Electrical Specification

11 K.V 3x400 mm² AL / XLPE / SWA / PVC – Cable Specification

Technical Specifications

- The following technical Specifications and particulars are applicable for the manufacturing, testing, and supplying of the materials in general condition, **unless otherwise is mentioned in the following special requirements section.**

1. Climate Particulars:

The following is applicable unless otherwise is mentioned:

a.	Maximum Ambient Temperature	50 C^o
b.	Minimum Ambient Temperature	-10 C^o
c.	Design temperature	75 C^o
d.	Maximum daily range of air temperature	20 C^o
e.	Maximum Wind Pressure	700 n/m^2
f.	Ice Thickness	10 mm.
g.	Snow Falls	1-4 days – 30 cm.
h.	Site altitude	0-1400m ASL
i.	Average annual rainfall	40cm during November–April
j.	Relative humidity in the range	30 to 60%.
k.	Average number of thunder storms	15 days / year

l. Prevailing wind winter average daily approximately 5-8 m/s, with gust up to 30 m/s.

m. Summer wind average afternoon 10-13 m/s, during morning generally light and variable, gust speed up to 30 m/s.

2. Power System Particulars;

The plant and materials supplied shall be suitable in all respect for continuous operation in the existing system having the following data:

Normal Voltage	415V	11KV	33KV
Maximum Voltage	500V	12 KV	36KV
No. Of phases	3	3	3
System frequency (Hz)	50	50	50
No. of wires	5	3	3
Fault level (MVA)	25	350	1500
Fault Current / Duration	*	20	31.5 kA / 3s
Earth Fault Current / Duration	*	3 kA / 3 s	3 kA / 3 s
Neutral point Earthing	Solid	Resistance	Resistance
Conductor arrangement	Vertical	Horizontal	Horizontal

3. Particulars of 12Kv cables: The offer shall be for :

- Rated 12 Kv, three cores cable, Aluminum conductor of 400 mm^2, XLPE insulated, copper tape screened, steel wire armored, and PVC sheath

1. As per the details

a) Depth of laying: as shown in the drawings
b) Ground temperature 25 C^o at 1.2 m
c) Solid thermal resistively 1, 75 C^o m/ w
d) Spacing between single core cable circuits 0.55 m

2. Solid Dielectric power cable: This section of the specification applies to single core and multi core cables with an extruded solid dielectric insulation. They shall be generally manufactured in accordance with the latest International Electro technical commission Publication 60502.

a. Conductors: Conductors shall consist of a stranded aluminum wires, as detailed elsewhere in the specification. They shall comply with latest IEC publication 60228. Non circular conductors shall be pre spiraled and compacted.

b. Conductor screen: Conductor screening shall be non-metallic in accordance with, latest of I.E.C publication 60502-2.

c. Insulation: The insulating compounds shall consist of chemically cross-linked polyethylene (XLPE) in accordance with latest of I.E.C publication 60502-2.

d. Core screen and core identification: The core screens shall consist of a non – metallic semi conducting extruded layer in combination with a metallic layer in accordance with clause 7.3 and 10 of latest I.E.C publication 60502. For multi core cables. The cores shall be identified by means of a semi conducting tape marked with a colored strip (red, yellow, or blue) applied in combination with a metallic tape over each core in accordance with latest of IEC publication 60502-2.

e. Metallic layer: Where the cable core screen shall in adequate to meet the earth fault current specified, for three core cable the total geometrical cross – sectional area of metallic layer screen shall be not less than 50 mm2, after assembly where in the assembly the metallic layer on each phase shall be touch each other**,** for single core cable the geometrical cross – sectional area of metallic layer screen shall be not less than 36 mm^2**,** a metallic layer of adequate cross – sectional area shall be included in the design either laid- up with the main cores or applied over the screen. The metallic layer shall be constructed of annealed high – conductivity copper in accordance with IEC publication 60502.

f. Manufacturer's identification tape: The identity of the manufacturer shall be provided throughout the length of the cable by means of a plastic tape on which is printed the name of the manufacturer, year of manufacture and cable nominal voltage at intervals more than 300 mm.

g. Lying – Up: The insulated cores, the metallic layer and the manufacturer's identification tape shall be laid-up with suitable synthetic non – hydroscopic preformed fillers to make a circular cable and then bound over all.

h. Anti – corrosion sheath: The anti- corrosion sheath shall consist of an extruded PVC compound to I.E.C publication 60502-2 applied directly over the laid-up cores.

i. Armor bedding: The armor bedding shall consist of PVC tapes or alternatively may be in the form of an extruded PVC compound in accordance with I.E.C publication 60502-2.

j. **Armor:** The armor on multi core cables shall consist of one layer of galvanized steel wires complying with I.E.C publication 60502-2.On single core cables, the armor shall consist of aluminum wire or other non- magnetic armoring as approved by the Engineer.

