

Model PVIV-TC-VAC

Temperature Controlled Vacuum Chuck



User's Manual

Oriel®
INSTRUMENTS
A Newport Corporation Brand

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1 INTRODUCTION

Oriel Instruments offers the PVIV-TC-VAC temperature controlled vacuum chuck for use with the Oriel Instruments I-V Test System. This assembly positions and holds a variety of sample shapes and sizes for testing. It had been designed to easily incorporate a chiller, vacuum pump, and electrical contact probes.

The sliding stage provides a means of positioning the sample or reference cell under the light source output. A thermistor incorporated into the vacuum plate may be used for temperature monitoring of the sample. The cooling plate's temperature range allows for testing to be performed under a variety of conditions. When used with a controlled cooling system such as the Oriel PVIV-CHILLER, highly accurate and repeatable test results may be obtained.

Prior to installation, read this instruction manual and all other documentation which pertains to the system. Check to ensure that all parts have been included. If there are any questions or concerns, contact Oriel Instruments before incorporating this assembly into the PVIV system. Refer to Section 8.1 for contact information.

Included items with the chuck:

- PNs 90026536, 91530-1040, 9002653, 90026534, 90023583: Temperature controlled vacuum chuck assembly
- PN SP-2: 2" Post qty 4
- PN SP-4: 4" Post qty 4
- PN BC-5: Clamp qty 4
- PN 84-40-114: Pipe to Hose Fitting qty 2
- PN 84-20-006: Tubing, 1/4" OD PVC
- PN 90009203: Cable, BNC maLe to double banana plug, 60" lg qty 1
- PN 90026574: Connector, red banana jack to #8 spade lug qty 2
- #6-32 x 3/4" lg socket hd cap screw, qty 4
- #1/4-20 x 1/2" lg socket hd cap screw, qty 4
- #8-32 x 1/8" lg pan hd screws, qty 4
- PN TA-8Q20-10: Thread adaptor (English), 1 pkg
- PN TA-8M6-10: Thread adaptor (Metric), 1 pkg
- PN 90-11-065: Allen wrench, 7/64
- PN 90-11-069: Allen wrench, 3/16
- PN 90-11-046: Allen wrench, 1/8

The following accessories are sold separately (refer to Section 6 for more information):

- PN PVIV-CHILLER: Chiller
- PN PVIV-VAC-PUMP (-220V): Vacuum Pump
- PN PVIV-PROBE-KIT: Electrical Contact Probes
- PN PVIV-XA: PVIV Measurement Systems in 1, 3, 5, or 10 Amp configurations

The end user is responsible for providing a chiller line relief valve, tubing and filtration, as well as the cooling liquid.

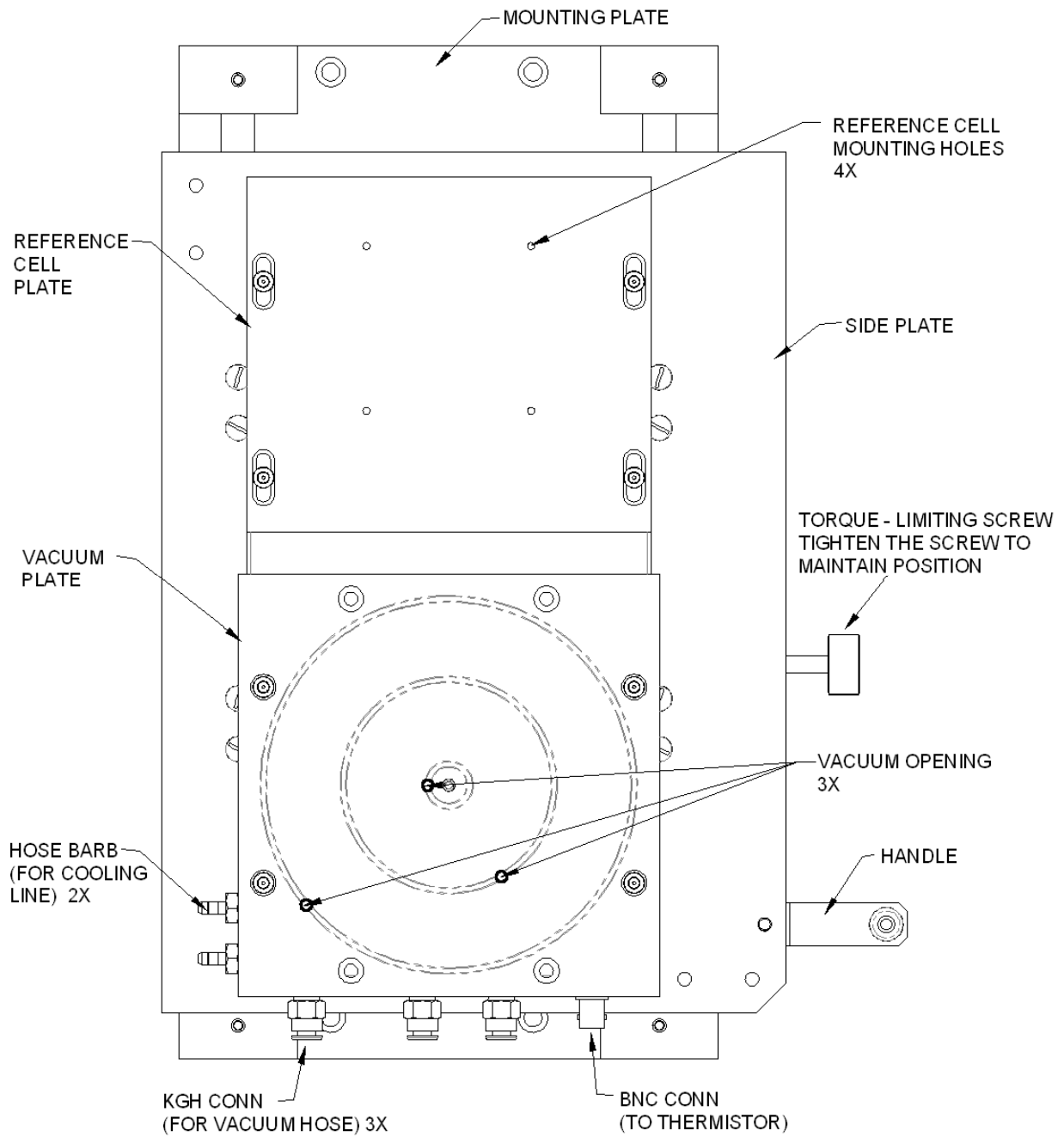


FIGURE 1: VACUUM CHUCK FEATURES

2 BASIC INSTALLATION

2.1 LOCATION OF ACCESSORIES

Position the vacuum pump and chiller in locations where the AC mains can be reached and air can flow freely over the units. Blocking air flow in any way may cause overheating, which will damage the equipment. The vacuum pump case will get very warm during use, so it must not be located in an area where personnel may come into contact with it. Refer to the instruction manuals that came with the pump and chiller, and follow their guidelines for installation and operation of these products.

2.2 SETTING UP THE CHUCK

The PVIV-TC-VAC is shipped with two stop blocks installed so that the slide will not move while in transit. The stops must be moved outward to enable the sliding action and allow access to the chuck's mounting holes. To set up the slide prior to its first use, loosen the two set screws on each of these stop blocks with the supplied 1/8" hex wrench. Slide them outward, as shown in Figure 2, until they are flush with the edge of the base plate. Note that two other stop blocks are already in position on the opposite rail. Re-tighten the two set screws to secure the two blocks that had been moved. Please note that whenever moving this chuck, the stop blocks should be relocated back to the "transit" position to prevent damage to the unit.

Refer to Figure 3 for overall product dimensions of the PVIV-TC-VAC. Mounting holes are provided for securing the chuck to an optical table, as shown in Figure 4 (U.S. size) and Figure 5 (metric size).

Note: some components are not shown for clarity.

