

CONTECComissão de Normalização
Técnica**SC-06**

Electricity

**Low-Voltage Switchgear - Load Distribution
Center****1st Amendment**

This is the 1st Amendment to PETROBRAS N-316 REV. D and it is used to alter the text of the Standard in the parts indicated below:

NOTE 1 The news pages with the performed amendments are placed in its corresponding positions.

NOTE 2 The amended pages, indicated the date of the amendment, are placed at the end of this standard, in chronological order, and shall not be used.

CONTENTS OF THE 1st AMENDMENT - 02/2014

- Section 2:

Replacing the IEC 60446 by IEC [60445](#).

- Enumeration b) and c) of Subsection 6.9.2:

Replacing the IEC 60446 by IEC [60445](#).

Low-Voltage Switchgear - Load Distribution Center

Specification

This Standard replaces and cancels its previous revision.

The CONTEC - Authoring Subcommittee provides guidance on the interpretation of this Standard when questions arise regarding its contents. The Department of PETROBRAS that uses this Standard is responsible for adopting and applying the sections, subsections and enumerates thereof.

Technical Requirement: A provision established as the most adequate and which shall be used strictly in accordance with this Standard. If a decision is taken not to follow the requirement ("non-conformity" to this Standard) it shall be based on well-founded economic and management reasons, and be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by imperative nature.

Recommended Practice: A provision that may be adopted under the conditions of this Standard, but which admits (and draws attention to) the possibility of there being a more adequate alternative (not written in this Standard) to the particular application. The alternative adopted shall be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by verbs of a nonmandatory nature. It is indicated by the expression: **[Recommended Practice]**.

Copies of the registered "non-conformities" to this Standard that may contribute to the improvement thereof shall be submitted to the CONTEC - Authoring Subcommittee.

Proposed revisions to this Standard shall be submitted to the CONTEC - Authoring Subcommittee, indicating the alphanumeric identification and revision of the Standard, the section, subsection and enumerate to be revised, the proposed text, and technical/economic justification for revision. The proposals are evaluated during the work for alteration of this Standard.

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CONTEC

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Introduction

PETROBRAS Technical Standards are prepared by Working Groups - WG (consisting specialized of Technical Collaborators from Company and its Subsidiaries), are commented by Company Units and its Subsidiaries, are approved by the Authoring Subcommittees - SCs (consisting of technicians from the same specialty, representing the various Company Units and its Subsidiaries), and ratified by the Executive Nucleus (consisting of representatives of the Company Units and its Subsidiaries). A PETROBRAS Technical Standard is subject to revision at any time by its Authoring Subcommittee and shall be reviewed every 5 years to be revalidated, revised or cancelled. PETROBRAS Technical Standards are prepared in accordance with PETROBRAS Technical Standard [N-1](#). For complete information about PETROBRAS Technical Standards see PETROBRAS Technical Standards Catalog.

Foreword

This Standard is the English version (issued in 09/2013) of PETROBRAS N-316 REV. D 12/2012. In case of doubt, the Portuguese version, which is the valid document for all intents and purposes, shall be used.

1 Scope

1.1 This Standard specifies the conditions to be followed for the purchase of low-voltage switchgear of the Load Distribution Center (CDC) type for rated voltages up to 1,000 V for distributing power and controlling electrical loads in PETROBRAS facilities.

1.2 This Standard is not applied to low voltage panel for installation in potentially explosive atmospheres.

1.3 This Standard applies to procedures started as of its date of issuance.

1.4 This Standard contains Technical Requirements and Recommended Practices.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

PETROBRAS [N-898](#) - Construction, Assembly and Conditioning of Instrumentation;

PETROBRAS [N-1219](#) - Colors;

PETROBRAS [N-2779](#) - Digital Protection Relays;

ABNT [NBR 5410](#) - Instalações Elétricas de Baixa Tensão (Low Voltage Electrical Installations);

ABNT [NBR 6855](#) - Transformadores de Potencial Indutivos (Inductive Voltage Transformers);

ABNT [NBR 6856](#) - Transformador de Corrente (Current Transformer);

ABNT [NBR IEC 60439-1](#) - Conjuntos de Manobra e Controle de Baixa Tensão Parte 1: Conjuntos com Ensaio de tipo Totalmente Testados (TTA) e Conjuntos com Ensaio de Tipo Parcialmente Testados (PTTA) (Low-Voltage Switchgear and Controlgear Assemblies - Part 1: Type-Tested [TTA] and Partially Type-Tested [PTTA] Assemblies);

