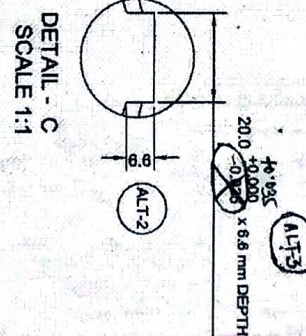
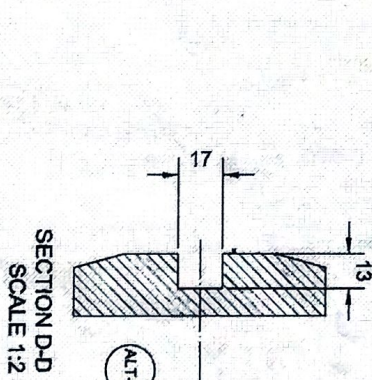
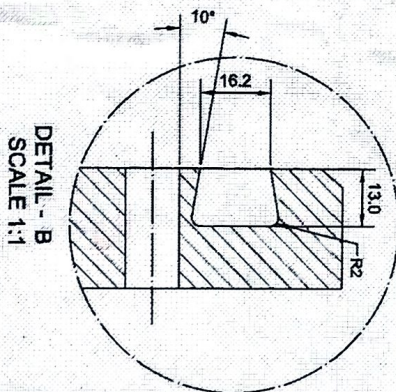
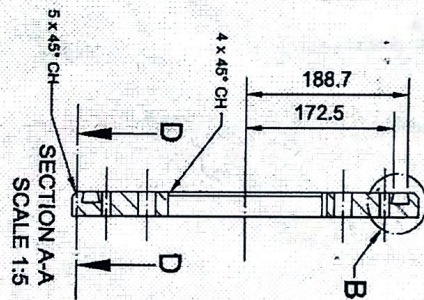
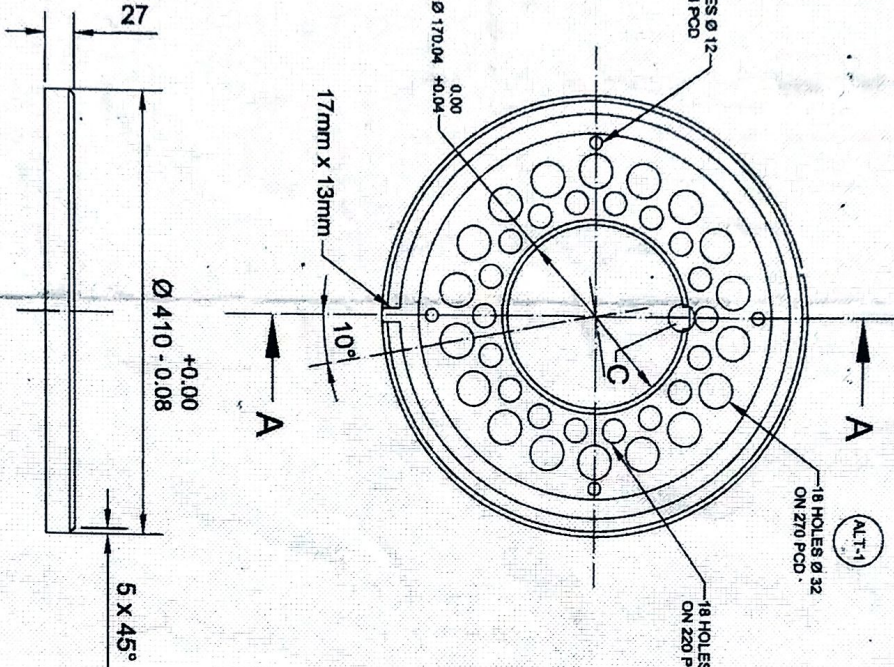


Dr.	29/09/2026
D	29/09/2026
C	29/09/2026
T	29/09/2026

NOTE:
MATERIAL SPECIFICATION SPHEROIDAL GRAPHITE CAST IRON (SGCI)-TO DIN - 1693 PART -
GR - GGG40 OR GR - 400/18 OF IS 1865 : 1991 (LATEST VERSION)



STATUS	ALT.	REF. NO.	DESCRIPTION	APPROVED BY	DATE
1	EL/2.1/2	1/2	DIMENSION MODIFIED	29/09/2026	29/09/2026
2	EL/2.1/2	2/2	DIMENSION MODIFIED	29/09/2026	29/09/2026

REF. NO.	PART NO.	DESCRIPTION	DETAIL DRG. NO.	NO. L000	DATE	SCALE	APPROVED BY	DATE
REF. NO.	3500000 - 1057	End Ring for shaft mounted zirconium copper sampling type resistance ring design of rotor for traction motor type 6 FRA 6068 for WAG9M77 locomotives						
REF. NO.	3500000 - 1057	End Ring for shaft mounted zirconium copper sampling type resistance ring design of rotor for traction motor type 6 FRA 6068 for WAG9M77 locomotives						

R.D.S.O. ELECT. DTE. SKEL - 4739	SUPERSEDED BY

Signature Not Verified

Digitally signed by MOHAMMAD KAMRUZZAMAN Date: 2024.10.19 12:02:26 IST

Reason: I am not a signatory (Misc)/351/2026-HEP-TXM20500 (Computer No. 350926)

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SPECIFICATION FOR
SPHEROIDAL GRAPHITE CAST IRON
COMPONENTS OF 3-PHASE
TRACTION MOTOR TYPE 6FRA-6068 & 6FXA-7059
OF ELECTRIC LOCOMOTIVES

