



**ODISHA POWER SECTOR EMERGENCY ASSISTANCE PROJECT**

**(PACKAGE – I, LOT – 2)**

**Technical Specification  
For 132kV HYBRID SWITCHGEAR**

# **TECHNICAL SPECIFICATION OF HV HYBRID SWITCHGEAR AT BERHAMPUR**

## **1. SCOPE**

Supplier shall be responsible for the design works, supply of materials, manufacture, fabrication, shop assembling, shop inspection, tests, quality assurance requirements, supervision of installation and pre-commissioning, guarantee, painting, packing and delivery, all necessary documentation required and satisfactory operation of the entire phase-segregated hybrid module with double bus bar configuration for 132KV incoming, outgoing.

The equipment supplied shall be in accordance with the instructions, requirements of this supply specification and all references or attached documentations.

## **2. REFERENCE DOCUMENTS AND STANDARDS**

The equipments shall match the performance requirements of the latest applicable standards of IEC (International Electrical Committee). The equipments shall also be designed, manufactured and tested in accordance with the same standards. The choice of material, suppliers, sub-assemblies and working procedures is governed by the international standard quality-assurance programs, which meet requirements specified by ISO 9001 and 14001. Specification, project engineering documents and/or drawings and standards shall govern any kind of conflict.

The following standards are applicable in the relevant parts of the individual components of the gas-insulated switchgear:

CENELEC	European Standards for gas filled enclosures
IEC 62271-205	High-voltage switchgear and control gear – Compact switchgear assemblies for operation at rated voltages above 52 kV
IEC 60044	Instrument transformers
IEC 60059	IEC standard current ratings
IEC 60060	High voltage test techniques
IEC 60137	Insulated bushings for alternating voltage above 1000 V
IEC 60265	High voltage switches
IEC 60270	High voltage test techniques – Partial discharge measurements
IEC 60376	Specification of technical grade sulphur hexafluoride (SF <sub>6</sub> ) for use in electrical equipment
IEC 60480	Guidelines for the checking and treatment of sulphur hexafluoride (SF <sub>6</sub> ) taken from electrical equipment and specification for its re-use.
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60815	Guide for the selection of insulators in respect of polluted conditions
IEC 61462	Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1000 V – Definitions, test methods, acceptance criteria and design recommendations
IEC 61634	High voltage switchgear and control gear – Use and handling of sulphur hexafluoride (SF <sub>6</sub> ) in high-voltage switchgear and control gear

IEC TR 62271-303	High voltage switchgear and control gear – Use and handling of sulphur hexafluoride (SF <sub>6</sub> ) in high-voltage switchgear and control gear
IEC 62271-1	High-voltage switchgear and control gear – Part 1: Common specifications
IEC 62271-100	High-voltage switchgear and control gear – Part 100: High-voltage alternating-current circuit breakers
IEC 62271-102	High-voltage switchgear and control gear – Part 102: Alternating current disconnectors and earthing switches
IEC 62271-207	High-voltage switchgear and control gear – Part 207: Seismic qualification for gas-insulated switchgear assemblies for rated voltage above 52 kV
IEC 62271-209	High-voltage switchgear and control gear – Part 209: Cable connections for gas-insulated metal-enclosed switchgear for rated voltage above 52 kV – Fluid-filled and extruded insulation cables – Fluid-filled and dry-type cable-terminations
IEC 60364 / 60479 / 60621	Standards for station grounding

### 3. **SITE SERVICE CONDITIONS**

The equipment specified shall be rated in accordance with the following requirements specific to its installations.

- 3.1. The equipment shall be suitable for use in locations with the following ambient conditions:
  - 3.1.1. Maximum ambient air temperature: 40°C;
  - 3.1.2. Minimum ambient air temperature: -30°C;
  - 3.1.3. Maximum relative humidity: 100%;
  - 3.1.4. Pollution level: 25 mm/kV or 31 mm/kV;
  - 3.1.5. Seismic severe condition: AF5 (0.5g)
- 3.2. The equipment shall be suitable for continuous operation at locations up to an altitude above 1000 meters above sea level.

