

Operation Manual

IEC[®] Centra GP6 and GP6R Centrifuges

VENTILATED

Cat. No.6459K: 120 VAC, 60Hz

Cat. No.6460K: 220/240 VAC, 50/60Hz

REFRIGERATED

Cat. No.6461K: 120 VAC, 60Hz

Cat. No.6462K: 220/240 VAC, 50 Hz



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Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION



Contents

1. Introduction	3
1.1 Product Description	4
1.2 About This Manual	4
2. Installation	4
2.1 Receive the Unit	4
2.2 Prepare the Installation Site	4
2.3 Verify Power Configuration	5
3. Operation	5
3.1 Rotor and Accessories	5
3.2 Starting and Stopping a Run	7
3.3 Stored Programs	7
3.4 Rotor Recognition System	8
3.5 Refrigeration (refrigerated systems only)	8
3.6 Front Panel	8
3.7 Diagnostic Messages and Error Codes	10
4. Applications	11
4.1 Introduction	11
4.2 Speed and Force Tables	12
4.6 Derating Tables for Dense Samples	14
4.7 Chemical Resistance Table	15
4.8 Decontamination Table	16
4.9 RCF Nomograph	17
5. Maintenance	18
6. Specifications	20

1. Introduction

1.1 Product Description

The IEC Centra GP6 Series units are low-speed, general purpose centrifuges used in medical, industrial, and scientific applications. They are available in two models:

- Ventilated (GP6)
- Refrigerated (GP6R)

Both models accommodate swinging bucket style rotors of either 4x750 mL or 6x250 mL. They can process a variety of tubes, bottles, and microsample tubes. The 4x750 mL rotor can process both standard and deepwell microplates. Pear shape and short form conical oil tube rotors are also available.

Operation Modes

There are two operation modes:

- **Manual Mode:** to enter temperature (GP6R only), speed/force, and time values for individual runs
- **Program Mode:** to define and save a maximum of 99 specific sets of run parameters, to recall and reuse

Timing Modes

Three timing modes are available on each unit:

- Automatic timed run
- Short spin (momentary)
- Hold (continuous mode).

Other Features

Acceleration and brake rates may be controlled to optimize runs; rapid for fast separations or slow for delicate samples. Repeat runs, with the same speed and time settings, may be achieved at the touch of a key.

A fail-safe cover interlock insures that the cover is closed before a run can begin, and keeps the cover closed until the rotor has reached a safe low speed (below 100 rpm), even in the event of a power failure.

The rugged steel cabinet and rigid construction provide quiet operation and long-term reliability.

1.2 About This Manual

Contents

This manual contains information to install, operate, and maintain IEC Centra GP6 series centrifuges. Differences between the refrigerated and ventilated models are noted in the text. This manual also contains speed and force, derating, chemical resistance, and decontamination tables.

Audience/Purpose

This manual is written for centrifuge operators. In addition to operation information, it contains a few basic troubleshooting techniques, and a chapter on maintenance. This manual is not a guide for servicing centrifuge units.

2. Installation

2.1 Receive the Unit

All units are shipped in protective packaging.

1. Follow the unpacking instructions on the carton.
2. Inspect the unit upon receipt and immediately file any damage claims with the shipper/carrier.
3. Complete and return the postage-paid warranty card.

2.2 Prepare the Installation Site

The unit normally resides on a bench top.

1. OPTIONAL:

The IEC Centra GP6 (ventilated model) can be placed in a cold room (no colder than 4°C), for processing temperature-sensitive samples.

⚠ CAUTION

When you remove the centrifuge from a cold environment, do not operate for a minimum of two hours to allow condensation to evaporate prior to use.

NOTE: When used in a cold room environment, some bearing noise may become evident. The bearing lubricant thickens at low temperatures. As the centrifuge speeds up, it is thinned and distributed more evenly. Once this occurs, any noise should subside.

2. Place the centrifuge on a clean, dry surface, to make certain that the suction feet at the bottom grip the surface firmly. Keep the area beneath the unit free of debris and loose materials.

⚠ CAUTION

The resting surface must be level, to ensure quiet, vibration-free operation. A rigid and stable location is important. An improperly loaded centrifuge may vibrate or move

3. Locate the centrifuge to allow a clearance of 8 cm (3 inches) on all sides of the unit, to ensure proper ventilation.

Dimensions:

	IEC Centra GP6R	IEC Centra GP6
Sample Loading Height	14.7" (37.3 cm)	
Cover Closed Height	16.5" (42.9 cm)	
Cover Open Height	41" (204.2 cm)	
Width	30" (76.2 cm)	23.3" (59.1 cm)
Height	25.8" (65.4 cm)	

⚠ WARNING

International Electrotechnical Commission standard 1010 part 2-20 limits the permitted movement of a laboratory centrifuge to 12" (300 mm) in the unlikely event of a disruption. Laboratory management procedures should require that no person or any hazardous materials enter within this boundary while the centrifuge operates.

2.3 Verify Power Configuration

1. Verify that the correct power cord and connector is provided for your installation.

The unit requires a grounded power supply (3-outlet).

If your facility does not have grounded power outlets, arrange for proper grounding. The power cord plugs in on the left side of the unit.

WARNING



ELECTRICAL HAZARD!

Do not remove the grounding pin from the centrifuge power cord. Do not use the bare wired power cord to attach a power plug that does not have a grounding pin.

The power cord provided with the unit is correctly rated for the highest current demand. This power cord should not be interchanged with cords from equipment with lower current demand. Exchange of power cords between equipment may create a fire hazard.

2. For best results, the refrigerated centrifuge should be used on a dedicated line. Variations in line voltage or frequency affect the unit's speed and other characteristics.

NOTE:

Less than nominal line voltage may prevent the centrifuge from reaching maximum published specifications of speed and/or temperature. Power line voltage, at some locations, may sag when the refrigeration system turns on

2.4 Main Power Switch

The main power switch is located on the left side of the centrifuge, next to the power cord.

2.5 Circuit Breaker

The system provides an automatic circuit breaker for emergency situations such as power surges that could damage the unit. If the circuit breaker trips:

1. Unplug the unit.
2. Press the white button, on the left side of the unit.
3. Plug the unit back in.

2.6 Moving the Unit

Suction cups at the bottom of the unit keep it anchored to the work surface. Keeping the unit stationary is a safety feature.

To move the unit to a new location:

WARNING



The unit can weigh up to 145 lb. (65.8 kg). Use caution when moving to avoid any injury.

1. Check that the new site meets the criteria in Section 2.2 before moving the unit.
2. Position a flat object, such as a tongue depressor, near a suction cup at the bottom of the unit.
3. Lift up an edge of the cup, and insert the flat object far enough to break the vacuum suction seal.

4. When all four suction cups are disengaged, lift the unit from the work surface.
5. When the unit is in its new location, ensure that the suction cups adhere correctly to the work surface

3. Operation

3.1 Rotor and Accessories

A balanced load is essential for all centrifuges. An unbalanced load produces vibration, and can damage the unit. ALWAYS balance containers on opposite sides of the rotor.

