NEW YORK INDEPENDENT SYSTEM OPERATOR

MANUAL 2

Ancillary Services Manual

December 2007

3. VOLTAGE SUPPORT SERVICE

This section describes the voltage support service (VSS).

3.1 Description

In order to maintain transmission voltages on the NYS Transmission System within acceptable limits, facilities under the control of the NYISO are operated to produce (or absorb) Reactive Power. Thus, Reactive Supply and Voltage Control Service ("Voltage Support Service") must be provided to support all Transactions on the NYS Transmission System. The amount of VSS that must be supplied will be determined based on the Reactive Power support necessary to maintain transmission voltages within limits that are generally accepted in the region and consistently adhered to by the NYISO.

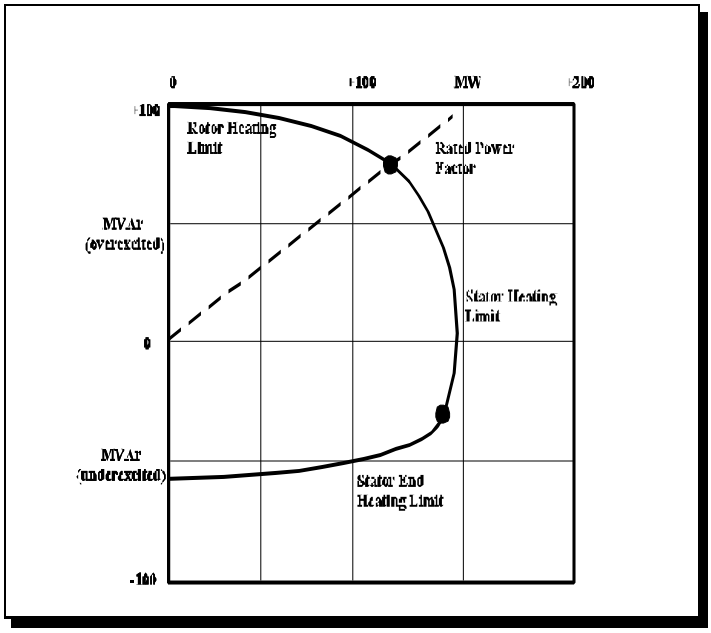


Figure 3.1: Generator MVAr versus MW Capability

The ability of a generator to produce or absorb Reactive Power (MVAr) is limited by generator heating considerations. At full load, a generator is able to produce or absorb a relatively small amount of Reactive Power. As the generator's production of real power decreases, its ability to produce or absorb Reactive Power increases. Figure 3.1, called a reactive capability curve or a D-Curve, is representative of generators limiting characteristics at a particular temperature. Reactive capability decreases as the generator heats up and increases as the generator cools down. The reactive capability curve therefore will "shrink" with heating and "expand" with cooling of the machine.

3.2 Supplier Qualification

The NYISO requires that VSS suppliers meet the following criteria. Each resource must:

- Be able to produce and absorb Reactive Power within its tested reactive capability range
  - *If the resource is precluded from running in "l~~L~~ead" mode in which it can absorb reactive power, then the unit is not eligible to provide Voltage Support Services.*
- Be able to maintain a specific voltage level under both steady-state and post-contingency operating conditions, subject to the limitation of its tested reactive capability
- Be able to automatically respond to voltage control signals; for a generator, a functioning Automatic Voltage Regulator (AVR) is required
- Be under the operational control of the NYISO, a Transmission Owner, or an External Control Area operator
- Successfully perform a Reactive Power (MVAr) capability tests in accordance with the NYISO Procedures described below

In order to qualify to receive payments as a VSS Supplier the candidate Supplier, including previously disqualified VSS Suppliers that must re-qualify, must:

- complete a VSS Qualification Form. That form is provided as Attachment A of this manual. The Qualification Form must:
  - be completed by a representative of the Supplier and signed by a Vice-President (or equivalent signing authority) of the corporation
  - include a statement of intent to provide Voltage Support Services and attach documentation that the synchronous generator or synchronous condenser has an automatic voltage regulator (AVR). This documentation shall include the voltage regulator block diagram and associated data, the manufacturer's model number and specifications, and a generator reactive capability data sheet ("D-curve").
- ~~The candidate VSS Supplier must complete and~~ return the Voltage Support Service Suppliers Qualification Form, ~~a copy of which is provided in Attachment A of this document,~~ and supporting data to:

  Manager, Auxiliary Market Operations
  New York Independent System Operator, Inc.
  3890 Carman Road
  Schenectady, NY 12303

~~The original application form must be completed by a representative of the Supplier and signed by a Vice-President (or equivalent) of the corporation.~~

3.3 Responsibilities for Service

The NYISO directs the Supplier's Resources to operate within their tested reactive capability

limits. The scheduling of VSS is the responsibility of the NYISO.

- NYISO — The NYISO coordinates the NYS Power System voltages throughout the NYCA.
- Transmission Owners — Transmission Owners are responsible for the local control of the Reactive Power resources that are connected to their network.
- Suppliers — Suppliers are expected to operate their Resources within demonstrated reactive capability limits. VSS suppliers are also expected to maintain a specific voltage level, as directed by the NYISO and the Transmission Owner System Operator, under both steady-state and post-contingency operating conditions subject to the limitations of the Resource's tested reactive capability.

3.4 Payment for Service

This section describes the payments for VSS and covers the following:

- Method for determining payment
- Payments made to suppliers of VSS
- Payment for lost opportunity cost
- Payments made by transmission customers and LSEs

For more information, see ***NYISO Accounting & Billing Manual***.

