VB Bakeout
System Manual

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Inspecting the Packaging for Damage

The packaging RBD Instruments uses when shipping components is designed to withstand the demands of normal shipping activities. However, once the boxes leave our facility, their treatment is out of our control.

Warning! Wear protective latex gloves whenever handling the IRB600 Emitter. The oils on your hands and fingers can adversely affect the performance of the Emitter and could create a hazardous condition. If the Emitter lamp does come into contact with bare skin, carefully wipe the lamp with Isopropyl alcohol.

Inspect the outside container (if available), inner packaging, and components as soon as possible so that you can report any necessary damage claims in a timely manner with the shipping company. This is especially important when there is evidence of mishandling on the outside of the box.

Once you have confirmed that all components have arrived intact, verify that you have the following items.

- BC-3 Controller
- IRB600 Emitter Assembly
- Main Power Cable
- Voltage Output Cable
- TC Sensor Cable
- Vacuum Interlock Cable
- Kapton Tape
- 2.75" Gasket for each Emitter Assembly
- “Caution Hot Surface” safety signs

If any components are missing, please contact RBD Instruments at 541-330-0723 or start a ticket by sending an email to support@rbdinstruments.com.

Safety Notices

The equipment manufactured by RBD Instruments, Inc. (RBD) is designed with consideration of the safety of those who come in contact with them. In this manual we define the skills and knowledge that operators and maintenance personnel must have to interact with our products.

Authorized Personnel

Operators of RBD equipment are expected to be familiar with the technical information and instructions provided in the included documentation. It is also expected that, unless Operators have the skills and knowledge required by maintenance personnel, Operators will not attempt to repair or maintain the equipment without the assistance of a fully-qualified RBD employee. Doing so could void the warranty.

Your qualified and skilled maintenance personnel who will work with an RBD employee will have the following knowledge and experience:

- Training and experience with voltages above 230 VAC
- Familiarity with and understanding of the documentation included with the equipment
- Awareness, familiarity, and understanding of all safety notices and symbols that are included in the documentation and on the equipment

Safety Symbols

To help you quickly recognize possible safety hazards, we have provided safety symbols below that are used elsewhere in this document as well as on the equipment itself, as applicable.

This symbol indicates hazardous voltages may be present that could cause death or serious personal injury. Service to be done by trained personnel only.

This symbol indicates a risk of death, personal injury, and/or damage to equipment exists. Service to be done by trained personnel only.

This symbol indicates that the equipment must be unplugged from its power source before any service or maintenance is performed on the equipment.

VB Introduction

This manual provides information about the VB Vacuum Chamber Bakeout Package, which comprises the BC-3 Bakeout Controller and the IRB600 Emitter.

BC-3 Vacuum Chamber Bakeout Controller Specifications, Controls, and Connections

The BC-3 Controller provides all the necessary voltage and current required to operate the IRB600 Emitter. One BC-3 Controller can operate up to two IRB600 Emitter assemblies. It can also control heat tape: you cannot exceed 600 watts for two heat tapes or 1200 watts for one heat tape.

Specification	Description
Input Voltage	120 or 230 VAC @ 47-63 Hz, Single Phase
Output Power	600 W per standard IRB600 Emitter Assembly; up to two Emitter Assemblies or one Emitter Assembly and one heat tape per BC-3 Controller
Dimensions	12" wide x 3.5" high x 12" deep (fits in a standard 19" rack mount RU 2 height). 19" mounting brackets are included. The BC-3 controller can also be used as a table top unit.

Front Panel Controls	Description/Function
Power Switch	Turns the BC-3 Main Power ON and OFF
Output Voltage %	Controls the output voltage percentage from 0 to 100 percent of the line voltage
Temperature Controller	Sets the temperature setpoint limit
Timer	Sets the time during which the BC-3 provides output power
Vacuum Interlock	Enables and disables the vacuum interlock feature

Back Panel Connections	Description/Function
Emitter Connection	120VAC or 230 VAC output plug
Fuse	120 VAC/15 amps, or 230 VAC/8 amps
Vacuum Interlock BNC	Interlock cable connection to customer-provided vacuum gauge controller
Remote start	BNC connector for remote start of the timer. When the BNC input is low (because the contacts are shorted), the timer will start.
TC Input	J-type thermocouple temperature sensor cable plugs in here.

