Bhakra Beas
Nation's Pride

BHAKRA BEAS MANAGEMENT BOARD
Planning & Design (TS) Directorate
SLDC Complex, Indl. Area Phase-I, Madhya Marg
CHANDIGARH – 160 002
Telefax : 0172-**2654468** EPABX-0172-2653735 Extn- **301** E.mail: dirpp@bbmb.nic.in

To

M/S EMCO Ltd.,
Regd. AD Plot F-5, Road No. 28, Wagle Ind. Estate,
Speed Post Thane - 400604. **Fax No. 022-2582571**

Memo. No. 552 /P&D(TS)SS-I/PNGS-656/A/EMCO Dated. 05.02.2010

Subject: Manufacturing, testing, supply, delivery of 1 No., 4MVA, 132/11KV Power Transformer, 1No, 6.3/8MVA 66/11KV Power Transformer &1No., 12.5/16MVA 66/11KV Power Transformer against Specification No.BBMB/SS-I/356.

References:
1. Your offer No. C-0016/AKG/2009 dated 09-09-2009
2. Your letter dated 16-10-2009
3. Your letter No. C-0016/AKG/2009 dated 30-10-2009
4. Your letter No. C-0016/AKG/2009 dated 04-11-2009
5. L.O.I. placed vide this office memo no.150**/**P&D(TS)SS-I/PNGS-656/A/ EMCO dated 15-10-10 and confirmed vide your letter no.C-0016/AKG/ 2009 dated 1.2.2010

Dear Sir,

With reference to above, I am directed to place upon you a detailed purchase order for design Manufacture, testing, Supply and Delivery up to FOR destination of following material at the prices, terms and conditions as detailed hereunder as well as in Schedule-A and Annexure – B to E enclosed herewith

Continued on page-2-

I. SCOPE & SCHEDULE OF PRICES :-

Sr. No.	Description	Qty	Unit Ex-Works Price including Packing & forwarding charges (Rs.)	Unit freight & Insurance charges (Rs.)	Unit FOR Destination price (Rs.)	Total FOR destination price) exclusive of Taxes & duties (Rs.)
1	2	3	4	5	6	7
1.	(a) 4MVA. 132/11KV, ONAN cooled, oil immersed outdoor type transformer suitable for 3 phase 50Hz, frequency, STAR- STAR connected in accordance with vector group YNyno with neutral brought out on both sides. The transformer will be fitted with Off load circuit Tap changer gear with HV variation from +5% to-5% in 4 equal steps of 2.5%each and 5positions. Tapings being provided on separate tapping coil. %age impedance HV to LV as 7.15%. The transformer shall be completed with flanged bi-directional roller (1676mm rail gauge) and all the fittings and accessories as per specification and with EHV Grade Nepthenic base Transformer oil for first filling and 10% extra. The transformer shall be fitted with 2X60% tank mounted radiators along with Thermosyphon filter of requisite capacity & Air cell type conservator tank (For Dehar Power House, Slapper (HP)	1No.	5138571	161693	5300264	5300264
	(b)Spares as per schedule-A	1Set	346154	37500	383654	383654
	Sub Total (a+b) (Rs.)					5683918
2	(a) 66/11KV, 6.3/8MVA, 3 Phase, 50Cycles ONAN/ONAF cooled, oil immersed, out door type transformer, star-star connected in accordance with vector group YNyno with neutral brought out on both sides. The transformer will be fitted with Off load circuit Tap changer gear with Tapping on HV side for HV variation from +5% to-5% in 4 equal steps of 2.5%each and 5positions and %age impedance HV to LV as 8.5%.,The transformer shall be fitted complete with flanged bi-directional roller (1676mm rail gauge) and all fittings and accessories as per specification and with EHV Grade Nepthenic base Transformer oil for first filling and10% extra. The transformer shall be fitted with Thermosyphon filter. The transformer shall be having 2x60% tank mounted radiators. The radiator shall be fitted with cooling Fans and stand by cooling fans equal to 15% of cooling capacity with min. one no. Fan with each radiator unit. The transformer shall be	1No.	5373377	173067	5546444	5546444

Sr. No.	Description	Qty	Unit Ex-Works Price including Packing & forwarding charges (Rs.)	Unit freight & Insurance charges (Rs.)	Unit FOR Destination price (Rs.)	Total FOR destination price) exclusive of Taxes & duties (Rs.)
	equipped with Air cell type conservator tank.(For Bhakra Left Bank Power House, Nangal)					
	(b)Spares as per schedule-B	1set	301936	39500	341436	341436
	Sub Total (a+b) (Rs.)					5887880
3	(a) 66/11KV,12.5/16MVA., 3 phase 50Hz,ONAN/ONAF cooled, oil immersed outdoor type transformer star-star connected in accordance with vector group YNyno with neutral brought out on both windings. The transformer shall be fitted with full capacity OLTC gear with tapping on HV side for HV variation from +5%to -15% in steps of 1.25 each with 16 steps in 17 positions (1 to 17). Tapings being provided on separate tapping coil. %age impedance HV to LV as 10%. The transformer shall be complete with flanged bi-directional roller (1676mm rail gauge) and all the fittings and accessories as per specification and with EHV Grade Nepthenic base Transformer oil for first filling and10% extra. The transformer shall be fitted with 2X60% tank mounted radiators. The radiator shall be fitted with cooling Fans and stand by cooling fans equal to 15% of cooling capacity with min. one no. Fan with each radiator unit. . The transformer shall be equipped with Air cell type conservator tank & Thermosyphon filter of requisite capacity (For 220KV Substation, Jagadhri)	1No,	8002208	257611	8259819	8259819
	Spares as per schedule-C	1 Set	372812	56500	429312	429312
	Sub Total (a+b) Rs.					**8689131**
	Total for item No, 1 to 3 (Rs.)					**20260929**

(Rs. Two crore two lac sixty thousand Nine hundred twenty nine only.)

II. **NOTE:**

i). The prices of transformer mentioned at 1(a), 2(a) and 3(a) are variable subject to IEEMA variation formula for basic prices of raw material used in manufacturing of transformer without any ceiling with base date as 1.08.2009. The prices of spares are FIRM

ii). Excise Duty, Central Sales Tax (against concessional Sales Tax form C) on item 1to 3 shall be payable as applicable at the time of delivery but limited to rates prevailing

within contractual delivery period. Present rate of Excise duty is @ 8.24% and CST @ 2% against Form C. Octroi will be paid as applicable at the time of delivery.

iii). Type tests charges & Charges for Supervision of Erection & Commissioning of transformers have been included in the Prices of main transformer units.

iv). Bank charges, if any, shall be borne by the supplier.

III. MAIN TERMS & CONDITIONS ARE AS UNDER:-

1.0 GENERAL TERMS & CONDITIONS:-

All the terms & conditions of purchase order are given in the Appendix-A, subject to the extent modified by the clauses mentioned hereunder

2.0 DELIVERY:-

Delivery of equipment (transformer) as stipulated in this contract shall be started by supplier within five months from the date of receipt of technically and commercially clear order and shall be completed @ one unit every two months thereafter. The commencement of delivery shall be started with 6.3/8MVA,66/11KV Power transformer and thereafter 4MVA,132/11KV Power transformer & 12.5/16MVA, 66/11KV Power transformer. The technical clearance of the P.O. will be deemed from receipt of approved drawings by the supplier, allowing seven days for postal transit. The supplier will, however, ensure that the complete drawings as per clause -22 of Annexure-C shall be supplied within 60 days of receipt of P.O. If the drawings are found to be deficient in any manner, the deficiency, so communicated, would be rectified within next 20 days. The delay beyond 60 days in submission of drawings in the first instance and beyond 20 days in resubmission of drawings (after removal of deficiencies, if pointed out) would count towards levy of penalty as specified in Clause 5 below. Delivery shall be made as per dispatch instructions in Annexure-E. However, Purchaser can change the destination in case of emergence of transformer at any station falling with in the jurisdiction of BBMB.

3.0 IMPORTANT PARAMETERS

The Power Transformers on order shall have the following guaranteed and other technical particulars besides technical particulars enlisted in schedule of guaranteed & other technical particulars as per Annexure-A-I ,A2 & A3 & Annexure -B-1,B2 and B3 shall strictly comply with latest edition of IEC-76, IEC-354 & IS: 2026 : relevant CBIP specification & BBMB specification No. SS-I/356 and your offer. The salient features of the BBMB technical specification are enclosed herewith as Annexure-C.

A. For 132/11KV, 4MVA Power transformer:

i)	Transformer rating	= 4MVA
ii)	No load loss at rated voltage, frequency normal tap	=5.5KW (Max.)
iii)	Load loss at rated current at principal tapping at 75 deg.C in KW(Max.)	=22KW
iv)	Impedance at normal tap at 75 deg.C & at rated MVA	=7.15%
v)	Temperature rise	
a)	Top oil	=50^0C
b)	Winding	=55^0C
c)	Hot spot Temp. calculated over an annual Weighted temperature of 32deg.C	=98^0C
d)	Limits of hot spot temp. for which transformer is designed as per IS:6600/IEC-354	=140^0C
vi).	Masses (Kg)	
a)	Bare copper used	
	i) For winding	=2020Kg (approx)
	ii) For leads & connection	=120Kg (approx)
b)	Windings	
	i) With insulation	=2150Kg (approx)
	ii) Soaked in oil	=2185Kg (approx)
c)	Core	
	i) CRGO Laminations	=4500Kg (approx)
	ii) Supporting frame work	=950Kg (approx)

B. For 66/11KV, 6.3/8MVA Power transformer:

i)	Transformer rating	=6.3/8MVA
ii)	No load loss at rated voltage, frequency normal tap	=6.5KW (Max.)
iii)	Load loss (excluding auxiliary loss) at rated current at principal tapping at 75 deg.C in KW (Max.)	=49.5KW
iv)	Total Aux. Losses at ONAF in KW (Max.)	=1KW
v)	Impedance at normal tap at 75 deg.C & at rated MVA	=8.50%
vi)	Temperature rise	
a).	Top oil	=50^0C
b).	Winding	=55^0C
c).	Hot spot Temp. calculated over an annual Weighted temperature of 32deg.C	=98^0C

d).	Limits of hot spot temp. for which transformer is designed as per IS:6600/IEC-354	=140^{0}C
vii).	Masses (Kg)	
a)	Bare copper used	
	i) For winding	=2230Kg (approx)
	ii) For leads & connection	=90Kg (approx)
b)	Windings	
	i) With insulation	=3300Kg (approx)
	ii) Soaked in oil	=3366Kg (approx)
c)	Core	
	i) CRGO Laminations	=5780Kg (approx)
	ii) Supporting frame work	=790Kg (approx)

B. For 66/11KV, 12.5/16MVA Power transformer:

i)	Transformer rating	=12.5/16MVA
ii)	No load loss at rated voltage, frequency normal tap	=10KW (Max.)
iii)	Load loss (excluding auxiliary loss) at rated current at principal tapping at 75 deg.C in KW(Max.)	=72KW
iv)	Total Aux. Losses at ONAF in KW(Max.)	=2KW
v)	Impedance at normal tap at 75 deg.C & at rated MVA (60MVA base)	=10%
vi)	Temperature rise	
a).	Top oil	=50^{0}C
b).	Winding	=55^{0}C
c).	Hot spot Temp. calculated over an annual Weighted temperature of 32deg.C	=98^{0}C
d).	Limits of hot spot temp. for which transformer is designed as per IS:6600/IEC-354	=140^{0}C
vii).	Masses (Kg)	
a)	Bare copper used	
	i) For winding	=5240Kg (approx)
	ii) For leads & connection	=130Kg (approx)
b)	Windings	
	i) With insulation	=5400Kg (approx)
	ii) Soaked in oil	=5510Kg (approx)

c) Core

i) CRGO Laminations =9300Kg (approx)

ii) Supporting frame work =980Kg (approx)

The no load losses, load losses and auxiliary losses wherever applicable are guaranteed maximum without any positive tolerances. Benefit of lower losses of any component losses will not be accounted for total losses.

Tolerance in %age impedance shall be as per IS:2026.

No positive tolerance shall be allowed on temperature rise of oil, winding and hot spot temperature that the guaranteed value.

No negative tolerance shall be allowed on weights of copper & core.

4.0 TERMS OF PAYMENT: -

100% payment within 30 days after the receipt of material at site in good condition and according to the specification and physical verification and record entry by the consignee in the relevant GR/MB.

5.0 PENALTY CHARGES:-

If the supplier fails to abide by the provisions of Delivery clause, he shall be liable to pay @1/2% per week or a part thereof the ex-works delivery price excluding taxes and duties (but including freight and insurance charges where break up of FOR Destination price is not available) of such portion of material as has not been delivered within "Delivery Period" subject to maximum of 10%of the contract value of the delayed/undelivered portion of material as penalty charges.

6.0 WARRANTY AND WARRANTY DEED:

The warranty for the equipment shall be 12 months from the date, the material is commissioned/put to use by the end user or 18 months from the date of despatch whichever period may expire earlier.

The supplier shall execute a Warranty Deed (as per Appendix-B) on a non-judicial stamp paper as per clause-12 of Appendix-A of the purchase order immediately after placement of purchase order.

7.0 PERFORMANCE BANK GUARANTEE: -

The supplier shall furnish Performance Bank Guarantee (on the standard Performa of BBMB enclosed herewith as per Appendix-C) to the tune of 10% value of contract as per Clause-13 of Appendix-'A' of this purchase order. The PBG should be for Rs. **20,26,093**/-. This PBG should be accepted and retained by this office till the validity of the PBG. The validity of the PBG can be extended if required.

8.0 SUPERVISION OF ERECTION AND COMMISSIONING:-

The erection & commissioning of transformer shall be carried out departmentally. However complete supervision required during erection & commissioning shall be provided by the supplier engineer(s). Charges for supervision of erection & commissioning of transformers unit have been included in the Prices of Main Transformer Unit.

9.0 INSPECTION AND TESTS :-

The routine/type/special tests as per clause-24 of Annexure-C (Salient feature of Technical specification No.BBMB/SS-1/356) shall be carried out at the works of supplier. Charges for routine/type/special tests of transformer unit have been included in the Prices of Main Transformer Unit.

10.0 DRAWINGS, LITERATURE AND INSTRUCTION BOOK:

The contract drawings in quadruplicate based on tender drawings shall be submitted by the supplier immediately after the receipt of purchase order **(not later than 60 days)** for the approval of purchaser . The drawings, if found in order, shall be approved by the purchaser. Ten sets of approved drawings and their reproducible shall be submitted after approval. The supplier shall also supply six sets of Instruction books containing necessary information regarding installation, operation and maintenance of the equipment covered in the purchase order along with final test results /test certificates of the transformer. The prices include the cost of such drawings/instruction books and nothing extra shall be paid on this account.

11.0 SPECIFICATION AND DETAILS OF EQUIPMENT:-

The material to be manufactured and supplied under this PO shall be in accordance with specification no. BBMB/SS-I-356, which shall form a part of this contract subject to departures from the provision of the specification, issued by the purchaser whether on account of manufacture practice or for any other reason and mutually agreed upon between supplier and the purchaser.

The material shall further be manufactured and supplied as per details given in Annexure-A-I, A2 & A3 & Annexure -B-1,B2 and B3.

12.0 GUARANTEED & OTHER TECHNICAL PARTICULARS:-

The transformer and transformer oil shall satisfy the guaranteed & other technical particulars in Annexure-A-I, A2 & A3 & Annexure -B-1, B2, B3 and B4.

13.0 COMPLETENESS OF MATERIAL:-

All fittings, accessories and apparatus which may have not been specifically mentioned in the order but are actually otherwise necessary for completeness of equipment shall be deemed to have been included in the contract. All equipment shall be completed in all respects where such details are mentioned in purchase order or not.

Each transformer shall be completed with fittings and accessories described in Annexure-D besides any other fitting/accessory considered necessary by the manufacturer.

14.0 EARNEST MONEY/SECURITY DEPOSIT:-

The supplier shall deposit Rs. **2,02,609**/- (1% of the order value) in the form of Cash receipt /Demand Draft/Bank Guarantee (Appendix- D) /Deposit at call receipt/FD in favour in favour of Sr. Accounts Officer, BBMB, Chandigarh as Security deposit within 7 days of receipt of this purchase order as per clause no. 24 of section IA of Specifications BBMB/SS-I/356

15.0 TRANSPORTATION, INSURANCE & HANDLING OF MATERIAL :-

The supplier shall be responsible for Transportation, Insurance and handling of material upto destination station as per despatch instructions. The material shall be despatched by Rail/Road on" Freight pre-paid". The supplier shall be responsible for insurance and handling of material upto destination station. The Purchaser shall have the right to lodge claim/claims for shortage/damages etc. if any, during transit with the supplier within 30 days of the receipt of material. The settlement of such claims with the underwriters shall be supplier's responsibility. In such an event, the BBMB shall obtain an open Delivery and Certification from the Railway/ Carrier.

16.0 METHOD OF RAISING INVOICES:-

a) Invoices for payment shall be prepared in pen-triplicate. Original copy (duly stamped and pre-receipted) and one spare copy along with despatch documents shall be sent to the concerned BBMB, Sr. Accounts Officer, one copy of the same shall be sent to the consignee, one copy to concerned SE /O&M circle and one copy to this office. The supplier shall give at least 15 days notice before despatch to the Sr. Accounts Officer and the consignee so that necessary arrangements for the funds and unloading of the material are made by them respectively.

b) Payment shall be made by the paying Authority viz Sr. Accounts Officer, BBMB, on presentation of the following documents**:-**

i) Copy of the invoice.

ii) Certificate for Central Sales Tax & Excise Duty.

iii) Copy of Despatch Authorization.

c) Bank - State Bank of India of the respective city

d). No. goods shall be accepted unless accompanied by prices challan or invoices.

e). Please also state on your invoice, the number & date of your challan and the name of the officer or person to whom goods are delivered.

17.0 COMMERCIAL TERMS & CONDITIONS:-

Commercial terms and conditions applicable to this purchase order shall be as per Appendix–A enclosed herewith.

18.0 ACKNOWLEDGMENT:-

You are requested to acknowledge the receipt of this purchase order and return one copy of the purchase order duly appended with the signatures of your authorized person legally competent to sign as per Clause no.20 of Appendix-A.

Chief Engineer/SystemOperation
BBMB, Chandigarh.

DA/ 3 copies of PO, each having

1. Schedule –A List of spares to be supplied along with each transformer
2. Annexure-A1 Guaranteed Technical Particulars of 132/11KV, 4MVA Power transformer
3. Annexure-A2 Guaranteed Technical Particulars of 66/11KV, 6.3/8MVAMVA Power transformer
4. Annexure-A3 Guaranteed Technical Particulars of 66/11KV, 12.5/16MVA Power transformer
5. Annexure-B1 Other Technical Particulars of 132/11KV, 4MVA Power transformer
6. Annexure-B2 Other Technical Particulars of 66/11KV, 6.3/8MVA Power transformer
7. Annexure-B3 Other Technical Particulars of 66/11KV, 12.5/16MVA Power transformer
8. Annexure –B4 Guaranteed characteristics of transformer oil
9. Annexure –C Salient feature of BBMB specification
10. Annexure -D Fitting & accessories
11. Annexure -E Dispatch Instructions
12 Appendix-A Terms & Conditions of P.O.
13. Appendix-B Warranty Deed Proforma.
14. Appendix-C Performance Bank Guarantee Proforma.
15. Appendix-D Performance Bank Guarantee Proforma.

PO NO. 1659 /P&D(TS)SS-I/PNGS-656/A/EMCO DATED: 05.02.2010

पृश्ठांकन न: 553-73 /PNGS-669/SS-I/ABB दिनांक: 05.02.2010

उपरोक्त की प्रति निम्नलिखित को आवश्यक कार्यवाही हेतु भेजी जाती है जी।

1.	**प्रमुख्य अभियन्ता ,जनरेशन ,पावर विंग ,बीबीएमबी ,नंगल टाउनशिप ।**
2.	मुख्य अभियन्ता, प्रणाली परिचालन (कार्य भाग) **बीबीएमबी,** चण्डीगढ़।
3.	मुख्य अभियन्ता, पारेषण प्रणाली (कार्य भाग) **बीबीएमबी**, चण्डीगढ़।
4.	वितीय सलाहकार एवं मुख्य लेखा अधिकारी, **बीबीएमबी,** चण्डीगढ़।
5.	**उप मुख्य अभियंता/योजना एवं रूपांकन ।पीपी।, बीबीएमबी, चण्डीगढ़ ।**
6.	अधीक्षण अभियन्ता, ओ एंड एम सर्कल, 220 के वी ग्रिड सबस्टेशन, **बीबीएमबी** जमालपुर ।
7.	अधीक्षण अभियन्ता, **देहर पावर हाउस, बीबीएमबी, सलापड़ ।**
8.	अधीक्षण अभियन्ता, **भाखड़ा पावर हाउस सर्कल, बीबीएमबी, नंगल।**
9.	वरिष्ठ कार्यकारी अभियन्ता,ओ एंड एम डिविजन, 220 **के** वी सबस्टेशन,बीबीएमबी,**जगाधरी** ।
10.	वरिष्ठ कार्यकारी अभियन्ता, **इएमडी, देहर पावर हाउस, बीबीएमबी, सलापड़ ।**
11.	**रैज़ीडैंट अभियंता, देहर पावर हाउस, बीबीएमबी, सलापड़**
12.	वरिष्ठ कार्यकारी अभियन्ता, **इएमडी, भाखड़ा पावर हाउस, बांया किनारा बीबीएमबी, भाखड़ा ।**
13.	वरिष्ठ कार्यकारी अभियन्ता, **एसटीडीएवंपी, बीबीएमबी, नंगल ।**
14.	वरिष्ठ लेखा अधिकारी, **बीबीएमबी, चण्डीगढ़ ।**
15.	वरिष्ठ लेखा अधिकारी, **बीबीएमबी, धूलकोट ।**
16.	वरिष्ठ लेखा अधिकारी, **बीबीएमबी, सलापड़ ।**
17.	वरिष्ठ लेखा अधिकारी, **बीबीएमबी, नंगल ।**
18.	**सीनीयर सब स्टेशन इजीनियर, 220केवी सब स्टेशन, बीबीएमबी, जगाधरी ।**
19.	उप मण्डल अधिकारी, **स्टोर, बीबीएमबी, नंगल**
20.	उप मण्डल अधिकारी, एस एंड टी, **बीबीएमबी, सलापड़ ।**
21.	EDP Manager BBMB, Chandigarh . A soft copy of purchase order is forwarded for hosting the purchase order on the Website of BBMB

This issues with the approval of the Purchase Committee of BBMB (PW) accorded in its meeting held on 13-01-2010 as conveyed by Special Secretary, BBMB, Chandigarh vide memo No. 1443-46/B-1547/PC/13-01-10/2P dated 13-01-2010/15-01-2010.This has been scrutinized by the Sr. Accounts Officer, BBMB, Chandigarh vide H.M No. 197 Dated 05.02.2010

