

**Ministry of Electricity
Planning and Studies Office
Baghdad – Iraq**

Specification No.	D-03
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**TECHNICAL SPECIFICATION
OF
MEDIUM VOLTAGE POWER CABLES**

REVISION	December 2013
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1. Scope:

The specification includes the design, manufacture, test, suitable packing, transportation of 18/30 (36) kV and 12/20 (24) kV cables. Including installation , energizing

2. General Requirements:

The materials shall be of first class quality and designed for continuous satisfactory operation as continuity of supply is of prime importance and to operate satisfactorily under variation of load, voltage and short circuit or other conditions which may occur on the system provided that these variations are within the assigned rating of the apparatus. The materials used shall be suitable for the following climatic and soil conditions.

2.1 Ambient temperature:

Highest maximum (in the shade) 55 °C for about 6 hours a day

Lowest minimum (-10) °C

Maximum yearly average (+30) °C

Maximum daily average (+40) °C

2.2 Sun shine temperature:

Black objects under direct sunshine attain a temperature of 80 °C

2.3 Air humidity:

Maximum: 92% at 40 °C

Minimum : 12%

Yearly average : 44%

2.4 Altitudes:

From sea level up to (1000m)

3. Technical Requirement:

System Data:

a. 33 KV System	
Nominal voltage	33000 volts
Highest system voltage	36000 volts
System	3-phase, 3 wire with neutral grounding zig-zag transformer to limit the earth fault current to 1000 Amp.
Frequency	50 Hz
Short circuit breaking current	25KA. R.M.S at 33000 volts

b. 11 KV System	
Nominal voltage	11000 volts
Highest system voltage	12000 volts
System	3-phase, 3wire neutral earthed through resistance of 21.1 Ohm limiting the earth fault current to 300A
Short circuit breaking current	25 KA R.M.S at 11000 volts

4. Standards:

The cable should be in accordance with the latest edition of the IEC standard particularly IEC no. 60502, 60228 and all other relevant IEC standards.

5. Deviations:

The tenderer shall particularly mention in the tender all deviations of the offer from the specifications described in these tender documents.

6. General Cable Characteristics:

6-1 Conductor:

The conductor shall be class 2 compacted annealed stranded circular copper conductor having resistance within the limits specified in table No.1 mentioned below. The minimum number of strands in the conductor shall not be less than the appropriate minimum numbers specified in table No.1. The conductor shall be according to the IEC 60228 and all other relevant IEC standards.

6-2 Conductor screen:

Conductor screen shall be non-metallic and shall consist of a layer of extruded semi-conducting compound which shall be firmly bonded to the inner surface of the insulation. The contact of the semi-conducting shields with the cable insulation must be perfect without void creation at the inner surfaces. The interfaces must be smooth in a regular geometric shape and avoid stress concentration and the semi-conducting compound must have homogeneous structure particularly at the interfaces. The semi-conducting shields must be mechanically stable under load cycling of the power cable and high temperature conditions.

6-3 Insulation:

The insulation of the cable shall be extruded XLPE cured with dry curing process, designed and manufactured for the specified voltage. The manufacturing process shall ensure that insulation shall be free from voids. The insulation shall withstand mechanical and thermal stress under steady state and transient operating conditions. The extrusion method should give very smooth interface between semi-conducting screen and insulation. The insulation of the cables shall be of high standard quality. The thickness of the insulation shall not be less than that specified in the relevant standards.

- a- For 24 kV , nominal thickness is 5.5 mm
- b- For 36 kV , nominal thickness is 8 mm

Conductor screen, insulation and insulation screen shall be extruded by triple extrusion method.

6-4 Insulation screen:

- a- Non-metallic screen: shall consist of a layer of extruded semi-conducting compound firmly bonded provided over the insulation simultaneously with the extrusion of the insulation. Semi-conducting swelling tape with suitable overlap over the extruded semi-conducting layer of compound shall be applied.
- b- Metallic screen: a combination of copper wires with copper counter spiral tape shall be applied over the non-metallic insulation screen. The equivalent total cross sectional area of metallic screen shall be not less than:
 - a. 25 sq. mm for cables having a conductor size up to 150 sq. mm.
 - b. 35 sq. mm for cables having a conductor size more than 150 sq.mm.

6.5 Phase Identification:

For 3 core cables, Red, Yellow and Blue colored strips shall be applied under the metallic screen throughout the length of the cable for phase identification.

6.6 Filler:

The three cores then laid up with a suitable extruded material to provide a substantially circular cross section before the inner covering is applied. The filler material should be non-hygroscopic, easy to be removed and good flexibility material, suitable for the operating temperature and compatible with the insulating material. The materials shall be new, unused and of finest quality.

6.7 Inner sheath:

a PVC inner covering then extruded over the circular assembly with a thickness proportional to the fictitious diameter over laid-up cores as specified in IEC 60502-2/Clause 8.1.3 .