Specification No. 4TMS.096.068, Rev-2, Alt-3

TRACTION MOTOR DEPARTMENT
 CHITTARANJAN LOCOMOTIVE WORKS
 CHITTARANJAN – 713365
 WEST BENGAL

Approved By
DINESH PRASAD SAH CEE/TM Digitally signed by DINESH PRASAD SAH Date: 2026.08.28 11:40:42 +05'30'

Prepared & Checked By SSE/TMDO	MOHAMMAD KAMRUZZAMAN AN	Reviewed By Dy.CEE/TMD	SHRAVAN KUMAR VERMA VERMA
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AMENDMENT SHEET

ALT. No.	AUTHORITY	DESCRIPTION	SIGNATURE	DATE
1.	Dy.CEE/TMD	Note added in Para 8.2	-Sd-	As Signed
2.	Dy.CEE/TMD	Para 4.8 revised and SN (vii) added in para 9.0	-Sd-	As Signed
3.	Dy.CEE/TMD	i) Para 2.1, item under SN-3(i) deleted ii) Para 3.1 & 3.6 revised iii) Note added in Para 4.8 iv) Para 5.1 revised v) Para 6.0 & 6.1 revised and para 6.2 added vi) Para 7.1 a) revised vii) Para 10.1 revised viii) Para 13.0 deleted	-Sd-	As Signed

Prepared & Checked By	MOHAMMAD KAMRUZZAM AN	Digitally signed by MOHAMMAD KAMRUZZAMAN Date: 2026.08.28 10:21:20 +05'30'	Reviewed By	SHRAVAN KUMAR VERMA	Digitally signed by SHRAVAN KUMAR VERMA Date: 2026.08.28 11:31:36 +05'30'
SSE/TMDO			Dy.CEE/TMD		

TECHNICAL SPECIFICATION OF
END FRAME (DE), END FRAME (NDE), ROTOR END RING (MODIFIED),
SET OF LABYRINTHS AND SPEED PROBE HOUSING MADE FROM
SPHEROIDAL GRAPHITE CAST IRON (SGCI) FOR USE ON
THREE PHASE TRACTION MOTORS TYPE 6FRA-6068 & 6FXA-7059

1.0. SCOPE:

1.1 This specification covers the technical requirements, manufacture, inspection and packing of End Frame (DE), End Frame (NDE), Rotor End Ring (Modified), Set of labyrinths and Speed Probe Housing made from Spheroidal Graphite Cast Iron (SGCI) for use on Three Phase Traction Motors type 6FRA-6068 & 6FXA-7059.

2.0. MATERIAL SPECIFICATION AND DRAWING OF COMPONENTS:

2.1 The castings shall conform to Gr. 400/18 of IS: 1865 (Latest version) in regard to chemical composition, physical properties and other relevant aspects.

The details of castings/items covered in this specification are given below:

SN	Description	CLW Drg. No.	ABB Drg. No.
COMPONENTS FOR 6FRA-6068			
1	END FRAME/DE	1TWD.096.005	3EHM 112008
2	END FRAME/NDE	0TWD.096.003	3EHM 030965
3(i)	ROTOR END RING	2TWD.096.100	3EJD0000001057
3(ii)	END RING PLATE FOR SCHEME-I ROTOR	SKEL 4739Alt-3	-
3(iii)	ROTOR END RING FOR SCHEME-II ROTOR	SKEL 4732 Alt-3	-
4	SPEED PROBE HOUSING	1TWD.096.077	3EHM 111880
5	OUTER BEARING CAP/DE	1TWD.096.006	3EHM 112045
6	CLAMP PLATE/NDE	2TWD.096.033	3EHM 211622
7	BEARING CAP/NDE	3TWD.096.032	3EHM 311758
8	INNER LABYRINTH/DE	4TWD.096.028	3EHM 413061
9	INNER LABYRINTH/NDE	4TWD.096.031	3EHM 412822
10	INNER LABYRINTH/NDE	4TWD.096.042	3EHM 412821
11	INNER LABYRINTH/DE	4TWD.096.043	3EHM 413072
12	OUTER LABYRINTH/DE	4TWD.096.029	3EHM 413071
COMPONENTS FOR 6FXA-7059			
13	END FRAME/DE	1TWD.097.011	3EHM 111956
14	END FRAME/NDE	0TWD.097.012	3EHM 030957
15	CLAMP PLATE/NDE	2TWD.097.040	HMMT 211395
16	BEARING CAP/NDE	3TWD.097.039	HMMT 311492
17	BEARING COVER/DE	3TWD.097.036	3EHM 413033
18	INNER LABYRINTH/NDE	4TWD.097.034	HMMT 412270
19	INNER LABYRINTH/NDE	4TWD.097.038	HMMT 412371
20	INNER LABYRINTH/DE	4TWD.097.037	3EHM 413036
21	INNER LABYRINTH/DE	4TWD.097.035	3EHM 413034
22	ROTOR END RING (MODIFIED)	2TWD.097.013	3EHM 211728

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3.0. MANUFACTURING:

Alt-3 3.1 The choice of manufacturing method are left to the manufacturer provided physical/chemical properties of specified grade nominated on the drawing are obtained. However, all the components should be machined on CNC Machine and the manufacturer should fulfil schedule of Technical requirements as per RDSO's STR No. RDSO/2007/EL/STR/0021, Rev-1 (or latest) and CLW's STR No. CLW/TM/18109, Rev-1, Alt-1(or latest) as applicable.

