ELECTRICAL SAFETY

WHAT IS ELECTRICAL SAFETY?

ELECTRICAL SAFETY CAN BE DEFINED AS "RECOGNIZING HAZARDS ASSOCIATED WITH THE USE OF ELECTRICAL ENERGY AND TAKING PRECAUTIONS SO THAT HAZARDS DO NOT PRODUCE INJURY OR DEATH.

ELECTRICAL HAZARDS INCLUDE

"A DANGEROUS CONDITION SUCH THAT CONTACT OR EQUIPMENT FAILURE CAN RESULT IN ELECTRIC SHOCK, ARC-FLASH BURN, THERMAL BURN OR BLAST."

WHY ELECTRICAL SAFETY IS REQUIRED?

- ELECTRICAL ENERGY IS THE MOST COMMONLY USED FORM OF ENERGY.
- ONE CAN NOT IMAGINE LIFE WITHOUT ELECTRICITY IN MODERN SOCIETY.
- USING ELECTRICITY IS VERY SIMPLE, BUT, LITTLE DOES ONE KNOW ABOUT HOW ELECTRICITY REALY WORKS.
- IT CAN CAUSE INSTANTANIOUS DEATH, LIFE LONG DISABILITY DUE TO SEVERE BURNS OR DEVASTATING FIRES TURNING CRORES OF RUPEES WORTH PROPERTY TO ASHES.

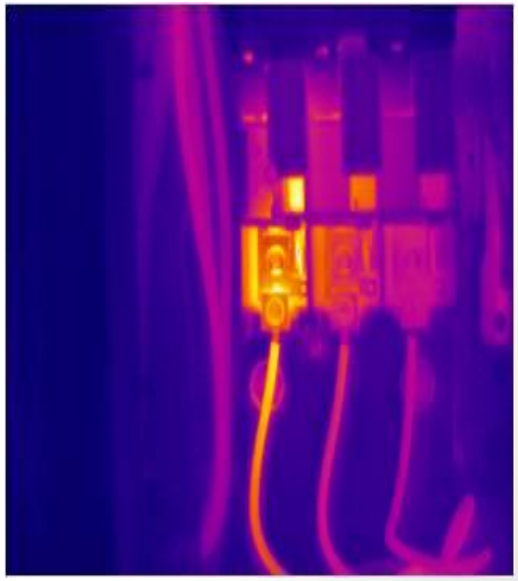
WHY ELECTRICAL SAFETY IS REQUIRED?

- IT IS THEREFORE ABSOLUTELY ESSENTIAL THAT ONE SHOULD KNOW SOME OF THE BASIC PRINCIPLES OF ELECTRICITY.

- WHAT ARE THE HAZARDS IN USING IT AND WHAT SHOULD BE DONE TO AVOID EXPOSURE TO THESE HAZARDS?

BASIC PRINCIPLES OF ELECTRICAL SAFETY

- AVOID INADVERTENT CONACT.
- IF ACCIDENTAL CONTACT ESTABLISHES, SEE THAT THE MAGNITUDE OF CURRENT IS MINIMUM, IT IS NOT THROUGH VITAL BODY ORGANS, OR THE TIME OF PASSAGE IS THE LEAST.
- DO NOT ALLOW HIGH TEMPERATURE SPOTS, SPARKS.



ELECTRICAL HAZARDS

* IT CAN BE BROADLY CLASSIFIED IN TWO MAIN CATEGORIES.

A) TO LIVING HUMAN BEINGS

I. ELECTRIC SHOCK CAUSE BY STATIC CHARGE & ELECTRIC CHARGE

II. BURNS

III. FALLS CAUSED BY ELECTRIC SHOCK

B) TO PROPERTY

A) I. WHAT IS ELECTRIC SHOCK ?

ELECTRIC SHOCK IS THE NET EFFECT OF THE DIRECT PASSAGE OF THE CURRENT THROUGH A HUMAN BODY WHEN IT ACCIDENTLY BRIDGES THE GAP BETWEEN TWO POTENTIALLY DIFFERENT POINTS.