### 4. **SPECIFIC REQUIREMENTS**

#### 4.1. **GENERAL**

The following description refers to the attached single line diagram and drawings and refers to integrated phase-segregated multifunctional apparatus SF<sub>6</sub> gas insulated switchgear, which includes:

- three-pole circuit breaker, single or three pole motor operated;
- one or two combined three-pole disconnector / earthing switch, motor operated;
- one or two sets of three-pole ring type current transformers housed in cases;
- SF<sub>6</sub> gas insulated voltage transformers installed aboard (optional);
- one (1) control cabinet;
- Bushings SF6/air made of silicon rubber;
- HV Cable housing (optional).

All the above mentioned components will be installed onto a unique support frame and assembled in compact execution.

The module will be suitable for outdoor transmission substations DBB (Double Bus Bar) arrangements.

All the components constituting the hybrid integrated multifunctional apparatus must have technology and performance identical to the relevant conventional AIS and GIS equipment in service since long period.

#### 4.2. SPECIAL REQUIREMENTS

- 4.2.1. The module shall be fully pre-fabricated, electrically and mechanically fully pre-tested (i.e. routine tests) at factory.
- 4.2.2. The transport of the module shall be without dismantling of major parts such as breaker, disconnections and current transformers. Moreover, the three phases have to reach the installation site already installed on a single and unique frame. In this way the module (understood almost as a bay) will maintain the factory's certifications and therefore no HV tests will be necessary at the site. Such pre-fabrication and pre-testing is also recommended in order to reduce the time consuming activities at the site related to complex re-installation of the major components, gas treatment of the main vessels and then erection and commissioning.
- 4.2.3. Preferred are those modules which are fully transportable inside ISO containers or wooden boxes in order to be transportable on standard trailer on normal road conditions.
- 4.2.4. Once at site, the module will not require repetition of the electric tests (apart for the commissioning tests and wire connections between modules, bus bars and other components such as voltage transformers, line traps etc. of the substation).
- 4.2.5. The module shall be designed in order to require the minimum civil work foundation (i.e. unique concrete platform or even few concrete blocks only).
- 4.2.6. The module shall be designed in order to require minimum erection time.
- 4.2.7. Replacement of one phase of the module shall be possible with a minimum down time of the substation provided that a spare pole is available at site. Therefore preferred are those modules with single-phase metal enclosed design.
- 4.2.8. Current transformers (CTs) shall also require no maintenance and shall be ring-type cores mounted on bushings. Change of ratio (at secondary terminal blocks) shall be available.
- 4.2.9. Three-pole and single-pole operating mechanism spring type shall both be available as alternative. According to substation layout, the module shall be able to be connected to standard AIS bus bar system supported by standard AIS bus bar structure (conventional post insulator) unless cable-sealing ends are required.
- 4.2.10. Electrical interlocking between breaker and the disconnect or/earthing switches shall be always available. Disconnecting function will be combined with the earthing switch. A mechanical interlock between disconnect or switch and earthing switch is required. Therefore preferred are those modules provided with a unique drive mechanism for both disconnect or and earthing switch.
- 4.2.11. The module is preferred when it has the minimum steel structures requirements. This is necessary in order to have the best compaction of the substation in the switchyard area.
- 4.2.12. Preferred are those modules with minimum number of flanges and optimized number of gas segregations in order to prevent and reduce the risk of gas leakages during the lifespan of the modules.
- 4.2.13. Supplier maintenance manual shall be provided.
- 4.2.14. Reference list of at least five/seven years installation and three satisfactory letters from customers shall be provided.
- 4.2.15. Degree of protection of the module and control cabinet shall be IP55.

#### 4.3 CIRCUIT BREAKER

The circuit breaker shall be SF6 gas insulated auto puffer self blast type, designed and fully type tested in accordance to the relevant IEC 62271-100, moreover the circuit breaker shall have the following characteristics:

- metal glad enclosed type;
- auto re-closing facility;
- very low re-strike probability class C2;
- mechanical endurance class M2, suitable for at least 10,000 satisfactory open and close mechanical operations;
- fitted with power spring drive mechanism (three-pole or single-pole operating);
- including pressure relief device or bursting disk to relieve any pressure rise developed during internal flashover.

