CHAPTER 1

ACCESS TO THE NATIONAL TRANSMISSION GRID

CONTENTS

SECTION 1B – TECHNICAL REGULATIONS FOR CONNECTION

1B.1 SUBJECT

1B.1.1 This section, 1B, regulates the technical conditions for regulated access to the **NTG** in order to guarantee the proper functioning of the **national electricity system**.

The following form the purpose of the Technical regulations for connection (hereinafter **Technical Regulations**):

(a) the functional and performance characteristics of the **NTG** at the **connection sites**;

(b) the essential technical requirements concerning design and operation with particular regard to the operational criteria of design and the operation characteristics of **power generation plants**, **grids with third party connection obligations**, **plants** corresponding to **consumption units** and of **grids** other than **grids with third party connection obligations**.

1B.2 SCOPE OF APPLICATION

1B.2.1 The Technical Regulations are applied to:

a) **power generation plants**;

b) plants corresponding to **consumption units;**

c) plants corresponding to **grids with third party connection obligations**;

d) plants corresponding to **grids** other than **grids with third party connection obligations**;

e) **merchant lines**.

1B.2.2 Adjustment of the Technical Regulations of existing systems that are not in compliance shall come about gradually, taking into consideration the service demands, the commitment of resources needed by the interventions and the sustainability of the relative costs, also resorting to the derogations in Chapter 14, section 14.3. and in accordance with the procedures and time frames established by the AEEGSI.

1B.3 NTG FEATURES AND SERVICES AT CONNECTION SITES

The operational features of the **NTG** at the **connection sites**, found under paragraph1B.4.14 of this chapter, are assured by the **Operator** provided that:

(a) no critical conditions exist concerning the safety of the **national electricity system** or any part of it;

(b) the **NTG Users** respect the regulations laid out in the Technical regulations (and in general in the Grid Code).

For the values primarily influenced by the plant features under paragraph 1B.3.5, the values shown refer to the quality objectives set out in the planning phase of the **NTG**.

More information concerning the service quality indexes is shown in Chapter 11 of this Grid Code.

As for the quality indexes indicated in the following paragraphs 1B.3.4 and 1B.3.5, the relative values may also be updated following specific monitoring campaigns.

The definition of the different operational **conditions** (**normal**, **alarm, emergency, interruption** and **recovery**) of the **national electricity system** is included in Chapter 10 of this Grid Code.

1B.3.1 Frequency variation limits

1B.3.1.1 The nominal frequency of the **NTG** is 50 Hz.

1B.3.1.2 In **normal** or **alarm conditions,** the frequency is kept within the interval 49.9 – 50.1 Hz, with the exception of Sardinia and Sicily where the frequency is kept within the interval 49.5 – 50.5 Hz.

1B.3.1.3 In **emergency** or **recovery conditions,** the frequency can vary between 47.5 Hz and 51.5 Hz.

1B.3.2 Voltage variation limits

1B.3.2.1 For each **connection site,** the nominal voltage and the operational voltage are specified.

1B.3.2.2 Under **normal**, **alarm**, **emergency** or **recovery conditions**, the voltage values are specified in the document “Livelli attesi della qualità della tensione” (Expected levels of voltage quality), published on the website www.terna.it, in the Transmission Service Quality section, which is annually updated.

1B.3.3 Service interruptions

1B.3.3.1 The levels of transmission service quality, as specified in Chapter 11 of this Grid Code, are given in the document "Qualità del servizio di trasmissione-Rapporto annuale" (Transmission Service Quality - Annual Report) published on the website www.terna.it, in the Transmission Service Quality section, which is annually updated.

1B.3.4 Expected number of power sags

The number of **power sags** for each **connection site** can vary from ten times up to a hundred times a year. The variability is a function of the location of the **NTG connection site**, of the nominal voltage level, the **short circuit power** and the extent of the **grid** meshing into which the **connection site** is attached.

1B.3.5 Other voltage features under normal operating conditions

Disturbances allowed to single **Users** are evaluated also on the basis of preset **short circuit power** values, declared to the **User** in the **connection sites** under **normal conditions** of the **NES (National Electric System, or SEN)**.

The choice of the **grid** meshing cannot be influenced by the need to reduce the phenomena mentioned in this paragraph.

1B.3.5.1 Maximum level of total harmonic distortion

Under **normal conditions,** the **total harmonic distortion factor** (**THD**) on the **NTG** is generally included within the following values:

(a) 3% for 150-132 kV grids;

(b) 1.5% for 380-220 kV grids.

1B.3.5.2 Maximum degree of three-pole voltage dissymmetry

Under **normal conditions**, the **degree of dissymmetry** at **each connection site** is, generally, less than 1%, except for cases of **interruptions** in one phase, against which no specific **protection** has been put into place on the **NTG**.

1B.3.5.3 Flicker severity ratios

The values used in the planning phase of the **NTG**, of the **short-term flicker severity ratio (P_{st})** and the **long-term flicker severity ratio (Plt)** are included within the following thresholds:

Voltage level (kV)	P_{st}	P_{lt}
220 – 380	0.70	0.50
132 – 150	0.85	0.62

1B.3.6 Resistance levels to overloads and coordination of insulation

Coordination of insulation of operational **NTG** apparatus has not been developed according to uniform standards due to the fact that the plants were built in different periods.

For this reason, the levels of resistance in the **NTG** apparatus that are important for the coordination of insulation in the **connection sites** are identified in the documentation under paragraph 1B.4.14.1.

1B.3.7 Maximum and minimum values of short circuit current

1B.3.7.1 The **short circuit** currents in the various **connection sites** depend on the characteristics of the **grid** and the **operating** conditions of the same. The criteria and the general procedures for calculating the conventional maximum and minimum **short circuits** power are described in the document A.8 “Correnti di corto circuito e tempo di eliminazione dei guasti negli impianti delle reti a tensione uguale o superiore a 120 kV” (Short circuit currents and clearance times for faults in plants of grids with a voltage equal to or greater than 120 kV)” in Appendix A of this chapter.

1B.3.7.2 The **Operator** makes available on its website, within the Transmission Quality Service section, the minimum and maximum conventional **short circuit** power values for each **connection site**, which are updated annually.

1B.3.7.3 For more details, please see Chapter 11, section 11.8 of this Grid Code.

1B.3.8 Characteristics and performance of protection systems

1B.3.8.1 In the planning and **operation** of their plants, **Users** must take into consideration the general criteria and the characteristics of selectivity, speed and reliability of the **NTG protection** system referred to in this paragraph.

1B.3.8.2 The characteristics and performance of the **protection** relative to significant **NTG** apparatus in order to coordinate them with the **User’s protection** can be found in the **Operating Regulations**.

1B.3.8.3 The system of **grid protection** is primarily based on distance relay and differential relay, within whose technical operational limits the correct clearance of **faults** is guaranteed.

1B.3.8.4 With reference to the **protection** systems, the contents of document A.4 “Criteri generali di protezione delle reti a tensione uguale o superiore a 120 kV”

(General grid protection criteria for grids having a voltage equal to or greater than 120 kV) and in document A.11 “Criteri generali per la taratura delle protezioni delle reti a tensione uguale o superiore a 120 kV” (General criteria for the calibration of the protections of grids with a voltage equal to or greater than 120 kV) in Appendix A of this chapter, shall apply.

(a) *Principal protections*

The **NTG protection** systems are created with the objective of putting out of service only those **grid** areas affected by a **fault** which can be isolated through circuit breakers.

The principal **protections** used on the **NTG** are of a size and calibration able to interrupt the current of a **short circuit** - with the exception of highly resistive **faults** - in the maximum times listed herein below, except in particular plant zones:

(i) 100 ms in 380 kV plants;

(ii) 100 ms in plants isolated in SF_6 at 380 kV and 220 kV;

(iii) 100 ms in **power generation plants** close to plants where there are particular problems with **stability**;

(iv) 150-350 ms (depending on the construction characteristics of the plant) in plants isolated in SF6 at 150-132 kV.

(v) 500 ms in plants isolated in air at 220 kV and 150-132 kV (not coming under any of the previous categories).

The times set out in letters (i), (ii) and (iii) are compatible, even in the event of failed opening of the principal circuit breaker, with a maximum limit of 250 ms set to guarantee the **transient stability** of the transmission system.

(B) *Back-up protection*

In the event the principal **protection** fails, the **fault** is cleared by **protection** placed in adjacent grid components. In this circumstance, such **protection** has the function of back-up to the principal **protection**.

In order to achieve selectivity in a **grid** portion, the protection of the adjacent **grids**, in their function as **back-up protection**, are suitably delayed so as not to be activated in advance on the principal **protection**.

Different levels of **back-up protection** are provided for; the relative action times are between 0.3 and 3.5 seconds, depending on the condition of the **grid** and **fault** and the nominal voltage of the **grid**.

1B.3.9 Characteristics of circuit breakers and isolators

1B.3.9.1 Due to the different periods of installation, the technical and operational characteristics of the circuit breakers and isolators in the plants which currently make up the **NTG** do not correspond to uniform standards.

1B.3.10 Neutral state

The **NTG** is designed and operates with the neutral solidly earthed.

1B.3.11 Running of transmission power plants

1B.3.11.1 The **Operator** and the other **NTG owners** are in charge of the good operation of the plants, within the performance limits of said services, and are responsible for the **operation** and running of the plants, their **maintenance** as well as the safety of persons and property. Any failure in the plants of other

NTG Owners that limits the operation and influences the operation of the **NTG** must be communicated to the **Operator**.

The **operation** of the plants includes continual management and **monitoring** of the state of the plants, the execution of **commands** and prompt intervention. **Commands** are executed remotely through remote operation systems or, manually, through the plants' systems.

1B.3.11.2 In order to **operate** and run the plants, the **Operator** and the other **NTG Owners** provide structures and organization to continuously ensure (24 hours a day for every day of the year) the fulfilment of the assigned tasks and with adequately timed action.

1B.3.12 Communication systems performance

1B.3.12.1 Installed in the **NTG** system are **devices for metering**, data transmission and interfacing for reception of intertripping, telecontrols and remote signals.

1B.3.12.2 The relevant operational services of the remote transmission systems installed on the **NTG** are listed in Table 1 of paragraph 1B.4.8.

1B.3.13 Active and reactive power exchange limits

1B.3.13.1 Acceptable withdrawal and input values of **active** and **reactive power** at the **connection sites** are established by the **Operator**.

The following factors contribute to the determination of said values and any possible limitations to that which the **User** has requested:

(a) **N-1 security** and number of available connections;

(b) power flows in particular **load** situations (winter peak, summer, night, annual minimum, etc.);

(c) keeping the static and dynamic **operational** safety;

(d) restrictions on the **operation** of long-distance power lines posed by the competent authorities, which are known as of the same date.

(e) downtime for works.

1B.4 TECHNICAL REGULATIONS COMMON TO ALL CATEGORIES OF PLANTS DIRECTLY CONNECTED

1B.4.0.1 The **connection** of a **User** to the **NTG** must not cause any deterioration in the performance or the reliability of the **NTG**, and must contribute to the safety and quality of the electricity service, according to the type of the plant.

1B.4.0.2 The design of the **User plant** must be drafted so that the **connection** of the plant must not negatively influence the operation of the **NTG** nor may it damage the other **NTG Users**.

1B.4.0.3 The **User** shall design and build the apparatus respecting national and international regulations governing safety and the protection of safety of persons and property (in compliance with the CEI, IEC, CENELEC, UNI, ISO regulations). The construction of the apparatus must make use of materials and components built and installed with good workmanship (please see paragraph 1B.4.6 for more information).

1B.4.2 Points of functional separation

1B.4.2.1 The points of separation between the activities which the **Operator** is responsible for and those which the **User** is responsible for are independent of

the properties of the plants. These points are identified on the **NTG** as those beyond which the status of the disconnector and circuit breakers which is present does not influence the setting of the **NTG** itself.

1B.4.2.2 In the connection in antenna layouts specified in Attachment 2 "Guida agli schemi di connessione" (Guide to connection schemes) in Appendix A of this chapter, which in no way influence the setting of the **NTG**, the point of operational separation can be identified upstream or downstream from the general circuit breaker whose closing must in any case be agreed upon with the **Operator**.

1B.4.2.3 As far as control and protection of **low voltage** circuits is concerned, the border is identified in special interfaces or interface terminal boards which provide for the exchange of data and the galvanic separation of the circuits.

1B.4.3 Management of power stations

The management of the **User** plant relative to a **delivery station** involves operational relations between the **User**, the **Operator**, and possibly other **Owners of a portion of the NTG** which, for **dispatching** and **transmission activities**, must be formalized through appropriate regulations.

(a) The **delivery station** is made up of at least two distinct zones belonging to, respectively, the **User** and the **Operator** or another **Owner of a portion of the NTG**. The areas of competence and responsibility in the **operation**, management and **maintenance** of the different parts must be well identified in the diagrams and at the site by clear physical boundaries and must be reported as well in the **Operating Regulations**.

The separation of responsibilities must also be confirmed in the separation of the ancillary circuits through appropriate interfaces and in the **HV** and **EHV** parts by means of interposing isolating apparatus, for the responsibility linked to the safety of persons and property.

For existing **electric stations** where objective difficulty is encountered in developing the circuit separation, any agreements and regulations already stipulated between the **User** and the **Operator** or another **Owner of a portion of the NTG** must be jointly re-examined, if necessary, in order to clearly define the responsibilities.

The grounding meshes for the **delivery station** must be set up to connect to the grounding mesh of the **User** plant, so that the grounding meshes of nearby stations can be connected or kept separate. The sizing and periodic contact and step voltage tests are based on the conventional maximum value of the **short circuit** current and the relative clearance time and are established by the **Operator**.

(b) Management of the parts of the **connection site** which are not part of the **NTG** but important in the **dispatching** and **transmission activities** is coordinated by the **Operator** by means of the **service contracts**.

