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Section 1: INTRODUCTION & DESCRIPTION

This manual is a service guide for the SORVALL® RC-5B PLUS Superspeed Refrigerated Centrifuge. It contains descriptive information, mechanical and electrical theories of operation, maintenance procedures, calibrations, and an illustrated parts list for ordering replacements.

1-1. Intended Use

WARNING
To avoid personal injury, all replacement and calibration procedures should be performed by qualified service personnel.

This manual is for qualified service personnel who are familiar with electronics and factory methods for performing repairs, adjustments, and calibrations. It provides a fault isolation method that isolates and identifies the cause of a problem within the centrifuge, a parts list, and information for ordering replacement parts needed for the repair of parts or systems within the centrifuge.

Warnings, Cautions, and Notes are used throughout this manual to emphasize important and critical instructions. Service personnel are expected to be familiar with their meaning (see page ii) and to read them before servicing the centrifuge.

1-2. Centrifuge Description

The RC-5B PLUS is a high-speed (to 21 000 rpm), floor-model centrifuge used to separate substances of different densities at controlled temperatures. Its function is to increase the effects of gravity by centrifugal force to separate substances of different size or densities at controlled temperatures.

The centrifuge has a fan-cooled motor that is balanced and enclosed in an air-cooled silencer to ensure smooth, quiet operation over its full speed range and to promote long life for the brushes and bearings. The durable motor brushes have increased life and the gyro-action self-centering drive spindle allows you to balance the centrifuge tubes by "eye" rather than by weighing them.

The refrigeration system is a low-temperature, hermetically-sealed unit consisting of a compressor, condenser, evaporator/rotor chamber and interconnecting tubing. It is charged with SUVA® refrigerant, one of DuPont's CFC-replacement coolants. During operation, the cooling system will maintain rotor compartment temperature within 1°C of setpoint.

Run parameters are selected by setting the dials on the front control panel. Actual run conditions are continuously displayed during operation by easy-to-read analog displays.

The RC-5B PLUS accepts the SORVALL® superspeed rotors listed in the Rotor Information Table in Section 4, which includes all the rotors compatible with earlier floor-model, superspeed centrifuges.

Refer to figure 1-1 to identify the parts of the RC-5B PLUS.

