mFRR Test Program

Version: 5.2  
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# Introduction

This document outlines the tests needed to verify the compliance of mFRR providing entities. The document also serves as a template for a test program.

Note that this is a translation of the Swedish document Testprogram mFRR 6.3 in case of any inconsistency between the Swedish and English version, the Swedish version shall prevail.

# Planning for prequalification

Prior to performing prequalification tests, the applying company should assure compliance with the following bullet points. Establish contact with Svenska kraftnät (Svk) well in advance when necessary.

* Take note of current regulations stated in current balance responsible agreement and associated appendices.
* Ensure that latest version of all documents are used. Information and documents are available on Svenska kraftnäts website.
* Ensure that all information requested in the application document are available.
* Svenska kraftnät has the right to send an observer to the test facility. The responsible part at Svenska kraftnät may ask the applying company to arrange the tests another day in order to be able to participate during the tests. The applying company is responsible for the costs incurred during the tests and has to provide the equipment needed. Svenska kraftnät is only responsible for its own costs.
* Svenska kraftnät has approved identified limitations regarding the tests before initiating the tests.
* Decide a capacity (active power) interval for which the unit or group should be prequalified. Perform separate tests for each end-point of the interval. Delivered capacity is only for tested capacity level(s).
* During delivery data according to table 1 & 2 needs to be continuously registered.
* When testing capacities from 50 MW establish contact with Svenska kraftnät one week in advance. See more information at [Prequalification | Svenska kraftnät](https://www.svk.se/en/stakeholders-portal/electricity-market/provision-of-ancillary-services/prequalification/)

Table 1. Requirements for active power.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Category | Rated power[[1]](#footnote-1) | Accuracy |
| Instantaneous  active power | A | P < 1,5 MW | 5 % |
| B | 1,5 P < 10 MW | 1 % |
| C+D | 10 MW | 0,5 % |

Table 2. Requirements for resolution and sampling time for measurement and regulation of active power and frequency

|  |  |  |
| --- | --- | --- |
|  | Resolution | Sample time |
| Instantaneous active power | 0,1 MW | 10 s |

# Preparing the tests

Verify below points before performing the tests.

* The unit or group should be set up such that it provides active power according to the plan.
* Ensure that the data outlined below is logged and saved during test, see description in section 4.
* Ensure that logging equipment is correctly time synchronized.

Table 3. Summary of measurements and logging during the test.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Unit | Resolution[[2]](#footnote-2) | Recommended  sample time[[3]](#footnote-3) |
| Instantaneous active power | MW | 0,01 MW | 5 s |
|  |  |  |  |

In addition, it is recommended that important states that may affect the test results are logged during the test. Such data includes but is not limited to:

* If status ID can be changed automatically during test which indicates active controller parameter setting.
* Output signal from control unit

For hydro units

* Guide vane opening
* Runner blade angle (Kaplan units)
* Upstream water level above sea level [m]
* Downstream water level above sea level [m]

For thermal units

* Turbine control valve opening

For wind power plants:

Wind speed rate [m/S]

For PV-panels:

Solar radiation [W/m2]

For batteries:

* State of charge

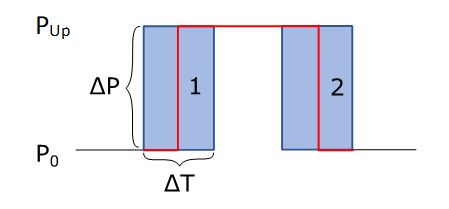
# Prequalification test

Disclose the results on the application form. Attach he logged test data to the application form.

## Upward Regulation Test

If the application considers mFRR for upward regulation, the upward regulation test should be performed for the unit or group. If the application only considers mFRR for downward regulation, this test should not be performed.

1. Perform the activation sequence for mFRR upward regulation in Figure 1.

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**Figure 1.** Activation sequence for mFRR, where is less than or equal to the given activation time. The numbers corresponds to the steps of the activation sequence for mFRR upward regulation.

**Table 4.** Explanatory table for Figure 1.

|  |  |
| --- | --- |
|  | Set point for active power after maximal activation of mFRR upward regulation |
|  | Set point for active power before activation of mFRR upward regulation |
|  | The time required from the moment when Svenska kraftnät order an activation of the unit or group until the active power has increased from to |
|  | The difference between and  If the test is properly executed = desired capacity |