DA/As above

मुख्य अभियन्ता, **प्रणाली परिचालन,**
बी बी एम बी, चण्डीगढ़।

SCHEDULE-A

DETAILS OF PRICES OF SPARES FOR 132/11KV, 4MVA POWER TRANSFORMER

Sr. No.	Details of spares	Qty.	Unit Rate(Rs.)	Total(Rs.)
1	HV bushing (complete assembly)	1No.	137275	137275
2	LV bushing(complete assembly)	2No. (Including Neutral end bushing)	7280	14560
3	Complete set of Gaskets	1set	32975	32975
4	WTI with remote indicator	1No.	5833	5833
5	Magnetic oil level gauge	1No.	7708	7708
6	OTI with remote indicator	1No.	5833	5833
7	Silica gel container along with Silica gel (for one time filling)for main tank	2No.	2635	5270
8	Pressure release valve(PRV)	1No.	6550	6550
9	Thermosyphon filter unit along with absorbent for one time filling in Thermosyphon filter assembly.	1No.	41667	41667
10	Buchholz relay	1No.	4033	4033
11	Dial type thermometer for OTI	1No.	833	833
12	Set of valves for radiators	1set	20958	20958
13	Switches, fuses, relays for electric control circuit	1set	6667	6667
14	Set of Jacks(2Nos, in 1set)	2set	15496	30992
15	HV neutral end bushing	1No.	25000	25000
16	Sub Total			346154
17	F & I charges(Schedule-A/1)			37500
18	Total FOR destination exclusive of taxes & duties(Rs.)			383654

Note: Voltage & current rating of spares bushings shall be as per Sr. No. 37 of Other Technical paticulars of transformer (Annexure-B1)

PO NO. 1659 /P&D(TS)SS-I/PNGS-656/A/EMCO DATED: 05.02.2010

Annexure-A1/1

Sr. No.	Details of spares	Qty.	Unit Rate(Rs.)	Total(Rs.)
1	HV bushing (complete assembly),145KV,2000Amp	1No.	10000	10000
2	LV bushing(complete assembly),36KV,630Amp	2No.(Including Neutral end bushing)	2000	4000
3	Complete set of Gaskets	1set	5000	5000
4	WTI with remote indicator	1No.	500	500
5	Magnetic oil level gauge	1No.	500	500
6	OTI with remote indicator	1No.	500	500
7	Silica gel container along with Silica gel (for one time filling)for main tank	2No.	500	1000
8	Pressure release valve(PRV)	1No.	500	500
9	Thermosyphon filter unit along with absorbent for one time filling in Thermosyphon filter assembly.	1No.	10000	10000
10	Buchholz relay	1No.	500	500
11	Dial type thermometer for OTI	1No.	100	100
12	Set of valves for radiators	1No.	1000	1000
13	Switches, fuses, relays for electric control circuit	1No.	400	400
14	Set of Jacks(2Nos, in 1set)	2set	1000	2000
15	HV neutral end bushing	1No.	1500	1500
16	Total Frieght & Insurance charges for spares			37500

SCHEDULE-B

DETAILS OF PRICES OF SPARES FOR 66/11KV, 6.3/8MVA POWER TRANSFORMER

Sr. No.	Details of spares	Qty.	Unit Rate(Rs.)	Total(Rs.)
1	HV line end bushing Complete	1No.	85659	85659
2	LV line end bushing Complete	1No.	10498	10498
3	Complete set of Gaskets	1set	32975	32975
4	WTI with remote indicator	1No.	13333	13333
5	Magnetic oil level gauge	1No.	7708	7708
6	OTI with remote indicator	1No.	5833	5833
7	Silicagel container along with Silicagel (for one time filling) for main tank	2Nos.	2150	4300
8	Pressure release valve(PRV)	1No.	6550	6550
9	Thermosyphon filter unit along with absorbent for one time filling in Thermosyphon filter assembly.	1No.	41667	41667
10	Buchholz relay	1No.	4033	4033
11	Dial type thermometer for OTI	1No.	833	833
12	Set of valve for radiator	1set	15230	15230
13	Switches, fuses, relays for electric control circuit	1set	6667	6667
14	Cooling fan with motor	1No.	7132	7132
15	set of jacks(2Nos, in 1set)	2set	19261	38522
16	HV neural end bushing	1No.	10498	10498
17	LV neutral end bushing	1No.	10498	10498
18	Sub Total			301936
19	F & I charges (Schedule-B/1)			39500
20	Total FOR destination prices exclusive of taxes & duties(Rs.)			341436

Note: Voltage & current rating of spares bushings shall be as per Sr. No. 40 of Other Technical paticulars of transformer (Annexure-B2)

SCHEDULE-B/1

DETAILS OF FREIGHT & INSURANCE CHARGES OF SPARES FOR 66/11KV,6.3/8MVA POWER TRANSFORMER AGAINST TENDER				
Sr. No.	Details of spares	Qty.	Unit Rate(Rs.)	Total(Rs.)
1	HV line end bushing Complete, 72.5KV,1250A	1No.	10000	10000
2	LV line end bushing Complete, 36KV, 1250A	1No.	2000	2000
3	Complete set of Gaskets	1set	5000	5000
4	WTI with remote indicator	1No.	500	500
5	Magnetic oil level gauge	1No.	500	500
6	OTI with remote indicator	1No.	500	500
7	Silicagel container along with Silicagel (for one time filling) for main tank	2Nos.	500	1000
8	Pressure release valve(PRV)	1No.	500	500
9	Thermosyphon filter unit along with absorbent for one time filling in Thermosyphon filter assembly.		10000	10000
10	Buchholz relay	1No.	1000	1000
11	Dial type thermometer for OTI	1No.	100	100
12	Set of valve for radiator	1set	1000	1000
13	Switches, fuses, relays for electric control circuit	1set	400	400
14	Cooling fan with motor	1No.	1000	1000
15	set of jacks(2Nos, in 1set)	2set	2500	5000
16	HV neural end bushing, 36KV,1250A	1No.	500	500
17	LV neutral end bushing,36KV,1250A	1No.	500	500
18	Total Frieght & Insurance charges for spares			39500

SCHEDULE-C

DETAILS OF PRICES OF SPARES FOR 66/11KV, 12.5/16MVA POWER TRANSFORMER

Sr. No.	Details of spares	Qty.	Unit Rate(Rs.)	Total(Rs.)
1	HV line end bushing Complete	1No.	85658	85658
2	LV line end bushing Complete	1No.	20460	20460
3	Complete set of Gaskets	1set	42868	42868
4	WTI with remote indicator	1No.	13333	13333
5	Magnetic oil level gauge	1No.	7708	7708
6	OTI with remote indicator	1No.	8202	8202
7	Silicagel container along with Silicagel (for one time filling) for main tank	2Nos.	3108	6216
8	Pressure release valve(PRV)	1No.	10273	10273
9	Thermosyphon filter unit along with absorbent for one time filling in Thermosyphon filter assembly.	1No.	41667	41667
10	Buchholz relay	1No.	9015	9015
11	Dial type thermometer for OTI	1No.	833	833
12	Set of valves for radiators	1set	20958	20958
13	Switches, fuses, relays for electric control circuit	1set	8333	8333
14	Silicagel container along with silicagel (for one time filling) for OLTC	2Nos.	2000	4000
15	set of jacks(2Nos, in 1set)	2set	22618	45236
16	HV neutral end bushing	1No.	20460	20460
17	LV neutral end bushing	1No.	20460	20460
18	Cooling fan with motor	1No.	7132	7132
19	Sub Total			372812
20	F & I charges (Schedule-C/1)			56500
21	Total FOR destination prices exclusive of taxes & duties(Rs.)			429312

Note: Voltage & current rating of spares bushings shall be as per Sr. No. 39 of Other Technical paticulars of transformer (Annexure-B3)

SCHEDULE-C/1

DETAILS OF FREIGHT & INSURANCE CHARGES OF SPARES FOR 66/11KV, 12.5/16MVA POWER TRANSFORMER

Sr. No.	Details of spares	Qty.	Unit Rate(Rs.)	Total(Rs.)
1	HV line end bushing Complete,72.5KV,1250A	1No.	10000	10000
2	LV line end bushing Complete,36KV,2000A	1No.	5000	5000
3	Complete set of Gaskets	1set	5000	5000
4	WTI with remote indicator	1No.	4000	4000
5	Magnetic oil level gauge	1No.	500	500
6	OTI with remote indicator	1No.	500	500
7	Silicagel container along with Silicagel (for one time filling) for main tank	2Nos.	500	1000
8	Pressure release valve(PRV)	1No.	2000	2000
9	Thermosyphon filter unit along with absorbent for one time filling in Thermosyphon filter assembly.	1No.	10000	10000
10	Buchholz relay	1No.	2000	2000
11	Dial type thermometer for OTI	1No.	100	100
12	Set of valves for radiators	1set	1000	1000
13	Switches, fuses, relays for electric control circuit	1set	2400	2400
14	Silicagel container along with silicagel (for one time filling) for OLTC	2Nos.	500	1000
15	set of jacks(2Nos, in 1set)	2set	1000	2000
16	HV neutral end bushing,36KV,1250A	1No.	4000	4000
17	LV neutral end bushing,36KV,2000A	1No.	5000	5000
18	Cooling fan with motor	1No.	1000	1000
19	Total Frieght & Insurance charges for spares			56500

ANNEXURE-A1

GUARANTEED PARTICULARS OF 132/11KV ,4MVA POWER TRANSFORMER FOR DEHAR POWER HOUSE SLAPPER

Sr. No.	Particulars	M/S EMCO
1	Normal continuous rating under site condition at any tap	ONAN
	a). HV winding(MVA)	4
	b). LV winding(MVA)	4
2	No. of phases	3
3	Frequency	50HZ
4	Rated voltage of HV winding	132KV
5	Rated voltage of LV winding	11KV
6	Impedance voltage at rated current for the principal tapping at 75deg. C	7.15%
7	Connections	
	a). HV winding	Star
	b). LV winding	Star
8	Vector Group	YNYno
9	Off Load Taps	
	a)Range	+5% to -5%
	b) Number of steps	4
	c)For high voltage variation/low voltage variation	For H.V. variation
	d) Location (Line/control/Neutral) end of winding.	Neutral end of winding
10	Type of cooling corresponding capacity of transformers	ONAN
11	System short Ckt. Withstand capacity (MVA) at 132KV and duration (sec.)	10,000MVA for 2 Sec.
12	DC Voltage for relays	220V
13	Reference ambient temperatures	
	i). Maximum ambient air temperature deg ^{0}C	50^{0}C
	ii). Maximum daily average ambient temp. deg ^{0}C	40^{0}C
	iii). Maximum yearly weighted average temp. deg ^{0}C	32^{0}C
	iv). Minimum ambient air temp. deg ^{0}C	-5^{0}C

14	Temperature Rise over maximum ambient air temp. 50^0c	
	i). Top oil by thermometer	50^0C
	ii). Winding by resistance	55^0C
	iii). Hot spot temperature calculated over an annual weighted ambient temp. of 32^0C.	98^0C
	iv). Limits of hot spot temperature for which transformer is designed as per IS:6600	140^0C
15	Quantity of	
	i). Adsorbent in Thermosyphon filter (% age of total oil by Wt).	1.25% (approx)
	ii). Oil in Thermosyphon filter(%age of total oil).	4%(approx)
16	Base of transformer oil	Napthenic/ IS335
17	Class of major insulation	ClassA(105 degree) imported
18	Type of Tank	Conventional Type
19	Short circuit withstand capacity of bushing	25 times of rated current for 2 seconds
20	Withstand pressure of tank(when empty of oil)	As per CBIP Manual
21	Withstand pressure of cooling equipment(when empty of oil).	As per CBIP Manual
22	Core	
	i)Thickness of core lamination	<=0.27mm
	ii)insulation of core lamination	Carlite
23	Size of rail gauge.	
	a). Longitudinal	1676mm
	b). Transverse	1676mm
24	Total length of transformer with radiators with rail gauge at both side of centre line.	5000 x 3400 x 4700 mm (approx)
25	Material of winding conductor	Electrolytic grade copper

ANNEXURE-A2

GUARANTEED PARTICULARS OF 66/11KV, 6.3/8MVA POWER TRANSFORMER for left bank power house Bhakra

Sr. No.	**Particulars**	**M/S EMCO**
1	Normal continuous rating under site condition at any tap	ONAN/ONAF
	a). HV winding(MVA)	6.3/8
	b). LV winding(MVA)	6.8/8
2	No. of phases	3
3	Frequency	50HZ
4	Rated voltage of HV winding	66KV
5	Rated voltage of LV winding	11KV
6	Impedance voltage at rated current for the principal tapping at 75deg. C	8.50%
7	Connections	
	a). HV winding	Star
	b). LV winding	Star
8	Vector Group	YNyno
9	Off Load Taps	
	a)Range	+5% to -5%
	b) Number of steps	4
	c)For high voltage variation/low voltage variation	For HV variation
	d) Location (Line/control/Neutral) end of winding.	Neutral end
10	Type of cooling corresponding capacity of transformers	ONAN=6.3MVA ONAF=8MVA
11	System short Ckt. Withstand capacity (MVA) at 132KV and duration (sec.)	3000MVA for 2 Sec.
12	DC Voltage for relays	220V
13	Reference ambient temperatures	
	i). Maximum ambient air temperature deg ^{0}C	50^{0}C
	ii). Maximum daily average ambient temp. deg ^{0}C	40^{0}C
	iii). Maximum yearly weighted average temp. deg ^{0}C	32^{0}C
	iv). Minimum ambient air temp. deg ^{0}C	-5^{0}C

14	Temperature Rise over maximum ambient air temp. 50^0c	
	i). Top oil by thermometer	50^0C
	ii). Winding by resistance	55^0C
	iii). Hot spot temperature calculated over an annual weighted ambient temp. of 32^0C.	98^0C
	iv). Limits of hot spot temperature for which transformer is designed as per IS:6600	140^0C
	b) Time for which transformer can be run at rated MVA (Max.) in case of failure of all cooling equipment.	10Minutes
15	Quantity of	
	i). Adsorbent in Thermosyphon filter (% age of total oil by Wt).	1.25%
	ii). Oil in Thermosyphon filter(%age of total oil).	4%
16	Base of transformer oil	Napthenic/IS:335
17	Class of major insulation	A Class(105degree)Imported
18	Type of Tank	Conventional Type
19	Short circuit withstand capacity of bushing	25 times of rated current for 2 seconds
20	Withstand pressure of tank(when empty of oil)	As per CBIP Manual
21	Withstand pressure of cooling equipment(when empty of oil).	As per CBIP Manual
22	Core	
	i)Thickness of core lamination	<=0.27mm
	ii)insulation of core lamination	Carlite
23	Size of rail gauge.	
	a). Longitudinal	1676mm
	b). Transverse	1676mm
24	Material of winding conductor	Electrolytic grade copper
25	Neutral Current Transformer	
	i) Voltage & Type	15KV, out door type
	ii) Ratio	600/1A
	iii) VA burden	15VA
	iv) Accuracy class	5P-15

ANNEXURE-A3

GUARANTEED PARTICULARS OF 66/11KV, 12.5/16MVA POWER TRANSFORMER for 220KV, SUBSTATION BBMB JAGADHRI

Sr. No.	**Particulars**	**Offered by M/S EMCO**
1	Normal continuous rating under site condition at any tap	ONAN/ONAF
	a). HV winding(MVA)	12.5/16
	b). LV winding(MVA)	12.5/16
2	No. of phases	3
3	Frequency	50HZ
4	Rated voltage of HV winding	66KV
5	Rated voltage of LV winding	11KV
6	Impedance voltage at rated current for the principal tapping at 75deg. C	10.00%
7	Connections	
	a). HV winding	Star
	b). LV winding	Star
8	Vector Group	YNyno
9	On Load Taps	
	a)Range	5% to -15%
	b) Number of steps	16
	c)For high voltage variation/low voltage variation	For high voltage Variation
	d) Location (Line/control/Neutral) end of winding.	neutral end of winding
10	Type of cooling corresponding capacity of transformers	ONAN=12.5MVA ONAF=16MVA
11	System short Ckt. Withstand capacity (MVA) at 132KV and duration (sec.)	3000MVA for 2 Sec.
12	DC Voltage for relays	220V
13	Reference ambient temperatures	
	i). Maximum ambient air temperature deg ^{0}C	50^{0}C
	ii). Maximum daily average ambient temp. deg ^{0}C	40^{0}C
	iii). Maximum yearly weighted average temp. deg ^{0}C	32^{0}C
	iv). Minimum ambient air temp. deg ^{0}C	-5^{0}C
14	Temperature Rise over maximum ambient air temp. 50^{0}c	

	i). Top oil by thermometer	50^0C
	ii). Winding by resistance	55^0C
	iii). Hot spot temperature calculated over an annual weighted ambient temp. of 32^0C.	98^0C
	iv). Limits of hot spot temperature for which transformer is designed as per IS:6600	140^0C
	b) Time for which transformer can be run at rated MVA (Max.) in case of failure of all cooling equipment.	10Minutes
15	Quantity of	
	i). Adsorbent in Thermosyphon filter (% age of total oil by Wt).	1.25%
	ii). Oil in Thermosyphon filter(%age of total oil).	4%
16	Base of transformer oil	Napthenic/IS:335
17	Class of major insulation	A Class(105 degree) Imported
18	Type of Tank	Conventional Type
19	Short circuit withstand capacity of bushing	25 times of rated current for 2 seconds
20	Withstand pressure of tank(when empty of oil)	As per CBIP Manual
21	Withstand pressure of cooling equipment(when empty of oil).	As per CBIP Manual
22	Core	
	i)Thickness of core lamination	<=0.27mm
	ii)insulation of core lamination	Carlite
23	Size of rail gauge.	
	a). Longitudinal	1676mm
	b). Transverse	1676mm
24	Total length of transformer with radiators with rail gauge at both side of centre line	5000 x 3500 x4100 mm (approx)
25	Material of winding conductor	Electrolytic grade copper

ANNEXURE-B1

SCHEDULE OF OTHER TECHNICAL PARTICULARS OF TRANSFORMERS FURNISHED BY M/S EMCO(For 132/11KV 4MVA transformer)

Sr. No.	Particulars	Transformers	M/S EMCO
1	Name of the Manufacturer & place of manufacture		EMCO Ltd. Jalgoan
2	Service		outdoor, continuous
3	Rated current		
	a) HV winding	A	17.49
	b) LV winding	A	209.94
4	a) Temp Gradient between Average winding and average oil temp.	^{0}C	15
	b) Hot spot temperature calculated over maximum ambient temperature 50^{0}C	^{0}C	98
	c) Hot spot gradient	^{0}C	16.5
5	Reactance at rated current and rated voltage	%	
	a) HV-LV (positive sequence)	%	7.12% (approx)
	b) HV-LV (zero sequence)	%	65 to 90% of +ve sequence (approx)
6	a) No load current at rated voltage and rated Frequency		1% of rated rull load current
	b)Power factor of no load current at rated voltage and rated frequency		<=0.18 (approx)
	c)No load current at (Approx. calculated values)		
	i) 75% voltage	%	0.0122%of rated rull load current
	ii) 80% voltage	%	0.0140%of rated full load current
	iii) 85% voltage	%	0.0155%of rated full load current
	iv) 90% voltage	%	0.0176%of rated full load current

	v) 95% voltage	%	0.0197%of rated full load current
	vi) 100% voltage	%	0.0216%of rated full load current
	vii) 105% voltage	%	0.0263%of rated full load current
	viii) 110% voltage	%	0.0269%of rated full load current
7	Efficiency at 75 deg. C unity power factor		
	a) At full load Percent	%	99.31
	b) At ¾ full load Percent	%	99.4
	c) At ½ full load Percent	%	99.45
8	Maximum efficiency and load at which max. Efficiency occurs		99,31% @ 50% load\ at 0.8pf
9	Regulation at full load at 75 deg. C at normal tap		
	a) At unity power factor	%	0.8
	b) At 0.8 power factor lagging	%	4.86
10	Noise level when energized at normal voltage & frequency without load.		As per NEMA TR-1
11	Equipment for ONAN/ONAF cooling(where ever required)		
	a) State Whether		
	i) Radiators on main tank		YES
	ii) Separate cooler bank		NO
	b) ONAN rating		4000KVA
	c) ONAF rating		n/a
12	Details of off –load Tap changer		
	a). Make		Allways/Paragon
	b). Type		off load full power
	c). Whether pad lock is provided		provided
13	Terminal arrangement		
	a) High Voltage		Bare bushing

	b) LV		Cable box
	c) Neutral		Bare bushing
14	Approximate overall dimensions		
	a) Length	mm	5000
	b) Breadth	mm	3400
	c) Height	mm	4700
15	Dispatch details		
	a) Approximate mass of heaviest package (kg)	Kg.	18,200 (approx)
	b) Approximate dimensions of largest package		
	i) Length	mm	2950
	ii) Breadth	mm	1850
	iii) Height	mm	2900
16	Untanking Height (Including Sling)	mm	5 to 6 m (approx)
17	Thickness of transformer tank/radiators sheets		
	a) Sides	mm	8
	b) Bottom	mm	12
	c) Top	mm	12
	d) Radiators Cooling tube	mm	1.2
18	Overall dimensions of HT bushings	mm	L=1835mm (approx) D=230 (approx)
19	Working flux density as a percentage of knee voltage		1.7 T
20	Percentage of Harmonics at normal frequency and at maximum system voltage		1% approx.
21	Continuous overload in percent		As per IS 6600
22	Type of winding		
	a) HV winding		
	i) Main winding		Disc
	ii) Regulating winding		Disc
	b) LV winding		Disc
23	a) Insulation of HV winding		kraft paper
	b) Insulation between LV & HV winding		Pressboard, oil duct
	c) Insulation between HV & regulating winding		Pressboard, oil duct
	d) Insulation of LV winding		kraft paper

