



Bharat Heavy Electricals Limited, Bhopal

Transformer Engineering Department

Tender Enquiry No. E02140606

Dated :05.04.2022

To,

Subject: TENDER ENQUIRY “CONDUCTING DYNAMIC SHORT CIRCUIT TEST ON 1 No. 315 MVA, 27/420/√3 KV, 1-PHASE, GENERATOR TRANSFORMER”.

Dear Sir,

We are manufacturing 315 MVA, 27/420/√3 KV, 1-phase, Generator Transformer for M/s PVUNL in which Dynamic short circuit test is to be conducted.

We invite your quotation for “Conducting Dynamic Short Circuit Test” on the above-mentioned transformer at your test lab.

A. SCOPE OF WORK

1. The scope of test is as per attached Annexure -A
2. Technical specification is as per attached Annexure-B

B. GENERAL TERMS & CONDITIONS OF ENQUIRY

1. Offer shall be sent through courier having 2 different envelopes put in 1 outer envelope as mentioned below:
 - **First Part** – It must contain only the technical offer and commercial terms and **conditions (but without price i.e. unpriced offer). If price is indicated in this part, then offer is liable to be rejected.**
 - **Second Part** – It must contain the actual price and price breakup (i.e. price bid), **Total Price must be indicated in figures and words both and in case any ambiguity between the figures and words, words shall prevail.**
 - **Both these parts shall be duly signed by authorized representative of the bidder.**
2. BHEL expects that the bidder must respond to the enquiry. Regret letter, for not participating in the tender will be submitted where the bidder is unable to submit offer. Repeated lack of response on the part of vendor may lead to his deletion from BHEL’s approved vendor list.
3. **Pricing Terms**
Prices once quoted shall remain firm within the validity or any extension thereof for placement of order, till complete execution of the order, without any escalation / increase for any reason, whatsoever, unless specifically provided for in the Enquiry & PO.



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4. Terms of Payment

Payment shall be released by BHEL normally within 90 days by electronic-pay mode on submission of invoice for the work after completion of work.

For MSME bidders, payment shall be release by BHEL within 45 days by electronic-pay mode on submission of invoice for the work after completion of work.

5. Taxes and Duties

All taxes/bank charges as per statutory requirement in the country of bidder shall be borne by the bidder. Income tax as applicable shall be deducted during final settlement of bill. TDS will be deducted from contractors Bill both under Income Tax Act and GST Act.

Necessary tax deduction at source from supplier's bill will be made as per statutory requirements. Tax if applicable shall be paid extra. Any new tax introduced in future shall be considered as applicable. Any loss of tax credit to BHEL due to the reason attributable to the contractor will be recovered from them along with interest.

- a) Wherever bidders are required to supply services at project site Party has to submit GST registration no. of the State in which project site is located along with copy of registration certificate at the time of submission of Bid. In case the same is not available at the time of submission of bid, the contractor has to give an undertaking that the same will be arranged before award of work order
- b) HSN Code/SAC, rate of tax under GST and applicable GST (IGST/CGST/SGST/UTGST) and GSTIN shall be clearly mentioned by the Bidder
- c) GST portion of the invoice shall be released only upon: -
 - (i) All invoices raised by contractors/vendors must be GST compliant Tax invoices as per GST invoice rules.
 - (ii) Contractor declaring such invoice in his GSTR-1 or any modified return as notified by government
 - (iii) Receipt of goods/services and Tax Invoice by BHEL
 - (iv) Confirmation of payment of GST thereon by contractor on GSTN portal.
 - (v) Alternatively, Contractor has to submit BG of appropriate value which shall be valid at least one month after the confirmation of date of payment of GST by contractor on GSTN portal and receipt of Tax invoice and receipt of services, whichever is later. Contractor has to give an undertaking in this regard
 - (vi) Contractor has to give an undertaking to BHEL that they have declared invoice in his return and paying GST within timeline prescribed for availing ITC by BHEL
- d) Payment to Contractor for GST portion will be released only after completion of above activity and on availment of ITC by BHEL
- e) In case GST credit is delayed/denied to BHEL due to non/delayed receipt of services/goods and/or tax invoice or expiry of the timeline prescribed in GST Law for availing such ITC, or any other reasons not attributable to BHEL, GST amount shall be recoverable from the contractor along with interest levied/ leviable on BHEL



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- f) Tax Deduction at source (TDS) as per extant provisions of the Income Tax Act and GST Act shall be deducted from supplier/contractor bill.
6. The offer shall be evaluated on the basis of total delivered cost of entire package to BHEL (including all the activities starting from sending transformer from BHEL works & receiving back transformer to BHEL works & completion of all activities related to Short Circuit at BHEL works till certification) which shall include foreign currency conversion rate on the date of technical bid opening.

The total delivered cost means 'total cost to BHEL' including to and fro freight, Customs Duty, GST / Other taxes as applicable). Exchange rate (TT selling rate of State Bank of India) applicable on the date of Part-I bid opening shall be considered for evaluation of foreign bids. If the relevant day happens to be a bank holiday in India, then the FOREX rate as on the previous bank working day shall be taken for evaluation.

7. In case of any deviation, the same may be clearly mentioned in the offer and checklist to be filled in by the bidder.

8. Variation of orders

No variation to the Engineering Order is permitted unless authorized in writing and signed by or on behalf of purchase executive, BHEL Bhopal.

9. Secrecy Clause

Bidder should not divulge any technical document/ information of BHEL to any third party without prior written permission of BHEL. Further no publications/ patent to be taken from above work without prior written permission of BHEL.

10. Arbitration:

Any disputes arising out at any stage of execution of the work to be mutually discussed and settled. Any Arbitration shall be conducted in accordance with the provisions of the Indian Arbitration and Reconciliation Act, 1996 with latest amendments.

The arbitration proceedings shall be held in Bhopal.

11. Right of rejection/Non-placement of PO:

BHEL reserves the right to accept the offers in part or in full, cancel the Tender Enquiry or short close the contract without assigning any reason.

12. THE BHEL CONCILIATION SCHEME:

The Parties agree that if at any time (whether before, during or after the arbitral or judicial proceedings), any Disputes (which term shall mean and include any dispute, difference, question or disagreement arising in connection with construction, meaning, operation, effect, interpretation or breach of the agreement, contract or the Memorandum of Understanding (delete whichever is inapplicable), which the Parties are unable to settle mutually), arise inter-se the Parties, the same may, be referred by either party to Conciliation to be conducted through Independent Experts Committee to be appointed by competent authority of BHEL from the BHEL Panel of Conciliators.

Notes:

- (i) No serving or a retired employee of BHEL/Administrative Ministry of BHEL shall be included in the BHEL Panel of Conciliators.



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- (ii) Any other person(s) can be appointed as Conciliator(s) who is/are mutually agreeable to both the parties from outside the BHEL Panel of Conciliators.

The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided in BRIEF PROCEDURE FOR CONDUCT OF CONCILIATION PROCEEDINGS.

13. OVERWRITING IN THE PRICE BID

Bid should be free from correction, overwriting, using corrective fluid etc. Any interlineation, cutting erasure or overwriting shall be valid only if they are attested under full signature(s) of person(s) signing the bid else bid shall be liable for the rejection.

14. DISCREPANCY IN WORDS & FIGURES - QUOTED IN THE PRICE BID

- (a) If, in the price structure quoted for the required goods! services! works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless in the opinion of the purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly.
- (b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
- (c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject of (a) and (b) above.
- (d) If there is such discrepancy in an offer, the same shall be conveyed to the bidder with target date upto which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of the purchaser, the bid is liable to be ignored.