For such part of the plant the **User** must ensure:

(i) remote surveillance of the plant by means of telemetering and remote signals;

(ii) the effectiveness of the disconnector and circuit breakers, automatic systems, interlocking and **protections systems**;

(iii) the management of the plant without interruption and with adequate execution times;

(iv) prompt intervention and safety implementation of the plants.

(c) As far as the procedures for planned **unavailability** are concerned, the provisions in Chapter 3 of this Grid Code shall apply.

1B.4.3.1 Multiple delivery points

The parallel between portions of the **NTG** via **grids** with many **connection sites** is regulated by the **Operator**.

The **User** must take measures to avoid paralleling, either accidental or unauthorized, between two different points of the **NTG**.

Any interlocking systems in the **User** plant must be agreed upon with the **Operator**.

1B.4.3.2 Emergency power supply

In the presence of emergency power supply, the **User** must prevent, through appropriate interlocking systems, the simultaneous closing of said power and of the main one, so as to avoid either accidental or unauthorized parallels between two different points of the **NTG** or between different **grids**.

1B.4.3.3 Responsibility for safety

The **Users** shall adopt safety regulations for the execution of works at the plant itself in compliance with all laws governing the subject and with the procedures adopted by the **Operator** and by the other **Owners of a portion of the NTG**.

The **Operator**, the other **Owners of a portion of the NTG** and the **Users** shall update the safety regulations in line with changes in legislation and modifications to plants.

More details can be found in Chapter 3 of this Grid Code.

1B.4.4 Maintenance of equipment

1B.4.4.1 The installation and **maintenance** of equipment belong to the **Operator** or to other **NTG Owners** or to **Users** fall under the control and responsibility of the owner of the same, even if installed in an area belonging to another party.

The **Operating Regulations** shall include a detailed list of said equipment.

1B.4.4.2 The regulation of the **unavailability** plans can be found in Chapter 3 of this Grid Code.

1B.4.5 Protection systems

1B.4.5.1 General criteria

1B.4.5.1.1 The **User's protection** systems must:

(a) be coordinated with those of the **NTG**;

(b) be monitored by the **User** for purposes of ascertaining the performance and for the reconstruction of **grid outages**;

(c) ensure back-ups in the event of malfunctioning in the main **protection** of nearby **grid** portions;

(d) contribute to the safe identification of faulty components and their consequential exclusion, in order to accelerate the **detection of grid outage** and the restoration of service.

1B.4.5.1.2 The choice of the **protection** system must be made in coordination with the **Operator**, taking into consideration – among others – the following:

(a) arrangement of **protection** in the **delivery station** and, where the **delivery station** overlaps with the **User** plant, in the nearby **station/s**;

(b) voltage level of the **connections**

(c) **connection** and station service;

(d) the characteristics of the **delivery station** and, where the **delivery station** overlaps with the **User** plant, in the nearby **station/s** (such as with air insulation, in SF_6, etc.);

(e) the characteristics of the connection (overhead lines, cables or mixed) and its length.

1B.4.5.1.3 The characteristics and the type of the relays to be used must take into consideration the active or passive nature of the **User** plant. **Utilities** are considered active in the presence of generation or multiple power supplies.

1B.4.5.1.4 For utilities with low **short circuit** power, particular arrangements must be used to guarantee the selectiveness, as indicated in paragraph 1B.4.5.5.

1B.4.5.1.5 The indexes for proper operation with **faults** of the **protection** systems for the **User** plant, the **delivery station** and the connection lines must not be less than 99%.

1B.4.5.2 Delivery station protection

1B.4.5.2.1 The main system for **protection** at the **delivery station** must clear the **faults** in a selective manner and in the times coordinated with those used by **NTG** at equal voltage levels.

1B.4.5.2.2 **Backup protection** must be provided for, which, suitably coordinated, compensate, when necessary, in the event the main **protection** fails to function.

1B.4.5.2.3 The busbar systems of **delivery stations** at 380 kV must have differential busbar **protection**.

In the busbar systems of **delivery stations** at 120, 132, 150 and 220 kV the use of a differential busbar **protection** is established by the **Operator**, taking into consideration the functional and construction characteristics of the plant.

1B.4.5.3 Protection from faults outside the User plant

1B.4.5.3.1 The **User** plant equipment must be protected against stress due to **faults** not cleared by the **NTG protection** or not covered by them (such as, for example, longitudinal faults).

In order to prevent damage to its plants, stemming from harmonic distortions and **voltage dissymmetry** within the **grid**, the **User** must install adequate **protection** which isolates the plant from exceeding the set limits. Said **protection** may be calibrated, in agreement with the **Operator**, so as not to exclude beforehand the plant in transient capacity and with the objective of safeguarding the availability requirements of the **NTG**.

1B.4.5.4 Protection from faults inside the User plant

1B.4.5.4.1 The **protection** against inside **faults** must promptly and selectively isolate only the part of the **User** plant which is involved, compatibly with the connection service adopted, without involving parts of the **NTG** or other **Users** directly or indirectly connected.

1B.4.5.4.2 The **User** is responsible for keeping the effectiveness of the **protection** system against internal **faults**.

1B.4.5.5 Protection of HV and EHV connections between the delivery station and the NTG

1B.4.5.5.1 The **HV** and **EHV** connection lines pertaining to the **delivery station** must be protected according to the criteria adopted by the **Operator** for the **NTG** lines

of the same voltages, as specified in document A.4 “Criteri generali di protezione delle reti a tensione uguale o superiore a 120 kV” (General criteria for the protection of grids with a voltage equal to or greater than 120 kV) as per Appendix A of this chapter.

1B.4.5.5.2 The **delivery station** must be equipped with circuit breakers able to interrupt the maximum **short circuit** current as calculated by the **Operator**.

1B.4.5.5.3 The circuit breakers in the **delivery station** connected to the grid at 380 kV must have **protection** against failed opening.

1B.4.5.5.4 In **delivery stations** connected to grids of a voltage equal to 120, 132, 150 and 220 kV, the employment of **protection** against failed opening is set out by the **Operator**, taking into consideration the functional and construction characteristics of the plant.

1B.4.5.5.5 In the cases of small-sized **generation plants** and with **short circuit power** too low to guarantee proper functioning of the distance **protection**, maximum current **protection** must be employed, coordinated with minimum voltage relays. When using isolated neutral operating unit transformers, the **protection** system must be integrated with the homopolar maximum voltage relays.

1B.4.5.6 Calibration of protection devices

1B.4.5.6.1 The calibration of all the electricity **protection**, both main and backup, wherever they may be installed (in the **delivery station**, in nearby plants or in the **User** plant), which affects the clearance of the **faults** on the **NTG,** are established by the **Operator** through codified procedures and according to the criteria set out in document A.11 “Criteri generali per la taratura delle protezioni delle reti a tensione uguale o superiore a 120 kV” (General criteria for the calibration of the protections of grids with a voltage equal to or greater than 120 kV) as per ’Appendix A of this chapter.

The **Operator** and the **User** must exchange all necessary information in this regard.

1B.4.5.6.2 Should the **User** deem that the calibrations do not guarantee the integrity of its machinery or of its own equipment, it shall immediately notify the **Operator** of the same, who shall take suitable measures.

1B.4.5.7 Interventions on protection devices

1B.4.5.7.1 The operational characteristics and the calibration of the agreed upon electricity **protection** or of those already structured into the **protection** itself, cannot be changed by the **User** without prior approval from the **Operator**.

1B.4.5.7.2 The **User** must adjust the **protection** installed in its plants in the area bordering the **NTG**, also upon request of the **Operator**, in the event of insufficient operation.

1B.4.5.8 Automatic reclosing equipment

1B.4.5.8.1 Rapid and/or slow reclosing equipment must be part of the **protection** systems described herein above.

1B.4.5.8.2 The **Operator**, depending on the characteristics of the plant and the surrounding **grid**, defines the type of reclosing equipment to be used (unipolar, three-pole, uni-three-pole), the timing and, if necessary, the synchronism conditions. These choices must be made according to the criteria normally used for the **NTG** lines having an equal voltage level.

1B.4.5.8.3 In general, the rapid three-pole reclosing is not used in connections directly pertaining to conventional **power generation plants** with rotary **generators**, so as to avoid unacceptable mechanical stress on the **generators** there, and in following **grid** sections where there is a higher risk of synchronism loss.

1B.4.5.8.4 In particular cases, as indicated in paragraph 1B.5.11.2.5,, the rapid three-pole reclosing can be adopted also in the proximity of conventional **power generation plants** with rotary **generators**, establishing suitable protection systems and high standards of safe **operation**.

1B.4.5.8.5 To limit power overloads, the rapid three-pole reclosing is not used on 380 kV grids.

1B.4.5.8.6 For connections in antenna, in order to ensure successful rapid unipolar reclosing linked to the phase selection and arc extinction, specific suitable ancillary devices must be employed.

1B.4.5.8.7 At the request of the **Operator** the **User** is obliged to adopt unipolar circuit breakers in bay lines to allow for unipolar automatic reclosing.

1B.4.5.9 Rapid intertripping for protection

With regard to the characteristics of the plant and the **connection** service, the **Operator** can envisage the use of direct intertripping systems which act on the circuit breakers of the **User** plant.

1B.4.5.10 Protection using telecommunication

In the case of a **User** line in which one or more extremities belong to the **NTG**, the extremity for which the **User** is responsible must be equipped with protection devices using telecommunication compatible with those used by the **NTG**.

1B.4.6 Characteristics of electrical components

1B.4.6.1 The following rules shall be applied to:

(a) the **delivery station**, even if it overlaps with the **User** plant;

(b) the neighbouring **stations** to the **delivery station**.

1B.4.6.2 All the parts of the plant and the equipment must comply, by law, with technical and quality standards in force twelve months prior to the installation, except in special cases, which will be identified by the **Operator**.

The parts of the plant important for reliability and continuity of the **NTG** service (such as, for example, machines, equipment or systems for control testing) must be supplied by vendors operating under quality regimes.

All equipment and circuits, both primary and secondary, must possess permanent and transitory (for at least 1 sec) characteristics for operation and overload, corresponding to nominal characteristics and maximum flow of the **NTG short circuit** current in the **connection sites**.

Particular attention must be paid to the choice of circuit breakers, disconnector, **CTs**, **VTs** and transformers, for which performance features must be selected taking into consideration the characteristics of the **NTG**.

1B.4.6.3 The owner of each component or apparatus shall guarantee the compliance of the component or apparatus with the requirements requested.

1B.4.7 Neutral state

1B.4.7.1 For voltage equal to or greater than 120 kV, the power station's neutral points of the step-up transformers and of the interconnection between grids must be prepared for solidly earthed connections.

1B.4.7.2 The **Operator** establishes a ground connection plan for the star centres of transformer cluster centres to ensure, respecting the isolation characteristics of the machines which are already installed, that the neutral of the **grids** having a voltage equal to or higher than 120 kV remains effectively grounded at each point and that the single-phase **short circuit** currents do not exceed those of the three-phase **short circuit**.

1B.4.8 Interfacing with Operator systems and the performance of communication systems

The **User** plant must be integrated into the check (real time and delayed) and management processes of the **NTG**.

The safety of the **operation** shall be ensured through the exchange of data and information between Plants, control rooms, control centres and remote operation centres belonging to the **Operator**.

The exchange of information, orders and commands concerns the checks in real time, the remote controlled regulation, the remote transmission of data, telephones and telecontrols.

In order to allow the **Operator** to make checks of the **NTG**, the **User** must provide metering and signals on parts of its own plant, in such a way so as to ensure that the plant can be monitored and the management functions of the system can be carried out.

The transmission of single or aggregate data from the plant to the **Operator's** base is at the **User**'s expense and responsibility, who must also guarantee that the information and data sent corresponds to that which is configured on the **control system** of the **Operator**, as well as that communicated, and all the system services under paragraph 1B.4.12 and connected thereto.

The **Operator** determines the data format and communication protocols. The method of interfacing must be compatible with the **control system** of the **Operator**.

Any interfaces with the **Operator's** offices, both hardware and the conversions of formats and protocols, are at the charge of the **User**, even if they are installed at the **Operator's** control testing and remote operation centres.

The methods of interfacing with the **Operator** are found in document A.6 “Criteri di telecontrollo e acquisizione dati” (Criteria for telecontrol and data acquisition) under Appendix A of this chapter.

From an operational point of view, the minimum requirements of the telecontrol systems in the **connection sites**, functional to the operation of the **NTG**, are listed in the following Table 1.

TABLE 1

Function	Frequency or delay	Precision class (*)	Mode	Availability (3)	Integrity (3)
REAL-TIME CONTROL					
Metering					
Voltage (1)	4”	0.5	Periodic		$<10^{-6}$
Frequency (1)	4’’	0.5	Periodic		$<10^{-6}$
Active power (1)	4’’	2.2	Periodic		$<10^{-6}$
Reactive power (1)	4’’	2.2	Periodic		$<10^{-6}$
Status signals					
Circuit Breakers	2”-4’’	=	Spontaneous		$<10^{-10}$
Disconnector	4’’	=	Spontaneous		$<10^{-10}$
Events (2)	4’’	=	Spontaneous		$<10^{-10}$
Alarms (2)	4’’	=	Spontaneous		$<10^{-10}$
REMOTE DATA TRANSMISSION					
Monitoring					
Chronological events	10”	=	Spontaneous		
File transfer	1 h	=	Spontaneous		
Telecontrols					
Circuit Breaker commands	1’’	=		0.9995	$<10^{-14}$
Other telecontrols	2”	=		0.9995	$<10^{-14}$
Remote-regulation					
Active power	2’’	1	Periodic		
Reactive power	2’’	1	Periodic		
Voltage	2”	0.5	Periodic		
Frequency	2”	0.5	Periodic		

(1) In most cases, with the exception of metering used in the remote regulation of voltage and frequency, which is referenced in the last section of the (remote regulation) table.

