

## COMMON EQUIPMENTS & TROUBLE SHOOTING

The module is designed to complement in-service education and orientation of nursing personnel involved in care of newborns.

### LEARNING OBJECTIVES

The participants will learn about:

- **Use and upkeep of neonatal equipments: Radiant warmer, Incubator, Phototherapy machine, Weighing machine - Electronic, Resuscitation bag, Suction machine - electric & foot-operated**
- **Learn trouble shooting, keeping them sterile and routine maintenance**

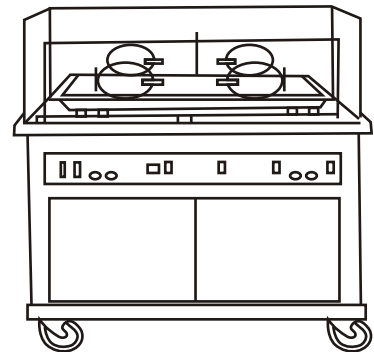
### MODULE CONTENTS

The module includes following elements:

- **Text material:** Easy to read format for quick reproduction and essential reference material for the participants. Key messages are highlighted in the boxes.
- **Demonstration:** Observing the functioning and upkeep in the hospital setting.
- **Self-evaluation:** At the end of text, self evaluation based on what has been learnt is included. Feel free to consult your text material, if you need assistance in recapitulating.

### I. INCUBATOR

- Determine the appropriate temperature for the incubator based on the baby's weight and age (Table)
- Warm the incubator to the desired temperature before placing the baby inside



**Recommended incubator temperature for Air Mode**

Weight of baby	Incubator Temperature by Age*			
	35°C	34°C	33°C	32°C
Less than 1.5 kg	1 to 10 days old	11 days to 3 wks old	3 to 5 wks old	More than 5 wks old
1.5 to 2.0 kg		1 to 10 days old	11 days to 4 wks old	More than 4 wks old
2.1 to 2.5 kg		1 to 2 days old	3 days to 3 wks old	More than 3 wks old
More than 2.5 kg			1 to 2 days old	More than 2 days old

\* If the **incubator is single-walled**, increase the incubator temperature 1°C for every 7°C difference in temperature between the room and the incubator.

- Clean the mattress and cover it with a clean sheet
- Ensure that the incubator's water reservoir is empty; dangerous bacteria may grow in the water and infect the baby. Leaving the reservoir dry will not affect the function of the incubator

- Ensure that the baby's head is covered and the baby is clothed or covered unless it is necessary for the baby to be naked or partially undressed for observation or a procedure
- Place only one baby in each incubator. If baby is in supine position, place the skin probe on the right hypochondrium. When in prone position, place the probe on the loin area
- Close the hood as quickly as possible after placing the baby inside and keep the portholes of the incubator closed at all times to keep the incubator warm
- Work in air mode if baby is unstable and skin mode/servo mode if baby is stable. If the incubator is in skin/servo mode the set temperature should be between 36°C to 37°C. Smaller the baby, higher is the set temperature
- Check the temperature of the **incubator** every hour for the first eight hours, and then every three hours:
  - If the temperature of the incubator does not match the set temperature, the incubator may not be functioning properly; adjust the temperature setting until the desired temperature is reached inside the incubator or use another method to warm the baby
- Measure the **baby's** temperature every hour for the first eight hours, and then every three hours:
  - If the baby's temperature is less than 36.5°C or more than 37.5°C, adjust the temperature of the incubator accordingly;
  - If the baby's temperature remains less than 36.5°C or more than 37.5°C inspite of the incubator being kept at the recommended setting, suspect infection
- Move the baby to the mother as soon as the baby no longer requires special care, frequent procedures and or treatment. For a stable baby, if the heater output is less than 25% on skin/servo mode or in air mode at 28°C to 30°C and the baby is maintaining the skin temperature, it is time for shifting the baby to the mother
- Place the incubator in a place where there is no direct sunlight OR
- Place the incubator shielded from direct sunlight. Always position the incubator in such a way that free air enters the air inlet
- When the equipment is in use, all approachable internal and external surfaces should be cleaned daily with soap and water. Spirit or other organic solvents must NOT be used to clean the incubator hood or panel
- Every seventh day, after shifting the baby to another clean incubator, the used equipment should be cleaned thoroughly, first by light detergent solution and then by antiseptic solution. All detachable assemblies, especially from the under deck area, are to be treated similarly. After drying, the parts are reassembled and sterilized using a vaporizing agent and/or fumigation. Adding 50 ml of formalin to 50 ml of distilled water in humidity tank and plugging it for 4 hours leads to fumigation of the incubator. Gluteraldehyde (2%) is a good alternative. After fumigation it should be thoroughly aired. The sleeves of the access windows must preferably be changed daily and cleaned. Check and dust the air filter every day
- Maintenance checklist
  - Date of change of air-filters : every 3 months
  - Date of temperature calibration : every 3 months
  - Date of preventive check : every 6 months

