

# UVCS Version 2.0

For use with Fusion Flood Lamps



## Operation Manual

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The DYMAX UVCS UV Light-Curing Conveyor System was developed and manufactured by the DYMAX engineering team. Before shipping, your conveyor system was tested to ensure peak operating performance.

The proper set up and operation of this Conveyor System will maximize safety and user-friendly integration, providing optimum yield and productivity.

**THEREFORE, WE ENCOURAGE YOU TO READ, UNDERSTAND, AND FOLLOW ALL SAFETY AND OPERATING INSTRUCTIONS AND RECOMMENDATIONS COMPILED IN THIS AND OTHER RELATED MANUALS** prior to setting up and operating this new system or its individual components.

If you encounter a problem, have any questions, or would like to provide suggestions or recommendations, please contact DYMAX Applications Engineering or Customer Service.

## UNPACKING AND INSPECTION

Upon receipt of the unit, carefully remove the contents from the boxes and check for damage. DYMAX is not responsible for damage from shipping – all claims for shipping damage should be made with the carrier.

Check all boxes for contents and write down any serial numbers for further reference. You may wish to retain the original shipping cartons in case you need to repackage any item for return.

If you observe or experience any problem with your equipment, notify DYMAX Customer Service, your authorized distributor, or your DYMAX representative immediately.

System includes:

- UVCS Conveyor Unit
- Lamp and Power Source Options (dependent on model number ordered as listed in Table 2)
- Two Pairs UV Goggles
- Operation Manual

**NOTE: REPORT ANY SHORTAGE TO DYMAX CORPORATION CUSTOMER SERVICE.**

Before continuing with unpacking and installation, please read the following chapters of this manual for safety recommendations and installation, operation, and troubleshooting instructions.

## SAFETY

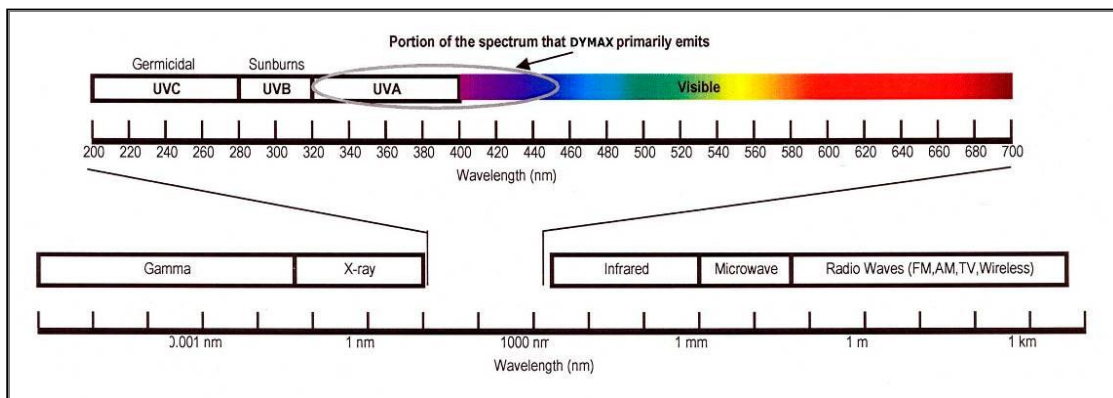
DYMAX ultraviolet light-curing technology has been used successfully for over 30 years. The fast cure, one-component nature of our UV light-curing technology has made it the process of choice for many manufacturers requiring a "cure-on-demand" assembly process. There are four common questions/concerns related to UV light-curing systems: UV exposure, high-temperature surfaces, ozone, and bright, visible light.

### UV EXPOSURE

Standard DYMAX UV light-curing systems and bulbs have been designed to primarily emit UVA light (as shown in Chart 1). UVA light is generally considered the safest of the three UV ranges: UVA, UVB, and UVC. Although OSHA does not currently regulate ultraviolet light exposure in the workplace, the American Conference of Governmental Industrial Hygienists (ACGIH) does recommend Threshold Limit Values (TLV's) for ultraviolet light. The strictest interpretation of the TLV (over the UVA range) for workers' eyes and skin is 1 mW/cm<sup>2</sup> (intensity), continuous exposure. Unless workers are placing bare hands into the curing area, it is unusual to exceed these limits. To put 1 mW/cm<sup>2</sup> limit into perspective, cloudless summer days in Connecticut regularly exceed 3 mW/cm<sup>2</sup> of UVA light and also include the more dangerous UVB light (primarily responsible for sun tans, sun burns, and skin cancer) as well.

The human eye can not detect UV energy, only visible light. A radiometer should be used to measure stray UV energy to confirm the safety of a UV light-curing process. A workstation that exposes an operator to more than 1 mW/cm<sup>2</sup> of UVA energy continuously should be redesigned.

Curing of UV light-curable chemistry can be a regulatory compliant, "worker-friendly" manufacturing process when the proper safety equipment and operator training is utilized. There are two ways to protect operators from UV exposure: shield the operator and/or shield the source.