k. **Outer- Covering:** Unless otherwise specified the cable outer cover rings shall be provided in the form of an extruded continuous black PVC sheath which meet the requirements of BS 6747 or equivalent I.E.C standard. As a protection against termite attack the outer covering shall preferably contain an evenly dispersed mixture of aldrin and dieldrin in the ratio of 0.25% aldrin and 0.25% dieldrin by weight of PVC, or another suitable deterrent which shall be stated in the tender for approved by the Engineer. The contractor shall stage on the cable test certificate the amounts of insecticide added. The Engineer reserves the right to select samples of such outer coverings for analysis to check the quantities added.

l. **Voltage – Identification:** The plastic over sheath shall be embossed with the name of the manufacturer followed by: IRBID DEVELOPMENT AREA, Electric cables – 11 kV – (Cable size) Contract No , the letters and numerals shall comply with the requirements of BS 6346, or equivalent.

m. **Sealing and drumming:** Immediately after the works tests, both ends of the cable shall be sealed against the ingress of moisture, dirt and insects and the end projecting from the drum shall be adequately protected against mechanical damage during handling and shall be fitted with a pulling eye bonded to cores, sheath and armors.

n. **Jointing Accessories:** Stranded aluminum conductors shall be jointed with indentation ferrules or by a welding process. Conductor temperature during welding shall be monitored by means of a thermocouple. The temperature shall not exceed the value stated in the schedule of particulars and guarantees. Compression type ferrules are not approved for stranded aluminum conductors.

o. **Drumming**: All cables shall be supplied on robust drums of approved materials and construction suitable to withstand very rough transport and handling and to enable conductors or cables to be pulled out smoothly. Drums shall be non- returnable and, if made from timber, shall be pressure – impregnated against fungal and insect attack. Wooden drums shall be logged with closely fitting battens in accordance with BS .1559 or such other standard as may be approved. Battens shall be firmly secured to the drum flange using steel tape not less than 25 mm wide and 2mm thick and stapled to at least every third batten. Drum spindle holes shall be reinforced by steel plates. Drum diameters and the maximum width of drums shall be suitable for the jacks provided under this contract. Each drum shall bear a distinguishing number on the outside of flange. Particulars of the conductor or cable, i.e. Voltage, conductor size and material, number of cores, length type code name and gross and net weights shall also be clearly shown on one flange, together with an approved mark. The gross weight of cable drums shall be clearly shown on one flange. The direction of rolling shall be indicated by an arrow on each flange. The method of marking shall be by gouging, burning or other legible and indelible method approved by the Engineer. Immediately after works tests both ends of cables shall be sealed against the ingress of moisture, dirt and insects and the end projecting from the drum shall be adequately protected against mechanical damage during handling. Cut ends of bare conductors shall also be treated in an approved manner. Where applicable, cables and conductors shall be supplied in maximum drum length, bearing in mind the transport limitations in gaining access to the site. No drum shall contain more than one length. The cables shall be supplied in drum lengths of not less than as specified in the table

below unless shorter lengths are specified or are required to complete a specific order.

Table No.1

Item	CABLE SIZE	LENGTH IN M
1	Rated 11 K.V 3x400 mm² Cable.	500+ 10% , -5%

p. Condition of operation, System Parameters: Except where otherwise specified in the schedule of requirements, all cables shall be suitable for operation at the guaranteed max. Sustained rating throughout all the seasons of the year. The nominal A.C system voltages to which the cables will be connected are 11 KV. The highest operating voltages for this system will be 110% of the nominal value; the cable shall with stand the highest operating voltage and the nominal A.C system voltage. **(Nominal system voltage 11Kv, Highest system voltage 12kV, Fault Current rating 20kA for 3 Sec, Earth fault current rating 3 KA for 3 Sec).**

q. Current rating: The maximum continuous current rating and the maximum permissible conductor temperature for the cable shall be stated in the schedule of particulars and guarantees by the Tenderer.

r. Reliability: All cables shall be designed for operation on systems where continuity of supply is the first consideration. They shall also be satisfactory in operation under the atmospheric and climatic conditions prevailing at the site and under such variations of current, voltage and frequency as may be met under fault and surge conditions on the system.

s. Type of approval: Cables and accessories for voltages of 11 kv and above shall have satisfactorily passed type approval tests equal to those required by the International Electro Technical commission IEC and details of the cable designs offered shall be given in the appropriate place in the schedules here to.

t. Design particulars: Cable shall comply with the design details entered in the schedules of particulars and guarantees here to and except where otherwise specified, their individual components shall meet the requirements of IEC standards. The conductor shall certify that the cables and /or accessories offered will be identical in all essential particulars in respect of design, materials and workmanship with the cables and/ or accessories for which type approval certificates are offered in support of his tender. The contractor shall also ensure that all materials used will be subjected to and shall have satisfactorily with stood such tests as are customary in the manufactures. They shall be available for inspection if required by the Engineer.