The circuit breakers shall have the following ratings:-

i.	Nominal system voltage	:	132 KV
ii.	Highest system voltage	:	145 KV
iii.	Rated frequency	:	50 C/S
iv.	Lightning impulse withstand voltage:		
	a) To earth and between poles	:	650 KV
	b) Across the isolating distance	:	750 KV
v.	Power frequency withstand voltage:		
	a) To earth and between poles	:	275 KV
	b) Across the isolating distance	:	315 KV
vi.	No. of poles	:	3
vii.	Rated normal current	:	1250 Amperes
viii.	Rated short time withstand current for 3 seconds	:	31.5 KA
ix.	Rated making current	:	78.75KAp
x.	Minimum creepage	:	3625 mm
xi.	Control circuit voltage	:	220V DC

#### 4.3. MOTOR-CHARGED SPRING-OPERATED MECHANISM

- 4.3.1. The operating mechanism shall use a stored-energy system for tripping and closing. It shall consist of a motor-charged spring operated type mechanism, complete with all associated devices and accessories for efficient and reliable operation.
- 4.3.2. The operating mechanism shall be capable of storing energy for a single O-CO cycle without closing spring recharge and performing a complete duty cycle O – 0.3s – CO - 1 min – CO.
- 4.3.3. A reliable, easily readable mechanical position indicator shall be provided to indicate the open and closed positions of the circuit breaker. The indicator shall be mechanically connected with the operating linkage.
- 4.3.4. An operations counter shall be provided to indicate the number of tripping operations performed by the operating mechanism.
- 4.3.5. Provision for manual spring charging shall be provided which shall automatically cut off the spring charging motor circuit.
- 4.3.6. Mechanical indicator of spring(s) position (charged and discharged) shall be provided.
- 4.3.7. Preferred are those module with spring type mechanism; hydraulic type shall be avoided.

#### 4.4. COMBINED DISCONNECTOR/EARTHING SWITCH

- 4.4.1. The disconnect or/earthing switch will be in accordance to the relevant IEC 62271-102 standard.
- 4.4.2. Isolating and earthing function are carried out through a unique moving multi-positions (i.e. closed, isolated, earthed) contact. In particular the relevant drive shall be motorized.
- 4.4.3. Manual operation shall be always possible in case of failure of the auxiliary feeding system.
- 4.4.4. Mandatory are those hybrid apparatus where portholes allow visual inspection of the contacts of the disconnect or/earthing switch.
- 4.4.5. Disconnect or and earthing switches operating mechanism shall be capable of being locked in the open or closed position. Operating motor shall be provided with thermal overload protection.
- 4.4.6. The disconnecting and the earthing operations, in any case, shall be executed into the full respect of the GIS technology in accordance to the relevant IEC standard.
- 4.5.7 The disconnect and earthing switches shall have the following ratings:-
  - i. Nominal system voltage : 132 KV
  - ii. Highest system voltage : 145 KV
  - iii. Rated frequency : 50 C/S
  - iv. Lightning impulse withstand voltage:
    - a) To earth and between poles : 650 KV
    - b) Across the isolating distance : 750 KV
  - v. Power frequency withstand voltage:
    - a) To earth and between poles : 275 KV
    - b) Across the isolating distance : 315 KV
  - vi. No. of poles : 3
  - vii. Rated normal current : 1250 Amperes
  - viii. Rated short time withstand current for 3 seconds : 31.5 KA
  - ix. Minimum creepage : 3625 mm
  - x. Control circuit voltage : 220V DC

#### 4.5. CURRENT TRANSFORMERS

- 4.5.1. The current transformers shall be ring type with cast resin cores in order to be maintenance free. The cores shall be housed in cases. Each bushing of the hybrid module shall accommodate one case of multi-core and multi-ratio current transformers.
- 4.5.2. The current transformers will be in accordance to IEC 60044-1 standard.

#### 4.6.3 TYPE AND RATING:

- 1. The current transformers shall have the following ratings:-

- i) Nominal system voltage. 132 KV
- ii) Highest system voltage. 145 KV
- iii) No. of phases in the system. Three
- iv) Earthing of system. Effectively earthed
- v) Frequency 50 Hz  $\pm$  5%

- vi) Rated short time thermal current 31.5kA for 1 sec
- vii) Insulation level
- a) 1.2/50 micro second lightning impulse withstand voltage 650KVp
- b) 1 minute power frequency withstand voltage 275KVrms
- viii) Minimum creepage distance 3625 mm

