4.1).

6.4.3 Possible Cause
Oil recirculation valve (Pos 275) not properly working or clogged. Proper function is that when blowing into check valve, it should close. When sucking on it, check valve should open. (Only on Super Models)

Remedy: Replace oil recirculation check valve.

6.4.4 Possible Cause
If Super Series vacuum pumps run continuously over 10 hours without ever being shut down, it may be possible that oil accumulates behind the exhaust box cover (Pos 153) to the extent that oil is blown out of the exhaust with the exhaust gas.

Remedy: Shut pump down during break periods or install additional oil return line assembly. Check that oil recirculation valve (Pos 275) is free and drains oil back into pump when Super Series pump is stopped.

6.4.5 Possible Cause
Oil return line (Pos 290) on RC 118/138 standard pumps clogged or broken.

Remedy: Free clogged line, replace broken line, but only with proper size, and check that oil is pumped out of oil sump below foam block (Pos 131) while vacuum pump is operating.

NOTE: A pressure guage can be supplied for all R5 series pumps, so that the pressure in front of the exhaust filters can be monitored. The green field (0 through 0.6 bar) is between 0 and 9 psi and indicates that the filters are still effective. Any back pressure above 9 psi requires immediate change of the exhaust filter (Pos 61).

6.5 Trouble
Pump runs very noisy.

6.5.1 Possible Cause
Coupling insert worn.

Remedy: Replace coupling insert in motor/pump coupling (Sections 3.3 and 4.2).

6.5.2 Possible Cause
Bearing noise.

Remedy: Follow disassembly and assembly instruction in Sections 3.3 and 4.2 and replace bearings.

6.5.3 Possible Cause
Vanes stuck.

Remedy: Follow disassembly and assembly instructions in Sections 3.3 and 4.2 and replace vanes. Use SAE 30 motor oil and change oil more frequently.

6.6 Trouble
Pump runs very hot.

NOTE: The oil temperature with closed inlet should be approximately 85 degrees C (185 degrees F). At 20 inches Hg, vacuum oil temperature can go above 105 degrees C (220 degrees F). (These values are with normal 20 degrees C [68 degrees F] ambient temperature. Maximum ambient temperature for operating the R5 Series pump continuously is 40 degrees C (104 degrees F)].

6.6.1 Possible Cause
Not enough air ventilation to pump.

Remedy: Clean motor and pump air grills. Do not install pump in enclosed cabinet unless sufficient amount of fresh air is supplied to pump. On pumps with oil cooling coils, clean outside fin assembly.

6.6.2 Possible Cause
Automotive type oil filter clogged and pump does not receive enough oil.

Remedy: Change automotive oil filter (Sections 3.2.2 and 4.1).

6.6.3 Possible Cause
Not enough oil in oil reservoir or badly burned oil is used for pump lubrication.

Remedy: Drain and refill only with non-detergent oil, increase oil change intervals.

NOTE: On some high temperature applications, it may be necessary to change to a high temperature oil. Contact the factory for recommendations.

6.7 Trouble
Pump is seized.

6.7.1 Possible Cause
Pump operated without oil and vanes broke.

Remedy: Disassemble and exchange vanes per instructions in Sections 3.3 and 4.2.

6.7.2 Possible Cause
Pump was operated for an extended period of time in the wrong rotation.

Remedy: Inspect vanes and replace.

6.7.3 Possible Cause

Liquid carryover into pump cylinder broke vanes while pump was running or oil broke vanes on start-up.

Remedy:

a) Install condensate trap on inlet of pump.
b) Pump was overfilled with oil in oil reservoir. Follow oil filling procedure (Section 2.1.2) and do not overfill.
c) Built-in-anti-suck valve (Pos 251) leaking while pump was shut down and vacuum was left in manifold. Clean valve seat and check that anti-suck back valve holds vacuum on inlet when pump is shut down.
d) Two pumps on same main line. Install a manual or automatic operated valve in front of each pump, if more than one vacuum pump is pumping on the same main line.

6.8 Trouble
Automotive type oil filter (Pos 100) does not get warm within 2-5 minutes when cold pump is switched on.

6.8.1 Possible Cause
Automotive type oil filter is clogged.

Remedy: Replace automotive type filter per Section 3.2.2 and 4.1 and exchange oil per Section 2.1.2.

6.8.2 Possible Cause
Wrong automotive type filter is used and/or oil lines leading to pump are clogged.

Remedy: Use only automotive filter as listed in Section 2.2 and blow lines free.

7.0 PARTS LIST
Enclosed according to proper pump type.

GROVE GEAR
ENGINEERING INFORMATION

LUBRICATION

Size 1100 thru the 1600 Reducers ordered from the factory will be filled to the proper level with lubricant. **SIZE 1700 THRU 11,000 ARE SHIPPED WITHOUT LUBE OIL AND MUST BE FILLED TO THE CORRECT LEVEL PRIOR TO OPERATION.**

After the installation of the breather plug, the unit is ready for use. Before installing the breather plug, refer to the instruction tag and determine the proper position according to reducer mounting specifications.

Grove Gear recommends changing oil every six months or 2500 hours of service under Class I service. If service is more severe, the oil should be changed more frequently.

To assist you in the proper selection of replacement lubricant, we recommend the following oils for the ambient temperatures specified.

Manufacturer	15° to 60° Ambient Temperature AGMA Compounded No. 7	50° to 125° Ambient Temperature AGMA Compounded No. 8
Amoco Oil Co.	Worm Gear Oil	Cylinder Oil #680
Chevron USA, Inc.	Cylinder Oil #460X	Cylinder Oil #680X
Exxon Co. USA	Cylesstic TK-460	Cylesstic TK-680
Gulf Oil Co.	Senate 460	Senate 680D
Mobil Oil Corp.	600W Super	Extra Hecla Super
Shell Oil Co.	Valvata Oil J460	Valvata Oil J680
Sun Oil Co.	Gear Oil 7C	Gear Oil 8C
Texaco	Honor Cylinder Oil	650T Cylinder Oil
Union Oil Co. of California	Steaval A	Worm Gear Lube 140

NOTE: For temperature ranges not shown and synthetic lubrication, contact factory.

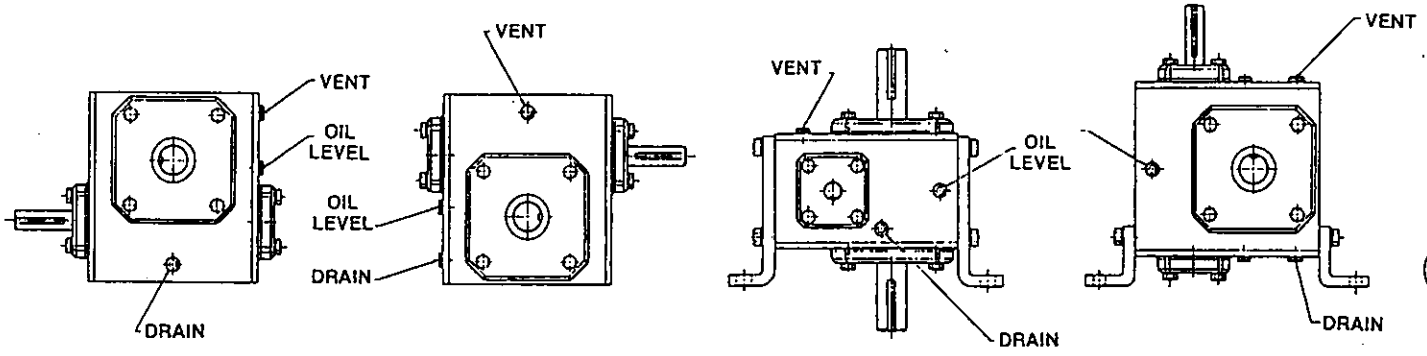
OIL CAPACITIES (oz.'s)

MOUNTING POSITION	UNIT SIZE														
	1100	1133	1154	1175	1206	1238	1262	1300	1325	1425	1525	1600	1700	1800	11000
WORM OVER	3	5	10	15	21	25	45	55	73	135	200	310	563	768	1152
WORM UNDER	4	7	14	18	25	30	49	61	89	127	216	330	525	822	1280
VERTICAL OUTPUT	4	6	13	16	23	26	46	58	74	120	216	320	332	460	640
"J" MOUNT	3	7	12	16	24	25	47	60	75	126	216	325	585	800	1200

NOTE: These units are shipped without lube oil and must be filled to correct level before starting.

VENT PLUG LOCATION

Before putting unit into operation, substitute the vent plug for the solid pipe plug at the position desired. Arrows indicate the recommended vent plug locations.



INSTRUCTION SHEET

FINCOR® SERIES 2250 MODELS 2251 AND 2252

SINGLE-PHASE ADJUSTABLE-SPEED HALF-WAVE REGENERATIVE DC MOTOR CONTROLLERS 1/6 THROUGH 1HP

GENERAL INFORMATION

DESCRIPTION

Series 2250 Controllers statically convert single-phase AC line power to regulated half-wave DC for adjustable-speed, four-quadrant armature control of shunt-wound and permanent-magnet motors. Series 2250 Controllers control the speed and direction of motor rotation and also the direction of motor torque. Applications include those which require controllable bidirectional speed and torque for overhauling loads, contactorless reversing, and static braking.

MODEL TYPES

Series 2250 Controllers are offered in two standard models as shown in Table 1.

TABLE 1. MODEL TYPES

MODEL	HP RANGE	POWER SOURCE (single-phase)	OUTPUT VDC	
			Armature	Field
2251	1/6-1/2	115V 50 or 60 Hz	0-90	50/100
2252	1/3-1	230V 50 or 60 Hz	0-180	100/200

MOTOR SELECTION

Motor may be shunt-wound or permanent-magnet DC type. Since the controller output is half-wave, and since motors are normally designed for full-wave current, the motor horsepower rating must be greater than that of the controller. See Table 2.

CAUTION FAILURE TO USE A MOTOR WITH HP RATING GREATER THAN THAT OF THE CONTROLLER CAN CAUSE MOTOR DAMAGE RESULTING FROM OVERHEATING.

ENCLOSURE

Nonventilated, dust resistant, NEMA Type 1, constructed of die-cast aluminum alloy. The enclosure forms an integral heat sink with the power control devices electrically isolated from the enclosure. Complete controller is attached to the front cover, which can be removed from the enclosure by removing four screws.

OPERATOR CONTROLS

The operator controls are integrally mounted on the front cover. Included are:

1. POWER ON/OFF Toggle Switch — Provides motor start and stop functions. Switch is maintained in ON and OFF positions.
2. MOTOR SPEED Potentiometer — Provides speed and direction control. Pot may be reconnected for unidirectional operation.

RATINGS

1. Service Factor 1.0
2. Duty ..... Continuous
3. Overload Capacity ..... 150% for 1 minute
4. Motor Speed Potentiometer ..... 100K, ½W

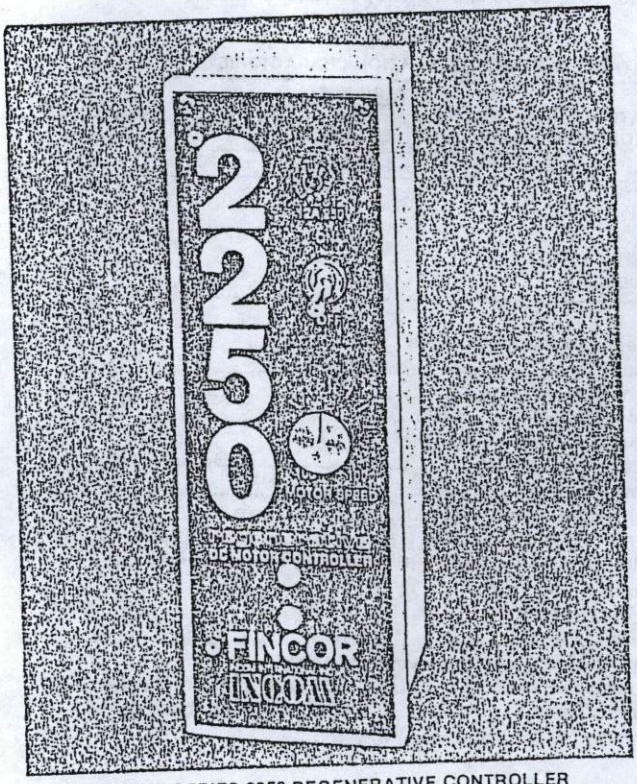


FIGURE 1. SERIES 2250 REGENERATIVE CONTROLLER

TABLE 2. RATINGS

COMPONENT			RATINGS					
Rated Horsepower (HP)			1/6	1/4	1/3	1/2	3/4	1
Rated Kilowatts (KW)			0.124	0.187	0.249	0.373	0.560	0.746
1-PHASE AC INPUT (FULL LOAD)	Line Amps	115V Unit	4.7	6.0	7.1	10.0	—	—
		230V Unit	—	—	3.6	4.9	6.8	10.2
	Controller KVA		.58	.69	.83	1.15	1.64	2.35
	Transformer KVA(1)		.75	1.00	1.00	1.50	2.00	3.00
DC OUTPUT (FULL LOAD)	Full-Load Motor Amps	90V	2.0	2.8	3.5	5.4	—	—
		180V	—	—	1.8	2.6	3.8	5.5
	Maximum Motor Amps	90V	3.0	4.2	5.3	7.1	—	—
		180V	—	—	2.7	3.9	5.7	7.2
	Motor Field Amps	50V/100V	1.0	1.0	1.0	1.0	1.0	1.0
		100V/200V	1.0	1.0	1.0	1.0	1.0	1.0
Recommended Motor Nameplate Horsepower Rating (KW) (2) (3)			½ (0.373)	½ (0.373)	¾ (0.560)	¾ (0.560)	1½ (1.12)	1½ (1.12)
Full-load torque (lb-ft) with 1750 RPM base speed motors			0.5	0.75	1.0	1.5	2.2	3.0
Controller Weight			2.0 lbs. (0.9) Kg.					

NOTES: (1) If a line isolation transformer is used, half-wave DC flows in the transformer secondary, which may cause transformer saturation and overheating. Therefore, the transformer KVA rating must be greater than the controller KVA rating, as shown in the table.

(2) Since the controller is a half-wave converter, the motor HP rating must be greater than the controller HP rating because motor heating will be greater for any given load or speed than with a full-wave converter.

(3) Motor HP ratings less than recommended may prevent the motor from attaining rated torque.

OPERATING CONDITIONS

1. Line Voltage Variation ..... −0 to +10% of rated (1)
2. Line Frequency Variation ..... ±2 Hertz
3. Ambient Temperature ..... 0 to 40°C (32°F to 104°F)
4. Altitude (standard) - 1000 meters (3300 feet) maximum

NOTE: (1) Low line voltage may prevent the motor from attaining rated speed under full-load conditions, or may cause fuse blowing or controller damage. See "Adjustment Instructions," note 2.

PERFORMANCE CHARACTERISTICS

1. Controlled Speed Range ..... 0 to motor base speed
2. Speed Regulation (See Table 3) – Regulation percentages are of motor base speed under steady-state conditions.

TABLE 3. SPEED REGULATION CHARACTERISTICS

REGULATION METHOD	VARIABLE				SPEED RANGE
	Load Change	Line Voltage	Field Heating	Temperature	
	95%	±10%	Cold/Normal	±10 °C	
Standard Voltage Feedback with IR Compensation	2%	± 1%	5-12%	± 2%	50:1

3. Efficiency (at maximum speed and rated load)
   a. Controller 97%
   b. Controller with motor 87%
4. Displacement Power Factor 86%
   (at maximum speed and rated load)
5. Acceleration Control ..... By current limit
6. Bandwidth (1) ..... 10 Hz.
7. Current Form Factor (2) 2.22
8. Current Ripple Frequency (1) ..... 60 Hz.

(1) With a 60 Hz. power source (2) At motor base speed and rated load

ADJUSTMENTS

1. Current Limit ..... 50 to 150% of full-load torque
   (Independent forward and reverse circuits)
2. IR Compensation ..... 0 to 100% of rated load
3. Maximum Speed ..... 60 to 100% of motor base speed
   (Common forward and reverse circuit)

INSTALLATION AND WIRING

1. Report shipping damage immediately to the carrier.
2. Unpack the controller and remove all packing material.
3. Remove the four screws on the front cover, and remove the cover from the enclosure.
4. Check components in the controller. All damaged components must be replaced..
5. Remove the applicable calibration shunt wire(s) with a wire cutter, as shown in Table 4 and Figure 2.

CAUTION FAILURE TO REMOVE THE CORRECT SHUNT WIRE(S) CAN CAUSE MOTOR DAMAGE.

6. For 50 Hertz operation, remove the 60 Hz jumper wire from the circuit board with a wire cutter. (See Figure 2.)
7. The controller is designed for surface mounting in a dry location. Never mount the controller immediately beside or above heat-generating equipment, or directly below water or steam pipes.
8. If the controller is subjected to external vibrations, it must be shock-mounted. Vibration can cause broken connections and component damage.
9. Mount the enclosure with its 1-⅛ inch diameter conduit hole at the bottom to ensure adequate clearance between the external wiring and controller components. See Figure 3 for dimensions.
10. Be sure the line voltage and frequency are compatible with the rating of the controller.
11. Insert external wiring through the enclosure conduit hole. Use #14 AWG stranded wire. Comply with the National and local electrical codes. Oversized or solid wire, as well as the use of large screwdrivers, can break terminal strip barriers.
12. Connect the motor and single-phase power to the controller as shown in Figure 2. If unidirectional operation is desired, rewire the MOTOR SPEED pot as shown. Then, remove the pot's bidirectional dial plate, thereby revealing a unidirectional dial plate.

STARTUP AND OPERATION

1. Recheck the wiring before applying power.

CAUTION INCORRECT WIRING AND ACCIDENTAL GROUNDS CAN DAMAGE THE CONTROLLER.

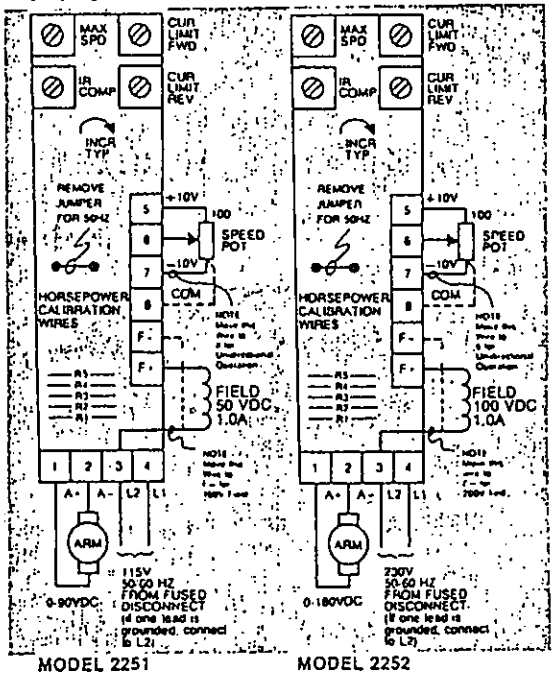
2. Replace the front cover on the enclosure and tighten the four screws.
3. Turn the MOTOR SPEED pot to zero on its dial.
4. Place the POWER ON/OFF switch in OFF position.
5. Apply AC input power to controller Terminals 3 and 4.
6. Place the POWER ON/OFF switch in ON position.
7. Slowly turn the MOTOR SPEED pot until the motor rotates.

   NOTE: If motor rotation is opposite to that desired, turn-off the POWER ON/OFF switch and the AC input power, and interchange the motor armature leads at the motor connection box.

WARNING WHENEVER AC POWER IS APPLIED TO THE CONTROLLER, POTENTIALLY HAZARDOUS VOLTAGE IS PRESENT ON THE ARMATURE AND FIELD TERMINALS. THIS VOLTAGE CAN CAUSE ELECTRIC SHOCK RESULTING IN PERSONAL INJURY OR LOSS OF LIFE.

8. To obtain top speed, turn the MOTOR SPEED pot to 100 on its dial.
9. If the controller is wired for bidirectional operation, turning the MOTOR SPEED pot clockwise from zero rotates the motor in the forward direction, and turning it counterclockwise from zero results in reverse rotation. When the pot is in center position (0), motor speed is zero.

   NOTE: If motor base speed cannot be reached or speed regulation is inadequate, refer to Table 5.



MODEL 2251 MODEL 2252

FIGURE 2. CONNECTION DIAGRAM

TABLE 4.
CALIBRATION WIRES

CONTROLLER HP RATING		REMOVE SHUNT WIRES
MODEL 2251	MODEL 2252	
1/6	1/3	R3,R4,R5
1/4	1/2	R4,R5
1/3	3/4	R5
1/2	1	None

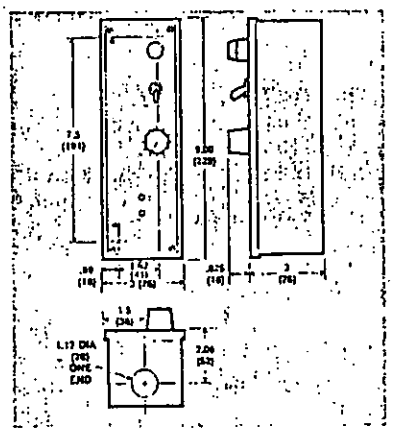


FIGURE 3. SERIES 2250 DIMENSIONS

TABLE 5. TROUBLESHOOTING

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
1. Controller fuse blows when AC input power is applied to the controller	Wiring faulty, incorrect or grounded	Check all external wiring terminating in the controller.
	Motor shunt field shorted or grounded	Repair or replace motor.
	Components shorted	Check Diodes D12, D13, D14, and D15. Varistor RV1, and SCR's SCR1 and SCR2. Replace shorted components or the circuit board.
2. Controller fuse blows when ON/OFF switch is placed in ON position	Motor armature shorted or grounded	Repair or replace motor.
	Shorted SCR SCR1 or SCR2, or circuit board failure	Replace circuit board or shorted SCR.
3. Controller fuse blows while motor is running	Loose or corroded connection, or wiring faulty, incorrect or grounded	Check all terminal connections and wiring between the line, controller, and motor.
	Motor overloaded	Check motor armature current. If current exceeds controller rating, check for a mechanical overload or faulty motor. Also check shunt field current. Low shunt field current causes excessive armature current.
	Circuit board failure	Replace circuit board.
4. Controller fuse blows when motor speed is decreased	Low line voltage	Increase line voltage to rated, -0 to +10%.
	Maximum speed set too high	See "Adjustment Instructions," note 2.
5. Motor does not rotate	Wiring faulty, incorrect, or grounded	Check all external wiring terminating in the controller.
	Controller not reset	Place POWER ON/OFF switch in OFF position, then in ON position.
	Too many calibration shunt wires removed	See Table 4 and Figure 2.
	CUR LIMIT pot(s) turned fully counterclockwise	See "Adjustment Instructions," step 1.
6. Motor does not reach base speed	Low line voltage	Check for rated line voltage, -0 to +10%.
	Motor overloaded	See Indication 3.
	MAX SPD pot misadjusted	See "Adjustment Instructions," step 3.
	Circuit board failure	Replace circuit board.
7. Unstable speed, inadequate regulation, or low torque	Wrong shunt wire(s) removed	See Table 4 and Figure 2.
	Motor faulty	Check motor commutator and brushes. Refer to motor manufacturer's instructions.
	IR COMP and/or CUR LIMIT pot(s) misadjusted	See "Adjustment Instructions."
	Circuit board failure	Replace circuit board.

TABLE 6. PARTS LIST

PART	FINCOR PART NUMBER		PART	FINCOR PART NUMBER	
	Model 2251	Model 2252		Model 2251	Model 2252
Circuit Board	1042350 01	1042350 02	Knob, MOTOR SPEED Pot	3014081	3014081
Diodes, Shunt Field (D12-D15)	3303157	3303157	Pot, MOTOR SPEED	3620001	3620001
			SCR (SCR1, SCR2)	3302187	3302188
Fuse (F1), 12A 250V	3002221	3002221	Switch, POWER ON/OFF (S1)	3004003	3004003
Fuse Holder	3204006	3204006	Varistor (RV1)	3318070	3318071

FINCOR®

IMO

Imo Corporation

3750 East Market Street
York, PA 17402

10. To stop the motor, either turn the MOTOR SPEED pot to zero for regenerative braking, or place the POWER ON/OFF switch in OFF position, thereby allowing the motor to coast to a stop.

    NOTE: Whenever the AC input power to Terminals 3 and 4 is interrupted (turned-off), the controller must be reset when the AC power is restored by placing the POWER ON/OFF switch in OFF position, then in ON position, thereby preventing accidental restarting.

MAINTENANCE

Maintenance consists of keeping the controller clean and dry. Refer to maintenance instructions supplied by the motor manufacturer.

A fuse is located on the front cover. If the motor doesn't rotate, turn-off the AC input power and check the fuse. Remove the fuse by unscrewing the plastic fuse holder cap. If the fuse is blown, replace it with an exact replacement.

CAUTION SUBSTITUTE FUSES CAN CAUSE CONTROLLER DAMAGE.

If the replacement fuse blows, turn-off the AC input power and refer to Table 5. Most controller failures are caused by incorrect connections, overload, or the accumulation of dirt, dust, or moisture. If motor operation becomes faulty, proceed as follows:

WARNING BE SURE THE AC INPUT POWER IS TURNED-OFF BEFORE WORKING ON THE CONTROLLER.
High voltage within the controller can cause electric shock resulting in personal injury or loss of life.

1. Check for: a. Blown fuse. b. Loose or missing terminal screws. c. Unattached wires. d. Charred, darkened, or punctured components and wires.
2. If the MOTOR SPEED pot feels rough or stiff when rotated, an open or shorted pot is indicated.
3. Measure the AC input voltage to the controller on Terminals 3 and 4, and compare with controller rating.

ADJUSTMENT INSTRUCTIONS

The controller is factory tested and adjusted with a motor under simulated operating conditions. Therefore, with the possible exception of maximum speed, internal readjustments are not normally necessary. If the internal pots are changed from the factory settings, or to change the operating characteristics of the controller, the following adjustments can be made:

1. Turn the CUR LIMIT FWD and CUR LIMIT REV pots fully clockwise. If a lower limit of current is required, these pots can be readjusted to limit armature current to as low as 50% of rated.
2. If motor speed is unstable, turn the IR COMP pot counterclockwise until speed stabilizes.

   NOTE: If IR COMP pot is turned too far counterclockwise, top speed will be reduced.
3. Turn the MAX SPD pot to obtain motor base speed or less when the MOTOR SPEED pot is set at 100 on its dial.

CAUTION DO NOT EXCEED MOTOR BASE SPEED. Overspeed may cause controller damage.

NOTES: 1. Line voltage less than rated may prevent the motor from attaining rated base speed when operating with full load.

2. If maximum speed is set too high and line voltage is less than rated, the controller fuse may blow when motor speed is decreased rapidly. If this occurs, perform either one of the following:
   a. Decrease maximum speed with the MAX SPD pot to equal the percentage that the line voltage is below rated. For example, if the line voltage is 10% below rated, decrease maximum speed by 10%. In this case, if the motor base speed is rated at 1750 RPM, set maximum speed at or below 1575 RPM.
   b. Increase line voltage with an autotransformer to equal the controller rating (-0, +10%).

CAUTION CONTINUAL FUSE BLOWING CAN CAUSE CONTROLLER DAMAGE.

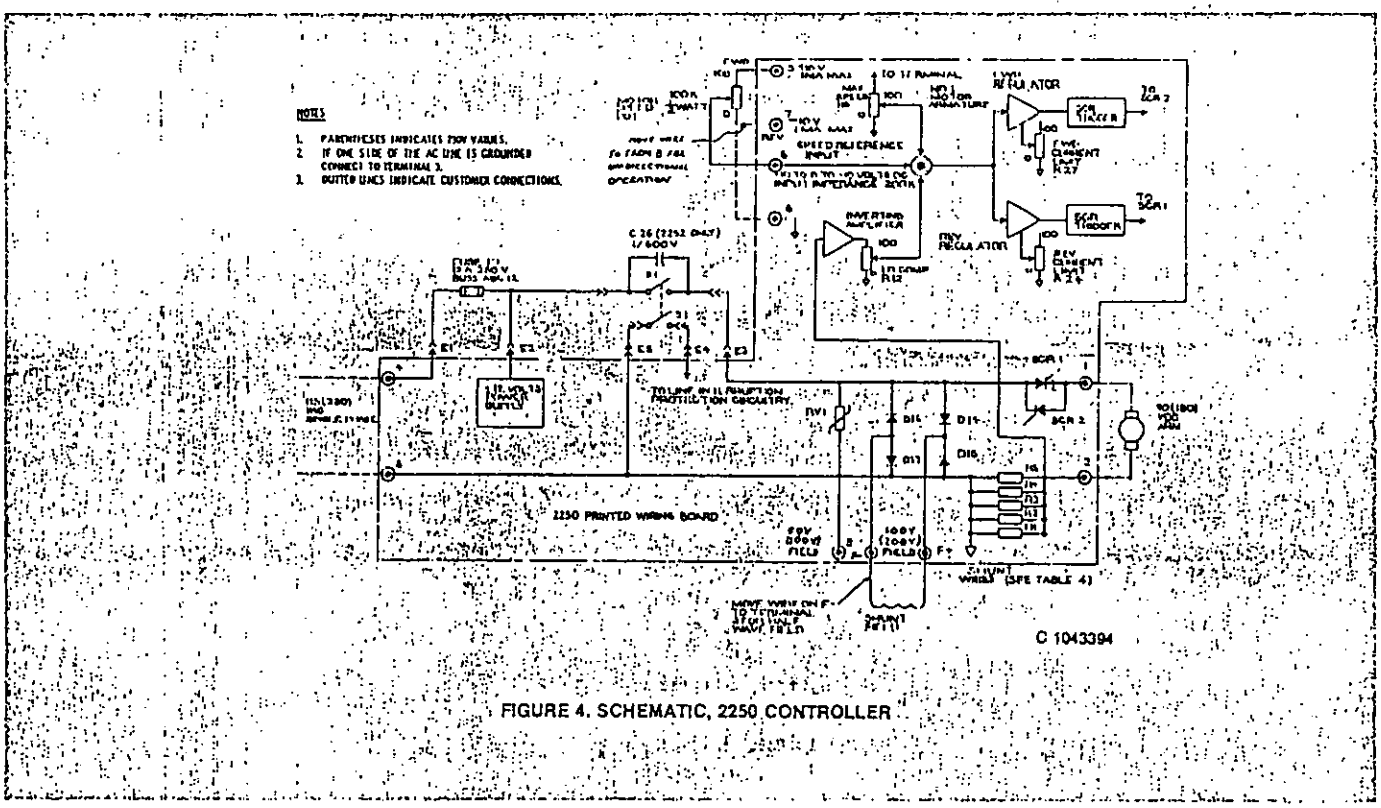


FIGURE 4. SCHEMATIC, 2250 CONTROLLER

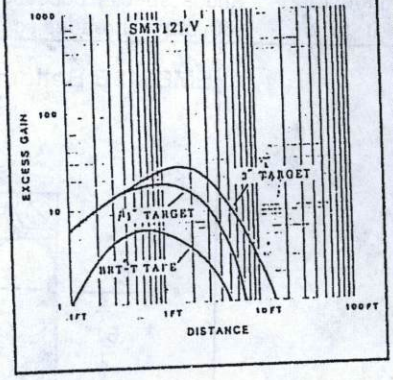
MINI-BEAM™ SM312LV SELF-CONTAINED DC RETROREFLECTIVE SENSOR

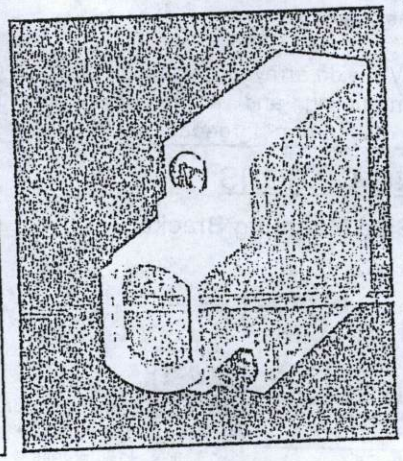
the photoelectric specialist

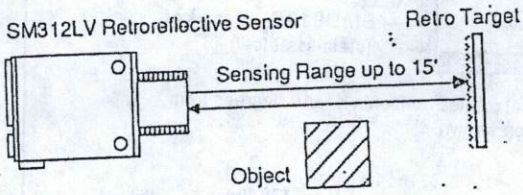
FEATURES

- Retroreflective sensor with range to 15' (used with 3" retroreflector)
- Physically and electrically interchangeable with inductive proximity switches and 18-mm photoelectric switches
- Small effective beam (1/2" dia. at 1' distance from lens)
- Modulated visible red light beam for immunity to ambient light and ease of alignment
- Switch-selectable for light or dark operate
- Both sourcing *and* sinking outputs, short-circuit protected
- Low leakage current; low saturation voltage
- Includes Banner's *exclusive* "AID"™ alignment system
- 10 to 30 VDC operation; reverse polarity protected
- No false pulse on power-up
- Easy interfacing to programmable controllers
- 15-turn sensitivity adjustment
- Compact size: only 2.1" long x 1.2" high x .5" wide
- Rugged and epoxy-encapsulated: meets NEMA standards 1, 2, 3, 3S, 4, 4X, 12, and 13

Excess gain curve, model SM312LV







DESCRIPTION

The Banner MINI-BEAM™ series SM312LV is a self contained visible-light retroreflective sensor having a sensing range of 15 feet. Its small effective beam (1/2 inch dia. at 1 foot from the lens) makes it a good choice for sensing relatively small objects, and its visible red light beam makes it extremely easy to align.

SM312LV retroreflective sensors consist of an LED light source, a sensitive phototransistor, an alignment indicator, and a custom designed state-of-the-art CMOS integrated modulator/demodulator/amplifier circuit. Digital modulation/demodulation makes the SM312LV nearly immune to interference from ambient light. Alignment and system performance monitoring are greatly simplified by Banner's *exclusive* "AID"™ alignment system (U.S. patent #4356393) which lights a conveniently located rear-panel LED whenever the sensor sees a "light" condition, with a superimposed pulse rate proportional to the received light signal strength. Two open-collector outputs are provided: a current sinking NPN output and a current sourcing PNP output, both rated at 150 ma. The SM312LV's low output leakage and saturation voltage make it ideal for interfacing to programmable controllers and other solid-state circuitry. The SM312LV also interfaces directly to DC loads of up to 150 ma., such as small relays. SM312LVs are electrically interchangeable with many existing photoelectrics and inductive proximity switches. They are fully protected against power supply polarity reversal, false pulse on power-up, continuous overload or short circuit of outputs, and inductive load transients. The SM312LV operates on 10 to 30 VDC at less than 25 ma., exclusive of load.

A convenient control on the back of the SM312LV allows a choice of *either* light or dark operate sensing mode. A rugged 15-turn slotted brass screw clutched GAIN control enables very precise adjustment of system sensitivity. The maximum sensing range of 15 feet will be attained when using the model BRT-3 3" corner-cube retroreflective target.

P/N 03364

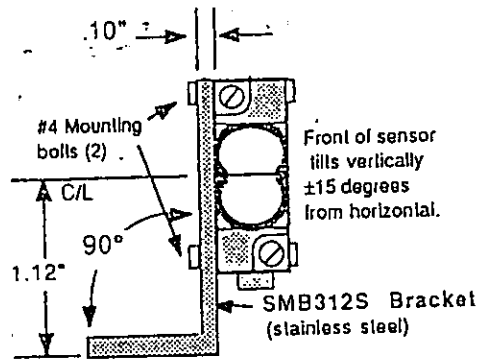
Printed in USA

The SM312LV is fully encapsulated and gasketed against moisture and other contaminants and conforms to NEMA standards 1, 2, 3, 3S, 4, 4X, 12, and 13. It is supplied with 6 feet of rugged, PVC-covered 4-conductor cable. Hardware is stainless steel.

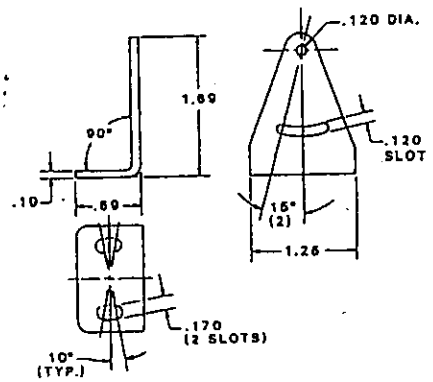
The SM312LV's wide array of mounting options is designed to simplify mounting and alignment in any industrial environment. Its 18-mm threaded barrel allows it to be physically interchanged with existing 18-mm barrel sensors and proximity switches. It may also be mounted using an adjustable, stainless steel side-mounting or bottom-mounting bracket (models SMB312S and SMB312B, respectively) which allows two axes of sensor movement and thus greatly simplifies alignment. Alternatively, the SM-312LV can be custom-mounted via its built-in mounting peg and a special accessory mounting foot (model SMB312F) with brass-threaded screw insert.

MOUNTING OPTIONS

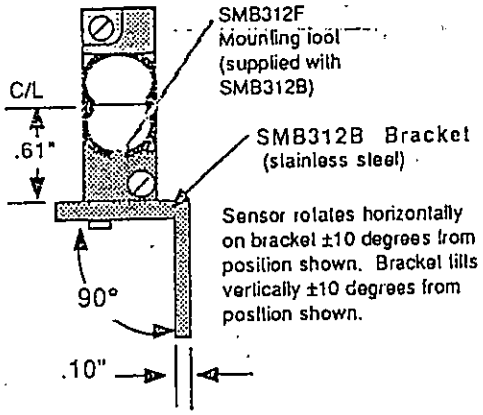
SMB312S Side Mounting Bracket

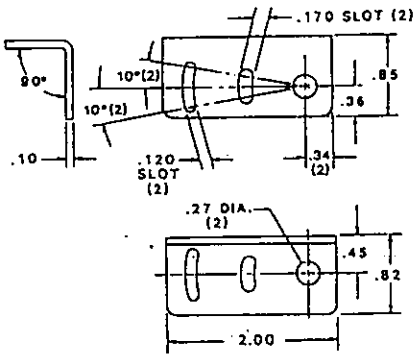


Bracket rotates horizontally ±10 degrees from position shown.