Inspection and Testing

1. General *Requirement*

The whole of the material by the contract will be subject to inspection and testing by the engineer during manufacture and on completion. The approval of the engineer or the passing of any such inspection or test will no, however; prejudice the right of the purchaser to reject the material if it fails to comply with the specification when erected or to give complete satisfaction in service. The costs of all tests and inspection shall be borne by the contractor and shall be deemed to be included in the contract price. Before any material is packed or dispatched from the main or sub-contractor's works, all tests called for are to have been successfully carried out in presence of the engineer.

Adequate notice shall be given when the material is ready for inspection or test and every facility shall be provided by the contractor and his inspection and his sub-contractors to enable the Engineer to carry out the necessary inspections and tests.

Triplicate copies of all principal test records and test certificates shall be supplied to the Engineer for all tests carried out in accordance with the provisions of the contract.

2. *Sub-Contractors*

Within two months of acceptance of the tenders the contractor shall forward to the engineer a list of all sub-orders placed or intended. The contractor shall submit three copies of all sub-orders or selected by the engineer for progress or inspection. One copy of all drawings referred to in the sub-order is to be submitted unless otherwise agreed by the engineer. The drawings and sub-orders submitted to the engineer will cover all major components which are subject to electrical and mechanical pressure or stress when the material is in operation and also auxiliaries and stores which will be dispatched to site direct from the sub-contractor's work. For the purpose of this clause inter-works orders are to be treated as sub-order. Sub-orders are to include a statement advising the sub-contractor that the items being order will be subject to inspection and test by the Engineer. It is important that all copies of such orders are clearly marked with the main contractor's name and the following reference:

IRBID DEVELOPMENT AREA. CONTRACT No (---------)

Sub-Contractors are to comply with all the applicable requirements of this specification. Orders issued by the sub-contractor are also to include the main contractor's reference on their sub–order in addition to the above–mentioned heading.

3. *Material Tests*

The contractor shall provide test prices as required by the engineer to enable him to determine the quality of the material supplied free of charge and any cost of the tests shall be borne by the contractor. If any test pieces fails to comply with the requirements of the appropriate specifications for the material in question, the engineer may reject the whole of the material represented by that piece, the contractor's designers and metallurgists will be consulted before any material is so rejected. In the event of the engineer being furnished with the certified particulars of the tests which have been carried out for the contractor by the suppliers of the material, he may, at his own discretion, dispense with the previously mentioned tests entirely.

4. Tests at Manufacture's Works

Works tests shall include all routine, electrical, mechanical and hydraulic tests in accordance with the relevant IEC standard or other standard may be approved except where departures there from and modifications thereto are embodied in this specification. For material not covered by an IEC or British standard or specifically mentioned in this specification the tests shall be agreed with the Engineer. After satisfactory completion of the witnessed tests at the works, the material shall be submitted for the engineer's approval preparatory to shipping. No item of material is to be dispatched to site until the Engineer has given his approval in writing.

5. Test Certificates

Triplicate sets of all principal test records test certificates and performance curves shall be supplied for all tests carried out in accordance with the provisions of this contract. These test records, certificates and performance curves shall be supplied for all tests, whether or not they have been witnessed by the engineer. The information given in such test certificates and curves shall be sufficient to identify the material or equipment to which the certificates refers and should also bear the contract reference and heading.

6. Rejection of Plant

IF Any item of material or component which fails comply with the requirements of this specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the engineer either in whole or in part as he considers necessary, and after adjustment or modification if so directed by the Engineer, the contractor shall submit the item for the item for the further inspection and / or test. In the event defects of such a nature that the requirements of this specification cannot be fulfilled by adjustment or modification shall be replaced by the contractor, at his own expense, to the entire satisfaction of the engineer.

7. Maintenance

The contractor is to guarantee the efficient and good working of the material supplied under the contract for a period of twelve months (Gregorian) from the date of delivery of the material to Irbid, in accordance with the General conditions of contract.

8. Tests

All tests meet the requirements of latest international standard mentioned in the contract or any relevant standard.

For test purpose (Uo= 6.05 KV for 11KV cables, U= 11 KV nominal system voltage, Um = 12 KV highest system voltage).

(i) Routine test at works: Each cable drum shall be routine tested according to IEC 60502-2 or relevant equivalent.

1. **High voltage/partial discharge test:** Each completed cable drum length shall be subjected to a combined high voltage/ partial discharge test in three steps to measure the permissible discharge. The A.C Test voltage shall be applied between the conductor and the core screen and /or metal sheath connected together and bonded to earth. The tests

shall be made at normal room temperature generally in accordance with IEC 60502-2 and IEC 60885-3 or relevant equivalent.