### SHIELD THE OPERATOR

- **UV-Blocking Eye Protection** – UV-blocking eye protection is recommended when operating UV light-curing systems. Both clear and tinted UV-blocking eye protection is available from DYMAX.
- **UV-Blocking Skin Protection** – Where the potential exists for UV exposure upon skin, opaque, UV light-blocking clothing, gloves, and full-face shields are recommended.

### SHIELD THE SOURCE OF UV

Any substrate that blocks UV light can be used as a shield to protect workers from stray UV light. The following materials can be used to create simple shielding structures or blind corners:

- **Sheet Metal** – Aluminum, steel, stainless steel, etc. Sheet metal should be coated black or black anodized to minimize reflection of UV and visible light toward operators.
- **Rigid Plastic Film** – Transparent, UV-blocking plastics (typically polycarbonate or acrylic) are commonly used to create shielding where transparency is also desired. These rigid plastic films are available either water-clear or tinted.

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- **Flexible Film** – UV-blocking, flexible urethane films can be used to quickly create workstation shielding. This UV-blocking, flexible urethane film is available from DYMAX.

## **HIGH-TEMPERATURE SURFACES**

Surfaces exposed to high-intensity curing lights will rise in temperature. The intensity, distance, exposure time, cooling fans, and the type/color of the surface can all affect the actual surface temperature. In some cases, exposed surfaces can reach temperatures capable of producing a burn or causing damage to a substrate. In these cases, care must be taken to ensure either a more moderate surface temperature or appropriate protection/training for operators.

## **OZONE**

Standard DYMAX bulbs (UVA type) generate an insignificant amount of UVC and therefore essentially no ozone. Some UV light-curing systems, like those used to cure UV inks, emit primarily “shortwave” (UVB and UVC) energy. Upon exposure to UVC light (specifically <240 nm), oxygen molecules (O<sub>2</sub>) split into oxygen atoms (O) and recombine with O<sub>2</sub> to create ozone O<sub>3</sub>. The current, long-term ozone concentration limit recommended by ACGIH, NIOSH, and OSHA is 0.1 ppm (0.2mg/m<sup>3</sup>).

## **BRIGHT, VISIBLE LIGHT**

The bright, visible light emitted by some UV light-curing systems can be objectionable to some workers and can cause eyestrain. Tinted eye protection and/or opaque/tinted shielding can be utilized to address this concern.

## **SUMMARY**

UV light sources can be more “worker friendly” than many commonly accepted industrial processes provided the potential concerns are addressed. Contact your DYMAX representative for information regarding the proper use of DYMAX UV light-curing systems.

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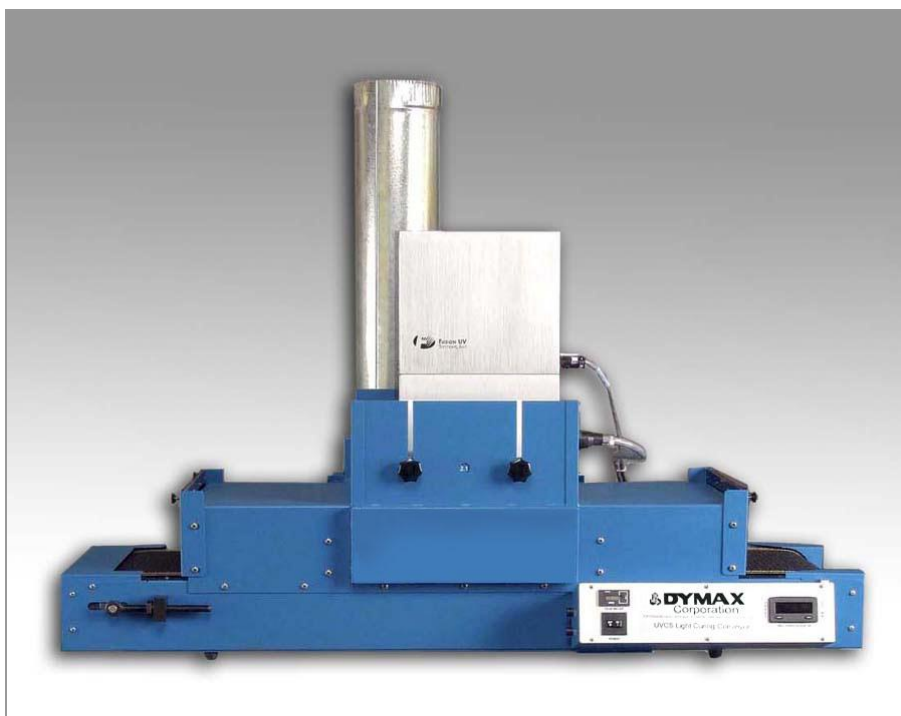
## GENERAL INFORMATION

The DYMAX UVCS Light-Curing Conveyor System is designed to provide reliable and consistent processing of UV/Visible light-curable adhesives and coatings. Standard features include a Direct-Drive Motor, adjustable Lamp height, integrated and adjustable Cooling System, and a UV-Resistant Belt.