SHOCK IS NOT A PHENOMENON BUT IS A GENERAL TERM FOR THE EXCITATION OR DISTURBANCE OF THE FUNCTION OF NERVES OR MUSCLES CAUSED BY THE PASSAGE OF AN ELECTRIC CURRENT.

HUMAN RESISTANCE TO ELECTRIC CURRENT

BODY AREA	RESISTANCE (OHMS)
DRY SKIN	100000 – 600000
WET SKIN	1000
INTERNAL BODY (HAND TO FOOT)	400 –600
EAR TO EAR	100

BODY RESISTANCE

- BODY RESISTANCE IS INVERSELY TO THE SQUARE OF THE APPLIED VOLTAGE.

- FOR WOMEN AND CHILDREN THE VALUE OF BODY RESISTANCE SHOULD BE TAKEN AS HALF WHAT IS GIVEN ABOVE.

- FOR DC THE VALUE OF RESISTANCE SHOULD BE TAKEN AS FOUR TIMES THAT OF AC FOR THE SAME VALUE OF VOLTAGE.

- OVER AND ABOVE THIS WE MUST ADD THE RESISTANCE OF OUR FOOT AND FOOTWEAR.

SO IT IS NORMALLY NOT POSSIBLE FOR ANY ONE TO GET FATAL SHOCKS UNLESS HE IS SO CARELESS AS TO TOUCH A LIVE LINE WITH WET HANDS OR MOIST HANDS IN BARE FOOT.

STATIC CHARGE

A STATIC ELECTRIC CHARGE IS CREATED WHENEVER TWO SURFACES CONTACT AND SEPARATE, AND AT LEAST ONE OF THE SURFACES HAS A HIGH RESISTANCE TO ELECTRICAL CURRENT (AND IS THEREFORE AN ELECTRICAL INSULATOR).

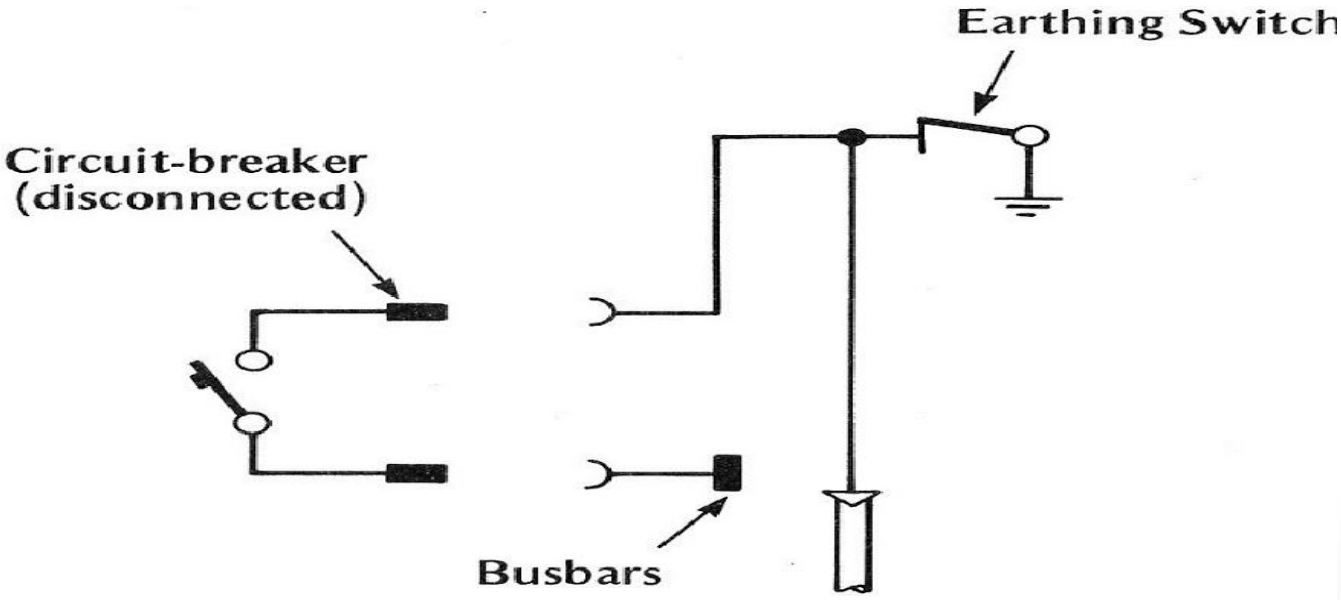
PROPER GROUNDING AND BONDING IS USED TO ADDRESS THE DANGERS OF STATIC ELECTRICITY. IN ORDER FOR GROUNDING TO PROTECT, ALL SURFACES MUST BE BONDED TOGETHER AND GROUNDED TO EARTH.

