



Exploration & Production

GENERAL SPECIFICATION

ELECTRICAL

GS EP ELE 133

G.I.S. High voltage switchgear and controlgear

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1. Scope

This specification covers the minimum requirements for the design, manufacture, and supply of Gas Insulated Switchgear (G.I.S.) high voltage switchgear rated for voltage 72.5 kV and above.

For G.I.S. switchgear under 72.5 kV, Company specification **GS EP ELE 131** is applicable.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Design and engineering shall conform as a minimum requirement to the current edition of the following in order of preference:

- Applicable laws, rules and regulations of the country in which the system will be operated. In cases where no "local" regulations exist, the French laws and legislation shall be used
- Company Particular Specifications (if any)
- Company General Specifications
- Applicable International Electro-technical Commission (IEC) Standards
- Applicable CENELEC Standards
- Applicable recognised standards and codes (e.g. UTE-NFC, BSI, VDE, etc.) where IEC publications have not yet been issued.

Any conflict or inconsistency between the above set of documents (standards, specification, codes and local regulation or laws) shall be raised to Company attention for resolution at tender stage.

Standards

Reference	Title
IEC 60044 (Parts 1; 2)	Instrument transformers – (Parts 1; 2)
IEC 60050-441	International Electro-technical Vocabulary. Chapter 441: Switchgear, controlgear and fuses
IEC 60050-441/A1	Amendment 1 to publication IEC 60050-441:1994
IEC 60060	High Voltage test techniques
IEC 60071	Insulation co-ordination
IEC 60099	Surge arresters
IEC 60137	Insulated bushings for alternating voltages above 1000 V
IEC 60255	Electrical relays
IEC 60270	High-voltage test techniques - Partial discharge measurements
IEC 60376	Specification of technical grade sulfur hexafluoride (SF ₆) for use in electrical equipment



Reference	Title
IEC 60480	Guidelines for the checking and treatment of sulphur hexafluoride (SF6) taken from electrical equipment and specification for its re-use
IEC 60529	Classification of degrees of protection provided by enclosures
IEC 60706	Maintainability of equipment
IEC 61000	Electromagnetic Compatibility (EMC)
IEC 61321-1	High voltage testing techniques with very fast impulse - Part 1 Measuring systems for very fast front over voltage generated in gas insulated substations
IEC 61639	Direct connection between power transformers and gas insulated metal enclosed switchgear for rated voltage of 72.5 kV and above
IEC 61640	Rigid high voltage, gas insulated transmission lines for rated voltage of 72.5 kV and above
IEC 61850	Communication networks and systems in substations
IEC 62271 (All parts)	High-voltage switchgear and controlgear – (All parts)
IEC 62305-4	Protection against Lightning - Part 4: electrical and electronic system within structures
IEC 62402	Obsolescence management - Application guide

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	



Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP ELE 131	High voltage switchgear
GS EP TEC 007	Obsolescence and Lifetime Cycle Management

3. Definitions

For the purpose of this specification, the following definitions apply:

- **G.I.S.:** metal enclosed switchgear in which the insulation is obtained by an insulating gas other than air at atmospheric pressure
- **Compartment:** Part of the G.I.S. totally enclosed except for openings for interconnections and control. One compartment may include one or several switching devices
- **Bay:** assembly of compartments designed for one unique purpose (incomer, bus tie, busbar or outgoer)
- **Control Cabinet:** Equipment related to one apparatus (breaker, switch, voltage transformers, etc.) that includes all necessary equipment for its use (motors, mechanical linkages, terminal blocks, etc.). They are located next to the compartments, they can be located outdoor if required
- **Control Cubicle:** Cubicle/panel related to one unique bay. It includes all auxiliary units necessary for information exchange from each control cabinet related to this bay as well as the control/command of each equipment. It includes of the protection and the communication. They can be located away from the G.I.S. in a different location.

4. Service conditions

The G.I.S. shall be suitable in all aspects for continuous operation at full load service.

The G.I.S. can be installed indoor or outdoor. In any case, control cubicles shall be installed in an air-conditioned room.

The G.I.S. and its control cubicles shall be able to operate in unusual conditions as defined in the project data sheet.

Variations of voltage and frequencies shall be confirmed by the local grid Authority, however the G.I.S. shall be suitable for operation, without deleterious effect, with minimum variations of voltage and frequencies as follows:

- High voltage supply (permanent): $\pm 15\%$
- Frequency: $\pm 5\%$.

5. General characteristics

5.1 General electrical characteristics

The general electrical characteristics shall be in compliance with the values indicated in [IEC 62271-1](#) - paragraph 4.2 (Table 1a). Preferred equipment ratings are as follows:

System	3 phases/3 wires			
Rated frequency	50 Hz - 60Hz			
Nominal system voltage	220 kV	132 kV	90 kV	63 kV
Rated voltage kV (r.m.s)	245 kV	145 kV	100 kV	72.5 kV
Rated one minute power-frequency withstand voltage kV (r.m.s)	460 kV	275 kV	185 kV	140 kV
Rated lightning impulse withstand voltage kV (peak)	1050 kV	650 kV	450 kV	325 kV
Neutral system	As per data sheet			

Each G.I.S. shall be equipped with surge arrestors (at incomer location whenever it is possible, if not at busbar location).

5.2 Breaking technology

The breaking technology shall be Gas (SF6).

The Manufacturer shall clearly indicate in his proposal which provisions have been taken to limit switching overvoltages (e.g.: RC filters, surge arrestors, ferrites, etc.).

5.3 Particular characteristics for breakers

5.3.1 Rated short-circuit breaking current

The making and the breaking capacities shall be as a minimum rated to the peak current values and the short time withstand current in compliance with [IEC 62271-100](#).

However, when a G.I.S. is close to a generator, it shall be capable of breaking a short circuit current with a higher percentage d.c. component than the usual value. In this case the percentage d.c. component shall be calculated and specified in the project particular specification.

5.3.2 Rated out-of-phase breaking and making current

The requirements of [IEC 62271-100](#) are applicable to all circuit breakers (incomers and ties).

5.3.3 Power-frequency Short time Overvoltage

Circuit breakers intended for use in synchronizing operation, when a substantial switching surge may simultaneously occur, shall withstand 1.4 times the nominal system voltage indicated in paragraph 5.1 for a minimum of 10 s.

5.3.4 Rated capacitive switching currents

Circuit breakers shall have a minimum rated capacitive switching current in accordance with the values in table 9 of [IEC 62271-100](#).