The UVCS is designed for bench- or table-top operations. The self-contained Cooling System and integral UV light allows the Conveyor to be placed virtually anywhere space permits.

DYMAX UV light-curing sources are capable of curing a wide variety of light-curable adhesives, coatings, and inks. They have extensive use in a variety of applications such as bonding, potting, sealing, and encapsulating. These light sources offer exceptional versatility and expandability to accommodate most process demands.

A large number of accessories are available for the base Conveyor. These items address safety, as well as functional flexibility, which is depicted and discussed in this manual.



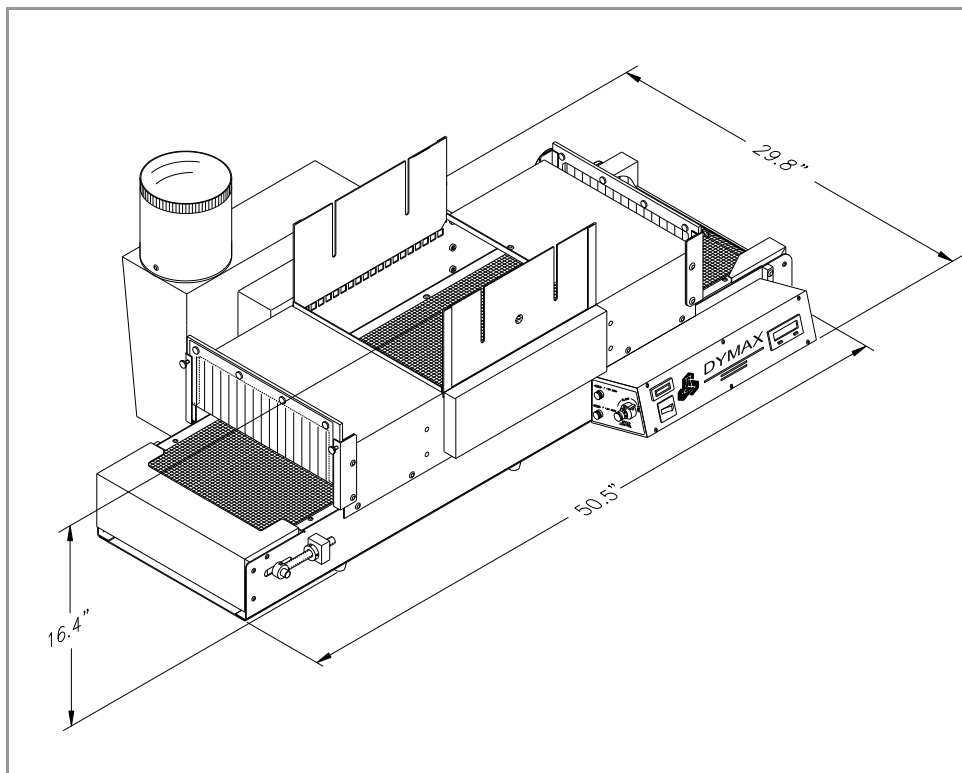
**Figure 1.** DYMAX UVCS with Two Fusion Lamps

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## SPECIFICATIONS

### GENERAL

- A Lamp Power Supply that allows external electrical inputs and provides power to the Lamp located in the Reflector Assembly Housing. The Power Supply contains the On/Off Power Switch, Control, and Interlock Circuitry.
- The Power Supply also houses its own Cooling Fans. The rear panel has an AC Power Receptacle, connections for the Lamp, Conveyor Interlocks, and Slave-Unit Control.
- The Lamp Power Supply allows adjustment for different voltage and frequency conditions suitable for virtually any electrical system in the world. Switching between 50 and 60 HZ frequency operation requires movement of Capacitor Jumpers in the Power Supplies. See the Fusion Lamp Operators Manual included with your Conveyor System for specific instructions.
- A Power Cord.
- Fusion “D” Bulbs (PN 36399) are standard, “H” Bulbs (PN 36441) and “V” Bulbs (PN 38146) are available upon request.



