



CIGRE/CIRED/UIE JWG C4.110 Voltage dip immunity of equipment in installations

Joint Workshop on Voltage Quality Monitoring
Brussels, 18 November 2009

Math Bollen

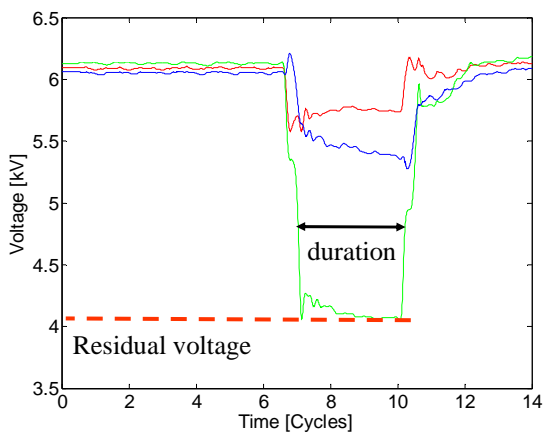
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History

- Nine meetings: April 2006 – January 2009
- Final report approved and will be available for free from CIGRE
- Scope of the working group
 - Move voltage-dip immunity a step further
 - Recommendations to the stakeholders
- October 2009: UIE WG2 takes over the dissemination of the results

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A voltage dip

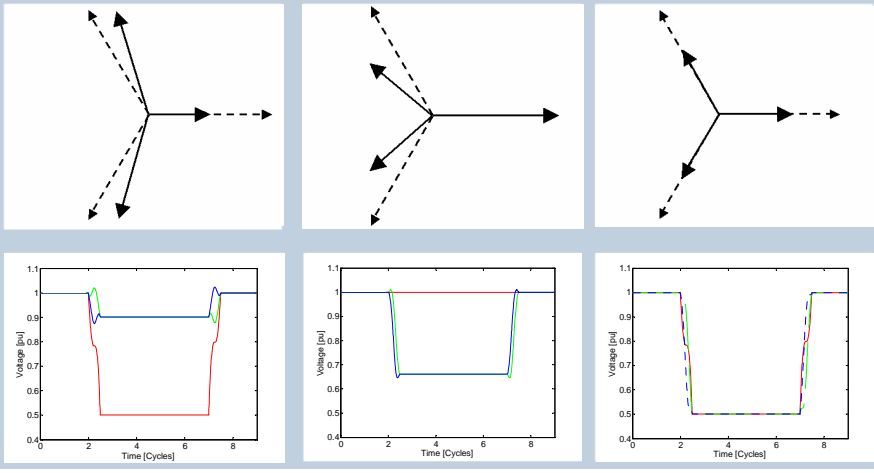


In a three-phase system

