NEW YORK INDEPENDENT SYSTEM OPERATOR

MANUAL 2

Ancillary Services Manual

~~March 2007~~

Version: 3.~~7~~8
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Committee Acceptance: ~~March 8, 2007~~

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Revision History Page

Revision	Date	Changes
3.8	**TBD**	**Section 3.2** ▪ Second paragraph – added "Attachment A". **Section 3.6** ▪ Second paragraph—corrected "Test data reports must be submitted electronically by the VSS Supplier within ten (10) business days..."—originally stated five (5) business days throughout the section. **Attachment A** ▪ Updated first bullet – added "including voltage regulator...data sheet ("D-curve"). **Attachment B** ▪ Section B-2 and B-3 – Removed "Part 1" from figure titles. **Attachment C** ▪ Changed calculation for the Real time regulation performance index in accordance to the information Contained in the Performance Tracking System Functional Requirements Specification.
3.7	**3/8/07**	**Administrative change** ▪ Removed 10 Krey Blvd address for Manager, AMO, and replaced with 3890 Carman Road address. **Section 3.6** ▪ Clarify that functioning AVR is required during
3.6	**12/8/06**	**Deleted Attachment B – AGC Functional Requirements** ▪ There were no references to the Attachment in version 3.5 of the manual **Inserted New Attachment A – VSS Qualifications Request Form** ▪ Inserted Qualification Request Form from TB 103 (TB 103 can be retired). Subsequent Attachments have been relabeled. **Inserted New Section 1.3** ▪ Inserted new section 1.3 "Payments and Charges for Ancillary Services" (from TB 121, TB 121 should be incorporated in the Accounting & Billing Manual before being retired) sections following 1.3 have been renumbered. **Inserted New Section 3.2** ▪ Inserted new section 3.2 Supplier Qualifications (from TB 091 and TB 103) sections following 3.2 have been renumbered. **Modified Section 3.6** **Changes to this section are in accordance with RT SCHD 2, Sect 1.1.** ▪ Changed title of heading to "Reactive Power Capability Demonstration" ▪ Second paragraph – inserted language on providing data during actual operation. ▪ Section 3.6 (old section 3.5) – Incorporated TB 091 (TB 091 can be retired) **Modified Section 3.6.1** ▪ Changed title of heading to "Frequency and Timing" ▪ First paragraph – inserted language stating each calendar year resources providing VSS must demonstrate both lagging and leading reactive capability. **Modified Section 3.6.2** ▪ First paragraph – inserted language on how measurements should be taken and how tests must be performed. **Modified Section 3.6.4** ▪ Changed title of heading to "Reporting Requirements" ▪ Replaced demonstration with "tests and/or demonstrations." ▪ Section 3.6.4 (old section 3.5.4) – Incorporated TB 126 (TB 126 must also be incorporated in ICAP manual then can be retired)

- 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 ~~five (5)~~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.

3.2 Supplier Qualification

A VSS Supplier's Resource must be a Generator or a Synchronous Condenser. Suppliers of VSS must provide a Resource that has an Automatic Voltage Regulator (AVR) and has successfully performed a Reactive Power (MVAr) capability test in accordance with the NYISO Procedures described below. VSS suppliers must be able to produce or absorb Reactive Power within the Resource's tested reactive capability range and be able to maintain a specific voltage level under both steady-state and post-contingency operating conditions subject to the limitations of the Resource's tested reactive capability.

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 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.
10 Krey Boulevard
Rensselaer, NY 12144

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.

(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 three (3) 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.

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)~~five (5)~~ 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)~~five (5)~~ 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)~~five (5)~~ business days of the completion of that test.