3.4.1 Method for Determining the Payments for Voltage Support Service

Payments to synchronous generators and synchronous condensers eligible for VSS are based upon a fixed dollar amount per MVAr as specified in the NYISO Market Services Tariff Rate Schedule 2 and the gross lagging MVAr capability as determined by annual capability testing performed by the generator and verified by the NYISO.

3.4.2 Payments made to Suppliers for Voltage Support Service

The rate provided in Rate Schedule 2 shall be used to calculate payments to all eligible Suppliers providing VSS as applied on a Resource-specific basis. The NYISO shall calculate the payments on an annual basis, as the product of the compensation rate specified in Rate Schedule 2 and the gross lagging MVAr capability as demonstrated by actual test in the preceding calendar year. The NYISO shall make payments to Suppliers on a monthly basis. Suppliers whose Resource(s) meet the requirements to supply Installed Capacity and are under contract to supply Installed Capacity receive one-twelfth the annual payment for VSS except as noted below for Non-Utility Generators. Suppliers whose Generators are not under contract to supply Installed Capacity, Suppliers with synchronous condensers, and, except as noted in the following paragraph, Qualified Non-Generator Voltage Support Resources receive one-twelfth the annual payment pro-rated by the number of hours that Generator or synchronous condenser operated in that month, as recorded by the NYISO.

For Non-Utility Generators that are operating under existing power purchase agreements, the entity that is purchasing Energy and/or Capacity under such agreement or providing Transmission Service under that agreement is contacted by the NYISO when the NYISO requires VSS from the contracted Resource.

3.4.3 Payments for Voltage Support Service Provided by Non-Utility Generators with Existing Power Purchase Agreements

The NYISO pays each holder of a contract for a Non-Utility Generator operating under an existing power purchase agreement, which provides VSS.

- If that non-utility Generator provides installed capacity, the NYISO will pay it the

product of: (1) one -twelfth of the annual $/MVAr rate for NYISO payments to Suppliers of VSS and (2) the lesser of the tested Reactive Power production capability (MVAr) of the Non-Utility Generator or the contract MVAr capability.

- If that non-utility Generator does not provide Installed Capacity, the NYISO will pay it the product of (1) and (2), as calculated above, multiplied by the number of hours in the month the Non-Utility Generator provided VSS divided by the number of hours in the month.
- In the case of the Cross-Sound Scheduled Line, the product of $3919/MVAr and that tested, Reactive Power (MVAr) capacity measured at maximum real power flow.

The NYISO calculates and makes payments on a monthly basis.

3.4.4 Payments for Lost Opportunity Cost

A Supplier providing VSS from a Generator that is In-Service is entitled to receive Lost Opportunity Costs (LOCs) in the event the NYISO dispatches or directs the Generator to reduce its real power (MW) output in order to allow the unit to produce or absorb more Reactive Power (MVAr).

The method for calculating LOC is based on the following:

- Real-Time LBMP
- Original dispatch point
- New dispatch point
- Bid curve of Generation supplying VSS

Figure 3.3.4 graphically portrays the calculation of the LOC for a Generator that reduced its MW output to allow it to produce or absorb more Reactive Power (MVAr).

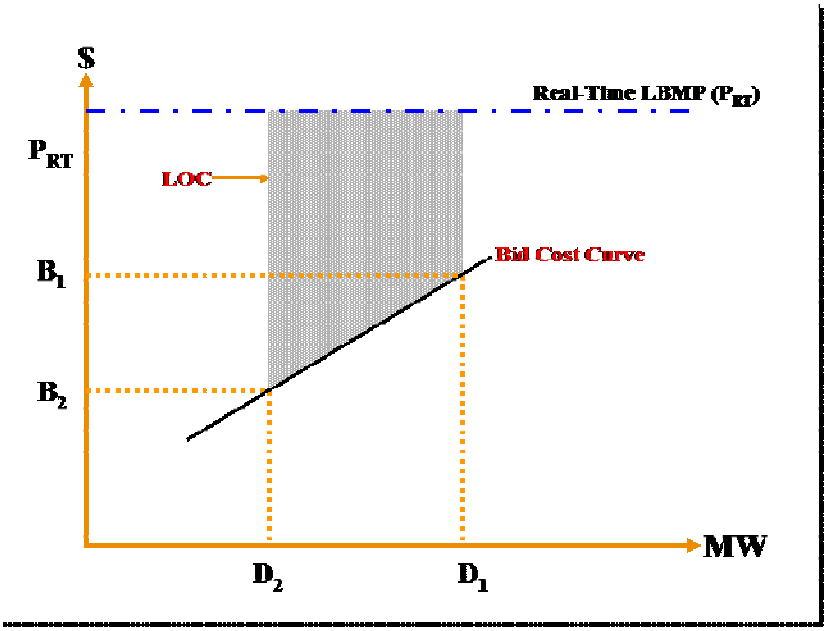


Figure 3.4.4-1: Method for Calculating LOC

$$LOC = P_{RT}\,(D_1 - D_2) - \int_{D_2}^{D_1} Bid$$

Where: P_{RT} = Real Time LBMP

D_1 = Original Dispatch Point, which shall be equal to the Generator's Economic Operating Point

D_2 = New Dispatch Point, which shall be the greater of the Generator's Real-Time Scheduled Energy Injection, or the Generator's Actual Energy Injection, or the amount of Energy the Generator is scheduled to produce for the hour in the Day-Ahead Market

Bid = Bid curve for generation supplying Voltage Support Services

3.4.5 Payments made by Transmission Customers and LSEs

Transmission Customers and Load Serving Entity (LSEs) taking service under the NYISO OATT pay the NYISO for VSS associated with energy withdrawals from the transmission system in accordance with Rate Schedule No. 2 of the OATT.

