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BENCHMARK S MANUAL

Heated Laboratory Centrifuge



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L-K Industries warrants its manufactured products against defects in materials and workmanship for a period limited to one year from the date of shipment. If purchased from a Distribution Partner, the warranty lasts one year from the in-service date. During the one-year warranty period, L-K Industries shall repair or replace defective equipment free of charge. L-K Industries shall only be liable for repairs or replacements if L-K is contacted immediately following discovery of defect(s).

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Getting Started

Introduction and Safety Precautions

The Benchmark S Heated Centrifuge is intended for general use in test laboratories and refineries, where Class I, Division 2 certification is not required. It operates on 120/240VAC, and comes completely assembled and ready for installation. A power cord can be purchased separately if the unit will not be hard-wired. It is recommended to keep the custom packaging materials for future shipping or storage. For best results, the centrifuge should be housed in a controlled environment. Exposure to solvents (i.e. toluene) may degrade the sealing properties of materials used in the front panel switches.

This centrifuge is designed to minimize operator injury and includes a lockable sliding door for safe operation. Carefully following safety guidelines and knowing the limits of this unit will help prevent accidents.

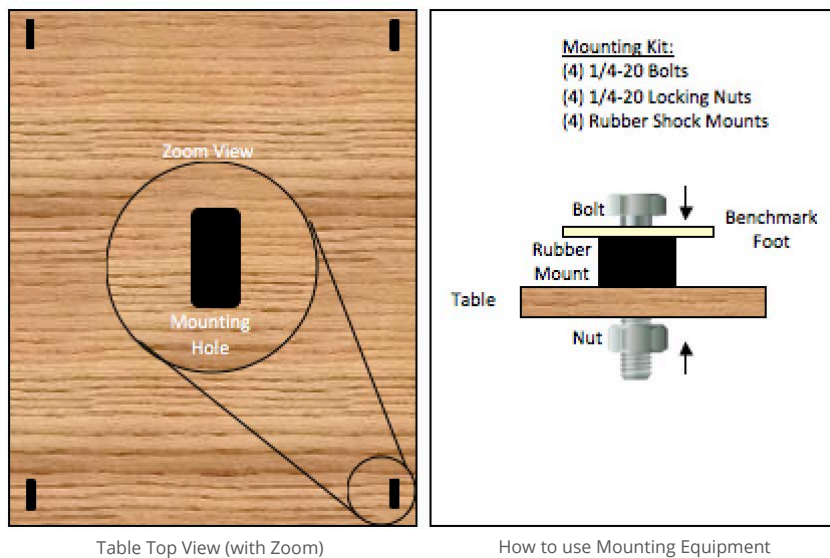
- ⚠ **REMOVE** all foreign objects from the centrifuge bowl.
- ⚠ Keep the sliding door **CLOSED** while samples are spinning.
- ⚠ **NEVER** try to slow the trunnion arm down manually. Never place an object inside the bowl while the trunnion arm is spinning. Allow the trunnion arm to come to a complete stop before removing samples.
- ⚠ Turn all switches **OFF** when not in use.
- ⚠ **NEVER** leave the centrifuge unattended while it is turned on or operating.
- ⚠ **DISCONNECT** the power supply before removing or replacing electrical or mechanical parts.
- ⚠ **DO NOT** leave oily or combustible materials in or around the centrifuge.
- ⚠ **DO NOT** allow unauthorized persons to access the centrifuge.
- ⚠ **BE AWARE** of surroundings. **DO NOT** operate the unit when fatigued or under the influence of medication, alcohol or illegal substances.
- ⚠ **DO NOT** operate this machine with unbalanced tubes and shields.
- ⚠ If a tube has broken inside of a shield, the cushion **MUST** be replaced.
- ⚠ Use **CAUTION** during heated operation, as the top of the unit is hot to the touch.

