Appendix I - Explanation of Terms and Instructions for Data Preparation of NX-9

ISO New England Transmission Equipment Rating, Characteristic, and Operational Data

Other Equipment

Effective Date: October 26, 2023

Review By Date: October 26, 2025

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I. EQUIPMENT REQUIREMENTS

Data for all transmission equipment designated as part of the Bulk Electric System[1] (BES) or connecting to the New England Transmission System[2] at a voltage of 69 kV or greater shall be provided by the Transmission Owners and Market Participants who own the equipment.[3] This includes shunt connected dynamic reactive power devices, voltage sensing phase shifters and other equipment not previously defined in this procedure and installed on the New England Transmission System.

Data for equipment connected at voltages that are less than 69 kV may be required when ISO determines the data is necessary for reliable operation of the New England Transmission System. When required by ISO, the TO or MP shall submit the data within thirty (30) calendar days of ISO's notification.

While specific NX-9 forms for each of these equipment types do not exist, data required for reliable operation of the New England Transmission System can be input on the existing NX forms, NX-9A, NX-9B, NX-9C,NX-9D, NX-9G, NX-9H, and NX-12D. This Appendix shall serve as a guide for using these NX-9 and NX-12D forms to provide data for equipment other than the equipment specified in those Appendices.

ISO recognizes that these instructions may not readily fit all equipment added to the system. If this is the case, please contact the ISO NX-9 Administrator (nx9admin@iso-ne.com) to discuss and come to agreement on how to represent the equipment on the available forms.

MPs or TOs adding equipment connecting at voltages that are 69 kV and greater and not defined within OP-16 Appendices A, B, C, D, G, H or I shall contact the ISO NX-9 Administrator (nx9admin@iso-ne.com) for instructions for providing NX-9 data.

II. GENERAL DATA INSTRUCTIONS

All NX-9 forms provide for entry of both ISO and MP/TO data. ISO fields cannot be modified by the MP or TO. The MP or TO is responsible for providing data for all non-ISO fields via the NX Application.

The circuit number shall be initially entered by the MP or TO for new equipment and thereafter maintained by ISO.

Select the terminals that reflect the connection points of the equipment. Terminals are created and maintained by ISO. The user should contact the ISO

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[1] Bulk Electric System (BES) is defined in the Glossary of Terms Used in NERC Reliability Standards.

[2] New England Transmission System is defined in the ISO Transmission, Markets, and Services Tariff, Section I.2.2.

[3] Generally, under Section I of Operating Procedure No. 16, data shall be provided by Transmission Owners (TOs) and Market Participants, *i.e.* Market Participants who own the equipment or Lead Market Participants for Generator Assets (collectively MPs).

NX-9 Administrator (nx9admin@iso-ne.com) if terminal additions or changes are needed.

To remove equipment from service, select the Remove Equipment From Service checkbox. Equipment is removed from service either when the equipment is retiring from service or if new forms are being submitted as a replacement due to a change in configuration.

III. RATING DATA INSTRUCTIONS

When required, as defined in sections VI-VII of this Appendix, facility rating data shall be provided in MVA (rounded down to the nearest whole number) and determined in accordance with Planning Procedure 7, "Procedures for Determining and Implementing Transmission Facility Ratings in New England" (PP7). The definition of Thermal Ratings is described in PP7 Section 2.0 Collaborative Development of Rating Procedures. A facility rating shall equal the rating of the most limiting individual equipment, shall reflect relay loadability limits[4], and shall account for auxiliary support equipment such as wave traps and any other equipment that Good Utility Practice suggests is necessary. This requirement does not remove the TO's obligation to adhere to PRC-023-4, and it successor standards, nor does it suggest a TO be allowed to change a relay setting to create a more limiting thermal rating for a facility.

The NX-9 form provides for entry of both summer (April 1 through October 31) and winter (November 1 through March 31) thermal ratings. The ambient temperature (reported in Fahrenheit) and wind speed (reported in feet per second) used to establish the normal ratings shall be entered for each rating set. If ratings for special conditions or configurations are added to the NX-9 form, comments that describe the associated circumstances for use of the special ratings are required. The MP or TO is also responsible for providing a statement as to the authority of ISO and the Local Control Center (LCC) for use and distribution of these special ratings.

IV. EXPLANATION OF DATA CHANGES

Any time an NX-9 form is modified or created, a brief description of the reason(s) for the entry shall be provided in the Revision Comments field. It will provide a written record of the change and clearly identify the equipment changes made in the field and/or other reasons that necessitated the update of the NX-9 form. This data is utilized by ISO in the NX-9 form review and approval process.

V. EQUIPMENT NOTES

The Equipment Notes field is used to provide explanations of data or other pertinent or operational information.

[4] The term "relay loadability limits", as used in this Appendix, represents the minimum flow at which the relay acts.

Fields are provided for both ISO and MP/TO notes. An additional private field is available to the MP or TO for internal notes that can be edited and viewed only by the MP or TO owning the record.

