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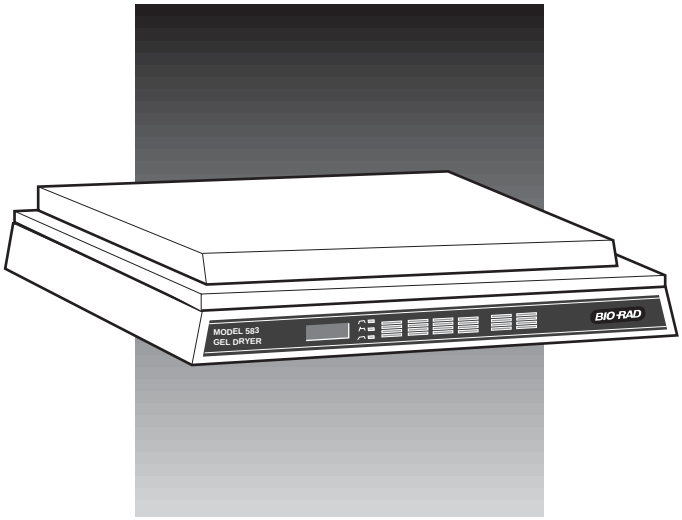
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MODEL 583 GEL DRYER

INSTRUCTION MANUAL

Catalog Numbers
165-1745
165-1746

BIO-RAD

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SAFETY



Caution/Warning

Disconnect the Gel Dryer before servicing. No user-serviceable parts are inside. Refer servicing to Bio-Rad service personnel.

This instrument is intended for laboratory use only.

This product conforms to the “Class A” standards for electromagnetic emissions intended for laboratory equipment applications. It is possible that emissions from this product may interfere with some sensitive appliances when placed nearby or in the same circuit as those appliances. The user should be aware of this potential and take appropriate measures to avoid interference.

The Bio-Rad Model 583 Gel Dryer (220/240 V AC) is designed and certified to meet EN 61010-1* and CE* safety standards. Certified products are safe to use when operated in accordance with the instruction manual.

This instrument should not be modified or altered in any way. Alteration of this instrument will void the manufacturer’s warranty, void the EN 61010-1* and CE certification, and create a potential safety hazard for the user.

Bio-Rad is not responsible for any injury or damage caused by the use of this instrument for purposes other than for which it is intended or by modifications of the instrument not performed by Bio-Rad or an authorized agent.

*EN 61010-1 and CE are internationally accepted electrical safety standards for laboratory instruments.

1.0 INTRODUCTION

The Model 583 Gel Dryer is designed to dry sequencing and protein gels fast! With three pre-programmed drying cycles, the Model 583 provides optimal drying conditions for different types of gels. The exclusive design incorporates a floating heating element in the lid, to heat the gel from the top, while the vacuum pulls gel liquids from the bottom.

