Automatic Underfrequency Load Shedding Program Standard PRC-006-MRO-01

Frequently Asked Questions - Practical Compliance and Implementation

DRAFT 1, v1
December 9, 2008

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1. Introduction

The following is a draft collection of questions, and answers as developed, that the MRO UFLS SDT believes could be helpful to those implementing MRO Standard PRC-006-MRO-01 Automatic Underfrequency Load Shedding Program.

2. Executive Summary

Write later if needed

3. Additional Topics for Consideration in FAQ

Write later if needed

4. Terms Used in PRC-006-MRO-01

Credible Island (R1, R3, R3.1, R3.2, & R13) – A portion of the transmission network that is capable of sustaining a balance of its own generation, load, and loss characteristics if synchronization with the grid is lost

Load and Resource Balancing Method (R4.1, R7.1, R7.2, R9, & R9.2) – A Load and Resource Balancing Method is any . . . [Be sure to provide sufficient reactive device detail to allow proper modeling of the device in a dynamics simulation.]

Load Characteristics (R5) – The load attributes the Distribution Provider (DP) must consider when developing or revising its portion of the UFLS plan. All Load Serving Entities within the DP's Footprint shall provide input, which should include (but not limited to) the following data points:

- Critical loads to be avoided in plan development
- Installed under frequency capability
- If present, frequency setpoints of under frequency relays in service
- Possible loads to be added to the under frequency plan
- Seasonal peak loads (Winter and Summer)
- Distributed generation locations (may want to avoid)

Reactive Power Device (R7.1, R7.2, R9, & R9.1) – Applicable reactive power devices may include capacitor banks, static var compensators, inductor banks, for example, devices that are tripped by frequency or voltage relays. These devices may be rated 100 kV or higher. Reactive power devices that are rated less than 100 kV should be considered if they may have a significant effect on the BES. [Be sure to provide sufficient reactive device detail to allow proper modeling of the device in a dynamics simulation.]

System Protection Scheme (R4.1, R7.1, R9, R9.2, R10.1, R12, & R13) – Applicable schemes may include: non-Fault clearing schemes, tie-tripping schemes, islanding schemes, or additional Load shedding schemes. [Be sure to provide sufficient protection scheme detail to allow proper modeling of the scheme in a dynamics simulation.]

5. Frequently Asked Questions

5.1 We have an Underfrequency Load Shedding system in place that prevents one of our distribution substations from supplying load in the case of an Underfrequency excursion. If the load is not part of the BES, does this load fall within this standard?

If an underfrequency excursion is on the BES or impacts the BES, then this frequency excursion needs to be mitigated by shedding load. The participation of this load is determined by the UFLS program and not dependent on whether it meets a particular voltage rating.

5.2 Is the UFLS Program expected to prevent the collapse of any islanded portion of the BES for all underfrequency events?

No. The UFLS program is to provide a line of defense against the collapse of any islanded portion of the BES for a wide range of possible system conditions. However, it is not practical or reasonable to expect a UFLS Program to be effective for every possible system condition and underfrequency event.

5.3 Can the UFLS Program be designed to trip more than 30% of the island load?

Yes. Some credible islands of the BES have facility characteristics and system conditions that would be protected better by a UFLS Program that trips more than 30% of the load. The guiding objective is to provide a line of defense against collapse of the island for the best range of possible system conditions.

5.4 Can the "equivalent inertia" analysis method be used to assess the expected performance of a UFLS Program?

Yes. The "equivalent inertia" method is an effective approach for assessing the expected performance of a UFLS Program for a wide range of facility characteristics and system operating conditions. However other methods, such as dynamic simulation must be used to evaluate the possible system bus voltage levels.

5.5 Can the MRO 2007 UFLS Report be used to fulfill any of the PRC-006-MRO-01 requirements?

Yes. The MRO report may be used to fulfill portions of the performance methodology requirement, the assessment requirement, and other requirements generally until it becomes more than 5 years old (2013). The report identifies recognized credible islands (R2), suggests design and performance methodology (R4), and assesses the expected performance of the proposed UFLS program (R7).

5.6 What forms of compliance evidence are acceptable?

Acceptable forms of evidence include but are not limited to:

- Process document or plan
- Data (such as relay settings sheets, photos, SCADA).
- Database screen shots that demonstrate compliance information.
- Diagrams, engineering prints, schematics, maintenance and testing records, etc.

- U.S. mail, memos, or email proving the required information was exchanged, coordinated, submitted or received.
- Database lists.

Evidence of the distribution of information to applicable entities (Requirements R2, R4.2, R4.3, R7.2, R8, R9, R10, & R14):

- U.S. mail letters
- Business memos
- Email proving

These forms of communication should demonstrate that the required information was exchanged, coordinated, submitted or received.

5.7 What data should be provided on applicable reactive power devices (R9.1)?

Reactive power device data may include:

- Point of interconnection on the transmission system where the reactive power device effect can be modeled
- A block quantity and size for each reactive power device
- Set points for any frequency or voltage tripping function associated with the reactive power device
- Time delay duration for each frequency or voltage tripping function
- Voltage range of reactive power devices and their voltage step sizes

5.8 How should intentional time delay be handled?

Generally, an intentional relay time delay should be not more than ten cycles, with certain documented exceptions. The documentation shall consist of reports of mis-operations or distributed generation issues or analysis of large motor Loads:

- For installations where large motor Loads may be isolated, undercurrent supervision shall be used to avoid false operation during Fault isolation. If this is not available, planned total time delay may be increased to no greater than 29 cycles.
- For installations where distributed generation may be isolated, undercurrent supervision shall be used to avoid false operation during Fault isolation. If this is not available, planned total time delay may be increased to no greater than 29 cycles.

5.9 What types of relays may be used in a UFLS Program?

High speed digital or computer based relays are faster and more effective in responding to underfrequency events than electromechanical relays. However, to prevent false trips, the electronic relay operating time delay should be set to at least 6 cycles.

5.10 Should the automatic load restoration be considered along with a UFLS Program?

No. The automatic restoration of load may aggravate island frequency oscillations. Load should be restored carefully through manual means after the island frequency has recovered to 60 Hz to maintain acceptable

5.11 Should the automatic tripping of reactive power devices be considered along with a UFLS Program?

Yes. Overvoltage conditions may occur when significant amounts of load are automatically tripped in an area where reactive power devices, particularly capacitor banks are in service to provide adequate pre-event voltage. The proper tripping of bulk power capacitor banks and/or distribution substation capacitor banks can prevent severe overvoltage conditions. However, capacitor bank trip settings should be chosen carefully because the bank cannot be restored for at least 5 minutes after it is tripped. Keep in mind that in some cases, the tripping of lower voltage capacitor banks can be more effective than tripping higher voltage capacitor banks.