3.5 Failure to Perform by Suppliers

A resource will have failed to provide voltage support if it:

1) fails at the end of 10 minutes to be within 5% (+/-) of the requested Reactive Power (VArs) level of production or absorption as requested by the NYISO or applicable Transmission Owners for levels below its Normal Operating limit, which must be at least 90% of its Dependable Maximum Net Capability (DMNC).

2) fails at the end of 10 minutes to be at 95% or greater of the resource's demonstrated Reactive Power capability (tested at its Normal Operating Limit or at 90% of its DMNC, whichever is greater in MW) in the appropriate lead or lag direction when requested to go to maximum lead or lag reactive capability by the NYISO or applicable Transmission Owner.

3) fails to automatically respond, following a system contingency, to produce (or absorb) the Reactive Power required in accordance with published NYISO (or Transmission Owner) system operating studies.

4) fails to maintain its automatic voltage regulator (AVR) in service and in automatic voltage control mode, or fails to commence timely repairs to the AVR.

Any resource that fails to provide voltage support when it is being paid to provide voltage support and is not otherwise excused pursuant to a forced outage, derate or maintenance outage as addressed in section 3.7.2 will be penalized in accordance as described below.

3.5.1 Failure to Respond to NYISO's Request for Steady State Voltage Control

a) An installed capacity supplier of voltage support that fails to provide steady-state voltage support on a given day will forfeit 1/12th of the annual payment that resource would have received for providing voltage support, and must reimburse the NYISO for any lost opportunity costs paid to replacement sources of steady-state voltage support.

b) A non-installed capacity supplier of voltage support that fails to provide steady-state voltage support on a given day will forfeit the voltage support payment received by that resource in the last month in which that payment was positive (as a proxy for 1/12th of the annual payment that resource would have received for providing voltage support), and must reimburse the NYISO for any lost opportunity costs paid to replacement sources of steady-state voltage support.

c) A Resource will be disqualified as a supplier of voltage support after it fails to provide steady-state voltage support on three separate days within a 30-day period.

Reinstatement of Payments

The NYISO may reinstate payments once the Supplier complies with the following conditions to the NYISO's satisfaction:

- the Supplier's Resource must successfully perform a Reactive Power (MVAr) capability test, and
- the Resource must provide VSS for 30 consecutive days without any compliance failures. No payments for VSS or LOC are made to the Supplier during this period.

3.5.2 Failure to Provide Voltage Support Service when a Contingency Occurs on the NYS Power System

a) An installed capacity supplier of voltage support that fails to provide voltage support following a contingency on a given day will forfeit 1/12th of the annual payment that resource would have received for providing voltage support on the first such occurrence, and 1/4th of the annual payment that resource would have received for providing voltage support on the second such occurrence. Generators that fail to provide voltage support following contingencies will not be charged lost opportunity costs for replacement sources of voltage support because there will not be enough time to arrange for replacement sources.

b) A non-installed capacity supplier of voltage support that fails to provide voltage support following a contingency on a given day will forfeit the voltage support payment received by that resource in the last month in which that payment was positive (as a proxy for 1/12th of the annual payment that resource would have received for providing voltage support) on the first occurrence. Additionally, it will forfeit the payment received by that resource in the last three months in which those payments were positive (as a proxy for 1/4th of the annual payment that resource would have received for providing voltage support) for the second failure. Generators that fail to provide voltage support following contingencies will not be charged lost opportunity costs for replacement sources of voltage support because there will not be enough time to arrange for replacement

sources.

c) A Resource will be disqualified as a supplier of voltage support after it fails to provide voltage support following a contingency on two separate occasions within a 30-day period.

Reinstatement of Payments

In addition, the Supplier that is in violation is prohibited from receiving VSS payments for the non-complying Resource until the Supplier complies with the following conditions to the NYISO's satisfaction:

- the Supplier's Resource successfully performs a Reactive Power (MVAr) capability test, and
- the Resource provides VSS for 30 consecutive days without any compliance failures. No payments for VSS or LOC are made to the Supplier during this period.

3.5.3 Failure to Maintain Automatic Voltage Regulator in Service

a) A Resource will be disqualified as a supplier of voltage support after it fails to maintain the automatic voltage regulator in operation and fails to commence timely repairs following a failure of the automatic voltage regulator within a 30-day period.

Reinstatement of Payments

The Supplier will not receive Voltage Support Service payments for the disqualified Resource until the Supplier complies with the following conditions:

- the Supplier provides documentation to the NYISO of the completion of the repairs,
- the Supplier's Resource successfully performs a Reactive Power (MVAr) capability test, and
- the Resource provides Voltage Support Service for 30 consecutive days without any compliance failures. No payments for Voltage Support Service or LOC are made to the Supplier during this period.

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. VSS suppliers must have a functioning automatic voltage regulator (AVR). 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's AVR is in proper working condition and 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 be tested to demonstrate both Lagging and

Leading Reactive Power capability or must provide data collected during actual operation to demonstrate both Lagging and Leading Reactive Power capability. In all cases, the Supplier's AVR must be enabled and providing automatic voltage control during the demonstration period. Tests may take the form of demonstration of Reactive Power capability based upon actual generator output data or tests conducted pursuant to the procedures set forth in this Manual. Tests must be coordinated with the NYISO and the Transmission Owner (TO) in whose service territory the unit is located. 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 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.

3.6.1 Frequency, Timing, and Other Requirements

At least once each calendar year each Resource providing Voltage Support Service must test or demonstrate both Lagging and Leading Reactive Capability. The demonstrated *Gross* Lagging MVAr capability will be the basis for compensation in the next compensation (calendar) year.

