CoolWave™ Ultraviolet Microwave Applied Curing System
Six-Inch Lamphead

Customer Product Manual
Part 775361B
Issued 6/03

To order parts call 866-885-1212.
For technical support call 800-524-1322.

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Nordson

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Section 1
Safety

Introduction

Read and follow these safety instructions. Task- and equipment-specific warnings, cautions, and instructions are included in equipment documentation where appropriate.

Make sure all equipment documentation, including these instructions, is accessible to all persons operating or servicing equipment.

All equipment is designed and manufactured to International Safety Standards to ensure that the health and safety of the operator is protected at all times.

Qualified Personnel

Equipment owners are responsible for making sure that Nordson equipment is installed, operated, and serviced by qualified personnel. Qualified personnel are those employees or contractors who are trained to safely perform their assigned tasks. They are familiar with all relevant safety rules and regulations and are physically capable of performing their assigned tasks.

Intended Use

Nordson ultraviolet (UV) equipment is intended specifically for integration into other machines and should **NOT** be operated as a standalone system or without appropriate safety guarding, shielding, and interlocks. It is the responsibility of the integrator and end user to ensure that the final assembly fulfills all necessary legislation and is completely safe before operation.

This equipment is designed for the accelerated curing of UV inks, adhesives, and coatings. Do not use this equipment to cure alternative materials unless approved by the material supplier.

The equipment is not flame or explosion proof and is not designed for use in hazardous areas.

Use of Nordson equipment in ways other than those described in the documentation supplied with the equipment may result in injury to persons or damage to property.

Some examples of unintended use of equipment include:

- using incompatible materials
- making unauthorized modifications
- removing or bypassing safety guards, shielding, or interlocks
- using incompatible or damaged parts
- using unapproved auxiliary equipment
- operating equipment in excess of maximum ratings
- using equipment in hazardous areas

Regulations and Approvals

Make sure all equipment is rated and approved for the environment in which it is used. Any approvals obtained for Nordson equipment will be voided if instructions for installation, operation, and service are not followed.

Currently there are two organizations that set recommended guidelines for exposure to occupational microwave radiation exposure, OSHA (U.S. Department of labor, Occupational Safety and Health Administration - Directive 29cfr 1910.97) and ANSI (American National Standards Institute - Directive C95.1-1982). The ANSI directive, which is more stringent and most commonly referred to, states that individuals should not be exposed to microwave radiation levels above 5 mW/cm^2 at 2.45 GHz on a continuous basis.

Personal Safety

To prevent injury follow these instructions.

- Do not operate or service equipment unless you are qualified.
- Do not operate equipment unless safety guards, light shields, doors, and/or covers are intact and automatic interlocks are operating properly. Do not bypass or disarm any safety devices.
- Keep clear of moving equipment. Before adjusting or servicing any moving equipment, shut off the power supply and wait until the equipment comes to a complete stop. Lock out power and secure the equipment to prevent unexpected movement.
- Obtain and read Material Safety Data Sheets (MSDS) for all materials used. Follow the manufacturer's instructions for safe handling and use of materials. Always use recommended personal protection devices.
- Make sure the UV area is adequately ventilated.
- The UV equipment runs at extremely high temperatures. Do not touch the UV lamphead face during operation or immediately after shutting off the equipment.
- To prevent injury, be aware of less-obvious dangers in the workplace that often cannot be completely eliminated, such as hot surfaces, sharp edges, energized electrical circuits, and moving parts that cannot be enclosed or otherwise guarded for practical reasons.
- Always wear safety glasses that offer UV protection.
- Never expose any part of the body to direct or indirect UV light.

Ultraviolet Radiation

WARNING: Ultraviolet light is a form of electromagnetic radiation and can be harmful if exposure exceeds recommended levels. Protect eyes and skin from direct exposure to UV light. All equipment or areas where UV light is used must be adequately guarded, shielded, and interlocked to prevent accidental exposure.

Ultraviolet light is not capable of penetrating into the body and interacting with internal tissues and organs.

The National Institute for Occupational Safety and Health (NIOSH) document *Criteria for Recommended Standard... Occupational Exposure to Ultraviolet Radiation* (PB214 268) establishes guidelines for safe use.

See Figure 1-1. Ultraviolet light is divided into wavelength bands A, B, C, and V along with vacuum UV. Although values for wavelength bands will vary depending on the source, the following ranges may be used as a guide.

- Vacuum UV (100-200 nanometers) - absorbed by air and poses no danger to humans.
- UV-A (315-400 nanometers) - represents the largest portion of UV energy and is most responsible for human skin aging and increased pigmentation. UV-A is at the lower limit of sensitivity to the human eye. Referred to as far UV.
- UV-B (280-315 nanometers) - most responsible for reddening and burning of the skin and damage to the eyes.
- UV-C (200-280 nanometers) - filtered by ozone. Referred to as near UV.
- UV-V (400-450 nanometers) – visible UV

Exposure to UV radiation can result in

- reddening of skin
- headaches
- sore eyes

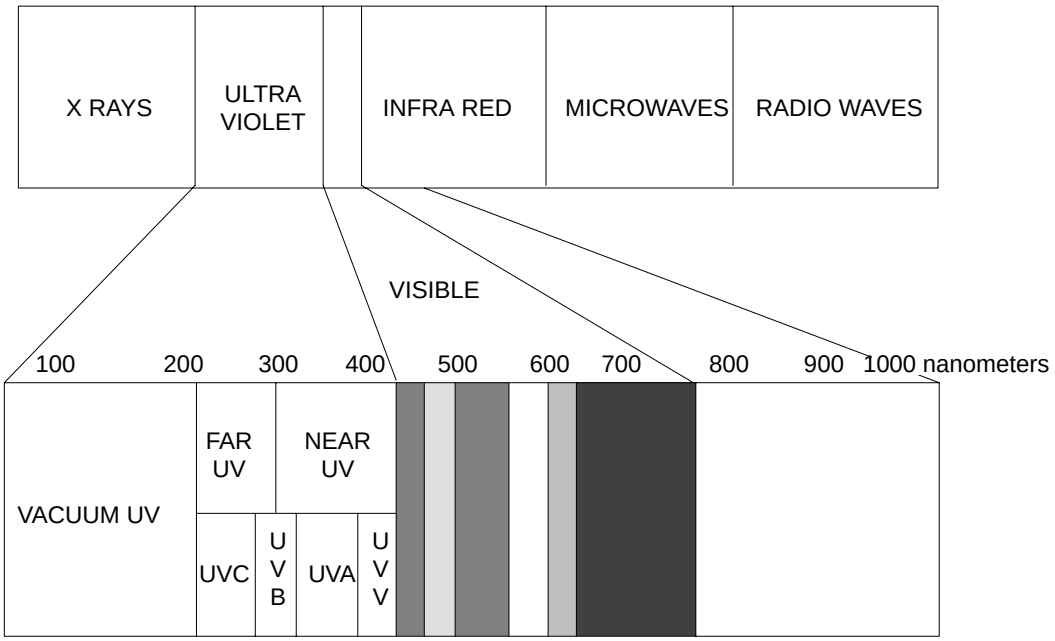

Figure 1-1 Ultraviolet Light Wavelength Bands

It is very important that all precautions are taken to prevent all UV light, whether direct or indirect, from escaping the curing area. Exposure to UV light can be harmful to both eyes and skin. Use the following table to determine the permissible exposure time to UV light on unprotected eyes or skin.

Permissible Ultra Violet Exposures as Recommended by the American Conference of Government and Industrial Hygienists	
Duration of Exposure (Per Day)	**Effective Irradiance (E Micro Watts/cm sq)**
8 hours	0.1
4 hours	0.2
2 hours	0.4
1 hour	0.8
30 minutes	1.7
15 minutes	3.3
10 minutes	5.0
5 minutes	10
1 minute	50
30 seconds	100
10 seconds	300
1 second	3000

First Aid

Store-bought creams, lotions, or aloe can be applied to affected areas of the skin. Seek immediate medical attention for skin burns and direct UV exposure to the eyes.

Microwave Radiation

The lamp system utilizes high powered RF microwave energy generated by a magnetron to provide power to the UV lamp. This technology is identical to that of residential microwave ovens and like these ovens can be dangerous if misused. The lamp system is safe provided that the RF screen and gasketing are intact. Any damage such as rips or holes in the screen may cause leakage of dangerous amounts of microwave radiation. The power to the lamp is interlocked to the RF detector and will shut down if microwave leakage in excess of 2 mW/cm^2 is detected. Any excessive leakage will cause the system to shutdown and the RF Detector fault will illuminate on the front of the power supply.

Ozone Gas

Ozone (O_3) is a colorless gas that is generated by the reaction of short-wave UV light (around 200-220 nanometers) with air, and it occurs whenever high-energy electrical discharge is present.

Ozone readily reverts to breathable oxygen when mixed with atmospheric air. Ozone should be removed from the UV source via a sealed duct and discharged to atmosphere according to local regulations. The discharge location should be away from pedestrian walkways and window openings and should be well above the average human breathing height for the area.

Regular ozone checks should be carried out every three months using an ozone meter. Recommended levels of ozone in the atmosphere of a factory should not exceed 0.1 parts per million (PPM). This level is easily obtainable if factory recommended exhaust rates are followed.

Ozone has a very distinct, strong odor even at low levels. Immediate ozone checks should be made if an operator can smell ozone. Most people can smell ozone at about one third the maximum allowable 0.1 PPM level.

Ozone exposure will cause headaches and fatigue. It will also irritate the mouth and throat. Overexposure can lead to respiratory infections.

If ozone is detected,

1. Shut down the UV system.
2. Check exhaust ducting for leaks.
3. Check the operator working area with an ozone meter.

If a person is overcome by ozone,

- Move the individual to a warm uncontaminated atmosphere and loosen tight clothing at the neck and waist.
- Keep the individual at rest.
- If the person has difficulty breathing, oxygen may be administered provided that suitable apparatus and a trained operator are available.
- If breathing is weak or has ceased, artificial respiration should be started.
- Seek medical assistance.

High Temperature

UV curing systems generally run at extremely high temperatures. A sudden shock from touching a high temperature surface might cause an operator to jump or take his attention away from other potential hazards.

When shutting down UV equipment for maintenance, allow the equipment to cool before beginning work, or wear protective gloves and clothing to prevent burns.

High Voltage

The UV curing equipment operates at high voltages up to 5000 Vdc. The system uses high-voltage, self-discharging capacitors. **Once power to the power supply is shut off, the capacitors need 120 to 130 seconds to discharge.**

If any electrical faults develop, the operator should:

1. Switch the equipment off immediately.
2. Make no attempt to service the equipment.
3. Call a qualified electrician, trained to service this type of equipment.

Mercury Bulbs (Lamps)

The bulbs used in UV lamp systems contain mercury under medium pressure. Mercury is a toxic substance and must not be ingested or come into direct contact with the skin. Under normal UV operating conditions, mercury presents no hazard as it is completely contained in the sealed quartz tube of the bulb; however, it is strongly recommended that protective gloves and eye protection be worn when handling UV bulbs.

These precautions should be followed when disposing of UV bulbs:

- Place the bulb in a rigid protective carton.
- Dispose of used bulbs through a local mercury recycling center.
- Wash your hands if a bulb breaks: mercury could come into contact with your skin.
- Do not store or handle bulbs near food or beverages.
- Nordson Corporation will dispose of UV bulbs free of charge provided the customer covers all shipping costs associated with returning the bulbs. For bulb disposal, please clearly mark on the all bulb containers AND shipping packages BULBS FOR DISPOSAL ONLY

Bulbs should be shipped to:

Primarc
Bulb Disposal Department
2 Danforth Drive
Easton, Pennsylvania 18045

UV Curable Inks and Products

Some materials used in UV curable inks, adhesives, and varnishes are toxic. Before handling them, read the Material Safety Data Sheets provided by the manufacturer, use the recommended personal safety equipment, and follow the recommended procedures for safe use and disposal.

Fire Safety

Under proper operating conditions, the surface temperature of the bulb is anywhere between 700-900 °C (1300-1700 °F), and the vapor gas inside the bulb is several thousand degrees Fahrenheit. As a result, there is always a risk of fire, should any paper or flammable materials get jammed under the lamp or in the lamp's vicinity, or should there be any build-up of lint, dirt, or powder within the lamp housing.

To avoid a fire or explosion, follow these instructions.

- Know where emergency stop buttons, shut-off valves, and fire extinguishers are located.
- Clean, maintain, test, and repair equipment according to the instructions in this manual.
- Always keep a fire extinguisher approved for electrical equipment near the unit.

Should a fire occur, the operator must:

1. Switch the equipment off immediately.
2. If possible, put out the fire with a fire extinguisher.

Action in the Event of a Malfunction

If a system or any equipment in a system malfunctions, shut off the system immediately and perform the following steps:

1. Disconnect and lock out system electrical power.
2. Identify the reason for the malfunction and correct it before restarting the system.

Safety Precautions While Servicing

A qualified competent electrician must carry out all electrical maintenance and servicing of this equipment.

WARNING: This equipment operates at high voltages up to 5000 volts dc and is therefore potentially dangerous. The electrician servicing this equipment must take all precautions.

WARNING: Isolate the equipment at the main, disconnect or lockout before removing any of the cover panels

Control System Cleaning

Keep all contactors and relays clean and free from dirt and dust. Check these regularly, particularly in extremely dusty or powder-charged working rooms.

High Voltage Connections

Checks the high voltage connections within the equipment carefully to make sure that these do not become dirty or coated with powder or other possible conducting material. Clean them regularly, at least whenever the lamp is changed, possibly more often where a particularly heavily polluted atmosphere occurs.

Cabinet Cooling

Check the cabinet cooling fan at least weekly and kept clear of any material that might clog or stop its operation. The power supplies run warm and keeping them cool with proper ventilation will prolong their life.

Disposal

Dispose of equipment and materials used in operation and servicing according to local codes.

Safety Symbols

The following safety symbols are used in this manual. The symbols are used along with warnings to help you operate and maintain your equipment safely. Pay attention to all warnings and follow directions to avoid personal injury.

WARNING: Mechanical or combined mechanical/electrical hazards.

WARNING: Electrical hazard

WARNING: Ultra violet light hazard

WARNING: Burn hazard

CAUTION: Equipment hazard

Section 2
Description

Introduction

This section provides a general overview of ultraviolet (UV) curing and the components of the Nordson CoolWave ultraviolet microwave applied curing system.

The system is designed to cure UV inks, adhesives, and coatings for numerous industrial applications.

The system consists of an individual six-inch lamphead, a corresponding fixed output power supply, and an RF detector. Additional lampheads can be lined up end-to-end to form longer curing widths.

Figure 2-1 and Table 2-1 illustrate and describe the major components of a typical setup for a CoolWave ultraviolet microwave applied curing system. Your system may appear different depending on your application requirements.

What is UV Curing?

Ultraviolet curing is achieved by a chemical reaction in special inks and coatings when intense UV energy is focused on them. Curing efficiency depends on UV power, coating weight, operation speed, type of substrates, material chemistry, and other factors.

How Does it Work?

A microwave generator (magnetron) operating at 2400 to 2500 MHz is used to excite a medium pressure mercury bulb installed in a lamphead. Ultraviolet light between 220 and 470 nanometers is emitted.

Microwave energy from a magnetron is directed into a cavity containing the UV bulb. A screen located at the opening of the cavity allows the UV light to pass through while the microwave radiation is contained.

In addition to ultraviolet light, the high-energy bulbs radiate heat. Therefore, a cooling system is incorporated to take away the excess heat and make sure that the bulbs and lamphead assembly remain at an acceptable operating temperature.

The unit is equipped with interlocks and safety measures to prevent the operation of the system in an unsafe condition. In the event of a UV fault a LED on the power supply's front panel will indicate the fault type.

The power supply provides high voltage for the lampheads and a control circuit to interlock the lampheads with the machine.

System Components

Refer to Table 2-1 and see Figure 2-1.

Table 2-1 System Components

Item	Component	Description
1	Lamphead with external blower	The lamphead consists of a bulb housing, UV bulb, wave guide, reflectors, light detector, starter bulb, and the magnetron assembly. The patented wave guide couples RF energy to the bulb and provides cooling for the bulb. The lamphead reflects the emitted UV light onto the substrate. 225 CFM @ 2.5 in. H_2O of cooling air from an external source is required at each lamphead.
2	Lamphead with internal blower	This lamphead is the same as the external blower lamphead but contains an internal blower to cool the UV bulb and magnetron. The internal blower is sized to provide a minimum of 225 CFM at 2 in. H_2O.
3	Reflectors	Refer to *Reflectors* on page 2-4 for more information. Elliptical shaped focus reflectors are used to guide the UV light in a tight band across the surface of the material being cured. The reflectors are manufactured from borosilicate glass, with a dichroic coating to give maximum UV reflectivity while minimizing infrared radiation. **NOTE:** A wider band of light can be produced by using optional flood reflectors. Contact a Nordson UV representative for details.
4	Ultraviolet Bulbs	**CAUTION:** Only genuine Nordson replacement bulbs should be used with this system. Other bulbs may damage the control or overheat the reflector system. **NOTE:** The system warranty is void if genuine Nordson UV bulbs are not used. Contact a Nordson UV representative for ordering information. The system uses medium pressure mercury bulbs. The bulbs consist of high purity quartz and have various fills including doped spectrally enhanced metal halide bulbs to produce light at different wavelengths. Bulbs and controls are carefully matched to give optimum UV output and wavelength requirements.
5	Starter Bulb	The starter bulb acts as the ignitor for the ultraviolet bulb. The starter bulb is switched on at the same time the magnetron is energized. After the UV bulb reaches full power the starter bulb turns off automatically.
6	Magnetron	The magnetron is a 1.8 kW, 2450 MHz microwave generator that converts high voltage electrical inputs to energy. The wave guide cavity is designed to couple the microwave energy with the UV bulb, thus exciting a UV emitting plasma within the bulb.
7	External Blowers for Cooling	External blowers are used to cool the UV bulb and magnetron on the external blower lamphead. The lamphead requires approximately 225 CFM at 2.5 in. H_2O of cooling air per lamphead in order to function properly. The external blowers must be sized appropriately to provide adequate cooling.
8	Power Supply	The power supply is fully modular. One power supply must be provided for each lamphead. The power supply can operate as a standalone system or part of a Master/Remote circuit. Refer to the *Power Supply* on page 3-1 for details.
9	RF Detector	An RF detector monitors microwave energy levels. The system will shut down when RF levels above 2mW/cm^2 are measured. Systems operated as standalone units require one RF detector per power supply unit. If multiple systems are networked then the master power supply unit must be connected to one RF detector. Refer to the *RF Detector* on page 3-3 for details.

