

# ***OPERATING INSTRUCTIONS***

**SORVALL<sup>®</sup> RC-M120EX**

***Micro-Ultracentrifuge***

Sorvall Products, L.P.  
Newtown, Connecticut  
U.S.A.

**SORVALL<sup>®</sup>**  
**C E N T R I F U G E S**

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# **Chapter 1: DESCRIPTION**

This manual provides you with the information you need to install, operate, and maintain your SORVALL® RC-M120EX Micro-Ultracentrifuge. If you encounter any problem concerning operation or maintenance that is not covered in this manual, please contact Sorvall for assistance. In the United States, call toll free (800) 522-SPIN (800 522-7746). Outside the United States, contact the distributor or agent for SORVALL® products.

## **Centrifuge Description**

The SORVALL® RC-M120EX Micro-Ultracentrifuge is designed to be user friendly and reliable. They are microcomputer controlled which allows for programming of run conditions (up to ten programs can be saved); step-mode operation (up to nine steps per program); delayed start operation; variable acceleration and deceleration rates; three steps of vacuum level indication (low, intermediate, and high); and alarm codes that help identify the cause of a performance error.

The drive system uses a high-torque, high-frequency air-cooled motor that offers the optimum in centrifuge drive performance. The high torque of the motor results in faster acceleration and braking. The motor is brushless, which eliminates the maintenance problems associated with carbon brushes.

## **Safety features include:**

### **Rotor Chamber Guard Ring**

The rotor chamber is enclosed by a thick steel guard ring, which provides protection in the event of a rotor failure.

### **Imbalance Detector**

Detects rotor imbalance and will cause a run in progress to terminate if abnormal imbalance is detected to protect the centrifuge drive system and help prevent rotor failure.

### **Overspeed Detector**

Detects rotor speed in excess of the maximum allowable speed of the rotor in use. In the event rotor speed exceeds the allowable limit during a run, the overspeed detector will cause the run in progress to terminate. In addition, if a set speed is selected that is higher than the maximum rated speed of the installed rotor, this detector will cause the run to terminate when the rotor accelerates above 5000 rpm.

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**Door Lock**

The door lock will not allow centrifuge operation until the chamber door is completely closed, which activates the door lock switch. The door remains locked until the VACUUM is turned OFF and the STOP lamp is lit, indicating that the rotor has stopped spinning.

## **Centrifuge Accessories**

The following accessories are provided with the centrifuge:

Catalog No.	Description
45218	Allen Wrench
45208	Leveling Pad
45217	Rotor Locking Tool
45210	Phillips Head Screwdriver
45128	Vacuum Pump Oil
65937	Vacuum Grease
45214	Tubing
45215	Funnel
45216	Level
45165	Fuse 15A (3)
45533	Fuse 1.6A (1)
45530	Instruction Manual
45531	Operating Guide

## Centrifuge Specifications

### Maximum Speed\*:

RC-M120EX ..... 120 000 rpm

### Maximum RCF:

RC-M120EX ..... 649 825 x g

Drive Motor ..... High frequency (direct drive), Air Cooled

Speed Control .....  $\pm 100$  rpm

Time ..... Set from 1 minute to 99 hours and 59 minutes; or select HOLD for continuous operation

Temperature Control .....  $\pm 2^{\circ}\text{C}$  from  $0^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$

Set Temperature .....  $0^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$

Ambient Temperature Range .....  $+5^{\circ}\text{C}$  to  $+35^{\circ}\text{C}^{**}$

Electrical Requirements ..... Single phase; 115 Vac  $\pm 10\%$ ; 50/60 Hz; 13 A\*\*\*  
Single phase; 208/220/230/240  $\pm 10\%$ ; 50/60 Hz; 7A

### Dimensions:

Width ..... 47 cm (18.6 inches)  
Depth ..... 56 cm (22.2 inches)  
Height ..... 102 cm (40.2 inches) to top of control panel;  
89 cm (35 inches) to top deck

### Weight:

RC-M120EX ..... 155 kg (342 lb)

\*Speed in revolutions per minute (rpm) is related to angular velocity,  $\omega$ , according to the following:

$$\omega = (\text{rpm}) \left( \frac{2\pi}{60} \right) = (\text{rpm}) (0.10472)$$

Where  $\omega$  = rad/s. All further references in this manual to speed will be designated as rpm.

\*\*Refrigeration system performance is optimal at ambient temperatures from  $+15^{\circ}\text{C}$  to  $+25^{\circ}\text{C}$ .

## Chapter 2: **INSTALLATION**

This chapter describes the location, temperature, and electrical requirements that you must make provisions for prior to installation of the centrifuge by an authorized Sorvall representative.

**NOTE** This centrifuge must be installed by an authorized Sorvall representative. If the centrifuge is installed by anyone else, the centrifuge warranty will be void.

### **Unpacking and Inspection**

As soon as you receive your centrifuge, carefully open the shipping container and remove all packing material — do not use sharp tools to open the container. Inspect the centrifuge for any signs of shipping damage. If you find damage, please report it immediately to the transportation company and file a damage claim, then notify Sorvall (see back cover).

Check the parts received with the centrifuge against the packing list; if parts are missing, contact Sorvall.

### **Location**

Locate the centrifuge on a solid, level floor capable of withstanding 350 kg/sq. m (71.7 lb/sq. ft) with minimal vibration transmission characteristics.

To permit free air circulation, the location must allow space for the size of the centrifuge (figure 2-1), plus an additional 20 cm (8 inch) or more behind the centrifuge and 15 cm (6 inch) on each side of the centrifuge. Free air circulation is very important for proper centrifuge operation. Do not locate the centrifuge in direct sunlight or near heat-generating machines or equipment; to do so will have a detrimental affect on the centrifuge cooling performance. Also, do not locate the centrifuge in a dusty environment.

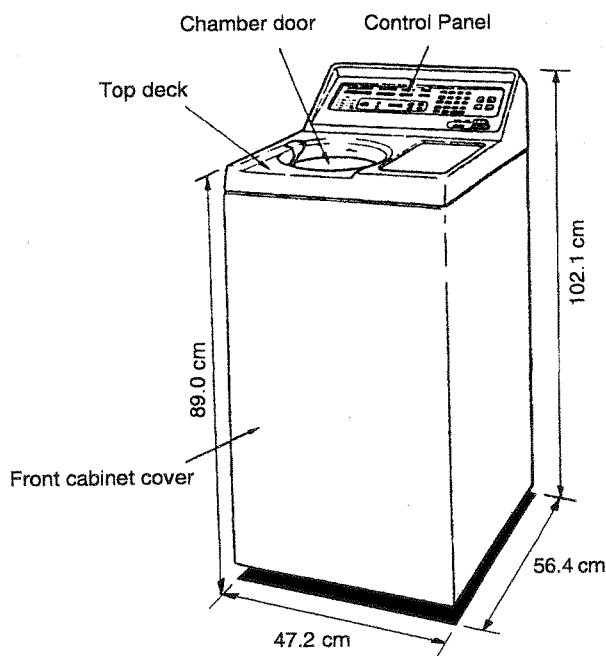
### **Ambient Temperature**

An ambient temperature range of +5°C to +35°C must be maintained. Optimum refrigeration system performance is in an ambient temperature range of +15°C to +25°C.



#### **CAUTION**

If the centrifuge must be moved after it has been installed, refer to the special instructions at the end of this chapter, Moving and Leveling the Centrifuge, to avoid damaging the centrifuge.



*Figure 2-1. Centrifuge Dimensions*

## **Electrical Requirements**



### **CAUTION**

The centrifuge can be damaged if connected to the wrong voltage. Check the voltage before plugging the centrifuge into a power source.

The centrifuge must be connected to the power source that is specified on the nameplate on the back of the centrifuge, it will be: single phase; 115 Vac  $\pm$  10%, 50/60 Hz, 13 A, or single phase; 208/220/230/240 Vac  $\pm$  10%; 50/60 Hz; 7 A. The centrifuge must be operated on a dedicated circuit (that is, no other equipment can share the same electrical circuit).



## Moving and Leveling the Centrifuge



### CAUTION

If the centrifuge must be moved, make sure there is no rotor in the rotor chamber before you lower the casters and move the centrifuge.

When the centrifuge is situated at its operating location, level it as follows:

**NOTE** You do not have to remove the cabinet panels to level the centrifuge.

1. Determine which of the four bottom corners of the centrifuge is most difficult to access, then place a leveling pad (Catalog No. 45208, supplied with the centrifuge) under the leveling screw at that corner (see figure 2-2).
2. Place a 13 mm open-end wrench over the flats of the leveling screw (same corner as Step 1) and turn the leveling screw until the caster is approximately 6 mm (1/4 inch) off the floor.
3. Using a 24 mm open-end wrench, secure the lock nut on the leveling screw to the centrifuge frame by tightening the nut in the direction of the arrow in figure 2-2.

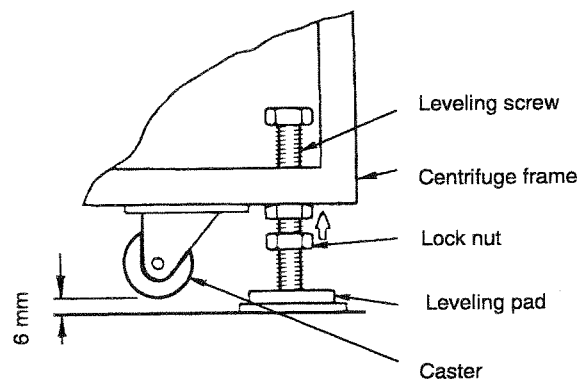


Figure 2-2. Leveling Adjustment

4. Repeat steps 1 and 2 at the three remaining corners (do not secure lock nut at these corners yet).
5. Plug centrifuge power cord into the outlet and turn the centrifuge power ON.
6. Open the chamber door and install a SORVALL® Fixed-Angle Micro-Ultracentrifuge Rotor *without* the rotor cover in place. Place the level (Catalog No. 45216) supplied with the centrifuge

across the top of the rotor. (If the power supply is not available yet, open the chamber door according to the procedure for Emergency Sample Recovery on page 4-7).

7. Adjust the leveling pad at each of the three corners until the bubble in the level indicates that the centrifuge is level.
8. Remove the level from the rotor, and remove the rotor from the centrifuge.
9. When centrifuge is level, make sure leveling screw at each leveling pad is secure. Next, secure the lock nut at each of the three corners to the centrifuge frame using a 24 mm open-end wrench, tighten each nut in the direction of the arrow in figure 2-2.