(2) 1” if concerning events or alarms of particular importance for the operation.

(3) Definition according to CEI Regulation 57-7, 1st edition, Feb. 1998, file 57-7 3632 R.

(*) The precision class indicated refers to the precision class for the entire metering chain for mixed readings (active power and reactive power), while it concerns measure transformers (VT) for voltage readings. Converters must have a higher precision class than current transformers (at least 0.5 per PU subject to telecontrol only, and 0.1 - 0.2 class for PUs participating in remote power or voltage control)

1B.4.8.1 Telecontrol and remote signal devices

1B.4.8.1.1 The **Operator** may request that one or more telecontrol and/or remote signal devices (ex. Unità Periferica di Difesa e Monitoraggio, UPDM (Defense and Monitoring Peripheral Unit, DMPU)) within the **User** plant be dedicated to particular operations, such as intertripping or remote signalling for **generation groups** and/or **load** disconnection and data transmission. The use of machines dedicated to single functions (such as intertripping systems), the installation of which is at the expense of the **User** or the **grid Operator** with third party connection obligations, may be requested in order to be in line with safety requirements and the execution times of commands and signals, relative to document A.9 "**Piano di Difesa**" (Defence Plan) in Appendix A of this chapter.

Attachments A.52 "Unità periferica dei sistemi di difesa e monitoraggio. Specifiche funzionali e di comunicazione" (Defense and Monitoring Peripheral Unit. Functional and Communication Specifications) and **A.69** "Criteri di connessione degli impianti di produzione al sistema di difesa di Terna" (Criteria for the connection of production plants to the defence system of Terna), under Appendix A in this chapter describe the technical and functional characteristics of the defence system.

1B.4.8.1.2 For delayed data transmission (e.g. files), the **Operator** must give its authorization to the employment of non-integrated devices in the telecontrol apparatus.

1B.4.8.2 Information sent by the User

1B.4.8.2.1 Each **User** must send the **Operator** the information on its plants in order to depict the historical demand series, for the ordinary **operation** of the **NTG**, for the restoration of service and for tracing **grid outages**.

1B.4.8.2.2 For each **User** category there shall be a minimum standard list of such information in the relative section.

1B.4.8.2.3 The detailed list of the information requested can be found in the **Operation Regulations**. .

1B.4.8.3 Telecontrols for implementing Defence plan measures

1B.4.8.3.1 The **User** plant must be suitably prepared to be able to receive, sort and implement controls of remote stimulation, remote reduction and only opening of circuit breakers, both automatic and manual, given from a distance by the **NTG protection** systems or by the **Operator's** central systems belonging to the grid's **Defence Plan**.

In regards to the provisions of the plants concerning these functions, please refer to Attachment A.69, as well as the subsequent attachments for the specific plant category:

- for wind energy plants, Attachments A.64 and A.17;
- for solar production plants, Attachment A.68
- for **User** plants that supply **interruptible load service**, Attachments A.40, A.41 and A.42

For this purpose, the plant must be equipped with reception devices which are compatible with those used by the **NTG**.

1B.4.8.3.2 The telecontrols for opening in the event of overloads on parts of the **grid** or for avoiding power imbalances in a given area of the **NTG** will act upon:

(a) the circuit breakers for **transmission activities**, of the **User** plant or those belonging to stations nearby or other points on the **NTG**, so as to exclude the entire plant;

(b) on other plant circuit breakers, agreed upon with the **Operator**, in order to disconnect **load** portions or exclude from operation the **generation plants**.

1B.4.8.3.3 The sorting circuits must include delays for possible relay repeaters within 10 ms.

1B.4.8.3.4 The rapid **telecontrols** for protection are considered similar to **intertripping**.

1B.4.8.3.5 The **telecontrols** of tele-stimulation and tele-reduction act, via the telecontrol apparatus, on the power regulation and modulation systems of the **User** plant.

1B.4.8.4 Telephone connections

1B.4.8.4.1 The **Operator's** control and remote management centres give instructions to the **User's** Control Rooms concerning the operation of the plant, both under **normal conditions** and **emergency conditions**.

1B.4.8.4.2 If requested by the **Operator**, the **User** shall arrange for a dedicated telephone line.

1B.4.8.4.3 The functional characteristics of the equipment which is necessary for the subject are defined by the **Operator**.

1B.4.9 Contribution to short circuit current

1B.4.9.1 The **Operator** calculates in the same way as the calculations are envisaged in paragraph 1B.3.7.1 the contributions to the **short circuit** currents originating from the **User** plants, on the basis of the data which the **User** is required to communicate and update.

1B.4.9.2 The **short circuit** current in every part of the **NTG**, including the contribution from the **User** plant, must not exceed 90% of the **interruption** power of the installed circuit breakers.

The nominal **short circuit** power of the circuit breakers, as defined by the CEI regulations, is, as a rule, chosen from one of the following values:

(a) 50 kA or 63 kA for 380 kV;

(b) 31.5 kA or 40 kA or 50 kA for 220 kV;

(c) 20 kA or 31.5 kA or 40 kA for 132-150 kV.

1B.4.9.3. The action times for the **protection**, provided in paragraph 1B.3.8, may not be increased in the event of weak contributions.

1B.4.9.4 Possible provisions for decreasing contributions to **short circuit** current can be adopted with modifications to the plant or with the implementation of specific devices.

1B.4.10 Insulation coordination

1B.4.10.1 The coordination of insulation should be carried out consistently with the criteria adopted on the **NTG** (see paragraph1B.3.6) at the same nominal voltage level.

1B.4.10.2 If so requested by the **Operator**, the **HV** and **EHV** windings of the transformers must be equipped with full insulation towards ground, in order to allow, in any moment, the operation with non-grounded cluster centres.

1B.4.11 Power exchange limits

The applicable general conditions can be found herein below, whereas for particular conditions, please refer to the paragraphs relative to the different types of **Users**.

1B.4.11.1 Exchange under normal conditions

The construction characteristics of the plant must be such as to guarantee a continuity and regularity of the exchange of **active** and **reactive power** consistently with the energy input and withdrawal programs as well as the **regulations** which govern the plant.

1B.4.11.2 Exchange in other conditions

1B.4.11.2.1 The construction characteristics of the plant (including processes, the regulation of said processes and their relative calibration) must be suitable:

(a) for **power generation plants**, to meet voltage and current developments within pre-fixed limits, remaining connected and producing the programmed **active power**;

(b) for plants corresponding to **consumption units**, to guarantee the same power withdrawn previously in **normal conditions**, except for the share of this which depends on frequency and voltage and except for the inclusion of the **User** plant in the **Defence Plan** drafted by the **Operator**.

1B.4.12 System services for generation plants

A summary of the system services that owners of **generation plants**, directly or indirectly connected to the **NTG**, are required to possess so as to be able to supply the **Operator** are given below.

The table also contains chapter references within the Grid Code, as well as the attached documents that explain in detail the technical characteristics and requirements of **generation plants** for the provision of the indicated system services.

Service	Obligation/option of service performance	Requirements and technical characteristics
Solution of congestion in planning phase	Mandatory for suitable Pus that are authorised to supply the service on the DSM	Par. 4.4.1
Primary power regulation	Mandatory for significant PUs suitable for the service	Par. 1B.5.6.1; 1B.5.7;4.4.2; Attachment A.6; Attachment A.15
Secondary frequency/power regulation	Mandatory for suitable PUs that are authorised to supply the service on the DSM	Par. 1B.5.6.2.3; Par. 4.4.3; Attachment A.23
Tertiary frequency/power regulation	Mandatory for suitable PUs that are authorised to supply the service on the DSM	Par. 1B.5.6.2.3; Par. 4.4.4
Balancing	Mandatory for suitable PUs that are authorised to supply the service on the DSM	Par. 4.4.5; Attachment A.23

Service	Obligation/option of service performance	Requirements and technical characteristics
Primary voltage regulation	Mandatory for significant PUs suitable for the service	Par. 1B.5.6.2; Par. 1B.5.8; Par. 4.4.7; Attachment A.6; Attachment A.14; Attachment A.16
Secondary voltage regulation	Mandatory for significant PUs suitable for the service	Par. 1B.5.6.2.3; Par. 4.4.8; Attachment A.6; Attachment A.14
Load rejection	Mandatory for thermal PUs having power greater than 100 MW	Par. 1B.5.3.4; Par. 4.4.9
Participation in the power recovery of the Electricity System	Mandatory for significant PUs indicated in Attachment A.10	Par. 1B.5.6.2.3; Par. 1B.5.12; Par. 4.4.10; Attachment A.10
Intertripping systems	Mandatory upon request from the Operator and for all significant PUs qualified for MSD located in the limited production hubs	Par. 1B.4.8 Par. 4.4.11; Attachment A.9

Note: the **Operator** has the right to request the following system service performance - found in table "A" above - even from significant PUs fed by unplanned renewable source, for reasons related to the safety of the **National Electricity System**: **Intertripping systems, Primary voltage regulation, Secondary voltage regulation.**

1B.4.13 Technical documentation of the connection site

The **Operator** and the **User** shall univocally identify the plant and determine the contact personnel authorized to provide technical information.

For every **connection site** the technical documentation of reference must be prepared for the purpose of managing the **connection site**.

The **User** is responsible for the drafting, updating, safekeeping and formal communication to the **Operator** of the technical documentation concerning its own plant.

Said documentation must include at least:

(a) single-line wiring diagrams, the plan and the sections of the **connection User** plant;

(b) functional diagrams of the command and control system for each component of the plant;

(c) technical descriptions, manuals and inspection dates of the **HV** and **EHV** equipment, of command, protection and control systems, of auxiliary services and of machinery present in the plant.

The graphs used in the plant's electricity diagrams must comply with current technical regulations.

The **User** must, upon simple request by the **Operator**, place at the same disposal all the technical documentation concerning the plant, in an electronic form and in the formats defined by the **Operator,** limited to the parts of the plant which influence the operation of the **NTG**.

The **User** must also collaborate with the periodic updating of the **Operator's control system** data base when requested by the same.

When new equipment is installed or replaced and features technical characteristics that are not identical to the previous devices, the **User** must provide advance information concerning the characteristics in order to guarantee the optimum **operation** of the **NTG**.

For every **connection site** the **Operator** shall keep the list of the technical characteristics of the site itself. The **Operator** shall be responsible for the creation and updating of said list, on the basis of the information provided by the **User**. The list shall also reflect any dispensations which may have been granted.

Information concerning the performance of the plants and the processes of electricity production can be found in the **Operation Regulations**.

1B.4.13.1 Single-wire diagram, plan and section of the plant

1B.4.13.1.1 The single-wire diagram must accurately represent the circuits and their **connections** for the entire **connection site**.

The single-wire diagram must show all the **MV**, **HV** and **EHV** equipment as they are placed in the plant, and the connections to all external circuits and **low voltage** circuits. The single-wire diagram must show, moreover, the names, numbers and principal nominal characteristics of all the machinery and all the **HV** and **EHV** equipment present in the plant. All interlocks that are present in order to prevent the parallel connection to different sources of power must be indicated. The electricity **protection** of the plant should be described in the single-wire diagram.

The plan and its sections of the plant must show all the **MV**, **HV** and **EHV** equipment, and the property borders between **grid apparatus for connections** (**delivery station**, **EHV** or **HV** connections) and **User** plant must be clearly identified.

1B.4.13.1.2 If gas-insulated, metal-enclosed equipment is present at the **connection** site, such circumstances must be clearly indicated on the diagram by highlighting the compartments.

1B.4.13.2 Functional diagrams of the Command, Control, and Protection System

1B.4.13.2.1 The following must be prepared for the **bays** of the **delivery station** and the **User** plant:

(a) a functional diagram, also simplified, which documents the fundamental logics of **protection**, interlocks and the relationship between the automatic and **protection** functions;

(b) a diagram or a list of the available logical and analogue signals for monitoring.

1B.4.13.3 Technical description, user manual and test data

1B.4.13.3.1 For each type of plant apparatus and component it is responsible for, the **User** must provide all the necessary data for the **Operator's** activities. Such data may also be gathered from the builder's manual.

1B.4.13.3.2 For the parts subject to testing, the data shall be replaced with the test data.

1B.4.14 Grid technical data, project documentation for the User plant and Operation Regulations

1B.4.14.1 The documentation concerning the **connection**, made available by the **Operator** and **User** within their respective areas of responsibility, complies with the following features:

a) services performed by the **NTG** at the specific **connection site** (as indicated in section1B.3);

b) characteristics of the **NTG** and **User** plant and of the connection lines in the specific **connection site**;

c) regulations governing the relationship between the **Operator** and the **User** as regards the **operation**, control and **maintenance** of the functional parts of the **NTG** plant, with particular reference to what is set out in paragraphs 1B.4.2 and 1B.4.3 and section 1B.9.

1B.4.14.2 The main subjects covered by the **connection** documentation are the following.

(a) *Indicative performance of the NTG at the connection site*

(i) voltage variation limits;

(ii) maximum level of **total harmonic distortion**;

(iii) maximum value of the **flicker severity ratio**, both short-term and long-term;

(iv) any deviations, due to obsoleteness or particular planning specifications, of the performance of the **NTG** with respect to what is declared in section 1B.3.

(b) *Characteristics of plants and processes*

(i) NTG plants

- coordination of the insulation relating to the **delivery station**;
- characteristics of the **protection** system in at the **delivery station**.

(ii) User plants

- list and location of the circuit breakers controlled remotely by the **NTG protection** systems or by the **Operator's** devices (such as, for example, those necessary for the execution of the grid's **Defence Plan**);
- characteristics of the converters of the **User HV/MV** or **EHV/MV** transformers;
- possible employment and location of devices for **loads** interruption or **generation groups** interruption;
- supplementary criteria for the definition of the functional competency borders when dealing with a **User** with a great need for interoperability vis-à-vis **NTG** (for example, a **distribution grid**) or a plant involved in particular industrial processes;
- possible employment of automatic devices for introducing and removing **reactive power** compensation reserves (such as, for example, power factor correction capacitors or reactor groups);
- a list of any apparatus belonging to the **Operator** which are installed in the **User** plant.