NOTE: A 2-gram load imbalance, at a speed of 4600 RPM, imparts force equivalent to 20 pounds (9.1 kg) at rest. Always ensure that the rotor is loaded symmetrically, with a full complement of accessories, and a full (or paired) set of tubes. Tube adapters should also be installed symmetrically.

Balance load within 1 gram

The rotors are dynamically balanced at the factory. The manufacturer matches removable parts (trunnion rings, shields, buckets, and carriers) to within 1 gram, and stamps the weight on each piece. Check these markings, whenever you interchange parts, to ensure that opposite parts are matched. Ensure that the total weight of samples and removable parts, loaded in opposing positions, are equal in weight, to within 1 gram. The position numbers, present on many rotors and adapters, identify opposing tube positions.

Opposing containers must be alike in shape, thickness, and distribution of glass or plastic. This is especially important for large containers.

NOTE:

Swinging Bucket Rotors:

Tubes loaded into swinging bucket rotors must be symmetric, around the axis of rotation. Verify this by rotating the entire rotor 180° by hand. The loads should be in the same apparent positions (not mirror images). In addition, the loads within each bucket must, also, be symmetric around the bucket's pivot axis. Verify this by ensuring that each bucket is loaded so that it does not tilt from the vertical, when the rotor is at rest. Maintaining balance within each bucket ensures that the bucket and the tubes swing out to horizontal, when the rotor reaches operating speed, applying centrifugal force toward the bottom of the tubes. Failure to achieve full swing-out causes vibration and premature wear of the rotor and the motor.

Samples of like (similar) specific gravities may be processed in the same run, provided that the samples of the same type are balanced around the rotor, as though they were the only pairs in the rotor.

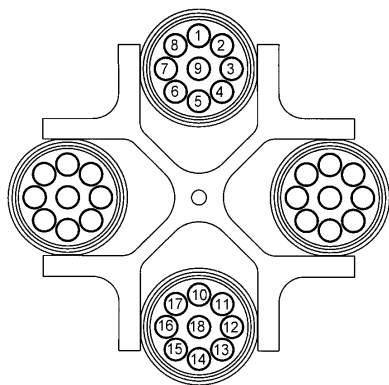
CAUTION

Do not exceed maximum rated speed for each rotor/accessory combination. Maximum rated speeds can be found in Section 4.2 - Speed And Force Tables.

Rotor Balance

Load tubes in the following manner:

1. Load two tubes at positions: 9 and 18.
2. Load four tubes at positions: 1, 5 and 10, 14 or 7, 3 and 16, 12
3. Load six tubes at positions: 1, 9, 5 and 14, 18, 10 or 7, 9, 3 and 12, 18, 16
4. Loading an odd number of tubes is not recommended.



Avoiding Vibration

All centrifuges have critical speeds at which vibration occurs. As the speed increases beyond the critical speed, vibration will cease. This inherent condition also occurs during deceleration. An imbalanced load intensifies these critical vibrations. You should avoid running the centrifuge at or near its "critical speed" to avoid excessive vibration.

Rotor Installation

To install the rotor:

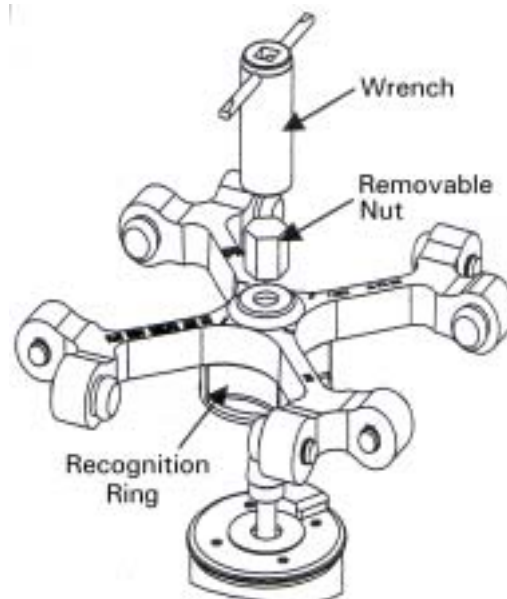
1. Place the rotor (with recognition ring facing down and all printing facing up) onto the shaft.
2. Tighten the locking nut with the provided wrench. Slide the wrench handle to one side in order to utilize maximum torque. Remove the wrench.

NOTE: There are two styles of locking nuts: one is removable the other is captive (not removable).

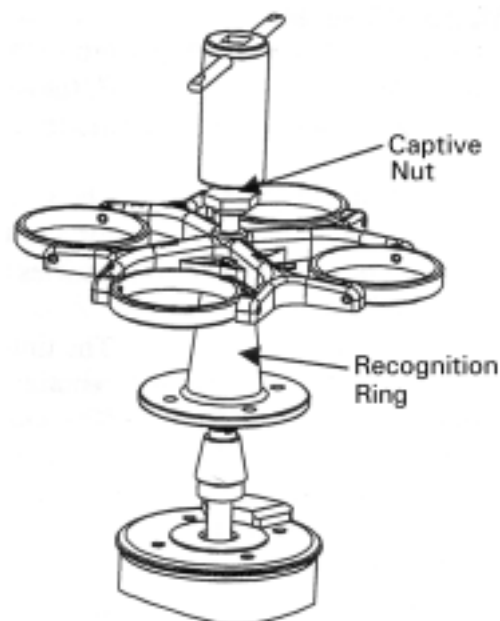
Rotor Removal

To remove the rotor:

1. Using the wrench provided, loosen the rotor locking nut.
2. Remove the wrench.
3. Remove the locking nut if removable or lift up the captive nut to free the rotor.
4. Lift the rotor off the shaft.



Removable Locking Nut



Captive Locking Nut

3.2 Starting and Stopping a Run

The display above the Program key shows the unit's operating mode:

- blank The unit is in manual operation.
- 1-99 The unit is under control of the displayed stored program number.

The rest of the display indicates the last parameters selected.

Manual Operation

For manual operation:

1. Press the MANUAL key so that the program display is blank.
2. Select the desired temperature (refrigerated system only).
3. Select the speed/g-force, run time, acceleration mode, and braking mode.
4. Press START to start the spin.

The rotor will accelerate to 100 - 200 rpm and then coast for a few seconds while the rotor recognition system verifies the rotor and set parameters.

The time display counts down, and displays the time remaining in the current spin, during manual operation.

The specified run time begins when the START key is pressed. Braking begins when the set time elapses. Run time does not include braking time.

The spin will stop automatically, at the end of the desired interval.

IMPORTANT:

A run can be stopped at any time by pressing the STOP key.

The settings can be changed during a manual run. These changes affect the run in progress. If the time setting is changed during a run the unit adjusts the count-down timer to display the revised setting as the total time of the run. If the new time selected is less than the elapsed time, the run will end.

The unit's mode (settings) cannot be changed during a program mode spin.

3.3 Stored Programs

The centrifuge has an internal memory capable of holding 99 sets of run parameters. Programs are retained in memory even if the power is turned off. When necessary, a program can be modified for a particular run or changed permanently.

NOTE: You cannot change the unit's program, rotor/radius, or timing modes during a spin.

