

# ***SILENCER***®

## **TANK-R & ROVER-R Series**

### **Instruction Manual**



Proudly designed and manufactured in the great United States

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Global Focus Marketing & Distribution, Ltd.

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## Chapter 1

# Getting Started

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## SCOPE

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This manual contains information with regards to application, installation, operation, and care of the Silencer<sup>®</sup> TANK-R benchtop and ROVER-R floor model refrigerated centrifuges, and must be read prior to setup or operation of the centrifuge.

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## UNPACKING AND INSPECTION

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Your new Silencer<sup>®</sup> centrifuge is packed in a specially designed shipping carton. Upon arrival please check the condition of carton and note any damage. Keep all packing materials for the warranty period of the centrifuge.

After unpacking your Silencer<sup>®</sup> carefully inspect it for damage. It is your responsibility to report all damages to the transportation company and filing, if necessary, any damage claims.

At this point take a moment to ensure you have received the correct rotor, tube adapters, etc. If not or if you have any questions regarding compatibility with your tubes, please contact GFMD, Ltd. at 800-323-4306 before proceeding.



### **WARNING**

Do not operate this equipment in a combustible atmosphere!

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## SETUP

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For your own safety and to prevent damage to the centrifuge, be sure to read this manual before continuing with setup or operation of this centrifuge.

For smooth operation and long equipment life, choose a stable and level location.

Avoid sources of heat and/or moisture such as sinks, water baths, heating ducts, and direct sunlight. A suitable environment is 20° to 25° C (68° to 77° F) with a relative humidity range of 30% to 60%. The minimum clearance is 6" on all sides. A cooler ventilated location will allow the refrigeration unit to operate more efficiently thereby reducing maintenance.

Plug the power cord into a properly grounded outlet and turn on main power interrupt (on back of unit next to power cord). For safety, equipment life, and proper performance, your Silencer<sup>®</sup> TANK-R / ROVER-R's power requirements are 115V AC, 15 amperes, 60Hz. The power cord must be UL listed or CSA certified, 14 AWG, and 6' 7" or less in length.



### **WARNING**

Operating the centrifuge without proper grounding can cause dangerous electrical conditions and could result in serious operator injury!

# Getting Started

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## **CAUTION**

Operation of centrifuge on an emergency power circuit can cause damage to electronic circuits.

## **CAUTION**

Operation of centrifuge on a power strip increases ground resistance and can cause damage to electronic circuits.

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## **ROTOR INSTALLATION**

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Insert the rotor onto the motor shaft ensuring the alignment pin in the motor shaft fits correctly into the alignment groove in the bottom of the rotor. The rotor must be installed correctly for proper operation.

Replace the rotor securing nut. The nut must be securely tightened.

## **WARNING**

Failure to securely tighten the rotor securing nut may result in damage to the centrifuge and/or operator injury!

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## **ROTOR IMBALANCE SENSOR**

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The rotor imbalance sensor is factory preset, but may require minor adjustment upon installation. Contact GFMD, Ltd. at 800-323-4306 for assistance if adjustment is required.

## Chapter 2

# About The TANK-R / ROVER-R

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## PURPOSE

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The Silencer<sup>®</sup> TANK-R / ROVER-R is a quiet, general purpose centrifuge designed to be used to accelerate sample separation through the application of relative centrifugal force (RCF). This product is not intended to diagnose, treat, cure or prevent any disease.

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## DESCRIPTION

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The direct drive system employs a powerful, specially designed, balanced, brushless motor ensuring a smooth quiet operation spanning the full speed range of the instrument. This design also promotes long bearing life and eliminates brush maintenance, thereby reducing operating costs.

Excellent stability against imbalance is achieved due to special vibration absorbing drive assembly mounts.

The operator and the TANK-R / ROVER-R are protected by several safety features:

- The centrifuge cannot be started with the lid open.
- The centrifuge will not run if the lidlock fails to securely lock.
- Once the rotor is in motion the lid cannot be opened until the rotor has stopped.
- The see-through high-strength lid allows the operator to view the rotor chamber without opening the lid.
- The high-strength alloy rotor chamber is strong and easy to clean.
- The imbalance detector shuts the centrifuge down in case of a severe imbalance and gives the operator a visual indicator.

For complete equipment specifications see Appendix A.

## Chapter 3

# Using The TANK-R / ROVER-R

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## ORIENTATION

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Take time now to acquaint yourself with the TANK-R / ROVER-R's displays and controls. The basic operation is very simple and the controls are mostly self-explanatory.

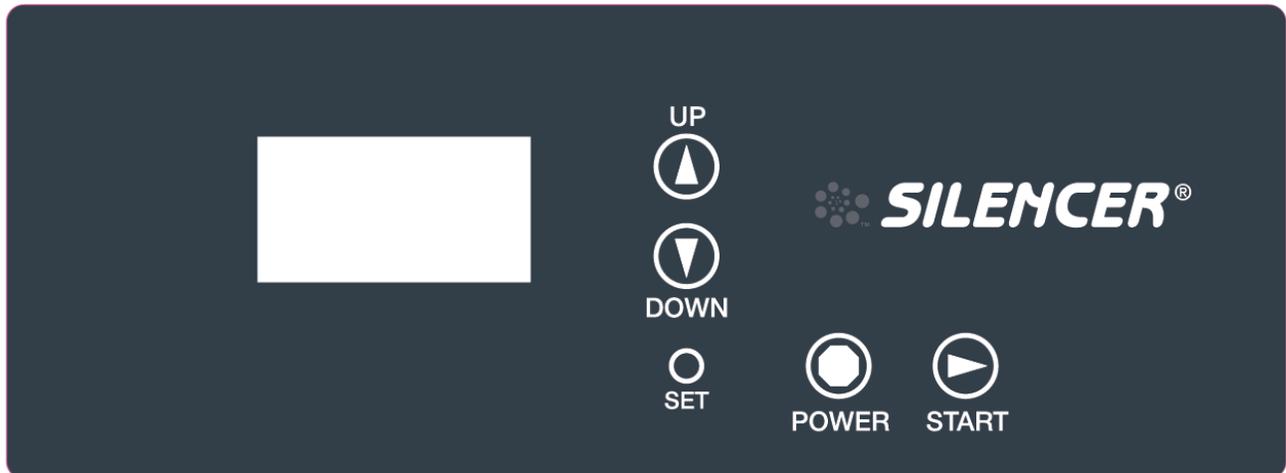


Figure 3.1



## WARNING

Turning the power off does not remove power to the centrifuge. Remove all power to the unit by unplugging the power cord.

