



**FUSION UV SYSTEMS, INC.®**

# F300S/F300SQ Ultraviolet Lamp System

Installation, Operation, and Maintenance

Manual No. 509252 Rev R 3/04

FUSION UV SYSTEMS, INC.

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# F300S/F300SQ Ultraviolet Lamp System

## Installation, Operation, and Maintenance

Manual No. 509252 Rev R 3/04

Applies to systems using P300M/P300MQ/P300MT power supplies,  
and I300M/I310M series irradiators Serial Numbers 1001 and later.

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The products covered herein conform to EC standards.



See Appendix A for details.

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# Introduction

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This manual is designed to be used, not set aside until problems occur. The following list of chapters and appendixes describes where to find information in this manual.

- This Introduction provides a brief description of the total system, and system components. It also contains the Fusion UV Systems warranty policy and shipping instructions for returning equipment.
- [Chapter 1, “Safety,”](#) contains important information! This chapter should be read by all persons who will operate or troubleshoot system equipment.
- [Chapter 2, “Mechanical Installation,”](#) gives unpacking instructions, and instructions for equipment placement, mounting, shielding and exhaust venting.
- [Chapter 3, “Electrical System,”](#) explains the power supply software setup, including single and multiple unit programming and connections. HV capacitor frequency tapping instructions are also provided.
- [Chapter 4, “Operation,”](#) describes steps for initial startup for both single and multiple unit systems, how to operate master/slave and remote systems, and how to reset the system after a fault. It also contains setup and operations instructions for the Quick Restart Option (QRO).
- [Chapter 5, “Troubleshooting,”](#) consists mainly of information in table form. There is a reference table for faults and indications, tables describing unit and system fault indications, and a fault diagnosis table. The fault diagnosis table provides faults, causes, and corrective actions.
- [Chapter 6, “Maintenance,”](#) covers routine maintenance and removal/replacement instructions for the irradiator, power supply and modular blower. There is a maintenance procedure page locator at the front of the chapter.
- [Appendix A, “Specifications,”](#) outlines the various characteristics of major components of the F300S/F300SQ Ultraviolet Lamp System. It also lists agency approvals and certificates for the relevant systems and components.
- [Appendix B, “Cables and Connectors,”](#) provides information on the interconnect cables and system connector contact kits used with the F300S/F300SQ Ultraviolet Lamp System.

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- [Appendix C, “Outline Drawings,”](#) contains drawings that provide overview details for general reference for Fusion UV Systems products. These drawings are **not** to be used in designing an installation; contact Fusion directly for current specifications.
  - [Appendix D, “Lamp System Maintenance Log,”](#) contains an example of a Fusion UV Systems form to use for tracking lamp system maintenance.
  - [Appendix E, “Replacement Parts,”](#) lists the various accessory replacement parts available for Fusion UV Systems Irradiators.
  - [Appendix F, “Ignitor Bulb,”](#) applies to lamps manufactured before July 1, 2002. It describes the operation of the ignitor bulb that provides ignition to the main bulb.
  - [Appendix G, “Schematics,”](#) contains figures that illustrate the various wiring diagrams for Irradiator components.

## Document Conventions

The products and components discussed in this document are designed and tested for safe operation; however, they use technologies and resources that have inherent risks. This section describes the conventions used throughout this manual when discussing such technologies, so that users can plan and act accordingly when installing, operating, or troubleshooting equipment.

## Indications of Note, Caution, Warning, and Danger

Four categories of notice are indicated in this document; descriptions and examples of their formatting are provided next.

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**NOTE:** Notes serve to point out additional information about a subject or process that is important, but not hazard-related.

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**CAUTION:** Cautions generally indicate areas where a user should take special care to avoid minor or moderate injury. It may also indicate unsafe practices that could damage equipment or materials.

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**WARNING:** Warnings indicate actions that can cause recoverable physical harm; or destruction of equipment, data, or products.

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**DANGER: Danger indications identify conditions where death or permanent injury to personnel can occur if proper procedures and precautions are not followed.**

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## Icon Usage

Several icons are used throughout the documentation to identify the types of hazardous resources or technologies used when working with a particular aspect of the system. Table 1, “Icons,” lists these and their definitions. Exercise extreme care by reading the material thoroughly and following all procedures when working with the various components.

**Table 1. Icons**

Icon	Definition
	<p><b>CAUTION:</b></p> <p>Exclamation Mark: This icon is used for other instances and items for which a standard symbol does not exist.</p>
	<p><b>CAUTION: Risk of Electric Shock</b></p> <p>This icon identifies instances where dangerous or lethal voltages might be present when working with various components of the irradiator or site power.</p>
	<p><b>CAUTION: Microwave Radiation</b></p> <p>The Fusion UV Lamp System is powered by high energy RF microwave power which can be dangerous if misused or inadequately shielded. The lamp system should never be turned on if the lamp housing and screen are not intact, or if the microwave leak detector and interlock are not functioning.</p>

**Table 1. Icons (continued)**

Icon	Definition
	<p><b>CAUTION: Ultraviolet Radiation</b></p> <p>This icon identifies instances where damaging levels of ultraviolet radiation may be present. Adequate shielding around the equipment and region must be provided, and personnel should be required to wear goggles with UV certified lenses. All personnel within ten feet of the lamp should wear gloves and long sleeves to protect their hands and arms, and ensure that their legs are covered.</p>
	<p><b>CAUTION: Radio Interference</b></p> <p>Fusion lamps operate at a fundamental frequency of 2.45 GHz. The unit may cause interference with some local area networks (LANs) that also operate at this frequency. Please check with your LAN manufacturer for compatibility. Ensure that the equipment is properly maintained and shielded.</p>
	<p><b>CAUTION: Ozone</b></p> <p>High concentrations of ozone can cause discomfort, or at sufficiently high levels be dangerous. Although Fusion lamp systems make ozone at a level that could barely be detected by odor and at a factor of five below the level of 0.1 parts per million allowable for continuous exposure (American Conference of Governmental Hygienists), all Fusion UV Lamp Systems should be exhausted to the outdoors.</p>
	<p><b>CAUTION: Hot Temperature, Do Not Touch</b></p> <p>Surface temperatures of the lamp during normal operation may exceed 120° F. Metal components near the lamp will also be hot. Observe appropriate precautions to avoid burns.</p>

**Table 1. Icons (continued)**

Icon	Definition
	<b>Protective Conductor Terminal</b>
	<b>Earth (ground) Terminal</b>
	<b>Three Phase Alternating Current</b>

## System Description

The Fusion Ultraviolet Lamp System has been designed specifically for applications involving the industrial curing of inks and coatings and may be used effectively for a wide variety of applications.

An ultraviolet (UV) lamp system for industrial curing must generate extremely intense radiation in the 200-400 nanometer region. Such radiation, when properly generated and focused, and used in conjunction with specially formulated UV sensitive inks and coatings, causes virtually instantaneous curing (drying) of the exposed materials.

The unique properties of the Fusion UV Lamp System are obtained by using microwave radiation to energize the lamp. Microwave energy at 2450 MHz is generated by a power tube (magnetron) of the type widely available for commercial microwave cooking ovens. The patented Fusion UV Systems lamp has no electrodes, and consequently overcomes many of the basic limitations of conventional mercury arc lamps.



**Figure 1. F300S/F300SQ Lamp System**

The F300S/F300SQ Fusion UV Lamp System (Figure 1) is modular, consisting of independent 6-inch (15.2 cm) lamp units and corresponding modular power supplies. Two lamps can be placed end-to-end to form a 12-inch (30.5 cm) lamp system or can be placed in a continuous array to form lamps of 18-inch (45.7 cm), etc. This is possible because the illumination of the lamp is a full 6". When two 6" lamps are placed end-to-end forming a 12" lamp, material being irradiated in the focal plane 53.3mm (2.1") below the lamp bottom, and at the juncture between the two lamps, receives sufficient radiation from each 6" module to provide uniform curing over the entire region.

Microwave energy from a single magnetron is directed into the cavity formed by an aluminum reflector and a screen over the bottom of the reflector. The lamp bulb is located inside this chamber. The screen keeps microwaves inside the chamber but allows UV light to pass through onto the material to be cured.

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Electrical inputs to the lamp module are provided by a high voltage/control cable with a quick-connect fitting which supplies power for the magnetron, filament transformer and the interlock circuitry.

## System Components

The basic F300S/F300SQ system consists of the following items:

- A P300M/P300MQ/P300MT power supply
- An HV Cable H340 (no modular blower)
- An HV Cable H341 (with modular blower)
- An I300 series irradiator
- An RF detector cable H790
- An RF-1 detector

In addition, the user must supply the following if not provided by Fusion UV Systems:

- Cooling for the irradiator, if no modular blower is provided. (See [Appendix A, “Specifications”](#) and [Appendix C, “Outline Drawings”](#) for irradiator cooling requirements.)
- Mechanical mounting of the lamp modules over a substrate, conveyor, or other transport mechanism
- Light shield surrounding the lamps
- Exhaust system for the light shield
- Any desired interlock mechanisms (see [Chapter 3 on page 39](#))
- Electrical wiring of the power supply into the plant electrical system

## Control

The control system of the F300S/F300SQ provides precise control of high voltage and filament voltage supplies. The control board also monitors cooling air pressure, detection of RF, power levels, bulb ignition, and interlocks such as transformer thermal switches. If a problem arises, the control system turns off all high voltage power to the lamp and flashes a fault LED indicator on the power supply control panel.

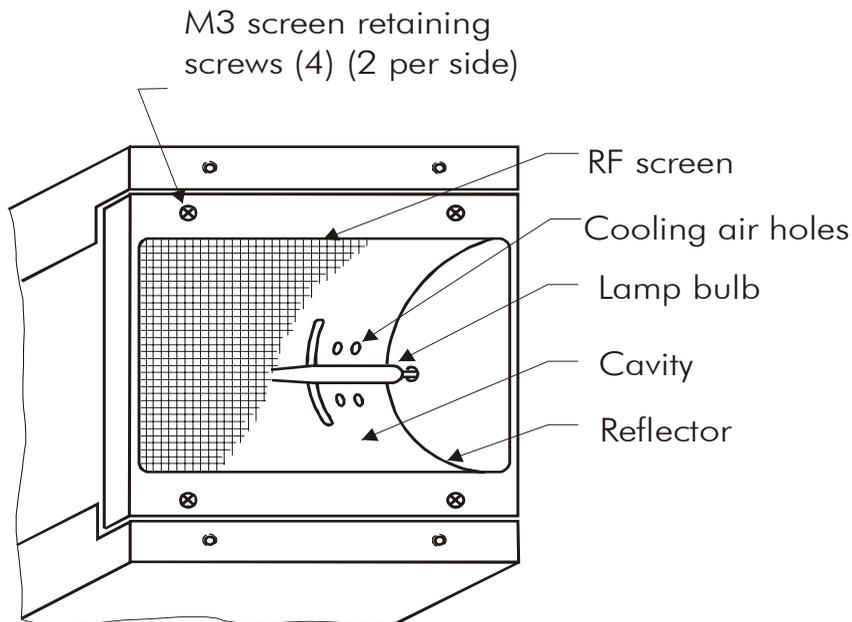
Inputs for customer ON/OFF control are available. Outputs allow detection of STANDBY or LAMP ON operation, or of interlock failures.

## Cooling

Proper operation of the lamp requires adequate cooling of the magnetron and the bulb. (See [Appendix C, page 129](#), for irradiator cooling requirements.) Cooling air from a blower goes through the magnetron cooling fins and into the lamp housing. At this point, the airflow splits into two paths: one path exhausts through the irradiator housing vent holes, and the rest of the air flows into the cavity through cooling holes in the reflector. This airflow cools the bulb and exhausts through the RF screen.

## Irradiators

The I300M irradiator family is the heart of the UV system. For example, the model I300M contains both the 15.2 cm (6") long electrodeless lamp bulb mounted in the elliptical reflector and the magnetron which energizes the bulb. The reflector is elliptical in cross-section and the lamp bulb is mounted at the focus of the ellipse, producing an intense strip of light at the other focus of the reflector (53 mm [2.1"] below the bottom rails of the lamp).



**Figure 2. Reflector Assembly**

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The following table lists the various irradiator models manufactured by Fusion UV Systems, and describes their high-level differences.

**Table 2. Irradiator Models**

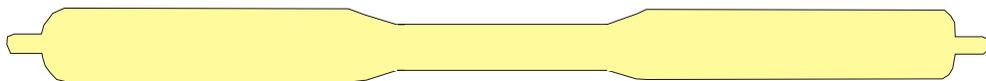
Irradiator Model	Photoresistor Assembly	RF Gasket	Air Delivery
I300M	Direct View	Standard	Front Connect Plenum
I301M	Direct View	Standard	Top Connect Plenum
I300MB	Direct View	Standard	Modular Blower
I310MP	Scatter View	I6	Front Connect Plenum
I311MP	Scatter View	I6	Top Connect Plenum
I310MB	Scatter View	I6	Modular Blower
I310MP-D	Direct View	I6	Front Connect Plenum
I311MP-D	Direct View	I6	Top Connect Plenum
I310MB-D	Direct View	I6	Modular Blower

## Reflector and Cavity

The top of the reflector contains two rectangular slots which admit microwave energy into the cavity. The slots are fed by one 1800 W, 2450 MHz magnetron located in the top half of the lamp enclosure and connected to the cavity by a waveguide launcher.

## Lamp Bulb

The lamp bulb ([Figure 3](#)) is made of quartz and has a tapered shape which optimizes its UV, thermal, and microwave properties. The short quartz stubs at either end of the 15.3 cm (6") bulb provide mechanical support for quick mounting into spring-loaded receptacles at the cavity ends. They are not electrodes and have no electrical function.



**Figure 3. Lamp Bulb**

Access to the cavity for changing the bulb or routine cleaning of the bulb and reflector is easily accomplished by removing the screws which secure the screen assembly to the bottom of the lamp. This procedure is explained in detail in [Chapter 6, “Maintenance”](#). The fine mesh screen must be intact and firmly secured to the lamp if the system is to work properly and safely. The RF leakage interlock automatically shuts the system off if excess microwave energy passes through the screen.

---

## Mounting

The lamps can be mounted over a moving substrate or web, supported by the bottom rails. The lamps should be mounted so that the rails sit 53 mm (2.1") above the surface to be cured. This allows the elliptical reflector to focus the most intense strip of light very near the substrate.

## Power Supply

Each lamp system has its own power supply to house the high voltage circuits necessary to energize the magnetron, as well as all control and interlock electronics, and the built-in cooling fan.

The power supply is fully modular. Up to six units may be interconnected and controlled from a single master unit. Any power supply may assume either Master or Slave status in a multi-unit installation.

## P300M/P300MQ/P300MT

The power supply high voltage circuit consists of a dual half-wave voltage doubler circuit which supplies a regulated source of high voltage power (approximately 3900V, 700 mA DC) to the magnetron in the irradiator. The capacitors and diodes provide regulation and rectification to the high voltage transformer outputs.

## RF Detector

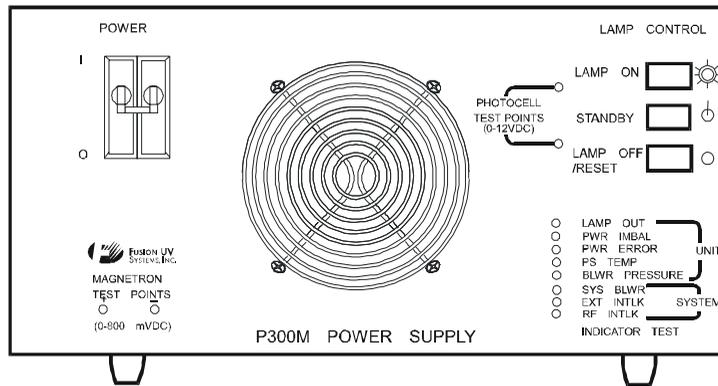
The system includes a detection device which shuts the system down if microwave energy in excess of permissible levels is in danger of being released into the work environment. This might be caused by a faulty RF screen or some other type of damage to the lamp, or by inadequate or damaged shielding.

The power supply fault detection circuitry searches the system for a functioning RF detector by means of the System Interconnections Bus. A multi-unit installation must have at least one RF detector, which is usually connected to the master power supply. Additional detectors may be connected to slave units.

During the startup sequence, each power supply will automatically perform a functional test on any installed RF detector (if switch S1-5 is set to "YES"). The operator may also verify detector operation by pushing a test button on the RF-1 module for 4 seconds. Complete information appears in [Chapter 5, "Troubleshooting"](#).

## System Interconnections

All electrical connections to the power supply are made through connectors at the rear. Instructions for wiring are provided in [Chapter 3, "Electrical System"](#). The power supply does not require any routine maintenance other than occasional cleaning of the interior with compressed air (depending on the environment).



**Figure 4. P300M Front Panel**

## Warranty Policy

Items manufactured by Fusion UV Systems Incorporated are warranted (under normal and proper use) to be free from defects in material and workmanship. Fusion UV Systems will repair or replace, at its option, any defective parts when returned to Fusion by the purchaser, transportation paid. See the Terms & Conditions included with your sales order for the length of the warranty period.

Equipment may not be returned, whether for warranty or other purposes, without prior authorization and issuance of a Returned Material Authorization Number by Fusion UV Systems. After inspection and acceptance, equipment returned for credit will be subject to a handling and restocking charge.

Fusion UV Systems assumes no expense or liability for repairs made outside its plant without written consent nor for any labor costs which are so incurred. For equipment manufactured by others, Fusion UV Systems will pass along to the purchaser whatever warranty it receives and will not be responsible for any incurred expense outside of such warranty.

If repair of equipment is required but return of such equipment to Fusion UV Systems is not feasible, then by mutual consent of Fusion and the purchaser, an authorized Fusion UV service representative will be sent to the purchaser's plant to effect necessary repairs. The purchaser will be charged for the representative's time and expense.

The two consumable items in a Fusion UV lamp system are the lamp bulb and the microwave power tube (magnetron). The special warranties on these components are detailed on the sales contract.

---

**NOTE:** Any repairs or alterations, including the use of non-Fusion UV Systems (Fusion) parts, made by the user of this product without Fusion UV Systems' prior written consent shall void all warranties provided by Fusion UV Systems and such warranties shall cease to be in effect. No allowance will be granted for such repairs or alterations. No person, agent, representative, or distributor is authorized to give any warranties on behalf of Fusion UV Systems, or to accept for Fusion UV Systems any other liability in connection with any of Fusion UV Systems' products.

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## Shipping Instructions

Read the following sections carefully to ensure compliance with the requirements and recommendations for returning products or components, whether for credit, replacement, or repairs.

### Returned Material Authorization Number

Equipment may not be returned, whether for warranty or other purposes, without prior authorization and issuance by Fusion UV Systems of a Returned Material Authorization Number. After inspection and acceptance, equipment returned for credit will be subject to a handling and restocking charge. Returned equipment must be shipped prepaid.

### General Packing Instructions

If possible, original packaging materials should be reused for return shipment to Fusion UV Systems. If Fusion UV Systems' packaging materials are not used, equivalent packaging, as outlined in the following sections, is to be used.

#### Power Supply

Secure the chassis to the cover by M5 x 12 mm screws. (There are three on each side of power supply for the P300M/P300MQ, two on each side of power supply for the P300MT.)

Box:                      Bursting Test: 24 kg/cm<sup>2</sup> (350 lbs./sq. in.)

Gross Weight Limit: 70 kg (155 lbs.)

Fills:                      Rigid high density styrofoam or cardboard fills as required to ensure power supply does not shift in box during shipment.

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**CAUTION:** Packaging materials should not push against connectors or controls.

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## Irradiators

Irradiators should be returned in their original packaging. If this is not available, lamps must be double boxed, as follows:

The lamp is to be placed in an inner box, using cardboard fills to assure a snug fit. The RF screen should be protected by taping a piece of cardboard over it. The inner box should then be placed in an outer box that provides about a two-inch clearance on all sides. High density styrofoam corner pads should be placed in the corners between the outer and inner boxes to isolate the lamp from impact.

Box:                      Bursting test: 24 kg/cm<sup>2</sup> (350 lbs./sq. in.)

Gross Wt. Limit: 70 kg (155 lbs.)

## Magnetrons

If available, use a special Fusion replacement magnetron shipping box. Otherwise, magnetrons must be double boxed as described next.

Wrap magnetrons in three layers of plastic “bubble wrap” or equivalent. Place magnetrons in the box and add loose styrofoam fill. Place this inner box in an outer box and surround the inner box with loose styrofoam fill.

## UV Bulbs

Place the bulb in a rigid tube (use Fusion UV Systems’ plastic lamp bulb replacement shipping tube if available.) Secure ends to prevent impact against the tube and wrap the tube in three layers of plastic “bubble wrap” or equivalent. Ship with loose styrofoam fill in the box.

## Control Cards

The integrated circuits in control board assemblies are susceptible to damage from static electrical charges which may be transmitted by handling or packaging materials. To guard against static, place control cards in anti-static bags, if available. If not, wrap control cards in aluminum foil. Isolate the cards from impact with additional wrapping of “bubble wrap” or equivalent.

## RF Detectors

RF Detectors should be wrapped in two layers of “bubble wrap” or equivalent and placed in a box with loose styrofoam fill.



# Chapter 1. Safety

---

Fusion UV Systems' Ultraviolet (UV) Lamp Systems have been designed to operate safely. Many systems are in production in a wide variety of industrial environments without any problems of worker safety or health hazards. However, like most industrial equipment, this equipment can present worker safety problems if care is not taken to install, operate, and maintain it correctly.

The following pages provide information concerning various aspects of worker safety with regard to this equipment. Because some features of the system may be new to personnel using the equipment, an attempt has been made to provide a fairly extensive background on these issues as well as references, where feasible, to further information or U.S. Government Standards.



**IMPORTANT:** All personnel using the equipment must become familiar with this safety information.

Care in installation and operation, coupled with adequate worker training, should ensure that no unusual safety problems arise.

---

## Ultraviolet Radiation

	<p>Ultraviolet radiation which is emitted during normal operation of the Fusion Ultraviolet Lamp System can be dangerous to the eyes and skin of personnel. Adequate shielding around the system and the region to be irradiated must be provided. If unsafe levels of light are allowed to escape during operation, then all personnel in the vicinity of the lamps should be required to wear goggles with UV certified lenses. Protection is needed for indirect as well as direct eye exposure; UV certified lenses are recommended. Discomfort from excessive eye exposure to ultraviolet light typically occurs about six hours after exposure. Personnel who experience eye pain after possible exposure to direct rays from the UV lamp should see a doctor. Furthermore, in the event that adequate shielding is not possible, all personnel within ten feet of the lamp should wear gloves and long-sleeved shirts to protect hands and arms.</p>
---	---

There are no present U.S. government standards on worker exposure to ultraviolet light. However, there is a NIOSH document, “Criteria for a Recommended Standard...Occupational Exposure to Ultraviolet Radiation” (No. HSM 73-11009), and several useful publications are available from the Bureau of Radiological Health of the Food and Drug Administration.

## Microwave Radiation

	<p>The Fusion UV Lamp System is powered by high energy RF microwave power. This form of energy is identical to that used in home microwave ovens and, as in the case of ovens, can be dangerous if misused or inadequately shielded. In the Fusion UV lamp, the shielding is adequate only as long as the lamp and the screen on the bottom of the lamp are intact. Any rip or large hole in the screen may lead to microwave radiation leakage in dangerous amounts. The power to the lamp is interlocked to shut off if there is excessive microwave radiation leakage. The lamp system should never be turned on if the lamp housing and screen are not intact, or if the microwave leak detector and interlock are not functioning.</p>
---	---

Fusion UV equipment is interlocked to shut down if microwave leakage in excess of 5 mW/cm<sup>2</sup> (milliwatts per square centimeter) is detected.

---

## Personnel Effects of Microwave Radiation

OSHA (U.S. Department of Labor, Occupational Safety, and Health Administration - Standard 29CFR 1910.97) and ANSI (American National Standards Institute - Standard C95.1-1999) are the only major national organizations with voluntary guidelines for safe limits of occupational microwave radiation exposure.

The ANSI recommendation is the more stringent of the two guidelines. Conservatively expressed, it states that a worker should not be exposed to microwave radiation levels in excess of  $8 \text{ mW/cm}^2$  on a continuous basis at 2.45 GHz. It allows for short-term exposure to much higher levels by stating that over a six-minute period the average power density to which a worker is exposed to microwave radiation should not exceed  $8 \text{ mW/cm}^2$ .

Microwave radiation is considered a non-ionizing electromagnetic radiation, which is not known to produce genetic damage. The primary effect of this energy is to simply raise the temperature of a body which absorbs it. For example,  $5 \text{ mW/cm}^2$  will raise 1 cc of water  $0.07^\circ \text{C}$  in one minute. If the average worker were exposed to this energy level continuously, he would absorb about 30 watts over his whole body. At rest, the body dissipates about 100 watts. Therefore, this additional heat load is considered safe, although we do not recommend continuous exposure to levels anywhere near  $5 \text{ mW/cm}^2$ .

Fusion UV Systems equipment normally produces low level leakage well below  $8 \text{ mW/cm}^2$  in the work environment. If a microwave survey meter is used, one should read levels well below  $1 \text{ mW/cm}^2$  where personnel are likely to be continuously exposed. When a lamp is started, leakage levels may increase by a factor of two or three for the few seconds it takes to start and couple energy to the bulb. This is considered safe due to the requirement to average under  $8 \text{ mW/cm}^2$  over a six-minute period.

## Radio Interference



Fusion UV lamps are classified as non-consumer industrial, scientific and medical equipment, as defined in Federal Communication Commission (FCC) Rules and Regulations Volume 47, Part 18. As required by these rules, Fusion UV Systems verifies that their systems are capable of compliance with applicable technical standards governing radiated emissions when the equipment is properly maintained and is installed in an appropriate light shield.

Fusion lamps operate at a fundamental frequency of 2.45 GHz. The unit may cause interference with some local area networks (LANs) that also operate at this frequency. Please check with your LAN manufacturer for compatibility.

---

## Ozone



Ozone is a gaseous form of oxygen which is formed by ultraviolet light. It has a characteristic pungent odor to which most people are quite sensitive (people can typically detect concentrations of several parts per hundred million). At high concentrations it can cause discomfort or at sufficiently high levels be dangerous.

The Fusion UV Lamp System makes less ozone than a conventional arc lamp. For example, a pair of lamps running for twelve hours in a non-vented room resulted in a steady state concentration of less than 0.02 parts per million. This was a level that could barely be detected by odor and a factor of five below the level of 0.1 parts per million allowable for continuous exposure (American Conference of Governmental Hygienists).

All Fusion UV Lamp Systems should be exhausted to the outdoors.

## Temperature



Surface temperatures of the lamp during normal operation may exceed 120° F. Metal components near the lamp will also be hot. Before attempting service procedures on the lamp, allow the unit to operate in STANDBY so that the blower continues to run. The bulb will cool completely in less than one minute. If the blower is not allowed to run, the bulb will retain heat for several minutes. Observe appropriate precautions to avoid burns.

Handle the bulb with cotton or surgical gloves or a lint-free towel at all times, as fingerprints can be etched into the quartz.

---

## High Voltage

Insulated electrical cables carry power at 3900 Volts from the power supply to the lamp. These voltages can be dangerous, so some precautions should be taken in both the location and protection of these lines. High voltages are exposed within the power supply chassis, which should never be operated without its cover.



**DANGER:** Never touch the power supply/lamp cable connections while the system is ON or in STANDBY. A faulty magnetron may cause 7000 Volts DC to appear on connector pins and may cause serious injury.

Do not touch power supply/irradiator harness plug P10 near the contacts, and do not lay P10 down on any conductive material.

Never troubleshoot the power supply without first disconnecting all external power and discharging the high voltage capacitors with an insulated screwdriver.

A high quality cable, rated at 10,000 Volts, is used in all high voltage cables manufactured by Fusion UV Systems, and can be supplied to users for any additional connections that may be required.

## UV Curable Materials

Please consult your UV materials supplier for recommended precautions regarding the proper handling and use of these products.



# Chapter 2. Mechanical Installation

## Mechanical Installation Checklist

Before operating the ultraviolet lamp system for the first time, be sure the following procedures have been completed.

**Table 3. Mechanical Installation Checklist**

Item	Chapter
<input type="checkbox"/> Review safety procedures	<a href="#">Chapter 1, "Safety"</a>
<input type="checkbox"/> Light shields in place	<a href="#">"UV Light Shielding" on page 34</a>
<input type="checkbox"/> RF detector positioned correctly	<a href="#">"RF Detector Mounting" on page 35</a>
<input type="checkbox"/> Fan connection for exhaust of light shield	<a href="#">"Remote Blowers" on page 36</a>
<input type="checkbox"/> RF screen and lamp bulb inspected	<a href="#">Introduction, page 11</a>

This chapter describes the physical installation of the F300S/F300SQ Fusion UV Lamp System. Directions regarding mounting and shielding of the system are somewhat general because they will vary depending upon the details of each individual installation.

## Unpacking and Inspection

This Fusion UV lamp system has been thoroughly tested inspected, and packed prior to shipment. Before unpacking, examine all shipping containers for damage. After unpacking, examine the equipment for damage. Any damage should be reported immediately to the shipper and to Fusion UV Systems Incorporated. A delay of more than 10 days may invalidate future claims for damages.

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**CAUTION:** Irradiators are particularly vulnerable to dust, dirt, metal chips, and RF screen damage. They are shipped with a protective covering over the screen. The covering should not be removed until just prior to installation.

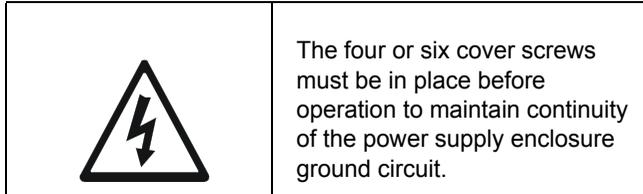
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When unpacking, identify and compare each item with the packing list enclosed. Remember to examine each component for damage. [Appendix E, "Replacement Parts"](#) details the items included with the system which will be required to complete the installation.

---

Preliminary unpacking and inspection should be completed immediately on receipt of equipment to allow time for repair or replacement if necessary prior to installing the equipment.

The P300M/P300MQ power supplies are shipped with six large Phillips head screws holding the cover to the chassis. There are three screws located on each side. The P300MT power supply is shipped with four large Phillips head screws holding the cover to the chassis. There are two screws located on each side of the P300MT.



After the inspection is completed, all components must be carefully re-packed and stored until actual installation. Save the packing materials. They will be valuable if any component must be returned to Fusion UV Systems for service. See [“Shipping Instructions” on page 22](#) for more information.

## Power Supply Unit(s) Placement

The mechanical installation of a power supply unit is almost entirely at the user’s convenience. It can be placed on a sturdy shelf or in a cabinet provided that approximately 30 cm (12 inches) of space is left behind the power supply for cooling air to escape, and so that the cable harnesses can be run to the other components. See [Appendix C, page 129](#) for restricted space clearance minimums.

The P300M/P300MQ power supplies can function in any position, although standard horizontal mounting is recommended. Mounting the power supply so that the control panel is facing upward is not recommended because this allows dirt and dust to settle into the unit. In this position, the horizontal surface that is provided by the inlet finger guard also can be easily blocked by papers, notebooks, or other flat materials that will cause thermal overload and system shutdown.

Power supplies are stackable up to three (3) units high. However, a power supply can weigh up to 40.3 kg (88.6 lbs.), so units should not be stacked to, or installed at, a height that makes access of chassis removal difficult.

