



INTEGRAL ENERGY POWER QUALITY CENTRE NEWSLETTER

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New Standards Australia Publication on Power Quality

Standards Australia has just published guideline to two of Australia's most important PQ standards on harmonics and flicker. The handbook, HB264-2003 "Power Quality – Recommendations for the application of AS/NZS 61000.3.6 and AS/NZS 61000.3.7", was written by the PQ Centre.

Although both standards have been adopted for a couple of years, there has been industry concern about the difficulty of using them because their practices were very different to those used in the previous AS2279 standards. Both standards have been called up recently by NEMMCO for distributors and it is now important that they be clearly understood. Although the standards apply from MV to EHV voltage levels, the guidebook concentrates on radial systems from 415V to 132kV.

In the case of harmonics, the standard was found to be particularly difficult to interpret and implement, and new procedures were developed. Some departures from the standard include:

- A new set of Planning Levels which reduce from LV to higher voltage levels in such a way as to promise an equitable

allocation of harmonic current across the distribution system.

- In most instances, only the 5th harmonic and the THD need to be measured and assessed.
- The only statistical measure for utility voltage is the 95% value of the 10-minute readings over a day, scaled up by 1.1 to give a smoothed estimate of the maximum.
- For installation current, 100% values have been retained since these can be directly controlled. The allocated current is defined as that actually flowing into the installation when the voltage follows the utility's undertaking for power quality.
- There is only one test under each of Stages 1 and 2 rather than the three in the standard.
- A practicable method is given for allocating current to loads distributed along long feeders with significant changes in fault level.
- Guidelines are given for how much additional current can be allocated under Stage 3.
- A systematic approach to the selection of system harmonic reactance is given.

Power Quality Code

In May this year, the Power Quality Centre completed a report for the Australian Strategic Technology Program of the Electricity Supply Association of Australia which provided a framework for the

production of a national power quality (PQ) code of practice for Australian electricity companies.

The framework consisted of two parts. Part A dealt mainly with conceptual and policy issues including:



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- PQ disturbance types and their interaction over the network.
- Roles and responsibilities of the various parties involved in the generation, distribution and use of electrical energy.
- PQ management and planning by electricity companies.
- PQ agreements.
- PQ monitoring methodology and reporting.
- Customer complaint processes.

Part B considered technical issues such as:

- Characterisation of PQ disturbances, their limiting values and their methods of measurement.
- PQ survey and reporting method details.

This document provides a firm basis for the development of a national code of practice which will both allow control of PQ disturbances and lead to reduced equipment down time for consumers.

ESAA Advanced Power Quality Course

In February this year, the Power Quality Centre ran its "Advanced Quality of Electrical Supply" course for the second time on behalf of the Electricity Supply Association of Australia (ESAA). This course is one of two 3-day advanced power quality courses run by the Centre. This course focuses on continuous power quality disturbances, in particular voltage unbalance, voltage fluctuations and harmonics. The course consists of lectures with accompanying computer-aided tutorial sessions to reinforce learning through the use of "what if..." scenarios.

Special presentations were provided by two industry consultants both of whom are

Visiting Professors to the University of Wollongong. Mr Alex Baitch, Principal of BES (Aust) Pty Ltd, lectured on voltage fluctuations and their mitigation, and Dr. Keith Walshe, Principal of Power Quality Technologies Pty Ltd, gave presentations on power capacitor applications in the presence of harmonics and the design and application of harmonic filters.

The course was attended by participants from every state and territory of Australia except the Australian Capital Territory, providing a good opportunity for both learning and networking.

EESA Power Quality Forum

The Electric Energy Society of Australia held a Power Quality Forum at Energy Australia headquarters on the evening of February 12. There were papers presented by Paul Howarth from Energy Australia, Robert Barr ("Voltage sags - Customer needs versus what Distributors can deliver"), David Sweeting ("Voltage sag impacts on customers") and Vic Gosbell ("Planning Levels for Harmonic Management"). Before the presentations, Robert and Vic were presented with the Conway prize for the best member paper at the 2002 EESA Annual Conference in Canberra.

Vic began by referring to the Eurelectric report, "PQ in European Electricity Supply Networks" which stated that in Europe, harmonics are the worst PQ problem, being near the limits at many sites, and increasing at the rate about 1% per decade. Harmonics do not lead to immediate equipment malfunction and their importance can be underestimated. Their control requires the industry to be proactive by adopting suitable harmonic standards and ensuring that levels are contained by means of routine monitoring at a sample of sites.



Harmonic current emissions are allocated to MV customers based on target values of harmonic voltages called Planning Levels which vary with voltage level. Their values are set at LV by the immunity of LV equipment, but utilities are free to choose how they reduce at the higher voltage levels. These Planning Levels have to be chosen carefully if the network is to have an adequate harmonic absorption where it is required. The Power Quality Centre was commissioned by Standards Australia to determine suitable

generic values for Australian Distribution systems. Typical power system topologies, parameters and loadings were sought from distributors. Studies were made for different power system models to cover the range of distributor submissions. Suitable compromise values were then chosen. These values appear in the newly published Standards Australia publication HB264-2003 "Power Quality – Recommendations for the application of AS/NZS 61000.3.6 and AS/NZS 61000.3.7" which has been reviewed above.