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## CONTROLS

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### POWER

Press the POWER button once to bring the unit out of SLEEP mode and into STANDBY mode. This unlocks the lid and turns the display on. Pressing the POWER button while the power is on turns the display off and puts the unit into a low power SLEEP mode.

Pressing the POWER button during a run cycle stops the cycle.

Pressing the POWER button while in any SET mode cancels and returns the centrifuge to the STANDBY MODE.

### SET

Press to enter the SET POINT mode

### UP

Press the UP button to increase the value of the selected item.

# Using The TANK-R / ROVER-R

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## DOWN

Press the DOWN button to decrease the value of the selected item.

## START

If pressed when the unit is in the STANDBY mode, the START button will start the run cycle, which is indicated by the display going into inverse mode (dark background and light text).

Pressing the START button while in any SET mode will accept changes and return to the STANDBY mode.



## WARNING

Do not operate this equipment in a combustible atmosphere!

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## OPERATION

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Chapter 1 must be read and the TANK-R / ROVER-R must be setup accordingly before continuing.

Press the POWER button to bring the centrifuge out of the SLEEP mode, turn the display on, and unlock the lid.

2000 RPM / 800 x G
5 MINUTES
+25 C

The set speed, time, and temperature defaults to the last saved speed, time, and temperature setting. The settings can be changed in the SET POINT mode or a saved program can be recalled in the PROGRAM RECALL mode. The displayed temperature during standby or run will be the actual temperature.

Open the lid and load your samples, taking care to maintain a balanced load. A rotor must never be run with buckets missing. The rotor and four buckets are a five piece, balanced system. All opposing loads must balance to within 10 grams. If opposing buckets are run with a partial load of tubes in their inserts, the tubes must be arranged symmetrically both with respect to the pivotal axis of each bucket, and across the center of rotation.

Care must be taken to ensure that plastic tubes are loaded opposite plastic tubes and glass tubes are loaded opposite glass tubes due to the considerable difference in weight of plastic and glass.

For examples of balanced and unbalanced loads, see Fig. 3.2.

Balanced Loads ..... 1, 2, 3, 4, 5, and 6.

# Using The TANK-R / ROVER-R

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Unbalanced Loads ..... 7, 8 and 9.

Close the lid and press the START button. The lidlock will engage, the display will show the actual speed, and the centrifuge will accelerate to the set speed. Upon reaching the set speed the time will start counting down, and the display will show the time remaining.

When the set time has elapsed, the centrifuge will decelerate to a stop.

When the rotor has come to a complete stop the lidlock will release, and display will revert back to set speed and time.

---

## SET POINT

---

The SET POINT mode shows the current speed and time settings.

**NOTE:** The current settings can not be changed if the centrifuge is in the LOCKED mode.

```
SET POINTS
▶ RPM: 2000 RCF: 0800
  TIME: 005 MINUTES
  TEMP: +025 C
```

The currently selected item is indicated with an arrow. To select another parameter for modification press and release the SET button.

Modify the selected parameter by pressing the UP or DOWN button.

Cancel changes by pressing the POWER button.

Accept the changes and return to the STANDBY mode by pressing the START button.

If you wish to save these settings press and hold the SET button for approximately two seconds to enter the PROGRAM STORE mode (indicated by three short beeps).

---

## PROGRAM STORE

---

The PROGRAM STORE mode displays the three program locations.

```
PROGRAM - STORE
▶ PROG NUMBER: 1
  PROG NUMBER: 2
  PROG NUMBER: 3

RPM    TIME
2000   005
```

# Using The TANK-R / ROVER-R

---

The currently selected program is indicated with an arrow. Press the SET button to select another program location.

The current saved speed and time for the selected program is displayed below the program list.

Press the POWER button to cancel programming and return to the STANDBY mode.

Press the START button to store the settings into the selected program location and return to the STANDBY mode.

---

## PROGRAM RECALL

---

Press and hold the SET button for approximately 2 seconds to enter the PROGRAM RECALL mode (indicated by three short beeps).

The PROGRAM RECALL mode displays the three selectable programs.

```
PROGRAM - RECALL
▶ PROG NUMBER: 1
  PROG NUMBER: 2
  PROG NUMBER: 3

RPM      TIME
2000     005
```

The currently selected program is indicated with an arrow. Press the SET button to select another program location.

The programmed speed and time for the selected program is displayed below the program list.

Press the POWER button to cancel program selection and return to the STANDBY mode.

Press the START button to accept the program selection and return to the STANDBY mode.

---

## SETTINGS MENU

---

Press the POWER button to put the centrifuge into the SLEEP mode (indicated by one beep).

Press and hold the SET button while pressing and releasing the POWER button.

Continue to hold the SET button until the unit enters the SETTINGS MENU (indicated by 2 short beeps)

Release the SET button.

