

**GUARANTEED TECHNICAL PARTICULARS FOR 33kV, 200A, 50 Hz AB SWITCH,(CHAPTER-E16)****3 POLE, SINGLE BREAK TYPE**

Sl. No	Particulars	Desired values	Bidder's offer
1	2	3	4
1	Maker's name and country of origin	To be specified by the tenderer	
2	Type of Switch	Rotating type only	
3	Suitable for mounting	Horizontal only	
4	Number of supporting Post Insulators per phase	4 nos. (22kV / 24kV Post Insulators per phase as per ISS-2544/1973)	
5	Post Insulator.		
a)	Maker's name and country of origin	To be specified by the tenderer	
b)	Type of cementing	To be quoted for original cemented only & as per IS-2544-1973 & relevant IEC.	
c)	One minute power frequency withstand voltage Dry	95kV rms.	
d)	One minute power frequency withstand voltage Wet	75kV rms.	

e)	Visible discharge voltage	27kV rms.	
f)	Dry Flash Over Voltage	125 kV	
g)	Power frequency puncture with stand voltage	1.3 times of actual dry flash over voltage	
h)	Impulse withstand voltage (switch in position)	170kV(peak)	
i)	Creepage distance (mm)	430 mm minimum. (actual Creepage distance for which type test have been conducted is to be specified by the tenderer)	
6	Impulse withstand voltage for positive and negative polarity 1.2 / 50 micro-second wave		
a)	Across the isolating distance	195kV(peak)	
b)	To earth & between poles	170kV(peak)	
7	One minute power frequency withstand voltage		
a)	Across the isolating distance	80kV(rms)	
b)	To earth & between poles	70kV(rms)	
8	Rated normal current and rated frequency	200 Amp 50 Hz	

9	Rated short time current.	16kA( rms )	
10	Rated short circuit making capacity	25kA(rms)	
11	Rated peak withstand current	40kA( Peak )	
12	Rated cable charging breaking capacity	40kA( rms )	
13	Rated Transformer off load breaking capacity	16 Amp(rms)	
14	Rated line charging breaking capacity	5.3 Amp( rms)	
15	Minimum clearance between adjacent phases		
a)	Switch Closed ( centre to centre)	1200 mm	
b)	Switch Opened ( centre to edge of blade)	640 mm	
16	Temperature rise		
a)	Temperature rise shall not exceed the maximum limit as specified below at an ambient temperature not exceeding in	40 0 C	
b)	Copper contacts in air	65 <sup>0</sup> C	

c)	Terminal of switch intended to be connected to external conductor by bolts	50°C	
17	Vertical Clearance from top of insulator cap to mounting channel	508 mm (minimum)	
18	Type of Contact: -	a) Self aligned, high pressure jaw type fixed contacts of electrolytic copper of size 80 mm x 50 mm x 8 mm duly silver plated. Each contact should be revetted with three nos. Copper rivets with a bunch (minimum 3 mm thick) consisting of copper foils, each may vary from 0.15 mm to 0.25 mm. These total thickness of copper foils per jaw should be 6 mm. Jaw assemblies are to be bolted through stainless steel bolts and nuts with stainless steel flat and spring washer.	
		b) Solid rectangular blade type moving contact of electrolytic copper size 250 mm x 50 mm x 8 mm duly silver plated ensuring a minimum deposit of 10 micron of silver on copper contacts or as may be prescribed under relevant ISS / IEC.	
		c) Pressure spring to be used in jaw contacts shall be Stainless Steel having 8 nos of turn x 28 mm height x 14.4 mm diameter with 14 SWG wire (minimum six nos springs shall be used)	

19	Connectors:-	Terminal connectors for both movable and fixed should be of copper flats of same size similar to that of moving contact blades (minimum 95% copper composition). The fixed connector shall of size 80 mm x 50 x 8 mm and the size of movable connector shall be size 80 x 50 x 8 mm with machine finishing duly silver plated with 2 nos. of 3/8" stainless steel bolts, nuts, plain washers & spring washers should be provided along with 2 nos solder less bimetallic sockets for each connector suitable up to 232 mm <sup>2</sup> AAA Conductor.					
20	Moving Contacts:-	Movable contact is to be supported by galvanized angle of 50 x 50 x 5 mm in each phase and the moving contact are to be bolted					
21	Galvanization	a) Iron parts shall be dip galvanized as per IS-2633/1972.					
		b) The pipe shall be galvanized as per IS-4736/1968.					
22	Details of Phase						
a)	Coupling Rod	25 mm nominal bore G.I. pipe medium gauge.					
b)	Operating Rod	32 mm nominal bore G.I. pipe medium gauge single length 6 mtrs. The detailed dimension of the G. I. pipe as per IS-1239 (Pt. I) as					
		Nominal base (mm)	Outside diameter (mm)	Diameter thickness (mm)	Nominal base (mm)	Outside diameter (mm)	Diameter thickness (mm)
			Max	Min	Max	Min	

		25	34.2	3.25			
		32	42.9	3.25			
c)	Arcing Horns	10 mm dia G.I. rod with spring assisted operation.					
d)	Force of Fixed contact spring	To be specified by the tenderer.					
e)	Copper braided flexible tapes:-	450 mm length of flexible electrolytic copper tape or braided chord (with tin coated) having minimum weight 450 gms per meter and both					
f)	Quick break device	Lever mechanism.					
g)	Bearings	4 nos. self lubricated bearing to be provided with grease nipple including 4th bearing being a thrust bearing.					
h)	Locking arrangement	Pad Lock & Key arrangement at both 'ON' & 'OFF' position.					
i)	Earth Terminal:	To be provided at base channels.					
23	Supporting Channels	100 mm x 50 mm M.S. Channel hot dip galvanized.					
24	Weight of each pole complete	To be specified by the tender					

**GUARANTEED TECHNICAL PARTICULARS FOR 11kV, 200A, 50 Hz AB SWITCH, (CHAPTER-E16)**

**3 POLE, SINGLE BREAK TYPE**

Sl. No.	Particulars	Desired values	Bidder's offer
1	2	3	4
1	Maker's name and country of origin	To be specified by the tenderer	
2	Type of Switch	Rotating type only	
3	Suitable for mounting	Horizontal only	
4	Number of supporting Post Insulators per phase	2 nos. (12 kV Post Insulators per phase as per ISS-2544/1973)	
5	Post Insulator.		
a)	Maker's name and country of origin	To be specified by the tenderer	
b)	Type of cementing	To be quoted for original cemented only & as per IS-2544-1973 & relevant IEC.	
c)	One minute power frequency withstand voltage Dry	35kV rms.	

d)	One minute power frequency withstand voltage Wet	35kV rms.	
e)	Visible discharge voltage	9kV rms.	
f)	Dry Flash Over Voltage	55 kV	
g)	Power frequency puncture with stand voltage	1.3 times of actual dry flash over voltage	
h)	Impulse withstand voltage (switch in position)		
i)	Creepage distance (mm)	330 mm minimum. (actual Creepage distance for which type test have been conducted is to be specified by the tenderer)	
6	Impulse withstand voltage for positive and negative polarity 1.2 / 50 micro-second wave		
a)	Across the isolating distance	85kV(peak)	
b)	To earth & between poles	75kV(peak)	



7	One minute power frequency withstand voltage		
a)	Across the isolating distance	32kV(rms)	
b)	To earth & between poles	28kV(rms)	
8	Rated normal current and rated frequency	200 Amp 50 Hz	
9	Rated short time current.	16kA( rms )	
10	Rated short circuit making capacity	25kA(rms)	
11	Rated peak withstand current	40kA( Peak )	
12	Rated cable charging breaking capacity	10kA( rms )	
13	Rated Transformer off load breaking capacity	6.3 Amp(rms)	

14	Rated line charging breaking capacity	2.5 Amp( rms)	
15	Minimum clearance between adjacent phases		
a)	Switch Closed ( centre to centre)	760 mm	
b)	Switch Opened ( centre to edge of blade)	380 mm	
16	Temperature rise		
a)	Temperature rise shall not exceed the maximum limit as specified below at an ambient temperature not exceeding in	40 0C	
b)	Copper contacts in Silver Plated	65 <sup>0</sup> C	
c)	Terminal of switch intended to be connected to external conductor by bolts	50 <sup>0</sup> C	
17	Vertical Clearance from top of insulator cap to mounting channel	254 mm (minimum)	

18	Type of Contact: -	a) Self aligned, high pressure jaw type fixed contacts of electrolytic copper of size 80 mm x 50 mm x 8 mm duly silver plated. Each contact should be revetted with three nos. Copper rivets with a bunch (minimum 3 mm thick) consisting of copper foils, each may vary from 0.15 mm to 0.25 mm. These total thickness of copper foils per jaw should be 6 mm. Jaw assemblies are to be bolted through stainless steel bolts and nuts with stainless steel flat and spring washer.	
		b) Solid rectangular blade type moving contact of electrolytic copper size 220 mm x 50 mm x 8 mm duly silver plated ensuring a minimum deposit of 10 micron of silver on copper contacts or as may be prescribed under relevant ISS / IEC.	
		c) Pressure spring to be used in jaw contacts shall be Stainless Steel having 8 nos of turn x 28 mm height x 14.4 mm diameter with 14 SWG wire (minimum six nos springs shall be used)	
19	Connectors:-	Terminal connectors for both movable and fixed should be of copper flats of same size similar to that of moving contact blades (minimum 95% copper composition). The fixed connector shall of size 80 mm x 50mm x 8 mm and the size of movable connector shall be size (80 x 50) x(80x50)x 8 mm with machine finishing duly silver plated with 2 nos. of 12mm dia. hole with suitable brass & double nuts with brass flat washers and 2nos solderless bimetallic sockets per each connector suitable 80 mm <sup>2</sup> AAA Conductor.	

20	Moving Contacts:-	Movable contact is to be supported by galvanized angle of 50 x 50 x 5 mm in each phase and the moving contact are to be bolted through 2 no stainless steel bolts and nuts with suitable stainless steel flat and spring washers.	
21	Galvanization	a) Iron parts shall be dip galvanized as per IS-2633/1972.	
		b) The pipe shall be galvanized as per IS-4736/1968.	
22	Details of Phase		
a)	Coupling Rod	25 mm nominal bore G.I. pipe medium gauge.	
b)	Operating Rod	32 mm nominal bore G.I. pipe medium gauge single length 6 mtrs. The detailed dimension of the G. I. pipe as per IS-1239 (Pt. I) as mentioned below :-	
c)	Arcing Horns	8 mm dia G.I. rod with spring assisted operation.	

d)	Force of Fixed contact spring	To be specified by the tenderer.	
e)	Copper braided flexible tapes:-	320 mm length of flexible electrolytic copper tape or braided chord (with tin coated) having minimum weight 450 gms per meter and both ends shall be crimped with copper sockets through brass bolts and nuts with brass flat washers. Two nos of suitable copper sockets shall be used at both ends. The minimum no. of flexible wires should be 1536 of 36 SWG for each flexible chord.	
f)	Quick break device	Lever mechanism.	
g)	Bearings	4 nos. self lubricated bearing to be provided with grease nipple including 4th bearing being a thrust bearing.	
h)	Locking arrangement	Pad Lock & Key arrangement at both 'ON' & 'OFF' position.	
i)	Earth Terminal:	To be provided at base channels.	

j)	T connection	The T connection provided on the channel having moving contact shall be of G.I Nut & bolt at the bottom end to facilitate replacement of this unit only during requirements & avoid entire change of the arm				
k)	I Bolt	The I bolt shall be longer with 75mm thread				
23	Supporting Channels	100 mm x 50 mm M.S. Channel hot dip galvanized.				
24	Weight of each pole complete	To be specified by the tender				

## GUARANTEED AND OTHER PARTICULARS FOR STATION TRANSFORMERS (CHAPTER-E16)

### 33/0.433 kV 100kVA Station Transformer

(To be furnished by the Manufacturer)

Sl. No.	Particulars	Bidder's Offer
1	Make	
2	Name of Manufacturer	
3	Place of Manufacture	
4	Voltage Ratio	
5	Rating in kVA	
6	Core Material used and Grade:	
	a) Flux density	
	b) Over fluxing without saturation	
	(Curve to be furnished by the Manufacturer in support of his claim)	
7	Maximum temperature rise of:	
	windings by resistance method	
	Oil by thermometer	

8	Magnetizing (no-load) current at:	
	a) 90% Voltage	
	b) 100% Voltage	
	c) 110% Voltage	
9	Core loss in watts:	
	a) Normal voltage	
	b) Maximum voltage	
10	Resistance of windings at 20°C, 75°C	
	(with 5% tolerance)	
	a) HV Winding (ohms)	
	b) LV Winding (ohms)	
11	Load losses (watts) at 75°C at normal tap (100% Load Condition)	



12	TOTAL Losses (Load loss +No Load Loss)at 100% load at 75°C at rated Voltage, frequency & at normal tap.	
13	Total Losses at 50% load at 75°C	
14	Current density used for: (Ampere/sq mm)	
	a) HV Winding.	
	b) LV Winding.	
15	Clearances: (mm)	
	a) Core and LV	
	b) LV and HV	
	c) HV Phase to phase	
	d) End insulation clearance to earth	
	e) Any point of winding to tank.	