Getting Started

Installation

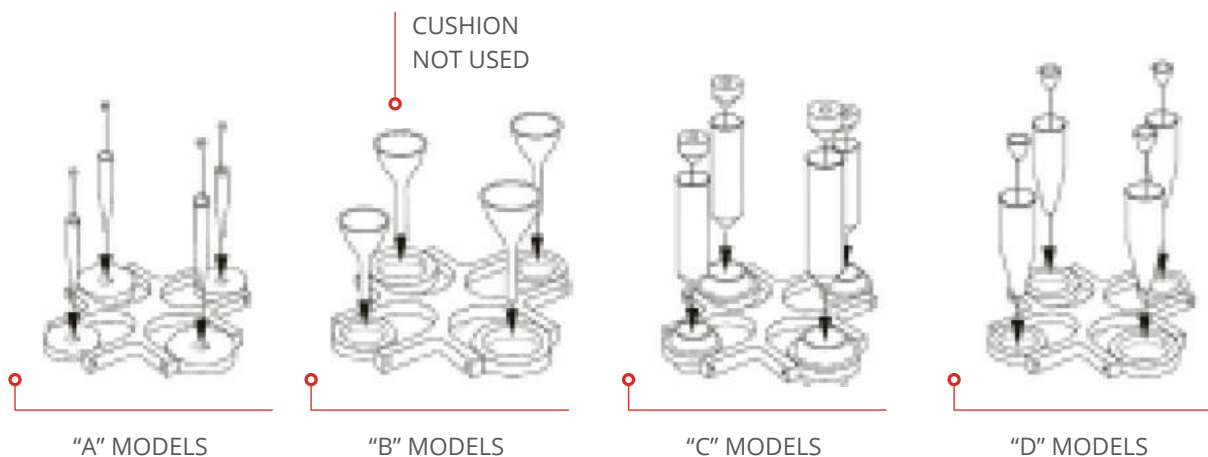
For best results, the centrifuge should be housed in a controlled environment. It is recommended that the centrifuge be secured to the benchtop, table, stand etc. using the hardware supplied. Allow for optimum working clearance around the unit. Mount centrifuge loosely with larger holes in the tabletop, to allow room for slight movement of centrifuge. Shown in Figures 1-3. Ensure the unit is level by adjusting the shock mounts.

Figure 1: Schematic of Mounting Bolts



Ensure that all collars, cushions and shields are installed properly and in the correct orientation, as shown in figure 1-2.

Figure 1-2 A/B/C/D Cushion Orientation



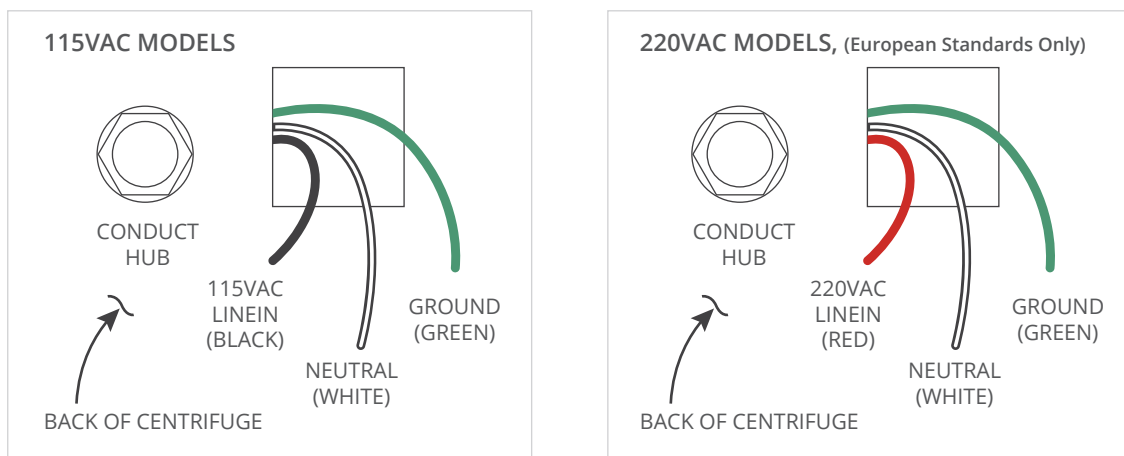


Getting Started

Electrical Connection

If the unit will be hard-wired, remove the access panel on the back of the unit to expose wires. Feed the supply voltage wire through the conduit hub and attach according to local electric code. Replace the back cover. Hard-wiring shall be done by a licensed commercial electrician per local electric code. Wiring details are shown in figure 1-3.

