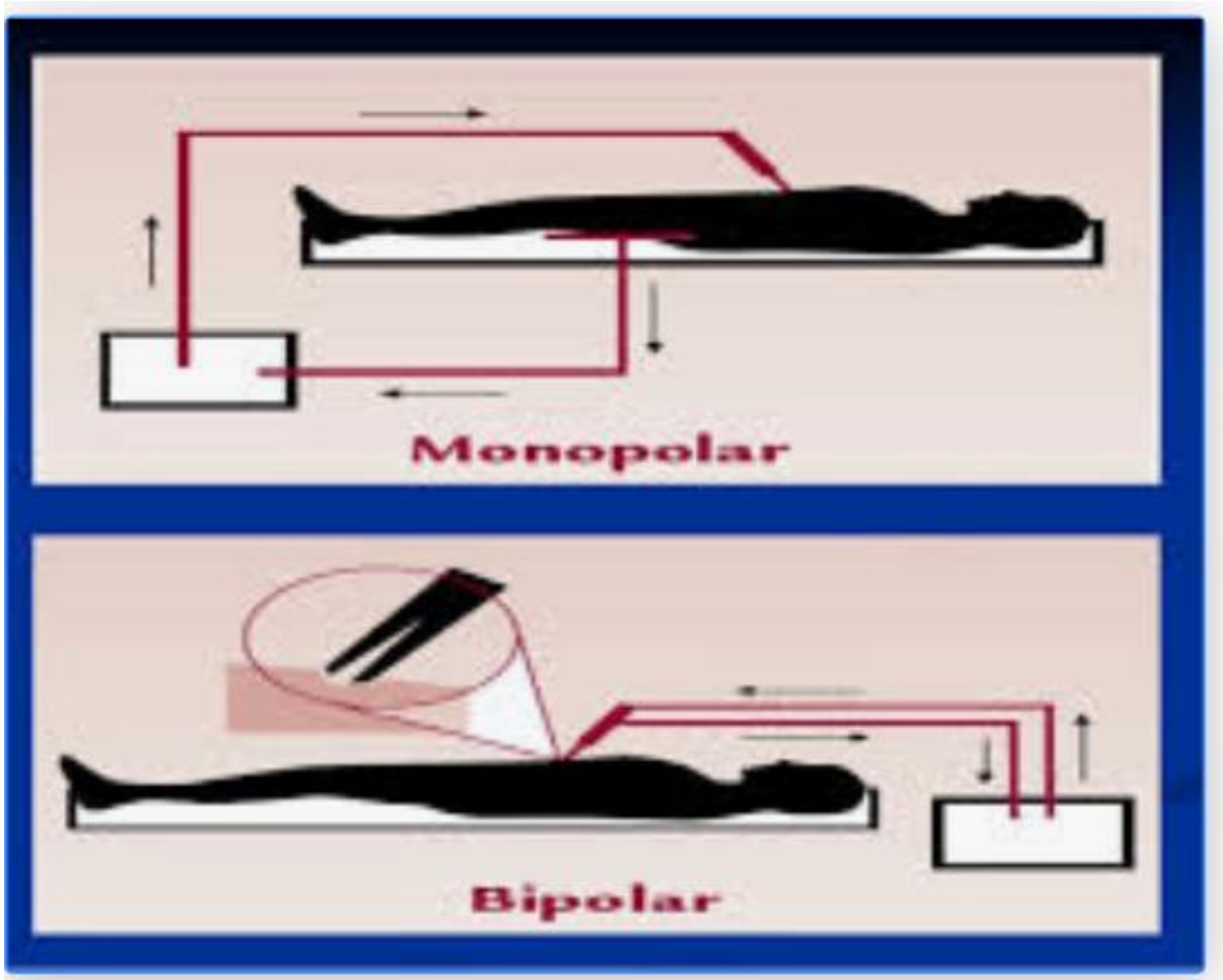
Electro Surgery Techniques

Mono Polar Technique : Two different electrode set up. The current passes through the active electrode to the patient body and then to an indifferent electrode (reference electrode) and then back to the machine.