2. The current transformers of different ratings shall have the following characteristics.

Sl. No.	Rated transformation ratio/core	Accuracy class at all ratios	Rated Burden at all ratios	Accuracy limit factor/instrument security factor at all ratios	Purpose.
1.0	<b>100-50/1/1/1A</b>				Transformer
	Core-I	0.2s	30 VA	ISF $\leq$ 3.5	Metering
	Core-II	5P	30 VA	ALF : 10	O/C & E/F protection.
	Core-III	PS	-	-	Differential protection
2.0	<b>400-200/1/1/1A</b>				Feeder/Bus Coupler
	Core-I	0.2s	30 VA	ISF $\leq$ 3.5	Metering
	Core-II	5P	30 VA	ALF : 10	O/C & E/F protection.
	Core-III	PS	-	-	Distance protection

#### 4.6. INTERLOCKING SYSTEM

##### Circuit breaker (CB):

- the remote operation of the CB of the module shall be possible only when the disconnect or is closed or opened;
- local operation of the CB of the module shall be possible;
- the CB operations shall be possible only if the pole gas pressure is higher than the threshold block. The CB can also be operated in case of the gas pressure drop down to the atmospheric value.

##### Disconnect or/earthing switch:

- the dis-connector/earthing switch operation (both motor or manually operated) shall be possible only when the CB is opened. A design combining together DS/ES shall be preferred because of the natural mechanical interlocking between the two functions and therefore no further electrical interlock shall be needed between dis-connector and earthing switch being intrinsically available;
- all the interlocking shall be in accordance with the relevant IEC standards in order to allow the operations in fully safety conditions for the operator.

#### 4.7. CONTROLS

4.7.1. The circuit breaker electrical controls shall be in accordance with IEC standards.

4.7.2. The circuit breaker shall be electrically and mechanically trip free and shall be designed for closing and tripping by Remote and/or Local electrical controls. A three position selector switch shall be provided in the breaker control cabinet to transfer

breaker control from Remote/Local/Manual. In the Local position the breaker shall be operated at the breaker cubicle bypassing all remote controls and remote interlocking devices. In the Remote position, breaker control shall be transferred to the control switch at the station's control switchboard.

4.7.3. The circuit breaker control circuit shall incorporate anti-pump feature.

4.7.4. The circuit breaker shall be supplied with two (2) electrically independent tripping coils and one (1) closing coil per operating mechanism.

#### 4.8. HIGH VOLTAGE BUSHINGS

4.8.1. Exposed bushings insulator shall be in accordance to IEC 60137 standard made by composite material (silicon rubber over a fiberglass core).

#### 4.9. CONTROL CABINET

The components of the operating mechanism, the associated control devices, instrumentation, etc. and the terminal blocks for current transformer secondary and control wiring shall be housed in a weatherproof enclosure (IEC 60529).

The control cabinet shall be installed at an appropriate height above the circuit breaker foundation and be accessible to maintenance personnel.

The control cabinet shall be supplied with an interior light controlled by a contact, which actuates when the door is opened.

A removable plate for conduit entry shall be provided at the bottom of the control cabinet.

A schematic diagram showing the equipment's single line diagram (HV part) and identifying labels of primary HV components shall be affixed inside the cubicle. The diagram shall be marked on aluminum engraved plate or equivalent.

#### 4.10. SPACE HEATERS

Space heaters designed for continuous operation shall be provided in the control cabinet. They shall be designed to maintain the interior of the operating mechanism cabinet at a minimum temperature of 5°C above ambient.

#### 4.11. ELECTRIC INTERFACING WITH THE CONTROL AND PROTECTION SYSTEM

The module shall be supplied with a unique local control cabinet, fully pre-fabricated, pre-wired and pre-tested as unique interface between the multifunctional module and the control and protection system of the whole substation.

In order to minimize wiring and cabling at the site and consequently the risk of wrong electrical connections, modules having plug-in connectors from the local control cabinet to the drive mechanism of the circuit breaker and to the drive mechanism of the dis-connector and the earthing switch are preferred.

#### 4.12. SF<sub>6</sub> GAS REQUIREMENT

4.12.1. The SF<sub>6</sub> gas shall comply with the requirements of IEC 603376 standard.

4.12.2. SF<sub>6</sub> gas sealing system shall be designed to ensure safe operation and interruption at the specified ratings of the breaker with the site conditions described in section 3.