24	Maximum out of balance force in winding on shot circuit at terminals		Pressboard, oil duct
25	Type and details of winding hot spot temp. indicator		Dial type, 150mm. 5A 230VAC
26	Total volume of conservator for		
	a) Main tank	Ltrs.	6.5% of volume of radiator & tank(approx)
27	Volume of conservator between the highest and lowest levels for Main tank	Ltrs	60% of volume of conservator (approx)
28	i) Whether windings are preshrunk?for HV & LV winding?		Yes
	ii) Whether adjustable coil clamps are provided		No
	iii) Whether steel rings are used for the windings, if so, whether these are split?		Permawood ring provided
	iv) Whether electrostatic shields are provided to obtain uniform voltage distribution in the HV & LV winding?		No
29	Resistance per phase at in ohms at Normal Temp (75^0C).		
	a) HV winding		9.25 (approx)
	b) LV winding		0.251 (approx)
30	Calculated oil time constants		
	i) Natural cooling (ONAN)	Hrs.	2 to 4 (approx)
	ii) Forced air cooling (ONAF)	Hrs.	NA
31	Wave form for impulse test		1.2/50 microsec
32	Inter turn insulation		
	a) Extent of extreme end turns		Kraft paper
	b) Reinforcement		
	c) Extent of end turns reinforcement		
	d) Extent of turns adjacent to tapping reinforced.		
33	Type of axial coil supports		
	a) HV winding		permawood, press

	b) Regulating winding		board
	c) LV winding		
34	Type of radial coil supports		permawood
	a) HV winding		
	b) Regulating winding		
	c) LV winding		
35	Whether HV winding are interleaved. Details of special arrangements (if any) made to improve stress conditions.		Yes
36	Buchholz relay description data		Dial type, 150mm.
37	Bushing:	HV,LV,HV-N, LV -N	HV/(LV/HV-N/ LV -N)
	i). Make		(cgl/areva/trench)/ (cji genesis)
	ii). Type of bushing		Condenser/ Porcelin type
	iii). Rated Voltage class (KV)	KV rms	145/36/36/36
	iv). Rated current (Amperes)		2000/630/630/ 630A
	v) Dry over voltage	KV rms	275/70KV rms
	vi) Wet flash over voltage	KV rms	275/70KV rms
	vii) Weight of assembled bushings	KV rms	135/12kg (approx)
	viii). Free space required at the top for removal of bushings	mm	3000/800mm (Approx)
	ix). Short time withstand capacity(KA)	mm	25 time rated current for 2 sec
	x). Creep age distance	mm	25mm/kv
	xi).Quantity of oil in bushing and specification of oil used.	Lt.	18/NA lits (approx)
38	Detail of equipment in M. Box		Oti,wti,fuses,space heater, tube etc.
39	Total Losses (Maximum) at rated voltage (at principal tapping, rated frequency at ONAN /ONAF rated output at 75 deg. Including cooler loss.	ONAN (KW)	27.5KW
		ONAF (KW)	

	a) No load loss at rated voltage on principal tapping, rated frequency at 75 deg. C	KW(Firm)	5.5
	b) Load loss excluding auxiliary losses at rated current at principal tapping at 75deg. C	KW(Firm)	22
	c) Total Loss	KW(Firm)	27.5
40	Impedance voltage at rated current for principal tapping at 75deg,C		
	a) HV-LV	%	7.17 (+/- IS tol)
41	Masses(Kg)		
	a)Bare copper used		
	i). For winding	Kg.	2020(approx)
	ii). For leads and connections	Kg.	120(approx)
	a) Windings		
	i) With insulation	Kg.	2150(approx)
	ii) Soaked in oil	Kg.	2185(approx)
	b) Core		
	i) CRGO Laminations	Kg.	4500(approx)
	ii) Supporting frame work	Kg.	950(approx)
	c) Core & Winding package	Kg.	
	d) Tank, fittings and accessories	Kg.	6900(approx)
	e) Oil	Kg.	5300(approx)
	f) Total weight (as erected)	Kg.	20200(approx)
42	Approximate quantity of oil required for first filling	Ltrs.	6550(approx)
43	Maximum flux density in iron at normal voltage at Normal Tap & frequency		
	a). Core	Wb/m^2	1.7T
	b). Yoke	Wb/m^2	1.7T
	c). Working Flux density for continuous operation for overfluxing factor upto 1.1, this factor being $v/v_m \times f_n /f$.	Wb/m^2	1.87T

	d). Maximum flux density considering overfluxing factor 1.25 & duration for the same(in seconds) .	Wb/m^2	2.15T for 60 sec
	e). Maximum flux density considering overfluxing factor 1.40 & duration for the same(in seconds) .	Wb/m^2	2.38 T for 5 sec (saturated)
44	Core		
	i) Grade of core material		HI-B grade
	ii) Whether core plates are cold rolled grain orianted		
	iii). Insulation of core bolts		NA
	iv). Insulation of core bolt washers		NA
	v). No. of steps of stacking per half section		11
	vi). Stacking factor of core		95
	vii). Name & address of vendor supplying CRGO		Amod,Kryffs, Vilas Transcore,National Lamination
	viii). Core to bolt insulation withstand for1minute(KVrms)		2
	ix). Details of oil cooling ducts		NA
	a). Whether in the plane of winding		
	b). Across the plane of lamination		
45	Input to cooling Fan	kW	NA
46	Neutral Current Transformer (for 66/11KV,6.3/8MVA transformer)		NA
	i) ISF		NA
	ii) STC		NA
	iii) Excitation current		NA
	iv) Secondary Resistance		NA
47	Insulation level		
	a) Separate source power frequency voltage withstand		
	i)HV winding	KV rms	275KV rms
	ii) LV winding	KV rms	38 KV rms
	b) Induced over voltage with stand		

	i)HV winding	KV rms	275
	ii). LV winding	KV rms	2xrated voltage @ 100Hz
	c) Full wave lighting impulse with stand		
	i)HV winding	KVp	650 KVP
	ii) LV winding	KVp	95KVP
	d). Voltage for which star point will be insulated	KV rms	95/38kvp/kv rms
48	Period of working at full load without fan		NA
49	Continuous MVA rating without fan		4000KVA
50	Working Current density		
	i). HV winding (Ampere/cm^2)		162
	ii). LV winding(Ampere/cm^2)		320
	iii). Regulating winding (Ampere/cm^2)		162
51	Type of release device provided if the oil temp. rise beyond 115^0C		pressure relief device

ANNEXURE-B2

SCHEDULE OF OTHER TECHNICAL PARTICULARS OF TRANSFORMERS FURNISHED BY M/S EMCO (For 66/11KV 6.3/8MVA TRANSFORMER)			
Sr.No.	**Particulars**	**Transformers**	**M/S EMCO**
1	Name of the Manufacturer & place of manufacture		EMCO ltd.
2	Service		outdoor
3	Rated current		
	a) HV winding	A	69.98
	b) LV winding	A	419.89
4	a) Temp Gradient between Average winding and average oil temp.	^{0}C	15
	b) Hot spot temperature calculated over maximum ambient temp. 50^{0}C	^{0}C	98
	c). (for 6.3/8MVA 66/11KV Transformers)Hot spot temp. at 50^{0}C ambient temp.at rated load &	^{0}C	
	(i) After 10 min. of all auxiliary supply failure condition.	^{0}C	66.5
	(ii) After 20 min. 50% auxiliary supply failure condition if two cooler banks are provided	^{0}C	72.5
	(ii) After 30 min. 50% auxiliary supply failure condition if two cooler banks are provided	^{0}C	88.2
	d) Hot spot gradient	^{0}C	16.5
5	Reactance at rated current and rated voltage	%	
	a) HV-LV (positive sequence)	%	8.48% (approx)
	b) HV-LV (zero sequence)		60 to 90% of +ve sequence
6	a) No load current at rated voltage and rated Frequency		1% of rated full load current
	b)Power factor of no load current at rated voltage and rated frequency		<=0.18 lac (approx)

	c)No load current at (Approx. calculated values)		
	i) 75% voltage		0.039% of rated full load current
	ii) 80% voltage		0.045% of rated full load current
	iii) 85% voltage		0.050% of rated full load current
	iv) 90% voltage		0.057% of rated full load current
	v) 95% voltage		0.063% of rated full load current
	vi) 100% voltage		0.095% of rated full load current
	vii) 105% voltage		0.084% of rated full load current
	viii) 110% voltage		0.086% of rated full load current
7	Efficiency at 75 deg. C unity power factor		
	a) At full load Percent	%	99.39
	b) At ¾ full load Percent	%	99.5
	c) At ½ full load Percent	%	99.58
8	Maximum efficiency and load at which max. Efficiency occurs		99.48%, 39.34% at 0.8 pf
9	Regulation at full load at 75 deg. C at normal tap		
	a) At unity power factor	%	0.88%
	b) At 0.8 power factor lagging	%	5.71%
10	Noise level when energized at normal voltage & frequency without load.		As per NEMA TR-1
11	Equipment for ONAN/ONAF cooling(where ever required)		
	a) State Whether		
	i) Radiators on main tank		YES
	ii) Separate cooler bank		NO
	c) ONAF rating		8000KVA

12	Details of off –load Tap changer		
	a). Make		Paragon/Alwaye
	b). Type		Off load full power
	c). Whether pad lock is provided		Provided
13	Terminal arrangement		
	a) High Voltage		Bare bushing
	b) LV		Cable box
	c) Neutral		Bare bushing
14	Approximate overall dimensions		
	a) Length	mm	4100
	b) Breadth	mm	3650
	c) Height	mm	4200
15	Dispatch details		
	a) Approximate mass of heaviest package (kg)	Kg.	18,800 (approx)
	b) Approximate dimensions of largest package		
	i) Length	mm	2600
	ii) Breadth	mm	1900
	iii) Height	mm	2900
16	Untanking Height (Including Sling)	mm	5 to 6 m (approx)
17	Thickness of transformer tank/radiators sheets		
	a) Sides	mm	8
	b) Bottom	mm	12
	c) Top	mm	12
	d) Radiators Cooling tube	mm	1.2
18	Overall dimensions of HT bushings	mm	L=1025mm (approx) D=200(approx)
19	Working flux density as a percentage of knee voltage		1.7T
20	Percentage of Harmonics at normal frequency and at maximum system voltage		1%(approx)

21	Continuous overload in percent		As per IS 6600
22	Type of winding		
	a) HV winding		
	i) Main winding		Disc
	ii) Regulating winding		Disc
	b) LV winding		Disc
23	a) Insulation of HV winding		kraft paper
	b) Insulation between LV & HV winding		Pressboard, oil duct
	c) Insulation between HV & regulating winding		Pressboard, oil duct
	d) Insulation of LV winding		kraft paper
24	Maximum out of balance force in winding on shot circuit at terminals		calculation attached
25	Type and details of winding hot spot temp. indicator		Dial type, 150mm. 5A 230VAC
26	Total volume of conservator for		
	a) Main tank	Ltrs.	6.5% of volume of radiator & tank
	b). OLTC	Ltrs.	NA
27	Volume of conservator between the highest and lowest levels		
	a) Main tank	Ltrs.	65% of volume of conservator (approx)
	b). OLTC	Ltrs.	NA
28	Type, make and specifications of fan.		Squirrel cage motor, Make- Marathon, Khaitan,415V, 3phase, 50Hz ,AC supply
29	a) temperature rise of motors at full load.		45 deg C (over ambient of 35 deg C)
	b) Efficiency of motors at full load.		67%

30	i) Total No. of fan motors including stand by		3
	ii) No. of stand by fans.		1
	iii) Capacity of fans.		0.5KW
31	i) Whether windings are preshrunk?		Yes
	ii) Whether adjustable coil clamps are providedfor HV & LV winding		No
	iii)Whether steel rings are used for the windings, if so, whether these are split?		Permawood ring provided
	iv) Whether electrostatic shields are provided to obtain uniform voltage distribution in the HV & LV winding?		No
32	Resistance per phase at in ohms at Normal Temp (75^0C).		
	a) HV winding		1.28 (approx)
	b) LV winding		0.0351(approx)
33	Calculated oil time constants		
	i) Natural cooling (ONAN)	Hrs.	2 to 4 hrs (approx)
	ii) Forced air cooling (ONAF)	Hrs.	NA
34	Wave form for impulse test		1.2/50Microsec
35	Inter turn insulation		
	a) Extent of extreme end turns		Kraft winding
	b) Reinforcement		
	c) Extent of end turns reinforcement		
	d) Extent of turns adjacent to tapping reinforced.		
36	Type of axial coil supports		
	a) HV winding		Permawood, Pressboard
	b) Regulating winding		
	c) LV winding		
37	Type of radial coil supports		

	a) HV winding		Permawood
	b) Regulating winding		
	c) LV winding		
38	Whether HV winding are interleaved. Details of special arrangements (if any) made to improve stress conditions.		Yes
39	Buchholz relay description data		Dial type 150mm
40	Bushing:	HV,LV,HV-N, LV -N	HV/(LV/HV-N/LV - N)
	i). Make		(CGL/Areva/ Trench)/(CJI/ Genesis)
	ii). Type of bushing		Condenser/Porcelain
	iii). Rated Voltage class (KV)	KV	(72.5)/(36KV)
	iv). Rated current (Amperes)	KV rms	1250/2000/630/ 2000A
	v) Dry flash over voltage withstand	KV rms	140/70KV rms
	vi) Wet flash over voltage	KV rms	140/70KV rms
	vii) Weight of assembled bushings	KV rms	46/12kg (approx)
	viii). Free space required at the top for removal of bushings	Kg	2000/800 mm(approx)
	ix). Short time withstand capacity(KA)	KA	25for 2sec/31.5 for 2sec
	x). Creep age distance	mm	25mm/KV
	xi).Quantity of oil in bushing and specification of oil used.	Lt.	4.5 ltrs (approx), IS:335
41	Detail of equipment in M. Box		Oti,wti,fuses, space heater, tube etc.
42	Total Losses (Maximum) at rated voltage (at principal tapping, rated frequency at ONAN /ONAF rated output at 75 deg. Including cooler loss.	ONAN (KW)	49.5KW
		ONAF (KW)	
	a) No load loss at rated voltage on principal tapping, rated frequency at 75 deg. C	KW(Firm)	6.5KW

	b) Load loss excluding auxiliary losses at rated current at principal tapping at 75deg. C	KW(Firm)	42KW
	c) Auxiliary losses(Including cooler losses & Thermosyphon filter losses)	KW(Firm)	1
	d) Total Loss	KW(Firm)	49.5KW
43	Impedance voltage at rated current for principal tapping at 75deg,C		
	a) HV-LV	%	8.5%(+/-IS tol)
44	Masses(Kg)		
	a)Bare copper used		
	i). For winding	Kg.	2230 (approx)
	ii). For leads and connections	Kg.	90 (approx)
	b) Windings		
	i) With insulation	Kg.	3300 (approx)
	ii) Soaked in oil	Kg.	3366Kg(approx)
	c) Core		
	i) CRGO Laminations	Kg.	5780 (approx)
	ii) Supporting frame work	Kg.	790 (approx)
	d) Core & Winding package	Kg.	9080 (approx)
	e) Tank, fittings and accessories	Kg.	5800 (approx)
	f) Oil	Kg.	5400 (approx)
	g) Total weight (as erected)	Kg.	21300 (approx)
45	Approximate quantity of oil required for first filling	Ltrs.	6600 (aprox)
46	Maximum flux density in iron at normal voltage at Normal Tap & frequency		
	a). Core	Wb/m^2	1.7
	b). Yoke	Wb/m^2	1.7
	c). Working Flux density for continuous operation for overfluxing factor upto 1.1, this factor being v/v_m x f_n /f.	Wb/m^2	1.87

	d). Maximum flux density considering overfluxing factor 1.25 & duration for the same(in seconds) .	Wb/m^2	2.15 for 60 sec.
	e). Maximum flux density considering overfluxing factor 1.40 & duration for the same(in seconds) .	Wb/m^2	2.38 for 5 sec(saturated)
47	Core		
	i) Grade of core material		HI-B grade
	ii) Whether core plates are cold rolled grain orianted		Yes
	iii). Insulation of core bolts		NA
	iv). Insulation of core bolt washers		NA
	v). No. of steps of stacking per half section		8
	vi). Stacking factor of core		0.95
	vii). Name & address of vendor supplying CRGO		Amod,Kryffs, Vilas Transcore, National Lamination
	viii). Core to bolt insulation withstand for1minute(KVrms)		2
	ix). Details of oil cooling ducts		NA
	a). Whether in the plane of winding		
	b). Across the plane of lamination		
48	Input to cooling Fan	kW	NA
49	Neutral Current Transformer (for 66/11KV,6.3/8MVA transformer)		
	i) ISF		<5
	ii) STC		1.2times continously
	iii) Excitation current		≤30mA
	iv) Secondary Resistance		8 ohm (approx)
50	Insulation level		

	a) Separate source power frequency voltage withstand		
	i)HV winding	KV rms	140KV rms
	ii) LV winding	KV rms	38 KV rms
	b) Induced over voltage with stand		
	i)HV winding	KV rms	140
	ii). LV winding	KV rms	2xrated voltage @ 100Hz
	c) Full wave lighting impulse with stand		
	i)HV winding	KVp	325
	ii) LV winding	KVp	95
	d). Voltage for which star point will be insulated	KV rms	95/38kvp/kv rms
51	Period of working at full load without fan		50% cooling failure - 10minute, 100%cooling failure - 20minute
52	Continuous MVA rating without fan		6.3MVA
53	Working Current density		
	i). HV winding (Ampere/cm^2)		202 (approx)
	ii). LV winding(Ampere/cm^2)		250(aprox)
	iii). Regulating winding (Ampere/cm^2)		202 (approx)
54	Type of release device provided if the oil temp. rise beyond 115^0C		pressure relief device

ANNEXURE-B3

SCHEDULE OF OTHER TECHNICAL PARTICULARS OF TRANSFORMER FURNISHED BY M/S EMCO FOR 12.5/16MVA 66/11KV POWERTRANSFORMER

Sr. No.	Particulars	Transformers	M/S EMCO
1	Name of the Manufacturer & place of manufacture		EMCO ltd.
2	Service		outdoor
3	Rated current		
	a) HV winding	A	139.96
	b) LV winding	A	839.78
4	a) Temp Gradient between Average winding and average oil temp.	^{0}C	15
	b) Hot spot temperature calculated over maximum ambient temperature 50^{0}C		98
	c). Hot spot gradient	^{0}C	16.5
	d). Hot spot temp. at 50^{0}C ambient temperature at rated load &	^{0}C	
	i). After 10 min. of all auxiliary supply failure condition.	^{0}C	66.5
	ii). After 20 min. 50% auxiliary supply failure condition if two cooler banks are provided	^{0}C	72.5
	ii). After 30 min. 50% auxiliary supply failure condition if two cooler banks are provided	^{0}C	78 2
5	Reactance at rated current and rated voltage		
	a) HV-LV (positive sequence)	%	9.98% (approx)
	b). HV-LV (zero sequence)	%	60 to 90% of +ve sequence
6	a) No load current at rated voltage and rated Frequency		1% of rated full load current
	b)Power factor of no load current at rated voltage and rated frequency		<=0.18 lag (approx)
	c)No load current at (Approx. calculated values)		
	i) 75% voltage		0.031% of rated full load current

	ii) 80% voltage		0.036% of rated full load current
	iii) 85% voltage		0.040% of rated full load current
	iv) 90% voltage		0.045% of rated full load current
	v) 95% voltage		0.051% of rated full load current
	vi) 100% voltage		0.060% of rated full load current
	vii) 105% voltage		0.068% of rated full load current
	viii) 110% voltage		0.070% of rated full load current
7	Efficiency at 75 deg. C unity power factor		
	a) At full load Percent	%	99.49
	b) At ¾ full load Percent	%	99.58
	c) At ½ full load Percent	%	99.65
8	Maximum efficiency and load at which max. efficiency occurs		99.58%, 37.26% at 0.8pf
9	Regulation at full load at 75 deg. C at normal tap		
	a) At unity power factor	%	0.94
	b) At 0.8 power factor lagging	%	6.65
10	Noise level when energized at normal voltage & frequency without load.		As per NEMA TR-1
11	Equipment for ONAN/ONAF cooling		
	a) State Whether		
	i) Radiators on main tank		Yes
	ii) Separate cooler bank		No
	b) ONAN rating		12500KVA
	c) ONAF rating		16000KVA
12	Details of On-load Tap Changer		
	a) Make		OLG/CTR
	b) Type		On load full power
	c) Rating		
	i)Rated voltage	KV	66
	ii).Rated current	A	300
	iii).Step voltage	V	476.31
	iv).Number of steps	Nos.	16

	d) Control		local manual and local/Remote Electrical
	e) Auxiliary supply details		220V AC/110V DC
	f) voltage Control		Non-automatic.
	g) Parallel operation		Provided
	h) Protective devices		Fuses,contactar , oil surge relay
	i) Approx. over all weight	Kg	Included in over all weight
	j) Approx. over all dimensions	mm	Included in over all Dimensions
	k) Approx. over all quantity of oil	Liters	1200
	l) Voltage variation range	%	
	m) Time for complete tap operation (on step)	Sec.	4 - 6 Sec approx
	n) Value of max. shot circuit current	KA for Sec.	3.5KA for 2 sec
	o) Max. Impulse withstand test voltage with 1.2/50 µs full wave between switch assembly & ground.	KVP	350
	p) Max. Power frequency test voltage between switch assembly & ground	KV rms.	140
	q). Max. impulse withstand test voltage with 1.2/50 µs across the tapping range	KV peak	150
13	Terminal arrangement		
	a). High Voltage		Bare bushing
	b).Low voltage		Bare bushing
	c).Neutral		Bare bushing
14	Approximate overall dimensions		
	a).Length	mm	5000
	b). Breadth	mm	3400
	c).Height	mm	4100
15	Dispatch details		
	a).Approximate mass of heaviest package (kg)	Kg.	27,600 kgs
	b).Approximate dimensions of largest package		
	i). Length	mm	3600
	ii). Breadth	mm	2100
	iii). Height	mm	2900
16	Untanking Height (Including Sling)	mm	5 to 6 m (approx)

17	Thickness of transformer tank/radiators sheets		
	a). Sides	mm	8
	b).Bottom	mm	12
	c).Top	mm	12
	d).Radiators Cooling tube	mm	1.2
18	Overall dimensions of HT bushings	mm	L-1025mm D-200mm (approx)
19	Working flux density as a percentage of knee voltage		1.7T
20	Percentage of Harmonics at normal frequency and at maximum system voltage		1% approx
21	Continuous overload in percent		As per IS 6600
22	Type of winding		
	a).HV winding		
	i) Main winding		Disc
	ii) Regulating winding		Disc
	a) LV winding		Disc
23	a). Insulation of HV winding		kraft paper
	b).Insulation between LV & HV winding		Pressboard, oil duct
	c).Insulation between HV & regulating winding		Pressboard, oil duct
	d).Insulation of LV winding		kraft paper
24	Maximum out of balance force in winding on shot circuit at terminals		Separate regulating winding has been provided
25	Type and details of winding hot spot temp. indicator		Dial type, 150mm, 5A 230VAC
26	Total volume of conservator for		
	a).Main tank	Ltrs.	6 .5% of volume of radiator and tank (approx)
	a) OLTC	Ltrs.	120 cubic dm(approx)

27	Volume of conservator between the highest and lowest levels for		
	a).Main tank	Ltrs	65% of volume of conservator (approx)
	a) OLTC	Ltrs.	60%volume of conservator (approx)
28	Type, make and specifications of fan.		Khitan/cgl,prop.axial flow type, 415V,0.5KW, 3ph,50HZ AC
29	a).Temperature rise of motors at full load.		45 deg C over 35 deg C ambient
	b).Efficiency of motors at full load.		67% (approx)
30	i) Total No. of fan motors including stand by		4
	ii) No. of stand by fans.		1
	iii) Capacity of fans.		0.5KW
31	i) Whether windings are preshrunk?		YES
	ii) Whether adjustable coil clamps are provided for HV & LV winding?		Permawood ring provided
	iii) Whether steel rings are used for the windings, if so, whether these are split?		NO
	iv) Whether electrostatic shields are provided to obtain uniform voltage distribution in the HV & LV winding?		NO
32	Resistance per phase in ohms at Normal Tap (75^{o}C).		
	a).HV winding		0.43 ohm (approx)
	b).LV winding		0.0195 (approx)
33	Calculated OIL time constants		
	i) Natural cooling (ONAN)	Hrs.	2 to 4 (approx.)

	ii) Forced air cooling (ONAF)	Hrs.	2 to 4 (approx.)
34	Wave form for impulse test		1.2/50 microsec.
35	Inter turn insulation		
	a).Extent of extreme end turns		Kraft paper
	b).Reinforcement		
	c)..Extent of end turns reinforcement		
	d).Extent of turns adjacent to tapping reinforced.		
36	Type of axial coil supports		
	a).HV winding		Permawood, Pressboard
	b).Regulating winding		
	c).LV winding		
37	Type of radial coil supports		
	a).HV winding		Permawood
	b).Regulating winding		Permawood
	c).LV winding		Permawood
38	Buchhloz relay description data		Double float type
			150m
39	Bushing:	HV,LV,HV-N, LV -N	HV/(LV/HV-N/ LV - N)
	i). Make		(CGL/Areva/ Trench)/(CJI/ genesis)
	ii). Type of bushing		Condenser/procelain
	iii). Rated Voltage class (KV)		72.5/36/36/36KV
	iv). Rated current (Amperes)	KV rms	1250/2000/630/ 1250A
	v) Dry flash over voltage	KV rms	140/70 KV rms
	vi) Wet flash over voltage	KV rms	140/70 KV rms
	vii) Weight of assembled bushings	KV rms	50/20/9/9kg
	viii). Free space required at the top for removal of bushings	Kg	3500/2500mm (approx)
	ix). Short time withstand capacity(KA)	mm	25 times rated current for 2 sec.
	x). Creep age distance	mm	1812/900 mm
	xi).Quantity of oil in bushing and specification of oil used.	Lt.	5/NA litrs(approx), IS:335
40	Detail of equipment in M.Box		Fuses,relsy, contractor etc.