6.8 Waterproof tape:

A layer of suitable tape (swelling tape) for water proofing to be laid over the armour layer.

6.9 Metallic Armour:

The three cores then armoured with double galvanized steel tapes of thickness not less than 0.5 mm and the gap between adjacent turns of each tape shall not exceed 50 % of the width of the tape. The metallic armour shall confirm to IEC 60502 standard with latest addendums and amendments.

6.10 Outer sheath:

Over all, an oversheath is extruded and should be as follows:

- a. Material: extruded PVC .
- b. Color: RED for 36 kv and BLACK for 24 kv .
- c. Thickness: According to the formula ($t_s = 0,035 D + 1,0$) where D is the fictitious diameter immediately under the oversheath, in millimeters.
- d. Suitable for the operating temperature.
- e. Has a good corrosion and humidity protection.
- f. Suitable additives to be added to prevent attack by rodents and termites.
- g. Identification:

The following identification marks shall be permanently embossed along two lines diametrically opposite to each other on the cable at suitable intervals:

----- Volts; mm^2 , copper cable; XLPE insulated , MoE - IRAQ , Year of manufacture , manufacturer's name.

Length of cable on one meter intervals shall be embossed on the outer jacket. Marking on the over-sheath shall indicate cumulative length of the cable, wound on the drum, such marking starting with "000" on the inner end and actual length on the drum.

6.11 Packing:

Packing shall be sturdy to protect the cable from any injury during transportation, handling and storage. The cut ends of the cable shall be sealed by means of non-hygroscopic sealing material. The cable shall carry the following information either stenciled on the drum or contained in a label attached to it:-

- a. Reference to the standard.
- b. Manufacturer's name, brand or trade mark.
- c. Type of cable and voltage grade.
- d. Order No. .
- e. No. of cores, material and nominal cross-sectional area of conductor.
- f. Length of cable on drum.
- g. Drum number.
- h. Gross and net weight of the cable.
- i. Country of manufacture.
- j. Year of manufacture.
- k. Direction of rotation of drum (an arrow).

No drum shall contain more than one length of cable. The inner as well as outer end of cable shall be brought out on the drum flange and shall be clamped in such a manner to make the cable length marking easily visible. The diameter of bore for the cable drum for inserting the shaft shall not be less than 120 mm.

Cable Drum Length:

The length of cable for drum shall be according to the table No.2 below, variation of ± 5 % of the cable drum length is acceptable.

7. Types of Cables:

7.1 36 KV cables:

7.1.1 1x400 mm²

For this cable the applicable paragraphs of article 6 are :-
6.1, 6.2, 6.3, 6.4, 6.8, 6.10, 6.11 with rated voltage 18/30 (36) kV.

7.1.2 3x150 mm²

For this cable the applicable paragraphs of Article 6 are :-
6.1,6.2,6.3,6.4,6.5,6.6,6.7,6.8,6.9,6.10,6.11 with rated voltage 18/30 (36) kV.

7.2 24 KV cables:

7.2.1 1x400 mm²

For this cable the applicable paragraphs of Article 6 are :
6.1,6.2,6.3,6.4,6.8,6.10,6.11 with rated voltage 12/20 (24) kV.

7.2.2 1x150 mm²

For this cable the applicable paragraphs of Article 6 are: 6.1,6.2,6.3, 6.4,6.10,6.11, (same note as para.7-2-1) .

7.2.3

1x95 mm²

1x70 mm²

1x50 mm²

(same statement as 7.2.2)

7.2.4 3x150 mm²

For this cable, the applicable paragraph of Article 6 is:
6.1,6.2,6.3,6.4,6.5,6.6,6.7,6.8,6.9,6.10,6.11 with rated voltage 12/20 (24) kV.

8. Tests:

Certified copies of type test certificates shall be submitted along with the offer. Cables and accessories shall be subjected to inspections and tests by our inspectors or international inspectors at any time during manufacture. The manufacturers shall provide inspection facilities for the said inspection shall be made at place of manufacture or at international testing facilities.

9. Technical Information for Cables:

The tenderer is requested to give the following information with the offer as listed in schedule A below.

10. Cables joints and terminations:

Cable joints and terminations to be slip on or heat shrinkable type complete with all necessary jointing materials suitable for 24 & 36 kV underground cable from qualified manufacturers, The terminations and joints should be as follows :-

- A. Straight through joint for cable shown under 7.1.1 complete.
- B. Outdoor terminations suitable for cable shown under 7.1.1 complete.
- C. Indoor terminations suitable for cable shown under 7.1.1 complete.
- D. Straight through joint suitable for cable shown under 7.1.2 complete.
- E. Outdoor terminations suitable for cable shown under 7.1.2 complete.
- F. Indoor terminations suitable for cable shown under 7.1.2 complete.
- G. Straight through joint suitable for cable shown under 7.2.4.
- H. Indoor terminations suitable for cable shown under 7.2.4 complete.
- I. Outdoor terminations suitable for cable shown under 7.2.4.
- J. Indoor terminations suitable for cable shown under 7.2.2.
- K. Indoor terminations suitable for cable shown under 7.2.3.