16	Efficiency at 75°C	
	a)Unity P.F and	
	b) 0.8 P.F.	
	1) 125°C load	
	2) 100°C load	
	3) 75°C load	
	4) 50°C load	
	5) 25°C load	
17	Regulation at:	
	a) Unit P.F.	
	b) 0.8 P.F. at 75°C	

18	% Impedance at 75°C	
19	Flash test:-	
	i) HV 70 kV/ 50HZ for 1 minute	
	ii) LV 3 kV /50 Hz for 1 minutes.	
20	Over potential test (Double voltage and	
	Double frequency for 1 minute)	
21	Impulse test.	
22	Mass of : (kg)	
	a) Core lamination (minimum)	
	b) Windings (minimum)	
	c) Tank and fittings	

	d) Oil	
	e) Oil quantity (minimum) (litre)	
	f) Total weight	
23	Oil Data:	
	1) Quantity for first filling (minimum) (litre)	
	2) Grade of oil used.	
	3) Maker's name	
	4) BDV at the time of filling (kV)	

24	Transformer:	
	1) Overall length x breadth x height (mm x mm x mm)	
	2) Tank length x breadth x height	
	3) Thickness of plates for	
	a) Side plate (min)	
	b) Top and bottom plate (min)	
	4) Conservator Dimensions.	
25	Radiation:	
	1) Heat dissipation by tank walls excluding top and bottom	
	2) Heat dissipation by cooling tube	
	3) Diameter and thickness of cooling tube.	

	4) Whether calculation sheet for selecting cooling	
	area to ensure that the transformer is capable	
	of giving continuous rated output without	
	exceeding temperature rise is enclosed.	
26	Inter layer insulation provided in design for:	
	1)Top and bottom layer	
	2)In between all layer	
	3)Details of end insulation.	
	4)Whether wedges are provided at 50°C turns of the HV coil.	
27	Insulation materials provided.	
	a)For Conductors	

	1 HV	
	2 LV	
	b)For Core.	
28	Material and Size of the wire used.	
	HV	
	Dia (mm)	
	Number of conductors in parallel	
	Total cross sectional area	
	LV	
	Dia (mm)	
	Number of conductors in parallel	

	Total cross sectional area	
29	Whether the name plate gives all particulars as required in tender	
30	Particulars of bushings HV/LV	
	1)Maker's name	
	2)Type IS-3347/IS-2099/IS-7421	
	3)Rating as per IS	
	4)Dry power frequency voltage withstand test	
	5)Wet power frequency voltage withstand test.	
Note:		
The following shall be specifically confirmed:		
1)	Whether the offer conforms to the limits of impedance mentioned in the specification.	
2)	Whether the offer conforms to the limits of temperature rise mentioned in the specification.	



3)	Whether the losses of the transformers offered are within the limits specified.	
4)	Whether the transformer offered is already type tested for the design and test reports enclosed.	
Sl. No.	Description	
1	Core Grade	
2	Core diameter(mm)	
3	Gross core area(Sq cm)	
4	Net core area(Sq cm)	
5	Flux density(Tesla)	
6	Mass of core(Kg)	
7	Loss per kg of core at the specified flux density(watt)	
8	Core window height(mm)	
9	Center to enter distance of the core(mm)	
10	No.of LV Turns	
11	No.of HV turns	

12	Size of LV conductor bare/covered(mm)	
13	Size o HV conductor bare/covered(mm)	
14	No. of parallels	
15	Current density of LV winding.(A/sq mm)	
16	Current density of HV winding.(A/sq mm)	
17	Wt. of the LV winding for Transformer (kg)	
18	Wt. of the HV winding for Transformer (Kg)	
19	No. of LV Coils/phase	
20	No. of HV Coils/phase	
21	Height of LV Winding.(mm)	
22	Height of HV Winding.(mm)	
23	ID/OD of HV winding(mm)	
24	ID/OD of LV winding(mm)	
25	Size of the duct in LV winding(mm)	
26	Size of the duct in HV winding(mm)	

27	Size of the duct between HV and LV(mm)	
28	HV winding to LV winding clearance(mm)	
29	HV winding to tank clearance(mm)	
30	Calculated impedance(%)	
31	HV to earth creepage distance(mm)	
32	LV to earth creepage distance(mm)	

GUARANTEED TECHNICAL PARTICULARS FOR 100 mm <sup>2</sup> AAAC (CHAPTER-E16)			
Sl. No.	Particulars	Desired Value	Bidder's offer
1	Make		
2	No. of strands	7	
a)	3 Wire dia in mm.:		
	Nominal	4.26	
	b) Minimum	4.22	
	c) Maximum	4.3	
4	Approximate overall dia of the conductor in mm. Cross-sectional area of:	12.78	
5.a)	Individual wire in mm <sup>2</sup>	14.25	

b)	Stranded conductor in mm <sup>2</sup>	99.81	
6.a)	Approx Mass of :		
b)	Individual wire in Kg/Km	38.48	
c)	Stranded Conductor in Kg/Km	272.86	
7.a)	Minimum breaking load in KN		
b)	Individual wire	4.18	
c)	Conductor (U.T.S.)	29.26	
8.a)	Calculated maximum DC resistance at 20 °C in Ohm/ Km		
b)	Individual wire	2.345	

c)	Conductor	0.339	
9	Lay ratio for 7 wire conductor	Min : 10, Maxm : 14	
10	Direction of Lay	Right handed	
11	Modulus of Elasticity (Kg/ cm <sup>2</sup> )	$0.63\ 24 \times 10^6$	
12	Co-efficient of linear expansion per <sup>0</sup> C	$23.0 \times 10^{-6}$	
13	Standard length (Mtr.)	$2000 \pm 5\%$	
14	Size of drum in mm.		
15	No. of lengths in one drum		
16	No. of cold pressure butt welding	8 (Eight)	

**GUARANTEED TECHNICAL PARTICULARS FOR 200 AMP, 3 POLE, H.G. FUSE WITH SUPPORT INSULATOR. (CHAPTER-E16)**

<b>Sl. No.</b>	<b>Particulars</b>	<b>Desired Values</b>	<b>Bidder's Offer</b>
1	2	3	4
1	Maker's name and country or origin	To be specified by the tenderder.	
2	Suitable for mounting	Horizontal only.	
3	Number of supporting post insulator per phase	4 nos. 22KV/24KV Post Insulator per phase as per ISS - 2544/ 1973	
4	Post Insulator		
(a)	Maker's name and country or origin	To be specified by the tenderder.	
(b)	Type of cemeting	To be quoted original cemented only.	
(c )	One minute power frequency withstand voltage dry	95KV RMS	
(d)	One minute power frequency withstand voltage wet.	75 KV RMS.	
(e)	Visible discharge voltage	27KV RMS	
(f)	Dry Flashover Voltage	To be specified by the tenderder.	
(g)	Power frequency puncture withstand voltage	1.3 times of actual dry flash over voltage.	

(h)	Impulse withstand voltage(Switching Position)	170KV (peak)	
(I )	Creepage distance	380mm minimum. (actual creepage distance for which type test have been conducted is to be specified by the bidder )	
5	Impulse withstand voltage for positive and negative polarity (1.2/50 micro second wave)		
(a)	Across the isolating distance	195 KV (peak)	
(b)	To earth & between poles	170 KV (peak)	
6	One minute power frequency withstand voltage		
(a)	Across the isolating distance	100 KV (RMS)	
(b)	To earth & between poles	75 KV (RMS)	
7	Rated normal current and rated frequency.	200 amps, 50 Hz , 3 Pole	
8	Operating Voltage	33 KV	
9	Vertical clearance from top of insulator cap to mounting Channel	508 mm (minimum)	
10	Height of the riser for carrying the horns.	250mm from the cap (top) of insulator.	



11	Details of Arcing Horns	Copper rod having 8.32 mm dia Silver-plated provided with screwing arrangement for fixing use wire made of copper casting. (Total length 995mm). All the bolts, nuts and washers should be made out of brass.	
12	Riser Unit	(a) The shape of connectors may be made of straight copper Flat of size adequate enough to carry a current density not less than 1.5 Amp/ mm <sup>2</sup> . 2 Nos of 3/8" G.I. Bolts, double nuts, plain and spring washers and 2 nos. solder less bimetallic shockets per each connector suitable up to 232 mm <sup>2</sup> AAA conductor.	
	(250mm total height).		
		(b) 170mm height G.I. Riser made of 25mm nominal bore medium gauge G.I. Pipe welded with 2 nos. G.I. Flat of 35 x 5 mm at both ends fixed with 10mm dia stainless steel, bolts and nuts with flat stainless steel spring washers.	
13	Supporting Channels	100 x 50 x 6 mm M.S. Channel (galvanized)	
14	Galvanisation	All ferrous parts should be galvanized as per IS-2633/1972 & all non-ferrous part should be duly electroplated with silver.	

15	Weight of each pole (complete)	To be specified by the tenderder.	
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GUARANTEED TECHNICAL PARTICULARS FOR 200 AMP, 3 POLE, H.G. FUSE WITH SUPPORT INSULATOR. (CHAPTER-E16)			
Sl. No.	Particulars		
		11 KV	Bidder's Offer
1	Maker's name and country or origin	To be specified by the tenderder.	
2	Suitable for mounting	Horizontal only.	
3	Number of supporting post insulator per phase	2 nos. 12KV Post Insulator per phase as per ISS -2544/ 1973	
4	Post Insulator		
(a)	Maker's name and country or origin	To be specified by the tenderder.	
(b)	Type of cementing	To be quoted original cemented only.	
(c )	One minute power frequency withstand voltage dry	35KV RMS	
(d)	One minute power frequency withstand voltage wet.	35KV RMS	

(e)	Visible discharge voltage	9KV RMS	
(f)	Dry Flashover Voltage	To be specified by the tenderder.	
(g)	Power frequency puncture withstand voltage	1.3 times of actual dry flash over voltage.	
(h)	Impulse withstand voltage(Switching Position)	75KV (peak)	
(l )	Creepage distance	230mm minimum. (actual creepage distance for which type test have been conducted is to be specified by the bidder )	
5	Impulse withstand voltage for positive and negative polarity (1.2/50 micro second wave)		
(a)	Across the isolating distance	85KV (peak)	
(b)	To earth & between poles	75 KV (peak)	
6	One minute power frequency withstand voltage		
(a)	Across the isolating distance	32 KV (RMS)	
(b)	To earth & between poles	28 KV (RMS)	

7	Rated normal current and rated frequency.	200 amps, 50 Hz , 3 Pole	
8	Operating Voltage	11 KV	
9	Vertical clearance from top of insulator cap to mounting Channel	254 mm (minimum)	
10	Height of the riser for carrying the horns.	150mm from the cap (top) of insulator.	
11	Details of Arcing Horns	Copper rod having 7.62 mm dia Silver-plated provided with screwing arrangement for fixing use wire made of copper casting. (Total length 635mm). All the bolts, nuts and washers should be made out of brass.	

12	Riser Unit	(a) The shape of connectors may be made of straight copper Flat of size adequate enough to carry a current density not less than 1.5 Amp/ mm <sup>2</sup> . 2 Nos of 3/8" G.I. Bolts, double nuts, plain and spring washers and 2 nos. solder less bimetallic shocklets per each connector suitable up to 100 mm <sup>2</sup> AAA conductor.	
	(250mm total height).		
		(b) 100mm height G.I. Riser made of 19mm nominal bore medium gauge G.I. Pipe welded with 2 nos. G.I. Flat of 30 x 5 mm at both ends fixed with 10mm dia stainless steel, bolts and nuts with flat stainless steel spring washers.	
13	Supporting Channels	75 x 40 x 6 mm M.S. Channel (galvanized)	
14	Galvanisation	All ferrous parts should be galvanized as per IS-2633/1972 & all non-ferrous part should be duly electroplated with silver.	
15	Weight of each pole (complete)	To be specified by the tenderder.	