STATIC ELECTRICITY IS THEREBY RELEASED TO EARTH AS IT IS GENERATED, PREVENTING THE ACCUMULATION OF DANGEROUS CHARGES THAT MAY IGNITE FLAMMABLE / HAZARDOUS SUBSTANCES OR CAUSE SHOCKS.

RESIDUAL CHARGE

A RESIDUAL ELECTRIC CHARGE IS PRESENT IN A ELECTRICAL SYSTEM EVEN WHEN IT IS ISOLATED BECAUSE OF INHERENT CAPACITANCE IN THE SYSTEM (CABLES, INSULATORS ETC)

PROPER LOCAL GROUNDING IS DONE BEFORE STARTING ANY MAINTAINENCE WORK OM ELECTRICAL CIRCUIT TO RELEASED THIS RESIDUAL CHARGE TO EARTH AS IT MAY CAUSE SHOCK.



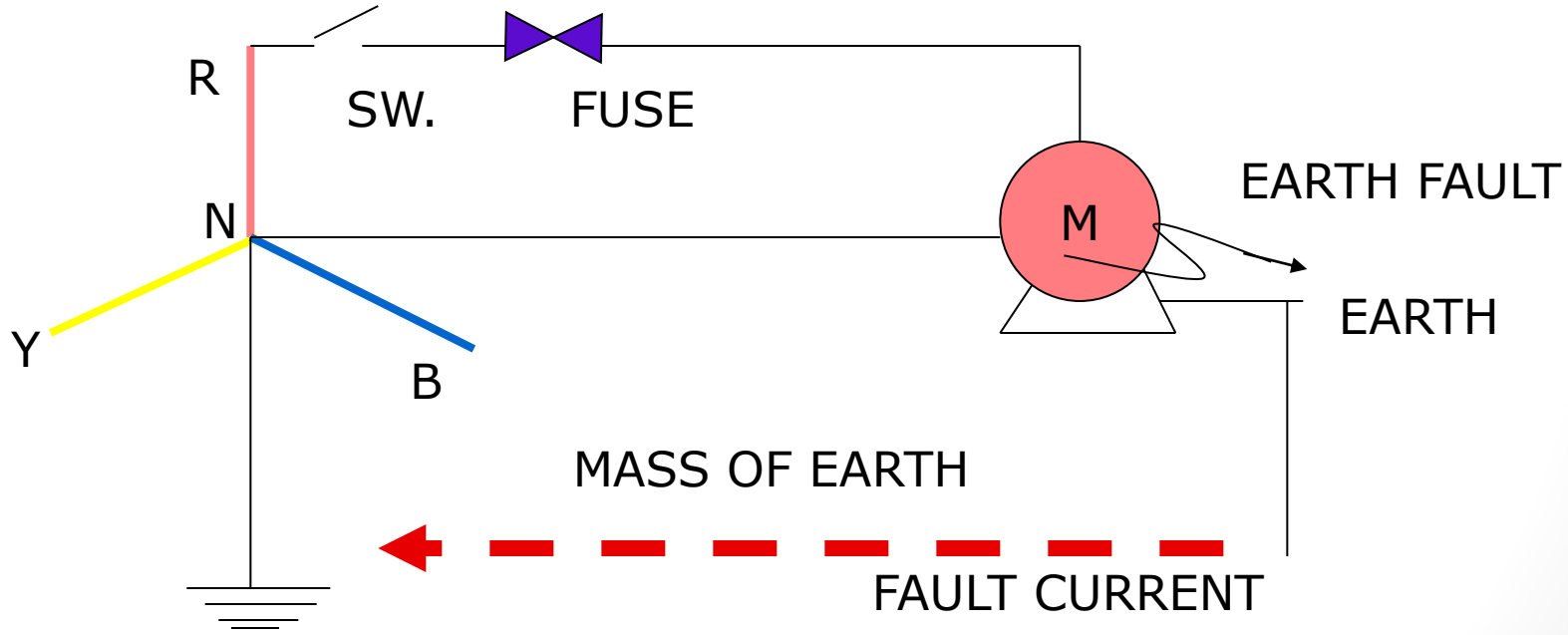
(a) FEEDER EARTH BY EARTH SWITCH

B) LOSS OF PROPERTY

- GENERATION OF HEAT IS PROPORTIONAL TO I2Rt.
- IF HEAT IS NOT DISIPATED PROPERLY OR ALLOWED UN CONTROLLABLY, CAN CAUSE THE ARC, HEATING OF THE MEDIUM, SURROUNDING AND THERE BY RESULT INTO FIRE.
