

SECTION 1 OVERVIEW

A. GENERAL

1. Intended Use

The model APB S-PH fully automatic stainless steel shrink film bundler was specifically designed for the pharmaceutical industry. This machine creates multi-packs accepting either bottled or cartoned products and provides the simplicity and durability required for production in today's pharmaceutical environment.

2. Description

An intermittent motion shrink film bundler providing up to 100 round or rectangular shape bottles (depending on bottle size and pack pattern) per minute packaging. Equipped with a program-mable logic controller, the APB S-PH bundler provides easy operation/diagnostic capabilities.

B. SPECIFICATIONS

1. Cabinetry & Construction

- ♦ Stainless steel, welded tubular frame construction
- ♦ Compact design with integrated wrapper/tunnel
- ♦ Easy load film locations with spare roll positioning
- ♦ Overhead hold down kit
- ♦ Solid "Hot Knife" seal bar with safeties
- ♦ Thomson case hardened shafts and linear bearing guidance systems
- ♦ Positive, powered, "On Demand" film feed assemblies

C. INSTALLATION REQUIREMENTS

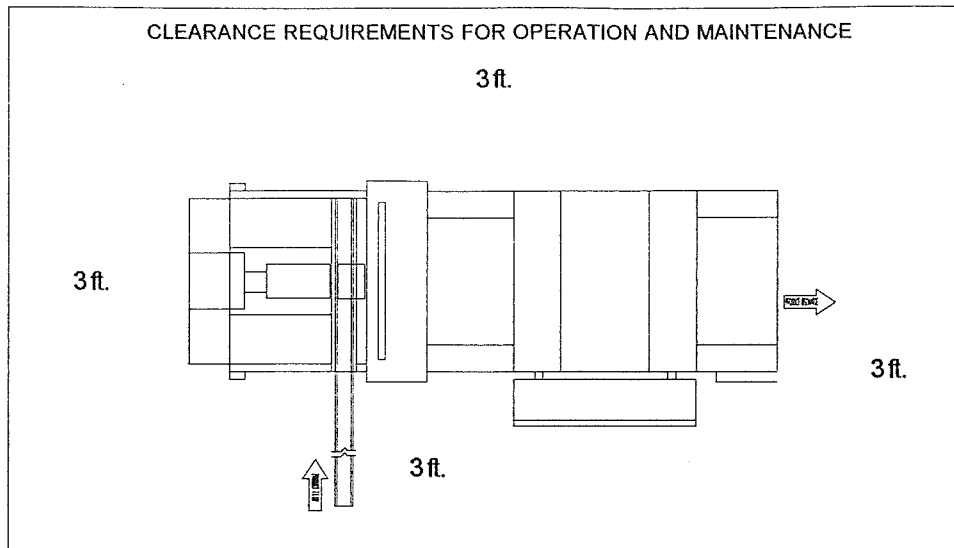
1. Electrical - 208/480Vac., 3 Phase, 60Hz., 60Amp service.
2. Compressed Air - 15 CFM at 100Psi. minimum filtered.
3. Space - 3 feet of additional space around the machine is needed for operator movement and maintenance accessibility.

D. INSTALLATION

1. Placing the equipment

The APB S-PH is mounted on six roller casters. These casters are located on the bottom corners and middle of the machine frame and provide the mobility needed to position the equipment where desired.

When positioning the equipment, make sure it is in a location that leaves ample room for operator movement, shrink film loading, product infeed and discharge conveyor hookups and maintenance accessibility (see illustration on page 1.2).



2. Leveling the equipment

Near the lower outer corners and lower center of the frame are six leveling legs. These legs are adjustable.

It is recommended that once the equipment is leveled, solid blocks should be put in place to provide a more permanent operating platform.

Place a level on the shrink tunnel conveyor (middle of the machine) in a North-South, East-West position and adjust the leveling legs accordingly until the level in both positions shows level.

3. Conveyor arm installation

- a. Remove the six (6) screws from the machine where the arm will be mounted.
- b. Unroll the conveyor track (keep the short top end of the track on top of the machine) to the floor.
- c. Attach the arm to the machine with the screws (use the leveling legs to line up the arm to the machine). Tighten screws when arm is level and flush to the machine at it's mounting.
- d. On one end of the conveyor track will be the connecting pin needed to link the conveyor ends together. Remove this pin, it will be installed later.
- e. Thread the long bottom end of track up inside the conveyor arm and over two rollers, then around the roller wheel and up to the top of the arm.
- f. Bring the two ends of the conveyor track together and install the connecting pin.

E. UTILITIES HOOK-UP

1. Electrical

NOTE: IT IS RECOMMENDED THAT A LICENSED ELECTRICIAN INSTALL THE ELECTRICAL SERVICE TO THE MACHINE AND THAT ALL LOCAL ELECTRICAL CODES ARE FOLLOWED.

The following information is provided to assist in communicating with a qualified, licensed electrician. The APB S-PH bundler has high voltage and current requirements, and inexperienced personnel should not attempt to work with "live" power.

The APB S-PH bundler requires 208,220/240 or 480Vac, 3 phase, 60Hz. electrical power. Circuit breakers must be rated for 60Amp.

The electrical (control) box does not have a hole punched in it for the incoming electrical service. Since API does not know where your service will come from (floor, ceiling, etc.), it is best you determine where to put the hole. This way, the installation will be custom fit to your situation.

Since a neutral leg is not used on the machine (all 120Vac power is supplied by a step down transformer inside the machine), the three hot legs can be mounted to any terminal 1,3 or 5 of the main power switch on the machine. The ground lug for incoming ground wire is located next to the L1, L2, L3 terminal strip.

2. Compressed air

A clean (free of contaminants) air supply of at least 15 CFM at 100PSI is required. An independent manually operated shut off valve should be installed upstream from the bundler. This valve will serve as an emergency/maintenance shut off. The air line connection to the machine can be a hard mount or quick disconnect (depending on your situation) at the FRL (filter/regulator/lubricator).

F. INSTALLATION CHECKLIST

Item	Yes	No (EXPLAIN)	Comments
APB S-PH BUNDLER PLACED IN BEST POSITION FOR OPERATION	<input type="checkbox"/>	<input type="checkbox"/>	_____
APB S-PH BUNDLER LEVELED AND PROPERLY BLOCKED	<input type="checkbox"/>	<input type="checkbox"/>	_____
CORRECT ELECTRICAL REQUIREMENTS INSTALLED	<input type="checkbox"/>	<input type="checkbox"/>	_____
CORRECT COMPRESSED AIR REQUIREMENTS AND UPSTREAM SHUT OFF INSTALLED	<input type="checkbox"/>	<input type="checkbox"/>	_____
INFEED AND DISCHARGE CONVEYOR SYSTEMS INSTALLED	<input type="checkbox"/>	<input type="checkbox"/>	_____
ADEQUATE SPACE AROUND BUNDLER FOR OPERATOR AND MAINTENANCE MOVEMENT/ACCESS	<input type="checkbox"/>	<input type="checkbox"/>	_____
LUBRICATOR FILLED WITH CORRECT OIL (SEE PAGE 4.2)	<input type="checkbox"/>	<input type="checkbox"/>	_____

G. PRE-OPERATION CHECK

Apply electrical and compressed air to the machine.

1. Open both air shut off valves (the one installed upstream from the machine and the one at the FRL). Check for any air leaks.

WARNING! A HIGH PRESSURE AIR LINE CAN CAUSE SERIOUS INJURY IF BLOWN OFF. ALWAYS SHUT OFF MAIN AIR VALVE AND ALLOW MACHINE TO DRAIN AIR PRESSURE BEFORE ATTEMPTING TO SERVICE THE AIR SYSTEM ON THE MACHINE.

2. Check air pressure gauge at FRL for 80PSI reading, adjust pressure regulating valve (PRV) if necessary. Check air pressure gauge at solenoid bank for 20-25PSI and adjust if necessary.
3. Press the green start button on the side of the electrical/control panel.
 - The oven tunnel conveyor belt should start running.
 - The short stroke counter, knife and oven thermostats should light up (the green numbers on the thermostats are the SET temperatures, the red numbers are the ACTUAL temperatures).

