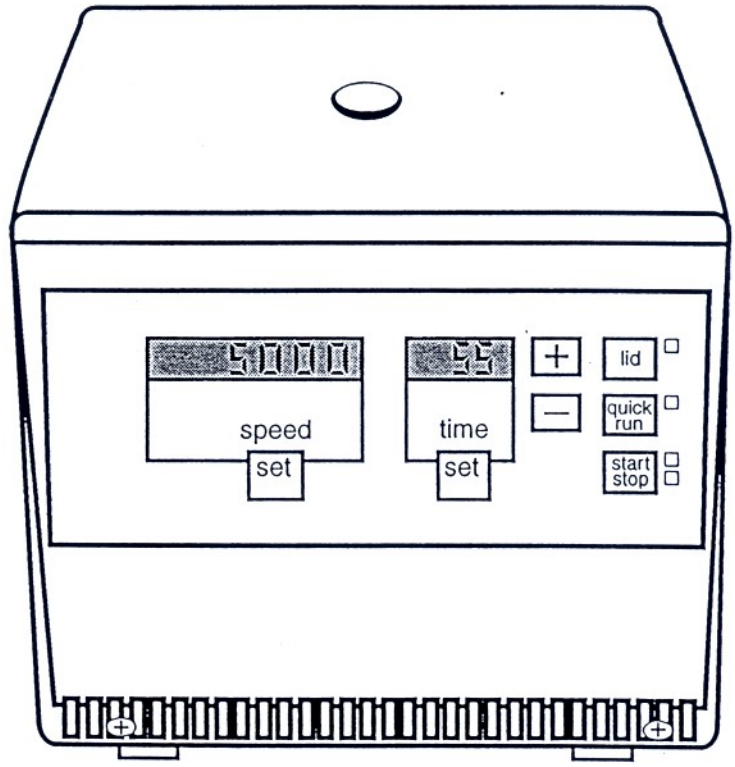
Heraeus

CLINIFUGE ™

Operating Instruction Manual



READ ME FIRST

The **Clinifuge** centrifuge is designed to perform a variety of separation tasks in small-scale laboratories. Before operating, follow these few simple cautions and guidelines.

A FEW DO'S AND DON'Ts

Read all parts of this manual carefully before attempting to operate the unit, to insure smooth operation and avoid damage to the unit or its accessories.

If a malfunction occurs, consult the Troubleshooting Guide at the end of this manual. If problems persist, call Heraeus Instruments at 1-800-441-2554 or FAX information about the problem to Heraeus at 1-908-754-9494.

Never attempt to open the lid manually while the rotor is spinning!

Always use tube adaptors when loading 5 ml. and 7 ml. tubes (see Section 3.6). 10-, 12- and 15-ml. tubes are loaded without adaptors.

Complete the warranty card shipped with your unit and return to the manufacturer.

FOR SAFETY, NEVER OPERATE THE CENTRIFUGE IF:

- the lid is open
- the rotor is not properly installed (see Section 3.5)
- the expiration date stamped on the rotor has passed (see Section 6.3) or the rotor has been used more than 10,000 cycles (see Section 6.2)
- the maximum weight of a tube including sample exceeds 24 grams or the density of the sample material exceeds 1.2 $g \cdot cm^{-3}$ for top speed operation
- the rotor is not loaded symmetrically (see Section 4.1)

Never operate the **Clinifuge** if you have not checked the maximum centrifugal speed recommended by the tube manufacturer.

WARNING! In case of imbalance (e.g. tube breakage or non-symmetrical loading), shut off power to the unit immediately. To accomplish this:

1. press the **STOP** key on the front of the unit immediately
2. less preferably, pull the power plug.

NOTE: When performing centrifugation and other functions which may expose workers to splashed blood or body fluids, all laboratory personnel must follow universal laboratory precautions. For details, contact your local laboratory safety officer.

Clinifuge Centrifuge Operation Manual

(Revision 05/93)

READ ME FIRST 1

Table of Contents

FAST STARTUP REFERENCE GUIDE

Setting Up the Clinifuge

1. Set unit on a flat, sturdy, resonance-free surface in a well ventilated area.
2. After plugging into power supply, turn on the main power switch located under the left side of the unit. (See Electrical Requirements, Section 2.2.)
3. Open the lid by pressing the LID keypad.
4. Remove all packing materials. Rotor must move freely.
5. If adaptors are required, remove the rotor (See Section 3.6, Fig. 15), and insert adaptors (See Section 3.6, Fig. 16.)
6. Mount the rotor on the drive shaft, aligning the groove on the underside of the rotor base with the cross-pin in the drive shaft. Screw locking nut in place. (See Section 3.5, Figures 13 and 14 for full rotor installation instructions)

WARNING! **If the locking nut does not easily engage the threaded portion of the drive shaft, do not try to force the rotor further onto the drive shaft. Instead, remove the rotor and re-install, making sure the rotor is correctly seated on the drive shaft cross pin.**

7. Load tubes making sure the rotor is symmetrically balanced. (See Section 4.1, Fig. 17 on Positioning Tubes.)
8. Close lid making sure both lid locks are engaged. Display will read **"OPEN"** and centrifuge will not operate if both locks are not fully engaged.

Programming the First Run

9. To set time, press the **SET** keypad in the **TIME** field. Change time by pressing "+" or "–" keypads.
10. To set speed for a timed run, press the **SET** keypad in the **SPEED** field. Change speed setting by pressing "+" or "–" keypad.
11. For timed runs, press **START** keypad. Unit will shut off automatically.
    For untimed runs, press **QUICK START** keypad and hold for desired time.

Preparing the Next Run

12. At end of cycle, remove all tubes from rotor.
13. Check for broken glass or leakage into rotor and/or chamber.
14. To remove rotor, remove locking nut by turning counter-clockwise. Insert index fingers into opposite tube holes and lift rotor straight up. To prevent damage to drive shaft, do not lift rotor at an angle.

To prepare the next run, follow the routine cleaning procedure (Section 6.4), if necessary, then repeat Steps 3 to 14.

For more detailed information about **Clinifuge** features, operation and guidelines, consult other sections of this manual.

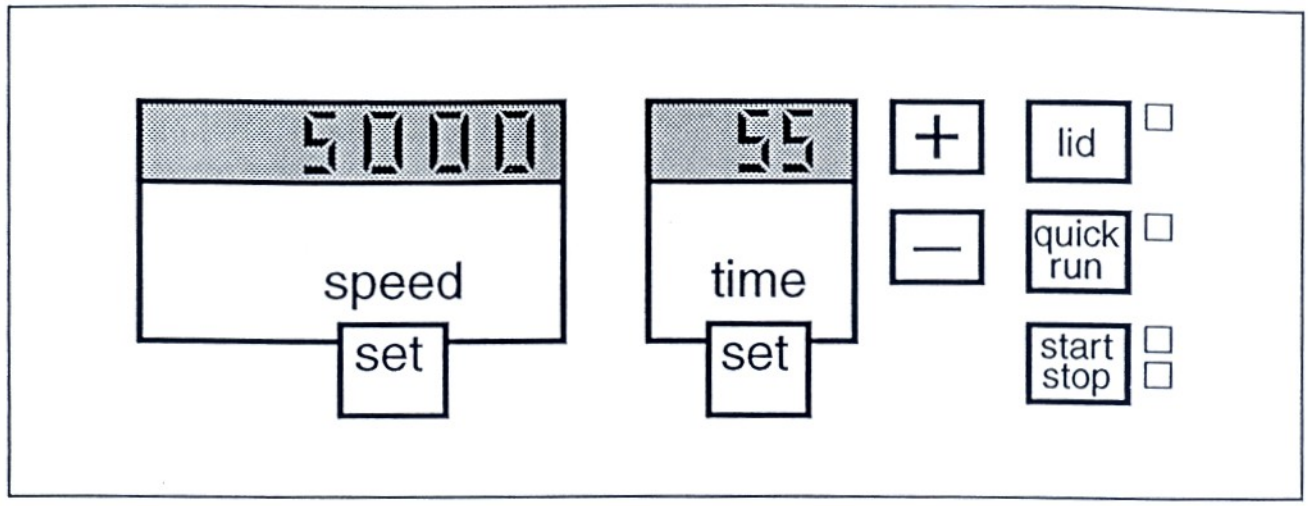


Figure 1. Clinifuge Control Panel

TO SET TIME:

Press SET keypad
in the TIME field.
Change time by
pressing "+" or "–" keypads.

TO SET SPEED:

Press SET keypad
in SPEED field.
Change speed setting by
pressing "+" or "–" keypad.

+ / – KEYS

Use to change speed
and time settings up or down.

LID KEY

Press to open.
Lid will pop up
automatically.

QUICK RUN KEY

Use for untimed runs.
Hold to start.
Release to stop.

START/STOP KEY

Press to start timed runs.
To stop anytime,
press START/STOP keypad.
Panel will display "br" message.

