

Grid Code Review Panel

Proposed Amendment of Appendix 5 of the Connection Conditions Technical Requirements for Low Frequency Relays

Introduction

1. This paper proposes an amendment to Appendix 5 of the Grid Code Connection Conditions that includes an indication of the technical requirements of Low Frequency Relays used as part of the automatic low frequency demand disconnection scheme specified under Operating Code OC6.6. The change is proposed to ensure that the Grid Code requirements are consistent with those contained in Energy Networks Association (ENA) Technical Specification 48-6-5 Issue 1, 2005, used by the Distribution Network Operators.

Background

2. The electricity system in Great Britain is protected against system collapse due to a severe fall in system frequency by the national automatic low frequency demand disconnection scheme specified under Grid Code OC6.6. This was originally conceived by the CEGB and the Scottish companies in the late 1960s and further developed in the 1970s and 1980s. In the event of a large fall in system frequency caused by very severe generation deficits beyond normal planning and operation security standard, the relays are specified to operate to disconnect customer demand in stages. In total, up to 60% of system demand in England and Wales (and 40% in Scotland) can be disconnected by the Low Frequency Relays.
3. The Grid Code includes an indication of the technical requirements for these relays. This can be found in Appendix 5 to the Connection Conditions and is referenced from CC.6.4.3. Further requirements on National Grid and Distribution Network Operators relating to the settings and operation of the automatic low frequency demand disconnection scheme are included in OC6.6.
4. A review of the relay settings and overall performance of the scheme carried out by National Grid identified the need to replace the old slow relays with modern fast acting ones, in addition to some setting changes. Some relays had already been replaced by the DNOs but for the remaining ones, a DNO replacement programme over their Price Control Review period and funding was agreed by Ofgem in 2002.
5. Since then, National Grid has supported the DNOs and the Energy Networks Association subgroup 'Protection Relay Assessment and Approval Panel' to ensure that the specification and functional testing for approval of modern replacement relays was adequate and consistent. Relays from a number of manufacturers have now been approved by the ENA.
6. Based on this experience, and during 2005, the ENA introduced a technical specification on functional test requirements for voltage and frequency protection relays. This specification covers the functional testing of the Low Frequency Relays required to meet the Grid Code CCA.5. It also includes an additional technical requirement on accuracy not specified under CC.A.5.1.1.

Proposal

7. National Grid proposes that the technical requirements included in CC.A.5.1.1 are updated to line up with the ENA technical specification and functional test requirements.
8. The proposed change would ensure consistency between the Grid Code technical requirements and the ENA's technical specification used by the DNOs. This would also improve transparency by publicising the functional test requirements that embedded Low Frequency Relays will be required to meet. Attachment 1 to this paper includes Grid Code Connection Conditions Appendix 5 with the proposed modification.

Recommendation

9. Members of the GCRP are invited to consider and discuss the proposed changes to Connection Conditions Appendix 5. Having considered all comments at the meeting, National Grid intends to carry out a short industry consultation on the changes.

Attachment 1 - Proposed Grid Code Text

APPENDIX 5

TECHNICAL REQUIREMENTS LOW FREQUENCY RELAYS FOR THE AUTOMATIC DISCONNECTION OF SUPPLIES AT LOW FREQUENCY

CC.A.5.1

LOW FREQUENCY RELAYS

CC.A.5.1.1

The **Low Frequency Relays** to be used shall be in accordance with the requirements of the **Bilateral Agreement**. They should have a setting range of 47.0 to 50Hz and be suitable for operation from a nominal AC input of 63.5, 110 or 240V. The following general parameters on the requirements of approved **Low Frequency Relays** for automatic installations is given as an indication, without prejudice to the provisions that may be included in a **Bilateral Agreement**:

- (a) **Frequency settings:** 47-50Hz in steps of 0.05Hz or better, preferably 0.01Hz;
- (b) **Measurement period settings:** Within a minimum selectable settings range of 4 to 6 cycles;
- (c) **Operating time:** Between 100 and 150ms dependent on measurement period setting;
- (d) **Voltage lock-out:** Selectable within a range of 55 to 90% of nominal voltage;
- (e) **Facility stages:** One or two stages of **Frequency** operation;
- (f) **Output contacts:** Two output contacts per stage to be capable of repetitively making and breaking for 1000 operations.

(g) Accuracy: 0.01 Hz maximum error under reference environmental and system voltage conditions.
0.05 Hz maximum error at 8% total harmonic distortion
Electromagnetic Compatibility Level.

CC.A.5.2

LOW FREQUENCY RELAY VOLTAGE SUPPLIES

CC.A.5.2.1

It is essential that the voltage supply to the **Low Frequency Relays** shall be derived from the primary **System** at the supply point concerned so that the **Frequency** of the **Low Frequency**

Relays input voltage is the same as that of the primary **System**. This requires either:

- (a) the use of a secure supply obtained from voltage transformers directly associated with the grid transformer(s) concerned, the supply being obtained where necessary via a suitable automatic voltage selection scheme; or
- (b) the use of the substation 240V phase-to-neutral selected auxiliary supply, provided that this supply is always derived at the supply point concerned and is never derived from a standby supply **Generating Unit** or from another part of the **User System**.

CC.A.5.3

SCHEME REQUIREMENTS

CC.A.5.3.1

The tripping facility should be engineered in accordance with the following reliability considerations:

- (a) Dependability

Failure to trip at any one particular **Demand** shedding point would not harm the overall operation of the scheme. However, many failures would have the effect of reducing the amount of **Demand** under low **Frequency** control. An overall reasonable minimum requirement for the dependability of the **Demand** shedding scheme is 96%, ie. the average probability of failure of each **Demand** shedding point should be less than 4%. Thus the **Demand** under low **Frequency** control will not be reduced by more than 4% due to relay failure.

- (b) Outages

Low **Frequency Demand** shedding schemes will be engineered such that the amount of **Demand** under control is as specified by **NET** and is not reduced unacceptably during equipment outage or maintenance conditions.

CC.A.A.5.4 **Low Frequency Relay Testing**

CC.A.5.4.1 **Low Frequency Relays installed and commissioned after 1 January 2007 should comply with Energy Networks Association Technical specification 48-6-5 Issue 1 dated 2005 "ENA Protection Assessment Functional Test Requirements – Voltage and Frequency Protection".**

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