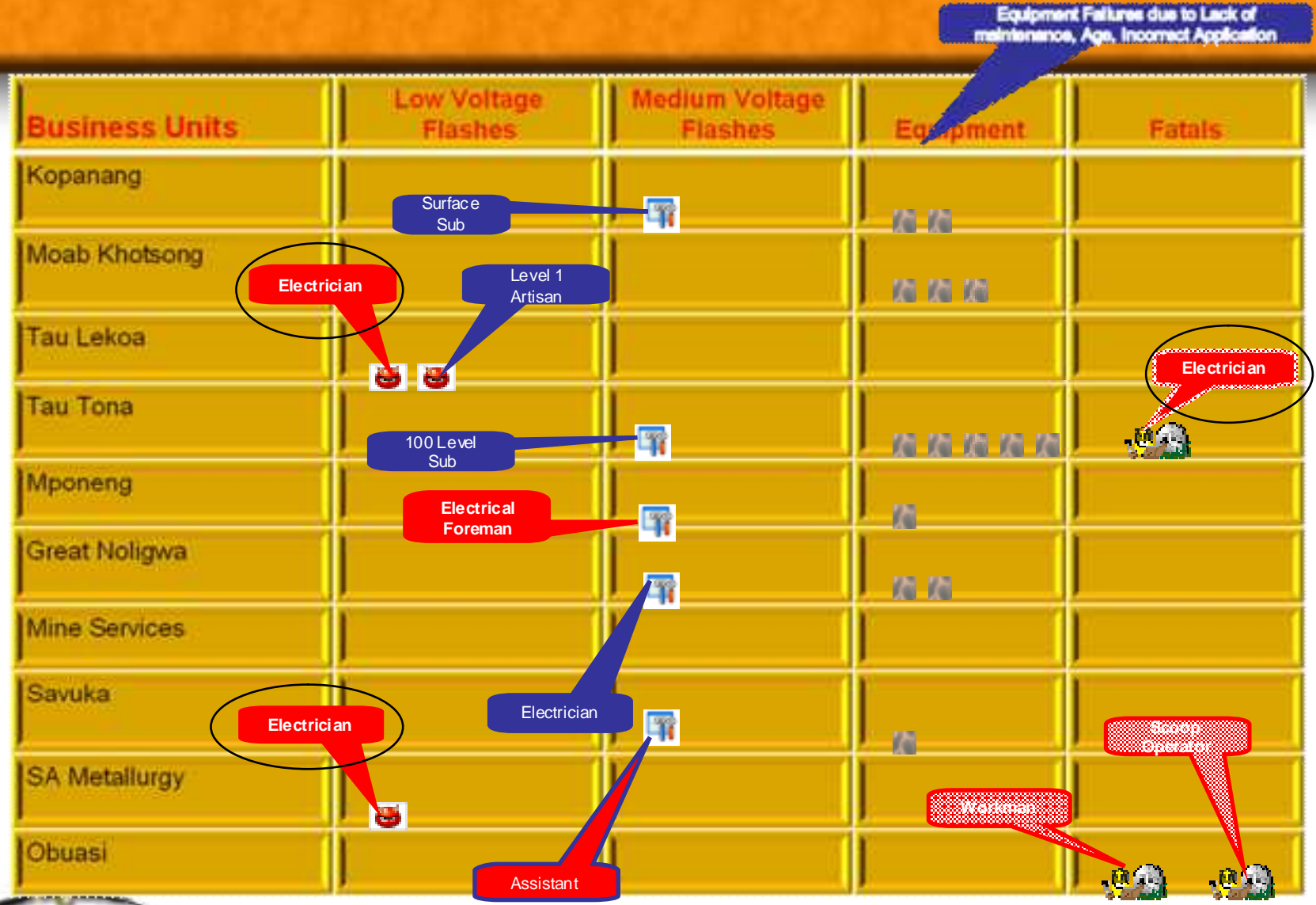




**Electrical Safe Working
Practises**

Score Board For AngloGold Ashanti Deep Level Mines



What / Who Causes Accidents ??



There are 2 reasons for unsafe acts:

- ✓ We know better but intentionally do something unsafe.
- ✓ We don't know better.

Avoid the following unsafe acts:

- ✓ Failure to de-energize, lockout, make safe & Earth hazards during maintenance, repair or inspections.
- ✓ Use of defective and unsafe tools.
- ✓ Use of tools or equipment too close to energized parts.
- ✓ Not draining off stored energy in capacitors.
- ✓ Not verifying power is off when making repair (drilling into a 110 Volt a.c. line can kill).
- ✓ Working in an elevated position near overhead lines.