3.2 The dimension indicated on the relevant drawing are for the finish-machined components. The working drawing of the pattern and the pattern shall be prepared by the manufacturer/tenderer himself. Responsibilities for pattern design shall be with the manufacturer/supplier completely.

3.3 Machining variations in the linear and angular dimensions without tolerance indications shall be in accordance with IS: 2102 (part-I).

3.4 The surface of the castings shall be free of mould and core sand and any unevenness impairing the usability of the castings.

3.5 The castings shall not exhibit any defects which will impair their machinability or usefulness to more than insignificant extent.

Alt-3 3.6 Welding shall not be allowed for repair of castings. Casting should be offered for stage inspection in bare condition i.e. without any coating/painting.

3.7 In the event of castings proving defective from foundry in the course of preparation, machining or assembly, such castings may be rejected notwithstanding any previous certification or satisfactory testing and/or inspection.

4.0. INSPECTION:

4.1 Prototype inspection:-The successful tenderer shall offer a minimum of two m/sets of Components under procurement for Prototype Inspection/Testing to the Dy.CEE/TMD/ CLW/ CRJ before undertaking bulk production supply, for the first time.

4.2 The inspection shall be carried out as per Gr. 400/18 of IS: 1865 (latest Version).

4.3 The Inspection shall be carried out in two stages:

- i) Metallurgical Inspection of casting by CC&M/CLW/CRJ or as per stipulation in P.O.
- ii) Dimensional inspection of finish machined components as per P.O. stipulation.

4.4 Any shortcoming/defects in the design and workmanship of the castings shall be pointed out to the supplier after Prototype Inspection tests to enable him to incorporate necessary improvement before bulk supply is commenced.

4.5 Routine inspection of the items shall be carried out as per Para 4.2 and 4.3 above only after the approval of prototype sample by the authorised representative.

4.6 The manufacturer shall provide all the necessary facilities at their Works/Premises for Prototype as well as Routine inspection.

4.7 The inspection authority of purchaser shall have free access to the Works of the manufacturer at all times during manufacture. He shall be free to inspect the manufacture at any stage, to reject any material which do not confirm the terms of specification.

Alt-2 4.8 To ensure the accuracy and precision in the supplies of machined items procured in kit form, measurement of dimensions of 100% material during routine inspection in presence of CLW's inspector/TPI agency against P.O. quantity must be done by three-dimensional Co-Ordinate Measuring Machine.

Alt-3 **NOTE:** Para 4.8 applicable for PL No. 29941003, UVAM item ID-2100501 & PL No. 29945422, UVAM item ID-2100502.

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5.0. NON-DESTRUCTIVE TEST:

Alt-3 5.1 Castings shall be subjected to radiographic or other method of Non-destructive inspection (5% offered qty. selected at random). Radiography test shall be carried out from NABL accredited lab having valid AERB Licence.

5.2 Radiographic Test shall be done as per ASTM E689-95.

Radiograph shall be graded in accordance with **ASTM E-446** and **ASTM E-186** as per TABLE-1.

TABLE-1	
Shrinkage	3
Inclusion	3
Gas Porosity	3
Crack	Not Allowed
Hot Tears	Not Allowed
Chaplets	Not Allowed

The casting having defects exceeding the above radiographic quality limits shall not be accepted.

5.3 The sampling of castings shall be in accordance with clause of relevant specification nominated on the relevant drawing.

5.4 Sample of the castings shall be inspected by the authorised representative of purchaser for its physical property test.

5.5 In case the radiographic test is not possible due to special shape or contour of the casting, it may be subjected to other Non-destructive test.

6.0. BALANCING:

Alt-3

6.1 **STATIC BALANCING:** Rotor End Ring for Scheme-II Rotor (PL No. 29941350) & Rotor End Ring (Modified) (PL No.29945203) required to be checked for 100% static unbalance. The permissible unbalance in fully machined condition shall be limited to 25 gram (max).

6.2 **DYNAMIC BALANCING:** End Ring Plate for Scheme-I Rotor (PL No.29941325) required to be checked for 100% on dynamic balancing m/c for unbalance. The permissible unbalance in fully machined condition shall be limited to 5 grams.

7.0. DOCUMENTS TO BE SUPPLIED:

7.1 The tenderer shall furnish following information along with their offer:

Alt-3

a) Facilities available for casting and machining as per as per relevant STRs and testing of castings including Non-destructive testing etc.

7.2 The manufacturer shall produce the records of all tests carried out by them along with tested sample to the inspecting authority at the time of inspection.

7.3 Certificate of physical property test of individual components shall be supplied by the manufacturer along with each supply.

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8.0. MARKING:

- 8.1 Each cast component should have individual distinct number embossed by the foundry in format 'FFF/YY/XXXX/CCC' (where, 'FFF' is trademark or initial of foundry, 'YY' is year of casting, 'XXXX' is unique four-digit Batch/Heat No. & 'CCC' is customer code for the foundry).
- 8.2 Each finish/machined component shall be legibly and indelibly marked/etched/punched properly mentioning the following, not necessarily in same order:
- Manufacturer's initial or trademark.
 - Manufacturer's Unique Serial Number in format 'XX/MMYY/ZZZZZ' (where, 'XX' is code unique to a vendor to be obtained from Dy.CEE/TMD's Office, 'MMYY' is month & year of manufacture of subject item and 'ZZZZZ' is **unique & incremental five-digit serial number from 00001 to 99999 specific to a vendor irrespective of P.O. No. or P.O. placing authority**).
 - Batch/Heat Number.
 - 'SGCI' marking.
 - Drawing number (preferably last 03 digits).