- #5 amber light for seal bar will be ON until set temperature is reached then go out.
- #6 amber light for oven heater will be ON until set temperature is reached then go out.
- when #5 light goes out, #3 green will start to flash signalling machine is ready to operate - no faults found.

4. Press and hold the manual seal button - seal bars should come together for a second or two then return to their home positions.
5. Turn ON the infeed conveyor switch and make sure conveyor tract is running towards the machine. Turn OFF infeed switch.
6. Open door to top shrink film area and push dancer bar towards the seal bar area. The green film advance roller should start turning. Release dancer bar and close door.
7. Push lower dancer bar towards the seal bar area. The green film advance roller should start turning. Release dancer bar.
8. At the solenoid manifold assembly, each solenoid will trigger something to move. On the bottom of each solenoid is a button that, when pressed, will move an internal plunger that will direct air to a specified component on the machine.

CAUTION: NEVER ATTEMPT TO PUSH IN ANY SOLENOID BUTTONS IF THE MACHINE IS ACTUALLY RUNNING AND BUNDLING PRODUCT - SERIOUS MACHINE DAMAGE CAN OCCUR!

- SV-1 Triggers the top seal bar/knife to go down and back up.
- SV-2 Triggers the main pusher to move towards the seal bar and return.
- SV-3 Triggers the barrier bar to go up and down.
- SV-4 Triggers the hold down to go up and down.
- SV-5 Triggers the bottom seal bar to go up and down.
- SV-6 Triggers the guides through seal bar to extend and contract.

SECTION 1 NOTES

SECTION 2 OPERATION

A. START - UP

1. Preparing to run

- a. Open all compressed air shut off valves.
- b. Turn on main power switch - make sure infeed conveyor switch is OFF.
- c. Press green start button - tunnel conveyor will start running.
- d. Check air regulator gauge for 80Psi reading. Adjust if necessary.
- e. Using the chart below, find the product to be run and check/adjust the settings on the machine to match those on the chart:

PRODUCT	SHRINK FILM SIZE / TYPE	CONVEYOR SPEED	DELAY BEFORE PUSH TIMER	SEAL BAR DWELL TIMER	KNIFE THERMOSTAT	OVEN THERMOSTAT	OTHER:

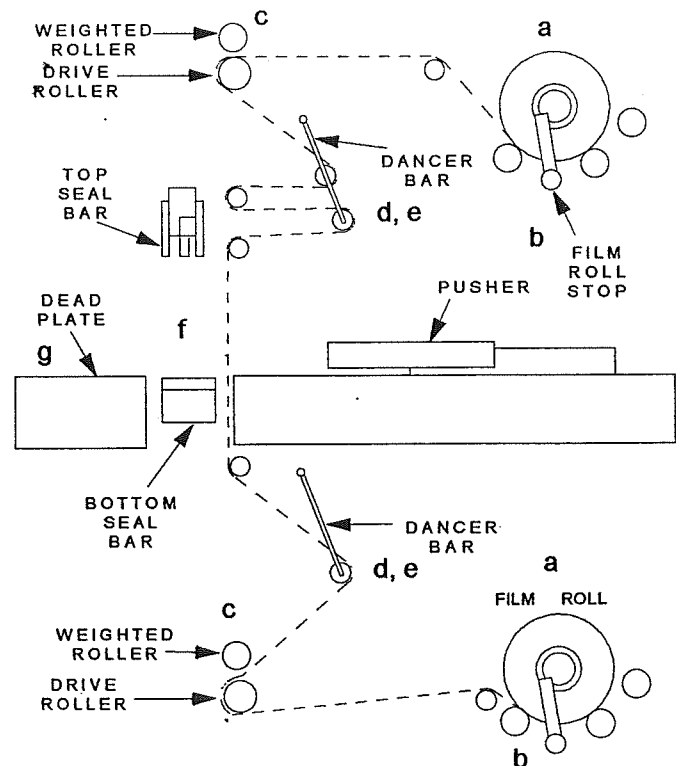
WHEN CHANGING FROM ONE PRODUCT TO ANOTHER, THERE ARE ADJUSTMENTS THAT NEED TO BE DONE TO THE MACHINE. SEE CHANGING PRODUCT LATER IN THIS SECTION

NOTE: THE APB S-PH BUNDLER WAS SHIPPED FROM THE MANUFACTURER SET UP TO RUN A PARTICULAR PRODUCT. PUT THAT PRODUCT AND ITS SETTINGS IN THE FIRST COLUMN.

2. Loading the shrink film

The letter for each step below corresponds with the same letter on the illustration.

- a. Place and center top and bottom shrink film rolls.
- b. Move film roll stops to within 1/16" of rolls and tighten down.
- c. Lift up weighted rollers and thread shrink film between the green drive rollers and the weighted rollers. Let the weighted rollers back down.
- d. Hold onto the end of the shrink film, and while keeping a slight tension, push the dancer bar towards a vertical position. This will activate the film feed drive motor and advance the shrink film. Run enough film to thread it through the seal bar area.
- e. Thread film through the dancer bars to the seal bar area.



- f. Run film between top and bottom seal bars towards oven conveyor.

CAUTION: TOP SEAL BAR/KNIFE IS HOT, TAKE CARE WHEN THREADING SHRINK FILM THROUGH THIS AREA!

- g. Line up and lay flat the two film ends on the dead plate. You may have to hold onto them so they don't slip back and out from between the seal bars.
- h. Press and hold the manual seal button until the seal bars go back to their home positions. The two ends of film should now be joined together.

CAUTION: KEEP FINGERS  AND OTHER OBJECTS AWAY FROM SEAL BAR AREA WHEN DOING A MANUAL SEAL!

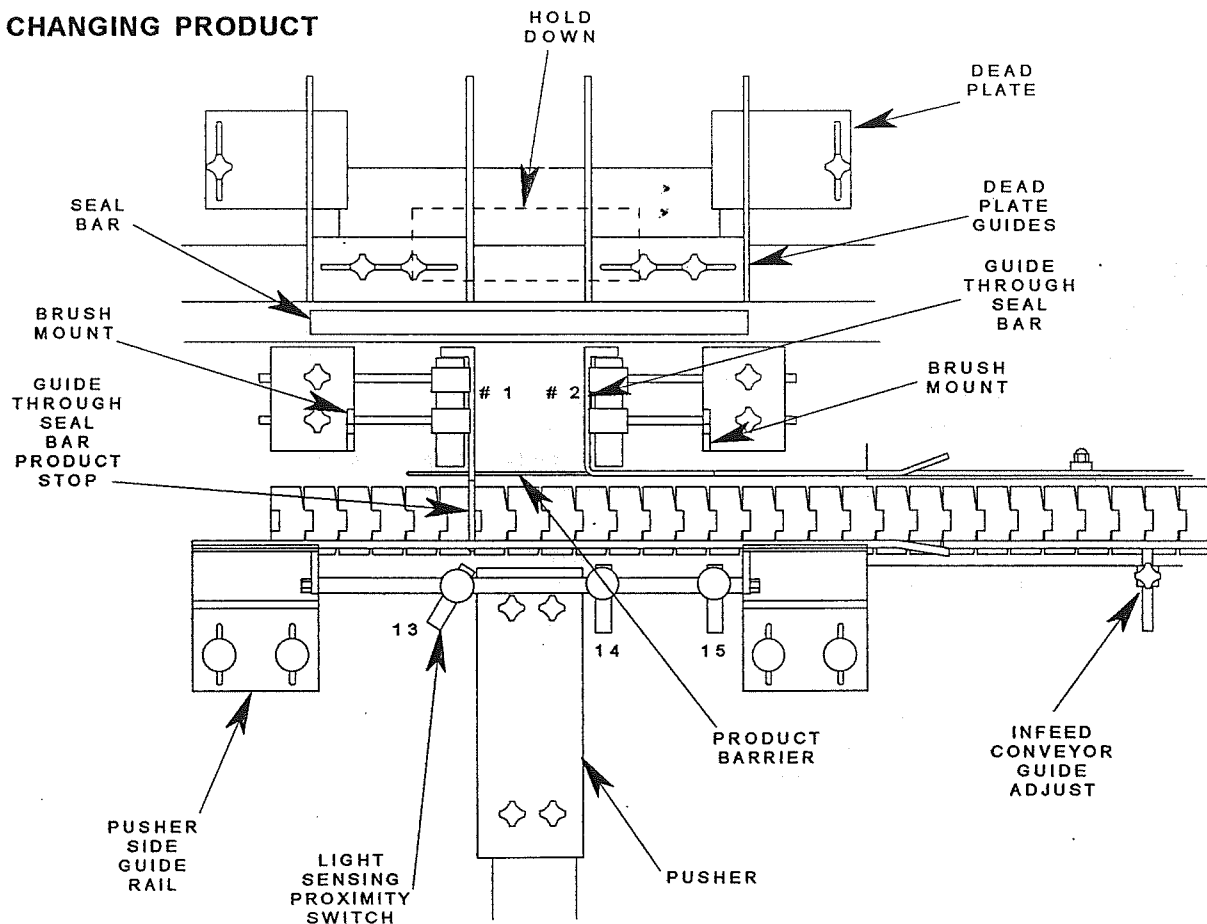
- i. Remove excess film from joined ends.