2. **Conductor resistance test:** The D.C. resistance of the conductor of the completed cable shall be measured and, when corrected to 20 C^{o}, shall not exceed the guaranteed values stated in the schedule of particulars and guarantees and also shall not exceed the appropriate value specified in IEC 60228.

3. **Capacitance test**: The capacitance of each core of every drum length of completed cable shall be measured at room temperature and recorded on the test certificate.

4. **Insulation thickness measurement:** The measurement of the insulation thickness shall be determined from a representative sample of the cable not more than 150mm in length taken no less than 300 mm from the end of each factory length. Measurements shall be made by an optical method in which the error of determination does not exceed 0.025 mm. The measurements shall be made at six approximately equally spaced points round the periphery of the sample and care shall be taken to ensure that the minimum thickness is measured the average value stated in the schedule of particulars and guarantees.

5. **Voltage test on outer covering:** Each drum length of completed cable shall with Stand a voltage test in accordance with clause 3.1 of IEC 60229. If the cable outer sheath is not provided with a baked-on graphite coating, the cable drum length shall be completely immersed in water for the execution of this test.

6. **Measurement of extruded bidding and over sheath thickness** The thickness of the bedding and over sheath shall be measured on a representative sample taken from the cable, not less than 150mm from the end of a manufacturing length, by a method in which the error of determination does not exceed 0.025mm (e.g., by use of a micrometer or an optical device)

ii. **Sample Tests:** Sample tests shall be required for cable manufacturer's lengths in accordance with IEC 60502. One cable sample 10 meters long shall be cut from the completed cable and subjected to the following tests in the following sequence.

a. Conductor examination, clause (17.4)
b. Check of dimensions, clause (17.5, 6, 7, & 8)
c. Voltage test for cables of rated voltage above 7.2 KV, clause (17.9).
d. Hot set test for EPR, HEPR and, XPLE insulation and elastomeric sheaths, clause (17.10).
e. galvanized wires tensile strength and thickness of galvanized coating according to approved latest B.S standard.

iii. **Type Approval Test Requirement:** (11 KV) cables and associated jointing and terminating accessories shall have satisfactorily passed type approval tests generally in accordance with IEC. 60811 and IEC 60502-2 as follows:

a. Insulation resistance measurement at room temperature, IEC 60502-2 or equivalent
b. Partial discharge test as per IEC 60502 –2
c. Bending test as per IEC 60502-2
d. Partial discharge test as per sample test at works
e. Power factor/voltage and capacitance measurement as per IEC 60502-2 Power factor/temperature measurement at maximum temperature as per IEC 60502-2
f. Insulation resistance measurement at maximum temperature as per IEC 60502-2
g. Heating cycle test as per IEC 60502-2
h. Impulse withstand test as per IEC 60502-2 but withstand value to be 170 KV (10+ve 10-ve) followed by a power frequency test, and hot partial discharge test at 3U0 as per sample test at works.
i. Abrasion, penetration and saline tests on outer sheath as per IEC 60229 and IEC 60450
j. Impulse and d.c voltage tests on protective boxes for use with jointing accessories having a sheath sectionalizing insulation. Also the tests procedure shall be performed by qualified and well – recognized testing accredited laboratories such as KEMA, CISI and IBH.
k. Aging test: the manufacturer shall perform ageing test in accordance with IEC – 60811-1-2 or equivalent latest approved standards. The supplier shall provide the necessary documentations associated with the performance of ageing test for power cables.

Schedule (1)
Technical particulars and guarantees

Rated 11 K.V 3x400 mm² AL / XLPE / SWA / PVC – Cable.

Description	Unit	Particulars
1- voltage between phase of 3-phase circuit	KV	**11**
2- number of cores		**3**
3- Conductor (cross sectional area	mm^2	**400**
(Material		
(Design		
(Over all dimension	mm	
(Soldering temperature	c^o	
4- Conductor screen (Material		
(Nominal thickness	mm	
5- Insulation (Type of curing		
(Minimum radial thickness	mm	
6- Core screen (Material		
(Nominal thickness	mm	
(Diameter over screen	mm	
Cross sectional area per phase	mm^2	
7- Fillers (Material		
(Three core only)		
8- Binders over (Material		
Laid –up cores (Nominal thickness	mm	
(Three core only) (Diameter over binder	mm	
9- PVC anti-corrosion (Material		
(Sheath thickness	mm	
10- Armor bedding (Material		
(Nominal thickness	mm	
11- Armor (Material of wire or tape		
(Number of wires or tapes		
(Diameter of wire	mm	
(Thickness and width of tapes	mm	

