EEHC DISTRIBUTION MATERIALS SPECIFICATION 24KV MV GIS SWITCHGEAR	EDMS 01-202-1 **19-12-2023**

EDMS 01-202-1

Technical specification for
24KV MV GIS SWITCHGEAR

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توجد بنود اختيارية (Option items) يجب تحديدها بواسطة شركة التوزيع قبل الطرح.

يلزم إرفاق المواصفات الفنيه للعدادات الذكيه جهد متوسط (كود رقم EDMS 22-401-1)

يلزم طرح ال surge arrestor بالمواصفات المذكوره عند طلب Elbow Terminations

تستخدم هذه المواصفه كمواصفه خاصه فى حاله الأرتفاعات الأعلى من 1000 متر عن سطح البحر فقط.

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1-SCOPE

This specification covers the minimum requirements for Indoor medium voltage (24 KV) AC. metal enclosed, metal clad, factory assembled, type tested, three pole metal enclosed SF6 gas insulated medium voltage switchgear equipped to work with SCADA system without RTU, 3-phases single copper bus bar system in accordance with the latest international standard IEC62271-200, IEC62271-100 unless otherwise specified.

The design, engineering, manufacture, testing at the manufacturer's factory, painting, packing for transport, insuring, transportation by road, and delivery at destination shall be supported.

- It should be made of sheet steel and equipped with SF6 gas insulated medium, vacuum circuit breaker, copper bus bars and all necessary connections.
- The switchgear consists of (X) panels as follows:-
- (X1) as incoming feeder panels.
- (X2) as outgoing feeder panels.
- Bus-sectionalizer panel coupler & riser (One or Two functional unit are accepted).
- One AC Low Voltage Distribution Board. (Option);
- One DC Low Voltage Distribution Board. (Option)

Note: X1 and X2 should be defined according to ….EDC.

2. DEFINITIONS

2.1 Metal- Enclosed Switchgear:
Switchgear assemblies with an external metal enclosure in which components are arranged in separate compartments with metal partitions, enclosure and partitions intended to be grounded.

2.2 Enclosure:
Surrounding part of metal- enclosed switchgear used to prevent personnel from accidentally approaching live or moving parts contained therein and to protect internal equipment against external effects.

2.3 Grounding Position:
A position in which the closing of a mechanical switching device cause a main circuit to be short-circuited and grounded.

2.4 Rated Normal Current:
The value of the current which a circuit of metal-enclosed switchgear is capable of carrying continuously under specified conditions of use and behaviour.

2.5 Short- Time Withstand Current:
The current that a circuit of metal- enclosed switchgear can carry during a specified short time under the prescribed conditions of use and behavior. It is expressed as an r.m.s. value.

2.6 Peak Withstand Current:
The value of peak current that a circuit of metal-clad switchgear can withstand under the prescribed conditions of use and behaviour.

2.7 Ambient Air Temperature (OF Metal- Enclosed Switchgear):
The temperature, determined under prescribed conditions, of the air surrounding the external enclosure of the metal- enclosed switchgear.

2.8 DMT
Definite minimum time over current protection.

2.9 RTU
Remote terminal unit

2.10 MDMS
Meter Data Management System (MDMS)

2.11 DCC
Distribution control center

3- ENVIRONMENTAL CONDITIONS

The performance of switchgear should be guaranteed for following environmental conditions, any differences in the guaranteed performance should be clearly set out in the offer.

Minimum ambient temperature	-5°c.
Maximum ambient temperature	45°c (50 °c as option).
Maximum relative humidity	95%.
Maximum altitude	2000 m.

4-GENERAL DATA

Rated voltage.	24KV
Insulation level at power frequency.	50 KV
Basic impulse level (BIL)	125 KV
Frequency.	50 HZ
System Grounding	Solidly earthed
Body Color.	Preferred (light grey)
Auxiliary voltage.	110VDC±20%
Degree of protection	IP65 for SF6 Gas filled compartment, IP2X for operating mechanism and cable comparment
Copper purity	not less than 99.9 %
Copper Conductivity	not less than 57 MS/ m
Contact resistance/C.B.	less than 60 μΩ @current supplied 100A
Conductivity resistance for each panel	Less than or equal 300 μΩ

5-APPLICABLE STANDARDS

Unless otherwise specified in this specification, the 24 KV MV GIS SWITCH GEAR equipped to work with SCADA without RTU (Remote Terminal Unit) and should be comply with the latest edition of IEC standard and should be designed, manufactured and tested in accordance with the applicable IEC standards as following table:

Table 1

S. No	Standard No.	Description
1.	IEC 62271	High-voltage switchgear and control gear Part 100: High-voltage alternating-current circuit-breakers Part 200: AC metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV Part 102: AC disconnectors and earthing switches. Part 103: switches for rated voltages above 1 kv up to and including 52 kv Part 106: Alternating current contactors, contactor-based controllers and motor-starters
2.	IEC 61869-1,2	Current transformer
3.	IEC 61869-1,3	Voltage transformer
4.	IEC61850	Communication protocol (Edition 2).
5.	IEC60225-27	Measuring relays and protection equipment - Part 27: Product safety requirements
6.	IEC60068-2-27	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock
7.	IEC60255-21-2	Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment - Section Two: Shock and bump tests
8.	IEC 60529	Classification of degrees of protection provided by enclosures

6-CIRCUIT BREAKERS

A- The 24 KV circuit breakers should be maintenance free fixed type vacuum circuit breaker inside SF6 enclosure.

B- The necessary closing, tripping and blocking coils should be (110VDC). With an electric spring charge motor drive (110VDC) mechanism consists of three coils (one per pole) and all phases connected to each other using synchronizing shaft.

C- The circuit breakers should be mechanically and electrically trip free and with provision for manual operation.

D- Necessary auxiliary contacts for controlling, signaling& free contacts (4NO-4NC) without repeater at least in low voltage compartment and all accessories needed for operation should be provided.

E- The failure of C.B in switching off during any fault should be indicated through programmed LED from the relay and (through flag relay or heavy-duty led lamp)

F- All circuit breakers should be fitted with an operation counter fixed on the circuit breaker not on the cover.

G- The minimum rupturing capacity of all the 24KV, Circuit breakers should be symmetrical short circuit current of 25KA for 3 Sec at least

H- The normal current ratings for C.B's at 40^{o}C are as follows:

Incoming C.B's : 1250 A.
Outgoing C.B's : 1250 A (630 A as option).
Bus Coupler C.B : 1250 A

I- Closing and tripping coil of circuit breaker should be protected by anti-slam and anti-pumping for closing coil.

J- The incoming feeder should be equipped with three surge arrestors pluggable type on cable T plug 10KA, 24KV-max continuous operating voltage 20 KV± 5% or any other approved technology to overcome switching over voltage for cable feeders. (out of scope of supply)

7-BUSBARS

A- Main Bus Bars

1. The busbar configuration entails a 1250A round copper bar made of best quality, high conductivity copper with a single-pole design, featuring silicon rubber solid insulation and screened plug-in connectors. These busbars are strategically positioned above the SF6-gas compartment of each panel.
2. The primary busbar is affixed to each panel vessel from an overhead position and

securely fastened to the vessel bushings using robust bolts, ensuring a stable connection.

3. Inter-panel connectivity is achieved through the implementation of solid-insulated plug-in busbars, also situated outside the gas compartment. These components are enclosed within a metallic compartment for safety and protection.
4. An essential feature of the switchgear system is its extensibility, allowing for expansion at both ends of the busbar to accommodate evolving operational requirements.
5. The busbar shall be contact-proof due to an external conductive layer connected to the earth.
6. The busbar shall be resistant to condensation and contamination.
7. The bus bar compartments should be placed at the upper part of the switchgear and fitted with dielectric support.
8. The entire bus and structure should be constructed to withstand the short circuit effects due to the rated short circuit current of 25KA for 3 Sec at least.
9. Main B.B should be extendable and securely mechanically bonded to each unit.
10. The connection between any bars to each other or between bars and droppers should be with the same area of the bus bar cross section not part of its cross section.
11. Three single phase metal enclosed plug in busbar voltage transformer with the following ratios:

$\frac{22000}{\sqrt{3}}/\frac{110}{\sqrt{3}}/\frac{110}{3}$ 50 VA, cl 0.5 for first core and 30 VA, cl 3P for second core (Voltage factor 1.9 for 8 hrs. &1.2 continuous) as option as per ….EDC requirements.