## TECHNICAL REQUIREMENT FOR 33 KV CURRENT TRANSFORMERS (CHAPTER-E16)

The Current Transformers under this specification shall conform to the parameters given below :-

Sl. No.	Particulars	Desired Value	Bidder's Offer
1	2	3	4
1	Make	To be Specified by Bidder	
2	Type of CT/Installation.	Single phase, dead tank, oil filled, hermetically sealed, outdoor, self-cooled	
3	Type of mounting.	Pedestal type	
4	Suitable for system frequency.	50 HZ $\pm$ 5 %	
5	Rated voltage (KV rms)	33	
6	Nominal system voltage (KV rms)	33	
7	Highest system voltage (KV rms)	36	
8	Current ratio (A/A)	a) 400-200/ 1-1-1A	
9	Method of earthing the system where the current transformer will be installed.	Solidly Effectively earthed.	
10	Rated continuous thermal current (A)	120 % of rated primary current	

11	Acceptable limit of temperature rise above 50°C ambient temperature for continuous operation at rated continuous thermal current.		
(a)	Winding	45°C	
(b)	Oil	40°C	
(c)	External surface of the core, metallic parts in contact with or adjacent to, insulation.	45°C	
12	Acceptable partial discharge level	Less than 10 picco coulombs	
13	Maximum radio interference voltage at 1.1 times the maximum rated voltage.	Less than 500 micro volts	
14	1.2/50 micro second lightning impulse withstand voltage (KVP) (dry)	170	
15	1 minute dry power frequency withstand voltage primary (KV rms)	70	
16	Switching Impulse with stand and voltage (KVP)	-- -	
17	1 Minute dry power frequency withstand voltage secondary (KV rms)	3	
18	Minimum creepage distance of porcelain Housing (mm)	900	
19	Rated short time withstand current for 1 second at all ratios (KA rms)	25KA	
20	Instrument security factor at all ratios for metering core.	Not more than 5.0	
21	Minimum rated short time thermal current density of the primary winding at all ratios (A/mm <sup>2</sup> )	As per clause No9.6.3- Note of IS: 2705 (Part-I)/1992	



22	Application, current ratio, output burden, accuracy class, minimum knee point voltage, secondary winding resistance, maximum excitation current at minimum knee point voltage etc.		
23	Type of core		
24	Seismic acceleration	0.15g (Vertical) 0.3g (Horizontal)	
25	Accuracy class of standard C.T. to be used during testing towards determination of ratio errors and phase angle errors for metering cores.	0.2 or better.	

**INSULATOR PIN TYPE**  
**Technical Parameters (CHAPTER-E16)**

SI No.	Particulars	Desired Value	Bidder's Offer
1	Make	To be Specified by Bidder	
2	Type	Confirming to IEC 273 (solid core)	
3	Voltage class (kV)	36	
4	Dry and wet one minute withstand voltage (kV rms)	70	
5	Dry lightning impulse withstand voltage (kV p)	170	
6	Wet switching surge withstand voltage (kV p)	NA	
7	Max. RIV at corona extinction voltage (micro volts)	NA	
8	Corona extinction voltage (kV rms)		
9	Total minimum cantilever strength (kg)	Not < 300	
10	Minimum torsion moment	As per IEC 273	
11	Total height of insulator (mm)	508	
12	Minimum PCD (mm) top/bottom	76	

13	No. of bolts top/bottom	04-Aug	
14	Diameter of Bolts Hole (mm) top /Bottom	M12	
15	Pollution level as per IEC 815	Heavy	
16	Minimum total creepage distance (mm)	1050	

**INSULATOR PIN TYPE (CHAPTER-E16)****Technical Parameters**

SI No.	Parameters	11kV	Bidder's Offer
1	Make	To be Specified by Bidder	
2	Type	Confirming to IEC 273 (solid core)	
3	Voltage class (kV)	12	
4	Dry and wet one minute withstand voltage (kV rms)	28	
5	Dry lightning impulse withstand voltage (kV p)	75	
6	Wet switching surge withstand voltage (kV p)	NA	
7	Max. RIV at corona extinction voltage (micro volts)	NA	
8	Corona extinction voltage (kV rms)		
9	Total minimum cantilever strength (kg)	Not < 300	
10	Minimum torsion moment	As per IEC 273	
11	Total height of insulator (mm)	254	
12	Minimum PCD (mm) top/bottom	57	
13	No. of bolts top/bottom	04-Aug	
14	Diameter of Bolt holes (mm) top/ Bottom	M12	
15	Pollution level as per IEC 815	Heavy	
16	Minimum total creepage distance (mm)	450	

## TECHNICAL REQUIREMENTS FOR METAL OXIDE (GAPLESS) SURGE ARRESTERS (CHAPTER-E16)

Sl. No	Particulars.	Technical Parameters for 33kV Surge Arrestors	Bidder's Offer
		33 kV	
1	Make	To be Specified by Bidder	
2	Nominal system voltage (phase to phase) (KV rms).	33	
3.a)	Highest system voltage (phase to phase) (KV rms).	36	
4	System Frequency (HZ).	50 $\pm$ 5%	
5	System Neutral earthing.	Effectively earthed	
6	Installation.	Outdoor	
7	Class.	Station class, 30 KA, heavy duty type.	
8	Type of construction for 10 KA rated arrester.	Single column, single phase	
9	No. of phases.	Three	
10	Maximum duration of earth fault (Sec.)	3	
11	Maximum prospective symmetrical fault current at arrester location	40	
12	Rated arrester voltage (KV rms)	30	
13.a)	Nominal discharge current (KAP)	10 KA of 8/20 $\mu$ sec Wave.	
b)	Discharge current at which insulation co-ordination will be done		
14	Minimum energy discharge capability (KJ/KV)	As per relevant ISS/IEC	

15	Maximum continuous operating voltage at 50° C (KV rms)	25	
16	Maximum switching surge residual voltage (KVP)	72 at 500A	
17	Maximum residual voltage at 8/20 micro second(KVP)		
(i)	5 KA.	85	
(ii)	10 KA Nominal discharge current.	90	
(iii)	20 KA.	100	
18	Long duration discharge class	2	
19	High current short duration test value (KAP) (4/10 Micro-second wave).	100	
20	Current for pressure relief test (KA-rms)	40	
21	Minimum total creepage distance (mm).	900	
22	One minute dry and wet power frequency withstand voltage of Arrester housing (KV-rms).	70	
23 (a)	Impulse withstand voltage of arrester housing with 1.2/ 50 micro-second wave (KVP).	110.5	
b)	Switching Impulse Voltage (Wet) (KVP)		
24	Pressure relief class.	A	
25	Corona extinction voltage (KV-rms).	-	

26	RIV at 92 KV rms.	Less than 500 micro volts	
27	Partial discharge at 1.05 times continuous over-voltage.	Nor more than 50 PC	
28	Seismic acceleration.	0.3g horizontal 0.15g vertical	
29	Reference ambient temperature.	50°C	
30.a)	IR at MCOV.	Less than 400 micro amperes	
b)	IC at MCOV.	Less than 1200 micro amperes	
31.a)	Reference Current (mA)	1 to 5 mA	
b)	Reference voltage at reference current.	Greater than rated voltage.	
32	Maximum steep current Impulse RDV (KVP). at KAP	100	
33	Maximum cantilever strength of the arresters (KGM).	325	
34	TOV(KVP).		
(i)	0.1 sec.	53	
(ii)	1.0 sec.	51	
(iii)	10.0 sec.	49	
(iv)	100.0 sec.	47	

**TECHNICAL REQUIREMENTS FOR METAL OXIDE (GAPLESS) SURGE ARRESTERS (CHAPTER-E16)**  
**Technical Parameters for 11kV Surge Arrestors**

Sl. No	Particulars.	Desired Value	Bidder's Offer
1	Make	To be Specified by Bidder	
2	Nominal system voltage (phase to phase) (KV rms).	11	
3	Highest system voltage (phase to phase) (KV rms).	12	
4	System Frequency (HZ).	50 $\pm$ 5%	
5	System Neutral earthing.	Effectively earthed	
6	Installation.	Outdoor	
7	Class.	Station class, 10 KA, heavy duty type.	
8	Type of construction for 10 KA rated arrester.	Single column, single phase	
9	No. of phases.	Three	
10	Maximum duration of earth fault (Sec.)	3	



11	Maximum prospective symmetrical fault current at arrester location (KA rms)	40	
12	Rated arrester voltage (KV rms)	9	
12	Nominal discharge current (KAP)	10 KA of 8/20 $\mu$ sec Wave.	
13	Minimum energy discharge capability (KJ/KV)	As per relevant ISS/IEC	
14	Maximum continuous operating voltage at 50° C (KV rms)	9.6	
15	Maximum switching surge residual voltage (KVP)	28	
16	Maximum residual voltage at 8/20 micro second(KVP)		
(i)	5 KA.	32	
(ii)	10 KA Nominal discharge current.	35	
(iii)	20 KA.	40	
17	Long duration discharge class	2	

18	High current short duration test value (KAP) (4/10 Micro-second wave).	100	
19	Current for pressure relief test (KA-rms)	40	
20	Minimum total creepage distance (mm).	380	
21	One minute dry and wet power frequency withstand voltage of Arrester housing (KV-rms).	28	
22	Impulse withstand voltage of arrester housing with 1.2/ 50 micro-second wave (KVP).Switching Impulse Voltage (Wet) (KVP)	41.6	
23	Pressure relief class.	A	
24	Corona extinction voltage (KV-rms).	-	
25	RIV at 92 KV rms.	Less than 500 micro volts	
26	Partial discharge at 1.05 times continuous over-voltage.	Nor more than 50 PC	
27	Seismic acceleration.	0.3g horizontal 0.15g vertical	
28	Reference ambient temperature.	50°C	

29.(a)	IR at MCOV.	Less than 400 micro amperes	
(b)	IC at MCOV.	Less than 1200 micro amperes	
30.a)	Reference Current (mA)	1 to 5 mA	
b)	Reference voltage at reference current.	Greater than rated voltage.	
31	Maximum steep current Impulse RDV (KVP). at KAP	100	
32	Maximum cantilever strength of the arresters (KGM).	325	
33	TOV(KVP).		
(i)	0.1 sec.	20	
(ii)	1.0 sec.	18	
(iii)	10.0 sec.	16	
(iv)	100.0 sec.	14	

**Basic Technical Requirements of 33 KV VCB (Indoor) (CHAPTER-E16)**

<b>Sl. No</b>	<b>Particulars</b>	<b>Requirements</b>	<b>Bidder's Offer</b>
1	Make	To be Specified by Bidder	
2	Service type	Indoor	
3	No. of Poles	3	
4	Nominal system voltage	33KV	
5	Highest system voltage	36KV	
6	Rated normal current at 50 °C		
i)	For Bus-bar of Circuit Breaker	1250A	
ii)	For Interrupter	1250A	
iii)	For Outgoing Feeders/ For Incomer & Bus Sections	1250A	
7	Rated short circuit breaking current (rms)	25KA	
8	Rated short circuit making current (peak)	<b>63KA</b>	
9	Rated short time current withstand capability for 3 sec.	25KA(Panel)/25KA (Interrupter)	
10	Rated insulation level:		
i)	One minute power frequency withstand voltage to earth (wet and dry) rms	70KV	

ii)	Impulse withstand voltage to earth with 1.2/50psec, wave of +ve and —ve polarity (Peak)	170KV	
11	First — pole — to clear factor	1.5	
12	Rated operating sequence (for auto reclosing)	0-0.3 Sec- CO-3 min-CO	
13	Maximum break time	3 cycles	
14	Rated out of phase breaking current	25% of the symmetrical short circuit breaking current	
15	Maximum pole scatter	10 mili seconds	
16	Rated Auxiliary supply for spring charge motor, lamp & heater circuit.	230V A.C	
17	Rated supply voltage for trip/close coil	48V D.C	
18	Minimum creepage distance (mm)	900 mm	
19	Minimum protected creepage distance (mm)	As Per IS	

Basic Technical Requirements 11kV Circuit Breaker(Indoor) (CHAPTER-E16)			
Sl. No	Particulars	Desired Value	Bidder's Offer
1	Make	To be Specified by Bidder	
2	Service type	Indoor	
3	No. of Poles	3	
4	Nominal system voltage	11KV	
5	Highest system voltage	12KV	
6	Rated normal current at 50 °C		
i)	For Bus-bar of Circuit Breaker	1250A	
ii)	For Interrupter	1250A	
iii)	For Outgoing Feeders/ For Incomer & Bus Sections	1250A	
7	Rated short circuit breaking current (rms)	25KA	
8	Rated short circuit making current (peak)	<b>63KA</b>	
9	Rated short time current withstand capability for 3 sec.	25KA(Panel)/25KA (Interrupter)	
10	Rated insulation level:		

i)	One minute power frequency withstand voltage to earth (wet and dry) rms	28KV	
ii)	Impulse withstand voltage to earth with 1.2/50psec, wave of +ve and —ve polarity (Peak)	75KV	
11	First — pole — to clear factor	1.5	
12	Rated operating sequence (for auto reclosing)	0-0.3 Sec- CO-3 min-CO	
13	Maximum break time	3 cycles	
14	Rated out of phase breaking current	25% of the symmetrical short circuit breaking current	
15	Maximum pole scatter	10 mili seconds	
16	Rated Auxiliary supply for spring charge motor, lamp & heater circuit.	230V A.0	
17	Rated supply voltage for trip/close coil	48 V D.C	
18	Minimum creepage distance (mm)	As Per IS	
19	Minimum protected creepage distance (mm)	As Per IS	