41	Total Losses (Maximum) at rated voltage (at principal tapping) rated frequency at ONAN /ONAF rated output at 75 deg. Including cooler loss.	ONAN (KW)	54
		ONAF (KW)	84
	a) No load loss at rated voltage on principal tapping, rated frequency at 75 deg. C	KW(Firm)	10KW (Firm)
	b) Load loss excluding auxiliary losses at rated current at principal tapping at	KW(Firm)	72KW (Firm)@ 16 mva base
	c)Auxiliary losses(Including cooler losses & thermosyphon filter losses)	KW(Firm)	2KW (Firm)
	d) Total Loss	KW(Firm)	84KW(Firm)
42	Impedance voltage at rated current for principal tapping at 75deg,C between		
	HV-LV	%	10
43	Masses(Kg)		
	a). Bare copper used		
	i) For winding	Kg.	5240 (approx)
	ii) For leads and connections	Kg.	130 (approx)
	b).Windings		
	i). With insulation	Kg.	5400 (approx)
	ii). Soaked in oil	Kg.	5510(approx)
	c). Core		
	i). CRGO Laminations	Kg.	9300 (approx)
	ii). Supporting frame work	Kg.	980 (approx)
	d). Core & Winding package	Kg.	14700 (approx)
	e). Tank, fittings and accessories	Kg.	8200 (approx)
	f). Oil	Kg.	7600 (approx)
	g).Total weight (as erected)	Kg.	32100 (approx)
44	Approximate quantity of oil required for first filling	Ltrs.	9280 (approx)
45	Maximum flux density in iron at normal voltage at Normal Tap & frequency		
	a). Core	Wb/m^2	1.7
	b). Yoke	Wb/m^2	1.7
	c). Working Flux density for continuous operation for overfluxing factor upto 1.1, this factor being $v/v_m \times f_n / f$.	Wb/m^2	1.87

	d). Maximum flux density considering overfluxing factor 1.25 & duration for the same(in seconds) .	Wb/m^2	2.125 for 60sec
	e). Maximum flux density considering overfluxing factor 1.40 & duration for the same(in seconds) .	Wb/m^2	2.38 for 5sec
46	Core		
	i) Grade of core material		HI-B grade
	ii) Whether core plates are cold rolled grain oriented		yes
	iii). Insulation of core bolts		NA
	iv). Insulation of core bolt washers		NA
	v). No. of steps of stacking per half section		12 Nos. (approx)
	vi). Stacking factor of core		0.95
	vii). Name & address of vendor supplying CRGO		Amod,Kryffs, Vilas Transcore,National Lamination
	viii). Core to bolt insulation withstand for 1minute(KVrms)		2
	ix). Details of oil cooling ducts		NA
	a). Whether in the plane of winding		
	b). Across the plane of lamination		
47	Input to cooling Fan	KW	0.5KW
48	Insulation level		
	a) Separate source power frequency voltage withstand		
	i)HV winding	KV rms	140
	ii) LV winding	KV rms	38
	b) Induced over voltage with stand		
	i)HV winding	KV rms	140
	ii). LV winding	KV rms	2xrated voltage @ 100Hz
	c) Full wave lighting impulse with stand		
	i)HV winding	KVp	325
	ii) LV winding	KVp	95
	d). Voltage for which star point will be insulated	KV rms	95/38 KVp/KVrms

49	Period of working at full load without fan		50% cooling failure-20minutes, 100% cooling failure-10minutes
50	Continuous MVA rating		12.5MVA
51	Working Current density		
	i). HV winding (Ampere/cm^2)		215 (approx)
	ii). LV winding(Ampere/cm^2)		265 (approx)
	iii). Regulating winding (Ampere/cm^2)		215 (approx)
52	Type of release device provided if the oil temp. rise beyond 115^0C		Pressure relief device

ANNEXURE-B4

A) SCHEDULE OF GUARANTEED CHARACTERISTICS OF NEW TRANSFORMER OIL(IN DRUMS)

S.No.	Characteristics	Requirement
1.	Appearance	The oil shall be clear, transparent and free from suspended matter or sediment.
2.	Density at 29.5^0C (Max.)	0.89 g/cm^3
3.	Kinematic Viscosity at 27^0C (Max.)	27 CST
4.	Interfacial tension at 27^0C (Min.)	0.04 N/M
5.	Flash point, Pensky – Marten (closed) (Min.)	140^0C
6.	Pour point (Max.)	-6^0C
7.	Neutralization value i. Total acidity) (Max.) ii. Inorganic acidity/alkalinity	 0.03 mg KOH/g Nil
8.	Corrosive Sulphur (in terms of classification of copper strip)	Non-corrosive
9.	Electric strength (breakdown voltage) (Min.)	
	a) New untreated oil	30KV (rms). If this value is not attained, the oil shall be filtered
	b) After filtered	60KV (rms)(Min.)
10.	Dielectric dissipation factor (tan delta) at 90^0C (Max.)	0.002
11.	Specific resistance (resistivity)	
	a) At 90^0C (Min.)	$35x10^{12}$ Ohm- cm
	b) At 27^0C (Min.)	$1500x10^{12}$ Ohm- cm
12.	Oxidation stability(After oxidation for 164 hours@100^0C	
	a) Neutralization value after oxidation (Max.)	0.40 mg KOH/g
	b) Total sludge, after oxidation (Max.)	0.10 percent by weight
13.	Presence of oxidation inhibitor	Absent
14.	Water content (Max.)	50 ppm
15.	Ageing characteristics after accelerated ageing (open beaker method with copper catalyst i.e.96hours at 115^0C) (a) Specific resistance i) at 27^0C (min) (ii) at 90^0C(min) (b) Tan delta at 90^0C(max) (c) Total Acidity(max) (d) Total sludge(max)	 $2.5x10^{12}$ Ohm – cm $0.2x10^{12}$ Ohm – cm 0.2 0.05mg KOH/g 0.05% by weight
16.	Presence of oxidation inhibitor	Absent
17.	PNA contents i). P ii). N iii). A	 <46% >46% <8%

B) CHARACTERSTICS OF OIL IN THE TRANSFORMERS

The important characteristics of the transformer 0.1 after it is filled in the transformer (after 3 months & within one year of filling) shall be as follows:

Sr.No.	Characteristics	Permissible limit (IS-1866) (Satisfactory for use)
1.	Electric Strength (Break down Voltage)	60KV (Minimum, Prior to energisation) After energiasation >40KV for Um>72.5KV<170KV >30KV for Um upto72.5KV
2.	Water content (PPM)	≤40for Um>72.5<170KV
3.	Specific Resistance (Resistivity) ohm-cm at 90 deg.C	0.1X10 Ohm Cm (Min.)
4.	Dielectric dissipation factor (Tan Delta) at 90 deg.C	1.0(Max.) for Um≥72.5KV <170KV
5.	Neutralization value (Total acidity)	0.3mg KOH/gm (Max.)
6.	Sediment and/or perceptible sludge	Absent
7.	Flash point	15 deg. C (Max.) decrease from initial value
8.	Interfacial tension at 27 deg.C	0.015 N/m (Min.)

ANNEXURE-C

SALIENT FEATURE OF BBMB SPECIFIXCATION

1. **GENERAL :**

The equipment required is 132/11KV, 4MVA Power Transformer, 66/11KV, 6.3/8MVA Power Transformer &66/11KV, 12.5/16MVA Power Transformer for the location as indicated below:

Sr.No.	Name of S/Stn.	Quantity
1.	132/11KV,4MVA Power transformer for Dehar Power House BBMB, Slapper	1 No.
2.	66/11KV, 6.3/8MVA Power Transformers for Bhakra Left Bank Power House, Bhakra (Nangal).	1 No.
3.	66/11KV, 12.5/16MVA Power Transformers for 220KV S/Stn. , BBMB , Jagadhari	1 No.

2. SCOPE:

a) This specification provides the design manufacturing testing assembly at manufacturers works before despatch, supply and delivery FOR destination of Power Transformers alongwith all allied equipment**.**

b) i) The transformer to be offered shall be complete in all respects including fixtures if any, to be embedded in the concrete at site for holding the equipment in correct position.

ii) Any item not specifically stated in these specifications, but considered necessary for troubled free operation of the transformer or accessories thereof shall be deemed to be covered in the bid prices unless specifically stated otherwise.

3. CODES & STANDARDS:

All Standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments & revisions as on date of opening of bid. The following standards & codes and also those mentioned else where in these specifications shall be applicable: -

IS: 5 Colour for ready mix paints
IS: 325 Three phase induction motors
IS: 335 New insulating oils for transformer (Test Procedure)
BS-148 &
IEC-296
IS: 13155 Method of Test for Carbon Type (PNA) Analysis of Mineral oils by infra
(1991) Red Spectrophotometer.
IS: 375 Marking & arrangement of switchgear Bus bars main connections and auxiliary wiring.
IS: 1367 Hot dip galvanized coatings on threaded fasteners.
IS: 1866 Code of practice for maintenance of insulation oil.

IS: 2026 & IEC-76 Specification for Power Transformers.
IS: 2099 Bushing for alternating voltages above 1000V.
IS: 2147 Degree of protection provided by enclosures for low voltage switchgear & control gear.
IS: 2705 Current transformers
IS: 3347 Dimensions of porcelain transformer bushings for use in lightly polluted atmosphere.
IS: 3637 Gas operated relays.
IS: 3639 Fittings & accessories for power transformers.
IS: 6272 Industrial cooling fans
IS: 6600 & IEC-354 Guide for loading of oil immersed transformers.
IS: 8468 & IEC: 214 On load tap changer
IS: 8478 On load tap changers application guide.
IS: 8603 Dimensions for porcelain transformer bushings for use in heavily polluted atmosphere (36KV class). Dimensions for oil filled porcelain transformer bushings for use in medium polluted atmospheres.
IS: 3024 Grain oriented. Electrical Steel sheet & strip.
IS: 649 Methods for testing steel sheets for magnetic circuits of Power Electrical Apparatus.
IS: 9434 Guide for sampling and analysis of free and dissolved gas in oil filled equipment.
IS: 10028 Code of practice for selection installation & maintenance of transformers.
IS: 10594 Method for evaluating the Analysis of gas.
IS: 12676 Dimensions for OIP insulated condenser bushings.
IEEE: 32 IEEE standard requirement terminology and test procedure for neutral grounding device.
CBIP Manual on transformers.

The successful bidder shall submit list of supplies and their manufacturers, of all bought out items for approval immediately after placement of LOI/PO.

4. SERVICE CONDITIONS :

(A) REFERENCE AMBIENT TEMPERATURE

The reference ambient temperatures for which the transformers are to be designed are as under: -

i) Maximum ambient air temp. 50^0C
ii) Maximum daily average ambient temp: 40^0C
iii) Maximum yearly weighted average ambient temp. (Reference ambient temp.) 32^0C

vi) Minimum ambient air -5^0C

(B) **CLIMATIC CONDITIONS**:

i)	Maximum relative humidity	100%
ii)	Yearly Average number of thunder storms	60
iii)	Average no. of rainy days per annum	60days
iv)	Average number of days of fog per annum	70days
v)	Average no. of hailstorms days per annum	5 days
vi)	Number of months during which tropical monsoon conditions prevail.	3 months
vii)	Average number of dust storms days per annum	40
viii)	Average annual rainfall	Above 76cm.
ix)	Maximum wind pressure:	150Kg/sq.m

(C) **ALTITUDE**

Altitude above M.S level not exceeding 1000 mtrs.

(D) Sites are susceptible to earthquakes. The earthquakes forces for which equipment is to be designed: -

i) Horizontal direction	0.30g
ii) Vertical direction	0.15g

5. LIMITS OF TEMPERATURE RISE:

(a) With the above service conditions, given in caluse-4 , transformer shall be capable of operating continuously on any tap at their normal rating without exceeding following temperature rises over maximum ambient temperature of 50 ^{0}C.

i) 50 deg. C in Top oil by thermometer
ii) 55 deg. C in winding by resistance
iii) Temp. of hot spot in winding not to exceed 98 deg.C. when calculated at maximum annual weighted average temp. of 32 deg. C

(b) The limits of temperature rise mentioned above and over load capacity as per IEC 354 (1993) will have to be satisfied by the manufacturer by carrying out the heat run test at the lowest negative tap. This test shall be carried out by feeding the following losses:-

"1.1 times the total losses at 75 deg. C". (at highest current tap)

6.. OVER LOAD CAPACITY & CONTINUOUS RATING

a). The safe over load capacity of the transformer and the duration of over load for each type of cooling (ONAN/ONAF) under maximum temperature conditions (clause 4 above) without any damage to the winding or harmful effects on the insulation shall

be clearly stated in the tender, which must be as per IEC-354. (Guide for Loading of Oil Immersed Transformers)

(b) The transformer shall be suitable for operation without exceeding temperature rise, winding gradient and hot spot injurious heating at any particular tapping at the rated MVA provided that the voltage does not vary by more than ± 10% of the voltage corresponding to that tapping. Transformer shall be capable of remaining in operation at full load for **10minutes after failure of the blowers without the calculated winding hot spot temperature exceeding 150ºC. Transformers fitted with two coolers each capable of dissipating 50 percent of losses at Continuous Maximum Rating (CMR) shall be capable of remaining in operation for 20 minutes in the event of failure of the blowers associated with one cooler without the estimated winding hot spot temperature exceeding 150ºC.**

7. PARALLEL OPERATION

The transformers listed in the 'Schedule of Requirements,' Appendix-A, shall be capable of satisfactory parallel operation with the existing similar transformers.

8. FREQUENCY

The transformers shall be suitable for continuous operation with a frequency variation of ± 3% from normal 50 cycles per second without exceeding the specified temperature rise.

9. SUPRESSION OF HARMONICS

The transformer shall be designed with particular attention to suppression of harmonic voltages especially the 3rd and 5th. Percentage of harmonics at normal voltage and at maximum system voltage shall be stated in the tender.

10. DESIGN AND CONSTRUCTION:

(a) The transformers shall be 3-phase oil immersed type, with core type of construction, type of cooling as per 'Schedule of Requirements', with external heat exchangers as Tank mounted Radiators, shall be suitable for out door service, with adequate Ceramic Ball/ spacers provided in the core/windings for circulation of oil so as to ensure proper cooling. All apparatus shall be designed to ensure satisfactory operation under such sudden variation of load and voltage as may be met with under working conditions on the system including those due to short circuits. To minimize the eddy current losses in the windings, Continuous Transposing of Conductor shall be used wherever required similarly for minimizing the stray losses, magnetic shield in the yoke, magnetic shunt in tank walls, bushing turrets, clamps, flitch plates etc. shall be provided wherever required. Manufacturer shall indicate the design value of eddy current losses, stray losses as a %age of load losses in the design.

(b) All materials used in the manufacture of the transformers shall be of the best quality of their respective kind, obtainable in the market and shall conform to relevant Indian Standards. The design of transformer and properties of the material used should be such as to reduce to the minimum, the risk of development of acidity in oil.

(c) Corresponding parts, liable for replacement shall be interchangeable.

(d) All outdoor apparatus, including bushing insulators with their mountings shall be designed so as to avoid pockets, in which water can collect. Means shall be provided for easy Lubrication of all bearings and wherever necessary, if any mechanism or moving part that is not oil immersed.

e). **DIMENSIONS & SIZE CONSTRAINTS**

6.3/8MVA, 66/11KVTransformer for left Bank Bhakra

The size of the transformer (including radiators) shall be such that this can easily be installed in the earmarked space in the 220KV Left Bank Switchyard where the existing transformer is operating and shall match existing terminal arrangements on LV/HV sides. A sketch showing site plan/location for installation of the transformer is attached as **Annexure-VI.** As the transformer is to replace the existing one and is to be accommodated/connected as per existing arrangement, the tenderer may visit the site before quoting for exact dimensions after taking permission from this office. The approximate dimensions of the existing transformer which is to be replaced are as under:-

Length	3550mm
Breadth with radiators	3450mm
Height (upto bushing)	3550mm
Height (Over all)	4100mm (from bottom of wheels to conservator top.

Please also see clause 14(b)of section –2B)

The overall height of the transformer to be offered by the tenderer shall not exceed the above figure.

10.1 CORE AND FLUX DENSITY

The transformer should be so designed that the working flux density in any part of the core and yoke of the transformer at normal voltage and frequency shall be such that the flux density in over voltage condition (considering voltage and frequency variation not exceeding the rated v/f ratio by 10%) shall not exceed 1.9 Tesla. For consideration of overfluxing, the transformer shall be suitable for continuous operation for overfluxing factor upto 1.1, this factor being $v/v_m \times f_n/f$, where v & f are the system voltage & frequency respectively, v_m is mean system voltage and f_n is rated system frequency. The tenderers shall state the over fluxing capability and corresponding withstand durations for the Transformers for factors 1.1, 1.25 and 1.4.

The core shall be built up with thin laminations of high grade, non-ageing, low loss, high permeability, cold rolled super grain oriented silicon steel, known as HIB Grade CRGO or superior grade CRGO steels of maximum 0.27mm or low lamination thickness especially suitable for transformer core. The tenderer should specify which grade of HIB is being used.

Purchaser shall inspect the built-up core for verification of flux density for which all facilities shall be provided. The purchaser shall inspect/test the core material for various tests as per relevant IEC/IS to ensure quality. Core may also be inspected during horizontal assembly, built-up assembly.

NOTES

i) Yoke bolt area and flitch plate areas shall not be counted in the net core area if these are provided for fastening of core.

ii) The design of limb and yoke shall so co-ordinate that there is no cross fluxing at the joints.

10.2 **WINDING**

The conductor used for the winding shall consist of solid drawn high conductivity electrolytic grade copper best suited to the requirement and free from scale and burns.

In case of copper strip, the corners shall be rounded off to eliminate risk of injury to internal insulation during winding & other operations. No Strip conductor wound on edge should have width exceeding six times its thickness.

10.3 INSULATION LEVELS

10.3.1 The insulating material to be used, shall be of Class-"A" as specified in the latest edition of IS: 1271.

10.3.2 The dielectric strength of windings insulation and of the bushings shall conform to values given in IS: 2026/1981 Part-III amended up to date except for the changes made in this specification.

10.3.3 The impulse test and power frequency test voltage for 66/11KV class Power transformers would be as under:-

.

Rated system voltage (KV)	**Highest system voltage (KV)**	**1.2/50 µs positive impulse withstand voltage of line end (KV peak)**	**One minute PF withstand voltage**	
			Line end (KV)	**neutral end (KV)**
11	12	95	38	38
66	72.5	325	140	38
132	145	650	275	38

The provision of note under clause 5 of IS: 2026 (Part-III)-1981 should be kept in view while offering this parameter. The star connected windings of the transformers may have graded insulation category for HV winding.

All windings for system voltage lower 66KV shall have uniform insulation.

10.4 Short Circuit strength and provision of separate tapping coil for regulation:-

Transformers shall be designed and constructed to withstand without damage the thermal effects on external short circuits for 2 seconds under conditions specified in IS: 2026 (Part-I) – 1977 and Dynamic withstand ability for 0.25seconds as per Clause 4.2.5 of IEC 60076-5.

The transformers shall be provided with separate tapping coil to limit the short circuit forces.

The position of the tapping coil shall be so arranged that at extreme negative tap, the percentage regulation is less than that at normal tap.

10.5 TANK (CONVENTIONAL TYPE)

The transformer tank and cover shall be air tight and shall be fabricated from good commercial grade low carbon steel suitable for welding **(IS:1977/IS: 2062**) and of adequate thickness. The tank and the cover shall be of welded construction. All seems shall be welded and wherever practicable they shall be double welded. Transformer with cooling bank, bushing and other accessories shall be tested for any oil leakage at high pressure (normal pressure plus 35 KN/Sq.m measured at the base of tank) and at room temperature. The tank cover shall be bolted to the tank and the transformer design shall be such that it shall be possible to move the complete transformer unit by skidding in any direction without injury when using plates or rails.

Man holes with welded flange and bolted covers shall be provided on the tank cover. The man holes shall be of sufficient size to afford easy access to the lower ends of bushings , terminals, OLTC etc.

Suitable no. of jacking bolts shall be provided on tank cover, inspection covers to facilitate moving of the transformer and they shall be suitably braced in the vertical direction so that bending does not occur when the pull has a vertical component.

The transformer tank should be provided with prismatic oil level gauge duly protected from external injury to show the transformer oil level**.**

10.6 OIL CONSERVATOR (AIR CELL TYPE)

(i) An oil conservator tank complete with sump, filling hole and drain valve shall be mounted above the radiators and located so as not to obstruct bare connections taken off from the transformer terminals.

(ii) The capacity of the conservator tank shall be adequate to meet the requirements of expansion of the total cold oil volume in the transformer and cooling equipment from minimum ambient temperature of minus 5 deg. C. to 115 deg. C.

(iii) The minimum indicated oil level shall be with the feed pipe from main tank cover, under not less than 15mm depth of oil and the indicated range of oil level shall be from minimum to maximum.

(iv) One magnetic type oil level gauge with alarm contacts shall be mounted at a convenient height to be read from ground level. Prismatic type oil level gauge shall also be provided.

(v) Oil level at 30 deg. C. shall be marked on the gauge.

(vi) The conservator tank shall have one oil filling hole with cap at the top and drain valve of appropriate size at the bottom. A shut off valve shall be provided at the conservator to cut off oil supply to the transformer.

