

## PQR, Rev-00- (Numerical and Electromagnetic relays)

Annexure-1

## 1. Past Performance

The Bidder shall have supplied at least 10% of the total quantity covered under this enquiry as on the date of techno-commercial bid opening of this enquiry

Document required: Bidder to furnish unpriced P.O or Invoice copy or relevant documents in support of supply.

## 2. Experience Criteria

The offered type of relays as per enquiry should be in successful operation for at least 2 year in last 7 years as on the date of techno-commercial bid opening date of this enquiry

Document required: Bidder to furnish MOM with customer/ Site or Customer email/ letter or any customer document for commissioning status

## 3. Organizational Capability:

a) The bidder should be OEM

Bidder to furnish OEM certificate

b) The Bidder shall have after sales service support set-up for providing product repair/ rectification in India.

Bidder to furnish set-up details along with an undertaking in respect of above.

Arvind Kumar  
Dy. Manager / SWE

**ANNEXURE –A**  
**(Technical Specification of Numerical Relays, Trip Relays, Auxiliary Relays, Metrosil and Stablising resistor)**

**Item-01: Numerical IEC61850 compliant, Non-Directional Over-Current & Earth Fault Protection Relay (5CT Input) with dedicated element for REF/SEF (For Incomer & Outgoing)**

Details	Required Parameter	Vendor Compliance
IDMT O/C & E/F Relay	IDMT relay with three O/C and one E/F (both measured and derived E/F functions) with high set instantaneous elements for Phase and Earth fault	Complied / Not complied
Protection Settings		Complied / Not complied
Time Multiplier Setting	0.01 to 1.0 (in step of 0.01)	
Phase Fault	20% to 200% (in step of 1%)	
Earth Fault	5% to 40% (in step of 1%)	
High set Phase fault	50% to 1200% (in step of 1%)	
High set Earth Fault	50% to 400% (in step of 5%)	
SEF or REF (One of them will be used at a time)	Relay shall also have separate input for using as Standby Earth Fault (SEF) or Restricted Earth Fault (REF).	Complied / Not complied
REF (Restricted E/F) Setting	10-40% or better	Complied / Not complied
SEF (Standby E/F) Setting	2-16% or better (in steps of 1%)	
Time delay Settings for SEF	0-25 Seconds (in steps of 0.1 sec)	
Curve selection provision for IDMT 3 Sec. & 1.3 Sec (Extreme inverse, very inverse, Normal inverse, & High set instantaneous and High set with following IDMT Curves: NI 1 (1.3 Sec), NI 3 3 Sec) EI, VI, DT, DTL IS/IEC/IEEE/Curves of 3.0sec/1.0sec(time & current) shall be available. The relay should have CB Fail protection and time settable as per user. The relay should have features to monitor broken conductor.		Complied / Not complied
Mounting	Flush Mounted draw out type	Complied / Not complied
<b>Model</b>	<b>Vendor to inform in Tech. Offer</b>	
DC Auxiliary Supply	24V or 220V DC <b>(to be confirmed during order execution)</b>	Complied / Not complied
Operating voltage:	-20% to 10% of rated voltage.	Complied / Not complied

