

**SYRIAN ARAB REPUBLIC
SYRIAN ELECTRICITY COMPANY
Electricity Transmission Administration
ETA**

INTERNAL/EXTERNAL

TENDER NO. ()

**SUPPLY AND ERECTION MATERIALS OF ONE OHL BAY (66) kV
FOR OUTDOOR SUBSTATION**

SUMMARY

BOOK 1-A	SLD DRAWING
BOOK 1-B	GENERAL TECHNICAL SPECIFICATIONS
BOOK 2	GUARANTEE SCHEDULES
BOOK 3	TOTAL FINANCIAL SCHEDULES

TECHNICAL SPECIFICATION

BOOK (1-B)

CONVENTINAL (66) kV OUTDOOR TYPE SWITCHGEAR

3.1 (66) KV CONVENTIONAL INDOOR TYPE SWITCHGEAR :**3.1.1 Design Data of the Switchgears :**

The switchgears shall be designed to the following data :

ITEM	ADTA	UNIT	DESCRIPTION
1	Highest system voltage	KV	72.5
2	Nominal system voltage (service voltage)	KV	66
3	System frequency	HZ	50
4	Nominal short circuit current , 1 sec.	KA	31.5
5	Neutral earthing		Effectively earthed
6	Configuration		Double sectional bus bar
7	Clearances : a) Minimum clearance to earth b) Minimum clearances between phases c) Safety clearance Horizontal Vertical d) Minimum height to base of insulation a) Minimum height above ground	 m m m m m	 According to IEC 71.5

The bus conductor and accessories shall be designed , manufactured and tested in accordance with IEC 111 ,14 , 207 .

3.1.2 General for Switchgears :

All switchgears shall comply with IEC Publication 694 . They shall be so designed as to prevent accident contact being made with any live part . Every current-carrying part of the switchgear equipment including circuit breakers , isolating switches , busbars , current transformers , connections and joints , etc. shall be capable of carrying is specified rated current continuously under the atmospheric conditions existing on site , and in no part the temperature shall exceed the values specified in the relevant IEC Publication .

Every part of the switchgear equipment shall also withstand without mechanical or thermal damage the instantaneous peak current and rated short-time current pertaining to the rated bearing capacity of the circuit breaker .

3.1.2-1 Type of the Switchgears :

The construction of the (66) KV switchgear shall be outdoor type .

2.1.2-2 Arrangements of the Feeders :

The arrangement of the feeders of (66) KV switchgear is given on the single-line diagrams in Book “ 1 – A “ . Details for the bay’s equipment , control , metering and protection apparatus are given in the annexed drawings to Book “ 1 - A “ . All the metering and relay units shall be located at control room .

All the elements of the switchgears shall be corona free .

Free place must be envisaged for extension of the switchgear (refer to Book 1- A) .

3.1.2-3 Clearances :

The clearances and positions of the equipment including the access facilities , shall permit safe maintenance of any section of the equipment , while the remaining sections are alive and the removal or temporary covering of circuit breakers , disconnect switches and transformers without reducing the clearance specified .

The requirements of IEC 71-2 relating to correlation between insulation levels and minimum phase –to earth air clearances shall be taken in consideration .

Where arcing horns or rings are provided , the minimum distance between live metal and earthed metal is the distance between the arcing rings and earthed parts or between the horns .

The minimum height from earth to the base of all post – type insulator or the flange of the bushing insulator shall be as specified in IEC standards .

Where post-type or bushing insulators are not mounted vertically , the minimum height from the earth to any live part of the equipment , which is not in a screened enclosure shall be as specified in IEC standards .

3.1.3 Circuit Breakers :

The circuit breaker shall of outdoor , three phase , SF6 type suitable for high- speed auto-reclosing duty and remote operation .

All circuit breakers shall be designed and fully tested in accordance with relevant latest edition especially IEC 56 , IEC 144 , IEC 694 , IEC 815 , and IEC 1233 . All type tests shall be carried out either at an independent testing laboratory and acceptable test reports provided “ not older than five years “ or witnessed by an independent observer .

The design of the circuit breakers shall require minimum and easy maintenance and shall be such that they produce very low over voltage (< 2.5 pu) when switching low currents , capacitive and inductive , including reactors swtching duties .

The design of the circuit breaker shall be such that it can satisfactorily perform :

- Twenty full short circuit operations on a single set of contacts and nozzles .
- Extended mechanical endurance tests (minimum 5000 operations) beyond the IEC requirements .

3.1.3-1 Design Data :

The rating and performance of the circuit breakers which will be equipped in the substations shall be equal to or better than the following values :

ITEM	DATA	UNIT	DESCRIPTION
1	Highest system voltage	KV	72.5
2	Service voltage	KV	66
3	Lightning impulse withstand voltage 1.2 / 50 microsec.	KV (Peak)	325
4	Power frequency 1 min. withstand voltage	KV	140
5	Rated normal current : For coupler For others	A A	N.A 1250
6	Rated breaking current a) SYM b) ASYM	KA KA	31.5 at 72.5KV acc. to IEC 56
7	Rated short time current , 1 sec.	KA	31.5 at 72.5 KV
8	Rated making current	KA (Peak)	79
9	Maximum overvoltage produced during any capacitive and inductive switching duty	p.u	< 2.5
10	Degree of protection		IP 54
11	Rated duty cycle	O – 0.3s – CO - 3 min – CO	
12	Rated supply voltage of closing and opening devices	DC V	220
13	Rated supply voltage of auxiliary circuits	AC V and DC V	

3.1.3-2 Technical Requirements for Circuit Breakers :

The circuit breaker shall be of rugged construction and easy maintenance. The construction must give the possibility for replacing of each unit pole with the spare one. No part of the circuit breaker or its supporting structure shall be permanently strained when breaking or making the rated short circuit currents.

Circuit Breaker Operating Mechanism :

All types of operating mechanism shall be designed so that the circuit breaker is trip fully in accordance with IEC recommendation (latest edition).

In the event of a failure to latch in the closed position, it shall not be possible for the circuit breaker to open, except at normal tripping speed.

Indicator shall be provided on each circuit breaker operating mechanism to show whether the circuit breaker is open or closed.

The various parts shall be of substantial construction carefully fitted so as to ensure free action, and design shall be such as to reduce mechanical shock to a minimum during operation and to prevent inadvertent operation due to vibration or other cause.

It shall be possible to make independent adjustments on each pole . Operation of the three -phase poles shall be simultaneous .Approved means shall be provided to ensure simultaneous operation of the three phases. Provision shall be made in the protection relay panel for automatic tripping of the circuit breaker and for a remote alarm indication in the event of any phase failing to complete a closing operation. The necessary equipment shall be provided to initiate and control three-phase auto-reclosures.

The circuit breaker mechanism shall include operating counters to record the number of closing strokes.

Each circuit breaker shall be provided with a local control panel located in a position outside the circuit breaker.

- All circuit breakers shall be fitted with two trip coils .

For the purpose of moisture-proofing a space heater with an appropriate capacity shall be

attached inside the housing of operating mechanism.
Auxiliary contacts shall be provided too.

Means shall be provided to avoid the local and remote control equipment from being in operation simultaneously. It shall be possible to trip ;mechanically the circuit breaker from the local control even if the electrical supply is not available, unless locked out.

A lock-out device, with provision for remote indication shall be incorporated in each circuit breaker to prevent operation whenever the operating pressure (if any) is less than that required for satisfactory operation at the specified rating.

Circuit Breaker Making And Breaking Capacity :

Breaker shall be capable of making and breaking short circuit faults in accordance with the requirements of service operation, for the three-phase short circuit ratings.

Each circuit breaker shall be capable of making or breaking the magnetizing current of transformers and the charging current of overhead lines and cables without sustaining any damage or causing excessive overvoltages.

The Contractor shall supply special tools and standard tool sets for circuit breakers.

It shall be possible to charge the operating springs with the circuit breakers in either the open or closed positions in normal operating , recharging of the operating springs shall commence immediately and automatically upon completion of the closing operation. Closure whilst a spring charging operation is in progress shall be prevented ,and release of the springs shall not be possible until they are fully charged.

- For maintenance purposes, means shall be provided for manual operation including the slow closing.
- Operating mechanism , and control circuit design of the breakers shall include 2 separate trip coils for isolated operation with primary and pack-up protective relays .trip one and close commands will fed by control voltage one , but trip two will be gained from the control voltage2.
- Provisions shall be made for remote indication of the following operations through a pair of NC+NO voltage free contacts:
 - 1- Circuit breaker opened.
 - 2- Circuit breaker closed.
 - 3- Failure to complete the closing or opening operation.
- Gas density in the SF6 circuit breakers shall at all times be not less than the insulation density and switching capability of SF6. gas density monitoring

equipment shall be provided with two level, first level for refill and the 2nd step for blocking or emergency trip of c.b if requested , circuit breakers shall be equipped with gas pressure gauge , preferably ambient temperature compensated.

- Circuit breakers shall be of single low – pressure puffer type or thermal blast type .
- The control cabinet shall be equipped with hinged doors and provided with stops and means of locking the door in the open position .
- A continuous rubber gasket shall be provided for weather proofing in accordance with I E C 144,IP 54 .a three point locking handle shall be provided to securely hold the doors closed at the top .bottom and middle .
- easy access shall be provided to all terminal blocks and control equipment .
- The spring shall be charged by an electrical motor automatically , hand charging shall be possible by crank . means shall be provided and suitably installed , so that the charging motor electrical circuit is disconnected when it is tried to insert the hand crank .
- Provision should be made for remote indication of “spring charged” and “ spring charge fail ”conditions .

3.1.4 Disconnecting Switches With or Without Earthing Switches :

3.1.4-1 Design Data

The ratings and performance shall be equal to or better than the following values:

ITEM	DATA	UNIT	DESCRIPTION
1	Highest system voltage	KV	72.5
2	Service voltage	KV	66
3	Type		
3	Lightning impulse withstand voltage 1.2 / 50 micro sec.: to earth and (phase-to- phase) across open contacts	KV (peak) KV (peak)	325 375
4	Power frequency 1 min. withstand voltage : a) to earth and (phase-to-phase) b) across open contacts	KV KV	140 160
5	Rated normal current : For coupler For others	A A	N.A 1250
6	Rated short time current , 1 sec.	KA	31.5 at 72.5KV
7	Rated peak short circuit current	KA (peak)	79
8	Operating mechanism		motor
9	Rated supply voltage	AC V	220

3.1.4-2- Technical Requirements :

Disconnecting switches shall be outdoor type capable of carrying the full-load current of the circuit and shall be arranged for operation while the equipment is alive. They will be required to break the charging current of open busbars and connections to bus and magnetizing current of the power transformer in the circuit of transformer feeder.

The minimum total length of air gap between terminals of the same pole with the disconnecting switch open, shall be designed to provide an impulse voltage withstand level as per IEC 129.

Disconnecting switches shall be so designed that they shall not open by forces due to currents passing through it, and shall be self-locking in both the “open” and “closed” positions.

Rotary type disconnecting switches will be acceptable .