15. EVALUATION IN CASE OF MORE THAN ONE L-1 BIDDER

In the course of evaluation, if more than one bidder happens to occupy L-1 status, effective L-1 will be decided by soliciting discounts from the respective L-1 bidders.

In case more than one bidder happens to occupy the L1 status even after soliciting discounts, the L-1 bidder shall be decided by a toss / draw of lots, in the presence of the respective L-1 bidder(s) or their representative(s)

Ranking will be done accordingly. BHEL's decision in such situations shall be final and binding.

16. RISK AND COST

If the work is not executed or partly executed within the agreed execution period, BHEL reserves the right to cancel the order and get the executed from alternate source(s) at the Risk and Cost of Contractor. In such an even, it shall be obligatory on the part of contractor to make good any loss suffered by BHEL.



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17. FORCE MAJEURE

“Notwithstanding anything contained in the contract, neither BHEL nor the Contractor shall be held responsible for total or partial non-execution of any of the contractual obligations, should the obligation become unreasonably onerous or impossible due to occurrence of a 'Force Majeure' which directly affects the obligations to be performed by the BHEL or the contractor; Such events include war, military operations of any nature, blockages, revolutions, insurrections, riots, civil commotions, insurgency, sabotage, acts of public enemy, fires, explosion, epidemics, quarantine restrictions, floods, earthquake, or acts of God, restrictions by Govt. authorities; over which the BHEL or the contractor has no control. The party claiming to be affected by force majeure shall notify the other party in writing without delay, within two weeks from the occurrence of such situation and on the cessation thereof. Extension of time sought by the contractor along with supporting evidence and so granted by BHEL for the work affected, if any, shall not be construed as waiver in respect of remaining execution. Rescheduling of execution on account of force majeure conditions, if so agreed by BHEL, will not entail the contractor to claim any increase in the price on whatsoever account.

Notwithstanding above provisions, BHEL shall reserve the right to cancel the Contract, wholly or partly, in order to meet the overall project schedule and make alternative arrangements. If deemed necessary, BHEL may takeover partly processed work at a mutually agreed price”

18. INTEGRITY PACT

Bidder shall submit integrity pact duly signed by its authorized signatory (Format for the same is attached).

19. MSME BENEFIT APPLICABILITY

Bidder shall submit the all the necessary registration certificates in case of applicability of MSME benefits.

20. DECLARATION REQUIRED BY FOREIGN BIDDERS

Foreign bidders to submit declaration of Permanent Establishment and business connection (PEBC) for remittances purpose. Declaration to be submitted in formats either in Annexure A or B whichever is applicable as per their transaction entered into with BHEL.

In the absence of certificates from the bidders, withholding tax at applicable rates along with surcharge and cess will be recovered at the time of remittance to the bidder.

Foreign bidders to submit Tax Residency Certificate (TRC) & Form 10F (for obtaining DTAA benefits) as per Annexure C in respect of services. The TRC (tax residency certificate) is to be issued by the authorities of the government of bidder's country. If the informative part of the format (other than residency) is not furnished by the authorities, the same may be furnished by the bidder as a declaration.”

21. PRICE BID FORMAT

Bidders to submit the price bid in given price bid format.



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C. ADDRESS FOR SENDING OFFERS

1. Offer may be sent in sealed envelope to following address or on e-mail:
mmtender.bpl@bhel.in:

In Charge,
Works Contract (GREEN BOX),
MM Tender Room
BHEL Administrative Building, GF
BHEL Piplani, Bhopal (India) 462022

Before tender due date 29.04.2022 (Friday) & time 11am, clearly super scribing the Tender Enquiry No. & Subject on the top of envelope.

2. The quotation thus received shall be opened on the same day i.e. 29.04.2022 at 2 pm.

Thanking you.

(Pawan Prajapat)
Manager (TRE)
BHEL, BHOPAL, INDIA



Bharat Heavy Electricals Limited, Bhopal

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CHECKLIST FOR SCOPE OF WORK (Annexure-A)

Note: Bidder shall fill in the following details and no column should be left blank

1	Name & address of the bidder Fax / Email address		
2	Name & designation of the official of the tenderer to whom all the references shall be made.		
3	Bidder's proposal No. & date		
		YES	NO
4	Sl. No. 4.1		
	Sl. No. 4.2		
	Sl. No. 4.3		
	Sl. No. 4.4		
	Sl. No. 4.5		
	Sl. No. 4.6		
	Sl. No. 4.7		
	Sl. No. 4.8		
	Sl. No. 4.9		
	Sl. No. 4.10		
	Sl. No. 4.11		
5	Sl. No. 5.0		
6	Sl. No. 6.0		
7	Sl. No. 7.0		
8	Sl. No. 8.0		
9	Sl. No. 9.0		
10	Sl. No. 10.0		
11	Sl. No. 11.0		
12	Sl. No. 12.0		
13	Sl. No. 13.0		
14	Sl. No. 14.0		
15	Sl. No. 15.0		



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CHECKLIST FOR GENERAL TERMS & CONDITIONS OF ENQUIRY

Note: Bidder shall fill in the following details and no column should be left blank

1	Name & address of the bidder Fax / Email address		
2	Name & designation of the official of the tenderer to whom all the references shall be made		
3	Bidder's proposal No. & date		
		YES	NO
4	Sl. No. 3		
5	Sl. No. 4		
6	Sl. No. 5		
7	Sl. No. 6		
8	Sl. No. 7		
9	Sl. No. 8		
10	Sl. No. 9		
11	Sl. No. 10		
12	Sl. No. 11		
13	Sl. No. 12		
14	Sl. No. 13		
15	Sl. No. 14		
16	Sl. No. 15		
17	Sl. No. 16		
18	Sl. No. 17		
19	Sl. No. 18		
20	Sl. No. 19		
21	Sl. No. 20		
22	Sl. No. 21		

PRICE BID FORMAT

Tender Enquiry No.:

Rating of Transformer:

Name of Test:

S. No.	Description	Charges	
		In fig.	In words
1	SC Test Charges		
2	Inspection Charges		
3	Other charges if any		

BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL
TRANSFORMER ENGINEERING DEPARTMENT

FORM NO: TRE-2003A

Sht 1 of 2 sheets

ANNEXURE TO INDENT-CUM-ENQUIRY - **E02140606**

DTD.: -

DESCRIPTION OF EQUIPMENT : SHORT CIRCUIT TEST ON 315 MVA, 27/420 kV, 1-Ph,
 GENERATOR TRANSFORMER.

