TRANSPOWER

Distribution Asset Test Requirements

GL-EA-0766

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0.1	Nov 2018	First Draft
0.2	Mar 2019	Removed comments, revised and accepted changes, removed unwanted appendices.
1.0	16 Sep 2019	Issued
2.0	13 April 2022	Alignment to newly published Ancillary Services Procurement Plan
3.0	15 May 2023	General update and title change
4.0	09 November 2023	Minor changes to align with the latest Procurement Plan
5.0	25 June 2026	General overhaul; ancillary services tests (for interruptible load) removed to GL-EA-1333.

	Name & Position	Date
Prepared and reviewed By	Power Systems Group	June 2026
Approved By	Head of SO Power Systems Group	June 2026

IMPORTANT

Disclaimer

This document is developed within the current regulatory framework and is accurate as at the published date. Subsequent changes to the Code or other regulations and policies may result in inaccuracies. Please contact Transpower to discuss current requirements.

This document does not relieve asset owners from identifying and meeting their obligations set out in the Code. Where there is conflict between this document and the Code, the Code takes precedence. Asset owners are strongly advised to seek expert advice to understand their full obligations under the Code.

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Table of Contents

Introduction

This document guides owners of distribution assets to understand what must be considered when conducting asset testing. These requirements will help you to demonstrate the performance of your asset, which in turn helps the System Operator to assess compliance. Asset owners can also use test results to validate the functionality of their equipment and maintain their Distributor Asset Capability Statement (ACS).

The methodology and standards set out in this document are for:

- asset testing during commissioning and after modification; and
- the routine testing of assets as set out in the Electricity Industry Participation Code (the Code).

The System Operator expects this document to be read in conjunction with:

- the Electricity Industry Participation Code 2010, especially Part 8, which includes the most up-to-date performance requirements;
- the *Connected Asset Commissioning, Testing, and Information Standard (CACTIS)*, especially Chapter 7;
- the latest AUFLS Technical Requirements Report (ATR);
- UG-SD-940 *AUFLS User Guide*;
- *DT-EA-1181 AUFLS Routine Testing Results Template*; and
- *DT-EA-1182 Statement of Compliance – AUFLS*.

Navigating the Document

The document begins by providing an overview of the testing process and our requirements, then details common quality test requirements for relevant assets.

Note: *AUFLS validation remains the responsibility of asset owners, as does compliance with all your obligations as stipulated in the Code (and any incorporated documents, such as the CACTIS or ATR). You therefore need to read, understand, and comply with asset owner obligations outlined within the Code. If there is a conflict between this document and the Code, the Code takes precedence. If you engage a consultant for testing and model validation purposes, it is your responsibility to ensure that they are aware of our requirements and expectations.*

1 Abbreviations and Terms

Term/Abbreviation	Description
ACS	Asset Capability Statement
AOPO	Asset Owner Performance Obligations
ASCII	American Standard Code for Information Interchange
ATR	AUFLS Technical Requirements Report
AUFLS	Automatic under-frequency load shedding
CACTIS	Connected Asset Commissioning, Testing, and Information Standard
COMTRADE	Common format for transient data exchange for power systems
CSV	Comma-separated values
ROCOF, or **df/dt**	Rate of change of frequency
The Code	Electricity Industry Participation Code 2010

2 General Requirements for Testing

Testing assets while connecting to the power system is a controlled process. It has two objectives:

1. to meet the asset test objectives, and
2. to ensure minimal disturbance to the operation of the power system.

Testing requirements for assets are detailed in chapter 7 of the *CACTIS*. Ensure you familiarise yourself with the applicable obligations so that your testing can demonstrate compliance appropriately.

To assess the performance and risks associated with testing an asset, the System Operator must receive a full and current asset capability statement for that asset. The following sections provide further details on requirements before, during, and after testing.

If you need to test the performance of multiple pieces of equipment of the same design (i.e. a group of identical assets, built by the same manufacturer), you must:

- first complete a full set of tests on the asset that is to be representative of the group; then
- complete sufficient testing on the remainder of the assets to demonstrate the performance is fully consistent with the representative asset; and,
- certify to the System Operator the performance of assets is fully consistent with the representative asset as detailed in the Code.

2.1 Before Testing

2.1.1 Engineering Methodology

If deviating from the tests within this document, you must submit an engineering methodology document that includes a full description of the proposed tests containing the information listed below:

- the proposed test methodology and expected results;
- the signals to be monitored; and
- confirmation that data format will be in either ASCII, CSV or COMTRADE files.

The asset owner must ensure that the data sampling rate is sufficient to demonstrate the fastest equipment characteristics of interest. Any deviation from recommended sampling rate (as listed in the methodologies below) must be noted in documentation.

2.1.2 Operational Test Plans

If deviating from the tests within this document, you must submit an operational test plan to the System Operator, which must summarise the testing. This will allow us to assess any potential risks related to the System Operator's ability to meet their principal performance obligations (PPOs).