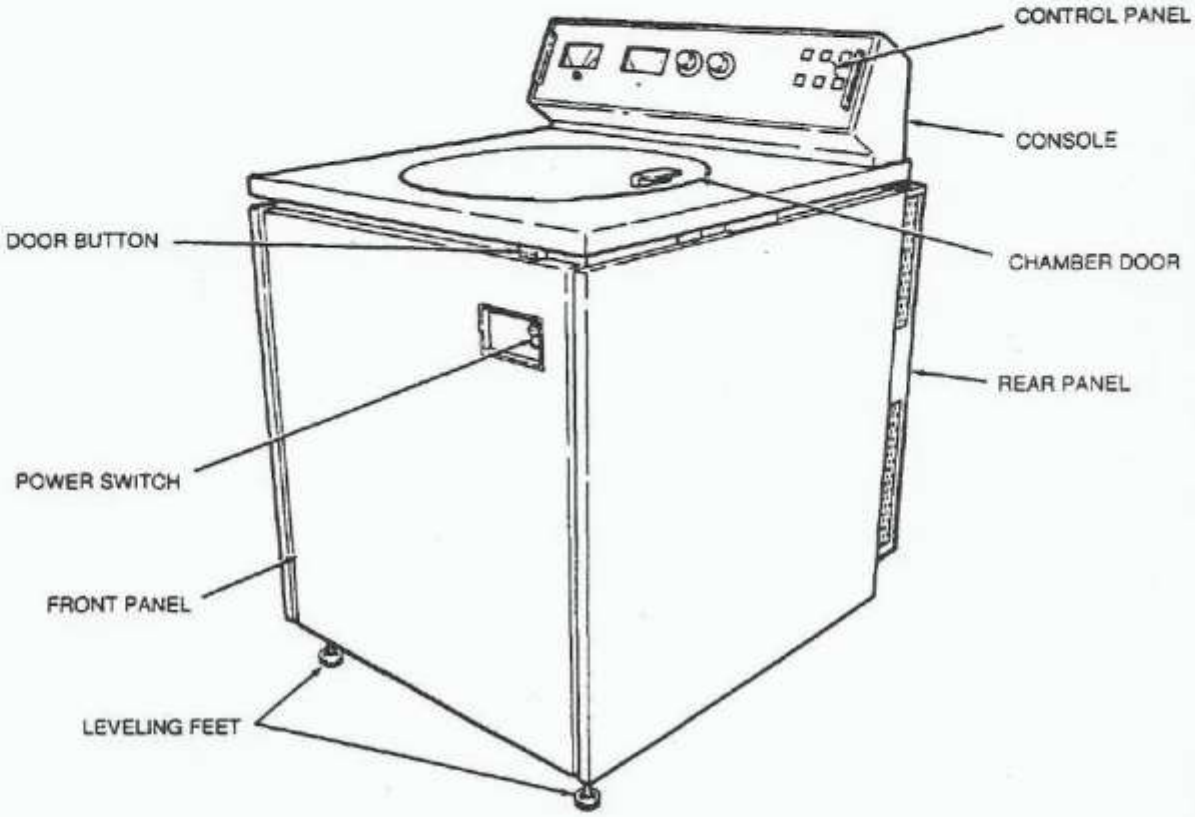

Figure 1-1. Centrifuge Parts Location and Identification

1-3. Centrifuge Accessories

The following accessories are provided with the centrifuge:

Catalog No.	Description
74143	Condensed Operating Instructions
74013	Instruction Manual
68025	9/16-inch Wrench
12284	Motor Brush Replacement Kit

1-4. Centrifuge Warranty

E. I. duPont de Nemours and Company makes no warranty of any kind, expressed or implied, except as stated in this warranty policy.

The SORVALL® RC-5B PLUS Superspeed Centrifuge is warranted to be free from defects in material and workmanship for a period of one year from the date of delivery. The compressor, condenser, evaporator and all interconnecting tubing are warranted to be free of defects in material and workmanship for a period of five years from the date of delivery. DuPont will repair or replace and return free of charge any part which is returned to its factory within said period, transportation prepaid by user, and which is found upon inspection to have been defective in materials or workmanship. This warranty does not apply to any damage to any instrument resulting from: normal wear and tear; misuse; abuse; use of electrical currents or circuits other than those specified on the plate affixed to the instrument; accident; negligence; failure to follow operating instructions; or use of any rotor other than a SORVALL® rotor intended for use in this instrument.

DuPont reserves the right to change, alter, modify, or improve any of its instruments without any obligation whatsoever to make corresponding changes to any instrument previously sold or shipped.

The foregoing obligations are in lieu of all other obligations and liabilities including negligence and all warranties, of merchantability or otherwise, expressed or implied in fact or by law, and state our entire and exclusive liability and buyer's exclusive remedy for any claim or damages in connection with the sale or furnishing of goods or parts, their design, suitability for use, installation or operation. DuPont will in no event be liable for any special or consequential damages whatsoever, and our liability under no circumstances will exceed the contract price for the goods for which liability is claimed.

1-5. Service Decontamination Policy

WARNING

Because of the characteristics of the samples likely to be processed in this centrifuge, 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 DuPont personnel, either at the customer's laboratory or at a DuPont facility, comply with the following procedure to ensure the safety of all personnel:

1. Clean the centrifuge or rotor to be serviced of all encrusted material and decontaminate it (see "Cleaning and Decontamination" on page 4-2 of the RC-5B PLUS Operator Manual) prior to servicing by the DuPont representative or

returning it to the DuPont 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. Also, this instruction manual contains specific guidance about cleaning and decontamination methods appropriate for the product it describes.

Clean and decontaminate your centrifuge and rotor as follows:

For rotors:

Remove tubes, bottles, and adapters from the rotor and decontaminate rotor using an appropriate method. If tubes or rotor caps are stuck in the rotor, or the rotor cover is stuck, notify DuPont representative; be prepared with the name and nature of the sample so the DuPont Chemical Hazards Officer can decide whether to authorize the rotor's return to a DuPont facility.

For superspeed centrifuges:

1. Remove rotor from the rotor chamber.
2. Decontaminate chamber door, rotor chamber, and drive spindle using appropriate method (see "Cleaning and Decontamination" on page 4-2 of the RC-5B PLUS Operator Manual).
3. Remove all encrusted material from around the motor and drive assemblies.
4. Remove, wash, and decontaminate the motor sealing gasket and pad.

2. Complete and attach Decontamination Information Certificate (SORVALL® Instruments Form No. IPDP-59 or E53603) to the centrifuge or rotor before servicing or return to DuPont facility. If Certificate is not available, attach a written statement verifying decontamination (what was contaminant and what decontamination method was used).

If the centrifuge or rotor must be returned to a DuPont facility:

1. Contact your DuPont 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 DuPont 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 a centrifuge or rotor to be serviced does not have a Decontamination Information Certificate attached and, in DuPont's opinion presents a potential radioactive or biological hazard, the DuPont representative will not service the equipment until proper decontamination and certification is complete. If DuPont receives a centrifuge or rotor 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.