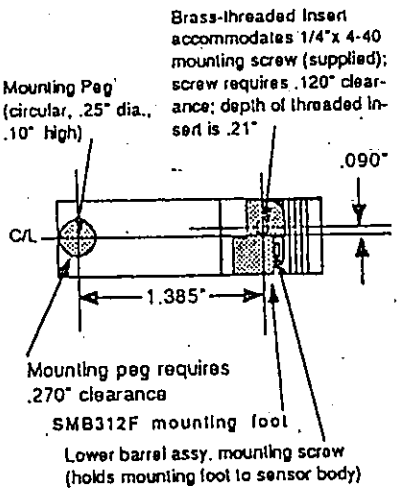


SMB312B Bottom Mounting Bracket

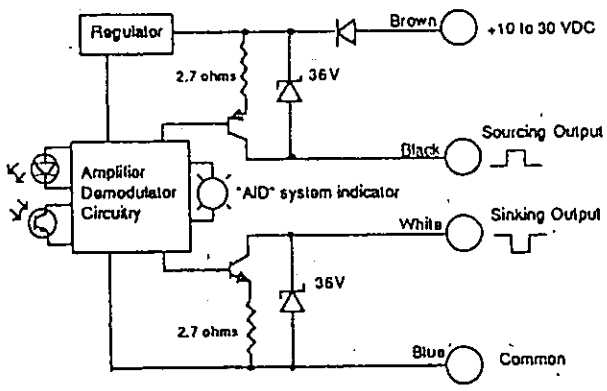




SMB312F Mounting Foot (bottom view):

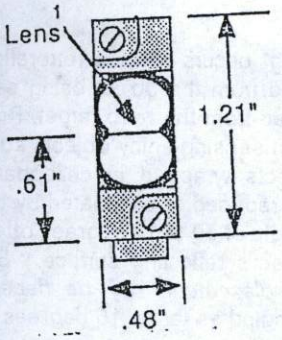


FUNCTIONAL DIAGRAM, SM312LV

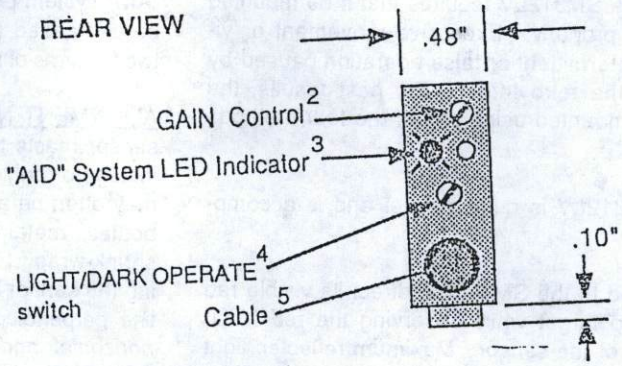


IMENSION DRAWINGS

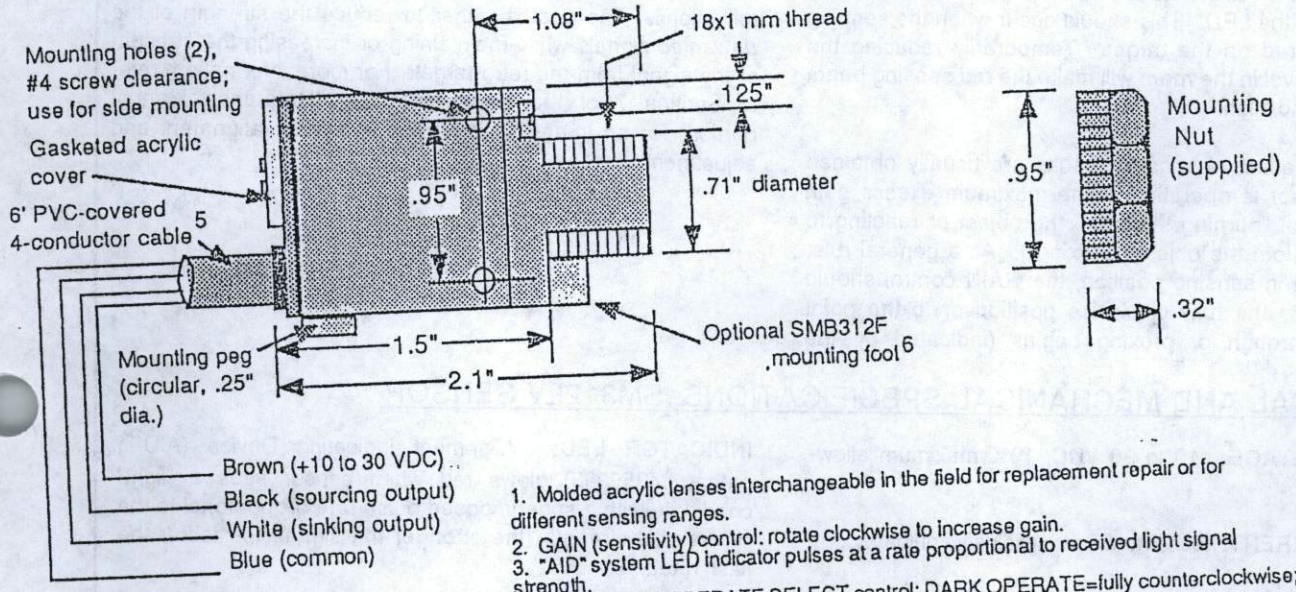
NT VIEW



REAR VIEW



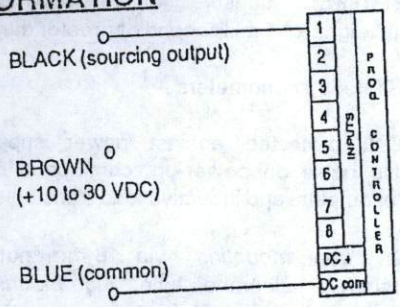
SIDE VIEW



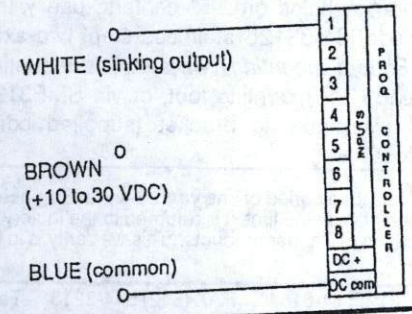
1. Molded acrylic lenses interchangeable in the field for replacement repair or for different sensing ranges.
2. GAIN (sensitivity) control: rotate clockwise to increase gain.
3. "AID" system LED indicator pulses at a rate proportional to received light signal strength.
4. LIGHT/DARK OPERATE SELECT control: DARK OPERATE=fully counterclockwise; LIGHT OPERATE=fully clockwise
5. 6' PVC-jacketed 4-wire cable supplied.
6. Optional SMB312F mounting foot used for bottom mounting of sensor with or without SMB312B Bottom Mounting Bracket. Mounts at front of sensor body beneath barrel. Supplied with SMB312B bracket order, or order separately.

HOOKUP INFORMATION

TO PROGRAMMABLE CONTROLLER REQUIRING CURRENT SOURCE

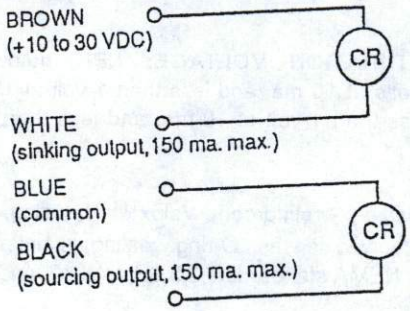


TO PROGRAMMABLE CONTROLLER REQUIRING CURRENT SINK

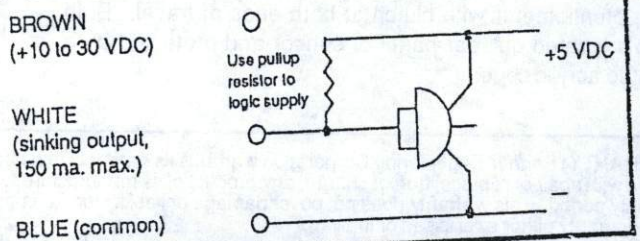


TO DC RELAY

Either sourcing or sinking output (or both) may be used



TO TTL LOGIC



INSTALLATION AND ALIGNMENT

Proper operation of the SM312LV requires that it be mounted securely and aligned properly. Excessive movement or vibration can result in intermittent or false operation caused by loss of alignment to the retro target. For best results, the SM312LV should be mounted using one of the four methods described on page 2.

Alignment of the SM312LV is quite simple, and is accomplished as follows:

1) With power applied to the SM312LV, direct its visible red light beam at its retro target while observing the red "AID" indicator on the back of the sensor. Maximum reflected light and optimum sensor alignment to the target are indicated by adjusting alignment for the fastest LED pulse rate that is obtainable with the GAIN control set at the lowest setting needed to light the LED. This should occur when the sensing beam is centered on the target. Temporarily reducing the ambient light level in the room will make the red sensing beam easier to see and align.

2) Best retroreflective sensing results are usually obtained when the sensor is operating at the maximum excess gain possible without "burning through" the object or reacting to light reflected from the object ("proxing"). As a general rule, with the object in sensing position, the GAIN control should be advanced to the fully clockwise position or to the point where burn through or proxing begins (indicated by the "AID" system LED coming on). From that point, GAIN should be decreased (turn control in counterclockwise direction) by two full turns of the 15-turn pot.

ALIGNMENT NOTE: "Proxing" occurs when a retroreflective sensor reacts to light reflected from the object being sensed instead of only to light reflected from the retro target. Proxing may often be a problem when sensing shiny objects such as bottles, metal cans, or objects wrapped in cellophane or shrink-wrap. Proxing can be reduced or eliminated by directing the sensor beam at an angle of 10 to 15 degrees off of the line perpendicular to the object's reflecting surface. *Both a horizontal and a vertical displacement may be necessary.* The sensing beam may be angled as far as 15 degrees away from "straight-on" to the reflector without compromising efficiency. It is not usually necessary to do away with *all* reflections. The goal is rather to reduce the strength of the *unwanted* signals while maintaining or increasing the strength of the signal from the retro target. For more information, refer to Section 7 of the Banner Catalog (Reference Manual portion) for an in-depth discussion of sensor alignment and adjustment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS, SM312LV SENSOR

SUPPLY VOLTAGE: 10 to 30 VDC, 10% maximum allowable ripple.

SUPPLY CURRENT: less than 25 ma. exclusive of load.

OUTPUT TYPE: one current sourcing (PNP) and one current sinking (NPN) open-collector transistor.

OUTPUT RATING: 150 ma. maximum, each output.

OUTPUT LEAKAGE: less than 1 microamp in the off-state.

OUTPUT SATURATION VOLTAGE: NPN output less than 200 millivolts at 10 ma. and less than 1 volt at 150 ma.; PNP output less than 1 volt at 10 ma. and less than 2 volts at 150 ma.

CONSTRUCTION: reinforced Valox™ housing, totally encapsulated, acrylic lenses, O-ring sealing, stainless steel screws. Meets NEMA standards 1,2,3,3S,4,4X,12, and 13.

ADJUSTMENTS: "light" or "dark" operate select switch, and 15-turn slotted brass screw GAIN (sensitivity) adjustment potentiometer with clutch at both ends of travel. Both controls located on rear panel of sensor and protected by a gasketed acrylic cover.

INDICATOR LED: Alignment Indicating Device (AID™, patent #4356393) glows red when sensor sees a "light" condition, with a superimposed pulse rate proportional to the light signal strength (the stronger the signal, the faster the flash rate).

TEMPERATURE RANGE: -20 to +70 degrees C (-4 to +158 degrees F).

CABLE LENGTH AND MATERIAL: PVC jacketed 4-conductor cable, 6' long.

RESPONSE TIME: sensors will respond to either a "light" or "dark" signal of 1 millisecond or greater duration.

WAVELENGTH: 650 nanometers.

PROTECTION: protected against power supply polarity reversal, false pulse on power-up, continuous overload or short-circuit of outputs, and inductive load transients.

MOUNTING: *front mounting* via 18-mm nut (supplied) through 18-mm (.71") clearance hole. *Side mounting* via two No. 4 clearance holes on .95" centers; use with or without optional model SMB312S stainless steel two-axis mounting bracket. *Bottom mounting* via sensor's mounting peg and optional SMB312F mounting foot, or via SMB312B stainless steel two-axis mounting bracket (supplied complete with mounting foot).

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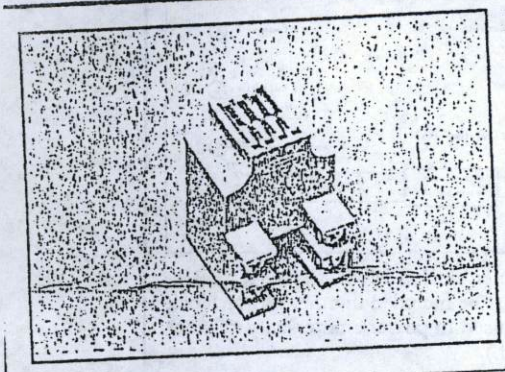
MULTI-BEAM®

for MULTI-BEAM modular photoelectric sensors

3- and 4-wire AC Power Block Modules

the photoelectric specialist



MULTI-BEAM 3- and 4-wire AC power block modules provide regulated low voltage DC to power the scanner block module and logic module in MULTI-BEAM modular photoelectric sensors. They also contain a solid-state infinite-life switch (except in emitter-only scanner blocks) for switching external circuitry.

Connections are made to heavy-duty screw terminals which accept up to #14 gauge wire (no lugs are necessary). All power blocks are epoxy-encapsulated and rated for -40 to +70 degrees C (-40 to +158 degrees F). Response times are determined by the scanner block used.

All 3- and 4-wire AC power block modules are color-coded red.

AC Models *Connections* *Functional Schematic*

PBA

Ⓤ Listed Ⓒ Certified

Input: 105 to 130V ac, 50/60Hz.

PBB

Ⓤ Listed Ⓒ Certified

Input: 210 to 250V ac, 50/60Hz.

PBD

Input: 22 to 28V ac, 50/60Hz.

PBD-2

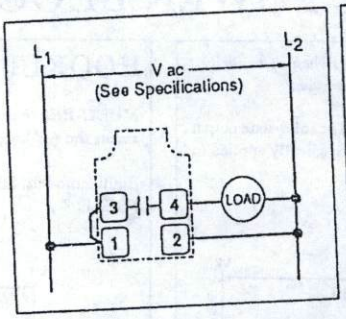
Ⓤ Listed Ⓒ Certified

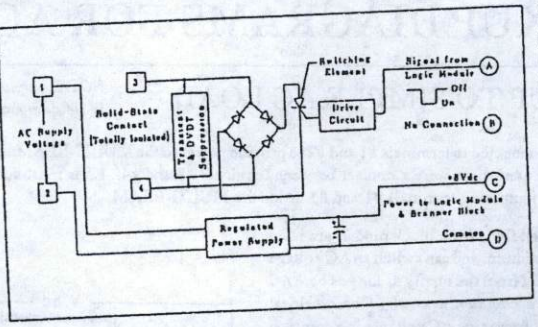
Input: 11 to 13V ac, 50/60Hz.

Output: SPST solid-state switch for AC, 3/4 amp maximum (derated to 1/2 amp at 70 degrees C). 10 amp maximum inrush for one second or 30 amps for one ac cycle (non-repeating).

On-state voltage drop of less than 2.5V ac at full load.

Off-state leakage current less than 100 microamps.





These power blocks are the most commonly used for ac operation. As the typical hookup shows, they are intended to switch the same ac voltage as is used to power the MULTI-BEAM sensor. However, the output of all four blocks is rated for 250V ac maximum, and is able to switch a voltage which is different than the supply as long *as both ac circuits share a common neutral*. For example, a PBA could switch a 24V ac door chime, etc. Observe local codes when mixing ac voltages in a wiring chamber. These blocks are designed to handle the inrush current of ac inductive loads like motor starters and solenoids. The "holding current" specification of any inductive load should not exceed the 750mA output rating. There is no minimum load requirement. These power blocks will interface directly to all AC programmable controller inputs. All contain built-in transient suppression to prevent false turn-on or damage from inductive loads and line "spikes". Outputs of multiple power blocks may be wired in series or parallel for "AND" and "OR" logic functions.

PBAT

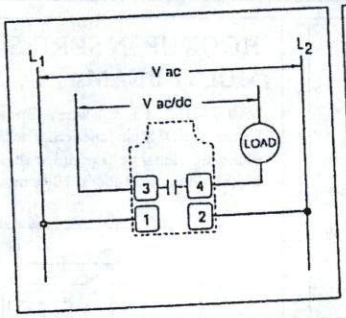
Ⓤ Listed Ⓒ Certified

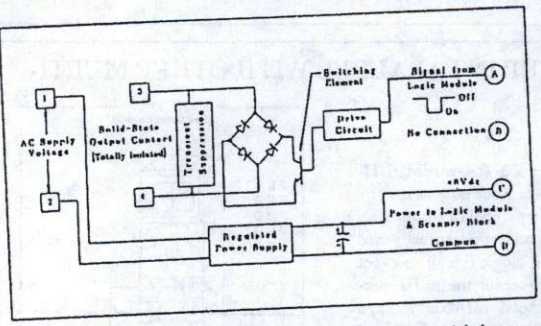
Input: 105 to 130V ac, 50/60Hz.
Output: SPST isolated solid-state switch; 100mA maximum (no inrush capacity), 200V dc max., 140V ac max.
On-state voltage drop of less than 3 volts at full load.
Off-state leakage current less than 100 microamps.

PBBT

Ⓤ Listed Ⓒ Certified

Input: 210 to 250V ac, 50/60Hz.
Output: SPST isolated solid-state switch; 100mA maximum (no inrush capacity), 350V dc max., 250V ac max.
On-state voltage drop of less than 3 volts at full load.
Off-state leakage current less than 100 microamps.





Power block models PBAT and PBBT have an isolated solid-state output switch which may be used to switch either ac or dc. The switch is rated at 100mA maximum, and there is no capacity for inrush. As a result, these power blocks usually should not be used to switch ac inductive loads. However, 100mA is enough capacity to switch many inductive *dc* loads like small relays and solenoids.

Models PBAT and PBBT interface directly to all ac programmable controller inputs. NOTE: since the saturation voltage of these power blocks is typically greater than 1 volt, they should *not* be used to interface 5V dc logic circuits like TTL. Instead, use special order power block model PBOL or PBOBL.

P/N 03501

Printed in USA

-MULTI-BEAM 3- & 4-wire AC power blocks

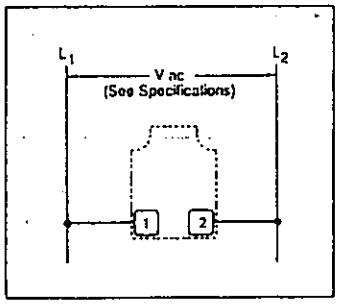
AC Models *Connections* *Functional Schematics*

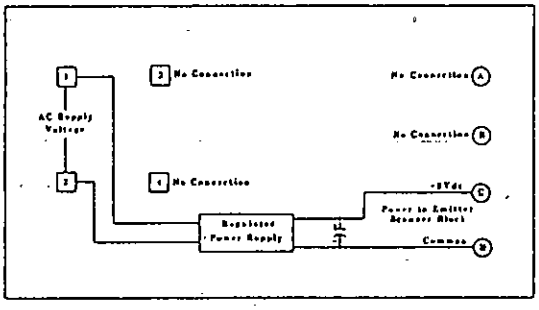
These are power blocks for emitter scanner blocks only (models SBE, SBED, SBEX, SBEV, SBEXD, SBEF, SBEXF). Emitter assemblies do not require logic modules.

PBA-1 Ⓤ Listed Ⓒ Certified
Input: 105 to 130V ac, 50/60Hz.

PBB-1 Ⓤ Listed Ⓒ Certified
Input: 210 to 250V ac, 50/60Hz.

PBD-1
Input: 22 to 28V ac, 50/60Hz.





These power blocks are used to power emitter-only scanner blocks. Models PBA-1, PBB-1, and PBD-1 save the cost of the output circuitry that must be included in other power block models. (These other power blocks may, however, be used to power emitter-only scanner blocks, with the output switching circuitry going unused.)

HOOKUP DIAGRAMS FOR AC POWER BLOCKS

HOOKUP TO SIMPLE AC LOAD

NOTE: output switching capacity is 3/4 amp maximum.

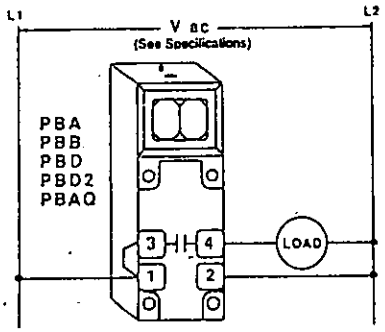
AC voltage is connected to terminals #1 and #2 to provide power to the MULTI-BEAM. The solid-state output switch behaves as if there were a contact between terminals #3 and #4. L1 is most conveniently applied to terminal #3 by jumpering terminals #1 and #3 inside the MULTI-BEAM.

The outputs of all five power block models are rated for 250V ac maximum, and can switch an AC voltage which is different from the supply *as long as both AC circuits share a common neutral.* Observe local wiring codes when mixing AC voltages in a common wiring chamber.

Since the output switch is a solid-state device, contact continuity cannot be checked by means of an ohmeter, continuity tester, etc. To check the functioning of the output switch, a load must be installed and tested along with the MULTI-BEAM.

CAUTION: the output switch could be destroyed if the load becomes a short circuit (i.e., if L1 and L2 are connected directly across terminals #3 and #4).

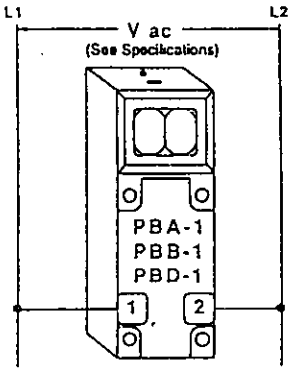
NOTE: this hookup depicts the output switch as a normally open contact. *Model PBAQ actually has a normally closed output switch.*



HOOKUP OF AC EMITTER

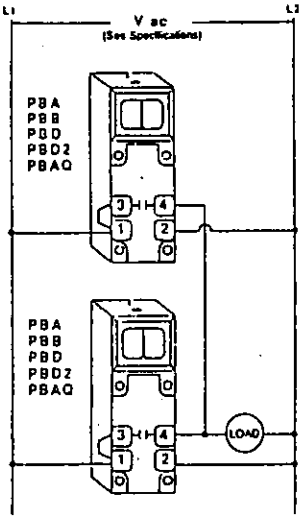
MULTI-BEAM emitter-only AC power blocks connect directly across the AC line; as shown.

Emitter models: SBE, SBED, SBEX, SBEV, SBEXD, SBEF, & SBEXF.



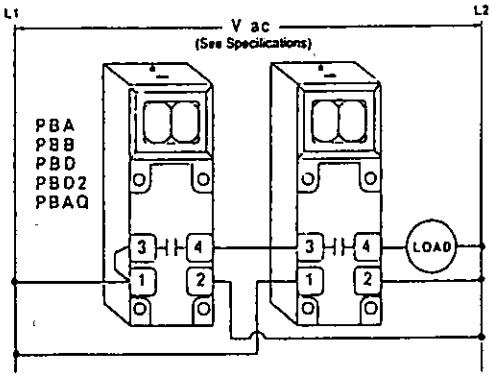
HOOKUP IN PARALLEL WITH OTHER MULTI-BEAMs

Any number of 3- & 4-wire MULTI-BEAM power block outputs may be connected in parallel to a load. Parallel sensor connection is usually used to yield "OR" logic (i.e., if an event occurs at any sensor, the load is energized). The total off-state leakage current through the load is the sum of the leakage current of the individual power blocks. However, the maximum leakage current of MULTI-BEAM 3- & 4-wire AC power blocks is only 100 microamps. As a result, installation of an artificial load resistor in parallel with the load is necessary only for large numbers of sensors wired in parallel to a light load.



HOOKUP IN SERIES WITH OTHER MULTI-BEAMs

MULTI-BEAM 3- & 4-wire AC power blocks may be wired in series with each other for the "AND" logic function. The total voltage drop across the series will be the sum of the individual voltage drops across each power block (approximately 3 volts per block). With most loads, 10 or more power blocks may be wired in series.

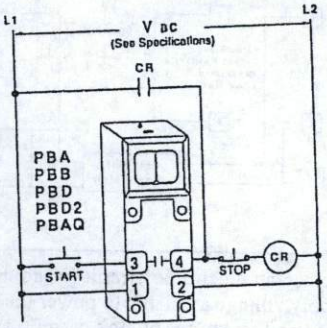


MULTI-BEAM 3- & 4-wire AC power blocks

OKUP DIAGRAMS FOR AC POWER BLOCKS (continued)

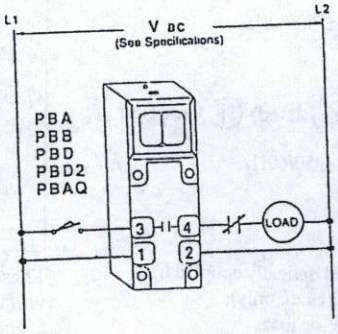
HOOKUP IN PARALLEL WITH CONTACTS OR SWITCHES

Any number of "hard" contacts may be wired in parallel with one or more MULTI-BEAM 3- & 4-wire power blocks. All models have less than 100 microamps (0.1 milliamp) of off-state leakage current. The load operates when either the contacts close or the MULTI-BEAM output is energized.



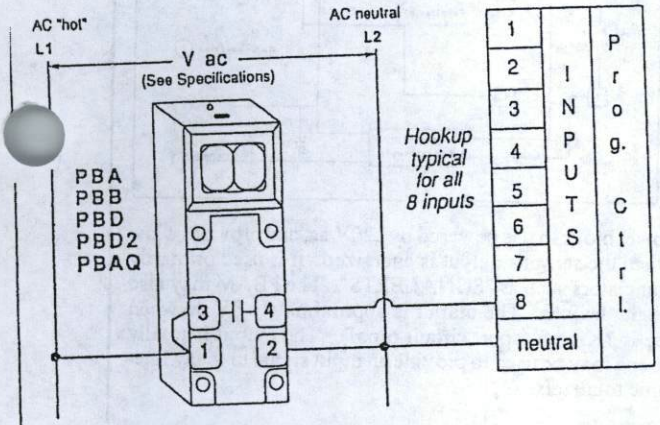
HOOKUP IN SERIES WITH CONTACTS OR SWITCHES

Terminals #3 and #4 of MULTI-BEAM 3- & 4-wire power blocks may be connected in series with one or more "hard" contacts. The load operates only when all contacts are closed and the MULTI-BEAM output is energized.

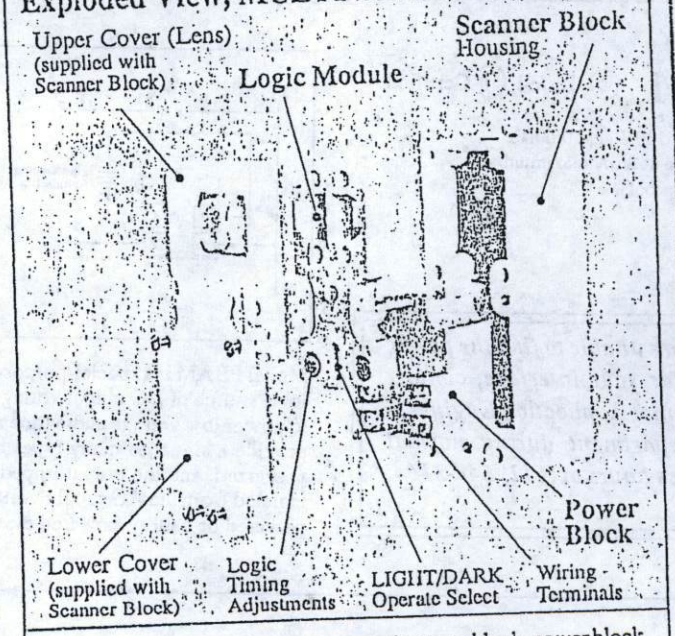


HOOKUP TO A PROGRAMMABLE LOGIC CONTROLLER (PLC)

Interfacing to a PLC I/O is direct with MULTI-BEAM 3- & 4-wire AC power blocks. All models have less than 100 microamps (0.1 milliamp) of off-state leakage current. If you have a question on hookup to a particular brand of PLC, contact the Banner Applications Department during normal business hours.



Exploded View, MULTI-BEAM Sensor

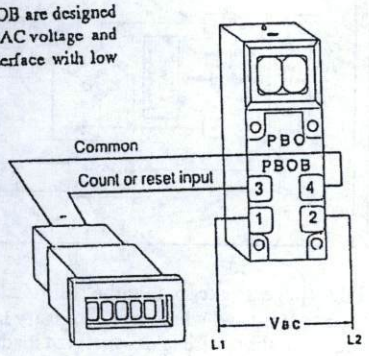


MULTI-BEAM modular components (scanner block, power block, and logic module) are all purchased separately. (Note: a scanner block consists of a scanner block housing, an upper cover assembly, and a lower cover).

HOOKUP TO COUNTER

Power block models PBO and PBOB are designed to power the MULTI-BEAM with AC voltage and to permit the sensor output to interface with low voltage DC circuits and devices.

A common situation involves inputing to battery-powered LCD totalizers, rate meters, etc. The output switch is the transistor of an optical coupler, which may be connected to switch DC common to the count input. Polarity must be observed.



Banner Engineering Corporation 9714 10th Avenue No., Minneapolis, Mn. 55441 Telephone: (612) 544-3164 FAX (applications): (612) 544-3573

MULTI-BEAM 3- & 4-wire AC power blocks

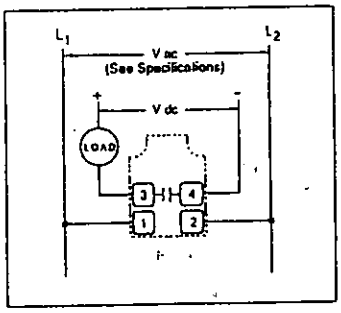
AC Models *Connections* *Functional Schematics*

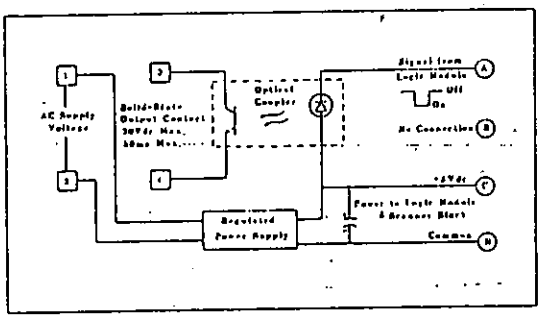
PBO Ⓤ Listed Ⓒ Certified

Input: 105 to 130V ac, 50/60Hz.

PBOB Ⓤ Listed Ⓒ Certified

Input: 210 to 250V ac, 50/60Hz.





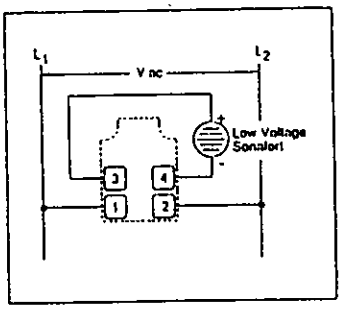
Output: SPST isolated optically coupled transistor switch (will switch dc only):
50mA maximum, 30V dc max.
On-state saturation voltage less than 1 volt at 2mA, less than 1.3mA at 50mA.
Off-state leakage current less than 10 microamps.

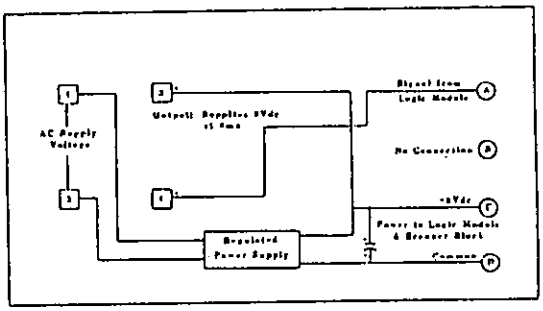
These power blocks are designed to interface an electronic circuit (or control) at a low DC voltage level, but where there is no DC supply voltage available to power the MULTI-BEAM. Since the output is isolated it may be wired to either source or sink current, and multiple units may be wired in either series or parallel. The output of model PBO or PBOB will directly interface Banner component system logic modules. NOTE: the 1-volt saturation prevents direct interfacing to 5-volt logic systems such as TTL. For these low-voltage interfaces, use instead special order model PBOL or PBOBL.

PBAM Ⓤ Listed Ⓒ Certified

Input: 105 to 130V ac, 50/60Hz.
Output: 8Vdc at 8mA maximum (short circuit proof).

If you are unable to find the power block for your interface, contact the Banner Application Engineering Department during normal business hours at (612) 544-3164.





Model PBAM is a special-purpose power block that is powered by 120V ac, and provides a low level source of DC output voltage when the sensor's output is energized. It is used primarily to power low voltage audio tone annunciators such as "SONALERTS". The PBAM may also provide a signal to many types of logic devices. The output is approximately 8V dc when energized, and the output impedance is 1K ohm (short circuit proof). The output is totally isolated from the AC supply voltage, and may be used to provide an input signal to many line-powered or battery-powered electronic totalizers.

PBAQ Ⓤ Listed Ⓒ Certified

Input: 105 to 130V ac, 50/60Hz.

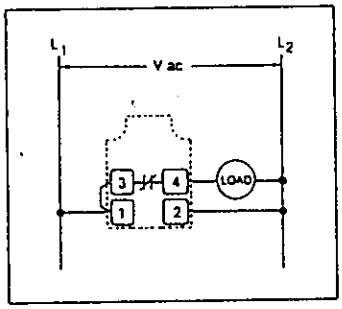
Output: SPST isolated solid-state switch; normally closed, 3/4 amp maximum (derated to 1/2 amp at 70 degrees C).

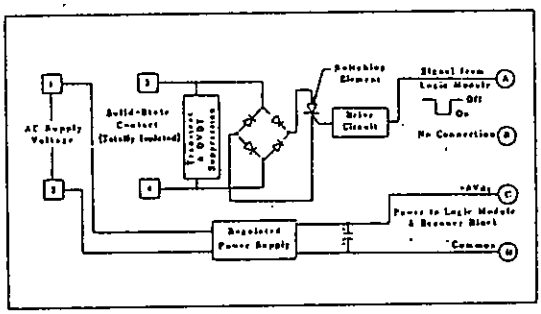
10 amp maximum inrush for one second or 30 amps for one ac cycle (non repeating).

On-state voltage drop of less than 2.5V ac at full load.

Off-state leakage current less than 100 microamps.

NOTE: the output of the PBAQ will not conduct when power is removed from terminal #1 or 2.





Model PBAQ is identical to model PBA (page 1) except that the solid-state output contact is normally closed instead of normally open. It is used where it is necessary to have the load de-energize when something is sensed (e.g.- one shot pulse to de-energize load). When no timing logic is involved, model LM3 can program any power block for normally open or normally closed operation via the light/dark operate jumper.

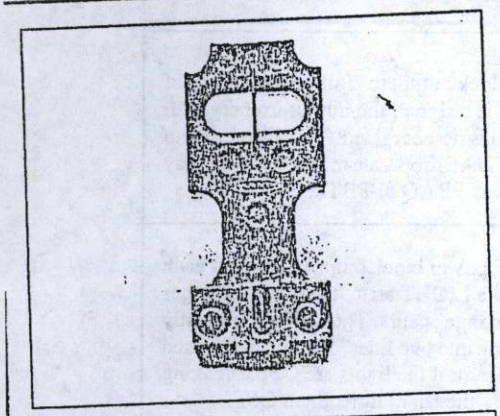
NOTE: model PBAQ is *not* compatible with logic module models LM5 and LM5-14. For normally closed on-delay logic, use PBA with LM5R and reverse the light/dark function.

MULTI-BEAM®

for MULTI-BEAM modular photoelectric sensors

- and 4-wire Logic Modules

the photoelectric specialist

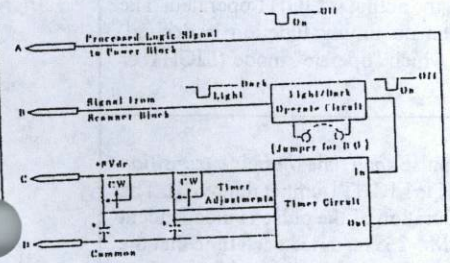


The logic module interconnects the power block and scanner block both electrically and mechanically using a unique blade-and-socket connector concept. It also provides the LIGHT/DARK operate function (except in the LM1) and the timing functions, all of which are fully adjustable.

The photo (left) shows a typical logic module for 3- or 4-wire operation. Note that all 3- & 4-wire logic modules are color-coded red. The time ranges specified for the logic modules are standard time ranges. Other time ranges are available; see page 4 for information.

In the diagrams below, the "signal" represents the light condition (in LIGHT operate) or the DARK condition (in DARK operate), and the "output" represents the energized condition of the solid-state output switch (power block). "Delay" refers to the time delay before the output operates, and "hold" refers to the time that the output remains "on" after the event has occurred.

FUNCTIONAL SCHEMATIC



RESPONSE TIME: response time will be that for the scanner block plus power block (plus the programmed delay if the logic includes a delay function).

SPECIFICATIONS, 3- AND 4-WIRE LOGIC MODULES

CONSTRUCTION: molded Valox™ housing; electronic components epoxy encapsulated. Gold plated blade connectors.

