# Infant Incubator

## 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.

***Infant Incubators*:** Remove any tape adhered to the unit. Check all rubber and plastic gaskets in the unit for signs of deterioration. The condition of the hood is important for power control of the environment. Ensure the hood is free of cracks, warping or other deterioration signs. Verify all parts are assembled correctly. Remove the hood, bed, baffle, main deck and other parts and thoroughly inspect the interior for foreign objects, deterioration or misassembly of internal components that could interfere with performance.

**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.

***Infant Incubators*:** Check that all nuts and bolts are tightened fully. Use a screwdriver and systematically try to tighten every screw on the hood. Operate the iris type port closures to ensure proper function. Examine the iris diaphragms and port sleeves for tears. Verify that disposable irises are being replaced after each incubator use, these items are not re-usable.

**c. Casters/Brakes:** If the device moves on casters, check their condition. Look for accumulations of lint and thread around the casters, and be sure that they turn and swivel, as appropriate. Check the operation of brakes and swivel locks, if the unit is so equipped.

**d. 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.

**e. 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.

**f. 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.

**g. 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.

**h. Tubes / Hoses / Bulbs**: Check the condition of all tubing, cuff, hoses, and bulbs (if present). Be sure that are not cracked, kinked or dirty. Inspect all oxygen orifices to make sure that they are clear and free of foreign matter.

i. **Cables:** Inspect the cables of sensors, electrodes, remote control and their strain reliefs and general conditions. Carefully examine cables to detect breaks in the insulation and to ensure that they are gripped securely in the connectors at each end to prevent rotation or other strain.

j. **Fittings / Connectors:** Examine all fittings and electrical cable connectors for general condition. Electrical contact pins or surfaces should be straight and clean. Fittings should be tight and should not leak. If keyed connectors are used, make sure that the keying is correct.

k. **Electrodes/Probes:** Confirm that special paddles and electrodes are available if appropriate for the area of use. Examine all paddles and probes for physical conditions and cleanliness. Should the equipment have fluids, dried electrode gel or debris on it, inform the clinical staff. Clean paddles and electrode surfaces if needed and ensure they are completely dry before testing. Ensure that probe labels clearly identify the associated units. Improperly interchanged probes of different types or from different manufacturers may adversely affect temperature control. Confirm that any necessary transducers (if applicable) are on hand and check their physical condition.

l. **Filters**: 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. Clean filter.

m. **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.

n. **Heater**: Disassemble the heating unit enough to expose the heating element. Examine the element for severe discoloration or foreign deposits. Heating elements normally change color with use, but dark, distinct surface spotting may indicate that material has come into contact with the element, possibly after falling through the air duct. Foreign matter touching the hot surface could cause a fire or the generation of noxious fumes. If you find such discoloration, examine the control unit compartment for signs of overheating. If screw terminals connect the heating element to the control circuitry, check that they are tight.

o. **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.

p. **Fluid Levels**: Check all fluid levels, including lead-acid battery levels.

q. **Battery / Charger:** Inspect the physical condition of batteries and battery connectors, if readily accessible. Check operation of battery-operated power-loss alarms, if so equipped. Operate the unit on battery power for several minutes to check that the battery is charged and can hold a charge. (The inspection can be carried out on battery power to help confirm adequate battery capacity.) Check battery condition by activating the battery test function or measuring the output voltage. Check the condition of the battery charger and, to the extent possible, confirm that it does, in fact, charge the battery. Be sure that the battery is recharged or charging when the inspection is complete. Some batteries require periodic deep discharges and recharging to maintain a maximum battery capacity. If this is recommended by the manufacturer, verify that it is being performed on schedule.

r. **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.

s. **User Calibration/Self-Test**: Verify operation of these features, if applicable.

t. **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.

u. **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.

v. **Labeling:** Check that all necessary labels, conversion charts, and instruction cards are present and legible.

***Incubators*:** Since Incubators carry oxygen, a fire hazard sign must be visible. Also a sign warning of the effects of high oxygen concentrations should be present (high oxygen concentration can cause fibroplasias and blindness in infants.)

w. **Accessories:** Check the hood thermometer for cracked glasses or separations in the liquid column. If the liquid column has separated, it might be possible to consolidate it by removing the thermometer and carefully dipping it into hot water. If the thermometer has an expanded space at the top, the liquid will pool in the small reserve chamber. When the gap in the column disappears into the pool, cool the thermometer and recheck it. Repeat the process if necessary. Be careful not to overheat the thermometer, for the liquids in it will expand and crack the glass. If the position of the mattress is adjustable, check the ease of motion and security of lock mechanism. Examine mattress for cleanliness. If the unit is used in the presence of flammable anesthetics, check that a conductive mattress cover is used.

## 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 maxi- mum leakage current. Chassis leakage current to ground should not exceed 300µA.

## 3. Preventive Maintenance Quantitative Tests

**a. Temperature Control:** Check the action of the primary and safety thermostats with the incubator fully assembled. Set the temperature to 36° C. Test the thermostats according to manufacturer's instructions, and record on the form the temperature at which safety or backup thermostats turns off heater.

**b. Skin-Temperature Alarms:** If the incubator is equipped with high and low skin-temperature alarms, verify alarm function. Adjust skin temperature set point to 36° C. Place sensor in incubator and allow temperature to stabilize. Remove the sensor from the incubator and verify that alarm activates. To verify the high skin-temperature alarm, place sensor near the heaters exit where the temperature is higher than the stabilize temperature throughout the incubator. Note point at which high alarm responds.

**c. Safety Thermostat:** To test the operation of safety thermostat and high temperature alarm, disable primary thermostat or disconnect from control circuit so heater remains on continuously. In some cases, this can be achieved by turning temperature control to max setting. It's possible to speed up the rise in temperature by supplementing the incubator heater output with a heat gun. Record hood thermometer and the true midhood temperature at which the alarm activates. It is important the air not be heated too quickly, for the mid-hood temperature may increase faster than the hood thermostat temperature and have the alarm go off before expected time.

**d. Air-Temperature Alarms:** If the incubator is equipped with high and low air-temperature alarms other than those that are controlled by a secondary temperature controller, verify that the alarms are functional. Adjust the air-temperature set point to 36° C and allow the air temperature to stabilize. Verify that low air-temperature alarms activates when the incubator hood opens. To test the high air-temperature, set the point to 36° C and increase temperature inside with outside source (hair blower or heat gun).

| Set (° C) | Delivered (° C) |
|---|---|
| 36 | |
| Hi alarm | |
| Low alarm | |
| Alarm Activated | |

(Verify other quantitative tests that may apply for Transport Incubators.)

**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.