12- Outer covering (Material (minimum average thickness (Type of termite repellent	 mm	
13- Completed cables(Over all diameter (Weight per meters (Maximum drum length	mm kg m	
14- Maximum dielectric stress at the conductor screen (assumed smooth)	Mv /m	
15- Maximum (laid direct in ground Conductor (Drawn in to duct Temperature (Erected in air	c c c	
16- Minimum radius of (laid direct Bend around which cable can(In ducts Be laid (In air	m m m	
17- Nominal internal diameter of pipes or ducts Through which cable may be pulled	mm	
18- Maximum Dc (of conductor Resistance per (of metallic layer Meter of cable At 20 C	 Micro-ohm Micro- ohm	
19-Maximum AC resistance of conductor per Meter of cable at maximum conductor Temperature	Micro-ohm	

20- Insulation (At 20 C resistance per (At maximum rated Meter of cable (temperature Per core	 Mega-ohm Mega-ohm	
21- Equivalent star reactance per meter of three phase circuit at 50 HZ	Mega-ohm	
22-Maximum electrostatic capacitance per phase per meter of cable	PF	
23-Maximum charging current per conductor Per meter of cable at nominal Voltage and frequency	mA	
24- Current carrying capacity - Laid directed in ground: One circuit Two circuits Three circuits - Drawn in to single way ducts One circuit Two circuits Three circuits In air One circuit	 amps amps amps amps amps amps amps	
25-Conductor short circuit Carrying capacity for one second, cable loaded as above before short circuit and final conductor temperature 250 C	KA	
26-Metallic layer loss (including armor if applicable) Of cable per meter of three phase circuit at nominal voltage and normal frequency at circuit rating as stated in reference 24		

27-Maximum dielectric loss of cable per meter of three Phase circuit when laid direct in the ground at Nominal voltage and normal frequency at maximum Conductor temperature	W	
28-Maximum dielectric loss angle of charging VA of Cable when laid direct in ground at nominal Voltage and normal frequency: - A conductor temperature of 20 C - Maximum conductor temperature	TAN	
29-Maximum dielectric loss angle of charging VA cable At normal frequency and conductor temperature of 20 C at: - 50 % rated voltage - 200 % rated voltage		
30-Metallic layer earth fault current Carrying capacity for one second , cable fully Temperature of 250 C	mm KA	
31-Cable drum (Diameter (Width (Weight loaded	m m kg	
32-Conditions upon which current carrying Capacities are based: - Axial spacing between phase cables -Axial spacing between circuits - Soil thermal resistivity - Ground temperature - Air temperature - Burial depth - Type of earth bonding	 mm mm c-m/w c c m	

Special Requirements

The Below mentioned requirements shall have a precedence in all of the preceding specifications and requirements, and the tenderer is kindly requested to strictly follow.

1. The manufacturer shall print IRBID DEVELOPMENT AREA Contract No.
2. Maintenance instructions: Where the equipments / materials supplied are subject to maintenance during service the manufacturer shall submit for approval a draft of the recommended maintenance instructions. After approval the supplier shall supply any further copies required by the Engineer. These maintenance instructions shall be provided before the taking over of any part of the equipment.
3. Catalogues: a set of the manufacturer's catalogues shall be attached to the tender.
4. All Inspection Costs (Visa, Air Tickets, Hotel, Accommodation, Transportation, etc.) of at least (2) IDA representative engineers, at the manufacturer house, for each purchase order to ensure the proper handling and operation of the supplied materials is required. And contractor is to handle all related costs.
5. When the visit to a factory is required for evaluation purposes before signing the agreement, the tenderer must do all necessary arrangement for this visit; the related cost of visit by IDA team will be borne by the manufacturer.
6. Same as mentioned in the previous technical specifications, No further special Requirements.
7. The material safety data sheet (MSDS) of all equipments / materials is required to be submitted with the offer.

Manufacturing and Delivery

- ✓ **Below schedule shall be completed by the tenderer and the periods entered shall be binding on the contractor. All periods entered below are to be in weeks and relate to the placing of the contract.**

Schedule 3 (Manufacturing & Delivery)

Required	**DATA for item (1)** **Rated 11 K.V 3x400 mm² AL / XLPE / SWA / PVC**
Manufacturer	
Manufacturing Place	
Inspection Place	
Manufacturing Period and Delivery (week) to ……. from purchase order date	

Ring Main Unit Specification

Technical Specifications

- The following technical Specifications and particulars are applicable for the manufacturing, testing, and supplying of the materials, **unless otherwise is mentioned in the following special requirements section.**

1. Climate Particulars:

The following is applicable unless otherwise is mentioned:

a.	Maximum Ambient Temperature	50 C^o
b.	Minimum Ambient Temperature	-10 C^o
c.	Design temperature	75 C^o
d.	Maximum daily range of air temperature	20 C^o
e.	Maximum Wind Pressure	700 n/m^2
f.	Ice Thickness	10 mm.
g.	Snow Falls	1-4 days – 30 cm.
h.	Site altitude	0-1400m ASL
i.	Average annual rainfall	40cm during November–April
j.	Relative humidity in the range	30 to 60%.
k.	Average number of thunder storms	15 days / year

l. Prevailing wind winter average daily approximately 5-8 m/s, with gust up to 30 m/s.

m. Summer wind average afternoon 10-13 m/s, during morning generally light and variable, gust speed up to 30 m/s.

