OPERATING INSTRUCTIONS

SORVALL® RC-3B

GENERAL PURPOSE AUTOMATIC REFRIGERATED CENTRIFUGE

Du Pont Company
Medical Products
Sorvall® Instruments
Wilmington, Delaware 19898
U.S.A.

Sorvall® Centrifuges

DUPONT

PN 55145-5
Issued January 1986

This manual is a guide to the use of the

SORVALL® RC-3B GENERAL PURPOSE AUTOMATIC REFRIGERATED CENTRIFUGE

The data contained in this manual has been verified and is believed adequate for the intended use of the centrifuge. If the centrifuge or procedures are used for purposes over and above the capabilities specified herein, confirmation of their validity and suitability should be obtained; otherwise DuPont does not guarantee results and assumes no obligation or liability. This publication is not a license to operate under, nor a recommendation to infringe upon, any process patents.

Publications prior to the Issue Date of this manual may contain data in apparent conflict with that provided herein. Please consider all data in this manual to be most current.

NOTES, CAUTIONS, and WARNINGS within the text of this manual are used to emphasize important and critical instructions.

WARNING A Warning informs the operator of a hazard or an unsafe practice that could result in personal injury, affect the operator's health, or contaminate the environment.

CAUTION A Caution informs the operator of an unsafe practice that could result in damage of equipment.

NOTE A Note highlights essential information.

WARNING

Regarding the Use of Hazardous Material

If using radioactive, toxic or pathogenic material, be aware of all characteristics of the material and the hazards associated with it should leakage occur during centrifugation. If leakage does occur, neither the centrifuge nor the rotor can protect you from the particles dispersed into the air. To protect yourself, we recommend additional precautions be taken to prevent exposure to these materials, for example controlled ventilation or isolation. DO NOT USE MATERIALS CAPABLE OF PRODUCING FLAMMABLE OR EXPLOSIVE VAPORS.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

WARRANTY

The Sorvall® RC-3B Centrifuge is warranted (subject to the conditions specified below and in the warranty clause of the DuPont terms and conditions of sale in effect at the time of sale) to be free from defects in material and workmanship for a period of one (1) year 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 include normal wear from use, it does not apply to any instrument or part which has been altered by anyone other than an employee of DuPont, nor to any instrument which has been damaged through accident, negligence, failure to follow operating instructions, the use of electric currents or circuits other than those specified on the plate affixed to the instrument, misuse or abuse.

DuPont reserves the right to change, alter, modify or improve any of its instruments without any obligation whatever 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. DU PONT 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.

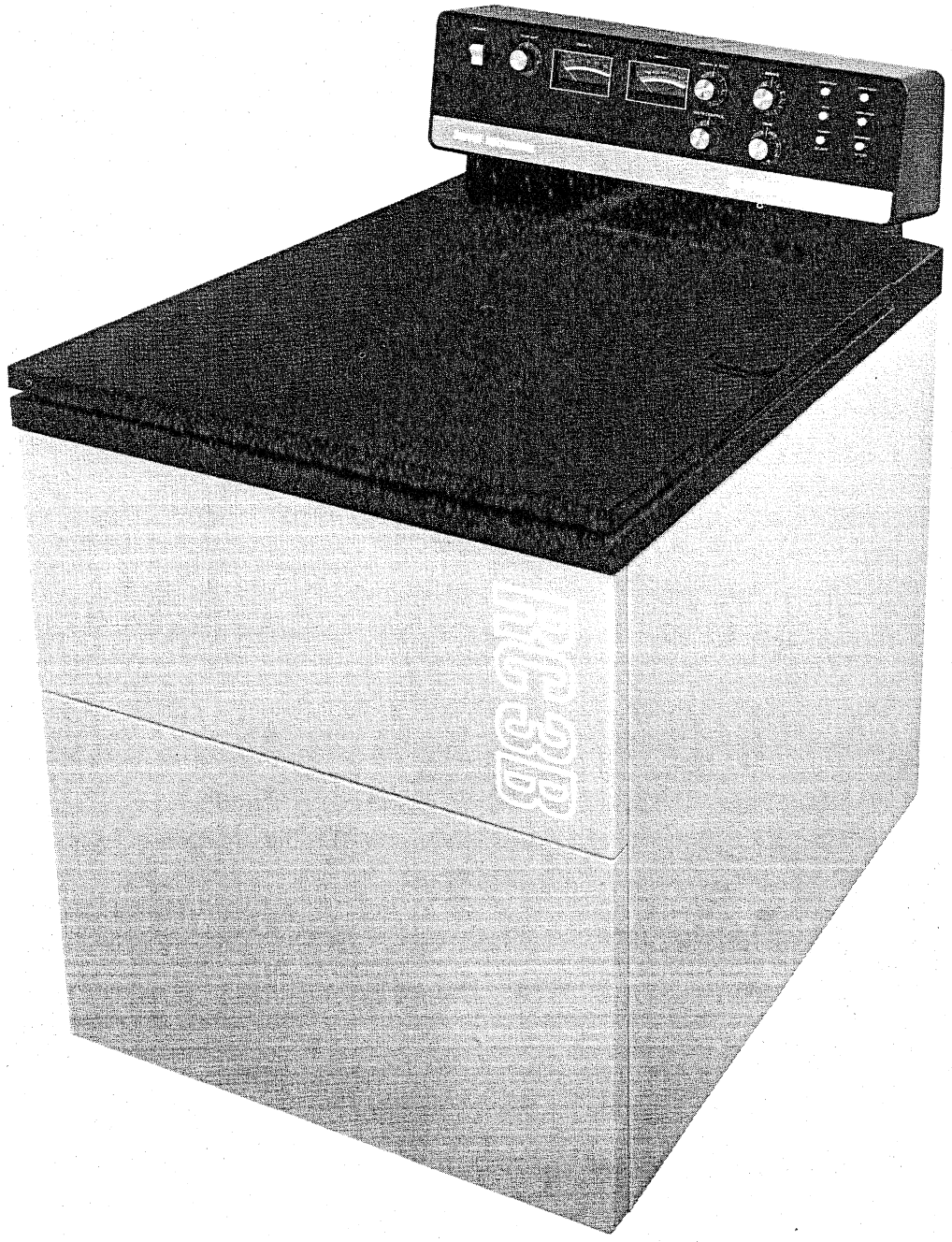


Figure 1-1. Sorvall® RC-3B General Purpose Automatic Refrigerated Centrifuge

Section 1. DESCRIPTION

1-1. SCOPE OF THE MANUAL

This manual contains the information you will need to install, operate, and maintain your Sorvall® RC-3B General Purpose Automatic Refrigerated Centrifuge. If you encounter any problem concerning either operation or maintenance that is not covered in the manual, please contact the nearest district office (see back cover) or your local SORVALL Instruments representative.