Section 2: INSTALLATION

After you receive your centrifuge, inspect it for damage before using it. The RC-5B PLUS centrifuge must be installed in a location that meets all of the location and electrical requirements specified in this section. Installation instructions are on page 2-2.

2-1. Inspection

As soon as you receive your RC-5B PLUS you should carefully inspect it for any shipping damage that may have occurred. If you find any damage, please report it immediately to the transportation company and file a damage claim, then notify DuPont. If any parts are missing, contact one of the DuPont district offices or the local representative of SORVALL® Products. You will find a list of offices in the back of this manual.

2-2. Location Requirements

The location of the centrifuge should be carefully considered because free air circulation is very important for the centrifuge to function properly. To allow adequate air circulation, locate the centrifuge in an area that will allow 10 cm (4 in) clearance between the wall and the sides of the centrifuge and has an ambient temperature within 15°C to 38°C. If the inlet air temperature is above 25°C, the centrifuge may not maintain low temperatures at high speeds.

When the centrifuge is situated at its operating location, install it as specified later in this section.

2-3. Electrical Requirements

The appropriate single-phase power source must be available to plug the centrifuge into. Check the nameplate on the back panel of the centrifuge to determine the electrical configuration of your centrifuge, which is one of the following:

240 V, 50 Hz, 30 A*
230 V, 60 Hz, 30 A*
220 V, 50 Hz, 30 A*
208 V, 60 Hz, 30 A*
200 V, 60 Hz, 30 A*
208 V, 60 Hz, 50 A*
230 V, 60 Hz, 50 A*

*CSA and UL approval is applied for.
Instruments shipped to Canada are shipped without a power cord (see paragraph 2-5).

To connect the centrifuge to a voltage other than what is specified on the nameplate (including polyphase), it will have to be rewired and its power cord may have to be replaced. Contact DuPont to have a Field Service Engineer do the rewiring.

The centrifuge is equipped with a 3-wire power cord with a 3-prong grounded plug (NEMA 6-30P) that fits NEMA receptacle 6-30R or equivalent. (Centrifuges shipped to Canada are supplied with a power cord to fit a NEMA 6-50R receptacle or equivalent.) For connection to other receptacles, the power cord may have to be replaced. Follow local electrical codes.

CAUTION

The centrifuge can be damaged if it is connected to a line voltage that varies more than ±10% of its nominal value. Check the voltage before plugging the centrifuge into any power source. DuPont is not responsible for improper installation.

If the line voltage varies by more than ±10, it may damage the centrifuge. ***Read the CAUTION.***

The main power ON/OFF switch is a 30 A circuit breaker; therefore, a separate line disconnect switch is not needed unless required by local codes.

2-4. Installation

To install the centrifuge:

1. *If you are installing a new centrifuge,* remove any packaging.
2. Roll centrifuge into position. Open the chamber door by following the emergency sample recovery procedure in Section 11.
3. Install a rotor WITHOUT its lid. Place a level on the center hub of the rotor.
4. Turn the two front feet with the 9/16-inch wrench provided until they bear weight. Alternately turn the feet with the wrench to raise or lower the feet until the centrifuge is level. Remove the level. ***Read the CAUTION.***
5. Plug the centrifuge into the appropriate electrical outlet.

CAUTION

The centrifuge can be seriously damaged if it is operated when it is not level.

2-5. Rewiring the Centrifuge

When converting either a 60 Hz or 50 Hz centrifuge to any voltage, connect wire 210 on TB101 as follows:

Input Voltage	TB101 Terminal
200	TB101-3
208	TB101-4
220	TB101-5
230	TB101-6
240	TB101-7

When converting a centrifuge from either 60 Hz to 50 Hz or from 50 Hz to 60 Hz, refer to the chart above. For 50 Hz conversion, move wire #143 to TB101-3; for 60 Hz conversaion move wire #143 to TB101-6.

Refer to System Wiring Diagram, figure 5-1.

WARNING

Tampering with the high voltage electrical circuits in this centrifuge can cause severe electrical shock: this procedure must be performed by a qualified electrician only.

Conversion to Single Phase Permanent Wiring

This procedure applies to instruments shipped to Canada.

Connect the incoming power lines to the centrifuge as follows:

1. Set the main circuit breaker, POWER switch, to OFF.
2. Disconnect the power cord from the power supply.
3. Remove the right cabinet panel from the centrifuge.
4. Connect the safety ground wire to the lug connector marked GND ⏚ , figure 2-1 (on the next page).
5. Connect the incoming ac power wire to TB102-1.
6. Connect the ac power return wire to TB102-2.
7. Reinstall right cabinet panel.