- THE FIRE IS ALSO IMMINENT WHEN SPARKING TAKE PLACE DUE TO LOOSE CONTACT, PHASE TO PHASE, PHASE TO EARTH FAULTS, LIGHTING STROKE. STATIC ELECTRICITY, SUDDEN BREAKING OF LOADING CKT. CAUSING ARC.
- CHANCES OF FIRE ARE MORE IN HIGHLY INFLAMMABLE LOCATIONS LIKE GAS, OIL, EXPLOSIVE ETC.

EARTHING

EARTHING MEANS TO CONNECT THE SYSTEM WITH MASS OF EARTH. THE FRAME OF EVERY METAL CASED ELECT. EQUIPMENT SHOULD BE EFFICIENTLY EARTHED, TO DRAIN AWAY LEAKAGE CURRENT/VOLTAGE DUE TO POOR / LOSS OF INSULATION, SO THAT IT MAY ALWAYS BE SAFE.



EARTHING RESISTANCE

INSTALLATION	MAX. PER. VALUE
LARGE POWER STATION	0.5 OHMS
MAJOR SUBSTATION	1.0 OHMS
SMALL SUBSTATION	2.0 OHMS
IN ALL OTHER CABLES	8.0 OHMS
EARTH CONT… IN SIDE INSTALLATION	1.0 OHMS

EFFECTS

* THE ELECTRIC CURRENT PASSING THROUGH BODY AFFECTS THE VITAL BODY SYSTEMS SUCH AS NERVOUS SYSTEM, RESPIRATORY SYSTEM,CARDIAC SYSTEM ETC.

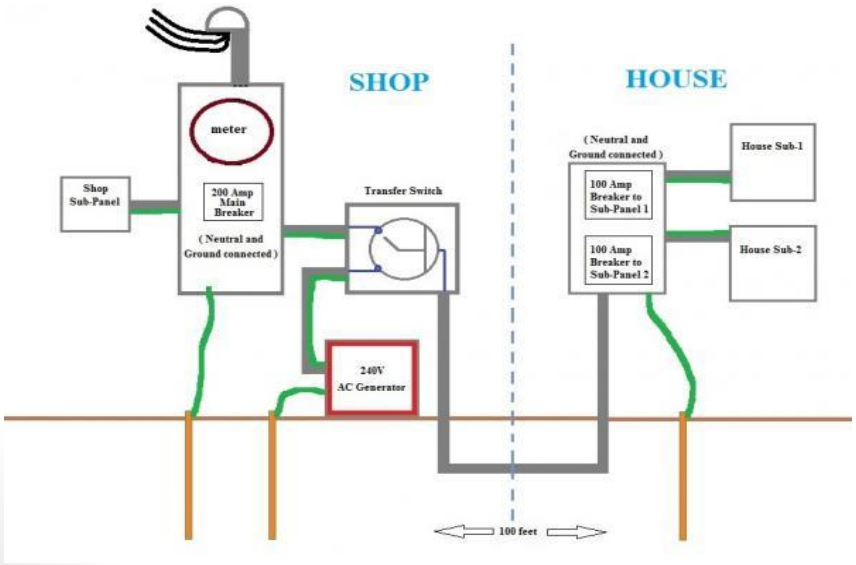
- THE EFFECT OF PROGRESSIVELY INCREASING CURRENT VALUES ARE

