



PURCHASE SPECIFICATION
GROUP: TRACTION ENGINEERING

P. S. NO: PS/445/2560

REV. NO: 01

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Specification for 1.3mH 3-Phase Sine Filter Inductor

Code No.: TI0668108000

REVISION HISTORY SHEET

REV. NO.	DATE	NATURE OF ISSUE	REASONS	PREPARED BY	APPROVED BY
00	17.10.2016	First issue		Girish Chand	Venkateshalu K
01	17.01.2018	Revision	Dimensional changes	Girish Chand	Venkateshalu K

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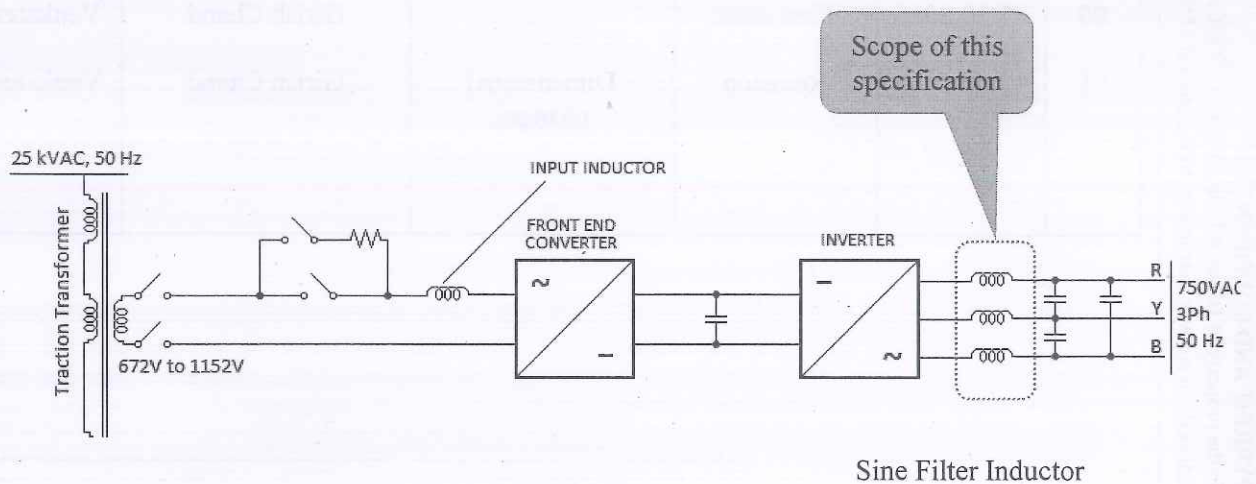
1 General Instructions

Type Test: Type tests (mentioned in clause 4 of this document) are to be done on one number of inductor at accredited labs like CPRI etc. Type test certificates to be submitted along with the supply.

If type tests has been done earlier on inductors of same specification (electrical and mechanical), then certificates to be submitted along with material supply.

2 Functional Requirements

This document covers specification of a 3 ph. sine filter inductor, to be used at the output of inverter. The inductor will be mounted in a cabinet/enclosure and will be used in **traction applications for on board mounting**. The block diagram is show below indicating the sine filter inductor location.



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3 Technical Information

3.1 Inductance

3.1.1 Nominal inductance : 1.3mH, Three phase

3.1.2 Tolerance limit : $\pm 5\%$

3.2 Current

3.2.1 Rated current (rms) : 385A

3.2.2 Peak to peak current : $\pm 545A$ (max)

3.2.3 Short time over current (rms) : 750A for 3 sec

3.3 Voltage

3.3.1 Maximum switching voltage : 1800V

3.4 Frequency

3.4.1 Nominal frequency : 50 Hz

3.4.2 Switching frequency : 1 kHz

3.5 Core

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

3.6 Construction

: The inductor is open type. The inductor shall be compact. Winding shall be Foil.

3.7 Cooling Type

: Natural Cooling

3.8 Temperature Class

3.8.1 Thermal class of winding : H

3.8.2 Temperature rise : H (Duty class 2) as per IEC 60310

3.8.3 Insulation voltage : 5 kV for 1 min.

3.9 Losses

: Power loss at rated current at 115°C temperature shall be less than 2.5 kW

3.10 Impregnation

: Inductor assembly impregnated under vacuum with epoxy based resin for achieving high hygroscopic acid and alkali resistant insulation. The complete winding should have smooth finish after impregnation to ensure high mechanical strength. Thickness of the resin should be smooth. The insulation should be self-extinguish type.

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4 List of Tests to be performed on Inductor

Sl No.	Nature of Test	Test clause as per IEC60310:2016	
		Type	Routine
1	Visual checks	13.3.3	13.3.3
2	Mass	13.3.4	13.3.4
3	Measurement of winding resistance	13.3.5	13.3.5
4	Determination of losses	13.3.6	--
5	a) Measurement of inductance	13.3.7	13.3.7
	b) Measurement of inductance with linearity up to 1.1 times of rated current	13.3.7	--
6	Temperature-rise test	13.3.8	--
7	Insulation resistance test	13.3.9	13.3.9
8	Separate source voltage withstand test	13.3.10.2	13.3.10.2
9	Lightning impulse voltage withstand test	13.3.10.3	--
10	Partial discharge test	13.3.11	--
11	Shock and vibration test (as per class B (Body mounted); IEC 61373)	13.3.13	--
12	Noise measurement	13.3.15	--

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5 Test Protocol

Supplier shall submit immediately after the receipt of the order, test protocol for Routine and Type tests as per clause 4 of this specification for BHEL approval.