WORK ORDER NO. : **67047-A-512-01**

CUSTOMER : M/s PVUNL

SPECIFICATION OF SHORT CIRCUIT TESTING OF TRANSFORMER

- 1 This specification calls for short circuit testing of Power Transformer as per IEC: 60076-5:2006 having technical particulars as per Annexure 'B'.
2. Transformer shall be assembled to our OGA drawing no. 34520001160 (PVUNL drg. no. 9585-001-501-PVE-B-001) enclosed herewith, however cooling equipments & associated fittings as per OGA part list shall not be assembled during this test.
3. The transformer shall be tested for short circuit between HV-LV pair by applying 3 shots on HV terminal with LV terminals pre-shortcd i.e one at maximum tap position, one at normal tap position & one at minimum tap position.
 Bidder to submit the complete procedure for testing alongwith the offer including values of currents, duration of each shot, test arrangement & justification for each value chosen and also how the effect of system impedance shall be taken into consideration.
4. Scope of work: Bidder to cover the following in their scope of work & if necessary in collaboration with other agencies for part of work normally not performed by them.
 - 4.1 Unloading of transformer at nearest sea-port (if applicable).
 - 4.2 Transportation upto test laboratory.
 - 4.3 Transportation upto test bed.
 - 4.4 Arranging crane, crane operator etc for mounting bushings, turrets, pipework, conservator & other fittings. **Charges for the same are to be quoted by bidder on per hour or per day basis** specifying constraints, limitations if any. Number of working hours considered in a day with time applicable. **Additional charges (if any) for providing above facilities after normal working hours & on weekly off days to be clearly spelt out.**
 This facility shall also be required after Short Circuit testing for dismantling the fittings.
 - 4.5 Arranging of **processed oil as per IEC 600296** suitable for filling in Transformer tank. The oil should **specifically comply the following requirements** in addition to IEC:
BDV $\geq$ 70 kV, ppm $\leq$ 5, Tan delta at 90°C: 0.002(max.)
 Total oil quantity required: 60000 litres approx.
 The offer should also include charges **for disposal/ processing** in case oil parameter exceeds the limit of IEC: 600296 after completion of test.
 - 4.6 Arranging vacuum pump, oil filtration plant etc for processing of transformer. The processing of transformer shall include the following activities:
 - 4.6.1 Vacuum pulling & holding vacuum for 72 hours approx.
 - 4.6.2 Oil filling under vacuum at the rate of 3500-4500 LPH.
 - 4.6.3 Oil circulation for 45 hours approx. (Approx. 3 complete circulation of oil)
 The above process shall be continuous without any break & therefore may include weekly-off days depending on the day the process is started. **Bidder to furnish the charges of complete processing on lump sum basis. Bidder is also required to quote charges for additional working hours on per hour basis if the above process could not be completed in the mentioned duration** due to oil parameters after circulation not meeting the desired parameters.
 - 4.6.4 Draining of oil after completion of test.
 - 4.7 **Performance of Short Circuit Test including all LV tests (as listed below) before & after SC Test.**

BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL
TRANSFORMER ENGINEERING DEPARTMENT

FORM NO: TRE-2003A

Sht 2 of 2 sheets

ANNEXURE TO INDENT-CUM-ENQUIRY -

WORK ORDER NO. : **67047-A-512-01**

(If breakup cost is not given, and if repetition of these tests are required then it shall be considered that the cost of same has been built-in the Short Circuit test charges)

- 4.7.1-Measurement of capacitance and $\tan \delta$ of windings and HV bushing.
- 4.7.2-DGA
- 4.7.3-Measurement of Transformation ratio at all taps
- 4.7.4-Measurement of resistance of HV winding at max, min & rated taps & full winding of LV
- 4.7.5-Measurement of insulation resistance
- 4.7.6-Measurement of Magnetizing current at low voltage
- 4.7.7-Measurement of oil parameters e.g. **BDV, PPM (shall be conducted 3 times).**
- 4.7.8-SFRA Test
- 4.8 Transportation upto nearest seaport & loading on ship.
- 4.9 Inspector charges for carrying out inspection at works.
- 4.10 Submission of test report in 2 copies, which shall include all the tests (S.C. test, low voltage test, inspection report etc. alongwith calibration certificate of testing equipments). After successful completion of test & inspection of the transformer at our works, test certificate declaring the successful passing of S.C. test to be furnished.
- 4.11 Time sheet for each activity on hour/per day basis shall be prepared & duly signed by lab or its collaborator & BHEL. This shall be furnished alongwith invoice at the time of final settlement of bills.
- 5.0 Short circuit test shall be continued till the following conditions are met –**
 - (i) Variation of Short Circuit reactance is within 2% after each shot &**
 - (ii) Current and Voltage wave shapes are sustained for entire test cycle of 0.25 second.**
- 6.0 Any other observations during Short Circuit testing i.e. PRD, wave shape, DGA etc shall be dealt with as per the provisions laid down in IEC 60076-5 without interrupting the test schedule.**
- 7.0 Termination of Short Circuit test to be mutually agreed between Testing laboratory and BHEL.**
- 8.0 All the test and measuring instruments employed in the Short Circuit Testing should have been calibrated and calibration certificates made available to BHEL or its end customer whenever required.
- 9.0 Bidder may also quote the other miscellaneous charges required for satisfactory completion of testing eg. Assembly hall, photograph, N2 cylinder & custom clearance.
- 10.0 The bidder to confirm that in case of unforeseen circumstances like accident, transportation delay etc. the scheduled test dates may have to be cancelled/deferred.
- 11.0 Bidder to submit the details about the laboratory & list of transformer tested therein for Short Circuit test.
- 12.0 Bidder should allow test witness by purchaser's representatives.
- 13.0 Bidder to furnish complete techno-commercial offer and a specific point wise response to each of the clauses of this indent. Any offer not responding to any of the clauses may be ignored without any explanation.
- 14.0 Our staff will be at test laboratory for assembly, dismantling, witnessing of test etc. of the transformer. Suitable office accommodation to be provided for them during their stay.

ANNEXURE 'B'

TECHNICAL PARAMETERS

<u>SL. NO.</u>	<u>ITEM</u>	<u>DETAILS</u>
1.	Type of cooling	OFAF
2.	Continuous rating (MVA)	
	(a) HV	315
	(b) LV	315
3.	Rated Voltage (KV)	
	(a) HV at principal tap	420/ $\sqrt{3}$
	(b) LV	27
4.	Rated frequency (Hz)	50
5.	No. of Phases	1
6.	Connections	
	(a) HV	STAR
	(b) LV	DELTA
7.	Connection symbol	YNd11 (IN BANK)
8.	Line current at rated no load voltage and on principal tap (Amps).	
	(a) HV	1299.04
	(b) LV	11666.67
9.	Terminal arrangement:	
	(a) HV side	OIL-AIR BUSHING
	(b) LV side	OIL-AIR BUSHINGS
	(c) Neutral	OIL-AIR BUSHING
10.	Test voltage for HV/LV windings	
	(a) Lightning impulse withstand test voltage (kVp)	
	HV	1425 (FW), 1570 (CW)
	LV	170 (FW), 187 (CW)
	HVN	95 (FW)
	(b) Switching Impulse (kVp) HV	1175
	(c) Power frequency withstand test voltage HV/LV(1-min.)	630/70 kVrms
	(d) Separate source on HV/LV (KV rms)	38/70
11.	Type of Tap changer	OFF CIRCUIT
12.	Tap Changer on winding	HV winding
13.	Tapping's on HV winding for regulations:	
	(a) Step voltage & steps	$\pm 2 \times 2.5\%$
	(b) Plus and minus range of variation	+5% to -5%

14. Positive sequence impedance on 315 MVA base at rated current and frequency at 75°C winding temperature :

	Normal Tap (Tap 3)		Maximum Tap (Tap 1)		Minimum Tap (Tap 5)	
	Guaranteed	Calculated	Guaranteed	Calculated	Guaranteed	Calculated
HV-LV	16.0% ± 5% Tol.	16.5 ± 3% Tol.	14.4% - 17.6% (approx.)	16.5% ± 3% Tol.	14.4% - 17.6% (approx.)	16.9 ± 3% Tol.

15. Apparent fault level (MVA)
HV (63 kA for 3 sec) (Um = 420 kV) 45830
16. Category III
17. Approximate mass with oil without cooling system(kg) 242500
18. Approximate volume of oil to be filled during testing (L) 47000
19. Approximate mass without oil without cooling system(kg) 201500
20. Un-tanking weight (kg) 17000
21. Approximate shipping dimensions (L x W x H) (mm) 7400 x 4100 x 4400 mm
22. Approximate height with bushings (From rail level) (mm) 9900

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

09110 00 01160

DRG. NO. 3

102

103

104

105

106

107

108

TOP TANK

LIFTING LUG FOR CORE ASSY.