12. The insulation of the main busbar within a gas-insulated tank, located within its respective functional unit, and the interconnection between each functional unit utilizing suitable solid insulation is also acceptable.

B-Earth bus bar

An earth copper bar at the bottom of the switchgear extending the entire length of each distribution panel should be provided with a cross section area to withstand the rated short circuit current of the system .The bus should be extendable and securely mechanically bonded to each unit with C.S.A not less than (150) mm^2. It shall be supported with type test.

8-INSTRUMENT TRANSFORMERS

1. Incoming cubicles C.T burden should be 10VA class 0.5 for measuring and 15VA class 5P10 for protection relays (The burden is achieved for both two ratios 300-600/5/5A).

2. In coupler cubicle C.T burden should be 10VA class 0.5 for measuring and 15VA class 5P10 for protection relay (The burden is achieved for both two ratios 400-800/5/5A).
3. In Outgoing cubicles C.T burden should be 10VA class 0.5 for measuring and 15VA class 5P10 for protection relay (The burden is achieved for both two ratios 200-400/5/5A).
4. The winding of the instrument transformers should be made of copper.
5. Three single-phase ring-core current transformers should be employed for every cubicle. These transformers should be mounted on the cable bushings outside the gas enclosure. They must be designed to be free from dielectric stress, not affected by climate variations, and allow for secondary connections and ratio adjustments through a terminal strip located within the low-voltage compartment.
6. The current transformers should have the capability to endure a short circuit current of 25 kA for duration of 3 seconds.
7. These transformers should be capable of maintaining their performance and reliability in a range of environmental conditions, ensuring that they remain functional and accurate in measuring current.
8. Three single phase metal enclosed plug in cable voltage transformer with the following ratios:
   $\frac{22000}{\sqrt{3}}/\frac{110}{\sqrt{3}}/\frac{110}{3}$ 50 VA, cl 0.5 for first core and 30 VA, cl 3P for second core (Voltage factor 1.9 for 8 hrs. &1.2 continuous).
9. The potential transformers shall be single pole encased in metal plug-in design. It is designed to function reliably in various environmental conditions and can be switched using a 2-position disconnector with "ON" and "Earth" positions. This disconnector is operated externally from the gas enclosure.
10. Voltage transformers (VTs) should have primary protection provided by high rupturing capacity (HRC) fuses if applicable (value should be support with documents and calculations). These VTs consist of three single-pole units, each equipped with open delta winding and a damping resistor.

* In case of no need for open delta connection, the supplier should close it by a suitable resistance (the resistance value should be calculated with supporting documents) or by Smart Load relay that protect the VT against the ferro-resonant phenomenon by proper and prompt damping action without creating excessive power consumption during normal operation (option).

9-TECHNICAL SPECIFICATIONS

9.1. Incoming feeder panel

Each consists of:

The Gas insulated compartment consists of a hermetically sealed stainless steel gas enclosure, housing a maintenance-free, fixed-type vacuum circuit breaker, and a three-position disconnector (ON - OFF - Earth). The gas maintains constant insulation properties throughout its operational lifespan, independent of environmental factors such as ambient conditions and altitude.

The operating mechanisms for both the vacuum circuit breaker and the three-position disconnector are positioned outside the sealed gas enclosure.

The three-position disconnector serves a dual purpose: it simplifies the functional elements inside the enclosure and is used for safe grounding in conjunction with the circuit-breaker for incoming panel cables.

The three-position disconnector can be operated both manually and with a motorized mechanism, while maintaining a mechanical interlock.

The main bus bar for the medium voltage (MV) GIS switchgear is of a type-tested design, rated for a current of 1250A.

The vacuum circuit breaker is specified at 1250A (rated current) and 25KA (rated short circuit breaking current) for 3 seconds, operating at 24KV. It is equipped with a 110V DC motorized mechanism, and features an operating counter on the front panel for monitoring purposes.

The three-position disconnector is specified at 1250 A (rated current) and 25kA (rated short time withstand current) for three second. It is equipped with a 110V DC motorized mechanism

- The operating sequence of C.B should be (O-0.3sec–CO-3min-CO) or (O-0.3sec–CO-15sec-CO).
- Closing time ≤ 60 ms.
- Opening time ≤ 50 ms.
- Three single ring core current transformers which mounted on the bushing to the cable connection with 300-600/5/5A (10VA cl 0.5 for measuring & 15VA cl 5P10 for

Protection).

- The name plate should be in the front.
- Three single phase metal enclosed plug in cable voltage transformer + primary protection fuse if applicable + two position disconnector (ON/Earthed) with the following:
  $\frac{22000}{\sqrt{3}}/\frac{110}{\sqrt{3}}/\frac{110}{3}$ 50 VA , cl 0.5 for first core and 30 VA cl 3P for second core - (Voltage factor 1.9 for 8 hrs. & 1.2 continuous).
- The contractor must ensure that the potential transformers in any one of the incomer cell are capable of energizing both the energy meters within the incomer cell itself and those in the outgoing cells.
- Three ammeters digital programmable type with suitable scale, accuracy class 0.5 fed from power supply of 110VDC.
- One voltmeter with scale (0-24) KV and selector switch 7 positions, digital type with accuracy class 0.5 fed from power supply 110VDC.
- One mechanical position indicator for the circuit breaker.
- One mechanical position indicator for the three position disconnector (ON - OFF - Earth).
- One mechanical position indicator in case of VTs two position disconnector (ON - Earth).
- Indicating lamps (LED TYPE) (on - off - trip -Trip circuit supervision) - (red - green - yellow - yellow).
- Activate the function of trip circuit supervision (TCS) from the protective relay through binary input and indicate it through yellow indication lamp.
- Three push buttons (on – off - reset of protective relay) electrical.
- Lamps for voltage phases (Ll- L2- L3) (LED TYPE).
- Three surge arrestors pluggable type on cable T plug for MV GIS switch gears.
- One 3 phase combined directional and Non directional over current and earth fault protection relay according to the attached specifications.
- One flag relay with a reset push button for each of the following (D.C loss. - AC loss – insufficient gas - any M.C.B trip -protective relay trip) and alarm.
- Reset by push button to reset the protective relay trip flag and the contact of protective relay.

9.2. Bus Sectionalizer panel/s

Consists of:

- Three-pole hermetically sealed corrosion-resistant stainless steel gas enclosure including maintenance free fixed type vacuum circuit breaker and three position disconnector (ON - OFF - Earth).

- Vacuum circuit breaker & three position disconnector operating mechanisms should be outside the sealed gas enclosure to ensure safe access during operation.
- The three position disconnector shall be operated manually & motorized via motor control 110V DC keeping the mechanical interlock.
- The MV GIS switch gear main bus bar should be type tested design for rated current of 1250A.
- Vacuum circuit breaker 1250A, 25KA for 3 Sec at least, 24KV, provided with motor operated 110VDC, with operating counter at the front.
    - Closing time ≤ 60 ms.
    - Opening time ≤ 50 ms.
- The operating sequence of C.B should be (O-0.3sec–CO-3min-CO) or (O-0.3sec–CO-15sec-CO).
- Three Single Phase current transformers 400-800/5/5A (10VA cl 0.5 for measuring & 15VA cl 5P10 for Protection). Current transformers should be ring-core transformers and mounted around the main bus bar, arranged outside the gas enclosure.
- Three ammeters digital programmable type with suitable scale, with accuracy class 0.5 fed from power supply of 110VDC.
- One mechanical position indicator for the circuit breaker.
- One mechanical position indicator for the three position disconnector (ON - OFF – Earth)
- One flag relay with a reset push button and alarm for each of the following (D.C loss. - AC loss – any M.C.B trip - protective relay trip).
- Indicating lamps (LED TYPE) (on - off - trip) - (red - green – yellow - yellow).
- Activate the function of trip circuit supervision (TCS) from the protective relay and indicate it through yellow indication lamp.
- Three push buttons (on- off- reset of protective relay) electrical operation.
- One 3 phase combined directional and Non directional over current and earth fault protection relay according to the attached specifications.
- Reset by reset push button to reset the protective relay trip flag and the contact of protective relay.
- Two MCB 2 pole for dividing the auxiliary supply 110 V DC for each section.
- One horn fed from power supply 110VDC fitted on the riser cabinet to give alarm during the following cases:
    - DC loss in any panel.
    - Protection relays trip.
    - AC incoming feeder 22 KV loss for any incoming panel
    - Any M.C.B trip

- The horn should be held by dual reset from push bottom and timer then a yellow lamp indicates the status of horn reset.