2. Power System Particulars;

The plant and materials supplied shall be suitable in all respect for continuous operation in the existing system having the following data:

Normal Voltage	415V	11KV	33KV
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No. of wires	5	3	3
Fault level (MVA)	25	350	1500
Fault Current / Duration	*	20 KA/3s	31.5 kA / 3s
Earth Fault Current / Duration	*	3 kA / 3 s	3 kA / 3 s
Neutral point Earthing	Solid	Resistance	Resistance
Conductor arrangement	Vertical	Horizontal	Horizontal

3. **R.M.U's** supplied under this Contract / specifications shall be non-motorized RMU, and vacuum/gas isolated type for the interrupters in the form of a metal enclosed , extensible type and very compacted size suitable for outdoor/indoor floor mounting on 50 Hz systems, with system nominal voltage of 11 kV. **Two or three(as mentioned in BoQ) main non motorized/ manual switches rated at 630A in both incoming and outgoing side, and one manual in tee off Transformer circuit breaker rated at 630A, shall be arranged where specified to form an extensible 11 kV ring main units, at the outgoing side or incoming side, which shall be provided as complete insulated assemblies ready for installation**. The extension of such assemblies shall be possible without having to relocate the RMU, RMU's shall have a rated normal current of 630 A, and capable of withstanding the duty cycle for 350 MVA at 11 kV. The rated short – circuit making capacity and rated short time current shall apply when operated to the "ON "and to the "Earth ON "positions. Each tee off fuse switch (CB) shall be equipped with tripping device to disconnect all three phases. Outgoing sides shall be equipped with a fault indicator. Testing facilities shall be provided for carrying out tests on the feeder connected to the RMU. Mechanical interlock between status positions shall be safe and cannot be earthed directly from ON position to Earth position, and cannot be earthed while the cable energized by suitable electrical interlocking. Terminal blocks with 4 contacts for each side (2 for open/close indication, 2 for earth switch open/close indication) must be provided. Manual operation ON-OFF -Earth shall be easy for use, with interlock to prevent earthing on energized cable. The operation mechanisms and interlocks shall comply with the attention that for the purpose of applying these clauses the word "transformer " whenever is mentioned in this clause shall mean " transformer feeder" (the feeder connected to the Tee-off). Each side shall be completed with cable box suitable for accepting 3 core 11 kV cables having cross section of 400 mm^2 Al, XLPE When the cable box is removed the rear of the transformers feeder switch complete with flange plate and bushing shall be suitable for direct connection to the transformer feeder having higher voltage of 11 kV, the Tenderer is required to submit full details, drawings of the Tee-off switch offered and the connection arrangement between the Tee-off switch and the transformer feeder when both have their cable boxes removed. All safety facility shall be applied in case of using switches. C.T of fault indicator shall be enough radius for 3x400 mm2 cores inside cable box.

   Cable box shall be removed only if the switch in earth position, by means of suitable inter locking device.

4. **Insulation Level:** The rated lightning impulse withstand voltage of switchgear and equipment when tested in accordance with IEC standard shall be 75 kV (peak) for 12 kV systems.

5. **Type And Design:** The equipment shall comply with the appropriate IEC standards, unless amended to the contrary in this specification or other standards are specifically mentioned, each equipment shall be for free standing situations, rigid and stable on their own supports and shall be rust proof, rodent and insect proof, each equipment shall also be capable of operating in tropical and humid conditions and have suitable weather proof covers to prevent ingress of moisture into any compartment containing parts which may be live. External surface shall not create water traps. Access to handles for operation and access for viewing of indications and instruction labels shall be on side only. This does not necessarily mean that all operating handles shall be located on one side only. Instructions for the assembly of equipment shall be provided by the manufacturer. The instructions shall cover the method in which all items required under this tender shall be extended using the adjustments provided, in the sequence necessary bus bar coupling links. Equipment shall be designed for minimum maintenance. Adjustment of mechanisms shall not be required at less than 1000 operation.

Regular maintenance shall not be required at less than five-year intervals apart from any maintenance due to unusual climatic, service or environmental conditions. switches and Tee-off circuit breakers shall have three operating positions: " ON ", " OFF " , and "Earth ON " with an interlock to prevent "Earth ON" position making while the cable is energized.

6. **Bus bars and connections to switches:** The normal current rating of bus bars connections and each current carrying component shall be 630A minimum and the temperature rise conditions shall be in accordance with or the appropriate IEC Recommendations. Tenderer are requested to state in the schedule of particulars the permissible over load rating for the switchgear operating under emergency conditions at an ambient temperature 50C^{o} each equipment shall be capable of withstanding the specified 3 phase short – circuit current for a period of three seconds.