Add/Change Program

1. Press **PROGRAM** to enter Program mode.
2. Select a program number with the numeric keypad. The current program parameters will appear on the display.
3. Modify the desired parameters including speed/RCF, time and temperature (if a refrigerated unit). Use the numeric keypad or modify the ACCEL or BRAKE modes. Additionally, a radius value may be stored explicitly in the program.

NOTE: The program number will flash indicating that the program was changed but not saved.

4. To make changes temporary, press **START**. To make changes permanent, press the **SAVE** key.

NOTE:

After pressing the SAVE key, the program number will stop flashing. The program will remain in memory until further changes are made.

Because the centrifuge has a fully automatic rotor recognition system, the very first rotor spun using a particular program will be identified and have its identity automatically stored in the program. If you did not set a radius value, the default radius (or maximum allowable radius) for that rotor will be stored with the program as well. If you attempt to run a rotor other than the one whose identity is stored in the program, a "ch hd" (check head) message will appear.

To clear the rotor and its radius from memory, press the SAVE button. The very first rotor spun after SAVE is pressed will have its identity stored in the program, together with its default radius (if not explicitly entered to the program).

Recall Program

1. Press the **PROGRAM** key to enter program mode.
2. Select the appropriate program number by entering the desired program number on the numeric key pad and press **ENTER**. The program's set parameters will display.
3. Press **START**, to begin this run.

Lock Program/Unlock Program

- To lock a program to prevent changes to the program's parameters:

1. Select the desired program on the numeric keypad.
2. Press the **SAVE** key three times.

When you scroll to a locked program, the letter **L** will flash in the program display after the program number is displayed.

- To unlock a program to change parameters:

1. Select the desired locked program on the numeric keypad.
2. Press the **SAVE** key three times.

3.4 Rotor Recognition System

The centrifuge is equipped with a fully automatic rotor recognition system that internally detects and identifies the rotor installed. Since these units are designed to spin a variety of rotors, their software databases contain the maximum settable values for speed, RCF, and radius for each. This enables the centrifuge to verify that parameters entered by the user do not exceed the prescribed safety limits for the specific rotor.

If a user has input a value for speed, RCF, or radius that exceeds the specified limit, the control panel will display a message and the unit will coast to a stop:

Condition	Message
Input Speed value exceeds maximum allowable	"SPD" toggled with the max. allowable speed setting for the rotor
Input RCF value exceeds maximum allowable	"rCF" toggled with the max. allowable RCF setting for the rotor
Input Radius value exceeds maximum allowable	"RAD" toggled with the max. allowable radius setting for the rotor
No Rotor Installed	"HEAD"
Rotor Installed but incomplete or no rotor signature is read	"HEAD"
Faulty Rotor Recognition System	"HEAD"
Incorrect rotor signature is read (i.e. does not correspond to one in the software database)	"Err14"

To clear an error message, take one of the following actions:

- Press the STOP key
- Turn the unit off and on

3.5 Refrigeration (refrigerated systems only)

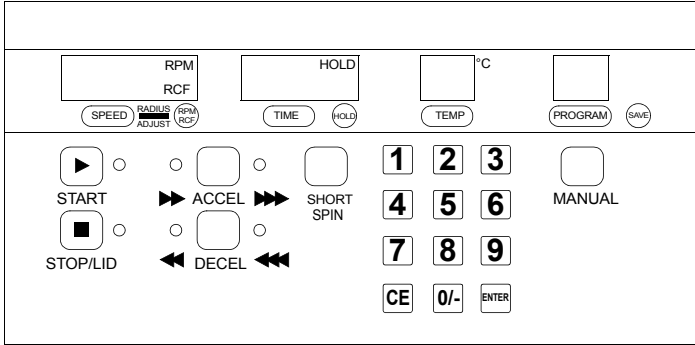
Refrigerated units refrigerate the rotor chamber to a specific temperature whenever the cover is closed and the unit is switched on.

NOTE: If you use the keypad and momentarily display a cold temperature (stepping through stored programs, for example), refrigeration will not be activated.

CAUTION

If the rotor chamber is not at the specified temperature, it will NOT abort a spin. Press the STOP key if you need to stop a run. At the beginning of a spin, if the chamber temperature differs by more than 5° C from the specified temperature, the temperature display will switch between the actual and set/programmed temperatures until the two temperatures come to within 5° C.

3.6 Front Panel



Front Control Panel

The control panel contains numeric displays for all operational controls. These displays have two states or modes: Actual (bright display) and Set (dim display).

Actual Mode

In Actual mode (bright display), the display indicates current run conditions, such as:

- rotor speed or force
- elapsed time or time remaining in the run
- actual temperature (Refrigerated only)
- program number

Set Mode

In Set mode (dim display), the display indicates the desired settings for the run. Set mode is activated when SPEED, TIME, TEMP., or PROGRAM are pressed, briefly at the start of a run, or briefly after the unit is switched ON.





The numeric displays also display warning or error messages.

Control/Indicator	Function
SPEED	Switches the display from Actual to Set mode. Select the desired speed using the numeric keypad then press ENTER. A selection must begin before 5 seconds elapse or the display will revert to the Actual reading.
RPM RCF	The number in the speed/force display represents the rotor speed in RPM or force in RCF. Press this key to toggle between RPM and RCF. When RPM is selected the display indicates revolutions per minute. When RCF is selected the display indicates relative centrifugal force in units of g. Use the numeric keys to change the set speed or force. Select speed in increments of 50 RPM, from 500 through 3,600 RPM (depending on the max. allowable speed limit for the particular rotor). Select RCF from 500 - 3,000 xg (depending on the max. allowable RCF limit for the particular rotor) in increments of 50 xg.
ROTOR RADIUS	SPEED & RPM/RCF: Press these keys together to change the radius of rotation. Select the radius using the numeric keypad then press ENTER. Also see Section 3.4 Rotor Recognition System.
TIME	Switches the display from Actual to Set mode. Select the desired time using the numeric keypad then press ENTER. A selection must begin before 5 seconds elapse or the display will revert to the Actual reading. Time display: The number in the display indicates time. Time is displayed as minutes:seconds up to 99 minutes, 59 seconds. The timer begins counting at the start of a run, for example, when START is pressed. In manual mode the timer counts down from the set point. In time HOLD or SHORT SPIN modes, the timer counts up.
HOLD	The hold feature is used to initiate an indefinite spin. Press the HOLD key so that HOLD appears in the display. Pressing START will then begin a run at the set parameters. The timer counts up and the run will not end until the STOP key is pressed.
SHORT SPIN	The short spin is used for quick separations. Pressing SHORT SPIN will begin a run at the set parameters. The timer counts up and the run will not end until the SHORT SPIN key is released.

