

Electromagnetic Fields

Reduction In Domestic Environments

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THE REDUCTION OF ELECTROMAGNETIC FIELDS IN DOMESTIC ENVIRONMENTS

I. Introduction:

In any electrical system there is likely to be the presence of electromagnetic fields. The electromagnetic field consists of two parts, the electric field and the magnetic field. These fields are believed to be responsible for many illnesses when people are subjected to even moderate intensities over extended periods of time.

II. The Electric Field:

The electric field exists whenever voltage is present and regardless of whether an electric current is flowing or not. For example, the electric field will exist around an active wire right up to the switch. If the switch is OFF the electric field will not exist beyond the switch. Conversely if the switch is ON the electric field will exist beyond the switch for the whole length of circuit.

The effects of an electric field can be minimised by maintaining a distance away from the live conductor, by applying insulating materials and by providing alternative conductive paths between the live conductor and the object to be shielded. It is sometimes appropriate to consider the electric field as a minute leakage of electricity from the conductor to the surroundings, and eventually to earth

In domestic situations where we have a normal voltage of 240 v. a.c. a distance of 10 cm or more will normally ensure minimum effects, and except for electrically sensitive people is not considered to be a significant problem.

III. The Magnetic Field:

The magnetic field exists whenever a current flows through a conductor. In the above example it will only exist when the switch is ON.

Unlike the electric field, the magnetic field is not minimised by the insertion of insulating materials. Materials such as timber and concrete have no effect. Ferro magnetic materials will provide an alternative path for magnetic fields, but due to expense and mechanical difficulties this is rarely a practical solution.

In domestic situations clearances of at least 1 metre may be necessary. Fortunately there are other solutions which can be applied, as described in the following.

IV. Minimisation techniques:

A. Electric Fields:

As previously mentioned, insulation by means of plastic coverings and conduits will minimise the electric field effects. This is normal good wiring practice and no extra precautions in this area need be considered.

In the case of TV and Computer screens a significant reduction in electric fields can be achieved with earthed conductive glass screens. These can be obtained from most computer stores. Be sure that the screen has an earthing connection.

For the electrically sensitive it is recommended that consideration be given to installing a device that switches off the circuit whenever all switches are OFF. These are particularly valuable in bedroom situations where no field is permitted at night times during sleep periods. The lighting and power circuits can be switched off at the switchboard. Power is immediately restored when any switch in the circuit is turned ON.

B. Magnetic fields:

The magnetic field surrounding a conductor has a rotational direction directly related to the direction of current in the conductor. If we locate the send and receive conductors of a circuit closely beside each other the field of one will cancel the field of the other. In practical terms we should locate the Active and Neutral together. Fortunately this is almost normal practice and provided this is adhered to strictly throughout a building the magnetic fields can be kept to a minimum.

Frequently circuits within a dwelling are changed for various reasons, and when this happens it is considered expedient to run a single Active wire from one place to another. This then permits a field to exist without any cancelling effect from the Neutral and a large magnetic field then exists. It is therefore very important to ensure that the original and subsequent wirings strictly adhere to the role that Active and Neutral conductors are bound together.

For most circuits the neutral (return) current will equal the active (send) current and the earth current will be zero. In some circuits, such as those to multiple fluorescent lights or computers, there can be a leakage, or induction to earth so that the Earth conductor actually carries a current in the same direction as the Neutral current. In that case the sum of the neutral and earth currents will equal the active current. It is therefore important that the three conductors, Active Neutral and Earth are bound together to prevent any stray fields.

The cable normally used by electricians is called a twin and earth and this suits our requirements very well, provided it is used for all circuits from Switchboard to Junction boxes to light fitting(s) or power point(s). The only twin cable to be used is from the junction box to the light switch. Since this is the send and return of the active current the fields will be cancelled and the external field will be minimised.

Please refer to the attached sketches for recommended wiring practice.

To further reduce radiation effects all the wiring in the ceiling or under the floor should be located above or below dividing walls as nearly as practical. Refer attached sketches. Avoid running wires diagonally across floors or ceilings.