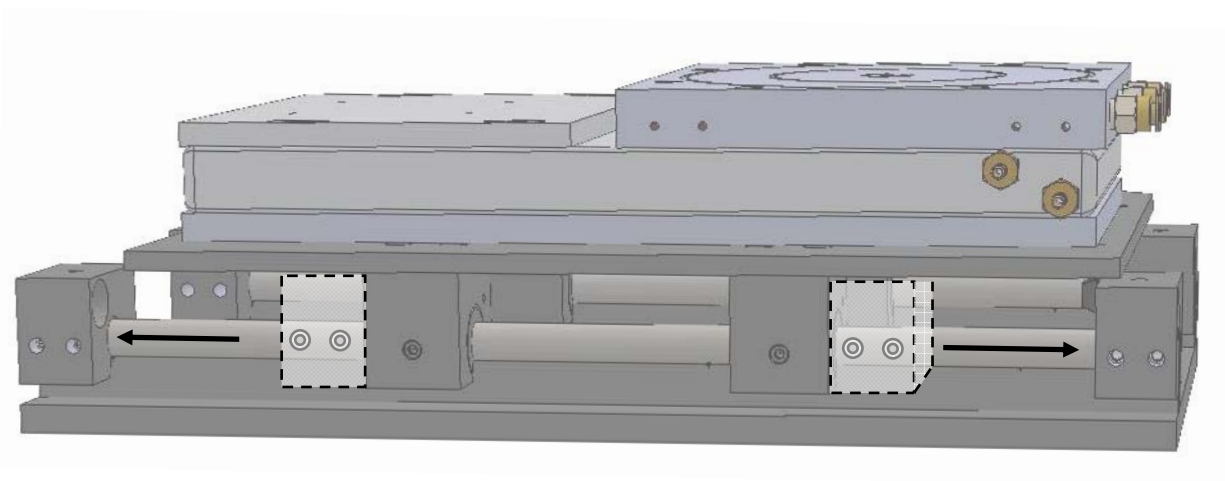


FIGURE 2: STOP BLOCKS

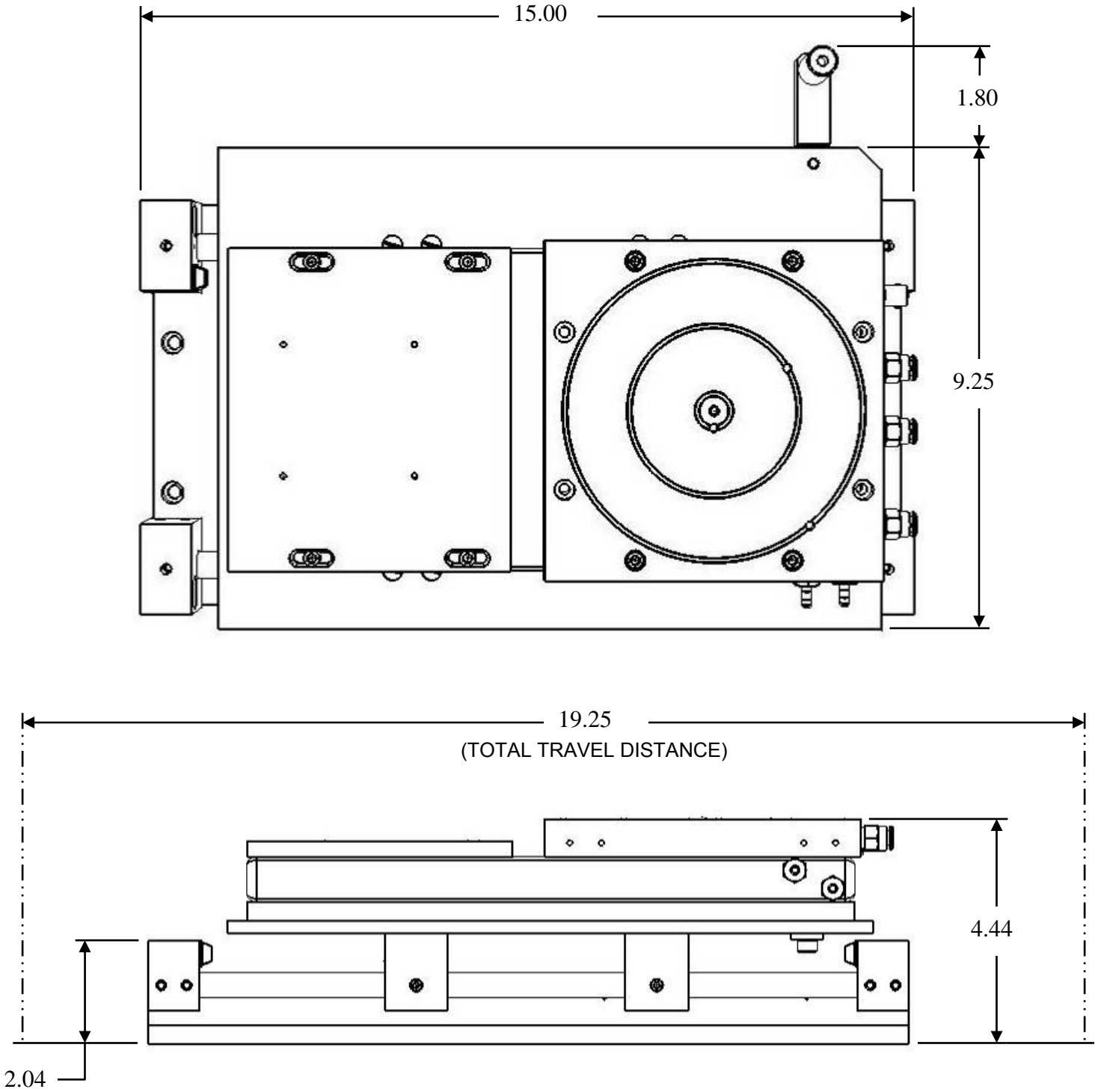


FIGURE 3: DIMENSIONS, INCHES

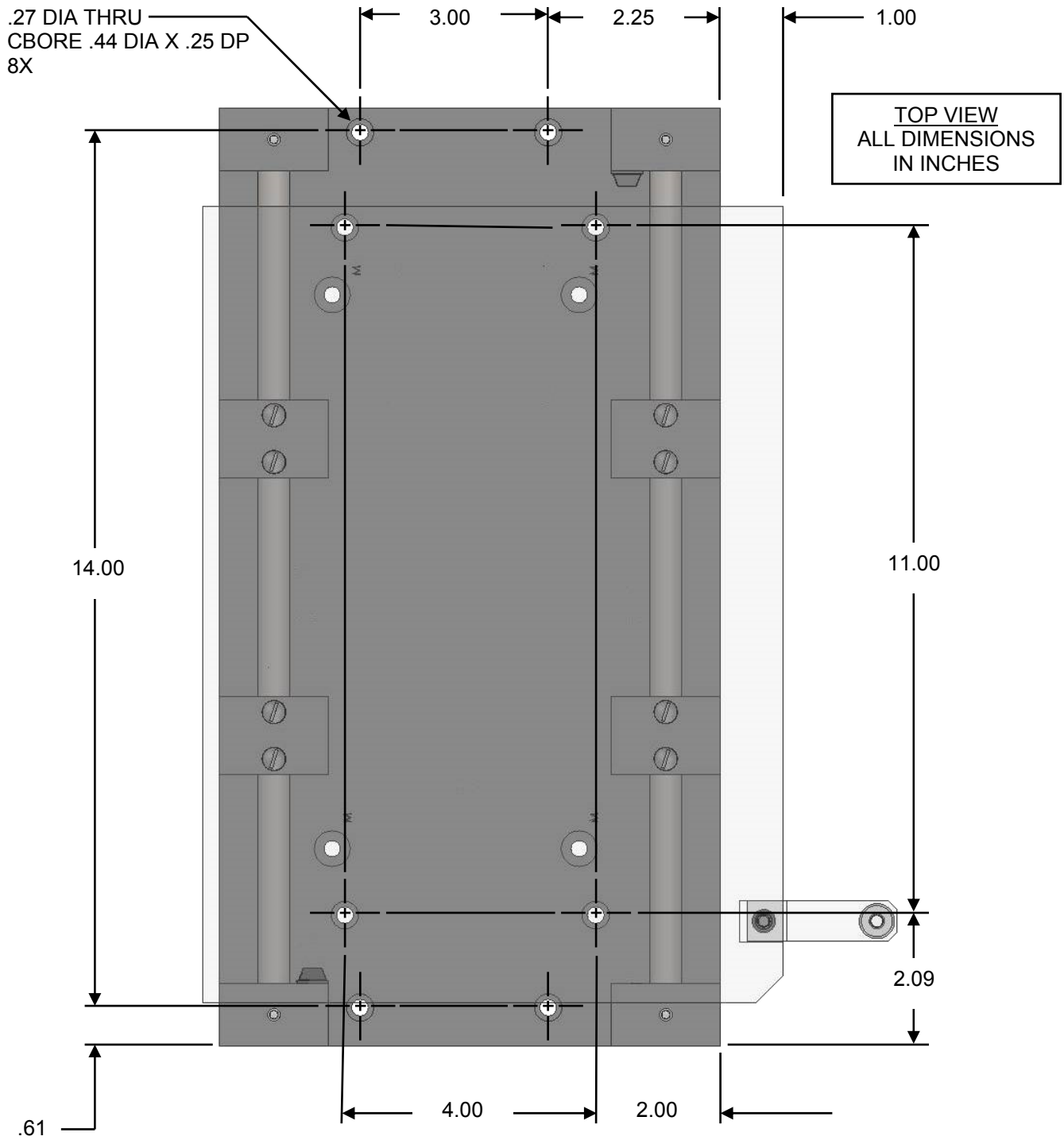


FIGURE 4: MOUNTING HOLES, U.S. SIZE

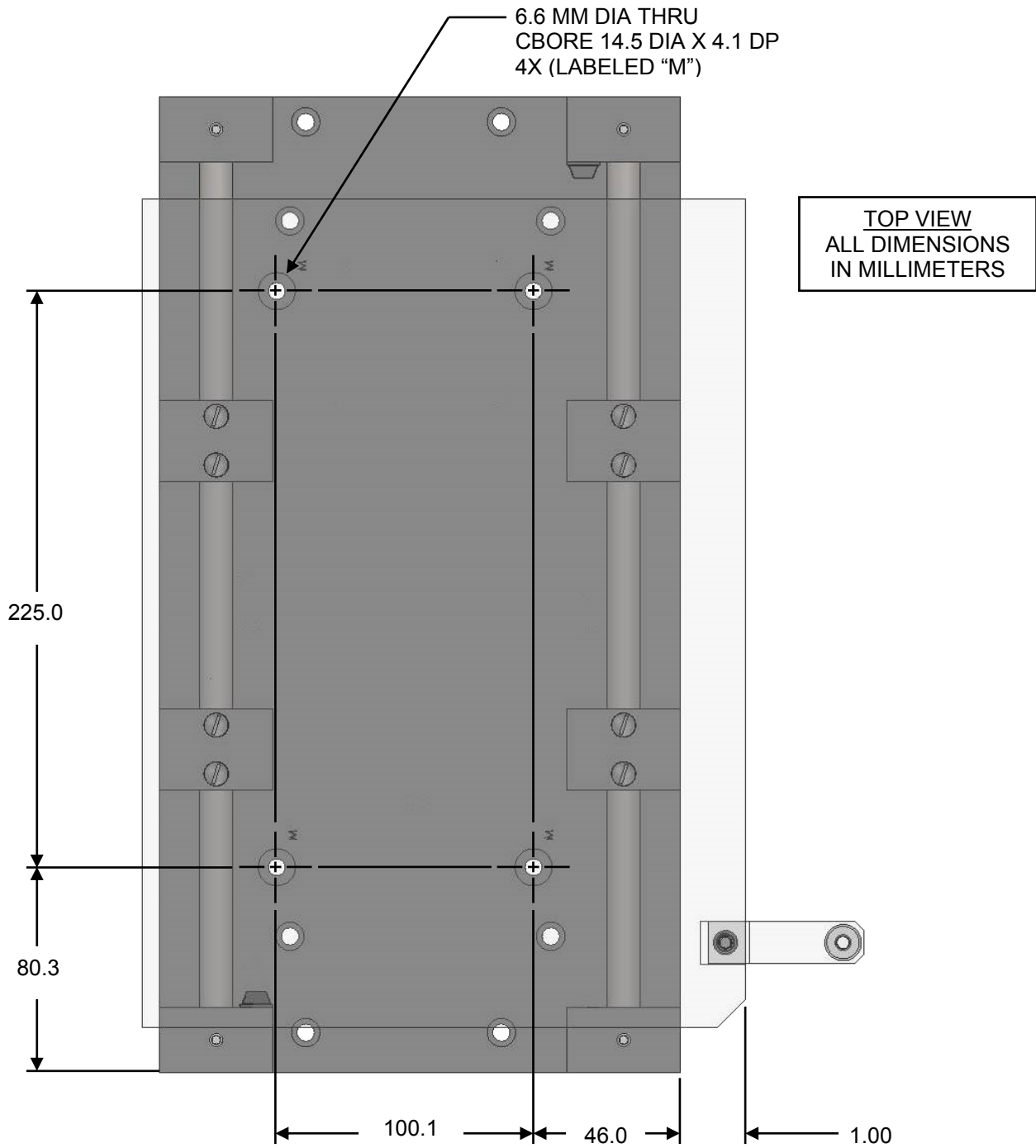


FIGURE 5: MOUNTING HOLES, METRIC

2.3 MOUNTING WITH NEWPORT SOLAR SIMULATORS

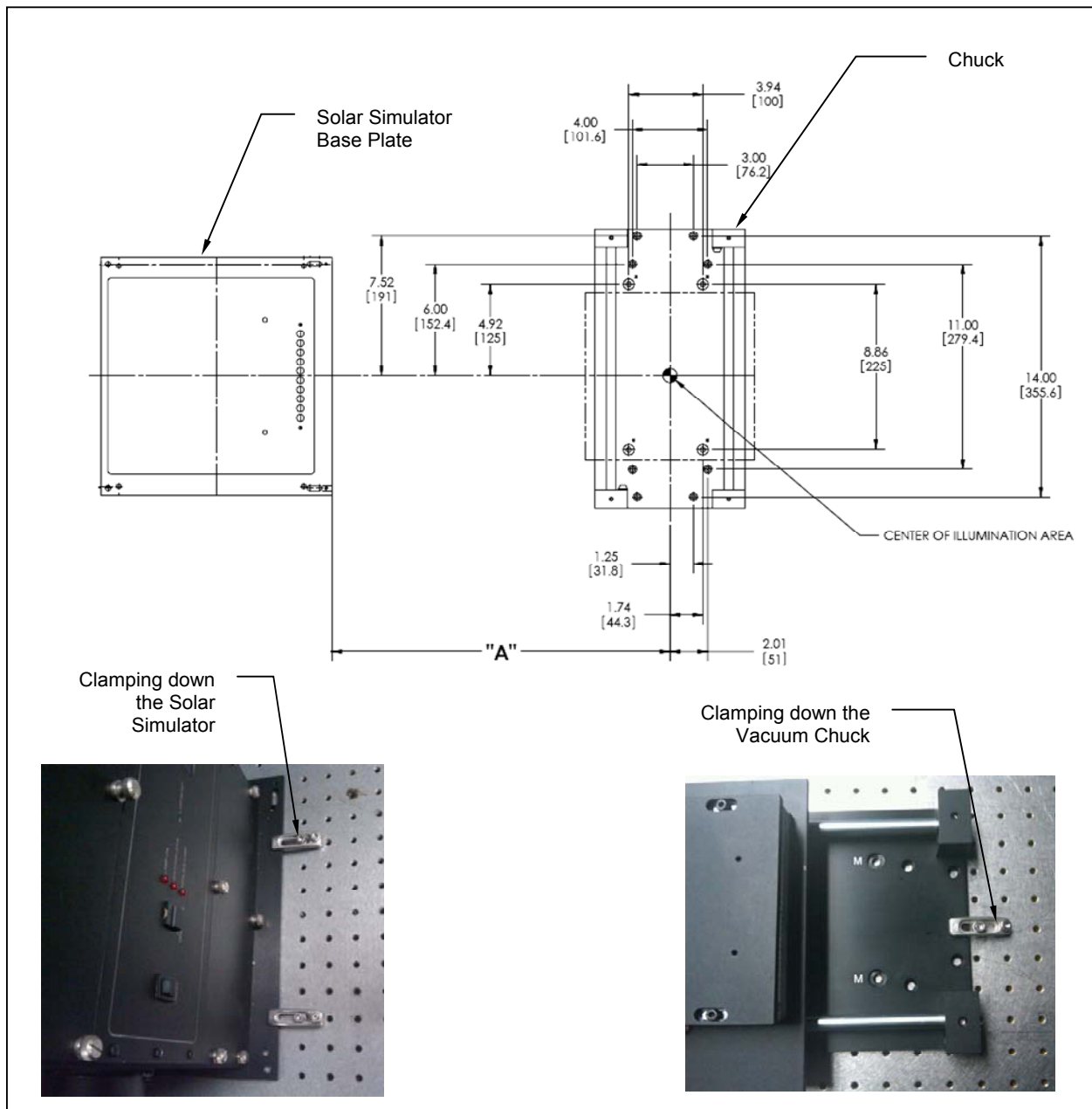
The sample or reference cell under test must be located at the correct working distance from the PVIV system's light source output. The vacuum chuck or light source may need to be raised vertically to achieve this.

The vacuum chuck also needs to be positioned properly to the center of the illuminated area of the solar simulator. To achieve this, please refer to Figure 6 and the table below.

The following tables show how to mount the PVIV-TC-VAC to the appropriate location with all of the Newport solar simulator models. If you are mounting the solar simulator and chuck to a standard optical table, some of the mounting holes may not line up with the thread holes on the optical table. In such cases, please use the clamps (BC-5) included. Refer to the following table and figure 6 for where to use the clamps and the mounting dimensions. If you are using a metric optical table, some metric adaptors are included for the posts. You may need to provide your own metric screws.

