Material Specification code: GRI-GRI-MAT-NE&D-0010

Version no. 2 dated 17/05/2024

Subject: GSSM001 – Polyphase and Monophase Smart Meter for direct and indirect connection on LV networks

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids and Innovability*

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THE HEAD OF GLOBAL NETWORK DEVICES
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1. DOCUMENT AIMS AND APPLICATION AREA

This document describes the requirements for the purchase monophase or multiphase energy meter for billing with direct and indirect connection, in accordance with ANEEL Normative Resolutions, ABNT Technical Documents and INMETRO Metrological Technical Regulations, which regulate the electrical energy measurement system of Group B consumer units.

This document applies to Enel Grids Brazil.

This policy applies to the Enel Group with the respect to its operations in Brazil, in accordance with applicable laws, regulations, collective agreements and governance standards, including the General Data Protection Law, which in any situation take precedence over the provisions contained in this document.

The General Data Protection Act, Law No. 13,709/2018 (LGPD) regulate the processing of personal data. The LGPD defines that treatment is any operation carried out with personal data, such as those related to collection, production, reception, classification, use, access, reproduction, transmission, distribution, processing, filing, storage, deletion, evaluation or control of information, modification, communication, transfer, dissemination or extraction, as well as that Personal Data is all information related to a natural person (physical person), which can make it identified or identifiable (such as: name, CPF, address, name of family members, consumption profile, geolocation, Consumer Unit number, etc. , which in isolation, or associated with two or more, may directly or indirectly identify a data subject).

The Processing of Personal Data carried out during the activities described in this document, must be duly mapped in the Enel Group personal data processing registry system, according to the Operational Instruction n. 3341 - Management of Personal Data Processing Registry and must take place in line with the rules of Personal Data Protection, SDG and Information Security of the Enel Group, established in the respective internal Policies and Procedures, listed in section 4 of this document.

This document shall be implemented and applied to the extent possible within the Enel Grids Business Line and in compliance with any applicable laws, regulations and governance rules, including any stock exchange and unbundling-relevant provisions, which in any case prevail over the provisions contained in this document.

1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

This document doesn’t require implementation of further documents.

Anyway, each Enel Grids Company can issue, under the supervision of Enel Grids and Innovability Global Network Devices a detailed documents, according to the provisions of the present document and in case of specific needs.

2. DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
1	14/04/2023	First issuing of "Polyphase Smart meter for direct connection" Material Specification
2	17/05/2024	Inclusion of a single-phase meter with direct connection and a polyphase meter with indirect connection. It Replaces the Material Specification no. GRI-GRI-MAT-E&C-0040 of the same object.

3. UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

- Enel Grids and Innovability: Network Engineering and Development / Engineering Components and Devices / Network Devices unit.

Responsible for authorizing the document:

- Enel Grids and Innovability: Head of Network Devices unit;
- Enel Grids and Innovability: Operational Excellence and Processes Quality unit.

4. REFERENCES

- Integrated Policy for Quality, Health and Safety, Environment, anti-Bribery and Information security;
- ISO 9001- Quality Management System – Requirements;
- ISO 14001 - Environmental Management System - Requirements with guidance for use;
- ISO 45001 - Occupational Health and Safety Management System - Requirements with guidance for use;
- ISO 37001 - Anti-bribery Management System - Requirements with guidance for use;
- ISO 27001 - Information Security Management System – Requirements;
- Policy n.344 - Application of Privacy Regulation within the scope of the Enel Group;

- Organizational Procedure 375 Gestão de Informação Documentada;
- Organizational Procedure n.1626 -; Aplicação da Lei Geral de Proteção de Dados Pessoais no âmbito das Empresas do Grupo Enel;
- Policy n.33 - Information Classification and Protection;
- Policy n.347 - Policy Personal Data Breach Management;
- Operational Instruction 3341 - Gerenciamento de Registro de Tratamento de Dados Pessoais;
- Operational Instruction 3340 - Metodologia para o processo de Avaliação de Impacto na Proteção de Dados;
- Policy n.241 - Gestão de Crises e Incidentes Brasil;
- Policy n.25 - Management of Logical Access to IT Systems;
- Policy n.37 - Enel Mobile Applications;
- NBR 14519: Electronic electrical energy meters;
- NBR 14520: Electricity electronic meters;
- NBR IEC 60529: Protection degrees provided by enclosures (IP codes);
- NBR 5426: Sampling plans and inspection procedures by attributes;
- INMETRO. INMETRO Ordinance No. 586/2012;
- INMETRO. INMETRO Ordinance No. 587/2012;
- INMETRO. INMETRO Ordinance No. 520/2014;
- INMETRO. INMETRO Ordinance No. 095/2015;
- INMETRO. INMETRO Ordinance No. 221/2022;
- ANEEL Resolution No. 1000/2021 - General Conditions for Electricity Supply;
- PRODIST. Module 5 - Metering Systems and Reading Procedures;
- NIE-DIMEL-123 - Sealing marks.
- GSSMC001: Tests and Test conditions of Static Meters;
- GSSMC002: Qualification and reliability tests for meters production process validation;
- GSSM001A: Packing, barcodes and key writing station requirements for Polyphase meters for direct connection supply

Notes:

1) The supplier must make available, for the Enel inspector, at the site of the inspection, all the abovementioned Standards, in their latest revisions.