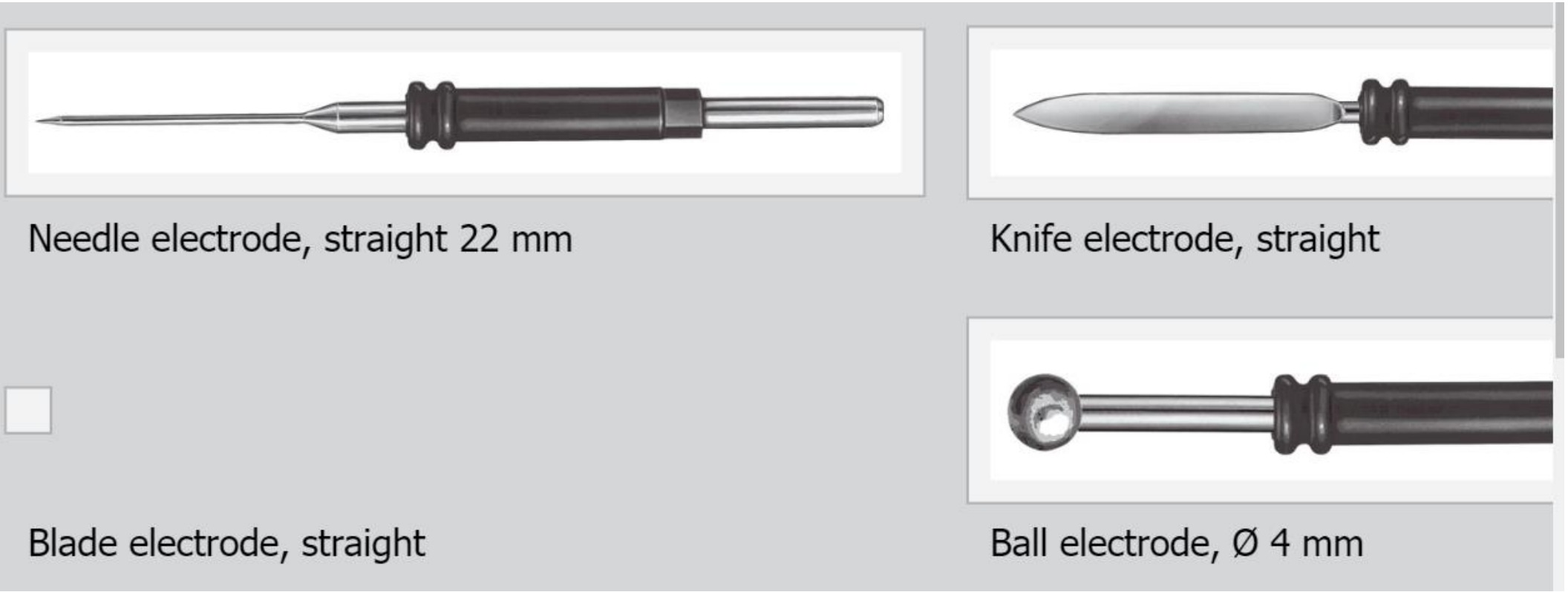
Bipolar Technique: Single assembly of electrodes with two tongs of electrodes, the current passes between the tip of these two electrodes through the tissue. The area of contact for the current is very small and hence larger heating power is generated locally. More important the current does flows only through the tissue being operated and back to the machine.

