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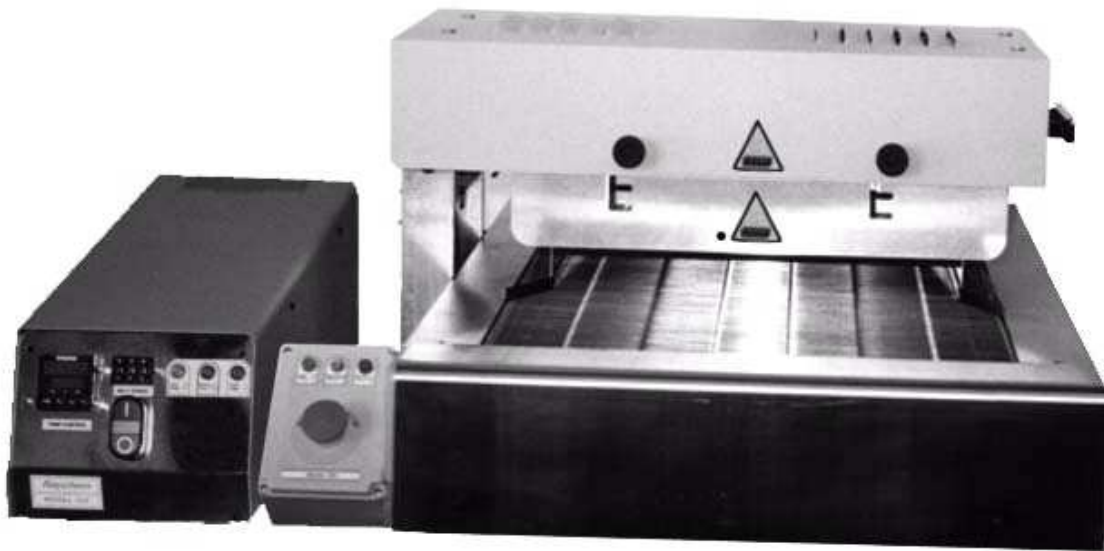
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# Operating manual

MODEL 105 TUNNEL OVEN (TE 1-1198896-5  
RAYCHEM 955018-000)

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# 1 DESCRIPTION

## 1.1 General

The Model 105 Tunnel Oven is a low maintenance, high production heater that provides a controlled processing system, suitable for processing a variety of products, including heat-shrinkable tubing and thermal curing of various products. The unit is designed as a modular unit consisting of the upper heater chamber and base, modular wire mesh belt conveyor with lower heater element, and a remote electrical enclosure. The standard unit, P/N 12000012 is provided with a 39" long conveyor. The wire mesh belt conveyor is designed to permit custom conveyor lengths in excess of 39" for specific customer application requirements. A four foot detachable umbilical cable connects the processor unit to the control enclosure.

The Model 105 Tunnel Oven is a table top unit. Overall dimensions of the unit is approximately 27" W x 39" L x 16 ½" H. The two key process parameters of conveyor speed, and heater element temperature are controlled using closed loop electronic modules. Speed settings range from 0 to 5 feet/minute, and temperature settings range from ambient to 700°C, however settings below 0.5 feet per minute and above 600°C are not recommended. The Tunnel Oven is designed to run continuously at the recommended settings. The Model 105 Tunnel Oven has two upper housing height positions. The upper pivot position provides 4 inch nominal oven clearance for large part production. The lower position provides 2.25 inch nominal oven clearance for smaller parts.

An auxiliary E-Stop enclosure is provided on a flying lead, suitable for customer positioning when two operators are required for production processing.

The Model 105 Tunnel Oven also contains many self diagnostic and safety features to protect the operator, machine and product. These include alarms, indicator lights and cool down circuitry, when the OFF ("O") push button is pressed, the Tunnel Oven goes into a 20 minute Cool Down mode that allows the conveyor and fans to run without the heater elements. This prevents components in the machine from being repeatedly exposed to high temperatures when powered down.

These indicator lights and alarms include:

"Cool Down" - Power has been turned off and the machine is in cool down mode.

"Process Ready" - The oven temperature is in the preset temperature range for processing product.

"Over Temp" – the internal chamber temp exceeds the rating of a thermal switch.

"Heater Fault"-- one of the heating elements fails.



**It is the user's responsibility to independently verify all process parameters and settings immediately after equipment is installed. The user must also maintain and adjust the equipment, monitor the process, and inspect the installed product to ensure that process requirements are met on an ongoing basis.**

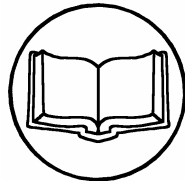
## 1.2 Introduction

### Caution



This symbol (black print on yellow background) indicates that there is something that could damage the machine or cause bodily harm if not handled properly. Refer to the manual for further instructions.

### Read Manual



This symbol directs the operator to read the manual in order to understand the operation of the machine.

### Hot Surface



This symbol (black print on yellow background) indicates that a given surface becomes hot during normal operation of the machine. Care must be taken to avoid direct skin contact with this surface.

### High Voltage



This symbol (black print on yellow background) indicates that high voltage is present in the vicinity. Only trained technicians should be working in such an area. Normal procedures for working in such an area dictate that the machine be powered down, and the power be removed by unplugging the main power cord from the facility's power supply outlet. In circumstances where this is not possible, the technician must exercise extreme care to avoid contact between body parts, conductive tools, and electrical conductors.

### Wear Protective Clothing



This symbol directs the operator to wear protective clothing when operating the machine. Most specifically cotton gloves and long sleeve cotton shirts which protect the operator from hot surfaces which may be encountered.

### Use Protective Eye Wear



This symbol directs the operator to use protective eye wear when operating the machine.

### Keep Hands Out of This Area of the Machine



This symbol directs the operator to keep their hands out of this area while operating the machine.

## 1.3 Left-Right Conventions

In this document, left and right are always defined with respect to the operator when standing in a normal working position. That is, standing in front of and facing the Tunnel Oven.

## 1.4 Safety Features/Self Diagnostic Circuitry

### Cool Down Circuit

To prevent equipment damage, a timer circuit allows the fans and belt to continue running after the OFF ("O") button is pressed. This circuit will shut off power to the heater elements while allowing the conveyor and fans to run for a period of 20 minutes, at which time all power will shut off automatically. The Cool down Indicator illuminates when the Tunnel Oven is operating in this mode.