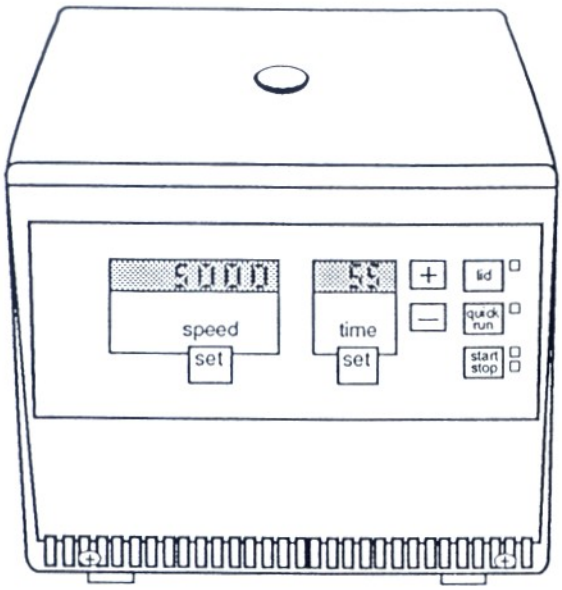


Figure 2. Closed Clinifuge (Control Panel)

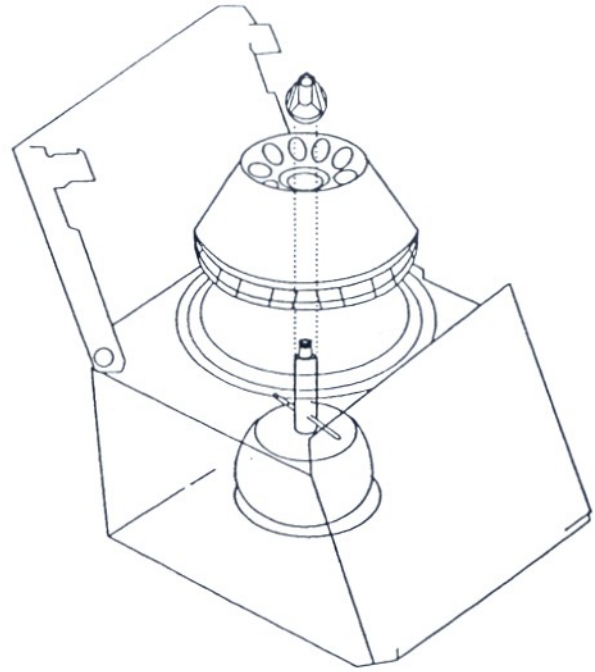


Figure 3. Open Clinifuge (down view w/rotor mounted)

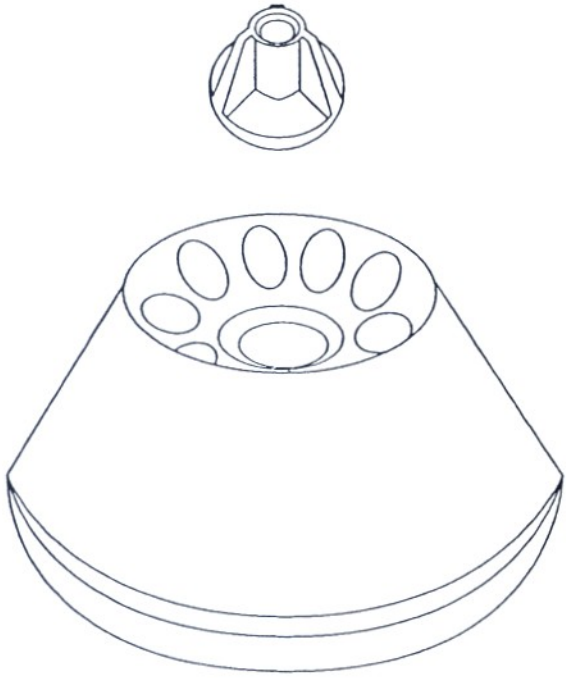


Figure 4. Locking Nut & Assembled Rotor

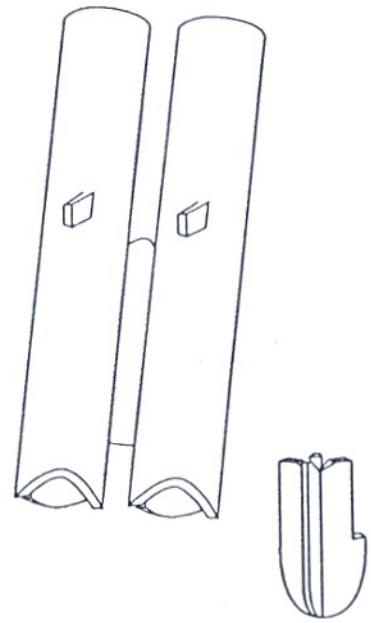


Figure 5. Tube Adaptors & Inserts (optional)

1. DESCRIPTION OF UNIT

1.1. Definition

The **Clinifuge** is a laboratory centrifuge used for a variety of separation tasks in small-scale laboratories. The following features provide easy, efficient operation:

- maintenance-free induction drive motor
- microprocessor controlled
- no carbon dust build-up due to elimination of carbon brushes
- membrane touch pads for easy cleaning
- CSA listed (Canadian Standards Association)
- angle rotor designed to carry 10-, 12- and 15-ml. tubes
  (tube adaptors available as optional equipment for 5 ml. and 7 ml. tubes)

1.2. Standard Parts

The **Clinifuge** you have been shipped comes with the following parts:

1. Two-part rotor (Figure 4)
2. Locking Nut (Figure 4)

1.3 Optional Equipment

Tube adaptors and inserts (See Figure 5.)

1.4 Mechanical Construction

The **Clinifuge** frame is constructed of solid steel with an armor chamber and a suspension for the drive and lid mechanics which provide extra security in the event of rotor malfunction. The impact-resistant plastic casing is mounted to the frame to reduce noise and vibration. Digital displays (LED's – light emitting diodes) indicate speed, time and operating conditions.

1.5 Electrical Construction

The **Clinifuge** operates on one circuit board using microprocessor-controlled digital LED displays and key pads on the face of the unit to control program settings.

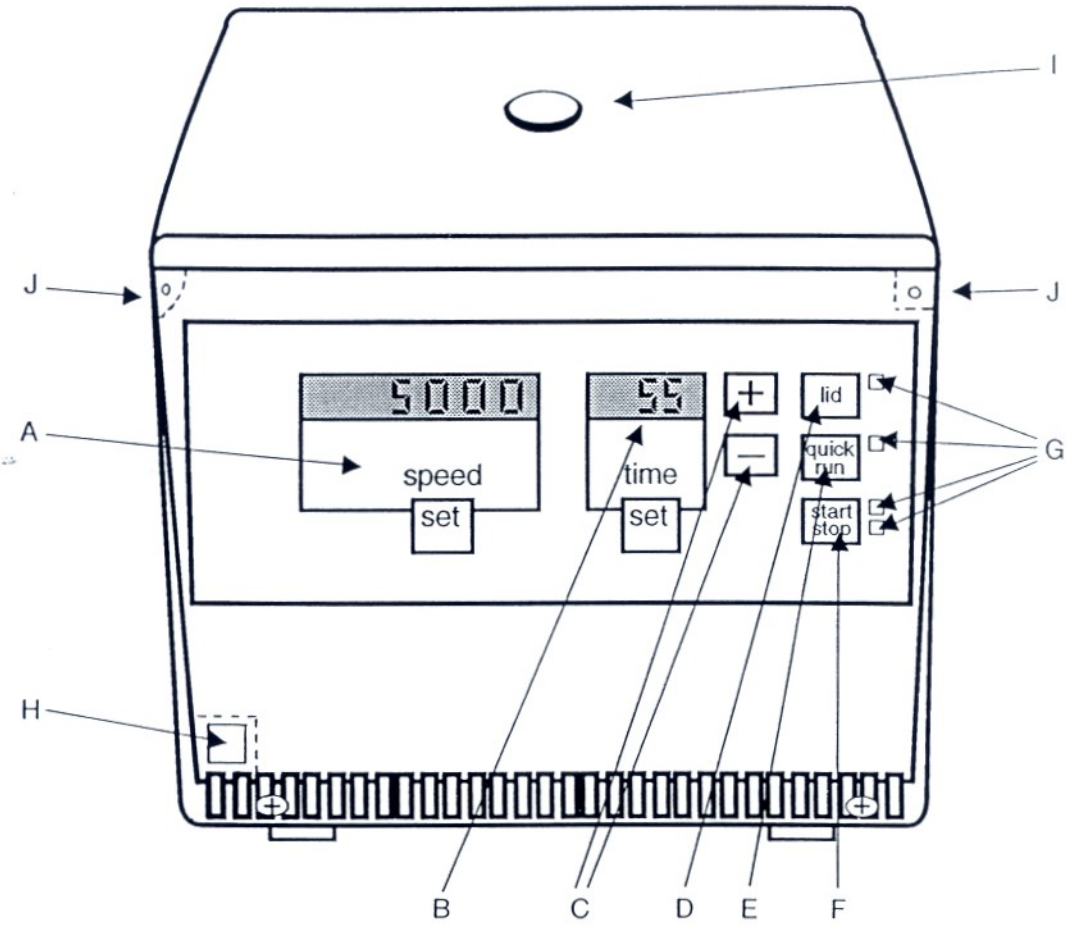
CAUTION: The microprocessor board is located directly behind the front panel. To avoid electric shock or damage, only a **factory trained technician** may service this area.

1.6 Warranty

The **Clinifuge** is warranted against defects in materials and workmanship for a period of one year after shipment to the customer.

The **Clinifuge** rotor is warranted against defects in materials and workmanship for the period of 10,000 cycles or the expiration date stamped on the rotor, whichever occurs first.

1.7. Operating Controls



A. Speed Setting and Indication Field
B. Time Setting and Indication
C. + and – Keys for Time and Speed Setting
D. Lid Opening Key
E. Quick Run Key
F. Start/Stop Key
G. Indicator LED's
H. Main Power Switch (left side under base)
I. Window
J. Access holes (for manual and emergency lid opening)

Figure 6. Clinifuge Operating Controls and Control Panel

1.8. Display Features

1.8.1. Speed

Shows set speed during acceleration and centrifugation phases. When the unit brakes, "br" is indicated in the speed field window.

1.8.2. Time

Records time in seconds up to one minute. Settings above one minute are counted down in full minutes, with the last minute counted down in seconds.

1.8.3. Standby Mode Light

A red flashing dot in the time display field indicates the unit is in standby mode. (See Section 2.4, Standby Mode.)