Alt-1 * **NOTE:** Applicable for PL No. 29941003, UVAM item ID-2100501 & PL No. 29945422, UVAM item ID-2100502.

9.0. PACKING:

- The components shall be suitably packed to prevent transit/long storing damage.
- The components shall be coated with antirust varnish/compound after inspection.
- Varnished components shall be wrapped in polythene paper followed by corrugated paper.
- The wrapped components shall finally be sealed in thick polythene bag.
- All sealed components in a kit bearing same serial number shall be **finally packed in single wooden crate separated by different wooden compartments for each item**, properly lined/padded by big bubble wrapper/thick foam/thermocool sheets to prevent transit damage to machined surfaces.
- Packing list shall be provided on the boxes.
- CMM report jointly signed by TPI agency/Inspector & firm to be kept in packing box.

10.0. DEVIATION:

- Alt-3 10.1 While submitting the offer, the tenderer shall furnish a list of deviation, if any, from this, specification and relevant drawings, and the manufacturing facility as per relevant STRs. Even if the tenderer has no particular deviation in their offer, a NIL statement shall be submitted.

11.0. Clause wise comments have to be furnished by the tenderer. Vague comments like noted and understood are not acceptable. Compliance have to be clearly stated, otherwise, CLW reserves the right to reject the offer.

12.0. Metallurgical testing for prototype supplies shall be carried out by Dy.CC&M/CLW/CRJ or NABL approved laboratory for which sample to be drawn, stamped & sealed by authorised representative of Dy.CEE/TMD/CLW/CRJ and for bulk supplies metallurgical test shall be done by Dy. CC&M/CLW/CRJ or NABL approved laboratory, to be witnessed by authorised representative of CLW Zonal Inspection Cell.

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Alt-3

13.0. ~~Firms shall make bulk procurement of individual items required for subassemblies or complete equipments from Part I source of CLW/RDSO only. Procurement from Part II sources can be made up to 15% of total procurable qty. or the highest qty. of a past order successfully executed in Rlys. Units/PUs in the preceding three years. Upper limit of qty. to be procured from such Part II source will not exceed 25% of the net procurable qty. in a given procurement case. In case where Part I source is not available, material may be procured from Part II sources of respective items as indicated in ASL of CLW/RDSO. Firm shall keep all such procurement records and will submit the same to inspecting agency at the time of inspection to ensure that above procurement procedure is strictly adhered to.~~

THE DETAILS OF ITEMS COVERED IN THIS SPECIFICATION FOR
“ASSOCIATED COMPONENTS OF MACHINED STATOR ASSLY.”
FOR TM TYPE 6FRA-6068 ARE GIVEN BELOW:-

Sl. No.	DESCRIPTION	CLW DRG. No.	QTY./TM	REMARKS
ASSOCIATED COMPONENTS OF MACHINED STATOR ASSLY.				
1	END FRAME/DE	1TWD.096.005	1 No.	
2	END FRAME/NDE	0TWD.096.003	1 No.	
3	SPEED PROBE HOUSING	1TWD.096.077	1 No.	
4	OUTER BEARING CAP/DE	1TWD.096.006	1 No.	
5	CLAMP PLATE/NDE	2TWD.096.033	1 No.	
6	BEARING CAP/NDE	3TWD.096.032	1 No.	
7	INNER LABYRINTH/DE	4TWD.096.028	1 No.	
8	INNER LABYRINTH/NDE	4TWD.096.031	1 No.	
9	INNER LABYRINTH/NDE	4TWD.096.042	1 No.	
10	INNER LABYRINTH/DE	4TWD.096.043	1 No.	
11	OUTER LABYRINTH/DE	4TWD.096.029	1 No.	

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TME 2019

PRODUCT STANDARD

TME DIVISION, BHOPAL

TM 12548

Rev. No. 01

PAGE 01 OF 04

Specification for Identification Marking of Traction Machines Components

1.0 Scope: This specification governs the requirements for identification marking of all components of traction machines (except electrical items, hardwares & bearings) either manufactured in-house or outsourced in raw material, semi-finished or fully finished condition.

2.0 Identification marking of components: The component manufacturer shall provide the identification marking depending upon the type of component (raw material/semi-finished castings, raw material/semi-finished forgings & fabricated components, fully finished components or sheet metal components) manufactured by it as per guidelines given below:-

A) CASTED COMPONENTS:

Sl. No.	Condition of supply	Identification marking requirement
1.	Castings/ semi-finished castings	a) Method of marking in castings: Each casting shall be embossed & punched on un-machined surface/ etched on machined surface legibly and indelibly with following details:- i) Supplier's name initial , Heat no. ← To be embossed. (Example: SAIL/341) ii) xxxxx , MM-YY ← To be embossed/punched on cast surface or etched on machined surface. 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: 00345/0319) b) Method of marking in semi-finished castings: Each casting shall be embossed & punched on un-machined surface/ etched on machined surface legibly and indelibly with following details:- i) Supplier's name initial , Heat no. ← To be embossed. (Example: SAIL/341) ii) xxxxx , MM-YY ← To be embossed/punched on cast surface or etched on machined surface. 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: 00345/0319) c) Size & location: For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.

