

REPORT ON AS3003 WORKSHOP

Held during the

PERM-IT'97 CONFERENCE

ADELAIDE

SEPTEMBER 1997

INTRODUCTION

At the 1997 annual Australasian Biomedical Engineering and Medical Physics conference, entitled PERM-IT '97, held in Adelaide during September 8-11 a breakfast session/workshop was held on the topic of AS3003. This was convened on Thursday 11th between 8 and 9am and took the form of a sit down breakfast. The format comprised a number of selected people presenting a brief overview of particular issues followed by general discussion. The session was entitled "Is equipotential earthing necessary?" so as to focus on one of the major current topics of debate in relation to the standard. The cost for attendees was \$20 per head with the session being sponsored by Electrical Safety Products, a major international supplier of products used in the wiring of patient treatment areas. In excess of 50 people attended representing a broad range of engineering and technical staff from major hospitals in Australia and New Zealand, with significant attendance also from private contractors and consultants. The workshop was convened by myself.

SPEAKERS

Mr Adrian Richards , Senior Technical Officer , Biomedical Engineering Services , The Queen Elizabeth Hospital

SA Health Commission representative to HT/21

I gave a brief overview and update of the current status of AS3003 and its revision. I outlined that the draft that went out for public comment a couple of years ago was currently within its final stages of incorporating changes and that it was planned to publish it within the near future. It was highlighted that in general terms the content was similar to its predecessor particularly with regards to the inclusion of the requirement for equipotential earthing in cardiac protected areas. The committee's resolve to commence, almost immediately, the further updating of the standard was mentioned in order to address the increasing body of opinion that EP earthing was difficult to justify. The thrust of the next revision was to significantly modify this requirement. The publication of the planned third edition was justified on the basis of the work that had gone into the changes, the fact that the alterations were deemed to be worthwhile in themselves and that the existing second edition was essentially past its "use by" date according to Standards Australia policy.

Mr Martin Grace , Technical Consultant , Electronic Safety Products

Martin provided an outline of the concepts of providing electrical protection within patient treatment areas on the basis of risks of micro or macro electrocution. His stance was that he felt that the risks were real and

present and that measures currently prescribed provided a good safeguard against them. He also provided a brief overview of ESP as an organisation and the range of products that they supply into the world market. From his perspective the requirement for EP earthing meant little commercially as the bulk of their market consists of RCDs and associated products.

Mr Peter Selvey , Testing and Certification Australia, Sydney

Peter gave a brief overview of what he sees as being one of the main issues in the EP earthing discussion, being the risk of the combination of circumstances actually occurring which may lead to ventricular fibrillation. This combination was presented as:-

A 100mV potential existing caused by circulating or fault currents

The application of this potential to a conductor in direct contact with the heart which will most likely involve a number of skin contact resistances.

Fibrillation actually resulting from the above set of circumstances

He proposed that the probability of this occurring, although it has not been calculated accurately, was undoubtedly very low.

Mr Steve Morrisby , Senior Electrical Engineer , Bestec Consulting Engineers

Bestec are a significant Adelaide based practice of consulting electrical engineers. They have been and are currently involved in a number of electrical upgrade projects in South Australian hospitals involving patient treatment areas. He outlined the consulting process that typically takes place in the specifying of patient treatment areas highlighting that this will typically include the end user having the major say in differentiating between body and cardiac protected requirements. He stressed that on a significant number of occasions they are put in the position of being considered the expert consultant and their clients looking them for final advice on this matter. He suggested that this was an expectation that they are not particularly well prepared or best qualified to fulfil. They would normally opt for cardiac protected in a situation such as this where there may be any doubt at all. He also provided some interesting figures on costs that they will typically allow for the wiring of areas during a new installation. Body protected requirements to a ward area add an average of \$300 to \$350 per bed above standard wiring. This is inclusive of the hardware requirements, installation and commissioning. The specification of cardiac protection to a ward area would add a further \$1000 to \$1200 per bed. This relationship was quite linear in the case of body protected requirements but not so in the case of cardiac protected with the figure per bed tending to come down as the number of beds increased. In the case of an operating room the costs for cardiac protected requirements would vary between \$5 and \$10,000. For upgrades to areas no standard figure could be quoted due to the variable nature of such exercises.

Mr Martin Dwyer , Manager, Biomedical Engineering , Canberra Hospital

Martin highlighted his belief that the incidence of micro electrocution was highly overstated and that there remains no accurately documented or reported cases of it actually occurring. He believes that the currents required to induce ventricular fibrillation may be higher than presently thought by a factor of up to ten as a result of the manner in which the current figures were determined, being via myocardial disc electrodes on hearts that may be susceptible or exhibit lower than normal thresholds. Martin proposed that the present assumption of the level of circulating currents within a building, being 10 Amps, may be significantly higher than what we would see in a typical acute care area. He felt that the requirements for EP earthing were unnecessary and that there were far more relevant requirements that would have a greater impact such

as the specification that earthing checks should be performed routinely in body protected areas to address failing GPO contacts for example.

GENERAL DISCUSSION

The general discussion that ensued picked up on a number of points raised during the above presentations, they can be summarised as below.

There was general feeling that the 10 milliohm requirement was excessively stringent and that it should be relaxed if not removed based upon the lack of documented evidence of microshock. Some people felt cautious about removing it all together and that a factor of 10 relaxation would be "comfortable". Concern was raised that the present fibrillation threshold current is the best information that we have to go on and questioned the desirability of relaxing things without further hard data. This data was felt not to exist at this point time and that any animal studies performed may not necessarily be indicative in human terms.

A minority felt that the risks were significant and that the existing requirements could be justified. One individual did express the belief that microshock was in fact killing people but this was being covered up by the hospitals. This person was challenged to provide the evidence of such.

The assumed level of circulating leakage currents was discussed with 10 amps being considered as the worst of the worst case and that it would normally be expected to be substantially lower than this. It was suggested that if these figures were based upon actual measurements that high neutral current may be the cause and it was questioned where the measurements may have been made in relation to the MEN point. Some work in this area was considered to be appropriate and necessary to determine the validity of these figures on which some of the standards requirements are based.

Some detail on testing and commissioning of areas was also a suggestion for inclusion in forthcoming editions. In particular the recommendation of staged inspection as in many instances in the course of building works significant aspects of an installation were "built in" and very difficult to inspect at the point of practical completion.

Based upon the comments by the consulting engineer detailed above the inclusion of some guidance on the specification of areas both in terms of body or cardiac protected and RCD or isolated supply protection were seen to be worthwhile. The value of AS2500 in this regard was acknowledged but further guidance above that already provided in AS3003 was considered to have merit also.

SUMMARY

I believe that the viewpoints expressed and issues raised presented as far as possible a balanced perspective from a range of parties involved in the issues relating to electrical supplies to patient treatment areas.

The overall discussion very much adopted the flavour of the desire for change in the direction of relaxation of the 10 milliohm EP earthing requirement but there was an air of caution relating to the removal of this altogether in a single move. The need for further research into fibrillation thresholds and the figures used for circulating leakage currents was flagged.

Cost/benefit of EP earthing emerged as an issue both in terms of the significant expense involved versus the arguably low risk and the overspecification of cardiac protected areas in cases where body protected requirements were more appropriate. The specification of isolated supplies rather than RCD protection, with the significant cost implications of this, was also considered a factor with the real need for isolated supplies being debatable

Adrian Richards

October 31, 1997

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