N.B:-

1. The prices shall be based on L.M.E. price for copper bar () US\$/ton. The formula for price variation shall be given.
2. The total length of the cable on drums should not exceed the total required amount stated in the contract. Otherwise, any extra amount should be free of charge.

Table No. (1)

	cross sectional area mm ²	Min. No. of wires	Max. D.C resistance at 20 °C ohm/km	Short circuit current for 1 sec. in KA
1.	50	6	0.387	7.5
2.	70	12	0.268	10.5
3.	95	15	0.193	15
4.	150	18	0.124	21.5
5.	400	53	0.0470	55

Table No. (2)

	Cable size	Drum length (m)		Cable size	Drum length (m)
1.	1x400 sq. mm / 36 kv	500	5.	1x95 sq. mm /24 kv	500
2.	3x150 sq. mm /36 kv	250	6.	1x70 sq. mm /24 kv	500
3.	1x400 sq. mm /24 kv	250	7.	1x50 sq. mm /24 kv	500
4.	1x150 sq. mm /24 kv	500	8.	3x150 sq. mm /24 kv	250

Schedule A
GUARANTEED TECHNICAL INFORMATION

S.NO.	Description	Unit	Bidder's data
1.	Manufacturer and country of origin		
2.	Applicable Standards		
3.	Voltage grade of cable Vo/V (Vmax)	kv	
4.	Number of cores	Single/Three	
5.	Conductor details: a. Material b. Compacted c. Number of wires in each conductor d. Diameter of wire in each conductor e. Area f. Diameter of conductor in stranded and compacted shape	Yes/No No. mm Sq. mm mm	
6.	Conductor screen: a. Material b. Nominal thickness c. Minimum thickness d. Total diameter after conductor screen e. Whether extruded f. Resistivity	mm mm mm Yes/No Ohm-m	
7.	Insulation: a. Material b. Nominal thickness of insulation c. Minimum thickness of insulation d. Total diameter	mm mm mm	
8.	Insulation screen: A. Semi-conducting screen (extruded) i. Material ii. Nominal thickness iii. Minimum thickness iv. Total diameter v. Resistivity B. Semi-conducting tape i. Material ii. Nominal thickness iii. Minimum thickness iv. Width v. Total diameter vi. Swelling	mm mm mm Ohm-m mm mm mm mm mm Yes/No	

	<p>C. Metallic screen</p> <p>i. Material</p> <p>ii. Electrical cross section</p> <p>iii. Minimum cross section of each wire</p> <p>iv. Number of wires</p> <p>v. Total diameter</p> <p>vi. Fault current rating for 1.0 sec</p> <p>vii. Spiral equalizing tape</p> <ul style="list-style-type: none"> • Material • Width and thickness • Lay length 	<p>Sq. mm</p> <p>Sq. mm</p> <p>Pcs</p> <p>mm</p> <p>kA</p> <p>mm</p> <p>mm</p>	
9.	Phase identification strips	Yes/No	
10.	<p>Filler:</p> <p>a. Material</p> <p>b. Extruded</p>	Yes/No	
11.	<p>Inner covering:</p> <p>a. Material</p> <p>b. Extruded</p> <p>c. Nominal thickness</p> <p>d. Minimum thickness at any point</p>	<p>Yes/No</p> <p>mm</p> <p>mm</p>	
12.	<p>Armour:</p> <p>a. Material</p> <p>b. Type</p> <p>c. Thickness of tape</p> <p>d. Total diameter</p> <p>e. Galvanizing thickness</p>	<p>mm</p> <p>mm</p> <p>micron</p>	
13.	<p>Waterproof tape</p> <p>a) Tape description</p> <p>b) location</p>		
14.	<p>Outer sheath:</p> <p>a. Material</p> <p>b. Nominal thickness</p> <p>c. Minimum thickness at any point</p> <p>d. Termite resistant</p> <p>e. Rodent resistant</p>	<p>mm</p> <p>mm</p> <p>Yes/No</p> <p>Yes/No</p>	
15.	Nominal overall diameter of completed cable	mm	
16.	Minimum weight of copper (conductor + metallic screen)	Kg/m	
17.	Weight of completed cable	Kg/m	
18.	Allowable minimum radius of bend around which cable can be laid	mm	
19.	Maximum DC resistance of conductor at 20° C	Ohm/km	
20.	Maximum DC resistance of metallic screen	Ohm/km	