9.3. Outgoing feeder panels:

Each consists of:

- Three-pole hermetically sealed corrosion-resistant stainless steel gas enclosure including maintenance free fixed type vacuum circuit breaker and three position disconnector (ON - OFF - Earth).
- Vacuum circuit breaker & three position disconnector operating mechanisms should be outside the sealed gas enclosure to ensure safe access during operation.
- The three position disconnector shall reduce the functional elements inside the enclosure and has to be used for make-proof earthing in combination with the circuit-breaker for the panel outgoing cables.
- The three position disconnector shall be operated manually & motorized via motor control 110V DC keeping the mechanical interlock.
- The MV GIS switch gear main bus bar should be type tested design for rated current of 1250A.
- Vacuum circuit breaker 1250A, 25KA for 3 Sec at least, 24KV, provided with motor operated 110VDC, with operating counter at the front.
    - Closing time ≤ 60 ms.
    - Opening time ≤ 50 ms.
- The operating sequence of C.B should be (O-0.3sec–CO-3min-CO) or (O-0.3sec–CO-15sec-CO).
- Three single phase current transformers 200-400/5/5 A (10VA cl 0.5 for measuring & 15VA cl 5P10 for Protection). Current transformers should be ring-core transformers and mounted on the bushings to the cable connection, arranged outside the gas enclosure.
- The name plate should be in the front.
- Three ammeters digital programmable type with suitable scale, accuracy class 0.5 fed from power supply of 110VDC.
- One mechanical position indicator for the circuit breaker.
- One mechanical position indicator for the three position disconnector (ON–OFF– Earth).
- Indicating lamps (LED TYPE) (on - off - trip) - (red - green – yellow – yellow).
- Activate the function of trip circuit supervision (TCS) from the protective relay and indicate it through yellow indication lamp.
- Three push buttons (on- off- reset of protective relay) electrical operation.
- One 3 phase combined directional and Non directional over current and earth fault

protection relay according to the attached specifications.

- One flag relay with reset push button and alarm for each of the following :
  - (D.C loss - any M.C.B trip - protective relay trip).
- Reset by push button to reset the protective relay trip flag and the contact of protective relay.

❖ Notice:

- Smart Meters will be at every incoming & outgoing panel
- The….EDC should attach the technical specification of the required smart meter
- The Smart meter should be one of the approved types with the Egyptian Electricity Holding Company and meet all specifications of the unified smart meter specification for medium voltage application (code no.: **EDMS 22-401-1)**

10-DESIGN CRITERIA

1. The switchgear should be consist of Metal Enclosed Classified LSC2 and Partition Class PM as per IEC62271-200 cubicles of MV gas insulated switchgear with maintenance free fixed type vacuum circuit breaker inside gas enclosure.
2. Each cubicle should be built as a self-supporting structure from rolled steel sheets of 2.5mm thickness before paint at least or with a mechanical impact class not less than IK07and should support by certificate.
3. The width of the cubicle should not be less than 60 cm.
4. The cubicles should be bolted together.
5. Each cubicle should be divided into four sealed and isolated compartments: (The bus bar compartment, cable connection compartment, circuit-breaker compartment and a fully isolated low-voltage compartment).
6. Each compartment should be internally arc proofed (IAC AFLR 25KA for 1 Sec) and should be provided with pressure relief upwards through rear duct.
7. Electrical and Mechanical interlock will be between any incoming feeder panel for each section and coupler.
8. Mechanical interlock should be introduced against the following:
   A. Opening of the cable compartment door with the earthing switch opened.
   B. Disconnecting Earthing Switch with the cable Door opened.
   C. Three-position disconnector can only be operated with circuit-breaker in OPEN position
   D. Circuit-breaker can only be operated with three-position disconnector in end position

and operating lever removed

9. All metallic parts not carrying current should be connected to an earthing copper bus bar of suitable cross-sectional area.
10. All equipments (push buttons– indicating lamps – sockets and plugs – terminal blocks for C.Ts & P.Ts and control …etc) should be made of hygroscopic and non-flammable material.
11. All the circuit carrying current parts of the switchgear component should be made of high-grade copper, the windings of instrument transformer should be made of copper.
12. Cable connections should be put from the below rear or front of the cubicles arrangement should be enough for connection of three single phase aluminum cable of cross-sectional area up to 3x1x 500 mm^2 or 3x500 mm^2 to each incoming cubicle and the connection of three phase aluminum cable of different cross-sectional area up to 3x300 mm^2 for each outgoing cubicles.
13. Wiring of secondary circuits should be executed using 450/750 V non-flammable PVC-insulated Flexible copper conductors of cross-sectional area not less than the following:
    - Voltage circuits 1.5 mm^2 with opening slides terminal block
    - Current circuits 3 mm^2 with short circuits slides terminal block

Wiring Color code:

- [1] For CT & VT: R ph : Red - Y Ph: Yellow - B Ph – Blue - Neutral: Black.
  [2] For DC & AC: black. [3] Earth: green.
- Laser Printed: At both ends of wire with stated marking.
- Lugs: Tinned copper, pre-insulated, fork type and pin type as applicable.
- Circuit function letters: [1] CP: current wires for protection. [2]CM: current wires for metering. [3] V: 110 Vac wiring. [4] D: 110 Vdc wiring. [5] X: control wiring.

17. The secondary circuits of circuit-breaker should be connected by means of flexible copper wires into a flexible metallic conduit and by multi-pin plug and socket of suitable size.
18. The insulation of secondary circuit should be withstand at least a test voltage 1 KV, 50 c/s for 1 minute.
19. All relays should be of DC version i.e timing relays, auxiliary relays and tripping relays should be 110VDC operated.
20. All the contacts in the control, protection and signaling circuits should be properly selected to be capable to interrupt and switch on the currents flowing through them during their operation.
21. The voltage secondary circuits should be protected by suitable automatic M.C.B.
22. The universal motor should be protected by 2 pole MCB.
23. The metal enclosed structure should be treated against rust or anti rust material, and provided with priming, intermediate and finishing coats of electrostatic painting powder.

The external coat is generally light grey color for required parts to be painted.

24. The instruments should be of flush type and mounted on hinged door at the front of each cubicle.
25. The switchgear should be designed according to IEC62271-200 LSC2 to give maximum reliability and safety in service concerning operation, inspection and maintenance and all operations can be performed from panel front.
26. The switchgear has to be designed to be safe against spread of fire, formation of internal excessive pressure (each compartment should be provided with its own pressure relief device with the use of dedicated system for arc protection independent of the protection relay), contact of live parts, ingress of dust and splashing liquid.
27. Every incoming and outgoing feeder, cubicle should be equipped with three position disconnector (ON – OFF – Earth) for make-proof earthing in combination with the circuit breaker for the panel incoming cables
28. The construction of switchgear and the C.B's should comply with these specifications and IEC62271-200, IEC62271-100.
29. The permissible (guaranteed) number of switching (ON/OFF) cycles of C.B's mechanism should be $\geq$ 10000 cycle.
30. The indicating lamps & push button should be heavy duty.
31. Indicating lamps (LED) for voltage phases (L1, L2, L3) should be fed from capacitive divider.
32. All measuring instrument should be digital type with range not less than 120 % of their nominal rating.
33. The meters should be supplied with their software and cables needed for communicate it with any computers.
34. All current transformers should be provided with a current continuous factor =**1.2**

11-DRAWINGS AND CATALOGUES

The tenderer should be delivered with the offer a complete copy of outline drawings, single line diagram and a complete catalogue (and a wiring diagram at delivery) for each component containing the full technical data in order to allow complete study of his offer.