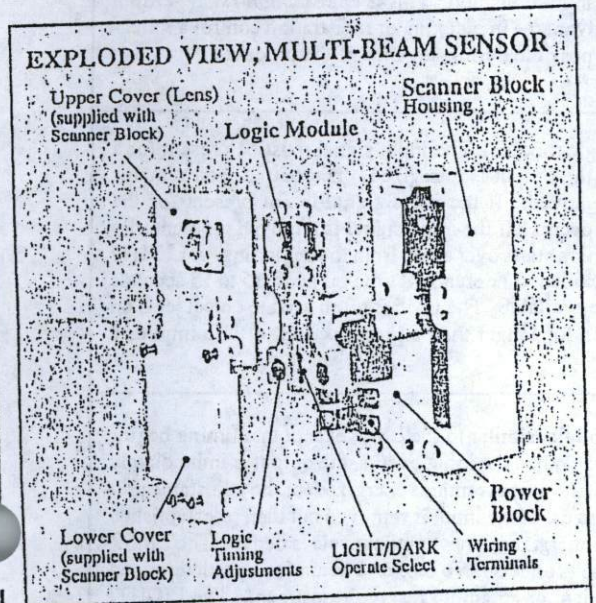
OPERATING TEMPERATURE: -40 to +70 degrees C (-40 to +158 degrees F).

TIMING ADJUSTMENT(S): one or two single turn potentiometers with slot for blade-type screwdriver adjustment. NOTE: when turning time adjustments fully clockwise or counterclockwise, avoid excessive torque to prevent damage to potentiometers.

TIMING REPEATABILITY: plus or minus 2% of maximum range under constant power supply and temperature conditions; plus or minus 5% of maximum range under all conditions of supply voltage and temperature.

TIMING RANGE: useful range is from maximum time down to 10% of maximum (e.g.- from 1 to 0.1 seconds, or from 15 to 1.5 seconds). When timing potentiometer is set fully counterclockwise, time will be approximately 1% of maximum.

EXPLODED VIEW, MULTI-BEAM SENSOR



A MULTI-BEAM sensor consists of a scanner block module, a logic module, and a power block module (all purchased separately).

Other Banner MULTI-BEAM Products:

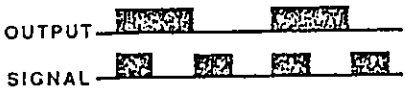
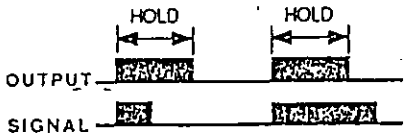
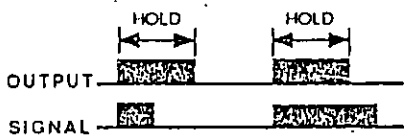
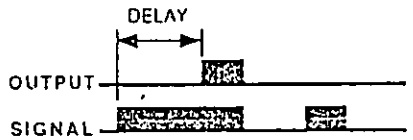
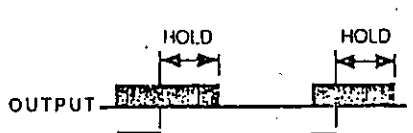
The MULTI-BEAM product family includes a comprehensive selection of 3- and 4-wire scanner block modules, logic modules, and power block modules to satisfy a large variety of sensing requirements. This modular design, with field-replaceable power block and logic module, permits over 5,000 sensor configurations, resulting in exactly the right sensor for any photoelectric application. The emitters of MULTI-BEAM emitter-receiver pairs do not require logic modules. Further information may be found in the Banner product catalog and in the following data sheets:

3- and 4-wire Scanner Blocks:	
Opposed mode	Data sheet P/N 03492
Diffuse mode	Data sheet P/N 03495
Retroreflective mode	Data sheet P/N 03493
Convergent mode	Data sheet P/N 03494
Fiberoptic mode	Data sheet P/N 03496
Ambient Light Receivers	Data sheet P/N 03497
3- and 4-wire AC Power Blocks:	Data sheet P/N 03501
3- and 4-wire DC Power Blocks:	Data sheet P/N 03499
3- and 4-wire Logic Modules:	This data sheet, P/N 03304

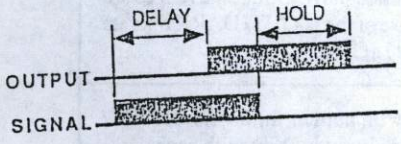
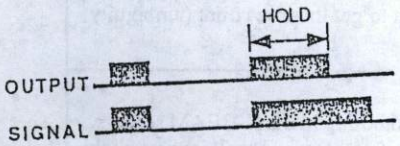
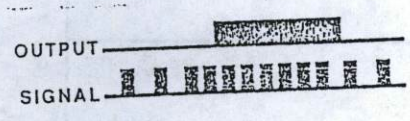
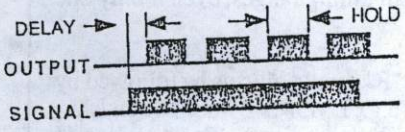
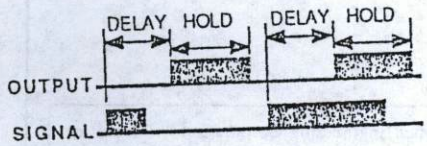
P/N 03304J8C

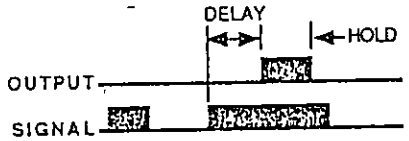
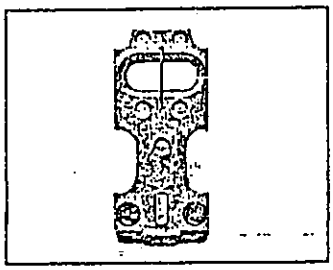
Printed in USA

MULTI-BEAM® 3- and 4-wire Logic Modules

Model and Function	*Description of Logic*
LM1 on-off  	LM1 is an on-off logic module that causes the power block output to "follow the action" of the scanner block: when the scanner block sees a LIGHT signal, the output is energized; when the scanner block sees a DARK signal, the output is de-energized. This is referred to as the LIGHT operate mode. If the application calls for DARK operate mode, the LM1 may be used with normally-closed type power blocks such as PBAQ or PBT2.
LM2 alternate action  	The LM2 provides "flip-flop" or toggling action of the power block output, such that each time the scanner block changes from a DARK state to a LIGHT state, the output changes state. The output remains in the last state until another change occurs. The LM2 is frequently used to operate a diverter gate that splits a production line into two lines. It may also be used to operate room lighting by breaking a photoelectric beam: if the lights are OFF, breaking the beam turns them ON; if the lights are ON, breaking the beam turns them OFF.
LM3 on-off  	The LM3 is an on-off logic module that has the ability to be programmed for either LIGHT operate or DARK operate. It comes with a jumper wire installed: with the jumper in place, the output is DARK operated; with the jumper removed, the output is LIGHT operated. The LM3 is the most commonly used logic module when no timing function is desired, particularly if it is not known at the time of ordering which "operate" mode (LIGHT or DARK) will be needed.
LM4-2 one-shot (retriggerable)  Setable time range: .1 to 1 second.	The LM4-2 provides a one-shot ("single shot") output pulse *each time there is a transition* from LIGHT to DARK (jumper installed) or from DARK to LIGHT (jumper removed). The output pulse time range is from .01 to 1 second. The duration of the pulse is independent of the duration of the input signal. The timing of the LM4-2 is restarted each time that the input signal is removed and then reapplied. This is referred to as a *retriggerable* one shot, and this feature may be applied to some rate sensing applications (use LM6-1 for true rate sensing).
LM4-2NR one-shot (non-retriggerable)  Setable time range: .1 to 1 second.	The LM4-2NR provides a one-shot ("single shot") output pulse each time there is a transition from LIGHT to DARK (jumper installed) or from DARK to LIGHT (jumper removed). The output pulse time range is from .01 to 1 second. The duration of the pulse is independent of the duration of the input signal. The output pulse of the LM4-2NR must complete before it recognizes another input transition. This is called a *non-retriggerable* one shot, which sometimes offers an advantage in indexing or registration control applications where multiple input signals are possible during advance of the product.
LM5 on-delay  Setable time range: 1.5 to 15 seconds.	The LM5 is a true "on-delay" type logic module. The input signal must be present for a predetermined length of time before the output is energized. The output then remains energized until the input signal is removed. If the input signal is not present for the predetermined time period, no output occurs. If the input signal is removed momentarily and then reestablished, the timing function starts over again from the beginning. A LIGHT/DARK operate selection jumper is included. The standard time range is .15 to 15 seconds (field adjustable), and other ranges are available. The LM5 is often used to detect jams on a conveyor line, where a beam broken for longer than a preset period of time implies a product jammed in the light beam.
LM5R off-delay  Setable time range: 1.5 to 15 seconds.	The LM5R is an "off-delay" logic module, similar to the LM5, except that timing begins on the *trailing* edge of the input signal. When the input occurs, the output is immediately energized; if the input is then removed, the output remains energized for the adjustable predetermined time period, then de-energizes. If the input is removed but then re-established while the timing is holding the output energized, a new output cycle is begun. The LM5R might typically be used to tell when no products have broken a beam for a predetermined length of time, therefore indicating a jam or an empty reservoir upstream. The LIGHT/DARK operate jumper wire is included. Timing range is .15 to 15 seconds, and optional ranges are available.

MULTI-BEAM® 3- and 4-wire Logic Modules

Model and Function	*Description of Logic*
LM5-14 on- & off-delay  Setable time range: 1.5 to 15 seconds.	The LM5-14 combines the function of an "on-delay" and an "off-delay" into one logic module. When the signal is present for more than the on-delay time, the output energizes. The off-delay circuit is now active, and holds the output on even if the input signal disappears for short periods of time. If the input signal is gone for longer than the off-delay time, the output finally drops out. The most common use for the LM5-14 is to control fill level, for example in a bin: when the bin is full, a beam is broken, and a predetermined time later, the flow is stopped. After the level has fallen below the beam for a time, the flow is restarted. The time delays control the high and low levels. Each delay is independently adjustable for .15 to 15 seconds.
LM5T limit timer  Setable time range: 1.5 to 15 seconds.	The LM5T "limit" timer combines the function of on-off logic and on-delay logic. As long as the signal is present for only short periods of time, the output "follows" the action of the input signal. If the input signal is present for longer than the predetermined time, the output deenergizes. The output only reenergizes when the input signal is removed and then reestablished. Interval timers are used to operate loads which must not run continuously for long periods of time, such as intermittent duty solenoids and conveyor motors. The LM5T may be used to run a supermarket checkout conveyor, always bringing the product up to the scanner beam and then stopping the motor. When the last item is removed, the motor times out and stops. Timing range is .15 to 15 seconds.
LM6-1 rate sensor  Setable rate: 60 to 1200 pulses per minute.	The LM6-1 is a true overspeed or underspeed sensing logic module that monitors signals from a scanner block and continuously calculates the time between input signals, and compares that time with the reference set by the "HOLD" potentiometer. A jumper allows the mode to be changed from *overspeed* (jumper installed) to *underspeed* (jumper removed). In the overspeed mode, the output will drop if the preset rate is exceeded. In the underspeed mode, the output remains energized until the input rate drops below the preset. The output will not "pulse" at low speeds, as retriggerable one-shots do. A "DELAY" adjustment allows the LM6-1 to ignore data for the first several seconds after power is applied, to permit the rate to accelerate to operating speed without false underspeed outputs. The sensing rate may be adjusted from 60 to 1200 pulses per minute (.05 to 1.0 second per pulse), and the power-up inhibit from 1 to 15 seconds.
LM8 repeat cycler  Setable time range: 1.5 to 15 seconds.	The LM8 is a repeat cycle timing module with independently adjustable delay and hold times. When an input signal is received from the scanner block, a delay period begins during which there is no output. If the signal remains, the delay period is followed by a hold period, during which the output is energized. If the signal still remains, the hold period times out, releasing the output and starting a new delay period. This sequence continues indefinitely until the input signal is removed. The LM8 is used in edgeguide and other registration control schemes where it is desired to "pulse" the correction motor to avoid overcorrection that might occur with a continuous output. Both time ranges are independently adjustable from .15 to 15 seconds. NOTE: use of the LIGHT/DARK operate jumper is reversed: remove for DARK, leave in place for LIGHT.
LM8-1 delayed one-shot  Setable time range: 1.5 to 15 seconds.	The LM8-1 is a delayed one-shot that functions very much like two individual one-shots, with the end of the first initiating the second. When an input signal occurs, a delay period is initiated, during which time the output is not energized. After the delay, the output is energized for the hold period, then deenergized. No further action takes place unless the signal is removed and then reestablished. This sequence is independent of the duration of the input signal. The LM8-1 is frequently used to sense a product, and then act on that product a short time later when it is clear of the inspection station. An example might be to inspect cartons for open flaps, and to eject the faulty cartons when they have completely passed the inspection point. Both time ranges are adjustable from .15 to 15 seconds.

Model and Function	*Description of Logic*
LM8A on-delay one-shot  Setable time range: 1.5 to 15 seconds.	The LM8A differs slightly from the LM8-1. It too incorporates both a delay and a hold time, except that the delay is a true on-delay. If the input signal does not last for the total duration of the delay time, no output action ever occurs (with the LM8-1, even a momentary signal generates one complete cycle of timing). If the delay time passes, the one-shot output occurs, regardless of what happens to the input signal. Removing the input signal and reapplying it begins a new cycle. The LM8A is used to eject a part that has remained in the sensor beam longer than the delay time (for instance, a jammed part). Both time ranges are independently adjustable from .15 to 15 seconds. NOTE: use of the LIGHT/DARK operate jumper is reversed: remove for DARK, leave in place for LIGHT.
LM10 +10 counter  	The LM10 is a fixed-count divide-by-ten logic module, with neither timing nor LIGHT/DARK operate functions. When power is first applied, the output is OFF; with each dark-to-light transition, the LM10 enters one count in its memory. After five counts, the output is energized, and it remains energized until the tenth count. It then deenergizes, and the sequence continues. The LM10 is intended for product counting applications using programmable logic controllers or computers, where the scan time of the input section of the controller is too slow to permit "catching" high speed count rates. It may also be used with electromechanical totalizers, which suffer from this same slow response. In operation, of course, the registered count must be multiplied by ten to get the true count (ambiguity of five).
LMT test logic 	LMT is a plug-in test logic module for use when troubleshooting MULTI-BEAM sensors. It contains LED indicator lights in place of the timing potentiometers and a miniature switch in place of the LIGHT/DARK operate jumper. The indicator lights display the operation of the scanner block and power block to verify proper functioning, and the switch permits manual operation of the load to verify the output switching circuit. The step-by-step testing procedure included with the LMT will allow a MULTI-BEAM to be completely tested without removing it from the installation, and, if there is a faulty scanner block, power block, or logic module, the LMT will identify it.

Logic Module Modifications

The time ranges of any MULTI-BEAM 3- & 4-wire logic module may be factory modified. Time range modification is often necessary to improve the setability of the timing function. Some time range modifications are carried in stock. The current Banner products price list is the best source of this information. Other time range modifications may be quoted. When ordering modified logic modules, add the letter "M" after the model number, followed by the maximum time desired (in seconds). The table below lists possible modifications.

MODEL NUMBER SUFFIX	SETABLE TIME RANGE
M.01	.001 to .01 seconds
M.1	.01 to .1 seconds
M.5	.05 to .5 seconds
M1	.1 to 1 second
M5	.5 to 5 seconds
M15	1.5 to 15 seconds

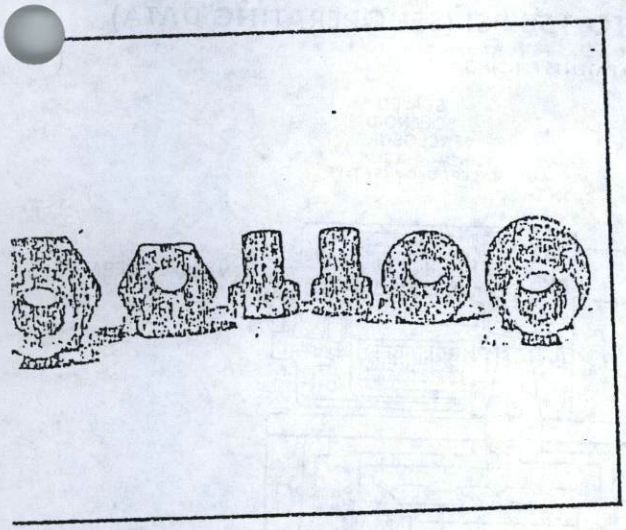
- For logic modules with a single timing function, specify the maximum desired time in seconds (e.g., LM5M5 indicates an LM5 on-delay with the delay time adjustable up to 5 seconds).

- For logic modules with dual timing functions, specify the maximum desired delay and hold time in seconds (e.g., LM5-14M1M5 indicates an LM5-14 on-off delay with an on-delay adjustable up to 1 second and an off-delay adjustable up to 5 seconds). Always specify both timing ranges, even if only one is to be modified.

- For fixed timing, the letter "F" should always be followed by the desired time, in seconds (e.g., LM5MF1 would be an LM5 on-delay with a fixed 1 second delay time). For fractions of seconds, use decimal equivalents, such as LM5MF.5, or LM5MF.01, etc.

Banner Engineering Corporation 9714 10th Avenue No., Minneapolis, Mn. 55441 Telephone: (612) 544-3164 FAX (applications): (612) 544-3573

lapter Bushings: Sizes and Specifications

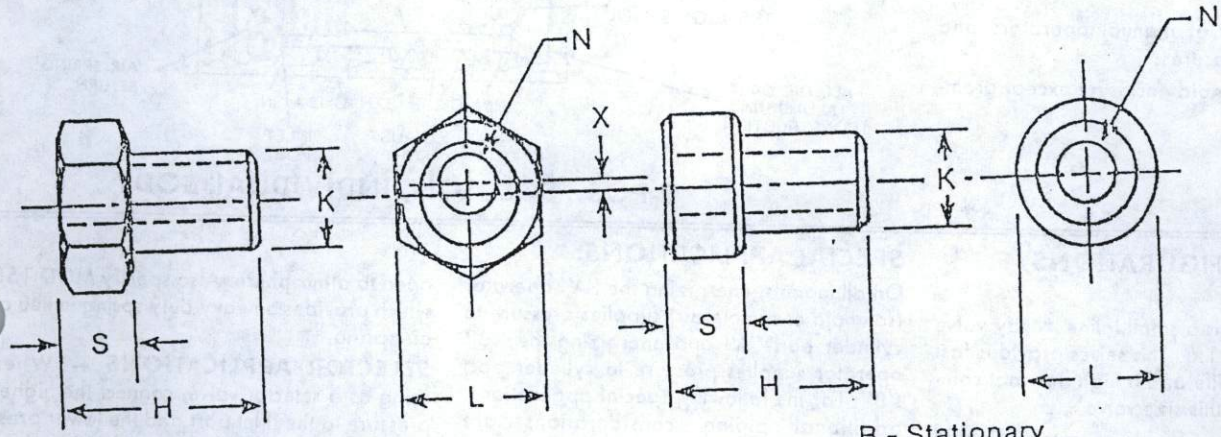


Specifications:

BX = Adjustable bushing. Eccentric mounting hole. By rotating the BX bushing on its mounting bolt, the clearance between the wheel and track can be adjusted.

B = Stationary bushing. Concentric mounting hole. The major load should be carried on the stationary bushings.

Bushings are leaded screw stock, plated finish or stainless steel.



BX - Adjustable

B - Stationary

SIZE	H	K*	L	N	(screw size)	X†	S	WT./lbs.
1	.550"	.1873"	7/16"	.140	#6	.012"	.250"	.011
2	.706"	.3748"	9/16"	.250	1/4"	.024"	.281"	.025
3	.990"	.4722"	3/4"	.312	5/16"	.042"	.375"	.059
4	1.177"	.5904"	7/8"	.375	3/8"	.060"	.437"	.100

All mounting information in this catalog assumes a "central" position of the BX bushing, allowing an adjustment from plus "X" to minus "X"

corresponding wheel bore.

Order: Specify quantity, style, size and material. To order stainless steel add suffix SS.

Example: 5 ea., BX 4 (five, adjustable bushings, size #4, standard material) or
5 ea., BX 4SS (five, adjustable bushings, size #4, stainless steel).

900
SERIES

4-WAY, SOLENOID PILOT AND REMOTE AIR PILOT, INDIVIDUAL OR STACKING BODY

1/8" & 1/4" — C_V UP TO 1.6

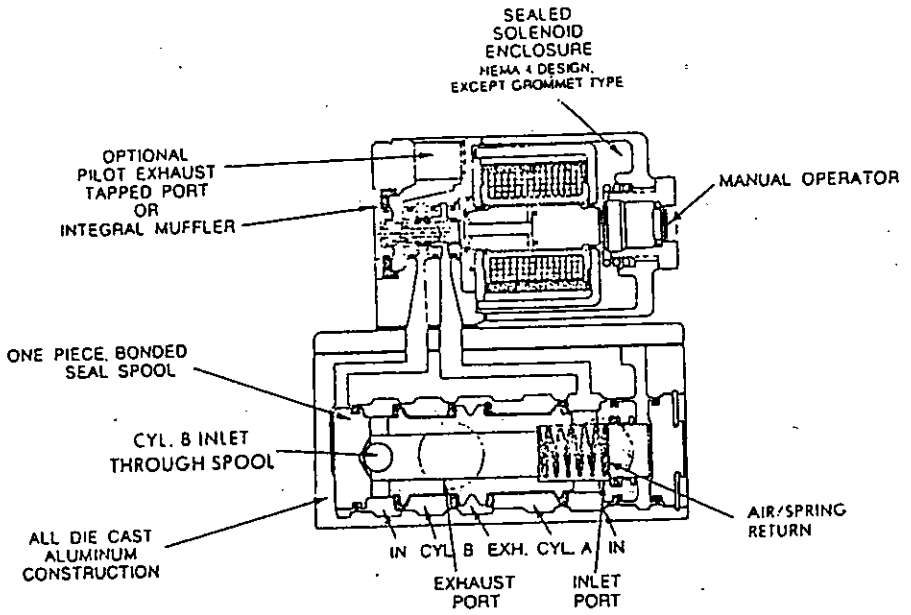
PRESSURE RANGE — VACUUM TO 150 PSI (SEE OPERATING DATA)

PATENTS AND PATENTS PENDING

SERIES FEATURES—SOLENOID PILOT OPERATED VALVES

The solenoid versions feature:

- The patented MACSOLENOID® with its non-burn out feature on AC service.
- Air/spring return on single solenoid valves.
- Use for lube or non-lube service.
- Optional low wattage DC solenoids down to 1 watt.
- Various types of manual operators and electrical enclosures.
- NEMA 4 solenoid enclosure except grommet type.



2-POS., SGL. SOL., INDIVIDUAL BODY

VALVE CONFIGURATIONS AVAILABLE

The 900 Series is a small Inline 4-way valve with a C_V up to 1.6. This series provides fast response, long life and a high flow not commonly found in this size valve.

- 2-Pos., single or double operator (solenoid or remote air).
- Individual body or stacking body models.
- Remote air bleed-off models.
- Manual and mechanical operators available. See section T-5 to order.

SERIES FEATURES—REMOTE AIR PILOT OPERATED VALVES

The remote air versions feature:

- Air/spring return on single remote air valves.
- Use for lube or non-lube service.
- Optional remote air pilot, pilot operated models available when application requires a pilot signal below the main valve pressure. See Section T-2.

SPECIAL APPLICATIONS:

On all models, energizing the "A" operator (solenoid or remote air) supplies pressure to cylinder port "A" and energizing the "B" operator supplies pressure to cylinder port "B". For the following special applications, additional piping considerations are required.

VACUUM APPLICATIONS (Remote Air Models Only)—Connect the vacuum source to the Exhaust port and leave the Inlet open to atmosphere. Also specify MOD 158 which provides a heavy duty spring in lieu of air/spring.

SELECTOR APPLICATIONS — When using as a selector valve, connect the higher pressure to the Inlet port and the lower pressure to the Exhaust port. On solenoid models, the Inlet pressure must be a minimum of 25 PSI on singles or 10 PSI on doubles.

OPERATING DATA

PRESSURE RANGE

MAIN VALVE:		Pressures shown are minimum and maximum safe working pressures.
Single Solenoid, Spring Return	25 to 150 PSIG	
Double Solenoid	10 to 150 PSIG	
Remote Air Pilot	VAC to 150 PSIG	
REMOTE PILOT OPERATOR SIGNAL:		
Single Operator, Spring Return ①	25 to 150 PSIG, but main valve pressure cannot exceed pilot signal	
Double Operator	10 to 150 PSIG	

NOTE:
① For main valve pressures of vacuum to 25 PSIG, MOD 158 (heavy duty spring) and a minimum of 35 PSIG air pilot signal are required

FLOW CONSTANT:

C_V Average all ports		
	0.8	1.2
	1.2	1.6

FLUIDS: Air or inert gases

LUBRICATION: Not required, but if lubrication is used a medium range aniline oil is recommended.

AMBIENT TEMPERATURE RANGE: 0° to 120°F. (—18° to 50°C.)

ELECTRICAL:

AC 120/60	Inrush 14.7 Volt-amps (.12 amps) Seal 10.4 Volt-amps (.09 amps)
DC 24 VOLTS	8.5, 6, 2.5 and 1 watt
ABOVE COILS	General Purpose Class "A", continuous duty, encapsulated.
LEADS:	#18 AWG x 18" Std.

MAC Valves guarantees these valves for a period of 18 months from the original date of shipment from our factory and will rebuild or replace any valve which fails to operate properly when returned transportation prepaid to our factory in accordance with the MAC Guarantee set out in full in the front of the catalog.

PRECAUTION
Improper application use, installation or service of MAC valves could create a dangerous situation—Consult "Precautions" on the inside of the back cover of the catalog first.

MAC VALVES, INC.
PO Box 111
30569 Beck Road
Wixom, Michigan 48096
Tel: (313) 624-7700
Tlx: 23-5738 or 164116

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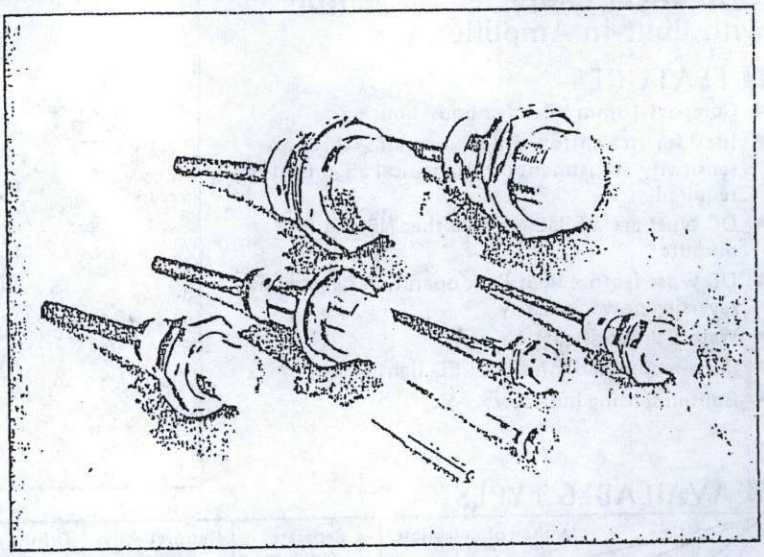
Tlx: 846-41895

INDUCTIVE PROXIMITY SENSOR

Model E2E

Short Length Cylindrical Type Inductive Proximity Sensor



FEATURES

- Wide operating voltage; 10 to 30 VDC and 20 to 264 VAC
- Operating indicator
- Short-circuit and reverse-polarity protection for most DC operating types
- Optional short-circuit protection for AC operating types (M18 and M30 types at 110/120 VAC)
- UL and CSA approvals pending

AVAILABLE TYPES (E2E-□: Add the appropriate code when placing your order, e.g., E2E-CR8C1)

- DC SWITCHING TYPE

Size		4 (0.16) dia.	M5	5.4 (0.21) dia.	M8		M12		18		M30	
Type		Shield	Shield	Shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield
Detecting distance [mm (inch)]		0.8 (0.03)	1 (0.04)	1 (0.04)	1.5 (0.06)	2 (0.08)	2 (0.08)	5 (0.20)	5 (0.20)	10 (0.39)	10 (0.39)	18 (0.71)
NPN	NO	-CR8C1	-X1C1	-C1C1	-X1R5E1	-X2ME1	-X2E1	-X5ME1	-X5E1	-X10ME1	-X10E1	-X18ME1
	NC	-CR8C2	-X1C2	-C1C2	-X1R5E2	-X2ME2	-X2E2	-X5ME2	-X5E2	-X10ME2	-X10E2	-X18ME2
PNP	NO	-CR8B1	-X1B1	-C1B1	-X1R5F1	-X2MF1	-X2F1	-X5MF1	-X5F1	-X10MF1	-X10F1	-X18MF1
	NC	-CR8B2	-X1B2	-C1B2	-X1R5F2	-X2MF2	-X2F2	-X5MF2	-X5F2	-X10MF2	-X10F2	-X18MF2

- AC SWITCHING TYPE

Size			M8		M12		M18		M30	
Type			Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield
Detecting distance [mm (inch)]			1.5 (0.06)	2 (0.08)	2 (0.08)	5 (0.20)	5 (0.20)	10 (0.39)	10 (0.39)	18 (0.71)
Short-circuit protection	Not provided	NO	-X1R5Y1	-X2MY1	-X2Y1	-5MY1	-X5Y1-US	-X10MY1-US	-X10Y1-US	-X18MY1-US
		NC	-X1R5Y2	-X2MY2	-X2Y2	-5MY2	-X5Y2-US	-X10MY2-US	-X10Y2-US	-X18MY2-US
	Provided	NO	—	—	—	—	-X5Y1-53-US	-X10MY1-53-US	-X10Y1-53-US	-X18MY1-53-US
		NC		—	—	—	-X5Y2-53-US	-X10MY2-53-US	-X10Y2-53-US	-X18MY2-53-US

SPECIFICATIONS

- RATINGS

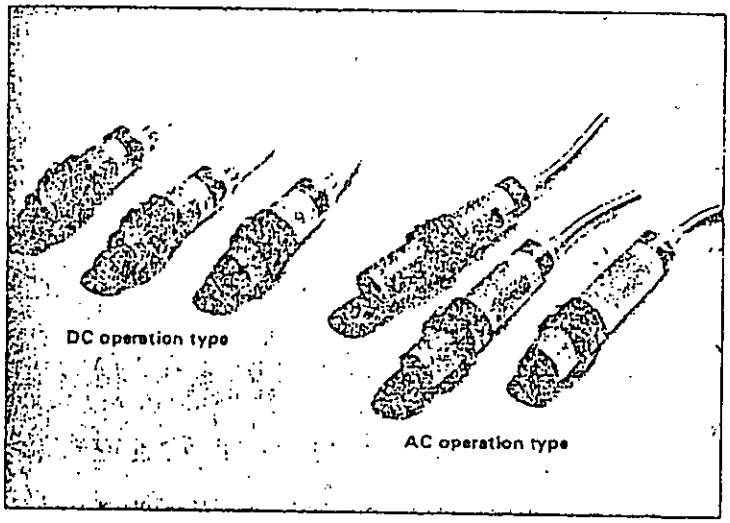
DC switching type

Type / Item	NPN / PNP	E2E-CR8C□ / E2E-CR8B□	E2E-X1C□ / E2E-X1B□	E2E-C1C□ / E2E-C1B□	E2E-1R5E□ / E2E-1R5F□	E2E-X2E□ / E2E-X2F□	E2E-X5E□ / E2E-X5F□	E2E-X10E□ / E2E-X10F□	E2E-X5ME□ / E2E-X5MF□	E2E-X10ME□ / E2E-X10MF□	E2E-X18ME□ / E2E-X18MF□
Supply voltage		12 to 24 VDC (Operating 10 to 30 VDC)									
Current consumption		10mA max.			17mA max.						
Target		Ferrous metals									
Detecting distance		0.8mm (.03") ± 15%	1mm (.04") ± 15%		1.5mm (.06") ± 10%	2mm (.08") ± 10%	5mm (.20") ± 10%	10mm (.39") ± 10%	5mm (.20") ± 10%	10mm (.39") ± 10%	18mm (.71") ± 10%
Setting [with standard target]		0 to 0.5mm (0 to .02") [Iron: 5x5x1t (.20x.20x.041)]	0 to 0.7mm (0 to .03") [Iron 5x5x1t (.20x.20x.041)]		0 to 1.2mm (0 to .05") [Iron 8x8x1t (.31x.31x.041)]	0 to 1.6mm (0 to .06") [Iron 12x12x1t (.47x.47x.041)]	0 to 4mm (0 to .16") [Iron 18x18x1t (.71x.71x.041)]	0 to 8mm (0 to .31") [Iron: 30x30x1t (1.18x1.18x.041)]	0 to 4mm (0 to .16") [Iron 15x15x1t (.59x.59x.041)]	0 to 8mm (0 to .31") [Iron 30x30x1t (1.18x1.18x.041)]	0 to 14mm (0 to .55") [Iron 54x54x1t (2.13x2.13x.041)]
Differential travel		15% max. of detecting distance			10% max. of detecting distance						
Response frequency		3kHz			2kHz	1.5kHz	600Hz	400Hz	400Hz	200Hz	100Hz
Control output		100mA max			200mA max						
Short-circuit protection		No			Yes						
Operation indicator		Detection indicator									
Cable length		2m (6.56')									
Material of housing		Brass and nickel plated									
Degree of protection		IP67 (IEC 144), NEMA types 1, 4, 6, 12, 13									

PHOTOELECTRIC SENSOR

Model E3F

Cylindrical Photoelectric Sensor with Built-in Amplifier



FEATURES

- Compact 18mm threaded body housing
- Ideal for straightforward applications where no sensitivity adjustment or mechanical alignment is required
- DC types are available with either NPN or PNP outputs
- DC types feature light/dark operation selected by reversing power polarity
- Watertight construction
- Pulse-modulated infra-red LED light source
- Built in sensing indicators

AVAILABLE TYPES

Type of operation	Operating state of output	Output configuration \ Method of detection / Detecting distance	Separate type 3m	Retroreflective type* 2m	Diffuse reflection type 0.1m
DC operation type	LIGHT ON/ DARK ON (selectable)	PNP open collector	E3F-3B4	E3F-R2B4	E3F-DS10B4
		NPN open collector	E3F-3C4	E3F-R2C4	E3F-DS10C4
AC operation type	LIGHT ON	SCR	E3F-3Z1	E3F-R2Z1	E3F-DS10Z1
	DARK ON		E3F-3Z2	E3F-R2Z2	E3F-DS10Z2

NOTE: * Includes Type OER-04 target.

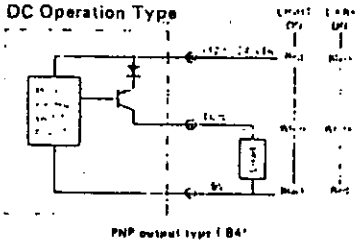
SPECIFICATIONS

• RATINGS

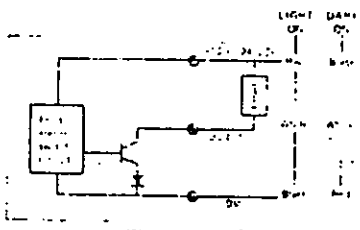
Item \ Type	DC operation type			AC operation type		
	E3F-3B4 E3F-3C4	E3F-R2B4 E3F-R2C4	E3F-DS10B4 E3F-DS10C4	E3F-3Z1 E3F-3Z2	E3F-R2Z1 E3F-R2Z2	E3F-DS10Z1 E3F-DS10Z2
Supply voltage	12 VDC −10% to 24 VDC +10% Ripple (p-p): 10% max.			24 VAC −10% to 240 VAC +10%		
Power consumption	45mA max.	25mA max.		10mA max.	5mA max.	
Detecting distance	3.0m	0.1 to 2.0m with OER-04 target	0.1m (with 5x5cm white mat paper)	3.0m	0.1 to 2.0m with OER-04 target	0.1m (with 5x5cm white mat paper)
Detectable object	Opaque materials (11mm min.)	Opaque materials (56mm min.)	Transparent and opaque materials	Opaque materials (11mm min.)	Opaque materials (56mm min.)	Transparent and opaque materials
Directional angle	3 to 10°	3 to 20°	–	3 to 10°	3 to 20°	–
Distance differential	–		20% max. at 0.1m	–		20% max. at 0.1m
Control output (solid-state output)	100mA max.			5 to 200mA		
Response time	2.5msec. max.			30msec. max.		
LED operation indicator: Light source	POWER ON	–		POWER ON	–	
LED operation indicator: Receiver	LIGHT ON			LIGHT ON		

• OUTPUT STAGE DIAGRAM

DC Operation Type

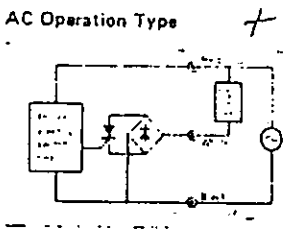


PNP output type (-B4*)



NPN output type (-C4)

AC Operation Type



SCR output type (-Z1, -Z2)

NOTE: The operating state of output is reversible from "LIGHT ON" to "DARK ON" and vice versa by interchanging the connections of the red and black power supply leads.

MOSIER
The creators of the Ecology Cylinder

Prices effective January 1, 19??
F.O.B. Plant in Brookville, Ohio

Tiny Tim Series ET and EDT 3/4" and 1-1/8" Bore Single and Double Acting Single and Double Rod End Style Air Cylinders

MAINTENANCE INSTRUCTIONS & REPLACEMENT PARTS LIST PRICES

Prices are based on manufacturing costs at time of publication and are subject to change without notice.

Cyl. Series	Cyl. Bore	Rod Dia.	Buna-N Part No.	Buna-N Price	Viton Part No.	Viton Price
ET & EDT	3/4"	5/16"	ECK-10	—	EVCK-10	—
	1-1/8"	5/16"	ECK-125	—	EVCK-125	—
		3/8"	ECK-127	—	EVCK-127	—

Proper application, installation and maintenance are most important for the Tiny Tim Series ET and EDT cylinders to provide maximum life and trouble-free performance.

APPLICATION DATA:

Max. Operating Pressure — 150 psig Air

Ambient Operating Temperatures —
20°F (-35°C) to +200°F (93°C) with Buna-N seals
-20°F (-35°C) to +400°F (204°C) with Viton seals

LUBRICATION

Cylinders are lubricated with a petroleum base, Buna-N compatible lubricant at time of shipment. For maximum seal life, the air supply should be free of moisture; filtered to remove abrasive particles from the air stream, and atomized oil introduced into the system.