TEMP (refrigerated model only)	<p>The TEMP key switches the display from Actual to Set mode. Select the desired temperature using the numeric keypad, and then press ENTER. A selection must begin before 5 seconds elapse or the display will revert to the Actual reading.</p> <p>Temperature display: The number in the display represents temperature in degrees Celsius, from -9° C through +40° C.</p> <p>Note: If the actual rotor chamber temperature differs by more than 5° C from a selected set point temperature, the °C display will switch between the actual and set/programmed temperatures, until the two temperatures come to within 5° C.</p>
PROGRAM	Switches the display from Manual to Program mode.
SAVE	Saves the currently displayed desired settings as stored programs 1 through 99. The numeric display shows the stored program number and mode of operation.
MANUAL	Returns the unit to manual operation from the Program Mode.
<div> <div>1</div> <div>2</div> <div>3</div> </div> <div> <div>4</div> <div>5</div> <div>6</div> </div> <div> <div>7</div> <div>8</div> <div>9</div> </div> <div> <div>CE</div> <div>0/-</div> <div>ENTER</div> </div>	<p>Numeric keypad allows inputs to change the Set parameters for Speed/Force, Time, Temperature (refrigerated only), Rotor/Radius, or Program. When any mode key is pressed (SPEED, TIME, TEMP or PROGRAM), the numeric display switches from Actual readings to Set parameters without changing them. The numeric keypad may be used to change a parameter value. A selection must begin before 5 seconds elapse or the display will revert to the Actual reading.</p> <p>The CE key clears a selection that has not yet been entered to memory.</p> <p>The 0/- key may be used to select a negative temperature.</p> <p>NOTE: Temperature control range is specified from +4° C to ambient at maximum rated speed. Lower temperatures can be achieved at less than maximum speed.</p> <p>The ENTER key <i>must</i> be pressed after each parameter selection to enter the value into memory.</p>

Acceleration and Braking

Gentle acceleration and braking can be selected, when centrifuging delicate samples. The gentle settings avoid mixing of density gradients or breakup of pellets.

ACCEL	<p>The Acceleration key controls rotor acceleration up to 400 RPM. Press this key to toggle between fast and slow acceleration.</p> <p>Fast acceleration is selected when the indicator above the  is lit.</p> <p>Slow acceleration is selected when the indicator above the  is lit.</p> <p>Slow acceleration takes from 15 to 35 seconds to achieve 400 RPM depending on the rotor and its contents. After 400 RPM, full acceleration is applied until the set speed is reached.</p>
DECEL	<p>The Deceleration key controls rotor braking. Press this key to toggle between fast, slow, and no brake.</p> <p>Fast braking is selected when the  indicator is lit.</p> <p>Slow braking is selected when the  indicator is lit. When no indicators are lit, coast (no brake) is selected. The rotor will coast from operating speed to a stop.</p>
START	Starts a run. A run is governed by the Set parameters (manual or programmed). The green indicator light blinks until the rotor reaches 95% of the set run speed. The light stays on until the end of the run.
STOP/LID	Stops a run or unlocks the cover when the unit is not running. (A run will also stop automatically when the set time has elapsed or the Short Spin key is released in the Short Spin mode.) The red indicator light flashes to indicate the rotor is still slowing down (braking or coasting). When the run ends, the red light stays on indicating the rotor has stopped.

3.7 Diagnostic Messages and Error Codes

The beeper sounds in these situations:

- Two times on power up.
- Three times at the end of a spin.
- Five times when a warning occurs

Diagnostics

Diagnostic messages appear in place of the speed display in the following cases:

Message	Description
bAL	bAL indicates an unbalanced rotor. Open the cover to erase this message. Verify that a balanced load is installed. Inspect the rotor and rearrange the tubes, or add additional tubes with fluid to balance the rotor.
HEAD	HEAD appears if either of the following occur: - No rotor is installed when START key is pressed. - Recognition system fails to read a valid rotor (due to improper rotor or a faulty recognition system). Press STOP to erase this message.
ch hd	Change Head. The rotor recognized is not in the list of supported rotors or, in Program mode, current Program is set up to run with a different rotor. Press STOP to erase this message, open the cover, and install the appropriate rotor.
Lld	Lld appears if you press the START key when the cover is not closed. Close the cover to erase this message.
PFAIL	PFAIL indicates that power was interrupted during a run. This message appears when the unit is turned back on following the failure. The front panel will alternate between the PFAIL message and the remaining run time (or elapsed time if in Hold mode). Press STOP to erase this message. Press START to resume the previous run.
RAD	rAD appears (and flashes with the max. allowable value) if the input radius is greater than the maximum allowable for the rotor detected. Press the STOP key to clear this message. - When in PROGRAM mode press then the SAVE key to use the default (max.) radius for the rotor installed. - When in MANUAL mode the correct radius must be entered. See Section 3.3, Add/Change Program for instructions on changing the radius.
rCF	rCF appears (and flashes with the max. allowable value) if the input RCF is greater than the maximum allowable for the rotor detected. rCF can also appear if the entered combination of rCF and RAD requires a speed in excess of the maximum allowable for the rotor. The rCF value flashing is the maximum allowed with the radius entered. Press the STOP key to clear this message. Enter a new RCF value within the max. allowable or enter a new radius.
SPD	SPD appears (and flashes with the max. allowable value) if the input speed is greater than the maximum allowable for the rotor detected. Press the STOP key to clear this message. Enter a new speed value within the max. allowable.
dFL	Drive Fault The drive fault error can occur due to one of the following conditions: - the motor experiences an abnormally high current or voltage condition - the drive PCB operating temperatures exceed 70°C - a brake circuit fault has been detected - a short to ground has occurred in the motor The rotor will coast to a stop. To clear the error, unplug the unit (or turn power switch off) and reconnect the unit (or turn power switch on). Check for obstruction of the cooling fans or vents. If repeated dFL errors occur, contact service personnel.

Error Codes

An error code typically means that the internal microprocessor has detected impermissible readings or a failure in the unit. Error messages appear in the speed display. When an error code is displayed, unplug and reconnect the unit to power. If the error code reappears, factory-authorized maintenance may be required. Contact your local Thermo representative and tell the service personnel which message appeared when you report the problem.

Error Code	Description
Err 1	No Tachometer Tachometer signals were not present during the run. The rotor coasts to a stop. Cover opening is inhibited after this error. Unplug and reconnect the unit to power to reset this error.
Err 14	Incorrect Rotor Signature The rotor signature detected does not correspond with the database of rotors.
OSPd	Overspeed Speed is 200 RPM above the maximum speed for the installed rotor. The rotor will brake to a stop.
rEFR	Refrigeration Failure (Refrigerated only) The unit displays this code if the measured temperature exceeds 45°C, at any time during the run.
norEF	No Refrigeration Temp. Sensor (Refrigerated only) The unit displays this code, if the microprocessor is not detecting a temperature measurement from the temperature sensor.
FSAFE	Fail-safe Time out Independent circuitry on the circuit board has sensed a lack of activity from the control microprocessor. All power circuits (including motor, latch, solenoid, etc.) are disabled.
COPF	Cop Watchdog/OpCode Trap Error The microprocessor has sensed a lack of activity from the program that controls the centrifuge. The rotor will coast to a stop.
COP	COP Watchdog Not Enabled The microprocessor COP is not enabled. The rotor will coast to a stop.
UndFI	Undefined Interrupt The microprocessor was interrupted by an undefined source. The rotor will coast to a stop.
ILLOP	Op-Code Trap Error The rotor will coast to a stop
dIR	Wrong Direction of Rotation The microprocessor discovered wrong direction of rotation, during acceleration
Warnings during a spin: Lld, PFAIL, and dIR error messages can occur during a spin. In this case, the rotor brakes or coasts to a stop and the run ends.	