Family	Model #	Output Beam Size	Solar Simulator Working Distance	To get to solar simulator working distance (Height)	Clamps Figure 6	Dimension "A" Figure 6
	VeraSol-2	2" x 2"	8.0" +/- 0.5"	No additional mounting equipment required	Clamp down PVIV-TC-VAC	Mount directly underneath
AAA	94023A	2" x 2"	12" +/- 0.5"	No additional mounting equipment required	Clamp down PVIV-TV-VAC	10"
	94043A	4" x 4"	6" +/- 0.5"	Use 2.5" post (SP-2.5) to lift the solar simulator	Clamp down PVIV-TV-VAC	10"
	94063A	6" x 6"	7" +/- 0.5"	Use 2.5" post (SP-2.5) to lift the solar simulator	Clamp down PVIV-TV-VAC	14.5"
	94083A	8" x 8"	15" +/- 0.5"	Use 2" post (SP-2) to lift the solar simulator	Clamp down PVIV-TV-VAC	7.4"
	94123A	12" x 12"	12" +/- 0.5"	No additional mounting equipment required	Clamp down PVIV-TC-VAC	6.0"
	94123A-CPV	12" x 12"	4" +/- 0.5"	Use 8" post (SP-8) to lift the vacuum chuck	Clamp down Solar Simulator	6.0"

Family	Model #	Output Beam Size	Solar Simulator Working Distance	To get to solar simulator working distance (Height)	Clamps Figure 6	Dimension "A" Figure 6
ABA	94022A	2" x 2"	2" +/- 0.5"	Use 3" (SP-3) post to lift the vacuum chuck	Clamp down Solar Simulator	5.4"
	94042A	4" x 4"	6" +/- 0.5"	Use 2.5" (SP-2.5) post to lift the solar simulator	Clamp down PVIV-TV-VAC	10.4"
	94062A	6" x 6"	7" +/- 0.5"	Use 4" (SP-4) post to lift the solar simulator	Clamp down PVIV-TV-VAC	14.7"
	94082A	8" x 8"	15" +/- 0.5"	Use 2" post (SP-2) to lift the solar simulator	Clamp down PVIV-TV-VAC	10.0"
	LSH-7320	2" x 2"	11.0" +/- 0.5"	No additional mounting equipment required	Clamp down PVIV-TC-VAC	Mount directly underneath
ABB	94011A (-ES)	1.5"x1.5"	7" +/- 0.5"	No additional mounting equipment required	Clamp down PVIV-TC-VAC	7.2"
	94021A	2" x 2"	2" +/- 0.5"	Use 3" (SP-3) post to lift the vacuum chuck	Clamp down Solar Simulator	5.4"
	94041A	4" x 4"	6" +/- 0.5"	Use 2.5" (SP-2.5) post to lift the solar simulator	Clamp down PVIV-TV-VAC	10.4"
	94061A	6" x 6"	7" +/- 0.5"	Use 4" (SP-4) post to lift the solar simulator	Clamp down PVIV-TV-VAC	15"
	94081A	8" x 8"	15" +/- 0.5"	Use 2" post (SP-2) to lift the solar simulator	Clamp down PVIV-TV-VAC	10.0"



**FIGURE 6: CHUCK POSITION RELATIVE TO NEWPORT SOLAR SIMULATORS
 (DIMENSIONS GIVEN IN INCHES [MILLIMETERS])**

2.4 COOLING PLATE CONNECTIONS

The types of fluids that can be used in a chiller can vary, based upon manufacturer recommendations and the end user's specific application. It is the customer's responsibility to ensure that all tubing and valves purchased for the chiller line are compatible with the cooling fluid being used.

Oriel provides the PVIV-CHILLER which includes PVC tubing for easy integration with the cooling plate. Refer to section 7.3 for specifications.

It is the customer's responsibility to provide a pressure relief valve on the chiller line for safety. This valve must be located where discharge will not harm any persons or equipment. The environment should be clean so that contaminants will not clog the discharge port. The pressure at which the valve provides relief must be selected with reference to the operating specifications of the chiller and the characteristics of the tubing material.

Filtration of the coolant line is the customer's responsibility. Clogging of the cooling plate by contaminants will void the product warranty. To best prevent leakage at the chiller, it may be necessary that the chiller not be placed on the floor below the cooling plate.

2.5 VACUUM PLATE CONNECTIONS

Oriel supplies PVC tubing, a brass barb fitting, and a shutoff valve for use with a vacuum pump (sold separately as PVIV-VAC-PUMP). A 220V model is also available for applicable geographic regions. It is the customer's responsibility to note the specifications of their vacuum pump and ensure that these items are compatible with that particular model of pump.

The shutoff valve should be located where it can be conveniently accessed for ease of sample removal from the vacuum plate.

The valve must be oriented so that the arrow is pointing as shown in Figure 7. When the valve knob is set to the SHUT position, the vacuum holding the sample in place is automatically released (there is no exhaust port).

Ensure that the tubing is not kinked when connecting it from the vacuum pump to the vacuum plate. The connector which the vacuum line tubing is attached to the vacuum plate depends upon the sample size being tested. Refer to Figure 8 for details.