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Relay Configuration Software for relay settings, I/O configuration, programming scheme logic, retrieving and analyzing disturbance records, events etc. shall be supplied along with each lot of the relay.	One for a lot of 10 relays	Complied / Not complied
Standard	The relay shall comply with IS3231, IEC60255 & IEC61850	Complied / Not complied
CT Input Rating	<b>1A/5A (User Selectable)</b>	Complied / Not complied
For connecting wire	(A)Rear Access terminals.	Complied / Not complied
	(B) Each terminal shall be suitable for connecting two wires of 4 mm square cross-section for CT/PT and 2.5 sq mm for others.	Complied / Not complied
	(C) For termination of CT/PT wires terminals suitable for ring type lugs only are acceptable.	Complied / Not complied
	(D) Special lugs or socket, if required, shall be supplied in adequate quantity along with the relay.	Complied / Not complied
Frequency	50 Hz	Complied / Not complied
Programmable Digital Input and Digital output	12 DI + 10 DO	Complied / Not complied
Contact Rating- Carry Continuously Breaking capacity Making capacity	DC 5A @ 24V & 220V Maximum 1250VA Minimum 16A	Complied / Not complied
LED	Atleast 4 programmable LEDs with latching option	Complied / Not complied
Push Buttons	For setting the relay	Complied / Not complied
Password facility	Required	Complied / Not complied
Locals/remote switch with sufficient PF contacts	Required	Complied / Not complied
16x2 Bright Alphanumeric LCD display for settings, readings and fault tripping data of minimum number 10 reports( with date and time stamping)		Complied / Not complied
Measurements	L1,L2,L3 and Earth	Complied / Not complied
Burden AC Current input 5 A Rating	$\leq 0.2$ VA	Complied / Not complied
Environmental Temperature Operating range Storage range Humidity	As per IEC , 56 days at 40 <sup>0</sup> C and 95% RH	Complied / Not complied
<b>Additional Functions required</b>		
Trip circuit supervision (Scheme to be	Pre & Post	Complied / Not complied

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<b>submitted with the offer)</b>		
Disturbance Recording facility	Required	Complied / Not complied
Time Synchronization port	By IRIG-B or SNTP	Complied / Not complied
DC Healthy Protection	Required	Complied / Not complied
Relay should have two optical ports at rear for parallel redundancy to interface with third party SCADA on IEC61850 protocol.	Required	Complied / Not complied
Relay should have front port (RS232/RJ-45/USB) for relay configuration and records retrieval.	Required	Complied / Not complied
Front Port communication cable	One for a lot of 10 relays	Complied / Not complied
The relay should be able to communicate with all type of IEC 61850 compliant other and similar make relays and the local and remote workstations via optical fibre communication.		Complied / Not complied

**Item-02: Numerical IEC61850 compliant, Non-Directional over Current & Earth Fault Protection Relay (4 CT Input) (For Bus-coupler & Transformer)**

<b>Details</b>	<b>Required Parameter</b>	<b>Vendor Compliance</b>
IDMT O/C & E/F Relay	IDMT relay with three O/C and one E/F (both measured and derived E/F functions) with high set instantaneous elements for Phase and Earth fault	Complied / Not complied
Protection Settings		Complied / Not complied
Time Multiplier Setting	0.01 to 1.0( in step of 0.01)	
Phase Fault	20% to 200% (in step of 1%)	
Earth Fault	5% to 40% (in step of 1%)	
High set Phase fault	50% to 1200% (in step of 1%)	
High set Earth Fault	50% to 400% (in step of 5%)	
Curve selection provision for IDMT 3 Sec. & 1.3 Sec (Extreme inverse, very inverse, Normal inverse, & High set instantaneous and High set with following IDMT Curves: NI 1 (1.3 Sec), NI 3 3 Sec) EI, VI,DT,DTL IS/IEC/IEEE/Curves of 3.0sec/1.0sec (time & current) shall be available. The relay should have CB Fail protection and time settable as per user.		Complied / Not complied
Mounting	Flush Mounted draw out type	Complied / Not complied

