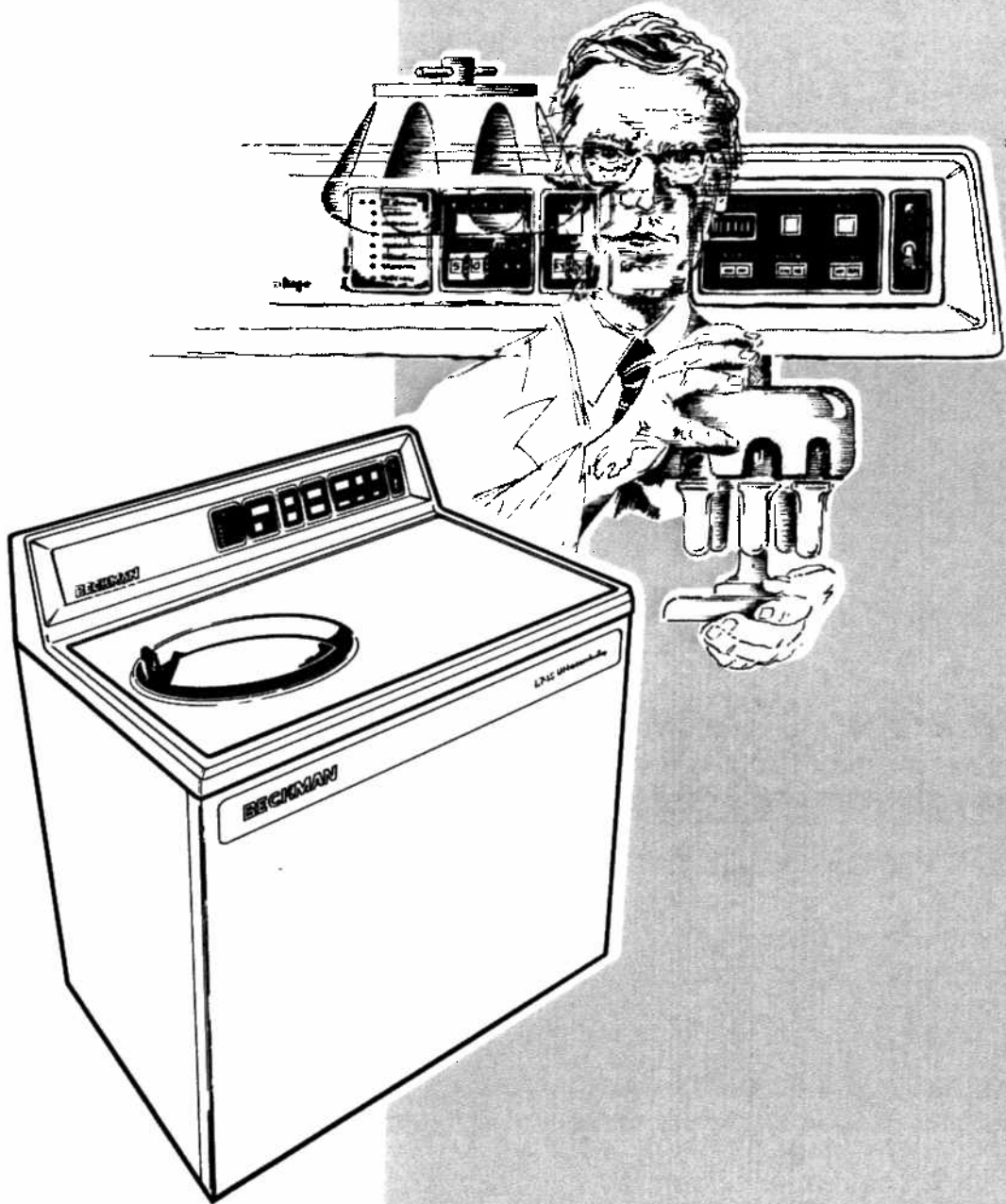


**BECKMAN**

# Model L7 Series Preparative Ultracentrifuges



**INSTRUCTION MANUAL**



## **SAFETY NOTICE**

This safety notice summarizes information basic to the safe operation of the equipment described in this manual. The international symbol displayed above is a reminder that all safety instructions should be read and understood before installation, operation, maintenance, or repair of this instrument is attempted. When you see the symbol on other pages, pay special attention to the safety information presented. Observance of safety precautions will also help to avoid actions that could damage or adversely affect the performance of the instrument.

### **Safety During Installation and/or Maintenance**

This instrument is designed to be installed by a Beckman Field Service representative. Installation by anyone other than authorized Beckman personnel invalidates any warranty covering the instrument.

Any servicing of this equipment that requires removal of any covers can expose parts which involve the risk of electric shock or personal injury. Make sure that the power switch is off and the instrument is disconnected from the main power source and refer such servicing to qualified personnel.

### **Electrical Safety**

To reduce the risk of electrical shock, this instrument uses a three-wire electrical cord and plug to connect this equipment to earth-ground.

Make sure that the matching wall outlet receptacle is properly wired and earth-grounded.

Do not place containers holding liquid on or near the chamber door. If they spill, liquid may get into the instrument and damage electrical or mechanical components.

### **Safety Against Risk of Fire**

Fuses protect certain electrical circuits within this equipment against overcurrent conditions. For continued protection against the risk of fire, replace only with the same type and rating specified.

This instrument is not designed for use with materials capable of developing flammable or explosive vapors. Do not centrifuge such materials (e.g., chloroform, ethyl alcohol, etc.) in this instrument nor handle or store them within the 30-cm (1-ft) clearance envelope surrounding the centrifuge.

### **Mechanical Safety**

- Use only the rotors designed for use in this ultracentrifuge.
- Do not exceed the maximum rated speed of the rotor in use.
- NEVER attempt to slow or stop the rotor by hand.
- Do not lift or move the ultracentrifuge while the drive motor is turning.
- NEVER attempt to override the door interlock system while the rotor is spinning.
- For operator safety, maintain a 30-cm (1-ft) “clearance envelope” around the instrument while it is running. During operation you should come within the envelope only to adjust instrument controls, if necessary. Do not bring any flammable substances within the envelope. Do not lean on the instrument or place items on the centrifuge while it is operating.
- In the event of a power failure, do not attempt to retrieve the sample from the instrument for at least one hour. Then follow the instructions for recovery of the sample in Section 3: TROUBLESHOOTING.

### **Chemical and Biological Safety**

Normal operation may involve the use of solutions and test samples that are pathogenic, toxic, or radioactive. Such materials should not be used in this instrument, however, unless *all necessary safety precautions are taken*.