BC-3 Controller Diagrams

The diagrams below show the switches, buttons, and connections on the front and back panels of the BC-3 Controller.

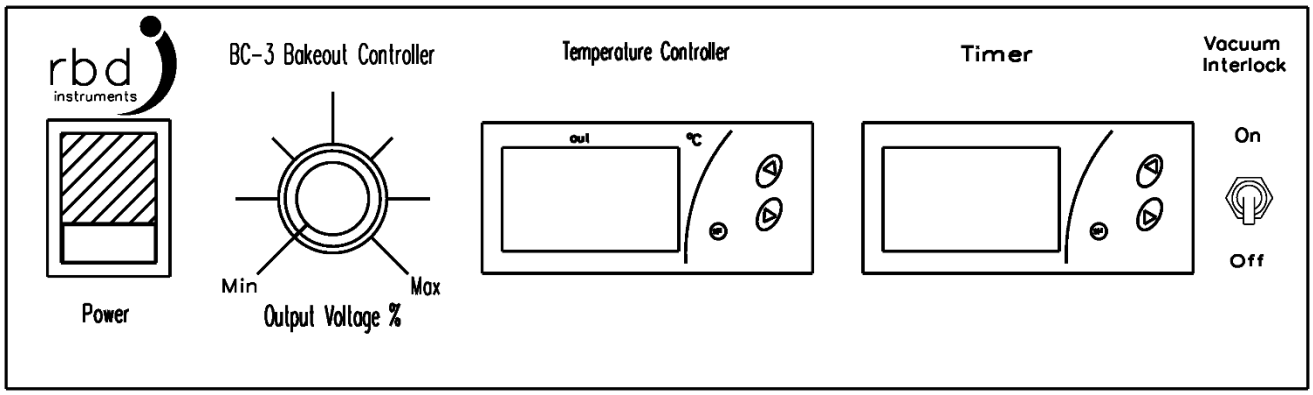