2. SETTING UP THE CLINIFUGE

2.1. Location

Remove packing materials and place the centrifuge on a sturdy, resonance-free table in an area allowing good air flow in and around the unit. Proper ventilation is required to keep the motor cool during operation. A fan built into the bottom of the centrifuge also helps maintain cool operation.

Before operating, be sure to remove packing materials inside the unit used to secure and protect the rotor during shipment. To open the unit, you will need to plug it in.

2.2. Electrical Requirements

Before connecting the unit to the main power supply, make certain that:

1. the line voltage imprinted on the identification plate is equal with the one available (120 Volts);
2. the line voltage circuit breaker is a 15 Amp, type K, slow release caracteristic commonly used for instruments.

A main power switch located under the left side of the unit may be used to turn the unit on and off as desired. (See Figure 6.)

Once the power supply plug is connected, the main switch is turned on, and the self-check cycle is completed, the unit is ready for operation.

2.3. Self Check Cycle

Each time the unit is turned on, the microprocessor performs an automatic self-check of the electronics, indicating all LED's temporarily. Whenever the centrifuge is disconnected during run, the unit will make a humming sound. When the self-check is complete, the yellow LID light will illuminate, permitting the lid to be opened.

2.4. Standby Mode

For convenience, the **Clinifuge** is designed to operate as a "constant on." After two minutes of inoperation, the microprocessor automatically blanks out all displays and goes into a **Standby Mode**, indicated by a flashing red LED dot in the time display field. Press any key to reactivate the displays and to perform the centrifugal function.

2.5. Automatic Lid Lock

The lid is all-steel construction with an integrated strobe port and tabs on both sides to engage the automatic dual lid locks.

2.6. Opening the Lid

To open the lid, turn the unit on and press the **LID** key pad. The lid will pop up automatically.

Three conditions will automatically prevent the lid from being opened:

1. The unit is not plugged into the electrical power source and/or the main switch is not turned on.
2. To prevent injury, the lid can not be opened while the rotor is spinning. Wait until the rotor comes to a full stop before attempting to open the lid. This may be checked by looking through the window in the lid.
3. If a power failure occurs during operation, the lid will remain locked until power returns. In case of power failure, the centrifuge always performs a complete braking cycle. When power is restored to the centrifuge, the "br" code will be displayed accompanied by a buzzing sound. To re-start after braking cycle is completed, press key pad for desired function. (Refer to Emergency Lid Opening instructions in Section 2.7.)

NOTE: Time and speed settings are retained in memory and do not need to be re-entered after power failure or between operating cycles.

2.7. Emergency Lid Opening

WARNING! Never attempt to open the lid manually while the rotor is still spinning.
Confirm that rotor has stopped spinning by looking through the round window in the middle of the lid.

Disconnect power cord before using the following Emergency Lid Opening Procedure.

2.8. Accidental Lid Opening during Run

If the lid opens during a run, the microprocessor will flash the LID error message. Before lifting the lid, confirm that the rotor has come to a full stop by looking through the round window in the middle of the lid.

In case of a prolonged power failure or defect, the LID button can not be used to open the lid. The locked cabinet lid can be opened manually as follows:

1. Disconnect the power cord before using the emergency lid opening procedure.
2. Make sure the rotor is fully stopped by looking through the round lid window.
3. Insert two rods into the access holes on both side panels (See Figure 7) and unlock the lid, one side at a time.

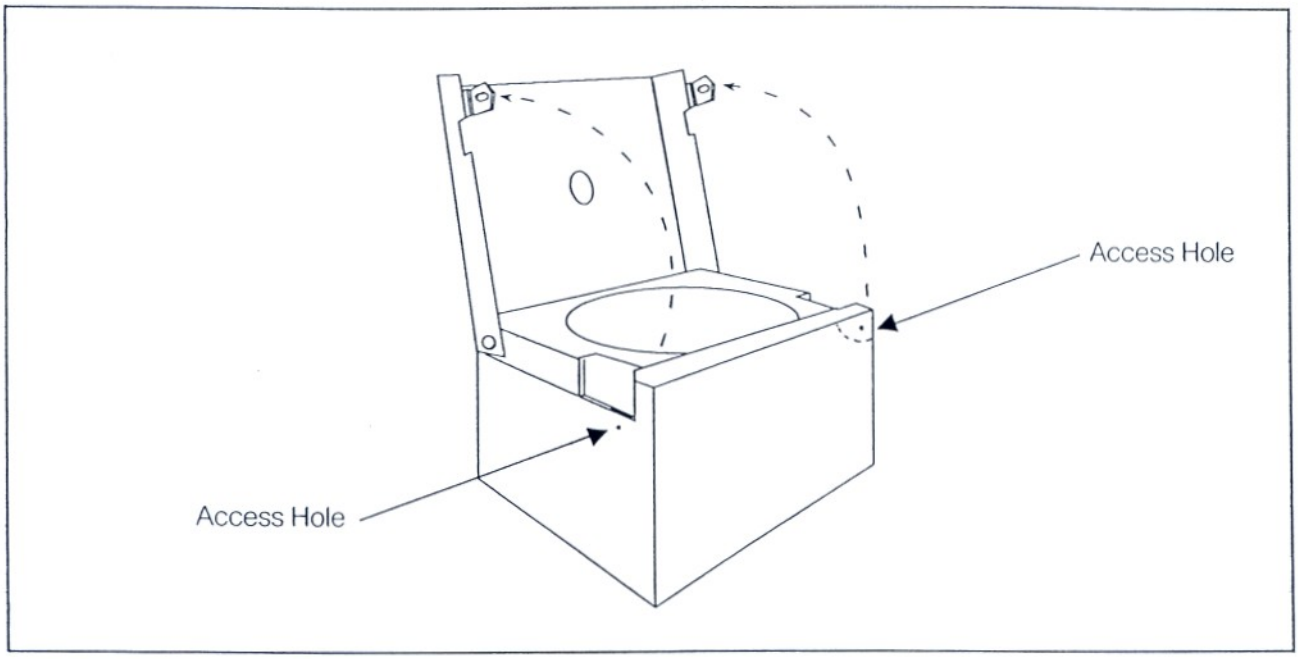


Figure 7. Emergency Lid Opening

Not to be used while rotor is still spinning!

3. ROTOR REMOVAL AND INSTALLATION

The **Clinifuge** rotor is shipped installed in the centrifuge and secured for shipping.

WARNING! Before operating the centrifuge, remove all packing material placed inside the unit for shipping. To operate, the rotor and drive shaft must turn freely and the rotor nut must be checked for tightness by turning clockwise. For safety in operation, check the locking nut for tightness before each run.

Each time the rotor is re-installed, the rotor and chamber must be completely free of contamination (dust, glass splinters, etc.).

To insure proper operation and prevent damage, the rotor must be properly positioned on the specially formed drive shaft each time it is re-installed. (See Section 3.1, Fig. 9 and Section 3.5.)

3.1. Rotor Parts

The rotor is a two-piece unit connected to the drive shaft by a locking nut.