Figure 1-3 115VAC/220VAC Model Wiring Diagrams



If the unit is not hard-wired, a power cord with the appropriate connections shall ONLY be purchased through the L-K Industries warehouse.

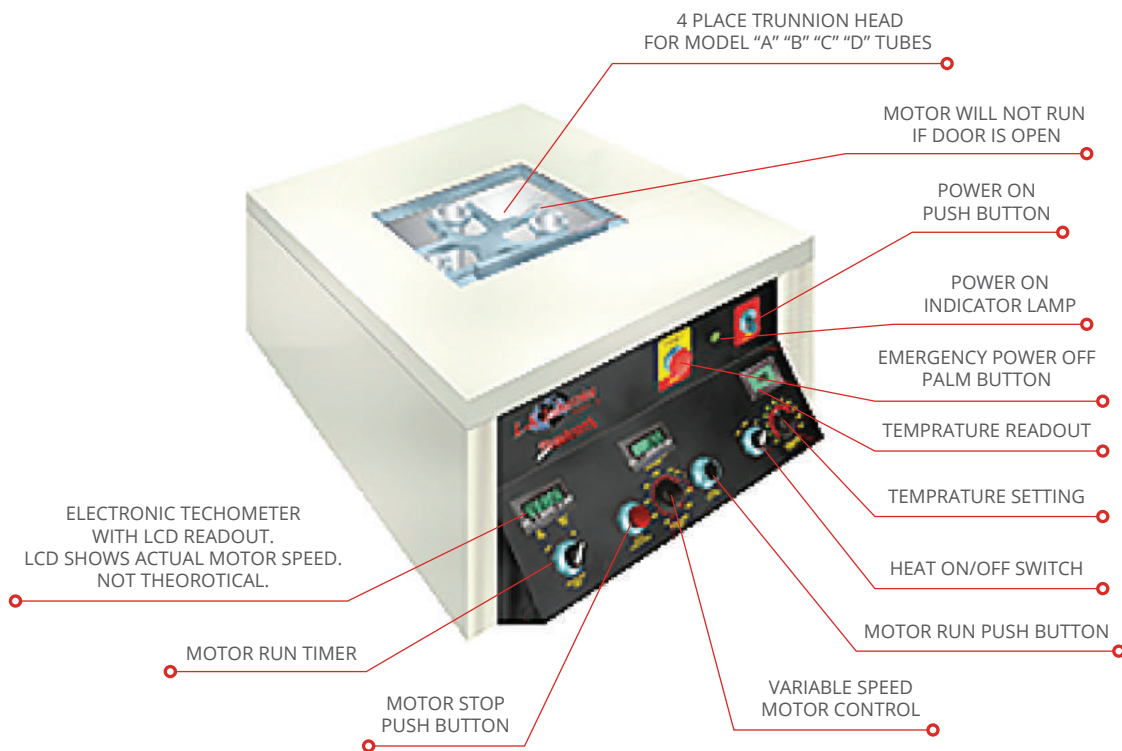
In geographical regions where power load is prone to fluctuation, power conditioning is recommended to filter out reductions and spikes in power. Failure to do so may void the warranty on the unit. Contact L-K Industries for power/line conditioner recommendations (hard-wire and plug-in options).

Operation

This unit and all L-K Industries sample tubes are designed and fabricated in compliance with API & ASTM standards. For optimal results, L-K Industries sample tubes (along with matching shields, cushions and collars) should be used. Verified and certified tubes are also available.