2) The International System of Units (Metric System) must be used for any and all supplies to be carried out.

Group Pillar References:

- The Code of Ethics of Enel Group;
- The Enel Group Zero Corruption Tolerance Plan (ZTC);
- Human Rights Policy;
- Organization and Management Model as per Legislative Decree No. 231/2001;
- Enel Global Compliance Program (EGCP).

5. ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Engineering & Construction

Macro Process: Devices and Components Development

Process: Standard Catalog Management

6. DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
ABNT	Brazilian Association of Technical Standards
Acceptable Quality Level (NQA)	Acceptable Quality Level
ANEEL	National Electric Energy Agency
ANATEL	National Telecommunications Agency
Brazilian National Institute of Metrology, Quality and Technology (INMETRO)	Brazilian National Institute of Metrology, Quality and Technology
Dado Pessoal/Personal Data	Personal Data is any information relating to an identified or identifiable natural person, such as name, identification number, location data, an online identifier, or to one or more of the characteristic elements of his/her physical, physiological, genetic, mental, economic, cultural or social identity (see also Special categories of personal data).
Distribution Line Carrier (DLC)	System technology used a frequency range of 9 to 500 kHz with data rate up to 576 kbit/s.
General Data Protection Law or LGPD	Brazilian Law No. 13.709/18 issued on 14 August 2018, subsequently amended by Law 13.853/19, which provides for the processing of personal data, including in digital media, by natural person or legal

	entity of public or private law, in order to protect the fundamental rights of freedom and privacy and the free development of the personality of the natural person.
IEC	International Electrotechnical Commission
Legal Metrology Board (DIMEL)	Legal Metrology Board
Low VoltageManager (LVM)	Low Voltage Manager
L1	Phase R
L2	Phase S
L3	Phase T
Metrological Technical Regulation (RTM)	Metrological Technical Regulation
NBR	Brazilian Standard
Personal Data Holder	Natural person to whom the personal data subject to processing refer to. He / she understood as an identified or identifiable natural person.
Power Line Communication (PLC)	carries data on a conductor that is also used simultaneously for AC electric power transmission or electric power distribution to consumers.
Processing	Any operation carried out with personal data, such as those relating to collection, production, reception, classification, use, access, reproduction, transmission, distribution, processing, filing, storage, elimination, evaluation or control of the information, modification, communication, transfer, dissemination or extraction.
PRODIST	Procedures of Electric Power Distribution in the National Electric System
Sensitive Personal Data (including biometric and health data)	In the context of data protection, particular attention deserves the category of personal data concerning racial or ethnic origin, religious conviction, political opinion, membership of a trade union or organization of a religious, philosophical or political nature, to data concerning to health or sex life, genetic or biometric data, if linked to a natural person. These data are defined by the LGPD as Sensitive Personal Data. - Genetic data: personal data concerning the genetic, inherited or acquired characteristics of a natural person which provide unambiguous information about the physiology or health of such natural person, and which result in particular from the analysis of a biological sample of the natural person in question; - Biometric data: personal data resulting from specific technical processing relating to the physical, physiological or behavioural characteristics of a natural person which allow or confirm the unique identification of that person, such as photo, video, facial images or fingerprint data

	Health data: personal data relating to the physical or mental health of a natural person, including the provision of health services, which reveal information about the state of health of that person

7. ENEL GRIDS CODES

Item	N of phases	N of wires	Nominal Current (A)	Maximum Current (A)	Nominal Voltage (V)	Operating Voltage (V)	Cut-off Relay (A)	Conection	Brazil Code
1	**2**	**3**	**15**	**120**	**120/240**	**0,8Vn a 1,15Vn**	**120**	**Direct**	510344
2	**3**	**4**	**15**	**120**	**120/240**	**0,8Vn a 1,15Vn**	**120**	**Direct**	510339
3	**1**	**2 or 3**	**15**	**100**	**120/240 or 240V**	**0,8Vn a 1,15Vn**	**100**	**Direct**	510351
4	**1**	**2**	**15**	**100**	**120/240**	**0,8Vn a 1,15Vn**	**100**	**Direct**	510352
5	**1**	**3**	**15**	**100**	**240**	**0,8Vn a 1,15Vn**	**100**	**Direct**	510388
6	**2**	**3**	**2,5/5**	**10/20**	**120/240**	**0,8Vn a 1,15Vn**	**Without**	**Indirect**	510925
7	**3**	**4**	**2,5/5**	**10/20**	**120/240**	**0,8Vn a 1,15Vn**	**Without**	**Indirect**	510924

Table 1 - Material codes and characteristics

7.1 Constructive Characteristics

7.1.1.General requirements

The meter must have a design that incorporates, as much as possible, the improvements that modern technique suggests, even when not referred to in this specification.

If several units of the same meter are provided in a supply, each meter must be the same and have the same design as the others, with all its corresponding parts identical and interchangeable.

The meter must have a valid INMETRO approval according to RTM 520, RTM 586, RTM 587 or an approval according to the new RTM 221.