21.	Inductance of cable for 1000m length	mH	
22.	Capacitance of cable for 1000m length	μ F	
23.	Maximum conductor temperature for continuous operation	deg. C	
24.	Maximum conductor temperature under short circuit	deg. C	
25.	Insulation resistance between cores / screen	M.OHMS	
26.	Voltage drop per 1000 m cable at rated current: When laid in air at 40 deg. C	volts	
27.	Voltage drop per 1000 m cable at rated current: When laid in ground at 30 deg. C	volts	
28.	Maximum dielectric loss of three phase circuit when operating at normal voltage and frequency at maximum conductor temperature of 90° C	W/km	
29.	Maximum continuous current carrying capacity per conductor for a single circuit when laid direct in the ground at : Maximum conductor temperature 90 °C Ambient air temperature 30 °C Ground temperature 20 °C Depth of laying 1 m Thermal resistivity of soil 1.5 K.m/W	Amp	
30.	Conductor short-circuit current permissible for a period of 1 second	kA	
31.	Maximum dielectric loss angle at normal voltage and frequency at a conductor temperature of :- a. 20 °C b. 90 °C	Tan δ	
32.	Maximum permissible pulling force at total cable in drums	kN	
33.	Cable drum details :- a. Nominal delivery length per drum b. Maximum gross weight of full drum c. Steel or wooden drums d. Weight of empty drum e. Drum dimensions: • Flange diameter • Bore diameter • Width	m Kg Kg mm mm mm	
34.	Cross section drawing and details of cable layers and catalogues.		

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**Ministry of Electricity
Planning and Studies Office
Baghdad – Iraq**

Specification No.	D-07
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**TECHNICAL SPECIFICATION
OF
11&33 KV INDOOR TYPE SWITCHGEAR
FOR CONSUMER SUBSTATION**

REVISION	YEAR 2015
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1. SCOPE OF THE WORK

The tender include for the supply , manufacture testing , packing , shipping of complete 11kv, vacuum or sf6 insulated ring main unit 20KA r.m.s indoor type for consumer substation enclosed type 630A rating , and the switch gear is as follow :

- Item one non extensible switchgear ring main unit (RMU) each consist of:
- two load break switch
 - one switch fuse complete with H.R.C cartridge fuse
 - (with necessary interlocks)

Note: The no. of load break switches may be more than three according to the tender requirements.

- Item two Extensible switchgear consist of:
- load break switch panel
 - switch fuse panel
 - circuit breaker panel
 - metering panel
 - (with necessary interlocks)

2- GENERAL REQUIREMENTS

The equipment shall be of first class quality and designed for continuous satisfactory operation as continuity of supply is of prime consideration. The design shall allow all necessary precautions for the safety of the operation and maintenance personnel. All the equipment shall operate satisfactorily under such variations of load, voltage and short circuit or other conditions which may occur on the system provided that these variations are within the assigned of the apparatus. All the equipment shall be designed to obviate the risk of accidental short circuit or damage due to insects and vermins. The materials used shall be suitable for the following climatic conditions prevailing at the substation site:

Note (1): This specification is for two types of switchgears as below and according to tender requirement

A-Non-extensible type (compact)

B-Extensible type (each panel separately connected with one bas-bar)

Note (2): The switch gear can be suitable to operate remotely from the main dispatch center (according to tender requirement).

2-1 AMBIENT TEMPERATURES:

highest maximum (in the shade)	+ 55 °C
lowest minimum	- 10 °C
Maximum yearly average	+ 30 °C
Maximum daily average	+ 40 °C

2-2 TEMPERATURE UNDER SUN:

Black objects under direct sunshine may attain a temperature of +80°C

2-3 AIR HUMIDITY:

Maximum	92% at 40°C
Minimum	12%
Yearly average	44%

2-4 ALTITUDES:

From sea level up to (1000m)

2-5 SAND STORMS:

In general the atmosphere is dusty which may result in a layer of dust being deposited on all exposed surfaces. Also fine dust particles may penetrate even through minute openings, covering all equipment inside panels, marshalling boxes and kiosks.

3- SYSTEM DATA :

3-1 (11 KV)

Nominal voltage	11000 volts
Highest system voltage	12000 volt
Short circuit Level	25 KA r.m.s 11kV
Frequency	50 Hz
System	3- phase, 3 wire with neutral isolated but provision is made for earthing in future through earthing resistance of 21.1 ohms to limit the earth fault current to 300 amps

3-2 (33 kV)

Nominal voltage	33000 volts
Highest system voltage	36000 volt
Short circuit Level	25 KA r.m.s 33kV
Frequency	50 Hz
System	3- phase, 3 wire grounded through grounding transformer to limit the earth fault current to 1000 amps

4- STANDARDS:

All the equipment and accessories shall be in accordance with IEC 62271-200, 62271-105, 62271-102, 62271-100, 60265-1, 60044-1, 60044-2 and the latest issue of the international electro-technical commission (IEC) specifications. Where these specifications are incomplete then the national standards of contractors country shall be considered subject to our approval. Successful tenderer shall submit two copies of IEC standards

5- DEVIATIONS :

The tenderer shall particularly mention in his tender all deviation from the specifications described in these tender specifications.

6- 11&33KV SWITCHGEAR

6-1 The switchgear shall be completely metal enclosed type with 630 amps for 11 kV and 800 amps for 33 kV, 20kA r.m.s air insulated single bus-bar (compound filled bus-bar chamber will be rejected) for indoor installation.