Figure 1: BC-3 Front Panel

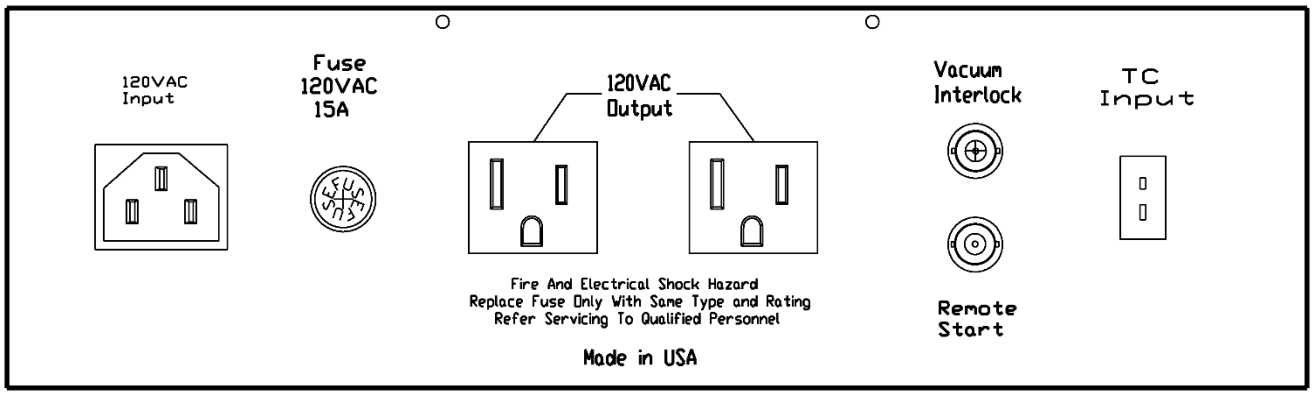


Figure 2: BC-3 Back Panel 120V

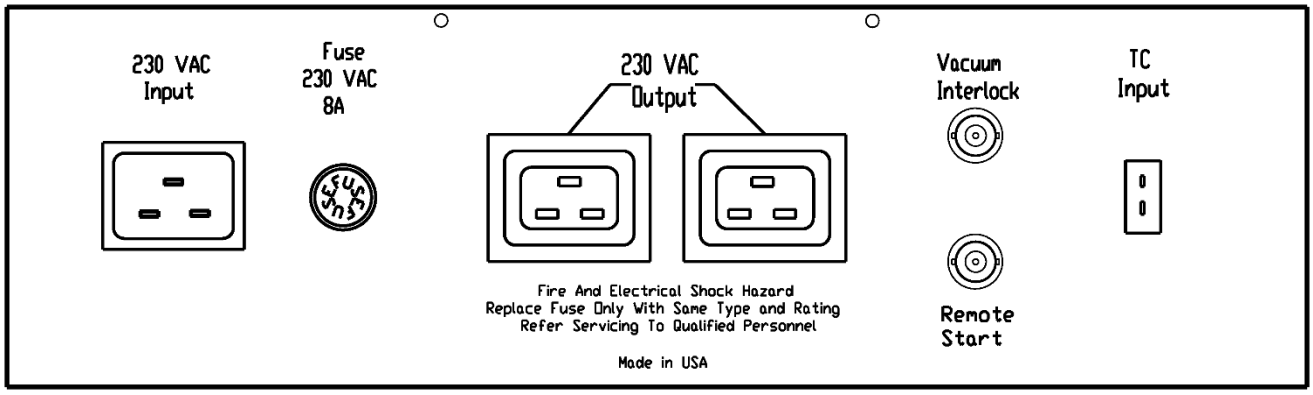
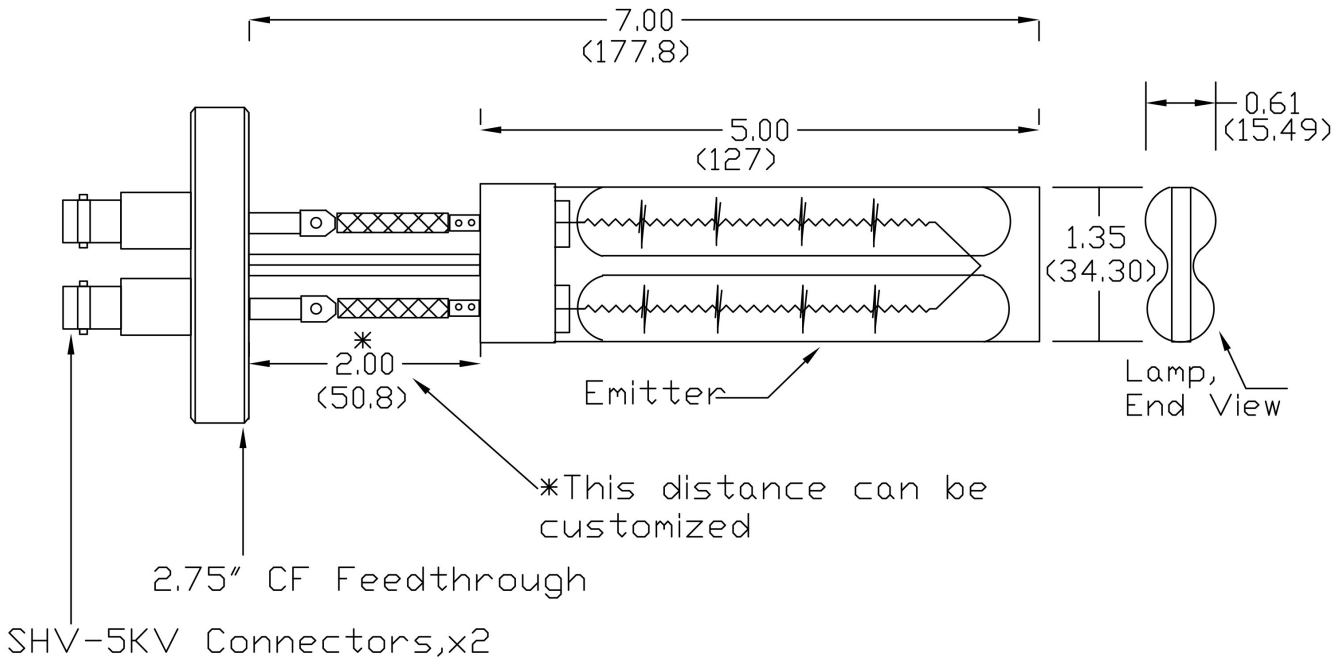