DYNAMIC SEAL REPLACEMENT KITS

Under normal conditions, the first area that will need maintenance will be the rod seal. To replace, disassemble cylinder by removing the tie rods. Pull out the head and with a sharp object remove the worn seal. No special tools are necessary to replace the rod seal. Once a year replacement of these seals will provide maximum cylinder operating efficiency.

Machine downtime and labor being the major cost of cylinder repair, we recommend the simultaneous replacement of all dynamic seals. Seal kits illustrated here include every part required to overhaul your cylinder.

CYLINDER REASSEMBLY

Before engaging in the reassembly of the cylinder, check the oil-filled rod bushing for excessive wear and inspect the piston rod for possible damage incurred during normal cylinder operation.

Due to the technique employed in the assembly of the bushing to the cylinder head, *individual replacement of the rod bushing is not recommended.* If the bushing is out of concentricity, you must replace the entire head assembly.

In the event that normal operations have bowed or scored the piston rod, replacement of the entire assembly may be necessary for best cylinder operating efficiency.

Finally, make certain the tube gaskets are positioned properly before proceeding to tighten the tie rod nuts.

Torque Ratings:
3/4" Bore — 10 to 14 in/lbs.
1-1/8" Bore — 20 to 25 in/lbs.

ORDERING INFORMATION

To assure prompt and correct shipment of the parts, proper care should be taken in the selection of the parts and part number(s).

Whenever possible the following information should be supplied along with the order: Cylinder Series, Bore, Stroke, Rod Diameter and Optional equipment.

The minimum billing for a parts order is $10.00.

If assistance is required, consult your Mosier Distributor.

Viton® is a registered trade mark of E. I. DuPont DeNemours and Company

Distributed by:

Manufactured by:
The creators of the Ecology Cylinder
MOSIER
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325 Carr Drive, Brookville, Ohio 45309
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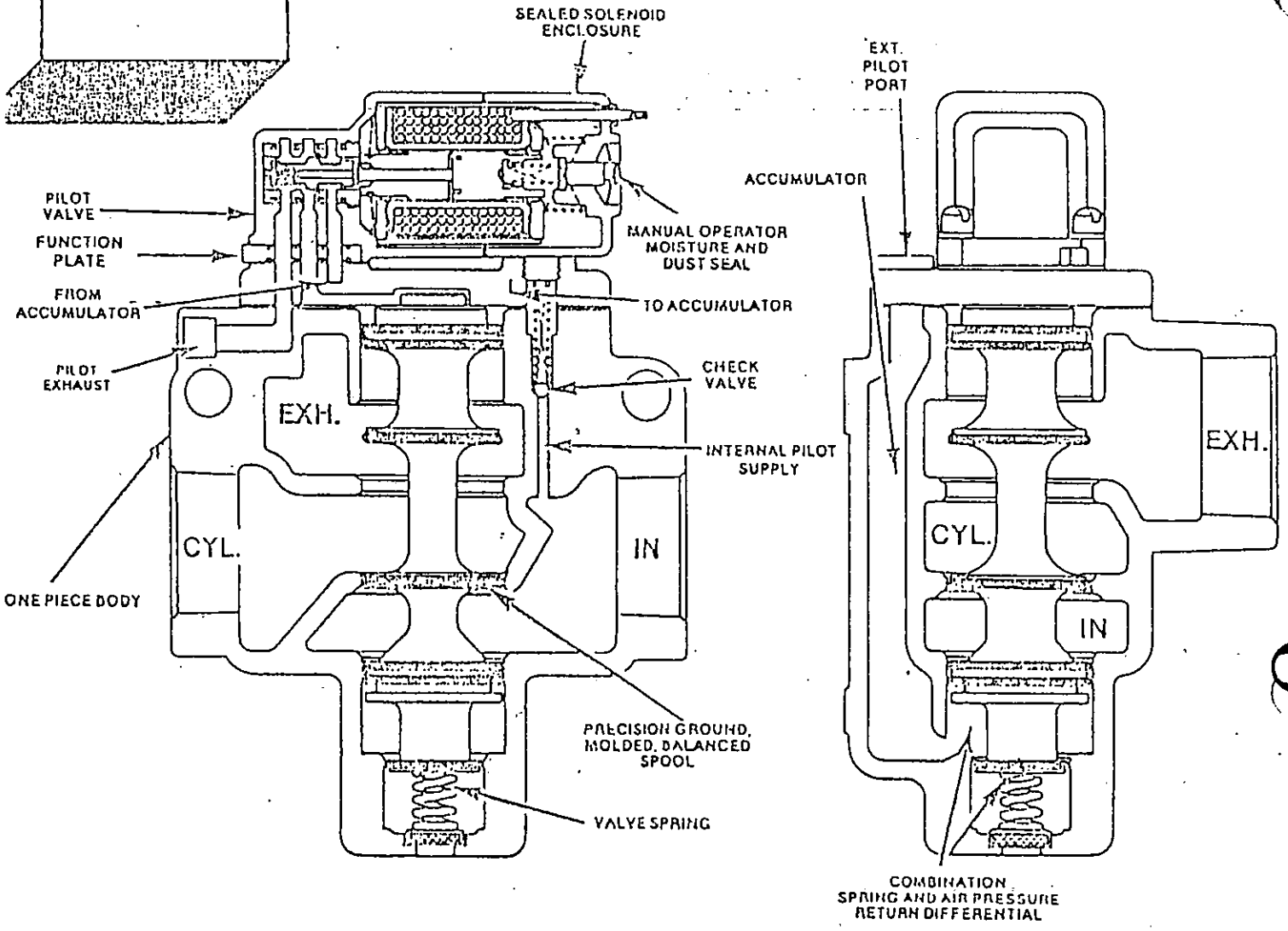
MAC®

50 SERIES



SOLENOID PILOT VALVE

The solenoid pilot valve is the three-way manifold version of the MAC 100 Series on the 56 Series, and the MAC 200 Series on the 57, 58 and 59 Series. These pilot valves feature the extremely fast and reliable spring biased, floating pole Macsolenoid® and high flow balanced poppet. This patented design practically eliminates the two most common causes of solenoid pilot valve failure: coil burnout on A.C. service and failure to shift. Conversion from N.C. to N.O. operation is achieved by turning over the function plate between the pilot valve and main valve.

PILOT AIR SYSTEM

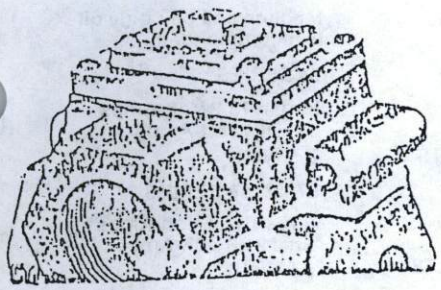
The pilot supply, internal or external, feeds the integral accumulator which stores more than five times the pilot air required to cycle the valve. Internally piloted, it is protected from inlet pressure variations by a check valve. This accumulator supplies the differential return area of the spool as well as the solenoid pilot, assuring positive, constant shifting characteristics. This differential means the valve will operate with or without the main valve spring. External pilot operation is accomplished simply by removing the 1/4" pipe plug from the external pilot port and installing a 1/8" pipe plug in the bottom of the same hole and piping a 1/4" supply.

MAIN VALVE

All 50 Series 3-ways feature MAC's patented one-piece lightweight aluminum spool. The unique main spool design incorporates both the actuating and differential return areas. All seals are permanently bonded, precision ground and chemically surface hardened to provide long, consistant operation. The pressure balanced spool design is not affected by back pressure in the exhaust and may be plugged for two-way operation. The one-piece silicon aluminum body houses a large pilot air accumulator which supplies both the pilot valve and differential return.

MAC®

Features & options

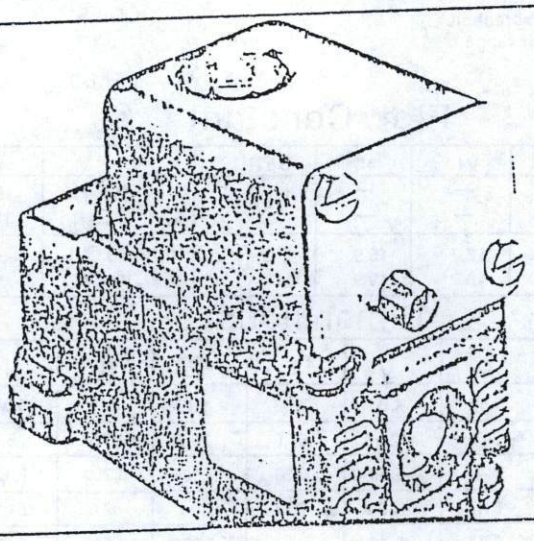


REMOTE AIR PILOT VALVES

The 50 Series valves are available in a normally closed remote air pilot version. It will function as a normally open valve when a normally open pilot valve is used. The full orifice pilot port assures maximum response of the main valve spool.

J.I.C. ENCLOSURE

The optional J.I.C. enclosure provides a generous wiring tuck space, a chained access cover and is supplied with a ground screw. The gasketed access cover seals the enclosure and provides the location for an optional indicator light.



INDICATOR LIGHT

An optional indicator light is available on the 57, 58 and 59 Series which, when wired in parallel with the coil leads, will indicate if the valve is receiving an electrical signal. Lights have a rated life in excess of 25,000 hours and are available for voltages of 120/60, 110/50, 240/60 and 220/50.

MANUAL OPERATORS

A recessed non-locking manual operator is furnished as standard on all solenoid pilot valves. Locking and/or extended operators are optional. A no operator option is also available.

ELECTRICAL CONNECTIONS

Solenoid enclosures are available in grommet, conduit and J.I.C. styles. Also available are ground wires and 2 or 3 pin M.S. connectors. Standard lead wires are #18 AWG, 18" long. Other lengths are optional.

OTHER OPTIONS

Other options include extended lead length wires, special voltage coils, Class F rated coils and higher wattage D.C. coils for a very rapid response.

HOW TO ORDER:

56A-, 57A-, 58A-, 59A— X X — XX X X

Type Size Voltage Operator Enclosure

Type	
1	N.C. Sol. Int. Pilot
2	N.O. Sol. Int. Pilot
3	N.C. Sol. Ext. Pilot
4	N.O. Sol. Ext. Pilot
5	N.C. Remote Air Pilot

Size	
1	
1	1/4" NPTF
2	3/8" NPTF
3	1/2" NPTF
1	
1	1/2" NPTF
2	3/4" NPTF
3	1" NPTF
1	
1	1" NPTF
2	1-1/4" NPTF
3	1 1/2" NPTF
1	
2	2" NPTF
3	2 1/2" NPTF

Voltage	
11	120/60, 110/50 (56 Series)
11	120/60, 110/50 24 VDC (6 watt) (57 58 59 Series)
12	240/60, 220/50
20	6/60
21	12/60
22	24/50-60
23	32/60
24	48/60, 42/50
25	240/50
26	480/60, 440/50 (57 58 59 Series)
60	12VDC (Std)
61	24VDC (Std)
62	24VDC (Opt)*
63	12VDC (Opt)*
64	6VDC
65	32VDC
66	48VDC
67	64VDC
68	120VDC
69	250VDC

Operator	
0	No Operator
1	Non-locking recessed (Std.)
2	Locking recessed
3	Non-locking extended
4	Locking extended
5	No operator lights*
6	Non-locking recessed lights*
7	Locking recessed lights*
8	Non-locking extended lights*
9	Locking extended lights*

* Lights are available for 120/60, 110/50, 240/60, and 220/50 with JIC Enclosure Only

Enclosure	
A	J.I.C. Enclosure
B	Grommet
C	Conduit ½" NPS
F	M.S. 2 (2 Pin)
G	M.S. 3 (3 Pin)
N	Conduit ½" NPS with grd. wire
R	Conduit 3/8" NPS (56 Series)

Modifications:

" For Class F Coil Option

" Heavy Duty return spring required on remote pilot operated valves for applications with vacuum to 25 PSI main valve pressure.

For Voltages Not Shown Consult Factory

* For low wattage requirements only. 6 watt

56A-12-111A: 56 Series, 3-way inline valve, Solenoid operated, Normally Closed, Internally piloted 2" N.P.T.F., 120/60 Hz., Non Locking Recessed manual operator, J.I.C enclosure.

59A-50-50 Series, 3-way inline valve, Remote air pilot operated, Normally Closed, 2½" N.P.T.F.

† For BSP threads, use 4, 5 and 6 respectively, in place of 1, 2 or 3.

OPERATING DATA

PRESSURE RANGE:		LUBRICATION:	Medium aniline range oil is recommended.
INTERNAL PILOT	25-150 PSIG Max.	ELECTRICAL:	56 SERIES
EXTERNAL PILOT	Main Valve Pressure: Vacuum to 150 PSIG Max — Minimum Pilot Pressure: Minimum of 25 PSIG	A.C. 120/60	Inrush 13.2 Volt-Amps, Seal 8.4 volt-Amps
REMOTE AIR PILOTS	75% of Main Valve Pressure With a Minimum of 25 PSIG. Pilot pressure using MOD 158 should be a minimum of 35 PSI.	D.C. 24 VOLTS	8.5 Watt
			57, 58, 59 SERIES
		A.C. 120/60	Inrush 32.4 Volt-Amps, Seal 21.6 Volt-Amps
		D.C. 24 VOLTS	8.5 Watt
AMBIENT TEMPERATURE RANGE:	0 degrees to 120 degrees fahrenheit. Consult factory outside this range.	COILS	General Purpose Class A Encapsulated-Continuous Duty
FLUIDS:	Air or Inert Gases	LEADS	#18 AWG X 18" Std.

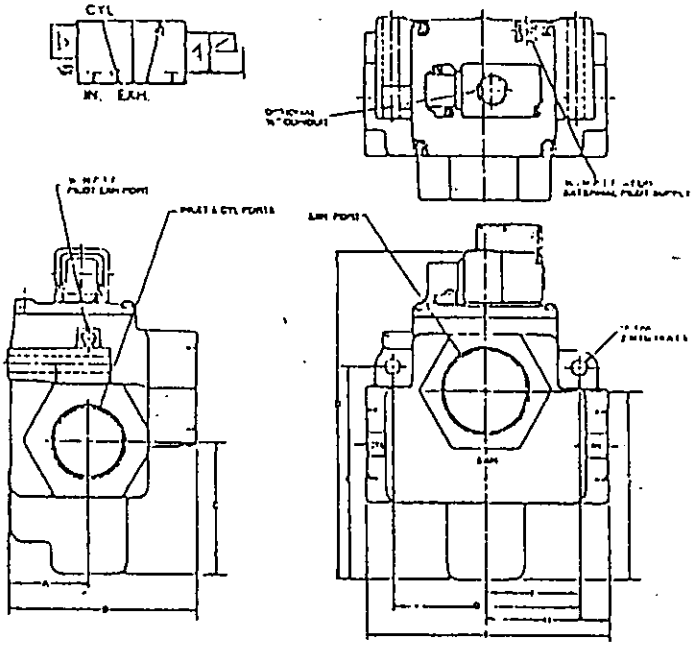
Flow Constant C_v

SERIES		1/4"	3/8"	1/2"	3/4"	1"	SERIES		1"	1 1/4"	1 1/2"	2"	2 1/2"
56A	Inlet to Cyl.	2.8	4.8	5.8	—	—	58A	Inlet to Cyl.	18.7	23.0	24.9	—	—
	Cyl. to Exh.	3.7	6.0	6.5	—	—		Cyl. to Exh.	31.2	32.5	33.5	—	—
57A	Inlet to Cyl.	—	—	9.0	12.7	15.9	59A	Inlet to Cyl.	—	—	—	55.0	60.0
	Cyl. to Exh.	—	—	11.0	18.2	19.9		Cyl. to Exh.	—	—	—	60.0	65.0

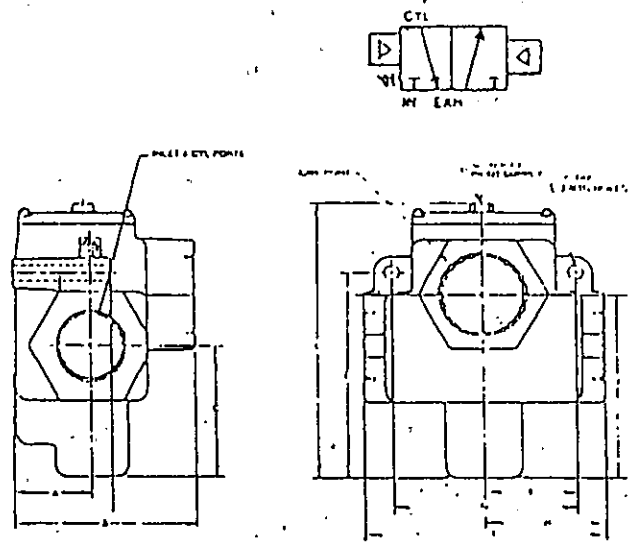
Dimensions

MODEL		A	B	C	D	E	F	G	H	I	J	K	L
56A SERIES	INCHES	1.38	3.00	1.16	4.86	2.66	1.13	2.25	1.38	2.75	1.84	.32	3.84
	MM	35.1	76.2	29.5	123.4	67.6	28.7	57.1	35.1	69.8	46.7	8.1	97.5
57A SERIES	INCHES	1.68	3.81	2.43	6.73	3.56	1.563	3.250	2.13	4.38	3.56	.34	5.15
	MM	42.7	96.8	61.7	170.9	90.4	39.7	82.6	54.1	111.3	90.4	8.6	130.8
58A SERIES	INCHES	1.88	4.62	3.31	8.10	4.91	2.270	4.660	2.69	5.50	4.50	.53	6.52
	MM	47.7	117.3	84.1	205.7	124.7	57.7	118.4	68.3	139.7	114.3	13.5	165.6
59A SERIES	INCHES	2.65	6.25	4.37	10.85	6.87	3.062	6.125	4.00	8.00	6.12	.53	8.27
	MM	67.3	158.8	111.0	275.6	174.5	77.8	155.6	101.6	203.2	155.4	13.5	235.5

Solenoid Pilot



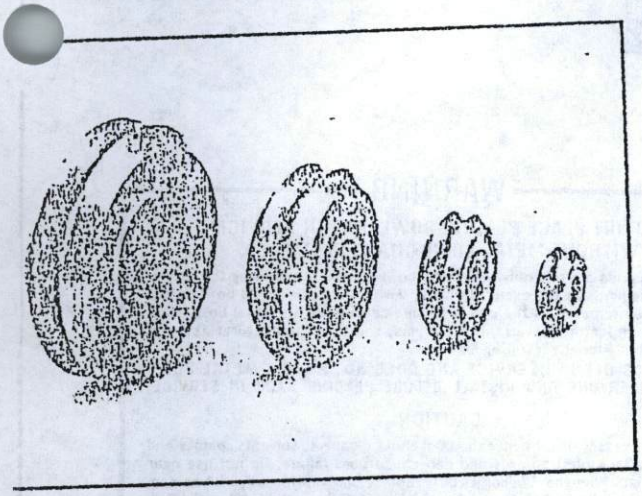
Remote Air Pilot



DISTRIBUTED BY

VALVES, INC.
P.O. Box 111
30569 BECK ROAD
WIXOM, MICHIGAN 48096
(313)624-7700
TELEX 23-5738

uide Wheels: Specifications



Specifications: Ground, double row, angular contact ball bearings, ABEC-1, pre-lubricated, external surfaces lightly oiled.

W = SAE 52100 Steel, hardened 60-62 Rockwell C, shielded.

W X = SAE 52100 Steel, hardened 60-62 Rockwell C, sealed.

W SSX = AISI 440C, hardened 60-62 Rockwell C, sealed.

AE 52100 Guide Wheel Capacity

SIZE	DYNAMIC RADIAL CAPACITY, LBS*				STATIC RADIAL CAPACITY (lbs)	THRUST CAPACITY (lbs)*	MOMENT CAPACITY (lbs)†*
	33.3 RPM	100 RPM	500 RPM	1000 RPM		33.3 RPM	33.3 RPM
1	345	240	140	110	250	60	38
2	700	485	285	225	600	110	80
3	1330	920	540	430	1000	530	120
4	2000	1385	810	645	1560	635	180

AISI 440C Guide Wheel Capacity

1	310	215	125	98	224	54	34
2	560	388	228	180	480	88	64
3	1070	740	434	346	805	426	97
4	1590	1101	644	513	1240	505	143

Ratings are for 2500 hours average life. Additional information on request.
†At rolling radius MD_W Inside.

Service Factor: Divide the load capacity by the following:

Fs = 0.5 for smooth, shock-free, well lubricated service.

Fs = 1.0 for normal, lightly lubricated service.

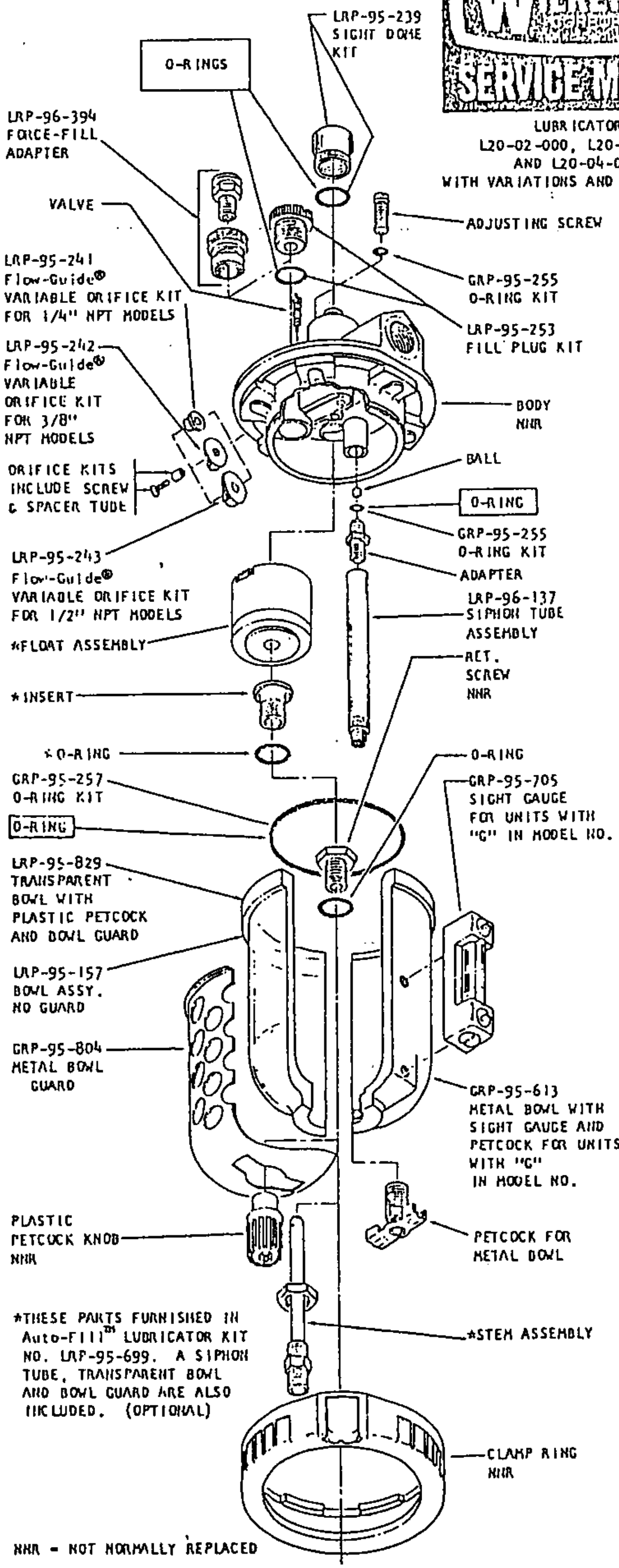
Fs = 2.0 for heavy shock, dry or contaminated service.

To Order: Specify quantity, size, material, shielded or sealed.
Example: 4 ea., W4 X (Four wheels, size #4, standard steel, sealed).

WILKERSON SERVICE MANUAL

REPLACES SERVICE MANUAL PAGES F4-30, SM-3002E SERIES "A", SM1-3002E SERIES "A", SM2-3002E SERIES "A", SM3-L20 9SM-AG-L20 and 9SM-CG-L20

LUBRICATOR
L20-02-000, L20-03-000
AND L20-04-000
WITH VARIATIONS AND ACCESSORIES



*THESE PARTS FURNISHED IN Auto-Fill™ LUBRICATOR KIT NO. LRP-95-699. A SIPHON TUBE, TRANSPARENT BOWL AND BOWL GUARD ARE ALSO INCLUDED. (OPTIONAL)

NNR - NOT NORMALLY REPLACED

WARNING

DO NOT PLACE PLASTIC BOWL UNIT IN SERVICE WITHOUT METAL BOWL GUARD INSTALLED.

Plastic bowl units are sold only with metal bowl guards. To minimize the danger of flying fragments in the event of plastic bowl failure, the metal bowl guards should not be removed. If the unit is in service without the metal bowl guard installed, manufacturer's warranties are void, and the manufacturer assumes no responsibility for any resulting loss.

IF UNIT HAS BEEN IN SERVICE AND DOES NOT HAVE A METAL BOWL GUARD, ORDER ONE AND INSTALL BEFORE PLACING BACK IN SERVICE.

CAUTION

Certain compressor oils, chemicals, household cleaners, solvents, paints and fumes will attack plastic bowls and can cause bowl failure. Do not use near these materials. When bowl becomes dirty replace bowl or wipe only with a clean, dry cloth. Reinstall metal bowl guard or buy and install a metal bowl guard. Immediately replace any crazed, cracked, damaged or deteriorated plastic bowl with a metal bowl or a new plastic bowl and metal bowl guard.

SOME OF THE MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS

Acetaldehyde	Cresol	Methylene salicylate
Acetic acid (conc.)	Cyclohexanol	Milk of lime (CaOH)
Acetone	Cyclohexanone	Nitric acid (conc.)
Acrylonitrile	Cyclohexene	Nitrobenzene
Ammonia	Dimethyl formamide	Nitrocellulose lacquer
Ammonium fluoride	Dioxane	Phenol
Ammonium hydroxide	Ethane tetrachloride	Phosphorous hydroxy chloride
Ammonium sulfide	Ethyl acetate	Phosphorous trichloride
Antifreeze	Ethyl ether	Propionic acid
Benzene	Ethylamine	Pyridine
Benzoic acid	Ethylene chlorohydrin	Sodium hydroxide
Benzyl alcohol	Ethylene dichloride	Sodium sulfide
Brake fluid	Ethylene glycol	Styrene
Bromobenzene	Formic acid (conc.)	Sulfuric acid (conc.)
Butyric acid	Freon (refrigerant & propellant)	Sulphural chloride
Carbolic acid	Gasoline (high aromatic)	Tetrahydronaphthalene
Carbon disulfide	Hydrazine	Thiophene
Carbon tetrachloride	Hydrochloric acid (conc.)	Toluene
Caustic potash solution	Lacquer Thinner	Turpentine
Caustic soda solution	Methyl alcohol	Xylene
Chlorobenzene	Methylene chloride	Perchlorethylene and others
Chloroform		

TRADE NAMES OF SOME COMPRESSOR OILS, RUBBER COMPOUNDS AND OTHER MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS.

Atlas "Perma Guard"	Pace #1306 Neoprene
Buna N	Petron PD287
Cellulube #150 and #220	Prestone
Crylex #5 cement	Pydraul AC
Eastman 910	Sears Regular Motor Oil
Garlock #93403 (polyurethane)	Sinclair oil "Lily White"
Haskel #55F 023	Some Loctite Compounds
Hilgard Co's hil phene	Stauffer Chemical FYRQUEL #150
Houghton & Co. oil #1120, #1130 and #1055	Stillman #SR 269 75 (polyurethane)
Houghto-safe 1000	Stillman #SR 513-70 (neoprene)
Kano Kroil	Tannergas
Keystone penetrating oil #7	Telar
Marvel Mystery Oil	Tenneco anderol #495 and #500 oils
Minn. Rubber 366Y	Tiion
National Compound #N11	Zerex
"Nylock" VC 3	

WE CANNOT POSSIBLY LIST ALL HARMFUL SUBSTANCES. SO CHECK WITH A MOBAY CHEMICAL OR GENERAL ELECTRIC OFFICE FOR FURTHER INFORMATION ON POLYCARBONATE PLASTIC

CAUTION

Except as otherwise specified by the manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication, and manufacturer assumes no responsibility for any resulting loss.

TO OVERHAUL THIS UNIT, ORDER

REPAIR KIT NO. LRP-95-145

THESE INDIVIDUAL PARTS FURNISHED IN REPAIR KIT

WILKERSON CORPORATION
ENGLEWOOD, COLORADO 80150

(continued on reverse side)

Printed in U.S.A.

ont'd.)

STALLATION

to warning on front.
all as close as possible to the equipment which is to lubricated.
.nstall the unit with the air moving through the body in the direction indicated by the arrow.
Install a unit with the same pipe size as the line in use. The unit may be filled under pressure by removing the fill port. The bowl may be taken off after the fill plug is removed if a more rapid fill is required. Do not replace the fill plug until the bowl is in position and the clamp ring is locked in place. NOTE: As the fill plug is removed, the air pressure in the bowl will be released.
. Use clean, nondetergent oil only; SAE 10 or lighter is recommended.
. The rate of oil delivery may be controlled by turning the adjusting screw counterclockwise for more and clockwise for less oil delivered. The L20 lubricator delivers all the oil downstream that passes through the sight dome. The oil delivery rate will change automatically to deliver more oil during higher airflows and less oil for airflows lower than that at which the original setting was made.
. The maximum pressure and temperature ratings are: transparent plastic bowls, 150 psig (10,3 bar) and 125° F (51,7° C); metal bowls, 200 psig (13,8 bar) and 175° F (79,4° C).

\INTENANCE

. Given clean operating conditions, this unit will be trouble-free. Contaminants from dirty oil may collect on the siphon tube inlet filter, requiring the filter to be cleaned by tapping on a hard surface and blowing off with an air blow gun.
. If the oil delivery rate drops, the lubricator should be cleaned. Shut off the air supply and reduce the pressure to zero. Remove the Flow-Guide® variable orifice screw and clean its air passage with a small wire.
k the bore that the screw fits into for contaminants clean, if necessary. Be sure that the passageway om the sight dome cavity into the Flow-Guide® variable orifice post is open. Remove the adjusting screw and clean the needle and the seat in the body. Inspect and clean the passage from the needle seat down into the adapter.
. Drain off any contaminants which collect in the bottom of the bowl.
. Lubricate o-rings with Parker O-Lube before assembly.
. Do not pressurize the unit until the bowl and bowl guard are in position and the clamp ring is locked in place.

SSEMBLIES

or Auto-Fill™ Lubricator Order Kit No. LRP-95-699 which includes Float Assembly, Insert, O-ring , Stem
ssembly, Siphon Tube, Transparent Bowl and Bowl Guard.
IOTE: DO NOT ATTEMPT TO REPAIR THE Auto-Fill™ LUBRICATOR SSEMBLY MECHANISM IN THE FIELD; IF IT MALFUNCTIONS, PURHASE A NEW ASSEMBLY.

(continued from reverse side)

INSTALLATION

1. Install as close as possible to point where air is being used.
2. Install the unit with the air flowing through the body in the direction indicated by the arrow.
3. Install the same size unit as the pipe line in use. Avoid using fittings, couplings, etc., that restrict the air flow.

MAINTENANCE

1. A. IF UNIT HAS RIGID (FELT) FILTER ELEMENT, remove and clean periodically by tapping on hard surface and blowing off with air blow gun.
   B. IF UNIT HAS SOFT, CLOTH ELEMENT, replace with a new one at least every six months, or sooner if it looks dirty or causes excessive pressure drop (10 psi or more at rated flow).
2. A. IF UNIT IS EQUIPPED WITH MANUAL PETCOCK, drain bowl at least once per work shift.
   B. IF UNIT IS EQUIPPED WITH MECHANICAL DRAINER:
      1) Clean the small screen around the drain seat each time the element is cleaned or changed by removing adaptor nut (GRP-30-505) and removing drain assembly (GRP-95-714). Clean screen by blowing off with air blow gun.
      2) For mechanical drainer repair see 9SH-95-714; formerly SM3-GRP-95-714.

ASSEMBLIES:

PARTS WHICH CAN BE FURNISHED ASSEMBLED BY THE FACTORY

GRP-95-774	Transparent Plastic Bowl with Mechanical Drain and Bowl Guard.
FRP-95-611	Metal Bowl with Mechanical Drain.
FRP-95-612	Metal Bowl and Manual Petcock.
GRP-95-613	Metal Bowl, Sight Gauge, Manual Petcock.
FRP-95-831	Transparent Plastic Bowl, Flexible Drain Assembly and Bowl Guard.

(continued)

ENANCE

1. Occasionally remove bottom plug and clean plug, body and valve seat.
2. TO DISASSEMBLE -- shut off air to regulator and vent air line on both sides of regulator. Turn adjusting screw counterclockwise to relieve compression on the spring. Remove screws, cover, spring, and pressure disk. Diaphragm assembly can now be removed. By removing bottom plug and spring, the valve can be removed from the bottom of the regulator.
3. IF UNIT WILL NOT REGULATE TO PRESSURE NEEDED, OR IF PRESSURE BECOMES EXCESSIVE -- remove bottom plug, spring and valve. Clean and check o-ring, valve stem and valve seat for wear or damage. Replace worn or damaged parts. Install Repair Kit No. RRP-95-131 for self-relieving models and Repair Kit No. RRP-95-132 for non-relieving models for complete overhaul.
4. IF UNIT LEAKS AT RELIEF PORT (A) -- Install proper repair kit as listed above.
5. WHEN REPLACING DIAPHRAGM ASSEMBLY -- The RRP-96-213 Diaphragm Assembly includes a relieving disk seal (not shown) installed. The seal is not required on non-relieving models.

The DUA-L-VEE® System: Three Components, Four Sizes

The DUA-L-VEE® Guide Wheel System is a proven, economical method of obtaining precision linear motion or all types of mechanical applications.

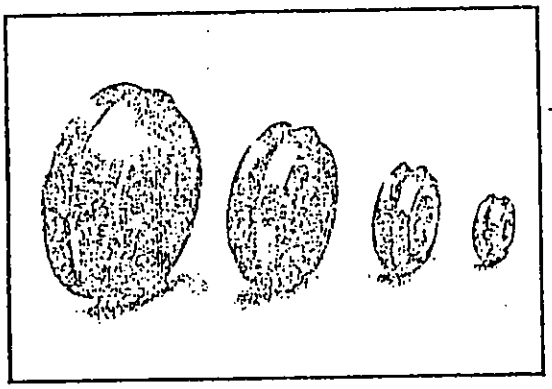
A low friction accurate slide, such as the one illustrated below, can be made quickly and inexpensively without the aid of costly machine tools. All that is needed is a rule and a drill press. There are no linear seals o wear out.

The guide wheels are precision ground, double row angular contact ball bearings, which are pre-lubricated and available shielded or sealed.

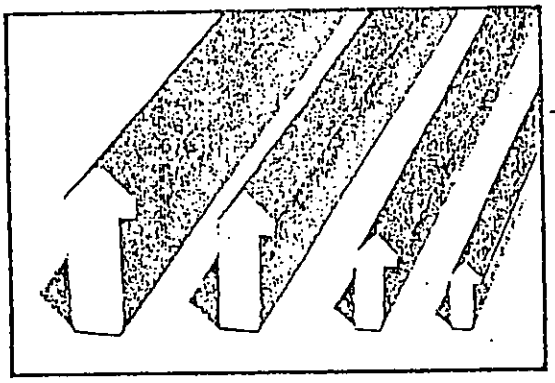
The track is cold formed from medium carbon steel and is available as formed or hardened and polished on the top contact surfaces. The lower portion of the track is left soft to permit drilling for mounting.

Eccentric bushings are used opposite concentric bushings to provide a simple and effective means of adjusting the free play of the system.

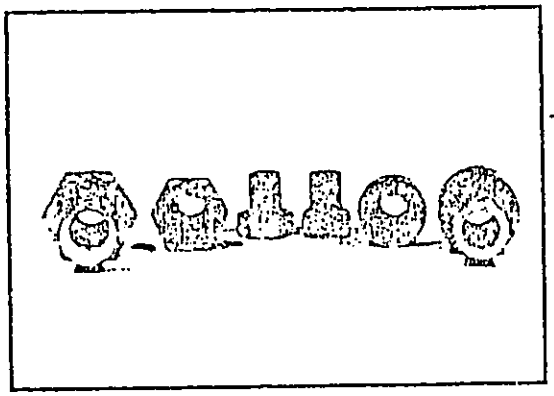
Since the circumference of the wheels is greater at the major diameter than the minor diameter, there is a constant wiping action on the track which gives a self-cleaning effect. Contaminants do not cause any great loss of efficiency in the system.