# Chapter 3: Operation

This chapter provides the information necessary to operate the RC-M120EX Micro-Ultracentrifuge.

## Controls and Indicators

Figure 3-1 shows the location of all controls and indicators and Table 3-1 describes their function.

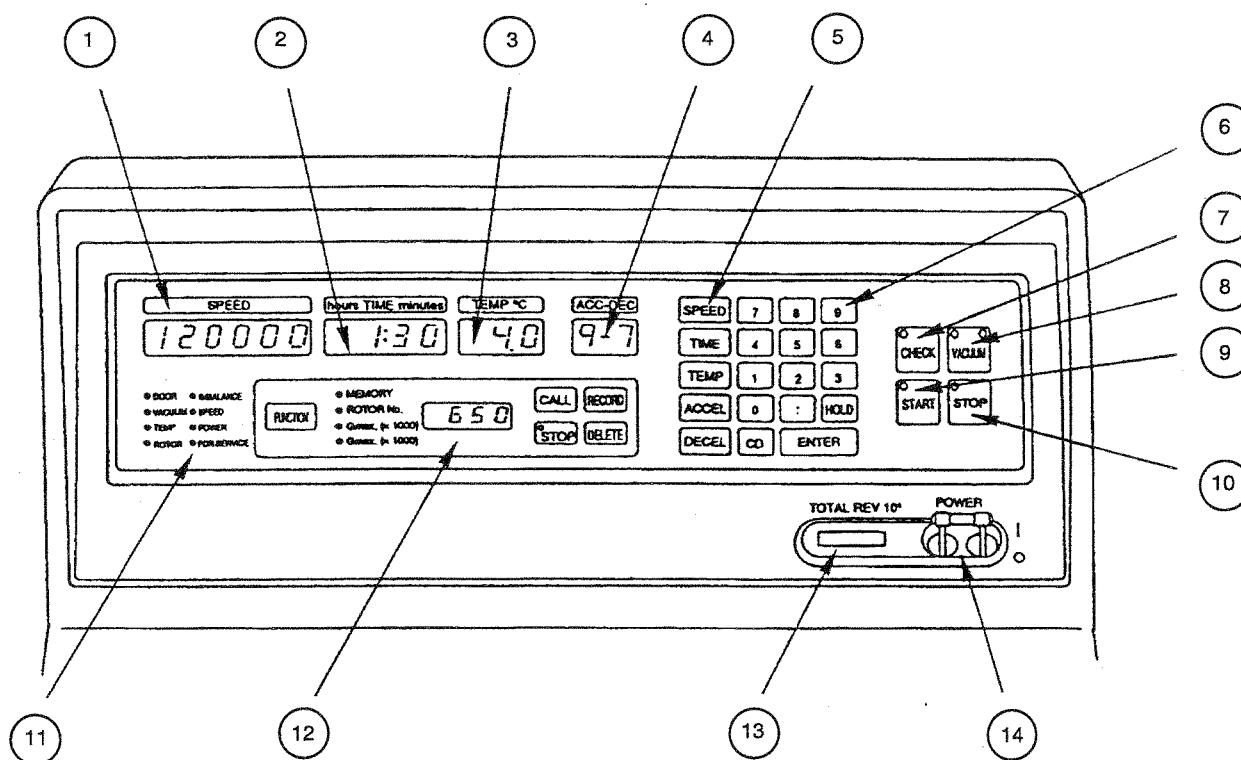


Figure 3-1. Controls and Indicators

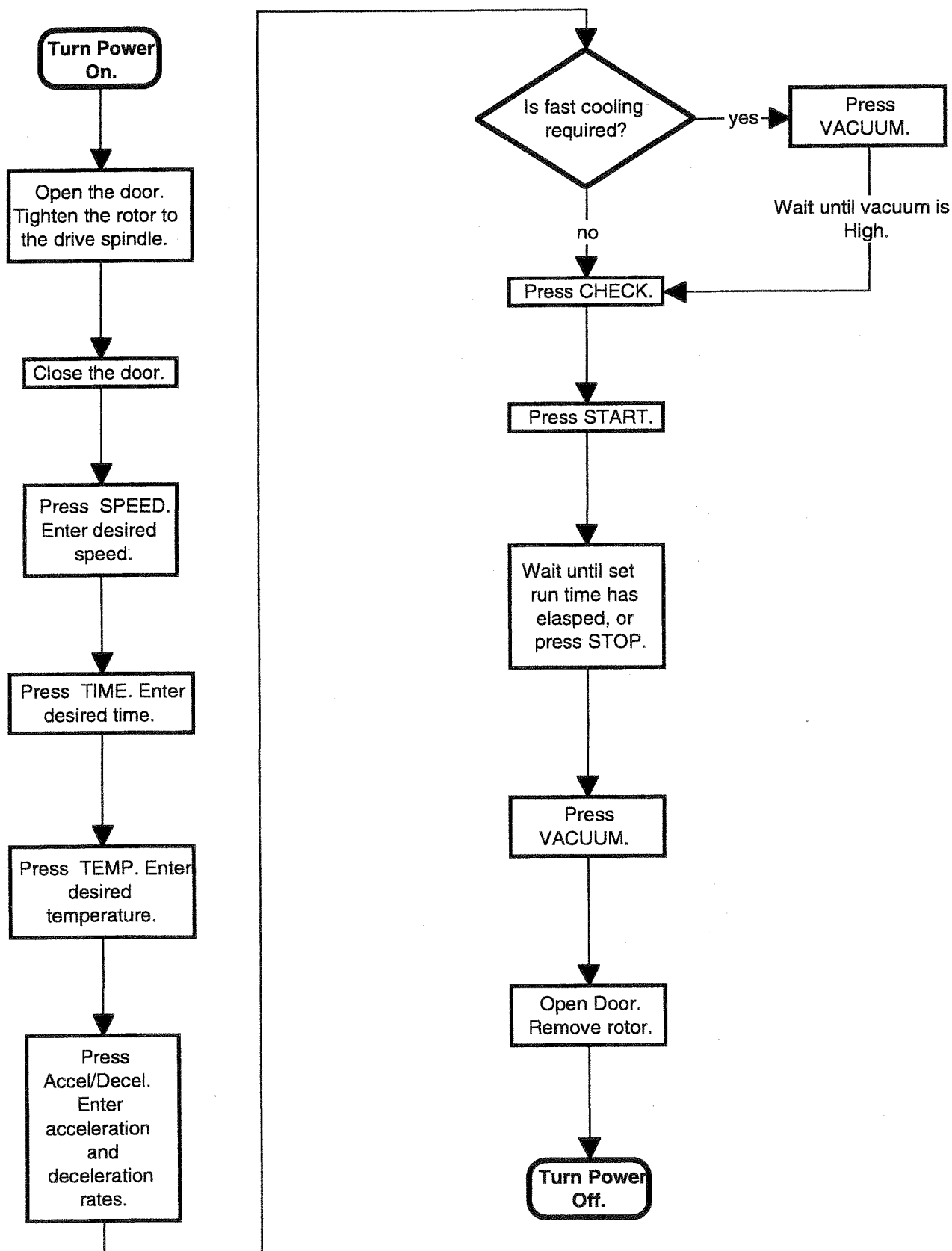
**Table 3-1. Controls and Indicators  
(keyed by item number to figure 3-1)**

Item No.	Name	Function
1	SPEED Display	Displays actual rotor speed in increments of 10 up to 5000 rpm and increments of 100 above 5000 rpm.
2	TIME Display	Displays remaining time. If <b>HOLD</b> is selected, it displays accumulating run time.
3	TEMP Display	Displays rotor temperature in increments of 0.1°C.
4	ACC-DEC Display	On the left, displays code number (1 to 9) for the acceleration rate selected. (Number 9 selects fastest rate). On the right, displays code number (1-9) for deceleration rate selected or F if free coast ( <b>HOLD</b> ) has been selected.
5	Parameter Selection Keys	<p><b>TIME</b> is used to select run time from one minute to 99 hours, 59 minutes.</p> <p><b>SPEED</b> is used to select run speed from 5000 rpm to 120 000 rpm.</p> <p><b>TEMP</b> is used to select desired run temperature from 0°C to +40°C in 1°C increments.</p> <p><b>ACCEL</b> is used to select desired rotor acceleration rate.</p> <p><b>DECEL</b> is used to select desired rotor deceleration rate.</p>
6	Keypad	The numeric keypad is used to input numbers from 0 to 9 to select run parameter values. <b>HOLD</b> selects a continuous run. <b>CE</b> cancels an entry or resets a displayed error code. <b>ENTER</b> causes an input value to be accepted.
7	<b>CHECK</b> Key	When pressed, the <b>CHECK</b> indicator light above the key comes on and all set run parameters are displayed for 20 seconds. After 20 seconds, the indicator light goes out, and the displays automatically change back to show current run conditions. The <b>CHECK</b> indicator light must be on when <b>START</b> is pressed for the run to begin.
8	<b>VACUUM</b> Key	Used to turn vacuum pump on and off before a run is started. If key is not pressed before <b>START</b> is pressed, vacuum pump will automatically come on when <b>START</b> is pressed. Temperature control begins when the pump turns on; when the pump is off, temperature is maintained at 25°C. It must be pressed after a run to release the vacuum and allow access to the chamber.

**Table 3-1. Controls and Indicators  
(continued)**

Item No.	Name	Function
8	<b>VACUUM</b> Key (continued)	<p>○ ● Left light is lit. Indicates that vacuum level is Low. Rotor cannot accelerate above 5000 rpm until chamber reaches Intermediate vacuum level.</p> <p>○ ☼ Left light is lit and right light is blinking. Indicates Intermediate vacuum level.</p> <p>○ ○ Both lights are lit. Indicates vacuum level is High. Note: If temperature control is critical to the sample, do not press <b>START</b> until the chamber is at High vacuum level.</p>
9	<b>START</b> Key	Starts the centrifuge run (CHECK indicator light must be on when <b>START</b> is pressed). The indicator light above the key blinks while the rotor is accelerating to set speed. When the rotor reaches set speed, the light stops blinking but stays lit.
10	<b>STOP</b> Key	Stops the centrifuge run. The indicator light above the key blinks while the rotor is decelerating. When the rotor stops, the light stops blinking but stays lit.
11	Alarm Indicators	<p>When a problem occurs that affects centrifuge operation, the indicator light that corresponds to the problem will come on (Chapter 4, Table 4-1)</p> <p>If the FOR SERVICE indicator lights, a maintenance code will be displayed in the TIME display (Chapter 4, FOR SERVICE Alarm).</p> <p>When the problem has been corrected, clear the display by pressing <b>CE</b>. If the problem is not corrected, the display indicator light will come back on after <b>CE</b> is pressed.</p>
12	Advanced Feature Controls	Saves and recalls a collection of run conditions for programmed operation (see Advanced Features).
13	TOTAL REV Counter	Indicates accumulated total drive revolutions in millions.
14	POWER	When ON, applies power to the centrifuge.