The switchgear shall be provided with suitable interlocks and adequate safety devices to prevent access to the live compartment. It should have insulated protection cover between switches and the cable for the switch and the fuse switch. It shall be arranged to allow easy extension on either direction. The circuit breakers shall be equipped with lockable shutters for bus-bar and feeder sides automatically actuated with drawout of circuit breaker.

Earthing device preferably of the built in type shall be provided for earthing the cable feeder (fault earthing switch).

The switch gear should be of vacuum or SF6 type interrupter.

The circuit breaker should have a service position, test position and draw out position.

6-2 DEGREE OF PROTECTION

The degree of protection of persons against hazardous approach to live parts should be (IP40).

6-3 THE LOAD BREAK SWITCH

(Non – automatic) suitable for use in conjunction with circuit breaker panels and switch fuses to form composite extensible switchboards. The switch to be of a single break type having on, off and earth positions with quick make and break features in all positions. The switch shall be of SF6 sealed chamber interrupters, the switch must be capable of making, carrying and breaking currents under normal circuit conditions which may include specified operating overload conditions and also carrying for a specified time currents under specified abnormal circuit conditions such as of short circuit. It may be capable of making, but not breaking short circuit currents . It must have continuous current rating not less than 630 amps it shall be suitable for and equipped with the followings:-

- A- The operating mechanism shall be of local hand control spring assisted type with lockable on, off and earth positions.
- B- Mechanical indication on, off and earth in addition to switch position indication.
- C- Mechanical interlocking for earthing switch is to be provided such that it can not be closed unless the switch is in the off position (i.e. live parts protection).
- D- Cable testing facilities are to be closed provided.
- E- Potential indicators are to be provided with neon lamps and placed on the cable side or on the front of the switch panel in order to indicate whether the cable is energized or not
- F- Earth fault and S.C indication complete with C.T's and relay suitable for a maximum earth fault current of (300 amps for 11 kv and 1000 amps for 33 kv) in accordance with paragraph (7-3).

6-4 FUSE SWITCH

The fuse switches should be hand operated totally enclosed in line with switch panel . The fuse switch shall be of sf6 gas sealed chamber interrupters. The fuse switch shall be triple pole with provisions for automatic tripping in case of failure of any fuse also reclosing can not be carried out unless the burnt fuse is replaced. The switch fuse must be capable of switching on and off the normal current and must have a continuous current rating not less than 200 amps. with a cartridge H.R.C fuse according to the size of the transformer. The switch fuse shall be suitable for and equipped with the following:-

- A- Operating mechanism for local hand control spring assisted type with lockable ON, OFF positions with mechanical push bottom.
- B- Mechanical indication ON, OFF in addition to switch position indication.
- C- For 11 kV switch fuse (only) suitable protection for earth fault to open the switch fuse in case of low current earth fault in the transformer side.
- D-Suitable tripe coil for external tripping order.

6-5 CIRCUIT BREAKER PANEL

Suitable for use in conjunction with load break switch, switch fuse and metering panels to form composite extensible switch boards.

The circuit breaker shall comply with IEC recommendations.

It shall be of the vacuum or SF6 gas sealed with complete control and self-protection devices for OC & EF (low current) with drawable carriage and earthing switch (for AIS switchgear) or any alternative to isolate the CB completely and earthing the outgoing circuit through a fault making earth switch for safety (with suitable inter lock) during maintenance .

The circuit breaker shall be of rating 630 amps. 25 kA r.m.s. It shall be connected to the bus bars and outgoing feeder cables by means of plugs and socket connections.

Isolation of the circuit breaker shall be obtained by drawing out the circuit breaker.

The isolation operation shall be carried out manually through a level, handle or crank reducing the effort necessary to a reasonable degree.

All circuit breakers of the same type shall be inter changeable the operating mechanism shall be of local hand control spring assisted.

Closing speed must be independent of hand operation speed.

Circuit breaker tripping by combination of C.T's operated over-current and earth fault trip coils.

Both tripping relay operation and tripping supply should be achieved either by shutting the protection C.T's or by any other relevant method which does not require an external tripping supply with additional local mechanical push-button tripping provided with captive cover.

Also mechanical indication (ON, OFF) for circuit breaker position is required.

The protection relay shall be electronic type very inverse characteristics with over current and earth fault protection. Over current and instantaneous release adjustable current transformers with double winding for measuring and protection 300-150/5/5A class1, 5p 20.

6-6 METERING PANEL

The position of metering panel shall be between the extensible types of switch panel and switch fuse panel or C.B. panels, the metering panel shall be measure (KWH, KVAh, Voltage, Current, KW, KVAR and PF) for 3-phase, 3-wire system. The ampere meter & voltmeter with a selector switches should be fixed on the panel, and a suitable place to connect the KWH & KVAh (supplied by MOE). All secondary circuits terminals for VTs & CTs should be equipped with sealing cover with a sealing pad to avoid tampering. For all metering panels provision and wiring must be made for installing one kwh, and one KVAh meters. The kwh meter fuses and the P.T fuses also for locking the front door of the panel with padlock and locking P.T. in the (on) position.