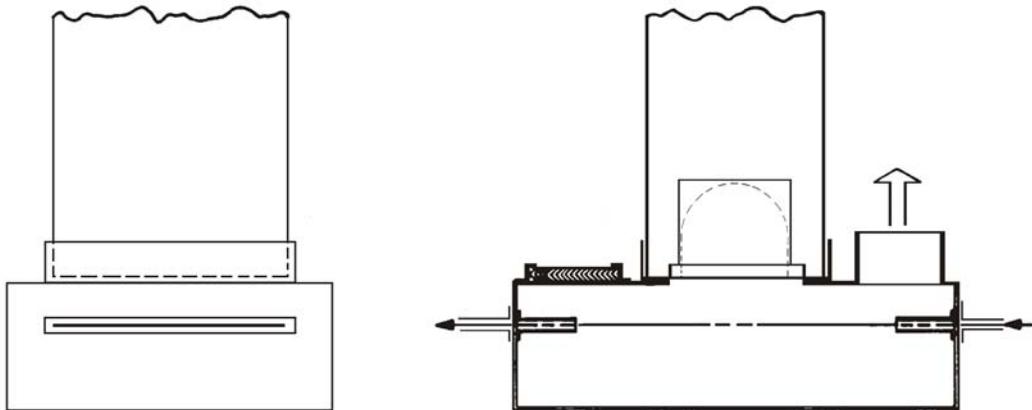
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## Irradiator Mounting

The irradiator mounting structure must also provide UV shielding and adequate venting for the cooling air. This is described on the following pages. Each user will normally design the mounting structure to suit the particular application, and the user is responsible for providing the required shielding and ventilation. (Irradiator dimensions are shown in [Appendix C, “Outline Drawings”](#) and detailed in the [Appendix A, “Specifications”](#)).

The easiest and most common mounting position is with the irradiator vertical and the screen at the bottom 53 mm (2.1 in.) above the substrate. Simply rest the module on a pair of angle irons oriented in the same direction as the lamp bulb. One common mounting scheme is shown in [Figure 5](#).

Vertical mounting requires that no part of the support can push against the irradiator screen, causing it to tear. Provisions may be made for raising or lowering the support structure with respect to the substrate to be irradiated. This allows the user to optimize the curing by working in focus or somewhat out of focus.

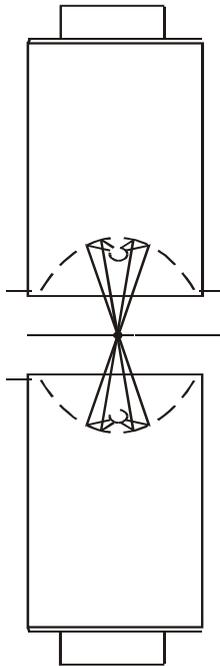


**Figure 5. Vertical Mounting Design for Irradiators**

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## Lamps Mounted in Opposing Configuration

	<p><b>IMPORTANT:</b> If two lamps are to be mounted opposing each other (as shown in <a href="#">Figure 6 on page 34</a>), lamp performance and operation may be impaired. Contact Fusion UV Systems Technical service department for consultation.</p>
---	---



**Figure 6. Lamps in Opposing Configuration**

## UV Light Shielding

Adequate light shielding must be provided for each irradiator in the system. If shielding is not used, or if UV light escapes around the irradiator support, the operator must wear a welder's helmet or UV blocking eye wear. Long sleeved clothing is required to protect the skin from the effects of UV light.

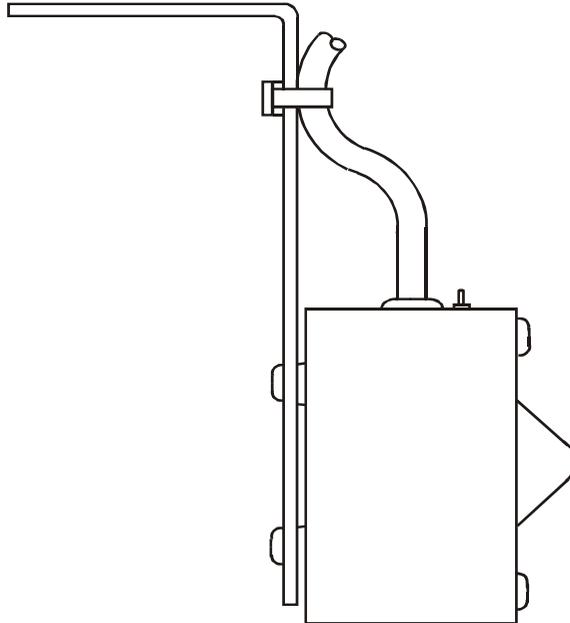
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The louvers which allow the flow of cooling air away from the irradiator must be of a light shielding design.

(For more information on safety considerations, see [Chapter 1, “Safety.”](#))

## RF Detector Mounting

[Figure 7](#) illustrates the proper mounting of the RF Detector.



**Figure 7. Fusion UV Systems RF Detector RF-1**

One RF detection device must be installed for each light shield. The antenna should point toward the irradiator screen, which is the potential source of RF leakage. However, to protect the antenna from heat and UV light, it should be placed outside the light shield. It may “look” into the light shield through an existing opening, or one made for this purpose. The tip of the sensing cone should be at least two inches from the opening of the light shield.

The presence of metal surfaces near the detector may cause false readings; allow a maximum open area around the device.

The connection of the cable from the RF detector to the power supply is explained in [Chapter 3, “Electrical System”](#).

---

## Remote Blowers

An optional remote blower package is available from Fusion UV Systems. The package includes an air distribution plenum (for multi-lamp systems), inlet filter box, and flexible hoses or ducts for cooling the system. The blower delivers 2.8 m<sup>3</sup>/min (100 cfm) of air to each irradiator inlet at 695 Pa (2.8" H<sub>2</sub>O). See [Chapter 6, "Maintenance"](#) for information on the measurement procedure.

## Irradiator Exhaust Venting

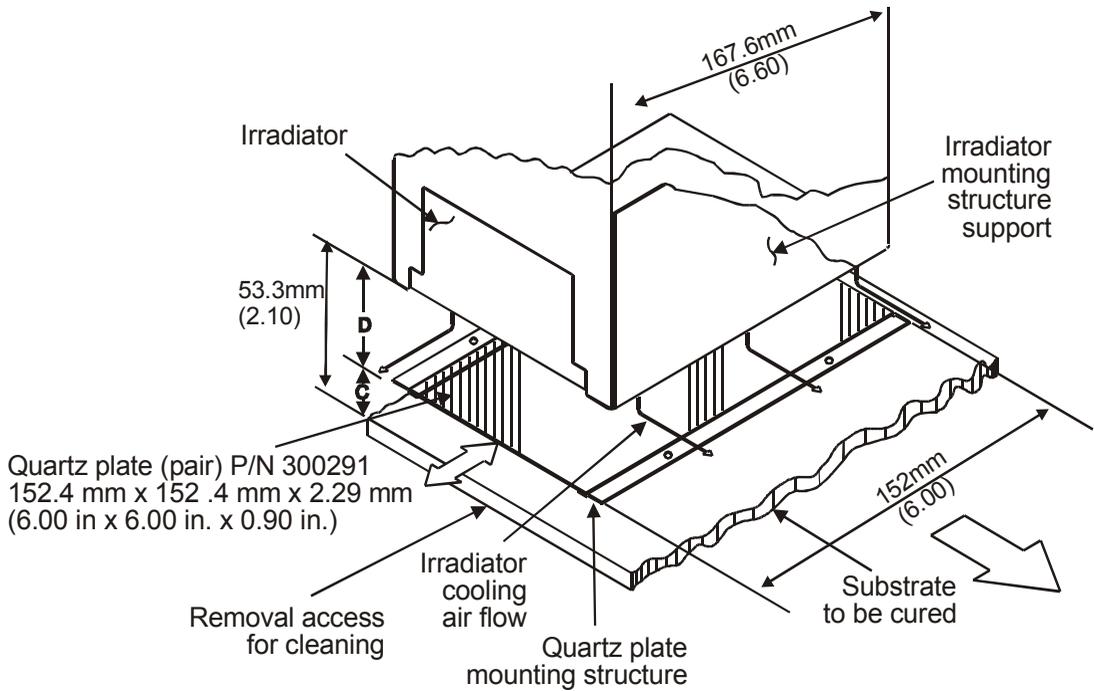
Fusion UV Systems recommends that 3.6 m<sup>3</sup>/min (130 cfm) of air be exhausted from each irradiator. The air flow must be vented below the irradiator to prevent back pressure buildup, which would reduce the flow of cooling air. An exhaust fan is recommended to draw hot air and ozone away from the UV lamp and discharges them to the outside. The fan must remove at least 30% more air than is supplied to the irradiator inlets so a negative pressure will exist under the lamps. The makeup air enters through the UV shielding louvers or any other vents in the light shielding enclosure.

Light shielding louvers are recommended. At least 142 cm<sup>2</sup> (22 sq. in.) of louvered area is recommended for each irradiator to allow free flow of make-up air. If the exhaust air is not vented outside the building care should be taken to prevent it from recirculating into the inlet of the blower(s).

## Quartz Plates

To protect the material being cured, quartz plates may be mounted below the UV lamp to block the air carrying heat away from the bulb. A typical mounting design is shown in [Figure 8 on page 37](#). Details of the mounting structure depend upon the position and location of the irradiator and UV shielding.

Clearance C prevents the substrate from striking and breaking the quartz plate but varies with the application. Distance D should be at least one inch and as large as practical to provide maximum area for the escape of cooling air (see [Figure 8 on page 37](#)).



**Figure 8. Quartz Plates - Example Mounting Design**



## Chapter 3. Electrical System

This chapter discusses the electrical installation and electrical setup aspects of the F300S/F300SQ Ultraviolet Lamp System.

### Electrical Installation/Setup Checklist

Before operating the ultraviolet lamp system for the first time, be sure the following items have been reviewed and/or tested.

**Table 4. Electrical Installation and Setup Checklist**

Item	Chapter
<input type="checkbox"/> AC input voltage matches equipment label and connected correctly	<a href="#">Chapter 3, “Electrical System”</a>
<input type="checkbox"/> Power supply HV capacitors tapped for AC line frequency	<a href="#">Chapter 3, “Electrical System”, page 51</a>
<input type="checkbox"/> Power supply HV transformers correctly tapped for AC input voltage	<a href="#">Chapter 3, “Electrical System”, page 51</a>
<input type="checkbox"/> Programming correct for each unit	<a href="#">Chapter 3, “Electrical System”, page 43, page 44</a>
<input type="checkbox"/> Interconnection cables secure	<a href="#">Chapter 3, “Electrical System”, page 44, page 49</a>
<input type="checkbox"/> RF cable secure	<a href="#">Chapter 3, “Electrical System”, page 45, page 49</a>
<input type="checkbox"/> User inputs (EXTERNAL INTERLOCK, SYSTEM BLOWER) connected if wanted	<a href="#">Chapter 3, “Electrical System”, page 40</a>
<input type="checkbox"/> Remote inputs (RESET, LAMP ON) connected if wanted	<a href="#">Chapter 3, “Electrical System”, page 45</a>
<input type="checkbox"/> User outputs (FILAMENT ON, HV ON, FUTURE USE, LAMP ON, and PRESS ENABLE) connected if wanted	<a href="#">Chapter 3, “Electrical System”, page 46</a>
<input type="checkbox"/> Review normal operating procedures	<a href="#">Chapter 4., Operation, on page 55</a>

### Accessory Parts List

The Accessory Parts List is located in [Appendix E, “Replacement Parts,”](#) and should be reviewed when setting up your system.

## Interconnect Cables

The F300S/F300SQ interconnect cables and connector contact kits are listed in [Appendix B, “Cables and Connectors”](#). See this list for the available varieties and lengths.

## Connection and Program Log

To facilitate operation and maintenance, it is advisable to keep a record of the input/output connections and programming used on each unit. A blank log form is included in [Appendix D, “Lamp System Maintenance Log”](#) of this manual.

## Installing the External Interlocks Control

An input has been made available for use as an external interlock control. When activated, this circuit will cause the system to shut down. (See [Chapter 5, “Troubleshooting”](#) for details.)

## User Connections

Pin removal and crimping tools are required to complete the optional user input/output connections to P105A and P106. Make these connections as described next.

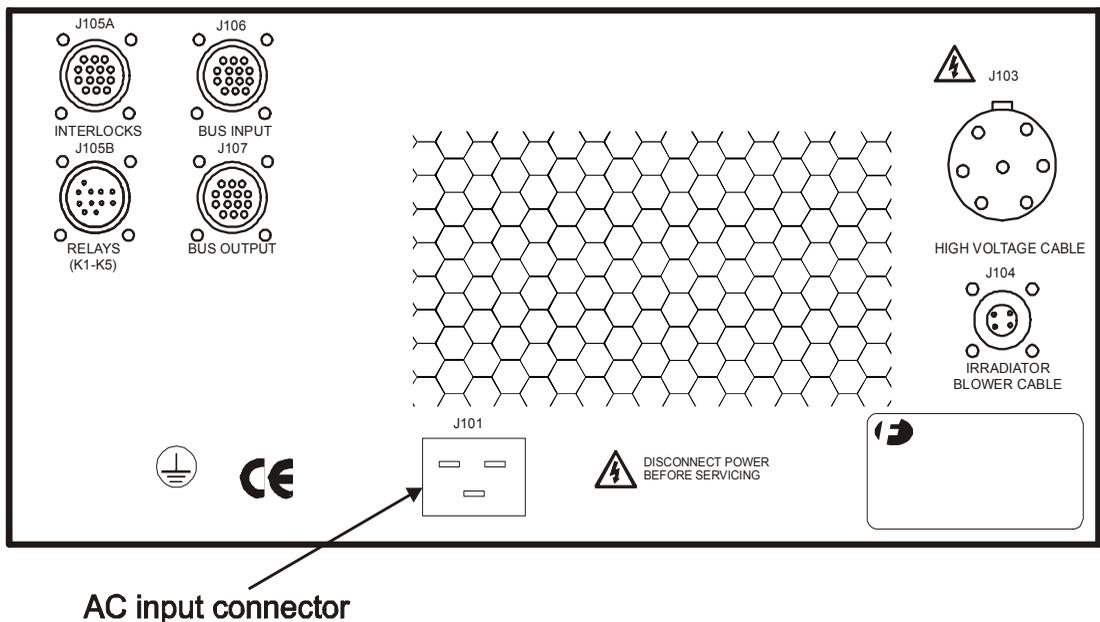


Figure 9. P300M/P300MQ Power Supply Rear Panel

- 
1. Disassemble the strain relief housing by removing the retaining screws and unscrewing the housing from the connector body.
  2. To connect EXT INTLK or SYS BLWR inputs, remove jumper wires and the attached pins as indicated in [Table 5](#), [Table 6](#), and [Table 7](#) in this chapter.
  3. With a crimping tool, attach wires from user devices to new pins (supplied with system) and insert the pins in the proper locations.
  4. Reassemble the strain relief housing.

## Power Supply Programming

P300M/P300MQ/P300MT power supplies may be interconnected to form a complete system of up to six lamps. Through use of the System Interconnections Bus control functions, the entire system may be operated by the lamp control switch of one master power supply, or by a switch on an external control panel.

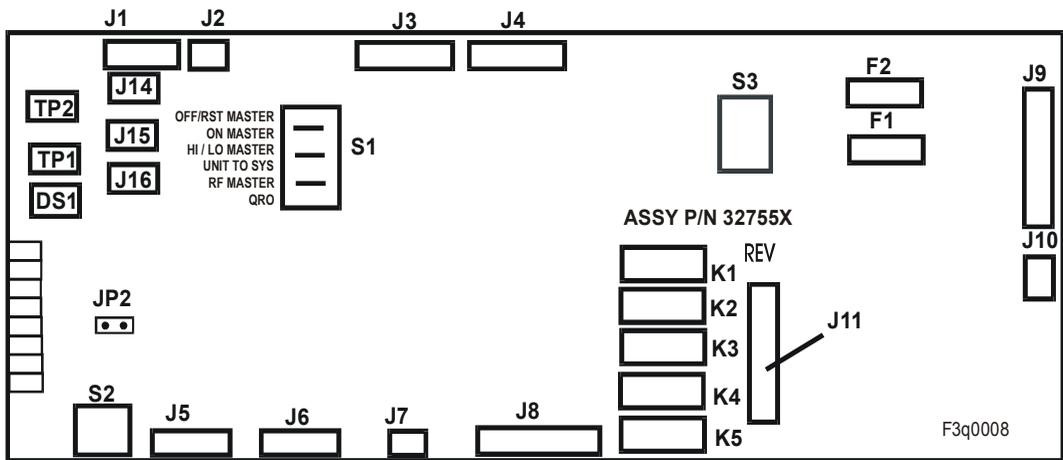
See [Figure 10 on page 42](#) for the location of programming switch S1. To access S1, remove the six screws on the side of the power supply cover. For programming switch S1 settings, see the table illustration in [Figure 11 on page 43](#).

### Settings for Six-Position Switch S1

Positions 1, 2, and 3 of S1 (see [Figure 10](#)) must be set to determine whether a power supply is a master or a slave.

Position 4 determines whether a unit fault will turn off all power supplies or only the unit where the fault occurs.

Position 5 indicates to the system bus whether a power supply (either the master or a slave) has an RF Detector connected to it. (There must be at least one RF Detector connected to a system.)



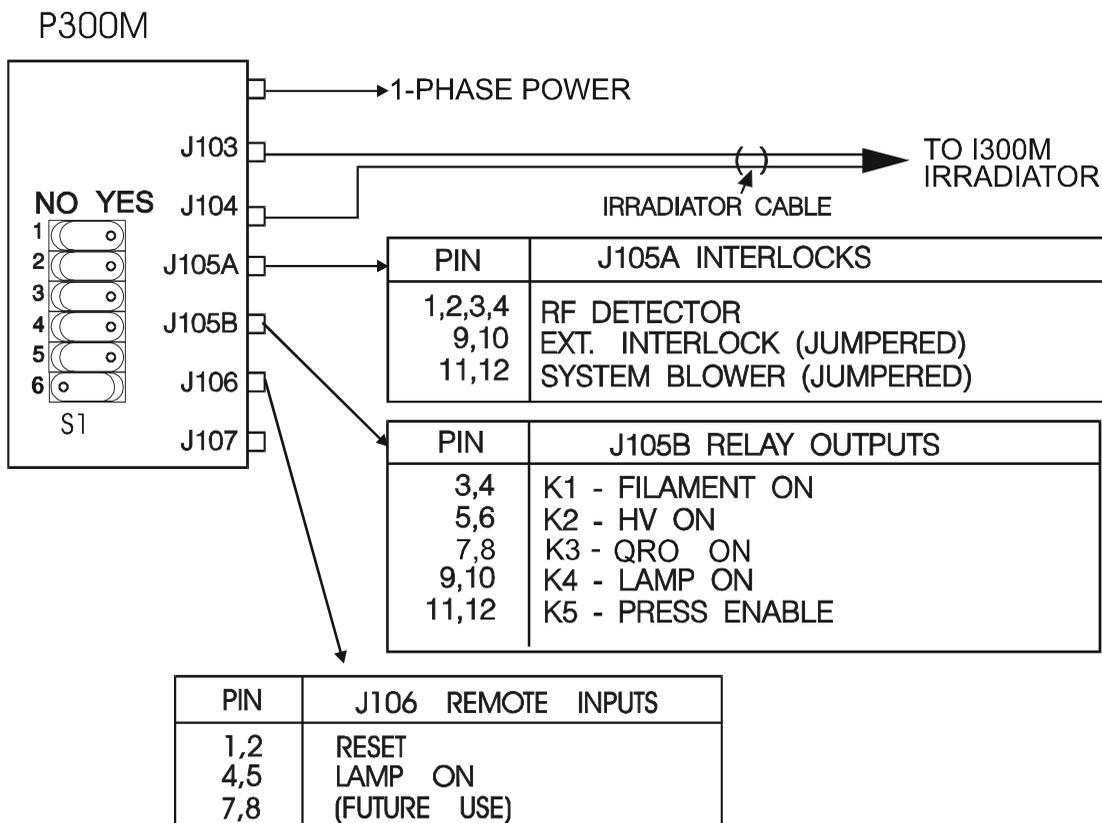
**Figure 10. Location of Programming Switch S1 on PWB**

TABLE A PROGRAMMING SWITCH S1								
Switch Position 1, 2, and 3 Configure for Master?		POS4 Response to Unit Fault:		POS5 RF Detector Connected?		POS6 QRO		
YES (ON)	NO (OFF)	SHUT DOWN ALL UNITS YES (ON)	SHUT DOWN UNIT ONLY NO (OFF)	YES (ON)	NO (OFF)	YES (ON)	NO (OFF)	
✓		✓		✓		✓		
✓		✓			✓	✓		
✓			✓	✓			✓	
✓			✓		✓		✓	
	✓	✓		✓		✓		
	✓	✓			✓	✓		
	✓		✓	✓			✓	
	✓		✓		✓		✓	

Figure 11. Table A: Programming Switch S1

## Single Unit Programming and Connections

The programming and connections necessary to operate a single-unit F300S/F300SQ system are summarized in [Figure 12](#).



**Figure 12. F300/F300SQ Single-unit Installation**

## Programming

Select one unit as the Master. Set S1-1, 1-2, 1-3, and 1-5 of this unit to “YES.” For programming switch S1 setting definitions, see [Figure 11](#).

### Irradiator Cable H340 Connections

Non-blower version cable H340 connects to J103 and J104 on the power supply; and to J10 on the irradiator. All connectors are labeled, and keyed so they cannot be inadvertently interchanged.

Blower version cable H341 connects to J103 and J104 on the power supply, and to J10 and J11 on the irradiator. All connectors are labeled, and keyed so they cannot be inadvertently interchanged.

---

## Input/Output Connections

The P300M/P300MQ/P300MT has three customer use interlock inputs. A fault condition on any of these inputs will cause the system to shut down; the fault must be corrected before the system can be restarted.

There must be one RF detector per system. The remaining interlock inputs are optional. The system blower and external interlock inputs in the P105A connector must be jumpered if these inputs are not used.

---

**NOTE:** All external switches must have gold contacts or be designed for use with logic-level signals to ensure reliable operation.

---

**Table 5. J105A Inputs (Customer Use Interlocks)**

Interlock	Pins	Fault Condition	Contact Ratings	Application Comments
RF Detector (Master)	1,2,3,4	RF trip or no detector present	12mA @12 VDC	Single lamp: One detector per system Multiple lamps: RF Master must have RF detector.
RF Detector (Slave)	3,4	OPEN CIRCUIT	12mA @12 VDC	Single lamp: N/A Multiple lamps: Typically jumpered. User should remove jumper to install additional RF detectors and set S1-5 to ON (Yes)
SYS Blower	11,12	OPEN CIRCUIT	12mA @12 VDC	Typically jumpered. User may remove jumper to install N.O. pressure switch. Multiple switches should be wired in series.
External Interlock	9,10	OPEN CIRCUIT	12mA @12 VDC	Typically jumpered. User may remove jumper to install N.O. interlock switch. Multiple switches should be wired in series.

## Remote Inputs

One switch is required for remote operation of an F300S/F300SQ (to control the STANDBY/LAMP ON functions). Connections are made through the P106 connector. Single or Master/Slave systems may be operated remotely.

**NOTE:** A dry contact (such as a relay contact or a PLC containing a relay contact) with gold contact material should be used to drive the remote inputs. The cable length to the dry contact should be no more than 6 meters. Shielded cable should be used to minimize possible electrical interference.

In a multi-lamp system, connections are made to the Master power supply.

If there is a requirement for clearing faults remotely, a Remote Reset switch must be used.

**Table 6. J106 Inputs (Remote Operation)**

Signal	Pins	Active Condition	Contact Ratings	Application Comments
REMOTE LAMP ON	4,5	Closed circuit	12mA @12 VDC	Set switch S1-2 of Master to NO. Leave S1-1 and S1-5 set to YES.
REMOTE RESET	1,2	Closed circuit	12mA @12 VDC	Set switch S1-1 of Master to NO.
CABLE SHIELD	8	N/A	N/A	Keep cable length to a minimum.

## Output Ports (J105B)

There are five relay outputs available on the P300M/P300MQ/P300MT through J105B. These outputs may be used to synchronize customer equipment with the system. In a multi-lamp system, connections are made to the Master power supply.

**Table 7. J105B Outputs (Customer Interface)**

	J105B	Asserted State	Circuit Ratings	Comments
Filament ON (K1)	3, 4	Closed	1 A @120 VAC (10mA minimum)	K1 contacts close when filament voltage is applied (STANDBY).
HV ON (K2)	5, 6	Closed	1 A @120 VAC (10mA minimum)	K2 contacts close when high voltage is applied to lamp.
QRO	7, 8	Closed	1 A @120 VAC (10mA minimum)	K3 contacts close when QRO is active.

**Table 7. J105B Outputs (Customer Interface) (continued)**

	J105B	Asserted State	Circuit Ratings	Comments
LAMP ON (K4)	9, 10	Closed	1 A @120 VAC (10mA minimum)	K4 contacts close when photocell is satisfied. Note: If using K4 for press control, wait 6-8 seconds for lamp output to stabilize.
PRESS ENABLE (K5)	11, 12	Closed	1 A @120 VAC (10mA minimum)	K5 contacts remain closed when no unit or system error exists.

---

**NOTE:** When using circuit currents for K1-K5 below 10mA, contact Fusion UV Systems Customer Service.

---

## Alternate Function for K5

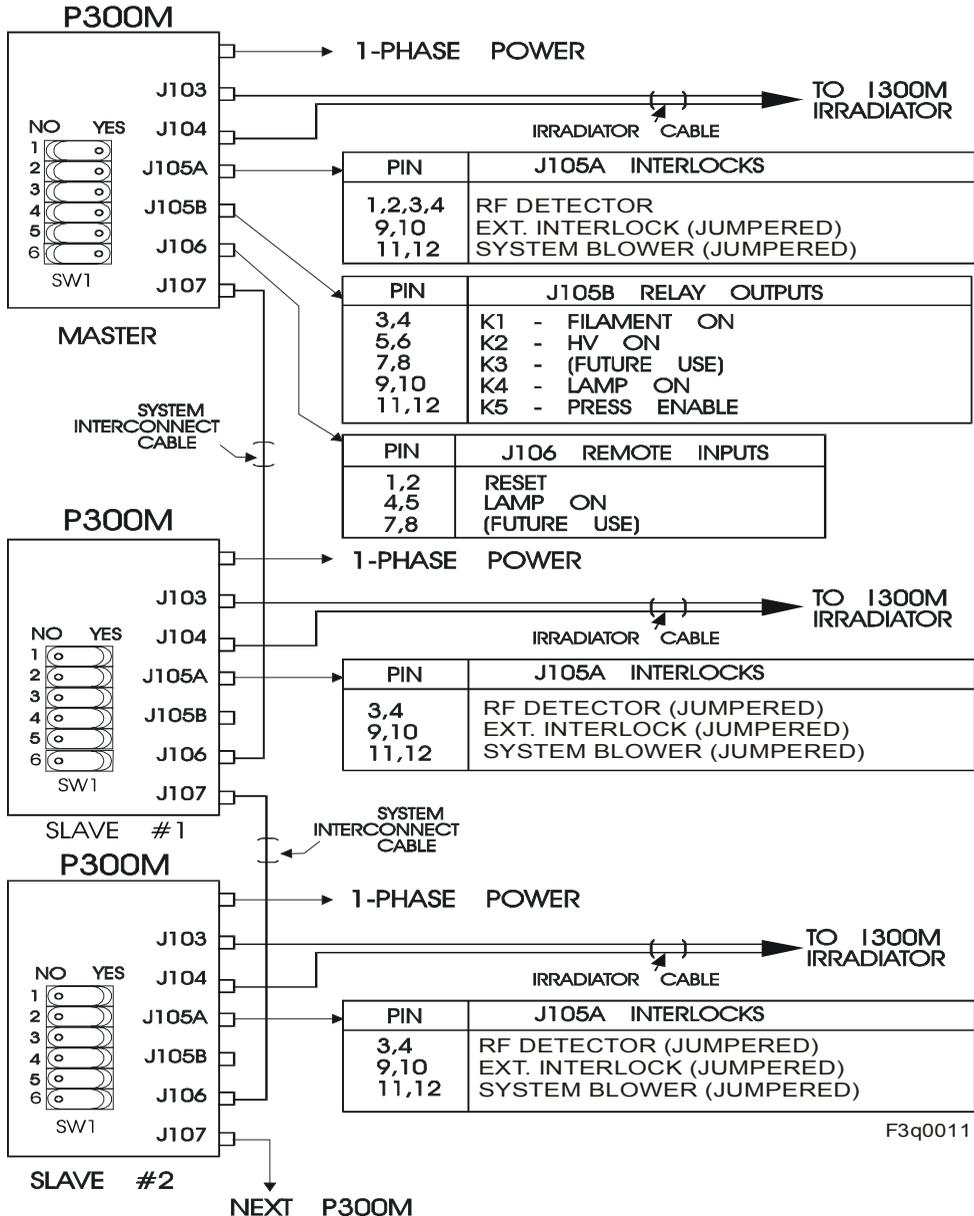
An alternate K5 function may be selected by installing a jumper onto JP2 on the control card. The STANDBY-READY function is asserted (K5 closed) when the power supply completes the transition from the STANDBY-WAIT (flashing yellow) to the STANDBY-READY state (steady yellow). K5 remains closed for the LAMP ON state (flashing or steady green), the QRO state (alternate flashing of yellow and green), and the return to the STANDBY-READY state (steady yellow). K5 opens during the OFF/RESET state and the STANDBY-WAIT state (flashing yellow) from either the LAMP ON state or from the OFF/RESET state.

**Table 8. Alternate Function for K5**

	J105B	Asserted State	Circuit Ratings	Comments
STANDBY READY (K5 alt.)	11, 12	Closed	1 A @120 VAC (10mA minimum)	K5 contacts close once STANDBY-READY state is achieved, and for any higher state.

# Multiple-Unit Programming and Connections

Programming and connections for multiple-unit systems are summarized in [Figure 13](#). Typically, one unit will operate as the MASTER and all others as slaves to the ON/OFF commands of this Master unit. Refer to detailed descriptions in [Chapter 4](#), “[Operation](#)” of this manual.



**Figure 13. F300S/F300SQ Multiple Unit Programming & Connections**

---

## Programming

Refer to [Figure 11](#) for programming switch S1 settings and set programming switches of each power supply as follows:

1. Select one unit as the Master. Set S1-1, 1-2, 1-3 and 1-5 of this unit to YES.
2. Set S1-1, 1-2, 1-3, and 1-5 of all slaves to NO.
3. To shut down all units in case of a single-unit fault, set S1-4 on all units to YES (For a detailed explanation of unit faults, see [Chapter 4, “Operation.”](#))

## Connections

The following procedure describes how to connect multiple power supplies (master/slave) within a system.

1. For proper operation, including fault detection, connect each power supply to the next using the H760 interconnect cables supplied with the system. Cables run from J107 of one unit to J106 of the next.
2. Install input/output plugs P105A (with jumpers - provided with system) in J105A of slave units.
3. The Master power supply must have an RF Detector connected to J105A; additional RF detectors may be plugged into J105A of the Slave power supplies by replacing the jumpered plug with the RF detector cable connector.
4. Make interlock connections to the Master using the P105A plug on RF detector cable harness as indicated in [“Input/Output Connections” on page 45](#) in this chapter.