1-2. PURPOSE OF EQUIPMENT

The RC-3B is a large capacity, versatile, quiet and reliable centrifuge for low speed (to 6000 rpm) work designed to meet the needs of research and clinical laboratories, blood banks and plasmapheresis centers.

1-3. DESCRIPTION

The centrifuge system has a fan-cooled motor with automatic programmed acceleration and braking. The motor is balanced to ensure smooth, quiet operation over its full speed range and to promote long life for the brushes and bearings. A gyro-action drive with a square spindle drive shaft accepts a variety of SORVALL rotors. A clear acrylic viewing port located in the center of the chamber door permits calibration of rotor speed with a stroboscope.

The refrigeration system consists of a low-temperature condensing unit with a twin cylinder, hermetically-sealed power assembly (motor and compressor), a finned condenser and a fan. The cooling system is designed to maintain temperature within 3°C of setpoint.

The centrifuge includes the following safety features: protective, armor plate steel guard within the cabinet; automatic shutoff of the drive motor for overspeed protection and of the refrigeration motor to prevent damage from overheating; electrical circuit breakers on the main power and the control panel circuits; operating controls which may be changed during operation without damage to the centrifuge; and a door interlock which prevents opening the chamber door while the rotor is in motion and/or starting of the rotor drive while the door is open.

1-4. SPECIFICATIONS

Operating Temperature Range:	-20°C to +40°C (depending on the type and speed of the rotor in use)
Electrical Requirements:	
Voltage	208 V, 60 Hz, single phase 230 V, 60 Hz, single phase 220 V, 50 Hz, single phase

Circuit breakers	30A
Current	24A

Dimensions:

Width	81.2 cm (32 in)
Depth	93.9 cm (37 in)
Height, worktop	93.9 cm (37 in)
Height, console	120.6 cm (47.5 in)
Mass (weight)	285 kg (627 lb)

Maximum Operating Speed*	6000 rpm**
Shortest Braking Time at maximum BRAKE dial setting	approximately two times the acceleration time of the rotor
Average heat output during operation	2.9 kW (10 000 BTU/h)
Rotor Chamber Diameter	58.4 cm (23 in)

1-5. PRINCIPLES OF OPERATION

The centrifuge is capable of two modes of operation: STANDBY and RUN.

a. STANDBY Mode

The STANDBY mode exists whenever the following conditions exist:

1. The POWER lamp is on.
2. The RUN lamp is either off, indicating that the rotor is at zero speed, or it is blinking, indicating that the rotor is decelerating.
3. The OPEN DOOR lamp is on, indicating that the door gearmotor has retracted and the door can be opened.

With the rate controller set to N, the centrifuge compressor will maintain the preset temperature. Thirty seconds after power is turned on, the compressor will turn on until the selected chamber temperature is reached. The compressor will turn off for a minimum of 30 seconds, then turn on again, as necessary, to cool the chamber. The compressor will continue to cycle on and off as required to maintain chamber temperature.

CAUTION

When the rate controller is engaged and set from 1 to 5, the compressor will remain OFF, until the speed of 250 rpm is reached. The standby temperature will not be maintained.

* Maximum speed is dependent on line voltage and rotor used.

** 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.

b. RUN Mode

The RUN mode exists whenever the following condition exist:

1. The POWER lamp is on.
2. The RUN lamp is on.
3. The OPEN DOOR lamp is off, indicating that the door is shut and latched.

The conditions listed above will only exist when all steps necessary to enter the RUN mode from the STANDBY mode have been taken. Those steps are:

1. Setting the rev/min x 1000 dial at a speed other than 0.
2. Setting the TIME dial for a specific amount of time or to HOLD.
3. Closing the chamber door.
4. Pushing the START switch.
5. Eliminating an automatic shut-off condition.

An automatic shut-off condition is one which will override the start command given when the START switch is pushed and either prevent the centrifuge from entering the RUN mode or cause it to transfer back to the STANDBY mode during a run. An automatic shut-off condition falls into two categories: an unprogrammed stop and a programmed stop.

a) Unprogrammed Stop

An unprogrammed stop occurs when an undesirable condition which affects centrifuge performance is detected. The following conditions would initiate an unprogrammed stop:

(1) Chamber temperature exceeds the preset temperature by 7 $^{o}C \pm 3^{o}C$. This condition is indicated by the illumination of the OVERTEMP lamp.

(2) Excessive rotor imbalance. This condition is indicated by the illumination of the IMBALANCE lamp.

(3) Centrifuge overspeed (exceeding 6200 rpm +000, -100 rpm).

(4) Motor overtemperature.

(5) Door open.

The condition which initiated an unprogrammed stop must be eliminated before the centrifuge can enter or reenter the RUN mode. If the condition persists, contact the DuPont Service Representative.

NOTE

When an OVERTEMP or IMBALANCE condition has been corrected, the lamp will remain lit until the START switch is pushed to reenter the RUN mode.

b) Programmed Stop

A programmed stop occurs as a result of an operation which has been deliberately induced by the operator to end the run. The following conditions would initiate a programmed stop.

(1) Preset time period elapses.

(2) TIME dial is manually reset to 0.

(3) $\int\omega^2 dt$ accessory, when activated, reaches the preset $\omega^2 t$ factor.

(4) The STOP switch is pushed.

When an automatic shut-off condition occurs during the RUN mode, the centrifuge will immediately transfer to the STANDBY mode. As a result, braking (if selected) will begin, the RUN lamp will start to blink, and the OPEN DOOR lamp will come on when the rotor has come to a complete stop.

Whenever the BRUSHES lamp comes on, whether in the STANDBY or RUN mode, it will stay on until the motor brushes are replaced. This condition serves only as a warning to take corrective maintenance action and will neither initiate a stop nor prevent the centrifuge from entering the RUN mode.

CAUTION

Failure to replace motor brushes after the BRUSHES light has come on could result in damage to the centrifuge drive motor.

1-6. DOOR OPERATION

a. Normal Door Operation

The door interlock prevents the chamber door from being opened while the rotor is in motion and prevents the centrifuge from entering the RUN mode if the door is not properly shut and latched.

The door is hinged on the left side and has a latch on the right side. To open the door, lift the latch and pull up on the door. Two gas springs counterbalance the weight of the door and hold it in the open position. To close the door, push down on it gently but firmly.