Figure 3: BC-3 Back Panel 230V

IRB600 Emitter Voltage and Dimensions

Power	Voltage
600 Watts	120 or 230 VAC @ 47-63 Hz, Single Phase



Dimensions in inches and (mm)

Installing the IRB600 Emitter Assembly

1. **Warning!** Do not touch the Emitter Assembly emitter without protective latex gloves on. The oils from your hands and fingers can adversely affect the performance of the emitter; oils are not good for the vacuum. Clean the Emitter Assembly with isopropyl alcohol if it accidentally comes in contact with skin.

2. Choose a vacuum chamber port that allows for maximum exposure of the emitter to the interior space of the vacuum chamber. This location must also ensure that the emitter does not touch any interior component or the inner wall of the vacuum chamber.

   Warning! To avoid overheating, do not install the Emitter Assembly on a 2.75" flange port that has a tube length of greater than 3 inches unless the emitter has been extended accordingly.

3. Remove the blank from the vacuum chamber port into which you are installing the emitter.
4. Place a new 2.75" copper gasket onto the open vacuum chamber flange. A gasket is included with your IRB600 shipment, one for each Emitter Assembly you are installing.
5. While wearing protective gloves, carefully remove the Emitter Assembly from its package.
6. Insert the emitter into the vacuum chamber.
7. Tighten the flange.
8. Pump down the system.

Installing the BC-3 Controller

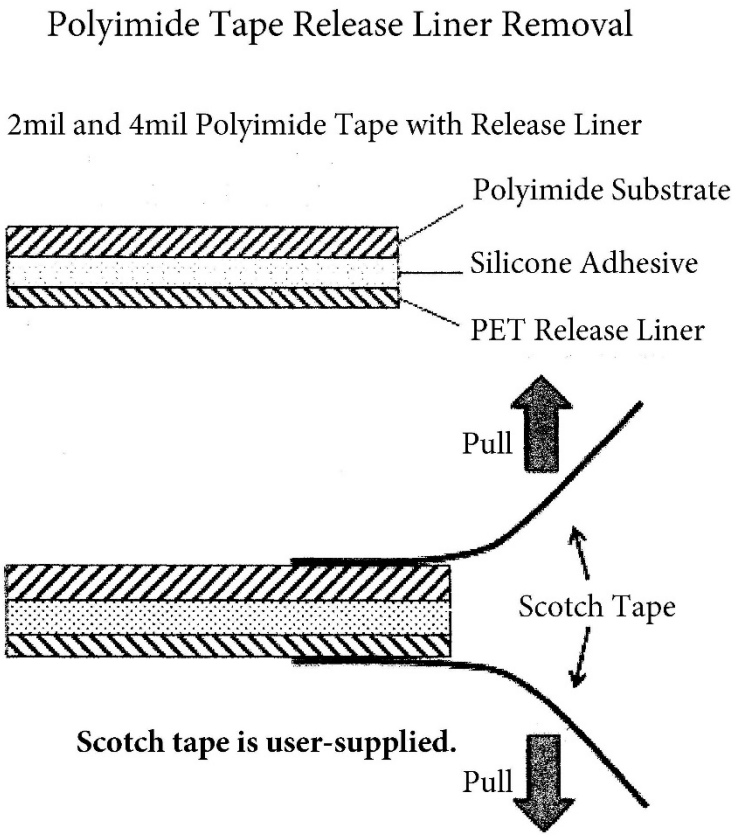
1. Place the BC-3 controller where you will be using it. 19" rack adaptor brackets and hardware are included if mounting into a standard electronics rack.
2. Make sure that the BC-3 main power switch is OFF.
3. Connect the output voltage cable(s) to the IRB600 emitter(s) or heating tape(s). The number of cables is determined by the quantity of emitters and heating tapes you're using.
4. Connect the TC sensor to the vacuum chamber (see "Installing the TC Sensor to the Vacuum Chamber" below). Connect the plug end of the TC sensor cable to the back of the BC-3 controller.
5. If you want to use the Vacuum interlock feature, connect the Vacuum interlock cable to the back of the BC-3 controller.
   The end of the vacuum interlock cable that is bare wire needs to be connected to a set point option on your vacuum gauge controller. It is important that your setpoint connection to the vacuum gauge controller is a relay type contact. Do not apply voltage to the vacuum interlock connector. When the Setpoint relay contacts close on your vacuum gauge controller, the BC-3 will provide power to the IRB600 emitters or heating tapes. If you do not want to use the Vacuum Interlock feature, set the Vacuum interlock switch on the BC-3 front panel to OFF.
6. If you want to use the remote start option, you will need to add a BNC cable (not included with your purchase) from the Remote Start BNC connector on the back of the BC-3 to your process controller. The control signal on your process controller needs to be a relay (not a voltage). When the relay is closed, the BC-3 bakeout timer will turn on and start the bakeout count down.
7. Plug in the main power cable to the back of the BC-3 and the other end of the main power cable into the power receptacle that you will be using to provide voltage to the BC-3.