(iii) Connection lines

- coordination of insulation;
- characteristics of circuit breakers and disconnectors;
- metering and **protection** systems.

(iv) Power generation plants

- technical characteristics of the plant and method of **operation**, with particular reference to production flexibility (type of service, minimum safe output, load acceptance gradient depending on the power supplied, etc.);
- Detailed technical data concerning the **generators**
- Detailed technical data concerning the primary engines
- Detailed technical data concerning step-up transformers with the definition of the transformation ratio and the voltage regulation range and the description of any tap changer.
- Detailed technical data concerning the frequency regulators with the definition of the droop values set on velocity regulators
- Detailed technical data concerning voltage regulators and the associated IEEE model
- The **capability curve** of generators with different voltage and temperature values
- Reverse current curve permitted by the generators

- Inertia constants for the entire generation axis (turbine, compressor, joints, alternator) and separately for the individual components

- intervals of voltage and frequency in which, in the presence of **essential loads**, the owner of the **generation plant** shall guarantee the production of **active power**;

- any employment of **generator** excitation systems different from the **primary regulation of voltage** (regulation of **HV** and **EHV** voltage in the **delivery point**; **reactive power** supply program; regulation at constant **reactive power**; regulation at constant power factors);

- List of **generator protection** and step-up transformers specifying the manufacturer, model, regulations and trip matrix (controlled circuit breakers, trips, locks, etc...);

- logic implemented for **load rejection** and island operation after disconnection from the **grid**

The data described above must be inserted into the **Consolidated Records Management System of Production Plants - CRMSPP** via the specific internet portal (www.terna.it) and must comply with the requirements given in Attachment A.65 - "Dati tecnici dei gruppo di generazione" (Technical data of the generator groups) under Appendix A of this chapter.

The data should be entered in accordance with the provisions in the document "Istruzioni Operative per il Produttore (dotato di Certificato Digitale) - Registrazione delle Unità di Produzione Rilevanti" (Operating Instructions for the Producer (equipped with a Digital Certificate) - Registration of Relevant Production Units) published on the website of the **Operator**.

The aforementioned data will be used to outline the calibration plans for the plant regulation and **protection** systems and cohesively included in the **Operation Regulations**.

(c) *Operation, management and control of the plants*

- Management of the multiple **delivery points** and the emergency power supplies which involve the parallel connection of distinct parts of the **NTG**;
- characteristics of the **telecommunication systems**;
- the **User** transient method of interfacing to the **Operator** for the exchange of data;
- any certification for the **User** to participate in the system services;
- choice of **unavailability** periods of parts of the plant;
- access to the plants and procedures for carrying out the works;
- safety for persons and property during **maintenance** interventions.

1B.4.14.3 Without prejudice to the provisions in the **Standard Agreement** for relationships between the **Operator** and **NTG owners**, the **Operator** shall conventionally regulate with the **User,** with respect to these Technical Regulations, the following activities:

(a) **operation**, management and control of the plants;

(b) **protection** and **monitoring** procedures within the plants;

(c) **regulation** and command procedures within the plants;

(d) responsibility for testing grounding systems;

(e) access to the plants and safety procedures for carrying out the works;

(f) **unavailability** of parts of the plant in the event of **maintenance** works and the general time frame of the same;

(g) measuring commercial items

(h) remote disconnection of **generator groups** or **loads**.

The rules, procedures and information needed for **connection** to the **NTG** are contained in the following documents:

a) the **connection contract** which the **Operator** adopts to regulate the methods for **connecting** to the **NTG (Attachment A. 57)**;

b) the **Operation Regulations** stipulated between the **Operator** and **User** to regulate the relationships concerning the **operation** and **maintenance** of the **connection site**, as well as relations between the concerned units, specifying their respective areas of competency. (with particular reference to what is included in sections 1B.4.2 and 1B.4.3 and section 1B.9); The **Operation Regulations** also contain a detailed list of the information (remote signals, metering, controls, regulations) which the **User** and the **Operator** must exchange with each other and any derogation to the Technical Regulations granted by the **Operator** according to the procedure described in Chapter 14, section 14.3.,

c) The procedures agreed upon between the **Operator** and **User** in order to establish the operative modes concerning specific activities or processes.

1B.5 TECHNICAL REGULATIONS FOR GENERATION PLANTS WHICH ARE DIRECTLY CONNECTED TO THE NTG

The contents of this paragraph apply to all power **generation plants** which are directly connected to the **NTG**, including **generation groups** of plants where both generation and consumption of electricity takes place. The regulations differ according to the plant type: conventional thermal cycle, combined cycle, wind, photovoltaic, etc.

For wind and photovoltaic **production plants** the attachments A.17 "Sistemi di controllo e protezione delle centrali eoliche" (Systems of control and protection of wind power stations) and A.68 "Impianti di produzione fotovoltaica - requisiti minimi per la connessione e l'esercizio in parallelo con la rete AT" (Photovoltaic production plants: minimum requirements for the connection and operation in parallel to the HV grid), under Appendix A **of this chapter apply, in accordance with the procedures and time frames provided for by the Authority.**

1B.5.1 Voltage characteristics

1B.5.1.1 Harmonic distortion

1B.5.1.1.1 The **Producer** shall provide, at the time of the **connection application**, all the planning data relating to the harmonic emissions; on the basis of said data, the **Operator** shall evaluate the effects on the grid, under minimum **short circuit power** conditions on the **grid** itself.

1B.5.1.1.2 The harmonic emissions from the plant must be such that the **THD** in the **connection site** does not exceed the values indicated in paragraph1B.3.5.1.

1B.5.1.1.3 In calculating the **THD**, the **Operator** shall include the disturbance **loads** of the power **generation plant**.

1B.5.1.2 Voltage dissymmetry

The **Producer** shall document any present and supplied **loads** so as to induce dissymmetry in the voltage.

1B.5.2 Performance of power generation plants

1B.5.2.1 The **User** must declare, upon request by the **Operator**, the characteristics of the plant for the single **generation group**. The data declared must refer to those of **operation**. Should the **User** fail to provide the requested data, the **Operator** will notify the **Authority**.

Besides the general information on the type of the plant, also requested are the type of the process and the primary sources utilized.

The **User** must also declare any limitations connected to the process, restrictive of the typical performance of the sector type and any possible environmental restrictions.

1B.5.2.2 The characteristics of primary interest for purposes of identifying flexibility in the **operation** are indicated in chapter 4 of this Code.

1B.5.2.3 The characteristics of interest for purposes of electricity behaviour are all those necessary for the execution of static and dynamics calculations, such as **short circuit**, load flow, electromechanical transients, etc. and must refer to the single **generator** or generation group, as laid down in Attachment A.65, "Dati tecnici dei gruppi di generazione" (Technical data of generation groups) under Appendix A of this chapter.

For the purposes of capacity to supply system services, the characteristics are those of the regulators and the **capability curve** in the range of voltage variation.

1B.5.2.4 Data relating to the fault rate may be requested by the **Operator,** and in such case the **User** shall have to provide the same.

Should the above data not be made available by the **User**, for the evaluations of its competency the **Operator** shall consider the value corresponding to the historical data of the same type of plant or data available in the technical bibliography.

The User shall also provide the efficiency rate of the **generation plant** which are processed according to the provisions in Chapter 12, section12A.3, of this Grid Code.

1B.5.2.5 The same obligations of declaration and responsibility shall be applied to information relating to:

(a) capability to supply power to isolated portions of the **NTG** and/or **proprietary loads**;

(b) capability to support **load rejection**;

(c) capability to supply the service for **power restoration**.

The above listed characteristics shall be taken into consideration when evaluating the suitability of the plant to supply energy and system services.

It should be understood that in all instances of violations concerning the disclosure obligations referred to in the present paragraph, the **Operator** will inform the competent **Authority**.

1B.5.3 Performance of the generation groups

1B.5.3.1 **Generators** must be able to continuously maintain a state of operation within the following limits:

(a) any **active power** supplied (Pc), included between the **efficient power** (P_e) and minimum safe output declared;

(b) the **reactive power** requested by the **grid**, between the minimum value ($Q_{c.min}$) and the maximum value ($Q_{c.max}$), derived from the **capability curve** (fig.1) in correspondence with the **active power** supplied and at voltage and frequency values included in area A of fig. 2.

1B.5.3.2 Moreover, the **generators** must be able to maintain, for single periods not exceeding 15 minutes and in compliance with the conditions set out by the CEI technical regulations of reference on conventional rotary generators, the following state of operation:

(a) any **active power** supplied (Pc), included between the **efficient power** (P_e) and minimum safe output declared;

(b) the **reactive power** if requested by the grid, between the minimum value ($Q_{c.min}$) and the maximum value ($Q_{c.max}$), derived from the **capability curve** in correspondence with the **active power** supplied and at voltage and frequency values included in:

(i) area B of fig. 2, for round rotor with a nominal power equal to or exceeding 10 MVA;

(ii) area C of Fig. 2, for round rotor with a nominal power less than 10 MVA and for salient pole **generators**.

The **producer** must not limit the characteristics of the plant if it is capable of supplying operation areas larger than those given in fig. 2 and should come to an agreement with the **Operator** on the mode of management in this regard.

1B.5.3.3 The nominal power factor (in over excitation) at the conventional rotary **generator** terminals must be:

(a) for round rotor machines not exceeding:

(i) 0.85 for sizes up to 200 MVA;

(ii) 0.9 for sizes exceeding 200 MVA;

(b) for salient pole machines not exceeding:

(i) 0.85 for sizes up to 70 MVA;

(ii) 0.9 for sizes exceeding 70 MVA.

The power factor in under excitation at the **generator** terminals must not exceed the nominal power by 0.95. The presence of limiters or apparatus to regulate voltage must not significantly reduce the **reactive power** limit. The calibration of the **protection** and limiters must in any case be agreed upon with the **Operator**.

1B.5.3.4 Thermoelectric **generation groups** with power exceeding 100 MW, except for cases of proven technical impossibility, must provide the **load rejection** service consisting of remaining in stable operation conditions against disconnection of the **generation group** from the **grid**, powering its own auxiliary services from its respective unit transformers for a time of at least 12 hours.

The required 12-hour duration can be subject to review on the basis of the results of the tests under paragraph 1B.5.12.1 and of the execution needs for **power restoration**.

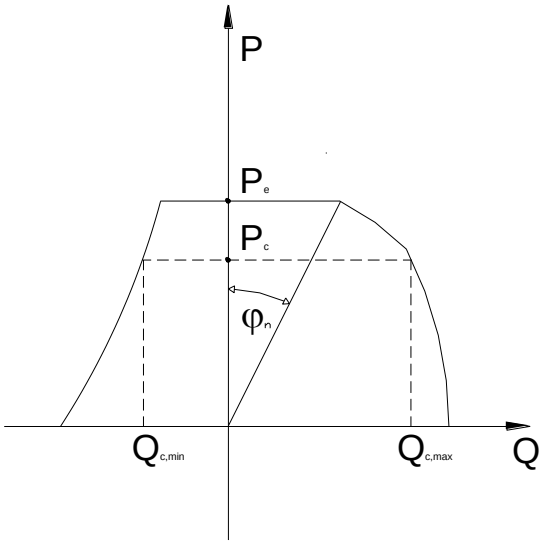

Fig. 1 – Typical capability curve for a generation group.

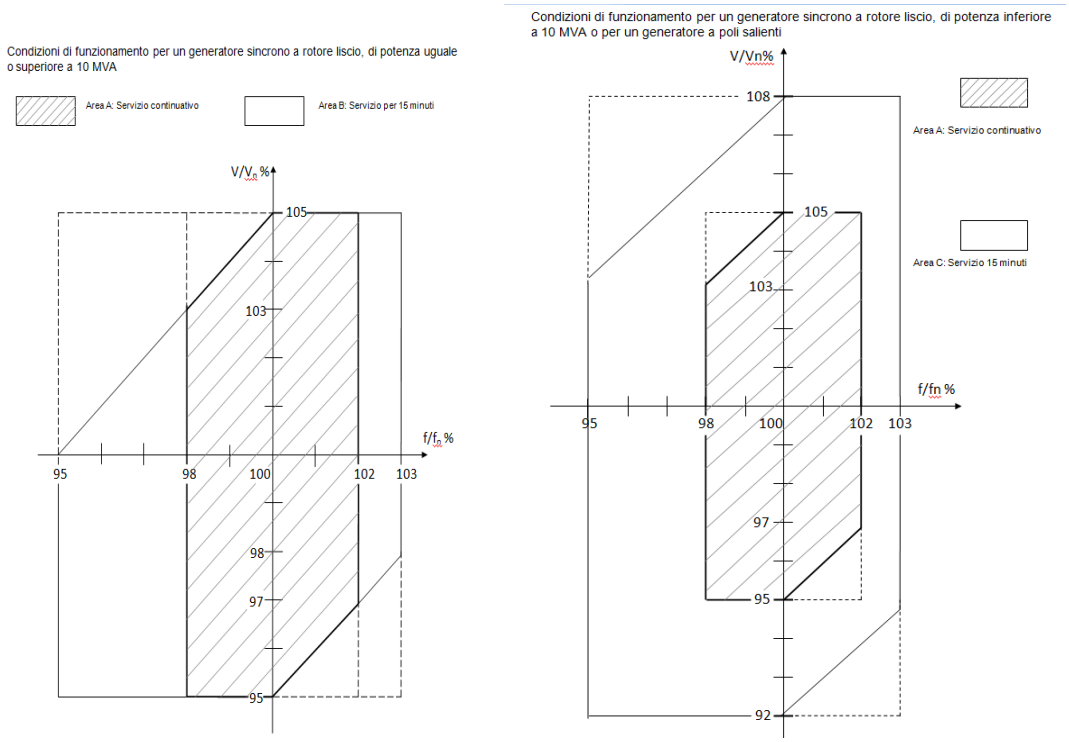

Fig. 2 – Operational state of generators. In x-coordinate the frequency is reported; in y-coordinate the voltage at the generator terminal is reported. Both sizes are expressed as a percentage of the respective nominal values.