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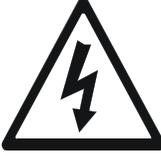
**NOTES:** When installing additional RF detectors on slave power supplies, be sure to set S1-5 to YES on those power supplies.

If additional RF detectors are used, an RF fault in a slave will automatically be interpreted as a system fault; this will shut down the entire system.

Additional interlocks such as RF, Remote Blower, and External Interlock may be connected to a SLAVE unit through P105A. Remove any factory-installed jumpers.

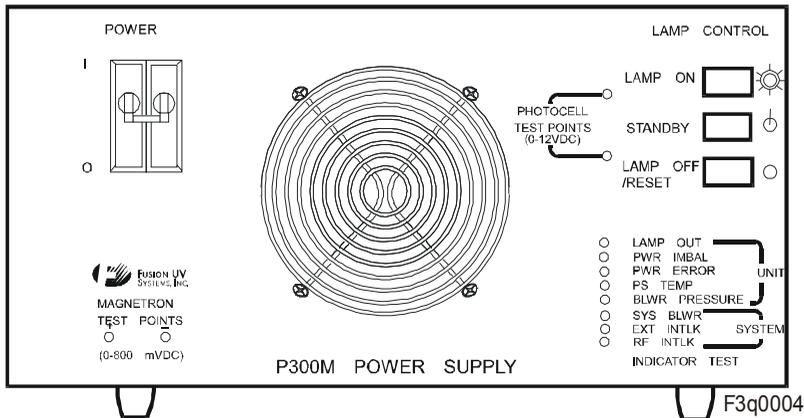
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# Power Source

	<p><b>CAUTION:</b> Measure the main single-phase voltage of your plant facilities to ensure that it conforms to the factory-wired operating voltage specified on the equipment label (rear panel of power supply). Available line voltage should be within 10% of the nominal operating voltage.</p> <p>Fusion UV equipment must be connected in accordance with local wiring codes. Use applicable standards for wire sizes, fuse sizes, and disconnect box locations. Each power supply requires a separate, fused single-phase circuit with a line disconnect.</p>
---	---

**NOTE:** If a line voltage greater than 230V and a frequency of 50 Hz is used, see the [“F300S Relay Coil Resistor Assembly Installation”](#) on page 53 at the end of this chapter.

## System Power Connections



**Figure 14. Power Supply Front Panel**

Listed current ratings indicate current demands during normal full-power operation. Your customer-supplied wiring and circuit breaker or fuses should be sized to allow for heavier current draw at startup. Current ratings are the same for 50 Hz or 60 Hz systems. The recommended power cord to wire to P101 is:

---

North American Applications: 3x12 AWG UL listed

International Applications: 3x2.5 mm<sup>2</sup> Harmonized, VDE

Both cable types should have minimum ratings of 16A, 300V, 0-60 °C.

Refer to [Table 11 on page 57](#) in [Chapter 4, “Operation,”](#) for the leg currents for each power supply/voltage combination.

## Frequency Tapping of HV Capacitors

If it becomes necessary to configure the system for a line frequency other than that delivered, the following steps should be followed:

1. Turn the unit POWER switch OFF and unplug the power cord.
2. Remove the power supply cover (six screws).
3. Locate the HV capacitors C101 and C102 (refer to [Figure 15 on page 54](#)).
4. Discharge the capacitor by shorting the capacitor terminals with an insulated screwdriver.
5. Locate the jumper connected to the T terminal of each capacitor.
6. Disconnect the opposite end of this jumper from the capacitor terminal to which it is connected, and reconnect it to the appropriate terminal for the desired line frequency (50 for 50 Hz, 60 for 60 Hz).

## QRO HV Capacitors (For QRO only)

When the Quick Restart Option is installed, one element of the retrofit is the replacement of the HV capacitors. These HV capacitors are a different value than the standard HV capacitors, but the frequency tapping procedure is exactly the same.

## High Voltage Transformer Taps

Standard high voltage transformers have labeled taps. Power supplies are shipped with transformers tapped according to customer power specifications. If a unit is relocated or a transformer must be replaced, connections should be installed as shown in the following table.

**Table 9. High Voltage Transformer Taps**

Power		HV Plate Transformer
		Primary Tap

**Table 9. High Voltage Transformer Taps (continued)**

Power		HV Plate Transformer
50 Hz	200	200
	208	
	220	220, 240
	240	
60 Hz	200	200
	208	
	220	
	240	220, 240

### QRO Transformer Taps (FOR QRO only)

When the Quick Restart Option is installed, the QRO transformers must be tapped according to the frequency and voltage specifications of the customer. Should these specifications change, or if a transformer is replaced, the transformer should be tapped as follows:

**Table 10. QRO Transformer Taps (Optional)**

Power		QRO Transformer	
		Primary Front Tap	Primary and Secondary Rear Taps
50 Hz	200	200V	50 Hz
	208		
	220	240V	
	240		
60 Hz	200	200V	60 Hz
	208		
	220	240V	
	240		

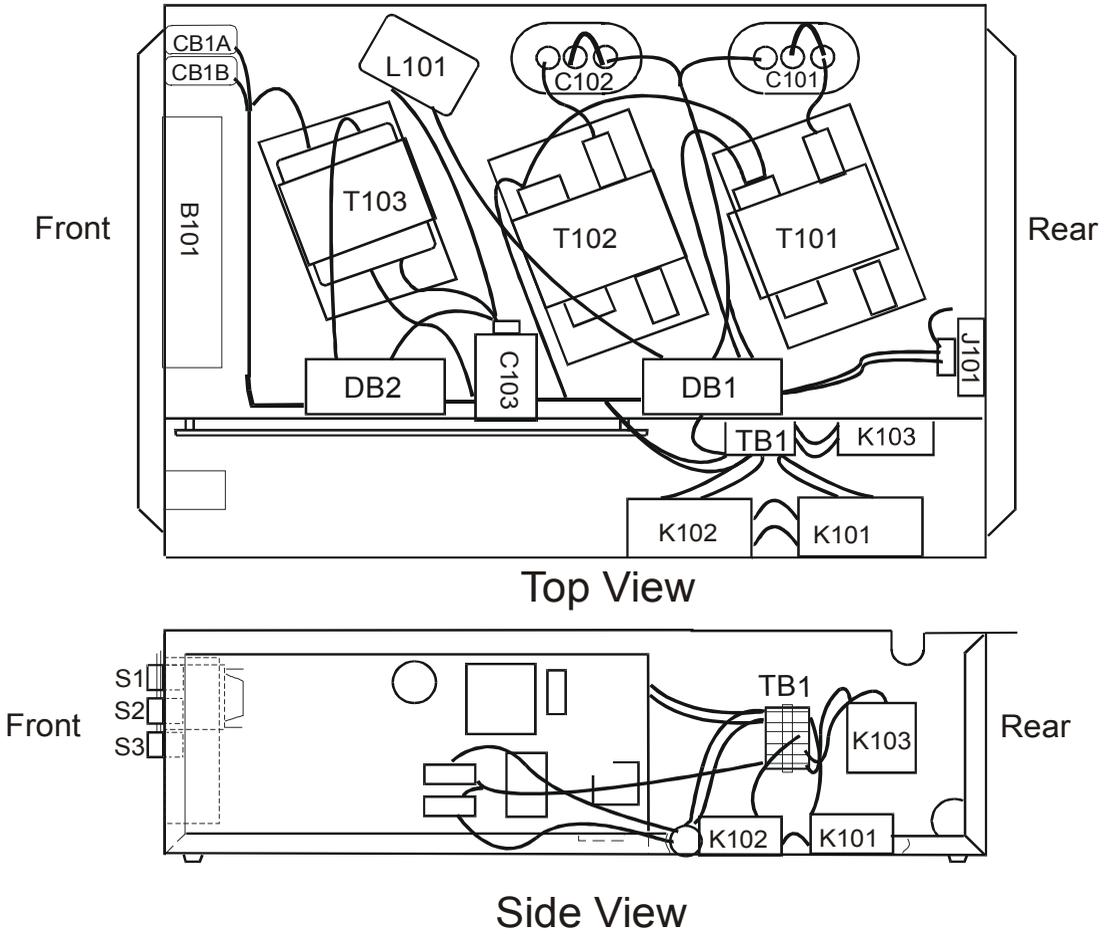
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## F300S Relay Coil Resistor Assembly Installation

The relay coil resistor assembly must be used if the line voltage and frequency used with a P300M/P300MQ/P300MT power supply is 230-240 VAC at 50 Hz (nominal voltage). These resistor assemblies prevent the premature failure of the relay coils in high line voltage environments. There are two coil resistor assemblies available in a retrofit kit (See [Appendix E, “Replacement Parts”](#)). One assembly is placed in series with each of the coils of K101 and K102 in the power supply. These resistors should also be used when it becomes necessary to configure the system for a line voltage and frequency of greater than 230 VAC at 50 Hz (nominal voltage.)

### Installation Instructions

1. Turn off the power and disconnect power from the power supply.
2. Remove the six cover screws and cover from the P300M/P300MQ power supply. (Remove the four cover screws and cover from the P300MT power supply.)
3. Locate relays K101 and K102. K101 is closer to the rear of the power supply and K102 is closer to the front (refer to [Figure 15 on page 54](#)).
4. On K102, locate tab 0. A black wire with a pink-insulated terminal will be connected to it.
5. Disconnect the black wire and press the pink-insulated female terminal of one resistor assembly onto K102 relay tab 0.
6. Connect the black wire with the red-insulated terminal to the red male terminal of the resistor assembly. The leads of the resistor assembly should be bent to form a U shape to make this connection easier.
7. On K101, locate tab 1. Two black wires with pink-insulated terminals will be connected to it.
8. Disconnect the black wire with the fully insulated right-angle terminal and leave the double terminal with the pink insulation connected. Press the female terminal of the remaining resistor assembly onto the exposed tab of the double terminal.
9. Connect the right-angle terminal to the male terminal of the resistor assembly. The leads of the resistor assembly should be bent to form a Z shape to make this connection easier.



**Figure 15. K101 and K102 on P300M/P300MQ**

# Chapter 4. Operation

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**WARNING:** Before operating the system, the operator must become familiar with the operating safety information presented in [Chapter 1, “Safety”](#).

## System Operation Controls

The lamp system is operated from the controls on the front of the power supply.

---

**NOTE:** Ambient system operating temperature is 0 to 45°C.

---

## Lamp Control

At STANDBY, power (115 VAC) is applied to the magnetron filaments without energizing the bulb. All interlocks and controls will continue to operate in STANDBY. An external blower can be triggered through a connection to output relay K1.

Pressing the LAMP ON button energizes the lamp to its full power level after a STANDBY delay and an additional “full power” delay. If after 8 seconds in the ON position the bulb has not successfully ignited, the lamp will shut down. Check the LED display on the power supply; it will indicate the probable source of the problem.

A “LAMP OUT” is a result of many different causes. The following are some reasons that may be a source of this fault condition:

- Successive short cycles
- Operation at improper air pressure
- Operation at continuous reduced power level with improper air pressure
- Improper initial ignition of the system
- Poor distribution of the fill material inside the bulb as a result of shipping and handling

- 
- Bulb producing insufficient output to activate the photocell

For proper initial ignition, the recommended “MINIMUM LAMP ON” time required for this system is “ten (10) seconds” at normal air pressure (3.5 inches w.c.) and full power operation (100% power level).

As previously mentioned, a “LAMP OUT” fault can occur when the bulb does not reach sufficient output to activate the sensing photocell. This will particularly occur at initial startup of the system, after successive “short cycles” (LAMP ON times below 10 seconds), or at the initial startup of a new bulb. In these instances, the bulb fill material has not completely vaporized. With repeated attempts to start the system, the problem may become worse, and can reduce the life of the electrical components.

Refer to [Chapter 5, “Troubleshooting”](#) for other possible causes of a LAMP OUT condition.

## Power

With the POWER switch in the OFF position, neither the control card nor the high voltage circuitry are energized. With the switch in the ON position, the power supply cooling fans and the control card are energized, and the LAMP Control switches are enabled.

## Off/Reset Control

When a fault occurs, the fault must be corrected and the unit(s) reset by pressing the LAMP OFF/RESET switch before operation can be resumed.

1. If a UNIT fault occurs, correct and reset the individual unit.
2. If a SYSTEM fault occurs, reset the Master unit.
3. If a slave has an RF detector connected, reset the Master when the Slave indicates a fault.
4. If a system is operated by a remote ON/STANDBY switch, reset the MASTER power supply when a system fault occurs.
5. If a system uses a remote LAMP OFF/RESET switch, that switch may be used instead of the front panel switch to reset a fault.

## Initial Startup Procedure, Single Unit

1. Turn POWER switch to ON position and press the LAMP OFF/RESET switch: The red LAMP OFF indicator is lit.
2. Press the STANDBY switch: the yellow STANDBY indicator blinks, then stays lit.

3. Press the LAMP ON switch: the green LAMP ON indicator blinks, then stays lit.
4. Check the line currents. The line currents should conform to the values in [Table 11](#).

**Table 11. P300M/P300MQ/P300MT Current Requirements**

System Line Voltage Single Phase	Line Currents (A)	
	with K300M Modular Blower	without K300M Modular Blower
200	15	14.5
208	14	13.5
220	14	13
230	13.5	13
240	13.5	12

5. Check RF detector and customer use interlocks as described in [Chapter 5](#), “[Troubleshooting](#).”

## Initial Startup Procedure, Multiple-Unit Systems

1. Turn POWER switches of all units to ON.
2. Press the LAMP OFF/RESET switch of the Master.
3. Press the LAMP ON switch of all slaves.
4. Press LAMP ON switch of the Master.

---

**NOTE:** Front panel controls take precedence over remote or master commands.

---

## Master/Slave Operation

One master power supply can control up to five slave units. Review [Chapter 2](#), “[Mechanical Installation](#)” to understand the interconnections and programming needed.

## Operating the System

1. Turn POWER switches of all units to ON.
2. Press the LAMP OFF/RESET switch of the Master.
3. Press the LAMP ON switch of all slaves.

- 
4. The LAMP CONTROL switches on the Master may now be used to activate all units in the system at the same time.

---

**NOTE:** LAMP CONTROL flashers of slaves will follow LAMP CONTROL on Master.

---

## Resetting the System After a Fault

If a fault occurs in the system, press the LAMP OFF/RESET switch on the Master, or cycle the remote LAMP OFF/RESET switch, then press the Master LAMP ON switch to reset the system.

**NOTE:** Times indicated are approximate and will vary. The exact interval is determined by conditions within the system.

If additional RF detectors are connected to slaves, an RF fault in one of these slaves will automatically be interpreted as a system fault shutting down the entire system.

In a Master/Slave system, the Slave units must be switched to STANDBY or ON before Master power supply is switched from OFF to STANDBY.

**Table 12. Routine Operation**

Time	Power Switch	Lamp Control	Lamp Control Flasher	Operation
0 sec	ON	Lamp Off	Red	Control card energized
1-2 sec		Standby	Yellow flash	Power supply FAN ON; Modular Blower ON
10 sec			Steady yellow	Interlocks and fault detection circuits function. Ready to start.
0 sec		Lamp On from Standby	Green flash	Start HV transformers
2-8 sec				UV bulb ignites
8-10 sec			Steady green	UV bulb at full power
0 sec		From LAMP OFF to LAMP ON	Slow flash yellow	
10 sec				
12-18 sec			Fast flash green	UV bulb ignites
18-20 sec				Steady green
0 sec		From LAMP ON to STANDBY	Yellow flash	UV bulb extinguished
18 sec			Steady yellow	Ready to restart

## Remote Operation

The F300S/F300SQ can be operated remotely with a STANDBY/LAMP ON switch connected to the Master. Refer to [Chapter 3, “Electrical System”](#) for instructions on connecting remote switches.

The following procedure describes how to operate a lamp remotely:

1. Turn all remote switches OFF (open contacts).

2. Turn the Master POWER switch ON and press the LAMP ON switch.
3. The system will now operate from remote switches. Remote switch functions are virtually the same as front panel switch functions.

**Table 13. Remote Switch Functions**

Remote Switch	Equivalent Panel Control	Lamp Status	
		Switch Open	Switch Closed
Lamp ON	Lamp ON	Standby	Lamp ON
Lamp RESET	LAMP OFF/RESET	Default to lowest state	LAMP OFF/RESET

## Operation with Remote Controls

**Table 14. Operation with Remote Controls**

Panel Controls on Master		Remote Switches	
Power	Lamp Control	Lamp ON	Lamp Status
Off/Reset	S	S	Off/Reset
ON	LAMP OFF/RESET	S	LAMP OFF/RESET
ON	ON	Remote RESET Switch CLOSED	LAMP OFF/RESET (overrides remote Lamp ON switch)
ON	STANDBY	OPEN	STANDBY
		CLOSED	
	ON	OPEN	Lamp ON
		CLOSED	

KEY:

S- Switch position does not matter.

## Quick Restart Option (QRO)

The Quick Restart Option (QRO) provides the ability to restart the lamp at any time, even immediately after the lamp has been switched to Standby mode. Thus, the mandatory 18-second restart cycle time associated with routine operation has been eliminated. The QRO may be installed at the time of the P300MQ power supply construction or may be retrofitted into P300M power supplies in the field by trained personnel.

---

The QRO consists of a high-voltage, low-current power supply section located in the P300MQ power supply that allows the magnetron in the irradiator to maintain an ignited bulb at a very low input power level (approximately 10%) and a very low UV output level (less than 1%). This feature is intended for use in processes that require occasional periods of decreased UV output, or in the event of a short duration process interruption.



**CAUTION:** The QRO is not intended for use as a shutter, or in processes that require rapid On-Off cycles. This kind of use may be detrimental to bulb life span.

The actual restart time of the bulb will depend upon the elapsed time from when the lamp was switched from the Lamp On state to the Standby state. Representative data for the restart time from the QRO state to the Lamp On state (70%, 80%, and 90% UV output) is shown versus QRO state duration in [Figure 16](#), [Figure 17](#), and [Figure 18](#).

The QRO state, when enabled, will automatically occur when the power supply is switched from the Lamp On state to the Standby state. The QRO state is indicated by the alternate flashing of the green Lamp On and yellow Standby buttons on the front of the power supply. The QRO state will last for a maximum of 40 seconds, after which it will revert to the Standby state and the yellow button only will remain on.



**WARNING:** While the lamp's light output is low during the QRO state, both eye and skin protection should be worn in the event of possible direct or indirect exposure. Refer to [Chapter 1, "Safety"](#) for detailed information regarding ultraviolet radiation safety.

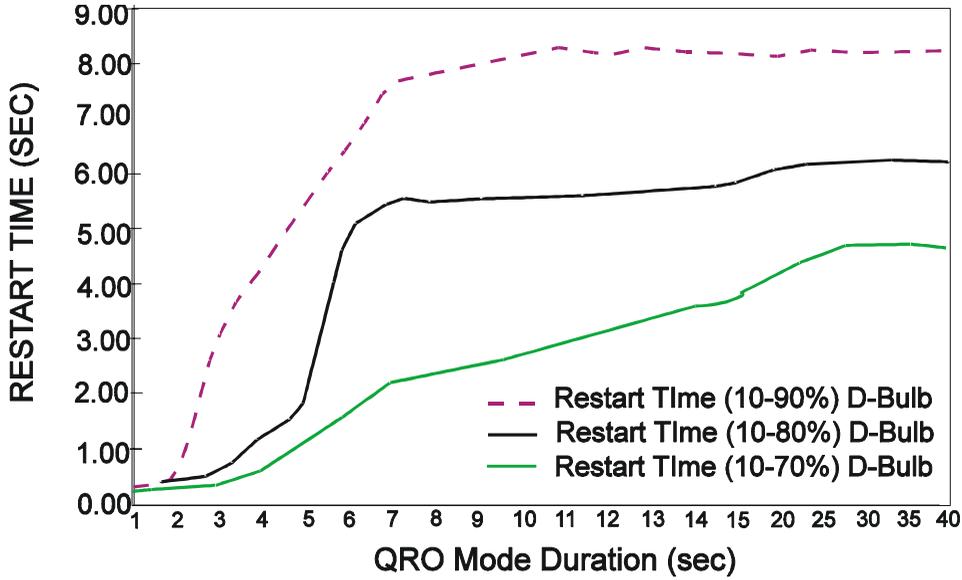


Figure 16. Restart Time Versus QRO State Duration, D-bulb

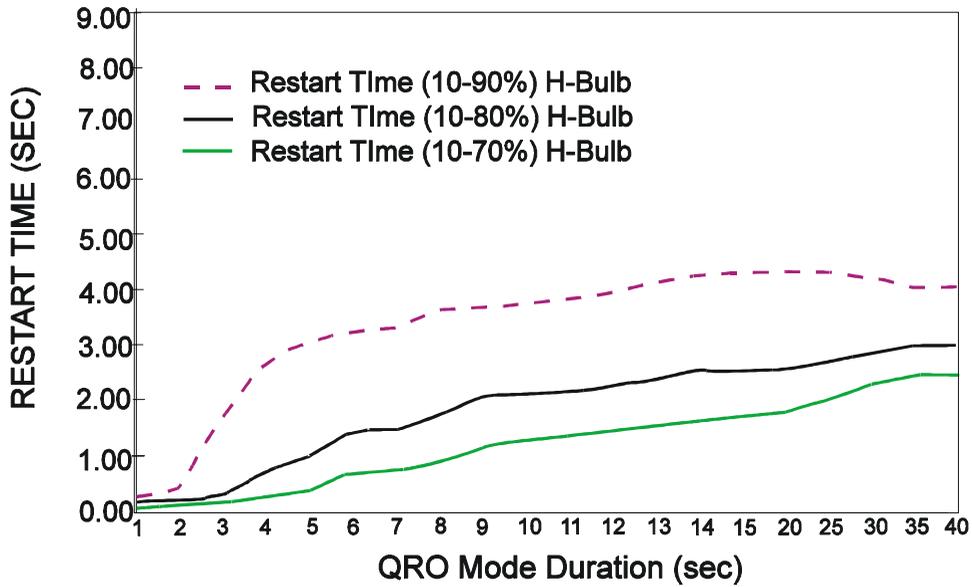


Figure 17. Restart Time Versus QRO State Duration, H-bulb

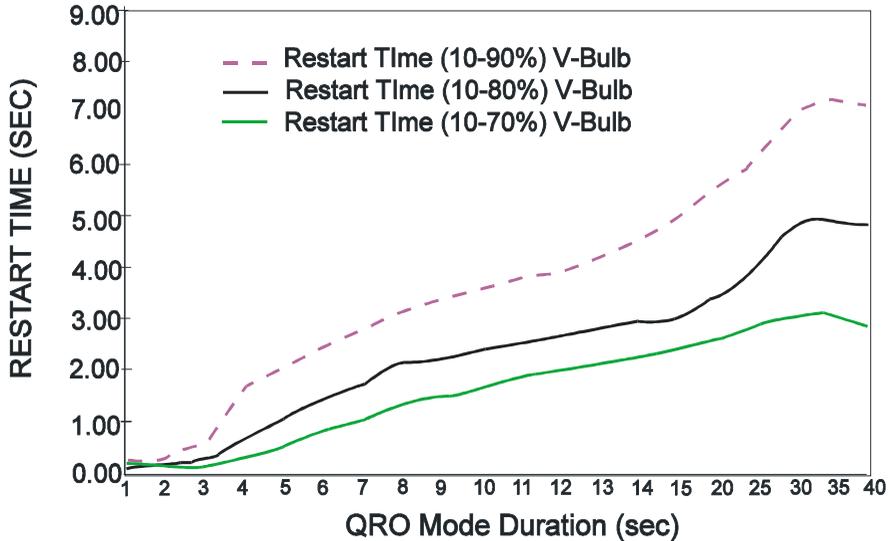


Figure 18. Restart Time Versus QRO State Duration, V-bulb

## Electrical Installation and Setup

For a power supply with the QRO components installed and properly connected, the QRO can be enabled by setting the control card DIP switch S1-6 (marked QRO) to the YES position. See [Chapter 3, “Electrical System”](#) for further programming details.

## Operation

The QRO state, when enabled by programming switch S1-6 on the control card, will be active during every transition from the Lamp On state to the Standby state, whether the lamp is operated remotely or from the front panel. The Lamp On state may be reentered by pressing the LAMP ON front panel switch or by remotely switching to Lamp On. If no other action is taken, the Standby state will become active after a QRO state duration of 40 seconds. The Reset state may be entered at any time by pressing the RESET front panel switch or by remotely switching to Reset.

In a multiple-unit configuration, mixing QRO and non-QRO units is unlikely. However, if power supplies with and without the QRO are mixed, units with the QRO will operate as described in the preceding paragraph, and the units without the QRO will operate as described previously for a standard P300M power supply. The Initial Startup Procedure, Master/Slave Operation, and Remote Operation of power supplies with the QRO are the same as for standard non-QRO units.

See [Appendix E, “Replacement Parts”](#) for the QRO parts list.



## Chapter 5. Troubleshooting

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**DANGER: High Voltage** -- Use extreme caution at all times when troubleshooting the power supply. Line voltages are present even when the lamp control switch is set to STANDBY.

**Do not measure any voltages not specified in the troubleshooting procedures: dangerously high voltages exist in the power supply.**

**Do not touch power supply/irradiator cable connectors while the system is on. High voltages are present in the connector.**

**Do not touch any power supply components or wiring while the unit is operating.**

**To troubleshoot the power supply, first turn off and disconnect all power to the unit. All high voltage capacitors have an internal discharge resistor which should discharge to a safe level in five seconds. Physically shorting the capacitor terminals with an insulated screwdriver blade is advised as an additional safety measure.**



**DANGER: Ultraviolet Radiation** -- Do not test the irradiator without using adequate ultraviolet light shielding and never look directly at the UV lamp. Severe ultraviolet burning of the skin and eyes can result without proper safeguards.

### Basic Checks

Check that input power is connected properly. Actual line voltage must be within 10% of the voltage rating shown on the equipment label. Labels are located on the rear of the power supply. If the input voltage does not match, contact Fusion UV Systems.

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## Safety Interlock Tests

The fault indicators, RF detector, and external interlocks should be tested at regular intervals to assure safe operation of the UV system.

1. With the power supply chassis inserted into the cover and single-phase power applied, depress the IND TEST button on each power supply. All LED indicators should light.
2. Turn all POWER control switches to ON. (No UV light is being produced by the bulb.) Press the STANDBY switches of all units.
3. Operate the external interlock switch(es), by opening light shields, etc. The system should shut down and produce an LED signal. Reset unit by pressing the LAMP OFF/RESET switch on the master units.
4. To actuate self-test of the RF detector, depress the test button on the detector and hold it down for 4 seconds. The system should shut down and produce an RF Interlock LED signal. Reset as before.

## Fault Indicators

When an interlock switch is opened or improper equipment operation is detected, a fault signal is generated. Power is removed from the irradiator and blower of one or all units, depending on the type of fault and the programming selected by the user. The type of fault (Unit or System) is indicated on the front panel of the unit detecting the fault.

## Unit Faults

Unit faults are those detected within an individual module. The Lamp Control switch and the top five light-emitting diodes on the front panel indicate the unit faults (see [Figure 14 on page 50](#)).

**Table 15. Unit Faults**

Indicator	Description
(HV Cable)	If the LAMP OFF/RESET switch is lit when the POWER switch is ON, but the unit will not go to STANDBY when the switch is pressed, the high voltage cable is not connected or faulty.
LAMP OUT	After ON switch pressed: the photocell was not satisfied within 8 seconds of initial startup time, or the light output fell low enough to unsatisfy the photocell at any time after startup. After STANDBY switch: Shorted Photocell detected.

**Table 15. Unit Faults** (continued)

Indicator	Description
PWR ERROR	Improper operation of magnetron: either no magnetron anode current 2-4 seconds after high voltage is applied, or the presence of high voltage when the Lamp system is in OFF or STANDBY.
	<b>CAUTION:</b> If a PWR ERROR fault is indicated, press the LAMP OFF/RESET switch immediately. To prevent magnetron damage, single-phase power should be disconnected (see PWR ERROR fault).
PS TEMP	The power supply is overheating.
BLWR PRESSURE	Cooling air pressure within the irradiator is insufficient.

## System Faults

The bottom three LEDs indicate system faults. These faults always shut down ALL units in the system, causing all LAMP CONTROL switches to flash.

System interlock switches and the RF detector may be connected to any unit, but are normally connected to the master. System faults will then be detected and displayed at the master power supply.

**Table 16. System Faults**

Indicator	Description
SYS BLWR	Insufficient cooling air pressure in an external supply or exhaust blower causes pressure switch to open.
EXT INTLK	Open external interlock switch on a plenum cover, for example, connected at customer option.
RF INTLK	Excessive RF at the RF detector, or loss of power to detector.

## Fault Diagnosis Tables

To determine the likely cause of failure in an F300S/F300SQ unit, note the operating sequence when the failure occurs. Also, record which fault indicator LED lights. The indicator may light immediately when the unit is switched from one condition to another (for example, from STANDBY to ON); or the signal may be displayed until after a programmed internal delay has elapsed.

There is a troubleshooting table for each fault indicator, showing secondary symptoms to help localize the problem. The possible causes are listed, followed by testing and repair instructions.

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Table 18, “Troubleshooting/Fault Diagnosis,” on page 69 covers miscellaneous faults and malfunctions.

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**NOTE:** The control card may be responsible for any of the fault conditions described following. If the fault cannot be determined after investigating all possible causes listed, check the control card for damage or improperly secured connectors.

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Return malfunctioning control cards to Fusion UV Systems.

## Failure Diagnosis Cross-Reference

The F300S/F300SQ system is designed to signal the operator when a failure occurs in one unit or a multiple unit system. Table 18, “Troubleshooting/Fault Diagnosis,” on page 69 is organized around these signals and observable clues. Use the following table to locate the fault indicated.

Notice that the failure of some signals to light is also an indication of a fault.

**Table 17. Fault Diagnosis Cross Reference**

Signal	Page
Arcing sound	81
EXT INTLK	74
LAMP OUT	74, 75, 77, 78, 79, 81
LAMP OUT light is off	77, 78, 79
BLWR PRESSURE	75
PS TEMP	76
PWR IMBAL	75, 80
PWR ERROR	76, 80
LAMP OFF/RESET light is off	73
RF INTLK	73, 75, 80
STANDBY switch does not light	75
SYS BLWR	76
Failure with no signal	73, 75

**Table 18. Troubleshooting/Fault Diagnosis**

Operation	Signal/ Other Symptoms	Possible Cause	Corrective Action
POWER switch from OFF to ON	LAMP OFF/RESET button does not light at power up	Fuses F1 and F2	Check fuse and replace if blown.
		Power supply wiring	If fuse immediately blows again, replace fuses. Then: A. Disconnect P104 on back of power supply, P10 from the irradiator, and P20 at the RF detector. Press STANDBY LAMP CONTROL button. If fuse does not blow, proceed to (B). If the fuse blows, the problem is in the internal wiring or control card.
		Control card	Replace control card.
		Irradiator cable	B. Turn OFF. Reconnect P104. Press STANDBY. If the fuse does not blow, proceed to (C). If the fuse blows, the problem is in the connectors or cable.
		RF detector	C. Turn OFF. Reconnect P20 at the RF detector. Press STANDBY. If fuse does not blow, proceed to (D). If the fuse blows, the problem is in the RF detectors or cable.
		Filament transformer	D. Turn OFF. Reconnect P10 to the irradiator. Press STANDBY. If the fuse blows, the problem is in the filament transformer or connections.
	Master turns slaves ON but not OFF	Programming error	Close S1-1 (YES) on master.
	RF INTLK indicator lights on slave with slave OFF, master ON	Cable connection	Connect cable H760 to slave.
	RF INTLK indicator lights on all units	Programming error	Close S1-5 (YES) on master.
	System shuts down; no fault indicators light	Momentary loss of AC	Turn off all units and then turn each unit on. A momentary loss of power to one or more units may be interpreted as a system fault.

