APPENDIX B -

RESOURCE REACTIVE CAPABILITY DATA EXPLANATION OF TERMS AND INSTRUCTIONS FOR DATA PREPARATION FOR ISO FORM NX-12D

Effective Date: March 5, 2024

Review By Date: March 5, 2026

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References:

1. North American Electric Reliability Corporation (NERC) Reliability Standard VAR-002 - Generator Operation for Maintaining Network Voltage Schedules
2. ISO New England Operating Procedure No. 12 - Voltage and Reactive Control (OP-12), Appendix B - Voltage & Reactive Schedules (OP-12B)
3. ISO New England Operating Procedure No. 12 - Voltage and Reactive Control (OP-12), Appendix D - Voltage Schedule Annual Transmittal Form (OP-12D)
4. ISO New England Operating Procedure No. 14 - Technical Requirements for Generators, Demand Response Resources, Asset Related Demands and Alternative Technology Regulation Resources (OP-14)
5. ISO New England Operating Procedure No. 16 - Transmission System Data (OP-16)

I. INTRODUCTION

Reactive capability (NX-12D) data defines and represents the physical characteristics and ratings of a reactive device, including (but not limited to): Generators (as defined in ISO New England Operating Procedure No. 14 – Technical Requirements for Generators, Demand Response Resources, Asset Related Demands and Alternative Technology Regulation Resources (OP-14)), Dispatchable Asset Related Demands (DARDs), or other dynamic reactive devices (e.g., synchronous condensers or flexible alternating current transmission systems (FACTS) devices) and is required by ISO New England (ISO) and the Local Control Centers (LCCs) in order to develop accurate system models and to support the reliable operation of the New England Transmission System. Each Market Participant (MP) is required to provide this data through the ISO NX submittal software as described in this Appendix B to OP-14 (OP-14B).

NX-12D data is required for each device that is located in the New England Reliability Coordinator Area (RCA) and is either

i) part of a Generator, including generating facilities consisting of multiple generating units, where that Generator has a total real power capability of at least 1 MW,

ii) part of a DARD that is contained within an Electric Storage Facility (ESF DARD),

iii) A shunt-connected dynamic reactive power device (e.g.., Static VAR Compensator (SVC), or Synchronous Condenser), or

iv) is another type of dynamic reactive device for which ISO or the LCC requires and specifically requests reactive capability data.

The MP may submit one set of representative reactive capability data, including the number of devices installed, for electricity producing or consuming devices that:

i) use an inverter (e.g., photovoltaic, wind, etc.),

ii) are associated with the same Resource, DARD or other piece of dynamic reactive equipment; and,

iii) have the same Point of Interconnection.

NX-12D data may be required by ISO and the LCC for other dynamic reactive devices that support the reliable operation of the New England Transmission System. Because the capabilities of these devices may not match the descriptions in this OP-14B, ISO, the LCC, and the MP will work together to determine how to accurately represent the reactive capability of these devices through the NX submittal software.

The manufacturer nameplate lagging and leading reactive power (MVAr) output capability is based on the design parameters of the equipment. This capability represents the theoretical maximum reactive capability of a specific reactive device.

The manufacturer nameplate operating lagging and leading MVAr output capability may be limited during normal operation by any one of several devices or considerations other than the manufacturer nameplate capability curve. Examples of limiting devices include, but are **not** limited to, excitation limiters, electrical protection relaying, and thermal protection relaying. Examples of limiting considerations include, but are **not** limited to, internal station voltage requirements, auxiliary equipment constraints, resource interconnection generator step-up transformer (GSU) overheating, fuel or prime mover limitations, and contractual arrangements. When any such limitations are present, the equipment **cannot** operate at the manufacturer nameplate reactive capability. This restricted capability represents the normal reactive operating capability and, accordingly, it shall be included in the NX-12D data.

The MP shall report any change in the reactive capability of a device in Real-Time to ISO and the appropriate LCC control room. If it is determined that the change will last longer than six (6) months, then the MP shall update NX-12D data in the NX submittal software.

The MP shall verify all NX-12D data is accurate upon submittal and at least annually. ISO shall initiate, and the MP shall respond to, the annual NX-12D data verification, which shall be performed through the NX submittal software.

II. DATA SUBMITTAL REQUIREMENTS

The MP shall submit NX-12D data through ISO NX submittal software under the following conditions:

1. Prior to ISO designating a Resource or ESF DARD as being ready to follow dispatch;
2. Prior to a dynamic reactive device being placed in service;
3. No later than thirty (30) calendar days from the date when a determination is made by ISO or the MP that the data contained in the NX submittal software is inaccurate; or,
4. No later than thirty (30) calendar days from the date of determination that a temporary modification to a Reactive Resource with NX-12D data, that affects that Reactive Resource's reactive capability, will be in effect for longer than six (6) months.

Synchronous Generator Assets or ESF DARDs that are comprised of multiple individual machines require a separate NX-12D form for each machine and a separate NX-12D form for the composite Reactive Resource.

Non-Synchronous Generator Assets or ESF DARDs that are comprised of multiple individual pieces of dynamic reactive equipment require a separate NX-12D form for each equipment type at the asset. Reactive devices with multiple types of reactive equipment require a separate NX-12D form for the composite asset. For example, a wind plant that is comprised of twenty-five (25) turbines from one (1) manufacturer and twenty-five (25) turbines from another manufacturer would require two (2) separate NX-12D forms (one for each unique machine type) and an additional NX-12D form that captures the entire plant composite reactive power capability.

III. DATA DETERMINATION FOR SUBMITTAL

A. Prerequisites for filling out the NX-12D form

The following are required in order for the MP to provide accurate data on the NX-12D form:

1. Manufacturer Nameplate Reactive Capability curve. This curve is also referred to as the P/Q or MW/MVAr curve. This curve is provided by the manufacturer of the reactive equipment and is a graphic illustration of the reactive capability of a machine as a function of real power output or consumption. It represents the physical limitations of that machine based upon design parameters. This curve shall be uploaded to the application using the File Attachments tab. NOTE: If this curve is not available because the manufacturer is out of business or other similar circumstance, the curve shall be created by the MP using the best possible data for the resource capability.

2. Reactive Capability curve showing any limitations to the Nameplate Reactive Capability curve. This curve is referred to as the Normal Operating curve. These limitations can include, but are **not** limited to: under-/over-excitation, prime mover (maximum MW limit), and procedural limitations. This may be provided by the manufacturer or may need to be created by the MP using all of the known limitations overlaid onto the Manufacturer Nameplate Reactive Capability curve. This curve shall be uploaded to the application using the File Attachments tab.

3. Voltage schedule or automatic voltage regulator exemption as provided by the Transmission Operator.

B. Theoretical and Tested Values

The Theoretical and Tested Values section of the NX-12D data form is where MPs provide reactive capability data that has been derived from the Nameplate Reactive Capability and Normal Operating curves in order to discretely model those curves in ISO systems. In order to determine these discrete data points, MW values are determined based upon manufacturer maximum MW value, minimum MW value, and certain other MW values that may be present on a given reactive capability curve. The MVAr values that correspond to these MW values are then determined either graphically or mathematically from the reactive capability curves.

- These capability values represent gross reactive (MVAr) and real (MW) power as measured at the equipment terminal prior to station service load.
- Lagging (over-excited) capability is defined as the Resource providing reactive power to the electrical system and is denoted as a positive value.
- Leading (under-excited) capability is defined as the Resource absorbing reactive power from the electrical system and is denoted as a negative value.