MAGNITUDE OF CURRENT	EFFECT
UP TO 10 m A	TINGLING SENSATION
10 – 30 m A	PAIN IS FELT IN THE MUSCLES.
30 – 80 m A	PAIN INCREASES, MUSCULAR CONTRACTION OCCURS,
100 – 200 m A	BREATHING BECOMES DIFFICULT. UNCONTROLLED SPASTIC SWITCHING OF HEART (VENTRICULAR FIBRILLATION). DISRUPTION OF BLOOD FLOW DEATH
Above 200 m A	INSTANT STOPPAGE OF HEART.

PRECAUTIONS

NORMALLY WE ACHIEVE SAFETY FROM ELECTRICAL SHOCK BY FOLLOWING :

1. ISOLATION
2. INSULATION
3. CURRENT LIMITATION
4. EARTHING



PRECAUTIONS

- MAINTAIN ALL THE LIVE PARTS INACCESSIBLE BY USING SUITABLE BARRIER GUARDS, INTERLOCKS ETC.

- BEFORE STARTING WORK ON ANY INSTALLATION ENSURE THAT IT IS PROPERLY ISOLATED FROM MAINS, DISCHARGED AND EARTHED.

- DO NOT START WORK UNLESS YOU ARE FULLY KNOWLEDGEABLE ABOUT THE WORK, HAZARD INVOLVED AND CARE REQUIRED TO BE TAKEN WHILE WORKING.USE HANDGLOVES, RUBBER MATS, SAFETY SHOES WHILE WORKING.USE OF PROPER SIZE CABLES, FUSES, SWITCHES, PROTECTION ETC. SUITABLE FOR THE LOAD

PREVENTION

1. AS FAR AS POSSIBLE DON'T TOUCH ANY ELECTRICAL THING BY LEFT HAND.
2. NEVER PLAY WITH ELECTRICITY AND DON'T TAKE ANY CHANCE WITH APPLIANCES.
3. NEVER WORK BARE FOOTED.
4. MAKE IT A REGULAR PRACTICE TO CHECK YOUR EARTHING.
5. NEVER BE IN A HURRY WHILE WORKING ON HIGH VOLTAGE.
6. WHILE WORKING ON HIGH VOLTAGE SWITCH GEAR CHECK AND DOUBLE CHECK BEFORE CLOSING THE CIRCUIT BREAKER

