

# **Voltage Schedule issued to Generator Operators within the Québec Interconnection**

**Direction principal Contrôle des mouvements  
d'énergie et exploitation du réseau**

Prepared by a working group

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## 1. PURPOSE

This operating plan defines the methodology and the application of voltage schedule (providing either a range or a target value with an associated tolerance band) on the system by Generator Operators (GOP).

This schedule is used in the operation of the Main Transmission System (RTP) and to ensure voltages are monitored, controlled and maintained in real-time within the limits set to preserve equipment integrity and reliable operation of transmission system.

In short, this plan provides guidance on the requirements set out in reliability standard [VAR-002-4.1](#) — *Generator Operation for Maintaining Network Voltage Schedules*. It also ensures Hydro-Québec TransÉnergie's Direction – Contrôle des mouvements d'énergie unit has access to the data it needs to perform its function as Transmission Operator (TOP) under reliability standard [VAR-001-4.2](#) — *Voltage and Reactive Control*.

## 2. SCOPE OF APPLICABILITY

This guideline applies to Main Transmission System (RTP) generation facilities, which are listed in the [Register of Entities Subject to Reliability Standards](#) filed with the Régie de l'énergie. (VAR-001 – Québec Appendix and VAR-002 – Québec Appendix)

## 3. APPLICABLE ENTITIES

This operating plan is intended for Entities exercising the GOP function. (VAR-001 and VAR-002)

The list of applicable entities is found in the [Register of Entities Subject to Reliability Standards](#) filed with the Régie de l'énergie.

## 4. DATA CONFIDENTIALITY

Under this operating plan, Hydro-Québec will keep the data submitted by applicable entities confidential in accordance with the [Transmission Provider Code of Conduct](#) and the [Reliability Coordinator Code of Conduct](#).

## 5. RTP VOLTAGE SCHEDULE

### 5.1. VOLTAGE SCHEDULE CRITERIA

System voltages vary with the time of day and season. They are strongly influenced by the load profile, system state and power flows over the system. The TOP is responsible for maintaining the system in accordance with the following criteria: RTP operating limits, equipment voltage facility ratings and regulator ranges. (VAR-001-R5.3)

### 5.2. VOLTAGE SCHEDULE IMPLEMENTATION

The TOP has various means at its disposal to control voltages (VAR-001-R2), including:

- Switching reactors and capacitors on the RTP
- Adjusting the set point of static and synchronous compensators
- Adjusting the voltage set point of tap-changing transformers
- Switching transmission lines
- Adjusting the active or reactive power output of generating stations
- Adjusting the interconnection exchanges
- Adjusting the reactive power control set point of converter units

## 6. VOLTAGE SCHEDULE APPLICABLE TO GOPS

### 6.1. VOLTAGE SCHEDULE SET POINTS

In accordance with GOP voltage control strategies, the TOP is responsible for providing GOPs with one of the following instruction, which constitute the voltage schedule (VAR-001-R1):

- Voltage set point
- Voltage range
- Reactive power set point
- Active power set point for loading lines and modifying voltage
- Power factor set point

When the TOP instruction is a set point, it shall be accompanied by a tolerance range. By default, the TOP instruction is a set point at nominal voltage of connection point on the high-voltage side with a tolerance range of  $\pm 3\%$  for wind farms and  $\pm 5\%$  for other types of power plants.

The GOP shall not change the instruction on its own initiative. The instruction remains in effect until the TOP issues a new one to the GOP.

### 6.2. CONNECTION POINTS

The TOP specifies the GOP voltage schedule at the following connection points:

- i. If the GOP is a Transmission Owner (TO), generally at the points of interconnection of its system to the Main Transmission System (VAR-002, Quebec Appendix, R2)
- ii. If the GOP is not a TO and the instruction is not made by telecontrol from TOP, generally on the high-voltage side of the step-up transformers (VAR-001-R5)
- iii. If the GOP is not a TO and the instruction is made by telecontrol from TOP, generally on the low-voltage side of the step-up transformers (VAR-001-R5)

### 6.3. MAINTENANCE AND MONITORING OF VOLTAGE SCHEDULE

Each GOP shall maintain the generator voltage schedule provided by the TOP (within each generating facility's capabilities). (VAR-001-R5.1 and VAR-002-R2)

The GOP shall monitor the voltage and reactive power at the connection points to maintain the instruction provided by the TOP. Should a GOP not monitor the voltage and reactive power at the point specified by the TOP, it shall have an appropriate methodology to convert that instruction into an equivalent value for the point where that is actually monitored by the GOP. (VAR-002-R2.3)

A GOP that fails to maintain the voltage range or tolerance range set by the voltage schedule shall inform the TOP within **60 minutes** of range exceeding unless it is restored within that period. If the exceeding is due to the GOP's inability to comply with the schedule, the GOP shall provide an explanation. (VAR-001-R5.2; VAR-002-R2 and R2.2; TOP-001-R4)

## 6.4. EXEMPTION CRITERIA FOR VOLTAGE SCHEDULE IMPLEMENTATION

The GOP is exempted from following a voltage schedule when the required actions (VAR-001-R4 and TOP-001-R3):

- Are physically impossible
- Breach regulatory or statutory requirements
- Compromise safety
- Contravene material/equipment-related requirements (such as the facility rating)

If the GOP fulfills an exemption criterion, it shall notify the TOP within **60 minutes** of becoming aware of the criterion, unless the exemption criterion is restored within that time, and it shall subsequently follow the TOP's instructions.