HELPFUL HINT: When a film roll reaches the end, tape the beginning end of the new roll to the end of the old roll. This way the new film will be threaded through the machine for you. Do a manual seal and discard the taped ends once they go through the seal bar area.

3. Running the product

- a. Turn the infeed switch ON. This will start the infeed conveyor running. The bundler is now in an automatic mode.
- b. Observe product and machine movement for proper operation.
- c. Observe bundled product for proper stacking and check bundles coming out of the oven for proper shrinkage of the film.

B. CHANGING PRODUCT



C. CONTROLS

Generally, changing product size does not necessarily mean that all or some of the controls need to be changed. If the same type shrink film is used (same thickness/material), the settings could remain the same (width of the shrink film roll does not matter).

The following information is designed to be a guide when setting the controls. Consult your shrink film supplier for recommendations on proper heat/time etc.

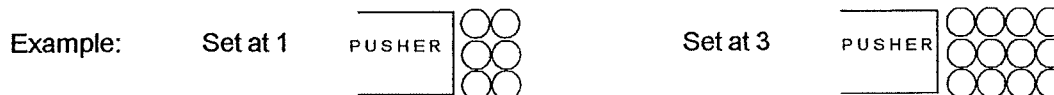
1. Delay Before Push Timer

This is the time set in-between pusher strokes. Enough time must be set so that the incoming product can replace the product pushed off the infeed conveyor.

To change time: pull off plastic lock ring, adjust to time desired. Line up lock ring groove with timer pin and install lock ring.

2. Short Stroke Counter

This sets the number of short strokes to be performed by the pusher to produce the bundle size desired. If the counter is set at 1, the pusher will do one short stroke and one long stroke. If set at 3, the pusher will do three short strokes and one long stroke, etc.



3. Seal Bar Dwell Timer

Determines the amount of time that the top seal bar/knife and bottom seal bar stay pressed together. The seal bar dwell timer must work in concert with the knife thermostat in order to make a satisfactory seal. If the time is too short, the seal will not be complete. Too long, and the film will melt away causing holes in the film.

To change time: pull off plastic lock ring, adjust to time desired. Line up lock ring groove with timer pin and install lock ring.

4. Knife Thermostat

Heat range should be between 330 - 400°F (165 - 204°C). The temperature depends on the type of shrink film used. The knife thermostat temperature must work in concert with the seal bar dwell timer in order to make a satisfactory seal.

NOTE: EXPERIMENTATION WITH DIFFERENT TIMES AND TEMPERATURES WILL PRODUCE A SATISFACTORY SEAL. PULL SHRINK FILM THROUGH THE SEAL BAR AREA AND MAKE A MANUAL SEAL. THE FILM SEAL ENDS SHOULD PULL OFF EASY FROM EACH OTHER AND THE SEALED AREA SHOULD NOT PULL APART IF YOU FIRMLY TUG ON IT.

The set temperature (SV) can be changed by pressing the up or down arrow buttons on the thermostat.

5. Oven Conveyor Speed Control

The speed of the conveyor determines how long the bundle will be in the oven tunnel. The oven conveyor speed must work together with the oven thermostat in order to create the proper shrinkage around the bundle. Adjust the conveyor speed to the point where there is a bundle space between

bundles on the conveyor. Turning the conveyor speed control knob clockwise increases speed, counterclockwise decreases speed. You do not want the bundles pushed against each other - this causes insufficient air flow around the bundle and creates a loose wrap. See NOTE in 6. below.

6. Oven Thermostat

Heat range should be between 300 - 400° F (149 - 204° C) for polyethylene shrink film. Check shrink film supplier for recommended temperatures. The oven thermostat and oven conveyor speed must work together in order to create the proper shrinkage around the bundle. The set temperature (SV) can be changed by pressing the up or down arrow buttons on the thermostat.

NOTE: SOME INDICATIONS OF INCORRECT SHRINKAGE ARE; OVEN TOO HOT,
CONVEYOR TOO SLOW - SHRINK FILM WILL HAVE HOLES MELTED IN IT.
POSSIBILITY OF BUNDLE COMING APART. OVEN NOT HOT ENOUGH,
CONVEYOR TOO FAST - SHRINK FILM WILL FIT VERY LOOSE, PRODUCT
WILL BE ABLE TO SHIFT INSIDE THE WRAP.

HELPFUL HINT: Now that all the adjustments have been made to successfully bundle this new product, go back to page 2.1 and record all the new settings on the chart. Attaching a chart like this (see last page of this manual) to the machine would give you ready access to the information the next time this product change occurs.

SECTION 2 NOTES

SECTION 3 THEORY OF OPERATION SERVICE & REPAIR

A. SEQUENCE OF OPERATION

This operation sequence is made with the assumption that the machine controls are properly set, the infeed and oven conveyors are running and that operating temperatures have been achieved.