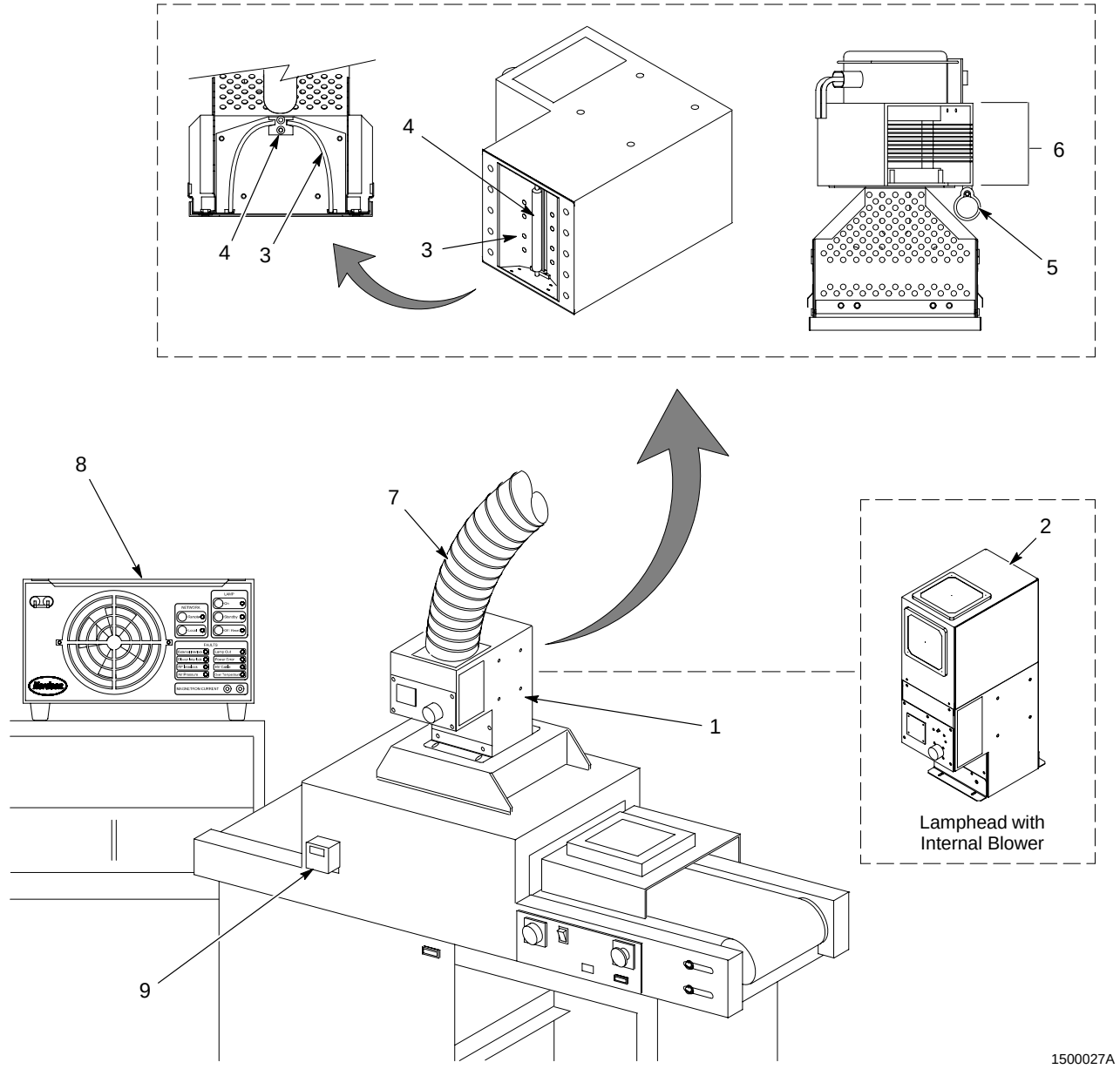

Figure 2-1 System Components (Typical UV curing system setup)

1. Six-inch lamphead with external blower
2. Six-inch lamphead with internal blower
3. Reflectors
4. Ultraviolet bulb
5. Starter bulb
6. Magnetron
7. Tubing to external blowers for cooling
8. Power supply
9. RF detector

Reflectors

Two types of reflectors are available for the lamphead: focus and flood. The flood reflectors produce a wider band of light.

The reflectors use different retaining brackets to secure them in place in the lamphead. Figures 2-2 and 2-3 illustrate the curve in each reflector and the differences in their retaining brackets.

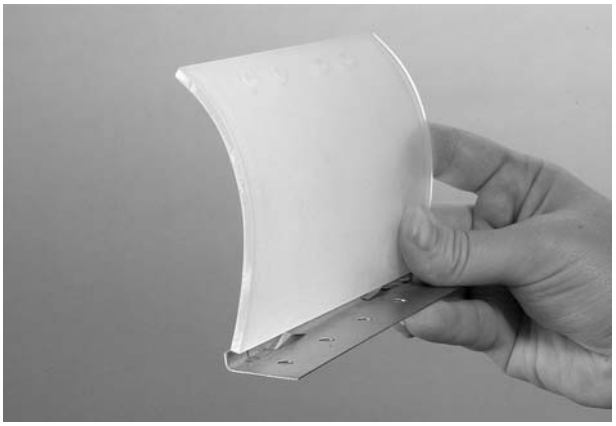

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Figure 2-2 Focus Reflector and Bracket

Note: The bracket for the focus reflector is 23.3-mm (0.92-in.) wide

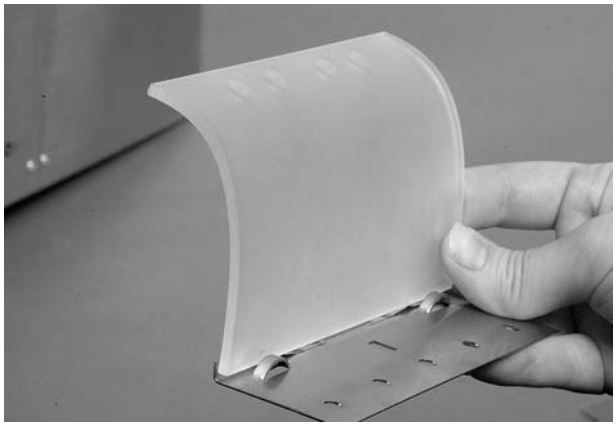

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Figure 2-3 Flood Reflector and Bracket

Note: The bracket for the flood reflector is 33.3-mm (1.31-in.) wide

Section 3
Installation

WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.

Introduction

This section contains the necessary information for installing the CoolWave system. Directions for mounting and shielding are explained in general terms due to differences for each independent installation.

Inspection and Packaging

The Nordson CoolWave system has been carefully tested, inspected, and packaged prior to shipping. Upon receipt, inspect the shipping materials and components for visible damage. Report any damage immediately to the shipper and to the Nordson UV systems engineering department.

NOTE: When opening the packaging, please take care so that the packaging can be re-used to ship the unit to the next destination. Keep all packaging materials together and in a location that they will not get damaged.

Mounting Guidelines

Power Supply

WARNING: Heavy equipment. Be careful when moving the unit.

See Figure 3-1 for power supply dimensions and clearance requirements.

- The power supply can be mounted on any horizontal surface.
- Power supplies can be stacked up to five units high but due to the weight of each unit (approximately 71 lb) it is recommended that they be stacked so they can be easily accessed for service.
- Leave six inches of ventilation clearance on the front and rear of the power supply and one inch of ventilation clearance on each side of the power supply.
- A blower is mounted on the front of the power supply and needs to be free and clear of any obstructions. Cool air is drawn in the front of the power supply and expelled out the rear.

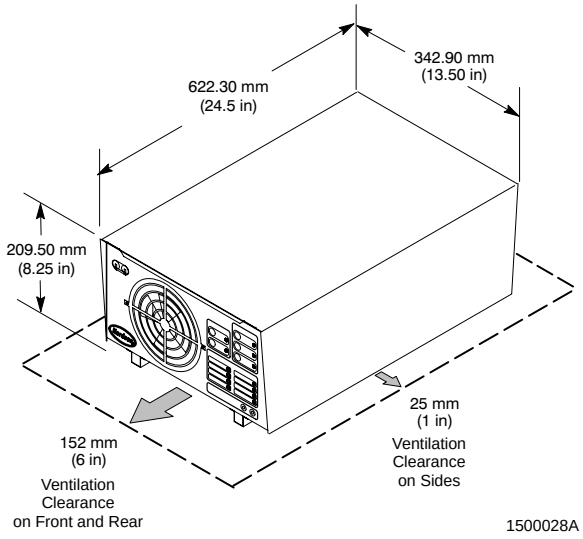

Figure 3-1 Power Supply Dimensions

External Blowers - Cooling Air

The cooling requirements for each lamphead is 225 cfm @ 2.5 in. H_2O of static pressure at the lamphead.

See Figure 3-2.

Many applications have multiple lampheads that get their cooling air from a common source, such as a plenum.

Air flow adjustment dampers should be added to each drop for each lamphead as close to the lamphead as possible.

Lamphead

The lamphead mounting must include provisions for shielding the UV light and venting for the cooling air. Each application contains different constraints and therefore requires custom design of enclosures and light shielding. Contact Nordson UV systems engineering department for help with design.

Figures 3-3 and 3-2 illustrate the physical dimensions of the lampheads. Install the lamphead screen (bulb end) 53.3 mm (2.1 in.) above the substrate for optimal focal positioning when using focus reflectors.

NOTE: If flood reflectors are used there is no set focus distance. The screen to substrate distance is not as critical and can be adjusted to vary dosage.

NOTE: Detailed dimensional data is provided for each lamphead on page 8-7 in the *Specification* section.

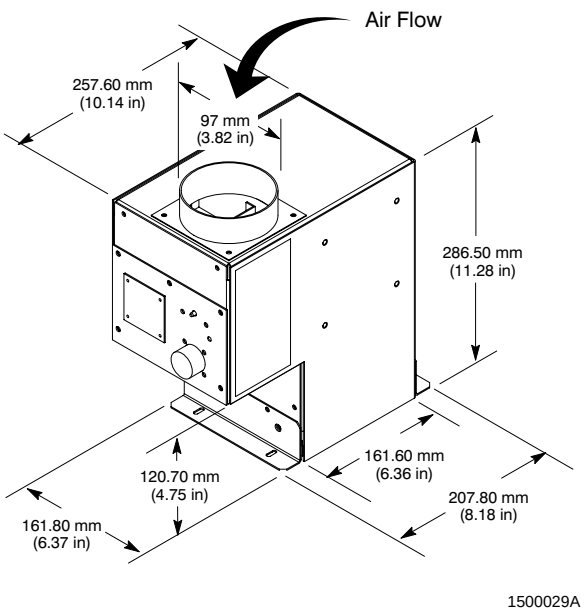

Figure 3-2 Lamphead with External Blower

Note: The mounting holes on both sides of the lamphead are the same.

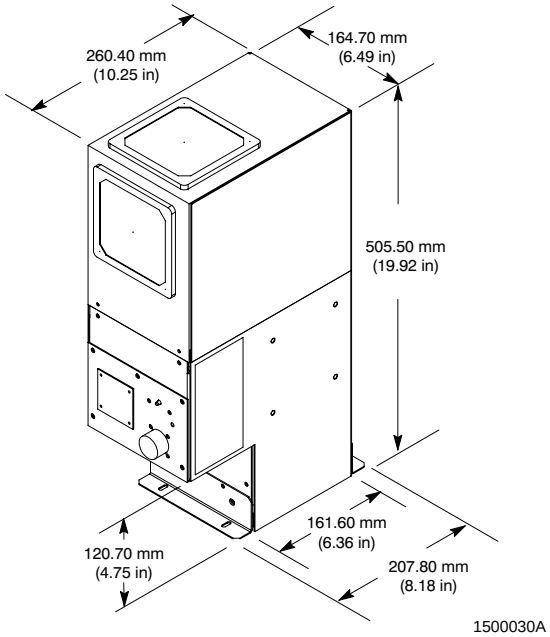

Figure 3-3 Lamphead with Internal Blower

Note: The mounting holes on both sides of the lamphead are the same.

Light Shielding

- Provide adequate shielding of UV light. The lamphead must be enclosed so that no UV light is allowed to escape.
- Any louvered material used for exhausting must be of a light shielding design.
- If UV light does escape the operator must wear approved UV-protective eyewear and long-sleeved clothing.

RF Detector

See Figure 3-1.

- One RF detector is normally required for every 16 networked units within one curing enclosure. However, some applications and systems may require a RF detector on each unit. Contact your Nordson representative for more information.
- Mount the RF detector so that the antenna faces the lamphead screen and is between the operator and the lampheads or the lampheads and any opening (the major source for RF leakage).
- The minimum distance should be eight inches to prevent excessive heat on the detector surface.
- Do not mount the RF detector directly below the lamphead.
- For RF detector connections, refer to *RF Detector* on page 3-10.

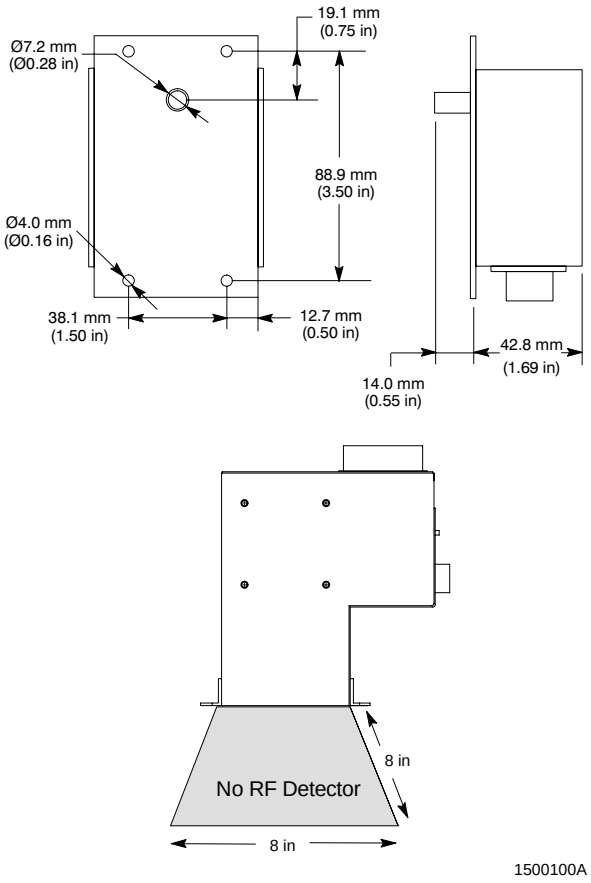

Figure 3-4 RF Detector Dimensions and Mounting Guidelines

Electrical Installation Guidelines

To ensure safe performance, follow these electrical installation guidelines for the CoolWave components.

Power Line Connections

Refer to Table 3-1. This unit is designed to accommodate a broad range of power line voltages for both 50 and 60 Hz found around the world. The power line input is single phase, and the contactor taps must be changed to select the operating voltage range. The power supplies are designed to operate at +/- 10% of the normal voltage for a given tap setting.

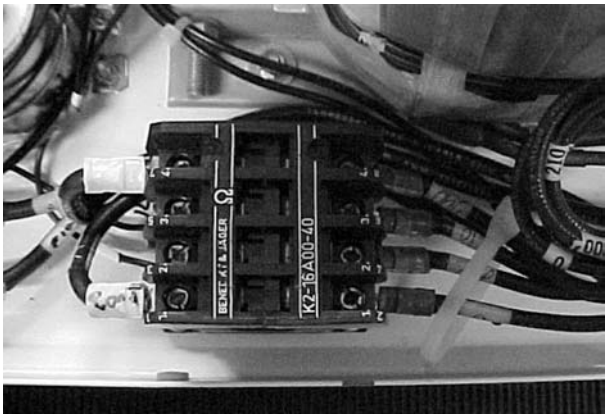

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Figure 3-5 Contactor

Table 3-1 Contactor Taps

Normal Voltage	Voltage Range	Transformer Tap	Contactor Tap
240 +/- 10%	216-264	240	1 and 4
210 +/- 10%	189-231	210	1 and 3
200 +/- 10%	180-220	200	1 and 2

Input Power Configuration

Refer to Table 3-2. Current ratings indicate current demand during normal full-power operation. Size supply wiring and circuit breakers or fuses to allow for full current draw during startup.

NOTE: You must provide stable and clean power.

Table 3-2 Power Line Current

Line	60 Hz			50 Hz		
	Amps @ 200 Vac	Amps @ 210 Vac	Amps @ 240 Vac	Amps @ 200 Vac	Amps @ 210 Vac	Amps @ 240 Vac
L1	16	15	14	17	16	15
L2	16	15	14	17	16	15

Power Source

The customer power source must be wired in accordance with either the National Electric Code, Part I or the Canadian Electrical Code, Part I, or local codes.

The Hubble connector on the power supply is for single-phase input power. A 300 Vac, 20 Amp twist lock connector is supplied with the system for the power input.

Measure the incoming power source voltage from the main power supply. Make sure that the power source voltage matches the contactor tap settings.

Environmental Operating Conditions

Condition	Specification
Altitude	Up to 2000 meters
Temperature	5-50 °C
Rh	80%

Capacitor Configuration

The power supply can be configured to operate at 50 Hz or 60 Hz. See Figures 3-6 and 3-7 to see how the capacitors should be wired for each configuration.

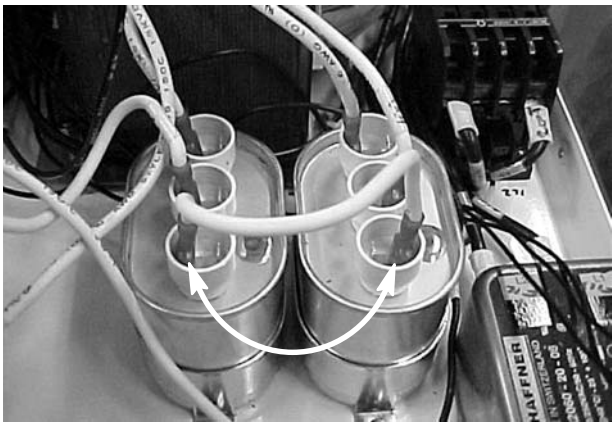

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Figure 3-6 50 Hz Capacitors

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Figure 3-7 60 Hz Capacitors

Network Connections

NOTE: Equipment must be connected in accordance with the NEC and local wiring codes.

The power supply can be configured to form a network of up to 16 systems. The entire network can be operated either from the master control unit front panel or from a remote source.