ACCIDENT PREVENTION

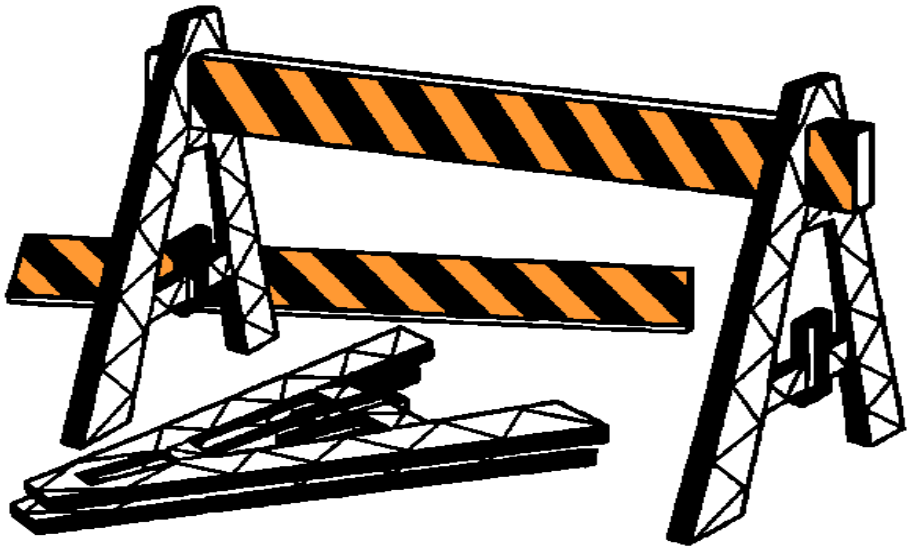
- BY PLANNING

SAFETY PLANNING BEFORE STARTING THE WORK

- DETERMINE LOCATION OF WORK
- DETERMINE VOLTAGE
- DETERMINE FIRE - EXPLOSION HAZARD

ACCIDENT PREVENTION

- EARTH MAT STUDY
- SAFETY ASPECTS OF EQUIPMENT
  - SIGNS
  - SYMBOLS
  - TAGS
  - BARRICADES
  - ATTENDANTS



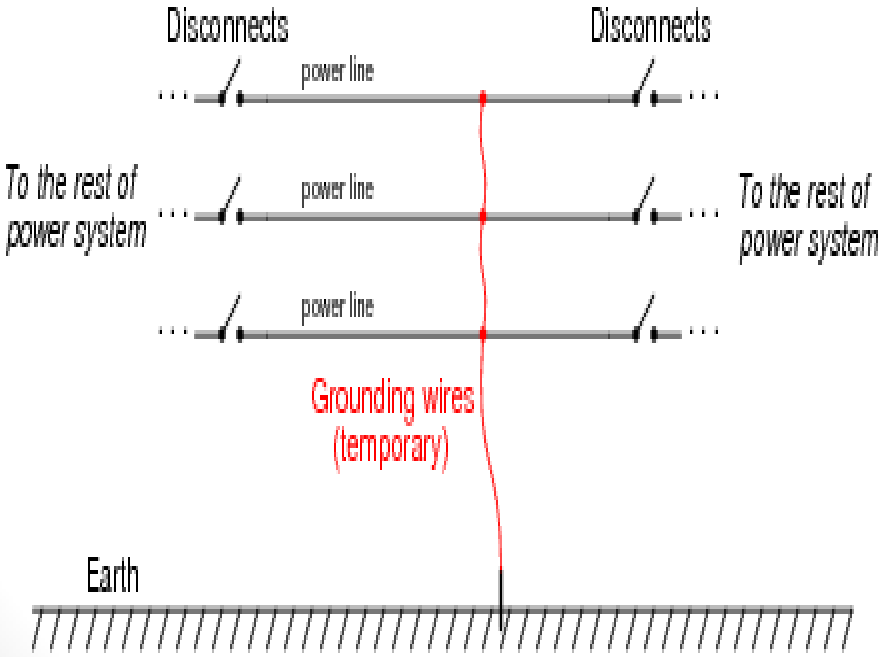
SIDE RULE

S : SWITCH OFF

I : ISOLATE

D : DISCHARGE

E : EARTH



SAFETY RULES

MAINTENANCE WITH HT, EHT, OH FOLLOWING RULES AS FOLLOWS.

- SAFETY FIRST AND ALWAYS, IT PREVENTS ACCIDENT WHICH NORMALLY RESULT LOSS OF MAN HOURS AND EQUIPMENT.
- ALL LINES AND EQUIPMENT MUST BE CONSIDERED ENERGISED.
- ALL VOLTAGES MUST BE CONSIDERED DANGEROUS.
- ACCIDENT DON'T JUST HAPPEN. ACCIDENTS ARE THE RESULT OF UNSAFE CONDITION OR UNSAFE ACTS OR COMBINATION OF BOTH.