# Using The TANK-R / ROVER-R

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```
SETTINGS MENU
▶ BEEPS (EOR):      1
  BEEPS (error):    5
  RCF MODE:         OFF
  BRAKES:           9
  OPTIONAL EOR LED: 2
```

The SETTINGS MENU shows the current user settings.

The currently selected item is indicated with an arrow. To select another parameter for modification press and release the SET button.

Modify the selected parameter by pressing the UP or DOWN button.

Accept the changes and return to the STANDBY mode by pressing the START button.

## **BEEPS (EOR)**

This determines the number of times the centrifuge will beep at the end of each run. The default is 1 and the allowable settings are 0 to 9.

## **BEEPS (error)**

This determines the number of times the centrifuge will beep when an error is incurred. The default is 5 and the allowable settings are 5 to 9.

## **RCF MODE**

This allows the operator to choose how speed will be set. If the RCF MODE is OFF the speed is set by RPM in 100 RPM increments. If the RCF MODE is ON the speed is set by RCF in increments of 10xg.

## **BRAKES**

This adjusts the braking level. The default is 9 and the allowable settings are OFF to 9.

## **OPTIONAL EOR LED**

This setting has no effect unless the optional End of Run Light is installed. This setting determines the length of time (in minutes) that the green LED will remain on at the end of each run. The default is 2 and the allowable settings are 0 to 99.

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## **OPERATION TIPS**

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- Do not drop or slam the lid!
- Use the emergency lid lock release only for emergencies.
- Only use the supplied emergency lid lock release tool.

# Using The TANK-R / ROVER-R

- Unplug the centrifuge before using the emergency lid lock release tool.
- Keep the lid closed except when loading and unloading.

If there are any questions regarding operation please contact GFMD, Ltd. at 800-323-4306.

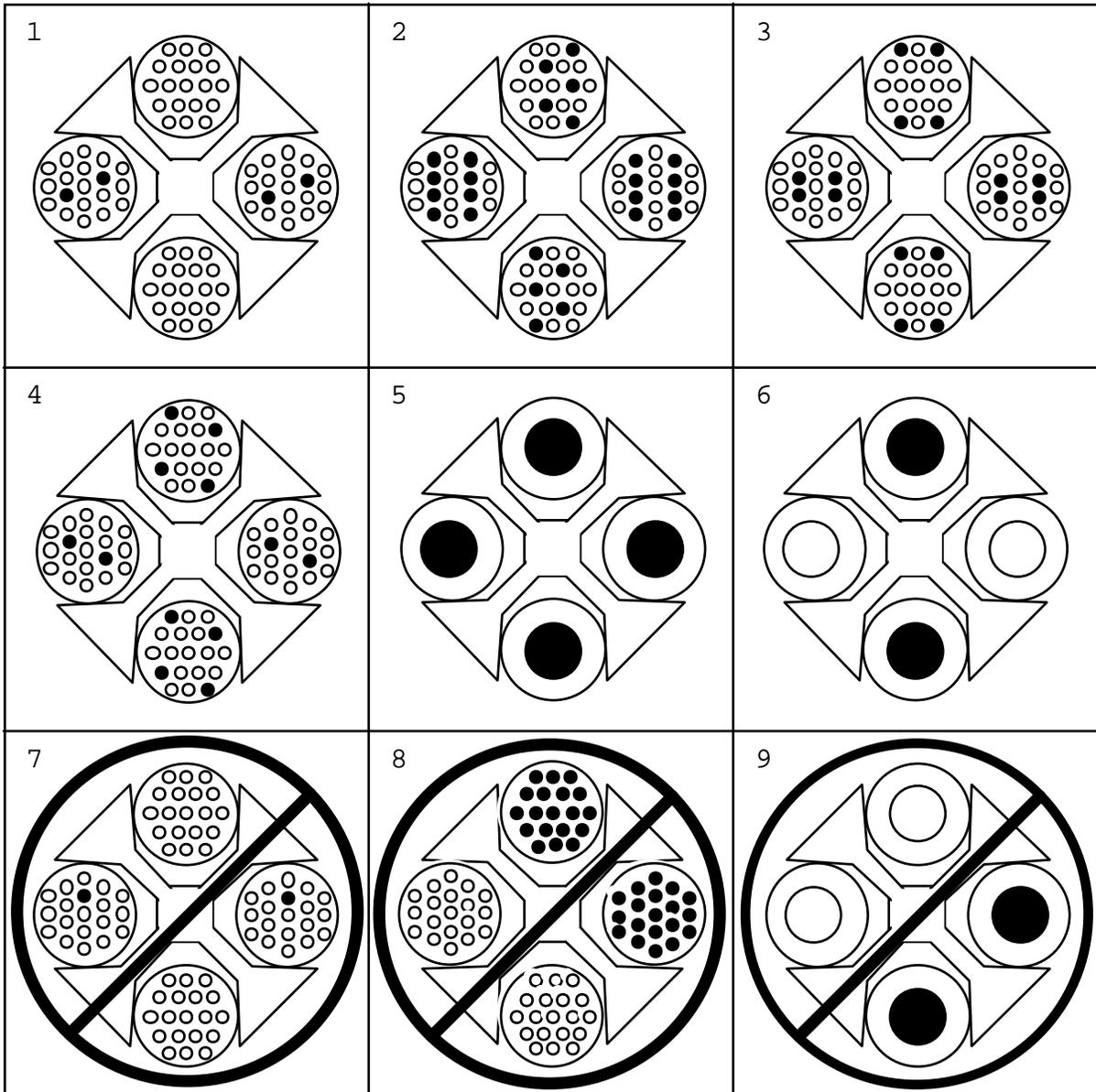


Figure 3.2

# Using The TANK-R / ROVER-R

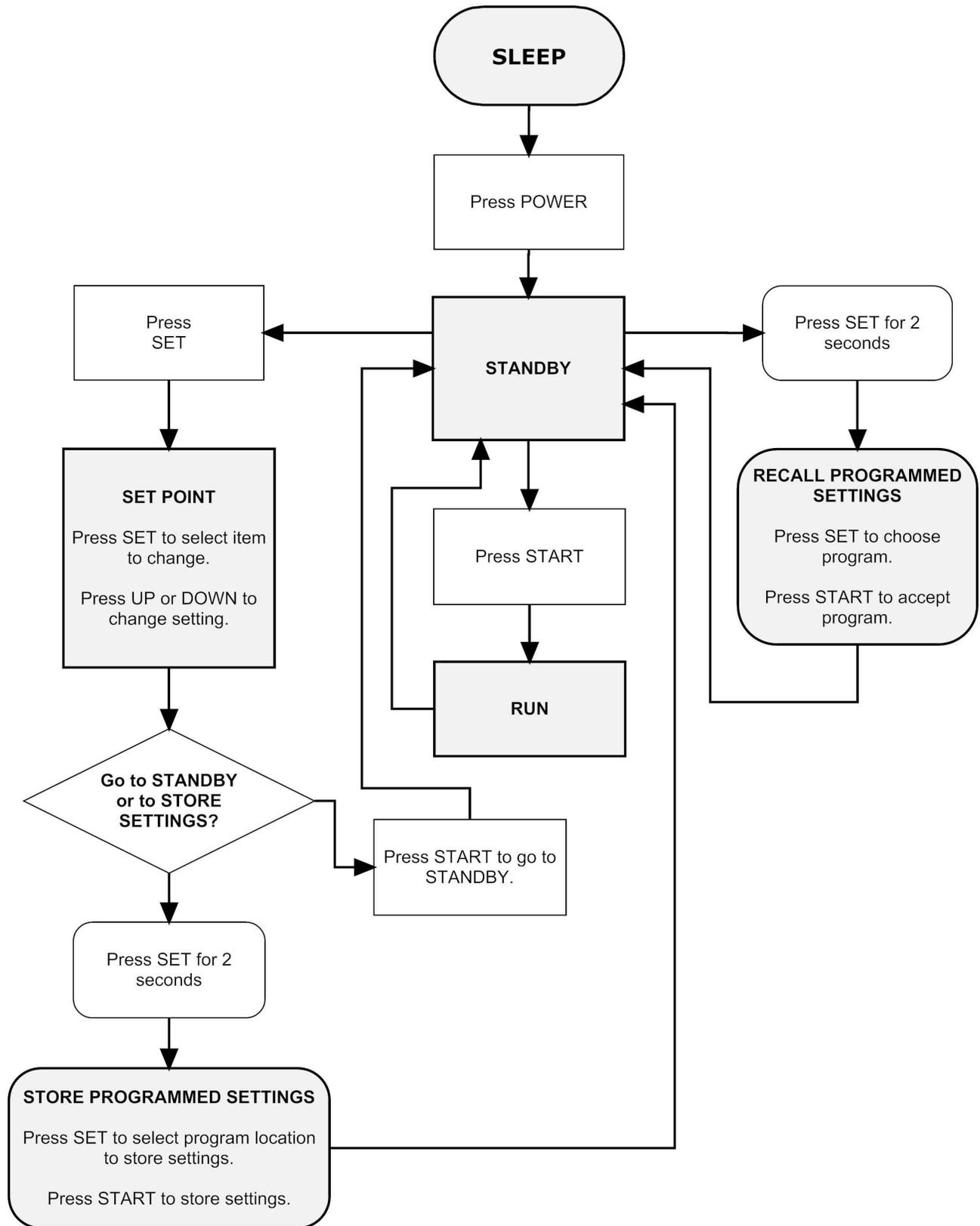


Figure 3.3

# Care Of The TANK-R / ROVER-R

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**⚠ WARNING** Turning the power off does not remove power to the centrifuge. Remove all power to the unit by unplugging the power cord.

**⚠ WARNING** Standard safety precautions for handling of biological hazards must be followed!

**CAUTION** Do not get any liquids into the top of the motor. Many disinfectants are extremely corrosive and may damage the motor.

**CAUTION** Allowing liquid levels in the rotor chamber to rise to the bottom of the motor seal may result in serious damage to the centrifuge.

**CAUTION** Use of disinfectants with PH >8 is not recommended.

- The rotor must be removed from the centrifuge for disinfecting. The rotor can be disinfected with PH neutral disinfectants if rinsed and dried prior to use. The disinfectant manufacturer's instructions must be followed. Do not use if the disinfectant manufacturer warns against use on aluminum, stainless steel, or neoprene.

- Clean tube breakages and spills immediately and thoroughly. The interior can be disinfected with PH neutral disinfectants. Disinfectants such as bleach can be used for the rotor chamber only. The interior must be rinsed and dried thoroughly before using the centrifuge. Use water sparingly when rinsing, as the motor seal is not watertight.

- Residue from broken tubes is highly abrasive. Operating the centrifuge with residue from broken tubes can damage the finish on the accessories and rotor chamber possibly compromising their protection from chemicals.

A white powder inside the rotor chamber is indicative of the debris from broken plastic tubes not being thoroughly removed prior to operating.

A charcoal grey residue inside the rotor chamber is indicative of the debris from broken glass tubes not being thoroughly removed prior to operating.

- The exterior should be kept clean with the use of a mild soap and a damp (not wet) lint-free cloth. The centrifuge must be dried thoroughly before using.

- As needed, the condenser coils should be cleaned by vacuum or compressed air.

- As needed, the drain must be emptied by removing the drain cap on the back of the centrifuge.
- The horizontal rotor and carriers must be cleaned and lubricated with the cleaner/lubricant Tri-Flow™ (see Appendix F for details):
  - ◇ when a NOTE: 201 message appears on the display