Network Connectors IN1 and OUT1

See Figure 3-8 and refer to Table 3-3. Use the IN1 and OUT1 connectors (1) (shielded RJ45) to connect multiple units in a Master/Remote fashion. The connection cable is commercially available and should have a rating of CAT3 or higher. Repeat this for each unit

Table 3-3 IN1 and OUT1 Network Connectors

Cable	From	To	Length (ft)	Part
Network	OUT1 connector of a unit	IN1 connector of the next unit	6	775031

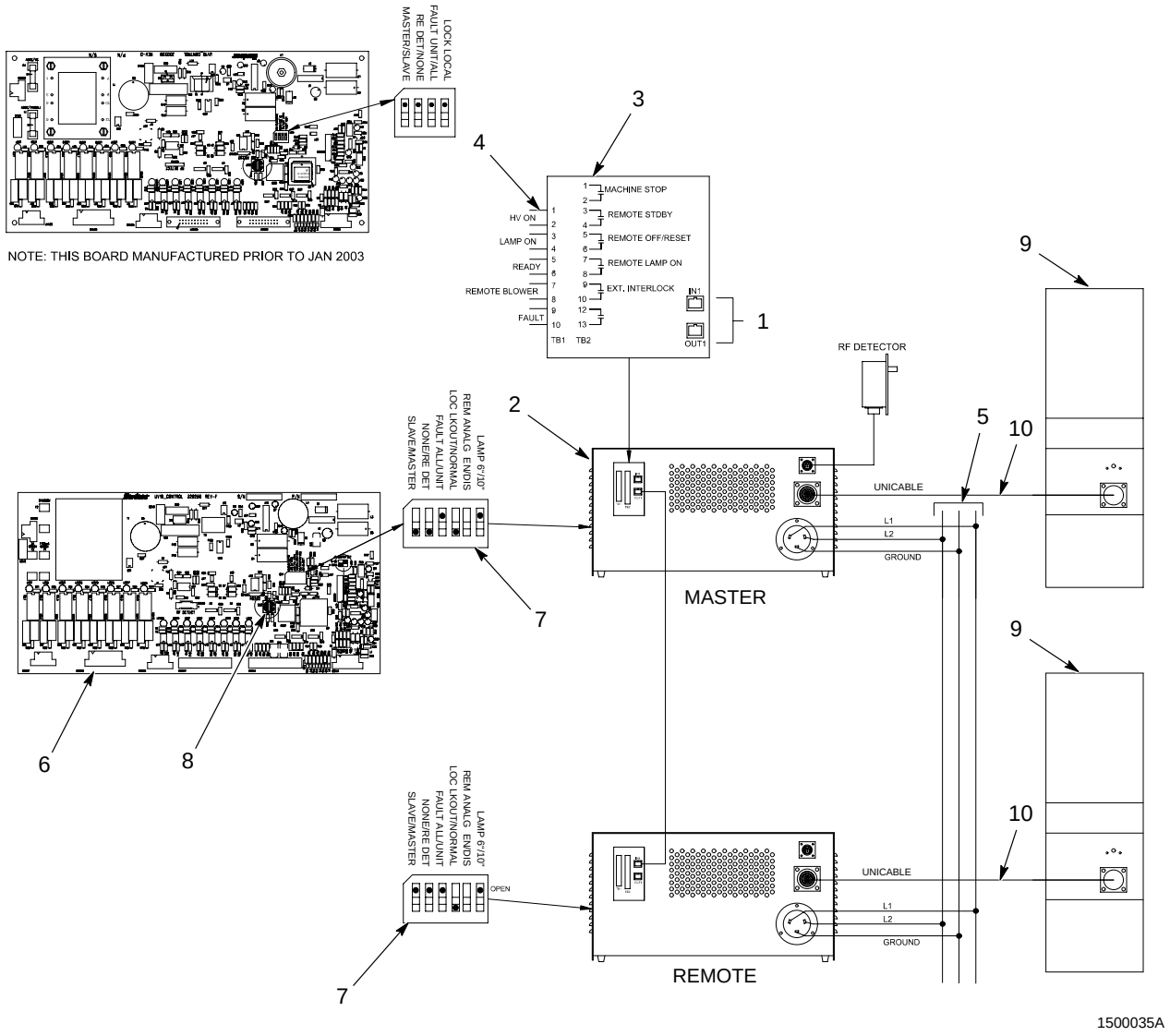

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Figure 3-8 Network Connections

1. Network connectors IN1 and OUT1
2. Power supply
3. Input connector TB2
4. Output connector TB1
5. Power lines
6. Main control board
7. DIP switches
8. Rotary address switch
9. Lamphead
10. Unicable

Note: Refer to the *Specifications* section for a more detailed system drawing.

Input Connector TB2

Refer to Table 3-4 and see Figure 3-8.

The inputs from the TB2 input connecter (3) are designed for contact closure or an open collector output. The input terminal voltage is 24 Vdc and will source about 8 ma.

Table 3-4 Input Connector TB2 Pin Assignments

Pin	Function	Remote	Local	Description
1	Common	X	X	If this input is not interfaced to external equipment, a jumper must be installed. Opening this input returns the unit to Off, sets the FAULT output, and causes the External Interlock LED to illuminate solid.
2	Machine Stop			
3	Common	X	NA	Remotely controls the power supply unit when operating in the Remote mode. A pulse or momentary contact closure to this input places the power supply unit in the Standby mode. (The Off/Reset contact must be closed)
4	Remote Standby			
5	Common	X	NA	Remotely controls the power supply unit when operating in the Remote mode. This contact must be closed for the lamphead to be turned on. Opening the contact will turn the lamphead off and will clear a fault condition.
6	Remote Off/Reset			
7	Common	X	NA	Remotely controls the power supply unit when operating in the Remote mode. A pulse or momentary contact closure to this input turns the CoolWave lamphead to the on state. (The Off/Reset contact must be closed). The Off/Reset contact must be opened to turn the lamphead off.
8	Remote Lamp On			
9	Common	X	X	If this input is not interfaced to external equipment, a jumper must be installed. Opening this returns the unit to Off, sets the FAULT output, and causes the External Interlock LED to illuminate at a slow blink.
10	External Interlock			
11	Chassis Ground	X	X	Not Used
12	Common	NA	NA	Not used
13	—	NA	NA	Not used

Lamp Start-Up Timing Diagram for Remote Input Contact Closures

The Off/Reset contact must be closed for the unit to go to Standby or On. Once the lamphead is put into the Standby or On mode the lamphead will remain in that mode until the Off/Reset contact is opened.

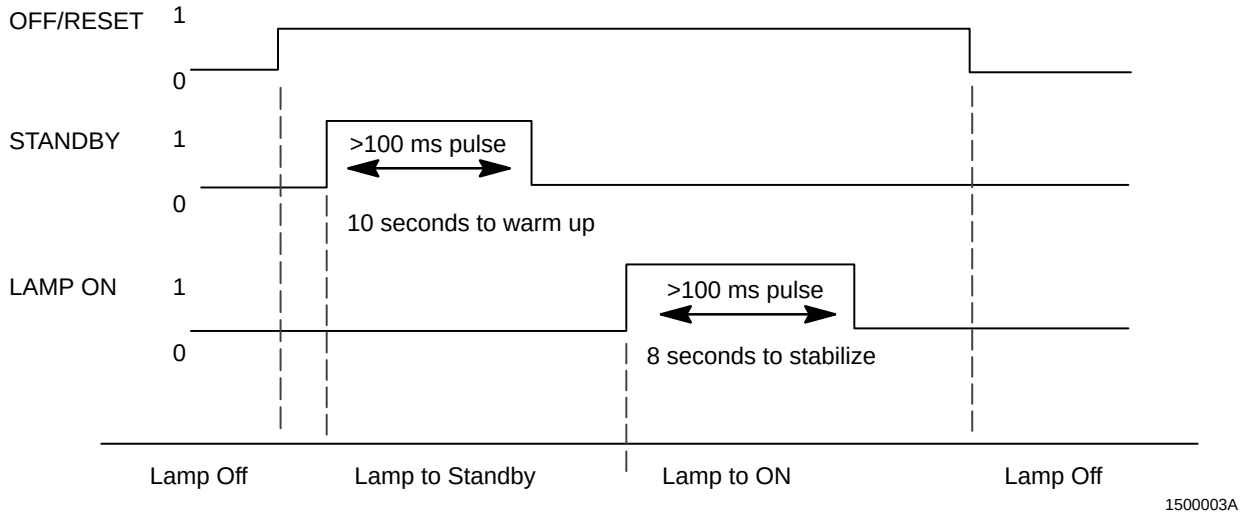

Figure 3-9 Lamp Start Up Timing Diagram for Remote Input Contact Closures

Rapid Startup

Use if your system will sit idle in the Standby mode before moving to the On mode.

1. On the LAMP selector of the host machine (or master control unit's lamp selector), press the Standby button. There will be an approximate 10 second warm-up time for the magnetron filament.
2. After the 10 seconds the system will go into standby and remain there indefintely.

   NOTE: Do not leave the power supply in the standby mode for longer than 30 minutes. Prolonged standby periods will shorten the magnetron life.
3. Press the On button to enable the UV light. The light will turn on instantly but will take approximately 8 seconds to stabilize. After the 8 seconds, the system ready output contact (TB1) will close.

Standard Startup

Use to go directly through the warm-up to the On mode.

1. On the LAMP selector of the host machine (or master control unit's LAMP selector), press the LAMP On button.
2. During the next 10 seconds the unit will go through the warm up cycle before turning to On.
3. After approximately 8 more seconds the unit has stabilized and the system is ready to run. The system ready output contact (TB1) will close.

Output Connector TB1

Refer to Table 3-5.

All outputs from the TB1 output connector are isolated normally open relay contacts and are rated at 240 Vac, one amp maximum.

Table 3-5 Output Connector TB1 Pin Assignments

Pin	Function	Description
1, 2	High Voltage ON	Contact closes when high voltage is applied to the magnetron.
3, 4	Lamp ON	Contact closes when the light detector has detected light output from the lamphead.
5, 6	System Ready (network)	Contact closes after the power supply unit has been turned on and the light detector senses light output. In a networked system all power supply units that are turned on must be sending Lamp On output to the master power supply for system ready to go closed on the master unit.
7, 8	Remote Blower	This output contact closes when the lamphead is placed in Standby or On and remains on for cooling after the lamphead is turned off.
9, 10	Fault Output	Contact closes whenever there is a fault present on the system.
11, 12	Not Used	

Cable Connections

See Figure 3-8.

Lamphead

Refer to Table 3-6.

Table 3-6 Lamphead Cable Connections

Cable	From	To	Length (ft)	Part
Unicable	Power supply unit connector	Lamphead	25	775023
			50	775375
			75	775377

RF Detector

Refer to Table 3-7.

NOTE: Each network requires at least one RF detector. If there are multiple light shielding chambers at least one RF detector must be located in each chamber.

Table 3-7 RF Detector Connections

Cable	From	To	Length (ft)	Part
RF Detector	CoolWave power supply	RF detector	25	775029
			50	775050
			75	775051
			100	775052

Main Control Board Standard Configurations

See Figures 3 -10 and 3-11.

The following information identifies the standard switch configurations for the power supply unit. The systems may be configured to run as standalone or interconnected to form a complete networked system of up to 16 lamps.

NOTE: The main control board was changed in 2003. Figure 3-11 illustrates the previous control board.

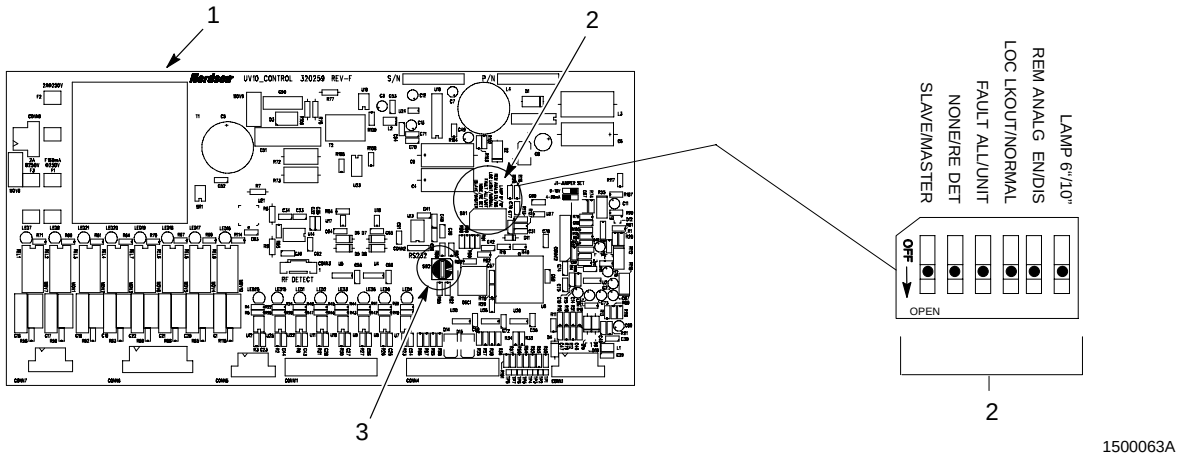

Figure 3-10 Main Control Board

1. Main control board
2. Dip switches
3. Power supply address switch

Note: Switch 5, REM ANALG EN/DIS, is only used in the UV MAC 10 power supply.

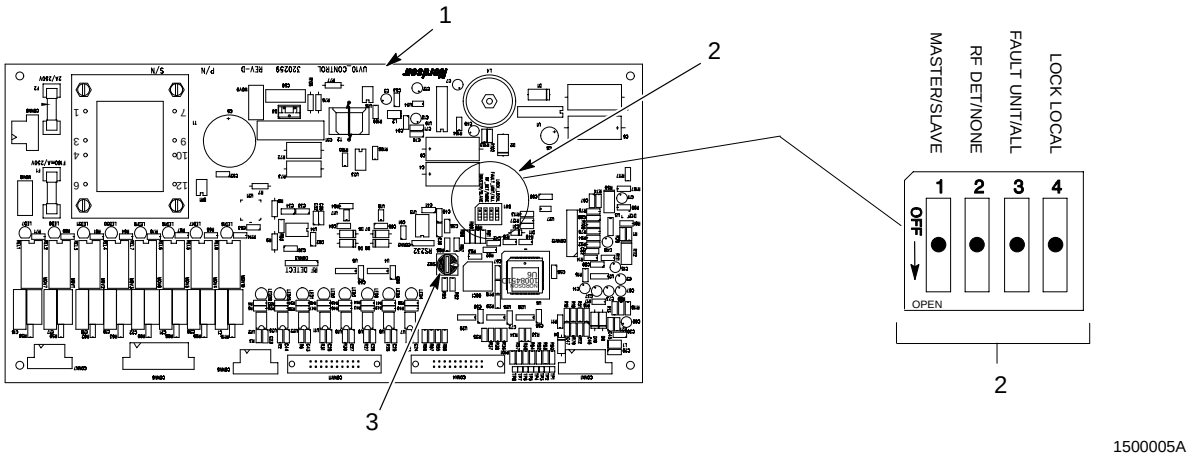

Figure 3-11 Main Control Board Manufactured before 2003

1. Main control board
2. Dip switches
3. Power supply address switch

Main Control Board Dip Switches

There are six switches on the main board DIP switch that need to be set depending upon the system configuration. Table 3-8 provides an explanation of each switch.

NOTE: Switches 5 and 6 were added to control boards manufactured after 2002. Switch 5, REM ANALG EN/DIS, is only used with the UV MAC 10 power supply.

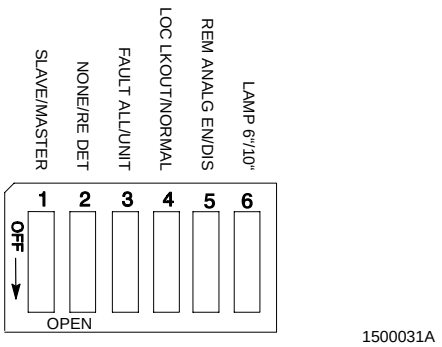

Figure 3-12 Dip Switch Configurations

Table 3-8 Main Board Dip Switches

Dip Switch	Description	Function
1	Open/Off = Master unit Closed/On = Remote unit	Configures the power supply to be operated as either a master or remote unit. Systems that operate as standalone units are set up as masters. Systems that operate as remote units are configured as remote (slave) units and are networked to be controlled by a master unit. The networked master unit can be contolled locally or by a remote source (such as a PLC, remote operator panel, parent machine, etc.).
2	Open/Off = RF Detector is used Closed/On = RF Detector is not used	Configures the power supply unit to be operated with or without an RF detector. Standalone systems or master units cannot operate without an RF detector. An RF detector can be installed at each power supply when necessary. Networked systems are typically configured for the master unit to have one RF detector while its remote units (up to 16 units) do not. **NOTE:** Up to 16 units can be networked and operate with one RF detector but it is recommended that every six units have one RF detector.
3	Open/Off = Fault individual unit Closed/On = Fault all units	Configures the power supply (standalone or networked system) to shut down the individual lamp or the entire network in the event of a fault.
4	Open/Off = Enables the front panel controls Closed/On = Disables the front panel controls	Configures the front panel of an individual power supply to be enabled or disabled. When disabled, all operational functions must be controlled by the inputs or the network master.
6	Open/Off = Six-inch power supply is used/10-inch power supply is not used Closed/On = Six-inch power supply is not used/10-inch power supply is used	Configures the main control board for the six-inch or the 10-inch power supply and lamphead.

Dip Switch Configurations

See Figure 3-12. Refer to Tables 3-9 through 3-12 for the four possible configurations in which the dip switches can be set.

OPEN = Off

CLOSED = On

NOTE: Switches 5 and 6 were added to control boards manufactured after 2002. Switch 5, REM ANALG EN/DIS, is only used with the UV MAC 10 power supply.

Table 3-9 Single System Operating Locally

Power Supply	SW1-1	SW1-2	SW1-3	SW1-4	SW1-6
Standalone (Set Front Panel to: Local)	Master (Open)	RF Detector (Open)	Fault (Open)	Front Panel (Open)	6 in. = Open/Off 10 in. = Closed/On

Table 3-10 Single System Operating Remotely

Power Supply	SW1-1	SW1-2	SW1-3	SW1-4	SW1-6
Standalone (Set Front Panel to: Remote)	Master (Open)	RF Detector (Open)	Fault (Open)	Front Panel (Open/Off = Enabled) (Closed/On = Disabled)	6 in. = Open/Off 10 in. = Closed/On

Table 3-11 Networked System Operating Locally

Power Supply	SW1-1	SW1-2	SW1-3	SW1-4	SW1-6
Master (Set Front Panel to: Local)	Master (Open)	RF Detector (Open)	Fault (Single= Open/Off) (All= Closed/On)	Front Panel (Open/Off = Enabled) (Closed/On = Disabled)	6 in. = Open/Off 10 in. = Closed/On
Remote (Set Front Panel to: Remote)	Remote (Closed)	RF Detector (Open=Off) (Closed=On)	Fault (Single= Open/Off) (All= Closed/On)	Front Panel (Open/Off = Enabled) (Closed/On = Disabled)	6 in. = Open/Off 10 in. = Closed/On

Table 3-12 Networked System Operating Remotely

Power Supply	SW1-1	SW1-2	SW1-3	SW1-4	SW1-6
Master (Set Front Panel to: Remote)	Master (Open)	RF Detector (Open)	Fault (Single= Open/Off) (All= Closed/On)	Front Panel (Open/Off = Enabled) (Closed/On = Disabled)	6 in. = Open/Off 10 in. = Closed/On
Remote (Set Front Panel to: Remote)	Remote (Closed)	RF Detector (Open=Off) (Closed=On)	Fault (Single= Open/Off) (All= Closed/On)	Front Panel (Open/Off= Enabled) Closed/On= Disabled)	6 in. = Open/Off 10 in. = Closed/On

Power Supply Address Switch

See Figure 3-13

The rotary address switch is located on the main board next to the DIP switch and has 0 through 9 and A through F as locations.

Standalone Units

When operating the power supply as a standalone unit (single) the switch should be set to the 0.

Networked Units

When operating the power supplies in a networked configuration (master/remote), you must set the rotary power supply address switches as follows:

Unit	Rotary Switch Setting
Master	0
Remote(s)	any different value
Example: Set the master to 0, remote1 to 1, remote 2 to 2, etc.	

