`XPM2 and XPM3

Reflow Soldering Systems

Technical Reference Manual
Conveyor Systems

TABLE of CONTENTS

PURPOSE OF THIS MANUAL & WHO SHOULD USE IT

This manual is intended to meet the needs of service personnel responsible for the regular service of Vitronics-Soltec Reflow Ovens. Vitronics-Soltec does not consider this manual a specification for Vitronics-Soltec products or any components contained in those products and reserves the right to change information contained in this manual without notification.
This manual is intended to be a reference. Some of the topics explain manufacturing and assembly methods and practices; however, many topics deal with specific service information and methods. Hopefully, insight will be provided about the various sub-systems of the electrical control system to allow quick identification of problems and possible solutions.

IMPROPER SAFETY PRECAUTIONS OR UNSAFE WORK METHODS MAY RESULT IN SERIOUS INJURY!

ATTENTION

This Manual is NOT INTENDED as a substitute for proper technical training or educational background in the various technologies used in reflow ovens.
This manual is for service of Vitronics-Soltec ovens by **Trained Qualified Personnel. An appropriate understanding and use of safety procedures when working on and around the oven is NECESSARY.**

Caution

The following conditions may be encountered when working on any reflow oven:

- ⇒ **High Temperature areas (up to 350° C)**
- ⇒ **High Voltage areas (up to 480 VAC)**
- ⇒ **High Current areas (up to 200 Amps)**
- ⇒ **Moving Mechanical Parts and Systems**
- ⇒ **Heavy Components**
- ⇒ **Sensitive Electronic Components**

Some people who might use this manual are:

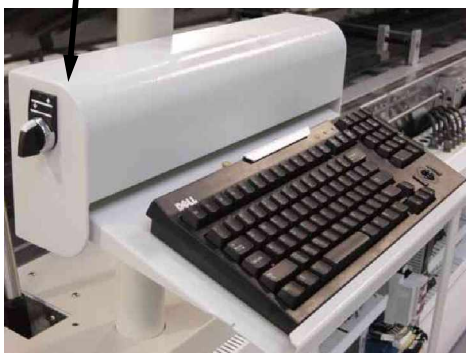
Vitronics-Soltec service technicians
Customer service technicians
Customer facilities maintenance personnel
Technical operators

CONTROL PANEL SYMBOLS

Use Caution

NOTICE
WHEN CONTROL POWER IS INTERUPTED, PARTS OF THE OVEN ARE ELECTRICALLY POWERED AND DANGEREROUS TO PERSONNEL!

SELECTOR SWITCH ADJUSTS RAIL IN or OUT



KEY SWITCH RAISES AND LOWERS THE OVEN HOOD

OPERATOR CONTROL STATION

GLOSSARY OF TERMS GLOSSARY OF TERMS & MEASUREMENT CONVERSIONS

999 º C	Indicates an open thermocouple or thermocouple connection.
Actuator	Used to raise and lower the top section of the oven.
AI	Analog Input board. One of the boards in the Oven internal control unit.
Antistatic	Device to inhibit the generation and instantaneous dissipation of static electricity.
Control Ladder	Oven electrical schematic which show the relationship of all electrical circuits the oven controller and to each other.
DC Drive	An electronic power amplifier used to control the speed of DC motors.
E-stop	Emergency stop.
EPO	Emergency Power Off
Encoder	The electronic mechanism that supplies feedback information to the oven controller on how fast the conveyor system is moving.
ESD	Electro Static Discharge.
FNPT	Female National Pipe Thread.
GPM	Gallons Per Minute.
Heat slinger	A set of fan blades mounted on the shaft of every cell motor. The function of a heat slinger is to push heated air away from the motor windings and thus prevent premature motor failure.
Heater panel	A large aluminum “sandwich” panel on the face of each heater cell in the oven.
Heat sink	A piece of metal generally used to dissipate heat from some device.
ICB	Inter Cell Baffle. These are pieces of metal used to help increase zone definition within the Oven process tunnel.
Interlocks	Optional Switches used to ensure that the access panels are closed on the Oven.
Inverter	Variable Frequency Drive used to control the speed of the convection fan motors in the Oven.
IR	Infrared, refers to a component of the heat which is generated in an oven.
LED	Light Emitting Diode.
DI	Digital Input Board. One of the boards in the Oven internal control unit.
MNPT	Male National Pipe Thread.
Offload	The end of the oven where product exits the tunnel.
Ohmmeter	A precision instrument used to check and display the value of electrical resistances in Ohms.
Onload	The end of the oven onto which product is placed.
Phase	One leg of three-phase power.
Plenum	A large (or elongated) cavity or chamber, usually in ductwork.
Preheat t	A thermal area inside a Vitronics-Soltec Reflow oven.
Recipe	A part of the Vitronics-Soltec software in which heater temperatures and conveyor speed are set.
Reflow	A thermal area inside a Vitronics-Soltec Reflow oven.
ROSCO	Redundant Over-temperature Sensing and Control Option.
RTV	Brand name for a silicone sealing agent used in the Reflow oven.
Set point	A number used to define a particular parameter in the oven. For example, the temperatures that are defined in a recipe are referred to as the heater set points for each heater.
Slot settings	Air passages (slots) on both sides of the heater panel that can be adjusted from fully open to fully closed. Slot settings refers to the actual opening size of these air passages.
SSR	Solid State Relay
T/C	ThermoCouple
OCP	Oven Control Program. The software which controls the operation of the Vitronics Soltec Reflow oven.
VCS	Vitronics Control System – Oven controller consisting of the card cage / backplate, a DI board, and one or more A.I boards
Zone	An area of a Vitronics-Soltec Reflow oven that is comprised of an upper and a lower cell within the process tunnel. Usually referred to as a “heat zone” or “cooling zone”.

MEASUREMENT CONVERSIONS

Temperature
Degrees Celsius (°C) = 5 / 9 x (°F - 32)
Degrees Fahrenheit (°F) = (9 / 5 x °C) + 32

Length
Centimeters (cm) = 2.54 x inches
Feet (') = 3.281 x meters
Inches (") = 0.03937 x millimeters
Inches (") = 0.3937 x centimeters
Meters (m) = 0.3048 x feet
Millimeters (mm) = 25.4 x inches

Area
$Centimeters^2 = 6.452 \times inches^2$
$Inches^2 = 0.155 \times centimeters^2$
$Feet^2 = 10.76 \times meters^2$
$Meters^2 = 0.0929 \times feet^2$

Volume
$Centimeters^3 = 1000000 \times meters^3$
$Centimeters^3 = 16.387 \times inches^3$
$feet^3 = 0.161 \times$ Imperial gallons
$feet^3 = 35.31 \times meters^3$
$feet^3 = 0.134 \times$ US gallons
$inches^3 = 0.061 \times centimeters^3$
$inches^3 = 0.061 \times$ milliliters (ml)
$inches^3 = 1728 \times feet^3$
Imperial gallons = 0.833 x US gallons
Imperial gallons (gal) = 0.22 x liters (l)
$Liters (l) = 1000 \times meters^3$
Liters (l) = 3.7854 x US gallons (gal)
Liters (l) = 4.55 x Imperial gallons (gal)
Liters (l) = 0.001 x milliliters (ml)
$meters^3 = 0.00455 \times$ Imperial gallons
$meters^3 = 0.02832 \times feet^3$
$meters^3 = 0.00379 \times$ US gallons
US gallons (gal) = 0.264 x liters (l)
US gallons = 1.2012 x Imperial gallons

Pressure
Bar = 1.01325 x atmosphere (ATM)
$Kilograms / meter^2 (kg/m^2) = 10332.3 \times$ atmosphere (ATM)
$Kilograms / centimeter^2 = 0.0703 \times pounds / inch^2$ (psi)
KiloPascals (KPa) = 101325 x atmosphere (ATM)
$Kilograms / meter^2 (kg/m^2) = 703.07 \times pounds / inch^2$ (psi)
millimeters mercury (mm Hg) = 1 x Torr = 760 x atmosphere (ATM)
$Pounds / inch^2$ (psi) = 14.696 x atmosphere (ATM)
Pounds per square inch (psi) = 14.504 x Bar

Volumetric flow rates
Imperial gallons / minute = $0.1035 \times feet^3$ / hour
Imperial gallons / minute = $220.06 \times meters^3$ / Min
$liters^3$ / second = 0.06308 x US gallons / minute
$meters^3$ / minute = $0.00006 \times centimeters^3$ / second
$meters^3$ / hour = $0.02832 \times feet^3$ / hour
$meters^3$ / hour = 0.22713 x US gallons / minute
US gallons / minute = $264.18 \times meters^3$ / minute
US gallons / minute = $0.12468 \times feet^3$ / hour

CONVEYOR OVERVIEW

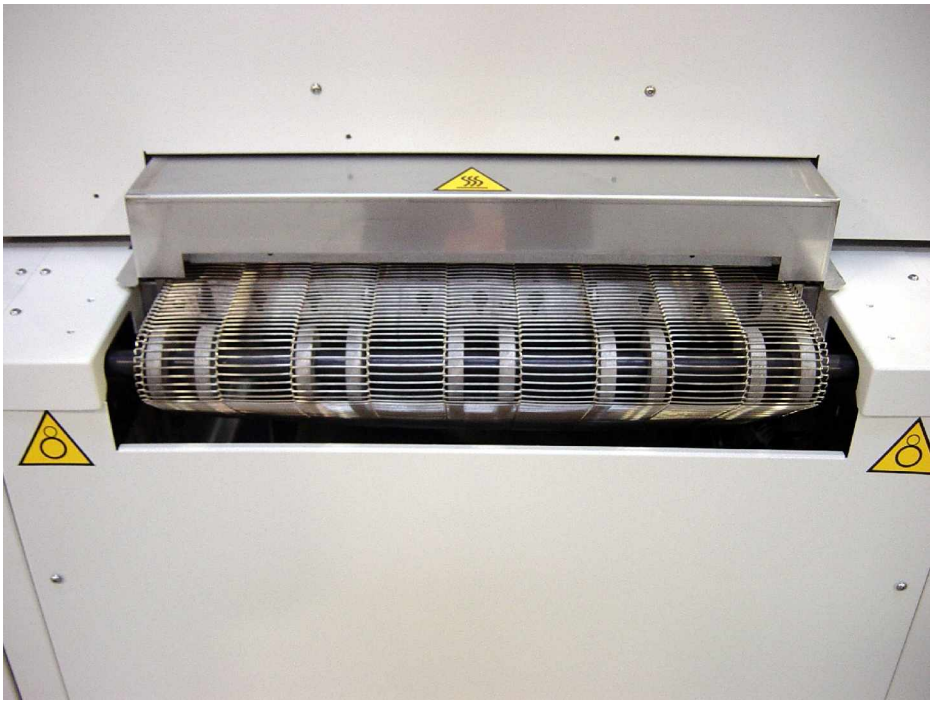
CONVEYOR TYPES

This Section describes the five types of conveyor transport systems available on the Vitronics-Soltec Reflow Ovens. They are:

1) "Belt-Only" Mesh Belt Conveyor System.
2) "Rail-Only" Edge Rail Conveyor System.
3) "Combo" Edge Rail and Belt Conveyor System
4) "XCS" Edge Rail System with Extruded Center Support
5) "MBS" Combination Edge Rail and Belt System with Metal Band Support

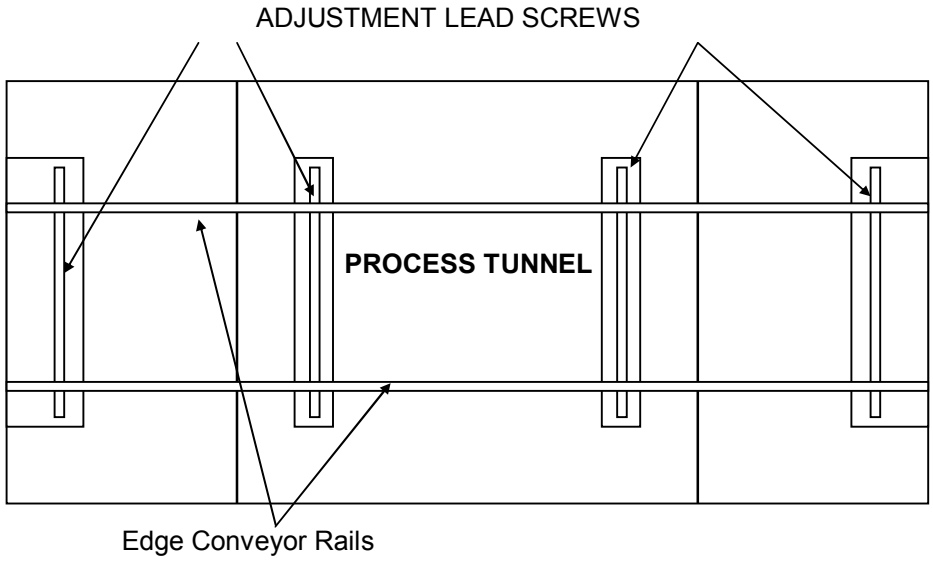
The Mesh Belt system is base standard conveyor on Vitronics-Soltec Reflow Ovens. The Rail-Only, Combo, XCS, or MBS Conveyor Systems are offered on new ovens by special order.

"BELT-ONLY" MESH BELT CONVEYOR SYSTEM
The mesh belt conveyor system is used to process single sided surface mount printed circuit boards.



"RAIL-ONLY" EDGE / RAIL CONVEYOR SYSTEM

The edge / rail conveyor system (shown below) permits single or double sided surface mount printed circuit boards to be processed through the oven. The standard chain conveyor carries circuit boards on 0.185 inch (4.75mm) long pins extending from the chains. This conveyor system provides a convenient interface to other equipment in the production line. Some Ovens have two sets of rails and chains (Dual Rail) for the processing of two PCBs at the same time.



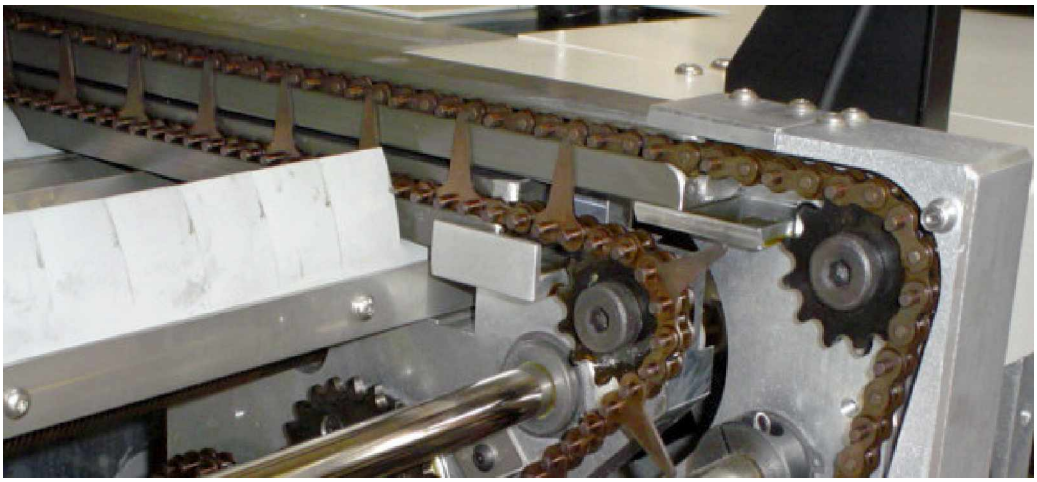
Edge / rail conveyor system.

"COMBO" COMBINATION CONVEYOR SYSTEM

The combination belt/rail conveyor has both the edge rail and a mesh belt. The mesh belt is approximately 7/8' (22mm) below the edge rail conveyor, and both conveyors are driven together. The belt conveyor is shorter than the outside edge of the machine with the sheet metal covers on, and shorter than the end of the rails with chain guards installed.

Approximately 3 inches between end of belt and end of rail conveyor (both ends).

"XCS" EDGE RAIL WITH EXTRUDED CENTER SUPPORT SYSTEM



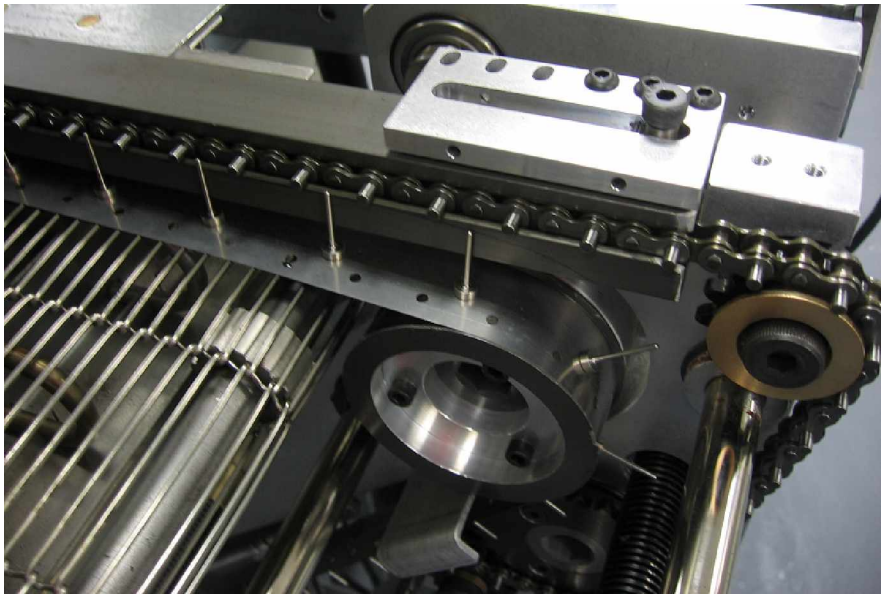
The eXtruded Center Support system consists of an additional rail extrusion and a special "XCS" chain with extended side plates that supports the middle of the PCB to prevent warping. The XCS plates extend to the same height as the top of the edge rail chain pins where the PCB sits. The XCS chain can be parked between the conveyor pins on the fixed rail chain, enabling the user to move the system out of the process lane when not required. After a period of time both the conveyor chains and the XCS chain will stretch, and it may not be possible to park the XCS between the fixed rail pins. When this happens, the fixed edge rail chain and the XCS chain must be replaced as a matched set.

This option is available with both manual and automatic positioning. When automatic positioning is specified both the edge rail and XCS rails are computer controlled.

XCS system general specifications:	
Chain - Fixed Edge Rail	ANSI #35 D3 (9.5mm / 0.375") pitch chain with .186" long extended pin
Chain - Moveable Edge Rail	ANSI #35 D1 (19 mm / 0.750") pitch chain with .186" long extended pin
Chain - XCS	Special ANSI #35 D3 (9.5mm / 0.375") pitch chain with extended side plates installed on 38.1mm / 1.50" pitch spacing.
Edge Rail parallel	0.5 mm / .020" maximum at feedscrews, 1.3 mm /.052" max total
XCS Chain Plate Height	22.2 mm /.875" (17mm / .67" directly over XCS rail)
XCS Chain Plate Width	1.25 mm /.050"
XCS rail to fixed rail parallel	0.5 mm /.020" maximum at feedscrews, 1.3 mm /.052" max total
XCS height to edge rail	+0 / -2.0 mm (+0 /-.08")
XCS chain plate tracking	± 1.3 mm / ± .050"
XCS plate height variation	0.15 mm / .006" maximum.
XCS park position	XCS plates park between* and completely within the fixed rail chain pins.
Auto Rail repeatability	0.1mm / .004" (edge rail and XCS axes)
Auto Rail set point accuracy	0.3mm / .012" max variation from command position (edge rail and XCS axes)

** After extended service the XCS and edge rail chains may wear at different rates and this can affect their pitch match. If excessive mismatch develops it may no longer be possible to park the XCS between the edge rail pins.*

"MBS" COMBINATION EDGE RAIL AND BELT SYSTEM WITH METAL BAND SUPPORT



The Metal Band Support system consists of a combination rail and belt conveyor with a thin stainless steel band having vertical pins riding on the mesh belt to support the middle of the PCB. They extend to approximately .025" below the surface of the edge rail chain pins where the PCB sits. The MBS pins can be parked between the conveyor pins on the fixed rail chain, enabling the user to move the system out of the process lane when not required. Although the MBS can be operated as a straight combo system by removing the MBS bands, due to packaging constraints most of the components in the MBS conveyor ends are unique and will not interchange with standard combo conveyor subassemblies.