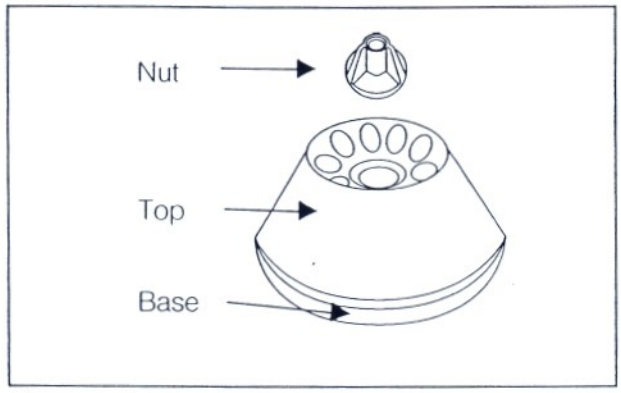


Figure 8. Fully Assembled Rotor

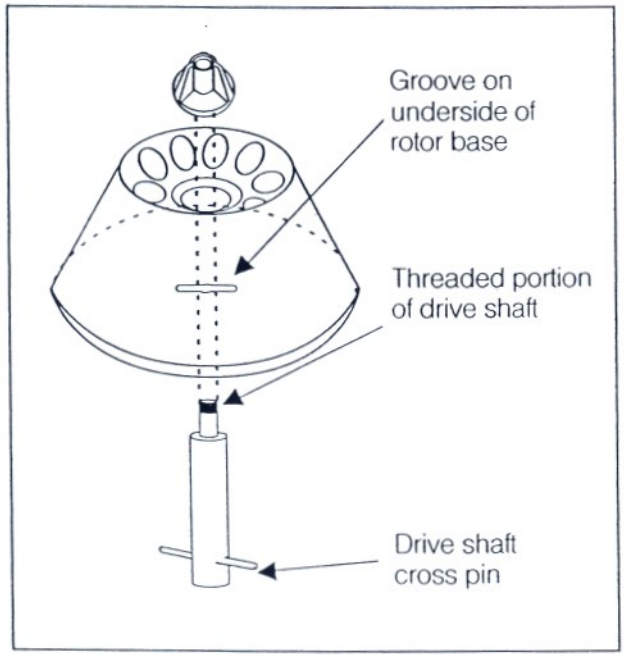


Figure 9. Correct Rotor Installation

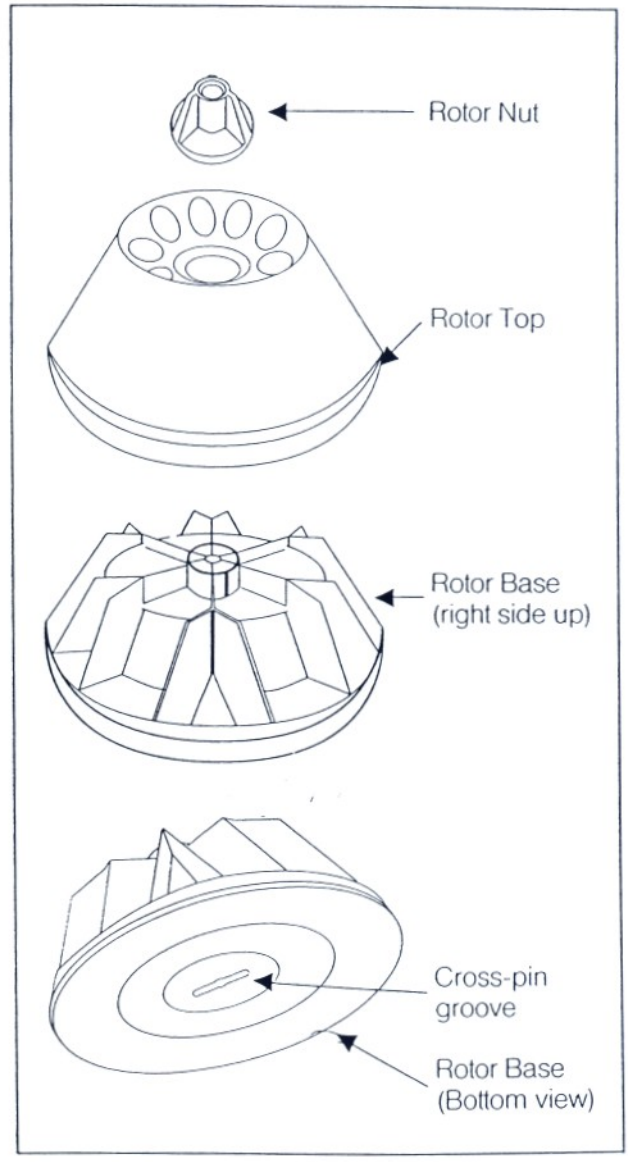


Figure 10. Disassembled Rotor

3.2. Removing the Rotor

To remove the rotor from the chamber:

1. Open the lid.
2. Remove all tubes and check for broken glass.
3. Remove rotor locking nut by turning counter-clockwise.
4. To remove rotor, insert index fingers into holes in rotor and pull straight up. If properly installed, the entire rotor will lift out. (Before inserting fingers, check holes for broken glass.)

WARNING! Never pull the rotor up at an angle. Doing so could bend the drive shaft and cause permanent damage to the motor.

3.3. Taking the Rotor Apart

To separate the rotor top from the rotor base:

1. Remove rotor from unit and place on a flat surface.
2. Insert index fingers into empty tube holes on opposite sides of the rotor top.
3. Using thumb, press firmly down on centerpiece. The two halves of the rotor should separate easily.

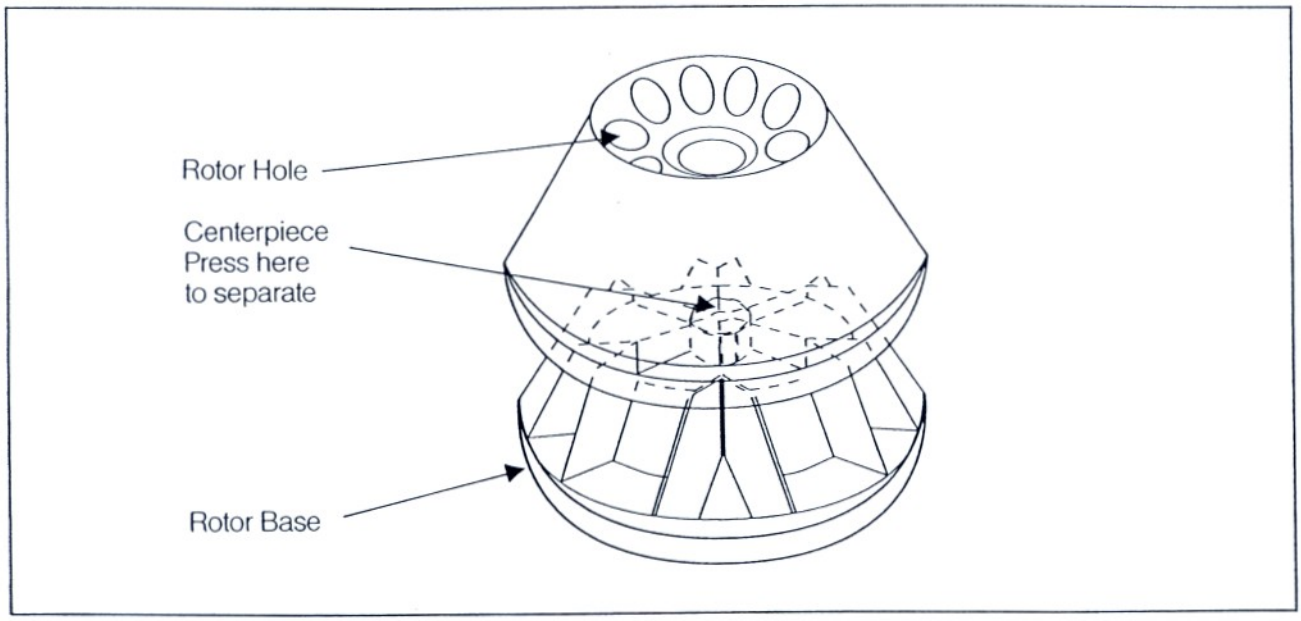


Figure 11: Rotor Disassembly – Top View

3.4. Assembling the Rotor

1. Before each installation, clean the chamber and rotor of dust, glass splinters and any other materials.
2. Insert tube adaptors, if required. (See Section 3.6, Rotor Tube Adaptors and Section 4., Proper Rotor Balancing and Loading.)
3. To assemble, line up the tab in the center hole of the rotor top with the corresponding notch in the rotor base centerpiece. Push down gently until the unit snaps together. The center of the base will be slightly recessed.

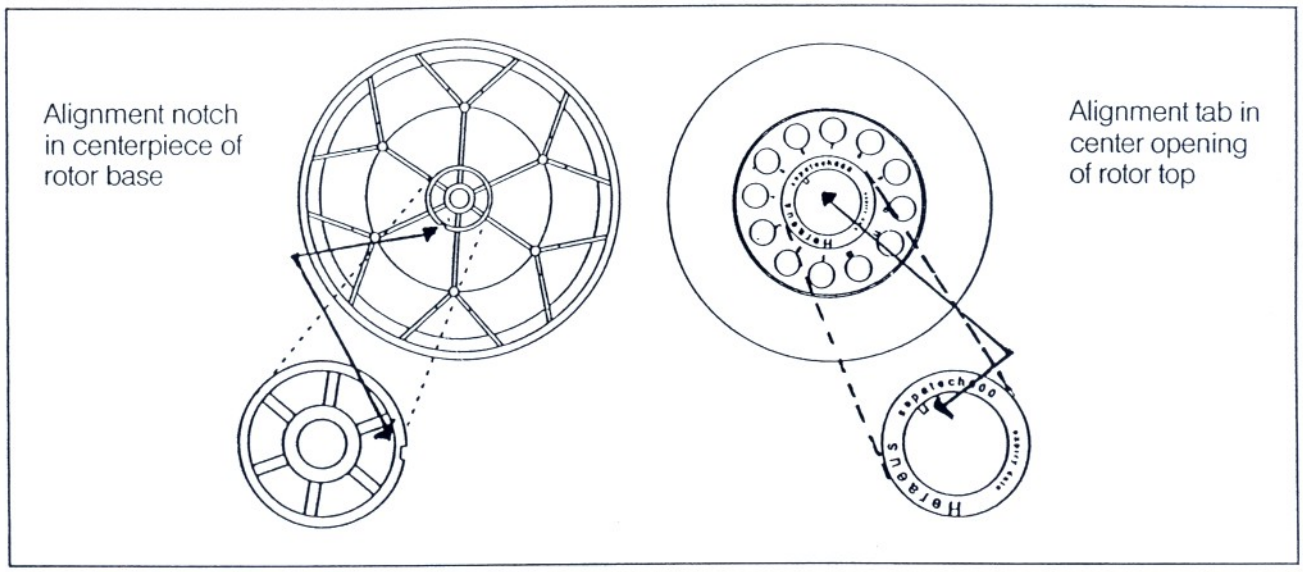


Figure 12. Assembling the Rotor

3.5. Installing the Rotor

A slot matching the cross pin on the drive shaft is grooved into the underside of the rotor base and must be aligned precisely when installing the rotor in the chamber.

WARNING! Position the rotor so that the slot grooved into the underside of the rotor base seats in exact alignment with the cross pin on the drive shaft. Failure to do so will prevent proper seating.

1. Turn the drive shaft to place the cross pin in a known position, e.g. long bar pointing to front (See Figure 9).
2. Using the tab in the rotor centerpiece as a guide, position the grooved notch on the underside of the rotor base in exact alignment with the cross pin on the drive shaft. Press firmly into place.
3. When rotor is properly seated, secure the locking nut, turning clockwise.

NOTE! If the locking nut does not easily engage the threaded portion of the drive shaft, do not try to force the rotor further onto the drive shaft. Instead, remove the locking nut and the rotor, and re-install, making sure that the the rotor is properly seated. (To insure correct seating, be sure Step # 2 is properly performed.)