ABNT [NBR IEC 60439-2](#) - Conjuntos de Manobra e Controle de Baixa Tensão - Parte 2: Requisitos Particulares para Linhas Elétricas Pré-Fabricadas (Sistemas de Barramentos Blindados) (Low-voltage Switchgear and Controlgear Assemblies - Part 2: Particular requirements for Pre-Fabricated Electrical Lines [Shielded Busbar Systems]);

ABNT [NBR IEC 60529](#) - Graus de Proteção para Invólucros de Equipamentos Elétricos (código IP) (Degrees of Protection Provided by Enclosures (IP Code));

ABNT [NBR IEC 60947-1](#) - Dispositivos de Manobra e Comando de Baixa Tensão - Parte 1: Regras Gerais (Low-voltage Switchgear and Controlgear - Part 1: General Rules);

ABNT [NBR IEC 60947-2](#) - Dispositivos de Manobra e Comando de Baixa Tensão - Parte 2: Disjuntores (Low-voltage Switchgear and Controlgear - Part 2: Circuit-breakers);

ABNT [NBR IEC 60947-6-1](#) - Dispositivos de Manobra e Controle de Baixa Tensão - Parte 6-1: Dispositivos Multifuncionais - Equipamento de Comutação de Transferência Automática (Low-voltage Switchgear and Controlgear - Part 6-1: Multiple Function Equipment - Transfer Switching Equipment);

ABNT [NBR NM 60898](#) - Disjuntores para Proteção de Sobrecorrentes para Instalações Domésticas e Similares (IEC 60898:1995, MOD) (Circuit-breakers for Overcurrent Protection for Household and Similar Installations);

IEC [60073](#) - Basic and Safety Principles for Man-Machine Interface, Marking and Identification - Coding Principles for Indicators and Actuators;

IEC [60092-201](#) - Electrical Installations in Ships - Part 201: System Design - General;

IEC [60092-302](#) - Electrical Installations in Ships - Part 302: Low-Voltage Switchgear and Controlgear Assemblies;

IEC [60417](#) Database Snapshots - Graphical Symbols for Use on Equipment - Part 1: Overview and Application;

IEC [60445](#) - Basic and Safety Principles for Man-machine Interface, Marking and Identification – Identification of Equipment Terminals, Conductor Terminations and Conductors;

IEC [60533](#) - Electrical and Electronic Installations in Ships - Electromagnetic Compatibility;

IEC [61000-5-2](#) - Electromagnetic Compatibility (EMC) - Part 5: Installation and Mitigation Guidelines - Section 2: Earthing and Cabling;

IEC [61892-3](#) - Mobile and Fixed Offshore Units - Electrical Installations - Part 3: Equipment Installation;

IEC [TR 61641](#) - Enclosed Low Voltage Switchgear and Controlgear Assemblies - Guide for Testing Under Conditions of Arcing Due to Internal Fault;

IEC [TR 61850-1](#) - Communication Networks and Systems in Substations - Part 1: Introduction and Overview;

ISO [3864-2](#) - Graphical Symbols Safety Colours and Safety Signs Part 2: Design Principles for Product Safety Labels;

ISO [7010](#) - Graphical Symbols Safety Colours and Safety Signs Safety Signs Used in Workplaces and Public Area;

ISO [13850](#) - Safety of Machinery - Emergency Stop - Principles for Design;

ASTM [F855](#) - Standard Specifications for Temporary Protective Grounds to Be Used on De-Energized Electric Power Lines and Equipment;

ASTM [F1166](#) - Standard Practice for Human Engineering Design for Marine Systems, Equipment and Facilities;

ASTM [E1934](#) - Standard Guide for Examining Electrical and Mechanical Equipment with Infrared Thermography;

NOTE For documents referred in this Standard and for which only the Portuguese version is available, the PETROBRAS department that uses this Standard should be consulted for any information required for the specific application.

3 Terms and Definitions

For purposes of this Standard, the terms and definitions indicated in 3.1 to 3.15 are adopted.