Front of Control Enclosure

### Heater Fault Circuit

The Heater Fault Circuit constantly monitors the current flowing to the two heater elements during normal operation. In the event of a heater element failure (open circuit) the heater fault circuit senses a difference in current between the two elements, and sounds an audible alarm. The Heater Fault Indicator is also illuminated. If this condition occurs, the operator should press the OFF ("O") button and allow the unit to begin cooling. **The operator must not run product through the Tunnel Oven while this indicator is on.** After the Tunnel Oven has cooled down, an ohmmeter can be used to probe the end of the heater element plug and determine which heater element has failed. Once the problem has been corrected, normal operation may begin again.



### Over Temperature Indicator

In the event of the heater element temperature becomes excessive, a light on the front of the Control Enclosure will illuminate. The machine will automatically enter Cool Down mode. See over Temperature Switch Below for more information.

### Emergency Stop Enclosure

The Emergency Stop Enclosure is located on the front left hand side of the Tunnel Oven. Aside from the Emergency Stop Button, the enclosure contains a second Cool down Indicator a second Heater Fault Indicator as well and a Process Ready Indicator. If so desired by the user, an additional Emergency Stop station may be added to the unit. This can be done by purchasing an Auxiliary Emergency Stop Enclosure from TE. Simply remove the rear jumper plug from the factory installed Emergency Stop Enclosure, and plug the Auxiliary Emergency Stop Enclosure flying lead into the connector on the rear of the factory installed enclosure. The Auxiliary Emergency Stop Enclosure may be mounted where deemed necessary by the user.



Emergency Stop Enclosure

### Processor Ready Indicator

When the heater element temperature falls within the allowable processing temperature limits, a light on the Emergency Stop Enclosure will illuminate. **The operator must not run product through the Tunnel Oven unless this indicator is on.** The factory setting for this indicator is  $\pm 20^{\circ}\text{C}$  of the temperature set point. This value is set in the Band Alarm 2 location in the Temperature Controller.

### Emergency Stop Button

There is an Emergency Stop button located on the upper heating chamber. Pressing this button will kill all power to the Tunnel Oven.



**Note:** Do not use the Emergency Stop Button for normal shut down as it will defeat the cool down circuit.

### Circuit Breaker

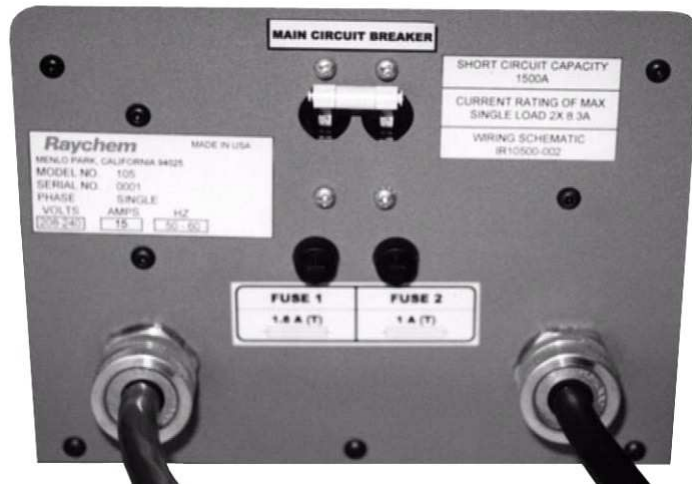
All mains circuitry is protected from electrical overload by the Main Circuit Breaker (1CB) located on the rear of the Control Enclosure. It may be left on indefinitely and should be turned OFF only after the Tunnel Oven has completed its Cool Down mode.



**Note:** Do not use the Circuit Breaker for normal shut down as it defeats the cool down circuit.

### Fuses

There are two (2) fuses protecting the Tunnel Oven control circuitry. These fuses are labeled 1 Fuse (1FU), and 2 Fuse (2FU) and are located on the rear of the Control Enclosure. Fuse 1FU protects the control transformer (1XFMR) and fuse 2FU protects all 120V control circuits including fans and control devices. These fuses are 5x20mm IEC low breaking time delay fuses. 1FU is a 1.6A fuse (Littelfuse #21801.6, Bussman #GDC-1.6A or equivalent) while 2FU is a 1A fuse (Littelfuse #218001, Bussman #GDC-1A or equivalent).



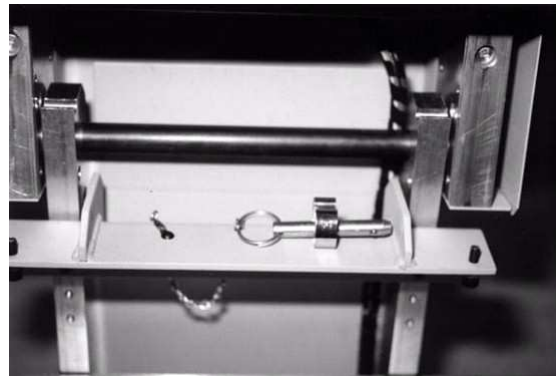
Rear of Control Enclosure

## Top Lock Pin

The Top Lock Pin is used to lock the top of the Tunnel Oven in a full open (vertical) or partially open (30° from vertical) position for heater element change or other maintenance. To use the Top Lock Pin, open the Tunnel Oven Top with one hand by grasping the handle on the right side of the unit and hold it at the desired position. This will expose the Top Lock Pin in its holder. Retrieve the Top Lock Pin from its holder. (The pin is tethered to the Tunnel Oven by a chain.) While still supporting the top with one hand, fully insert the Top Lock Pin into the hole or channel in the Pivot Stand, making sure that the pin also passes through the hole in the Pivot Block. When fully inserted the top will be locked in position. Work on the Tunnel Oven can then proceed safely. When work is complete, support the top with one hand and remove the pin with the other, and reverse the process described above to place the Tunnel Oven into its normal operating state. When returning the pin to its holder, make sure the chain is hanging in the cavity between the holder mounting angle and the electrical control enclosure.



Top Lock Pin – Engaged

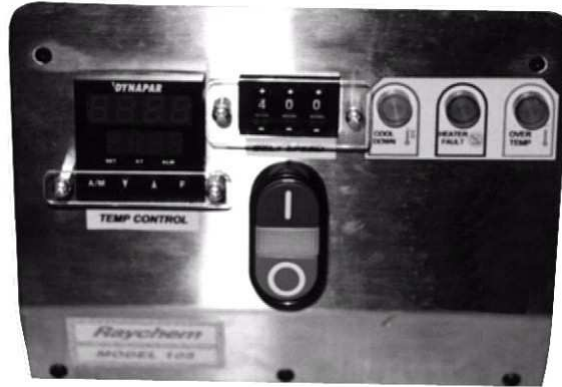


Top Lock Pin - Stored

**Note:** Always use the Top Lock Pin to secure the hinged conveyor top when it is not in the horizontal position. Failure to do so can result in serious personal injury and/or damage to the unit.