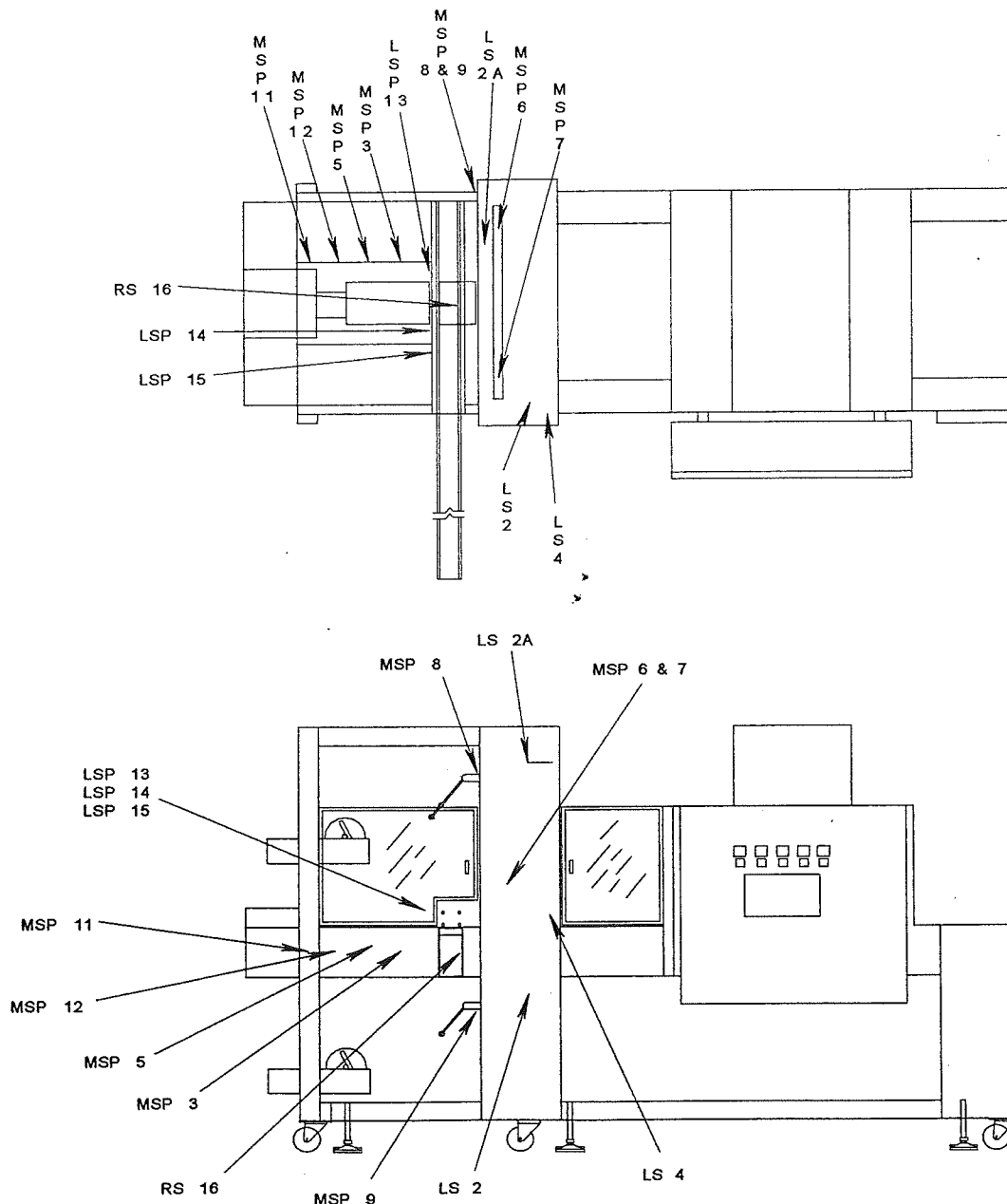
<u>Function</u>	<u>Switches, solenoids, affected</u>
1. Product on the infeed conveyor is stopped by the guide through seal bar #1 product stop.	Activates LSP/13,14,15 (detect product at pusher). The delay before push timer times out.
2. The product barrier drops down.	SV-3 activated. RS/16 activated (barrier at low position).
3. The pusher pushes the product off of the infeed conveyor and returns. NOTE: Depending on where the short stroke counter is set, determines whether or not a short stroke will occur. If counter is set at zero - go to step 7.	SV-2 activated. MSP/12 detects pusher at short stroke. NOTE: If counter is set at zero - go to step 7.
4. The product barrier comes up.	SV-3 is deactivated. RS/16 deactivated. The delay before push timer is activated.
5. Product on the infeed conveyor is stopped by the guide through seal bar #1 product stop.	Activates LSP/13 (LSP/14 & 15 most likely stayed activated). Detect product at pusher. The delay before push timer times out. SV-3 activated. RS/16 activated.
6. The product barrier drops down.	SV-3 activated. RS/16 activated.
7. The pusher pushes the product off of the infeed conveyor, through the film curtain and onto the dead plate. The guides through seal bar extend at the same time. The hold down plate drops down on top of the product. The pusher retracts to its home position,	SV-2,4 & 6 activated. MSP/8 & 9 activated (film feed). MSP/3 activated (pusher at end of stroke slave relay). MSP/5 activated (start seal cycle). MSP/11 activated (pusher at rest position).
8. The product barrier comes up.	SV-3 deactivated. RS/16 deactivated. The delay before push timer is activated. LS/2 & 2A deactivated.
9. The top and bottom seal bars come together and seal the film.	SV-1 & 5 activated. LS/4 activated (seal bar at dwell position).
10. Top and bottom seal bars retract to their home positions. This completes the sealing cycle and forms the loose shrink film sleeve around the bundle.	LS/2 & 2A activated. LS/4 deactivated.
11. The loose bundle will remain on the dead plate until the next bundle coming through the film curtain pushes it off onto the shrink tunnel conveyor.	

12. The bundled product on the conveyor passes through the shrink tunnel. The heat inside the tunnel causes the film to shrink up around the product.
13. Upon exiting the shrink tunnel, enough time should be allowed for the film to cool down before the bundle is handled, turned, etc. The time involved depends on the thickness of the film and the size and nature of the bundle.

NOTE: FAILURE TO ALLOW THE SHRINK FILM TO COOL DOWN BEFORE HANDLING WILL RESULT IN A LOOSE WRAP.

14. The bundles are now ready to be transferred to your conveyor system or packed.

B. SENSING DEVICES - SWITCHES



1. Metal sensing proximity switch (MSP)

There are eight (8) of these switches on the machine. MSP - 3, 5, 11 & 12 are located on the underside of the pusher area next to the pusher air cylinder. MSP - 8 & 9 are located near the pivot ends of the dancer bars, and MSP - 6 & 7 are on the top seal bar support arm.

This switch operates on 110Vac and is normally open. When metal passes in front of the switch, the switch senses it and closes, sending a signal to an appropriate component, relay, etc.

These switches are not repairable and must be replaced when found defective.

2. Light sensing proximity switch (LSP)

There are three (3) of these switches on the machine. LSP - 13, 14 & 15 are located on the bar above the pusher plate.

These are diffuse-reflective sensors that detect a reflected beam from the object to be detected. When reflected light (infrared) is detected, the output is operated.

An indicating LED is incorporated in the cable end of the sensor to indicate operation. This indicator is useful for setup and diagnostic purposes.

3. Limit Switch (LS)

There are three (3) of these switches on the machine. LS - 2 is located underneath and to the right (when viewing machine from the front) of the bottom seal bar. LS - 2A is located above and to the left of the top seal bar support arm. LS - 4 is located above and to the right of the bottom seal bar.

Each switch has an arm with a roller on it. This arm when moved by the action of the seal bars will mechanically close or open the electrical contacts inside the switch.

Manually operating the arm while performing a continuity test on the contacts can determine if the switch is operating correctly.

4. Reed Switch (RS)

There is one reed switch on the machine and it is located on the side/bottom of the product barrier air cylinder.

This switch is activated by a magnetized piece on the air cylinder plunger.

The light on the back of the switch is illuminated when the electrical contacts inside are closed.

5. Magnetic Switch (MS)

There are five (5) magnetic switches (not shown on the illustration) on the machine. One switch is located on the inside lower right corner of the electrical/control panel. The other four (4) switches are located at the Lexan guard doors. All of these switches are used to detect when a door is open.

Magnets fastened to the doors close the contacts inside the switches (when the doors are closed).

Performing a continuity test on the switch leads while passing a magnet in front of the switch will determine if the switch is operating correctly.