Project specification shall address requirements for more stringent capabilities especially when overhead lines and/or capacitor banks are considered.

5.3.5 Inductive load switching

Circuit breakers shall comply with the requirements of the [IEC 62271-110](#) for the inductive load switching.

5.3.6 Operating control

Circuit breakers shall have electrical closing and opening devices with a manual and motor charged stored energy mechanism release.

Closing and tripping supplies will be from a secure 48 VDC + 10% - 15% power source, unless otherwise specified in the data sheet. Each CB shall be provided with two independent trip systems per mechanism. An emergency mechanical tripping device shall be provided.

The spring charging motors shall be ac supplied.

Anti pumping system shall be installed within each breaker command.

5.3.7 Circuit breaker class requirements

Unless otherwise stated, the circuit breaker shall be designed according to the following:

- Class E2 electrical endurance
- Class M1 mechanical endurance for distribution feeders/incomers
- Class M2 mechanical endurance for motor unit-transformer feeder application.

5.4 Switches: Disconnecter and earthing switch

All switches (disconnectors and earthing switches) shall be motorized with a manual override.

They shall be equipped with a locking system to prevent any switch movement in open and in closed position.

They shall be equipped with position indicators and auxiliary switches (On and Off).

5.4.1 Disconnectors

Disconnectors shall be supplied to isolate each equipment. Two types of disconnectors are used, bus-bar disconnector and line disconnector.

Disconnectors can be combined with earthing switch.

Safety function shall only allow disconnector movement in a no-load condition.

5.4.2 Earthing switches

Earthing switch shall be provided to earth each part of the G.I.S. conductive bar (for the line incomer, for the main bus-bar, between disconnectors and breakers, etc.).



Minimum one earthing switch per bay shall be equipped with make safe earthing switches (very fast switching type).

Safety function shall prevent closing the earthing switch if any of the switching devices (disconnecter or breaker) next to it, is closed.

5.5 Instrument transformers

5.5.1 Voltage transformers

Voltage transformers shall be installed within separate SF6 gas filled enclosure.

The preferred solution is in a gas filled compartment isolated from the bus bar by a disconnecter. Any other solution must be agreed by Company.

Three voltage transformers shall be provided with star connection and neutral earthed.

They shall be protected by adequate fuses at the secondary. The accuracy shall be:

- Metering of contractual type (when required) accuracy class 0.2
- Measurement: accuracy class 1 (minimum)
- Protection: accuracy class 3P.

The secondary rated voltage shall be 100 V or 110 V as required in the data sheet.

Voltage transformers shall be designed with a rated voltage factor of 1.9 Un/30 s as a minimum and 1.9 Un/8 hours when the neutral earthing system is totally isolated.

Voltage transformers shall be designed with a primary rated voltage factor of 1.2 Un continuous.

Voltage transformers shall be able to withstand G.I.S. dielectric tests by injection at secondary side.

5.5.2 Current transformers

Current transformers shall be installed within SF6 gas filled enclosure.

Current transformers shall be:

- Accuracy class 0.2 for contractual metering (when required)
- Accuracy class 0.5 for measuring circuits when a high level accuracy is required (metering, regulation, power measuring)
- Accuracy class 1 for current measuring
- Accuracy class 5P for protective relays when required by the Manufacturer
- Accuracy class 10P for other cases (over current relay).

The secondary current rating shall be either 1A or 5A. However, where remote metering is required, the current rating shall be 1A. For differential protection the current rating shall be 1A 5P20 or class X.

Current transformers shall be rated to withstand the thermal and magnetic stresses resulting from the switchgear rated fault level.



Measurement of earth fault current shall be provided preferably by open type core balance CTs. If this is not possible, measurement of residual current from connection of 3 CTs shall be provided.

Special CT may be required for power measurement identical to the one defined by the local grid Authority.

5.6 Metering, protection, control and indication

Metering, protection, control and indication shall be in accordance with the single line diagrams, typical protection diagrams and data sheets.

Meters and relays shall be capable of withstanding without damage the secondary currents associated with the switchgear rated fault current flowing in the primary of current transformers.

Multiple test blocks shall be provided for each instrument transformer.

Current transformers shall be wired to shorting type terminal blocks.

Protection relays shall be microprocessor based and programmable type units.

All the relays shall be able to be synchronised with an external clock and shall have a simplified electrical network disturbance recorder included inside its software.

Interlock and intertrip circuits shall use hardwired auxiliary contacts without repeat relays.

Specific function of relevant compartment shall be clearly indicated.

All indicators shall be made of multi LED only.

As a minimum, the following colour code shall be used:

- Status:
 - On/closed/Running: RED
 - Off/Open/Stopped: GREEN
 - Fault/Trip: YELLOW
 - Voltage presence: WHITE
- Push button:
 - On/Close/Start: GREEN
 - Off/Open/Stop: RED
 - Emergency Stop RED (when any)
 - Lamp test BLACK (when any)
 - Reset BLUE (when any)

Special provisions (spare contacts, analog interface, etc.) shall be taken for interconnection with an electrical network disturbance recorder.



6. Construction requirements

6.1 General

6.1.1 Degree of protection

The minimum Ingress protection for control cabinet shall be IP31 if installed indoor, IP66 if installed outdoor. All indoor equipment shall be IP31.

Higher protection could be requested in the data sheet.

When tropicalisation is required in the Data Sheet, Manufacturer shall indicate in his proposal the additional treatment.

6.1.2 Internal fault

The G.I.S. shall withstand arcing due to an internal fault at the same value as the short-circuit current for a duration of 1 s minimum.

6.1.3 Electromagnetic Compatibility

The Manufacturer shall ensure that effects of induced voltages, earth potential raise, electromagnetic interference and “noise” are carefully considered, and means taken to prevent any mis-operation, erratic performance or failure due to these effects.

6.2 Structure

Appropriate base frames to provide a substantial foundation for the G.I.S. installation together with holding bolts, nuts and washers, rails, etc., shall be included.

Each bay shall be divided in different gas-tight compartments (busbars, circuit breaker(s), disconnectors, etc.). Each gas-tight barrier insulator ensures that any effects on adjacent components are kept to a minimum.

G.I.S. shall have facilities for extension on both sides unless otherwise specified in the data sheet.

The Manufacturer shall provide the key interlocking devices and shall interface with other electrical equipment.

G.I.S. shall be designed and constructed to facilitate inspection, transport, cleaning, repair and maintenance and to ensure absolute safety.