The disconnecting switches shall be provided with electrical operating mechanism and shall be arranged for local and remote control and with manual operation.

Means shall be provided at the local control point to prevent the local and remote control equipment from being in operation simultaneously.

The operating mechanism shall be located so that it can be maintained while the disconnect is alive.

The mechanism shall normally open and close all three poles simultaneously.

The equipment shall operate safely and reliably and without undue maintenance or operator attention under all operating and site conditions.

The disconnecting switches could be equipped with one or two sets of earthing switches, according to the attached drawings (book one A) , which shall have suitable ratings for short-circuit current. Earthing switch shall be motor driven, local operation , with a possible emergency manual operation. Earthing switch shall be secured against reopening.

Service conditions require that disconnecting switch shall remain alive and in service without being operated and without maintenance for period of up to (1) year. The contacts shall therefore remain capable of carrying their rated load and short-circuit currents without overheating for this period under the atmospheric and climatic conditions existing at site. After such periods, the maximum torque required to open them at the manual operating

handle shall be within the capabilities of one man.

Life lubrication of the bearings of all disconnecting and earthing switch shall guarantee maintenance free service life.

Contacts paste :

-Contacts paste shall be used on all contact surfaces during installation of all kinds of connectors. The dropping point of the contacts paste must be above 100

C . it shall not be poisonous or inflammable and effectively prevent corrosion throughout the service period.

The contact past shall not decay .evaporate, harden or under service conditions.

-contact paste must be easily applied to the contact surfaces within temperature range of

-contact paste must be easily applied to the contact surfaces within temperature range of – 10°C to +55°C, and shall have good adherence and chemically neutral in relation to both aluminum and copper conductors and other materials included in the connectors.

3.1.5 - Voltage Transformers :**3.1.5-1 Design Data :**

The ratings and performance shall be equal to or better than the following values:

ITEM	DATA	UNIT	(66) kV
1	Highest system voltage	KV	72.5
2	Service voltage	KV	66
3	Lightning impulse withstand voltage 1.2/50 micro sec.	KV	325
4	Power frequency 1 min. withstand voltage	KV	140
5	Type		capactive or inductiv
6	Primary rated voltage	KV	$66 / \sqrt{3}$
7	Secondary rated voltage	V	$100 / \sqrt{3}, 100 / \sqrt{3}$
8	Voltage factor	-	1.2
9	Accuracy class and burden	Protection and determined by relay, instrument, telecontrol design following values : - 50 VA 0.5+3P - 50 VA 0.5+3P	metering to be the contractor to suit synchronization and but not less than the for measuring for protection
10	Total capacitance of main and shunt capacitors (in case of capacitive type)	Pico F. PF	More than 8000
11	Outlet for PLC (in case of capacitive type)	Should be provided	

--	--	--

3.1.5-2 Technical Requirements :

(66) kV Voltage Transformers :

The V.T. shall be single-phase porcelain , for outdoor use, capacitive or inductive type, self-standing, oil filled and hermetically sealed. Outlets for PLC and suitability for mounting of a line-trap and auxiliary devices for carrier transmission in case of capacitive type shall be provided.

Combined voltage and current transformers are not acceptable.

The Contractor shall be responsible for sizing, rating and details pertaining to the all V.T and shall submit the calculations sheets for approval by the ETA

The secondary cabinet shall consist of a terminal board for V.T. (and PLC - when available) secondary circuits, a short circuit bar for restraining burden and a short circuit protective device for V.T. secondary circuit. The V.T. secondary circuit shall be fuseless and shall have a control device for secondary short circuit current.

The Contractor shall supply the special tools and standard tool sets for the V.T.

3.1.6 Current Transformers :**Design Data :** (for Rated secondary current 1 A)**3.1.6-1-****a) For oil protection current transformers :**

The ratings and performance shall be equal to or better than the following values:

ITEM	DATA	UNIT	(66) KV
1	Highest system voltage	KV	72.5
2	Power frequency 1 min. withstand voltage	KV	140
3	Lightning impulse withstand voltage 1.2/50 micro sec.	KV (peak)	325
4	Cores	No.	3
5	Rated primary current : - For coupler - For outgoing feeders - For transformer feeder	A	N.A 3 core (1200-600-300) N.A
6	Rated secondary current	A	1
7	Accuracy class and burden	the folowing data should be guranteed for all ratios and specialy for minnum ratios.	
	Core 1 Core 2 Core 3	clx , VK > 500 V , Rct (IEC) Feeder , Transformer , 5P20 , (20-30)VA Feeder , Transformer Coupler cl 0.5 , Fs = 5 , (20-30) VA Coupler , Trnasformer , Feeder	
8	rated dynamic current	KA	79
9	Rated continuous thermal current	120 % the rated current	

10	Rated short-time current (1 sec.)	KA	31.5 at 72.5 KV
----	------------------------------------	----	-----------------

3.1.6-3 Technical Requirements :

Current transformers shall be oil porcelain insulated and suitable for outdoor use. They shall comply with the requirements of IEC-185 standards (latest revision). Bushing current transformers and combined voltage and current transformers are not acceptable. Current transformers shall be single pole; hermetically sealed, base mounted with the number of cores and ratios indicated on the drawings and design data . The short circuit rating of the current transformers primary winding shall be equal to that of their associated circuit breaker.

The secondary winding of each set of current transformers shall be earthed at one point only and shall be accessible while the equipment is alive. Current transformers shall have sufficient capacity to support the burden of the connected devices.

Polarity, phase and tap indication shall be provided on each current transformer secondary windings.

Conductors required for grounding the secondary windings shall be of stranded type, with a minimum cross section of 4 mm².

The accuracy class and burden of the C.T. shall meet the applicable requirements of IEC standards but not less than the values given in design data . The Contractor shall be responsible for sizing and details pertaining to the all C.T. and shall submit the calculations sheets for approval by the ETA .

- Porcelain insulators shall be brown glazed and manufactured and tested in accordance with relevant IEC standard and comply with the requirements of current transformers .
- The current transformers shall be supplied with Oil level indicator, filling and draining (sampling) plugs for oil immersed current transformers.

Current transformers shall be designed , manufactured and tested in accordance with the applicable requirements of the standards IEC 44-1, 296, and ISO 1461. The Contractor shall supply the special tools and standard tool sets for the C.T.

3.1.7 Lightning Arresters :**3.1.7-1 Design Data**

The ratings and performance shall be equal to or better than the following values :

ITEM	DATA	UNIT	LOCATION
			(66) KV out-going feeder and (66) KV transformer feeder
1	Highest system	KV	72.5
2	Rated voltage , approx.	KV	66
3	Nominal discharge current	KA	10
4	Line discharge class		3
5	Continuous operating voltage	KV	60

TECHNICAL SPECIFICATION S

BOOK (1-B)

PROTECTION, CONTROL AND METERING EQUIPMENT

4.1. NUMERICAL CONTROL AND PROTECTION SYSTEM :

4.1.1-1 Protection Types :

All Relays should be able to communicate with the (CSCS)

All relays should perform a measuring function and must be based on the use of numerical circuits. Auxiliary relays, repeat relays, trip relays and any other simple auxiliary or contact multiplication function may be based on standard attracted armature .

Numerical relays should be based on numerical design techniques. It is the responsibility of the tenderer to demonstrate that all relays equipment offered has a reasonable level of in-service experience. For above mentioned numerical relays, the following conditions also apply :

- * Numerical , differencial , distance and overcurrent relays for (66) kV should have fault recorder .

- * The tenderer must be able to demonstrate that a minimum of 10 relays of each type offered have been in full service without relay failures occurring for a minimum of three years in two different countries, one of which may be the country of manufacture. Experience involving trial installations are not accepted.

- * The tenderer must include a statement of the number of years of guaranteed manufacturing and parts support which will be provided for the relays offered.

- * The tenderer is assumed to state the full firmware version together with the version of relays for which experience records are offered.

For relays which are provided with communication facilities, the communications facility should allow all information which is available locally at the relay front panel to be accessed remotely. It should also be possible to carry out bulk transfer of settings and fault record information using the appropriate PC based software.

4.1.1-2 Protection Discrimination :

On the occurrence of a fault on the power system network the high speed discriminating protection systems (main protection) shall rapidly detect the fault and initiate the opening of only the circuit breaker which is necessary to disconnect the faulted electrical element from the network. Protection equipment associated with adjacent electrical elements may detect the fault, but must be able to discriminate between an external fault and a fault on the electrical element which it is designed to protect . Sequential time delayed tripping is not permitted except in the following specific circumstances:

* Protection for the short connections between post current transformer housings and circuit breakers when the technical advantages of complete overlapping of the protection are outweighed by economic considerations, (i.e. short-zone protection).

* Operation of time graded back-up protection takes place as a result of either the failure of the main protection systems, or the fault resistance is substantially greater than a value which can be detected by main protection systems.

4.1.1-3 Protection Settings :

A list of the settings to be applied to all protection systems together with all associated calculations, shall be provided for review and approval not less than 1 month prior to the first program date for commissioning. The settings for feeder protection shall be such as to permit correct operation of the protection for earth faults with up to 100 ohms fault resistance. Any limitations imposed on the power system as a result of the settings proposed shall be explicate stated. In the absence of system data required for calculation purposes, assumptions may be made providing these are clearly identified as such in the relevant calculations .

4.1.1-4 Fault Clearance Time Requirements :

The protection equipment shall be capable of achieving the following discriminative fault clearance times, inclusive of circuit breaker and signaling times:

* (100) ms for all electrical elements whose boundary connections are defined by circuit breakers located within a given substation.

* For interconnecting tie lines in which the boundary connections of the electrical element being protected are defined by circuit breakers located in adjacent switching stations, an additional 20 ms fault clearance time is allowed at the substation remote from the fault point. This additional fault clearance time is permitted subject to the requirement that the positive sequence impedance of the primary circuit from the switching terminal to the point of fault shall not be less than 10 ohms.

The tenderer shall supply ETA with details of the operating times under defined conditions of all protection equipment proposed. Any limitation in operating time performance shall be declared by the tenderer, for example end of zone faults where distance protection is applied , high resistance faults, faults at high X/R with significant dc component and time constant . The tenderer shall specify the increase in operating time which could occur under such conditions .

4.1.1-5 Protection Accommodation :

Protection systems shall preferably be accommodated in standard 19 inch rack or hinged rack cubicles and be of modular construction with factory assembled and tested wiring. units which must be mounted to allow access to the front and rear of the Relays mounted on such panels shall be flush mounted. The construction method shall offer the benefits of minimum site construction times and circuit outage requirements.

Interconnections shall be identified in accordance with the requirements for dependent local end marking as specified in IEC Publication 391 Section 3.4.1.a 1 and 5.1.2. The interconnections shall be recorded on an appropriate schedule or diagram.

Logic diagram for protection system should be offered with the tender. For modular protection systems, means shall be provided to lock positively each withdrawable module or unit in the “service” position. It shall not be possible to remove any module without first short-circuiting all associated current transformer circuits.

4.1.1-6 Operator Interface :

All numerical protection systems shall be provided with an integral local operator interface facility to enable communication with the relay without the use of external equipment. No exceptions to this requirement shall be accepted and pcs will be part of this tender.