Before operating the unit, the top must be returned to its horizontal position. To do this, support the Tunnel Oven Top with one hand by grasping the handle. Remove the Top Lock Pin from the Pivot Stand with the other hand and return it to its holder. Gently lower the top until it engages the Top Rest Pins.

## 1.5 Components and Controls



Front of Control Enclosure

### **ON ("I") Push Button**

This button is used to turn the machine on at the beginning a shift, or to restore power to the heater elements during the Cool Down mode. It is located on the front of the Control Enclosure.

### **OFF ("O") Push Button**

This button is used to turn off the Tunnel Oven. Pressing this button puts the Tunnel Oven in the cool down mode, shutting off power to the heater elements and illuminating the Cool down Indicator. This button is also used to clear the Heater Fault Circuitry, turning off the indicator light and silencing the Audible Alarm once it has been activated. After the OFF ("O") button is pressed, the conveyor and fans to continue to operate for 20 minutes, allowing the Tunnel Oven cool to a safe temperature. At the end of this Cool Down period, the conveyor and fans will shut OFF automatically. The OFF ("O") push button is located on the front of the Control Enclosure.

### **"On" Indicator**

This Tunnel Oven "On" indicator is located between the ON ("I") and OFF ("O") push buttons. When illuminated, it indicates that the Tunnel Oven is in normal operating mode with power applied to the heater elements. If it is not illuminated, the Tunnel Oven is completely shut down, or in Cool Down mode, which means there is no power applied to the heater elements.

### **Temperature Controller**

The temperature controller uses type K thermocouple (integral to the Upper Heater Element) to close the temperature loop. The heater element temperature set point may be adjusted from 0 to 600°C for different types and sizes of assemblies and tubing. UP and Down arrows on the face of the controller adjust the temperature set point. The Temperature Controller is located on the front of the Control Enclosure.

### **Oven Top Assembly**

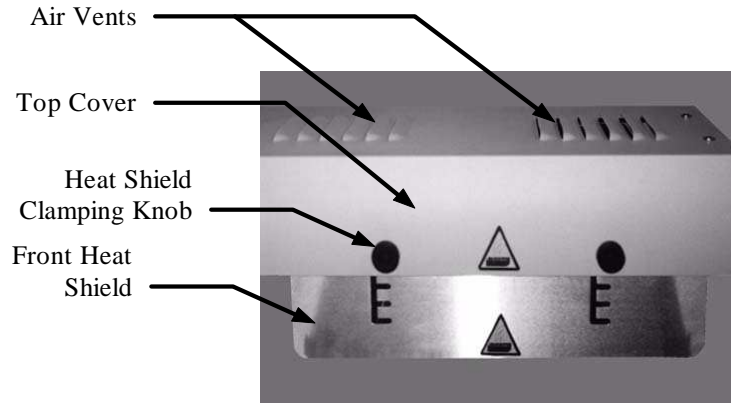
The Oven Top Assembly can be set to two (2) different positions. The upper position provides a 4 inch vertical opening for taller parts. The lower position provides a 2 ¼ inch vertical opening. The lower setting is recommended if the height of parts to be run through the machine do not exceed 2 ¼ inches.

### **Top Cover/Air Vents**

There are air vents located on the oven Top Cover of the Tunnel Oven. When reinstalling this cover make sure the vent openings face away from the top lift handle. (Venting toward the left side of the Tunnel Oven). Failure to do so may cause over heating of critical electrical components in the top of the Tunnel Oven.

### Front and Rear Heat Shields

Heat Shields are located on the front and rear of the oven Top Cover. These covers are to be adjusted to the lowest possible position that still provides clearance for parts to enter the oven chamber. This will ensure optimum efficiency and consistent performance.



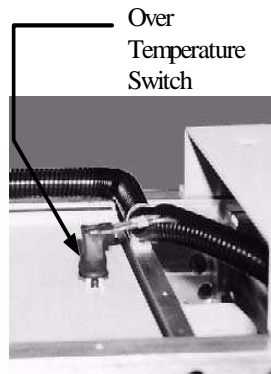
Oven Top Assembly

### Heater Elements

Two (2) infra-red heater elements, one upper and one lower are used in the Tunnel Oven. Each elements is rated 1500 Watts at 240 Volts, and may be used at nominal mains voltages ranging from 208 to 240 Volt 50/60 Hz AC. The upper heater element contains an integral "K" type thermocouple.

### Over Temperature Switch

An Over Temperature Switch Located on top of the upper Heater Element Enclosure protects the machine from Over Temperature conditions resulting from faulty control components or shorted thermocouple wiring. When an excessive temperature is sensed, the switch trips, the Over Temperature Indicator on the front of the Control Enclosure will illuminate. The machine will automatically enter Cool Down mode.



### Drive Chain

The drive chain is located between the motor and the rear conveyor shaft. It should be lubricated with a commercially available chain lubricant every six months.

**Note:** Drive chain may cause personal injury or product damage if fingers, clothing, or product enters into drive chain/sprocket area. Never operate machine without chain guard and left rear belt guard in place.

### Conveyor Shaft Bearings

The rear conveyor shaft is mounted into permanently lubricated bearing units. The front roller rides on permanently lubricated roller bearings as well. The front roller can be loosened and moved using a 13 mm open end wrench to adjust conveyor belt tension if required (see section 5.3.1). Spacer clips on the front roller bearing assemblies must be removed before the wrench can be inserted on the clamping bolt. Always replace spacer clips after tightening clamping bolts. No lubrication of the bearing units is required over the life of the Tunnel Oven.