**Figure 2.** Conveyor Dimensions

**GENERAL SPECIFICATIONS:**

**Table 1.** Electrical Specifications

<b>Voltage Requirements</b>	208 or 230 VAC, 50 or 60 HZ
<b>Current Requirements</b>	Defined in Table 2
<b>Lamp/Power Supply Input Voltage</b>	200-240 VAC Fusion Lamp systems
<b>Input Current</b>	Defined in Table 3 for individual model numbers
<b>Conveyor and Lamps Total Input Current</b>	Defined by Table 4

**Table 2.** Physical Specifications

<b>Model</b>	UVCS Version 2.0
<b>Cure Width</b>	6" - 12" [152 - 305 mm]
<b>Lamp Configurations</b>	Up to Two Fusion F300 Series Lamps
<b>Motor Drive</b>	Direct
<b>Belt Speed</b>	1.0 – 32.0 ft/min [0.3 – 9.7 m/min]
<b>Belt Speed Display</b>	Red LED, 1 decimal place
<b>Lamp Focus Adjustment</b>	2.1" - 4.5" [53.3 mm - 114 mm]
<b>Maximum Part Height</b>	4.5" [114 mm]*
<b>Exhaust System</b>	1 integral centrifugal Blower

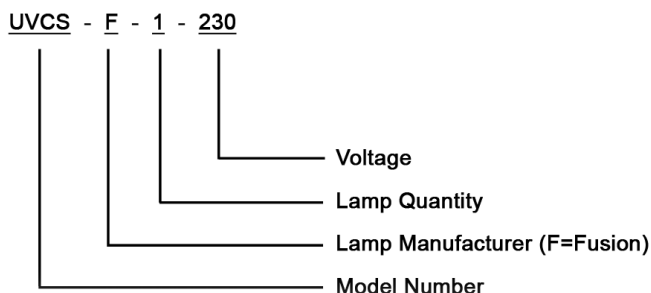
\* Larger part heights are achievable with the installation of optional Riser Kits.

The UVCS Series Conveyor has a 12" belt width. A single Fusion Lamp will utilize the center 6" of the Belt, while the Dual-Fusion Lamp configuration could span the full 12" width.

**Table 1.** Possible Conveyor Configurations

<b>Model Type</b>	<b>Part Number</b>
UVCS-F-1-230	39150 (1 Lamp)
UVCS-F-2-230	39160 (2 Lamps)

**Naming Convention**



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**Table 2.** Conveyor AC Current Values (Start/Run Current)

Part	Reading at 200-230 VAC 50/60 Hz
Total Conveyor	2.4 A / 1.2 A rms
Fan	1.0 A rms
Motor Control	200 mA rms

**Table 3.** Lamp Current Values and AC Current Requirements for Conveyor Systems

Product	AC Current at 115VAC	AC Current at 230VAC	Maximum Quantity on Conveyor
Fusion	N/A	15 A (each Lamp)	2

**Table 4.** Conveyor and Lamps Total Current

Item	Model Number	Total Conveyor and Lamp Current
1	UVCS-F-1-230	16.2 A
2	UVCS-F-2-230	31.2 A

# LAMP INSTALLATION AND SYSTEM INTERCONNECT

## Fusion Series Lamps

**NOTE:** Refer to the Fusion Lamp operator's manual for detailed Irradiator and Power Supply information.

1. If the optional Conveyor Cart (PN 39215) has been purchased, assemble the Conveyor Cart prior to building the Conveyor System.
2. Uncrate and assemble the Conveyor. See DYMAX UVCS-Fusion Conveyor System Quick Start Instructions for Conveyor assembly instructions.
3. Install the Connector Cables from the Fusion Power Supply's J-105B and J-106 Connectors to the rear of the Conveyor (Figure 3).
4. Unpack the Fusion Lamp Assembly(ies). Each Lamp Assembly includes an Irradiator (Lamp), and Lamp-Connector Cord (Figure 4). For Dual-Fusion Lamp units, the Master Lamp Assembly includes an RF Detector, an RF-Detector Connector Cord, and "Master" to "Slave" Power-Supply Connector Cords.

**CAUTION:** Each Fusion Lamp Assembly has a fine mesh RF Screen covering the Lamp Face. Great care should be taken during installation and handling of these units to avoid puncturing or damaging the RF Screen. RF energy can be released if the RF Screen is damaged in any way.

5. Inspect the RF Screen on the bottom of the Irradiator. Make sure there are no rips or tears in the RF Screen.

**NOTE:** Any tears in the RF Screen will result in an RF Interlock failure when the equipment is operated.

6. Mount the Irradiator(s) into the Conveyor's Lamp Support (Figure 5). Take particular care not to damage the Protective Screen covering the Bulb end of the Irradiators.
7. Locate the RF Detector Mounting Bracket on the opening provided in the Lamp Basket Assembly (Figure 7). The RF Detector senses microwave leakage through the Rubber Window in the wall of the Conveyor. Microwave leakage indicates a torn Protective Screen on the bottom of the Irradiator.

