

EREC G5 Stage 2 Sub-group

Meeting No. 3

Held at ABB Ltd, Daresbury Park, Warrington WA4 4BT

On Wednesday 7th September 2016 10:00-15:00

Meeting Notes

Attendee	Affiliation	Initials	Role
Frank Griffiths	ABB	FG	Member
Andrew Oliver	TNEI	AO	Member
Simon Scarbro	WPD	SPS	Chair
Ahmed Shafiu	Siemens	AS	Secretary

Item	Topic & Note	Action
2.	Agree Notes of Previous Meeting Agreed.	
3.1	Actions from Meeting 2: Modelled 11kV Impedance Versus Frequency Curves (see Mtg 2 Notes: 4) AO has done further modelling using various representations of the load (series R-X, parallel R-X, X plus parallel R-X & 'harmonic loads' based on WPD second order model/DCHF0RR representation). The conclusion that further work – either modelling or measurement or both – would be required to bottom this issue out. Given the timescales involved, it was decided to proceed based on the existing maximum impedance approach with k vales as set in Table 8 of EREC G5/4-1.	
3.2	Actions from Meeting 2: ECRC Report 1681 (see Mtg 2 Notes: 4) SPS: EATL have located the document and we await them sending a copy.	SPS
3.3	Actions from Meeting 2: ACE 73 Division of Maximum kVA by 6 (see Mtg 2 Notes: 6) SPS had circulated information explaining the basis of the 12kVA in Table 6 and 130kVA in Table 10 of EREC G5/4-1. In ACE 73 the maximum aggregate kVA was derived as 100kVA and 800kVA respectively based on an assumed harmonic emission profile and allowable increase in voltage distortion. These values were then divided by 8 and 6 respectively. The 8 comes from an assumption of 20 pieces of disturbing equipment on an LV network with summation according to a paper by Sherman based on random phase angles and a 1% risk of exceeding the limits. Similarly, the 6 is based on 10 pieces of disturbing equipment on an HV network. This is a form of allocation. FG advised that the underlying assumption of random phase angle is not valid. SPS suggested that it may be reasonable to assume that background distortion, which accounts for assumed 75% of PL, can be	

	<p>attributed to 75% of the pieces of equipment; so at LV the maximum aggregate kVA is allocated to 25% of 20 pieces of disturbing equipment, giving division by 5 if summation is assumed to be linear. Similarly, this gives division by 2.5 for HV. FG suggested a coincidence factor of 0.9 might be used. SPS Post-meeting note: This would give division by 4 and 2 for LV and HV respectively.</p>	
4.1	<p>Stage 2: Maximum kVA Values Derived from Typical Current Emission Profiles FG tabled calculations used to derive maximum aggregate kVA values using modern current emission profiles. The profiles differ from those underpinning the values in EREC G5/4-1 and give lower values for 6-pulse. FG highlighted that the values derived depend on the size and number of drives assumed. FG agreed to give some thought to the impact size and number of drives assumed. SPS Post-meeting note: Perhaps it should be assumed that there are 4 equally sized items for LV PCC and 2 for HV PCC as explained in 3.3 above.</p>	FG
4.2	<p>Stage 2 Draft Flow Charts – Review SPS explained the draft flow charts. It was noted that the limiting harmonic for the Active Front-end Converter was 25th for LV PCC and 5th for HV PCC, not the 23rd for both as assumed. FG highlighted that different manufacturers may produce slightly different profiles and so the limiting high order harmonic may vary. SPS to amend draft flow chart and associated text.</p> <p>SPS asked that all Sub-group members review and comment.</p>	SPS All
4.3	<p>Stage 2 Draft Text – Review SPS asked that all Sub-group members review and comment.</p>	All
4.4	<p>Stage 2 Worked Examples – Test Practicality SPS explained that he had produced various worked examples to check the practicality of the draft flow charts. SPS to write these examples up and circulate for review.</p>	SPS All
5	<p>Stage 1 (Out of scope but consistent approach required) SPS explained that Stage 1 is out of scope for this sub-group but given the action on the G5 draft section 5.3 taken and need to ensure Stage 1 and Stage 2 are consistent it had proven sensible to prepare Stage 1 text and flow charts. The Sub-group noted this.</p>	
5.1	<p>Stage 1 Draft Flow Charts – Discuss as appropriate SPS explained the draft flow charts.</p> <p>SPS highlighted that in Figure 3 the aggregate of the customer equipment rated current, $\sum I_{equ}$ should be used rather than I_{equ}.</p> <p>SPS asked that all Sub-group members review and comment.</p>	All
5.2	<p>Stage 1 Draft Text – Discuss as appropriate SPS asked that all Sub-group members review and comment.</p>	All
5.3	<p>Stage 1 Worked Examples – Discuss as appropriate SPS explained that he had produced various worked examples to check the practicality of the draft flow charts. One of the examples considers the more complex case of single-phase equipment; this issue was addressed in ETR122 for EREC G5/4-1. SPS to write these examples up and circulate for review.</p>	SPS All