Figure 1 – Data Required for Theoretical and Tested Values

NX12D

Reference Number: | Participant: | NETMOM Unit ID: | Station Svc Location: | Testing Required:
Form State: | Generator Name: | NETMOM Unit Name: | Identical Unit Count:
Form is Valid | Asset ID: | Short Name: | FCM Resource ID: | PSSE Machine ID: | User Contact:
Phone:
Terminal A: | Bus #: | Station: | LCC: | Email:

Related Equipment | **Theoretical & Tested Values** | Impedance & Voltage Schedule | EIA Generator | Equipment Notes | File Attachments | Admin Comments | ISO Review | Revisions | History

Theoretical Values	Nameplate Reactive Capability				Normal Operating Reactive Capability				Station Service Load	
	Lagging (MVAR value positive)		Leading (MVAR value negative)		Lagging (MVAR value positive)		Leading (MVAR value negative)			
MW Output Reference	MW	MVAR	MW	MVAR	MW	MVAR	MW	MVAR	MW	MVAR
Minimal Manual Load Point										
Intermediate Load Point										
Three Quarter Load Point										
Break Load Point										
Transitional Load Point										
Unity Generating Unit Power Factor Load Point		0		0						
Summer Seasonal Claimed Capability Load Point										
EcoMin Load Point										
Motoring Capability										
Full Pumping Capability										

Tested Values	Tested Reactive Capability (MVAR Lag is positive, Lead is negative)		Station Service		Date Tested
MW Output Reference	MW (Gross)	MVAR (Gross)	MW	MVAR	mm/dd/yyyy
At S-SCC Load Point - Lag Test					
At EcoMin Load Point - Lead Test					

Values at Rated MVA and Rated Power Factor from Interconnection Agreement		
	MW	MVAR
Lagging		
Leading		

1. Synchronous Machines That Produce Real Power and Pump DARDs

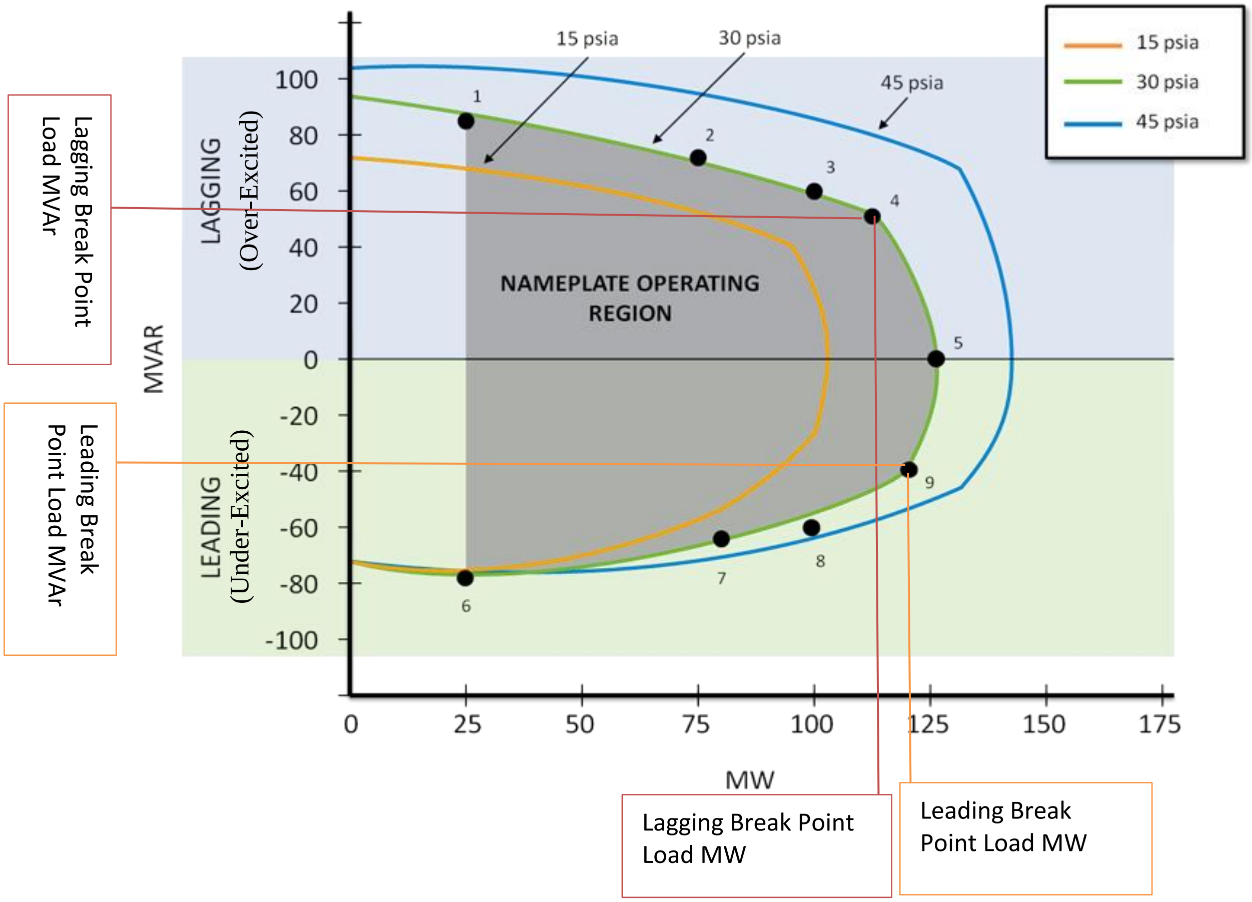
NOTE: Synchronous machines are considered any rotating machine that is electrically coupled to the electrical system through an electrical generator.

The “Identical Unit Count” field shall be equal to “0” unless otherwise directed by ISO.

a. Nameplate Reactive Capability Data Determination

The Nameplate Reactive Capability curve is provided by the manufacturer based upon design specifications of the equipment. Figure 2 illustrates a typical Nameplate Reactive Capability curve for a sample synchronous machine at various hydrogen pressures when **not** encumbered by any protective or limiting concerns. The sample synchronous machine is designed to operate at thirty (30) PSIA hydrogen pressure. For equipment nameplate capability, the requested data consists of MW and MVAr pairs for nine (9) points along the capability curve (see, Figure 2).

Figure 2



NOTE
Some manufacturers provide a curve with lagging (over-excited) and leading (under-excited) axes reversed (i.e. leading will be on the positive y-axis and lagging will be on the negative y-axis).

(1) Nameplate Real Power Data Values

i. General Instructions

(a) These MW values are the same regardless of whether the MP is determining reactive power capability for Nameplate Reactive Capability or Normal Operating Curves.

(b) These MW values will be N/A on data for the Normal Operating curve if the machine cannot reach that MW value on the Normal Operating curve.

- An example of this is a machine that is capable of twenty (20) MVA but limited by the prime mover capability of ten (10) MW. In this case, the machine cannot produce enough real power in order to reach the Three Quarter or Unity Generating Unit Power Factor Load Points on the Normal Operating curve.

(c) If there are multiple temperature-based Nameplate Reactive Capability curves for the machine output, the curve that most closely approximates forty (40) degrees Celsius (40°C) shall be used to determine reactive capability.

(d) If there are multiple voltage-based Nameplate Reactive Capability curves, the curve for 1.0 per unit (p.u.) shall be used.

(e) Motoring Capability and Full Pumping Capability MW values shall be N/A (if the Resource is part of a storage facility, the reactive capability while consuming will be reported on a separate NX-12D form).

ii. Nameplate Real Power Data Point Determination

(a) Determine the Minimum Manual Load Point MW (see, Points 1 and 6 on Figure 2). This value:

- is the lowest MW output at which the machine can produce both real and reactive power;
- is a manufacturer-provided value;
- shall be the lower of the summer and winter values if there are separate values; and
- if modified, changes the values of the Intermediate and Three Quarter Load Points.

(b) Determine the Unity Generating Unit Power Factor Load Point MW (see, Point 5 on Figure 2). This value is the:

- maximum real power capability of the machine at unity power factor, not taking into account any limitations such as prime mover capability;
- point where the Nameplate Reactive Capability curve crosses the zero (0) MVAr point; and
- if modified, changes the values of the Intermediate and Three Quarter Load Points.