The protection relay shall also be supplied with the facilities identified below.

Identifications :

Each protection system shall have a unique identifier which is clearly visible The software reference and issue level shall be identified.

Settings:

Each protection system shall provide means by which the user can easily access the protection system to apply the required settings, which is also secure from inadvertent operation. A display of the selected settings shall be provided on the protection system.

Indications :

Each relay or protection scheme shall be provided with an adequate number of indications to ensure that the appropriate faulted phase, zone, etc.. can be easily identified after a fault condition. Each indicator shall be visible and capable of being reset without removing the relay cover. Unless otherwise approved, indications shall only be given by the protection(s) causing the fault to be cleared.

Indication shall be provided for failure detected in the protection relay . The status of the dc power supplies shall be permanently indicated . The indication provided shall be designed to allow the defective item to be quickly identified .

Details of the indication required for specific types of relay are provided in the individual sections of this specification covering particular types of relay.

4.1.1-7 Protection System output Contacts :

All protection systems shall be provided with an adequate number of contacts of suitable rating to carry out the required tripping functions, alarm indications, fault recorder functions and such supplementary signaling functions as may be necessary for initiation of automatic switching control, intertripping etc.. In all cases contacts intended for tripping duty shall be designed such that they cannot inadvertently interrupt trip coil current.

4.1.1-8 Test and Isolation Facilities :

Each functional protection system shall be so arranged that operational and calibration checks can be carried out with the associated primary circuit(s) in service.

Adequate test facilities shall be provided within the protection system to enable the protection and equipment to be tested from the front of the protection equipment panel with the primary circuit(s) in service. The test points shall be clearly identified and labeled.

Relays shall include supervision facilities which provide a periodic self check of the key elements within the relay and also provide continuous self monitoring of all internal power supplies and microprocessor operation. A defect in any of the self supervision facilities shall not cause maloperation of the protection relay internal self-test facilities and shall give an alarm should an internal fault occur.

Adequate facilities shall be provided, preferably at the front of each protection equipment unit to isolate all dc and ac incoming and outgoing circuit so that work may be carried out on the equipment with complete safety for personnel and without loss of security in the

operation of the switching station. The isolation points shall be clearly identified and labeled. The labels on the isolation points shall either describe the function or be uniquely numbered.

The tenderer shall provide a list of all of the protection and equipment being offered under the contract. The tenderer shall also provide a list of all the test and ancillary equipment required for commissioning and routine testing of all protection and autoreclose equipment.

4.1.1-9 Service Life and Service Support :

The protection systems shall be designed for a service life of at least 15 years, and preferably 20 years, given that normal maintenance in accordance with manufacturers recommendations is carried out during the lifetime of the protection system.

The tenderer shall state the service life of the protection system equipment in relation to that of the main HV plant and apparatus so that ETA can assess the cost of any replacement during the life of the substation.

The tenderer shall state the period for which lifetime support will be provided for the protection system equipment and shall make recommendations for the provision of spare parts in accordance with price schedule (Book 3) .

The tenderer shall supply circuit diagrams for each protection system and the associated tripping system(s). The diagrams shall provide sufficient information to enable fault finding and maintenance to be carried out .

When the tenderer has been notified if incorrect operation or failure to operate when required, of any protection system supplied under the contract, the tenderer shall investigate the incident and inform ETA of any such incidents if they result in the necessity to modify the equipment. The tenderer shall also inform ETA of the details of the modifications required to prevent such incidents re-occurring .

The tenderer shall offer a service to enable any faulty item of protection equipment to be rectified or replaced within a stated period of the fault being reported. The tenderer shall state the repair/replacement period (refer also to juridical book).

The tenderer shall, when requested, offer ETA a maintenance contract for the protection equipment supplied under the contract. The tenderer shall supply details of the cost of the maintenance contract and information on test procedures and test frequencies that would be supplied under the maintenance contract . In case of upgrading for soft wars the contractor should provide the new version of this soft war for ETAE without increase in prices.

4.1.1-10 Environmental Requirements :**Atmospheric Environment****Temperature :**

The standard nominal range of ambient temperature shall be
(-5 °C to + 50 °C) for insid equipment .
(-10 °C to + 55 °C) for outsid equipment

The protection system shall operate satisfactorily when tested to the following requirements :

IEC Publication 68-2-1 with severity class-10 °C (96 hours) .

IEC Publication 68-2-2 with severity class 55°C (96 hours) .

The protection system shall be able to withstand the temperature requirements for storage and transportation and shall be tested to the following requirements:

IEC Publication 68-2-1 with severity class-25 °C (96 hours) .

IEC Publication 68-2-2 with severity class 70 °C (96 hours) .

Relative humidity:

The protection system shall operate correctly with a relative humidity of 93% and shall be tested to IEC Publication 68-2-3 with severity class 56 days.

Enclosure:

The protection relay shall meet the requirements of the tests detailed in IEC Publication 529 with classification IP 50 (dust protected) . If the individual enclosure of the relay is to a class less than IP 50 then the tenderer shall provide a cubicle to classification IP 50 to accommodate the relay.

Vibration:

The protection system shall meet the requirements of the tests detailed in IEC Publication 255-21-1 with severity class 1.

Shock and bump:

The protection system shall meet the requirements of the tests detailed in IEC Publication 255-21-2 with severity class 1.

Seismic:

The protection system shall meet the requirements of the tests detailed in IEC Publication 255-21-3 with severity class 1.

Electrical Environment

DC Auxiliary energizing quantity:

The protection systems shall be capable of being energized from a dc auxiliary energizing voltage of 110V (nominal).

The protection system or its associated power supply for use in a 110V (nominal) dc supply system shall operate correctly over a voltage range of -30% to + 10% of rated voltage.

110 vdc control voltage shall be for the substation

The protection system shall meet the requirements of IEC Publication 255-11 with interruptions to the dc auxiliary energizing quantity of 50 ms.

Frequency:

The standard rated frequency shall be 50 Hz. The nominal range of frequency shall be (- 5 per cent) to (+ 5 per cent) .

Thermal rating of equipment

Relay equipment intended to perform a current measurement function shall be capable of continuous operation at a current of not less than 2.4 times the nominal rating or 2 times the setting value, whichever is the more onerous .

Relay equipment intended for use in a normally quiescent mode and having a short time rating - for example, high impedance differential protection - shall be rated in accordance with the intended function and taking account of such inherent protective devices as may be incorporated in the design.

Voltage sensitive equipment intended for use on effectively earthed networks shall have a continuous withstand of not less than 1.2 times nominal voltage and a short duration withstand of not less than 1.5 times nominal phase-to-ground voltage for 30s.

Insulation

Rated insulation voltage:

The rated insulation voltage of circuits connected to current transformers of high impedance relays shall be 1 000V. All other circuits shall have an insulation voltage of 250 V.

Dielectric tests:

The protection system shall comply with the dielectric test requirements of IEC Publication 255-5. The test voltage shall be selected according to the rated insulation voltage of the circuits being tested form Series C of Table 1 of IEC Publication 255-5.

Impulse voltage:

The protection system shall comply with the impulse test requirements of IEC Publication 255-5 with test voltage of 5 kV.

Electromagnetic Compatibility

The requirements of this section of the specification are applicable to numerical protection system and may also be applied to some electromechanical relays which are very sensitive or of high speed, at the discretion of ETA

1 Mhz burst Disturbance:

The protection system shall comply with the requirements of IEC Publication 255-22-1 with severity Class III .

Electrostatic discharge:

The protection system shall comply with the requirements of IEC Publication 255-22-2 with severity Class III.

Radiated electromagnetic field disturbance:

The protection system shall comply with the requirements of IEC Publication 255-22-3 with severity Class III. The test shall be carried out by using Test Method A and by sweeping through the entire frequency range 27 Mhz to 500 Mhz.

Fast transient disturbance:

The protection system shall comply with the requirements of IEC Publication 255-22-4 with severity level IV.

4.1.1-11 Test Requirements :**4.1.1-11-1 General Requirements :**

The tenderer shall supply test results and/or in service operating evidence to confirm compliance with the general and performance requirements as detailed this specification.

4.1.1-11-2 Pre-commissioning and Energizing tests :

The tenderer shall submit details of all pre-commissioning and energizing factory tests to ETA for approval prior to the tests, and shall provide ETA or their representatives with the opportunity to witness the commissioning tests and there would be the in time notice for any witnessing of clients representing .

4.2 STANDARDS PROTECTION SCHEMES :

The following sections of this specification identify the protection requirements for specific circuit types. See also attached drawings .

4.2.1 (66) KV Overhead Lines Protection :

All (66) KV overhead lines shall be provided with protection equipment shown in drawing which shall comply with the requirements as specified below in addition to the following relays as part of the protection panel

- trip circuit supervision relay (sub 1 and sub 2).
- trip relay (sub 1 and sub 2).
- loutck out relay .
- test switch for each main protection relay
- test plug for each substation ..

4.2.1-1 Distance Protection (21) :

The protection relay shall provide a minimum of three independent protection Zones and one reverse Zone . The protection characteristics shall be such that the Zone 1 and Zone 2 elements shall operate only for faults in the line direction Under no circumstances shall the Zone 1 and Zone 2 elements operate for reverse faults, even when the voltage that the relay uses for measurement purposes fall to zero on all three phases.

Where the relay operation is affected by current levels, operation shall be possible at current levels >20 per cent of the relay current rating. Distance protections should be suitable for short overhead lines .

When the protection relay is energized from capacitor voltage transformers, the Zone 1 and Zone 2 elements shall not operate due to the transient response of the voltage transformers during or following the clearance of close up faults behind the relay. Details of

the methods used to ensure that the Zone 1 and Zone 2 characteristics are maintained for all types of faults close to the relaying point shall be provided by the tenderer.

The Zone 3 protection characteristics shall be non-directional and shall be capable of being off-set in both the forward and reverse directions independently of the Zone 1 and Zone 2 elements.

None of the measuring elements shall operate during normal power system switching conditions or during de-energisation of the protected line.