## Normal Operation Flowchart



## Normal Operation



### WARNING

When loading the rotor, do not exceed its maximum compartment mass. If maximum compartment mass is exceeded, maximum operating speed must be lowered according to procedure in the rotor instruction manual. Rotor loads in excess of the maximum compartment mass can cause rotor failure, which can result in personal injury and/or centrifuge damage.



### CAUTION

The rotor must be gently placed on the drive spindle to avoid damaging the drive shaft and/or bearings.

**NOTE** Prepare the rotor according to the instructions in the appropriate rotor instruction manual.

A normal run is controlled by time with run temperature and run speed parameters selected.

To perform a normal run:

***Read all WARNINGS and CAUTIONS listed on the Safety Information Page in the front of this manual.***

1. Turn centrifuge power ON.

When POWER is ON, all control panel indicator lights come on, and the door lock releases.

2. Open the chamber door. Make sure the rotor chamber is dry. Wipe any frost or moisture from the chamber using a clean, dry cloth.

**NOTE** If the rotor chamber is not completely dry at the beginning of a run, it will take longer for the chamber to reach Intermediate and High vacuum levels.

3. Wipe the drive spindle with a soft cloth. Wipe any iron powder from the bottom of the rotor. *Gently* place the rotor on the drive spindle. Secure the rotor to the drive spindle using the rotor locking tool (Catalog No. 45217) supplied with the centrifuge.

**NOTE** To tighten the rotor to the drive, set the switch on the rotor locking tool in the DOWN position and turn the tool clockwise. To remove the rotor, set the switch in the UP position and turn tool counterclockwise. (When the switch is set in the middle position, the ratchet mechanism is locked and the wrench can be used as a standard wrench.)

4. Close the chamber door.
5. Input all desired run parameters:

Press **SPEED** and input the desired run speed (minimum 5000 rpm) in thousands only; for example, for a run speed of 100 000 rpm, input **1 0 0**.

For Normal Operation  
input sequence, see  
example below:

**SPEED**, 1, 0, 0

**TIME**, 1, :, 3, 0

**TEMP**, 2, 0

**ACCEL**, 9, **DELETE**, 9

**ENTER**

**CHECK**

**START**

Press **TIME** and input the desired run time. For a run that is less than one hour, you must press the **:** key before you input the desired number of minutes. For a run longer than one hour, first input the number of hours, then press the **:** key and input the number of minutes. For a continuous run, press **TIME** then press **HOLD**.

Press **TEMP** and input the desired run temperature.

If desired, press **ACCEL** and/or **DECEL** and enter the desired acceleration and deceleration rates (see Acceleration Rates and Deceleration Rates). For free coast deceleration press **DECEL**, then press **HOLD**. If **HOLD** is selected the letter "F" will appear in the display.

Press **ENTER**.

**NOTE** If you press a selection key by mistake, press the correct selection key and it will override the incorrect selection. If no entry is made within 20 seconds after the selection key begins to blink, the display will automatically change to show current run conditions. (To verify selections, press **CHECK** to display set parameters.)

If an incorrect value is entered, press **CE** to clear the entry then input the desired value.

6. If fast cooling *is not* required, press the **CHECK** key then press **START**.

**NOTE** The **CHECK** indicator light must be ON when **START** is pressed. If it is OFF, press **CHECK** then press **START** within 20 seconds.

The rotor will start to accelerate, and the START indicator light will begin to blink. The rotor will stop at 5000 rpm and wait until vacuum reaches the Intermediate level. When Intermediate vacuum level is reached, the timer will start and the rotor will accelerate to set speed. At set speed, the START indicator light will stop blinking, but it will stay lit.

If fast cooling *is* required, press **VACUUM**. Current chamber vacuum level is indicated by the two VACUUM indicator lights located in the upper left and right corners of the **VACUUM** key (see Table 3-1, Item 8).

Once the chamber vacuum is at a high level, press the **CHECK** key, then press **START**. The chamber will cool faster without the rotor spinning, and temperature sensitive samples will be better protected.



**NOTE** The centrifuge will not control temperature until the chamber door is closed and **VACUUM** or **START** is pressed.

If you wish to change a **HOLD** run to a timed run while the run is in progress, enter the additional run time desired plus the accumulated time. For example, if a run has been in progress for 5 hours with **HOLD** selected and you want the run to continue for one hour and 30 minutes, press the following keys (in the order given).

**TIME** **6** **:** **3** **0** **ENTER**



### CAUTION

If a run is ended by pressing **STOP**, wait 5 minutes after **STOP** is pressed, then press **VACUUM** to conserve diffusion pump oil. (If a run ends when selected time has elapsed, the diffusion pump automatically shuts off 5 minutes before the rotor begins to decelerate.)

7. If the current operation needs to be discontinued, press the **STOP** key.

When **STOP** is pressed or the selected length of run time has elapsed, the rotor will begin to decelerate. The **START** indicator will go out. The **STOP** indicator will blink. When the rotor comes to a stop, the **STOP** indicator will stop blinking and an alarm will sound.

8. Press **VACUUM**.

This will release vacuum in the chamber. As soon as the chamber has reached atmospheric pressure, the door lock will release, allowing chamber door to be opened.

Do not turn centrifuge power OFF before chamber has reached atmospheric pressure.

9. Open the chamber door, and remove the rotor. Wipe the rotor chamber dry using a clean, soft dry cloth.

Whenever the temperature inside the chamber is colder than ambient temperature, keep the chamber door closed to prevent moisture from accumulating on the chamber walls.

## Acceleration Rate and Deceleration Rate

The acceleration rate adjusts the time it takes a rotor to accelerate from 0 to 5000 rpm. At 5000 rpm, the rotor will accelerate at its maximum rate to set speed. The deceleration rate adjusts the time it takes a rotor to decelerate from 5000 to 0 rpm. The rotor decelerates from set speed to 5000 rpm with full dynamic braking. If you want the rotor to coast from set speed to a stop, press **DECEL** then press **HOLD** (the letter "F" will be displayed in the ACC-DEC display to indicate that a free coast has been selected).

The rotor acceleration and deceleration rates can be optimized to allow the minimum time possible without causing disturbance to the gradient or pellet (see figure 3-2).

The numbers on the curves in figure 3-2 are keyed to the Code Numbers in Table 3-2. To achieve the desired acceleration/deceleration rate, press either **ACCEL** or **DECEL** and input the Code Number that corresponds to the desired rate. If no rate is selected, the maximum rate (9) will be used. Deceleration rate can be changed while the rotor is decelerating.

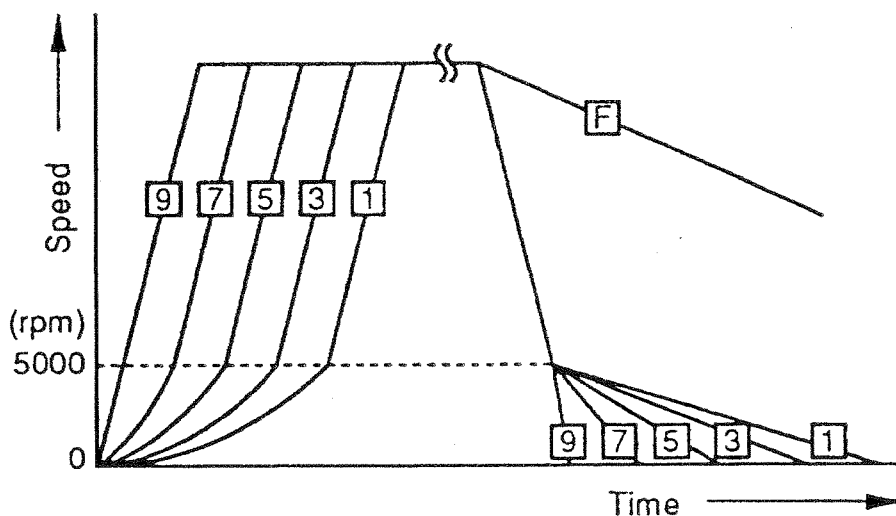


Figure 3-2. Examples of Acceleration/Deceleration Rates

**Table 3-2. Acceleration/Deceleration Rate  
Code Numbers**

Code No.	Time (in minutes) for acceleration from 0 to 5000 rpm	Time (in minutes) for deceleration from 5000 to 0 rpm
9	0.3	0.3
8	0.5	1.0
7	1.0	2.0
6	1.5	3.0
5	2.0	4.0
4	2.5	5.0
3	3.0	6.0
2	3.5	7.0
1	4.0	8.0
F*	-	Coasting deceleration from set speed

\*Press **HOLD** key to select Code F (free coast from set speed to stop).

**NOTE** The minimum acceleration/deceleration time may be longer than the value shown, depending on the rotor being used.

## Advanced Features

The centrifuge has special features, for example, program save, step mode operation, delayed start and centrifugal force values display and setting capability. Figure 3-3 shows the location of all the advanced feature controls and indicators and Table 3-3 describes their function.

