



ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY **AUTONOMOUS INSTITUTION**

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Anjugramam - Kanyakumari Main Road, Palkulam, Varyoor P.O. - 629 401, Kanyakumari District.

1.4 ECG Machine Maintenance and Troubleshooting:

1.4.1 ECG Machine Maintenance:

- ❖ The typical hospital ECG machine is a rugged instrument and must be reliable under very difficult circumstances. In many hospitals the machines receive little care from operating personnel, but many hospitals now delegate an ECG technician or biomedical equipment technician to periodically inspect and perform minor repairs to the ECG machines.
- ❖ A reasonable procedure for daily or weekly operational checks is as follows:
 1. Turn machine on and allow it to warm up for a minute or so (longer on vacuum tube models).
 2. Place the function switch in RUN, and the lead selector switch in STD. Observe whether a trace is present.
 3. Press the 1-mV cal. button several times. Take note of
 - (a) whether vertical edges of the pulse are visible and
 - (b) whether the sensitivity control can be adjusted to provide at least 10 mm of deflection.
 - (c) Is the pulse reasonably square?
 4. Adjust the position control through its entire range and note whether the stylus is able to travel to the limits or stops at the top and bottom margins of the paper.
 5. Short together all electrode connectors at the patient end of the cable, and then turn the lead selector switch through all 12 positions. You should see a quiet, stable baseline on the paper in all positions of the switch. This test will spot an open wire in the cable. If you note which leads are not “quiet,”

then you can determine which wire in the cable is open by noting which electrode is uniquely common to all affected leads.

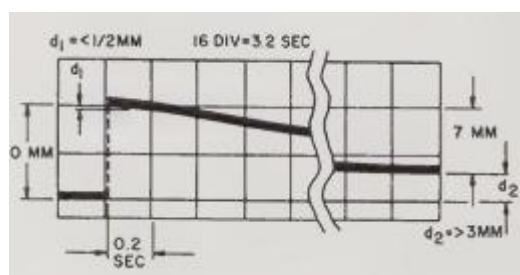
6. Adjust the sensitivity for exactly 10-mm deflection when the lead selector is in STD and the 1-mV cal button is pressed.
7. Press and hold the 1-mV cal button. The stylus should deflect 10 mm and then slowly drop back to its original position (see Figure). The decay rate should be slower than 7 mm in 16 large divisions (i.e., 3.2 s). This checks the low-frequency response of the machine.

ECG machine manufacturers may specify a more elaborate procedure for half-yearly or yearly checks, but the foregoing procedure will locate and allow correction of the most commonly found faults, and it can be performed in only a few minutes per machine.

ECG Faults and Troubleshooting:

- ❖ Internal electrical or mechanical faults occur only occasionally in ECG machines, yet incidents of malfunction occur often enough that many hospital personnel become convinced that ECG machines “are always on the blink.”

In most cases, however, the malfunction is an operator error or can be corrected by a simple adjustment or repair. The problems discussed in the following examples are common enough to occur daily in many large hospitals



1. Poor Signal or No Signal

Causes:

- Loose or disconnected leads.

- Dry or improperly placed electrodes.
- Broken cables or faulty ECG machine.

Solutions:

- **Check Connections:** Ensure all leads are securely connected to the electrodes and ECG machine.
- **Inspect Electrodes:** Replace dried-out or expired electrodes.
- **Prepare Skin:** Clean the skin using alcohol wipes or an abrasive pad to remove oils or dead skin.
- **Check Machine Settings:** Ensure the device is set to the correct mode and gain.
- **Inspect Cables:** Look for damage or wear and replace faulty cables.

2. Excessive Noise or Artifact

Causes:

- Electrical interference from nearby devices.
- Muscle movement (EMG interference).
- Loose or poorly placed electrodes.
- Patient movement or shivering.



Solutions:

- **Minimize Movement:** Ensure the patient is calm and still during the procedure.
- **Secure Electrodes:** Reapply electrodes firmly and ensure good contact.
- **Reduce Electrical Interference:**
 - Move away from sources of electromagnetic interference (e.g., phones, fluorescent lights).
 - Use proper grounding for the ECG machine.
- **Adjust Filters:** Enable high-pass or low-pass filters on the ECG machine to remove noise

3. Baseline Wander

Causes:

- Respiratory movements affecting the signal.
- Poor electrode contact.
- Loose leads.

Solutions:

- **Check Electrode Placement:** Ensure they are not over bony or moving areas (e.g., ribs during breathing).
- **Use Adhesive Gel:** Apply sufficient conductive gel to improve contact.
- **Minimize Respiratory Motion:** Ask the patient to breathe normally and avoid deep breaths during recording.
- **Apply Filters:** Use baseline correction or drift filters if available.

EXAMPLE 1:

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- ❑ Symptom: Machine runs, but the thermal tip stylus does not write, or writes very lightly.
 - ❑ Possible Causes:
 - (1) Too little heat on the stylus tip and
 - (2) insufficient stylus pressure on the paper.
 - ❑ Troubleshooting (Machine running):
 1. Using an insulated probe such as a screw- driver, gently press the stylus onto the paper.
 2. If a dark line appears on the paper, then the problem is pressure, but if no dark line appears, then the problem is heat. (Note: Some people use their finger to quickly touch the stylus to see if there is plenty of heat, but this is potentially painful. If the heat is sufficient to write on the paper, then it is also sufficient to cause second-degree burns.)

SOLUTIONS

1. For no heat, check the heater voltage at the stylus wires. If the voltage is correct, then change the stylus. If the voltage is not correct, then refer to the service manual for troubleshooting.
2. Adjust the stylus pressure

DO NOT GUESS at the proper pressure, as different models may require anything between 2 and 20 g. Use a stylus pressure gage and refer to the manufacturer's service manual for the correct value. On some models the pressure must be made at a specific heater voltage.