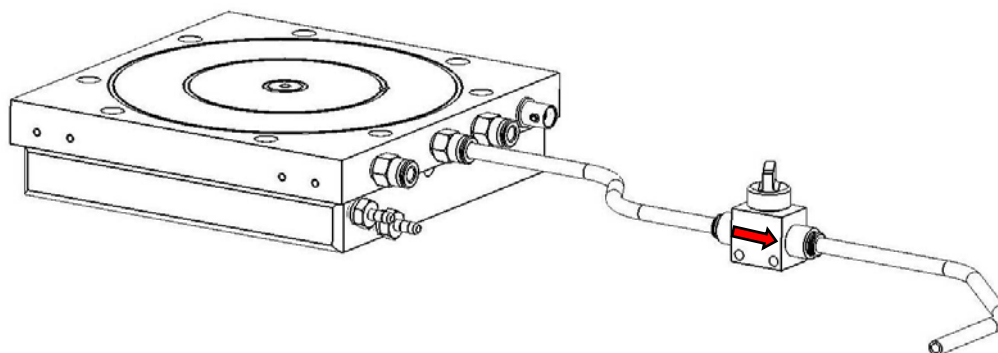


FIGURE 7: VALVE ORIENTATION

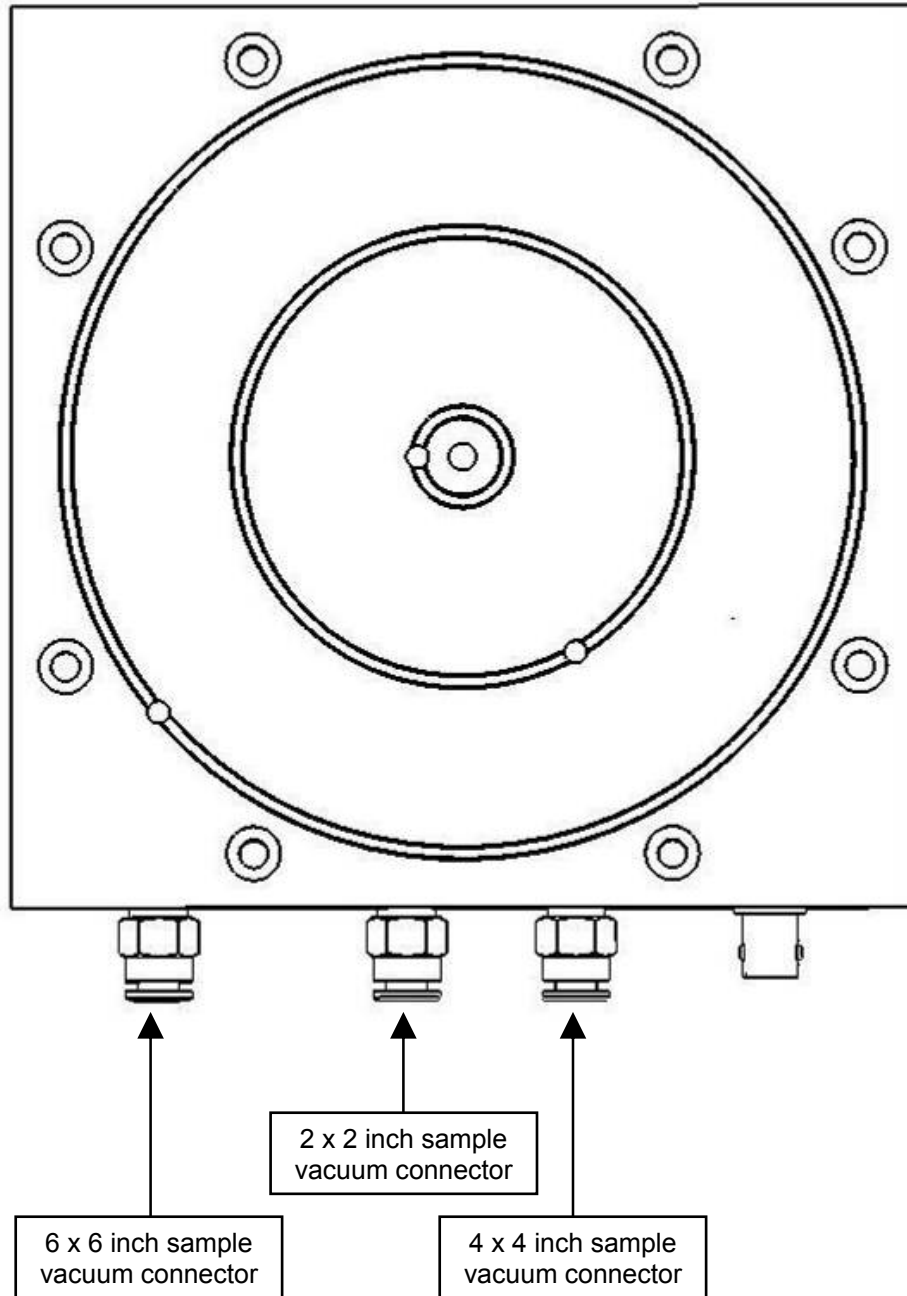


FIGURE 8: VACUUM PLATE CONNECTIONS

3 SAMPLE AND REFERENCE CELL POSITIONING

Prior to use, ensure that the thermistor in the center of the vacuum chuck is able to move up and down freely when gently pressed with a finger. This NTC (negative temperature coefficient) thermistor has a value of 10K ohms at 25°C. It is wired to the female BNC connector located on the side of the vacuum chuck, as shown in Figure 9.

With the valve knob set to SHUT, start the vacuum pump. Center the sample to be tested on the vacuum plate. When satisfied with its location on the plate, turn the valve knob to the OPEN position to allow the vacuum to hold the sample in place.

In order to remove the sample when testing is complete, turn the valve knob to the SHUT position. The vacuum will be released, allowing the sample to be removed from the plate.

Note that vacuum may be applied and released using the pump controls, if the vacuum pump being used is equipped with that feature.

Mount the reference cell on its plate, as shown in Figure 10. Use four #6-32 x 3/4" lg socket head cap screws to secure the reference cell.