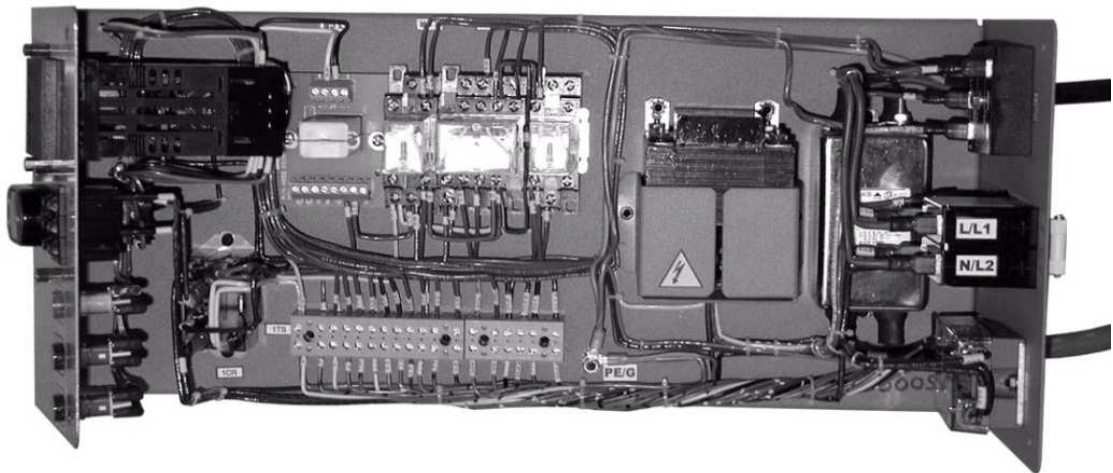
### Conveyor Belt

The conveyor belt is made out of stainless steel and needs no lubrication during its service life. If required, the belt may be taken apart by cutting the splice link that holds it together. Animated instructions on installing and removing splice clips can be found on the Internet at URL <http://www.wirebelt.com>. This is a low tension belt and should not be over tightened. Generally the belt needs to be only tight enough to present slipping on the drive belt cogs. Replacement belts and splice clips may be purchased from TE.

**Note:** Conveyor belt may cause personal injury or product damage if fingers, clothing, or product gets entangled in belt slots or pinched between moving and stationary components. Exercise caution when operating the machine. Never operate machine without all belt guards in place. There are seven (7) belt guards on the machine. They are the front side, center side, and rear side guards (both left and right sides), and the front belt guard.

## 1.6 Control Enclosure Layout

The Control Enclosure (shown at right) houses the bulk of the electrical and electronic components. All items are identified by schematic designation. The below table defines the each of the mentioned items.



---

**Electrical Enclosure Components**

<b>Designator</b>	<b>Description</b>
1CB	Circuit Breaker, 2 Pole, 15A, 250VAC, 50/60 Hz, UL, CSA, VDE Approved
2PB	Contact Block, 22.5mm IEC, 3 Across, NC
3PB	Contact Block, 22.5mm IEC, 3 Across, NO
2,3PB,1LT	Dual Push Button w/ 125 VAC Pilot Light, Red "O" Button, Green "I" Button, 1NO Contact on "I" Button, 1NC Contact on "O" Button
1FLT	Line Filter, 120/250 VAC, 20A, 50/60 Hz
1XFMR	Transformer, 130 VA - 115/230 V Input, 115/230 V Output, 50/60 Hz, VDE Approved
CRM	Relay, 4PDT, 10A, 220VAC Contacts, 120 VAC 50/60Hz Coil, VDE Approved
CRM	Relay Socket, 4PDT, 10A, 220VAC, Surface or DIN Rail Mount
CRF,2CR	Relay, DPDT, 10A, 220VAC Contacts, 120 VAC 50/60Hz Coil, VDE Approved
CRF,2CR	Relay Socket, DPDT, 10A, 220VAC, Surface or DIN Rail Mount
1CR	Relay, DPST, 25A, 220VAC Contacts, 110 VAC 50/60Hz Coil, VDE Approved
1TMR	Timer, Delay on Break, 20 Minute Delay Time, 1 A, 120 VAC 50/60 Hz
1TEMPCON	Dynapar Temperature Controller, 1/16 DIN, Type K Input, 4 VDC Output, 0.5 Sec. Cycle Time
1POT	Digital Potentiometer, 3 Digit, 5K, 2 Watt, 0.1%
1R	Resistor, Metal Oxide Film, 2 Watt, 5%,47K
1SSR	Solid State Relay, 24-330VAC, 40A Output, 4-20VDC Input, w/ Safety Cover
1TS	Terminal Strip, 12 Position, Type G 5/12
1TS	Terminal Strip, 6 Position, Type G 5/6
3CR	Electrical Subassembly, R10 Relay Socket, 2 Pole
3CR	Relay, Super Sensitive, SPDT, 2A, 155VAC Contacts, 5 VDC Coil
CRM,CRF,2,3CR	Relay Mounting Track, DIN Style, 3 Ft. Extruded Aluminum Section
2XFMR	Current Transformer, 600 Turns, 600 VAC Working Class, 50/60 Hz
1,2FU	Fuse Holder, IEC 5x20mm Fuses, 10A, 250VAC, 16A, 120VAC, VDE Approved
1FU	Fuse, IEC 5x20mm, Low Breaking, Time Delay, 250V, 1.6A
2FU	Fuse, IEC 5x20mm, Low Breaking, Time Delay, 250V, 1A
5LT	Ind. Light, 125 VAC Neon, Amber, 0.5" Round Snap-in Panel Mount, 0.250 Tabs
6LT, 7LT	Ind. Light, 125 VAC Neon, Red, 0.5" Round Snap-in Panel Mount, 0.250 Tabs
1TVS	Transient Voltage Surge Suppressor (MOV), 130VAC, 20mm Disk
2TVS	Transient Voltage Surge Suppressor (MOV), 275VAC, 20mm Disk

## 1.7 Specifications

Input power		208-240VAC 15A 3500 Watts, 50/60Hz single phase
Heating	- Stamped foil IR elements	20.3cm (8.00") wide x 38.7cm (15.25") long - 1500 Watts, 240V
Vertical Oven	Upper Position	10cm ((3.9"))
Clearance	Lower Position	5.6cm (2.2")
Effective Heat Zone - Horizontal		35.5cm (14")
Fuses	1FU	5x20 mm IEC, 1.6A Time Delay Low Breaking
	2FU	5x20 mm IEC, 1A Time Delay Low Breaking
Temperature Control		Dynapar Temp. Control w/ Type K T/C interface
Operating Temperature		Ambient to 700°C maximum
Sound Level		Less than 70dB(A)
Conveyor Speed		15.2 to 152.4 cm/min (0.5 to 5.0 ft/min) (100 to 999 pot setting)
<b>Potentiometer Setting</b>	<b>Speed (cm/min)</b>	<b>Speed (ft/min)</b>
100	15.2	0.5
200	30.5	1.0
300	45.7	1.5
400	61.0	2.0
500	76.2	2.5
600	91.4	3.0
700	106.7	3.5
800	121.9	4.0
900	137.2	4.5
999	152.4	5.0
Conveyor Dimensions		76cm (30") W x 99cm (39") L x 42cm (16 ½") H
Conveyor Weight		91 Kg (200 lb)
Electrical Enclosure Dimensions		22cm (8 ½") W x 46cm (19") L x 17cm (6 ½") H
Electrical Enclosure Weight		8 Kg (17 lb)
Shipping Case		114cm (45") x 135cm (53") x 64cm (25") high