The meter must be approved by ANATEL and with its certificate in force when receiving the equipment, including the certification label on the equipment body.

The meter must have self-diagnostics routines (watchdog) reaching all its internal functional modules.

Measurement records must only consider the fundamental component of the measured electrical quantities (without the influence of harmonics).

The meter must be delivered to the DSO with the energy registers zeroed, including the displayed values.

The meter's power supply must not be considered as consumption of the consumer unit (line-load).

All meter technical literature, operating manuals, catalogs and software must be in Portuguese (Brazil).

The meter must offer sufficient shielding to external electromagnetic fields, so as to ensure stable performance and reliability under normal operating conditions.

The metrological accuracy and functionality of the meter must be immune to strong neodymium magnets of up to approximately 1.2 T (The test must be carried out with 1 (one) magnet of size 50x50x25 mm).

The meter must have a minimum useful life of 13 years with a failure rate of up to 1% p.a.

7.1.2.Electrical requirements

Meters **with direct connection** connection must contain the following characteristics:

- Mono-phase:1 element, 2 wires, 120/240V, nominal current 15A, maximum current 100A.
- Mono-phase:1 element, 3 wires, 240V, nominal current 15A, maximum current 100A.
- Bi-phase model: 2 elements, 3 wires, 120/240V, nominal current 15A, maximum current 120A.
- Three-phase model: 3 elements, 4 wires, 120/240V, nominal current 15A, maximum current 120A.

Meters **with indirect connection** must contain the following characteristics:

- Bi-phase model: 2 elements, 3 wires, 120/240V, nominal current 2,5/5, maximum current 10/20A.
- Three-phase model: 3 elements, 4 wires, 120/240V, nominal current 2,5/5, maximum current 10/20A.

The meter must be able to be used both at 120V and at 240V in auto-range (Phase-Neutral) mode.

The meter must come into operation as soon as it is energized, by any of the phases.

The nominal frequency must be 60Hz.

The operating voltage must be between 0.8Vn to 1.15Vn.

Limit voltage: The meter will be able to withstand 440 V (all L-N combination) for at least 6 hours without damage.

The temperature operative range must be from -10 ºC to +70º C.

The temperature storage range must be from -25 ºC to +70º C.

The meter must be able to operate from sea level up to a height, at least, of 2000 meters above sea level.

7.1.3.Measurement Registers

The meter must measure active and reactive energy, even if it must display active energy values only.

The meter must be bidirectional and it must have separate registers for import and export energy. It must have a “ratchet” type recorder for direct energy and a “ratchet” type recorder for reverse energy.

The meter must indicate on the display which phases are energized.

The meter must indicate on the display the direction of energy flow (import or export and, for reactive energy also inductive or capacitive).

7.1.4.Display Requirements

The meter must have an LCD display. The display must be active and showing information whenever the meter is mains supplied.

The display must be composed by two different areas: it must show at least 16 alphanumeric characters in one area and icons (special symbols or operating indicators). The dimension of the alphanumeric characters must not be less than 9 x 3 mm.

Icon's area must show icons related to the following information:

- Quadrant in use
- Measurement unit indication for active/reactive energy/power (kW, kWh, kvar, kvarh)
- Per phase voltage presence
- Per phase current presence and direction (for example, "+" -> import active energy, "-" -> export active energy, " " -> current not present).
- Alarm condition indicator
- PLC communication indicator
- Cut-off element open

Display device must be capable of registering, starting from zero, for a minimum time of 1150h, the energy corresponding to the maximum current at the highest rated voltage and unitary power factor.

The display must show the energy quantity (kWh) with 5 (five) full digits.

The display must have a viewing angle of at least 120º.

The display must be able to show all registers, with their respective identification code, at an interval time of 6s for each register.

The meter must display cyclically, the active energy in kWh, with at least the codes 03 and 88 bellow, according to ABNT 14522 standard, at the time of delivery.

Code	Magnitude
03	Import Active energy totalizer
88	Display test

Table 2 – Display code ABNT

In addition, the meter must allow the configuration, locally or remotely, of the display with the codes 01, 02, 04, 06, 08, 103, 104, 106 and 108 bellow, according to ABNT 14522 standard.

Code	Magnitude
01	Date
02	Hour
04	Active energy totalizer "da ponta"

06	Active energy totalizer “intermediário”
08	Active energy totalizer “do fora ponta”
103	Export Active energy totalizer
104	Export Active energy totalizer “da ponta”
106	Export Active energy totalizer “intermediário”
108	Export Active energy totalizer “do fora ponta”

Table 3 – ABNT display code

The meter must allow also other configurations of display messages showed on the display for future implementation.

In particular, it must guarantee the opportunity to display messages related to:

- Firmware version running into the meter
- Checksum of the Firmware version running into the meter
- N° of download of new Firmware performed on the meter
- Date of Last Billing period closure
- Instantaneous Voltage
- Instantaneous Current
- Instantaneous Power
- Instantaneous Frequency

7.1.5.Push-button

The equipment must have an accessible push-button to allow interacting with the relay, with the display and navigating in the provided menu.

The material must be resistant against the actions of rodents and intact for the whole life of the meter.