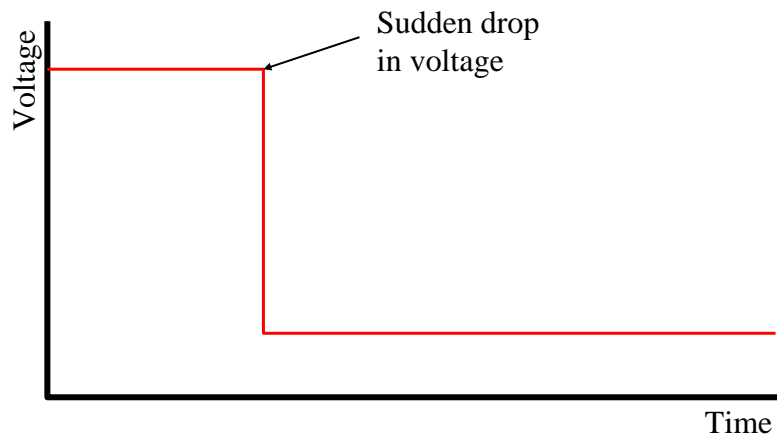
Type I

Type II

Type III

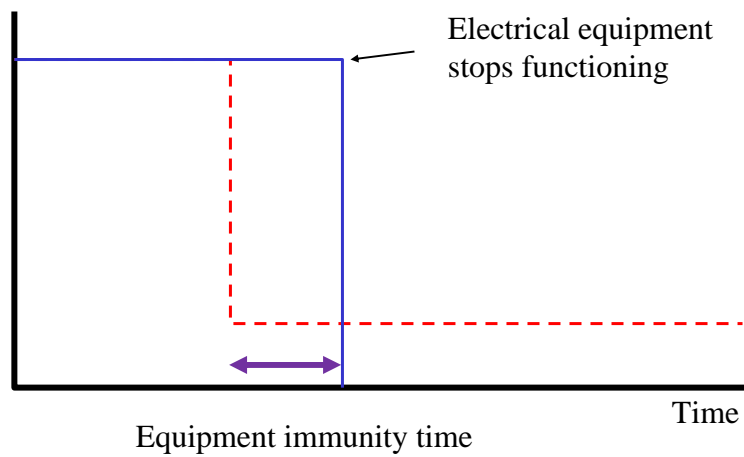


Voltage dip



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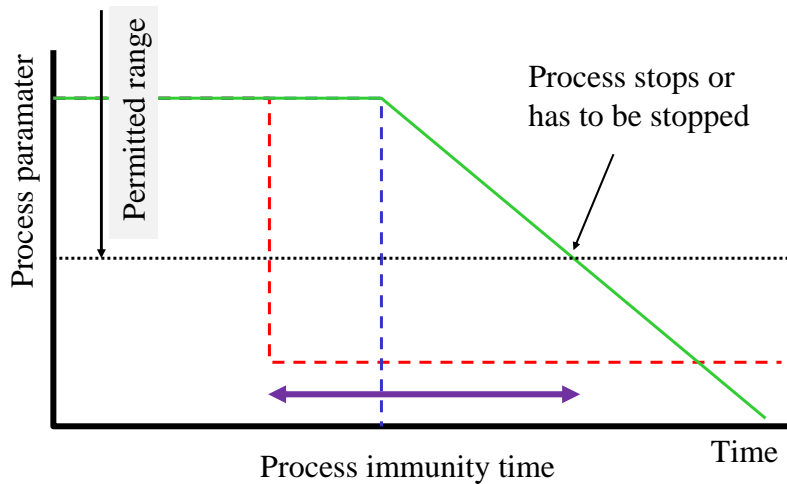
Immunity of equipment



Equipment immunity time

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Immunity of the process



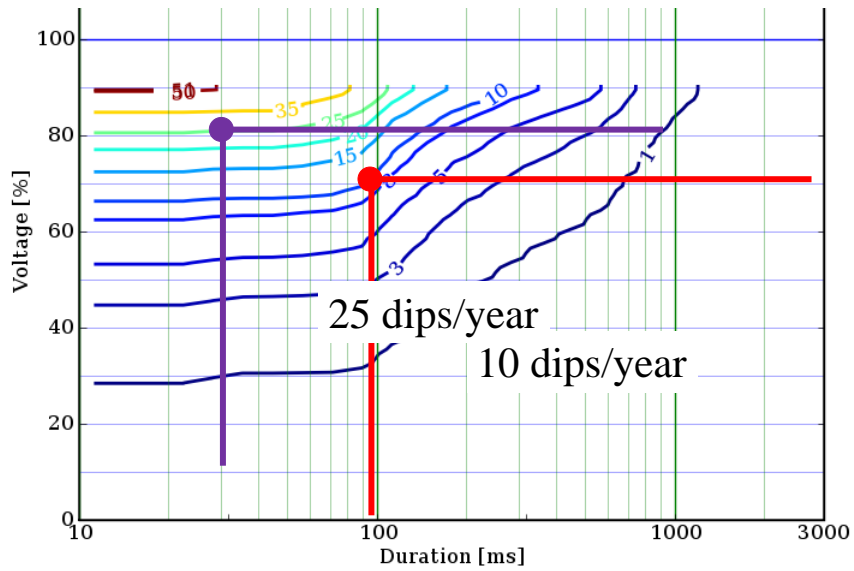
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Global voltage-dip statistics

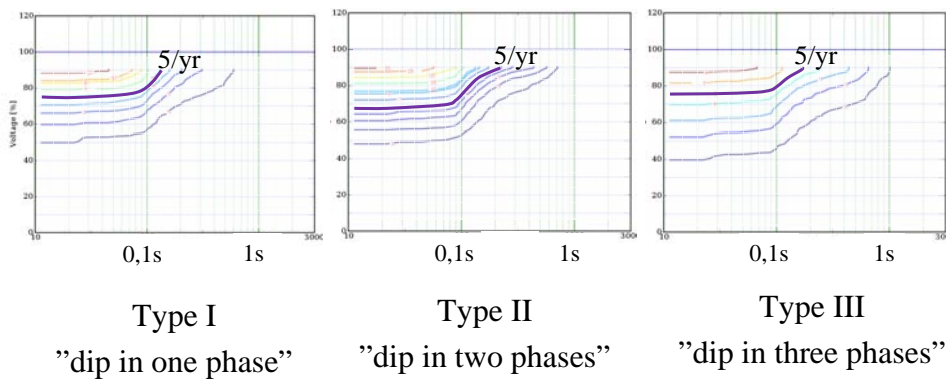
- 1000 measurement locations
- Canada, Scotland, Portugal, South Afrika, Australia, Spain, USA, Japan, New Zealand
- All data in the same database
- Presented as a contour chart, percentile and dip type.