12-GUARANTEE TABLES

The tenderer should be filled in all the guarantee tables attached with these specifications accurately. The offer which will not be accompanied with a complete copy of drawings, catalogues and filling guarantee tables will not be considered.

13-MARKING

Marking of the cubicles and their components should be done according to IEC standards.

14-TESTING

a. Type tests should be as per IEC62271 (last edition).
b. Routine tests:
   - Routine tests of all components should be carried out according to latest IEC standards by the manufacturer, a representative of Distribution Company will attend these tests before acceptance – (attached list of the routine tests to be carried out).
   - Minimum Medium voltage switchgears checklist for routine tests according to ….EDC specifications and approved S.L.D (….EDC have the right to add any test during delivery to check the quality of the product):

Panel's Type:		**Panel's Name**	
DESCRIPTION OF TESTS		**Pass(P) , Fail (F) , Un-completed (U) , Not available (NA)**	
A	**IDENTITY CHECK/VISUAL CHECK**	**الفحص الظاهري**	**Evaluation**
1	**Nameplate of SWG**	تركيب ومراجعه لوحة البيانات	
2	**layout of SWG (Arrangement of cubicles, Type & dimensions of each c**	مراجعه ال Layout (ترتيب الخلايا , الابعاد , ...)	
3	**Availability of components according to SLD and control drawing and specifications**	وجود المكونات باللوحه طبقا للرسومات والمواصفات (S.L.D و Control)	
4	**Installation of devices according the layout**	تركيب المكونات طبقا للرسومات (S.L.D و Control)	
5	**revising of installation , ambient temperature and sheets thickness**	مراجعه ال Technical data (درجه الحراره , سمك الصاج)	
6	**cross section of bus bars and thickness of sheet plate according to technical data and Addition**	مساحه مقطع البارات وسمك الصاج طبقا للرسومات والمواصفات	
7	**additions of busbars if required (Silver, tin-plated or insulated by raycham**	الاضافات (الفصدره , الريكم, التفضيض,,)	
8	**Verification of the earthing of the voltage transformers**	التأكيد من توصيل الارضى للمحولات الجهد	
9	**Check the painting for painted parts and the touch up necessity**	مراجعه جوده الدهانات و ال Touch up	
10	**Earthing of doors and checking the strengh of earthing connetion**	التأكد من الرباط و التوصيل اسلاك الارضى على الضلف	

11	Earthing of devices and checking the earthing labels	التأكد من الرباط و التوصيل اسلاك الارضى للأجهزه ومسمى الارضى	
12	Easiness of reach to devices operated by customer	سهوله وصول العميل للأجهزه التى يتم التعامل معها	
13	Apparent quality of devices and components	الجوده الظاهريه للأجهزة والمكونات	
14	Completeness of accessories	استكمال الاكسسوارات	
15	Overall cleanliness inspection	نظافه اللوحات	
16	Completeness of labels according to S.L .D and control drawings and specifications	استكمال المسميات طبقا للرسومات والمواصفات	
17	Installation of the mimic diagram according to the drawings.	مراجعة تركيب الرسم التخطيطى mimic diagram طبقا للرسومات	
18	Alarm and horn operation	التاكد من تشغيل وعمل دوانرالانذار	
19	Certified copper quality and copper purity From an accredited laboratory	شهادة معتمدة بجودة النحاس ونسبه نقاءة من معمل محايد	
B	WIRING CHECK	فحص الاسلاك	
1	Completeness of control connection (wiring)	استكمال اعمال الكنترول	
2	Cable cross section according to control diagram suitability	مساحه مقطع اسلاك الكنترول طبقا للتيار و رسومات الكنترول والمواصفات	
3	Insulated wires are not laying at sharp edges or live parts	عدم ملامسه الاسلاك للأجزاءالحاده و الكهرباء	
4	Apparent quality of cables and wires' insulation	الجوده الظاهريه للكابلات و العزل	
5	Cables and wires are neat	تنظيم الاسلاك	
6	Flexibility of wires	مرونه الاسلاك	
7	Numbering of wires and terminal blocks	ترقيم الاسلاك و الروزيتات	
8	Unity of cable terminals	توحيد الترامل	
9	Verification of the strong connection of wires on terminal blocks	قوه تثبيت الاسلاك على الاجهزه و الروزيتات	
10	Color code of wires according to drawings	الالتزام بالوان الاسلاك طبقا للرسومات والمواصفات	
11	The conformity of auxiliary and control circuits to the circuits diagrams and wiring diagrams shall be checked	التحقق من مطابقة الدوائر المساعدة ودوائر التحكم رسومات الدوائر ورسومات الأسلاك	
C	MECHANICAL TESTS	الاختبارات الميكانيكية	
1	Mechanical operation of C.B in ON/OFF positions	التشغيل الميكانيكي في أوضاع on/off/trip	

2	Easiness of the mechanical movement of the earthing socket	سهولة الحركة الميكانيكية لدخول يد السكين	
3	Mechanical operation of earthing switches in ON/OFF positions	التشغيل الميكانيكيه للسكينة (on/off)	
4	Mechanical interlock between C .B and cable door	الربط الميكانيكى بين القاطع والباب	
5	Mechanical interlock between C.B and earthing switch	الربط الميكانيكى بين القاطع والسكينة	
6	All mechanical parts work properly	جميع الاجزاء الميكانيكية تعمل بحالة جيدة	
7	Fixing of devices ,C.B . ,contactors …etc. in the low voltage compartm	تثبيت المكونات	
8	Doors function (hinges & locks….)	حركة الابواب و الضلف	
D	POWER FREQUENCY VOLTAGE WITHSTAND TEST		
	No flash over for 24KV(50KV/MIN)	تحقيق عدم وجود Spark	
1	Main circuit L1 where L2&L3 are earthed	اختبار الفازة L1 وتوصيل L2,L3 بالارضى	
2	Main circuit L2 where L1&L3 are earthed	اختبار الفازة L2 وتوصيل L1,L3 بالارضى	
3	Main circuit L3 where L1&L2 are earthed	اختبار الفازة L3 وتوصيل L2,L1 بالارضى	
E	ELECTRICAL TESTS	الاختبارات الكهربيه	
1	Electrical operation of C.B in ON/OFF positions	تشغيل القاطع ON/OFF	
2	Electrical operation of C.B	تشغيل القاطع ON/OFF	
3	Testing of control circuit devices according to the control diagram	اختبار دائره الكنترول طبقا للرسومات	
4	opportunity of devices with required control circuit (voltage/ampere/burden)	مناسبه الاجهزه طبقا لدائره الكنترول(الفولت , التيار, burden)	
5	availability of devices protection with fuses/MCBs with suitable ratio	وجود حمايه للاجهزه من خلال الفيوزات و المفاتيح بقيم مناسبه	
6	availability of control circuits protection with fuses/MCBs with suitable	وجود حمايه للدائره من خلال الفيوزات و المفاتيح بقيم مناسبه	
7	function of control circuit according to the circuit diagram's proper d	الوظيفه المطلوبه للدائره طبقا للتصميم الصحيح (تعديلات)	
8	Protection relays and devices are parameterized/programmed	برمجه اجهزه الكنترول و الوقايه	
9	Verification of the protection relays functions	تحقيق الحمايات المطلوبه من خلال اجهزه الوقايه	
10	Check the signal list availability on the binary	التاكد من اتاحة واستقبال قائمة الاشارات بالمدخلات بأجهزة الوقاية	

	input of the protection relay		
11	Testing of circuit breaker timing (close/open)	اختبار زمن الفصل والتوصيل للقاطع	
12	Measure and control all signals from the protection relays by mean of RTU	قراءه وتحكم فى الأشارات الواصله لأجهزه الوقايه بواسطه وحده طرفيه (RTU)	
13	Measuring the contact resistance of the circuit breaker	قياس مقاومة التوصيل للقاطع	
14	primary injection test for Current and voltage transformers (C.T's &V.T)	الحقن الابتدائى ل (C.T's & V.T's)	
15	Secondary injection test for protection relays and metering device	الحقن الثانوى لأجهزه الوقايه و العدادات	
16	Partial Discharge measurement (IEC61869-2/3)	قياسات التفريغ الجزئي	
17	Thickness of silver plate for connection point	قياس سمك طبقة الفضه التي يتم طلاء نقاط التوصيل بها بالموزع	
18	Measurement of conductivity resistance of the panel	قياس مقاومه التوصيل للخليه	

15-PROTECTION RELAYS

Protection for all cubicles (Incoming, Outgoing and Bus Coupler) should be through 3-phase combined directional and non-directional digital protection relay (over current + earth fault) With timer in one unit connected to three single phase current transformers and three single phase voltage transformers of the protected object and suitable for resistance earthed neutral system fulfilling the following requirements and specifications:

1- General characteristics:-

1.1-The protection relay is based on a multiprocessor digital type.