6.3 Busbars

Busbars shall be installed in separate SF6 gas filled enclosure.

Busbars shall be of the same cross-sectional area throughout the G.I.S.

Busbars and connections shall be adequately sized, braced and supported to withstand the mechanical forces and thermal effects resulting from the G.I.S. rated short circuit current.

6.4 External bushings

For outdoor connection to overhead line, outdoor bushings shall be used. They shall be so designed as to provide an improved protection against pollution and their insulation level shall be enhanced.



6.5 Bus ducts

Gas Insulated Busducts may be used between the G.I.S. bays and the external bushings or the transformers.

Special care shall be taken whenever they are crossing wall openings.

Bus ducts whenever they are longer than 5 meters shall be supported every 3 meters.

For direct connection to transformer, [IEC 61639](#) shall be applied.

6.6 Cable sealing ends

For cable connection to G.I.S., [IEC 62271-209](#) shall be applied.

6.7 Control cubicles

Doors shall be fitted with mimic diagram with position indicators, control switches, visual alarm indicators and with an audible alarm.

Each equipment shall be fitted with a local/remote selector switch.

Unless otherwise specified, no key or locking device to open enclosure and doors is required. Only door handles shall be provided.

The local grid Authority shall define the protection/communication cubicles (e.g.: line differential protections, etc.) either supplied by the Manufacturer or by the local grid Authority.

6.7.1 Secondary wiring within cubicles

Secondary wiring shall be stranded copper, self extinguishable, insulated with black or white PVC 750 V grade with the following minimum cross-sections:

- 2.5 sq. mm for current circuits
- 1 sq. mm for voltage circuits
- 1 sq. mm for auxiliary wiring (control, signals, etc.).

For electronic circuit wiring, Manufacturer standard shall be used.

When required by Project, wiring shall be halogen free.

All wiring for external connections and for analogue circuits shall be brought out to individual terminals on a readily accessible terminal block. Wires shall be terminated using compression type lugs, or crimp sleeves if spring terminals are not used.

Secondary wiring shall be securely held in position (either loomed or run in trunking).

Identification shall refer to the related wiring diagram.

Flexible conductors shall be used for connections on door mounted equipment.

Interconnection between sections separated for shipping shall be made with plug-in type connectors.

6.7.2 Cable terminations

Cable terminating facilities and terminals shall be suitable for the specified cable type and conductor size.



Terminals for external conductors shall be so arranged as to be accessible for mounting, wiring, maintenance and replacement.

Positioning of cable termination facilities shall avoid obstruction of other cable terminations, removable covers, etc., and provide easy access for terminating cables.

Terminals shall be identified in accordance with the wiring diagram. The lay out shall be logical and consistent.

Cable supports shall be provided to avoid undue strain on cable terminations.

Power and control cables shall be routed and terminated in separate cable trays.

Spring terminals are preferred.

20% spare terminals shall be provided.

6.8 Interconnecting wiring

Wiring between control cubicles and control cabinets shall be prepared before installation.

All interconnecting cables shall be routed under a mechanical protection. Each cable shall be terminated on proper terminal blocks, no direct wiring is allowed.

Plug type termination are preferred.

6.9 Miscellaneous

6.9.1 Earthing

An earthing busbar shall be provided for each bay of the G.I.S., it shall be bonded one by one to the main earthing bus bar. Earthing busbars shall be made of hard drawn copper.

All metallic non-current carrying parts of the G.I.S. and control cabinets including hinged doors shall be bonded together to the bay earthing busbar.

When the control cubicles are close to the G.I.S., the earthing systems (one for the G.I.S. and the cabinets and another for the cubicles) shall be interconnected to the same main earthing bus bar.

Provision shall be made, adjacent to the cable terminations, for cable armour and screen connection to the earthing busbar.

6.9.2 Anti-condensation heaters

Control cabinets and control cubicles shall be equipped with anti-condensation heaters of sufficient capacity to prevent formation of condensation within the enclosure under the service conditions.

Anti-condensation heaters shall be installed at the bottom of each vertical section and shall be individually protected by miniature circuit breakers. Heaters shall be controlled by hygrometers. A dedicated feeder breaker shall be provided with alarm contacts.

6.9.3 Labels

Cubicles, cabinets, compartments, circuit breakers and components shall be identified by labels with circuit numbers. Cubicle label designations (at front and rear of panel) shall be in accordance with the G.I.S. single line diagram and associated data sheet.

Nameplates shall bear all identification in accordance with the reference standards. Language used for labelling shall be stated in the data sheet.

Nameplates shall be laminated engraved plastic with black letters on a white background.

Warning labels for SF6 shall be provided with GIS.

6.9.4 Special tools and accessories

Handles, tools, appropriate mobile platform and service trucks for operation and maintenance of G.I.S. shall be provided in the electrical room or building where it is installed.

A portable gas delivery/recovery service, vacuum pump and gas treatment unit, three way valves, necessary hoses and connectors shall be supplied for maintenance.

6.9.5 Maintainability

A crane shall be installed above the equipment to help during the installation and the maintenance (out of Manufacturer's scope). The Manufacturer shall indicate the loads and clearances for G.I.S. handling.

6.10 Specific requirements for gas tightness in G.I.S.

The G.I.S. shall be equipped of a monitoring system of the insulating gas pressure.

Each compartment shall be equipped with a pressure relief device, preferably oriented away from operator possible position.

The relative leakage rate F_{rel} per gas compartment shall be less than 0.5% for SF6 gas mixture and for SF6 Gas per year as specified in [IEC 62271-1](#) paragraph 5.15.2 and in [IEC 62271-203](#) paragraph 5.15.

The time between refilling T shall be at least 10 years as specified in [IEC 62271-1](#) paragraph 5.15.2 and in [IEC 62271-203](#) paragraph 5.15.

7. Interfaces with (ECS) Electrical Control System (Optional)

When specified, G.I.S. may be connected to an Electrical Control System dedicated to manage the general electrical network.

Protection relays shall be interfaced with the ECS using RS485 Serial Link and Modbus protocol type, or, alternatively, [IEC 61850](#) based network and protocol. Proprietary protocols are not allowed. However, other protocols than above mentioned ones may be used after Company prior approval.

Specific requirements will be developed within the Project Particular Specification.

8. Inspection and testing

8.1 General

The G.I.S. shall be type-tested in accordance with the procedure described in [IEC 62271-203](#) paragraph 6.

All equipment covered by this specification shall be subject to inspection and testing by Company at the Manufacturer's works during manufacture. In certain cases these activities may extend to the Manufacturer's Sub-Contractors.