Installing the TC Sensor to the Vacuum Chamber

The setpoint temperature you set the BC-3 to is influenced by the distance of the TC sensor from the IRB600 emitter or heating tape. Typically, you will want the TC sensor to be about 6 inches away from the IRB600 emitter or heating tape. If you are using two heating elements, place the sensor as close to

midway between the two heating elements as possible so that the TC sensor averages the chamber's temperature.

1. Determine the correct placement of the TC sensor on the vacuum chamber.
2. Bend the sensor to match the curvature of your vacuum chamber.
3. Remove the tape liner from the Kapton (polyimide) tape. The tape is sticky on one side, smooth on the other. Instructions for removing the tape liner are shown here.



4. Place the thermocouple sensor under the sticky side of the Kapton tape.
5. Attach the TC sensor to the chamber.
6. If not already done, connect the plug end of the TC sensor cable into the back of the BC-3 controller.

BC-3 Principles of Operation

The BC-3 controls up to two heating elements: two IRB600 emitters, one IRB600 emitter and one heating tape, or two heating tapes. The maximum wattage is 600 watts for each heating tape or one heating tape of 1200 watts.

The "Output Voltage %" knob sets the amount of power provided to the emitters or heating tapes.

A J-type thermocouple sensor provides temperature feedback from the vacuum chamber to the BC-3.

A timer sets the bakeout time from 0 to 999 minutes.

The Vacuum Interlock switch enables or disables pressure feedback from the user provided vacuum gauge controller.

A remote start option for automated bakeout processes is included.

Caution HOT safety signs are included to warn that the chamber is hot during bakeout.

Initial Setup of the BC-3 Controller

These steps are usually done only once.

1. Set the Output Voltage %

1. Turn on the BC-3 (red Power switch).
2. Set the Output Voltage % a little under the maximum. This lets you go higher if necessary. For example, if you set the temperature setpoint to 115°C but the temperature doesn't reach 115°C, you'll need to increase the Output Voltage % value.

2. Set the Temperature Controller Setpoint

Set the Temperature Controller setpoint. This is typically between 115°C and 125°C. When the temperature setpoint is reached, the heating elements are turned off.

1. Press the Set button.
    a. SP is displayed.
2. Press Set again.
3. Scroll the temperature up/down using the up and down arrows to the correct temperature. This will be 115°C to 150°C depending on the distance (discussed above).
4. Press Set again.
5. The display for the Temperature Controller now displays SP. After approximately one minute, the actual room temperature is shown.