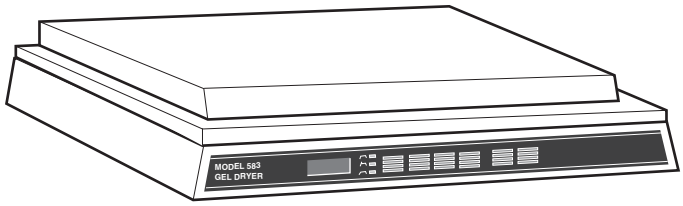


Figure 1. Model 583 Gel Dryer

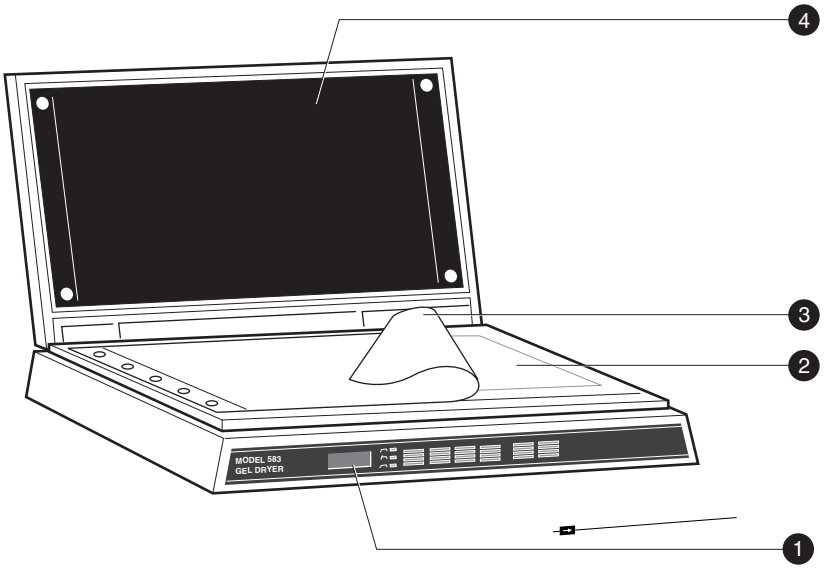
1.1 FEATURES

The Model 583 Gel Dryer has the following features:

- Drying cycles are user programmable for greater flexibility and repeatability
- Microprocessor controlled temperature
- Gels can be viewed at any time during the drying cycle
- Heat and vacuum pressure are evenly distributed across the gel
- The dryer automatically seals when the lid is closed

1.2 PHYSICAL DESCRIPTION

Table 1.
Physical Features



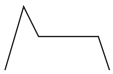
Feature	Description
1. Dryer Control Panel	The front panel controls are used to program drying cycles.
	The panel's display shows dryer temperature or the amount of time left in the cycle.
	Three different pre-programmed cycles optimize drying of gradient, sequencing, and PAGE gels. Drying cycle parameters are maintained in memory as long as the gel dryer power is left on. To select a cycle, press the key twice, and then use the Raise and Lower keys to scroll through the cycles.
	**PAGE**: The dryer temperature is raised to 80° C (its default value) and that temperature is held throughout the drying cycle.
	**Sequencing**: The dryer temperature is raised to 80° C (its default value) then slowly lowered at the rate of 1° C/min., until the set temperature is reached.
	**Gradient**: The temperature is raised 1° C/min. until the dryer reaches 80° C (its default value). Slow heating reduces stress created by a rapid rise in temperature at the gel surface.

Table 1 (continued)
Physical Features

Feature	Description
    	**TEMP**: Drying temperatures can be set between 50° C and 90° C. To set a drying temperature, press this key twice, and then press the RAISE and LOWER keys to select the desired temperature. **TIME**: Drying time can be set between 5 minutes and 9 hours 55 minutes. To set a drying time, press the key twice, and then use the RAISE and LOWER keys to select the desired time. **START/STOP**: Starts and Stops the drying process. **RAISE**: Use this key to select cycles, temperature, and time. **LOWER**: Use this key to select cycles, temperature, and time.
2. Gel Support	The porous Gel Support ensures evenly distributed vacuum pressure.
3. Sealing Gasket	The transparent Sealing Gasket allows gels to be viewed at any time during the drying cycle without disturbing the vacuum seal. To remove the Sealing Gasket for cleaning or replacement, pull up the plastic strip running along the left edge of the Sealing Gasket.
4. Heater Element	Gels are heated by an element suspended from the lid. The floating element provides equal contact across the gel, producing even heating over the entire surface. Temperature fluctuations are minimized by continuous microprocessor control of dryer temperature.

2.0 SET UP AND BASIC OPERATION

2.1 SET UP

Table 2 discusses the electrical and vacuum connections required for the Model 583 Gel Dryer and a vacuum pump. Refer to the vacuum pump instruction manual for complete instructions on pump set-up.

Note
Always use vacuum grade tubing. Vacuum tubing is generally thick-walled to prevent collapse. Minimize tubing lengths whenever possible to achieve the best drying efficiency.

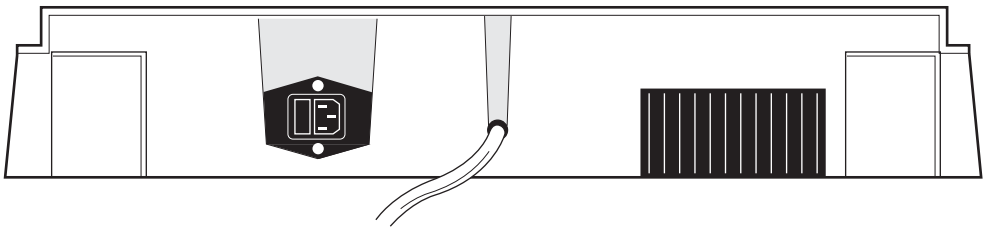


Figure 2. Rear View of the Gel Dryer

Table 2
Gel Dryer Set Up

Step	Procedure	Description
1.	Connect the tubing from the Gel Dryer to the vacuum source.	Leave 15 cm of space between the rear of the gel dryer and the wall. This distance prevents the vacuum tubing from crimping.
2.	Plug the dryer into the A.C. outlet.	If you are using Bio-Rad's HydroTech Vacuum Pump, connect the tubing directly to the pump's vacuum line using the barbed connector shipped with the Model 583 Gel Dryer.