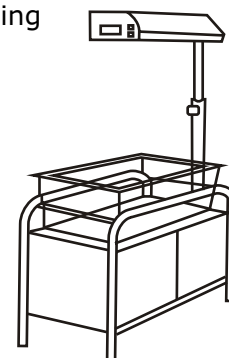
## ALARMS ON THE INCUBATOR:

Whenever alarm is ON try to identify the reason and take corrective action. Silencing the alarm without understanding may harm the baby.

Alarm	Problem	Response
"Power alarm"	This alarms if the mains power fails.	Find alternative means for heating if power cannot be fixed e.g. (KMC).
"System alarm"	This alarms if there is an error in the electrical circuit. There will be "Error codes" (EEE) on the display.	Change incubator as the incubator needs repair.
"Over temperature alarm"	This signals that the temperature inside the incubator is too high. The heater power will be automatically disconnected. It sounds when the air temperature is > 38°C in manual mode or when the air temperature is > 39°C in servo mode.	Check "set" temperature settings and adjust down if set too high. If set temperature appropriate then change incubator as it needs repair
"Air flow alarm"	This alarm sounds if the air circulation in the incubator fails.	Change the air filter as per the recommendation or look if the fan is moving. If problem persists, the incubator should be changed; this is a maintenance issue.
"Sensor alarm"	This alarm sounds if the air sensor is not connected properly or if it is not functioning properly.	Try to re-connect the sensor correctly. If this does not work, it requires changing.
"Skin temperature alarm"	This alarm operates in servo mode only. It sounds when the patient temperature differs from the SET temperature by > 1°C in skin mode and 3°C in air mode	Change to manual mode and adjust the temperature to try and normalize the baby's temperature. Check for signs of infection.
"Set temperature alarm"	This alarm operates in manual mode only. It alarms if the set temperature is >1.5°C above or < by 3°C below the air temperature once the incubator has had sufficient time to heat after turning on.	The incubator needs repair.

## II. RADIANT WARMER

- Ensure that the temperature of the room is  $\geq 22^{\circ}\text{C}$  for optimal functioning
- Place the warmer away from air currents
- Clean the mattress and platform, and cover the mattress with clean linen sheet
- When it is known beforehand that a baby is to arrive in the newborn unit, turn on the warmer for at least 20 minutes prior to pre-warm the linen and mattress so that the baby does not lie on a cold surface initially
- Read temperature on display. Adjust heater output to
  - High : If baby temperature is below  $36^{\circ}\text{C}$
  - Medium : If baby temperature is between  $36^{\circ}\text{C}$ - $36.5^{\circ}\text{C}$  and to
  - Low : If baby temperature is between  $36.5^{\circ}\text{C}$ - $37.5^{\circ}\text{C}$