6 Pre-shipment Inspection

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

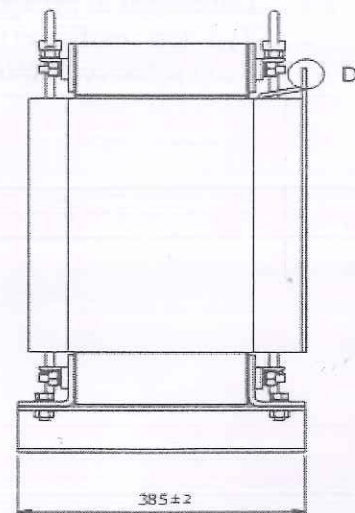
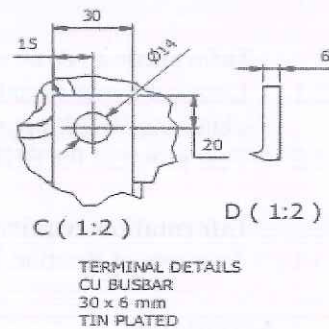
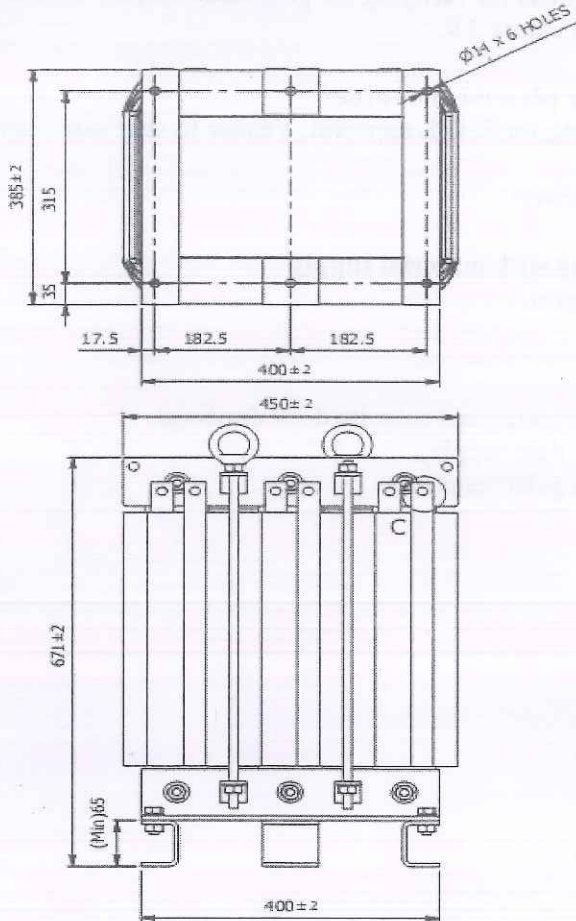
7 Mechanical dimension limitation

Below are the limiting Dimensions. Supplier has to manufacture the inductor within these limits. Mounting hole/foot print has to be matched as given below. Supplier has to submit dimensional drawing to BHEL along with quotation.

Width: 450 ± 2 mm

Height: 671 ± 2 mm

Depth: 385 ± 2 mm



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8 Documentation

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

8.1.1 Supplier shall furnish clause wise confirmation/comments to the technical specification. 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. PS/445/2560".

8.1.2 Supplier shall take a copy of this specification and sign on each page and submit the signed copy along with offer to confirm that the supplier has understood the specification and will comply with all clauses of this technical specification.

8.1.3 Outline General Arrangement (OGA) and dimensional and mounting details.

8.1.4 3D model in STEP/IGES formats for verifying the proposed inductor dimensions.

8.1.5 Power loss calculation as per clause 3.9.

8.2 Information required after placement of order

8.2.1 Detailed dimensional drawing for BHEL approval. Vendor to start manufacture only after obtaining BHEL approval.

8.2.2 Test protocol for BHEL approval.

8.3 Information required along with material supply

8.3.1 Two sets of Routine Test report.

9 Acceptance

9.1 Dimensions as per approved drawing and submitted 3D drawings.

9.2 Type test certificates (for first time supply)

9.3 Routine test certificates (for regular supplies).

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10 Rating plate details

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

- Manufacturer's name;
- Manufacturer's type designation or number;
- Manufacturer's serial number;
- Date and place of manufacturing;
- Connection diagram;
- Tapings;
- Rated power, voltage and frequency of each winding;
- Rated current (R.M.S. value, or mean direct current);
- Value of the inductance (at one or more specified refer current values);
- Identification of cooling method;
- Total mass.
- Application.
- BHEL specification no.

11 Environmental conditions

11.1	Ambient Temperature	55°C
11.2	Maximum Temperature	75°C (when locomotive standing dead under sun) 60°C (when locomotive working)
11.3	Average Temperature	47°C
11.4	Humidity	Up to 100% during rainy season
11.5	Altitude	up to 1776 m above mean sea level
11.6	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

12 Reference Standards

IEC 60076	Power transformers
IEC 60077-1	Railway applications – electric equipment for rolling stock-part 1.
IEC 60085	Thermal evaluation and classification of electrical insulation
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/IEC61558-2-16	Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1100 V
EN50124-1,IEC1376	Railway Applications - Insulation Coordination Basic Requirements - Clearance And Creepage Distances
IEC60571/EN50155	Operating conditions

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