**Table 18. Troubleshooting/Fault Diagnosis** *(continued)*

Operation	Signal/ Other Symptoms	Possible Cause	Corrective Action
Lamp control at OFF, or from OFF to STANDBY	EXT INTLK indicator lights	Open control input.	A jumper or an external circuit between J105A-9 and J105A-10 must be closed by a jumper or an external switch.
		Poor connection	Disconnect all power. Reseat control board assembly connections. Try again.
		Control card	Replace the control card.
Switch from OFF to STANDBY or from LAMP ON to STANDBY	LAMP OUT indicator lights	Shorted photocell	Press LAMP OFF switch. Attach voltmeter probes to Photocell Voltage Test Points. Press the STANDBY switch. Measure the photocell voltage between Photocell Voltage Test Points while in STANDBY. The voltage level indicated should be greater than +9.3 VDC. If the voltage level indicated is less than this value, the photocell is defective. Replace the photocell assembly.

**Table 18. Troubleshooting/Fault Diagnosis (continued)**

Operation	Signal/ Other Symptoms	Possible Cause	Corrective Action
Switch from OFF to STANDBY	BLWR PRESSURE indicator lights	Single-phase voltage missing phase	See “Basic Checks” on page 65.
		Air pressure	Measure air pressure inside irradiator following the procedure described in Chapter 6, “Maintenance”. IF PRESSURE IS LOW:
		Dirty air filters	Replace dirty air filter on remote or modular blower.
		Pressure switch faulty	Replace the pressure switch.
		Air handling design	Check for adequate air handling requirements.
	STANDBY switch does not light	HV cable disconnected	Connect HV cable.
	No fault indicators light.	Faulty HV cable	Inspect cable, check for continuity.
		Control card	Replace control card.
	LAMP OUT and/or PWR IMBAL indicators light immediately	Card connectors not secure	Check control card. All connectors must be properly secured.
		Control card	Replace control card.
	RF INTLK indicator lights or flashes alternately with the lamp control switches	No RF detector connected	Connect RF detector. A system must have at least one RF detector connected.
		Programming error: 1. All units have S1-5 open. 2. Unit(s) with S1-5 open and no jumper between J105A-3 and J105A-4.	1. Close S1-5 on unit with RF detector connected.  2. Install jumper.
		RF cable shorted or open	Check cable for continuity.
		RF detector faulty	Replace RF detector.
		Control card	Replace control card.

**Table 18. Troubleshooting/Fault Diagnosis (continued)**

Operation	Signal/ Other Symptoms	Possible Cause	Corrective Action
Switch from OFF to STANDBY or from STANDBY to ON	PS TEMP indicator lights	Power supply fan inoperative	Repair or replace fan.
		Power supply too hot or in poor location	Move to cooler location.
		Temperature switch faulty or not connected.	With power off, check the T101 and T102 thermal switches, which should be closed, with an ohmmeter or DVM. Check that the thermal switch interconnections are secure.
		Card connectors not secure	Reseat connectors.
		Control card	Replace control card.
	SYS BLWR indicator lights	Blower power; pressure	If SYS BLWR input for external blower in J105A is in use, check external blower power and pressure in the same manner as remote blower.
		Jumper in J105A	If SYS BLWR input not in use, check jumper is in place in connector J105A.
Control card		Replace control card.	
Lamp Control at STANDBY	PWR ERROR indicator lights	K101	Check for presence of magnetron current. If within specifications, then examine relays for stuck armature or contacts welded shut. Check operation of relay with single-phase power only connected.
		Control card	Replace control card.
	<p><b>CAUTION:</b> Disconnect single-phase power at main circuit breaker immediately. Magnetron may be severely damaged by application of high voltage when lamp control is in OFF or STANDBY.</p>		

**Table 18. Troubleshooting/Fault Diagnosis (continued)**

Operation	Signal/ Other Symptoms	Possible Cause	Corrective Action
Switch from STANDBY to ON	LAMP OUT indicator lights after 8 seconds; Lamp bulb does not light	High Voltage Cable	Check cable connections at J103, J104, J10, and J11.
		Lamp Bulb	<p>Measure the Photoresistor output at the photocell test points and magnetron current test points on the front panel while switching to LAMP ON.</p> <p>If the photocell voltage does not drop when the magnetron current voltage changes, replace the bulb.</p> <p>If the photocell voltage drops, remove and inspect the bulb for normal mercury condensation. If normal mercury condensation is not observed, (if all the pellets are at one end, or at the center of the bulb), if possible, test the bulb in a separate unit. If the bulb starts, check your process (air handling, duty cycle, etc.). If the bulb does not start, replace the bulb.</p>
		New bulb	During its first start, a new lamp bulb may take up to 8 seconds after ignition before reaching full intensity if the mercury (Hg) fill has accumulated at one end or at the center of the tube.
		High Voltage cable	Check cable connections at J103, J104, J10, and J11.
		Control	<p>Listen for the sound of K101, the high voltage contactor, inside the power supply. It should be heard closing with an audible click when switched ON (after a three second wait in STANDBY). If not detected:</p> <p>Disconnect single-phase power. Reseat control board assembly connectors P8 and P9. Observe K1 and K102 when switching to STANDBY. Reconnect the single-phase power and observe K2 and K101 when switching to ON.</p>
		K1, K2 Relays	Replace K1 and K2 on the control board assembly.
		Control card	Replace control card.

**Table 18. Troubleshooting/Fault Diagnosis** (continued)

Operation	Signal/ Other Symptoms	Possible Cause	Corrective Action
Switch from STANDBY to ON  (continued)	LAMP OUT indicator lights after 8 seconds; Lamp bulb does not light  (continued)	Diodes, capacitors	If the readings are not different, a power supply fault is indicated. Disconnect all power and inspect for wiring damage. Test diodes and capacitors according to the procedures in <a href="#">Chapter 6, "Maintenance"</a> .
		Irradiator	Disconnect all power. Remove the irradiator cover (see <a href="#">Chapter 6, "Maintenance"</a> ). Inspect for obvious damage to wiring. Inspect the reflector for pitting near the large slots, which is evidence of arcing.
		Magnetron	If no power supply fault can be found, disconnect all power. Replace magnetron (see <a href="#">Chapter 6, "Maintenance"</a> ).
	<p><b>WARNING:</b> If no magnetron test voltage is measured at the magnetron test points, remove power from the unit immediately. Consult Fusion UV Systems Technical Services.</p>		

**Table 18. Troubleshooting/Fault Diagnosis** *(continued)*

Operation	Signal/ Other Symptoms	Possible Cause	Corrective Action
Switch from STANDBY to ON <i>(continued)</i>	LAMP OUT indicator lights after 8 seconds; Lamp Bulb does not light <i>(continued)</i>	Dirty surface	Inspect lamp bulb and reflector. Clean or replace as necessary. Try to start again.
		Line voltages out of specification	NOTE: If the magnetron needs to be replaced prematurely, check that the single-phase voltage is within specification (see “Basic Checks” on page 65).
		Weak magnetron	If photoresistor reading does not fall to below 9.3 VDC in 8 seconds, a weak magnetron is commonly indicated.
	LAMP OUT indicator lights after 8 seconds; UV bulb reaches full intensity	Photoresistor	Measure photoresistor output at Photocell Voltage Test Points while switching to ON (see schematic) +12 VDC at STANDBY, 2-5.5 VDC at ON. If voltages are incorrect, remove the irradiator cover and replace the photoresistor as described in Chapter 6, “Maintenance”.
		Weak magnetron	If photoresistor reading does not fall to below 9.3 VDC in 8 seconds, a weak magnetron is commonly indicated.
		Connections	Disconnect all power. Remove the power supply cover. Reseat the control card connectors P6 and P10. Restart.
		Control card	Replace the control card.

**Table 18. Troubleshooting/Fault Diagnosis (continued)**

Operation	Signal/ Other Symptoms	Possible Cause	Corrective Action
Switch from STANDBY to ON <i>(continued)</i>	PWR IMBAL indicator lights	Power Supply	Usually, a diode or capacitor failure will reduce magnetron current by one-half. Test the diodes and capacitors according to <a href="#">Chapter 6, "Maintenance"</a> . The voltage to the primary coils ONLY of the high voltage transformers should also be checked.
		Filament Transformer	Check the filament transformer and connections.
		Control Card	Replace the control card if no power supply, magnetron, or other malfunctions are found.
		Failing (Moding) Magnetron	Check magnetron current at front panel test points. If it is not within specifications, replace magnetron.
	PWR ERROR indicator lights	Filament transformer	Check filament transformer and connections.
		Magnetron	Check for presence of magnetron current. If it is zero, disconnect all power, and replace magnetron. If magnetron current is low or half, check diode block and HV capacitors.
		Control Card	Replace the control card.
	RF INTLK indicator lights	Lamp bulb faulty	Replace the lamp bulb.
		RF Screen damaged	Replace the RF screen.
		RF - arcs forming	Inspect reflector for pitting; replace if necessary.
		RF Detector faulty	See <a href="#">"RF Detector" on page 20</a> to test RF detectors.
		Position	Reposition the detector farther from the screen and/or the light shield opening.
	<p><b>WARNING:</b> The RF detector should at all times be closer to the screen or light shield opening than personnel working nearby. It should be aimed so that it intercepts RF radiation from the irradiators.</p>		

**Table 18. Troubleshooting/Fault Diagnosis (continued)**

Operation	Signal/ Other Symptoms	Possible Cause	Corrective Action
Lamp Control at LAMP ON	LAMP OUT indicator does not light, or UV lamp does not light	Control card	Replace control card.
	Arcing sound from irradiator, a grinding noise	Damaged Reflector	Disconnect all power. Inspect reflector for pitting near large slots. Replace reflector if necessary.
		Wiring or connector	Remove irradiator cover and inspect wiring for damage.
	Magnetron	Replace the magnetron; see <a href="#">Chapter 6, "Maintenance"</a> .	
System not responding in accordance with programming switch SW1 settings	Incorrect MASTER/SLAVE arrangement or cable hook up	See <a href="#">Chapter 3, "Electrical System"</a> .	



# Chapter 6. Maintenance

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This chapter provides maintenance procedures for the I300M irradiator, the I310M/311M Irradiator, the P300MT power supply, and the K300 modular blower.

## I300M Irradiator

### Bulb, Screen, and Reflector Maintenance

#### Cleaning Guidelines

At least every 500 hours of operation, the irradiator should be removed from the light shield, and the screen, lamp bulb, and reflector inspected carefully. Clean as needed. Instructions for removing and replacing these components appear later in this chapter. Guidelines for cleaning these components follow.

If the reflector or bulb surfaces show signs of dirt, oil, or vaporized materials, they should be removed and cleaned with a good industrial cleaner, using a lint-free cloth or tissue. The cleaner should contain no waxes, silicones, dyes or perfumes. Simple Green® and Windex® are recommended. Wipe away any residues, using the cloth or tissue with pure water. Alcohol, isopropyl, or methanol may be used for final removal of residues, except when alcohol is not allowed as a solvent.

If deposits on the screen, bulb, and reflector are consistently found at 500-hour inspections, the blower filters should be changed more frequently, or a more efficient filter should be used. These deposits can cause premature failures when particles burn into the quartz lamp or result in dulling of the reflectors.

#### Bulb Cleaning

Handle bulbs with a lint-free cloth or tissue taking care not to leave fingerprints.

Baked-on material can be removed from bulbs with a MILD abrasive cleaner such as Soft Scrub®, followed by a thorough rinse with water. If alcohol is allowed, do a final wipe with alcohol. Harsh abrasives and steel wool should NEVER be used on bulbs.

#### Reflector Cleaning

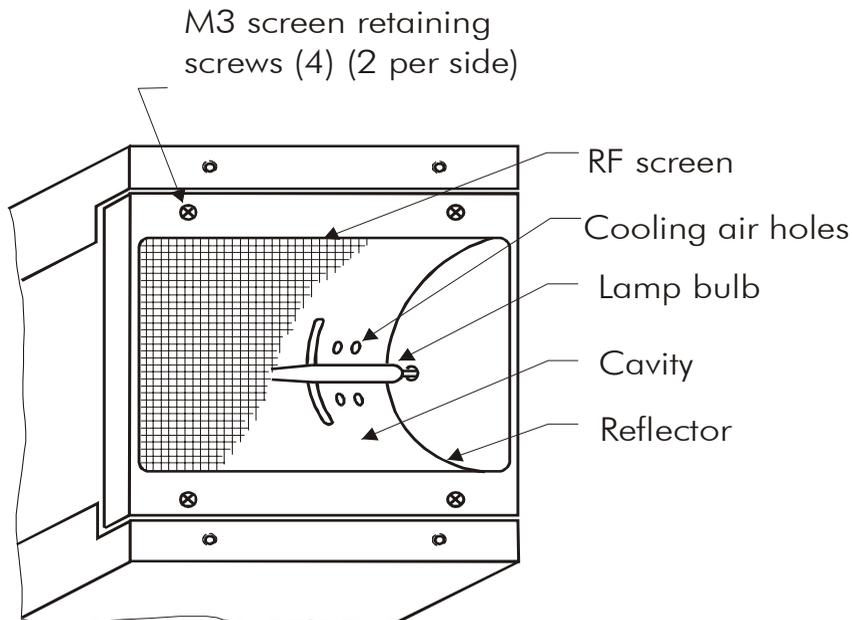
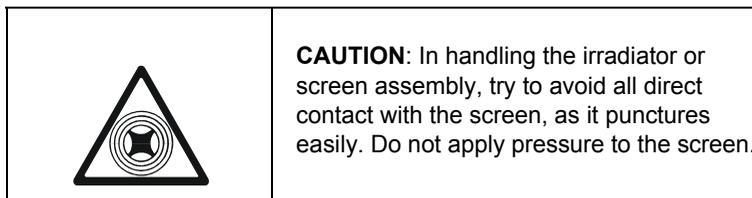
If the reflector surface is dull or discolored, it should be cleaned. Abrasives should **never** be used on reflectors.

If cleaning reflectors while assembled in the irradiator, drying with compressed air is NOT recommended because particles or residues can be driven into spaces between components and into optical sensing elements.

## Screen Cleaning

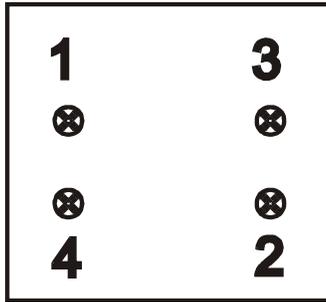
Screens may be cleaned with the same cleaners cited previously, soaking if necessary, brushing lightly and rinsing well. Take care not to damage the gaskets or the fine screen wires.

## I300M Screen Assembly Removal/Replacement



**Figure 19. Reflector Assembly (I300M)**

1. Refer to [Figure 19](#). Loosen the four M3 screen retaining screws three turns each. Repeat, this time removing screws. Grasp the screen frame by both ends, taking care not to twist or bend the screen itself, and remove screen assembly.
2. To replace existing screen or install a new one, place the screen assembly in position.
3. Apply pressure to the frame only and press firmly into place. Install the four screws alternately, working from side to side. Tighten each to a snug position; finally tighten to 0.9 N-m (8 inch-lbs.) using a torque-controlled screwdriver.



**Figure 20. RF Screen Screw Tightening Sequence**

## Lamp Bulb Removal/Replacement

	<p><b>WARNING:</b> During operation, the lamp bulb and adjacent metal surfaces become very hot. Operate the blower for about one minute to cool hot surfaces.</p>
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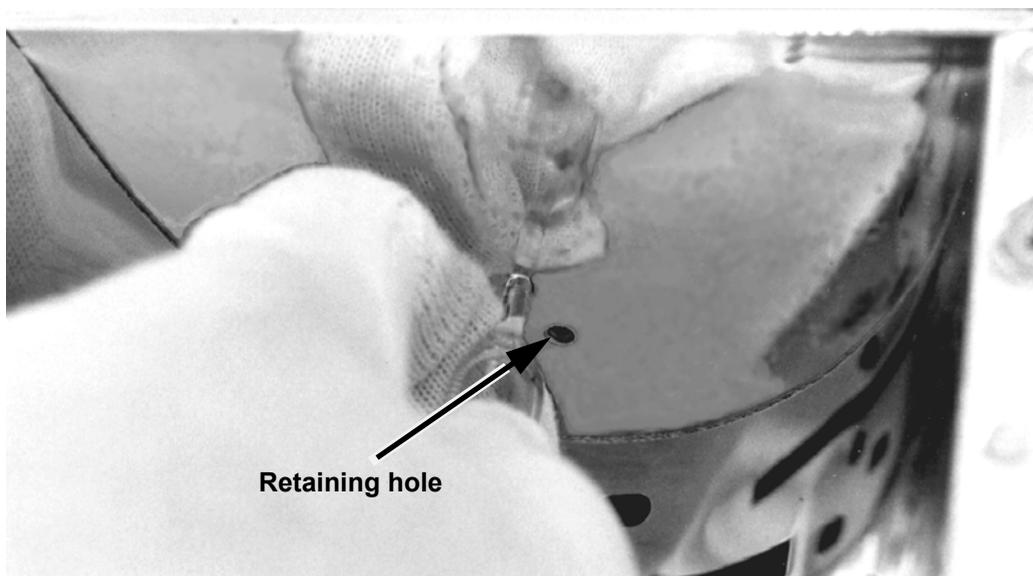
1. Remove the screen as described in [“I300M Screen Assembly Removal/Replacement”](#) on page 80.
2. Next, see [Figure 21](#) on page 82. Using clean cotton gloves or lint free tissue, grasp the lamp bulb at one end between the thumb and fingers and apply firm pressure axially toward the opposite end. When the tip of the bulb has cleared its retaining hole and is free to move past or along the end reflector, gently slide it up and out.

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**CAUTION:** Do not apply bending force to the lamp bulb. Do not touch the bulb with bare fingers or allow it to contact dirty or greasy surfaces. Contaminants can be burned into the quartz envelope, causing premature bulb failure.

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3. Clean any deposits from the surface of the bulb (see [“Cleaning Guidelines”](#) on page 79).



**Figure 21. Removing or Replacing the Bulb**

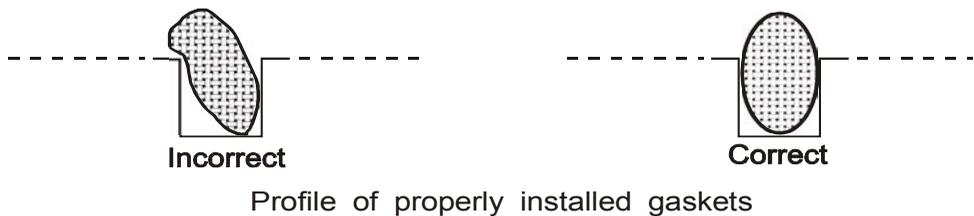
4. To replace a lamp bulb in the reflector, hold it near the middle and insert the tip of the bulb into the retaining hole of one end reflector. Apply pressure in the direction of the length of the bulb, moving it toward the end that is inserted. This will allow the free end to clear the end reflector. Gently slide the end of the bulb down to the retaining hole and allow it to pop into position.

## Reflector Removal/Replacement

Replace the reflector only if it becomes dull and its surface cannot be cleaned successfully, or if severe arcing is apparent (dark or burned spots).

1. Remove the screen assembly and the bulb.
2. Remove the six flat head screws and lift the reflector out.

3. Referring to [Figure 23](#), remove and discard the two end reflectors and the gaskets underneath. If evidence of arcing is present, clean the gasket grooves with emery cloth to remove all oxide.
4. Insert both end reflectors, ensuring that they both seat fully and evenly. The replacement end reflectors must be installed before installing the new bulb and reflectors and the new RF Gasket.
5. Install the two pre-cut (long) RF gaskets into the grooves for the end reflectors. Insert one end flush with the top of the mounting surfaces ([Figure 22](#)). Working toward the other end of the groove, press the gasket strip down firmly with the thumbnail so that it rests at the bottom of the groove.



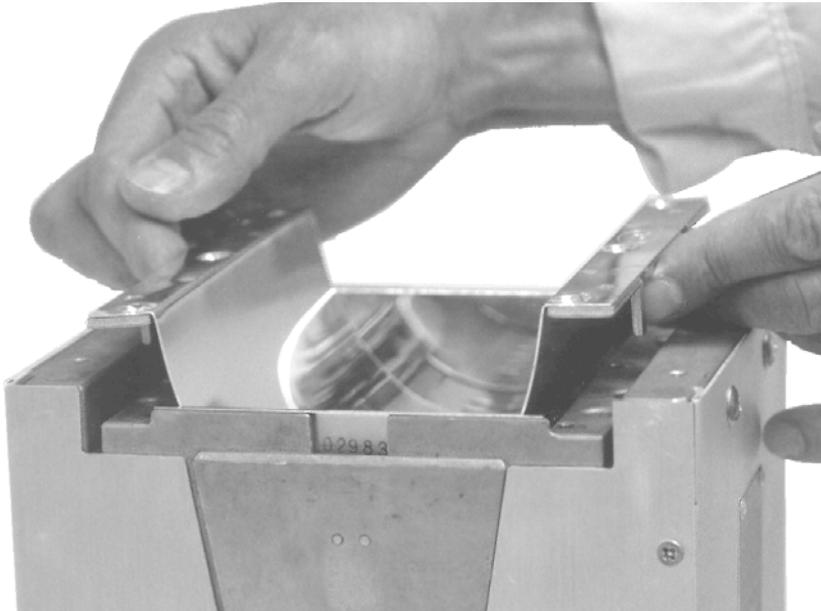
**Figure 22. Gasket Installation**

6. Examine the cross-guide gaskets for evidence of arcing. Replace if there is any evidence of wear or arcing (dark or burned spots). Also if there is evidence of arcing on the back side of the reflector caused by the cross-guide gaskets (behind the reflector), then replace them.

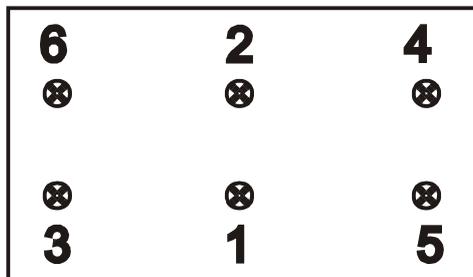
Install the two pre-cut RF gaskets (short ones) into the grooves for the extrusions. Insert one end flush with one edge of the mounting surfaces. Working toward the other end of the groove, press the gasket strip down firmly with a thumbnail so that it rests at the bottom of the groove.

	<p><b>IMPORTANT:</b> The dichroic reflector and the R350 reflector do not have plastic protective covers on the reflector surface. The dichroic reflector has a dark purple reflective coating. Do not attempt to remove the purple reflective coating.</p>
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7. Align the reflector squarely over the opening. With gentle pressure and a rocking motion, slide the reflector down in place. It should not bind against the end reflectors as it goes into place. As a final motion, grasp the sides of the reflector and gently force them together a small amount, then settle the reflector down over the mounting surfaces (Figure 23). Start the six flat head screws in the reflector but do not tighten. Tighten the six screws in the sequence 1-6 as shown in Figure 24 to a snug position; finally tighten to 3.4 N-m (30 inch-lbs.) using a torque controlled screwdriver. Repeat tightening the screws as illustrated and at the specified torque.



**Figure 23. Reflector Removal or Replacement (I300M)**

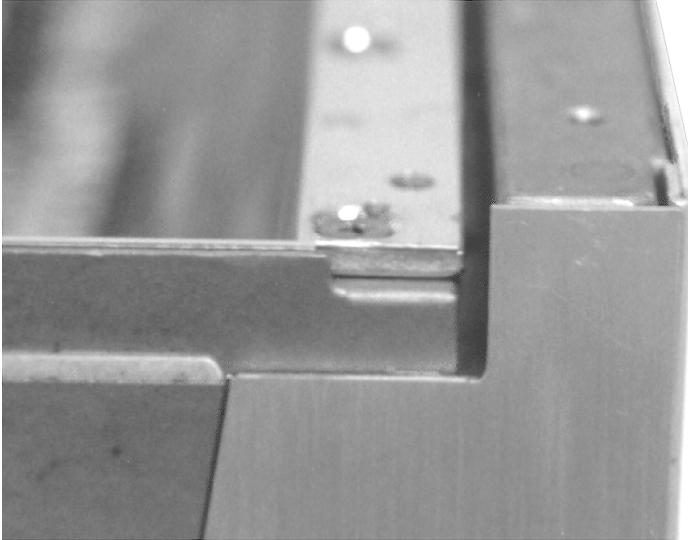


**Figure 24. Reflector Screw Tightening Sequence**

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**CAUTION:** Do not use the flathead screws to pull the reflector into place. Excessive pull on these screws will deform the reflector face at its bend radius or loosen its rivets. This would result in a failure of the screen assembly to seat properly and subsequent damage to the screen gaskets.

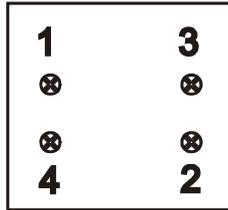
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**Figure 25. Correct Reflector Alignment (I300M)**

8. When the reflector is properly installed, the face should be flush and even with the outer face of the two end reflectors as shown in [Figure 25](#).
9. Clean the reflector to remove fingerprints.
10. Clean and insert the lamp bulb according to “[Cleaning Guidelines](#)” on [page 79](#).

- 
11. Replace the screen assembly. After replacing the screen assembly, refer to [Figure 26](#); hand-tighten the four M3 screws as shown until snug. Tighten them in sequence to 0.9 N-m (8 inch-lbs.) using a torque-controlled screwdriver. Repeat tightening the fasteners according to the sequence and torque specified.



**Figure 26. RF Screen Screw Tightening Sequence (I300M)**

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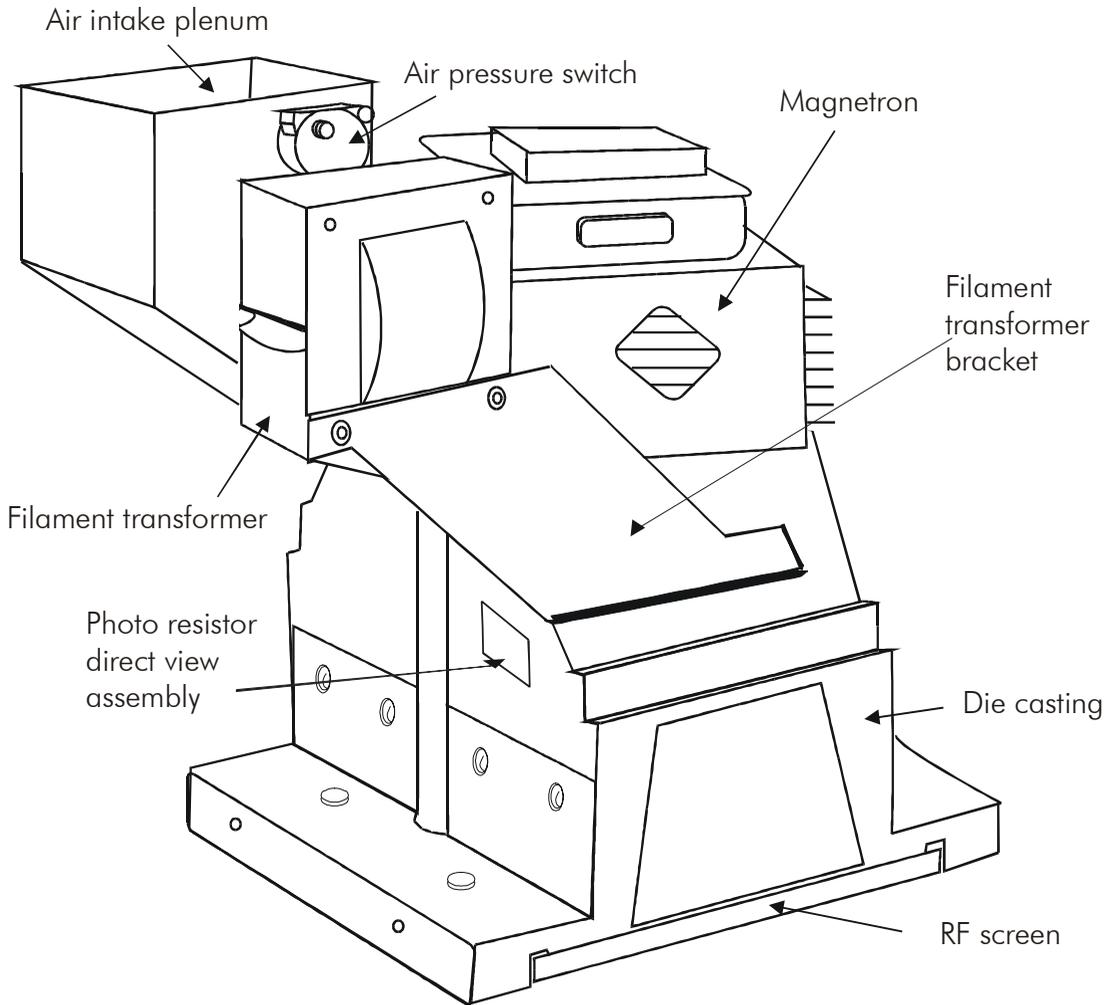
**NOTE:** After installing the reflector in the irradiator, the reflector mounting screws should be retightened (using a torque controlled screwdriver to 3.4 N-m (30 inch-lbs.)) after a minimum of 10 minutes of operation.

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## I300M Irradiator Housing Removal/Replacement

The I300M irradiator enclosure is removed as described in the following procedure.

1. Disconnect the cables from J10 and J11.
2. Place the irradiator (screen down) on a clean, level surface.
3. Remove two M3 flat head screws from each side of the irradiator housing.
4. Remove four M5 truss head screws that secure the housing to the casting.
5. Remove two M5 truss head screws that secure the perforated panel to the front of the irradiator housing.
6. Disconnect the pressure switch tubing from the perforated panel and remove the panel.
7. Unthread the large plastic nut that secures the J10 connector to the housing and push the connector into the housing.
8. Lift the housing straight up to remove.
9. Reverse these steps to reassemble.