Rev. No. 01

Distribution

Prepared

Checked

Approved

Date: 16/03/2019

TME - 2 MNX - 1
TXM - 1 TAM - 1
QTM - 1

J. Kumar
(J. Kumar)

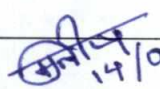
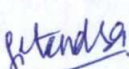
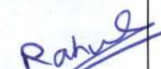
R. Chaudhry
(R. Chaudhry)

M. Verma
(M. Verma)

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				Rev. No. 01
				PAGE 02 OF 04
2.	Machined castings on labour basis	a) Method of marking after finish machining: i) When embossed marking is not removed: In case the embossed marking is not removed during finish machining of the component, the component shall be punched with following details below the already existing embossed marking:- Supplier's name intial , xxxxx , MM-YY 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/341) ← Already embossed. ABCD/00345/0319 ← To be punched.		
		ii) When embossed marking is removed: In case the component is machined all over & the embossed marking is removed, the same shall be re-punched on fully finished component. Date of finish machining in MM-YY format & manufacturer's details shall be punched below the above punched marking as per details given below:- Supplier's name intial , xxxxx , MM-YY 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/341) ← To be punched. ABCD/00345/0319 ← To be punched. b) Size & location: For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.		
3.	Fully finished casted components	a) Method of marking in finished components: i) When embossed marking is not removed during machining: Each component shall be embossed & punched on un-machined surface/ etched on machined surface legibly and indelibly with following details:- Supplier's name initial , Heat no. ← To be embossed/already embossed. (Example: SAIL/341) xxxxx , MM-YY ← To be embossed/punched. 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: 00345/0319)		

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	ii) When embossed marking is removed during machining: In case the component is machined all over & the embossed marking is removed, the same shall be re-punched on fully finished component. Date of finish machining in MM-YY format & manufacturer's details shall be punched below the above punched marking as per details given below:- Supplier's name intial , xxxxx , MM-YY 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/341) ← To be punched. ABCD/00345/0319 ← To be punched. b) Size & location: For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.							
	B) FORGING / FABRICATED COMPONENTS: <table border="1"> <tr> <td>1.</td> <td>Raw material/ semi-finished forgings and fabricated components</td> <td> a) Method of marking in forgings & fabrications: Each component shall be punched legibly and indelibly with following details:- Supplier's name initial , xxxxx , MM-YY , xxx Heat no. 4 digits of date of manufacturing (forging/fabrication) in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/00345/0319/341) b) Size & location: For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing. </td> </tr> <tr> <td>2.</td> <td>Machined forgings/ fabrications on labour basis</td> <td> a) Method of marking after finish machining: i) When punched marking is not removed: In case the punched marking is not removed during finish machining of the component, the component shall be punched with following details below the already existing punched marking:- Supplier's name intial , xxxxx , MM-YY 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/00345/0319/341) ← Already punched. ABCD/00345/0319 ← To be punched. </td> </tr> </table>			1.	Raw material/ semi-finished forgings and fabricated components	a) Method of marking in forgings & fabrications: Each component shall be punched legibly and indelibly with following details:- Supplier's name initial , xxxxx , MM-YY , xxx Heat no. 4 digits of date of manufacturing (forging/fabrication) in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/00345/0319/341) b) Size & location: For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.	2.	Machined forgings/ fabrications on labour basis
1.	Raw material/ semi-finished forgings and fabricated components	a) Method of marking in forgings & fabrications: Each component shall be punched legibly and indelibly with following details:- Supplier's name initial , xxxxx , MM-YY , xxx Heat no. 4 digits of date of manufacturing (forging/fabrication) in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/00345/0319/341) b) Size & location: For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.						
2.	Machined forgings/ fabrications on labour basis	a) Method of marking after finish machining: i) When punched marking is not removed: In case the punched marking is not removed during finish machining of the component, the component shall be punched with following details below the already existing punched marking:- Supplier's name intial , xxxxx , MM-YY 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/00345/0319/341) ← Already punched. ABCD/00345/0319 ← To be punched.						

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	ii) When punched marking is removed: In case the component is machined all over & the punched marking is removed, the same shall be re-punched on fully finished component. Date of finish machining in MM-YY format & manufacturer's details shall be punched below the above punched marking as per details given below:- Supplier's name initial , xxxxx , MM-YY 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/00345/0319/341) ← To be punched. ABCD/00345/0319 ← To be punched. b) Size & location: For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.		
	3. Fully finished forged/fabricated components	a) Method of marking in finished components: Each component shall be punched on un-machined surface/ etched on machined surface legibly and indelibly with following details:- Supplier's name initial / xxxxx / MM-YY / xxx Heat no. 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/00345/0319/341) b) Size & location: For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.	
C) SHEET METAL COMPONENTS:			
1. Sheet metal components	a) Method of marking: Each component shall be etched or punched as the case may be legibly with following details:- Supplier's name initial , xxxxx , MM-YY 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. (Example: SAIL/00345/0319) b) Size & location: For etching/painting and size & location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.		