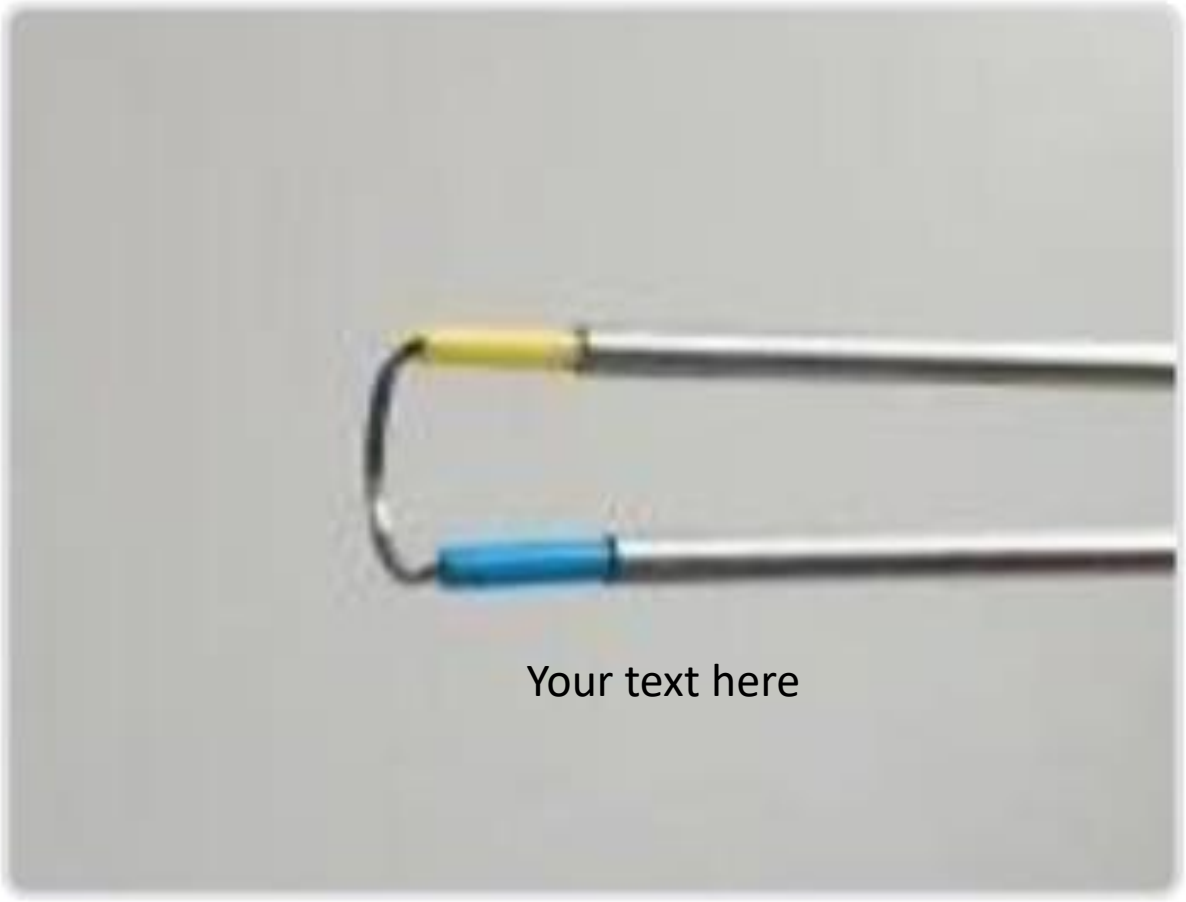

Monopolar
Bipolar

Electrodes used for surgical Diathermy

There are different types of electrodes used for diathermy. The Bipolar technique is the most popular with the active electrode being mounted on an insulating handle the current passes through this. The electrodes come in different shape depending upon the application. Lancet electrodes are normally used for cutting applications whereas specific types of needle electrodes are preferred for epilation and desiccation. Loop electrodes are employed for exsecting (or opening up) channels and extirpating growths, etc. The active electrodes for coagulation purposes are of ball type (Fig. 27.9) or plate type. In electro-surgery, the surgeon must be able to switch the high frequency current on and off himself. This can be done with a finger-tip switch in the electrode handle or a foot switch