CORE & COIL ASSY.

BOTTOM TANK

3965

2860

100

4075

11000

H.V. BUSHING
WEIGHT 1150 KG

OF TRANSF.

4830

1640±5

11100±100

UNTANKING

UNTANKING WT. = 17000 KG

MIN. AIR CLEARANCES	
H.V. - EARTH	3500mm
NEUTRAL - EARTH	320 mm
LV - EARTH	320 mm

DISCONNECTION-HV BUSHING

EARTHING TERMINAL PLATE

TO CL

TO CC

TO TANK

DETAILED VIEW OF 10 KV ISOLATION
(CORE TO CLAMP, CLAMP TO TANK, TANK TO CORE)

NOTES:-

1. FOR NOTES, REFERENCE DRAWINGS, DETAILS OF WEIGHTS & OIL QUANTITIES AND PART LIST REFER DRG. SHEET 05 OF 05

2. FOR ALL THE DIM. TOL. SHALL BE ±2% EXCEPT DIM RELATED TO LV BUSDUCT, LV BUSHING, RAIL AND FOUNDATION.

3. PLEASE ENSURE THE FOLLOWING BEFORE USE OF ITEM 19a (JACKING PADS FOR TOP TANK ONLY)

a. INTERNAL CONNECTION OF BUSHINGS DISCONNECTED.

b. HV BUSHINGS ARE REMOVED.

c. OCTC FLANGE AND DRIVE SHAFT ARE OPENED.

d. ALL OTHER RELATED INTERFERENCE FOUND ON SITE.

e. COOLERS AND RELATED PIPES SHALL BE DISCONNECTED.

4. JACKING PADS (IT NO. 19) ARE PROVIDED FOR UPLIFTING AND AT RAIL WHERE IT TURNS 90 DEGREE, THIS JACKING PAD SHALL BE USED FOR CHANGING THE ROLLER DIRECTION .

5. SPACE BELOW TANK (WITH ROLLERS) IS SUFFICIENT TO PLACE JACK BELOW JACKING PADS MARKED AS IT NO.19 AND UPLIFT THE TRANSFORMER TANK.

6. COOLERS PIPES WILL NOT AFFECT/FOUL THE FUCNTIONING OF ALL THE VALVES INCLUDING FILTER VALVE HOSE FIXING.

7. ALL MATERIALS & ITEMS TO BE AS PER CONTRACT & NTPC QA APPROVED.

8. MATERIALS, FITTING & ITEM SHOWN OR NOT SHOWN TO BE AS PER CONTRACT.

135

50

900

45

22.5

2 HOLES M12

RAIL LEVEL

DETAIL-A

EARTHING TERMINAL PLATE

REV

DATE

ALT.

RM

REV

DATE

ALT.

RAKESH

02

05/06/20

CKD.

LK

01

18.07.19

CKD.

KD

ZONE

SHEET 02 TO 05 UPDATED.

ZONE

DRAWING REVISED INLINE WITH NTPC COMMENTS.

PVUNL DRG. NO.

9585-001-501-PVE-B-001

ADDITIONAL INFORMATION

W.O.- 67047 - A - 512 - 01

STATUS OF DRAWING "PR"

DISTRIBUTION OF PRINTS

TYPE OF PRODUCT

315MVA, 27/420/Å3KV, 1-PH.GENERATOR TRANSFORMER

DEPT

CODE

WEIGHT(kg)

SCALE

PO. NO.

01/PVUNL-CS-9585-001-2/NOA-SC , DATED : 08/03/18

TRE

406

COMP.SCALE-1:1

NAME OF CUSTOMER

PATRATU VIDYUT UTPADAN NIGAM LTD.

TITLE

OUTLINE GENERAL ARRANGEMENT

NOTES

PROJECT

3 X 800 MW PATRATU SUPER THERMAL POWER PROJECT EXPANSION, PH-1

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल

DRN.

NAME

SIGN

DATE

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल

CHD.

RAKESH/RM

31.05.19

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल

APPD.

KD

01.06.19

DRG. NO

3 4520001160

REV.

02

SHEET

01

OF

05

101

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108

REF.DRG.NO.

SIGN.DATE

INVENTORY NO.

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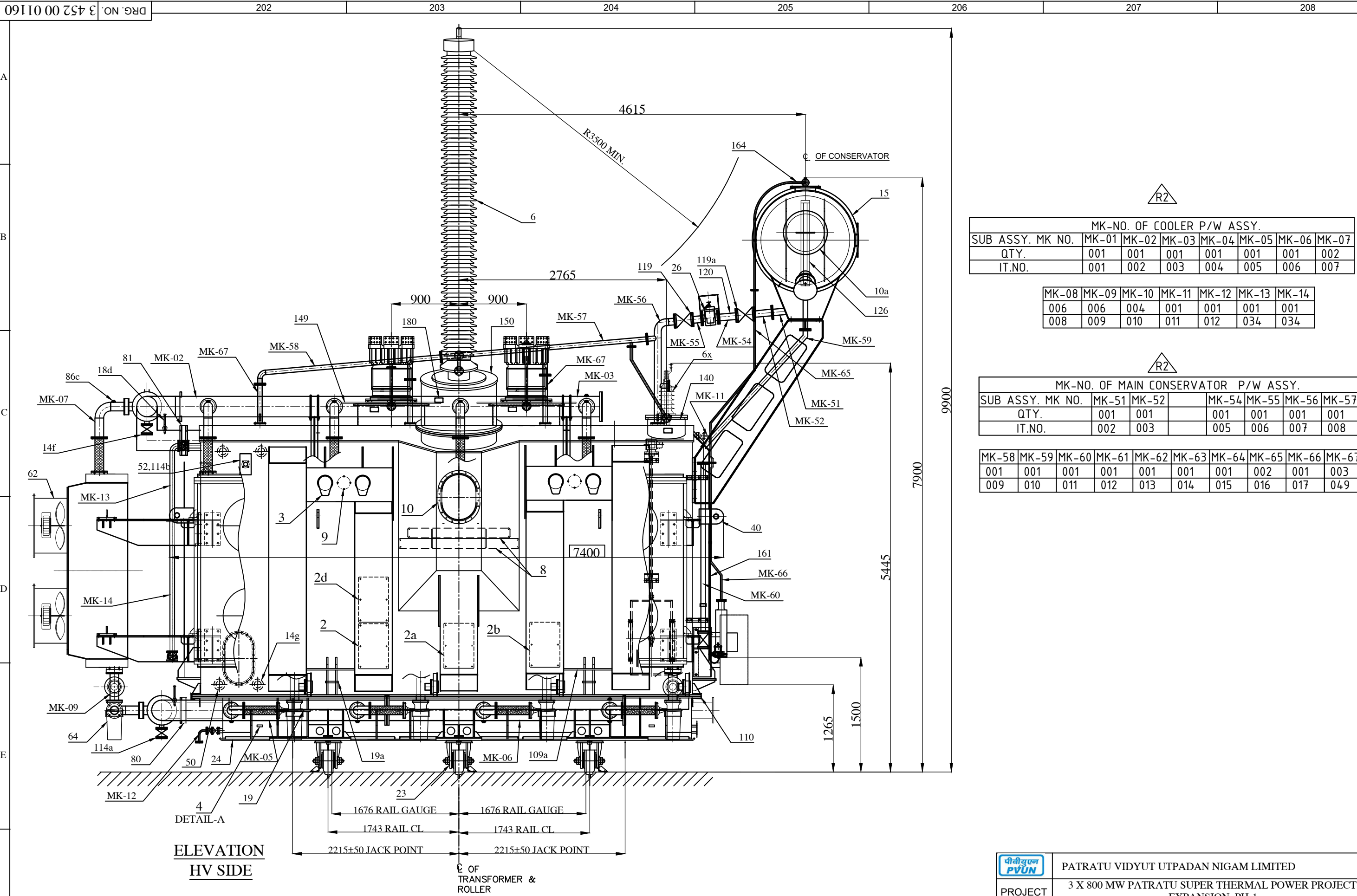
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REF.DRG.NO.