(vii) The conservator tank will be designed in such a way that the same can withstand strong wind pressures by adding adequate stiffeners if necessary.

(viii) Each conservator shall be fitted with a double compartment breather with oil seal in which silicagel is the dehydrating agent and designed so that:-

a) The passage of air is through the silicagel.

b) The external atmosphere is not continually in contact with the silicagel.

c) The moisture absorption is indicated by a change in colour of the tinned crystals and can be daily observed from distance.

d) All breathers shall be mounted at approximately 1400mm above ground level.

e) The breather should be made of superior quality see through material and should consist of two compartments placed in series**. (Capacity 2x100%)**

f) In addition to M.O.G., prismatic type oil gauge shall also be provided.

g) The conservator shall be of air cell type having provision for the rubberized air cell so that air does not come in contact with oil in the conservator.

h) One end plate of the conservator shall be bolted so that it can be removed for cleaning purposes.

10.7 INSULATING OIL

(i) Sufficient insulating oil of Nepthenic type (made from Nepthenic crude) conforming to IS:335 shall be supplied for first filling of each transformer at site.

(ii) 10% extra oil of the total quantity of oil shall also be supplied along with the transformer

(iii) In case the transformer is to be supplied gas filled, particular attention shall be paid to deliver the oil at site free from moisture and of uniform quality through out in non-returnable epoxy coated steel drums.

(iv) The quantity of oil for first filling of transformer shall be stated in tender, along with trademark of the oil to be supplied.

(v) Use of inhibitors in oil shall not be resorted to.

10.8 BUSHINGS, INSULATORS AND TERMINALS

Transformer shall be fitted with bushing insulators as follows :-

A). 132/11KV Transformer shall be fitted with bushing insulators as follows:-

a)	LV-N bushing :	36KV Class, oil communicating type porcelain bushing
b)	LV bushing :	36KV Class, oil communicating type porcelain bushing.
c)	HV bushing :	145KV class, ,OIP condenser bushing.
d)	HV-N bushing	36KV Class, oil communicating type porcelain bushing rating

B). For 12.5/16MVA,66/11KV class Power Transformer:

a)	LV-N bushing	36KV Class, oil communicating type porcelain bushing rating
b)	LV bushing	36KV Class, oil communicating type porcelain bushing rating.
c)	HV bushing	72.5KV Class, condenser bushing
d)	HV-N bushing	36KV Class, oil communicating type porcelain bushing .

C). **For 6.3/8MVA, 66/11KV class Power Transformer**:

Transformer shall be fitted with bushing insulators as follows :-

a)	LV-N bushing	36KV Class, oil communicating type porcelain bushing.
b)	LV bushing	36KV Class, oil communicating type porcelain bushing.
c)	HV bushing	72.5KV Class, condenser bushing
d)	HV-N bushing	36KV Class, oil communicating type porcelain bushing.

Note:- **Bushings should be suitable for 25 times rated current for 2 secs**.

i). Bushings for 66KV& above shall be filled with transformer oil and there shall not be communication with the oil in the transformer. An oil gauge, preferably of prismatic type shall be provided to indicate that correct level is maintained.

ii) The electrical characteristics of bushings shall be in accordance with IS: 3347 and IS: 2099.

iii). These bushings shall be suitable for single/Twin ACSR Zebra conductor connection. All bushings shall be equipped with suitable terminals of approved type and size and all external current carrying surfaces shall be adequately silver plated. All ends as well as all tapings on the windings shall be brought to terminals. In case of connection required outside the tank these shall be brought out to their respective terminals through well insulated bushings which shall be detachable and replaceable without disturbing the internal connections. Bushings which pass through the cover shall be removable without disturbing the transformer cover. Any change , if required shall be intimated to successful bidder.

The Bushings of 11KV side of the 132/11KV, 4MVA transformer shall be housed in cable end box made from the same plate as that of tank material and provided with removable cover. The cable end box shall have glands of suitable size for accommodating PVC armored aluminum cable of 3 cores, 185mm^2 size. The cable end box shall have filling and venting plugs for compound filling. The 11KV bushings and the cable end box should preferably be horizontally positioned below top cover level with vertical entry of the 11KV cable.

iv). The bushings shall have high factor of safety against leakage to ground and shall be so located as to provide adequate electrical clearances between bushings of various voltages and between bushings and grounded parts.

v). Bushings of identical voltage shall be interchangeable. The insulating class of the high voltage neutral bushing shall be properly coordinated with the insulation class of neutral of the high voltage winding.

vi) Clamps and fittings made of steel or malleable iron shall be galvanized.

vii). Each bushing shall be so coordinated with the transformer insulation that all flash-over will occur outside the tank. All bushings shall have puncture strength greater than dry flash over value.

viii). Any stress shield shall be considered as integral part of bushing assembly. For voltages 66KV and above only condenser type bushings shall be accepted.

ix). Short time current withstand capacity of Bushing shall be 31.5KA for 2 seconds or more.

x) Oil conservator tanks for main transformers, transformer bushing shall be capable to take care of expansion up to 115^{o}C. If the oil temperature rise beyond 115^0 C, what is the release provided, be specified.

xi) Provision of BCT having variable tap is required for compensation to arrive at correct hot spot temperature to be indicated through WTI.

xii) Provision of suitable test point in the condenser bushing for measurement of tan delta and capacitance may be made

10.9 THERMOSYPHON FILTER ARRANGEMENT

Thermosyphon filter arrangement shall be provided on the transformer for preserving the quality of transformer oil. The filter assembly shall be mounted on the

transformer as well as ground supported and connected with pipes and shut off valves. Suitable instructions required to be followed for commissioning, dismantlement & maintenance of the filter arrangement, re-generation and storage of the adsorbent etc. must be included in the instruction manual. A detailed drawing showing internal arrangement, shall also be required to be submitted. **Suitable capacity pump (alongwith motor) shall also be provided to boost circulation of oil. The pump and motor should not be in main pipe line. It should be in bypass pipe line having suitable valve to isolate from main pipe line. The main pipe line should have two shut off valves at the bottom.**

NOTE:- The pump and motor should be weather proof (Flow well Type).

The oil & Sorbent capacity required in the Thermosyphon Filter is as under:-

i) Quantity of oil 4.0 % of total oil by weight.

ii) Quantity of Adsorbent 1.25% of total oil by weight.

10.10 NEUTRAL CURRENT TRANSFORMER: (For 6.3/8MVA,66/11kV Transformer)

11.10.1 The supplier shall provide outdoor type tank mounted single core NCT of LV for restricted earth fault protection. The particulars of NCT shall be as under:-

Normal voltage	Ratio	Frequency	Burden(VA)	Accuracy class	Short time current rating	Insulation level
15KV	600/1	50Hz	15VA	5P-15	13.1 KA/3 Sec.	38KV/ 95Kvp

10.10.2 Supplier shall provide Neutral CT as specified above and complete equipment for forming neutral inclusive of copper bar etc.

10.10.3 Supporting structure and bimetallic clamps for connection to station copper ground flat of size 50x8mm shall be in the supplier's scope. The drilling of holes on bimetallic clamps shall be done at site.

10.10.4 Secondary terminals of NCT shall be separately brought out to the terminal box.

10.10.5 Particulars of NCT mentioned are tentative and subject to confirmation at the time of award of contract. Any change shall however have no bearing on the price of transformer.

10.10.6 Testing of NCT shall comply with type test including short time current test as stipulated inIS:2705. The reports of all type tests and other test conducted on similar equipment shall be supplied alongwith the tender.

Neutral Current transformer shall be subjected to routine tests as per relevant Indian Standards in presence of Purchaser's representative. Test certificates for type tests shall be submitted by the supplier. All the test reports shall be submitted and got approved from the purchaser before despatch of equipment.

10.10.7 The tenderer should recommend the minimum insulation resistance values of (i) Primary winding to secondary winding (ii) Primary winding to secondary

winding earthed with 2500 volts and 5000 volts Meggar below which NCT should not energized.

The tenderer should recommend minimum values of tan delta and partial discharge level for the Neutral current transformer offered.

11.1 TAPPING & OFF CIRCUIT TAP CHANGER FOR 6.3/8MVA,66/11KV TRANSFORMER:

11.1.1 The transformer shall be fitted with Off Circuit Tap changer with HV variations from –5%to +5% in 4steps of 2.5% each.

11.1.2 The transformer shall be provided with rotary type Off Circuit Tap Changing switch with off circuit links for carrying its effective ratio of transformation while the transformer is de-energized, without producing phase displacement.

11.1.3 The off circuit switch handle shall be provided with a locking arrangement along with tap position indicator, thus enabling the switch to be locked in position and its operation can be done by a man standing at ground level.

11.1.4 A warning plate, indicating that the switch shall be operated only when the transformer is de-energized, shall be fitted. The taps shall be so designed that the transformer gives full load output on all taps without exceeding the limits of guaranteed temperature rise in oil, winding and hot spot temperature.

11.1.5 The current rating of the tap changer contacts shall be one step higher than the maximum current, which shall be passing through them at the lowest tap. A permanent legible diagram plate, showing position and designation of each terminal to achieve voltage steps shall be fitted.

11.1.6The tap changing mechanism shall be of strong construction and shall be provided with low resistance contacts under condition of external short circuit. Tap changing equipment should be capable of carrying the same current as the transformer windings.

11.2 TAPPING& ON LOAD TAP CHANGER FOR 12.5/16MVA, 66/11KV POWER TRANSFORMER:

11.2.1 The tapping range shall be as given in the ‘Schedule of requirements’(Appendix-A). 11.2.2 The12.5/16MVA,66/11KV power transformer & 10/12.5 MVA, 66/11KV Power transformer should be provided with the ON Load Tap Changers having local manual and electric control, as well as group electrical remote control from the Remote Tap Changer Control (RTCC) panel. These tapings may be used to get 10% over voltage on low voltage side at no load. When under this condition, the high voltage side experience an over voltage, the tapping shall be changed so that the continuous over excitation is limited to 10%only

11.3 TAPPING & OFF CIRCUIT TAP CHANGER FOR 4MVA,132/11KV TRANSFORMER:

11.3.1 The transformer shall be fitted with Off Circuit Tap changer with HV variations from –5% to +5% in 4steps of 2.5% each.

11.3.2 The transformer shall be provided with rotary type Off Circuit Tap Changing switch with off circuit links for carrying its effective ratio of transformation while the transformer is de-energized, without producing phase displacement.

11.3.3 The off circuit switch handle shall be provided with a locking arrangement along with tap position indicator, thus enabling the switch to be locked in position and its operation can be done by a man standing at ground level.

11.3.4 A warning plate, indicating that the switch shall be operated only when the transformer is de-energized, shall be fitted. The taps shall be so designed that the transformer gives full load output on all taps without exceeding the limits of guaranteed temperature rise in oil, winding and hot spot temperature.

11.3.5 The current rating of the tap changer contacts shall be one step higher than the maximum current, which shall be passing through them at the lowest tap. A permanent legible diagram plate, showing position and designation of each terminal to achieve voltage steps shall be fitted.

11.3.6 The tap changing mechanism shall be of strong construction and shall be provided with low resistance contacts under condition of external short circuit. Tap changing equipment should be capable of carrying the same current as the transformer windings.

12. ELECTRICAL CLEARANCES:

The electrical clearances in air between live conductive parts to each structure shall be as under:-

Nominal system voltage (KV)	**Testing voltage Impulse(KVP)**	**Clearances**	
		Phase to Phase (mm)	**Phase to Earth** (mm)
132	650	1430	1270
66	325	700	660
11	95	280	140

13. TOLERANCES

Various tolerances on technical parameter shall be as under:-

I. **Impedance:-**

Maximum tolerances allowed on impedances at all taps shall be as per IS:2026 (Latest Edition)

II **Losses:-**

No positive tolerance shall be allowed on guaranteed no load losses, load losses and auxiliary losses individually at rated voltage, frequency, current, principal tap and 75^0 C temp.

III. **Temperature Rise Test**

No positive tolerance shall be allowed on temperature rise of oil , winding, winding temperature gradient and hot spot temperature than the guaranteed values.

IV **Weights**

No negative tolerance shall be allowed on weight of copper, weight of CRGO & weight of oil etc.

V. Transformer shall be tested for overload conditions as specified in IEC: 354/1993, which shall be read with IEC: 76/1993.

14. ANTI EARTH QUAKE CLAMPING DEVICE

To prevent transformer movement during earthquake, a clamping, device shall be provided for fixing the transformer to the foundations. The supplier shall supply necessary bolts for embedding in the concrete. The arrangement shall be such that the transformer can be fixed to or unfastened from these bolts as desired. The fixing of the transformer to the foundation shall be designed to withstand seismic events to the extents that a static coefficient of 0.3g applied in the direction of least resistance to that of loading will not cause the transformer or clamping device as well as bolts to be overstressed.

15. EARTHING TERMINALS

Two earthling pads suitable for connecting 50x8 mm mild steel flat shall be provided at positions close to the two diagonally opposite bottom corners of tank. These grounding terminals shall be suitable for bolted connection. Two earthling terminals shall also be provided each on marshalling box and any other equipment mounted separately.

16. UNDER CARRIAGE

The transformer shall be supported on a strong structural steel base equipped with forged steel or cast steel, single flanged, bi-directional wheels suitable for moving the transformer completely filled with oil. Jacking pads shall be provided to make it possible to change the direction of wheel through 90 degree when the transformer is lifted on jacks and permit movement of the transformer both in the longitudinal and transverse direction. Track gauge in longitudinal and transverse direction shall be 1676mm. Means shall be provided for locking the swivel movement in position parallel to and at right angles to longitudinal axis of the tank.

Pulling eyes and skids shall be provided to facilitate moving of the transformer and they shall be suitably braced in the vertical direction so that bending does not occur when the pull has a vertical component.

17 JOINTS, GASKETS AND VALVES

All gaskets used for making oil tight joints shall be of proven material such as granulated cork bonded with synthetic rubber. The material used should not deteriorate under the action of hot oil.

All valves shall be of gun metal or of cast steel. They shall be of full way type with internal screw and shall open when turned counter clockwise when facing the hand wheel. Means shall be provided for padlocking the valves in the open and closed position. Every valve shall be provided with flanges having machined faces. The drilling of valves flanges shall comply with the requirement of IS:2026/IS:3639.

18. MARSHALLING BOX

A sheet steel of minimum 3mm thickness vermin proof, well ventilated and weather proof marshalling box of a suitable construction shall be provided for the transformer auxiliary apparatus. Wiring upto marshalling box shall be with PVC/SWA,PVC copper cable **1100** volts grade. The box shall have sloping roof.

The marshalling box shall accommodate the following equipment:

a) Temperature indicators for WTI & OTI
b) Terminal blocks and gland plates for incoming and out going cables and control/ protection equipment .
c) Control & protection equipment for cooling plant.

All the above equipment except (b) shall be mounted on panels and back of panel wiring shall be used for inter-connection. The temperature indicators shall be so mounted that the dials are not more than 1600 mm from the ground level and the door(s) of the compartment(s) shall be provided with glazed window of adequate size.

To prevent internal condensation, an approved type of metal clad heater with thermostat shall be provided. Controlled by water tight single pole iron clad rotary switch mounted on outside of the box. The ventilation louvers, suitably padded with felt, shall also be provided. The louvers shall be provided with suitable felt pads to prevent ingress of dust.

All incoming cables shall enter the kiosk from the bottom and the gland plate shall not be less than 450mm from the base of the box. The gland plate and associated compartment shall be sealed in suitable manner to prevent the ingress of moisture from the cable trench.

19. CONTROL CONNECTION,INSTRUMENT WIRING, TERMINAL BOARDS & FUSES

All wiring connections, terminal blocks, fuses and links shall be suitable for tropical atmosphere. Any wiring liable to be in contact with oil shall have oil resisting insulation. There shall be no possibility of oil entering connection boxes

used for cables and wiring. When 415 volts connections are taken through junction boxes or marshalling boxes, they shall be adequately screened and 415 volts danger notice must be affixed to the outside of junction boxes or marshalling boxes. All wiring shall be in accordance with relevant ISS. All wiring shall be with stranded copper of **1100** volts grade and size not less than 4.00 sq. mm. for CT leads and not less than 2.5 sq. mm. for other connections. **All wiring cables shall carry ISI mark / certified.**

All wires on panels and all multicore cables shall have ferrules which bear the same number at both ends. The same ferrule number shall not be used on wires in different circuits, on the same panel. Ferrules shall be of white insulating material and shall be provided with glossy finish to prevent adhesion of dirt. They shall be clearly and durably marked in black and shall not be affected by dampness or oil. Wiring shall in general be accommodated on sides of the box and wires for each circuit shall be separately grouped. Back of panel wiring shall be arranged so that access to the connecting stems of relays and other apparatus is not impeded. ALL THE CABLES AND CAPILIARY TUBES OF OTI & WTI ETC. ARE TO BE WIRED PROPERLY ON CABLE TRAYS WITH THE HELP OF SUITABLE CLEATS UPTO THE MARSHALLING BOX. **THE CABLES TRAYS SHALL BE KEPT MINIMUM 100MM FROM THE TANK BODY TO AVOID EXCESSIVE HEATING OF CABLES/ WIRES.**

Wires shall not be jointed or tied between terminal points. Wherever possible all circuits in which the voltage exceeds 125 volts, shall be kept physically separated from the remaining wiring. The function of each circuit/equipment shall be marked on the associated circuit/equipment.

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Where apparatus is mounted on panels, all metal cases shall be separately earthed by means of copper wire.

No live metal part shall be exposed at the back of terminal boards.

All fuses shall be of HRC cartridge type and fuses and links shall be labeled.

All wiring diagrams for control panels shall preferably be drawn as viewed from the back.

The overall design of wiring shall be such that various wires and ends of the same wire can be traced easily and there is convenience to access the terminations and ferrule number shall be readable with convenience. Terminal blocks shall have 20% spare terminals.

20. <u>DRYING OUT AND ERECTION</u>

The transformer shall be dried out by an appropriate method at the manufacturer's works and so arranged for transportation and storage that it may be put into service without further drying out at site. For any subsequent drying which may

be necessary at site the manufacturer shall give details of the method recommended for using the same.

The transformer shall be designed to withstand pressure and vacuum tests as specified by CBIP specification for power and distribution transformers.

i) Vacuum of 760mm of mercury as per CBIP manual applied to tank and cooling equipment when empty of oil.

ii) Pressure of 1Kg/cm^2 of mercury applied to tank and cooling equipment when empty of oil.

iii) Pressure of 0.357Kg/cm^2 to be applied at conservator on fully assembled transformer when full of oil.

Clear instructions shall be given in the maintenance manual regarding special precautionary measures which must be taken before applying the specified vacuum treatments. The maximum vacuum which the complete transformer filled with oil, can safely withstand without any special precautionary measures being taken shall also be stated in the maintenance manual. The bushing shall be capable of withstanding vacuum operation when drying the transformer.

21. APPROVAL OF DESIGNS:

The supplier shall finalize the design and furnish to the purchaser the following data complete with calculations for approval before starting the manufacturing:-

i) Minimum weight of bare copper in each winding & taps along with weight of insulating material.
ii) Weight of steel laminations.
iii) Weight of core and windings.
iv) Cross-section of core.
v) Flux density and its calculations.

Data/calculations not covered above and as specified under relevant standard

22. DRAWINGS LITERATURE & INSTRUCTION MANUALS:

The supplier after the award of the contract shall supply four copies of the following drawings within 60 days after the receipt of the purchase order, which will describe the equipment in detail for approval by the Purchaser. Purchaser (i.e. Bhakra Beas Management Board), Purchaser's ref. No. (i.e. PO No. & Date, specification No.), Rating of Transformer should invariably be specified on each drawing. If the drawings are found to be deficient in any manner, the deficiency, so communicated, would be rectified within next 20 days. The delay beyond 60 days in submission of drawings in the first instance and beyond 20 days in resubmission of drawings (after removal of deficiencies, if pointed out) would count towards levy of penalty as per Clause 5 of Section- IB.

Bill of material in respect of each drawing must indicate the quantity, make and specification of each item. Approval of purchaser of Contractor's drawings shall

not be held to relieve the contractor of any part of his obligation to meet all the requirements of the specifications or of the responsibility for the correctness of the drawings & design.

A). Drawing for 6.3/8MVA,66/11KV class Power Transformer:

i) Detailed outline General Arrangement drawing showing plan, front elevation, side elevation with all fittings and accessories etc. The following information must be specifically included on this drawing.

a) Make of transformer oil.
b) Electrical clearances, minimum as well as actual.
c) The no. of radiator headers, number of radiator elements width , thickness of sheet & height of each radiator.
d) A small sketch showing Untanking details.
e) Thickness of transformer tank bottom, side & top plates.
f) Type, shade, shade No. and thickness of transformer paint.
g) Roller, rail gauge sketch.
h) Weight of oil, bare copper weight, windings, core, Untanking mass, transportation mass and dimensions etc.
i) The no. of cooling fans , input to each cooling fan & its sweep.

ii) Detailed drawing of bushings, showing plan elevation, terminal details, mounting details, make and type number, incorporating electrical characteristics, description of various parts, total creep age/protected creep age distance, weight of oil, total weight of bushing, dimensions(L2,LG,Le) short time rating etc.

iii) Transportation sketch showing dimensions and weights of the heaviest package & the shipping arrangements of the transformer.

iv) Rating and diagram plate.
Bare copper weight & weight of core should be invariably specified on the rating plate.

v) Detailed structural drawings for the transformer tank, under carriage, conservator, radiators, supporting structures for cooling fans etc.

vi) Dimensional drawings of multi bolt bimetallic connectors for line ends and flexible connectors for the neutral ends.

vii) Drawing of off circuit Tap changer.

viii) **COOLING EQUIPMENT DRAWINGS:**
a) General assembly of marshalling box and fan control cubical. The plan view showing foundation details must be specifically included if this cubicle box is separately mounted.
b) Schematic diagram of cooler control scheme along with detailed write up explaining the sequence of operations and functions of each equipment.

ix) Wiring diagram/cabling details of control fan cubicle showing connections with OTI, WTI, MOG etc.

x) **CORE DRAWINGS:**

a) Core dimensional drawing showing core frame size(Elevation plan), limb and yoke sections alongwith step details and calculations for flux density and make of CRGO.

b) Calculations for no load current, no load losses and characteristics of the core material shall also be furnished.

c) Make of CRGO and Sub- Supplier name for cutting of CRGO shall be given in the drawing .

xi) **WINDING DRAWING:**

a) HV, LV and Regulating winding conductor cross sections alongwith calculations for current density.

b) Make of copper used and insulating paper/ press board used shall be given in the drawing.

c) Name of the vendor for processing of copper shall be given.

xii) Thermosyphon arrangement drawing, showing tray details, internal tray arrangement and removal of tray assembly etc. showing dimensions, qty. of oil and Sorbent used.

xiii). Roller stopper arrangement drawing.

xiv). Drawings of off circuit Tap changer.

xv). **<u>ADDITIONAL DRAWING</u>**

The following drawings shall be supplied for reference and record in addition to the above drawings enlisted from (i) to (xi v):

a) Schematic diagram showing flow of oil in the cooling system as well as each limb of the core and winding and cross sectional views showing duct sizes, cooling pipes etc. for the transformer/heat exchanger drawn to scale shall be furnished.

b) Large scale drawing of high and low voltage windings of transformer showing the nature and arrangement of insulation and terminal end connections.

c) Drawing showing sectional view of the HV & LV windings when viewed from top.

d) Detailed drawings of conservator & pressure relief device (explosion vent) mounted on position.

e) Valve & plug schedule plate indicating the location of various valves on the transformer mentioning the functioning of each.

f) A schedule showing the requirement of set of spare gaskets

g) Fan mounting details.

h) Foundation Plan of the transformer including auxiliary equipment.

i) Any other drawing considered necessary by the Purchaser.

xvi). **INSTRUCTION MANUALS**

The supply shall be required to supply 6 sets of instruction manuals per transformer, each properly bound in hard cover. Each set shall consist of the following.

a) All drawings listed above.

b) Erection, operation & maintenance manual for transformer and pamphlets for all spare parts e.g. OTI, WTI, MOG, Buchholz relay, silicagel and breather/pressure relief valve etc.

c) Instructions for dehydration, if any.

d) Precautions prior to vacuum application, if any.

e). Any other information/data/documents/instructions considered necessary by the manufacturer for efficient functioning of the transformer.