After assessing your operational test plan, we may impose certain conditions. Testing can only go ahead if the asset owner agrees with those conditions. Further details and the *form* to use are available on our *Asset Testing webpage*. Send it to *operationaltestplans@transpower.co.nz*.

2.1.3 Submission of Information

When reviewing the provided documentation, the System Operator will agree the preferred method of delivery of results and reports to ensure confidentiality.

2.2 During Testing

If providing a test plan (see the above section), all conditions noted on the agreed plan must be followed at all times.

2.3 After Testing

2.3.1 Results and Test Report

Submit the results of your testing in the AUFLS application on the Operations Customer Portal and inform us at *compliance@transpower.co.nz*. The AUFLS application requires two key artefacts, as documented in the *AUFLS User Guide*:

- A completed *DT-EA-1181 AUFLS Routine Testing Results Template*, submitted as the "Test Report"; and
- A raw export from the testing equipment used, submitted as the "Test Data."

2.3.2 File Names

We have provided the file name format in Table 1 below to help you correctly associate test result files to specific tests. Your files names should follow this pattern:

AssetOwner_GXP_FeederID_BlockID(s)_DateTime

Table 1: Expected File Name Pattern Explanations

Part	Explanation
AssetOwner	The asset owner; for example, the name of a station
GXP	The grid exit point (in typical format)
FeederID	The unique feeder identification matching the feeder listed in the AUFLS application (in the Operations Customer Portal)
BlockID(s)	The AUFLS block(s) for which the relay under test is armed
DateTime	The timing of the test formatted as follows: DDMMYYYYhhmmss

2.3.3 Time Stamping

You should GPS-time stamp all data to ensure that data obtained from different sources aligns accurately. If a GPS time stamp is not available, submit data as indicated in section 2.3.1.

3 AUFLS Profiles and Trip Setting Tests

Application: Each North Island connected asset owner, every South Island grid owner, and any other industry participant that has an AUFLS obligation under the Code.

Test Objectives: perform these tests to…	**Test Outcomes:** provide sufficient data to…
▪ verify a set of trip settings and time delays, ▪ demonstrate relay operation consistency, ▪ confirm voltage block function, and ▪ confirm end-to-end operation times.	▪ demonstrate the AUFLS relay functionality including the guard frequency, AUFLS scheme trigger signal and any intentional time delays (hold times), ▪ demonstrate ROCOF functionality where utilised, ▪ demonstrate the AUFLS relay functionality during low system voltage, and ▪ verify manufacturer and custom relay logic, both to confirm operation is in accordance with relay and instrumentation diagrams and with operating notes. For avoidance of doubt, see the *AUFLS technical requirement report* for the performance requirements.

Specific Tests: perform these tests to achieve the required outcomes… (ctrl+click to go to each test)

AUFLS Relay Trip Test (DIS_UFT)

AUFLS Voltage Block Test (DIS_UFB)

3.1 AUFLS Relay Trip Test (DIS_UFT)

Purpose: This test aims to…

- verify the trip settings and time delays and demonstrate the relay operation.

Pre-testing:

- Review station single line diagram and switch/outage program with the System Operator, if applicable.
- Obtain equipment information, including relay settings.
- Verify test equipment connections are correct.
- Ensure appropriate tripping isolation is applied; electrically disconnecting customer demand is at the industry participant's discretion.
- **Asset operation mode:** configure relay to operate in the normal mode.

Monitoring Signals: Record the following:

- Injected test signal
- Measured frequency – Hz
- Measured time – milliseconds

Methodology:	**Notes:**
For an analogue, and non self-monitoring AUFLS system, repeat all tests at least five times to confirm the relay operation. 1. Inject a test signal into the relay and measure: ▪ For frequency set points: relay pickup frequency and time while varying the injected frequency from 50 Hz down to the frequency threshold (for example down to 47.8 Hz or 47.3 Hz) in 0.1 Hz steps.	*Data Requirements:* ▪ Ensure data sampling rate is 100 ms or faster. *Accuracy Requirements:*

▪ For ROCOF set points: relay pickup ROCOF, frequency and time while varying frequency sweep ROCOF from -0.1 Hz/s to -2.2 Hz/s in -0.1 Hz/s steps.	▪ If electrically disconnecting demand, ensure measured load (MW) is no less than 1% of the maximum AUFLS block MW or 0.1 MW, whichever is larger. ▪ Frequency ± 0.01 Hz. ▪ Rate-of-change of frequency ± 0.1 Hz/s. ▪ Intentional time delay (hold time) ± 2% of the time delay setting, but not larger than 0.01 s.

Acceptance Criteria: Demonstration that the AUFLS relay operates, by issuing correct trigger signal for an AUFLS block being tested, when:

- the injected frequency drops below the frequency set point; or
- the injected frequency sweep ROCOF drops below the ROCOF set point.

Separately, testing must also demonstrate:

- intentional time delay (hold time);
- delays associated with the protection logic; and
- circuit breaker operating time.