- 4.12.3. All the gas seals shall be double O-ring type and located at the flanges of the equipment enclosures. The gas leakage rates shall be less than 0.5% per year of each gas compartments.
- 4.12.4. SF<sub>6</sub> gas seals shall be tested with a leak detector such as an automatic halogen leak detector or similar instrument. The SF<sub>6</sub> gas shall be monitored by a pressure gauge or gauges.
- 4.12.5. Temperature compensated pressure (density) monitor shall be provided to protect the circuit breaker against unsafe operation if the SF<sub>6</sub> pressure (density) in the interrupter falls below the rated operating level. It shall be possible to test and replace each pressure gauge and density switch without degassing the circuit breaker.
- 4.12.6. Each gas density monitor shall have two alarm thresholds with the following characteristic:
  - advanced warning when SF<sub>6</sub> gas pressure drop down below first alarm threshold;
  - circuit breaker preventing trip / lock out when SF<sub>6</sub> gas pressure drop down below second alarm threshold.

#### 4.13. GROUNDING

Dead tank shall be grounded through steel structure.

#### 4.14. PAINTING

The control cabinet, gas manifold and operating mechanism enclosure and all ferrous materials shall be painted, plated or treated to prevent corrosion and shall meet latest standard requirements. The Vendor's Standard Paint System will be considered as alternative.

#### 4.15. STEEL STRUCTURE

The tenderer shall separately quote for steel structure, each of height of 2.5 metres which shall be complete with rigid bases, suitable clamps, foundation bolts etc. for mounting the equipment. A loading diagram for the steel structures under the severest operating conditions of the equipment shall be given with the tender.

The steel structure will be made of stainless steel or hot dip galvanized steel.

#### 4.16. NAMEPLATES

- 4.16.1. The following minimum data, when applicable, shall appear on the nameplates of each circuit breaker and each associated device.

##### Circuit breaker

- 1) Manufacturer's name
- 2) Manufacturer's type designation
- 3) Manufacturer's serial number
- 4) Year of manufacture
- 5) Rated frequency
- 6) Rated continuous current
- 7) Rated maximum voltage (kV)
- 8) Rated full wave impulse withstand voltage (kV)
- 9) Rated short-circuit current
- 10) Rated interrupting time
- 11) Normal operating pressure
- 12) Weight of gas per breaker
- 13) Instruction book number
- 14) Parts list number

#### Operating mechanism

- 1) Manufacturer's name
- 2) Manufacturer's type designation
- 3) Manufacturer's serial number
- 4) Year of manufacture
- 5) Closing control voltage range
- 6) Tripping control voltage range
- 7) Closing current
- 8) Tripping current
- 9) Wiring diagram number
- 10) Instruction book number
- 11) Parts list number

#### Current transformers

- 1) Identification
- 2) Manufacturer
- 3) Pertinent operating characteristics according to latest relevant standard

#### 4.17. ASSEMBLING, DISASSEMBLING AND HANDLING

The assembling, disassembling and handling of the whole multifunctional apparatus shall be shown in detail and shall be submitted along with the bid.

The Bidder shall indicate in the bid the time and modalities required for the erection and commissioning of the apparatus.

Preferred are those modules where the SF<sub>6</sub> gas treatment of the compartment and vessels is not required. This is necessary in order to reduce time-consuming activities and mainly to avoid the risk of contamination of the SF<sub>6</sub> enclosures of the apparatus.

#### 4.19 TERMINAL CONNECTORS

The Bidder shall also offer for terminal connectors connecting the module and bus conductor which shall be bimetallic and suitable for ACSR Zebra conductor and shall also meet the following requirements:

- (i) The terminal connectors shall be manufactured and tested in accordance with the latest edition of relevant standard.
- (ii) All current carrying parts shall be designed and manufactured to have minimum contact resistance.
- (iii) Connectors shall be designed to be corona free in accordance with the stipulations in the latest edition of relevant standard.
- (iv) Each terminal connector shall be suitable for both vertical and horizontal connection of bus conductor.

Appropriate number of suitable terminal connectors for earth connections shall also be supplied.

### 5. OFFICIAL LANGUAGE

All the correspondence as well as drawings, instructions, data sheet, design calculations and any other written information shall be issued in the English language.