7.1.6.Accuracy Class

Direct Meter: The meter must have an accuracy class equal to 1% (class B) or better according to RTM 587/2012 or RTM 221/2022 for active energy measurement.

Indirect Meter: The meter must have an accuracy class equal to 0,5% (class C) or better according to RTM 587/2012 or RTM 221/2022 for active energy measurement.

The meter must be able to measure reactive energy with an accuracy class equal to 2% (class B) or better according to RTM 587/2012 or RTM 221/2022 for measuring reactive power.

The meter must be able to provide and store in independent registers the following measurands:

- Active (imported and exported) energies per phase;
- Reactive (imported and exported) in the 4 quadrants energies per phase;
- Active and Reactive Power per phase;
- rms voltage and current values (phase and neutral currents with 1% accuracy);
- power factor and phases angle values;
- last quarter mean power value;
- frequency.

7.1.7.Climat conditions

The meter that has a Type Approval Certificate based on RTM 587/2012 must withstand the climatic conditions established in items 5.2.1 and 5.2.2 of RTM 587/2012.

The meter that has a Type Approval Certificate based on RTM 221/2022 must withstand the climatic conditions established in table 1 of item 2.3.1 of RTM 221/2022

7.1.8.General mechanical requirements

The meter, intended for internal use, must conform to the degree of protection of the Brazilian technical standard ABNT NBR IEC 60529. The metrology compartment must ensure an IP52 protection degree to prevent any access (both intentional and unintentional) to inner components without visibly braking meter case.

The meter must be overvoltage category III according to IEC 62052-31.

The base and the cover of the meters must have the following characteristics:

- polycarbonate 10% glass fiber suitable for recycling (related symbol must be printed on bigger parts)
- color light resistant
- heat and flame resistant (class V0 in accordance with UL94)
- the case must show no deformations, brittleness process or surface hardness reduction, in the temperature range from –25 to + 100 °C and must be suited to withstand down to –40 °C temperature.

The transparent window (display) must be made with a plastic material that isn't subject to degradation due to direct solar radiations. The transparency of the window must be guaranteed for the whole lifetime of the meter when installed indoor and within rated environmental conditions.

Metal parts of the meter subject to corrosion must be protected and must resist to abrasives substances and normal operating handling.

The assembly, base, terminal block, terminal cover and cover must be realized with insulating and non-

hygroscopic materials. Materials must also be able to withstand high temperatures without deforming during the meter's useful life.

The meter must have a clamping device in the upper rear part for mounting on the measurement panel.

The meter must have two holes in the lower part so that, by means of screws, the mounting on the measurement panel is completed (these screws must be protected by the sealing of the terminal block cover).

7.1.9.Cover

The meter must have a cover constructed and adjusted so that to ensure the perfect operation of the device in normal condition and in cases of non-permanent deformation.

The electromechanical parts of the meter must be assembled in such a way as to prevent any access to the internal electronics without making external damage evident. This means that the base and the cover must be anchored to each other through a process that makes them like a single body avoiding their disassembling. In addition, this process doesn't have to show residues from the joining (such as burrs or damages to the cover and/or base).

The meter cover must be attached to its base throughout its perimeter, so that it is possible to identify a possible opening of the lid.

7.1.10. Terminal Block Cover

The meter must have the terminal block cover with the inscription "LINHA - CARGA", engraved externally and indelibly.

The terminal block cover must allow the use of an external seal (for more details please refer to section 7.1.16 Seals).

The terminal block cover of the Meter must be made of polycarbonate 10% glass fiber in a color that allows good visualization of the meter terminals. Moreover, the terminal cover material must comply with NBR 6527 (at 650°C ±10°C for 30s ±1s).

7.1.11. Terminals block

a) The meter must have a terminal block made of insulating material capable of not deforming after the meter has been submitted to the maximum current heating test.

b) The terminal material must comply with NBR 6527 (at 960°C ±15°C for 30s ±1s).

c) The meter must have the terminal block fixed to the base so that it can be removed only by breaking the seals of the meter cover and leaving on the cover the evidence of braking.

d) The meter must have an identification of the neutral terminal position in blue color, on the front face of the terminal block.

e) The meter must not allow the terminals to move inside the meter, regardless of the fastening screws of the connection cables.

f) The terminals must be arranged in the line-load format according to what defined into RTM 587/2012 or RTM 221/2022.

g) The terminals must be rated as 4 to 50 mm² (A10 wire form) section.

h) Terminal block must prevent accidental contact or short circuit of any live part.

i) All terminals must be clearly, unequivocally, and indelibly numbered on their front face, from left to right (meter in operating position) showing the function of the connected wires.

j) Terminals and screws set must be dimensioned to resist to a torque of 4 Nm

k) The screws set must be of the "cross-slotted" type.

l) The set of screws and terminals must be made of carbon steel with zinc-nickel.

m) The terminals must be of the drawer type.

n) Terminals and communication device (if any) must be galvanically isolated from each other.

7.1.12. Visual Measurements Indication Device

The meter must have one or two optical test output for verification of energy consumption. If the device has only one optical test output, it must be selectable for both active and reactive energy by push - button or SW.

This output will emit light in the visible spectrum.

This output will allow the user a visual indication of the energy measurement.

