



## **Manual 2**

# **Ancillary Services Manual**

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### **3.6. Reactive Power Capability Testing or Demonstration**

The purpose of the Reactive Power capability testing or demonstration is to establish a uniform procedure of determining, confirming, and documenting the Reactive Power capability of VSS Suppliers for real-time system voltage control. The procedures set forth below provide the NYISO with accurate and timely information on the Reactive Power capability of the VSS Suppliers. The demonstration also provides confirmation that the supplier is able to automatically adjust its reactive power production or consumption to properly control voltage.

Each year resources that participate in VSS must demonstrate Lagging and Leading Reactive Power capability. Resources can satisfy this requirement by either performing Reactive Capability Tests as described below in section [3.6.2. Test Procedure for Generators](#), or by providing data collected during

actual operation. However, if granted an exemption for absorbing Reactive Power as described in section [3.6.6 Allowance for Out-of-Period Reactive Capability Testing](#) of this manual, a resource is not required to demonstrate Leading Reactive Power capability. In all cases, the Supplier must have its automatic voltage controlling equipment enabled during the demonstration period. All tests must be coordinated with the NYISO and the Transmission Owner (TO) in whose service territory the unit is located. See the [Transmission & Dispatch Operations Manual, section 6.7.6. Rules for Resources Conducting Certain Scheduled Steady-State Tests](#) for more details. All test data reports must be submitted electronically by the VSS Supplier within ten (10) business days of the test to the NYISO for review and acceptance. The demonstrated performance of the Lagging and Leading Reactive Power capability tests is the basis for compensation to Suppliers of VSS.

#### **Definitions**

**Lagging MVar** – Reactive Power that is generated out of a generator and into the power system. By convention, lagging MVar is a positive (+) number.

**Leading MVar** – Reactive Power that is absorbed by a generator out of the power system. By convention, leading MVar is a negative (-) number.

**Charging Mode** – State of operation of an Energy Storage Resource where real power flows from the grid, through the inverter, to be stored in the Energy Storage Resource for later injection back onto the grid at the same location.

**Discharging Mode** – State of operation of an Energy Storage Resource where real power flows from the Energy Storage Resource, through the inverter, onto the grid.

#### **3.6.1. Frequency, Timing, and Other Requirements**

At least once each calendar year each Resource providing Voltage Support Service must test or demonstrate Lagging and Leading Reactive Capability. If granted an exemption for absorbing Reactive Power as described in section 3.6.7 of this manual, a resource is not required to demonstrate Leading Reactive Power capability.

The demonstrated gross Lagging and Leading MVar capability (output without discounting any consumption required for operation and delivery to the NYCA transmission system), will be the basis for compensation in the next compensation (calendar) year. However, if gross metering

data is not available, net metering data of Lagging and Leading MVAR capability (output net of any consumption required for operation and delivery to the NYCA transmission system) will be the basis for compensation in the next compensation (calendar) year. All reactive power demonstrations and tests will be verified using metering data transmitted to the NYISO through existing Transmission Owner communication equipment. VSS suppliers that do not make adequate metering data available for the NYISO during the Capability Year will be disqualified as VSS suppliers.

### **3.6.1.2 Identical Treatment Units**

Small, identical units at the same site may apply test results from one unit to another unit at the same site. In order to qualify for this treatment, the units must be electrically identical and must be less than 60 MW nameplate capacity each. Qualification to apply test results from one unit to another requires one-time submittal of the capability-curve and registration information for each unit, along with a request for this treatment, and pre-approval by the Manager of Operations Engineering. The form to request this treatment is provided as [Attachment A-2](#) Each year, only one identical treatment unit must be tested to represent the capabilities of each other identical treatment unit.

3.6.1.3 Testing Periods Lagging and leading MVAR capability tests shall be performed during different yet overlapping time periods:

- Lagging MVAR capability must be tested or demonstrated during the Summer Capability Period (May 1 through October 31, inclusive).
  - Normally performed during on-peak hours. The VSS Supplier must operate at maximum Lagging MVAR for at least one hour for the test to be acceptable.
- Leading MVAR capability must be tested or demonstrated between January 1 and October 31, inclusive, unless granted an exemption for absorbing Reactive Power as described in section [3.6.6. Allowance for Out-of-Period Reactive Capability Testing](#).
  - Normally performed during off-peak hours. The VSS Supplier must operate at maximum Leading MVAR for at least one hour for the test to be acceptable.

