ANNEX III

ENGINEERING SPECIFICATION
No. EP-7000-1

Consolidated Edison Company of New York, Inc.
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conEdison

System Operation Manual No.5
All District

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VOLTAGE SCHEDULE, CONTROL, AND OPERATION OF THE TRANSMISSION SYSTEM

1.0 PURPOSE

1.1 This specification describes for all system load conditions the methods and the steps to be taken for the maintenance of acceptable voltage on the transmission system.

2.0 GENERAL GUIDELINES

2.1 The System Operator shall have the overall responsibility for the maintenance of acceptable voltage on the system in accordance with the specifications and instructions issued by the Transmission Planning and Substation and Transmission Engineering Departments, and coordinated with the New York Independent System Operator (NYISO) operating requirements.

2.2 The generator terminal voltage shall be maintained as per specifications EP-7200, EP7230, EP-7240, EP-7250, EP-7260, EP-7270, EP-7290 and EP-7300. The control room operators are responsible for maintaining scheduled voltages. Deviations from the scheduled voltage envelope shall be made only with approval or by direction of the System Operator.

2.3 All transmission level shunt reactors (345 kV and 138 kV) are to be kept in service as required. If a system voltage level in paragraph No. 3 cannot be held, the reactors may be switched out of service to achieve the required voltage levels. The order to switch these reactors must be given by the System Operator. The associated risks and the recommended removal sequence when taking reactors out of service are given in Appendix 2.

2.4 The 345 kV East Fishkill transmission level shunt capacitors are to be kept in service as required. If a system voltage level as prescribed in paragraph No. 3 is exceeded, the shunt capacitors may be switched out of service to achieve the required voltage levels. The order to switch these capacitors must be given by the System Operator.

2.5 The tertiary shunt reactors associated with transformers at the Rainey and East 13th Street Station are to be kept out of service. However, they must be available during times of system restoration (see EP-7400). If high system voltage conditions require any or all available tertiary switchable shunt reactors they may be placed in service. The order to do so must be given by the System Operator.

2.6 Tap-changing-under-load (TCUL) associated with 345/138 kV autotransformers shall be employed as an additional means to control transmission voltage levels. The tap positioning by remote manual control of 345/138 kV autotransformers shall be the responsibility of appropriate personnel at the Energy Control Center.

2.7 The Queensbridge 69 kV voltage levels controlled via the 138/69 kV autotransformers shall be the responsibility of the appropriate personnel at the Energy Control Center in compliance with EP-7210.

2.8 The 69 kV voltage levels at East River controlled via generation and via the 138/69 kV autotransformers shall be the responsibility of the Generator Station Operator and the East River Station Operator, respectively, at East 13th Street in compliance with EP-7220 and EP-7240.

3.0 NORMAL AND PEAK SYSTEM LOAD CONDITIONS

For both Normal and Peak load conditions, the 345 kV and 138 kV voltages shall be maintained within the following limits.

Date	345 Voltage Schedule
All Year	350 kV + 9 kV - 4kV
All Year	138 kV + 5 kV - 2kV

To maintain the proper transmission voltage levels the following steps, not necessarily in this order, can be taken:

3.1 Capacitor banks at area substations shall be switched into service.

3.2 Raise the voltage on the high side (345 kV) of the generator main power transformers for those generating units directly connected to the 345 kV system to the maximum level permitted by the manufacturer's

specifications. Full reactive power output is to be obtained from each unit within the applicable operational capability and stability limit curves.

3.3 Raise the terminal voltage for all generators directly connected to the 138 kV transmission system to the maximum level permitted by the manufacturer's specifications.

3.4 Utilize the 345/138 kV autotransformers' tap ratio in a manner favoring the worst of low voltages: the 138 kV or the 345 kV systems. The autotransformers, whose tap ratios are to be changed to raise the low voltage at the transmission buses are listed in Appendix 1.

3.5 The control room operators of generation facilities connected to the 138 kV and 345 kV system shall maintain their respective high-side voltage in accordance with the voltage schedule given in paragraph 3.0.

3.6 The transmission level shunt reactors (Fixed/Switchable) may be removed from service to assist in maintaining adequate voltages. Appendix 2 lists the fixed and switchable reactors and their associated impact on system conditions if they are removed from service.

3.7 The gas turbines connected to the 138 kV system may be utilized to supply reactive power to the system. These units may be delivering active power (MW) to the system at times of peak load as well as reactive power. These gas turbines shall at all times be operated within the upper limits specified by the operational capability and stability limit curves applicable to each individual unit.