7. **Main switches and circuit breakers:** Each switch and circuit breaker shall have a rated normal current of 630 A. Each switch and circuit breakers equipment shall have a rated short-circuit making capacity and short-t time rating equivalent to 350 MVA at 11 KV. The rated short-circuit making capacity and rated short-time current shall apply when operated to the "ON" and "Earth ON" positions. The operating mechanisms and inter locks shall be in accordance to the ENA 41-12 clause 8.3 and 8.6 as appropriate. Testing facilities shall be provided for carrying out test on the feeder connected to the switches and to the circuit breakers. Each switch and circuit breaker shall be complete with cable box suitable for accepting cable with 400 mm^2 cross-sections, Al \ XLPE, 3 cores 11 KV.

8. **Earthing, Testing Facilities, Cable boxes and painting:** Each Tee-off circuit breaker and switch shall be provided with facilities for carrying out applied high voltage tests and injected current tests on the feeder connected to the switches and to circuit breakers and this shall be effected by the insertion of a three phase plug in testing device when the switch and circuit breakers is in the "Earth" position, to become effective when the switch and circuit breakers is in the "OF" position. Four sets of these test plugs shall be supplied under this contract the cost of which deemed to be included in the contract prices. Tests access covers shall be provided with padlocking facilities and fully water proofed. If SF6 R.M.U's where offered, gas pressure gage shall be supplied with test plug mentioned above. Each equipment shall be provided with a main earth bar of not less than 40 mm X 2.5 h.d.h.c. copper strip or equivalent. The earth bar shall be bolted to the main frame and conveniently provide facilities for Earthing cable sheaths and cable glands. Cable boxes for all sides shall be suitable for 11 KV 3-core aluminum conductors, paper or XLPE insulated, screened, load sheathed and armored, of any conductor size up to and **including 400 mm^2.** Compound-filled cable dividing and sealing boxes shall comply with the requirements of relevant BS or equivalent and shall be supplied under this contract, the cost of which deemed to be included in the contract prices. All cable boxes fitted it each switch and circuit breaker or oil circuit breaker or supplied under this section, shall be for heat shrink termination shall be fitted with insulated glands for the purpose of fitting earth fault indicating equipment. Each Tee-Off circuit breaker and switches shall be supplied with all necessary materials, extensible busbar set should be insulated in addition to supply insulation kit for the remaining extensible parts that should be insulated , bus bar duct, gasket, screws, … etc.) needed to connect one side of its bus bar from the insulated extension side to other RMU or Feeder switch supplied under this section. Drawing of the extension joint shall be submitted with the tenderer offer for approval. Each equipment supplied under this section shall be painted in accordance with requirements of relevant standard. Each equipment shall be supplied with all necessary materials, fuses, compound, sealing boxes; cable lugs glands, etc., needed to make it ready for erection and operation.

9. Testing and certificate :

9.1 type test

- **Units should be type tested in accordance with standards IEC 62271-100 /200/102/103 and 60529 or other relevant standards .**

- **Type test report shall be submitted with the offer |.**

9.2 Routine test: should be carried out in accordance with IEC 62271-200 or other relevant standards.

Schedule (1)
Technical Particulars and Guarantees
Extensible R.M.U 11 KV with one tee-off
Non-Motorized

This schedule shall be completed by Tenderer.

No	Particular	Yes	No
1	Extensible		

No	particular	unit	11 K.V R.M.U	Tee off Switch	Main Switch
1	Manufacturer				
2	Type Number				
3	Insulation medium				
4	Degree of protection (IP)				
5	Class				
6	Normal current rating	Amp			
7	Breaking current				
8	Making capacity (peak)	KAmp			
9	Short-circuit withstand current				
	a) For one second	KAmp			
	b) For three seconds	KAmp			
10	Earth switch making (peak)	KAmp			
11	Earth switch Short-circuit withstand current				
	a) For one second	KAmp			
	b) For three seconds	KAmp			
12	Type Test Certificate				
13	Type Test Authority				
14	Report reference				
15	Number of breaks in circuit Per pole				
16	Total length of break per pole	mm			
17	Type of main contact				
18	Type of arcing contacts and /or control device				
19	Minimum clearance in air				
	a) Between Two poles	mm			
	b) Between live parts and earth	mm			
20	No. of auxiliary contact				
21	D.C supply voltage				
22	Closing circuit type				
23	tripping circuit type				

Inspection and Testing

1. General *Requirement*

The whole of the material by the contract will be subject to inspection and testing by the engineer during manufacture and on completion. The approval of the engineer or the passing of any such inspection or test will no, however; prejudice the right of the purchaser to reject the material if it fails to comply with the specification when erected or to give complete satisfaction in service. The costs of all tests and inspection shall be borne by the contractor and shall be deemed to be included in the contract price. Before any material is packed or dispatched from the main or sub-contractor's works, all tests called for are to have been successfully carried out in presence of the engineer.
Adequate notice shall be given when the material is ready for inspection or test and every facility shall be provided by the contractor and his inspection and his sub-contractors to enable the Engineer to carry out the necessary inspections and tests.