6-7 FUSES

In general fuse links should be current limiting and should comply with IEC 60282. The successful tenderer will be required to select the rated current and time/current characteristics of fuse link as described under clause 21.2 of IEC 60282. The tenderer will also be required to furnish the purchaser with the time/current characteristics and rating of the circuit breaker which has to be used on the L.T. side of the transformer according to H.V. fuses selected by the tenderer in order to afford correct discrimination.

7- PROTECTION AND INSTRUMENT TRANSFORMERS

7-1 PROTECTION RELAYS

All protection relays shall be of the flush mounting type and designed for tropical climate with dust proof cases (IP 50) and must be capable of carrying continuously the full load current and must not be damaged by fault current.

7-2 INSTRUMENT TRANSFORMERS

A- CURRENT TRANSFORMERS:

In general the instrument and protection current transformers must comply with IEC 60185, and 60044 cast resin insulated.

The secondary winding of the current transformer shall be designed for a rated current of 5 A. for metering shall be of class accuracy (0.5) and 15VA burden.

B -VOLTAGE TRANSFORMER

In general the voltage transformers must comply with IEC 60186, and 60044. It should be of 50VA class (1) and protected by means of easily accessible fuses and both H.V & L.V sides.

The secondary voltage shall be 110 V between phases.

The voltage transformers used metering shall be of 3 single phase (star/star) connected.

The secondary star winding shall be used for metering and indication.

The voltage transformer shall have a padlock arrangement for locking the V.T. in position – also padlocking the L.V. fuses compartment.

They shall have safety facilities when opening the door as a second meshed door with danger sign.

The V.T. type should be suitable to withstand the earth fault condition in the system (isolating neutral) and suitable voltage factor (1.9) is required.

7-3 EARTH FAULT INDICATION

The arrangement for earth fault indication is to be provided on each sub-station with proper cancellation facilities.

The arrangement is to be done in such a way that when an earth fault current passes through the bus-bar of the sub-station it will be indicated. This is to enable the location of the earth fault in the

main feeder. The position of this indicator shall be at load break isolator. These indications are to be RED lamps indicators, or any other alternative solutions.
The design must be suitable for this arrangement.

8- DRAWINGS AND INSTRUCTION BOOKS

8-1 With tender documents

The following documents shall be submitted in three copies with tender documents in English language.

- A- Technical literature giving full description of the switch, fuse switch and circuit breaker with all details of the panels and their contents. Also outline drawings with dimensions showing the front, side and top elevation of the switchgear including terminals.
- B- Complete description of the operating mechanism of the switch, switch fuse and circuit breaker.
- C- The attached technical specification tables to be filled by tenderer.
- D- Type and routine test certificates.
- E- Origin of goods and catalogues

8-2 After award (by the successful tenderer)

The following documents and drawings shall be submitted in three copies in the English language within two months of the date of the order.

- a- Schedule of the anticipated shipping dates.
- b- Foundation details.
- c- Installation drawings.
- d- Outline drawings of the panels.
- e- Sectional elevation of all switchgear.
- f- General arrangement and schematic diagram of all equipments.
- g- One set of reproducible print on C.D disk AutoCAD file type and one set printed drawings paper of all approved drawings plus three sets of printed copies per ring unit of all drawing, operation and maintenance instruction books, catalogs and renewal part lists, bound in a proper files.

N.B.

It must be noted that all drawing are subject to approval before manufacture.

8-3 BEFORE SHIPMENT

- a- The list of crates with shipping weights and dimensions.
- b- All instruction to store and to erect the materials.
- c- All instructions for maintenance, testing and commissioning of all relays and equipment.
- d- Renewal part list.

9- PACKING

The supplier will pack or protect the goods in the most appropriate manner. He will responsible for any loss or damage arising from careless packing or protection up to the place of final destination. After completion of the inspection and tests at the factory each item shall be packed for export shipment. The tenderer shall provide clear means of identification for items concerning each type of switchgear . Items belonging to any type shall not be mixed with items belonging to other types. All parts provided for shipping purposes only and which are to be removed at the time of erection shall be conspicuously tagged. The method of packing shall be such to protect all of the items against excessive corrosion or dampness. And shall afford adequate protection against breakage or other injury or loss due to breakage of cases or crates from the time, the item leaves the factory until finally installed during which time, the apparatus will travel by rail , by along sea voyage again by rail or truck to the site or store. The apparatus will also undoubtedly stand on wharves and in the open during and in between periods of transportation and will thereby be exposed to heavy rains, hot sun, humid climate and sudden changes of temperature. More over the containers should be very strong to withstand numerous handling, also extra ordinary care should be given to the packing of the equipment and especially the items having insulating material

to prevent the injury due to moisture from sources external to the packing or from excessive condensation with the packing.