## 2 PREVENTING EQUIPMENT DAMAGE

1. To prevent over heating of conveyor belt, do not set the speed potentiometer to less than 100.
2. For normal shutdown, press the OFF ("O") button. When the machine cool down cycle completes (20 minutes), the conveyor and fans stop running, and the cool down lights turn OFF the circuit breaker and unplug the machine. Do not attempt to bypass the circuit breaker.
3. For normal maintenance and repair, after the first cool down cycle, restart the machine by pressing the ON ("I") and immediately press the OFF ("O") button again. When the second cool down cycle completes, turn off the circuit breaker and unplug the machine. Do not attempt to bypass the circuit breaker.
4. Do not set the temperature above 600°C. Operating the Tunnel Oven above 600°C will shorten the life of the Heater Elements.
5. Do not cover the fan vents. Covering the vents by setting objects on or next to them may cause uneven heating, or over heating of components.
6. An exposed thermocouple wire due to abrasion of the insulation will cause an over temperature condition which can destroy components of the Tunnel Oven and cause inconsistent processing of assemblies. When replacing the covers, ensure that no wires get pinched between the cover and the frame.
7. Excessive conveyor belt tension can cause premature belt wear. Tension the belts as called out in section 5.3.1 of this manual.
8. Emergency Stop: In the case of a product catching fire, excessive smoke, sparks, grinding noises, or any other signs of malfunction, press the Emergency Stop button. Then (with gloved hands) raise the Tunnel Oven Top Assembly with one hand, and manually remove any assemblies which may be in the heating chamber to prevent fire damage. Contact Maintenance Personnel to investigate the cause of the problem before restarting the machine.

**Note:** Such malfunctions are the only reasons to press the E-Stop while the belts and fans are still running. DO NOT use this as the normal shut down procedure as it will defeat the cool down circuit.

9. Use only as advised: This machine was designed for use with TE approved products only.

## 3 SETUP

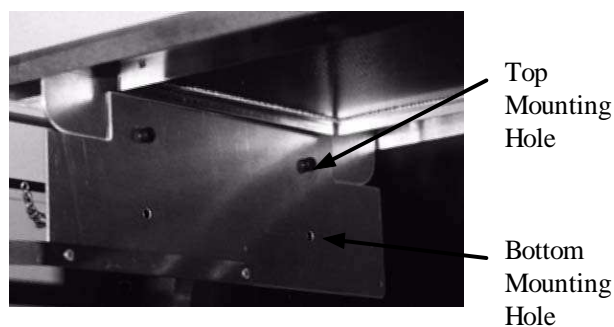
### 3.1 Unpacking, Transport, Handling and Storage

1. The Model 105 has a mass of 99 Kg. When unpacking, transporting, handling or moving the unit to storage, it is recommended that no less than two persons or a lift truck be used for the process. When storing the unit it should be placed in a suitable crate 114cm x 135cm x 64cm tall, and stored indoors away from any harmful effects of weather or other hazards.
2. Remove the processor from its shipping container and check for damage. Inspect the shipping container and processor for any evidence of damage during shipment. If you believe there has been damage, contact the shipping agent immediately.
3. Set the processor on a flat, level surface. Choose a work area with enough room around the processor for loading and unloading wire harnesses. Also allow room for routine maintenance and repair.
4. Provide adequate ventilation. Allow enough clearance above and around the processor so that the fans can circulate cooling air without obstruction. Do not place anything on the upper chamber or cover the fan louvers.
5. Remove packing material from between the heaters. Packing material has been placed between the heating elements to prevent vibration damage during shipment. Discard this material.

### 3.2 Top Assembly Adjustment

The M105 tunnel oven has two upper housing height positions. The unit is shipped with the top engaged in the upper (4 inch nominal oven clearance) position. A second lower position (2.25 inch nominal oven clearance) is designed into the unit. If your parts are 2 inches or less in height, it is recommended that the Oven Top Assembly be placed in the lower position. To make this change, follow the steps detailed below.

**Note:** If you plan to use the M105 Tunnel Oven in the 4" nominal position, the below steps may be skipped. Always perform this operation with the control box power cord unplugged from the facility's power outlet, and the umbilical cord unplugged from the machine.



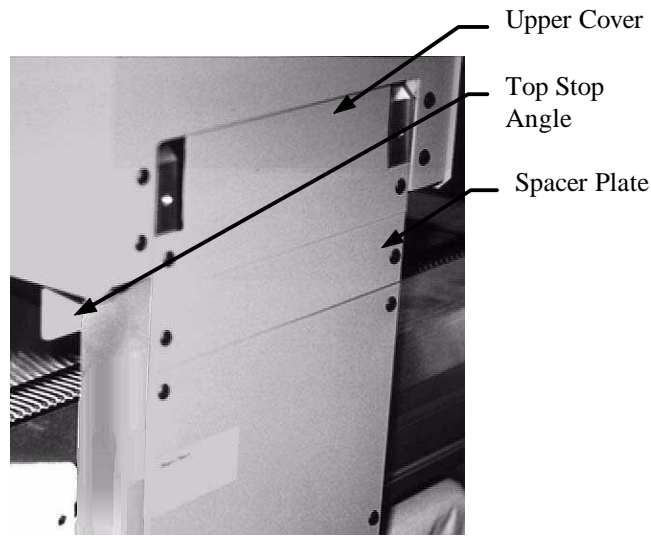
Left Heat Shield

1. **Remove Oven Top Cover.** Remove the Top Cover by turning the four (4) quarter turn fasteners counter-clockwise and lifting the cover vertically from the machine.
2. **Install the Shipping Support.**

**Note:** If you are just unpacking the unit, the Shipping Support is already installed.

Remove the two (2) M8 button head screws with flat washers from the right side belt guard. Install the Shipping Support using the two (2) M8 button head screws with flat washers and placing them through the bottom two (2) holes of the support.