**NOTE:** The RF Detector Assembly is pre-installed on all new Conveyors purchased with Fusion Lamps.



Figure 3. Cable Configuration



Figure 4. Irradiator



Figure 5. Conveyor with Lamp(s) Installed



Figure 6. RF Detector Assembly

8. Install the RF Detector next to the Fusion Irradiators on the Conveyor's intake side (if not already installed). Attach the RF Detector's Connector Cord to the RF Detector (Figure 7).
9. Connect the Irradiator Cable(s) to the Irradiators (Figure 8).
10. Unpack the Power Supply(ies). A 220-Volt Power Cord is provided with each Power Supply (Figure 9). The Power Supplies may be configured for either 50 or 60 HZ operation and for 208-, 220-, 230-, or 240-Volt operation. Changing between 50 and 60 HZ operation requires repositioning of two Capacitor Jumpers in each Power Supply. The Power Supply's shipping box is labeled with the voltage and frequency set at the factory. Detailed Power Supply setup instructions are provided in the Fusion Lamp operator's manual.
11. Position the Power Supply(ies) on the Conveyor's Mounting Stand or in a location near the Conveyor. Attach the Connector Cable leading from the RF Detector to the J-105A Receptacle on the back of the Master Power Supply. Attach the cables leading from the back of the Conveyor to the J-105B and J-106 Receptacles of the Master Power Supply (Figure 10). These cables are labeled to aid in assembly.
12. For dual-Fusion units, connect the Jumper Cable between J-107 of the Master Power Supply and J-106 of the Slave Power Supply. Install the Jumper Plug in J-105A of the Slave Power Supply.
13. Connect the other end of the Irradiator Cable to the J-103 and J-104 Receptacles of the Power Supply(ies). Connect the Power Cord to the back of the Power Supply and to a 208-240-Volt Power Source.
14. Plug in the Conveyor and turn it on. When the Conveyor is operating, and the Belt is in motion, turn the Power Supply on by closing the Breakers on both of the Power Supply's Front Panels.
15. Turn the Irradiators on by pressing the Lamp On Button of the Master Power Supply (Figure 11). Both the Master and the Slave Power Supplies will go through a warm-up cycle. The Blower inside the Irradiators will turn on and the Lamps will ignite. The Lamps reach full intensity within 5 seconds after ignition. Your UVCS Conveyor is now ready for operation.

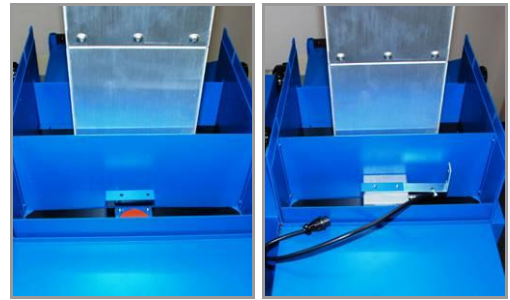


Figure 7. RF Detector Connector Cord

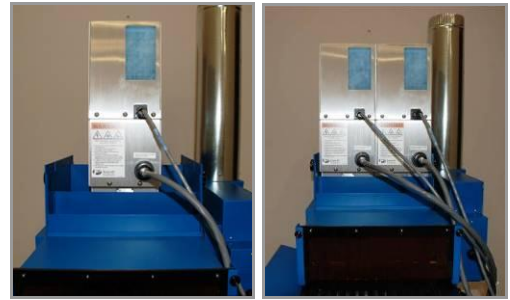


Figure 8. Irradiator Cable Connections



Figure 9. Power Supplies (front)



Figure 10. Power Supplies (back)



Figure 11. Power Supply (front)

## CONVEYOR OPERATION

1. Install all safety accessories to protect operator from UV-light emissions.
2. Apply power to the Conveyor and turn it on.
3. Unlock the Speed Control Knob (Figure 13) and adjust the speed for the desired setting. The Speed Control Knob is a 10-Turn Potentiometer and allows speed adjustment from approximately 0.9 FPM to 32 FPM (feet per minute).
4. If any adjustments are needed for the Belt alignment, refer to the Maintenance Section of this manual.
5. Adjust the height of the Lamps to the desired distance.
6. Once all the settings (speed and Lamp height) have been properly set, the Conveyor is ready for operation.
7. When the Conveyor is operating and the Belt is in motion, turn the Power Supply on by closing the Breaker(s) on both of the Power Supply's Front Panels.
8. Turn the Irradiators on by pressing the Lamp On Button of the Master Power Supply (Figure 11). Both the Master and the Slave Power Supplies will go through a warm-up cycle. The Blower inside the Irradiators will turn on and the Lamps will ignite. The Lamps reach full intensity within 5 seconds after ignition. Your UVCS Conveyor is now ready for operation.

**NOTE:** The Fusion Power Supplies are interlocked with the Conveyor so that the Conveyor must be operating and the Conveyor Belt in motion before the Lamps will ignite. This prevents Belt overheating and damage that can result if the Belt is stationary when the Lamp is turned on.



Figure 12. Conveyor Front Panel



Figure 13. Speed Control Knob



Figure 14. Access Panel

## ADJUSTING CONVEYOR BLOWER SPEED

The Blower controls the amount of cooling air provided to the Lamp Assemblies to keep them at proper operating temperatures. A small percentage of the cooling air is also diverted downward through the Conveyor Belt. This air flow provides a small hold-down force to keep light objects from moving while traveling on the belt. The Exhaust Blower speed is set at the factory during final system testing for the Conveyor model ordered.