10- TESTS

10-1 INSPECTION

The material shall be subject to inspection and tests by our authorized inspecting authority at any time during manufacture. The manufacturer shall provide all inspection facilities for the said inspection and tests. All testing and inspection shall be made at the place of manufacture. The inspector shall have the right to reject any portion of the material at any time during manufacture if it does not meet with requirements of this specification in all particular. Also the inspector shall have the right of overseeing the packing and shipping off all materials to be supplied.

10-2 TEST AT MANUFACTURER WORK

Test at manufactures work shall comprise type tests and routine tests.

A- TYPE TEST

These tests are in general those detailed in IEC which pertain to the equipment being tested. Type tests are to prove the general design of the equipment and the manufacturer may submit test certificates of tests which have been carried out on identical equipments notwithstanding any provision in an IEC. The inspector shall have the right to accept such certificate in lieu of the specified type test or to reject them. The type test prescribed shall be carried out in all cases where such certificates are not available or are rejected.

The type test shall be carried out according to IEC standard as follows: -

IEC 60298, 60129 for switch

IEC 60056 for circuit breaker

IEC 60282 for fuses

IEC 60185 and 60186 for C.T and V.T.

The switch gear of each type and rating shall be subjected to the following type test in accordance with IEC standards.

1. Operation test
2. Mechanical endurance
3. Test of temperature rise
4. Making capacity and short time current test
5. Short circuit type test
6. Insulation level (full wave and chopped wave)

However certified test certificate, issued internationally recognized testing authority for type test carried on identical switch and circuit breaker will be accepted in lieu.

B- ROUTINE TEST

The switch gear shall be subjected to routine test, at manufacturer s works according to the latest issue of IEC specifications. Each circuit breaker and switch shall be subjected to all routine tests under section (2) chapter (3) of IEC 60265, 60129. Each fuse switch shall be subjected to all routine tests according to relevant IEC. All relays and meters shall be subjected to routine test specified in the latest issue of IEC specifications. All current and voltage transformers shall be subjected to routine test according to IEC 60185, 60186.

SCHEDULES OF MATERIALS

ITEM ONE

Non- extensible switchgear RMU of the following: -

- 1-1 Two load break switch for feeders connection 630 A for 11 KV and 800 A for 33 KV with:**
- Integrated fault making earth switch.
 - Power cable connection suitable for 3x150 sq. mm XLPE (12/20 (24) kV or 18/30 (36) kV) cable complete with suitable termination slip-on or pluck in type (premould).
 - 3 capacitive voltage indicators (neon) for each feeder.
 - Necessary interlocking.
 - Fault indicator with all required accessories.
- 1-2 One load break switch fuse for transformer feeder not less than 200A with:**
- high voltage (H.R.C) fuse
 - Integrated fault making earth switch.
 - Tripping device for all three fuses tripped if on fuse fails.
 - Interlocking system between earth position and fuse chamber.
 - Power cable connection for the transformer (the transformer not included) complete with termination slip-on or pluck in type (premould).
 - For 11 kV switch fuse (only) suitable protection for earth fault to open the switch fuse in case of low current earth fault in the transformer side.

ITEM TWO:

Extensible switchgear of the following

- 2-1 One load break switch for feeder connection 630 A for 11 KV and 800 A for 33 KV with:**
- Integrated fault making earth switch.
 - Power cable connection suitable for 3x150 sq. mm XLPE (12/20 (24) kV or 18/30 (36) kV) cable complete with termination kit.
 - Slip-on or pluck in type (premould) .
 - 3 capacitive voltage indication.
 - Necessary interlocking.
- 2-2 One load break switch fuse for Transformer feeder not less than 200 A with (same requirement switch in 1-2 item one)**
- 2-3 One vacuum or SF6 circuit breaker 11 kV or 33 kV panel, 630 A, 25KA drawable type, C.T. ratio 150-300/5. Inverse time relays for O/C and E/F with instantaneous and no-load earthing switch.**
- 2-4 One set of 11 kV or 33 kV metering panel complete of C.Ts and V.Ts.**

SPARE PARTS

- Set of recommended spare parts (unit price for each item)
- Additional itemized spare parts.