3. **Remove the Left and Right Side Heat Shields.** These are removed by loosening two (2) M5 socket head cap screws.

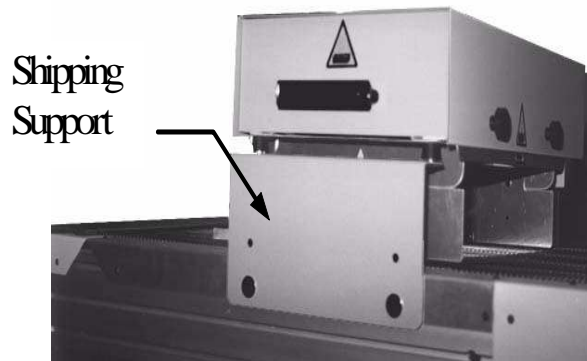


Left Side of Tunnel Oven

4. **Remove the Upper Cover from between the Pivot Shaft Stands on the left side of the unit.** This is upper most cover that is fastened to the stationary Pivot Shaft Stands (not fastened to the moveable top of the unit) and resembles an upside down "T". The Upper Cover is removed by loosening two (2) M5 button head screws.
5. **Remove the Spacer Plate between the Pivot Shaft Stands.** This is the 1.75" high plate located beneath the right side top cover you just removed. The Spacer Plate is removed by loosening two (2) M5 button head screws. Place the Spacer Plate in a safe location as it will be required when the upper Oven Top Assembly setting used.
6. **Remove the Top Stop Angle.** The Top Stop angle is located on the inside of the Pivot Shaft Stands and contains the Top Lock Pin, tether chain and mounting clip. Its purpose is to hold the Oven Top Assembly in a horizontal position when the Shipping Support is removed. The Top Stop angle is removed by loosening four (4) M5 socket head screws.
7. **Reinstall the Top Stop Angle.** Move the Top Stop angle down to the lower set of mounting holes a reinstall it using the screw you just removed.
8. **Remove the Pivot Shaft.** Loosen and remove the two (2) M6 socket head set screws using a 3 mm hex wrench. Supporting the Oven Top Assembly, slide the pivot shaft out of the Pivot Stands and bushing blocks.
9. **Reinstall the Pivot Shaft.** Move the Oven Top Assembly down to the lower Pivot Shaft holes and slide the pivot shaft back into the bushing blocks and of the Pivot Stands. Make sure the Pivot Shaft is centered and the flats are aligned with the set screw holes. Replace and tighten the two (2) M6 socket head set screws.
10. **Ensure electrical wiring is neatly routed.** The wiring that powers the Oven Top Assembly must be positioned so that the Top Cover and fasteners will not pinch or damage the wire bundle in either the fully opened or fully closed position.
11. **Replace covers and shields.** This includes the Left and Right Side Heat Shields, Left Side Upper Cover, and the Oven Top Cover. The Left and Right Side Heat Shields must be attached using the bottom two (2) holes when Oven Top Assembly is in the lower position.

### 3.3 Removing Shipping Support.

Removing Shipping Support. Before using the M105 Tunnel Oven, the Shipping Support may be removed. Loosen and remove two (2) M8 button head screws with flat washers to remove Shipping Support. Replace the two (2) screws / flat washers to keep right side belt guard secure to the side rails of the conveyor. It is recommended that the Shipping Support and shipping container be stored in a safe place for possible later use should the unit need to be shipped to another location. The shipping support is also used for changing the Oven Top Assembly adjustment. **Shipping Support must be reinstalled before shipping the unit or serious damage may occur.**



Tunnel Oven with Shipping Support Installed

### 3.4 Inspection (Power Off)

At the completion of the unpacking sequence, follow these steps to inspect the Tunnel Oven before making any electrical connections. If you believe there is damage that may have been caused during shipping, contact the shipping agent immediately.

1. **Inspect the Heater Elements for damage.** Visually check the Heater Elements for evidence of cracking or chipping of the glass face during shipment. The heater screws should be snugly fastened to heater trays.
2. **Ensure that the covers are in place and secure.** There are four (4) quarter-turn fasteners that secure the top cover. All other covers and guards are secured with M4 or M5 screws.

### 3.5 Electrical Connections



**Electrical Connections Should Be Carried Out By a Qualified Electrician**

1. **Attach an appropriately rated power plug to the end of the power cord.** A 250V, 15A or greater plug is recommended. This plug serves as the disconnecting means for the machine during service operations. The power cord insulation colors are defined below.

Brown	=	L1
Blue	=	L2
Green/Yellow	=	PE Ground (Protective Earth)
2. **Connect the umbilical cord plug (PL1) from electrical enclosure to mating receptacle on conveyor (PL1).**

3. **If an auxiliary E-stop was ordered/provided with the M105. Remove the PL2 jumper plug from the rear of the fix mounted E-stop and connect PL2 from the flying lead of the Auxiliary E-stop to the mating receptacle (PL2).**
4. **Connect installed Mains plug to an appropriate 230VAC supply receptacle. A 15A or larger service is required.**

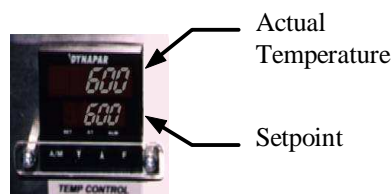
**Note:** This unit is designed for industrial use only. As such, it is to be connected to an industrial power system. This unit is not intended to be connected to a public power system.

### 3.6 Inspection (Power On)

When the Power Off inspection, and the electrical connections sequence have been completed, follow these steps to complete the inspection and set up of the Tunnel Oven.

1. **Switch the Circuit Breaker On.**
2. **Ensure the Emergency Stop is not depressed.** A ¼ counter-clock wise turn will release the E-Stop.
3. **Press the ON ("I") button.** With the temperature set above ambient and the conveyor speed control set above 100, the heaters, conveyor, and fans will begin to function.
4. **Set the temperature controller to 600°C, and the speed control potentiometer to 999 (maximum).**
5. **Change the digital-speed control from maximum (999) to minimum (100)** to verify that the belt speed increases and decreases smoothly, with no jerky motion or excessive noises.
6. **Wait approximately 5 minutes for the temperature to reach its setpoint.** When this occurs, the Processor Ready Indicator will go on.
7. **The lower display on the temperature controller face indicates the temperature set point, the upper display indicates the actual Heater Element temperature.** Both displays should read within 2°C of the same temperature during normal operation.
8. **Press the OFF ("O") button.** The conveyor and fans will continue to run for 20 minutes. At that point the Heater Elements will have cooled to a safe temperature and the conveyor and fans will turn off and all displays will power off.