1.2-The modern technology should be applied in both hardware and software solution.

1.3-The relay should be designed for protection against (O.C. & E.F & S.C) in parallel feeders from S/S to distribution switchgear and for outgoing from distribution switchgear to kiosk and include the following:

- The current unit should be supplied from 3-single phase current transformers ($I_R - I_S - I_T - I_N$)
- The voltage unit should be supplied from 3-single phase voltage transformers (22000 /√3/110/ √3 / 110/3) volt. ($V_R - V_S - V_T - V_0$)

- Nominal current I_n= 5A / 1 A , frequency 50 Hz

- Nominal voltage V_n (110-100) volt , frequency 50 Hz
- Reset factors ≥ 95%
- Operating temp. From -5 C° to +55 C°.
- Humidity > 90% non-condensation
- Auxiliary supply: (48-250 Vdc ± 10 %; 100-240 Vac ± 10 %) and should be able to operate without intended delay.
- Indication and Programmable LEDs
  - Each start and trip from every protection function should be clearly indicated.
  - It should also be possible to transfer the start and trip signals to the binary outputs if required.
  - It should be possible to transfer them to an upper level system via communication link.
  - The resetting of indications and alarm LEDs should be easy, preferably by pressing one button only.
  - Operation indication, with hand reset and automatic reset for tripping order and include one LED for each fault type and monitoring at least 4 programmable led besides LEDs of ready of protection and trip indication.
- Self-monitoring and blocking for internal faults with alarm contact and led indication.
- The relay should be flush mounted, having withdrawn out facility without removing wire connection or with withdrawable connectors with an automatic short-circuit mechanism in the CT connector. Therefore, detaching the plug-in unit will not open the secondary circuit of the CT which could cause dangerously high voltages.
- Special attention should be paid in minimizing the replacement time of a defective unit, preferably by means of ”plug-in” units. The relay should have full flexibility in terms of assigning any binary input and output signal to the internal logic circuits.
- Binary Inputs and Outputs
  - The number of inputs/outputs should be enough to interface the relay to the external circuits in order to enable the full use of the protection relay functionality excluding the dedicated relay internal fault output.
  - The threshold voltage of the binary inputs should be settable using a dedicated parameter with rated voltage operating range of (48-250 Vdc ± 10 %; 100-240 Vac ± 10 %) supply with a threshold voltage of (16 to 176 ± 20% V AC/DC Supply).
  - Grouping of binary inputs under a common ground potential is allowed, as far as more than one common ground potential is available.
  - The inputs should be fully isolated from the protection relay internal circuits.

- It should be possible, by software, to freely assign the binary inputs and outputs to the protection relay internal function logic.
- A possibility to introduce simple logic functions in the form of AND and OR gates, including signal inversion, in front of the binary inputs and outputs should also be foreseen. As an example, a possibility to energize a binary output from a number of internal relay signals (OR gate) should be available.
- The numbers of the binary inputs should be 14 binary inputs at least

- Output contacts (Tripping contacts) (tripping contacts) should cover the following specification:
  - Rated voltage (250 V AC/DC) with ripple content (3-4) %.
  - Continuous carrying capacity 5 A DC.
  - Making and carrying current capacity for 0.5 sec $\geq$ 25 A.
  - Make and carry for 3.0 sec $\geq$ 10 A.
  - Free contacts at least (1 N.O for O.C & 1 N.O for E.F and 1 N.C for signaling).
  - Two trip contacts and two configurable contacts and one contact for relay healthy per relay
- Phase discontinuity protection for three phases
- Three-phase thermal protection
- The relay should have the inrush current blocking based on the second order harmonic percentage which can be used in all protection stages, without using multiplayer
- The relay should be of a numerical communicating type offering extensive protection, control and measuring functions in one enclosed unit.
- The relay should meet the latest revision of IEC publication 60255.
- The relay should meet standard Relays and Relays System ANSI C.37.90.
- All parameters and events can be set or read by P.C and manually by keypad
- Smaller dimensions preferred
- Tender should supply with offer detailed instruction and catalogue
- The relay should include event recorder and should be read by screen.
- Conductor broken from consumer (open circuit fault): 46 bc.
- Zero sequence ground
- Original software, firmware, plug connections to (PC and / or laptop) for all protection relays and test plugs should provide by the contractor.
- Continuous self-supervision and self-diagnosis of electronics and software
- User-selectable password protection for HMI
- Display of primary / secondary (current & voltage) values

- Housing degree of protection IP 52 according to IEC60529
- The relay should be supported by standard protocol IEC61850 (Edition 2)–and Modbus protocol.
- The protection relay basic design and data modeling should be based on the IEC61850 standard
- The relay should have four setting tables at least.
- Circuit breaker failure protection (0.1……..1) sec including C.B. time failure and S.C. function time
- Output contacts can be programmed by keypad and PC.

1.4-Standard tests

a. Insulation tests :

- **Dielectric tests :**

according to the IEC60225-27 or equivalent, tests voltage 1KV , 50 HZ, 60 sec.

- **Impulse voltage test:**

according to the IEC60225-27 or equivalent, tests voltage 5KV, unipolar impulses, waveform 1.2/50µs

- **Insulation resistance measurements:**

according to the IEC60225-27.

b. High frequency interference withstands:

According to class III IEC60225-5

c. Overload

- Current circuit temporary ≥ 60 In for 1.0 sec
- Polarization temporary ≥ 1.3 Ur max (Ur = 3 Uo)

d. Mechanical tests

- Vibration test (sinusoidal) according to the IEC60068-2-6 (test Fc) / IEC60255-21-1).
- Shock and bump test according to the IEC (test Ea shock) / IEC60068-2-27(test Eb bump) / IEC60255-21-2)

1. 5 The relay should be including the following protection

- I > Three-phase low-set over current stage with definite–time and inverse definite minimum time characteristic (IDMT)

- I >> Three-phase high-set over current stage with the instantaneous or definite time characteristic.
- Io > low-set non-directional earth –fault stage with definite-time or inverse definite minimum time characteristic (IDMT).
- Io >> High-set non-directional earth-fault stage with instantaneous or definite –time characteristic.8

2-Parameterization

The parameter can be set either locally over HMI or exeternally via the serial or RJ45 communication using relay software compatable with all new version of windows.

3-Nonvolatile memory

The protection relay should be equipped with a nonvolatile memory for preserving important data during auxiliary supply failure. The relay setting and programming should be stored in EEPROM. The memory does not need batteries, and a lifelong service is guaranteed and following data is stored:

- Date and Time
- Setting values
- Disturbance records
- Record last five fault data (with all fault parameters).
- At least, Last 50 events recorded
  - Recorded values are stored from start, trip and other important external input.
  - At least, the last 50 events that occurred before the auxiliary power supply breaks can be viewed in the HMI event buffer. Time and date for the events are also restored.
  - Disturbance recorder with the following features:
    - Nonvolatile memory for disturbance records all data should be kept even for switch off D.C. power supply.
    - Eight analogue channels for (Ia , Ib , Ic , Io) – (Va , Vb , Vc , Vo) .
    - Eight digital channels at least.
    - The relay should keep minimum of 5 records which can be stored.
    - Recording time capacity ≥ 15 sec.
    - Recording time up to three seconds duration for each storage fault.
    - Pre event and post event recording and memory time adjustable.
  - Oscillography recorder: voltage and current waves should be recorded so that can be analyzed oscillography through PC for all abnormal.

- Fault recording from prefault up to fault clearing stage with all electrical parameters.