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Model	Vendor to inform in Tech. Offer	
DC Auxiliary Supply	24V or 220V DC <b>(to be confirmed during order execution)</b>	Complied / Not complied
Operating voltage:	-20% to 10% of rated voltage.	Complied / Not complied
Relay Configuration Software for relay settings, I/O configuration, programming scheme logic, retrieving and analyzing disturbance records, events etc. shall be supplied along with each lot of the relay.	One for a lot of 10 relays	Complied / Not complied
Standard	The relay shall comply with IS3231, IEC60255 & IEC61850	Complied / Not complied
CT Input Rating	<b>1A/5A (User Selectable)</b>	Complied / Not complied
For connecting wire	(A)Rear Access terminals.	Complied / Not complied
	(B) Each terminal shall be suitable for connecting two wires of 4 mm square cross-section for CT/PT and 2.5 sq mm for others.	Complied / Not complied
	(C) For termination of CT/PT wires terminals suitable for ring type lugs only are acceptable.	Complied / Not complied
	(D) Special lugs or socket, if required, shall be supplied in adequate quantity along with the relay.	Complied / Not complied
Frequency	50 Hz	Complied / Not complied
Programmable Digital Input and Digital output	12 DI + 10 DO	Complied / Not complied
Contact Rating- Carry Continuously Breaking capacity Making capacity	DC 5A, 24V & 220V Maximum 1250VA Minimum 16A	Complied / Not complied
LED	At least 4 programmable LEDs with latching option	Complied / Not complied
Push Buttons	For setting the relay	Complied / Not complied
Password facility	Required	Complied / Not complied
Locals/remote switch with sufficient PF contacts	Required	Complied / Not complied
16x2 Bright Alphanumeric LCD display for settings, readings and fault tripping data of minimum number 10 reports( with date and time stamping)		Complied / Not complied
Measurements	L1,L2,L3 and Earth	Complied / Not complied
Burden AC Current input		Complied / Not complied

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5 A Rating	$\leq 0.2$ VA	
Environmental Temperature Operating range Storage range Humidity	As per IEC , 56 days at 40 <sup>0</sup> C and 95% RH	Complied / Not complied
<b>Additional Functions required</b>		
Trip circuit supervision ( <b>Scheme to be submitted with the offer</b> )	Pre & Post	Complied / Not complied
Disturbance Recording facility	Required	Complied / Not complied
Time Synchronization port	By IRIG-B or SNTP	Complied / Not complied
DC Healthy Protection	Required	Complied / Not complied
Relay should have two optical ports at rear for parallel redundancy to interface with third party SCADA on IEC61850 protocol.	Required	Complied / Not complied
Relay should have front port (RS232/RJ-45/USB) for relay configuration and records retrieval.	Required	Complied / Not complied
Front Port communication cable	One for a lot of 10 relays	Complied / Not complied
The relay should be able to communicate with all type of IEC 61850 compliant other and similar make relays and the local and remote workstations via optical fibre communication.		Complied / Not complied

**Item-03: Numerical IEC61850 compliant, Non-Directional Over-Current & Earth Fault Protection Relay (4CT +4VT) Input (Capacitor Feeder panel)**

Details	Required Parameter	Vendor Compliance
IDMT O/C & E/F Relay	IDMT relay with three O/C and one E/F (both measured and derived E/F functions) with high set instantaneous elements for Phase and Earth fault	Complied / Not complied
Protection Settings		Complied / Not complied
Time Multiplier Setting	0.01 to 1.0( in step of 0.01)	
Phase Fault	20% to 200% (in step of 1%)	
Earth Fault	5% to 40% (in step of 1%)	
High set Phase fault	50% to 1200% (in step of 1%)	
High set Earth Fault	50% to 400% (in step of 5%)	
NDR, Under voltage and Over voltage	The relay should have in built NDR, Under voltage and Over	Complied / Not complied

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	voltage features.	
NDR voltage Setting Time range Time Multiplier Setting  Under voltage relay (110V, 50Hz, AC) Setting Time delay range Time Multiplier Setting  Over voltage relay (110V, 50Hz, AC) setting Time delay range Time Multiplier Setting	2.5V to 20V(in suitable steps) 0.5 sec -20 sec (in steps of 1sec) 0.01 to 1.0 ( in step of 0.01)  30 to 95% (in steps of 5%)  0 sec -25 sec (in steps of 1sec) 0.01 to 1.0 (in step of 0.01)  105-170 % (in steps of 5%)  0 sec -25 sec (in steps of 1sec) 0.01 to 1.0 (in step of 0.01)	Complied / Not complied
Curve selection provision for IDMT 3 Sec. & 1.3 Sec (Extreme inverse, very inverse, Normal inverse, & High set instantaneous and High set with following IDMT Curves: NI 1 (1.3 Sec), NI 3 3 Sec) EI,VI,DT,DTL IS/IEC/IEEE/Curves of 3.0sec/1.0sec(time &current) shall be available. The relay should have CB Fail protection and time settable as per user.		Complied / Not complied
Mounting	Flush Mounted draw out type	Complied / Not complied
<b>Model</b>	<b>Vendor to inform in Tech. Offer</b>	
DC Auxiliary Supply	24V or 220V DC <b>(to be confirmed during order execution)</b>	Complied / Not complied
Operating voltage:	-20% to 10% of rated voltage.	Complied / Not complied
Relay Configuration Software for relay settings, I/O configuration, programming scheme logic, retrieving and analyzing disturbance records, events etc. shall be supplied along with each lot of the relay.	One for a lot of 10 relays	Complied / Not complied
Standard	The relay shall comply with IS3231, IEC60255 & IEC61850	Complied / Not complied
CT Input Rating	<b>1A/5A (User Selectable)</b>	Complied / Not complied
For connecting wire	(E) Rear Access terminals.	Complied / Not complied
	(F) Each terminal shall be suitable for connecting two wires of 4 mm square cross-section for CT/PT and 2.5 sq mm for others.	Complied / Not complied
	(G)For termination of CT/PT wires terminals suitable for ring type lugs only are acceptable.	Complied / Not complied