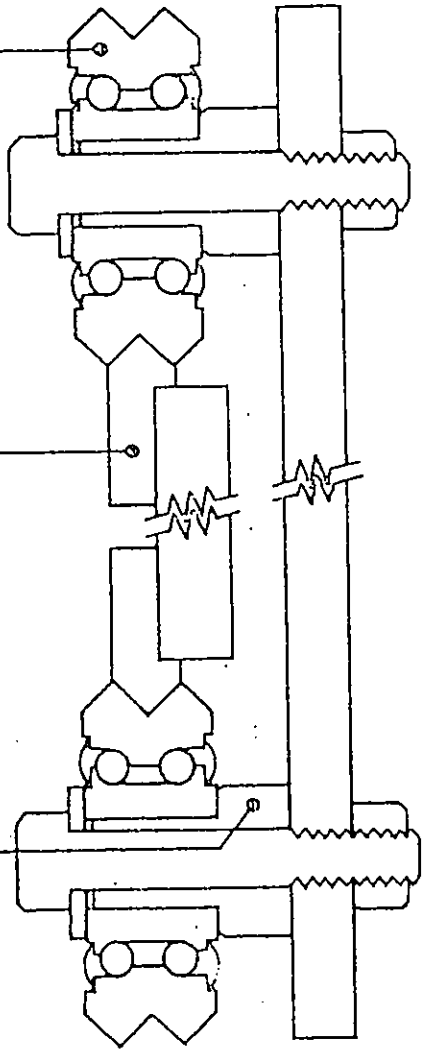
Wheels



Track



Bushings

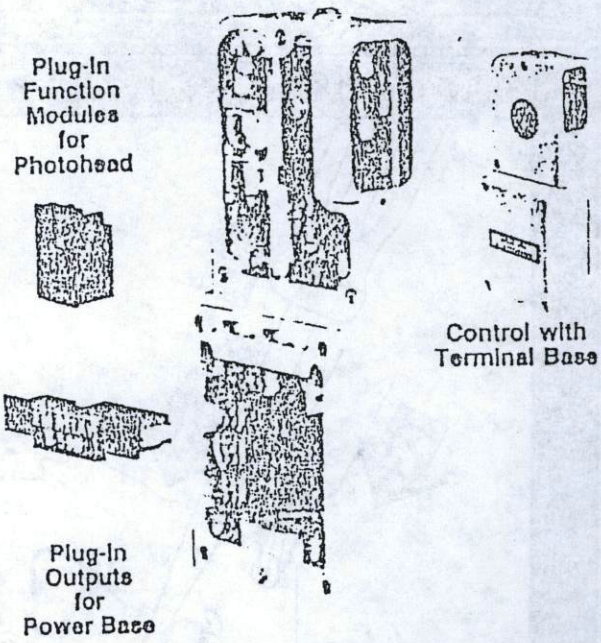


Type 42MR Full Feature Reflex and Proximity Controls

Series 5000 LED Quick Disconnect

Plug-In Functions and Outputs Provide Maximum Flexibility and Product Capability

GREEN LINE



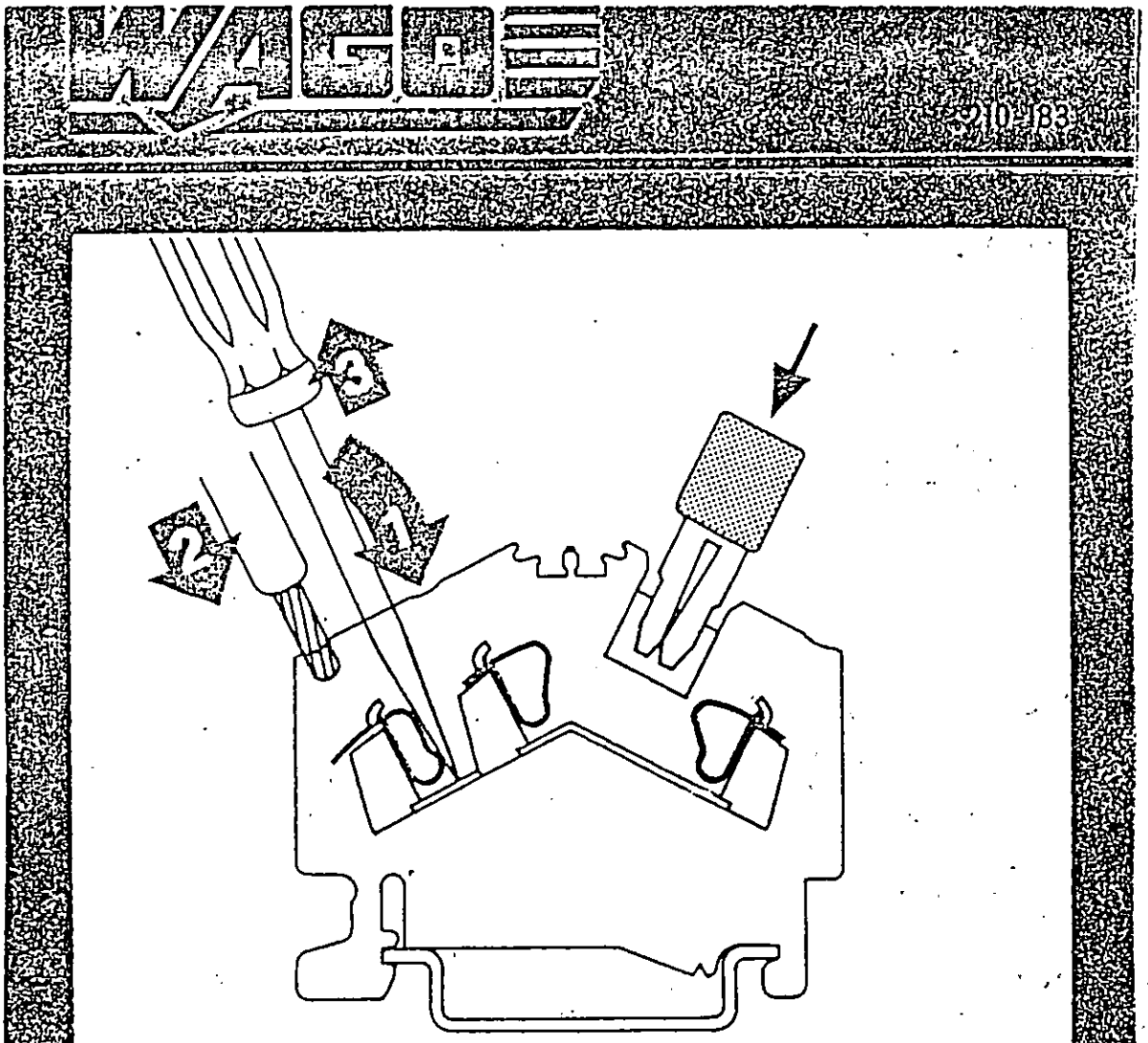
Type 42MRU or 42MRP PHOTOHEAD with Type 42MTB POWER BASE

FEATURES

- Reflex and Proximity Beam Models
- Reduced Size with Increased Operating Features
- Quick Disconnect (QD) Design Reduces Down Time
  —No Disruption of Alignment or Wiring
- Rated Operating Range
  —1" to 30' (.03m to 9.15m) on Reflex
  —0 to 7' (0 to 2.2m) on Proximity
- Single Terminal Type POWER BASE Provides for Plug-In EM Relay, F.E.T. and Triac Solid State Relay Outputs
- POWER BASES Available for 120VAC, 240VAC, 48VAC/DC and 24VAC/DC
- PHOTOHEAD Includes Provision for Plug-In Two Way Time Delay, One-Shot, Delayed One-Shot and Motion Detector Function Modules
- PHOTOHEAD Contains Functional Electronics and Optics
- Thick Film Microcircuitry for Quality and Reliability
- Dual Range Adjustable Input Sensitivity
- Switch Selection for Light or Dark Operation
- No False Turn-On Pulse
- Synchronous Detection Circuitry
- Circuit Response Time
  —Type 42MRU - 1 Millisecond
  —Type 42MRP - 2.5 Millisecond
- LED Alignment Indicator - Visible 360°
- NEMA 3, 4, 5, 12 & 13 Corrosion Resistant, High Impact Valox 357 Housing
- Low Power Consumption - 2VA at 120VAC
- UL and CSA Approval Applied For

PHOTOSWITCH®

Type 42MR Series 5000 Full Feature Reflex and Proximity Controls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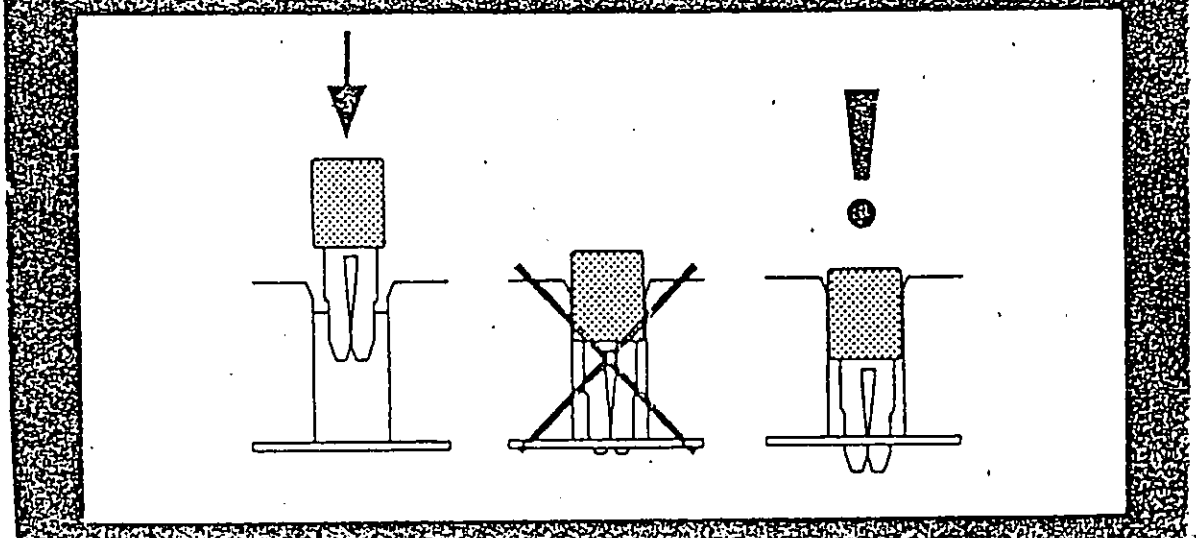
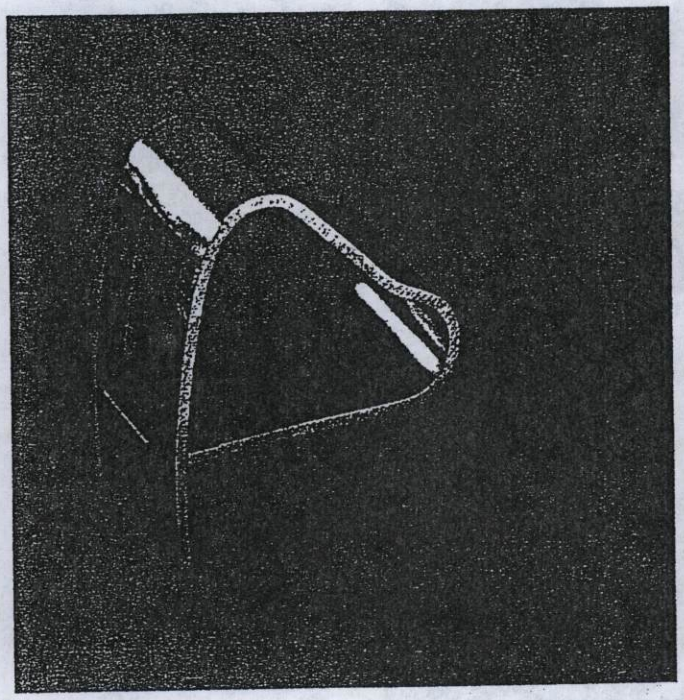
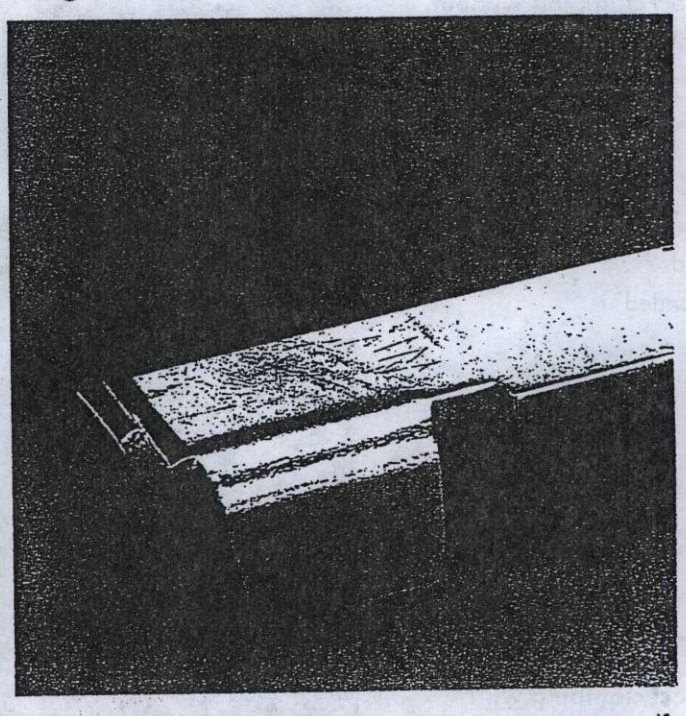
1
2


!

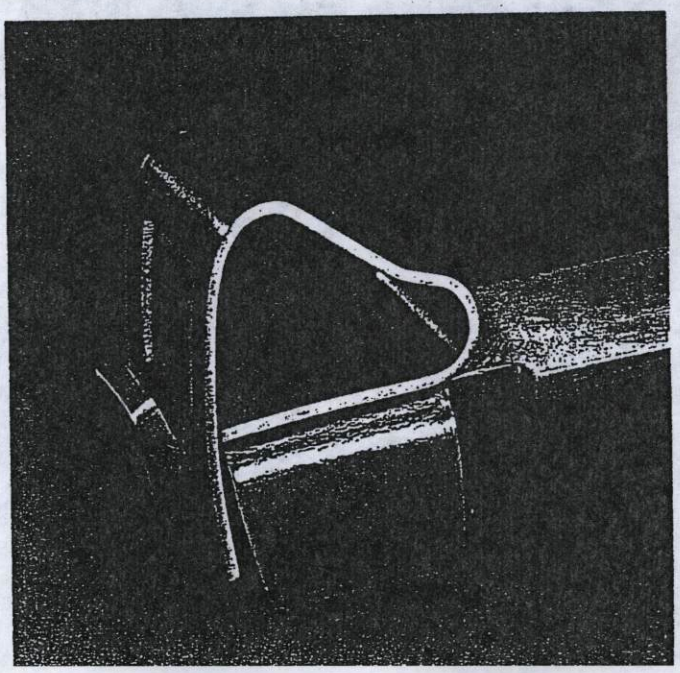
The WAGO Cage-clamp*
8 good reasons to use it

1. Wire clamping force is independent of insulating housing





Cage-clamp* spring
+ current bar
= cage-clamp* unit



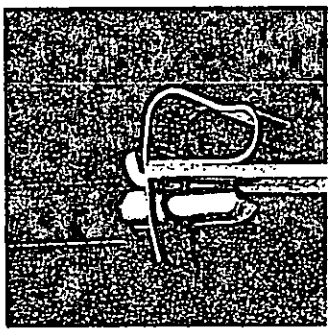
The cage-clamp* spring is self-secured to the current bar. The complete clamping unit is self-contained, ready for assembly into the insulating housing.

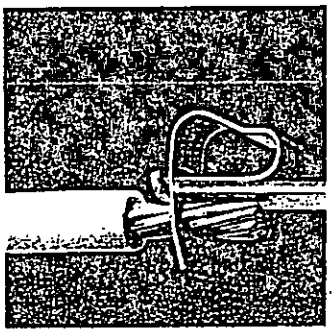
The separation of the mechanical requirements from the electrical allows the choice of the optimum spring material of stainless steel together with high conductivity copper for the current bar. This combination provides the best of both worlds.

2. Suitable for all copper conductors from AWG 26 (0.08 mm²) up to AWG 2 (35 mm²)

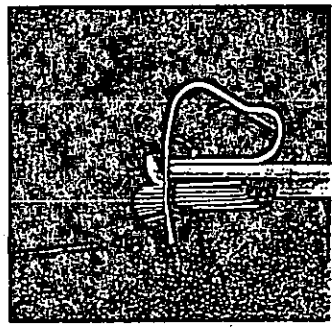
Direct clamping without special cable preparation

solid





stranded



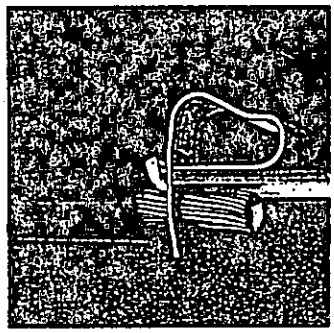
flexible

The cage-clamp* spring is suitable for the direct clamping of solid, stranded and flexible copper conductors without any special preparation such as with crimped ferrules or pin terminals. Under normal conditions of wiring and use direct clamping is technically the best and at the same time the most economical method of using the advantages of the cage-clamp* system.

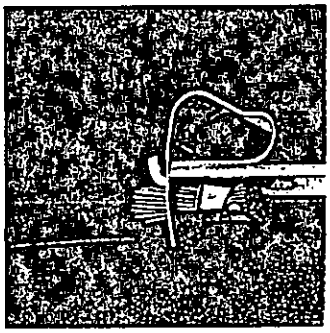
Correctly handled, the funnelled conductor entry holes ensure the individual conductor strands do not splay.

Direct clamping with special cable preparation

flexible, front end tinned



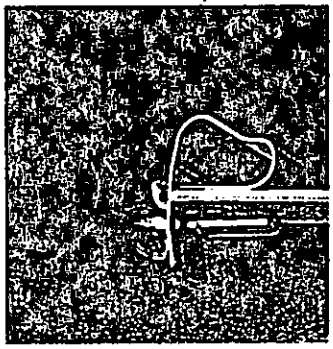
flexible with WAGO anti-splaying clip



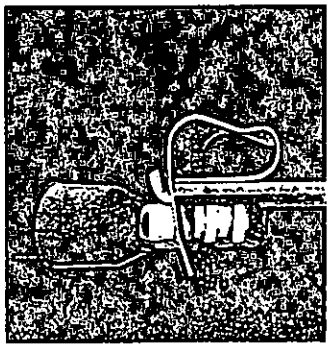
Protection of the conductor ends is necessary in the case of pre-harnessed cables or where wire handling conditions are difficult.

Indirect clamping

flexible with crimped ferrule

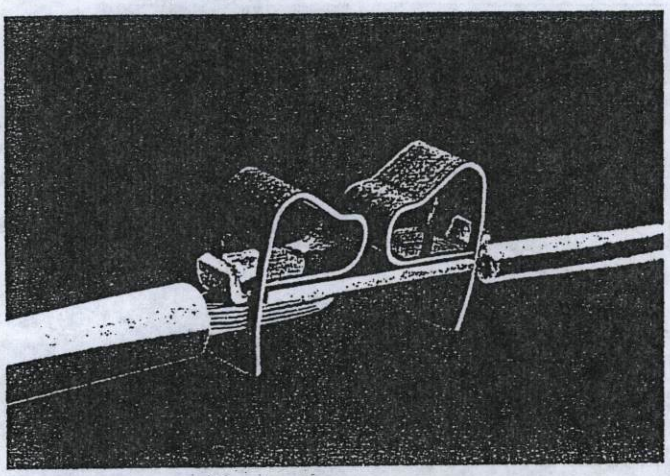


flexible with crimped pin ter-



Crimped ferrules or pin terminals, preferably produced from copper with tinned surface may be crimped on to the conductor end in a gas-tight manner.

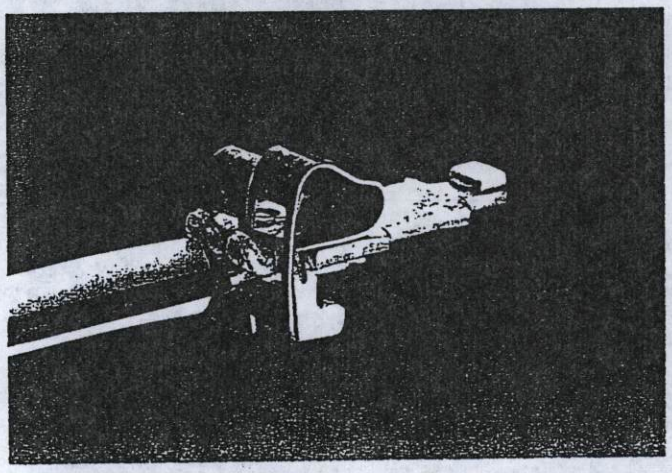
3. One conductor per clamping unit



Cage-clamp* unit
for 1 conductor
– side-entry –

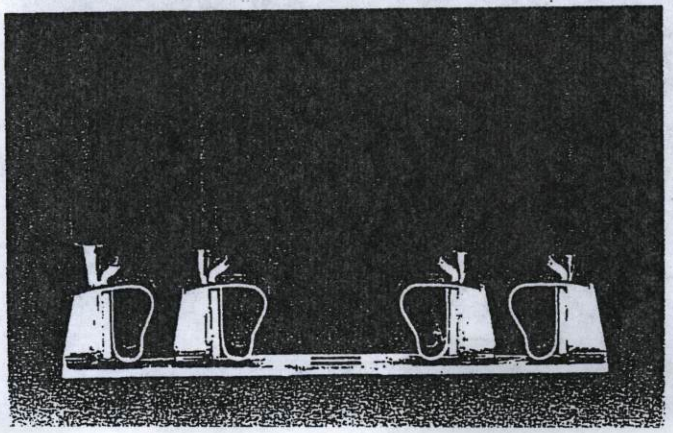
To ensure a high level of safety and security it is essential that this principle is observed.

Only when a single conductor is clamped per clamping unit can one obtain satisfactory performance.



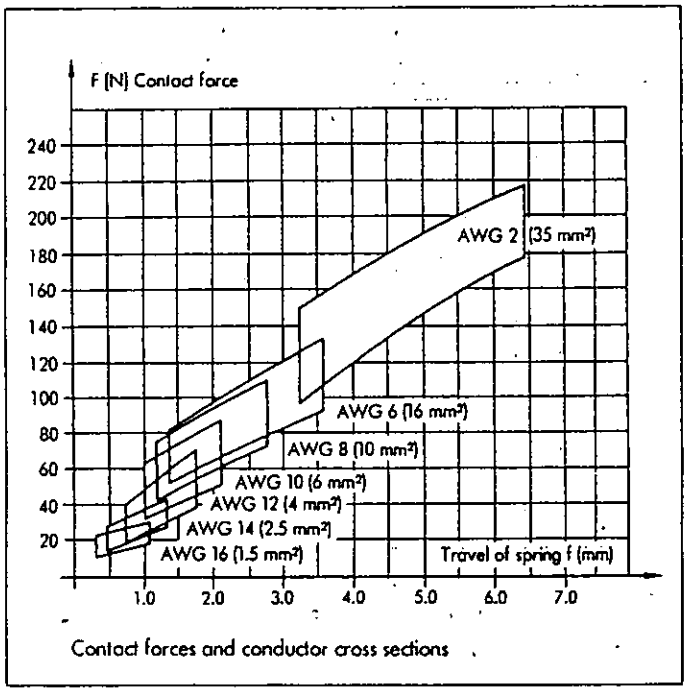
Cage-clamp* connection of a contactor for 2 conductors
– side-entry –

If more than one conductor per pole is required the provision of additional clamps must be considered so that different size conductors can be clamped independently of each other.

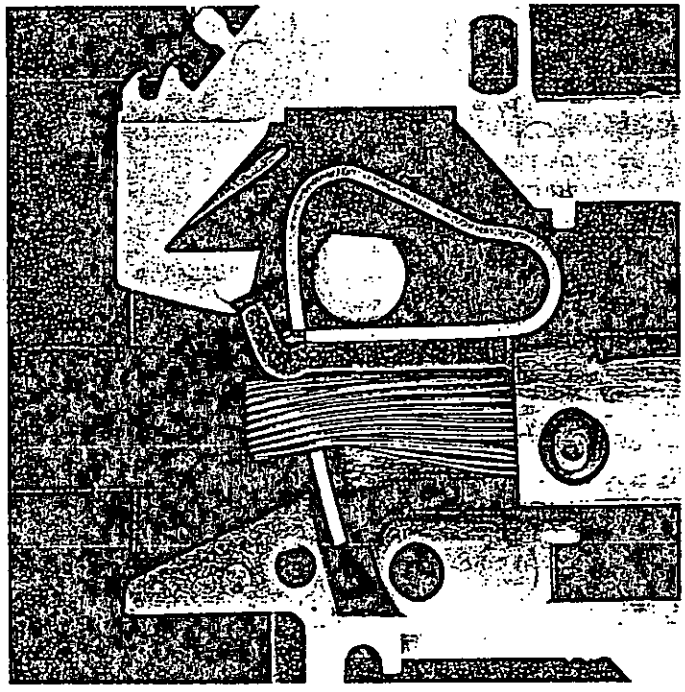


Cage-clamp* unit
for 4 conductors

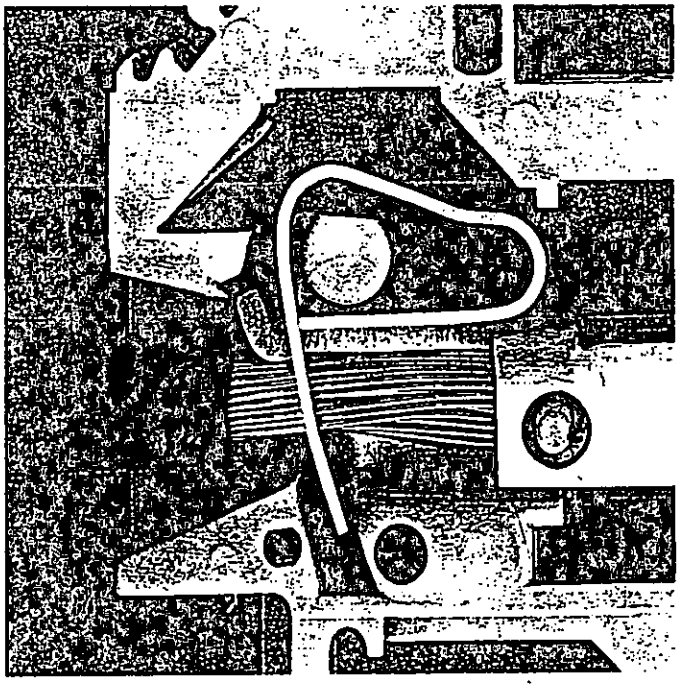
4. Clamping of the wire without damage through unique design



Contact forces and conductor cross sections



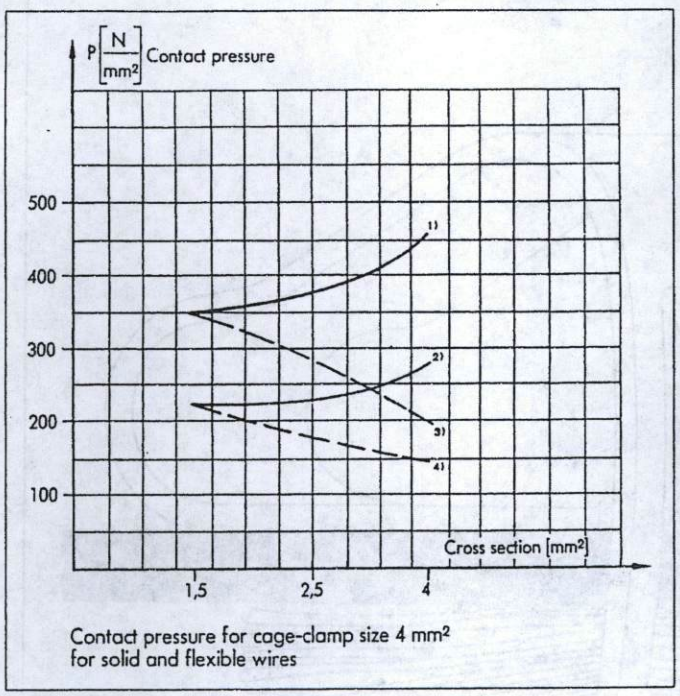
The rating curves of the cage-clamp* springs are such that the clamping force automatically adjusts to the size of conductor.
Any deformation of the conductor, e.g. due to cold flow or settling of strands is automatically compensated by the spring.
Cage-clamp* is a dynamic clamping mechanism, unlike a static screw.
Self-loosening is thus positively avoided.



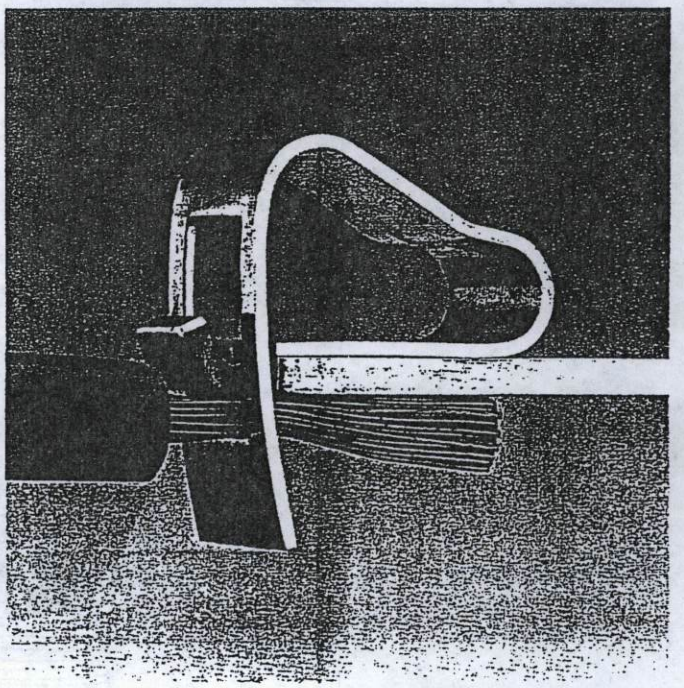
The flat clamping face of the cage-clamp* spring presses the wire against the current bar without damaging the conductor, even after many connection and disconnection cycles.

The clamping arm of the cage-clamp* spring has a backwards direction against the conductor. By this special angle an additional wedge force is obtained when pulling on the conductor and as a result, the conductor pull-out force is increased without

5. Gastight contact area between conductor and current bar



Contact pressure for cage-clamp size 4 mm² for solid and flexible wires



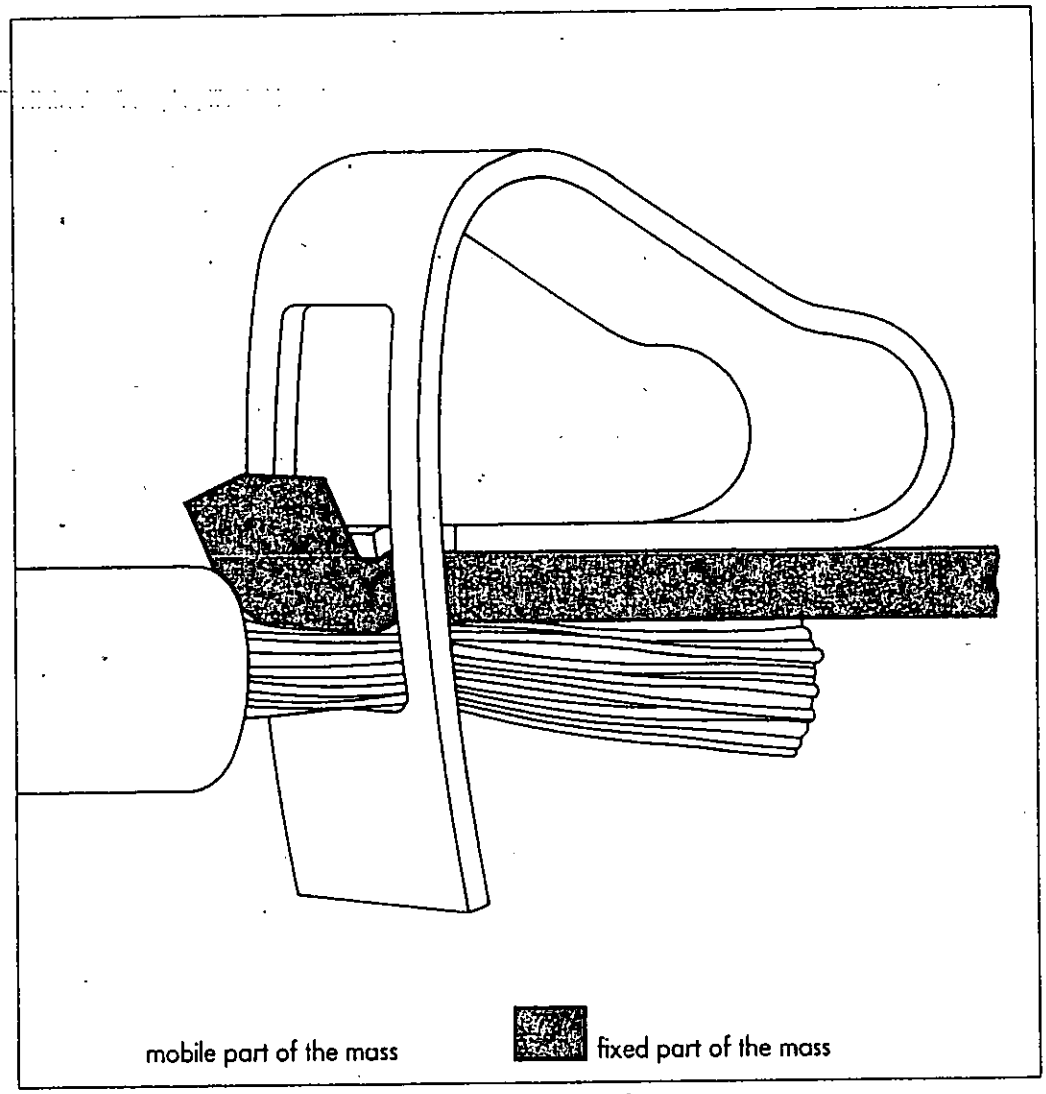
1) cage-clamp* with solid conductor
2) cage-clamp* with flexible conductor
3) screw-clamp with solid conductor
4) screw-clamp with flexible conductor
* Please see technical journal "etz" number 1/83

The cage-clamp* spring presses the conductor against the current bar in the front section where it is slightly curved. At this point the conductor is embedded into the soft tin/lead surface with a high specific pressure, resulting in a good protection of the contact point against corrosive deterioration.
Due to this concentration of the clamping force in a defined contact area between conductor and current bar, the value of the contact pressure is comparable with that of screw-clamp terminal blocks with the screws correctly tightened.

Cage-clamp* connections are suitable for high current applications as well as for the transmission of low voltages and low currents in the mV and mA range for electronic applications and in the process control technique.

6

6. Vibration- and shock resistant



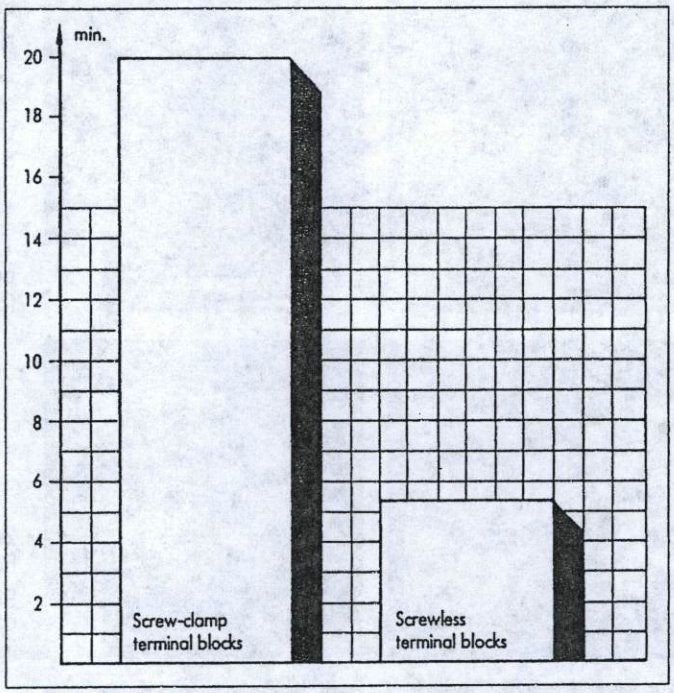
Due to the best possible use of the material characteristics the cage-clamp* spring has very little mass in relation to the high force produced.

Furthermore the cage-clamp* spring damps the wire and the solid current bar such that a favourable division of the

The interaction of these factors results in a connection which has high resistance to vibration and shock, as confirmed in many approval tests. Vibration and shock neither result in conductor damage nor in a measureable contact interruption.

7. Fast and reliable

Average wiring time for 100 clamping connections each with screw-clamp and screwless terminal blocks.



Public wiring competitions have proven a reduction of the wiring time by 75% when comparing manual wiring of screw-clamp terminal blocks with screwless terminal blocks. (Please see "elektroanzeiger" volume 7/83).

Even when powered screwdrivers are used for tightening of the clamping screws, there is still a time advantage for the cage-clamp* terminal blocks.
(Please see "technisch-wissenschaftliche Veröffentlichung" VER 21-668 KLÖCKNER-MOELLER).

In all cases, where the wires can be clamped directly, the expense for the preparation of the end of the wire can be eliminated, viz:

- the material cost of the ferrule or pin terminal
- the price and the maintenance cost for the crimping tool

the time for

- handling the ferrule or pin terminal
- handling the crimping tool
- placing the ferrule in the tool
- insertion of the wire into the ferrule
- crimping

There are important additional cost savings:

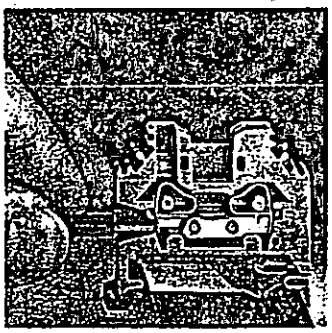
- there is no need to check the clamping screws to ensure they are correctly tightened and
- the high cost of downtime on expensive equipment, due to failure of an inexpensive connection, is reduced.

8. Easy and obvious handling

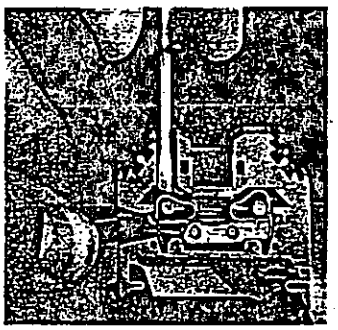
Side-entry:

Depression of the cage-clamp* spring from the front, wire entry from the side.

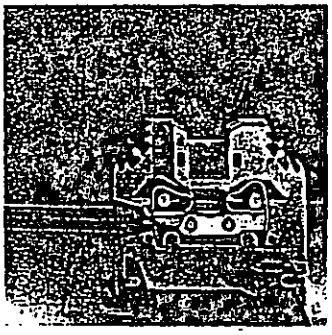
1. Stripped wire is introduced just before the clamping unit.