3.1

compartment

a section or subsection that is closed except for of the openings needed for interconnection, control or ventilation

3.2**future compartment**

a section or subsection that is closed with the exception of openings needed for interconnection, control or ventilation, with the structural components and electrical connectors prepared for the future installation of a functional unit. It shall have all removal and insertion mechanisms and only exclude switching, control, measurement, signaling, and protection devices

3.3**assembly (low-voltage switchgear and controlgear assembly)**

a combination of one or more low-voltage switching, controlling, measuring, signaling, protection, and regulating devices and equipment, fully assembled, with all internal electrical and mechanical interconnections and structural parts under the manufacturer's responsibility

3.4**EMC (Electromagnetic Compatibility)**

ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to that environment

3.5**ESC**

Monitoring and Control Station

3.6**IT scheme**

connection scheme in which all live parts are insulated from ground or in which a supply point is grounded through impedance. The masses of the installation are grounded to the same power supply grounding electrode, if any, or to a different grounding electrode

3.7**TX scheme**

it refers to all grounding schemes in which a supply point is directly grounded

3.8**FPSO**

Floating Production Storage and Off-Loading Unit

3.9**FSO**

Floating Storage and Off-Loading Unit

3.10**Assembly plate**

a plate designed to support various components and suitable for installation in an assembly

3.11**section**

a construction unit of an assembly between two successive vertical separations

3.12**tropicalization**

an industrial treatment process against degradation of electronic and mechanical components, which is intended to ensure their proper functional performance when subject to the environmental conditions of tropical climate regions

3.13**functional unit**

part of an assembly covering all electrical, mechanical, and electronic elements that contribute to the implementation of the same function

3.14**functional unit reservation**

a functional unit with all electromechanical and electronic components installed for the implementation of a specific function

3.15**package unit**

equipment or part of the installation supplied with all internal equipment items installed and interconnected in such a manner as to allow its perfect operation, depending only on the supply of external utilities (electric power, compressed air etc.)

4 General Conditions

4.1 Any item that is not sufficiently covered by ABNT standardization shall comply with IEC and ISO international standards.

4.2 The application of IEC [60092-201](#), IEC [60092-302](#) and IEC [61892-3](#) is restricted to switchgear for offshore facilities. For installation in ships, (FPSO and FSO), the IEC [60092-201](#) and IEC [60092-302](#) shall take precedence over the others.

4.3 The specific characteristics of the switchgear are those indicated on the Data Sheet of Annex A, which together with this Standard shall comprise an integral part of the Material Requisition (RM).

4.4 The blank items on the Data Sheet of Annex A shall be filled in by the supplier, which shall return it to PETROBRAS duly authenticated. The supplier is responsible for all information included in that Data Sheet.

4.5 Whenever there are discrepancies between the Data Sheet of Annex A and this Standard, the information contained in the former shall prevail.

4.6 Any alternative presented by the bidder shall be explicitly indicated in the bid in an item entitled "DEVIATIONS".

5 Constructive Characteristics

5.1 The switchgear and its components shall be designed and manufactured in accordance with the recommendations contained in the standards mentioned in Section 2 of this Standard and on the Data Sheet of Annex A. Electrical interlocking and interconnection of wiring between the sections comprising the switchgear shall be available and provision shall be made for interlocking between devices installed a long distance away.

5.2 Unless otherwise indicated on the Data Sheet of Annex A, the switchgear shall be of the fully tested and approved (TTA) type, according to ABNT [NBR IEC 60439-1](#).

5.3 Classification of assemblies in relation to ABNT [NBR IEC 60439-1](#)

5.3.1 Switchgear units shall be metallic assemblies of the multiple column type.

5.3.2 Unless otherwise indicated on the Data Sheet of Annex A, the switchgear shall be suitable for sheltered installation.

5.3.3 Unless otherwise indicated on the Data Sheet of Annex A, the switchgear shall be of the fixed assembly type.

5.3.4 Degree of Protection

5.3.4.1 The degree of protection of the switchgear shall be at least according to Table 1 as per ABNT [NBR IEC 60529](#).

Table 1 - Degree of Protection

Installation	Onshore	Offshore
Sheltered in panel room	IP21	IP22
Sheltered in engine room	IP31	IP32
Outdoor and covered	IP43	IP56SW
Outdoor and uncovered	IP54SW	IP56SW
NOTE When the W suffix is used this means that the equipment is suitable for operation in a salt-laden, hot, and wet environment with the presence of hydrocarbons.		

5.3.4.2 The degree of protection between adjacent compartments of the switchgear shall be at least IP21B, in accordance with ABNT [NBR IEC 60529](#).

5.3.4.3 The degree of protection shall be maintained with the functional units in the test positions and isolated and during transfer from one position to the other.