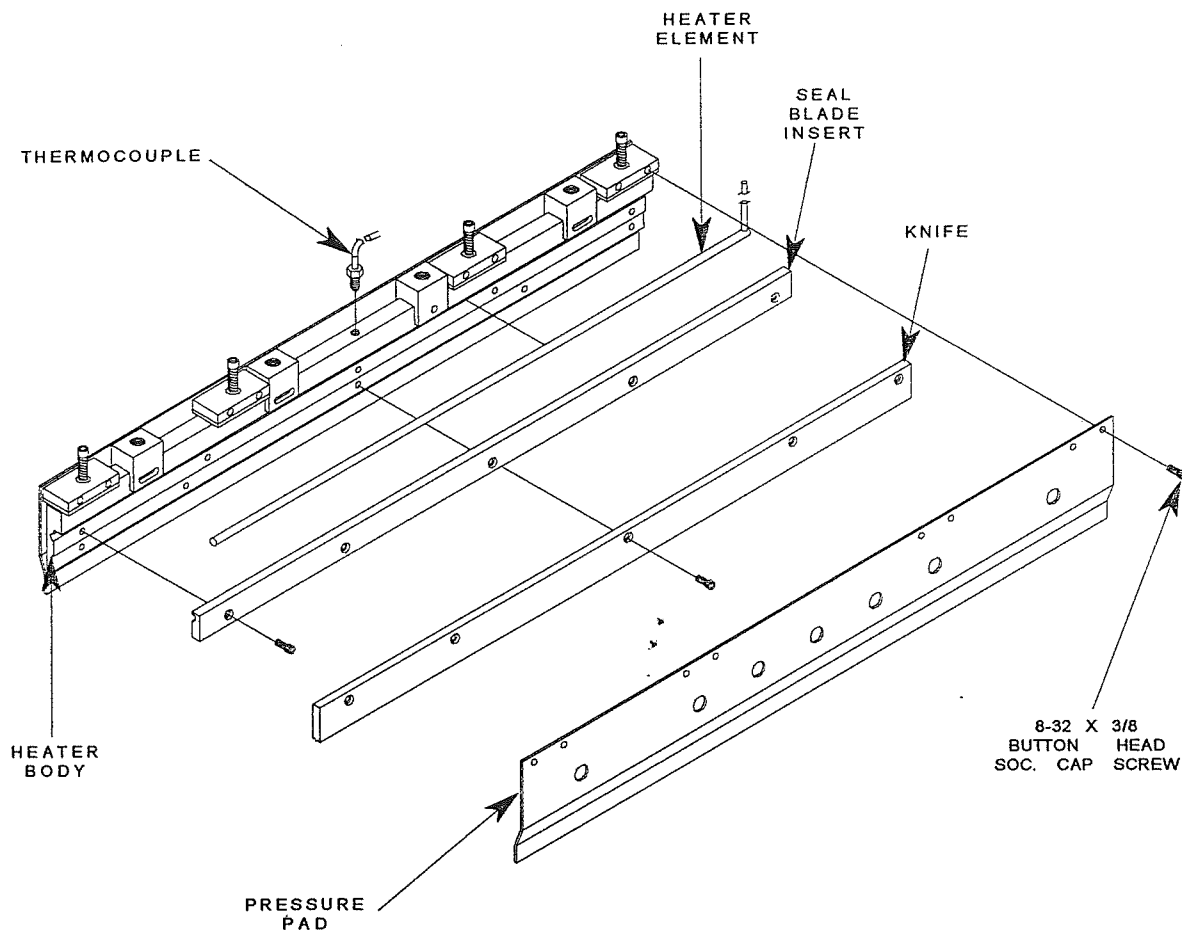
C. SEAL BAR/KNIFE ASSEMBLY

The seal bar/knife assembly is basically the heart of the machine. Proper operation, alignment and heating are the key factors to efficient and trouble free sealing.

With the air pressure to the machine off, check the up and down movement of the assembly on the guide bars.

CAUTION: IF THE MACHINE WAS RUNNING JUST PRIOR TO THIS CHECK, THE SEAL BAR AREA WILL BE HOT. USE CARE WHEN ATTEMPTING TO LIFT THE ASSEMBLY.

There should be no "sticking" or "wobble" in the movement. Check for proper sealing by performing the sealing test outlined in the bottom seal bar assembly instructions later in this section. If the seal is not correct after testing, follow the bottom seal bar adjustment instructions.



1. Knife Heater Element

The heater element is a 1/4" round 18" long tubular heater. The heater element is completely surrounded and clamped in place inside the heater body to ensure rapid heat transfer to the heater body and knife blade.

Testing: With a volt-ohm meter set for resistance, place the two leads of the meter onto the leads of the heater element. The resistance reading should be around 40 - 45 Ohms. If no reading occurs, the element is defective and must be replaced.

To replace the heater element:

All parts being removed will be on the side of the seal bar assembly closest to the dead plate area.

- a. Turn off electrical power to the machine.
- b. Remove the eight (8) 8-32 x 3/8 screws securing the two switch brackets (MSP - 6 & 7) and the pressure pad to the seal bar.
- c. Remove the five (5) 8-32 x 3/8 screws securing the seal blade insert to the heater body and remove heater element.
- d. Remove/cut all wire ties securing wiring to seal bar area and disconnect wiring in electrical junction box.
- e. Install new heater element in reverse order.

NOTE: PLACE A SMALL AMOUNT OF "ANTI - SEIZE" (see lubrication in Section 4) ON THE THREADS OF THE SCREWS BEFORE INSTALLING.

2. Heater Knife

The heater knife performs two essential functions on the shrink film. At the proper temperature, the rounded edges on both sides of the knife edge melt the two film strips together forming the seal. The knife edge separates the sealed film ends from each other.

See Section 2 page 2.4 items 3 & 4 for adjustments/temperature setting. Check the knife blade and edges for any dents/knicks. Use a clean dry cloth to wipe off any dirt/debris.

To replace the knife:

CAUTION: DO NOT ATTEMPT TO REMOVE THE KNIFE BLADE WITH THE ELECTRICAL POWER ON AND THE SEAL BAR AREA HOT !

- a. Turn off electrical power to the machine.
- b. Remove the eight (8) 8-32 x 3/8 screws securing the two switch brackets (MSP - 6 & 7) and the pressure pad to the seal bar.
- c. Remove the five (5) 8-32 x 3/8 screws securing the knife to the heater body and remove knife.
- d. Install new knife in reverse order.

NOTE: PLACE A SMALL AMOUNT OF "ANTI - SEIZE" (see lubrication in Section 4) ON THE THREADS OF THE SCREWS BEFORE INSTALLING.

3. Thermocouple

The thermocouple is the sensing device for the seal bar thermostat. The resistance reading the thermostat receives from the thermocouple will determine when heat is needed on the seal bar/knife.

Testing: The two leads of the thermocouple should be disconnected from the machine wiring. With a volt-ohm meter set for resistance, place the two leads of the meter onto the two leads of the thermocouple. The resistance reading should be around 3.0 - 4.0 Ohms at 75°F (24°C) ambient temperature. If no reading (resistance) occurs, or the Ohm reading is drastically different, the thermocouple is defective and must be replaced.

To replace the thermocouple:

- a. Disconnect thermocouple wires from the machine wiring.
- b. Remove/clip off all wire ties securing thermocouple wiring to seal bar assembly.

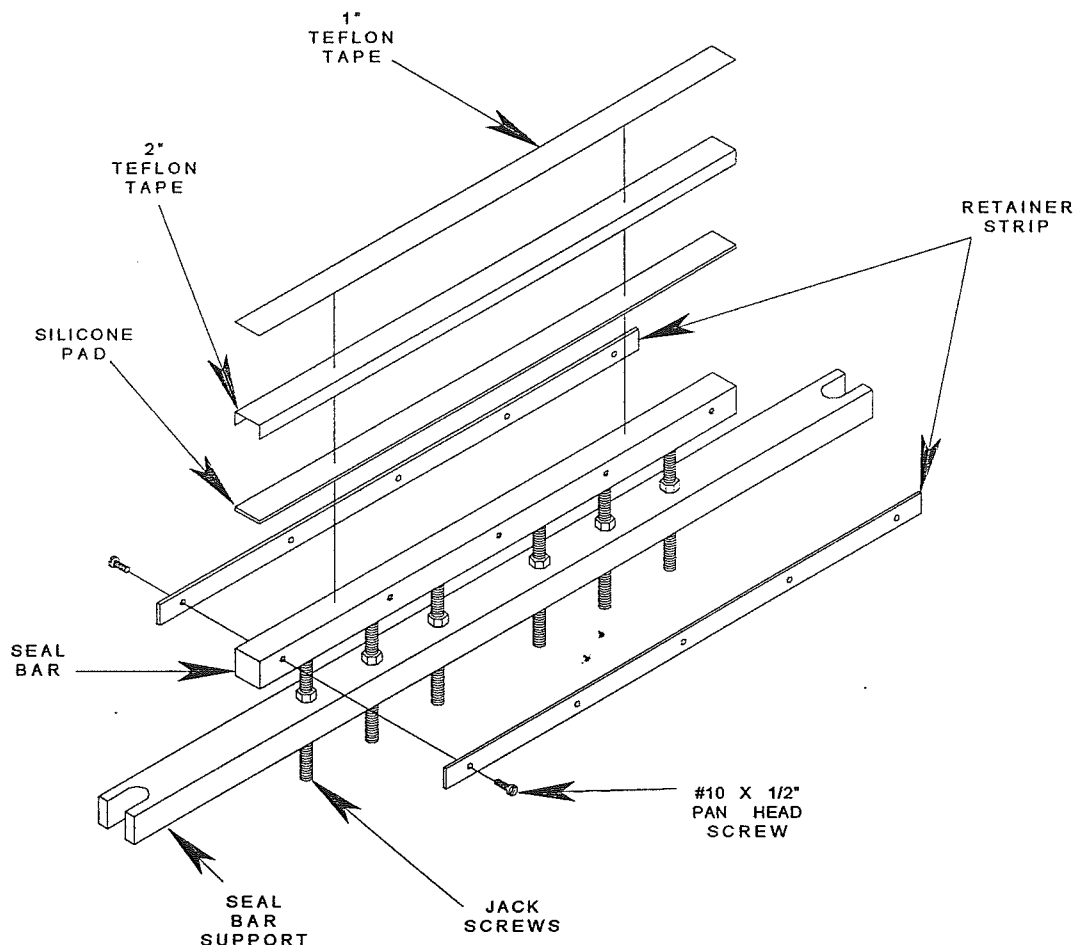
- c. With a 5/16 open end wrench, remove the thermocouple from the seal bar heater body.