Both Lagging and Leading testing may be performed on the same day during the Summer Capability Period.

A VSS Supplier may schedule additional MVAR tests during the testing periods after completing their Reactive Capability tests. When scheduling an additional Reactive Capability Test, the VSS Supplier must again follow the test procedures given in the Transmission & Dispatch Operations Manual, section [6.7.6](#).

[Rules for Resources Conducting Certain Scheduled Steady-State Tests](#).. The VSS Supplier will be placed at the end of the queue for scheduling requests when requesting additional tests during a given capability period.

Demonstration results must be retained for the current and most recent prior test period. Any supplemental engineering analysis to support data for the current and most recent prior test period must also be retained.

### 3.6.2. Test Procedure for Generators

Reactive Power capability tests are to be carried out under normal operating conditions. Extreme measures that might overstate a unit's reactive capability must be avoided. (For example, measurements should be made with the unit operating with normal hydrogen pressure or other normal coolant conditions).

Both Lagging and Leading MVar capability are to be measured at the generator terminal (gross) and, if available, at the point of interconnection (net). If generator terminal (gross) metering is not available, then Lagging and Leading MVar capability are to be measured at the point of interconnection (net). If a VSS Supplier's gross metered data does not reflect its ability to absorb or produce MVars, the net metered data at the point of interconnection may be used as the basis of MVar compensation.

The verification of Reactive Power capability for facilities with multiple resources that share a single Point of Injection and/or are dependent upon one another for normal operation shall be based on the Reactive Power capability of the facility at the Point of Injection, and not the sum of the capabilities of the individual generators. (Example: A Combined Cycle combustion turbine.)

Lagging and Leading tests must be performed for a duration of at least one hour at the real power levels described in Figure 4.

**Figure 4: Real Power Level Requirements for Reactive Power Capability Testing**

	Intermittent Power and Limited Control Run-of-River Hydro Resources		All Other Generators	
	Lagging	Leading	Lagging	Leading
<b>ICAP Suppliers<sup>1</sup> and Non-ICAP Suppliers with a Valid DMNC (or DMGC, where appropriate) Test<sup>2</sup></b>	≥ 90% of UCAP <sup>3</sup>	≥ 10% of UCAP <sup>3</sup>	≥ 90% of DMNC <sup>4</sup>	≥ 10% of DMNC <sup>4</sup>

<b>All Other Non-ICAP Suppliers</b>	≥ 90% of Generator Nameplate MW	≥ 10% of Generator Nameplate MW	≥ 90% of Generator Nameplate MW	≥ 10% of Generator Nameplate MW
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- 1 *ICAP Supplier* refers to resources qualified to supply UCAP as defined in the *NYISO Services Tariff*.
- 2 DMNC tests cannot be used for Limited Control Run-of-River Hydro Resources that are not ICAP Suppliers.
- 3 *Unforced Capacity (UCAP)* refers to the rating assigned to ICAP Suppliers as defined in the *NYISO Services Tariff*. The UCAP value that is tested to must correspond to the Available UCAP recorded in the NYISO ICAP Automated Market System.
- 4 *DMNC* refers to the Dependable Maximum Net that is in effect at the time of the test. The DMNC value that is tested to must correspond to the DMNC recorded in the NYISO ICAP Automated Market System.

### 3.6.2.1 Testing Coordination

See Transmission & Dispatch Operations Manual, section [6.7.6. Rules for Resources Conducting Certain Scheduled Steady-State Tests](#).

### 3.6.3. Test Procedure for Synchronous Condensers

Each synchronous condenser providing this service will be required to demonstrate the maximum leading and lagging MVar capability it can maintain for one hour.