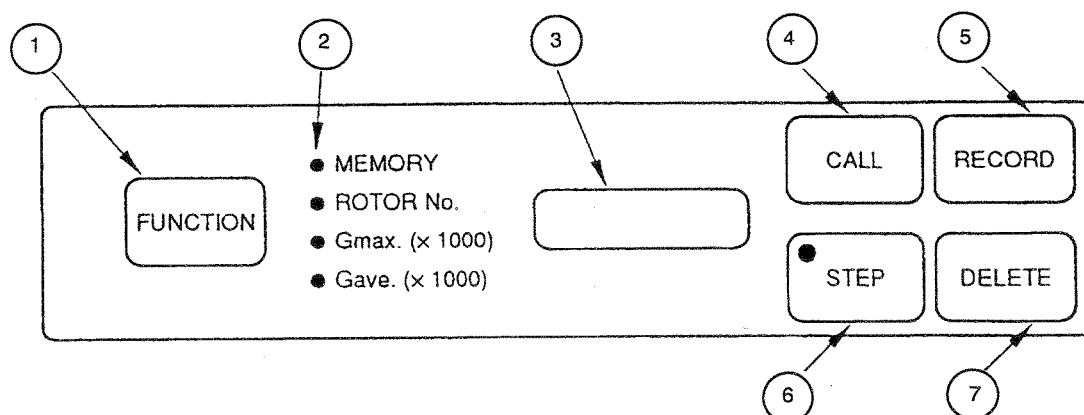


Figure 3-3. Advanced Feature Controls and Indicators

**Table 3-3 Advanced Feature Control Indicators**

No.	Name	Function
1	<b>FUNCTION</b> Key	Used to select one feature from among the available advanced features. Pressing this key once turns on the MEMORY indicator light. Pressing this key a second time causes the ROTOR No. indicator light to blink. Pressing this key a third time causes the Gmax indicator light to blink. Pressing this feature a fourth time causes the Gave indicator to blink. After five seconds, the indicator will stay lit.
2	FUNCTION Indicator Lights	The FUNCTION indicator light of the selected advanced feature will blink to indicate that the centrifuge is waiting for numeric values to be entered.
3	Advanced Feature Display	Displays memory locations, run set parameters, rotor numbers, and centrifugal force values (G-values).
4	<b>CALL</b> Key	Recalls the run conditions saved in memory. Pressing this key displays the symbol "[".
5	<b>RECORD</b> Key	Saves the set run conditions in memory. Pressing this key displays the symbol "P".
6	<b>STEP</b> Key	Saves two or more different sets of run parameters at one location in memory for step-mode operation. When a saved set of run parameters is recalled, the STEP indicator will light.
7	<b>DELETE</b> Key	Deletes existing information from memory.

The sidebar indicates what is displayed on the centrifuge while performing the corresponding step.

## Programmed Operation

The RC-M120EX memory can store up to 10 programs. Each program saves a set of run parameters that can be recalled by entering the assigned program number (from 0 to 9) and pressing **START**.

## Program Save

**Read all WARNINGS and CAUTIONS listed on the Safety Information Page in the front of this manual.**

To save a program:

Follow the instructions under the Section titled Normal Operation (page 3-5) through step 5.

1. Press **FUNCTION**. The Memory light indicator will come on.
2. Press **RECORD**. When **RECORD** is pressed, a "P" and a flashing "□" will appear in the Advanced Feature display. Enter a number from 0 to 9 and assign it to this program.
3. Press **ENTER**.

The MEMORY display will stop blinking, indicating that run parameters are saved.

Record program number and run parameters in the Program Log (see Appendix).

## Program Recall

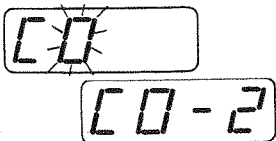
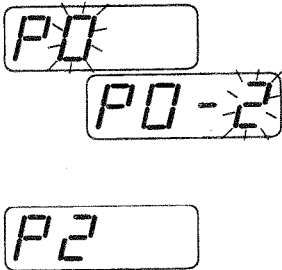
**Read all WARNINGS and CAUTIONS listed on the Safety Information Page in the front of this manual.**

To recall a saved program:

Follow the instructions under the Section titled Normal Operation (page 3-5) through step 5.

1. Press **CALL**.

The MEMORY display will show a "C" and a flashing "□". Input the assigned program number (from 1 to 9). All run parameters will automatically be displayed on the main display.



**NOTE** If run parameters are abnormally displayed, it is an indication that the memory battery is weak. All values stored in the memory must be reset. To charge the battery, turn the centrifuge power ON and leave it on for at least 10 hours.

2. If *fast cooling is not required*, press **START**.

**NOTE** The **CHECK** indicator light must be ON when **START** is pressed. If it is OFF, press **CHECK** then press **START** within 20 seconds.

The rotor will start to accelerate, and the **START** indicator light will begin to blink. The rotor will stop at 5000 rpm and wait until vacuum reaches the Intermediate level. When Intermediate vacuum level is reached, the **START** indicator light will stop blinking, but it will stay lit.

If *fast cooling is required*, press **VACUUM** and wait for the chamber to reach the High vacuum level (about 5 minutes) then press **START** (the chamber will cool faster without the rotor spinning, and temperature sensitive samples will be better protected).

The vacuum indicator lights show current state of vacuum inside the rotor chamber (see Table 3-1, Item 8).

**NOTE** The centrifuge will not control temperature until the chamber door is closed and **VACUUM** or **START** is pressed.

All prerecorded run parameters will automatically be established to control centrifuge operation.

As soon as the selected length of run time has elapsed, the rotor will begin to decelerate. The **STOP** indicator will blink while the rotor is decelerating. When the rotor comes to a stop, the indicator light will stop blinking and an alarm will sound.

**NOTE** To end a timed run before the selected time has elapsed, press **STOP**.

3. Wait for the **STOP** light to stop blinking, then press **VACUUM**.

The sidebar indicates what is displayed on the centrifuge while performing the corresponding step.

This will release vacuum in the chamber. As soon as the chamber has reached atmospheric pressure, the door lock will release, allowing chamber door to be opened.

Do not turn the centrifuge power OFF before the chamber has reached atmospheric pressure.

4. Open the chamber door, and remove the rotor using the rotor locking tool. Wipe the rotor chamber dry using a clean, soft dry cloth.

Whenever temperature in the chamber is colder than ambient temperature, keep the chamber door closed to prevent moisture from accumulating on the chamber walls.

## Program Delete

To delete programmed runs:



1. Press the **CALL** key. The MEMORY indicator will be lit and the Advanced Feature display will display the letter "C" and a flashing "C".



2. Press the appropriate key on the numeric keypad to enter the address value from which you are deleting run conditions.

The address value will be displayed on the Advanced Feature display.

If the operation being deleted is a Step-Mode run the STEP indicator will be lit.

3. Hold down the **DELETE** key and press **ENTER**. All run conditions at the selected address will be deleted.

**NOTE** This procedure will delete all steps of a Step Mode run if **DELETE** and **ENTER** are pressed while displaying the first step of the run. If only later steps are to be deleted, press the **STEP** key until the first step to be deleted appears on the display. The desired step and any subsequent steps will be deleted when the **DELETE** and **ENTER** keys are pressed.

For Input sequence of a Step-Mode operation, see example below:

**First Step:**

(SPEED) , (1) , (2) , (0)

(TIME) , (2)

(TEMP) , (2) , (0)

(ACCEL) , (9) , (DECEL) , (9)

(ENTER)

(FUNCTION)

(RECORD) , (0) , (ENTER)

**Second Step:**

(SPEED) , (1) , (0) , (0)

(TIME) , (1)

(ENTER)

(RECORD) , (0) , (STEP)

(ENTER)

**Third Step:**

(SPEED) , (8) , (0)

(TIME) , (:), (3) , (0)

(DECEL) , (7)

(RECORD) , (0) , (STEP)

(ENTER)

## Step-Mode Operation

Step-mode operation allows centrifuge operation to be automatically controlled by two or more sets of run parameters in a single memory location. This mode is ideal for isopycnic centrifugation to shorten centrifugation time. See figure 3-4 for an example of a three step run.

The step-mode feature can also be used to delay the start of a run so you can program a run to end when you will be there to remove the sample (see Delayed Start Operation).

Run Parameter	First Step	Second Step	Third Step
Speed	120 000 rpm	100 000 rpm	80 000 rpm
Run Time	2 hrs.	1 hr.	30 min.
Temperature	20°C	20°C	20°C
Acceleration rate	9	9	9
Deceleration rate	9	9	7

The example above shows run parameters and the values required for an example three step run. Figure 3-4 depicts how the example run will proceed.

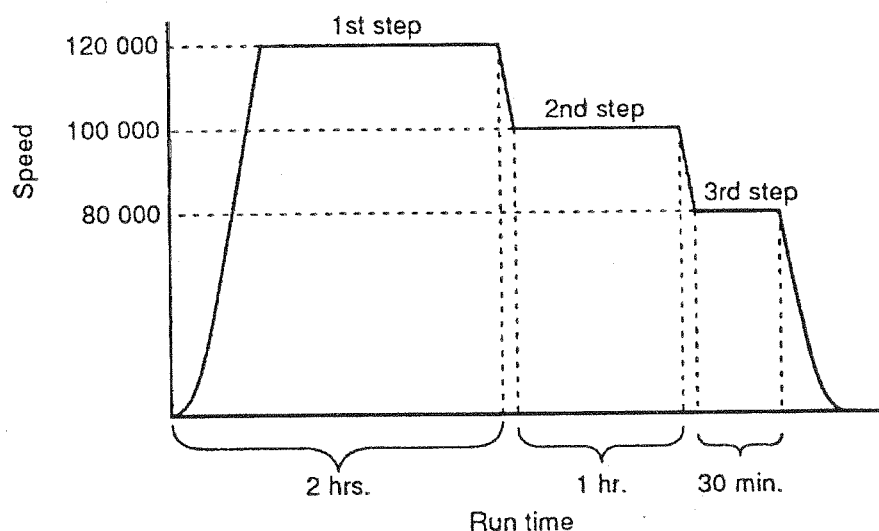


Figure 3-4. Step-Mode Operation Theory



To begin a Step-Mode operation run, see input sequence below:

**CALL**, 0

**STEP**

**STEP**

**START**

At the end of the run, press:

**VACUUM**

**Read all WARNINGS and CAUTIONS listed on the Safety Information Page in the front of this manual.**

To operate the Step Mode feature follow the instructions under Normal Operation (page 3-5) through step 4 then perform the following steps which illustrate the run in figure 3-4:

**First Step** of operation:

1. Input all parameters desired for the 1st step of operation:

Press **SPEED** and input the desired run speed in thousands only; for a run speed of 120 000 rpm, input 1 2 0.

Press **TIME** and input desired run time. For a run that is less than one hour, you must press **:** before you input the desired number of minutes. For a two hour run input 2.

Press **TEMP**. For a temperature of 20°C input 2 0.

Press **ACCEL** and 9 then **DECEL** and 9 for the acceleration and deceleration rates in this example. Press **ENTER**.

**NOTE** If you press a selection key by mistake, press the correct selection key and it will override the incorrect selection. If no entry is made within 20 seconds after the selection key begins to blink, the display will automatically change to show current run conditions. (If you need to verify selections, press **CHECK** to display set parameters.)

If an incorrect value is entered, press **CE** then input the desired value.

The sidebar indicates what is displayed on the centrifuge while performing the corresponding step.

