

## 2.11 Infant Warmer

### 2.11.1 Clinical Use and Principles of Operation

The infant warmer is an open device for keeping a baby warm. True infant warmers use resistance or radiant (infrared energy) heating elements, not heat lamps, which can burn. Warmers are often used for the patients that require the most care, as it is easier to work on the infant on a warmer instead of an incubator which is a closed system. On the other hand, as they are open, warmers do not offer the environmental protection of an incubator from air borne particles, pathogens or humidity variations.

Infant warmers like this one are not common in the developing world. Many of the hospital's rooms are always at 37 degrees Celsius or higher without the need for heating. In this unit, the baby is placed on the platform in the middle of the image. The warming elements are near the top of the image.



In the resistance element, long rods are placed approximately 1 meter above the level of the infant, reflecting heat downwards. There is an open grille that covers the rods. When energized the rods glow red. Some old versions may use open coils, which can give inconsistent heat distribution over the infant.

With radiant warmers the heating elements are not visible as they are imbedded in the cover material or behind the cover. The elements are focused over the infant providing for a consistent distribution of heat. It is difficult to judge if the unit is working by sight, but if it is working you can feel the heat.

In more sophisticated warming units, a thermistor is placed over the liver of the infant, (the largest internal organ, closest to the skin, with good blood flow), and is connected to the control module. The output of the heaters varies around the set point, similar to an incubator, as the infant's temperature varies. In the developing world, these thermistor probes are often lost, broken or forgotten when donated. Therefore, most units are operating in manual mode (constant output from heaters). This mode is more dangerous as the baby can be overheated.

Many infant warmers will have exam lights and bili-lights (see the next chapter) built into the warming hoods. These exam lights can vary from simple incandescent light bulbs, to mini-spot lights to reflector type (Halogen) lamps. Bili-lights can range from fluorescent tubes to reflector type lamps with special filters to pass only the proper wavelength of light.

### **2.11.2 Common Problems**

There are very few problems with user error and power supply in infant warmers, as they are generally simple devices. However, the probe, as already mentioned, is a frequent problem. The technology in the probe is simple; typically just a thermistor. However, determining the exact type and resistance of thermistor requires data from the manufacturer. If this data can be obtained, than a replacement probe can be manufactured from a standard thermistor and the proper connector. However, without the manufacturer's data, it can be impossible to construct the probe.

A possible solution to a missing thermistor probe is to place a known, fixed resistor in its place, essentially forcing the device to operate in manual mode. A potentiometer can be used to determine the value of resistance that is required to force the lights to come on.

Thermocouple probes are sometimes used on warming units, in which case a resistance will not substitute for the probe. A voltage source might work, however. Using a potentiometer, a battery and a fixed resistor, a voltage divider can sometimes be created and adjusted until the warming unit comes on. Since the device is now in manual mode, care should be used to insure that the patient's temperature is carefully monitored.

The warming units burn out from time to time. Finding replacements can be difficult in the developing world. Some units use quartz elements and some use resistive elements. Both are common in the developing world, but finding an exact match for the quartz element is very difficult. In some cases, you can find a specialist that can adapt or replace the heating element in a resistive warming unit.

### **2.11.3 Suggested Minimal Testing**

If you have defeated the temperature sensing function, then you must be careful to explain the risk of overheating to the nursing staff. Fixing an alternative temperature sensing device to the warming unit with an alarm is an excellent option, if it is available.

Besides concerns with the manual mode, the only other necessary test is the ability of the device to warm. The temperature on a blanket placed where the baby will go should be uniform across the field. In most cases, you can simply mark dead spots and warn the staff. In some cases, you can adjust the reflectors to better distribute the heat. The temperature should not rise about 40 degrees Celsius. However, if you have left the device in manual mode, it may exceed this value. Be especially careful to explain the risks of using such a device with a physician. In some cases, if there are no other infant warmers, it may still be preferable to release the device which overheats as compared to having no warmer at all. However, in most cases, if the temperature exceeds 40 degrees anywhere on the blanket or in the patient area, then you will need to adjust the heating system to provide less heat, or abandon the unit.