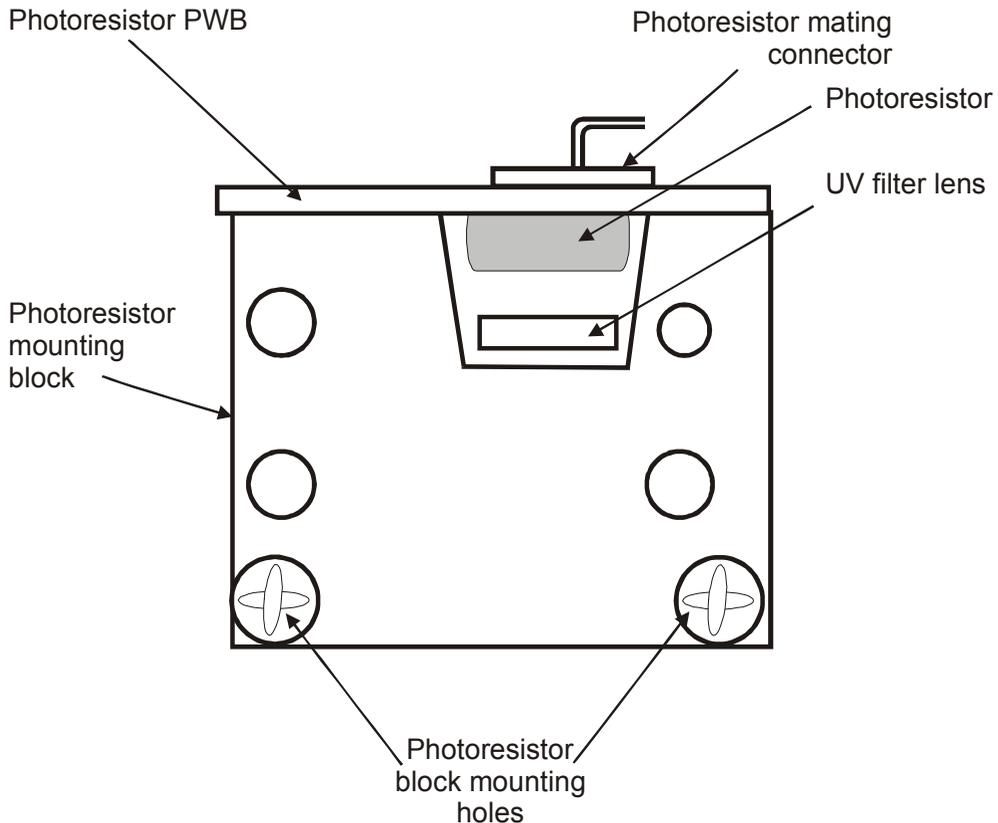


**Figure 27. I300M/I301M Irradiator Component Location**

## Direct View Photoresistor Removal/Replacement

1. Remove the housing as described in the previous section.
2. Unplug the photoresistor 3-circuit connector (P30) from the photoresistor PWB.
3. Remove the two M4 screws securing the photoresistor mounting block to the casting and remove the photoresistor assembly.
4. Remove the single screw holding the photoresistor PWB to the mounting block.

5. Remove and discard the PWB and inspect the UV filter lens for damage.
6. Replace the photoresistor and UV filter lens assembly.
7. Reinstall the housing.



**Figure 28. Photoresistor Assembly for Direct View (I300M)**

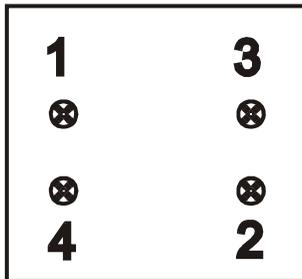
## Filament Transformer Removal/Replacement

1. Remove the irradiator housing.
2. Cut the cable ties and slide the PVC tubing off the magnetron connections.
3. Remove the filament terminal screws. Disconnect the leads at the primary terminals. Remove the two anchor screws holding the transformer to the side rail, and remove the transformer.
4. Replace the transformer by reversing the process.

5. Reconnect the filament transformer wires to the magnetron and tighten the terminal screws to 0.9 N-m (8 inch-lbs) using a torque-limiting screwdriver. Reposition the tubing over the terminal screws and install cable ties.
6. Install the irradiator housing as described in [“I300M Irradiator Housing Removal/Replacement”](#) on page 86.

## Magnetron Removal/Replacement

1. Remove the irradiator housing as described previously.
2. Disconnect filament transformer wires from magnetron by removing the cable ties and sliding back the tubing. Remove the terminal screws.
3. Remove the filament transformer bracket and air plenum.
4. Remove the four screws fastening the magnetron to the casting. Lift the magnetron off the waveguide assembly and place it upside down in a clear area on a wooden bench, at least five inches from any magnetic materials (such as iron or steel).
5. Install the replacement magnetron and fasten it to the casting using the associated hardware.
6. Refer to [Figure 29](#); hand tighten the magnetron fasteners in sequence as shown until snug. Then, tighten the fasteners ¼ turn in sequence. Finally, tighten the fasteners in sequence to 3.4 N-m (30 inch-lbs) using a torque-controlled driver.



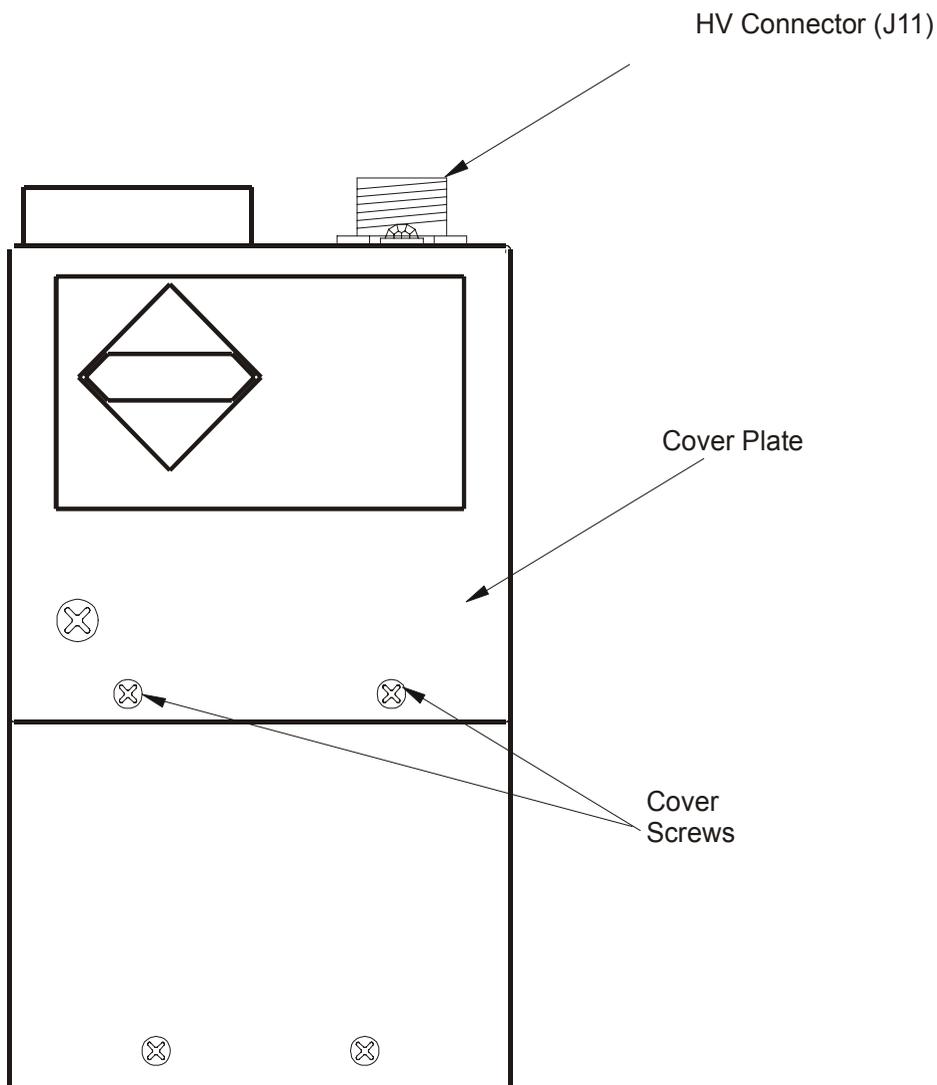
**Figure 29. Magnetron Fastener Tightening Sequence (I300M)**

7. Install the filament transformer bracket and air plenum.
8. Reconnect the filament transformer wires to the magnetron and tighten the terminal screws to 0.9 N-m (8 inch-lbs) using a torque-limiting screwdriver. Reposition the tubing over the terminal screws and install cable ties.
9. Install the irradiator housing as described in [“I300M Irradiator Housing Removal/Replacement”](#) on page 86.

## Air Pressure Verification

To test air pressure inside the irradiator, remove one cover plate screw and, using a mannehelic, place the end of the tube over the screw hole (Figure 30 on page 90). For the I300M, the pressure should be 447-596 Pa (1.8-2.4" H<sub>2</sub>O) with respect to outside (ambient) air.

For the I300MB irradiator (modular blower), pressure should be 447 - 822 Pa (1.8 to 3.3" H<sub>2</sub>O).



**Figure 30. Air Pressure Test Points (I300M) - I300 MB Similar**

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## Air Pressure Switch Replacement

1. Remove the irradiator cover.
2. Pull the silicone tubing off the low pressure port of the switch.
3. Disconnect the two electrical leads from the switch.
4. Reach inside the air distribution plenum and remove the short length of silicone tubing which secures the pressure switch to the plenum wall.
5. Insert the high pressure port (longer) of the new switch through the hole in the plenum wall and secure the switch with a new length of silicone tubing (supplied with the switch.)
6. Reconnect the electrical leads.
7. Reconnect the low pressure tube to the low pressure port (shorter) on the switch.
8. Reinstall the irradiator cover.

## I310M/I311M Irradiator

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**NOTE:** The I310M/I311M model is different from the standard I300M irradiator in its internal construction, specifically in the reflector assembly and the RF gaskets used.

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## Bulb, Screen, and Reflector Maintenance

### Cleaning Guidelines

At least every 500 hours of operation, the irradiator should be removed from the light shield, and the screen, lamp bulb, and reflector inspected carefully. Clean as needed. Instructions for removing and replacing these components appear later in this chapter. Guidelines for cleaning these components follow.

If the reflector or bulb surfaces show signs of dirt, oil or vaporized materials, they should be removed and cleaned with a good industrial cleaner, using a lint-free cloth or tissue. The cleaner should contain no waxes, silicones, dyes or perfumes. Simple Green® and Windex® are recommended. Wipe away any residues, using the cloth or tissue with pure water. Alcohol, isopropyl, or methanol may be used for final removal of residues, except when alcohol is not allowed as a solvent.

If deposits on the screen, bulb, and reflector are consistently found at 500-hour inspections, the blower filters should be changed more frequently, or a more efficient filter should be used. These deposits can cause premature failures when particles burn into the quartz lamp or cause dulling of the reflectors.

---

## Bulb Cleaning

Handle bulbs with a lint-free cloth or tissue taking care not to leave fingerprints.

Baked-on material can be removed from bulbs with a mild abrasive cleaner such as Soft Scrub®, followed by a thorough rinse with water. If alcohol is allowed, do a final wipe with alcohol. Harsh abrasives and steel wool should never be used on bulbs.

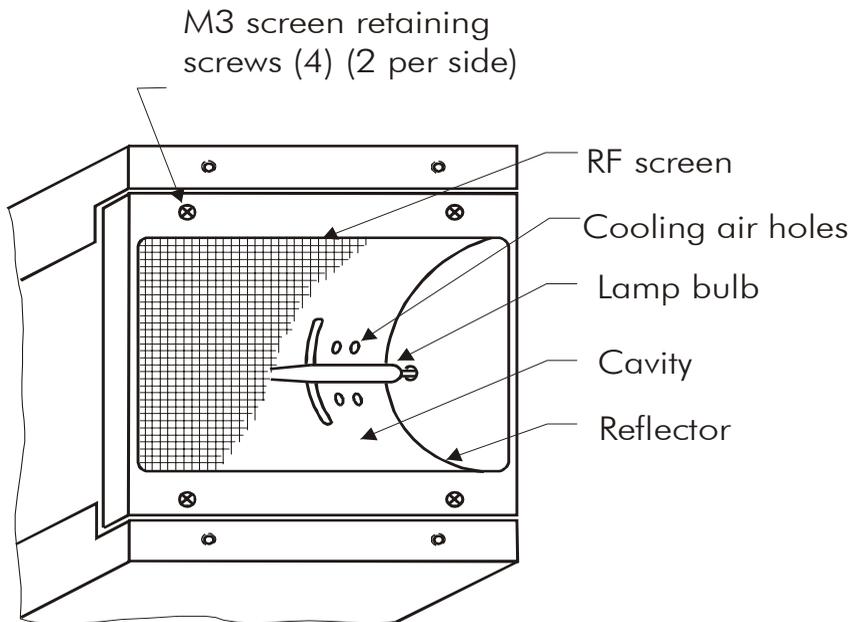
## Reflector Cleaning

If the reflector surface is dull or discolored, it should be cleaned. Abrasives should never be used on reflectors.

If cleaning reflectors while assembled in the irradiator, drying with compressed air is **not** recommended because particles or residues can be driven into spaces between components and into optical sensing elements.

## Screen Cleaning

Screens may be cleaned with the cleaners discussed earlier, soaking if necessary, brushing lightly, and rinsing well. Take care not to damage the gaskets or the fine screen wires.



**Figure 31. Reflector Assembly (I310M/I311M)**

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## Screen Assembly Removal/Replacement



**CAUTION:** In handling the irradiator or screen assembly, try to avoid all direct contact with the screen, as it punctures easily. Do not apply pressure to the screen.

1. Refer to [Figure 31](#). Loosen the four M3 screen retaining screws, using three turns each. Repeat, this time removing screws. Grasp the screen frame by both ends, taking care not to twist or bend the screen itself, and remove the screen assembly.
2. To replace an existing screen or install a new one, place the screen assembly in position.
3. Apply pressure to the frame only and press firmly into place. Install the four screws alternately, working from side to side. Tighten each to a snug position; finally tighten to 0.9 N-m (8 inch lbs.) using a torque-controlled screwdriver (see [Figure 37](#)).

## Lamp Bulb Removal/Replacement



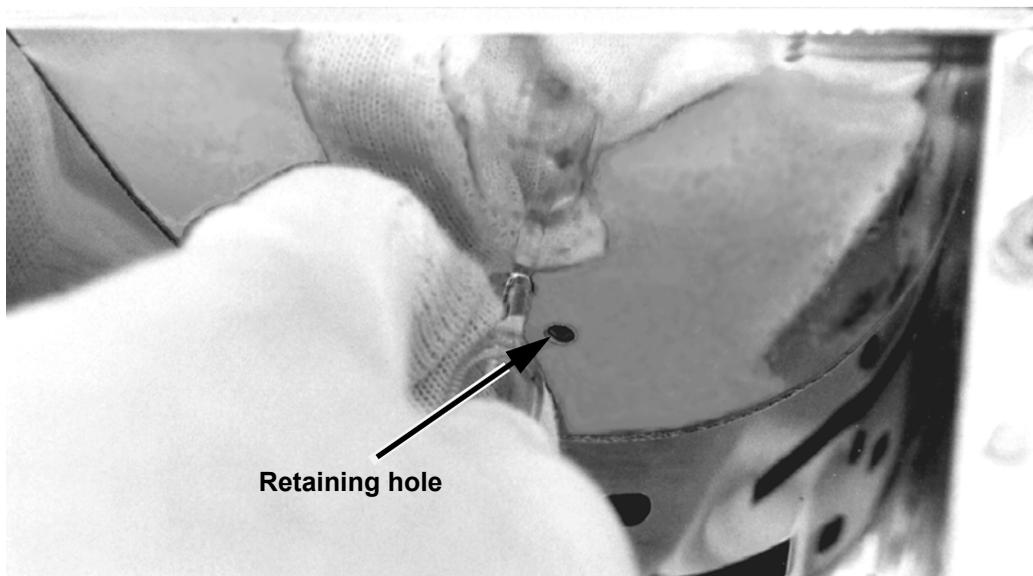
**WARNING:** During operation the lamp bulb and adjacent metal surfaces become very hot. Operate the blower for about one minute to cool hot surfaces.

1. Remove the screen as described in “[Screen Assembly Removal/Replacement](#)” on page 93.
2. Refer to [Figure 32 on page 94](#). Using clean cotton gloves or lint free tissue, grasp the lamp bulb at one end between the thumb and fingers and apply firm pressure axially toward the opposite end. When the tip of the bulb has cleared its retaining hole and is free to move past or along the end reflector, gently slide it up and out.

---

**CAUTION:** Do not apply bending force to lamp bulb. Do not touch the bulb with bare fingers or allow it to contact dirty or greasy surfaces. Contaminants can be burned into the quartz envelope, causing premature bulb failure.

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**Figure 32. Removing or Replacing the Bulb (I310M/I311M)**

3. Clean any deposits from the surface of the bulb (see [“Cleaning Guidelines” on page 91](#)).
4. To replace a lamp bulb in the reflector, hold it near the middle and insert the tip of the bulb into the retaining hole of one end reflector. Apply pressure in the direction of the length of the bulb, moving it toward the end that is inserted. This will allow the free end to clear the end reflector. Gently slide the end of the bulb down to the retaining hole and allow it to rest in position.

## Reflector Removal/Replacement

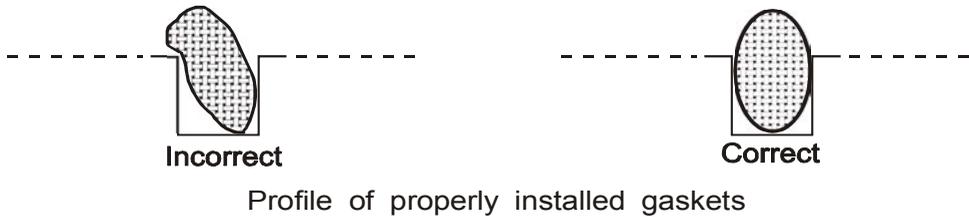
Replace the reflector only if it becomes dull and its surface cannot be cleaned successfully or if severe arcing is apparent.

1. Remove the screen assembly and the bulb.

- 
2. Remove the six flat head screws and lift the reflector out. Examine the cross-guide gaskets for wear and/or arcing; replace if there is any sign of either. Replace as described in [“Replacing the RF Gasket Assembly”](#) on page 99.
  3. Refer to [Figure 33 on page 95](#), and remove and discard the two end reflectors and the gaskets underneath. If evidence of arcing is present (dark or burned spots), clean the gasket grooves with emery cloth to remove all oxide.



**Figure 33. Reflector Removal or Replacement (I330M/I311M)**



**Figure 34. Gasket Installation (I330M/I311M)**

4. Insert both end reflectors, ensuring that they both seat fully and evenly. The replacement end reflectors must be installed **before** the new RF Gasket.
5. Install the two pre-cut (long) RF gaskets into the grooves for the end reflectors. Insert one end flush with the top of the mounting surfaces (Figure 34). Working toward the other end of the groove, press the gasket strip down firmly with the thumbnail so that it rests at the bottom of the groove.
6. If you detect evidence of arcing on the back side of the reflector caused by the RF gasket assemblies behind the reflector, then replace the two RF gasket assemblies. Replace as described in [“Replacing the RF Gasket Assembly” on page 99](#).

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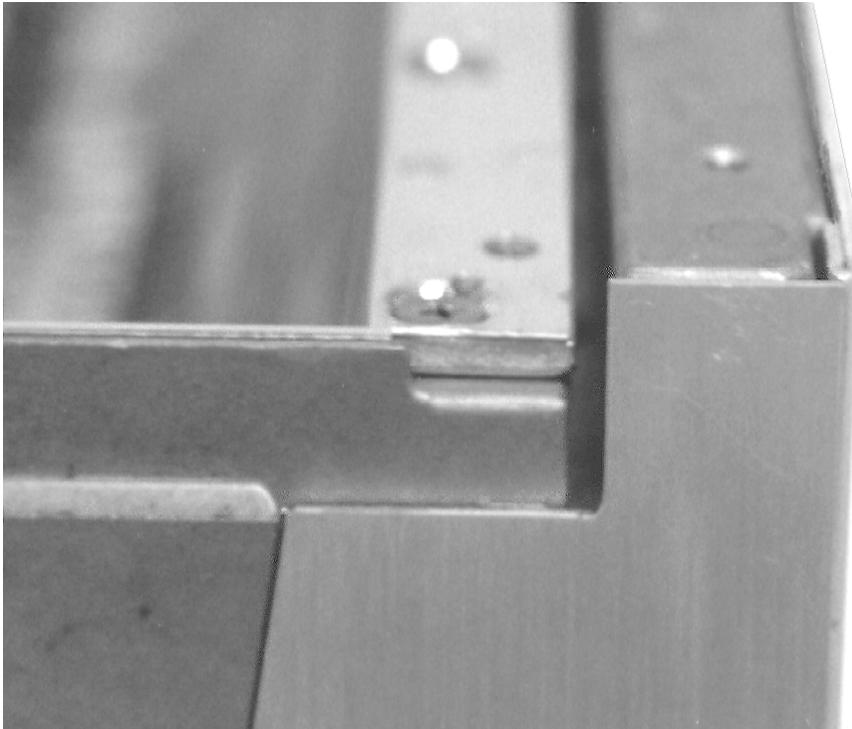
**CAUTION:** Do not use the flathead screws to pull the reflector into place. Excessive pull on these screws will deform the reflector face at its bend radius or loosen its rivets. This would result in a failure of the screen assembly to seat properly and subsequent damage to the screen gaskets.

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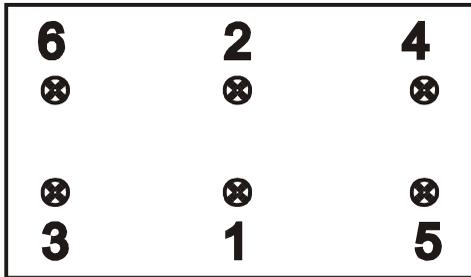
**IMPORTANT:** The dichroic reflector and the R350 reflector do not have a plastic protective cover on the reflector surface. The dichroic reflector has a dark purple reflective coating. Do not attempt to remove the purple reflective coating.

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**Figure 35. Correct Reflector Alignment (I310M/I311M)**

7. Align the reflector squarely over the opening. With gentle pressure and a rocking motion, slide the reflector down in place. It should not bind against the end reflectors as it goes into place. As a final motion, grasp the sides of the reflector and gently force them together a small amount, then settle the reflector down over the mounting surfaces (Figure 33). Start the six flat head screws in the reflector but do not tighten. Tighten the six screws in the sequence 1-6 as shown in Figure 36 to a snug position; finally tighten to 3.4 N-m (30 inch-lbs.) using a torque-controlled screwdriver. Repeat tightening the screws according to the illustrated sequence, and at the specified torque.



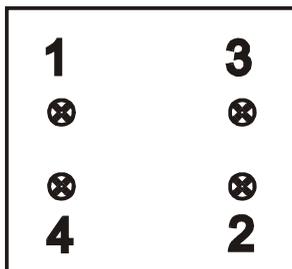
**Figure 36. Reflector Screw Tightening Sequence (I310M/I311M)**

8. When the reflector is properly installed, the face should be flush and even with the outer face of the two end reflectors as shown in [Figure 35](#).
9. Clean the reflector to remove fingerprints.
10. Clean and insert the lamp bulb as instructed earlier in this chapter.
11. Replace the screen assembly. Hand-tighten the four M3 screws in sequence as shown in [Figure 37](#) until snug. Tighten the fasteners in sequence to 0.9 N-m (8 inch-lbs) using a torque-controlled screwdriver. Repeat tightening the fasteners according to the sequence and torque specified.

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**NOTE:** After installing the reflector in the irradiator, the reflector mounting screws should be retightened (using a torque-controlled screwdriver to 3.4 N-m (30 inch-lbs) after a minimum of 10 minutes of operation.

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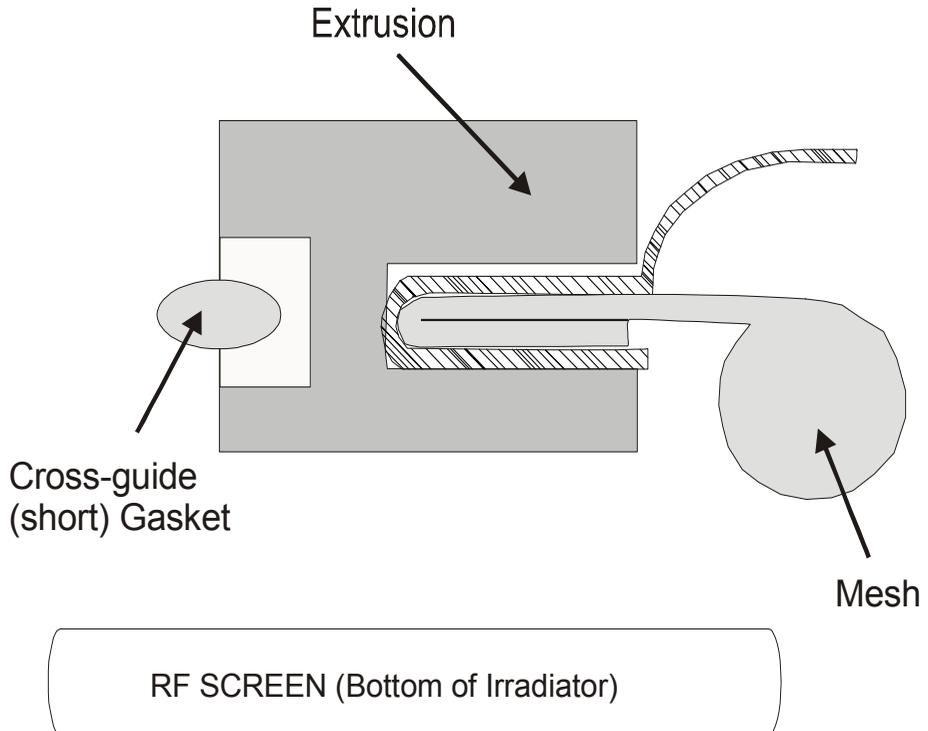


**Figure 37. RF Screen Screw Tightening Sequence (I310M/I311M)**

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## Replacing the RF Gasket Assembly

1. If you detect evidence of arcing on the back of the reflector caused by the RF gasket assemblies (behind the reflector), then you will need to replace the two RF gasket assemblies with the main reflector removed.



**Figure 38. Gasket Installation with Cross-guide (Short) Gaskets (I310M/I311M)**

2. Remove the housing (see [“I310M/I311M Irradiator Housing Removal/Replacement”](#) on page 100).

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**IMPORTANT: The extrusion and the RF gasket assembly are one assembly, and should not be separated from each other. To replace the RF gasket requires removal of the old extrusion as well as the old RF gasket.**

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3. Access the casting by placing the lamp on its side and gently sliding the casting out of the housing until the eight extrusion screws are accessible. (There are four screws on each side).

- 
4. Remove the extrusions. While holding the extrusion inside the casting, remove the four screws securing the extrusion to the casting. Repeat for the extrusion on the opposite side. Discard the old extrusions and the RF gaskets behind each.
  5. Install the gasket assemblies (with extrusions) with the mesh facing outward toward the RF screen (at the bottom of the irradiator) along with the two cross-guide (short) gaskets behind each assembly. Install the replacement extrusions using the same mounting screws. The extrusions should be positioned flush to the casting and as far from the face of the lamp as the mounting screws allow. Tighten the screws to 2.5 N-m (22 inch-lbs.) using a torque-limiting screwdriver.

## I310M/I311M Irradiator Housing Removal/Replacement

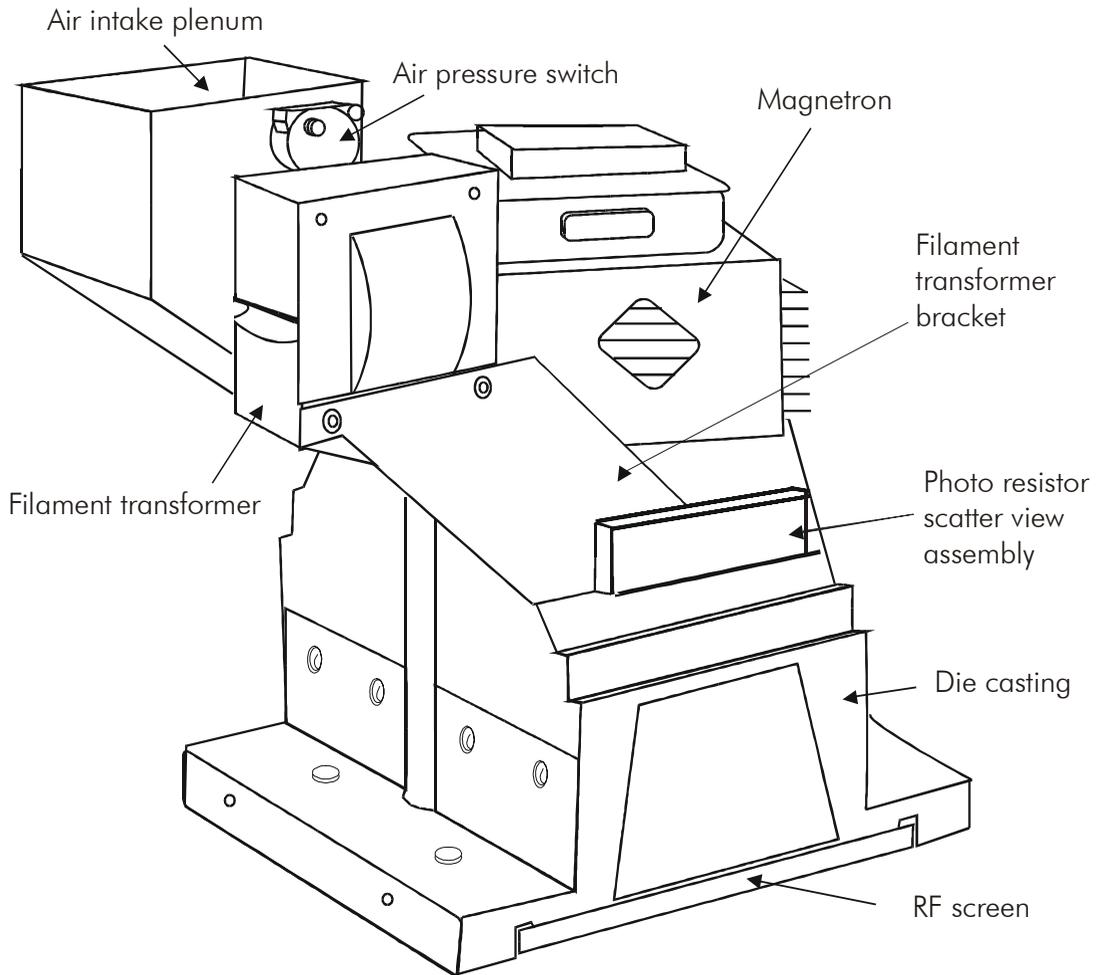
The irradiator enclosure is removed as follows:

1. Disconnect the cables from J10 and J11.
2. Place the irradiator (screen down) on a clean, level surface.
3. Remove two M3 flat head screws from each side of irradiator housing.
4. Remove four M5 truss head screws that secure the housing to the casting.
5. Remove two M5 truss head screws that secure the perforated panel to the front of the irradiator housing.
6. Disconnect the pressure switch tubing from the perforated panel and remove the panel.
7. Unthread the large plastic nut that secures the J10 connector to the housing, and push the connector into the housing.
8. Lift the housing straight up to view the interior components of the irradiator, as shown in [Figure 39 on page 101](#).
9. Reverse these steps to reassemble.

## I310M/I311M Scatter View Photoresistor Removal/Replacement

[Figure 39 on page 101](#) shows the I310M/I311M Irradiator component locations.

1. Remove the irradiator housing.
2. Unsolder the photoresistor lead wires (blue wire next to the diode and a blue/white wire at the top terminal.)
3. Remove the two M5x10 mm photoresistor fastening screws and remove the photoresistor assembly.
4. Reverse these steps to replace the photoresistor assembly.