4. Applications

4.1 Introduction

This section describes the use of specific rotors and accessories. More detailed information is shipped with the rotor or accessory itself. This section contains five reference sections:

- Speed and Force Tables
- Derating Table for Dense Samples
- Chemical Resistance Table
- Decontamination Table
- Nomograph

CAUTION

Do not exceed maximum rated speed for each rotor/accessory combination. Maximum rated speeds can be found in Section 4.2 - Speed And Force Tables.

Relative Centrifugal Force (RCF or G-force) at a given speed varies with the rotor, and with the distance away (rotating radius) from the shaft of the centrifuge (center of rotation). The rotating radius is measured to the furthest inside tip of the tube, away from the centrifuge shaft. The Speed and Force Tables indicate the maximum speed and RCF that the IEC Centra CL5(R) can achieve, with various rotor/accessory combinations. The Derating Table specifies reductions in maximum RPM, when spinning samples with specific gravity above 1.2.

Use of any tube above its rated RCF can cause tube cracking. To avoid this, compare the G forces, specified in the Speed and Force Tables, with the ratings for the tubes that you are using. If the tubes are not rated for the force that the centrifuge will apply, look up their reduced g force rating and enter it on the control panel.

Corrosive Solvents

Your centrifuge is made of materials designed to resist immediate attack from most laboratory chemicals. Prolonged exposure should be avoided, by immediately removing the chemical from rotor or assembly. Rotors and accessories placed in the chamber are made of a variety of materials, including aluminum and polypropylene. The Chemical Resistance Table shows the suitability of each material with different classes of reagents.

Section 5.2 describes how to clean and remove corrosion from the chamber, rotors, and accessories. Follow these instructions and clean spills promptly to minimize the effect of corrosive chemicals and to avoid expensive repairs.

4.2 Speed and Force Tables

Rotor 6554C 4-Place Swinging Bucket, 4x750ml

Complete with 4-316 buckets and rotor recognition disk, but without sealed tube adapters

Tube		Maximum		Radius	Sealed Adapter**
No. x Vol. (ml)	Description	RPM / RCF			Qty. x Cat. No.
4 x 750 ml sunsealed	05-112-76 bottle	3400	2550	19.6	not required
4 x 500 ml unsealed	Use 05-112-76 bottle (graduated to 600 mL)				
4 x 250 mL unsealed	Corning conical 05-538-53 bottle	3400	2625	20.3	4 x 7080
	Coring round bottom glass 05-586			18.1	4 x 7081
	Coring flat bottom glass 05-587A				
4 x 250 mL sealed	05-432A, 05-432B bottles	3400	2340	18.1	4 x 7080
4 x 175/225mL sealed	Falcon conical 05-538-62/05-538-61				4 x 7069
8 x 100mL sealed	38x111 mm	3400	2310	17.9	4 x 7002
20 x 50 mL sealed	Falcon/Corning conical	3400	2370	18.3	4 x 7012
28 x 50 mL sealed	29x116 mm round bottom glass/plastic	3400	2480	19.2	4 x 7007
28 x 25-30 mL sealed	25 x 105 mm	3400	2380	18.4	Use 7 x 7243 in each 7007
48 x 15 mL sealed	Falcon/Corning conical	3400	2440	18.9	4 x 7012
48 x 10 mL sealed	Kova/Urisystem				
48 x 10-15 mL sealed	Vacutainer® 16 x100, 16x125mm	3400	2520	19.5	4 x 7013
60 x 7-10 mL sealed	Vacutainer 16x75-100mm	3400	2520	17.5	4 x 7015
100 x 7 mL sealed	Vacutainer 13x100mm	3400	2260	17.2	4 x 7025
	Hemogard Vacutainer 13x100 mm	3400	2220		
100 x 5 mL sealed	Vacutainer 13x75 mm				
	Hemogard Vacutainer 13x75 mm				
148 x 3-5 mL sealed	10x75, 12x75 mm, Falcon #2063	3400	2050		
100 x 1.5/2 mL sealed	Microtubes			4 x 7025	
100 x 0.7 mL sealed	Microtainers			4 x 7025	
100 x 0.5 mL sealed	PRC microtubes			and 9 pk/12 5763	
100 x 0.4 mL sealed	Microtubes			4 x 7025	
100 x 0.25 mL sealed				and 9 pk/12 5764	
4 x Deepwell plates 1-3 std. microplates	86x128x53 mm microplates 86x128 mm microplates	3400	2210	17.2	4 x 7085

* Adapters with Number Series 70xxC are sold by the pack/2.

Note: Sealed Adapters comply with the aerosol containment requirements of:

OSHA 29 CFR Part 1910.1030 Occupational Exposure to Bloodborne Pathogens; Final Rule dated 12/06/91

Falcon, Vacutainer and Microtainer are registered trademarks of Becton Dickinson & Co.

4.3 Rotor 6553C 6-Place Swinging Bucket, 6x250ml

Complete with 4 - 51138 buckets and mounted rotor recognition disk, but without sealed tube adapters.

Tube		Maximum RPM / RCF	Radius	Sealed Adapter** Qty. x Cat. No.
No. x Vol. (ml)	Description			
6 x 250ml sealed	Thermo 2502 bottles	3600 3030	20.9	6 x 6558
6 x 175/225ml sealed	Falcon conical 05-538-62/05-538-61	3600 3010	20.8	
1 x 100ml sealed	38x111mm		20.8	
12 x 50ml sealed	Falcon/Corning conical	3600 3000	20.7	6 x 6557
12 x50ml sealed	29x116mm round bottom glass/plastic		20.7	6 x 6556
18 x 25-30ml sealed	Universal, 25x105mm		20.7	6 x 6560
30 x 15ml sealed	Falcon/Corning conical		20.7	6 x 6568
30 x 10ml sealed	Kova/Urisystem		20.7	6 x 6561
48 x 10ml sealed	16.5x103mm		3600 2770	
54 x 10-15ml sealed	Vacutainer 16x100, 16x125mm	3600 3000	20.7	6 x 6567
54 x 7ml sealed	Vacutainer 13x100mm			6 x 6562
	Hemogard Vacutainer 13x100mm			6 x 6563
	Vacutainer 16x75mm	3600 2620	18.1	
54 x 5ml sealed	Vacutainer 13x75mm			6 x 6565
	Hemogard Vacutainer 13x75mm			
72 x 5ml sealed	Hemogard Vacutainer 13x75mm	3600 2430	16.8	6 x 6565 and 4 pk/12 5763
72 x 3-5ml sealed	10x75, 12x 75mm, Falcon # 2063			
72 x 1.5/2ml sealed	Microtubes	3600 2160	14.9	6 x 6565 and 4 pk/12 5764
72 x 0.7ml sealed	Microtainers			
72 x 0.5ml sealed	PCR microtubes			6 x 6565C and 6 pk/12 5763
72 x 0.4ml sealed	Microtubes			6 x 6565 and 6 pk/12 5764
72 x 0.25ml sealed	Microtubes			

* Adapters with Number Series 65xxC are sold by the pack/2.