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Contour chart



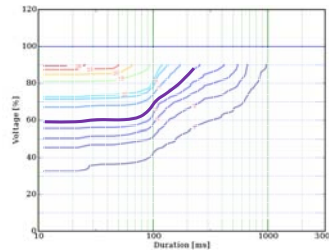
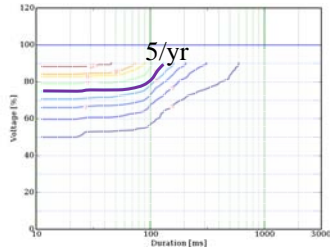
Dip type



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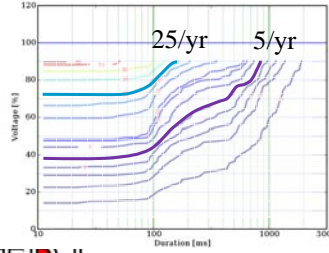
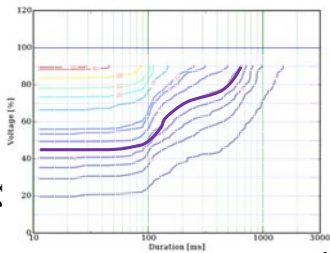
Percentile of the sites

Type I, 50% site



Type I, 75% site

Type I, 90% site

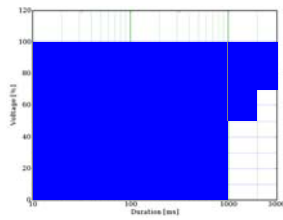


Type I, 95% site

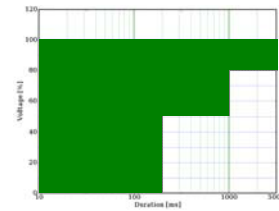
STR I

Different classes of equipment Immunity requirement for Type I and Type II

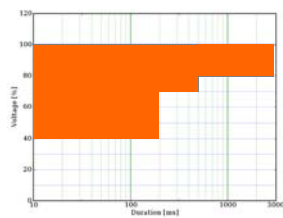
Class A



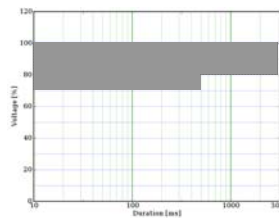
Class B



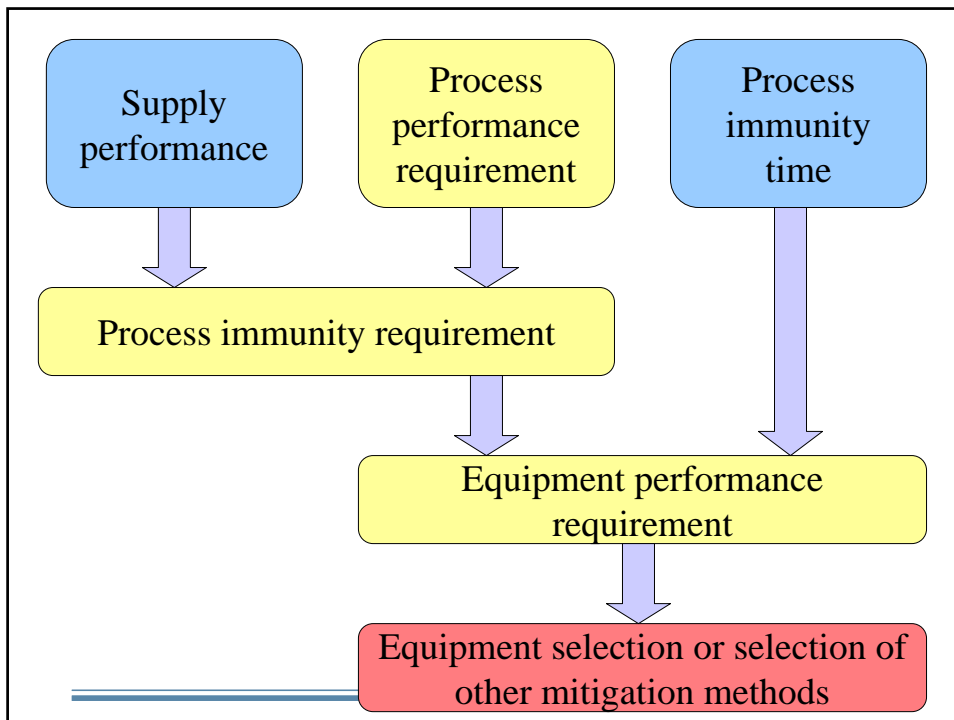
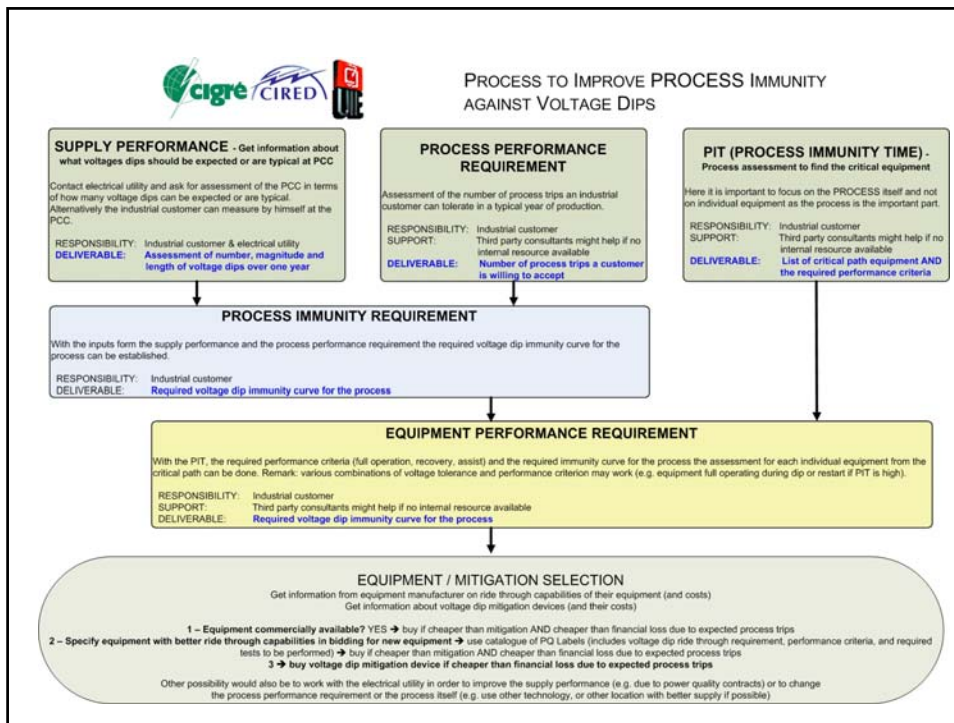
Class C



Class D



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The different stakeholders

- Equipment manufacturers
- Industrial installations
- Domestic and commercial customers
- Network operators
- Standard-setting organisations
- Regulators
- Researchers
- Educators

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Manufacturers

- Include dips as early as possible in the design of equipment
- Represent equipment immunity through a voltage-tolerance curve
- Classification of equipment based on its immunity against voltage dips.

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Industrial installations

- Method for **improving immunity of the process** by choice of equipment
- Mapping the underlying immunity of the process
- An economic evaluation is important

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Network operators

- **Provide information to customers about the expected number of dips**
- Present this in the form of a contour chart or something similar
- Distinguish between Type I, II and III dips

- Improvements in the network are also possible

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Standard-setting organisations

- Include type III in immunity requirements
- Performance during test should be defined better
- Classification of equipment based on its immunity against voltage dips
- **Distinguishing between Type I, II and III**
- Recommendations to network operators on how to report on dip performance
- Methods for dip segmentation and characterization.

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Regulators

- A framework for responsibility-sharing between customers and network
 - One or more responsibility-sharing curves
 - Data on economic consequences of immunity requirements
- Requirements on network operators to inform their customers
 - Presentation of the results

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Researchers

- Chapter on “Need for further work”
 - How do multiple dips impact equipment?
 - What is the typical immunity of a well-designed installation?
 - What is the typical performance of a well-designed power system?
 - Economics of voltage-dip immunity
 - Voltage-dip characterization
 - .. and much more

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Educators

- Package the results from this working group for the different stakeholders
- Explain the messages and spread them

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Conclusions

- Main contributions from JWG C4.110
 - Process immunity time
 - Global voltage-dip database
 - Presentation of the results from large surveys
 - Checklist of voltage-dip characteristics
 - Type I, II, III and segmentation
 - Importance of economics

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