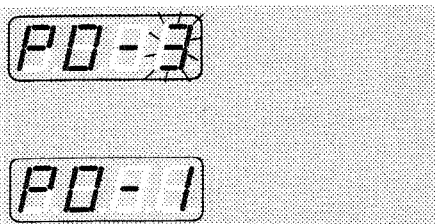


2. Press the **FUNCTION** key to select programmed operation (MEMORY). The MEMORY indicator light will come on.
3. Press **RECORD**, then the number of the desired location, in this example press 0. Press **ENTER**. This saves the run parameters for the First Step at MEMORY Code "0". If no run conditions, or only one set of run conditions, are saved at the desired location, the entered address value will blink on the advanced feature display.

**NOTE** If two or more run conditions are already saved at the desired address, the entered address value will blink along with the "r" symbol on the advanced feature display.



The sidebar indicates what is displayed on the centrifuge while performing the corresponding step.



If the "P" symbol is displayed you can: 1) overwrite the old run conditions with the new ones, 2) select another address, or 3) delete the old run conditions, as described on page 3-13, to create unused space, then save the new conditions.

To overwrite old run conditions: Press the **STEP** key. The step number that is smallest among the unused step numbers at the desired address will blink on the display.

Use the numeric keypad to enter the desired address, in this example "1". Press the **ENTER** key.

### Second Step of operation:

1. Input all parameters desired for the 2nd step of operation.

**NOTE** If one or more parameters for the 2nd Step are the same as the 1st Step, they do not need to be reset.

Press **SPEED** and input the desired run speed; for a run speed of 100 000 rpm input **1 0 0**.

Press **TIME** and input the desired time; for one hour enter **1**.

Press **ENTER**



2. Press **RECORD**, then use the numeric keypad to input the address value **0** where run conditions for the first step are saved.
3. Press the **STEP** key. The number that is smallest among the unused step numbers at the desired address, in this case 2, will blink on the display.
4. Press **ENTER**. The run conditions set for this step are saved at address "0-2".

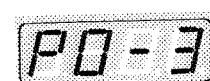
### Third step of operation:

1. Input all parameters desired for the third step of the operation.

Press **SPEED** and input the desired run speed; for a run of 80 000 rpm, input **8 0**.

Press **TIME** and input desired run time. For a run time of 30 minutes, input **: 3 0**.

The sidebar indicates what is displayed on the centrifuge while performing the corresponding step.



In this example the deceleration changes to seven for step three. Press **DECEL** and input **7**.

Press **ENTER**.

2. Press **RECORD**, then press **0**. Since the run conditions for the first and second steps are already saved at the address, the entered address value and the "r" symbol will blink.
3. Press the **STEP** key. The step number that is smallest among the unused step numbers at the desired address, in this case 3, will blink on the display.
4. Press the **ENTER** key. The run conditions set will be saved at the third location in address 3.

To begin the run:

1. Press **CALL**, then using the numeric keypad input the appropriate numeric value representing the address where the run conditions for the three steps have been saved (for example the value 0).

The run parameters for the *First Step* will be displayed on the control panel. The address of the saved run conditions will appear on the advanced feature display.

To view the run conditions for *Second* and *Third Steps* on the control panel press the **STEP** key. Each time the **STEP** key is pressed, the next step number and run conditions will be displayed.

2. If *fast cooling is not required*, press **START**.

**NOTE** The **CHECK** indicator light must be ON when **START** is pressed. If it is OFF, press **CHECK** then press **START** within 20 seconds.

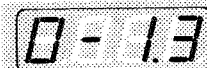
The rotor will start to accelerate, and the **START** indicator light will begin to blink. The rotor will stop at 5000 rpm and wait until vacuum reaches the Intermediate level. When Intermediate vacuum level is reached, the timer will start and the rotor will accelerate to set speed. At set speed, the **START** indicator light will stop blinking, but it will stay lit.

If *fast cooling is required*, press **VACUUM** and wait for the chamber to reach High vacuum level (about 5 minutes) then press **START** (the chamber will cool faster without the rotor spinning, and temperature sensitive samples will be better protected).

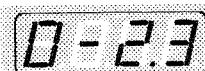
The **VACUUM** key shows the current state of vacuum inside the rotor chamber (see Table 3-1, Item 8).

**NOTE** The centrifuge will not control temperature until the chamber door is closed and **VACUUM** or **START** is pressed.

During step-mode operation, the Advanced Features display during the *First Step* of operation will be as follows:

A digital display showing the number 0-1.3, representing the first step of operation.

When the operation changes to the *Second* and *Third Steps*, the display will change, respectively, as follows:

A digital display showing the number 0-2.3, representing the second step of operation.A digital display showing the number 0-3.3, representing the third step of operation.

**NOTE** Run parameters for the 2nd Step cannot be changed while the centrifuge is operating in the 1st Step. If a change is required, press **STOP** and change the parameter(s), or make the change(s) when operation shifts to 2nd Step.

As soon as the selected length of run time has elapsed, the rotor will begin to decelerate. The STOP indicator will blink while the rotor is decelerating. When the rotor comes to a stop, the indicator light will stop blinking and an alarm will sound.

**NOTE** To end a timed run before the selected time has elapsed, press **STOP**.

3. Wait for the STOP light to stop blinking and the alarm will sound. Press **VACUUM**. This will release vacuum in the chamber. As soon as the chamber has reached atmospheric pressure, the door lock will release, allowing chamber door to be opened.

Do not turn centrifuge power OFF before the chamber reaches atmospheric pressure.

4. Open the chamber door, and remove the rotor. Wipe the rotor chamber dry using a clean, soft dry cloth.

Whenever temperature in the chamber is colder than ambient temperature, keep the chamber door closed to prevent moisture from accumulating on the chamber walls.

## Delayed Start Operation

A delayed start run allows you to program a run to end when it is convenient for you to be there to remove the sample.

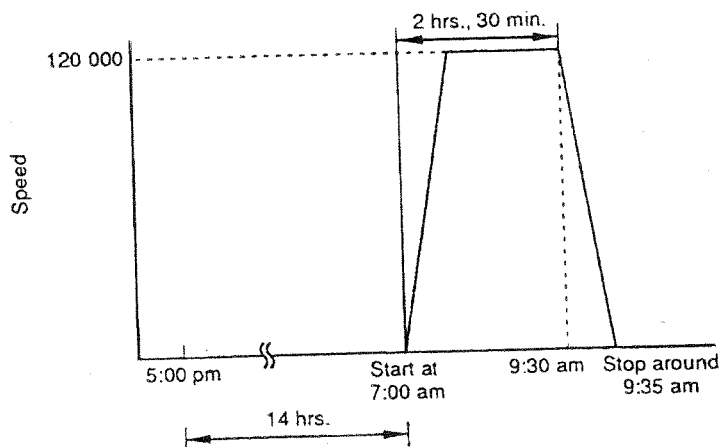


Figure 3-5. Delayed Start Operation Theory

To perform a delayed start run, follow all steps for step-mode operation (paragraph 3-5), except enter **SPEED** and **TIME** parameters as follows:

**First Step of operation:**

1. Press **SPEED** and input **0** rpm.

Press **TIME**, enter the length of time (in hours and minutes) that the start of the run is to be delayed.

2. Save the run conditions for the first step by following the procedure for Step-mode operation (page 3-15). For example, press the **FUNCTION** key, followed by the **RECORD** key, the numerical location, and **ENTER**.

**Second Step of operation:**

1. Press **SPEED** and enter the desired run speed.

Press **TIME**, enter the length of desired run time (in hours and minutes).

2. Save the run conditions for the second step by following the procedure for Step-mode operation (page 3-15). Press the **FUNCTION** key, followed by the **RECORD** key, the numerical location, and **ENTER**.
3. Press the **CHECK** key.
4. Press **START**.

### For Example:

To program a 2 hour, 30 minute run at 5:00 P.M. that you want to end at 9:30 A.M. the next day, subtract 2 hours, 30 minutes from 9:30 A.M. to find the time of day the run should start. In this case, it is 7:00 A.M.. Next, determine the length of time from 5:00 P.M. to 7:00 A.M..

To enter **TIME** for the 1st Step of this example, press **TIME**, then press **1** **4**. To enter time for the 2nd Step, press **TIME**, then press **2** **:** **3** **0**.

## Displaying and Setting RCF (Relative Centrifugal Force)

The centrifuge automatically computes the RCF (g force) from the set speed, or the speed from the set g force, and then displays the computed values on the control panel.

To display g force.:

1. Set the desired rotor speed (see page 3-5 Normal Operation).
2. Press the **FUNCTION** key twice. The ROTOR No. indicator will blink for five seconds.
3. Select the desired rotor number from the list of available rotor numbers (see Table 3-4 ). Use the numeric keypad to input the number that corresponds to the desired rotor. Press **ENTER**.

**Table 3-4. Available Rotors and Corresponding Rotor Numbers**

Rotor Name	Rotor No.	Rotor Name	Rotor No.
RP120AT 8x2ml	1	S100AT5 8x5.1ml	15
S120AT2 10x2ml	2	RP100VT 8x2ml	16
S120AT3 14x0.5ml	3	RP80AT	21
RP120VT 8x2ml	4	RP80AT2	22
RP100AT 8x2ml	11	RP70AT	23
RP100AT2 14x5.1ml	12	RP55S 4x2.2ml	24
RP100AT3 20x2ml	13	RP45A 12x1.5ml	25
RP100AT4 6x35ml	14		

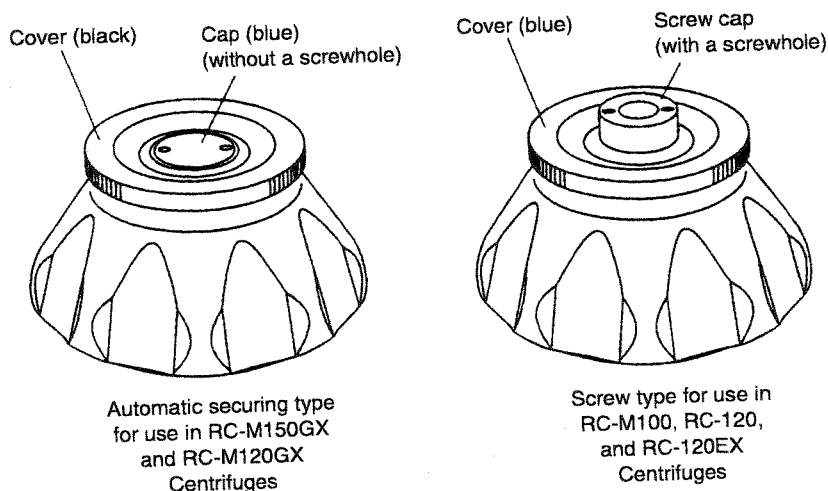
**NOTE** The rotor number must be entered while the ROTOR No. indicator is blinking. If the ROTOR No. indicator stays lit and is no longer blinking, press the **FUNCTION** key again.