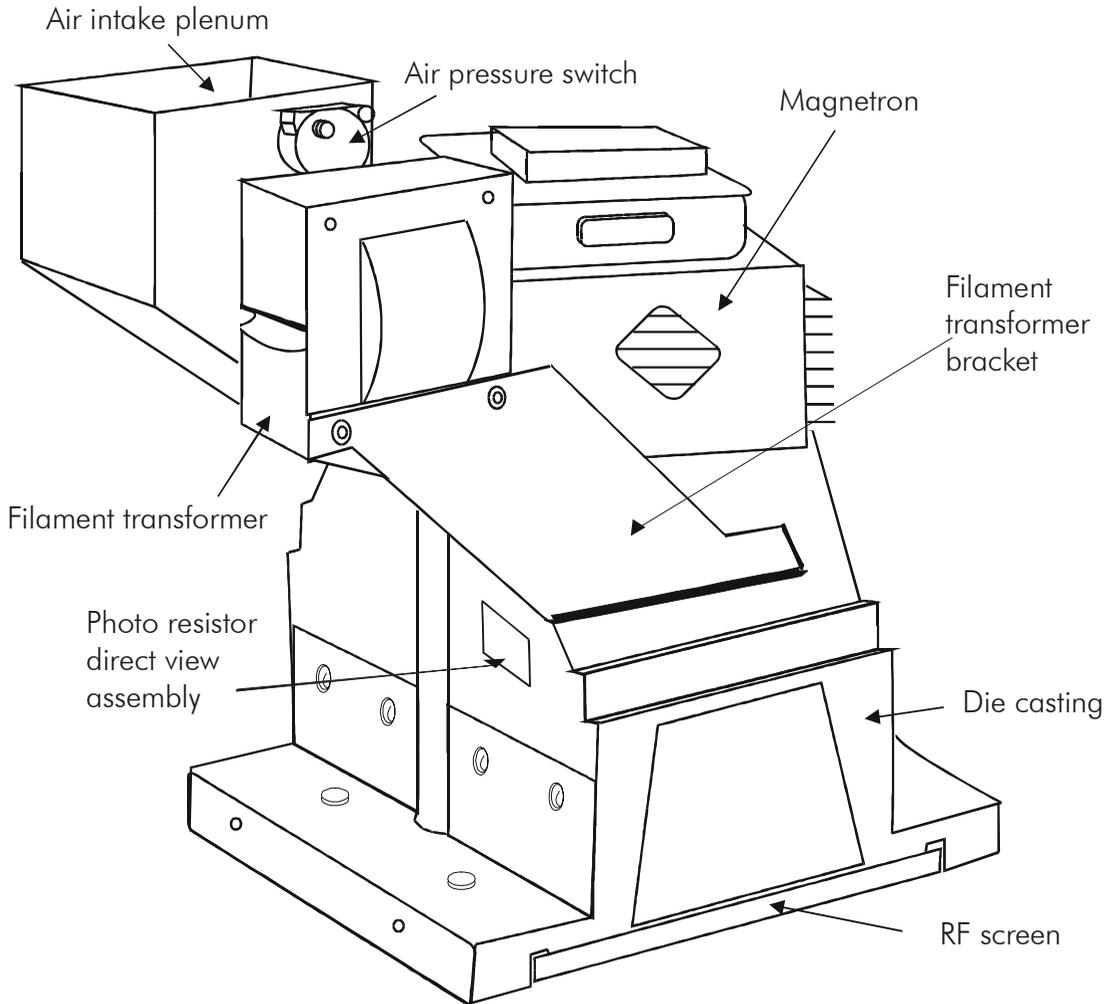


**Figure 39. I310M/I311M Irradiator Component Location (Scatter View)**

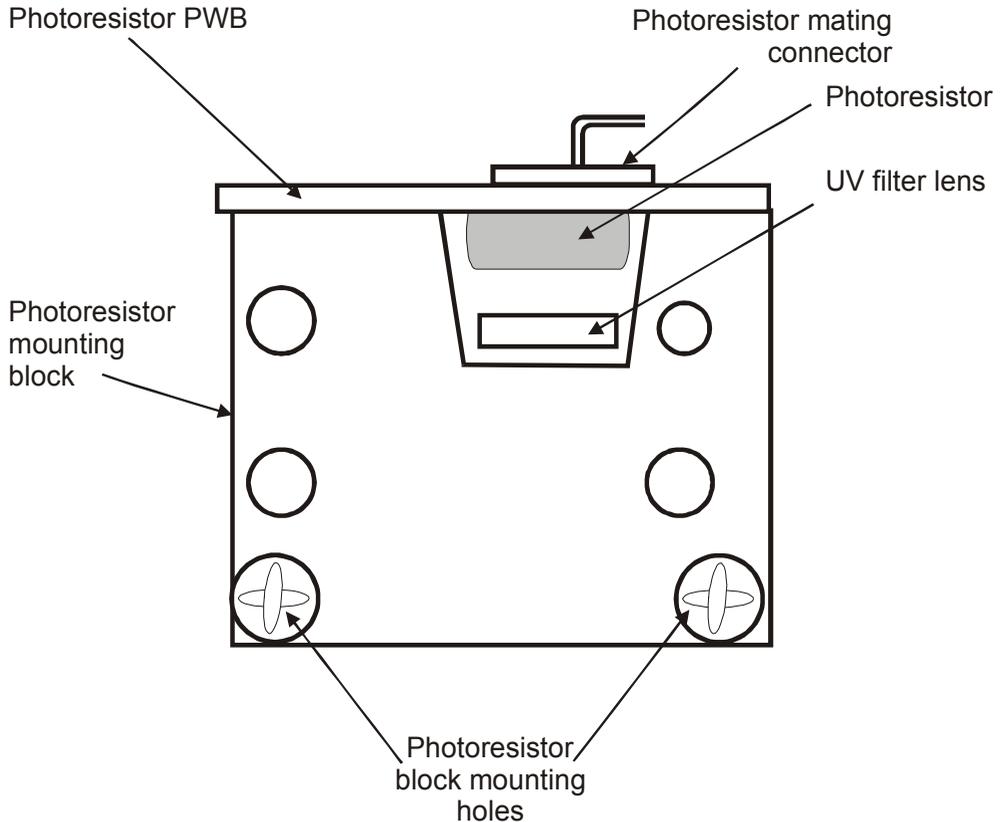
## Direct View Photoresistor Removal/Replacement

1. Remove the housing as described in the previous section.
2. Unplug the photoresistor 3-circuit connector (P30) from the photoresistor PWB.
3. Remove the two M4 screws securing the photoresistor mounting block to the casting and remove the photoresistor assembly.
4. Remove the single screw holding the photoresistor PWB to the mounting block.
5. Remove and discard the PWB and inspect the UV filter lens for damage.

6. Replace the photoresistor and UV filter lens assembly.
7. Reinstall the housing.



**Figure 40. I310M-D/I311M-D Irradiator Component Location (Direct View)**



**Figure 41. Photoresistor Assembly for Direct View (I300M)**

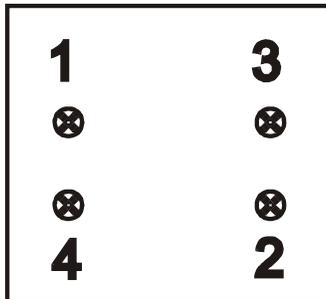
## Filament Transformer Removal/Replacement

1. Remove irradiator housing.
2. Cut the cable ties and slide the PVC tubing off the magnetron connections. Remove the filament terminal screws. Disconnect the leads at the primary terminals. Remove the two anchor screws holding the transformer to the side rail, and remove the transformer.
3. Replace the transformer by reversing the process.
4. Reconnect the filament transformer wires to the magnetron and tighten the terminal screws to 0.9 N-m (8 inch-lbs.) using a torque-limiting screwdriver. Reposition the tubing over the terminal screws and install cable ties.
5. Install the irradiator housing as described in [Chapter 6, page 100](#).

---

## Magnetron Removal/Replacement

1. Remove the irradiator housing as described previously.
2. Disconnect the filament transformer wires from magnetron by removing the cable ties and sliding back the tubing. Remove the terminal screws.
3. Remove the filament transformer bracket and air plenum.
4. Remove the four screws fastening the magnetron to the casting. Lift the magnetron off the waveguide assembly and place it upside down in a clear area on a wooden bench, at least five inches from any magnetic materials (iron, steel, etc.).
5. Install the replacement magnetron and fasten to the casting using the associated hardware.
6. Refer to [Figure 42](#). Hand tighten the magnetron fasteners in sequence as shown, until snug. Then, tighten the fasteners  $\frac{1}{4}$  turn in sequence. Finally, tighten the fasteners in sequence to 3.4 N-m (30 inch-lbs) using a torque-limiting screwdriver.



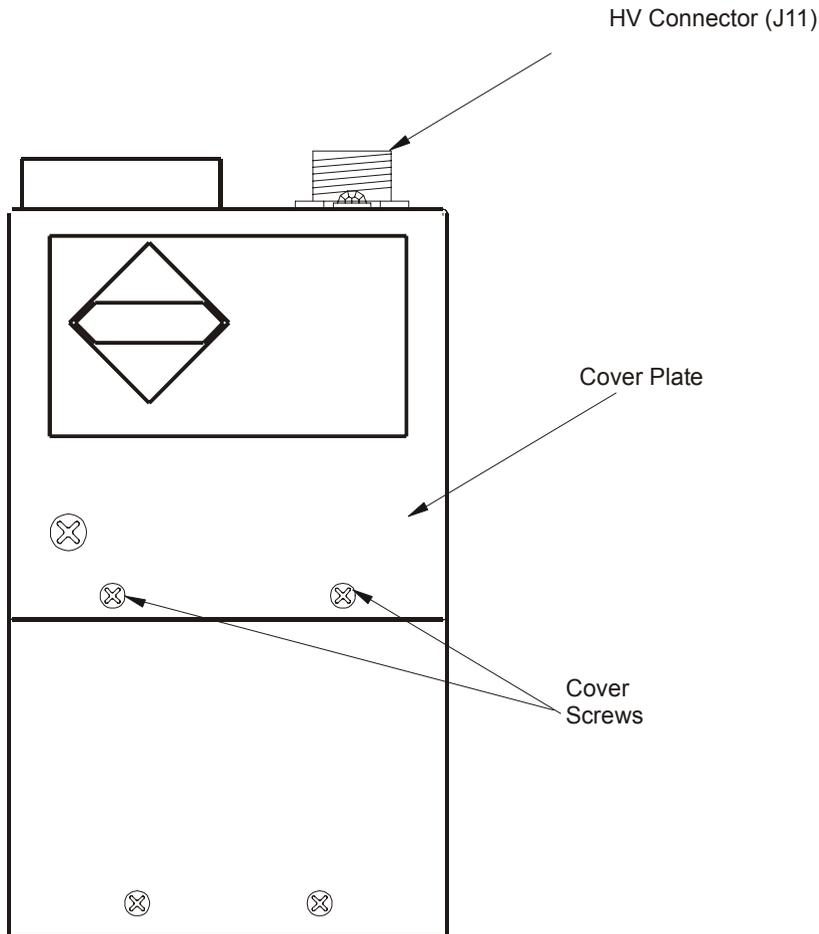
**Figure 42. Magnetron Fastener Tightening Sequence**

7. Install the filament transformer bracket and air plenum.
8. Reconnect the filament transformer wires to the magnetron and tighten the terminal screws to 0.9 N-m (8 inch-lbs.) using a torque-limiting screwdriver. Reposition the tubing over the terminal screws and install cable ties.
9. Install the irradiator housing as previously described.

## Air Pressure Verification

To test air pressure inside the irradiator, remove one cover plate screw and, using a magnehelic, place the end of the tube over the screw hole (see [Figure 43](#)). For the I310M/I311M and I310M-D/I311M-D, the pressure should be 447-596 Pa (1.8-2.4" H<sub>2</sub>O) with respect to outside (ambient) air.

For the I310MB irradiator (modular blower), pressure should be 447 - 822 Pa (1.8 to 3.3" H<sub>2</sub>O).



**Figure 43. Air Pressure Test Points**

### Air Pressure Switch Replacement

1. Remove the irradiator cover.

2. Pull the silicone tubing off the low pressure port of the switch.
3. Disconnect the two electrical leads from the switch.
4. Reach inside the air distribution plenum and remove the short length of silicone tubing which secures the pressure switch to the plenum wall.
5. Insert the high pressure port (longer) of the new switch through the hole in the plenum wall and secure the switch with a new length of silicone tubing (supplied with the switch.)
6. Reconnect the electrical leads.
7. Reconnect the low pressure tube to the low pressure port (shorter) on the switch.
8. Reinstall the irradiator cover.

## P300M/P300MQ Power Supply

The only routine maintenance required on the power supply is periodic cleaning. The service interval will vary depending on the environment in which the unit is operated.

### Safety Procedures

Before servicing the power supply, first turn off and disconnect all power to the unit.

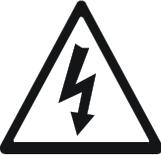


**WARNING:** Exercise extreme caution; the chassis weighs up to 40.3 kg (88.6 lbs.)

All high voltage capacitors have internal discharge resistors which should discharge to a safe level in 5 seconds. Physically shorting the capacitor terminals with an insulated screwdriver blade is advised as a second level of safety.

**CAUTION:** The integrated circuits on the control board assembly can be damaged by relatively small charges of static electricity. Static charges transmitted by fingertip (for example, those generated by walking across a carpet) may be sufficient to cause damage. Always touch a grounded metal surface before removing or examining the control card.

## Test Point Voltages

	<p><b>WARNING:</b> Before taking magnetron current readings, turn the unit off. Check resistance between “MAG CURRENT” test points. Reading should be approximately 40K Ohms. If this value is not correct, do not attempt current reading. Damage could result to the meter or personnel injury could result. Contact Fusion UV Systems Customer Service if 40K Ohms reading is not obtained.</p> <p>After checking resistance, be sure to switch the meter to correct setting for DC voltage reading.</p>
---	---

**Table 19. Operating Voltages**

Test Points	Application	Status	
		Standby	Lamp On
Photoresistor Test (TP101 and TP102)	P300M/ P300MQ	12 VDC	0-6 VDC
Magnetron Current Test MAG A - COM (TP105 and TP106)	P300M/P300MQ	0	0.650-0.750 VDC

### Control Card Removal/Replacement

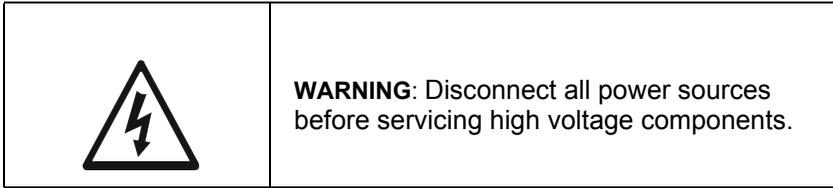
This unit must be disconnected and returned to Fusion UV Systems for repair or direct replacement. The control card cannot be repaired in the field.

1. Remove the six screws from the power supply cover. Remove the cover.
2. Remove all connectors. Remove three screws at the top of the card. Slide the card approximately an inch away from the front panel and raise it up out of its bottom track.
3. To install a replacement card, reverse this procedure. Note the location of connectors in [Figure 44 on page 109](#) and reinstall as shown.

---

## Diode Test

An ohmmeter can be used to check for a shorted or open capacitor. (Isolate the component before making continuity tests.)



Ohmmeters having less than a 6V battery can give erroneous indications of high resistance in both directions when testing these high voltage diodes.

1. With an insulated screwdriver, short the capacitor terminals to each other to assure discharge of capacitor voltage.
2. Disconnect the wiring from the terminals of the rectifier assembly.
3. Set the ohmmeter to highest resistance setting and measure resistance between the AC terminals and both the - (minus) terminal and the GND terminal.
4. Measure the resistance between diode terminals with meter leads reversed. Readings should be 50,000 ohms or less one way and infinite with leads reversed.

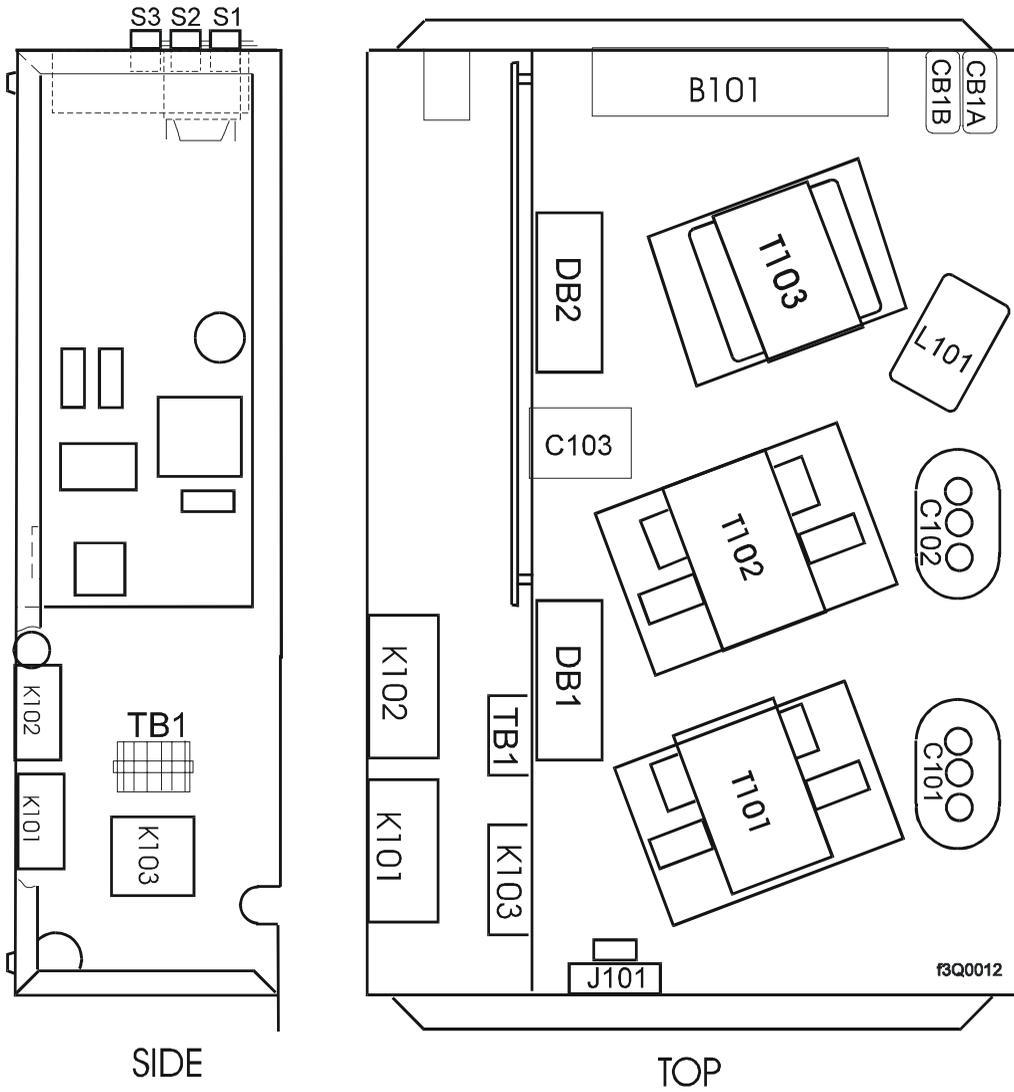


Figure 44. P300M/P300MQ Component Identification

---

## Capacitor Test

---

**CAUTION:** An ohmmeter can be used to check for a shorted or open capacitor. (Isolate the component before performing continuity tests.)

---



**WARNING:** Disconnect all power sources before servicing high voltage components.

The ohmmeter should have a minimum 6V battery, and should be set on the high resistance scale.

1. Remove all power, discharge the capacitor, and disconnect all leads from the capacitor terminals.
2. With an ohmmeter set on the highest scale, measure the resistance between the two outside capacitor terminals and the center terminal. The meter needle should momentarily deflect upward to indicate continuity, and should then return to infinity. Reversing the meter leads should give the same indication.
3. If the ohmmeter indicates continuity between the capacitor terminals at all times (shorted capacitor), or if no meter deflection occurs at all (open capacitor), the capacitor should be replaced.
4. A resistance check between each capacitor terminal and chassis ground should indicate infinite resistance (regardless of meter lead polarity).

## High Voltage Transformer Removal/Replacement

---

**CAUTION:** To maintain proper polarity, transformers must be installed with terminals in correct locations. Wiring must be reconnected correctly to the terminals from which it was removed.

---



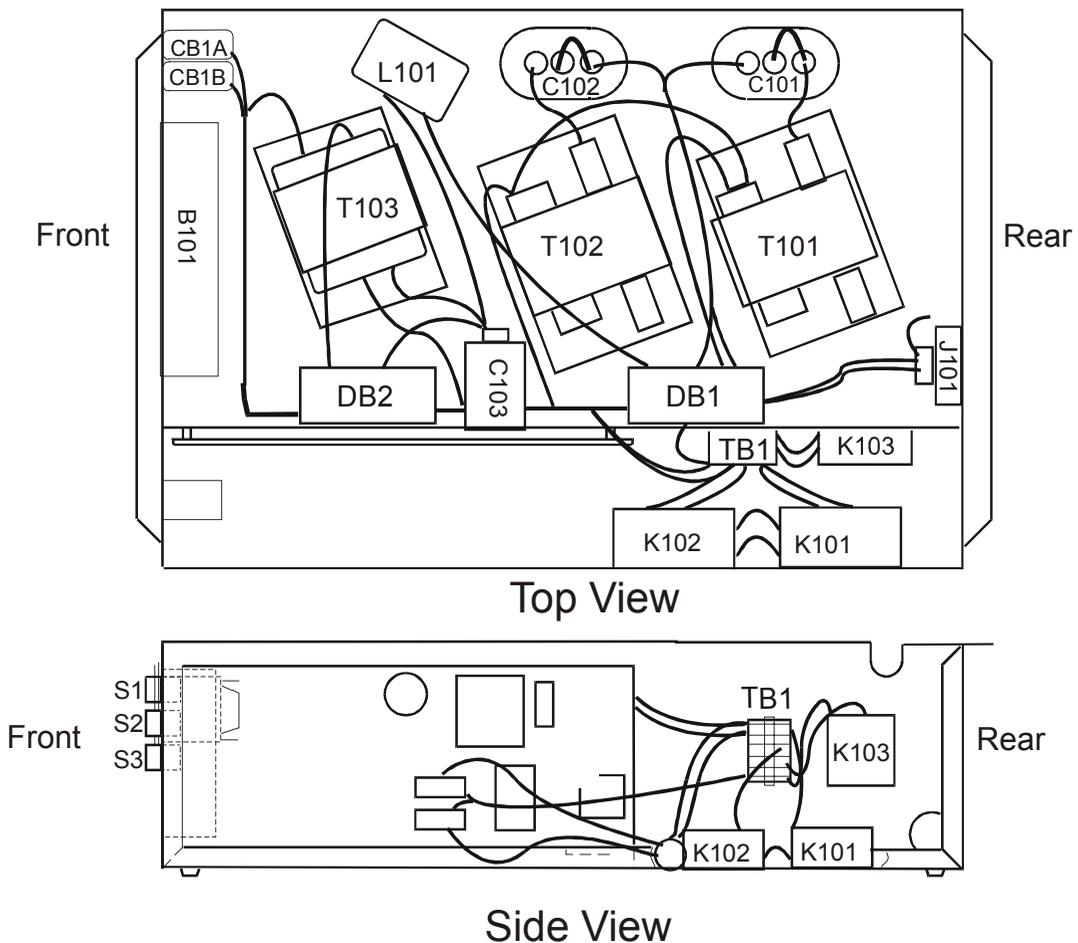
**WARNING:** Disconnect all power sources before servicing high voltage components.

1. Disconnect all power, discharge the high voltage capacitors, and disconnect all leads from the transformer terminals.
2. Unbolt the transformer from the power supply chassis.
3. To replace the transformers, reverse the steps, being certain that terminals are in the correct locations. Refer to [Table 20, “Transformer Terminal Orientation,”](#) on [page 112](#) that follows.

---

**CAUTION:** Transformers must be securely mounted to the chassis to provide adequate transformer grounding.

---



**Figure 45. P300M/P300MQ HV Wiring**

**Table 20. Transformer Terminal Orientation**

	<b>XFMR</b>	<b>COM</b>	<b>Tap</b>
P300M/ P300MQ	T101	Black/White	Red/White
	T102	Black/White	Red/White

**NOTE:** When colors are indicated, the first is the wire color and the second is the stripe color.

## P300MT Power Supply

The P300MT power supply is electrically identical to the standard P300M power supply except that the chassis is 7 inches (184 mm) shorter than the standard P300M.

**NOTE:** The P300MT cannot be retrofitted for the Quick Restart Option (QRO).

## Routine Maintenance

The only maintenance required on the power supply is periodic cleaning. The service interval will vary depending on the environment in which the unit is operated.

## Safety Procedures

Before servicing the power supply, first turn off and disconnect all power to the unit.

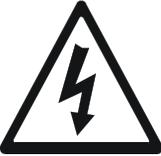


**WARNING:** Exercise extreme caution; the chassis weighs up to 40.3 kg (88.6 lbs.)

All high voltage capacitors have internal discharge resistors which should discharge to a safe level in 5 seconds. Physically shorting the capacitor terminals with an insulated screwdriver blade is advised as a second level of safety.

**CAUTION:** The integrated circuits on the control board assembly can be damaged by relatively small charges of static electricity. Static charges transmitted by fingertip (for example, those generated by walking across a carpet) may be sufficient to cause damage. Always touch a grounded metal surface before removing or examining the control card.

## Test Point Voltages.

	<p><b>WARNING:</b> Before taking magnetron current readings, turn the unit off. Check resistance between “MAG CURRENT” test points. Reading should be approximately 40K Ohms. If this value is not correct, do not attempt current reading. Damage could result to the meter or personnel injury could result. Contact Fusion UV Systems Customer Service if 40K Ohms reading is not obtained.</p> <p>After checking resistance, be sure to switch the meter to correct setting for DC voltage reading.</p>
---	---

**Table 21. Operating Voltages**

Test Points	Status	
	Standby	Lamp On
Photoresistor Test (TP101 and TP102)	12 VDC	0-6 VDC
Magnetron Current Test MAG A - COM (TP105 and TP106)	0	0.650-0.750 VDC

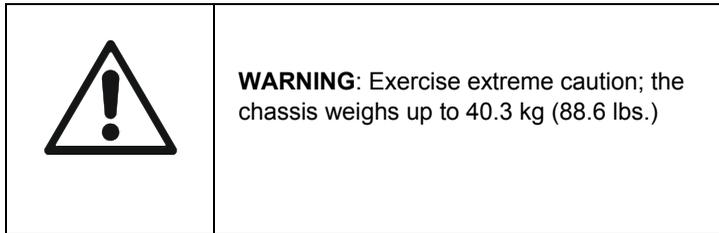
## Control Card Removal/Replacement

This unit must be returned to Fusion UV Systems for repair or direct replacement. The control card cannot be repaired in the field.

	<p><b>WARNING:</b> Disconnect all power sources before servicing high voltage components.</p>
---	---

1. Remove the six screws from the power supply cover.
2. Remove the cover.

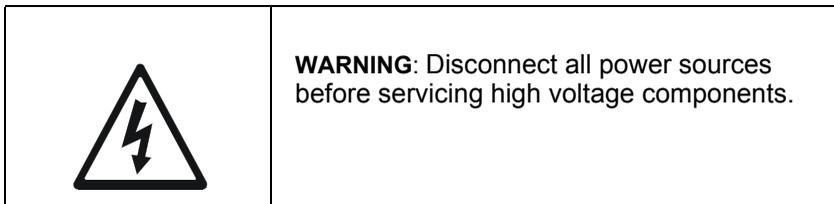
3. Remove all connectors.



4. Remove three screws at the top of the card. Slide the card approximately an inch away from the front panel and raise it up out of its bottom track.
5. To install a replacement card, reverse this procedure. Note the location of the connectors in [Figure 46 on page 115](#) and reinstall as shown.

## Diode Test

An ohmmeter can be used to check for a shorted or open capacitor. (Isolate the component before making continuity tests.)



Ohmmeters having less than a 6V battery can give erroneous indications of high resistance in both directions when testing these high voltage diodes.

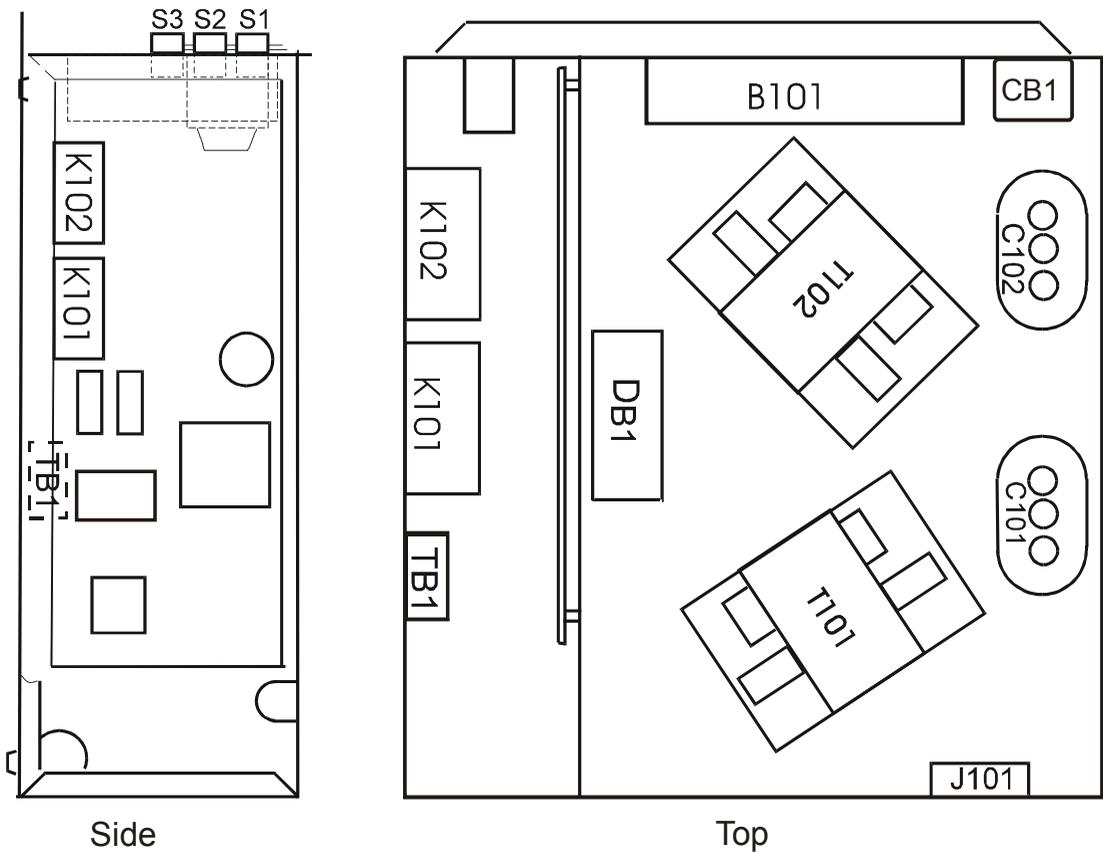
1. With an insulated screwdriver, short the capacitor terminals to each other to assure discharge of capacitor voltage.
2. Disconnect the wiring from the terminals of the rectifier assembly.
3. Set the ohmmeter to highest resistance setting and measure resistance between the AC terminals and both the - (minus) terminal and the GND terminal.
4. Measure the resistance between diode terminals with meter leads reversed. Readings should be 50,000 ohms or less one way and infinite with leads reversed.

## Capacitor Test

	<p>An ohmmeter can be used to check for a shorted or open capacitor. (Isolate the component before making continuity tests.)</p>
---	--

The ohmmeter should have a minimum 6V battery, and should be set on the high resistance scale.