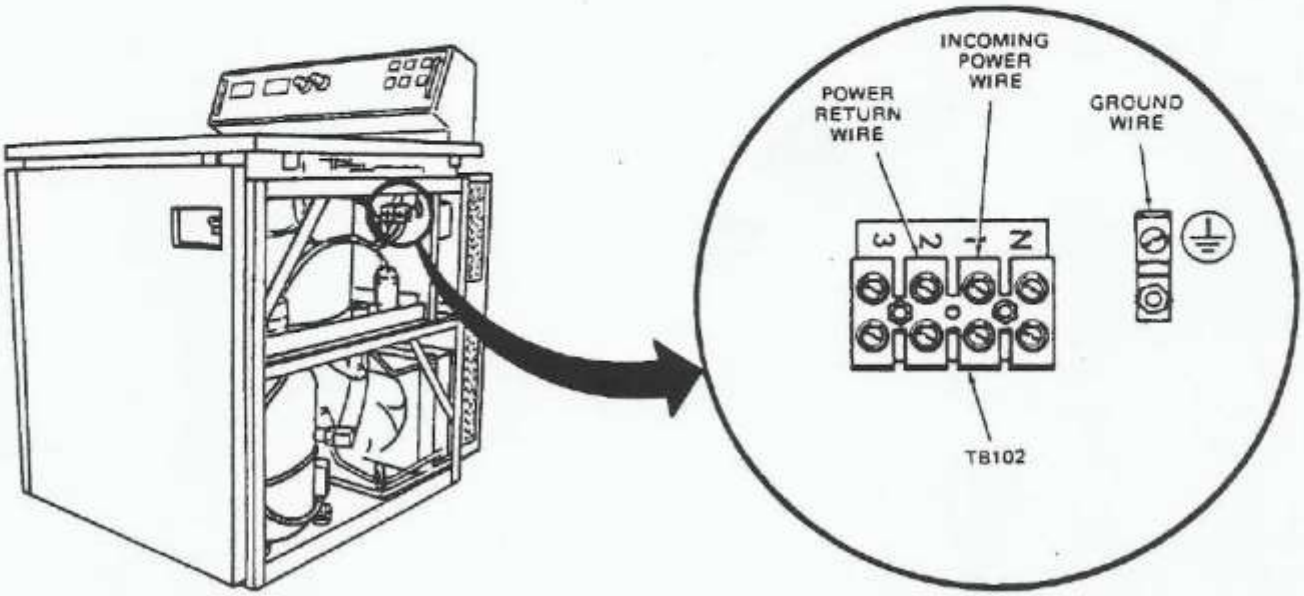

Figure 2-1. Single Phase Permanent Wiring

2-6. Test Run Procedure

After completing installation/rewiring of the centrifuge, perform a test run.

1. Ensure that the centrifuge is connected to a power supply and that the main circuit breaker, POWER switch, is set to ON.

2. Set up the centrifuge as follows:

   a. Set SPEED dial to 10 000.

   b. Set TEMPERATURE needles to 0°C.

   c. Set TIME dial to HOLD.

   d. Set BRAKE switch ON.

   e. Install SS-34 rotor in centrifuge.

3. Close the centrifuge chamber door.
4. Press the START switch.
5. Verify the following:
   - The rotor acceleration rate is slow and even.
   - The set speed is maintained within 1%.
   - The set temperature is maintained within 1°C.
6. Set the TIME dial for one minute. Verify that the rotor starts to decelerate after one minute.
7. Press the STOP switch.
8. When the rotor stops, remove it from the centrifuge.
9. Record the test run parameters.

Section 3: OPERATION

This section describes the RC-5B centrifuge controls, and includes their locations and functions. It also provides step-by-step instructions on how to set the centrifuge power ON, open the chamber door, and perform a run, and how to precool the rotor.

3-1. Setting the Centrifuge Power On

The centrifuge power ON/OFF switch is located on the front panel, below the control panel. Press the top of the switch to set the centrifuge power on.

NOTE Upon start-up, an imbalance fault is indicated until the door is opened.

3-2. Opening the Chamber Door

Press the door release button located under the top deck (see figure 1-1) to release the door latch and open the chamber door.

3-3. Centrifuge Controls Description

The RC-5B PLUS control panel is used to select desired run parameters and, during a run, indicate actual run conditions, such as chamber temperature, rotor speed, and remaining or elapsed run time. The control panel light turns on, as required, to indicate that the power is ON, the brake is ON, the centrifuge detects a rotor imbalance, the brushes are worn and need to be replaced, or the door can be opened.

