

**Minutes of the 5th Meeting of the ER P24
Task Group**

17th October 2016

Held at the Network Rail Offices, Milton Keynes.

Attendees:

| Name | Initials | Company |
|-----------------|-----------------|---------------------------------|
| David Hewings | DH | NR |
| Gavin Baxter | GBa | NPg |
| Graham Brewster | GBr | WPD |
| Ben Gomersall | BG | National Grid (NGrid) |
| Stuart Stone | SS | SSEN |
| Pavel Januska | PJ | SSEN |
| Richard Parke | RPe | Threepwood Consulting Ltd (TCL) |

Apologies:

| | |
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| Razvan Pabat-Stroe | SPEN |
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Absent:

| | |
|---------------|-----------------------|
| Roger Pateman | National Grid (NGrid) |
|---------------|-----------------------|

1. Welcome, Introductions

GBa welcomed everybody to the fifth meeting of the ER P24 Task Group.

Attendance, apologies and absences were noted.

In his role as Chair, GBa agreed the Agenda for the meeting proposed by RPe who subsequently facilitated the meeting.

2. Minutes and Actions from previous meeting (07.07.16)

RP presented the previous minutes and actions for review. Those outstanding actions were noted and RP reminded relevant persons to follow-up as soon as possible.

3. Technical discussions

3.1 Voltage imbalance

RP summarised the latest content in Table 1 of the document and explained that the measurement criteria for <132 kV is likely to be revised in a future revision of P29. The basis of the work would likely involve harmonisation with BS EN 61000-4-30. DH expressed concerns that BS EN 61000-4-30 does not adequately cover traction loads. RP explained that P29 is unlikely to begin until after P28 has completed.

ACTION — RPe to determine BSi Committee responsible for the BS EN 61000-4-30.

SS queried the clarity of the considerations in Table 1 - the Group agreed that Table 1 should indicate the sequence of steps to be followed. The relevant steps should be as follows: item 2, item 3, item 1. BG explained that NGrid have 10 steps for investigating voltage imbalance scenarios.

ACTION — RPe to amend guidance for Table 1.

ACTION — BG to share National Grid internal guidance on assessing voltage imbalance for connections.

3.2 Harmonic penetration studies

The Group accepted the amendments to the harmonic determination method.

Regarding harmonic penetration studies, DH expressed concerns that the provision of an impedance value by the NGrid represents a 'hands off' approach. In particular, this could lead to contractual drivers as opposed to collaboration. DH asked BG if NGrid can provide accurate harmonic impedance values. BG agreed that it is difficult to pin down an impedance value, particularly for traction connections.

DH provided an open and honest description of an existing issue at Didcot. NR have committed a lot of new equipment at Didcot including monitoring. An issue with harmonic current at 3 KHz has been uncovered. The issue is preventing the commissioning of the site. NR believe the issue is being caused by a harmonic resonance on the network/system. The source of the 3 KHz harmonics is the traction load but there is no conclusion yet as to the reason for the resonance. DH explained that NR are investigating all items of electrical plant including the SGT. DH explained that there is almost ½ terabyte of data. There appears to be a lot of background harmonic on the network.

BG explained that NGrid would be liable if the network has determined to be above limits during a Study. DH explained that it would be much more beneficial if both parties accept that there are risks at all stages of a connection. There are many unknowns and it is impossible for a study to be conclusive. BG explained that the NGrid process has been challenged in the past and Ofgem have been satisfied with the NGrid approach. However, BG accepted that the problem is complex and agreed to work with NR to uncover the root cause at Didcot. The Group welcomed this approach.

GBr suggested that learnings from Didcot should be circulated with the EMC & Power Quality Group (EMCPQG) at ENA. DH agreed but requested that details are not shared until investigations are concluded.

ACTION — BG and DH to meet and discuss root cause of harmonic resonance at Didcot and hence include learnings in P24.

3.3 Earthing studies

RP introduced the latest earthing by guidance prepared by GBr.

GBr explained that a fully bonded system and segregated System are described including diagrams. The fully bonded system includes neutral bonding at the TX. The segregated system includes neutral bonding at the disconnector compound.

DH explained that for feeder compounds which are at least 1 km from the network transformer; there should be no issues with fully bonded systems. This should be for information only and should be used as a rule of thumb.