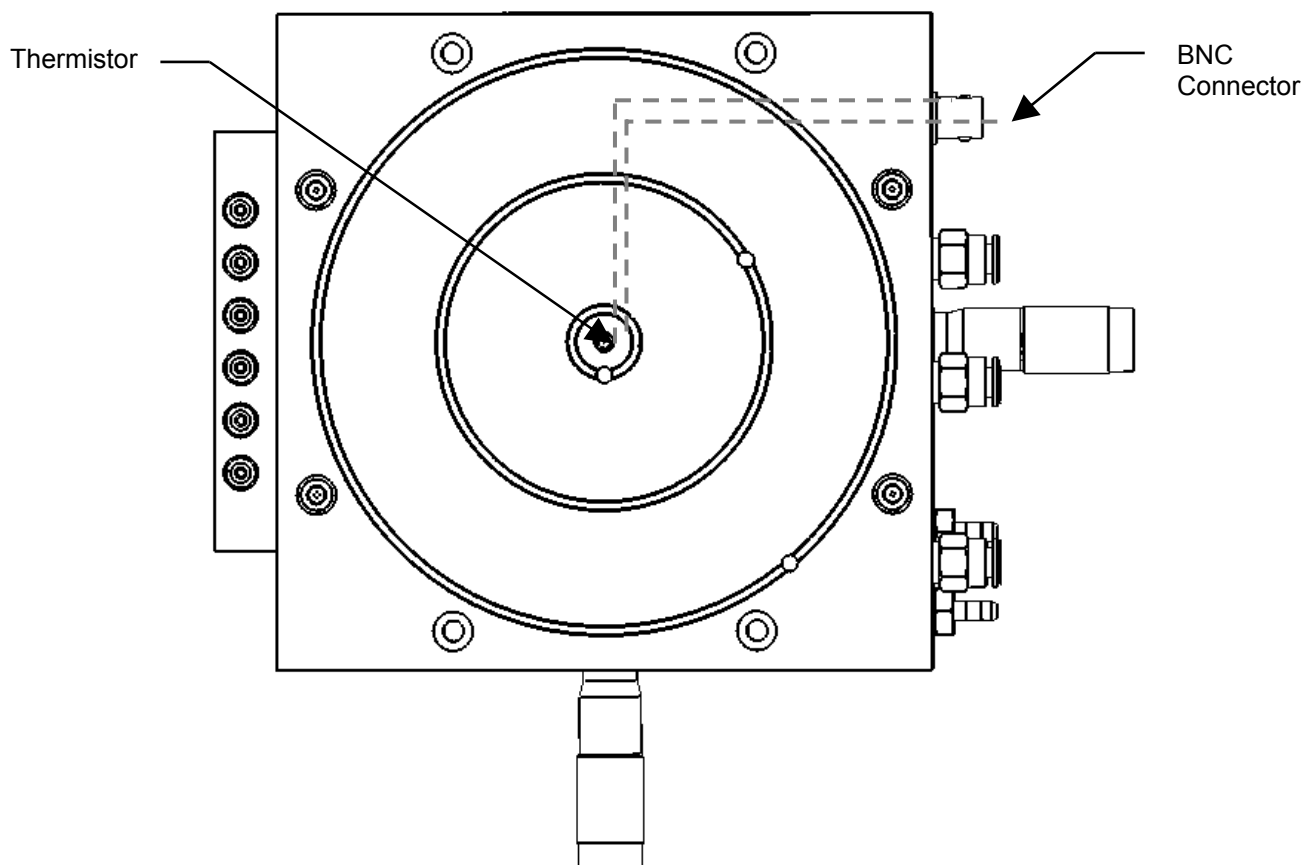


FIGURE 9: THERMISTOR

NOTE ORIENTATION
OF REFERENCE CELL
CONNECTORS

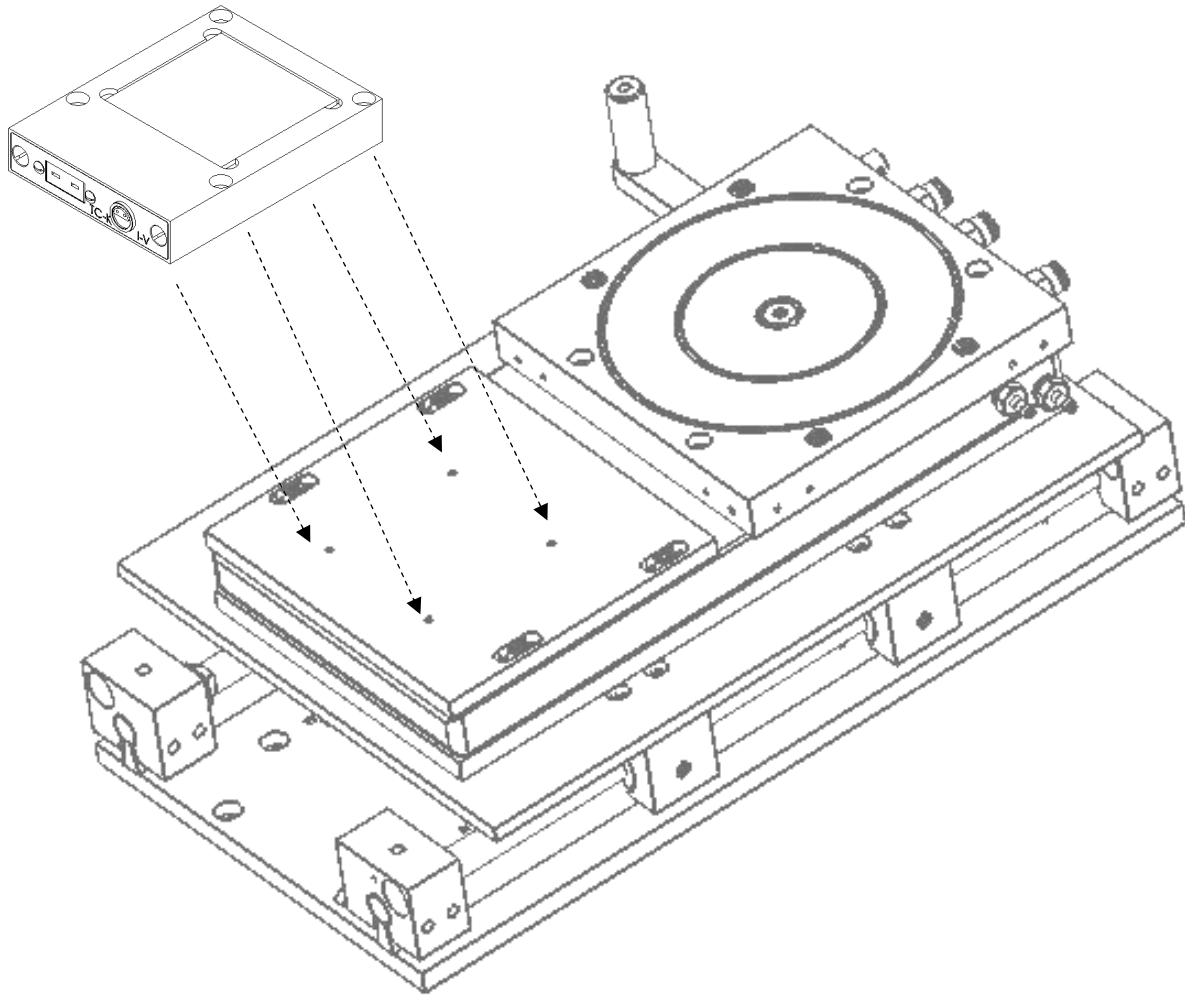


FIGURE 10: REFERENCE CELL INSTALLATION

4 TEST SETUP

Connection to the PVIV system is achieved using the cables and connectors included with the vacuum chuck. Refer to Figure 11 and Figure 12 for typical setup configurations. Section 6 lists some optional accessories for alternate configurations. Other products may be available to assist users with non-standard test setups. Contact an Oriel Instruments sales engineer or regional sales representative for more information.

Oriel Instruments offers an electrical contact probe, model PVIV-PROBE-KIT, which is designed to work with this vacuum chuck. Each assembly contains one (1) magnet-mounted electrical probe with X-Y micro-positioning control. Refer to the manual included with the probe kit for assembly and installation instructions.

The reference cell offered by Oriel Instruments includes its own meter, thermocouple, and interconnection cable. Refer to the reference cell manual for details on its usage.