### Basic Technical Requirements Power Transformer (CHAPTER-E16)

Sl. No	Particulars	Desired Value	Bidder's Offer
1	Rated MVA of Transformer (ONAN rating)	3.15MVA 5.00MVA 8.00MVA	
2	No. of Phases	3	
3	Type of Installation	Outdoor	
4	Frequency	50 Hz (± 5% )	
5	Cooling medium	Insulating Oil (ONAN)	
6	Type of mounting	On Wheels, Mounted on rails.	
7	Rated voltage		
	a) High Voltage Winding	33 kV	
	b) Low Voltage Winding	11 kV	
8	Highest continuous system Voltage		
	a) Maximum system Voltage ratio (HV / LV )	36 kV/ 12 kV	
	b) Rated Voltage ratio (HV / LV )	33 kV/ 11 kV	
9	No. of windings	Two winding Transformers	
10	Type of Cooling	ONAN (Oil natural & Air natural)	
11	MVA Rating corresponding to ONAN cooling system	100%	



12	Method of connection:		
	HV:	Delta	
	LV:	Star	
13	Connection symbol	Dyn 11	
14	System earthing	Neutral of LV side to be solidly earthed.	
15	Percentage impedance voltage on Normal tap and MVA base at 75°C corresponding to HV/ LV rating and applicable tolerances :	% Impedance for 3.15MVA-6.25%,5MVA-7.15% and for 8MVA - 8.35%	
		(Tolerance +10%)	
		(No negative tolerance will be	
		allowed)	
16	Intended regular cyclic overloading of windings	As per IEC –76-1, Clause 4.2	
17	a) Anticipated unbalanced loading	Around 10%	
	b) Anticipated continuous loading of windings (HV / LV)	110 % of rated current	
18	Type of tap changer	On-Load In-tank Type tap changer hanger for 8 MVA and OFF load in 3.15 and 5 MVA transformer	
a)	Range of taping	+ 5% to – 15% in 9 equal steps of 2.5% each on HV winding	
19	Neutral terminal to be brought out	On LV side only	

20	Over Voltage operating capability and duration	112.5 % of rated voltage (continuous)	
21	Maximum Flux Density in any part of the core and yoke at rated MVA, rated voltage i.e 33kV / 11kV and system frequency of 50 Hz	1.5 Tesla	
22	Insulation levels for windings :-	33 kV      11 kV	
a)	1.2 / 50 microsecond wave shape Impulse withstand (KVP)	170      95	
b)	Power frequency voltage withstand (KVrms)	70      28	
23	Type of winding insulation		
	a) HV winding	Uniform	
	b) LV winding	Uniform	
24	Withstand time for three phase short circuit	2 Seconds	
25	Noise level at rated voltage and frequency	As per NEMA Publication No. TR-1.	
26	Permissible Maximum Temperature Rise over ambient temperature of 50 <sup>0</sup> C		
a)	Of top oil measured by thermometer.	35 <sup>0</sup> C	
b)	Of winding measured by resistance.	40 <sup>0</sup> C	
c)	Hot Spot Temperature rise	54 <sup>0</sup> C	
27	Minimum clearances in air (mm) :-	Phase to Phase    Phase to ground	

a)	HV	400	320	
b)	LV	280	140	
28	Terminals :-			
a)	HV winding line end	36kV oil filled communicating type		
		porcelain bushings ( Antifog type)		
b)	LV winding	12kV porcelain type of bushings ( Antifog type)		
29	Insulation level of Bushing :-	HV	LV	
a)	Lightning Impulse withstand (KVP)	170	95	
b)	1 Minute Power Frequency withstand voltage (KV-rms)	70	28	
c)	Creepage distance (mm) (minimum)	900	300	
30	Material of HV & LV Conductor	Electrolytic Copper		
31	Maximum current density for HV and LV	2.4 A/ mm <sup>2</sup>		
	winding for rated current at normal tap			
32	Polarisation Index i.e ratio of Megger values at 600 sec. to 60 sec for HV to earth, L.V to earth and HV to LV	Shall be greater than or equal to 1.5, but less than or equal to '5'.		
33	Core Assembly	Boltless type		
34	Temperature Indicator			

a)	Oil	One number	
b)	Winding	One number	
35	Maximum permissible no load loss at rated voltage and rated frequency.	3.15MVA-3.0 KW (Maximum)	
		5.0MVA- 3.6. KW (Maximum)	
		8.0MVA- 4.5KW (Maximum)	
36	Maximum permissible load loss at rated current,at normal tap and at 75 <sup>0</sup> C	3.15MVA-17.0 KW (Maximum)	
		5.0MVA- 21.0. KW (Maximum)	
		8.0MVA- 38.0KW (Maximum)	
37	Paper Covering thickness of HV Winding Conductor	0.6 mm( minimum )	
38	Paper Covering thickness of LV Winding Conductor	0.5 mm( minimum )	
39	Clearances:-		
a)	Gap between HV Coil to the inside of the	65 mm( minimum )	
	tank on the longer side		
b)	Gap between HV Coil to the inside of the	65 mm( minimum )	

	tank on the width side (LV Side)		
c)	Gap between HV Coil to the inside of the	115 mm( minimum )	
	tank on the width side (HV Side to		
	accommodate delta and tapping leads )		
d)	Gap between Core yoke to tank bottom	55 mm( minimum )	
e)	Yoke insulation at top and bottom	130 mm( minimum )	
f)	Phase to Phase clearance between HV	20 mm( minimum )	
	Limbs		
g)	Radial Clearance between LV and HV	20 mm( minimum )	
	Coil		
h)	Radial Clearance between Core to LV Coil	12.5 mm( minimum )	
40	The difference of Ampere Turns at each location	shall not be more than 5 % at all percentages of tappings	
41	Winding to winding clearance	should have minimum 20% of sum of pressboard Cylinder/Barrier.	
42	Tap changing gear:-		
(i)	Type- In Tank,	High Speed Resistor Type	
(ii)	Provided on	HV Side	
(iii)	Tap range	15% to +5%	

(iv)	Tap Step	2.5% of 33kV	
(v)	Minimum Rated current	For 3.15MVA-100A,5MVA-150A &8MVA-200A	
(vi)	Minimum Rated short circuit current	3KA	
(vii)	Automatic control required	YES	
(viii)	Remote Control Panel required	YES	
(ix)	Marshalling kiosk required	YES	
43	Minimum Air core reactance of HV winding	20%	
44	Type of oil preservation	Air-cell type	

**GUARANTEED TECHNICAL PARTICULARS FOR 3 PHASE 4 WIRE CT/ PT OPERATED**  
**FULLY STATIC AMR COMPATIBLE TRI-VECTOR ENERGY METERS ( Common Protocol (CHAPTER-E16)**  
**Energy Meter Conforming to companion standard for IEC 62056/IS15959) Category-A**

Sl. No.	Particulars	Desired Value	Bidder's Data
1	Make		
2	Type	3PH 4 Wire, Trivector Energy Meter (AMR Compatible)	
3	Country of origin	India	
4	Application	3 phase 4 wire, CT PT operated	
5	Rated Voltage	(i)For CT/PT operated HT Meters-Suitable for operation from 110V Ph-Ph or 63.5V Ph-N	
6	Rated Current (Basic current)	1A for -/1A,5A for -/5A	
7	Frequency	50 Hz $\pm$ 5 %	
8	Overload capacity	200% of Ib	
9	Minimum starting current in % of base current	As per IS 14697: 1999	
10	Short Time Current	As per IS 14697: 1999	
11	Loss in potential circuit	Less than 1.5 Watt & 8VA per phase	
12	Loss in Cuurent circuit	Less than 1 VA	
13	Power Factor	0.0 Lag -Unity- 0.0 Lead	

14	Change in error due to		
a.	Variation in frequency	50 Hz +/- 5%	
b.	Variation in temperature	As per IS 14697: 1999	
c.	Variation in voltage	As per IS 14697: 1999	
15	Accuracy Class	LT- 0.5s, HT-0.2s	
16	Constructional Requirement/Meter Cover	As per Clause:-5.0 of Tech.	
	Sealing arrangement	Specification.	
17	Meter Cover & Case	As per Clause:-5.1 of Tech. Specification.	
18	Meter Case Opening Temper Recording	As per Clause:-5.1.1 of Tech. Specification.	
19	Terminal & Terminal Block	As per Clause:-5.2 of Tech. Specification.	
20	Terminal Cover	As per Clause:-5.3 of Tech. Specification.	
21	Terminal Arrangement	As per Clause:-5.4 of Tech. Specification.	
22	Connection Diagram	As per Clause:-5.5 of Tech. Specification.	
23	Sealing of Meter	As per Clause:-5.6 of Tech. Specification.	
24	Working environment & degree of protection.	As per Clause:-6 of Tech. Specification.	
25	Manufacturing Process assembly & Testing	As per Clause:-7 of Tech. Specification.	



26	Displays	As per Clause:-8.0 of Tech. Specification.	
27	Non Volatile Memory	The data stored in the meters shall not be lost in the event of power failure. The meter shall have Non Volatile Memory (NVM), which does not need any battery backup. The NVM shall have a minimum retention period of 10 years.	
28	Battery Back up	In case of failure of power supply the meter could be powered up the meter could be powered up through an internal battery backup with a push button arrangement.	
29	Performance under	As per IS -14697/1999	
	Influence Quantities	(reaffirmed 2004) & CBIP	

		Technical Report	
30	Out Put Device	As per Clause:-10 of Tech.	
		Specification.	
31	RTC	As per Clause:-11 of Tech. Specification.	
32	Quantities to be measured & displayed.	As per Clause:-12 of Tech. Specification.	
33	Demand Integration Period	Should be programmable & 15 min by default.	
34	MD Reset	Auto reset at 24:00 hrs at the end of each billing cycle.	
35	Marking	As per Clause:-15 of Tech. Specification.	
36	Communication Capability	As per Clause:-16 of Tech. Specification.	
37	HHU	As per Clause:-17 of Tech. Specification.	
38	Free supply of HHU	One DLMS Compliant HHU shall be provided by the supplier to DISCOM free of cost for each 50(fifty) meters for data down loading. It shall be compatible to the DLMS compliant energy meters that are to be procured/supplied on the basis of this technical specification	
39	Tamper & Fraud	As per Clause:-18 of Tech.	

39	monitoring features	Specification.	
40	Abnormality Events Detection	As per Table A6.1 to A6.7 “Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification” enclosed).	
41	Load Survey capability Parameter Logged	1.Real Time Clock – Date and Time.	
1		2.Current – IR 3. Current – IY 4.Current – IB	
2		5.Voltage – VRN 6.Voltage – VYN 7.Voltage – VBN 8.Block Energy kWh	
		9.Block Energy – kvarh – lag 10.Block Energy – kvarh – lead 11.Block Energy – kVAh	
ii.	Logging interval	(PROGRAMMABLE,15 Minutes by default )	
iii.	No. of days of Load Survey	60 power on days	
iv.	Apparent Calculation	Lag + Lead	
42	TOD TIMING (Both MD & ENERGY)	00: 00 Hrs to 06:00 Hrs 06:00 Hrs to 24:00 Hrs	
43	MD RESET REQUIRED	AUTO MODE ONLY, MANUAL RESET NOT REQUIRED	

44	Software Locking	The meter shall have password protected software locking provision for changing the TOD timings & MD integration period.	
45	Software	The firm has to provide required base computer & MRI software for data down loading & analysis with free of cost.	
46	Meter Reading Protocol	The Supplier has to provide Meter Reading Protocols for billing parameters, tamper data etc. at free of cost.	

**GUARANTED TECHNICAL PARTICULARS FOR POLYCARBONATE OR SMC OR COMBINATION OF POLYCARBONATE & SMC PILFER PROOF METER BOX TO HOUSE THE THREE PHASE FOUR WIRE HTTV ENERGY METERS**

<b>Sl. No.</b>	<b>Characteristics</b>	<b>Requirements</b>	<b>Bidders Data</b>
1	Manufacturer's / Supplier's name and address with works address.		
2	Material used for box body	Poly Carbonate/SMC (Sheet Moulding Compound)ref-IS: 13410/1992 /IS:14772 :2000Combined	
3	Color of Box	Dark Admiral Gray/off White/Transparent	
4	Dimensions of box (L x W x H)	45x38x20 CM (approx)	
5	Meter Fixing Arrangement	Adjustable Meter Mounting Arrangement may be provided to accommodate any make of Meters (like Secure, L&T etc.).	
6	Earthing Provisions	To be provided	

7	Thickness of meter box		
a.	From Back Side	2.5 mm Back Side 2.0 mm all other side.	
b.	From all other sides		
8	Clearance of meter from box surface approx. :(Varies from meter to meter)		
a.	Right , Left	10 cm	
b.	Top side	1 cm	
c.	Bottom side ( from meter terminals)	12 cm	
d.	Bottom side ( from terminals cover)	8 cm	
e.	Front side	11cm	
9	Additional “D” Port	Additional “D” Port provision provided in the inner door of the box with sealing arrangement for downloading data through MRI.	