5.3.5 The switchgear shall be comprised of draw-out parts with the following positions:

- a) connected;
- b) test;
- c) extracted (isolated);
- d) removed.

5.3.6 Each functional unit shall be a separate draw-out part. Draw-out parts shall slide on rails or guides.

5.3.7 Draw-out circuit breakers with different specifications shall have device to stop the wrong interchangeability between them.

5.3.8 It is necessary to ensure protection against electric shock caused by direct contact through protective barriers, enclosures, and insulation of busbars.

5.3.9 Protection against electric shock caused by indirect contact shall be ensured through protection circuits (ground bar).

5.3.10 The assembly shall be designed and organized in such a manner as to allow similar inspection and operations by authorized personnel when the assembly is in service and under voltage.

5.3.11 Unless otherwise indicated on the Data Sheet of Annex A, the switchgear shall be divided into compartments according to internal separation method 4b.

5.3.12 The types of electrical connections of the functional units for the main input circuit, the main output circuit, and the auxiliary circuits shall be of the draw-out type (WWW type).

5.3.13 Unless otherwise indicated on the Data Sheet of Annex A, the switchgears shall be suitable for installation in an environment of electromagnetic compatibility environment level 2, according to ABNT [NBR 60439-1](#).

5.4 Structure

5.4.1 The switchgear shall be manufactured from steel plates, self-supporting type, having structural sections in accordance with the manufacturer's standard, extensible at both ends.

5.4.2 The switchgear shall be comprised of standard and independent vertical sections where the equipment is housed. Each vertical section shall be subdivided into at least the following segregated compartments:

- a) busbar;
- b) switching equipment;
- c) output cables.

5.4.3 Each section shall have a hinged door at the front. The doors shall have electrical continuity with the switchgear structure through a flexible copper braid. Unless otherwise indicated on the Data Sheet of Annex A, rear access shall be through a hinged door provided with a lock.

5.4.4 Every hinged door shall have a locking device in the open position.

5.4.5 For switchgear installed in floating offshore units the front and rear doors shall be provided with handrails made of insulating material along the full length of the switchgear.

5.4.6 The switchgear shall have holes for installation of devices intended for attaching it to the base, as well as eyes for lifting and handling purposes. The devices shall be supplied by the switchgear manufacturer.

5.4.7 Together with the equipment a truck and suitable tools for removing circuit breakers shall be provided for ease of maintenance.

5.4.8 Switchgear units shall be designed to withstand thermal stresses due to rated short-time withstand current (I_{cw}) for 1 s. Switchgear shall be designed to withstand dynamic stresses due to rated peak withstand current (I_{pk}). The values of these currents shall be informed on the Data Sheet of Annex A.

5.4.9 The switchgear shall be provided with a document holder inside it for the filing and safekeeping of technical documents pertaining to the switchgear.

5.4.10 The equipment shall be selected so that the rated value of its withstand impulse voltage is not lower than feed phase-earth rated voltage of de 1 000 Vca RMS and overvoltage category IV, according to ABNT [NBR IEC 60439-1](#).

5.4.11 For sizing of minimum air and leakage insulation distances, it shall be considered non-homogeneous field, pollution degree 3 and material group III A, as per ABNT [NBR IEC 60439-1](#).

5.4.12 The switchgear shall be certified to provide protection to personnel under internal arc conditions, in accordance with IEC [TR 61641](#), complying at least with criteria 1 to 5 of test assessment. The allowable current under arc condition (I_p arc) for test shall be the bearable short-duration rated current (I_{cw}) or more, and the allowable arc duration (t_{arc}) shall be at least 0,3 s.

5.5 Corrosion Supportability

5.5.1 The switchgear shall be resistant to corrosion caused by humidity, pollution and characteristic atmosphere of installation site, as indicated on the Data Sheet in Annex A.

5.5.2 The final finish coat color shall be as per indication in Data Sheet in Annex A.

5.5.3 The final color of inner faces of doors and assembly plates shall comply with code 1867 of PETROBRAS [N-1219](#) (Munsell 2.5 YR 6/14).

5.5.4 For offshore facilities or those subject to aggressive environments, all the material used in hinges, latches, bolts, locking devices, structural attachment elements and elements for attaching identification plates shall have anticorrosive protection such as a dichromate finish or use of series AISI 300 stainless steel.