2.2 OPERATION

Once the drying parameters are set, they are retained in memory until changed by the user or until power is turned off.

Table 3
Gel Dryer Operation

Step	Procedure	Description
1.	Turn on the power switch.	The power switch is located at the back of the gel dryer. The dryer's front panel displays OFF when the dryer is ON.
2.	Select the drying cycle.	a. Press the **CYCLE** key twice. b. When the light above the key flashes, press the **RAISE** or **LOWER** key to select either the **PAGE**, **Sequencing,** or **Gradient** cycle.
3.	Set the cycle temperature.	a. Press the **TEMP** key twice. b. When the light above the key flashes, press the **RAISE** or **LOWER** key to select a temperature between 50 and 90° C.
4.	Set the cycle time.	a. Press the **TIME** key twice. b. When the light above the key flashes, press the **RAISE** or **LOWER** key to select cycle time.
5.	Place the gel in the dryer.	a. Place the gel and its filter paper backing on the porous Gel Support. b. Position the transparent Sealing Gasket over the gel. c. Close the lid. The Sealing Gasket will seal quickly once the vacuum pump is started.
6.	Turn on the vacuum pump as directed in the pump's instruction manual.	Determine whether or not the pump requires a warm-up period. Bio-Rad's HydroTech pump does not require a warm up period.

Table 3 (continued)
Gel Dryer Operation

Step	Procedure	Description
7.	Start the drying cycle.	a. Press the **START/STOP** key. b. During dryer operation, the indicator light above the **START/STOP** key is lit.
8.	Adjust the temperature or time at any time during the drying cycle.	Press the **TEMP** or **TIME** key to view the actual temperature or time remaining. To make an adjustment, a. Press the **TEMP** or **TIME** key twice. b. Press the **RAISE** or **LOWER** key to change the value.
9.	When the cycle is complete and the gel is dry, break the seal on the Sealing Gasket before turning off the vacuum pump.	This prevents the liquid in the vacuum line from flowing back to the gel dryer.
10.	Turn off the vacuum pump.	
11.	To repeat the current cycle and settings, simply press the **START/STOP** key.	Do not continue running the vacuum pump after the vacuum seal is broken.

2.3 DETERMINING IF YOUR GEL IS DRY

Carefully note the appearance of the gel at the start of drying. The initial hydrated thickness will cause the transparent Sealing Gasket to assume the shape of the gel once the vacuum seal is formed. During drying, the gel will compress as the liquid is removed. When the gel is completely dry, the gasket will be perfectly flat for gels < 10% T, but retain a slight gel shape for gels > 10% T. Gradient gels, depending on the percent range, will be flat at one end and show some gel shape at the other. Feel the gel through the gasket. A dry gel will feel warm to the touch across its entire surface. Incompletely dried gels will feel cool in some areas and warm in other areas.

3.0 GEL PREPARATION TECHNIQUES

Techniques for drying the following gels are discussed in this section:

- Sequencing Gels
- Acrylamide Protein Gels ≤ 14%
- Gradient gels, gels ≥15%, and 1.5 mm thick gels

Warning
Use of enhancers such as PPO and DMSO will void the manufacturer's warranty.

Gels dried prior to autoradiography require a non-porous plastic film cover such as Saran Wrap™. The film, which prevents the Sealing Gasket from becoming contaminated, can be peeled away and discarded as radioactive waste.

To prevent the porous Gel Support from becoming contaminated with radioactivity, always use two sheets of filter paper Use one sheet for the gel and the second sheet to absorb contamination from the gel.

For gels without radioactive label, a single sheet of filter paper for gel backing is all that is required.