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		<u>SPECIFICATION FOR AIR DRYING PAINT FINISH FOR TRACTION MACHINES</u> (THIS SPEC. SUPERSEEDS SPEC. NO. BP0674184)			
1. GENERAL: This standard details the process to be followed to provide the standard paint finish for traction motors, traction generators/alternators, motor generators, motor alternators & ECC, Auxiliary machines, oil rig motors & alternators for application in Indian Railways/Oil Rigs. This standard also covers the painting requirements of traction machines/oil rig machines for coastal areas/export. The finishing of the outer surfaces of the field coils and armature, including commutators and creepage surfaces, is covered by the appropriate Insulation Process Specifications where a special finish is required, it will be called for on the appropriate drawings and specification sheets.					
2. COMPLIANCE WITH STANDARDS: This standard to be used along with corporate standard AA0674123.					
3. MATERIALS:					
3.1 Materials Required: The finish painting of different traction machines/oil rig machines shall be as per table-4 of the specification unless otherwise mentioned in the drawing/work order/MID. Note: The materials shall be used after ensuring that material TC's is as per the requirement of paint specification & expiry date of paint is not crossed.					
3.1.1 Primer Paint: i) Anti Corrosive priming paint to AA56101 (Red). ii) Inorganic ethyl zinc silicate primer to AA56113.					
3.1.2 Intermediate Paint: i) High build intermediate epoxy paint to AA56112.					
3.1.3 Finish Paints: i) Polyurethane finishing paint to AA56142: For requirements of Industrial, Oil rigs & Traction machines including for coastal areas & export. ii) Paint to AA56128 (Aluminum): For blower motors.					
Revision : 06 Date: 14.05.2021		Distribution TXM TAM TGM/TNX QTM TME	Qty. 1 1 1 1 2	Approved :  (M. Verma)	Prepared:  (J. Kumar)
				Checked:  (R. Chaudhry)	Date: 14.05.21

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		iii) Oil Resistant Air Drying Synthetic Enamel to AA56132 (Jasmine Yellow shade): For surfaces in contact with lubricant. iv) Epoxy Red Gel Coat (Base, Hardner & Diluent) to BP27476 or Anti Tracking Red Insulating Varnish to BP 27599 or Becktol Red- Prop of M/s Dr Beck & Co.Pune: For coils & insulation. v) Anti Tracking Epoxy based finishing paint to CIT-033: For interior surfaces of frame & pole pads. vi) Silicone based finishing paint to CIT-064: For field coils & pole assy. and connections. vii) Grey Insulating Enamel to BP 27595: For terminal box interiors. 3.1.4 Thinners: The application of thinners for different primer/finish paints are as given in clause 3.2. i) White Spirit Gr. 145/205 to AA56701. ii) Xylole-Industrial Solvent Grade to AA56703. iii) Special Thinner for Epoxy Red Gel Coat/MEK. iv) Derusting Solution (hydrochloric acid/sulphuric acid) to BP0690086. 3.2 Consistency of Materials at normal shop temperature in cup No.4 of IS:3944: <table border="1" data-bbox="280 1153 1445 1778"> <thead> <tr> <th>Paint</th> <th>Thinner</th> <th>Applicant</th> <th>Consistency in Seconds to 27° C</th> </tr> </thead> <tbody> <tr> <td>AA56101 (Red)</td> <td>White spirit</td> <td>Spray</td> <td>30₊₂ sec</td> </tr> <tr> <td>AA56128 (Aluminum)</td> <td>White spirit</td> <td>Spray</td> <td>30₊₂ sec</td> </tr> <tr> <td>AA56142</td> <td>As recommended by supplier</td> <td>Spray</td> <td>30₊₂ sec</td> </tr> <tr> <td>AA56132(Jasmine Yellow)</td> <td>White Spirit</td> <td>Spray</td> <td>30₊₂ sec</td> </tr> <tr> <td>BP25795</td> <td>Xylole</td> <td>Spray</td> <td>30₊₂ sec</td> </tr> <tr> <td>BP27476/ BP2799 Becktol Red.</td> <td>Special Thinner/ MEK</td> <td>Spray</td> <td>30 – 40 sec</td> </tr> </tbody> </table> For application by spray, the paints shall be obtained ready for use or thinned down to the flow time shown on the chart when measured at the shop temperature. The consistency of the paint require adjustment, the appropriate thinner given in the above chart shall be used.	Paint	Thinner	Applicant	Consistency in Seconds to 27° C	AA56101 (Red)	White spirit	Spray	30 ₊₂ sec	AA56128 (Aluminum)	White spirit	Spray	30 ₊₂ sec	AA56142	As recommended by supplier	Spray	30 ₊₂ sec	AA56132(Jasmine Yellow)	White Spirit	Spray	30 ₊₂ sec	BP25795	Xylole	Spray	30 ₊₂ sec	BP27476/ BP2799 Becktol Red.	Special Thinner/ MEK	Spray	30 – 40 sec
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED It must not be used directly or indirectly in any way detrimental to the interest of the company	3.3 <u>Compatibility chart for Primer Paint, Intermediate Paint & Finish Paint:</u> <table border="1" data-bbox="354 497 1311 638"> <thead> <tr> <th>Primer Paint</th> <th>Intermediate Paint</th> <th>Finish Paint</th> </tr> </thead> <tbody> <tr> <td>AA56113</td> <td>AA56112</td> <td>AA56142</td> </tr> <tr> <td>AA56101</td> <td>-</td> <td>AA56128</td> </tr> </tbody> </table> For achieving better quality of painting, the combinations of primer paint, intermediate paint & finish paint as mentioned in above table shall be used. 3.4 <u>MIXING OF PAINTS:</u> 3.4.1 Before application, any skin formed on the paint in the tin shall be carefully removed, any settled pigment broken up and loosened, and the paint shall be thoroughly stirred to ensure complete and uniform mixing of the constituents. Care shall be taken to avoid air entry into the paint whilst stirring. 3.4.2 <u>AA56113 PRIMER:</u> AA56113 primer as supplied consists of two separate ingredients viz primer base and accelerator. Shortly before use mix together primer base and accelerator in the proportion 1:1 by volume or as recommended by supplier, care being taken not to entrain air while mixing. It is important that only small quantity of primer which can be consumed within 4 hours can be mixed. Further thinning of the paint prepared as above is not required for application by spraying. 3.4.3 <u>EPOXY RED GEL COAT (BP27476):</u> This consist of 3 parts viz Epoxy red gel coat, Hardner EH411 and Diluent C. These to be mixed in the ratio 100:40:10 by weight. Should the consistency of the paint require adjustment the same to be done by using special Thinner/MEK. 4. <u>APPLICATION :</u> A complete paint (as per Table 1, 2, 3 & 4) should be applied so that the equipment has a well finished appearance & adequate protection against corrosion. It is important that each coat of paint is completely dry before the next is applied. The paint shall be applied by spraying/air less spraying only. 5. <u>PROCESS FOR PAINTING OF TRACTION/OIL RIG/INDUSTRIAL MACHINE COMPONENTS:</u> For the painting of Traction/Oil rig/Industrial machines components, the process mentioned in painting scheme no. 8 of annexure-II(a) of corporate standard AA0674123 shall be followed.		Primer Paint	Intermediate Paint	Finish Paint	AA56113	AA56112	AA56142	AA56101	-	AA56128
	Primer Paint	Intermediate Paint	Finish Paint								
AA56113	AA56112	AA56142									
AA56101	-	AA56128									