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)~~five (5)~~ 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)*	*Location*	*NYISO ICAP Contract*	*NYISO MIS PTID*	*Generator MW Capability*

Market Participant Information:

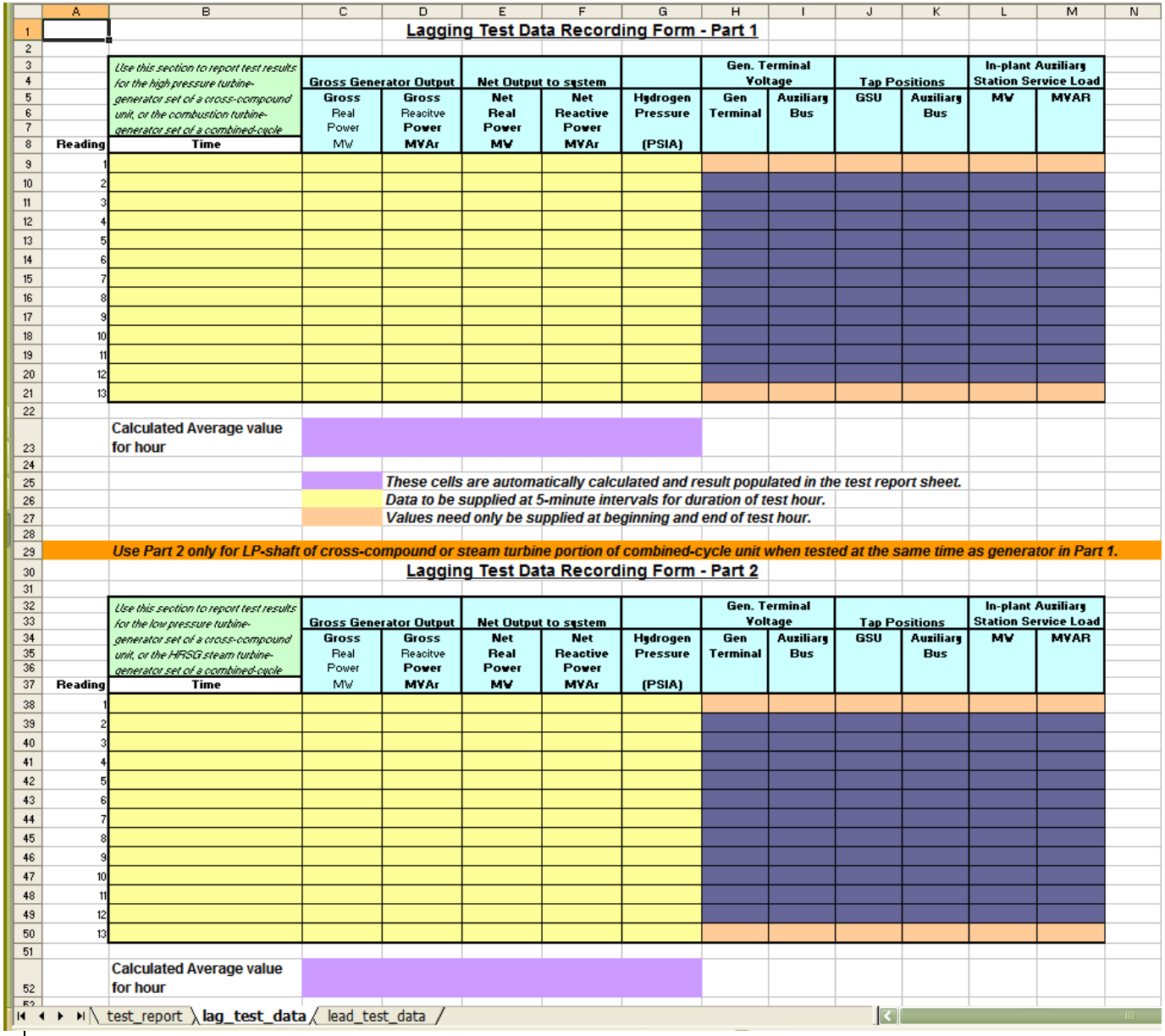
Officer's Signature Date

New York ISO Approval:

Approved by Date

Manager, ~~Grid Accounting and Settlements~~Auxiliary Market Operations Date

Attachment B –
Generator MVAr Capability Test



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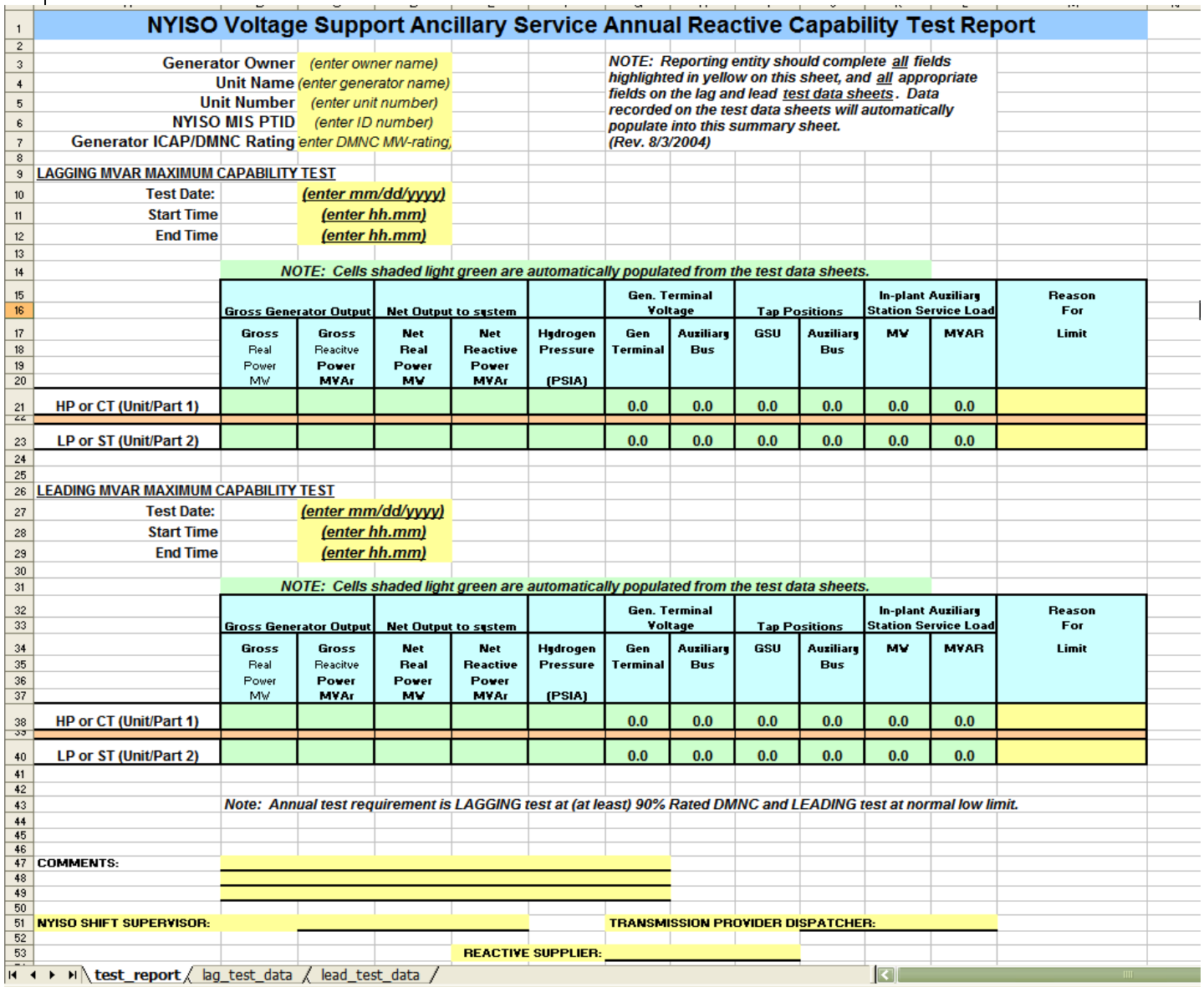
Use this section to report test results for the low pressure turbine-generator set of a cross-compound unit, or the HRSG steam turbine-generator set of a combined-cycle

Calculated Average value for hour

test_report | lag_test_data | lead_test_data

Figure B-2: Lagging Test Data Recording Form ~~– Part I~~



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.