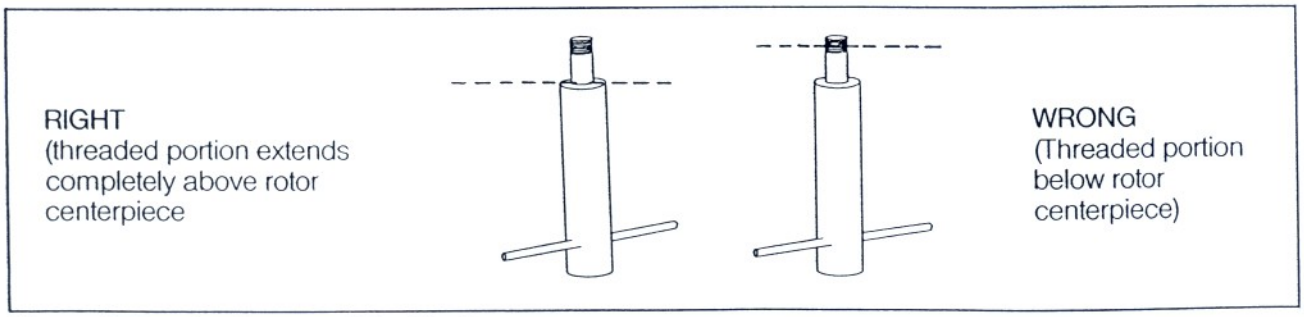


Figure 13. Seating Rotor on Drive Shaft

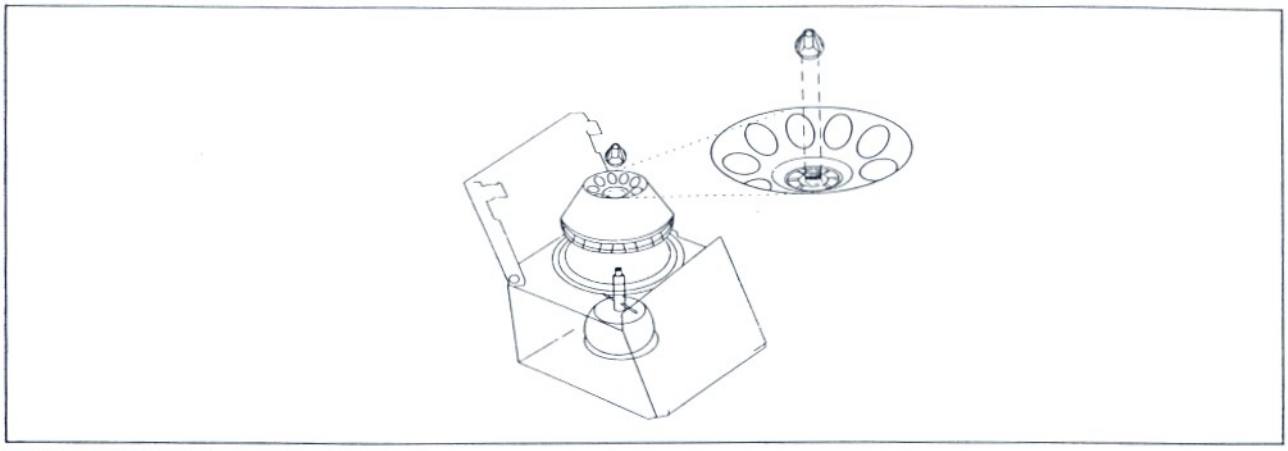


Figure 14. Rotor Installation Procedure

3.6. Rotor Tube Adaptors

The **Clinifuge** rotor is designed to hold 5 ml., 7 ml., 10 ml., 12 ml. and 15 ml. tubes.

Tube adaptors and inserts (Section 1.3, Fig. 5) are available as optional equipment and tubes must be positioned as follows:

- 10, 12 and 15 ml. tubes may be placed directly into the rotor without adaptors
- 7 ml. tubes must be loaded into adaptors without inserts before being positioned in the rotor (See Figure 16)
- 5 ml. tubes must be loaded into adaptors which have been fitted with inserts before being positioned into the rotor (See Figure 15)

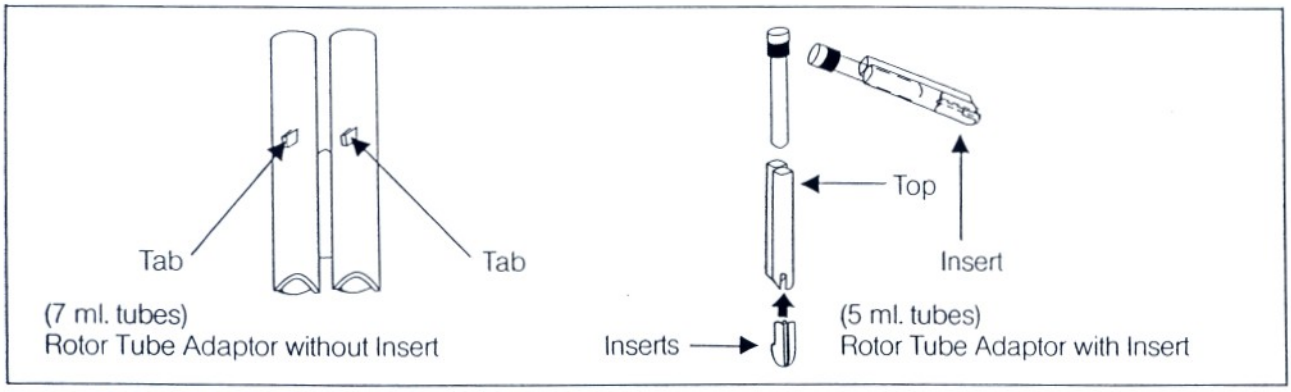


Figure 15. Rotor Adaptors with and without Inserts

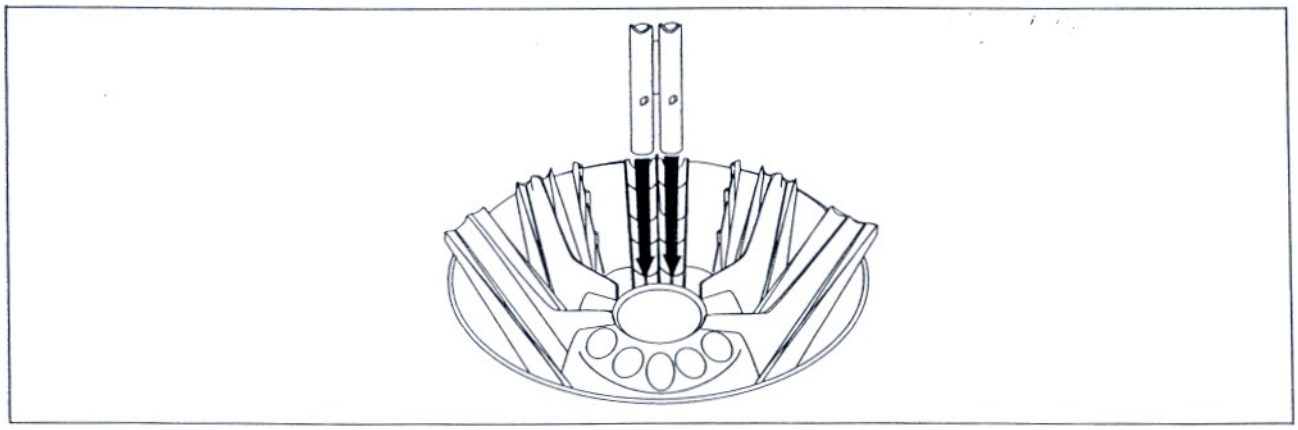


Figure 16. Tube Adaptors Loaded in Rotor

4. PROPER ROTOR BALANCING AND LOADING

WARNING! The rotor must always be symmetrically balanced when loading.

In case of imbalance (caused by tube breakage or non-symmetrical loading), press the STOP key immediately, pull the plug or turn off circuit breaker.

To maintain symmetrical balancing, insert tube adaptors in all empty opposing slots.

4.1. Positioning Tubes for Symmetrical Balancing

For correct balance in loading the rotor, tubes and adaptors must be placed exactly opposite tubes (and adaptors) of equal size and weight.

The maximum allowable difference in weight between opposing tubes (and adaptors, if used) is one gram.

Glass tubes have different wall thicknesses and, therefore, hold different volumes. This must be taken into consideration when positioning tubes in the rotor.

CAUTION! G-forces vary from rotor to rotor. To prevent breakage, observe tube manufacturer recommendations. Tubes made of Polystyrol tend to break at very low g-forces.

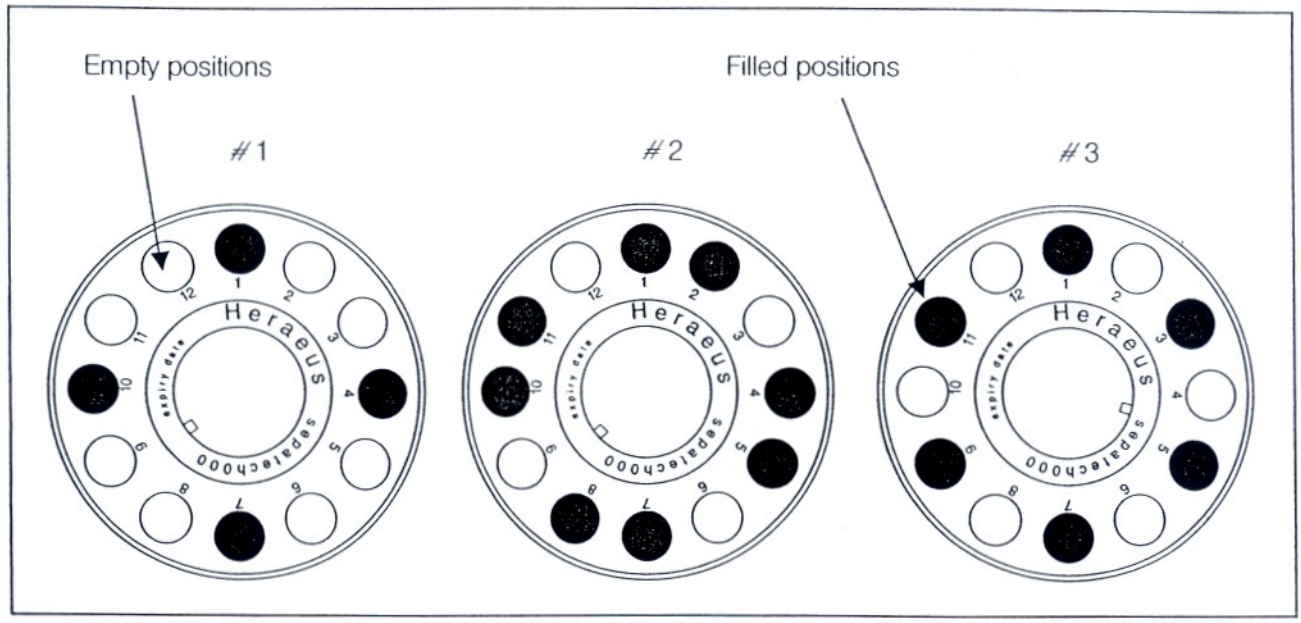


Figure 17. Correct Tube Positions

NOTE: When using either flared top, 12-ml. or 15-ml. tubes, load symmmetrically in every other position for proper balance. (See # 3)

4.2. Positioning Tube Adaptors

Tube adaptors for 5 ml. tubes and 7 ml. tubes must be installed before loading tubes into the rotor.