7.1.13. Nameplate of the meter

Nameplate of the meter must comply with type approval report “Portaria de Aprovação de Modelo” and it must be agreed with the distribution company.

The name plate of the meter must include a serial number that allows its exclusive identification by the distribution company, be sent by the distribution company, according to the commercial agreements with each manufacturer.

Serial number of the meter must be available also into the meter memory to be available for remote reading and visualization on the display (if required).

7.1.14. Maximum dimensions

The meter must meet the maximum dimensions of the regulations in force (RTM 587/2012 and/or RTM

221/2022).

7.1.15. Voltage outages

The meter must be capable of maintaining the internal clock time, configuration and recorded information during a power failure of at least 8.760 hours (365 calendar days).

The meter must be able to record and store, at least, the last 20 Voltage outages for each phase.

The meter must have a routine to automatically return to normal operation mode when power is restored.

7.1.16. Seals

The seal must meet the NIE Dimel -123 standard, item 5.4 of RTM 587/2012, in addition to the requirements below:

- Every meter must have independent devices for sealing the meter cover, the terminal block cover, and the demand reset device, if any.
- The meter must be capable of including 2 seals (on opposite sides).
- The seal must conform to NIE Dimel-123.
- The sealing holes must not be smaller than 2.0 mm.
- The seals must be semi barrier" type.

7.1.17. Firmware requirements

The meter firmware must be compliant with RTM 586/2012 (221/2022) and it must be developed with line and table structure, maintaining its principles of openness, interoperability, efficiency, robustness and communication security.

The meter must support, among the other functionalities, firmware update through remote communication interfaces, complying with the characteristics and specifications of the "Meters and More" technology.

The meter must be compatible and interoperable with other devices (smart meters and data concentrators) already installed into the DSO's low voltage network (these devices implement "Meters and More" technology) without having to make firmware changes to data-concentrator or having to install new ones.

The meter must be able to be a repeater for single phase smart meter already installed into the DSO's low voltage network and communicate with data concentrator and remote system that are currently used by DSO.

The meter must support a functionality for the optimization of communication paths, for automatic retransmission of messages when they are not received by the data concentrator and for the automatic network configuration and management as supported by Meters and More protocol.

The meter must allow its remote (through PLC) and local programming (through optical port) for different applications, such as simple tariffs (single tariff), hourly tariffs, distributed generation and others.

Remote and local programming must be done using the same protocol commands.

The supplier must offer unlimited support for activities related to firmware updating, including communicating any FW changes that may have an impact on the meters already installed.

7.1.18. Security

The meter must guarantee a high level of encryption and authentication, using 128 bits AES algorithm. It must be provided with security keys to allow access only to authorized users and prevent the attempt of any unauthorized intervention, whether the access is local or remote.

Keys management must comply with requirements included in the document “GSSM001A.

The meter must allow the configuration of two keys (for authentication and encryption) with 16 bytes, one for reading and another for writing, in hexadecimal base (letters, numbers or both).

The meter must implement a procedure that locks for a programmable time period the optical communication interface (i.e., blocks of the access to the local meter by means of optical interface) after a programmable consecutive number of failed authentication attempts.

The meter must store the number of failed authentication attempts for each communication interface (PLC/ZVEI) even if the interface results already locked.

The device must guarantee the compliance to all security legal requirements applicable in Brazil for smart meters.

7.1.19. Alarms

The meter must support at least the following sensors that must be monitored by the meter also to activate an alarm:

- Magnetic sensors for the detection of external magnetic fields.
- Sensor to detect removal of the terminal block cover (even with the meter off);
- Sensor to detect current flow with relay open.
- Sensor (or alternative solution) to detect status of the relay (open/closed).
- Sensor (or any other solution) for detecting the presence of voltage on the consumer side. It means that being the customer disconnected (i.e., meter main relay open) the meter must be able to detect the presence of voltage at the “client side”, between any phase and neutral. If the voltage read is greater than a certain threshold when the cut-off device is in open status an alarm must be activated.

The meter must be able to detect and record (or activate an alarm) the following conditions:

- Fault and intervention alarms in the voltage and neutral circuits.
- Event to records Low Voltage Network overvoltage, undervoltage and voltage spikes in real time.
- The meter must generate alarms to identify the events occurring and must allow the alarms status to be extracted locally or remotely.
- Fault in a power supply backup element (necessary to keep the RTC and antitamper circuits running also when the meter is not powered).

The meter must support independent and autonomous opening and closing of the relay according to the low voltage values (it means that the cut-off device must open the output terminals if the voltage is higher than a specific threshold and it have to automatically reclose when the voltage come back to a nominal value).

7.1.20. Battery

The battery must be a high-quality lithium battery to guarantee its correct operation for 13 years.

The battery must maintain the meter's internal clock, preserve its programming and detect opening of the terminal block cover, in case of power failure for the entire lifetime of the meter.

The battery must be internal the meter or, if it is external, it must guarantee its functionality for the entire lifetime of the meter and it must be accompanied with the seal specified in 7.1.16.

7.1.21. Communication requirements

The meter must communicate with the data concentrator through PLC interface using band A of communication (according to EN 50065-1), implementing "Meters and More" protocol.