CAUTION

To avoid damaging the door latching mechanism, never force the door open and always close it gently.

b. Mechanical Door Interlock Override

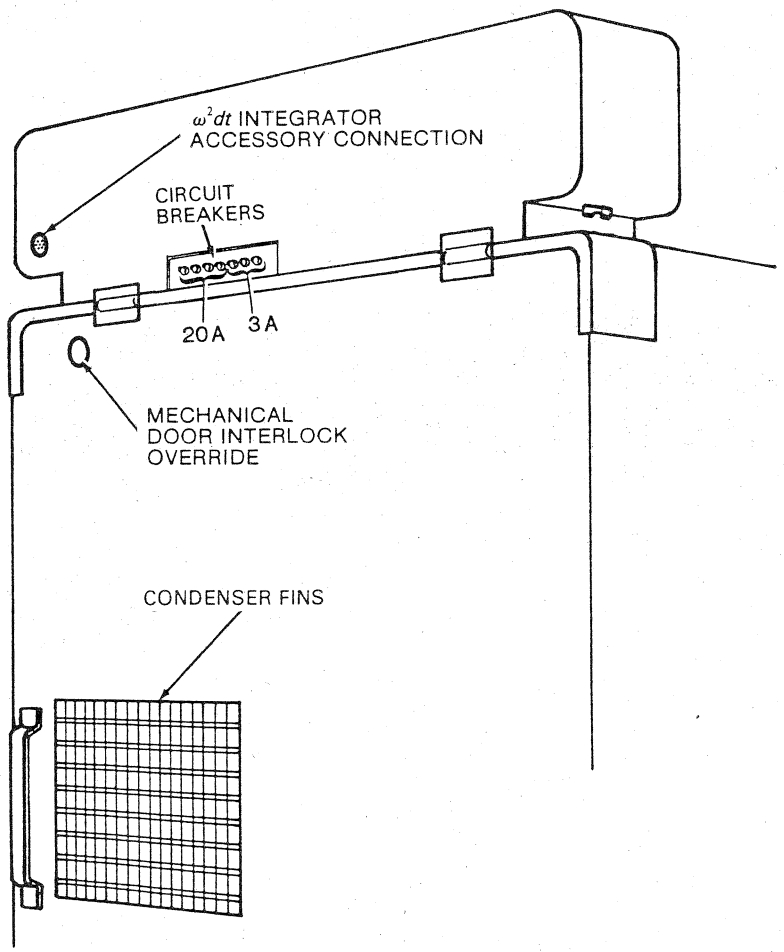
The door interlock prevents the chamber door from being opened when a rotor is spinning. However, if the main power is shut off, either manually or as the result of a power failure, it may be necessary to remove the rotor from the centrifuge to preserve the sample. For this purpose, a mechanical door interlock override is provided.

WARNING

The mechanical door interlock override is provided for use only in the event of an emergency power failure and should never be used to operate the centrifuge with the door open or to open the door when the rotor is spinning.

In the event of a power failure, the brake will not operate; wait at least 10 minutes for the rotor to decelerate before using the mechanical door interlock override.

The mechanical door interlock override is located on the back of the centrifuge (see figure 1-2). To activate the override mechanism, push the lever recessed in the back cabinet panel, then lift the latch and open the door.



10/80/3
RC-3B/9

Figure 1-2. RC-3B Centrifuge – Rear View

1-7. INTEGRATOR ACCESSORY

The RC-3B is designed with a connection for the SORVALL $\omega^2 dt$ Integrator Accessory. The location of the connection is shown in Section 1, figure 1-2. Instructions for installation and operation are supplied with the Integrator.

1-8. AUTOMATIC RATE CONTROLLER (Optional)

RC-3B Centrifuges that are equipped with the optional automatic rate controller can be programmed to slow the rotor acceleration rate at the start of a run. When the automatic rate controller is engaged, transition to the selected run speed will occur at approximately 250 rpm. Figure 1-3 depicts the RUN mode with the rate controller engaged.

The RATE CONTROL dial has six settings. When the dial is set at N, the centrifuge is set for normal operation without rate control. When the dial is set on a number, from 1 to 5, the rate controller is engaged. A setting of 1 provides the slowest acceleration. The acceleration rate increases in discrete steps as the setting is changed to higher numbers. The actual acceleration rate for each setting will vary depending on the rotor in use and the total mass it carries. For example, a partially loaded H-4000 Rotor will take approximately 30 seconds to accelerate to transition speed at setting 5 and approximately 1.5 minutes at setting 1.

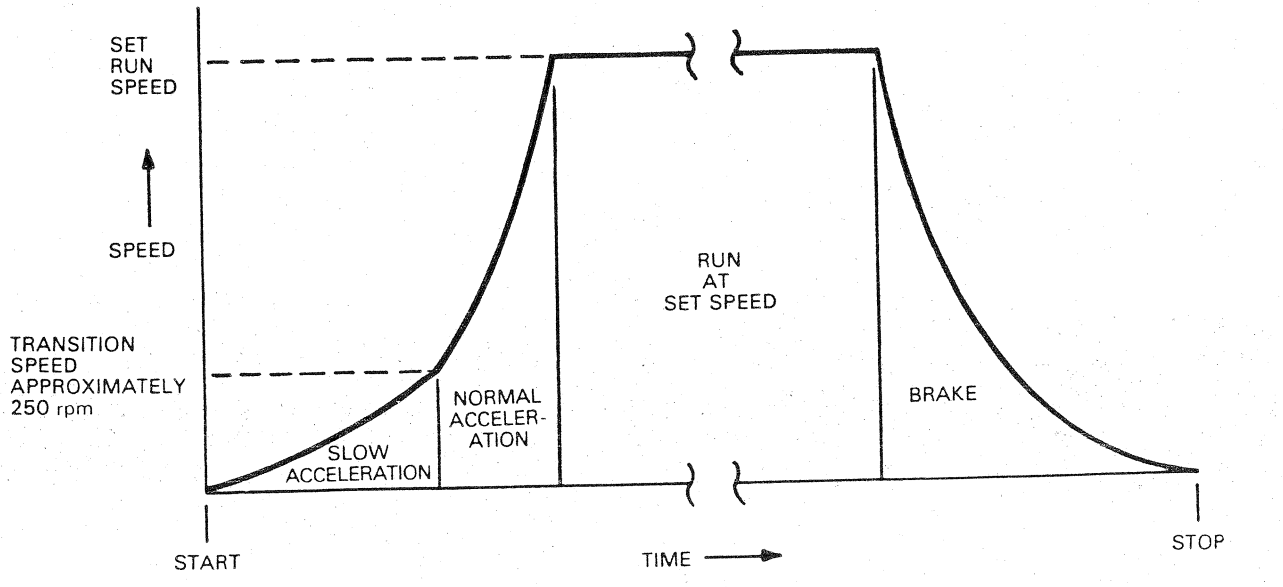


Figure 1-3. Timing Sequence with Optional Automatic Rate Controller Enlarged

Section 2. INSTALLATION

This section provides the information necessary to inspect and install the centrifuge prior to operation.