Triplicate copies of all principal test records and test certificates shall be supplied to the Engineer for all tests carried out in accordance with the provisions of the contract.

2. Sub-Contractors

Within two months of acceptance of the tenders the contractor shall forward to the engineer a list of all sub-orders placed or intended. The contractor shall submit three copies of all sub-orders or selected by the engineer for progress or inspection. One copy of all drawings referred to in the sub-order is to be submitted unless otherwise agreed by the engineer. The drawings and sub-orders submitted to the engineer will cover all major components which are subject to electrical and mechanical pressure or stress when the material is in operation and also auxiliaries and stores which will be dispatched to site direct from the sub-contractor's work. For the purpose of this clause inter-works orders are to be treated as sub-order. Sub-orders are to include a statement advising the sub-contractor that the items being order will be subject to inspection and test by the Engineer. It is important that all copies of such orders are clearly marked with the main contractor's name and the following reference:

IRBID DEVELOPMENT AREA. CONTRACT No

Sub-Contractors are to comply with all the applicable requirements of this specification. Orders issued by the sub-contractor are also to include the main contractor's reference on their sub–order in addition to the above–mentioned heading.

3. Material Tests

The contractor shall provide test prices as required by the engineer to enable him to determine the quality of the material supplied free of charge and any cost of the tests shall be borne by the contractor. If any test pieces fails to comply with the requirements of the appropriate specifications for the material in question, the engineer may reject the whole of the material represented by that piece, the contractor's designers and metallurgists will be consulted before any material is so rejected. In the event of the engineer being furnished with the certified particulars of the tests

which have been carried out for the contractor by the suppliers of the material, he may, at his own discretion, dispense with the previously mentioned tests entirely.

4. Tests at Manufacture's Works

Works tests shall include all routine, electrical, mechanical and hydraulic tests in accordance with the relevant IEC standard or other standard may be approved except where departures there from and modifications thereto are embodied in this specification. For material not covered by an IEC or British standard or specifically mentioned in this specification the tests shall be agreed with the Engineer. After satisfactory completion of the witnessed tests at the works, the material shall be submitted for the engineer's approval preparatory to shipping. No item of material is to be dispatched to site until the Engineer has given his approval in writing.

5. Test Certificates

Triplicate sets of all principal test records test certificates and performance curves shall be supplied for all tests carried out in accordance with the provisions of this contract. These test records, certificates and performance curves shall be supplied for all tests, whether or not they have been witnessed by the engineer. The information given in such test certificates and curves shall be sufficient to identify the material or equipment to which the certificates refers and should also bear the contract reference and heading as given in clause 7.2 of this section.

6. Rejection of Plant

IF Any item of material or component which fails comply with the requirements of this specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the engineer either in whole or in part as he considers necessary, and after adjustment or modification if so directed by the Engineer, the contractor shall submit the item for the item for the further inspection and / or test. In the event defects of such a nature that the requirements of this specification cannot be fulfilled by adjustment or modification shall be replaced by the contractor, at his own expense, to the entire satisfaction of the engineer.

7. Maintenance

The contractor is to guarantee the efficient and good working of the material supplied under the contract for a period of twelve months (Gregorian) from the date of delivery of the material to Irbid, in accordance with the General conditions of contract.

8. Tests

All tests meet the requirements of latest international standard mentioned in the contract or any relevant standard.

Special Requirements

1. The Below mentioned requirements shall have a precedence in all of the preceding specifications and requirements, and the tenderer is kindly requested to strictly follow.

2. The Tender Is Based on Full Quantity Delivery.

3. The manufacturer shall print IRBID DEVELOPMENT AREA Contract No. (-------), and country of origin.

4. Maintenance instructions: Where the equipments / materials supplied are subject to maintenance during service the manufacturer shall submit for approval a draft of the recommended maintenance instructions. After approval the supplier shall supply any further copies required by the Engineer. These maintenance instructions shall be provided before the taking over of any part of the equipment.

5. Catalogues: a set of the manufacturer's catalogues shall be attached to the tender.

6. The material required under this contract shall be inspected by two IRBID DEVELOPMENT AREA engineers and all Inspection Costs (Visa, Air Tickets, Hotel, Accommodation, Transportation, etc.) of at least (2) IRBID DEVELOPMENT AREA representative engineers, at the manufacturer house shall be borne by the contractors.

7. **The Manufacturer / Contractor has to submit all required manuals for Occupational Health and Safety, and the manuals for environmental aspects / precautions, and all related Material Safety Data Sheets (MSDS).**

8. The manufacturer shall to submit with his offer reference list for his products for last five years ago.