The rotor number entered will remain unchanged until another rotor number is entered.

Be sure to enter the correct ROTOR No.

**WARNING**

DO NOT use the automatic securing type rotors in the RC-M120EX centrifuge.



*Figure 3-6. Rotor Identification*

4. Press the **FUNCTION** key twice. The ROTOR No. indicator will blink then the Gmax indicator will blink. The maximum RCF will be displayed on the advanced features display window.

To view the Gave value for the rotor, press the **FUNCTION** key twice.

5. Press the **CHECK** key. The CHECK indicator will go out and the displays will show the current run conditions.

To set the RCF:

1. Press the **FUNCTION** key until the ROTOR No. indicator blinks. It will blink for 5 seconds.
2. Use the numeric keypad to enter the number that corresponds to the desired rotor (see Table 3-4 ). Press **ENTER**.

**NOTE** The rotor number must be entered while the ROTOR No. indicator is blinking. If the ROTOR No. indicator stays lit and is no longer blinking, press the **FUNCTION** key again.

The rotor number entered will remain unchanged until another rotor number is entered.

Be sure to enter the correct ROTOR No.

3. Press the **FUNCTION** key twice. The Gmax indicator will blink for five seconds.

4. Enter the desired maximum RCF. *RCF values are in increments of 1000 x g.* Press **ENTER**.

For example: If you want to set an RCF of 650 000, you only need to input **6** **5** **0**.

**NOTE** The RCF can only be entered while the Gmax indicator is blinking. To enter the RCF once the Gmax indicator is lit but is no longer blinking, press the **FUNCTION** key.

Be sure to enter the correct RCF.

The RCF will appear on the advanced feature display. The centrifuge will compute the rotor speed from the set rotor number and RCF value. The result will be displayed on the SPEED display.

5. To compute the rotor speed from the average RCF, press the **FUNCTION** key twice. The Gave indicator will blink for five seconds.

6. Enter the desired average RCF. *RCF values are in increments of 1000 x g.*

The RCF will appear on the advanced feature display. The centrifuge will compute the rotor speed from the set rotor number and RCF value. The result will be displayed on the SPEED display.

**NOTE** When using a rotor speed computed from the set RCF, there may be a slight difference (maximum of 2%) between the set RCF and the actual RCF.



# Chapter 4: CARE, MAINTENANCE & TROUBLESHOOTING

This chapter describes routine maintenance procedures that must be performed by the user, plus a description of the ALARM indicators, and limited troubleshooting information. Any maintenance or repair procedures not included in this chapter, should be performed by a Sorvall Service Representative or other qualified service personnel.



## **WARNING**

Because the High voltage electrical circuits in this centrifuge can cause severe electrical shock, untrained personnel must not attempt procedures not included in this manual. Failure to comply with this warning can result in personal injury.

If hazardous materials have been processed in the centrifuge, take all necessary precautions when cleaning or servicing the centrifuge to avoid personal exposure to contaminants.



## **CAUTION**

Do not use chlorides to disinfect the chamber. Chlorides are extremely harmful to aluminum alloy rotors and can cause stress corrosion cracking.

## **Cleaning**

### **Rotor Chamber**

The rotor chamber should be kept clean and wiped dry routinely to maintain efficient cooling. Wash the chamber with a mild dish-washing liquid, then rinse the chamber and dry it with a soft absorbent cloth.

Wipe the rotor chamber with a cloth dampened with 70% ethanol to disinfect it or a 2% glutaraldehyde solution to sterilize it, then rinse the chamber well with deionized water. For general radioactive decontamination, use a solution of equal parts of ethanol, 10% SDS, and water. Follow this with ethanol rinses then deionized water rinses. Dry with a soft absorbent cloth. Dispose of all wash solutions in proper radioactive waste containers.

### **Drive Spindle**

Wipe the drive spindle with a dry soft cloth before every run to reduce the chance of the rotor sticking to the spindle.

### **Cabinet**

Use a mild *non-alkaline* detergent and water or a household wax cleaner to clean the cabinet panels.

### **Chamber Door Seal**

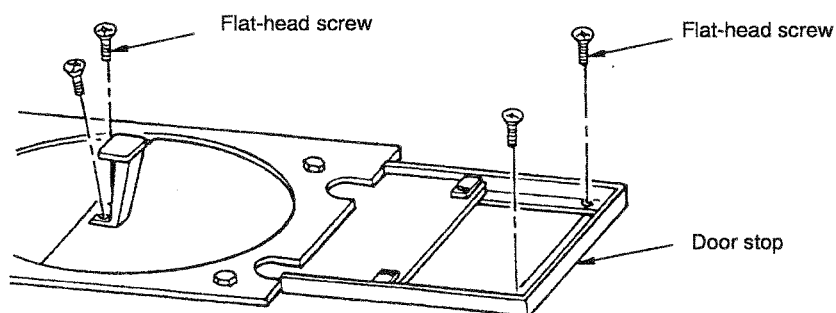
To ensure that a High Vacuum level is obtainable, the chamber door seal O-ring must be kept clean; if damaged, it must be replaced.

Remove the door seal O-ring once every three to four months, and clean it as follows:

1. Open the chamber door.
2. Unplug the centrifuge power cord.
3. Set the centrifuge power switch at ON (this will not energize the centrifuge because the power cord is unplugged).
4. Using the 3 mm Allen wrench (Catalog No. 45218) supplied with the centrifuge, remove the two screws from each side of the top deck, then remove the top deck (see figure 4-2).
5. Remove the front cabinet panel by removing the two mounting screws at the lower front of the centrifuge.
6. Remove the two screws securing the door handle to the door, then remove the door handle (see figure 4-2).

**NOTE** Be very careful not to drop the screws removed in Steps 6 and 7.

7. Remove the two screws securing the door stop to the door, then remove the door stop (see figure 4-1).



*Figure 4-1. Door Seal O-Ring Removal*

8. Open the chamber door all the way so the entire door seal O-ring can be seen.
9. Using a smooth, tapered tool, remove the seal O-ring from the groove being very careful not to damage it.

10. Inspect the door seal O-ring for signs of cracks, tears, or abrasions. If damaged, replace it (Catalog No. 45043). If the door seal O-ring is not damaged, wipe it clean using a soft cloth dampened with alcohol.
11. Clean the door seal O-ring groove with a clean, soft cloth dampened with alcohol.
12. Apply a thin coat of vacuum grease (Catalog No. 65937) to the door seal O-ring.
13. Install the door seal O-ring in the door seal groove.
14. Close the chamber door. If the door lock is in the way, press the door lock solenoid pin (see figure 4-3).
15. Reinstall the door stop, the door handle, the front cabinet panel, and the top deck.
16. Turn the centrifuge power OFF, and plug in the power cord.

### **Refrigeration System Condenser**

To maintain the efficiency of the refrigeration system, keep the condenser fins at the back of the centrifuge free of dust and dirt. Clean the fins with a brush or vacuum cleaner at one to three month intervals.

## ALARM Indicators

When a problem occurs that affects centrifuge operation, one or more of the ALARM indicators will come ON. If an ALARM indicator is ON, the centrifuge will not start.

Table 4-1 describes the problem that each indicator represents and gives the corrective action. After the problem has been corrected, press the **CE** key to clear the alarm and turn the indicators OFF.

**Table 4-1. ALARM Indicators**

ALARM Indicator	Cause	Corrective Action
DOOR	The <b>START</b> or <b>VACUUM</b> key was pressed with the chamber door open.	Close chamber door, then press <b>START</b> or <b>VACUUM</b> .
	The Chamber door opened while the rotor was spinning.	Call DuPont for Service.
VACUUM	Required state of vacuum cannot be reached.	Wipe all moisture from inside the chamber.
		Clean the door seal O-ring and apply vacuum grease (see Cleaning).
		Check vacuum release tube: make sure knob is on tight and that O-ring is seated in the groove on the tube.
		If you cannot hear the vacuum pump running, the fuse is blown. Remove front cabinet panel and install new fuse (Catalog No. 45165)*.
TEMP	Rotor chamber temperature is greater than 50°C.	If the problem cannot be corrected, call DuPont for Service.
		Check fuse for refrigeration (see Fuse Replacement). If fuse is blown, install a new fuse (Catalog No. 45165)*.
ROTOR	No rotor installed.	If replacing the fuse does not correct the problem, call DuPont for Service.
	Rotor not properly secured to drive spindle.	Install a rotor.
		Secure rotor to drive spindle using the rotor locking tool.
		If problem cannot be corrected, call Sorvall for Service.

\*See figure 4-5 for location of fuse.

**Table 4-1. ALARM Indicators (Continued)**

ALARM Indicator	Cause	Corrective Action
IMBALANCE	Rotor is not properly balanced.	Remove the rotor and balance it according to instructions in the rotor manual.
SPEED	Rotor speed is set higher than maximum rated speed of installed rotor.	Select speed at maximum speed of installed rotor.
POWER	A power interruption occurred during a run.	If run time has not elapsed, restart the run.

**NOTE** If the ROTOR Alarm Indicator lights up, the centrifuge will not accept input from the **CE** or **VACUUM** key for seven minutes. Wait for seven minutes without turning off the power. After seven minutes press the **CE** Key.

## FOR SERVICE Alarm

If the FOR SERVICE indicator lights up, press the **CHECK** key to turn the CHECK light OFF. The Advanced Feature display will blink showing a maintenance code (see example below).

**E - 13**

Maintenance codes are described in Table 4-2. All of these problems require that you call Sorvall for Service. When you call, inform Service personnel which maintenance code is displayed.

**Table 4-2. Maintenance Codes**

Maintenance Code	Problem
E10 ~ 19	Rotor speed detector.
E20 ~ 29	Motor or motor control circuit.
E30 ~ 34	Vacuum system.
E35 ~ 39	Temperature sensing system.
E40	Power supply waveform.
E41	Drive motor temperature.
E43	Either the memory element or the memory element battery.