Types of Electrodes





Band Electrodes

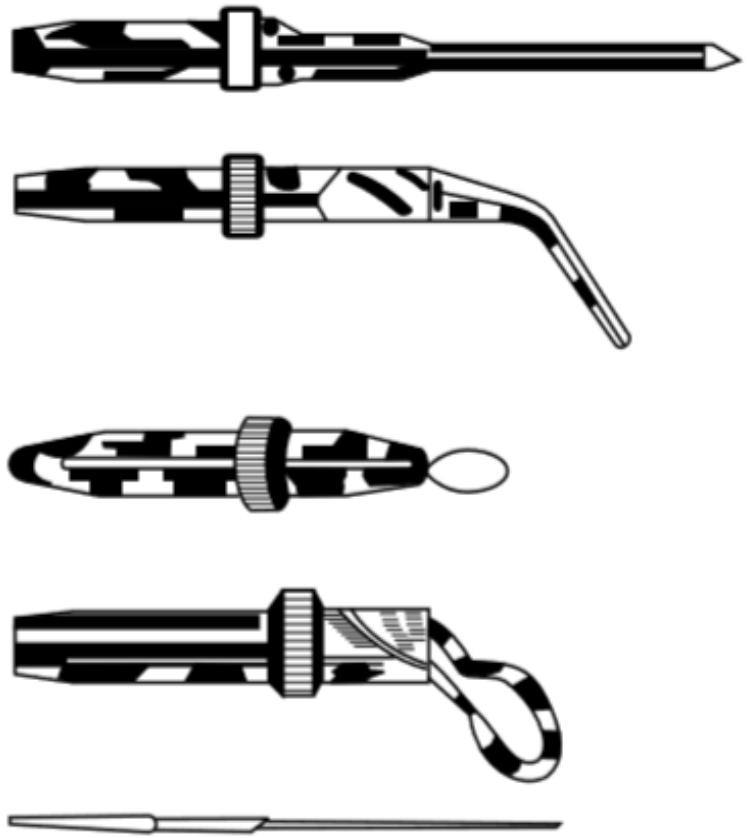
(a) Needle electrode

(b) Angulated lancet electrode

(c) Wire loop electrode

(d) Angulated band loop electrode

(e) Straight lancet electrode



➤ **Fig. 27.8** *Cutting electrodes used with diathermy machine*

Reference Electrode

The low potential terminal of the radio frequency output leads is connected to the indifferent or dispersive electrode. This electrode consists of a lead plate (15 X 20 cm) wrapped in a cloth bag, soaked in saline solution and strapped onto the patient's thigh. An alternative arrangement is to use a flexible non-crumpling stainless steel sheet plate without any covering. Good contact is established with the film of perspiration rising between the plate and the patient's body. Quite often, a liberal amount of conductive paste like ECG paste is applied to the plate. This gives excellent electrical contact and removes the need to keep a wet gauze pad. However, problems may arise if the paste is not cleaned from the plate after use as it may form a hard insulating layer.

An alternative method is to use a thin metallic sheet sandwiched between neoprene sheets which act as a capacitor with patients body without making any physical contact the rf current flows though. However this induces the danger of current from other equipment passing through this capacitor, if the patients body is grounded.

Some manufacturers offer disposable gel soaked sponge covering a metallic electrode, which is backed by a pressure adhesive surface.

Reference Electrode Safety issues

There is no universal agreement over the safe effective area of the indifferent electrode necessary for diathermy current to exit without causing a rise in skin temperature. The American National Fire Protection Association manual (NFPA 1975) carries the suggestion that the plate area should be 1 Cm^2 per 1.5 W applied power, leading to an area of 267 Cm^2 for a 400 W unit. In Britain, the recommendation calls for 180 Cm^2 plate area. Indifferent electrodes currently available range from 50 to 200 Cm^2

The most common reason for faulty performance of an electro-surgical unit is improper placement of the indifferent electrode. This electrode must be placed in firm contact with a fleshy portion of the patient and as near as possible to the operating site. Poor contact or excessive distance from the operating site causes a considerable loss of energy available for the actual surgical procedure. An alarm will be introduced in the indifferent electrode circuit to indicate any abnormality. The change in the impedance can be detected .