1B.5.4Minimum performance in the presence of frequency and voltage variations

1B.5.4.1 The **power generation plant** and the related machinery and equipment must be planned, built and operated to remain in parallel also under **emergency conditions** and **restoration** of the **grid**.

Under such conditions the power **generation plant** must guarantee, pursuant to what has been established in this Chapter and specified in the documentation under paragraph 1B.4.14.1:

(a) supply of the planned **active** power;

(b) the possible participation in frequency regulation according to the characteristics of the **groups**;

(c) the possible participation in voltage regulation, according to the characteristics of the **groups**.

The regulator must guarantee the stable operation of the **group** for an indefinite period of time, for any frequency between 47.5 Hz and 51.5 Hz and with any **load** between the auxiliary services **load** and the maximum power generable by the **group**. Furthermore, it must guarantee proper functioning up to 46.5 Hz for limited periods of time (fractions of seconds).

1B.5.4.2 For **power generation plants** integrated in processes with loads essential to the production of electricity and declared during the definition and signing of the **Operation Regulations** at paragraph 1B.4.14.1 and 1B.4.14.3 that are not suitable for operation under **emergency conditions** of the **grid**, the **Producer** must declare the voltage range and the frequency range in which the production of **active power** is guaranteed. The **Operator** reserves the right to limit in advance the withdrawal of power to keep the supply safe.

1B.5.4.3 Each **User** is responsible for **protecting** its own machinery and equipment from damage caused by any possible frequency and/or voltage states which are outside the variation range under **emergency conditions** or **restoration** of the **grid**. Methods of separation from the **grid** in frequency and/or voltage states outside the limits expressed and methods of re-entrance into service shall be agreed upon with the **Operator** in the **Operation Regulations**.

1B.5.5 Operation in the presence of inverse sequence currents

1B.5.5.1 Each **generation group** must tolerate, without disconnecting, the inverse sequence current caused by dissymmetry faults, cleared by **NTG backup**

protection with the following timing: 2 seconds for 150-132 kV grids; 2.6 seconds for 220 kV grids; 4 seconds for 380 kV grids.

1B.5.6 System services

1B.5.6.1 Primary frequency regulation

1B.5.6.1.1 All **groups** with nominal power greater than 10 MVA must contribute to the **primary regulation of frequency** (see Attachment A.15), according to the procedures established by the **Operator** in the Dispatching regulations as in Chapter 4 of this Grid Code, with the exception of those lacking, due to their nature, regulating capacity, such as, for example:

(a) **generation groups** and pumping systems equipped with a reversible Francis turbine;

(b) geothermal electricity groups.

Renewable wind and photovoltaic plants must not cause any deterioration in the system during frequency transients, in accordance with: that which is laid down in attachments A.17 "Sistemi di controllo e protezione delle centrali eoliche" (Systems of control and protection of wind power stations) and A.68 "Impianti di produzione fotovoltaica - requisiti minimi per la connessione and l'esercizio in parallelo con la rete AT" (Photovoltaic production plants: minimum requirements for the connection and operation in parallel to the HV grid) under Appendix A of this chapter.

Upon request by the **Operator**, the **groups** must be able to regulate the frequency, even if functioning on an isolated portion of the **grid**, in such a way as to restore and maintain the frequency at a nominal value of ±0.25%, and allow the re-meshing of the **grid**.

1B.5.6.2 Voltage regulation and additional services

1B.5.6.2.1 All **generation groups** must contribute to the **primary regulation of voltage** (see Attachments A.14 and A.16).

1B.5.6.2.2 The requested methods of **regulation** (from **HV** or **EHV** group or busbar), any voltage profiles to be achieved and the supply program of **reactive power** to be implemented are defined in the **Operation Regulations**. The **Operator** sends the **User** the relevant voltage or **reactive power** levels to be adopted via the Control System referred to in Attachment A.34 or with similar systems for **enabled PUs**.

1B.5.6.2.3 On the basis of **NTG** needs and according to the procedures which are established in the Rules for dispatching, as in Chapter 4, a **production unit** can be selected, with all its **groups** or with part of them, with reference to the following activities:

(a) **Secondary frequency/power regulation**;

(b) Tertiary frequency/power regulation;

(c) **secondary regulation of voltage**

(d) **defence plan**;

(e) restoration of the electricity system.

The plants and the relative **groups** may be chosen among those qualified and most suitable due to their characteristics and their location with respect to the **grid**, to supply the specific service.

The procedures for provision of the services are described in the following attachments:

- Attachment A.15 for **secondary frequency regulation**;

- Attachment A.16 for **secondary voltage regulation**;
- Attachments A.9, A.52 and A.69 for the **Defence Plan**;
- Attachment A.10 for the **restoration of the electricity system**.

1B.5.7 Characteristics of speed regulators

1B.5.7.1 Every **generation group** must be equipped with a speed regulator whose **load** reference signal can be varied from 0 to 100% of the nominal **load** in a maximum time of 50 seconds. The regulator must be able to function properly also in disturbed conditions of auxiliary voltage supply (for example, when there are **faults** on the **NTG**).

1B.5.7.2 If the **group** participates in the **primary regulation of frequency**, the regulator must possess further operational requirements described herein below.

Degree of droop	To be calibrated between 2% and 8%
Maximum tolerance of speed measure	0.02%
Zone of maximum insensibility	± 10 mHz

1B.5.7.3 The droops are coordinated by the **Operator** and normally set in the following ranges:

(a) for hydroelectric **groups**, between 2% and 5%;

(b) for thermal **groups**, between 5% and 8%.

In defining the droop value, the characteristics of the **generation group**, the location of the plant in the **NTG** and the possible participation of the plant in the **power restoration** shall be taken into consideration, among other values.

1B.5.7.4 The values to be set for the dead bands to be calibrated are defined by the **Operator** on the basis of the characteristics of the plants in compliance with the **ENTSO-E** rules.

1B.5.7.5 For the **groups** that participate in the **secondary regulation of frequency** the speed regulators must also be able to receive from the **Operator's** central regulator, telecontrols for the variation of the load reference signal.

1B.5.7.6 Upon the **Operator's** request, the groups must be able to regulate the frequency, also if operating on an isolated portion of the grid, in such a way as to restore and maintain the frequency at a nominal value of ±0.25%, and allow for the re-meshing of the grid.

1B.5.8 Characteristics of voltage regulators

1B.5.8.1 An automatic system of excitation control, with continuous action, must regulate the clamp voltage of the **generation group** with an error not greater than ±0.5% of the reference value set. The excitation system must be equipped with over excitation and under excitation limiters for the respect of the equipment's performance curve and must possess the requirements described herein below.

Maximum allowed voltage error	±0.5%
Voltage reference	To be calibrated between 80% Vn and 110% Vn
Nominal operation **ceiling**	Static exciters: 200 %
	Other exciters: 160 %
Ceiling maintenance time in the event of a nearby short circuit (for power generators > 100 MVA)	2 s
Maximum range current for 10 s (for power generators > 100 MVA)	150%
Positive compound (for power generators > 50 MVA)	70%-80% of the voltage drop on step-up transformers

1B.5.8.2 In general, provisions are not made for constant **reactive power regulation** or constant power factor regulation. In particular cases the **Operator** and the **Producer** will be able to agree on the adoption of one of such methods, stating it clearly in the **Operation Regulations**.

1B.5.8.3 The over excitation limit must be temporarily exceeded in order to allow the forcing of the range current in the event of a **fault** in the **NTG**.

1B.5.8.4 The excitation system (for static exciters) must operate regularly also with power supply voltage equal to 20% of its nominal voltage (provided that the individual phase voltages are kept symmetrical).

1B.5.8.5 For power **generators** greater than 100 MW, or if requested by the **Operator**, stabilization devices (“Power System Stabilizer”, PSS) must be provided, which act on the excitation system in such a way as to dampen the power swings caused by disturbances on the **NTG**. The calibrations of such devices must be agreed upon with the **Operator** in the scope of the **Operation Regulations**.

1B.5.9 Information forwarded by the Producer

Herein below is a list of the type of information each **Producer** must forward to the **Operator**. The detailed list and methods of exchange of information are established for each **power generation plant** in the **Operation Regulations**.

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1B.5.9.1 Signals and metering for NTG management

1B.5.9.1.1 For **operation** of the **NTG** in real time it is necessary that each **generation plant** sends the telemetry and remote signals in accordance with the requirements and procedures set out in Attachments A.6 “Criteri di telecontrollo e acquisizione dati” (Criteria for telecontrol and data acquisition) and A.13 “Criteri di connessione al sistema di controllo di Terna" (Criteria for connection to Terna’s control system), under Appendix A of this chapter.

1B.5.9.1.2 For the economic regulation of the energy metering, please refer to Chapter 7 of this Grid Code.

1B.5.9.2 Information for the rapid restoration of service

1B.5.9.2.1 Following an outage, the **User** must promptly inform the **Operator** of:

(a) the availability of the plant excluded during the outage, the causes which determined the exclusion and the causes which prevented its coming back on line;

(b) the time necessary to come back on line.

1B.5.9.2.2 The information from the chronological event recorders (RCE) at the **User’s** plant and limited to the borders between the **NTG** and the plant, must be received by the **Operator** within 10 seconds of the event.

1B.5.9.3 Information for the reconstruction of outages

1B.5.9.3.1 For reconstructing outages, the **User** must make available to the **Operator**:

(a) the registrations taken from the **Energy disturbance curve oscillographs** (relating, for example, to the instantaneous current and voltage values, logic signals relating to the operation of the **protection** systems);

(b) the chronological recordings of events;

(c) the electromechanical transient recordings;

(d) local signals.

Said information must be kept by the **User** for a period of not less than 10 years.

1B.5.10 Regulation levels transmitted by the Operator

The plants of **Users** participating in the **secondary regulation of voltage** and the **secondary regulation of frequency/power** must be equipped to receive the relative level reports transmitted by the **Operator.**

1B.5.11 Protection of generation group

1B.5.11.1 Protection from internal faults

1B.5.11.1.1 The minimum set of electricity **protections** to be adopted (referring to a single **generator**) shall be made up of the following:

(a) differential **generator** protection (for power **generators** equal to or greater than 10 MVA);

(b) minimum impedance (for power **generators** equal to or greater than 50 MVA);

(c) stator ground;

(d) rotor ground;

(e) under excitation and/or loss of excitation;

(f) maximum voltage;

(g) **active power** directional (for thermoelectric **generators**);

(h) maximum flow (for power **generators** equal to or greater than 50 MVA);

(i) out of step (for power **generators** equal to or greater than 100 MVA);

(j) maximum speed;

(k) maximum temperature of active parts and/or coolant fluid;

(l) step-up or total transformer differential (for power **generators** equal to or greater than 10 MVA);

(m) distance protection on the **HV** or **EHV** sides of the step-up transformer, with a metering area oriented towards the transformer (for power **generators** equal to or greater than 200 MVA);

(n) maximum current on the **HV** or **EHV** side of the step-up transformer (for power **generators** less then 200 MVA);

(o) failure of the **group** circuit breaker to open (for power **generators** equal to or greater than 20 MVA).

Without prejudice to what is specifically provided for in the **Operation Regulations** in relation to particular types of plants, the electricity **protections**

listed herein above shall be valid (with the exceptions indicated) for all **generation groups**, independent of the type and of the **nominal power**.

1B.5.11.1.2 The **protections** for “under excitation and/or loss of excitation”, “maximum voltage”, “active power directional”, “maximum flow” and “out of step” are susceptible to disturbances on the **NTG** (such as faults and electromechanical oscillations) and to **emergency conditions** or **restoration** of the **NTG**. The calibration of such **protections** must, therefore, be agreed upon with the **Operator**.

1B.5.11.1.3 The **protection** for failure of the **group** circuit breaker to open can send an opening command to circuit breakers installed in the **delivery station** or in the nearby station/s via intertripping.

1B.5.11.1.4 The **protection** against internal **faults** must control the block of the **generation group**.

1B.5.11.2 Protection from external faults

1B.5.11.2.1 Each **generator** must be equipped with **protection** able to separate it from the **NTG** in the event of faults on the **NTG** which were not properly cleared. The calibrations of such **protection** must be coordinated with the **NTG** protection and shall be, therefore, established by the **Operator**.

1B.5.11.2.2 The **protection** against external **faults** must be limited to the opening of **HV** or **EHV** machine circuit breakers for the aim of separating the **generator** and the step-up transformer from the **NTG**. Furthermore, they must stay into operation for their own auxiliary services, ready for restoration of the parallel with the **NTG**.

1B.5.11.2.3 The forms of **protection** in question are the following:

(a) distance **protection HV** or **EHV** side of the step-up transformer with three metering areas oriented in the direction of the grid (for power **generators** equal to or greater than 200 MVA);

(b) maximum current with minimum voltage **MV** side (for power **generators** less than 200 MVA);

(c) homopolar maximum voltage relays **HV** or **EHV** side (for **generation groups** whose step-up transformer is operated with isolated neutral);

(d) inverse sequence relay (current imbalance);

(e) maximum and minimum frequency;

(f) busbar **protection**, if present in the **delivery station**.

1B.5.11.2.4 **User** plants that are connected, either directly or through lines, to **delivery stations** equipped with **protection** against failure of the relative circuit breakers to open, must be prepared to receive an opening command to be sorted to its own circuit breakers. In particular, this requirement arises in the instance that the **User plant** is connected to the **delivery station** via a connection with no circuit breakers on the station side.

