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**DESCRIPTION**

The P4800 Heat-treatment Incubator, supplied by Boekel Scientific, is a dosimeter heat-treatment system comprised of the incubator, a timer, and a digital thermometer. The system provides excellent incubator performance at an economical cost. Features include an analog thermostat for temperature control, a digital temperature display, and a double-walled chambered door.

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**APPLICATION(S)**

The P4800 Heat-treatment Incubator is used for post-irradiation heat-treatment or annealing of radiochromic dosimeters to achieve dosimeter stability.

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**SPECIFICATIONS**
**Physical Specifications:**

Chamber Volume	0.8 cu. ft. (0.02 cu. m)
Chamber Dimensions	29.2cm (w) x 30.5 (d) x 26.7 (h)
Temperature Range	Ambient +5°C to 60°C
Temperature Stability	±3°C at 37°C
Temperature Uniformity	±1°C at 37°C (within the bounds of the shelf area)
Temperature Display Resolution	0.1°C
Supply Voltage Range	120V +/- 10%, 50/60 Hz
	230V +/- 10%, 50/60 Hz
Power Rating	Boekel Model 133000: 90W
	Boekel Model 133000-2: 90W
Plug Options	US, EU, or UK plug (user specified)
Shelves Included	2
Shelf Area	1.7 ft. <sup>2</sup>
Shipping Weight	22 lbs. / 10 kg

**Included Components:**

- Integral bottom shelf and adjustable shelves included. Additional shelving may be purchased (max 4 shelves per unit).
- Magnetic door latch
- Power switch
- Pilot light (heater indication light)

**Storage:**

Store at room temperature (15 – 25 °C).

**Environmental Influences:**

Intended for indoor use. Optimal performance within ambient temperature range of 10°C to 35°C, with maximum relative humidity of 80% (non-condensing). Suitable for operation at altitudes of up to 6,500 feet.

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**USAGE**
**How to Use:**

- Please refer to the Boekel Incubator Operating Instructions for detailed usage information (provided upon request).

**GEX Technical Usage Information**

1. The post-irradiation heat-treatment specification temperature range (55°C to 65°C) can be used for the effective heat-treatment or annealing of B3 film dosimeters.
2. Ideal heat-treatment temperature is 58.5°C ±1.0°C.
3. Heat-treatment time: 15-20 minutes (minimum).

4. Please reference GEX Technical Report #100-201: *Post-Irradiation Heat-Treatment of B3 Dosimeters* for additional details (see References).

**Setup and Installation**

1. Un-package and inspect for any shipping damage.
2. Place the incubator on a flat and stable, even surface with unobstructed airflow around the incubator and preferably away from air drafts. Ensure the surface used can withstand the radiated heat produced by typical incubators.
3. Plug power cord into the power supply that matches the voltage listed on the serial number label located on the rear of the unit.
4. Insert the shelves at desired heights.
5. Note the timer is located on the inside chamber of the incubator, and has its own set of usage and calibration instructions. Attach it to the outside of the incubator using the magnetic attachments. It can also be attached to a belt or made to stand-up freely.

**Site Acceptance Testing**

Internal temperature mapping validation is required to establish incubator location and time intervals.

**Operation**

- The power switch controls power to the unit.
  - The temperature display shows the chamber temperature in degrees Celsius.
  - The heater lamp indicates when the heater is operating.
  - The temperature adjust knob is used to control the chamber temperature.
1. After turning the unit on, set the desired chamber temperature. The heater lamp will illuminate and remain lit until the chamber reaches set temperature. After set temperature is reached, the heater lamp will cycle on and off.
  2. Allow a 60 minute chamber temperature equilibration when starting from cold start.
  3. Allow at least 15 minutes for the re-equilibration when changing temperatures.
  4. To turn off, switch the power switch to the OFF position. If the temperature adjustment knob is not moved when the incubator is powered down, it will return to its previously set temperature upon restart.

**Calibration:**

Each individual company's standard operating procedures will dictate the calibration frequency of included components.

**Typical industry practices**

- Incubator – accuracy is verified by comparing the value of the digital display against a NIST calibrated digital thermometer.
- Timer – annually, or at replacement.

**PRODUCT PHOTOS**

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## LIMITATIONS/PRECAUTIONS

GEX continues to offer its P4800 Incubator System as a cost-effective but adequate means for post-irradiation, heat-treatment (annealing) of B3 dosimeters although the P4900 Micro Incubator System is promoted as an optimal solution.

## HEALTH / ENVIRONMENTAL INFORMATION

Do not touch with wet hands; it may cause an electric shock.

## WARRANTY / GUARANTEE

### Warranty:

2 year manufacturer's warranty when used in laboratory conditions and according to proper operating instructions.