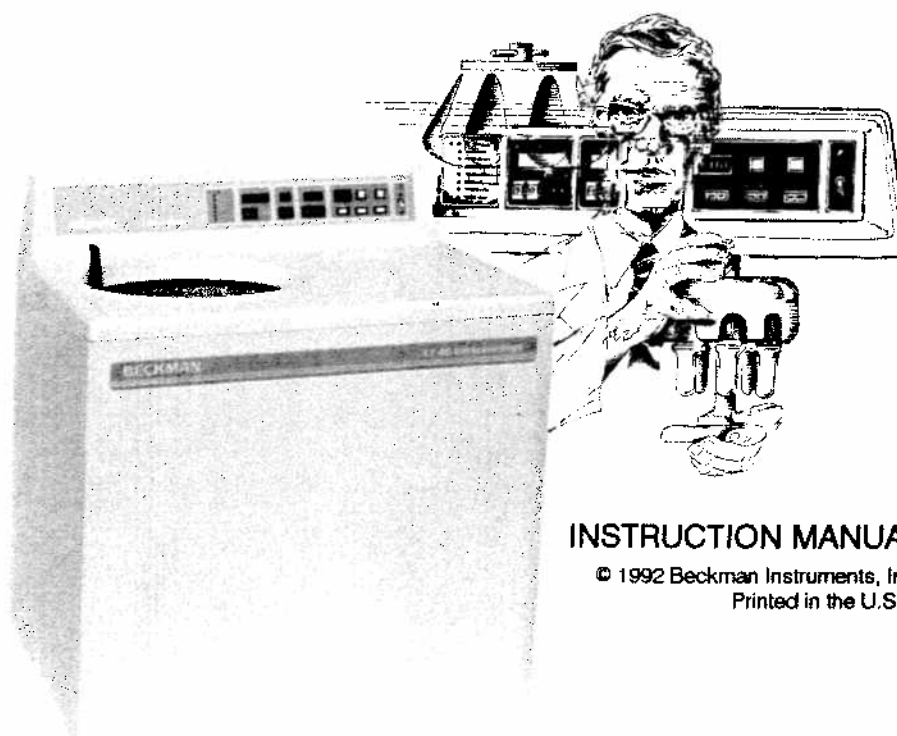
- Observe all cautionary information printed on the original solution containers prior to their use.
- Because leaks may generate aerosols, observe proper safety precautions for aerosol containment. (The instrument O-rings have *not* been designed as bioseals for aerosol containment.)
- Handle body fluids with care because they can transmit disease. No known test offers complete assurance that they are free of micro-organisms. Some of the most virulent—Hepatitis (B and C) and HIV (I–V) viruses, atypical mycobacteria, and certain systemic fungi—further emphasize the need for aerosol protection.
- Other infectious samples must also be handled according to good laboratory procedures and methods to prevent spread of disease.
- Dispose of all waste solutions according to appropriate environmental health and safety guidelines.

**It is your responsibility to decontaminate the instrument and accessories before requesting service by our Field Service representative.**

Multi-language safety labels are attached to the instrument. Replacement labels will be provided free of charge by writing to Beckman Instruments, Centrifugation Marketing Department, Box 10200, Palo Alto, California 94304.

# BECKMAN

## Model L7-80, L7-65 and L7-35 Preparative Ultracentrifuges



**INSTRUCTION MANUAL**

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To obtain additional copies of this manual, the appropriate rotor bulletins, and other referenced publications, contact Beckman Instruments, Technical Publications Department, 1050 Page Mill Road, Palo Alto, CA 94304, U.S.A.

This manual is designed to familiarize you with the Beckman Model L7 ultracentrifuge, its functions, specifications, operation, and routine operator care and maintenance. We recommend that you read the entire manual, but especially the SAFETY NOTICE and safety-related information, before operating the Model L7 or performing instrument maintenance.

※ **NOTE** ※ If the equipment is used in a manner other than as specified in this manual, the safety and performance of the equipment could be impaired. Further, the use of any equipment other than that intended for use by Beckman has not been evaluated for safety. Use of any equipment not specifically recommended in this manual shall be the sole responsibility of the user.

## CONVENTIONS

Certain symbols are used in the manual to call out safety related and other important information. These are reproduced and described below.

※ **NOTE** ※ Used to call attention to information that should be followed during installation, use, and/or servicing of the equipment.



### CAUTION

Used to indicate a potentially hazardous situation which, if not avoided, may result in minor or moderate injury and/or mechanical damage. It is also used to alert against unsafe practices.



**WARNING**

*Used whenever an action or condition may potentially cause serious personal injury or loss of life. Mechanical damage may also result.*



**DANGER**

or



**WARNING**

*Indicates high voltage or risk of electric shock. Refer servicing of all areas displaying either symbol to qualified personnel.*



# PREINSTALLATION REQUIREMENTS



## CAUTION

Do not attempt to install the Model L7 ultracentrifuge. Its purchase price includes installation by Beckman personnel. Installation by anyone other than authorized Beckman personnel invalidates any warranty covering the instrument.

Preinstallation requirements have been sent prior to shipment of the instrument. The following information is provided in case the ultracentrifuge must be relocated. Contact your Beckman Field Service representative to adjust and level the instrument if it must be moved. Pads affixed to the floor under each leveling leg at installation prevent possible rotation of the instrument in the event of a rotor mishap. They must be reanchored if the instrument is moved.

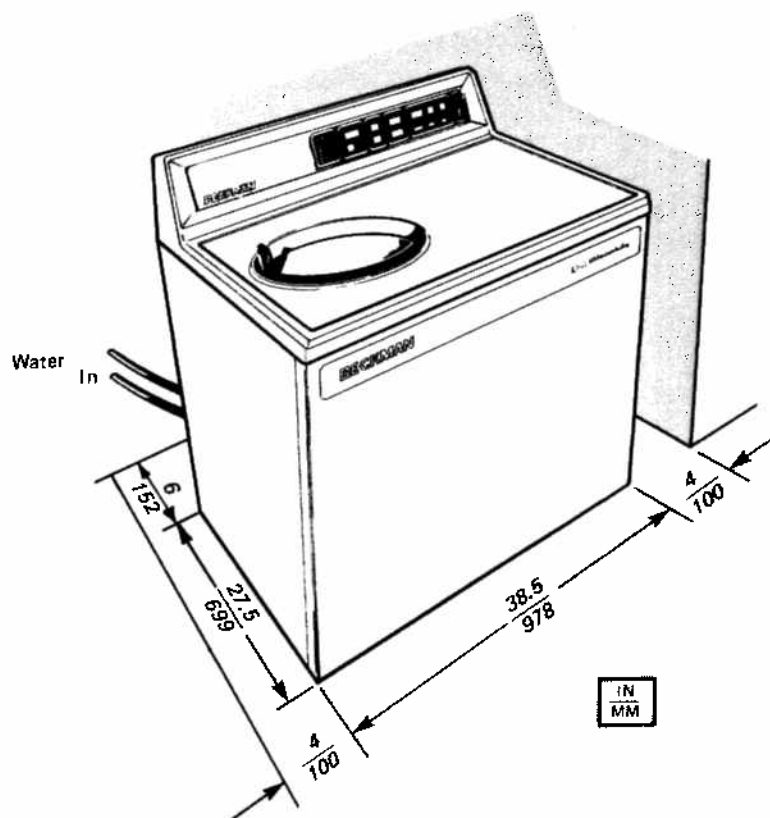
## ELECTRICAL REQUIREMENTS

The Model L7 series of preparative ultracentrifuges is rated for 200 Vac, 60 or 50 Hz, fused for 30 Amps. It requires nominal 200 to 240 Vac power, 60 or 50 Hz (single phase), fused for 30 Amps. To reduce the risk of electrical shock, the Model L7 uses a three-wire electrical cord (1.5 m; 5-ft) and plug to connect the equipment to earth-ground. (A receptacle and plug that meet local electrical and safety requirements must be supplied for 50-Hz instruments. Contact your Beckman Service Office for specific information regarding local requirements.) Make sure that the matching wall outlet receptacle is properly wired and earth-grounded.

To ensure safety, the instrument should be wired to a remote emergency switch (preferably outside the room where the centrifuge is housed, or adjacent to the exit from that room), in order to disconnect the instrument from the main power source in case of a malfunction.