B). **Drawings for 132/11KV 4MVA Power transformer:**

i) Detailed outline General Arrangement drawing showing plan, front elevation, side elevation with all fittings and accessories etc. The following information must be specifically included on this drawing.

a) Make of transformer oil.
b) Electrical clearances, minimum as well as actual.
c) The no. of radiator headers, number of radiator elements width , thickness of sheet & height of each radiator.
d) A small sketch showing Untanking details.
e) Thickness of transformer tank bottom, side & top plates.
f) Type, shade, shade No. and thickness of transformer paint.
g) Roller, rail gauge sketch.
h) Weight of oil, bare copper weight, windings, core, Untanking mass, transportation mass and dimensions etc.

ii) Detailed drawing of bushings, showing plan elevation, terminal details, mounting details, make and type number, incorporating electrical characteristics, description of various parts, total creep age/protected creep age distance, weight of oil, total weight of bushing, dimensions(L2,LG,Le) short time rating etc.

iii) Transportation sketch showing dimensions and weights of the heaviest package & the shipping arrangements of the transformer.

iv) Rating and diagram plate.
Bare copper weight & weight of core should be invariably specified on the rating plate.

v) Detailed structural drawings for the transformer tank, under carriage, conservator, radiators etc.

vi) Dimensional drawings of multi bolt bimetallic connectors for line ends and flexible connectors for the neutral ends.

vii) General assembly of marshalling box. The plan view showing foundation details must be specifically included if this cubicle box is separately mounted.

viii) Wiring diagram/cabling details of control cubicle showing connections with OTI, WTI, MOG etc.

ix). Drawing of off circuit Tap changer.

x) **CORE DRAWING:**

a) Core dimensional drawing showing core frame size, limb and yoke sections along with step details and calculations for flux density and make of CRGO.

b) Calculations for no load current, no load losses and characteristics of the core material shall also be furnished.

c) Make of CRGO and Sub- Supplier name for cutting of CRGO shall be given in the drawing .

xi) **WINDING DRAWING:**

a) HV, LV and Regulating winding conductor cross sections alongwith calculations for current density.

b) Make of copper used and insulating paper/ press board used shall be given in the drawing.

c) Name of the vendor for processing of copper shall be given.

xii) Thermosyphon arrangement drawing, showing tray details, internal tray arrangement and removal of tray assembly etc. showing dimensions, qty. of oil and Sorbent used.

xiii) Roller stopper arrangement drawing.

. xiv). **ADDITIONAL DRAWING**

The following drawings shall be supplied for reference and record in addition to the above drawings enlisted from (i) to (xii):

a) Schematic diagram showing flow of oil in the cooling system as well as each limb of the core and winding and cross sectional views showing duct sizes, cooling pipes etc. for the transformer/heat exchanger drawn to scale shall be furnished.

b) Large scale drawing of high and low voltage windings of transformer showing the nature and arrangement of insulation and terminal end connections.

c) Drawing showing sectional view of the HV & LV windings when viewed from top.

d) Detailed drawings of conservator & pressure relief device (explosion vent) mounted on position.

e) Valve & plug schedule plate indicating the location of various valves on the transformer mentioning the functioning of each.

f) A schedule showing the requirement of set of spare gaskets

g) Foundation Plan of the transformer including auxiliary equipment.

h) Any other drawing considered necessary by the Purchaser.

xv) **INSTRUCTION MANUALS**

The supplier shall be required to supply 6 sets of instruction manuals per transformer, each properly bound in hard cover. Each set shall consist of the following.

a) All drawings listed above.

b) Erection, operation & maintenance manual for transformer/OLTC and pamphlets for all spare parts e.g. OTI, WTI, MOG, Buchholz relay, silicagel and breather/pressure relief valve etc.

c) Instructions for dehydration, if any.

d) Precautions prior to vacuum application, if any.

e). Any other information/data/documents/instructions considered necessary by the manufacturer for efficient functioning of the transformer.

C). <u>Drawings for 12.5/16MVA 66/11KV Power Transformer:</u>

i) Detailed outline General Arrangement drawing showing plan, front elevation, side elevation with all fittings and accessories etc. The following information must be specifically included on this drawing.

a) Make of transformer oil.
b) Electrical clearances, minimum as well as actual.
c) The no. of radiator headers, number of radiator elements width , thickness of sheet & height of each radiator.
d) A small sketch showing Untanking details.
e) Thickness of transformer tank bottom, side & top plates.
f) Type, shade, shade No. and thickness of transformer paint.
g) Roller, rail gauge sketch.
h) Weight of oil, bare copper weight, windings, core, Untanking mass, transportation mass and dimensions etc.
i) The no. of cooling fans , input to each cooling fan & its sweep.

ii) Detailed drawing of bushings, showing plan elevation, terminal details, mounting details, make and type number, incorporating electrical characteristics, description of various parts, total creep age/protected creep age distance, weight of oil, total weight of bushing, dimensions (L2, LG, Le) short time rating etc.

iii) Transportation sketch showing dimensions and weights of the heaviest package & the shipping arrangements of the transformer.

iv) Rating and diagram plate.
Bare copper weight & weight of core should be invariably specified on the rating plate

v) Detailed structural drawings for the transformer tank, under carriage, conservator, radiators, supporting structures for cooling fans etc.

vi) Dimensional drawings of multi bolt bimetallic connectors for line ends and flexible connectors for the neutral ends.

vii) **COOLING EQIUPMENT DRAWING:**

a) General assembly of marshalling box and fan control cubical. The plan view showing foundation details must be specifically included if this cubicle box is separately mounted.

b) Schematic diagram of cooler control scheme along with detailed write up explaining the sequence of operations and functions of each equipment.

viii) Wiring diagram/cabling details of fan control cubicle showing connections with RTCC, WTI, MOG etc.

ix) **RTCC PANEL DRAWING:**

a) General Assembly of remote tap change control panel (RTCC) including plan view showing foundation details indicating all audio/visual indications.

b) Wiring diagram of RTCC panel.

c) Additional alarm and indication circuit in RTCC.

x) **OLTC DRAWING:**

a) Schematic diagram of OLTC scheme along with detailed write up explaining the sequence of operation and functions of each equipment, along with its location having master follow up operation.

b)All drawings of OLTC viz. O.D. drg., diagram of connections for drive mechanism, wiring diagram tap change control panel.

xi) Wiring diagram/cabling details showing inter connections between motor drive – RTCC and marshalling box/ fan control cubicle.

xii) **CORE DRAWING:**

a) Core dimensional drawing showing core frame size, limb and yoke sections along with step details and calculations for flux density and make of CRGO.

b) Calculations for no load current, no load losses and characteristics of the core material shall also be furnished.

c) Make of CRGO and Sub- Supplier name for cutting of CRGO shall be given in the drawing.

xiii) **WINDING DRAWING:**

a) HV, LV and Regulating winding conductor cross sections alongwith calculations for current density.

b) Make of copper used and insulating paper/ press board used shall be given in the drawing.

c) Name of the vendor for processing of copper shall be given.

xiv) Thermosyphon arrangement drawing, showing tray details, internal tray arrangement and removal of tray assembly etc. showing dimensions, qty. of oil and Sorbent used.

xv). Roller stopper arrangement drawing.

. xvi) **ADDITIONAL DRAWING**

The following drawings shall be supplied for reference and record in addition to the above drawings enlisted from (i) to (xv):

a) Schematic diagram showing flow of oil in the cooling system as well as each limb of the core and winding and cross sectional views showing duct sizes, cooling pipes etc. for the transformer/heat exchanger drawn to scale shall be furnished.

b) Large scale drawing of high and low voltage windings of transformer showing the nature and arrangement of insulation and terminal end connections.

c) Drawing showing sectional view of the HV & LV windings when viewed from top.

d) Detailed drawings of conservator & pressure relief device (explosion vent) mounted on position.

e) Valve & plug schedule plate indicating the location of various valves on the transformer mentioning the functioning of each.

f) A schedule showing the requirement of set of spare gaskets

g) Fan mounting details.

h) Foundation Plan of the transformer including auxiliary equipment.

i) Any other drawing considered necessary by the Purchaser.

Note:- (i) Four sets of Instruction manuals per transformer & four sets of final test results/test certificates of each transformer shall be dispatched alongwith the transformer to the consignee failing which transformer shall be considered supplied as incomplete. Two sets of Instruction manual per transformers shall be supplied to the Director/P&D(TS), SLDC Complex, Industrial Area-I, Chandigarh.

(ii).(a) Any manufacturing done prior to approval of drawings, certification of raw material shall be at firm's risk , purchaser reserve the right to make any changes in design/ raw material etc. which shall be necessary to make the equipment conform to the stated provisions of the specification without any additional cost to purchaser . approval of drawings by the purchaser will not relieve the firm of any part of the contract obligation to meet all the requirement of the specification or responsibility for the correctness of the firm's design.

(b). The supplier shall also be required to supply one set of drawings listed above on superior quality tracing paper/cloth suitable for reproduction.

23. TRANSPORTATION:

a). 66/11KV, 6.3/8MVA Power Transformer for Bhakra Left Bank Power House Bhakra:

The transformer may be transported by rail , road or by rail cum road. However transportation by road shall be preferred. In case of road transport, the trailer plus transformer transport height should not exceed 4500mm which is the clear height available below an over bridge at Olinda on Nangal-Bhakra Left Bank Power House road. Transportation of the transformer up to destination i.e. Service bay of Bhakra Left Bank Power House shall be supplier's responsibility. In case of Rail transport taking delivery from nearest Railway Station i.e. Nangal Dam (Punjab) and further transportation from Nangal Dam Railway Station to Service Bay of Bhakra Left Bank Power House through Olinda Bridge shall be the responsibility of the Supplier.

b) 132/11KV,4MVA Power Transformer for BBMB Power House Slapper :

The transformer may be transported by rail, road or by rail cum road. For transportation by rail the nearest railway station is Kiratpur Sahib(Punjab). If the transformer is transported by rail, further transportation from railway station to the Dehar switch yard of BBMB, Power House Slapper shall be the responsibility of the supplier. Slapper Power House is situated on NH-21, about 85Km from Kiratpur Sahib.

c) 66/11KV, 12.5/16MVA Power Transformer for 220KV S/Stn, Jagadhari (Haryana):

The transformer may be transported by rail or road. The nearest railway station is Jagadhri(Haryana). If the transformer is transported by rail, further transportation from railway station to the service bay of 220KV s/stn. Jagadhri shall be the responsibility of the supplier.

24. INSPECTION AND TESTING

The successful tenderer shall submit complete set of drawings as already brought out in this specification within 60 days from the receipt of purchase order. Along with the drawings the suppliers will furnish the following intimation:-

a) Schedule of manufacturing of the transformer.

b) Name of the Vendor from whom cutting of CRGO & Processing of copper shall be made, in case the facilities do not exist at the supplier works.

c) Name of the Sub-Supplier for manufacturing of tank.

d) The quality assurance programme of the vendors/sub-suppliers.

e) Make of the CRGO, Copper, Insulating Paper, Press Board, Tank Steel etc.

Purchaser can inspect the raw material, manufacturing process at sub-supplier works for which advance intimation of manufacturing activities shall be given.

A. STAGE INSPECTION

Stage inspection of built up core (in horizontal/vertical position), windings, tank and radiators shall be carried out as detailed below:-

a) CORE:

i) Measurement of Flux Density.
ii) No Load Loss Measurement by providing dummy coils.
iii) Tests on CRGO sample taken from the core shall be carried out for Carlite test(Resistance-Measurement), Watt. Loss Test, Lamination Thickness & Ageing Tests.
iv) Physical Inspection for quality of workmanship.
v) Physical measurement of cross section of core & silicon steel weight.

b) WINDINGS:

i) Measurement of Cross – sectional area for current density.
ii) The measurement of weight of bare copper/covered copper by Resistance Method, ID/OD method, Per unit length methods.

c) TANK:

i) Vacuum Test as per CBIP manual.
ii) Pressure Test as per CBIP manual.
iii) DP Test.
iv) Peel-off Test.

Note:- For permissible deflection as per CBIP for pressure and vacuum test, Horizontal Width shall be taken between nearest stiffeners.

b) **RADIATORS:**

Radiator shall be routine/type tested at sub-supplier works as per relevant standards.

B. ROUTINE TESTING

All Routine tests shall be carried out on transformer as per IS: 2026/IEC-76 & IEC-354 with latest amendments.

C. TYPE TESTING

Following type tests and overload with stand capacity as per IEC-354 shall be carried out as per IEC-76/IEC-354 & IS:2026 – on unit of each transformer.

i) Temp. Rise Test **with 2x50% coolers only**
ii) Impulse Voltage Withstand Test with chopped impulse on any one phase (HV & LVwinding)**.**

D. **SPECIAL TESTS : Following Special test shall be carried out on each transformer**:

i) DGA Test before and after temp. rise test.

ii) Measurement of Tan Delta & Capacitance of Transformer windings and bushings at 5KV & 10KV.

iii) Magnetic balance test.

iv) Magnetizing current at low voltage, excitation loss at 90% & 110% of rated voltage measured by average voltmeter method . The excitation losses shall also be measured after impulse tests are completed .

v) Measurement of percentage impedance at all taps at low voltage.

vi) Oil leakage test as per CBIP.

vii) Measurement of harmonics.

viii) Noise level test

NOTE:-

a) The insulation resistance values of the transformer windings will be recorded at the time of carrying out routine tests, for 20 seconds, one minutes, two minutes **& 10 minutes** with the help of 5000V motorized meggar. (Meggar Make). **The polarization index values (ratio of 120sec/20 sec., & ratio of 10 minute / 1 minute values) will be accordingly calculated and recorded in the test certificates and it should not be less than 1.5 & 2.0 respectively.**

b) Dissolved gas analysis test of oil shall be got carried out before and after heat run test at CPRI Bangalore/works of supplier.

c) Capacitance and Tan delta values for each transformer and condenser bushings will be taken and recorded in the test certificates at 5KV & 10KV. Insulation Resistance value of condenser bushings shall also be recorded.

d) Pressure/Vacuum test on empty tank and oil leakage test as per CBIP however, vacuum test shall be carried out at full vacuum.

e) Lightning impulse test with the chopped wave applications as per clause 13 of IS:2026/1981 (Part-III) amended upto date with chopped impulse on one limb of HV & LV windings.

f) The tenderer should clearly indicate the testing facilities available with them and tests which are to be arranged outside.

Supplier shall submit in house test certificates at least 15 days in advance for final testing of transformer. For testing of transformer, all Measuring Instruments shall be of highest efficiency and best quality. These shall be got calibrated from NPL/Govt. Agency and be got sealed by calibrating agency in the temper proof fashion. BBMB reserves the right to calibrate the instruments in the manner it desires.

Losses shall be measured with 3 – Wattmeter method only. Resistance shall be taken with Double – Kelvin Bridge. Losses can be measured Directly from CT's and PT's and not through the panel. Ratios of the measuring instruments shall be such that the multiplying factor is the minimum.

All tests shall be carried out in the presence of the Purchaser before dispatching the material. Test certificates in quadruplicate will be submitted to the

Purchaser for approval. No material shall be dispatched without prior inspection and approval of test certificates unless otherwise agreed to. Type and routine test certificates of all bought out items from recognized testing agency shall be submitted for approval before commencing supplies. OLTC scheme including the master follower functioning shall also be checked. **Only fully assembled transformer including mounting of radiators shall be put up for final inspection.**

25. TESTING OF TRANSFORMER OIL

The transformers are to be supplied oil filled or gas filled. Sufficient quantity (along with 10% extra of insulating oil of Nepthenic base confirming to BS: 148/IEC: 296 Class-I/IS-335(1993) shall be put up for inspection at least three weeks before offering the transformer for inspection for carrying out necessary tests as per procedure prescribed in the relevant IS:335/BS/IEC. The testing shall be carried out in the presence of purchaser representative at the works of oil supplier. The oil will also be got tested from CPRI Bangalore for all the tests. The inspected oil shall be filled in transformer under the direct supervision of inspecting officer if the transformer is supplied oil filled other wise the oil shall be dispatched directly from sub-supplier works in non-returnable sealed drums, epoxy quoted from inside. Composite sample of oil shall be further tested for IFT, tan delta, resistivity, water contents and BDV on receipt of oil at site. The charges for all the above-mentioned tests shall be borne by the supplier and shall be included in the prices of the transformer/oil. If all the oil is dispatched separately in sealed drums then filling of oil in the transformer at site will be done in the presence of suppliers representative if the supplier so desires.

26. FOUNDATION & FIXINGS

All plant and equipment shall be provided with a complete set of foundation bolts, washers, nuts, plates and other fixtures as may be required and these shall be supplied by the supplier. These fittings shall be fixed by the purchaser in the foundations, unless otherwise specified. All foundations bolts, fixtures etc. shall be supplied as soon as possible after the contract drawings have been approved.

27. PACKING, DESPATCH AND DELIVERY

The Supplier shall be responsible for suitable packing of all equipment and marking of the consignments so as to avoid any damage during transit, storage and to ensure correct despatch to the destination. **The LV bushings if mounted on the transformer during transportation should be suitably protected with Steel Plate Cover.** Damages to the equipment due to improper packing shall be to Supplier's account. All parts requiring protection from moisture shall be especially packed to prevent ingress of moisture. No parts of any kind shall be packed inside other larger parts. Heavy parts shall be so mounted that there is no difficulty in attaching slings etc. for unloading at destination.

All parts shall be adequately marked to facilitate field erection. Boxes and crates shall be marked with contract number and shall have a packing list enclosed, showing the parts contained therein.

The weight and dimensions of the heaviest package of transformer shall be so arranged by tenderer that the transformer can be transported upto site in Indian Railways or by Road. It will be the entire responsibility of the supplier to obtain clearance from Indian Railways on all matters connected with despatch of transformer and its accessories and their receipt if the transformer is despatched by rail.

If the transformer is supplied oil filled then the escort should be provided to avoid theft/pilferage of oil/any other item. It is the responsibility of the supplier that transformer along with all the accessories are received safe up to the site of destination.

In case the transformer is dispatched gas filled and oil for the first filling is dispatched separately sufficient quantity of gas in NON RETURNABLE cylinders shall be supplied to maintain the pressure of the gas in the tank at site before , it is filled with oil. The supplier will depute his representative along with the trailers for maintaining the Nitrogen Pressure in case of Nitrogen filled Transformer.

ANNEXURE-D

FITTING AND ACCESSORIES :

A: FOR 132/11KV, 4MVA POWER TRANSFORMER:

Each transformer shall be complete with following fitting and accessories:-

i) One 150mm (6") dial type indicating thermometer (OTI) of robust pattern mounted on the side of the transformer at a convenient height to read the temperature in the hottest part of oil and fitted with alarm and trip contacts.

ii) 2 Nos. 150mm dial type winding hot spot temperature indicators (WTI) placed in HV/LV winding, as described below:-

"It shall be indicating type responsive to the combination of top oil temperature and winding current calibrated to follow the hottest spot temperature of transformer winding. The device shall have and additional pointer to register the highest temperature reached. Each winding temperature indicator should have four sets of contacts. Two contacts of the WTI shall be used for trip and alarm purpose, wiring of which will go to the main control and relay panel of the transformer (external control cables from the marshalling box to the C&R panel to be provided by the purchaser. The 3rd set & fourth set of contacts shall be spare.

The contacts of each WTI should be adjustable to close between 60 deg. C to 120 deg. C and shall reopen when the temperature has fallen by any desired amount between 10 deg. C to 25 deg. C. However, supplier should mention in their manuals the actual adjustable setting of these contacts".

iii). One pressure relief valve/device (PRV) of minimum 150m (6 inch) size for main tank with provision of trip contacts.

iv) One explosion vent on transformer tank cover should be provided on opposite side of PRV.

v) Inspection covers with jacking bolts in the top cover plate of the tank.

vi) One filter cum oil drain valve with plug or blanking flange: size 80mm.

vii) One filter valve of size 50mm at top of transformer tank.

viii) Three oil sampling valves for taking samples of top, middle and bottom oil.

ix) Set of lifting lugs/jacking lugs and eye bolts on all parts for ease of handling.

x) One double float gas/oil surge detecting (Buchholz) relay in the pipe connecting the conservator with tank, complete with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressure, complete with two shot off valves on conservator side as well as tank side and coupling to permit easy removal without lowering flanges/oil level in the main tank. The size of shut off valve shall be 80mm.

xi) Two grounding terminals on diagonally opposite bottom corners of tank. However, if provided on the length side of tank then these grounding terminals shall be out side the rail gauge.

xii) One ONAN cooling equipment comprising of two no. radiators banks of 60% cooling capacity each, shot off valves, air release, drain plug. 2 Nos.

metal-encased alcohol thermometer for each cooler for fixing on incoming &outgoing headers of the coolers.

xiii) Skids and pulling eyes on both sides.

xiv)One marshalling box housing dial type thermometers for winding and oil temperature indicators, heater, complete wiring and supply isolating switches with H.R.C. fuses.

xv)Two thermometer pockets for mercury in glass thermometer of minimum 10" depth from top level.

xvi)A set of universal type bi-metallic multi-bolt double grooved conductor clamps for HV each capable of receiving single ACSR conductor (Zebra) .Change, if any , will be intimated to successful bidder.

xvii) Suitable bi-metallic flexible connectors for neutral terminals.

xviii) 1 set of terminal bushings each for HV & LV winding.

xix) 1 set of Neutral bushing (s).

xx) a) .1 No. Filling valve.
b) Oil valve between cooler & main tank.
c) Two Nos. header valves on diagonally opposite corners (50mm) of each cooler.

xxi) Suitable size bi-directional wheels for 1676mm rail gauge in both directions- 4 Nos. along with locking & bolting devices.

xxii) The following plates in English shall be fixed to the transformer tank at about 1750mm above ground level: -

a) Rating plate bearing data as specified in IS: 2026/1977, it must contain insulation levels of various windings, impedance at normal & extreme taps short circuit duration, WTI ratio besides other information.
b) Terminal marking plate showing the internal connections & voltage vector relationship of various windings in accordance with IS: 2026/1977 (Latest Edition).
c) Diagram plate showing the location and function of all valves and air release cocks or plugs.

xxii) One off circuit tap changer with rotary handle and provision of padlocking in any direction.

xxiv)Oil conservator (for main tank, Air cell type) complete with magnetic type oil level gauge, prismatic oil level gauge, filling hole and cap drain valve size 19mm, shut off valve, inter connecting pipes etc. Magnetic type oil level gauge shall be provided with low oil level alarm contacts and a dial showing minimum, maximum and normal oil level. The gauge shall be readable from the transformer base level. Silica gel breather with oil seal shall be fitted as already prescribed. Breather should be made of see through material and should consist of two compartments placed in parallel with 2X100% capacity. One drainpipe up to floor level with one valve may be provided.

xxv) One No. Thermosyphon filter arrangement with suitable capacity oil pump fitted with motor for forced circulation of oil & spare Alumina for one time replacement.

xxvi) One No. Spare pocket on tank cover for thermometer

xxvii). One Off circuit tap changer with rotary handle and provision of padlocking in any direction.

xxviii) Any other item, which is not included above but is essential for the satisfactory operation of the equipment.