If adjustment is required, remove the Access Panel from the front of the Exhaust Blower Housing (Figure 14), unlock the Speed Control Knob (Figure 15), adjust the Exhaust Blower speed setting, and relock the Speed Control Knob. The range of the Exhaust Blower Speed Control Knob is 0.0 to 0.85 turns. Table 7 shows the approximate settings for Exhaust Blower speed.



Figure 15. Speed Control Knob

**Table 7.** Blower-Speed Potentiometer and Lamp-Cradle Height Settings for Optimum Bulb Cooling

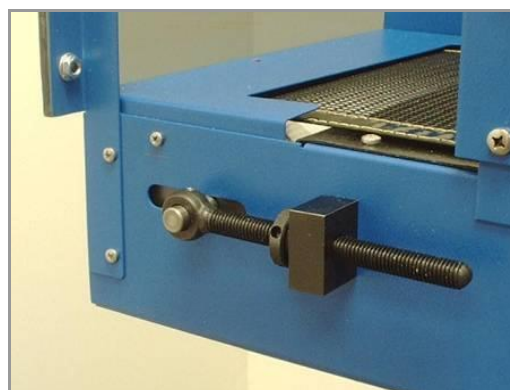
Model Number	Blower-Speed Potentiometer Setting		
	1"	3"	4.5"
UVCS-F-1-230	0.20	0.40	0.54
UVCS-F-2-230	0.45	0.54	0.80

## CONVEYOR MAINTENANCE

### BELT-TRACKING ADJUSTMENT

All DYMAX UVCS Conveyors are factory adjusted to provide proper tracking of the Belt. Should further adjustments become necessary, this is done via two knurled Adjustment Knobs located at the input end of the Conveyor (Figure 16). To adjust tracking, simply tighten the side to which the Belt is tracking.

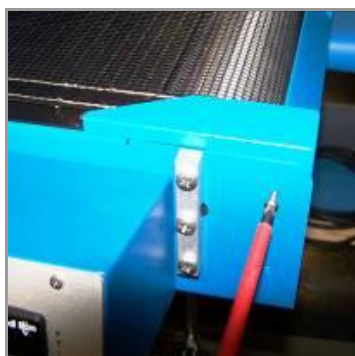
**NOTE:** Do not over tighten the Belt. This will lead to accelerated degradation of the Belt. The Belt should be stoppable with moderate hand pressure.



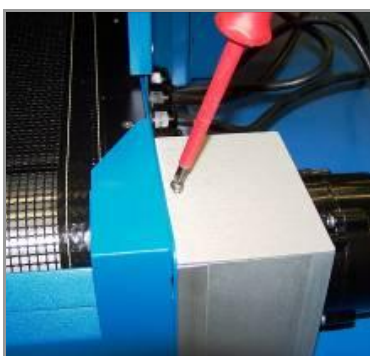
**Figure 16.** Belt-Tension Adjustment Knob

### CONVEYOR BELT REPLACEMENT

1. Remove the Pinch Guard from the Motor side of the Conveyor by removing the two M4x8 Screws (Figure 17) on the front side of the Conveyor and the M4x25 Screw (Figure 19) from the motor drive side of the Conveyor. Remove the motor box cover (Figure 18) to obtain access to the M4x25 Screw.



**Figure 17.** M4x8 Screws



**Figure 18.** Remove Motor Box Cover



**Figure 19.** M4x25 Screw

2. Remove all tension from the Belt by fully backing off the Belt-Tension Adjustment Knobs (Figure 16).
3. Position the Belt Splice to the end of the Conveyor (Figure 20). Remove the Fiberglass Rod that ties the ends of the Belt together (Figure 22). Remove the Belt.
4. Run the new Belt around the Conveyor Frame (Figure 23).
5. Install the Fiberglass Rod through the Belt Loops.
6. Apply some adhesive to both ends of the Fiberglass Rod to prevent it from moving during Conveyor operation (Figure 24).