5.5.5 The printed circuits of the electronic modules of the functional units shall have undergone tropicalization treatment. The manufacturer shall inform in its bid the processes used for tropicalization treatment, subject to approval by PETROBRAS.

5.6 Interlocks

5.6.1 All circuit breakers shall allow the installation of a padlock, locking them in the "off" position. In the "on" position, it shall not be possible to open the compartment door.

5.6.2 The main terminals of the busbar shall be automatically covered by a closing plate made of insulating material when the switching device is withdrawn, thus preventing access to live parts.

5.6.3 The electrical actuators of the circuit breaker shall be operated from outside the switchgear and without having to open the compartment door. The front doors of the compartment shall have mechanical interlocking so that they can only be opened when the switching device is off or withdrawn and with the closing plate closed. Operation of the switching device shall be inhibited while the door is open.

5.6.4 All switchgear units shall be provided with physical means for blocking accidental reconnection, such as locking units for padlocks in circuit breakers, switches, and other reconnection devices, also immune to commands originating from supervisory systems.

5.7 Assembly

5.7.1 Incoming and tie circuit breakers shall be located in the central sections of the switchgear so as to allow future expansion on both sides.

5.7.2 All the major components of the functional units intended for feeding similar equipment (same type and power), such as: busbars, circuit breakers, contactors, protection relays etc., shall have the same specification.

5.7.3 Unless otherwise indicated on the Data Sheet of Annex A, intelligent electronic instruments and devices shall be installed in the functional units of the switchgear, integrated and interconnected on a data communication network, in accordance with the communication requirements of PETROBRAS [N-2779](#).

5.7.4 Each section of the switchgear with Intelligent Electronic Devices (IED) shall have 127 Vac 2 P+T or 220 Vac service outlets powered by the same external source as the heating resistors of the switchgear. This outlet is intended for connecting notebooks or handhelds used in the configuration of the IEDs.

5.7.5 The entire control and protection system of the main circuit breakers, unless otherwise indicated on the Data Sheet of Annex A, shall be at 125 Vdc. Direct current shall be supplied via the circuits shown on the one-line and functional diagrams. The manufacturer shall install a terminal block strip from which the distribution inside the switchgear shall be made. For each protection and/or control circuit, a short circuit selective protection device shall be provided.

5.7.6 Unless otherwise indicated on the functional diagrams, for feeding the direct current loads of the switchgear at least the following segregation criteria shall be adopted from the direct current switchgear:

- a) exclusive direct current supply circuits shall be provided for each incoming and tie circuit breaker of the switchgear;
- b) exclusive direct current supply circuits shall be provided for each MCC (Motor Control Center) power supply circuit breaker;
- c) for the other outgoing circuit breakers of the switchgear units having a tie circuit breaker loads of bar A shall not be mixed together in the same circuit with those of bar B;
- d) exclusive direct current power supply circuits shall be provided for the protection relays associated with each incoming and tie circuit breaker of the switchgear;
- e) exclusive circuits shall be provided for feeding the protection relays of each of bars A and B of the switchgear.

5.7.7 Switchgear units shall have lock-out coil and breaker trip coil supervision. Provision shall be made for remote alarm and local signaling through white lamps. Contacts for remote alarm shall be individual for incoming and tie circuit breakers. Two alarm summaries shall be provided for the outgoing circuit breakers of the same busbar, one of which for the circuit breakers feeding the MCCs and another one for circuit breakers feeding the other loads. The contacts for remote alarm mentioned may be summarized in other ways according to the criteria set forth in the basic design, sending alarms to the supervisory system.

5.7.8 Provision shall be made for remote alarm for lack of direct current in the control and protection circuits of the circuit breakers.

5.7.9 Unless otherwise indicated by PETROBRAS, protection diagrams shall be implemented considering logic selectivity between the protection relays associated with the outputs and the protection relays associated with the inputs and with interconnection.

5.7.10 Switchgear units shall be designed in such a manner as to allow inspection through infrared thermography with panels energized. Provision may be made for the use of "special sight glasses" allowing thermographic inspection without having to previously shut down the equipment or embedded and continuous thermal monitoring with optical and electronic sensing technology.

5.7.11 Switchgear units shall allow access to their busbars and insertion clutches through the back part, with possibility of access for maintenance from the front and back sides.

5.7.12 When installed on floating platforms and ships (FPSO and FSO), the switchgear units shall be suitable for operation subject to inclination variations (static and dynamic) specified by the Classifying Society.