The meter must have a local communication interface (optical), which accepts parameter modification commands and data reading commands, with reserved protection keys (activable/deactivable), according to IEC 62056-21.

The communication protocol used for the local interface must be the same indicated below for PLC channel.

The supplier must provide an updated version of the software for local reading and parametrization of the meter.

7.1.22. Non volatile memory

Meter registers must store mass memory at at least minus 5 minutes, but the meter must be able to set values for: 5, 10, 15, 30 or 60 minutes.

The meter must have at least 9 channels for load profiles recording. These channels can be configured in order to record load profile of voltage, current, direct and reverse active energy, and direct and reverse reactive

energy (Q1, Q2, Q3, Q4).

The meter must be able to set the integration period to the following values: 5, 10, 15, 30 or 60 minutes. Integration period defines how often data must be saved in nonvolatile memory. Considering an integration period of 5 minutes, the meter must store information related to the 9 channels for at least 37 days.

7.1.23. Cut-Off Device (Only for meters with direct connection)

The meter must have an internal relay to allow the power disconnection and reconnect function.

- Reconnecting function of the internal relay must be implemented in the following way:
- Automatic (depending on the functionality)
- Protocol command (by remote PLC command of Data concentrator).
- Local command (by pressing the button)
- Remote command triggered from the customer premises.

The internal relay must not have any parts accessible from the outside.

The meter must have a polyphase cutoff module that allows continuous conduction and switching of loads up to 120A for each phase.

The relay must operate in the ambient temperature range of -10 to 70°C and in the voltage range of 120-240V ± 20%.

The relay must be able to perform 5.000 operating cycles (10 s ON and 20s OFF) at operating voltage (240 V), I max (120A) and PF 1, then, on the same sample 5.000 operating cycles (10 s ON and 20s OFF) at operating voltage (240 V), I max (120 A) and PF 0,5 ind. This test must be done with the relay integrated in the meter completely assembled (endurance test).

The closing of the relay should only be allowed in the absence of voltage on the customer side.

Closing of the relay must only be allowed in the absence of line-side overvoltage.

The relay must return to the same condition (open or closed) after irregular events (e.g. blackout).

The relay shall generate information about functionality success or functionality failure beyond the interface of communication.

7.2 Specific requirements

The meter must meet all the requirements of section 7.1 of this document, plus the additional requirements below, when necessary to display the “tarifa branca” energy registers with direct flow and/or reverse flow.

The meter must calculate consumption in at least 4 (four) tariffs (6 tariffs would be preferable to allow any future developments).

The meter must allow the configuration of at least 8 (eight) different time slots throughout the day.

The meter must allow the start and end of each tariff band to be programmed.

The must support seasonal configuration to allow the customer to have at least two tariff structures during the year (one for summer and one for winter).

The meter must be able to show the active tariff on the display.

The meter must allow the automatic management (activation and de-activation) of the daylight-saving time (DST). This functionality must be configurable to be disabled or activated in other days of the year compared to the standard ones.

The meter must have sufficient memory to manage at least 20 public holidays (fixed or mobile) throughout its useful life or allow public holidays to be updated remotely, see 7.9.

7.3 Identification

7.3.1.Meter

The meter identification must be provided to the distributor by ENEL before starting the production process. The identification of the meter must be included into the marking of the meter. Marking of the meter must comply with Brazilian regulation and it must include also a QR code.

Markings of the meter must be indelible and easily readable.

The QR-code, printed on the meter, must comply with the following format indications:

- The type of coding to be used is "Alphanumeric".
- The QR code pattern is "Model 2".

The QR-code version to be used is 5 (up to 122 alphanumeric characters can be encoded with error correction level "M"). The meter identification must have the space reserved for the DSO with a minimum of: 12x60mm and a maximum of 15x90mm, while the area for QR code must be at least 19,5x19,5 mm.

The identification must have a contrast that allows reading.

Marking of the meter must include also logo of the DSO, that must be indelibly engraved in monochromatic colors.

The asset number must be engraved in bas-relief and completed with indelible monochromatic ink (according to requirement 7.1.13) alternatively the asset number must be laser engraved or conventionally printed.

7.3.2.Packaging label

Packaging must comply with requirements included in the document “GSSMC002)

The packaging label must be approved by the DSO before starting the production process.

The packaging used for the materials for this acquisition must contain the following information:

a) name or trademark of the manufacturer;

b) Complete identification of the content;

c) Type and quantity;

d) Mass (gross and net) and dimensions of the envelope;

e) Client name;

f) Purchase order number.

7.4 Tests

Suppliers must submit, compulsorily, upon product approval, or at any time, at the request of the DSO, under their responsibility, the following certificates and test reports:

- Ordinance approving model (initial and any modifications).
- Test reports referring to the type approval process at INMETRO, of all the regulations, for which the equipment is approved/mentioned in an approval decree;

All legal certificates need to allow the infield installation of the devices according to national regulation

All tests must be carried out by laboratories accredited to INMETRO and, in the absence of accredited laboratories, the laboratory must have a traceable standard. Tests for meters must comply with Inmetro Ordinance 587/2012 and for meters with an hourly rate, Inmetro Ordinance 520/2014. The tests described in these ordinances (587/2012, 520/2014 and 586/2012) will be accepted for deliveries until December 31, 2028. After this date, only tests performed according to Inmetro Ordinance 221/2022 will be accepted.