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	(H) Special lugs or socket, if required, shall be supplied in adequate quantity along with the relay.	Complied / Not complied
Frequency	50 Hz	Complied / Not complied
Programmable Digital Input and Digital output	12 DI + 10 DO	Complied / Not complied
Contact Rating- Carry Continuously Breaking capacity Making capacity	DC 5A @ 24V & 220V Maximum 1250VA Minimum 16A	Complied / Not complied
LED	At least 4 programmable LEDs with latching option	Complied / Not complied
Push Buttons	For setting the relay	Complied / Not complied
Password facility	Required	Complied / Not complied
Locals/remote switch with sufficient PF contacts	Required	Complied / Not complied
16x2 Bright Alphanumeric LCD display for settings, readings and fault tripping data of minimum number 10 reports( with date and time stamping)		Complied / Not complied
Measurements	L1,L2,L3 and Earth	Complied / Not complied
Burden AC Current input 5 A Rating	$\leq 0.2$ VA	Complied / Not complied
Environmental Temperature Operating range Storage range Humidity	As per IEC , 56 days at 40°C and 95% RH	Complied / Not complied
<b>Additional Functions required</b>		
Trip circuit supervision ( <b>Scheme to be submitted with the offer</b> )	Pre & Post	Complied / Not complied
Disturbance Recording facility	Required	Complied / Not complied
Time Synchronization port	By IRIG-B or SNTP	Complied / Not complied
DC Healthy Protection	Required	Complied / Not complied
Relay should have two optical ports at rear for parallel redundancy to interface with third party SCADA on IEC61850 protocol.	Required	Complied / Not complied
Relay should have front port (RS232/RJ-45/USB) for relay configuration and records retrieval.	Required	Complied / Not complied
Front Port communication cable	One for a lot of 10 relays	Complied / Not complied
The relay should be able to communicate with all type of IEC 61850 compliant other and similar make relays and the local and remote workstations via optical fiber communication.		Complied / Not complied



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**Item-04: Master Trip Relay**

Details	Required Parameter	Vendor Compliance
HIGH SPEED TRIPPING RELAY	High burden with coil cut-off contacts	Complied / Not complied
Type	Electro-magnetic type	Complied / Not complied
Contacts	6 NO + 4 NC, , Electrically reset	Complied / Not complied
Flag	Hand reset	Complied / Not complied
Auxiliary Supply	24V or 220V DC <b>(to be confirmed during order execution)</b>	Complied / Not complied
Operating voltage:	-20% to 10% of rated voltage.	Complied / Not complied

**Item-05: Three Element Auxiliary Relay**

Details	Required Parameter	Vendor Compliance
AUXILIARY RELAY	Three Element (Combination of two element + one element is acceptable)	Complied / Not complied
Type	Electro-magnetic type	Complied / Not complied
Contacts per element	4 NO + 2 NC, Self-Reset	Complied / Not complied
Flag	Hand reset	Complied / Not complied
Auxiliary Supply	24V or 220V DC <b>(to be confirmed during order execution)</b>	Complied / Not complied
Operating voltage:	-20% to 10% of rated voltage.	Complied / Not complied