Equipment notes are carried forward when an NX-9 form is updated. MPs and TOs should review and modify or delete any MP or TO note that is no longer pertinent. ISO is responsible for maintaining ISO notes.

VI. SHUNT CONNECTED DYNAMIC REACTIVE POWER DEVICE - CHARACTERISTIC AND OPERATIONAL DATA INSTRUCTIONS

Shunt connected dynamic reactive power devices (e.g., Static VAR Compensator (SVC), Static Compensator, Dynamic VAR Compensator (D-VAR), Synchronous Condenser) generally consist of a transformer connected to one or more reactive devices.

The reactive device data shall be reported using the NX-12D form and the Operating Procedure 14 Appendix B instructions.

Series reactive devices will continue to be reported using the NX9H form and Operating Procedure 16 Appendix H instructions.

The transformer portion of the equipment shall be reported using the NX-9B and the Operating Procedure 16 Appendix B instructions.

VII. VOLTAGE SENSING PHASE SHIFTER - CHARACTERISTIC AND OPERATIONAL DATA INSTRUCTIONS

Voltage sensing phase shifting devices shall be reported using the NX-9B and NX-9C forms.

A copy of the manufacturer’s nameplate, either by document (.pdf format) or digital photograph (.tif or .jpg formats), shall be included as a file attachment to the NX-9C form for new or replaced equipment.

A copy of the manufacturer’s test report document (in .pdf format) shall be included as a file attachment to the NX-9C form for all new or replaced equipment and upon revision of existing NX-9C forms.

The transformer characteristics shall be reported as described in Appendix B on the NX-9B form.

The phase shifter characteristics shall be reported as described in Appendix C on the NX-9C form.

Example 1 shows sample NX-9C and NX-9B forms for a voltage sensing phase shifter.

EXAMPLE 1, VOLTAGE SENSING PHASE SHIFTER

ISO New England Equipment Rating, Characteristic, and Operational Data Implementation Form
Phase Shifter (NX-9C)

Reference 9999 **Participant ID** Abc VSPS
Participant Test Company **ISO ID** abc
Form State Preliminary **Ckt** 1

Terminal A Station1 115kV **Bus #** 123456 **EMS** STATION1
Terminal B Station1 Phase Shifter **Bus #** 234567 **EMS** STATION1

Default Summer 77 F

	MVA	Limiting Device / Description	Location
Normal	235	Phase Shifting Transformer -	STATION1
LTE	250	Phase Shifting Transformer -	STATION1
STE	300	Phase Shifting Transformer -	STATION1
DAL	435	Phase Shifting Transformer -	STATION1

Default Winter 41 F

	MVA	Limiting Device / Description	Location
Normal	290	Phase Shifting Transformer -	STATION1
LTE	305	Phase Shifting Transformer -	STATION1
STE	340	Phase Shifting Transformer -	STATION1
DAL	530	Phase Shifting Transformer -	STATION1

	Tap Number	Impedance Tap Correction Multiplier
Up /	1	1.68
	17	1
Down /	33	1.68

Name Plate kV 115 / 115 **Step Size (Deg)** 3.2625 **Max Angle (Deg)** 52.2 **Min Angle (Deg)** -52.2
Type Non-Auto **Auto Mode Tap Switch Delay (sec)**
Normal Operating Mode Manual-Remote **Normal Heavy Load Tap Number** 0
Impedance Data (%) (100 MVA Base) **Normal Light Load Tap Number** 0
R 0.0663 **X** 4.0397 **Advancing Tap Increases MW Flow From Terminal A to Terminal B** N

Revision Comments Revision Comments Not Available

Equipment Notes This form is a partial representation of this voltage controlling phase shifting transformer. For full representation, the companion 9B datasheet must also be referenced. Total impedance information is included on this form.

Data Revision Number 0 **Date Created** mm/dd/yyyy **Prepared By** Participant Username
Requested Effective Date mm/dd/yyyy **Date Received** **Approved By**
Actual Effective Date **ISO EMS Implementation Date**

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EXAMPLE 1 (CONTINUED), VOLTAGE SENSING PHASE SHIFTER

ISO New England Equipment Rating, Characteristic, and Operational Data Implementation Form Transformers (NX-9B)

Reference 9999
Participant Test Company
Form State Preliminary

Participant ID Abc VS PS
ISO ID abc
Ckt 1

Primary Station1 115kV — **Bus #** 123456 — **EMS** STATION1
Secondary Station1 Phase Shifter — **Bus #** 234567 — **EMS** STATION1
Transformer Type TCUL-Auto
Normal Operating Mode (TCUL) Manual-Remote
Number of Windings 2
Tap Switching Time Delay if Normal Mode is Auto (TCUL only) (Seconds)

Default Summer 77 F

	MVA	Limiting Device / Description	Location
Normal	235	Phase Shifting Transformer -	STATION1
LTE	250	Phase Shifting Transformer -	STATION1
STE	300	Phase Shifting Transformer -	STATION1
DAL	435	Phase Shifting Transformer -	STATION1