Country Energy Training Course on Harmonics and Flicker Standards

A one day training course covering Australian standards on harmonics and flicker was presented by Vic Gosbell and Sarath Perera on 27th March 2003 at the Stamford Sydney Airport Motel. The course was attended by about 20 participants from Country Energy. A short introduction presented the contents of AS/NZS61000.4.7 (harmonic instrumentation and measurement standard) and AS/NZS61000.3.2 (LV equipment harmonics standard). A detailed coverage of

AS/NZS61000.3.6 relevant to MV and HV systems was followed by an MV case study. A brief introduction to the flickermeter standards AS/NZS4376 and 4377 was followed by description of the LV equipment standards AS/NZS61000.3.3 and 3.5. AS/NZS61000.3.7 that covers emission limits for MV and HV systems was given an in-depth coverage followed by example calculations.

TXU Training Course on Voltage Fluctuations and Flicker

TXU Melbourne organised a one-day workshop on Australian voltage fluctuations and flicker standards for staff from Victorian utilities. The workshop was presented by Sarath Perera on the 29th April 2003 at the Duxton Hotel in Melbourne. 22 engineering personnel from a number of utilities attended the workshop. The topics covered include an introduction to voltage fluctuations and flicker. Coverage of the flickermeter

standards AS/NZS4376 and 4377 was followed by the most utility-relevant standard AS/NZS61000.3.7 that addresses the connection of fluctuating loads to MV and HV power systems. The equipment standards AS/NZS61000.3.3 and 3.5 were briefly covered. A large number of examples were solved during the workshop followed by a few open-ended problems.

CIREN 2003 Conference, Barcelona, Spain

During the month of May, Duane Robinson attended the 17th international conference on electricity distribution (CIREN) in Barcelona, Spain. This conference is held biannually and is Europe's leading international conference and exhibition on power distribution engineering. The conference was held over

five days including tutorials, technical sessions, interactive forums, round table discussions, technical visits and a distribution equipment exhibition. The conference was well attended by over 900 distribution managers, engineering professionals and academics, with over 600 papers and



contributions published in the conference proceedings. The Integral Energy Power Quality Centre presented three papers at the conference.

At the conference Mr. Robinson attended the following sessions:

- a tutorial on distributed generation covering the types of distributed generation, and technical and economic connection issues.
- the distributed generation technical session which dealt with utility experiences and investigations into the application of distributed generation.

- the technical session on power quality and EMC.
- the power quality and EMC interactive forum.
- a round table discussion on the impact of deregulation on the electricity distribution business.
- the academic village where the problem of attracting more students to the power engineering discipline was discussed.

The next CIRED conference will be held in Torino, Italy in 2005.

CIRED 2003 paper abstracts

1. XML schema for power quality data

J. BRAUN, V. GOSBELL, D. ROBINSON

The introduction of deregulation and competition in the energy market has forced utilities around the world to focus on the improvement of both efficiency and cost effectiveness of their operations. Central to this aim is the need to integrate a large amount of real time and historical data in order to extract the knowledge so essential for better decision-making. This amalgamation of data originating from various technical and business systems is known as Enterprise Application Integration (EIA) and will in the future include Power Quality (PQ) data. This paper discusses the appropriate organization of data and presents an XML schema for power quality data.

2. A study of continuous PQ disturbance levels in MV/LV distribution systems

V. GOSBELL, D. ROBINSON

Distribution Network Service Providers need to be aware of the general variation of PQ disturbances across their network, from sites as diverse as the MV bus bar of a zone substation, the end of a MV feeder, and at the near and far ends of LV mains. This paper develops an understanding of PQ variations across such a system from survey results of continuous PQ disturbances (e.g. voltage deviations, unbalance, fluctuations and

harmonics) correlated with approximate analysis used to assign a PQ disturbance ranking to each site.

3. A transient index for reporting power quality surveys

C. HERATH, V. GOSBELL, S. PERERA, D. ROBINSON

Impulsive transients are often blamed for the destruction of customer appliances. Advances in PQ monitors will soon make it feasible to incorporate impulsive transients into routine PQ surveys. This paper considers how the transient events captured over a period at many sites may be reported in a simple but useful manner. The paper first summarizes a recent publication by some of the authors, which attempt to give a complete framework for the analysis of utility PQ data. This framework provides a basis for evaluating existing transient characterization practices as well as for the proposed new transient index that will be discussed in the paper. A review of current transient characterization practices and their limitations, followed by the development of new transient index for use in site ranking is given. The application of the new transient index is illustrated through an example.



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