### Guarantee:

1 year GEX satisfaction guarantee. May be returned with or without reason with one year from the date of delivery.

## ACCESSORIES

GEX Part No.	Description	Purpose	Link
P4120	Genesys 20 Spectrophotometer	For measuring the optical absorbance of dosimeters Integrated to communicate directly with GEX WINdose software for automated data-transfer	<a href="http://gexcorporation.com/pdf/100-127_P4120_Genesys20_PI_090110.pdf">http://gexcorporation.com/pdf/100-127_P4120_Genesys20_PI_090110.pdf</a>
P4502	WINdose Hinged Dosimeter Holder	Dosimeter holder for Genesys 20 spectrophotometer	<a href="http://gexcorporation.com/pdf/100-116_P4502_Hinged_Holder_PI_082304.pdf">http://gexcorporation.com/pdf/100-116_P4502_Hinged_Holder_PI_082304.pdf</a>
P4506	DoseStix Dosimeter Holder	Dosimeter holder for Genesys 20 spectrophotometer	<a href="http://gexcorporation.com/pdf/100-106_P4506_DoseStix_Holder_PI_082304.pdf">http://gexcorporation.com/pdf/100-106_P4506_DoseStix_Holder_PI_082304.pdf</a>
P4900	Micro-Incubator Development System	Post-irradiation treatment of radiochromic dosimeters to achieve stability	<a href="http://gexcorporation.com/pdf/100-123_P4900_Micro_Incubator_PI_102908.pdf">http://gexcorporation.com/pdf/100-123_P4900_Micro_Incubator_PI_102908.pdf</a>
P8005	PENVAC Dosimeter Handling Tool	Dosimeter handling	<a href="http://gexcorporation.com/pdf/100-118_P8005_PENVAC_PI_021413.pdf">http://gexcorporation.com/pdf/100-118_P8005_PENVAC_PI_021413.pdf</a>
P8006	Dosimeter Handling Forceps – 4.5 inch curved	Dosimeter handling	<a href="http://www.gexcorp.com/purchase-pricelist.php">http://www.gexcorp.com/purchase-pricelist.php</a>
S5100	WINdose for Excel worksheet program	Integrated with P4120 Spectrophotometer for automated data-transfer	<a href="http://gexcorporation.com/pdf/100-153%20S5100-WINdose%20for%20Excel%202002%20Manual_100213.pdf">http://gexcorporation.com/pdf/100-153%20S5100-WINdose%20for%20Excel%202002%20Manual_100213.pdf</a>

## REFERENCES

### References:

- Boekel Incubator Operating Instructions
- ISO/ASTM 51261: Practice for calibration of routine dosimetry systems for radiation processing
- ISO/ASTM 51275: Practice for use of a radiochromic film dosimetry system
- ISO/ASTM 51707: Guide for estimating uncertainties in dosimetry for radiation processing
- ISO/ASTM 52628: Describes the basic requirements that apply when making absorbed dose measurements in accordance with the ASTM E61 series of dosimetry standards. In addition, it provides guidance on the selection of dosimetry systems and directs the user to other standards that provide specific information on individual dosimetry systems, calibration methods, uncertainty estimation and radiation processing applications.

## Heat-treatment Incubator System with timer

- ISO/ASTM 52701: Guide for performance characterization of dosimeters and dosimetry systems for use in radiation processing
- NPL CIRM 29 Guidelines for the Calibration of Dosimeters for use in Radiation Processing, Peter Sharpe and Arne Miller, 1999; National Physical Laboratory, Teddington, UK.
- Miller A., Batsberg W. and Karman W. (1988); A New Radiochromic Thin-Film Dosimeter System; Radiation Physics and Chem. Volume 31, Nos 4-6, Elsevier Science Ltd. Pergamon Press, Great Britain.
- Abdel-Fattah A. A. and Miller A. (1996); Temperature, Humidity, and Time. Combined Effects on Radiochromic Film Dosimeters; Radiation Physics and Chem. Vol. 47, No. 4 pp 611-621, Elsevier Science Ltd. Pergamon Press, Great Britain.

### **GEX Procedures:**

- [100-253: Dosimetry Lab Requirements](#)
- [100-258: Measuring GEX Dosimeters](#)
- [100-259: Investigation of B3 WINDose Measurements](#)
- [100-260: Energy Estimation](#)
- [100-261: Uniformity Measurement](#)

### **GEX Technical Reports:**

- [100-201 Post-Irradiation Heat-Treatment of B3 Dosimeters](#)

To learn more about GEX products and services, visit [www.gexcorp.com](http://www.gexcorp.com) or contact a GEX representative at +1 303 400-9640.