Refer to figure 3-1 for the location of the controls described in this chapter. The figure is keyed to Table 3-1.

Table 3-1. Centrifuge Controls

Item Number	Name	Function
1	TEMPERATURE Control and Meter	The refrigeration system automatically maintains the chamber temperature when the power is ON. During a run, the blue needle selects the desired chamber temperature and the red needle selects the maximum allowable temperature (overtemperature). When the timer is off (centrifuge is in standby or decelerating), the red needle selects the chamber temperature. The black needle indicates actual temperature in the rotor chamber. If the black needle indicates a temperature 3°C or greater than the red needle, the run will not start or, if a run is in progress, the run will terminate.
2	SPEED Dial and Meter	This dial is used to set desired run speed (in rpm). The meter shows actual rotor speed during a run.
3	TIME Dial	This dial is used to select the desired length of a run, up to 120 minutes for a timed run or continuous if set at HOLD. The STOP setting is selected to end a run in HOLD or to end a timed run before the selected time has elapsed.
4	START Switch and Light	When the START switch is pressed, the run will begin and the START light will turn on.
5	BRAKE Switch and Light	Press the BRAKE switch to set the brake either ON or OFF. If the BRAKE light is on, the brake is set ON and the rotor will brake (rather than coast) at the end of the run. If the BRAKE light is OFF, rotor will coast to a stop.
6	POWER Light	The POWER light will turn on (red) when the main POWER switch is set ON.
7	DOOR Light	The DOOR light will turn on when rotor speed is below approximately 100 rpm during deceleration, indicating that the chamber door can be opened.
8	BRUSHES Light	The BRUSHES light will turn on when the motor brushes are worn and must be replaced; the run in progress will continue, but a new run cannot be started.
9	IMBALANCE Light	The IMBALANCE light will turn on when a rotor imbalance occurs; the run in progress will terminate.
	POWER Switch	The POWER switch applies main power to the centrifuge when set to ON. It is located on the front panel.
	DOOR Button	Press the DOOR button and lift the door handle to open the door. It is located on the front panel.

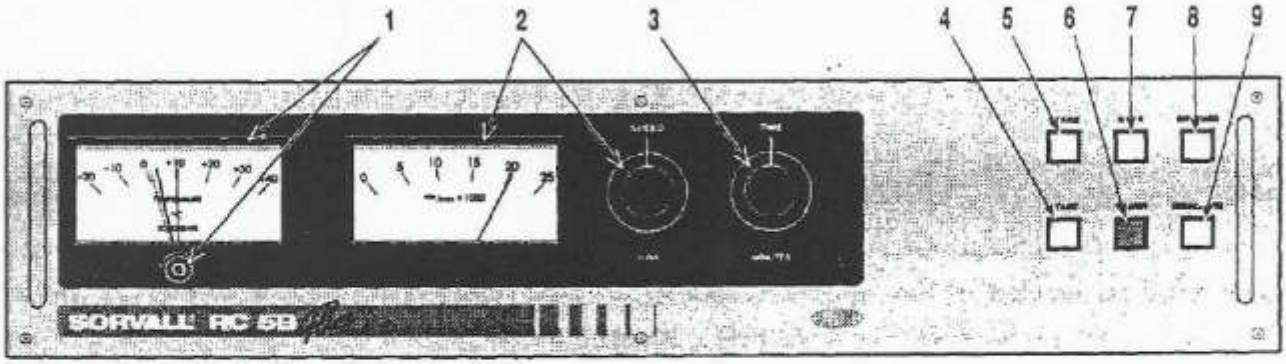

Figure 3-1. RC-5B PLUS Control Panel

3-4. Centrifuge Operation

WARNING

Do not exceed the recommended design mass for the maximum speed of the rotor in use. If design mass is exceeded, the operating speed must be reduced accordingly. (See rotor instruction manual for design mass and instruction on how to reduce speed in proportion to actual mass.)

Load and balance the rotor according to the instructions in the rotor manual, then operate the centrifuge as follows (refer to Table 3-1):

1. Set the POWER switch to ON. Upon start-up, an imbalance fault is indicated until the door is opened.

2. Push the DOOR button and open the chamber door.

NOTE Before installing the rotor, make sure that the rotor centerhole and the tapered spindle are clean and free of nicks or scratches. Wipe surfaces clean before each operation to reduce the chance of the rotor sticking to the spindle.

If the chamber temperature is below room temperature and the rotor has not been precooled, allow time for the rotor to cool to the chamber temperature before locking it in place.