2-1. ELECTRICAL REQUIREMENTS

The RC-3B has specific power requirements and must be connected to the correct supply for proper performance. The nameplate on the back panel of the cabinet specifies one of the following:

208 V, 60 Hz, single phase, 30 A
230 V, 60 Hz, single phase, 30 A
220 V, 50 Hz, single phase, 30 A

The line voltage should be checked with a voltmeter, then you should verify that the voltage indicated on the nameplate on the back panel is in agreement with the measured line voltage.

CAUTION

If the power cord is connected to the wrong voltage, it can cause damage to the centrifuge. Check the voltage listed on the nameplate before plugging the power cord into the power source. DuPont is not responsible for incorrect installation.

If the line voltage is within ± 10% of the nominal voltage specified above, you may notice variations in the performance of the centrifuge. If the line voltage exceeds this tolerance, it may damage the centrifuge.

The single phase system includes a ground wire and two power leads with 30 A circuit protectors as shown in figure 2-1.

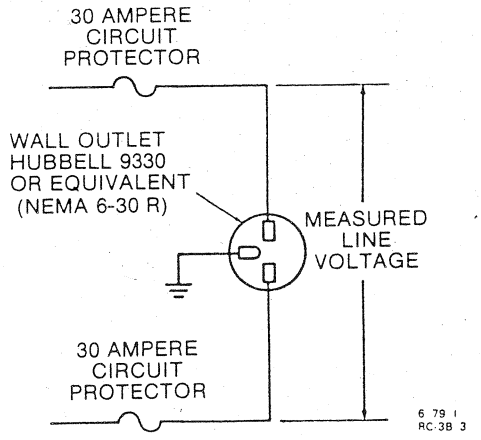


Figure 2-1. RC-3B Electrical Requirements

The RC-3B is equipped with a three-wire cord with three-prong cap including connection to fit Hubbell Receptacle No. 9330 or equivalent. This cord may be changed to meet local electrical code requirements; the green and yellow wire is the ground and must be connected to the centrifuge frame.

2-2. LOCATION

The location of the centrifuge should be carefully considered since free air circulation is very important for proper functioning of the refrigeration system, as is ambient temperature. During centrifuge operation, surrounding temperatures exceeding 33°C (90°F) will cause components to fail prematurely. Therefore, avoid areas near heat sources (e.g., heating pipes and radiators). Also, avoid close grouping of centrifuges or other heat-producing laboratory equipment.

The cooler the location, the better the operating conditions will be for the RC-3B. To allow adequate air circulation, maintain a minimum 10 cm to 16 cm (4 in to 6 in) clearance between walls and cabinets on all sides. (Centrifuge dimensions are given in figure 2-2.)

CAUTION

Locate the centrifuge on a reasonably level floor to avoid imbalance during operation.

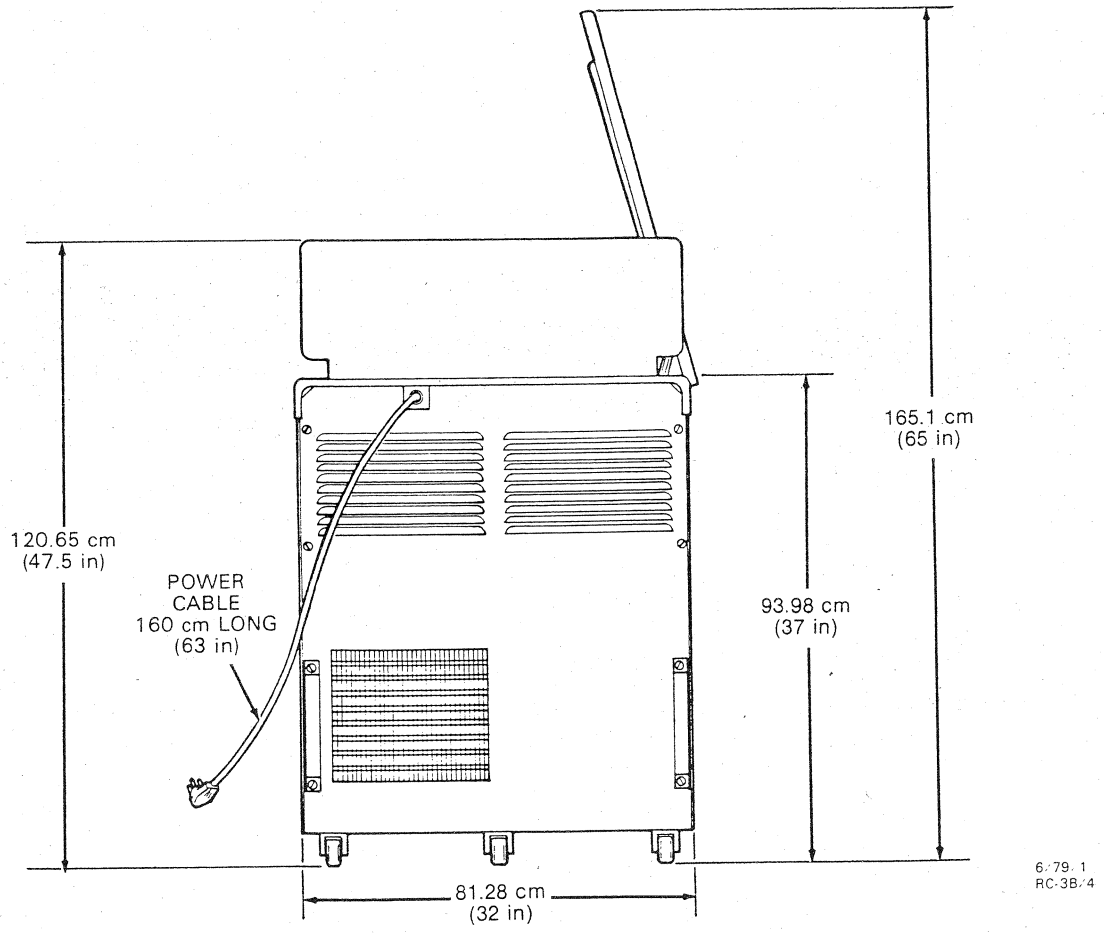


Figure 2-2. RC-3B Dimensions

2-3. INSPECTION

As soon as you receive your RC-3B you should carefully inspect it for damage that may have occurred during shipment. If you find damage, please report it immediately to the transportation company and file a damage claim, then notify DuPont. If any parts are missing, contact the nearest representative or district office for Sorvall® Instruments.