Note: Sealed Adapters comply with the aerosol containment requirements of:

OSHA 29 CFR Part 1910.1030 Occupational Exposure to Bloodborne Pathogens; Final Rule dated 12/06/91

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4.4 Pear-Shaped Oil Tube Rotor 52042C 4-Place Swinging Bucket, 4x100m

Complete with 4 - 338 removable buckets with cushions and 1 mounted rotor recognition disk.

Tube		Maximum RPM / RCF	Radius
No. x Vol. (ml)	Description		
4 x 100ml	05-620, 05-622 pear-shaped tubes	2500 1350	19.2

4.5 Short-Form Conical Oil Rotor 59572C 4-Place Swinging Bucket, 4x100m

Complete with 4 - 1120 removable buckets with cushion and 1 mounted rotor recognition disk.

Tube		Maximum RPM / RCF	Radius
No. x Vol. (ml)	Description		
4 x 100ml	05-621 short-form conical tube	2450 1350	20.1

4.6 Derating Tables for Dense Samples

The Speed and Force Tables list the maximum speed for each rotor/adaptor combination for the IEC Centra CL5 Series centrifuges. These speeds are specified for samples whose specific gravity is not greater than 1.2 for swinging bucket rotors.

For denser samples, the maximum specified speed in RPM is reduced (derated) by a factor from the table below:

Derating Factor for:	
Specific Gravity	Swinging Bucket
1.2	1.000
1.3	.960
1.4	.925
1.5	.894
1.6	.866
1.7	.839
1.8	.816
1.9	.794
2.0	.774
2.1	.755
2.2	.738
2.3	.721
2.4	.707
2.5	.692
2.6	.678
2.7	.666
2.8	.654
2.9	.642
3.0	.632

Derating Example: A rotor rated for 4,000 RPM used with samples with a specific gravity of 1.4, cannot spin faster than 3,700 RPM. (4,000 x .925 = 3,700)

Specific gravities greater than 3.0.

This table is based on the formula:

$$\sqrt{(S_o/S_a)}$$

Use the same formula to compute derating factors for specific gravities greater than 3.0.

- S_o is the maximum specific gravity allowed before derating (1.2).
- S_a is the actual specific gravity of the sample.

⚠ CAUTION

Do not exceed the rated speed or specific gravity. Higher speeds or specific gravities will impose unnecessary wear on the centrifuge and can cause rotor failure. Wear and damage caused in this manner are not covered under warranty.

4.7 Chemical Resistance Table

The centrifuge, rotors and accessories are comprised of made of materials that are designed to resist attack from most laboratory chemicals. For your convenience, the chemical resistance table below shows the suitability of various materials with different classes of reagents.

NOTE: Refer to the cleaning section for information on cleaning and removing corrosion from various parts. Clean spills promptly to minimize the effect of corrosive chemicals and avoid expensive repairs.

	Plastic										Metal					Other				
	POLYALLOMER	POLYCARBONATE	POLYETHYLENE	POLYPROPYLENE	POLYURETHANE	MODIFIED PHENYLENE OXIDE (NORYL®)	(DELIRIN®)	ACETAL HOMOPOLYMER (CELCON®)	ACETAL COPOLYMER	NYLON	POLYSTYRENE	TITANIUM	STAINLESS STEEL	ALUMINUM	MAGANESE BRONZE	MAGNESIUM	RUBBER	BUNA-N	VITON®	PHENOLIC FIBER
Acids, dilute or weak	E	E	E	E	G	E	F	N	F	E	G	G	F	F	N	F	E	E	E	E
Acids*, strong or conc.	E	N	E	E	F	N	N	N	N	F	N	N	N	N	N	N	F	G	N	N
Alcohols, aliphatic	E	G	E	E	F	E	E	E	N	E	E	E	E	E	F	E	E	G	E	E
Aldehydes	G	F	G	G	G	G	G	G	F	N	E	E	E	E	E	E	E	N	E	E
Bases	E	N	E	E	N	G	N	G	F	E	E	E	E	E	E	E	G	G	N	N
Esters	G	N	G	G	N	E	G	G	E	N	E	E	E	E	E	E	N	N	N	E
Hydrocarbons, aliphatic	G	F	G	G	E	N	E	E	E	N	E	E	E	E	E	E	N	E	E	E
Hydrocarbons, aromatic	F	N	G	F	N	N	E	E	E	N	E	E	E	E	E	E	N	N	E	E
Hydrocarbons, halogenated	F	N	F	F	N	N	G	E	G	N	E	E	E	E	E	N	N	N	F	E
Ketones	G	N	G	G	N	N	E	E	E	N	E	G	G	G	E	N	N	N	N	E
Oxidizing Agents, strong	F	N	F	F	N	N	N	N	N	N	E	F	N	N	N	N	N	F	E	E
Salts	E	E	E	E	E	E	E	E	E	E	E	F	F	F	N	E	E	E	E	E

*For Oxidizing Acids, see "Oxidizing Agents, strong".

Classification
of Resistance
E = EXCELLENT
G = GOOD
F = FAIR
N = NOT RECOMMENDED

4.8 Decontamination Table

Compatible Processes For Decontamination

Sterilization Methods		Plastic									Metal					Other				
	POLYALLOMER	POLYCARBONATE	POLYETHYLENE	POLYPROPYLENE	POLYURETHANE	MODIFIED PHENYLENE OXIDE (NORYL)	ACETAL HOMOPOLYMER (DELIRIN)	ACETAL COPOLYMER (ICELCON)	NYLON	POLYSTYRENE	TITANIUM	STAINLESS STEEL	ALUMINUM	MAGANESE BRONZE	MAGNESIUM	RUBBER	BUNA-N	VITON	PHENOLIC FIBER	PT - PAINTED SURFACE
Mechanical																				
Autoclave*	S	M	U	S	M	U	S	S	S	U	S	S	S	S	S	S	S	M	S	M
Ethylene Oxide Gas	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	U	U	S	S	S
Dry Heat (2Hrs. @ 160°C)	U	U	U	U	U	U	U	U	U	U	S	S	U	S	S	U	U	U	U	U
Chemical																				
Ethanol	S	S	S	S	U	S	S	S	U	M	S	S	S	S	S	S	S	S	S	S
40% Formalin	S	S	S	S	U	S	S	S	S	U	S	S	S	S	S	S	U	S	S	S
Methanol	S	M	S	S	M	S	S	S	U	M	S	S	S	S	S	S	S	U	S	S
2-Propanol	S	S	S	S	M	S	S	S	U	S	S	S	S	S	M	S	S	S	S	S
.5% Sodium Hypochlorite**	S	S	S	S	U	S	U	U	U	S	S	M	U	U	U	S	U	S	S	M
3% Hydrogen Peroxide	S	S	S	S	S	S	M	S	U	S	S	S	S	S	U	S	S	S	S	M
100% Hydrogen Peroxide	S	S	S	S	S	U	U	U	U	S	S	S	S	S	S	U	U	S	S	U
5% Phenol Solution	M	U	U	S	U	U	M	M	U	M	M	M	M	M	M	M	U	S	S	U