SIGN.DATE

INVENTORY NO.



MK-NO. OF COOLER P/W ASSY.							
SUB ASSY. MK NO.	MK-01	MK-02	MK-03	MK-04	MK-05	MK-06	MK-07
QTY.	001	001	001	001	001	001	002
IT.NO.	001	002	003	004	005	006	007

MK-08	MK-09	MK-10	MK-11	MK-12	MK-13	MK-14
006	006	004	001	001	001	001
008	009	010	011	012	034	034

MK-NO. OF MAIN CONSERVATOR P/W ASSY.							
SUB ASSY. MK NO.	MK-51	MK-52		MK-54	MK-55	MK-56	MK-57
QTY.	001	001		001	001	001	001
IT.NO.	002	003		005	006	007	008

MK-58	MK-59	MK-60	MK-61	MK-62	MK-63	MK-64	MK-65	MK-66	MK-67
001	001	001	001	001	001	001	002	001	003
009	010	011	012	013	014	015	016	017	049

		PATRATU VIDYUT UTPADAN NIGAM LIMITED			
PROJECT		3 X 800 MW PATRATU SUPER THERMAL POWER PROJECT EXPANSION, PH-1			
W.O.- 67047 - A - 512 - 01		भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल		NAME	SIGN
STATUS OF DRAWING "PR"		DEPT	CODE	WEIGHT(kg)	SCALE
DISTRIBUTION OF PRINTS		TRE	406	----	COMP.SCALE-1:1
TRE-1, TRM-3		TITLE		DRG. NO.	REV.
		OUTLINE GENERAL ARRANGEMENT (ELEVATION VIEW)		3 452 00 01160	02
				SHEET	02 OF 05

REV	DATE	ALT.	RM	APD.	REV	DATE	ALT.	RAKESH	APD.	PVUNL DRG. NO.	9585-001-501-PVE-B-001	ADDITIONAL INFORMATION	W.O.- 67047 - A - 512 - 01
02	05/06/20	CKD.	LK	APPD.	01	18.07.19	CKD.	KD	APPD.	TYPE OF PRODUCT	315MVA, 27/420/Å3KV, 1-PH.GENERATOR TRANSFORMER	STATUS OF DRAWING "PR"	
ZONE					ZONE					PO. NO.	01/PVUNL-CS-9585-001-2/NOA-SC , DATED : 08/03/18	DISTRIBUTION OF PRINTS	TRE-1, TRM-3
LV BUSHING BUS DUCT MOUNTING UPDATED AND PIPE MARKING NO. (MK NO.) ADDED.					DRAWING REVISED INLINE WITH NTPC COMMENTS.					NAME OF CUSTOMER	PATRATU VIDYUT UTPADAN NIGAM LTD.		

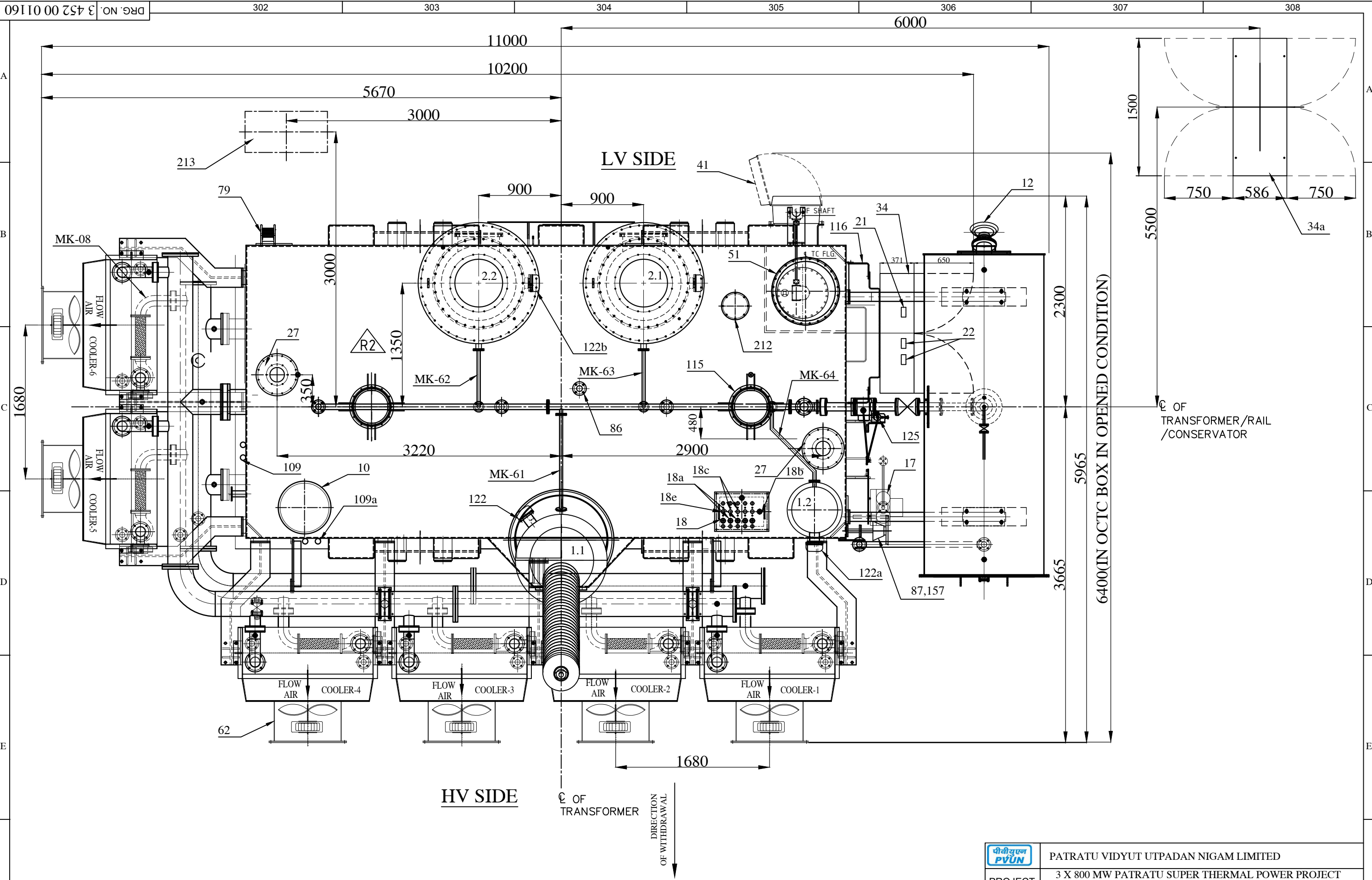
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REF.DRG.NO.

SIGN. DATE

INVENTORY NO.