Inspection and tests shall be performed in accordance with IEC standards ([IEC 62271-100](#) § 10.2 and [IEC 62271-203](#) § 6 and 7 for instance).

8.2 Type tests

Type tests in accordance with the referenced standards shall have been carried out on Manufacturer's similar equipment and the type test certificates issued by a recognized testing laboratory shall be provided with the quotation.

8.3 Factory acceptance tests

Factory acceptance tests shall be performed by Manufacturer in the presence of Company representative.

At least the following tests shall be performed:

- Visual check (aspect, painting, finish, welding, sheet metal, lifting ring, assembly bolt torque, conformity of torque values for main connections, lining up of measuring apparatus, handling devices, remote control and signalling, labels)
- Dimension controls (terminals, busbar and wires, leakage path and insulation distance, fixation axis, overall dimensions, weight)
- Check for conformity and existence of name plates, marking labels, notice boards for danger, marking of miscellaneous G.I.S., wire marking, terminal marking, earth marking, phase marking with colours and all extra markings depending on specification requirements
- Auxiliary device test
- Quality and quantity check for wearable parts and spare parts according to the specification concerned
- Control of protective devices by primary current injection corresponding to the protection setting values (Secondary injection is acceptable when the appropriate relevant certificates of CT's are provided)
- Power-frequency voltage tests on the main circuit
- Dielectric test of main circuits
- Dielectric test of auxiliary circuits
- Mechanical test
- G.I.S. electrical operation test
- Insulation resistance measurement
- Check for validation of the interface link with the ECS. The tests will be carried out in accordance with the tools and support (meeting, procedure and documentation) proposed by the ECS Manufacturer
- Participation in the Factory Acceptance Tests of the ECS in order to test all the protection and Measurement Management Units (MMU), and the specific functions (restarting, automatic transfer, load-shedding, etc.).

A test report shall be issued.

8.4 Installation, Field tests

Installation and Field tests shall be made before the G.I.S. is energised and/or put in service and include in accordance with [IEC 62271-203](#) paragraph 10 requirements:

- Insulation measurement
- Dielectric tests on main circuits
- Dielectric tests on auxiliary circuits
- Partial discharge measurement
- Time tests on switching devices
- Contact resistance of main circuit
- Tightness tests
- Gas moisture content (refer to [IEC 62271-203](#) paragraph 10.2.101.6 Gas quality verifications)
- SF6 supervision system check
- Primary injection and adjustment of all protective devices
- Interlock and intertrip functions
- No-load operation
- Phase rotation
- Incomer transfer sequences
- ECS interface functions (if applicable).

8.5 Manufacturer's assistance

The Manufacturer shall provide field services for:

- Erection
- Precommissioning
- Commissioning
- Start-up
- Training.

9. Design Life & Obsolescence

Facilities are typically designed with an expected design life in the order of 20 to 25 years.

Obsolescence management shall be in accordance with [GS EP TEC 007](#).

The Switchgear design shall therefore take into account the requirement that the equipment will most probably require to be upgraded during the design life of the facilities in particular for all the electronic based components. These requirements shall be incorporated from Basic Engineering stage.



The design will include provisions to allow an upgrade of the Switchgear to be performed with minimal disturbance to the power generation and distribution systems, fixed cabling infrastructure and infrastructure.

All hardware and software that may be developed by the Supplier further to the Switchgear delivery, shall ensure full ascending compatibility to allow for easy replacement of equipment that became obsolete with limited reconfiguration.

At the Bid stage, the Switchgear Supplier shall detail his lifecycle management strategy focusing on product obsolescence, support options and further migration alternatives. The lifecycle/obsolescence management plan and associated cost shall be part of the Bid process evaluation.

The Switchgear Supplier shall complete an inventory of all provided equipment (hardware and software) matching to different lifecycles phases, including all Sub-Vendors equipment (e.g. protection relays, switches, HMI (Human Machine Interface)).

Switchgear **Supplier** shall guarantee that:

- Switchgear components (including software and hardware) shall remain in the “active products” range (i.e. supporting developments and releases) over a period of at least 10 years after the SAT
- An announcement to Customer is provided 5 years prior the end of the commercial phase
- Switchgear components (including software and hardware) shall be fully supported and available over a period of at least 20 years after the SAT
- Maintenance services including availability of engineering services shall be available to support the Switchgear during the plant life time.

10. Documentation

Unless otherwise specified in project particular specification, Manufacturer shall provide Information as per lists described in [IEC 62271-100](#) § 9 and [IEC 62271-203](#) § 9 and at least the following documents:

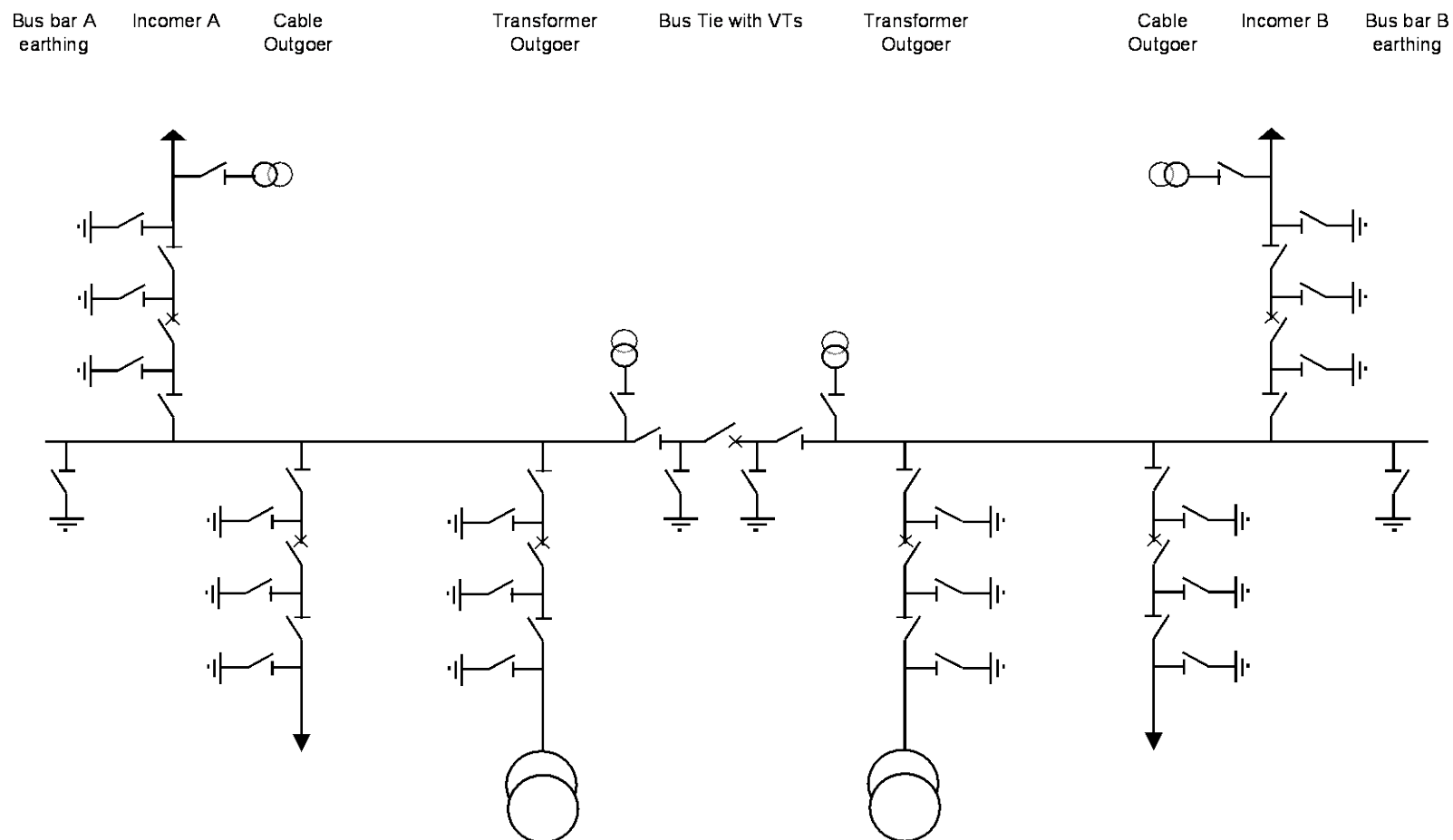
	With the Bid	After Purchase Order
• List of clarifications/deviations from the Specifications	X	X
• Overall arrangement drawing	X	X
• Filled-up HV Switchgear data-sheets	X	X
• Heat dissipation	X	X
• Civil works drawings	X	X
• Tropicalisation specification if needed	X	X
• One line diagram	X	X
• Earthing drawing	X	X
• Wiring diagrams		X
• Schematic diagrams		X
• Interconnection diagram (between G.I.S. and control bays)		X
• Logic Diagrams		X
• Digital relay setting sheets		X
• Maintenance and operation manuals		X
• Spare part list and consumables (SF6 bottles, etc.)		X
• Detailed equipment information (technical documentation)	X	X
• Copy of software and configuration of PLC/digital relays, etc		X
• Transportation procedure		X
• Type test reports	X	X
• Pressure test reports of SF6 enclosures and pressure relief devices certificates		X
• FAT reports		X
• Obsolescence management dossier	X	X



11. Other references

Following standards are applicable: [IEC 60044 \(Parts 1; 2\)](#), [IEC 60050-441](#), [IEC 60050-441/A1](#), [IEC 60060](#), [IEC 60071](#), [IEC 60099](#), [IEC 60137](#), [IEC 60255](#), [IEC 60270](#), [IEC 60376](#), [IEC 60480](#), [IEC 60529](#), [IEC 60706](#), [IEC 61000](#), [IEC 61321-1](#), [IEC 61640](#), [IEC 62305-4](#), [IEC 62402](#).

Appendix 1 Typical One line Diagram





Appendix 2 Data sheet High voltage switchgear


Exploration & Production

DATA SHEET	N°
Project:	
DS EP ELE 131	High voltage switchgear
Rev. 03 - 10/05	

Rev. Date						
Written						
Verified						
Approved						

Appel d'offres/Call for tender ☐		Commande/Order ☐	
1	REPERE DE L'EQUIPEMENT/EQUIPMENT IDENTIFICATION :		
2			
3			
4	CONDITIONS D'INSTALLATION		
5	INSTALLATION CONDITIONS		
6			
7	Température ambiante :	normale °C	Maximum °C
8	Ambient temperature	normal	Maximum
9			Minimum °C
10	Hygrométrie relative :	normale %	Maximum %
11	Relative humidity	normal	Maximum
12			
13	Altitude : > 1000 m	mètres	Intérieur ☐
14	Altitude : > 1000 m		On-shore ☐
15			Off-shore ☐
16	Salle ventilée ☐	Salle climatisée ☐	Salle surpressée ☐
17	Ventilated room	Air conditioned room	Pressurized room
18			
19	Mise en place	Sol béton/planéité 2 mm/1000 ☐	Faux plancher ☐
20	Installed on	Concreted floor/Flatness	Châssis ☐
21			Caniveau ☐
22			
23			
24			
25			
26			
27	CARACTERISTIQUES TECHNIQUES		
28	TECHNICAL DATA		
29			
30	Règles de conception/Rules for conception		
31			
32	Appareillage sous enveloppe métallique ☐	Blindé ☐	Compartmenté ☐
33	Metal enclosed switchgear and controlgear	Metal-clad	Compartmented
34			Bloc ☐
35	Degré IP enveloppe	Degré IP cloisons	
36	Degree of protection for enclosure	Degree of protection for partitions	
37			
38	Raccordements puissance	Bas ☐	Haut ☐
39	Main connections	Bottom	Top
40			Arrière ☐
41	Raccordements câbles auxiliaires	Bas ☐	Haut ☐
42	auxiliary cables connection	Bottom	Top
43			Arrière ☐
44	Extension future/Future extension ☐	Gauche/Left ☐	Droite/Right ☐
45			
46	Verrouillages/interlocks	Standard/Standard ☐	Complémentaire/Additional ☐
47			
48	Peinture	Standard constructeur ☐	Autre ☐
49	Painting	Supplier's standards	Other
50			
51	Etiquettes	Dilophane ☐	Inox ☐
52	Labels		Fixées par vis ☐
53			Fixées par collage ☐
			Langue