(c) Determine the Intermediate Load Point MW (see, Points 2 and 7 on Figure 2). This is a calculated value that is halfway between the Minimum Manual Load Point and the Unity Generating Unit Power Factor Load Point and is determined by the equation:

$$\mathit{Intermediate\ Load\ Point\ MW} = 0.5 * (\mathit{Unity\ Generating\ Unit\ Power\ Factor\ Load\ Point} - \mathit{Minimum\ Manual\ Load\ Point}) + \mathit{Minimum\ Manual\ Load\ Point}$$

- This point is N/A for Normal Operating curve data if the machine is MW limited to a point that the machine cannot reach the MW value in normal operation.
- This point will change if the Unity Generating Unit Power Factor Load Point or the Minimum Manual Load Point are changed.

(d) Determine the Three Quarter Load Point MW (see, Points 3 and 8 on Figure 2). This is a calculated value that is seventy-five percent (75%) between the Minimum Manual Load Point and the Unity Generating Unit Power Factor Load Point and is determined by the equation:

$$\mathit{Three\ Quarter\ Load\ Point\ MW} = 0.75 * (\mathit{Unity\ Generating\ Unit\ Power\ Factor\ Load\ Point} - \mathit{Minimum\ Manual\ Load\ Point}) + \mathit{Minimum\ Manual\ Load\ Point}$$

- This point is N/A for Normal Operating curve data if the machine is MW limited to a point that the machine cannot reach the MW value in normal operation.
- This point will change if the Unity Generating Unit Power Factor Load Point or the Minimum Manual Load Point are changed.

(e) Determine Lagging Break Point Load MW (See Point 4 Figure 2). This value:

- is determined by examining the Manufacturer Nameplate Reactive Capability curve.
- Is the MW value that corresponds to the point on the lagging (over-excited) portion of the curve where there is an intersection between the curve sections reflecting the field winding limit and stator design limit;

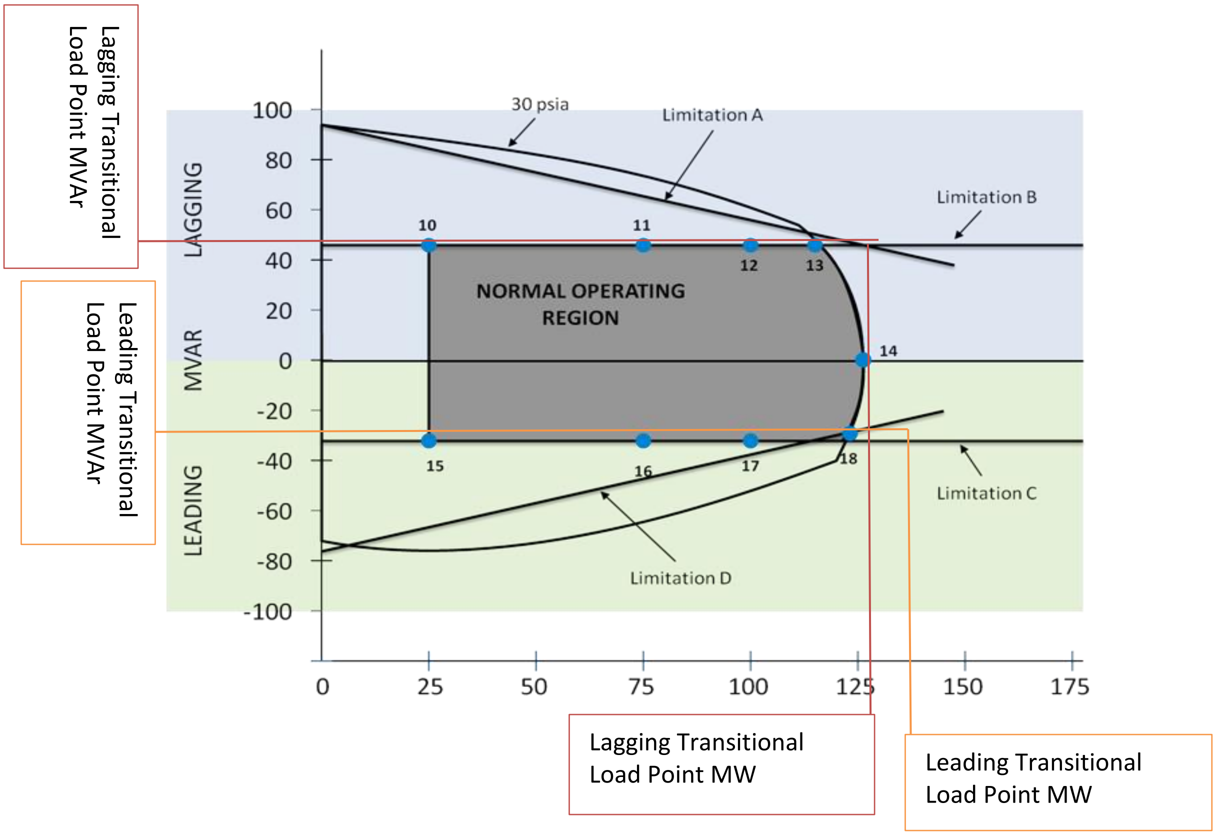
- may be a different value than the Leading Break Point Load MW value;
- is N/A for Nameplate and Normal Operating curve data if there is no break point in the curve; and
- is N/A for Normal Operating curve data if the machine is MW limited to a point that the machine cannot reach the MW value in normal operation.

(f) Determine Leading Break Point Load MW (See Point 9 Figure 2). This value:

- is determined by examining the Manufacturer Nameplate Reactive Capability curve;
- is the MW value that corresponds to the point on the leading (under-excited) portion of the curve where there is an intersection between the curve sections reflecting the stator design limit and the end region heating limit;
- may be a different value than the Lagging Break Point Load MW value;
- is N/A for Nameplate and Normal Operating curve data if there is no break point in the curve; and
- is N/A for Normal Operating curve data if the machine is MW limited to a point that the machine cannot reach the MW value in normal operation.

The Transitional Load Point MW values are determined by overlaying any limitations (e.g. over-/under-excitation limiters or turbine max power limits) on the Nameplate Reactive Capability curve. This combined curve is referred to as the Normal Operating curve for the machine. Figure 3 illustrates a typical Normal Operating curve for a sample synchronous generating unit at various hydrogen pressures when that machine is limited by protective relaying or limiting concerns. The sample generating unit is designed to operate at a thirty (30) PSIA hydrogen pressure level.

Figure 3



NOTE
Curve limitations may be labeled using abbreviations such as OEL (over-excitation limit), UEL (under-excitation limit), MEL (minimum or maximum excitation limit), etc.

(g) Determine Lagging Transitional Load Point MW (see, Point 13 Figure 3). This value:

- is determined by examining the Normal Operating Reactive Capability curve;
- is the MW value that corresponds to the point on the lagging (over-excited) portion of the curve where the most limiting limit curve intersects the Nameplate Reactive Capability curve;
- may be a different value than the Leading Transitional Load Point MW value;
- is N/A for Nameplate and Normal Operating curve if there is no limitation or that limitation does not intersect with the Nameplate Reactive Capability curve; and
- is N/A for Normal Operating curve data if the machine is MW limited such that the machine cannot reach the MW value where the limit curve intersects the Nameplate Reactive Capability curve.

(h) Determine Leading Transitional Load Point MW (See Point 18 Figure 3). This value:

- is determined by examining the Normal Operating Reactive Capability curve;
- is the MW value that corresponds to the point on the leading (under-excited) portion of the curve where the most limiting limit curve intersects the Nameplate Reactive Capability curve;

- may be a different value than the Lagging Transitional Load Point MW value;
- is N/A for Nameplate and Normal Operating curve if there is no limitation or that limitation does not intersect with the Nameplate Reactive Capability curve; and
- is N/A for Normal Operating curve data if the machine is MW-limited, such that the machine cannot reach the MW value where the limit curve intersects the Nameplate Reactive Capability curve.