There are 3 types of electricians working on Electricity

- ✓ Electricians that **KNOW** == { Following the Rules and are still working safely }
- ✓ Electricians that **THINK** they **KNOW** { Taking short cuts and was lucky == Carrying the scars }
- ✓ **Dead Electricians** == { They were not that lucky they paid with it with their lives }

Equipment can also cause accidents

- ✓ Loose connections – **Highest cause of electrical accidents**
- ✓ Faulty insulation – **Wrong specification or ageing of insulation material**
- ✓ Improper Earthing through out the network – **Fatal as no protection will operate**
- ✓ Use of "homemade" tools e.g. extension cords, testers, defective testing equipment.
- ✓ Defective parts – **"make a plan concept"**
- ✓ Unguarded live parts--for example: **Bare conductors or exposed terminals**
- ✓ Metal parts of equipment may become energized when connected by cord or plug.
- ✓ Capacitance may cause up to 55% of line voltage to be **stored** on the casing of metal tools. { ZORK }

Step and Touch Potential

"Step potential" is the voltage between the feet of a person standing near an energized earthed object.

- Lightening strikes high killer on the golf course

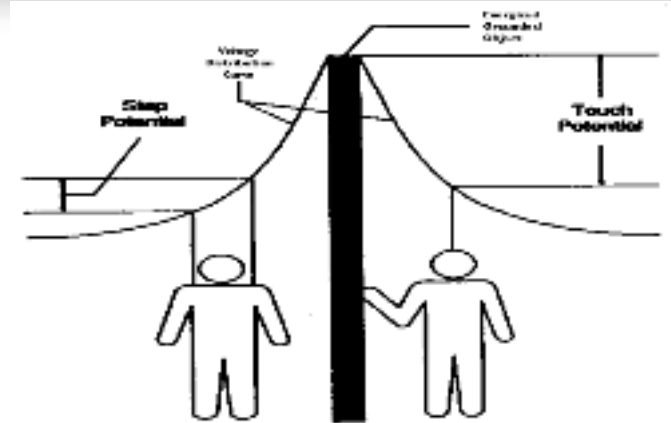
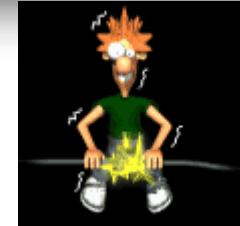


Figure 2 - Step and Touch Potentials

"Touch potential" is the voltage between the energized object and the feet of a person in contact with the object.

Electric Shock

The human body conducts electricity. If any part of the body receives an electric shock, the electricity will flow through the tissues with little obstruction into the blood stream.



Depending on the length and severity of the shock, injuries can include:

- ✓ Burns to the skin
- ✓ Burns to internal tissues
- ✓ Electrical interference and / or damage to the heart, which could cause the heart to stop or beat erratically.

'Let go' current

With sufficiently high current there can be a muscular spasm which causes the affected person to grip and be unable to release from the current source. The maximum current that can cause the flexors of the arm to contract but that allows a person to release his hand from the current's source is termed the let-go current.

For DC, the let-go current is about 75 mA for a 70-kg man.

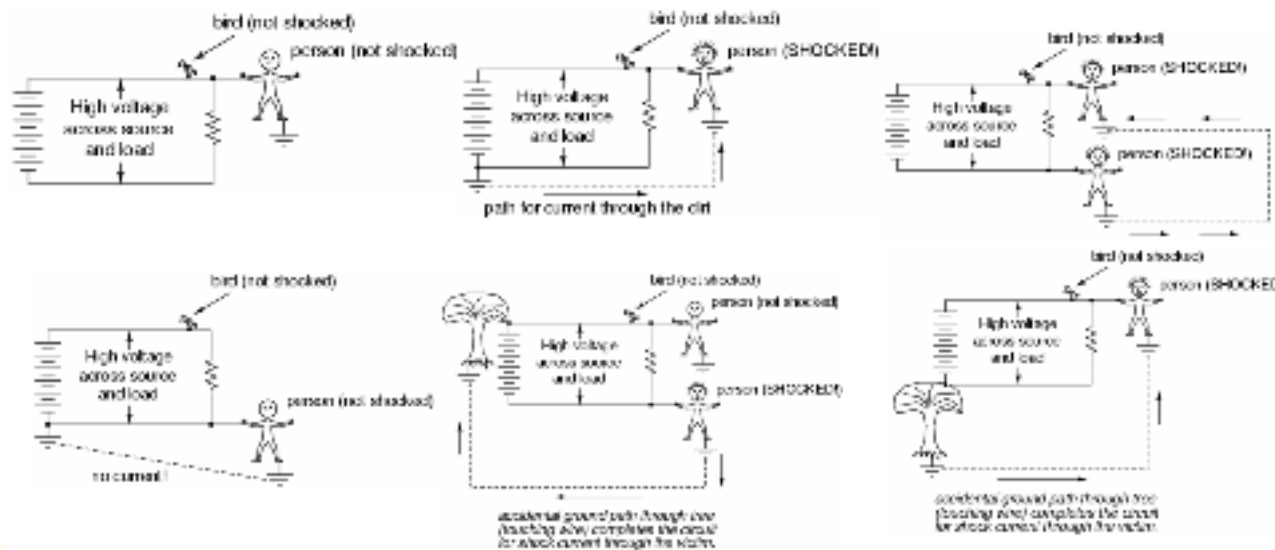
For AC, the let go current is about 15 mA, dependent on muscle mass.