NOTE: WHEN REMOVING OR INSTALLING THE THERMOCOUPLE, ALLOW THE WIRING TO TURN WITH THE THERMOCOUPLE.

- d. Install new thermocouple in reverse order. Make sure that the white wire is connected to the machine wire marked +, and the red wire to the machine wire marked -.

NOTE: PLACE A SMALL AMOUNT OF "ANTI - SEIZE" (see lubrication in Section 4) ON THE THREADS OF THE THERMOCOUPLE BEFORE INSTALLING.

D. BOTTOM SEAL BAR ASSEMBLY

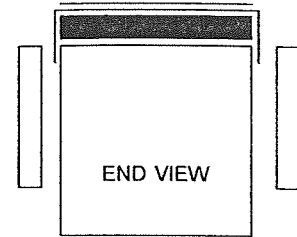


Unlike the top seal bar, the bottom seal bar is not heated. Its function, however, is just as important. The seal bar is mounted to a support bar. This support bar has an air cylinder attached to it that pushes the seal bar assembly upward 1" every time a seal is made.

On the top face of the seal bar is a silicone pad and two strips of Teflon tape. The Teflon tape provides a non-stick surface for the film and top seal bar knife to press against. The silicone pad provides a soft but firm base to ensure that the top seal bar knife can effectively seal and cut (separate) the shrink film.

Over time the top layer of Teflon tape will show signs of wear; a deep groove, cracking or flaking of the tape, etc. Once the tape shows signs of any of these conditions, it is recommended to replace the top layer of tape.

NOTE: IF THE TOP LAYER OF TAPE IS LEFT ON TOO LONG AFTER SIGNS OF BREAKDOWN OCCUR, THE POSSIBILITY OF IMPROPER SEALING/CUTTING IS INCREASED. WEAR WILL ALSO START OCCURRING ON THE BOTTOM LAYER OF TAPE.



Since the top seal bar/knife does not hit in the center of the bottom seal bar top surface, the silicone pad and both layers of Teflon tape should be rotated (turned end for end) every four months. This will increase the life of the silicone pad and ensure a flat even surface for sealing.

To rotate/replace silicone pad and Teflon tape:

- a. Remove the ten (10) pan head screws securing the two retainer strips to the seal bar and remove strips.
- b. Peel the Teflon tape/silicone pad off of the seal bar.
- c. Clean the seal bar (top and sides) with lacquer thinner and let dry.
- d. Rotate end for end (or replace) the Teflon tape/silicone pad and place on the seal bar. If you are replacing the Teflon tape that adheres to the silicone pad, clean pad with lacquer thinner before applying the new tape.
- e. Apply new piece of 1" Teflon tape (if bottom layer was replaced). If replacing 1" tape, clean the surface of the bottom layer of tape with lacquer thinner before applying.
- f. Install the two retainer strips and screws.

1. Seal test:

- a. Place a piece of paper (legal size or a little larger) over the bottom seal bar. Make sure the paper covers the same area of the seal bar that the shrink film covers.
- b. Press and hold the manual seal button until the seal bars go back to their home positions.

CAUTION: KEEP FINGERS  AND OTHER OBJECTS (except the paper) AWAY FROM SEAL BAR AREA WHEN DOING A MANUAL SEAL !
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- c. Check the paper for a good impression all the way across. If any area of the impression looks weaker than the rest, the surface of the seal bar is not even with the top seal bar. Any dents/nicks in the knife will also show up on the paper.

NOTE: IF ANY SEALING PROBLEMS OCCUR, IT IS BEST TO CHECK THE TEFLON TAPE/SILICONE PAD AREA FIRST BEFORE ATTEMPTING TO ADJUST THE JACK SCREW NUTS. DOUBLE CHECK TO SEE IF THE TAPE SURFACE IS LEVEL AND THAT THE TEFLON TAPE IS IN GOOD CONDITION.

- d. If dents/knicks show up on the paper, the knife needs to be replaced.

2. Bottom seal bar adjustment:

If weak impression areas show up on the paper used to perform the seal test, the following instructions should be followed in order to restore a uniform seal of the shrink film.

- a. Loosen the nuts on the jack screws where the impression/seal was weak. Do not loosen the nuts directly below the seal bar. Only use the nuts on both sides of the seal bar support.

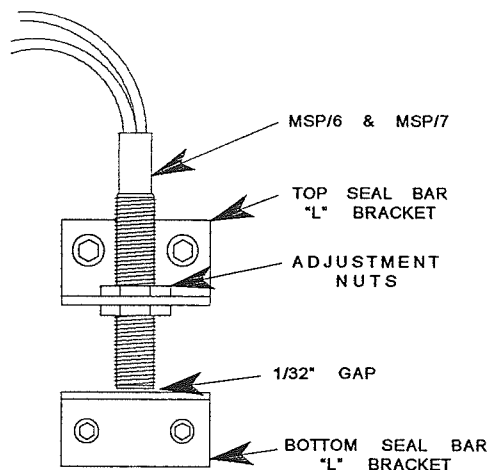
- b. Depending on which way the seal bar needs to be "straightened", will determine which nut must be tightened and which must be loosened in order to "bend" the bar.
- c. Place a piece of paper over the bottom seal bar and repeat the seal test above.
- d. Continue adjustments until the seal impression is uniform across the paper.
- e. Tighten down all jack screw nuts.

E. SEAL BAR SAFETIES

At both ends of the top and bottom seal bars are "L" brackets. The top seal bar brackets have the metal sensing switches MSP/6 & 7 mounted to them. The bottom seal bar brackets are the "metal" that the switches sense.

The gap between the end of the switch and the bottom seal bar "L" bracket should be $1/32$ " with the air pressure to the machine off and the top seal bar down and resting on top of the bottom seal bar.

If the switch is hitting the bottom seal bar bracket, the switch will eventually breakdown and cease working.



1. Turn off air pressure to the machine and allow the top seal bar to come down and rest on the bottom seal bar.
2. Check gap between switch and bottom seal bar bracket.
3. If necessary, loosen the adjustment nuts and turn nuts until proper gap is achieved. Tighten nuts.
4. Turn on air pressure to the machine and do a manual seal. Seal bar dwell timer should time out. If seal bar timer did not time out (seal bars touched and immediately retracted to their home positions), increase the gap on both switches an equal amount and try another manual seal. Repeat this procedure until the seal bar dwell timer times out.
5. Place a piece of wood or some other suitable (nonmetal) object between the seal bars and do a manual seal - the switches should sense the obstruction and the seal bars should retract immediately.