Safety Aspects in Surgical Diathermy Machines

Potential Risks

- Burns
- Ventricular Fibrillation
- Explosion due to Sparks
- Electrical interference caused with other electrical devices as Pace Makers
- Burns: The predominant hazard associated with electro-surgical units is burns caused by excess current density at a rate other than that at which it is meant to be present. The burn usually occurs at the dispersive electrode because of failure to achieve adequate contact. The injury can also occur because an unintended current pathway may be created. In the latter case, the lesion usually occurs at a point where the patient is inadvertently touching a grounded object and contact is made over a small area of skin.

Improper contact with the body surface is a risk factor

The risk is due to the moisture because of accumulation of blood or wet surfaces around the area of the indifferent electrode. Small conducive areas result in concentrated high density current which results in burns.

The output power of the device should not exceed the limit.

The active electrode when not in use should be kept away to avoid touching, this is to avoid activation of the electrode due to accidental operation of the foot switch.

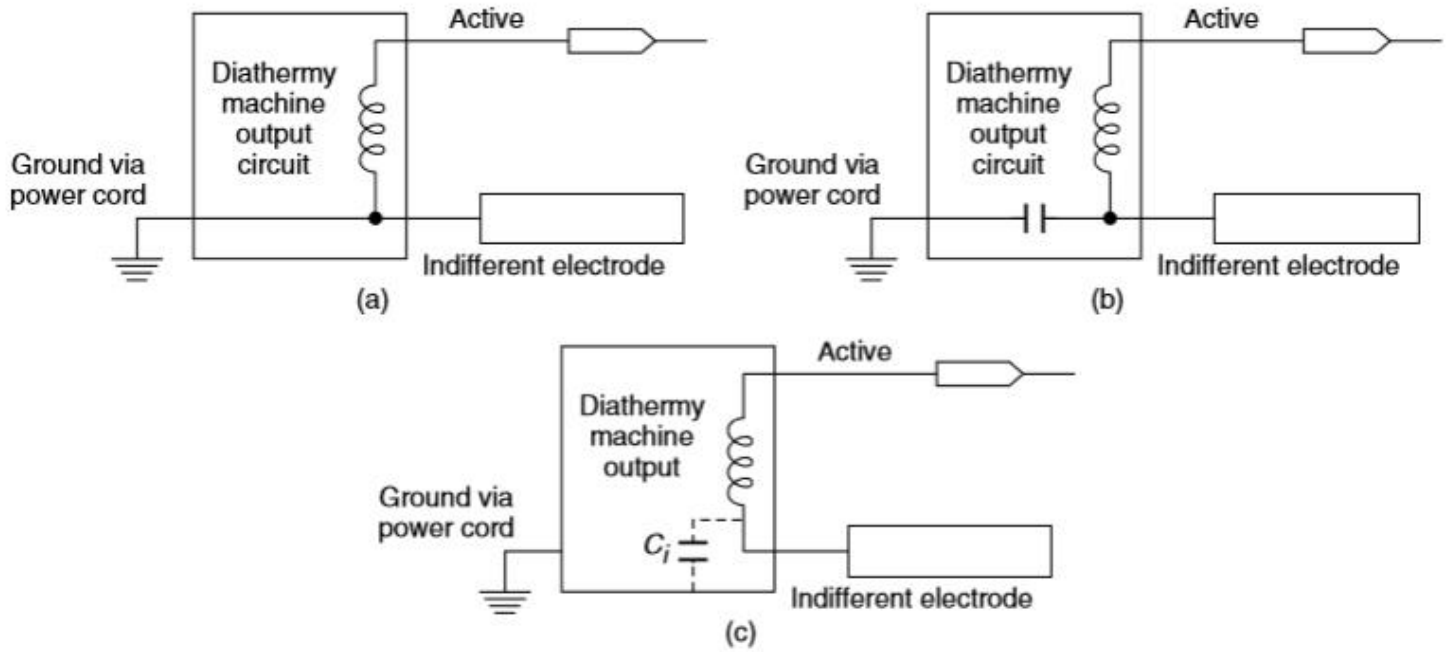
High Frequency Current Hazards

The possibility of electrocution of the patient may occur due to the faulty mains. If the equipment is grounded to earth then the current will find a pathway to reach the ground, resulting in electrocution of the patient. Fig. 27.10.a