3. Install the rotor. Make sure it is locked to the drive.

4. Close the chamber door.

5. Set the TEMPERATURE needles to the desired settings.

NOTE To achieve the desired rotor temperature, follow the procedure in *Rotor Speed and Temperature Differential Compensation* to set the proper chamber temperature.

6. Turn the TIME dial to the desired run time setting or to HOLD.

7. Turn the SPEED dial to the desired run speed setting.

8. If you want the rotor to brake at the end of the run, set the brake ON by pressing the BRAKE switch so that the light is on.

9. Press the START switch. The centrifuge will accelerate to the selected speed and run for the selected time. The run will coast or brake to a stop when the time expires.

NOTE If it is necessary to stop the rotor during HOLD or before the selected time has elapsed, always turn the TIME control dial to STOP. DO NOT stop the rotor by turning the SPEED dial to 0 rpm.

If a power interruption occurs during a run, the run can be continued by pressing the START switch.

During deceleration, the chamber temperature will be controlled by the red temperature needle setpoint (standby).

When the rotor has decelerated below 100 rpm, the DOOR light will turn on. The chamber door can then be opened by pushing the DOOR button and lifting the door handle. Remove the rotor.

3-5. Rotor Speed/Temperature Differential Compensation

Graphs

CAUTION The temperature offset technique should be used on all runs to prevent overtemperature or freezing of sample. This is particularly important at low set temperatures and at speeds lower than maximum rotor speed.

To create a graph, plot the selected temperature versus the actual sample temperature at a specific speed and ambient condition. For example: To achieve and maintain a +7.5°C sample temperature with a GSA Rotor at 13 000 rpm, the blue needle must be set at approximately +4°C, which is 3°C colder than the desired temperature.

NOTE An ambient temperature of 25°C or less is required to obtain optimum cooling efficiency. At higher ambient temperatures, a lower operating speed may be necessary to maintain sample temperature.

Test Run Procedure

More accurate temperature offset data can be obtained by doing a test run and dynamically calibrating a specific rotor/centrifuge/desired speed combination and ambient condition. Using an immersible centigrade thermometer calibrated in 1.0°C increments, perform the procedure given on the next page.

1. Select the desired sample temperature.

2. Prepare two tubes or bottles of dispensable fluid. Balance according to instructions in rotor instruction manual.

NOTE The dispensable fluid should have a freezing point somewhat below the desired sample temperature.

3. Precool the thermometer to 1.0°C below the desired sample temperature.

4. Set the blue TEMPERATURE select needle to the desired sample temperature.

5. Install the empty rotor in the centrifuge, and precool the rotor.

6. When precool time has elapsed, load the prepared tubes or bottles into the rotor, and run the rotor for at least one hour at the desired speed.

7. When the run time has elapsed and the rotor has stopped, open the chamber door; then open one rotor compartment, and immerse the precooled thermometer into the liquid. Agitate the thermometer in the liquid for approximately five (5) to ten (10) seconds. Record the indicated temperature.

8. Adjust the blue TEMPERATURE select needle according to the recorded temperature indication. For example: if the recorded temperature is 2°C warmer than the desired temperature, reset the blue TEMPERATURE select needle downward 2°C.

9. Record all data for future use.

NOTE Although the indicated chamber temperature could vary some 2°C during a run, the actual temperature will vary only a few tenths of a degree. In the standby mode, indicated temperature could vary 10°C, with an actual chamber temperature change of ±1°C.

3-6. Precautions to Prevent Samples from Freezing

If a sample freezes, it is not necessarily caused by a malfunction of the centrifuge. Because of the high capacity of the refrigeration system, certain operating conditions can cause a sample to freeze. However, you can prevent this from happening by using the proper technique.

Freezing will occur when the following three conditions happen simultaneously:

1. The speed setting is below 7000 rpm.

2. The blue temperature select needle is set below 5°C.

3. The black temperature indicator needle is several degrees above the setting of the blue needle.

When these conditions occur simultaneously, the temperature control system senses a need to reduce the chamber temperature several degrees. As a result, the refrigeration system is set ON, causing liquid refrigerant to enter the evaporator. However, heat is not being generated at a balanced rate in the rotor chamber, so the refrigerant entering the evaporator is more than what is needed to absorb heat from the chamber. As the refrigerant absorbs the heat, naturally, the chamber temperature drops. When the temperature has dropped to the point where the black needle crosses the blue needle, the compressor will shut off. However, the excess refrigerant in the evaporator continues to absorb heat from the chamber. This will lower the chamber temperature several degrees below the desired temperature, and the sample may freeze.

The problem can be overcome in three ways, all of which involve stabilizing the actual chamber temperature (indicated by the black needle) at or below the blue needle setpoint before the run begins. Please try one of the following methods before notifying your Field Service Engineer.