Small 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. Qualification to apply test results from one unit to another requires one-time submittal of the D-curve and registration information for each unit, along with a request for this treatment, and pre-approval by the Manager, Auxiliary Market Operations. Each year, a test result form must be submitted for each unit that is requesting this treatment. The test form must reference the PTID of the unit at the site that actually performed the test and the date and time of the test.

Both Lagging MVAr and Leading MVAr capability must be tested or demonstrated during the Summer capability period (May 1 through October 31, inclusive). Failure to test or demonstrate the resource's Reactive Power capability will result in the disqualification of the resource in the next compensation year. The Supplier's AVR must be enabled and providing automatic voltage control during the demonstration period. Lagging MVAr capability testing will normally be 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.

The Leading MVAr testing will normally be 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.

A VSS Supplier may schedule additional MVAr tests during the Summer capability

period, however; only one test at a time may be scheduled. When scheduling an additional Reactive Capability Test, the VSS Supplier must again follow the test procedures given below. The VSS Supplier will be placed at the end of the queue for scheduling requests when requesting additional tests during a given capability period.

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 leading and lagging MVAr are to be measured at the generator terminal (gross) and, if metered data is available, at the point of interconnection (net).

The lagging MVAr test must be performed at a net real power level of 90% (or greater) of,

- the generator's Dependable Maximum Net Capability (DMNC), that is in effect at the time of the test, for ICAP providers and non-ICAP providers with a valid DMNC test. ~~must be performed at a net real power level of 90% (or greater) of the generator's Dependable Maximum Net Capability (DMNC).~~ The DMNC value that is tested to must correspond to the DMNC recorded in the Automated ICAP Market System.
- the generator's nameplate value for non-ICAP providers without a valid DMNC test.

The leading MVAr test should be performed at the generator's minimum MW level (consistent with a real power level typical for off-peak or light load conditions).

The Transmission Owner is responsible for coordinating the test with the respective plant. Each Transmission Owner shall notify the NYISO at least one hour prior to the initiation of generator MVAr testing. The NYISO in turn notifies any other affected Transmission Owners. Test procedures are set forth below:

1. The VSS Supplier must notify the NYISO and the Transmission Owner (TO), at least five (5) business days prior to the day that the test is to be performed if the Supplier is a generator sized 100 MW or larger. Other VSS Suppliers must also notify the NYISO and TO of their plan to test, but a five-day notification is not required, though it is encouraged. The following information must be included in the notification of intent to perform a Reactive Capability test:
   - VSS Supplier name (as listed in the NYISO MIS)
   - VSS Supplier point identifier (PTID – a five digit number)
   - Net operating capability of the unit (MW)
   - VSS Supplier operator company name
   - Transmission Owner area

- Test requested (lagging or leading)
- Date and time of the test start
- Name and telephone number of the person requesting the test

A generator that is normally scheduled in the DAM and is operating within 100 MW of its normal operating capability may perform the MVAr test without the 5-day prior notification. If a generator's normal operating capability is less than 100 MW, the 5-day prior notification is also not required but is still recommended.

2. The NYISO will notify the VSS Supplier of the status of the request three (3) business days prior to the planned test date. It should be noted that test approvals are subject to a NYISO reliability review and the NYISO reserves the right to cancel or terminate the test at any time. The TO may also request that the NYISO cancel or terminate the test at any time should local reliability criteria be violated. The NYISO will document all approvals, cancellations, and terminations including the party responsible and reason for implementing the cancellation or termination.
3. On the day prior to the scheduled date of the Reactive Capability Test, generators with a normal MW operating capability of 100 MW or greater must bid energy into the Day-Ahead Market (DAM). The bid must be structured to ensure that the generator is scheduled at the appropriate MW level for the hours requested to perform the Reactive Capability Test. The VSS Supplier must notify the NYISO (notify NYISO Generation Scheduling at (518) 356-6050) by hour 14:00 of the prior business day that the unit has been scheduled in the DAM, and that the test will be conducted as scheduled. If the generator is not scheduled, then the Reactive Capability Test is cancelled. If the generator has a net operating capability of less than 100 MW or if the generator is a quick start unit that can be committed by the Real-Time Commitment (RTC), a DAM bid is not required. The VSS Supplier must still notify the NYISO and the TO, by hour 14:00 of the prior business day, of the intent to perform a Reactive Capability Test.
4. On the day of the scheduled Reactive Capability Test, the VSS Supplier, through the TO, must request permission from the NYISO System Operator to perform the test at least three (3) hours prior to the test start time. The generator must also bid energy into the Hour-Ahead Market (if not previously committed in the DAM) to ensure that the generator is scheduled at the appropriate MW level for the hours requested to perform the Reactive Capability Test. The NYISO System Operator will approve or deny the request, through the TO, at least two (2) hours prior to the scheduled test, allowing time for any desired Hour-Ahead Market bid adjustments. The NYISO will document all approvals, cancellations and terminations of the tests. The log will include the name of the party and reason for implementing the cancellation or termination.
5. Upon beginning the test, the VSS Supplier must notify the NYISO System Operator, through the TO, that the Reactive Capability Test has started.
6. The NYISO will log that the VSS Supplier is performing a Reactive Capability

Test.

7. Upon completion of the test, the VSS Supplier must notify the NYISO System Operator, through the TO, that the test is complete. The NYISO will log the completion time and the name of the generator plant personnel reporting the test.

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 Reporting Requirements

Attachment B of this manual illustrates the spreadsheet based test report forms ~~spreadsheet~~ that are~~is~~ to be used to document the results of Reactive Power capability tests and demonstrations. An electronic version of the test report forms ~~spreadsheet~~ is available on the NYISO's web site. Suppliers of VSS must complete the ~~spreadsheet~~ forms and submit the completed ~~spreadsheet~~ forms to the NYISO within ten (10) business days of the test or demonstration. The forms ~~report spreadsheet~~ 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. These data must be sampled at the beginning and end of the test or demonstration period and least once every five (5) minutes during the test or demonstration period. The test report forms ~~spreadsheet~~ must clearly indicate the start and end times of the test or demonstration period.