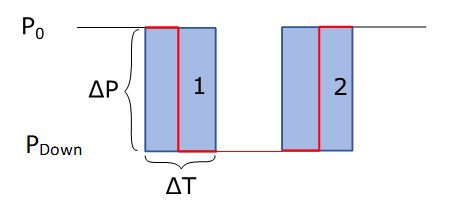
1. Start by making sure that the active power is following the predefined plan (). In Figure 1, this is illustrated with a black line.
2. The next step is to increase the active power until it reaches the specified maximum set point for mFRR upward regulation (). The active power should be increased in accordance with the technical requirements of the specific unit or group. The unit or group is obliged to be fully activated within the specified activation time, i.e. inside the blue area in Figure 1. An example of how can be reached is represented by the red line in Figure 1.
3. When the desired maximum set point () is reached the unit or group must be able to stay at the same level for at least 15 minutes to test the endurance for scheduled activation. If direct activation is used the test should be performed during 30 minutes instead. If the prequalification refers to a capacity interval only one endurance test has to be performed for the most limiting capacity level, which normally is the maximum capacity.
4. The active power is finally restored from to .
5. If the prequalification refers to a capacity interval two tests should be performed, one for the maximum and one for the minimum capacity. Follow the instructions in points 1-5 for tests of both maximum and minimum capacity. The minimum capacity to apply for is 1.0 MW.

## Downward Regulation Test

If the application considers mFRR for upward regulation, the downward regulation test should be performed for the unit or group. If the application only refers to mFRR for upward regulation, this test should not be performed.

1. Perform the activation sequence for mFRR downward regulation in   
   Figure 2.

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**Figure 2.** Activation sequence for mFRR, where is less than or equal to the given activation time. The numbers corresponds to the steps of the activation sequence for mFRR downward regulation.

**Table 5.** Explanatory table for Figure 2.

|  |  |
| --- | --- |
|  | Set point for active power after maximal activation of mFRR downward regulation |
|  | Set point for active power before activation of mFRR downward regulation |
|  | The time required from the moment when Svenska kraftnät order an activation of the unit or group until the active power has decreased from to . |
|  | The difference between and . If the test is properly executed = desired capacity |

1. Start by making sure that the active power is following the predefined plan (). In Figure 2, this is illustrated with a black line.
2. The next step is to decrease the active power until it reaches the specified maximum set point for mFRR downward regulation (). The active power should be increased in accordance with the technical requirements of the specific unit or group. The unit or group is obliged to be fully activated within the specified activation time, i.e. inside the blue area in Figure 2. An example of how can be reached is represented by the red line in Figure 2.
3. When the desired maximum set point () is reached the unit or group must be able to stay at the same level for for at least 15 minutes to test the endurance for scheduled activation. If direct activation is used the test should be performed during 30 minutes instead. If the prequalification refers to a capacity interval only one endurance test has to be performed for the most limiting capacity level, which normally is the maximum capacity.
4. The active power is finally restored from to .
5. If the prequalification refers to a capacity interval two tests should be performed, one for the maximum and one for the minimum capacity. Follow the instructions in points 1-5 for tests of both maximum and minimum capacity. The minimum capacity to apply for is 1.0 MW.

## Evaluation of forecasted bidding capacity and reference power

If the power from the unit or group varies depending on environmental conditions, at least 2 months of logged data (Reporting of measurement values ​​for units and groups with variable production and consumption), must be attached to the application. Collected data must contain at least 150 hours of bidding. Data to be logged and submitted must follow the specified format according to Reporting of measurement values ​​for units and groups with variable production and consumption.

Please note that, depending on the accuracy of the reference value, the minimum capacity may be adjusted when evaluating the prequalification application.

# Format for data logging

In order for Svenska kraftnät to be able to review submitted data as smoothly and objectively as possible, the process for this is partially automated. Formatting and file names should therefore follow the specifications *Tekniska villkor för förkvalificering och leverans av mFRR* och *Rapportering av data mFRR.*

It is mandatory to report all signals for mFRR in order to receive an approved pre-qualification decision.

However, it is possible to apply for an exception to deliver the signals that cannot be demonstrated during the prequalification tests specified below. If an exception is issued, the validity period of the approved prequalification is limited. During this period, it is important that the provider’s system is updated so that all signals that can be logged.

The file format for data delivery is the European standard csv-file, character encoding in ASCII where values are delimited by comma (,), decimal separator is point (.) and record delimiter is carriage return (↵ ASCII/CRLF=0x0D 0x0A). Naming format for the file is [Resource]\_[Service]\_[TestType]\_[Area]\_[Timezone].csv, where the sub-elements are denoted as described in: *Rapportering av data mFRR*.

1. Rated power for the unit/group tested [↑](#footnote-ref-1)
2. The resolution is not a formal requirement but a guideline. [↑](#footnote-ref-2)
3. Recommended sample time for the logged test data. The sample time may not exceed the maximal sample time for normal operation (10 seconds) [↑](#footnote-ref-3)