REV	DATE	ALT.	RM		REV	DATE	ALT.	RAKESH		PVUNL DRG. NO.	9585-001-501-PVE-B-001	ADDITIONAL INFORMATION				भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल					NAME	SIGN	DATE								
												W.O.- 67047 - A - 512 - 01				BHARAT HEAVY ELECTRICALS LTD. BHOPAL				DRN.	RAKESH/RM		31.05.19								
02	05/06/20	CKD.	LK		01	18.07.19	CKD.	KD		TYPE OF PRODUCT	315MVA, 27/420/Δ3KV, 1-PH.GENERATOR TRANSFORMER	STATUS OF DRAWING "PR"				DEPT	CODE	WEIGHT(kg)	SCALE		CHD.	KD		01.06.19							
		APPD.	LK/PP				APPD.	KD/PP				DISTRIBUTION OF PRINTS				TRE	406	----	COMP.SCALE-1:1		APPD.	KD/PP		01.06.19							
ZONE	LV BUSHING BUS DUCT MOUNTING UPDATED AND PIPE MARKING NO. (MK NO.) ADDED.				ZONE	DRAWING REVISED INLINE WITH NTPC COMMENTS.				PO. NO.	01/PVUNL-CS-9585-001-2/NOA-SC, DATED : 08/03/18						TRE-1, TRM-3				TITLE OUTLINE GENERAL ARRANGEMENT (PLAN VIEW)				DRG. NO 3 452 00 01160		REV. 02				
										NAME OF CUSTOMER	PATRATU VIDYUT UTPADAN NIGAM LTD.																				
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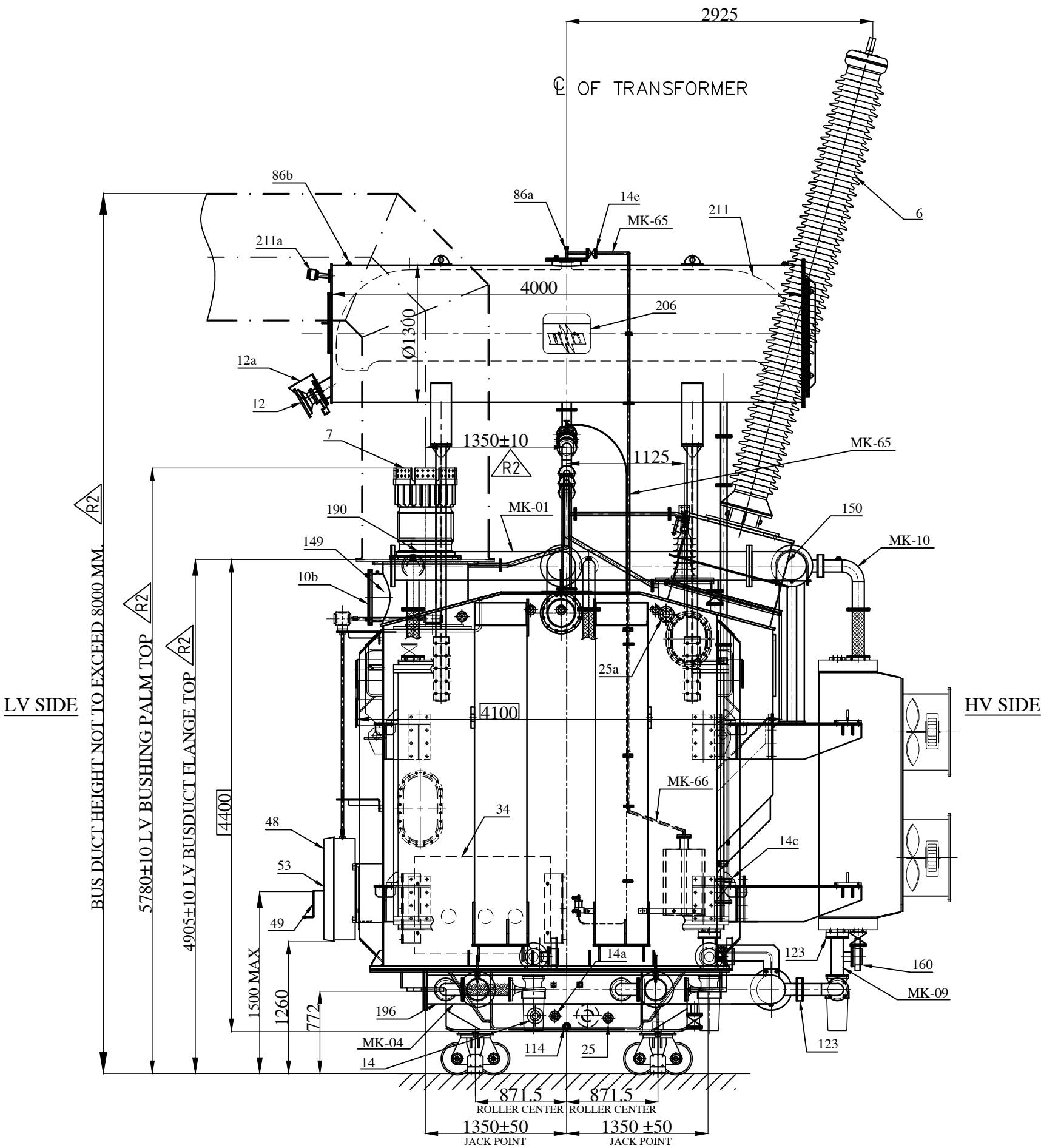
REF.DRG.NO.

SIGN.DATE

INVENTORY NO.

09110 00 01160

DRG. NO. 3 452 00 01160



REV	DATE	ALT.	RM		REV	DATE	ALT.	RAKESH		PVUNL DRG. NO.	9585-001-501-PVE-B-001	ADDITIONAL INFORMATION		भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल		NAME	SIGN	DATE			
02	05/06/20	CKD.	LK		01	18.07.19	CKD.	KD		TYPE OF PRODUCT	315MVA, 27/420/3KV, 1-PH,GENERATOR TRANSFORMER	W.O.- 67047 - A - 512 - 01		BHARAT HEAVY ELECTRICALS LTD. BHOPAL	DRN.	RAKESH/RM		31.05.19			
		APPD.	LK/PP					APPD.	KD/PP				STATUS OF DRAWING "PR"	DEPT	CODE	WEIGHT(kg)	SCALE	CHD.	KD	01.06.19	
ZONE	LV BUSHING BUS DUCT MOUNTING UPDATED AND PIPE MARKING NO. (MK NO.) ADDED.				ZONE	DRAWING REVISED INLINE WITH NTPC COMMENTS.				PO. NO.	01/PVUNL-CS-9585-001-2/NOA-SC , DATED : 08/03/18	DISTRIBUTION OF PRINTS	TRE	406	----	COMP.SCALE-1:1		APPD.	KD/PP		01.06.19
										NAME OF CUSTOMER	PATRATU VIDYUT UTPADAN NIGAM LTD.	TRE-1, TRM-3	TITLE OUTLINE GENERAL ARRANGEMENT (END VIEW)				DRG. NO.	3 4520001160			REV.
										SHEET 04 OF 05											

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REF.DRG.NO.

SIGN.DATE

INVENTORY NO.

09110 00 00 01160

DRG. NO.