## WATER REQUIREMENTS (for instruments with water-cooled drives)

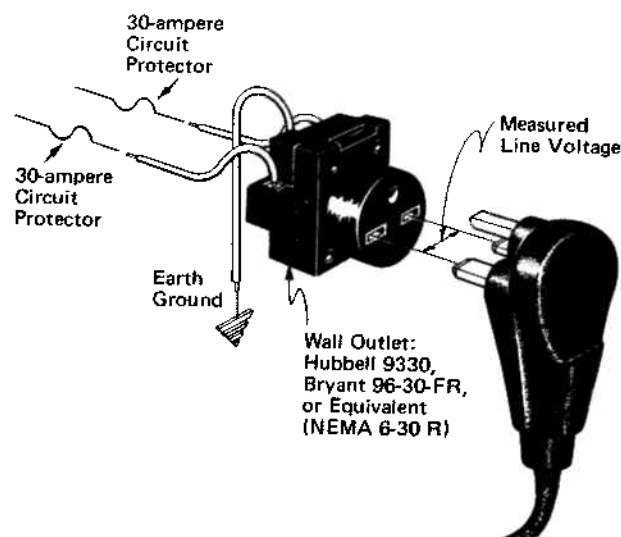
The Model L7, with a water-cooled drive, requires clean (water hardness of 80 ppm maximum, and pH of 6 to 10), cool water at a flow rate of at least 1.9 liters (0.50 gal) per minute, measured at the drain line. This flow rate requires that



the cooling water pressure be at least 140 kPa (20 psig). The instrument is shipped with 1.8-m (6-ft) inlet and outlet lines attached. Each line is equipped with a 6.35-mm (1/4-in.) female flare fitting. The user must provide a manual valve with a 6.35-mm (1/4-in.) male flare fitting; the drain may be either open or provided with a 6.35-mm (1/4-in.) male flare fitting as well.

Some customers may want to install a sediment filter on the inlet line. One suitable type is the AP11-T or S unit with AP10 filter, manufactured by Cuno Engineering Co., Meriden, CT, U.S.A.

Models L7-80 and L7-65 are also available with a self-contained refrigerated drive. The Model L7-35, however, is available only with an air-cooled drive.

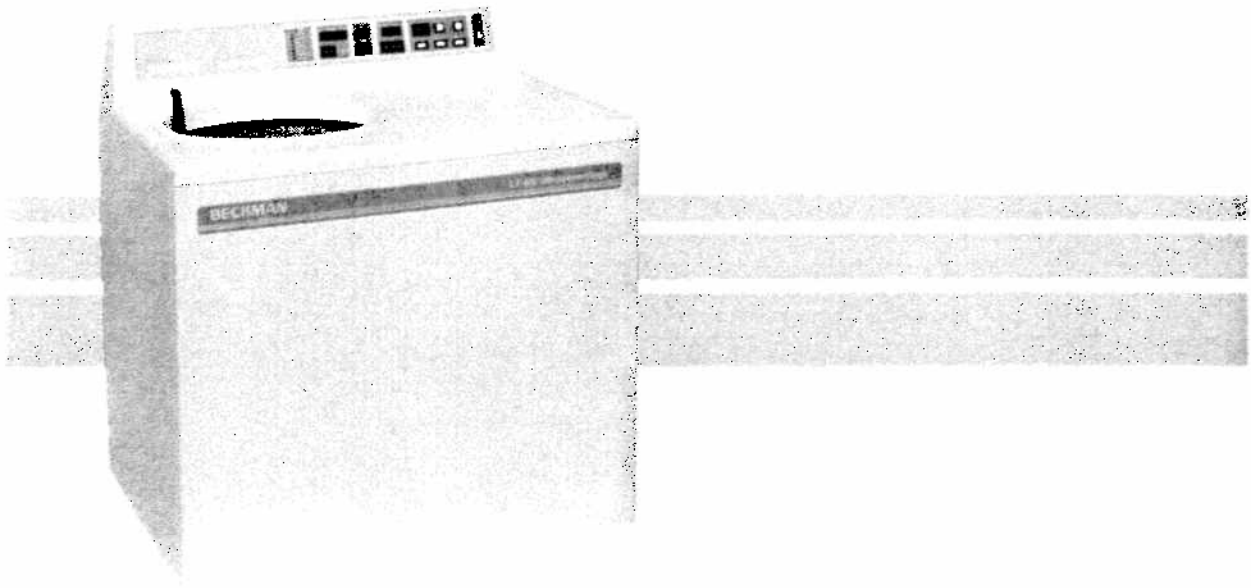


**PHYSICAL DATA**

Weight .....	558 kg (1230 lb)
Height (to top of control panel) .....	1168 mm (46 in.)
Width .....	978 mm (38.5 in.)
Depth .....	699 mm (27.5 in.)
Clearances .....	100 mm (4 in.) sides; 152 mm (6 in.) rear
Maximum heat dissipation into the room	
Freon*-cooled instruments .....	1.80 kW (6150 Btu/h)
Water-cooled instruments .....	1.35 kW (4600 Btu/h)
Air-cooled instruments (L7-35) .....	1.7 kW (5700 Btu/h)
Noise level measured 0.91 m (3 ft) in front of instrument .....	<60 dBA
Humidity restrictions .....	<95% (non-condensing)
Nominal power .....	200/240 Vac, 60 Hz; 220/240 Vac, 50 Hz; single phase
Fusing .....	30-A circuit breaker (on/off)
Finish .....	coated polycarbonate control panel; urethane paint on top surface; general purpose paint on other surfaces
Refrigerant .....	R 12 (dichlorodifluoromethane)

Locate the Model L7 in a clean, safe uncluttered environment. Observe the rear and side clearances, as sufficient air ventilation is required. The instrument will operate within specifications in a laboratory with an ambient temperature ranging from 15 to 40°C.

\* A trademark of E.I. Du Pont de Nemours & Company.



*Only values with tolerances on limits are guaranteed data. Values without tolerances are information data, without guarantee.*

## CONTROL CHARACTERISTICS

### Speed

Set speed ..... 1000 rpm to maximum permitted speed in increments of 1000 rpm.  
(Maximum speed will be 80 000, 65 000, 55 000\* or 35 000 rpm, depending on the model being used.)

Speed control and display ..... Digital readout indicates actual rotor speed in increments of 100 rpm.

### Rotor Temperature

Set temperature ..... 0 to 29°C in increments of 1°C

Normal operating range ..... 2°C to ambient

### Temperature control

and display ..... Digital readout indicates actual rotor temperature  $\pm 2^\circ\text{C}$  of set temperature (after equilibration).

### Time

Set time ..... Up to 9 hours 59 minutes or HOLD

Time display ..... Digital readout indicates time remaining in a TIME run. Zeros appear in the display during a HOLD run.

Acceleration ..... Automatic soft-start from 0 to 300 rpm (will vary slightly depending on the weight of the rotor) followed by full acceleration at a fixed maximum rate

Deceleration ..... Choice of two deceleration rates: full dynamic braking to (a) 0 rpm or (b) 800 rpm followed by no braking to a gentle stop

\* The Model L7-55 is no longer available. Current L7-55 users may use this edition of the manual, noting that the maximum speed permitted is 55 000 rpm; all other instructions are applicable to the Model L7-55.

## OPERATIONAL FEATURES

Revolution Counter	Accumulates total number of rotor revolutions in thousands
Barrier Ring	41-mm (1.63-in.) heat-treated steel alloy armor ring surrounded by 13-mm (0.5-in.) steel vacuum chamber provide full protection for the operator
Door	17-mm (0.67-in.) high-strength structural steel
Vacuum	Diffusion pump in series with a mechanical vacuum pump reduces chamber pressure to below 5 microns (0.665 Pa).
Instrument Classification	R (uses all Beckman preparative rotors except the Type 15 fixed angle rotor and zonal and continuous flow rotors)

Diagnostic Message*	Condition
IMBALANCE	Imbalanced rotor
OVERSPEED	Excessive rotor speed
ROTOR DISK	Unacceptable rotor overspeed disk signal or missing disk
OVERTEMP	Chamber temperature exceeds 30°C
DRIVE	Overheated drive or oil pump failure
TACHOMETER	Unacceptable tachometer signal
TUBE LEAK	Loss of chamber vacuum due to tube leakage (while the rotor is spinning at 20 000 rpm or higher)

---

\* See Section 3: Troubleshooting for detailed information on actions to take should any of these diagnostic messages appear on the control panel.