### 3.6.4. Test Procedures for Energy Storage Resources

Each Energy Storage Resource (ESR) providing this service will be required to demonstrate its leading and lagging capabilities while it injects Energy onto the grid (*i.e.*, Discharging Mode) and while it withdraws Energy from the grid (*i.e.*, Charging Mode). The test requirements to demonstrate Reactive Capability for both charging and discharging are described in Section [3.6.2. Test Procedure for Generators](#). Charging Reactive Power capability demonstrations do not have associated real power requirements. The lower of the two demonstrated leading capabilities and the lower of the two demonstrated lagging capabilities, as verified by metering data, will be the basis of compensation for the following calendar year. For example,

Charging/discharging	Leading MVar	Lagging MVar	Compensation MVar
Charging	50	40	30 (leading) + 40 (lagging) = 70 MVar (total)
Discharging	30	45	

### 3.6.5. Reporting Requirements

Suppliers of VSS must submit test results to the NYISO Voltage Support Test Data System within ten (10) business days of the test. Suppliers of VSS using operational data to demonstrate their Reactive Power

capability must submit the operational data to the NYISO Voltage Support Test Data System within ten (10) business days of the end of the test period (October 31st). Any operational data that is submitted more than 10 business days after the end of the test period will not be accepted. Any Supplier that did not submit their test data or operational data by this time will be disqualified from the Voltage Support Service. The submitted data must include supporting performance data including gross and net MW and MVAR output, terminal or station bus voltage, and unit auxiliary load MW and MVAR.

The NYISO will review and indicate the status of submitted test data in the Voltage Support Test Data System within fifteen (15) business days of the data submittal. If the test results are rejected, the VSS Supplier may qualify for an Out-of-Period test under Section 3.6.6, Allowance for Out-of-Period Reactive Capability Testing.

The NYISO collects the reactive capability data of VSS Suppliers. The NYISO provides these data to the operating division of the supplier's Transmission Owner (TO) within sixty (60) days of the end of the Summer Capability Period. This allows sufficient time for the NYISO to assemble the data with due consideration to VSS Supplier owner reporting requirements.

#### **3.6.5.1. Data Transmission Requirements**

The NYISO may reject a Reactive Capability Test if the resource does not provide accurate metering data transmitted through existing Transmission Owner telecommunication equipment, that can be used to verify the resource's real and reactive power output for the duration of the Reactive Capability Test.

If during a Reactive Capability Test, the Transmission Owner's telecommunication equipment is not functioning, and an ICCP link is already available, the NYISO will use direct ICCP communications to validate the test. However, if there is no pre-existing direct ICCP link, the Generator Owner may qualify for an Out-of-Period test under Section 3.6.6, Allowance for Out-of-Period Reactive Capability Testing.

If during a Reactive Capability Test, the Transmission Owner's telecommunication equipment is functioning, but the Generator Owner's metering data is inaccurate, the NYISO will reject the test, and the Generator Owner will have to schedule another test. If the NYISO rejects a test on the grounds of data inaccuracy, the generator may qualify for an Out-of-Period test exemption under Section 3.6.6, Allowance for Out-of-Period Reactive Capability Testing.

#### **3.6.6. Allowance for Out-of-Period Reactive Capability Testing**

There are six (6) conditions where NYISO, at their discretion, will provisionally accept testing for Voltage Support Service when that test is not conducted within the specified test or demonstration period.

If approved by the NYISO, the results of successful Out-of-Period Reactive Capability Testing can be used to satisfy the requirement to demonstrate reactive power capability for the following year. The six (6) conditions are as follows:

- A new resource entering the Voltage Support Service
- An existing provider's resource returning to service from an extended forced outage
- An existing resource that was prevented from testing during the specified period by the Transmission Owner (TO), in whose Transmission District the resource is located, due to a transmission facility outage
- An existing resource becoming eligible to qualify as a VSS supplier
- A nuclear generating unit that has an AVR that is not functioning during the test period
- An existing resource has its test results rejected by the NYISO after September 30.

#### **Qualification of New Resource**

For a new resource entering the Voltage Support Service, the resource must complete the annual test requirements within thirty (30) days of entering service, and forward the completed test report, in electronic form, to NYISO within ten (10) business days of the completion of that test.

