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PURCHASE SPECIFICATION
GROUP: TRACTION ENGINEERING

P.S NO. : PS4452499

REV. NO: 02

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SPECIFICATION FOR TRANSFORMER

Code No. TI0668107905

REVISION HISTORY SHEET

REV. NO.	DATE	NATURE OF CHANGE	REASONS	PREPARED BY	APPROVED BY
00	02.04.2014	FIRST ISSUE		David J	Shekar R
01	23.07.2014	SECOND ISSUE		David J	Shekar R
02	24.12.2015	THIRD ISSUE 1) Added: Earth connection details 2) Removed: Impulse voltage withstand test	Better End Product	Purushottama Rao	Shekar R

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24/12/2015

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24/12/2015

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DATE

24.12.2015

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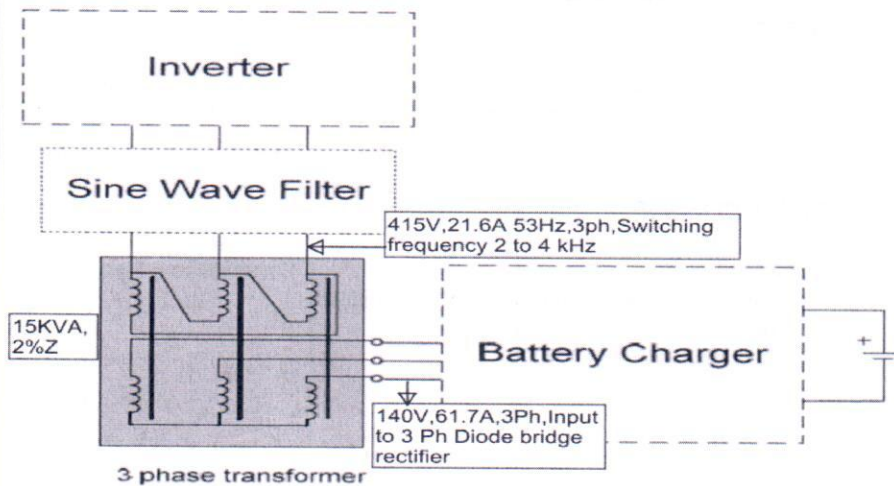
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SPECIFICATION FOR TRANSFORMER

1.0 FUNCTIONAL REQUIRMENTS:

This document covers specification of a Battery Charger Transformer, to be used at the output of an IGBT based inverter. The Transformer will be mounted in a cabinet/enclosure and will be used in traction applications for on board mounting. The block diagram is shown below.



2.0 DUTY: Rectifier Duty - 3 Phase Full Wave Diode Rectifier Bridge

3.0 TYPE: Dry Type, Air natural cooling

4.0 REFERENCE STANDARDS:

IEC 60076/ IS2026/IS11171	Power transformers
IEC 60077-1	Railway applications – electric equipment for rolling stock-part 1.
IEC 60310	Traction transformers and inductors
IEC 61287-1	Electronic power converters installed on rolling stock
IEC 61373	Railway applications – Rolling stock equipment –shock and vibration tests
EN61558/ IEC 61558-2-16	Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V
EN50124-1, IEC1376	Railway Applications - Insulation Coordination Basic Requirements - Clearance And Creepage Distances
IEC60571/EN50155	Operating conditions

The equipment shall comply with the latest issues of applicable IEC and other standards, Including at least the Following

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SPECIFICATION FOR TRANSFORMER**5.0 ENVIRONMENTAL CONDITIONS:**

5.1 Ambient Temperature : 55°C

5.2 Maximum Temperature : 70°C (when locomotive standing dead under sun)
55°C (when locomotive working)
47°C Nominal 12.45.3 Relative Humidity : IEC60571
up to 95% any moisture condensation during operation shall not lead any
Damage or failure
Yearly average $\leq$ 75% Rel Humidity

5.4 Altitude : up to 1200 m above mean sea level

5.5 Atmosphere during hot weather: Extremely dusty and desert terrain in certain areas. The dust concentration
in air may reach a high value of 1.6mg/cub meter.5.5 Air Pollution : The equipment shall be designed to work in coastal area in humidity and salt
laden Corrosive atmosphere. The maximum values will be as follows
(a) Maximum pH Value : 8.5
(b) Sulphate : 7mg/liter
(c) Maximum concentrate of chlorine: 6mg/liter
(d) Maximum conductivity: 130 μ Siemens/CM

5.6 Climate : Tropical, Hot and humid Climate

6.0 ELECTRICAL REQUIREMENTS

6.1 Primary Voltage: 415 V, 3 ph, Constant Flux

6.2 Secondary Voltage: 140 V, 3 ph

6.3 Primary Current: 21.6A

6.4 Secondary current: 61.7A

6.5 Efficiency: > 95%

6.6 Impedance: < 2% (Short circuit voltage)

6.7 Frequency: Min 0 Hz, Nom 50 Hz, Max 53 Hz at Constant Flux

6.8 Noise Level Max: 75 dB

6.9 Switching Frequency: 2 to 4 KHz

6.10 Output power: 15KVA

6.11 Short Time Duty : 30 KVA for 5 sec at nominal output voltage

6.12 Vector group: Dyn5

6.13 Input Wave form THD: 10 %

6.14 Combined voltage and frequency variation: 10% (Absolute sum)

6.15 Voltage/ Freq ratio operation shall be designed for continuous operation at no load and 110
Percent of rated V/F.

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6.16 Short circuit: withstand ability should have the ability to withstand over currents during external Short circuits. In line with IS/IEC standards.

6.17 Loss: Maximum loss values to be indicated in the data sheet for no load and full load

7.0 CONSTRUCTION

7.1 Core: Electrical steel should be CRGO silicon steel laminations with grade of M4 or better along with test certificate.