## 6.5. OPERATION IN VOLTAGE CONTROL MODE

### 6.5.1. Automatic or "SGP\* On" mode

The GOP shall operate each generator with the automatic voltage regulator or, for wind farms, with "SGP On" mode (VAR-001-R5.1 and VAR-002-R1).

If the regulator is operating in a normal mode that is not the automatic or "SGP On" voltage control setting, the GOP shall follow the TOP's instructions. (VAR-002-R1)

### 6.5.2. Manual or "SGP\* Off" mode

If a generator does not have an automatic voltage regulator or if its automatic voltage regulator is out of service, the GOP shall operate each generator in Manual or "SGP Off" mode, taking the following actions (VAR-002-R2.1):

- Notify the TOP within **30 minutes** of an automatic voltage regulator loss, unless control is restored within that period (VAR-002-E3).
- Follow the TOP's instructions. (VAR-001-R5 and VAR-002-R2.1)

### 6.5.3. Automatic voltage regulator status and Power system stabilizer status

The GOP shall notify the TOP of any status change on automatic voltage regulator or power system stabilizer within **30 minutes** of the change unless its initial status is restored within that period. (VAR-002-R3)

## 6.6. REACTIVE POWER CAPACITY

The GOP shall notify the TOP within **30 minutes** of becoming aware of a change in reactive capability, due to factors other than a status change on automatic voltage regulator or power system stabilizer, unless the initial capacity is restored within that time. (VAR-002-R4)

\* Automated generating fleet management system

## 6.7. TESTING, START-UP AND SHUTDOWN STATUS OF GENERATORS

The GOP is exempted from following the voltage schedule, power system stabilizer requirements and automatic voltage regulator requirements in any of the criteria below: (VAR-001-R4 and VAR-002-R1)

- a) Generator testing:  
Notification shall be provided by the GOP via prior transmission of the test procedure.
- b) Generator start-up:  
Start-up is deemed to have ended when the generator has reached its minimum continuously sustainable load and is ready for normal operation. No further notification from the GOP is required, because start-up is authorized in advance by the TOP.
- c) Generator shutdown:  
Shutdown is deemed to begin when the generator has been ramped down to its minimum continuously sustainable load and is ready to go offline. No further notification from the GOP is required because shutdown is authorized in advance by the TOP. However, in the event of an emergency shutdown, the GOP shall notify the TOP within **60 minutes** of shutdown unless it is restored within that period.
- d) Operating mode other than the one demanded by the applicable standards for a reason other than start-up, shutdown or testing:  
The GOP shall notify the TOP if it has not already been informed of the mode in use.

## 6.8. METHOD OF COMMUNICATION

The GOP shall notify the TOP through the control center specified in the common operating instructions.

## 6.9. SUMMARY TABLE OF EXEMPTION CRITERIA AND TOP NOTIFICATION CRITERIA

Exemption criteria and TOP notification criteria	Exemption from following TOP instruction	Exemption for operating automatic voltage regulator	Time limit for notifying TOP
Exceeding of voltage schedule (TOP range)			60 min
Physical impossibility (e.g., low-power wind turbine facility)	✓		60 min
Breach of regulatory or statutory requirements	✓		60 min
Compromise to safety	✓		60 min
Violation of material/equipment-related requirements	✓		60 min
Generator not equipped with an automatic voltage regulator*		✓	Authorized by TOP
Out of service automatic voltage regulator		✓	30 min
Status change on automatic voltage regulator			30 min
Status change on power system stabilizer			30 min
Change in reactive power capability			30 min
Generator testing	✓	✓	prior transmission of the test procedure**
Generator start-up	✓	✓	Authorized in advance by TOP
Generator shutdown in normal operating mode	✓	✓	Authorized in advance by TOP
Generator emergency shutdown	✓	✓	60 min
Other mode, for a reason other than start-up, shutdown or testing	✓	✓	If TOP has not been informed

\* Each generator shall be equipped with an automatic voltage regulator under the connection requirements. However, if there is a case where this criteria exists, the TOP shall authorize it.

\*\* Does not exclude the need to get authorization again by TOP in real time before starting testing.