The completed test ~~or~~ report forms must be submitted electronically (by email) to the NYISO at the following email address: vss_test_results@nyiso.com. If the lagging and leading MVAr capability tests or demonstrations are performed on different dates, then the results of the lagging and leading tests or demonstrations can be submitted separately.

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

3.6.5 Allowance for Out-of-period Reactive Capability Testing

There are four (4) conditions where NYISO will provisionally accept testing for Voltage Support Service when that test is not conducted within the specified Summer Capability Period:

1. A new resource entering commercial operation, or
2. An existing provider's resource returning to service from an extended forced outage, or
3. An existing resource becoming eligible to qualify as a VSS supplier, or
4. A nuclear generating unit that has an AVR that is not functioning during the test period.

Initial Qualification of New Resource

For a new resource entering commercial service and requesting qualification as a Voltage Support Service supplier, 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. The resource shall also provide, in writing, the required documentation of the resource's reactive capability and automatic voltage regulator.

Existing Resource returning from Extended Forced Outage

An existing supplier's 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 becoming eligible as a VSS Supplier

If, as the result of equipment upgrades or changes in qualification requirements, an existing supplier's resource becomes eligible, 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 MVArs 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.

Follow-up Testing Requirement

For any of the above conditions, the following conditions and requirements apply:

The NYISO will accept the demonstrated lagging MVAr capability as the basis for compensation on a provisional basis until the beginning of the next Summer Capability Period.

To continue qualification to receive VSS payments the resource is required to perform a complete annual test within thirty (30) days of the start of the Summer Capability Period, and forward the completed test report, in electronic form, to NYISO within ten (10) business days of the completion of that test. This "in period" test will also qualify the resource for continued participation in the VSS in the next compensation year.

3.7 Voltage Support

The following procedures apply to VSS.

3.7.1 Request for Voltage Support Service

The NYISO may request corrective actions from voltage support facilities that are already in service and available. The procedures for Real-Time voltage control are covered in the ***NYISO Emergency Operations*** and ***Transmission & Dispatching Operations Manuals.***

3.7.2 Voltage Support Availability

Supplier Actions:

The supplier is obligated to provide timely notification of any operational restrictions that may limit the voltage support capability.

The supplier must perform the following:

1) The Automatic Voltage Regulator (AVR) shall be maintained in service in automatic voltage regulation mode at all times, unless instructed otherwise by the NYISO or the Transmission Owner System Operator.

2) Provide immediate notification to the NYISO through the Transmission Owner System Operator whenever the AVR, or any other equipment necessary for maintaining the resource's demonstrated Reactive Power capability (including, but not limited to, auxiliary cooling systems, exciters, etc.) is forced out of service or derated, and provided notice as required by the ***NYISO Outage Scheduling Manual*** prior to removal from service for scheduled maintenance.

3) Notify the NYISO and Transmission Owner System Operator of the estimated time for completion of necessary AVR (or other) repairs, or scheduled

maintenance.

4) Notify the NYISO and Transmission Owner System Operator when maintenance is complete and the resource's voltage support capability is fully restored.

Attachment A –
VSS Qualification Request Form

Voltage Support Services

Qualifications Request Form

- _____Attached to this form is documentation that demonstrates that the resource(s) listed below have an Automatic Voltage Regulator (AVR), including voltage regulator, block diagram and associated data, manufacturer's model number and specifications, and a generator reactive capability data sheet ("D-curve").
- _____Attached to this form is a completed NYISO Reactive Power Capability Test Report documenting that the resource(s) listed below have successfully performed Reactive Power capability testing during current calendar year.

The resource(s) listed below will participate in Voltage Support Ancillary Service under the direction of the NYISO and agree to comply with all applicable rules and procedures associated with NYISO voltage and Reactive Power control.

Resource	*Type (Generator or Synchronous Condenser, etc.)*	*Location*	*NYISO ICAP ~~Contract~~ DMNC or Nameplate*	*NYISO MIS PTID*	*Generator MW Capability*

Market Participant Information:

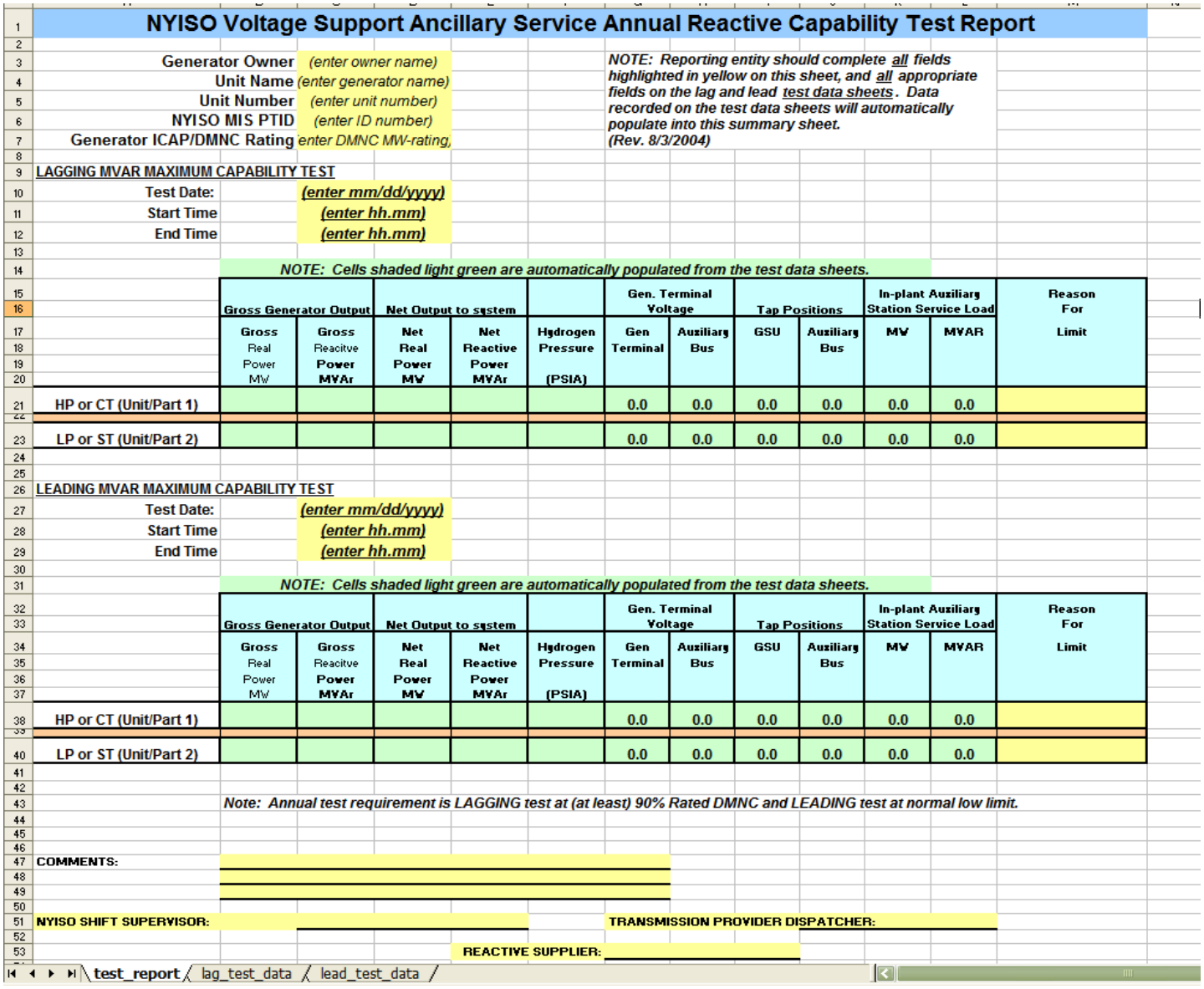
Officer's Signature Date

New York ISO Approval:

~~Approved by~~ ~~Date~~

Manager, Auxiliary Market Operations Date

Attachment B – Generator MVAr Capability Test



NYISO Voltage Support Ancillary Service Annual Reactive Capability Test Report

Generator Owner *(enter owner name)*
Unit Name *(enter generator name)*
Unit Number *(enter unit number)*
NYISO MIS PTID *(enter ID number)*
Generator ICAP/DMNC Rating *enter DMNC MW-rating*

NOTE: Reporting entity should complete all fields highlighted in yellow on this sheet, and all appropriate fields on the lag and lead test data sheets. Data recorded on the test data sheets will automatically populate into this summary sheet. (Rev. 8/3/2004)

LAGGING MVAR MAXIMUM CAPABILITY TEST

Test Date: *(enter mm/dd/yyyy)*
Start Time *(enter hh.mm)*
End Time *(enter hh.mm)*

NOTE: Cells shaded light green are automatically populated from the test data sheets.

	Gross Generator Output		Net Output to system			Gen. Terminal Voltage		Tap Positions		In-plant Auxiliary Station Service Load		Reason For Limit
	Gross Real Power MW	Gross Reacitve Power MVAr	Net Real Power MW	Net Reactive Power MVAr	Hydrogen Pressure (PSIA)	Gen Terminal	Auxiliary Bus	GSU	Auxiliary Bus	MW	MVAR	
HP or CT (Unit/Part 1)						0.0	0.0	0.0	0.0	0.0	0.0	
LP or ST (Unit/Part 2)						0.0	0.0	0.0	0.0	0.0	0.0	

LEADING MVAR MAXIMUM CAPABILITY TEST

Test Date: *(enter mm/dd/yyyy)*
Start Time *(enter hh.mm)*
End Time *(enter hh.mm)*

NOTE: Cells shaded light green are automatically populated from the test data sheets.

	Gross Generator Output		Net Output to system			Gen. Terminal Voltage		Tap Positions		In-plant Auxiliary Station Service Load		Reason For Limit
	Gross Real Power MW	Gross Reacitve Power MVAr	Net Real Power MW	Net Reactive Power MVAr	Hydrogen Pressure (PSIA)	Gen Terminal	Auxiliary Bus	GSU	Auxiliary Bus	MW	MVAR	
HP or CT (Unit/Part 1)						0.0	0.0	0.0	0.0	0.0	0.0	
LP or ST (Unit/Part 2)						0.0	0.0	0.0	0.0	0.0	0.0	

Note: Annual test requirement is LAGGING test at (at least) 90% Rated DMNC and LEADING test at normal low limit.