Item	Unit price
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A.H.R.C. fuses 11 kV or 33 kV:-

- H.R.C. fuses 11 KV or 33 kV 100 KVA Transformer
- H.R.C. fuses 11 KV or 33 kV 250 KVA Transformer
- H.R.C. fuses 11 KV or 33 kV 400 KVA Transformer
- H.R.C. fuses 11 KV or 33 kV 630 KVA Transformer
- H.R.C. fuses 11 KV or 33 kV 1000 KVA Transformer
- H.R.C. fuses 11 KV or 33 kV 1600 KVA Transformer
- H.R.C. fuses 11 KV or 33 kV 2000 KVA Transformer

B. Neon lamp indicators

C. Complete 11 KV or 33 kV earth fault indication

D. current transformer

E. Bus-Bar voltage transformer

F. H.V fuses for the V.T.

G. L.V fuses for the V.T.

H. 11 KV or 33 kV bushing for cable box.

I. interrupters for C.B

J. Trip coil for C.B.

K. Complete 11 KV or 33 kV C.B.

L. Complete 11 KV or 33 kV load break switch

M. Complete 11 KV or 33 kV fuse switch

N. Amper meter

O. voltmeter

P. switch with earth fault indicators

Q. switch without earth fault indicators

TECHNICAL SPECIFICATION FOR 11KV OR 33 kV SWITCH GEAR

item	description	unit	specifications
1.	Make		
2.	Type		
3.	Bus bar		
	a. normal current rating	Amp	
	b. temperature rise on continues operation at normal current	°C	
	c. cross sectional area	mm ²	
	d. insulation of bus bar		
	e. maximum working temperature of bus bar insulation	°C	
	f. bus bar joints insulation		
	g. minimum clearance between phases	mm	
	h. minimum clearance between phase& earth	mm	
4.	service voltage	KV (r.m.s)	
5.	highest voltage	KV (r.m.s)	
6.	impulse withstand voltage	KV (peak)	
7.	1 min power frequency with stand voltage	KV (r.m.s.)	
8.	dimension		
	a. length	mm	
	b. width	mm	
	c. height	mm	

TECHNICAL SPECIFICATION FOR 11KV OR 33 kV INDOOR SWITCH & FUSE SWITCH

item	description	unit	specifications
1.	Make		
2.	Type SF6		
3.	System highest voltage		
4.	Normal current rating	Amp	
5.	breaking capacity		
6.	making capacity	kA (peak)	
7.	rated short time current (3 seconds)		
8.	certification for the above capacities		
	a. name of certifying authority		
	b. number of certificates issued by the authority a copy of which is enclosed with the tender		
9.	impulse voltage withstand 1.2/50 wave	k.v crest	
10.	standard 1 min. 50 Hz withstand voltage	k.v crest	
11.	temperature rise of main contacts on continuous operation at rated current		
12.	type of closing mechanism		
13.	no. of breaks in circuit per pole total length of break per pole		
	A. OFF, ON		
	B. OFF, ON		
14.	min. clearance in air		
	a. between phases	mm	
	b. between live part & earth	mm	
15.	number of tanks or containers for each three phase equipment		

TECHNICAL SPECIFICATION FOR 11KV OR 33 kV INDOOR CIRCUIT BREAKER

item	description	unit	specifications
1.	Make		
2.	Type (vacuum or SF6)		
3.	Nominal rated voltage	V	
4.	Nominal rated current	Amp.	
5.	Breaking capacity		
	Symmetrical	KA (r.m.s)	
	Asymmetrical	KA (r.m.s)	
6.	Making capacity	KA (peak)	
7.	Rated short time current (3 sec.)	KA (r.m.s)	
8.	certification for the above capacities		
	a. name of certifying authority		
	b. number of certificates issued by the authority a copy of which is enclosed with the tender		
9.	Impulse voltage withstand 1.2/50 wave		
10.	standard min. 50 Hz withstand voltage		
11.	Temperature rise of main contact on continuous operating at rated current		
12.	opening time at 100% breaking current		
13.	Total break time		
14.	Type of closing mechanism		
15.	Power at normal voltage for		
16.	shunt trip coil		
17.	Minimum clearance in air		
	a. between phases	mm	
	b. between live part & earth	mm	
18.	number of tanks or containers for each three phase equipment		

TECHNICAL SPECIFICATION FOR 11KV OR 33 kV CURRENT TRANSFORMER

item	description	unit	specifications
1.	Make		
2.	Type		
3.	Impulse voltage withstand 1.2/50 wave	KV (peak)	
4.	1 min. power frequency withstand voltage	KV (r.m.s)	
5.	Rated short time current (3 sec.)	KA (r.m.s)	
6.	temperature rise of windings on continuous operation at rated current		
7.	For metering:		
	a. type		
	b. accuracy class		
	c. transformation ratio		
	d. current ratio error	%	
	e. phase displacement	min	
8.	For protection		
	a. type		
	b. accuracy class		
	c. transformation ratio		
	d. current ratio error	%	
	e. phase displacement		

TECHNICAL SPECIFICATION FOR 11KV OR 33 kV VOLTAGE TRANSFORMER

item	description	unit	specifications
1.	Make		
2.	Type		
3.	Impulse voltage withstand 1.2/50 wave	KV (peak)	
4.	1 min. power frequency withstand voltage	KV (r.m.s)	
5.	temperature rise of windings on continuous operation at rated current	°C	
6.	For metering		
	a. type (single phase or two phase V.T)		
	b. accuracy class		
	c. transformation ratio		
	e. voltage ratio error		
	f. phase displacement		
	g. voltage factor		
	h. tertiary winding (open delta)		
	i. burden (VA)		