Since mains is at low frequency direct grounding is avoided and grounding is done through a capacitor, which prevents getting shunted to ground. As the capacitor will allow only RF current and block the low frequency mains. Direct earthing is not used any more in medical equipments. Fig. 27.10.b

There are three types of systems i. Earthed Ground System (not used anymore) ii. Earthed Reference System iii Isolated Power System

Grounding Systems



➤ **Fig. 27.10(a)** *Output circuit configuration in which the indifferent circuit is directly connected to the mains earth*

(b) *Use of capacitor in the output circuit. This permits RF currents to flow to earth through the diathermy machine. However, it effectively blocks the passage of low frequency currents (50 Hz)*

(c) *RF isolated output circuit configuration. Obviously, there is no direct connection of the indifferent circuit to ground. The RF leakage current is due to stray capacitance within the machine*

The Isolated power systems no connection to earth fig. 27.10.c . No path for grounding of the earth. The capacitor shown in the fig. is the stray capacitance in the equipment, which might conduct leakage RF current to the ground. Lower the leakage current safer is the patient. The current technology limits it to 100 mA. Of the three types of electro-surgical output systems—earthed, earth-referenced and isolated— only the last two are recommended by IEC (1978). For surgical applications in which the danger of ventricular fibrillation cannot be excluded, electro-surgical units of the isolated output type (type CF) should be used as they offer the best protection against fibrillation. Earth-referenced systems, type BF are recommended for most general applications

Explosion Hazards

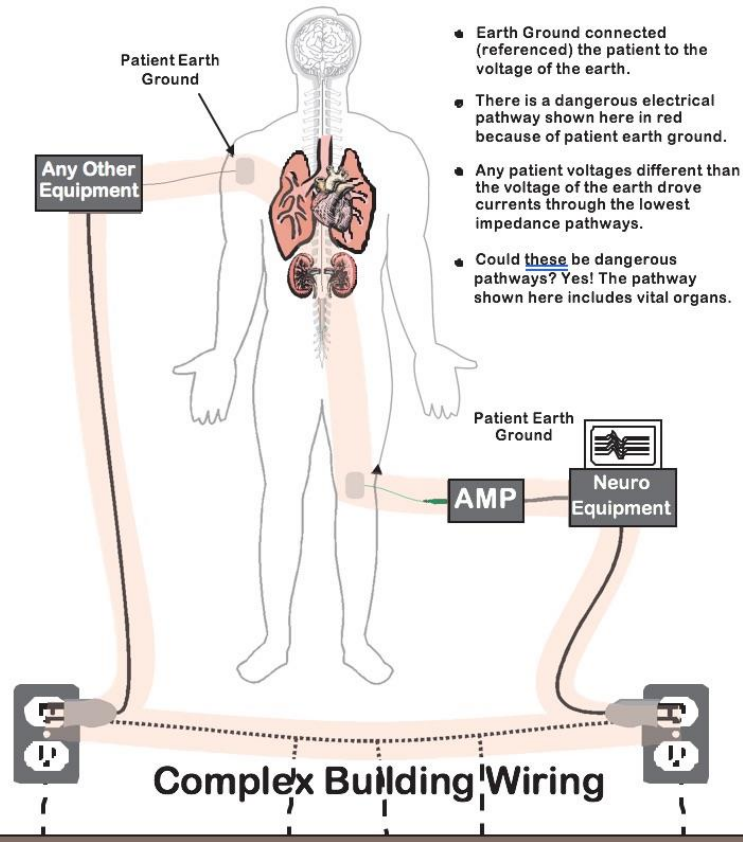
- Explosion Hazards: In operating theatres, danger zones can develop through the use of cleansing agents such as ether and alcohol, and by using explosive anaesthetic gas or mixtures with oxygen. The sparks associated with the use of surgical diathermy can cause a dangerous explosion if proper precautions are not taken. The use of non-explosive anaesthetics such as nitrous oxide, fluothane or halothane is recommended to prevent sparks generated during electro-surgery. If flammable gases are used, it is important that the electro-surgical unit be located outside the zone in which the anaesthetic is used. In addition, the foot-switches of the electro-surgical unit should always be explosion-proof.