COMMENTS:

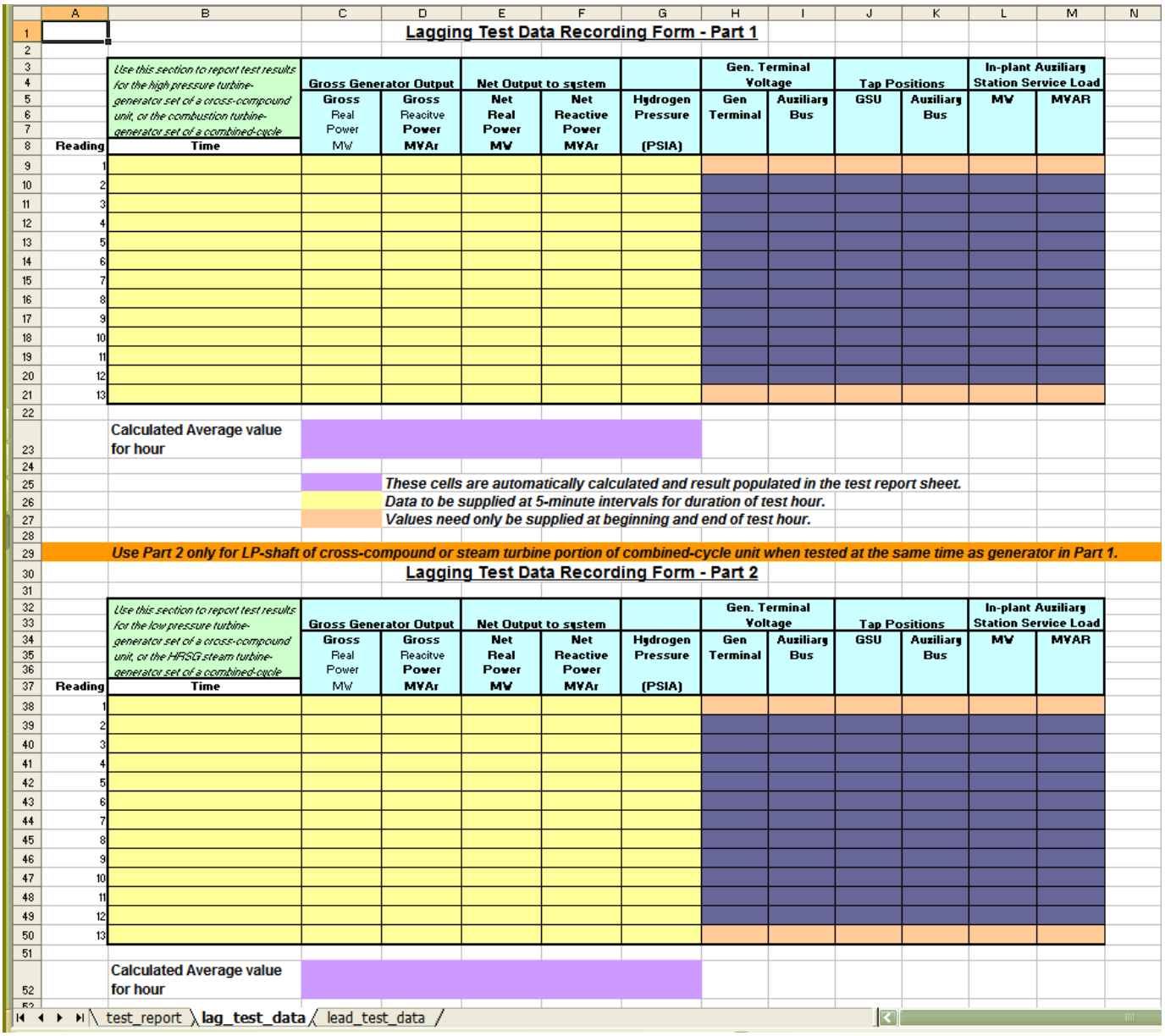
NYISO SHIFT SUPERVISOR:

TRANSMISSION PROVIDER DISPATCHER:

REACTIVE SUPPLIER:

test_report | lag_test_data | lead_test_data

Figure B-1: NYISO Voltage Support Ancillary Service Annual Reactive Capability Test Report



Lagging Test Data Recording Form - Part 1

Reading	Time	Gross Generator Output: Gross Real Power MW	Gross Generator Output: Gross Reacitve Power MVAr	Net Output to system: Net Real Power MW	Net Output to system: Net Reactive Power MVAr	Hydrogen Pressure (PSIA)	Gen. Terminal Voltage: Gen Terminal	Gen. Terminal Voltage: Auxiliary Bus	Tap Positions: GSU	Tap Positions: Auxiliary Bus	In-plant Auxiliary Station Service Load: MW	In-plant Auxiliary Station Service Load: MVAR
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

Use this section to report test results for the high pressure turbine-generator set of a cross-compound unit, or the combustion turbine-generator set of a combined-cycle

Calculated Average value for hour

These cells are automatically calculated and result populated in the test report sheet.
Data to be supplied at 5-minute intervals for duration of test hour.
Values need only be supplied at beginning and end of test hour.

Use Part 2 only for LP-shaft of cross-compound or steam turbine portion of combined-cycle unit when tested at the same time as generator in Part 1.

