



FORUM

Conducted by Neville Williams

The mains voltage knows no favourites . . .

Electricity, like fire, is a good friend but a bad enemy. The same power which lights and warms and moves in a most convenient and efficient manner can also kill. Perhaps I am stating the obvious but recent events would seem to indicate that the obvious can too easily be overlooked.

A recent news item in the press featured a statement by the Chairman of the Electricity Authority of NSW, Mr F. H. Campbell.

Mr Campbell warned that many portable amplifiers used by pop music groups do not comply with Australian electrical safety standards being, in fact, a potential hazard to anyone using them.

Mr Campbell is certainly not exaggerating the situation. From time to time we have heard reports of performers receiving a shock from amplifying equipment, sometimes with tragic results. To be specific, we reproduce in precis form in the accompanying panel a report in the Sydney "Sun" concerning a coroner's inquest held recently in Wollongong, NSW.

How do such things happen and why are "pop" amplifier systems in particular open to question?

The answer lies in the nature of the equipment and the way it is used.

Pop group amplifiers are almost invariably of the portable variety, relying on trailing leads for their connection to the AC supply and to earth via the power point. This, of course, is true of a great many mains-operated appliances, from toasters to television sets but there are two notable points of difference.

Most domestic appliances are under close scrutiny and control by the electricity supply authorities. Whether manufactured locally or imported, they cannot legally be sold in Australia unless they conform to rigid safety standards.

There is no such control over portable amplifying equipment. A supplier may seek type approval as a matter of prudence but he is under no legal obligation to do so.

A second point is that amplifiers are of no value in themselves; they have to be connected to input and output devices. So, when a pop group arrives with their amplifiers, the next operation is to bring in the guitars, the microphones and the loudspeakers and plug them in to the relevant sockets.

When a performer subsequently picks up a guitar and strokes the strings with his hands, he is making contact with metalwork which is electrically bonded back to the amplifier.

When he nuzzles up to a microphone or takes a firm grip of the stand, he is doing likewise.

He might conceivably make simultaneous contact with a guitar connected to one amplifier and a microphone connected to another. Or he may make contact with other metal objects around the stage.

The interconnection of the guitar, microphone and amplifier metalwork is not just a convention or a whim of the manufacturer. It is done deliberately to combat hum injection, penetration by radio and television signals, and interference from lighting dimmers, etc.

In the normal way it does not produce any kind of a hazard; quite the reverse, in fact. The third wire in the power cord links the metal work or "earthy" circuitry in the amplifier to the earthed pin in the power point. Therefore, the metalwork of all the amplifiers, all the guitars and all the microphones is at earth potential. The same should be true of exposed metalwork on stage lighting fixtures, etc. It should be

LETHAL GUITARS

A Coroner has claimed that there are hundreds of lethal electric guitar amplifiers in use by NSW musicians.

But there is no official control over importing or selling the killer instruments.

Technicians at the Sydney County Council equipment testing division said today that amplifiers were not on a list of electrical goods requiring a compulsory check-out. It was not essential for the importer or retailer to submit them for examination.

"A voluntary test scheme does operate and if an amplifier submitted for this was proved to be faulty, the importer or retailer would be instructed not to market them until necessary modifications were made," one technician explained.

Wollongong coroner, Mr B. J. Wilson, said that some 500 guitar amplifiers had been released on to the market despite an SCC warning that they were "hazardous."

Mr Wilson was inquiring into the death of a 16-year-old Wollongong youth who died from an electrical shock while playing a guitar attached to a faulty amplifier. (Sydney "Sun", June 14, 1972)

impossible to sustain a shock under such conditions.

Unfortunately, these conditions are not always realised, particularly in equipment which is designed overseas and imported, either by individuals, or by business concerns which lack a technical background.

Many overseas manufacturers are accustomed to supplying a market which involves 110V mains and a two-wire power cord — with no provision to earth the frame of the device.

The most obvious difference about the Australian and European markets is that they require 240V operation. The overseas manufacturer may simply adapt the internal works of the appliance to 240V operation, taking no special precautions with the high voltage, and still supplying the original 2-wire cord and plug.

In Australia, the purchaser simply cuts off the original 2-pin plug, substitutes a 3-pin plug and puts the appliance into service with no earthing provision. If it happens to be an amplifier, the microphones and guitars connected to it consequently lack an earth return and are free to float at some random (and hopefully small) potential above earth.

If the power transformer has adequate insulation around the primary winding and everything else is in order, the worst that is likely to happen is that a performer may notice a "tingle" when he touches some of the metalwork. This would be the result of stray capacitive coupling between the mains and the metalwork.

However, if an ohmic path were to be set up within the amplifier between the mains and the chassis, the metalwork of the amplifier, guitars and microphones could become "live" at the full mains potential. The lethal path might be provided by a stray strand of wire in a fraying lead, by breakdown of a mains bypass capacitor or breakdown of the insulation within the power transformer itself.

This is the very situation that the earth wire is there to protect against. With an effective earth, any such path to chassis would simply result in blown fuses and a service call to discover what had gone wrong.

Without the earth wire, the live metalwork would be a potential death trap for any performer who happened to touch it while also in contact with an earth return path.