F. PNEUMATIC SYSTEM

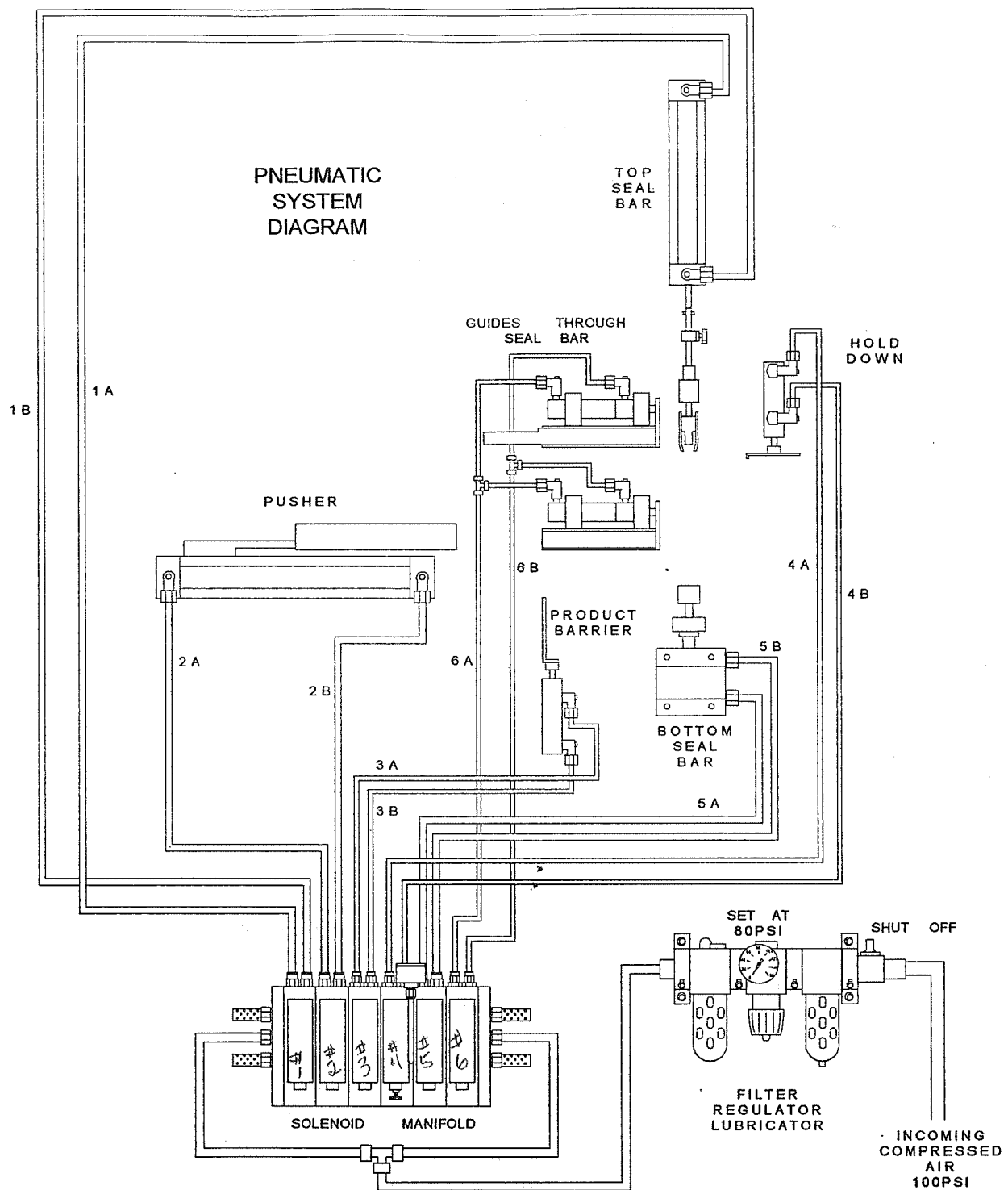
The pneumatic system on the machine consists of the filter/regulator/lubricator (FRL), solenoid bank, air cylinders for; main pusher, product barrier, guides through seal bar, top seal bar, bottom seal bar and product hold down.

Through the machine's programming and series of switches, the solenoids are electrically activated. The system diagram illustrates which solenoid affects which cylinder.

1. Filter/Regulator/Lubricator (FRL)

As the name indicates, the filter removes moisture and contaminants from the incoming compressed air. The regulator (pressure regulating valve) controls the amount of air pressure (80Psi for most applications) supplied to the machine. The lubricator automatically adds lubricant (oil) to the air system for the valves, cylinders, etc. The oil is introduced into the pneumatic system only when the machine is running.

NOTE: SEE LUBRICATION IN SECTION 4 FOR ADJUSTMENTS AND RECOMMENDED LUBRICANTS FOR FRL.



2 Solenoid manifold

The solenoid manifold consists of six (6) solenoids mounted on a modular manifold. Each solenoid, when electrically activated, releases compressed air to a specific component (see diagram). At each end of the manifold are exhaust mufflers. These mufflers reduce the noise generated by rapid air release, and should be removed and cleaned with a nonflammable solvent monthly to ensure free air flow.

G. DRIVE MOTORS

The APB 2000 S - PH utilizes five (5) drive motors. Two (2) motors are used for upper and lower shrink film advance. One (1) motor for operating the infeed conveyor. One (1) motor for the shrink tunnel (oven) fan and one (1) motor for the shrink tunnel conveyor.

1. Shrink film drive motors

On the end of the dancer bar pivot supports is a triangular tab. As the dancer bars are pulled in by the shrink film, the tabs rotate in front of metal sensing proximity switches (see page 3.3). These switches (MSP/8 & 9) sense the tabs and send a signal to contactors inside the electrical/control panel. The contactors close, sending 120Vac to the shrink film drive motors. The motors in turn, power sprocket and chain drive systems hooked up to the drive rollers for the shrink film. This feeds the film to the machine as needed. When the metal tabs on the dancer bars rotate away from the switches (enough film has been fed through the drive roller), the circuits are opened and the motors stop.

Testing/repair:

Check for 120Vac at motor electrical box (activate the appropriate dancer bar to trigger the metal sensing switch MSP/8 or MSP/9).

- If 120Vac is present, fault lies in either the motor (check motor resistance) or brake. Remove cover to brake and observe the solenoid plunger to see if it retracts when 120Vac is applied to the motor. If plunger retracts, but the motor still doesn't run - the motor is defective. If plunger does not retract, push in the plunger and apply 120Vac to the motor - if motor runs, the brake is defective.
- If no 120Vac is present, fault lies in the electrical system for the motor. Check; dancer bar alignment with the switches, the switches themselves, contactors (labeled E for top motor, F for bottom motor), overloads (directly under the contactors) and associated wiring for problems.

Motor replacement:

- a. Remove motor electrical box cover and disconnect machine wiring from motor. Loosen knurled nut on cord grip and pull machine wiring out of the box.
- b. Remove the four (4) nuts and lockwashers securing motor to frame of machine. Slip off drive chain and remove motor.
- c. Remove wiring for the brake from the motor electrical box.
- d. Remove both cord grips from electrical box and install to new motor box.
- e. Remove the two (2) screws securing the brake cover and remove cover.
- f. Remove the four (4) screws, lockwashers and spacers securing the brake to the motor. Remove brake assembly.
- g. Loosen the two (2) set screws securing the cam to the motor shaft and remove cam.
- h. Loosen the two (2) set screws securing the sprocket to the motor shaft - remove sprocket and shaft key.
- i. Reassemble to new motor in reverse order.
- j. See page 3.12 for brake adjustment.

2. Infeed conveyor motor

Same motor as the shrink film drive motors. This motor is turned on by the infeed conveyor switch on the electrical/control panel. The light sensing proximity switches (LSP/13, 14 & 15) that detect product on the conveyor will intermittently stop the motor when all switches sense product. Follow above instructions for shrink film motors if replacing infeed conveyor motor.

1. Fan assembly - shrink tunnel

Through a pulley and shaft system, the fan inside the tunnel circulates the heated air. The fan assembly consists of the fan motor, two (2) pulleys, V-belt, fan shaft, two (2) bearings and fan blade.

Check/repair:

Periodically check tension of V-belt and adjust as necessary. Inspect shaft and bearings for any noise or wobble, replace if worn. The bearings have permanent seals and cannot be greased even though they have grease fittings on them.

2. Thermocouple

The thermocouple is the temperature sensing device for the oven thermostat. The resistance reading the thermostat receives from the thermocouple will determine when heat is needed inside the shrink tunnel.

Testing:

The leads of the thermocouple should be disconnected from the machine wiring.

- With a VOM set for resistance, place the two leads of the VOM onto the leads of the thermocouple. The resistance reading should be around 2.0 - 3.0 Ohms at 75 °F (24 °C) ambient temperature.
- If no reading (resistance) occurs, or the reading is out of range, the thermocouple is defective and must be replaced.