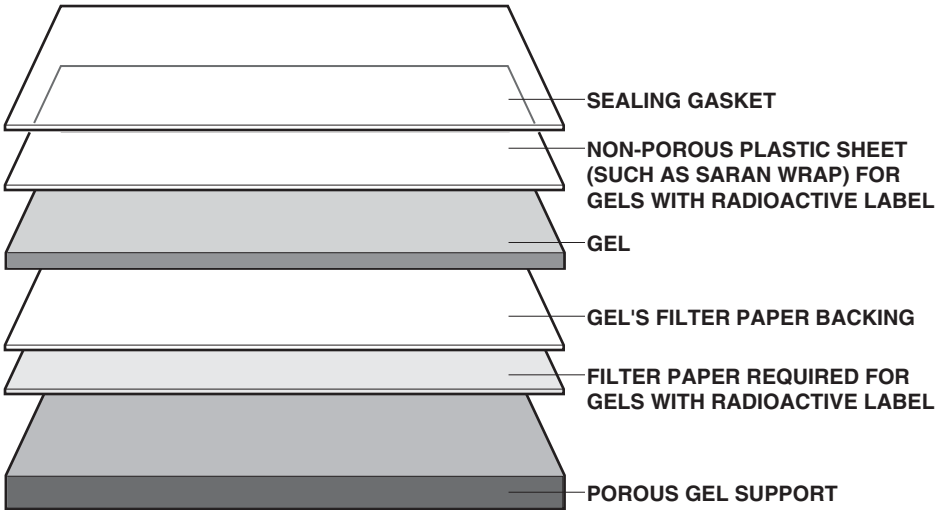


Figure 3. Arrangement for Drying Gels

Table 4
Drying Gels

Step	Procedure	Description
1.	For gels with radioactive label, place a dry sheet of filter paper on top of the porous Gel Support.	This procedure is necessary only for gels with radioactive label.
2.	Use a second sheet of filter paper to mount the gel, and place the gel in the gel dryer.	a. Cut a second piece of the filter paper that is slightly larger than the gel. This will serve as the gel backing. b. Place the gel on this second piece of filter paper. If the gel has dried out, lightly mist the surface of the gel with water prior to applying the filter paper. c. Gently roll a pipette over the filter paper to remove bubbles trapped between the gel and filter paper. d. Place the gel and its filter paper backing in the gel dryer.
3.	For gels with radioactive label, cover the gel with a thin non-porous plastic film, such as Saran Wrap™.	Trim the plastic wrap to a size slightly larger than the gel. The plastic wrap should not interfere with the Sealing Gasket.
4.	Position the transparent Sealing Gasket over the gel and close the lid.	Make sure the gel, filter paper, and plastic wrap are not interfering with the Sealing Gasket.
5.	Turn on the vacuum pump.	Verify the dryer has formed a vacuum seal. The Sealing Gasket should appear slightly depressed in the middle.

Table 4 (continued)
Drying Gels

Step	Procedure	Description
6.	Program the drying cycle.	For Sequencing gels: a. Select the **Sequencing** cycle. b. For normal rapid drying, the default temperature is 80°C. For gels containing fluors for autoradiography, set the temperature to 60°C. c. Select a drying time. Refer to Chapter 4, Drying Times, for recommended drying times. For gels having ≤ 14% constant concentration acrylamide: a. Select the **PAGE** cycle. b. For normal rapid drying, set a temperature of 80°C. For gels containing fluors for autoradiography, select 60°C. c. Select a drying time. Refer to Chapter 4 for recommended drying times. For gradient gels, gels having ≥ 15% constant concentration acrylamide, and 1.5 mm gels: a. Begin by soaking the gel for about one hour in a 500 ml solution of 3% glycerol (5%, if the gradient is very steep), 40% MeOH, and 10% HOAc. Gently agitate during the entire soak period. b. Select the **GRADIENT** cycle. c. Set a temperature of 60°C to 70°C. d. Select a drying time. Refer to Chapter 4 for recommended drying times.

Table 4 (continued)
Drying Gels

Step	Procedure	Description
7.	Press **Start** to begin the drying cycle.	The dryer will turn off automatically when the cycle is complete.
8.	When the cycle is complete, check that the gel is dry before breaking the vacuum seal.	Check the gel by running your finger over the Sealing Gasket; a dry gel is warm over its entire area. Breaking the vacuum seal before turning off the vacuum pump prevents liquid in the vacuum line from flowing back into the gel dryer.
9.	Turn off the vacuum pump.	Do not continue running the vacuum pump after the vacuum seal is broken.