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CUSTOMER'S REFERENCE DRAWING

DESCRIPTION	BHEL DRAWING NO.	NTPC DRAWING NO.
OUTLINE GENERAL ARRANGEMENT (OGA), LIST OF FITTINGS AND ACCESSORIES	3 452 00 01160	9585-001-501-PVE-B-001
LOADING GAUGE & TWIN BI-DIRECTIONAL ROLLER	3 452 00 01161	9585-001-501-PVE-B-002
BILINGUAL RATING & DIAGRAM PLATE	3 452 00 01162	9585-001-501-PVE-B-003
VALVE SCHEDULE PLATE	3 452 00 01163	9585-001-501-PVE-B-004
GA DRAWING OF HV BUSHING	3 452 00 01164	9585-001-501-PVE-B-005
GA DRAWING OF HV NEUTRAL BUSHING	3 452 00 01165	9585-001-501-PVE-B-072
GA DRAWING OF LV BUSHING	3 452 00 01166	9585-001-501-PVE-B-073
TERMINAL CONNECTOR (HV)	3 452 00 01167	
FOUNDATION DRAWING (1 PH)	3 452 00 01168	9585-001-501-PVE-V-001
INTERNAL SECTION SKETCH FOR TRANSFORMER	3 452 00 01169	9585-001-501-PVE-B-006
BUSDUCT TERMINATION DETAILS-GT (1-PH)	3 452 00 01170	9585-001-501-PVE-B-008
COMBINED FOUNDATION DRWG. AND ASSEMBLY DRWG. FOR NEUTRAL FORMATION/GROUNDING	3 452 00 01171	9585-001-501-PVE-B-009
OVERFLUXING WITHSTAND DURATION CURVE	4 452 00 00084	9585-001-501-PVE-N-002

APPROX. OIL QUANTITY

DESCRIPTION	LITERS
OIL IN TANK AND ACCESSORIES	47000
OIL IN COOLER & PIPEWORKS	3000
TOTAL OIL QTY.	50000

APPROX. WEIGHTS

DESCRIPTION	WT. IN KG.
CORE & WINDING ASSY.	171500
TANK AND FITTINGS	29850
COOLERS AND ACCESSORIES	25900
TOTAL OIL	43500
TOTAL WEIGHT INCLUDING OIL	270750
SHIPPING WEIGHT OF TRANSFORMER (GAS FILLED)	199000
UNTANKING WEIGHT	17000

CONSERVATOR & ITS PIPE WORK

10a	INSPECTION COVER FOR CONSERVATOR	1
12	MAGNETIC OIL GAUGE WITH LOLA	1
12a	RAIN HOOD (FOR PRV,MOG,BUCHHOLZ RELAY,SPR)	5
14c	DRAIN G.M.GATE. VALVE FOR MAIN CONSERVATOR 50 NB WITH TANK SUPPORTED PIPE (TOP & BOTTOM)	1
14e	BREATHER CONNECTION GATE VALVE 15 NB FOR MAIN CONSERVATOR	1
15	OIL CONSERVATOR MAIN (1300 DIA. WITH AIR CELL) WITH LIFTING LUGS	1
17	ONLINE NON CARCINOGENIC REGENERATIVE MAINTENANCE FREE BREATHER.	1
26	BUCHHOLZ RELAY 80 NB MAGNETIC TYPE	1
86a	AIR RELEASE PLUG (1/4"BSP) FOR AIR CELL ON CONSERVATOR	2
86b	AIR RELEASE PLUG (3/4"BSP) FOR MAIN CONSERVATOR	2
119	ISOLATING GATE VALVE FOR BUCHHOLZ RELAY 80NB	1
120	MAIN CONSERVATOR 80NB PIPE SET.	1
125	GAS COLLECTING DEVICE	1
126	PRISMATIC OIL GAUGE	1
119a	ISOLATING GATE VALVE 80 NB FOR BUCHHOLZ RELAY	1
161	BUCHHOLZ GAS RELAY DEVICE PIPE 6 DIA (COPPER)	1
164	BREATHER PIPE 15 N.B.(FOR MAIN CONSERVATOR)	1
206	MONOGRAM	1
211	ATMOSEAL (AIR CELL) ARRGT. OF CONSERVATOR	1
211a	AIR CELL LEAKAGE DETECTOR	1

COOLING SYSTEM

14f	FILTER VALVE 50 NB G. M. GATE VALVE FOR COOLERS PIPES TOP & BOTTOM	4
18d	THERMOMETERS ON COOLER PIPE WORKS	2
62	OFAF COOLERS (5 WORKING + 1 STANDBY) (FAN WITH GI WIRE MESH/ COOLER WITH LIFTING LUGS) WITH DRAIN AND THERMOMETER	6
64	OIL PUMP AND MOTOR (5 WORKING + 1STANDBY) WITH DRAIN /AIR RELEASE PLUG	6
86c	AIR RELEASE PLUG (3/4"BSP) ON COOLER PIPE WORK	8
114a	DRAIN/PLUG (3/4") ON COOLER PIPES	2
123	ISOLATING B/F VALVE FOR PUMP & MOTOR,OIL FLOW INDICATOR 100 NB & 100 NB P/W	18
160	OIL FLOW INDICATOR (TOP TO BOTTOM FACING DIAL) WITH REVERSE FLOW INDICATOR	6
190	TOP OIL PIPE ASSY. (250 NB.)	1
196	BOTTOM OIL PIPE ASSY. (250 NB.)	1

TURRETS & BUSHING

6	H.V. LINE BUSHING	1
6x	H.V. NEUTRAL BUSHING	1
7	L.V. BUSHING	2
10b	INSPECTION COVER L.V. BUSHING CONNECTION WITH HANDLE	2
122	C.T. TERMINAL BOX FOR H.V.	1
122a	CT TERMINAL BOX FOR H.V. NEUTRAL	1
122b	CT TERMINAL BOX FOR L.V.	2
140	NEUTRAL TURRET	1
149	L.V. TURRET NON MAGNETIC STAINLESS STL.	2
150	H.V. TURRET	1
157	NEUTRAL GROUNDING CONNECTOR (COPPER) 10 X 125 WIDE	1
180	TERMINAL MARKING	ADEQUATE
181	H.V. TERMINAL CONNECTOR	1