This option is available with both manual and automatic positioning. When automatic positioning is specified both the edge rail and MBS rails are computer controlled.

The MBS bands are considered consumables. The MBS bands must bend and straighten as they enter and exit each of the four pulleys in the system and this flexing eventually causes cracks from metal fatigue. When this happens the MBS bands must be replaced. The MBS bands were revised in January 2008 to improve service life. The ¼" vent holes were removed and the thickness of the stainless steel was reduced from .006" to .005" to lower the internal stresses that cause the cracking. The new MBS bands must not be mixed with the old bands as premature failure of the new thinner bands will result.

MBS system general specifications:	
Chain – Both Edge Rails	Rail ANSI #35 D1 (19 mm / 0.750") pitch chain with .186" long extended pin
Edge Rail parallel	0.5 mm / .020" maximum at feedscrews, 1.3 mm /.052" max total
MBS Pin Height	21.6 mm /.850"
MBS Pin Diameter	Ø1.52 mm /Ø.060"
MBS Pin to fixed rail parallel	1.3 mm /.052" max total
MBS Pin height to edge rail	+0 / -2.0 mm (+0 /-.08")
MBS Pin tracking	± 1.3 mm / ± .050"
MBS Pin height variation	0.76 mm / .030" maximum.
MBS park position	MBS pins park between and completely within the fixed rail chain pins.
Auto Rail repeatability	0.1mm / .004" (edge rail and MBS axes)
Auto Rail set point accuracy	0.3mm / .012" max variation from command position (edge rail and MBS axes)

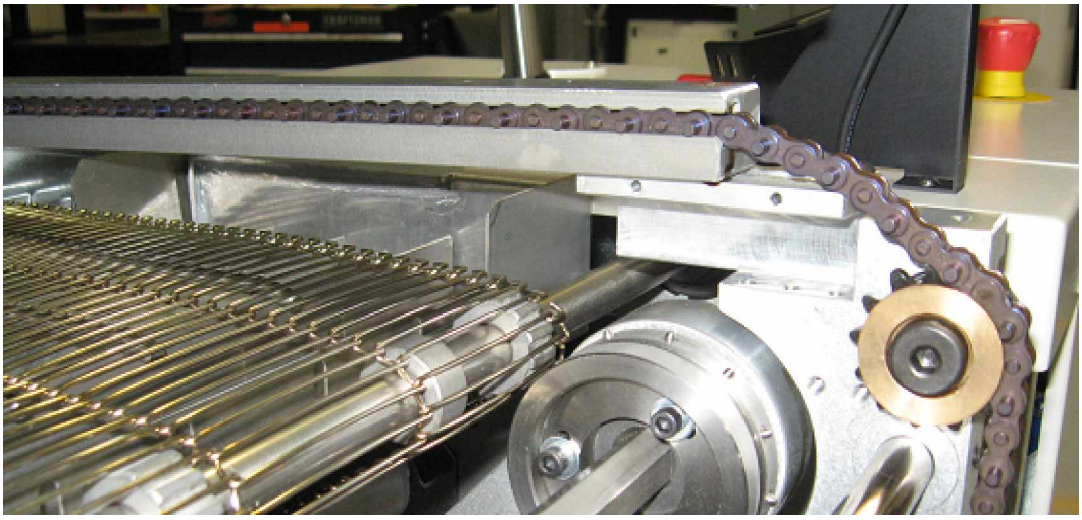
CONVEYOR BELT, CHAIN & RAIL SERVICE

REMOVE AND REPLACE CONVEYOR MESH BELT

1. The mesh belts installed on XPM2 and XPM3 are available in several widths and in two different pitches, “standard” ½” (12.7mm) and “fine” .286” (7.26mm). If splice clips are to be replaced verify that you have the correct clips for the specific mesh belt.

2. Locate the splice point in the mesh belt by finding the double size 'holes' created by the splice clips. There are four to six splice clips, depending on the width of the belt. For ease of access, turn the conveyor until the splice point is positioned just inside the oven over one of the deck pans.

3. On conveyor systems with edge rails remove the chain guards from the rail ends near the splice clips, remove the shoulder bolts that retain the rails in the capture brackets, and reposition the rails on top of the capture brackets. It is not necessary to break the edge rail chains. Raising the rails will greatly improve the working space above the mesh belt splice clips.



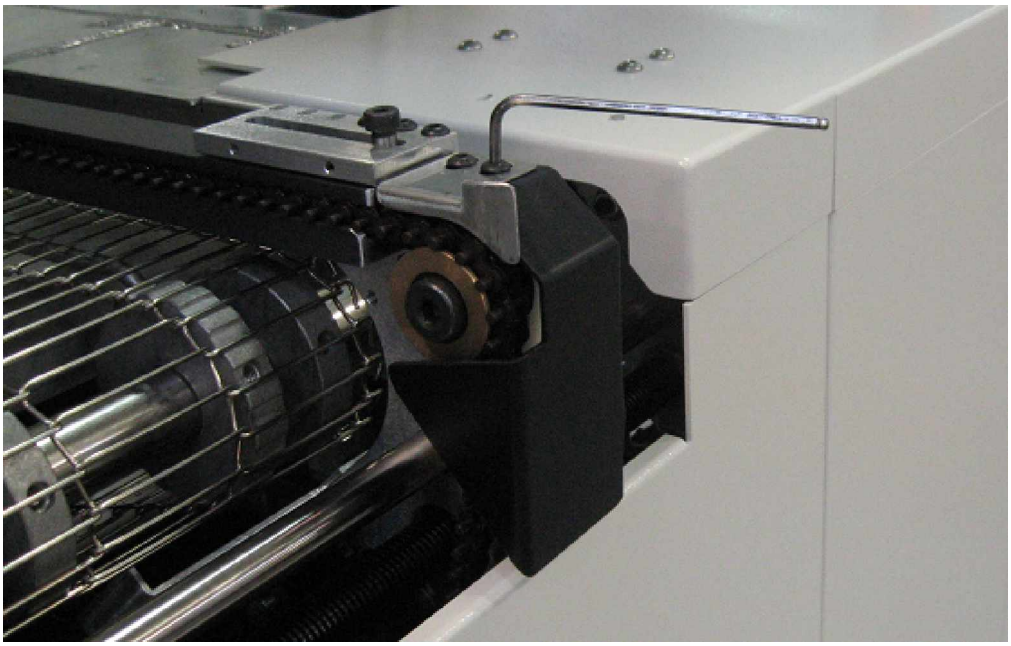
4. Start with the splice clip at one edge of the belt. Using a screwdriver or needle nose pliers unhook one side of the clip from the belt. Rotate the clip through the belt to unhook its other end and remove it from the belt.

5. Remove the remaining clips in the same manner to separate the mesh belt.
6. Installation is the reverse of removal. It may be helpful to temporarily bind the ends of the mesh belt together with tie-wraps while installing the splice clips.

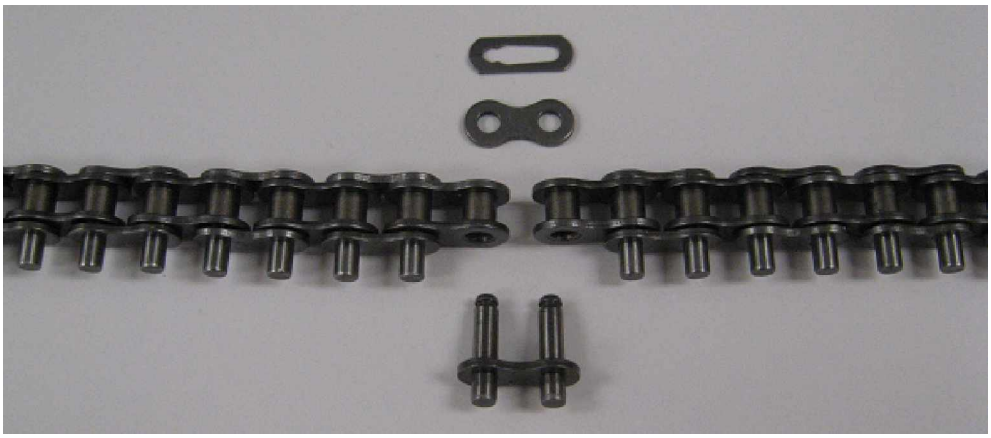
REMOVE AND REPLACE EDGE RAIL CONVEYOR CHAINS AND RAILS

REMOVE CHAINS

1. At the off-load end of the oven, remove the chain guard from each rail by removing the button head screws with a 1/8" hex key.



2. Run the conveyor until the master link for one of the chains comes up just under the rail. Remove the master link from the chain and unthread the chain from all of the sprockets that it wraps around on its way under the oven. Make sure that the chain is off the drive sprocket and tie-wrap it to the idler shaft just below the end of the oven.



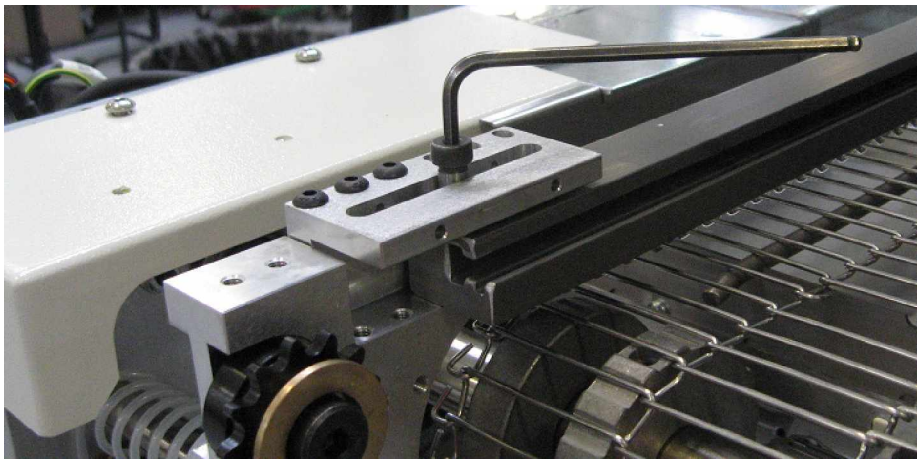
3. Go to the on-load end of the oven and remove the chain guards. Pull the chain out of the rail and let it drop down. Tie wrap the end of the chain to the idler shaft below the end of the oven.

4. Repeat steps 2. and 3. to remove the chain from the remaining edge rail(s).

REMOVE RAILS

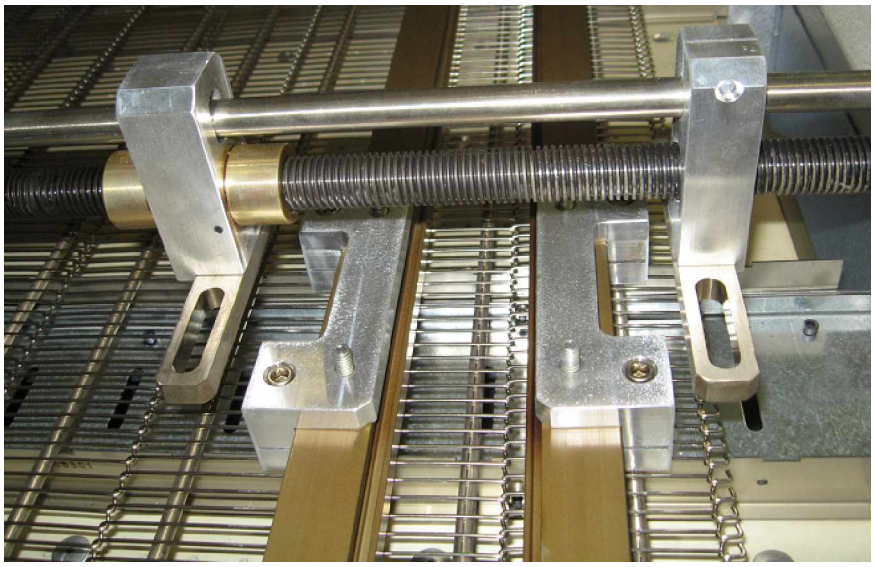
1. Remove both edge rail chains (see above).

2. Use a 5/32" hex key to remove the shoulder bolts that retain both ends of each rail in the rail capture brackets.

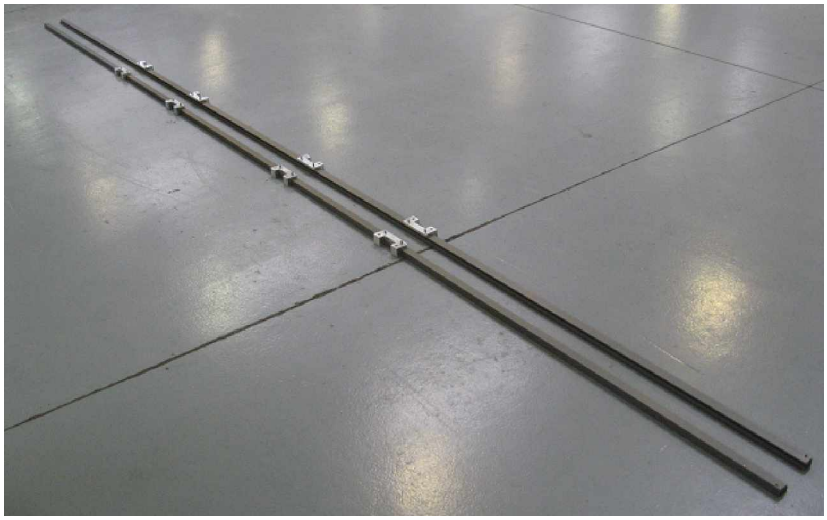


3. Use a 1/8” hex key to loosen the set screw in the top of the barrel nuts on all rail of the hangers.

4. With a 5/8” hex wrench remove all of the barrel nuts and thrust washers. The rail (with rail clamps still attached) will drop down to rest on the mesh belt.



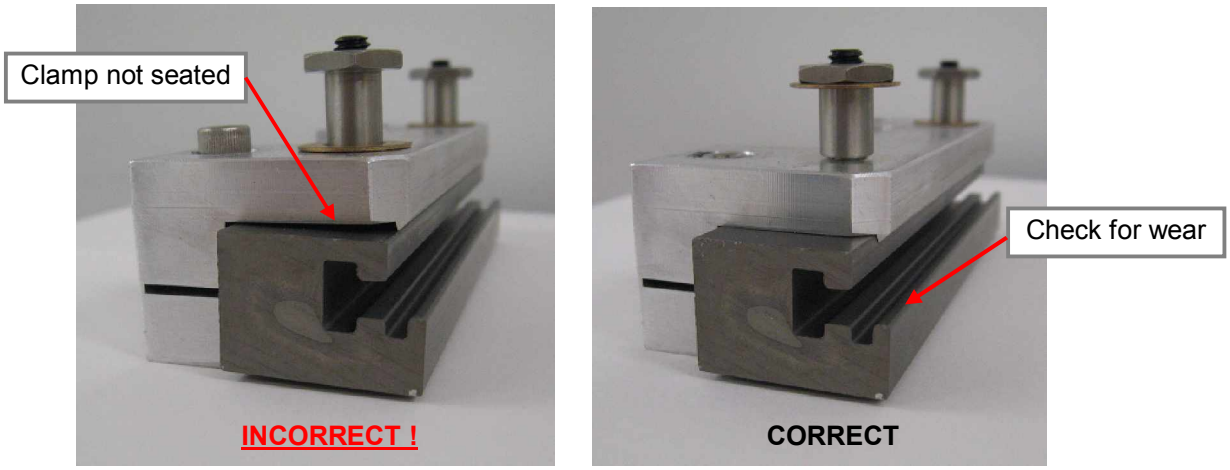
5. Slide the rail assemblies out from under the hanger bars and withdraw the rail from the oven tunnel. Exercise extreme care when handling the rails. DO NOT to let them bend or they may be permanently deformed.



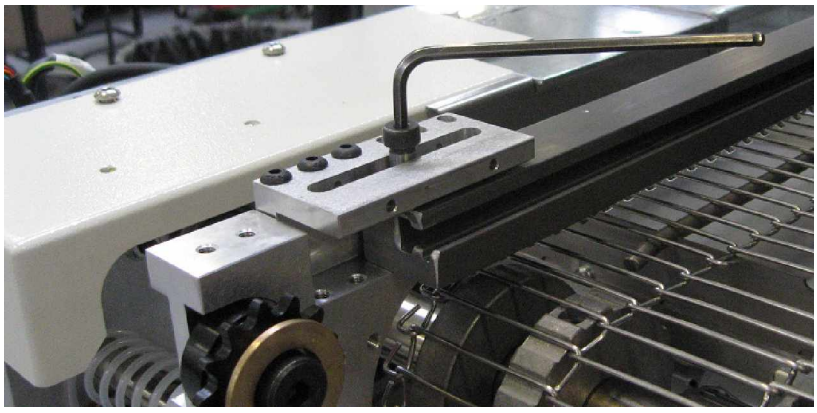
6. Using a 3/16" hex key loosen but DO NOT REMOVE the two ¼-20 socket head cap screws in each rail clamp and slide the clamps off the rail extrusions.

INSTALL RAILS

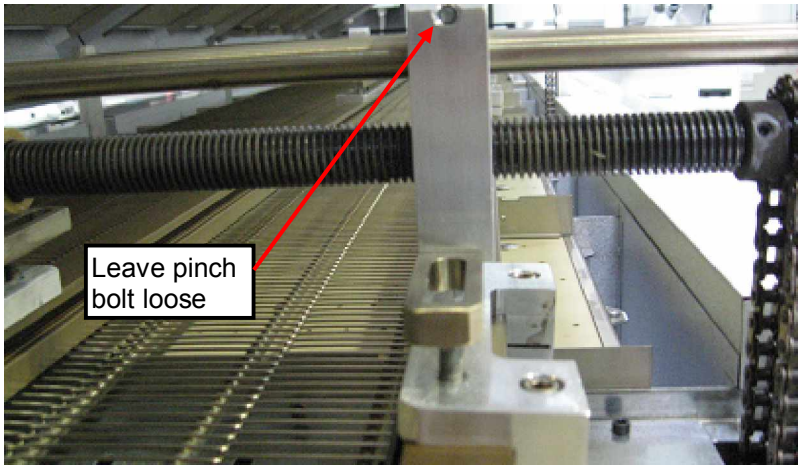
1. Visually inspect the rails for straightness and wear or damage to the chain guide surfaces.
2. Slide the appropriate number of rail clamps on each rail extrusion. Check that each clamp is properly seated on the rail. Do not tighten the rail clamps, their position will be adjusted later in the installation.



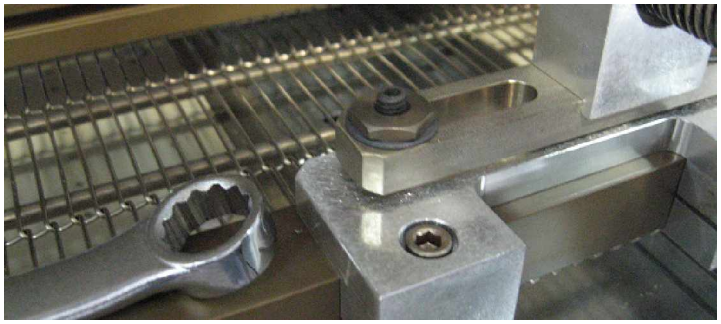
3. Place the rail and clamp assemblies in the tunnel. Slide the rails under the hanger bars and place the ends of the rails into the conveyor end plates. Position the rails all the way toward the onload end of the machine and install the shoulder bolts through the capture brackets to retain the rails in the end plates.