The Model L7 series of preparative ultracentrifuges (Models L7-80, L7-65, and L7-35; L7-55 is no longer available) is classified R. The Model L7 can be used with all Beckman fixed angle (except the Type 15), vertical tube, near vertical tube, and swinging bucket rotors. It is not equipped, however, for open-door zonal or continuous-flow operation.

Figure 1-1 shows the Model L7 control panel. Refer to it or the foldout illustration at the back of the manual to locate the switches and displays being described.

## CONTROL PANEL

### POWER SWITCH

The white POWER switch, labeled I (ON) and O (OFF) controls electrical power to the instrument. An amber light above the switch lights when the power is ON.

### START AND STOP BUTTONS

The START button is used to begin a run. The button lights up when pressed and remains on while the run is in progress. The STOP button flashes when pressed, to indicate that the rotor is decelerating; it stops flashing when the rotor comes to rest. If it is necessary to end a run in progress, the STOP button—not the power switch—should be pressed.

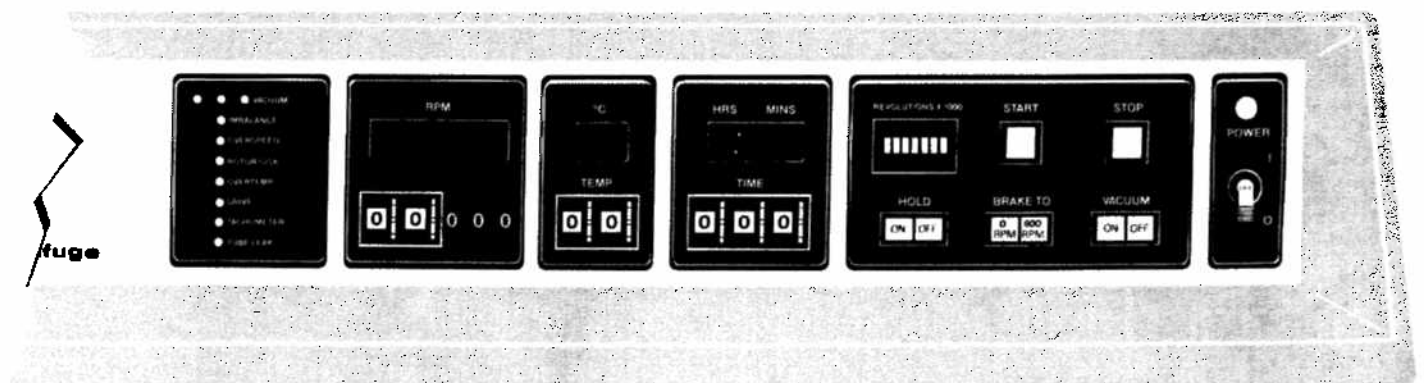


Figure 1-1. Model L7 Control Panel

**SPEED** Two thumbwheel switches are provided to set the rotor speed from 1000 to 80 000, 65 000, 55 000, or 35 000 rpm (depending on the model) in increments of 1000 rpm. (Although the thumbwheel switches permit physically setting a speed as high as 89 000, 69 000, 59 000, or 39 000 rpm, respectively, *the instrument will only accept the maximum speed permitted for that model.*) The speed display indicates actual rotor speed in increments of 100 rpm.

**TEMPERATURE** Two thumbwheel switches are provided to set the run temperature between 0 and 29°C. The normal operating range is 2°C to ambient. The temperature display indicates actual rotor temperature within 2°C after equilibration has been reached.

**TIME** Three thumbwheel switches are provided to set the run time for up to 9 hours, 59 minutes. In a TIME run (HOLD switch is in the OFF position), the display indicates the time remaining in the run. When the time display reaches zero, the rotor automatically decelerates to a stop.

**HOLD SWITCH** For longer runs, a HOLD switch is provided. In the HOLD mode (the switch is in the ON position), three zeros appear in the TIME display. To end a run in the HOLD mode, the STOP button must be pressed. Should the HOLD switch be turned off during the run, however, the instrument automatically reverts to the TIME mode and displays the settings indicated by the thumbwheel switches.

**BRAKE SWITCH** This two-position switch controls the duration of braking during deceleration. The 0 rpm position is used for full dynamic braking to a stop. The 800 rpm position is used to interrupt the dynamic braking at 800 rpm, followed by no braking to a gentle stop.

**VACUUM SWITCH** The VACUUM switch must be turned on before pressing the START button to begin the run. Three green lights in the upper left of the control panel (see Figure 1-1) light up—one by one—to indicate that the chamber is being evacuated. The VACUUM switch must be turned off at the end of the run to vent the chamber before opening the door.

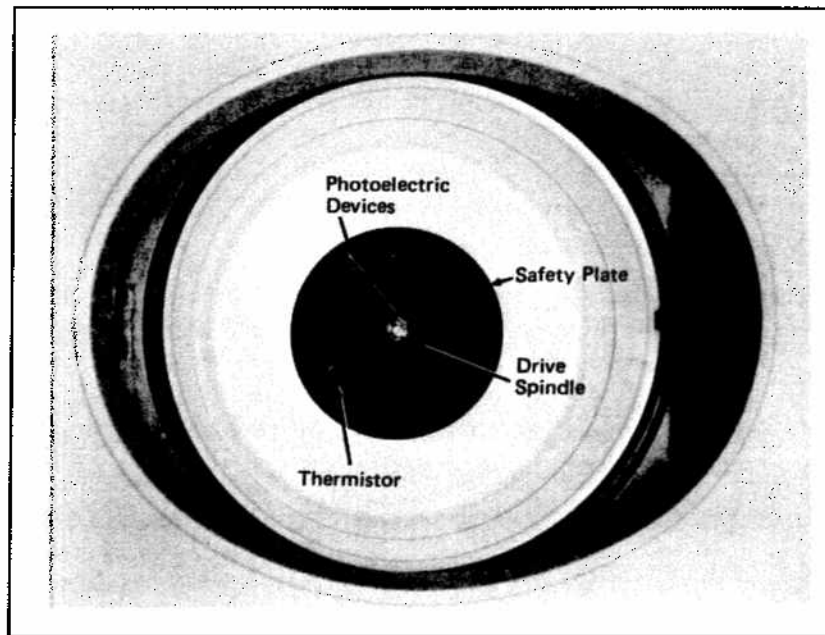
**DIAGNOSTIC MESSAGES** Diagnostic messages are listed on the control panel to indicate conditions that cause the rotor to decelerate to a stop. A red light flashes by the message in question to indicate the nature of the problem. The messages and recommended actions are described in detail in Section 3: TROUBLESHOOTING.

**DOOR** The chamber door is made of 17-mm (0.67-in.) high-strength structural steel. A solenoid interlock prevents it from being opened during

operation. The door can be unlocked only by using the door handle, and opened only if the power is ON and the vacuum is OFF (chamber at atmospheric pressure).

## ROTOR CHAMBER

The rotor chamber is heavy aluminum, coated with a chemically resistant epoxy finish. The rotor drive spindle, thermistor, photoelectric devices, and safety plate are visible in the bottom of the chamber (Figure 1-2).



*Figure 1-2. The Rotor Chamber*

## VACUUM SYSTEM

The instrument uses a diffusion pump in series with a mechanical vacuum pump to reduce chamber pressure to below 5 microns (0.665 Pa). (A vacuum sensor is located in the bottom of the rotor chamber, under the safety plate.) The vacuum pump starts when the VACUUM switch is turned on. The diffusion pump is automatically activated when the drive has started and the first vacuum light has come on (chamber pressure is about 1000 microns). Two lights on indicate that the pressure is still being reduced. All three vacuum lights on indicate that the chamber is at normal operating pressure.