To position adaptors:

1. Before loading, separate the two halves of the rotor. (See Section 3.3)
2. Turn the rotor top upside down and place on a flat surface.
3. For 7 ml. tubes, insert each adaptor pair pointing the flat ends down with the two tabs turned extending into the center of the bowl. Secure each adaptor by pushing firmly into the rutted sleeves.

   For 5 ml. tubes, push the flat end of the inserts into the curved openings in the adaptor, sliding the side tabs on the insert into the grooves in the adaptor. Follow # 3 to position the adaptor inside the rotor.

   To remove inserts, push a pencil or similar tool through the open end in the adaptor.

WARNING! When loading adaptors, opposite sides of the rotor must be equally balanced in weight. (See Section 4, Proper Rotor Balancing and Loading.)

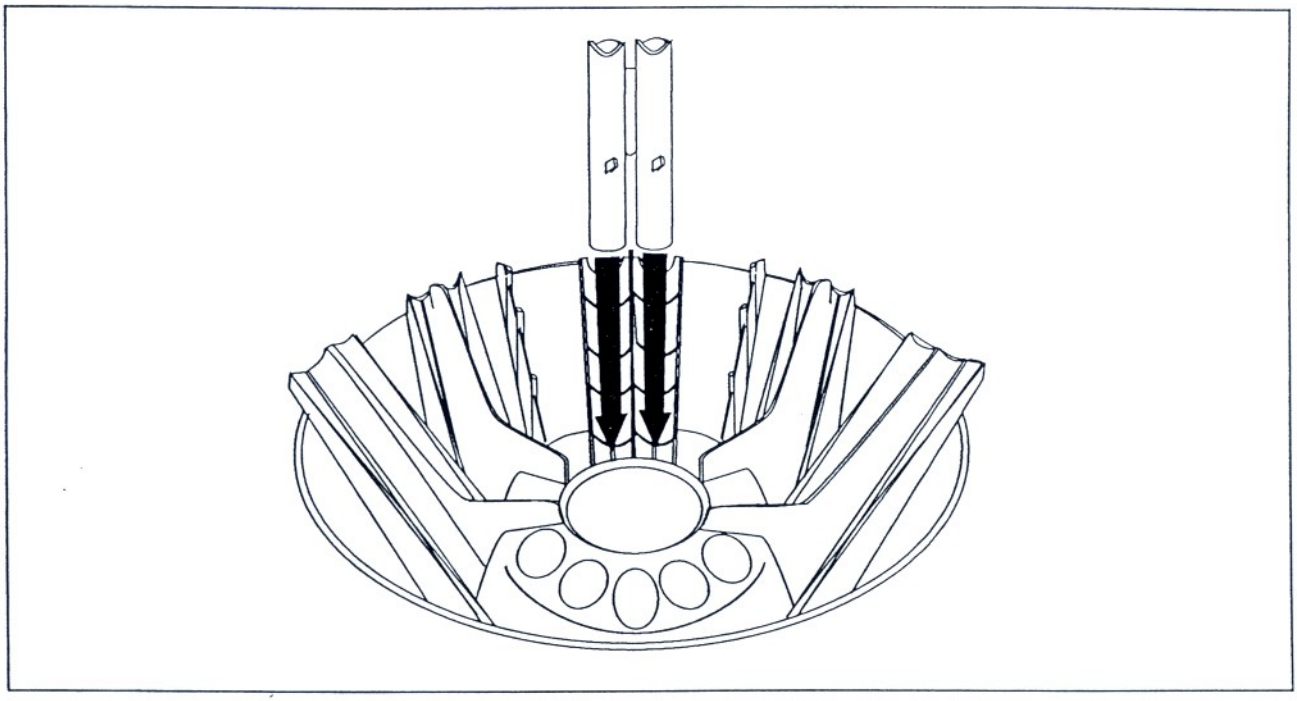


Figure 18. Loading Tube Adaptors into Inverted Rotor Top

5. OPERATING AND PROGRAMMING PROCEDURES

5.1. Opening the Lid

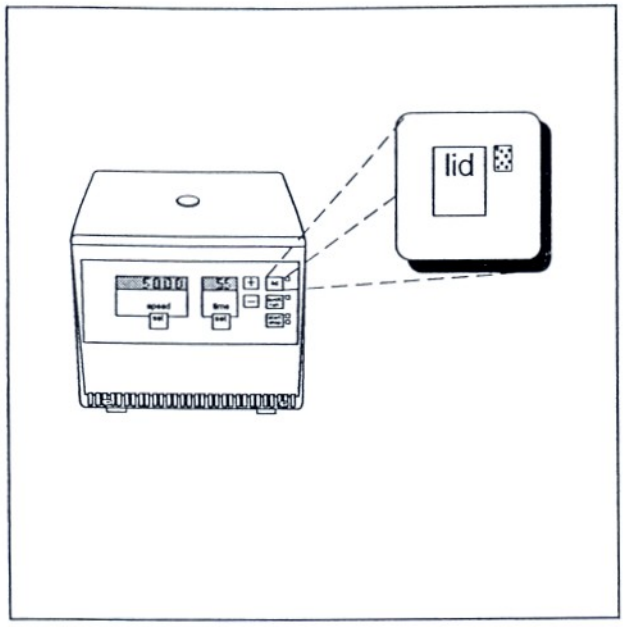


Figure 19. LID Key

The lid can be opened only when the braking process is completed and the yellow **LID** LED goes on. To open, press the **LID** key pad. The lid will pop up automatically.

Once the unit starts, the **LID** key is disabled for the entire operating cycle.

NEVER TRY TO OPEN THE LID WHILE ROTOR IS TURNING. (See **Emergency Lid Opening Procedure.**)

NOTE: In case of power failure, the **LID** key pad cannot be used to open the lid. Follow **Emergency Lid Opening Procedure**, Section 2.7, Fig. 7.

5.2 Start/Stop

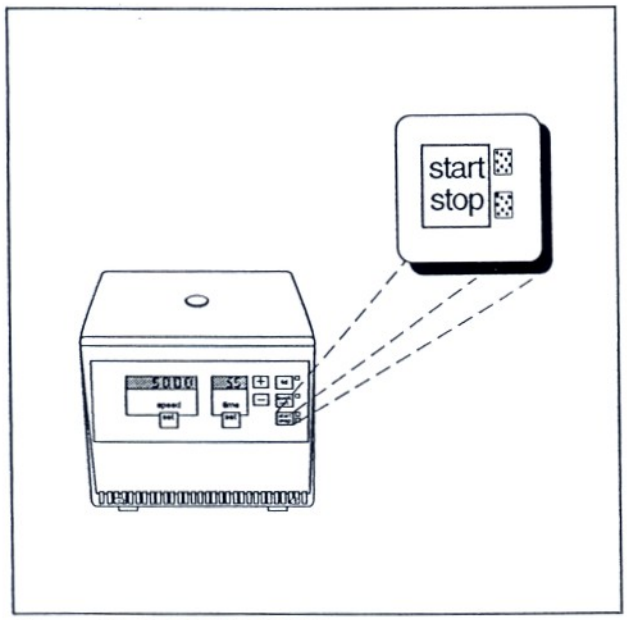


Figure 20. START/STOP Key

When the green **START** LED is on, centrifugation may be started by pressing the **START/STOP** key pad. When the rotor starts turning, the green **START/STOP** LED goes off and the red LED goes on, indicating the **STOP** function is available.

When the cycle is completed and the braking cycle has ended, the green **START** LED and yellow **LID** LED will both illuminate, indicating that the unit may be opened or another cycle may be started.

To stop centrifugation, press the **START/STOP** key pad when the red LED is illuminated.

After each stop, the green **START** LED lights up again, indicating that the interrupted cycle may be continued at any time. If START is pressed during the braking cycle there will a delay before the Clinifuge begins to accelerate.

5.3. Quick Run

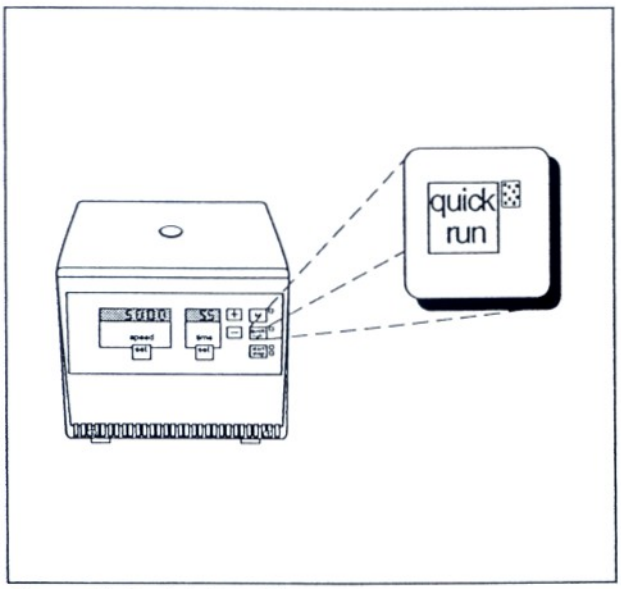


Figure 21. Quick Run Key

If the green START LED is on, centrifugation may also be started with the QUICK RUN key. To operate in QUICK RUN mode, press and hold the QUICK RUN key for the required length of time. While the QUICK RUN key is pressed, the rotor accelerates gradually to its highest speed. Centrifugation continues until the key is released, which causes the rotor to brake immediately.