1B.5.11.2.5 For **generation groups** having a size less than 10 MVA and connected to **grids** with a voltage of 120 -150 kV, methods of disconnection for external **faults** can be agreed upon by the **Operator** and **User** in order to allow for the rapid three-poles reclosing, also in proximity of the **groups** themselves, for the benefit of service continuity. These procedures must be governed by the **Operation Regulations**

1B.5.12 Periodic checks

1B.5.12.1 The **Operator** shall define procedures for checks concerning:

(a) the level and control functions of the **active** and **reactive power** involved in the **grid**;

(b) the automatic disconnection functions of the **generation plants** upon the occurrence of pre-established **grid** conditions;

(c) the execution of **load rejection** actions (see paragraph1B.5.3.4);

(d) the execution of actions provided for during the restoration of the electricity service phase following **interruption** of the service;

(e) the operation of the **protection** apparatus subject to coordination action with the **protection** devices installed on the **NTG**.

The checks in points c) and d) herein above are preparatory to more complex tests of the **power restoration** procedures of the electricity system and must be repeated periodically. They must refer to the functionality of the plants used for the preparation of the **power restoration** procedures, with reference to:

(a) tests of **rejection of load** of thermoelectric **groups**;

(b) tests for disconnection from the **grid** of the first **power restoration plants**, or of simple starting up following planned stoppages with restart-up under **black start up** conditions.

1B.5.12.2 The methods of making resources available and of carrying out tests can be found in the following documents in Appendix A of this chapter:

A.15 “Partecipazione alla regolazione di frequenza e frequenza/potenza”(Participation in the regulation of frequency and frequency/power);

A.18 “Verifica della conformità delle unità di generazione alle prescrizioni tecniche del Gestore” (Verification of compliance of the generation units with the Operator’s technical regulations);

A.19 "Prescrizioni per la verifica delle prestazioni delle unità di produzione per la riaccensione del sistema elettrico" (Regulations for the verification of the services of the production units for the restoration of the electricity system).

1B.5.12.3 Parties involved in the tests in point 1B.5.12.1 must participate and cooperate with the **Operator** for carrying out the tests.

1B. 5.b TECHNICAL REGULATIONS FOR GENERATION PLANTS WHICH ARE INDIRECTLY CONNECTED TO THE NTG

The contents of this paragraph shall be applied to all **power generation plants** which are indirectly connected to the **NTG**. For plants where both generation and consumption take place, the parts of the plant dedicated to generation and indirectly connected to the NTG are defined as "indirectly connected power generation plants"

The indirectly connected **power generation plants** are divided in:

(a) type 1 plants: **production units** connected to the **NTG** through a **grid** portion with nominal voltage equal to or greater than 120 kV (generally a system of busbars);

(b) type 2 plants: relevant **production units**, as defined under Chapter 4 of this Grid Code, connected to the **NTG** through a portion of the **grid** with nominal voltage lower than 120 kV

(c) type 3 plants: non relevant **production units** connected to the **NTG** through a **grid** portion with a voltage lower than 120 kV.

The Technical Regulations for directly connected **power generation plants** shall apply to the type 1 plants (see paragraph 1B.5).

For all three types of plants, the general principle that the **connection** must not cause any deterioration to **NTG** performance shall be valid.

The Technical Regulations relative to the type 2 and 3 plants are indicated in the following paragraphs.

1B. 5 bis.1 Signals and metering transmitted by the plant

1B.5 bis.1.1 The signals and metering which each type 2 **power generation plant** generically must transmit to the **Operator** when requested by the same, are:

(a) reporting the status of disconnectors;

(b) **active power** and **reactive power** measurement in the **delivery point** and separately for each **generation group**.

A detailed list for each **production plant** can be found in the **Operation Regulations**

1B. 5 bis.1.2 Type 3 **generation plants** must provide the **grid operator** with the required information so that the latter can send the **Operator** that which is required by paragraph 1B.6.5.1.1, in accordance with the provisions of Attachment A.70.

1B. 5 bis.2 Grid frequency variation limits

In general, all **power generation plants** and the related machinery and equipment must be planned, built and operated to remain in parallel under **emergency** conditions also.

1B. 5 bis.2.1 Type 2 plants, in regards to the frequency ranges within which the plant itself must stay connected, follow the Technical Regulations that apply to **power generation plants** which are directly connected, referred to in paragraph 1B.5.

1B. 5 bis.2.2 For type 3 plants, the regulations concerning the **grid** frequency variation limits are described in Attachment A.70, according to CEI 0-16 and CEI 0-21 guidelines. The procedures for applying these regulations are contained within the provisions of the **Authority**.

1B. 5 bis.3 Maximum power of the power generation plants

The **grid operator** of the **grid** to which the type 2 and 3 **power generation plants** are directly connected must verify that the overall maximum power (active and reactive) of the plant and those of the single **generation groups** are compatible with the power capacities, the allowed voltage drops and the general **operating** conditions of all the connection lines affected.

1B.5 bis.4 Recovery of electricity service

Indirectly connected type 2 and type 3 **power generation plants** do not participate in the recovery of electricity service belonging to the **Operator**, unless otherwise required by the operator of the **grid** to which they are directly connected.

1B. 5 bis.5 Frequency regulation

1B. 5 bis.5.1 Type 2 plants must contribute to the **primary frequency regulation**, with the exception of those that by their nature do not have regulating capacity (such as, for example, flowing water hydroelectric groups).

The droop level is jointly agreed by the **Operator** and **producer** in a range between 2% and 5%.

1B. 5 bis.5.2 For type 3 plants, the regulations concerning the regulation of grid frequency are described in Attachment A.70, according to CEI 0-16 and CEI 0-21 guidelines. The procedures for applying these regulations are contained within the provisions of the **Authority**.

1B. 5 bis.6 Voltage regulation

1B. 5 bis.6.1 For type 2 groups, participation in voltage regulation, if required by the **Operator**, must follow the Technical Regulations that apply to directly connected **power generation plants** (see Chapter 1B.5). The implementation methods of voltage regulation, that being the operating procedures for exchanging signals and measures, is subject to an agreement between the **producer** and the **grid** to which the type 2 power generation **plant** is directly connected.

1B. 5 bis.6.2 For type 3 groups, participation in voltage regulation, if required by the **Operator**, must follow the regulations described in Attachment A.70 of this Grid Code, according to CEI 0-16 and CEI 0-21 guidelines.

1B. 5 bis.7 Flexibility requirements

1B. 5 bis*.7.1 Procedures for restoration and conditions of start-up and parallel*

1B. 5 bis.7.1.1 For type 2 plants, the procedures for restoration and the start-up and parallel conditions are the subject of the agreement between the **producer** and the **grid operator** of the **grid** to which the type 2 **power generation plant** is directly connected.

1B. 5 bis.7.1.2 For type 3 plants, the procedures for restoration and the start-up and parallel conditions must follow the regulations described in Attachment A.70 of this Grid Code, according to CEI 0-16 and CEI 0-21 guidelines.

1B. 5 bis*.7.2 Load acceptance*

1B. 5 bis.7.2.1 For type 2 plants, the regulations concerning **load** acceptance must follow the Technical Regulations that apply to directly connected **power generation plants** (see Chapter 1B.5).

1B. 5 bis.7.2.2 For type 3 plants, the **Operator** agrees with the **grid operator** of the **grid** to which the plant is directly connected any possible regulations concerning the **load** acceptance of the **groups**; this latter operator guarantees compatibility with the **power generation plant**.

1B. 5 bis*.7.3 Reactive power variation capacity*

1B. 5 bis.7.3.1 For type 2 plants, the regulations concerning the capacity to vary the **reactive power** must follow the Technical Regulations that apply to directly connected **power generation plants** (see Chapter 1B.5).

1B. 5 bis.7.3.2 For type 3 plants, the regulations concerning the capacity to vary the **reactive power** must follow the regulations described in Attachment A.70 of this Grid Code, according to CEI 0-16 and CEI 0-21 guidelines.

1B. 5 bis*.7.4 Operation following external faults*

1B. 5 bis.7.4.1 In the event of **faults** on the **grid** whose plant is directly connected, the rules established by the **grid operator** of said **grid** shall apply. Convenient methods of selective disconnection of the type 2 and 3 plant can be agreed

upon in order to isolate the affected plant and to allow for the rapid three-pole automatic reclosing also in proximity of the plant itself, for the benefit of service continuity.

1B. 5 bis.7.4.2 In the event of (total or partial) blackout on the **NTG**, it is necessary to avoid that the type 2 or type 3 **power generation plant** supplies power, even indirectly, to said **grid**.

1B. 5 bis*.7.5 Capacity to supply isolated portions of the NTG*

The type 2 and 3 **power generation plants** cannot supply isolated portions of the **NTG**. When a **grid** island including **NTG** plants is accidentally created, the entire **power generation plant** must be separated from the **distribution grid** to which it is connected.

1B. 5 bis.8 Information for rapid restoration of service and for reconstruction of outages

For certain special situations, the **Operator** can request information taken from:

(a) chronological event recorders;

(b) **energy disturbance curve oscillographs** (such as, for example, the instantaneous values of the current and voltage, reports on the status of circuit breakers, etc.).

1B. 5 bis.9 Protection of groups

1B. 5 bis.9.1 For type 2 plants, the regulations concerning the **protection** of **groups** must follow the Technical Regulations that apply to directly connected **power generation plants** (see Chapter 1B.5).

1B. 5 bis.9.2 For type 3 plants, the regulations concerning the **protection** of **groups** must follow the regulations described in Attachment A.70 of this Grid Code, according to CEI 0-16 and CEI 0-21 guidelines.

1B. 5 bis.10 Verifications

The indications in paragraph 1B.5.12 apply.

1B. 5 bis.11 Procedures guaranteeing the safety of the electricity system

For type 3 plants, the **Operator**, for reasons concerning **National Electricity System** security, may ask for a reduction in the distributed generation (DG) connected to **medium voltage** (**MV**) electrical **grids**, in accordance with the methods specified in Attachment A.72 "Procedura per la Riduzione della Generazione Distribuita in condizione di emergenza del Sistema elettrico Nazionale (RIGEDI)" (Procedure for the Reduction of Distributed Generation in state of emergency of the National Electricity System - RIGEDI) under Appendix A of this chapter.

1B.6 DIRECTLY CONNECTED GRIDS WITH THIRD PARTY CONNECTION OBLIGATIONS

1B.6.0.1 The regulations in this paragraph are applied to all **grids with third party connection obligation** directly connected to the **NTG** through simple or multiple (multi-site) **connections**.

Following are descriptions of the criteria and procedures for the coordinated management of the **NTG** with **grids having third party connection**

obligations in order to guarantee adequate levels of **grid interoperability** as well as to guarantee the safety of the operation of the **national electricity system**.

The direct **connection** of plants of this type of **grid** takes place, as a rule, through 150-132 kV lines and 220 kV/**MV** or 150-132 kV/ **MV** direct transformers or HV/HV transformers

Considering the configuration of the **NTG** at 150 and 132 kV, there is a great need for interoperability between the **NTG** and the **grids with third party connection obligations**.

For this reason:

(a) distribution electrical islands of 132 and 150 kV must be monitored from the **Operator's control system**, as indicated in document A.6 "Criteri di telecontrollo e acquisizione dati" (Criteria for telecontrol and data acquisition) in Appendix A of this chapter and in accordance with the characteristics of transmission systems specified in attachment A.13 "Criteri di connessione al sistema di controllo" (Criteria for connection to Terna's control system);

(b) the **protections** in the segments composing the island must be strictly coordinated with those present in the **NTG**, in accordance with the provisions of document A.4 "Criteri generali di protezione delle reti a tensione uguale o superiore a 120 kV" (General grid protection criteria for grids having a voltage equal to or greater than 120 kV) and in document A.11 "Criteri generali per la taratura delle protezioni delle reti a tensione uguale o superiore a 120 kV" (General criteria for the calibration of the protections of grids with a voltage equal to or greater than 120 kV).

For the **stations** and electricity lines which make up a part of the **grid with third party connection obligations** and which are directly connected to **NTG** plants, the **operator of the grid with third party connection obligations** must adopt the technical rules for **connection** vis-à-vis third parties which do not contrast with those adopted by the **Operator** for **plants directly connected to the NTG**.

1B.6.1 Voltage characteristics

1B.6.1.1 On the **HV** and **EHV** grid **the operator of the grid with third party connection obligations** must limit the disturbances generated by its own users with the same regulations and limitations adopted by the **Operator** for the **NTG** of equal voltage.

1B.6.2 Load disconnection

1B.6.2.1 **Loads** supplied by the **distribution grids** are integrated in the **defence plan** drawn-up by the **Operator**. In this scope, load reduction is carried out:

(a) with devices installed in the **power stations** of the **distribution grid** (local method);

(b) with central devices of the **Operator** (remote disconnection), which act on the circuit breakers of the **distribution grids**, either directly or indirectly, via the **control system** of the **grid operator with third part connection obligations**;

(c) with devices installed in **consumption units** plants which are indirectly connected to the **NTG** and controlled by the **Operator's** centralised system.

Local load reduction is done, in view of frequency variations, in such a way as to ensure that the minimum **load** (in MW) necessary to restore the nominal frequency, is selectively disconnected.

To this end, load reduction devices sensitive to frequency and/or its derivatives should be installed in the **grids with third party connection obligations** upon request of the **Operator** and at the care of the respective operators, in compliance with Attachments A.12 “Criteri di taratura dei relè di frequenza del sistema elettrico” (Criteria for the calibration of frequency relays of the electricity system) and A.53 “Caratteristiche tecniche e funzionali degli apparati equilibratori di carico” (Technical and functional characteristics of the load balancing equipment).

1B.6.2.2 The **operator of the grid with third party access** is responsible for the **maintenance** of said devices and must report any substantial variation of **loads** to be disconnected.

1B.6.2.3 For load reduction carried out with central devices, the rules at paragraphs 1B.4.8.1 and 1B.4.8.3 shall be applied.