B: FOR 66/11KV, 6.3/8MVA POWER TRANSFORMER :

Each transformer shall be complete with following fitting and accessories:-

i).One 150mm (6") dial type indicating thermometer (OTI) of robust pattern mounted on the side of the transformer at a convenient height to read the temperature in the hottest part of oil and fitted with alarm and trip contacts..

ii). 2 Nos. 150mm dial type winding hot spot temperature indicators (WTI) placed in HV/LV winding, as described below:-

"It shall be indicating type responsive to the combination of top oil temperature and winding current calibrated to follow the hottest spot temperature of transformer winding. The device shall have and additional pointer to register the highest temperature reached. Each winding temperature indicator should have four sets of contacts. Two contacts of the one of the WTI shall be used for trip and alarm purpose, wiring of which will go to the main control and relay panel of the transformer (external control cables from the marshalling box to the C&R panel to be provided by the purchaser. The 3rd set of contacts of WTI acts as a winding temp. Control for ONAF cooling for automatic control of fans depending on the temp. The fourth set of contacts shall be spare.

The contacts of each WTI should be adjustable to close between 60 deg. C to 120 deg. C and shall reopen when the temperature has fallen by any desired amount between 10 deg. C to 25 deg. C. However, supplier should mention in their manuals the actual adjustable setting of these contacts".

Cooler control contacts of all the WTIs shall be wired in parallel.

iii). One pressure relief valve/device (PRV) of minimum 150m (6 inch) size for main tank with trip contacts.

iv). One explosion vent on transformer tank cover should be provided on opposite side of PRV.

v). Inspection covers with jacking bolts in the top cover plate of the tank.

vi). One filter cum oil drain valve with plug or blanking flange: size 80mm.

vii). One filter valve of size 50mm at top of transformer tank.

viii). Three oil sampling valves for taking samples of top middle and bottom oil.

ix). Set of lifting lugs/jacking lugs and eye bolts on all parts for ease of handling.

x). One double float gas/oil surge detecting (Buchholz) relay in the pipe connecting the conservator with tank, complete with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressure, complete with two shut off valves on conservator side as well as tank side and coupling to permit easy removal without lowering flanges/oil level in the main tank. The size of shut off valve shall be 80mm.

xi). Two grounding terminals on diagonally opposite bottom corners of tank. However, if provided on the length side of tank then these grounding terminals shall be out side the rail gauge.

xii).One ONAN/ONAF cooling equipment comprising suitable2x60%tank radiators with shut off valves, air release, drain plug and fans. The fans shall be arranged in two groups. 2 Nos. metal-encased alcohol thermometer for each cooler for fixing on incoming &outgoing headers of the coolers.

xiii). Skids and pulling eyes on both sides.

xiv).One Marshalling box housing dial type thermometers for winding and oil temperature indicators, heater, complete wiring and local/auto selector switch, and supply isolating switches with H.R.C. fuses. The MB shall have automatic control equipment for controlling fan motors. MCBs & Ammeter for indicating current auxiliary equipment.

xv). Two thermometer pockets for mercury in glass thermometer of minimum 10" depth from top level.

xvi).A set of universal type bi-metallic multi-bolt double grooved conductor clamps for HV&LV bushing.

xvii).Suitable bi-metallic flexible connectors for neutral terminals.

xviii).1 set of terminal bushings each for HV & LV winding.

xix). 1 set of Neutral bushing (s).

xx). a) 1 No. Filling valve.
b) 2 Nos. valves between cooler & main tank.
c) Two Nos. header valves on diagonally opposite corners (50mm) of each cooler.

xxi). Suitable size bi-directional wheels for 1676mm rail gauge in both directions- 4 Nos. along with locking & bolting devices.

xxii). One Off circuit tap changer with rotary handle and provision of padlocking in any direction.

xxiii). The following plates in English shall be fixed to the transformer tank at about 1750mm above ground level: -

a) Rating plate bearing data as specified in IS: 2026/1977, it must contain insulation levels of various windings, impedance at normal & extreme taps short circuit duration, WTI ratio besides other information.
b) Terminal marking plate showing the internal connections & voltage vector relationship of various windings in accordance with IS: 2026/1977 (Latest Edition).
c) Diagram plate showing the location and function of all valves and air release cocks or plugs.

xxiv).A plate showing the rated no load voltage at various taps shall be affixed on the control panel in order to facilitate the operator in deciding the tap position on which the transformer is to be operated corresponding to the incoming voltage.

xxv). Oil conservator (for main tank) complete with magnetic type oil level gauge, prismatic oil level gauge, filling hole and cap drain valve size 19mm, shut off valve, inter connecting pipes etc. Magnetic type oil level gauge shall

be provided with low oil level alarm contacts and a dial showing minimum, maximum and normal oil level. The gauge shall be readable from the transformer base level. Silicagel breather with oil seal shall be fitted as already prescribed. Breather should be made of see through material and should consist of two compartments placed in parallel with 2X100% capacity. One drainpipe up to floor level with one valve may be provided.

xxvi). One No. Thermosyphon filter arrangement with spare Alumina for one time replacement.

xxvii). One No. Spare pocket on tank cover for thermometer

xxviii). 1No. Neutral CT for LV winding.

xxix). Any other item, which is not included above but is essential for the satisfactory operation of the equipment.

C). FOR 66/11KV, 12.5/16MVA POWER TRANSFORMER:

Each transformer shall be complete with following fitting and accessories:-

i). One 150mm (6") dial type indicating thermometer (OTI) of robust pattern mounted on the side of the transformer at a convenient height to read the temperature in the hottest part of oil and fitted with alarm and trip contacts. Provision in the OTI for connected to repeated in RTCC shall also be provided.

ii). 2 Nos. 150mm dial type winding hot spot temperature indicators (WTI) placed in HV/LV winding, as described below:-

"It shall be indicating type responsive to the combination of top oil temperature and winding current calibrated to follow the hottest spot temperature of transformer winding. The device shall have and additional pointer to register the highest temperature reached. Each winding temperature indicator should have four sets of contacts. Two contacts of the one of the WTI shall be used for trip and alarm purpose, wiring of which will go to the main control and relay panel of the transformer (external control cables from the marshalling box to the C&R panel to be provided by the purchaser. The 3rd set of contacts of WTI acts as a winding temp. Control for ONAF cooling for automatic control of fans depending on the temp. The fourth set of contacts shall be spare.

The contacts of each WTI should be adjustable to close between 60 deg. C to 120 deg. C and shall reopen when the temperature has fallen by any desired amount between 10 deg. C to 25 deg. C. However, supplier should mention in their manuals the actual adjustable setting of these contacts"

Repeaters for both WTIs shall also be provided in the RTCC panel. Repeaters for all WTIs shall also be provided in the RTCC panel

iii) One conservator along with two No. Shut off valves, oil surge relay, breather connecting pipe etc. exclusively for OLTC.

iv). One pressure relief valve/device (PRV) of minimum 150m (6 inch) size for main tank and one No. PRV for OLTC of size 75mm (3 inch) (approx.) with provision of trip contacts.

v). One explosion vent on transformer tank cover should be provided on opposite side of PRV.

vi). Inspection covers with jacking bolts in the top cover plate of the tank.

vii). One filter cum oil drain valve with plug or blanking flange: size 80mm.

viii). One filter valve of size 50mm at top of transformer tank.

ix). Three oil sampling valves for taking samples of top , middle and bottom oil.

x). Set of lifting lugs/jacking lugs and eye bolts on all parts for ease of handling.

xi). One double float gas/oil surge detecting (Buchhlolz) relay in the pipe connecting the conservator with tank, complete with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressure, complete with two shot off valves on conservator side as well as tank side and coupling to permit easy removal without lowering flanges/oil level in the main tank. The size of shut off valve shall be 80mm.

xii). Two grounding terminals on diagonally opposite bottom corners of tank. However, if provided on the length side of tank then these grounding terminals shall be out side the rail gauge.

xiii). One ONAN/ONAF cooling equipment comprising suitable2x60%tank radiators with shut off valves, air release, drain plug and fans. The fans shall be arranged in two groups. 2 Nos. metal-encased alcohol thermometer for each cooler for fixing on incoming &outgoing headers of the coolers

xiv). Skids and pulling eyes on both sides.

xv). One marshalling box housing dial type thermometers for winding and oil temperature indicators, heater, complete wiring and local/auto selector switch, and supply isolating switches with H.R.C. fuses. The MB shall have automatic control equipment for controlling fan motors. MCBs & Ammeter for indicating current auxiliary equipment.

xvi). Two thermometer pockets for mercury in glass thermometer of minimum 10” depth from top level.

xvii). A set of universal type bi-metallic multi-bolt double grooved conductor clamps for HV&LV bushing.

xviii). Suitable bi-metallic flexible connectors for neutral terminals.

xix). 1 set of terminal bushings each for HV & LV winding.

xx). 1 set of Neutral bushing (s).

xxi). a) .1 No. Filling valve.
b). Oil valve between cooler & main tank.
c). Two Nos. header valves on diagonally opposite corners (500mm) of each cooler.

xxii). Suitable size bi-directional wheels for 1676mm rail gauge in both directions- 4 Nos. along with locking & bolting devices.

xxiii). One OLTC along with remote control panel with each transformer complete with wiring, oil surge relay, both with trip & alarm contacts.

a. OLTC conservator pipe and valves diameter should be 25mm.
b. The height of RTCC panel should be 2312mm & shade of paint should be of No.631 of IS: 5

xxiv). The following plates in English shall be fixed to the transformer tank at about 1750mm above ground level: -

a. Rating plate bearing data as specified in IS: 2026/1977, it must contain insulation levels of various windings, impedance at normal & extreme taps short circuit duration, control voltage of OLTC, WTI ratio besides other information.
b. Terminal marking plate showing the internal connections & voltage vector relationship of various windings in accordance with IS: 2026/1977 (Latest Edition).
c. Diagram plate showing the location and function of all valves and air release cocks or plugs.

xxv). A plate showing the rated no load voltage at various taps shall be affixed on the remote control panel in order to facilitate the operator in deciding the tap position on which the transformer is to be operated corresponding to the incoming voltage.

xxvi). Oil conservator (for main tank, Air cell type) complete with magnetic type oil level gauge, prismatic oil level gauge, filling hole and cap drain valve size 19mm, shut off valve, inter connecting pipes etc. Magnetic type oil level gauge shall be provided with low oil level alarm contacts and a dial showing minimum, maximum and normal oil level. The gauge shall be readable from the transformer base level. Silicagel breather with oil seal shall be fitted as already prescribed. Breather should be made of see through material and should consist of two compartments placed in parallel with 2X100% capacity. One drainpipe up to floor level with one valve may be provided.

xxvii). One No. Thermosyphon filter arrangement with suitable capacity oil pump fitted with motor for forced circulation of oil & spare Alumina for one time replacement.

xxviii). One No. Spare pocket on tank cover for thermometer

xxix). Any other item, which is not included above but is essential for the satisfactory operation of the equipment.

PO NO. 1659 /P&D(TS)SS-I/PNGS-656/A/EMCO DATED: 05.02.2010

ANNEXURE-E

DEAPATCH INSTRUCTIONS FOR THE EQUIPMENT

Sr. No.	Description	Quantity	Destination on which equipment should be dispatched.	Name of Consignee.	Name of the concerned Sr. Xen/Addl. SE/ Resident Engineer	Name of the concerned Accounts Officer.	Name of the Bank.	Nearest Railway Station
1	**2**	**3**	**5**	**6**	**7**	**8**	**9**	**10**
1	132/11KV,4MVA Power transformer complete with all accessories & spares as per specification NoBBMB/SS-I/356	1No.	BBMB Dehar Power House Slapper TIN NO. PTLR 11360G	SDO/S&T, BBMB, Slapper (HP)	RE, BBMB, Slapper (HP)	Sr. AO BBMB, Slapper (HP) Telephone No. 01907-262231	SBI Slapper (HP)	Kiratpur Sahib (Punjab)
2.	66/11KV,6.3/8MVA Power transformer complete with all accessories & spares as per specification NoBBMB/SS-I/356	1No.	BBMB Left Bank Power House Bhakra TIN NO. 03451049200	SDO/Store, BBMB, BBMB, Nangal	Sr. Xen/STD&P, BBMB, Nangal	Sr. AO BBMB, Nangal Telephone No. 01887-223249	SBI Nangal	Nangal
3	66/11KV,12.5/16MVA Power transformer complete with all accessories & spares as per specification NoBBMB/SS-I/356	1No.	220KV Sub station BBMB, Jagadhari TIN NO. 064-52608183 PNP	SSE, 220KV Sub station BBMB, Jagadhari	Sr. Xen/ O&M Division ,BBMB, Dhulkote (Ambala)	Sr. AO BBMB, Dhulkote (Ambala) Telephone No. 0171-2541118	SBI ,Dhulkote (Ambala)	Ambala

APPENDIX-A

COMMERCIAL TERMS AND CONDITIONS

1. DELIVERY PERIOD

Supply of items as stipulated in this contract shall be completed by supplier within five months from the date of receipt of technically and commercially clear order and shall be completed @ one unit every two months thereafter. The commencement of delivery shall be started with 6.3/8MVA,66/11KV Power transformer and thereafter 4MVA,132/11KV Power transformer & 12.5/16MVA, 66/11KV Power transformer The technical clearance of the P.O. will be deemed from receipt of approved drawings by the supplier, allowing seven days for postal transit. The supplier will, however, ensure that the complete drawings are received by the purchaser within 60 days of receipt of purchase order. The delay in submission of drawings by the supplier shall also invite levy of penalty @ specified in Para 4 below.

In case the supplier is unable to complete whole or any item of supply within stipulated period, for recognized reasons of 'Force Majeure' mentioned in clause 3 below, he shall be responsible to furnish well in time sufficient documentary evidence to the satisfaction of the purchaser to prove the existence of conditions mentioned in the Clause 3, so as to justify grant of extension by the purchaser of the 'Delivery Period' mentioned above. Such extension will be granted by purchaser for the period for which the completion of supply is proved, by the supplier, to have been delayed for the said reasons due to 'Force Majeure'. In case of delay in delivery, the dispatches shall be made only after obtaining written consent of the purchaser.

2. FORCE MAJEURE

The supplier shall not be liable for any penalty charges due to delay in manufacture or delivery of material resulting from any causes beyond the supplier's reasonable control including but not limited to compliance with regulations, orders or instructions of Central/State or Municipal Govt. or Agency, thereto, acts of God, Acts of Civil & Military authorities, fires, floods, strikes, lockouts, freight embargoes, war risks, riots and civil commotion's. The supplier will seek extension of delivery period within three weeks of occurrence of such an event and clearly state anticipated delay in supply on account of such an event/events. On receipt of such request from the supplier, extension in delivery period may be granted for the period for which the completion of work is proved by the supplier to have been delayed for circumstances covered by reasons of 'Force Majeure' subject to further conditions that if the delivery period is likely to be extended by more than 60 days on account of any event, the purchaser shall have the option to accept any portion of the balance material and cancel the order for the rest provided, however, that if material had been manufactured exclusively for the purchaser under contract prior to the commencement of FORCE MAJEURE circumstances, it shall be accepted by the purchaser and

the cancellation will be without any liability for damages on the part of the supplier and without any payment of compensation by the Board.

3. EXTENSION IN DELIVERY PERIOD

Any genuine delay in approval of technical detailed drawings, issuance of amendment of purchase order, conducting inspection and approval of inspection test/tests certificates for allowing despatches etc. will count towards extension of delivery period by corresponding period other than admissible under Force Majeure conditions, if any, substantiated by the supplier and duly accepted by the Purchasing Authority.

Date of delivery shall be taken as 7th day after the date of readiness of material for inspection in case of purchase order upto Rs.5 lac and 14th day after the date of readiness of material for inspection in case of purchase order more than Rs.5 lac, provided the material offered has passed the inspection and proof of despatch of material within 7 days of the receipt of despatch authorization and road permit (wherever required) is given by the supplier. In case, however, the material fails during inspection at the works/site, as the case may be, either fully or partially or the material is not ready for inspection when the inspector visits the works for inspection, the re-inspection charges shall be recovered from the firm. The date of readiness of the material in this case will be reckoned with reference to the date from which the material/equipment is offered to be ready for the re-inspection provided the material passes the inspection that follows the offer. The road permit shall be supplied by the consignee expeditiously to ensure the timely despatch of material. In case the material is not dispatched within 7 days of the receipt of dispatch authorization and the road permit(wherever required), date of delivery shall be taken as date of receipt of material by the consignee at site/store.

4. PENALTY CHARGES

If the supplier fails to abide by the provisions of clause 'Delivery period', he shall be liable to pay penalty @ 1/2% per week or part thereof the ex-works delivery price excluding taxes & duties (but including freight & insurance charges where break-up of FOR Destination price is not available) of such portion of material as has not been delivered within the "Delivery period" subject to maximum of 10% of the contract value of the delayed/undelivered portion of the material .

5. TERMS OF PAYMENT

100% payment will be made within30 days after the receipt of material at site in good condition and according to the specification and physical verification and record entry by the consignee in the relevant G.R./M.B.

6. CENTRAL SALES TAX/STATE SALES TAX

The Central sales tax/Punjab/Haryana/Himachal sales tax will be paid extra at actuals at the rates prevailing at the time of delivery but limited to the rates prevailing within contractual delivery period.

The supplier shall furnish original vouchers and/or following certificates duly signed by the supplier:-

i) Certified that the transaction on which sales tax has been claimed/shall be included in the return submitted/to be submitted to the Sales Tax authorities for the assessment of the Sales Tax and the amount claimed from the purchaser has been/shall be paid to the sales Tax Authorities.

ii) Certified that the goods on which Sales tax has been charged have not been exempted under the Central Sales Tax Act, the rules made there under and the charges on account of Sales Tax on these goods are correct under the provisions of the relevant Act, or rules made there under.

iii) Certified that we shall indemnify the purchaser in case it is found at a later stage that wrong or incorrect payment has been recovered on account of the Sales Tax paid by us.

iv) Certified that we are registered as a dealer under the Central Sales Tax and our Registration No. is_____.

7. EXCISE DUTY,OCTROI AND OTHER DUTIES

a) **EXCISE DUTY**

The payment of statutory excise duty will be made extra subject to actual proof of payment having been made by you to the Excise Department but limited to the rates prevailing within the contractual delivery period. The supplier shall also furnish following certificates duly signed by him while claiming payment of excise duty:-

i) Certified that the sum of Rs._____(Rupees_____

_____) towards Excise duty has been paid to the

Central Excise Authorities towards despatch of (Name of material)

affected from_____ Station_____ to_____consigned

to_____ Under R.R.No._____Dated_____vide

Bill No._____ dated_____.

ii) Certified that the excise duty charged is at the prevailing rates & no part of the same is refundable. In case, any excise duty paid on this material is refunded to the supplier it will be passed on to the purchaser.

iii) Certified that the goods on which Excise duty has been charged have not been exempted under the Central Excise Duty and the Central Excise Duty charged on these goods is not more than what is payable under the provisions of the relevant Act or rules made there under.

iv) Certified that we shall indemnify the purchaser, in case it is found at a later stage that wrong or incorrect payment has been recovered on account of Excise duty paid to us.

(b) OCTROI & OTHER DUTIES/TAXES

Octroi and other duties/taxes, if livable on the finished goods at the station of despatch at the time of supply shall be paid at actuals subject to production of original payment documents and subject to the rates prevailing within the contractual delivery period, if the same have not been included in the quoted prices. To avoid any complications, with regard to Octroi at the destination station, the material shall be despatched in the name of consignee and not to self. However, OCTROI charges as applicable at the destination station shall be borne by the purchaser.

8. NEGLIGENCE

If the supplier neglects to execute the work with due diligence and expedition or refuses or neglects to comply with any reasonable orders given in writing by the purchaser in connection with purchase orders or contravene the provisions of the purchase order, the purchaser may give 21 day's Notice in writing to the supplier to make good the failure, neglect or contravention complained of and should the supplier fail to comply with the notice within a reasonable time from the date of service thereof, in case of failure, neglect or contravention capable of being made good within that time or otherwise within such time as may be reasonably necessary for making it good then and in such case the purchaser shall be at liberty to take the work wholly or partly out of the hands of the supplier and recontract at reasonable price with any other person or persons. In such an event, it shall be lawful for the purchaser to retain any such balance which may otherwise be due by him to the supplier on any account including the amount of Bank Guarantees and apply the same towards the execution of the whole or balance of the work so recontracted, as aforesaid. If, no such balance is due by the purchaser to the supplier or if due is not sufficient to cover the amount thus recoverable from the supplier, it shall be lawful for the purchaser to recover the whole or balance of the amount from the supplier by action of the law.

9. BANKRUPTCY

If the company shall commit any act of bankruptcy or being corporation commence to be wound up except for reconstruction purpose, or carry on its business under a receiver, the executors, successor or other representative in law of the estate of the supplier or any such receiver, liquidator, or any person in whom the contract may become vested shall forth-with give notice whereof in writing to the purchaser and shall for one month during which company shall take all reasonable steps to prevent a stoppage of the works, have the option of carrying out the contract subject to the supplier, providing such guarantee as may

be required by the purchaser but not exceeding the value of the work for the time being remaining unexecuted. In the event of stoppage of the work the period of the option under this clause shall be fourteen (14) days only. Provided that should the above option not be exercised, the contract may be determined by the purchaser by notice in writing to the supplier and the same power and provisions reserved to the purchaser in the last proceeding clause of taking the work out of the supplier's hands shall immediately become operative.