In the case of single storey dwellings it is better to run as much wiring as possible in the ceiling rather than under the floor. It is further from the ceiling to our head than from the floor to our feet.

In multiple storey buildings this is not so easy, so always endeavour to keep the wiring as far away as possible from where people may spend large amounts of time, like lounge chairs, beds, desks and kitchen sinks.

C. Position of the meter box:

Unfortunately there is generally a high electromagnetic field emanating from the meter box. This is because the Active Neutral and Earth conductors need to be separated from each other and the power meters have large coils of wire which magnify the magnetic effect..

Location of the meter box is very important. It should not be located on the outside of a bedroom wall as the strong field will pass through the wall without any reduction in intensity. It would be better to place it on a garage wall, or better still on a galvanised steel post a few metres from the house. The additional benefit of such a location would be that the power lines from the street need not come close to the house.

Some power supply authorities will provide external power lines known as bundled conductors. The Active and neutral of bundled conductors are twisted together and much lower magnetic fields result.

For multiple storey houses avoid the situation of power lines entering the house at first floor level, as the field may be quite high.

D. Water pipes

The water pipes must not be used as the main earth for the house. Suitable earth stakes must be used in accordance with the Australian Standard 3000 "SAA Wiring Rules".

In many cases stray earth currents of significant magnitude (3 or 4 amps) can travel along the water pipes from external sources. Such currents will result in magnetic fields in excess of 100 milligauss. An acceptable safe level is approx. 2 milligauss.

It is therefore important to insert a short (300 mm) length of strong plastic pipe between the external water meter and the piping to the house. This will block any stray currents that may appear from time to time.

When the house is functioning use a clamp ammeter and ensure that no currents are flowing in the pipes.

V. Appliances

Treat all modern electrical appliances with caution. The newer the appliance and the more electronic gadgetry included, the greater the likelihood of magnetic fields. Digital displays generally radiate the most.

In order of importance the following items should be avoided wherever possible, and in any case should be located so that at least 1 metre clearance is maintained to the nearest position where people may congregate for any period of time of an hour or more.

A. Microwave ovens.

Think carefully whether these are really essential. The seals may stop the microwaves emitting, but they do not stop the power frequency fields escaping whenever the oven is functioning. Fields as high as 200 milligauss can be measured at the door.

B. Digital displays

as mentioned above. Remember they are radiating 24 hours per day, every day, for as long as the appliance is plugged in whether the appliance is operating or not.

C. Clock radios.

Potentially the most dangerous object in the house. They can radiate 8 milligauss and are frequently located within a few centimetres of people's heads when they are sleeping. If they must be kept, locate them across the room away from the bed. It is good strategy to have to get out of bed to turn off an alarm !

D. Electric blankets and under floor electric heating.

Turn off at the wall before lying on. For electrically sensitive people it may also be wise to actually pull the plug out at the wall

E. TVs and Computer monitors.

Significant fields can be experienced at the sides and backs. Try and place them near an outside wall. Do not locate them alongside a wall where a bedroom exists on the other side. The power frequency fields at the front are generally not so significant provided a clearance of at least a metre is maintained. As previously mentioned The electric field can be significantly reduced using an earthed conductive screen available from most computer stores. Insist that it has an earthing connection and make sure it is connected to earthed metal at the rear of the computer.

F. Hi Fi Stereo and VCR equipment

Not such a problem but try and maintain 1 metre clearance in all directions, including through walls.

G. Fluorescent lights

One or two fluorescent lights are not of great concern, but extensive use of them should be avoided. It is absolutely essential to adhere to the wiring practices recommended in previous paragraphs.

H. Low voltage lights

as such are not a problem, but the transformers used with the lights can be a potential source of radiation, particularly if they are encased in plastic. Select transformers in metal cases. For a good bright light these are preferable to the low energy lights which emit a multitude of different frequencies.

I. Electronic Insect eradicators.

Remember how we were told that DDT only killed the insects and was harmless to people. Well these devices are in the same league. If it kills an insect quickly it will be slower with a human being.

Some other appliances such as hair driers will also emit significant radiation, but provided they are not used for extended periods they should not be a major problem.