*For Oxidizing Acids, see "Oxidizing Agents, strong"

Autoclaving 121° C for 20 min. @ 2 ATM (15 PSIG)

** 1 to 10 Dilution of Household Bleach

S = SATISFACTORY

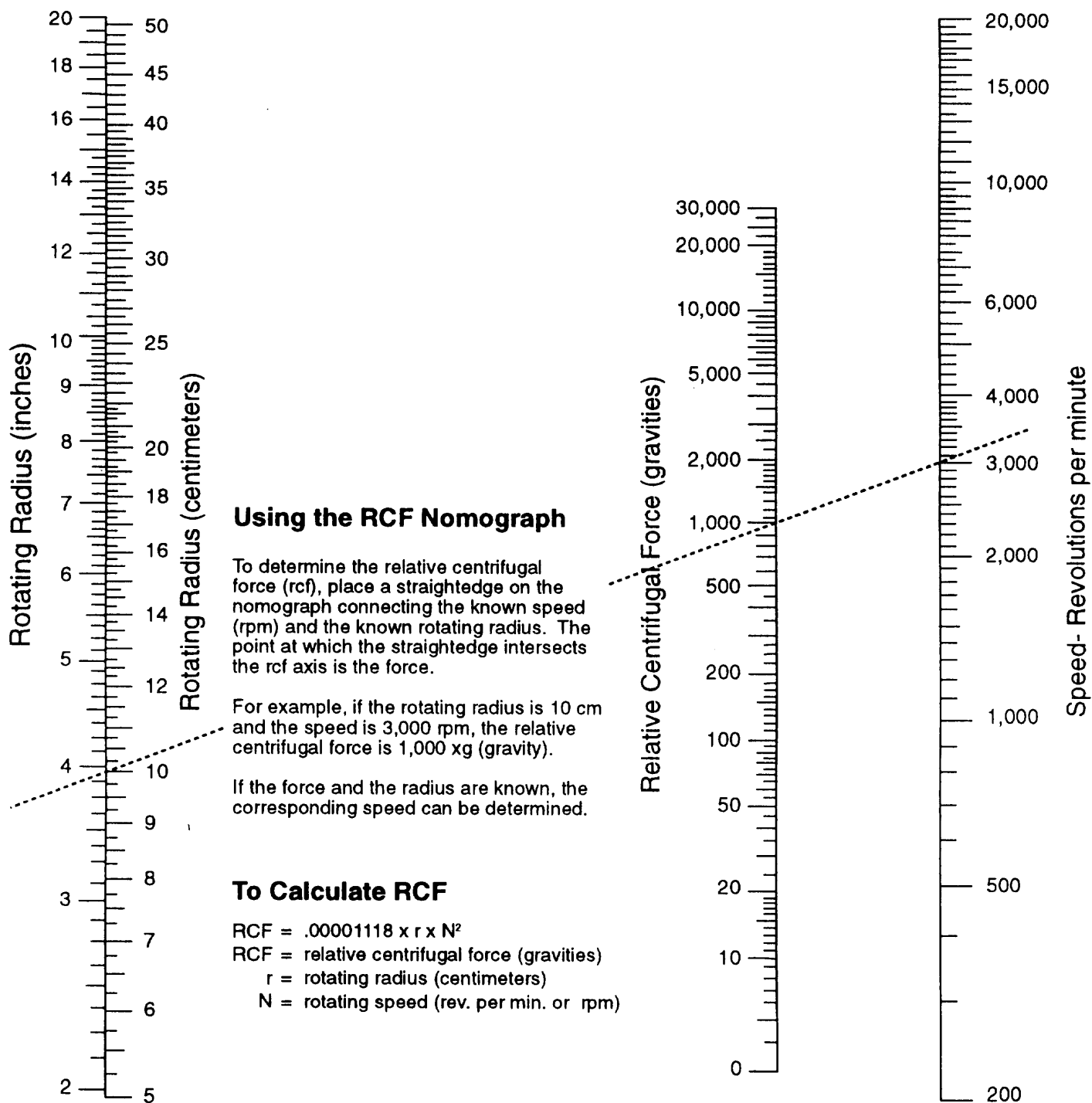
M - MARGINAL

U - UNSATISFACTORY

WARNING

This chart describes the material compatibility of various sterilization methods. It does not specify the adequacy of sterilization. Refer to the Chemical Resistance Table on the previous page for material compatibility during centrifugation.

4.9 RCF Nomograph



5. Maintenance

5.1 Care and Cleaning

- Keep the centrifuge clean to ensure good operation and to extend its life.
- Clean the sample chamber, rotor, and lid, at the end of each work day, and immediately after any spill. Use a damp sponge, warm water, and a mild liquid detergent suitable for washing dishes by hand, such as Ivory® liquid. Do not use caustic detergents or detergents that contain chlorine ions. These attack metals.
- Remove stubborn stains with a plastic scrub pad. Do not use steel wool, wire brushes, abrasives, or sandpaper as they create corrosion sites. Never pour water directly into the rotor chamber.
- Scrub the rotor's tube cavities with a stiff test tube brush that has end bristles and a non-metallic tip. After cleaning, dry each part with a clean absorbent towel.

CAUTION

In the case of glass breakage, be careful to remove ALL particles of glass from the unit! In particular, be sure thoroughly scrub adapters and cushions with a wire brush or replace these items as glass shards embedded in the adapters can cause further breakage.

5.2 Corrosion Cleaning Procedure

The rotors and structural accessories are finished to give maximum resistance to corrosion. To maximize the life of the unit, continually inspect the rotor cavities for corrosion, especially if you use chloride ion solutions such as sodium chloride (saline), and sodium hypochlorite (household bleach), because these solutions attack most metals.

Clean the rotor, rotor chamber, and accessories (particularly the sample compartments and bucket cups) thoroughly after each exposure. Inspect all surfaces under bright light for corrosion. Be aware that small crevices grow deeper, eventually resulting in system failure.

If you see any corrosion, remove it immediately, using the following procedure:

1. Follow the cleaning procedure at the start of this section.
2. Soak the product in mild hand dish-washing detergent and scrub the product thoroughly with a stiff test tube brush. The brush should have end bristles and a non-metallic tip.
3. Soak the product in clear warm water for a minimum of an hour.
4. Rinse the product in warm water then in distilled water.
5. Dry the product thoroughly with a clean absorbent cloth.

CAUTION

If this procedure does not remove the corrosion, discontinue use of the product and inform technical service.

5.3 Storage: Keep the Unit Dry

Store parts on a soft surface to avoid damage.

Rotors and other parts should be clean and dry. Store them open to the air, not in a plastic bag, so any residual moisture evaporates. Face the parts upward to avoid moisture retention in the cavities.

5.4 Decontamination Procedures

WARNING

If tube breakage occurs releasing toxic, infectious, pathogenic, or radioactive material into the unit, decontaminate the chamber.

Rotors have sealed containers that provide aerosol containment and, if used as directed, keep spillage confined. If breakage occurs it may be sufficient to only decontaminate the sealed carriers.