5.7.13 When installed on floating platforms and ships (FPSO and FSO), the switchgear units shall be suitable for operation according to the vibration and acceleration requirements set forth by the Classifying Society.

5.7.14 When installed on floating platforms and ships (FPSO and FSO), the switchgear units shall be designed to meet the minimum requirements for emission, immunity, and performance criteria concerning the EMC specified by IEC [60533](#).

5.7.15 The category for utilization of functional units for feeding transformers shall be AC-6a according to IEC [60947-4-1](#).

5.7.16 Unless otherwise indicated on the Data Sheet of Annex A, the category for utilization of motor starting devices shall be AC-3 according to IEC [60947-4-1](#).

5.7.17 The category for utilization of functional units for feeding capacitor banks shall be AC-6b according to IEC [60947-4-1](#).

5.7.18 In the test position the power contacts of the functional units shall comply with the requirements for minimum leakage distance and clearance according to ABNT [NBR IEC 60439-1](#).

5.7.19 When incoming or tie circuit breakers of the switchgear are designed for transfer switching the requirements set forth in ABNT [NBR IEC 60947-6-1](#) shall be followed for utilization category AC-33A.

5.7.20 It is not acceptable to use forced ventilation systems to limit the temperature rise of the connections between busbars and functional units.

5.7.21 For cabinets with frequency converters and soft starters, temperature rise tests of these cabinets shall be performed considering the temperature at rated load with closed door.

5.8 Grounding

5.8.1 All metallic parts comprising the switchgear, which are not intended for current-carrying purposes, shall be connected to the grounding busbar of the switchgear, using electrical connection jumpers with a cross-section according to Table 3A of ABNT [NBR IEC 60439-1](#). This busbar shall be located in the lower inside part of the switchgear, running along its full length and supplied with non-welded type connectors suitable for stranded bare copper cables with a 70 mm² section for onshore installations and a 95 mm² section for offshore installations; at each of its ends.

5.8.2 When provision is made for intelligent electronic devices and instruments, each compartment shall contain a terminal block strip or an electronic reference bar isolated from the structure.

5.8.3 Grounding and the equipotential connection of electronic reference terminals of intelligent electronic devices and instruments shall meet the requirements set forth in IEC [61000-5-2](#).

5.8.4 Facilities shall be provided for temporary protection grounding through a standard device as per ASTM [F855](#).

5.8.5 The manufacturer shall provide together with the panel a temporary grounding kit containing at least one ground rod clamp, three busbar clamps and one cable, sized in accordance with ASTM [F855](#).

5.9 Safety and Product Identification and Graphic Signaling

5.9.1 The switchgear shall be provided with a main identification plate made of series AISI 300 stainless steel containing the data specified in ABNT [NBR IEC 60439-1](#).

5.9.2 The switchgear shall be provided with a supplementary identification plate made of series AISI 300 stainless steel containing at least the following data:

- a) Petróleo Brasileiro S.A. - PETROBRAS;
- b) name of PETROBRAS department;
- c) project name;
- d) switchgear number;
- e) RM number;
- f) Material Purchase Order (PCS) number;
- g) as an alternative to f), the contract number, in case the acquisition is made under a Turn Key, Lump Sum, and other similar types of contracts.

5.9.3 The switchgear shall be provided with a second supplementary identification plate made of series AISI 300 stainless steel according to the figure below:

 DANGER	
	ELECTRIC ARC AND SHOCK RISK
	USE THE RECOMMENDED EPI
VOLTAGE LEVEL: _____ V SAFE APPROACH DISTANCE FOR ACTIVITIES SUBJECT TO ELECTRIC ARC: _____ INCIDENT ENERGY: _____ J/cm ² (cal/cm ²)	

Figure 1 - Supplementary Identification Plate

5.9.4 All compartments shall have on the front an external black plastic identification plate with engraved white letters. The equipment number shall be indicated on the first line; on the second line (and third line, if necessary) the equipment function shall be included. These data are indicated on the one-line diagram. In reserve and empty sections (future installation) the plates shall be supplied without engraving. Each compartment shall include the identification of its functional unit on the back part and in the fixed and movable front parts.

5.9.5 In the front and back sides there shall be an identification plate for the sections.

5.9.6 All components of the compartments or functional units shall be identified with identification plates attached to the assembly plate and to the component.