  - ◇ after cleaning or decontamination of rotor, carriers, or rotor chamber
  - ◇ after tube breakages
  - ◇ when experiencing frequent rotor imbalances at speeds below 1,000 RPM
  - ◇ when experiencing excessive vibration at speeds below 1,000 RPM
  - ◇ at least once per month (more frequent in high frequency use or high speed applications)
- The Imbalance Sensor Assembly should be tested when a NOTE: 202 message appears on the display. See Appendix G for instructions on performing this test.

## Chapter 5

# Troubleshooting

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## STATUS CODES

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This is a list of error codes and the brief description that the centrifuge displays when an error is encountered. Check under symptoms for more details.

- ERROR: 1.1 Indicates no power is getting to the motor.
- ERROR: 1.2 Indicative of low line voltage or a momentary sag.
- ERROR: 1.3 Indicative of a momentary drop or loss of line voltage. (LOCKING)
- ERROR: 3.0 Imbalance at speeds < 100 RPM. Check the imbalance sensor.
- ERROR: 3.1 Dynamic imbalance: Perform the rotor cleaning and lubricating.
- ERROR: 3.2 Imbalance: Ensure carriers are in the proper position and the load is balanced.
- ERROR: 3.3 Tighten rotor nut and motor screws. Ensure the rotor is level.
- ERROR: 7.1 Check the lid safety interlock switch for proper alignment and continuity.
- ERROR: 7.2 Check the lid safety interlock switch for proper alignment and continuity.
- ERROR: 7.3 Do not attempt to open the lid until the unit has stopped. (LOCKING)
- ERROR: 8 Ensure the line voltage is stable & the circuit isn't overloaded.

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## ERROR RESET

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Pressing the front panel POWER button will reset most error messages.

Locking errors indicate an issue that needs to be addressed before the unit is put back into service. Unplug the centrifuge for approximately 20 seconds in order to reset locking errors.

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## TROUBLESHOOTING TABLE

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<b>SYMPTOM</b>	<b>The lid remains locked and the displays are not illuminated when the POWER button is pressed.</b>	
	<b>POSSIBLE CAUSES</b>	<b>POSSIBLE SOLUTIONS</b>
	No power to the TANK-R / ROVER-R.	Ensure the TANK-R / ROVER-R is plugged in, there is power to the receptacle, and the main power switch is on.
	The circuit breaker has tripped.	Reset the circuit breaker. If the circuit breaker trips again contact GFMD, Ltd. at 800-323-4306 for assistance.

# Troubleshooting

<b>SYMPTOM</b>	<b>Will not start when the START button is pressed and “ERROR: 7.1” is displayed.</b>	
	<b>POSSIBLE CAUSES</b>	<b>POSSIBLE SOLUTIONS</b>
	The lid safety interlock switch is defective or misaligned.	Check the lid safety interlock switch for proper alignment and continuity.
	Lid is not closed completely preventing the lid from locking.	Make sure the lid is completely closed.
	Locking mechanism is mechanically binding.	Check for proper lid lock solenoid movement.
	Lid lock safety interlock switch is defective or misaligned.	Check the lid lock safety interlock switch for proper alignment and continuity.

<b>SYMPTOM</b>	<b>Will not start when the START button is pressed and “ERROR: 1.1” is displayed.</b>	
	<b>POSSIBLE CAUSES</b>	<b>POSSIBLE SOLUTIONS</b>
	Indicates no power is getting to motor.	<p>Ensure the motor wires are securely connected to the Drive / Brake Relay Socket.</p> <p>Ensure the motor wires from the Drive / Brake Relay Socket are properly connected to BLACK1, GREEN1, and RED1 on the Power PCB.</p> <p>The Drive / Brake Relay’s drive contacts may be pitted or worn.</p> <p>The Drive / Brake Relay may be loose in the relay socket.</p>
	The motor tachometer cable is unplugged.	Ensure the motor tachometer cable is connected to MOTOR1 on the Power PCB.
	Bad Hall Effect Sensor in the motor.	See Appendix H for testing procedure.
	The power sagged so the unit did not start before the bootstrap capacitors discharged.	<p>Check electrical outlet for stable line voltage, and ensure that the circuit isn’t overloaded.</p> <p>Reset the unit by turning the main power switch off for approximately 20 seconds and then back on.</p>

# Troubleshooting

<b>SYMPTOM</b>	<b>Shuts down and a status code is displayed.</b>	
	<b>POSSIBLE CAUSES</b>	<b>POSSIBLE SOLUTIONS</b>