**NOTE** Code E13 represents a problem with the rotor speed detection signal. If this code is displayed, you will not be able to turn the alarm OFF for approximately 25 minutes. This allows time for the rotor to come to a complete stop. As long as code E13 is displayed, the vacuum pump will run, even if the **VACUUM** key is pressed to turn the vacuum pump off. This is to prevent the chamber door from being opened.

The centrifuge must remain on until the 25 minutes elapses. Otherwise, it will remember where it stopped and will continue the run from that point when the power is restored.

## Emergency Sample Recovery



### WARNING

When the main power shuts off, the brake will not operate. Wait until the rotor stops spinning before using the mechanical override. Reaching into the rotor chamber while the rotor is spinning can cause personal injury.

If the power fails, a partial vacuum will remain in the chamber, temperature control will be maintained, and the rotor will safely coast to a stop. If power is restored while rotor speed is *above* 300 rpm, the rotor will accelerate to set speed and the run will continue (an RC-M120EX centrifuge will wait two minutes before accelerating rotor back to set speed). If rotor speed is *below* 300 rpm when power is restored, the rotor will continue to decelerate to a stop and the run will not resume until **START** is pressed.

When power is restored, all set parameters are restored by means of a battery backup. Also, the **POWER** Alarm indicator lights to show that a power interruption occurred.

If power is not restored right away, the vacuum must be released manually so the chamber door can be opened to remove the sample.

To manually release vacuum:

1. Make sure the rotor has coasted to a complete stop. A large rotor needs more than 20 minutes to coast to a stop. Allow time accordingly.
2. Turn centrifuge power OFF, then unplug the centrifuge power cord.
3. Set the centrifuge power switch to ON.
4. Using the 3 mm Allen wrench (Catalog No. 45218) supplied with the centrifuge, remove the two screws from each side of the top deck, then remove the top deck (see figure 4-2).



### WARNING

This procedure is included for emergency sample recovery only. Because of the high voltages in the centrifuge, never use this procedure for any other purpose.

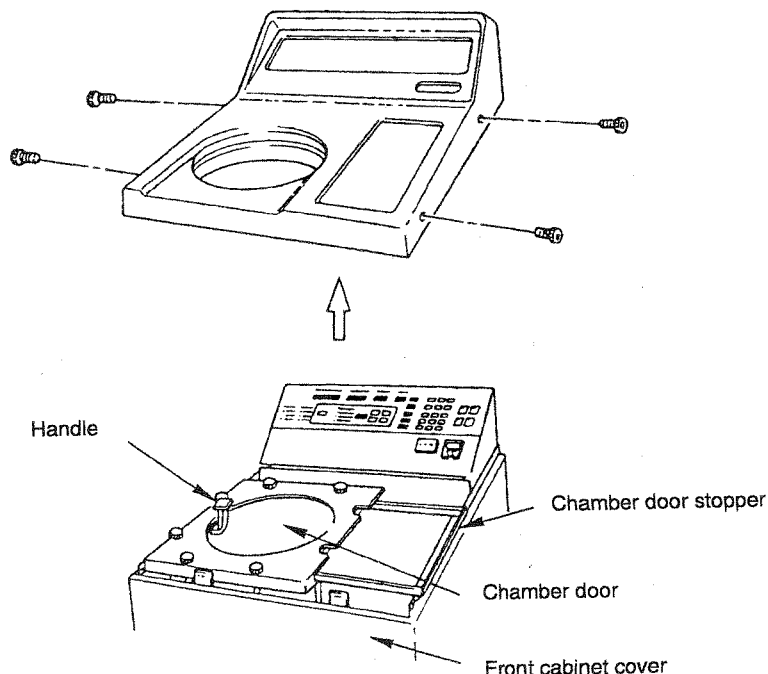
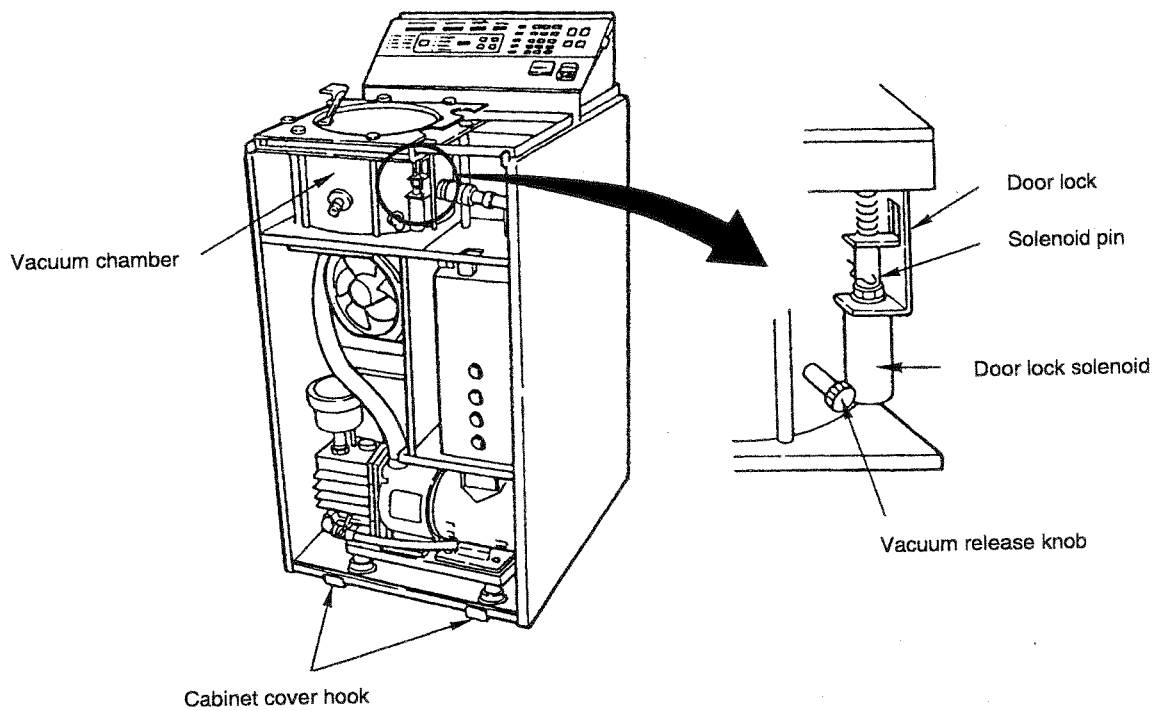


Figure 4-2. Top Deck Removal

5. Remove the front cabinet panel by pulling it forward and lifting it up .
6. Turn the vacuum release knob counterclockwise to let air into the chamber (see figure 4-3).
7. Press down on the door lock solenoid pin (see figure 4-3), then open the chamber door.
8. Remove the rotor from the chamber.



*Figure 4-3. Location of Vacuum Release Knob and Door Lock Solenoid Pin*

9. Turn the vacuum release knob clockwise until it is back in its original position.
10. Reinstall the front cabinet panel and the top deck cabinet.
11. Set the centrifuge power OFF.
12. Plug in the power cord.



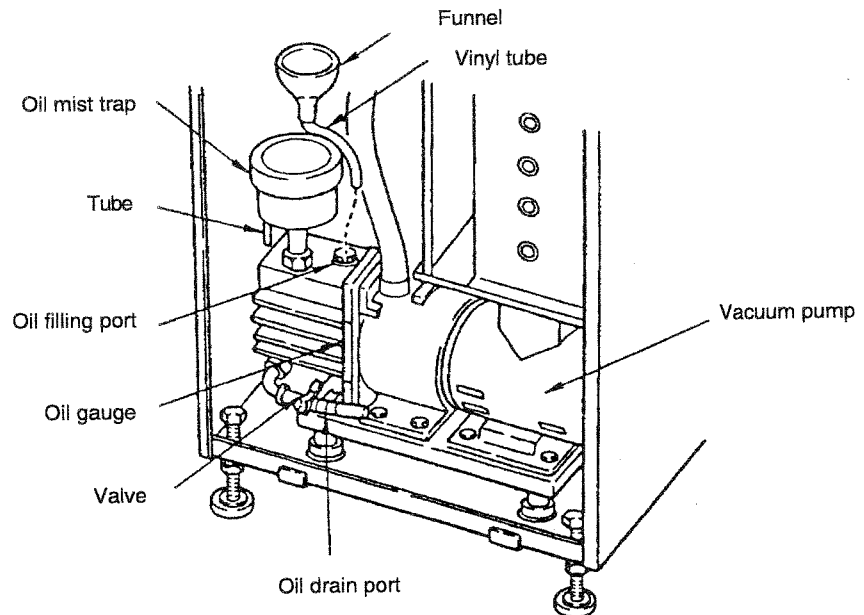
## Vacuum Pump Maintenance

If it is taking a long time for the rotor chamber to reach Intermediate or High vacuum level, it may be because there is water in the vacuum pump.

Drain all water from the vacuum pump and add oil:

**NOTE** This is best done when the centrifuge has not been used for a while because the water and oil will be separated, and the water will be at the bottom of the pump.

1. Turn the centrifuge power OFF and unplug the power cord.
2. Remove the front cabinet panel by pulling it forward and lifting it up.
3. Turn the vacuum pump valve (see figure 4-4) to allow the water to drain from the pump.



*Figure 4-4. Vacuum Pump Maintenance*

4. After the pump has been drained, attach the vinyl tube (Catalog No. 45214) to the bottom of the funnel (Catalog No. 45215), then insert the tube into the oil fill port of the vacuum pump. Refill the pump with vacuum pump oil (Catalog No. 45128) until oil is up to the "H" level on the oil gauge.

**NOTE** If the vacuum pump oil that was drained from the pump is dirty, refill the pump with new oil. If the centrifuge is frequently used, the oil should be changed once every four to six months.

5. Check the tube at the bottom of the oil mist trap. If there is oil in the tube, the oil mist trap is clogged with oil mist. Replace the oil mist trap (Catalog No. 45124).