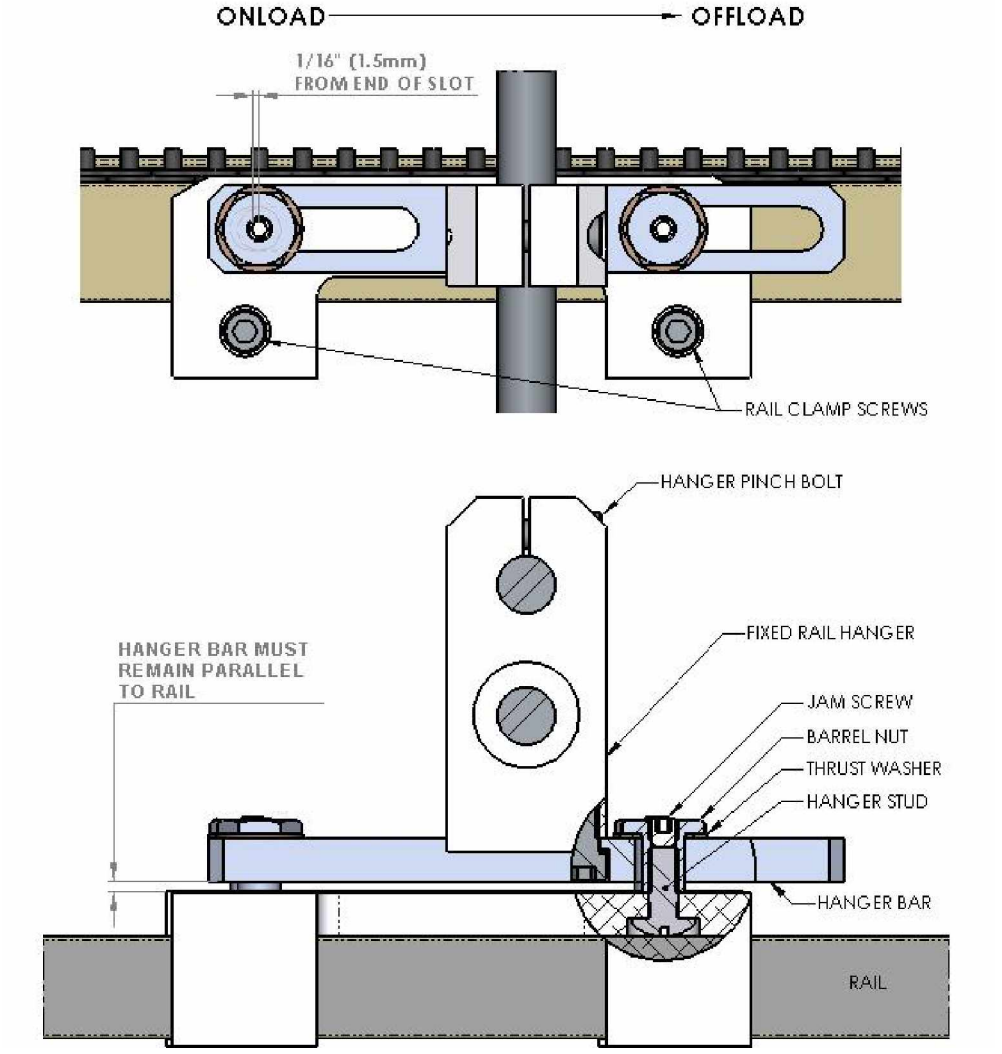
4. Check that all hanger bars are in line above the rail clamps. The pinch bolts in the fixed rail hangers should be left loose.



5. Lift the rails up into the hanger bars and secure with barrel nuts and thrust washers. Do not force the nuts into the hanger slots, they should turn all the way down by hand. Excessive force will gall the stainless steel nuts and bar slots preventing free movement of the rail for thermal growth. If the barrel nuts bind, stop and check alignment of the hanger with the rail. Tighten the barrel nuts until they bottom out against the top of the rail clamps. Make sure that the jam screw in the top of the barrel nut is backed off enough so that it does not stop the barrel nut before it is fully seated. Once the barrel nuts are tightened tighten the jam screws.



6. Visually check that all hangers are resting level with the rail, then slide each rail hanger clamp toward the onload end of the machine until the barrel nuts are approximately 1/16” (1.5mm) from the end of the hanger bar slots. Use a 3/16” hex key to tighten the rail clamp screws to lock the clamps to the rails.

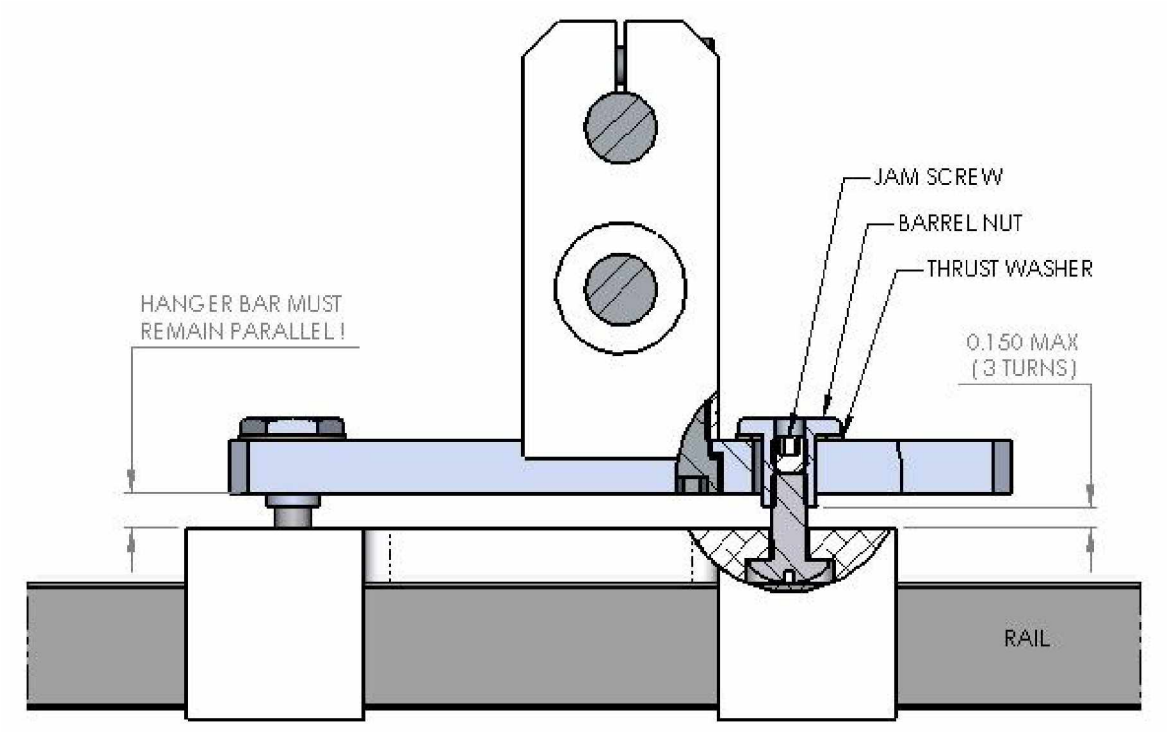


7. Turn the thrust washer under each barrel nut by hand to verify that all of the nuts are in contact with the hanger bars.

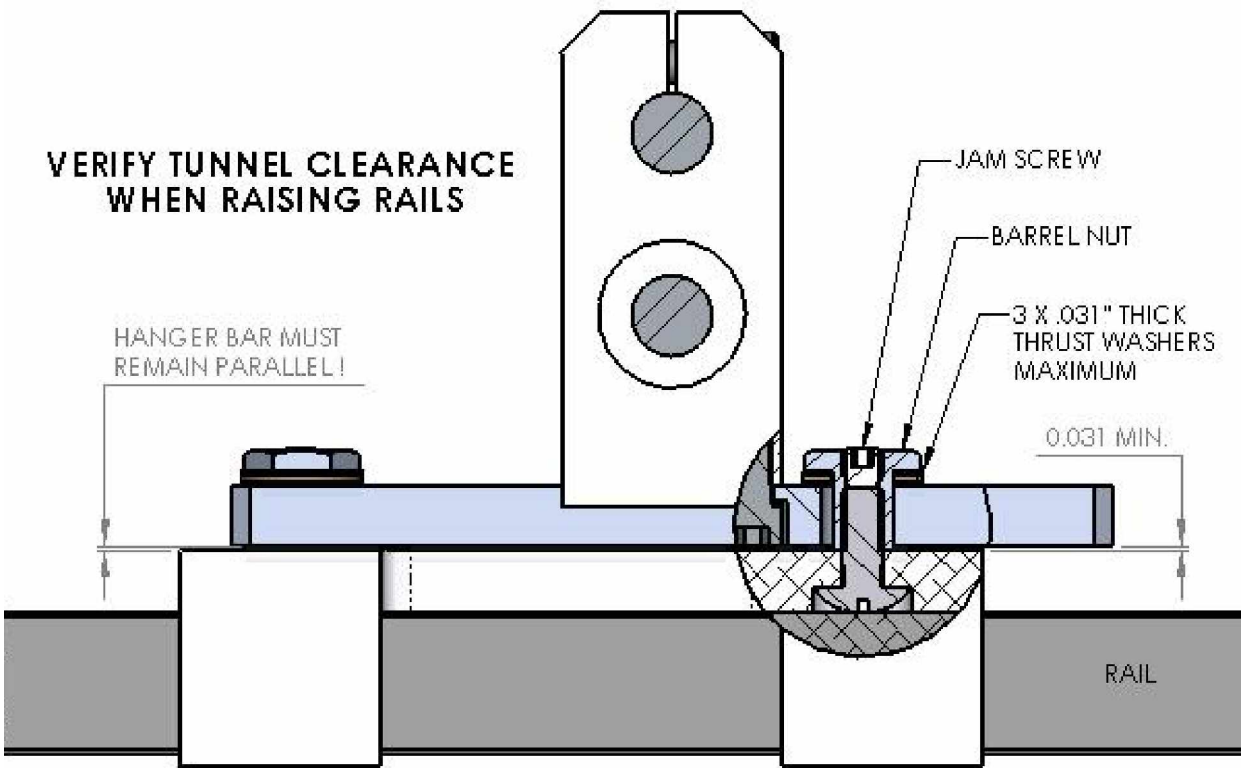
NOTE: It is very important to the function of the hanger system that all barrel nuts carry some load. The installed height of the gantries can vary slightly due to tolerance stack-ups in the oven sheet metal subassemblies so it is sometimes necessary to adjust the height of the rail in the hangers. Equal height of all hangers is especially important on 1240 machines where two pairs of supports are only separated by one cell.

If adjustment is needed use the intermediates as the known height reference and make adjustments to the hangers at the gantries.

To lower the rail height in a hanger loosen the jam screws then unscrew both barrel nuts an equal amount, up to three full turns of the barrel nuts maximum.



To raise the rail height add one or two thrust washers under both barrel nuts, fully seat the nuts, then unscrew them equal amounts to fine tune as necessary. There is only enough clearance for two additional thrust washers, do not attempt to use more than three.



When adjustments are complete tighten the jam screws to lock the barrel nuts in place.

8. After aligning the fixed rail and setting parallel (see next section), temporarily remove the fixing screws from the onload end capture brackets and check for free movement of both rails in the hanger brackets. The barrel nuts should slide in the hanger bar slots without catching or tending to twist the hanger assembly around its mount.

ALIGN AND PARALLEL EDGE RAILS

ALIGN FIXED RAIL

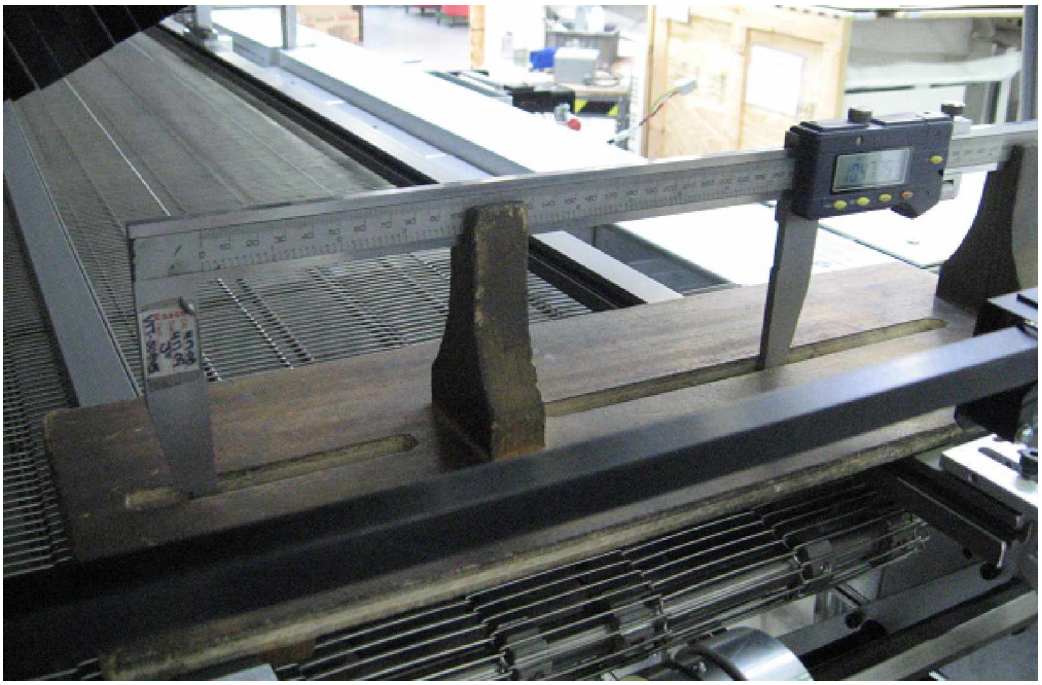
1. The fixed rail is adjusted straight using a string and three small metal plates of identical thickness.
2. Clamp one of the small plates to each end of the fixed rail and stretch a string between them.

3. Use the third plate to gauge the position of the rail at each gantry and intermediate.

4. Adjust the position of the intermediate and gantry fixed rail hangers on the cross bars to straighten the rail relative to the string.

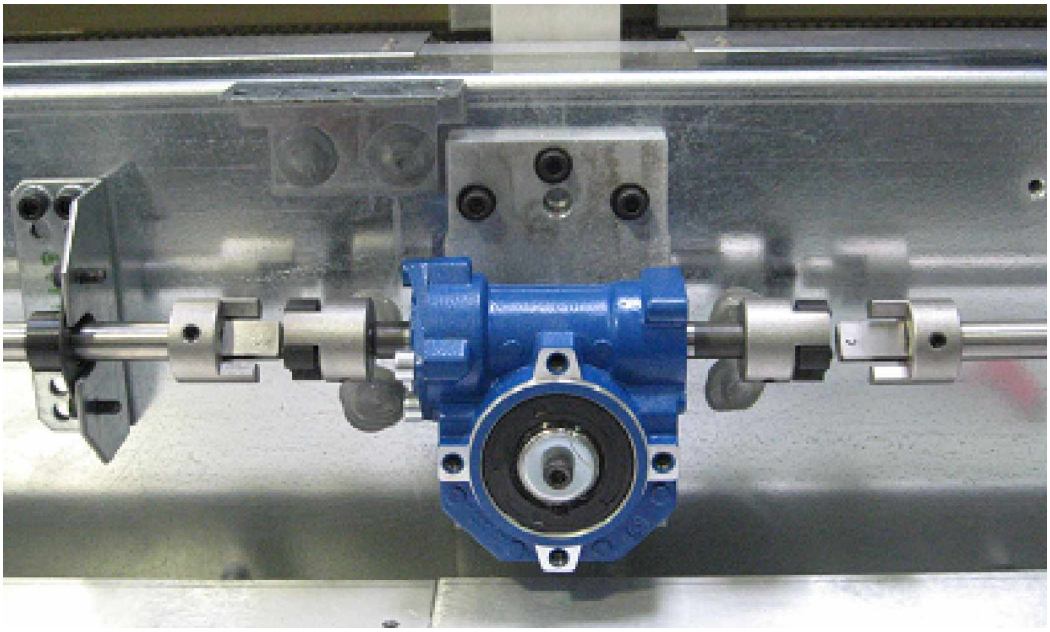
SET LANE PARALLEL

1. Measure lane width near the feedscrew locations: (onload, offload, and intermediates). The measured width at all feed screws must fall within a .020" (0.5mm) range.



Digital calipers (in wooden support) measuring lane width at face above chain groove.

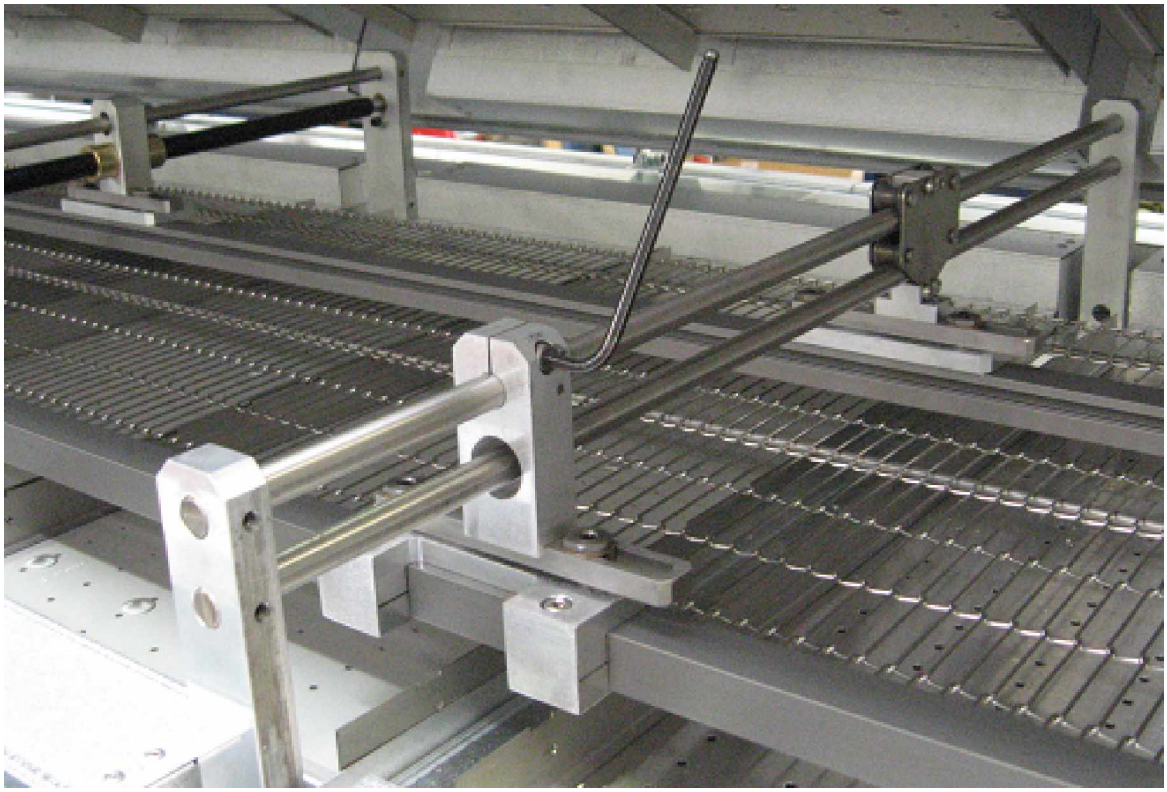
2. If adjustment is required de-couple the wormgear boxes from the width adjust shafts to allow turning one feedscrew at a time. Adjust feedscrews by hand to bring the lane width variation into specification then reconnect the width adjust shafts.



Decouple worm gear box and turn by hand to adjust parallel

3. Measure lane width midway between the feedscrew locations. Compare measurements to width at the feedscrews. Allowable variation is .052” (1.32mm).

4. If adjustment is required in the span between the feedscrews move the fixed rail hanger on the gantry to bring the measurements into specification.