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TABLE NO. 1

FINISHING PAINT FOR NON-ROTATING PARTS OF TRACTION MACHINES

Part	Traction Motors		Other Machines	
	Paint	Coats	Paint	Coats
Exterior surfaces of machines including gearcase	AA56142 (Black)	2	AA56142 (Traffic Green)	2
	AA56142 (Traffic Green)	2	AA56142 (Light Grey)	2
	AA56142 (Light Grey)	2		2
Interior Surface of machines	CIT-033 (See note-2)	2	CIT-033 (See note-2)	2
Surface in contact with Lubricant	AA56132 (Jasmine Yellow)	2	AA56132 (Jasmine Yellow)	2
		2		2
Terminal Box Interiors	BP27476/ BP27599 Becktol Red.	2	BP 27595	2
Field coils & pole assy. and Connections	CIT-064	2	CIT-064	2
Brush gear and brush gear Insulators	Plant Standard BP0674183 to be followed			

NOTES:

1. Light alloy & glass fibre cover and other readily detachable parts in the traction machines shall not be painted.
2. Interior surface of frames & pole pads to be painted with CIT-033 for adjacent coils, cable etc.
3. Epoxy bonded components must not be painted prior to bonding.
4. The paint/colour of finish painting in different traction machines/oil rig machines is mentioned in table-4 of this specification.