4.0 SUGGESTED DRYING TIMES

Gel drying time is a function of temperature, vacuum, gel porosity, and gel thickness. With the exception of gels containing scintillant fluors, gels are not damaged by excessive drying.

The following table provides approximate drying times for various gel concentrations, given the dryer's temperature and vacuum are kept at 80° C and 28" Hg, respectively. Deviations from these guidelines are given below and are based on the use of additional materials or other environmental settings:

- At vacuum levels of 22" Hg to 25" Hg, add 50% to the drying times.
- At 60°C, add 100% to the drying times.
- Gels > 14% T may crack at a vacuum < 25" Hg.

Table 5
Suggested Drying Times for Single Percentage Gels

Acrylamide Concentration	Slab Thickness	Time at 80° C
3% to 10%	0.375 mm	30 min.
10% to 20%	0.375 mm	30 min.
3% to 10%	0.5 mm	40 min.
10% to 20%	0.5 mm	40 min.
3% to 10%	0.75 mm	40 min. to 60 min.
10% to 20%	0.75 mm	60 min. to 120 min.
3% to 10%	1.5 mm	45 min. to 60 min.
10% to 20%	1.5 mm	60 min. to 120 min.
3% to 10%	3.0 mm	60 min. to 120 min.
10% to 20%	3.0 mm	120 min. to 180 min.

5.0 MAINTENANCE AND TROUBLESHOOTING

Gel Dryer maintenance consists of:

- Cleaning and replacing the porous Gel Support
- Cleaning and replacing the transparent Sealing Gasket

A Troubleshooting chart is provided in Table 6, Troubleshooting Guide.

5.1 ROUTINE MAINTENANCE

Model 583 Gel Dryer maintenance consists of wiping the dryer body and the transparent Sealing Gasket clean with a damp cloth.



Note
Do not use solvents, concentrated acids, or bases on the unit.

Occasionally, the transparent Sealing Gasket requires cleaning or replacement. For example, filter paper fibers may adhere to the gasket and interfere with the vacuum seal. The gasket also can wear, crack, and dry with age so that it no longer maintains a vacuum. To remove the gasket, simply pull up on the strip holding the gasket in place.

The Gel Support may need to be replaced if it comes in direct contact with the gel or gel fragments. This direct contact may cause the gel to melt, resulting in clogged areas in the Gel Support.

5.2 TROUBLESHOOTING GUIDE

Refer to Table 6, Troubleshooting Guide, for the dryer problem you are experiencing. For further Troubleshooting assistance, call 1-800-4BIORAD in the U.S.A.; or contact your local Bio-Rad representative.

Table 6
Troubleshooting Guide

Indication	Problem	Action
No power; front panel display is blank.	No AC power to the gel dryer.	Check to insure the unit is plugged into a live outlet.
	Gel dryer is turned off.	Make sure the power switch, at the back of the unit, is in the “on” position.
	Gel dryer fuse needs to be replaced.	Unplug the dryer. Then pry open the cover on the power switch from the left and pull out the fuse holder. (See Appendix B for replacement fuse specifications.) A second fuse is inside the unit and can only be replaced by a qualified Bio-Rad service person.
	Hardware failure.	Call Bio-Rad for service.
No vacuum seal.	Sealing Gasket is not properly seated.	Check that the filter paper, gel, and gel cover do not extend beyond the edge of the Gel Support.
	Sealing Gasket is not clean.	Check that the Sealing Gasket is clean, with no particles along the seal area.
	Vacuum is weak or leaking.	The vacuum must be at least 125 Torr or 25 inches of Hg, and pump capacity must be >10L/min. • Check the vacuum source. • Check the vacuum line for leaks. • Check that the tubing between the gel dryer and the vacuum pump is not too long.
	The porous Gel Support is clogged.	Replace the porous Gel Support.