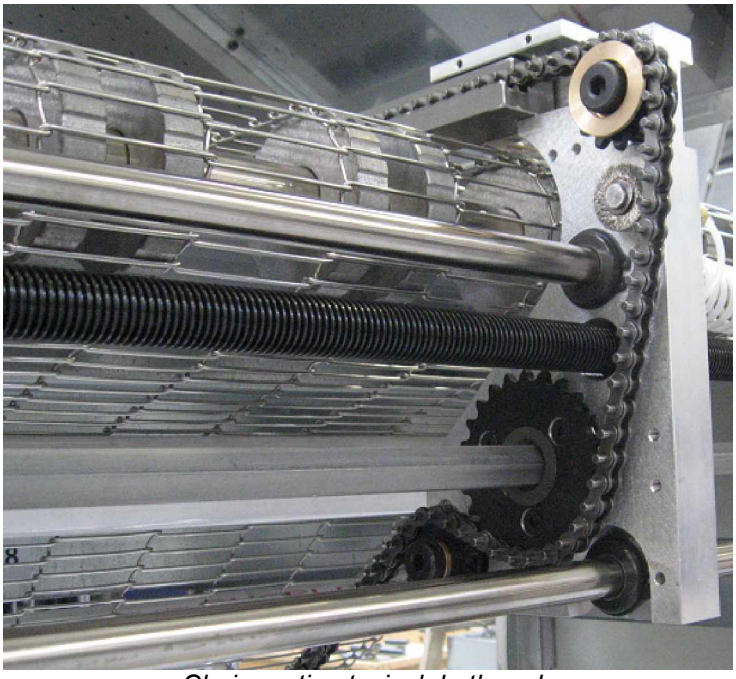


INSTALL CHAINS

1. Install the chains in the rails making sure the long pins face in toward the center of the oven. Be careful not to twist the chains.

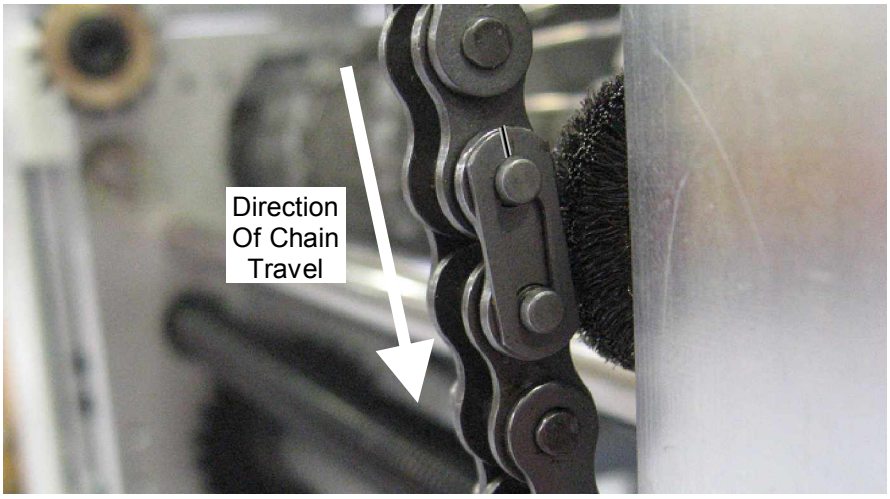
2. Slide the chains through the rails until they reach the off-load end of the oven.

3. Rethread the chains on the sprockets at the on-load end of the oven. Reinstall the chain guards with the button head screws using a 1/8" hex key.



Chain routing typical, both ends

4. At the off-load end of the Oven, rethread the chains through the sprockets. Reconnect the master links in both chains. *Make sure the closed end of the keeper clip is facing the direction of conveyor travel (off-load end).* Reinstall the chain guards on the rails with the button head screws using a 1/8" hex key.

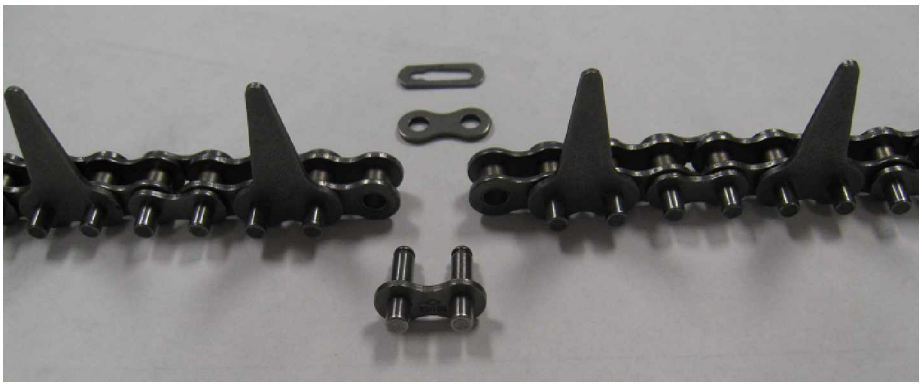


5. Make sure the chains are not hung up or twisted anywhere on top or underneath the Oven.

REMOVE AND REPLACE XCS CONVEYOR CHAIN AND RAIL

REMOVE XCS CHAIN

1. Run the conveyor until the master link in the XCS chain comes up just under the offload end of the XCS rail. Remove the master link from the chain and unthread the chain from all of the sprockets on the conveyor end. Tie-wrap the free end of the chain to the machine frame to keep it from running away under the oven.

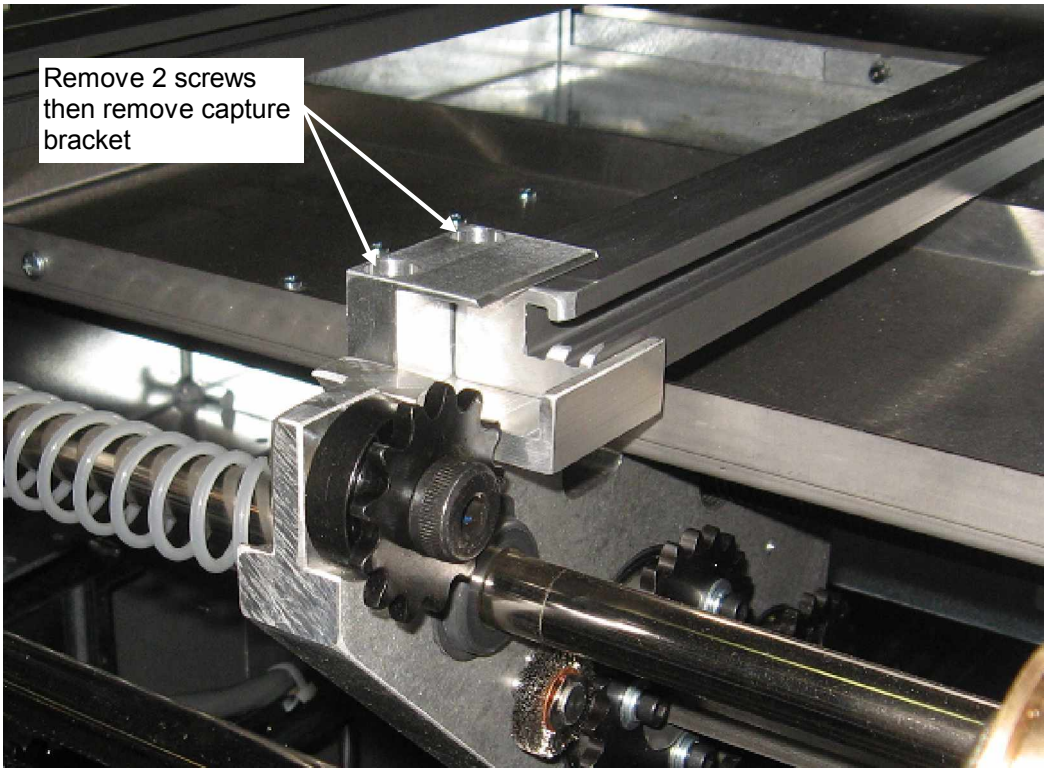


2. Move to the onload end of the oven. Pull the XCS chain out of the rail and guide it into a clean container.

REMOVE XCS RAIL

1. Remove the XCS chain (see above).

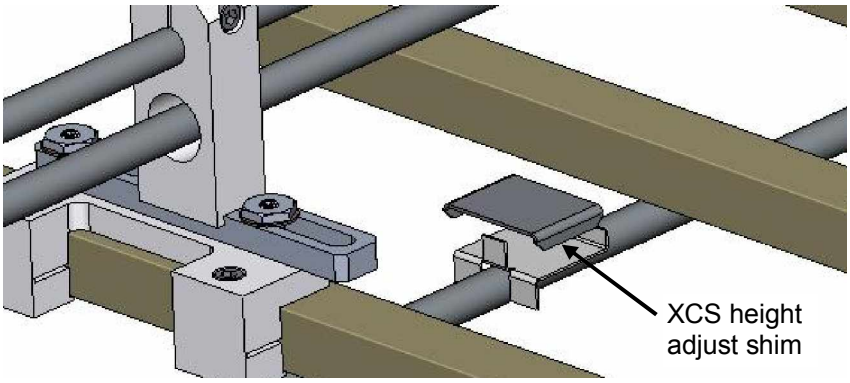
2. Use a 3/16" hex key to remove the XCS rail capture bracket from one end of the machine.



3. Slide the XCS rail out of the other capture bracket and carefully remove it from the machine.

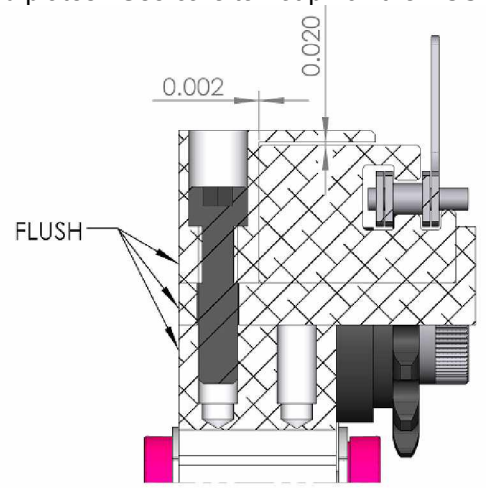
   !!! Exercise extreme care when handling the XCS rail.
   DO NOT let the rail bend or it may be permanently deformed.

   Watch for height adjustment shims that may be installed at the gantry and intermediate positions. Keep the shims away from the cell ducts. Do not swap these shims between locations.

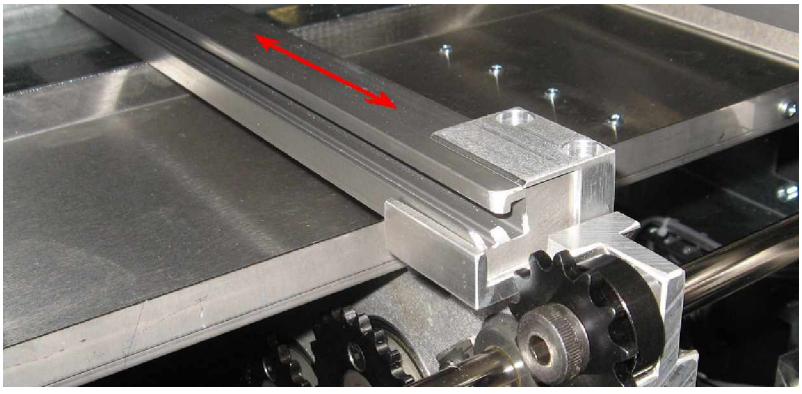


INSTALL XCS RAIL

1. Visually inspect the rail for straightness and wear or damage to the chain guide surface.
2. Carefully place the rail in the XCS support nests
3. Install the XCS rail capture brackets on each end of the machine. Position the rear face of the capture brackets flush with the rail end plates. Use care to not pinch the XCS rail with the capture brackets.

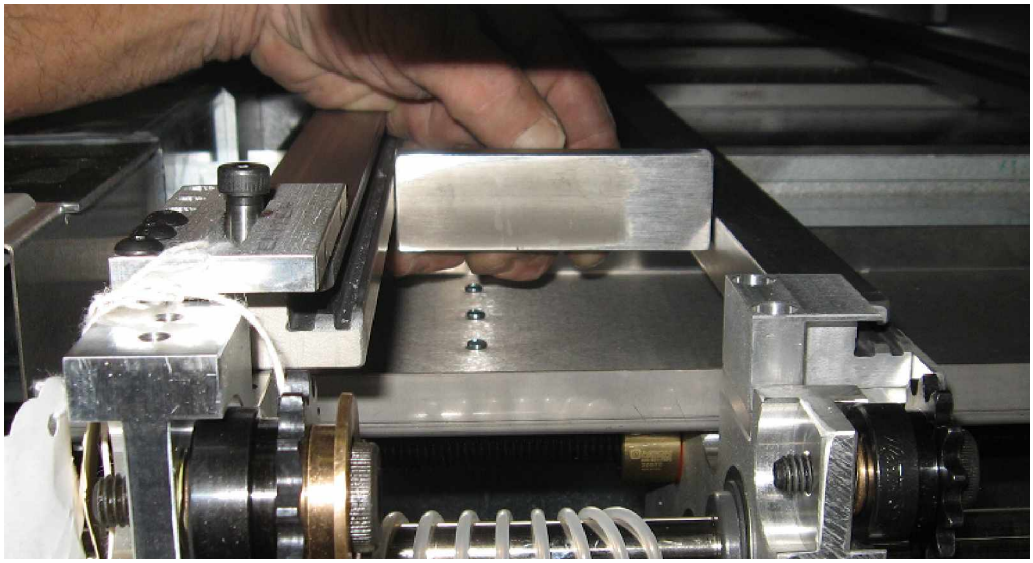


4. Slide the XCS rail back and forth in the rail capture brackets to test that there is no binding.

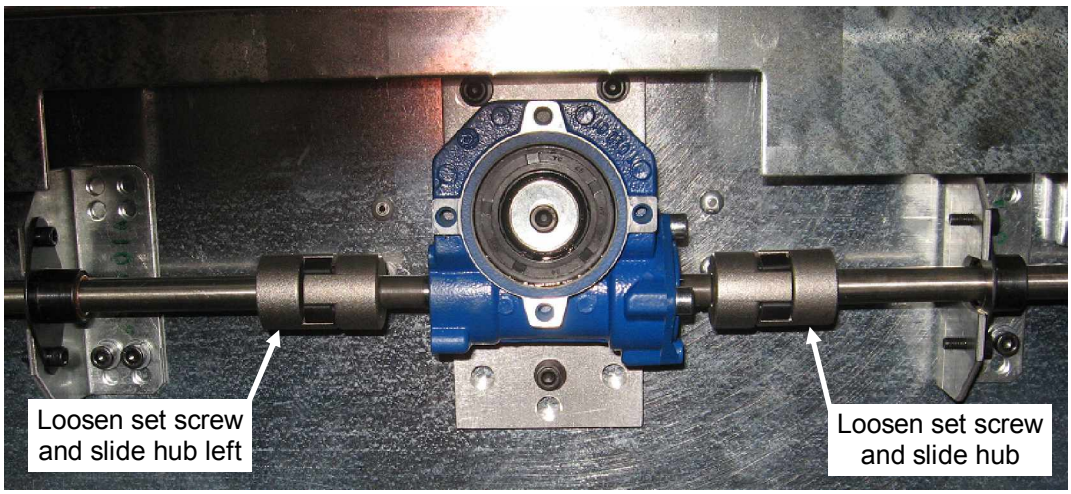


ALIGN XCS RAIL

1. Verify that the edge rail system is aligned and adjusted parallel within specification.
2. Use a gauge block and feeler gauges or a pair of calipers to measure the distance from the fixed edge rail to the XCS rail near each of the feedscrew locations: (onload, offload, and intermediates). The measured width at all feed screws must fall within a .020” (0.5mm) range.



3. If adjustment is required de-couple the wormgear boxes at the rear of the machine from the width adjust shafts to allow turning one feedscrew at a time. Adjust feedscrews by hand to bring the XCS rail location into specification then reconnect the width adjust shafts.

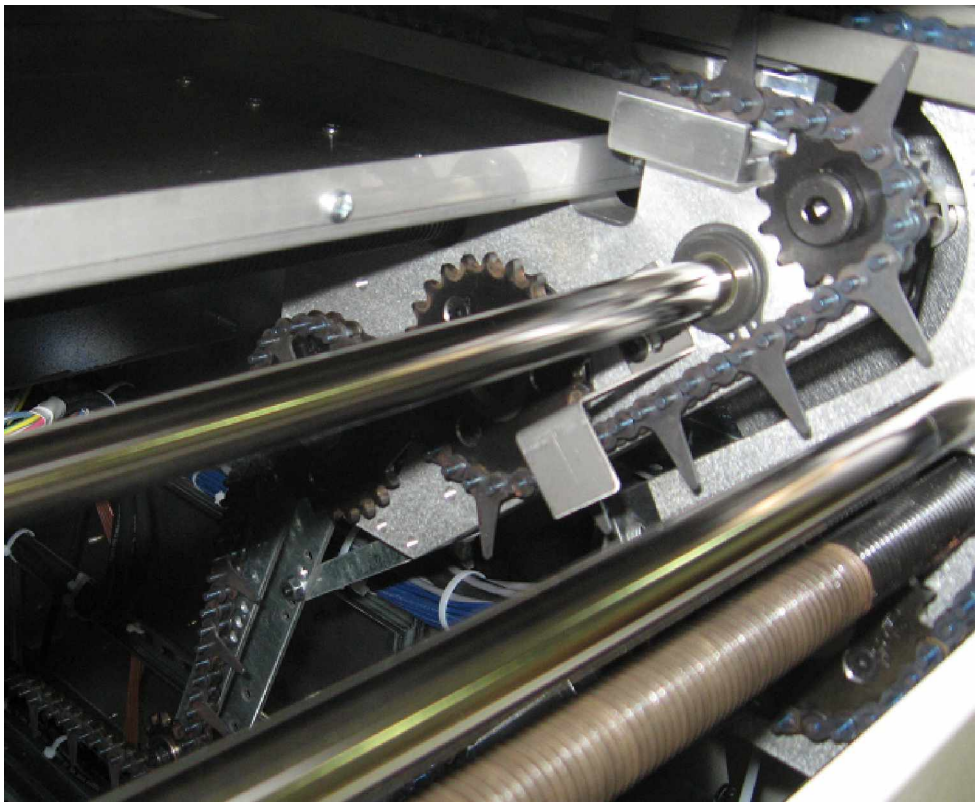


4. Verify XCS parallel in the spans between the feedscrew locations. The distance from the fixed edge rail to the XCS rail midway between the feedscrew locations must be within .052” (1.32mm) of the measurement at the feedscrews. XCS parallel can not be adjusted at the gantry locations. Replace the XCS rail if variation is excessive.

INSTALL XCS CHAIN

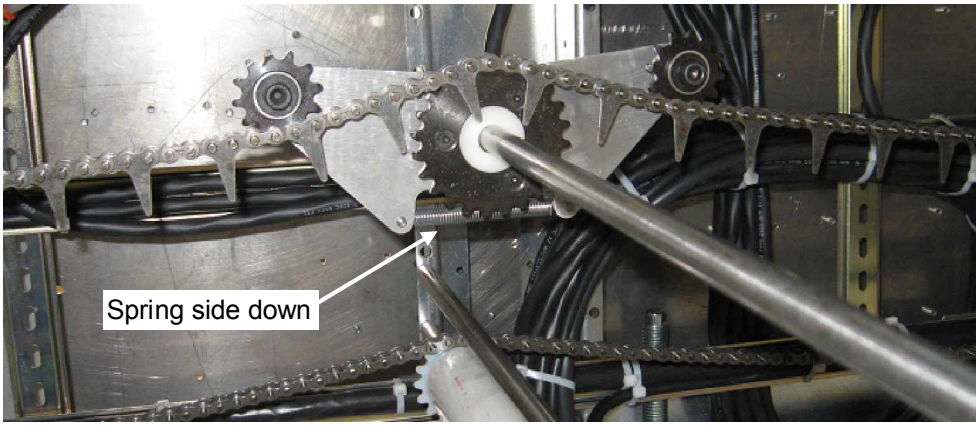
Note: The XCS chain is custom manufactured as a pitch matched set with the fixed edge rail chain. Do not mix or splice these chains. Always replace both chains as a set.