1B.6.2.4 In the event that current violations were found on **NTG** connections subsequent to events on the **NTG**, specific emergency procedures will be agreed to reduce the **load** withdrawal by the **User** with third party connection obligations, which will be manually carried out by the **User**

1B.6.2.3 Disconnection of the DG

The **Operator**, for reasons concerning **National Electricity System** security, may ask the **grid operato**r to

the reduction in the distributed generation (DG) connected to **MV** electrical **grids**, in accordance with the methods specified in Attachment A.72

"Procedura per la Riduzione della Generazione Distribuita in condizione di emergenza del Sistema elettrico Nazionale (RIGEDI)" (Procedure for the Reduction of Distributed Generation in state of emergency of the National Electricity System - RIGEDI) under Appendix A of this chapter

1B.6.3 Procedures for restoration and recovery of power

With respect to arranging the plants following extensive outages, the **grids with third party connection obligations** shall participate in the **restoration** procedures as established by the **Operator** in Chapters 4 and 10 of this Grid Code.

1B.6.4 Devices for the production or absorption of reactive power

1B.6.4.1 In order to limit **reactive power** transits towards the **connection sites**, the **Operator** may request the use, in the **grids with third party connection obligations,** of means for compensation of the **reactive power**(for example, power factor correction capacitors), arranging for their most efficient location and the schedule for their connection/disconnection times.

1B.6.4.2 Voltage regulation carried out through the variation of the transformation ratio of the **EHV/MV** or **HV/MV** transformers must be coordinated with the **Operator's** action. The **Operator** has the right of requesting service controls on the on-load tap changer of the transformers in the case of operating conditions close to voltage collapse.

1B.6.4.3 For voltage quality purposes and for the minimization of grid losses, the **Operator** may oblige the **operators of grids with third party connection obligations** power factors in exchange points.

1B.6.4.4 In order to control voltage, the **Operator** can request that **operators of grids with third party connection obligations** implement systems to regulate

secondary voltage, under their own responsibility, also making use of **plants which are indirectly connected** to the **NTG** for their own **grid**.

1B.6.5 Signals and metering transmitted by the User

To ensure the interoperability between the **NTG** and the **grids with third party connection obligations**, the **operator of the grid with third party connection obligations**, for all the plants within its competence, must remotely transmit to the **Operator** the type of the signals and readings listed in the following paragraphs.

A detailed list for each **grid** can be found in the **Operation Regulations**.

1B.6.5.1 Signals and metering for ordinary NTG operation

1B.6.5.1.1 For the ordinary **operation** of the **NTG,** the following signals and readings must be provided for:

(a) reporting the status of disconnectors;

(b) voltage readings;

(c) if requested by the **Operator**, **active power** and **reactive** power readings.

Active power and **reactive power** readings, if requested, shall be provided separately for each component of the plant.

For the economic regulation of energy metering, please see Chapter 7 of this Grid Code.

The **operator of grids with third party connection obligations**, to which type 3 **power generation plants** are connected, referred to in paragraph 1B.5.bis, will send the **Operator**, when so requested, the signals and metering

of **active power** and **reactive power**, aggregated according to the various types of generation, corresponding to the **connection point**.

1B.6.5.2 Information for the rapid restoration of service and for reconstruction of outages

1B.6.5.2.1 For reconstructing outages, the **grid operator** must make available to the **Operator**:

(a) All useful information required for the reconstruction of outages, including the comprehensive protocol outside of the **Operator's** perimeter of observability, if so requested;

(b) the registrations taken from the **Energy disturbance curve oscillographs** (relating, for example, to the instantaneous current and voltage values, logic signals relating to the operation of the **protection** systems);

(c) the chronological recordings of events;

(d) local signals.

Said information must be synchronized through GPS signals or an equivalent system.

1B.6.6 Small isolated grids

1B.6.6.1 For the **small isolated grids**, the **Operator** shall establish the criteria, when necessary, for a safe and reliable **connection** with the **NTG**, taking into consideration the provisions of article 1, paragraph 43 of Law no. 239/2004.

1B.6.7 Interoperability and development of the grids

1B.6.7.1 In order to attain adequate levels of interoperability between the **NTG** and **grids with third party connection obligations**, it is necessary to coordinate the **management**, **operation**, **maintenance** and **development** of the **grids** in question with the **NTG**.

1B.6.7.2 The **service contracts** are stipulated between the **Operator** and the interested parties to regulate the relationships concerning the running, the **operation**, the **maintenance** and the **development** of the **power stations** which do not belong to the **NTG** but are accessory to it.

1B.6.7.3 The **operation** of the **power stations** accessory to the **NTG** is the responsibility of the respective owners. Structure and organization must be provided which will ensure the completion of the functions assigned on a continuous basis (24 hours a day) and with adequate intervention times.

The **operation** includes the continuous supervision of the state of the plants, the execution of the **controls** (ordinary, emergency, putting into safety) remotely or locally, automatically or manually and emergency services.

The owners of the **stations** in question guarantee the operational state of the plants within the performance limits and are responsible for the **maintenance** and safety of people and property.

The running of the **electricity stations** is coordinated by the **Operator** with the control of the **national electricity system** through adequate informative flow from and towards the telecontrol centres and, exceptionally, from and towards the plants.

1B.6.7.4 For ordinary and extraordinary **maintenance** and for every other intervention concerning the **NTG**, the **Operator** shall coordinate the **unavailability** of all the parties affected, taking into the utmost consideration the aspects linked to

the safety of the transmission, as indicated in detail in Chapter 3 of this Grid Code.

In the event of extraordinary service measures which involve adopting temporary **grid diagrams** (bypass of connection, T-connection, etc.) for the periods of time strictly necessary, the **Operator** may temporarily depart from the levels of safety typical of a **normal situation** according to the provisions in the following section 1B.12.

Similar limitations may be necessary also during ordinary **maintenance** in **grid** portions not adequately meshed.

1B.6.7.5 As far as the **development** of the **grid with third party connection obligations** is concerned, the relative **grid operators** shall notify the **Operator** of all the planned modifications concerning **grids** with voltage between 120 and 220 kV. The **Operator** shall evaluate the proposed plans in order to attain adequate levels of interoperability.

1B.6.8 Limited portions of the NTG

The limited portions of the **NTG** given to third parties to manage must be in compliance with the criteria set out in section1B.3 for the **NTG** in general.

1B.6.9 Grids belonging to Ferrovie dello Stato

The stations of Ferrovie dello Stato (Italian State Railways) or its assignees, which connect its own **grids** to the **NTG** must be in compliance with the **Technical Rules for connection**, pursuant to article 3, paragraph 4 of Ministerial Decree dated 25 June 1999.

Considering the configuration of the **NTG** at 150 and 132 kV there are significant demands of interoperability between the same **grids**.

For this reason:

(a) the 132 and 150 kV islands should be monitored from the **Operator**'s **control system**, according to what has been set forth in document A.6 "Criteri di telecontrollo e acquisizione dati" (Criteria for telecontrol and data acquisition), under Appendix A of this chapter;

(b) the **protections** must be coordinated;

(c) the **maintenance** must be coordinated.

For the **connection** of **power generation plants** to **NTG** lines, the **operator of the grid** in question must adopt the **connection** rules consistent with those adopted by the **Operator**.

Power generation plants connected to the **grids** of Ferrovie dello Stato must adopt **protection** criteria and regulations similar to those established for **plants which are directly connected to the NTG**.

Operation Regulations are associated to the connection points between the **HV grids** of the **Operator** and those of Ferrovie dello Stato, which were agreed upon by the parties and establish the conditions of **grid interoperability**, operational responsibilities and competences, methods of **operation** and **maintenance**, plant access and the protection structure.

1B.6.9.1 Load disconnection

1B.6.9.1.1 The **loads** powered by **grids** belonging to Ferrovie dello Stato (or its assignees) are integrated into the **Defence Plan** drawn up by the **Operator**.

Within the scope of the **Defence Plan**, load reduction in the **national electricity system** is carried out with widespread methods such as to ensure

that the minimum **load** necessary is selectively reduced in order to re-establish nominal frequency.

1B.6.9.2 Procedure for restoration and recovery of power

With respect to the arrangement of the plants following extensive **outages**, the **internal utility grids** of Ferrovie dello Stato (or its assignees) shall take part in the **restoration** procedure as established by the **Operator**.

1B.6.9.3 Devices for the production or absorption of reactive power

For purposes of regulating voltage in the **connection sites**, the **Operator** may request that means for compensation of the **reactive power** be used (for example, power factor correction condensers), arranging for their most efficient location and the connection/disconnection times.

1B.6.9.4 Signals and metering transmitted by the User

1B.6.9.4.1 In order to allow interoperability with the **NTG**, the operator of the grids in question shall forward to the **Operator** the signals and the readings generically listed herein below.

The detailed list is established in the **Operation Regulations** stipulated between the **Operator** and Ferrovie dello Stato, for each **connection site**.

(a) *Signals and metering for ordinary operation of the NTG*

(i) reporting status of disconnectors;

(ii) voltage readings;

(iii) if requested by the **Operator**, **active power** and **reactive power** readings.

Active power and **reactive** power readings, if requested, shall be provided separately for each component of the plant (line, transformer, etc.).

(b) Information for the rapid restoration of service and for reconstruction of outages

In some particularly important stations, which depend on the **NTG**, information concerning said lines is taken from:

(i) chronological event recorders;

(ii) **energy disturbance curve oscillographs** (instantaneous values of current and voltage, signals of position of interrupters or other).

Said information must be synchronized through GPS signals or an equivalent system.

1B.7 TECHNICAL REGULATIONS FOR CONNECTION OF PLANTS CORRESPONDING TO CONSUMPTION UNITS

1B.7.0.1 The regulations in this paragraph shall be applied to all plants corresponding to **consumption units** directly connected to the **NTG**, with simple or multiple (multi-site) **connections**, including the plant **loads** where both generation and electricity consumption take place.

1B.7.1 Voltage characteristics

1B.7.1.1 The maximum disturbance emission quotas granted to a single **User** connected to the **NTG** or who intends to make significant modifications to an already connected plant, shall be set keeping in mind the planning values adopted, the emissions of other **Users** already connected to the same **grid**, the emissions transferred from the rest of the **grid**, and the future emissions of new **Users** who have already begun the **connection application** process.

In the portions of the **grid** where planning limits have already been exceeded, no connections of new disturbing **Users** shall be allowed without action being taken to bring the values back within limits.

1B.7.1.2 In order to evaluate the impact of the new **User** on the **NTG**, the following data are necessary:

(a) the technical data of the **connection User plant**;

(b) the characteristics of the **grid** parameters at the connection **node**;

(c) the **User** emission limits typical of the plant in relation to the size declared by the **User**;

(d) the emissions of the **User** plant, evaluated by the **Operator** presuming the plant itself is already connected and taking into consideration the pre-existing disturbance.

1B.7.1.3 In evaluating the emission limits of the **User** plant, the following alternatives can be verified:

(a) the emissions of the plant do not exceed the projected values: the plant can be connected;

(b) the emissions of the plant exceed the projected limits: the **connection** is conditioned on an additional compensation such as to return within the projected limits and in any case not greater than 70%.

1B.7.1.4 The plant of the **User** must guarantee withdrawal with an inductive power factor between 0.9 and 1. Withdrawal is not allowed with a leading power factor. The **Operator** can request that the **User** reduce any power factor correction device installed.

1B.7.2 Load disconnection devices

1B.7.2.1 Load reduction is carried out:

(a) with devices installed in the plant;

(b) with the **Operator's** central devices (remote disconnection).

Local load reduction is done, in view of frequency variations, in such a way as to ensure that the minimum **load** (in MW) necessary to restore the nominal frequency, is selectively disconnected. To this end, upon the **Operator's** request, load reduction devices that are sensitive to the frequency and/or its derivatives should be installed.

1B.7.2.2 The **User** is responsible for the **maintenance** of the devices in question.

1B.7.2.3 For load reduction carried out with central devices, the rules at paragraphs 1B.4.8.1 and 1B.4.8.3 shall be applied.

1B.7.2.4 The position and mode of intervention of load reduction devices are set out in the **Operation Regulations**.

1B.7.2.5 In the case the user has stipulated a contract for regulating the **interruptible load service** with the **Operator**, the same has the right of carrying out at any

time at the **User plant** inspections, tests and verifications in order to ascertain the requirements for the **interruptible load service**.

1B.7.3 Signals and metering transmitted by the User

1B.7.3.0.1 The **User** must forward to the **Operator** the types of the signals and measurements listed in this paragraph limited to the **connection point**.

A detailed list for each **User** shall be established in the **Operation Regulations**.

1B.7.3.1 Signals and metering for ordinary NTG operation

1B.7.3.1.1 The following must be provided for:

(a) reporting the positions of control devices;

(b) voltage readings;

(c) if requested by the **Operator**, **active power** and **reactive** power readings.

Active power and **reactive power** readings shall be provided separately for each component of the plant.

1B.7.3.1.2 For the economic regulation of the energy metering, please refer to Chapter 7 of this Grid Code.

1B.7.3.2 Information for the rapid restoration of service and for reconstruction of outages

1B.7.3.2.1 Upon the **Operator's** request, with reference to the **NTG** connection lines, Users must supply, if available, information taken from:

(a) chronological event recorders;

(b) fault locators;

(c) energy disturbance curve oscillographs;

(d) local signals.

Said information must be synchronized through GPS signals or an equivalent system.

1B.7.4 Devices for the production or absorption of reactive power

1B.7.4.1 The Operator may request the employment of compensation means of the reactive power (such as, for example, power factor correction capacitors or reactors) conveniently located, and the related injection programs.

1B.8 TECHNICAL REGULATIONS FOR PLANTS CORRESPONDING TO GRIDS OTHER THAN GRIDS WITH THIRD PARTY CONNECTION OBLIGATIONS

The regulations in this paragraph shall be applied to all of the simple or multiple (multi-site) interconnection circuits of the **NTG with other electricity grids**.