NOTE: The material must have implemented all technical requirements that were determined during the approval process (TCA). If the material changes, the supplier must inform Enel to prior assessment of the impact on the distribution network. Depending on the change, the supplier must carry out new tests so that the change in material does not compromise the minimum requirements required in this design technique. As provided for in GSCG002, any change in technology, the supplier must carry out a new TCA process with Enel.

7.4.1. Type Tests

Type tests to be carried out in accordance with INMETRO Ordinance 587/2012.

a) Dielectric test (applied voltage and dielectric)

b) Impulse voltage test

c) Applied voltage test

d) Meter start-up test

e) Verification test of the active energy calculation method

f) Starting current test

g) Idling test

h) Current variation test

i) Ambient temperature influence test

j) Internal loss verification test

k) Potential circuit and power supply test

l) Current circuit test

m) Voltage variation influence test

n) Frequency variation influence test

o) Test of influence of harmonic component in voltage and current circuits

p) Phase sequence inversion influence test

q) One or two phase interruption influence test

r) Influence test of the DC component (1/2 wave) in the AC current circuit

s) Influence test of external DC magnetic induction

t) External AC magnetic induction influence test

u) Influence test of the operation of internal devices

v) Communication interface influence test

w) Short term overload test

x) Self-heating test

y) Heating test

z) Sudden voltage variation test

aa) Display test

bb) Autonomy time verification test

cc) Electromagnetic compatibility tests

dd) Combined impulse test

ee) Electrical transient test

ff) Electrostatic discharge immunity test

gg) Immunity test to radiated radio frequency electromagnetic fields

hh) Immunity test to radiated radio frequency electromagnetic fields

ii) ii) Immunity test to short interruptions and voltage drops

jj) Conducted radiofrequency electromagnetic fields immunity test

kk) Moist heat cyclic test

Type tests to be carried out in accordance with INMETRO Ordinance 520/2014.

a) Accuracy of the meter clock

b) Accuracy of meter clock with operative reserve

c) Influence of temperature on the accuracy of the meter clock

d) Influence of electromagnetic disturbances on the accuracy of the meter clock

e) Display test by tariff stations

f) Exchange test and registration of tariffs

Type tests to be carried out according to INMETRO Ordinance 221/2022:

a) Dielectric test (applied voltage and dielectric)

I. Impulse voltage test

II. Applied voltage test

b) Meter start-up test

c) Verification test of the active energy calculation method

d) Starting current test

e) Idling test

f) Current variation test

g) Ambient temperature influence test

h) Internal loss verification test

I. Potential circuit and power supply test

II. Current circuit test

i) Voltage variation influence test

j) Frequency variation influence test

k) Test of influence of harmonic component in voltage and current circuits

l) Phase sequence inversion influence test

m) One or two phase interruption influence test

n) Influence test of the DC component (1/2 wave) in the AC current circuit

o) Influence test of external DC magnetic induction

p) External AC magnetic induction influence test

q) Influence test of the operation of internal devices

r) Communication interface influence test

s) Short term overload test

t) Self-heating test

u) Heating test

v) Sudden voltage variation test

w) Display test

x) Autonomy time verification test

y) Electromagnetic compatibility tests

z) Combined impulse test

aa) Electrical transient test

bb) Electrostatic discharge immunity test

cc) Immunity test to radiated radio frequency electromagnetic fields

dd) Immunity test to radiated radio frequency electromagnetic fields

ee) Immunity test to short interruptions and voltage drops

ff) Conducted radiofrequency electromagnetic fields immunity test

gg) Moist heat cyclic test

hh) Odd harmonic influence test

ii) Subharmonic influence test.

jj) Meter clock accuracy

kk) Meter clock accuracy with operative reserve

ll) Influence of temperature on meter clock accuracy

mm) Influence of electromagnetic disturbances on the accuracy of the meter clock

nn) Display test by tariff stations

oo) Exchange test and registration of tariffs

7.4.2.Special Tests

The special tests are complementary to the type tests and must be complied with by the supplier.

a) Flammability test for plastic parts, following UL94 V0, according to IEC 60695-11.

b) Test to ensure compliance with the IP protection degree, according to NBR IEC 60529.

c) Test report for relay endurance according to requirement included in section 7.1.23

d) ANATEL Certificate of the product with its respective number

e) Sudden temperature variation test (NBR 14520)

f) Overvoltage test as established in this document

g) Terminals according to NBR IEC 60695-2-13

h) Firmware integrity test

i) Metallography test (ipc-a-610 acceptability of electronic assemblies)

The tests below for meter approval will be carried out, at the discretion of the ENEL group, in its own facilities or in laboratories indicated by it.

a) Vulnerability tests:

1. Analysis of the Influence of External Magnetic Fields (The test will be carried out with 1 (one) magnet neodymium strong of size 50x50x25 mm);
2. Analysis of the Mechanical Parts of the Meter;
3. Analysis of Internal Access through the Cover;
4. Analysis of Internal Access through the Meter Base;
5. Analysis of Internal Access by the Terminal Block;
6. Analysis of Tampa Solidarity;
7. Analysis of Cover Screws;
8. Seals;
9. Display Analysis.

