



OP-12 – Voltage and Reactive Control

Revision to OP-12 to clarify voltage control options and schedule

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OP-12 – Highlights

- Why are we changing OP-12 now?
 - Periodic review process
- What are the major changes in OP-12?
 - Revised language in Section II.A for OP-12 application
 - Revised language and additional clarity for Options A, B, and C
 - Added explicit voltage control requirements for Options A and B
 - Provided clarification for voltage schedule changes
 - Adjustments within Voltage Control Bandwidth are Acceptable:
Voltage schedule requests within control range are not considered to be a voltage schedule change
- Where are these changes in OP-12?
 - Section II.A: *Voltage Schedules and Limits for Transmission Equipment and Generators*



Follow Up from June RC

- Relationship between proposed OP-12 revisions, the ISO's Schedule 2 program, and the FERC NOPR on reactive power compensation
 - As stated during the June RC by the ISO, and confirmed following an internal review, there is no connection between the proposed OP-12 changes and any aspect of the Schedule 2 program, including compensation for VAR Service
 - Further, the proposed revisions to OP-12 do not modify any statements contained in the ISO's comments provided in response to the FERC NOPR on reactive power compensation
- As a result, no changes were made to the proposed OP-12 revisions



OP-12 – Changes

Where	Example	Why?
<p>Section II.A: <i>Voltage Schedules and Limits for Transmission Equipment and Generators</i></p>	<p>As described 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), Generators are required to submit Form NX-12D. As described in ISO New England Operating Procedure No. 16 – Transmission System Data (OP-16), Transmission Owners (TOs) are required to submit Form NX-9 for transmission equipment. Non-Generator Dynamic Reactive Resources are also required to submit Form NX-12D. As described 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), Generators are required to submit Form NX-12D. As described in ISO New England Operating Procedure No. 16 – Transmission System Data (OP-16), Transmission Owners (TOs) are required to submit Form NX-9 for transmission equipment.</p> <p>OP-12B includes schedules and device information for:</p> <ul style="list-style-type: none"> ○ <u>Transmission-connected Generators, which includes but is not limited to:</u> <ul style="list-style-type: none"> ▪ <u>Multi-machine Synchronous Generator Plants</u> ▪ <u>Solar Photovoltaic Generation Plants</u> ▪ <u>Wind Turbine Generation Plants</u> ▪ <u>Fuel Cell Plants</u> ○ <u>Transmission-connected Non-Generator Dynamic Reactive Resources, which includes but is not limited to:</u> <ul style="list-style-type: none"> ▪ <u>Transmission Static Synchronous Compensators (STATCOMs)</u> ▪ <u>Transmission Static VAR Compensators</u> ▪ <u>Synchronous Condensers</u> <p>⇒ <u>For the above devices, OP-12B reports voltage schedules and device parameters as approved in Form NX-12D. Reactive capabilities shall represent test data. If test data is not available, theoretical values may be used. Generators – OP-12B reports voltage schedules and device parameters as approved in Form NX-12D. Reactive capabilities represent test data unless otherwise noted. In some cases, test data is not available and theoretical values are used.</u></p>	<p>Revised language in Section II.A for OP-12 application</p>

OP-12 – Changes

Where	Example	Why?
<p>Section II.A: <i>Voltage Schedules and Limits for Transmission Equipment and Generators</i></p>	<ul style="list-style-type: none"> • Non-Generator Dynamic Reactive Resources, which include: <ul style="list-style-type: none"> ◦ Transmission Static Synchronous Compensators (STATCOMs) ◦ Transmission Static VAR Compensators ◦ Synchronous Condensers <p>OP-12B is the source of information for Non-Generator Dynamic Reactive Resources' voltage schedule; this type of equipment does not have a Form NX with the information reported in OP-12B.</p> <ul style="list-style-type: none"> • Autotransformers with Load Tap Changers (LTCs) — OP-12B reports voltage schedules and device parameters as approved in Form NX-9B. <p>OP-12B also includes size information for:</p> <ul style="list-style-type: none"> • <u>Autotransformers with Load Tap Changers (LTCs) – OP-12B reports voltage schedules and device parameters as approved in Form NX-9B.</u> • Transmission Capacitors – OP-12B reports device parameters as approved in Form NX-9D. • Transmission Reactors – OP-12B reports device parameters as approved in Form NX-9D and Form NX-9G. 	<p>Revised language in Section II.A for OP-12 application</p>