Lagging Test Data Recording Form - Part 2

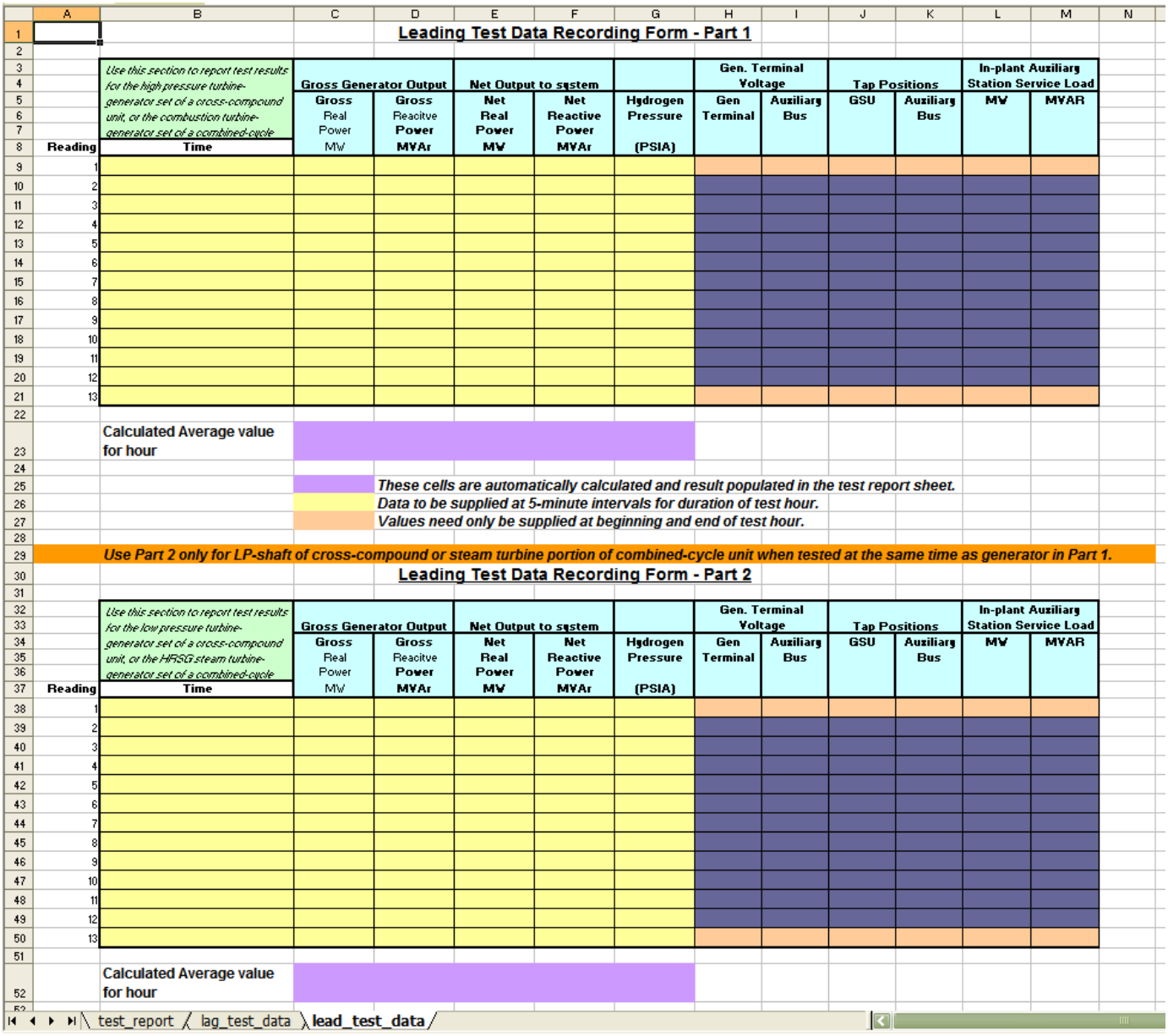
Reading	Time	Gross Generator Output: Gross Real Power MW	Gross Generator Output: Gross Reacitve Power MVAr	Net Output to system: Net Real Power MW	Net Output to system: Net Reactive Power MVAr	Hydrogen Pressure (PSIA)	Gen. Terminal Voltage: Gen Terminal	Gen. Terminal Voltage: Auxiliary Bus	Tap Positions: GSU	Tap Positions: Auxiliary Bus	In-plant Auxiliary Station Service Load: MW	In-plant Auxiliary Station Service Load: MVAR
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

Use this section to report test results for the low pressure turbine-generator set of a cross-compound unit, or the HRSG steam turbine-generator set of a combined-cycle

Calculated Average value for hour

test_report | lag_test_data | lead_test_data

Figure B-2: Lagging Test Data Recording Form



Leading Test Data Recording Form - Part 1

Reading	Time	Gross Generator Output: Gross Real Power MW	Gross Generator Output: Gross Reactive Power MVAr	Net Output to system: Net Real Power MW	Net Output to system: Net Reactive Power MVAr	Hydrogen Pressure (PSIA)	Gen. Terminal Voltage: Gen Terminal	Gen. Terminal Voltage: Auxiliary Bus	Tap Positions: GSU	Tap Positions: Auxiliary Bus	In-plant Auxiliary Station Service Load: MW	In-plant Auxiliary Station Service Load: MVAR
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

Use this section to report test results for the high pressure turbine-generator set of a cross-compound unit, or the combustion turbine-generator set of a combined-cycle

Calculated Average value for hour

These cells are automatically calculated and result populated in the test report sheet.

Data to be supplied at 5-minute intervals for duration of test hour.

Values need only be supplied at beginning and end of test hour.

Use Part 2 only for LP-shaft of cross-compound or steam turbine portion of combined-cycle unit when tested at the same time as generator in Part 1.

Leading Test Data Recording Form - Part 2

Reading	Time	Gross Generator Output: Gross Real Power MW	Gross Generator Output: Gross Reactive Power MVAr	Net Output to system: Net Real Power MW	Net Output to system: Net Reactive Power MVAr	Hydrogen Pressure (PSIA)	Gen. Terminal Voltage: Gen Terminal	Gen. Terminal Voltage: Auxiliary Bus	Tap Positions: GSU	Tap Positions: Auxiliary Bus	In-plant Auxiliary Station Service Load: MW	In-plant Auxiliary Station Service Load: MVAR
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

Use this section to report test results for the low pressure turbine-generator set of a cross-compound unit, or the HRSG steam turbine-generator set of a combined-cycle

Calculated Average value for hour

test_report | lag_test_data | lead_test_data

Figure B-3: Leading Test Data Recording Form