1. Feed the XCS chain into the offload end of the XCS rail until it reaches the opposite end of the machine.
2. Continue to thread the XCS chain over the sprockets at the on-load end then feed it back under the oven.

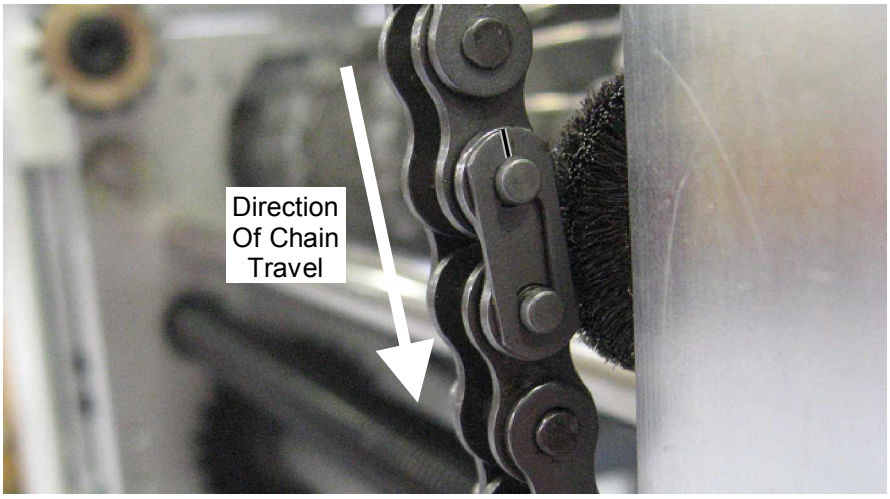


XCS chain routing typical, both ends

3. Thread the XCS chain through the tensioner trolley at the center of the return loop. The XCS tensioner trolley is properly oriented when its extension spring is beneath the large sprocket.



4. At the off-load end of the oven, thread the XCS chain through the sprockets. Reconnect the master link. *Make sure the closed end of the keeper clip is facing the direction of conveyor travel.*



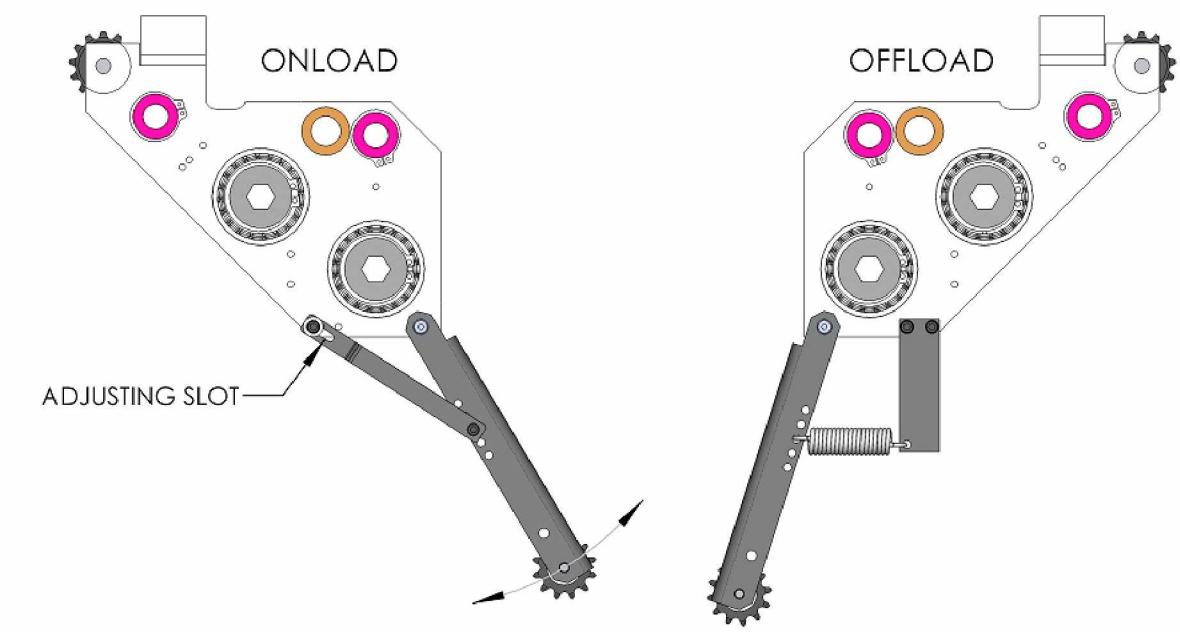
5. Check that the XCS chain is properly engaged with all of the sprockets and is not hung up or twisted anywhere on top or underneath the oven.

SET XCS TENSION

Caution: Excessive tension in the XCS system will accelerate wear of the XCS chain.

1. Run the conveyor through several revolutions to ensure the XCS chain is properly settled.

2. The XCS tension is adjusted at the onload end of the machine by moving the XCS drop arm. The arm is fixed by a slotted link. Use a 5/32" hex key and loosen the clamp screw to reposition the arm.



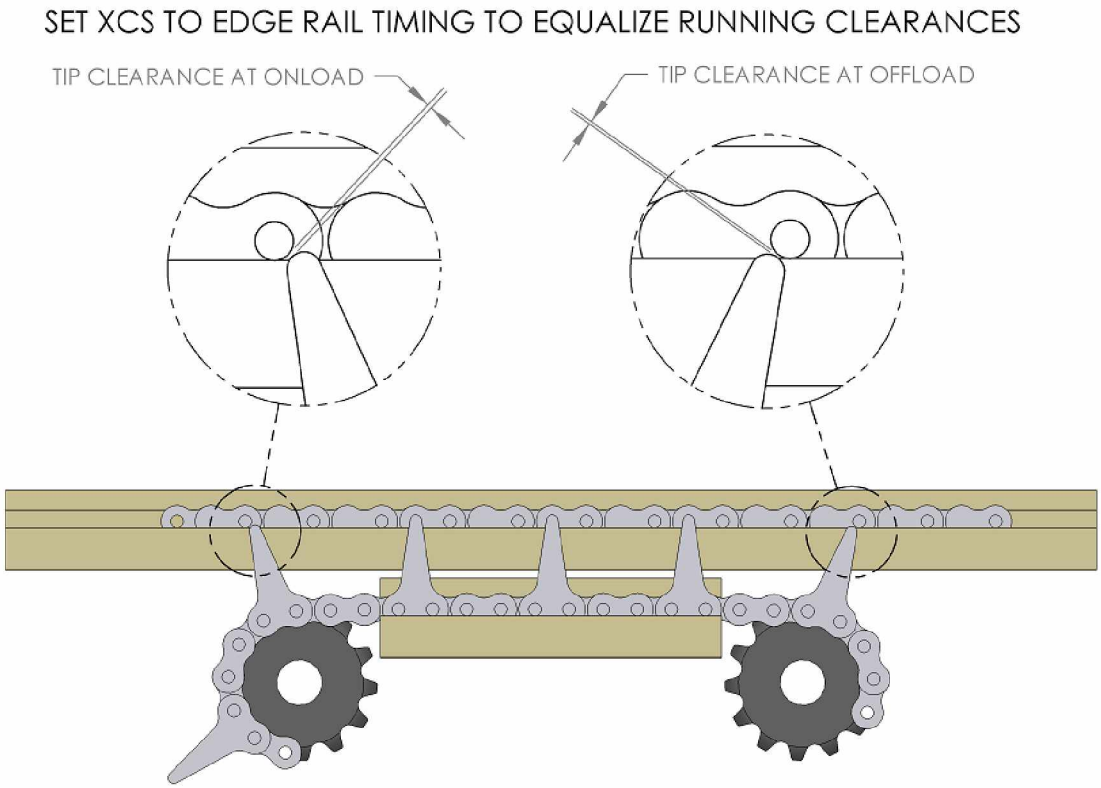
3. Adjust the XCS onload drop arm so that the lowest point of the XCS return loop is 2 to 3 inches (50 to 75mm) from touching at its lowest point.

SET XCS TIMING

Note: After extended service the XCS and edge rail chains may wear at different rates and this can affect their pitch match. It may not be possible to park the XCS between the edge rail pins if excessive mismatch develops. It is always better to set the XCS park position outside the edge rail pins if possible.

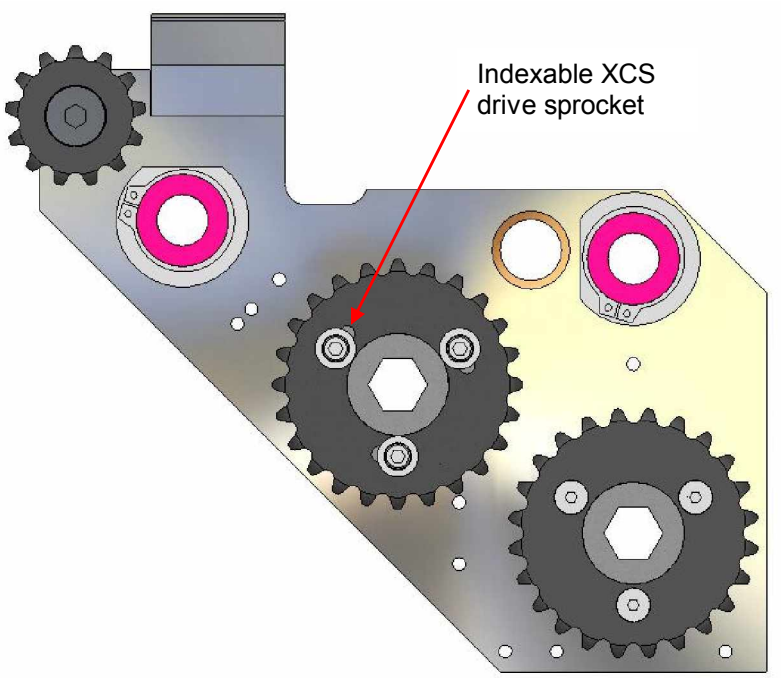
1. Position the XCS rail just outside of the fixed edge rail chain pins.

2. Examine the position of the XCS plates relative to the edge rail pins. Adjust the XCS timing to equalize the available clearance between the tip of the XCS plates and edge rail pins as the XCS plates sweep in and out of position at either end of the machine.



3. Make coarse (3/8”) timing adjustments by moving the XCS chain ahead or back one tooth at a time on the drive sprocket at the offload end of the machine.

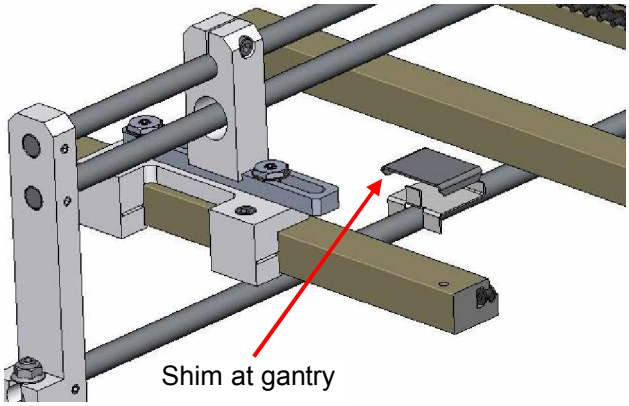
4. Fine adjust the timing (within the last 3/8”) by indexing the slotted drive sprocket on its hub.

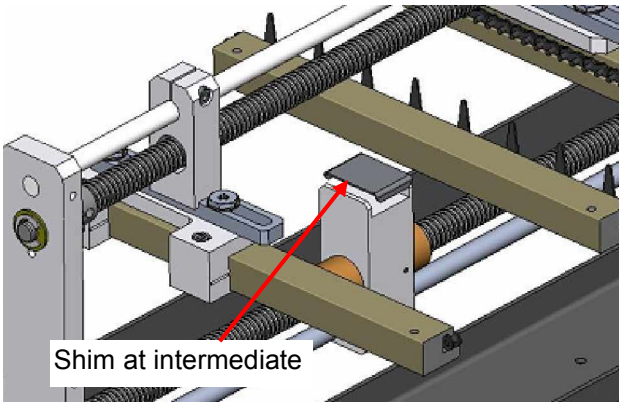


5. Operate the conveyor and watch the interaction of the XCS plates and fixed rail pins through several revolutions of the chain loops before moving the XCS into park position.

SET XCS HEIGHT

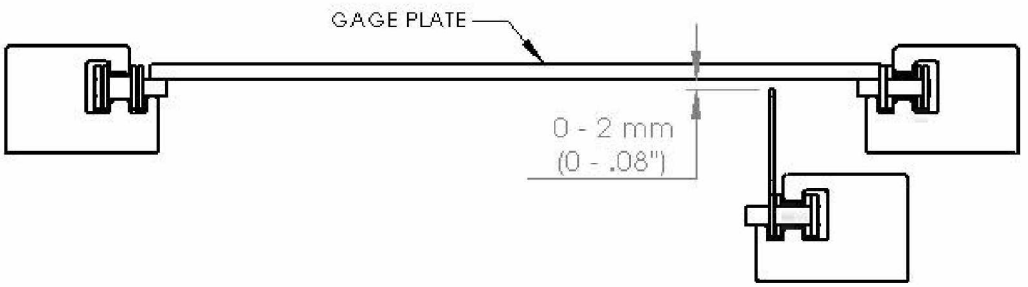
The height of the XCS support is adjusted relative to the edge rails by changing the thickness of the stainless steel shims under the XCS rail at the gantry and intermediate locations. The height can also be adjusted between the front and rear of the tunnel by raising or lowering the edge rails in the rail clamps (see INSTALL RAILS). Verify tunnel clearance whenever edge rails are raised.





The height of the XCS is checked using an 18" or 22" wide aluminum gage plate and a .08" (2mm) feeler gauge:

1. Make sure the machine is leveled and properly resting on all feet.
2. Set the conveyor width for the gage plate and position the XCS rail about 1" (25mm) from the park position.
3. Place the gage plate on the edge rail chains as you would a PCB.



4. Look below the plate and wiggle it to verify that the XCS fingers are not touching (too high). Move the plate down the conveyor and repeat the check every couple of feet (½ meter) along the conveyor.
5. Next, move the gage plate to the first gantry. Verify that a 2mm feeler gauge will not pass between the bottom of the plate and the XCS fingers. Check several XCS fingers in a row at each location. Move the plate down the conveyor and repeat the check every couple of feet (½ meter) until you reach the last gantry. The minimum XCS height does not apply between either end of the machine and the first support location.
6. Move the position of the XCS rail to one inch from the moveable rail and repeat the test.
7. Move the XCS to the middle of the lane and repeat the test.
8. Change the thickness of the XCS shims and adjust edge rail height as necessary to bring all measurements into specification. If edge rails are raised verify tunnel height. If XCS is lowered pass a feeler gage or stiff paper under the length of the XCS rail to verify that it does not contact any ICBs.

DUAL LANE DUAL XCS

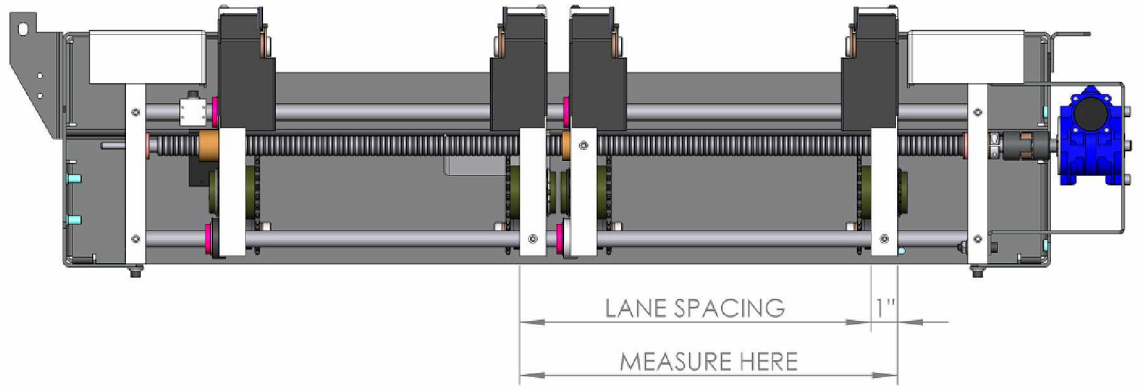
The dual lane dual XCS conveyor system consists of two complete edge rail / XCS rail systems sharing a common set of width adjust feed screws. Because the moveable components of the two lanes are coupled to the same feedscrews the width and XCS position of the front and rear lanes remain identical.

DUAL LANE DUAL XCS LANE SPACING ADJUSTMENT

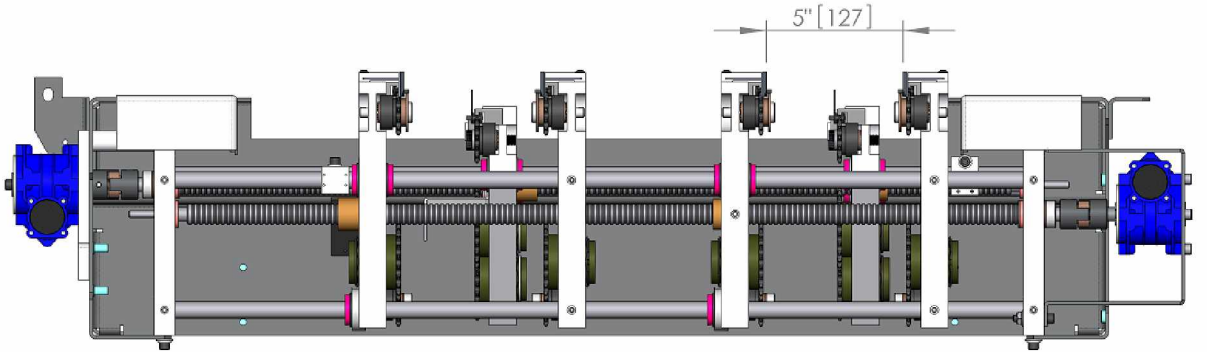
The distance between the two lanes is fixed at the factory. Adjustment of the lane spacing dimension is accomplished by indexing (rotating) the acme nuts in the rail support plates of the front lane. The indexable nuts are installed in the front lane rather then the rear lane to improve access to the adjusting mechanisms inside the tunnel at the intermediate positions.

- *If starting with a conveyor that is not properly qualified, set the lane to lane spacing between the pair of rails on each feed screw using the indexable Acme nuts (ref. steps 9 & 10 below), then refer to "ALIGN AND PARALLEL EDGE RAILS" to set lane parallel.*
- *If starting with a dual lane conveyor system that is properly set up and qualified, the most efficient method of changing lane spacing is to move each rail an exact amount w/in ±.005" (±0.13mm) as follows:*

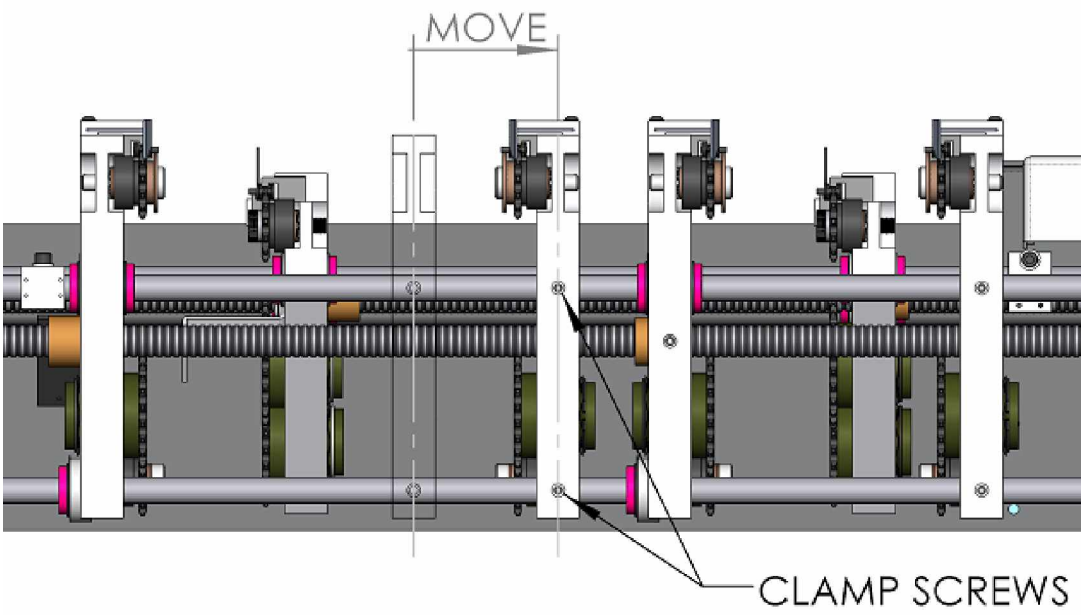
1. Measure and record the distance from one fixed rail extrusion to the other at every attachment point (onload, offload, gantry and intermediates). It does not matter what face of the rails is used for the measurement as long as you are consistent.
2. Repeat step 1 for the moveable edge rails.
3. Repeat step 1 for the XCS rails.
4. Determine the current lane spacing: At the onload end measure the distance between the outside surfaces of the two fixed rail end plates. Subtract 1" (25.4mm) from this measurement (*example*: 361.95mm – 25.40mm = 336.55mm).