(2) Nameplate Reactive Power Data Point Determination

i. General Instructions

(a) These values do **not** take into account any limitations (under-/over-excitation, prime mover (max P limit), procedural, etc.) on the Nameplate Reactive Capability curve.

(b) The reactive power values may differ between Nameplate Reactive Capability curve values and Normal Operating Curve values depending upon any machine limitations. The absolute value of the Normal Operating curve MVAr values cannot be greater than the absolute value of the Nameplate Reactive Capability curve MVAr values.

(c) These reactive power values will be N/A on the Normal Operating curve if the machine cannot reach the MW value on the Normal Operating curve. An example of this is a machine that is capable of twenty (20) MVA but limited by the prime mover capability of ten (10) MW. In this case, the machine cannot produce enough MW in order to reach the Three Quarter or Unity Generating Unit Power Factor Load Points.

(d) If there are multiple temperature-based Nameplate Reactive Capability curves for the machine output, the curve that most closely approximates 40 degrees Celsius (40°C) shall be used to determine reactive capability.

(e) If there are multiple gas pressure curves, the curve that represents the machine's normal operating pressure shall be used.

(f) All values shall be in MW or MVAr. If the curve provided by the manufacturer is not in MW or MVAr, these values shall be converted by the MP.

(g) Motoring Capability and Full Pumping Capability MVAr values shall be N/A.

ii. Nameplate Lagging Reactive Power Value Determination

(a) Determine the Lagging Minimum Manual Load Point MVAr. This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Minimum Manual Load Point MW value.

(b) Determine the Lagging Intermediate Load Point MVAr. This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Intermediate Load Point MW value.

(c) Determine the Lagging Three Quarter Load Point MVAr. This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Three Quarter Load Point MW value.

(d) Determine Lagging Break Point Load MVAr. This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Lagging Break Point Load MW value. This point is N/A if there is no break point in the curve.

(e) Determine Lagging Transitional Load Point MVAr. This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Lagging Transitional Load Point MW value. This point is N/A if there is no limitation or that limitation does not intersect with the nameplate curve.

iii. Nameplate Leading Reactive Power Value Determination

(a) Determine the Leading Minimum Manual Load Point MVAr. This is the point on the leading (under-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Minimum Manual Load Point MW value.

(b) Determine the Leading Intermediate Load Point MVAr. This is the point on the leading (under-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Intermediate Load Point MW value.

(c) Determine the Leading Three Quarter Load Point MVAr. This is the point on the leading (under-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Three Quarter Load Point MW value.

(d) Determine Leading Break Point Load MVAr. This is the point on the leading (under-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Leading Break Point Load MW value. This point is N/A if there is no break point in the curve.

(e) Determine Leading Transitional Load Point MVAr. This is the point on the leading (under-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Leading Transitional Load Point MW value. This point is N/A if there is no limitation or that limitation does not intersect with the nameplate curve.

b. Normal Operating Capability Data Point Determination

(1) Normal Operating Capability Real Power Values

(a) These MW values are the same regardless of whether the MP is determining reactive power capability for either the Nameplate or Normal Operating curves.

(b) These MW values will be N/A on data for the Normal Operating curve if the machine cannot reach that MW value on the Normal Operating curve.

- An example of this is a machine that is capable of 20 MVA but limited by the prime mover capability of 10 MW. In this case, the machine cannot produce enough real power in order to reach the Three Quarter or Unity Generating Unit Power Factor Load Points on the Normal Operating curve.

(2) Normal Operating Capability Reactive Power Data Determination

These values shall reflect any limitations (under-/over-excitation, prime mover (max P limit), procedural, etc.) that restrict the machine MVAr or MW capability to less than the Nameplate Reactive Capability curve.

(a) The reactive power values may differ between the Nameplate Reactive Capability curve values and Normal Operating curve values depending upon any machine limitations. The absolute value of the Normal Operating curve MVAr values cannot be greater than the absolute value of the Nameplate Reactive Capability curve MVAr values.

(b) These reactive power values will be N/A on the Normal Operating curve if the machine cannot reach the MW value on the Normal Operating curve. An example of this is a machine that is capable of 20 MVA but limited by the prime mover capability of 10 MW. In this case, the machine cannot produce enough MW in order to reach the Three Quarter or Unity Generating Unit Power Factor Load Points.

(c) If there are multiple temperature-based Normal Operating Capability curves for the machine output, the curve that most closely approximates forty (40) degrees Celsius (40^{o}C) shall be used to determine reactive capability.

(d) If there are multiple gas pressure curves, the curve that represents the machine’s normal operating pressure shall be used.

(e) All values shall be in MW or MVAr. If the curve provided by the manufacturer is not in MW or MVAr, these values shall be converted by the MP.

(f) Motoring Capability and Full Pumping Capability MVAr values shall be N/A.

i. Normal Operating Lagging Reactive Power Data Determination

(a) Determine the Lagging Minimum Manual Load Point MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Minimum Manual Load Point MW value.

(b) Determine the Lagging Intermediate Load Point MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Intermediate Load Point MW value.

(c) Determine the Lagging Three Quarter Load Point MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Three Quarter Load Point MW value. This point is N/A if the machine is MW limited and cannot reach the Three Quarter Load Point MW value in normal operation.

(d) Determine Lagging Break Point Load MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Lagging Break Point Load MW value. This point is N/A if there is no break point in the curve or the machine is MW limited and cannot reach the Break Point Load MW value in normal operation.

(e) Determine Lagging Transitional Load Point MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Lagging Transitional Load Point MW value. This point is N/A if there is no limitation or that limitation does not intersect with the nameplate curve.

ii. Normal Operating Leading Reactive Power Data Determination

(a) Determine the Leading Minimum Manual Load Point MVAr. This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Minimum Manual Load Point MW value.

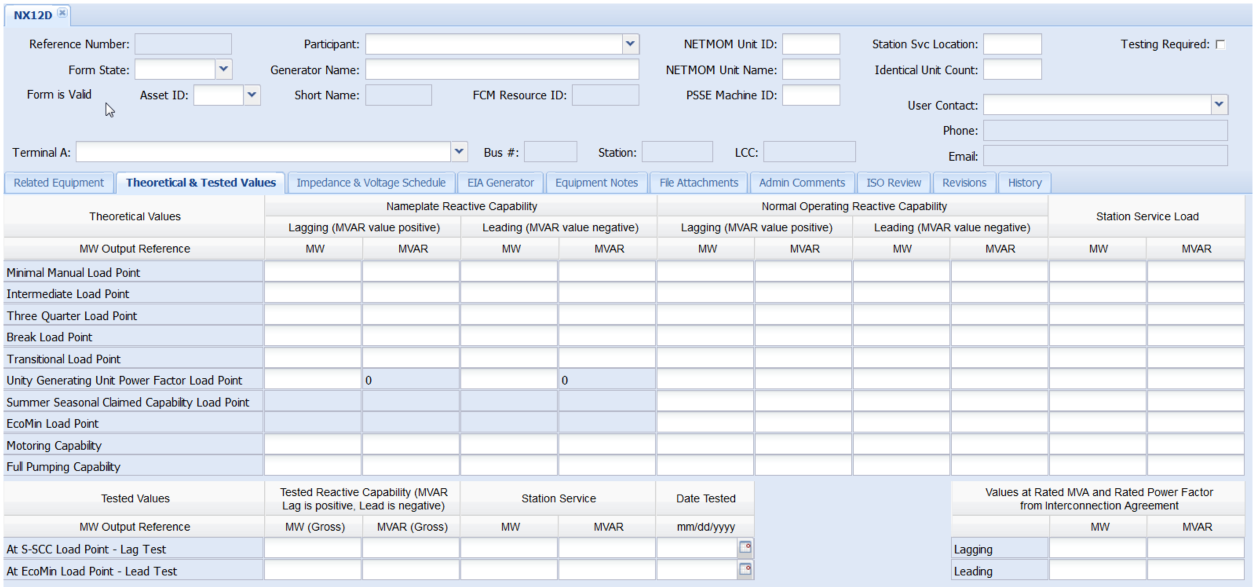
(b) Determine the Leading Intermediate Load Point MVAr. This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Intermediate Load Point MW value.