## Troubleshooting

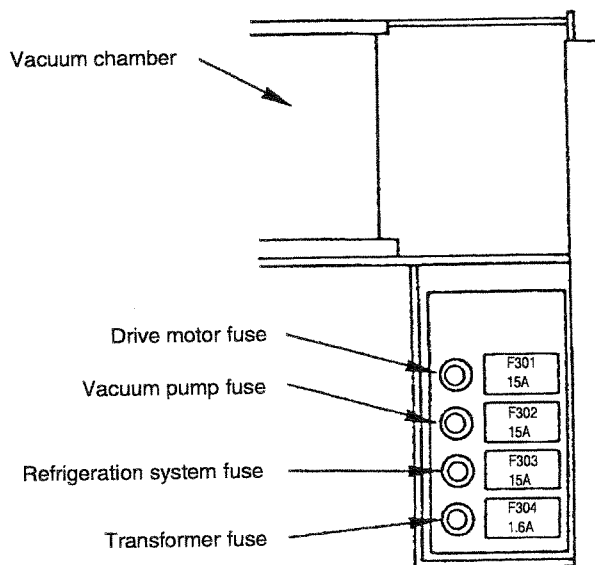
Some problems that may occur that can be corrected by the user are described in Table 4-3. If a problem cannot be solved by the recommended action given in the table, call Sorvall for Service. Also call Sorvall for Service if a problem occurs that is not described in the table or elsewhere in this chapter.

**Table 4-3. Troubleshooting**

Symptom	Cause	Action
Centrifuge power is ON and fan starts, but display is blank.	Building power circuit breaker is not closed or the fuse is blown.	(1) Close circuit breaker. (2) If fuse is blown, check the power supply wiring for a short circuit.
Centrifuge power is ON and fan starts but display is blank.	Main fuse for circuit is blown.	Replace fuse (see Fuse Replacement).
Rotor does not accelerate when <b>START</b> is pressed.	Drive motor problem.	Call Sorvall for Service.
Rotor does not cool.	(1) High vacuum not reached. (2) Temperature control circuit fuse is blown.	(1) Fill vacuum pump with new oil. (2) Check fuse and replace if necessary (see Fuse Replacement).

## Fuse Replacement

All fuses are located behind the front cabinet panel. To replace a fuse, remove the front cabinet panel, remove the fuse, and replace it with a new fuse of the specified rated amperage. If the new fuse blows soon after it is installed, call Sorvall for Service. See figure 4-5 for identification of each fuse.



*Figure 4-5. Fuse Location and Identification*

## Parts Ordering Information

To order replacement parts: in the United States, call toll-free (800) 522-SPIN (800 522-7746). Outside the United States, contact the local distributor or agent for SORVALL® products. Be sure to provide a description of the part, the centrifuge mode, and the centrifuge serial number.

## Service Decontamination Policy



### WARNING

Because of the characteristics of the samples likely to be processed, biological or radioactive contamination may occur. Always be aware of this possibility and take normal precautions. Use appropriate decontamination procedures should exposure occur.

If a centrifuge or rotor that has been used with radioactive or pathogenic material requires servicing by Sorvall personnel, either at the customer's laboratory or at a Sorvall facility, comply with the following procedure to ensure the safety of all personnel:

1. Clean the centrifuge to be serviced of all encrusted material and decontaminate (see Maintenance Section of centrifuge ) it prior to servicing by the Sorvall representative or returning it to the Sorvall facility. There must be no radioactivity detectable by survey equipment.

The SORVALL® Rotors, Tubes, Bottles, Adapters, and Accessories Catalog contains descriptions of commonly used decontamination methods and a chart showing method compatibility with various materials. The Care and Maintenance Section of this instruction manual contains specific guidance about cleaning and decontamination methods appropriate for the product it describes.

Clean and decontaminate your centrifuge as follows:

- a. Remove rotor from the rotor chamber.
  - b. Decontaminate door and rotor chamber using an appropriate method.
2. Complete and attach Decontamination Information Certificate (in the back of your rotor or instrument manual) to the centrifuge before servicing or return to Sorvall facility. If Certificate is not available, attach a written statement verifying decontamination (what was the contaminant and what decontamination method was used).

If the centrifuge must be returned to a Sorvall facility:

1. Contact your Sorvall representative to obtain a Return Service Order Number (RSO No.); be prepared with the name and serial number of the centrifuge or rotor and the repairs required.
2. Send item(s) with the RSO No. clearly marked on the outside of packaging to the address obtained from your Sorvall representative.

**NOTE** United States federal regulations require that parts and instruments *must* be decontaminated before being transported. Outside the United States, check local regulations.

If the centrifuge to be serviced does not have a Decontamination Information Certificate attached and, in Sorvall's opinion presents a potential radioactive or biological hazard, the Sorvall representative will not service the equipment until proper decontamination and certification is complete. If Sorvall receives a centrifuge at its Service facilities which, in its opinion, is a radioactive or biological hazard, the sender will be contacted for instructions as to disposition of the equipment. Disposition costs will be borne by the sender.

Decontamination Information Certificates are included with these instructions. Additional certificates are available from the local Account Representative or Field Service Engineer. In the event these certificates are not available, a written statement certifying that the unit has been properly decontaminated and outlining the procedures used will be acceptable.

**NOTE** The Field Service Engineer will note on the Customer Service Repair Report if decontamination was required and, if so, what the contaminant was and what procedure was used. If no decontamination was required, it will be so stated.

# Warranty

SORVALL PRODUCTS, L.P. MAKES NO WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING THAT OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE EXCEPT AS STATED IN THIS WARRANTY POLICY STATEMENT.

Subject to the exceptions and upon the conditions specified in this Warranty Policy Statement, Sorvall warrants each SORVALL® RC-M120EX Micro-Ultracentrifuge (instrument) to be free from defects in material or workmanship for a period of one (1) year from the date of installation of any such instrument. Sorvall agrees to correct, either by repair or, at Sorvall's election, by replacement, any defects of material or workmanship which develop within one (1) year after installation of any such instrument, provided that investigation and/or factory inspection by Sorvall discloses that such defect developed under normal and proper usage. The exceptions and conditions mentioned above are the following:

- (a) Some components and accessories by their nature are not intended to and will not function for the warranty period. If any such component or accessory manufactured by Sorvall and part of the instrument sold fails to give reasonable service for a reasonable period of time, Sorvall will, at its election, replace or repair such component or accessory. What constitutes reasonable service and what constitutes a reasonable period of time shall be determined solely by Sorvall after Sorvall is in possession of all the facts concerning operating conditions and other pertinent factors and after such component or accessory has been investigated and/or factory inspected by Sorvall.
- (b) All items claimed defective must be returned to Sorvall, transportation charges prepaid, and will be returned to Buyer with transportation charges prepaid. Sorvall will be released from all obligations under this warranty in the event that any such instruments have been installed by, or repairs or modifications are made by, persons other than its own or service personnel authorized by it unless such installation, modification and/or repairs by others are made with the prior written consent of Sorvall.
- (c) Sorvall is not obligated to incorporate into any instrument any design, engineering, or performance change developed after delivery of the instrument to the original purchaser.

In addition to the foregoing one (1) year warranty and subject to the foregoing exceptions and conditions, Sorvall warrants the drive assembly of the SORVALL® RC-M120EX Micro-Ultracentrifuge to be free from defects in material or workmanship for five (5) years from the date of installation, subject to all the conditions, limitations, and other aspects of warranty expressed above and to the following further conditions:

- (a) The instrument shall be operated only within its rated maximum speed and temperature in accordance with the instructions in this manual.

- (b) The drive unit shall not be overloaded nor loaded with an unbalanced rotor or an improper rotor and it shall be free from any corrosion or rust caused by spilled sample or solution on the drive spindle or in the chamber.
- (c) The drive unit shall not be modified, disassembled, or repaired by any party but Sorvall or by a service representative authorized, in writing, by Sorvall.

If any defect should happen to the drive unit within the aforesaid warranty period and accumulated number of revolutions, the defective drive unit shall be replaced at the cost in accordance with the formula set forth below.

- (a) First year: free replacement.
- (b) Second year through fifth year:

$$\text{Replacement Cost} = \text{Selling price} \times \frac{\text{Age of Drive (Years)}}{5 \text{ Years}}$$

SORVALL EXPRESSLY DISCLAIMS ANY LIABILITY TO ITS CUSTOMERS, DEALERS, AND REPRESENTATIVES, AND TO USERS OF ITS PRODUCTS, AND TO ANY OTHER PERSON OR PERSONS FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND AND FROM ANY CAUSE WHATSOEVER ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE SALE, HANDLING, REPAIR, MAINTENANCE OR REPLACEMENT ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE USE OF SAID PRODUCTS.

Representations and warranties made by any person, including dealers and representatives of Sorvall, which are inconsistent or in conflict with the terms of this warranty (including but not limited to the limitations of the liability of Sorvall as set forth above), shall not be binding upon Sorvall unless reduced to writing and approved by Sorvall.

NO CLAIM OF ANY KIND, WHETHER IT IS TO GOODS DELIVERED OR FOR NONDELIVERY OF GOODS, SHALL BE GREATER IN AMOUNT THAN THE PURCHASE PRICE OF THE GOODS IN RESPECT OF WHICH SUCH DAMAGES ARE CLAIMED, AND FAILURE TO GIVE NOTICE OF CLAIM WITHIN NINETY (90) DAYS FROM DATE OF DELIVERY OR THE DATE FIXED FOR DELIVERY, OR AS OTHERWISE PROVIDED IN THIS WARRANTY POLICY STATEMENT SHALL CONSTITUTE A WAIVER BY BUYER OF ALL CLAIMS IN RESPECT OF SUCH GOODS. No charges or expenses incident to any claim will be allowed unless approved by authorized representative of Sorvall in writing. Goods shall not be returned to Sorvall without Sorvall's permission.

# Program Log

Location	Step	Speed	Run time	Temp.	ACC	DEC	Remarks
EXAMPLE  0	1	120 000	2:00	20°C	9	9	User: J. Jones
	3	80 000	:30	20°C	9	7	Date logged: 10/28/93
	5						Rotor used: RP100AT
	7						Note:
	9						
Location	Step	Speed	Run time	Temp.	ACC	DEC	Remarks
0	1						User:
	2						
	3						Date logged:
	4						
	5						Rotor used:
	6						
	7						Note:
	8						
	9						
Location	Step	Speed	Run time	Temp.	ACC	DEC	Remarks
1	1						User:
	2						
	3						Date logged:
	4						
	5						Rotor used:
	6						
	7						Note:
	8						
	9						



# Program Log

Location	Step	Speed	Run time	Temp.	ACC	DEC	Remarks
2	1						User:
	3						Date logged:
	5						Rotor used:
	7						Note:
	9						
Location	Step	Speed	Run time	Temp.	ACC	DEC	Remarks
3	1						User:
	3						Date logged:
	5						Rotor used:
	7						Note:
	9						
Location	Step	Speed	Run time	Temp.	ACC	DEC	Remarks
4	1						User:
	2						
	3						Date logged:
	4						
	5						Rotor used:
	6						
	7						Note:
	8						
	9						