b) Accuracy test, according to Inmetro Ordinance 587/2012, annex B or 221;

c) Display test, according to NBR 14520.

d) Display test, exchange and registration of tariff stations, according to Inmetro Ordinance 520/2014 (if the meter has an hourly tariff)

e) Functional Tests (cyclic test of the display, analysis of the displayed channels, indication of phases and lack of phases, test of indication of reverse flow, test of indication of leds, indication of quadrants (if available), test of connection of cables for the biggest section)

f) Interoperability with other devices (smart meter and data concentrator) used by the DSO (see section 7.1.17);

g) Communication tests to ensure integration to the SMMePlus system used by the ENEL group for measurement and functionalities management.

h) Other tests may be carried out or requested to be carried out by the supplier, by the DSO, in addition to those mentioned above, if deemed necessary.

In addition to the previous tests (carried out to ensure product compliance with mandatory regulations in Brazil and with requirements included into this document) meters must comply with requirements included in the document “Tests and Test Conditions of Static Meters (GSSMC001).

7.4.3. Receipt Tests

Receipt tests will be carried out according to the INMETRO Ordinance 587/2012, Annex B or INMETRO Ordinance 221/2022.

Receipt tests will be carried out in accordance with INMETRO Ordinance 587/2012, Annex B:

a) Visual inspection of correspondence to the approved model

b) General inspection of the meter.

c) Applied voltage test;

d) Accuracy test;

e) Starting current test;

f) Control test of functions and magnitudes with temperature increase;

g) Test of peripheral outputs, if applicable;

h) Verification test of the lower limit of the use voltage;

i) Display test.

Receipt tests will be carried out in accordance with INMETRO Ordinance 221/2022;

a) visual inspection of correspondence to the approved model;

b) general inspection of the system or meter;

c) applied voltage test;

d) accuracy test;

e) starting current test;

f) control test of functions and magnitudes with temperature increase;

g) testing of auxiliary circuits, if applicable;

h) testing to verify the lower limit of the operating voltage;

i) display test;

j) software integrity verification test, if applicable; It is

k) clock accuracy test (for multiple billing systems or meters).

7.5 Production process and Sampling

Before starting production, manufacturer must guarantee that “Product Qualification Test” and “Accelerated Life Test” are done according to requirements included into the document “GSSMC002”.

Production process of meter must comply to Brazilian standards and regulation and it must be constantly monitored to ensure the quality and reliability of the produced meters over time.

The sampling plan of the DSO must consider inspection level II for a NQA of 1%. Depending on the batch size, the inspection must consider sampling plans.

The procedure for monitoring the production process quality must be agreed with the DSO before the award of the tender. At least it must include the following test steps during production process:

- In Circuit Tests (ICT)
  These parametric tests must be done on 100% of produced boards, at least on the principal boards (boards performing power supply, measurement and data management).
  During technical evaluation of the tender procedure, specific boards to be checked at ICT will be defined for each bidder.
- Functional test at circuit level (Functional Circuit Test - FCT)
  These functional tests must be done on 100% of produced boards at least on the principal boards (boards performing measurement and data management).
  During technical evaluation of the tender procedure, specific boards to be checked at FCT will be defined for each bidder.
- Functional test on assembled meter (FMT)
  These tests must be done on 100% of produced meters to verify at least the main functionalities required in section 7.1)
  During technical evaluation of the tender procedure, main functionalities to be checked at FMT will be defined for each bidder.
- Calibration of 100% of produced meters
- Verification of the accuracy of 100% of produced meters after calibration process. This process can be performed on the same calibration's rack and it is preliminary and independent from the sampled required accuracy verification required by Brazilian Regulation.
  Verification benches for calibration and sampled verification must be realized by two different suppliers.
  During technical evaluation of the tender procedure, load points to be verified will be defined for each bidder.
- The areas dedicated to calibration and sampled accuracy verification for acceptance test equipment are installed must be controlled in temperature and humidity:
  - Environmental temperature = 23° C ±2° C
  - 20% < RH < 75%

7.6 Transport, packaging and conditioning

Provide packaging that aid the circular economy and the environment, i.e.:

- Use of reusable packaging;
- Packaging made with recycled raw material.

The material must be packed so as to prevent the penetration of water and contain the identification referred to in 7.3.2.

7.7 Supply

For the supply to DSO, a prototype must be homologated in advance.

7.8 Warranty

The equipment, as well as its components and accessories must have a factory warranty for the minimum period 5 years or as indicated in the acquisition processes, against any manufacturing defect, counted from the date of delivery.

The equipment must have a failure rate of up to 1% per year throughout the warranty period and if this rate exceeds the limit of 1.00%, the supplier must automatically extend the guarantee for another 12 months, up to a limit of 7 years.

The meter must have a minimum useful life of 13 years.

The battery must have a useful life of at least 13 years with the meter installed and at least 3 years if the meter is installed is not installed.

The equipment must have 1 (one) year of local technical support to resolve problems, if necessary.

The supplier must provide the necessary support for the installation and use of the equipment.

8. ANNEX

8.1 Guaranteed Technical Characteristics – CTG