(c) Determine the Leading Three Quarter Load Point MVAr. This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Three Quarter Load Point MW value. This point is N/A if the machine is MW limited and cannot reach the Three Quarter Load Point MW value in normal operation.

(d) Determine Leading Break Point Load MVAr. This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Leading Break Point Load MW value. This point is N/A if there is no break point in the curve.

(e) Determine Leading Transitional Load Point MVAr. This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Leading Transitional Load Point MW value. This point is N/A if there is no limitation or that limitation does not intersect with the nameplate curve.

2. Non-Synchronous Machines That Produce Real Power and non-Pump DARDs



NX12D

Reference Number: | Participant: | NETMOM Unit ID: | Station Svc Location: | Testing Required:
Form State: | Generator Name: | NETMOM Unit Name: | Identical Unit Count:
Form is Valid | Asset ID: | Short Name: | FCM Resource ID: | PSSE Machine ID: | User Contact:
Phone:
Terminal A: | Bus #: | Station: | LCC: | Email:

Related Equipment | Theoretical & Tested Values | Impedance & Voltage Schedule | EIA Generator | Equipment Notes | File Attachments | Admin Comments | ISO Review | Revisions | History

Theoretical Values	Nameplate Reactive Capability				Normal Operating Reactive Capability				Station Service Load	
	Lagging (MVAR value positive)		Leading (MVAR value negative)		Lagging (MVAR value positive)		Leading (MVAR value negative)			
MW Output Reference	MW	MVAR	MW	MVAR	MW	MVAR	MW	MVAR	MW	MVAR
Minimal Manual Load Point										
Intermediate Load Point										
Three Quarter Load Point										
Break Load Point										
Transitional Load Point										
Unity Generating Unit Power Factor Load Point		0		0						
Summer Seasonal Claimed Capability Load Point										
EcoMin Load Point										
Motoring Capability										
Full Pumping Capability										

Tested Values	Tested Reactive Capability (MVAR Lag is positive, Lead is negative)		Station Service		Date Tested
MW Output Reference	MW (Gross)	MVAR (Gross)	MW	MVAR	mm/dd/yyyy
At S-SCC Load Point - Lag Test					
At EcoMin Load Point - Lead Test					

Values at Rated MVA and Rated Power Factor from Interconnection Agreement		
	MW	MVAR
Lagging		
Leading		

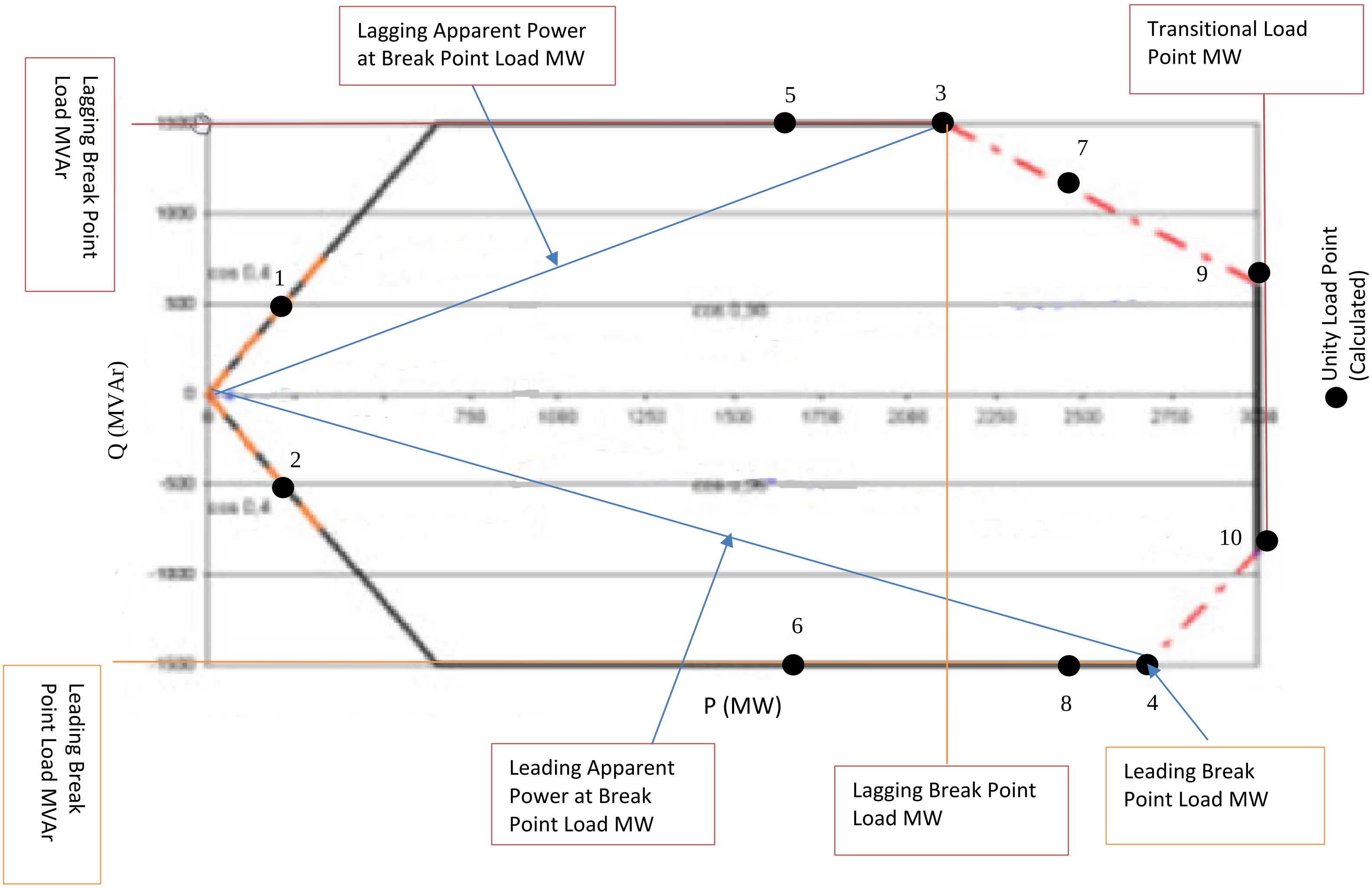
NOTE: Non-Synchronous machines are any machine that is electrically coupled to the electrical system through power electronics. These machines include, but are not limited to, inverter-based resources.

The “Identical Unit Count” field shall be equal to the number of identical power producing pieces of equipment at the asset. For example: a wind plant with ten (10) turbines would have “10” in the “Identical Unit Count” field or a solar plant with one thousand (1000) inverters would have “1000” in the “Identical Unit Count” field.

a. Nameplate Reactive Capability Data Point Determination

The Nameplate Reactive Capability curve is provided by the manufacturer based upon design specifications of the equipment. Figure 3 illustrates a Nameplate Reactive Capability curve for a sample non-synchronous machine. A specific reactive capability curve for a non-synchronous machine may look different than the example curve in Figure 3; however, the concepts for determining the MW and MVAr points are similar for all types of curves. For equipment reactive power capability, the requested data consists of MW and MVAr pairs for eleven points along the capability curve (see, Figure 3).

Figure 3 – Non-Synchronous Resource Nameplate Reactive Capability curve



NOTE

Some manufacturers provide a curve with lagging (over-excited) and leading (under-excited) axes reversed (i.e. leading will be on the positive y-axis and lagging will be on the negative y-axis).

(1) Nameplate Real Power Values

i. General Instructions

(a) These values are the same regardless of whether the MP is determining reactive power capability for Nameplate or Normal Operating curves.