2-4. INSTALLATION

To install the RC-3B:

NOTE

Use the mechanical door interlock override to open the chamber door. Press the door release lever which is recessed in the back cabinet panel of the centrifuge (Section 1, figure 1-2).

1. Remove the two standoff brackets packed in the rotor chamber and attach them to the back of the centrifuge as follows (see figure 2-3).

   a. Remove the attachment screws.

   b. Position brackets over screw holes.

   c. Screw brackets securely in place.

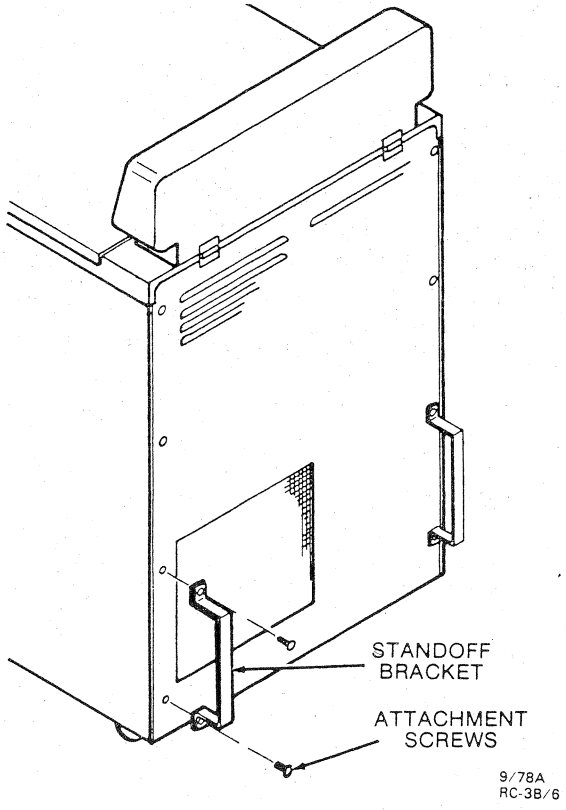


Figure 2-3. Standoff Bracket Attachment

2. Roll the centrifuge to the selected location. Verify that a minimum clearance of 10 cm (4 in) exists on all sides.

3. Use a 9/16 inch wrench to lower the two locking stabilizers in the front of the centrifuge until they lightly contact the floor. Rotate each stabilizer an additional four turns. This will raise the center caster about 6 mm (1/4 in) off the floor. Check that the centrifuge does not rock on its four support points, the two front stabilizers and the two rear casters (see figure 2-4).

CAUTION

Locate the centrifuge on a level floor to avoid imbalance during operation.

4. Be sure the POWER switch is set to OFF, then plug in the centrifuge power cord. The RC-3B is now ready for use.

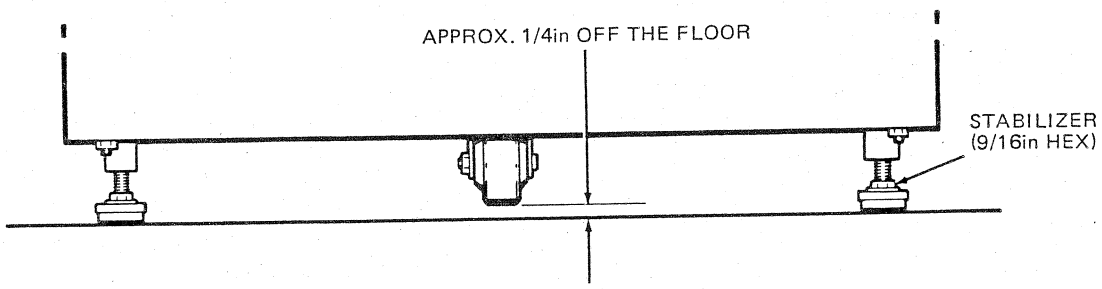


Figure 2-4. Front Locking Stabilizer Adjustment

Section 3. OPERATION

This section describes the function of each operating control and indicator and provides the information necessary to operate the centrifuge.

3-1. CONTROLS AND INDICATORS

Figure 3-1 shows the location of operating controls and indicators. Table 3-1 lists them by item number and describes their function.

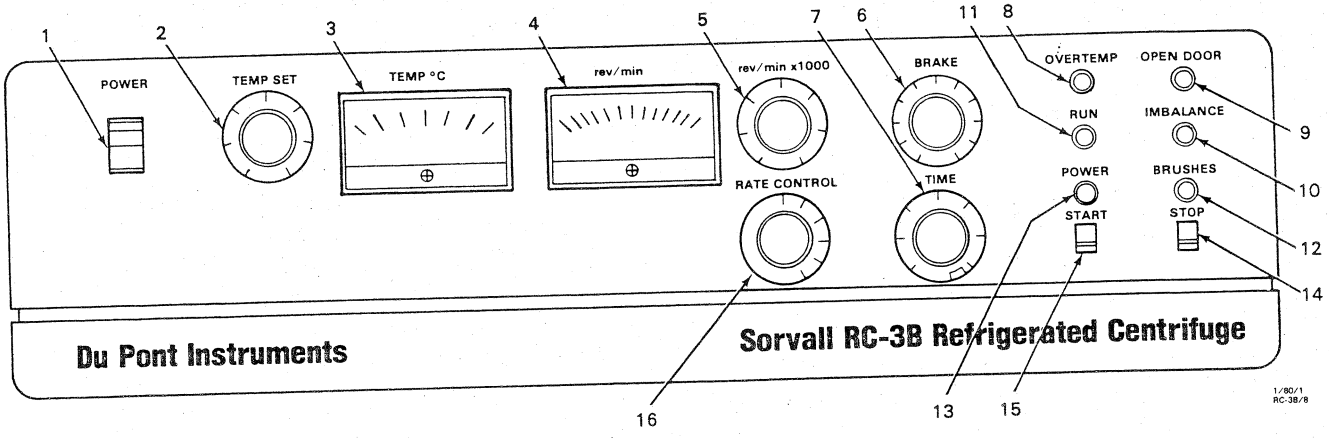


Figure 3-1. Controls and Indicators

Table 3-1. Controls and Indicators

Item Number (figure 3-1)	Name	Function
1	POWER Switch	When set at ON, applies power to the centrifuge.
2	TEMP SET Dial	Sets desired chamber temperature.
3	TEMP °C Indicator	Indicates actual chamber temperature, ±3°C.
4	rev/min Indicator	Indicates actual rotor speed in rpm, ±20 rpm or 1%, whichever is greater.
5	rev/min x 1000 Dial	Sets desired run speed.