#### **Existing Resource returning from Extended Forced Outage**

An existing VSS resource returning to service following an extended forced outage must complete the annual test requirements within thirty (30) days of returning to service, and forward the completed test report, in electronic form, to NYISO within ten (10) business days of the completion of that test.

#### **Existing Resource prevented from Testing due to a Transmission Facility Outage**

An existing VSS resource that was prevented from testing by a Transmission Owner, due to a transmission facility outage reported to the NYISO in accordance with the Outage Scheduling Manual, must complete the annual test requirements within thirty (30) days of the transmission facility returning to service, and forward the completed test report, in electronic form, to NYISO within ten (10) business days of the completion of that test. Suppliers must notify the NYISO of a planned test within two (2) business days of the Transmission Owner's decision to allow the test.

#### **Existing Resource becoming eligible as a VSS Supplier**

If, as the result of equipment upgrades or changes in qualification requirements, an existing resource becomes eligible to provide VSS, the Supplier must complete the annual test requirements within thirty (30) days of the effective date of the change in qualification requirement or equipment upgrade, and forward the completed test report, in electronic form, to NYISO within ten (10) business days of the completion of that test.

#### **Nuclear Unit with Non-Functioning AVR**

If the unit is able to successfully complete the test with a functioning AVR after the test period but before the end of the current year, full compensation will be allowed for the next payment year. The unit will be required to meet the follow-up requirement set forth below to continue receiving payments after the beginning of the test period. If that test results in reduced voltage support, the payments will be reduced for that entire year, including return of excess compensation for the months before the in-period test.

If the unit is able to successfully conduct an out-of-period test after the beginning of the year, the unit will receive monthly VSS payments at the level achieved in the test for all months following the conduct of the test. To receive payments at the levels achieved in the out-of-period test, the unit will voluntarily provide voltage support within operational limits without compensation in the months of the year prior to its out-of-period test. The unit will be required to meet the follow-up requirement set forth below to continue receiving payments after the beginning of the test period. If the units produces a lower level of MVAr than was achieved in the out-or-period test, the VSS payments will be reduced consistent with the results of the in-period test for the remaining months of the year; provided further, however, should a generator perform a subsequent in-period test that demonstrates a higher level of MVAr capability, the VSS payments will be based on the results of the later test for the remaining months of the year.

#### **Test Rejected Near the End of the Testing Period**

If the NYISO rejects an in-period Reactive Capability Test after September 30, and the Supplier cannot demonstrate its leading and lagging reactive capability using either other performed tests or data collected during actual operation, the Supplier must complete the annual test requirements before December 1, and forward the completed test report, in electronic form, to NYISO within ten (10) business days of the completion of that test.

### **3.6.7. Exemption from Requirement to Absorb Reactive Power**

The following three conditions must be met in order for the NYISO to grant an exemption from the requirement to absorb Reactive Power.

1. The ability of the resource to produce Reactive Power must be determined by the NYISO to be needed for reliable system operation.
2. The ability of the resource to absorb Reactive Power must be determined by the NYISO to not be necessary for reliable system operation.
3. The resource must be unable, due to system configuration, to absorb Reactive Power.

The NYISO will review a request for exemption with the Transmission Owner in whose Transmission District the Resource is located and determine whether the request will be granted. An exemption will not be granted over the objection of the Transmission Owner, except upon the approval of the President and Chief Executive Officer of the NYISO. Exemptions that are granted will be reviewed annually with the Transmission Owner in whose Transmission District the resource is located.

All requests for exemptions from absorbing Reactive Power must be made in writing to the Manager of Operations Engineering at the NYISO. These requests must include the specific resource(s) and the basis for requesting the exemption. Additional documentation may be required during the NYISO review. A request for exemption must be signed by an officer of the organization owning the resource (or equivalent signing authority) and can be submitted to the following e-mail box or address:

[yss\\_test\\_results@nyiso.com](mailto:yss_test_results@nyiso.com)

Manager, Operations Engineering  
New York Independent System Operator, Inc.  
10 Krey Boulevard  
Rensselaer, NY 12144

Requests for exemptions from absorbing Reactive Power must be submitted prior to the end of the test period.