10	Doors	Provision of two (Inner door & outer door) arrangement to be provided.	
11	Push button hole	Push button hole shall be done by DISCOMs at the time of installation.	
12	The material of inner door shall be	SMC	
13	Cable Entry Hole.	For cable entry, one suitable circular holes	
		fitted with adjustable glands will be provided at the bottom of the box for cable inlet and outlet. Internal diameter of the gland will be such as to accommodate the control cable having outer diameter 25-30mm. The cable entry hole position can be changed by DISCOMs as per the field requirement & will be narrated during the placement of Purchase Order.	
14	Type of Use Meter Box should be suitable for	Meter Box should be suitable for indoor & outdoor use.	
15	Suitable to house	The meter box will be suitable to house one number three-phase four-wire HTTV energy meter & a modem of any make.	

16	The meter box shall comply with	IS:13410- 1992	
17	Roof tapering	Meter Box will have a roof tapering	
		arrangement for easy flow of rainwater, as per sample.	
18	Hinges	Box cover will be fixed with minimum three nos hinges in each door well protected against corrosion. Box cover will be able to open by more than 120 degrees. Concealed hinges should fix the Box and cover, with hardware from inside in such a manner that it can't be manipulated from outside.	
19	Gasket	Soft rubber gasket for protection from ingress of dust and water will be provided on all around the box.	
20	Handle	Handle/Knob will be provided on the Box door for easy door opening.	
21	Inner door, viewing window & D-Port.	The box shall be provided with two (inner & outer) doors. A viewing window must be provided in inner door if not transparent. One D-Port provision for communication must be provided in the inner door of each box with sealing arrangements.	

22	Fixing Holes	Box shall be provided with 4 nos. fixing holes of 6 mm diameter at all four corners of meter box.	
	Sealing & Latches.	For holding and sealing the outer door, U-shaped latches/clamps with two sealing holes will be provided. Two nos Latches will be provided on the base of the box. These metallic parts will be protected against corrosion. Provision shall be made for sealing of doors at two locations.	
24	Viewing window	The viewing window for meter reading will be made of break resistant, UV stabilized, transparent Polycarbonate of minimum 2.0 mm. Thickness the transparent window will be properly welded/fixed in rigid way with meter	
25	Adjustable meter mounting Arrangement	Adjustable meter mounting arrangement to be provided in such a way that the display portion of any make meter can be easily aligned with the viewing window of outer door, So that meter reading can be done easily without opening any door of meter box.	
26	Name Plate.	Purchase order No. & Date, Property of	
		Owner Name-OPTCL. will be mentioned on metallic name plate in such a manner that it will not be erased & removed easily. Name of Manufacturer will be embossed on meter box cover.	



Guaranteed Technical Particulars of 33 kv Insulator-70 KN (B & S Type) (CHAPTER-E16)

Sl. No.	Particulars	Desired Value	Bidder's Data
1	Name of the Manufacturer		
2	Type of Insulator	Polymeric Composite	
3	Standard according to which the insulators manufactured and tested.	IEC 61109	
4	Name of material used in manufacture of the insulator with class/grade)	SILICON Wacker-Germany Dow Corning-USA	
(a)	Material of core(FRP rod)	ECR or BORRON FREE	
	(I)E-glass of ECR-glass.		
	(II)Boom content		
(b)	Material of housing Et weathersheds (silicon content by weight)	SILICON RUBBER 43 %	
(c)	Material of end fittings	SGI	
(d)	Sealing compound for end fittings	RTV SILICON	
5	Colour	GREY	
6	Electrical Characterstics		
(a)	Nominal system voltage	33 KV	

(b)	Highest system voltage	36 KV	
(c)	Dry Power frequency withstand voltage	105 KV	
(d)	Wet Power frequency withstand voltage	75 KV	
(e)	Dry flashover voltage	125 KV	
(f)	Wet flash over voltage	85 KV	
(g)	Dry lighting impulse withstand voltage		
	(a) Positive	170 KV	
	(b) Negative	170 KV	
(h)	Dry lighting impulse flashover voltage		
	a) Positive	180 KV	
	b) Negative.	180 KV	
(i)	RIV at 1 MHz when energized at 10 kV/30kV (rms) under dry condition.	40	
(j)	Creepage distance (Min.)	900 MM	
7	Mechanical characteristics Minimum failing load.	70KN	
8	Dimensions of insulator		

(i)	Weight	1.6	
(ii)	Dia of FRP rod	16 MM	
(iii)	Length of FRP rod	440 MM	
(iv)	Dia of weathersheds	100 MM	
(v)	Thickness of housing	3 MM	
(vi)	Dry arc distance Dimensioned drawings of insulator (including weight with tolerances in weight) enclosed.	382 MM	
9	Method of fixing of sheds to housing (specify). Single mould or Modular construction (injection moulding/compression moulding)	Injection moulding	
10	No of weathersheds	8	
11	Type of sheds		
i)	Aerodynamic	Aerodynamic	
ii)	With underribds		
12	Type of packing	Wooden Box	
13	Any other particulars which the bidder may like to give.		

14	The insulators shall have "W" type phosphors Bronze security clips for ball sockets portion of insulators confirming to IS-2486 (P-III/1974).	YES	

**Guaranteed Technical Particulars of 11 kv Insulator (B & S Type) (CHAPTER-E16)**

**BIDDER HAS TO CONFIRM FOLLOWING IMPORTANT REQUIREMENT:**

Sl. No.	Particulars	Desired Value	Bidder's Data
1	Name of the Manufacturer :		
2	Type of Insulator	Polymeric Composite	
3	Standard according to which the insulators manufactured and tested.	IEC 61109	
4	Name of material used in manufacture of the insulator with class/grade)	SILICON Wacker-Germany Dow Corning-USA	
(a)	Material of core(FRP rod)	ECR or BORRON FREE	
	(I)E-glass of ECR-glass.		
	(II)Boom content		
(b)	Material of housing Et weathersheds (silicon content by weight)	SILICON RUBBER 43 %	
(c)	Material of end fittings	SGI	
(d)	Sealing compound for end fittings	RTV SILICON	
5	Colour	GREY	

6	Electrical Characterstics		
(a)	Nominal system voltage	11 KV	
(b)	Highest system voltage	12 KV	
(c)	Dry Power frequency withstand voltage	70 KV	
(d)	Wet Power frequency withstand voltage	50 KV	
(e)	Dry flashover voltage	77 KV	
(f)	Wet flash over voltage	55 KV	
(g)	Dry lighting impulse withstand voltage		
	(a) Positive	129 KV	
	(b) Negative	135 KV	
(h)	Dry lighting impulse flashover voltage		
	a) Positive	135 KV	
	b) Negative.	141 KV	

(i)	RIV at 1 MHz when energized at 10 kV/30kV (rms) under dry condition.	20	
(j)	Creepage distance (Min.)	320 MM	
7	Mechanical characteristics Minimum failing load.	70 KN	
8	Dimensions of insulator		
(i)	Weight	1.25 KG(Approx.)	
(ii)	Dia of FRP rod	16 MM	
(iii)	Length of FRP rod	240 MM	
(iv)	Dia of weathersheds	90±1 MM	
(v)	Thickness of housing	3 MM	
(vi)	Dry arc distance Dimensioned drawings of insulator (including weight with tolerances in weight) enclosed.	160±5 MM	
9	Method of fixing of sheds to housing (specify). Single mould or Modular construction (injection moulding/compression moulding)	Injection moulding	

10	No of weathersheds	3	
11	Type of sheds		
i)	Aerodynamic	Aerodynamic	
ii)	With underribds		
12	Type of packing	Wooden Box	
13	Any other particulars which the bidder may like to give.		
14	The insulators shall have "W" type phosphors Bronze security clips for ball sockets portion of insulators confirming to IS-2486 (P-III/1974).	YES	



**HT STAY SET (CHAPTER-E16)**  
**GURANTEED TECHNICAL PARTICULARS**

(To be submitted along with Offer)

Sl. No.	Item Description	Specified Parameters			Bidder's Offer
		Section Tolerances	Fabrication Tolerances	Material	
1	Anchor Plate	8mm thick+2.5%-5%	300x300mm+1%	5 GIPlate 8 mm thick	
2	Anchor Rod	20mm dia +3%-2%	Length 1800mm +0.5% Round Eye 40mm inside dia + 3%. Threading 40mm =11%-5%	GI Round 20mm dia	
3	Turn Buckle Bow	16mm dia +5%-3%	Length180mm +1% 50x50x6mm Channel length 200mm + 1%	GI Round 16mm dia. GI Angle GI Channel 100x50x4.7mm	
4	Eye Bolt Rod	20mm dia + 3% - 2%	Length450mm +1%Threading 300mm +1% Round Eye 40 mm inside dia +3%	GI Round 20mm dia.	

33 KV & 11 KV V CROSS ARM (CHAPTER-E16)				
GURANTEED TECHNICAL PARTICULARS				
(To be submitted along with offer)				
Sl. No.	Description Unit	Unit	Bidder's offer	
			33 Kv	11 Kv
1	Type of crossarm			
2	Grade of steel			
3	Steel standard			
4	Fabrication Standard			
5	Dimensions	Mm		
6	Steel section utilized			
7	Steel tensile strength	N/cm <sup>2</sup>		
8	Working load	Kg		
9	Details of Galvanising Methods utilised and Standard/Specification			
10	Weight of cross arm	kg		
11	Whether drawing has been submitted with the bid			

<b>POLE TOP BRACKETS (F CLAMP) (CHAPTER-E16)</b>				
<b>GURANTEED TECHNICAL PARTICULARS</b>				
(To be submitted along with offer)				
<b>Sl. No.</b>	<b>Description Unit</b>	<b>Unit</b>	<b>Bidder's offer</b>	
			<b>33 Kv</b>	<b>11 Kv</b>
<b>1</b>	Type of crossarm			
<b>2</b>	Grade of steel			
<b>3</b>	Steel standard			
<b>4</b>	Fabrication Standard			
<b>5</b>	Dimensions	Mm		
<b>6</b>	Steel section utilized			
<b>7</b>	Steel tensile strength	N/cm <sup>2</sup>		
<b>8</b>	Working load	Kg		
<b>9</b>	Details of galvanizing method utilized and standard/specification			
<b>10</b>	Weight of F Clamp	kg		
<b>11</b>	Whether drawing has been submitted with the bid			

**BACK CLAMP FOR “V” CROSS ARM (CHAPTER-E16)****GURANTEED TECHNICAL PARTICULARS**

(To be submitted along with offer)

Sl. No.	Description Unit	Unit	Bidder's offer	
			33 Kv	11 Kv
1	Type of Clamp			
2	Grade of steel			
3	Steel standard			
4	Fabrication Standard			
5	Dimensions	Mm		
6	Steel section utilized			
7	Steel tensile strength	N/cm <sup>2</sup>		
8	Working load	Kg		
9	Details of Galvanising Methods utilised and Standard/Specification			
10	Weight of back clamp	kg		
11	Whether drawing has been submitted with the bid			

GUARANTEED TECHNICAL PARTICULARS FOR (CHAPTER-E16)			
(RS JOISTS of sizes 150x150mm)			
<u>Dimensions and Properties</u>			
Sl. No.	Particulars	150 x 150 mm ISHB	Bidder's Data
1	Length of Joist in Mtr with +1 00mm/-0% Tolerance	11 mtr	
2	Weight kg/m with±2.5% Tolerance	34.6	
3	Sectional Area (cm <sup>2</sup> )	44.1	
4	Depth(D) of Section (mm) with +3.0mm/ - 2.0mm Tolerance as per IS 1852-1985	150	
5	Width (B)of Flange (mm) with ±2.5mm Tolerance for116 x 100 mm ISMB & ±4.0mm Tolerance for 150 x 150 mm ISHB IS 1852-1985	150	
6	Thickness of Flange (Tf) (mm) with±1 .5mm Tolerance	9	
7	Thickness of Web(Tw) (mm) with±1 .0mm Tolerance	11.8	
8	Corner Radius of Root (mm)	8	
9	Corner Radius of Tow (R2) (mm)	4	