Electric Shock

How electric shock happens

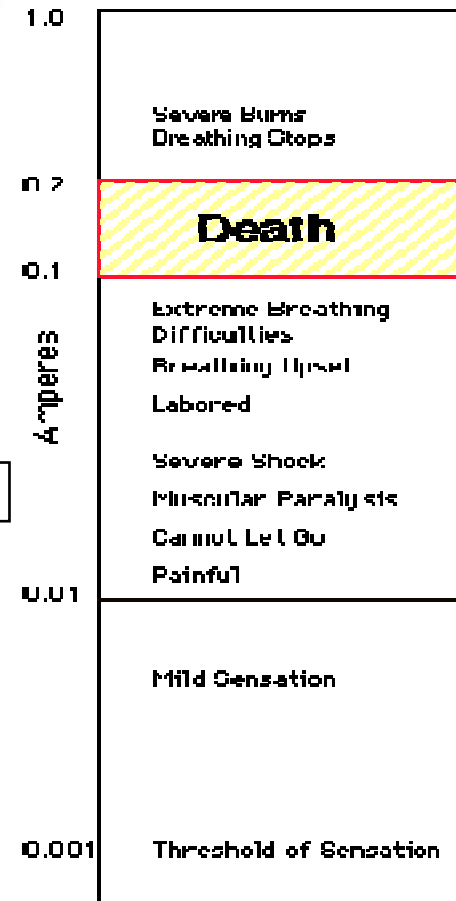
The “live” wire is at 120 volts or 6600 volts (depending on the mains voltage) and the other wire is neutral or ground. If a person were to touch the neutral wire only, no shock would result simply because there is no voltage on it.

If he were to touch the hot wire only, again nothing would happen to him unless some other part of his body were to become grounded. A person is considered to be grounded if he comes in contact with a water pipe, metal conduit, the neutral or earth wire, or stands barefoot on a concrete floor.



Lethal Current

- The real measure of shock's intensity lies in the **amount of current (amperes) forced through the body, and not the voltage.**
- Any electrical device used on a house wiring circuit can, under certain conditions, transmit a fatal current.
- Current over 10 milliamps (0.01 amp) is capable of producing painful to severe shock,
- Currents between 100 and 200 mA (0.1 to 0.2 amp) are lethal.**
- Currents above 200 milliamps (0.2 amp), while producing severe burns and unconsciousness, do not usually cause death if the victim is given immediate attention.
- Although 100mA earth leakage most probably would not protect you, no fatal reported to date if in working condition