6	Agree Further Work (Single phase) Agreed as shown above.	
7	AOB It was agreed that the new G5 needs to have an explanation of 6-pulse Converters and Active Front-end Converters. Both SA and FG agreed to review existing definitions/draft text. AS does not need to look at the resonant plant equation/derivation in Scan_Doc0049 as this does not now feature in the draft text on the ground of being too complex for Stage 1/2. The Sub-group reviewed the draft specification noting whether issues had been addressed, were still outstanding or no longer relevant See table below.	SA & FG
8	Future meetings <ul style="list-style-type: none"> Dates Post meeting note: date changed to 12 October 2016. Agenda items None agreed. 	

Draft Spec for Stage 2 Update (SPS version 1)

Serial	Item	Comment
1	Alignment with Stage 1 approach.	Agreed and draft complete.
2	Include a 'Compliant with Resonant plant requirement?'	Rejected.
3	Aggregation as per general text. NB This will affect Table 10 & 12 values.	Rejected. Agreed that linear aggregation to be used for derivation of kVA values.
4	Extension to 100 th harmonic.	Complete but Sub-group agreed all have some concern over this. Some monitor manufacturers are starting to consider this for future models but we still have the problem of many thousands of would VTs with accuracy problems at higher order frequencies.
5	No allocation (except as inferred in the two tables, equivalent to Stage 1 tables 13 and 14).	Rejected. Sub-group agreed that allocation is inherent in the derivation of maximum kVA values and this should continue.
6	Ignore transfer from upstream.	Agreed.
7	No alignment with Stage 2 of IEC TR 61000-3-6.	Agreed.
8	Improve clarity over scaling of values in Tables 10 & 12.	Agreed and Stage 1 & 2 draft addresses this.
9	Update harmonic emission profiles used to derive Table	Agreed and FG has this in hand.

	10. NB This will affect values in Table 10.	
10	Change typical fault level to be more typical (e.g. 60MVA for 11kV). Dependant on approach used for item 8 this would also feed into Table 12 values.	Agreed as 60MVA for 11kV PCC and 10MVA for LV PCC and addressed in Stage 1 & 2 draft.
11	Bring table 11 values into line with updated planning limits.	Agreed as not now required.
12	G5/5 draft 6 brings all 33kV connections into stage 2, we should provide a view to the main group on whether including 33kV connections in stage 2 is appropriate.	Agreed that Stage 2 will not apply to 33kV. Stage 1 & 2 draft addresses this.

Minimum Requirements

Serial	Item	Comment
1	Update for voltage sources.	Agreed to include text in Stage 2C that permits more advance model whether Thevenin or Norton Equivalent. Stage 1 & 2 draft addresses this.
2	Review Maximum Impedance Zh Envelope.	Agreed and complete.
3	Consider including $S_i/S_c \leq 0.2\%$ simplified assessment.	Agreed as not now required.
4	Provide method of inferring HV levels from measurement at LV.	Agreed that this is not within scope of Stage1 or 2 text.
5	Revise assessment to predict voltage distortion on basis of fault level and % PL	Agreed. Stage 1 & 2 draft addresses this.
6	Consider Stage 2 plus (simplified Stage 3) where the actual Z versus frequency driving point impedance is used rather than Maximum Impedance Envelope	Full WG agreed to keep in Stage 3. Stage 1 & 2 draft addresses this.
7	Consider if PWHD clause for many marginal current exceedences $23 \leq h \leq 50$ of table 12 is worthwhile or if the connection in that case should just proceed to the voltage calculation.	Agreed as not now required.

Possible Review/Requirements