TRANSFORMER

OFF CIRCUIT TAP SWITCH

TABLE OF FITTINGS		
ITEM NO.	DESCRIPTION	QTY./ SET
2	RATING AND DIAGRAM PLATE (BILINGUAL)	1
2a	VALVE SCHEDULE PLATE	1
2b	DO'S AND DON'T INSTRUCTION PLATE	1
2d	INSTRUCTION PLATE FOR OIL FILLING	1
3	LIFTING BOLLARD PAIR (FOR COMPLETE TRANSFORMER WITH OIL)	4
4	EARTHING PAD WITH BOLTS,NUTS PLAIN & S. WASHERS M10 DIAGONALLY OPP.	2
8	NAME PLATE HINDI AND ENGLISH (ONE EACH)	2
9	INSTRUCTION PLATE FOR LIFTING	4
10	INSPECTION COVER FOR TANK/COVER WITH HANDLE	2
10b	INSPECTION COVER FOR LV	2
14	DRAIN GATE VALVE FOR TOTAL DRAINAGE 100 NB	1
14a	SAMPLING 15 NB G.M. VALVE-1 AT TOP + 1 BROUGHT DOWN TO BOTTOM (2 IN SERIES) & 2 AT BOTTOM TANK) (2 IN SERIES)	4
114b	40 NB G.M.GATE VALVE FOR SUDDEN PRESSURE RELAY	1
14g	15 NB G.M.GATE VALVE FOR ON LINE DRY KEEP SYSTEM MOUNTING	2
18	POCKET FOR OIL TEMPERATURE INDICATOR	1
18a	POCKET FOR WINDING TEMPERATURE INDICATOR	2
18b	ORDINARY THERMOMETER WITH POCKET	1
18c	POCKET WITH RTD-WTI	2
18e	POCKET WITH RTD-OTI WITH SPARE POCKET	2
19	JACKING PAD (SUITABLE FOR TOTAL WEIGHT WITH OIL)	4
19a	JACKING PAD (SUITABLE FOR TOPTANK)	4
21	O.T.I. (IN M.BOX)	1
22	W.T.I. (IN M.BOX)	2
23	3200 TWIN BI-DIRECTIONAL ROLLERS	6
24	SKIDS (BOTH DIRECTIONS)	1
25	50 NB FILTER G.M. GATE VALVE (BOTTOM) WITH THREADED MALE ADAPTORS	1
25a	FILTER 50 NB G.M. VALVE-1 AT TOP + 1 BROUGHT DOWN TO BOTTOM WITH SAMPLING ATTACHMENT IN BOTTOM WITH THREADED MALE ADAPTORS	1+1
27	P.R.V. WITH OIL COLLECTOR,DRAIN PIPE AND DISCHARGE ARGT.	2
34	MARSHALLING BOX FOR OTI AND WTI	1
34a	COOLER CONTROL CABINET (CCC)	1
40	WAGON ANCHORING LUG	4
50	50 NB GATE VALVE FOR ON LINE DGA MOUNTING	2
52	SUDDEN PRESSURE RELAY	1
79	LADDER WITH LOCKING DEVICE	1
80	OIL INLET BUTTER FLY VALVE 200 NB	2
81	OIL OUTLET BUTTER FLY VALVE 250 NB	1
86	AIR RELEASE VALVE G.M. (1/2" BSP)	1
87	36 KV POST INSULATOR	4
109	HAULAGE LUG 50 DIA . LONGITUDINAL	4
109a	HAULAGE LUG 50 DIA . TRANSVERSAL	4
110	TOP TANK AND BOTTOM TANK SHORTING LINK HV AND LV SIDE	2
114	SLUDGE REMOVAL PLUG (1" BSP) ON EACH SIDE OF BOTTOM TANK	2
115	HOLE FOR CLAMPING CORE AND COIL TO TOP TANK	8
116	M. BOX SUPPORT (SET)	1
212	10 kV,EARTHING TERMINAL BOX (CORE, CLAMP AND TANK EARTHING)	1
213	ONLINE DGA	1
41	BEVEL GEAR BOX	1
48	OFF CIRCUIT TAP SWITCH DRIVING UNIT	1
49	OFF CIRCUIT TAP SWITCH DRIVING HANDLE	1
51	OFF CIRCUIT TAP SWITCH	1
53	OCTC WARNING PLATE	1

NOTES:-

1. WHEN REFERRING THE O.G.A DRG. PLEASE QUOTE MVA & W.O. N.O.

2. DIMENSIONS SHOWN THUS  ARE OVERALL SHIPPING DIMENSIONS.

3. WIRING FROM INSTRUMENTS, CTS, CMB, IOD BOX AND CMS ETC. NOT SHOWN FOR CLARITY.

4. JACK POINT MARKED  THUS ARE UNLOADING FROM WAGON.

5. THE DESIGN FEATURES SHOWN ON THIS DRAWING(GENERALLY IN LINE WITH IS:2026,IEC:60076 & CUSTOMER SPECIFICATION) MEETS THE STATUTORY, REGULATORY AND SAFETY REQUIREMENT WITH RESPECT TO EARTHING ARRGMT. DANGER AND LABLES, CLEARANCE IN AIR, PROVISION FOR PRESSURE RELIEF DEVICE, GAS & OIL ACTUATED RELAY AND ANTI-EARTHQUAKE CLAMPING ARRGMT.

6. FOUNDATION BOLTS, NUTS, HARDWARES/FASTENERS FOR EARTHING CONNECTIONS, PADS ETC. ARE SUPPLIED BY BHEL.

7. ROLLERS TO BE USED FOR TRANSPORTATION/INSTALLATION ARE IN SCOPE OF BHEL SUPPLY.

8. OIL SHALL BE INLINE WITH CUSTOMER SPECIFICATION

9. THE MAKE OF FITTINGS INCLUDING ONLINE REGENERATIVE MAINTENANCE FREE BREATHER SHALL BE AS PER NTPC APPROVED VENDOR LIST.

10. OUTSIDE FINISH PAINT SHADE SHALL BE RAL BLUE SHADE 5012 AND PAINTINGS SHALL BE AS PER NTPC TECHNICAL SPECIFICATION AND NTPC APPROVED PROCEDURE.

11. ALL GASKET(IN CONTACT WITH OIL) SHALL BE O-RING NITRIL RUBBER(AS PER SPECIFICATION)

12. ALL BOLTS AND NUTS SHALL BE HOT DIP GALVANIZED.

13. EARTHING LINK PROVIDED AT ALL NON ELECTRICALLY CONNECTED JOINTS(INCLUDING TANK TO M.BOX,DM BOX, COOLERS ETC).

14. ALL VALVES ARE LOCATED IN SUCH A WAY THAT ITS FUNCTIONING (O&M) WILL NOT BE OBSTRUCTED BY COOLERS AND PIPES ETC.

15. HARDWARES AND METAL PARTS NEAR LV BUSHING AND TURRETS SHALL BE OF SS.

16. SLOPE IS PROVIDED FOR TANK, M.BOX ETC. TO AVOID RAIN WATER ACCUMULATION.

17. HVN WILL FORM NEUTRAL FORMATION OF 3 BANK, BUT NOT SHOWN FOR CLARITY. ALL PHASES WILL BE PROVIDED WITH SUITABLE TANK SUPPORTS AND ACCESSORIES & PROVISION TO BECOME THE CENTER PHASE & EARTH THE NEUTRAL TO THE GROUND.

18. TERMINAL MARKING PLATE WILL BE PROVIDED FOR ALL VALVES, ACCESSORIES, BUSHINGS ETC.

19. RUNNING OF ALL 6 COOLERS (INCLUDING STANDBY) WILL NOT ADVERSELY AFFECT THE TRANSFORMER AND WILL NOT LEAD TO STATIC DISCHARGE.

20. MATERIALS, FITTING, ITEM SHOWN OR NOT SHOWN TO BE AS PER CONTRACT.

REV

DATE

ALT.

RM



REV

DATE

ALT.

RAKESH



PVUNL DRG. NO.

9585-001-501-PVE-B-001

ADDITIONAL INFORMATION

W.O.- 67047 - A - 512 - 01

02

05/06/20

CKD.

LK

APPD.

LK/PP

01

18.07.19

CKD.

KD

KD/PP

TYPE OF PRODUCT

315MVA, 27/420/Δ 3KV, 1-PH,GENERATOR TRANSFORMER

STATUS OF DRAWING "PR"

DISTRIBUTION OF PRINTS

TRE-1, TRM-3

ZONE

DESCRIPTION OF ITEM NO.80,81,190 & 196 & QUANTITY OF ITEM NO.14c, 86a, 80,81,109,114a,190 & 196 CORRECTED.

ZONE

WEIGHT UPDATED.

PO. NO.

01/PVUNL-CS-9585-001-2/NOA-SC , DATED : 08/03/18

NAME OF CUSTOMER

PATRATU VIDYUT UTPADAN NIGAM LTD.

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PATRATU VIDYUT UTPADAN NIGAM LIMITED

PROJECT

3 X 800 MW PATRATU SUPER THERMAL POWER PROJECT EXPANSION, PH-1



भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल

DRN.

NAME

SIGN

DATE

CHD.

KD

APPD.

KD/PP

01.06.19

01.06.19

DEPT

CODE

WEIGHT(kg)

SCALE



DRG. NO

3 4520001160

REV.

02

TRE

406

COMP.SCALE-1:1



SHEET

05

OF

05