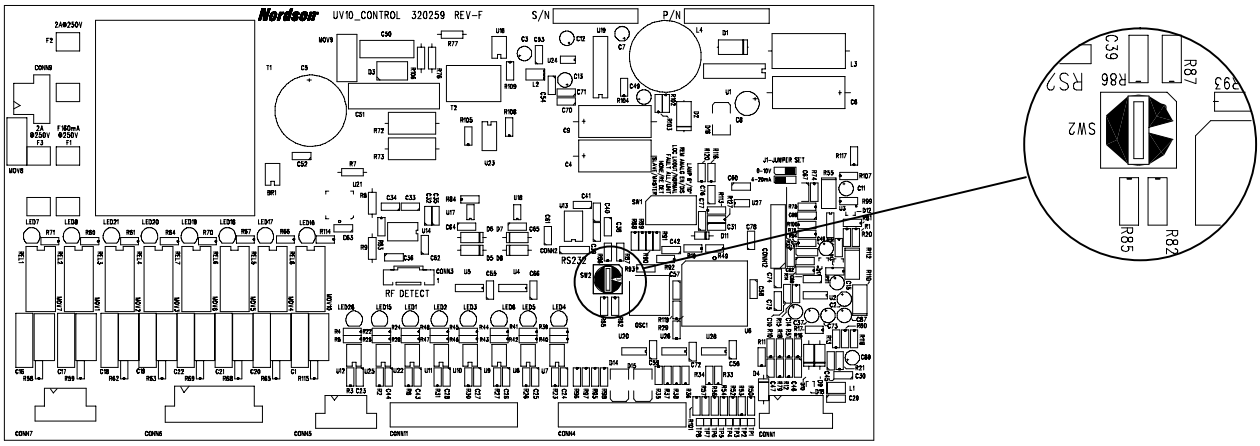

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Figure 3-13 Power Supply Address Switch

Section 4
Operation

WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.

Introduction

Startup procedures will vary depending on how the system was integrated into other equipment. As a result, the startup procedures documented in this manual are strictly for the UV equipment.

Display and Controls

See Figure 4-1 and refer to Table 4-1.

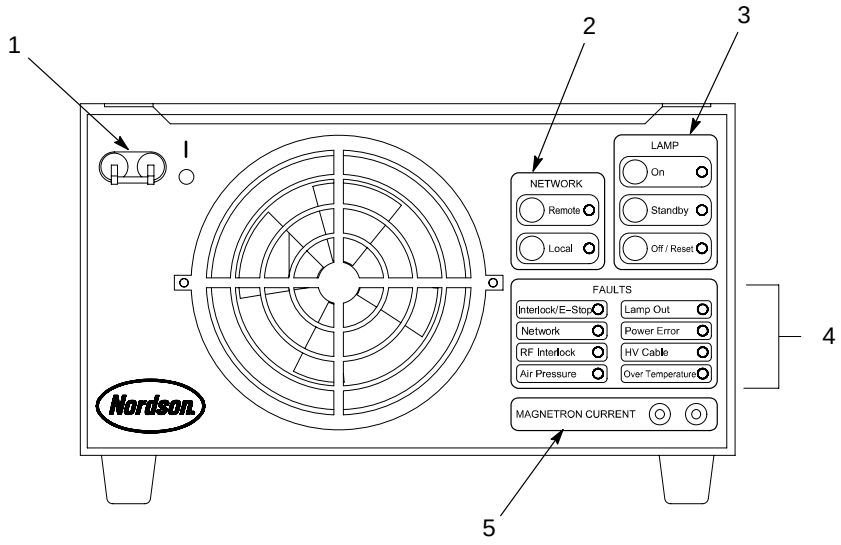

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Figure 4-1 Displays and Controls

Display and Controls *(contd)*

Table 4-1 Displays and Controls

Item	Control	Description
1	Main Power Switch	Turns the main power on and off to the CoolWave system.
2	NETWORK	Sets system operation from the Local (front panel) mode to a Remote (external device or controller [TB2]).
3	LAMP	On Mode: Turns the lamphead on after magnetron filament is warm. Standby Mode: Applies warm-up power to the magnetron filament. Off/Reset Mode: Turns the lamphead off.
4	FAULT INDICATORS	Indicate system faults/failures. Refer to *Fault LEDs*.
5	MAGNETRON CURRENT	Test point for magnetron current.

Fault LEDs

When a fault is detected, the unit shuts down the high voltage, turns on the FAULT relay output, and a fault LED lights. Table 4-2 lists the fault LEDs.

Table 4-2 LED Messages

LED	Description
Interlock/E-Stop	
Slow Blink LED	External interlock input is open.
Solid LED	E-stop circuit is open.
Network	The control board can no longer communicate with a previously detected power supply.
RF Interlock	RF detector is disconnected or has sensed high level of RF leakage from the lamphead.
Air Pressure	Insufficient or no air pressure in the lamphead.
Lamp Out	There was insufficient output from the light detector when the power supply is in the On mode.
Power Error	
Fast Blink LED	Magnetron current has been sensed when the power supply is in the Off mode.
Slow Blink LED	Magnetron current exceeds 950 ma.
Solid LED	Magnetron current has dropped below 200 ma for a duration of more than 600 ms.
HV Cable	The high-/low-voltage cable from the power supply to the lamphead is disconnected or open.
Over Temperature	Transformer thermal switch(es) open. May be caused by insufficient air flow through power supply cabinet.

Resetting a Fault

Operating in the Local Mode: Press the Off/Reset button to clear a fault once it has been corrected.

Operating in the Remote Mode: Open and close the off/reset contact to reset a fault once it has been corrected.

NOTE: Once the fault has been corrected a remote unit can be reset by either the front panel of the master unit or a host controlling the master unit.

Lamp Start-Up Timing Diagram for Remote Input Contact Closures

The Off/Reset contact must be closed for the unit to go to Standby or On. Once the lamphead is put into the Standby or On mode the lamphead will remain in that mode until the Off/Reset contact is opened.

NOTE: If the LAMP On LED does not light, refer to the *Troubleshooting* section on page 6-1.

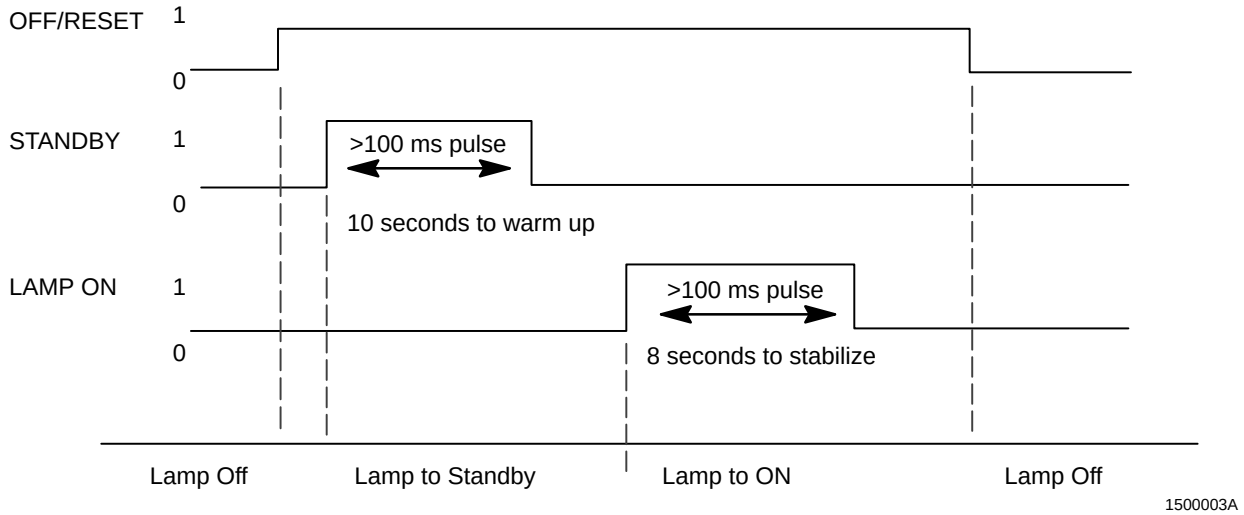

Figure 4-2 Lamp Start Up Timing Diagram for Remote Input Contact Closures

Startup

NOTE: Refer to the *Troubleshooting* section on page 6-1 if the system faults during startup.

Locally Operated Units

Refer to Table 4-3.

Table 4-3 Startup Procedures for Locally Operated Units

Step	Single Unit Operated Locally	Multiple Units Networked to a Master Unit Operated Locally
1	Switch the electrical disconnect enclosure to ON.	
2	Turn the main power switch on the front of the power supply unit to the on position.	
3	Make sure that all interlocked access doors are closed and the e-stops are enabled. If the remote blower lamphead is not directly connected to the power supply blower contacts, make sure the exhaust fan is running. Refer to the *Troubleshooting* section on page 6-1.	
4	On the NETWORK selector, press Local.	Set the NETWORK configuration. • On the master unit's NETWORK selector, press Local. • On the remote units' NETWORK Selector, press Remote.
5	**Lamphead with external blower**: Enable the cooling fan with either an external/remote switch or the set of contacts from the power supply. If the exhaust fan is wired to the normally open set of contacts on the power supply they will close when the lamphead is put in Standby or Lamp On mode. Refer to table 3-5 for external blower connection. **Lamphead with internal blower**: The blower will be controlled by the power supply. If there is insufficient pressure (less than 2.5 in. H_2O static pressure) there will be a system fault and the Air Pressure fault LED will appear in the display. (Check for proper pressure with the appropriate instrumentation.)	
6	Start up the lampheads. **NOTE:** If the Lamp On LED does not light, refer to the *Troubleshooting* section on page 6-1. **Rapid Startup** Use if your system will sit idle in the Standby mode before moving to the On mode. 1. On the LAMP selector of the host machine (or master control unit's lamp selector), press the Standby button. There will be an approximate 10 second warm-up time for the filament transformer. 2. After the 10 seconds the system will go into standby and remain there indefintely. **NOTE:** Do not leave the power supply in the standby mode for longer than 30 minutes. Prolonged standby periods will shorten the magnetron life. 3. Press the On button to enable the UV light. The light will turn on instantly but will take approximately 8 seconds to stabilize. After the 8 seconds, the system ready output contact (TB1) will close. **Standard Startup** Use to go directly through the warm-up to the On mode. 1. On the LAMP selector of the host machine (or master control unit's LAMP selector), press the LAMP On button. 2. During the next 10 seconds the unit will go through the warm up cycle before turning to On. 3. After approximately 8 more seconds the unit has stabilized and the system is ready to run. The system ready output contact (TB1) will close.	

Remotely Operated Units

Refer to Table 4-4.

NOTE: The system can be wired to initiate lamphead start from either the process machine or from the UV power supply control panel.

Table 4-4 Startup Procedures for Units Operated Remotely

Step	Single Unit and Units Networked to a Master Unit Operated Remotely
1	Switch the electrical disconnect enclosure to ON.
2	Turn the main power switch on the front of the power supply unit to the on position.
3	Make sure that all interlocked access doors are closed and that the exhaust fan is running. If external interlocks are wired and open, the Interlock/E-stop fault LED will light.
4	On the NETWORK selector, press Remote. **NOTE:** For networked remote units, press Remote at each NETWORK selector.
6	**Lamphead with external blower**: Enable the cooling fan by either an external/remote switch or the set of contacts from the power supply. If the exhaust fan is wired to the normally open set of contacts on the power supply they will close when the lamphead is put in Standby or Lamp On mode. Refer to table 3-5 for external blower connection. **Lamphead with internal blower**: The blower will be controlled by the power supply. If there is insufficient pressure (less than 2.5 in. H_2O static pressure) there will be a system fault and the Air Pressure fault LED will appear in the display. (Check for proper pressure with the appropriate instrumentation.)
7	There are many ways that the system can be configured to operate Remotely. By utilizing the power supply I/O the UV system can be controlled from a simple panel or fully automated to work in concert with a complete process. Contact a Nordson UV Curing representative for details.

Shutdown

CAUTION: Properly cool down the system before shutdown. Failure to do this may result in equipment damage. Abruptly removing power to an operating lamphead is not recommended and should only be done in an emergency.

Refer to Table 4-5 for shutdown procedures for the CoolWave UV system.

The system will stop if any of the following conditions occur:

- LAMP Off/Reset push button on UV operator station is pressed
- The power supply switch is turned to the off position.
- The LAMP On/Off switch is turned to Off
- Cooling air for the lamphead stops or reaches an insufficient level
- Any of the safety interlocks wired into the UV equipment are interrupted. These include exhaust fan, access panels, doors and process equipment
- Any fault condition occurs

Table 4-5 Shutdown Procedures

Step	Shutting Down Systems Locally	Shutting Down Systems Remotely
1	Press the Lamp On/Off button.	Press the Lamp On/Off button on the remote or host machine to the off position.
2	Allow the lampheads to cool for five minutes before shutting off the exhaust and cooling air. **CAUTION**: Failure to do this can cause problems restarting the lamps as well as greatly reduce the life of the lamphead bulbs.	Allow the lampheads to cool for five minutes before shutting off the exhaust and cooling air. **CAUTION**: Failure to do this can cause problems restarting the lamps as well as greatly reduce the life of the lamphead bulbs. **NOTE:** Typically, the cooling fan will be controlled by the remote or host machine of the UV system.
3	Turn off the main power to all units.	

Section 5
Maintenance and Repair

WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.

Maintenance and Replacement Schedule

Table 5-1 lists typical maintenance guidelines and replacement schedules for the components of the CW6 UV microwave applied curing system with a six-inch lamphead.

Recommended maintenance to the lamphead consists of changing bulbs and reflectors; and cleaning or replacing filter material. Reflectors and screen should be cleaned periodically.

Recommended maintenance to the power supply consists of cleaning or changing the cooling fan filter material, if present, and removing dust from the power supply.

Establish acceptable curing levels for your process and then develop a maintenance schedule that fits your needs. Radiometers can be used to measure relative readings for spectral output as a means of monitoring spectral intensity.

The maintenance and replacement schedule for the system will depend upon your:

- application process
- plant environment
- quality of cooling air passing through the system
- coating formulation

Maintenance and Replacement Schedule *(contd)*

Table 5-1 Typical Maintenance and Replacement Schedule

Component	Maintenance Guidelines	Replace component...
UV Bulb	Bulbs are warranted for a specific number of hours when operating under manufacturer's operation specifications (hours vary with differing bulbs). Depending on your application, some installations may provide acceptable curing well beyond the warranty. **NOTE:** Do not touch or handle the bulb with bare hands. Be sure to clean them with a lint free cloth or tissue to remove any fingerprints that might be present.	after 3000 hours of operation or as needed
Magnetron	The magnetron is warranted for a specific number of hours when operating under the manufacturer's operation specifications. Each application will be different and, in many cases, the magnetron life will last well beyond the warranty.	after 3000 hours of operation or as needed
Screen	The screen should be free of all debris such as cured material, lint, dust, or any thing that might impede cooling or UV transmittance. Soaking in a compatible solvent to remove any such items may clean the screen. ⚠ Do not use damaged screens. This can result in RF detector leakage.	as needed
Reflector	Reflector surfaces should be cleaned every 500 working hours (more frequently in dirty environments) and at every bulb change. Wipe the reflector surface and the cavity with a clean, lint-free cloth dipped in a suitable solvent such as isopropyl alcohol. Be careful when replacing reflectors. They are made of glass and may break if dropped or forced. ⚠ Never use metal polish or any abrasive media to clean the reflectors.	as needed
Pressure Switch	Pressure switches are rated for operation between -40 °C and 120 °C. If your system experiences repeated loss of cooling air, the pressure switch may overheat and fail. Make sure that the lamphead cooling fan cools the system sufficiently to avoid pressure switch and other internal lamphead component failures. Refer to the *Operation* section for recommended cooling fan timer settings.	when failure occurs
Filters	Filter material is designed to capture dust and contaminants from the plant before entering the UV equipment. These filters are located on the lampheads, remote blowers, and some power supplies (customer supplied filters). Eventually, the filters will become loaded with matter and will start to impede the flow of air. A dirty filter also will release matter into the air stream that may deposit on the part being cured as well as the bulb and reflector. Use soap and water to wash all filter material that provides cooling to any part of your UV system.	
Remote blower		Weekly or as needed
cooling fan electrical enclosure/ lamphead		Weekly or as needed

Replacement Procedures

Preparation

1. Turn off the UV system from the process equipment controller or at the UV panel.
2. Allow the lamphead fan to complete its cooling cycle. If this has been prevented by premature isolation of the control cabinet, always allow sufficient time for the bulb to cool before proceeding.
3. Turn off the main electrical disconnect. Follow all relevant OSHA established lockout procedures.
4. Disconnect all cables to the lamphead.
5. If necessary, loosen the M4 lamphead mounting fasteners and remove the assembly from the brackets.

Bulb Replacement

1. Perform the *Preparation* procedure.
2. See Figure 5-1. Turn or place the lamphead assembly so that the entire bulb area is exposed and accessible.
3. Using a 2.5-mm hex wrench, remove the six screws from the lamphead base and remove the RF screen.

   NOTE: The locations of the screws are circled for reference.

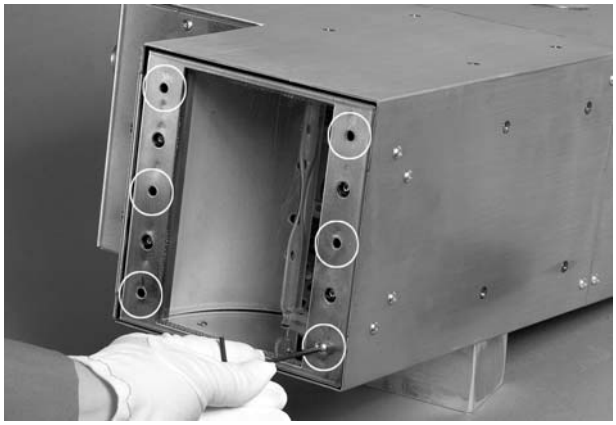

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Figure 5-1 Removing the Six Hex Screws

Bulb Replacement *(contd)*

NOTE: Do not touch the quartz portion of the bulb with bare hands. Use protective gloves.

4. See Figure 5-2. Grasp the ends of the bulb and push it to one side. Lift one end of the bulb out of the retaining hole; the other end of the bulb should come out of the other retaining hole.
5. Place one end of the new bulb into the retaining hole, push to one side and lower the bulb into place. Install the remaining end of the bulb into the other retaining hole.
6. Place the old bulb in the new bulb packaging and dispose of according to your company's disposal policies. Refer to page 1-5 in the *Safety* section for the bulb return policy.
7. Install the RF screen to the lamphead base with the six screws and tighten screws to 1.1 N•m (10-in. lb).

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Figure 5-2 Bulb Replacement

Reflector Replacement

Two types of reflectors may be used in the lamphead: **Flood** and **Focus**. The reflectors use different retaining brackets within the lamphead.

Remove the Reflectors

1. Perform the *Preparation* procedures on page 5-3.
2. Remove the bulb. Refer to *Bulb Replacement* beginning on page 5-3.
3. See Figure 5-3. Using a 2.5-mm hex wrench, remove the four screws and the two retaining brackets from the lamphead base.