Mechanism of an Arc Flash

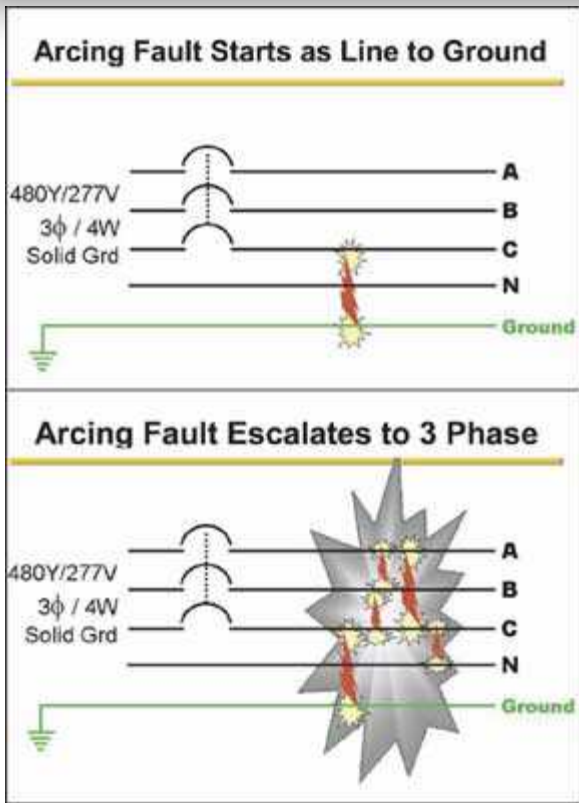


Figure 1. An arcing fault can start out as a line-to-ground fault and quickly escalate into a multiple-phase arcing fault.

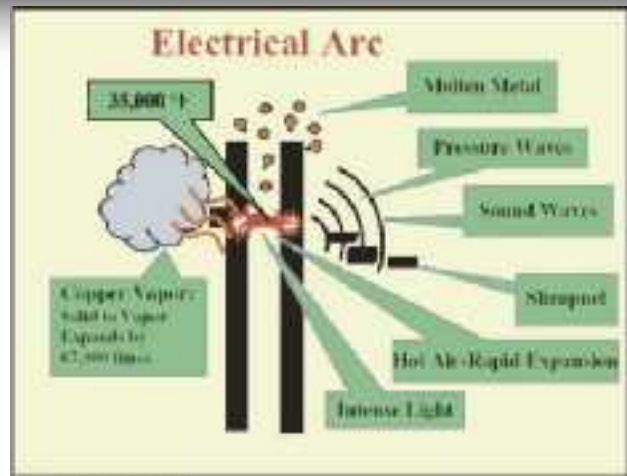


Figure 2. Arc Model



Arc Flashes

An arc fault happens when electric current flows through air gaps between conductors.

Arc flash is caused by uncontrolled conduction of electrical current from phase to ground, phase to neutral, and/or phase to phase accompanied by ionization of the surrounding air.

Because of the expansive vaporization of conductive metal, a line-to-line or line-to-ground arcing fault can escalate into a three phase arcing fault in less than a 1/1000 of a second.

The temperature of an arc can reach more than 35000 F as it creates a brilliant flash of light and a loud noise.

Enormous amount of concentrated radiant energy explodes outward from the electrical equipment, spreading hot gases, melting metal, causing death or severe radiation burns, creating pressure waves that can damage hearing or brain function and a flash that can damage eyesight.



Figure 3. Test 4 - 22,600 - A rms, 480-V, fault initiated on line lug of size 1 starter, feeder protected by a 640-A noncurrent-limiting overcurrent protective device, and fault was cleared in 6 cycles.



Effect of an ARC FLASH on the SKIN

Temperature of Skin	Time of Duration	Effect on Skin
110 deg F	6 hours	Cell Breakdown Begins
158 deg F	1 sec	Complete Cell Destruction
176 Deg F	0.1 sec	Curable Burn
205 deg F	0.1 sec	Incurable Burn