**Note:** Using the Emergency Stop or circuit breaker as the normal shut down procedure defeats the automatic cool down circuit and will cause heat damage to the Tunnel Oven.



Temperature Controller

## 4 Operation

After the Tunnel Oven has been set up and inspected as described on the preceding pages, read the following warnings carefully and proceed with the steps in sections 4.1 to 4.3 for normal operation.

WARNING!	
	<ul style="list-style-type: none"> <li>■ Only trained qualified personnel are to operate this machine. To minimize the risks of burns, electrical shock, or other injuries, all safety precautions must be observed.</li> <li>■ Because this piece of equipment is first and foremost an oven, it contains hot components and surfaces which can cause burns. The conveyor belt and workpieces exiting the oven will be hot. Protective clothing and equipment such as cotton gloves, long sleeved cotton workshirt and protective eye wear are required for safe operation.</li> <li>■ Opening the electrical panel while the machine is powered may cause electrical shock. Always press the OFF ("O") button (if machine is hot, allow it to cool down), turn OFF the circuit breaker, and unplug the Tunnel Oven prior to any electrical maintenance or repair.</li> <li>■ If hands, hair, clothing, or any other foreign objects are caught by the Tunnel Oven's moving parts, you could be injured and the equipment could be damaged. Operate the Tunnel Oven with all guards and covers in place.</li> <li>■ If you open the top of the Tunnel Oven and do not use the Top Lock Pin, the top may fall and cause injury to the operator and damage the Tunnel Oven. Always use the top lock pin, and ensure it is fully seated its hole on the Pivot Block when opening the top. (Top cover must first be removed to use the Top Lock Pin. See "Top Lock Pin" in section 1.4)</li> <li>■ Emergency Stop - In the case of a product catching fire, excessive smoke, sparks, grinding noises, or any other signs of malfunction, press the Emergency Stop button. Then (with gloved hands) raise the Tunnel Oven Top Assembly with one hand, and manually remove any assemblies which may be in the heating chamber to prevent fire damage. Contact Maintenance Personnel to investigate the cause of the problem before restarting the machine. <b>Note:</b> Such malfunctions are the only reasons to press the E-Stop while the Tunnel Oven is still running.</li> <li>■ Do not use the circuit breaker or Emergency Stop as your normal shut down procedure as it will defeat the cool down circuit and will cause heat damage to the Tunnel Oven.</li> <li>■ To keep the Tunnel Oven in optimum working condition, please follow all of the maintenance procedures described in Section 5.1 and 5.2.</li> <li>■ This machine is designed for use on industrial power systems. Do not connect it to a public power system.</li> <li>■ This machine was designed for use with TE approved products only. Always use TE recommended process settings.</li> </ul>

## 4.1 Power On and Warm-up

1. **Verify that the machine is plugged in to the proper power source, that the circuit breaker is ON, and the E-Stop is not depressed and the speed control is set to 100 or greater.**
2. **Press the ON ("I") Button**
3. **Set the temperature controller to the correct set point temperature for your application.** Remember, Temperature above 600°C will greatly reduce Heater Element life.
4. **Set the belt speed to the proper setting for your application.** Always set the belt speed at or above 100. A setting of less than 100 will cause belt over heating. Refer to the chart in the Specifications section 1.6 to translate dial setting to actual belt speed.
5. **Take note of indicator lights while machine is warming up.** The control power light located between the ON ("I") and OFF ("O") buttons on the control enclosure will be illuminated. The Temperature Controller will display Heater Element temperature and setpoint temperature. No other indicators will be illuminated.
6. **Allow the Tunnel Oven to warm up for about 10 minutes.** It takes about 5 minutes for Heater Elements to reach the set point, allow an additional 5 minutes of soak time and processing can begin.

## 4.2 Loading and Unloading

At the completion of the Power On and Warm-up sequence, follow these steps to process workpieces.

1. **Prepare the workpiece.**
2. **Place workpiece onto conveyor belt making sure the portion to be heated is aligned with the heat zone.**
3. **Allow workpiece to travel through the oven.**
4. **Remove the workpiece from the conveyor belt after it has cleared the cooling fans in the rear of the conveyor, or simply allow the workpiece to fall into a collection tray positioned at the end of the conveyor.**

## 4.3 Power OFF and Cool-Down


1. **At the end of the work shift, press the OFF ("O") button.** The conveyor and the fans will continue to run for 20 minutes, until a safe temperature has been reached, at which time they will shut off automatically.
2. **Take note of indicator lights while machine is cooling down.** The control power light located between the ON ("I") and OFF ("O") buttons on the control enclosure will be illuminated. The Temperature Controller will display Heater Element temperature and setpoint temperature. The Cool Down indicator light located on the Emergency Stop Enclosure will also be illuminated.



**Note:** DO NOT use the Circuit Breaker or E-stop for the normal shutdown procedure. This defeats the automatic cool down cycle and will cause heat damage the Tunnel Oven.

## 5 MAINTENANCE

The Model 105 Tunnel Oven is a very low maintenance machine, however, given a few minutes each week will ensure reliability and the long life of the Tunnel Oven. The following are guidelines for daily, weekly, and monthly maintenance procedures that will keep the Model 105 Tunnel Oven in optimum working condition. Don't wait until the Tunnel Oven has problems to give it some attention.

WARNING!	
	<ul style="list-style-type: none"> <li>■ These procedures should be performed only by trained qualified personnel. To minimize the risks of burns, electrical shock, or other injuries, all safety precautions must be observed.</li> <li>■ Always perform maintenance operations on a cool machine. If the machine is already hot, place the machine in cool down mode by pressing the OFF ("O") button. The conveyor and the fans will continue to run for 20 minutes. At this point, the Heater Elements will likely remain too hot to allow work on the machine. To avoid any burns or injury, initiate a second cool down cycle by pressing the ON ("I") button, and the immediately pressing the OFF ("O") button, wait for the cool down to complete. The machine should now be cool enough to begin maintenance. (See item 3 in section 2.0 "Preventing Equipment Damage")</li> </ul>

**Note:** Do not use solvents for cleaning. Solvents are unnecessary and may damage some components of the Tunnel Oven.

### 5.1 Daily Maintenance

Before the daily production begins, while the Tunnel Oven is cool, take a few minutes to perform the following steps.