   NOTE: The locations of the screws are circled for reference.

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Figure 5-3 Removing the Screws

4. See Figure 5-4. Carefully slide the two reflectors from the lamphead base.

   NOTE: Be careful when replacing reflectors. They are made of glass and may break if dropped or forced.

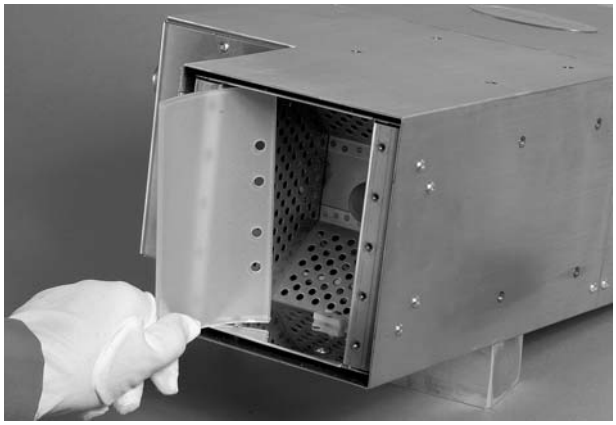

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Figure 5-4 Slide the Reflectors from the Lamphead

Install the Reflectors

1. See Figure 5-5. Slide the focus or flood reflectors into the lamphead with the holes to the inside.

   NOTE: The inside edge of the reflector should slide into the upper and lower notches of the white retainers.

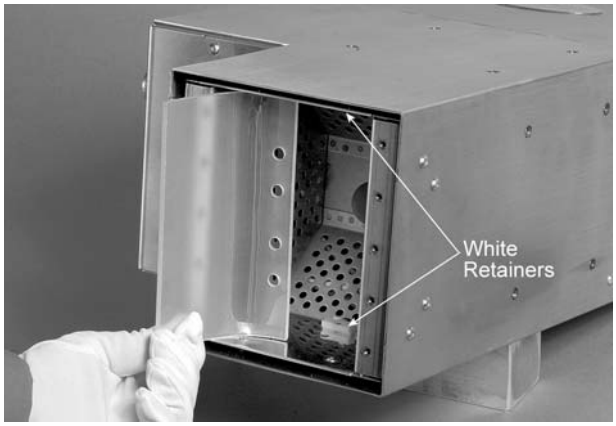

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Figure 5-5 Slide the Reflectors Into the Lamphead

Install the Reflectors *(contd)*

2. Set the retaining brackets in place. The placement of the retaining brackets differs between focus and flood reflectors.

   Focus Reflectors: See Figures 5-6 and 5-7. The bracket for the focus reflector is 23.3-mm (0.92-in.) wide. The edge of the reflector will sit on the retainer springs on the inside edge of the bracket.

   The lip on the focus bracket will go to the inside of the lamphead and wrap around the reflector. Line up the retaining bracket mounting holes with the mounting holes in the lamphead base.

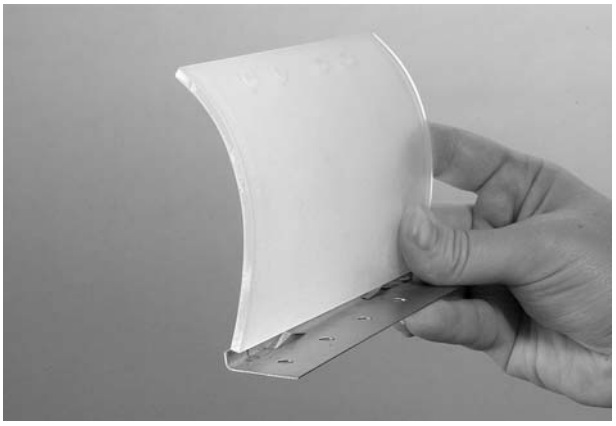

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Figure 5-6 Focus Reflector Curve and Retaining Bracket

1500047A

Figure 5-7 Placing the Focus Retaining Bracket

   Flood Reflectors: See Figures 5-8 and 5-9. The bracket for the flood reflector is 33.3-mm (1.31-in.) wide. The edge of the reflector will sit on the retainer springs on the inside edge of the bracket.

   The lip on the flood bracket will go to the inside of the lamphead and wrap around the edge of the reflector. The curve of the reflector causes the reflector to sit farther away from the side of the lamphead. Line up the retaining bracket mounting holes with the mounting holes in the lamphead base.

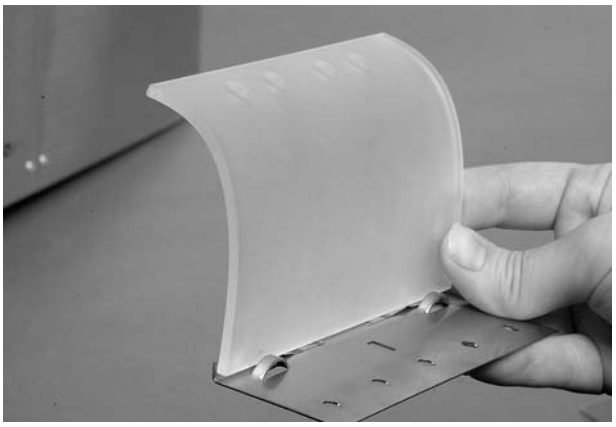

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Figure 5-8 Flood Reflector Curve and Retaining Bracket

1500049A

Figure 5-9 Placing the Flood Retaining Bracket

3. Using a 2.5-mm hex wrench, secure the the two retaining brackets to the lamphead base with the four screws and tighten screws to 1.1 N•m (10-in. lb).
4. Install the bulb.
5. Install the RF screen to the lamphead base with the six screws and tighten screws to 1.1 N•m (10-in. lb).

Internal Component Replacement

Remove the lamphead cover to replace the following internal components:

- Pressure switch
- Light detector board
- Starter bulb
- Magnetron

NOTE: Step 2 is optional and is only to prevent damage to the RF screen and UV bulb.

1. Perform the *Preparation* procedures on page 5-3.
2. Remove the bulb. Refer to *Bulb Replacement* beginning on page 5-3.
3. **Internal Blower Lampheads**: Remove the screws to remove the blower from the lamphead.
4. Remove all the screws that are circled in Figure 5-10 to remove the lamphead cover.

   NOTE: Remove the two inside screws (not pictured) on the back of the lamphead as well.
5. Pull the cover off the lamphead base.

1500050A

Figure 5-10 Lamphead Cover Removal

Pressure Switch

1. Follow steps 1-5 under *Internal Component Replacement* on page 5-7 to remove the lamphead cover.
2. Note the orientation of the pressure switch with regard to the airflow direction.
3. See Figure 5-11. Using a wrench remove the two nuts and energizer washers from the pressure switch.
4. Pull the pressure switch from the front cover and turn it so you can easily grasp and remove the wires from the switch.

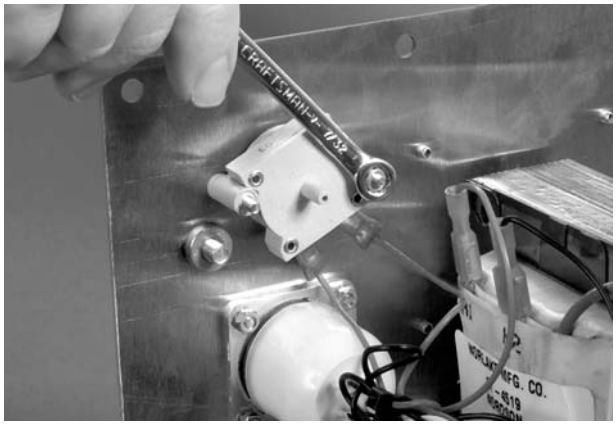

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Figure 5-11 Pressure Switch Removal

5. See Figure 5-12. Install the wires on the new pressure switch.
6. Using a wrench, secure the pressure switch on the front panel with the two energizer washers and nuts.
7. Install the cover on the lamphead base.
8. Install the bulb and RF screen, if necessary.

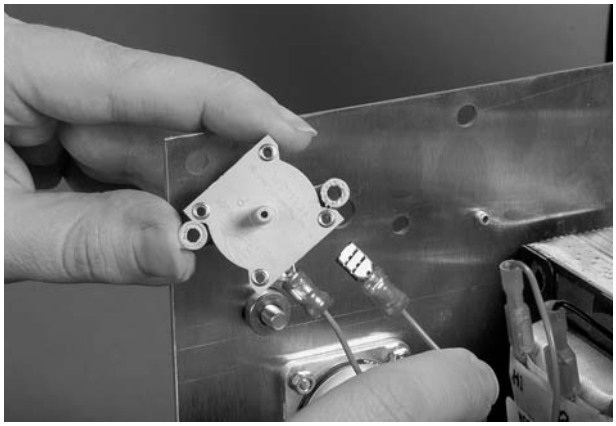

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Figure 5-12 Pressure Switch Wires

Light Detector Board

1. Follow steps 1-5 under *Internal Component Replacement* on page 5-7 to remove the lamphead cover.
2. See Figure 5-13. Disconnect the light detector board.
3. Remove the two M4 screws that are circled in the figure.
4. Replace and connect the new board and install it with the M4 screws.
5. Install the cover on the lamphead base.
6. Install the bulb and RF screen, if necessary.

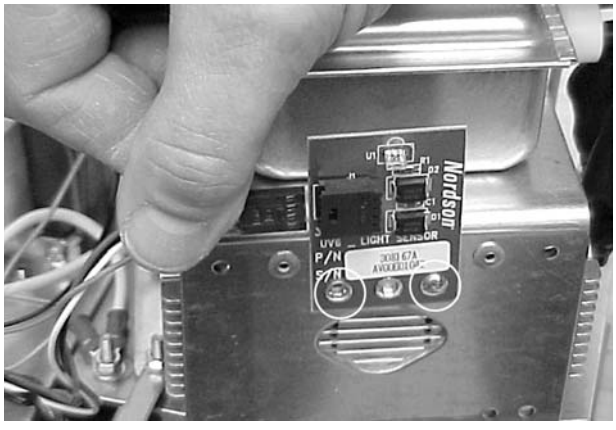

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Figure 5-13 Light Detector Board Replacement

Starter Bulb

1. Follow steps 1-5 under *Internal Component Replacement* on page 5-7 to remove the lamphead cover.
2. See Figure 5-14. Cut or remove the threadlocking material from the base of the bulb to remove the bulb.
3. Apply a small dot of threadlocking material to the base of the new bulb and install it.
4. Install the cover on the lamphead base.
5. Install the bulb and RF screen, if necessary.

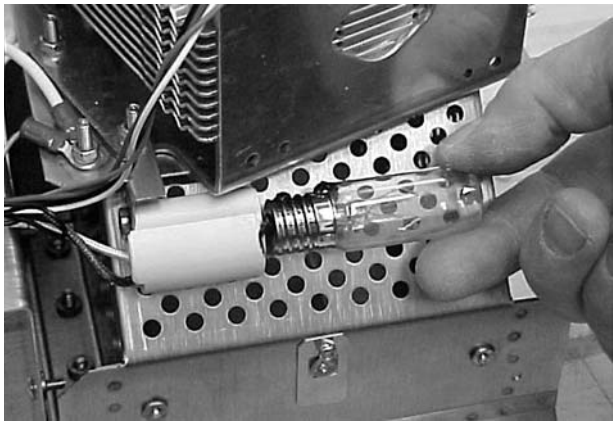

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Figure 5-14 Starter Bulb Replacement

Magnetron

Remove the Magnetron

1. Follow steps 1-5 under *Internal Component Replacement* on page 5-7 to remove the lamphead cover.

NOTE: Be careful not to cut or damage the black sleeving.

2. See Figure 5-15. Cut the four ties securing the black sleeving over the high-voltage ring terminals.

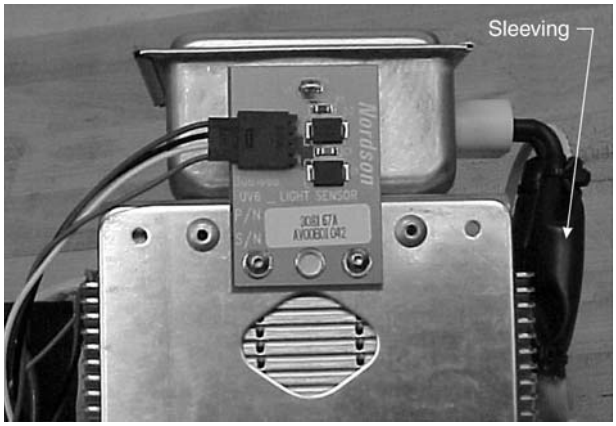

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Figure 5-15 Black Sleeving

3. See Figure 5-16. Slide the sleeving down to expose the two ring terminals. Remove the two screws.

1500066A

Figure 5-16 Ring Terminals

Magnetron *(contd)*

4. Disconnect and remove the light detector board as described on page 5-8.
5. See Figure 5-17. Using a wrench, remove the four nuts that secure the magnetron to the lamphead base. Remove the magnetron.

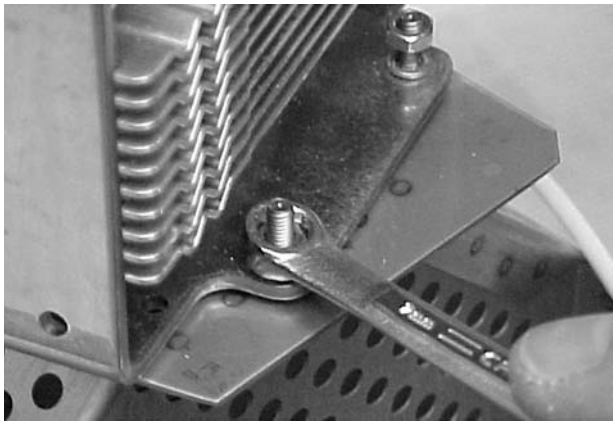

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Figure 5-17 Remove the Magnetron

Install the Magnetron

1. See Figure 5-18. Inspect the gasket around the antenna of the new magnetron making sure it is smooth and free of debris.

   Check for signs of arcing or burning around the flange. If arcing or burn marks are present, contact your Nordson representative.
2. Carefully insert the antenna through the hole in the lamphead base.

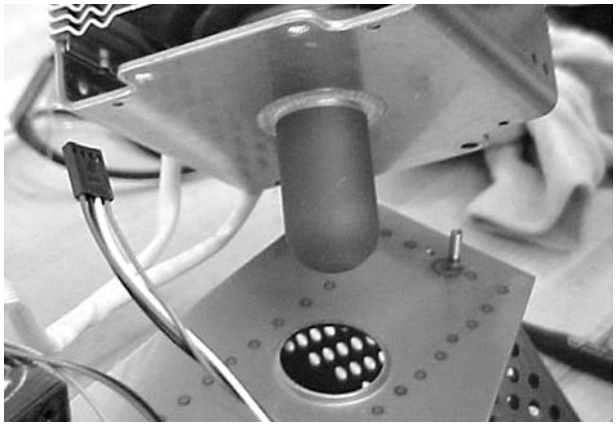

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Figure 5-18 Install the Magnetron

3. Make sure the magnetron gasket is sealed evenly on the flange and secure the magnetron to the lamphead with the four nuts. Tighten the nuts to 1.9 N•m (17-in. lb).
4. Connect and install the light detector board.
5. Secure the two high-voltage ring terminal with the two screws.
6. Pull the black sleeving up over the high-voltage terminal and secure it in place with tie wraps.
7. Install the cover on the lamphead base.
8. Install the bulb and RF screen, if necessary.

Fuse Replacement

See Figure 5-19 to identify the three fuses on the main control board that are replaceable.

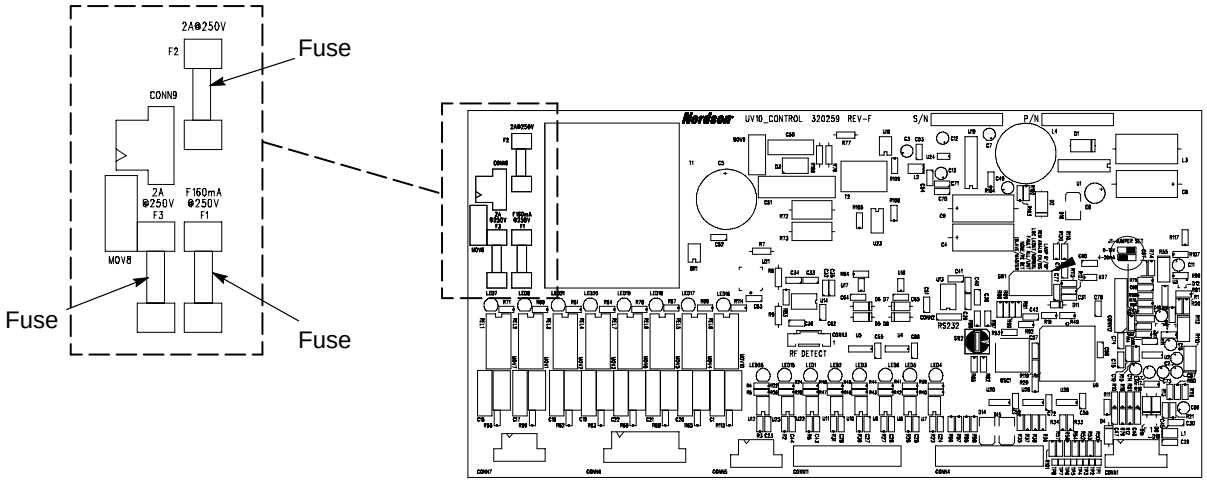

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Figure 5-19 Main Control Board Fuses

Air Filter Cleaning and Supply Cooling Fan

NOTE: Repeat the same procedure for all external blowers.

NOTE: Some filter media can be washed and reused. Please refer to the users' manual for your blower.

1. Turn off the main electrical disconnect. Follow all relevant OSHA-established lockout procedures.
2. Locate the cooling fan on the power supply. It is located on the front side of the power supply.
3. Make sure the safety cover is clean and free of any debris.
4. Examine fan blades for contamination. Clean or replace if necessary.

Section 6
Troubleshooting

WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.

Introduction

This section contains troubleshooting procedures. These procedures cover only the most common problems that you may encounter. If you cannot solve the problem with the information given here, contact your local Nordson representative for help.

General Troubleshooting

NOTE: If your unit does not start up, disconnect power to the unit then remove the cover and check the fuses. See Figure 7-2 for fuse locations.

LED	Possible Cause	Corrective Action
1. Lamp Fault **Fault LED:** **Lamp Out**	The light detector outputs a voltage when the lamphead is in operation: the voltage drops below a minimum	Check the magnetron current, main fuses, phase control board, and light detector.
	Unicable at lamphead or power supply is loose	Disconnect and reconnect the cable.
	Bulb has failed	Replace the bulb.
2. Pressure Fault **Fault LED:** **Air Pressure**	Cooling fan is not running	Remote Blower: Check the motor starter, fuses, and overloads. Reset or replace overloads and/or fuses if necessary.
	Unicable not connected	Check the unicable to the lamphead.
	External cooling blower is running in reverse	Check the wires at the blower and at the starter, check the fan rotation.
	Filter on cooling fan is dirty	Replace the filter on the blower. Wash the filter on the remote blower with soap and water.