- Once the baby's temperature is between 36.5-37.5°C, switch on to servo mode/skin mode
- If baby is in supine position place the skin probe on the right hypochondrium. When in prone position, place the probe on the loin area. To prevent skin injury, place tegaderm and fix the probe on it with an adhesive
- Ensure that the baby's head is covered with cap and feet secured in socks and the baby is clothed or covered unless it is necessary for the baby to be naked or partially undressed for observation or for a procedure
- Place only one baby under each radiant warmer
- Turn the baby frequently while under the warmer, if possible
- Check the temperature of the warmer and of the room every hour and adjust the temperature setting accordingly. Record the heater output in each shift (every 6 hours). Any sudden increase in heater output is an early indicator of sickness
- Move the baby to be with the mother as soon as the baby no longer requires frequent procedures and treatment. If the heater output is <20% in servo mode, it is safe to shift the baby to mother's side

### Servo Mode

- Set temperature at 36.5°C, heater output will adjust automatically to keep baby at set temperature. If baby temperature is below the set temperature, the heater output will increase; if baby is at set temperature or higher the heater output will become zero
- Look for probe displacement when the baby is in servo mode. Check for and ensure proper probe placement every hour

### Manual Mode

- Once connected to mains, heater output can be regulated by knob on front panel. The output is displayed as % or bars or bulbs
- Use maximum (100%) output for rapid warming of bassinet in labor room 10 minutes before delivery. Reduce output to 25-75% after 10 minutes depending on ambient temperature. If left on with heater output >80%; alarm is activated within 15 or 20 minutes and there after the heater output goes to 40%; if alarm is silenced the heater output will be kept on for another 15 to 20 minutes as per manufacturers recommendation
- For low birth weight or sick neonate adjust heater output depending on baby temperature.
- Never use full (100%) heater output unsupervised
- Record baby temperature every 2-4 hourly
- Use this mode only for pre-warming, during resuscitation and initial stabilization

### For disinfection

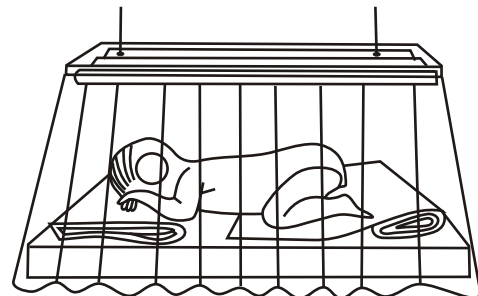
- For daily cleaning of front panel use damp cloth soaked in mild detergent (soap water)
- Don't use spirit or other chemicals
- Bassinet, cot should be disinfected daily using soap/detergent solution or disinfection solution

## ALARMS ON THE SERVO RADIANT WARMER (NO ALARMS IN MANUAL MODE)

Alarm	Problem	Response
"Power alarm":	This alarms if the mains power fails.	Find alternative means for heating if power cannot be fixed e.g. (KMC). Check the fuse.
"System alarm":	This alarms if there is an error in the electrical/ electronic circuit	Change WARMER, as it needs repair.
"Skin Probe failure alarm":	This alarm sounds if the temperature probe sensor is not connected properly or if it is not functioning properly.	Try to re-connect the sensor correctly. If this does not work, change it.
"Skin temperature alarm High or Low ":	This alarm operates in servo mode only. It sounds when the patient temperature differs from the SET temperature by $> 0.5^{\circ}\text{C}$ .	Change to manual mode with maximum output if baby is having low temperature and adjust the temperature to try and normalize the baby's temperature. If baby is having fever, shift to manual mode and set appropriate heater output. Check for signs of infection.
Heater Failure	Indicates heater is not working	Change warmer, needs repair.