If QUICK RUN is pressed again, acceleration will be re-activated.

The QUICK RUN key may be used for runs requiring less than one minute. (Braking will still require the same time.)

The QUICK RUN key may also be used to override the speed set in programming)

5.4. Speed Selection

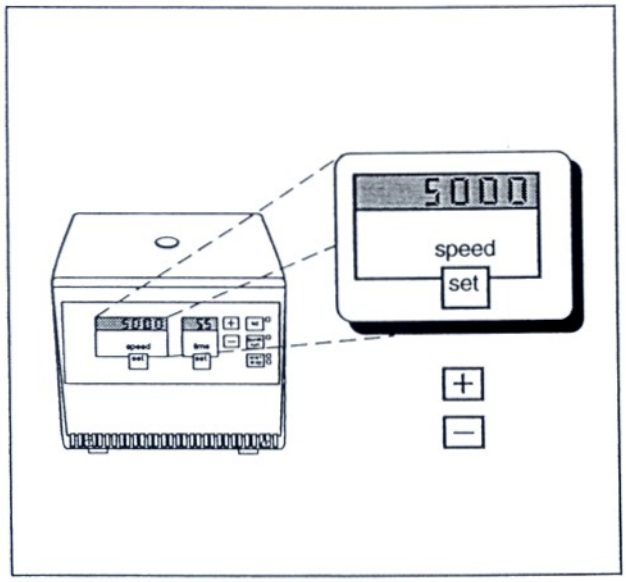


Figure 22. Speed Selection Keys

Speed is adjusted in gradations of 100 revolutions per minute.

Speed settings are retained in the unit's memory during standby periods, and need be entered only if changing the previously set value.

When the centrifuge is in Standby Mode, the display screens for TIME and SPEED are blank. To activate, press the SET key pad in the SPEED field. The previously set speed will appear, flashing the digit in the 100ths position in the speed display window.

Set the new speed up or down using the "+" or "–" keys.

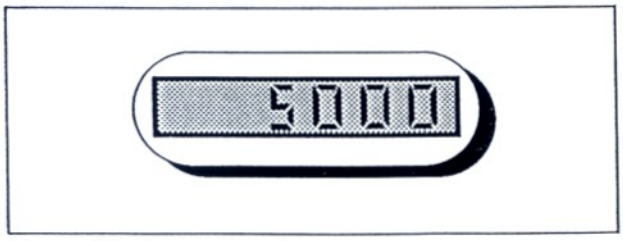


Figure 23. Speed Display

After entering the new speed, press the SET key pad in the SPEED field again to replace the previously set speed in memory. The speed setting mode is complete.

5.5. Time Selection

5.5.1. Timed Settings

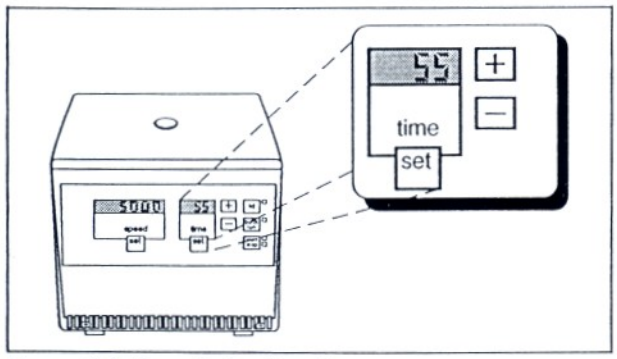


Figure 24. Time Selection Keys

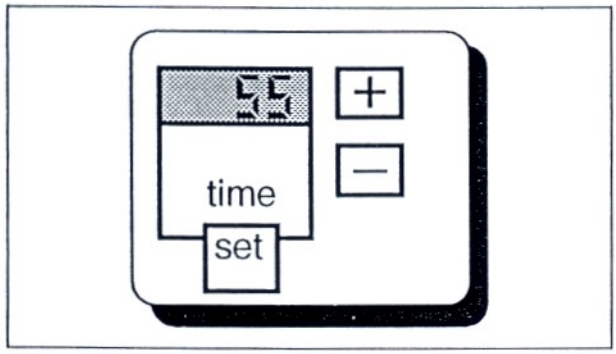


Figure 25. Time Display

The time setting is displayed in the TIME field and is activated by pressing the SET key pad in the TIME field.

Time settings are retained in memory during standby periods, and need be entered only if changing the previously set value.

When the centrifuge is in standby mode, the time display screen is blank. To activate, press the SET key pad in the TIME field. A red zero will appear. Press the SET key pad again. If the time is not set from previous operations, a red "hd" (hold) message will begin to flash. If set previously, the previous time setting will begin to flash.

The flashing position may be changed in one-minute gradations up or down by using the "+" or "–" key pads. Runs may be programmed from 1-99 minutes.

5.5.2. Untimed Runs

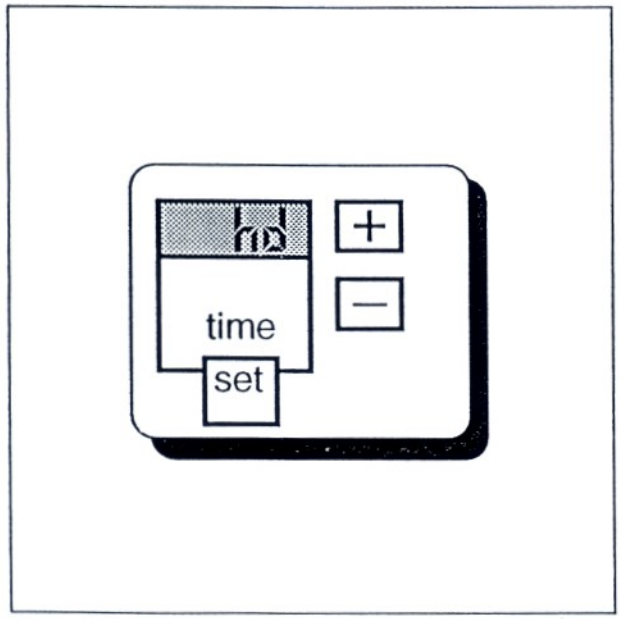


Figure 26. "hd" Time Display

If continuous operation is required, enter the "hd" (hold) function in the time display.

To enter the "hd" setting, press the "–" key pad several times, then press the SET key in the TIME field until "hd" appears on the screen in the TIME field.

When "hd" appears, press START. To end, push STOP.

An untimed run will continue until the operator stops the centrifuge.

6. MAINTENANCE

6.1. Cycle Counter Checkup

The **Clinifuge** Centrifuge is equipped with a cycle counter which the microprocessor automatically steps up each time a cycle is completed. A cycle is defined as: acceleration, run at speed, and deceleration to rest, regardless of the run duration.

The number of cycles recorded may be checked at any time by closing the lid and pressing both SET keys at the same time.

The remaining rotor cycles will be displayed.

The cycle counter may be used to maintain routine inspection schedules.

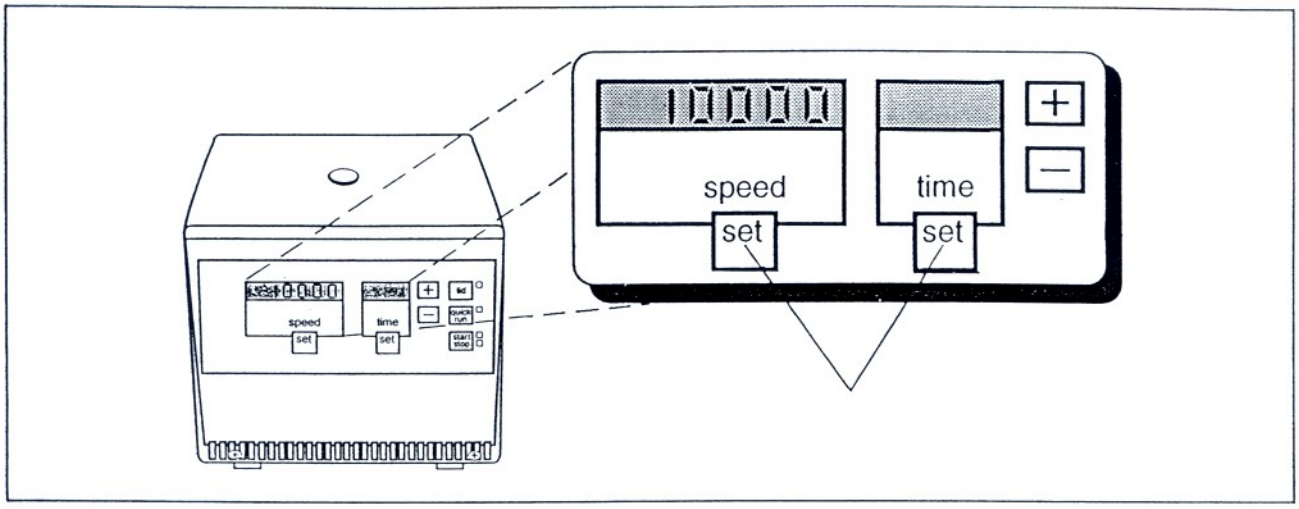


Figure 27. Cycle Counter

NOTE: The microprocessor counts the cycles upward from zero to 10,000 at which point the rotor must be replaced (running down of the rotor's working life).