1. **Inspect and clean any dirt from the surfaces of the Tunnel Oven.** Use a damp cloth to clean any stainless steel or painted surfaces. Black oxide steel surfaces should be cleaned with a dry cloth. A household spray cleaner such as Formula 409 or Windex may be used on stainless steel or painted surfaces to remove dirt that a damp cloth will not remove. Likewise dirt on black oxide steel surfaces that cannot be removed with a dry cloth can be removed using a cloth dampened with WD-40 or a lightweight oil.
2. **Inspect and the Heater Elements.** Look for any accumulation of debris or film on the Heater Elements. If necessary, clean the black glass surface of the Heater Elements using a damp cloth. Windex may also be used for this purpose.
3. **Verify that the temperature controller is not set above 600°C.** Operating the Model 105 Tunnel Oven at a set point above 600°C will shorten the life of the Heater Elements.
4. **General condition check.** As the Tunnel Oven warms up for normal operation, check the general condition of the Tunnel Oven. Ensure that all the fans are working properly, and listen for any abnormal noises. The conveyor should be run smoothly without a jerky motion. Check to see that all guards and covers are securely in place. Make any repairs or adjustments necessary to return the unit to proper working order.



## 5.2 Semi-Annual Maintenance

Take time every six months before daily production begins to perform the following procedures.

### 5.2.1 Clean the inside of the Tunnel Oven.

With the Tunnel Oven still cool at the beginning of the day, turn off the circuit breaker and unplug the unit. Remove all guards and covers. This includes the Rear Belt Guards, Front Belt Guards, Side Belt Guards, Top Cover. Using an air hose or cloth, clean any dirt, dust, tubing, or anything which has been trapped inside the Tunnel Oven.

### 5.2.2 Change temperature setpoint to 0°C.

With the Tunnel Oven still cool, plug the Tunnel Oven into its power source and turn on the circuit breaker on. Press the ON ("I") button, then immediately press the OFF ("O") button to put the Tunnel Oven in cool down mode. Change temperature setpoint to 0°C. This will prevent the Tunnel Oven from heating up in the subsequent steps of the procedure.

### 5.2.3 General condition check.

As the conveyor runs, check the general condition of the unit and listen for abnormal noises. Ensure that all the fans are working properly. Make any repairs or adjustments necessary to return the unit to proper working order.

### 5.2.4 Check the Conveyor Belt for tension.

Belt tension can be determined by observing the length of belt in contact with the lower glide rails. If there is no contact on this glide rails, the belt is overly taught. If there is more than eighteen (18) inches of contact, the belt is too loose.

### 5.2.5 Inspect the motor brushes.

Remove the brushes from the motor brush receptacles. If they are not at least ¼ inch long, replace them.

### 5.2.6 Lubricate Drive Chain.

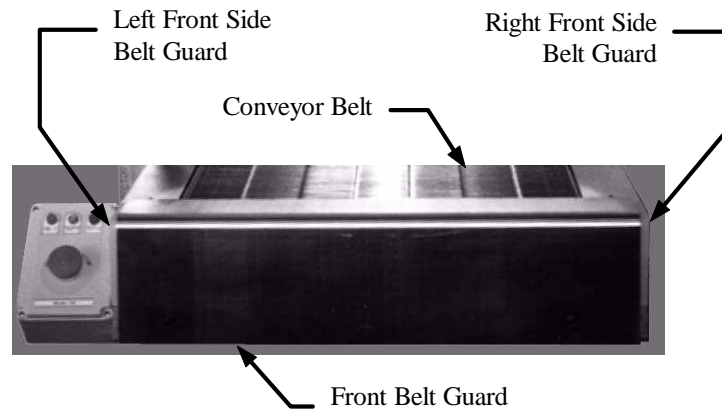
Use a commercially available roller chain lubricant on the steel drive chain.

## 5.3 Maintenance Procedures

Always perform maintenance procedures on a cool machine.

### 5.3.1 Belt Tension Adjustment

If the belt is too loose, a number of links will need to be removed to restore the tension to proper operating condition. Before starting, assess the number of links to be removed by squeezing a number of links together until the belt reaches the desired tension level (see 5.2.4). The distance you manually shrink the belt by this process should help you determine the number of links to remove. Every 0.3 inches the belt is squeezed represents 1 link to be removed.



#### Belt Tensioning Steps:

1. Run the conveyor in Cool down Mode by pressing the ON ("I") button, and the immediately pressing the OFF ("O") button. Watch the belt and find the previous splice link. Stop the conveyor belt when the splice link is in a convenient working position in the front portion of the conveyor. In this case the conveyor is stopped by pressing the E-Stop button. (Previous splices are normally identified by spice clips or slight deformation of the link in the belt. If you can not find the splice link, pick any link that is convenient).
2. Turn off circuit breaker and unplug the power cord from the facility's power outlet. Separate the umbilical cord from the unit for ease of working on the machine.
3. Remove four (4) screws from panel that houses the umbilical cord connector. This panel must be loose to allow for the subsequent removal of left center belt guard.
4. Remove front belt guard, and all side belt guards. This includes the front, center, and rear left side belt guards and the front, center, and rear right side belt guards.
5. Remove spacer clips on front roller bearings.
6. Note the position of the front roller for later repositioning. Use a 13mm open end wrench to turn the bearing hex bolts until they are loose enough to allow the roller to slide.
7. Loosen the four (4) screws that secure the front guide rail/fan tray assembly to the conveyor sides. Make sure the screws are sufficiently loose to allow the front guide rails to be lifted above the front roller.
8. Lift the front guide rail plate from the conveyor side extrusions, and slide front roller under the front guide rails. This will allow sufficient 'slack' room for resplicing the belt.
9. Use a diagonal cutters to cut the previous splice link into pieces which can easily be removed from the belt.
10. Remove the number of links required for adequate belt tension (as determined in the prelude to this procedure).
11. Resplice the belt using two (2) three position splice clips or one of the seven position links just removed. More information on the spicing procedure and animated instructions on installing splices can be found on the internet at URL <http://www.wirebelt.com>.
12. Slide the front roller forward until it clears the guide rails, then reposition the front and rear guide rail plates back into their original position making sure the 'T' nuts slide back into their slots on the conveyor side extrusions.
13. Reposition the front roller to its initial position and tighten into place. (Generally, this position is so that its foremost surface of the roller is flush with the foremost vertical surface of the conveyor side extrusions.)
14. Retighten front and rear guide rail plates.
15. Replace remaining components in reverse sequence to which they were removed.