### III. PHOTOTHERAPY UNIT

- Protect the eyes from light using eye patches once the lights are on
- Keep baby naked with a small nappy to cover the genitalia
- Change position from supine to prone after each feed 3 hourly
- Place the baby as close to the lights as the manufacturers' instructions allow. Use white curtains or linen as slings so as to reflect back as much light as possible to the baby, making sure not to cover top surface of unit which allows air flow for cooling the bulbs
- Encourage frequent breast feeding. No need to supplement breastfeeding with any other type of feed or fluids
- Temporary interruptions for feeding or procedures are allowed. But not for oro-gastric feeding or for IV fluids
- If baby is on IV fluids or expressed breast milk increase the volume by 10 %
- Monitor for and ensure urinary frequency 6-8 times/day
- Monitor temperature 4 hourly and weight every 24 hours



- Estimate serum bilirubin frequently ~ q12 hourly. Clinical or visual assessment of jaundice under lights becomes fallacious
- Change tube lights every 6 months (or usage time >1000 hrs) whichever is earlier; or if tube ends blacken or if tubes flicker
- Monitor irradiance of the phototherapy machine once every week. Use a flux meter to monitor irradiance. Change light source if irradiance falls below 6-8 microwatt/cm<sup>2</sup>/nm
- Do not place anything on the phototherapy unit ( this blocks air vents)

### Caution

- Do not use phototherapy unit under a warmer
- Ensure that the eye patches used do not obstruct the nostrils
- For babies below 2 kg preferably use phototherapy over incubator
- After switching on the unit check if all tubes/bulbs are on

### Trouble shooting

If unit is not switching on, check the following:

- Mains socket (change to another socket)
- Fuse
- Loose contact in the plug or a damaged mains cord

If any tube is flickering, do the following and check

- Change starter to the lamp
- Change lamp

After doing the above procedure(s), if the unit is still having problem, call a qualified technician to repair the unit.

### Cleaning/Disinfection

- Use moist cloth to clean unplugged unit
- Ensure the reflectors remain dust free

## IV. RESUSCITATOR/AMBU BAG/SELF INFLATING BAG

### Parts

- Valve assembly
- Patient outlet
- Air inlet
- Oxygen inlet
- Safety valve
- Body of the bag

### Test Function

- Block Patient outlet or mask by palm of your hand
- Squeeze the bag
  - i. You should feel pressure against your hand
  - ii. Check opening of inspiratory valve
  - iii. With higher pressure one can open pop-off safety valve

### Decontamination

- 1) Washing and rinsing
  - Wash in warm water using a detergent
  - Rinse in clean water

## 2) Disinfection/sterilization

- The whole bag (except reservoir) can be boiled, autoclaved or soaked in disinfectant solution. After soaking in disinfectant, clean with distilled water or running water. Dry the valves and then reassemble

## V. WEIGHING MACHINE (Electronic)

### Parts

- Pan or baby tray
- Weight scale display
- Machine proper

### Working

- Put on a firm even surface .Wipe clean the weighing pan
- Plug on and wait till the display panel registers zero
- Check for and adjust zero error
- Place a clean cloth/paper
- Press the knob to reset the reading to zero or else you will have to subtract the weight of the cloth from the total weight when baby is weighed along with the sheet
- Place the baby over the cloth/paper
- Detach as many tubes/equipment as possible prior to weighing. Keep the naked baby on the towel and record the weight (subtract the weight of the cloth if the scale has no facility to reset to zero)
- Keep baby in the middle of the weighing pan; hold the remaining tubes and lines in hand
- Read the weight to nearest 5-10 gms
- Record weight on baby record and plot on growth chart

### Do's

- Put the weighing scale on a flat, stable surface
- Record weight prior to feeding
- If using pre-weighed splint, reduce the weight from baby's weight
- Always look for and adjust zero error
- Remove excessive clothing
- Record weight only when display is stationary & not fluctuating

### Don'ts

- Do not stack up linen or other objects on the weighing pan when not in use
- Do not pour water on the electronic display

### Cleaning and disinfection

- Clean with soap and water; use damp cloth to clean
- Wipe with spirit swab between patient use or use clean cloth each time

### Troubleshooting

- Place on a flat firm surface
- Check for power cord
- Check for fuse
- Calibrate using a known standard weight every two weeks
- Record zero error if it cannot be corrected and account for it

## VI. SUCTION MACHINE (Electric)

### Parts

- Motor
- Vacuum gauge with precision regulator
- Suction bottles
- Suction catheter
- Suction tubing