1. Remove all power, discharge the capacitor, and disconnect all leads from the capacitor terminals.



**Figure 46. P300MT Component Identification**

2. With an ohmmeter set on the highest scale, measure the resistance between the two outside capacitor terminals and the center terminal. The meter needle should momentarily deflect upward to indicate continuity, and should then return to infinity. Reversing the meter leads should give the same indication.
3. If the ohmmeter indicates continuity between the capacitor terminals at all times (shorted capacitor), or if no meter deflection occurs at all (open capacitor), the capacitor should be replaced.
4. A resistance check between each capacitor terminal and chassis ground should indicate infinite resistance (regardless of meter lead polarity).

## High Voltage Transformer Removal/Replacement

---

**CAUTION:** To maintain proper polarity, transformers must be installed with terminals in correct locations. Wiring must be reconnected correctly to the terminals from which it was removed.

---



**WARNING:** Disconnect all power sources before servicing high voltage components.

1. Disconnect all power, discharge the high voltage capacitors, and disconnect all leads from the transformer terminals.
2. Unbolt the transformer from the power supply chassis.
3. To replace the transformer, reverse the steps, being certain that terminals are in the correct locations. Refer to [Table 22, “Transformer Terminal Orientation,” on page 116.](#)

---

**CAUTION:** Transformers must be securely mounted to the chassis to provide adequate transformer grounding.

---

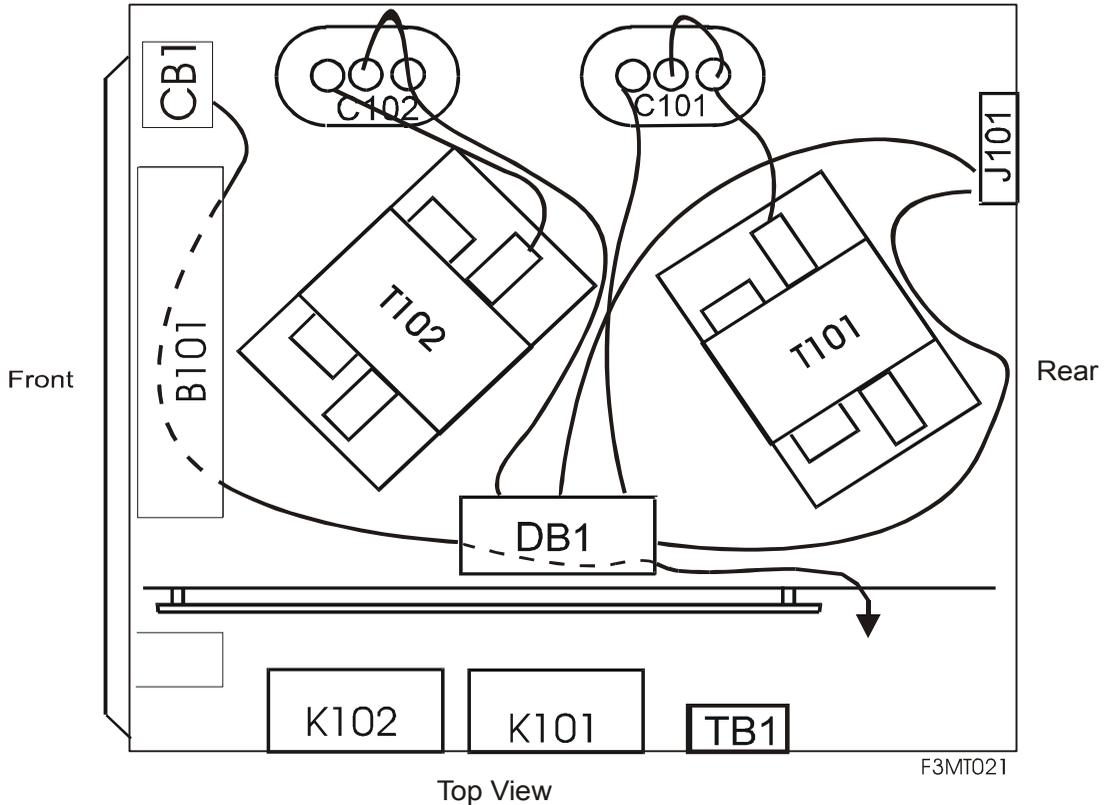
**Table 22. Transformer Terminal Orientation**

	<b>XFMR</b>	<b>COM</b>	<b>TAP</b>
P300MT	T101	Black/White	Red/White
	T102	Black/White	Red/White

---

**NOTE:** When colors are indicated, the first is the wire color and the second is the stripe color.

---



**Figure 47. P300 MT HV Wiring**

## K300 Modular Blower

### Routine Maintenance

The following sections discuss maintenance for the various parts of your blower system.

#### Blower Air Filters

The blower air filter is disposable and should be replaced when dirty. This interval may vary from daily to monthly depending upon the environment.

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The filters pull out easily. New filters should be tucked in at the edges. The white side belongs outside, so the blue side should face in.

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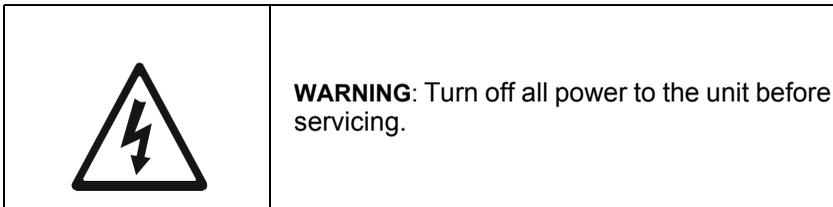
**CAUTION:** Do not operate the modular blower without a properly installed air filter. Unfiltered cooling air can reduce lamp bulb and reflector life.

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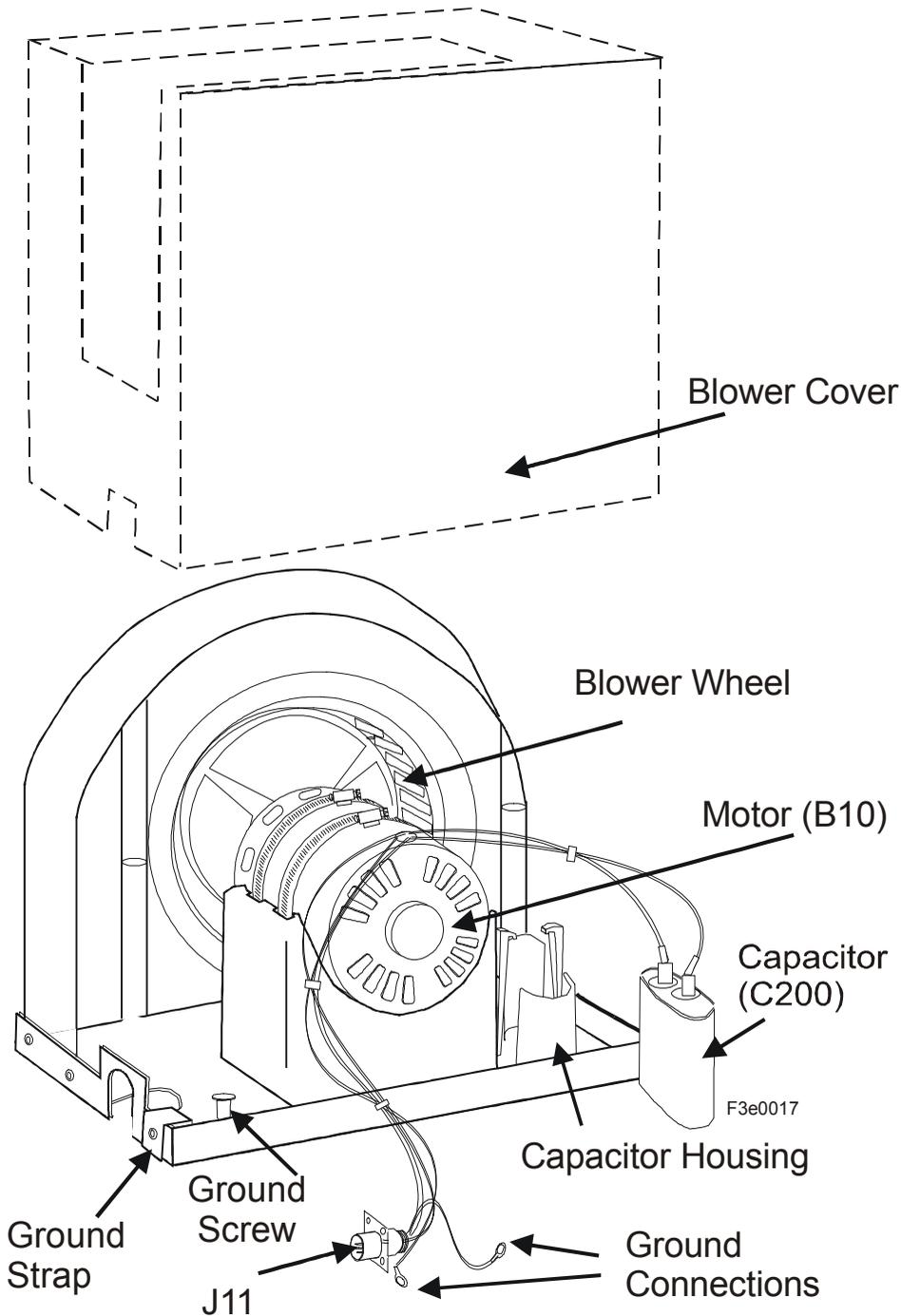
## Blower Cover Removal

Remove the six M5 truss head screws and lift off the blower cover. With this cover removed, the blower components are exposed and accessible.

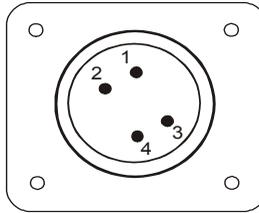
## Motor Replacement



1. Remove the blower cover. Remove the screws holding connector J11 to the blower chassis. Cut the leads to the blower and disconnect the ground wires from the ground screw (see [Figure 48 on page 119](#)).
2. Remove wires from capacitor C200.
3. Remove the blower housing cover plate.
4. Loosen the motor support clamps. Remove the motor and wheel through the housing.
5. Carefully measure and record the length of the shaft projection beyond the bearing hub.
6. To remove the wheel from the motor, loosen the wheel set screw and remove the wheel.
7. To replace these items, reverse the process, being careful to reinstall the wheel so that it is at the same point on the shaft.



**Figure 48. Blower Components**



**Figure 49. J11 Connections**

**Table 23. J11 Connections**

J11-1	Green/Yellow
J11-2	Black
J11-3	White

8. Connect the replacement J11 connector to the chassis. The black and white leads from the blower motor have pins installed; these pins must be inserted into the back of J11 as indicated in [Figure 49](#).
9. Connect the ring terminals on the green/yellow wire from J11 and the green/yellow wire from the blower to the ground screw.
10. Connect the push-on terminals to capacitor C200.
11. Reinstall the blower housing cover plate and the blower cover.

# Appendix A. Specifications

This appendix outlines the various characteristics of major components of F300S and F300SQ systems.

## System

**Table 24. System Operating Requirements**

Ambient Operating Temperature	0-45°C
Relative Humidity	30-95%

## Power Supply

The following table provides the F300S and F300SQ system power supply specifications.

**Table 25. F300S and F300SQ System Power Supply Specifications**

Mechanical	PM300M/P300MQ	P300MT
Length	584 mm (23")	400 mm (15.75")
Height	213 mm (8.4")	179.5mm (7.07")
Width	353 mm (13.9")	353 mm (13.9")
Weight	30.9 kg (68 lbs.)	
Weight w/QRO	40.3 kg (88.6 lbs.)	
Stacking	3 units maximum	
Finish	Stone gray textured polyurethane enamel	
Utilities		
1 Phase	50/60Hz	
Power	200/208/240 VAC +10%	
Control Power	+12VDC, +5VDC supplied by transformer and rectifiers on the PWB	

**Table 25. F300S and F300SQ System Power Supply Specifications** *(continued)*

Front Panel Controls	
System Power	ON/OFF - 2 position switch
Lamp Control	ON/STANDBY/OFF - 3 illuminated pushbutton switches
Interlocks	
Unit	HV Cable Disconnect
	Lamp Out
	Power Imbalance
	Power Error
	Power Supply Overtemperature
	Lamp Cooling Air Underpressure
System	System Blower Underpressure
	External Interlock Tripped
	RF Interlock Tripped
Rear Panel Connectors	High Voltage
	Irradiator/Cooling
	System Interconnections
	RF Detector/Interlocks
Power Supply Cooling	Air Flow 2.83 m <sup>3</sup> /min (100 cfm)

## Irradiators

Table 26 lists the various Fusion UV Systems Irradiator models and cooling method.

**Table 26. Irradiator Models and Details**

System	Power Supply	Irradiator Designation	Cooling Method
F300S/ F300SQ	P300M/P300MQ/ P300MT	I300M/I310M/I310M-D/ I311M/I311M-D	Remote cooling (Note 1) 2.8 m <sup>3</sup> /min (100 cfm) at 695 Pa (2.8 H <sub>2</sub> O) inlet pressure
		I300MB/I310MB	K300M Modular Blower

**NOTE:** All air flow specifications assume standard air density of 1.20 kg/m<sup>3</sup> (0.075 lbs/ft<sup>3</sup>). Remote blower specification must be corrected for air density variations at customer site.

### Cooling:

I300M/I310M/I310M-D/I311N/I311M-D: Requires a remote pressure blower.

I300MB/I310MB/I310MB-D: K300M modular blower mounts on top of the irradiator and is powered by the P300M/P300MQ power supply.

**Table 27. Power Inputs from P300M/P300MQ/P300MT**

Magnetron Power:	695 mA+45mA @ 3900 VDC
Filament Voltage: STANDBY	115 VAC
100% Power	85 VAC
Blower Voltage	2.0 A @ 200-240 VAC

Reflector: Polished and brightened aluminum elliptical reflector with protective aluminum oxide coating. Focus is 53.3 mm (2.1 inches) below irradiator base rails.

The standard reflector has R500 coating. Optional reflectors have R350 or Dichroic (cold) coatings.

Interlocks: Photoresistor assembly  
Air pressure switch

Weight: 12.0 kg (26.5 lbs) with modular blower.  
7.3 kg (16.0 lbs) without modular blower

Exterior: Brushed aluminum.

**Mechanical (without Blower):**

Length: 260.4 mm (10.25")

Height: 276.9 mm (10.9")

Width: 167.6 mm (6.6")

**Mechanical (with Blower):**

Length: 260.4 mm (10.25")

Height: 505.5 mm (19.9")

Width: 167.6 mm (6.6")

## Blower

**Mechanical:**

Length 260.4 mm (10.25")

Height 228.6 mm (9.00")

Width 167.6 mm (6.6")

## RF Detector

**Mechanical (without Bracket):**

Length: 60 mm (2.35")

Height: 75 mm (2.94")

Width: 75 mm (2.94")

**Mechanical (with Bracket):**

Length: 108 mm (4.28")

Height: 137 mm (5.4")

Width: 75 mm (2.94")

## System Agency Approvals

Table 28 lists the quality standards and agency regulatory guidelines against which the Fusion UV Systems products described in this document have been certified/validated.

**Table 28. System Agency Approvals**

Quality Measured	Standard
Electrical Safety (ETL/ITS)	EN60204-1, UL 775, CSA C22.2
Emissions (CE)	Group 2, Class A EN 55011 (CISPR-11)
Immunity (CE)	EN61000-4-2 (IEC 801-2) (ESD) EN50140 (IEC 801-3) (RF Susceptibility) EN61000-4-4 (IEC 801-4) (Fast Transient) EN61000-4-5 (IEC 801-5) (Surge) ENV50141 (IEC 801-6) (Conducted RF) IEC 1000-4-11 (Voltage Dips, Interruptions, and Variations)



# Appendix B. Cables and Connectors

This appendix provides information on the interconnect cables and system connector contact kits used with the F300S/F300SQ Ultraviolet Lamp System.

## Interconnect Cables

Fusion UV Systems irradiators use the interconnect cables described in [Table 29](#).

**Table 29. Interconnect Cables**

From	To	Cable Type	Length (M)	Part Number
Power Supply	Irradiator without Blower	H340 HV/Irradiator Cable	2	328521
			4	328522
			6	328523
			8	328524
			11	328525
			14	328526
			17	328527
			21	328528
			26	328529
			31	328531
			5	328532
Power Supply	Irradiator (with K300M Blower)	H341 HV/ Irradiator Cable	2	328551
			4	328552
			6	328553
			8	328554
			11	328555
			14	328556
			17	328557
			21	328558
			26	328559
			31	328561
			5	328562

**Table 29. Interconnect Cables (continued)**

From	To	Cable Type	Length (M)	Part Number
Power Supply	RF-1	H790 RF Cable	2	329281
			4	329282
			6	329283
			8	329284
			11	329285
			14	329286
			17	329287
			21	329288
			26	329289
			31	329291
			1.5	329292
			5	329293
Power Supply	Power Supply	H760 (F300S/F300SQ System) Interconnect Cable	0.65	091231

## System Connector Contact Kits

Each kit includes pins and contacts for referenced connections. See [Table 32 on page 141](#) for the proper contact extraction tool.

**Table 30. System Connector Contact Kits**

Connector	Description	Quantity per System	Part Number
P105B	Kit, contacts	1	204041
P106	Kit, contacts	1	204042

## Appendix C. Outline Drawings

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The drawings in this appendix provide overview details for general reference for Fusion UV Systems products. These drawings are **not** to be used in designing an installation; contact Fusion directly for current specifications.

- [Figure 50](#), P300M/P300MQ power supply dimensions and clearances
- [Figure 51](#), P300MT power supply dimensions and clearances
- [Figure 52](#), I300M Irradiator dimensions
- [Figure 53](#), I300MB Irradiator dimensions
- [Figure 54](#), I310M/I310M-D Irradiator dimensions
- [Figure 55](#), I310MB/I310MB-D Irradiator dimensions
- [Figure 56](#), I311M/I311M-D Irradiator dimensions
- [Figure 57](#), RF-1 RF Detector dimensions

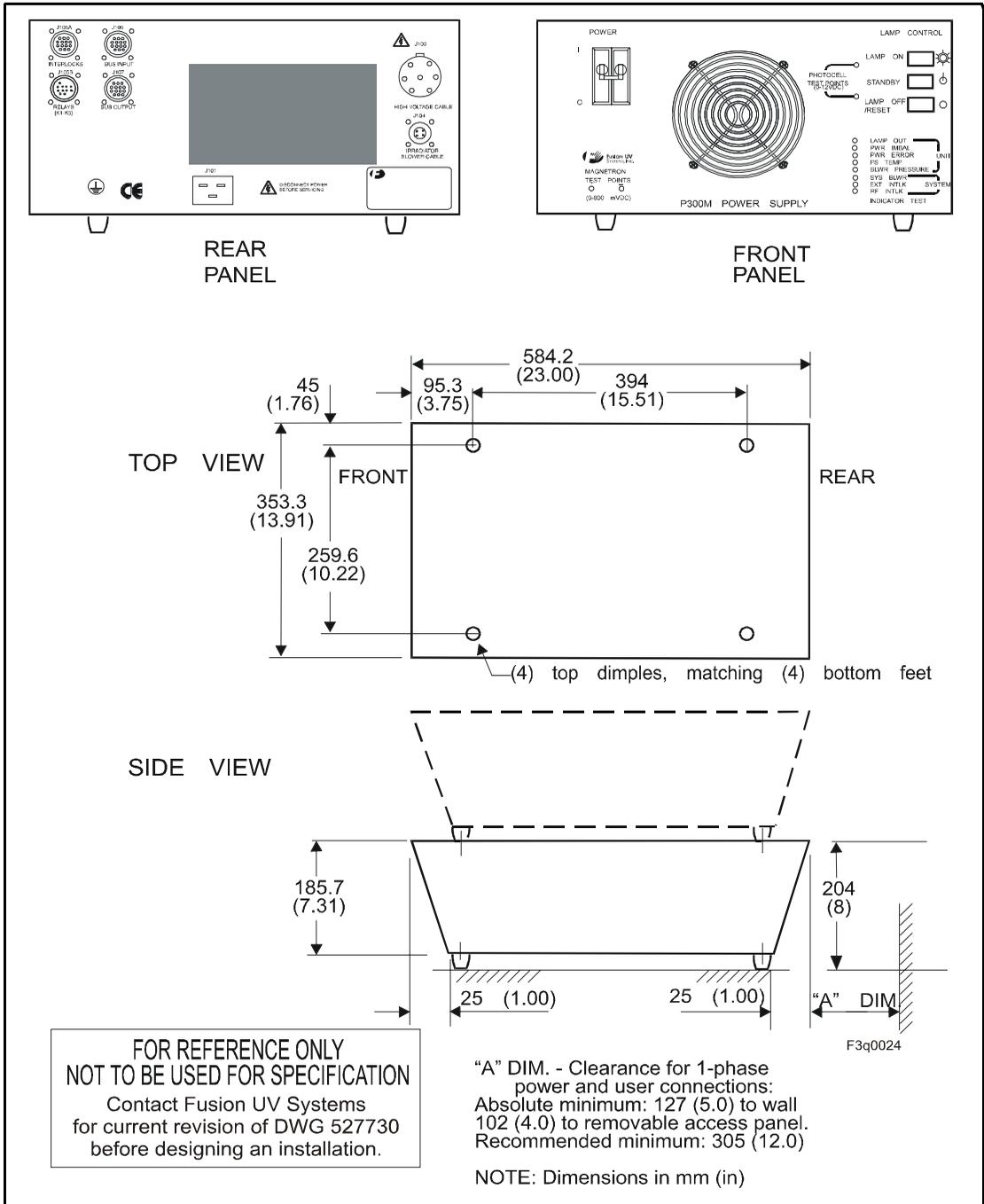
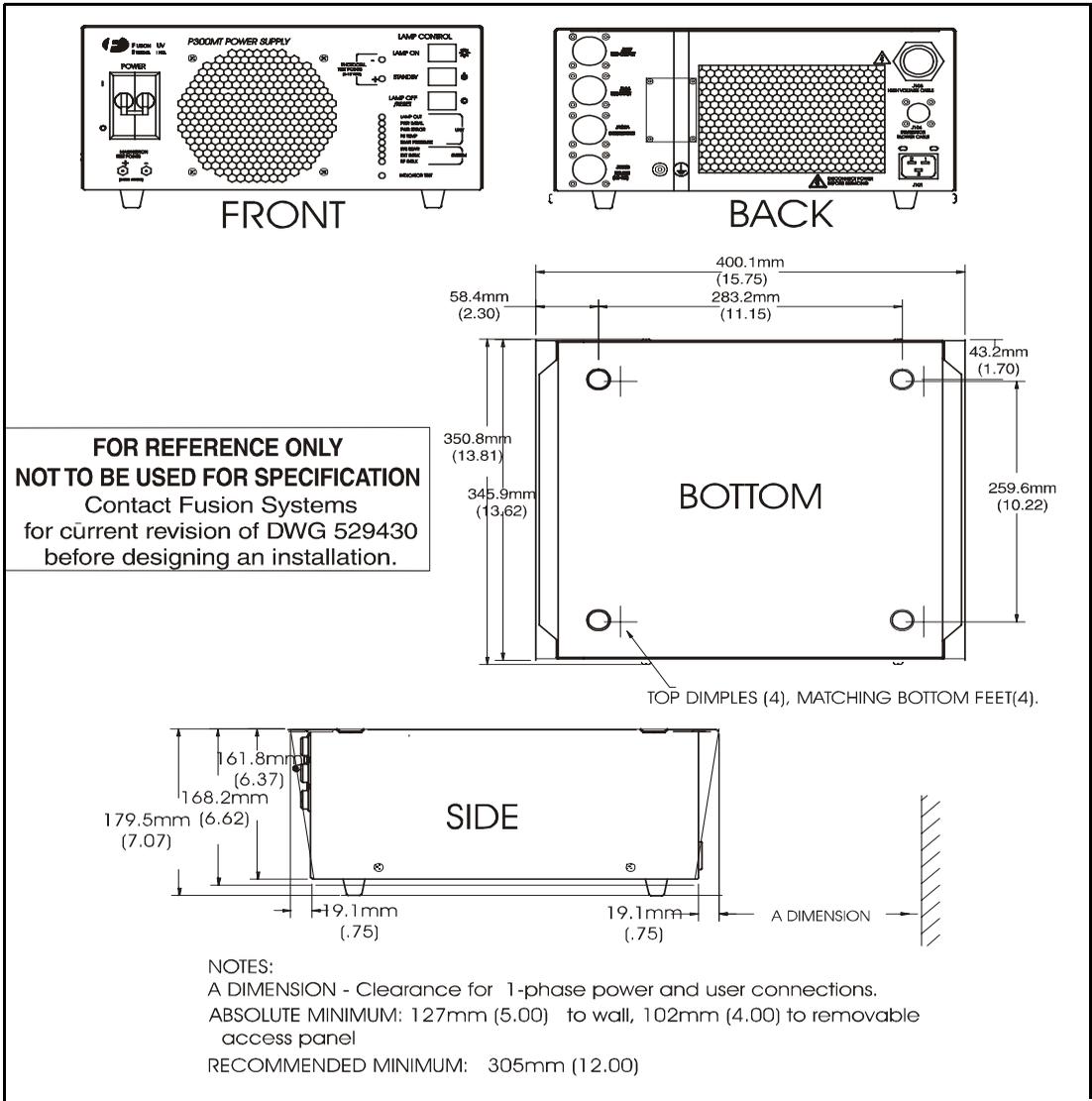
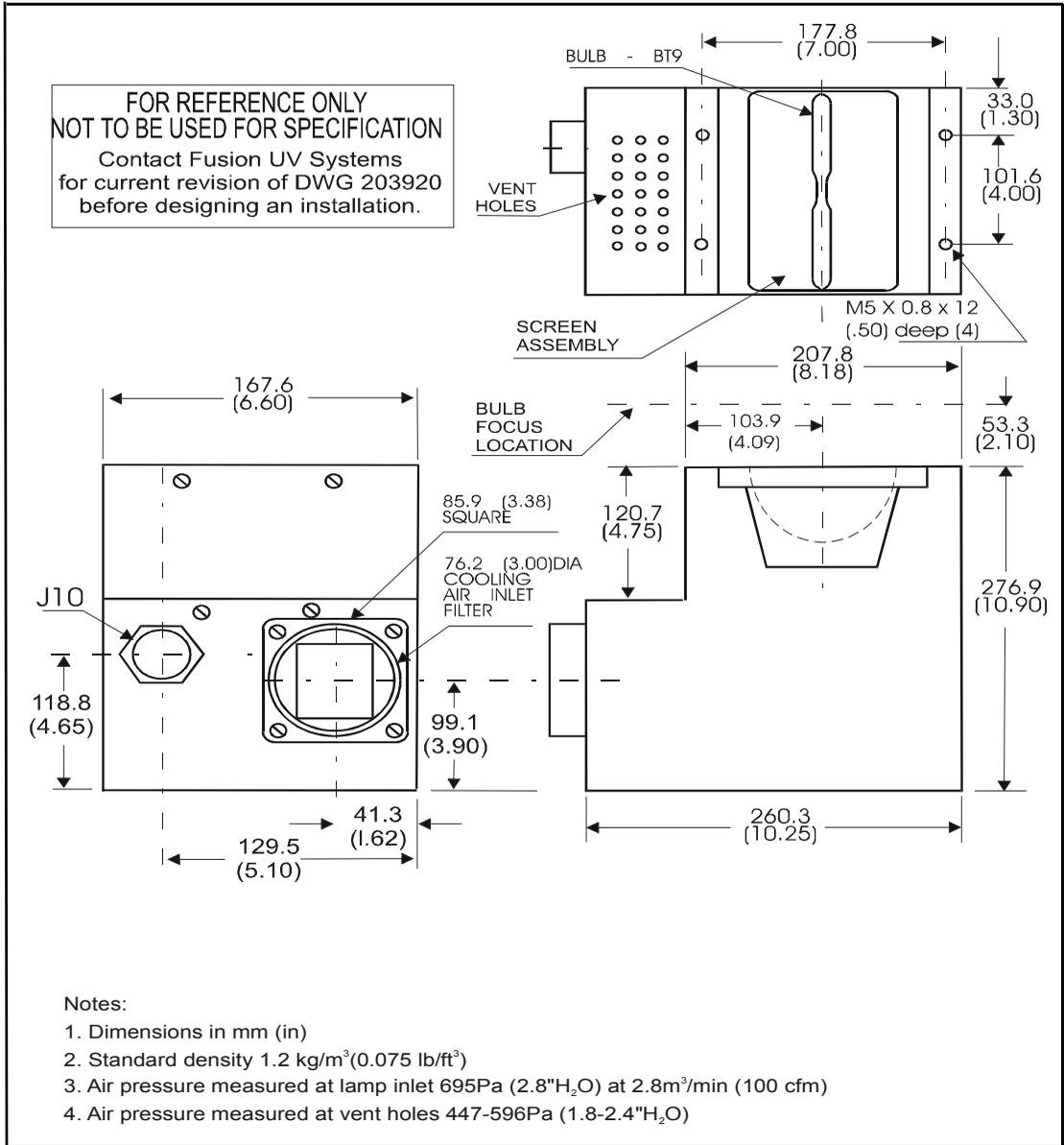


Figure 50. P300M/P300MQ Power Supply Dimensions and Clearances



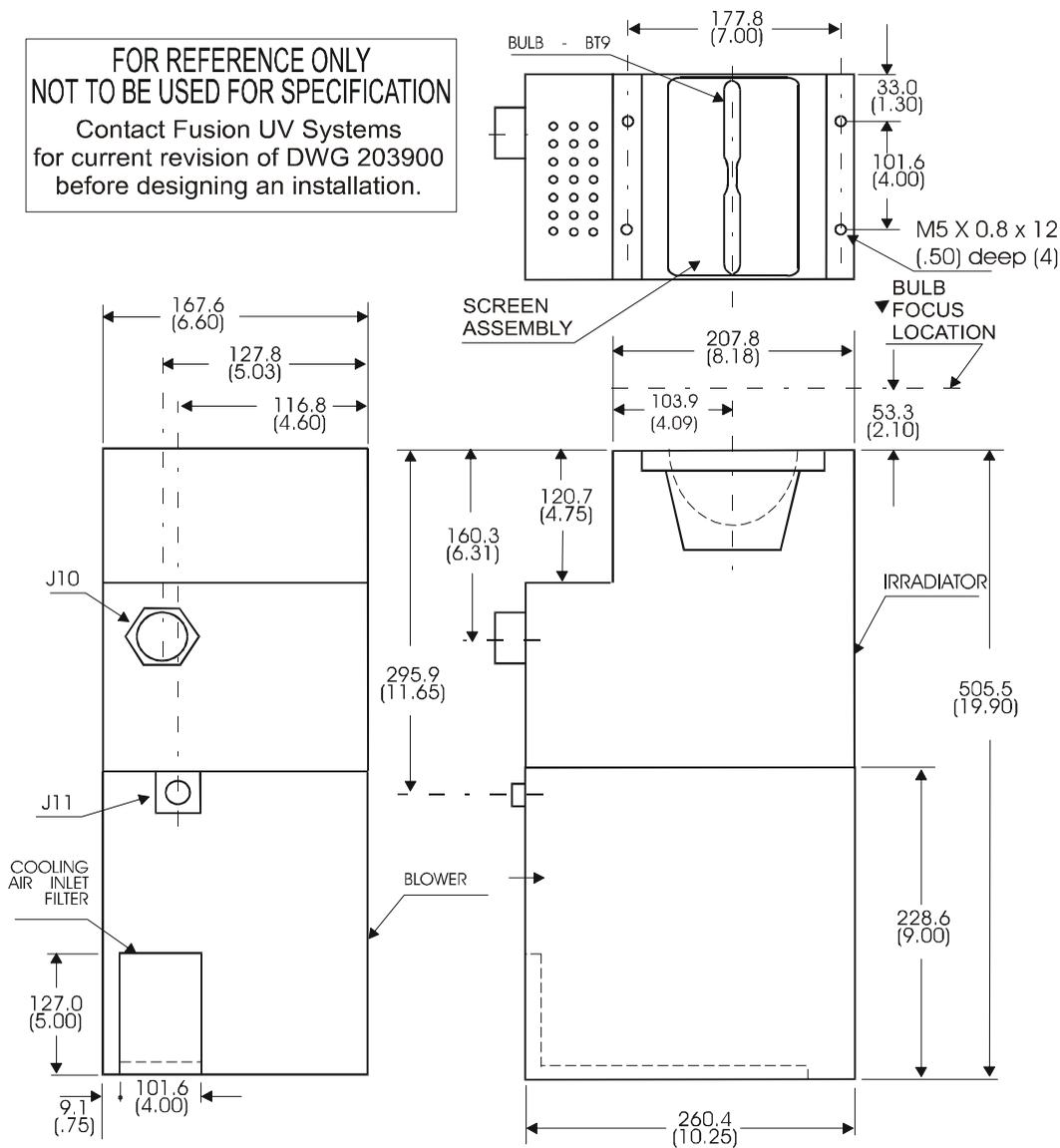
**Figure 51. P300MT Power Supply Dimensions and Clearances**