Remember an ARC FLASH can go up to 35000 F

Injuries Sustained During an Arc Flash



Or Even More Serious



88 kV Incident



Equipment To Prevent Serious Injury

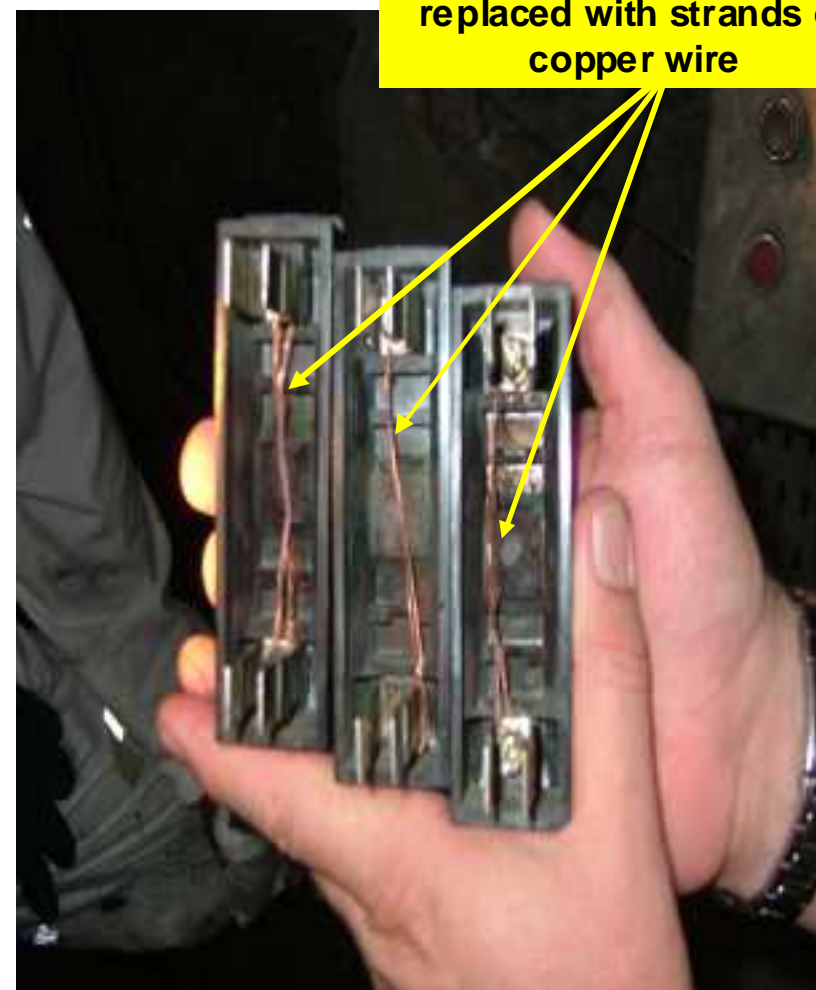
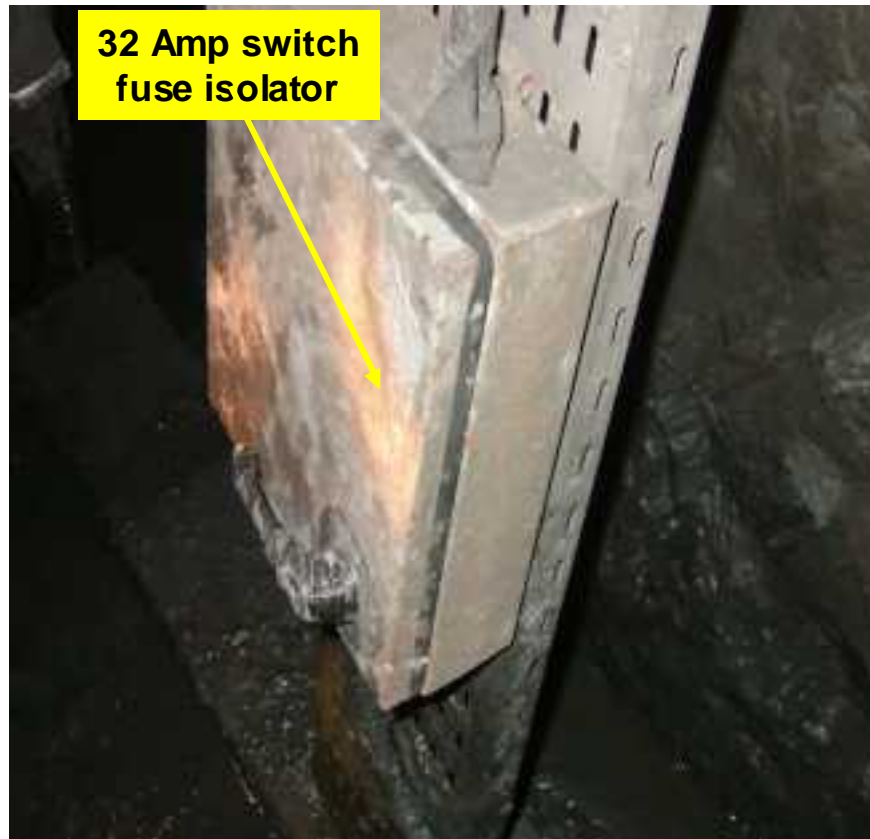


Some still think we are crazy to say "WEAR YOUR PPE WHEN WORKING ON ELECTRICITY"

Daily Work Practices where an Electric Shock can Occur



Picture 5 – Pump Isolator



Spot the problem



This is not the only one around !!!

How can we solve the problems

- ✓ **If you do not know ASK**
- ✓ Keep the installations to a **high standard**.
- ✓ Do not be a **HERO { Medals only get issued to WAR veterans }**
- ✓ Follow the **GOLDEN RULES** when working on Electricity.
- ✓ Make sure that the **earthing systems** are intact and tested.
- ✓ Do not take **short cuts { If you don't care I think your wife and kids do }**
- ✓ If you work near any bus section L.T. or H.T. make sure you **isolated, make safe, Locked out, tested and earthed** the system before you work on anything.
- ✓ When working on Medium / High Voltage use the **Permit to work system**.
- ✓ Make sure you are **trained** to do the job safely.