(b) These MW values are N/A on data for the Normal Operating curve if the machine cannot reach the MW value on the Normal Operating curve. An example of this is a machine that is capable of twenty (20) MVA but limited by the prime mover (e.g., solar panel, battery) capability of ten (10) MW. In this case, the machine cannot produce enough MW in order to reach the Three Quarter or Unity Generating Unit Power Factor Load Points.

(c) If there are multiple temperature-based curves for the machine output, the curve that most closely approximates forty (40) degrees Celsius (40°C) shall be used to determine reactive capability.

(d) If there are multiple voltage curves, the curve for one (1.0) per unit (p.u.) shall be used.

(e) All values shall be in MW or MVAr. If the curve provided by the manufacturer is not in MW or MVAr (e.g., kW or kVAr), these values shall be converted by the MP.

(f) Motoring Capability and Full Pumping Capability MW values shall be N/A.

ii. Nameplate Real Power Data Determination

(a) Determine the Minimum Manual Load Point MW (See Points 1 and 2 Figure 3). This value:

- is the lowest MW output at which the machine can produce both real and reactive power;
- is a manufacturer-provided value;
- shall be zero (0.0) MW if the machine can operate at zero MW output while still providing reactive power;
- shall be the lower of the summer and winter values if there are separate values; and
- if modified, changes the values of the Intermediate and Three Quarter Load Points.

(b) Determine Lagging Break Point Load MW (See Point 3 Figure 3). This value:

- is determined by examining the Manufacturer Nameplate Reactive Capability curve;
- is the MW value that corresponds to the point on the lagging (over-excited) portion of the curve where there is an intersection between the curve sections such as sections based on maximum voltage versus maximum current limits;
- is equal to N/A if there is no break-point in the curve;
- may be a different value than the Leading Break Point Load MW value; and
- is the point with the highest MW value if there are multiple break-points on the curve.

(c) Determine Leading Break Point Load MW (See Point 4 Figure 3). This value is:

- determined by examining the Manufacturer Nameplate Reactive Capability curve;
- the MW value that corresponds to the point on the leading (under-excited) portion of the curve where there is an intersection between the curve sections such as sections based on maximum voltage versus maximum current limit;
- equal to N/A if there is no break-point in the curve. This point may be a different value than the Lagging Break Point Load MW value; and
- the point with the greatest MW value if there are multiple break-points on the curve.

(d) Determine the Unity Generating Unit Power Factor Load Point MW (See Figure 3). This value is either:

(i) the point where the Nameplate Reactive Capability curve crosses the zero reactive power point (unity power factor); or,

(ii) If the Nameplate Reactive Capability curve does not cross zero:

- the greater of the apparent power of the machine at the Lagging Break Point Load MW and the Leading Break Point Load MW; and
- may not fall within the MW range of the Nameplate Reactive Capability curve. This is an acceptable result and this point will have a MVAr value of zero.

NOTE
$Apparent\ Power = \sqrt{(MW^2 + MVAR^2)}$ or $S = \sqrt{(P^2 + Q^2)}$

Modifications to the Unity Generating Unit Power Factor Load Point also change the values of the Intermediate and Three Quarter Load Points.

(e) Determine the Intermediate Load Point MW (see, Points 5 and 6 Figure 3). This is a calculated value found by the equation:

$$Intermediate\ Load\ Point\ MW = 0.5 * (Unity\ Generating\ Unit\ Power\ Factor\ Load\ Point - Minimum\ Manual\ Load\ Point) + Minimum\ Manual\ Load\ Point$$

- This point is N/A for Normal Operating curve data if the machine is MW limited.
- This point will change if the Unity Generating Unit Power Factor Load Point or the Minimum Manual Load Point are changed

(f) Determine the Three Quarter Load Point MW (see, Points 7 and 8 Figure 3). This is a calculated value found by the equation:

$$Three\ Quarter\ Load\ Point\ MW = 0.75 * (Unity\ Generating\ Unit\ Power\ Factor\ Load\ Point - Minimum\ Manual\ Load\ Point) + Minimum\ Manual\ Load\ Point$$

- This point is N/A for Normal Operating curve data if the machine is MW limited.
- This point will change if the Unity Generating Unit Power Factor Load Point or the Minimum Manual Load Point are changed

(g) Determine Lagging Transitional Load Point MW (see, Point 9 Figure 3). This is the maximum MW capability of the machine.

(h) Determine Leading Transitional Load Point MW (See Point 10 Figure 3). This is the maximum MW capability of the machine.

(2) Nameplate Reactive Power Data Point Determination

i. General Instructions

(a) These values do not take into account any limitations (under-/over-excitation, prime mover (max P limit), procedural, etc.) on the Nameplate Reactive Capability curve.

(b) The MVAr values may differ for Nameplate curve values compared to Normal Operating curve values depending upon any machine limitations. Normal Operating curve MVAr values cannot be greater (absolute value) than the Nameplate Reactive Capability curve MVAr values.

(c) These MVAr values will be N/A on the Normal Operating curve data if the machine cannot reach the MW value on the Normal Operating curve.

(d) If there are multiple temperature-based curves for the machine output, the curve that most closely approximates forty degrees Celsius (40ºC) shall be used to determine reactive capability.

(e) If there are multiple gas pressure curves, the curve that represents the machine's normal operating pressure shall be used

(f) Motoring Capability and Full Pumping Capability MVAr values shall be N/A.

ii. Nameplate Lagging Reactive Power Value Determination

(a) Determine the Lagging Minimum Manual Load Point MVAr (see, Point 1 Figure 3). This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Minimum Manual Load Point MW value.

(b) Determine the Lagging Intermediate Load Point MVAr (see, Point 5 Figure 3). This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Intermediate Load Point MW value.

(c) Determine the Lagging Three Quarter Load Point MVAr (see, Point 7 Figure 3). This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Three Quarter Load Point MW value.

(d) Determine Lagging Break Point Load MVAr (See Point 3 Figure 3). This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Lagging Break Point Load MW value.

(e) Determine Transitional Load Point MVAr (See Point 9 Figure 3). This is the point on the lagging (over-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Lagging Transitional Load Point MW value

iii. Nameplate Leading Reactive Power Value Determination

(a) Determine the Leading Minimum Manual Load Point MVAr (See Point 2 Figure 3). This is the point on the leading (under-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Minimum Manual Load Point MW value.

(b) Determine the Leading Intermediate Load Point MVAr (See Point 6 Figure 3). This is the point on the leading (under-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Intermediate Load Point MW value.

(c) Determine the Leading Three Quarter Load Point MVAr (See Point 8 Figure 3. This is the point on the leading (under-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Three Quarter Load Point MW value.

(d) Determine Leading Break Point Load MVAr (See Point 4 Figure 3). This is the point on the leading (under-excited) portion of the Nameplate Reactive Capability curve that corresponds to the Leading Break Point Load MW value.

(e) Determine Leading Transitional Load Point MVAr (See Point 10 Figure 3). This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Leading Transitional Load Point MW value.

b. Normal Operating Reactive Capability Curve Data Point Determination

(1) Normal Operating Real Power Data Point Determination

(a) These values are the same regardless of whether you are determining reactive power capability for Nameplate or Normal Operating curves.

(b) These values shall reflect any limitations (Under-/Over-excitation, Prime mover (max P limit), Procedural, etc.) on the Nameplate Reactive Capability curve. For non-synchronous Resources, these values are typically identical to the Nameplate Operating Capability values.

(c) These MW values are N/A on data for the Normal Operating curve if the machine cannot reach the MW value on the Normal Operating curve. An example of this is a machine that is capable of twenty (20) MVA but limited by the prime mover (e.g., solar panel, battery) capability of ten (10) MW. In this case, the machine cannot produce enough MW in order to reach the Three Quarter or Unity Generating Unit Power Factor Load Points.

(2) Normal Operating Reactive Power Data Point Determination

i. Normal Operating Lagging Reactive Power Value Determination

(a) Determine the Lagging Minimum Manual Load Point MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Minimum Manual Load Point MW value.