	<b>ERROR: 1.2</b> - Indicative of low line voltage or a momentary sag in line voltage.	Check for a loose power cord connection to the outlet, an overloaded circuit, or line voltage below 110 VAC.
	<b>ERROR: 1.3</b> - Indicative of a momentary drop in line voltage, loss of line voltage, or low line voltage.	Reset the unit by turning the main power switch off for approximately 20 seconds and then back on.
	<b>ERROR: 3.0</b> - Indicates a rotor imbalance occurred at a speed below 100 RPM.	Check for an open imbalance switch, a bent switch actuator, a missing magnetic proximity sensor actuator, or a break in the wiring between the switch and the Control / Display PCB. See Appendix G for imbalance sensor testing and adjustment procedures.
	<b>ERROR: 3.1</b> - Indicates a rotor imbalance occurred at a speed between 100 and 900 RPM.	This is normally indicative of a dynamic imbalance, which would mean the rotor and carriers need cleaning (see Chapter 4 Care Of The TANK-R / ROVER-R), or a substantially unbalanced load.  If cleaning the rotor and carriers does not resolve the error, ensure the carriers are in the proper rotor position and the load is balanced (see Chapter 3 Using The TANK-R / ROVER-R).
	<b>ERROR: 3.2</b> - Indicates a rotor imbalance occurred at a speed between 1000 and 1500 RPM.	This is indicative of a static imbalance. Ensure the carriers are in the proper rotor position and the load is balanced (see Chapter 3 Using The TANK-R / ROVER-R).
	<b>ERROR: 3.3</b> - Indicates a rotor imbalance occurred at a speed greater than 1500 RPM.	Imbalances at this speed are normally caused by the rotor not being level. Ensure the rotor retaining nut is tight, the motor mounting hardware is tight, and the counter-top is level.

# Troubleshooting

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	<p><b>ERROR: 7.2</b> - Indicates the lid safety interlock switch failed during a run cycle or an attempt was made to open the lid during the run cycle.</p>	<p>If there was not an attempt to open the lid before the unit came to a complete stop, see suggestions for the centrifuge not starting and giving an “ERROR: 7.1” error.</p> <p>If someone attempted to open the lid during the run cycle, please wait until the unit has come to a complete stop before opening the lid. Manually releasing the lid during the cycle creates a hazardous condition and is an OSHA safety violation.</p>
	<p><b>ERROR: 7.3</b> - Indicates the lid safety interlock switch failed during deceleration or an attempt was made to open the lid before the unit came to a complete stop.</p>	<p>If there was not an attempt to open the lid before the unit came to a complete stop, see suggestions for the centrifuge not starting and giving an “ERROR: 7.1” error.</p> <p>If someone attempted to open the lid during the run cycle, please wait until the unit has come to a complete stop before opening the lid. Manually releasing the lid during the cycle creates a hazardous condition and is an OSHA safety violation.</p>
	<p><b>ERROR: 8</b> - Indicates the speed was too erratic.</p>	<p>Check electrical outlet for stable line voltage, and ensure that the circuit isn’t overloaded.</p>

# Troubleshooting

<b>SYMPTOM</b>	<b>The TANK-R / ROVER-R is not maintaining set temperature.</b>	
	<b>POSSIBLE CAUSES</b>	<b>POSSIBLE SOLUTIONS</b>
	The lid is open when centrifuge is not spinning.	Keep lid closed when not loading or unloading centrifuge to prevent loss of cooling and to prevent rotor, carriers, and inserts from warming to ambient temperature.
	Set temperature has been changed by another operator.	Set in desired temperature (see Chapter 3 Using the TANK-R / ROVER-R).
	Condenser coils are clogged.	Clean condenser coils using vacuum or compressed air.
	Ambient temperature is too high.	Higher ambient temperatures lower the efficiency of heat dissipation. Lower the ambient temperature.
	Set speed is too high.	The higher the set speed the greater the heat generated by centrifuge rotors. Contact GFMD, Ltd. at 800-323-4306 for assistance with options.
Malfunction with centrifuge's refrigeration unit or control circuit.	Contact GFMD, Ltd. at 800-323-4306 for assistance.	

## Chapter 6

# Limited Warranty Statement

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New Silencer® centrifuges are warranted to be free from defects in material and workmanship for a period of one year from the date of delivery. GFMD, Ltd., or its agent, will repair or replace and return free of charge any part that is returned, transportation prepaid by user, to GFMD, Ltd., or its agent, within said period, and that is found upon inspection to have been defective in materials or workmanship.