3. Set the Timer

Set the Timer. You may not need to do this more than once if you always use the same amount of time for a bakeout. Typically, the bakeout time is set to 8-to-10 hours depending on the size of the vacuum

chamber and the desired vacuum level. A small chamber might need to be baked out only for an hour, while a large chamber might need to be baked out for 12 hours.

You will set only the upper limit of the timer; you don't set the lower limit because the lower limit is 0. The Timer display will normally show Off (standby mode) until you've set the timer.

1. Off is currently displayed.
2. Press and hold the Set button until "Ut" is displayed.
3. Hit the Set button again to display "Min" (minutes).
4. Press Set to save the "Min" setting. You'll set the number of minutes later in this procedure.
    a. "UT" is displayed again.
5. Press the down arrow.
    a. "Man" is displayed; it may look like Nan. This is manual mode, which you don't want; you want the timer to control when the bakeout process completes.
6. Press Set again.
7. Press the up or down arrow until "Off" is displayed.
8. Press Set to save Off.
9. Press the down arrow to see "Bc". This lets you indicate that you want the alarm to sound off when the bakeout timer has counted down to 0 (the bakeout has finished).
10. Press Set again. "Yes" blinks to indicate that you're setting an alarm after a specific number of minutes.
11. Press Set again.
    a. "Bc" is displayed again.
12. Press the down arrow.
13. "Top" is displayed. This lets you set the number of minutes for your bakeout.
14. Press Set to save "Top".
15. Press the Up or Down arrow to set the number of minutes for your bakeout.
    For an 8-hour bakeout, you'll set 480 minutes.
16. Press Set to save.
17. To exit programming mode, press and hold the Set button while pressing the down arrow. 0 is displayed.
18. Operate the BC-3 as indicated below.
    a. If you wait too long after completing the previous steps, "Off" is displayed indicating that you're in standby mode. This is OK. Simply follow the instructions for operating the BC-3 below.

Operating the BC-3

Operating Tip

To take advantage of molecular flow and increase the efficiency of the water vapor desorption process, start the bakeout as soon as you start pumping down the vacuum chamber. The Vacuum Interlock switch needs to be set to OFF.

By experimenting with the bakeout time you will be able to optimize the best bakeout time vs. the base vacuum ratio. For example, baking out for just 30 minutes into the turbo pump and then letting the chamber cool down for another 30 minutes will typically provide an adequate vacuum to start the ion pump. Once the ion pump has started, set the vacuum interlock switch to ON and bake into the ion pump for another 8 hours.

Using the Vacuum Interlock feature is explained below.

To run the BC-3 *after* setting the Output Voltage %, Temperature Controller Setpoint, and the Timer:

1. 

Place the Caution Hot Surface safety signs on the vacuum chamber.
2. Notify your colleagues that that you will be baking out your vacuum chamber. **This is Very Important**, as the chamber can get hot enough to burn when touched.
3. Turn on the BC-3 main power if it is not already on.
4. Set the Vacuum interlock switch to OFF initially. See "Using the BC-3 Vacuum Interlock" below for more information.
5. If 0 isn't displayed (because Off is displayed), press the Set button to display 0.
6. Press the down arrow to display the number of minutes you defined for the timer (for example, 480 minutes for an 8-hour bakeout).
7. Press Set to run the BC-3. "Run" is displayed briefly when the timer starts. This is replaced with the number of minutes that you set. This will count down until it reaches 0.

While the timer counts down, the temperature on the Temperature Controller increases until the temperature setpoint is reached.

Using the BC-3 Vacuum Interlock

The Vacuum Interlock function enables or disables the output voltage of the BC-3 controller via a BNC connector on the back of the controller. The vacuum interlock BNC provides a low current TTL voltage which, when pulled low via the setpoint relay in a user-provided vacuum gauge controller, will turn on the output voltage on the back of the BC-3. The vacuum gauge controller can be an ion gauge controller, a TC gauge controller or any other controller that can monitor the vacuum level in the chamber. The customer provided vacuum gauge controller must have an interlock relay output that can be programmed

by the user. The interlock relay connection to the BC-3 must be a relay with no voltage, only relay contacts. Applying a voltage to the vacuum interlock BNC will damage the BC-3 controller.