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Appel d'offres/Call for tender ☐		Commande/Order ☐	
1			
2			
3	Circuits principaux de puissance/Power main circuits		
4	Tension assignée d'emploi Rated operating voltage	kV	Tension assignée d'isolement Rated insulation voltage kV
5			
6			
7	Tension assignée de tenue à fréquence industrielle 50 Hz 1 min Rated impulse withstand voltage 50 Hz 1 min	kV eff	
8			
9			
10	Tension assignée de tenue aux chocs 1,2/50 ms Rated impulse withstand voltage 1,2/50 ms	kVc	
11			
12			
13	Fréquence assignée Rated frequency	Hz +/- %	
14			
15			
16	Courant assigné In Rated normal current	A	Valeur de crête de courant admissible assigné Rated peak withstand current kA
17			
18			
19	Courant de courte durée admissible assigné Rated short-time withstand current	kA kA	sec
20			
21			
22	% de composante courant continu % of DC component	%	
23			
24			
25	Circuit de contrôle et de signalisation/Control and signalling circuits		
26			
27	Tension de signalisation Signalling voltage	V + - %	AC ☐ DC ☐
28			
29			
30	Tension de contrôle Control voltage	V + %	AC ☐ DC ☐
31			
32			
33	Taux d'ondulation Rate of ripple	%	
34			
35			
36	Tension assignée de tenue à fréquence industrielle 50 Hz 1 min Rated impulse withstand voltage 50Hz 1 min	kV eff	
37			
38			
39	Régime de neutre/earthing system		
40			
41	Limitation du courant homopolaire : Zero sequence current limitation	Résistance ☐ Resistance	Générateur homopolaire Earthing transformer ☐
42			
43			
44	Courant Current	Maxi A Mini A	
45			
46			
47	Jeu de barres principal/Main busbars		
48			
49			
50	Type Type	Simple ☐ Double ☐ Isolé ☐ Single Double Completely insulated	
51			
52			
53	Courant assigné Rated current	A	
54			
55			
56			
57			