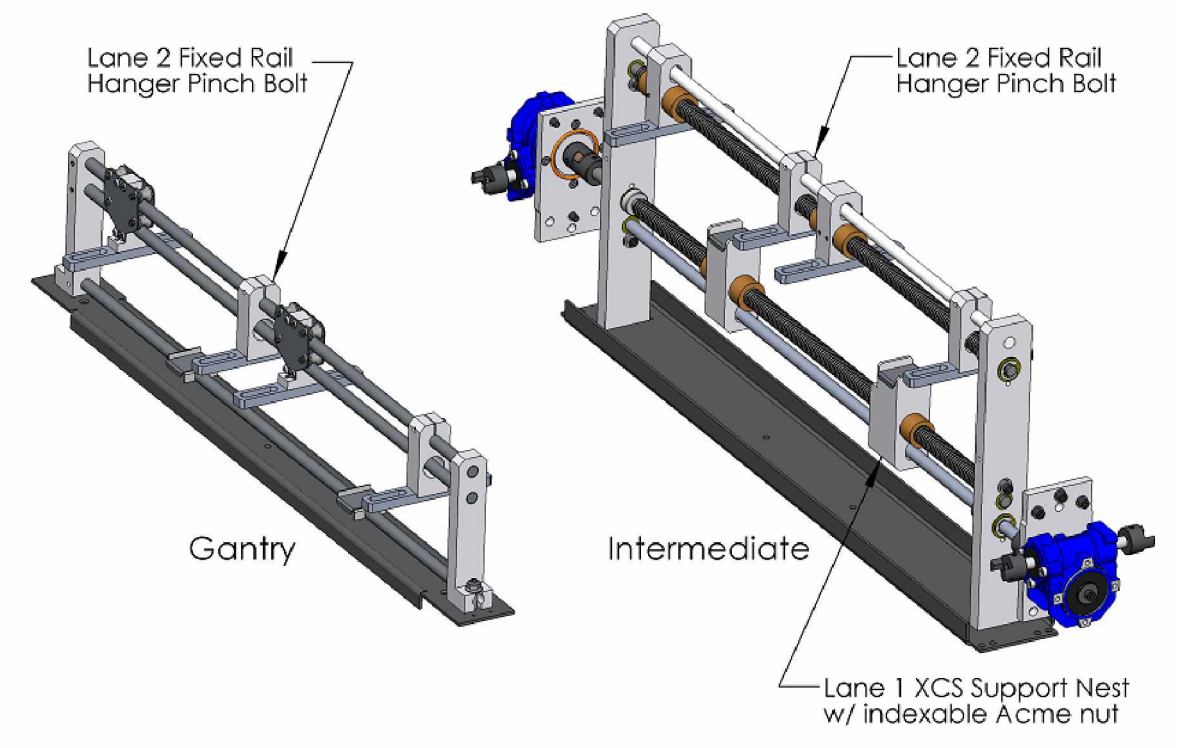


5. Calculate the amount all affected conveyor components need to move: Subtract the desired lane spacing from the current lane spacing (*example*: 336.55mm – 251mm = 85.55mm).
6. Establish the target lane settings: Subtract the amount to be moved from each of the width measurements taken in steps 1 through 3.
7. Set the lane width at approximately 5" (125mm) using the conveyor width system.

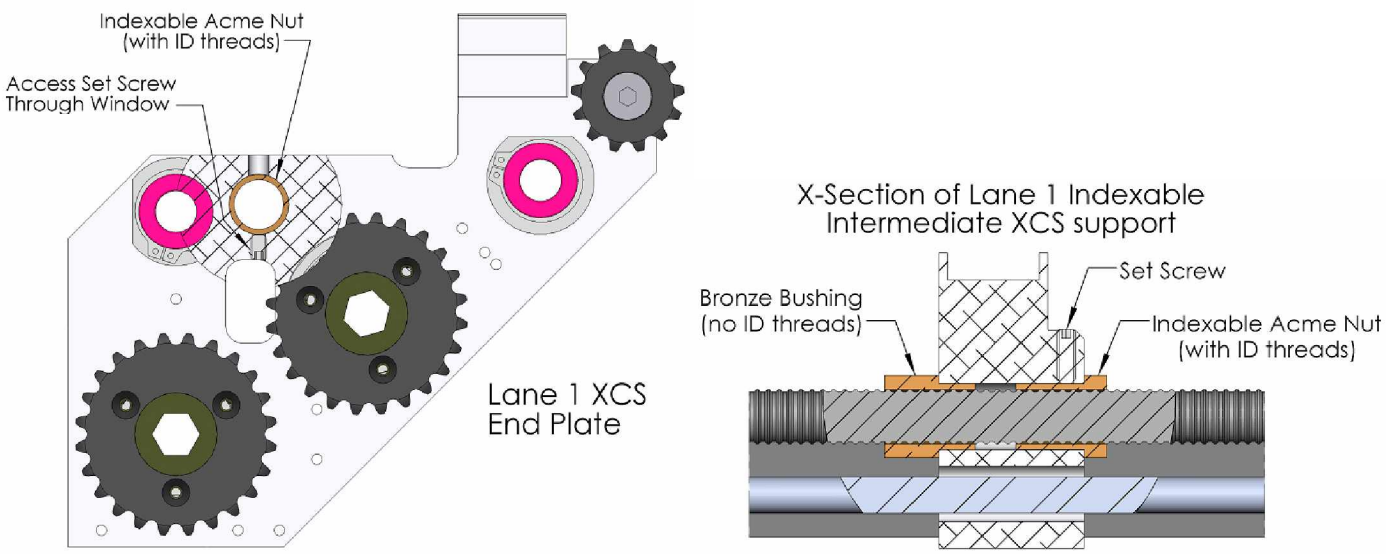


8. Move the lane 2 fixed rail: Loosen the lane 2 fixed rail end plate clamp screws and corresponding pinch bolts in each gantry and intermediate rail hanger, then move the lane 2 fixed rail to the target dimensions (±.005") calculated in step 6.

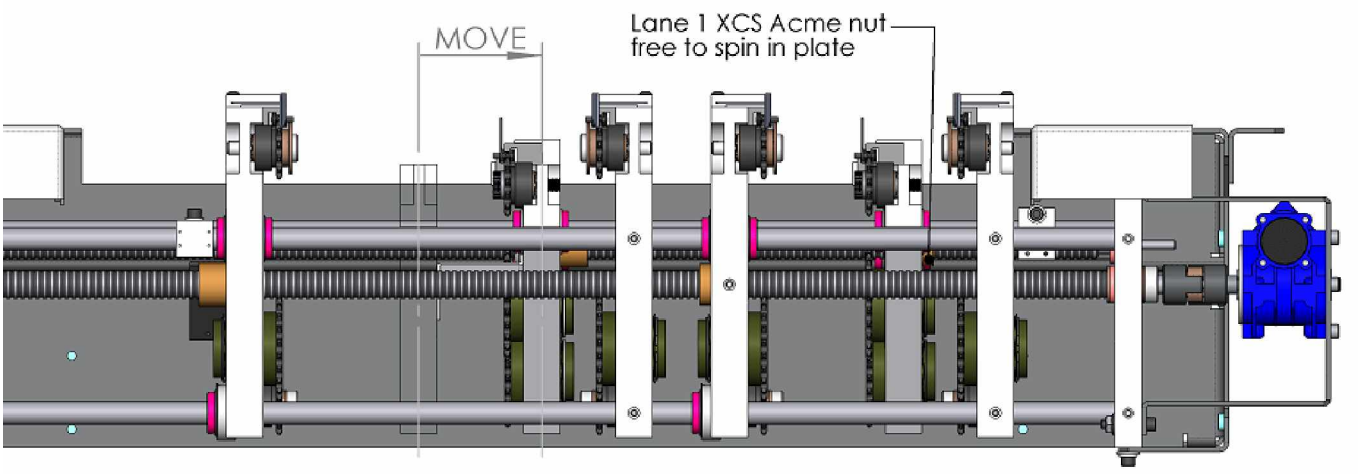




9. Decouple the lane 1 XCS Acme nuts by loosening the set screws in the onload and offload XCS end plates and intermediate support nest(s).

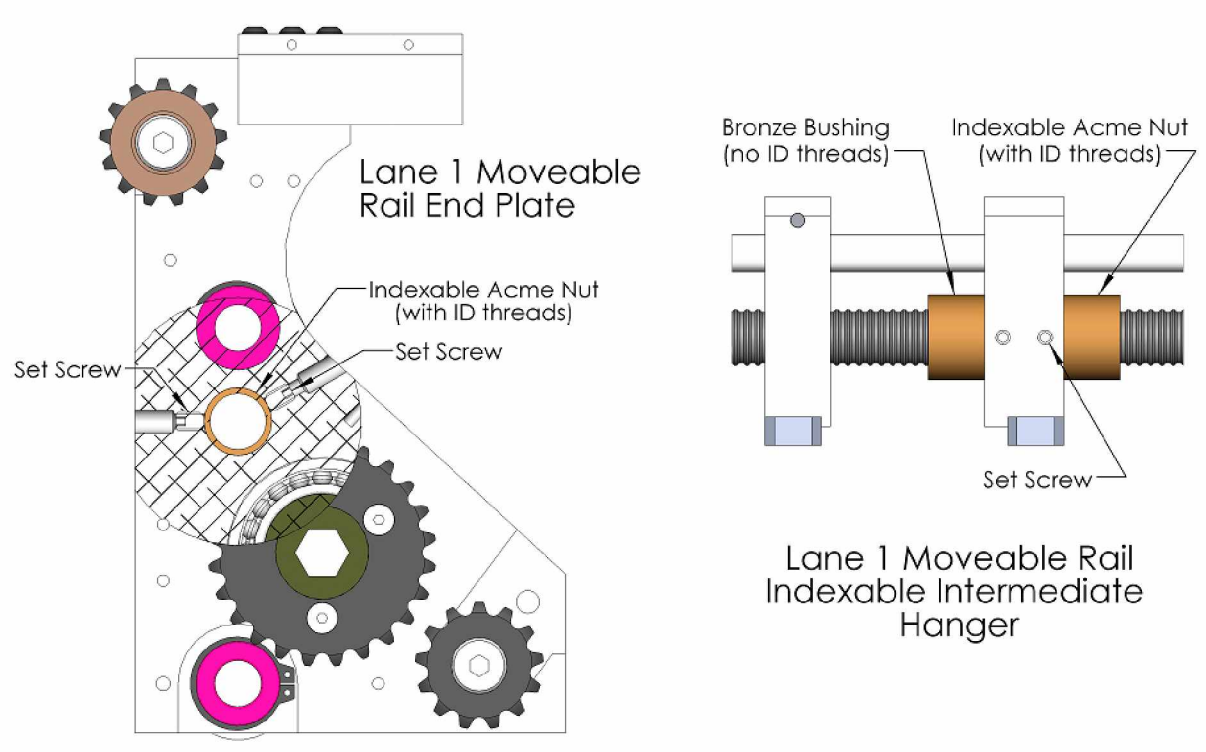


10. Move the lane 2 XCS toward the fixed rail by operating the XCS width adjust system. Make the move in small increments, stopping to rotate the indexable XCS Acme nuts in lane 1 so that the rail stays straight and the XCS chain does not run into the fixed rail. It may be necessary to temporarily remove the XCS chain and rail from lane 1 while performing this step.

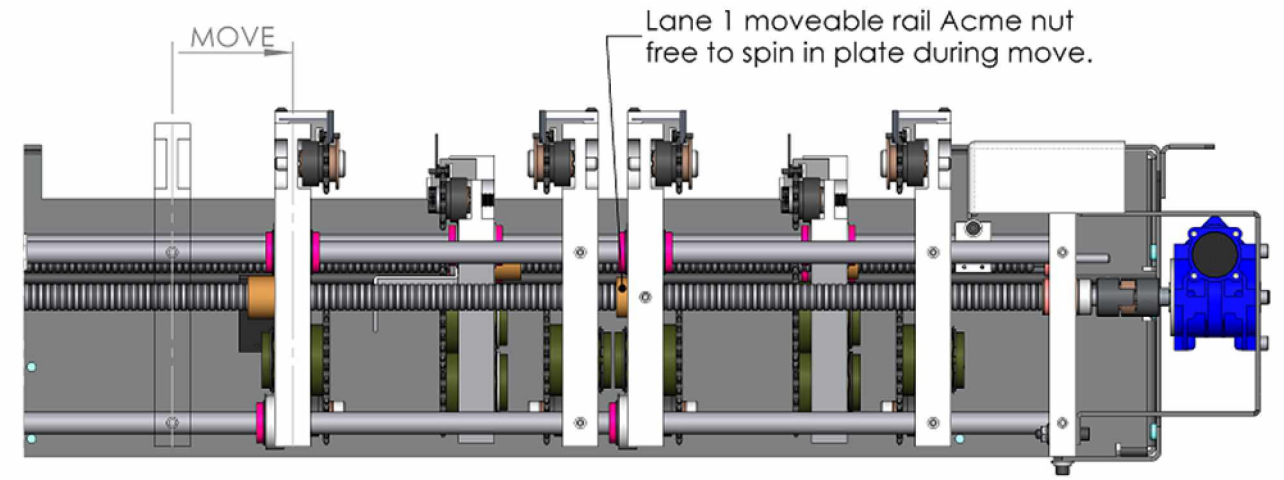


11. Once the XCS is approximately 1" (25mm) from the fixed rail adjust each of the lane 1 XCS Acme nuts to achieve the target dimensions (±.005") calculated in step 6. Be very careful to not over tighten the set screws when locking the adjustable Acme nuts in position. It is very easy to distort the Acme threads enough to bind the nut on the feedscrew.

12. Decouple the lane 1 moveable rail Acme nuts: Loosen the set screws in the onload and offload end plates and intermediate rail hanger(s). Note that there are two set screws acting on the Acme nut in each of the end plates.

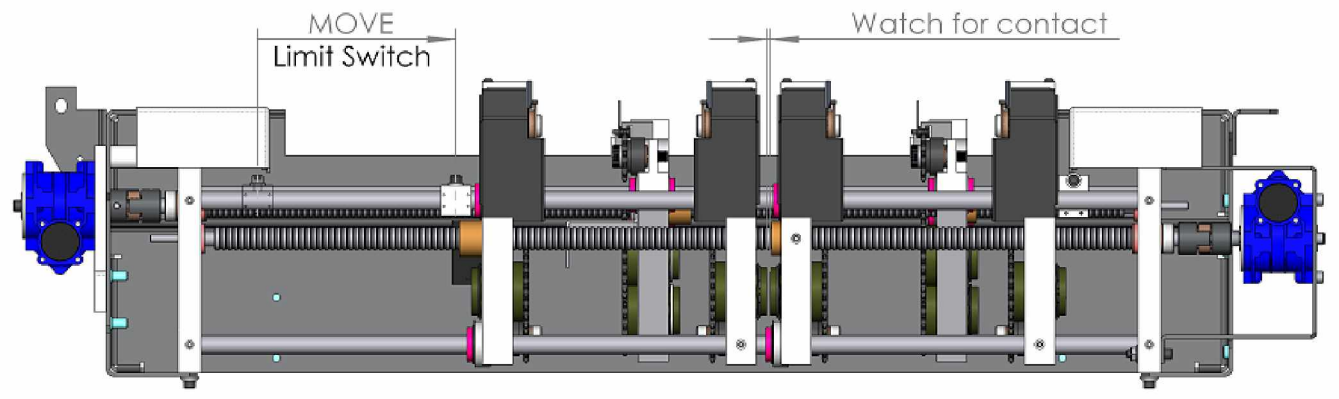


13. Move the lane 2 moveable rail toward the fixed rail by operating the edge rail width adjust system. Make the move in small increments, stopping to rotate the indexable Acme nuts in lane 1 so that the rail stays straight and does not run into the XCS. It may be necessary to temporarily remove the moveable rail and chain from lane 1 while performing this step.



14. When the moveable rail is close to position adjust each of the lane 1 moveable rail Acme nuts to achieve the exact target dimensions (±.005") calculated in step 6. Be very careful to not over tighten the set screws when locking down the adjustable Acme nuts. It is very easy to distort the Acme threads and cause the nut to bind on the feedscrew.

15. Reset the location of the end of travel limit switch block so that it stops the moveable rail before the lane 1 moveable end plate contacts the lane 2 fixed endplate.



16. Verify all lane parallel and XCS height measurements before returning machine to service.

CONVEYOR DRIVE SYSTEM

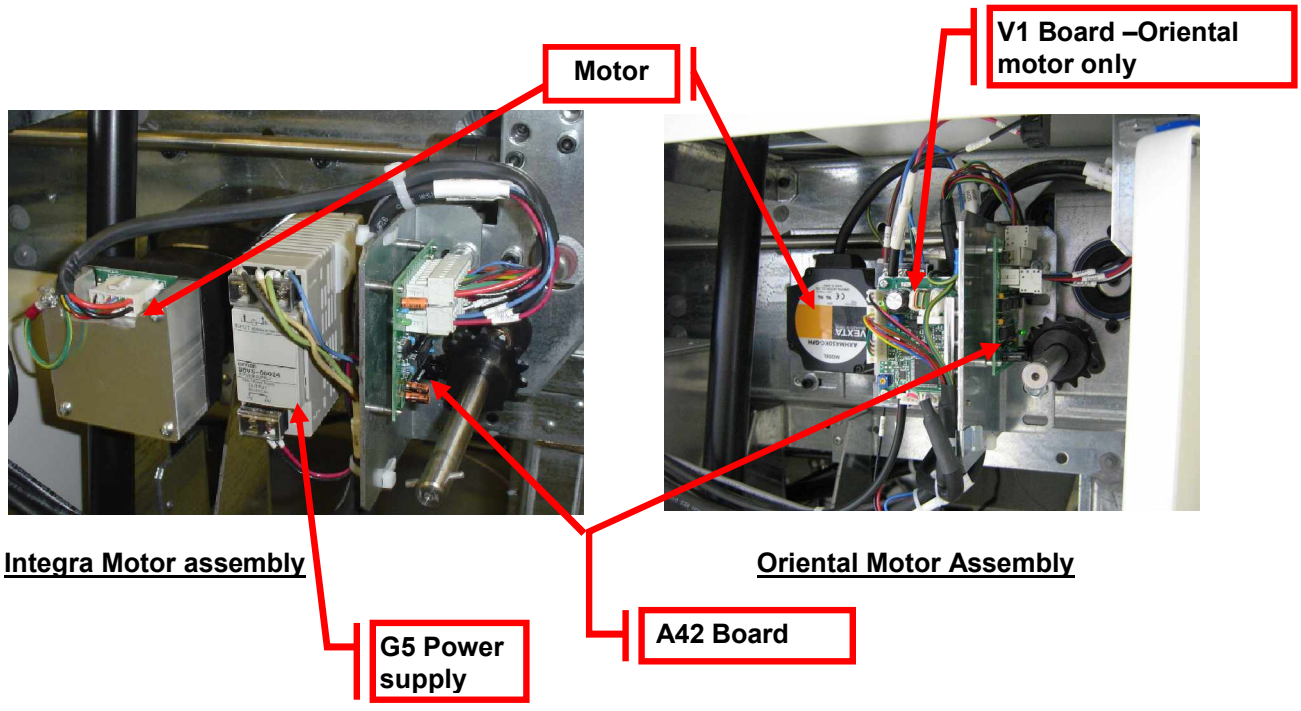
The oven controller supplies an analog voltage reference signal between 0 and 10 volts to the conveyor motor electronics to set the desired conveyor speed. The A42 board divides it in half and passes it through an Opamp to avoid loading and signal loss issues from the resistor voltage divider before it sends it to pin 9 on the Integramotor. The internal Integramotor electronics require a regulated power supply between 20 and 28 volts to operate, otherwise the electronics indicate a fault condition and the motor will not operate. The internal Integramotor electronics control the motor speed based on a 0- 5VDC reference signal that is supplied by dividing the 0-10VDC analog output voltage in half.