## TEMPERATURE SENSING

The temperature of the rotor is controlled by a thermistor mounted in the bottom of the rotor chamber (see Figure 1-2). Actual rotor temperature, after equilibration, is controlled to within 2°C of the set run temperature. The maximum overtemperature is preset at 30°C.<sup>1</sup> Should the temperature exceed this, the light by the diagnostic message **OVERTEMP** will flash and the rotor will automatically decelerate to a stop.

## REFRIGERATION

The refrigeration compressor is activated when the main power circuit breaker is turned on, *but there is no cooling effect in the chamber until the door is closed and the VACUUM switch is turned on.* The normal operating temperature range is from 2°C to ambient. For faster temperature equilibration, precooling the rotor before beginning a cold run is recommended.

## OVERSPEED SYSTEM

The overspeed system is a safety feature, which checks the rotor to ensure that it does not exceed its maximum allowable speed. This system includes photoelectric devices in the rotor chamber next to the drive hub (Figure 1-2) and an overspeed disk on the rotor bottom (Figure 1-3). Individual rotor bulletins provide information on the correct overspeed disks to be used with each rotor.

The overspeed disk has alternating light and dark sectors. As the rotor spins, the passage of reflecting and nonreflecting sectors over the photoelectric devices generates a series of pulses that are detected by the electronic circuitry. If the pulse rate, which is dependent on the number of sectors of the disk as well as on the speed of the rotor, exceeds a set limit, the rotor will coast to a stop and the light by the diagnostic message **OVERSPEED** will flash.

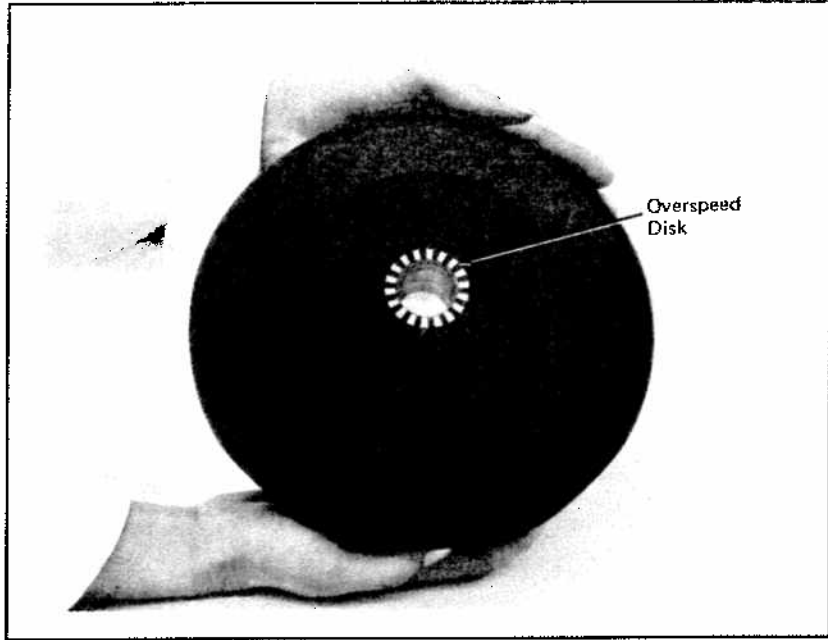
## DRIVE

The Model L7 uses the Ultra-Smooth™ direct-drive, induction motor system. The entire drive is integrated into a vacuum envelope—it requires neither an oil-bushing vacuum seal nor external oil reservoir. The system is frequency controlled, eliminating the need for motor brushes. Because the rotating shaft, or spindle, is attached directly to the motor, no gears are necessary. The absence of gears and motor brushes results in ultra-smooth, quiet, and long-life performance. The drive in Models L7-80 and L7-65 is Freon-cooled or, optionally, water-cooled. The drive in the Model L7-35 is air-cooled.

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<sup>1</sup> Early Model L7-55 instruments were preset at 50°C.





*Figure 1-3. Rotor with Overspeed Disk Attached*

**WARNING**

*Do not use the Model L7 in the vicinity of flammable liquids or vapors, and do not run such materials in the instrument. For additional operator safety, maintain a 30-cm (1-ft) "clearance envelope" around the instrument while it is running. During operation come within the envelope only to adjust instrument controls as required. Do not bring any flammable substances within the envelope; do not lean on the instrument or place items on it while it is operating.*

**WARNING**

*Normal operation may involve the use of solutions and test samples that are pathogenic, toxic, or radioactive. Operator error or tube failure may generate aerosols. Do not run toxic, pathogenic, or other hazardous materials in this instrument unless you take all appropriate safety precautions. Ask your laboratory safety officer to advise you about the level of containment required for your application and the proper decontamination or sterilization procedures to follow in the event that fluids escape from containers. Make sure that such procedures will not damage the instrument (see Section 4 for more detailed information.)*

**RUN PROCEDURE**

- ⊠ **NOTE** ⊠ Power must be turned on before the chamber door can be opened.

The Model L7 is classified R and can be used with all Beckman fixed angle (except the Type 15), vertical tube, near vertical tube, and swinging bucket rotors. The Model L7 is not equipped for open-door zonal or continuous-flow operation. Check that the rotor has the appropriate overspeed disk—undamaged and correctly installed. For fast temperature equilibration during a cold run, precool the rotor (outside of the instrument) beforehand. Wipe off any condensation on the rotor before placing it in the chamber to speed up chamber evacuation.

1. Turn the POWER switch ON. Open the chamber door and install the rotor.<sup>2</sup> Close the chamber door.
2. Turn the VACUUM switch ON. (The run cannot begin if this switch hasn't been turned on.)
3. Use the thumbwheel switches to enter values for SPEED and TEMP.
4. Enter a run time or, for runs longer than 9 hours, 59 minutes, turn the HOLD switch ON instead. (Zeros will appear in the TIME display during a HOLD run.)
5. Select a BRAKE position: 0 or 800 rpm.
6. Press START to begin the run.

The run begins with an automatic soft-start from 0 to 300 rpm, followed by full acceleration. The rotor will not accelerate beyond 1500 rpm, however, unless an adequate chamber vacuum has been achieved (about 1000 microns). At that time, the first vacuum light goes on and the rotor accelerates to set speed.

To end a run for any reason, press STOP. The STOP switch will flash to indicate that the rotor is decelerating. Runs in the TIME mode will terminate automatically when the TIME display counts down to zero.

After the rotor has stopped, turn the VACUUM switch OFF to vent the chamber. Open the chamber door, remove the rotor, then close the door. Keep the chamber door closed between runs.

## POINTS TO REMEMBER

- Never operate the drive without a rotor.
- Moisture in the rotor chamber will delay chamber evacuation thereby lengthening the time it takes to reduce chamber pressure before beginning the run. Follow these steps to keep the chamber clean and dry.
  - Keep the chamber door closed between runs. If left open, moisture will condense on the chamber walls—particularly after cold runs.
  - Wipe off the chamber walls and the rotor with a clean, dry cloth before placing the rotor into the chamber.
- For faster temperature equilibration, precool the rotor (outside of the instrument) before beginning a cold run.
- Do not run a rotor without the correct overspeed disk—the one for the rated speed of the rotor (or derated speed if applicable)—properly installed.
- Refer to the appropriate rotor bulletin for specifications and complete instructions on rotor use and care.

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<sup>2</sup> Should you bump the drive spindle while installing the rotor, the IMBALANCE diagnostic may be triggered. To clear it, simply press the STOP button.