After each 10,000 cycles, contact Baxter Scientific Products for replacement of the rotor.

6.2. Rotor Exchange

The Clinifuge rotor must be replaced after 10,000 cycles or no later than the Expiration Date stamped on the rotor (See Fig. 28).

NOTE: Rotors cleaned with bleach or alkaline-based cleaners must be replaced after every 5,000 cycles.

6.3. Rotor Expiration Date Stamp

To locate the expiration date, separate the two parts of the rotor. The words "Expiry Date" and a circular calendar are molded into one of the segments in the rotor base. The 2-digit number in the center indicates the expiration year. The point of the arrow indicates the expiration month. (See Fig. 28.)

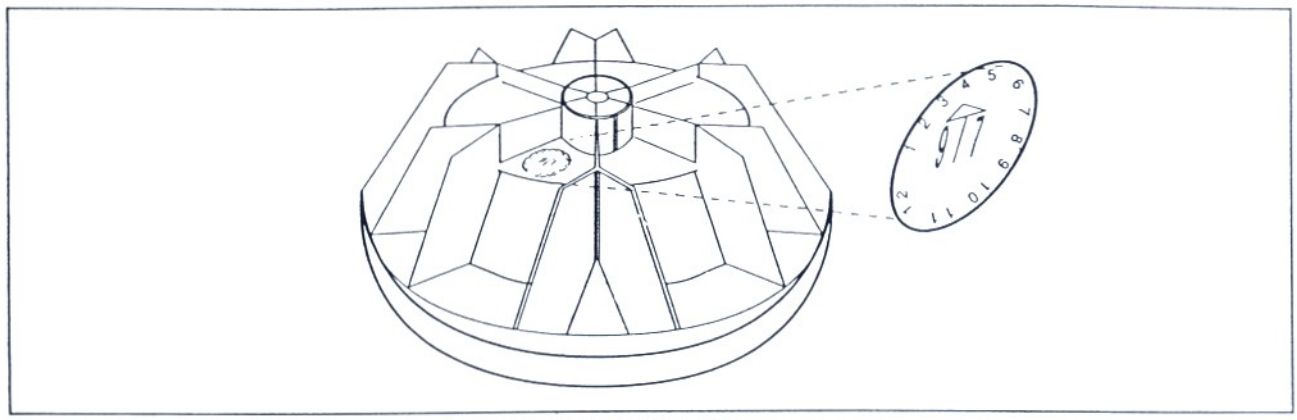


Figure 28. Expiration Date Stamp (for this example: april 1997)

6.4. Routine Cleaning Procedure

1. Press the LID key and open the lid.
2. Unplug the centrifuge from the power source.
3. Check for glass splinters or spilled liquid following laboratory safety guidelines.
4. Clean the exterior and all plastic surfaces using a cloth moistened with non-corrosive liquid.
5. Remove the locking nut by turning counter-clockwise, and lift the rotor out by inserting index fingers into holes and pulling rotor straight up.
6. Place rotor on a flat surface and press thumbs into centerpiece to separate top and bottom rotor sections. (See Section 3.3, Fig. 11)
7. Polypropylene rotors may be cleaned in a dishwasher at acceptable temperature ranges.
8. Before re-installing the rotor check that the motor cover is correctly in place.
   Check that the rotor turns freely before operation.

WARNING! Alkaline cleaning reagents such as bleach will affect rotor durability.
(See Section 6.2, Rotor Exchange.)

6.5. Decontamination Requirements

Infectious Materials

If infectious material leaks into the unit, disinfect using a non-alkaline disinfectant, following laboratory safety guidelines.

In case of contamination, the rotor may be autoclaved for a maximum of 20 times at 121°C. (482°F.), after which it must be discarded.

Before opening a centrifuge suspected of being contaminated, refer to the laboratory safety guidelines in Read Me First Section.

WARNING! No known test method can offer complete assurance that products derived from human sources will not transmit infection. Therefore, all human-sourced materials should be considered potentially infectious.

6.6. Shipping Requirements

When shipping the Clinifuge, use only the original packaging or a packaging of good quality. Heraeus will not accept liability for damage caused by incorrect transport packing.

Decontamination is required any time the unit is returned for servicing. Contact Heraeus Customer Service for return authorization and instructions.

7. TECHNICAL DATA

7.1. Electrical Line Supply – Model No. C 3538

120 Volts (+10%, –15%)	1.0 Amps
60 Hertz	65 Watts

7.2. Rotor Characteristics – Model No. 3760

Rotor Material	Polypropylene
Maximum Load Capacity	6 x 15-milliliter tubes 6 x 12-milliliter tubes 12 x 10-milliliter tubes 12 x 7-milliliter tubes with optional tube adaptors 12 x 5-milliliter tubes with optional tube adaptors
Maximum Tube Length	100 mm x 12 tubes, 131 mm x 6 tubes
Maximum Speed	5000 revolutions per minute
Maximum Relative Centrifugal Force (RCF)	2600 x g
Maximum Radius	9.6 centimeters
Maximum allowed imbalance	1 gram (.035 ounces)
Rotor Angle	38 degrees

7.3. Clinifuge Performance Features

Maximum speed	5000 revolutions per minute (rpm)
Minimum speed	1600 revolutions per minute
Maximum Relative Centrifugal Force (RCF)	2600 x g
Speed display	5-digit display indicates revolutions per minute (rpm)
Speed selection	Adjustable in stages of 100 rpm
Time display	2-digit display registers seconds or minutes
Time Selection (2 modes)	
1. "hd" Mode (hold)	Sets for continuous runs for unlimited time.
2. Minute Mode	Adjusts time setting in one-minute gradations up or down from 1-99 minutes
Lid opening key	For safety, the lid will not open while rotor is spinning.
Quick-run key	Accelerates rotor to maximum speed then brakes immediately when released. The QUICK-RUN key may also be used to override the speed set in programming.
Diagnostic status messages (See Trouble-Shooting Guide)	1. Lid open LID 2. Error codes (E-XX) 3. Speed and time settings 4. Braking (br)
Drive Motor	Maintenance-free, induction drive motor
Data Storage	Speed and time settings
Data Memory	With NV-RAM
Dimensions	H x W x D (9-1/4" x 10-1/2" x 14-3/4")
Weight	14.5 kilograms (32 pounds)

7.4. Environmental Requirements

Allowable room temperature ranges:

– during operation	4°C. – 35°C. (39° – 95° F.)*
– during storage or shipping	–10°C. – 50°C. (14° – 122° F.)
– maximum highest sample temperature	15°C. above ambient temperature

* Do not use where high humidity causes condensation.

8. TROUBLE-SHOOTING GUIDE

If malfunction occurs, try to correct the problem using the instructions in the following Trouble-Shooting Guide. If the problem persists, call Heraeus Instruments at 1-800-441-2554 or FAX details to 1-908-754-9494.

INDICATION	SYMPTOM	POSSIBLE CAUSE	REMEDY
All displays remain dark	1) Lid cannot be opened at rest	1) Unit is not supplied with power	1) Check main power switch under left side of bottom plate. For lid unlocking, see Emergency Lid Opening (Section 2.7, Fig. 7)
	2) Drive is cut off, rotor coasts to rest	2) Power failure during run	2) Check electrical supply cord connection. If in order, call Heraeus Technical Support.
Unusually loud running noises	Often accompanied by heavy vibration		**Press STOP key immediately. Open lid only when rotor has reached a complete stop.**
		1) Locking nut loose	1) Tighten locking nut. If nut does not engage properly, remove rotor and re-install rotor.
		2) Incorrect rotor installation	2) Remove rotor from drive shaft and re-install being careful to line up the cross pin on the drive shaft with the matching groove in the rotor base. Replace the locking nut and tighten. **ATTENTION: The rotor top must be correctly placed onto the rotor base.** (Section 3.4, Fig. 12)
		3) Rotor is loaded unsymmetrically.	3-4) Check rotor loading. Opposite sides must be balanced. For maximum allowable imbalance, see Section 7.2, Rotor Characteristics
		4) Sudden imbalance following tube breakage	
Display shows LID	Drive is cut off, rotor coasts to rest	Lid open during run	Wait till rotor stops. Switch power OFF and ON. Check lid. If error recurs, call Heraeus Technical Support.
Display shows OPEN	Lid appears closed but no start	Lid locking system is not activated	Check lid closure. Lid must be closed tightly on **both sides**. If the OPEN message remains in the display, call Heraeus Technical Support
Display shows a flashing red dot in the TIME field	Centrifuge is at rest; no other displays are illuminated.	Centrifuge in Standby Mode	The Standby Mode saves electrical energy. Press any key to reactivate the normal operating mode.
Display shows E-1 or E-12	All function keys are out of order	Error on main board, wrong or defective NV-RAM	Switch power OFF and ON again. If the error message remains in display, call Heraeus Technical Support.

INDICATION	SYMPTOM	POSSIBLE CAUSE	REMEDY
Display shows E-3	Drive is cut off, rotor coasts to rest	Motor safety circuit has tripped because no braking current is flowing	1) **Lid open during braking phase.** For remedy, see **LID** display. (Section 2.8.) 2) **Overheated motor** (Possible causes: Excessively high room temperature or insufficient air cooling). Switch power OFF and let the unit stand for 30 minutes. Check all vent holes and clean the small vent holes in the front panel using a paint brush. Then switch **ON** and start again. 3) If the centrifuge will not start 30 minutes later, it is a problem with the braking current. Call Heraeus Technical Support
		Error on main board	Replace main board
		Motor defect	Replace Motor
Display shows "br"	Power is turned on, centrifuge will not run, humming sound is heard.	Centrifuge power was lost during run.	Allow centrifuge to finish complete braking cycle. Display will return to normal.

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