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	TABLE-2 FINISHING PAINT FOR ROTATING PART OF TRACTION MACHINES																		
<table border="1" style="width: 100%;"> <thead> <tr> <th>Part</th> <th>Paint</th> <th>Coats</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>Steel Fans:</td> <td></td> <td></td> <td></td> </tr> <tr> <td>1) TM4601, TM4603</td> <td>AA56142 (Traffic Green)</td> <td style="text-align: center;">2</td> <td style="text-align: center;">-</td> </tr> <tr> <td>2) AG3101, AG2702, TA10102</td> <td>AA56142 (Light Grey)</td> <td style="text-align: center;">2</td> <td></td> </tr> </tbody> </table>				Part	Paint	Coats	Remarks	Steel Fans:				1) TM4601, TM4603	AA56142 (Traffic Green)	2	-	2) AG3101, AG2702, TA10102	AA56142 (Light Grey)	2	
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<table border="1" style="width: 100%;"> <thead> <tr> <th>Equipment</th> <th>Part</th> <th>Paint</th> <th>Coats</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Eddy Current Clutch and gear boxes surface</td> <td>Steel surfaces</td> <td>AA56142 (Traffic Green)</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Coil</td> <td>See Insulation Spec.</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Interior of gear box</td> <td>AA56132</td> <td style="text-align: center;">2</td> </tr> </tbody> </table>				Equipment	Part	Paint	Coats	Eddy Current Clutch and gear boxes surface	Steel surfaces	AA56142 (Traffic Green)	2	Coil	See Insulation Spec.	-	Interior of gear box	AA56132	2		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.	<u>Annexure-I</u>																																	
	<u>Acceptance criteria for Painting of Traction Machines</u> The acceptance criteria for the check points, which are to be ensured during painting of Traction Machines as per the requirements of specification TM94217, are as given below. The supplier to furnish below mentioned check points for each component in the format as per annexure-II along with consignment. 1) <u>Checking of Painting Material:</u> <table border="1" data-bbox="331 725 1474 977"> <thead> <tr> <th>Sl. no.</th><th>To be checked</th><th>Acceptance criteria</th></tr> </thead> <tbody> <tr> <td>i.</td><td>Expiry date of primer & intermediate paint.</td><td>Primer & intermediate paint shall be within expiry date.</td></tr> <tr> <td>ii.</td><td>Expiry date of finish paint.</td><td>Paint shall be within expiry date.</td></tr> <tr> <td>iii.</td><td>Verification of supplier's TC as per paint specification.</td><td>Painting material shall be used only after verification of TC.</td></tr> </tbody> </table> 2) <u>Surface Preparation (Before Primer Painting):</u> <table border="1" data-bbox="331 1079 1474 1904"> <thead> <tr> <th>Sl. no.</th><th>Operation</th><th>Acceptance criteria</th></tr> </thead> <tbody> <tr> <td>i.</td><td>Dressing & grinding of all flame-cut edges, welds & any major imperfections.</td><td>No sharp edges or protrusions.</td></tr> <tr> <td>ii.</td><td>Degreasing by using white sprite to AA56701 & removal of varnish in wet condition.</td><td>Free from grease & varnish.</td></tr> <tr> <td>iii.</td><td>Removal of light rust by hydrochloric acid/sulphuric acid to BP0690086 and removal of heavier localized rust by using emery cloth, steel scratch brush or portable power tool with abrasive tool & then applying hydrochloric acid/sulphuric acid.</td><td>Surface should exhibits grey colour in place of red rust.</td></tr> <tr> <td>iv.</td><td>In case surface is widely rusted to such an extent that pitting with hard rust flakes is exhibited, the surface shall be sand/shot blasted.</td><td>Surface should exhibits clean & grey colour in place of red rust.</td></tr> <tr> <td>v.</td><td>Visual inspection of condition of surface of components before application of primer paint.</td><td>As per the requirement of clause 5.</td></tr> <tr> <td>vi.</td><td>Checking of surface finish of the components.</td><td>Surface finish shall be as per IS:3073.</td></tr> </tbody> </table>		Sl. no.	To be checked	Acceptance criteria	i.	Expiry date of primer & intermediate paint.	Primer & intermediate paint shall be within expiry date.	ii.	Expiry date of finish paint.	Paint shall be within expiry date.	iii.	Verification of supplier's TC as per paint specification.	Painting material shall be used only after verification of TC.	Sl. no.	Operation	Acceptance criteria	i.	Dressing & grinding of all flame-cut edges, welds & any major imperfections.	No sharp edges or protrusions.	ii.	Degreasing by using white sprite to AA56701 & removal of varnish in wet condition.	Free from grease & varnish.	iii.	Removal of light rust by hydrochloric acid/sulphuric acid to BP0690086 and removal of heavier localized rust by using emery cloth, steel scratch brush or portable power tool with abrasive tool & then applying hydrochloric acid/sulphuric acid.	Surface should exhibits grey colour in place of red rust.	iv.	In case surface is widely rusted to such an extent that pitting with hard rust flakes is exhibited, the surface shall be sand/shot blasted.	Surface should exhibits clean & grey colour in place of red rust.	v.	Visual inspection of condition of surface of components before application of primer paint.	As per the requirement of clause 5.	vi.	Checking of surface finish of the components.
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			PAGE 08 OF 09																		
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Note: The sample size for quality checking of painting of traction machines should be as per IS: 2500 Part-2, Level 4 and AQL 1% as mentioned below:- <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Lot size</th> <th>Sample size</th> </tr> </thead> <tbody> <tr><td>2 to 8</td><td>3</td></tr> <tr><td>9 to 15</td><td>3</td></tr> <tr><td>16 to 25</td><td>4</td></tr> <tr><td>26 to 50</td><td>5</td></tr> <tr><td>51 to 100</td><td>7</td></tr> <tr><td>101 to 150</td><td>10</td></tr> <tr><td>151 to 300</td><td>15</td></tr> <tr><td>301 to 500</td><td>20</td></tr> </tbody> </table> Imp.: When sample size equals or exceeds lot size, every item in the lot shall be inspected.				Lot size	Sample size	2 to 8	3	9 to 15	3	16 to 25	4	26 to 50	5	51 to 100	7	101 to 150	10	151 to 300	15	301 to 500	20
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26 to 50	5																				
51 to 100	7																				
101 to 150	10																				
151 to 300	15																				
301 to 500	20																				

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<u>Annexure-II</u>			
<u>Checklist for Painting of Traction Machines</u>			
Machine type:		Machine/Component no.:	
Date of Painting:			
Sl. No.	Check points as per the requirement of annexure-I	Checking Remark (100%TP & 20%QC)	
1.	Checking of Painting Material: i. Expiry date of primer & intermediate paint ii. Expiry date of finish paint iii. Verification of supplier's TC as per paint specification	(ok/not ok) (ok/not ok) (ok/not ok)	
2.	Surface Preparation (Before Primer Painting): i. Visual inspection for absence of sharp edges or protrusions ii. Visual inspection for absence of grease & varnish iii. Visual inspection for absence of light rust iv. Visual inspection for absence of widely spread rust v. Visual inspection for condition of surface as per the requirement of clause 5 vi. Surface finish of the component	(ok/not ok) (ok/not ok) (ok/not ok) (ok/not ok) (ok/not ok)microns (ok/not ok)	
3.	Measurement of Primer & Intermediate Paint Thickness: i. Paint thickness after one coat of primer paint ii. Total paint thickness (primer + intermediate) after one coat of intermediate paint	microns (ok/not ok)microns (ok/not ok)	
4.	Inspection for Process Control (After Finish Painting): i. Visual inspection of finished component for absence of paint film defects ii. Total thickness of paint	(ok/not ok)microns (ok/not ok)	
5.	Adhesion by Tape Test (As per AA0674105): i. Adhesion by tape test	(ok/not ok)	
<u>Abbreviations:-</u> TP – Task Performer, QC – QTM/BHEL Authorized Quality Inspection Agency <u>Note:</u> 1) For the components supplied by the supplier in finish painted condition, the supplier to furnish dully filled checklist for each component along with consignment. 2) The acceptance criteria shall be as per annexure-I.			
(Task performer's signature)		(QC's signature)	