The frequency response of capacitor voltage transformers is such that primary system transients can cause both high and low frequency transient oscillations to occur at the output of the voltage transformers. The protection relay shall not maloperated in the presence of such transients and the tenderer shall provide test evidence to show that the relay responds correctly during transient conditions. The following features should be included in Distance Protection :

- 1- Power Swing Blocking
- 2 -fuse failure (e.g. external device or internal criteria) and all measurements elements shall be fitted to operate correctly during the transient response .
- 3- Zone extension and reset features in compliance with three phase single shot autoreclose
- 4- Inter tripping facility for accelerated trip (PERMISSIVE UNDER OR OVER REACHING ,BLOCKING)
- 5- Self supervision (continuous)
- 6-Directional Earth fault and phase fault zone rich independent settings
- 7- Inputs of distance protection relay are as below :
 - Voltage
 - Current
 - Auxiliary supply
 - Mounting
- 8- Tests sockets and plugs for secondary injection test to be included
- 9- Built in fault locator and disturbance recorder
- 10- Full range of indication for the type of fault which phase and zone etc. to be available on the relay along with major alarms output contacts for remote indication .
- 11- Over and under voltage function .
- 12- Input up to couplers rated for 110VDC , output contacts also to suit for above mentioned voltage .
- 13- Switch on to fault .
- 14-non – switched relays .
- 15-at least three forward measuring zones plus one reverse.
- 16-Quadrilateral starting and measuring characteristics are preferred

- 17-Operation bases on two separate algorithms is preferred.(details to be given by the bidders).
- 18-Fault current sensitivity $\leq 0.2 \text{ In}$.
- 19-Tripping time $\leq 25 \text{ ms}$.(measured at relay output terminals).
- 20-Unlimited directional sensitivity for all type of faults.
- 21-V.Ts circuit interruption- blocking function.
- 22-Self-monitoring function.
- 23-Weak infeed mode and echo logic
- 24-Full range of tele – protection schemes.
- 25-Directional earth fault comparison function with independent transmission 26-channels from the distance protection function channels
- 27-Back up directional earth fault function with both inverse time and definite time characteristics.
- 28-Over load protection function.
- 29-Emergency over current and earth fault in case of V.Ts failure.
- 30-Immunity against CVT transient errors.
- 31-Single and three phase , fast and timed auto- reclosing function with voltage and synchro –check functions.
- 32-Minimum 2 independent setting groups .
- 33-Front panel setting and display support with LED,s for the main fault signals.
- 34-Fault recording function with minimum capacity of 10 sec. circular memory.
- 35-The recorded fault information shall be at least -8 analogue signals and 16 36-digital signals during configured pre fault time (round 100 m .sec) and fault time (round 3 sec).
- 37-It is preferred to deal with fault recording by the same software program as the protection function . anyhow this program shall have all facilities required for fault analysis (details are required).
- 38-the fault recording shall be supported with real time and date indications.
- 39-fault location based on the following main characteristics:
unaffectedivity by :
- a) arc resistance in case of phase to earth fault .
 - b) high resistance earth faults with remot end in feed .
 - c) load current
- * distance to fault is displayed on the front panel in the from of kilometers .
- * less than 3 % measuring error .
- 40- Over and under voltage

input quantities :

- rated voltage : $100 \sqrt{3}/100/ \sqrt{3}$
- Permissible over voltage : $\geq 1.2 U_n$
- rated current : 5 Amp.
- rated frequency : 50 HZ
- permissible overload : $\geq 2 \text{ In}$ continuously

SETTING FEATURES :**The following features are preferred**

- Forward and one reverse measuring Zones based on separate setting of R and X With separate Measuring at least , 3 measuring elements for each fault loop

Sensitivity :unlimited , for all types of fault , 1 Directional

Starting :minimum impedance fault with individual setting for phase and earth fault operating thresholds .

4.2.1-2 Overcurrent Protection 50/50N- 51/51Nand directional earth fault : as Backup Directional Overcurrent Protection and directional earth fault (67 / 67N) :

A three pole backup overcurrent relay shall be provided and connected to current transformers on the high voltage connections of the transformer and should be irresponsive to transformer inrush current . An identical relay shall be provided and connected to current transformers on the low voltage .

It should be with sensitive earth fault facilities on each outgoing feeder to protect the 20 kV overhead line in the event of high resistance faults occurring within lines.

A protective scheme shall be required to ensure a "breaker failure" function for the CB of the MV incoming feeder. It shall trip the CB on the HV side of the transformer after a time delay in case of a failure on the CB of the MV incoming feeder.

A F50/50N instantaneous overcurrent protection and F51/51N time delayed overcurrent protection with 2 pick-up current stages ($I>$ and $I>>$) and 2 delayed times (definitive or inverse) shall be required to protect a MV incoming feeder.

This protection scheme shall detect, interrupt any kind of faults within the MV busbar and to ensure a selective, co-ordinated tripping operation between the protections of incoming bays and outgoing bays on a line fault (to ensure a back-up protection in case of a fault not interrupted by the outgoing bay). A F51/51N time delayed overcurrent protection with 2 pick-up current stages ($I>$ and $I>>$) and 2 delayed times (definitive or inverse) shall be required to protect a MV outgoing feeder.

The sensitive earth fault relay connected at the HV neutral point of the earthing auxiliary transformer for detecting and signaling the high resistance earth faults shall trip the LV side of the power transformer after a long time delay. This relay shall be a back-up protection for the resistive earth fault relay of the outgoing feeders (if any).

connections of the transformer

Relays shall include both dependent and independent time-current characteristics as identified below :

4.2.1-2-1 Dependent Time Relays :

- a- Dependent time relays shall be capable of providing the three characteristics as defined in Clause 3.1 of IEC Publication 255-3 (eg Normal, Very Inverse, Extremely Inverse).
- b- The current setting of dependent time relays shall be adjustable in a minimum of six equal steps over the following ranges:
 - * 50 to 200 per cent or
 - * 10 to 240 per cent in steps as specified by the tenderer.
- c- Dependent time relays shall have a facility to allow adjustment of the operating time by a factor known as the “time multiplier”. The time multiplier shall cover a range of 0.1 to 1.0 in steps of not greater than 0.025.
- d- The drop off/pick up ration of the relays shall not be less than 90 per cent.
- e- The overshoot of the relay shall not be greater than 30 ms.
- f- The relay shall have an effective range of operating current between 2 and 20 times the setting value as a minimum.

The accuracy of dependent time relays under the reference conditions stated by the tenderer shall be :

Preferably 5 per cent assigned error .

the following main features are required:

- both definit time and invers time characteristics.
- separate current / time measuring for each phase.
- separate indication at starting for each phase.
- separate LED as indication at starting for each phase.
- separate starting and tripping output relay for each phase is preferred , but general starting and general tripping contacts for all phases also accepted.

The protection relays module shall be withdrawable type with special current terminal contacts for shorting different current circuits.

Self- monitoring function for the relay elements is required to be included with alarm LED and output contact in case of internal defects

DETAILS OF TIME/ CURRENT CHARACTERISTICS:**4.2.1-2-2 : INVERSE TIME CHARACTERISTICS:**

- three characteristics as defined in clause 3.1 of IEC publication 255-3 to be included (normal inverse, very inverse, extremely inverse).
- The current setting shall be adjustable in several equal steps over the setting range , the wider range and the finer steps the better technical mark of evaluation .
- operating time shall be adjustable by a factor known as the time multiplier this time shall cover range of 0.1 to 1.0 in steps of not greater than 0.05.
- as instantaneous tripping characteristics, the relay shall have an effective range of operating current between 2 and 20 times the setting value as a minimum

4.2.1-2-3 : DEFINITE TIME CHARACTERISTICS:

- multi stages definite time over current and instantaneous high set over current characteristics.
 - The current setting of the multi stages definite time over current elements shall be adjustable in several equal steps over the setting range the wider range and the finer steps the better technical mark of evaluation.
 - the current setting of instantaneous high set over current elements shall be adjustable in a minimum of six equal steps over the range of at least 1 to 10 times relay setting . it shall be possible to disable the instantaneous high set over current element.
 - the resetting time of high set over current element shall not be greater than 40 ms when the input current is suddenly changed from 2 times settings to zero .
 - the operating time of high set over current elements shall not be greater than 30 ms at times setting
 - multi stages definite time over current elements shall be provided with time setting ranges at least equal to 0.1 to 10 seconds in steps not greater than 0.05 seconds.
- Anyhow longer time duration per each stage would be highly preferred.
- Current characteristics have the following characteristics :
- *over- shoot time not greater than 20 ms.
 - *reset time of not greater than 30 ms

4.2.1.2-4 Independent Time Overcurrent Relays :

- a- Independent time relays shall be capable of providing instantaneous overcurrent, instantaneous high set overcurrent and definite time overcurrent characteristics.
- b- The current setting of instantaneous overcurrent and definite time overcurrent independent time relays shall be adjustable over the ranges:
 - * 50 to 200 per cent or
 - * 10 to 240 per cent in steps as specified by the tenderer.
- c- The current setting of instantaneous high set overcurrent independent time relays shall be adjustable in a minimum of six equal steps over the range of at least 1 to 10 times relay rating. It shall be possible to disable the instantaneous high set overcurrent element.
- d- The drop off/pick up ration of all independent time relays shall be not less than 90 per cent.
- e- The resetting time of high set overcurrent relays shall not be greater than 40 mS when the input current is suddenly changed from 2 times setting to zero. The transient overreach of high set overcurrent relays shall not be greater than 5 per cent at X/R ratios up to 30. Transient over reach is defined as follows:

$$\% \text{ transient overreach} = \frac{I_s - I_f}{I_f} \times 100 \%$$

I_s = steady state RMS operating current
 I_f = AC component of asymmetrical operating current
- f- The operating time of high set overcurrent relays shall not be greater than 30 ms at 5 times setting.
- g- Independent time relays with definite time overcurrent characteristics shall be provided with time setting ranges at least equal to those shown below dependent upon the application:
 - * 0.1 to 10 seconds in steps not greater than 0.05 seconds.
 - * 10 to 1000 seconds in steps not greater than 5 seconds.

The timing elements associated with definite time overcurrent characteristics shall have the following characteristics:

- * Overshoot time not greater than 10 ms.
- * Reset time of not greater than 20 ms.

The assigned error of all independent time relays shall be $\leq \pm 5$ per cent under the reference conditions stated by the tenderer.

Requirements :

- Separate current/ time measuring module for each phase .
- Separate indication at starting for each phase
- Separate LED as indication for tripping per each phase
- Separate starting and tripping output relay for each phase is preferred but general starting and general tripping contacts for all phases are also accepted .
- The protection relays modules shall be withdrawal type with special currents terminal contacts for shorting different current circuits.
- self monitoring function for relay elements is preferred to be included with alarm LED and output contact in case of internal defects .
- the relay should have an effective range of operating current between 2 and 20times the setting value as a minimum.
- Permissible overload $\geq 2I_n$ continuously

4.2.1-2-5 Protection group for (66) KV lines :

All relays should have test switch .

Main Protection	Code	Backup Protection	Code
Distance protection	21	HV directional overcurrent	67 / 67N
TCS	-	TCS	-
Trip relay	94	Trip relay	94
	-	Lock out relay	86

5.13 POWER AND CONTROL CABLES, WIRING AND ACCESSORIES**5.13.2 Low Voltage Power and Control Cables :**

The 380V cable connecting the station service transformers and outdoor auxiliary equipment to the switchgear shall be of the four-core plastic insulated, steel armored . All power cables shall be PVC insulated cables for working voltage up to 380V shall be of an approved 500/1000V grade and shall comply with IEC 227 and 228 and the colors for PVC insulation shall comply with IEC 304.

Their cross section shall be sufficient for the specified load. They shall be laid in underground reinforced concrete ducts or in trenches and shall be labeled.

5.13-3 Necessary Requirements :

The power cables needed for control, measurement, annunciation circuitry, AC and DC

supply shall have a protection against electromagnetic disturbances. All power and control cables used for AC and DC circuits except the auxiliary supplies such as heating, lighting, .., shall be shielded by a continuous copper screen correctly connected to earth at both ends.