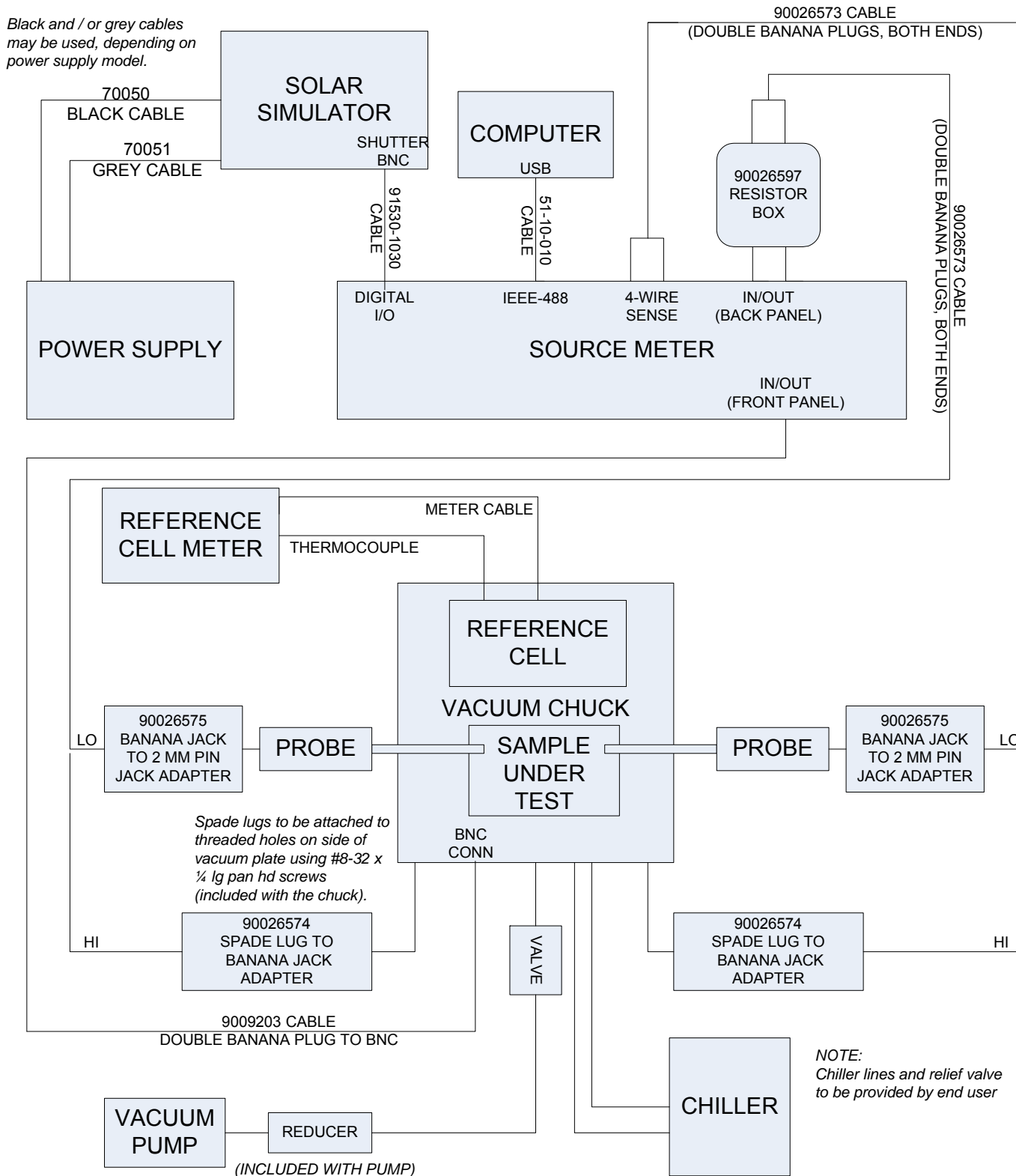


FIGURE 11: ONE, THREE, AND FIVE AMP SYSTEMS, TYPICAL SETUP

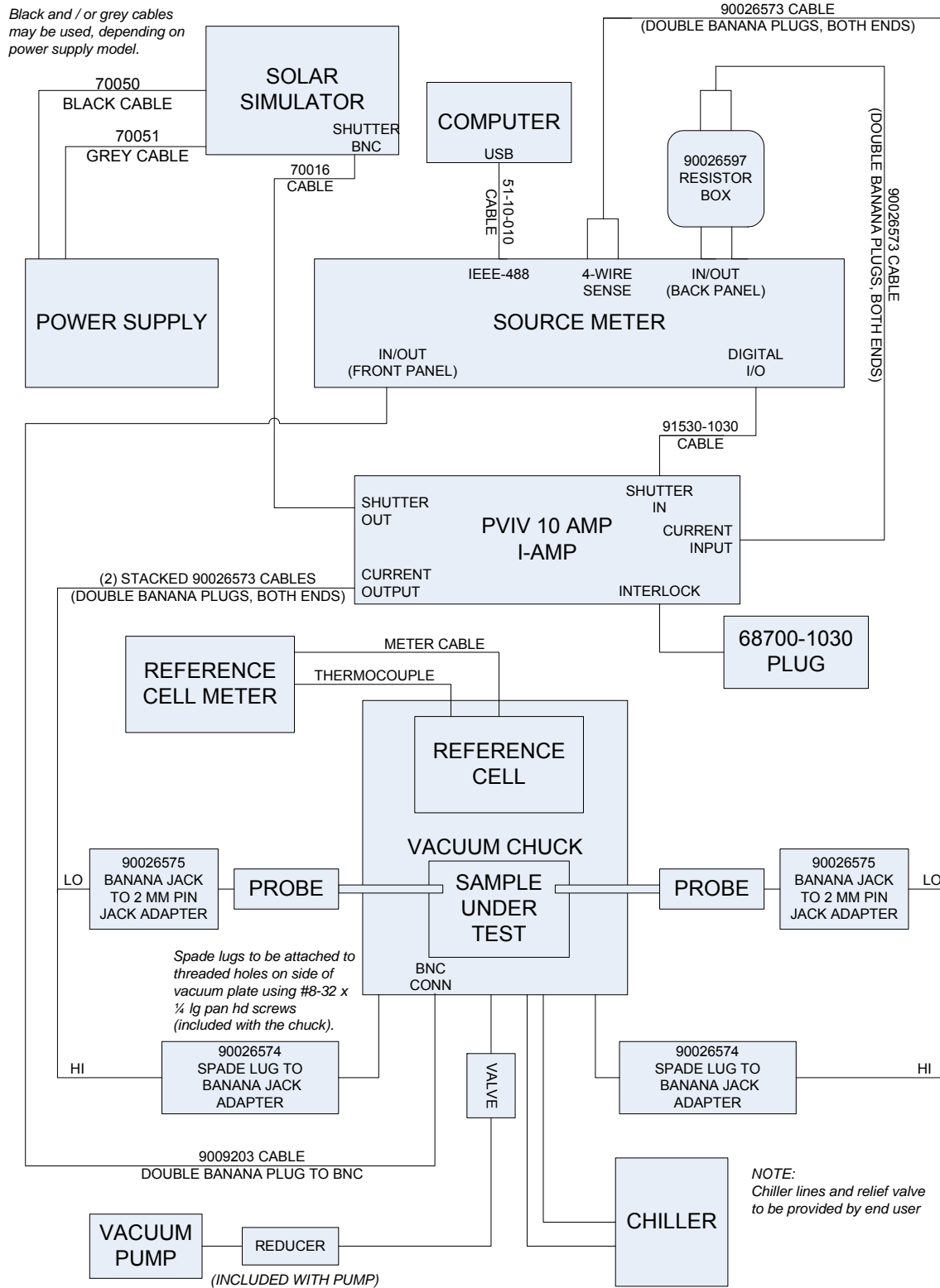


FIGURE 12: TEN AMP SYSTEMS, TYPICAL SETUP

5 CARE AND MAINTENANCE

This assembly is designed to support the weight of a test sample and the associated test equipment, such as probes and wiring. It is not intended to support heavy loads. Do not place any other items on top of the vacuum chuck assembly. Mechanical damage to the stage caused by overloading is not covered under warranty.

Monitor the condition of all tubing and wiring, particularly in the areas where they are exposed to light from the source. Replace these items if they begin to show signs of wear or UV degradation.

When the unit is stored, contaminants cannot be allowed to enter the cooling plate ports and tubing.

Refer to the manuals provided with the chiller, vacuum pump, probe kit, and PVIV system for information regarding their usage, maintenance and storage.

If the system is to be moved, put into storage, or needs to undergo maintenance, the tubing going to the chiller and vacuum pump will need to be removed. Turn off all equipment. Release the vacuum in the entire vacuum line by using the shutoff / relief valve. Move the stop blocks towards the center of the rail to lock the slide in place.

Place a container to collect the cooling liquid. The tubes and cooling plate must be emptied. To ensure that all liquid has been removed from the cooling plate, it may be necessary to tilt it so that the hose barbs point downward. The stage is not designed to support the weight of the assembly when it is on its side; support the vacuum chuck assembly with one hand when it is in this position.

The PVIV-TC-VAC should NEVER be shipped with cooling liquid inside. It must be completely drained. Note that, just as with any container for coolant, this plate may be hazardous when empty since it may still retain product residues (vapors, liquid). Observe all warnings and precautions listed for the cooling liquid which is used.

If this product is to be shipped to Oriel Instruments for servicing or return, notify the person issuing the RMA number of the type of cooling liquid that was used in this unit. Material safety data sheets for this liquid must be provided. If any assembly is shipped to Oriel without this information, it will be returned, unopened, to the sender.

6 OPTIONAL ACCESSORIES AND REPLACEMENT PARTS

The PVIV system has been designed to operate with the accessories listed below. Oriel Instrument cannot guarantee system performance if other products are substituted. Refer to Section 7 for specifications.

Part Number	Description
PVIV-CHILLER	Chiller, Thermoelectric
PVIV-VAC-PUMP	Vacuum Pump, 110 VAC / 60 Hz
PVIV-VAC-PUMP-220	Vacuum Pump, 220 VAC / 50 Hz
PVIV-PROBE-KIT	Electrical Contact Probe Kit
90023529	Valve, Shutoff / Relief
84-20-006	PVC Tubing, 1/8 ID x 1/4 OD (available in 1 ft increments)
91541 (optional)	Tabbing wire, 4" long (qty 10 per package)
10-60-034 (optional)	Red test lead, banana plug to minigrabber
10-60-035 (optional)	Black test lead, banana plug to minigrabber

For replacement connectors, please contact Oriel Instruments. Note that for installation, Teflon® tape will be required, which is not provided.

Oriel cannot guarantee field-repaired product performance. For guarantee, this item must be returned to Oriel for servicing.

7 SPECIFICATIONS

7.1 VACUUM CHUCK SPECIFICATIONS

Model PVIV-TC-VAC

Sample Size	6 inch x 6inch square maximum
Sample Temp Sensing Range	-40°C to 125°C, ±1°C
Temperature Controlled Range	15 ⁰ C – 35 ⁰ C
Temperature Holding	< 0.5 ⁰ C per minute with exposure to 1 SUN
Sample Temperature Sensing Tolerance	0.25 ⁰ C
Vacuum Plate Material	Nickel plated aluminum
Vacuum Requirement	150 mm Hg minimum
Motion, Micrometer	25 mm X-Y travel
Micrometer Sensitivity	1 µm
Cold Plate Size	6 inch x 12 inch
Weight	22lbs (10 kg) (does not include packaging)
Cable	BNC male to dual pin tip plugs, 5 feet long Operating Voltage: 30 VAC / 60 VDC maximum Operating Temperature: +50°C maximum
Tubing, Vacuum	1/4 OD clear PVC, 10 feet long
Connector, Thermistor	BNC female conn
Connectors, Vacuum	KGH conn accepts 1/4" OD tubing, quantity (3)
Connectors, Chiller	Hose barb accepts 1/8" ID tubing, quantity (2)

7.2 PROBE SPECIFICATIONS

Specifications for the probe assembly are included for reference only. Refer to the instruction manual that came with this item for more details. In the event of discrepancies between this manual and the probe assembly manual, the probe assembly manual takes precedence.

Model PVIV-PROBE-KIT

Probe quantity per kit	1
Probe base quantity per kit	1
Positioning (coarse)	Magnetic
Positioning (fine)	X-Y joystick, Z adjustment knob
Positioner material	Delrin
Arm material	Brass
Probe tip material	Beryllium copper [other materials available as a special order]
Probe tip diameter	125 µm standard [other sizes available]
Bracket material	Zinc plated steel
Arm length	4.75" long x .087 diameter
Tip dimensions	.025" shank diameter, .75" long, 12 µm diameter tip
Magnetic mount dimensions	1.75" long x .44" wide
Overall Dimensions	3.75" high x .44" wide x 5" long at maximum arm extension
Wire length	18"
Connector	Pin tip plug, .080 inch (2 mm) diameter
Maximum current	3 amps per probe, when using the standard probe tip
Weight	1 lbs (does not include packaging)

7.3 THERMOELECTRIC CHILLER SPECIFICATIONS

Specifications for the chiller are included for reference only. Refer to the instruction manual that came with this item for more details. In the event of discrepancies between this manual and the vacuum pump manual, the chiller manual takes precedence.

Model PVIV-CHILLER

Operating Range	2 ⁰ C – 45 ⁰ C
Set Point Range	50°F to 113°F (10°C to 45°C)
Control Accuracy	±2°C
Precision	0.1 ⁰ C with constant load
AC/DC Power Supply	200 watt, 13.5 VDC; 100 – 240 VAC output
Voltage	13.5 V DC, universal AC
Current	15 Amps max
Power consumption	< 100 W
Maximum Coolant Outlet Pressure	25 psig (1.72 bar)
Cooling Capacity	160 W at 20 ⁰ C
System Proof Pressure	50 psig (3.36 bar)
Coolant Fluid Connections	Quick disconnect fittings for 1/4 OD tubing
Coolant Outlet Pressure	5 psi @ 500mL/min, max 35 psi
Tank Volume	75 ml
Pump	500mL/minute
Coolant:	25% propylene glycol/ water
Noise	< 65 dB with 25% propylene glycol/water
Dimensions	7.5" x 5" x 7" (L x W x H, plus fittings)
Weight	8.1 lbs (3.7 kg) (does not include packaging)
Operating Environment	Less than 40°C
Storage Environment	Less than 100°C
Alarm	250 VAC 1 Amp dry contact relay
Communication	Top Panel or RS-232
Connection	1/8" CPC
Modes	Cool or heat cycle
Standards	CE

7.4 VACUUM PUMP SPECIFICATIONS

Specifications for the vacuum pumps are included for reference only. Refer to the instruction manual that came with this item for more details. In the event of discrepancies between this manual and the vacuum pump manual, the vacuum pump manual takes precedence.