Table 3-1. Controls and Indicators (continued)

Item Number (figure 3-1)	Name	Function
6	BRAKE Dial	Sets desired amount of braking for end of run, which will vary depending on the rotor in use (figure 3-2 can be used as a guide).
7	TIME Dial	Sets duration of centrifuge run from 0 to 30 minutes (60 Hz) or from 0 to 35 minutes (50 Hz); the HOLD setting allows a run without a time limit.
8	OVERTEMP Lamp	When on, warns of an overtemperature condition and initiates a stop if the centrifuge is in operation.
9	OPEN DOOR Lamp	When on, indicates either that the chamber door is not shut and latched properly (prevents the start of a run) or that a run has ended and the chamber door can be opened.
10	IMBALANCE Lamp	When on, warns of an imbalance condition and initiates a stop if the centrifuge is running.
11	RUN Lamp	Comes on as soon as the centrifuge enters the RUN mode and stays on until a stop is initiated. Starts to blink when the rotor begins to decelerate; when the rotor comes to a full stop, the light will go off.
12	BRUSHES Lamp	When on, warns that the motor brushes need to be replaced.
13	POWER Lamp	When on, indicates that the main power is on.
14	STOP Switch	When pressed, switches the centrifuge from RUN mode to STANDBY mode and initiates preset braking.
15	START Switch	When pressed, switches the centrifuge from the STANDBY mode to the RUN mode.
16	RATE CONTROL Dial*	When settings 1 through 5 are selected, the automatic rate controller is engaged for slow rotor acceleration. When set to N, the rate controller is not engaged.

* If the centrifuge is not equipped with the optional automatic rate controller, a hole plug will be in this position.

3-2. ROTOR PRECOOL

NOTE

Before operating a new centrifuge for the first time, be sure that it has been properly installed as explained in Section 2.

The rotor should be precooled before operation, either in the centrifuge chamber or elsewhere. To precool the rotor in the centrifuge chamber:

1. Carefully install the empty rotor on the centrifuge spindle (see paragraph 3-3).
2. Close the chamber door.
3. Set the rev/min x 1000 dial for 1000 rpm.
4. Set RATE CONTROL to N.
5. Set the TIME dial for 20 minutes.
6. Set the BRAKE dial for 10.
7. Set the TEMP SET dial to the desired temperature.
8. When the reading on the TEMP °C indicator is the same as the setting on the TEMP SET dial, press the START switch.

NOTE

The OVERTEMP lamp will come on if the difference between the indicated temperature and set temperature is greater than 7°C ± 3°C, and the centrifuge will not start. To override this condition, wait until the indicated temperature is the same as the set temperature, then press the START switch.

3-3. ROTOR INSTALLATION, LOADING, AND BALANCING

Install, load, and balance the rotor according to the instructions given in the rotor instruction manual.

CAUTION

Place the rotor on the centrifuge drive spindle carefully. The drive can be damaged if rotors are dropped onto it.

3-4. OPERATION

CAUTION

Do not operate the centrifuge in the RUN mode without a rotor in place on the drive spindle; to do so can damage the centrifuge drive.

WARNING

The centrifuge is not designed for use with flammable liquids.

To start a centrifuge run:

1. Set the TEMP SET dial to the desired run temperature. Calculation of temperature offset is discussed in paragraph 3-5.

2. Set the rev/min x 1000 dial to the desired run speed.

NOTE

If either a SORVALL superspeed rotor or the LA/S-400 Rotor is used, accelerate the rotor to 5000 rpm first, then gradually increase the speed to 6000 rpm. Direct acceleration to top speed may cause an overspeed condition and consequent automatic shutdown.

3. If rate control is desired (the centrifuge must be equipped with an optional automatic rate controller), set the RATE CONTROL dial to the desired setting, from 1 to 5 (see paragraph 1-8). If rate control is not desired, set the RATE CONTROL dial to N.

4. Set the TIME dial for the desired run time, up to 30 minutes for 60 Hz units or 35 minutes for 50 Hz units, or turn it to the HOLD position.

5. If the $\omega^2 dt$ Integrator Accessory is to be used to end the run, set the Integrator as explained in the Integrator Instruction Manual.

NOTE

When the $\omega^2 dt$ Integrator Accessory is used to stop the run, the TIME dial must be set to HOLD.

6. Set the BRAKE dial to the desired braking rate. Figure 3-2 shows a typical braking curve when a fully-loaded H-6000A rotor decelerates from 3800 rpm. Since many

variables can affect braking rate (e.g., type of rotor in use and load size) you should experiment with braking rates and collect data for future use.

CAUTION

When running blood bags, we recommend a brake setting from 4 to 6; a higher braking rate could cause sample stirring and resuspension of blood cells.

Also, a brake setting of 5 or less should be used when a superspeed rotor is used with the drive adapter. This will allow the rotor to come to a slow stop and prevent the rotor locking screw from jarring loose, possibly damaging the rotor and/or centrifuge.

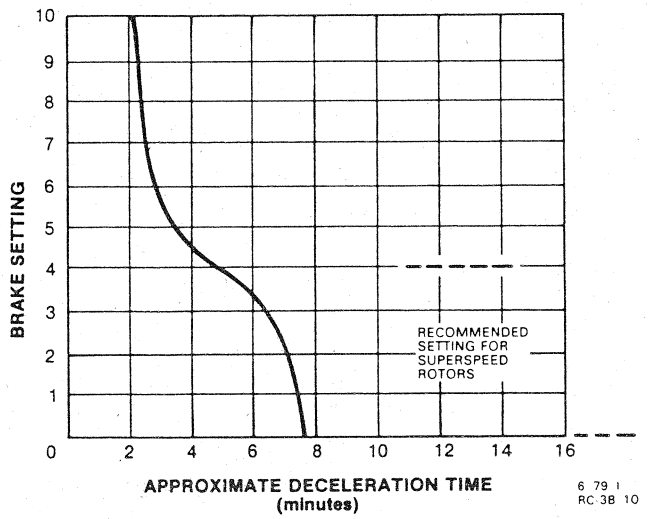


Figure 3-2. Brake Setting vs Deceleration Time

7. Close the chamber door.

8. Push the START switch. The rotor will accelerate to the preset speed and the centrifuge will continue to operate until a programmed stop is initiated.

NOTE

Any of the RC-3B controls may be reset during operation without damaging the centrifuge.