## **6. TEST REQUIREMENTS**

All type and routine tests are required to be carried out in accordance with IEC 62271-205 and IEC 62271-100 Ed.1.2 (2006) MOD for HV circuit breakers, IEC 62271-102 (2005) for disconnectors and earthing switches and IEC 60044.1 Ed.1.2 (2003) MOD for current transformers.

As the module is a unique multifunctional apparatus, its testing as unique switchgear is mandatory. Quality Control Plan and type tests reports shall be submitted along with the bid. Six copies of type test reports shall be submitted along with the bid. The type test reports shall not be more than five years from the date of opening of bid.

Routine/acceptance test reports shall be furnished by the Supplier before despatch of equipments for approval by the owner.

All the tests shall be in accordance to the latest IEC standards.

If the owner wishes to have a representative to witness the tests, tests shall be performed in his presence.

## **7. PACKING AND TRANSPORT**

The Bidders shall indicate in their bids the packing and the transport conditions of the module. The Supplier must be responsible for any damage to the equipment during transit due to improper and inadequate packing. Any material found short/damaged shall be replaced by the Supplier at no extra cost to the purchaser.

## **8. COMPLETENESS OF THE EQUIPMENT**

The tender shall be complete in all respect and include all accessories which may not be specifically mentioned in this specification but which are essential for the completeness of the equipment ordered.

## **9. DOCUMENTATION**

1. Technical descriptions, data sheets, catalogues and other material submitted with the bid must enable the purchaser's engineers to evaluate the proposal to its compliance with the inquired specification.
2. Layout and elevation drawings for the switchgear shall be part of the proposal. These drawings shall show the recommended clearances for safe operation and maintenance of the switchgear including the required lifting clearances for installation.
3. Minimum requirements for the offer:
  - i) Fully filled-in data sheets of the bid.
  - ii) Single line diagram of the Hybrid switchgear. The necessary busbar arrangement and the number of outgoing feeders including the future and final extensions shall be clearly shown in the single line diagram.
  - iii) Brochures and catalogues as well as reference lists of installed switchgears including customer identification and year of installation.
  - iv) Listing of the accessories included in the offer
  - v) Listing of the Tests included in the offer

4. In addition to the above, the tenderer may supply any other data, which in his opinion is necessary to describe the equipment in full detail.
5. After the completion of the erection work, the contractor shall furnish seven sets (including one soft copy) of the completed drawings.
6. Six copies of the instruction manual covering instruction for installation and maintenance check tests shall be supplied by the contractor as part of this contract.

**11. GUARANTEED & TECHNICAL PARTICULARS**

Guaranteed technical particulars as called for in Schedule - I shall be furnished along with the tender. Any bid lacking complete information in this respect is likely to be rejected. Particulars which are subject to guarantee shall be clearly marked.

<b>Normal Service Conditions</b>		
Installation type		
Altitude above sea level	m	
Maximum ambient air temperature	°C	
Minimum ambient air temperature	°C	
Relative humidity	%	
Wind pressure (wind speed 34 m/s)	Pa	
Solar radiation (IEC 694)	W/m <sup>2</sup>	
Earthquake (IEC1166)	g	
Degree of protection (IEC 60529)	IP class	
Pollution level (IEC 60815)		
<b>Standard Finishing</b>		
Support structure (hot dip galvanised according to DIN 50976)	µm	
Surface painting		

<b>Rated Insulation Levels</b>		
Rated voltage	kV	
Rated frequency	Hz	
Rated power frequency withstand voltage (1 min)		
<i>common value</i>	kV	
<i>across the isolating distance</i>	kV	
<i>across open CB</i>	kV	
Rated lightning impulse withstand voltage (1 sec)		
<i>common value</i>	kV	
<i>across the isolating distance</i>	kV	
<i>across open CB</i>	kV	

Composite Bushings		
Rated voltage	kV	
Rated Current	A	
Rated power frequency withstand voltage	kV	
Rated lightning impulse withstand voltage	kV	
Partial discharge level, $\leq 5$ pC	kV	
Radio Interference Voltage level $< 2500$ $\mu$ V	kV	
Power frequency withstand voltage (15 min) at 100 kPa / 20	kV	
Creepage distance	mm	
Connection diameter	mm	
Weigth	kg	
<i>Longitudinal</i>	N	
<i>Transversal</i>	N	
<i>Vertical</i>	N	
<i>Longitudinal</i>	N	
<i>Transversal</i>	N	
<i>Vertical</i>	N	