There is an additional one year warranty on parts plus an additional three years on the motor. During this period GFMD, Ltd., or its agent, will repair or replace and return free of charge any part that is returned, transportation prepaid by user, to GFMD, Ltd., or its agent, within said period, and that is found upon inspection to have been defective in materials or workmanship. Labor is not included during this period.

These warranties do not include normal wear from use, or operator maintenance. It does not apply to any instrument or part that has been altered by anyone other than an employee of the manufacturer or its agent nor to any instrument that has been damaged through accident, negligence, failure to follow operating instructions, natural disaster, the use of electric currents of circuits other than those specified on the plate affixed to the instrument, insufficient or excessive electrical supply, operation on emergency or backup generators, abnormal mechanical or environmental conditions, misuse or abuse.

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

The foregoing obligations are in lieu of all other obligations 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. GFMD, Ltd., or its agent, 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 that liability is claimed.

## Appendix A

# Specifications

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### **PERFORMANCE SPECIFICATIONS**

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- Maximum speed
  - Horizontal rotor 4,000 RPM
  - Microplate rotor 3,000 RPM
- Maximum RCF
  - Horizontal rotor 3,200 x g
  - Microplate rotor 1,328 x g
- Approximate acceleration rate (0 – 4,000 RPM): 60 seconds
- Approximate deceleration rate (4,000 - 0 RPM):
  - Brake on 60 seconds
  - Brake off 360 seconds
- Maximum noise level
  - Horizontal rotor 58 dBA
- Speed Control +/- 2%
- Timer +/- 5%
- Power requirements
  - 115 volts, 15 amperes

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## UNIT SPECIFICATIONS

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- Dimensions:      TANK-R      31.00"W x 21.50"D x 14.38"H  
                         ROVER-R      19.25"W x 21.50"D x 30.13"H
- Spill resistant control panel
- Completely enclosed rotor chamber
- High-strength alloy rotor chamber with drain
- See-through high-strength lid
- Gas piston lid support
- Dual safety interlock to ensure lid is closed and locked
- Rotor imbalance protection
- Direct drive system
- Brushless D.C. motor (1 HP)
- Microprocessor control
- Digital speed display
- Digital R.C.F. display
- Digital time display
- Timer range 1 - 999 plus hold
- Digital temperature display (set point and active)
- Variable automatic dynamic braking system
- Ozone safe refrigeration system
- Non-skid work surface located to the right of lid opening (TANK-R only)
- Biohazard containment option is easily added

## Appendix B

# R.C.F. Chart

### RELATIVE CENTRIFUGAL FORCE CHART

RPM	R.C.F.	
	2200-101 Horizontal Rotor	2200-105 Microplate Rotor
500	50	37
600	72	53
700	98	72
800	128	94
900	162	119
1,000	200	148
1,100	242	178
1,200	288	212
1,300	338	249
1,400	392	289
1,500	450	332
1,600	512	378
1,700	578	426
1,800	648	478
1,900	722	532
2,000	800	590
2,100	882	650
2,200	968	714
2,300	1,058	780
2,400	1,152	850
2,500	1,250	922
2,600	1,352	997
2,700	1,458	1,075
2,800	1,568	1,156
2,900	1,682	1,240
3,000	1,800	1,328
3,100	1,922	
3,200	2,048	
3,300	2,178	
3,400	2,312	
3,500	2,450	
3,600	2,592	

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RPM	R.C.F.
2200-101	
Horizontal Rotor	
3,700	2,738
3,800	2,888
3,900	3,042
4,000	3,200

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## Appendix D

# Replacement Parts List

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<b>Description</b>	<b>Qty Needed</b>	<b>Part No.</b>
Tri-Flow™, 2 oz, Non-Aerosol	1 ea.	SIL00181
Gasket, Lid	1 ea.	SIL00451
Gasket, Motor	1 ea.	SIL00456A
Hinge, Lid	2 ea.	SIL00510
Latch, Lidlock	1 ea.	SIL00643B
Lid	1 ea.	SIL00668B
Lidlock Assembly	1 ea.	SIL00671B
Solenoid (part of SIL00671B)	1 ea.	SIL00131
Switch, Lid Interlock (part of SIL00671B)	1 ea.	SIL02456
Switch, Lock Interlock (part of SIL00671B)	1 ea.	SIL02457
Motor Assembly	1 ea.	SIL00757B
PCB, Display/Control TANK / ROVER	1 ea.	SIL00816C
PCB, Power TANK / ROVER	1 ea.	SIL00842
Relay, Drive / Brake	1 ea.	SIL01103