**Item-06: Metrosil Resistor**

Metrosil Resistor for use with high impedance restricted earth fault / differential protection relays rated for 1A CT Secondary.	Complied / Not complied
Calculation/selection of Metrosil done shall be submitted for approval by BHEL before dispatch.	Complied / Not complied

**Item-07: Stabilising resistor**

Stabilising resistor of value 0-1000 ohms for use with high impedance restricted earth fault / differential protection.	Complied / Not complied
Calculation/selection of resistor done shall be submitted for approval by BHEL before dispatch.	Complied / Not complied

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	<b>GENERAL NOTES :</b>	
1	All relays shall comply with relevant IS/IEC. Type test reports may be required to produce during contract execution and in case of any ambiguity in the reports, same shall be carried out by vendor again without any binding on BHEL.	Complied / Not complied
2	Relay shall have rear access terminals suitable for taking two <b>lugged</b> wires of at least 2.5 square mm size for DC wiring and 4 mm square for CT/PT wiring.	Complied / Not complied
3	All contacts and coil connections of relay shall be independently wired out to relay terminals without any common point. Else all bunched output contacts or digital inputs will be treated as single output contact or digital input respectively.	Complied / Not complied
4	Special lugs / combiflex sockets (other than ring, fork and pin type lugs) required for wire terminations on the relay shall be supplied in adequate quantity with each relay, considering two terminations at each terminal. These shall be provided in the relay packing case itself (equal to twice the terminals) and shall not have any separate price implication.	Complied / Not complied
5	Five copies each of bound manuals comprising commissioning manuals, descriptive leaflets, wiring diagram and guaranteed technical particulars of each item shall be furnished before dispatch of equipment for submission to customer.	Complied / Not complied
6	Vendor shall furnish 2 sets of descriptive catalog, panel cutout, overall dimension drawings, electrical connection drawing, complete model number and technical particulars for each item along with the offer.	Complied / Not complied
7	The supplier shall guarantee the satisfactory performance of relays for a period 60 months from the date of commissioning.	Complied / Not complied
8	Vendor to keep the price of all the relays valid for two years from the date of last lot delivery for addressing the replacement of relays for the same customer/project in case of damage/theft during commissioning of panels.	Complied / Not complied
9	Items 1, 2 and 3 should conform to the IEC 255-5 or equivalent BS / ANSI for following: i) Overload withstand test ii) Dielectric withstand: 2 kV in common, 1 kV in differential mode iii) Impulse voltage: 5 kV in common, 1 kV in differential mode. iv) Insulation resistance > 100 MΩ v) Vibration: Shock and bump and seismic. vi) Storing and transportation vii) Radio interference: IEC 61000 for high frequency disturbance, Transient Disturbance, Electrostatic discharge. KEMI/CPRI certification for the particular model offered with respect to IEC 61850 protocol.	Complied / Not complied
10	<b>Type Tests :</b> The Numeric Over current relays(Items 1, 2 &3) shall comply with the requirements of following type tests as per latest edition of ISS/IEC: i) Dielectric withstand test-IEC 60255-5 ii) High voltage impulse test class III---IEC 60255-5(5 KV peak, 1.2/50 micro sec: 3 Positive and 3 negative shots at interval of 5 Sec.) iii) DC Supply interruption---IEC 60255-11 iv) AC ripple on DC supply --- IEC 60255-11 v) Voltage dips and fault interruptions---IEC 61000-4-11 vi) High frequency disturbance---IEC 60255-22-1,class III or upgraded relevant IEC vii) Fast transient disturbance---IEC 60255-22-4,CLASS IV viii) Surge withstand capability---IEEE/ANSI C 37.90.1(1989) or equivalent IEC ix) Degree of protection x) Electromagnetic compatibility xi) Mechanical stress/vibration test xii) Temperature withstand Where ever the above mentioned standards and IEC 61850 overlap the latter will prevail.	Complied / Not complied