**Figure 52. I300M Irradiator Dimensions**

**FOR REFERENCE ONLY  
NOT TO BE USED FOR SPECIFICATION**

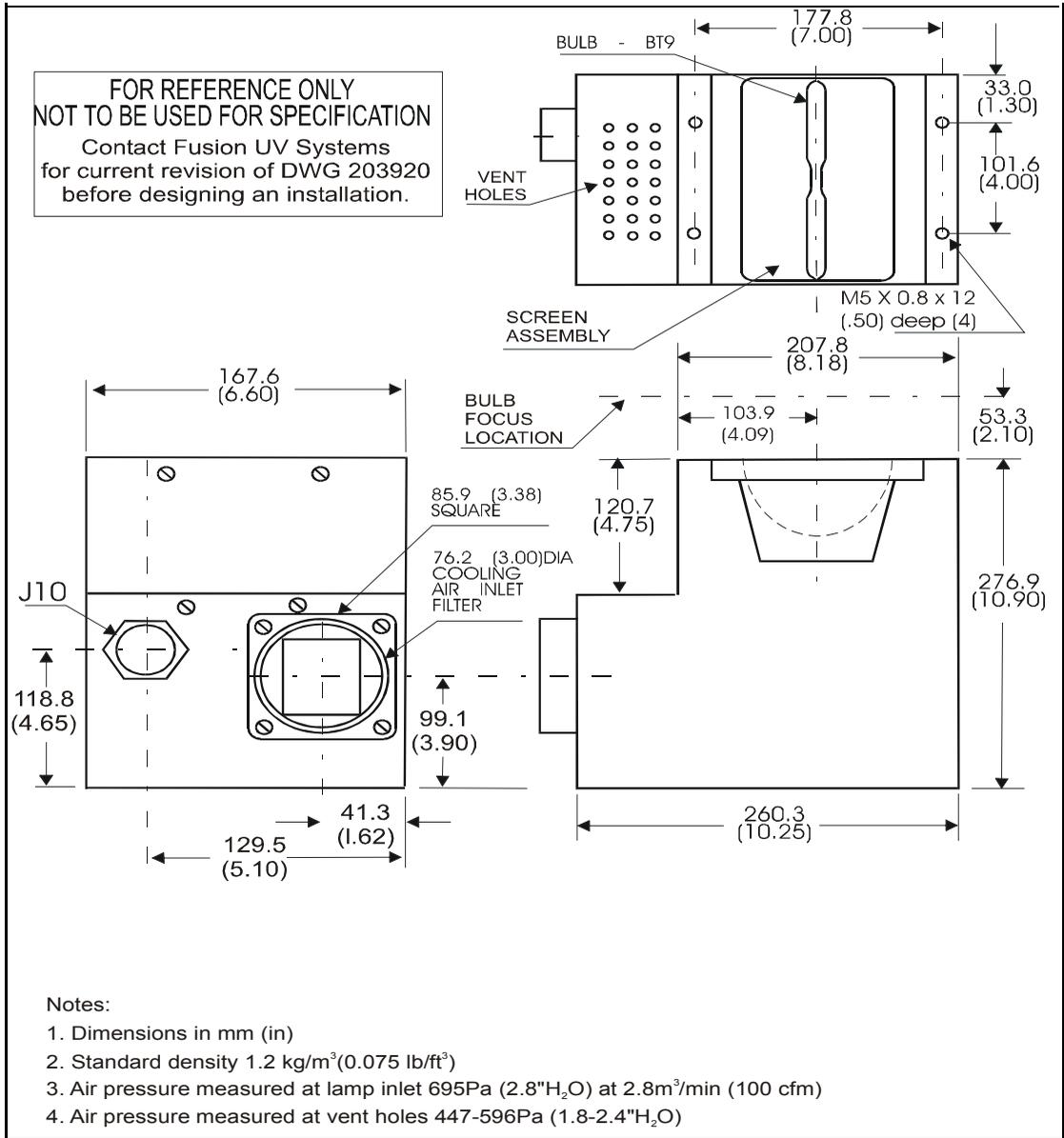
Contact Fusion UV Systems  
for current revision of DWG 203900  
before designing an installation.



**Notes:**

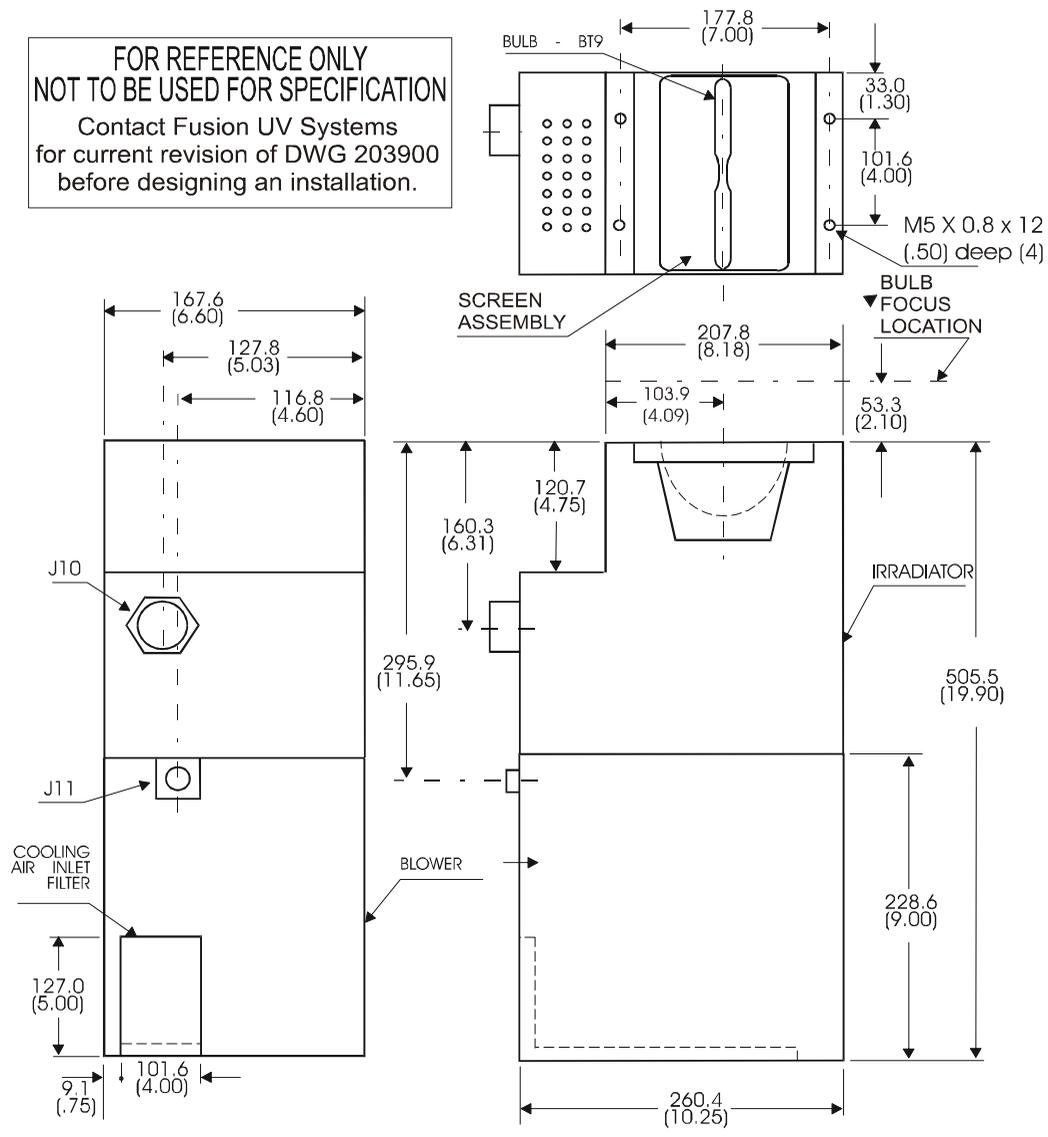
1. Dimensions in mm (in)
2. Air pressure at vent holes 447- 822 Pa (1.8 - 3.3"H<sub>2</sub>O)

**Figure 53. I300MB Irradiator Dimensions**



**Figure 54. I310M/I310M-D Irradiator Dimensions**

**FOR REFERENCE ONLY  
NOT TO BE USED FOR SPECIFICATION**  
Contact Fusion UV Systems  
for current revision of DWG 203900  
before designing an installation.



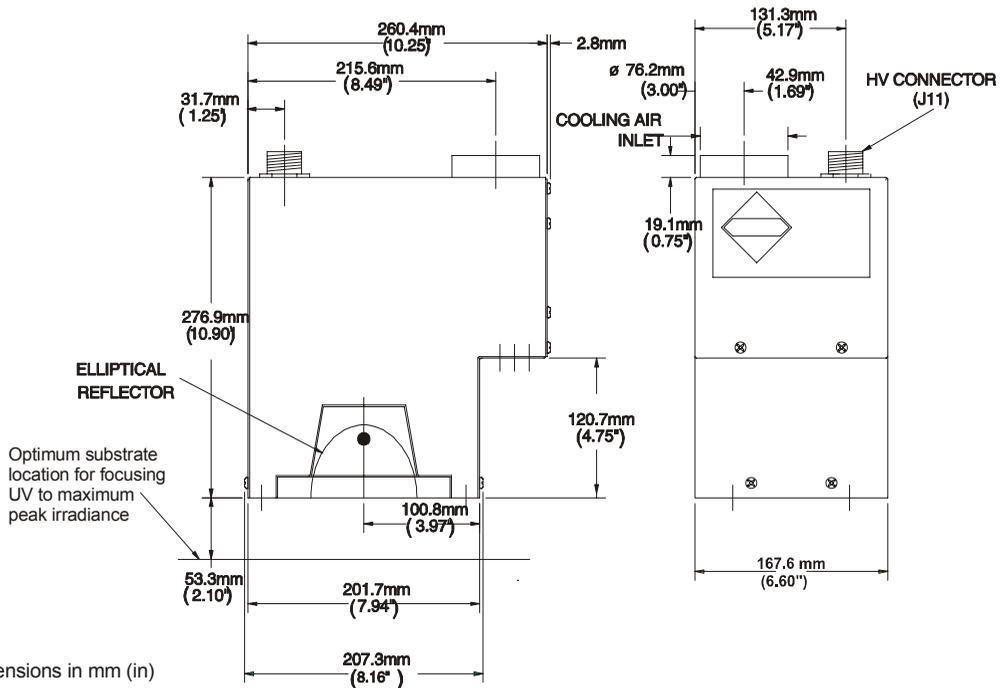
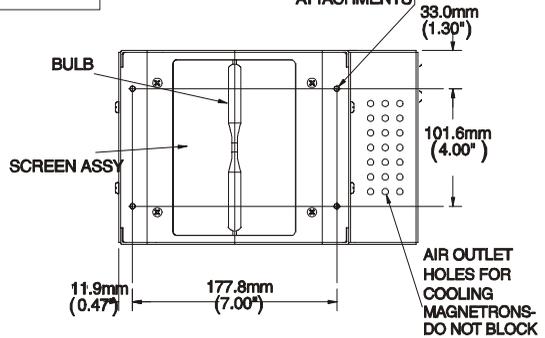
- Notes:**
1. Dimensions in mm (in)
  2. Air pressure at vent holes 447- 822 Pa (1.8 - 3.3"H<sub>2</sub>O)

**Figure 55. I310MB/I310MB-D Irradiator Dimensions**

FOR REFERENCE ONLY  
NOT TO BE USED FOR SPECIFICATION

Contact Fusion UV Systems  
for current revision of DWG 341400  
before designing an installation.

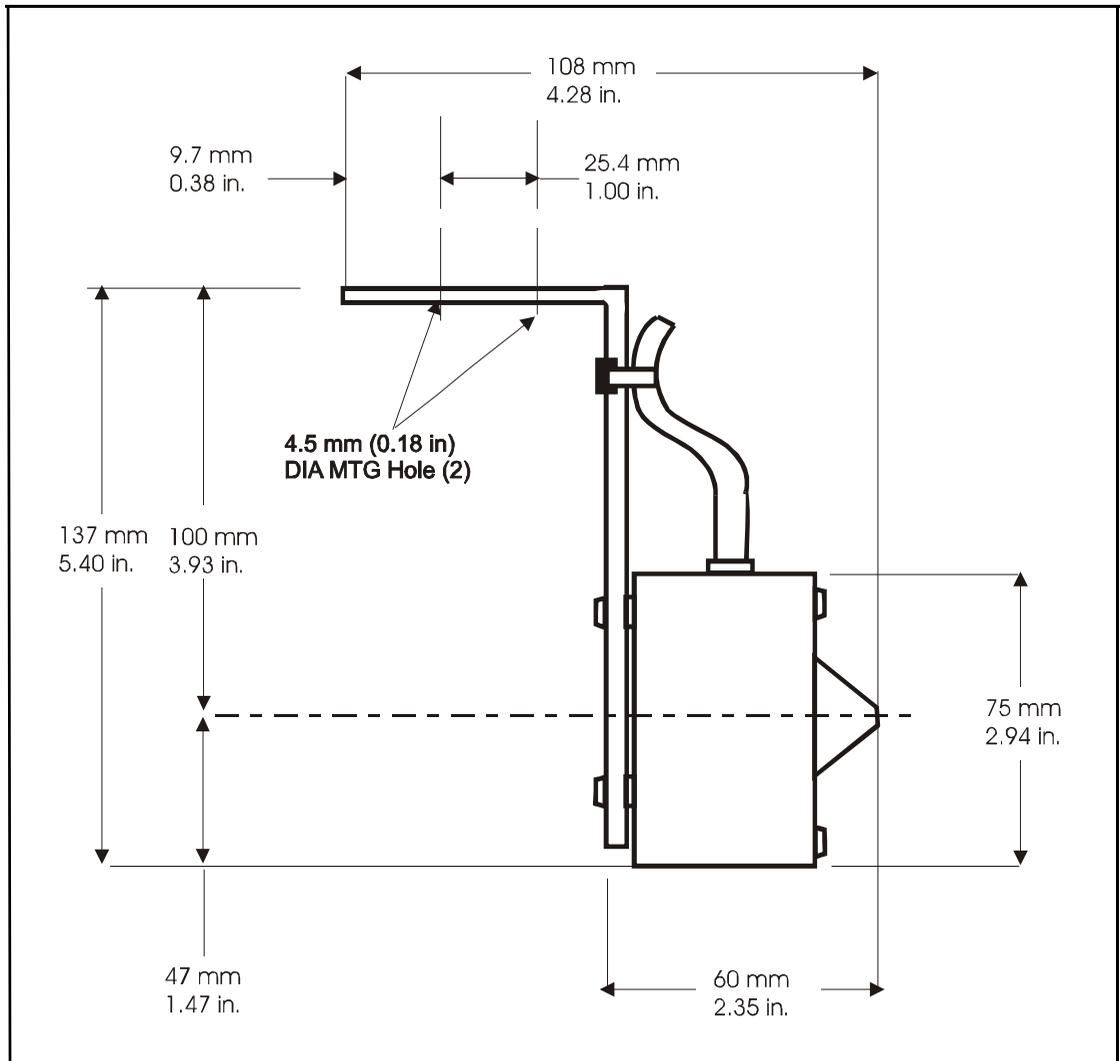
4X M5x.8 THREAD  
.50" DEEP-  
HOLES PROVIDED  
FOR MOUNTING,  
OR FOR LAMP  
ATTACHMENTS



Notes:

1. Dimensions in mm (in)
2. Standard density 1.2 kg/m<sup>3</sup> (0.075 lb/ft<sup>3</sup>)
3. Air pressure measured at lamp inlet 695Pa (2.8"H<sub>2</sub>O) at 2.8m<sup>3</sup>/min (100 cfm)
4. Air pressure measured at vent holes 447-596Pa (1.8-2.4"H<sub>2</sub>O)

Figure 56. I311M/I311M-D Irradiator Dimensions



**Figure 57. RF-1 RF Detector Dimensions**







# Appendix E. Replacement Parts

Table 32 lists the various accessory replacement parts available for Fusion UV Systems F300S/F300SQ Lamp Systems.

**Table 32. Accessory Parts List**

Description	Ref	P/N	Quantity	
			F300S/F300SQ	
			Modular Blower	Remote Cooling
Cable, irradiator w/K300M modular blower, 4M	H341	328552	1	—
Cable, irradiator w/o K300M modular blower, 4M	H340	328522	—	1
Cable, RF detector (RF-1), 4M	H790	329282	1	
Cable, system interconnections	H760	091231	Only provided in multiple lamp systems (one per slave)	
Clip, retaining, power cord	—	501031	1	
Connector assembly, RF (for slaves)	P105A	091241	Only provided in multiple lamp systems (one per slave)	
Connector, 16 CKT, plug (user outputs)	P105B	025791	1	
Connector, 14 CKT (remote controls)	P106	025794	1	
Fuse, 4.0A, 250V; for PWB	F1, F2	296397	2	
Kit, AC input plug with clip	P101	511591	1	
Kit, AC input plug with clip and resistor assemblies	P101	511592	1	
Kit, contacts (for P105B)	—	204041	1	
Kit, contacts (for P106)	—	204042	1	
Kit, I6 extrusion retrofit (for converting I300M irradiator to I310M irradiator only)	—	527321	1	
Kit, power supply connector - F300S	—	322947	1	
Kit, PWB, P300M spare	—	508241	1	

**Table 32. Accessory Parts List (continued)**

Description	Ref	P/N	Quantity	
			F300S/F300SQ	
			Modular Blower	Remote Cooling
Kit, RF detector	RF-1	079961	1	
Kit, retrofit, relay coil resistor assemblies	—	528641	1	
Tool, contact removal	—	043041	1	

## I300M/I310M Irradiator Parts List

Table 33 lists the various replacement parts available for Fusion UV Systems I300M and I310M Irradiators.

**Table 33. I300M/I310M Irradiator Parts List**

Description	Reference Designator	Part Number
Bulb, UV, (standard) BF9H2	—	558432
Bulb, UV, (optional) BF9D	—	558434
Bulb, UV, (optional) BF9V	—	558437
Bulb kit, 6" BF9H2 (1 bulb)	—	558442
Bulb kit, 6" BF9D (1 bulb)	—	558444
Bulb kit, 6" BF9V (1 bulb)	—	558447
Bulb kit, 6" BF9H2 (2 bulbs)	—	570202
Bulb kit, 6" BF9D (2 bulbs)	—	570204
Bulb kit, 6" BF9H2 (3 bulbs)	—	570212
Bulb kit, 6" BF9D (3 bulbs)	—	570214
End reflector, R500 (1 pc.)	—	029831
End reflector, R350 (1 pc.)	—	079246
Harness, for I30xM and I31xM-D series Irradiators (J10)	—	090426
Harness, for I31xM series Irradiators (J10)	—	090423
Hex nut, plastic, HV connector J10	—	254101
Kit, magnetron, for all I3xxM series Irradiators	—	078612

Table 33. I300M/I310M Irradiator Parts List (continued)

Description	Reference Designator	Part Number
Kit, reflector assembly, I300M, R500 (includes main reflector, 2 end reflectors and gaskets)	—	292161
Kit, reflector assembly, I300M, R350 (includes main reflector, 2 end reflectors and gaskets)	—	292162
Kit, reflector assembly, I300M, dichroic (cold/R500) (includes dichroic main reflector, 2 R500 end reflectors and gaskets)	—	292163
Kit, reflector assembly, I300M, dichroic (cold/cold) (includes main reflector, 2 end reflectors and gaskets)	—	292164
Kit, reflector assembly, I310M, R500 (includes main reflector, 2 end reflectors and gaskets) (for I31xM and I31xM-D series irradiator only)	—	528795
Kit, reflector assembly, I310M, R350 (includes main reflector, 2 end reflectors and gaskets) (for I31xM and I31xM-D series irradiator only)	—	528796
Kit, reflector assembly, I310M, dichroic (cold/R500) (includes main reflector, 2 end reflectors and gaskets) (for I31xM and I31xM-D series irradiator only)	—	528797
Kit, reflector assembly, I310M, dichroic (cold/cold) (includes main reflector, 2 end reflectors and gaskets) (for I31xM and I31xM-D series irradiator only)	—	528798
RF gasket (end reflector), 2 per lamp	—	002521
Kit, RF gasket	—	032932
Kit, RF gasket (for I31xM and I31xM-D series Irradiator only)	—	514371
Kit, screen assembly replacement	—	019712
Kit, switch, air pressure	S201	292551
Kit, transformer, filament, 50/60 Hz	T201A	036504
Photoresistor assembly (for I31xM series Irradiators)	—	007971
Photoresistor assembly (for I31xM and I31xM-D series Irradiators)	—	550582

## P300M/P300MT Power Supply Parts List

Table 34 lists the various replacement parts available for Fusion UV Systems P300M and P300MT power supplies.

**Table 34. P300M and P300MT Replacement Parts**

Description	Reference Designator	Part Number
Capacitor, Oil filled 0.85/0.43 MFD (50/60 Hz)	C101,C102	274951
Circuit Breaker, P300M, Power Switch, 2P, 20A	CB1	327611
Contact Kit, SKT, 20-24GA, Set of 50 (Use Extraction Tool 043031, Crimp Tool 037373)	J105A, J106, J107	204041
Contact Kit, SKT, 20-40GA, Set of 50 (Use Extraction Tool 043031, Crimp Tool 037373)	J105B	204042
Contact Kit, SKT, 16-18GA, Set of 50 (Use Extraction Tool 043031, Crimp Tool 037373)	—	201673
Control Board assembly, P300M/P300MQ	—	327554
Fan, 230, 50/60 Hz	B101	029225
Harness assembly, P300M, User I/O	J105A, J105B, P5, P11	327571
Harness assembly, P300M, Master/Slave	J106, J107, P3, P4	340761
Harness assembly, P300M, PWB PWR, I/F	P9, P15	508041
Harness assembly, P300M, AC Distribution	J101, CB1	508051
Harness assembly, P300M, HV I/O, Blower	J103, J104, P6, P10, P19	340792
Harness assembly, P300MT only, User I/O	J105A, J105B, P5, P11	529351
Harness assembly, P300MT only, Master/Slave	J106, J107, P3, P4	529341
Harness assembly, P300MT only, PWB PWR, I/F	P9, P15	529311
Harness assembly, P300MT only, AC Distribution	J101, CB1	529321
Harness assembly, P300MT only, HV I/O, Blower	J103, J104, P6, P10, P19	529331
Harness assembly, P300MT only	K101	529531
Hex Nut, Plastic, HV Connector (for J103)	J104	254101
HV Rectifier Bridge, 12KV, 700mA	DB1	327622

**Table 34. P300M and P300MT Replacement Parts** (continued)

Description	Reference Designator	Part Number
HV transformer, 230V, 50/60 Hz	T101, T102	341371
HV wire assembly, 8", White	—	340701
HV wire assembly, 3.5", Black	—	340704
HV wire assembly, 3.5" White	—	340702
HV wire assembly, 8" Black	—	340703
HV wire assembly, 9.6", White	—	340706
HV wire assembly, 9.6", Black	—	340707
HV wire assembly, 6", Black, P300MT only	—	529552
HV wire assembly, 7", White, P300MT only	—	529551
HV wire assembly, 8", Black Flag, P300MT only	—	330483
HV wire assembly, 8", White Flag, P300MT only	—	330481
Kit, F300S to F300SQ Conversion P300M only	—	530481
Relay, 20A; 240V Coil	K101, K102	327581
Switch assembly - LAMP CONTROL, LAMP OFF/RESET, Red	S3	327591
Switch assembly - LAMP CONTROL, STANDBY, Yellow	S2	327592
Switch assembly - LAMP CONTROL, LAMP ON, Green	S1	327593
Wire assembly, P300M, DB1 GND	—	340705
Wire assembly, P300M, HV MAG I TPS	—	340731
Wire assembly, P300M, K101/K102-TB1	—	340727
Wire assembly, P300M, K101-K102, Black	—	340712
Wire assembly, P300M, K101-K102, Red	—	340711
Wire assembly, P300M, T101-T102	—	340722
Wire assembly, P300M, T102-TB1	—	340723

## P300MQ Quick Restart Option Parts List

Table 35 lists the various replacement parts available for the Fusion UV Systems P300MQ Quick Restart Option.

**Table 35. P300MQ Quick Restart Option Parts List**

Description	Reference Designator	Part Number
Bracket, Mtg, 1.75 oval	For C103	222291
Inductor, QRO	L101	509111
Capacitor, HV, Oil-filled, dual, 0.81/0.36 mF	C101, C102	509121
Capacitor, Oil-filled,dual,0.2 mF	C103	500591
Clip, HV wire	—	326631
Rectifier Bridge, QRO,7A,12kV	DB2	502031
Solid State Relay assembly, P300MQ	K103	508101
Transformer, HV Plate, QRO	T103	500101
Wire assembly, P300M, HV, Black, 9.6 in	—	340703
Wire assembly, P300M, HV, White, 9.6 in	—	340701
Wire assembly, P300M, K101/K102, TB1	—	340727
Wire assembly, P300MQ, HV, Black,16.8 in	—	508482
Wire assembly, P300MQ, HV, Black, 9.6 in, F/I	—	508483
Wire assembly, P300MQ, HV,White,13.2 in F/I	—	508481
Wire assembly, P300MQ, TB1-T103	—	340728
Wire assembly, P300MQ, K103 Control	—	340732

## K300 Blower Assembly Parts List

**Table 36. K300 Blower Assembly Parts List**

Description	Reference Designator	Part Number
Capacitor, Fld. Fill, 4.0 MFD	C200	041981
Connector, 4 CKT (Use Contact Kit 201675)	J11	025802
Contact Kit, SKT, 16-18GA (set of 50)	—	201673
Contact Kit, pin, 16-18GA (set of 50)	—	201675
Cover, Blower	—	200231
Ground Strap, K300 Cover, copper	—	500211
Filters, Modular Blower (set of 20)	—	066398
Inlet Ring, Blower	—	032473
Kit, motor replacement, including terminals and J11 connector	B10	205661
Wheel, Blower	—	029284

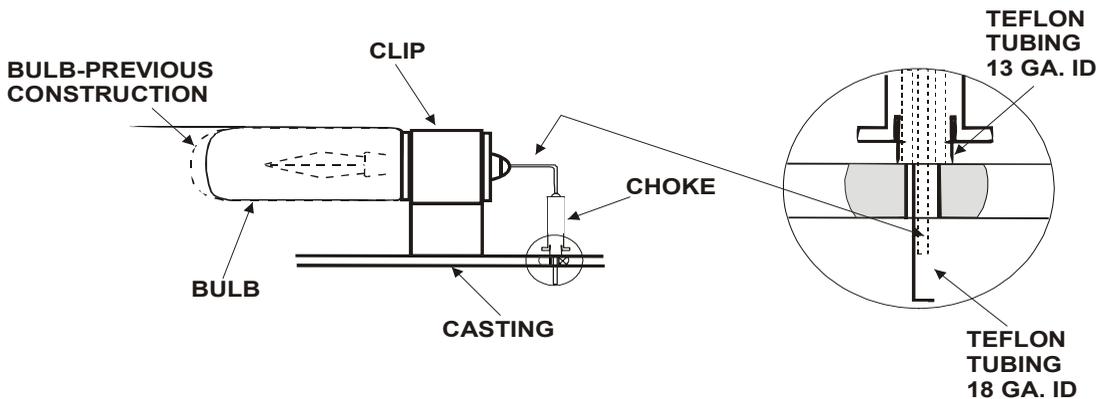


# Appendix F. Ignitor Bulb

**NOTE:** This appendix applies to lamps manufactured before July 1, 2002.

## Ignitor

The ignitor bulb is designed to provide positive instant ignition of the main bulb. As shown in Figure 58, the ignitor is a UV bulb with a probe which projects into the waveguide. The instant the magnetron is energized, the probe intercepts enough energy to ionize the ignitor bulb, creating a small amount of UV radiation which reliably causes ignition in the main bulb. When the main bulb is at full power, the energy level in the ignitor is reduced, prolonging the life of the bulb.



**Figure 58. Ignitor Bulb**

**Table 37. Routine Operations Associated with Ignitor Bulb**

(Refer to [Table 12 on page 59](#) for other operational information.)

Time	Power Switch	Lamp Control	Lamp Control Flasher	Operation
0 sec 2-4 sec  8 sec	On	Lamp on	Green flash  Steady green	Start HV transformers Ignitor bulb lights  UV bulb ignites; ignitor bulb turns off UV bulb at full power
0 sec  10 sec 12-18 sec  18-20 sec		From lamp off to lamp on	Slow flash yellow  Fast flash green  Steady green	Ignitor bulb lights  UV bulb ignites; ignitor bulb turns off  UV bulb at full power

**Table 38. Troubleshooting and Fault Diagnosis**

(Refer to [Table 18 on page 69](#) for other operational information.)

Operation	Signal/Other Symptoms	Possible Cause	Corrective Action
Switch from Standby to On	LAMP OUT indicator lights, or UV output is weak, or UV bulb does not light	Ignitor bulb position	The lead from the base of the ignitor bulb should be inserted up to its outer sleeve into the waveguide launcher
		Ignitor bulb	Replace ignitor bulb
	RF INTLK indicator lights	Ignitor bulb faulty	Replace ignitor bulb

## Ignitor Bulb Removal/Replacement

1. Replace the ignitor bulb only if the lamp does not start consistently and all other indications are normal.

2. Remove the irradiator housing as described in [Chapter 6, “Maintenance”](#).
3. Pull the defective bulb out and push the new bulb into the mounting clip. make sure the stem of the bulb fits into the waveguide so that the outer Teflon sleeve on the antenna wire is against the casting (see [Figure 58](#)).



# Appendix G. Schematics

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The following schematics are located within the F300 folder on your product documentation CD in a subfolder or directory entitled “Schematics”. These files are in PDF format. They illustrate various wiring diagrams and other schematics for F300S/F300SQ lamp systems.

- F300S System Wiring Diagram\*
- P300MQ Chassis Schematic\*
- PWB P300M Control w/QRO Schematic\*

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\* These documents pertain to systems with and without Quick Restart Option.