Brake Resistor Assembly	3 ea.	SIL01216
Rotor Chamber, Refrigerated	1 ea.	SIL00498
Switch, Imbalance	1 ea.	SIL02441

Parts are sold individually. The quantity listed is the quantity used per unit.

# Lid Release Tool

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 **WARNING**

The lid release tool is provided for emergency access to samples only. Unplug the centrifuge before attempting this procedure!

The correct tool must be used for your unit or the lid safety interlock switch may become damaged. If the interlock switch is damaged the unit can't detect the lid being closed and therefore won't start.

To use the release tool:

1. Unplug the centrifuge.
2. Insert the tool completely into the release access port on the left side of the unit (just below the lid locking bracket).
3. Push the handle towards the back of the unit and lift the centrifuge lid.

# Care of Rotor & Accessories

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### **WARNING**

Follow standard safety precautions for handling of potential biological hazards!

Proper rotor / carrier care is required on horizontal rotors to maintain smooth performance and to minimize rotor imbalances caused by dynamic carrier imbalances. The frequency it is required is dependent upon variables such as workload, tube breakages, and cleaning / disinfecting frequency. This procedure should be performed after any tube breakage (after all glass has been removed and the rotor chamber has been cleaned), and after any cleaning or disinfecting of the carriers or the rotor chamber is performed. If there is a procedure calling for scheduled cleaning and/or disinfecting, please add this procedure as the last step of that procedure.

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## MATERIALS REQUIRED

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1. Tri-Flow® cleaner / lubricant (available as GFMD, Ltd. cat. no. SIL00181)
2. Cotton Swabs
3. Rubber Gloves

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## CLEANING & LUBRICATING PROCEDURE

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1. Ensure all the carriers (buckets) have the same serial number. The serial number will be on the outside bottom of the carrier.
2. Ensure the carriers are in their correct rotor position. The rotor position number will be on the outside bottom of the carrier.
3. Starting with rotor position 1.
4. Remove the insert (tube holder) from the carrier and set aside.
5. Remove the carrier from the rotor.
6. Ensure there is no debris or residue from broken tubes in the carriers that may affect balance.
7. Set the carrier upside down on a convenient work surface.
8. Shake the Tri-Flow® well and apply a small amount into the recessed area on one side of the carrier.

# CARE OF ROTOR & ACCESSORIES

9. Clean the recessed area out using a cotton swab.
10. Repeat steps 8 & 9 using fresh cotton swabs until the swabs do not show any gray/black residue after use. Leave a film of lubricant when finished.
11. Perform steps 8 - 10 on the recessed area on the other side of the metal carrier.
12. Shake the Tri-Flow<sup>®</sup> well and apply a small amount to a fresh cotton swab and clean the rotor pivot pins by wiping with the cotton swab.
13. Repeat step 12 with fresh cotton swabs as necessary to thoroughly clean the rotor pins. Leave a film of lubricant when finished.
14. Replace the carrier onto its rotor position.
15. Ensure there is no debris or residue from broken tubes in the insert that may affect balance.
16. Replace the insert into its carrier.
17. Perform steps 4 - 16 on rotor positions 2 - 4.
18. Ensure that the opposite inserts are of the same type, balanced, and oriented the same.

## Appendix G

# Imbalance Sensor Assembly Testing



## WARNING

Follow standard safety precautions for handling of potential biological hazards!

The cleaning and lubricating procedure in Appendix F must be performed prior to performing this test for the test to be valid.

## MATERIALS REQUIRED

1. Four 10ml (16mm x 100mm) Tubes or six 7ml (13mm x 100mm) Tubes.
2. Personal Protection Equipment as specified by OSHA regulations.

## IMBALANCE SENSOR TESTING PROCEDURE

1. Ensure all the carriers (buckets) have the same serial number. The serial number will be on the outside bottom of the carrier.
2. Ensure the carriers are in their correct rotor position. The rotor position number will be on the outside bottom of the carrier.
3. Ensure that the opposite inserts are of the same type, balanced, and oriented the same.