10	Moment of Inertia		
	$I_{xx} \text{ (cm}^4\text{)}$	1640	
	$I_{yy} \text{ (cm}^4\text{)}$	495	
11	Radius of Gyration (cm)		
	$R_{xx}$	6.09	
	$R_{yy}$	3.35	
12	Modulus of Section		
	$Z_{xx} \text{ (cm}^3\text{)}$	218	
	$Z_{yy} \text{ (cm}^3\text{)}$	63.2	
13	Flange Slope(a) in Degree		94
14	Tolerance in Dimension		As per IS:1 852
15	Distinct Non-Erasable Embossings to be made on each R.S. Joist	a) Name & Logo of the Manufacturer.	
		b) B.I.S Logo(ISI Mark) if applicable.	
		c) Size	

**TECHNICAL REQUIREMENT FOR 11KV CURRENT TRANSFORMERS (CHAPTER-E16)**

The Current Transformers under this specification shall conform to the parameters given below:

<b>Sl. No.</b>	<b>Particular</b>	<b>Desired Value</b>	<b>Bidder's Offer</b>
1	Type of CT Installation	Single phase, dead tank, oil-filled Poly Crate hermetically sealed outdoor, self-cooled.	
2	Type of mounting	Pedestal type	
3	Suitable for system frequency	50 HZ $\pm$ 5%	
4	Rated Voltage (KV rms)	11	
5	Nominal System Voltage (KV rms)	11	
6	Highest System Voltage (KV rms)	12	
7	Current Ratio (A/A)	800-400-200 A/1-1-1 A & 400- 200-100/1-1A	
8	Method of earthing the system where the current transformers will be installed	Effectively earthed	
9	Rated Continous Thermal Current (A)	120% of rated primary current	
10	Acceptable limit of temperature rise above 50 <sup>0</sup> C ambient temperature for continuous operation at rated continuous thermal current		
	(a) Winding	40 <sup>0</sup> C	
	(b) Oil	35 <sup>0</sup> C	
	(c )External surface of the core, metallic parts in contact with or adjacent to, insulation.	40 <sup>0</sup> C	

11	1250 micro second lighting impulse withstand voltage (KVP) (dry)	95	
12	1 Minute dry power frequency withstand voltage primary (KV rms)	28	
13	1 Minute dry power frequency withstand voltage secondary (KV rms)	3	
14	Minimum creepage distance of porcelain Housing (mm)	350	
15	Rated short time withstand current for 3 second duration at all ratios (KA rms)	25	
16	Instrument security factor at all ratios for metering core	Not more than 5.0	
17	Maximum rated short time thermal current density of the primary winding copper conductor (A/mm <sup>2</sup> ) at all ratios	92	
18	Application, current ratio, output burden, accuracy class, minimum knee point voltage, secondary winding resistance, maximum excitation current at minimum knee point voltage etc.	Enclosed in separate sheets for each rating of the current Transformers.	
19	Type of Core	Torroidal type	
20	Seismic acceleration	0.15g (Vertical)	
		0.3g (Horizontal)	
21	Accuracy class of standard C.T to be used during testing towards determination of ratio errors and phase angle errors for metering cores.	0.05 or better.	



**55 mm<sup>2</sup> ALL ALUMINIUM ALLOY CONDUCTOR (AAAC) (CHAPTER-E16)****GUARANTEED TECHNICAL PARTICULARS OF 55MM<sup>2</sup> AAAC**

Sl.No.	Description	Unit	55mm <sup>2</sup>	Bidder's Offer
1	Manufacture's Address			
2	Indian Standard No. IS 398 (Part-4)1994		IS 398 (Part-4)1994	
3	IEC Standard No.IEC 1089		IEC 1089	
4	Materials of conductor	AAAC		
5	Aluminum alloy redraw rod manufacturer		Balco, Hindalco,Kunj Alloys,Nalco & any other approved sources.	
6	Drawing aluminum wire manufacturer			
7	Standing complete conductor manufacturer			
8	Nos. of Strands		7	
9	Dia of each strand	mm	3.15	
10	Total cross-sectional area of conductor	mm <sup>2</sup>	55	
11	Overall dia of stranded conductor	Mm	9.45	
12	Mass of conductor per kilometer(without grease)	Kg	149.2	

13	Mass of grease per kilometer of conductor (Approx.)	Kg	N.A.	
14	Total mass of greased conductor per kilometer(Approx.)	Kg	149.2 without grease	
15	Conductor grease type		N.A.	
16	Ultimate strength of conductor	Newton	16030	
17	Assumed equivalent modulus of elasticity of conductor	N/ mm <sup>2</sup>	62038	
18	Assumed equivalent co-efficient of elasticity	N/ mm <sup>2</sup>	62038	
19	Assumed equivalent co-efficient of linear expansion	Per °C	23.0x10 <sup>-6</sup>	
20	Maximum length of conductor supplied in one drum	Km	6.0±5%	
21	Maximum D.C. resistance at 20°C	Ohm/Km	0.621	
22	Maximum full load current at 75°C (40°C ambient)	Ampere	191	
23	Individual Aluminum alloy strands			
	a. Tensile breaking stress	N/ mm <sup>2</sup>	299.4	
	b. Elongation on 200mm length in breaking	%	4	
	c. Maximum electrical resistance at 20°C	Ohm/Km	4.29	

24	Particulars of raw material			
	Minimum purity of Aluminum alloy	%	97.25	
	Aluminum redraw rod conforming to	Type	Si-Mg	
	Elements			
	i. Si	%	0.50 to 0.90	
	ii. Mg	%	0.6 to 0.90	
	iii. Fe Max	%	0.5	
	iv. Cu Max	%	0.1	
	v.Mn Max	%	0.03	
	vi. Cr Max	%	0.03	
	vii.Zn Max	%	0.1	
	viii. B Max	%	0.06	
	ix. Other Element each Max	%	0.03	
	Total Max		0.1	
25	DC resistance of conductor at 20°C(Max)	Ohm/Km	0.621	
26	Standard length of conductor that can be manufactured	Meter	2000±5%	
27	Maximum length of conductor that can be manufactured	Meter	3000	
28	Tolerance on standard length of conductor	%	±5%	
29	Direction of layer for outside layer	RH/LH	RH	
30	Weight of the drum (only)	Kg	150 to 180	

31	Mass of conductor with drum			
	a. Standard	Kg/Km	149.2	
	b.Minimum	Kg/Km	146.47	
	c.Maximum	Kg/Km	152.16	
32	Modulus of Elasticity	Kg/cm <sup>2</sup>	0.6324x10 <sup>6</sup>	
33	Co-efficient of linear expansion (Per °C)		23.0x10-6	

<b>EARTHING COIL      (CHAPTER-E16)</b>		
<b>GURANTEED TECHNICAL PARTICULARS</b>		
(To be submitted along with Offer)		
<b>Sl. No.</b>	<b>PARTICULARS</b>	<b>Bidder's Offer</b>
1	Nominal diameter of wire	
2	No. of turns	
3	External dia of Coil	
4	Length of Coil	
5	Mass of Zinc	
6	Total weight of Coil	
7	Whether drawing enclosed (Yes/No)	

**GUARANTEED TECHNICAL PARTICULARS FOR 25KVA,11/0.4KV, 3-PHASE STAR RATED (CHAPTER-E16)**

**DISTRIBUTION TRANSFORMERS**

**(To be furnished by the Manufacturer)**

Sl. No	Particulars	Desired Value	Bidder's Offer
1	Make		
2	Name of the Manufacturer		
3	Place of Manufacture		
	(a)Type of B.E.E Specified Star Level to be fixed near Name Plate.	Three Star	
4	Voltage Ratio	11000/433V	
5	Rating in KVA	100	
6	Core Material used and Grade:	CRGO and M3 or Better /	
		Amorphous Metal	
	a) Flux density	1.5 Tesla (Max.)	
	b)Over fluxing without saturation (Curve to be furnished by the Manufacturer in support of his claim)		
7	Maximum temperature rise of:		
	a) windings by resistance method	40°C over an ambient of 50°C	
	b) Oil by thermometer	35°C over an ambient of 50°C	

8	Magnetizing (no-load) current at:		
	a) 90% Voltage		
	b) 100% Voltage	3% (Max.)	
	c) 112.5% Voltage	6% (Max.)	
9	Core loss in watts:		
	a) Normal voltage		
	b) Maximum voltage		
10	Resistance of windings at 20 <sup>0</sup> C (with 5% tolerance)		
	a) HV Winding (ohms)		
	b) LV Winding (ohms)		
11	Full load losses (watts) at 75 <sup>0</sup> C		
12	Total losses at 100% load at 75 <sup>0</sup> C	695Watts (Max.)	
13	Total losses at 50% load at 75 <sup>0</sup> C	210Watts (Max.)	
14	Current density used for : (Ampere/ Sq mm)		
	a) HV Winding	1.6(Max.)	
	b) LV Winding	1.6(Max.)	

15	Clearances : (mm)		
	a) Core and LV		
	b) LV and HV		
	c) HV Phase to Phase		
	d) End insulation clearance to earth		
	e) Any point of winding to tank		
16	Efficiency at 75 <sup>0</sup> C:		
	a) Unity P. F. and		
	b) 0.8 P.F		
	1) 125% load		
	2) 100% load		
	3) 75% load		
	4) 50% load		
	5) 25% load		
17	Regulation at:		
	a) Unity P.F.		
	b) 0.8 P.F. at 75 <sup>0</sup> C		



18	% Impedance at 75 <sup>0</sup> C	4.5+10%(No negative	
		tolerance)	
19	Separate Source Voltage withstand Test:		
	(I) HV 28kV/50 HZ for 1 minute	Yes	
	(ii) LV 3kV/50 HZ for 1 minute	Yes	
20	Induced Over Voltage withstand Test (Double Voltage and Double frequency for 1 minute)	22KV for HV winding by applying 0.866 KV on LV at 100Hz for the duration of 1 minute.	
21	Impulse test	HV-95KV peak, LV- NA	
22	Mass of : (kg)		
	a) Core lamination (minimum)		
	b) Windings (minimum)		
	c) Tank and fittings		
	d) Oil		
	e) Oil quantity (minimum) (litre)		
	f) Total weight		

23	Oil Data:		
	1. Quantity for first filling (minimum) (litre)		
	2. Grade of oil used		
	3. Maker's name		
	4. BDV at the time of filling (kV)		
24	Transformer:		
	1) Overall length x breadth x height (mmx mmx mm)		
	2) Tank length x breadth x height		
	3) Thickness of plates for		
	a) Side plate (min)	3.15mm	
	b) Top and bottom plate (min)	5mm	
	4) Conservator Dimensions.		
25	Radiation		
	1) Heat dissipation by tank walls excluding top and bottom		
	2) Heat dissipation by cooling tube.		
	3) Diameter and thickness of cooling tube.		
	4) Whether calculation sheet for selecting cooling area to ensure that the transformer is capable of giving continuous rated output without exceeding temperature rise is enclosed.		

26	Inter layer insulation provided in design for:		
	1) Top and bottom layer	Epoxy Dotted Kraft Paper	
	2) In between all layer	Epoxy Dotted Kraft Paper	
	3) Details of end insulation.	Press Board	
	4) Whether wedges are provided at 50% turns of the HV coil		
27	Insulation materials provided		
	a) For conductors		
	(1) HV	DPC	
	(2) LV	DPC	
	b) For Core	Carlite	
28	Material and Size of the wire used.		
	1) HV Dia (mm) (SWG)		
	2) LV		
	a) Strip size		
	b) No. of Conductors in parallel		
	c) Total area of cross section (sq mm)		

29	Whether the name plate gives all particulars as required in Tender	Yes	
30	Particulars of bushings HV/LV		
	1) Maker's name		
	2) Type IS-3347/ IS-2099/ IS- 7421		
	3) Rating as per IS		
	4) Dry power frequency voltage withstand test	HV-28KV, LV-3KV	
	5) Wet power frequency voltage withstand test	HV-28KV, LV-3KV	
Note: - The following shall be specifically confirmed:			
1)	Whether the offer conforms to the limits of impedance mentioned in the specification.		
2)	Whether the offer conforms to the limits of temperature rise mentioned in the specification.		
3)	Whether the losses of the transformers offered are within the limits specified.		
4)	Whether the transformer offered is already type tested for the design and test reports enclosed.		