**IN CASE OF POWER FAILURE DURING THE RUN**

Should a power failure occur during the run, the rotor coasts. If the rotor is still spinning when power is restored, the Model L7 will resume operation and the rotor will return to set speed. If the instrument is set in the TIME mode, it will automatically *reset the TIME display to the original set time*. The TIME display will flash to indicate that an outage has occurred and that the elapsed time shown is no longer accurate. In the HOLD mode, the instrument will return to set speed and zeros will reappear in the TIME display.

If the rotor comes to a complete stop during the power outage, you will have to press START to restart the run when power is restored.

**WARNING**

*Implement the following procedure only when absolutely necessary. Refer this procedure to qualified personnel. Wait at least an hour before attempting to recover the sample.*

**WARNING**

*Procedures requiring removal of instrument panels will involve exposure to electrical and mechanical hazards. **TURN THE POWER SWITCH OFF AND DISCONNECT THE INSTRUMENT FROM THE MAIN POWER SOURCE.** Refer such procedures to qualified personnel.*

In the event of an extended power failure, it may be necessary to trip the door-locking mechanism manually to retrieve the sample from the rotor. A rotor decelerating without the brake in a vacuum may take a few hours to come to a complete stop. The length of time will depend on the weight of the rotor and how fast it was spinning when the power outage occurred.

1. Make sure the instrument is disconnected from its power source.
2. Remove the front instrument panel<sup>3</sup> and LISTEN CAREFULLY.



**CAUTION**

Do NOT touch the diffusion pump—it may be HOT.

Touch the drive housing (Figure 3-1) to see if it is vibrating, and listen again. *Do not proceed while any sound or vibration is coming from the drive.*

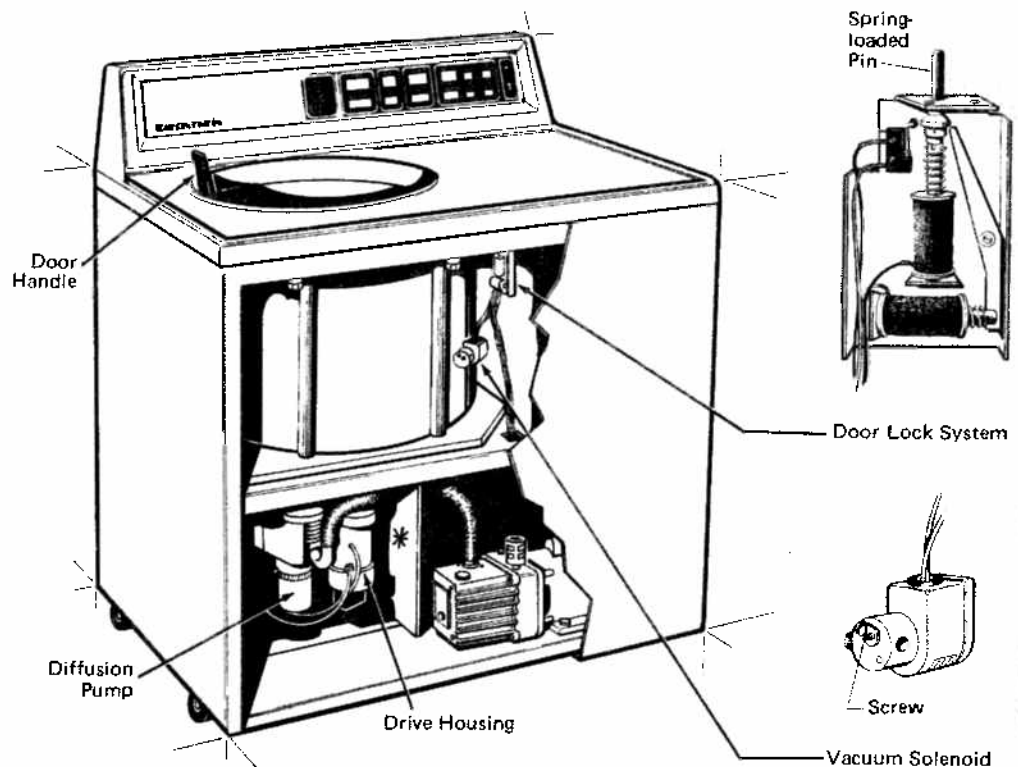


Figure 3-1. The Model L7 with Front Panel Cut Away. (The asterisk indicates the location of the drive-cooling fan in the Model L7-35.)

3. Release chamber vacuum by turning the screw clockwise (inward) on the vacuum solenoid valve (Figure 3-1) until you hear air rushing into the chamber. (If you hear a whining noise, close the valve and wait a while longer—**THE ROTOR IS STILL SPINNING.**) *After the vacuum is vented, return the screw counterclockwise to its closed position.*

<sup>3</sup> To remove the front panel, remove the two hex-head screws under the base of the panel. Carefully pull the bottom of the panel towards you a few inches. Then lower the panel sufficiently to release it from the two pins at the top of the frame.

4. To open the door, compress the spring on the horizontal solenoid (see the insert in Figure 3-1). Then pull the spring-loaded pin on the door lock down while pulling back on the door handle. If the rotor is still spinning, close the door and wait. The drive is particularly quiet and may emit no audible sounds below 5000 rpm.



**WARNING**

*Never try to slow or stop the rotor by hand.*

5. After removing the rotor, replace the front panel. Make sure that the panel rests on *top* of the tabs at the base of the instrument frame and that the screws are replaced.

## DIAGNOSTIC MESSAGES

The diagnostic messages on the control panel indicate shutdown conditions, which cause the rotor to decelerate to stop. A light blinks next to the diagnostic message in question to alert you to the nature of the problem. The chart below describes possible causes and recommended actions.

## DIAGNOSTIC MESSAGES CHART

Unless otherwise noted, let the rotor come to a complete stop before attempting to correct any problem listed below. The rotor will decelerate *with* the brake except in the case of a tachometer or overspeed problem, in which case it will decelerate *without* the brake. If a condition cannot be corrected, contact your Beckman Field Service representative for assistance.

**WARNING**

*It is your responsibility to decontaminate the Model L7 as well as any accessories before requesting service by Beckman Field Service representatives.*

**CAUTION**

If the TACHOMETER light is blinking, wait at least an hour before proceeding with the instructions given in the chart below.

Diagnostic Message	Condition	Possible Causes and/or Recommended Actions
IMBALANCE	Imbalanced rotor	<ol style="list-style-type: none"> <li>1. Drive spindle bumped while rotor is being installed. Press STOP to clear diagnostic.</li> <li>2. Check for proper and symmetrical placement of buckets and tubes.</li> <li>3. Check for tube leakage.</li> </ol>
OVERSPEED	Excessive rotor speed	Set speed exceeds that permitted by the overspeed disk. Correct the set speed if necessary. (The run can be resumed without the rotor coming to a stop.) If it is a speed control malfunction, there is no operator solution. Call your Beckman representative.
ROTOR DISK	Unacceptable over-speed disk signal	The rotor overspeed disk is damaged or missing. Consult the <i>Rotors and Tubes Manual</i> (LR-1M) for instructions on installing a new overspeed disk.
OVERTEMP	Chamber temperature exceeds 30°C	<p>Temperature exceeds the maximum permitted instrument temperature. The refrigeration system may need Freon or the vacuum system may be malfunctioning.</p> <ol style="list-style-type: none"> <li>1. Check the chamber door O-ring and clean if necessary.</li> <li>2. Check the level of vacuum pump oil.</li> </ol> <p>If there is no operator solution or no obvious cause for the overheating, call your Beckman representative.</p>
DRIVE	Overheated drive or oil pump failure	<ol style="list-style-type: none"> <li>1. Water-cooled: Lack of water. Check that water supply is turned on and moving at an acceptable rate (1.9 liters per minute). If there's a filter, check for dirt or an obstruction.</li> <li>2. Freon-cooled: Check that condenser fins are clean and unobstructed. Has there been a power outage during the run? If no obvious cause for the overheating, call your Beckman representative.</li> <li>3. Air-cooled: Check that the drive-cooling fan (see Figure 3-1) is operating correctly.</li> </ol> <p>If there is no operator solution or no obvious cause for the overheating, call your Beckman representative.</p>

*continued —*

Diagnostic Message	Condition	Possible Causes and/or Recommended Actions
TACHOMETER	Unacceptable tachometer signal	No operator solution. Call your Beckman representative. If you must retrieve your sample, WAIT AT LEAST AN HOUR. Then follow instructions "In Case of A Power Failure," above.
TUBE LEAK	Loss of chamber vacuum due to tube leakage	Liquid from a tube(s) has escaped from the rotor (while spinning at 20 000 rpm or higher), causing deterioration of the chamber vacuum. Remove the leaking or broken tube(s); clean the rotor and chamber.