The speed of a brushless motor is not controlled by varying the voltage to the windings of the motor like a brush type or a universal motor is controlled. The speed and rotation direction of a brushless motor is controlled in a similar method to that of a stepper motor. Through switching the motor windings on and off in a specific sequence for a specific direction. The faster the windings are switched on and off using the specified sequence the faster the motor rotates.

One major difference with a brushless motor versus a stepper motor is that a brushless motor has built in hall-effect sensors that are used by the drive electronics to sense and to regulate how fast the motor is rotating. A stepper motor has no internal feedback and no speed regulation.

The internal Integramotor electronics switch the windings of the motor faster as the 0-5VDC reference signal is increased while regulating the speed of the motor through the feedback from the built in hall-effect sensors.

A hall-effect sensor built into the conveyor motor supplies pulses to the oven controller, which is used by the controller for feedback to close loop the conveyor speed to the setpoint by varying the analog voltage signal to the conveyor motor electronics.



Set up the Conveyor Drive within the Oven Operation Program.
NOTE: This operation may require a password.

If the conveyor motor does not rotate, check the following:

- Verify that the conveyor is switched on in the PC oven software.
- Verify that K37 is energized and that A1-K8 is also energized.
- Verify that 120 VAC is present at the G5 power supply or verify that the green LED on the front of the power supply is on.
- If 120VAC is not present then make sure that A1-K8 is energized on the A1 board, that F68 is not tripped and that the inrush current limiter on pins 1 and 2 of connector P52 on the A1 board are intact.
- Verify the analog voltage reference signal to the A42 board.
- The signal should be +10 VDC between pins 1(+) and 2 (-) on connector P2 of A42 when the analog output is at full scale.
- If there is no signal present, make sure that the controller rack has +15 VDC at pin 4 of connector P26 of the A1 board. (-15 is not present or required on the new controller)
- If +15 VDC is present , but the drive is not receiving +10 VDC, there is either a wiring error or the DI board is faulty, or a poor wire connection.

If motor turns, but no speed is reported, check the following:

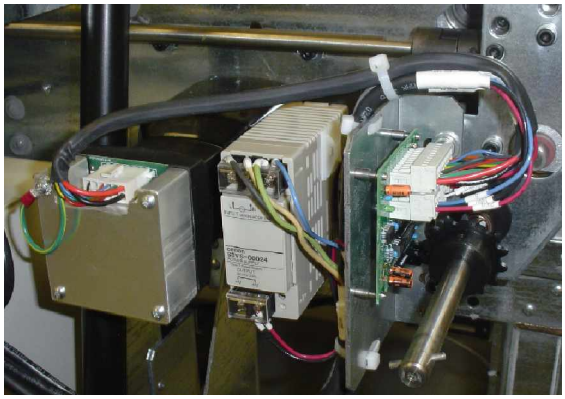
- Verify that the hex drive shaft is rotating.
- Verify that the sprocket installed on the hex drive shaft is also rotating.
- Verify that LED2 on A42 is flashing as each sprocket tooth from the sprocket on the hex drive shaft passes by the fork shaped sensor on A42.
- If LED2 is not flashing on A42 and the hex shaft and sprocket are rotating then perform the following:
- Verify the alignment of the sprocket with the fork shaped sensor on A42. The sensing area on the fork shaped sensor is on the top most edge of the sensor and only the tips of the sprocket teeth should be extending into the opening on the sensor. If the sprocket teeth extend too far the sensor won't detect the gaps between each sprocket tooth and will sense the hub around the sprocket teeth instead.
- If LED2 on A42 does not light or never changes state then test the following.
- Verify that 5VDC is present between pins 1(+) and 3(-) of connector P3 on A42. The 5VDC is required to operate the logic components on A42.
- If the polarity is reversed or if connector P1 and P3 are reversed on A42 then A42 will have to be replaced after the wiring has been corrected. Because reverse polarity and or 24VDC will permanently damage all of the logic components on A42.
- If 5VDC is present and LED2 on A42 still doesn't change state then perform the following:
- Shut off the conveyor motor.
- Unplug connector P4 from A42.
- Loosen and remove the (2) 1/4-20 bolts that secure the bracket that A42 is mounted on to the front of the rail width gearbox.
- With the A42 assembly separated from the sprocket on the hex drive shaft pass a small object back and forth between the top most tip of the fork sensor while observing LED42 on A42.
- A pen or the tip of your finger can be used.
- If LED2 still does not change state and 5VDC is present between pins 1(+) and 3(-) of connector P3 on A42 then A42 is defective and needs to be replaced.

After the conveyor system has been repaired, run the conveyor calibration routine in the Oven Control Program.

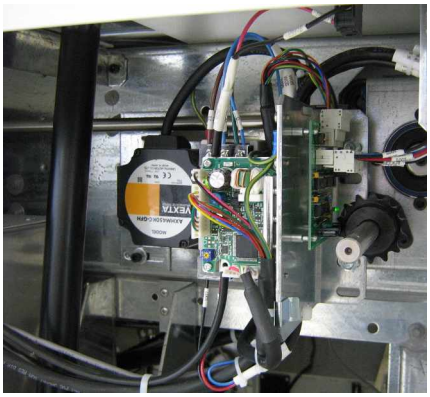
DRIVE MOTOR SERVICE & REPLACEMENT

Conveyor Drive Motor Replacement - MOTOR LOCATION

There are only two locations for the conveyor motor on all Vitronics-Soltec Reflow Ovens. On an oven with a left To right conveyor, the motor assembly is in the front right corner of the oven. On an oven with a right to left conveyor system, the motor assembly is on the front left corner of the oven.



Integra Motor



Oriental Motor

Left to Right Conveyor

CONVEYOR MOTOR REPLACEMENT

To remove/replace the Conveyor Drive Motor:

1. Open the Hood
2.  Turn off the U.P.S. and disconnect all power from the oven.
3. Remove the sheet metal at the exit end of the end the oven to gain clear access to the motor and components.
4. Remove the G5 power supply
5. Unplug the cable from the motor.
6. The Motor is attached to a mounting plate with four bolts. That plate is mounted with four bolts on the Oven Frame “C” Channel. Loosen the four bolts and slide the plate to the exit end of the oven. This will allow the Chain to be removed from the Drive Sprocket without removing the Master Link from the Chain.
7. While supporting the Motor, remove the four bolts. Remove the motor, mounting plate and sprockets from the Oven.
8. Rotate the Motor to permit access to the setscrews that secure the drive sprocket to the Motor Drive Shaft. Loosen the setscrews and remove the sprocket, then remove the Motor from the mounting plate.
9. Install the new motor and drive sprocket on the mounting plate.

Reverse steps 7 through 1 to replace the Conveyor Drive Motor

COMPUTER CONTROLLED EDGE-RAIL LUBRICATION

Computer Controlled Edge-Rail Lubrication is:

☐ Standard, (installed on all ovens) ☑ An option, (NOT installed on all ovens)

DESCRIPTION:

The edge-rail lubrication system is designed to improve the lifetime of the rail chain conveyor by periodically applying lubrication to the chain during oven operation.

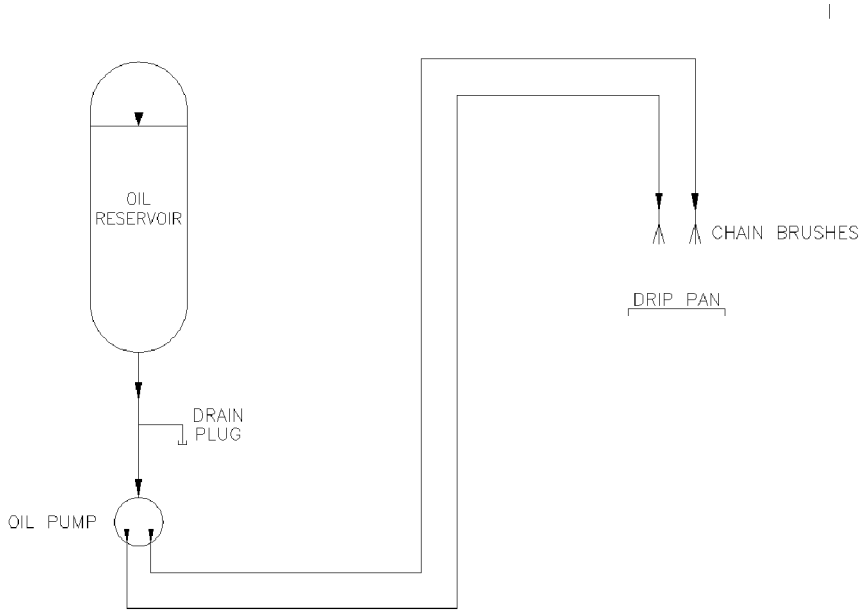
Two modes of lubrication are available, automatic and manual. Systems with automatic chain lubrication are also capable of performing manual chain lubrication, initiated by the operator, through the Oven Operation Program.

OPERATION:

⇒ Following the enabling of an output from the controller, the system pumps oil from the reservoir, through tubing, to stainless steel brush/wheels which are touching the chain and the oil is applied to the chain.
⇒ It is the user's responsibility to ensure that this reservoir is always filled with the required lubricant. The system generates a warning message when it calculates that the oil in the reservoir is getting low.
⇒ The lubricant type is DARMEX OIL # 773ND

During the lubrication process, the oil is applied for two complete cycles of the chain. The user may determine the number of chain cycles between automatic lubrications. 275 is the default number.

The number of complete lubrications held within one reservoir is set to the factory default of 50. The system will display a warning whenever it calculates that the reservoir level is getting low when the number of lubrication cycles that have occurred reaches the tank count number in the lubrication setup screen. Since the amount of oil dispensed in one application is system dependent, the number of complete lubrications is best found by trial and error.



Auto Chain Lube System Schematic

Construction:

The Auto Chain Lube System consists of a 1 quart polypropylene oil reservoir, drain plug, electrically powered pump, tubing for oil distribution, and two stainless steel brushes for the application of lubricating oil directly to both oven conveyor chains.

AUTO CHAIN LUBE TANK/PUMP ASSY

Operation:

The lubrication pump motor speed is 1 rpm with a displacement of .06cc per stroke (rev). The pump will output 1 drop of oil for each minute of conveyor chain travel. The oil is sent through the oil distribution hoses up to the stainless steel brushes.

Priming:

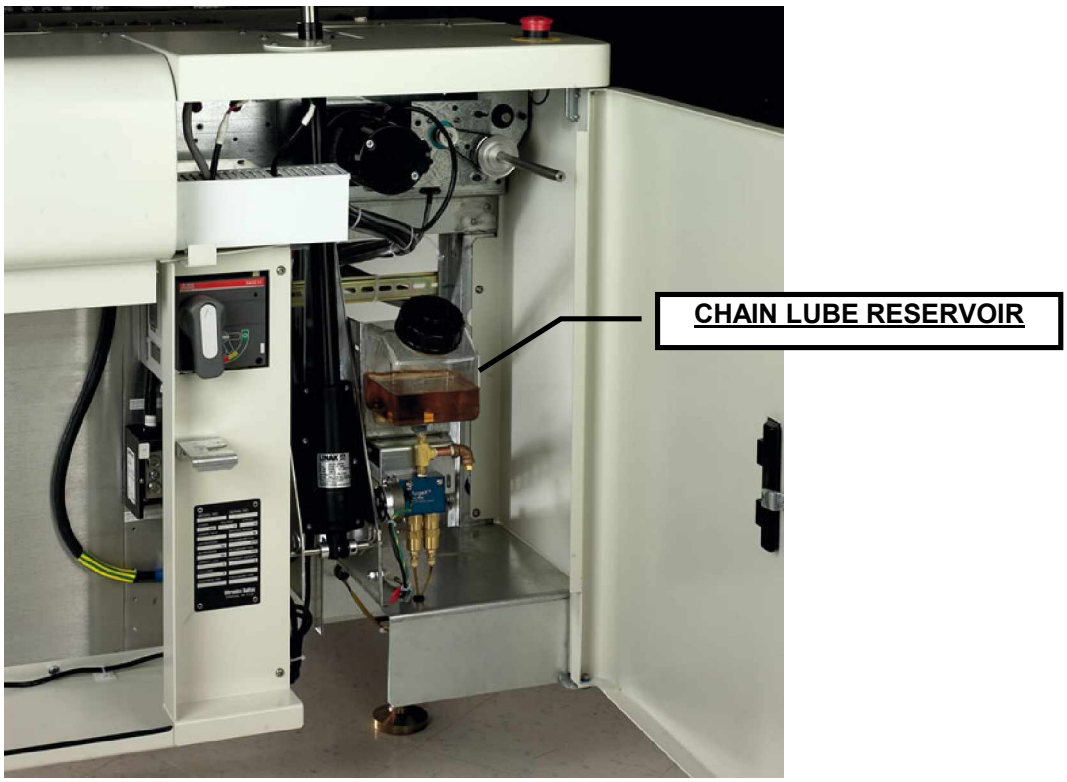
Priming the system through the software can be very time consuming because of the low displacement of the pump...

Priming should only be necessary after:

1. Servicing the auto lube system
2. The reservoir has been allowed to run dry and air has been pumped into the lube lines

Location:

The Lubrication Tank-Pump Assembly is mounted to the frame at the front of the oven, inside the utility cabinet, at the exit end of the oven.



INITIAL SETUP

The following process is done at the time the oven is built. It should be required only after repair or service of the Autolube System.

1) Locate the lubrication reservoir. (see illustration above)
2) Fill the reservoir with the lubricant, Darmex (Vitronics-Soltec P/N 1227204). (Remove the cap and pour the lubrication into the top of the reservoir.
3) Start the oven conveyor before you prime the lube system.
4) In the Oven Control Software click on the Oil Can Icon. This will bring up the Chain Lubrication utility dialog box. Click on the box for *Lube for Prime Period*.
5) Priming the autolube system can take as much 6 hours depending on the size of the oven. The priming operation will not shut-off automatically, therefore it MUST be monitored to prevent excess oil from dripping on the floor. (During normal "Manual" & "Auto" Lube operations, the system does stop automatically)

NORMAL OPERATION

First, refer to Rail Chain Lubri*cation* in the How Do I section under the Help menu in the oven software..

To perform a single manual lubrication of the conveyor chain:

Select manual lubrication in the Oven Control Software by clicking on the Oil Can Icon. This will bring up the Chain Lubrication utility dialog box. Click on the box for *Lube for Chain Distance*. The conveyor chain will run, and lube oil will be applied for two complete cycles of the chain(s).

For automatic lubrication of the conveyor chain on a regular basis:

Select automatic lubrication in the Oven Control Software by clicking on the Oil Can icon. This will bring up the Chain Lubrication utility dialog box. Put a check mark in the box for *Use Automatic Lubrication*.

In automatic mode, the lubrication process does not interrupt oven processing. **The chain will be lubed while there is product in the oven**.

ALARMS:

When the alarm count for lubrications has been reached a "*Low Oil Message*" will be displayed at the bottom of the Operating Screen. Automatic or manual lubrication will not be permitted until the reservoir has been filled, and the alarm reset. Reset the lubrication counter in the Oven Control Software by clicking on the Oil Can icon. This will bring up the Chain Lubrication utility dialog box. Click on the box for Reset Lubrication Counter After Filling Tank.

- This is the best time to adjust the cycles between lubes and/or the number of lubes before "Low Oil Message alarm.

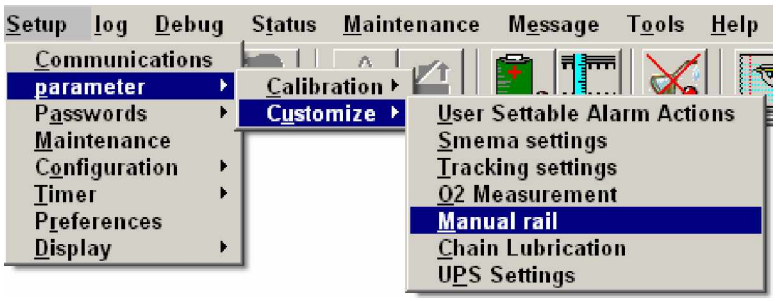
RAIL WIDTH ADJUST

OPERATION:

Run the "Manual rail adjust" within the Oven Control Program. NOTE: This operation may require a password. Manual rail adjust can be activated by clicking on the rail width adjust icon, 

OR

by selecting **S**etup, **P**arameter, **C**ustomize, **M**anual Rail from the menu bar.



Test Procedure

1. Enable the manual rail adjust.

2. Select the rail to move if the oven has more then one rail adjust axis installed. The manual in/out rail switch is a momentary 3 position rotary switch with a spring return to the center position and the center position is the off position. None of the rails will move until the manual in/out switch is rotated and held in one direction. The rail controller (A42) is a stand-alone controller that executes commands sent by the DI board through RS485 communication. The rail controller (A42) only activates one of the rail direction relays (A1-K23 through A1-K26) if the corresponding limit switch input is on or present. The rail controller (A42) activates the enable output relay A1-K22 one second after one of the rail direction relays (A1-K23 through A1-K26) has been set.

3. Turn the rail in/out button in one direction. If the rail motor does not turn, turn the button in the other direction. If the motor still does not turn, refer to the Oven Schematics and perform the following test procedure:
   - Disable the manual rail adjust.
   - Verify that the run status led on the rail controller (A42) is flashing. If the led is not flashing then there is a problem with the rail controller board (A42).
   - Verify that the rail controller (A42) is firmly seated into the A1 board. If the run status led is not flashing then the rail controller (A42) needs to be replaced.
   - If the run status led is flashing then verify that the cable from connector P3 on the front of the DI board to connector P48 on the A1 board is installed correctly and that there are no loose wires on either connector.
   - Verify that the COM3 RXD and COM3 TXD leds on the front of the DI board flash periodically to indicate that there is RS485 communication activity from the DI board to the rail controller (A42) and other boards connected to the RS485 network.
   - The rail controller (A42) will not activate any of the rail output relays without RS485 communications being initiated from the DI board.
   - Verify that the rail limit switch input status indicators are on on the rail controller (A42).

- Verify that each of the 2 manual rail in/out switch status indicator leds changes state on the rail controller (A42) when the manual rail in/out switch is actuated in each direction. Each manual switch led status indicator lights when the manual rail in/out switch is held on one direction.
- If the rail in/out selections do not cause the corresponding status indicators to change on the rail controller board to change, there MAY be a wiring error with the rail selector switch.
- Verify that the jumpers are installed correctly on connector P62 on the A1 board. Also verify that there is ~130 VDC at connector P62 on the A1 board between pins 1 and 4.
- Enable the manual rail switch.
- Select “Rail IN”: A1-K24 or A1-K26 should energize depending on which rail is selected for movement. A1-K22 should energize after a delay.
- Select “Rail OUT”:A1-K23 or A1-K25 should energize depending on which rail is selected for movement. A1-K22 should energize after a delay.
- After the rail selection logic has been corrected, check to see that the wiring to the motor is correct.
- Disable the manual rail adjust.
- Enable the manual rail adjust.
- Check the operation of both the “in” and the “out” adjust switch positions.
- Disable the manual rail adjust.