4. Ensure the carriers are pivoting smoothly. Test them by pressing down on the outer edge of each carrier and releasing. The carriers should swing a few times and end with the carrier vertical. If the carriers are not swinging smoothly contact GFMD, Ltd. at 800-323-4306 before proceeding.
5. Set the speed for 3,000 RPM.
6. Load two empty 10ml tubes opposite two 10ml tubes with 10ml of water in each creating a 20 gram imbalance. If using 7ml tubes load three empty tubes opposite three 7ml tubes with 7ml of water in each creating a 21 gram imbalance.
7. Press START. The unit should shut down and give an imbalance error prior to reaching a speed of 1,000 RPM. If the speed exceeds 1,000 RPM stop the unit by pressing START again.
8. If the unit shuts down with an imbalance error the test is complete. Remember to remove all tubes before returning to service.
9. If the unit did not shutdown with an imbalance error increase the imbalance by adding one more empty tube opposite one more full tube to increase the imbalance.

If the unit failed the imbalance sensor test proceed with the Imbalance Sensor Adjustment Procedure.

**Do NOT put the unit back into service until the imbalance sensor is functioning properly!**

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## IMBALANCE SENSOR ADJUSTMENT PROCEDURE

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1. The imbalance sensor assembly has two switches wired in series. When both switches are closed the signal between AUX1 pin 1 and AUX1 pin 2 on the Display / Control PCB (two red wires) will be < 1VDC. There is an imbalance plate positioned in front of the imbalance sensor assembly and mounted to the motor mounting assembly. Movement of this plate is relative to rotor imbalance. When there is excessive rotor imbalance this plate will activate one of the switches causing the circuit to open and generate an error.
2. The primary sensor is a snap action switch with a roller actuator (see red circle in Figure G.1). The normally closed contact is used and the switch contacts are opened by the roller actuator being pushed in by the imbalance plate.
3. The secondary sensor is a magnetic proximity sensor and is normally open. The contacts are held closed by the magnetic actuator that is mounted to the imbalance plate. This sensor acts as a backup to the primary sensor and since it operates in the opposite direction it will trigger if the imbalance sensor assembly is misadjusted in an attempt to desensitize the primary sensor.
4. The imbalance plate should be at roughly a 90 degree angle from the plate that it is mounted to. If the imbalance plate is bent in or out it will need to be reshaped prior to adjustment of the assembly.
5. If the plate is bent in at the bottom the plate can be adjusted by pulling out on the bottom.
6. If the plate is bent out at the bottom the plate can be adjusted by holding the top while pushing in on the bottom (see Figure G.2). Leverage can be gained by the use of a screwdriver (see Figure G.3) while pushing in on the bottom.
7. Once the imbalance plate is at the correct angle the imbalance sensor assembly can be adjusted. This is done by loosening the assembly mounting nut (see blue circle in Figure G.1) and sliding the assembly. The roller actuator (see red circle in Figure G.1) should be set so that it is just touching the rubber pad attached to the back of the imbalance plate.
8. Rerun the Imbalance Sensor Testing Procedure and repeat step 7 if necessary.

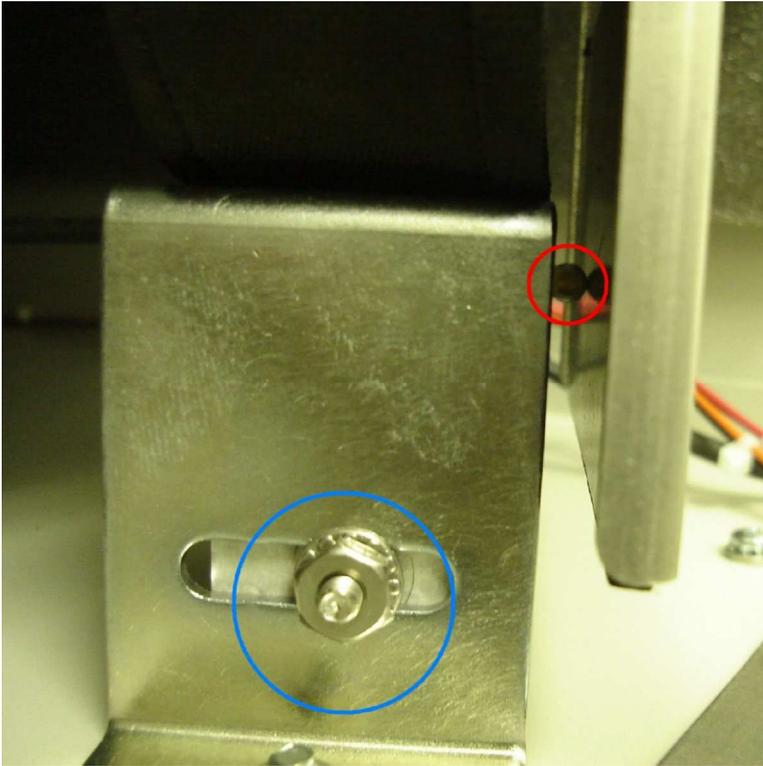


Figure G.1

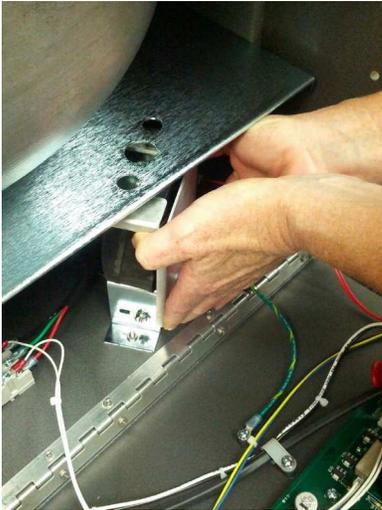


Figure G.2

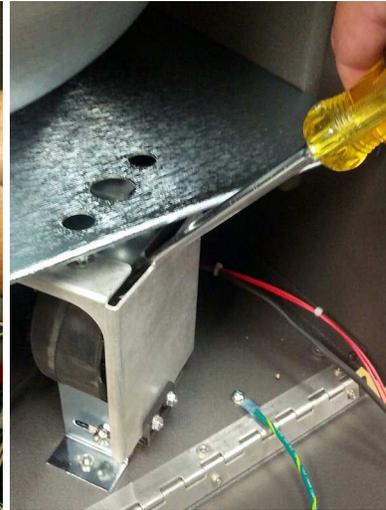


Figure G.3

## Appendix H

# Motor Hall Effect Sensor Testing

### **⚠ WARNING**

Follow standard safety precautions for handling of potential biological hazards!

The motor has three Hall effect sensors that are used for angular position information to determine which phase needs to be energized. Hall effect sensor A is also tach feedback for speed control. Some models do not have the DRIVE / BRAKE RELAY and the BRAKE RESISTORS but the Hall effect sensor testing is the same.

1. MOTOR1 pin 1 (yellow) is VCC (+5 VDC).
2. MOTOR1 pin 5 (gray) is VSS (common).
3. Measure the DC voltage from VSS to MOTOR1 pin 2 (brown) while slowly turning the rotor by hand.
4. The voltage should switch between high and low ( $> 4$  VDC and  $< 1$  VDC).
5. Repeat steps 3 and 4 for MOTOR1 pin 3 (blue) and MOTOR1 pin 4 (orange).