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1			
2			
3	Caractéristiques des disjoncteurs/Circuit breaker characteristics		
4	Pouvoir de coupure Breaking capacity	kA eff	Pouvoir de fermeture Making capacity kAc
5			
6			
7	Dispositif de coupure Type of breaking device	Vide Vacuum ☐	SF6 SF6 ☐
8	Autre Other ☐		
9			
10	Type de montage Type of mounting	Débrochable Withdrawable ☐	Fixe Fixed ☐
11	Déconnectable Disconnectable ☐		
12			
13	Organe de manoeuvre Operating mechanism	Réarmement manuel Manually charged ☐	Réarmement électrique Electrically charged ☐
14			
15			
16	Cycles de manoeuvre Operating cycles	0 - 3 min CO - 3 min CO ☐	0 - 0,3 sec CO - 3 min CO ☐
17	CO - 15 s - CO ☐		
18			
19	Alimentation commandes Control supply	Déclenchement/Enclenchement Tripping/closing V	AC ☐
20	DC ☐		
21			
22	Moteur réarmement Charging motor	V	AC ☐
23	DC ☐		
24			
25	Déclencheur à émission de tension Shunt release ☐	Déclencheur à manque de tension Under-voltage release ☐	Contact alarme pression basse Low gas pressure alarm switch ☐
26			
27			
28	Contacts auxiliaires position disjoncteur Breaker position auxiliary contacts	N/O ☐	Nombre Number
29	N/C ☐		
30	Nombre Number		
31			
32	Caractéristiques des contacteurs/Contactor characteristics		
33	Pouvoir de coupure Breaking capacity	kA eff	Pouvoir de fermeture Making capacity kAc
34			
35			
36	Dispositif de coupure Type of breaking device	Vide Vacuum ☐	SF6 SF6 ☐
37	Autre Other ☐		
38			
39	Type de montage Type of mounting	Débrochable Withdrawable ☐	Fixe Fixed ☐
40	Déconnectable Disconnectable ☐		
41			
42	Contacteur à maintien magnétique Magnetic latch-in contactor ☐	Contacteur à accrochage mécanique Mechanical latch-in contactor ☐	
43			
44			
45	Alimentation commandes Control supplies	Déclenchement/endenchement Tripping/closing V	AC ☐
46	DC ☐		
47			
48	Déclencheur à émission de tension Shunt release ☐	Déclencheur à manque de tension Under-voltage release ☐	Contact alarme pression basse Low gas pressure alarm contact ☐
49			
50			
51	Contacts auxiliaires position contacteur Contactor position auxiliary contacts	N/O ☐	Nombre Number
52	N/C ☐		
53	Nombre Number		
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1	Equipements cellules/Cubicle equipment		
2			
3	Arrivée générateur/Generator incoming	Reperer/Mark	
4	Equipements principaux / Main equipment		Calibre/Rating
5	Disjoncteur/Circuit breaker		
6	Contacteur fusibles/Fused contactor		
7	Interrupteur/Switch		
8	Interrupteur fusibles/Fused switch		
9	Sectionneur/Isolating switch		
10	Motosation/Motorization		
11	Transformateur d'intensité/Current transformer		
12	Transformateur de tension/Voltage transformer		
13	Tore homopolaire/Core balance CT		
14	Relais de protection/Protective relays		
15	Maxi I instantané/Instantaneous overcurrent (50)		
16	Max I à temps constant/Independent time overcurrent (51)		
17	Max I à temps dépendant/Inverse time overcurrent (51)		
18	Surcharge thermique/Thermal overload (49)		
19	Max I homopolaire/Earth fault (50N 51N)		
20	Max I homopolaire directionnel/Directional earth fault (67N)		
21	Différentielle longitudinale/Longitudinal differential (87)		
22	Masse cuve/Tank earth protection (50 51)		
23	Max I inverse/reverse phase (46)		
24	Max U/Over voltage (59)		
25	Mini U/Under voltage (27)		
26	Retour de puissance/Directional power (32)		
27	Max fréquence/Over frequency (81)		
28	Mini fréquence/Under frequency (81)		
29	Perte excitation/Field failure (40)		
30			
31			
32			
33			
34			
35			
36	Mesures/Measurement		
37	Ampèremètre/Ammeter		
38	Voltmètre/Voltmeter		
39	Wattmètre/Wattmeter		
40	Varmètre/Varmeter		
41	Fréquencemètre/Frequency meter		
42	Facteur de puissance/Power factor meter		
43	Compteur énergie active/Watthour meter		
44	Compteur énergie réactive/Varhour meter		
45			
46			
47			
48	Auxiliaires/Auxiliaries		
49	Résistance de chauffage/Anti-condensation heaters		
50	Interface de communication/Communication interface		
51			
52			
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1	Equipement cellules/Cubicle equipment		
2			
3	Arrivée câble/Incoming cable	Reperer/ Mark	
4	Equipement principaux / Main equipment		Calibre/Rating
5	Disjoncteur/Circuit breaker		
6	Contacteur fusibles/Fused contactor		
7	Interrupteur/Switch		
8	Interrupteur fusibles/Fused switch		
9	Sectionneur/Isolating switch		
10	Motorisation/Motorization		
11	Transformateur d'intensité/Current transformer		
12	Transformateur de tension/Voltage transformer		
13	Tore homopolaire/Core balance CT		
14	Relais de protection/Protective relays		
15	Maxi I instantané/Instantaneous overcurrent (50)		
16	Max I à temps constant/Independent time overcurrent (51)		
17	Max I à temps dépendant/Inverse time overcurrent (51)		
18	Surcharge thermique/Thermal overload (49)		
19	Max I homopolaire/Earth fault (60N 61N)		
20	Max I homopolaire directionnel/Directional earth fault (67N)		
21			
22	Mesures/Measurement		
23	Ampèremètre/Ammeter		
24	Voltmètre/Voltmeter		
25	Wattmètre/Wattmeter		
26	Varmètre/Varmeter		
27	Fréquencemètre/Frequency meter		
28	Facteur de puissance/Power factor meter		
29	Compteur énergie active/Watthour meter		
30	Compteur énergie réactive/Varhour meter		
31			
32	Auxiliaires/Auxiliary		
33	Résistance de chauffage/Anti-condensation heaters		
34	Interface de communication/Communication interface		
35			
36			
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1	Equipements cellules/Cubicle equipment		
2			
3	Départ cable/Cable feeder	Repère/ Mark	
4	Equipements principaux/Main equipment		Calibre/Rating
5	Disjoncteur/Circuit breaker		
6	Contacteur fusibles/Fused contactor		
7	Interrupteur/Switch		
8	Interrupteur fusibles/Fused switch		
9	Sectionneur/Isolating switch		
10	Motosation/Motorization		
11	Transformateur d'intensité/Current transformer		
12	Transformateur de tension/Voltage transformer		
13	Tore homopolaire/Core balance CT		
14	Relais de protection/Protective relays		
15	Max I instantané/Instantaneous overcurrent (50)		
16	Max I à temps constant/Independent time overcurrent (51)		
17	Max I à temps dépendant/Inverse time overcurrent (51)		
18	Max I homopolaire/Earth fault (50N 51N)		
19	Max I homopolaire directionnel/Directional earth fault (67N)		
20	Court circuit/Short circuit (50)		
21			
22	Mesures/Measurement		
23	Ampèremètre/Ammeter		
24	Voltmètre/Voltmeter		
25	Wattmètre/Wattmeter		
26	Varmètre/Varmeter		
27	Compteur énergie active/Watthour meter		
28	Compteur énergie réactive/Varhour meter		
29			
30	Auxiliaires/Auxiliary		
31	Résistance de chauffage/Anti-condensation heaters		
32	Interface de communication/Communication interface		
33			
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1	Equipement cellules/Cubicle equipment		
2			
3	Départ transformateur/Power transformer feeder	Repere/ Mark	
4	Equipement principaux/Main equipment		Calibre/Rating
5	Disjoncteur/Circuit breaker		
6	Contacteur fusibles/Fused contactor		
7	Interrupteur/Switch		
8	Interrupteur fusibles/Fused switch		
9	Sectionneur/Isolating switch		
10	Motorisation/Motorization		
11	Transformateur d'intensité/Current transformer		
12	Transformateur de tension/Voltage transformer		
13	Tore homopolaire/Homopolar torus		
14	Relais de protection/Protective relays		
15	Maxi I instantané/Instantaneous overcurrent (50)		
16	Max I à temps constant/Independent time overcurrent (51)		
17	Max I à temps dépendant/Inverse time overcurrent (51)		
18	Max I homopolaire/Earth fault (50N 51N)		
19	Max I homopolaire directionnel/Directional earth fault (67N)		
20	Différentielle longitudinale/Longitudinal differential (87)		
21	Masse cuve/Tank earth protection (50 51)		
22	DGPT2/Bucchoiz		
23			
24	Mesures/Measurement		
25	Ampèremètre/Ammeter		
26	Voltmètre/Voltmeter		
27	Wattmètre/Wattmeter		
28	Varmètre/Varmeter		
29	Fréquence/mètre/Frequency meter		