Continued...

General Troubleshooting *(contd)*

Problem	Possible Cause	Corrective Action
2. Pressure Fault **Fault LED:** **Air Pressure** (*contd*)	Remote cooling fan is wired improperly	Switch two of the main input power wires on the three-phase remote blower. Air flow will be in the same direction for all combinations; however, there will be greater air flow when the motor is spinning the correct direction. Follow the motor rotation diagram on the motor.
	Pressure sensor has failed	The pressure sensor is a normally open switch that closes with 2.5-in. wc static pressure. Make sure both the external and internal port of the switch are open and there are no obstructions. If there are no obstructions and the blower is operating, replace the switch.
	Pressure drop in remote blower ducting is too great	Ducting to the remote blower should be large enough with minimum of sharp bends to supply adequate ventilation. If pressure faults have consistently been a problem, you may want to consider mounting the remote blower closer to the lamphead or increasing the duct size.
3. Magnetron Current Fault **Fault LED:** **Power Error**		
Solid LED	The current in the magnetron has dropped below 200 ma for a duration of more than 600 ms	Reset the lamphead and restart the system. If the problem still exists there may be a magnetron failure.
	Magnetron current is detected when power is off	Reset the lamphead and restart the system. If the problem still exists there may be a magnetron failure.
Slow Blink LED	Magnetron current has exceeded 950 ma	Check capacitor for a short.
		Check all the power supply to lamphead cables for damage or arcing. Check for signs of arcing in the lamphead.
Fast Blink LED	Filament transformer circuit shorted or closed	Check filament transformer fuse on main circuit board. Check output on filament transformer.
4. Interlock/E-Stop Fault **Fault LED:** **Interlock/E-Stop**		
Slow Blink LED	Open external interlock	Check all system interlocks.
Solid LED	E-stop depressed	Check all e-stops.

Continued...

Problem	Possible Cause	Corrective Action
5. Power Supply Overtemp **Fault LED: Over Temperature**	Insufficient air flow to the power supply	Clean the blower filters and make sure that there are no obstructions in the blowers and the filters.
	Main power supply has detected excessive heat	Check the main power supply for proper voltage.
6. Network Fault **Fault LED: Network**	A fault detected somewhere on the network	Determine the unit with the fault and correct the fault. Clear the master control unit.
7. Irradiator will not light **Fault LED: HV Cable**	Power supply to lamphead cable disconnected or faulty	Check the cable connection. Check the continuity of the cable.
8. RF Fault **Fault LED: RF Interlock**	RF detector switch is not set properly on control board	Check the setting of the Master/Remote switches.
	RF detector is not properly connected	Check the connections.
	RF cable is faulty	Check the continuity of the cable. Replace the cable if necessary.
	RF detector is detecting a high level of RF	Check the lamphead screen for holes and tears. Replace the lamphead screen if necessary.

Troubleshooting Bulb Problems

NOTE: Any bulb that has been touched or contaminated should be cleaned with alcohol prior to use. Failure to do so can and possibly will result in premature failure of the bulb.

Problem	Possible Cause	Corrective Action
1. Bulbs have white fingerprints on quartz	Quartz was touched when bulb was installed: finger dirt and oils were deposited on the quartz and burned into the quartz when the bulb was running	Replace the bulb. The spectral output has diminished. In the future, do not touch the quartz portion of the bulb under any circumstances.
2. New bulb does not start	Pressure seal has been broken	Replace the bulb.
3. Quartz portion of bulb is rippled	Bulb is overheating	Check the ventilation. Clean the filter material. Check the pressure switch, it may have failed.
4. Quartz has a white or gray cloudy appearance	Bulb is overheating	Replace the bulb. If UV output is below acceptable levels.

Troubleshooting Curing Process Problems

Use the following table to troubleshoot UV curing process problems.

Problem	Possible Cause	Corrective Action
1. System running ok but material not curing	Reflectors are installed in the wrong orientation	Check to make sure reflectors are installed and are installed correctly.
	Reflectors are badly damaged or dirty	Replace the reflectors.
	RF screen dirty	Remove and clean the RF screen.

Section 7
Parts

Introduction

To order parts, call the Nordson Customer Service Center or your local Nordson representative. Use this five-column parts list, and the accompanying illustration, to describe and locate parts correctly.

Using the Illustrated Parts List

Numbers in the Item column correspond to numbers that identify parts in illustrations following each parts list. The code NS (not shown) indicates that a listed part is not illustrated. A dash (—) is used when the part number applies to all parts in the illustration.

The number in the Part column is the Nordson Corporation part number. A series of dashes in this column (- - - - - -) means the part cannot be ordered separately.

The Description column gives the part name, as well as its dimensions and other characteristics when appropriate. Indentions show the relationships between assemblies, subassemblies, and parts.

- If you order the assembly, items 1 and 2 will be included.
- If you order item 1, item 2 will be included.
- If you order item 2, you will receive item 2 only.

The number in the Quantity column is the quantity required per unit, assembly, or subassembly. The code AR (As Required) is used if the part number is a bulk item ordered in quantities or if the quantity per assembly depends on the product version or model.

Letters in the Note column refer to notes at the end of each parts list. Notes contain important information about usage and ordering. Special attention should be given to notes.

Item	Part	Description	Quantity	Note
—	0000000	Assembly	1	
1	000000	Subassembly	2	A
2	000000	• • Part	1	

Lamphead with External/Internal Blower

See Figures 7-1 and 7-3.

Item	Part	Part	Description	Quantity	Note
1a	775204		FOCUS LAMPHEAD, external, blower	1	
1a	775207		FLOOD LAMPHEAD, external blower	1	
1b		775203	FOCUS LAMPHEAD, internal, blower	1	
1b		775206	FLOOD LAMPHEAD, internal blower	1	
2	775242	775242	MERCURY BULB, CoolWave, H	1	A, B
2	775243	775243	IRON BULB, CoolWave, D	1	A, B
2	775244	775244	GALIUM BULB, CoolWave, V	1	A, B
2	775245	775245	INDIUM BULB, CoolWave, Qstarter	1	A, B
2	775246	775246	MERCURY PLUS BULB, CoolWave, H+	1	A, B
3	775260	775260	BRACKET, retaining, reflector, focus CoolWave 6	2	B, C
3	775261	775261	BRACKET, retaining, reflector, flood, CoolWave 6	2	B, C
4	775262	775262	SWITCH, pressure, CoolWave, 6	1	B
5	775385	775385	FILAMENT TRANSFORMER, CoolWave	1	B
6	775040	775040	BULB, starter	1	
7	775290	775290	FOCUSED REFLECTOR, CoolWave, standard	2	B, C
7	775300	775300	FLOOD REFLECTOR, CoolWave, standard	2	B, C
8	775335	775335	MAGNETRON, 1.8 kw, CoolWave 6	1	
9	775320	775320	SCREEN, lamphead, CoolWave 6	1	
10	775139	775139	SENSOR, light, CoolWave, 6	1	B
11	- - - - - -	- - - - - -	BUTTON HEAD SOCKET SCREW, M4 x 8, zinc plated, steel	32-external 38-internal	
12	- - - - - -	- - - - - -	BUTTON HEAD SOCKET SCREW, M3 x 6, zinc plated, steel	10	
13	- - - - - -	- - - - - -	BUTTON HEAD SOCKET SCREW, M4 x 10, zinc plated, steel	2	
14	- - - - - -	- - - - - -	HEX NUT, M4	2	
15	775389	775389	BRACKET, mounting, L, CW6	2	
NS	775361	775361	MANUAL, CoolWave 6	1	B

NOTE A: Order the correct bulb for your particular system.

B: Recommended spare part. Keep this part in inventory to avoid unplanned downtime.

C: Order the correct bracket and reflector for your particular system.

NS: Not Shown

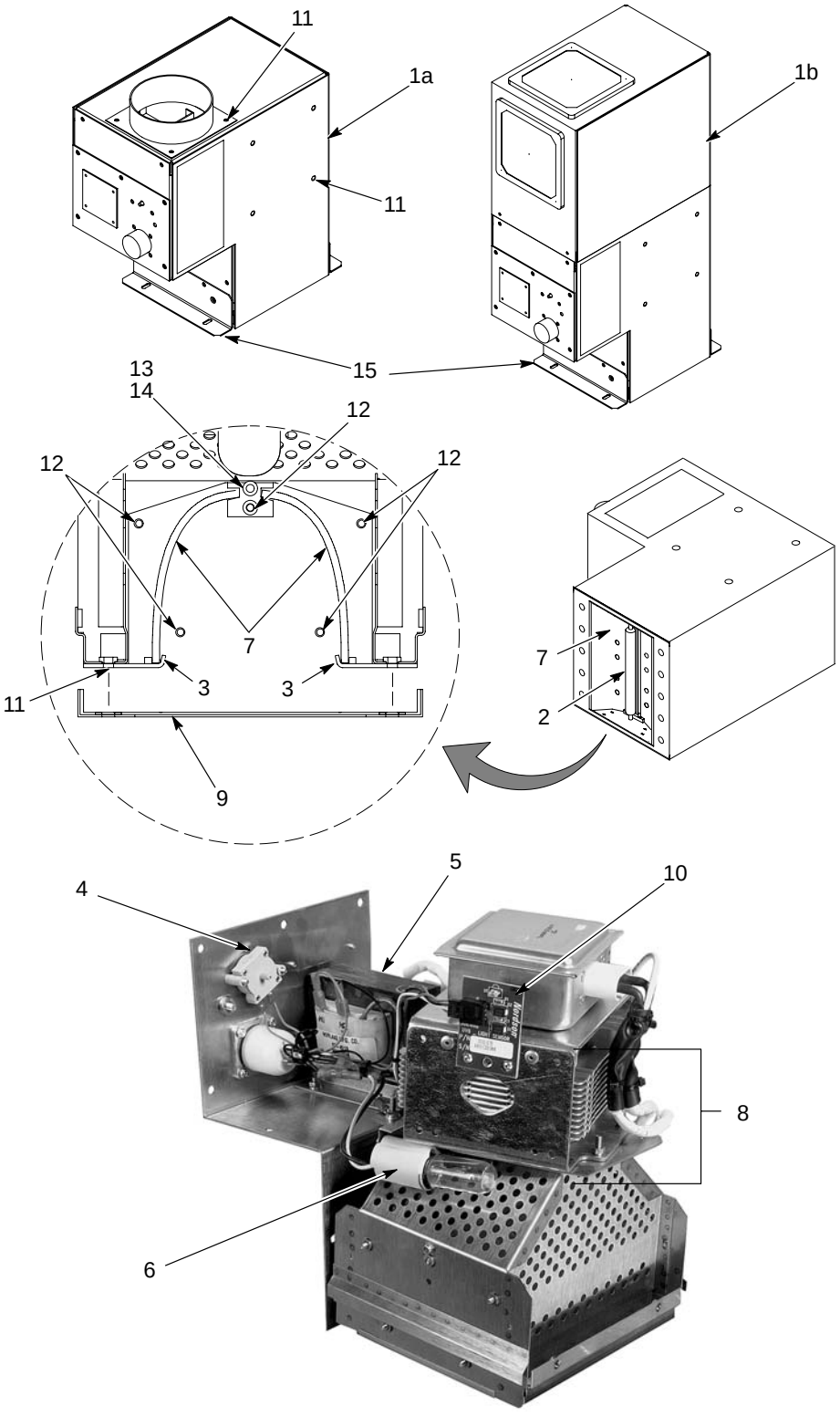

Figure 7-1 CoolWave Lamphead

Power Supply and RF Detector

See Figures 7-2 and 7-3.

Item	Part	Description	Quantity	Note
16	775221	50/60 HZ POWER SUPPLY, CW 6	1	
17	775266	POWER TRANSFORMER, CW 6	1	
18	775272	50/60 Hz CAPACITOR, 0.34 Mf, 2500 Volt, CoolWave	2	
19	775280	FUSE, kit, CoolWave	1	A, B
19a	- - - - - -	• • FUSE, 2 amp, 250 volt	1	B
19b	- - - - - -	• • FUSE, 160 microamp, 250 volt	1	B
19c	- - - - - -	• • FUSE, 2 amp, 250 volt	1	B
20	775373	CIRCUIT BREAKER, 20 amp	1	
21	775085	FAN, cooling, CoolWave	1	A
22	775140	PCB, CONTROL, CoolWave	1	
23	775146	PCB, I/O, CoolWave	1	
24	775150	MODULE, rectifier, CoolWave	1	
25	775148	PCB, DISPLAY, CW6	1	
26	775022	RF DETECTOR, CoolWave, 6/10	1	

NOTE A: Recommended spare part. Keep this part in inventory to avoid unplanned downtime.

B: The fuse kit part, 775280, contains two 2 amp, 250 volt fan fuse; and one 160 microamp, 250 volt control board fuse.

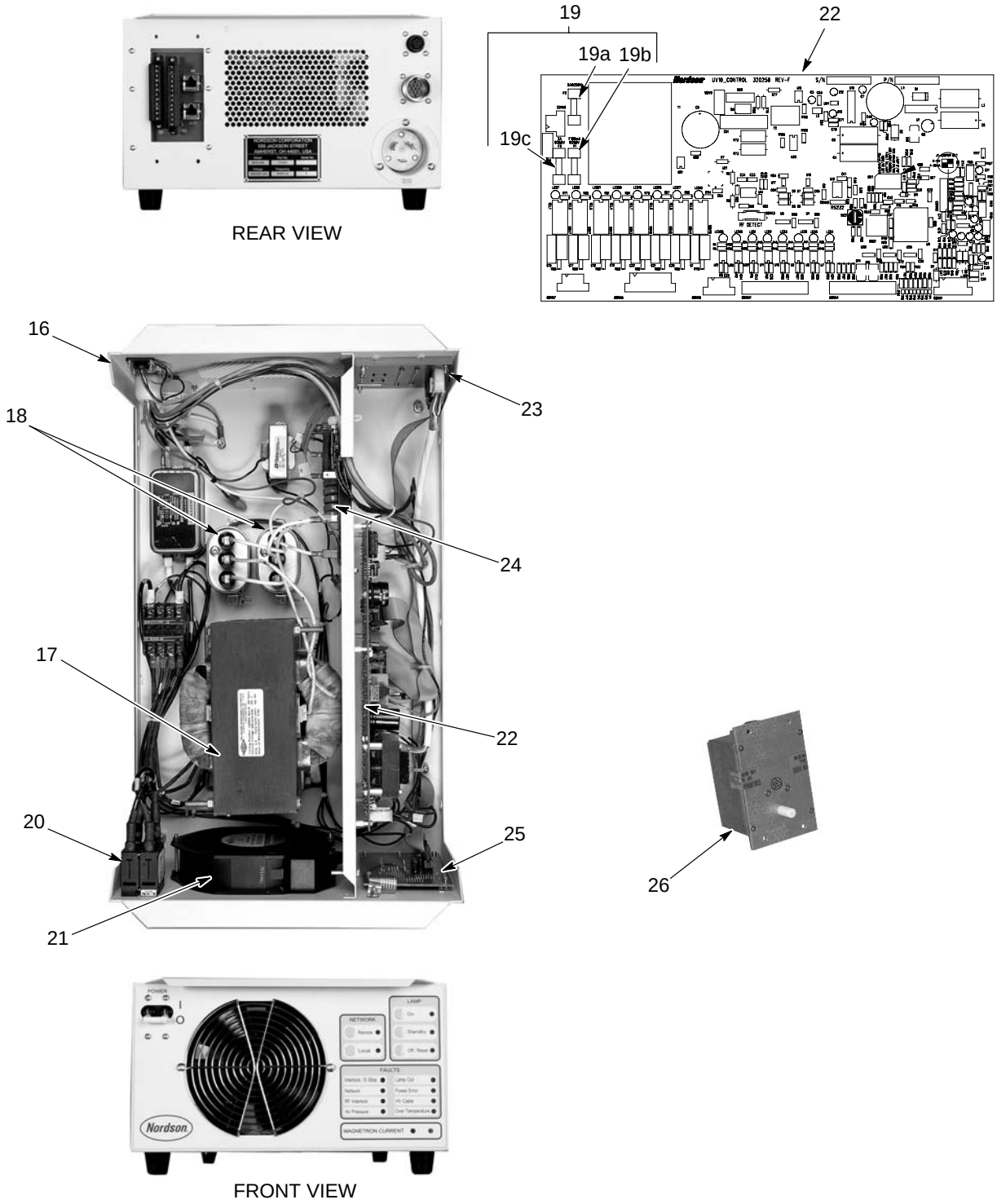

Figure 7-2 CoolWave Power Supply and RF Detector

CoolWave Cables

See Figure 7-3. Order the correct cable length for your particular system.

Item	Part	Description	Quantity	Note
27	775023	25-ft UNICABLE	1	
27	775375	50-ft UNICABLE		
27	775377	75-ft UNICABLE	1	
28	775029	25-ft CABLE, RF detector, 6/10	1	
28	775050	50-ft CABLE, RF detector, 6/10	1	
28	775051	75-ft CABLE, RF detector, 6/10	1	
28	775052	100-ft CABLE, RF detector, 6/10	1	
29	775031	NETWORK CABLE, 6-ft, 6/10	1	
NS	775162	60 Hz BLOWER, external, 60 Hz	1	
NS	775165	50 Hz BLOWER, external, 50 Hz	1	

NS: Not Shown

Recommended Spare Parts

Keep the following parts in inventory to avoid unplanned downtime. Quantities listed support a lamphead or power supply.

NOTE: Most of the recommended spare parts are listed with a level number (1, 2, or 3) to identify the part's level of importance to system operation. Level 1 parts are critical to the day-to-day operation of the UV curing system so be sure to keep these parts in inventory.

Part	Description	Quantity	Level	Note
775204	FOCUS LAMPHEAD, external, blower	1	3	
775207	FLOOD LAMPHEAD, external blower	1	3	
775203	FOCUS LAMPHEAD, internal, blower	1	3	
775206	FLOOD LAMPHEAD, internal blower	1	3	
775221	50/60 HZ POWER SUPPLY, CW 6	1	3	
775022	RF DETECTOR, CoolWave, 6/10	1	3	
775023	25-ft UNICABLE	1	3	
775029	25-ft CABLE, RF detector, 6/10	1	3	
775031	NETWORK CABLE, 6-ft, 6/10	1	3	
775242	MERCURY BULB, CoolWave, H	1	1	A
775243	IRON BULB, CoolWave, D	1	1	A
775244	GALIUM BULB, CoolWave, V	1	1	A
775245	INDIUM BULB, CoolWave, Qstarter	1	1	A
775246	MERCURY PLUS BULB, CoolWave, H+	1	1	A
775040	BULB, starter	1	2	
775262	SWITCH, pressure, CoolWave, 6	1	1	
775385	FILAMENT TRANSFORMER, CoolWave	1	2	
775280	FUSE, kit, CoolWave	1	1	
775140	PCB, CONTROL, CoolWave	1	2	
775146	PCB, I/O, CoolWave	1	2	
775148	PCB, DISPLAY, CW6	1	2	
775150	MODULE, rectifier, CoolWave	1	2	
775272	50/60 Hz CAPACITOR, 0.34 Mf, 2500 Volt, CoolWave	2	2	
775085	FAN, cooling, CoolWave	1	3	
775290	FOCUSED REFLECTOR, CoolWave, standard	2	3	B
775300	FLOOD REFLECTOR, CoolWave, standard	2	3	B
775320	SCREEN, lamphead, CoolWave 6	1	1	
775335	MAGNETRON, 1.8 kw, CoolWave 6	1	1	
775310	QUARTZ PLATE, kit, CoolWave 6			
775139	SENSOR, light, CoolWave, 6	1	3	
775361	MANUAL, CoolWave 6	1		

NOTE A: Order the correct bulb for your particular system.