4-The real-time clock

The relay should be supported by a real-time clock (RTC) with time synchronization facility which used for time stamping of events. It is also running during auxiliary power breaks.

When the supply is re-established, the relay sets the right time and new events are stamped accordingly.

All relays should be incorporated with all communication interfaces to enable time synchronization through NTP server.

5-Setting values and ranges

Nominal voltage (Un): 100-110 v, Fn: 50 HZ and In: 5 A / 1A.

Each protection function should be consisting of three separate settable stages covering wide setting ranges

The operation of the three stages should be settable to either definite time or inverse time mode supporting various type of inverse curves including user definable one

It should be possible to operate the directional stages in non-directional mode

5.1. Three-phase directional over current protection

- Setting current range : (0.05 -4) In , with steps≤ 0.05 In
- Start voltage: (2%) Un
- Operate time in DT mode : (0.05 : 3) sec with step ≤ 0.01 sec
- Basic angle φ (0 : 359° with step ≤ 5°) or (-90° : +90°)with Operation Direction (Forward & Reverse)
- Min. voltage of polarizing quantity for operation (sensitivity) should be ≤ 2% Un

5-2- Directional earth fault protection

- Setting current range : (0.01 : 0.6) In with steps ≤ 0.01 In
- Start voltage: (2%) Un
- Operate time in DT mode : (0.05 : 3 sec) with steps ≤ 0 .01 sec
- Basic angle φ (0 : 359°) at step ≤ 5° or (- 90° : + 90°) with Operation direction (Forward & Reverse)

- The polarizing quantity should be the zero-sequence voltage which the relay itself can reconstitute from the output voltage of the three single phase voltage transformers.

5-3- Three-phase non-directional over current protection

5-3-1- Current stages

- Low set over current I > (0.05 - 5) In with steps ≤ 0.05 In.
- High set over current I >> (0.1- 25) In with steps ≤ 0.05 In.

5-3-2 Operating time ranges

- Operating time in DT mode:(0.05-3)sec with step ≤ 0.01 sec
- Low set over current stage I > : (0.05- 3) sec with step ≤ 0.01 sec
- High set over current stage I >>: instantaneous or operating time (0–3) sec with step 0.01sec.

5-4- Non-directional earth fault protection

5-4-1- Current stages

- Low set earth fault Io > (0.01 – 0.6) In with steps ≤ 0.01 In.
- High set earth fault Io >> (0.1 - 10) In with steps ≤ 0.01 In.
- Sensitive earth fault : (0.005 - 0.5) In (option) by mean of ring core CT

5-4-2-Operating time ranges

- Definite time
- Low set earth fault (0.05 – 3) sec with steps ≤ 0.01 sec.
- High set earth fault (0 – 3) sec with steps ≤ 0.05 sec.
- Sensitive earth fault (0-3) sec (option)

5-5- Voltage Protection

5-5-1- Over voltage stages U >

- Over voltage setting range : 60 : 150 % Un (with steps ≤ 2. 5% Un)
- Definite time characteristics :
  Operating time : 0.05:300 (With steps ≤ 0.05 sec.)

5-5-2- Under voltage stages U <

- Under voltage setting range : 30 : 120 % Un (with steps ≤ 2. 5% Un)
- Definite time characteristics :
  Operating time : 0.05: 300 (with steps ≤ 0.05 sec.)

6- Diagnosis and Supervision

6-1- Supervision function for energizing current input circuit.
6-2- Supervision function for energizing voltage input circuit.
6-3- Trip circuit supervision.
6-4- Self test diagnostic

7-Measurement

There should be measurements functions and indication in the relay HMI for analogue inputs (current and voltage) connected to the relay, as per the followings:

- Phase current.
- Residual current.
- Current sequence component.
- Three phase voltage phase and line voltages measurements.
- Residual voltage
- Voltage sequence component.
- Active Power, reactive power, total power, frequency and power factor.
- KWH and KVAR (Energy measurements)

8-Communications

Support a range of communication protocols including but not limited to:

- The IEC61850 communication protocol (Edition 2) + Modbus.
- Local communication (PC or Laptop through RS-232 (RJ45) or other))
- Remote communication (through two redundant ports Ethernet RJ-45) to be connect in loop (RSTP) + {(HSR) or (PRP)} with RTU (in the future).
- Communication between protection relays installed in each LV cabinets of MV cells to retrieve analog values (voltage/current) and available status through Digital Inputs.
- IEDs will be connected in loop (RSTP) + {(HSR) or (PRP)} to communicate with RTU (in the future) over TCP/IP using IEC61850 and Modbus protocols.

16-SPARE PARTS (OPTIONAL)

Separate price of spare parts list should be delivered with the tender Only original spare parts to be guaranteed by the tenderer.

Spare parts list should be offered as following:

1- Three current transformer 200-400/5-5 A (as delivered).
2- Three current transformer 300-600/5-5 A (as delivered).
3- Three voltage transformers (as delivered).
4- (9) Digital Ammeter (as delivered).
5- One Digital voltmeter (as delivered).
6- Two combined directional & non direction (O.C+E.F+S.C) relay as delivered.
7- (6) H.V fuses for P.T (as delivered).
8- Two spring charging motor 110VDC (as delivered)
9- Two tripping coils (as delivered) in case of spring charge motor C.B. type.
10- Two closing coils (as delivered) in case of spring charge motor C.B. type
11- Two Blocking coils for incoming cell (as delivered) in case of spring charge motor C.B. type

❖ Notice: the items from 1 to 11 should be delivered in suitable wooden container.

17-TRAINING (OPTIONAL)

….EDC reserves its right to claim a priceless training for (3) three of its representatives on the vendor's factory, site, lab or as per mutually agreed.

The training should include and not limited to the following:

1. Installation.
2. Testing & Commissioning.
3. Troubleshooting.
4. Operating and Maintenance.

18-AFTER SALE SERVICE (OPTIONAL)

The tenderer should have a certified/qualified service center in Egypt covers all its deliverables.

….EDC reserves its right to claim a free after sale service all over the warranty period guaranteed by the tenderer that covers all its deliverables, after sale services should include and not limited to the following:

1. Technical support.
2. Maintenance.

3. Original Spare parts.
4. Submittals.

- All the services, spare parts, materials and accessories will be needed during the after-sale maintenance should be guaranteed by the tenderer immediately and wherever required (Warehouse – Site – Lab. ….etc.).

19-WARRANTEE: The supplier guarantees the Switchgear against all defects arising out of faulty design or workmanship, or of defective material for period of (2) years from date of delivery.

20-FACTORY VISITS & FABRICATION INSPECTION (OPTIONAL)

….EDC reserves its right to instruct the tenderer to arrange a priceless fabrication inspection and a factory visit for (3) of its representatives or as per mutually agreed to ensure the tenderer/vendor compliance with the tender.

21 -THE FOLLOWING DATA (AC AND DC PANELS) CAN BE CHANGED DUE TO ...EDC REQUIREMENTS

Low voltage 0.4KV AC Distribution Cabinet (As Option according To ....EDC requirements):

Made of sheet steel, Complete with copper bus-bar and all connections and consists of:

- Two for (incoming + outgoing) feeder (M.C.C.B):63A
- Two outgoing feeder (M.C.C.B):40A (both for lighting)
- One outgoing feeder (M.C.C.B):32A (as spare feeder)
- Three Digital Ammeter suitable class (0.5)
- Digital Voltmeter (500V) class (0.5) with digital selector switch 7positions, with indicating lamps.
- Alarm Circuit with Buzzer for dc loss
- Alarm Circuit and indication lamp with any m.c.b. Trip or 380 v absence
- One (3 phase) 4-wire digital meter, accuracy class 0.5 for active and 1 for reactive
- Three indication lamp (L1, L2, L3).

110 V D.C Distribution Cabinet (As Option according To ....EDC requirements):

Made of sheet steel, Complete with copper bus-bar and all connections and consists of:

- One 2 pole miniatures circuit breaker 63 A
- Digital D.C. Ammeter (60A) class (0.5).
- Digital D.C. Voltmeter (150V) class (0.5), with indicating lamps d.c.
- One 2 pole miniatures circuit breaker 63A from battery
- Four 2 pole miniatures circuit breaker 32A.
- Alarm Circuit with horn for ac loss and any MCB trip.