5.9.7 All equipment and devices shall be internally identified by means of tags or plates with the same designation as the one used on the functional diagram.

5.9.8 Besides the main and supplementary identification plates, the compartments of the electrical switchgear shall have signs with text and graphics containing instructions, precautions, warnings, and danger alerts according to the requirements for identification plates of ASTM [F1166](#) and the symbols of IEC [60417 DB](#), ISO [7010](#) and ISO [3864-2](#).

5.9.9 The text of all identification signs and plates of the switchgear shall be engraved in the Portuguese language.

6 Description of Component Parts

The equipment items listed below, when requested on the Data Sheet of Annex A and unless otherwise indicated, shall be supplied in accordance with the specifications described in 6.1 to 6.9.

6.1 Circuit Breakers

6.1.1 Circuit breakers shall be manufactured and tested according to ABNT [NBR IEC 60947-2](#) and shall satisfy the characteristics specified on the Data Sheet of Annex A.

6.1.2 Motor outgoing circuit breakers shall have an internal direct current undervoltage trip coil according to 5.7.6.

6.1.3 All switchgear circuit breakers shall be of the open construction and power air draw-out type, with main and auxiliary terminals of the plug-in type with an accumulated energy (spring) operating mechanism control method.

6.1.4 Spring loading shall be performed through a motor and hand lever. The loading lever shall be operated from the outside, without having to open the compartment door, or with protection ensuring the safety of the operator during circuit breaker operation.

6.1.5 All power air circuit breakers shall have electrical and manual opening and closing commands.

6.1.6 When the circuit breaker is withdrawn, there shall be a bypass of its Normally Closed (NC) auxiliary contacts by means of auxiliary contacts of limit switches.

6.1.7 Incoming and tie circuit breakers shall be identical and interchangeable. Motor output circuit breakers shall be identical and interchangeable. MCC feeder output circuit breakers and other non-motor loads shall be identical and interchangeable.

6.1.8 The opening mechanism shall be of the “free opening” type and the closing mechanism shall have an anti-pumping type device.

6.1.9 Control circuits, auxiliary contacts, and limit switches of circuit breakers shall be connected to the fixed part with a plug.

6.1.10 Circuit breakers of functional units for feeding motors, capacitors or other loads not requiring selectivity shall be utilization category A according to ABNT [NBR IEC 60947-2](#). Incoming, tie, and feeder output circuit breakers requiring selectivity shall be utilization category B.

6.1.11 Circuit breakers shall be manufactured with provision for maintenance according to ABNT [NBR IEC 60947-2](#).

6.1.12 The front part of the circuit breakers shall have a degree of protection at least equal to the degree of protection of the enclosure of the switchgear.

6.1.13 Circuit breakers shall be specified for continuous load rating according to ABNT [NBR IEC 60947-2](#).

6.1.14 When direct-acting trip devices are required for circuit breakers, these trip devices shall allow the following adjustments:

- a) long time delay trip (LTD) - from 80 % to 160 % of the rated current of the trip device;
- b) short time delay trip (STD) - 5, 7.5, and 10 times the rated current of the trip device;
- c) instantaneous trip device - 6 to 12 times the rated current of the trip device; for this device the manufacturer shall check if calibration is compatible with the circuit breaker breaking capacity.

NOTE 1 The circuits for loads installed in potentially explosive atmospheres - Zone 1 and circuits for loads whose cables cross potentially explosive atmospheres - Zone 1, when they also use direct-acting trip devices, shall include Differential Residual (DR) current trip devices.

NOTE 2 Feeders for loads installed based on the TT grounding scheme concept shall have devices for automatic disconnection of the power supply through DR current trip devices.

NOTE 3 Feeders for the loads installed based on the IT grounding scheme concept shall have Insulation Supervision Devices (DSI).

6.1.15 For Motor Starter Units (UPMs) that do not use contactors associated with the circuit breakers, such circuit breakers shall meet the supplementary requirements for circuit breakers used as starter contactors given in IEC [60947-4-1](#) for utilization category AC-3.

6.1.16 There shall be signaling in the front part of the “connected”, “test” and “extracted” positions of functional unit cabinet, through a mechanical device.

6.2 Contactors

6.2.1 When the use of contactors is specified, coordination with short-circuit protection devices shall be type “2”, as defined in IEC [60947-4-1](#). The manufacturer shall attach to the technical proposal a test certificate for each size of functional unit, issued by a recognized laboratory, demonstrating the type of coordination.