1. Perform the run with the red and the blue needles at the same temperature setting (one needle directly over the other). In this way, when the TEMPERATURE control switches to the red needle setting during standby, the temperature will not rise, so Condition 3 will not occur.

2. Set the blue needle at the desired run temperature. Install an empty rotor, and operate it at approximately one-half its maximum rated speed until the black indicator needle stabilizes near the blue needle. Then, stop the centrifuge and load the rotor. DO NOT adjust the blue needle. Set the SPEED dial at the desired run speed (below 7000 rpm) and restart the centrifuge.

3. During a short run, the temperature of the rotor and the evaporator will not change much. Therefore, if your run is to be less than 15 minutes, stabilize the temperature to a desired level using method 1 or 2, then when ready to begin the run, turn the red and the blue needles to the highest setting. The refrigeration system will not function during the run, but temperature rise will be minimal. Do a trial run at the desired conditions to see if the temperature rise is acceptable.

Using the methods outlined above will minimize the chance of samples freezing.

3-7. Rotor Precool

If you plan to run a temperature-sensitive sample in the RC-5B PLUS centrifuge, we recommend that you precool the rotor and the centrifuge before loading the sample. This will ensure that the rotor and chamber temperatures are at equilibrium at the start of the run.

CAUTION

Failure to load and install the rotor in accordance with the rotor instruction manual could result in damage to the centrifuge. The rotor cover must be on and locked in place and the rotor must be locked to the drive spindle.

1. Set the centrifuge power ON and open the chamber door.
2. Install the empty rotor (with cover installed, if applicable). Lock it to the drive spindle by turning the rotor locking screw counterclockwise. Close the chamber door.
3. Set a run speed of 2000 rpm.
4. Set the TIME dial to HOLD.
5. Set the TEMPERATURE needles for desired run temperature.
6. Set all other controls as you would for a normal mode run.
7. Press the START switch. The rotor will accelerate to 2000 rpm and quickly cool to the selected run temperature. It will typically take the rotor 30 minutes to cool, but the actual time will vary depending on the rotor weight and rotor material.

   When the displayed temperature equals the run temperature setting, stop the run.
8. After the rotor has come to a stop, open the chamber door and remove the rotor lid. Place the samples in the rotor and balance the load as specified in the rotor instruction manual.
9. Re-secure the rotor lid. Lock the rotor to the drive spindle. Close the chamber door.
10. Perform the desired centrifuge run.

3-8. Troubleshooting

Refer to Table 3-2 for possible causes and corrective actions to problems that occur either before or during a run.

Table 3-2. Troubleshooting

Problem	Possible Cause(s)	Suggested Corrective Action
Centrifuge will not start	The actual chamber temperature indicated by the black needle is 3° greater than the overtemperature set by the red temperature needle.	Set the red needle above the black needle or let the chamber cool before pressing START.
	Chamber door is open.	Close the chamber door.
	Main power is set OFF.	Set the POWER switch ON.
Run terminated	Power failure or interruption occurred.	Restart the run when power is restored.
	Chamber overtemperature occurred during the run.	Precool the rotor and chamber before starting run.
		Refrigeration system failure. Contact Service Engineer.
	Rotor imbalance occurred.	Balance rotor and restart the run.
	Overspeed condition caused by lack of rotor.	Install rotor and restart run.
BRUSHES light is on	Brushes are worn.	Replace brushes before starting a new run.
IMBAL light is on	Rotor imbalance occurred.	Balance rotor and restart the run
Door will not open	Power failure occurred.	Open chamber door manually (see *Emergency Sample Recovery* in Section 11).

3-9. Reducing Speed for Loads in Excess of Design Mass

There is a maximum allowable compartment mass established for each rotor (see the Rotor Information Table in Section 5 or the individual rotor manual). To prevent rotor failure, the total contents of any compartment, including specimen, tubes, sealing assembly, and adapters (if used), must not exceed the specified maximum compartment mass unless rotor speed is reduced proportionately.

WARNING

Failure to reduce rotor speed when compartment load exceeds maximum allowable compartment load can lead to rotor failure.

Strict adherence to the maximum allowable compartment mass or reduced rotor speed is required to prevent rotor failure. ***Read the WARNING.***

If the maximum compartment mass is greater than the value specified for the rotor, use the following formula to determine the reduced rotor speed that is required:

$$\text{Reduced Speed} = \text{Maximum Rotor Speed} \times \sqrt{\frac{\text{Maximum Compartment Mass}}{\text{Actual Compartment Mass}}}$$

Section 4: SPECIFICATIONS

This section contains centrifuge specifications and rotor information for the SORVALL® RC-5B PLUS Superspeed Refrigerated Centrifuge.