**WARNING**

*It is your responsibility to decontaminate the Model L7 as well as any accessories before requesting service by Beckman Field Service representatives.*

**INSTRUMENT CARE**

The Model L7 requires no regular customer maintenance other than routine cleaning. For maintenance not covered in this manual, contact your Beckman Field Service representative.<sup>4</sup> Diagnostic messages are covered under TROUBLESHOOTING.

**WARNING**

*Maintenance that requires the removal of instrument panels will involve exposure to electrical and mechanical hazards. TURN THE POWER SWITCH OFF AND DISCONNECT THE INSTRUMENT FROM THE MAIN POWER SOURCE. Refer such maintenance to qualified personnel.*

**CLEANING**

The top working surface of the Model L7 is finished with urethane paint; the sides are finished with general purpose paint. All surfaces can be washed with a mild detergent solution such as Beckman Solution 555™ or disinfected with 70% ethanol<sup>5</sup> in the event of contamination. The control panel, made of coated polycarbonate, should be wiped clean with a damp cloth if necessary.

**Chamber**

The rotor chamber is coated with epoxy resin paint and the chamber door O-ring is Buna N rubber. The chamber can be wiped clean with a cloth or washed with a mild detergent.<sup>6</sup> The O-ring should be cleaned

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<sup>4</sup> A service manual is available; contact your Field Service representative.

<sup>5</sup> Flammability hazard. Do not use in or near operating ultracentrifuges.

<sup>6</sup> Do not spray detergent into the chamber as it can cause shorting of the optical system.

with a tissue or lint-free cloth every 3 or 4 months. Replace the O-ring whenever it becomes worn or damaged. (Do not use sharp tools that will scratch or damage the O-ring groove—such damage can prevent a proper vacuum seal from being made. Instrument O-rings have *not* been designed as bioseals for aerosol containment.) Lightly coat the new O-ring with silicone vacuum grease before installing it to ensure an optimal vacuum seal.

⚠ **NOTE** ⚠ Keep the chamber door closed between runs to prevent moisture from collecting inside. Wipe off the chamber walls with a dry cloth before each run.

#### Refrigeration Condenser Fins

The fins on the refrigeration condenser (refer to the foldout illustration at the back of the manual) must be clean for efficient heat transfer. Use a vacuum cleaner or a damp cloth to clean the fins. Be careful—the fins are sharp.

#### CHANGING THE VACUUM PUMP OIL



#### **WARNING**

*Check with the operator for possible pathogenic, toxic, or radiation contamination and take the required safety precautions before servicing the instrument.*



#### **WARNING**

*Procedures requiring removal of instrument panels will involve exposure to electrical and mechanical hazards. **TURN THE POWER SWITCH OFF AND DISCONNECT THE INSTRUMENT FROM THE MAIN POWER SOURCE.** Refer such procedures to qualified personnel.*

The vacuum pump oil should be changed every 3 to 12 months—depending on use—or whenever the oil is cloudy, which indicates that it is contaminated. (Check by looking through the sight glass on the pump housing.) If the oil is leaking, however, call your Field Service representative for assistance. If the pump oil has been contaminated with radioactive or pathogenic materials, the necessary safety precautions must be followed when changing and disposing of it.

You may change the vacuum pump oil yourself or have your Beckman Service representative do it. We've provided directions for your convenience.

1. Make sure the instrument is disconnected from its power source.

2. Remove the front panel: unscrew the two hex-head screws under the base of the panel. Carefully pull the bottom of the panel towards you a few inches. Then lower the panel sufficiently to release it from the two pins at the top of the frame.
3. Lift the vacuum pump out of the instrument (refer to the foldout illustration), and disconnect its hose and power cord.
4. Drain all of the oil by removing the drain plug (at end of pump housing). Remove the exhaust filter from the top of the reservoir and refill the pump with direct-drive vacuum pump oil.
5. Replace the filter. Then reinstall the pump and connect its power cord. Replace the front panel, making sure that the panel rests on *top* of the two tabs at the base of the instrument frame and that the screws are replaced.

## STORAGE AND SHIPPING

To ensure that the instrument does not get damaged, contact your Beckman Field Service representative for specific instructions and/or assistance in preparing the Model L7 for long-term storage or shipping.

## SUPPLY LIST

Direct-drive vacuum pump oil .....	341661
Diffusion pump oil .....	330246
Silicone vacuum grease .....	335148
Spinkote lubricant .....	306812
Beckman Solution 555 .....	339555
Chamber O-ring .....	801778
Centering tool for overspeed disk .....	331325
Logbook for Preparative Ultracentrifuges .....	330049
Master Rotor Logbook .....	339587
Replacement lamp for START and STOP switches .....	847925

Consult individual rotor bulletins for a detailed list of available tubes and rotor accessories.

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## WARRANTY FOR THE MODEL L7 SERIES PREPARATIVE ULTRACENTRIFUGES

Subject to the exceptions and upon the conditions specified below, Beckman agrees to correct, either by repair, or, at its election, by replacement, any defects of material or workmanship which develop within one (1) year after delivery of the Model L7 Ultracentrifuge (the product), to the original Buyer by Beckman or by an authorized representative, provided that investigation and factory inspection by Beckman discloses that such defect developed under normal and proper use.

Some components and accessories by their nature are not intended to and will not function for as long as one (1) year. If any such component or accessory fails to give reasonable service for a reasonable period of time, Beckman will repair or, at its election, replace such component or accessory. What constitutes either reasonable service and a reasonable period of time shall be determined solely by Beckman.

### REPLACEMENT

Any product claimed to be defective must, if requested by Beckman, be returned to the factory, transportation charges prepaid, and will be returned to Buyer with the transportation charges collect unless the product is found to be defective in which case Beckman will pay all transportation charges.

Beckman makes no warranty concerning products or accessories not manufactured by it. In the event of failure of any such product or accessory, Beckman will give reasonable assistance to the Buyer in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

Damage to the instrument while operating a rotor not of Beckman manufacture is not covered by warranty or service contract terms. Further, Beckman shall be released from all obligations under all warranties either expressed or implied, if the product covered hereby is repaired or modified by persons other than its own authorized service personnel, unless such repair is made by others who meet qualifications similar to those required of Beckman's service personnel, or unless

such repair in the sole opinion of Beckman is minor, or unless such modification is merely the installation of a new Beckman plug-in component for such product.

### SPECIAL DRIVE WARRANTY

During the instrument's warranty period (one year) there will be no charge for drive replacement if the drive is installed, serviced and operated in accordance with the following conditions.