COMPUTER CONTROLLED AUTO RAIL ADJUST

Auto Rail Adjust is:

☐ Standard, (installed on all ovens) ☑ An option, (NOT installed on all ovens)

DESCRIPTION

The Oven Control Program automatically adjusts the rail in/out to meet the board size entered in the PRODUCT file in the Oven Control Program.

OPERATION
Run the Automatic rail adjust within the Oven Operation Program. NOTE: This operation may require a password.
(The direction of travel of the rail and the speed of the width adjust may be selected by choices in the Oven Operation Program.)

While conducting the following tests ensure that each rail moves to its minimum or maximum value and stop. The rail adjust system is designed to stop at these positions.

1. Verify that the DC drive card is receiving 120 VAC power between terminals L1 and L2. If not, verify that K37 is energized.
2. Check that the I/O board relay A1-K22 is energized.
3. Measure and verify that the voltage at wire number V2+ at P45 pin 1 on the I/O board is +10 VDC.
4. If voltage is present, check the wiring at the signal input of the DC Drive.
5. If the preceding steps check out, measure the DC voltage output of the DC drive circuit board between terminals A1 and A2. Voltage present should be 90-130 VDC. If there is no voltage present, the drive circuit board is likely to be defective. Otherwise, adjust the SIGNAL ADJUST potentiometer on the DC drive board to produce the 90-130 VDC.

If steps 1-5 have been performed and the rail motor still does not operate, refer to the Oven Schematics and proceed with the following:

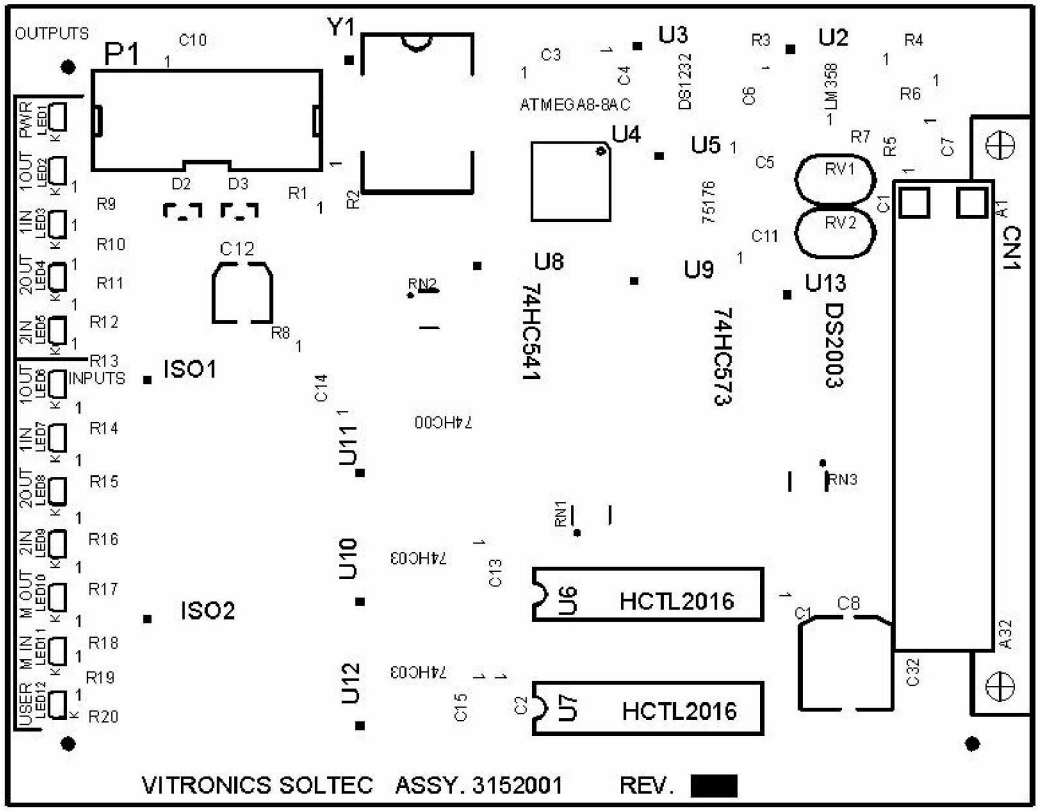
1. Verify the status of the rail limit switches by observing the status leds on the A40 board. These right angle leds on the outer edge of the A40 board. A rail is not allowed to move if the corresponding limit switch led on the A40 board is off in the desired direction to move. The A40 board will not energize relay A1-K22 if a rail is not allowed to move due to a limit switch input not being present. This also applies for all of the direction control relays A1-K23 through A1-K26.
2. Verify that the rail enable relay A1-K22 is energized.
3. Verify that the “rail out” relay A1-K23 or A1-K25 for the corresponding rail axis to move is energized.
4. If the correct relays are energized, check the associated wiring.
5. If the rail motor still does not turn, press an e-stop switch to disable 120 VAC control power.
6. Using an Ohm meter, verify that there is continuity through each rail limit switch.
   (If either the switch is wired incorrectly or the rail is pressed up against the limit switch, there should be no continuity through the switch.)
7. Pull out the E-stop recently pressed and reset the E-Stop in the Oven Control Program.

After the 'rail out' function has been tested, the 'rail in' function check out should be greatly reduced. Activate the 'rail in' function in the Oven Operation Program (this is assuming you have already logged into the software as previously described). The part of the auto rail circuit which can be a problem is the 'rail in' limit switch. The test procedure for these components would be the same as described for the 'rail out' circuit.

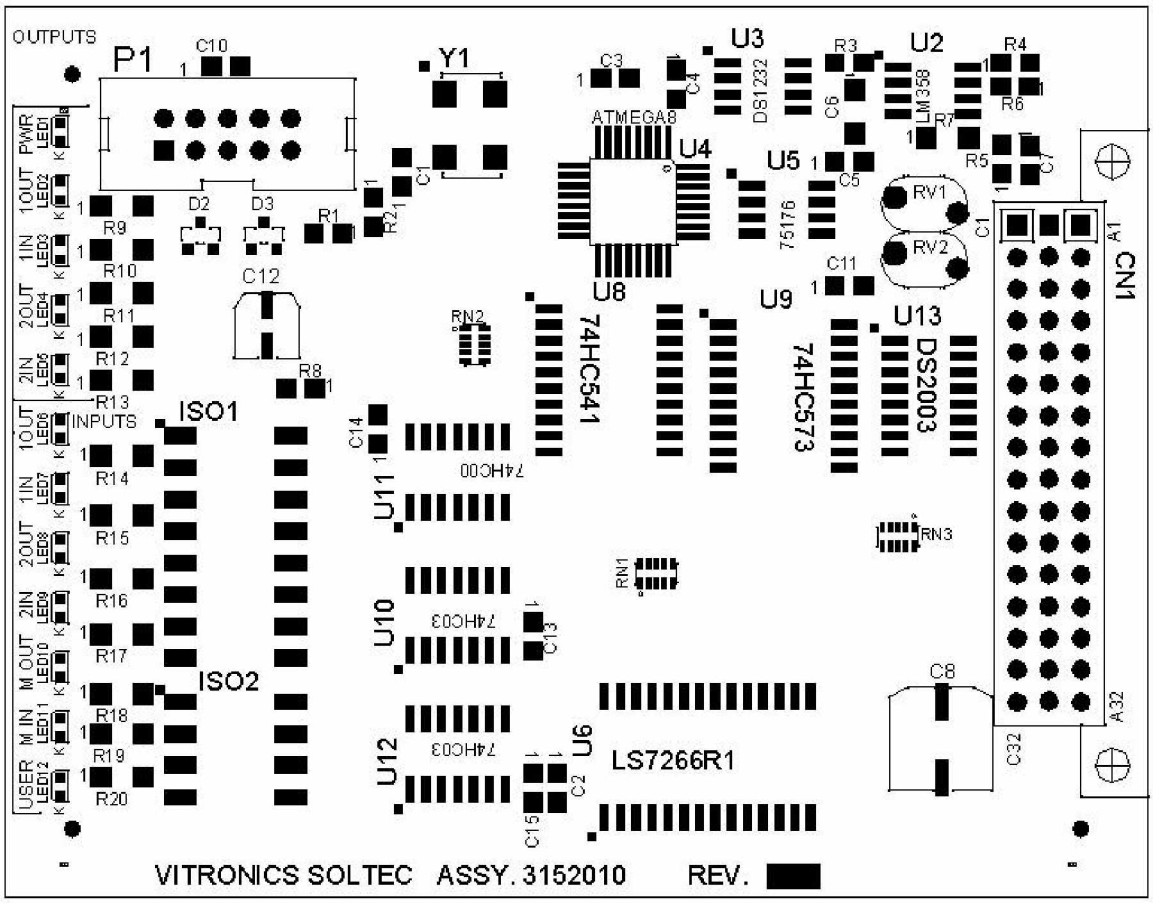
Rail Position Encoder

The final check out procedure is to verify that the rail position encoder feedback signal is being received and processed by the computer.
A rotary quadrature encoder has a minimum of 2 sets of lines on a circular shaped disk instead of only one set on a single ended encoder. One set of lines is 90 degrees out of phase with the other to allow the rotation direction of a shaft to be determined. There is an optical decoder and output signal for each set of lines designated as output channel A and output channel B. The rotation direction of a quadrature encoder is determined by monitoring which output channel signal is ahead of or leading the other.
The rail width adjust on the XPM3 uses a 250 pulse per revolution quadrature encoder mounted on the end of a lead screw. The lead screw is a ¾-10 acme screw, which translates to 10 turns to move a rail one-inch or 2.54 cm of travel.

The two axis rail controller board 3152001 utilizes a quadrature counter for the auto rail option. On the 3152001 two axis controller a quadrature counter IC must be installed by inserting a HCTL-2016 device into a separate 16 pin DIP socket for each of the 2 possible auto rail axes to be controlled. U6 is the quadrature counter location for the first axis and U7 is the quadrature counter location for the second axis. On the next generation 3152010 two axis controller two quadrature counters are part of the base board through a single surface mount device. This was due to the HCTL-2016 being obsoleted and discontinued by the manufacturer Agilent technologies.



3152001A Existing two axis rail control board.
U6 and U7 are only installed for auto rail options.



3152010A future two axis controller board.

Each quadrature counter has a digital input filter that is synchronized with the 8 megahertz microcontroller clock on the two axis rail controller board to filter out noise on the channel A and channel B inputs for each quadrature encoder.

Each quadrature counter is set up to count on every state transition (count up and count down) from a quadrature encoder. This is called 4X mode and results in the 250 pulse per revolution encoder used on the rail width adjust producing an equivalent of 1000 counts per revolution instead of 250.

The quadrature counter used on the two axis rail controller is a 16 bit counter on the 3152001 board and a 24 bit counter on the 3152010 board. Each quadrature counter counts independently of the microcontroller and does not lose counts as long as power is not shut off to the oven.

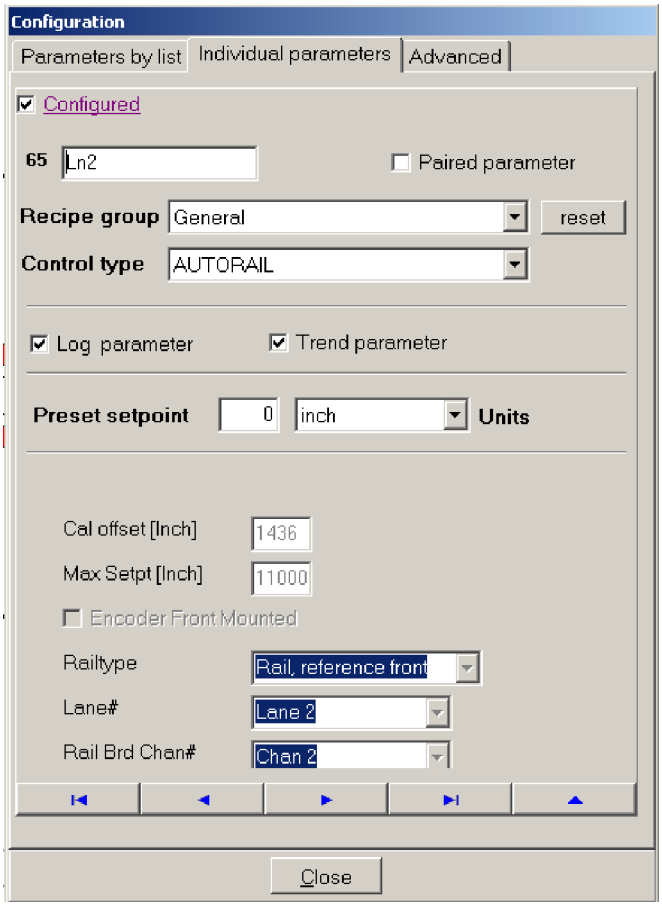
Channel A leading channel B results in counting up. Channel B leading channel A results in counting down.

TROUBLESHOOTING:

The quadrature encoder used on the rail width adjust is not subjected to much mechanical stress because of the slow rotating speed of the rail adjust lead screw and also due to the intermittent operation of the rail width adjust hardware. A properly aligned quadrature encoder shouldn't wear out or need to be replaced.

If an auto rail position fails to count or update verify the following:

1. The PC oven software is configured correctly. The correct lane number, and axis type is specified for an axis. The valid choices for lane number are 1 or 2. The axis type determines how and what direction the oven controller moves and axis. The valid selection choices for axis type are moveable rail reference front, moveable rail reference rear, board support 1 or board support 2. To view this configuration will require the highest level of password. The configuration can be viewed under the Vitronics Soltec menu. Go to Configuration, Parameters, Individual Parameters. Click on the button with the blue arrow pointing to the right until you come to the parameter you wish to view.



An axis will always reference at its fixed rail location by moving towards the fixed rail until the in limit switch input is encountered and then moving away from the fixed rail in the opposite direction until the in limit switch input is present again. Each quadrature counter is cleared or reset to zero when a rail axis is set to its in limit switch and then moved away from the in limit switch until the in limit switch signal is present again. This is considered the true reference position for an axis. Because the make contact distance for a limit switch can vary due to the large amount of over travel built into the switch mechanism, but the break contact distance is relatively constant and therefore more accurate to use as a reference.

2. The cable assembly (3156025) to the rotary encode is securely connected. Each rotary encoder has a finger release on the connector to disconnect the 5pin cable assembly from the encoder.
3. Verify the continuity of the encoder cable assembly 3156025.

Wire Color	A1-P46 or A1-P47 Pin #	5 Pin Connector on Encoder Pin #	Description
Red	1	4	5 VDC
Green	2	3	A channel output signal
White	3	5	B channel output signal
Black	4	1	0V dc common
Shield	5	No connection	Shield
-	-	2	Index output signal (not used)

4. Monitor the output signals on the 5pin connector on the A1 board for each encoder in question.
5. The channel A and channel B outputs should transition from 0v to 5v while a lead screw is rotating and 5v power should be present between pin 1(-) and pin 4(+) on the 5 pin connector on each encoder.
6. Verify that the plastic encoder disk is secured firmly on the lead screw by the set screw in the mounting collar.
7. Refer to the attached encoder manufactures instructions to verify the alignment of the encoder using the alignment tool supplied by the manufacturer to properly align the plastic optical disk with the sensor assembly.
8. Replace the encoder assembly (1480801) if the output signals do not transition correctly or if the plastic optical disk appears to be damaged.

DC DRIVE CALIBRATION **(RAIL WIDTH ONLY)**

1. Definitions-

A DC drive is actually a DC voltage amplifier. A small signal is sent to the drive and a large voltage is sent to the motor. The typical DC drive uses an AC power source of 120 or 240 volts.

The set of controls found on a DC drive is:

A. Minimum speed adjust
B. Maximum speed adjust
C. IR comp
D. Torque
E. Signal

2. What do the controls do?

A. Minimum speed adjust -- adjusts the minimum voltage output of the DC drive at the minimum-input value. This value is typically 0 - 10% of the maximum input voltage.

B. Maximum speed adjust – not used.

C. IR comp -- this adjusts the feedback circuit from the output of the DC drive. If the output voltage drops, the IR comp circuit senses the drop, and more power is fed to the motor. This function is preset to a value that covers 90% of all applications.

D. Torque -- this limits output current, and should only be adjusted by experienced people.

G. Signal -- signal adjust is found on DC drives which provide an option of being controlled by a computer. If the DC drive is adjusted by a speed control potentiometer, signal or signal adjust has no function.

Note: A DC drive with computer control will have a signal/manual selector switch or jumper. If the input does not match the input selected, the DC drive will not operate correctly.
If a computer controls the DC drive, the maximum adjustment potentiometer will have no function.

3. Additional useful information

A. Always recalibrate when any component of a control system is changed.

B. Conveyor speed can be calibrated to specific requirements. This takes practice, but can yield greater speed accuracy.

C. The conveyor speed should be measured with a stopwatch every sixty days.

D. Motor brushes wear out.

E. Calibration values may change with the age of the system.

F. Always record the adjusting potentiometer settings before replacing or calibrating a DC drive.

G. When replacing a DC drive, record the potentiometer settings; draw a sketch of the wire hookups; make sure all wires have labels.

CALIBRATION PROCEDURE FOR DC DRIVE BOARD (**rail width only)**

Tools required:

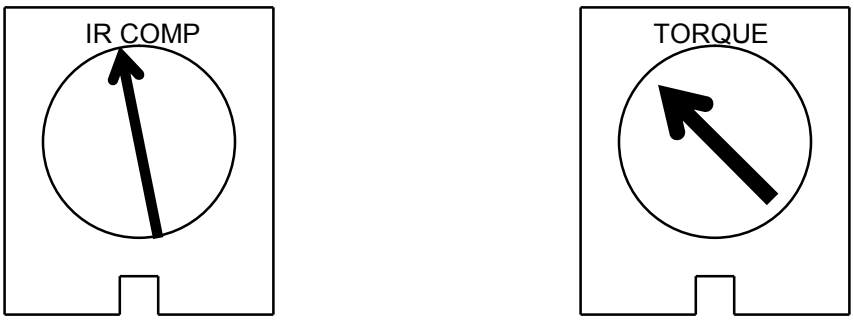
- Multimeter (auto-ranging)
- Small non-metallic screwdriver
- Stop watch or other device to time conveyor movement

Before connecting the power supply*:*

1. Set the 'Jumper' to 'signal'.
2. Set the MAX SPEED pot to full counter-clockwise.
3. Set the MIN SPEED pot to the 10 o'clock position.
4. Set the IR COMP pot to the 12 o'clock position.
5. Set the TORQUE pot to the 10 o'clock position.
6. Set the signal Pot to the 12 o'clock position.

With the power supply connected:

1. Set the multimeter to VOLTS AC and measure the input voltage to the control. If the voltage is less than 108V or greater than 132V disconnect the power supply and correct the supply voltage problem.
2. Disconnect the multimeter and set to measure VOLTS DC. Attach leads to the motor side of the control.
3. Log in to the oven software with the master password. Under Vitronics Soltec, Advanced, Service Mode Testing, go to the Conveyor tab. Type in a percentage number (0-100) in the box for Conveyor%, then select either Move in min speed or Move out min speed. Adjust the MIN speed pot so the conveyor is just barely moving. When done select Stop Rail.
4. Select either Move in Max speed or Move out Max Speed. Adjust the Signal Adjust pot until the conveyor movement speed is equal to 5 inches per minute. When done select Stop Rail and exit this function.
5. Verify that the width adjust hits setpoint. If not, the minimum speed may be set too low or too high.



MINARIK DRIVE POTENTIOMETER SETTINGS

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