Default Winter 41 F

	MVA	Limiting Device / Description	Location
Normal	290	Phase Shifting Transformer -	STATION1
LTE	305	Phase Shifting Transformer -	STATION1
STE	340	Phase Shifting Transformer -	STATION1
DAL	530	Phase Shifting Transformer -	STATION1

Name Plate KV of Windings		Impedance Data (%) (100 MVA Base)	
High kV	Low kV	R	X
115	115	0.0	0.0

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kV of Winding 115 — **Step Size** 0.0 — **Controlling Side Winding (TCUL Only)** Y
Heavy Load Norm Tap# 0 — **Heavy Load Normal Tap (p.u.)** 1 — **Controlled Side Winding (TCUL Only)** N
Light Load Norm Tap# 0

	Minimum	Nameplate	Maximum
Tap Number	0	0	0
Voltage (kV)	115.00	115.00	115.00

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kV of Winding 115 — **Step Size** 0.00575 — **Controlling Side Winding (TCUL Only)** N
Heavy Load Norm Tap# 0 — **Heavy Load Normal Tap (p.u.)** 1 — **Controlled Side Winding (TCUL Only)** Y
Light Load Norm Tap# 0

	Minimum	Nameplate	Maximum
Tap Number	-10	0	10
Voltage (kV)	108.39	115.00	121.61

Revision Comments Test Form has been created to represent new equipment.

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EXAMPLE 1 (CONTINUED), VOLTAGE SENSING PHASE SHIFTER

ISO New England Equipment Rating, Characteristic, and Operational Data Implementation Form Transformers (NX-9B)

Reference	9999	**Participant ID**	Abc VS PS
Participant	Test Company	**ISO ID**	abc
Form State	Preliminary	**Ckt**	1

Equipment Notes This form is a partial representation of this voltage controlling phase shifting transformer. For full representation the companion 9C form must also be referenced. This form does not contain impedance data. The impedance data for this phase shifting transformer is shown on the companion 9C form only.

Data Revision Number	0	**Date Created**	mm/dd/yyyy	**Prepared By**	Participant Username
Requested Effective Date	mm/dd/yyyy	**Date Received**		**Approved By**	
Actual Effective Date				**ISO EMS Implementation Date**	

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VIII. OP-16 APPENDIX I REVISION HISTORY

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

Rev. No.	Date	Reason
Rev 0	11/06/15	Initial document creation; With this set of revisions to OP16 and its appendices, separate NX-9 form types of NX-9G and NX-9H have been created to represent Variable Reactors and Series Devices which were originally included in Appendix G for Other Equipment. This new appendix has been created for Other Equipment which covers the equipment requirements for the remaining equipment types not represented on a specific NX-9 form. This allows each appendix to have the same letter designation as its corresponding form type. Due to the addition of the new form types and related new appendices, series devices and variable reactors are not included in this appendix; Specific changes made to the device types that remained in this appendix: Add instruction to contact NX-9 Administrator when the instructions do not fit the equipment being installed. Add instructions for use of the Remove Equipment From Service field; Add that ratings are to be provided in whole numbers; Add that facility rating is equal to the rating of the most limiting individual equipment that comprises the facility; Shunt connected dynamic reactive power devices: Instructions for when both capacitive and reactive capability exist Changes to mode of operation instructions Add equipment note requirements to clarify control scheme and capability data Add requirement for attachment of control scheme document Voltage sensing phase shifters: Submit attachments (nameplate and test report) with NX-9C for new or revised equipment Example NX-9B forms updated to show new field Heavy Load Normal Tap (p.u.)
Rev 1	08/05/16	Globally all footers, added the required corporate document identity; Update equipment requirements to include BES equipment;
Rev 2	11/03/17	Biennial review by procedure owner; Globally, made editorial changes to be consistent with current practices and management expectations (e.g., grammar changes from “must” to “shall”’ and “which” to “that” as appropriate; and remove capitalization from non-defined terms; Clarify circumstance for ISO to require reporting of equipment connected at voltages that are less than 69 kV is because it is needed for reliable operation of the New England Transmission System; Globally changed MVAr to MVAR for consistency;
Rev 2.1	06/06/19	Annual review by procedure owner requiring no changes; Made administrative changes required to publish the Minor Revision;
Rev 2.2	01/25/21	Annual review by procedure owner requiring no changes; Made administrative changes required to publish the Minor Revision;
Rev 3	08/22/22	Biennial review by procedure owner; Clarify ratings requirements to include relay loadability limits and other equipment deemed necessary by Good Utility Practice.
Rev 4	10/26/23	Periodic review by procedure owner; Add footnote to define “relay loadability limits” as used in this Appendix; Remove NX-9D requirement for shunt connected dynamic reactive device and add reference to OP14 App B to report it via the NX-12D form; Add a clarifying statement that series reactive devices are reported on the NX-9H form; Remove example for shunt connected dynamic reactive device; Replace examples for Voltage Sensing Phase Shifter (NX9C+NX9B).