Know Your Standards

We are working through the IEC 61000-series standards, but not in numerical order of the Parts (the single number following 61000). Even so, the next Part is IEC 61000-5: Installation and mitigation guidelines. The Sections of this Part are a mixed bag, but, contrary to what can be inferred from the Part title including 'guidelines', some of them are true standards, i.e. a document having requirements, with which conformity can be determined by specified methods. (This isn't the official definition of a standard but a discriminator between true standards and other types of standards publication, such as guides and reports.) The other Sections are either Technical Reports or Technical Specifications (a misleading term for a sort of 'pre-standard' or try-out': unlike IEC, BSI uses 'standard' as a general term and 'specification' to mean what I've just described as a 'true standard') Only the true standards have been adopted by CENELEC as ENs.

IEC 61000-5-1:1996

This concerns 'General considerations', and is published also as BS IEC 61000-5-1, but has not been adopted by CENELEC. It's a textbook, like many of the other Sections, and IEC really shouldn't be writing textbooks, but back in the 1990s there was such a lot of unreliable folklore about EMC in circulation that there was seen to be a need to promote the truth.

It is actually a Technical Report (formerly 'technical report type 3') and if revised would be designated TR 61000-5-1. IEC sells it at CHF190, which at present is about £133, and you can buy several good EMC textbooks for that sum. The other Sections are equally costly.

It may be important to note that the IEC editorial rules were not applied consistently in some of these documents. In particular, the word 'shall' appears in some Technical Reports, and in non-normative contexts elsewhere. The relevant texts should be interpreted as if the word were changed to 'should'.

IEC 61000-5-2:1997

This Section is 'Earthing and cabling' and had a very chequered career in development. It is a Technical Report, and originally recommended only those techniques used in the telecoms industry, which actually don't necessarily suit every other sector of the electrical-electronics business. The history of the controversy can be detected in this statement in the Introduction:

> ***It is important to note that the recommendations presented in this technical report do not seek to preclude existing installation practices, when they have been shown to perform satisfactorily. Special mitigation methods might not be necessary when the equipment satisfy* [sic] *applicable emissions and immunity standards.*** In particular, some installation practices such as a "Star Network" or "Isolated Bonding Network" for earthing are based on different approaches to EMC that have been found satisfactory for specific installations when correctly applied and the **topology maintained** by competent specialists. Nevertheless, the approach recommended here is more generally applicable to all types of facilities, especially when signals are exchanged between different apparatus.

It should be understood that the document deals with its subject very thoroughly, but the same or similar information is now available elsewhere more accessibly. Note the emphasis on 'topology maintained' – inadvertently introducing a mesh into a star network or a star point into a mesh can ruin everything. This was the cause of much of the controversy; people foresaw being required to implement mesh earthing when updating existing installations that used star earthing. This could very well be an extremely costly and difficult process, for no actual advantage other than conforming to a new orthodoxy.

IEC TR 61000-5-3:1999

This Section is again a Technical Report; it is called 'HEMP protection concepts' and is thus of very specialized interest (but is not about protecting plants from frost with sacking). HEMP is High-Altitude Electromagnetic Pulse, and the report is associated with HEMP due to nuclear weapons, but it's also possible that rare astronomical events can produce similar pulses. We may find out at some point. The high intensity EM radiation can seriously damage wired networks, both for power and telecoms. The report includes a comparison of HEMP and pulses caused by lightning (LEMP).

IEC TS 61000-5-4:1996

This is a Technical Specification (formerly 'technical report type 2'), but it hasn't been converted to a standard in 17 years! It deals with immunity to HEMP and discusses protective devices of the following kinds, but without performance requirements: barrier materials, shielded cables and conduits, gasketing materials and shielding components
It also includes an Annex on 'General theory', which is about as 'textbook' as they come.

IEC 61000-5-5:1996

This is a true standard and has been adopted by CENELEC. It contains actual specifications for HEMP protective devices, with references to the relevant IEC (component) product standards, but, not unexpectedly, after so many years these references are now out-of-date. It deals with:

Gas discharge tubes
Metal oxide varistors (MOV)
Expulsion-type arresters (not immigration officials, and not recommended for HEMP protection)
Non-linear resistor type arresters
Avalanche-junction transient voltage suppressors (protective diodes)
Filters

IEC 61000-5-6:2002

This is another Technical Report *alias* textbook, 'Mitigation of external EM influences'. It should have a front cover picture of a big switch in the 'off' position. It describes, in very general terms, screening, filtering, decoupling and the use of surge-protective devices.

IEC 61000-5-7:2001

This is a true standard (thereby contradicting the word 'guidelines' in the Part title). It deals with the degrees of protection by enclosures against EM disturbances, similarly to the more familiar IEC 60529 'IP code' about protection against mechanical penetration. It would be good to look at this in conjunction with IEC 61587-3 (prepared by SC48D).

IEC 61000-5-8:2009

This is another Technical Specification, on 'HEMP protection methods for the distributed infrastructure'. The effects of HEMP could be disastrous over a very wide area; the standard shows that a pulse generated at 170 km altitude would cover a circular area traced by Winnipeg, Quebec, Miami and Dallas, with an electric field of up to 50 kV/m.

IEC 61000-5-9:2009

This is also a Technical Specification, and describes how to assess the susceptibility of large systems to HEMP and HPEM. HPEM is 'High Power Electromagnetic', which seems an incomplete phrase, but the word 'environment' is meant to be understood. That's extremely obvious, isn't it? It's a large document and contains a great deal of information, but it still seems useful only to a small specialist group. Let's hope so, anyway.

Simulation

There are certain objections to creating HEMP, and, to a lesser extent, HPEM, in order to test equipment and systems for immunity. So there are a few (very costly indeed and very large) simulation facilities around the world. These include attractive 'boys' toys', such as helicopters, fixed-wing aircraft, balloons, 300 MW magnetrons and Marx generators. Who said EMC testing was dull and boring?

Next time

We shall look at the remaining Part 6 of IEC 61000; a Part 9 was planned (what happened to Parts 7 and 8 is not disclosed), but nothing is currently planned for that Part.

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