(b) Determine the Lagging Intermediate Load Point MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Intermediate Load Point MW value.

(c) Determine the Lagging Three Quarter Load Point MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Three Quarter Load Point MW value.

(d) Determine Lagging Break Point Load MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Lagging Break Point Load MW value.

(e) Determine Transitional Load Point MVAr. This is the point on the lagging (over-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Lagging Transitional Load Point MW value.

ii. Normal Operating Leading Reactive Power Value Determination

(a) Determine the Leading Minimum Manual Load Point MVAr. This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Minimum Manual Load Point MW value.

(b) Determine the Leading Intermediate Load Point MVAr. This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Intermediate Load Point MW value.

(c) Determine the Leading Three Quarter Load Point MVAr. This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Three Quarter Load Point MW value.

(d) Determine Leading Break Point Load MVAr. This is the point on the Leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Leading Break Point Load MW value.

(e) Determine Leading Transitional Load Point MVAr. This is the point on the leading (under-excited) portion of the Normal Operating Reactive Capability curve that corresponds to the Leading Transitional Load Point MW value.

3. Shunt-Connected Dynamic Reactive Power Devices

The “Identical Unit Count” field shall be equal to the number of identical reactive power producing or consuming pieces of equipment at the Reactive Resource. For example: a facility with ten (10) synchronous condensers would have “10” in the “Identical Unit Count” field.

a. Nameplate Reactive Capability Data Point Determination

The Nameplate Reactive Capability curve is provided by the manufacturer based upon design specifications of the equipment.

i. Nameplate Real Power Data Determination

(a) The Minimum Manual Load Point MW value shall be zero.
(b) The Intermediate Load Point MW value shall be zero.
(c) The Three Quarter Load Point MW value shall be zero.
(d) The Lagging Break Point Load MW value shall be N/A
(e) The Leading Break Point Load MW value shall be N/A
(f) The Lagging Transitional Load Point MW value shall be N/A.
(g) The Leading Transitional Load Point MW value shall be N/A.
(h) The Unity Generating Unit Power Factor Load Point MW value shall be N/A.

ii. Nameplate Reactive Power Data Point Determination

(a) The Minimum Manual Load Point MVAR value shall be determined from the manufacturer curve.
(b) The Intermediate Load Point MVAR value shall be determined from the manufacturer curve.
(c) The Three Quarter Load Point MVAR value shall be determined from the manufacturer curve.
(d) The Lagging Break Point Load MVAR value shall be N/A
(e) The Leading Break Point Load MVAR value shall be N/A
(f) The Lagging Transitional Load Point MVAR value shall be N/A.
(g) The Leading Transitional Load Point MVAR value shall be N/A.
(h) The Unity Generating Unit Power Factor Load Point MVAR value shall N/A.

b. Normal Operating Reactive Capability Curve Data Point Determination

The Normal Operating Reactive Capability Curve is typically identical to the Nameplate Reactive Capability Curve for these resources. If there are limitations to the reactive capability that restrict the Nameplate Reactive Capability Curve, the ISO will work with the MP to reflect those restrictions on the NX-12D form.

i. Normal Operating Real Power Data Determination

(a) The Minimum Manual Load Point MW value shall be zero.
(b) The Intermediate Load Point MW value shall be zero.
(c) The Three Quarter Load Point MW value shall be zero.
(d) The Lagging Transitional Load Point MW value shall be N/A.
(e) The Leading Transitional Load Point MW value shall be N/A.
(f) The Lagging Break Point Load MW value shall be N/A.
(g) The Leading Break Point Load MW value shall be N/A.
(h) The Unity Generating Unit Power Factor Load Point MW value shall be N/A.

ii. Normal Operating Reactive Power Data Point Determination

(a) The Minimum Manual Load Point MVAR value shall be determined from the manufacturer curve.
(b) The Intermediate Load Point MVAR value shall be determined from the manufacturer curve.
(c) The Three Quarter Load Point MVAR value shall be determined from the manufacturer curve.
(d) The Lagging Break Point Load MVAR value shall be N/A
(e) The Leading Break Point Load MVAR value shall be N/A
(f) The Lagging Transitional Load Point MVAR value shall be N/A.
(g) The Leading Transitional Load Point MVAR value shall be N/A.
(h) The Unity Generating Unit Power Factor Load Point MVAR value shall be N/A.

4. All Reactive Resources

a. Summer Seasonal Claimed and Economic Minimum Data

> **NOTE**
>
> The Summer Seasonal Claimed Capability Load Point MW value on the NX-12D form is **not** the same value as the Resource's Summer Seasonal Claimed Capability value as determined through auditing.

(1) Determine the Summer Seasonal Claimed Capability Data

i. Determine the Summer Seasonal Claimed Capability Load Point MW value. This value is:

- For Generator Assets, the MW value shall be ninety percent (90%) of the summer Network Resource Capability (NRC);
- For DARDS that are registered as part of Binary Storage Facilities, the MW value shall be the maximum normal demand for the asset;
- For DARDS that are registered as part of Continuous Storage Facilities, the MW value shall be ninety percent (90%) of the summer NRC applied in the consuming direction.
- For all other Reactive Resources this shall be zero.

ii. Determine the Summer Seasonal Claimed Capability Load Point Lagging MVAr value. This is the point on the lagging (over-excited) portion of the Normal Operating curve that corresponds to the Summer Seasonal Claimed Capability Load Point MW value.

iii. Determine the Summer Seasonal Claimed Capability Load Point Leading MVAr value. This is the point on the leading (under-excited) portion of the Normal Operating curve that corresponds to the Summer Seasonal Claimed Capability Load Point MW value.

(2) Determine the Economic Minimum (EcoMin) Data

i. Determine the EcoMin Load Point MW value.

(a) For real power producing resources and DARDs, this value is an MP-provided value determined by using the definition of Economic Minimum contained in Section I.2.2 of the ISO New England Inc. Transmission, Markets, and Services Tariff.

(b) For all other Reactive Resources this shall be zero.

ii. Determine the EcoMin Load Point Lagging MVAr value. This is the point on the lagging (over-excited) portion of the Normal Operating curve that corresponds to the EcoMin Load Point MW value.

iii. Determine the EcoMin Load Point Leading MVAr value. . This is the point on the leading (under-excited) portion of the Normal Operating curve that corresponds to the EcoMin Load Point MW value.

b. Station Service Load Data

Station s**ervice** means the electric energy that is used within the Resource to power the lights, motors, control systems, and other auxiliary electrical loads that are necessary for operation of the Resource. The MP shall provide the expected gross MW and MVAr station service loads for normal operation at the various load points. In the event that station service loads have seasonal variations, the MP shall provide the maximum station service load expected at that real power load point. The data provided shall reflect tested data if available.

c. Tested Data

The MP shall provide the real and reactive power values at the equipment terminals, the station service real and reactive power values, and the date of performance of the most recently performed Reactive Capability Audit (if the Reactive Resource has performed a Reactive Capability Audit).

d. Values at Rated MVA and Rated Power Factor from Interconnection Agreement

The MP shall provide the values from the currently effective Interconnection Agreement. (e.g., equipment rated at 100) MVA and required by the Interconnection Agreement to have a 0.95 lagging power factor and a 0.95 leading power factor would have lagging 95 MW (-31 MVAr); leading 95 MW (-31 MVAr). In the event that the equipment does **not** have an Interconnection Agreement with ISO, the MP shall provide values at the most restrictive capability or 0.95 lagging or leading whichever is less.

e. Generating Units Not Directly Connected at One-Hundred Fifteen (115) kV or Above

This block shall remain blank unless ISO requests that the MP fill in specific plant modeling information.

f. Bus Loading Not Explicitly Modeled on Equivalent Network

This block shall remain blank unless ISO requests that the MP fill in specific plant modeling information.