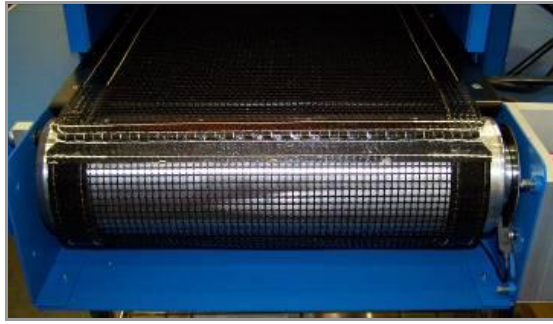


Figure 21. Spliced End of Belt

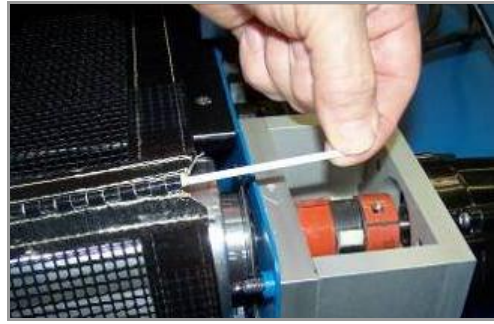


Figure 22. Fiberglass Rod



Figure 23. Replacing Belt

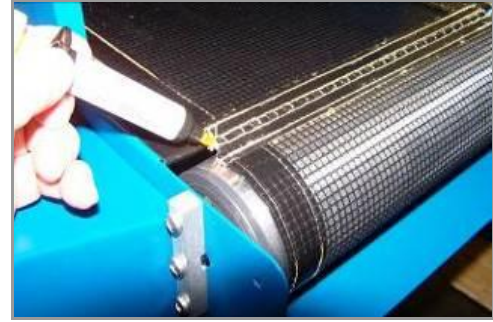


Figure 24. Applying Adhesive

7. Tighten the Belt-Tension Knobs (Figure 16) finger tight to remove excess slack from the Belt. The Belt should be loose enough to be moved across the two Rollers by hand when the Conveyor is not running.

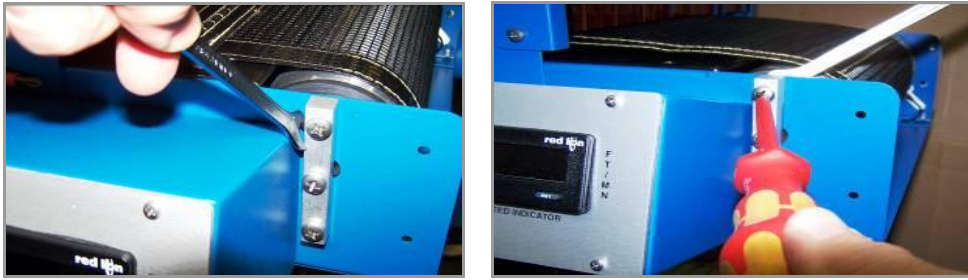
**CAUTION:** Excessive tightening of the Belt will result in early Belt failure. Since the two Conveyor Rollers have a crown in the middle, only minimum tightening is necessary.

8. Start the Conveyor and adjust the Belt-Tensioning Knobs until the Belt runs in the center of the loading end of the Conveyor. The Belt should be able to be stopped by hand when the Conveyor is running. If stopping the Belt stalls the Conveyor Motor, the Belt is too tight and must be loosened.
9. When the Belt runs in the center of the Loading End, observe the Belt's position at the Motor End. If the Belt runs too far to one side on the Motor End, adjust the Motor Pulley as follows:
  - a) Turn the Conveyor off.
  - b) Remove Belt tension by loosening the two Belt-Tensioning Knobs.
  - c) Loosen the two Drive-Roller Shaft-Support Fasteners (Figure 25), located on the front of the Conveyor Frame, enough to slightly move the Shaft Assembly.



Figure 25. Loosening Drive-Roller Shaft-Support Fasteners

- d) Move the Shaft Assembly slightly to realign the Drive Roller and center the Belt. Tighten the bolts when adjustment is complete (Figure 26).



**Figure 26.** Tightening Drive-Roller Shaft-Support Fasteners

- e) Turn the Conveyor on and adjust the Belt-Tension Knobs (Figure 16) until the Belt is properly tightened. Make sure that the Belt runs in the center of the Conveyor on both the Loading and Unloading Ends. Repeat this step as necessary to align the Belt.
- f) Reinstall the Pinch Guards on both ends of the Conveyor (Figure 27). This step is critical to Belt-Speed Sensor operation. The Pinch Guard on the Unloading End of the Conveyor contains a Shield for the Sensor to prevent damage if the Belt contacts it while operating.



**Figure 27.** Installing Pinch Guard (front & back)

## TROUBLESHOOTING

**CAUTION:** Only qualified maintenance personnel should attempt the following procedures.

Problem	Possible Cause	Testing	Corrective Action
<b>Conveyor is not operating</b>	Main-Line Circuit Breaker deployed	Toggle Power Switch off, then on, to reset the Circuit Breaker.	Check current rating of the Breaker and compare to Table 4.
	Improperly fastened connections	Check all connections.	Properly fasten Power Cord.
	Fuses for Motor Controller blown	Remove Fuses from Fuse Holders (located in the left side of Control Box of unit) and check with an Ohmmeter.	Replace if defective.
	Belt is hung up	Inspect the Belt for any signs of a mechanical bind.	Resolve bind and continue operation.
	Tension too low on Belt (Power Switch will light and Motor will turn but the Belt does not move)	Verify the operation of the Drive Shaft and Drive Rollers.	Use the Tracking Adjustment Knobs to increase the tension on the Belt. Both Knobs will have to be turned the same amount to not affect the alignment.
<b>Belt tracks to one side</b>	Belt-Adjustment Knobs are out of position	Visually inspect the Belt. Belt will track to one side.	Tighten the Adjustment Knob (the one located on the side to which the Belt is tracking towards) until Belt tracks straight. Only minor adjustments should be made at one time.
<b>Fusion Lamp(s) not igniting</b>	Please reference the Fusion Lamp operator's manual for troubleshooting assistance.		