**GUARANTEED TECHNICAL PARTICULARS FOR 63KVA,11/0.4KV, 3-PHASE 3 STAR RATED (CHAPTER-E16)****DISTRIBUTION TRANSFORMERS****(To be furnished by the Manufacturer)**

<b>Sl. No</b>	<b>Description</b>	<b>Desired Value</b>	<b>Bidder's Offer</b>
1	Make		
2	Name of the Manufacturer		
3	Place of Manufacture		
	(a)Type of BEE Specified Star Level to be fixed near Name Plate.	Three Star	
4	Voltage Ratio	11000/433V	
5	Rating in KVA	63	
6	Core Material used and Grade:	CRGO and M3 or Better	
	a) Flux density	1.5 Tesla (Max.)	
	b)Over fluxing without saturation (Curve to be furnished by the Manufacturer in support of his claim)		
7	Maximum temperature rise of:		
	a) windings by resistance method	40 <sup>0</sup> C over an ambient of 50°C	
	b) Oil by thermometer	35 <sup>0</sup> C over an ambient of 50°C	
8	Magnetizing (no-load) current at:		
	a) 90% Voltage		
	b) 100% Voltage		
	c) 110% Voltage		
9	Core loss in watts:		
	a) Normal voltage		
	b) Maximum voltage		

10	Resistance of windings at 20 <sup>0</sup> C (with 5% tolerance)		
	a) HV Winding (ohms)		
	b) LV Winding (ohms)		
11	Full load losses (watts) at 75 <sup>0</sup> C		
12	Total losses at 100% load at 75 <sup>0</sup> C	1250 (Max.)	
13	Total losses at 50% load at 75 <sup>0</sup> C	380 (Max.)	
14	Current density used for : (Ampere/ Sq mm)		
	a) HV Winding	1.6 (Max.)	
	b) LV Winding	1.6(Max.)	
15	Clearances : (mm)		
	a) Core and LV		
	b) LV and HV		
	c) HV Phase to Phase		
	d) End insulation clearances to earth		
	e) Any point of winding to tank		
16	Efficiency at 75 <sup>0</sup> C:		
	a) Unity P. F. and		
	b) 0.8 P.F		
	1) 125% load		
	2) 100% load		
	3) 75% load		
	4) 50% load		
	5) 25% load		
17	Regulation at:		

	a) Unity P.F.		
	b) 0.8 P.F. at 75°C		
18	% Impedance at 75°C	4.5+10%(No negative tolerance)	
19	Separate Source Voltage withstand Test:		
	(I) HV 28kV/50 HZ for 1 minute	Yes	
	(ii) LV 3kV/50 HZ for 1 minute	Yes	
20	Induced Over Voltage withstand Test (Double Voltage and Double frequency for 1 minute)	22KV for HV winding by applying 0.866 KV on LV at 100Hz for the duration of 1 minute.	
21	Impulse test	HV-95KV peak, LV- NA	
22	Mass of : (kg)		
	a) Core lamination (minimum)		
	b) Windings (minimum)		
	c) Tank and fittings		
	d) Oil		
	e) Oil quantity (minimum) (litre)		
	f) Total weight		
23	Oil Data:		
	1. Quantity for first filling (minimum) (litre)		
	2. Grade of oil used		
	3. Maker's name		
	4. BDV at the time of filling (kV)		
24	Transformer:		

	1) Overall length x breadth x height (mmx mmx mm)		
	2) Tank length x breadth x height		
	3) Thickness of plates for		
	a) Side plate (min)	3.15mm	
	b) Top and bottom plate (min)	5mm	
	4) Conservator Dimensions.		
25	Radiation		
	1) Heat dissipation by tank walls excluding top and bottom		
	2) Heat dissipation by cooling tube.		
	3) Diameter and thickness of cooling tube.		
	4) Whether calculation sheet for selecting cooling area to ensure that the transformer is capable of giving continuous rated output without exceeding temperature rise is enclosed.		
26	Inter layer insulation provided in design for:		
	1) Top and bottom layer	Epoxy Dotted Kraft Paper	
	2) In between all layer	Epoxy Dotted Kraft Paper	
	3) Details of end insulation.	Press Board	
	4) Whether wedges are provided at 50% turns of the HV coil		
27	Insulation materials provided		
	a) For conductors		
	(1) HV	DPC	
	(2) LV	DPC	
	3) For Core	Carlite	



28	Material and Size of the wire used.		
	1) HV Dia		
	(mm)		
	(SWG)		
	2) LV		
	a) Strip size		
	b) No. of Conductors in parallel		
	c) Total area of cross section (sq mm)		
29	Whether the name plate gives all particulars as required in Tender		
30	Particulars of bushings HV/LV		
	1) Maker's name		
	2) Type IS-3347/ IS-2099/ IS- 7421		
	3) Rating as per IS		
	4) Dry power frequency voltage withstand test	HV-28KV, LV-3KV	
	5) Wet power frequency voltage withstand test	HV-28KV, LV-3KV	
Note: The following shall be specifically confirmed:			
1)	Whether the offer conforms to the limits of impedance mentioned in the specification.		
2)	Whether the offer conforms to the limits of temperature rise mentioned in the specification.		
3)	Whether the losses of the transformers offered are within the limits specified.		
4)	Whether the transformer offered is already type tested for the design and test reports enclosed.		

GUARANTEED TECHNICAL PARTICULARS FOR 100KVA,11/0.4KV, 3-PHASE STAR RATED (CHAPTER-E16)			
DISTRIBUTION TRANSFORMERS			
(To be furnished by the Manufacturer)			
Sl. No.	Description	As Specified	Bidder's Offer
1	Make		
2	Name of the Manufacturer		
3	Place of Manufacture		
	(a) Type of B.E.E Specified Star Level to be fixed near Name Plate.	Three Star	
4	Voltage Ratio	11000/433V	
5	Rating in KVA	100	
6	Core Material used and Grade:	CRGO and M3 or Better	
	a) Flux density	1.5 Tesla (Max.)	
	b) Over fluxing without saturation (Curve to be furnished by the Manufacturer in support of his claim)		
7	Maximum Temperature of :		
	a) windings by resistance method	40°C over an ambient of 50°C	
	b) Oil by thermometer	35°C over an ambient of 50°C	
8	Magnetizing (no-load) current at:		
	a) 90% Voltage		
	b) 100% Voltage	3% (Max.)	
	c) 112.5% Voltage	6% (Max.)	

9	Core loss in watts:		
	a) Normal voltage		
	b) Maximum voltage		
10	Resistance of windings at 20 <sup>0</sup> C (with 5% tolerance)		
	a) HV Winding (ohms)		
	b) LV Winding (ohms)		
11	Full load losses (watts) at 75 <sup>0</sup> C		
12	Total losses at 100% load at 75 <sup>0</sup> C	1800Watts (Max.)	
13	Total losses at 50% load at 75 <sup>0</sup> C	520Watts (Max.)	
14	Current density used for : (Ampere/ Sq mm)		
	a) HV Winding	1.6(Max.)	
	b) LV Winding	1.6(Max.)	
15	Clearances : (mm)		
	a) Core and LV		
	b) LV and HV		
	c) HV Phase to Phase		
	d) End insulation clearance to earth		
	e) Any point of winding to tank		

16	Efficiency at 75 <sup>0</sup> C:		
	a) Unity P. F. and		
	b) 0.8 P.F		
	1) 125% load		
	2) 100% load		
	3) 75% load		
	4) 50% load		
	5) 25% load		
17	Regulation at:		
	a) Unity P.F.		
	b) 0.8 P.F. at 75 <sup>0</sup> C		
18	% Impedance at 75 <sup>0</sup> C	4.5+10%(No negative tolerance)	
19	Separate Source Voltage withstand Test:		
	(I) HV 28kV/50 HZ for 1 minute	Yes	
	(ii) LV 3kV/50 HZ for 1 minute	Yes	

20	Induced Over Voltage withstand Test (Double Voltage and Double frequency for 1 minute)	22KV for HV winding by applying 0.866 KV on LV at 100Hz for the duration of 1 minute.	
21	Impulse test	HV-95KV peak, LV- NA	
22	Mass of : (kg)		
	a) Core lamination (minimum)		
	b) Windings (minimum)		
	c) Tank and fittings		
	d) Oil		
	e) Oil quantity (minimum) (litre)		
	f) Total weight		
23	Oil Data:		
	1. Quantity for first filling (minimum) (litre)		
	2. Grade of oil used		
	3. Maker's name		
	4. BDV at the time of filling (kV)		

24	Transformer:		
	1) Overall length x breadth x height (mmx mmx mm)		
	2) Tank length x breadth x height		
	3) Thickness of plates for		
	a) Side plate (min)	3.15mm	
	b) Top and bottom plate (min)	5mm	
	4) Conservator Dimensions.		
25	Radiation		
	1) Heat dissipation by tank walls excluding top and bottom		
	2) Heat dissipation by cooling tube.		
	3) Diameter and thickness of cooling tube.		
	4) Whether calculation sheet for selecting cooling area to ensure that the transformer is capable of giving continuous rated output without exceeding temperature rise is enclosed.		
26	Inter layer insulation provided in design for:		
	1) Top and bottom layer	Epoxy Dotted Kraft Paper	
	2) In between all layer	Epoxy Dotted Kraft Paper	
	3) Details of end insulation.	Press Board	
	4) Whether wedges are provided at 50% turns of the HV coil		

27	Insulation materials provided		
	a) For conductors		
	(1) HV	DPC	
	(2) LV	DPC	
	b) For Core	Carlite	
28	Material and Size of the wire used.		
	1) HV Dia (mm) (SWG)		
	2) LV		
	a) Strip size		
	b) No. of Conductors in parallel		
	c) Total area of cross section (sq mm)		
29	Whether the name plate gives all particulars as required in Tender	Yes	
30	Particulars of bushings HV/LV		
	1) Maker's name		
	2) Type IS-3347/ IS-2099/ IS- 7421		
	3) Rating as per IS		
	4) Dry power frequency voltage withstand test	HV-28KV, LV-3KV	
	5) Wet power frequency voltage withstand test	HV-28KV, LV-3KV	

Note: The following shall be specifically confirmed:

1)	Whether the offer conforms to the limits of impedance mentioned in the specification.		
2)	Whether the offer conforms to the limits of temperature rise mentioned in the specification.		
3)	Whether the losses of the transformers offered are within the limits specified.		
4)	Whether the transformer offered is already type tested for the design and test reports enclosed.		



## GURANTEED TECHNICAL PARTICULARS OF ISOLATOR(33kV) (CHAPTER-E16)

Sl.No	Particular	Desired Value	Bidder's Offer
1	Main switch	Double end break Centre post rotating, gang operated	
2	Service	Outdoor	
3	Applicable standard	IS : 9921 / IEC-129/IEC-62271-102	
4	Pole	3 pole gang operator	
5	Rated voltage nominal/ Maximum	33/36 kV	
6	Rated Frequency	50 Hz $\pm$ 5%	
7	System earthing	Effectively earthed	
8	Temperature rise	As per relevant IS/IEC publication	
9	Insulation level impulse with stand voltage		
	a) Across Isolating distance	195 kV <sub>peak</sub>	
	b) To earth & between poles	170 kV <sub>peak</sub>	

10	1 minute power frequency withstand voltage		
	a) Across Isolating distance	80 kV <sub>peak</sub>	
	b) To earth & between poles	70 kV <sub>peak</sub>	
11	Rated current in Amp	1250	
12	Short time current for 3 sec	25kA	
13	Operating mechanism	Motorised	
14	Auxiliary voltage	33kV	
	a) Control & Inter lock	48 DC 80% to 110%	
15	Safe duration of overload		
	a)150% of rated current	5 minute	
	b)120% of rated current	30 minute	
16	Minimum creepage distance of support and Rotating insulator	900mm	
	i) Mounting structure	Upright on G.I structure	
	ii) Terminal connector type	Bimetallic clamp size as per	
	iii) Control	Local	

## GURANTEED TECHNICAL PARTICULARS OF ISOLATOR(11kV) (CHAPTER-E16)

### ISOLATOR (11kV) (CHAPTER-E16)

Sl.No	Particular	Desired Value	Bidder's Offer
1	Main switch	Double end break Centre post rotating, gang operated	
2	Service	Outdoor	
3	Applicable standard	IS : 9921 / IEC-129/IEC-62271-102	
4	Pole	3 pole gang operator	
5	Rated voltage nominal/ Maximum	11/12 kV	
6	Rated Frequency	50 Hz $\pm$ 5%	
7	System earthing	Effectively earthed	
8	Temperature rise	As per relevant IS/IEC publication	
9	Insulation level impulse with stand voltage		
	a) Across Isolating distance	85 kV <sub>peak</sub>	
	b) To earth & between poles	75 kV <sub>peak</sub>	

10	1 minute power frequency withstand voltage		
	a) Across Isolating distance	32 kV <sub>peak</sub>	
	b) To earth & between poles	28 kV <sub>peak</sub>	
11	Rated current in Amp	1250	
12	Short time current for 3 sec	25kA	
13	Operating mechanism	Manual	
14	Auxiliary voltage	11kV	
	a) Control & Inter lock	48 DC 80% to 110%	
15	Safe duration of overload		
	a)150% of rated current	5 minute	
	b)120% of rated current	30 minute	
16	Minimum creepage distance of support and Rotating insulator	500mm	
	i) Mounting structure	Upright on G.I structure	
	ii) Terminal connector type	Bimetallic clamp size as per	
	iii) Control	Local	