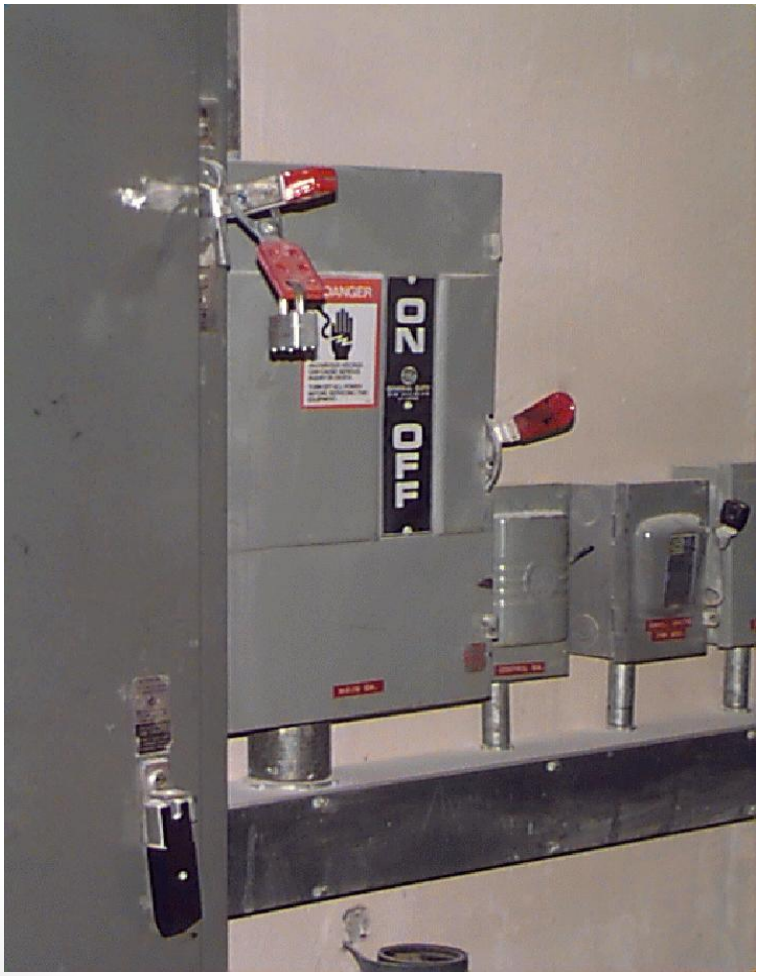
CLERANCES

Clearance above ground of the lowest conductor As per IE Rule 77

Over head Line Across Street	
Low and Medium Voltage	5.8 Meter
High Voltage	6.1 Meter
Over head Line Along Street (Parallel To Street)	
Low and Medium Voltage	5.5 Meter
High Voltage	5.8 Meter
Over head Line Without Across or Along Street	
Low/Medium /HT line up to 11KV If Bare Conductor	4.6 Meter
Low/Medium /HT line up to 11KV If Insulated Conductor	4.0 Meter
Above 11 KV Line	5.2 Meter
Above 33KV Line	5.8 Meter + Add 0.3 meter for every additional 33KV

LOCK OUT/TAG OUT

BREAKER LOCKED IN OFF POSITION



TO ENSURE THE SAFETY OF REPAIR PERSONNEL, ELECTRICAL PANELS AND EQUIPMENT WITH ELECTRICAL PANELS MUST BE LOCKED OUT AND EQUIPMENT TAGGED OUT OF SERVICE BEFORE ANY REPAIRS ARE PERFORMED. THE LOCK MUST NEVER BE REMOVED FROM AN ELECTRICAL PANEL UNTIL REPAIRS HAVE BEEN COMPLETED, AND ONLY THEN BY AN INDIVIDUAL WITH THE APPROPRIATE AUTHORITY. REPAIRS MUST ONLY BE PERFORMED BY TRAINED PROFESSIONALS.

USE OF ELCB

- ELCB'S GIVE PROTECTION BY AUTOMATIC DISCONNECTION OF SUPPLY AGAINST THE RISK OF DANGEROUS ELECTRIC SHOCK.
- CONTINUOUS HIGH EARTH LEAKAGE CURRENT CAN RESULT INTO FIRE WHICH CAN'T BE INTERRUPTED BY MCB OR FUSE.
- ELCB PROVIDE HIGH DEGREE OF PROTECTION AGAINST ABOVE FAULT.
- *AS PER I.E.RULE 61-A ELCB IS COMPULSORY FOR L.T. LOAD ABOVE 5KW.*

THANK YOU