7.2 Winding: Windings to be of electrolytic Grade copper conductor

7.3 Insulation: Class H All windings to be uniformly insulated. Neutral point of secondary windings to be insulated to full line voltage. Should meet the requirement as per IS2026 /IEC 60076 Insulation Voltage 2500 Vrms - Test voltage 50Hz/1min

Pollution degree: PD3A as of EN50124

7.4 Cooling

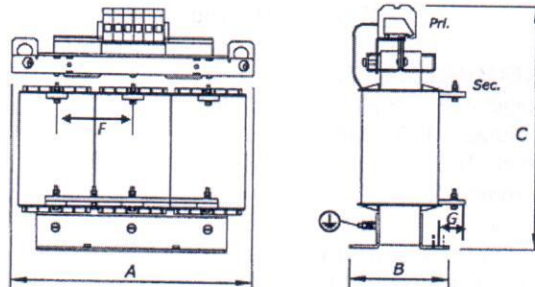
7.4.1 Air Natural at an ambient of 70 °C during summer

7.4.2 Supplier shall indicate if additional cooling is required and the required airflow.

7.5 Terminals ,markings, and connections: As per IS : 2026 and existing transformer

8.0 MECHANICAL DIMENSION LIMITATION

The Transformer dimensions (overall & mounting) shall not exceed the dimensions indicated in the below sketch. This sketch is given for guidance only for limiting dimensions. Supplier to prepare detailed drawing & submits to BHEL for approval before commencing manufacturing process.



Dimensions in mm

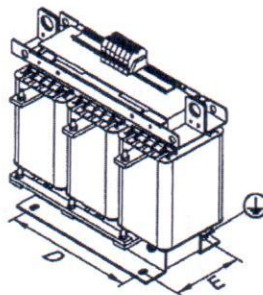
A= 450; B=235; C=440; D=316; E=173

F=140; G=22

Mounting hole = $\Phi 12 \times 18$

Output connecting bolt size on bus bar - M6

PE terminal bolt size - M8



Provision for PE connection to be provided on the bottom left side when facing the primary connection side

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SPECIFICATION FOR TRANSFORMER**9.0 Reliability and safety**

- 9.1 Life time: 30 yrs
- 9.2 Maintenance : Maintenance free
- 9.3 Operating hours : 8640 Per year
- 9.4 Power stress level : 100 %
- 9.5 FIT : 100 Failures / 10⁹ Operating hours
- 9.6 Safety : Fire / Smoke and insulation safety as per standards

10.0 TESTS TO BE CONDUCTED AT SUPPLIER'S WORKSPACE

Three Phase Transformer	IEC60310 Clause		
	Type	Routine	Investigative
Preliminary checks			
Measurement of winding resistance	10.2.4	10.2.4	
Measurement of voltage ratios	10.2.5	10.2.5	
Measurement of no-load primary current and losses	10.2.6.1	10.2.6.2	
Measurement of impedance voltage	10.2.7	10.2.7	
Measurement of load losses	10.2.8.2	10.2.8.3	
Determination of total losses	10.2.9		
Temperature-rise	10.2.10		
induced voltage withstand		10.2.11.1	
separate source voltage withstand		10.2.11.2	
Behavior under short-circuit conditions (optional)	-	-	10.2.12
Shock and vibration withstand	10.2.13	-	

10.1 Tolerance- As specified IEC60310 Standard**10.2 TEST PROTOCOL**

Supplier shall submit test protocol for Routine & Type tests along with techno-commercial offer. List of tests are as per clause 10.0 of this specification.

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SPECIFICATION FOR TRANSFORMER**11 DOCUMENTATION**

11.1 Information required along with techno commercial offer without which offer is liable for rejection.

11.2 Supplier shall furnish clause wise confirmation/comments to the technical specification in the Typical format given below. Deviation, if any, shall be clearly brought out indicating the clause Number, original specification, deviation sought with proper technical backup (catalogue, Technical brochure, international standards, calculations etc.
If no deviations required, then supplier shall furnish certificate indicating "NO DEVIATION REQUESTED" and we comply fully with all the technical requirements of this specification no. PS4452499

11.3 Supplier shall take a copy of this specification and sign on each page and submit the signed copy along with offer.

11.4 Supplier shall furnish winding material, winding resistance, winding cross section.

11.5 Supplier shall furnish the type of core used along with technical details of core.

11.6 Information required after the placement of order

11.7 Detailed dimensional drawing for BHEL approval

11.8 Test protocol for BHEL approval.

11.9 Information required along with material supply.

11.10 Two sets of Test certificates.

11.11 BHEL engineer witnessed Pre inspection report.

12 ACCEPTANCE

12.1 Dimensions as per approved drawing

12.2 Routine test certificate

12.3 Type test certificate

13.0 PRE-SHIPMENT INSPECTION

Pre-shipment inspection will be carried out by BHEL engineer as per the approved test protocol. BHEL engineers will witness Routine & Type tests before dispatch.

14.0 RATING PLATE DETAILS

Weather proof Rating Plate (with following information) shall be fixed at a suitable position.

14.1 BHEL Specification No;

14.2 KVA Rating; Voltage Ratio;

14.3 HV / LV Current;

14.4 No of Phases; Vector Grouping;

14.5 System Frequency;

14.6 Insulation Level/ insulation Class;

14.7 % Impedance;

14.8 No load Current: Amperes (optional);

14.9 Iron Loss / copper loss: Watts (optional);

14.10 Ambient Temperature; Temperature class of windings;

14.11 Weight;

14.12 Serial No;

14.13 Date of manufacture;

14.14 Manufacturer Name;

14.15 Cooling Medium Type; Identification of cooling method

14.16 Connection Diagram

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