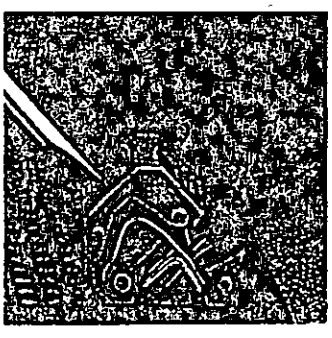


2. The cage-clamp* spring is pressed down and the wire is introduced into the clamping unit immediately.



3. The cage-clamp* spring is released – the conductor is automatically clamped.

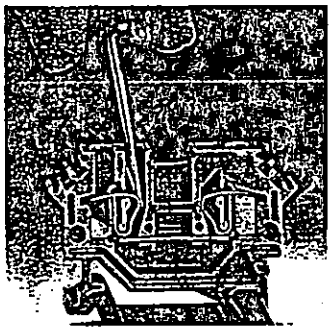




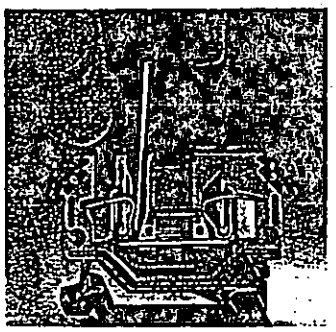
Some products allow optional side-entry or front-entry.

Front-entry:

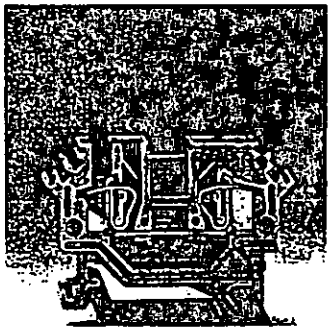
Depression of the cage-clamp* spring and wire entry from the front, both under visual control of the operator.



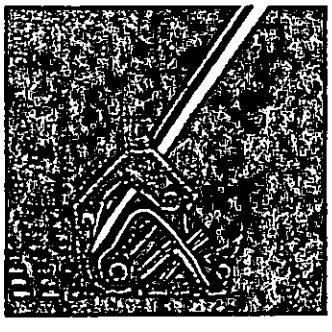
1. The screwdriver is introduced in the operating slot up to the stop.



2. The screwdriver blade holds the clamping spring open automatically so that the conductor can be introduced into the clamping unit.

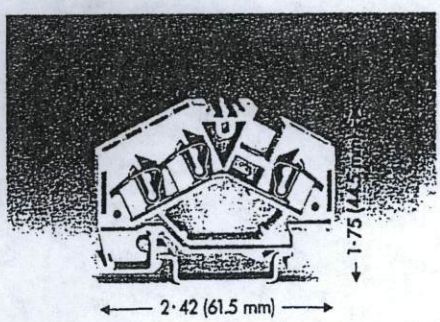


3. The screwdriver is withdrawn – the conductor is automatically clamped.



The contact quality of the cage-clamp* connection is almost independent of the

AWG 26 - 12 | **0.08 – 4 mm²** **600 V, 20 A** | **750 V~, Gr. C** **600 V, 25 A** | **34 A** **Terminal block width 0·236 in (6 mm)** **Stripped length 0·39 in (9 - 10 mm)** *			



	Item-No.	Pack.-unit pcs.		
	281-631	100		
	281-651	100		
3-conductor through terminal blocks				
0·098 in (2.5 mm) thick				
	281-312	25		
	281-313	25		
0·078 in (2 mm) thick				
	281-348	25		
	281-318	25		
0.08 - 0.2 mm² ❶	**281-470**	200 strips		
0.25 - 0.5 mm²	**281-471**	200 strips		
0.75 - 1.5 mm²	**281-472**	200 strips		
I_N 26 A	**281-401**	200 (8 x 25)		
	281-402	200 (8 x 25)		
	281-422	200 (8 x 25)		
I_N 26 A				
	281-406	100 (4 x 25)		
	281-409	100 (4 x 25)		
	281-482	100 (4 x 25)		
	281-483	100 (4 x 25)		
	281-490	50 (2 x 25)		
	281-492	100 (4 x 25)		
2-pole	**280-432**	1		
3-pole	**280-433**	1		
5-pole	**281-440**	1		
	280-404	100 (4 x 25)		
for test plug 210-137 0·090 in (2.3 mm) Ø				
	209-170	50 (2 x 25)		
for test plug 0·157 in (4 mm) Ø				
	281-407	100 (4 x 25)		
	281-415	100 (4 x 25)		

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Bill of Materials

8/2/2010

1575G188 1575G POLY BAG INSERTER

Seq	Item	Description	Qty	UM	Remarks
	160086	8" RISER	1	EA	
	160368	PLUNGER TUBE 3-5/8	4	EA	
	160369	SUPPORT BRACKET	4	EA	
	160373	UPPER TIE PLATE	1	EA	
	160374	LOWER TIE PLATE	1	EA	
	203-0124	HEAD STOP	1	BM	303-0034 C.ASSM.
	203-1877	6-1/2 & UNDER DP CASE	1	BM	
	203-2228	B/M 460 VOLT INPUT	1	BM	
	203-2478	ROLL LIFT 46S 48W	1	BM	303-0227 C.ASSM.
	203-2570	FRAME & GUARDS	1	BM	303-0715 C.ASSM.
	203-2571	BASIC CONVEYOR	1	BM	303-0716 C.ASSM.
	203-2573	PANEL U.L.	1	BM	603-0633 D.ASSM.
	203-2574	MACHINE INTERCONNECT 48" W	1	BM	603-0634,603-0635 D.ASSMS
	203-2575	ROLL LIFT ELECTRICAL	1	BM	
	203-2576	FILM MANDREL W/O SPACER 48"	2	BM	303-0703 B.ASSM.
	203-2577	DRIVE ASSEMBLY 48W X 34S	1	BM	303-0713 C.ASSM.
	203-2579	OPEN & SEPERATE 48W X 34S	1	BM	303-0714 C.ASSM.
	203-2582	INSERT HD 1575 TEARDROP EXT	1	BM	303-0230 C.ASSM.
	203-2583	PNEUMATICS 34"	1	BM	703-0246,703-0247 D.ASSMS
0098	200-0435	SPARE PARTS - 1575G SPECIAL	0	BM	

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Bill of Materials

8/2/2010

203-2570 FRAME & GUARDS

Seq	Item	Description	Qty	UM	Remarks
	303-0715	FRAME ASSEMBLY	0	EA	
0001	120074	DOOR STOP (B)	1	EA	
0002	503-3958	DOOR HINGE	1	EA	
0002	503-3963	DOOR HINGE	1	EA	
0003	503-3956	FRONT DOOR LEFT	1	EA	
0004	503-3957	FRONT DOOR RIGHT	1	EA	
0005	503-2716	WINDOW - RT	1	EA	
0006	503-2715	WINDOW - LT	1	EA	
0007	123938	CONTROL BOX BRACKET (B)	1	EA	
0008	123943	ANGLE CLIP (B)	1	EA	
0009	124225	REAR STOP PLATE (B)	1	EA	
[illegible]0	160921	STOP MOUNT	1	EA	
[illegible]2	38053	DOOR FASTENER	1	EA	
0013	143561	CYLINDER MOUNT	1	EA	
0014	160919	MOUNT BLOCK	1	EA	
0015	160917	CASE STOP	1	EA	
0016	146197	MNT BRACKET	1	EA	
0017	160194	SLEEVE	1	EA	
0018	76403	LEG, ADJUSTING 5.38"	4	EA	
0019	576-0503	SPACER, 3/4ODX11/32IDX3/4LG	6	EA	
0020	123996	STOP PAD (C)	1	EA	
0021	123885	UPPER SIDE FRAME LT (A1)	1	EA	
0022	503-2403	UPPER SIDE PANEL - RT	1	EA	
0024	600892A04	ROD END, RH FEMALE PTFE .38"	1	EA	
0025	143089	EYE MOUNT	2	EA	
0026	136361	STUDDED HANDLE 3/8 X 1 3/16	2	EA	
0027	145054	STEP PLATE	1	EA	48W
0028	123953	CONTROL BOX MNT (A)	1	EA	
0029	132621	AIR SHIELD BRACE (B)	2	EA	
0030	142878	WASHER RUBBER FACED 9/32	14	EA	
0031	142877	WASHER RUBBER FACED #10	12	EA	
[illegible]2	503-2361	TRANSFORMER MTG PLATE	1	EA	
0040	124590	BOX MOUNT EXTENSION (A)	2	EA	46S
0041	124594	LOWER SIDE PANEL (A)	1	EA	46S

Seq	Item	Description	Qty	UM	Remarks
0042	124598	MAIN FRAME	1	EA	46S-48W
0043	124778	TUBING SUPPORT 46"	1	EA	46S
0044	503-0790	AIR SHIELD	1	EA	46S-48W
0047	123071	RETRO TAPE	1	EA	
0048	600492	LABEL,VINYL-CUT 2.58"X12.00"LG	1	EA	
0049	503-2717	WINDOW FLANGE	1	EA	
0050	503-2718	WINDOW FLANGE	1	EA	
0051	503-2719	WINDOW FLANGE	1	EA	
0052	577-0111	ROLL, STRIPE	120	IN	
0053	26004	CLAMP %	4	EA	
0054	124224	NUT PLATE (B)	1	EA	
0055	600518	LABEL, WARNING	1	EA	
0056	600425	LABEL - WARNING	1	EA	
0057	600420	LABEL - WARNING	1	EA	
0058	600516	LABEL, WARNING PINCH POINT	3	EA	
0059	600508	LABEL, DANGER IMPACT HAZARD	1	EA	
0060	577-0119	LABEL, DANGER SHOCK HAZARD	1	EA	
0061	600957	NAMEPLATE, MAIN THIELE	1	EA	
0063	147726	LABEL-MODIFICATION	1	EA	INSIDE BOX-1
0064	28173	ROD END 1/4-28 RH F	1	EA	
0065	503-3478	LATCH GUIDE	1	EA	
0066	503-3955	LATCH ROD 33"	1	EA	
0067	160915	STOP MOUNT	1	EA	

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Bill of Materials

8/2/2010

203-2576 FILM MANDREL W/O SPACER 48"

Seq	Item	Description	Qty	UM	Remarks
	303-0229	DRIVE ASSEMBLY	0	EA	
	303-0703	FILM MANDREL W/O SPACER	0	EA	
0010	130161	SIDE GUIDE ADAPTER (C)	2	EA	
0013	160237	SHAFT	1	EA	
0014	124966	SIDE GUIDE HUB (B)	2	EA	
0015	130159	BAG ROLL SIDE GUIDE (C)	2	EA	
0045	126687	COLLAR (C)	2	EA	
0088	158426	BRK RETAINING SUPT PLATE	1	EA	
0088	581-0005	STUD HANDLE 1/4-20NC 1-1/2LG	1	EA	

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Bill of Materials

8/2/2010

203-2577 DRIVE ASSEMBLY 48W X 34S

Seq	Item	Description	Qty	UM	Remarks
	303-0713	DRIVE ASSEMBLY 1575	0	EA	
0003	123876	TIE BAR	1	EA	
0005	124959	TIE BLOCK (C)	2	EA	
0007	158475	SHOCK 1/2 X 2 WITH FLANGE	2	EA	
0008	130160	SPACER	16	EA	SEE MANDREL BILL
0009	10314	CHAIN, #40 .5" PITCH	22	IN	
0010	130161	SIDE GUIDE ADAPTER (C)	0	EA	SEE MANDREL BILL
0011	933	COLLAR, 1/2 SET	3	EA	
0012	132630	BAG GUIDE RAIL (B)	2	EA	
0014	124966	SIDE GUIDE HUB (B)	0	EA	
[illegible]5	130159	BAG ROLL SIDE GUIDE (C)	0	EA	SEE MANDREL BILL
0016	124775	CHAIN GUARD (A1)	1	EA	
0017	158479	LOWER CYLINDER MOUNT	1	EA	
0018	102834	DO NOT ORDER "SEE NOTE"	1	EA	
0019	32786	BEARING, 1" DIA RADIAL	4	EA	
0020	38025	DRIVE ROLLER (B)	2	EA	48W
0021	18269	B ROLL PIN 3/16 X 3/4 LON	10	EA	
0022	123870	RAIL SUPPORT (B)	1	EA	
0023	123868	TIE BLOCK (C)	2	EA	
0024	124601	REAR SUPPORT ANGLE (B)	4	EA	
0025	102720B03	SCREW,SHOULDER,SH,.50 X .63	2	EA	
0026	19694	PIN, ROLL 1/4 X 1 LONG	2	EA	
0027	70742	LINK, CONNECTING #40	1	EA	
0028	123900	ROLLER SIDE PLATE	2	EA	
0031	124964	SEPARATOR (B)	1	EA	
0032	124974	SPACER (B)	1	EA	
0033	123907	ROLLER PIVOT PLATE (A)	2	EA	
0034	123906	LEVER ARM (D)	2	EA	
0035	123882	BAG ROLL MOUNT	2	EA	
[illegible]6	160343	TIE BLOCK	1	EA	
0037	160337	HEAD TIE BLOCK	1	EA	
0038	160341	LOWER TIE BAR	1	EA	

Seq	Item	Description	Qty	UM	Remarks
0039	160336	SHOCK MOUNT INSERTER HEAD	1	EA	
0040	160338	UPPER TIE BAR	1	EA	
0041	160340	EYE MOUNT	3	EA	
0042	160335	WHEEL MOUNT	2	EA	
0043	160339	HEAD TIE PLATE	1	EA	
0044	124002	CYL EXTENSION THREADED	1	EA	
0045	126687	COLLAR (C)	0	EA	SEE FILM MANDREL
0046	503-1274	VERTICAL SWITCH MNT 34" S	1	EA	34S
0047	132603	GUIDE TUBE 34" STROKE	2	EA	34S
0048	503-1277	CYLINDER TIE BAR 34" STROKE	1	EA	34S
0049	11325	SPROCKET 40B17K 1.000	1	EA	
0050	160239	PIVOT SHAFT	1	EA	48W
0051	123912	ROLLER DRIVE GEAR (B)	2	EA	
0052	160240	FEED ROLL SHAFT	2	EA	48W
0053	124958	SPROCKET 40B19K .875	1	EA	
0054	160342	CYLINDER EXTENSION	1	EA	
0055	126362	BUSHING, DUAL VEE ADJ #3	4	EA	
0056	126361	BUSHING, DUAL VEE STAT #3	4	EA	
0057	157245	V-WHEEL	8	EA	
0058	160351	UPPER CYLINDER MOUNT	1	EA	
0060	132600	BRAKE RETAINING PLATE (B)	1	EA	
0061	132601	ROLL BRAKE (C)	1	EA	
0062	132602	ROLL WEIGHT (C)	5	EA	
0063	102720B07	SCREW, SHOULDER SH .50 X 1.50	4	EA	
0064	132612	TIE BAR (C)	1	EA	
0065	136354	FEMALE HANDLE 1/2 NC	1	EA	
0066	18270	ROLL PIN 3/16 X 1 LONG	1	EA	
0067	132626	KNOB BRACKET (B)	1	EA	
0068	132625	ADJUSTMENT SCREW (B)	1	EA	
0069	132613	RAIL SUPPORT (C)	1	EA	
0070	132624	RAIL MOUNTING BLOCK (C)	1	EA	
0071	132623	PIVOT BLOCK (C)	1	EA	
0073	132742	CLAMP BOLT (B)	2	EA	
0076	35103	HANDLE	1	EA	
0079	15894	KNOB	2	EA	
0080	132909	LIFT LEVER (B)	2	EA	
0081	503-1272	REFLECTOR MOUNT	1	EA	
0082	591-0521	REFLECTIVE TAPE 3"X100" ROLL	3	EA	
0083	503-1484	RETAINER AIR TUBE	3	EA	
0084	141114	AIR BLAST TUBE	1	EA	
0085	102698	NUT PLATE (C)	4	EA	
0086	155107	PIVOT ANGLE SPACER	2	EA	
0087	155106	HEAD TIE PLATE SPACER	1	EA	

Seq	Item	Description	Qty	UM	Remarks
0088	158426	BRK RETAINING SUPT PLATE	1	EA	

Thiele Technologies

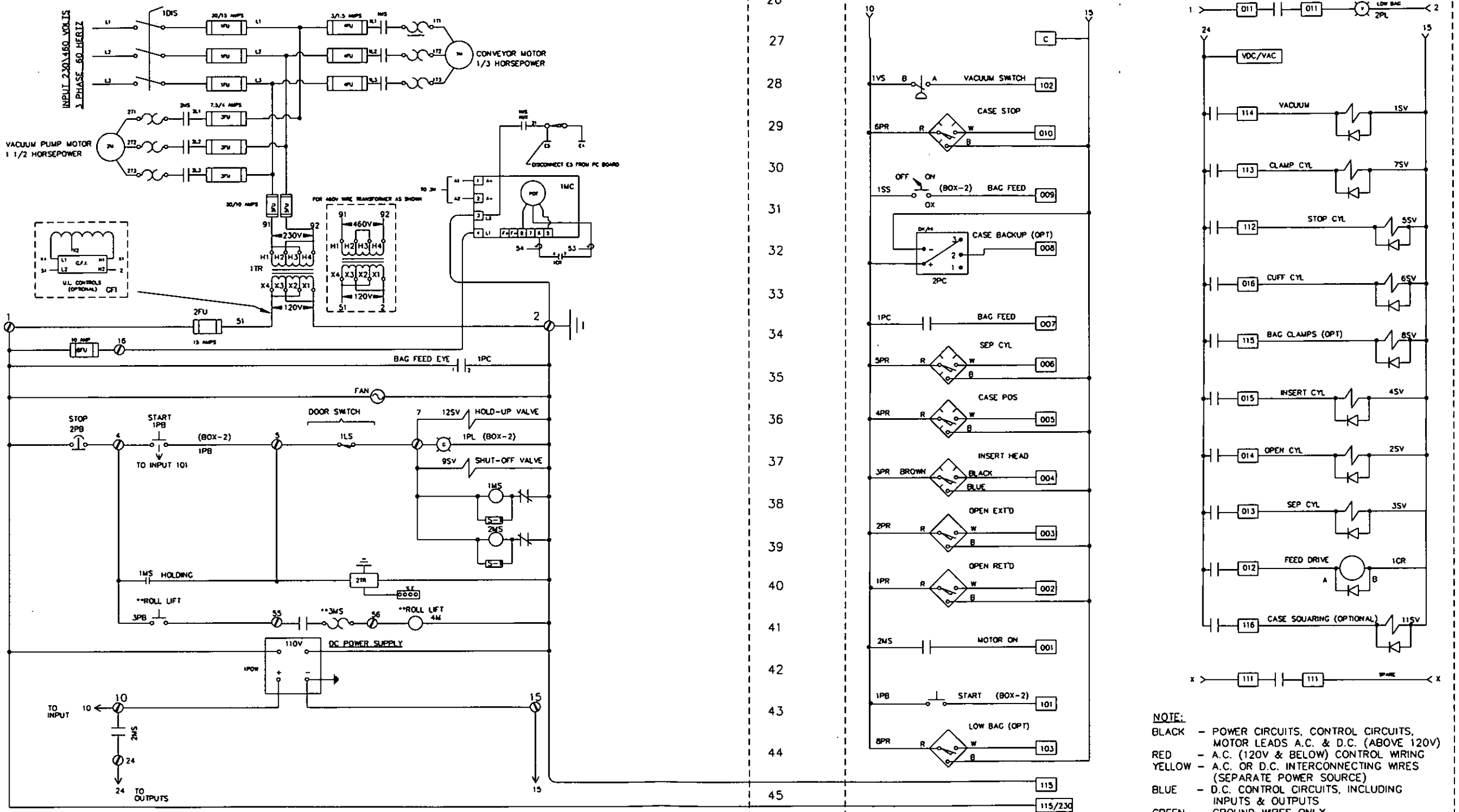
A Barry-Wehmiller Company

Bill of Materials

8/2/2010

203-2582 INSERT HD 1575 TEARDROP EXT

Seq	Item	Description	Qty	UM	Remarks
	303-0230	INSERT HEAD ASSEMBLY	0	EA	
0003	160903	INSERT MOUNT	4	EA	
0006	158048	CUFFER BRACKET	8	EA	
0007	160362	WASHER	4	EA	
0010	503-3674	PLUNGER TUBE MNT	4	EA	
0014	158373	MINIFOLD MOUNT	1	EA	
0019	160361	PIVOT - NUT	0	EA	
0020	190187	TUBING, .13 OD POLYETHYLENE	240	IN	
0021	158049	FINGER MOUNT	4	EA	
0022	123939	FINGER GUIDE (C)	8	EA	
0023	190163	CUFFING FINGER EXT 8-3/4" LG	4	EA	
[illegible]	127539	MALE CONNECTOR (A1)	8	EA	
0025	127538	NEEDLE VALVE (C)	4	EA	
0026	127541	TUBE CONN 1/8 TUBE X 10-32	4	EA	
0027	127540	CONNECTOR, MALE 1/8NPT-1/8T	4	EA	
0030	124603	MALE ELBOW	2	EA	
0033	127662	AIR CYLINDER	4	EA	
0034	86400	MANIFOLD (C)	2	EA	
0036	102717B05	SCREW, SHOULDER SH .25 X 1.0	4	EA	
0048	18000	PLUG, PIPE 1/8NPT HEX SOCT	2	EA	
0049	503-0037	EYE MOUNT	1	EA	



NOTE:
BLACK - POWER CIRCUITS, CONTROL CIRCUITS, MOTOR LEADS A.C. & D.C. (ABOVE 120V)
RED - A.C. (120V & BELOW) CONTROL WIRING
YELLOW - A.C. OR D.C. INTERCONNECTING WIRES (SEPARATE POWER SOURCE)
BLUE - D.C. CONTROL CIRCUITS, INCLUDING INPUTS & OUTPUTS
GREEN - GROUND WIRES ONLY
WHITE - NEUTRAL CONDUCTOR OF A.C. CONTROLS

REF: 603-0506

SLC-150/U.L./STANDARD

REV.	DATE	BY	DESCRIPTION

TOLERANCES UNLESS SPECIFIED
2 PL. DEC. ±.010
3 PL. DEC. ±.005
FRACTIONS ±1/64
ANGLES ±1/2°

BEMIS PACKAGING MACHINERY COMPANY

NEXT ASSY NO. :
DRWN MGC 10/21/92 SUPERSEDES NO
CHKD

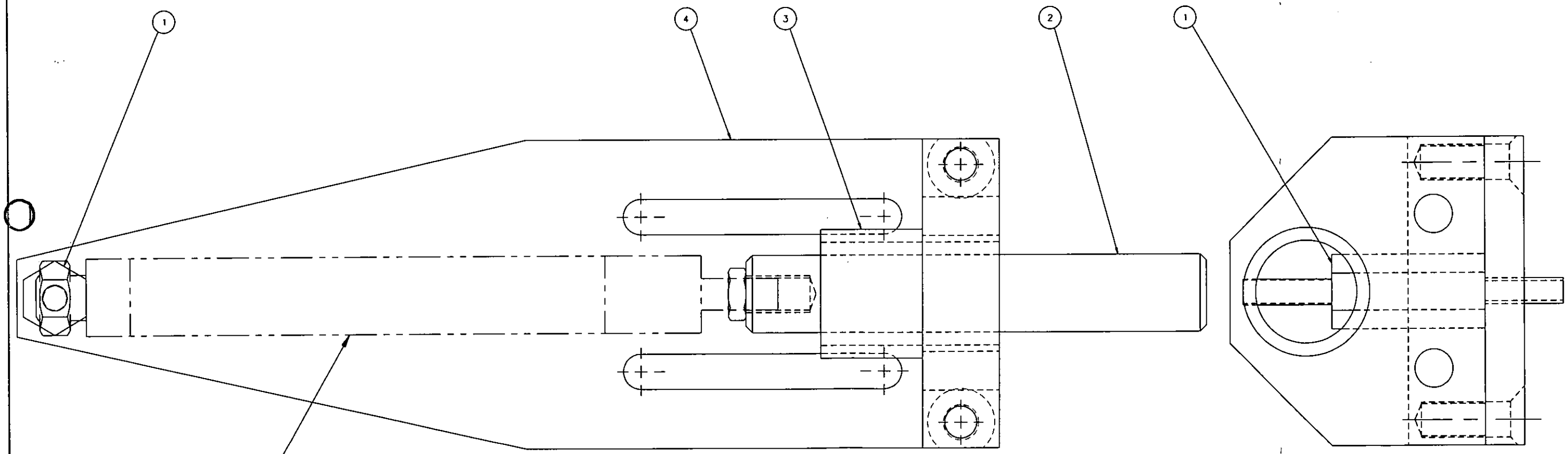
1575F
USED ON SZ
SCALE: NTS
SHEET 1 OF 1

TITLE: WIRING DIAGRAM

DWG NO 603-0635 D REV A

ITEM	PART NUMBER	QTY	DESCRIPTION
1	146452 A	1	CYLINDER STUD
2	146451 A	1	STOP
3	146453 B	1	ROD ALIGNER
4	146454 B	1	CLINDER MOUNT

NO.303-0034 B SHEET 1 OF 1



AIR CYL NO. 146450 A REF
(SEE PIPING DIAGRAM)

REV	DATE	BY	DESCRIPTION	E.R. NO.
D				
C				
B				
A	3-25-97	RM	CORRECTED DWG	N/A

G:\BLACK\1575STD\303-0034 (01/16/95)

TOLERANCES
UNLESS SPECIFIED
2 PL. DEC. ±.010
3 PL. DEC. ±.005
FRACTIONS ±1/64
ANGLES ±1/2°

BEMIS PACKAGING MACHINERY COMPANY

1575

NEXT ASSY NO. :				USED ON & SIZE
DRWN	DPW	10-17-94	SUPERSEDES NO	SCALE: 1"=1"
CHKD				SHEET 1 OF 1

MATL:

PRE REF:

POST REF:

TITLE HEAD STOP ASSEMBLY

NON STANDARD

DWG NO 303-0034 B

No. 303-0221C M

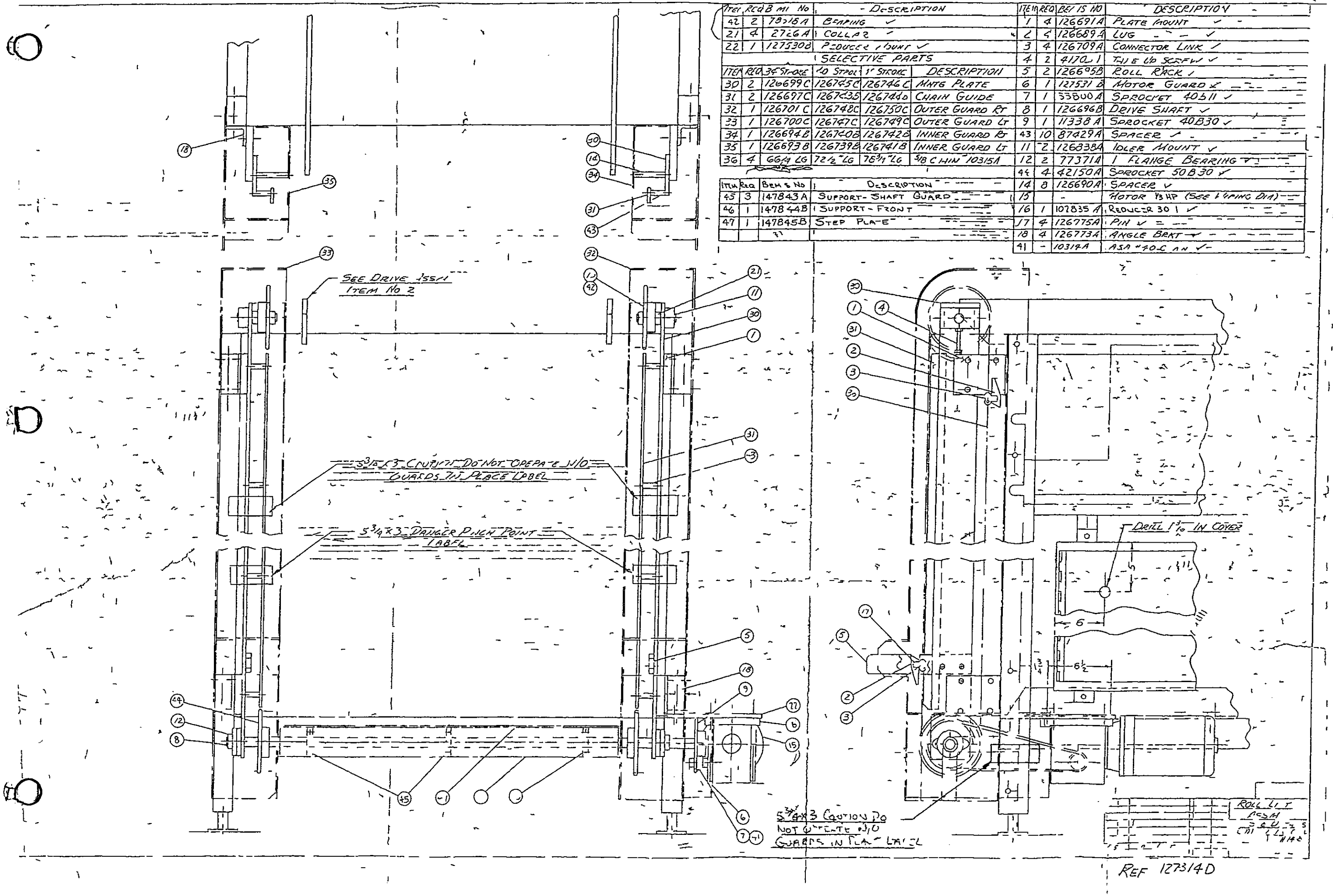
ITEM	REQ'D	B MI No	DESCRIPTION
42	2	78716A	BEARING ✓
21	4	2726A	COLLAR ✓
22	1	127530B	PRODUCER MOUNT ✓

SELECTIVE PARTS

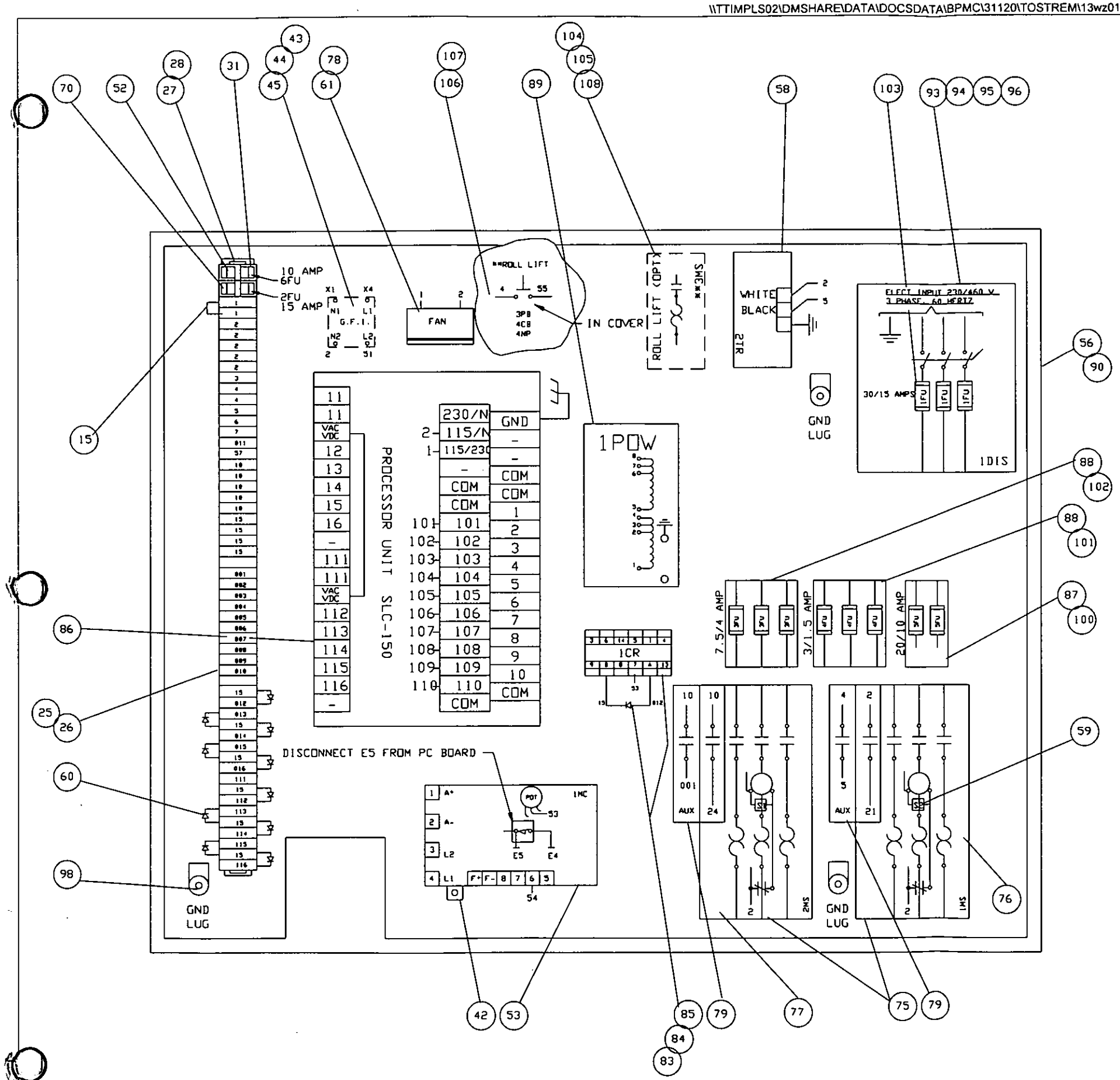
ITEM	REQ'D	36" STROKE	40" STROKE	51" STROKE	DESCRIPTION
30	2	126699C	126745C	126746C	MNTG PLATE
31	2	126697C	126743B	126744D	CHAIN GUIDE
32	1	126701C	126748C	126750C	OUTER GUARD RT
33	1	126700C	126747C	126749C	OUTER GUARD LT
34	1	126694B	126740B	126742B	INNER GUARD RT
35	1	126693B	126739B	126741B	INNER GUARD LT
36	4	66A LG	72½" LG	78¾" LG	5/8 CHAIN 10315A

ITEM	REQ	BEM & No	DESCRIPTION
45	3	147843A	SUPPORT-SHAFT GUARD
46	1	147844B	SUPPORT-FRONT
47	1	147845B	STEP PLATE

ITEM	REQ	BEM & No	DESCRIPTION
1	4	126691A	PLATE MOUNT ✓
2	4	126689A	LUG ✓
3	4	126709A	CONNECTOR LINK ✓
4	2	4170_1	TYE UP SCREW ✓
5	2	126695B	ROLL RACK ✓
6	1	127531B	MOTOR GUARD ✓
7	1	55800A	SPROCKET 40B11 ✓
8	1	126696B	DRIVE SHAFT ✓
9	1	11338A	SPROCKET 40B30 ✓
43	10	87429A	SPACER ✓
11	2	126338A	IDLER MOUNT ✓
12	2	77371A	1 FLANGE BEARING ✓
44	4	42150A	SPROCKET 50B30 ✓
14	8	126690A	SPACER ✓
15		-	MOTOR ⅓ HP (SEE WIRING DIA)
16	1	107835A	REDUCER 30:1 ✓
17	4	126775A	PIN ✓
18	4	126773A	ANGLE BRKT ✓
41	-	10317A	ASA #40-C NN ✓



REF 127314D



KEY	QTY	PART NO.	VENDOR NAME	VENDOR NO:	DESCRIPTION
15	13	157629 A	WAGO		JUMPER-FOR TERMINAL
25	45	157622 A	WAGO		TERMINAL BLOCK
26	26	595-0003 A	WAGO		DIN RAIL
27	1	157623 A	WAGO		END PLATE
28	2	158130 A	WAGO		END STOP
31	2	158132 A	WAGO		FUSE BLOCK
42	2	127466 A	BEMIS		CONTROLLER MOUNT
52	1	110269 A	BUSSMAN	BAF-10	10 AMP FUSE
53	1	123024 A	FINCOR	MODEL 2251 115V	MOTOR CONTROLLER
56	1	123965 D	BEMIS		CONTROL BOX
58	1	124774 A	SIMCO	F167	POWER UNIT
59	2	127509 A	RK ELECTRIC	RC-2A6	SURGE SURPRESSOR
60	9	132235 A	INT.L RECTIFIER	IN4004/D041	DIODE
61	1	133700 A	PAMOTOR	8500D	FAN
70	1	37861 A	BUSSMAN	BAF-15	15 AMP FUSE
75	2	46740 A	CUTLER HAMMER	A11BNDA	MOTOR STARTER
76	3	160206 A	SQUARE 'D'	B1.45	THERMAL UNIT FOR O.L.
77	3	160207 A	SQUARE 'D'	B4.15	THERMAL UNIT FOR O.L.
78	1	503-2624 A	BEMIS		FAN MOUNT
79	2	52757 A	CUTLER HAMMER	C32KA3	AUX. CONTACT
83	1	592-0018 A	ALLEN BRADLEY	700-HB332241	RELAY, 3 PDT 10 AMP, DC
84	1	592-0019 A	ALLEN BRADLEY	700-HN102	SOCKET, SCREW TERMINAL
85	1	592-0020 A	ALLEN BRADLEY		CUP RELAY, RETAINING
86	1	147112 A	ALLEN BRADLEY	1745-LP153	SLC 150 PLC CONTROLLER
86	1	140600 A	ALLEN BRADLEY	1745-M1	EEPROM MEMORY MODULE
86	1	592-0007 A	ALLEN BRADLEY	1745-B1	BATTERY PACK
87	1	593-0003 A	BUSSMAN	BC6032 S	DOUBLE FUSE BLOCK
88	2	593-0004 A	BUSSMAN	BC6033 S	TRIPLE FUSE BLOCK
89	1	593-0045 A	ACME	200B24	24V DC POWER SUPPLY
90	1	594-0526 D	BEMIS		INSERT PANEL
93	1	77376 A	WESTINGHOUSE	2607D63G01	DISCONNECT
94	1	77378 A	WESTINGHOUSE	504C323G04	HANDLE
95	1	77379 A	WESTINGHOUSE	2607D64G01	SHAFT
96	1	77840 A	WESTINGHOUSE	313C590G-10	FUSE KIT
98	3	593-0552 A	BLACKBURN	L-125	GROUND LUG
REF	1	141524 A	OMRON	3G2A3PR016	PROGRAMMER
SELECTIVE ITEMS (230V/460 INPUT)					
100	2	593-0027 A	BUSSMAN	KTK-R-20	
	2	593-0024 A	BUSSMAN	KTK-R-10	10 AMP FUSE (460 VOLT)
101	3	593-0512 A	BUSSMAN	FNQ-R-3	3 AMP FUSE (230 VOLT)
	3	593-0509 A	BUSSMAN	FNQ-R-1.5	1.5 AMP FUSE (460 VOLT)
102	3	593-0516 A	BUSSMAN	FNQ-R-7.5	7.5 AMP FUSE (230 VOLT)
	3	593-0513 A	BUSSMAN	FNQ-R-4	4 AMP FUSE (460 VOLT)
103	3	59523 A	BUSSMAN	FRS-30	30 AMP FUSE (230 VOLT)
	3	81002 A	BUSSMAN	FRS-15	15 AMP FUSE (460 VOLT)
OPTIONAL ITEMS (U.L. CONTROLS)					
43	1	593-0590 A	G.E.	TGTR2151	GROUND FAULT RECEPTACLE
44	1	132234 A	G.E.	97-101	DUPLEX COVER PLATE
45	1	6200 A	STERLING ELEC.	333D	HANDY BOX
OPTIONAL ITEMS (WITH ROLL LIFT)					
105	1	127110 A	CUTLER HAMMER	H1237	HEATER COIL
107	1	160201 A	SQUARE 'D'	9001-KRTGH13	PUSHBUTTON
108	1	61475 A	CUTLER HAMMER	9101-H74-A	MOTOR SWITCH

NOTE:
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YELLOW- A.C. OR D.C. INTERCONNECTING WIRES (SEPARATE POWER SOURCE)
BLUE - D.C. CONTROL CIRCUITS, INCLUDING INPUTS AND OUTPUTS
GREEN - GROUND WIRES ONLY
WHITE - NEUTRAL CONDUCTORS OF A.C. CONTROLS

* USED WITH U.L. CONTROLS
** USED WITH ROLL LIFT

REF: 603-0622

NO. 603-0633 D

BEMIS PACKAGING MACHINERY COMPANY MINNEAPOLIS, MN.