## GURANTEED TECHNICAL PARTICULARS OF CLAMPS (CHAPTER-E16)

### TENSION CLAMPS (CHAPTER-E16)

Sl. No.	Particular	Desired Value (Suitable for AAAC 148/100mm <sup>2</sup> )	Bidders Offer
1	Type	Compression type tension clamp	
2	Material	Ext. Al.Alloy/Ext. Al.	
3	Breaking Strenght	95% of UTS of Conductor	
4	Slipping Strenght	95% of UTS of Conductor	
5	Galvanising		
6	Ferrous Parts	Hot Dip Galvanised	
7	Spring Washers	Electro Galvanised	
8	Quality of Zinc used	99.50%	
9	Number of dips which the clamp can withstand	4/ 1 minute dips	
10	Standard to which Conforming	IS 2633	
11	Electrical conductivity		
12	Results of heating cycle test carried out	T.C. Attached	
13	Electrical Resistance	Not more than 75% of equivalent length of conductor	
14	Reference to type tests and other test reports attached	T.C. Attached	
15	Make of bolts and Nuts used	Local Make	

SUSPENSION CLAMPS			
Sl. No.	Particular	Desired Value (Suitable for AAAC 148/100mm <sup>2</sup> )	Bidders Offer
1	Type of material used for retaining rod for AGS assembly giving reference of ISS	Alluminium Alloy 6061/Equivalent	
2	Minimum tensile strength of retaning rod material	35 Kg/mm2	
3	Chemical composition of retaning rod materials	As per IS:733	
4	Electrical conductivity of Armour Rod material(In percentage of the conductivity of IACS i.e. International Annealed Copper Standard	Not less than 40 %of IACS	
5	Slipping strength of cushioned suspension assembly	8% to 15% of UTS of Conductor	
6	Breaking strength of suspension Clamp	6000 Kgf	
7	Minimum Tensile Strenght	2000 Psi	
8	Minimum ultimate Elongation	300%	
9	Ageing (guaranteed life of the assembly)	40 Years	
10	Hardness	65 to 80 A	

FLEXIBLE COPPER BOND			
Sl. No.	Particular	Desired Value	Bidders Offer
1	Drawings enclosed	Yes	
2	Stranding	37/ 7/ 0.417	
3	Cross sectional area(Sq.mm)	75.6	
4	Minimum copper equivalent area(sq.mm)	34(each individual wire)	
5	Length of copper cable(mm)	500	
6	Material Lugs	Tinned copper	
7	Bolt Size		
	(i)Diameter(mm)	16	
	(ii)Length(mm)	40	
8	Resistance(ohm)	0.0004(as per IS.2121)	
9	Total weight of Fexible copper bond(kg)	0.45(approx)	

## GURANTEED TECHNICAL PARTICULARS of STAY WIRE (7/10 SWG) (CHAPTER-E16)

Sl. No.	PARTICULARS	Bidder's Offer
1	Nominal diameter of wire	
2	Tolerance in diameter	
3	Sectional Area (In Sq. mm.)	
4	Tensile strength	
	A. Min. N/mm <sup>2</sup>	
	B. Max. N/mm <sup>2</sup>	
5	Minimum breaking load (KN)	



6	Type of coating Heavy/Medium/Light	
7	Variety Hard/Soft	
8	Weight of Zinc coating (Gms/Sq. Mtr.) Min.	
9	No. of dips the coating is able to withstand as $18 \pm 20^{\circ}\text{C}$	
10	Adhesion Test (Wrap Test at 1 turn per second coiling while stress not exceeding % nominal tensile strength)	
	A. Min. complete turn of wrap	
	B. Dia. Of Mandrel on each wrapped	

11	Bend Test	
	A. Angle	
	B. Dia round a format to be bent	
12	Freedom from defect	
13	Chemical composition the MS Wire used shall not exceed	
	A. Sulphur 0.060%	
	B. Phosphorous 0.065%	

**PSC Pole (CHAPTER-E16)**

**GUARANTEED TECHNICAL PARTICULARS**

(To be submitted along with offer)

Sl No.	Description	Unit	Bidder's Offer	
			10mtr X 400 Kg	10mtr X 300 Kg
1	Type of pole			
2	Factor of Safety			
3	Overall Length of Pole Meters	meters		
4	Working Load Kg	Kg		
5	Overall Dimensions			
	A.Bottom Depth	mm		
	B.Top Depth	mm		
	C.Breadth	mm		
6	Reinforcement Detail			

7	Diameter of prestressing wire			
8	No. of Tensioned wires			
9	No. of Untensioned wire			
10	Length of each untensioned wire			
11	Concrete Detail			
	A.Cement Type			
	B.Grade			
	C.Type			
	D.Quantity	Cubic meter/pole		
	E.Standard confirming to:			
12	Steel Quality	Kg/Pole		
	A.Ultimate Tensile Strength (UTS)	Km/Cm <sup>2</sup>		
	B.Weight			

**GUARANTEED TECHNICAL PARTICULARS OF OUTDOOR OIL IMMERSED 3P4W,11 KV,5A MU (CT: PT UNITS). (CHAPTER-E16)**

Sl no	Particulars	Requirement	To be furnished by the bidder
1	Maker's name & adress	To be indicated	
2	Manufacturer's Type & Design	To be indicated	
3	Type of cooling	To be indicated	
4	Nominal System Voltage	11 KV	
5	Highest System Voltage	12 KV	
6	Frequency.	50 HZ	
7	Specification of CT & PT of Metering Unit		
A	<b>Current Transformer</b>		
	Type	Oil immersed	
	Accuracy Class	0.2	
	Rated output	15 VA	
	Insulation level	28KVrms / 75 KVpk	
	Short time thermal current rating for 1 sec	CT Primary 6 KA for up to 20/5A & 13KA for >20/5A	
	Saturation factor	To be indicated	
	Normal current density of primary winding	=<1.6 Amps per Sq.mm	
	Knee Point Voltage	To be indicated	

	Continuous percentage over load	120%	
	ISF	As per IS	
B	<b>Potential Transformer</b>		
	Type	Oil immersed	
	PT ratio	11 KV/ $\sqrt{3}$ V /110/ $\sqrt{3}$ V	
	Rated output VA/phase	50	
	Class of accuracy	0.2	
	Insulation level	28KVrms / 75 KVpk	
	Winding connection	Star/Star	
	Rated voltage factor & duration	To be indicated	
8	<b>Dimension of MS hot dip Galvanized tank</b>		
i	Height mm	To be indicated	
ii	Breadth mm		
iii	Length mm		
9 i)	Thickness of MS Tank Side walls Bottom	3.15mm	
ii	Top	5 mm	
iii	Edge bending in the Top Cover	To be provided	
iv	Standard pressure & duration that can be withstand.	To be indicated	
10	<b>Weight of core and winding</b>		
A.	Current transformer		
	Core	To be indicated	
	Primary winding	To be indicated	
	Secondary winding	To be indicated	

B.	Potential transformer		
	Core	To be indicated	
	Primary winding	To be indicated	
	Secondary winding	To be indicated	
11	i) Quantity of oil in Ltr ( Min 45 Ltrs)	To be indicated	
	ii) Grade of Oil	To be indicated	
12	Total weight of complete ME including all accessories and oil	To be indicated	
13	Resistance of primary & secondary winding per phase at 75° C:-		
	CT Winding (i) Primary	To be indicated	
	(ii) Secondary	To be indicated	
	PT Winding (i) Primary	To be indicated	
	(ii) Secondary	To be indicated	
14	Maximum attainable winding temperature	85° C	
15	Minimum phase to phase distance	255mm	
	Shortest distance between metal part & earth	190 mm	
	Make & type of HT bushing	To be indicated	

16	Creepage distance of HV bushing	300mm (Min)	
17	Bi-metallic terminal connector with nut, plain washer, spring washer & check nut suitable for aluminum conductor as per CT rating.	6 nos to be provided	
18	Type of core material	To be indicated	
19	Type & thickness of gasket used on		
i	Top cover tank	To be indicated	
ii	Secondary terminal box	To be indicated	
iii	HV bushing	To be indicated	
20	Details of Metering Unit		
A	<b>CT details</b>		
	<b>Cross section area of each turn of CT winding (in sq. mm.)</b>		
	Primary winding	To be indicated	
	Secondary winding	To be indicated	
	<b>No. of turns</b>		
	Primary winding	To be indicated	
	Secondary winding	To be indicated	
	<b>Winding material</b>		



	Primary winding	To be indicated	
	Secondary winding	To be indicated	
B	<b>PT details</b>		
i	<b>Cross Section area of each turn of PT (in sq. mm.)</b>		
a	Primary winding	To be indicated	
b	Secondary winding	To be indicated	
ii	<b>Number of turns</b>		
a	Primary winding	To be indicated	
b	Secondary winding	To be indicated	
c	<b>Winding materials</b>		
i	Primary winding	To be indicated	
ii	Secondary winding	To be indicated	
21	Identification/marketing of		
i.	Primary terminals		
a	Incoming	RM, YM, BM	
b	Outgoing	RL, YL, BL	
ii	Secondary terminals		
a	CTs	1s1- 1s2, 2s1-2s2, 3s1-3s2	
b	PTs	r,y,b,n	
22	Size and material of		
i.	Primary studs	M12 up to 20A & M16 >20A	
ii	Secondary studs	M6	

23	Secondary Chamber shall have double door type & sealing arrangement in both the doors.	Secondary chamber shall have double door (inner & outer) with suitable <b>arrangement</b> for sealing of both the doors. The inner door shall be of transparent polycarbonate so that secondary terminal connections can be viewed with out breaking the inner door seals.	
24	Name Plate	The name plate shall be non-detachable type & fixed with rivets, not with bolts & nuts. The nameplate should bear year, month of manufacture , Guaranty period & other data as per IS.	
25	Sealing arrangements	The secondary terminal box cover, tank cover and inspection cover sealing arrangements have to be done with sealing bolts at all corners and bolts should be at least 10 mm diameter GI bolts spaced maximum 70 mm apart. Sealing holes also to be provided in the bolts fitted with bushing & body for sealing, so that one can not open the bushing with out breaking seals.	

26	Galvanization of Tank	Metering Unit tank including top cover shall be hot deep galvanized.	
27	Gap between I/C & O/G Studs of same phase	minimum 15° angle with the vertical axis to maintain a good distance at stud levels.	

**GUARANTEE TECHNICAL PARTICULARS FOR OIL**

Sl. No	Characteristic.	Particulars.	To be furnished by the bidder
1	Appearance.	The oil shall be clear and transparent and free from suspended matter or sediments and should conform to or latest versions. IS-335/93	
2	Density at 27 degrees C (max)	0.89 g/cm.	
3	Kinematic Viscosity at 27 degrees C (max)	27 CST.	
4	Interfacial Tension at 27 Degrees C (max)	0.04 N/M.	
5	Flash point, pensky – marten (closed) (min)	140 Degrees C.	
6	Pour point (max)	-10 Degrees C.	
7.	Neutralisation Value :		
	a) Total acidity (max)	0.01.	
	b) In-organic acidity alkalinity.	Nil	
8	Corrosive sulphur.	Non-corrosive.	

9	Electric Strength (breakdown voltage/ minute)		
	a) New unfiltered oil.	30 KV (rms)	
	b) After filtration.	50 KV (rms)	
10	Dielectric dissipation factor(Tan delta at 90 Deg. C (min)).	0.005.	
11	Specific resistance (Resistivity).		
	a) At 90 Deg. C (min)	$30 \times 10^{12}$ ohms- cm.	
	b) At 27 Deg. C (min)	$500 \times 10^{12}$ ohms-cm	
12	Oxidation stability		
	a) Neutralisation value after oxidation (max)	0.2 mg KOH/g	
	b) Total sludge after oxidation (max)	0.05% by Weight.	
13	Ageing characteristics after accelerating ageing (open breaker method with copper catalyst) for 96 Hrs.as per ASTM D. 1934-1978)		
	a) Specific resistance (Resistivity)		
	a. At 27 Deg. C (min) b. At 90 Deg. C (min)	$2.5 \times 10^{12}$ ohms-cm $0.20 \times 10^{12}$ ohms-cm	

	b) Dielectric dissipation factor Tan delta at 90 Deg. C (max)	0.2	
	c) Total sludge value (max)	0.5	
	d) Total acidity (max)	0.5	
14	Presence of oxidation inhibitor.	Nil	
15	Water content (max)	50 ppm	