22- Essential criteria that must be considered across all functional units of switchgear:

1. The operation mode of the medium-voltage circuit breakers in the switchgear functional units (on/off) must not change in the following cases:
   - **a.** Disconnecting the DC voltage from all switchgear functional units.
   - **b.** Disconnecting the DC voltage from any functional unit in the switchgear.
   - **c.** Disconnecting the DC voltage from the protection device in any functional unit.
   - **d.** Restoring the DC voltage to the switchgear.
   - **e.** Restoring the DC voltage to any functional unit.
   - **f.** Restoring the DC voltage to the protection device in any functional unit.
2. The operation of the switch gear is required to be both manual and electrical excluding automatic functionality. Taking into account the interlocking mechanism between incoming functional units and bus coupler functional.
3. All circuit breakers, including outgoing, incomer, and bus coupler units, are to be manually operated (ON/OFF) with the cable compartment door closed.
4. Each incoming circuit breaker should be operated separately to ensure a continuous power supply through one of the parallel lines. So, if one of the parallel incoming circuit breakers is turned off, it's important that the other one doesn't trip.
5. It is necessary to provide spare parts for each switchgear in a separate wooden container, items from 3 to 20 of spare parts, with the respective switchgear number clearly labeled on the box.
6. It is essential that the installation components for each switchgear are supplied individually within a designated wooden container, bearing the corresponding switchgear number.
7. The protective devices employed in the switchgear must have been previously supplied and utilized by electricity distribution companies, with a proven operational record at the site. In the case of devices that have not been previously supplied, they undergo testing by the Central Protection Authority and receive approval from the Egyptian Electricity Holding Company.
8. Protection devices should retain their memory integrity even when the auxiliary operating voltage is disconnected.
9. It is requisite to deliver two authentic catalogs comprising information on circuit breakers, protection devices, meters, current transformers, voltage transformers, executive diagrams, as well as protection and measurement circuits upon the delivery of the equipment.
10. The indicators and on/off switches must adhere to robust specifications, specifically of the heavy-duty category, the indicators shall utilizing LED technology.
11. The power supply for all devices located on the front panel of any functional unit must originate directly from the terminals within the functional unit. Separate control wires are required for each connection, and it is imperative not to employ bridges between the devices, such as indicators and operating switches, situated on the front of the functional

unit. This measure is undertaken to mitigate the occurrence of voltage interruptions within these devices.

12. All terminals block are fabricated from non-flammable, halogen-free materials.
13. Installation of crimp terminal connectors with numerical identification is mandatory for all control wires.
14. The terminals on the secondary circuits of the current transformer must be segregated into two groups: one for meters and the other for protection. They must be equipped with a shorting and isolating mechanism to facilitate secure modifications for meter or protection device replacement at any time.
15. Distinct colors are required for the wires of current transformers, ensuring differentiation from voltage transformer wires and DC voltage circuit wires.
16. Terminal numbering is applied in a non-erasable manner."
17. All terminal blocks and crimp terminals are manufactured using high-quality copper and are subjected to tin-plating.
18. Each switchgear unit must be supplied with one software program designed for the primary operation of the protection devices integrated into the switchgear. Additionally, one portable personal computer and four connecting cables for each switchgear should be provided. It is essential that protection engineers undergo training on the utilization of the software.
19. The mechanical and electrical design of the opening and closing coils for each breaker within the switchgear must be inherently safeguarded against dust, ensuring it remains unaffected and does not contribute to an extension of the specified opening/closing time.
20. The switchgear design must facilitate the maintenance of current transformers for testing purposes and provide easy access to voltage transformers.
21. Functional unit doors must be effectively grounded, and the grounding of measurement and protection devices is to be achieved through their respective ground bars rather than the body of the switchgear.
22. Each functional unit within the switchgear (incomer, outgoing, and bus coupler) must be equipped with dedicated terminals for remote control connectivity through protection devices. These terminals should enable the connection of auxiliary contacts and limit switches inside the breakers and functional units. The terminal should include information on:
    a. The positions of the circuit breaker (ON/OFF).
    b. The positions of the earth switch (ON/OFF).
    c. The positions of the disconnector switch (ON/OFF).
    d. AC auxiliary voltage from voltage transformers.
    e. Status of any miniature circuit breaker (MCB).
    f. Status of charging spring.
    g. Insufficient gas condition.

23. The earth switch is mandated to ground the cable heads of all incoming and outgoing functional units, signifying that the current transformers should be grounded from the cable heads rather than from the busbar.
24. A spare capacity equivalent to 25% of the connections of the installed terminals block in each functional unit is required. Additionally, 25% space should be allocated to accommodate potential future supply needs (as optional for EDC).
25. Capability for closing and opening the CB through binary inputs and outputs of the protection devices is essential.
26. A second shunt coil release is mandatory for the circuit breaker to ensure the completion of the tripping process.
27. Clear numbering of functional units on both the front and back panels using large and conspicuous numbers.
28. Provision of two limit switches on the earth switch, equipped with an indicator lamp, to indicate the switch position.
29. Installation of two limit switches to indicate the position of the voltage transformer carriage.
30. Inclusion of a 2-pole MCB for each functional unit, covering the charging motor, protection relay, signaling, tripping, and close functions. Additionally, a 4-pole MCB is required for each functional unit in the voltage transformer circuit to facilitate meter installation.
31. Incorporation of a solenoid/blocking coil in the incoming functional units to prevent the closing of the earth switch while voltage is present on the incoming cables.
32. Directional labeling on wires, specifying "From/To."
33. Provision of a Facility to bypass interlock, enabling the opening of the functional unit cable door earth switch while in the 'triggered' position for emergency service.
34. Installation of test blocks for the current and voltage circuits.
35. Interlock circuits achieved through blocking coils in the incoming functional units and bus coupler.
36. Inclusion of the cold load pickup feature in protection devices.
37. Creation of a mimic diagram displaying the positions of the circuit breaker, earth switch, and voltage transformers.
38. In the event of a loss of auxiliary power from the voltage transformers (110VAC) of incomers circuit from any of the 2 incomers for the switchgear and closing bus coupler, supply from the voltage transformers of the second sector is provided to all functional units of the first sector.
39. The connection between the bus bars must match the cross-section area of the bus bars without reduction.
40. Review and approval of switchgear and control circuit drawings by the electricity distribution company before manufacturing.
41. Communication between protection relays installed in each LV cabinets of MV cells to retrieve analog values (voltage/current) and available status through Digital Inputs. IEDs

(intelligent electronic devices) will be connected in loop (RSTP)+{(HSR) or (PRP)} to communicate with RTU (in the future) using IEC61850 and Modbus protocols.

42. The switch gear should be supplied with ID panel with water proof cover on the front outer enclosure of each cell.
43. Operation instructions of the switchgear should be declared on a sticker on front door of each panel (in arabic)

23-OPTIONS LIST

The following table should be filled/attached by …EDC during tendering.

NO	Option	Needed	Not Needed
1	Ambient temperature: 50°C		
2	C.B. Outgoing feeder panel 630A		
3	Voltage transformer in Busbar		
4	A spare capacity equivalent to 25% of the terminals blocks in each functional unit + 25% space for future supply needs		
5	Sensitive earth fault function		
6	Spare Parts		
7	Training		
8	After sale Service		
9	Factory Visits & Fabrication Inspection		
10	One AC Low Voltage Distribution Board		
11	One DC Voltage Distribution Board		
12	(X1) No. of incoming feeder panels……, (X2) No. of outgoing feeder panels…….		