CAUTION

If the centrifuge run ends early due to an unprogrammed stop, locate and correct the problem that caused the stop before attempting to reenter the RUN mode.

To end the centrifuge run:

1. Allow one of the following programmed stops to occur.
   a. let the timer complete the preset interval.
   b. turn the TIME dial to 0.
   c. let the $\omega^2 dt$ Integrator Accessory initiate a stop.
   d. press the STOP switch.

NOTE

When a stop is initiated, the RUN light will begin to blink indicating that the rotor is decelerating. The OPEN DOOR light will go on when the rotor reaches zero speed, signaling that the run is over.

2. Wait for the OPEN DOOR light to come on, then open the chamber door.
3. Remove the rotor (or just the specimen).
4. Close the chamber door.

3-5. ROTOR SPEED/TEMPERATURE DIFFERENTIAL COMPENSATION

The temperature offset between indicated and sample temperature depends upon centrifuge efficiency and location, ambient temperature, type of rotor, and rotor speed. When sample temperature is critical, the required offset should be determined for each specific run.

CAUTION

The temperature offset technique should be used on all runs at either low or high speeds to prevent overtemperature or freezing of sample.

For example, to derive a +4°C sample temperature with an H-4000 rotor at a speed of 4000 rpm in an ambient temperature of 25°C, it is necessary to set the TEMP SET dial at approximately +1°C, or 3° cooler than the desired sample temperature.

NOTE

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

To plot a correction curve and create a graph for each rotor in each centrifuge, it is necessary to plot the set temperature versus the actual sample temperature for the rotor used at a specific operating speed and ambient temperature.

NOTE

Blank rotor speed/temperature differential charts are provided in the back of this manual.

More accurate temperature offset data can be obtained and plotted by doing a test run and dynamically calibrating a specific rotor/centrifuge/desired speed combination and ambient condition. Using an immersible centrigrade thermometer calibrated in 1.0°C increments, perform the following steps.

1. Select the desired sample temperature.
2. Prepare two centrifuge tubes or bottles with a test fluid and balance them according to instructions in rotor instruction manual.

NOTE

The test fluid must be compatible with aluminum and have a freezing point below the desired sample temperature.

3. Precool the thermometer to 1.0°C below the desired sample temperature.
4. Set the TEMP SET dial to the desired sample temperature.
5. Install an empty rotor, and when the TEMP °C indicator reaches the selected temperature, precool the rotor (paragraph 3-2).
6. When the precool time has elapsed, load the prepared sample tubes or bottles into opposing rotor compartments and run the rotor at the desired speed for the anticipated length of the run with the BRAKE dial set to 5.
7. When the run time has elapsed and the rotor has stopped, open the door, then quickly open one rotor compartment and immerse the precooled thermometer into the test fluid. Agitate the thermometer in the liquid for approximately five to ten seconds. Record the indicated temperature.
8. If necessary, adjust the setting of TEMP SET dial as required by the recorded temperature. For example, if the recorded temperature is 2°C warmer than the desired temperature, reset the temperature setting downward 2°C.
9. Record all data for future use.

3-6. RUNNING HAZARDOUS MATERIAL

The RC-3B Centrifuge is designed with a refrigeration system that operates independently of the laboratory environment. Thus, if the centrifuge chamber contains

vapor or aerosols released from uncapped, leaking, or broken tubes, those vapors will be contained within the chamber during operation. However, once a run is completed and the chamber door is opened, the vapors or aerosols will be released into the laboratory area. For this reason, when materials which are pathogenic, toxic, or otherwise hazardous in nature are to be run, the centrifuge should be located in a biohazard safety enclosure and operated with all appropriate safety precautions.

WARNING

If using pathogenic, toxic, or otherwise hazardous materials in the RC-3B, we recommend that the centrifuge be located in a biohazard safety enclosure and operated with all appropriate safety precautions.

Use appropriate decontamination procedures should exposure to any hazardous material occur. See Section 4 for procedure to follow if a centrifuge or rotor that has been used with a hazardous material must be returned to our service facilities for repair.

WARNING

The use of sealed rotors, buckets, and/or sample containers will offer increased protection from contamination during routine operation. However, these items will not provide absolute protection in accidents that result in damage to the rotor or buckets. Should breakage or spillage occur, appropriate decontamination procedures should be followed.

Section 4. MAINTENANCE

This section describes routine maintenance procedures that should be performed on a regular basis. As the user, it is your responsibility to make certain these procedures are performed when necessary. Also, to keep your centrifuge in good working condition and ensure accurate test results, we recommend that, in addition to these routine procedures, you have the speed control, timer, temperature control, and rotor imbalance detector checked periodically by a DuPont Service Representative or other qualified service personnel because occasionally, these controls may need to be recalibrated. If further service is needed, contact the nearest representative for Sorvall® Instruments.

WARNING

Because of the high voltages in this centrifuge, anyone who is not properly trained in electronics must not test or repair the electrical circuits.

If hazardous materials have been processed in the centrifuge, observe all necessary precautions when cleaning or servicing the centrifuge to avoid contamination.

4-1. INSPECTION AND CLEANING

a. Inspection

Inspect the centrifuge each week for signs of wear, encrusted biological deposits, and general cleanliness.

b. Cleaning

1. Rotor Chamber

The rotor chamber should be defrosted and cleaned periodically to maintain efficient cooling; frost on the inner walls acts as an insulation between the chamber and the refrigerant. To defrost the chamber, install a rotor and close the chamber door. Set the TEMP SET dial for 40°C and run the centrifuge until the frost melts (approximately 5 minutes). When the rotor comes to a complete stop, remove the rotor and wipe the chamber dry. The chamber can also be defrosted by leaving the chamber door open and the main power off until the frost melts; wipe chamber dry.

CAUTION

Chlorides are extremely harmful to aluminum alloy rotors and can cause stress corrosion cracking. Therefore, if chlorides are used to disinfect the chamber, be sure to rinse the chamber thoroughly with water to remove all of the chloride cleanser.

2. Drive Spindle

   Before each run, wipe the spindle with a soft cloth before a rotor is installed to reduce the chance of the rotor sticking to the spindle. Periodically, wash the spindle with warm water.

3. Cabinet

   Clean the enameled cabinet panels with a household wax cleaner. Use a mild detergent and water to clean the top deck.

4. Refrigeration System Condensing Coils

   To maintain the efficiency of the refrigeration system, keep the condenser fins (located on the left side of the centrifuge) free of dust and dirt. Clean the fins with a brush or a vacuum cleaner at one to three month intervals. The fins will bend easily so be very careful when cleaning them.