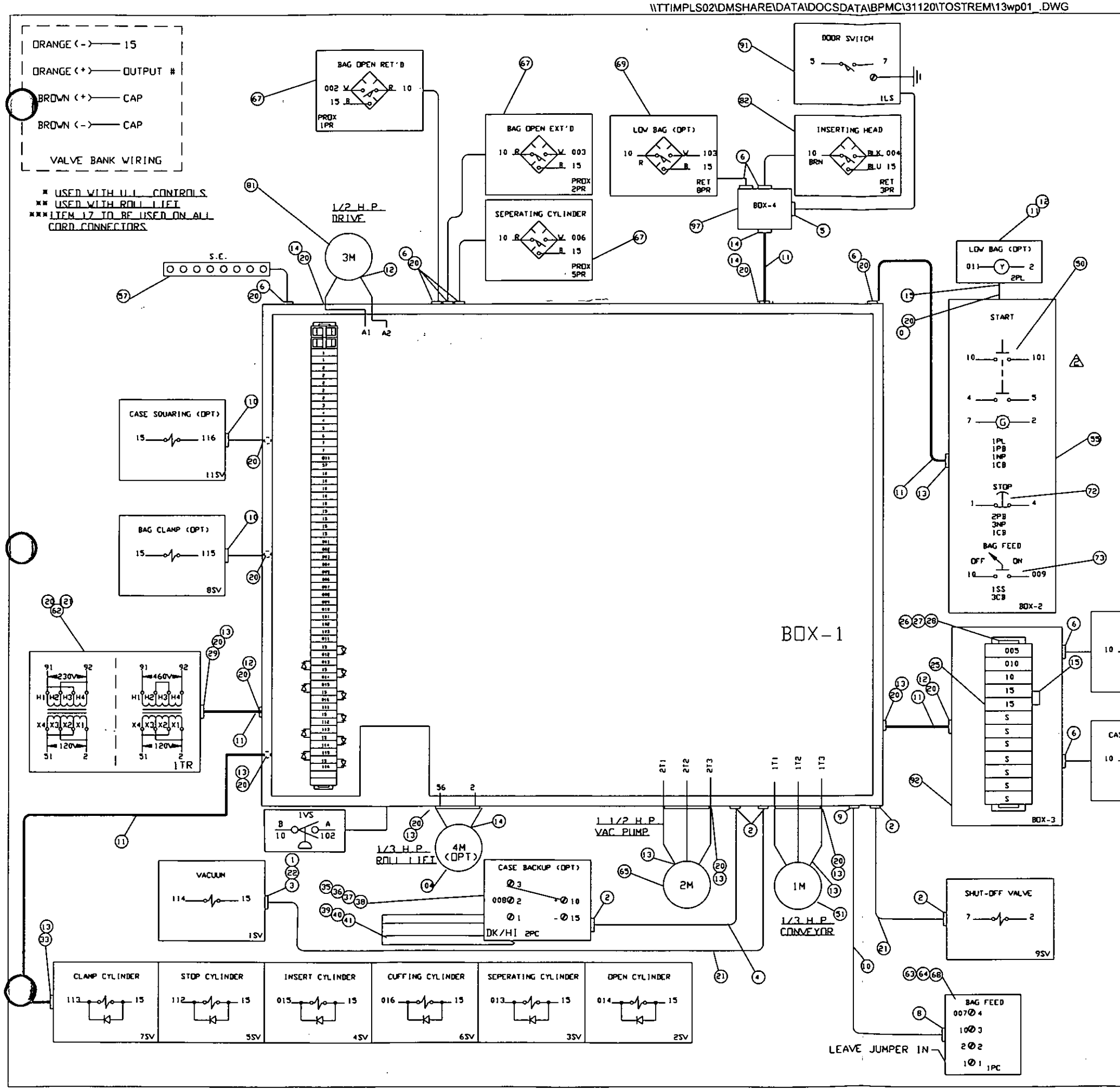
TITLE: WIRING DIAGRAM

1575F | USED ON | SZ

TOLERANCE | DRWN YW 10-8-92 | SCALE N/A | CHKD | SUPERSEDES NO | APP

PART/DRAWING NUMBER: 6 0 3 — 0 6 3 3 | REV

SHEET 1 OF 1



KEY	QTY	PART NO.	VENDOR NAME	VENDOR NO:	DESCRIPTION
1	5	4699 A	BEMIS		CORD-CONN-1/2 NPT-STR
2	2	23657 A	BEMIS		CORD-CONN-1/2 NPT-90 DEG
3	2	11141 A	BEMIS		NIPPLE-1/2 NPT CLOSE-ELEC
4	1	11206 A	BEMIS		CORD-RC-18 GA-4 WIRE
5	4	15058 A	BEMIS		CORD-CONN-1/2 NPT-90 DEG
6	3	18915 A	BEMIS		CORD-CONN-1/2 NPT-STR
8	1	4737 A	BEMIS		CORD-CONN-1/2 NPT-STR
9	1	19704 A	BEMIS		CONNECTOR
10	5	23579 A	BEMIS		WIRE CONTROL CABLE
11	1	35042 A	BEMIS		1/2 SEALTITE
12	3	35043 A	BEMIS		CONN-SEALTITE-1/2 NPT-STR
13	13	35044 A	BEMIS		CONN-SEALTITE-1/2 NPT-90 DEG
14	4	41506 A	BEMIS		CONN-SEALTITE-1/2 NPT-45 DEG
15	1	50574 A	BEMIS		JUMPER FOR TERMINALS
17	10	65422 A	BEMIS		WASHER-SEALING-1/2
18	10	4723 A	BEMIS		NUT-BOND-1/2 NPT
19	1	42590 A			1/2 TO 3/4 BUSHING
20	12	31261 A	MEYERS	ST-1	MEYERS HUB-1/2 NPT
21	1	19929 A	BEMIS		CORD-E WIRE 18 GA.
22	2	10179 A	BEMIS		ELBOW-CAPPED-1/2 NPT
25	12	38809 A	ALLEN BRADLEY	1492-CA1	TERMINAL BLOCK
26	5*	38810 A	ALLEN BRADLEY	1492-N1	CHANNEL
27	2	43821 A	ALLEN BRADLEY	1492-N2	CLIP-RETAINING
28	1	43822 A	ALLEN BRADLEY	1492-N16	PLATE-BARRIER
29	1	42590 A	BEMIS		REDUCING BUSH-3/4 TO 1/2 NPT
33	1	27815 A	BEMIS		1 1/2 REDUCER
50	1	160202 A	SQUARE 'D'	KILIGH13	PUSHBUTTON
51	1	102846 A	BEMIS		MOTOR 1/3 HP-56C-FACE
54	1	123914 A	BEMIS		NPLT-BAG FEED OFF-ON
55	1	594-0591	BEMIS		PUSHBUTTON BOX
57	1	135857 A	SIMCO	ME100	STATIC ELIMINATOR 60*
57	1	124773 A	SIMCO	ME100	STATIC ELIMINATOR 48*
62	1	105917 A	ACME	TA-1-81008	1-1/2 KVA TRANSFORMER
63	1	138214 A	BANNER	SBLX1MD	SCANNER BLOCK
64	1	138216 A	BANNER	LM3	LOGIC MODULE
65	1	139052 A	BEMIS		1-1/2 HP C-FACE, FOOT MNT MOTOR
66	1	591-0028 A	OMRON	E3F-D-S-1084	PHOTOEYE
67	3	591-0027 A	OMRON	TL-X10MF1	PROXIMITY SWITCH
68	1	146750 A	BANNER	PBD	POWER BLOCK
69	1	591-0029 A	OMRON	E3F-R2B4	PHOTO EYE
72	1	160203 A	SQUARE 'D'	9001-KR1RH13	PUSHBUTTON
73	1	160204 A	SQUARE 'D'	9001-KR7UH7	SELECTOR SWITCH
76	1	47183 A	BEMIS		NPLT STOP
77	1	47184 A	BEMIS		NPLT START
80	1	577-0658 A	BEMIS		LABEL KIT (NOT SHOWN)
81	1	58620 A	MINARIK	506-06-029	1/2 HP DC MOTOR
82	1	591-0008 A	BANNER	SM312LV W/30'	PHOTO EYE
91	1	66168 A	MICRO SWITCH	914CE1-6	COVER SWITCH
92	1	594-0586 A	BEMIS		JUNCTION BOX
97	1	88713 A	BEMIS		BOX & COVER
		OPTIONAL - BAG ROLL LIFT			
13	1	35044 A	BEMIS		1/2 NPT SEALTITE CONN 90*
14	1	41506 A	BEMIS		1/2 NPT SEALTITE CONN 45*
20	1	31261 A	MEYERS	ST-1	MEYERS HUB 1/2 NPT
104	1	114401 A	BEMIS		1/3 HP 110VAC MOTOR
		OPTIONAL BAG CLAMPS			
20	1	31261 A	MEYERS	ST-1	MEYERS HUB 1/2 NPT
110	1	141479 A	BEMIS		1/2 NPT x 2" LONG NIPPLE
		OPTIONAL BACK UP SAFETY			
2	2	23657 A	BEMIS		1/2 NPT CORD CONN 90*
4	0	11206 A	BEMIS		18 GA.-4 WIRE CORD
35	1	591-0020A	PHOTOSWITCH	8-593	OUTPUT MODULE 24VDC
36	1	591-0019A	PHOTOSWITCH	42MTB-5004	POWER BASE 24VDC
37	1	125126A	PHOTOSWITCH	42MRP-5000	PHOTO HEAD
38	1	125129A	PHOTOSWITCH	60-1791	TIMING MODULE
39	1	97018A	BEMIS		NUT BLOCK
40	1	126193A	BEMIS		ADJUSTING CHANNEL
41	1	126194A	BEMIS		BACK-UP EYE MOUNT
		OPTIONAL LOW BAG SENSOR			
0	0	41216 A	BEMIS		CONDUIT- 1/2 ALUMINUM
6	1	18915 A	BEMIS		CORD CONN 1/2 NPT STR.
20	1	31261 A	MEYERS	ST-1	MEYERS HUB 1/2 NPT
69	1	591-0029 A	OMRON	E3F-R2B4	PHOTO EYE
111	1	128142 A	BEMIS		YELLOW BULB
112	1	130977 A	BEMIS		LIGHT
113	1	144446 B	BEMIS		EYE MOUNT (SEE FRAME ASSM)
114	1	70618 A	BEMIS		REFLECTOR
115	1	67422 A	BEMIS		SEALING WASHER 1/2
116	1	403-0120 B	BEMIS		EYE MOUNT (SEE FRAME ASSM)
120	1	594-0583 A	BEMIS		BOX NEMA 4 FOR TRANSF.
121	1	594-0032 B	BEMIS		EYE MOUNT (SEE FRAME ASSM)

NOTE:
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RED - A.C. (120V & BELOW) CONTROL WIRING
YELLOW - A.C. OR D.C. INTERCONNECTING WIRES (SEPARATE POWER SOURCE)
BLUE - D.C. CONTROL CIRCUITS, INCLUDING INPUTS AND OUTPUTS
GREEN - GROUND WIRES ONLY
WHITE - NEUTRAL CONDUCTORS OF A.C. CONTROLS

REF: 603-0620 D

BEMIS PACKAGING MACHINERY COMPANY MINNEAPOLIS, MN.

TITLE: INTERCONNECT DIAGRAM

1575F USED ON

TOLERANCE: DECIMAL .XX=±.03 .XXX=±.010 FRACTIONAL=±1/16 ANGULAR=±1°

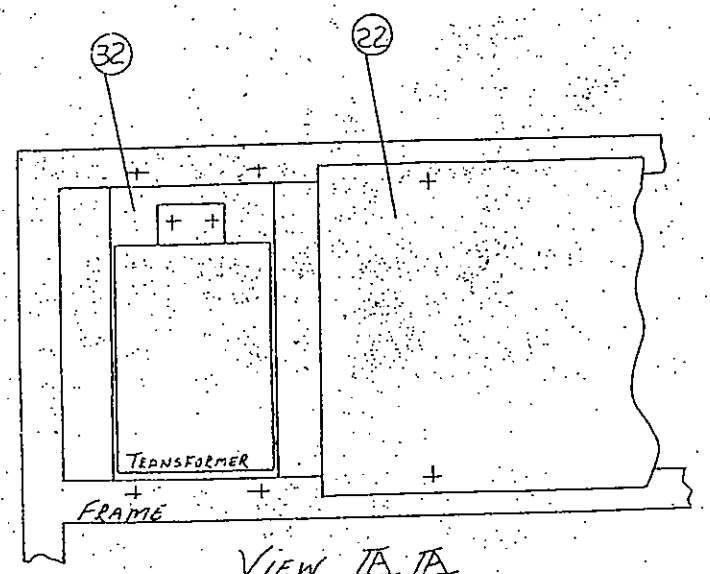
DRWN YW 10-8-92 SCALE: N/A
CHKD
APP
SUPERSEDES NO

PART/DRAWING NUMBER: 6 0 3 — 0 6 3 4 REV: A

SHEET 1 OF 1

ND 603-0634 D

303-0715-C



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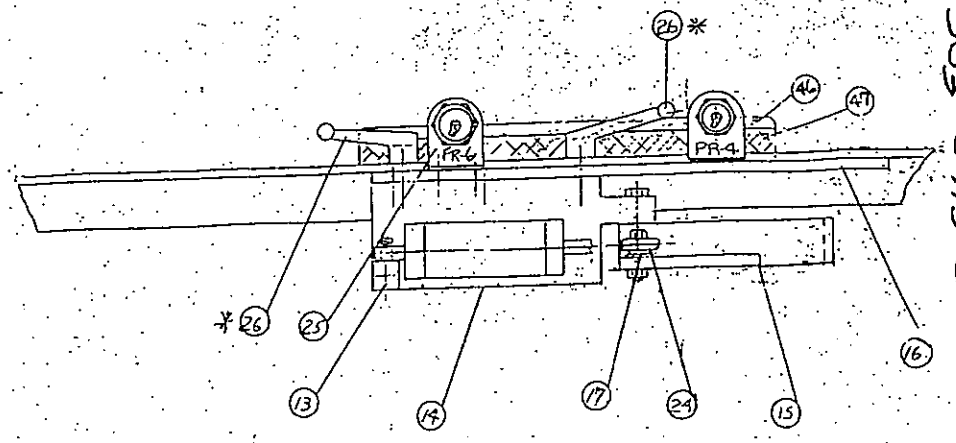
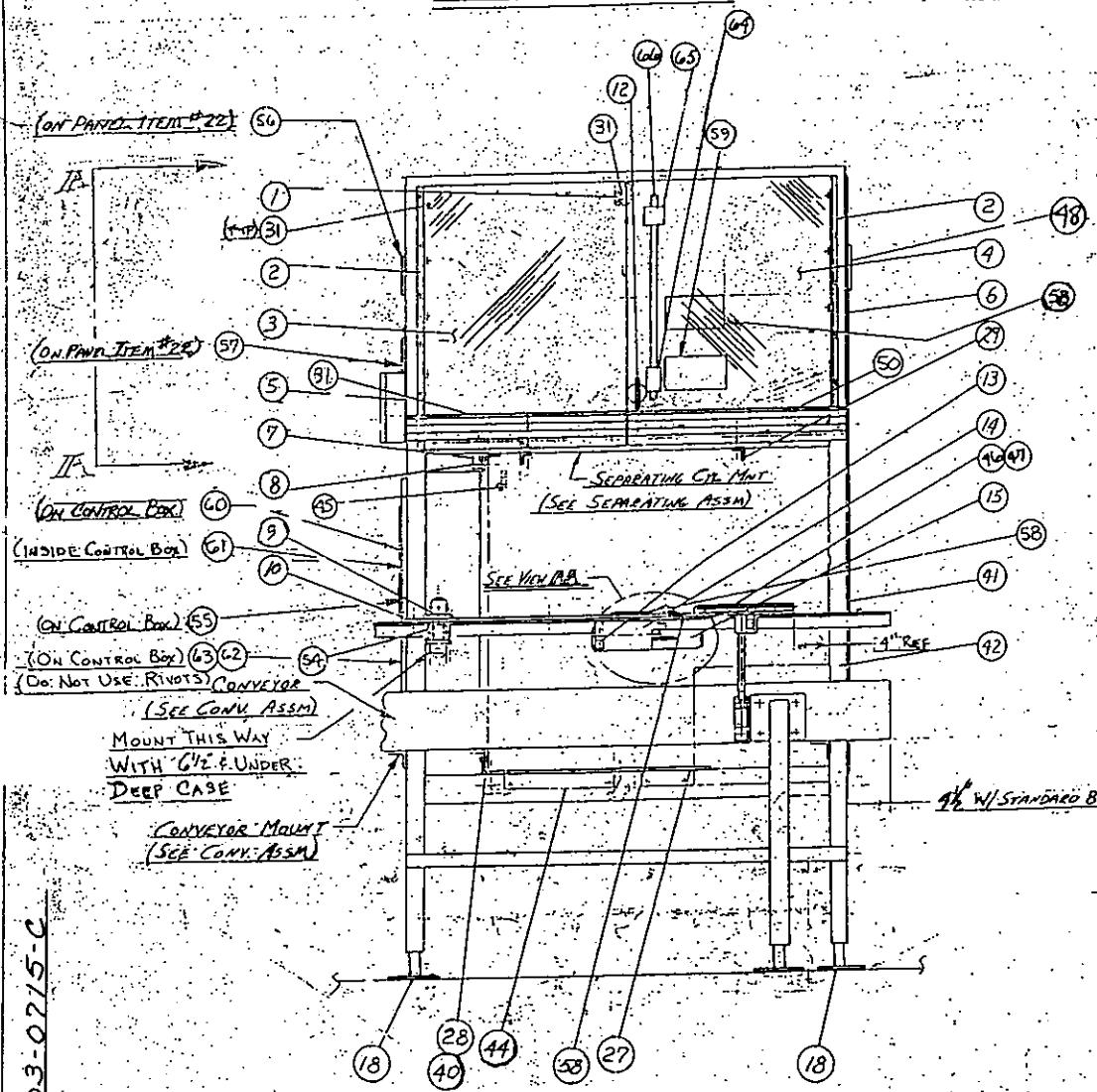
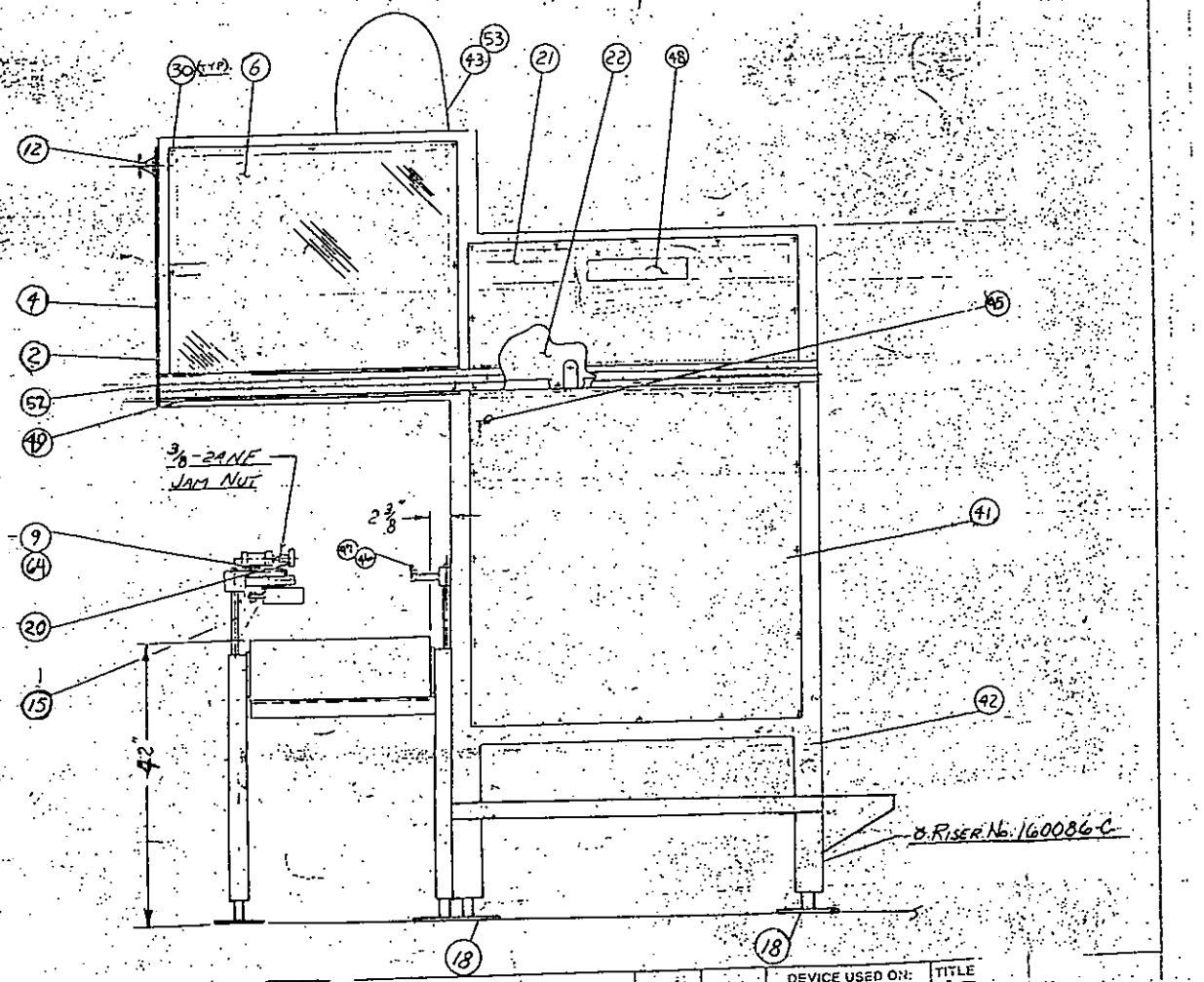


NOTE: ITEMS 47, 46, ARE MOUNTED AT ASS'M. PER CUSTOMER CASE SIZE

* IF THERE IS JUST ONE 'CASE' SIZE, USE BOLTS INSTEAD OF HANDLES





REV	REVISION DESCRIPTION	DATE	APPR.
G			
F			
E			
D			
C			
B			
A			

DEVICE USED ON: 1575

NEXT ASSY. NO.

TOLERANCES UNLESS OTHERWISE SPECIFIED
1 PL. DEC. ± .02
2 PL. DEC. ± .010
3 PL. DEC. ± .005
FRACTIONS ± 1/64
ANGLES ± 1°

TITLE: FRAME ASSM

DRWG. NO.

DR. [illegible] CH. SCALE 1/10

DATE 10-5-92 SH. 1 OF 1

BEMIS Producing Service MACHINERY CO.

Ref # 303-0228-C

NO. 303-0215-C

No. 303-0713 C

303-0713C

(AT ASSM)

OUTER SIDE PLATE
(SEE SEPARATE (OPEN ASSM).

SECTION C-C

SECTION A-A

VIEW-B

VIEW D-D

VIEW E-E

TAPE TARGET COMPLETELY

VIEW F-F DUAL SHOCK MOUNT

LOWER TIE BAR

ITEM 21. NOT SHOWN

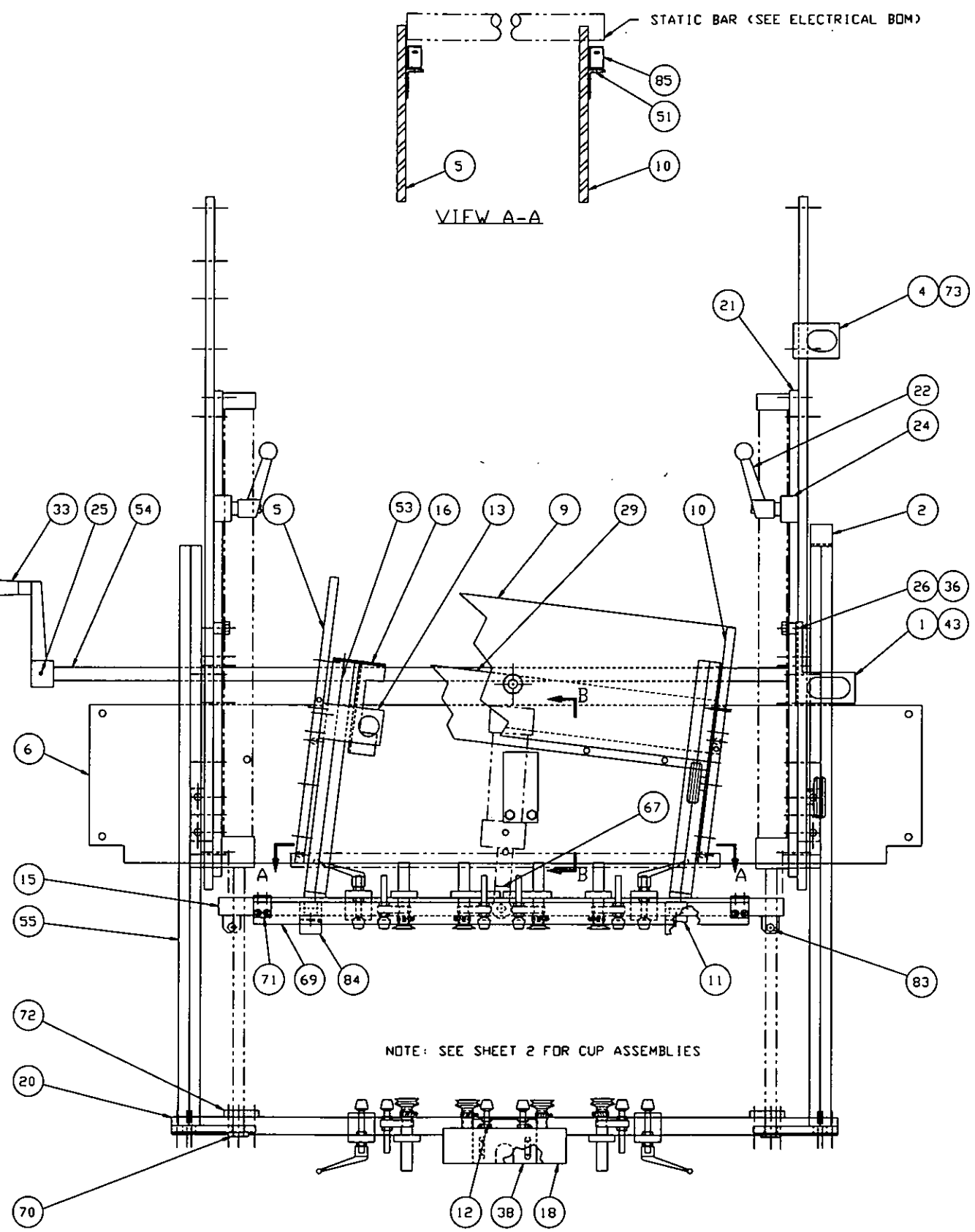
REF. 143635D, 303-0229 C

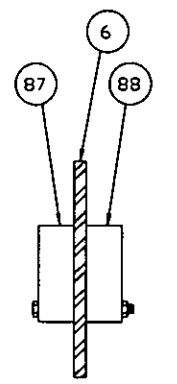
REV	REVISION DESCRIPTION	DATE	APPR.
G			
F			
E			
D			
C			
B			
A			

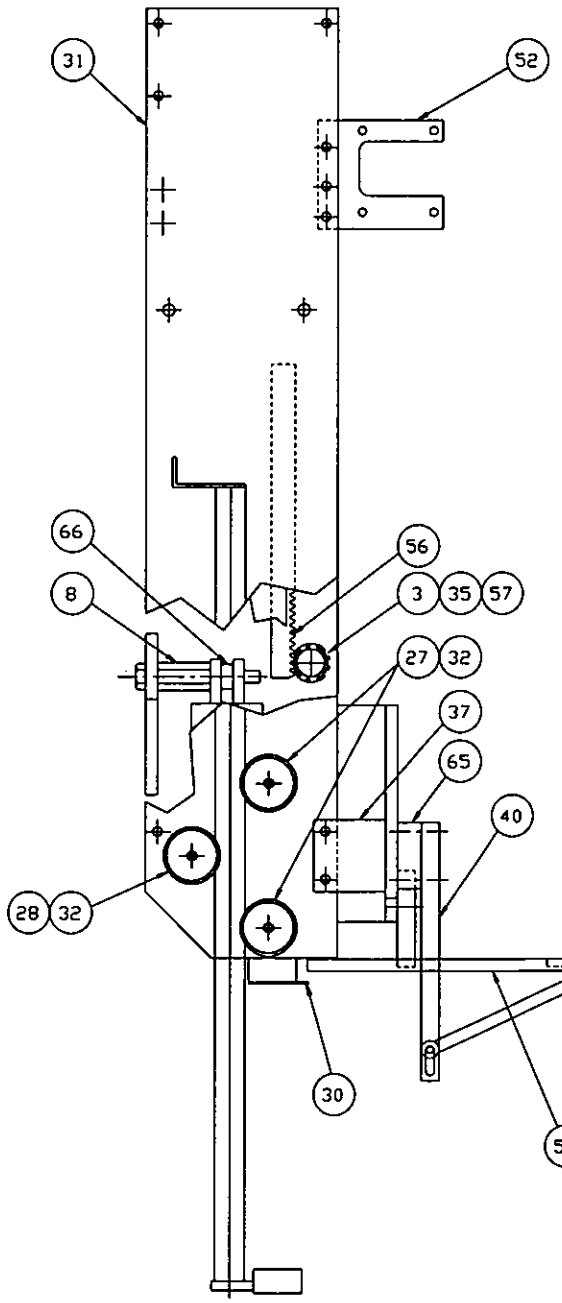
DEVICE USED ON: 1575
NEXT ASSY. NO.

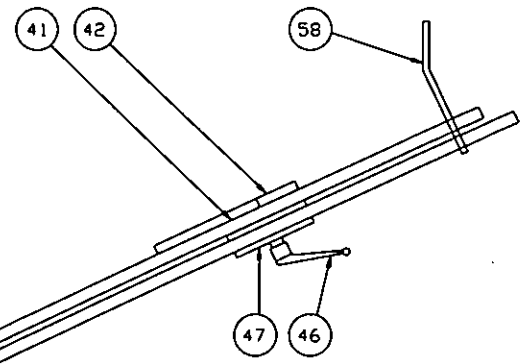
TOLERANCES UNLESS OTHERWISE SPECIFIED
1 PL. DEC. ± .02
2 PL. DEC. ± .010
3 PL. DEC. ± .005
FRACTIONS ± 1/64
ANGLES ± 1°

TITLE: DRIVE ASSM
DRWG. NO. 303-0713 C
DR. RAF CH. SCALE 3/4
DATE 9/20/82 SH. 1 OF 1
BEMIS Packaging Service MACHINERY CO.