30	Facteur de puissance/Power factor meter		
31	Compteur énergie active/Watthour meter		
32	Compteur énergie réactive/Varhour meter		
33			
34	Auxiliaires/Auxiliary		
35	Résistance de chauffage/Anti-condensation heaters		
36	Interface de communication/Communication interface		
37			
38			
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Appel d'offres/Call for tender ☐		Commande/Order ☐	
1	Equipements cellules/Cubicle equipment		
2			
3	Départ moteur/Motor feeder	Repère/ Mark	
4	Equipements principaux/Main equipment		Calibre/Rating
5	Disjoncteur/Circuit breaker		
6	Contacteur fusibles/Fused contactor		
7	Interrupteur/Switch		
8	Interrupteur fusibles/Fused switch		
9	Sectionneur/Isolating switch		
10	Motosation/Motorization		
11	Transformateur d'intensité/Current transformer		
12	Transformateur de tension/Voltage transformer		
13	Tore homopolaire/Core balance CT		
14	Relais de protection/Protective relays		
15	Maxi I instantané/Instantaneous overcurrent (50)		
16	Max I à temps constant/Independent time overcurrent (51)		
17	Max I à temps dépendant/Inverse time overcurrent (51)		
18	Surcharge thermique/Thermal overload (49)		
19	Max I homopolaire/Earth fault (50N 51N)		
20	Max I homopolaire directionnel/Directional earth fault (67N)		
21	Démarrage trop long/Overall starting time		
22	Blocage rotor/Locked rotor (51LR)		
23	Max I inverse/Reverse phase (46)		
24	Mini courant/Under current (37)		
25	Mini puissance/Under power (32)		
26	Limitation nombre démarrages/Limitation number of starts (66)		
27	Perte excitation/Field failure (40)		
28			
29			
30			
31	Mesures/Measurement		
32	Ampèremètre/Ammeter		
33	Voltmètre/Voltmeter		
34	Wattmètre/Wattmeter		
35	Varmètre/Varmeter		
36	Fréquence/mètre/Frequency meter		
37	Facteur de puissance/Power factor meter		
38	Compteur énergie active/Watthour meter		
39	Compteur énergie réactive/Varhour meter		
40	Compteur horaire/Hour meter		
41	Compteur de démarrage/Starting counter		
42	Auxiliaires/Auxiliary		
43	Résistance de réchauffage/Anti-condensation heaters		
44	Interface de communication/Communication interface		
45			
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Appel d'offres/Call for tender ☐		Commande/Order ☐	
1	Equipements cellules/Cubicle equipment		
2			
3	Générateur homopolaire/Earthing transformer	Reperer/ Mark	
4	Equipements principaux/Main equipment		Calibre/Rating
5	Disjoncteur/Circuit breaker		
6	Contacteur fusibles/Fused contactor		
7	Interrupteur/Switch		
8	Interrupteur fusibles/Fused switch		
9	Sectionneur/Isolating switch		
10	Motonisation/Motorization		
11	Transformateur d'intensité/Current transformer		
12	Transformateur de tension/Voltage transformer		
13	Tore homopolaire/Core balance CT		
14	Relais de protection/Protection relays		
15	Max I instantané/Instantaneous overcurrent (50)		
16	Max I à temps constant/Independent time overcurrent (51)		
17	Max I à temps dépendant/Inverse time overcurrent (51)		
18	Surcharge thermique/Thermal over load (49)		
19	Max I homopolaire/Earth fault (50N 51N)		
20	Max I homopolaire directionnel/Directional earth fault (67N)		
21	Mesures/Measurement		
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32	Auxiliaires/Auxiliary		
33	Résistance de réchauffage/Anti-condensation heaters		
34	Interface de communication/Communication interface		
35			
36			
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1	Equipements cellules/Cubicle equipment		
2			
3	Couplage/Bus tie	Repere/ Mark	
4	Equipements principaux/Main equipment		calibre / rating
5	Disjoncteur/Circuit breaker		
6	Contacteur fusibles/Fused contactor		
7	Interrupteur/Switch		
8	Interrupteur fusibles/Fused switch		
9	Sectionneur/Isolating switch		
10	Motosation/Motorization		
11	Transformateur d'intensité/Current transformer		
12	Transformateur de tension/Voltage transformer		
13	Tore homopolaire/Core balance CT		
14	Relais de protection/Protective relays		
15	Maxi I instantané/Instantaneous overcurrent (50)		
16	Max I à temps constant/Independent time overcurrent (51)		
17	Max I à temps dépendant/Inverse time overcurrent (51)		
18	Surcharge thermique/Thermal over load (49)		
19	Max I homopolaire/Earth fault (50N 51N)		
20	Max I homopolaire directionnel/Directional earth fault (67N)		
21			
22	Mesures/Measurement		
23	Ampèremètre/Ammeter		
24	Voltmètre/Voltmeter		
25	Wattmètre/Wattmeter		
26	Varmètre/Varmeter		
27	Fréquence/mètre/Frequency meter		
28	Facteur de puissance/Power factor meter		
29	Compteur énergie active/Watthour meter		
30	Compteur énergie réactive/Vatthour meter		
31			
32	Auxiliaires/Auxiliary		
33	Résistance de réchauffage/Anti-condensation heaters		
34	Interface de communication/Communication interface		
35			
36			
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Appel d'offres/Call for tender ☐		Commande/Order ☐	
1	Equipements cellules/Cubicle equipment		
2			
3	Remontée de barres et mesure/Bus riser and metering	Repere/ Mark	
4	Equipements principaux/Main equipment	Calibre/Rating	
5	Disjoncteur/Circuit breaker		
6	Contacteur fusibles/Fused contactor		
7	Interrupteur/Switch		
8	Interrupteur fusibles/Fused switch		
9	Sectionneur/Isolating switch		
10	Motorsation/Motorization		
11	Transformateur d'intensité/Current transformer		
12	Transformateur de tension/Voltage transformer		
13	Tore homopolaire/Core balance CT		
14			
15	Relais de protection/Protection relays		
16	max U/Over voltage (59)		
17	mini U/Under voltage (27)		
18	Retour de puissance/Directional power (32)		
19	Max fréquence/Over frequency (81)		
20	Mini fréquence/Under frequency (81)		
21			
22	Mesures/Measurement		
23	Ampèremètre/Ammeter		
24	Voltmètre/Voltmeter		
25	Wattmètre/Wattmeter		
26	Varmètre/Varmeter		
27	Fréquence/mètre/Frequency meter		
28	Facteur de puissance/Power factor meter		
29	Compteur énergie active/Watthour meter		
30	Compteur énergie réactive/Varhour meter		
31			
32	Auxiliaires/Auxiliary		
33	Résistance de réchauffage/Anti-condensation heaters		
34	Interface de communication/Communication interface		
35			
36			
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1			
2	ESSAIS		
3	TESTS		
4	Vérification du câblage/Checking for wiring		☐
5			
6	Essai de fonctionnement électrique/Electrical functional test		☐
7			
8	Essai de tension à la fréquence industrielle du circuit principal		☐
9	Power-frequency voltage test on the main circuit		
10			
11	Essai diélectrique des circuits auxiliaires et de commandes		☐
12	Dielectric test on auxiliary and control circuits		
13			
14	Vérification du fonctionnement mécanique/mechanical functional tests		☐
15			
16	Vérification de la résistance d'isolement/insulation resistance test		☐
17			
18	Vérification des mesures de protection contre les contacts directs et indirects		☐
19	Checking of protective measures against direct and indirect contacts		
20			
21	Vérification de la continuité électrique des circuits de protection		☐
22	Checking for the electrical continuity of the protective circuits		
23			
24	Vérification de l'interface avec l'ECS		☐
25	Checking for validation of the interface with the ECS		
26			
27	Participation aux tests en usine de l'ECS		☐
28	Participation to the FAT of the ECS		
29			
30	CARACTERISTIQUES A FOURNIR PAR LE CONSTRUCTEUR		
31	SPECIFICATIONS TO BE SUPPLIED BY THE SUPPLIER		
32			
33	Dimensions cellule	L/W=	
34	Cubicle dimensions	P/D=	
35		H/H=	
36		masse (kg)	
37		weight	
38	Désignation du type		
39	Type designation		
40	Jeu de barres principal : section et nature	Jeu de barres distribution : section et nature	
41	Main busbars: section and type	Distribution busbars: section and type	
42	Listes des fournisseurs disjoncteur contacteur fusibles relais, appareils de mesure, etc.		
43	Vendors list: circuit breaker, contactor, fuses, relays meters, etc.		
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