NOTE Centrifuge specifications may vary depending on the rotor being used.

4-1. Centrifuge Specifications

Run Speed[1]	
Speed Selection Range (rpm)	500 to 21 000
Speed Control Accuracy	±1% or 100 rpm, whichever is greater
Maximum Relative Centrifugal Force (using the F-20/MICRO Rotor)	51 070 *g*
Run Temperature	
Temperature Selection Range	−20 to +40°C
Temperature Control Range	−15 to +30°C[2,3]
Temperature Control Accuracy	±1°C[3,4]
Run Time Selection Range	0 to 120 minutes or Hold
Ambient Temperature Range	+15 to +38°C[3]
Mass (Weight)	308 kg (680 lb)
Dimensions	
Width	76 cm (30 in)
Height to top of control console	114 cm (45 in)
Depth	99 cm (39 in)
Electrical Requirements	
Input Power (single phase, 30 A)	240 V, 50 Hz 230 V, 60 Hz 220 V, 50 Hz 208 V, 60 Hz 200 V, 60 Hz

(continued on next page)

1 Speed in revolutions per minute (rpm) is related to angular velocity, ω, according to the following:

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

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

2 May vary at very low speeds (below approximately 2000 rpm).

3 The centrifuge will operate at ambient temperatures up to 38°C, but refrigeration system performance may be less than optimal above 25°C.

4 After the centrifuge system has reached equilibrium.

4-1. Centrifuge Specifications (continued)

Input Power (polyphase, 30A) 220V, 50Hz
Receptacle ..... NEMA 6-30R
(for NEMA 6-30P grounded plug that is supplied)

Maximum Noise Level ..... <62 dB[1]

Heat Output ..... 4.8 kW[2]
(16 500 Btu/h[2])

1 For the SS-34 rotor at 20 000 rpm.
2 For the SS-34 rotor spinning 20 000 rpm at 4°C, after it has reached equilibrium. Other rotors, speeds, and temperatures cause the heat output to vary.

Rotor Information Table

WARNING

The SORVALL® RC-5B PLUS can be used with SORVALL® rotors *only*. Use of another manufacturer's rotor can cause rotor failure which could result in personal injury and/or centrifuge damage.

ROTOR	MAX SPEED (rpm)	CRITICAL SPEED (rpm)	MAX RCF	K FACTOR	MAX COMPART-MENT MASS	RADIUS MAX (cm)	RADIUS MIN (cm)
GS-3	9000	750	13 689	4201	780.0 g	15.13	3.93
SA-600	16 500	1200	39 411	792	115.0 g	12.96	5.52
SS-34	20 000	1350	47 807	752	115.0 g	10.70	3.26
SE-12	21 000	1700	45 959	513	30.0 g	9.33	3.81
HB-4	13 000	1200	27 579	1678	250.0 g	14.61	4.75
HS-4	7000	1000	9 425	4495	1035.0 g	17.22	7.21
SM-24	20 000	1300	49 460[2]	457[2]	27.0 g	11.07[2]	5.37[2]
GSA	13 000	900	27 504	2019	580.0 g	14.57	3.77
TZ-28[3]	19 000	1000	42 535	605	1620.0 g	9.52	3.65
SH-MT	13 730[4]	1600	19 140[4]	656[4]	36.4 g	9.09[4]	5.57[4]
SH-80	20 000	700	45 394	399	78.0 g	10.16	5.40
F-28/13	19 500	1300	48 547	295	23.0 g	11.43	7.34
F-28/36	18 000	1300	41 366	480	66.0 g	11.43	6.18
S-20/36	8 000	400	11 509	2916	156.6 g	16.10	7.70
S-20/20	12 000	400	20 910	831	115.1 g	13.00	8.10
S-20/17	8 000	400	11 867	3587	130.1 g	16.60	6.70
F-16/250	14 000	900	29 774	1694	420.0 g	13.60	3.66
HB-6	13 000	1000	27 617	1765	164.0 g	14.63	4.50
F-28/50	19 500	1240	48 717	694	115.0 g	11.47	4.04
F-20/MICRO	20 000	1200	51 070	196.3	3.0 g	11.43	8.38
SA-300	21 000	1100	47 634	822	115.0 g	9.58	2.14
SLA-1000	16 500	800	35 792	1727	400.0 g	11.77	7.54

1 With maximum allowable volume at maximum speed.
2 Outer row
3 Continuous flow configuration only
4 Maximum speed of rotor is 20 000 rpm; actual maximum speed depends on tubes. Values given are typical for 1.5 ml microtubes.