5.13-4 Control Cables and Winding :

The control cables needed for control, measurement, annunciation circuitry, AC and DC supply shall have a protection against electromagnetic disturbances. All power and control cables used for AC and DC circuits except the auxiliary supplies such as heating, lighting, .., shall be shielded by a continuous copper screen correctly connected to earth at both ends .The contractor is responsible for checking all cables for burden of C.T.'s and V.T.'s, for voltage drop on DC control and trip circuits and for satisfactory service with the equipment supplied.

It is also the contractor's responsibility to route cables so as to minimize "pick-up" within the station and where is necessary to take precautions to prevent damage of the cable sheaths from system earth fault current.

Multicore cables shall be either solid or stranded copper conductor with cross-section not less than 1.5 sq.mm. Conductor larger than 4 sq. mm. shall be stranded.

Each cable and its cores shall be labeled and numbered individually.

Control and indication cables shall be installed with a minimum of (10) ten percent spare conductors.

Wiring shall be made in an orderly manner and different circuits shall be labeled and given different colours.

Markers shall be of an opaque nylon material, permanent and water-proof.

All conductor accessories including connectors, termination, support grips markers, cables ties and materials for insulating, jacketing, are proofing and cable cushioning shall be furnished and installed.

Contractor's installation instruction shall be obtained for cable accessories.

All control cables should be laid in separated channels not to be mixed with (20) kV power cables .

All control cables should be laid on cable trays in the main channels per bay and in the main channel in the s/s .

TECHNICAL SPECIFICATION

BOOK (2)

GUARANTEE SCHEDULES

2.2 - GUARANTEE SCHEDULES FOR CONVENTIONAL TYPE SWITCHGEAR

2.2-1-Guarantee Schedule for (66)kV Circuit Breaker

(To be filled-in and signed for each voltage and type)

Item	Description	Unit	ETA REQUIRMENTS	OFFERER VALUE
1	Manufacturer name / country		Europ –Westren Country	
2	ISO 9001 certificate	Yes/No	Should be submitted	
3	Type of circuit breaker		SF6	
4	Type designation			
5	Rated frequency	Hz	50	
6	Rated voltages :		66	
	a) - Highest system voltage	kV	72.5	
	b) - Minimum service voltage	kV		
7	Rated normal current at 50°C ambient temperature :			
	Coupler (busbar)	A	N.A	
	Overhead line	A	1250	
	Transformer bay	A	N.A	
8	Rated breaking current capacity			
	a) - symmetric (rms)	KA	31.5	
	b) - D.C. component	%		
9	Rated peak : - making current	KA (peak)	≥79	
10	Rated peak short-circuit current	KA (peak)	≥79	
11	Rated short-time current			
	a) - 1 sec.	KA (rms)	≥ 31.5	
	b) - 3 sec.	KA (rms)		
12	Rated line-charging breaking current	A		
13	Rated cable - charging breaking current	A		
14	Rated small inductive breaking current	A		
15	Rated breaking current under out-of-phase conditions	KA		
16	Restricting voltage :			
	a) - rate-of-rise (RRRV)	kV/ micro sec		
	b) - peak	kV (peak)		
17	First-pole-to-clear factor			
18	One minute power frequency withstand voltage :			
	a) - Phase to earth	kV (rms)	≥ 140	

	b) - Across open contacts	kV (rms)	≥ 160	
19	Lightning impulse withstand voltage - 1,2/50 micro sec	kV (peak)	≥ 325	
20	Rated operating sequence		O- 0.3S CO3 min CO	
21	Capacity to make :			
	a- High speed three phase auto reclosure			
22	Minimum time between each successive break/make operation	sec.	≥ 0.3	
23	Opening time (until separation of the arcing contacts)			
	a) -Without current	ms		
	b) -With 100%rated breaking current	ms		
24	Maximum total break time (until total arc-extinction)	ms		
25	Maximum time interval between opening of the first and the last phase	ms		
26	Maximum time interval between opening of the interrupters of one phase (if any)	ms		
27	Make time :			
	a) - Without current	ms		
	b) - With 100% rated making current	ms		
28	Maximum total make time (closing initiation to latching of circuit breaker in fully closed position)	ms		
29	Maximum time between closing of first and last phase	ms		
30	Maximum time interval between closing of interrupters of one phase.	ms		
31	Dead time	ms	≤ 300	
32	Maximum peak value of switching over-voltage when interrupting rated line charging current	kV (peak)		
33	Radio influence voltage (RIV) measured at rated voltage to earth	micro V		
34	Interrupting units in series per phase:			
	a) - Number			
	b) - Length of each break	mm		
35	Devices used to limit transient recovery voltages			
36	Creepage distance :	mm		
	a) - To earth	mm	≥ 1813	
	b) - Across terminals	mm		
37	Operating mechanism :			
	a) - Type		Spring	
	b) - Operating voltage			

	- Rated	VDC	220	
	- Range (Min-Max)	%	≤-20% +≥10%	
	c) - Rated power	W		
	d) - Operating pressure-normal/max/min.	bar		
38	Closing release coil :			
	a) - Rated operating voltage	VDC	220	
	b) - Minimum operating voltage	%	≤-20%	
	c) - Maximum operating voltage	%	≥+ 10%	
	d) - Rated power	W		
39	Trip release coil :			
	a) - Rated operating voltage	VDC	220/110	
	b) - Minimum operating voltage	%	≤ -30%	
	c) - Maximum operating voltage	%	≥ + 10%	
	d) - Rated power	W		
40	Clearances :			
	a) - Between phases	mm	≥ 630	
	b) - Between alive part and earth	mm	≥ 630	
41	Weight of circuit breaker :			
	a) - Total	Kg		
	b) - Heaviest part to be lifted during maintenance or repair procedure	Kg		
42	Type test certificate details :			
	a) - Testing station/authority			
	b) - Certificate number			
	c) - Applied standards			
43	Quantity of gas required to fill one three phase unit.	Kg		
44	Quantity of gas required to cover one year losses (per three phase unit).	%		
45	Gas operating pressure at 20 °C :			
	a) - normal	bar		
	b) - Maximum	bar		
	c) - Minimum	bar		
46	Low pressure alarm setting :			
	a) - First stage	bar	YES	
	b) - Second stage	bar	YES	
47	Type of pressure monitoring device			
48	Copy of the newest edition for relevant IEC	Yes / No		
49	Type test certificate details :			
	a) - Testing station			
	b) - Certificate numbers			
	c) - Applied standard specifications			

2.2-2- Guarantee Schedule For Disconnecting Switch (66) kV

(To be filled-in and signed for each type and voltage)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
1	Manufacturer 's name / country			
2	ISO certificate	Yes/No	Should be submitted	
3	Type designation			
4	Three-phase or single-phase design			
5	Earthing switch incorporated			
6	Rated voltage	kV	66	
7	Rated normal current at 45°C ambient temperature : a) - For bus coupler bay b) - For others	A A	N.A ≥ 1250	
8	Lightning impulse withstand voltage 1,2/50 micro sec : a) - To earth and between phases b) - Across open contacts	kV (peak) kV (peak)	≥ 325 ≥ 375	
9	One minute power frequency withstand voltage : a) - To earth and between phases b) - Across open contacts	kV (rms) kV (rms)	≥ 140 ≥ 160	
10	Rated short-time current :			
10.1	Disconnecting switch : a) - for 1 sec. b) - for 3 sec.	KA (rms) KA (rms)	31.5	
10.2	Earthing switch coupled with D.C. : a) - for 1 sec. b) - for 3 sec.	KA (rms) KA (rms)	≥ 31.5	
11	Rtead peak short circuit current : a) - For disconnecting switch b) - For earthing switch	KA (peak) KA (peak)	≥ 79 ≥ 79	
12	Operating mechanism for disconnecting switch :			
12.1	Type		MOTOR	
12.2	Operating voltage-rated/min/max for :			
	a) Operating coil	VDC	220	
	b) range	%	(-20 , + 10)	
	c) - Operating coil (if any)			
	d) - Motor	V		
12.3	Rated power : a) – Operating coil (if any) b) – Motor	W W		

13	Opening time-from the moment when the coil is energized until the complete extinction of arc between opened contacts (under system highest voltage conditions).	sec.		
14	Operation time-from the moment when the coil is energized until the disconnection of operating motor in limit open disconnector positioning.	sec.		
15	Operating mechanism for earthing switch :			
	a) - Type			
	b) - Operating voltage- min/max.	VDC	220	
	c) range	%	(-20% +10)%	
	d) - Rated power	W		
16	Clearances :			
	a) - Phase to earth arcing distance	mm	≥ 630	
	b) - Phase to phase distance in open position	mm	≥ 630	
	c) - Distance between contacts of open disconnector	mm	≥ 630	
17	Support insulators :			
	a) – Manufacturer / country			
	b) - Type designation of unit			
	c) - Creepage distance	mm	≥ 1813	
18	Total weight of complete disconnecting switch (one or three poles)	Kg		
19	Type test certificate details :			
	a) - Testing station			
	b) - Certificate numbers			
	c) - Applied standard specifications			
20	Capacity of lifting equipment necessary for repair or maintenance of one pole of disconnecting switch, or three poles	Kg		

2.2-3- Guarantee Schedule For Earthing Switches (66) kV

(To be filled-in and signed for each type and voltage)

Item	Description	Unit	ETA REQUIREMENTS	OFFER VALUE
1	Manufacturer / country			
2	ISO certificate	Yes/No	Should be submitted	
3	Type designation			
4	Type of contacts			
5	Materials of contact surface		Silver	
6	Rated short-time current : a) - for 1 sec. b) - for 3 sec.	KA (rms) KA (rms)	31.5	
7	Rated peak short circuit current	KA (peak)	79	
8	Gap between poles	mm		
9	One minute power frequency withstand voltage across open gap	kV	≥ 140	
10	Lightning impulse withstand voltage across open gap	kV (peak)	≥ 325	
11	Operating mechanism :			
	a) - Type			
	b) - Operating voltage:			
	- Rated	VAC	220	
	- Range	%	(-20%,+10%)	
	e) - Rated power	W		
12	Main dimensions	mm		
13	Total weight	Kg		
14	Type test certificate details : a) - Testing station/authority b) - Certificate number C- Applied standards			
15	Creepage distance	mm	$\geq 1813^*$	