3.8 It is understood that under peak load conditions the gas turbines will normally supply active power (MW) to the system, but whenever possible, their reactive (MVAR) generation capability shall also be employed as required. These gas turbines shall at all times be operated within the upper limits specified by the operational capability and stability limit curves applicable to each individual unit.

3.9 The decision to alleviate low voltage conditions by means of voltage reduction at area substations and, if required, by load shedding after all of the above-mentioned procedures have been implemented, remains the responsibility of the Senior System Operator or his designee.

4.0 LIGHT SYSTEM LOAD CONDITIONS

The following steps shall be taken, not necessarily in this order, to maintain both 345 kV and 138 kV voltage within the prescribed limits given in paragraph 3.0:

4.1 All available shunt reactors should be placed in service. Appendix 2 lists switchable and fixed shunt reactors.

4.2 Area substation capacitor banks shall be removed from service as required.

4.3 Reduce voltage on the high side (138 kV or 69 kV) of the generator main power transformers associated with the 138 kV or the 69 kV system. The generator field control shall be used to lower the generator terminal voltage for the absorption of reactive power. The lower limit of a generator terminal voltage shall at all time be within the limits specified by the operational capability limit curves applicable to each individual unit. If lowering the generator terminal voltage within the allowable limits does not reach the lower limit (leading MVARS) of the applicable generator capability curves, the transformer taps shall be lowered to permit additional reactive power absorption by the generator. These steps shall be coordinated by the Consolidated Edison Senior System Operator in conjunction with the NYISO and the System Operators of the other systems.

4.4 Reduce the voltage on the high side (345 kV) of the generator main power transformers associated with the 345 kV system. The lower limit of a generator terminal voltage shall at all time be within the limits specified by the operational capability and stability limit curves applicable to each individual unit.

4.5 Utilize the autotransformers listed in Appendix 1 to balance the voltage between the 345 kV and 138 kV systems. Voltage for each of the systems must not exceed 362 kV and 145 kV, respectively. If voltage levels exceed these restrictions, the permissible time exposures are listed in EO-4600, 60 Hertz Start-Up Procedure, General Discussion.

4.6 Request neighboring systems connected to the Consolidated Edison system by tie lines to lower their transmission voltage. These steps shall be coordinated by the Consolidated Edison Senior System Operator in conjunction with the NYISO and the System Operators of the other systems.

4.7 The switchable shunt reactors associated with transformer tertiaries at the Rainey station and East 13th Street station shall be placed in service to reduce system voltage if all other means have been exhausted. Bank loadings must be carefully monitored due to the reduction of through-rating when placing tertiary reactors in service.

4.8 The switchable shunt reactors TN-1 and TN-2 associated with the tertiary of Transformer Bank No. 1 (345/230 kV) at Goethals shall be placed in service to reduce system voltage. Bank loadings must be carefully monitored due to the reduction of through-rating when placing tertiary reactors in service.

4.9 The Gas Turbine units may be used to absorb reactive power from the transmission system as required while remaining within the limits specified by the capability limit curve applicable to each individual unit.

4.10 If voltage levels still remain above 362 kV and/or 145 kV, switching of 345 kV feeders is to be implemented. It should be recognized that the removal of a 345 kV feeder from service to reduce voltage levels is an extreme step since it reduces the reliability of the transmission system. In this regard special attention should be given to the status of bus tie breakers and the removal of North-South cables so that the remaining import capability is sufficient to deliver northern generation supplying in-City load. Assuming no contingencies immediately affecting the transmission system the following feeders, not necessarily in this order, may be switched out of service:

4.10.1 Feeder No. 25 (224 MVARS) or feeder 26 (226 MVARS) but not both, the reactors associated with each of the feeders R6 and R18, respectively, should be restored to service.

4.10.2 Feeder M51 (328 Mvars) or Feeder M52 (328 MVARS) but not both. The Sprain Brook reactors (two 150-Mvar per feeder) associated with each of these feeders are to be placed in service immediately following the removal of a feeder to alleviate the high voltage condition.

4.10.3 Feeder No. 71 (261 Mvars) or Feeder No. 72 (261 Mvars) but not both. The Rainey reactors (one 150-Mvar per feeder) associated with each of these feeders are to be placed in service immediately following the removal of a feeder to alleviate the high voltage condition.