Table 6 (continued)
Troubleshooting Guide

Indication	Problem	Action
Vacuum seal is lost during operation.	Vacuum leak in gel dryer.	Ensure the filter paper, gel, and gel cover do not overlap the edges of the Gel Support.
	Sealing Gasket is dirty or damaged.	Check the transparent Sealing Gasket for dirt, folds, or cracked areas. Replace if necessary.
	Gel Support is damaged.	Check the edges of the Gel Support for physical flaws or indentations. The edges must be kept smooth to maintain a good vacuum.
	The vacuum line leaks.	Check all tubing and connections between the dryer and the vacuum source for a vacuum leak.
	The vacuum pump is not pulling an adequate vacuum.	Check the performance of the vacuum pump.
Gels crack or are still wet.	Vacuum has been released before the gel is dry, or the vacuum fluctuated during the drying cycle.	Check the performance of the vacuum pump.
	The gel dryer lid is frequently opened and closed during the drying cycle.	Temperature fluctuations stress the gel and can result in cracking. Open the dryer lid only when necessary.
	The dryer temperature is set too high or changes too quickly. This is especially a problem for the more sensitive gradient and >15%T gels or the thicker 3.0 mm gels.	Reduce the temperature and dry the gels for a longer period of time. Also try using the gradient drying cycle.
	The glycerol concentration is too low for gradient gels.	Increase the glycerol concentration in pre-drying treatment to 5% (w/v).

Table 6 (continued)
Troubleshooting Guide

Indication	Problem	Action
Wet spot appears on the gel at the location of the vacuum outlet in the dryer base.	The vacuum pump was turned off before the vacuum seal was broken, causing liquid to be pulled back into the gel dryer from the vacuum line.	Open the Gel Dryer and lift the transparent Sealing Gasket prior to turning off the vacuum pump.
Front panel display flashes the message **HOT** and the alarm sounds.	The microprocessor is unable to control the heating element and the temperature has reached 100° C.	Press any key to clear the display. The dryer will attempt to control temperature until the run is completed. An internal thermostat protects the dryer by turning the heater off if it reaches 115° C. Turn off the gel dryer power, and then turn it back on. If the problem persists, contact your local Bio-Rad office for repair.
Front panel display flashes the message **rEg**.	The microprocessor is unable to keep the temperature stable at the set value.	Normal operation allows the dryer 20 minutes to reach set temperature. If the dryer does not reach the set value, or if it deviates from the set value by more than 2° C during the run, it will register a regulation error rEg. Press any key to clear the display. The dryer will attempt to control temperature until the run is completed. Turn off the gel dryer power, and then turn it back on. If the problem persists, contact your local Bio-Rad office for repair.

APPENDIX A. VACUUM SOURCE OPTIONS

A.1 VACUUM SOURCE REQUIREMENTS

Vacuum is commonly measured in inches of mercury (“ Hg) or millimeters of mercury (Torr). Atmospheric pressure at sea level is 760 Torr (29.64” Hg), while a perfect vacuum measures 0 Torr (0” Hg). Both quantities assume ambient temperature is 0° C.

Standard pressure gauges are often designed with one end vented to the environment, while the other end is the measuring port. These gauges indicate 0” Hg pressure when the absolute pressure is 29.64” Hg, and they indicate -29.64” Hg for a perfect vacuum. The relationship between gauge pressure and absolute pressure is:

Absolute Pressure = (Atmospheric Pressure, at Sea Level and 0° C) + (Gauge Pressure)
Absolute Pressure, in “ Hg = 29.64” Hg + (Gauge Pressure, in “ Hg)

Note: Gauge values are negative numbers, though the “-” sign is not marked on it’s face.

In practical terms, this means the larger the gauge value, the greater the vacuum, while the smaller the absolute pressure value, the greater the vacuum. Thus, the weakest vacuum specified for proper operation of the Model 583 dryer is a gauge pressure of 25” Hg, or an absolute pressure of 4.88” Hg.

A.2 TYPES OF VACUUM PUMPS

The types of vacuum sources discussed below each have unique advantages and disadvantages for gel drying. When choosing a vacuum source, keep in mind that it should be able to provide a vacuum pressure of at least 25” Hg and a capacity of 20 to 30 liters/min.

For best results, use Bio-Rad’s HydroTech Vacuum Pump. The HydroTech is specially designed to meet all the vacuum requirements of gel drying. It is low in maintenance, has a large capacity, and does not require a vapor or liquid trap. The pump attains a vacuum of 29” Hg (23.4 Torr.) or better with a capacity of 28 liters/min (1 CFM).

When using “house vacuum” the actual vacuum pressure varies as demands on the system change during the day, often dropping below 20” Hg. Variations of this magnitude can cause gels to crack, even though the dryer’s vacuum is still sealed.