Practice to prevent Electrical Shock

ISOLATE IT !

MAKE IT SAFE !

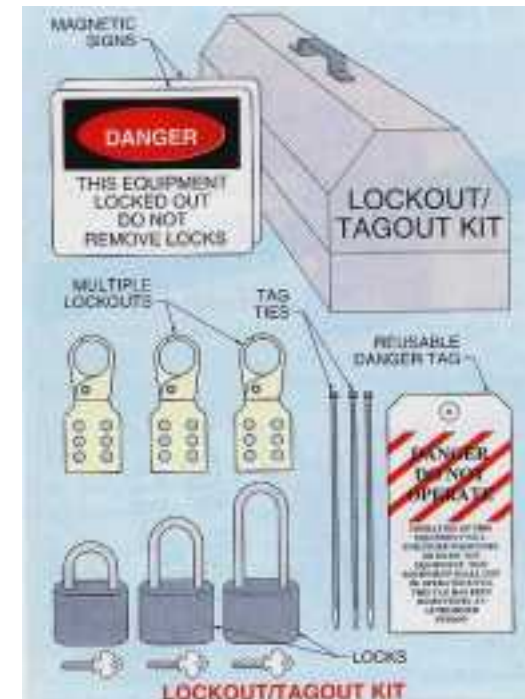
LOCK IT OUT !

TEST IT !

EARTH IT !

THEN WORK ON IT !

IF IT'S NOT EARTHED == IT'S NOT DEAD



Follow the Electrical “GOLDEN RULES”

GOLDEN RULES FOR ELECTRICAL SAFETY

1. Electrical tasks to be performed by **TRAINED** personnel only



2. Use **CORRECT** and **APPROVED** test equipment for testing

3. Ensure panels are **MARKED** to indicate multiple in-feeds and back-feeds



4. Never assume, always **TEST** for live conductors before performing tasks.

5. **ISOLATE** and **MAKE SAFE** before conducting electrical work

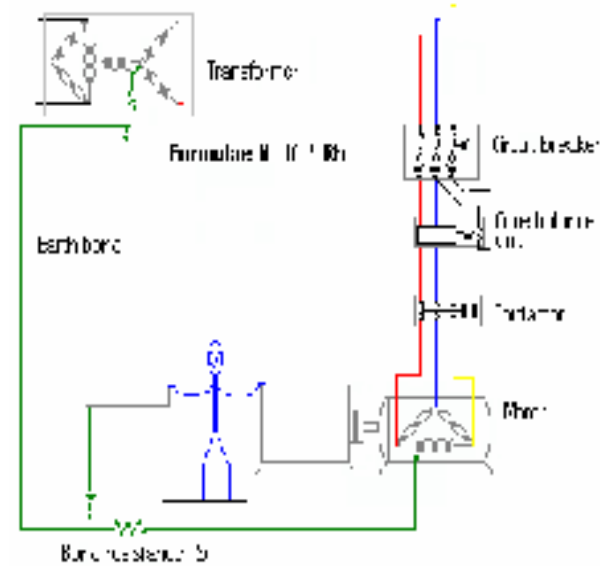
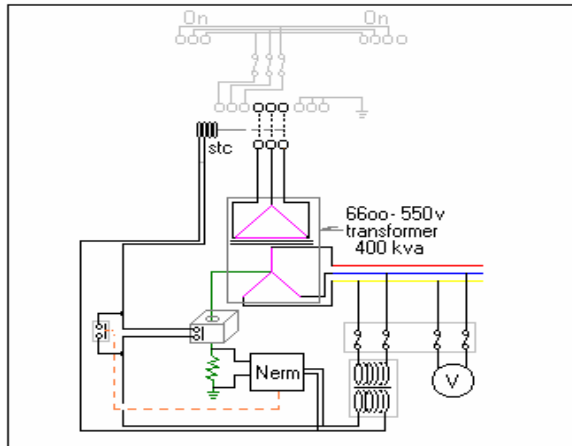


Keep our Standards High



Does this look familiar ?

Make Sure that all the Earthing Systems are intact



Video Clips



Questions

Do NOT let this happen to you PLEASE !!



Let's do what we were trained to do safely and correctly