Before centrifugation, all the tubes, collars, cushions and shields should be visually inspected for damage. Check for oil residue on cushions and ensure that the cushions rest flat inside the bottom of each shield. Damaged parts must not be centrifuged, as they may break and cause further damage to the centrifuge.

Figure 2-1 Front Panel Switches



Loading and Powering On

To supply power to the unit, turn the "MAIN DISCONNECT" switch to the right. The green indicator light should signify that power is on. Visually verify that the "EMERGENCY MOTOR OFF SWITCH" is not engaged.

Open the sliding door and place the filled sample tubes into the shields with collars resting at the top of the shields. Ensure that the tip of each tube rests firmly in the cushion.

Inspect inside the bowl for foreign objects and close the door. To start the motor, press the "PUSH TO RUN" button. To turn off the unit in an emergency, push the "EMERGENCY MOTOR OFF SWITCH".



Operation

Heated Operation

For faster performance, preheat the unit by turning the “HEAT POWER ON” switch to the right and setting the temperature controller to the desired operating temperature. In some conditions, it may be necessary to set the operating temperature approximately 15-20 degrees above the desired sample temperature (maximum 160°F). Dry block or water bath heaters may be purchased separately to preheat samples.

The temperature probe is located underneath the lid, above the centrifuge bowl. The temperature display indicates the temperature inside the bowl, NOT the samples. To determine sample temperature, a thermometer must be placed inside each sample tube once a test is complete. Thermometers may be purchased separately.

Motor Operation

- Press the “PUSH TO RUN” button. Verify the motor RPMs in the display, which shows actual RPMs (not theoretical).
- Turn the “SPEED ADJUST” control knob to the desired speed (see Appendix A for various RCF values). To prolong centrifuge life, use the lowest feasible speed setting. The maximum allowable speed is 2000 rpm. DO NOT attempt to run the motor with the door open, as the unit is designed to shut off when the door is opened.
- When the RPM INDICATOR reads “0”, wait a few seconds to open the door. DO NOT force the door open. A locking mechanism automatically engages the when the motor is turned on and stays engaged until the motor stops spinning.
- Verify that the trunnion arm has come to a complete stop. Remove samples and close the door. Keep the door closed at all times, as this minimizes heat loss.
- Contact the L-K Industries Tech Helpline for instructions for manually bypassing the locking mechanism. The manual bypass should ONLY be done to verify centrifuge speed.

Timer Operation

The Countdown Timer Display indicates the amount of remaining time on a test. If the countdown time must be changed, the controller must be reprogrammed. The controller will prompt for a code to change the program. Enter code “055”. See Appendix C for the Timer Quick Programming Guide. Otherwise, contact the L-K Industries Tech Helpline for timer programming instructions

NOTE: On initial startup or after any programming changes, reset the unit before beginning operation.



Maintenance

Replacement Parts & Repair Services

Replacement parts for all centrifuges can be procured through the L-K Industries warehouse (see <http://lk-ind.com/centrifuge/benchmarkS.html> for unit model number, serial number and replacement part numbers) or from a Distribution Partner.

L-K Industries also repairs and rebuilds all centrifuge models. For estimates and repairs, first obtain a RMA (return merchandise authorization) number from L-K Industries. Then ship the unit to L-K Industries with a description of any problems and include billing information (unless under warranty), return shipping address and a main contact.

Housekeeping

Clean the unit after each test. Oil residue can build up and cause difficulty operating the unit. Periodically check the sample tube cushions inside the trunnion shields. Before each test, examine moving parts for wear and stress. Replace parts as necessary.

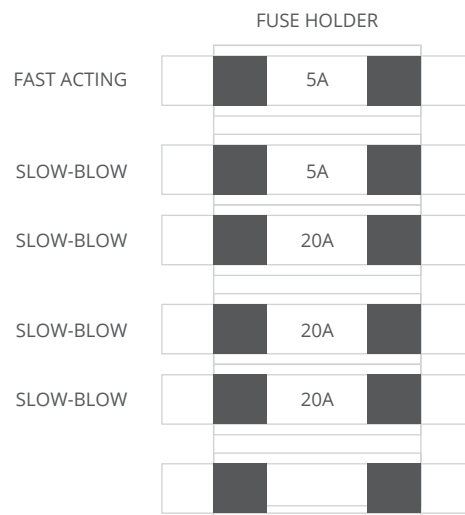
If a tube has broken inside a shield, the cushion **MUST** be replaced. Glass particles can become embedded in the cushions and cause future breakage of tubes. Two extra cushions are provided.