A vapor and liquid trap should be used with a mechanical vacuum source to protect the pump from the corrosive effects of gel liquids and vapors, such as methanol, acetic acid, and water. A simple trap system consists of a liquid trap followed by a vapor trap connected in-line between the dryer and pump. The vapor trap is a 2 liter side-arm flask set into a bucket of dry ice/alcohol solution. The dry ice has to be replenished often enough to keep all gel vapors in the side-arm flask. The liquid trap is a 2 liter side-arm flask without the dry ice or alcohol solution. The pump oil should be checked and probably changed frequently.

APPENDIX B. SPECIFICATIONS

Dryer body	Polycarbonate
Drying surface	35 x 45 cm
Weight	9.8 kg
Dimensions	11 x 55 x 50 cm
Gel support plate	Porous polypropylene, average 120 µm pore size
Sealing gasket	Transparent silicone rubber
Heating element	2.5 W/in2 (0.4 W/cm2)
Vacuum source	Minimum ultimate vacuum of at least 125 Torr (25" Hg). A pump with a rating of 28" Hg (48.8 Torr) or better, and a capacity of 20 liters/min or better, is recommended.
Electrical connection	3-wire power cord
Power requirements	
120 volt models:	100-120 V, 50/60 Hz
240 volt models:	220-240 V, 50/60 Hz
Power consumed during drying	360 Watts
Power consumed when not drying	15 Watts
Fuses required	Type T, 250 V (two each)
100/120 V:	6.3 Amp
220/240 V:	3.15 Amp
Operating temperatures	50° to 90°C
Operating time	5 min to 9 hr 55 min.
Operating cycles	3 programmable drying cycles

APPENDIX C. WARRANTY AND ORDERING INFORMATION

The Model 583 Gel Dryer is warranted for 1 year against defects in materials and workmanship. If any defects should occur during this warranty period, Bio-Rad Laboratories will replace the defective parts without charge. However, the following defects are specifically excluded:

1. Defects caused by improper operation.
2. Repair or modification done by anyone other than Bio-Rad Laboratories or their authorized agent.
3. Use with fittings or other spare parts not specified by Bio-Rad Laboratories.
4. Damage caused by deliberate or accidental misuse.
5. Damage caused by disaster.
6. Damage due to use of improper solvent or sample.
7. Tubing, fittings, and paint.
8. Damage due to use of enhancers such as PPO and DMSO.

For inquiry or request for repair service, contact your local Bio-Rad office.

ORDERING INFORMATION

Catalog Number	Description
Gel Drying Systems	
165-1789	**HydroTech Gel Drying System**, 100/120 V, includes Model 583 Gel Dryer, HydroTech Vacuum Pump, tubing and connectors.
165-1790	**HydroTech Gel Drying System**, 220/240 V, includes Model 583 Gel Dryer, HydroTech Vacuum Pump, tubing and connectors.
Vacuum Pumps and Accessories	
165-1781	**HydroTech Vacuum Pump**, 100/120 V, includes vacuum pump, power cord, quick disconnect fittings for 1/4-inch and 3/8-inch ID vacuum tubing, vacuum tubing, drain tubing, and instructions.
165-1782	**HydroTech Vacuum Pump**, 220/240 V, includes vacuum pump, power cord, quick disconnect fittings for 1/4-inch and 3/8-inch ID vacuum tubing, vacuum tubing, drain tubing, and instructions.
165-1788	**HydroTech Vacuum Gauge**, includes fittings to connect to the HydroTech vacuum line.
Gel Dryers and Accessories	
165-1745	**Model 583 Gel Dryer**, 100/120 V, includes power cord, porous Gel Support, transparent Sealing Gasket, Filter Paper Backing, Cellophane Membrane Backing, and instruction manual.
165-1746	**Model 583 Gel Dryer**, 220/240 V, includes power cord, porous Gel Support, transparent Sealing Gasket, Filter Paper Backing, Cellophane Membrane Backing, and instruction manual.
165-1747	**Porous Gel Support**, 35 x 45 cm
165-1748	**Transparent Sealing Gasket**, 41 x 51 cm
165-0962	**Filter Paper Backing**, 35 x 45 cm, 25 sheets
165-0963	**Cellophane Membrane Backing**, 35 x 45 cm, 50 sheets
165-1959	**Sequencing Gel Filter Paper**, 35 x 45 cm, 25 sheets

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