Additional Information to be Provided:

- the AUFLS scheme description detailing the applicable frequency set points as per ATR, guard frequency, intentional delay settings (hold time) and ROCOF settings;
- a populated *DT-EA-1181 AUFLS Routine Testing Results Template* for each relay, and each AUFLS block tested;
- a description of control tripping logic;
- confirmation that the test criteria have been met in full; and
- a statement that the AUFLS scheme has operated correctly in accordance with the Code, aligned with *DT-EA-1182 Statement of Compliance – AUFLS* – note: this can be done for a single or multiple AUFLS systems tests.

3.2 AUFLS Voltage Block Test (DIS_UFB)

Purpose: This test aims to…

- verify the trip settings and time delays and demonstrate the relay operation when the system voltage is outside the normal operational limit.

Pre-testing:

- Review station single line diagram and switch/outage program with the System Operator.
- Obtain equipment information, including relay settings.
- Verify test equipment connections are correct.
- Ensure appropriate tripping isolation is applied; electrically disconnecting customer demand is at the industry participant's discretion.
- **Asset operation mode:** configure relay to operate in the normal mode.

Monitoring Signals: Record the following:

- Injected test signal
- Measured frequency – Hz
- Measured time – milliseconds

Methodology:	**Notes:**
For an analogue, and non self-monitoring AUFLS system, repeat all tests at least five times to confirm the relay operation.	*Data Requirements:*

Voltage block tests should be carried out at the voltage levels indicated below:

- 40%
- 50%
- 65%
- 85%
- 115%

1. Set the voltage level as above.
2. Inject a test signal into the relay and measure:

- For frequency set points: relay pickup frequency and time while varying the injected frequency from 50 Hz down to the frequency threshold (for example down to 47.8 Hz or 47.3 Hz) in 0.1 Hz steps.
- For ROCOF set points: relay pickup ROCOF, frequency and time while varying frequency sweep ROCOF from -0.1 Hz/s to -2.2 Hz/s in -0.1 Hz/s steps.
- Ensure data sampling rate is 100 ms or faster.

Accuracy Requirements:

- If electrically disconnecting demand, ensure measured load (MW) is no less than 1% of the maximum AUFLS block MW or 0.1 MW, whichever is larger.
- Frequency ± 0.01 Hz.
- Rate-of-change of frequency ± 0.1 Hz/s.
- Intentional time delay (hold time) ± 2% of the time delay setting, but not larger than 0.01 s.

Acceptance Criteria: The testing must:

- clearly identify AUFLS relay operation status and pre-test voltage level;
- confirm that the AUFLS relay does not issue AUFLS trigger signal when voltage drops below the voltage inhibit threshold

Additional Information to be Provided:

- the AUFLS scheme description detailing the applicable frequency set points as per ATR, guard frequency, intentional delay settings (hold time) and ROCOF settings;
- a populated *DT-EA-1181 AUFLS Routine Testing Results Template* for each relay, and each AUFLS block tested;
- a description of control tripping logic;
- confirmation that the test criteria have been met in full; and
- a statement that the AUFLS scheme has operated correctly in accordance with the Code, aligned with *DT-EA-1182 Statement of Compliance – AUFLS* – note: this can be done for a single or multiple AUFLS systems tests..

Appendix A. Documentation

A.1 Checklist

ID	Description	Check
1	Pre-testing	
1A	Is my chosen test methodology in alignment with ATR and the rest of this guideline, or otherwise agreed with the System Operator?	
2	Post-testing	
2A	Did the test meet all the requirements stated in each test methodology?	
2B	Is the test data formatted according to the requirements?	
2C	Is the test report completed according to the requirements (in *DT-EA-1181 AUFLS Routine Testing Results Template*)?	
2D	Have you submitted a statement of compliance after the final AUFLS test?	

Appendix B. Results Templates

Use the appropriate test template to complete the test information.

B.1 AUFLS Relay Trip Test

By default, use the template spreadsheet to populate the test results: *DT-EA-1181 AUFLS Routine Testing Results Template*. Use the table below only if it the spreadsheet does not function.

Test ID:	
Frequency threshold setting (Hz):	
Intentional time delay settings (cycles or msec)	
Measured Trip frequency (Hz):	
Measured Trip time (cycles or msec):	
Circuit breaker model (provide circuit breaker opening time data if available)	
Under-frequency relay model:	

Note:

- Include test results that meet the requirements stated in this document.
- Repeat the table for the next test.

B.2 AUFLS Voltage Block Test

By default, use the template spreadsheet to populate the test results: *DT-EA-1181 AUFLS Routine Testing Results Template*. Use the table below only if it the spreadsheet does not function.

Frequency threshold setting (Hz):	
Intentional time delay settings (cycles/msec):	
Voltage inhibit setting:	
Measured Trip frequency (Hz):	
Measured Trip time (cycles/msec):	
Circuit breaker model (provide circuit breaker opening time data if available)	
Under-frequency relay model:	

Note:

- Include test results that meet the requirements stated in this document.
- Repeat the table for the next test.

4 Document Information

4.1 Metadata

Document ID Information			
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