Model PVIV-VAC-PUMP

Motor	100 - 110 VAC, 60 Hz, 1/8 HP
Vacuum	650 mm Hg max
Power Consumption	65 Watts
Current	0.7 Amps max
Sound Level	50 dB approx
Flow Rate	20 lpm (at 0 mm Hg) to 2 lpm (at 600 mm Hg)
Port Thread	5/16"
Coupler	Hose barb reducer from 5/16 ID to 1/8 ID tubing
Tubing	5/16" ID PVC, 1 foot long
Dimensions	11" x 6.5" x 6"
Weight	7.7 lbs. (does not include packaging)
Discharge	Oil free
Connection/coupler	Barded for use with 1/4" ID tubing

Model PVIV-VAC-PUMP-220

Motor	220 - 240 VAC, 50 Hz, 1/8 HP
Vacuum	650 mm Hg max
Power Consumption	60 Watts
Current	0.3 Amps max
Sound Level	50 dB approx
Flow Rate	17 lpm (at 0 mm Hg) to 1.5 lpm (at 600 mm Hg)
Port Thread	5/16"
Coupler	Hose barb reducer from 5/16 ID to 1/8 ID tubing
Tubing	5/16" ID PVC, 1 foot long
Dimensions	11" x 6.5" x 6"
Weight	7.7 lbs. (3.5 kg) (does not include packaging)
Discharge	Oil free
Connection/coupler	Barded for use with 1/4" ID tubing

8 WARRANTY AND SERVICE

8.1 CONTACTING ORIEL INSTRUMENTS

Oriel Instruments belongs to Newport Corporation's family of brands. Thanks to a steadfast commitment to quality, innovation, hard work and customer care, Newport is trusted the world over as the complete source for all photonics and laser technology and equipment.

Founded in 1969, Newport is a pioneering single-source solutions provider of laser and photonics components to the leaders in scientific research, life and health sciences, photovoltaics, microelectronics, industrial manufacturing and homeland security markets.

Newport Corporation proudly serves customers across Canada, Europe, Asia and the United States through 9 international subsidiaries and 24 sales offices worldwide. Every year, the Newport Resource catalog is hailed as the premier sourcebook for those in need of advanced technology products and services. It is available by mail request or through Newport's website. The website is where one will find product updates, interactive demonstrations, specification charts and more.

To obtain information regarding sales, technical support or factory service, United States and Canadian customers should contact Oriel Instruments directly.

Newport Corp - Oriel Instruments
31950 E Frontage Rd
Bozeman, MT 59715 USA

Telephone: 877-835-9620 (toll-free in United States)
949-863-3144

Fax: 949-253-1680

Sales: OrielPV.sales@newport.com

Repair Service & Technical Assistance: OrielPV.service@newport.com

Customers outside of the United States must contact their regional representative for all sales, technical support and service inquiries. A list of worldwide representatives can be found on Oriel's website: <http://www.newport.com/b/oriel>.

8.2 REQUEST FOR ASSISTANCE / SERVICE

Please have the following information available when requesting assistance or service:

- Contact information for the owner of the product.
- Instrument model number (located on the product label).
- Product serial number and date of manufacture (located on the product label).
- Description of the problem.

To help Oriel's Technical Support Representatives diagnose the problem, please note the following:

- Is the system used for manufacturing or research and development?
- What was the state of the system right before the problem?
- Had this problem occurred before? If so, when and how frequently?
- Can the system continue to operate with this problem, or is it non-operational?
- Were there any differences in the application or environment before the problem occurred?

8.3 REPAIR SERVICE

This section contains information regarding factory service for this product. The user should not attempt any maintenance or service of the system beyond the procedures outlined in this manual. This product contains no user serviceable parts other than what is noted in this manual. Any problem that cannot be resolved should be referred to Oriel Instruments.

If the instrument needs to be returned for service, a Return Merchandise Authorization (RMA) number must be obtained prior to shipment to Oriel Instruments. This RMA number must appear on both the shipping container and the package documents.

Return the product to Oriel Instruments, freight prepaid, clearly marked with the RMA number and it will either be repaired or replaced at Oriel's discretion.

Oriel is not responsible for damage occurring in transit. The Owner of the product bears all risk of loss or damage to the returned Products until delivery at Oriel's facility. Oriel is not responsible for product damage once it has left the facility after repair or replacement has been completed.

Oriel is not obligated to accept products returned without an RMA number. Any return shipment received by Oriel without an RMA number may be reshipped by Newport, freight collect, to the Owner of the product.

8.4 NON-WARRANTY REPAIR

For Products returned for repair that are not covered under warranty, Newport's standard repair charges shall be applicable in addition to all shipping expenses. Unless otherwise stated in Newport's repair quote, any such out-of-warranty repairs are warranted for ninety (90) days from date of shipment of the repaired Product.

Oriel will charge an evaluation fee to examine the product and determine the most appropriate course of action. Payment information must be obtained prior to having an RMA number assigned. Customers may use a valid credit card, and those who have an existing account with Newport Corporation may use a purchase order.

When the evaluation is completed, the owner of the product will be contacted and notified of the final cost to repair or replace the item. If the decision is made to not proceed with the repair, only the evaluation fee will be billed. If authorization to perform the repair or provide a replacement is obtained, the evaluation fee will be applied to the final cost. A revised purchase order must be submitted for the final cost. If paying by credit card, written authorization must be provided that will allow the full repair cost to be charged to the card.

8.5 WARRANTY REPAIR

If there are any defects in material or workmanship or a failure to meet specifications, notify Oriel Instruments promptly, prior to the expiration of the warranty.

Except as otherwise expressly stated in Oriel's quote or in the current operating manual or other written guarantee for any of the Products, Oriel warrants that, for the period of time set forth below with respect to each Product or component type (the "Warranty Period"), the Products sold hereunder will be free from defects in material and workmanship, and will conform to the applicable specifications, under normal use and service when correctly installed and maintained. Oriel shall repair or replace, at Oriel's sole option, any defective or nonconforming Product or part thereof which is returned at Buyer's expense to Oriel facility, provided, that Buyer notifies Oriel in writing promptly after discovery of the defect or nonconformity and within the Warranty Period. Products may only be returned by Buyer when accompanied by a return material authorization number ("RMA number") issued by Oriel, with freight prepaid by Buyer. Oriel shall not be responsible for any damage occurring in transit or obligated to accept Products returned for warranty repair without an RMA number. Buyer bears all risk of loss or damage to the Products until delivery at Oriel's facility. Oriel shall pay for shipment back to Buyer for Products repaired under warranty.

WARRANTY PERIOD

All Products (except consumables such as lamps, filters, etc) described here are warranted for a period of twelve (12) months from the date of shipment or 3000 hours of operation, whichever comes first.

Lamps, gratings, optical filters and other consumables / spare parts (whether sold as separate Products or constituting components of other Products) are warranted for a period of ninety (90) days from the date of shipment.

WARRANTY EXCLUSIONS

The above warranty does not apply to Products which are (a) repaired, modified or altered by any party other than Oriel; (b) used in conjunction with equipment not provided or authorized by Oriel; (c) subjected to unusual physical, thermal, or electrical stress, improper installation, misuse, abuse, accident or negligence in use, storage, transportation or handling, alteration, or tampering, or (d) considered a consumable item or an item requiring repair or replacement due to normal wear and tear.

DISCLAIMER OF WARRANTIES; EXCLUSIVE REMEDY

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES. EXCEPT AS EXPRESSLY PROVIDED HEREIN, ORIEL MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, REGARDING THE PRODUCTS, SOFTWARE OR SERVICES. NEWPORT EXPRESSLY DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE FOR THE PRODUCTS, SOFTWARE OR SERVICES. THE OBLIGATIONS OF ORIEL SET FORTH IN THIS SECTION SHALL BE ORIEL'S SOLE LIABILITY, AND BUYER'S SOLE REMEDY, FOR BREACH OF THE FOREGOING WARRANTY. Representations and warranties made by any person including distributors, dealers and representatives of Oriel / Newport Corporation which are inconsistent or in conflict with the terms of this warranty shall not be binding on Oriel unless reduced to writing and approved by an expressly an authorized officer of Newport.

8.6 LOANER / DEMO MATERIAL

Persons receiving goods for demonstrations or temporary use or in any manner in which title is not transferred from Newport shall assume full responsibility for any and all damage while in their care, custody and control. If damage occurs, unrelated to the proper and warranted use and performance of the goods, recipient of the goods accepts full responsibility for restoring the goods to their original condition upon delivery, and for assuming all costs and charges.

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