The recommended setpoint values for the vacuum gauge controller are:

- Turbo pumped vacuum chambers – 5 x 10 e -4 Torr
- Ion pumped vacuum chambers – 3 x 10 e -6 Torr

To operate the BC-3 using the vacuum interlock:

1. Set up the BC-3 as described previously in this document. Turn on the timer.
2. Set the Vacuum Interlock switch on the front panel of the BC-3 to ON. When the setpoint relay in the user provided vacuum gauge controller is ON (closed), the BC-3 will provide output voltage to the IRB600 / heating tape.
   If the vacuum in the chamber decreases to where the setpoint relay turns off (that is, the pressure in the chamber is too high), the BC-3 outputs will turn off. When the vacuum recovers, the BC-3 output voltage will turn back on. This cycle will repeat until the BC-3 timer completes the countdown to Zero minutes. During this time the BC-3 will also be regulated for temperature per the user defined temperature limit.

To bypass the Vacuum Interlock function if you do not want your vacuum gauge controller to regulate the pressure in the vacuum chamber, set the Vacuum Interlock switch on the front panel of the BC-3 to OFF.

Product Service

Any claims of product failure of performance must be reported to Company within 30 days of product's receipt by buyer. During this time, the buyer may return the product to RBD Instruments Company for repair at Company's cost and at no cost to the buyer. Please send an email to support@rbdinstruments.com for assistance or to obtain an RMA (Returned Merchandise Authorization) number.

The Company recognizes that expendable items may not function for the full year covered by this Limited Warranty. Expendable items, such as filaments, grids, special ceramics, and ionizers are therefore excluded from the Limited Warranty for the specific product of which they are a part. However, each of these expendable items will have its own warranty and will be replaced or repaired in accordance with its warranty.

Buyers who purchased the product through one of the Company's international sales representatives should contact their sales representative to make arrangements for return, repair, or replacement.

Limited Warranty

RBD Instruments, Inc. (referred to as "Company") warrants that the product(s) discussed in this document will perform in accordance with the accompanying written materials, and will be free from defects in materials and workmanship for the period of one year from receipt by buyer. In the event applicable law imposes any implied warranties, the implied warranty period is limited to 90 days from the date of receipt. Some jurisdictions do not allow such limitations on duration of an implied warranty, so the above limitation may not apply to the buyer.

Other than as described here, there are no other expressed or implied warranties.

Customer Remedies

The Company's and its suppliers' entire liability and Customer's exclusive remedy shall be the repair or replacement of the product that does not meet this Limited Warranty. This Limited Warranty is void if failure of the product has resulted from accident, abuse, modification, or misapplication of the product(s). Any replacement product will be warranted for the remainder of the original warranty period or 90 days, whichever is longer.

No Other Warranties

To the maximum extent permitted by applicable law, the Company and its suppliers disclaim all other warranties, either express or implied, including, but not limited to implied warranties of merchantability and fitness for a particular purpose. This limited warranty gives Customer specific legal rights. Customer may have other rights depending on the jurisdiction.

No Liability for Damages

To the maximum extent permitted by applicable law, in no event shall the Company or its suppliers be liable for any damages whatsoever (including without limitation, special, incidental, consequential, or indirect damages for personal injury, loss of business profits, business interruption, loss of business information, or any other pecuniary loss) arising out of the use of or inability to use this product, even if the Company has been advised of the possibility of such damages. In any case, the Company's and its suppliers' entire liability under any provision of this agreement shall be limited to the amount actually paid by the buyer.

In addition, this warranty does not cover loss, damage, or defects that result from transportation to buyer, improper care by buyer, buyer-supplied software or other components, unauthorized changes, use, or misuse (including, but not limited to, use outside of the specified environmental conditions).