### Working

- Connect to mains
- Switch on the unit and occlude distal end to check the pressure. Ensure it does not exceed 100mm Hg
- Take disposable suction catheter
- Connect to suction tubing
- Perform suction gently
- Switch off the suction machine and discard suction catheter

### Cleaning & Disinfection

- Wash suction bottle with soap & water
- Change bottle solution (savlon) every day

### Do's

- Suction gently
- Maintain asepsis during the suctioning procedure
- Use only disposable suction catheters
- Check adequacy of suction pressure

### Don'ts

- Do not do vigorous & deep suction

### Troubleshooting

- Check fuse
- Check cord
- Check earthing
- Check for leakages in the bottle/tubing

### Maintenance

- Check for adequacy of suction pressure
- Change tubing if leaky or broken

## VII. SUCTION MACHINE (Foot Operated)

### Parts

- Suction tubing
- Suction bottles

### Using the foot suction

1. Connect suction catheter to patient end of silicone tubing of machine.
2. Place the foot suction on floor across and in front of resuscitation trolley, with bellows on right side (if you use your right foot) and fluid collection jar on left side.

3. Ensure that foot suction is close to resuscitation trolley so that it can be operated while resuscitating the baby.
4. Ensure that suction catheter is placed on baby mattress and tube length is not short. Use 8FG to 10FG catheters for oropharyngeal suction.
5. Place right foot on bellows and press down ensuring that it slides down in contact with the central vertical metal plate. This ensures that bellows do not tilt outwards, preventing slipping of foot.
6. Foot pressure can be adjusted to ensure adequate suction pressure.
7. Pinching the suction catheter end, press bellows and check for suction pressure.  
*N.B* : for safety of newborn maximum suction pressure is limited to 100 mm Hg, irrespective of foot pressure.
8. In case thick mucus plug blocks the suction inlet, switch suction tubing to alternate suction inlet provided on the rubber stopper.

### Cleaning/sterilization

1. The foot suction must be cleaned immediately after use. Empty the fluid collection jar.
2. The fluid collection jar and silicone tubing can be autoclaved at 124°C. They can also be washed with soap and water.
3. Wash the rubber stopper with soap and water and rinse thoroughly.
4. Re-assemble when dry.
5. Replace in carry case.  
*N.B* : Rubber lid for fluid collection jar cannot be autoclaved. Wash thoroughly with soap water, rinse and dry.
6. Empty fluid jar immediately when filled to more than half mark.

### Do's

- Suction gently
- Maintain asepsis during the suctioning procedure
- Use only disposable suction catheters
- Check adequacy of suction pressure

### Don'ts

- Do not do vigorous & deep suction

### Troubleshooting

Check for leakage in the bottle/tubing

In case fluid jar cannot be emptied immediately when full, open the alternate suction inlet to prevent overflow of fluid into the bellows. No suction pressure will be created even if bellow is compressed

### Maintenance

- Check for adequacy of suction pressure
- Change tubing if leaky or broken



## SELF EVALUATION

Q1. The size of resuscitation bag for neonates should be

- a. Less than 240 ml
- b. Between 240 - 750 ml
- c. Between 500-750 ml
- d. Between 240 -1000 ml

Q2. Name the device used for increasing concentration of oxygen in the resuscitation bag

\_\_\_\_\_

Q3. Resuscitation bag can be disinfected easily by

\_\_\_\_\_

Q4. Incubator is preferable over warmer in following situations

\_\_\_\_\_

\_\_\_\_\_

Q5. Staff nurse must educate mother following instructions while giving phototherapy for jaundice

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Q6. In addition to recording weight what are other indications for use of weighing machine

\_\_\_\_\_

\_\_\_\_\_

Q7. How would you disinfect the following parts of foot operated suction machine :

- (i) Fluid collection jar : \_\_\_\_\_
- (ii) Rubber stopper : \_\_\_\_\_

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***\*You will be given individual feedback after you have done self evaluation***