2.2-4- Guarantee Schedule For Voltage Transformers (66) kV

(To be filled-in and signed for each type and voltage)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
			66 kV	66 kV
1	Manufacturer / country			
2	ISO certificate	Yes/No	Should be submitted	
3	Type designation			
4	Insulation material		Porcelain	
5	Rated frequency	Hz	50	
6	Highest system voltage	kV	72.5	
7	Rated insulation level			
7.1	Power frequency withstand voltage	kV	≥ 140	
7.2	Impulse 1,2/50 micro-sec withstand voltage	kV (peak)	≥ 325	
8	Rated voltages :			
8.1	Rated primary voltage	V	$66/\sqrt{3}$	
8.2	Rated secondary voltage	V	$100/\sqrt{3}$	
9	Rated output/accuracy class Two coils		$\geq 50 / 0.5- 3P$ See single line diagram	
10	Voltage factor			
11	Rated ratio			
12	Ratio error with rated output and : - 105% normal primary voltage - 5% normal primary voltage	%	$\leq 1\%$	
13	Ratio angle error with rated output and : - 105% normal primary voltage - 5% normal primary voltage	Degree		
14	Method of suppressing ferroresonance			
15	Creepage distance	Mm	$\geq 1813^{**}$	
16	Flash-over distance	Mm	≥ 630	
17	Main dimensions	Mm		
18	Total weight	Kg		
19	Applied standard specifications			

2.2-5- Guarantee Schedules for Current Transformers (66) kV

(To be filled-in and signed for each type and ratio)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
			66 kV	66 kV
1	Manufacturer/country			
2	ISO certificate	Yes/No	Should be submitted	
3	Type designation			
4	Highest system voltage	kV	72.5	
5	Insulation material		Porcelain	
6	Rated insulation levels :			
6.1	Lightning impulse withstand voltage - 1,2/50 micro-sec	kV (peak)	≥ 325	
6.2	One minute power frequency withstand voltage	kV (rms)	≥ 140	
7	Rated primary current :		See single line diagram	
	a) For coupler bay	A		
	b) For outgoing feeder bay	A		
	c) For transformer feeder (30) MVA	A		
8	Rating of secondary windings :			
	a) - Rated current	A	1	
	b) - Rated output/accuracy class :		See single line diagram And book B	
	- core 1 (measuring)	VA		
	- core 2 (protection)	VA		
	- core 3 (protection)	VA		
9	Overload capacity at 45 °C ambient temperature	%	≥ 120	
10	Creepage distance	Mm	$\geq 1813^{**}$	
11	Flash-over distance	Mm	≥ 630	
12	Dimensions	Mm		
13	Total weight	Kg		
14	Applied standard specifications			
15	Turns ratio			
	- Core 1			
	- Core 2			
	- Core 3			

2.2-6 Guarantee schedule for lightning arrestor **(Zinc Oxide Type) (66) kV**

(To be filled-in and signed for each type and ratio)

Item	Description	Unit	ETA REQUIRMENTS 66 kV	Offer value 66 kV
1	Manufacturer / country			
2	ISO certificate	Yes/No	Should be submitted	
3	Type reference			
4	Rated frequency	Hz	50 ± 5%	
5	Highest System voltage	kV	72.5	
6	Max Continuous operating voltage	kV	App. 60	
7	Power frequency withstand voltage for (1 min) (empty housing)	kV		
8	Lightning impulse withstand voltage (1.2/50 μs) (empty housing)	kV		
9	Temporary over voltage capability for (1 sec) .	kV/S		
10	Arrester current rating	KA		
11	Outdoor type		Yes	
12	Type of mounting		Pedestal	
13	Radio influence voltage measured at rated voltage to earth	μ v		
14	Maximum peak residual voltage of complete arresters at : Lightning impulse (8/20 μ s) 10 KA	kV Peak		
15	Discharge current withstand strength			
15.1	High current (4/10 μ s)	KA Peak		
15.2	Low current (2000 μ s)	KA Peak		
16	Energy impulse capability	KJ/kV		
17	Pressure relief capability for 0.2 sec.	KA		
18	Leakage current through the complete arrester at rated system phase voltage	μ A		
19	Creepage distance	mm	≥ 1813**	
20	Discharge class		Class 3	
21	Max safe load canti lever to one terminal	N.m		
22	Mass of each complete arrester	Kg		
23	Dimensions			
24	Maximum arrest of the long time impulse current which the series resistance blokes will withstand	A		
25	Type of surge counter	Yes/No	Should be submitted	

2.2-7 Guarantee Schedule for Bus-Bars and Connections for 66 kV

(To be filled-in and signed by offerer for each voltage)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
1	Type (flexible or tube) : (a) or (b)			
	a) – Busbars			
	b) – Connections			
2	Flexible conductors / for bus bar			
2.1	Type and material			
2.2	Nominal section	mm ²	≥ 1250	
2.3	Overall diameter	mm	≥ 40	
3	Bundled conductors :			
3.1	Type and material			
3.2	No. of conductors per bundle		2	
3.3	Spacing between conductors	mm		
4	Tubes for bus bar			
4.1	Material			
4.2	Outside diameter	mm	≥ 80	
4.3	Cross-sectional area	mm ²	≥ 1250	
5	Continuous current rating at 50 °C ambient temperature :			
5.1	Busbars	A	≥ 1600	
5.2	Connections	A	≥ 1250	
6	Maximum stress at surface of flexible conductor	kV/mm	≤ 16.5	
7	Radio influence voltage level measured at rated voltage to earth	micro V		
8	Testing authority			
9	Test certificate			
10	Applied standard specifications			
	* a) if the bus bar fllexible * b) if the bus bar tube			

2.2-8 Guarantee Schedule for Post Type Insulators (66) kV

(To be filled-in and signed by offerer for each voltage)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
			66 kV	
1	Manufacturer name / country			
2	ISO certificate	Yes/No	Should be submitted	
3	Maker's Type number of identification			
4	Insulator material			
5	Length	mm		
6	Flash over distance	mm	≥ 630	
7	Creepage distance	mm	$\geq 1813^{**}$	
8	Weight of complete post insulator	Kg		
9	Maximum cantilever working load (complete post insulator)	N	$\geq 3000^{**}$	
10	Minimum cantilever breaking load upright (complete post insulator)	N	$\geq 4000^{**}$	
11	Power frequency withstand voltage dry/wet	kV	≥ 140	
12	Impulse withstand voltage	kVp	$\geq 325^{**}$	
13	Radio influence voltage level measured at rated voltage to earth	micro V		
14	Method of drying			
15	Electrostatic capacity of complete insulator	F		
16	Applied standard specifications			

2.2-9 Guarantee Schedule for Tension and Suspension**Insulators Strings**

(To be filled-in and signed by offerer for each voltage and type)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
1	Manufacturer name / country			
2	ISO certificate	Yes/No	Should be submitted	
3	Maker's Type number or identification of unit			
4	Insulator material		glass	
5	Greatest diameter of unit	mm		
6	Distance between centres of units	mm		
7	Length of string, overall	mm		
8	Flash over distance	mm	≥ 630	
9	Creepage distance over the complete string	mm	≥ 1813	
10	Mass of string complete with all fittings	Kg		
11	Maximum working load	N	≥ 120000	
12	Power frequency withstand voltage of complete string	kV	≥ 140	
13	Impulse withstand voltage of complete string	kVp	≥ 325	
14	Radio influence voltage level measured at rated voltage to earth	Micro V		
15	Applied standard specifications			

2.2-10 Guarantee Schedule for Steel Structures

(To be filled-in and signed by offerer for each voltage and type)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
1	Manufacturer name / country			
2	Minimum tensile strength of material	kg/mm2		
3	Minimum yield strength of material	kg/mm2		
4	Standard of material	-		
5	Thickness :			
	a) - Main members	mm		
	b) - Bracing of lattice structures	mm		
6	Galvanizing : - minimum quantity of zinc coating	g/sq.m	$\geq 600^{**}$	
7	Applied standard specifications			

2.3 - GUARANTEE SCHEDULES FOR PROTECTION, CONTROL AND METERING EQUIPMENT**2.3.2- Guarantee Schedule For Numerical Over Current and Earth Fault Protection 66kV**

(To be filled-in and signed by offerer)

Item	Description	Unit	ETA REQUIREMENTS	OFFER VALUE
1	a-Manufacturer's name/country b- Type designation and (order number)		a- western europ country b-	
2	ISO 9001 certificate	Yes/No	Should be submitted	
3	Numerical		yes	
4	Rated current	A	1	
5	Rated frequency	Hz	50	
6	Setting range for pick up value	A		
7-1	Reset ratio:	%	≥95%	
7-2	Reset time:	%		
	a-for inverse time element .	ms		
	b-for definite time elements.	ms		
	c- for high set instantaneous element	ms		
8	Accuracy of current element(s)	%		
9	Accuracy of time element(s)	%		
10	Current reset ratio	%		
11	Drop - out time	ms		
12	Consumption of measuring inputs	VA		
13	Over load rating			
	a) continuously	xIn		
14	b) for one second	xIn		
	Setting range of the current (ranges and steps)	xIn		
15	a) for inverse time O/C elements.			
	b) for definite time overcurrent			
	c) for high set instantaneous O/C elements			
	Setting range of the time (ranges and steps)			
	a) for inverse time multiplier factor .	Sec		
	b) For definite time setting range.	Sec		
	c) operating time of high set instantaneous O/C relay at 5 IN	ms		
16	Contacts number :			

17	- tripping	No.		
	- alarming at starting	No.		
	Tripping contact rating :			
	- making current	A		
	- continuous current	A		
18	- breaking capacity	A		
	Consumption on auxiliary supply	W		
19	Degree of protection	IP	≥ 50	
20	Local signaling :			
21	- starting per phase	Yes/No		
	- tripping per phase	Yes/No		
	Operational temperature range			
	a) minimum temperature	°C	-5	
	b) maximum temperature		50	
22	Test voltages :			
	a) impulse withstand voltage 1.2/50 u sec	kV peak	5	
	b) power frequency withstand voltage	kV rms	2	
23	Reference catalogue	No.		
24	Does the relay include an integral fault recorder:		Yes/No	
	A) fault recording memory capacity.			
	B) number of analogue channels.			
	C) nubmer of digital channels.			
	D) pre fault time.			
	E) fault time.			
	F)sampling intervals			
	g) software indentification			
	GPS system inputs for real time synchronizig existance			
	h)sampling interval rate	s/c		
	i)the disturbances are collected and exported in COMTRADE format			
25	Does the relay include a self- monitoring feature		Yes/No	
26	Does the relay include an integral event recorder		Yes/No	
	Number of events can be stored			
27	Does the relay include facilities for communication with DCS equipment and what is the protocol .		Yes	

28	How many stages does this relay have for O/C (I>,I>>,I>>>)			
29	How many stages does this relay have E/F (I E >,IE>>,IE>>>).			
30	Does the relay have inverse characteristic for over current and earth fault :			
	a) Standard inverse		Yes/No	
	b) Very inverse		Yes/No	
	c) Extremely inverse		Yes/No	
	d)Standard Curve (Curve family) ie IEEE IEC etc			
31	Does the relay have separate contact for self-monitoring function			
32	Does the relay have instantaneous function for EF and OC		Yes/No	
33	Supply voltage and tolerance .		Vdc 220/110	
	tolerance		(-30 , +10)	
34	Type test certificate details :			
	a) - Testing station			
	b) - Certificate numbers			
	c) - Applied standard specifications			
35	Hardware properties:			
	a- No. of optically isolated inputs.			
	b- No. of output relays + watchdog output relay.			
	c- No. of fixed function LEDs and programmable LEDs.			
	d- No. of setting groups.			
	e- No. of front EIA (RS) 232 communication port (choice of protocol).			
	f- No. of rear EIA (RS) 485 communication port (choice of protocol)			
	- display characteristics :			
	a) dimensions			
	b) number of rows			
	c) number of characters in per row			
36	Does the Relay include configurable(programamable) logic			