4-2. LUBRICATION

All components are prelubricated and require no further lubrication. The refrigeration unit is hermetically sealed and the ball bearings in the gyro-action drive assembly and the centrifuge motor are permanently lubricated.

4-3. EMERGENCY SAMPLE RECOVERY

If the main power shuts off because of a power failure or a system malfunction while the rotor is spinning, the RC-3B chamber door will not open. A mechanical override is provided to allow sample recovery in the case of an emergency. This procedure should never be used routinely and is intended for emergency sample recovery only.

WARNING

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

The mechanical door release lever is recessed in the back cabinet panel (Section 1, figure 1-2). To open the chamber door, push the door release lever with a pencil or similar object, then carefully lift the door latch and pull the door open.

4-4. MOTOR BRUSH REPLACEMENT

When the drive motor brushes need to be replaced, the BRUSHES lamp on the front control panel will come on and will stay on until the brushes are replaced. This condition will not cause a run to end nor will it prevent the centrifuge from starting; however, we

recommend that you replace both brushes as soon as possible after the light comes on to prevent damage to the drive motor.

> **CAUTION**
>
> Continued operation with worn brushes can damage the centrifuge drive motor.

The catalog number to order replacement brushes is 55176; this includes two brushes plus installation instructions.

4-5. LAMP BULB REPLACEMENT

All RC-3B console lamps are illuminated by 24 Volt incandescent bulbs.

To replace a lamp bulb, Cat. No. 66681:

1. Push in on the lamp cover, twist it to the left and gently pull the lamp cover out.

> **CAUTION**
>
> Pulling the lamp cover out too quickly can cause the bulb to spring out.

2. Gently shake the old lamp bulb out and replace it with a new one.

3. Slide the lamp cover back into the socket, then turn it to the right to lock it in place.

4-6. CIRCUIT BREAKERS

The RC-3B has eight circuit breakers. The primary power circuit breaker is located on the front console panel (figure 3-1, item 1); the other seven circuit breakers are located on the rear console, shown in figure 1-2. Two of the 20A circuit breakers on the rear console protect the drive circuitry and the other two 20A breakers protect the refrigeration compressor. The three 3A circuit breakers protect the power supply.

If a circuit breaker trips, it can be reset by pushing the reset button on the breaker. Repeated tripping indicates a fault in the system, in which case you should contact a DuPont Service Representative.

4-7. PARTS ORDERING INFORMATION

To order replacement parts, telephone (800) 551-2121 in the United States. Outside the United States, contact your local representative of Sorvall® Products. Be sure to provide a description of the part plus the centrifuge model and serial number.

4-8. SERVICE DECONTAMINATION POLICY

WARNING

Either biological or radioactive contamination of the centrifuge can occur because of the samples likely to be processed. 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 DuPont facilities, comply with the following procedure to ensure the safety of DuPont personnel.

- Clean the centrifuge and/or rotor to be serviced of all encrusted material and decontaminate it prior to servicing by our representative. There must be no radioactivity detectable by survey equipment.

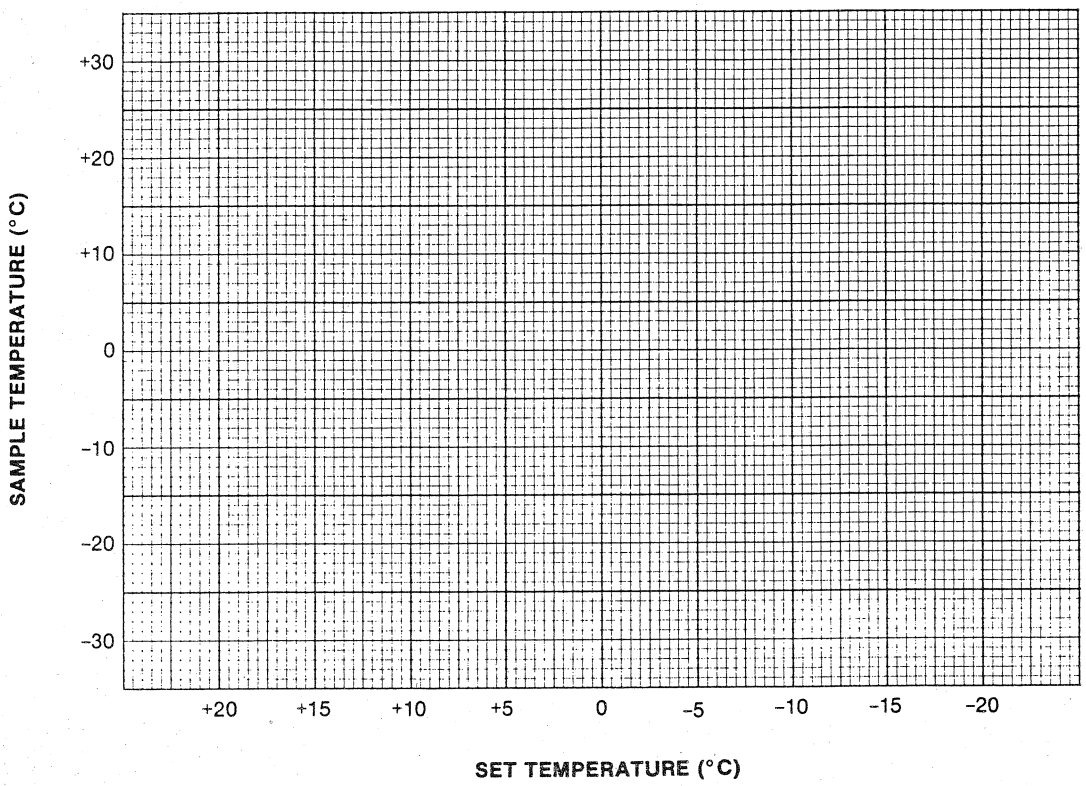
- Attach a completed Decontamination Information Certificate (SORVALL Instruments Form No. IPDP-59) to the centrifuge or rotor.

If the centrifuge or rotor to be serviced does not have a Decontamination Information Certificate attached and, in our opinion, presents a potential radioactive or biological hazard, our representative will not service the equipment until proper decontamination and certification is complete. If we receive a centrifuge or rotor at our Service facility which, in our opinion, is a radioactive or biological hazard, the sender will be contacted for instructions as to the 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 Technical or Service Representative. 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 Service Representative will note on the Customer Service Repair Report whether or not decontamination was required. When decontamination is required, the representative will specify the contaminant and the decontamination procedure used.



Rotor "Speed"/Temperature Differential Chart for the _____ Rotor

Instrument _____
Ambient Temperature _____
Rotor "Speed" _____

9/78
RC-3B/15