Current Ratings		
Rated continuous current	A	
Rated short-time withstand current	kA	
Rated short circuit duration	s	
Rated peak withstand current	kA	
Temperature rise of active parts at rated continuous current	°C	
Temperature rise of terminals at rated continuous current	°C	
Temperature rise of enclosure at rated continuous current	° C	

Current Transformers		
Type		
Application		
Standard		
Insulation		
Rated Voltage	kV	
Number of cores	-	
Rated primary current	A	
Rated Overcurrent Factor		
Rated secondary current	A	
Performance	VA	
<i>Protection Core</i>		
Class		
Accuracy Limit Factor		
<i>Measurement Core</i>		
Class		
Security Factor	-	

SF <sub>6</sub> Gas System (Relative Pressure)		
Annual SF <sub>6</sub> leakage	%	
CIRCUIT BREAKER AND DISCONNECTOR (RELATIVE VALUE)	kV	
Filling pressure at 20 °C	kPa	
Min. service pressure at 20°C	kPa	
Rated insul. pressure at 20 °C	kPa	
Alarm level 1 at 20 °C (Only Alarm)	kPa	
Alarm level 2 at 20 °C (Circuit breaker lock or trip)	kPa	
Design pressure	kPa	
Routine test pressure	kPa	
Bursting pressure	kPa	
Bursting disc release pressure	kPa	



<b>Circuit Breaker</b>		
Frequency		
Type		
Operating mechanism		
Maximum number of mechanical operation for drive mechanism		
Rated operating sequence acc. to IEC		
Stored switching sequence		
Rated current		
Rated short-time withstand current		
Rated making current		
Rated short circuit duration		
Maximum number of operations at rated current		
<b>Characteristic For Terminal Fault 100% (Test Duty 4, 5 Based On IEC 60056 CVD)</b>		
Short circuit breaking current	kA	
First reference voltage	kV	
Point of time $t_1$	$\mu s$	
Peak value	kV	
Point of time $t_2$ and $t_3$	$\mu s$	
Starting point $t_d$	s	
Rate of rise	KV/ $\mu s$	
<b>Characteristic For Short Line Fault (90% According To IEC 60056 CVD)</b>		
Frequency	Hz	
Short line fault current	kA	
Wave impedance	$\Omega$	
Peak value	kV	
Rated peak factor		
Time delay $t_{dL}$	$\mu s$	
Time $t_L$ to peak $u_L$	$\mu s$	
Rate of rise of transient recovery voltage	KV/ $\mu s$	
Opening time	ms	

Arcing time	ms	
Break time	ms	
Closing time	ms	
Contact speed:		
<i>Opening</i>	m/s	
<i>Closing</i>	m/s	
<b>AUXILIARIES</b>		
		DC
Rated voltage	V	
Rated current	A	
<b>OPERATING COILS</b>		
		DC
Rated voltage	V	
Rated power	W	
Operating current	A	
<b>CIRCUIT BREAKER MOTOR</b>		
AC/DC		
Rated voltage	V	
Rated power	W	
Operating current	A	
Starting current	A	
Auxiliary contacts		

<b>Combined Disconnecter &amp; Earthing Switch</b>		
Type		
Operating mechanism		
Rated voltage	kV	
Rated power frequency withstand voltage		
<i>Common value</i>	kV	
<i>Across the isolating distance</i>	kV	
Rated lightning impulse withstand voltage (1 sec)		
<i>Common value</i>	kV	
<i>Across the isolating distance</i>	kV	
Rated current	A	
Rated short time withstand current	kA	
Rated peak current	kA	
Rated short circuit duration	s	
Motor operating time (disconnecter)	s	
<b>AUXILIARIES</b>		
Rated voltage	V <sub>DC</sub>	
Rated current	A <sub>DC</sub>	
<b>DISCONNECTOR MOTOR FOR BUS-BAR SIDE AND LINE SIDE</b>		
AC/DC		
Rated voltage	V	
Rated power	W	
Operating current	A	
Starting current	A	
Auxiliary contacts		

(Signature of Tenderer)

Name (In block letters)

Stamp.