NOTE: "B" style tubes **DO NOT** require cushions or collars.

Replacement of Fuses

There are five fuses located behind the front panel of the centrifuge. These protect from over-current due to voltage spikes or other incidents. If replacement is necessary, disconnect power to the centrifuge. Open the front panel by removing screws and swinging it downward. Replace fuses with 250V "slow-blow" or "fast-acting" ceramic fuses that are CSA/UL certified, as indicated in figure 3-1. One extra slow-blow fuse and one fast-acting fuse are provided. Contact the L-K Industries Tech Helpline if assistance is needed in replacing fuses.

Figure 3-1 Fuse Types





Troubleshooting

Common Issues

Issues that may occur during centrifuge operation include excessive vibration, broken tubes, broken or malfunctioning LCD screens, cushions stuck in shields, etc. For issues that cannot be identified and resolved by the user, more technical troubleshooting details can be found on the L-K Industries website. Alternatively, contact the L-K Industries Tech Helpline for assistance.

Motor

If the motor does not run when the "PUSH TO RUN" button is pushed, make sure the power to the motor is on (green indicator light is on) and the sliding door is completely closed. In addition, check the fuses in the front panel. Contact the L-K Industries Tech Helpline if assistance is needed in checking fuses.

If using the Countdown Timer during operation, make sure there is time remaining. Once the timer runs out, the motor will automatically shut down. If the timer is not being used (i.e. for tests longer than the typical preset time), turn the timer to the "OFF" position.

If the motor does not run, ensure that the door is properly closed. The proximity switch uses a sensor to determine whether the door is closed and closes a circuit allowing power to feed to the motor.

When the motor controller is functioning properly, the green indicator light will be lit. If the green light does not turn on when power is supplied properly, there are a number of possibilities for the error. Contact the L-K Industries Tech Helpline for troubleshooting fault codes from the motor controller.

Lid and Door Assembly

The following are possible sources of malfunction of the lid and door locking mechanism:

- Sliding Door – Add grease for smoother opening and closing.
- Proximity Switch & Sensor – These work together to detect door position and allow power to the motor; failure of either prevents the motor from running.
- Magnet – This is mounted inside the sliding door and aligns with the sensor when the door is closed; can become detached.
- Solenoid & Locking Pin – These work together to lock the door during motor operation; locking pin may be misaligned with the door.

Contact the L-K Industries Tech Helpline to troubleshoot problems with the lid and door assembly.



Appendices

Appendix A: RCF/RPM Conversions**

TUBE MODEL/ DIST. TIP-TO-TIP	RPM* @500 RCF	RPM* @600 RCF	RPM* @700 RCF	RPM* @800 RCF
"A"/16.00"	1480	1620	1750	1870
"B"/17.75	1410	1540	1660	1780
"C"/19.25"	1350	1480	1600	1710
"D"/18.50"	1380	1510	1630	1740

*RPM = $265 \times \sqrt{\text{RCF}/D}$, where D = tip-to-tip tube diameter in inches

**ASTM minimum recommended RCF: 600

Appendix B: Wiring & Assembly Diagrams

The following schematics may be found at www.lk-ind.com/downloads

- 115VAC and 220VAC Wiring
- Outer Front Panel Schematic
- Inner Front Panel Schematic
- Motor Assembly
- Bowl Heater Assembly
- Bowl Assembly
- Door and Locking Mechanism Assembly
- Front Panel and Lid Assembly

Appendix C: Programming Overviews

The following programming diagrams may be found at www.lk-ind.com/downloads

- RPM Quick Programming
- Timer Quick Programming

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