B: Order the correct reflector for your particular system.

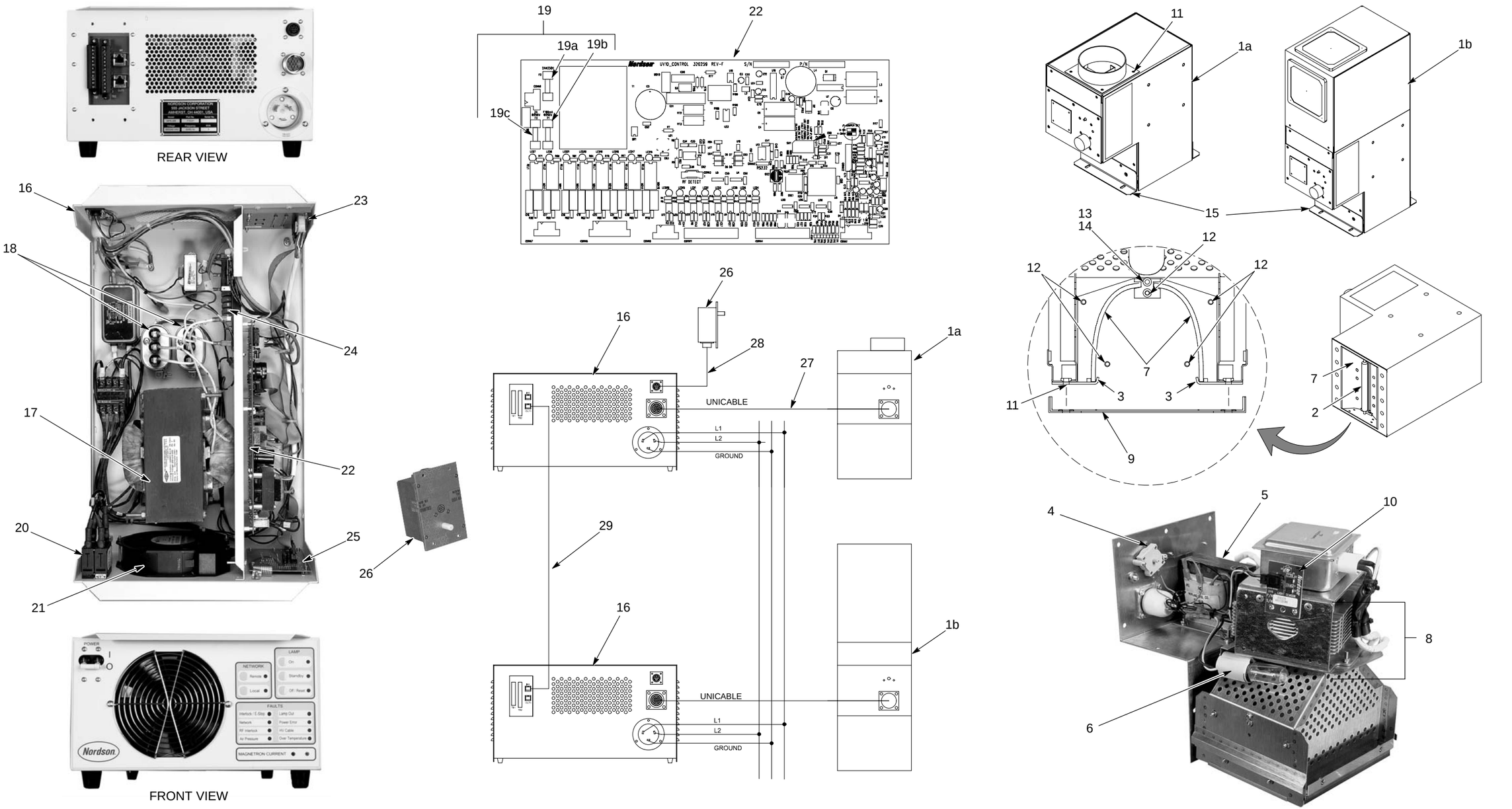

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Figure 7-3 CoolWave Ultraviolet UV Microwave Curing System Parts

Section 8
Specifications

Power Supply

Table 8-1 Power Supply Specifications

Item	Specification
Dimensions	
length	622.30 mm (24.50 in.)
width	342.90 mm (13.50 in.)
height	209.50 mm (8.25 in.)
Weight	32.2 kg (71 lb)
Voltage	200/210/240 Vac, Single Phase
Current	Refer to Table 8-2
Ambient Temperature	5-50 ° C

Table 8-2 Power Line Current

Line	60 Hz			50 Hz		
	Amps @ 200 Vac	Amps @ 210 Vac	Amps @ 240 Vac	Amps @ 200 Vac	Amps @ 210 Vac	Amps @ 240 Vac
L1	16	15	14	17	16	15
L2	16	15	14	17	16	15

Lampheads

Table 8-3 Lamphead Specifications

Item	Internal Blower Lamphead	External Blower Lamphead
Dimensions		
length	260.40 mm (10.25 in.)	257.60 mm (10.14 in.)
width	161.60 mm (6.36 in.)	161.80 mm (6.36 in.)
height	505.50 (19.92 in.)	286.50 mm (11.28 in.)
Weight	17.2 kg (38 lb)	8.6 kg (19 lb)
Cooling Air	225 cfm @ 2.5 in. H_2O; measured at lamphead	225 cfm @ 2.0 in. H_2O; measured at lamphead
Reflector	Borosilicate glass with dichroic coating: focus, flood profiles	
Focal Length	2.1 in.	

Bulb

Table 8-4 Bulb Specifications

Item	Specification
Length	153 mm (6 in.)
Power	300 watts/in. maximum
Types	Mercury, Mercury +, Iron, Gallium, Indium

RF Detector

Table 8-5 RF Detector Specifications

Item	Specification
RF Level Trip Level	2 mW/cm^2
Acceptable Level	5 mW/cm^2 ANSI Standard C95.1-1982 OSHA Standard 29 CFR 1910.97

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System Drawings

Figure 8-1: UV Connector Board

Figure 8-2: System Schematic

Figure 8-3: Lamphead Dimensions

Figure 8-4: System Installation

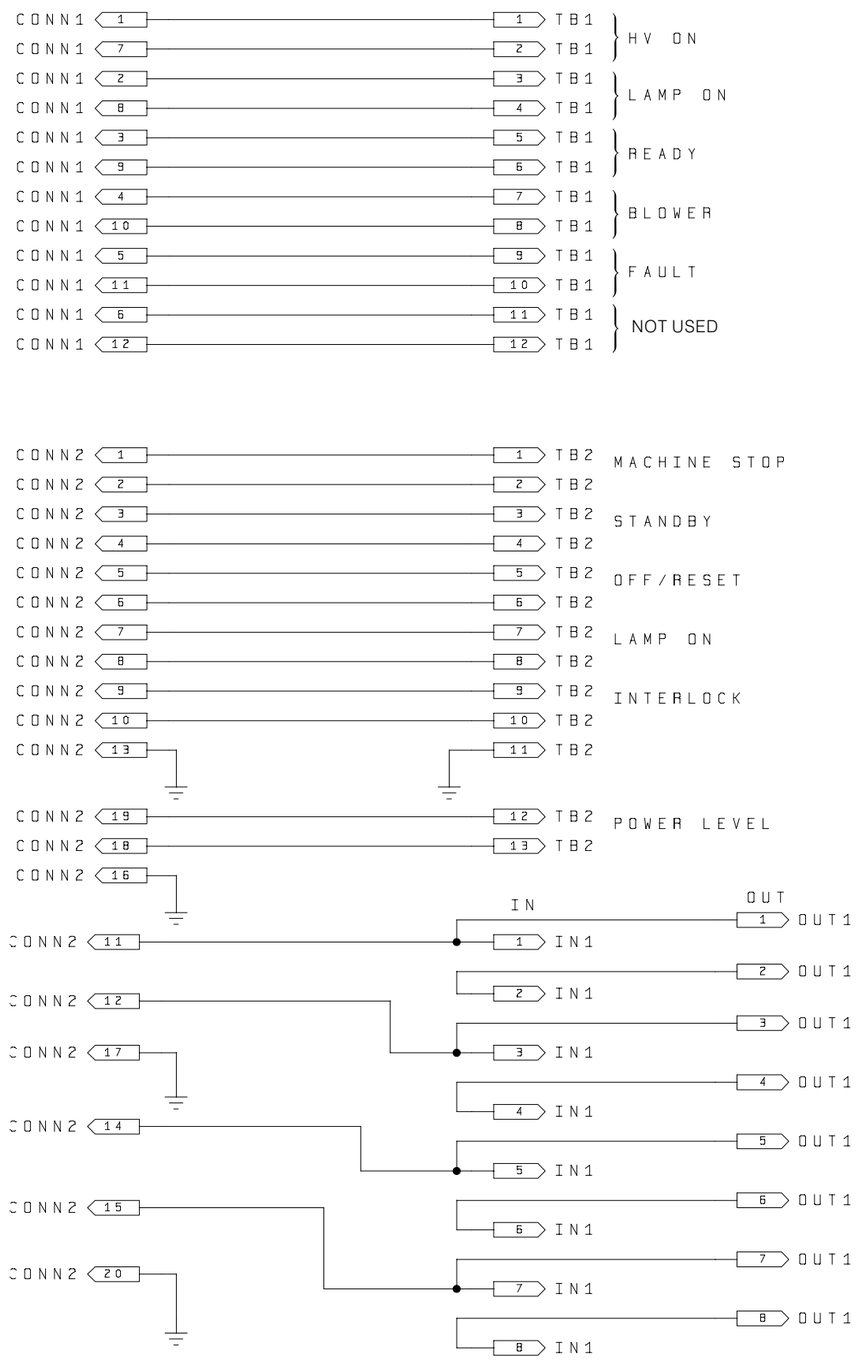
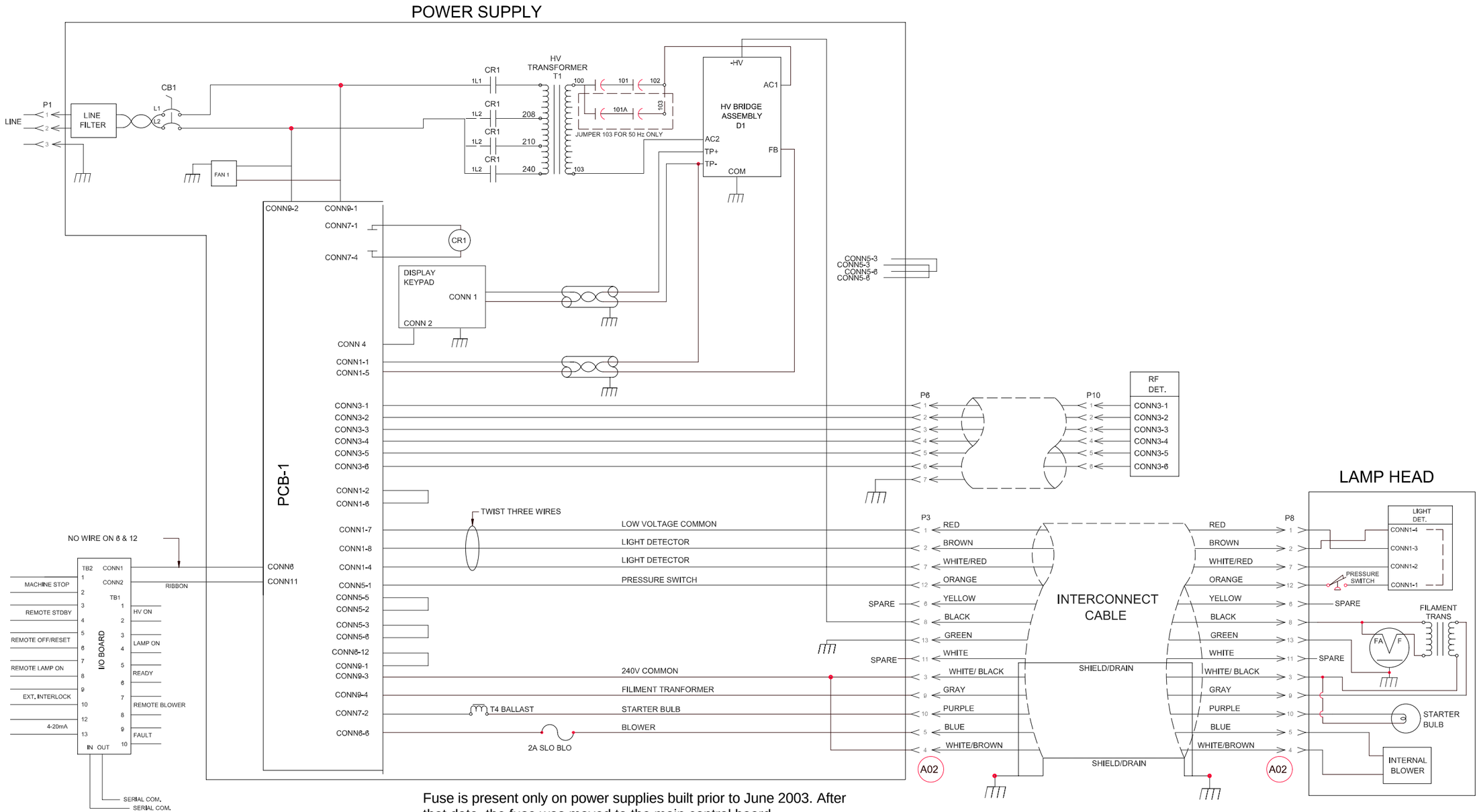


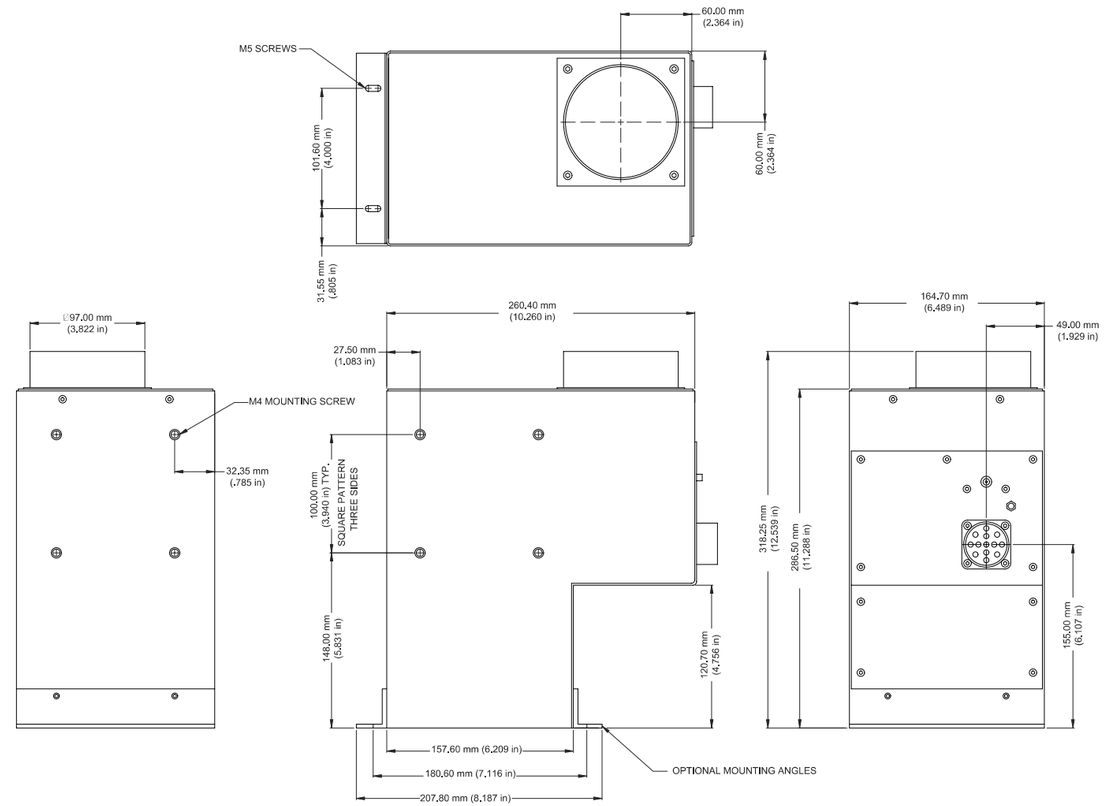
Figure 8-1 UV Connector Board



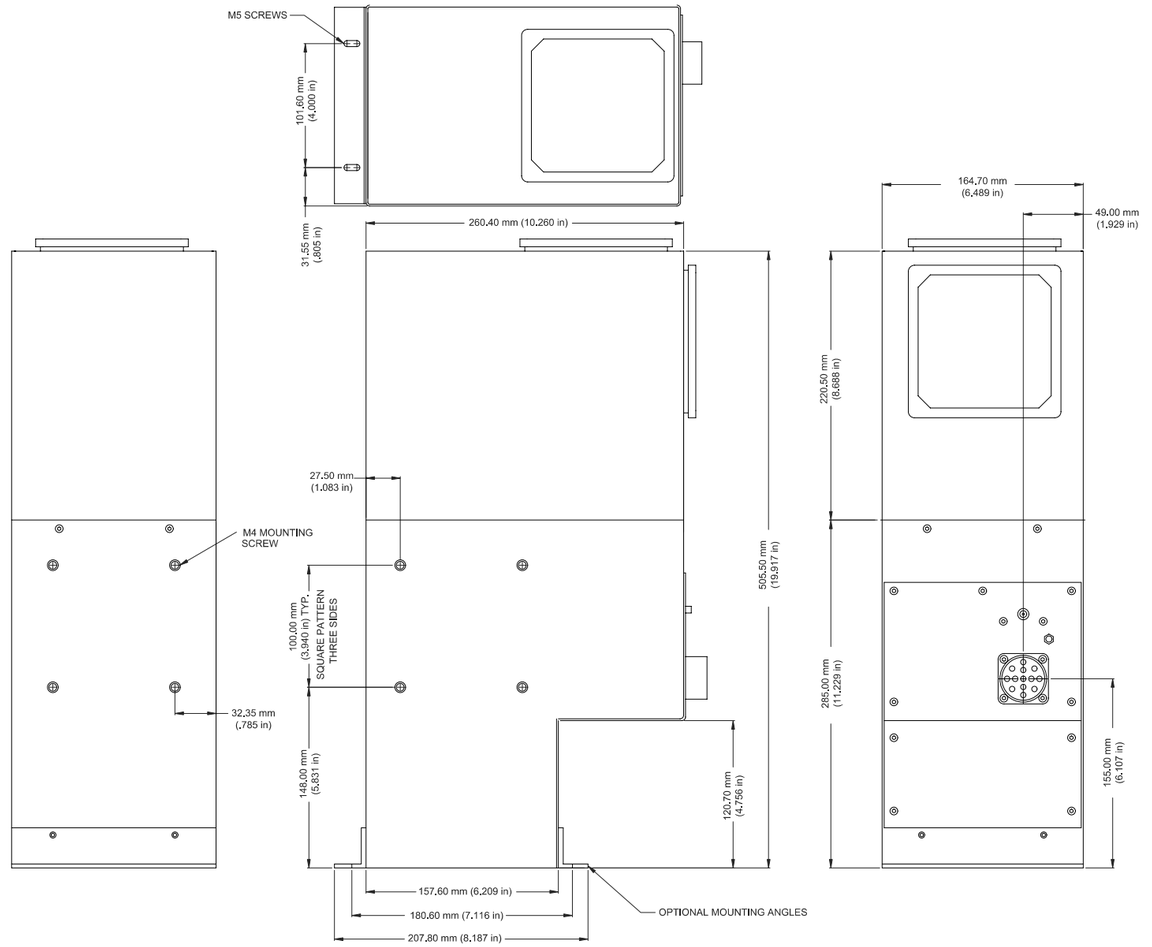
Fuse is present only on power supplies built prior to June 2003. After that date, the fuse was moved to the main control board.