OP-12 – Changes – Option A

Where	Example	Why?
<p>Section II.A: <i>Voltage Schedules and Limits for Transmission Equipment and Generators</i></p>	<p><u>OP-12B classifies the Generator and Non-Generator Dynamic Reactive Resources based on voltage control:</u></p> <p><u>Part of the Form NX-12D describes the Generator and Non-Generator Dynamic Reactive Resources capability to control voltage. A Generator or Non-Generator Dynamic Reactive Resources voltage control capability is described by one of these three categories: Part of the Form NX-12D describes the Generator's capability to control voltage. A Generator's voltage control capability is described by one of these three categories:</u></p> <ul style="list-style-type: none"> • <u>Option A – These Generators and Non-Generator Dynamic Reactive Resources directly regulate transmission system voltage (69kV and above) to a schedule. These Generators and Non-Generator Dynamic Reactive Resources are listed in OP-12B. These Generators control transmission voltage. These Generators are also listed in OP-12B. Note that transmission voltage schedules are not specified for Generators not modeled in the ISO Energy Management System (EMS) Network Database.</u> ○ <u>Newly-interconnecting transmission-connected Generators (and placeholder for Gen reactive installed devices) and Non-Generator Dynamic Reactive Resources must have a voltage control system that directly regulates a transmission bus to a voltage schedule. Transmission voltage schedules will be provided in OP-12B and are adjustable in real-time by the LCC / ISO. Plant terminal voltage(s) and/or reactive power output(s) must adjust automatically, without a human in the loop, to</u> 	<p>Revised language and added clarity for Option A's explicit voltage control requirements</p>

OP-12 – Changes – Option A

Where	Example	Why?
<p>Section II.A: <i>Voltage Schedules and Limits for Transmission Equipment and Generators</i></p>	<p><u>adhere to the plants transmission voltage schedule.</u></p> <p><u>Transmission-connected Generators and Non-Generator Dynamic Reactive Resources are those whose Point Of Interconnection (POI) is 69 kV and above, as described in their S/LGIA.</u></p> <p><u>By exception, if a documented technical rationale demonstrates that an alternate voltage control strategy not involving direct regulation of a transmission bus is warranted on an engineering basis (for example, as an outcome of the System Impact Study), such a transmission-connected Generator or Non-Generator Dynamic Reactive Resource would not be considered Option A.</u></p> <ul style="list-style-type: none"> ○ <u>Existing Option A Generators and Non-Generator Dynamic Reactive Resources may utilize human operator intervention to regulate a transmission bus to a voltage schedule. For example, an existing unit (without an automatic outer loop control system) where the plant operator provides the outer loop control function by manually adjusting a terminal voltage control set point to achieve transmission system voltage regulation to its OP-12B schedule will remain an Option A unit.</u> <u>If such an existing Generator or Non-Generator Dynamic Reactive Resource undergoes a reactive power control system replacement (e.g. excitation system upgrade), the Generator or Non-Generator Dynamic Reactive Resource shall meet the requirement described in i. for automatic outer loop direct transmission bus voltage regulation.</u> ○ <u>Generators and Non-Generator Dynamic Reactive Resources are considered to be interconnecting at transmission voltage levels if they are directly stepping up (or down), via transformation, from their local voltage into a transmission station.</u> • <u>Transmission voltage schedules are not specified for Generator and Non-Generator Dynamic Reactive devices not modeled in the ISO Energy Management System (EMS) Network Database.</u> 	<p>Revised language and added clarity for Option A's explicit voltage control requirements</p>