10. REPLACEMENT OF REJECTED MATERIAL

i) Material found damaged, substandard or defective or not conforming to the prescribed specification in any manner, at the consignee's end, shall not be accepted and intimation to this effect shall be given to the supplier and the purchasing office by the consignee. The Purchasing Authority shall promptly take up the matter with supplier/shall intimate the supplier to this effect and ask him to rectify or replace the defective substandard material forthwith and in any case within 60 days from the date of intimation or rejection of material, failing which the Board shall reserve right to get the defect/damages rectified at the supplier's cost or to dispose off such material and adjust the sale proceeds thereof, if any, against its claim on the supplier. All expenses involved in the replacement by way of handling, transportation, storage etc. shall be on supplier's account.

ii) In respect of the defective/substandard supplies the date on which such a supply is replaced shall be reckoned as the effective date of delivery there against and the delay shall be worked out accordingly with reference to the date on which the supply was due as per terms of contract, for the purpose of determining penalties/charges recoverable under clause-5 above.

iii) The provisions of sub clause (i) & (ii) above shall apply mutatis mutandis, to the material found substandard or defective during the period of warranty.

11 WARRANTY

The supplier shall be responsible to replace free of cost, with no transportation or Insurance cost to the purchaser up to the destination, the whole or any part of the material which in normal and proper use proves defective in quality or workmanship, subject to the condition that the defect is noticed within 12 months from the date, the material is commissioned/put to use by the end user, or 18 months from the date of despatch whichever period may expire earlier. The consignee or any other officer of the purchaser actually using the material will give prompt notice of each such defect to the supplier as well as the purchasing authority. The replacement shall be effected by the supplier within a reasonable time but not exceeding 60 days. The supplier shall also arrange to remove the defective supply within a reasonable period but not exceeding 60 days from the date of issue of the notice in respect thereof, failing which the purchasing authority shall reserve the right to dispose off the defective material in any manner considered fit by it at the sole risk of the supplier. Any sales proceeds of the defective material after meeting the expenses incurred on its custody, disposal, handling etc. shall, however, be credited to the supplier's account and set off against any outstanding dues of the purchaser against the supplier. These provisions shall also apply equally against the replaced material . In case the material is again found to be defective within a period of 12 months of its replacement it shall also have to be replaced similarly.

12 WARRANTY DEED

The supplier shall execute a warranty deed, on the standard proforma to be supplied by the purchaser, on a non-judicial stamp paper required for such deeds as per the relevant act of the state in which it will be executed and signed and shall be kept valid for a period of 12 months from the date the material is commissioned/put to the use by end user or 18 months from the date of despatch, whichever is earlier to cover the warranty period of the material to be supplied. The warranty deed shall be supplied immediately after placement of purchase order.

13 PERFORMANCE BANK GUARANTEE

The supplier shall furnish a performance Bank Guarantee (on a standard proforma to be supplied by the purchaser) to the tune of 10% value of the contract to cover the satisfactory working of the material during the period of warranty as per clause-12 above and it shall also be kept valid till such time any claim of the purchaser is pending against the supplier. The performance Bank Guarantee shall be furnished by the supplier one month before the commencement of delivery.

14 TEST AND INSPECTION

The supplier shall also intimate the purchaser about the readiness of material for inspection and same shall be inspected within 15 days from the receipt of notice. In case the representative of the purchaser finds on arrival at the supplier's premises that the material was not ready for inspection and that the notice given by the supplier was in fructuous, the expenditure incurred by the purchaser on arranging for such inspection shall be recovered from the supplier. No material shall be despatched without prior inspection and approval of test certificates by the purchaser unless otherwise directed. The inspected material shall be despatched within 7 days from the date of receipt of instructions allowing despatch of material. The Test certificates of each batch of supply shall be supplied in sextruplicates to the Director, Planning & Design Directorate (Transmission System), Bhakra Beas Management Board (Power Wing), 66KV Grid Substation, SLDC Complex, Industrial Area Phase-I, Chandigarh-160002 for approval. A Photostat copy of the inspection/test report and letter conveying approval of Test Certificates and clearance for despatch shall be attached by the supplier to the forwarding Railway Receipt or the receipted goods challan as the case may be. However, if the inspection is waived off by the purchaser, the supplier shall attach a copy of the Purchaser's letter waiving off inspection with the Railway Receipt or the receipted goods challan and the supplier shall be responsible for rectification of all defects noticed by the consignee after receipt of material.

15 PACKING

All apparatus and equipment shall be securely packed for safe delivery at destination and supplier shall be responsible for all losses or damages caused or occasioned due to improper or defective packing. Double boxing to give extra protection to the equipment against mechanical injury shall be used, if required.

All parts requiring protection from moisture including polished parts which rust rapidly, shall be double boxed with trapper or in such other approved manner. All parts such as coils parts, containing coils for electrical machines. Instruments, relays, motors etc. requiring utmost protection against moisture shall be packed in metal lined sealed boxes with trapper or sisal Kraft paper or any other approved material inserted between metal lined box and the outer layer of boxing.

All boxes shall be marked with signs indicating the up and down sides of the boxes and also unpacking instructions considered necessary by the supplier.

The contents of the boxes shall have place marks corresponding to the number in the packing list to enable easy identification. The prices include packing charges also and as such, no extra payment shall be made on this account.

16 TRANSPORTATION, INSURANCE & HANDLING OF MATERIAL

The supplier shall be responsible for transportation, insurance and handling of material upto the destination station as per despatch instructions. The material shall be dispatched by Rail/Road “Freight Pre-Paid”. The purchaser shall have the right to lodge claim/claims for shortage/damages etc. if any, during transit with the supplier within 30 days of the receipt of material. The settlement of such claim with the underwriters shall be the supplier’s responsibility. In such an event, the purchaser shall obtain an open Delivery and certification from the Railway/Carrier.

17 ARBITRATION

If at any time question, dispute or difference whatsoever, shall arise, between the purchaser and the supplier upon or in relation to or in connection with the contract either party may forthwith give to the other, notice in writing of the existence of such question, dispute or difference and the same shall be referred to award of (two) arbitrators one to be nominated by the purchaser and other to be nominated by the supplier or in the case of said arbitrators not agreeing then to the award of an umpire to be appointed by the arbitrators in writing before proceeding with the reference and the decision of the arbitrators or in the event of their not agreeing, of the umpire appointed by them, shall be final and binding on the parties and provision of “the Arbitration and Conciliation Act, 1996” of the rules there under and any statutory amendment/ modifications or re enactment thereof for the time being in-force shall be deemed to apply to and by incorporated in the contract.

Such a notice of the existence of any question, dispute or difference in connection with contract shall be served by either party within 180 days or the issue of receipt by the consignee for each consignment failing which all rights and claims under this contract shall be deemed to have been forfeited and absolutely barred.

The work under the contract shall reasonably possible continued during arbitration proceedings and no payment or payable by the purchaser shall be within on account of such proceedings.

18 CANCELLATION OF PURCHASE ORDER

The purchaser shall have the right to amend or cancel the order at any time before the receipt of intimation regarding manufacturing of material, if he is satisfied that the delay in execution of the order by the supplier is willful and detrimental to the interest of the Board. In case where after the commencement of manufacture, there is willful delay on the part of the supplier to the despatch/manufacture of the material, the purchaser may cancel the order for whole/unexecuted portion after giving a notice of 15 days to the supplier.

19 JURISDICTION OF COURT

In case of any dispute between the parties, the courts at Chandigarh only shall have the jurisdiction to settle/decide and adjudicate upon such matters.

20 SIGNING OF PURCHASE ORDER

The successful tenderer will be furnished with three copies of the purchase order. Two copies shall be retained by the supplier. The third copy of the purchase order will be returned by the supplier to the purchaser after signing each and every page of P.O. by his authorized representative in token of the unconditional acceptance of the purchase order. The supplier shall also furnish documentary evidence that the signatory is an authorized representative of the supplier.

APPENDIX-B

(WARRANTY DEED)

(To be executed on the appropriate value of Non-Judicial Stamp Papers)

This warranty deed made this day the_____ _____ between Messer's (supplier's name) through _____hereinafter referred to as "The supplier" which expression shall include its legal representatives, successors and assigns of the one part, and the Bhakra Beas Management Board, Chandigarh through Chief Engineer/System Operation , a statutory body constituted under Section 79 (1) read with Section-80 (6) of Punjab Re-organisation Act, 1966 hereinafter referred to as " the Board" which expression shall include its successors and assigns of the other part.

Where as the Board has placed on the supplier P.O. No._____

_____

_____

_____for the design, manufacture, testing, supply and delivery of the material as specifically and fully described in the said P.O. and whereas the above said P.O. has been accepted by the Supplier vide their letter No._____ _____thus constituting a legally enforceable contract between the parties above named.

NOW THEREFORE THIS DEED WITNESSTH AND THE SUPPLIER HEREBY WARRANTIES AS UNDER:-

That the supplier shall be responsible to replace free of cost, with no transportation or insurance cost to the Board upto the destination, as specified in the said P.O. or the Despatch instructions issued in pursuance of the said P.O. the whole or any part of the material which in normal and proper use proves defective in quality or workmanship subject to the condition that the defect is noticed within 12 months from the date of commissioning of equipment or 18 months from the date of despatch, whichever period may expire earlier. The consignees or any other representative of the Board actually using the material will give prompt written notice of each such defect to the supplier. The replacement shall be affected by the supplier within a reasonable time but

not in any case exceeding 60 (sixty) days. The supplier shall also arrange to remove the defective supply within a reasonable period but not exceeding 60 (sixty) days from the date of issue of the notice in respect thereof, failing which the Board shall reserve the right to dispose off the defective material in any manner considered fit by it at the sole risk and cost of the supplier. Any sale proceeds of the defective material after meeting the expenses incurred on its custody, disposal, handling etc. shall however, be credited to the supplier's account and set off against any outstanding dues of the Board against the supplier.

That the above provisions shall also equally apply to the replaced material. In case the material is again found to be defective within a period of 12 months of its replacement, it shall also have to be replaced similarly.

The supplier further declares that this deed has been executed by its lawfully constituted attorney legally competent to sign and execute and has been stamped as required under the relevant Act of the State in which it has been executed & signed and that the warranty herein before contained shall not be affected by any change in the constitution of the supplier.

In witness whereof the parties hereto have executed this deed on the date and year first above mentioned.

Witness:-

1. Signature:_____ For and on behalf of the supplier:

   Name & full address Signature:_____

2. Signature :_____ Name & Designation:-

   Name & full address.

Witness:-

1. Signature:_____ For and on behalf of the Board:-

   Name & full address:- Signature:_____

2. Signature:_____ Name & Designation:-

APPENDIX-C

PERFORMANCE BANK GUARANTEE

(TO BE EXECUTED ON THE APPROPRIATE VALUE OF NON-JUDICIAL STAMPED PAPERS)

This agreement is made this _____day of _____between M/S (Banker's Name)_____through a company registered under the Companies Act, 1956/Banking Statute/ a body corporate constituted under the Banking Companies (Acquisition and Transfer of undertaking) Act V or 1970 having its registered office at _____hereinafter called the "Guarantor" which expression shall unless repugnant to the context or meaning thereof include its successors and assigns of the first part, M/S _____through (designation of the person signing The Bank Guarantee _____(on behalf of the supplier) a company registered under companies Act, 1956, having its registered office at (Address of Registered office_____) hereinafter called the "Supplier" which expression shall unless repugnant to the context or meaning thereof include its successors and assigns of the second part and the Bhakra Beas Management Board, Chandigarh through Chief Engineer/System Operation , a statutory body constituted under Section 79 (1) read with Section-80 (6) of the Punjab Re-organisation Act, 1966 hereinafter called the 'Board' which expression shall unless repugnant to the context or meaning thereof include its successors and assigns of the third part.

Whereas the supplier had, interalia, agree to supply to the Board_____(hereinafter called the "said equipment) on the terms and conditions contained in the P.O.No._____

dt._____(hereinafter_____called the "said P.O..") Placed by the Board on the supplier and unconditionally accepted by the supplier.

And whereas under clause 13 of Appendix-A of the said P.O. the supplier is required to furnish a Bank Guarantee for a sum

Rs._____

(Rupees_____being the_____value of all the consignments of the said equipment on account of retention money, which but for this guarantee would be withheld by the Board till such time that the said equipment is received in good condition by the Board and in accordance with the specifications of the same and the said equipment has given satisfactory performance during its warranty period as per clause 11 of the appendix-'A' of the said P.O. and also till such time that any claim of the Board is pending against the supplier, to guarantee the payment of the

retention money on bill submitted against supply of the said equipment on order from time to time upto a maximum amount of the sum of Rs._____

(Rupees_____

_____

_____)

And whereas at the request on the supplier the Board has agreed not to retain 10% of the contract price of all the consignments and in lieu thereof to accept a Bank Guarantee equivalent to the 10% of the contract price of all the consignments from the guarantor for the aforesaid purposes & for the due performance of the said P.O. by the supplier on the terms & conditions hereinafter contained, this deed, witnesseth and it is hereby agreed by and between the parties hereto as follows:-

The Guarantor hereby guarantees to the Board the quality, workmanship and design of the said equipment in accordance with the prescribed specifications and the terms of the said P.O. and that the said equipment when received by the Board shall be in good condition and shall give satisfactory performance during its warranty period as per clause 11 of Appendix-'A' of the said P.O. and agrees to indemnify and keep indemnified the Board to the extent of Rs._____in the aggregate against all losses, damages, cost, charges and expenses which may be suffered or incurred by the Board on account of non-receipt of the said equipment in good condition or on account of any defect in the said equipment or on account of any breach or breaches on the part of the supplier of any of the terms and conditions of the said P.O. in the supply of and during the warranty period of the said equipment. The guarantor further agrees that the Board shall be the sole judge whether or not the supplies have been made according to the prescribed specifications, design and workmanship and laid down in the said P.O. and whether or not the said equipment has been received in good condition by the board and whether or not the said equipment has given satisfactory performance during its warranty period and whether or not the supplier has committed breach or breaches of any of the terms and conditions of the said P.O. and the extent of loss, damages, cost, charges or expenses suffered or incurred by the Board on account thereof. The guarantor hereby guarantees and undertakes to release & pay immediately the amount of Rs._____to the Board on receipt of written instructions from the Board and the supplier shall not have any right or cause to interfere.

All rights to get the Bank Guarantee encashed shall rest with the Board solely at its discretion without assigning any reason whatsoever.

The guarantor further agrees that this guarantee shall remain in full force and effect for 24 months from the date of its issue in the first instance. This guarantee shall be revalidated subsequently for a further period, if required, under clause 13 of appendix-'A' of the said P.O. so as to cover the warranty period as per Clause-11 of the Appendix-A of the said P.O. and also till such time any claim of the Board is pending against the supplier.

The guarantor also agrees and undertakes not to revoke this guarantee before the same is discharged as aforesaid except with the previous consent of the Board in writing.

The Guarantor hereby further agrees that the Board shall have the fullest liberty without affecting in any manner obligation of the guarantor hereunder with or without the consent of the guarantor to vary any of the terms of the said P.O. or to extend time of performance of the said P.O. by the supplier from time to time or to postpone for any time or from time to time any of the powers exercise-able by the Board against the supplier and either to forebear or enforce any of the terms or conditions relating to the said P.O. and the Guarantor shall not be relieved from his liability by reason of any variations or any extension being granted to the supplier or for any forbearance, act or commission on the part of the Board, or any indulgence by the Board to the supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving the guarantor, nor would it be necessary for the Board to sue the supplier before suing the said guarantor for the amount/damages due under this deed of guarantee.

The guarantor hereby further affirms and declares that this guarantee has been executed by their lawfully constituted attorney legally competent to sign and Execute and has been stamped as required for such guarantees under the relevant Act of the State in which it has been executed and signed and the guarantee herein before contained shall not be affected by any change in the Constitution of the Guarantor (Bank) or the Constitution of the supplier.

The Guarantor hereby further agrees that any claim or dispute arising under this deed shall fall within the exclusive jurisdiction of courts at Chandigarh.

Notwithstanding, anything herein before contained the Guarantor's liability under this guarantee is restricted to Rs._____

(Rupees_____). The guarantee shall remain valid upto_____.Unless claim in writing is presented to the guarantor within six months from that date and if unpaid, a suit or action to enforce such claim under this guarantee is filed against the guarantor within said period of six months, all the rights of the Board under the said guarantee shall be forefeited and the guarantor shall be released and discharged from all liability thereunder.

In witness whereof the parties hereto have put their perspective hands on the day and the year first above mentioned.

Witness:	For & on behalf of the Guarantor:
1.	Signatures:_____
2.	Name & Designation_____
	_____
Witness:	For and on behalf of the Supplier.
1.	Signatures:_____
2.	Name & Designation_____
	_____
Witness:	For and on behalf of the Board.
1.	Signatures:_____
2.	Name & Designation_____

APPENDIX-'D'

BANK GUARANTEE PROFORMA FOR SECURITY DEPOSIT

(To be executed on the Appropriate value of non-judicial stamped papers)

This deed of guarantee is made this_____ day of _____between M/s_____(Banker's Name) through (designation of the person signing the Bank Guarantee, on behalf of the Guarantor), a company registered under the Companies Act, 1956 (Banking Statue/body corporate constituted under the Banking Companies(Acquisition and Transfer of Undertakings) Act 1970 having its registered office at_____ Address of Registered office (hereinafter called the "Guarantor" which expression shall unless repugnant to the context of meaning thereof include its successors and assigns) of the first part and M/s ____through (designation of the person signing of Bank Guarantee on behalf of the supplier) company registered under Companies Act, 1956, having its registered office at_____ (Address of Registered Office) (hereinafter called the "Supplier" which expression shall unless, repugnant to the context or meaning thereof, include its successors and assigns) of the second part and the Bhakra Beas Management Board, through its Chief Engineer/System Operation a statutory body constituted under Section 79(1) read with section 80(6)of the Punjab Re-organization Act, 1966 (hereinafter called the 'Purchaser' which expression shall unless repugnant to the context or meaning thereof include its successors and assigns) of the third part.

2. WHEREAS _____(Name of suppliers) has submitted its tender Offer No._____ dated _____(Number and date of tender) (hereinafter called "the Tender") in response to Purchaser's open Tender Enquiry No.299 dated 09.06.09 as per BBMB's specification No.BBMB/SS-I/ 356 and Purchase order No._____ dated _____ has been placed on the Supplier for Design, manufacture, testing, supply and delivery of 1No, 132/11Kv, 4MVA Power transformer ,1No,66/11KV,6.3/8MVA Power transformer & 1No, 66/11Kv,12.5/16MVA Power transformer for BBMB, various sub stations at the rate and on the terms & conditions contained in the purchase order.

3. And whereas as per clause No.24 of Section IA of specification no. BBMB/SS-I/368, the earnest money furnished by the successful tenderer on whom the purchase order is placed shall be converted into Security Deposit and he shall be required to furnish Security Deposit within 7 days of receipt of purchase order.

4. WHEREAS by these presents the 'Guarantor' is bound unto purchaser in the sum of Rs._____(the amount submitted by the supplier on account of Earnest Money Deposit at the time of submission of tender) for which payment well and truly to be made to the said Purchaser, the Guarantor binds itself, its successors and assigns by these presents.

5. WHEREAS THE CONDITIONS of the obligation are the following:-

a) If the Purchase Order has been issued but the Supplier refuses to comply with it, irrespective of the fact whether the Purchaser sustains any loss on account of his default or not. This forfeiture shall be without prejudice to the right of the Purchaser to claim any other damages as admissible under the law as well as to take such executive action against the Supplier as black-listing etc.

b) Whereas the Purchase Order has been accepted but the Supplier stops making the supplies after partially fulfilling the purchase order and adjustment against any loss that may be caused to the Purchaser through risk purchase from alternative source and/or any other damage recoverable from the Supplier under the terms of the contract.

c) In the event of a breach of contract in any manner

The Guarantor hereby guarantees and under takes to release and pay immediately to the Purchaser upto the above amount unconditionally upon receipt of its first written demand without the Purchaser having to substantiate its demand, provided that in its demand the Purchaser will note that the amount claimed by it is due to it, owing to the occurrence of one or more of the above named conditions and specifying the occurred condition or conditions, and the Supplier shall not have any right or cause to interfere.

And it is agreed and declared by the Guarantor that the liability of the Guarantor to pay the said amount whenever called upon by the Purchaser shall be irrevocable and absolute and the Guarantor will not be entitled to dispute or inquire into whether the Purchaser has become entitled to forfeit the said amount as earnest money (or as security deposit) under the terms of the Purchase order/Contract or not and entitled to claim the same or not or whether the Supplier has committed any breach of the Purchase order/Contract or not or whether the

Purchaser is entitled to recover any damages from the supplier for breach of terms thereof or not.

And it is further agreed and declared by the Guarantor that any waiver of any breach of any term of the said purchase order/contract or any act of forbearance on the part of the Purchaser or any time given by the Purchaser to the Supplier for carrying out and completing the work under the said Purchase Order/Contract or any modifications made in the terms and conditions of the said Purchase Order/Contract or any other act or omission on the part of the Purchaser which could have in law the effects of discharging a Surety, will not discharge the Guarantor

6. WHEREAS this Guarantee will remain in full force and effects till the warranty period of the complete equipment from the date of issue of Purchase order in the first instance. The Guarantee shall be revalidated subsequently for a further period, if required by the Purchaser with the prior consent of the Supplier. The Guarantor also agrees and undertakes not to revoke this guarantee within its validity period as aforesaid.

7. It is agreed and declared that this guarantee will be enforceable even if the Supplier's company goes into liquidation or there is any change in the constitution of said company or management of the said company and shall ensure to the benefit of its successors and assigns and shall be binding on the successors and assigns of the Guarantor.

8. WHEREAS the Guarantor hereby further declares that this guarantee has been executed by its lawfully constituted attorney legally competent to sign and execute and has been stamped as required for such guarantees under the relevant Act of the State in which it has been executed and signed and this Guarantee shall not effected by any change in constitution of the Guarantor or the Supplier

9. WHEREAS the Guarantor & Supplier hereby further agree that any claim or dispute arising under this deed shall fall within the exclusive jurisdiction of courts at Chandigarh.

Not withstanding any thing herein before contained, Guarantor's liability under this guarantee is not restricted to Rs._____/- (Rupees_____only), (the amount submitted by the Supplier on account of Earnest Money Deposit at the time of submission of tender). This guarantee shall remain in force until_____ .

Unless a claim in writing is presented to the Guarantor within six months from that date and if unpaid a suit or action to enforce such claim is filed against the Guarantor within said period of six months, all the rights of the Purchaser under the said guarantee shall be forfeited and the Guarantor shall be released and discharged from all liabilities thereunder.

In witness whereof the parties hereto have put their respective hands on the day, month and the year first above mentioned.

For & on behalf of the Guarantor

Witness

1. Signature and Designation Signature_____

Full address Name & Designation_____

Full address with Rubber Seal

2. Signature and Designation Signature_____

& Full address Name & Designation_____

For & on behalf of the Supplier

Witness

1. Signature and Designation Signature_____

& Full address Name & Designation_____

2. Signature and Designation Signature_____

& Full address Name & Designation_____

For & on behalf of the Purchaser

Witness

1. Signature and Designation Signature_____

& Full address Name & Designation_____

2. Signature and Designation Signature_____

& Full address Name & Designation_____