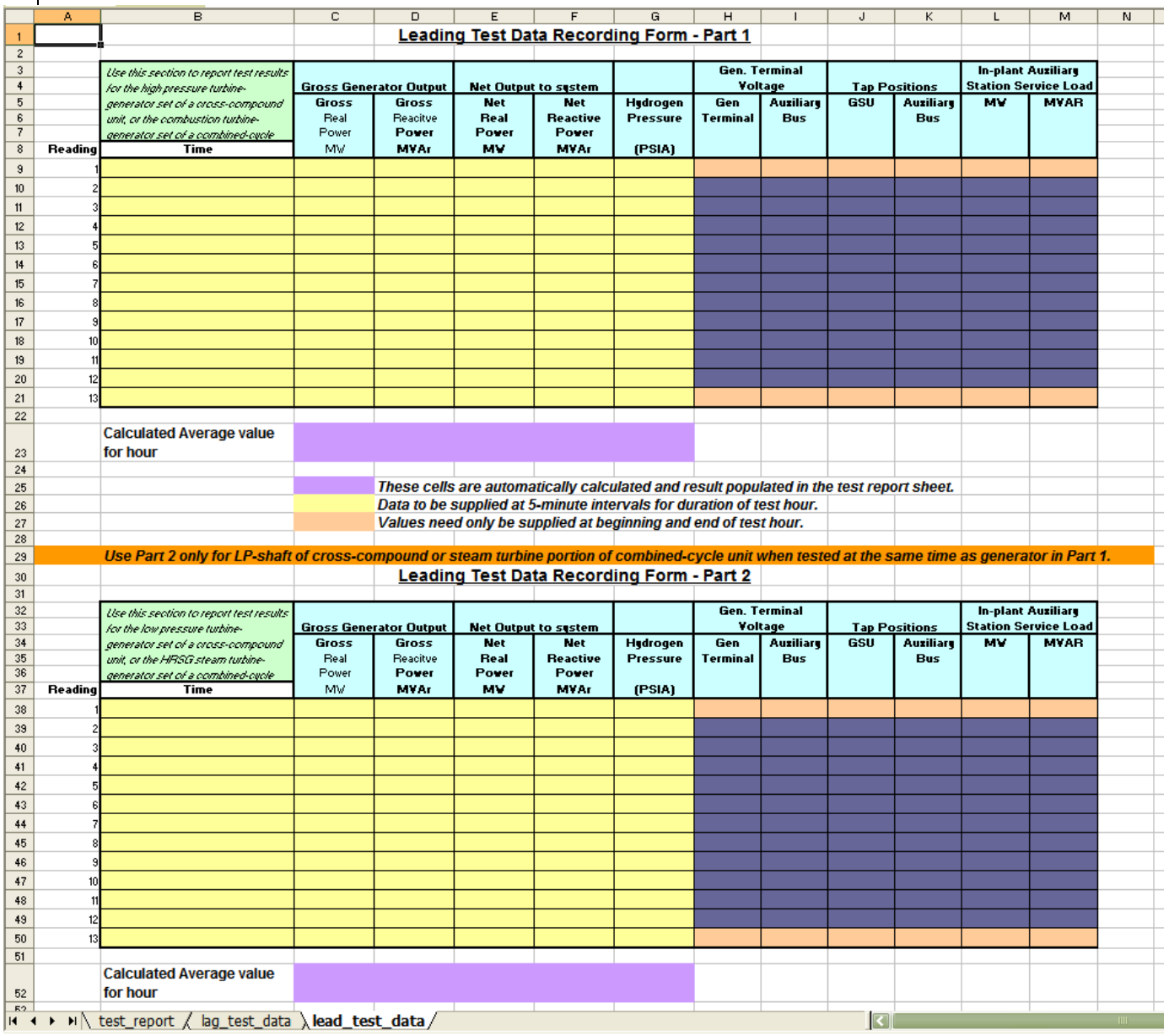
COMMENTS:

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



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
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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
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test_report | lag_test_data | lead_test_data