1500038A

Figure 8-2 System Schematic



External Blower
Lamphead



Internal Blower
Lamphead

1500065A

Figure 8-3 Lamphead Dimensions

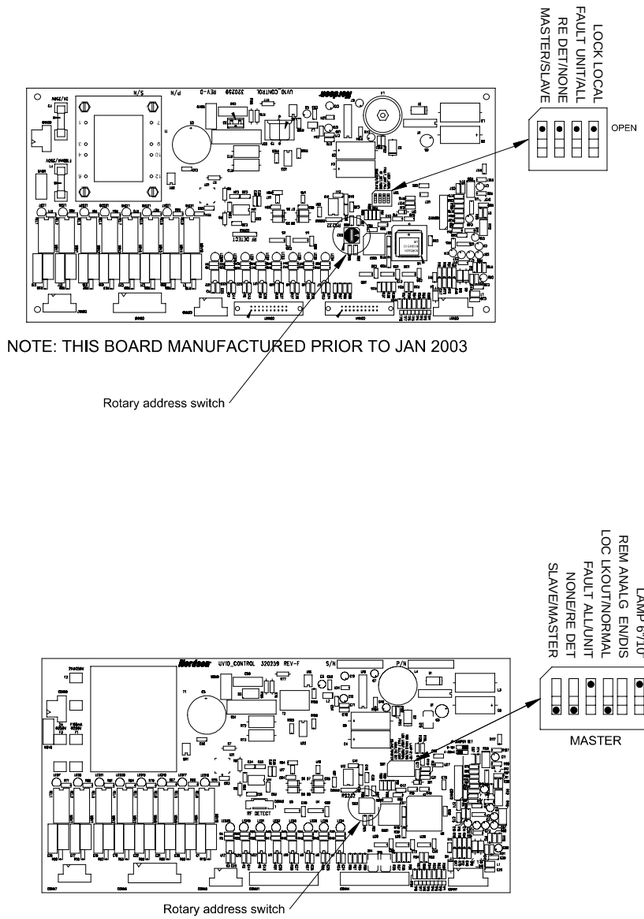


Figure 8-4 System Installation

Section 9
UV Glossary

absorption — Not reflecting. The partial loss in energy that results when light passes through or reflects off a medium.

actinic UV — Low-powered UV in the UVC band. Usually powered with several 100-watt power supplies or less instead of several 1000-watt power supplies. Nordson's UV Star and CoolWave product lines are much higher in irradiance and energy density than actinic UV products.

additive bulb — A mercury bulb that contains metal additives such as iron, gallium, indium, or others. These bulbs produce variations in spectral output as compared to mercury only bulbs.

adhesion — The state in which two surfaces are stuck together.

arc length — The distance measured between the electrodes in a quartz bulb. Also Refer to effective cure length.

ASTM spec D3359-95a — Refer to tape test.

ballast — An inductive transformer device that stabilizes the amount of current flowing through the bulb so that the power output remains constant.

black light UV — Low powered UV composed of wavelengths in the UVA band. Usually powered with several 100-watt power supplies or less instead of several 1000-watt power supplies. Nordson's UV Star and CoolWave product lines are much higher in irradiance and energy density than black light UV products.

bulb — A sealed quartz tube that contains a mixture of inert gas and mercury under medium pressure. Electrode bulbs are fitted with electrical connections at the ends of the bulb. Microwave bulbs contain no electrical connections. The mercury and inert gas are energized (vaporized) by either a voltage arc or microwave energy. The vaporized plasma gas emits UV light.

burn-in period — The second stage of the startup process of an electrode UV bulb. The total time that it takes the current and voltage inside the bulb to stabilize during startup.

capacitor	Corrects the power factor in the main power supply to reduce current levels in the UV system.
cold mirror	A reflector that is coated with a dichroic material that absorbs or passes wavelengths in the infrared range while reflecting those in the UV range. Refer to dichroic.
cover	The upper half of the lamp head assembly or the sheet metal top of the power supply. In the lamp head, the cover contains openings and baffles through which cooling air passes.
cradle	Supports the UV bulb and reflector inside an electrode lamp head housing.
cross hatch test	Refer to tape test.
cure	A UV drying process that occurs through a chemical reaction between a UV ink or coating and UV light.
cure length	Refer to effective cure length.
dichroic	A coating designed to pass certain wavelengths and reflect other wavelengths. In UV lamp heads, dichroics are used on reflectors to pass or absorb infrared energy and reflect UV energy.
devitrification	The act of making quartz glass opaque and porous through prolonged heating and UV exposure.
doped bulb	Refer to additive bulb.
dose (dosage)	Refer to energy density.
dose rate (dosage rate)	Refer to irradiance.
Dual Concentrated Focus (DCF)	An electrode system where two bulbs and two angled reflectors are positioned within one cradle. The UV light in a DCF system is concentrated into a single band of energy.
dynamic exposure	Exposure to a varying irradiance. It occurs when a lamp head passes over a substrate without pausing or when a substrate passes under a lamp head without pausing.

dynamic range	The span between the minimum irradiance and the maximum irradiance to which a radiometer will accurately respond. Measured in joules/cm^5.
effective cure length	The length of a bulb that delivers optimal UV output. For electrode bulbs, the effective cure length is always less than the arc length. For microwave bulbs, the effective cure length is the length of the bulb.
electrode	The electrical fitting on the inside of an arc bulb. The electrode consists of a tungsten pin surrounded by a tungsten coil and is used to maintain a voltage arc across the bulb. Electrode is also used to refer to the style of bulb or system when differentiating between microwave and electrode bulbs and microwave and electrode systems.
electrodeless	A microwave-powered UV system.
electromagnetic spectrum	The full wavelength range of electromagnetic radiation, including microwave, ultraviolet, visible, and infrared energy.
energy density	The total amount of UV energy delivered to a particular area, measured in joules/cm^2. Also referred to as total energy. Improperly referred to as dose.
erythermal UV	Low-powered UV in the UVC band. Usually powered with several 100-watt power supplies or less instead of several 1000-watt power supplies. Nordson's UV Star and CoolWave product lines are much higher in irradiance and energy density than erythermal UV products.
flood	An unfocused band of UV light that is more evenly and diffusely distributed across the width of the reflector.
flux	The flow of photons, measured in einsteins/second.
focal distance (length)	The perpendicular distance from the edge of the lamp head to the point where the UV light emitting from the bulb converges. This is the location of maximum UV concentration.
focus	The band where the UV energy reflected from the lamp head is at the highest concentration.
frequency	The number of times a periodic wavelength cycle occurs in one second, measured in Hertz (Hz).

gallium

A bluish-white metallic element used in additive mercury bulbs. The gallium additive provides a yellowish tint to an unenergized UV bulb and a violet coloration to the UV output. Gallium bulbs have a spectral peak around 417 nm and a spectral concentration between 400 and 450 nm. They are often used when deeper cure is required or with white coatings containing titanium oxides. In some industries, microwave gallium bulbs are referred to as V bulbs.

germicidal UV

Low-powered UV in the UVC band. Usually powered with several 100-watt power supplies or less instead of several 1000-watt power supplies. Nordson's UV Star and CoolWave product lines are much higher in irradiance and energy density than germicidal UV products.

housing

The lower half of the lamp head assembly. Its function is to support the cradle.

igniter

Refer to starter.

indium

A silver-white metallic element used in additive mercury bulbs. The indium additive provides a yellowish tint to an unenergized UV bulb and a violet coloration to the UV output. Indium is used to shift the spectral output past 400 nm. In some industries, indium bulbs are referred to as Q bulbs.

infrared energy

Energy having wavelengths between 1 and 100 μm.

integral cooling fan (blower)

The bulb-cooling fan when it is mounted to the lamp head.

integral shutter

A shutter assembly that is built into the lamp head. Common designs include a pneumatically actuated clam shell that blocks the light when closed and acts as a reflector when open and a pneumatic slide mechanism that moves the lamp head behind an internal louver when shuttered. Shutters are typically associated with electrode systems.

intensity

The amount of UV energy delivered to a particular area per unit time, measured in joules/cm^2/sec or watts/cm^2/sec. Also referred to as watt density. Improperly referred to as dose rate.

iron

A white metallic element used in additive mercury bulbs. The iron provides a reddish tint to an unenergized UV bulb and a bluish coloration to the UV output. Iron is used to concentrate the spectral output between 350 and 400 nanometers. In some industries, iron bulbs are referred to as D bulbs.

irradiance

Radiant power arriving at a surface from all forward angles per unit area, measured in watts/cm^2.

irradiator Refer to lamp head.

joule Metric unit for measuring work or energy. One joule is equivalent to the work done by a force of one Newton acting through a distance of one meter. (1 KW-hour equals 3.6×10^6 joules).

lamp Refer to bulb.

lamp head Assembly containing a sheet metal housing and cover and integral or remote cooling fan. An electrode system also contains cradles and a microwave system contains magnetrons, a cavity, and a screen.

light detector A photocell inside a microwave lamp head that confirms UV output.

long UV Refer to UVA.

louver A part of a UV shutter system or shielding section that blocks the UV light while allowing cooling air to pass through.

magnetron Assembly contained inside a microwave lamp head that converts high-voltage electrical input into RF energy.

mercury A silver-white metallic element that is liquid at room temperature and is used to create a vaporized, UV-emitting gas plasma inside a quartz tube when it is energized through the use of either a voltage arc or microwave energy. When energized the bulb produces a bright white UV output. Mercury bulbs have a peak spectral output around 365 nm and a concentration around 254 nm. In some industries, mercury bulbs are referred to as H bulbs.

mercury plus (H+) Microwave bulbs that contain additional mercury. Mercury plus bulbs are only available in microwave systems as it is difficult to vaporize the additional mercury in an electrode bulb.

mercury arc An electric discharge passed between two electrodes and through a mercury vapor medium inside a quartz tube.

metal halide bulb Refer to additive bulb.

micrometer (μm) Unit of length equivalent to one millionth of a meter.

microwave That part of the electromagnetic spectrum associated with the larger infrared waves and the shorter radio waves.

monomers	A molecule of relatively low molecular weight and simple structure capable of combining with itself or other similar molecules to form polymers.
nanometer (nm)	Unit of length equivalent to one billionth of a meter.
negative cooling	When the cooling air for the lamp head is drawn from the area surrounding the substrate being cured and through the lamp head. Negative cooling provides exhaust for the UV system if it is ducted to atmosphere. Negative cooling is most often supplied through a remote cooling fan.
nitrogen blanketing	Refer to nitrogen inerting.
nitrogen inerting	When the coating or ink is flooded with a nitrogen blanket to prevent the coating or ink from oxidizing before cure. Nitrogen inertion reduces oxygen inhibition.
oligomers	A low molecular weight resin or polymer used in a radiation curable coating.
out-of-focus	When a lamp head is located further away from the substrate or closer to the substrate than the focal distance.
oxidizing	When the coating or ink reacts with oxygen and slows the polymerization process of the cure.
oxygen inhibition	Oxygen slows the cure response of UV curable coatings. The higher the ratio of exposed surface area to coating mass, the greater the impact oxygen has on the coating.
ozone (O_3)	An unstable, colorless gas with a penetrating odor that is generated by the reaction of short-wave UV light (≈184 nanometers) with air.
ozone-inhibiting (ozone-free) bulbs	Bulbs where the quartz is manufactured with an additive that prevents the transmission of UV beneath 200 nm in wavelength. It is the reaction of short-wave UV light (≈184 nanometers) with air that produces ozone.
Parts Per Million (PPM)	The units of the Threshold Limit Value (TLV) when referring to the maximum level of a substance that a person should inhale over an 8-hour shift during a 40-hour week without producing an ill effect. Also refer to Threshold Limit Value.
peak irradiance (peak power density)	The maximum irradiance measured over a sample period, measured in joules/cm^2/sec or watts/cm^2.

photoinitiator — A molecule which when exposed to a specific wavelength of energy forms a reaction that begins the cure process.

photopolymerization — Turning a liquid (wet) into a solid (dry) through exposure to UV light.

planar shutter — A shutter assembly that is attached to the outside of a lamp head. The louvered shutter moves perpendicular to the emitted UV light.

polymer — A macromolecule consisting of a large number of monomer units.

positive cooling — When the cooling air for the lamp head is blown through the lamp head and onto the substrate being cured. Positive cooling can be supplied through either an integral or remote cooling fan. With positive cooling, an additional exhaust system is required to remove heat and ozone.

post cure — The continuation of chemical reactions in the ink or coating after exposure to UV has ceased.

power density — Refer to irradiance.

quartz plate — Plates that allow UV energy to penetrate with minimal loss in intensity and are mounted in front of the lamp head. The plates are used to prevent positive cooling air and airborne contaminants from contacting the substrate, negative cooling air from contaminating the bulb and reflectors, or to remove some of the infrared that is radiated from the UV bulb. If the goal is to reduce the amount of heat contacting the substrate, additional cooling air must be blown across the quartz. If additional air is not used, the quartz will eventually heat up and begin radiating heat onto the substrate. To further reduce heat, the quartz can be coated with a material that passes UV light and absorbs infrared energy.

quartz tube — (1) A sealed tube made from a silicate material that is filled with a precise mixture of mercury and various inert gases and sometimes fitted with electrical connections. The vapor emits light when it is energized through the use of either a voltage arc or microwave energy. Often used to refer to the bulb.

(2) An open tube made from a silicate material through which a substrate can pass. The tube is often placed in front of a UV lamp head and flooded internally with Nitrogen. Parts traveling through the tube are then safeguarded from exposure to the oxygen and ozone in the lamp head cooling air.

reflector	Reflect and concentrate the UV light onto the substrate. Rolled from highly polished aluminum sheet metal or formed from borosilicate into elliptical or parabolic profiles. Elliptical profiles optimize the concentration of UV energy that is reflected by guiding the radiation into a tightly focused UV band while parabolic reflectors result in a flood of UV light. Holes or slots in the reflector allow cooling air to pass through. The holes or slots are engineered for size and location to provide both optimal and balanced airflow across the length of the bulb.
remote cooling fan (blower)	The cooling fan when it is mounted separate from the lamp head and ducted in to the lamp head.
RF	Radio Frequency. Any frequency between normally audible sound waves and the infrared light portion of the spectrum lying between 10 KHz and 1,000,000 MHz.
RF detector	Monitors RF levels in the vicinity of the UV system and signals the power supply to shut off the UV if RF levels exceed allowable limits.
screen	A wire mesh assembly attached to a microwave lamp head that allows UV to pass through but prevents RF from leaking from the unit.
short UV	Refer to UVC.
single	An electrode lamphead assembly with a cradle that supports only one bulb and one reflector.
shutter	An assembly designed to block UV light while passing cooling air.
solarization	The effect of the UV light on the quartz bulb. Over time, UV light and heat will cause the quartz to devitrify or revert back to a crystalline and porous state.
spectral output	The various wavelengths of light emitted from a UV bulb.
spectral output efficiency graph	A graph or chart showing the relative concentration of UV at various wavelengths for a particular bulb type. Typically, the concentration is provided as a normalized percentage where the energy is integrated over 10-nanometer bands to reduce the difficulty of quantifying the effects of line emission spectra.
starter	Used in electrode, ballast-based systems to vaporize the mercury. The starter puts a 3,000-4,000 volt potential across the bulb during start up and has an internal circuit that discontinues the potential when current is established.

starter bulb	Used in the start up of microwave systems to ignite the mercury vapor in the bulb.
static exposure	Exposure to a constant irradiance for a controlled period of time.
striking	The initial phase of the startup process where the mercury in the bulb is vaporized.
surface cure	When the UV material is cured only on the surface exposed to the UV.
tape test for measuring adhesion	When an X-cut or lattice pattern of 6 or 11 cuts are scratched through the UV cured material to the substrate. Pressure-sensitive tape is then applied over the cuts and removed. Pulling the tape away from the substrate will reveal the degree of adhesion. If any material between the lines is pulled off with the tape, the adhesion is poor. If the material remains, the adhesion is good. The recommended guidelines for testing and evaluation are documented in the ASTM spec D3359-95a under Methods A and B. Method A employs the X-cut and is used for coatings that are 5 mils or greater. Method B calls for lattice cuts and is recommended for coatings with 0-5 mils of thickness.
through cure	When the UV material is cured down to and including the material / substrate interface.
Threshold Limit Value (TLV)	The maximum exposure a person should receive over an 8-hour shift during a 40-hour week without producing an ill effect. Often reported in (mg / m^3) or ppm.
Time-Weighed Average (TWA)	Refer to Threshold Limit Value (TLV).
total energy	Refer to energy density.
transmittance	The ratio of the radiant energy passed through a body to the total radiant energy received by the body.
ultraviolet light	Radiant energy in the wavelength band of 100 to 400 nanometers.
UVA (315-400 nanometers)	The portion of the electromagnetic spectrum ranging between 315 and 400 nm. UVA represents the largest portion of UV energy and is commonly referred to as long UV. UVA is most responsible for skin aging and increased skin pigmentation. UVA is at the lower limit of sensitivity to the human eye.

UVB (280-315 nanometers)	The portion of the electromagnetic spectrum ranging between 280 and 315 nm. UVB is most responsible for reddening and burning of the skin and damage to the eyes.
UVC (200-280 nanometers)	The portion of the electromagnetic spectrum ranging between 200 and 280 nm. UVC is typically referred to as short UV.
UVV (400-445 nanometers)	The portion of the electromagnetic spectrum ranging between 400 and 445 nm. The V stands for visible UV.
vacuum UV (100-200 nanometers)	The portion of the electromagnetic spectrum ranging between 100 and 200 nm. UVV does not transmit in air.
viscocity	The state or quality of having a cohesive and sticky fluid consistency.
vitrification	The act of changing pure opaque quartz into clear non-porous quartz through a fusion process.
watt	One joule per second.
watt density	Refer to irradiance.
waveguide	Directs microwaves toward the bulb in microwave UV systems.
wavelength	The measured cycle length of a wave in the direction of propagation.