	Does the relay supports IEC 61850 protocol			
	Numerical over current protection (66) KV total			

2.3.5- Guarantee Schedule For Directional Over current and directional earth fault Protection 66 kV

(To be filled-in and signed by offerer)

Item	Description	Unit	ETA REQUIREMENTS	OFFER VALUE
1	a-Manufacturer's name/country b- Type designation and (order number)		a- western europ country b-	
2	Type			
3	Rated current	A	1 A (programmable)	
4	Rated voltage	V	100/ $\sqrt{3}$	
5	Thermal rating of current circuit			
	a-continuous .	xIn		
	b-for 1 sec.	xIn		
6	Power supply		220/110(+10-30%)	
	Tolerance			
7	Thermal rating of voltage circuit	xUn		
8	Consumption			
	a- in current circuit	VA		
	b- in voltage circuit	VA		
	c- in aux. supply circuit	W		
9	Setting range of residual pick up power or current			
10	Reset ratio	%		
11	Accuracy of pick up value	%		
12	Response time for meas. element	m sec.		
13	Reset time for meas. element	m sec.		
14	Inverse time or definite time or both characteristic			
15	Accuracy of current element(s)	%		
16	Accuacy of time element(s)	%		
17	Current reset ratio			
18	Auxiliary voltage (Un)	Vdc		
19	Range			
20	Tripping contact			

	a- Max. service voltage	V.D.C.	≥ 220	
21	b- Making current	A/Sec.		
	c- continuous current	A		
	Local signal :			
	a- starting	Yes/No		
22	b- tripping	Yes/No		
	Signaling contact for :			
	a- starting	Yes/No		
	b- tripping	Yes/No		
23	Operational temperature range		-5 to +50	
24	Test voltages :			
	a – Impulse withstand voltage	kV	5	
	b- Power frequency withstand voltage	kV	2	
25	Weight	Kg		
26	Does the relay include an integral oscillographic recorder	Yes/No	Preferably integrated	
	a) fault recording memory capacity			
	b) number of analogue channels			
	c) number of digital channels			
	d) pre fault time			
	e) fault time			
	sampling intervals			
	F) software identification			
	GPS system inputs for real time synchronizing existence			
	g)the disturbances are collected and exported in COMTRADE format			
27	Hardware properties:			
	a- No. of optically isolated inputs.			
	b- No. of output relays			
	c- No. of fixed function LEDs and programmable LEDs.			
	d- No. of setting groups.			
	e- No. of front EIA (RS) 232 communication port (choice of protocol).			
	f- No. of rear EIA (RS) 485 communication port (choice of protocol)			
	- display characteristics :			
	a) dimensions			
	b) number of rows			
	c) number of characters in per row			
28	Type test certificate details :			
	a) - Testing station			
	b) - Certificate numbers			

	c) - Applied standard specifications			
29	Does the Relay include configurable(programamable) logic			
	Does the relay supports IEC 61850 protocol			
	Total 2.3.5 - Directional Over current Protection 66 kV			

2.3-7- Guarantee Schedule For Numerical Line Distance Protection

(To be filled-in and signed by offerer)

Item	Description	Unit	ETA REQUIRMEN TS	OFFER VALUE
1	a-Manufacturer's name/country b- Type designation and (order number)		a- western europ country b-	
2	ISO 9001 certificate	Yes/No	Should be submitted	
3	Type reference			
4	Principle of operation	Yes/No	Numerical	
5	<u>Input characteristics</u>			
	Rated voltage Un	V	100/v3	
	Rated current In	A	1 A (programmabl e)	
	Minimum operating current	x In		
	Rated frequency	Hz	50	
	Overload rating :			
	a) – Continuously	x In		
	b) - For 1 sec.	x In		
	Admissible sustained voltage	x Un		
	Internal consumption :			
	a) - Current circuit, max.	VA/ph		
	b) - Voltage circuit, max.	VA/ph		
	c) - Supply circuit, max.	W		
	d) - Auxiliary inputs, max.	mA		
6	<u>Measuring Data</u>			
	Number of directional and final steps		3F + 1R	
	Operating current :			
	a) - Phase current	x In		
	b) - Residual current	x In		
	Setting range for the line phase angle			

	in steps of			
	Setting range of the residual compensation factor $K_0 = \frac{(x_0 - x_1)}{(3x_1)}$ in steps			
	Does the relay have separate phase indication or starting element for initiation of the measuring loops in case of starting elements a) number of impedance starting element.	Yes/No		
	B) reset ratio of impedance starting element. C) setting range of impedance starting elements:			
7	- in forward direction.			
	- in reverse direction.			
	How many processor or micro controller is considered in the relay			
	<u>Measuring elements :</u>			
	- measuring principle (Z,X or X and R)			
	- measuring characteristic (circle, lens or quadrilateral			
	Zone 1 setting range	ohm/ ph		
	Zone 2 setting range	ohm/ ph		
	Zone 3 setting range	ohm/ ph		
	Measuring accuracy	%		
	Directional sensitivity	V		
	Tripping time :			
	- min. tripping time	msec		
	- max. reset time	msec		
	Step timing setting ranges :			
	- 2nd step	sec.		
	- 3rd step	sec.		
	- 4th step	sec.		
8	Accuracy of the time step relay in % of the full scale value	%		
	(respective fault)			
	Temperature error			
	In the range of -5°C to +50°C (referred to 25°C and full scale value)	%		
	<u>Output Characteristics</u>			
	Tripping contacts (for each function) :			
	a) - Making current	A		
	b) - Continuous current	A		
	c) - Breaking capacity	A		
	d) - Number and type of contacts	nos.		
	Indication contacts : for each function			

	- Making current	A		
	- Continuous current	A		
	- Breaking capacity	VA		
	- Nos. and type of contacts	Nos		
	Does the relay have separate contact for self-monitoring function	Yes/No		
9	- Operating voltage	VDC	nominal 220/110	
	- Making current	A		
	- Breaking capacity	VA		
	<u>Local Signalling :</u>			
	- Starting on phases R, S, T			
	- E/F			
	- Tripping of phases R, S, T			
	- Tripping time T2,T3, T4, T5			
10	Tripping by signal received from other end			
	- Protection in operation			
	- Internal alarm			
	- Others			
	<u>Blocking Unit For Power Swings</u>			
11	Type reference			
	Is the operation independent on the starting elements or not			
	Setting range			
	Does the relay have over-riding feature for power swing blocking when simultaneous fault and power swing happens	Yes/No		
	<u>General Data</u>			
	Power supply		220/110 (+10-30%)	
	Tolerance			
	Operational temperature range	°C	(-5 , + 50)	
	Guarantee data maintained			
	Test voltage :			
	a)- Impulse withstand voltage 1,2/50µs	kV	5	
	b) - Power frequency withstand voltage, 1min	kV	2	
	Weight	Kg		
12	<u>Testing and Monitoring Facilities :</u>			

	- Built in test feature	yes/No	Yes	
	- Built in self monitoring	yes/No	Yes	
	- Built in self testing	yes/No	Yes	
	Means for rapid functional test	yes/No	Yes	
13	Method of ensuring operation for close-up three phase faults			
14	Accuracy of impedance settings for:			
	system impedance ratios ≤ 30	%		
	system impedance ratios 30-60			
15	<u>1-OPERATING TIMES IN ACCORDANCE WITH TABLE :</u>			
	system impedance ratio = 10	ms		
	system impedance ratio = 30	ms		
	system impedance ratio = 60	ms		
	<u>2-TRIPPING SCHEMES INCLUDED:</u>			
	- <u>acceleration</u>	Yes/No		
	- <u>permissive under rich</u>	Yes/No		
	- <u>permissive over rich</u>	Yes/No		
	- <u>blocking</u>	Yes/No		
	- <u>transient cording</u>	Yes/No		
	- <u>back up overcurrent protection</u>	Yes/No		
16	Is shaping for load encroachment provided	Yes/No		
17	-Degree of protection	IP	≥ 50	
18	1- VT supervision:			
	-Is VT supervision provided	Yes/No	YES	
	-VT supervision blocked during single pole autoreclose	Yes/No		
	-Is VT supervision blocked during line deenergization	Yes/No	YES	
	-Does the operating time of fuse failure is less than Zone 1 operating time .	Yes/No	YES	
19	Is a 'switch-onto-fault' feature provided	Yes/No	YES	

20	Is integral or separate directional earth fault protection provided a) residual current or power setting range. B) reset ratio. C) accuracy of pick up value. D) response time for measuring element. E) reset time for measuring element. F) inverse time characteristics. g) accuracy of time element. h) tele-protection tripping scheme that the DEF is applied for. i) does the DEF function include time delay as backup feature in case of tele-protection scheme failure?	Yes/No	YES	
21	Does DEF operate in permissive overreach transfer trip mode	Yes/No		
22	Is over and under voltage protection function included in distance protection	Yes/No		
23	Does the relay include an integral fault locator:	Yes/No	YES	
	a) is fault location affected by: - arc resistance in case of phase to earth fault? - high resistance earth faults with remote end in feed? - load current?			
	B) distance to fault is displayed on the front panel in the form of: kilometers, percent of line length or both.			
	c) fault location measuring error.			
24	Does the relay include an integral oscillographic recorder	Yes/No	Preferably integrated	
	a) fault recording memory capacity			
	b) number of analogue channels			
	c) number of digital channels			
	d) pre fault time			
	e) fault time			
	sample interval	s/c		
	F) software identification			

	GPS system inputs for real time synchronizing existence			
	g)the disturbances are collected and exported in COMTRADE format			
25	Does the relay include a self-diagnostic feature.	Yes/No		
26	Does the relay include an integral event recorder.	Yes/No	YES	
27	Does the relay include facilities for remote communication with DCS and what is the protocol IEC 60850)	Yes/No	YES	
28	How many processor or micro controller is considered in the relay			
	Number of setting groups that can be set independently .			
	Number of fault data that can be read out at the front display of distance protection (to be specified).			
	Number of fault data that can be stored in distance protection and the total time of them (to be specified).			
	Number AI gorithems used for discriminating the faults(to be specified). .			
29	Method of communicating the relay BY both methods :			
	a) Manually (M.M.C) unit			
	b) By P.C			
	d) port for central control system			
30	- hardware properties:			
	- NO of optically isolated inputs			
	- NO of output relays			
	- NO of fixed function LEDs and programmable LEDs			
	- NO of setting groups			
	- NO of front EIA(RS) 232 communication port (choice of protocol)			
	- NO of Rear EIA (RS)485 communication port (choice of protocol)			
	- display characteristics :			
	a) dimensions			
	b) number of rows			
	c) number of characters in per row			
31	Type test certificate details :			

	a) - Testing station			
	b) - Certificate numbers			
	c) - Applied standard specifications			
32	Does the Relay include configurable(programamable) logic (programmable scheme logic PSL)			
	Does the software include actual metering and phaser diagram			
	Does the relay supports IEC 61850 protocol			
	Total 2.3-7 Numerical Line Distance Protection			