OP-12 – Changes – Option B

Where	Example	Why?
<p>Section II.A: <i>Voltage Schedules and Limits for Transmission Equipment and Generators</i></p>	<ul style="list-style-type: none">• Option B – <u>These Generator and Non-Generator Dynamic Reactive Resources regulate voltage at a bus below that of a transmission voltage level (less than 69 kV). They may follow local voltage schedules specified by the low voltage facility owner in accordance with LCC requirements or as required in their Interconnection Agreements. These Generators control distribution voltage. They follow local voltage schedules specified by the applicable Local Control Center (LCC) in accordance with LCC requirements or as required in their Interconnection Agreements.</u>• <u>At the discretion of ISO in coordination with the LCC, a transmission-connected Option B unit may warrant inclusion in OP-12B, listing the non-transmission voltage schedule.</u>	<p>Revised language and added clarity for Option B's explicit voltage control</p>

OP-12 – Changes – Option C

Where	Example	Why?
Section II.A: <i>Voltage Schedules and Limits for Transmission Equipment and Generators</i>	<ul style="list-style-type: none">Option C – <u>These Generators are exempt from the requirement to have an automatic voltage regulator (AVR). These Generators are listed in M/LCC 8A. As noted in M/LCC 8A, these Generators commonly follow a reactive power schedule by operating with a constant power factor as specified in their Interconnection Agreements.</u> These Generators are exempt from the requirement to have an automatic voltage regulator (AVR). These Generators are listed in M/LCC 8A. As noted in M/LCC 8A, these Generators follow a reactive power schedule by operating with a constant power factor.	Revised language and added clarity for Option C

OP-12 – Changes

Where	Example	Why?
<p>Section II.A: <i>Voltage Schedules and Limits for Transmission Equipment and Generators</i></p>	<p><u>During certain infrequent, atypical conditions at a generating station or on the power system, ISO or an LCC may issue an Operating Instruction to a Generator or Non-Generator Reactive Resource to deviate from its normal voltage schedule and to temporarily operate at a voltage output level outside of the normal voltage schedule tolerance band, but within the wider minimum and maximum “acceptable” voltage schedule range, which is also listed in OP-12B. Note this operation may need to be examined by engineering to determine if operation at this temporary voltage schedule impacts stability limits for the unit or system.</u></p> <p>During these conditions, if ISO or the LCC issue an Operating Instruction to a generating station to operate to a temporary voltage schedule, ISO or the LCC shall provide each applicable generating station operator with the following:</p> <ul style="list-style-type: none"> • The temporary voltage schedule to be maintained with the AVR in-service and controlling to a voltage setpoint • The temporary voltage schedule tolerance band to be maintained • The expected duration of this temporary voltage schedule change (if known, or “until further notice”) <p><u>During normal operations on the power system, the ISO or an LCC may issue an Operating Instruction to a Generator or Non-Generator Dynamic Reactive Resource to adjust their voltage setpoint while remaining within the normal voltage schedule tolerance band. Adjustments such as these are not considered a change to the OP-12B listed voltage schedule provided the setpoint remains within the original tolerance band.</u></p>	<p>Provided clarification for voltage schedule changes</p> <ul style="list-style-type: none"> • Adjustments within Voltage Control Bandwidth are Acceptable: Voltage schedule requests within control range are not considered to be a voltage schedule change

Conclusion

- The revisions to OP-12 include:
 - Revised language in Section II.A for OP-12 application
 - Revised language and additional clarity for Options A, B, and C
 - Added explicit voltage control requirements for Options A and B
 - Provided clarification for voltage schedule changes
 - Adjustments within Voltage Control Bandwidth are Acceptable:
Voltage schedule requests within control range are not considered to be a voltage schedule change
- No revisions were made to the proposed changes from June based on comments or questions posed

Stakeholder Schedule

Stakeholder Committee and Date	Scheduled Project Milestone
Reliability Committee June 18, 2024	Initial presentation and questions
Reliability Committee August 13, 2024	Respond to any remaining questions and vote
Participants Committee September 5, 2024	Vote

Questions