C. Impedance and Voltage Schedule Tab

1. Impedance Data (%)

This block shall remain blank unless ISO requests that the MP fill in specific plant modeling information.

2. Bus Loading Not Explicitly Modeled on Equivalent Network

This block shall remain blank unless ISO requests that the MP fill in specific plant modeling information.

3. High Side Visibility

NOTE

If the plant operator does **not** have Real-Time high side voltage reading, then the “High Side Visibility” box shall **not** be checked.

Check this box when the plant operator has, available in the control room, a Real-Time voltage reading indicating the voltage on the bus for which the voltage schedule is provided that can be used as a reference to make voltage control set-point corrections. This voltage reading would be comparable to the voltage schedule provided by the LCC.

4. Voltage Schedule

NOTE

For Resources with multiple pieces of reactive equipment aggregated behind a single Point of Interconnection, the transformer at the Point of Interconnection for these Resources is the equivalent of a GSU for conventional generators.

For wind, solar, or other plants that have geographically diverse generating or consuming pieces of equipment with the same Point of Interconnection, the terminal voltage is the voltage at the terminals of the generating or consuming equipment before any transformer/transformation to a different voltage level (e.g., between a turbine and its GSU or between a solar inverter and the collector transformer).

For Option A units, the maximum and minimum acceptable voltage schedule limits will typically differ from the more narrow voltage schedule tolerance bands as stated in ISO New England Operating Procedure No. 12 - Voltage and Reactive Control (OP-12), Appendix B - Voltage & Reactive Schedules (OP-12B).

The ISO or the LCC may operate the station at more restrictive voltages due to transmission equipment voltage limits.

a. General Instructions

i. The On-Peak schedule field is used for the default schedule, and the Off-Peak schedule field is used for alternate schedules. In the event that the asset is not provided an alternate schedule, the default schedule shall be entered into the Off-Peak schedule fields.

b. Reactive Resources that have been identified as "Option A" on the most recent ISO New England Operating Procedure No. 12 (OP-12) Appendix D-Voltage Schedule Annual Transmittal Form (OP-12D):

Voltage Schedule	Voltage(kV)	On Peak	Off Peak
	Maximum		
	Tolerance Band High		
	Scheduled		
	Tolerance Band Low		
	Minimum		
	Terminal Bus Maximum		
	Terminal Bus Scheduled		
	Terminal Bus Minimum		

Figure - 4 Voltage schedule data required for Option A Reactive Resources

(1) Select voltage control "Option A".

(2) Enter the maximum and minimum acceptable voltage limits. These limits shall reflect restrictions on generator-owned equipment, including but not limited to: terminal voltage constraints, auxiliary equipment limitations, station service requirements, GSU, or breaker ratings.

(3) Enter the tolerance band high, voltage schedule, and tolerance band low values. For existing assets, these values are provided by the LCC on OP-12D. For new assets, these values are communicated by ISO-NE.

(4) Enter the terminal bus voltage maximum and minimum limits as determined by generator-owned equipment limitations.

(5) Enter the voltage schedule as reflected on the terminal bus in the terminal bus schedule.

(6) If the asset does **not** have High Side Visibility:

i. Enter a detailed description of the method used to monitor GSU high side voltage in the voltage control option comments or as a separate attached document. If the description is provided as a separate file, enter a reference to the file in the voltage control option comments.

c. Reactive Resources that have been identified as "Option B" on the most recent OP-12D transmittal form:

Voltage(kV)	On Peak	Off Peak
Maximum		
Tolerance Band High		
Scheduled		
Tolerance Band Low		
Minimum		
Terminal Bus Maximum		
Terminal Bus Scheduled		
Terminal Bus Minimum		

Figure - 5 Voltage schedule data required for Option B Reactive Resources

(1) Select Voltage Control “Option B”.

(2) Enter the maximum, voltage schedule, and minimum values. For existing assets, these values are provided by the LCC on OP-12 D. For new assets, these values are communicated by the interconnecting entity.

(3) Enter the terminal bus voltage maximum and minimum limits as determined by generator-owned equipment limitations.

(4) Enter the voltage schedule as reflected on the terminal bus in the terminal bus schedule.

(5) If the asset does not have High Side Visibility:

i. Enter a detailed description of the method used to monitor GSU high side voltage in the voltage control option comments or as a separate attached document. If the description is provided as a separate file, enter a reference to the file in the voltage control option comments.

d. Reactive Resources that have requested and been identified by ISO as “Option C”, as described in ISO New England Operating Procedure No. 12 – Voltage and Reactive Control, are exempted from providing automatic voltage control:

Voltage Control Option Comments

Figure - 6 Voltage control comments required for Option C Reactive Resources

(1) Select voltage control “Option C”.

(2) Enter a description of the asset reactive controls and operation in lieu of maintaining a voltage schedule through use of AVR or its equivalent. This description can be entered in the voltage control option comments field or uploaded as a separate file. If the description is provided as a separate file, enter a reference to the file in the voltage control option comments.

5. Operation of Automatic Voltage Regulating Equipment (AVR)

OP-12 and NERC Reliability Standard VAR-002 - Generator Operation for Maintaining Network Voltage Schedules require each generator equipped with an AVR to operate with the AVR in-service in the automatic voltage control mode and controlling voltage and to notify ISO and the applicable LCC of any AVR status changes. The MP shall indicate when the AVR will automatically control voltage during start-up, normal operation, and shut-down. When such conditions occur that match the conditions indicated on Form NX-12D, this serves as advance standing notification to ISO and the LCC, and Real-Time reporting is **not** required.

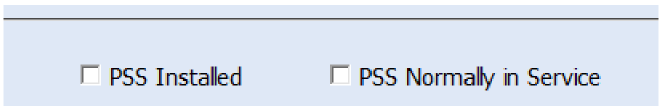
Shunt-connected dynamic reactive power devices shall provide indication of AVR status during start-up (if applicable), normal operation, and shut-down (if applicable).

6. Plant Voltage Control Document

For all Reactive Resources that employ an overall plant voltage control scheme (including but **not** limited to wind plant controllers and combined-cycle distributed control systems), the MP shall upload a file containing a detailed explanation of the voltage control scheme into the NX submittal software on the File Attachments Tab.

7. Power System Stabilizer

Figure 7 – Power System Stabilizer Information



a. The MP shall check the PSS Installed checkbox if the machine has a PSS installed, regardless of the status of that PSS (e.g., a machine that has a PSS installed, but the PSS was never commissioned would still indicate that a PSS is installed).

b. The MP shall check the PSS Normally in Service checkbox if the PSS is on and functional when the machine is producing or absorbing power. The required PSS status will be indicated in the System Impact Study.

NOTE

If the PSS Normally in Service box is checked, then the PSS Installed box shall also be checked.

8. Short-Term Overload Capability

Reactive Resources that have a short-term overload capability shall provide a document, on the attachments tab, describing the operation, capability, and duration of the overload capability.

OP-14B Revision History

<u>Document History</u> (This Document History documents action taken on the equivalent NEPOOL Procedure prior to the RTO Operations Date as well as revisions made to the ISO New England Procedure subsequent to the RTO Operations Date.)

Rev. No.	Date	Reason
-	10/01/19	For previous revision history, refer to Rev 10 available through Ask ISO:
Rev 11	10/01/19	Biennial review completed by procedure owner; Globally, made editorial changes consistent with current conditions, practices and management expectations; Update all sections to add in ESF DARDs and make wording more applicable to all types of resources; Truncated Revision History per SOP-RTMKTS.0210.0010 Section 5.6;
Rev 12	09/02/21	Biennial review completed by procedure owner; Document re-write to improve usability
Rev 12.1	09/02/21	Corrected typo in Revision 12 to record document effective date in Document History

Rev. No.	Date	Reason
Rev 13	09/07/22	Biennial review completed by the procedure owner; Clarified responsibility for voltage schedules
Rev 14	03/05/24	Biennial review completed by the procedure owner; Added requirements for synchronous condenser and FACTS device data.