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## SPARE PARTS

### CONVEYOR SPARE PARTS

Item	Part #
Blower, 230 VAC,	40147
Circuit Breaker, 115 VAC	39128
Conveyor Speed Potentiometer	40006
Curtain Assembly (2 Required)	39207
DC Motor Controller Resistor	40178
DC Motor Controller	40179
DC Motor Speed Indicator Sensor	39136
Exhaust Blower Speed Potentiometer	40149
Gear Motor, 90 VDC	39285
Hour Meter	35981
Mesh Belt	39134
Mesh Belt, Fine	39772
Pinch Guard, Conveyor Discharge	39119
Pinch Guard, Conveyor Inlet	39118
Red Lion Counter Timer 50020	39132
Red Lion 12V Power Supply	39133
Solid Acrylic Shield (2 Required)	39205
Speed Controller Knob	40143

### FUSION LAMP SPARE PARTS

Item	Part #
D Bulb UV (Standard)	38560
H Bulb (Optional)	36970
V Bulb (Optional)	36658
Fusion Lamp Filter Kit	36560
Fusion Irradiator Screen Kit	37010
Fusion Lamp/Power Supply	36402

### OPTIONAL CONVEYOR ACCESSORIES

Item	Part #
Conveyor Rolling Cart Kit	39215
Riser Kit, 2" (for 6" of Clearance)	39218
Riser Kit, 6" (for 10" of Clearance)	39200
Shield Extension Kit	39209

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## DEFINITION OF TERMS

**Bulb** - light source generating ultraviolet, visible, and infrared radiant energy from burning matter stimulated by electrical power conditioned by a proper power supply, which is an integral part of a lamp. A light source is usually placed into a reflector (of various geometry) to increase light source efficiency by collecting and directing radiant energy of selected spectra (for a given curing process).

**Intensity** - a measure of light energy over the unit of surface area (usually surface at the specified working distance from the bottom of a reflector housing) in  $W/cm^2$  or  $mW/cm^2$ . For the UV portion of light, this measure is often called in literature "irradiance", i.e. radiant energy arriving at a point on a surface per-unit area.

**Brightness (also known as luminance)** - description of energy in the visible region of the spectrum (approximately from 400 to 700 nm) and recorded in photometric units. "Intensity" (see below) of visible-light energy is called luminance.

**Luminance** - luminous flux (energy of visible light) incident per-unit area, and measured in Lx (lux) or  $Lumen/cm^2$ .

**Ultraviolet (UV)** - The invisible region of the spectrum just beyond the violet end of the visible region. Wavelength ranges in general from 1.0 to 400 nm. DYMAX bulbs (burners) do not radiate energy in deep ultraviolet; there are very minute amounts below 220 nm and practically nothing can be sensed below 200 nm. This is due to the use of an ozone-blocking quartz bulb envelope (see Ozone).

- **Ultraviolet A (UV-A)** - UV of long wavelength from within approximately 400 to 320 nm of the spectral band (4000 to 3200• ) - predominately produced by DYMAX flood lamps.
- **Ultraviolet B (UV-B)** - UV of medium wavelength from within approximately 320 to 280 nm - DYMAX flood lamps produce some amount of their energy within this bandwidth.
- **Ultraviolet C (UV-C)** - UV of short wavelength below 280 nm (we say from 280 to 200 nm) – a large amount of this energy is present in the sunlight.
- **Visible** – Light that can be seen 400-700 nm.

**Dose** - is irradiance integrated over time, or  $Irradiance (W/cm^2) \times Time (s) = Dose (Joules/cm^2)$ . Note: Watt is the power that gives rise to the production of energy at the rate of 1-joule (J) per second (s).

**Ozone** - oxidizing agent (O<sub>3</sub>) produced by the action of ultraviolet radiant energy (below 185 nm) or electrical corona discharge of oxygen on air.

**OSHA 1910.145** - "Regulation of Accident prevention Signs and Tags" defines the following headers as:

- **WARNING** – is used when there is a hazardous situation that has some probability of severe injury.
- **CAUTION** – is used to indicate a hazardous situation that may result in minor or moderate injury.
- **NOTICE** – is used to convey a message related directly or indirectly to the safety of personnel, or protection of property.

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## WARRANTY

### CAUTION!

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DYMAX offers a one-year warranty against defects in material and workmanship on all system components *with proof of purchase date*. Unauthorized repair, modification, or improper use of equipment may void warranty. The use of aftermarket replacement parts not supplied or approved by DYMAX Corporation, will void any effective warranties and may result in damage to the equipment.

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