REV	DATE	BY	DESCRIPTION	E.R. NO
D				
C				
B				
A	9/94	DPW	UPDATED TO CAD	

FILE:

UNLESS SPECIFIED TOLERANCES
2 PL. DEC. ±.010
3 PL. DEC. ±.005
FRACTIONS ±1/64
ANGLES ±1/2°

BEMIS PACKAGING MACHINERY COMPANY

NEXT ASSY NO. :			1575	
DRWN	DPW	9-22-94	SUPERSEDES NO	USED ON & SIZE
CHKD				SCALE: 1/8 = 1
				SHEET 1 OF 2

PRE REF:

POST REF:

TITLE SEPARATE & OPEN ASSEMBLY

NON STANDARD

DWG NO 303-0714 B

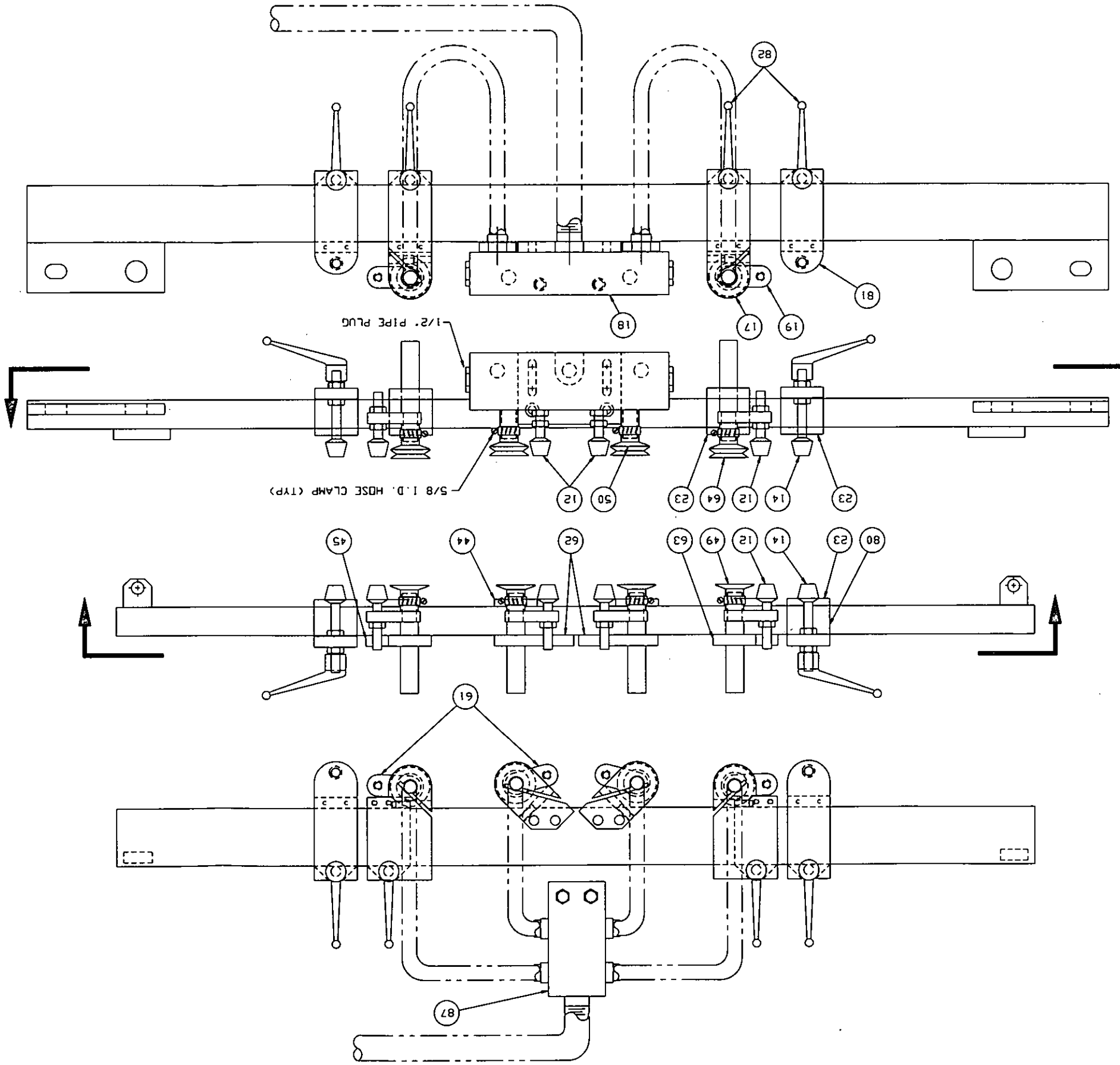
REV	DATE	BY	DESCRIPTION	E.R. NO
A				
B				
C				
D				

FILE:

UNLESS OTHERWISE SPECIFIED
TOLERANCES
DECIMALS ±.010
FRACTIONS ±1/64
ANGLES ±1/2°

BEMIS PACKAGING MACHINERY COMPANY

NEXT ASSY NO.	
DRWN DPW 9-22-94	SUPERSEDES NO
CHKD	
SCALE: 1/4 = 1	SHEET 2 OF 2
USED ON & SIZE	
1575	
TITLE SEPARATE & OPEN CUP ASSEMBLY	
DWG NO 303-0714 B	
NON STANDARD	
PRE REF:	
POST REF:	



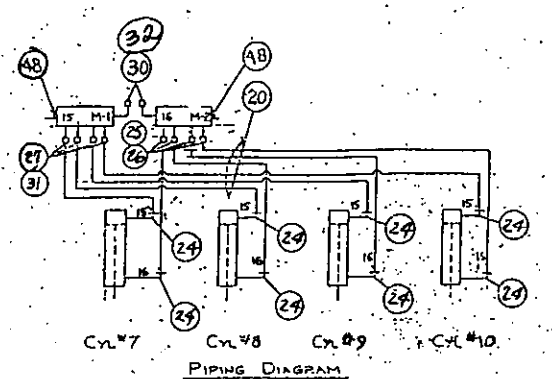
ITEM	PART NO.	QTY.	DESCRIPTION
1	161532	1	MOUNT, EYE
2	143056	1	TARGET
3	84560	2	ROLL PIN
4	161533	1	MOUNT, EYE
5	123897	1	INNER SIDE PLATE (RIGHT)
6	123904	1	SEPARATING CYL MOUNT
7			
8	132628	1	CYLINDER STUD
9	124776	1	SEPARATING GUARD
10	123898	1	INNER SIDE PLATE (LEFT)
11	126179	4	SHIM
12	163602	8	SHORT BUMPER SHAFT
13	161534	1	MOUNT, EYE
14	77940	4	LONG BUMPER SHAFT
15	158480	1	REAR VACUUM BAR STD
16	161548	1	TARGET
17	163081	2	MOUNT, CUP
18	163675	1	MANIFOLD, CUP
19	163077	6	CUP MOUNT COUPLING
20	143557	1	FRONT VACUUM BAR
21	123883	2	CYLINDER SLIDE PLATE
22	136367	6	STUDDED HANDLE
23	143552	4	CLAMP PAD
24	123865	4	CLAMP
25	18617	1	ROLL PIN
26	123878	2	SPACER
27	120244	8	BUSHING, DUAL VEE STAT
28	120243	4	BUSHING, DUAL VEE ADJUSTABLE
29	145741	1	SEPARATING TIE PLATE
30	503-1102	1	GUIDE
31	123899	2	OUTER SIDE PLATE
32	120242	12	WHEEL, GUIDE DUAL VEE
33	581-0007	1	CRANK HANDLE
34			
35	123913	2	SPACER
36	1152	2	WASHER 1/2 X 1 1/4 X 1/8
37	123871	2	TIE PLATE
38	158450	1	MOUNT, VACUUM MANIFOLD
39			
40	127090	2	UPPER GUIDE SUPPORT
41	74650	4	SPACER
42	139769	1	MOUNT, EYE
43	82480	2	SPACER
44	143553	2	CLAMP PAD

ITEM	PART NO.	QTY.	DESCRIPTION
45	163079	1	CUP MOUNT
46	136364	1	STUDDED HANDLE
47	123941	2	SPACER
48			
49	166091	4	VACUUM CUP
50	163873	8	SCREEN, VACUUM CUP INSERT
51	158448	2	MOUNT, STATIC ELIMINATOR
52	146114	1	REGULAR MOUNT
53	123896	2	GUIDE BAR SHORT
54	123866	1	ADJUSTABLE SHAFT
55	123895	2	GUIDE BAR LONG
56	123894	2	ADJUSTING RACK
57	74602	2	VERTICAL ADJUSTABLE PINION
58	123936	1	LOWER GUIDE MOUNT
59	123963	1	INNER GUIDE
60	123951	1	OUTER GUIDE
61	163872	4	CUP MOUNT COUPLING
62	163080	2	CUP MOUNT
63	163078	1	CUP MOUNT
64	163088	4	BELLOWS VACUUM CUP
65	127091	2	SPACER
66	933	1	COLLAR 1/2 SET PLATED
67	145055	1	ROD END
68			
69	503-3760	1	BACK-UP BAR
70	126622	2	FLOATING NUT
71	133364	2	BACK UP BAR MOUNT
72	145114	2	PAD
73	123107	2	SLEEVE
74			
75			
76			
77			
78			
79			
80	143551	2	BUMPER MOUNT
81	143550	2	BUMPER MOUNT
82	136357	8	STUDDED HANDLE
83	35371	2	CAM ROLLER
84	503-1483	2	BAG GUIDE
85	158449	2	MOUNT, ANG STATIC ELIMINATOR
86			
87	155282	1	MANIFOLD
88	132703	1	MANIFOLD

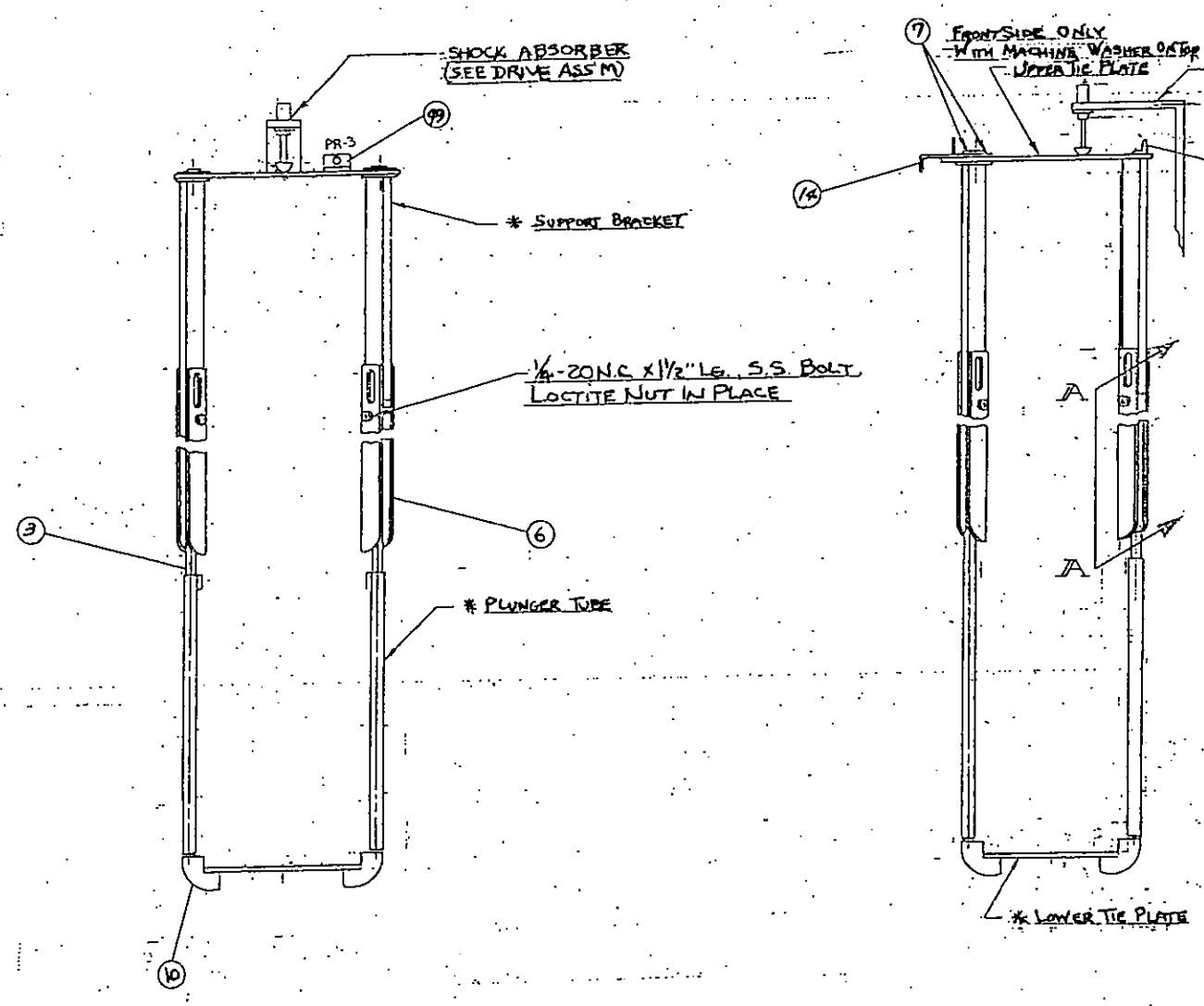
COMPONENT PART BILL OF MATERIALS

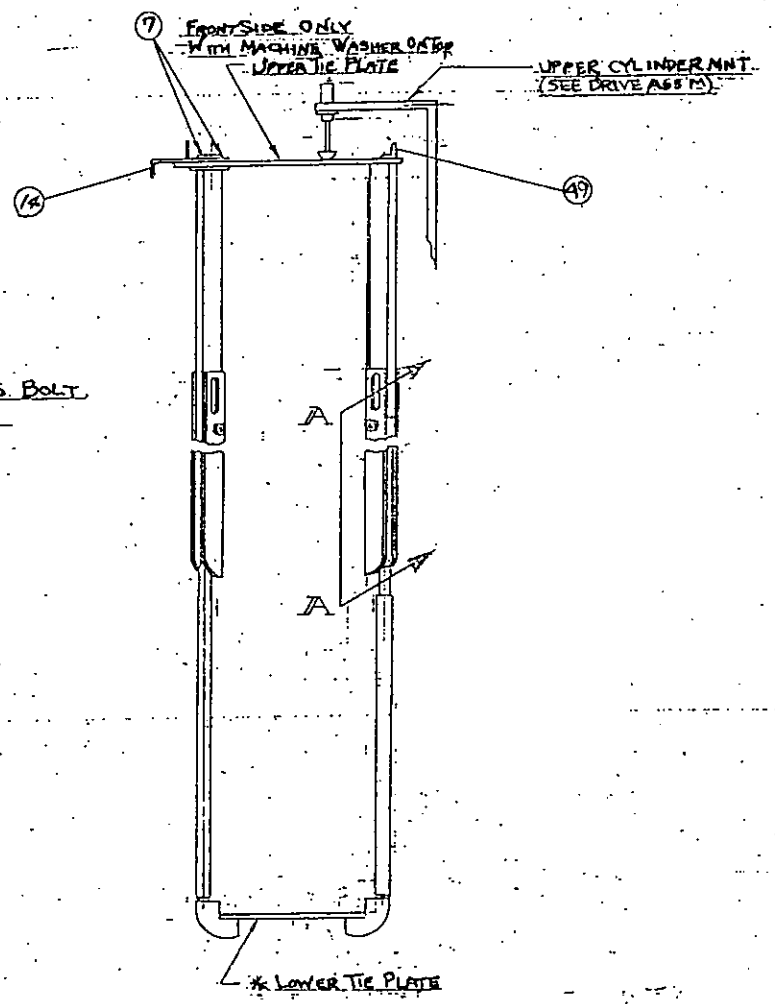
NO 303-0714 B SHEET 2 OF 2

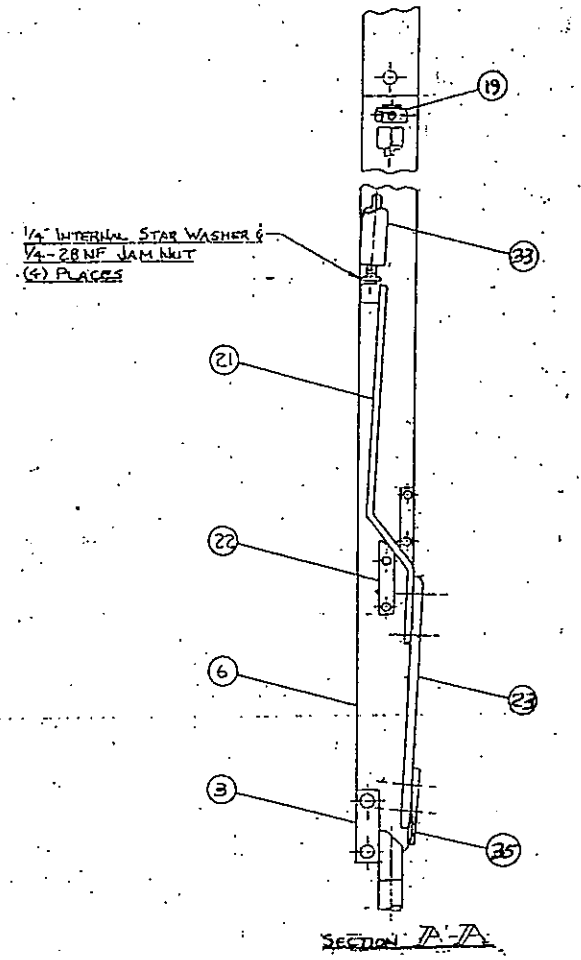
303-0230C



PIPING DIAGRAM







SECTION A-A

* SPECIAL PARTS: DEPENDS ON CUSTOMERS CASE SIZE

REF 146183C

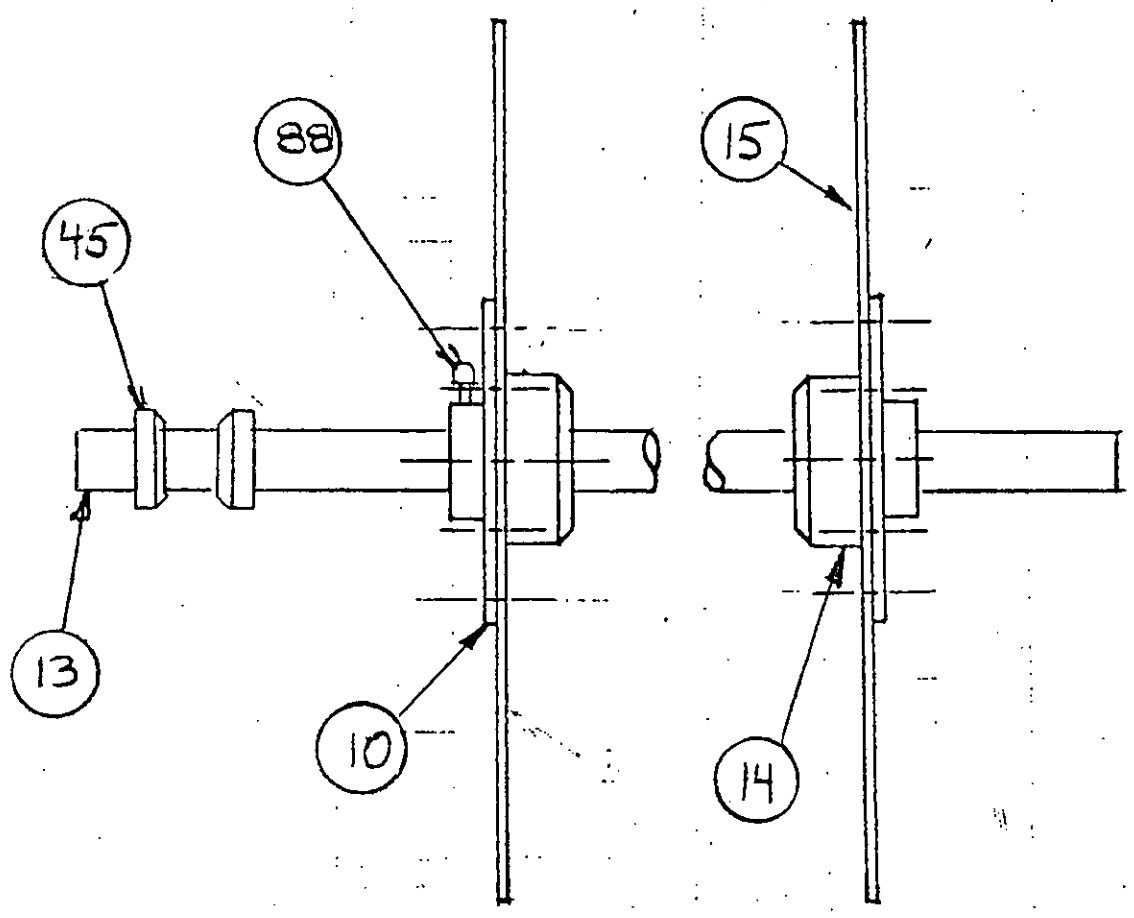
G			
F			
E			
D			
C			
B			
A			
REV	REVISION DESC	DATE	APPR.

DEVICE USED ON: 1575
NEXT ASSY. NO.
TOLERANCES UNLESS OTHERWISE SPECIFIED
1 PL. DEC. ± .03
2 PL. DEC. ± .010
3 PL. DEC. ± .005
FRACTIONS ± 1/64
ANGLES ± 1°

E
INSERTING HEAD ASSM
DRWG. NO. 303-0230C
DR. CH. SCALE FULL
DATE 4-7-88 SH. 1 OF 1
BEMIS Packaging Services MACHINERY CO.

NO. 303-0703 A

303-0703



	REF BILLS			REF ASSM
	48"	60"	HUBS	
SPACER	203-2363	203-2454	203-1011	303-0544A, 303-0704A, 303-0259A
NO SPACER	203-2364	203-2455	203-1010	303-0703A, 303-0258

REV	REVISION DESCRIPTION	DATE	APPR.
G			
F			
E			
D			
C			
B			
A			

525030

DEVICE USED ON: 1575

NEXT ASSY. NO.

TOLERANCES
UNLESS OTHERWISE SPECIFIED
1 PL. DEC. ± .02
2 PL. DEC. ± .010
3 PL. DEC. ± .005
FRACTIONS ± 1/64
ANGLES ± 1°

TITLE FILM MANDREL ASSEMBLY, NO SPACERS

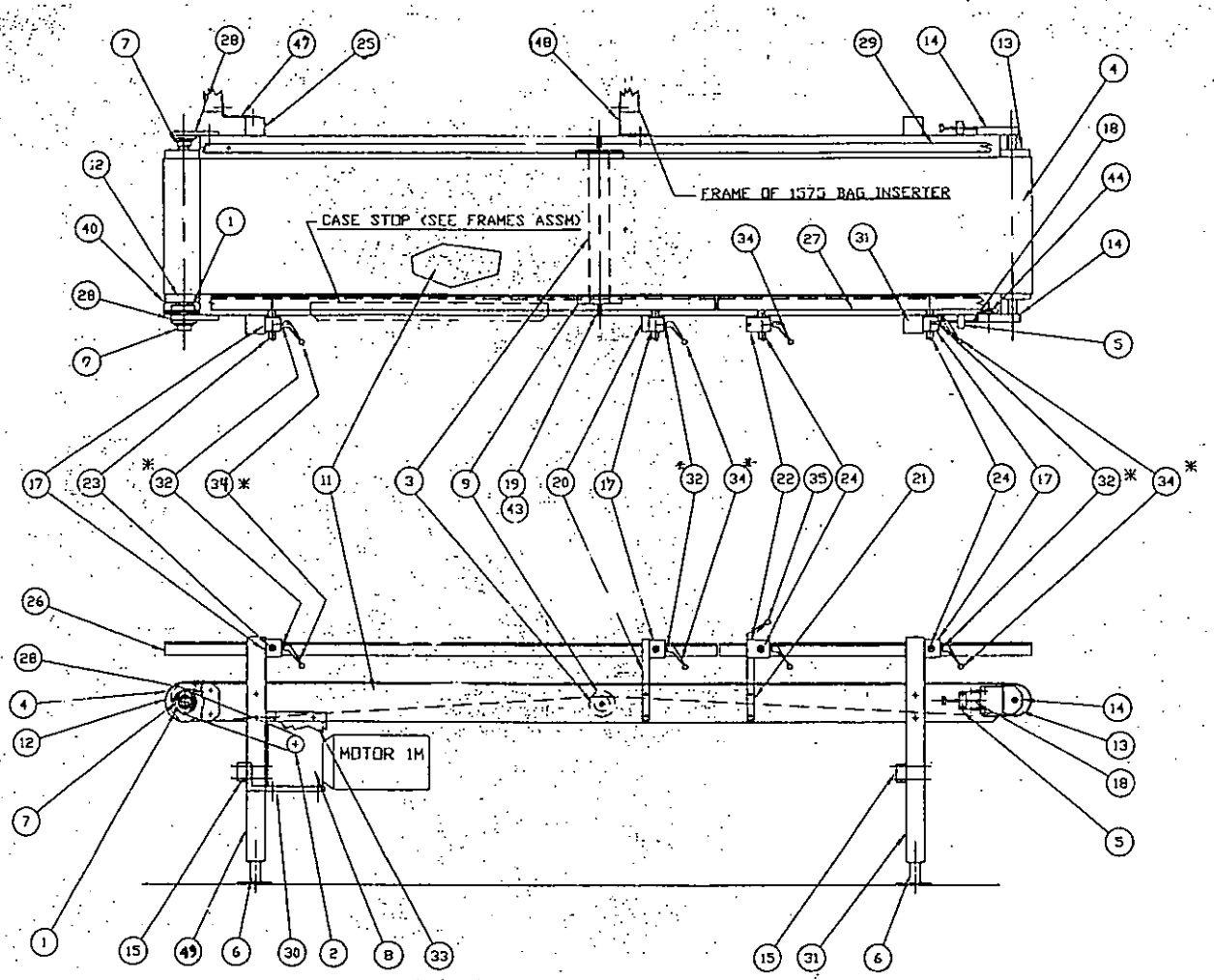
DRWG. NO. 303-0703

DR. RAF | CH. | SCALE 1:4

DATE 1/8/92 | SH. 1 OF 1

BEMIS Packaging Service MACHINERY CO.

ND 303-0716-C



ITEM	PART NO	QTY	DESCRIPTION
1	11324A	3	SPRKT 40B16-1000 (A1)
2	41037A	1	SPROCKET 40B13-.875
3	160169A	1	ROLLER
4	54040A	0	BELTING
5	74720A	2	ADJG SCREW BLOCK
6	76403B	4	FRAME BASE
7	160161A	2	BEARING-FLANGE 1 ID
8	102834A	1	20-1 SPEED REDUCER (B)
9	103162A	2	BELT GUIDE
11	503-3729D	1	8'-0 DECK
12	160171-C	1	DRIVE PULLEY
13	160170-B	1	TAIL PULLEY
14	503-3730B	2	ADJUSTING MOUNT
15	503-0603B	2	REDUCER MOUNT S.B.
17	503-3731A	3	ADJ BLOCK
18	142425A	2	ADJ. SCREW
19	160172A	1	ROLLER AXLE
20	160916A	1	ADJ BLOCK MOUNT
21	160138-A	1	ADJ BLOCK MNT - SWIVEL
22	503-3734A	1	ADJ BLOCK - SWIVEL
23	503-3735A	2	ADJ SHAFT
24	503-3736A	2	ADJ SHAFT
25	160112-A	2	LEG CONV 2X2X18-1/4
26	160920-B	1	GUIDE RAIL LONG
27	503-3739B	1	RAIL ADJ GUIDE 34
28	160168-B	2	PULLEY MOUNT
29	160132-C	1	RAIL STATIONARY GUIDE 96
30	503-1287B	1	REDUCER MOUNT
31	160111-A	1	LEG CONV 2X2X24-1/4
32	574-0549A	4	SET SCREW
33	503-3743B	1	CHAIN GUARD
34	136332A	4	FEMALE HANDLE 5/16-18NC
35	136364A	1	STUDDED HANDLE 3/8 X 2 3/8
40	503-3744B	1	CHAIN GUARD
43	933A	2	COLLAR
44	503-1347A	2	NUT BAR
47	503-3745B	1	CONVEYOR MOUNT
48	503-3746B	1	CONVEYOR MOUNT
49	160918-A	1	LEG

* SETSCREW MUST BE LOCKED INTO HANDLE WITH BRASS TIP OUT BEFORE ASSEMBLING TO POST

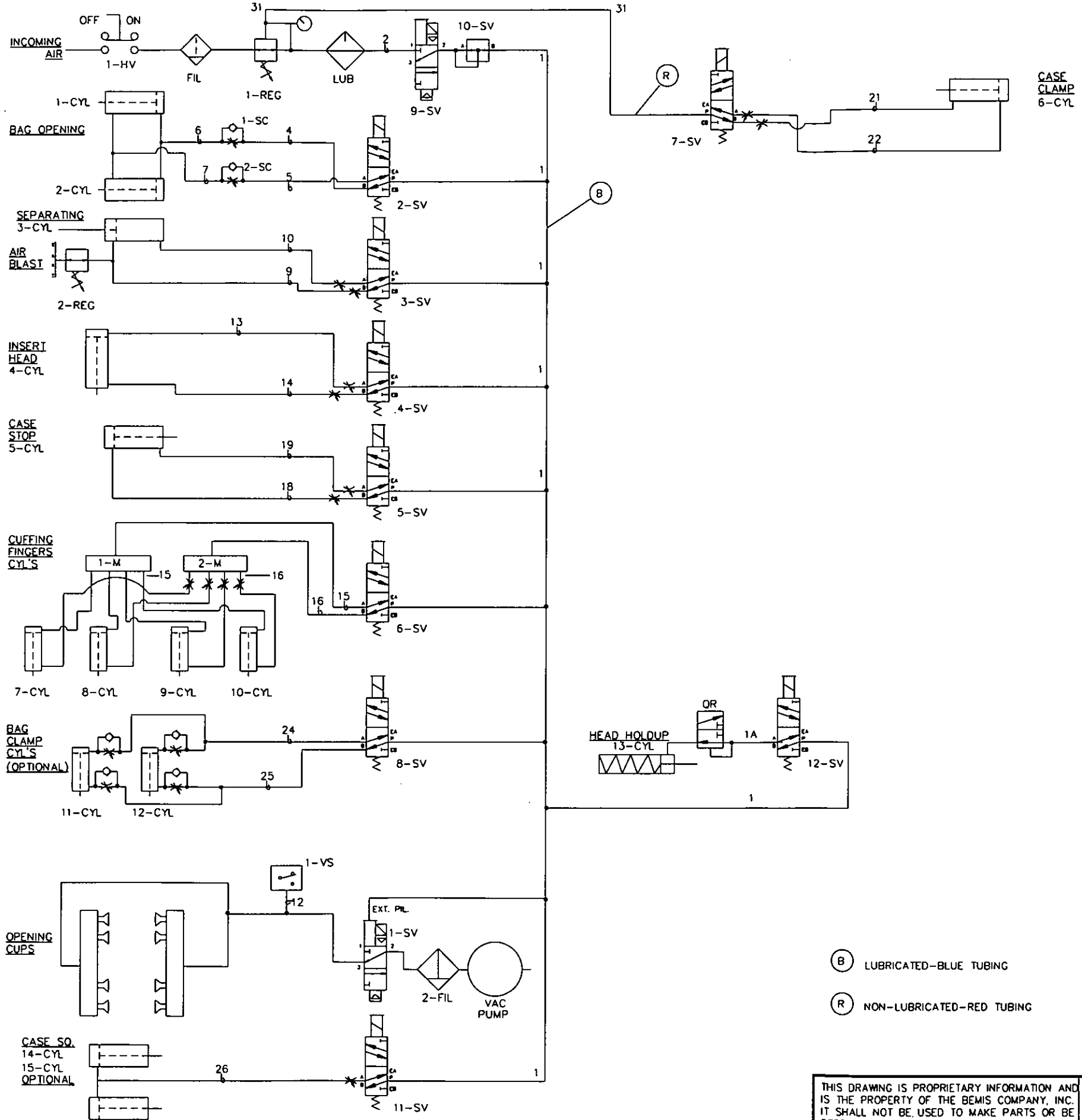
FOR OPPOSITE DIRECTION OF CONVEYOR ASSEMBLE GUIDE RAILS & MOUNTS ON OPPOSITE SIDES

REV	REVISION DESCRIPTION	DATE	APPR.
G			
F			
E			
D			
C			
B			
A			

DEVICE USED ON: 1575
NEXT ASSY. NO.:
TOLERANCES: 1 PL. DEC. = .XXX; 2 PL. DEC. = .XX; 3 PL. DEC. = .XXX; FRACTIONS = 1/64; ANGLES = 1/2°
TITLE: CONVEYOR ASSEMBLY
DRVG. NO. 308-0716-C
SH. 01 SCALE HALF
DATE: - SH. 1 OF 1
BEMIS INDUSTRIAL PACKAGING MACHINERY GROUP

Ref # 303-0633-D

NO. 703-0246 D



(B) LUBRICATED-BLUE TUBING

(R) NON-LUBRICATED-RED TUBING

REV.	DATE	BY	DESCRIPTION

TOLERANCES UNLESS SPECIFIED
2 PL. DEC. ±.010
3 PL. DEC. ±.005
FRACTIONS ±1/64
ANGLES ±1/2'

BEMIS PACKAGING MACHINERY COMPANY

NEXT ASSY NO. :			1575	
			USED ON	SZ
DRWN	MGC	10/21/92	SUPERSEDES NO	SCALE: NTS
CHKD		1		SHEET 1 OF 1

TITLE: PIPING SCHEMATIC

DWG NO 703-0246 D REV A

REV.	DATE	BY	DESCRIPTION

TOLERANCES UNLESS SPECIFIED 2 PL. DEC. ±.010 3 PL. DEC. ±.005 FRACTIONS ±1/64 ANGLES ±1/2°

BEMIS PACKAGING MACHINERY COMPANY

NEXT ASSY NO. :

DRWN	MGC	10/21/92	SUPERSEDES NO
CHKD			

SCALE: NTS

SHEET 1 OF 1

DWG NO 703-0247 REV D

TITLE: PIPING DIAGRAM

USED ON: 1575

SZ

OPTIONAL HOLD-UP VALVE

KEY	QTY	PART NO.	MFG. NAME	MFG. NO.	DESCRIPTION
12	2	586-0021 A			CONN. 1/4"TUBE, 1/4"NPT
30	1	36591 A			MUFFLER, 1/4"NPT
86	1	38671 A			PIPE PLUG, 1/4"NPT
97	1	142343 A	NUMATICS		VALVE

OPTIONAL BAG CLAMPS

KEY	QTY	PART NO.	MFG. NAME	MFG. NO.	DESCRIPTION
5	2	586-0027 A	BEMIS		ELBOW, 1/4"TUBE, 1/8"NPT
12	1	586-0021 A	BEMIS		CONN. 1/4"TUBE STRT. 1/4"NPT
19	1	586-0037 A	BEMIS		TEE, 1/4"TUBE, 1/4"NPT
30	2	36591 A	BEMIS		MUFFLER, 1/4"NPT
52	2	586-0154 A	BEMIS		UNION TEE, 1/4"NPT
60	2	113601 A	MOSIER	ETC 1-1/8" X 2"	AIR CYLINDER
62	1	585-0064 A	NUMATICS	082S4431M	4-WAY VALVE

OPTIONAL CASE SQUARING

KEY	QTY	PART NO.	MFG. NAME	MFG. NO.	DESCRIPTION
5	2	586-0027 A	BEMIS		ELBOW, 1/4"TUBE, 1/8"NPT
7	60"	19929 A	BEMIS		RUBBER CORD, 3 MME, 18 GA
6	2	4699 A	BEMIS		CONN-CORD, 1/2"NPT, 3/8"-1/2"
12	1	586-0021 A	BEMIS		CONN. 1/4"TUBE STRT. 1/4"NPT
19	1	586-0037 A	BEMIS		TEE, 1/4"TUBE, 1/4"NPT
30	2	36591 A	BEMIS		MUFFLER, 1/4"NPT
52	2	586-0154 A	BEMIS		UNION TEE, 1/4"NPT
62	1	585-0064 A	NUMATICS	082S4431M	4-WAY VALVE
65	2	48875 A	BIMBA	093-NR (1-1/16" X 3")	AIR CYLINDER

NOTES:
FITTINGS FOR INSERTING HEAD ARE SHOWN ON INSERT HEAD ASSM.

ON 1-SV THE WHITE TAB SHOULD BE TURNED SO NC IS FACING UP

ON 9-SV THE WHITE TAB SHOULD BE TURNED SO NO IS FACING UP

SELECTIVE PART (INSERTER CYLINDER)

39	1	143198 A	MOSIER	EA-677-A-1 1-1/2" X 24"	AIR CYLINDER
	1	143199 A	MOSIER	EA-677-A-1 1-1/2" X 40"	AIR CYLINDER
	1	1431200 A	MOSIER	EA-677-A-1 1-1/2" X 46"	AIR CYLINDER
80	1	36182 A			METERING VALVE
95	1	586-0037 A	BEMIS		TEE, 1/4"TUBE, 1/4"NPT
92	1	38674 A	BEMIS		ELBOW-STREET, 3/8"NPT
91	1	143095 A	BEMIS		CONN, 1/2"TUBE, 1/2"NPT
90	1	30010 A	BEMIS		ELBOW, 3/4"NPT
88	1	38677 A	BEMIS		NIPPLE, 3/8"NPT, 3"LG
87	1	4714 A	BEMIS		BUSH, 1/4"NPT, 1/8"NPT
85	1	141078 A	BEMIS		CONN, 1/4"TUBE, 1/8"NPT
84	1	11169 A	BEMIS		TEE, 1/2"NPT
83	1	68684 A	HORTON	9451	QUICK RELEASE VALVE
78	1	36583 A	BEMIS		SILENCER, 1/2"NPT
77	0	103781 A	BEMIS		VACUUM TUBE, 3/4"ID
76	0	28348 A	BEMIS		VACUUM TUBE, 1/2"ID
75	0	70099 A	BEMIS		TUBING, 1/2"OD
74	0	70273 A	BEMIS		TUBING, 3/8"OD
73	0	28020 A	BEMIS		TUBING, 1/4"OD
61	1	146450 A	HUMPHREY	6-SRP 1-1/2 1-16"X1-1/2"	AIR CYLINDER
58	1	97410 A	MILKERSON	R00-01-000	REGULATOR, 1/8"NPT
57	1	585-0078 A	MAC VALVE	56C-33-501C-M0015B	DC VACUUM VALVE
56	1	138787 A	MILKERSON	PPA-95-399	SHUT-OFF VALVE, 1/2"NPT
55	1	585-0067 A	BEMIS		VALVE BANK
54	1	38217 A	CAST	AB659C	FILTER, 2/4"NPT
53	1	15212 A	BEMIS		TEE, 3/8"NPT
51	1	143149 A	MOSIER	EA-2227-A-1-U(12) 2-1/2X4	AIR CYLINDER
49	2	22324 A	BEMIS		BUSH, 1/2"NPT, 1/4"NPT
50	2	38693 A	BEMIS		NIPPLE, 3/4"NPT, 3-1/2"LG
48	2	143148 A	MOSIER	A-977-A-1 1-1/2" X 22"	AIR CYLINDER
47	1	139542 A	NORGREN	A0015C	VALVE, SMOOTH START, 1/2"NPT
46	1	139521 A	MAC VALVE	56C-13-111CA	VALVE
45	2	12752 A	PARKER	63PT-8-6Z	INSERT, 1/2"TUBE
44	2	12175I A	BEMIS		CONN, 1/2"TUBE, 1/4"NPT
43	1	140094 A	BEMIS		RIGHT ANGLE BRACKET
42	1	27693 A	BEMIS		BUSH, 3/4"NPT, 3/8"NPT
41	1	111079 A	CAST	AA840A	RELIEF VALVE
40	1	136953 A	BUSCH	R00025	VACUUM PUMP, 1-1/2HP
39	1	136566 A	MILKERSON	R26-04-004	REGULATOR, 1/2"NPT
38	1	30028 A	BEMIS		NIPPLE-CLOSE, 3/4"NPT
37	1	38692 A	BEMIS		CROSS, 3/4"NPT
36	1	27699 A	BEMIS		BUSH, 3/4"NPT, 1/4"NPT
35	1	28779 A	MARSHALLTOWN	G10167	VACUUM GAUGE
34	1	1763 A	DONALDSON	BA500-0072	AIR CLEANER, 1/2"NPT
33	1	27984 A	BEMIS		BUSH, 3/4"NPT, 1/2"NPT
32	2	21231 A	BEMIS		ELBOW-STREET, 1/2"NPT
31	1	136565 A	MILKERSON	L26-04-002	LUBRICATOR, 1/2"NPT
29	1	132703 A	BEMIS		MANIFOLD, 3/8"NPT
28	4	586-0023 A	BEMIS		CONN, 3/8"TUBE, 3/8"NPT
27	2	136567 A	MILKERSON	PPA-95-393	MNTG. BRACKET
26	8	586-0032 A	BEMIS		ELBOW, 1/4"TUBE, 1/4"NPT
25	1	136564 A	MILKERSON	FP2-04-000	FILTER, 1/2"NPT
24	1	12343 A	MOSIER	TAE1 1-1/8" X 1"	AIR CYLINDER
23	2	35048 A	BEMIS		ELBOW, 1/4"TUBE, 1/4"NPT
22	2	586-0028 A	BEMIS		ELBOW, 1/4"TUBE, 1/4"NPT
21	2	41566 A	BEMIS		NIPPLE-CLOSE, 3/8"NPT
20	2	138785 A	MILKERSON	PPA-95-393	MODULAR SLEEVE
18	4	36590 A	BEMIS		MUFFLER, 3/8"NPT
17	2	11144 A	BEMIS		BUSH, 3/8"NPT, 1/4"NPT
16	1	123035 A	BEMIS		AIR CYLINDER
15	2	15228 A	BEMIS		NIPPLE-CLOSE, 1/8"NPT
14	4	586-0022 A	BEMIS		CONN, 3/8"TUBE, 1/4"NPT
13	4	3496 A	BEMIS		MUFFLER, 1/8"NPT
12	9	586-0021 A	BEMIS		CONN, 1/4"TUBE, 1/8"NPT
11	2	35591 A	BEMIS		ELBOW, 1/2"TUBE, 3/8"NPT
10	5	23953 A	BEMIS		NIPPLE-CLOSE, 1/2"NPT
9	1	155282 A	BEMIS		MANIFOLD, 1/2"NPT
8	1	38684 A	BEMIS		CROSS, 1/2"NPT
7	4	23933 A	BEMIS		NIPPLE, 1/2"NPT, 2"LG
6	6	31364 A	BEMIS		HOSE FIT, 5/8"ID HOSE, 1/2"NPT
5	6	586-0027	BEMIS		ELBOW, 1/4"TUBE, 1/8"NPT
4	1	118567 A	BACKSCALE	E15-H-VAC	VACUUM SWITCH
3	1	38683 A	BEMIS		UNION, 1/2"NPT
2	2	11135 A	PNEU-TROL	F-25-BK	SPEED CONTROL, 3/8"NPT
1	1	23592 A	BEMIS		CONN, 1/2"TUBE STRT, 1/2"NPT