24-SIGNAL LIST

….EDC reserves its right to Add/Delete or Modify/Rearranged signals according to operation requirements

Signal List for Medium voltage Switchgear

Items	Description	
Measurements		
3 phase currents	Analog signal from PR	Com. Link from protection relay
3 phase fault currents	Analog signal from PR	Com. Link from protection relay
3 phase voltages	Analog signal from PR	Com. Link from protection relay
Frequency	Analog signal from PR	Com. Link from protection relay
Power Factor	Analog signal from PR	Com. Link from protection relay
Active Power	Analog signal from PR	Com. Link from protection relay
Reactive Power	Analog signal from PR	Com. Link from protection relay
Active Energy	Analog signal from PR	Com. Link from protection relay
Reactive Energy	Analog signal from PR	Com. Link from protection relay
Others		
Status Indication		
CB ON Position	Digital input to PR	Com. Link from protection relay to RTU
CB OFF Position	Digital input to PR	Com. Link from protection relay to RTU
Disconnector switch ON Position	Digital input to PR	Com. Link from protection relay to RTU
Disconnector switch OFF Position	Digital input to PR	Com. Link from protection relay to RTU
VT Disconnector switch ON Position	Digital input to PR	Com. Link from protection relay to RTU
VT Disconnector switch OFF Position	Digital input to PR	Com. Link from protection relay to RTU
Earth Switch ON	Digital input to PR	Com. Link from protection relay to RTU
Earth Switching OFF	Digital input to PR	Com. Link from protection relay to RTU
Motor Spring Charged	Digital input to PR	Com. Link from protection relay to RTU
Commands		
CB Switching ON	Digital Output from PR	Com. Link to protection relay from RTU
CB Switching OFF	Digital Output from PR	Com. Link to protection relay from RTU
Alarms		
OC Trip	Digital Signal from PR	Com. Link from protection relay to RTU
DOC Trip	Digital Signal from PR	Com. Link from protection relay to RTU
EF Trip	Digital Signal from PR	Com. Link from protection relay to RTU
DEF Trip	Digital Signal from PR	Com. Link from protection relay to RTU
OV alarm	Digital Signal from PR	Com. Link from protection relay to RTU
UV alarm	Digital Signal from PR	Com. Link from protection relay to RTU
Protection Relay Faulty	Digital Signal	Hard Wire to RTU
DC Auxiliary Supply Loss	Digital Signal	Hard Wire to RTU
LV Auxiliary supply loss	Digital signal	Hard wire to RTU
VT Failure	Digital input to PR	Com. Link from protection relay to RTU
Any MCB OFF or Tripped	Digital input to PR	Com. Link from protection relay to RTU
Insufficient Gas	Digital input to PR	Com. Link from protection relay to RTU
Feeder Common Alarm	Digital Signal	Hard Wire to RTU
Battery Charger Common Alarm	Digital Signal	Hard Wire to RTU

GUARANTEE TABLE NO. (1) / (EQUIPMENT DATA)

1- CUBICLES :-

Maker's name	……..…
Type	……..……
Rated voltage	……KV.
Insulation level at power frequency	……..KV
Basic impulse level	……..KV
Frequency	……HZ
Aux. Voltage	……V
Material	……..……
Thickness of sheet steel + IK degree	…… mm + ……..
Dimensions: Width* Depth* Height	.mm *……mm *…….mm
Body color	……
Mimic diagram	……..…Yes / no.
Degree of protection (IP)	……

2- Environmental :-

Minimum ambient Temperature	……°C.
Maximum ambient Temperature	……°C
Maximum relative humidity	……%
Maximum altitude	……..m

3- MAIN BUS BARS :

Material	……
Copper purity	……..%
Copper Conductivity	……..……MS/ m
Number and Size per phase	……/……mm x mm
Short circuit current (for 3 sec.)	…… KA.
Withstand impulse voltage (peak)	…… KV.
One minute A.C 50 c/s test voltage	…… KV.
Max. Allowable temp.	……..°C

4- EARTH BUS BAR :-

Cross section area	……mm*mm

We guarantee the data given above for the equipment offered

Signature: ……
Date: ……

GUARANTEE TABLE NO (2) / CIRCUIT BREAKERS. 24 KV

1. Maker 's name ……
2- Standard specification ……
3- Type of CB ……
……
4- Type of main contacts:

5- Rated voltage ……KV
6- normal current rating at 40°C ……A
7- Rated breaking capacity at normal operating voltage (for 3 sec) ……KA
8- Type of operating mechanism
a- Closing ……
b- Tripping ……
9- Closing time ……..…… m.Sec
10- Opening time ……..… m.Sec

11- One-minute power frequency:
- ❖ Withstand voltage rms …… K.V

12- 1.2/50 micro second impulse
- ❖ Withstand voltage rms …… K.V

13- Weight of the breaker complete ……KG
14- Indication of C.B failure in switching off during fault …….
15- No. of auxiliary contacts for controlling, signaling& free contacts …… ……..
16- operation counter fixed on the circuit breaker not on the cover. …….
YES/NO
17- Contact resistance/C.B. ……μΩ
18- Thickness of silver plate for connection point ……μm

We guarantee the data given above for the equipment offered

Signature: ……
Date: ……

GUARANTEE TABLE NO. (3) / CURRENT TRANSFORMERS

1- **Maker's name** ……
2- **Type** ……
3- **Standard specification** ……
4- **Rated voltage** ……**KV.**
5- **Rated frequency** ……**HZ**
6- **Rated ratio :-**
   - **For incoming panels** ……**A**
   - **For coupler panel** ……**A**
   - **For outgoing panels** ……**A**
7- **Rated burden for:**
   a- **Measuring** ……**VA**
   b- **Protection** ……**VA**
8- **Accuracy class for :-**
   a. **Measuring** ……
   b. **Protection** ……
9- **Short circuit strength.**
   a- **For one second** ……**KA**
   b- **For three seconds** ……**KA**
10- **rated current factor and corresponding rated time** ……
11- **Power frequency withstand voltage r.m.s** ……**KV**
12- **Approximate weight** ……**Kg**

We guarantee the data given above for the equipment offered

Signature: ……
Date: ……

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GUARANTEE TABLE NO. (4) / POTENTIAL TRANSFORMERS

1- **Maker's name / Type** ……
2- **Type** ……
3- **Standard specification** ……
4- **Rated voltage** ……**K. V.**
5- **Rated frequency** ……**HZ**
6- **Rated ratio** ……
7- **Rated burden**
   a- **First core** ……**VA**
   b- **Second core** ……**VA**
8- **Accuracy class for:**
   a. **First core** ……
   b. **Second core** ……
9- **rated voltage factor and corresponding rated time** ……
10- **Power frequency withstand voltage(r.m.s)** ……**K. V.**
11- **Impulse test voltage (1.2/50)µS (r.m.s)** ……**K. V.**
12- **Approximate weight** …… **KGS**

We guarantee the data given above for the equipment offered

Signature: ……
Date: ……

GUARANTEE TABLE NO. (5) / (ACCESSORIES)

1. **Horn the bus coupler panel working in the following conditions :-**

.	DC loss in any panel .	.....YES / NO
i.	AC loss in any incoming panel .	.....YES / NO
ii.	Protection relay trip.	.....YES / NO
iii.	Any M.C.B trip .	.....YES / NO
IV.	Insufficient gas	.....YES / NO

We guarantee the data given above for the equipment offered

Signature: .....
Date: .....

GUARANTEE TABLE NO. (6) / MEASURING INSTRUMENT

A. AMETERS :-

a. **Type** .....
b. **Accuracy** .....
c. **Percentage of over range above normal rating** .....%

B. VOLTMETER :-

d. **Type** .....
e. **Accuracy** .....
f. **Selector switch 7 position** Yes / no
g. **Percentage of over range above normal rating** .....%

GUARANTEE TABLE NO. (7) / PROTECTIVE RELAYS.

DESCRIPTION:

1- Maker 's name	……
2- Country of manufacture	
3- Type and designation	……
4- Standard specification with which relay complies	……
5- Relays characteristics	……
6- Range of relay setting	I……(A) ……T……(Sec)
7- Current rating of relay coil	…… A
8- Voltage rating of relay coil	……V
9- Range of Auxiliary supply	……V
10- Relay order number	……
11- The relay should meet the latest revision of IEC publication 60255.	YSE/NO
12- The protection relay basic design and data modelling should be based on the IEC61850 standard	YSE/NO
13- Circuit breaker failure protection (0.1……..1) sec including C.B. time failure and S.C. function time	YSE/NO
14- (intelligent electronic devices) will be connected in loop (RSTP) + {(HSR) or (PRP)} to communicate with RTU over TCP/IP using IEC61850 protocols.	YSE/NO

We guarantee the data given above for the equipment offered

Signature: ……

Date: ……