Some of the attempts by oriental manufacturers to accommodate to Australian wiring practice have been more dangerous than their omissions.

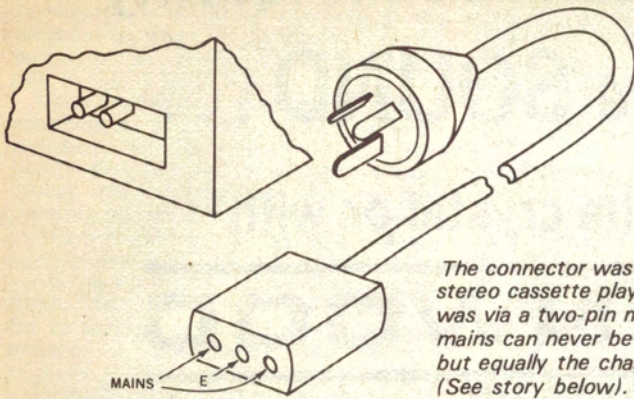
Two such situations were the subject of reference in earlier issues.

One involved fitting regular 3-core flex to equipment but with the black wire used for the earth return. This is an open invitation for some unwary person, when changing a plug at a later date, to assume green as the earth, and to connect black (and therefore chassis) to one side of the mains.

Worse than this was a batch of test instruments which landed in the country with the black wire connected to chassis and the green wire connected to the earth pin of the power plug. A staff member found out about the error in a very painful manner, when he "copped the lot" on the test bench.

Nor is this just a piece of history. The illustration shows an example of oriental power pluggery which we came across only

Power Connection - Oriental Style



The connector was supplied with an imported stereo cassette player where the power input was via a two-pin male socket as shown. The mains can never be connected to the chassis, but equally the chassis can never be earthed. (See story below).

a few days ago, while this article was being prepared.

The two male pins are protruding from the back of a stereo cassette player capable of operating from either 110/240VAC or batteries. The power cord was provided somewhere along the line between manufacturer and user. On one end is an Australian 3-pin power plug; on the other a 3-pin socket wired as shown.

While the latter socket is polarised in a rather vague way by slightly unequal spacing, it can in fact be forced on to the pins either way up and with the pins sliding into the centre and either one of the outer holes. But however it is inserted, the centre hole never gets the chance to earth the recorder chassis; it is always in the transformer primary circuit.

Obviously, the recorder will only work when the socket is so inserted that the pins connect between mains active and the power wiring earth!

The moral of all this is very clear. Don't take power cord connections for granted, particularly in equipment to which you're going to attach microphones, guitars or other metallic peripherals. Inspect the connections and check them with an ohmmeter to make quite sure that there is a circuit between the earth pin and the chassis, and NO circuit between the chassis and the mains supply pins.

One other point remains to be made. The trailing power cords attached to portable amplifiers take quite a beating; they are rolled and unrolled, kinked and unkinked, walked on and tripped over.

It is absolutely essential that they be checked from time to time and repairs initiated if they begin to look the worse for wear, particularly adjacent to the power point and the amplifier.

If a mains supply wire is fractured, the equipment will simply fail and the break must be mended. If an earth wire is fractured, the equipment will continue to operate normally — but without the vital safety protection that the earth wire provides.

Most important is the anchoring of the power cable inside the chassis of the amplifier. It must be firmly clamped so that it will resist either pulling or twisting without transmitting the movement to the electrical connections. A knot inside the chassis isn't good enough. It will resist any amount of pulling but it offers no protection against twisting.

In the face of all this, it is rather shat-

tering to have to refer to a "technical hint" which one of our staff picked up recently from a group of "musos" in a discotheque: "If your amplifier hums, try snipping through the earth wire inside the chassis."

Good grief!

If you value your life, you'll use 3-core flex, — good 3-core flex. You'll make sure it is properly anchored and wired at both ends and you'll make sure that it is inspected and maintained.

And if you're using multiple amplifiers, you'll touch the peripherals from one against the peripherals from the other just to make sure. Better a test before the show than a tragedy half-way through!

Let there be any misunderstanding, the problem here is not with people who built

their own amplifiers. If they know enough to turn a circuit into a piece of operational equipment, they will almost certainly know the elements of safety and what the earth wire is all about.

"Almost"?

Rather tragically, another news item in the daily press, about the same time, recorded the death by electrocution of two electricians, one in a building, the other in a ship. Both died because they were working in a live-circuit situation.

This is nothing new to electricians. Occasionally they do it as a matter of necessity. Sometimes they do it because switching off the power would involve a degree of inconvenience. Sometimes they just don't bother.

Whatever the reasons, electricians usually get away with it because they know the hazards and they take care not to inject themselves into a circuit. Exactly the same remarks could be made about other workers in the electronics field who have to bypass safety interlocks in order to diagnose and correct faults in high-voltage equipment.

But no electrician, no electronic serviceman carries a certificate of immunity from electrical shock. For all his technical knowledge he will suffer the same fate as the most non-technical performer if he gets across a 240-volt circuit.

A morbid subject?

Sure! But none of us in the E.A. office laughed at the kind of news item I've just referred to. Or at the warning from the Chairman of the NSW Electricity Authority; or at the idea of cutting the earth wire in a portable amplifier system! ☹

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