2.3.9 -Instruments(Mesuring center)

(FOR 66KV CONTROL PANEL& 20 KV SWITCHGEAR)

(To be filled-in and signed by offerer)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
1	Manufacturer name / country			
2	ISO 9001 certificate	Yes/No	Should be submitted	
3	Type reference			
4	Rated value :			
	a) Frequency	Hz	50	
	b) Voltage	V	100/ $\sqrt{3}$	
	c) Current	A	1	
5	Overload capacity (continuous)	%		
6	Measuring accuracy	Yes/No	cl. 0.5	
7	Temperature range	°C	(-5, +50)	
8	Test voltage :			
	a) Impulse	kV	5	
	b) Power frequency (1 min.)	kV	2	
9	Power consumption :			
	a) Voltage circuit	VA		
	b) Current circuit	VA		
10	Dimensions	mm		
11	With remote communication facilities with SCADA level and switchgear level .			
12	Terminals			
13	Does the M.C have tarriff (at least 3 tarriff) .	Yes/No	Yes	
14	Does the M.C have output pulse .	Yes/No	Yes	
15	The measuring center should measure the following quantities (at least) :			
	I) current , three phase	Yes/No	Yes	
	II) voltage , three phase	Yes/No	Yes	
	III) active power } (import and export)	Yes/No	Yes	
	IV) reactive power } (import and	Yes/No	Yes	

	export)			
	V) active energy	Yes/No	Yes	
	VI) reactive energy	Yes/No	Yes	
	VII) power factor	Yes/No	Yes	
	VIII) power quality (up to 15 th harmonic voltage and current input	Yes/No	Yes	
	IX) Max. demand	Yes/No	Yes	
	X) Load profile	Yes/No	Yes	
16	Number of quantities which can be measured	No.	≥ 10	
17	Accuracy for energy measuring	Yes/No		

2.3-10- Guarantee Schedule for Tripping and control relay)

(To be filled-in and signed by offerer)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
1	a-Manufacturer's name/country b- Type designation and (order number)		a- b-	
2	ISO 9001 certificate	Yes/No	Should be submitted	
3	Type reference			
4	Rated value :			
	a) Frequency	Hz	50	
	b) Voltage	V		
	c) Current	A		
5	Burdens :			
	a) Burden at higher rated voltage	W		
	b) Minimum operating current	mA		
6	Operate time			
	Operate time (Standard flag)	msec.		
	Operate time (Following flag)	msec		
7	Reset time	msec		
8	Operation indicator	msec		
9	Contacts:	msec		
	Contacts ratings	msec		
	Make and carry for 3 seconds	A		
	Make and carry continuously	A		
	current breaking			
	no of contacts			
10	Overload capacity (continuous)	%		
11	Contact resistance (see note 2)			

12	Insulation resistance (see note 4)			
13	Temperature range	°C	(-5, +50)	
14	Test voltage :			
15	a) Impulse	kV	5	
	b) Power frequency (1 min.)	kV	2	
	Power consumption :			
	a) Voltage circuit	VA		
	b) Current circuit	VA		
16	Self reset			
17	Weight	KG		
	Total 2.3-10 Tripping and control relay			

2.3-11- Guarantee Schedule for lock out relay)

(To be filled-in and signed by offerer)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
1	a-Manufacturer's name/country b- Type designation and (order number)		a- b-	
2	ISO 9001 certificate	Yes/No	Should be submitted	
3	Type reference			
4	Rated value :			
	a) Frequency	Hz	50	
	b) Voltage	V		
	c) Current	A		
5	Burdens :			
	a) Burden at higher rated voltage	W		
	b) Minimum operating current	mA		
6	Operate time			
	Operate time (Standard flag)	msec		
	Operate time (Following flag)	msec		
7	Reset time	msec		
8	Operation indicator			
9	Contacts:			
	Contacts ratings			
	Make and carry for 3 seconds			
	Make and carry continuously			
	Current breaking	A		

	Number of contact	No.		
10	Overload capacity (continuous)	%		
11	Contact resistance (see note 2)			
12	Insulation resistance (see note 4)			
13	Temperature range	°C	(-5, +50)	
14	Test voltage :			
	a) Impulse	kV	5	
	b) Power frequency (1 min.)	kV	2	
15	Power consumption :			
	a) Voltage circuit	VA		
	b) Current circuit	VA		
16	Electrical/ hand reset	Yes/No		
17	Weight	mm		
	Total for lock out relay			

2.3-12- Guarantee Schedule for trip circuit supervision TCS relay)

(To be filled-in and signed by offerer)

Item	Description	Unit	ETA REQUIRMENTS	OFFER VALUE
1	a-Manufacturer's name/country b- Type designation and (order number)		a- b-	
2	ISO 9001 certificate	Yes/No	Should be submitted	
3	Type reference			
4	Rated value :			
	a) Frequency	Hz	50	
	b) Voltage	V		
	c) Current	A		
5	Burdens :			
	a) Burden at higher rated voltage	W		
	b) Minimum operating current	mA		
6	Operate time			
	Operate time (Standard flag)	msec		
	Operate time (Following flag)	msec		
7	Reset time	msec		
8	Operation indicator			
9	Contacts:			
	Contacts ratings			
	Make and carry for 3 seconds			
	Make and carry continuously			
10	Overload capacity (continuous)	%		

11	Contact resistance (see note 2)			
12	Insulation resistance (see note 4)			
13	Temperature range	°C	(-5, +50)	
14	Test voltage :			
	a) Impulse	kV	5	
	b) Power frequency (1 min.)	kV	2	
15	Power consumption :			
	a) Voltage circuit	VA		
	b) Current circuit	VA		
16	Weight	kg		
	Total for trip circuit supervision TCS relay			

FINANCIAL SCHEDULES

BOOK (3)

(Part 1)

**SCHEDULES OF PRICES OF EQUIPMENT AND SPARE PART
FOR ONE OHL BAY(66) kV**

3.1-1 Schedule of Prices of Spare Parts for 66 kV Circuit Breaker

(a separate list to be submitted for each type)

Item	Description	Unit	Qty.	Unit Price FOB	Unit Price CPT	Total price FOB	Total Price CPT
1	Auxiliary switches of each type	set	1				
2	-Closing coils	No	2				
	-tripping coils	No	2				
3	Sealing gaskets for 3 poles	set	1				
4	Complete driving mechanism for circuit breaker with all the auxiliaries ready to be installed on poles . (Details to be given by offerer)	SET	1				
5	One bottle of 40 kg sf6	NO	1				
6	Total						

3.2-1 Schedule of Prices for Outgoing Feeder Bay 66 kV**(OVER HEADLINE)**

(To be filled-in and signed by offerer)

Item	Description	Unit	Qty.	Unit Price FOB	Unit Price CFR	Total price FOB	Total Price CFR
1	Set of bus bar connections	set	1				
2	Circuit breaker, 3 phase : - type SF6..... - 1250 A..... 31.5 KA.....	Nos.	1				
3	Disconnecting switch 3 phase without earthing switch, A. 1250 ..., .31.5 KA.....	Nos.	1				
4	Disconnecting switch with one earthing switch, 3 ph....1250.. A...31.5..... kA	Nos.	1				
5	Disconnecting switch 3 phase with one earthing switch, A. 1250 ..., .31.5 KA.....	Nos	1				
6	Current transformer , 1 phase as specified .	Nos	3				
6	Voltage transformer, 66 kv	Nos	3				
7	Lightning arresters 60 kv	Nos	3				
8	MATERIALS for connections with overhead line feeders *	set	1				
9	Steel structure	set	1				
10	All required materials for erection the bay (cables,connections.....etc)	set	1				
11	Marshaling kiosk for OHL	Nos.	1				
	Total for 66 kV outgoing feeder bay						

3.2-2 Schedule of Total Prices for 66 kV OHTL
(acc. to schedule no.(1) in Book (1-A)

(To be filled-in and signed by offerer)

Item	Description	Unit	Qty.	Unit Price FOB	Unit Price CPT	Total price FOB	Total Price CPT
2	Outgoing feeder bay acc. to Sch. (3.3.2-2)	Nos.	1				

3.2-3 SCHEDULES OF PRICES FOR PROTECTION, CONTROL AND METERING EQUIPMENT

3.2-3-1 Schedule of Prices for Protection , Control and metering for 66kV Outgoing Feeder Bay

(To be filled-in and signed by offerer)

Item	Description	Unit	Qty.	Unit Price FOB	Unit Price CPT	Total price FOB	Total Price CPT
	The conventional control / and protection panel shall be with the following facilities.	Compt.	1				
1	numerical measurements for voltage (0-80)kV (u1,u2,u3) & (u12,u23,u31). For currents (0-1200) A , (I1,I2,I3) at 66kV side and for Power factor included in measuring center in accordance to guarantee schedules (2-3-9) .						
2	Numerical Combined active and reac- tive power measurement with push button included in measuring center .						
3	Control and indicatings (discrepancy switches) for circuit breaker and disconnecting switch						
4	position indicators for earthing switches discrepancy switches						
5	Synchronizing switches						
6	Mimic diagram						
7	-Selector switch for local/remote control , dispatching center control -- -numerical annunciators ,current test box , voltage test box, push buttons.						
8	Set of terminals, protection switches, insulating and fixing, material, alarms and fault indication lamps						

	Total for conventional control of one 66kV feeder bay :						
--	---	--	--	--	--	--	--

Item	Description	Unit	Qty.	Unit Price FOB	Unit Price CPT	Total price FOB	Total Price CPT
9	3Ph,Numerical Programmable directional instantaneous –inverse-definite –time over current relay	Nos.	1				
10	Numerical directional Earth fault protection with the same for item (۹)	Nos	1				
11	Trip circuit supervision relays : - (T.C.S) trip relay - (94) trip relay - (86) look out relay - Under voltage relay(27)	Nos	2 2 1 1				
12	Distance protection (one system 21/21N)	Nos.	1				
13	Test switch for each main protection relay .	set	1				
14	Test plug for each substation						
15	Kwh – meter included in measuring center .	Nos.	2				
16	kVArh – meter included in measuring center .	Nos.	2				
17	Terminals auxiliary relays, protection switches, alarms & insulating and fixing material , panel , etc.	set	1				
18	Alarm unit with (20) windows						
19	One panel for protection equipment						
20	One panel for control equipment						
	Total for protection , control and metering for one 66 kv outgoing feeder :						

Grand total

Item	Description	Unit	Qty.	Unit Price FOB	Unit Price CPT	Total price FOB	Total Price CPT
1	Outgoing feeder bay	Nos.	1				
2	66kv control panel OHTL	Nos.	1				
3	66kv protection panel OHTL	Nos.	1				
4	Spare Parts for 66 kV Circuit Breaker	set	1				
5	Civil work (if required)	lot	1				
6	Errection ,testing.commessioning	LOT	1				
7	Civil & electricL DESIGN	LOT	1				
8	TOTAL						