The Decontamination Table in the previous section lists the sensitivity of various materials to common sterilization procedures. When using a 1-to-10 dilution of household bleach (sodium hypochlorite) to decontaminate metal rotors or accessories, follow decontamination by the corrosion cleaning procedure (5.2) since chloride ions attack most metals.

Always decontaminate for the minimum recommended time. If you observe corrosion, remove it as described earlier, discontinue use of the method and use an alternate decontamination procedure.

Polypropylene sealed carriers can be autoclaved. Remove any sample tubes before autoclaving unless they are completely full of sample. Remove caps, stoppers, and other tube closures before autoclaving to keep the tubes from collapsing under pressure. Autoclave the rotor and accessories at 121° C @ 15 psig for 20 minutes. Do not stack polypropylene rotors during this process. After cooling, perform a normal cleaning operation as described above.

Repeated autoclaving seriously degrades the performance of polycarbonate sealing covers.

5.5 Cover Interlock Bypass

The cover will remain locked if power fails. If you need to remove samples from the unit before power is restored, use the cover interlock bypass after the rotor has come to a stop. To bypass the cover interlock:

1. Unplug the centrifuge.
2. Locate the hidden plastic plug underneath the front ledge of the cabinet.
3. Use a screwdriver to pry out and remove the plug.
4. Pull the attached cord to release the cover interlock.
5. Replace the plug in the hole.

WARNING

Do not perform this operation routinely. The centrifuge's cover interlock provides operator safety. It allows the cover to be opened promptly, whenever rotation has stopped.

5.6 Fuses

The following fuses are located internally within the centrifuge. They should only be replaced by qualified service personnel.

F1 10A Type F Fast Blow, 250V

5.7 Condition of Returned Equipment

Obtain a return goods authorization (RGA) before returning equipment to the manufacturer. The RGA paperwork includes a Certificate of Decontamination for you to sign. It indicates that you have performed the proper steps for decontaminating the unit.

WARNING

All returned units must be decontaminated, free of radioactivity, and free of hazardous, infectious, pathogenic, or toxic materials.

All return equipment shipments will be refused until the signed certificate is received.

You must prepay transportation to the service depot.

5.8 Warranty

Warranty information is provided on the warranty card supplied with the centrifuge.

6. Specifications

	GP6	GP6R
Maximum Speed:	3,600 RPM	
Maximum G Force:	3,000 xg	
Maximum Rotating Radius:	21.0 cm	
Maximum Capacity:	3 liter (4 x 750 ml)	
Sound Level:	Max. 57 dbA (RMS)	Max. 62 dbA (RMS) w/compressor on
Operator Controls		
Chamber Temperature:		-9° to 40° C by 1°
Rotation:	Counterclockwise	
RPM:	500-3600 (by 50 RPM)	
RCF:	50-3,000xg (by 50 xg)	
Spin Duration:	0-99 min 59 sec by 1 min and/or 1 sec HOLD MODE Momentary Spin	
Brake:	Dynamic Electric (3 profiles)	
Repeatability		
Temperature Control:		± 2° C within range of 4° C to ambient
Rotation:	Accuracy within ± 10 RPM	
Timer:	Microprocessor controlled Accuracy within ± 1 sec	
System Components		
Motor:	3/8 hp, Brushless DC	
Refrigeration System		1/2 hp nominal
Refrigerant		non-CFC R-22 (6.5 oz. Hi-V Models)
Operating pressures at 4° C		150 psi (low side) 300 psi (high side)
Max sample temperature rise		7° C above ambient
Power Requirements and Output		
Power	6459K: 120 VAC, 60 Hz 6460K: 220/240 VAC, 50/60 Hz	6461K: 120 VAC, 60 Hz 6462K: 220/240 VAC, 50 Hz
Current:	6 Amps	12 Amps
Heat Output:	1860 Btu/hr	3600 Btu/hr
Dimensions		
Height:	16.5 in (41.9 cm)	
Width:	23.25 in (59.1 cm)	30.0 in (76.2 cm)
Depth:	25.75 in (65.4 cm)	
Shipping Dimensions:		
Height	27 in (68.6 cm)	
Width	36 in (91.4 cm)	
Depth	30 in (76.2 cm)	
Unit Weight:	118 lb. (53.5 kg)	145 lb. (65.8 kg)
Shipping Weight:	185 lb. (83.9 kg)	258 lb. (117 kg)
Environmental Conditions		
The equipment is designed to be safe under the following conditions:		
Installation location:	Indoor use	
Altitude:	up to 2000 m	
Ambient Temperature:	+ 4° C to 35° C	
Relative Humidity:	0 – 70% RH	
Overvoltage Category II in accordance with IEC 60664		
Pollution Degree 2 in accordance with IEC 60664		

Specifications subject to change without notice.

Warranty

Thermo warrants that the Products will operate substantially in conformance with Thermo's Specifications applicable to such Products, when subjected to normal, proper and intended usage by properly trained personnel, for a period of twenty-four (24) months from the date of installation, not to exceed thirty (30) months from date of shipment from Thermo (the "Warranty Period"). Thermo agrees during the applicable Warranty Period, provided it is promptly notified in writing upon the discovery of any defect and further provided that all costs of returning the defective Products to Thermo are pre-paid by Purchaser, to repair or replace, at Thermo's option, non-conforming Products so as to cause the same to operate in substantial conformance with said Specifications. Such repair shall include parts only during the final twelve (12) months of the Warranty Period. Replacement parts may be new or refurbished, at the election of Thermo. All replaced parts shall become the property of Thermo. Lamps, fuses, bulbs and other expendable items are expressly excluded from the warranty. Thermo's sole liability with respect to equipment, materials, parts or software furnished to Thermo by third party suppliers shall be limited to the assignment by Thermo to Purchaser of any such third party supplier's warranty, to the extent the same is assignable. In no event shall Thermo have any obligation to make repairs, replacements or corrections required, in whole or in part, as the result of (i) normal wear and tear, (ii) accident, disaster or event of force majeure, (iii) misuse, fault or negligence of or by Purchaser, (iv) use of the Products in a manner for which they were not designed, (v) causes external to the Products such as, but not limited to, power failure or electrical power surges, (vi) improper storage of the Products or (vii) use of the Products in combination with equipment or software not supplied by Thermo. If Thermo determines that Products for which Purchaser has requested warranty services are not covered by the warranty hereunder, Purchaser shall pay or reimburse Thermo for all costs of investigating and responding to such request at Thermo's then prevailing time and materials rates. If Thermo provides repair services or replacement parts that are not covered by the warranty, Purchaser shall pay Thermo therefore at Thermo's then prevailing time and materials rates. ANY INSTALLATION, MAINTENANCE, REPAIR, SERVICE, RELOCATION OR ALTERATION TO OR OF, OR OTHER TAMPERING WITH, THE PRODUCTS PERFORMED BY ANY PERSON OR ENTITY OTHER THAN THERMO WITHOUT THERMO'S PRIOR WRITTEN APPROVAL, OR ANY USE OF REPLACEMENT PARTS NOT SUPPLIED BY THERMO, SHALL IMMEDIATELY VOID AND CANCEL ALL WARRANTIES WITH RESPECT TO THE AFFECTED PRODUCTS.

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