DH shared the earthing arrangements for the RCBB, which should be captured in the diagrams. The arrangement allows isolation of the return conductor during transformer outages.

The Group agreed the use of a 'remote' disconnector compound should be standard practice. This is for feeder stations which are remote or local. The disconnector compound allows an appropriate dual access area to be established. The 'ownership' boundary is the cable sealing ends at the switches/isolators.

ACTION — Group to provide GBr with comments on the earthing guidance in the next 2 weeks and by 31/10/16.

3.4 Power electronics

The Group agreed that the guidance for power electronics can be captured in an Annex in P24. The intent is to provide high-level descriptions of the 3 main arrangements as follows:

- i. Power factor correction (PFC)/balancer which is fitted in parallel to the transformer. This is a technology from the 1980s which remains relevant for some installations.
- ii. High voltage boost (HVB)/static VAr control. This is also operates in parallel to the transformer
- iii. Static frequency controller (SFC) - modern power electronic unit used without a transformer.

Some of the issues with the above technology, in particular for the SFC, should be highlighted in the Annex:

- a) Earthing for an SFC connection.
- b) Protection. The Group agreed that the cable connected to the metering breaker should be protected via differential protection.
- c) Adjacent SFC sites may exhibit harmonic resonance and present difficulties with system synchronisation.
- d) Traction load represents a point load of 7 MVA per train passing. This could be problematic at lower voltages (33 kV) where SFC may be used.
- e) Is SFC technology robust given the UK's lack of experience? Other parts of Europe (France in particular) favour transformer connections.

ACTION — RPe to prepare an Annex for Power Electronics and circulate to Group for comment.

3.5 Other technical considerations

Auxiliary Supplies

Clause 5.3.6.2 of P24 is redundant. The Group agreed that the preference for auxiliary supplies is a VT supply connected to the feeding side of the metered breaker.

System Monitoring and Control - Scope of Signals

It was agreed that the following additions should be made to Clause 15.1.

Zone 1 - add 'Status of circuit breaker and/or HV line isolator (if applicable).

Zone 2 - add 'Status of 25kV circuit breaker and disconnector'.

ACTION — RPe to update Clause 5.3.6.2 and Clause 15.1.

4. AOB

The date of the next Task Group meeting was agreed as 06/12/16 to take place at National Grid Offices, Warwick.

Appendix 1

Summary of Actions from Current Meeting

| Item | Action | Responsibility | Due by |
|------|--|----------------|----------|
| 1 | RPe to determine BSi Committee responsible for the BS EN 61000-4-30. | RPe | 06/12/16 |
| 2 | RPe to amend guidance for P24 Table 1. | RPe | 06/12/16 |
| 3 | BG to share National Grid internal guidance on assessing voltage imbalance for connections. | BG | 30/11/16 |
| 4 | BG and DH to meet and discuss root cause of harmonic resonance at Didcot and hence include learnings in P24. | BG, DH | 30/11/16 |
| 5 | Group to provide GBr with comments on the earthing guidance in the next 2 weeks and by 31/10/16. | Group | 31/10/16 |
| 6 | RPe to prepare an Annex for Power Electronics and circulate to Group for comment. | RPe | 06/12/16 |
| 7 | RPe to update Clause 5.3.6.2 and Clause 15.1 | RPe | 06/12/16 |

Ongoing Actions

| Item | Action | Responsibility | Due by |
|------|--|----------------|----------|
| A | RP to ask ENA Power Quality Group for guidance in relation to the NPS limits at 132 kV. ENA ER P29 is planned for revision in 2017 alongside ETR 116 | N/A | Ongoing |
| B | RP to initiate the archiving of TS 41-15 Part 9 | RP | 2017 |
| C | RP to ensure that the earth isolation procedures is captured in Clause 16. RP to add earth isolation link to the drawings in Figure 6 & 7. | RP | 22/09/16 |
| E | DH to provide explanation of regenerative braking for P24. The explanation should include the perceived 'issues' and technical reasons as to why they are should be discounted for traction connection design. | DH | ASAP |
| F | DH to share diagrams and relevant information from presentation. | DH | ASAP |
| G | GBa to share diagrams from SVC presentation with RP. | GBa | ASAP |
| H | DH to advise typical reactor specification. | DH | ASAP |
| J | RPn to provide description of dual access sites (typical diagram & specification). | RPn | ASAP |