### CONDITIONS

1. The drive has been operated only within its rated speed and temperature ranges.
2. The drive unit has not been subjected to unequal loading, improper rotor installation, corrosion from material spilled onto the hub or accumulated in the chamber of the instrument.
3. The drive unit has not been disassembled, modified, or repaired, except by Beckman personnel or by a Service representative authorized by Beckman.
4. The drive unit was installed by a Beckman Field Service representative or other Service representative authorized by Beckman.

### DISCLAIMER

IT IS EXPRESSLY AGREED THAT THE ABOVE WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND OF THE WARRANTY OF MERCHANTABILITY AND THAT BECKMAN SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER ARISING OUT OF THE MANUFACTURE, USE, SALE, HANDLING, REPAIR, MAINTENANCE, OR REPLACEMENT OF THE PRODUCT.

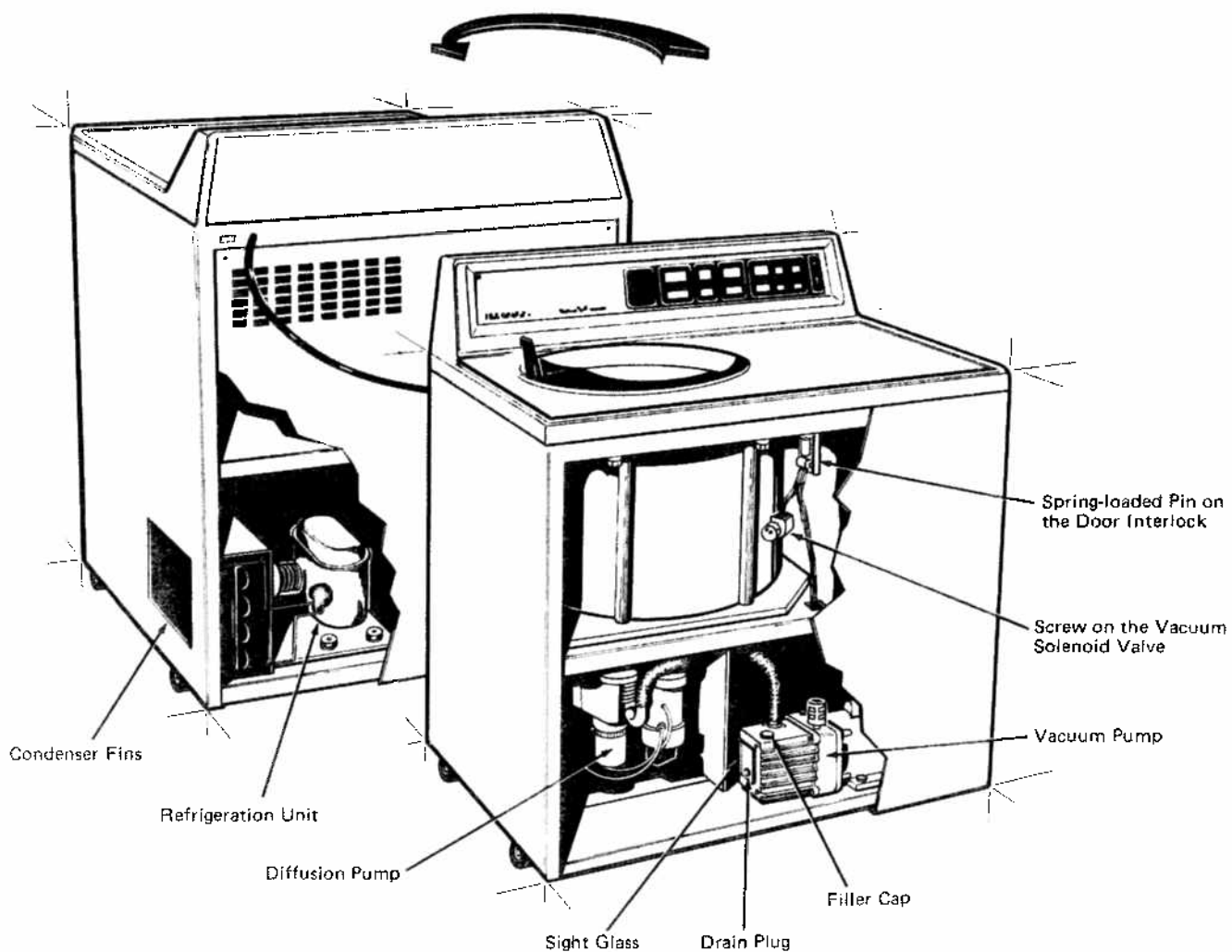
*Use the Logbook for Preparative Ultracentrifuges (p/n 330049) and the Master Rotor Logbook (p/n 339587) to keep an accurate record of the number of hours and the speed of each run for each rotor. This information will be required to derate the rotor and for warranty purposes.*

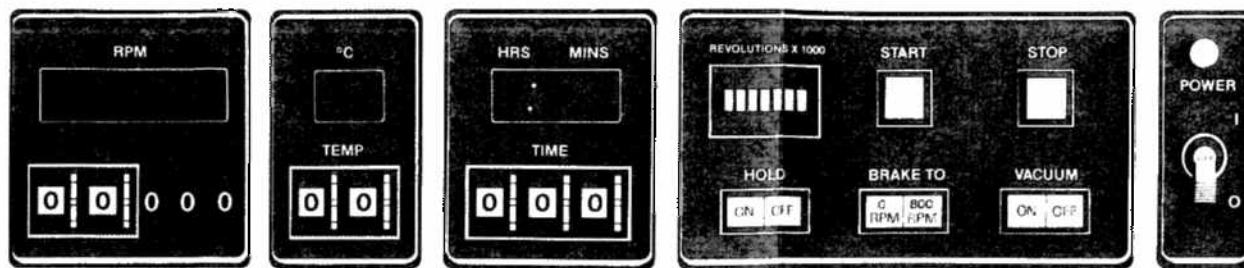
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# BECKMAN

MADE IN U.S.A.

## L7 Ultracentrifuge





## Summary of Operating Steps for the Model L7

**NOTE:** Power must be turned on before the chamber door can be opened.

The Model L7 is classified R and can be used with all fixed angle (except the Type 15), vertical tube, near vertical tube, and swinging bucket rotors. The Model L7 is not equipped for open-door zonal or continuous-flow operation. Check that the rotor has the appropriate overspeed disk-undamaged and correctly installed. For fast temperature equilibration during a cold run, precool the rotor (outside of the instrument) beforehand. Wipe off any condensation on the rotor before placing it in the chamber to speed up chamber evacuation.

1. Turn the POWER switch ON. Open the chamber door and install the rotor.\* Close the chamber door.
2. Turn the VACUUM switch ON. (The run cannot begin if this switch hasn't been turned on.)
3. Use the thumbwheel switches to enter values for SPEED and TEMP.

\* Should you bump the drive spindle while installing the rotor, the IMBALANCE diagnostic may be triggered. To clear it, press the STOP button.

4. Enter a run time or, for runs longer than 9 hours, 59 minutes, turn the HOLD switch ON instead. (Zeros will appear in the TIME display during a HOLD run.)
5. Select a BRAKE position: 0 or 800 rpm.
6. Press START to begin the run.

The run begins with an automatic soft-start from 0 to 300 rpm, followed by full acceleration. The rotor will not accelerate beyond 1500 rpm until an adequate chamber vacuum has been achieved (about 1000 microns). At this time, the first vacuum light goes on and the rotor accelerates to set speed. All three lights on indicates that the chamber is at normal operating pressure.

To end a run in progress, press STOP. The STOP switch will blink to indicate that the rotor is decelerating. In the TIME mode, the run will end automatically when the TIME display counts down to zero.

After the rotor has stopped, turn the VACUUM switch OFF to vent the chamber. Open the chamber door, remove the rotor, then close the door. Keep the chamber door closed between runs.