Thermocouple replacement:

- a. Disconnect thermocouple wiring from electrical junction box.
- b. Clip off/remove wire ties securing thermocouple wiring to machine.
- c. Loosen the two (2) screws of the clamp securing the thermocouple to the oven box. Pull out thermocouple.
- d. Install new thermocouple in reverse order.

3. Heater element assembly

Controlled by a thermostat, the heater elements supply all the heat required to shrink wrap the film around the product. There are nine (9) heater elements that make up this assembly. When viewing the heater element assembly from the discharge end of the tunnel, the elements are positioned from left to right; 9, 8, 7, 6, 5, 4, 3, 2, 1. Six (6) elements - 9, 8, 6, 4, 2, 1 are controlled by the thermostat, and three (3) elements - 7, 5, 3 are wired to stay on when electrical power is applied (at machine start up).

<p>CAUTION: THE HEATER ELEMENT ASSEMBLY CAN BE EXTREMELY HOT! MAKE SURE ELECTRICAL POWER IS TURNED OFF AND THAT THE HEATERS HAVE COOLED DOWN BEFORE ATTEMPTING ANY TESTING OR REPAIRS.</p>

Element testing:

Each individual element should have a resistance reading of:

24 - 30Ω for 208Vac.

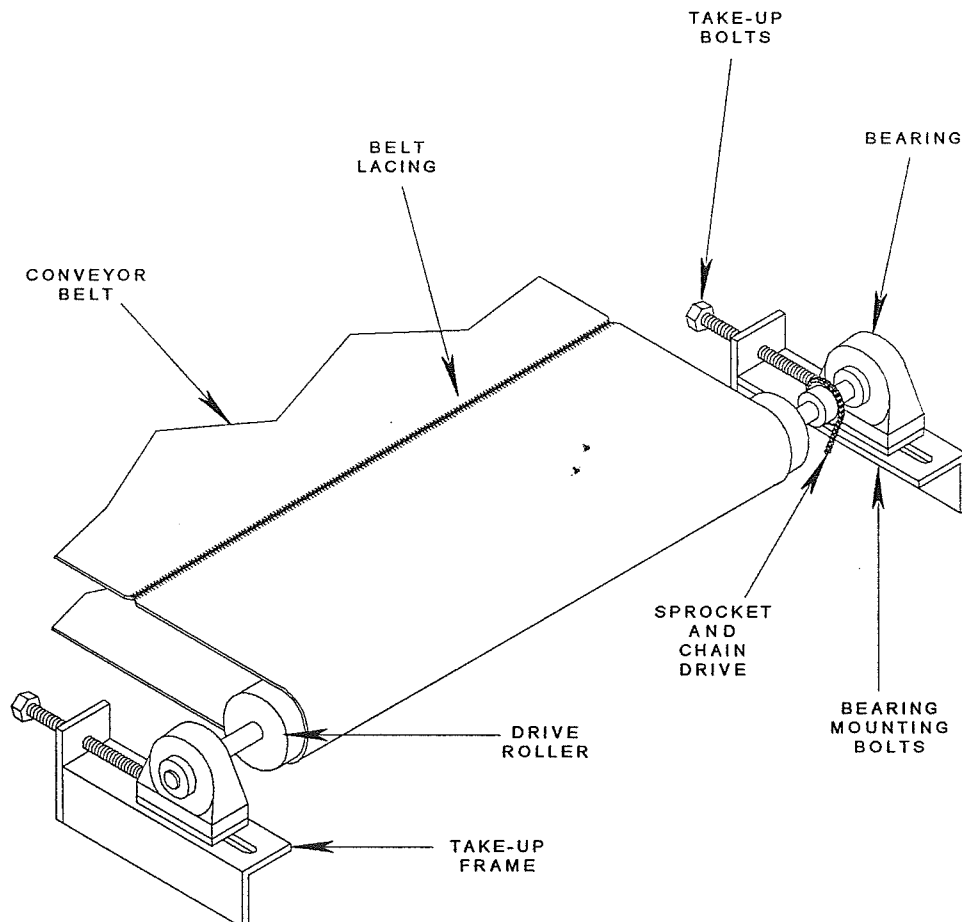
32 - 39Ω for 220, 240 or 480Vac.

Heater element replacement:

- a. Remove the twelve (12) screws and three (3) retainer strips securing the discharge curtain to the tunnel. Remove curtain.
- b. Remove the four (4) nuts (one at each corner of the heater element assembly) and lower assembly to the conveyor.
- c. Clip off the metal wire ties securing the wiring bundle and lie flat the assembly.
- d. Remove the wires from the element to be replaced.
- e. Remove the two (2) nuts, lockwashers and flatwashers securing element to assembly and remove element.
- f. Replace element and assembly in reverse order.

I. TUNNEL CONVEYOR BELT

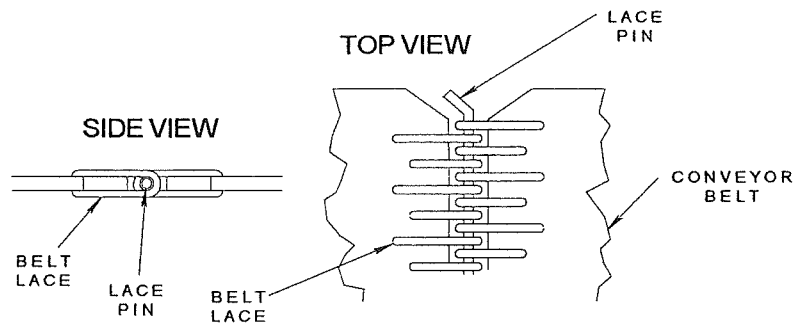
The tunnel conveyor belt is made of a high temperature silicone coated, fiberglass material. Two rollers enable the belt to rotate. The roller at the tunnel discharge end is driven by an adjustable speed motor (see page 3.12 item 4) through a sprocket and chain system. Tension and alignment adjustments of the belt are done at the take-up frames where the bearings for the drive roller are mounted.



Conveyor belt replacement:

- a. Rotate conveyor belt until the belt lace is half way between the discharge curtain and drive roller - turn off conveyor.
- b. Loosen the bearing mounting bolts (underneath take-up frame) one and a half to two turns.

- c. Loosen the locking nut on the take-up bolts and back off bolts 1 - 2".



- d. With a pair of pliers, straighten one end of the lace pin. Grab the other end with the pliers and pull the pin out of the belt lacing.
- e. Remove old belt from the machine.

NOTE: THERE ARE TWO WAYS OF PUTTING ON THE NEW BELT. THE FIRST IS TO THREAD THE NEW BELT THROUGH THE MACHINE AFTER THE OLD BELT IS REMOVED. THE SECOND IS TO LACE IN ONE END OF THE NEW BELT TO ONE END OF THE OLD BELT - AS YOU PULL OUT THE OLD BELT, THE NEW BELT WILL BE THREADED THROUGH THE MACHINE.

- f. Bring the two ends of the belt together and thread the lace pin through the belt lacing. Bend the end of the lace pin (see illustration) so it cannot work itself back out during operation.
- g. Pull the drive roller back to tighten the belt. Only a slight tension is needed.

CAUTION: TOO MUCH TENSION PUT ON THE BELT WILL CAUSE IT TO STRETCH.

- h. Screw in the take-up bolts until they start moving back the roller bearings.
- i. Snug up the bearing mounting bolts.
- j. Run the conveyor to check for proper tracking (two minutes). The belt should stay in the middle of the drive roller, it should not move to one side or the other.
If the belt moves to the left - loosen the tension on the right take-up frame, and vice versa.
- k. Once proper tracking is achieved, tighten down the bearing mounting bolts and locking nuts on the take-up bolts.

J. ELECTRICAL/CONTROL PANEL

This panel contains all the fuses, relays, contactors, overloads, programmer and operator switches (see Section 5 for illustrations and removal/replacement of controls).

Refer to the electrical wiring diagram at the end of this section for details of specific components and their associated wiring. All components inside the electrical/control panel are labeled for easy reference.