The interconnection of the **NTG** with **other electricity grids** must not give rise to any kind of deterioration of the services or the reliability of the **NTG** itself.

In the **connection sites** the same obligations to which the **NTG** is subject to must be respected concerning:

(a) the maximum allowable level of **total harmonic distortion** in input in the **NTG**;

(b) the maximum **degree of dissymmetry** allowed for the tri-phase **voltage** in input in the **NTG**;

(c) the maximum value allowed for the voltage flicker severity ratio;

(d) the level of overvoltage withstand and the criteria for coordination of insulation;

(e) the expected annual number of **power sags** originating in the **grids** of one's own competence.

The respect of these obligations may temporarily not be guaranteed if **emergency conditions do not** exist for the directly connected **grid**.

1B.8.1 Interconnection lines with foreign countries

1B.8.1.1 The **connection** to the **NTG** of the interconnection circuits with foreign electricity **grids** is established in agreement with the relevant **grid operators**, in particular, taking account of the rules and recommendations from **ENTSO-E** *(European Network of Transmission System Operators for Electricity)*:

1B.8.1.2 To each interconnection circuit is associated an **Operation Regulations**, agreed upon with the foreign **grid operators** who establish **grids interoperability** conditions, protection structures and methods of **operation** and **maintenance**.

Any operation which involves changes to the **Operation Regulations** of the interconnection circuits must be agreed upon between the **Operator** and the foreign **grid operators**.

1B.8.1.3 The **Operator** manages the exchange of **active and reactive power** in the connections in **N-1 security** and in such a way as to ensure the safety of the **national electricity system**, also enacting a **grid Defence Plan** in the event of more serious **grid outages**.

The **Operator** establishes, within the scope of the recommendations and the rules issued by **ENTSO-E**, the **Total Transfer Capacity** (TTC), the **Transmission Reliability Margin** (TRM) and the **Net Transfer Capacity** (NTC).

1B.8.1.4 The **Operator** and the foreign **grid operators** must exchange in advance all the information which could have repercussions on the transit of power between the respective transmission **grids**.

To this end, the **Operator** and the foreign **grid operators** define together, and based on the rules issued by ENTSO-E, a “region of influence” for each interconnection line, i.e. a part of the respective electricity systems which has a direct impact on the interconnection line itself.

1B.8.1.5 For each region of influence the **Operator** and the foreign **grid operators** shall exchange all the information necessary for the **management**, **maintenance** and **development** of the **grids**. Such information shall concern at least the following aspects:

(a) **grid** characteristics and equivalents;

(b) **operation** diagrams;

(c) **maintenance** plans;

(d) characteristics of the **protection** and control systems;

(e) implementation methods of voltage and frequency regulation;

(f) necessary data for the static and dynamic analysis of the **grids**;

(g) implementation methods of the restoration and **Defence Plan**.

1B.8.1.6 For **merchant lines** in direct current, the regulations of the reference document A.59 “Requisiti e caratteristiche di riferimento dei sistemi di trasmissione in corrente continua (HVDC)” (Requirements and reference characteristics of DC transmission systems (HVDC) under Appendix A of this chapter will be applied.

1B.8.2 Other grids directly connected to the NTG

The regulations in paragraphs 1B.4 and 1B.6.9 apply to other **grids** that are not **grids with third party connection obligations**.

1B.8.3. *Grids not directly connected to the NTG*

1B.8.3.1 The **grids** not directly connected to the **NTG** must be planned and operated in such a way as to ensure they do not cause, even indirectly, any deterioration in the performance of the **NTG** (under any operational conditions) or in the safety of the electricity service in general.

For this reason, the **management**, **operation** and **maintenance** procedures adopted in the **grids** involved must be coordinated with the Technical Regulations adopted by the **Operator** to whom the coordination activities have been entrusted.

1B.8.3.2 In particular, for the grids with third party connection obligations not directly connected (for control purposes in **emergency situations** of the **national electricity system**) and the restoration procedures, the indications in section 1B.6 shall apply.

1B.9 FUNCTIONAL SEPARATION OF TRANSMISSION ACTIVITIES FROM OTHER ELECTRICITY ACTIVITIES

1B.9.1 The location of the parts of the **User plant** that are important to transmission activities is, principally speaking, independent from the position of the points of functional separation under section 1B.4.2.

The following are defined as important to the **transmission activity**:

(a) all circuit breakers, disconnectors and busbar systems which, in relation to the **connection** service, are necessary for setting the **NTG**, or to guaranteeing the continuity, the meshing and the flexibility of **managing** the **NTG**;

(b) all **protection** systems, **intertripping**, and automatic opening systems which act on the circuit breakers under the foregoing letter (a) , as well as the regulation devices (of voltage and frequency) which guarantee the safety of persons and property and the operative **connection** of the **User plant** in the allowed operating conditions;

(c) monitoring, metering, and telecommunication equipment which guarantee the flow of information between the **Operator** and the **User**, with the exception of those concerning energy metering where regulations not included in these Technical Regulations apply.

1B.9.2 The relationship between the **Operator** and **User** is governed by the **service contracts** of which the **Operation Regulations** is an integral part.

The general criteria are as follows:

(a) the **operation**, and in particular the management, of the parts under letter (a) of the previous paragraph must be carried out by implementing the

Operator's orders, who determines the **grid** configuration by monitoring the control devices. Prompt interventions and making the plant safe must be assured in the shortest possible period of time;

(b) the **operation** of the parts according to the previous paragraph 1B.9.1 letter (b) must include the implementation, and the relative confirmation, of the calibration of the **protections** calculated by the **Operator**. In the event of malfunction, the restoration to full operation must take place in the shortest possible period of time, taking into consideration that the **unavailability** of the **protections** involves the opening of the connection;

(c) the **operation** of the parts according to the previous paragraph1B.9.1 letter (c) must ensure the same **User** performance that is ensured by the equipment described in letter (b), keeping in mind, however, the lower criticality of the parts of the plant in question with respect to the **protection** and control systems;

(d) the **development** of the parts under points (a), (b) and (c) of the previous paragraph must be harmonized with the **development** of the **NTG** and, therefore, must be agreed upon with the **Operator**, who reserves the right to request more suitable action;

(e) the **maintenance** of the parts under points (a), (b) and (c) of the previous paragraph must be coordinated with the **grid unavailability** and notified to the **Operator**, according to the procedures set out in Chapter 3 of this Grid Code.

1B.9.3 The functional separation of the **transmission activities** from the other electricity activities must, moreover, allow for:

(a) simplicity in the relations between the **Operator** and the others operating the plants in the **connection site**;

(b) the clear identification of responsibility concerning the operation and **maintenance** of every single device;

(c) the safety of persons and property in the **connection site**.

In particular, as regards the circuit continuity, the flexibility of the management of the **NTG** and the maintenance of the operative **connection**, the control devices which functionally make up a part of the **NTG** must be remotely or locally controlled by operative personnel on a 24 hour basis, 365 days a year.

1B.10 VIOLATIONS TO TECHNICAL REGULATIONS FOR CONNECTION

1B.10.1 Violations

1B.12.1.1 The **Operator** verifies, on the basis of the data and the information in its possession as self-certified by the **Users** pursuant to the President of the Republic's Decree no.445/2000, that the Technical Regulations have been complied with and identifies any violations committed by the **Users** directly and indirectly connected with the methods provided for in Chapter 14, section 14.4 of this Grid Code.

1B.10.1.2 In relation to the consequences for violating one or more of the Technical Regulations, it is possible to identify two different categories of violations:

Very serious violations

Following are examples, though not exhaustive, of very serious violations:

(i) failure on the part of the **NTG Users** to respect the Technical Regulations or the rules governing safety in the use of devices, equipment, or plants when this can cause serious damage or

danger of damage to plants, persons, property, animals or the environment;

(ii) unjustified refusal on the part of the **Users** to allow checks and inspections provided for in the Technical Regulations, or obstruction on the part of said **Users** for carrying out said checks and inspections;

(iii) unjustified refusal on the part of the **Operator** to grant access to the **NTG** to new **Users**;

(iv) unjustified interruption or suspension on the part of the **Operator** of the withdrawal or the supply of electricity to a **User**.

B) *Serious violations*

Following are examples, though not exhaustive, of serious violations:

(i) failure on the part of the **Users** of the NTG to respect the Technical Regulations or the rules governing safety in the use of devices, equipment, or plants when this does not cause serious damage or danger of damage to plants, persons, property, animals;

(ii) unjustified refusal on the part of the **Users** to provide the **Operator** with the necessary information or clarifications concerning conduct not in compliance with the regulations included in the Technical Regulations;

(iii) unjustified delays on the part of the **Operator** to provide the services requested by the new **Users**.

To contest the violations the procedure described in Chapter 14, paragraph14.4.2 of this Grid Code shall apply.

APPENDIX

A REFERENCE DOCUMENTATION

For the implementation of the provisions in this chapter, herein below is a list of the reference documents which represent attachments to the Grid Code.

A.1 “Criteri per il coordinamento degli isolamenti nelle reti a tensione uguale o superiore a 120 kV” (Criteria for the coordination of isolations in the grid having a voltage equal to or greater than 120 kV);

A.2 “Guida agli schemi di connessione” (Guide to connection schemes);

A.3 “Requisiti e caratteristiche di riferimento di stazioni e linee elettriche della RTN” (Requirements and reference characteristics of the NTG power electric stations and lines);

A.4 “Criteri generali di protezione delle reti a tensione uguale o superiore a 120 kV” (General grid protection criteria for grids having a voltage equal to or greater than 120 kV);

A.5 “Criteri di automazione delle stazioni a tensione uguale o superiore a 120 kV” (Criteria for the automation of stations having a voltage equal to or greater than 120 kV);

A.6 “Criteri di telecontrollo e acquisizione dati” (Criteria for telecontrol and data acquisition);

A.7 “Specifica funzionale per sistemi di monitoraggio delle reti elettriche a tensione uguale o superiore a 120 kV” (Operational specification for monitoring systems for electric grids with a voltage equal to or greater than 120 kV);

A.8 “Correnti di corto circuito e tempo di eliminazione dei guasti negli impianti delle reti a tensione uguale o superiore a 120 kV” (Short circuit currents and clearance times for faults in plants of grids with a voltage equal to or greater than 120 kV);

A.9 “Piano di Difesa del sistema elettrico” (Defence Plan for the electricity system);

A.10 “Piano di Riaccensione del sistema elettrico nazionale” (Restoration Plan for the national electricity system);

A.11 “Criteri generali per la taratura delle protezioni delle reti a tensione uguale o superiore a 120 kV” (General criteria for the calibration of the protections of grids with a voltage equal to or greater than 120 kV);

A.12 “Criteri di taratura dei relè di frequenza del sistema elettrico” (Criteria for the calibration of frequency relays of the electricity system);

A.13 “Criteri di connessione al sistema di controllo di Terna” (Criteria for connection to Terna’s control system);

A.14 “Partecipazione alla regolazione di tensione” (Participation in voltage regulation);

A.15 “Partecipazione alla regolazione di frequenza e frequenza/potenza” (Participation in the regulation of frequency and frequency/power);

A.16 “Sistema automatico per la regolazione della tensione (SART) per centrali elettriche di produzione” (Automatic system for the regulation of voltage (SART) for electricity production plants);

A.17 “Sistemi di controllo e protezione delle centrali eoliche” (Systems of control and protection of wind power stations);

A.18 “Verifica della conformità delle unità di generazione alle prescrizioni tecniche del Gestore” (Verification of compliance of the generation units with the Operator’s technical regulations);

A.19 “Prescrizioni per la verifica delle prestazioni delle unità di produzione per la riaccensione del sistema elettrico” (Regulations for the verification of the services of the production units for the restoration of the electricity system);

A.40 “Prescrizioni tecniche integrative per la connessione al Banco Manovra Interrompibili” (Integrative technical prescriptions for connection to the Interruptible Control Desk)

A.41 “Unità periferica distacco carichi. Guida alla realizzazione” (Peripheral unit load disconnection. Implementation Guide)

A.42 “Unità periferica distacco carichi. Profilo del Protocollo IEC 870-5-104” (Peripheral unit load disconnection. Profile of IEC 870-5-104 protocol)

A.52 “Unità periferica dei sistemi di difesa e monitoraggio. Specifiche funzionali e di comunicazione” (Peripheral units of the defence and monitoring system. Functional and communication specifications)

A.53 “Caratteristiche tecniche e funzionali degli apparati equilibratori di carico” (Technical and functional characteristics of the load balancing equipment)

A.57 “Schema di contratto tipo per la connessione alla rete di trasmissione nazionale” (Standard contract for the connection to the National Transmission Grid);

A.59 “Requisiti e caratteristiche di riferimento dei sistemi di trasmissione in corrente continua (HVDC)” (Requirements and reference characteristics of DC transmission systems (HVDC)).

A.64 "Modalità di utilizzo del teledistacco applicato ad impianti di produzione da fonte eolica" (Conditions for the use of remote load shedding applied to wind production plants)

A.65 "Dati tecnici dei gruppi di generazione" (Technical data of the generator groups)

A.68 "Impianti di produzione fotovoltaici. Requisiti minimi per la connessione e l'esercizio in parallelo con la rete AT" (Photovoltaic production plants: minimum requirements for the connection and the operation in parallel to the HV grid)

A.69 "Criteri di connessione degli impianti di produzione al sistema di difesa di Terna" (Criteria for the connection of production plants to the defence system of Terna)

A.70 "Regolazione tecnica dei requisiti di sistema della generazione distribuita" (Technical Rules for the system requirements related to distributed generation)

A.72 "Procedura per la Riduzione della Generazione Distribuita in condizione di emergenza del Sistema elettrico Nazionale – RIGEDI" (Procedure for the Reduction of Distributed Generation in state of emergency of the National Electricity System - RIGEDI)