

Centrifuges

1. Preventive Maintenance Qualitative Tests

- a. **Chassis/Housing:** Examine the exterior of the unit for cleanliness and general physical condition. Be sure that plastic housings are intact, that all hardware is present and tight, and that there are no signs of spilled liquids or serious abuse.
- b. **Mount/Fasteners:** If the device is mounted on a stand or cart, examine the condition of the mount. If it attached to the wall, or rests on a shelf, check the security of the attachment.
- c. **AC Plug/Receptacles:** Examine the AC power plug for damage. Attempt to wiggle the blades to check that they are secure. Shake the plug and listen for rattles that could indicate loose screws. If any damage is suspected, open the plug and inspect it. Should the equipment be placed on a cart that has extra electrical receptacles for other equipment, insert AC plugs into each and verify they are firmly held. Verify that no damage is present in the cart receptacles.
- d. **Line Cord:** Inspect the cord for signs of damage. If damaged, replace the entire cord or if the damage is near one end, cut out the defective portion. Wire a new power cord or plug on the same polarity. Check the line cords of battery chargers.
- e. **Strain Reliefs:** Examine the strain reliefs at both ends of the line cord. Be sure that they hold the cord securely. If the line cord is detachable, we recommend that the cord be affixed to the unit so that it cannot be removed by the operator.
- f. **Circuit Breaker/Fuse:** If the device has a switch-type circuit breaker, check that it moves freely. If the device is protected by an external fuse, check its value and type against that marked on the chassis and ensure that a spare is provided.
- g. **Controls/ Switches:** Before changing any controls or alarm limits, check their position any settings appear inordinate (e.g., alarm limits at the ends of their range), consider the possibility of inappropriate clinical use or of incipient device failure. Record the settings of those controls that should be returned to their original positions following the inspection. Examine all controls and switches for physical condition, secure mounting, and correct motion. Check that control knobs have not slipped on their shafts. Where a control should operate against fixed-limit stops, check for proper alignment, as well as positive stopping. Check membrane switches for membrane damage (e.g., from fingernails, pens). During the course of the inspection, be sure to check that each control and switch performs its proper function.
- h. **Motor/Fan/Pump:** Inspect fan blades for deterioration and damage. Ensure fan is securely attached to drive shaft and that the coupling is present and intact. Check that clearance between the fans and housing are adequate by looking for signs of rubbing. In some cases, an improperly inserted control module and heater assembly in the incubator base has bent and disabled fan. Verify whether if fan requires lubrication or not. Observe the fan in operation to determine if there are excessive vibrations or wobbling.

Centrifuges: Check the brushes, commutator and bearings of the motor. Check the condition of gaskets, seals and mounts. Check the rotor for balance and the condition of trunnion bearings,

and check the rotor attachment for tightness and excessive wear. Clean and lubricate components if necessary. If the unit has vacuum or diffusion pumps, check their conditions.

- i. **Indicators/Displays:** During the course of the inspection, confirm the operation of all lights, indicators, and visual displays on the unit and charger, if so equipped. Be sure that all segments of a digital display function properly.
- j. **Alarms:** Operate the device in a way that activates all the alarms. Check that any associated interlocks function. Check action of disconnected-probe alarm, if unit so equipped. If the device has an alarm-silence feature, check the reset method.

Centrifuges: Induce alarm conditions and verify the alarms are activated. Refrigerated units should indicate whether the unit is at the appropriate temperature. Check the lid latching mechanism for wear and verify that it holds securely. A lid interlock should either shut off the motor when the lid is opened or keep the lid latched until the rotor has stopped. The centrifuge should not start with the lid open. If the lid can be opened with the rotor spinning at high speed, check for appropriate labeling on or near the centrifuge, warning the operator not to open the centrifuge lid during operation. If the lid can be opened while the centrifuge rotor spins at low speed, the buckets or rotor should have an inner protective lid. Replace or modify any centrifuges that lack a latch. Do not use centrifuges that lack a lid, if a lid is retrofitted, it should have a safety latch

- k. **Audible Signals:** Operate the device to activate any audible signals. Confirm appropriate volume, as well as the operation of a volume control, if so equipped. If audible alarms have been silenced or the volume set too low, alert clinical staff to the importance of keeping alarms at the appropriate level.
- l. **Labeling:** Check that all necessary labels, conversion charts, and instruction cards are present and legible.
- m. **Accessories:** Confirm the presence and condition of accessories. Check for the proper type of accessory. Check that every tube holder has a cushion. If protective lids for the buckets or the rotor are available for that model centrifuge, verify that they are kept with the centrifuge and are routinely used; also ensure that the protective lids form a tight seal and positively lock onto the bucket.
- n. **Other Qualitative Tests:** Check the action of the mechanical or electrical brake. When the brake is applied, centrifuge should decelerate smoothly.



2. Preventive Maintenance Electrical Safety Test

- a. **Grounding Resistance:** Using an ohmmeter, electrical safety analyzer, or multimeter with good resolution of fractional ohms, measure and record the resistance between the grounding pin of the power cord and exposed (unpainted and not anodized) metal on the chassis. We recommend a maximum of 0.5 Ohms.
- b. **Leakage Current:** Measure chassis leakage current to ground with the grounding conductor of plug-connected equipment temporarily opened. Operate the device in all normal modes, including on, standby, and off, and record the maximum leakage current. Chassis leakage current to ground should not exceed 300 μ A.

3. Preventive Maintenance Quantitative Tests

- a. **Temperature Accuracy:** Check the temperature control on refrigerated centrifuges using an electronic thermometer. Place the electronic thermometer probe in the centrifuge bowl near the automatic temperature control sensor. Close the centrifuge, sealing the gasket around the thermometer cable. Compare the temperature control with the electronic thermometer at each setting or at the setting being used. The reading should not differ by more than $\pm 3^{\circ}$ C.
- b. **Timer Accuracy:** Check the timer against a stopwatch or watch with second hand. A centrifuge should not vary by more than $\pm 5\%$. Depending on various state regulations, this value may need to be recorded on the inspection tag.
- c. **Accuracy of Speed Setting:** Determine the range of speeds at which the centrifuge is used and a typical load. Set num the centrifuge to two or three speeds, and measure the different speeds using a tachometer. If a unit has an opaque cover, refer to the manufacturer's service manual to check the speed accuracy. The measured speed should not vary by $\pm 5\%$ of the displayed speed.

Speed (RPM)	Display (RPM)	Tachometer (RPM)
0.25		
0.50		
0.75		
Timer (min)		

4. Preventive Maintenance

- a. *Clean* the exterior and interior
- b. *Lubricate and clean* fan assembly if required
- c. *Calibrate* if needed
- d. *Replace* filter and battery if needed based on Scheduled Parts Replacement Policies.