Anti- Explosive

Some diathermy machines are fitted with automatic anti-explosion devices which make the sparks occurring at the active electrodes innocuous. When the foot-switch is actuated or the fingertip switch in the electrode handle is operated, this device causes a stream of nitrogen to emanate from the electrode handle to form a protective cloud around the cutting and coagulating electrode before the high frequency generator is switched on. Hence the explosive gas mixtures in the immediate vicinity of the electrode cannot ignite. An automatic control is incorporated in the unit which ensures that the high frequency current is not switched on until the active electrode is surrounded by protective gas. This is achieved by using an electrically heated thermistor in the handle which gets sufficiently cooled by the flow of protective gas. This ensures that an adequate stream of gas is emanating from the handle.

How it Used to Be

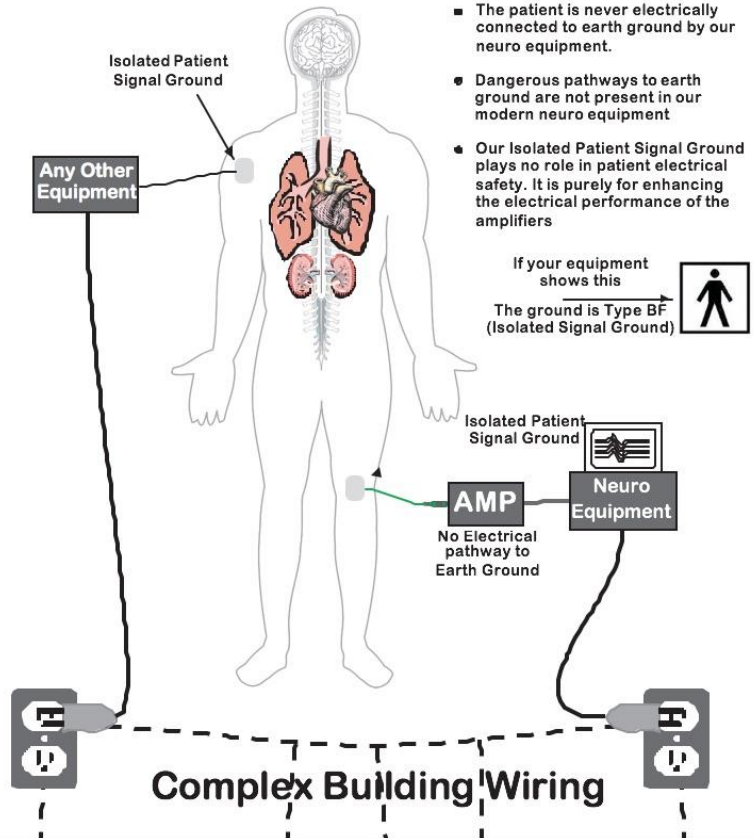
Use of Patient EARTH Ground
We NO LONGER USE THIS



- Earth Ground connected (referenced) the patient to the voltage of the earth.
- There is a dangerous electrical pathway shown here in red because of patient earth ground.
- Any patient voltages different than the voltage of the earth drove currents through the lowest impedance pathways.
- Could these be dangerous pathways? Yes! The pathway shown here includes vital organs.

How it is now

Use of Patient SIGNAL Ground
All patient connections are isolated



- The patient is never electrically connected to earth ground by our neuro equipment.
- Dangerous pathways to earth ground are not present in our modern neuro equipment
- Our Isolated Patient Signal Ground plays no role in patient electrical safety. It is purely for enhancing the electrical performance of the amplifiers

If your equipment shows this → The ground is Type BF (Isolated Signal Ground)

Figure 1.